PowerPlus 1557

Operating Instructions

SEAWARD

Figure 1 PowerPlus 1557 Front View

Figure 2 PowerPlus 1557 End View

No   Description
1   LCD Display
2   F1 – F4 soft keys.
3   Arrow keys
4   OFF/STOP key
5   ON/START key
6   RED test terminal
7   GREEN test terminal
8   BLACK test terminal

Figure 3 Earth Continuity/Insulation Measurement

Figure 4 Earth Continuity/Insulation Measurement using Cordless probe
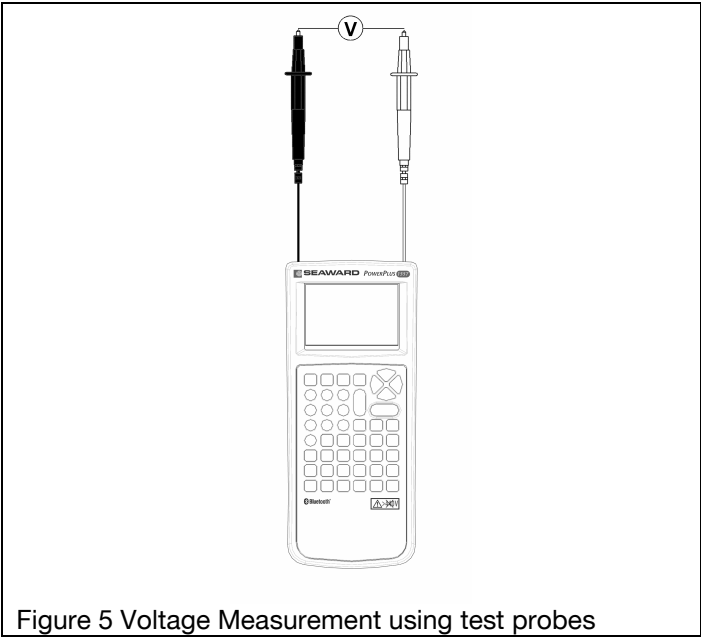
Figure 5 Voltage Measurement using test probes
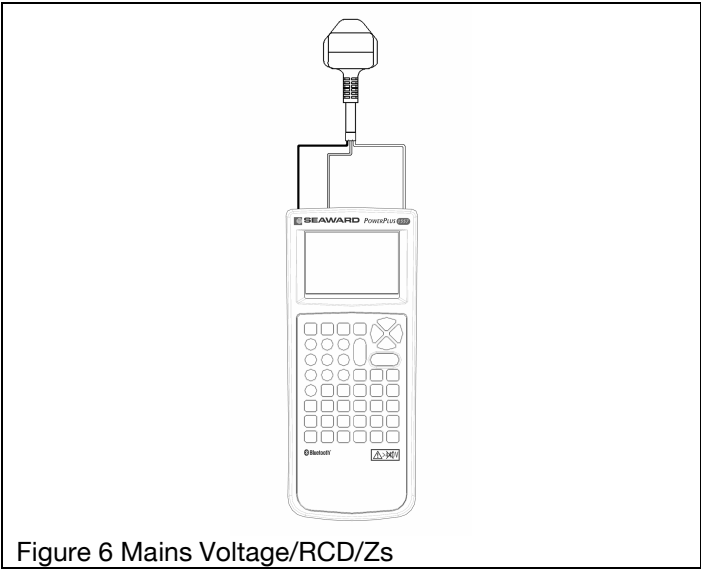
Figure 6 Mains Voltage/RCD/Zs

