HPAT550 HPAT650
HANDYPAT TESTER

Instruction Manual

MARTINDALE ELECTRIC

Keeping You Safe

⚠ ALWAYS READ THESE INSTRUCTIONS BEFORE PROCEEDING

WARNING

These instructions contain both information and warnings that are necessary for the safe operation and maintenance of this product. It is recommended that you read the instructions carefully and ensure that the contents are fully understood. Failure to understand and to comply with the warnings and instructions can result in serious injury, damage or even death.

In order to avoid the danger of electrical shock, it is important that proper safety measures are taken when working with voltages exceeding the extra low voltage (50V (25V) RMS AC or 120V (60V) DC. The values in brackets apply to restricted voltage ranges (for example in the medical or agricultural sector).

This portable appliance tester must only be used by a skilled and competent person capable of interpreting the results under the conditions and for the purposes for which it has been constructed, and who is familiar with the relevant regulations, the safety risks involved and the consequent normal safe working practices, and under the conditions and for the purposes for which it has been constructed and specified. Particular attention should be paid to the Warnings, Precautions and Technical Specifications. Always check the unit is in good working order before use and that there are no signs of damage to it. Do not use if damaged.

Where applicable other safety measures such as use of protective gloves, goggles etc. should be employed.

Please keep these instructions for future reference. Updated instructions and product information are available at: www.martindale-electric.co.uk/manuals

REMEMBER: SAFETY IS NO ACCIDENT

Meaning of Symbols and Markings

Caution - risk of danger and refer to instructions

Caution - risk of electric shock

Equipment protected by double or reinforced insulation (Class II)

AC (Alternating current)

Equipment complies with relevant EU Directives

Equipment complies with relevant UK Conformity Assessed marking

End of life disposal of this equipment should be in accordance with relevant Directives.

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1. INTRODUCTION

1.1 Inspection

Examine the shipping carton for any sign of damage. Inspect the unit and any accessories for damage. If there is any damage, then consult your distributor immediately.

Unpack the HPAT and check that you have the following accessories:

- Instructions
- Test Probe with crocodile clip (TL67)
- Adaptor Lead (EX332)
- Null pin on key fob (TL178)

1.2 Description

The battery powered HPAT is a Portable Appliance Tester with the following features:

Dual Insulation Test Voltage
The insulation measurement test voltage can be set to either 500V or 250V.

User Selectable Pass Levels
Appliance and lead test pass levels may be set to other than default values.

HPAT assist or fast mode testing
The HPAT can be operated in either of two test modes. In the HPAT assist test mode, aimed at the newcomer to PAT testing, a connection diagram for the selected test type is shown on the display. Each step of a test type requires confirmation by a press of the **Continue** button. In the Fast mode, for the experienced operator, the HPAT will automatically run through a selected test type without any further user interaction unless a failure is encountered.

IEC Lead Test
The HPAT can also be used to check IEC leads and extension leads for earth continuity, insulation, and correct polarity, (the Martindale EX332 Adapter lead is required for extension lead testing).

Test Data Memory Storage
The HPAT650 is able to store in memory the test data for up to 100 appliance tests.

Test Probe Null Function
A null function is incorporated in the HPATs to compensate for the test probe lead resistance when used for Class I earth continuity measurements.

This allows for alternative test probes to be used if desired.

The HPAT650 will perform the following test types: The substitute leakage test is not available on the HPAT550 model.

- **IEC Lead test sequence**
- **Class I test sequence**
- **Class II test sequence**
- **Substitute leakage test (HPAT650 model only)**
- **Class I Earth Continuity single test**
- **Class I Insulation single test**
- **Class II Insulation single test**

2. GENERAL OPERATION & FUNCTIONS

2.1 Precautions

This product has been designed with your safety in mind, but please pay attention to the following warnings and cautions before use.

If this equipment or the supplied accessories are used in a manner not specified by Martindale Electric, the protection provided by the equipment may be impaired.

WARNINGS

Before use check the unit for cracks or any other damage. Make sure the unit is free from dust, grease and moisture. Also check any associated leads and accessories for damage. Do not use if damaged. Be sure the HPAT is in good working order before use.

