Megger

S1-568 / S1-1068 / S1-1568

5 kV, 10 kV and 15 kV High Performance DC Insulation Resistance Testers

User Guide

Megger Ltd reserves the right to alter the specification of its products from time to time without notice. Although every effort is made to ensure the accuracy of the information contained within this document it is not warranted or represented by Megger Ltd. to be a complete and up - to - date description.

This manual supersedes all previous issues of this manual. Please ensure that you are using the most recent issue of this document. Destroy any copies that are of an older issue.

Declaration of Conformity

Hereby, Megger Instruments Limited declares that radio equipment manufactured by Megger Instruments Limited described in this user guide is in compliance with Directive 2014/53/EU. Other equipment manufactured by Megger Instruments Limited described in this user guide is in compliance with Directives 2014/30/EU and 2014/35/EU where they apply.

Contents

1. Safety warnings

Safety warnings must be observed during use:

- The circuit under test must be switched off, de-energised, isolated and checked to be safe before insulation test connections are made. Make sure the circuit is not reenergised whilst the instrument is connected.
- Only 15 kV rated Megger test leads with plug inserts of 75 mm must only be used on the S1-1568. Lead integrity can be verified by momentarily shorting clips together at the lowest test voltage range.
- Circuit terminals must not be touched during an insulation test or when the test LED is flashing to indicate a hazardous condition on the measurement circuit, before suitable grounding of the unit under test is in place in line with safe working practices.
- When powered by battery and with the mains supply disconnected, the pins on the mains socket may be electrostatically charged to a high voltage. There is not enough energy for this to be hazardous but, to reduce discomfort from accidental discharge if the mains inlet plug is touched, it is strongly recommended that the functional earth terminal is connected to a convenient earth or unipotential protection circuit. The user is fully protected for safety by double insulation and this connection need not be capable of taking a fault current.
- After completing a test, capacitive circuits must be completely discharged before disconnecting the test leads. Capacitive charges can be lethal.
- Tested items must be firmly shorted out with a shorting link, after discharge, until required for use. This is to guard against any stored dielectric absorption charge subsequently being released thereby raising the voltage to potentially dangerous levels.
- The voltage indicator and automatic discharge features must be regarded as additional safety features and not a substitute for normal safe working practice.
- It is rare, but in certain circumstances, breakdown of the circuit under test may cause the instrument to terminate the test in an uncontrolled manner, possibly causing a loss of display while the circuit remains energised. In this event, the unit must be turned off and the circuit discharged manually.
- Test leads, including crocodile clips, must be in good order, clean and with no broken or cracked insulation.
- The instrument must not be used if any part of it is damaged.
- Insulation testing in wet conditions might be hazardous. It is recommended that this instrument is not used in these circumstances. If this is unavoidable, the user must take all necessary precautions.
- This instrument is not intrinsically safe and must not be used in hazardous atmospheres.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- A test can be started at any time via remote control. Measurement connections must be handled only with the remote control indicator beacon removed from its socket.
- In the event of the instrument failing in remote control mode the test must be stopped manually by pressing the TEST button.
- If performing a two-wire test without guard using the S1-1068, insert the blue safety plug.
- Switch the instrument OFF and disconnect any AC source, measurement leads, and all other equipment before opening the case to change the battery. The instrument must not be operated with the case open. DANGER! Hazardous voltages are exposed with an AC source connected and the case open.

1.1 Battery warning

- Do not disassemble or modify the battery. The battery contains safety and protection devices which, if damaged, may cause the battery to generate heat, rupture or ignite.
- Never heat the battery in a fire or otherwise.
- Do not pierce or damage the battery in any way
- Do not subject the battery to strong impacts/shocks.
- Do not expose the battery to water, salt water or allow the battery to get wet.
- Never short circuit, reverse polarity or disassemble the battery pack.
- In the event of a battery cell leaking, do not allow the liquid to come into contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts water and seek medical advice.
- Keep cells and batteries out of reach of children
- Seek medical advice if a cell or battery has been swallowed.
- Do not leave a battery on prolonged charge when not in use.
- Retain the original product literature for future reference

Note: Note: THE INSTRUMENT MUST ONLY BE OPERATED 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.

2. Symbols Used on the Instrument

	Warning: High Voltage, risk of electric shock
	Caution: Refer to user guide.
	Equipment protected throughout by double insulation.
	Line Power / mains
	EU conformity. Equipment complies with current EU directives.
	UK conformity. This equipment complies with current UK legislation
	Equipment complies with current ‘C tick’ requirements.
	Do not dispose of to landfill, sewage systems or by fire.
	Reference earth connection. Not a protective earth terminal
	Universal Serial Bus (USB)

CAT IV Measurement category IV: Equipment connected between the origin of the low-voltage mains supply and the distribution panel. CATIV applies to voltage measurement function of these instruments

CAT III Measurement category III: Equipment connected between the distribution panel and the electrical outlets

CAT II Measurement category II: Equipment connected between the electrical outlets and the user’s equipment.

3. General Description

Megger's new utility focused S1 range of Insulation Resistance Testers (IRT) consists of three models; one 5 kV, one 10 kV and one 15 kV. Resistance measurement capability is up to 15 TΩ for the 5 kV model, 35TΩ for the 10 kV and 50 TΩ for the 15 kV.

3.1 Features

- S1-568 measures to 15TΩ and S1-1068, S1-1568 to 35 TΩ
- 8 mA noise rejection plus 4 filter options ensure highest quality resistance measurements
- All models support diagnostic and over voltage tests – PI, DAR, DD, SV and ramp test
- PI predictor function (**PI*p***)
- Remote Control (RC) mode via USB cable
- Bluetooth® link for live streaming data to PC and downloading saved results
- Rapid charge Li-ion battery pack
- Operate and charge battery from AC source (except during test)
- Safety rating : CAT IV 600 V (S1-568, S1-1068),
  CAT IV 1000 V (S1-1568 only)
- Advanced memory with time/date stamp
- DC and AC voltmeter (30 V to 660 V)
- Large display with backlight
- CertSuite Asset compatible.

4. Instrument Controls and Indicators

1.	Positive (+) terminal	9.	Range rotary switch
2.	GUARD terminal	10.	Save button
3.	Negative (-) terminal	11.	Test mode rotary switch
4.	9-pin remote control socket	12.	LED indicating line power / mains
5.	USB device interface	13.	Filter button
6.	Navigation/OK buttons and select burn/ breakdown (Brd)	14.	Display
7.	TEST button with associated HV warning lamp	15.	Power socket
8.	Backlight button	16.	Functional earth terminal – **S1-1568 only**

V	User lock voltage		Delete records
	Timer	USB	Download via USB
	Save		Filter
	Open records		Alarm
	Battery		Breakdown mode
	Ramp test		Burn mode
	Danger HV		Refer to manual
	Fuse		Noise detected
	Bluetooth®		

5. Preparations for Use

5.1 Initial instructions

- Remove instrument, power lead and pouch from the packing box.
- Clip the test lead pouch to the lid.
- Open the lid and familiarise yourself with the layout and position of the IEC 60320 power inlet on the left side of the panel. An isolated USB socket and a 9 pin D-type connector for the remote control indicator beacon are found on the right side of the instrument. Test terminals are located to the rear of the front panel.
- Unpack test leads and place them into the lead pouch.
- Read the product manual, especially the warnings.
- A quick reference is provided in the instrument lid.
- Keep the original packaging for re-use

5.2 Power lead and battery charging

- If the power lead supplied is not suitable for your AC connection, do not use an adaptor. Always use a power lead fitted with the correct plug.
- Do not use an inadequately rated AC lead.
- If using a fused plug, ensure that it is fitted with a 3A fuse.
- Supply voltage: 90 to 265 V rms ac at 50/60 Hz.
- A green LED illuminates when line power/mains is present.
- The battery will charge over its operating temperature range as long as an AC source is connected, except when a test is in progress.
- For optimum battery life, charge the battery after each use. Full charge duration is up to 2½ hours but a first charge time of 3 hours is advised.
- The battery must be charged between 0 °C and 40 °C ambient temperature. If the battery detects a temperature outside this range the battery symbol will flash

5.3 Power lead connection table

Connection	UK/International	USA
Earth/Ground	Yellow/Green	Green
Neutral	Blue	White
Live (Line)	Brown	Black

5.4 Functional verification

Simply turning on the instrument at the central rotary switch will initiate a start-up process and the display will respond. If an error is detected 'Err' will be displayed with an associated error number.

5.5 Calibration

The S1-568 and S1-1068 are supplied with a calibration certificate.

UKAS accredited calibration certificates are available from Megger.

5.6 Storage

Instruments should be stored in storerooms which meet the storage temperature and humidity specifications listed in this document.

6. Operating Instructions

6.1 General operation

The S1-568, S1-1068 and S1-1568 insulation resistance testers (IRTs) are primarily controlled by two rotary switches and a TEST button used to start and stop a test (see section entitled, "Instrument Control and Indicators").

The range rotary switch includes an 'OFF' position; the instrument switches on by rotating the switch either clockwise or anticlockwise from this position. A range of test voltages for insulation resistance tests up to 5 kV (S1-568), 10 kV (S1-1068) and 15 kV (S1-1568) are available, including a user selectable voltage range which can be set between 40 V and 5000V or 10000 V or 15000 V depending on the model. The 'lockable' test voltage range (VL) can be adjusted within the settings function.