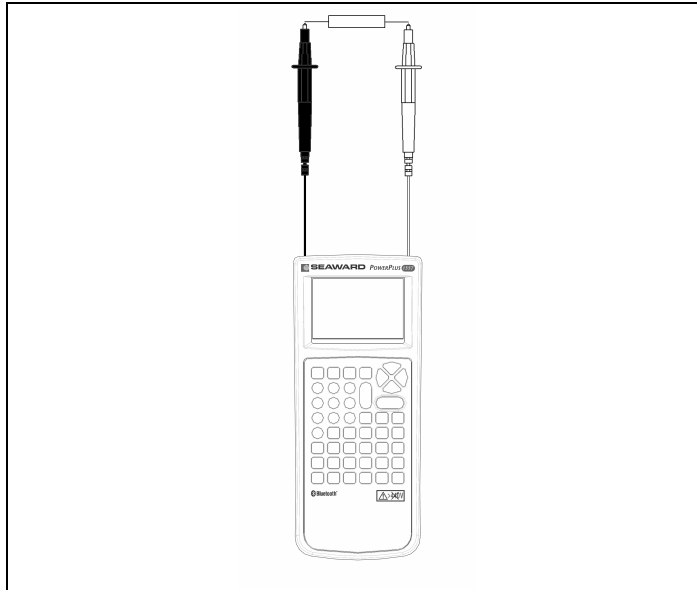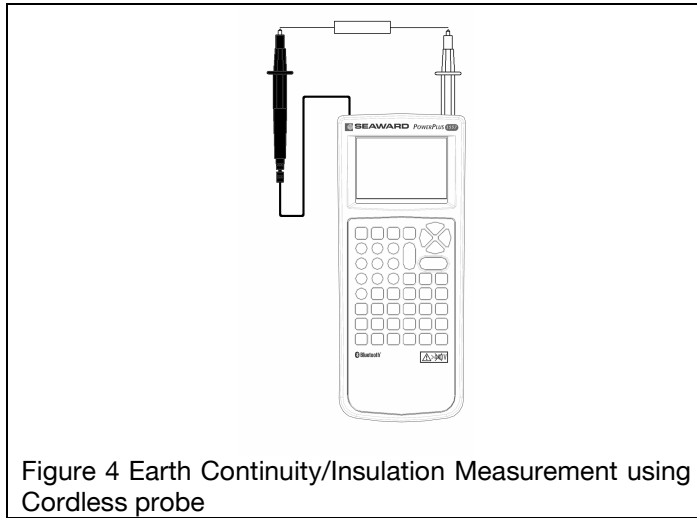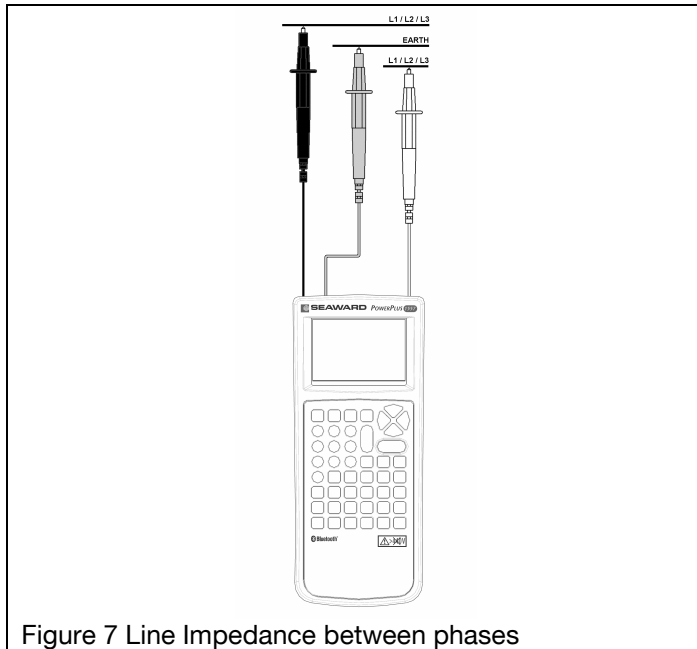Figure 7 Line Impedance between phases
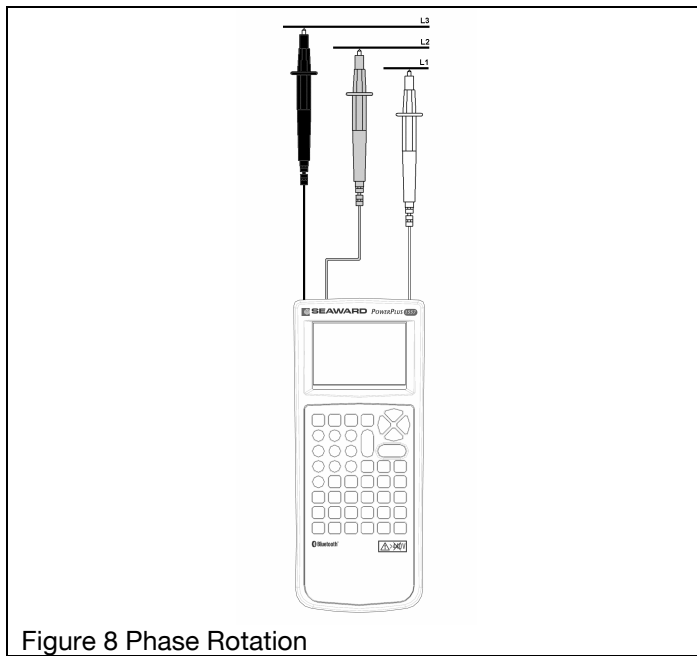
Figure 8 Phase Rotation