Only accessories that are supplied and meet the specific characteristics provided by Martindale Electric should be used.

The HPAT and this Instruction Manual are intended for use by personnel who are adequately trained and familiar with the 'IET Code of Practice for In-service Inspection and Testing of Electrical Equipment'.

Do not connect the HPAT to the mains supply via the IEC inlet.

Do not touch the appliance being tested or the test probe tip when the HPAT is performing an electrical test. Where possible, use the crocodile clip provided to attach the probe to the appliance.

Avoid severe mechanical shock or vibration and extreme temperature.

2.2 Power on / off

Hold down the green power button for at least 2 seconds to power on the HPAT. The HPAT will power on with the following display.

To power off the HPAT hold down the green power button for at least 3 seconds until 'Release the POWER button to switch off' is displayed on the screen. Then release the **Power** button to turn off the HPAT.

2.3 Display Indicators and Battery Charge

0-25%

>25 - 50%

>50 - 75%

>75 - 100%

Fully charged

Help screens and display diagrams

2.4 Connector descriptions

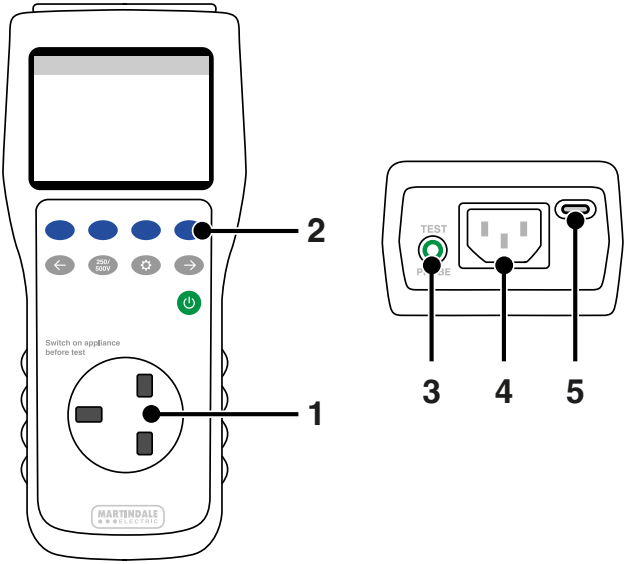
1. Front panel three pin socket outlet – Used to connect the appliance under test

2. Select / function buttons

3. 4.0mm Probe connector – Used for earth continuity/class II insulation test probe.
   *Recessed reset button – Used to reset the internal processor.

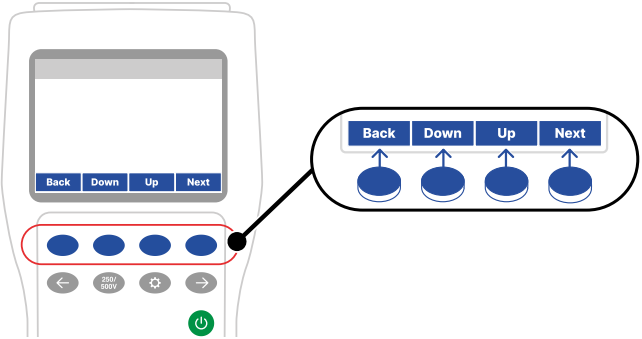
4. IEC Input socket – Used for IEC lead testing.
   Do not connect to a mains socket outlet supply

5. USB-C Input connection – Used for battery charging
   The HPAT will not operate while the USB charging cable is plugged in

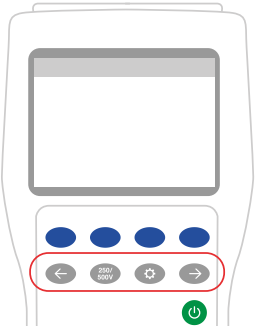


2.5 Menu & button descriptions

The top row blue selection buttons can be used to select and scroll through the various settings and menu options.



The bottom row buttons (HPAT650 only) are used for switching the insulating test voltage **250V / 500V**, scroll left ← and right →, and selecting the settings menu ⚙.



