FLUKE®

1550C/1555

Insulation Tester

Calibration Manual

Table 1. Required Equipment

Equipment	Minimum Required Characteristics	Recommended Model
HV Probe	6 kV, ±1 % (1000:1 Divider) 11 kV, ±2 % for the 1555	Fluke 80K-6 80K-15
Digital Multimeter	500 mVdc to 1 V: ±0.02 %	Fluke 8508
Load with Guard Terminal[1]	Resistances 200 kΩ, ±1.25 %, 500 V 500 kΩ, ±1.25 %, 500 V 1 MΩ, ±1.25 %, 1 kV 2.5 MΩ, ±1.25 %, 2.5 kV 5 MΩ, ±1.25 %, 5 kV 10 MΩ, ±1.25 %, 10 kV 1 GΩ, ±1.25 %, 10 kV 100 GΩ, ±1.25 %, 10 kV 200 GΩ, ±1.25 %, 10 kV 500 GΩ, ±5 %, 10 kV 1 TΩ, ±5 %, 10 kV 2 TΩ, ±5 %, 10 kV	Combinations of: Welwyn F Series, Welwyn MFP2 Series And Vishay HTS-523
Capacitors with Bleeder Resistors[2]	0.1 μF, ±5 %, 500 V, Polypropylene 1 μF, ±5 %, 2.5 kV, Polypropylene	
Calibrator	DC current: 2 mA Accuracy: ±1.25 % DC Voltage: 0 - 550 V Accuracy: ±0.005 % AC Voltage: 0 - 240 V, 60 Hz Accuracy: ±1.25 %	Fluke 5080, Fluke 5520A
IR Cable Assembly		Fluke P/N 2166275
Calibration Software[3]		Snorre
Ammeter		Fluke 8508
Personal computer	IBM compatible, with Microsoft Windows XP SP2 or later + .NetFramework 2.0 or later	

[1] Resistors must have a voltage coefficient consistent with the test voltage used.
[2] Can use (3) each, 0.033 μF, 2 kV capacitors in series and (8) each, 8 μF, 450 V capacitors in series to obtain required values. The 0.033 μF capacitors should have a 33 MΩ bleeder resistor across each capacitor. The 8 μF capacitors should have a 15 MΩ bleeder resistor across each capacitor.

Performance Test Procedures

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, do not contact the output terminals while performing the following procedures. There are potentially dangerous voltages at the output terminals when the product is in the MΩ TEST function.

The following performance tests should be completed yearly to ensure that the product, referred to as “the DUT” (Device Under Test) in this section of the manual, is in proper operating condition and meets the published accuracy specifications. If the DUT fails any of the performance test steps, repair or adjustment is needed. Refer to *How to Contact Fluke* for service information.

IR Port Verification Test

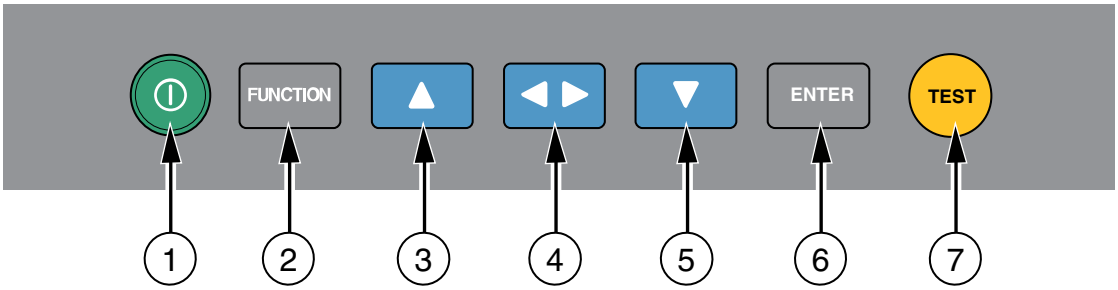
To verify operation of the IR Communications Port:

1. Using a Windows PC, connect the IR adapter cable from the product IR port to the computer COM port.
2. Activate the Snorre program from the Windows Start menu.
3. Select **Diagnostic**.
4. Select **Identification (ID)**. The PC sends out an ID command and the product responds to it.

Button Test

Use the pushbuttons to control the product, view test results, and scroll through chosen test results. Table 2 is a list of the pushbuttons and their functionality.

Table 2. Pushbuttons



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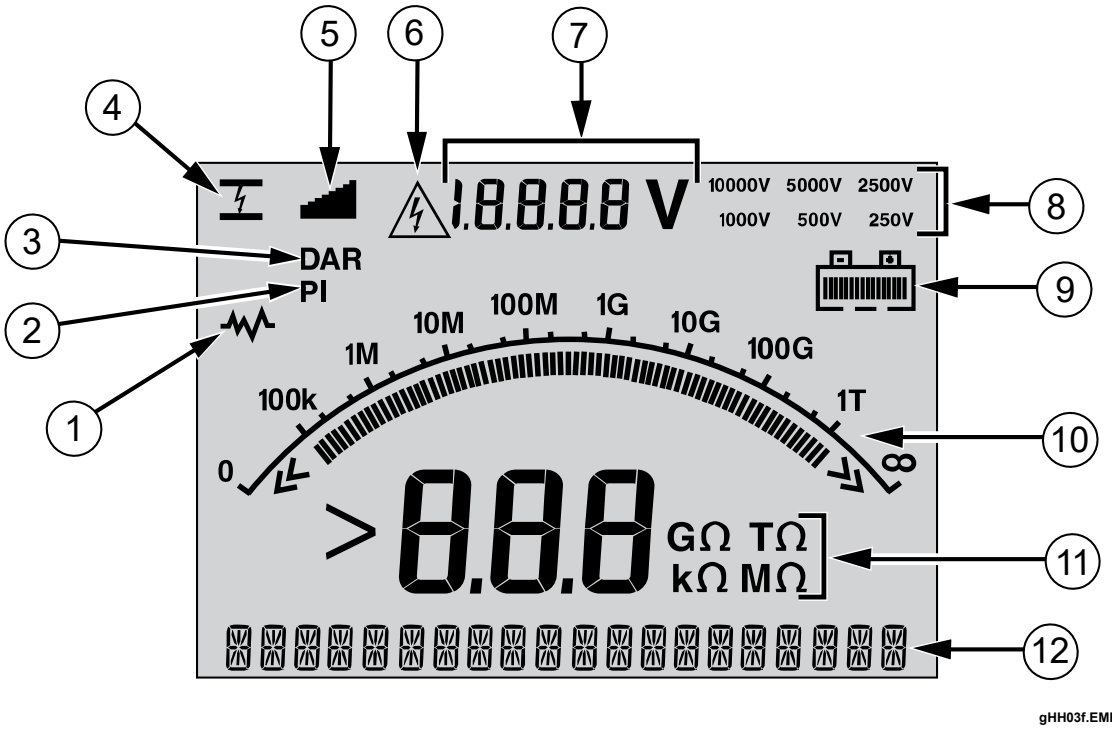
Item	Description
①	Turn on and turn off the Product.
②	Push FUNCTION to go to the Function menu. Push again to exit the Function menu. To scroll within the Function menu, use the arrow pushbuttons.
③	Scrolls through test voltages, stored test results, timer duration, and changes test tag ID characters. Also used to answer “yes” to yes/no prompts.
④	After a memory location is set, ◀▶ displays the test parameters, test results stored in memory. These include voltage, capacitance, polarization index, dielectric absorption ratio, and current.
⑤	Use to scroll through test voltages, stored test results, timer duration, and memory locations. Also used to answer “no” to yes/no prompts.
⑥	Use for Test Voltage mode to start incrementally setting the test voltage between 250 V and 10 000 V.
⑦	Starts and stops a test. Push and hold for 1 second to start a test. Push again to stop a test.

Display Test

Turn on the DUT several times while observing the display during power up. Compare the display with the example in Figure 1. Check all segments for clarity and contrast.



① Interference present. Readings could be out of specified accuracy range.

② Polarization Index

③ Dielectric Absorption Ratio

④ Electrical breakdown in Ramp mode

⑤ Ramp mode indicator

⑥ Possible hazardous voltage is at the test terminals.

⚠⚠ Warning

To prevent personal injury, before and after testing, confirm that the product does not indicate the presence of hazardous voltage. If the product beeps continuously and there is hazardous voltage, disconnect test leads and remove power from the circuit under test.

⑦ Voltage sourced by the product or from the circuit under test at terminals of the product.

