FLUKE®

6500
Appliance Tester

Users Manual

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6500 Appliance Tester
Users Manual

Introduction

The Fluke model 6500 Appliance Tester (hereafter referred to as 'the tester') is designed to carry out the following tests to ensure the integrity of electrical equipment / portable appliances:

- L-N Mains Volts and Mains Wiring test.
- Insulation test (500 V dc).
- Earth Bond test 200 mA and 25A with test lead zero facility.
- Substitute Leakage Current test.
- Touch Current test .
- IEC Lead test.
- Leakage test.
- Appliance Power and Load current test.
- PELV test

Contacting Fluke

To contact Fluke for product information, operating assistance, service, or to get the location of the nearest Fluke distributor or Service Centre, call:

- +31-402-678-200 in Europe

Visit Fluke's web site at: www.fluke.com

Register your Tester at: register.fluke.com

Unpacking the Tester

The tester comes with the items listed in Table 1. If the tester is damaged or an item is missing, contact the place of purchase immediately.

Table 1. Shipment Box Contents

6500 Appliance Tester
Crocodile Clip
Test Lead
Touch Current Probe
Hard Case
Users Manual (this manual)

Safety Information

The tester must only be used by a suitably trained and competent person.

Carefully read the following safety information before using the tester.

Definitions of symbols used	
	Caution! Risk of Danger. Refer to Manual
	Caution! Risk of Electric Shock
	Conforms to Relevant European Standard
	Double Insulated (Class II) Equipment
	Earth Ground

⚠⚠ Warnings: Read Before Using

To avoid possible electric shock or personal injury, follow these guidelines:

- **If the tester does not power up immediately after connecting it to the mains outlet disconnect and verify that the mains outlet is correctly wired.**
- **Use the tester only as specified in this manual, or the protection provided by the tester might be impaired.**
- **The tester shall not be used for measurements in electrical installations.**
- **When conducting tests do not touch the appliance as some tests involve high voltages and high currents.**
- **Do not use the tester around explosive gas, vapour or dust, or in wet environments.**
- **Inspect the tester before using it. Do not use the tester if abnormal conditions of any sort are noted (such as a faulty display, broken case, etc.).**
- **Use only test leads and probes supplied with the tester, or indicated by Fluke as suitable for the tester.**
- **Inspect the test leads for damaged insulation or exposed metal. Check test lead continuity. Replace damaged leads before using the tester.**
- **When testing, always be sure to keep your fingers behind the safety barriers on the test leads.**
- **Never open the tester's case because dangerous voltages are present. There are no user replaceable parts in the tester.**
- **Have the tester serviced only by qualified personnel.**
- **The tester must be properly earthed. Only use a supply socket that has a protective earth contact. If there is any doubt as to the effectiveness of the supply socket earth, do not connect the tester. Do not use a two-conductor adapter or extension cord; this will break the protective ground connection.**
- **The tester has been set for a nominal 230 V ac – 50 Hz operation, it must never be connected to a higher voltage.**
- **The tester may only be connected to a correctly wired mains socket protected for a maximum current rating of 13 A.**
- **The mains supply is never to be connected to the IEC lead test connector or to the appliance test connector.**
- **When carrying out Earth Bond tests, regularly zero the Earth Bond test lead.**
- **Under certain test conditions the test socket may have mains potential with a maximum current of 13 A.**
- **If the tester continuously emits a two tone sound, you should unplug it immediately as this indicates a dangerous condition.**

Operating Features

Front panel description

The connectors, controls and indicators of the tester are shown and listed below.

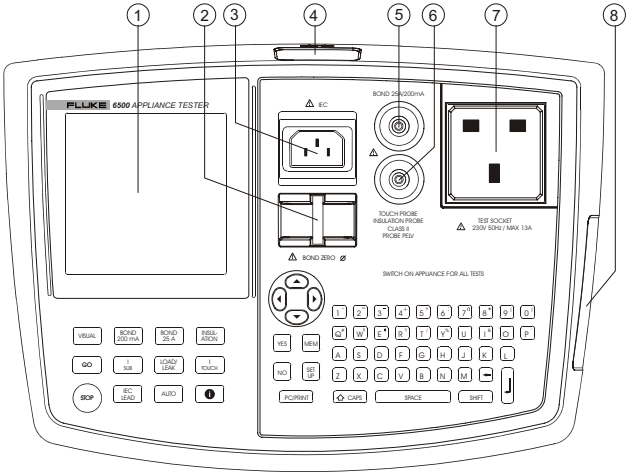

Figure 1. Fluke 6500

No.	Description
1	Liquid Crystal Display (LCD).
2	Earth bar to zero the Earth Bond test lead.
3	Socket to connect IEC lead for IEC Lead test .
4	Serial RS-232 Port to connect the Fluke printer, Fluke bar code scanner, or a computer.
5	Socket to connect test lead and crocodile clip for Earth Bond test.
6	Socket to connect test probe for Insulation test, Touch Current test, Substitute Leakage test and PELV test.
7	Socket to connect the appliance to be tested.
8	Slot to insert a Type I Compact Flash Memory Card.

Understanding the Pushbuttons

The table below shows the pushbuttons to control operation of the tester.

Button	Function
INSUL-ATION	Select the Insulation test.
BOND 25A	Select the 25 A Earth Bond test.
BOND 200mA	Select the 200 mA Earth Bond test.
VISUAL	Select the Visual Inspection test.
I TOUCH	Select the Touch Current test.
LOAD/ LEAK	Select the combined Load/Earth Leakage Current test.
I SUB	Select the Substitute Leakage Current test.
GO	Start /Enter selection.
i	Provide help on the current function.
AUTO	Select the auto-test mode.
IEC LEAD	Select the IEC Lead test.
STOP	Abort the current action and return to idle screen.
▲▼	Scroll up/down to highlight options in screen instructions (▲▲).
◀▶	Move left/right to change options in screen instructions (◀▶).
SET UP	Select the setup menu.
MEM	Store test results or viewing auto-test sequences.
YES	Confirm a proposed action.
NO	Reject a proposed action.
PC/PRINT	Download/Print test results and auto-tests.
⇧ CAPS	Use capital characters.
SPACE	Type the space character.
SHIFT	Assign special characters to keys.
↵	Enter typed data.
←	Backspace.

Understanding the Beeper Sounds

The tester can make several types of beeper sounds.

Sound	Meaning
Click	A key is pressed.
1 beep	A test passed.
2 beeps	- A test failed. - Warning, see display. - The STOP key is pressed, the current action is aborted.
Long beep	Test will start in continuous mode.
Continuous two tone sound	Dangerous condition! Unplug the unit immediately!

Understanding Displayed Symbols

The following symbols can be displayed:

	Caution! Risk of Electric Shock.
	Caution! Risk of Danger. Refer to Manual.
	Bond test lead has been zeroed.
	Auto-test failed. At IEC lead test: L-N/fuse test failed.
	Auto-test passed. At IEC lead test: L-N/fuse test passed.
LMT	Applicable limit is exceeded.
	The printer/PC is connected.
I II	Class I, Class II.
	Use buttons  .
Lockout on	Manual tests are locked out.

Powering the Tester

The tester will power up when you connect it to the mains supply. Disconnect the mains plug to power the tester down.

⚠⚠ Warning

Read the safety information on page 2 before powering the tester.

Understanding the Power-up Screen

On power up the display will perform a self-test. During this test it shows the Fluke model 6500 and the software version, for example V1.32.

After performing the self test, if all is well, the tester shows the idle screen:

`23/06/04 10:12`	← date and time
`Site: Fluke`	← most recent entered site name
V_{TN} `231.2 V`	← live-neutral voltage
V_{NR} `0.0 V`	← neutral-earth voltage
`50.2 Hz`	← line frequency
`Ø`	← bond test has been zeroed

If there is an error a self explanatory message will appear. Follow the screen instructions if an error message is displayed!

Setting Up the Tester: Basic Functions

This section describes how to set the parameters of the basic functions.

Adjusting the Display Contrast

To adjust the display contrast, do the following:

1		Power the tester up OR
		press STOP to see the idle screen.
2		Adjust the contrast.

Zeroing the Earth Bond Test

For correct Earth Bond test results you must zero the earth bond lead to eliminate its resistance:

- when setting up your new tester. Earth Bond tests are locked out unless the bond zero icon (**Ø**) is on.
- occasionally, dependent on the condition of the bond socket and the test lead plug a dirty plug/socket can result in a significant contact resistance. .

To zero the test lead, do the following:

1		Open the setup menu.

2	▲▼	Highlight **BOND ZERO set**.
3	GO	Open the setup menu and follow the screen instructions: - Attach the crocodile clip to the test lead and insert the test lead plug into the BOND 25A/200mA socket, see fig. 2. - Firmly attach the crocodile clip to the BOND ZERO Ø bar on the tester.

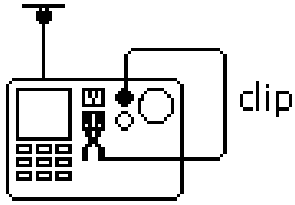

Figure 2. Bond Zero Connections

When finished the tester shows the bond zero symbol **Ø** , and the resistance value of the test lead, for example R_{PE} **0.09 Ω**. It will subtract this value from bond test results. As it saves this zero value you will not need to repeat the operation every time you use the tester.

If the display shows the message R_{PE} **> 1.99Ω** the lead resistance is more than 1.99 Ω and cannot be zeroed. Earth bond tests will now be locked out.

If the Earth Bond test lead has been zeroed, the idle screen and the earth bond test results screen will show the zero symbol **Ø**, for example:

Ø Bond test 25A

Setting Date and Time

The tester has a date and time clock. To set the date and the time, do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **DATE/TIME set**.
3	GO	Open the next menu and follow the screen instructions.

Setting the Site Text

To set the site text, do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **SITE text set**.
3	GO	Open the next menu and follow the screen instructions.

Setting Up the Tester: Advanced Functions

This section describes how to set the parameters of the advanced functions.

Changing the Access Code

The factory set access code is 9999. You need the access code to enter or edit auto-tests, to lock or unlock manual tests, and to edit the access code. If you forget your access code contact Fluke.

To change the access code, do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **ACCESS CODE set**.
3	GO	Open the next menu and follow the screen instructions.

Selecting Fast or Standard Test Mode

In the standard test mode the tester provides help information during the tests. In the fast mode this information is bypassed where possible to save test time. See also ‘Test Modes: Standard or Fast’ on page 15.

To select the fast or standard mode, do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **FAST MODE set**.
3	GO	Open the next menu and follow the screen instructions.

Creating/Editing an Auto-Test Sequence

The tester is provided with factory programmed automatic test sequences, see page 17. You can create new auto-test sequences, and edit tests you created.

To create or edit auto-tests, proceed as follows:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **AUTO-TEST setup**.
3	GO	Open the User auto-test setup menu.
4	9 9 9 9	Enter the access code, for example 9999.
5	GO	Accept the access code.