2.6 Default settings, pass levels and editing (HPAT650 only)

Editing pass levels

DEFAULT SETTINGS	
Insulation Voltage	250V
HPAT assist	Enabled
Fast mode	Enabled

DEFAULT PASS LEVELS	
Earth Continuity	
Class I	0.1Ω
IEC Lead	0.1Ω
Insulation	
Class I	1MΩ
Class II	2MΩ

NOTE: A load test is always carried out to check that the appliance is switched on and that there is a path for electricity to flow.

2.7 User Settable Pass Level Range (HPAT650 model only)

EARTH CONTINUITY	
Class I	0.1Ω to 0.9Ω in 0.1Ω increments
IEC lead	0.1Ω to 0.9Ω in 0.1Ω increments
INSULATION	
Class I	0.3MΩ to 0.9MΩ in 0.1MΩ increments 1MΩ to 10MΩ in 1MΩ increments
Class II	0.3MΩ to 0.9MΩ in 0.1MΩ increments 1MΩ to 10MΩ in 1MΩ increments

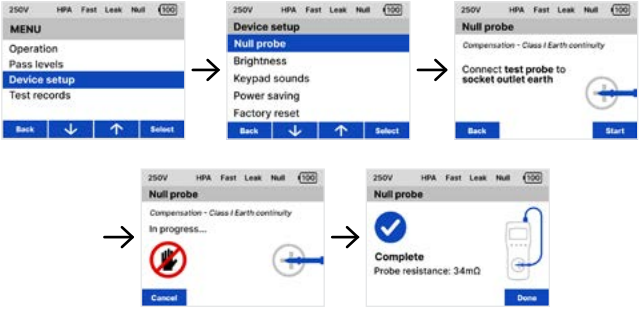
NOTE: Settings in the HPAT650 model should only be varied by experienced users familiar with the IET Code of Practice and the specific appliance under test.

2.8 Null of test probe lead resistance (Class I Earth Continuity only)

The null function is used to compensate for the test probe lead resistance when used for class I earth continuity measurements.

To null the test probe lead resistance select **Device setup** and scroll to **Null Probe**. Connect the supplied accessory probe (or Null Pin TL178) to the socket outlet earth and press **Start**.

The test in progress screen sequence will be displayed as depicted in the following screens.

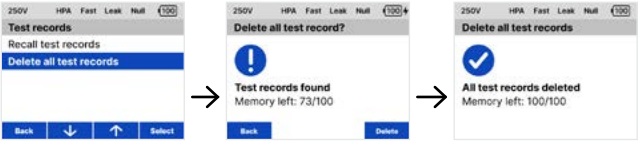


2.9 Saving Test Records to Memory and Recalling Test Records (HPAT650 model only)

Failed or Pass test results for any test type can be stored to memory using the save button. To recall test records from memory press **Settings** ⚙, **Recall Test Records** and then **Select**. The previous ← and next → buttons can then be used to scroll through the test records.

To delete an individual test record from memory, select **Recall test records** and then press **Select**. The up down buttons can then be used to scroll to the desired ID test record. Press the **Delete** button to complete the task.

To delete all test records from memory: From the main menu screen scroll down to **Test records** and press **Select**, use the up / down keys to highlight **Delete all test records**, press **Select** and then **Delete**.

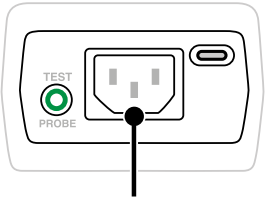


2.10 Auto power down

If the HPAT remains inactive for a period of 3 minutes, auto dimming of the LCD screen will start and the message ‘Auto power down’ will be displayed on the screen before auto power down after 5 minutes of inactivity.

2.11 Inadvertent Connection of Mains Supply Voltage

If mains voltage is inadvertently applied to the HPAT, via the IEC socket (1) at the top end, an error message will be displayed as per the diagram below and the HPAT will power down after approximately 3 seconds. All HPAT buttons will be inhibited until the source of the applied voltage is removed.



1

3.PERFORMING APPLIANCE & LEAD TESTS

WARNING

The HPATs and this instruction manual are intended for use by personnel who are adequately trained and familiar with the 'IET Code of Practice for in-service Inspection and Testing of Electrical Equipment'.