⑧ Test voltage selection (250 V, 500 V, 1000 V, 2500 V, 5000 V, or 10,000 V)

⑨ Battery charge status

⑩ Bar graph display of insulation resistance

⑪ Digital display of insulation resistance

⑫ Text display. Shows voltage, test current, capacitance, programmable test voltages, and menu options.

Figure 1. Display Features

Charging Test

1. With the product switched off, connect a mains supply to the ac supply receptacle and check that the DUT display shows **Charging**.
2. Disconnect the mains supply and check that the DUT turns off.
3. Turn on the product and see that all the battery symbol segments display as shown in Figure 1.

Note

A fully-charged battery is indicated when the battery symbol shows all segments. Recharge the battery as necessary to obtain all segments. A full charge may require 12 hours.

Insulation Accuracy Test

Using the various resistances shown in Table 3, perform the DUT insulation accuracy test. Push TEST for 2 seconds to start or discontinue a test.

Notes

- *For best results, allow for settling of up to 60 seconds when measuring high-value resistances (100 GΩ and above) and take care to avoid stray currents. Perform the test on a conductive work surface that is connected to the DUT's GUARD terminal and the load GUARD terminal.*
- *Motion/body capacitance can affect the stability of the reading at higher resistances. When taking the measurements above 1 GΩ, remain as motionless as possible.*

The capacitance reading is obtained by pressing ◀▶ after a test has started.

Table 3. Insulation Accuracy Test

Step	Voltage Range	Resistance	DUT Display Limits	
			Minimum	Maximum
1	250 V	0.1 μF	0.055	0.145
2	500 V	250 kΩ	237 kΩ	263 kΩ
3	500 V	1 GΩ	0.95 GΩ	1.05 GΩ
4	500 V	100 GΩ	80 GΩ	120 GΩ
5	1 kV	1 GΩ	0.95 GΩ	1.05 GΩ
6[1]	2.1 kV	1 μF	0.82	1.18
7	2.5 kV	1 GΩ	0.95 GΩ	1.05 GΩ
8	5 kV	1 GΩ	0.95 GΩ	1.05 GΩ
9	5 kV	100 GΩ	95 GΩ	105 GΩ
10	5 kV	1 TΩ	0.80 TΩ	1.20 TΩ
11	5 kV	5 MΩ	4.75 MΩ	5.25 MΩ
12[2]	10 kV	1 GΩ	0.95 GΩ	1.05 GΩ
13[2]	10 KV	200 GΩ	190 GΩ	210 GΩ
14[2]	10 KV	2 TΩ	1.6 TΩ	2.4 TΩ
15[2]	10 KV	10 MΩ	9.5 MΩ	10.5 MΩ

[1] Use “Programmable Test Voltage” mode by pushing ENTER.

[2] 1555 only

Output Voltage Test

In Table 4, the DUT output voltage is checked with various loads applied. In this test a voltmeter with a high-voltage probe must be connected to the load resistor to measure the DUT output voltage. Use 15 80K-6 for voltages below 6 kV.

Table 4. Output Voltage Test

Step	Voltage Range	Load Resistor	Reading Limits	
			Minimum	Maximum
1	250 V	250 kΩ	250 V	275 V
2	250 V	No Load	250 V	275 V
3	500 V	500 kΩ	500 V	550 V
4	500 V	No Load	500 V	550 V
5	1 kV	1 MΩ	1000 V	1100 V
6	1 kV	No Load	1000 V	1100 V
7	2.5 kV	2.5 MΩ	2500 V	2750 V
8	2.5 kV	No Load	2500 V	2750 V
9	5 kV	5 MΩ	5000 V	5500 V
10	5 kV	No Load	5000 V	5500 V
11[1]	10 kV	No Load	10000 V	11000 V
12[1]	10 kV	10 MΩ	10000 V	11000 V
[1] 1555 only. Requires 80K-15 probe.				

Short Circuit Current Test

To verify the DUT short circuit current, use the following procedure:

1. Connect an ammeter between the DUT + and - terminals.
2. Turn on the DUT and allow to startup.
3. Wait for **Test Voltage** to appear on the display and set the test voltage to 5000 V by pushing ▲.
4. Push TEST and note that the ammeter reading is within the reading limits referred to in Table 5.
5. Push TEST to discontinue the test.

Table 5. Short Circuit Current Test

DUT	Voltage Range	Reading Limits	
		Minimum	Maximum
1550C	5000 V	1.20 mA	1.80 mA
1555	10000 V	1.20 mA	1.80 mA

Voltage Measurement Accuracy

To verify voltage measurement accuracy of the Live Circuit Warning function, apply the voltages listed in Table 6 to the + and - terminals of the DUT.

Verify:

- DUT reading is within the display limits of Table 6.
- DUT is beeping at a 1-second interval.
- ⚠ is flashing on the display.

Table 6. Voltage Measurement Test

Step	Voltage Source Output	DUT Display	DUT Tone	DUT Display Limits	
				Minimum	Maximum
1	-38 V dc	Flashing Hazard	Beeps	30 V	46 V
2	240 V ac, 60 Hz	Flashing Hazard	Beeps	202 V	278 V

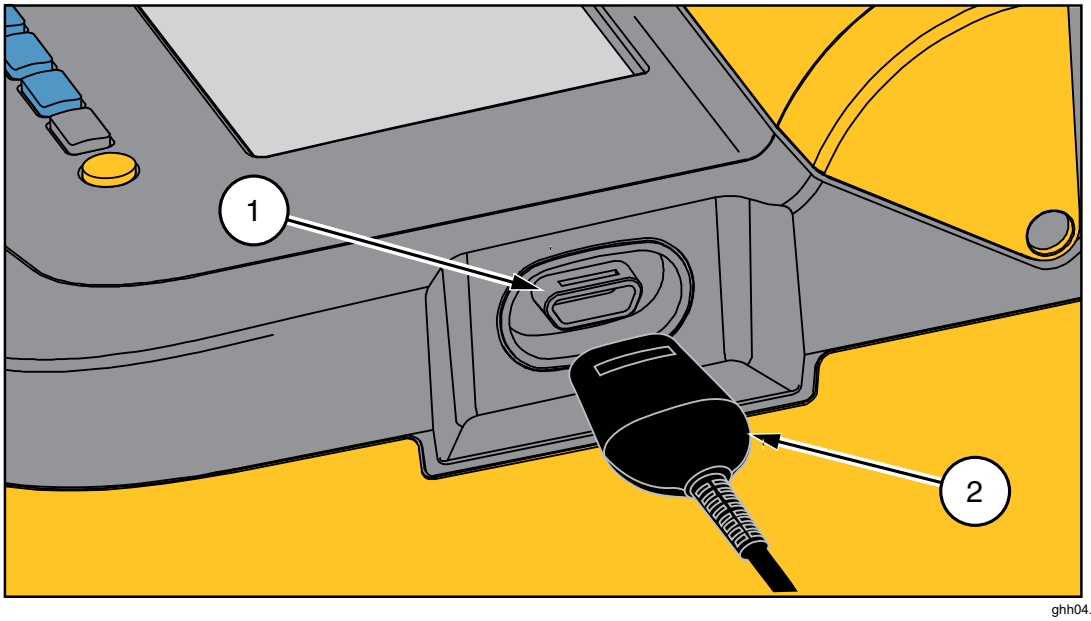
Adjustment Procedure

The product should be performance tested yearly to ensure compliance with its specifications. When required, use the following adjustment procedure to bring the DUT within its nominal accuracy specifications.

Interface Connection

Perform adjustment with software using a computer and IR (infrared) adapter.

Connect the Infrared Cable Assembly to the DUT IR Port and COM port of the computer. Refer to Figure 2.



① IR Port

② IR Device

Figure 2. IR Port

Instrument Setup

Turn on the product and wait for **Test Voltage** to appear on the display. From the computer terminal, activate the Snorre program from the Windows Start menu. On the Setup tab, confirm the selected COM port settings.

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, do not contact the output terminals or test equipment terminals while performing the following procedures. Potentially dangerous voltages can occur when the DUT is in the "Calibrate HV Output and Measurement" mode.

Normalizing the HV Probe and Digital Multimeter

1. Connect the HV probe and digital multimeter to the 5520A **NORMAL** output terminals, observing polarity. Manually set the multimeter for a range that has a 10 MΩ input impedance, for example, 100 V, and provides a maximum resolution for a 500 mV and 5000 mV input.
2. Set the 5520A output to 506 V and note the digital multimeter reading. Record this value.
3. Set the 5520A output to 1000 V and note the voltmeter reading. If the error is >0.025 % from the nominal value, convert the error from nominal to percentage. Multiply 5005 V by this percentage and algebraically add to 5005 V. Record this value.
4. Set the 5520A to standby and disconnect the HV probe and digital multimeter.