In the next step you must enter a 3-digit test number:

- Enter a new auto-test number to start creating a user programmed auto-test from scratch.
- Enter the number of a factory programmed auto-test to make a copy of it, edit the copy, and store it as a new user programmed auto-test. See page 17 for the factory programmed tests.
- Enter the number of an existing user-programmed auto-test to edit the test.

Continue as follows:

6	1 2 3	Enter the test number, for example 123.
7	GO	Accept the number. If you entered a factory programmed number do step 8 and 9 to make a copy. If you entered a new auto-test number or an existing user programmed auto-test number go to step 10.
8	4 5 6	Enter the number to be assigned to the copy of the factory programmed auto-test, for example 456.
9	GO	Accept the new auto-test number and enter the set-up/instruction screen.
10	▼	Start setting up the test.
11	▲ ▼	Use the up/down keys to select the test parameter(s) to be changed.
	◀ ▶	Use the left/right arrow key to change the test parameter For the test parameters see Table 2.
12	GO	When finished exit the set up screen.
13	◀	To review/edit.
	MEM	To save the auto-test.

Notes

Test numbers 137 to 142 and 235 to 240 are reserved for future factory programmed tests.

User programmed tests are stored in chronological order and not in numeric order.

To view saved auto-tests see ‘Viewing Auto-Test Sequences’ on page 29.

Table 2. Test parameters

Test	Parameter
Visual check	(Skipped) - SELECTED
Bond	
Current	200mA – 25A
Repeat [1]	R0 – R1 – R2 - R3
Limit	0.1Ω …19.9Ω
Duration	(Skipped) - 5s….60s
Insulation	
Repeat	R0 – R1 – R2 - R3
Safety Class [2]	I – II
Limit	0.1 MΩ…290MΩ
Duration	(Skipped) - 5s….60s
Substitute Leakage	
Limit	0.5mA … 19.5mA
Safety Class [2]	I – II
Duration	(Skipped) - 5s….60s
Load/leakage	
Limit Load	0VA…3200VA
Limit Leakage	0.5mA …19.5mA
Duration	(Skipped) - 5s….60s
Touch Current	
Repeat	R0 – R1 – R2 - R3
Limit	0.25mA, 0.5mA – 1.9mA
Duration	(Skipped) - 5s….60s
IEC Lead	
Limit Rpe	0.1Ω…19.9Ω
Duration [3]	(Skipped) - 5s….60s
Limit Riso	fixed at 2 MΩ

Notes

1) *The repeat test parameters R0, R1, R2, and R3 define how many times a test will be repeated. When you select for example R1, the test will be repeated once (two tests).*

2) *The selected class for the isolation test also applies to the substitute leakage test.*

3) *The IEC lead test can only be selected if all other tests, except for the visual check, are skipped.*

Setting Manual Test Limits

To set the manual test limits you need your access code (factory default 9999).

Do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **MANUAL LIMITS**
3	GO	Open the next menu and follow the screen instructions. To restore the factory set limits press NO. For the test parameters see Table 2.

Locking and Unlocking Manual Tests

To unlock/lock manual tests you need your access code (factory default 9999).

Do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **MANUAL TEST lock**.
3	GO	Open the next menu and follow the screen instructions.

Setting the Serial Port Communications Speed

The tester communications speed (baud rate) must correspond to the communications speed of the connected printer, bar code scanner, or computer.

To set the communications speed, do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **COMMS RATE set**.
3	GO	Open the Serial port baud rate menu and follow the screen instructions.

The default communications speed setting for the SP1000 printer and the SP15 scanner is 9600 baud.

Installing - Formatting a Compact Flash Card

You can copy saved test results and user defined auto-tests to a Type I Compact Flash Memory Card (FAT12/FAT16 formatted) for backup purposes.

⚠ Caution

- **Do not remove the card or do not press the STOP key during a format or a write operation. This will damage your card!**
- **Formatting a card will erase all data on that card.**
- **Do not force the CF card into the 6500 card socket. If you encounter resistance, stop and check that you have plugged in the card in the correct orientation. If you use force you may damage the card and the card reader.**

To install a card gently insert it into the slot, see figure 3. To remove the card press the card eject button next to the slot.

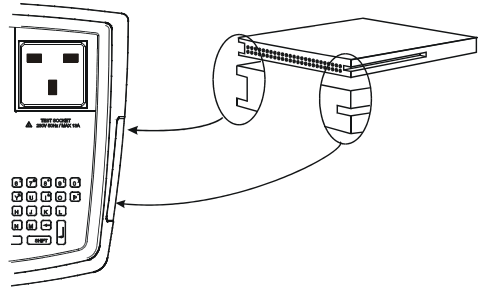

Figure 3. Inserting the CF card

If the card has an invalid file format a screen message will prompt you to format the card.

To format the card, do the following:

1	SET UP	Open the set-up menu.
2	◄ ►	Highlight **FORMAT a Compact Flash card**
3	GO	Open the Format menu and follow the screen instructions.

Note

If you are formatting a CF card on a PC, please ensure you format it to FAT 12 or FAT 16 formats.

Testing Appliances

For the vast majority of testing you can use the auto-test mode. This is advantageous because you can just follow the on screen instructions.

The manual test mode is designed for applications where one particular test must be repeated several times in a row and to quickly carry out a test.

⚠⚠ Warnings

- **Before commencing any testing you are strongly advised to make reference to the Electricity at Work Regulations 1989 and any relevant publications from the Health and Safety Executive.**
- **The appliance must be switched on for all tests.**
- **When conducting tests do not touch the appliance as some tests involve high voltages and high currents.**
- **The tests should only be performed by competent persons who are familiar with the requirements of the type of tests suitable for portable appliances.**
- **It is potentially hazardous for both user and appliance should the wrong type of tests be undertaken or if testing is carried out in an incorrect sequence.**
- **It is important that you fully understand the various tests required and how they should be performed.**
- **The appliance must have passed the visual inspection, the earth bond test (Class I), and the insulation test (in this sequence) prior to any other test. If any of these fail further testing must be stopped and any faults must be rectified.**
- **During the load/leakage test and the touch current test, the appliance will be energized at mains voltage. For this purpose, switch on the appliance. Appliances driven by motors or equipped with heating units may present a danger for the person testing (comply with the appliance instruction manual!). Ensure that the appliance is in a safe condition to run. Please secure it prior to the test.**

Aborting a Test

Pressing (STOP) immediately aborts whatever test is in progress, makes the tester safe and then shows the idle screen.

Test Modes: Single - Continuous Test

You can run manual tests in a single test mode or in a continuous test mode. A test in the auto-test mode will always be a single test.

Single Test

To run a single manual test press a test button to select a test and then press and release [GO] to start the test.

The tester connects the test supply, performs one test, disconnects the test supply and holds the result on the display. In the auto-test mode the tester will proceed with the next test.

Note

To start the Visual Inspection test just press the [VISUAL] key.

Continuous Test

To start a continuous manual test press a test button to select a test and then press [GO] and hold it down for at least 2 seconds. A long beep will indicate the continuous test has started.

The tester connects the test supply, makes the first test and displays the first result. Then the tester continues measuring and displaying results without disconnecting the test supply. The maximum run time is 8 minutes. After this time the test stops.

To stop a continuous test, press the selected test button or press [GO] again. The tester disconnects the test supply and holds the last test result on the display.

Note

The IEC-Lead test cannot be run in the continuous test mode.

Test Modes: Standard or Fast

In the standard test mode the tester displays instructions on how to perform a test. The factory-set mode is the standard mode.

In the fast test mode screen instructions will be bypassed where possible. During auto-tests in the fast mode the Visual test is assigned a pass and the test screen is not shown.

To select the fast mode or standard mode see ‘Selecting Fast or Standard Test Mode’ on page 9.

Using the Auto-Test Mode

The tester provides a number of factory programmed auto-tests, see Table 3 (Class I appliances) and Table 4 (Class II appliances). An auto-test consists of a number of single tests that will be carried out in the programmed order. The test limits are pre-set, and the test result will give a pass/fail indication.

See page 9 on how to create new auto-tests.

Auto-tests are locked out unless the Earth Bond test lead resistance has been zeroed out, see page 7.

When any test fails during an auto-test, further tests can not be carried out .

Performing Auto-Tests

You can run an auto-test in the standard mode or in the fast mode. See ‘Test Modes: Standard or Fast’ on page 15 and ‘Selecting Fast or Standard Test Mode’ on page 9 for more information.

To start an auto-test, do the following:

1	AUTO	Select the auto-test mode and follow the screen instructions.

The chapter ‘Description of the Tests’ on page 19 provides detailed information on the individual tests.

When the auto-test is finished a pass (✓) or a fail (✗) indication is displayed. Now you can review the results before saving them, and save the results.

Table 3. Factory Programmed Auto-Tests for Class I Appliances

Tests	131	132	133	134	135	136
Visual Inspection	Yes	Yes	Yes	Yes	Yes	Yes
Earth Bond 25A (Ω)	0.10	0.10	No	No	0.10	No
Earth Bond 200mA	No	No	0.10	0.10	No	0.10
Insulation (MΩ)	1.00	1.00	1.00	1.00	1.00	1.00
Touch Current (mA)	No	No	No	No	No	No
Substitute Leakage (mA)	No	No	No	No	No	No
Load/Leakage (VA/mA)	3000/3.5	3000/0.75	3000/3.5	3000/0.75	No	No

Table 4. Factory Programmed Auto-Tests for Class II Appliances

Tests	231	232	233	234
Visual Inspection	Yes	Yes	Yes	Yes
Earth Bond 25A (Ω)	No	No	No	No
Earth Bond 200mA	No	No	No	No
Insulation (MΩ)	2.00	2.00	2.00	2.00
Touch Current (mA)	0.25	0.25	No	No
Substitute Leakage (mA)	No	No	No	No
Load/Leakage (VA/mA)	3000/0.25	No	No	3000/0.25

Note: Test numbers 137 to 142 and 235 to 240 are reserved for future factory programmed tests.

Using the Manual Test Mode

To lock/unlock manual tests see page 12 .

⚠ Warning

NEVER carry out the TOUCH CURRENT and LOAD/LEAKAGE test unless you have first carried out a thorough visual inspection, followed by a test of the earthing (Class I appliances), and then a test of the insulation. You must verify that these tests are passed before engaging this test.

Table 5 shows the factory-set manual test limits.

Table 5. Factory-set manual test limits

Earth Bond	0.10 Ω
Insulation class I/class II	1 MΩ / 2 MΩ
Substitute Leakage class I/class II	3.5 mA / 0.5 mA
Touch Current	0.25 mA
Load	3200 VA
Leakage current	0.75 mA
IEC lead bond/insulation	0.10 Ω / 2 MΩ

To change the test limits refer to page 11.

Earth Bond tests are locked out if you did not zero the earth bond test lead resistance, see page 7.

Performing Manual Tests

You can run manual tests in the standard mode or in the fast mode. See ‘Test Modes: Standard or Fast’ on page 15 and ‘Selecting Fast or Standard Test Mode’ on page 9 for more information.

To perform a manual test do the following:

1	[ ]	Select the required test key. Follow the screen instructions.
2	[GO]	Press and release for a short single test. Press for longer than 2 seconds for a continuous test (not applicable for a visual inspection and IEC lead test). To stop a continuous test, press the selected test key or press [GO] again.

