Order code	Manufacturer code	Description
85-3511	n/a	FLUKE 6500 PORTABLE APPLIANCE TESTER KIT

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FLUKE®

6500
Appliance Tester

Users Manual

PN 2141150
April 2005, Rev 2 12/06

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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:

- for UK & Ireland:
  +44 (0)1603 256 600

- for other European countries:
  +31-402-678-200

Visit Fluke's web site at:

www.fluke.co.uk
or
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
1 pc. Alligator Clip
1 pc. Test Lead
1 pc. Test Probe for Touch Current
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 240 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.

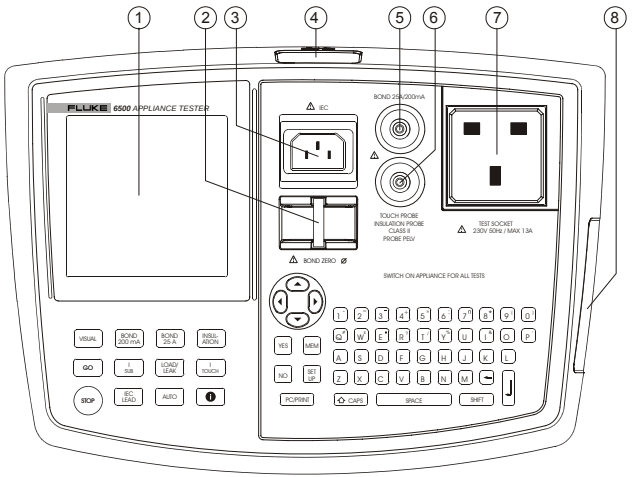

Figure 1. Fluke 6500

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 barcode 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
VISUAL	Select the Visual Inspection test.
BOND 200mA	Select the 200 mA Earth Bond test.
BOND 25A	Select the 25 A Earth Bond test.
INSUL-ATION	Select the Insulation test.
I SUB	Select the Substitute Leakage Current test.
LOAD/ LEAK	Select the combined Load/Earth Leakage Current test.
I TOUCH	Select the Touch Current test.
GO	Start /Enter selection.
STOP	Abort the current action and return to idle screen.
IEC LEAD	Select the IEC Lead test.
AUTO	Select the auto-test mode.
i	Provide help on the current function.
▲▼	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.
Ø	Bond test lead has been zeroed.
	Auto-test or manual test failed.
	Auto-test or manual test passed.
LMT	Applicable limit is exceeded.
	The printer/PC is connected.
I II	Class I, Class II.
	Use buttons  .
Lock-out 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 V1.18.

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

01/01/06 12:00	← date and time
Site / customer:	
Fluke	← most recently entered site name
USER:	
V_{LN} 241.2 V	← live-neutral voltage
V_{NE} 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	SET UP	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.

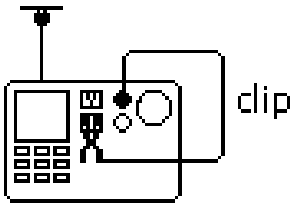

Figure 2. Bond Zero Connections

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/Customer Text

To set the site and customer text, do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **SITE/CUSTOMER**.
3	GO	Open the next menu and follow the screen instructions. Please note that the site name is entered in the first line and the customer name in the second line (customer name for reference only).

Setting the USER ID Text

(entry of USER ID for reference only)

To set the USER ID text, do the following:

1	SET UP	Open the set-up menu.
2	▲▼	Highlight **USER ID 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 product support.

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 16.

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 menu .
4	9 9 9 9	Enter the access code for example 9999 (factory default).
5	GO	Confirm the access code.
6	▶	Select test mode by arrow key

Creating/Editing an Auto-Test Sequence

The tester is provided with factory programmed automatic test sequences, see page 18. You can create new auto-test sequences (max. 50), and edit auto-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 (use numbers from 100 to 999; the numbers 131-142 & 231-240 are internally reserved numbers).
- 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 18 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 entering the test parameters exit the set up screen.
13	◀	To review/edit the test parameters, or
	MEM	To save the test parameters.
14	▼	Enter a text for auto-test description.
15	GO	Confirm text entry and save auto-test sequence.