HV Adjustment

1. Select the **CAL HV** tab.
2. Connect the HV probe and digital multimeter to the output terminals of the DUT, as shown in the connection diagram.
3. Press the **START** button to begin adjustment. The DUT briefly displays **HV OFFSET** then flashes ⚠ with PWM 600, while emitting a beep at 1-second intervals.
4. Use ▲ and ▼ on the terminal to modify the DUT output value to as close as possible to the value recorded in step 2 of *Normalizing the HV Probe and Digital Multimeter*. The nominal value for this adjustment is between 502 and 510 V.
5. Press the **Cal 500** button. The DUT now increases its output of the 1550C to nominally 5000 V, the output of the 1555 goes to a nominal 10,000 V.
6. Use ▲ and ▼ on the terminal to modify the DUT output value to as close as possible to the value obtained in step 3 of *Normalizing the HV Probe and Digital Multimeter*. The nominal value for the 1550C adjustment is between 5000 V and 5010 V, the target range for the 1555 adjustment is 10 000 V and 10 020 V.
7. Press the **Cal 500** button. The HV generation and measurement functions are now calibrated.
8. Disconnect the HV probe and digital multimeter from the DUT.

Current Adjustment

1. Select the **Cal Current** tab.
2. Attach a 2 mA current source to the LO and GUARD terminals of the DUT, connecting the current source LO to DUT GUARD terminal, as shown in the connection diagram.
3. Apply 2 mAdc to the DUT.
4. Press the **START** button and wait until the adjustment is complete.
5. The current measurement is now adjusted. Disconnect the current source.

Charge Adjustment

1. Select the **Cal Charge** tab.
2. Attach a 2 mA current source to the LO and GUARD terminals of the DUT, connecting the current source LO to DUT Guard.
3. Apply 2 mAdc to the DUT.
4. Press the **Start** button and wait until the adjustment is complete; progress is displayed.
5. The charge measurement is now adjusted. Set the current source to **STANDBY** and disconnect it from the DUT.

This completes the Adjustment Procedure.

Additional Procedures

Note

*The following additional procedures are used during factory calibration and repair but should **not** be performed in the field. They are included for information only.*

Various diagnostics are available from the **Diagnostic** tab as follows:

Identification (Id)

This button returns the model number and firmware version of the unit.

Clear Non-volatile Memory

To delete all saved test results:

1. Push FUNCTION to call the Function menu.
2. Push ▲ or ▼ to select the menu item DELETE RESULT.
3. Push ENTER to call the menu item.
4. Push ▲. REALLY DEL? shows on the display.
5. Push ▼ to confirm the deletion.

Note

The Delete function deletes all stored test results. Individual test locations cannot be deleted but are overwritten.

Restart DUT

This button first sets the DUT to CAL_DIAGS mode the sends out the restart hardware command. The DUT is then restarted.

Shutdown DUT

This button puts the DUT into **CAL_DIAGS** mode and sends out the power down command.

Get Diagnostics

Pressing this button continually gets Raw ADC values from the DUT and updates the Raw ADC Counts boxes (v_counts, i_counts, q_counts), pressing the button again turns off this feature.

Query Constants

Pressing this button provides an html screen dump of the present opvars obtained from the DUT. You will need to check that numerical values are reported for all nine variables. See Figure 3.

snorre 3.bmp

Figure 3. Query Constant Result

Save / Print html Page

The Save button brings up a Windows Save Dialog Box so that the html document being displayed can be saved to file.

The Print button brings up a Windows Print Dialog Box so that the rendered html document may be printed.

The window at the bottom of the page is a scrollable log of the Snorre methods issuing commands to the DUT and the corresponding responses received back from the DUT.

Battery Replacement Procedure

⚠⚠ Warning

For safe operation and maintenance of the product:

- **Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.**
- **Remove all probes, test leads, and accessories before the battery door is opened.**
- **Remove all probes, test leads, and accessories before the case is opened.**
- **The battery door must be closed and locked before you operate the product.**
- **Use only specified replacement fuses and batteries.**
- **Do not disassemble the battery.**

⚠ Caution

To prevent possible damage to the product or to equipment under test:

- **Do not attempt to repair or service the product unless qualified to do so and you have the relevant calibration, performance test, and service information.**
- **Remove batteries to prevent battery leakage and damage to the product if it is not used for an extended period.**
- **Be sure that the battery polarity is correct to prevent battery leakage.**
- **Repair the product before use if the battery leaks.**
- **Do not disassemble the battery.**
- **Do not short the battery terminals together.**
- **Keep cells and battery packs clean and dry. Clean dirty connectors with a dry, clean cloth.**
- **Do not disassemble or crush battery cells and battery packs.**
- **Do not keep cells or batteries in a container where the terminals can be shorted.**
- **Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.**

This Product uses a rechargeable 12 V lead-acid battery for power. Storing rechargeable lead-acid batteries in a low-charged state could decrease their life and cause damage. Fully charge the battery before storing it for extended periods and examine the charge at regular intervals.

Charge the 12 V lead-acid battery with the ac power cord. Expect up to 12 hours to fully charge the battery. Do not charge in very high or low temperatures.

Charge the battery if the Tester is not used for extended periods.

If the battery needs to be replaced, use the following procedure to replace the battery. Spent batteries should be disposed of by a qualified recycler or hazardous materials handler. Contact your authorized Fluke Service Center for disposal and recycling information.

Disassembly

⚠ Caution

To prevent possible damage to the product or to equipment under test, disassembly must be performed using proper ESD handling techniques. Place the product on an anti-static mat and use a grounded wrist strap during the following procedure.

1. Disconnect the test leads from any live source and power off the product.
2. Remove the mains supply cable leads from the instrument.
3. Turn over the product and place it on a level surface with feet up.
4. Remove the 4 screws from the case. This frees the top assembly from the base. The battery is attached to the base.
5. Lift the base from the top assembly and set it on its side next to the top assembly.
6. Disconnect the red and black leads for the battery.
7. Set the base on its feet and remove the 4 screws from the battery bracket.
8. Remove the bracket.
9. The battery (PN 2803592) can now be removed.

Re-assembly

1. Place the new battery assembly in position and then reinstall the battery bracket.
2. Reverse steps 2 through 9 of the disassembly procedure to re-assemble. When reconnecting the red and black battery leads, the red wire must be connected to the + terminal of the battery. Connect the black wire to the – terminal.

Cleaning

⚠⚠ Warning

For safe operation and maintenance of the product, remove excess water from the cloth before cleaning the product to ensure that water does not enter any terminal.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents to clean the product.

Replacement Parts/Accessories

Table 7 is a list of replacement parts.

Table 7. Replacement Parts

Parts	Part Number
Test Lead Set Fluke 1550	3477137
10 kV Clip	3611951
1550C 1555 Safety Input Cover	3529198
1550C Top Case	3622602
1555 Top Case	3624655
Input Jacks Decal	3624643
Case Screws	3552926
IR Cable Assembly	2166275
Battery Hold Bracket	3540654
Case Bottom	3524293
Battery	2803592
Rubber Foot	3777953
AC Power Cord (S. Africa)	1552363
AC Power Cord (Australia)	658641
AC Power Cord (UK)	769455
AC Power Cord (Continental Europe)	789422
AC Power Cord (North America)	284174
Soft Carrying Case	3592805
Extended Lead Set (5 kV rating)	2032761
1550C/1555 Quick Reference Card	3592822
ir3000 FC 1550 BLE-IR Adapter (FC kits only)	4460451

Specifications

General Specifications

Display	475 mm x 105 mm
Power	12 V lead-acid rechargeable battery 2.6 Ahr
Charger Input (AC)	85 V to 250 V ac, 50/60 Hz, 20 VA This Class II (double insulated) instrument is supplied with a Class 1 (grounded) power cord. The protective earth terminal (ground pin) is not connected internally. **The extra pin is for added plug retention only**.
Dimensions (H x W x L)	170 mm x 242 mm x 330 mm (6.7 in. x 9.5 in. x 13.0 in.)
Weight	3.6 kg (7.94 lb)
Tamper Protection	Kensington lock
Temperature (operating)	-20 ˚C to 50 ˚C (-4 ˚F to 122 ˚F)
Temperature (storage)	-20 ˚C to 65 ˚C (-4 ˚F to 149 ˚F)
Relative Humidity	80 % to 31 ˚C decreasing linearly to 50 % at 50 ˚C
Altitude	2000 m
IP Rating	IEC 60529: IP40
Input Overload Protection	1000 V ac
Safety	IEC 61010-1: 600 V CAT IV / 1000 V CAT III, Pollution Degree 2
Electromagnetic Compatibility (EMC)	
International	IEC 61326-1: Portable CISPR 11: Group 1, Class A *Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.* *Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.* *Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.* *Emissions that exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object.*
Korea (KCC)	Class A Equipment (Industrial Broadcasting & Communication Equipment) *Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.*
USA (FCC)	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.
Wireless Radio with Adapter	Frequency Range: 2412 MHz to 2462 MHz Output Power: <100 mW

Typical Battery Charge Capacity

Note

At temperature extremes, the battery needs to be charged more frequently.