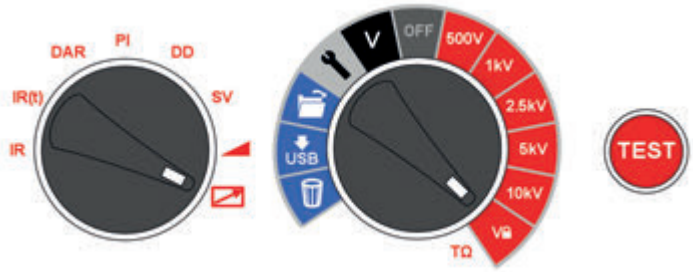
With the central rotary switch pointing at the spanner symbol and mode switch at IR, the settings for lock voltage, low resistance alarm, temperature / humidity and time/date are able to be changed and set.

A light blue coloured section of the rotary switch denotes memory functions; open records, download via USB or Bluetooth® and delete records. A dedicated save button is provided and all models have a backlight button

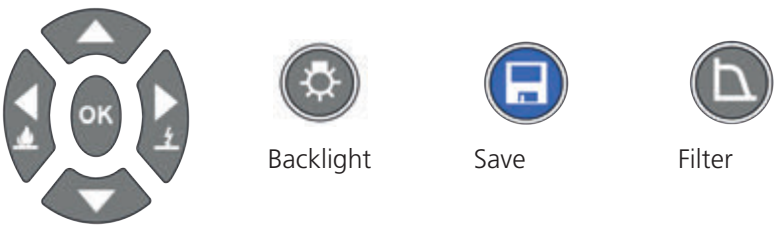
The mode rotary switch controls the insulation test type:

- Basic insulation resistance IR, timed insulation resistance IR(t), Dielectric Absorption Ratio (DAR), Polarisation Index (PI) and Dielectric Discharge (DD).
- Overvoltage tests Step Voltage (SV) and ramp test.
- Remote control mode (+ VL) test selection; start and stop of a test and other functions are set by a computer via a USB cable.

A cluster of directional buttons and an OK button are used in settings and memory functions. The up/down arrows also enable the test voltage to be adjusted during IR and IR(t) tests. Prior to the start of an IR or IR(t) test, holding down the left arrow button with a voltage level selected on the central rotary switch will activate burn mode. Burn mode is deactivated if the voltage range or mode is changed or by pressing the right arrow/breakdown button



Instrument controls are simple to operate. The central rotary switch incorporates the OFF position. The left hand rotary switch selects insulation test type. The TEST button starts and stops a test. Image depicts instrument setup for Remote Control mode.



Four arrow buttons + OK facilitate adjustment and selection of settings, voltages and modes. Breakdown/burn modes are set using the left and right arrow buttons. Backlight, Save and Filter functions are dedicated buttons.

6.2 Breakdown vs. burn mode

In breakdown mode insulation tests are automatically stopped and Brd displayed when a fault causes the applied voltage to drop rapidly. Burn mode IR tests ignore breakdown and continue to test the insulation and are therefore destructive tests. Burn mode is used to purposely create a carbon track in insulation to facilitate fault location.

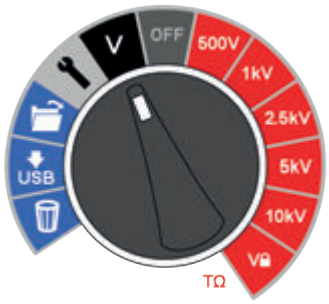
To enable measurements (IR, IR(t) modes) in very high noise substations, breakdown mode is turned off automatically when noise current exceeds 3.5 mA. Both breakdown and burn icons are switched off and the breakdown detector is disabled. High noise above 3.5 mA can appear to the instrument like a breakdown which would halt an IR/IR(t) test. Burn mode is not affected by the 3.5 mA limit.

To test for high noise select the voltmeter function and read the voltage. A high voltage will indicate a high noise environment

6.3 Voltmeter

A voltmeter is incorporated in the instrument and measures AC/DC voltage from 30 V to 660 V. Frequency (Hz) is measured and displayed for AC voltages. Voltmeter mode is activated by switching to 'V' mode as illustrated.

Positive and negative terminals are used for the voltmeter function; do not connect the GUARD terminal when in voltmeter (V) mode.

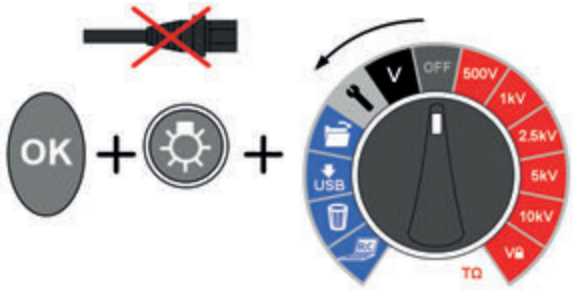


To assist user safety, the instrument will automatically switch to voltmeter mode if a voltage of 50 V or more is connected to the terminals. The measured voltage will be displayed accompanied by an intermittent beeper to warn the user that a dangerous voltage exists.

For further explanation see, "Running an Insulation Test" on page 11

6.4 Reset Default Settings

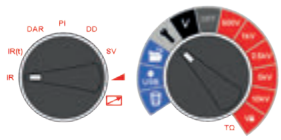
Remove AC source, press OK, backlight buttons and switch main rotary switch from OFF to setting icon.



7. Instrument Control

7.1 Initial setup

It is important to setup the Real Time Clock (RTC) on S1-568 and S1-1068 to ensure that records saved in the instrument are time/date stamped correctly. The RTC has a separate battery to maintain settings even when the primary battery is removed.



To set the clock and date, select the settings function (spanner) on the central rotary switch and turn the mode rotary switch to IR. Navigate using the left/right arrows to where the time and date is displayed.

Set the time using the up and down arrows. Change the hours and minutes then press OK to save

Select the day/month format required, i.e. d:m for day:month or m:d for month:day and press the right arrow button, then set the date and press OK to save

A tick on the left of the display indicates that a setting is saved, a cross is displayed during adjustment indicates that it is not set.

Select OK to confirm and ▶ to go to the next setting.

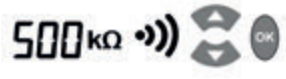
7.2 Lock Voltage

The user selectable 'lock' voltage range is set by adjusting the displayed voltage using the up and down arrow buttons. When the desired voltage is displayed it is saved by pressing the OK button. The setting does not change even if the instrument is switched off.

Press ▶ to go to the next setting.

7.3 Alarm setting

A low resistance alarm can be set to sound when the resistance of an insulator reaches this limit. The default alarm setting is 500 kΩ and inactive (x is displayed on the right of the display). Set range and mode switches to the settings and IR positions respectively. Press the right arrow button once. The low resistance alarm can be set at the default value by simply pressing the OK button, or changed to a different alarm resistance level using the up/down arrow buttons and save it by pressing OK.



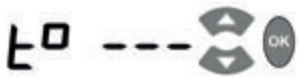
Press ▶ to go to the next setting.

7.4 Recording temperature, humidity

The S1-568 and S1-1068 are able to record insulation temperature and humidity measured by independent sensors. If you do not wish to record either temperature or humidity do not change the default setting or reset it if it was previously set. If temperature entry is enabled the humidity entry can be selected.

Move the central rotary switch to point to settings and press the right/left arrow buttons until 't° ---' is displayed. The default setting is no temperature record. This can be changed by pressing up or down arrows to select either °F or °C temperature entry. Pressing OK will confirm the settings. If humidity is to be recorded it is necessary to set the temperature and humidity before pressing OK to save them with a test result. Humidity will either be set "On") or not set ("---").

When prompted for temperature or temperature and humidity they can be entered using the up - down arrows. Temperature is entered in 1 degree steps, humidity is entered in 1% steps. The up and down arrows adjust the selected value, the OK button accepts the displayed value and advances to entering humidity if temperature is currently being entered



Temperature and humidity setting and is entered as follows:

Temperature and relative humidity are entered together:

1. At the t° --- prompt change the setting even if it shows the setting you require
2. Set t° to setting you require, it will flash, then press left arrow key again, do not press OK.
3. Enter rH setting On and press OK to confirm both temperature and relative humidity readings will be recorded

It is not possible to enter only a relative humidity reading as it is meaningless without temperature.

Press  to go to the next setting.

7.5 Filter button and Adaptive filter settings

All S1 models have a dedicated filter button which can be set before or after starting an IR test. 

The filter has four settings; 10 s, 30 s, 100s, 200s. It is also possible to turn off the hardware filter to speed up the response when there is no noise present. If a one minute spot test is to be performed a suitable filter would be 10 s or possibly 30 s activated towards the end of the test. Setting a longer filter would be meaningless because the test only lasts 60 s. The S1 range memorises all results in the current test to be able to give an instantaneous meaningful filtered reading of results as long as the duration of test is longer than the filter length.

7.5.1 Adaptive filter settings

To set the filter settings, use the up and down arrow to choose from the following:

- Hardware filter ON (Hard Fil)
- Adaptive filter ON (AdAP Fil)
- All filters ON
- All filters OFF

Select  to confirm. Exit settings by changing the central rotary switch to a different position.