For more information on the individual test refer to ‘Description of the Tests’ on page 19.

After performing a test you can save the result, see ‘Saving Test Results’ on page 28.

Description of the Tests

Visual Inspection Test

Visually inspect the appliance before you start electrical testing.

Check the appliance for the following:

- condition of the appliance cables, i.e. no cuts, cracks or any physical damage to the outer insulation layer.
- condition of the plug, cable securely attached, no signs of overheating and that the correct value of fuse is fitted.
- any signs of damage, and that any mains or control switches will physically switch on and off.
- any sockets for signs of overheating or physical damage.

Bond Test 25A/200 mA (R_{PE})

The test checks the resistance between the earth pin of the appliance cable plug and the exposed metalwork on the appliance. The test applies to Class I appliances.

Remarks:

- To enable the bond test and to obtain correct bond test results you must have zeroed the test lead, see page 7.
- You should use the lower current 200 mA for certain appliances. Please refer to appliance test standards and guidance material.
- Connect the appliance and the earth bond test lead as indicated on the display. Clip the crocodile clip to an exposed conductive part on the appliance that requires testing, see fig. 4.
  Do not use the probe for the 25 A bond test. The probe is only rated for 10 A!
- During the measurement flex the flexible cord along its length to help find any broken conductors or poor quality joints.
- Continuous 25 A bond test will periodically drop back to 200 mA test to prevent the tester from being overheated.

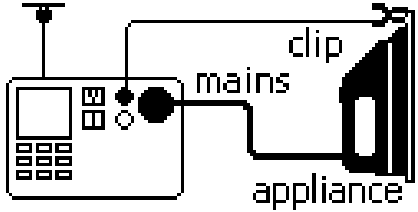

Figure 4. Bond Test Connections

The display can show the following specific information:

LMT `>0.1Ω+LEAD`	R_{PE} may have exceeded the recommended limit, possibly because of the length of the lead.
`> 19.99 Ω`	R_{PE} overrange.
Ø	Bond test lead has been zeroed.

Insulation Test (R_{ISO})

⚠ Warning

- **The test voltage is 500V dc. Do not touch the appliance during the insulation test! If the test fails any metal parts of the appliance could become live!**
- **Always make sure that the test has completed before disconnecting the appliance leads to ensure that all capacitances have discharged.**

⚠ Caution

Do not perform the Insulation test on appliances that failed the bond test or the visual inspection test.

The test checks the resistance of the insulation between

- the earth pin of the appliance cable plug (Class I)

or

- the test probe to be applied to the appliance (Class II)

and the Live and Neutral pins of the appliance (pins are connected together within the tester for this test).

The insulation test will be inhibited if the tester detects a terminal voltage >30 Vrms prior to initiation of the test.

Note

The insulation test may be not suitable for some types of appliances. For these appliances an alternative test may be conducted such as a touch current, leakage current, or substitute leakage current test. It is essential to refer to standards and/or reference material for the safe applicability of these alternative tests.

Remarks:

- Connect the appliance and the test probe as indicated on the display, see fig. 5 and fig. 6.
- For Class I appliances no probe is required.
- For Class II appliances apply the test probe to any exposed metalwork on the appliance. Do the test for all exposed metal parts on the appliance.

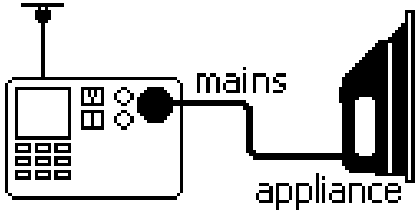

Figure 5. Insulation Test Connections Class I

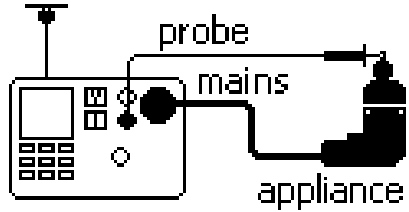

Figure 6. Insulation Test Connections Class II

The display can show the following specific information:

LMT <1.0MΩ	The test result is below the recommended class I limit.
LMT <2.0MΩ	The test result is below the recommended class II limit.
> 299 MΩ	R_{ISO} overrange.

Substitute Leakage Current Test (I_{SL})

The test measures the leakage current between

- the earth pin of the appliance cable plug (Class I)

or

- the test probe attached to the appliance under test (Class II)

and the Live and Neutral pins of the appliance (pins are connected together within the tester for this test).

It is essential to refer to standards and/or guidance material for the safe applicability of this test.

Remarks:

- Connect the appliance and the test probe as indicated on the display, see fig. 7 and fig. 8.
- For Class I appliances no test probe is required.
- For Class II appliances apply the test probe to any exposed metalwork on the appliance. Do the test for all exposed metal parts on the appliance.

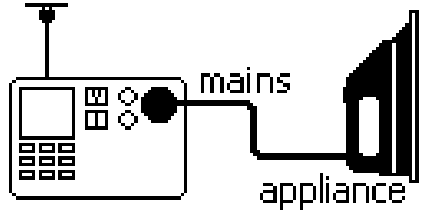

Figure 7. Substitute Leakage Test Connections Cl. I

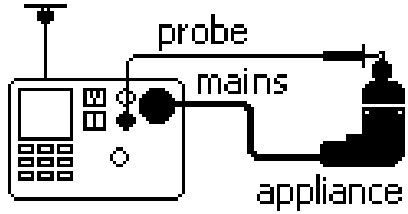

Figure 8. Substitute Leakage Test Connections Cl. II

The display can show the following specific information:

LMT `> 3.5 mA`	The acceptable test limit may have been exceeded. Refer to standards and/or guidance material.
`> 19.99 mA`	I_{SL} overrange.

Touch Current Test (I_{TC})

⚠ Warning

NEVER carry out this test unless you have first carried out a thorough visual inspection, followed by a test of the earthing (Class I appliances), and then a test of the insulation. You must verify that these tests have passed before engaging this test.

⚠ Caution

Live test! The appliance will be energized at mains voltage. For this purpose, switch on the appliance. Appliances driven by motors or equipped with heating units may present a danger for the person testing (comply with the appliance instruction manual!). Ensure that the appliance is in a safe condition to run. Please secure it prior to the test.

The Touch Current test consists of:

- a fuse and L-N loop pre-test
- a leakage current measurement with approx. 2 kΩ resistance connected between earth and exposed conductive parts on the appliance via the test probe. The measurement is performed by the direct method.

Connect the appliance and the test probe as indicated on the display (see fig. 9) and apply the test probe to:

- any exposed conductive part on Class II appliances
- any exposed conductive parts that are not connected to earth on Class I appliances.

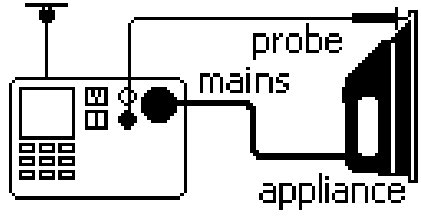

Figure 9. Touch Current Test Connections

The display can show the following specific information:

⚠	Live test going on!
LMT	The acceptable test limit may have been exceeded. Refer to standards and/or guidance material.
`> 1.99 mA`	Touch current overrange.

Fuse/L-N Pre-test

The pre-test verifies the fuse and lead continuity by applying a low voltage signal across the appliance phase and neutral pins.

If the pre-test fails the display will show a self-explanatory message.

A fail may indicate that the fuse is blown or that there is an open circuit in the L-N conductors. In this case press the MEM key to store the fail result.

The test could also fail because you forgot to switch the appliance on. In this case switch the appliance on and repeat the test.

Very low power appliances, or appliances with electronically controlled on/off switches or with an inductance may fail this test. To enable you to test these appliances you can assign a pass to the Fuse/L-N loop Pre-test by pressing GO to continue with the test.

Note

Accidental measurement of a defective unit may trip a RCCB (residual current circuit breaker).

Load/ Leakage Current (I_{PE}) Test

⚠ Warning

NEVER carry out this test unless you have first carried out a thorough visual inspection, followed by a test of the earthing (Class I appliances), and then a test of the insulation. You must verify that these tests are passed before engaging this test.

⚠ Caution

Live test! The appliance will be energized at mains voltage. For this purpose, switch on the appliance. Appliances driven by motors or equipped with heating units may present a danger for the person testing (comply with the appliance instruction manual!). Ensure that the appliance is in a safe condition to run. Please secure it prior to the test.

The Load/PE Leakage test consists of:

- a fuse and L-N loop pre-test.
- measurements of the appliance power consumption and load current at full mains voltage.
- measurement of the earth leakage current (differential measurement) at full mains voltage.

The measurements will be done in one test sequence.

Connect the appliance as indicated on the display (see also figure 10) .

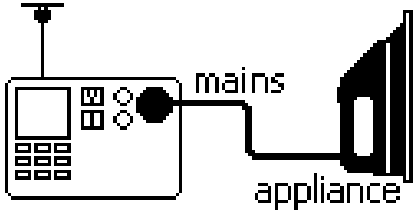

Figure 10. Load / Leakage Test Connections

The display can show the following specific information:

⚠	Live test going on.
I_{LN} 1.2 A P_{LN} 250 VA I_{PE} 0.3 mA	Load current. Reactive power. Leakage current.
LMT	The acceptable test limit may have been exceeded. Refer to standards and/or guidance material.
I_{LN} > 13 A P_{LN} > 3.2kVA I_{PE} >19.99 mA	Load current overrange. Power overrange. Leakage current overrange

Fuse/L-N Pre-test

The pre-test verifies the fuse and lead continuity by applying a low voltage signal across the appliance phase and neutral pins.

If the pre-test fails the display will show a self-explanatory message.

A fail may indicate that the fuse is blown or that there is an open circuit in the L-N conductors. In this case press MEM to store the fail result.

The test could also fail because you forgot to switch the appliance on. In this case switch the appliance on and repeat the test.

Very low power appliances, or appliances with electronically controlled on/off switches or with an inductance may fail this test. To enable you to test these appliances you can assign a pass to the Fuse/L-N loop Pre-test by pressing GO to continue with the test.

Note

Accidental measurement of a defective unit may trip a RCCB (residual current circuit breaker).

IEC Lead Test

The IEC lead test tests the IEC lead for:

- Earth bond resistance and insulation.
- Live-neutral lead/fuse continuity and polarity.

If there is a swapped polarity condition and a continuity failure in the same test, a failed polarity message will be displayed.

The IEC lead test runs only in single test mode.

Connect the IEC lead as indicated on the display (see also figure 11).

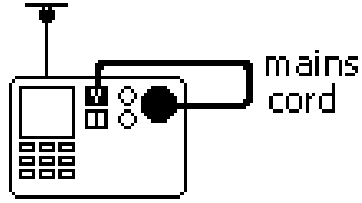

Figure 11. IEC Lead Test Connection

The display can show the following specific information:

R_{PE} 0.13 Ω	Protective earth conductor resistance.
R_{ISO} 55.6 MΩ	Insulation resistance.
Fuse ☑	The fuse/continuity is ok
LMT	One of the test limits has been exceeded.
Fuse ☒	Fuse/continuity not ok
Polarity ☒	L-N are swapped
R_{PE} > 19.99 Ω	Result overrange.
R_{ISO} > 299 MΩ	
LMT >0.1Ω+LEAD	R_{PE} has exceeded the recommended limit, possibly because of the length of the lead.
LMT <2.0MΩ CII	The test result is below the recommended class II limit.