Test Voltages	**Number of Tests**
250 V	4100
500 V	3600
1 kV	3200
2.5 kV	2500
5 kV	1000
10 kV	500

Electrical Specifications

Product accuracy is specified for 1 year after calibration at operating temperatures of 0 °C to 35 °C. For operating temperatures outside the range (-20 °C to 0 °C and 35 °C to 50 °C), add ±0.25 % per °C, except on the 20 % bands add ±1 % per °C.

Insulation		
Test Voltage (DC)	Insulation Resistance Range	Accuracy (±reading)
250 V	<250 kΩ 250 kΩ to 5 GΩ 5 GΩ to 50 GΩ >50 GΩ	unspecified 5 % 20 % unspecified
500 V	<500 kΩ 500 kΩ to 10 GΩ 10 GΩ to 100 GΩ >100 GΩ	unspecified 5 % 20 % unspecified
1000 V	<1 MΩ 1 MΩ to 20 GΩ 20 GΩ to 200 GΩ >200 GΩ	unspecified 5 % 20 % unspecified
2500 V	<2.5 MΩ 2.5 MΩ to 50 GΩ 50 GΩ to 500 GΩ >500 GΩ	unspecified 5 % 20 % unspecified
5000 V	<5 MΩ 5 MΩ to 100 GΩ 100 GΩ to 1 TΩ >1 TΩ	unspecified 5 % 20 % unspecified
10 000 V	10 MΩ 10 MΩ to 200 GΩ 200 GΩ to 2 TΩ >2 TΩ	unspecified 5 % 20 % unspecified
Bar graph range:	0 to 2 TΩ	
Insulation test voltage accuracy:	-0 %, +10 % at 1 mA load current	
Induced ac mains current rejection:	2 mA maximum	
Charging rate for capacitive load:	5 s/µF	
Discharge rate for capacitive load:	1.5 s/µF	

Leakage Current Measurement	**Range**	**Accuracy**
	1 nA to 2 mA	±(20 % + 2 nA)
Capacitive Measurement	0.01 µF to 20.00 µF	±(15 % of reading + 0.03 µF)

Timer	**Range**	**Resolution**
	0 to 99 minutes	Setting: 1 minute Indication: 1 second

Live circuit warning	**Warning Range**	**Voltage Accuracy**
	30 V to 1100 V ac/dc, 50/60 Hz	±(15 % + 2 V)

Short circuit current >1 mA and <2 mA

Principle of Measurement and Resistance

The product measures insulation parameters and displays the results with the following formulas.

Ohm's Law	**Capacitance (charge)**	**PI (Polarization Index)**	**DAR (Dielectric absorption ratio)**	**DAR [CN] (Dielectric absorption ratio)**
$R = \frac{V}{I}$	$C = \frac{Q}{V}$	$PI = \frac{R\ @\ 10\ min}{R\ @\ 1\ min}$	$DAR = \frac{R\ @\ 1\ min}{R\ @\ 30\ sec}$	$DAR\ [CN] = \frac{R\ @\ 1\ min}{R\ @\ 15\ sec}$

FLUKE®

1550C/1555

Insulation Tester

Users Manual

Introduction

The Fluke 1550C and 1555 Insulation Testers (the Tester or Product) are high-voltage insulation testers to validate general circuits, such as switchgear, motors, and cables.

The Tester features:

- Large liquid crystal display (LCD)
- Preset test voltages: 250 V, 500 V, 1000 V, 2500 V, 5000 V, (10 000 V 1555 only)
- Programmable test voltages: 250 V to 10 000 V (50/100 V steps)
- Resistance measurement: 200 kΩ to 2 TΩ
- Polarization Index (PI)
- Dielectric Absorption Ratio (DAR or DAR [CN])
- Ramp mode that linearly increases (100 V/s) the applied test voltage
- Test timer and storage for test results with user-defined ID tag
- Breakdown voltage indication
- Rechargeable lead-acid battery
- Auto shutoff after 30 minutes of inactivity
- Infrared (IR) port for downloading test data
- PC software (supplied)

Safety Information

A **Warning** identifies hazardous conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

⚠⚠ Warning

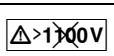
To prevent possible electrical shock, fire, or personal injury:

- **Carefully read all instructions.**
- **Read all safety information before you use the Product.**
- **Do not alter the Product and use only as specified, or the protection supplied by the Product can be compromised.**
- **Do not use the Product around explosive gas, vapor, or in damp or wet environments.**
- **Do not use the Product if it is altered or damaged.**
- **Do not use the Product if it operates incorrectly.**
- **Use Product-approved measurement category (CAT), voltage, and amperage rated accessories (probes, test leads, and adapters) for all measurements.**
- **Do not exceed the Measurement Category (CAT) rating of the lowest rated individual component of a Product, probe, or accessory.**
- **Do not use in CAT III or CAT IV environments without the protective cap installed on test probe. The protective cap decreases the exposed probe metal to <4 mm. This decreases the possibility of arc flash from short circuits.**
- **Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame-resistant clothes) to prevent shock and arc blast injury where hazardous live conductors are exposed.**
- **Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation and measure a known voltage.**
- **Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Do not apply more than the rated voltage between the terminals or between each terminal and earth ground.**
- **Measure a known voltage first to make sure that the Product operates correctly.**
- **Limit operation to the specified measurement category, voltage, or amperage ratings.**

- **Remove all probes, test leads, and accessories that are not necessary for the measurement.**
- **Keep fingers behind the finger guards on the probes.**
- **Use the correct terminals, function, and range for measurements.**
- **Place test leads in proper input terminals.**
- **Do not work alone.**
- **Do not use in distribution systems with voltages higher than 1100 V.**
- **Use only recommended test leads.**
- **Remove all power from the circuit under test and discharge circuit capacitance before testing resistance or capacitor with the tester.**
- **Results of measurement can be adversely affected by the impedances of additional operating circuits connected in parallel or by transient currents.**
- **Before and after testing, confirm that the Product does not indicate the presence of a hazardous voltage. If a hazardous voltage is shown on the display, remove power from the circuit under test or allow the installation capacitance to fully discharge.**
- **Do not disconnect the test leads before a test has been completed and the test voltage at the terminals has returned to zero. This ensures that any charged capacitance is fully discharged.**
- **Use the guard terminal only as specified in this manual. Do not allow other foreign objects to contact the guard terminals as safety can be compromised.**
- **Remove the input signals before you clean the Product.**
- **Use only specified replacement parts.**
- **Repair the Product before use if the battery leaks.**
- **Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.**
- **Have an approved technician repair the Product.**

Table 1 is a list of symbols used on the Product or in this manual.

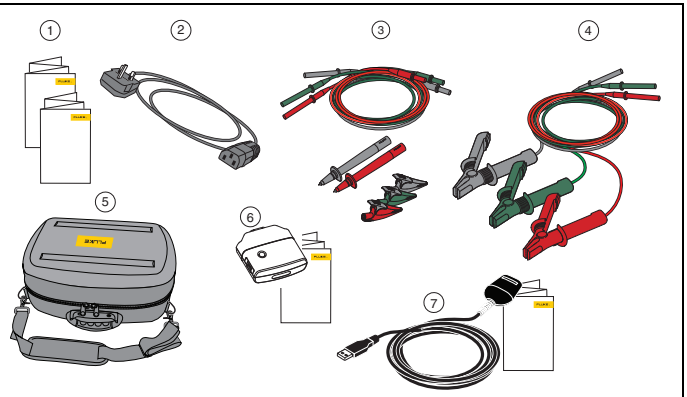
Table 1. Symbols

Symbol	Description	Symbol	Description
	Consult user documentation.		Conforms to relevant South Korean EMC standards.
	WARNING. RISK OF DANGER.		Conforms to relevant Australian EMC standards.
	WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.		Certified by CSA Group to North American safety standards.
	Earth		Conforms to European Union directives.
	AC (Alternating Current)		Certified by TÜV SÜD Product Service.
	Battery		Double Insulated
OK	Electrical breakdown		Interference is present. Displayed value might be outside of specified accuracy.
	WARNING. Do not apply greater than 1100 Volts.		Ramp mode indicator
CAT Ⅱ	Measurement Category II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.		
CAT Ⅲ	Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation.		
CAT Ⅳ	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.		
	This product complies with the WEEE Directive marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste.		