3.1 Preliminary Checks and set up

Ensure that the appliance is NOT plugged into the mains supply when removing fuses.

Appliance Visual and Fuse Checks:

- Visually inspect the appliance for any damage.
- Visually inspect the appliance mains lead and mains plug for any damage.
- Check that the fuse in the mains plug is of the correct rating.
- Check that any accessible fuses on the appliance are of the correct rating.
- **DO NOT** proceed with electrical testing if any of the visual or fuse checks fail.

IEC Lead/Extension Lead Visual and Fuse Checks

- Visually inspect the lead and plug for any damage.
- Visually inspect the extension lead socket for any damage.
- Check that the fuse in the plug is of the correct rating.
- **DO NOT** proceed with electrical testing if any of the visual or fuse checks fail.

Set Up

Check that the HPAT's pass levels are correctly set for the appliance or IEC lead being tested. This can be done by entering the **Set Pass Level** section of the **MENU**.

Reference should be made to the 'IET Code of Practice for In-service Inspection and Testing of Electrical Equipment' when determining correct pass levels.

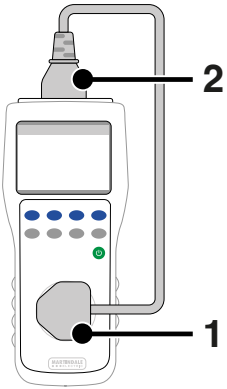
- Set the mains switch (if fitted) of the appliance being tested to the **ON** position.
- If required, perform a null to compensate for the test probe lead resistance before testing Class I earth continuity. Refer to 2.8 (Null of test probe lead resistance).

3.2 IEC Lead Test (HPAT assist)

Always refer to and perform 3.1 before proceeding

The following are performed:

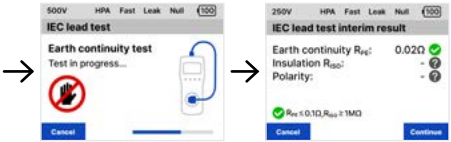
- **Earth continuity measurement** - measures the resistance of the lead earth.
- **Insulation measurement** - measures resistance between earth and line and between earth and neutral.
- **Wiring polarity check** - checks for open or short circuit wiring and crossed wiring.



Test connections

Refer to the IEC Lead connection diagram on page 16.

- Plug the IEC lead plug into the HPAT's front panel socket outlet (1).
- Connect the other end of the IEC lead to the HPAT's IEC input socket (2)
- From the main screen select **Lead** and press **Pass** after a visual check. After the visual check is satisfactory press **Start** to begin the earth continuity test. See screen sequence below.



- Press **Continue** to move onto the Insulation test and press **Continue** again to proceed to the polarity test. Press **Done** or **Save** to complete IEC lead tests. See screen sequence and test result example below.

3.3 Class I Test (HPAT assist)

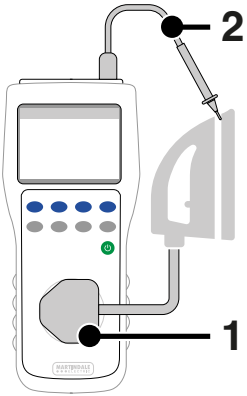
Always refer to and perform 3.1 before proceeding

The following are performed for a Class I appliance test:

- **Fuse check** - checks fuse continuity.
- **Class I earth continuity measurement** - measures resistance between earth and exposed metalwork.
- **Class I insulation measurement** - measures resistance between earth and line and between earth and neutral.

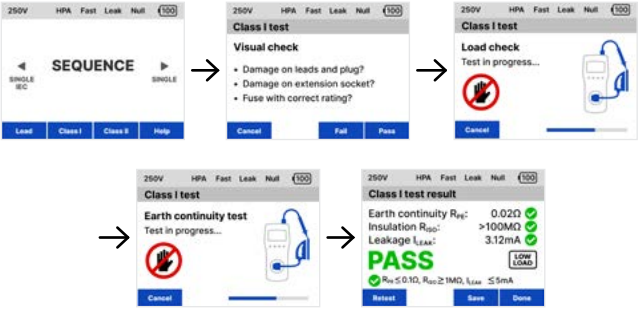
Test Connections

- Refer to the Class I connection diagram below.
- Plug the appliance mains plug into the HPAT's front panel socket outlet (1).
- Connect the test probe to the HPAT's 4mm test probe connector (2) and connect the other end to any exposed metal work on the appliance.
- If the appliance being tested has more than one instance of exposed metalwork, it is advisable to connect the test probe to each in turn and perform an earth continuity measurement. This can readily be done at the end of the Class I appliance test by making individual earth continuity measurements.