7.6 Breakdown / burn mode – in IR & IR(t) test modes

The insulation resistance 'IR' test operates in either 'Breakdown' or 'Burn' mode.

	Breakdown		Burn

	Default mode is breakdown. Left and right arrow buttons toggle between burn and breakdown mode when a voltage range is selected. In the breakdown mode the breakdown icon will be indicated. In breakdown mode the test will automatically terminate and display Brd on detection of a breakdown to prevent damage to the insulation

	**Burn mode disables the normal breakdown detection and test voltage continues after breakdown of the insulation. This enables the location of a failure to be detected but it is a destructive test.** Due to the potential damage that could occur, the unit produces two long beeps when starting a test with burn mode activated.

7.7 Running an insulation test

Before testing any reactive load ensure that the insulation is fully discharged
15 kV – The functional earth (⏚) terminal. Refer to Note below.

Great care should always be taken when connecting the leads to a system to be tested. Even isolated systems may exhibit charges or induced voltages and appropriate Safe Working Practices must be employed.

On connection of the test leads prior to starting a test, any voltages of 50 V or more will be indicated on the display, accompanied by an intermittent beeper, (see Voltmeter pg. 9). This is especially likely in electrically noisy environments.

Should electrical noise be present it will cause a current to flow through the instrument's internal discharge resistors. If this becomes excessive and exceeds instrument rating, damage to the instrument may result.

The S1-568, S1-1068 and S1-1568 have been designed to handle high noise currents up to 8 mA. If currents above 8 mA are detected the instrument will sound an urgent "warble" tone and be accompanied by the symbols ⚠ ∿ .

Note: When powered by battery and with the mains supply disconnected, the pins on the mains socket may be electrostatically charged to a high voltage. There is not enough energy for this to be hazardous but, to reduce discomfort from accidental discharge if the mains inlet plug is touched, it is strongly recommended that the functional earth terminal is connected to a convenient earth or unipotential protection circuit. The user is fully protected for safety by double insulation and this connection need not be capable of taking a fault current.

The instrument should be immediately disconnected from the supply after discharging the dc test voltage taking care to ensure Safe Working Practices. (NB very high induced voltages may be present)

To assist user safety, the instruments will not permit a test to be started if the induced voltage exceeds 8 mA.

It is possible to adjust the test voltage using the up and down arrow buttons, either before or during an IR and IR(t) test. Once a test has begun, it is advisable to only adjust the voltage in the first 10s of the test to prevent interference with the capacitive and absorptive currents in the insulator.

A test can be started by pressing the 'TEST' button for approximately 3 seconds from either the test screen or voltmeter screen. A timer will be displayed to indicate elapsed time during the test. The test is stopped by pressing the TEST button. As soon as the test is stopped a discharge of the insulator is automatically initiated and the display indicates a voltage if present on the insulator.

Do not disconnect instrument leads or clamps until the LED and display warnings are switched off indicating that the unit under test is discharged! Significant current can be stored in reactive loads which act as capacitors or inductors, which can be lethal.

The display shows the final resistance result, capacitance, test current and time constant (TC) in addition to test duration. On all S1 models the result can be saved by pressing the dedicated save (💾) button after a resistance test is complete. The save icon will appear momentarily to confirm the data is saved. If a full test curve is required the user must select logging by pressing the save button before starting the test. In this case, data will be logged every 5 seconds for the duration of a resistance test. It is not possible to log voltages in voltmeter mode.

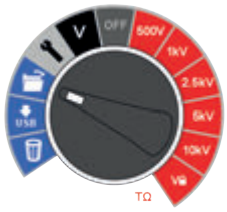
If temperature entry has been activated a prompt will appear for the user to enter a temperature reading after IR and IR(t) insulation tests. If relative humidity has been activated the user should enter a humidity reading. DAR, PI, SV, Ramp and DD tests will not prompt for temperature or humidity input.

Display backlight is activated by pressing the (☼) button. The backlight button can be pressed a second time to deactivate the backlight. Automatic deactivation will occur after a pre-set timeout period if not deactivated manually.

8. Memory functions, downloading and remote control

All S1 models have advanced storage, recall and download functions to facilitate documentation of insulation tests. Download is enabled via a USB cable or Bluetooth® connection.

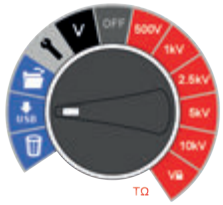
8.1 Recall results



Setting the central rotary switch to 'open folder' position enables the user to recall saved results beginning with the most recent result. Up and down arrow buttons enable the user to scroll through results based on a sequential four digit index. Left and right arrow buttons scroll through a single result showing all saved test data including time/ date. Where logging has been enabled, only the final result is displayed on screen. The full result can be viewed by downloading to PowerDB/PowerDB Lite.

In saved results, the test mode is identified by the icon or abbreviation of each test on the display. In addition, the open folder icon is displayed to indicate recall memory mode.

8.2 Download results



Downloading data function is selected by switching to the 'download via USB' icon on the central rotary switch. Before starting a download a USB PC-to-device cable must be connected between a PC and the USB port on the instrument, or alternatively a Bluetooth® connection setup to a suitably enabled PC or similar device.

PowerDB Pro, Advanced and Lite are Megger's asset and data management software packages with integrated forms for the S1 range of instruments. Ensure that the applicable version of PowerDB is loaded and running on the PC, then select the appropriate S1 by model number.

When using the USB cable, check the serial port allocation on Device Manager, and enter the serial port allocated when starting PowerDB.

PowerDB offers instructions specific to the S1 range regarding the download procedure. When results are downloaded the IRT can be disconnected from the PC/Bluetooth® device after the application releases the port.

8.3 Deleting results

There are two delete functions; delete a single result and delete all results. Select the bin icon on the central rotary switch. The first record indicated contains the result of the last test performed. Up/down arrows navigate through records and the OK button is used to select delete where the 'X' changes to a tick and the on screen bin icon flashes. A subsequent press of the OK button activates the deletion.

8.4 Real-time output during insulation tests

PowerDB can be used to record real time data output from the S1 range. Voltage, current and resistance data is sent at a rate 1 Hz from the IRT and displayed in real time on a graph, e.g. a plot of current (µA) versus voltage (kV) for the ramp test.

Before running a test where a real time output is required, attach a PC running PowerDB Pro, PowerDB Advanced or PowerDB Lite via a USB cable or Bluetooth® link.

Start the application and activate real time data capture in the form of choice. As soon as the test is started real time data output will begin. When the test is complete ensure that the form is saved in PowerDB Pro/Advanced/Lite.

8.5 Bluetooth® interface activation

The Bluetooth® interface is set with the main rotary switch pointing to setting and the mode switch pointing at the remote control icon.

To connect a PC or other intelligent device, enable the Bluetooth® on the S1 and the PC. Let the PC find the S1, its serial number will be part of the identifier and default passcode for connection is '0000'. Create a connection to the S1 and check the link works by connecting directly to the S1. It is also possible to check the Bluetooth® link using a terminal emulator.

PowerDB Lite running on a PC can be used to connect to the S1 units via Bluetooth®. Port allocations can be found in Windows Device Manager.

Memory functions, downloading and remote control

8.6 Testing with CertSuite Asset via Bluetooth®

The instrument can be connected to a range of remote devices for receiving the test results and passing them to the cloud-based Megger CertSuite Asset software. They are:

- Android phones and tablets
- Windows laptops and desktops

Each result can be transferred from the instrument to a mobile device running CertSuite™ in a browser, from which they are automatically transferred to the cloud if a network is available, or immediately a mobile network is detected if not available at that time.

Test results on the mobile device are synchronized with the cloud system every 90 seconds to reduce any risk of data loss from the mobile device.

A summary of the installation sequence is:

1. Create an account on the CertSuite™ web site. *Refer to 8.7 Creating a CertSuite Asset account on page 20*
2. Switch on the Bluetooth® mode on the S1. *Refer to 8.5 Bluetooth® interface activation on page 19*
3. Open the browser on your mobile device or Windows PC and log in to your account using the details from (1) above.
4. Connect CertSuite™ to your S1 from within CertSuite Asset by clicking on Get Data.

Note: The S1 does NOT need to be connected to a mobile device. The CertSuite™ software should find the instrument if the S1 and mobile device Bluetooth® are active.

8.7 Creating a CertSuite Asset account

Before CertSuite Asset can be used an account has to be created. Follow the guidance on the CertSuite™ web site.

Keep a record of your account information and password as you will need this when using CertSuite Asset on mobile devices.

8.8 Sending test results to CertSuite Asset

Once the S1 and CertSuite Asset are connected, results can be transferred to the mobile device. While the test is being run, the app builds a graph of the test results. it can store client's details, asset details, photos and comments.

9. PowerDB

PowerDB is software used for the collection and reporting of data from maintenance and inspection activities performed on electrical equipment used in the generation, transmission, and distribution of electric power.

The software includes interfaces for many test instruments and allows for automated testing and data acquisition, as well as imports from various file formats. Result and summary reports can be easily generated.