Before You Start

Table 2 is a list of the items included with your purchase. Carefully unpack and inspect each of the items.

Table 2. Pack List

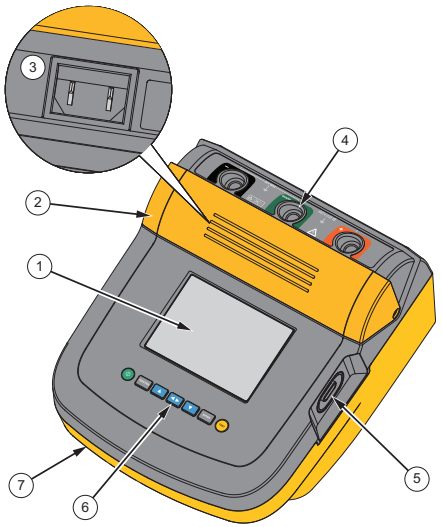


Item	Description
1	Quick Reference Guide and Safety Information
2	AC Power Cord
3	⚠ Test Cables with Alligator Clips (red, black, green) and Test Probes (red, black)
4	Heavy Duty Alligator Clips: Red, Black, Green (1555 and kits only) Available as optional accessory for 1550C, PN TLK1550-RTLC
5	Soft Carrying Case (Kit includes Hard Case)
6	ir3000 FC BLE-IR Adapter with Quick Reference Guide (FC kits only)
7	Infrared Adapter/Interface Cable with Installation Guide

The Tester

This section is about the Tester and its operation. The Tester is shown in Table 3.

Table 3. 1550C/1555 Insulation Tester

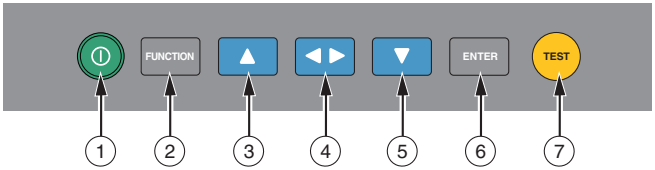


Item	Description
1	LCD
2	Safety Shutter
3	AC Plug
4	Input Terminals
5	IR Port
6	Pushbuttons
7	Built-in Handle

Pushbuttons

Use the pushbuttons to control the Tester, view test results, and scroll through chosen test results. See Table 4.

Table 4. Pushbuttons



Item	Description
①	Power on/off.
②	Push FUNCTION to go to the Function menu. Push again to exit the Function menu. To scroll within the Function menu, use the arrow pushbuttons.
③	Scrolls through test voltages, stored test results, timer duration, and changes test tag ID characters. Use to answer “yes” to prompts.
④	After a memory location is set, ◀▶ displays the test parameters, test results stored in memory. These include voltage, capacitance, polarization index, dielectric absorption ratio, and current.
⑤	Use to scroll through test voltages, stored test results, timer duration, and memory locations. Use to answer “no” to prompts.
⑥	Use for Test Voltage mode to start incrementally setting the test voltage between 250 V and 10 000 V.
⑦	Starts and stops a test. Push and hold for 1 second to start a test. Push again to stop a test.

Use ▲ and ▼ to access these menu items:

1.X Insulation Functions:

1.1 Ramp off (default)
1.2 Ramp on
1.3 DAR T= 01-00
1.4 DAR/PI T= 10-00
1.5 DAR [CN]= 01-00

2 Time limit xx-xx

3 Show results

4 Delete results

Push ENTER to make the selection.

Power On/Off

Push ⏻ to turn on the Tester.

The Tester does a self-check, self-calibration, shows the software version, and starts in the Test Voltage mode.

In Test Voltage mode, you can:

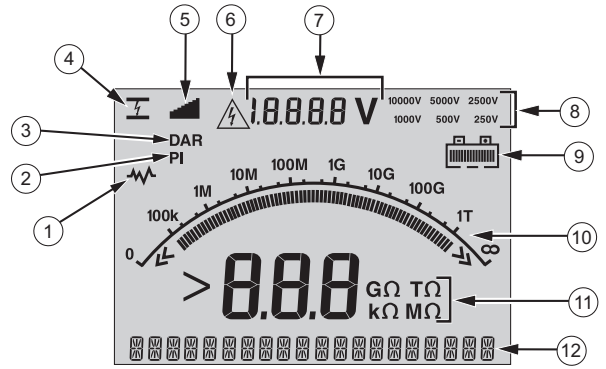
- Change test parameters
- Start an insulation test
- View stored test results
- Download test results

Push ⏻ again to turn off the Tester.

Display

Table 5 is a list of features for the display.

Table 5. Display Features



Item	Description
①	Interference present. Readings could be out of specified accuracy range.
②	Polarization Index.
③	Dialectric Absorption Ratio.
④	Electrical breakdown in Ramp mode.
⑤	Ramp mode indicator.
⑥	Possible hazardous voltage is at the test terminals.
⑦	Voltage sourced by the Tester or from the circuit under test at terminals of the Tester.
⑧	Test voltage selection (250 V, 500 V, 1000 V, 2500 V, 5000 V, or 10 000 V).
⑨	Battery charge status.
⑩	Bar graph display of insulation resistance.
⑪	Digital display of insulation resistance.
⑫	Text display. Shows voltage, test current, capacitance, programmable test voltages, and menu options.

Charge the Battery

This Tester uses a rechargeable 12 V lead-acid battery for power.

Storing rechargeable lead-acid batteries in a low-charged state could decrease their life and cause damage. Fully charge the battery before storing it for extended periods and examine the charge at regular intervals.

Charge the 12 V lead-acid battery with the ac power cord. Expect up to 12 hours to fully charge the battery. Do not charge in very high or low temperatures. Charge the battery if the Tester is not used for extended periods. Figure 1 shows how to connect the Tester to a power supply.

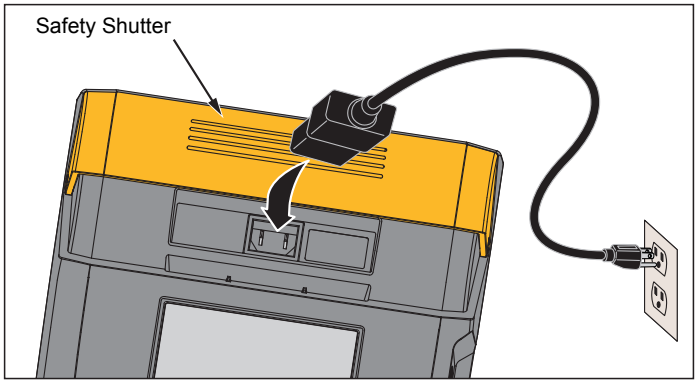


Figure 1. Power Supply Connections

To charge the battery with the ac power supply:

1. Turn off the Tester.
2. Disconnect the test leads from the Tester.
3. Move the safety shutter to access the power supply connection.
4. Connect the ac power cord to the IEC ac power socket on the Tester.
5. Connect the other end of the power cord to an ac power supply. See *General Specifications* for ac charger input specifications.

   The LCD displays **CHARGING**. You are able to download test results while the Tester is in the charge mode.

Guard Terminal Use

Note

Insulation resistance is measured between the (+) and (-) output connections. The Guard terminal (G) is at the same potential as the negative (-) terminal but is not in the measurement path.

For most tests, only two test leads are used. Connect the positive (+) and negative (-) test leads to the corresponding inputs on the Tester. Connect the test lead probes to the circuit under test. The Guard (G) terminal is left unconnected.

For the best accuracy when you measure very high resistances, use three-wire measurements and the Guard terminal. The Guard terminal is at the same potential as the negative (-) terminal, and can be used to prevent surface leakage or other unwanted leakage currents from degrading the accuracy of the insulation resistance measurement.