PELV Test

The PELV (Protective Extra Low Voltage) test measures the voltage on the **PROBE PELV** input when the idle screen is being displayed.

To perform the PELV test, do the following:

1	STOP	Revert to the idle screen if it is not already being displayed.
2		Connect the test probe to the tester **PROBE PELV** terminal and connect the appliance to a mains supply socket.
3		Apply the test probe to the test point.
4	MEM	Store the test result, if required.

The display can show the following specific information:

`PELV  30.0 V`	PELV FAIL result, the threshold (25V) is exceeded.
`PELV > 39.9 V`	PELV overrange.
`230 V` `50 Hz`	If the PELV threshold is not exceeded the display shows the mains voltage and frequency (PASS result)

Tip:

To store a PELV FAIL result press MEM and GO .

To store a PELV PASS result press MEM and select menu item “SAVE PELV pass result“.

Using the Memory

The tester has a non-volatile memory to save test results and auto-test sequences.

Saved test results or auto-tests will not automatically be saved on the compact flash card. The compact flash card is intended to be used as a backup for the non-volatile memory. Refer to page 32 for information on how to download the memory contents to compact flash card.

Beside saving test results and auto-tests you can also view saved results, delete individual result records, clear the entire memory and review auto-tests.

Saving Test Results

In the auto-test mode and in the manual single test mode you can save test results when a test has finished.

In the manual continuous test mode you can save the displayed test result. The display reverts to the testing screen after the results have been saved.

Warning

In continuous test mode the test continues whilst you are saving the result!

Proceed as follows to save the results:

1	MEM	Open the Save result screen and enter appliance information.
2	GO	Save test results and information.

The Save result screen will present you four fields that you can enter data into. The data can be inserted via the keyboard or the Fluke barcode scanner.

`Appliance ID`	← Mandatory field
`Location`	← Optional field
`Description`	← Optional filed
`Note`	← Optional field

Appliance ID

On pressing MEM the Appliance ID field will :

- automatically be incremented by 1 from the last stored value if you are using numeric only appliance ID references.
- show the last appliance ID If you are using alphanumeric ID references.

Location

On pressing MEM the display shows the last stored location as long as the tester has not been powered down.

Note

You can use the 4-digit Fluke coding system for the description, location, and notes field. This speeds up data entry. Please refer to the Fluke Power PAT Plus software.

Remarks:

- After saving the results the display shows the record number in the top right.
- If the display shows the warning ⚠`The store is full` you must save the data on PC or memory card and clear the store (see page 30).
- If you press MEM when the idle screen is displayed a PELV test pass result can be saved. See also 'PELV Test' on page 27.

Viewing Test Result Records

You can select the result records you want to view by record number, by date, by site, and by keyword search.

To view result records proceed as follows:

1	MEM	From the idle screen open the memory menu and follow the screen instructions. To see the idle screen press the STOP key.
2	▲▼	Highlight **VIEW RESULT records**.
3	GO	Enter the view function and follow the screen instructions.

Viewing Auto-Test Sequences

You can view factory set and user defined auto-test sequences by simply scrolling through the store.

Proceed as follows:

1	MEM	From the idle screen open the memory menu and follow the screen instructions. To see the idle screen press the STOP key.
2	▲▼	Highlight **VIEW AUTO-TESTS**.
3	GO	Enter the view function and follow the screen instructions.

Deleting Test Result Records

You can select the result records you want to delete by record number, by date, by site, and by keyword search.

To delete test result records proceed as follows:

1	MEM	From the idle screen open the memory menu. To see the idle screen press the STOP key.
2	▲▼	Highlight **DELETE a record**.
3	GO	Enter the delete function and follow the screen instructions.

Result records are not renumbered when a record in the middle of the store is deleted.

Deleting records does not free memory space! To free memory space see ‘Clearing the Memory’ on page 30.

Clearing the Memory

To free memory you must clear the store. This will delete all result records. Automatic test procedures will not be cleared.

⚠ Caution

Before clearing the store you need to be sure that the contents has been downloaded to PC and/or backed-up on Compact Flash Memory card.

To clear the memory proceed as follows:

1	MEM	From the idle screen open the memory menu. To see the idle screen press the STOP key.
2	▲▼	Highlight **CLEAR**.
3	GO	Enter the Clear menu and follow the screen instructions.

Printing - Downloading Data

The PRINT/DOWNLOAD functions enable you to :

- print some or all test results.
- print all auto-tests.
- download some or all test results to a PC for processing with Fluke Power PAT Plus software.
- download some or all test results to a Compact Flash memory card.

Only results or auto-tests that have been stored can be printed or downloaded.

You can download results in one of the following formats:

- .flk for Fluke PowerPAT Plus software.
- .csv (comma separated values), for example for Windows Excel.
- .prn SP1000 printer format (to compact flash card only).

Connecting the Printer or the PC

To establish a correct communication do the following:

1 Connect the SP1000 printer to the RS232 port using the cable supplied with the printer. In idle mode and in the print function the display shows the printer icon  when the printer is connected and is turned on.

2 Connect the PC to the RS232 port using the cable that is supplied with the Fluke Power PAT Plus software. Refer to this software for more specific information.

3 Ensure that the baud rate of the tester matches the printer baud rate (9600) or the PC com port baud rate. To set the tester baud rate see page 10.

Printing test results

To print one test result record or a range of test result records do the following:

1	PC/PRINT	Open the print/download menu.
2	▲▼	Highlight **Print results** (not possible if no results are available).
3	GO	Open the print results menu and follow the screen instructions.

Printing Auto-tests

To print all user programmed auto-tests do the following:

1	PC/PRINT	Open the print/download menu.
2	▲▼	Highlight **Auto-Tests printout**.
3	GO	Start printing.

Downloading Test Results to a PC

To download a range of test results to a PC using the Fluke Power PAT Plus software do the following:

1	PC/PRINT	Open the print/download menu.
2	▲▼	Highlight **Download to PC** (not possible if no results are available).
3	GO	Open the Download to PC menu and follow the screen instructions.

Transferring Results to Compact Flash Card

To transfer a range of test results to a compact flash card do the following:

1	PC/PRINT	Open the print/download menu.
2	▲▼	Highlight **Transfer data to CF card** (not possible if no results are available).
3	GO	Open the Transfer menu and follow the screen instructions.

The download format to be selected depends on the software you use to process the results, for example print format, Fluke Power PAT Plus format or CSV format (for Excel).

Maintaining the Tester

Cleaning

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

Dirt or moisture on the earth bond test lead plug can result in a contact resistance that affects the readings. Therefore periodically zero the earth bond test (see page 7).

Calibration

To ensure the accuracy of the tester is maintained at high level it is recommended that the tester is calibrated at least once every 12 months. Calibration must be carried out by qualified personnel. Contact your local Fluke representative for calibration (see ‘Contacting Fluke’ on page 1).

Accessories

Table 6 and Table 7 list the part numbers of the accessories.

To obtain the accessories contact your local Fluke representative, see ‘Contacting Fluke’ on page 1.

Table 6. Standard Accessories

Item	Part Number
Crocodile Clip	532269474055
Test Lead	532269474056
Touch Current Probe	1276841
Users Manual (this manual)	[1]

[1] Can be downloaded from your regional Fluke website, start at www.fluke.com .

Table 7. Optional Accessories

Item	Part Number
SPSCAN15 Barcode Scanner	1995050
SP1000 Mini Printer	1597281
EXTL100 Extension Lead Test Adapter	2414348
TA700 Appliance Adapter for 110V Tools	2389678
Fluke PowerPAT Plus Appliance Testing Software	2143155

Specifications

General Specifications

Size.....200 mm (L) x 275 mm (W) x 100 mm (H)

Weight..... 3.0 kg

Power Supply.....230 V + 10 % - 15 %, 50 Hz ± 2 %

Power Consumption (Tester)..... 13 W typical (idle)

.....60 W max. during 25A Bond Test

Operating temperature..... 0 to +40 °C

Storage temperature.....-10 to +60 °C

Relative Humidity

.....non condensing < +10 °C
.....95% from +10 to +30 °C
.....75% from +30 to +40 °C

Operating Altitude ..... 0 up to 2000 m

Sealing..... IP-40 (enclosure), IP-20 (connectors)

EMC.....complies with EN61326-1, criteria B

EMI Immunity.....3 V/m

Safety.....Complies with EN61010-1 2nd edition
DIN VDE0404-1 and DIN VDE0404-2
CAT II, 300 V, pol 2

Printer – PC RS232 Interface

Baud rate .....factory default 9600,
selectable 1200, 2400, 9600, 19200, 38400

Data bits 8

Stop bits..... 1

Parity ..... no

Test Specifications

The accuracy specification for the display range is defined as ± (%reading + digit counts) at 23 °C ± 5 °C, ≤ 75 % RH. Between 0 °C and 18 °C and between 28 °C and 40 °C, accuracy specifications may degrade by 0.1 x (accuracy specification) per °C.

The measurement range meets the service operating errors specified in EN61557-1: 1997, EN61557-2: 1997 , EN61557-4: 1997, DIN VDE0404-2.

Power-on Test

The test indicates reversed L-N, missing PE, and measures the mains voltage and frequency.

Operational Error Measurement Range ..... 195 V to 253 V

Display Range ..... 90 V to 264 V

Accuracy at 50 Hz .....± (2% + 3 counts)

Resolution ..... 0.1 V

Input Impedance.....> 1 MΩ // 2.2 nF

Maximum Input Mains Voltage ..... 300 V

Earth Bond Test

Operational Error Measurement Range ..... 0.2 to 1.99 Ω

Operational Error.....10.0%

Accuracy (after Bond Test zeroing).....± (5% + 4 counts)

Display Range ..... 0…19.99 Ω

Resolution ..... 0.01 Ω

Test Current .....200 mA ac -0% +40% into 1.99 Ω
25 A ac ± 20 % into 25 mΩ at 230 V

Open Circuit Voltage ..... > 4 V ac, < 24 V ac

Bond Test Zeroing.....can subtract up to 1.99 Ω

Used Current for Bond Test Zeroing 10A

Insulation Test

Operational Error Measurement range..... 0.1 to 5 MΩ

Operational Error.....9.0%

Accuracy .....± (5% + 2 counts) from 0.1 to 50 MΩ
± (10% + 2 counts) from 50 to 299 MΩ

Display Range ..... 0 to 299 MΩ

Resolution.....0.01 MΩ (0 to 19.99 MΩ)
0.1 MΩ (20 to 199.9 MΩ)
1 MΩ (200 to 299 MΩ)

Test Voltage.....500 V dc –0 % +25 % at 500 kΩ load

Test Current..... >1 mA at 500 kΩ load, < 15 mA at 0 Ω

Auto discharge time ..... < 0.5 s for 1 μF

Max. Capacitive Load ..... operational up to 1 μF

Touch Current Test

Operational error Measurement Range .. 0.1 to 1.99 mA ac

Operational error.....6.0%

Accuracy.....± (4% + 2 counts)

Display Range ..... 0 to 1.99 mA ac

Resolution.....0.01 mA

Internal Resistance (via probe).....2 kΩ

Measuring method .....Probe

The appliance under test is energized at mains potential.