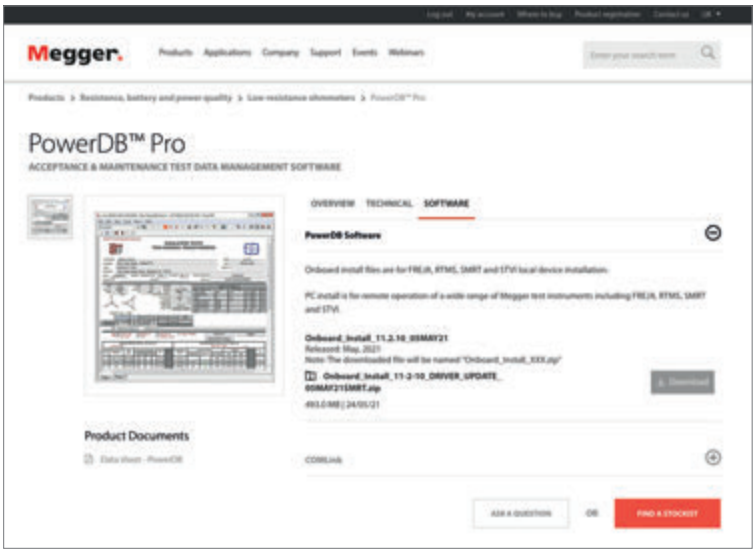
Three editions of PowerDB are available:

- PowerDB Pro
- PowerDB Advanced
- PowerDB Lite

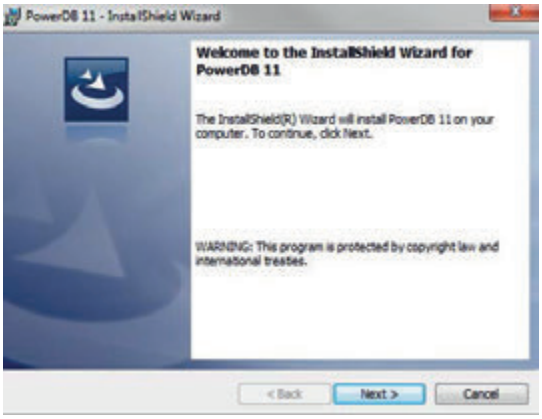
PowerDB provides a simple and consistent user interface to many Megger instruments including the DELTA Series Power Factor Test Sets, 3-Phase TTR units, earth testers, 5 kV and 10 kV insulation resistance testers (IRTs), and many more. PowerDB Lite is bundled with the Megger's MIT and S1-Series. The new S1-Series has remote control capability and a specific application to enable remote control testing of assets.

9.1 Download PowerDB

You can now download direct from the Megger website to ensure that you have the most recent version available.



The latest edition will be at the top. Click the "download" button beside the file. This will ask if you want to open or save the file. By clicking "Save" you will begin to download the installation package. Then just follow the onscreen instructions to complete installation.



9.2 Interfacing S1 range to PowerDB

The new S1 range has two PC interfaces; a USB device port and a Bluetooth® interface. Remote control is only available via the USB interface. The MIT range has a USB cable connection.

Connect the S1 to a PC via the USB cable provided and enable the driver for the S1 or MIT to be found via the internet. The instrument does not need to be powered up to respond to the driver as it is powered via the USB cable.

Run PowerDB Lite software by clicking the PowerDB Lite icon on your desktop. Make sure you are using PowerDB version 10.5 or higher.

Select the appropriate soft button for the instrument you are testing with from the window entitled, "Select An Instrument". This will take you to the Instrument Configuration window.

9.3 Connecting via Bluetooth® when using an S1

Connecting to the S1-Series via Bluetooth® is a straightforward process:

- On the S1 instrument select the left hand test mode switch to point at the remote control icon and the central switch to the spanner icon as illustrated.
- The Bluetooth® icon will be visible on the top right of the instrument display. If the word 'OFF' is flashing, press the up arrow once to select and 'ON' will flash. Confirm the setting by pressing OK

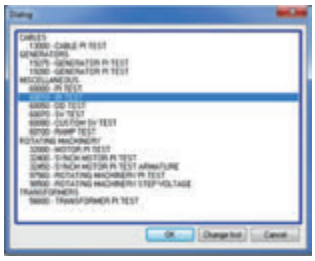
Bluetooth® is now enabled and will be detected by a PC with an activated Bluetooth® interface. The S1 product can be found by exploring devices. The S1-Series will identify itself by the model number and serial number on the PC. The Device Manager soft button is in Power DB, Instrument Configuration pop-up.

Click the Device Manager soft button to access Windows® Device Manager and verify that a serial port has been allocated to the instrument

- Expand the 'Ports section in Device Manager. One serial port should be allocated to 'Megger Device (COMxx)' where xx is the port number.
- If the Bluetooth interface is to be used, expand the ports in Device Manager and ensure that a Standard Serial over Bluetooth link (COMxx) has been allocated. There will be two ports which look similar, for example one may be COM6 and the other COM7. The lower number is to be used for PowerDB Lite.

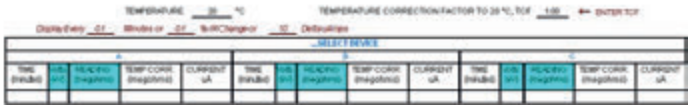
Ensure that port number xx is allocated correctly in the Instrument Configuration window, then click the OK to complete configuration after ensuring that the correct model is selected

Select the required test mode from the Select a Form window and click OK to continue



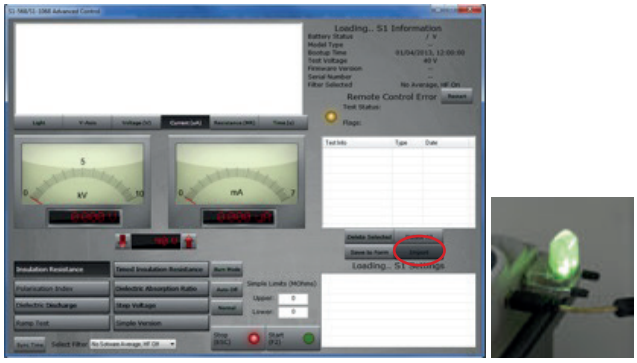
After the form loads, click the ‘zap’ icon on the toolbar to initialise the instrument. An ‘OK’ confirmation appears at the top of the form if communications have been successful.

Scroll down the PowerDB form until you see a table with cyan filled headers. RIGHT CLICK once on one of the cyan coloured areas to activate the S1-Series remote control application. The cyan filled cells represent three phases A, B and C. Right clicking on a phase will open up the appropriate application



9.4 S1 and Remote Control Application

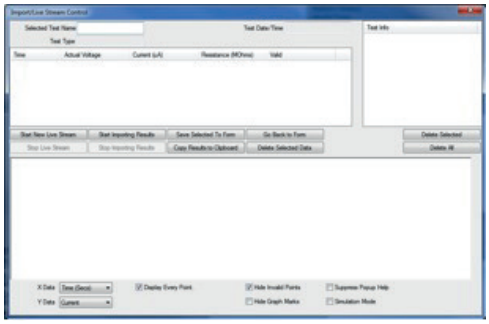
To use the remote control application the remote control safety beacon must be inserted into the 9-pin socket found adjacent to the USB port on the right side of the instrument as you look at it. All manual test functions are available in remote control as well as real-time streaming of test data and a graphical representation of resistance, voltage or current in the top left window



To activate the Import/Live Stream Control application click the Import soft button (circled) in the remote control application

9.5 Import/Live Stream Control Application

If you are using an S1 and clicked Import from the remote control application the Import/Live Stream Control Application will launch.

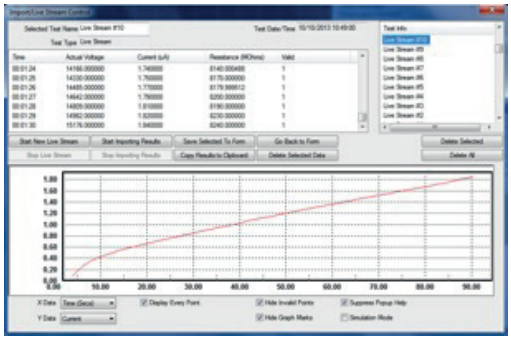


Import/Live Stream Control application enables capture of live streaming data directly by activating the Start New Live Streaming function. Results are recorded once a second for the duration of the test

Other functions include:

- Save Selected To Form – this soft key saves a selected test result in top right hand menu to the current form in PowerDB Lite. Typically three tables are available in the PowerDB form representing three phases named A, B and C. Tests listed in the Import/Live Stream Control application listed under Test Info can be saved in any form by exiting the logger (Go Back To Form), right clicking the require phase in the form and selecting to Save Selected To Form from the logger
- Copy Results to Clipboard function facilitates a copy of all data to Excel and other popular software
- Delete Selected Data – removes test data from the Test Info section
- Start Importing Results – download results saved on the instrument

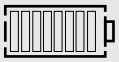
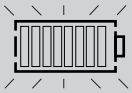
Sample remote control application: a timed insulation resistance test result shortly before completion of a 90 s test.



Sample Import/Live Stream Control application after a test.

10. Battery indicator

The battery symbol on the LCD display contains four pairs of segments. The battery is monitored continuously when the instrument is turned on. The charge remaining in the battery is indicated by segment pairs as follows:

Fully charged battery	
50% charged battery	
Tests cannot be started, insufficient charge	
Symbol flashes when there is not enough charge for a test and the instrument will turn itself off.	