Testing in HPAT assist mode (substitute leakage test enabled - HPAT650 model only)

- Press **Class I** button from the sequence screen Press **Pass** for the HPAT to display the **Visual Check** screen.
- If any visual or fuse checks fail, select **Fail** and abort the test and return to the sequence screen.
- If all visual and fuse checks pass, select **Pass** and **Start** for the HPAT to display the test screen and perform the tests.
- Press **Continue** for the HPAT to perform the Class I earth continuity measurement.
- If ‘FAIL’ is displayed after the Class I earth continuity measurement, refer to 3.6 (Earth continuity / insulation failure)
- Press **Continue** for the HPAT to perform the Class I insulation measurement.
- If ‘FAIL’ is displayed after the Class I insulation measurement, refer to 3.6 (Earth continuity / insulation failure)



3.4 Class II Test (HPAT assist)

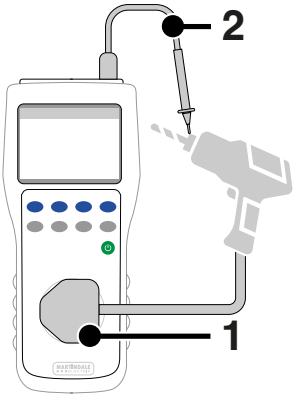
Always refer to and perform 3.1 before proceeding

The following are performed for a Class II appliance test:

- **Insulation measurement** - measures resistance between live and exposed metalwork and between neutral and exposed metalwork.

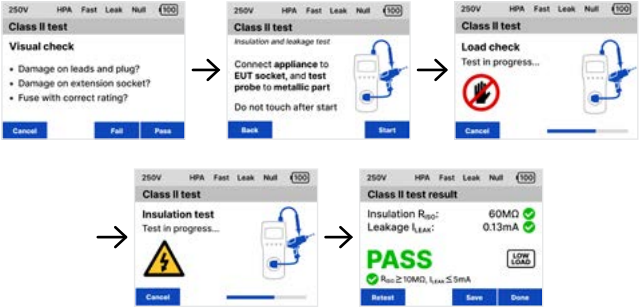
Test Connections

- Refer to the Class II connection diagram below.
- Plug the appliance mains plug into the HPAT's front panel socket outlet (1).
- Connect the test probe to the HPAT's 4mm test probe connection (2) and connect the other end to any exposed metal work on the appliance.
- If the appliance being tested has more than one instance of exposed metalwork, it is advisable to connect the test probe to each in turn and perform additional individual Class II insulation tests.
- Where the appliance being tested has multiple areas of possible insulation breakdown, such as cooling slots or cover joints, it is suggested to wrap metal foil tightly around the appliance and connect the test probe to the metal foil then perform Class II insulation tests.



Testing in HPAT assist mode (substitute leakage test enabled - HPAT650 model only)

- Press the **Class II** button from the **Sequence** screen for the HPAT to display the Visual check screen.
- If any visual or fuse checks fail, select Fail and abort the test and return to the select test screen.
- If all visual checks pass, select **Pass** and **Start** for the HPAT to display the test screen and perform the Insulation test, press **Continue** to perform the leakage test. Select **Save** or **Done** to complete the sequence.
- If 'FAIL' is displayed after the Class II insulation measurement or Leakage test, refer to 3.6 (Earth Continuity / Insulation Failure).



3.5 Extension Lead Testing (HPAT assist)

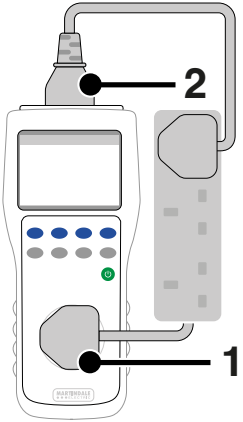
Always refer to and perform 3.1 before proceeding

To test extension leads the HPAT's IEC Lead Test is used with connections as detailed below.