Substitute Leakage Current Test

Operational Error Measurement Range ... 0.25 to 19.00 mA

Operational Error 10%

Accuracy .....± (5% + 5 counts)

Display Range ..... 0 to 19.99 mA ac

Resolution.....0.01 mA

Test Voltage.....35 V ac ± 20%

Load/Leakage Test: Load Current

Display Range .....0 to 13 A

Accuracy .....± (4% + 2 counts)

Resolution.....0.1 A

The appliance under test is energized at mains potential.

Load/Leakage Test: Load Power

Display Range ..... 0 to 999 VA
1.0 kVA to 3.2 kVA

Accuracy .....± (5% + 3 counts)

Resolution ..... 1 VA (0 to 999 VA
0.1 kVA (1.0 kVA to 3.2 kVA)

The appliance under test is energized at mains potential.

Load/Leakage Test: Leakage Current

Operational Error Measurement Range ...0.25 to 19.00 mA

Operational error 12.0%

Accuracy .....± (4% + 5 counts)

Display Range .....0.25 to 19.99 mA

Resolution ..... 0.01 mA

The appliance under test is energized at mains potential.

PELV Test

Display Range ..... 10.0 V to 39.9 V

Resolution ..... 0.1 V

Accuracy at 50 Hz .....± (2% + 3 counts)

Overload protection ..... 300 Vrms

Warning threshold ..... 25 Vrms

Influence Factor Errors

Influencing Factor	Designation	% Influencing Error
Position	E1	0.0%
Supply Voltage	E2	5.0%
Temperature	E3	5.5%
Current Consumption	E4	1.5%
Magnetic Fields	E5	2.5%
Impedance	E6	1.0%
Capacitance	E7	2.0%
Current Waveshape	E8	1.0%

FLUKE®

6200
Appliance Tester

Users Manual

PN 2141161
April 2005, Rev.1, 6/05

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is two years and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available only if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

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Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

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Fluke Europe B.V., P.O. Box 1186, 5602 BD Eindhoven, The Netherlands.

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6200 Appliance Tester Users Manual

Introduction

The Fluke model 6200 Appliance Tester (hereafter referred to as 'the tester') is designed to carry out the following tests to ensure the integrity of electrical equipment / portable appliances:

- L N Mains Volts and Mains Wiring test.
- Insulation test (500 V dc).
- Earth Bond test 200 mA and 25 A with test lead zero facility.
- Substitute Leakage Current test.
- Touch Current test.
- IEC Lead test.
- Leakage test.
- Appliance Power and Load Current test.
- PELV test

Contacting Fluke

To contact Fluke for product information, operating assistance, service, or to get the location of the nearest Fluke distributor or Service Centre, call:

- +31-402-678-200 in Europe

Visit Fluke's web site at: www.fluke.com

Register your Tester at: register.fluke.com

Unpacking the Tester

The tester comes with the items listed in Table 1. If the tester is damaged or an item is missing, contact the place of purchase immediately.

Table 1. Shipment Box Contents

6200 Appliance Tester
Crocodile Clip
Test Lead
Touch Current Probe
Hard Case
Users Manual (this manual)

Safety Information

The tester must only be used by a suitably trained and competent person.

Carefully read the following safety information before using the tester.

Definitions of symbols used	
	Caution! Risk of Danger. Refer to Manual.
	Caution! Risk of Electric Shock.
	Conforms to Relevant European Standard.
	Double Insulated (Class II) Equipment.
	Earth Ground.

⚠⚠ Warnings: Read Before Using

To avoid possible electric shock or personal injury, follow these guidelines:

- **If the tester does not power up immediately after connecting it to the mains outlet disconnect and verify that the mains outlet is correctly wired.**
- **Use the tester only as specified in this manual, or the protection provided by the tester might be impaired.**
- **The tester shall not be used for measurements in electrical installations.**
- **When conducting tests do not touch the appliance as some tests involve high voltages and high currents.**
- **Do not use the tester around explosive gas, vapour or dust, or in wet environments.**
- **Inspect the tester before using it. Do not use the tester if abnormal conditions of any sort are noted (such as a faulty display, broken case, etc.).**
- **Use only test leads and probes supplied with the tester, or indicated by Fluke as suitable for the tester.**
- **Inspect the test leads for damaged insulation or exposed metal. Check test lead continuity. Replace damaged leads before using the tester.**
- **When testing, always be sure to keep your fingers behind the safety barriers on the test leads.**
- **Never open the tester's case because dangerous voltages are present. There are no user replaceable parts in the tester.**
- **Have the tester serviced only by qualified personnel.**
- **The tester must be properly earthed. Only use a supply socket that has a protective earth contact. If there is any doubt as to the effectiveness of the supply socket earth, do not connect the tester. Do not use a two-conductor adapter or extension cord; this will break the protective ground connection.**
- **The tester has been set for a nominal 230 V ac – 50 Hz operation, it must never be connected to a higher voltage.**
- **The tester may only be connected to a correctly wired mains socket protected for a maximum current rating of 13 A.**
- **The mains supply is never to be connected to the IEC lead test connector.**
- **When carrying out Earth Bond tests, regularly zero the earth bond test lead.**
- **Under certain test conditions the test socket may have mains potential with a maximum current of 13 A.**
- **If the tester continuously emits a two tone sound, you should unplug it immediately as this indicates a dangerous condition.**

Operating Features

Front panel description

The connectors, controls and indicators of the tester are shown and listed below.

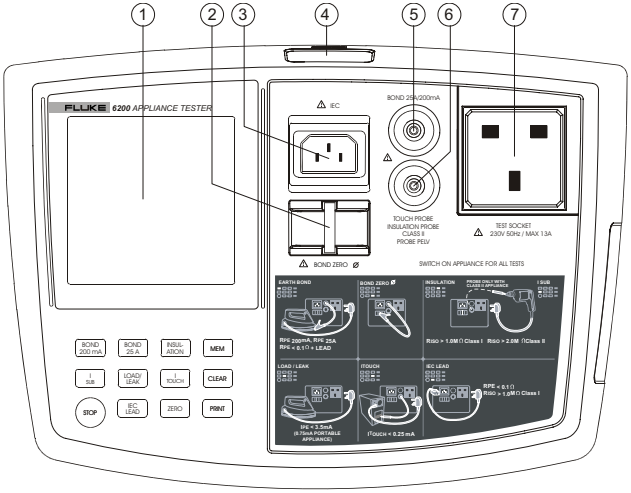

Figure 1. Fluke 6200

No.	Description
1	Liquid Crystal Display (LCD).
2	Earthed bar to zero the Earth Bond test lead.
3	Socket to connect IEC lead for IEC Lead test .
4	Serial RS-232 Port to connect the Fluke printer.
5	Socket to connect test lead and crocodile clip for Earth Bond test.
6	Socket to connect test probe for Insulation test, Touch Current test, Substitute Leakage test and PELV test.
7	Socket to connect the appliance to be tested.

Understanding the Pushbuttons

Use the pushbuttons to control operation of the tester.

Button	Function
STOP	Stop the current action and return to Idle screen.
INSUL-ATION	Start the Insulation test.
BOND 200mA	Start the 200 mA Earth Bond test.
BOND 25A	Start the 25 A Earth Bond test.
ZERO	Start zeroing the Earth Bond test.
I SUB	Start the Substitute Leakage Current test.
I TOUCH	Start the Touch Current test.
LOAD/ LEAK	Start the combined Load/Earth Leakage Current test.
IEC LEAD	Start the IEC Lead test.
MEM	Store test results.
CLEAR	Clear stored data.
PRINT	Print test results.

Understanding the Beeper Sounds

The tester can make several types of beeper sounds.

Sound	Meaning
Click	A button is pressed.
1 beep	A test passed.
2 beeps close together	- A test failed. - Warning, see display. - The STOP button is pressed, the current action is aborted.
1 long beep	A continuous non-live test has been started.
2 beeps + 1 long beep	A continuous live test has been started.
Continuous 2 tone sound	Dangerous condition ! Unplug the unit immediately!

Understanding the Display

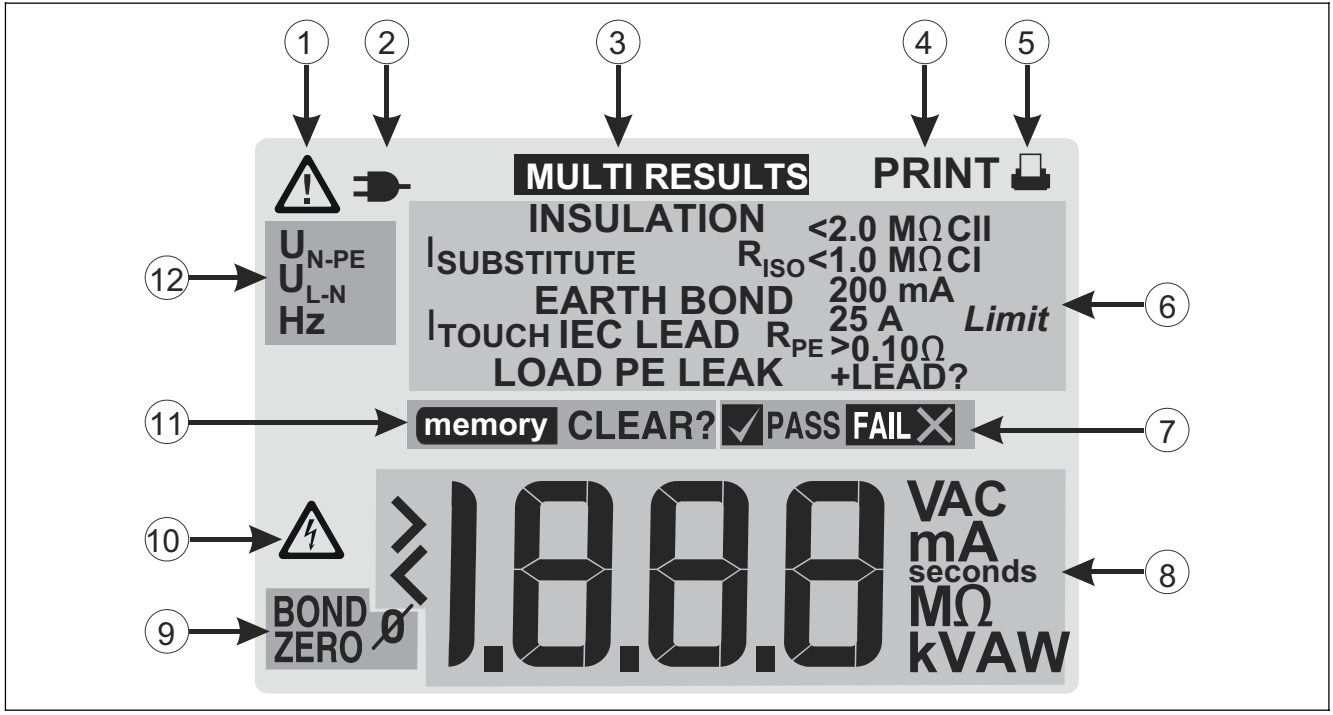

Figure 2. Display Features

No	Annunciator	Meaning
1	⚠	Caution! Risk of Danger. Refer to Manual.
2		Please check the mains polarity or the IEC-Lead polarity.
3	**MULTI RESULTS**	Multiple test results will be displayed in succession.
4	**PRINT**	Printing results.
5		SP1000 printer is connected.
6	**INSULATION** R_{ISO} **<2.0 MΩ CII** **<1.0 MΩ CI**	Insulation test. Lights up if the recommended insulation resistance (R_{ISO}) limit is exceeded (Class II <2.0 MΩ , Class I <1.0 MΩ).
	$I_{SUBSTITUTE}$	Substitute leakage test.
	EARTH BOND **200 mA** **25 A** R_{PE} **>0.10Ω** **+LEAD?**	Earth Bond test 200 mA or 25 A. Lights up if the recommended protective earth conductor resistance (R_{PE}) limit is exceeded. Notice that a long connection lead can add extra resistance.
	I_{TOUCH}	Touch current test
	IEC LEAD	IEC lead test.
	LOAD PE LEAK	Load/Leakage Current test
	Limit	The test result should be checked against the limit allowed for the appliance.