Limited Warranty & Limitation of Liability

SEAWARD Electronic Limited guarantees this product to be free from defects in material and workmanship under normal use and service for a period of 2 year. The period of warranty will be effective at the day of delivery.

Due to a policy of continuous development SEAWARD Electronic Limited reserves the right to alter the equipment specification and description outlined in this publication without prior notice and no part of this publication shall be deemed to be part of any contract for the equipment unless specifically referred to as an inclusion within such contract.

Disposal of old product
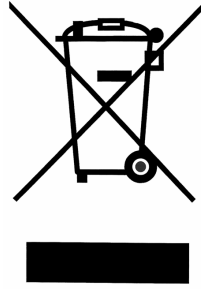
This product has been designed and manufactured with high quality materials and components that can be recycled and reused.

When this symbol is attached to a product it means the product is covered by the European Directive 2002/96/EC.

Please familiarise yourself with the appropriate local separate collection system for electrical and electronic products.

Please dispose of this product according to local regulations. Do not dispose of this product along with normal waste material. The correct disposal of this product will help prevent potential negative consequences for the environment and human health.

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CERTIFICATE OF CONFORMITY

As the manufacturer of the apparatus listed, declare under our sole responsibility that the product:

PowerPlus 1557

To which this declaration relates are in conformity with the relevant clauses of the following standard:

BS EN 61010-1:2001
Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements.

BS EN 61557-1,2,3,4,6,10:1997
Electrical safety in low voltage distribution systems up to 1000V a.c. and 1500V d.c. – Equipment for testing, measuring and monitoring of protective measures

BS EN 61326:1998
Electrical equipment for measurement, control and laboratory user-EMC Requirements

Performance: The instrument operates within specification when used under the conditions in the above standards EMC and Safety Standards.

The product identified above conforms to the requirements of Council Directive 89/336/EEC and 73/23 EEC.

Seaward Electronic Ltd is registered under BS EN ISO9001:2000 Certificate No: Q05356.

Introduction

The PowerPlus 1557 is a hand held, battery powered, multi-function electrical installation test instrument. When used in conjunction with PowerPlus PC the PowerPlus 1557 becomes part of a very comprehensive certificate entry and management system.

The PowerPlus 1557 is the first Installation tester which is capable of storing multiple certificates in memory. Each certificate can be called up and edited at any time. The PowerPlus 1557 can also perform electrical tests with the test result automatically placed into the certificate.
Certificates, complete and incomplete, can be transferred between the PowerPlus 1557 and the Windows application PowerPlus PC.