Figure 2 shows how to measure the resistance from one of the conductors to the outer shield. In this case, there is a leakage current along the surface of the inner insulation near the cables end. This leakage adds to the current that the negative terminal senses, and causes the Tester to read a lower resistance than it should.

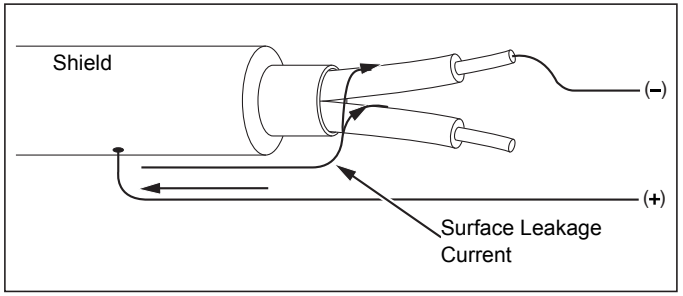


Figure 2. Surface Leakage Current

Figure 3 shows how to prevent surface current leakage with a lead connected from the Guard terminal to a conductor that surrounds the inner insulation. The surface leakage current is directed to the Guard terminal. This removes the leakage current from the measurement path between the positive and negative terminals, and improves the accuracy of the test readings.

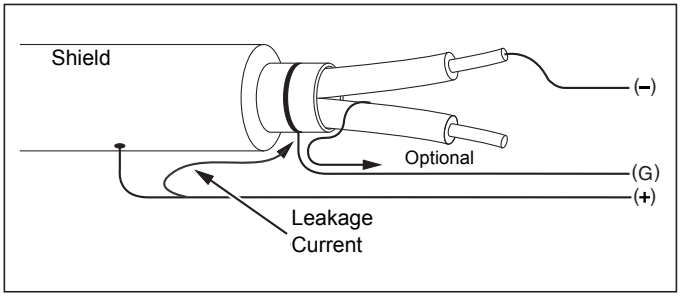


Figure 3. Guard Terminal Connection

Figure 4 shows how to make the measurement setup better. Connect the Guard terminal to the unused wire and attach it to the inner insulation. This ensures that the Tester measures the leakage between the selected conductor and the outer shield, but removes the leakage path between conductors.

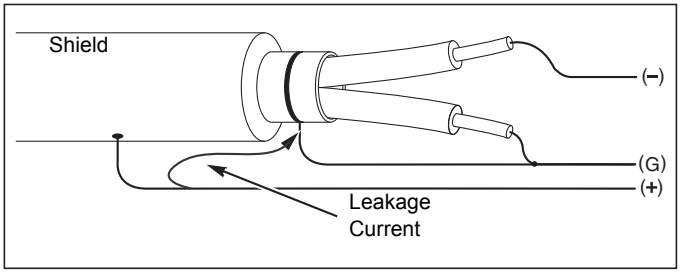


Figure 4. Improved Guard Terminal Connection

Measurements

Common measurement procedures are discussed in this section.

Connect to the Circuit Under Test

⚠⚠ Warning

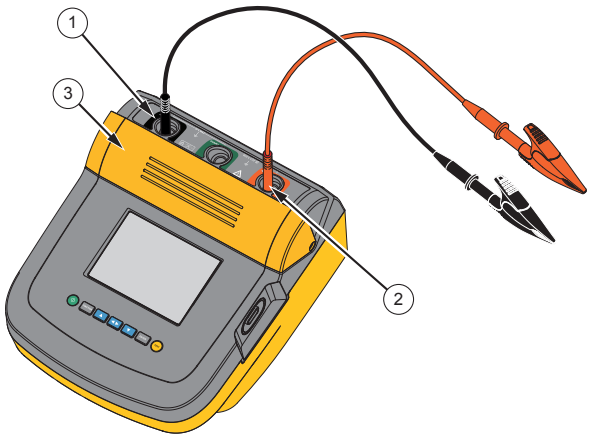
To prevent possible electric shock, fire or personal injury:

- **Remove all power from the circuit under test and discharge circuit capacitance before testing a circuit with the Product.**
- **Connect the common test lead before the live test lead and remove the live test lead before the common test lead.**
- **Before and after testing, confirm that the Product does not indicate the presence of a hazardous voltage, see Table 5. If the Tester beeps continuously and a hazardous voltage is shown on the display, remove power from the circuit under test and disconnect test leads.**

To connect to the circuit under test:

1. Move the safety shutter to access the input terminals.
2. Put the test leads into the correct terminals shown, see Table 6.
3. Connect the test leads to the circuit under test.

Table 6. Test Lead Connections



Item	Description
①	(-) Negative Terminal
②	(+) Positive Terminal
③	Safety Shutter

Note

The Tester is NOT specified for <200 kΩ. When the leads are shorted and a test is performed, the Tester gives an unspecified reading that is >0. This is normal for this input circuitry configuration and does not change readings that are in the specified accuracy range.

Before an Insulation Test

The Tester includes features and functions that let you adapt the test to your requirements. These features let you:

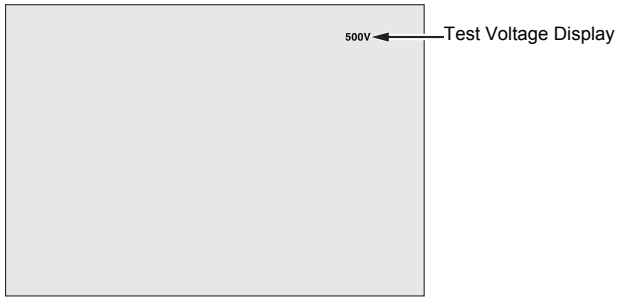
- define a test voltage
- make a ramp test selection
- set a time limit (duration) for the test
- measure polarization index (PI)
- measure dielectric absorption ratio (DAR or DAR[CN])
- measure capacitance

Use these alone or in combination. Set, clear, or account for (as appropriate) each feature before you start an insulation test. The features are discussed in this section.

Preset Test Voltage Selection

To make a preset test voltage selection:

1. With the Tester turned on, push FUNCTION to select **TEST VOLTAGE**.



2. Push ▲ or ▼ to scroll through the preset test voltage options (250 V, 500 V, 1000 V, 2500 V, 5000 V, and 10 000 V).

   The test voltage selection shows in the upper-right of the display.

Note

The actual test voltage can be up to 10 % higher than the selected test voltage.

Program a Test Voltage

To set a test voltage in between the preset test voltages:

1. Push ▲ or ▼ to scroll through the preset test voltage options (250 V, 500 V, 1000 V, 2500 V, 5000 V, and 10 000 V). Select the voltage closest to the level required.
2. The selected test voltage appears in the upper-right of the display.
3. Push ENTER.

   TV=xxxxV flashes in the lower-left of the display.
4. Push ▲ or ▼ to increment and decrement the voltage.
5. When the correct voltage level shows, push FUNCTION to go to the function menu.

   Do not push ENTER. Doing so will return the test voltage to a preset voltage selection.

Note

The test voltage can be up to 10 % higher than the test voltage you select.

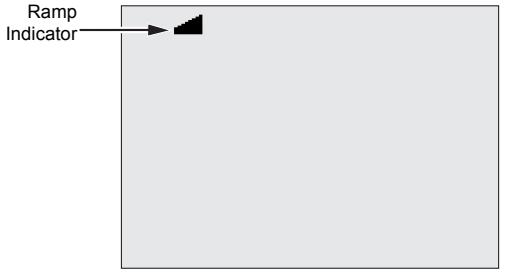
Select a Ramp or Steady-State Test

The ramp-test function is an automated test that checks insulation for a breakdown. During a ramp test, the output voltage starts at 0 V and increases linearly (100 V/s) until it reaches the specified test voltage or until a sudden drop in measured resistance is detected. Then, the Ramp stops, the test voltage drops to zero, and the voltage at the breakdown point is stored in memory on the Tester. All other test results are declared invalid if the test does not reach the specified test voltage.

If the test successfully meets compliance without breakdown, then the only valid test results are test voltage and insulation resistance.

To enable or disable the ramp function:

1. With the Tester turned on, push FUNCTION to enter the 1.X Function Menu.
2. Push ENTER to call the menu item.
3. Push U or ▼ to toggle the Ramp on or off. When the ramp is on, a blinking ◢ shows in the upper left-hand corner of the display.



4. Push ENTER or TEST to use the settings. TEST starts the test.

Set a Timed Test

You can control the length of an insulation test by setting a timer. The time (test duration) can be set in 1-minute increments up to 99 minutes. During a timed test, the time limit appears on the right bottom of the display, and the elapsed time is shown in the middle of the display. At the end of the elapsed time, the insulation test has been completed and the test is terminated.