Notes:

1) *Auto-test numbers 131-136 & 231-234 are reserved for pre-programmed auto-tests.*
2) *Auto-test numbers 137-142 & 235-240 are reserved for future auto-test updates.*
3) *User programmed tests are stored in chronological order and not in numeric order.*
4) *A standard text will be used when STOP is pushed during text entry mode.*

To view saved auto-tests see ‘Viewing Auto-Test Sequences’ on page 30.

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, barcode 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 Fluke 6500, SP1000 printer, SPScan15 barcode scanner and Fluke PowerPAT PLUS software are set as default to communicate at a COMMS RATE of 9600 baud.

It is recommended not to change this setting!

Installing - Formatting a Compact Flash Card (Quick Format)

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

Only data media formatted with FAT16 are supported, i.e. compact flash memory cards with 32MB to 1GB can be used.

It is possible to store up to 512 files on a compact flash memory card, with respect to card memory size (1 download set = 1 file).

Compact flash cards vary in their specification and some can cause interface problems with the Fluke 6500, due the internal CF card design which may change from time to time.
A document with recommendations of some tested CF card brands and sizes is provided in the scope of supply of every tester.

It is important that you follow the instructions on this document to verify the compatibility of your compact flash card together with the 6500 and that your PC can read the compact flash card file before you carry out testing.

⚠ 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.

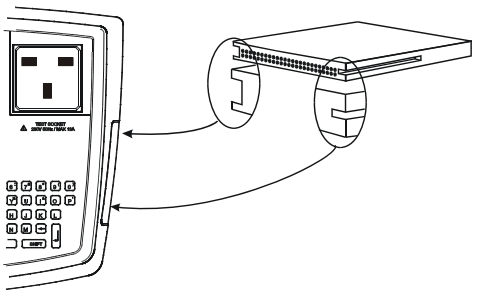

Figure 3. Inserting the CF card

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 the card has an invalid file format (FAT12 or FAT32) a screen message will prompt you to format the CF card. If you are formatting a CF card on a PC, please ensure you format it to FAT 16 (not FAT 32)!

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!). Please ensure that the appliance is in a safe condition to run and secure prior to testing.**

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. Tests which energize the appliance must be acknowledged using the YES key. In such cases the continuous test will start by pressing YES for at least 2 seconds after pressing GO. 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 running time is 8 minutes. After which the test will terminate.

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. Earth bond, insulation and substitute leakage tests will be performed without stopping. Tests which energize the appliance must be acknowledged by using the YES key after pressing GO, before the test will commence.

To select the fast mode or standard mode see page 10.

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 10 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 16 and ‘Selecting Fast or Standard Test Mode’ on page 10 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 20 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 13 .

⚠ 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 12.

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 16 and ‘Selecting Fast or Standard Test Mode’ on page 10 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). Tests which energize the appliance must be acknowledged using the [YES] key. In such cases the continuous test will start by pressing [YES] for at least 2 seconds after pressing [GO]. To stop a continuous test, press the selected test key or press [GO] again.

For more information on the individual test see page 20.

After performing a test you can save the result, see ‘Saving Test Results’ on page 29.

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.

Note:

A Visual test pass result must be confirmed by pressing YES *or 'Y' on the keyboard.*

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 test 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.

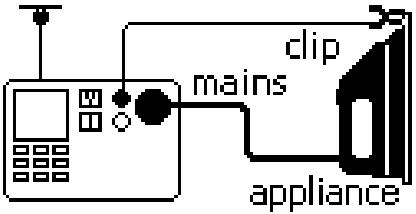

Figure 4. Bond Test Connections

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.

Note:

In the case that an Earth bond test fails, the pass/fail limit can be recalculated by using the SETUP key and entering the length and cross section of the mains lead.

Insulation Test (RISO)

⚠ 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.

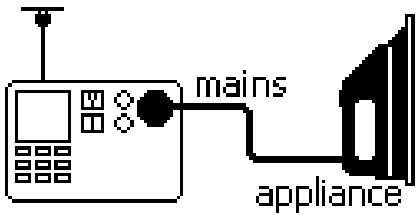

Figure 5. Insulation Test Connections Class I

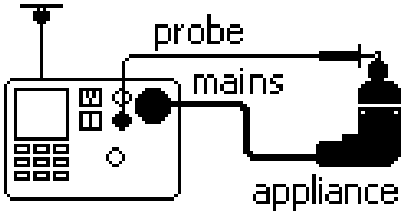

Figure 6. Insulation Test Connections Class II

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.