When mains power is present the indicator shows the battery is being charged by animating the segments of the bar graph.

A blinking full battery icon indicates that the battery is prevented from charging due to the temperature being out of the allowable charge temperature range, 0 °C to 40 °C, or that the battery has failed.

11. On screen error reporting

Should an error be detected during the operation of the S1 instrument, an error code is reported preceded by 'Err' with the 'read handbook warning'.

Error codes are given in the following table.

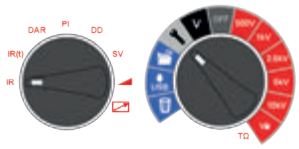
'Err' code	Fault
2	Output voltage over limit
3	FIFO (memory) overflow
4	HV board mismatch with control board setup
5	Battery low error
6	Control board detected inter-board communication failure
7	Test button stuck
8	Measurement board i2c failed
9	Measurement board detected inter-board communication failure
10	Isolation supply feedback fault
11	Instrument attempted auto power off but failed
12	HV circuit control fault

If an error occurs do not attempt to repair the instrument. Obtain a repair number from Megger Instruments Limited, carefully pack in a suitable box and send the faulty instrument to the nearest Megger Approved Service Centre, if possible noting the error that was reported.

12. Measurement Modes

12.1 Spot' IR test

The spot insulation resistance test (IR) is selected on the test mode rotary switch. Select the IR setting and then the required test voltage using the preconfigured voltage ranges on the central rotary switch or the V🔒 user settable/ lockable voltage range. All preconfigured voltage ranges, but not V🔒, are adjustable using up and down arrow buttons before and during the test, but their use should be limited to the first 10 seconds of IR or IR(t) test. Press and hold TEST for up to three seconds to start the test.



To set the user defined lock voltage V🔒, turn the central rotary switch to settings and the mode switch to IR. The preset voltage will flash and can be changed using the up/down buttons. When the required maximum voltage is displayed, press the OK button to save the setting. This setting will remain until it is reset.

Whenever V🔒 is selected the set voltage is shown on the display. The voltage lock is useful when, for example, testing insulation of XLPE cables that should not be tested above 5000 V. The lock function will ensure it does not exceed the V🔒 voltage within the stated output voltage accuracy.

Time Constant (TC) = Rinsulation x Cinsulation

On test completion, insulation capacitance (C) and Time Constant (TC) associated with it is calculated and displayed.

12.2 Timed IR test

A timed test IR(t) will automatically terminate an insulation test after a preset time. Default timer is set to 1 minute and is adjustable within the settings function. This is a useful feature which saves the user watching the display for the full duration of the test and the possibility of missing the 1 minute reading.

Turn the central rotary switch to the settings position. Select IR(t) on the test mode rotary switch. The default time of 1:00 minute will flash prompting the user to select a new time using the up/down arrow buttons. Press OK to set test duration and turn central rotary switch to desired test voltage. Press and hold TEST to start the test.

12.3 DAR, PI and PI predictor insulation tests

DAR and PI tests are measurements of resistance over time expressed as a ratio of resistance at time t2 divided by resistance at time t1. The assumption is that insulation temperature does not vary widely over the duration of the test so the resulting DAR and/or PI value are temperature independent. Testing should be done at or below 40 °C, 104 °F for this assumption to hold.

DAR and PI timers t1 and t2 are set when DAR or PI is selected on the test mode rotary switch, with the central rotary switch in the settings position. Timer t1 is set first, the up and down arrow buttons are used to change from the default values to anything from 30 seconds to 10 minutes. Press OK to confirm the t1 settings, then set Timer t2 and press OK to confirm again.

To turn on PI prediction (**PI*p***) testing, select PI on the test mode rotary switch, and with the central rotary switch select the required insulation test voltage. Press the OK button to toggle the **PI*p*** on and off. Then press and hold the TEST button to start the test.

Note: when using the PI predictor the t1 and t2 timers cannot be changed as with the standard PI test. The default values of 1m (t1) and 10m (t2) apply.

DAR and PI insulation test voltages are selected on the central rotary switch. Rotate the switch to the required insulation test voltage. Press and hold TEST to start a DAR/PI test.

12.3.1 What is a DAR test?

DAR is defined as the ratio of insulation resistance at 1 minute divided by insulation resistance at 30 seconds, although a 1 minute, 15 second DAR is also popular:

DAR = IR60s / IR30s

Insulation Condition	DAR result
Poor	<1
Acceptable	1 – 1,4
Excellent	1,4 – 1,6

12.3.2 What is a PI test?

IEEE standard 43-2000, Recommended Practice for Testing Insulation Resistance for Rotating Machines, defines PI as the ratio of insulation resistance at 10 minutes divided by insulation resistance at 1 minute:

PI = IR10 min / IR1 min

If IR1min > 5000 MΩ the PI may or may not be an indication of insulation condition and is therefore not recommended by IEEE std. 43.

Insulation Condition	PI result
Poor	< 1
Questionable	1 – 2
Acceptable	2 – 4
Good	> 4

PI results > 1.5 are regarded as acceptable by IEC60085:-01:1984 for thermal class rating A, and PI results > 2.0 for thermal class ratings B, F and H.

12.3.3 What is a PI predictor (PI*p*) test?

PI Predictor uses the first part of the IR curve to predict what the whole curve would be after a 10 minute test. During the start of the PI test, the scale will NOT flash, then once the prediction has started the PI scale starts to flash and Prediction starts after 3 minutes.

As the confidence in the prediction grows the scale becomes narrower, when the PI Predictor is 100% confident in the prediction, the test will end automatically and the predicted PI value will be displayed. The prediction can take between 3 and 7 minutes depending on the testing conditions.

If an open circuit is detected, the PI Predictor test will automatically stop after 10 seconds and an error code will appear (UC20, *Refer to 12.3.4 PI predictor (Plp) Error codes: on page 29*)

12.3.4 PI predictor (PI*p*) Error codes:

If there is an error when running the test using PI predictor, the following error codes will appear on the instrument:

Error code	Description
UC10	Too noisy for prediction
UC20	Not connected (e.g. open circuit)
UC30	Underrange (e.g. short circuit)

12.4 Dielectric Discharge Test

The Dielectric Discharge (DD) or reabsorption current test operates during the discharge of the dielectric under test. Originally developed by EDF, France's power utility company, it is a diagnostic insulation test that allows ageing, deterioration, and voids in the insulation to be assessed. The result is dependent on the discharge characteristic which tests the internal condition of the insulation and is largely independent of surface contamination.

The insulator must be charged until the only remaining component of current is leakage current. On discharge the capacitive component of the discharge current decays from a high value with a relatively short time constant of a few seconds. The released reabsorption current decays from a lower value with but has relatively long time constant of up to several minutes.

The DD timer (t1) defaults to 30 minutes of charge, which is generally sufficient time for full absorption to take place in an insulation material. The default test voltage is set to 500 V so the primary rotary switch must be set at 500 V. The discharge timer (t2) defaults to 1 minute. Timer settings t1 and t2 are adjustable.

DD should be selected on the test mode rotary switch and settings on the central rotary switch.

The 'DD' test requires the instrument to measure the discharge current 1 minute after the removal of the test voltage. On completion of the test, the instrument uses the current, the test voltage and calculated capacitance to produce a figure of merit indicating the quality of the insulation.

DD = I1min/(V x C)

where I1min is the discharge current in mA one minute after removal of the test voltage V in Volts and C is the capacitance in Farads.

Homogenous insulation will have a DD value of 0, while good multi-layer insulation will have a value up to 2. The following table is a guide to DD test results:

Insulation Condition	DD result
Bad	> 7
Poor	4 – 7
Questionable	2 – 4
Good	< 2
Homogenous	0

12.5 Step Voltage Test

The SV test is a controlled overvoltage test that can be applied to stator and rotor windings on synchronous and asynchronous AC motors and the armature and field windings on DC motors. It is advisable to perform a PI test before an SV test to determine if the insulation is suitable for overvoltage testing. If a PI test was performed to verify the winding's suitability for overvoltage testing, the winding must be completely discharged before an overvoltage test is performed.

The SV test is based on the principle that an ideal insulator will produce identical readings at all voltages, while an insulator which is being over stressed, will show lower insulation values at higher voltages.

The SV test is selected using SV mode switch position and any voltage range including VL range setting. If no custom SV test has been setup then a standard five step test will be performed where each step is 1/5th of the test voltage and 1/5th of the test time If a standard 5 step test is required at the VL voltage, set timer 1 to 0 sec. if a custom SV test has previously been setup.

12.5.1 Rotary switch setting indicated:

For a regular 5 step SV test, resistance readings for the first four 'steps' are displayed under consecutive time designators '1m' to '4m'. The 5 minute reading is displayed by the main display. The standard SV test duration can be adjusted if desired from the 5 minute default value using the up/down arrows and OK to save the setting. If the default 5 minute test duration is changed by the user the four readings will not show the respective '1m' to '4m' indicators.

For the standard five step SV test the step timer will always be set to total test time divided by 5. Too short a step time may result in incorrect readings and too long a step time may over stress a motor.