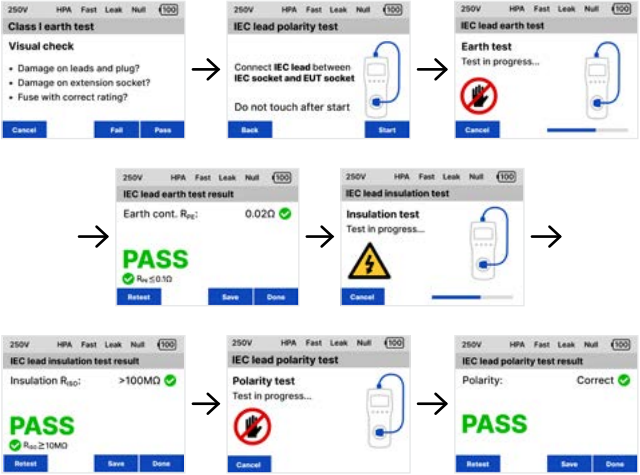
A Martindale EX332 IEC mains lead (or similar) is required to perform extension lead tests.

Test Connections

- Refer to the Extension Lead connection diagram below.
- Plug the extension lead plug into the HPAT's front panel socket outlet (1).
- Plug the EX332 IEC lead mains plug into the extension lead socket.
- Connect the other end of the EX332 IEC lead to the HPAT650 IEC input socket (2).



Test sequence for extension lead



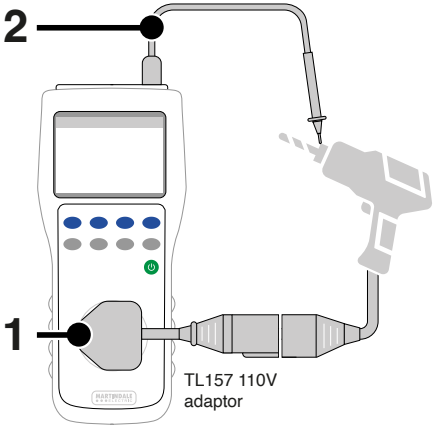
3.6 Earth Continuity/Insulation Failure

Possible reasons for failure other than a faulty appliance or lead:

- Appliance or lead being tested not correctly connected to the HPAT.
- Test probe is not making good contact with the appliance.
- Pass levels are not correct for the type of appliance or lead being tested.
- Null of the test probe lead resistance incorrect (refer to 2.8).

3.7 Testing of 110V Appliances

A TL157 PAT 110V Adaptor (available separately) is required for testing 110V appliances (yellow BS 4343 16A 110V plug). Refer to the connection diagram below.



Ensure that the appliance is switched ON. Undertake a test sequence as appropriate for the appliance (See 3.1 to 3.4).

NOTE: Connect the test probe to the HPAT's 4mm test probe socket (2) and connect the probe to the appliance appropriately, according to the test descriptions in sections 3.1 to 3.4.

NOTE: The TL157 PAT 110V Adaptor has a special configuration of internal connections to enable the safe testing of Earth Continuity and of Insulation resistance for 110V appliances.

However, for reasons of safety, the TL157 will not allow a 110V appliance to draw any run current through the socket Outlet (1). (This is to prevent inadvertent connection of a 110V appliance to 230V mains).

For this reason, the test of a 110V appliance using the TL157 will always result in a FAIL at the Load check.

Check that the appliance is switched ON. Begin the test again if necessary. The user should also have checked the fuse (if fitted). Assuming such checks above have been made, the Class I or Class II appliance test sequence can be continued beyond the simulated load check result by selecting **Continue**.

NOTE: A load test is always carried out to check that the appliance is switched on and that there is a path for electricity to flow.

3.8 110V Extension Lead Testing

⚠ Always refer to 3.1 and perform extension lead checks before proceeding

To test 110V extension leads, the HPAT's lead test is used with connections as detailed on page 27. Also refer to 3.2 (IEC Lead Test).