To set a test time limit:

1. With the Tester turned on, push FUNCTION to enter the Function Menu.
2. Push ▲ or ▼ to select the **2.Time Limit function**.
3. Push ENTER to call the menu item.
4. Push ▲ or ▼ to select the time.
5. Push ENTER or TEST to use the settings. TEST starts the test.

Polarization Index (PI)

As part of the insulation test, the Tester measures and stores polarization index (PI), when appropriate. A polarization index test requires 10 minutes to complete. Therefore, the Tester will start a countdown at 10 minutes. When an insulation test is 10 minutes or more, the polarization test is completed and stored. The results are available for display during a test by pushing the ◀▶ button or by storing the test results and scanning the **RESULTS** fields. The field is identified by:

$$PI = \frac{R\ @\ 10\ min}{R\ @\ 1\ min}$$

Dielectric Absorption Ratio

As part of the insulation test, the Tester measures and stores dielectric absorption ratio (DAR), when appropriate. A DAR test requires 1 minute to complete. Therefore, it is measured and stored as invalid data for all insulation tests <1 minute. When an insulation test is ≥1 minute, the DAR test is included in the results. The results are available for display during a test by pushing the ◀▶ button or by storing the test results and scanning the **RESULTS** fields. The field is identified by:

$$DAR = \frac{R\ @\ 1\ min}{R\ @\ 30\ sec}$$

The Tester also does the DAR test in accordance to the Chinese standards:

$$DAR\ [CN] = \frac{R\ @\ 1\ min}{R\ @\ 15\ sec}$$

Capacitance

As part of the insulation test, the Tester measures and stores capacitance when appropriate. The results are available for display during a test by pushing the ◀▶ button or by storing the test results and scanning the **RESULTS** fields. The field is identified by **C=**.

Insulation Test

⚠⚠ Warning

To prevent possible electric shock, fire, or personal injury:

- **Be aware that insulation resistance measurement requires the application of potentially dangerous voltages to the circuit. This may include exposed bonded metalwork.**
- **Remove all power from the circuit under test and discharge circuit capacitance before you do a circuit test with the Product.**
- **Before proceeding, ensure that the installation is wired correctly and no personnel are endangered by any tests.**
- **Connect the test leads to the Product inputs before you make connection to the circuit under test.**

PI/DAR Limits:

- Cap. Max >1 µF and Res. Max >100 MΩ
- Res. Min <200 kΩ
- Current min <50 mA
- If a limit is exceeded, the Tester shows **UNSPEC**. on the display.

To perform an insulation test:

1. With the Tester turned on, set the available measurement options to meet the test requirements. These include:
   - Test Voltage
     – Set range: 250 V to 1000 V (50 V steps)
     – Set range: 1000 V to 10 000 V (100 V steps)

     Note

     5000 V max for 1550C.
   - Ramp Test – Toggle on or off
   - Time Limit – No limit or from 1 to 99 minutes
2. Connect the probes to the circuit under test.

⚠⚠ Warning

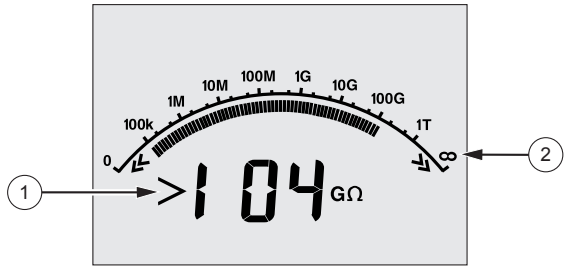
Before and after a test, confirm that the Product does not indicate the presence of a hazardous voltage. See Table 5. If the Product beeps continuously and a hazardous voltage is shown on the display, disconnect test leads and remove power from the circuit under test.

3. Push TEST for 1 second to start the insulation test.

   The Tester beeps three times as the test begins, and ⚠ flashes on the display to indicate potentially hazardous voltages may be present on the test terminals.

   The display indicates the measured insulation resistance after the circuit has stabilized. The bar graph displays this value continuously (in real time) as a trend, see Table 7.

Table 7. Measured Insulation Resistance Display



Item	Description
①	Digital Main Display
②	Bar Graph

   Any of these conditions terminate an insulation test:

   - User stop (push TEST)
   - Timer limit reached
   - Interference on the test circuit
   - Breakdown occurs with ramp test enabled
   - Battery depleted

   If breakdown occurs with ramp test enabled, push ENTER before going to step 4.

   After the termination of an insulation test, the Tester beeps when a potentially hazardous voltage remains on the test terminals due to charged-circuit capacitance or from the presence of an external voltage.

4. When the test is terminated, **STORE RESULT?** shows on the display. If appropriate, store the test results. See *Store Test Results*. Or, push ▼ to terminate the STORE RESULT? prompt. The results are not stored.

Store Test Results

When the insulation test is complete, the Tester shows **STORE RESULT?** as a prompt to save the measurement results for future use. The Tester includes enough memory to store the results of 99 insulation tests.

To store the results of an insulation test:

1. Push ▲ to save the measurement results. The Tester will assign and display a sequential tag number (00 to 99) to identify the measurement.
2. If the tag number is acceptable, push ▲ again to store the data. If a different tagging convention is required, proceed as follows to provide a custom 4-character tag.

   Notice that * is blinking on the display. This is the first of the four characters available for tagging the test results.

3. Repeatedly push ◀▶ to cycle through the character positions.

4. At each character position use ▲ or ▼ to assign a character (0-9, A-Z).
5. Push ENTER to store the results.

View Test Results Stored in Memory

Note

Parameters not appropriate for a test are shown as **INVALID**.

The Tester can store 99 sets of test data, including:

- Tags
- Ramp on or off
- Insulation Resistance
- Timer reading at termination of test (Timer)
- Test Voltage Selected (TV)
- Actual Test voltage (V)
- Capacitance I
- Polarization Index (PI)
- Dielectric absorption ratio (DAR or DAR[CN])
- Test current (I)
- Reason for ending the test
- Limit – off or timer setting from 1 to 99 minutes (T. Limit)

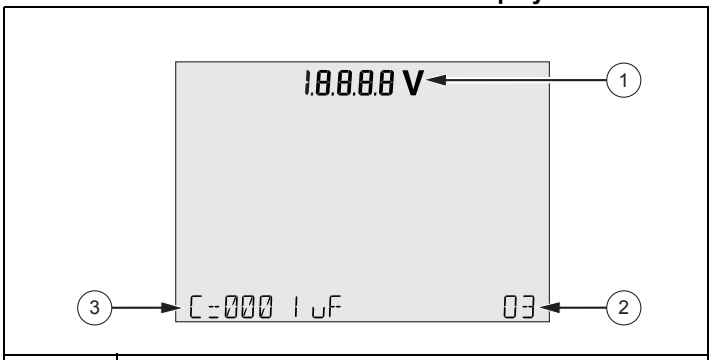
To view stored test data, see Table 8:

1. With the Tester turned on, push FUNCTION to call the Function menu.
2. Push ▲ or ▼ to select **3. Show Results**.
3. Push ENTER to select the menu item.

Note

When a voltage is present at the terminals, that voltage is always shown on the top-center of the display, regardless of whether that voltage is sourced by the Tester or is from the circuit under test.

Table 8. Stored Test Data Display



Item	Description
①	Voltage at terminals
②	Stored location
③	Stored test results

4. Push ▲ or ▼ to step through the stored locations.
5. Stop at the location you want to view.
6. Push ◀▶ to view the stored test data for a specific test. Test data appears on the alphanumeric text display and on the LCD.
7. Push ENTER to call the menu selection.

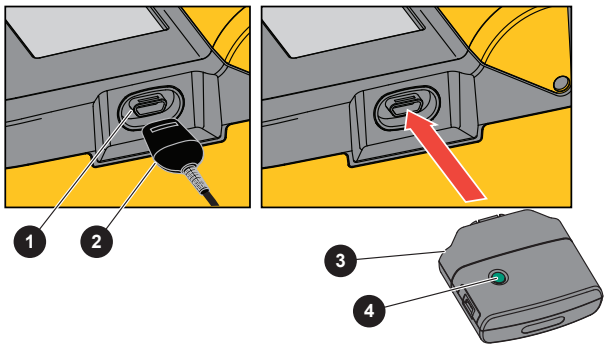
Download Test Results

You can use Fluke Connect® Desktop software to update your Product firmware and download all your stored test data to a PC.n infrared cable assembly is supplied for the Tester to PC connection.