A custom SV can be created with up to 10 steps. To set timing and voltages for this test press the right arrow from within the timer setup for the SV test. The SV settings are adjusted using up and down arrows and confirmed by OK. The custom SV enables each step duration and test voltage to be set on up to 10 steps. When all required steps have been setup change the subsequent time to 0 sec. To run the custom SV test, the mode switch is set to SV and main rotary switch to VL.

The reference standard for step voltage testing is IEEE 95-2002.

12.6 Ramp Voltage Test

The ramp voltage test is an overvoltage test similar to the SV test but with many very small steps. The slow continuous voltage ramp is less likely to result in unpredictable damage to the insulation than the rapid step increases employed in SV test.

The typical voltage ramp (dV/dt) is 1 kV/min which is the default for S1 range. This value is user adjustable from the settings function with the mode rotary switch set to ramp. Up and down buttons are used to adjust dV/dt to the required rate and OK confirms the setting. Press and hold TEST to start.

The test will ramp the voltage until it reaches the selected test voltage unless a breakdown or sudden fall in voltage is detected. The result displayed after the test is the final insulation resistance, voltage and current. If the result is saved a complete curve of current (µA) and voltage (kV) is recorded and can be read into PowerDB, PowerDB Lite or converted to a spreadsheet so that the current vs. voltage curves can be compared to published curves in IEEE 95-2002.

12.7 Remote control mode

Remote control of the S1 range is possible on all models via USB cable only and the Bluetooth® link is disabled.

Coloured lights in the dongle indicate remote control status. When the indicator is lit green it means that remote control is activated and when red that the instrument is not in remote control mode.

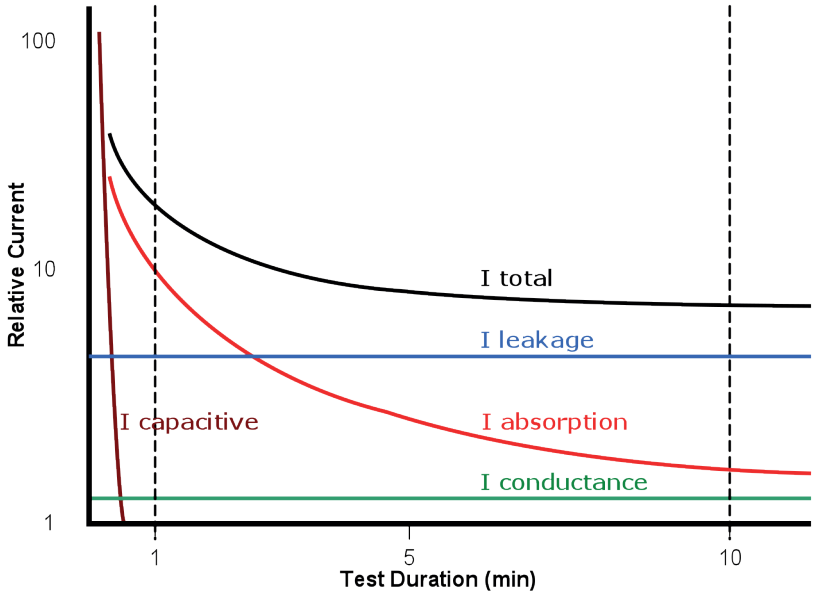
Remote control mode is activated with the test mode switch pointed at the remote control icon and the main rotary switch pointed at V🔒 - 

All manual test modes can be setup, tests started and stopped remotely.

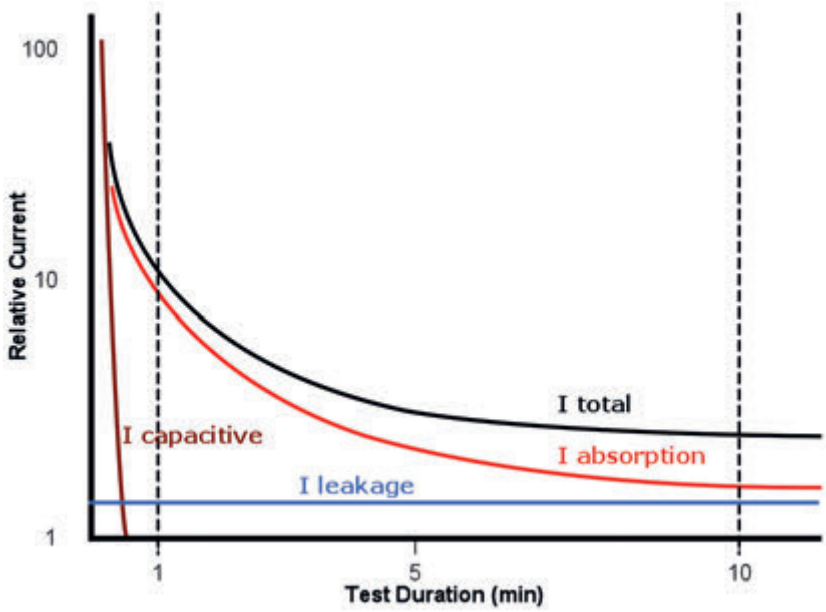
13. Measurement Techniques

13.1 Understanding Measurement currents

Insulation resistance is defined as the dc test voltage divided by the total current flowing in an insulator. The total has four components; capacitive current, absorption current, conductance current and leakage current. If a generator has wet or contaminated windings conductance current will be present



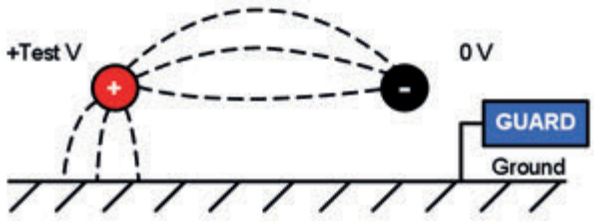
In the case of dry insulation conductance current may be negligible, and the leakage current may be low, in which case the absorption current will dominate the total current measured.



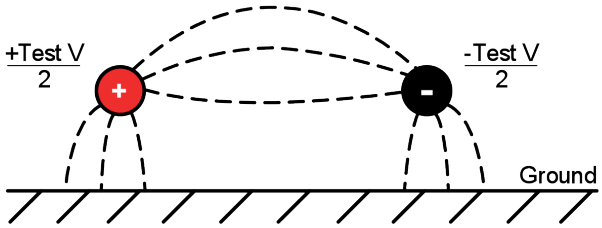
13.2 Insulation measurements above 100 GΩ

Measurements up to 100 GΩ can be made without any special precautions, assuming that the test leads are reasonably clean and dry. The guard lead can be used to remove the effects of surface leakage if necessary. When measuring resistances above 100 GΩ, the test leads should not be allowed to touch each other, or any other object since this will introduce leakage paths. Sharp points at the test lead connections should also be avoided since this will encourage corona discharge.

The output is isolated, and so will float relative to ground such that the positive terminal is at plus half of the test voltage, and the negative terminal is at minus half of the test voltage with respect to ground. Leakages therefore occur between the positive terminal and ground, between the negative terminal and ground, and directly between the positive and negative terminals. These leakages have a significant effect and can occur through air



If the guard lead is grounded, and since the negative terminal is at the same voltage as the guard terminal, the leakage into the negative terminal will be considerably reduced. This will improve accuracy because the current flowing into the negative terminal is measured by the instrument and used to calculate resistance. This technique is only permissible if the item under test is isolated from ground. In this context isolated means insulated by a resistance of at least 5 MΩ for the positive terminal, or at least 10 kΩ for the negative terminal.



Conversely, if the positive terminal is grounded, then the negative terminal will be at a voltage equal to the test voltage relative to ground, which will result in an increase in leakage current, and worsening of measurement accuracy.

When making measurements above 100 GΩ therefore, the user should ground the Guard lead where possible otherwise parallel leakage paths may occur.

Alternatively, screened leads are available as an optional accessory from Megger. When using a screened lead the screen is plugged into the Guard terminal, diverting any leakage currents. This considerably improves measurements made with a floating output, where the leads might touch each other or another object other than the test piece.

13.3 Terminals

There are three test terminals marked +, - and GUARD. These terminals are designed to accept only genuine Megger test leads. Shutters across the terminals prevent accidental ingress of dirt and other objects. Test lead plugs interlock with the shutters and are released by rotating the test lead plug by a quarter turn.

The GUARD terminal, as explained below, is only used in cases where surface leakage currents need to be eliminated. Most measurements use just the + and – terminals. The instrument's internal voltage generator drives the + terminal with respect to the – terminal, current being measured in the – terminal.

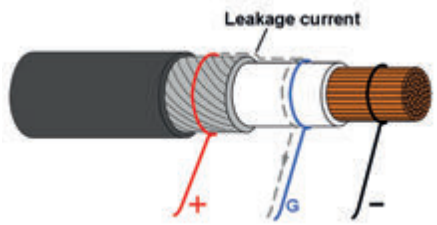
13.4 GUARD terminal, screened leads

For basic insulation tests and where there is little possibility of surface leakage affecting the measurement it is unnecessary to use the guard terminal, i.e. if the insulator is clean and there are unlikely to be any adverse paths.

However in cable testing for example, there may be surface leakage paths across the insulation between the bare cable and the external sheathing due to the presence of moisture or dirt. Where it is required to remove the effect of this leakage, particularly at high testing voltages, a bare wire may be bound tightly around the insulation and connected via the third test lead to the guard terminal 'G'.