No	Annunciator	Meaning
7	✓ **PASS** **FAIL X**	IEC lead fuse/L-N pass or fail.
8		Readings and measurement units field, error message field. **>** result overflow **<** or underflow
9	**BOND** **ZERO** Ø	Bond test zero function. **Ø** lights up if the bond test has been zeroed.
10	⚠	Caution! Risk of Electric Shock.
11	**memory** **CLEAR?**	Appears when storing results. Appears when clearing results.
12	**U_{N-PE}** **U_{L-N}** **Hz**	Neutral-Protective Earth voltage too high. Mains voltage out of limits. Mains frequency out of limits.

Powering the Tester

The tester will power up when you connect it to the mains supply.

Disconnect the mains plug to power the tester down.

⚠⚠ Warning

Read the safety information on page 2 before powering the tester.

Power-up & Warning Display Messages

At power up the tester performs a selftest and shows the software version.

If all is well the display will indicate the mains supply voltage, this screen is referred to as the IDLE screen.

If the tester detects special conditions at power up, for example a dangerous condition, a warning message will indicate the nature of the condition.

The adjacent table shows the messages that can be shown when you power up the tester. The values are examples and can differ from the displayed values.

DISPLAY	EXPLANATION
St	Selftest.
1.00	Software version, shown after power on.
230 VAC	Mains supply voltage, IDLE screen.
U_{N-PE} > 50 VAC	Mains problem, unplug unit! No testing possible.
U_{L-N} < 195 VAC	Mains voltage too low. No testing possible.
U_{L-N} > 253 VAC	Mains voltage too high. No testing possible.
< 48 Hz	Mains frequency too low. No testing possible.
> 52 Hz	Mains frequency too high. No testing possible
⚠ memory >	Memory full.
⚠ memory > 75	Memory nearly full (>75%).
⚠ + number	Tester failure, contact Fluke.

DISPLAY	EXPLANATION
⚠ + number	Dangerous tester failure. Unplug the tester, prevent it from being used, and contact Fluke for repair.
⚠ U_{N-PE} 11	The Neutral-Earth voltage is dangerously high. Unplug the tester!
⚠ 🔌 15	The mains polarity is incorrect. Unplug the tester!
⚠ U_{N-PE} 17	Mains supply earth connection is missing/open circuit. Unplug the tester!

Setting Up the Tester

The only requirement to set up the tester, is to zero the earth bond test.

Zeroing the Earth Bond Test

For correct earth bond test results you must zero the earth bond lead to eliminate its resistance:

- when setting up your new tester. Earth bond tests are locked out unless the bond zero icon ∅ is on.
- occasionally, dependent on the condition of the bond socket and the test lead plug a dirty plug/socket can result in a significant contact resistance.

To zero the test lead, do the following:

1		Attach the crocodile clip to the test lead and insert the test lead plug into the BOND 25A/200mA socket, see Figure 3.
2		Firmly attach the crocodile clip to the BOND ZERO bar on the tester.
3	ZERO	Press zero. The display shows the test progress, see the table on the next page.

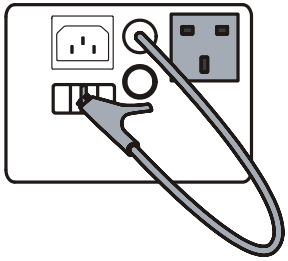

Figure 3. Bond Zero Connections

DISPLAY	EXPLANATION
BOND ZERO	The earth bond test lead zeroing function has been selected.
3 **seconds**	The test time is counted down
0.09 Ω	Zeroing completed, the tester shows the resistance value of the test lead (zero value). It will subtract this value from the bond test results.
> 1.99 Ω	The lead resistance is higher than 1.99 Ω , it cannot be compensated for. The zero value is set to the factory default of 0 Ω now. Earth Bond test will be locked out.

The tester saves the zero value so you will not need to repeat the operation every time you use the tester.

If the Earth Bond test has been zeroed, the idle screen and subsequent earth bond test results will be marked with ∅, for example:

∅ 0.09 Ω

Testing Appliances

Testing Safely

⚠⚠ Warnings

- **Before commencing any testing you are strongly advised to make reference to the Electricity at Work Regulations 1989 and any relevant publications from the Health and Safety Executive.**
- **The appliance must be switched on for all tests.**
- **When conducting tests do not touch the appliance as some tests involve high voltages and high currents.**
- **The tests should only be performed by competent persons who are familiar with the requirements of the type of tests suitable for portable appliances.**
- **It is potentially hazardous for both user and appliance should the wrong type of tests be undertaken or if testing is carried out in an incorrect sequence.**
- **It is important that you fully understand the various tests required and how they should be performed.**
- **The appliance must have passed the visual inspection, the earth bond test (Class I), and the insulation test (in this sequence) prior to any other test. If any of these tests fail further testing must be stopped and any faults must be rectified.**
- **During the load/leakage test and the touch current test, the appliance will be energized at mains voltage. For this purpose, switch on the appliance. Appliances driven by motors or equipped with heating units may present a danger for the person testing (comply with appliance instruction manual!). Ensure that the appliance is in a safe condition to run. Please secure it prior to the test.**

Test Modes: Single or Continuous

You can run tests in a single test mode or in a continuous test mode.

Single Test Mode

To run a single **non-live** test press the test button and then release it.

To run a single **live** test (load/leakage and touch current) hold down the test button and release it after the second beep, before you hear a third long beep.

The tester connects the test supply, performs one test, disconnects the test supply and holds the result on the display.

Continuous Test Mode

To start a continuous **non-live** test hold down the test button for at least 2 seconds. You will hear a long beep indicating the tester is in the continuous mode.

To start a continuous **live** test (load/leakage and touch current) hold down the test button until you hear two beeps followed by a third beep.

The tester connects the test supply, makes the first test and displays the first result. Then the tester continues measuring and displaying results without disconnecting the test supply. The maximum run time is 8 minutes. After this time the test stops.

To stop a continuous test run, press the test button again. The tester disconnects the test supply and holds the last test result on the display.

Note

The IEC-Lead test cannot be run in the continuous test mode.

Aborting a Test

Pressing (STOP) immediately aborts whatever test is in progress, makes the tester safe and then shows the IDLE screen. Test results will not be displayed.

Saving the Test Results

To save the result after completing a test, do the following:

1 [MEM] Press MEM. The actual test result is saved into memory. The display shows the number that has been assigned to the record, for example:

memory 5

For detailed information refer to Using the Memory on page 25.

Visual Inspection

Before performing any test check the appliance for the following:

- condition of the appliance cables, i.e. no cuts, cracks or any physical damage to the outer insulation layer.
- condition of the plug, cable securely attached, no signs of overheating and that the correct value of fuse is fitted.
- any signs of damage, and that any mains or control switches will physically switch on and off.
- any sockets for signs of overheating or physical damage.

Bond Test 25 A / 200 mA (R_{PE})

The test checks the resistance between the earth pin of the appliance cable plug and the exposed metalwork on the appliance. The test applies to Class I appliances.

Remarks:

- To enable the bond test and to obtain correct bond test results you must have zeroed the test lead, see page 10.
- Continuous 25 A bond test will periodically drop back to 200 mA test to prevent the tester from being overheated.
- You should use the 200 mA test current for certain appliances. Please refer to the appliance test standards and guidance material.

To perform the Earth Bond test, do the following:

1		Connect the appliance and the earth bond test lead as indicated on the tester, see also Figure 4. Connect the crocodile clip to an exposed conductive part on the appliance that requires testing. Do not use the probe for the 25 A bond test. The probe is only rated for 10 A!
2	BOND 200mA BOND 25A	Start the 200 mA test or the 25 A test: **Single test** - press momentarily **Continuous test** - hold down > 2 seconds The display shows the test progress, see the table on the next page.
3		During the measurement flex the flexible cord along its length to help find any broken conductors or poor quality joints.
4	BOND 200mA BOND 25A	**Continuous test only:** stop the test.
5		When the test is finished remove the earth bond lead from the appliance.
6	MEM	Store the test result, if required.

Note

If a double beep sounds the earth bond test lead has not been zeroed (no ∅ symbol on the LCD). You must zero the test lead, see page 10.

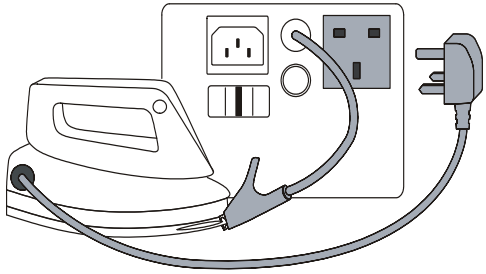

Figure 4. Bond Test Connections

DISPLAY	EXPLANATION
EARTH BOND R_{PE} 200 mA 25 A	The 200 mA or the 25 A earth bond test has been selected.
3 seconds	The test time is counted down.
Ø	The bond test has been zeroed.
0.03 Ω	R_{PE} is 0.03 Ω .
> 19.99 Ω	R_{PE} overrange.
Limit **> 0.10 Ω + LEAD?**	R_{PE} may have exceeded the recommended limit, possibly because of the length of the supply lead.

Insulation Test (R_{ISO})

⚠ Warning

- **The test voltage is 500V dc. Do not touch the appliance during the insulation test! If the test fails any metal parts of the appliance could become live!**
- **Always make sure that the test has completed before disconnecting the appliance leads to ensure that all capacitances have discharged.**

⚠ Caution

Do not perform the Insulation test on Class I appliances that failed the bond test.