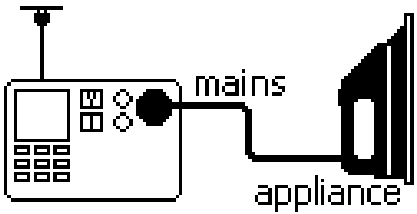

Figure 7. Substitute Leakage Test Connections Cl. I

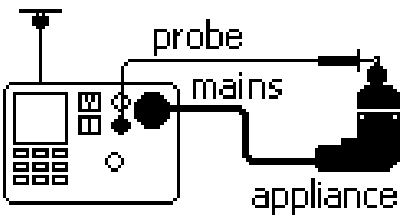

Figure 8. Substitute Leakage Test Connections Cl. II

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 and secure it prior to testing.

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.

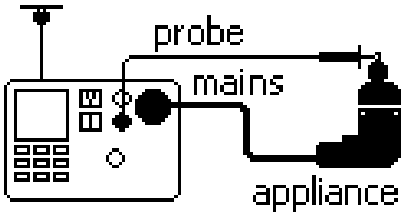

Figure 9. Touch Current Test Connections

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.

Live tests have to be confirmed by pressing YES . You will be prompted to do so after pressing GO .

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 and secured prior to testing .

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) .

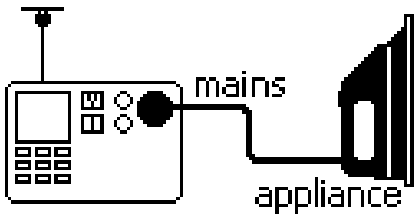

Figure 10. Load / Leakage Test Connections

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. Apparent 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

Live tests have to be confirmed by pressing the YES key. You will be prompted to do so after pressing GO .

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).

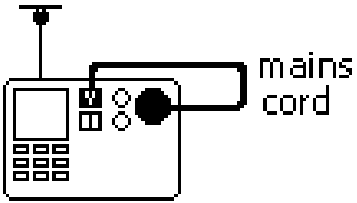

Figure 11. IEC Lead Test Connection

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
OK ☑	IEC lead test passed
FAIL ☒	IEC lead test failed
R_{PE} > 19.99 Ω R_{ISO} > 299 MΩ	Result overrange.
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 33 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 31).
- If you press MEM when the idle screen is displayed a PELV test pass result can be saved. See also 'PELV Test' on page 28.

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.

Notes:

1. *Result records are not renumbered when a record in the middle of the store is deleted.*
2. *Deleting individual records (test values) does not free memory space! To free memory space ALL individual data records must be deleted or the ENTIRE memory must be deleted, see 'Clearing the Memory' on page 31.*

Clearing the Memory

To free ENTIRE memory you must use menu function MEM - <CLEAR the store>. This will delete all result records. Additionally a <CLEAR the store> function is automatically performed after all individual records are deleted. Automatic test procedures will not be cleared.

⚠ **Caution**

Before clearing the store or deleting records 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 Fluke SP1000 Mini 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 11.

Note:

The interface cable must be a null-modem cable (direct link cable) with a gender changer, Fluke P/N COM3.

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
Interface cable, null-modem	COM3

Specifications

General Specifications

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

Weight ..... 3.0 kg

Power Supply ..... 240 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 IEC/EN61010 -1 2nd edition
DIN VDE0404-1 and DIN VDE0404-2
IEC/EN 61557, part 1,2,4
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.....264 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 9.99 MΩ)
0.1 MΩ (10 to 99.9 MΩ)
1 MΩ (100 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

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%
(at nominal mains input voltage)

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.

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

IEC Lead Test

Earth bond limit ..... 1.0 Ω

Test current ..... 10 A AC

Insulation resistance limit ..... 2.0 MΩ

Test voltage ..... 500 V DC

Fuse test and polarity check

Variation Factor Errors

Variation Factor	Designation	% Variation 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%