A Martindale EX331 IEC to 110V adaptor lead, plus TL157 PAT 110V adaptor is required to perform 110V extension lead tests.

Test Connections

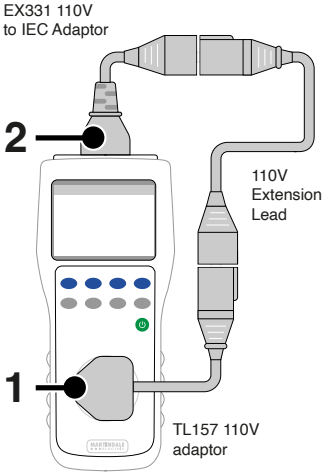
- Refer to the 110V Extension Lead connection diagram on page 27.
- Plug the TL157 110V adaptor into the HPAT's front panel socket outlet (1).
- Connect the TL157 coupler to the 110V plug of the 110V extension lead under test.
- Plug the EX331 110V plug into the coupler of the 110V extension lead under test.
- Connect the other end of the EX331 to the HPAT's IEC input socket (2).
- Ensure that any switches are set to ON.
- Undertake a Lead test (3.2)

NOTE: The TL157 PAT 110V Adaptor has a special configuration of internal connections to enable the safe testing of earth continuity and of insulation resistance for 110V appliances.

However, for reasons of safety, the TL157 will not allow a 110V extension lead to draw any run current through the mains socket (1). (This is to prevent inadvertent connection of a 110V appliance to 230V mains).

For this reason, the lead test of a 110V lead using TL157 will always result in a FAIL on polarity.

The lead test will have shown that the earth continuity is satisfactory, and will have tested that the Insulation is satisfactory between centre tapped earth and the two live 55V conductors. If both earth and insulation tests PASS, the extension lead is proven electrically safe, assuming the visual inspection was passed. Because the concept of polarity is irrelevant on 55-0-55, the failure of the polarity test can be ignored.



MAINTENANCE

4.1 Calibration

To maintain the integrity of measurements made using your instrument, Martindale Electric recommends that it is returned at least once a year to an approved calibration laboratory for recalibration and certification.

Martindale Electric is pleased to offer you this service. Please contact our Service Department for details.

Email: service@martindale-electric.co.uk
Tel: +44 (0)1923 650660

4.2 Cleaning

If contamination is found, clean with a damp soft cloth and if necessary, a mild detergent. Do not use abrasives, abrasive solvents, or detergents which can cause damage to the unit. If a mild detergent is used, the unit should subsequently be thoroughly cleaned with a water dampened soft cloth. After cleaning, dry and allow to remain in a dry environment for 2 hours before use.

4.3 Repair & Service

There are no user-serviceable parts in this unit. Return to Martindale Electric if faulty. Our service department will quote promptly to repair any fault that occurs outside the warranty period.

4.4 Storage Conditions

The instrument should be kept in warm, dry conditions away from direct sources of heat or sunlight, and in such a manner as to preserve the working life of the unit. It is strongly advised that the unit is not kept in a toolbox where other tools may damage it.

5. WARRANTY AND LIMITATION OF LIABILITY

This Martindale product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is 2 years and begins on the date of receipt by the end user. This warranty extends only to the original buyer or end-user customer, and does not apply to fuses, disposable batteries, test leads or to any product which, in Martindale's reasonable opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation, handling or storage.

Martindale authorised 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 Martindale.

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

This warranty is the buyer's sole and exclusive remedy and is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. Martindale shall not be liable for any special, indirect, incidental or consequential damages or losses, including loss of data, arising from any cause or theory.

Since some jurisdictions 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 part of 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 or other part of that provision.

Nothing in this statement reduces your statutory rights.