The test checks the resistance of the insulation between

- the earth pin of the appliance cable plug (Class I)

or

- the test probe to be applied to the appliance under test (Class II)

and the Live and Neutral pins of the appliance (pins are connected together within the tester for this test).

The insulation test will be inhibited if the tester detects a terminal voltage >30 Vrms prior to initiation of the test.

Note

The insulation test may be not suitable for some types of appliances. For these appliances an alternative test may be conducted such as a touch current, leakage current, or suitable leakage current test. It is essential to refer to standards and/or reference material for the safe applicability of these alternative tests.

To perform the Insulation test, do the following:

1		Connect the appliance and the probe as indicated on the tester, see also Figure 5. For Class I appliances no probe is required. For Class II appliances apply the probe to any exposed metalwork on the appliance.
2	INSUL-ATION	Start the test: **Single test** - press momentarily **Continuous test** - hold down > 2 seconds The display shows the test progress, see the adjacent table.
3	INSUL-ATION	Continuous test only: stop the test.
4	MEM	Store the test result, if required.
5		For Class II continue the test for all exposed metal parts on the appliance.

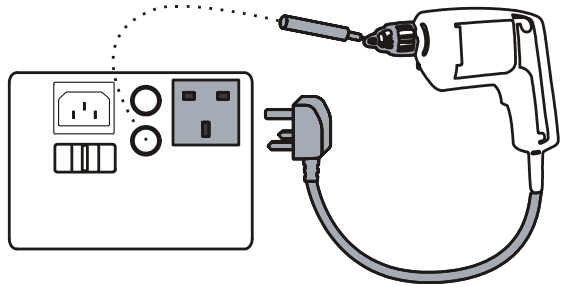

Figure 5. Insulation Test Connections

DISPLAY	EXPLANATION
INSULATION R_{ISO}	The insulation test has been selected.
5 seconds	The test time is counted down.
195 MΩ	R_{iso} is 195 MΩ.
> 299 MΩ	R_{ISO} overrange.
Limit	The test result is below one of the recommended limits.
<2.0 MΩ CII **<1.0 MΩ CI**	Riso is lower than 2 MΩ (Class II) Riso is lower than 1 MΩ (Class I)

Substitute Leakage Current Test ($I_{SUBSTITUTE}$)

The test measures the leakage current between

- the earth pin of the appliance cable plug (Class I)

or

- the test probe attached to the appliance under test (Class II).

and the Live and Neutral pins of the appliance (pins are connected together within the tester for this test).

It is essential to refer to standards and/or guidance material for the safe applicability of this test.

To perform the Substitute Leakage Current test, do the following:

1		Connect the appliance and the probe as indicated on the tester, see also Figure 6. For Class I appliances no probe is required. For Class II appliances apply the probe to any exposed metalwork on the appliance.
2	I SUB	Start the test: Single test - press momentarily Continuous test - hold down > 2 seconds The display shows the test progress, see the table on the next page.
3	I SUB	Continuous test only: stop the test.
4	MEM	Store the test result, if required.
5		For Class II continue the test for all exposed metal parts on the appliance.

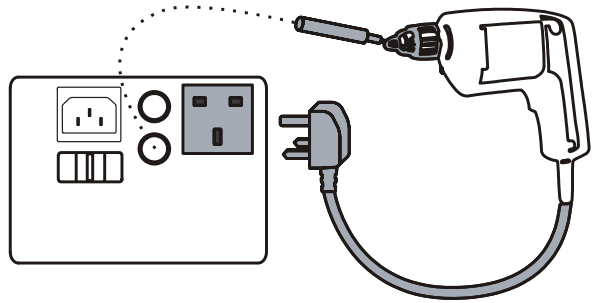

Figure 6. Substitute Leakage Current Connections

DISPLAY	EXPLANATION
I SUBSTITUTE	The substitute leakage current test has been selected.
3 seconds	The test time is counted down.
0.13 mA	$I_{SUBSTITUTE}$ is 0.13 mA.
>19.99 mA	$I_{SUBSTITUTE}$ overrange.
Limit	The acceptable test limit may have been exceeded. Refer to standards and/or guidance materials.

Touch Current Test (I_{TOUCH})

⚠ Warning

NEVER carry out this test unless you have first carried out a thorough visual inspection, followed by a test of the earthing (Class I appliances), and then a test of the insulation. You must verify that these tests are passed before engaging this test.

⚠ Caution

Live test! The appliance will be energized at mains voltage. For this purpose, switch on the appliance. Appliances driven by motors or equipped with heating units may present a danger for the person testing (comply with the appliance instruction manual!). Ensure that the appliance is in a safe condition to run. Please secure it prior to the test.

The Touch Current test consists of:

- a fuse and L-N loop pre-test
- a leakage current measurement with approximately 2 kΩ resistance connected between earth and exposed conductive parts on the appliance via the test probe. The measurement is performed by the direct measurement method.

To perform the Touch Current test, do the following:

1		Connect the appliance and the test probe as indicated on the tester, see also Figure 7. For Class II appliances apply the probe to any exposed metalwork on the appliance. For Class I appliances apply the probe to any exposed metalwork on the appliance that is not connected to earth.
2	I TOUCH	Start the test: **Single test** - hold down the button and release it after the second beep, before you hear a third long beep. **Continuous test** - hold down the button and release it after you hear a third long beep. The display shows the test progress, see the adjacent table.
3	I TOUCH	**Continuous test only:** stop the test.
4	MEM	Store the test result, if required.
5		Continue the test for all exposed metal parts on the appliance.

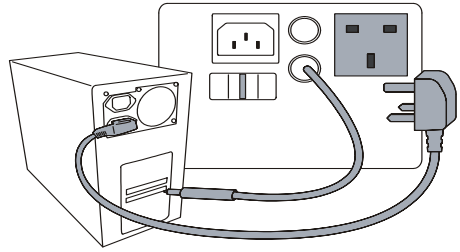

Figure 7. Touch Current Connections

DISPLAY	EXPLANATION
I TOUCH	The touch current test has been selected.
- - -	The live test delay period is in progress
⚠	WARNING, this is a live test!
5 **seconds**	The test time is counted down.
0.13 **mA**	I_{TOUCH} Is 0.13 mA
> 1.99 **mA**	Touch current overrange.
Limit	The acceptable test limit may have been exceeded. Refer to standards and/or guidance material.

DISPLAY	EXPLANATION
FAIL X	The Fuse/L-N Loop pre-test tailed. Check that the appliance power switch is on. See also Fuse/L-N Loop Pre-test below.

Fuse/L-N Loop Pre-test

The pre-test verifies the fuse and lead continuity by applying a low voltage signal across the appliances phase and neutral pins.

Very low power appliances, or appliances with electronically controlled on/off switches or with an inductance may fail this test. To enable you to test these appliances you can skip the Fuse/L-N Loop Pre-test.

To perform the test on appliances that fail the Fuse/L-N Loop Pre-test do the following:

release TOUCH and press it again before the FAIL X indication is removed from the display (press as described at step 2 of the test procedure).

Note

Accidental measurement of a defective unit may trip a RCCB (residual current circuit breaker).

Load/ Leakage Current Test

⚠ Warning

NEVER carry out this test unless you have first carried out a thorough visual inspection, followed by a test of the earthing (Class I appliances), and then a test of the insulation. You must verify that these tests are passed before engaging this test.

⚠ Caution

Live test! The appliance will be energized at mains voltage. For this purpose, switch on the appliance. Appliances driven by motors or equipped with heating units may present a danger for the person testing (comply with the appliance instruction manual!). Ensure that the appliance is in a safe condition to run. Please secure it prior to the test.

The Load/PE Leakage test consists of:

- a fuse and L-N loop pre-test
- measurements of the appliance power consumption and load current at full mains voltage
- measurement of the earth leakage current (differential measurement) at full mains voltage.

The measurements are performed in one test sequence.

To perform the Load/PE Leakage test do the following:

1		Connect the appliance and the test lead as indicated on the tester, see also Figure 8.
2	LOAD/ LEAK	Start the test: **Single test** - hold down the button and release it after the second beep, before you hear a third long beep. **Continuous test** - hold down the button and release it after you hear a third long beep. The display shows the test progress, see the table on the next page.
3	LOAD/ LEAK	Continuous test only: stop the test.
4	MEM	Store the test result, if required.

Note

Accidental measurement of a defective unit may trip a RCCB (residual current circuit breaker).

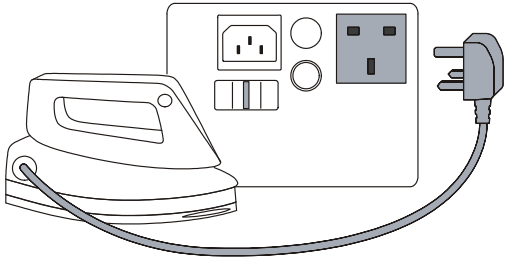

Figure 8. Load/Leakage Connections

DISPLAY	EXPLANATION
LOAD	The Load/Leak test has been selected.
- - -	The live test delay period is in progress
⚠	**WARNING**, a live test is going on!
5 **seconds**	The test time is counted down.
MULTI RESULTS	The results are being cycled through the display. In continuous test mode the results are updated for each new measurement.
LOAD 0.2 **A**	The load current is 0.2 A.
> 12.9 **A**	Load current overrange detected.
50 **VA**	The load power is 50 VA.
> 3.2 **kVA**	Load power overrange detected.
>	Excess load surge condition detected.
PE LEAK 0.2 **mA**	The leakage current is 0.2 mA
> 19.99 **mA**	Leakage current overrange.
>	Excess leakage current surge condition detected.
Limit	The acceptable test limit may have been exceeded. Refer to standards and/or guidance material.
FAIL X	The Fuse/L-N Loop pre-test tailed. Check that the appliance power switch is on. See also Fuse/L-N Loop Pre-test below.

Fuse/L-N Loop Pre-test

The pre-test verifies the fuse and lead continuity by applying a low voltage signal across the appliances phase and neutral pins.

Very low power appliances, or appliances with electronically controlled on/off switches or with an inductance may fail this test. To enable you to test these appliances you can skip the Fuse/L-N Loop Pre-test.

To perform the test on appliances that fail the Fuse/L-N Loop Pre-test do the following:

release [LOAD/ LEAK] and press it again before the FAIL X indication is removed from the display, (press as described at step 2 of the test procedure).

IEC Lead Test

The IEC lead test tests the IEC lead for:

- Earth bond resistance and insulation.
- Live-Neutral lead/fuse continuity and polarity.

If there is a swapped polarity condition and a continuity failure in the same test, a failed polarity message will be displayed.

You can use the adapter EXTL100 (optional accessory) to test extension leads.

To perform the IEC Lead test, do the following:

1		Connect the IEC lead as indicated on the tester, see also Figure 9.
2	[IEC LEAD]	Start the test. The IEC Lead test runs only in the single test mode. The display shows the test progress, see the table on the next page.
3	[MEM]	Store the test result, if required.