With the ir3000 FC BLE-IR adapter option, you can use a smartphone or tablet and the Fluke Connect® app to download test results as well as view measurements simultaneously at the inspection site and from the office or an off-site location.

Table 9 shows the IR port and options.

Table 9. IR Port



Item	Description
1	IR Port
2	IR Cable Assembly (included)
3	ir3000 FC BLE-IR Adapter (option-PN 4460451)
4	Power On/Off

Note

Before the USB-IR cable can be used, software drivers must be installed on your Windows PC. See the USB-IR Installation Guide for more information.

IR Cable Assembly

To connect the Tester to the PC for use with *FC Desktop* software:

1. Make sure the Tester is not in the test mode. When in test mode, serial communications are disabled.
2. Connect the USB-IR cable to an available USB port on the PC.
3. Attach the USB-IR cable to the IR port on the Tester.
4. Open *FC Desktop* software.
5. Turn the Tester on.
6. Follow the prompts in the software.
7. Verify that the download was successful before deleting the stored test results on the Tester.

Note

Results data stored in the Tester can be deleted from the PC using the FC Desktop software.

Fluke Connect App

The Product supports the Fluke Connect® Wireless System (may not be available in all regions). Fluke Connect® uses low-power 802.15.4 wireless radio technology to wirelessly connect to an app on your smartphone or tablet. The wireless radio does not cause interference with measurements. The app shows measurements on your smartphone or tablet display, saves to Fluke Cloud™ storage, and shares the information with your team.

Note

Changes or modifications to the wireless 2.4 GHz radio not expressly approved by Fluke Corporation could void the user's authority to operate the equipment.

The Fluke Connect app works with Apple and Android mobile products. The app is available for download from the Apple App Store and Google Play.

To set up:

1. Connect the ir3000 FC BLE-IR adapter to the IR port on the Tester.
2. Turn on the adapter.

On your mobile device:

1. Go to **Settings** > **Bluetooth**. Verify that Bluetooth is turned on.
2. Go to the Fluke Connect app and in the list of connected Fluke tools, select **155x FC**.
3. Follow the prompts in the app to continue.

Delete Test Results

To delete all saved test results:

1. Push FUNCTION to call the Function menu.
2. Push ▲ or ▼ to select the menu item **DELETE RESULT.**
3. Push ENTER to call the menu item.
4. Push ▲. **REALLY DEL?** shows on the display.
5. Push ▼ to confirm the deletion or push ENTER to return to **Test Voltage**.

Note

The Delete function deletes all stored test results. Individual test locations cannot be deleted but are overwritten.

Maintenance

⚠⚠ Warning

To prevent possible electric shock, fire, or personal injury:

- **Do not repair or service your Product beyond what is described in this manual.**
- **Have an approved technician repair the Product.**
- **There are no user-replaceable parts inside the Product.**

Cleaning

⚠⚠ Warning

To prevent possible electric shock, fire, or personal injury, remove excess water from the cloth before you clean the Product to ensure that water does not enter any terminal.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents to clean the Product.

Replaceable Parts and Accessories

Table 10 is a list of the replaceable parts for the Product. Table 11 is a list of the available accessories.

Table 10. Replaceable Parts

Part	Part Number
TL1550B, includes: Test Leads (Red, Black, Green) Test Clips (Red, Black, Green) Test Probes (Red, Black)	2788216
AC Power Cord (North America)	284174
AC Power Cord (Continental Europe)	769422
AC Power Cord (UK)	769455
AC Power Cord (Australia)	658641
AC Power Cord (S. Africa)	1552363
Soft Carrying Case	3592805
Infrared Cable Assembly	1578406
Quick Reference Card	3592822

Table 11. Accessories

Accessory	Part Number
Extended Test Lead Set, 25 feet (7.6 meters)	2032761
Rugged Alligator Clamps Leads	4112351
Soft Case	3592805
Hard Case	4253708
ir3000 FC BLE-IR Adapter	4460451

General Specifications

Display.....475 mm x 105 mm

Power.....12 V lead-acid rechargeable battery, 2.6 Ahr

Typical Battery Charge Capacity

Number of tests.....4100 @ 250 V
3600 @ 500 V
3200 @1 kV
2500 @ 2.5 kV
1000 @ 5 kV
500 @ 10 kV

At temperature extremes.....charge the battery more frequently

Charger Input (AC).....85 V to 250 V ac, 50/60 Hz, 20 VA
This Class II (double insulated) instrument is supplied with a Class 1 (grounded) power cord. The protective earth terminal (ground pin) is not connected internally. The extra pin is for added plug retention only.

Dimensions (H x W x L).....170 mm x 242 mm x 330 mm (6.7 in. x 9.5 in. x 13.0 in.)

Weight.....3.6 kg (7.94 lb)

Tamper Protection.....Kensington lock

Environmental Specifications

Operating Temperature.....-20 °C to +50 °C (-4 °F to +122 °F)

Storage Temperature.....-20 °C to +65 °C (-4 °F to +149 °F)

Relative Humidity.....80 % to 31 °C decreasing linearly to 50 % at 50 °C

Altitude.....2000 m

IP Rating.....IEC 60529: IP40

Safety ..... IEC 61010-1: 600 V CAT IV / 1000 V CAT III Pollution Degree 2

Electromagnetic Compatibility (EMC)

International ..... IEC 61326-1: Portable

CISPR 11: Group 1, Class A

Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.

Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Emissions that exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object.

Korea (KCC) ..... Class A Equipment (Industrial Broadcasting & Communication Equipment)

Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.

USA (FCC) ..... 47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.

Wireless Radio with Adapter

Frequency Range ..... 2412 MHz to 2462 MHz

Output Power ..... <100 mW

Electrical Specifications

The Tester accuracy is specified for 1 year after calibration at operating temperatures of 0 °C to 35 °C. For operating temperatures outside the range (-20 °C to 0 °C and 35 °C to 50 °C), add ±0.25 % per °C, except on the 20 % bands add ±1 % per °C.

Insulation		
Test Voltage (DC)	**Insulation Resistance Range**	**Accuracy (±reading)**
250 V	<250 kΩ 250 kΩ to 5 GΩ 5 GΩ to 50 GΩ >50 GΩ	unspecified 5 % 20 % unspecified
500 V	<500 kΩ 500 kΩ to 10 GΩ 10 GΩ to 100 GΩ >100 GΩ	unspecified 5 % 20 % unspecified
1000 V	<1 MΩ 1 MΩ to 20 GΩ 20 GΩ to 200 GΩ >200 GΩ	unspecified 5 % 20 % unspecified
2500 V	<2.5 MΩ 2.5 MΩ to 50 GΩ 50 GΩ to 500 GΩ >500 GΩ	unspecified 5 % 20 % unspecified
5000 V	<5 MΩ <5 MΩ to 100 GΩ 100 GΩ to 1 TΩ >1 TΩ	unspecified 5 % 20 % unspecified
10 000 V	<10 MΩ 10 MΩ to 200 GΩ 200 GΩ to 2 TΩ >2 TΩ	unspecified 5 % 20 % unspecified
	Bar graph range: Insulation test voltage accuracy: Induced ac mains current rejection: Charging rate for capacitive load: Discharge rate for capacitive load:	0 to 2 TΩ -0 %, +10 % at 1 mA load current 2 mA maximum 5 s/µF 1.5 s/µF

Measurement	Range	Accuracy
Leakage Current	1 nA to 2 mA	±(20 % + 2 nA)
Capacitance	0.01 µF to 20.00 µF	±(15 % of reading + 0.03 µF)

Timer	Range	Resolution
	0 to 99 minutes	Setting: 1 minute Indication: 1 second

Live circuit warning	Warning Range	Voltage Accuracy
	30 V to 1100 V ac/dc, 50/60 Hz	±(15 % + 2 V)

Short circuit current .....>1 mA and <2 mA

Principles of Measurement and Resistance

The Tester measures insulation parameters and displays the results using with the following formulas.

Ohm's Law	Capacitance (charge)	PI (Polarization Index)	DAR (Dielectric absorption ratio)	DAR [CN] (Dielectric absorption ratio)
$R = \frac{V}{I}$	$C = \frac{Q}{V}$	$PI = \frac{R\ @\ 10\ min}{R\ @\ 1\ min}$	$DAR = \frac{R\ @\ 1\ min}{R\ @\ 30\ sec}$	$DAR\ [CN] = \frac{R\ @\ 1\ min}{R\ @\ 15\ sec}$