The guard terminal is at the same potential as the negative terminal. Since the leakage resistance is effectively in parallel with the resistance to be measured, the use of the guard causes the current flowing through surface leakage to be diverted from the measuring circuit. The instrument therefore reads the leakage of the insulator, ignoring leakage across its surface.

The display will show a warning and fuse terminal symbol if the internal guard terminal fuse has blown. The instrument must be switched off to clear the message before further testing is permitted. The fuse must be replaced by an authorised repairer. The instrument may be used in the meantime if the guard terminal is not used. Refer to notes regarding measurements above 100 GΩ above.



This diagram illustrates GUARD terminal used to prevent surface leakage on cable insulation from affecting a high resistance measurement.

Screened leads are available for the complete range of insulation testers. They are useful in HV switchyards where induced currents are an issue. The screen connects to GUARD and prevents induced currents in the lead.

14. Preventive Maintenance

14.1 Cleaning

Disconnect the instrument and wipe it with a clean cloth slightly damped with soapy water or Isopropyl alcohol (IPA). Care should be taken near the terminals, IEC power and USB sockets

14.2 Care of the instrument

The instrument should always be handled with care and not dropped. Always ensure that the instrument is secured when being transported to prevent mechanical shock

14.3 Leads

Leads are silicone insulated and perform well in all weather conditions. Always keep the leads in the clip-on lead pouch supplied with the instrument.

Regular inspection of leads is recommended to ensure they are not damaged in any way. Damaged leads could affect insulation resistance readings and are a safety hazard

14.4 Battery Care

The battery should be charged on a routine basis at an absolute minimum of once a year. However more regular charging, i.e. once per quarter is preferable.

Never attempt to charge the battery below 0 °C or above +40 °C. The battery is charged by connecting line power at the instrument IEC power socket.

Store the instrument in a cool, dry location to improve battery life. Storage temperatures below freezing should be avoided

14.5 Replacing the battery

Read and fully understand the warnings on the Li-ion battery in the Safety Warnings section of this document.

Switch the instrument OFF, and disconnect the mains supply, measurement leads, and all other equipment before opening the case to change the battery. The instrument must not be operated with the case open. DANGER! Hazardous voltages are exposed with the mains connected and the case open.

The battery pack contains Lithium-ion cells and should be replaced when it no longer holds a charge. A new battery is available as a spare part from Megger. Genuine Megger battery packs must be used. Failure to use genuine parts may affect product safety performance and will invalidate your warranty.

Replacement involves removal of four screws from the bottom of the instrument after which the base can be lifted away from the front panel and internal moulded assembly. Care should be taken to keep the front panel and moulding assembly together. The battery pack is housed within a grey moulded cover secured by four screws.

Preventive Maintenance

14.5.1 S1-568, S1-1068 battery replacement instructions:

1. Switch the instrument OFF, and disconnect the AC supply, measurement leads, and all other equipment before opening the case to change the battery.
2. The instrument must not be operated with the case open. DANGER! Hazardous voltages are exposed with an AC source connected and the case open.
3. Remove the lid and invert the lower case resting the front panel on a soft surface so as not to damage the keypad.
4. Remove the four case fixing screws and lift off case bottom.
5. Carefully unclip the battery cable connector leading from the main printed circuit board to the battery and remove the cables from recesses designed to hold them in place.
6. Remove the four screws and lift off the battery cover.
7. Remove the used battery and replace with a genuine spare battery ordered from Megger, ensuring correct orientation of cable exit.
8. Route the battery cables via the recesses and clip the battery connector to the printed circuit board battery receptacle ensuring correct orientation.
9. Replace the battery cover and secure with the four screws.
10. Ensure the alignment of the instrument panel and high voltage moulding, then replace the lower case and secure with the retaining screws.
11. Check and verify instrument operation.

14.5.2 S1-1568 battery packs (x 2) replacement instructions:

1. Switch the instrument OFF, and disconnect the AC supply, measurement leads, and all other equipment before opening the case to change the battery.
2. Always replace both battery packs together.
3. The instrument must not be operated with the case open. DANGER! Hazardous voltages are exposed with an AC source connected and the case open.
4. Remove the lid and invert the lower case resting the front panel on a soft surface so as not to damage the keypad.
5. Remove the four case fixing screws and lift off case bottom.
6. Remove the two screws holding the battery support bracket and remove the bracket.
7. Withdraw one used battery and carefully unclip its battery cable connector, then the other used battery and its connector.
8. Replace with two genuine spare batteries ordered from Megger, ensuring correct orientation of the cable in the socket.
9. With both new batteries fitted, replace the battery support bracket and the two retaining screws.
10. Replace the lower case and secure with the retaining screws.
11. Check and verify instrument operation.

15. Technical Specification

15.1 Electrical specifications

AC Voltage input range:

5 kV, 10 kV:	90-264 V rms 47 – 63 Hz 100 VA
15 kV:	90-264 V rms 47 – 63 Hz 200 VA

Battery: 11.1 V, 5.2 Ah meets IEC 62133:2003

Battery life

S1-586:	6 hours (typical) continuous testing at 5 kV with a 100 MΩ load
S1-1068:	4.5 hours (typical) continuous testing at 10 kV with a 100 MΩ load
S1-1568:	4.5 hours (typical) continuous testing at 15 kV with a 100 MΩ load

Auto power off: Instrument turns off after a few minutes if non-use to conserves battery life

30 min. chg: 1 hour operation at 5 kV, 100 MΩ

Test voltages: 250V, 500V, 1000 V, 2500 V, 5000 V, 10000 V, 15000, V🔓

Lock test: 40 V to 1 kV in 10 V steps, 1 kV to 5 kV in 25 V steps,
5 kV to 10 kV in 25 V steps

Test voltage accuracy: +4%, -0%, ±10 V nominal test voltage at 1GΩ load (0 °C to 30 °C)

Resistance range:

S1-568:	10 kΩ – 15 TΩ
S1-1068:	10 kΩ – 35 TΩ
S1-1568:	10 kΩ – 35 TΩ

Accuracy (23 °C):

S1-568	5000 V	2500 V	1000 V	500 V	250 V
±5%:	1 TΩ	500 GΩ	200 GΩ	100 GΩ	50 GΩ
±20%:	10 TΩ	5 TΩ	2 TΩ	1 TΩ	500 GΩ
S1-1068	10000 V	5000 V	2500 V	1000 V	500 V
±5%:	2 TΩ	1 TΩ	500 GΩ	200 GΩ	100 GΩ
±20%:	20 TΩ	10 TΩ	5 TΩ	2 TΩ	1 TΩ
S1-1568	15000 V	10000 V	5000 V	2500 V	1000 V
±5%:	3 TΩ	2 TΩ	1 TΩ	500 GΩ	200 GΩ
±20%:	30 TΩ	20 TΩ	10 TΩ	5 TΩ	2 TΩ

Guard terminal performance: Guards out parallel leakage resistance down to 250kΩ with a maximum additional resistance error of 1% with a 100MΩ load*

* Assumes that the guard ring is positioned centrally across the insulating surface being guarded such that the resistances to the test conductors are equal.

Display range analogue 100 kΩ – 10 TΩ

Short circuit current 10 kΩ – 35 TΩ

Insulation alarm: 6 mA nominal

Insulation alarm: 100 kΩ – 10 GΩ

Technical Specification

Capacitor chg bat pwr: < 2.5 s/µF – 5 kV, < 5 s/µF – 10 kV
< 6,3 s/µF – 15 kV

Capacitor chg AC pwr: < 1,5 s/µF – 5 kV, < 2,7 s/µF – 10 kV
< 2,5 s/µF – 5 kV, < 4,4 s/µF – 15 kV

Capacitor discharge:

S1-568	<120 ms/µF discharge from 5 kV to 50 V
S1-1068	<250 ms/µF to discharge from 10 kV to 50 V
S1-1568	<3500 ms/µF to discharge from 15 kV to 50 V

Capacitance range:	With test voltage set above 500V
S1-568	10 nF to 25 µF
S1-1068	10 nF to 25 µF
S1-1568	10 nF to 50 µF

Capacitance accuracy(23 °C):
10 nF – 10 µF: ±10% ±5 nF

Current measurement range :
0,01 nA – 8 mA

Current measurement accuracy:
±5% ±0.2 nA at all voltages (23 °C)

Noise rejection:

S1-568:	1 mA per 150 V to a maximum of 8 mA
S1-1068:	1 mA per 320 V to a maximum of 8 mA
S1-1568:	1 mA per 350 V to a maximum of 8 mA

Software filtering:	4 filter settings: 10 s, 30 s, 100 s, 200 s
Voltmeter range:	30 V to 660 V ac or dc, 50/60 Hz
Voltmeter accuracy:	±3%, ±3 V
Frequency range:	45 Hz – 65 Hz
Timer range:	99 m 59 s, 15 s minimum setting
Memory capacity:	11 hrs logging @ 5 sec intervals
Test regimes:	IR, IR(t), DAR, PI, SV, DD, ramp test
Interfaces:	USB type B (device), Bluetooth
Real time output:	reading (V, I, R) at a rate of 1 Hz
Remote control:	Remote control via USB cable only (requires RC indicator dongle to be in position)

15.2 Environmental Conditions

Altitude:	3000 m (5 kV, 10 kV) 4000 m (15 kV)
Operating temp.:	-20 °C to 50 °C
Storage temp.:	-25 °C to 65 °C
Humidity:	90% RH non-condensing at 40 °C
Ingress protection:	IP65 (lid closed), IP40 (lid open)

15.3 General Specifications

Safety:	Meets requirements of IEC 61010-1, CATIV 600 V to 3000 m (5 kV, 10 kV)
	Meets requirements of IEC 61010-1, CATIV 1000 V to 4000 m (15 kV)
EMC:	Meets the requirements of IEC61326-1
Dimensions:	
5 kV, 10 kV	L 315 mm x W 285 mm x H 181 mm
15 kV	L 360 mm x W 305 mm x H 194 mm
Weight:	4.5 kg (5 kV, 10 kV) 6.5 kg (15 kV)

16. Repair and Warranty

If the protection of an instrument 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, 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 covered by a two year warranty from the date of purchase by the user, the second year being conditional on registration of the product. You will need to log in, or first register and then login to register your product. The second year warranty covers faults, but not recalibration of the instrument which is only warranted for one year. Any unauthorised prior repair or adjustment will automatically invalidate the warranty.