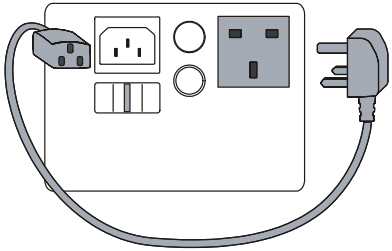

Figure 9. IEC-Lead Test Connections

DISPLAY	EXPLANATION
IEC LEAD	The IEC LEAD test has been selected.
5 **seconds**	The test time is counted down.
MULTI RESULTS	The test is finished. The results are being cycled through the display.
✓ **PASS** **FAIL X**	The fuse/L-N test passed or failed.
EARTH BOND	
0.13 **Ω**	R_{PE} is 0.13 Ω
> 19.99 **Ω**	R_{PE} overrange detected
R_{PE} > 0.10 Ω + LEAD?	R_{PE} has exceeded the recommended limit, possibly because of the length of the lead.
INSULATION	
195 **MΩ**	R_{ISO} is 195 MΩ.
> 299 **MΩ**	R_{ISO} overrange detected.
R_{ISO} < 2 MΩ CI	R_{ISO} is lower than 2 MΩ (Class II limit).
⇉	L-N are swapped.
Limit	The acceptable test limit may have been exceeded. Refer to standards and/or guidance material.

PELV Test

The PELV (Protective Extra Low Voltage) test measures the voltage on the **PROBE PELV** input when the idle screen iis being displayed..

To perform the PELV test, do the following:

1	STOP	Revert to the idle screen if it is not already being displayed.
2		Connect the test probe to the tester PROBE PELV input and connect the appliance to a mains supply socket.
3		Apply the test probe to the test point. The display shows the test result, see the table below.
4	MEM	Store the test result, if required.

DISPLAY	EXPLANATION
> PEL VAC	The PELV is above the acceptable limit.
230 VAC	The PELV is below the acceptable limit, the display shows the IDLE screen.

Using the Memory

The tester has a non-volatile memory to save a minimum of 100 test results. The power-on screen shows a message if the memory is full or nearly full:

memory > 75 : the store is nearly full (>75%)

memory > : the store is completely full

If one of these messages is shown you should print the stored test results (see page 26), and then clear the store (see page 26).

Saving Test Results

Warning

In continuous test mode the test continues whilst you are saving the result!

To save a test result, do the following:

1	MEM	The actual test result is saved into memory.

The display shows the number that has been assigned to the record for 2 seconds, for example **memory** 5, then:

- it reverts to the idle screen if a test was finished.
- in the continuous test mode, it shows the next result.

If you press MEM again while the record number is being displayed, the result will not be stored.

If you store a result in the continuous test mode while the test is running, the displayed result is stored without interrupting the test.

If you press MEM in the continuous test mode before a new result is available, the display shows **memory** 0 and the beeper sounds twice.

If the result cannot be saved as the store is full, you must clear the store, repeat the test and then store the result.

Clearing the Store

The clear function clears all memory locations. It is disabled when any appliance test is running.

Print the results before clearing the store if you want to preserve the results.

To clear the memory, do the following:

1	CLEAR	Hold down the button for more than 5 seconds, the display shows the progress, see the table below.

DISPLAY	EXPLANATION
CLEAR? **5 seconds**	A delay period is counted down. To prevent the clear action release the button within this period.
CLEAR? - - -	The store is being cleared.
CLEAR? 0	The store is empty, the display reverts to the idle screen. If a double beep sounds when this message is shown, the clear action has not started.

Printing Test Results

The print function prints all the stored results from the earliest to the latest using the optional Fluke SP1000 printer. Printing is disabled when any appliance test is running.

To print the results, do the following:

1		Connect the printer to the tester RS232 port.
2	PRINT	Start printing, the display shows the progress, see the table below.

DISPLAY	EXPLANATION
	The printer is connected and turned on.
MULTI RESULTS	All records will be printed
PRINT 12	Record 12 is in progress.
PRINT 0	Printing has finished or there are no results in the memory, the display reverts to the idle screen.

If the beeper sounds, and the  icon is turned off when you press PRINT, the tester could not detect the printer. In this case also the idle screen will not show the  icon.

If printing fails, do the following:

- verify that the SP1000 printer is connected to the tester and that the printer power is on.
- verify that you use the correct cable.
- Verify that the printer dip-switch settings are in the default position (see SP1000 User Guide).

Maintaining the Tester

Cleaning

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

Dirt or moisture on the earth bond test lead plug can result in a contact resistance that affects the readings. Therefore periodically zero the earth bond test (see page 10).

Calibration

To ensure the accuracy of the tester is maintained at high level it is recommended that the tester is calibrated at least once every 12 months. Calibration must be carried out by qualified personnel. Contact your local Fluke representative for calibration (see Contacting Fluke on page 1).

Accessories

Table 2 and Table 3 list the part numbers of the accessories.

To order the accessories contact your local Fluke representative (see Contacting Fluke on page 1).

Table 2. Standard Accessories

Item	Part Number
Crocodile Clip	532269474055
Test Lead	532269474056
Touch Current Probe	1276841
Users Manual (this manual)	[1]

[1] Can be downloaded from your regional Fluke website, start at www.fluke.com .

Table 3. Optional Accessories

Item	Part Number
SP1000 Mini Printer	1597281
EXTL100 Extension Lead Test Adapter	2414348
TA700 Appliance Adapter for 110V Tools	2389678
Fluke PowerPAT Plus Appliance Testing Software	2143155

Specifications

General Specifications

Size ..... 200 mm (L) x 275 mm (W) x 100 mm (H)

Weight ..... 3.0 kg

Power Supply ..... 230 V + 10 % - 15 %, 50 Hz ± 2 %

Power consumption (Tester) ..... 13 W typical (idle)
60 W max. during 25 A Bond Test

Operating temperature .....0 to +40 °C

Storage Temperature .....-10 to +60 °C

Relative Humidity

..... non condensing < +10 °C
..... 95% from +10 to +30 °C
..... 75% from +30 to +40 °C

Operating Altitude.....0 up to 2000 m

Sealing ..... IP-40 (enclosure), IP-20 (connectors)

EMC ..... complies with EN61326-1, criteria B

EMI Immunity ..... 3 V/m

Safety ..... Complies with EN61010-1 2nd edition
DIN VDE0404-1 and DIN VDE0404-2
CAT II, 300 V, pol 2

Printer – PC RS232 Interface

Baud rate ..... factory default 9600
Data bits 8
Stop bits 1
Parity .....no

Test Specifications

The accuracy specification for the display range is defined as ± (%reading + digit counts) at 23 °C ± 5 °C, ≤ 75 % RH. Between 0 °C and 18 °C and between 28 °C and 40 °C, accuracy specifications may degrade by 0.1 x (accuracy specification) per °C.

The measurement range meets the service operating errors specified in EN61557-1: 1997, EN61557-2: 1997 , EN61557-4: 1997, DIN VDE0404-2.

Power-on Test

The test indicates reversed L-N, missing PE, and measures the mains voltage and frequency.

Operational Error Measurement Range .....195 V to 253 V

Display Range .....90 V to 264 V

Accuracy at 50 Hz..... ± (2% + 3 counts)

Resolution.....0.1 V

Input Impedance ..... > 1 MΩ // 2.2 nF

Maximum Input Mains Voltage.....300 V

Earth Bond Test (R_{PE})

Operational Error Measurement Range .....0.2 to 1.99 Ω

Operational error..... 10.0%

Accuracy (after Bond Test zeroing)..... ± (5% + 4 counts)

Display Range .....0 to 19.99 Ω

Resolution..... 0.01 Ω

Test Current..... 200 mA ac -0% +40% into 1.99 Ω
25 A ac ± 20 % into 25 mΩ at 230 V

Open Circuit Voltage.....> 4 V ac, < 24 Vac

Bond Test Zeroing ..... can subtract up to 1.99 Ω

Used Current for Bond Test Zeroing 10A

Insulation Test (R_{ISO})

Operational Error Measurement Range .....0.1 to 5 MΩ

Operational Error 9.0%

Accuracy..... ± (5% + 2 counts) from 0.1 to 50 MΩ
± (10% + 2 counts) from 50 to 299 MΩ

Display Range .....0 to 299 MΩ

Resolution.....0.01 MΩ (0 to 19.99 MΩ)
0.1 MΩ (20 to 199.9 MΩ)
1 MΩ (200 to 299MΩ)

Test Voltage.....500 V dc –0 % +25 % at 500 kΩ load

Test Current..... >1 mA at 500 kΩ load, < 15 mA at 0 Ω

Auto discharge time ..... < 0.5 s for 1 μF

Max. Capacitive Load ..... operational up to 1 μF

Touch Current Test (I_{TOUCH})

Operational Error Measurement Range ..... 0.1 to 1.99 mA
Operational Error.....6.0%
Accuracy .....± (4% + 2 counts)
Display Range.....0 to 1.99 mA ac
Resolution ..... 0.01 mA
Internal Resistance (via probe)..... 2 kΩ
Measuring method..... Probe
The appliance under test is energized at mains potential.

Substitute Leakage Current Test (I_{SUB})

Operational Error Measurement Range ...0.25 to 19.00 mA
Operational Error.....10%
Accuracy .....± (5% + 5 counts)
Display Range.....0 to 19.99 mA ac
Resolution ..... 0.01 mA
Test Voltage ..... 35 V ac ± 20%

Load/ Leakage Test: Load Current

Display Range ..... 0 to 13 A
Accuracy .....± (4% + 2 counts)
Resolution ..... 0.1 A
The appliance under test is energized at mains potential.

Load/Leakage Test: Load Power

Display Range .....0 to 999 VA
1.0 kVA to 3.2 kVA
Accuracy .....± (5% + 3 counts)
Resolution .....1 VA (0 to 999 VA)
0.1 kVA (1.0 kVA to 3.2 kVA)
The appliance under test is energized at mains potential.

Load/Leakage Test: Leakage Current (I_{PE})

Operational Error Measurement Range .. 0.25 to 19.00 mA
Operational error 12.0%
Accuracy .....± (4% + 5 counts)
Display Range ..... 0.25 to 19.99 mA
Resolution ..... 0.01 mA
The appliance under test is energized at mains potential.

PELV Test

Display ..... PEL indicator only
Accuracy at 50 Hz..... ± (2% + 3 counts)
Overload protection ..... 300 Vrms
Warning threshold..... 25 Vrms

Test Limits for PASS result

R_{PE} 200 mA ..... < 0.10 Ω
R_{PE} 25 A ..... < 0.10 Ω
R_{ISO} .....> 1 MΩ Class I
> 2 MΩ Class II
I_{SUB} .....< 3.5 mA
I_{PE} .....< 0.75 mA
I_{TOUCH} .....> 0.25 mA
IEC Lead – R_{PE}..... < 0.10 Ω
IEC Lead – R_{ISO} ..... > 2 MΩ

Influence Factor Errors

Influencing Factor	Designation	% Influencing Error
Position	E1	0.0%
Supply Voltage	E2	5.0%
Temperature	E3	5.5%
Current Consumption	E4	1.5%
Magnetic Fields	E5	2.5%
Impedance	E6	1.0%
Capacitance	E7	2.0%
Current Waveshape	E8	1.0%