MARTINDALE ELECTRIC

Keeping You Safe

Specification
HPAT550

EARTH CONTINUITY
Test voltage: >4V DC (into open circuit)
Test current: >200mA DC (into short circuit)
Range: 0.1 - 20Ω
Resolution: 0.01Ω
Accuracy: ± (5% reading + 2 digits)
Pass limits:
Fixed ≤0.1Ω
≤0.1Ω selectable pass for long cable

INSULATION
Default test voltage:
>500V DC at 1mA (< 625V DC into open circuit)
User selectable test voltage:
>250V DC at 1mA (< 312.5V DC into open circuit)
Test current: 2mA (into short circuit)
Range: 0.1MΩ - 100MΩ
Resolution: 0.01MΩ (10kΩ-2MΩ),
0.1MΩ (2MΩ-20MΩ),
1MΩ (20MΩ-100MΩ),
Accuracy: 5% reading + 2 digits
Pass level:
Lead: ≥ 1.0 MΩ
Class I: ≥ 1.0 MΩ
Class II: ≥ 2.0 MΩ

POWER
Batteries: 3.7V 5000mAh lithium polymer battery (non-user replaceable)
Battery life: Fully charged, minimum 1700 complete tests approx.
Auto Power Down:
Auto dimming after 3 minutes, Auto power down after 5 minutes of inactivity

Environmental
Location: Suitable for indoor use, and outdoor use in dry weather conditions only
Altitude: Up to 2000m
Operating temperature: 0°C to 40°C
Humidity: ≤ 80% RH up to 31°C, decreasing linearly to 50% RH at 40°C
Ingress protection class: IP20
Pollution degree: 2

GENERAL
Overload protection: 300V AC / DC
Protection class: IP20
Safety: Complies to BS EN 61010-1

MARTINDALE ELECTRIC

Keeping You Safe

Specification
HPAT650

EARTH CONTINUITY
Test voltage: >4V DC (into open circuit)
Test current: >200mA DC (into short circuit)
Range: 0 - 20Ω
Resolution: 0.01Ω
Accuracy: ± (5% reading + 2 digits)
Pass limits:
Defaults ≤0.1Ω, user settable
≤0.5Ω selectable pass for long cable

INSULATION
Default test voltage:
>500V DC at 1mA (< 625V DC into open circuit)
User selectable test voltage:
>250V DC at 1mA (< 312.5V DC into open circuit)
Test current: 2mA (into short circuit)
Ranges: 0.1MΩ - 100MΩ
Resolution: 0.01MΩ (10kΩ-2MΩ),
0.1MΩ (2MΩ-20MΩ),
1MΩ (20MΩ-100MΩ),
Accuracy: 5% reading + 2 digits
Pass level:
Lead: ≥ 1 MΩ
Class I: ≥ 1 MΩ
Class II: ≥ 2 MΩ
User settable pass level
≥0.3MΩ to ≥1MΩ in 0.1MΩ steps
≥1MΩ to ≥10MΩ in 1MΩ steps

SUBSTITUTE LEAKAGE TEST
Test voltage: <50V AC (into open circuit)
0.02-20mA DC (into short circuit)
Accuracy: ±5% reading + 2 digits
Pass level: <5mA

MEMORY
Test records: 100 tests stored for on screen recall

POWER
Batteries: 3.7V 5000mAh lithium polymer battery (non-user replaceable)
Battery life: Fully charged, minimum 1700 complete tests, stored to memory
Auto Power Down:
Auto dimming after 3 minutes, Auto power down after 5 minutes of inactivity

Environmental
Location: Suitable for indoor use, and outdoor use in dry weather conditions only
Altitude: Up to 2000m
Operating temperature: 0°C to 40°C
Humidity: ≤ 80% RH up to 31°C, decreasing linearly to 50% RH at 40°C
Ingress protection class: IP20
Pollution degree: 2

GENERAL
Overload protection: 300V AC/DC
Protection class: IP20
Safety: Complies to BS EN 61010-1

Check out what else you can get from Martindale:

- 18th Edition Testers
- Accessories
- Cable Locators
- Calibration Equipment
- Continuity Testers
- Digital Clamp Meters
- Digital Multimeters
- Electricians' Kits
- Environmental Products
- Full Calibration & Repair Service
- Fuse Finders
- Labels
- Microwave Leakage Detectors
- Multifunction Testers
- PAT Testers & Accessories
- Phase Rotation Testers
- Proving Units
- Safe Isolation Kits
- Socket Testers
- Specialist Drummond Testers
- Thermometers & Probes
- Test Leads
- Voltage Indicators

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