These products contain no repairable parts, with the exception of the user replaceable battery, and if defective should be returned to your supplier in original packaging or packed so that it is protected from damage during transit. Damage in transit is not covered by this warranty and replacement/repair is chargeable

16.1 Calibration, Service and Spare Parts

For service requirements for Megger Instruments contact:

Megger operate fully traceable calibration and repair facilities, ensuring your instrument continues to provide the high standard of performance and workmanship you expect. These facilities are complemented by a worldwide network of approved repair and calibration companies to offer excellent in-service care for your Megger products.

16.2 Returning product to Megger UK & USA service centres

1. When an instrument requires recalibration, or in the event of a repair being necessary, a Returns Authorisation (RA) number must first be obtained from one of the addresses shown above. You will be asked to provide the following information to enable the Megger Service Department to prepare in advance for receipt of your instrument, and to provide the best possible service to you.
   Model, e.g. S1-568.
   Serial number, to be found on the underside of the case or on the calibration certificate.
   Reason for return, e.g. calibration required, or repair.
   Details of the fault if the instrument is to be repaired.
2. Make a note of the RA number. A returns label can be emailed or faxed to you if you wish.
3. Pack the instrument in the original packing box to prevent damage in transit.
4. Ensure the returns label is attached, or that the RA number is clearly marked on the outside of the package and on any correspondence, before sending the instrument, freight paid, to Megger. Copies of the original purchase invoice and packing note should be sent simultaneously by airmail to expedite clearance through customs. In the case of instruments requiring repair outside the warranty period, an immediate quotation can be provided when obtaining the RA number.

16.3 Approved Service Centres

17. Accessories, equipment and spares

Included accessories (S1-568, S1-1068)	Part Number
Power lead	
3 m leadset x 3, medium insulated clips	1008-022
Shielded USB cable	
Remote control indicator dongle	
S1-1068 only:	
3 m leadset x 3, large insulated clips	1002-534
S1-1568 only:	
3 m 15 kV leadset x 3, 15 kV clip	1008-023
Optional accessories	
HV test lead sets	
3m leadset x 3, medium insulated clips	6220-820
10m leadset x 3, medium insulated clips	1000-441
15m leadset x 3, medium insulated clips	1000-442
3m leadset x 3, large insulated clips	6220-811
10m leadset x 3, large insulated clips	1000-443
15m leadset x 3, large insulated clips	1000-432
3m leadset x 3, bare clips	8101-181
8m leadset x 3, bare clips	8101-182
15m leadset x 3, bare clips	8101-183
Screened HV test lead sets	
3 m, 5 kV screened un-insulated small clips	6220-835
15 m, 5 kV screened un-insulated small clips	6311-080
3 m, 10 kV screened un-insulated small clips	6220-834
10 m, 10 kV screened un-insulated small clips	6220-861
15 m, 10 kV screened un-insulated small clips	6220-833
Other	
CB101, 5 kV Calibration box	6311-077
Calibration certificate – CB101	1000-113
UKAS calibration certificate CB101	1000-047
Fused test probe and clip leadset 1002-913	1002-913
Control circuit test leadset	6220-822
Spares / Optional accessories:	
Spare Li-ion battery pack	1002-552
Spare remote control indicator beacon	1003-228
GILS1 EHV Guard interconnecting lead and strap kit	1011-357
GILS2 Advanced guard interconnecting lead and strap kit	1011-358

18. Decommissioning

18.1 WEEE Directive

The crossed out wheeled bin symbol placed on Megger products is a reminder not to dispose of the product at the end of its life with general waste.

Megger is registered in the UK as a Producer of Electrical and Electronic Equipment. The Registration No is WEE/ HE0146QT.

For further information about disposal of the product consult your local Megger company or distributor or visit your local Megger website.

18.2 Battery disposal

The crossed out wheeled bin symbol placed on a battery is a reminder not to dispose of batteries with general waste when they reach the end of their usable life.

For disposal of batteries in other parts of the EU contact your local Megger branch or distributor.

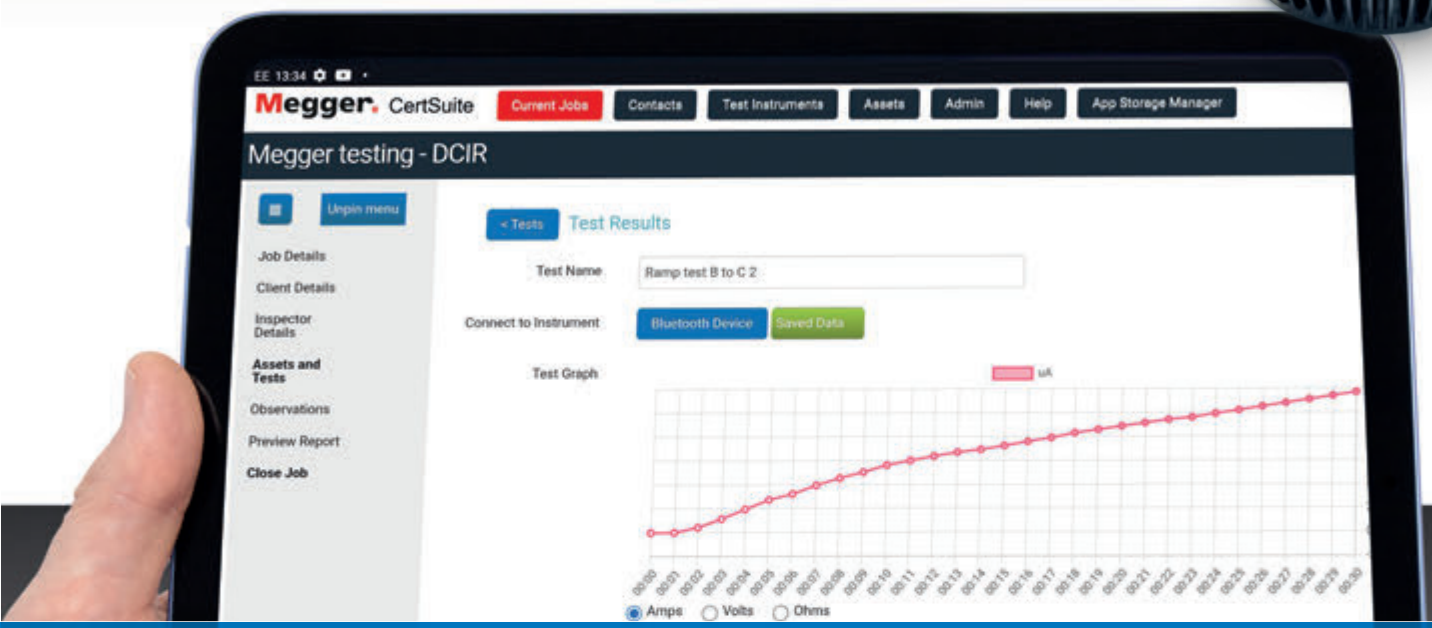
Megger is registered in the UK as a producer of batteries (registration No.: BPRN00142).

19. Worldwide Sales Offices

Sales Office		
UK		
USA – Dallas		
USA – Valley Forge		
USA – Dallas		
DEUTSCHLAND – Aachen		
SVERIGE		
AUSTRALIA		
中国		
中国 - 香港		
ČESKÁ REPUBLIKA		
AMÉRICA LATINA		
ESPAÑA		
SUOMI		
LA FRANCE		
ΕΛΛΑΔΑ		
MAGYARORSZÁG		
ITALIA		
日本		
한국		
العربية الرياض		
مملكة البحرين		
NEDERLAND		
NORGE		
POLSKA		
PORTUGAL		
ROMÂNIA		
РОССИЯ		
SLOVENSKO		
SOUTH AFRICA		
TÜRKIYE		

CertSuite **Asset**

Cloud based testing and reporting software that works with the Megger S1 and MIT insulation testers



Working with you, and your team, anywhere.

Connects to S1 and MIT

Free Trial >>

*CertSuite Asset connects to:
S1-568, S1-1068, S1-1568, MIT2500, MIT430/2, MIT525

Megger

Megger

Local Sales office

Manufacturing sites

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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