The PowerPlus 1557 is capable of performing a comprehensive range of tests, including:

1.   Earth Continuity at 200mA
2.   Insulation Resistance at 100V, 250V, 500V and 1000V
3.   Voltage and Frequency
4.   RCD Trip Time at ½IΔn, IΔn and 5xIΔn
5.   Automatic RCD test sequences
6.   RCD Trip current
7.   Low Current Earth Loop Impedance and PFC
8.   High Current Earth Loop Impedance and PFC
9.   Mains Impedance and associated PSC
10. Power socket wiring polarity
11. Phase Rotation

1 User Notes

This instrument and its operating instructions are intended for use by adequately trained personnel.

The following symbols are used in these operating instructions and on the PowerPlus 1557.

Warning of electrical danger!
Indicates instructions must be followed to avoid danger to persons.

Important, follow the documentation! This symbol indicates that the operating instructions must be adhered to in order to avoid danger.

Note: *Data may be lost or altered in virtually any electronic memory under certain circumstances. Therefore Seaward Electronic assumes no responsibility for financial losses or claims due to data lost or otherwise rendered unusable whether as a result of abuse, improper use, defects, disregard of operating instructions or procedures, or any allied causes.*

2 Safety Notes

This PowerPlus 1557 is fully compliant with the requirements of:

BS EN 61010-1: 2001.

BS EN 61557 part 1, 2, 3, 4, 6 and 10.

In order to ensure safe operation of this instrument, all notes and warnings in these instructions must be observed at all times.

⚠ The PowerPlus 1557 has been designed to make measurements in a dry environment.

⚠ The PowerPlus 1557 may be used to test circuits with a maximum over-voltage Category III, 300 V AC/DC with reference to earth.

⚡ High voltages are present at the probe tips of the PowerPlus 1557 during insulation resistance measurement. Always hold test probes above the hand guards.

⚠ The PowerPlus 1557 and all associated cables and leads must be checked for signs of damage before equipment is operated.

⚡ Prior to any resistance measurement, always ensure that the circuit under test is electrically isolated.

⚠ >440V Never connect the PowerPlus 1557 to a voltage source greater than 440V.

Where safe operation of the PowerPlus 1557 is no longer possible it should be immediately shut down and secured to prevent accidental operation.

It must be assumed that safe operation is no longer possible:
- if the instrument or leads show visible signs of damage or
- the instrument does not function or
- after long periods of storage under adverse environmental conditions.

⚠ If the PowerPlus 1557 is used in a manner not specified by this document then the protection provided by the equipment may be impaired.

3 Contents and Accessories

3.1 PowerPlus 1557 Contents

1 off PowerPlus 1557 unit
1 off Operating Instruction Manual
1 off Carrying case
1 off Carrying strap
1 off Mains lead
1 off 1.2 M black test lead including crocodile clip
1 off 1.2 M red test lead including crocodile clip
1 off 1.2 M green test lead including crocodile clip
1 off Cordless probe
6 off re-chargeable Batteries
1 off Battery Charger & Power Supply

3.2 PowerPlus PC Contents

1 off Belkin Bluetooth Adapter
1 off PowerPlus PC CD.

3.3 Professional PowerSolutions Kit Contents

1 off PowerPlus 1557
1 off PowerPlus PC

3.4 Advanced PowerSolutions Kit Contents

Professional PowerSolutions Kit plus;
1 off K3110 Printer
1 off Battery Powered Bluetooth module
1 off Power Supply
1 off K3110 Carrying case
1 off K3110 label cartridge

3.5 Optional Accessories

PC USB Bluetooth Adapter   339A910
PowerCheck 1557   369A910
K3110 Printer (includes Battery powered   363A950
Bluetooth module, power supply, case and
1x label cartridge)

4 Unit Description

Refer to fig. 1 and fig. 2.

The PowerPlus 1557 is a hand held, multi-function electrical installation test instrument, capable of performing all of the required electrical tests and entering data into certificates.

Identifying parts of the unit

1   LCD Display

2   F1 – F4 Function keys. The purpose of these keys changes depending upon the mode of the instrument. The lower part of the LCD display describes these functions.

3   Arrow keys. These keys are used to navigate the menu system and select the test type I test mode.

4   OFF/STOP key. Used to switch the PowerPlus 1557 off or to cancel or stop locked tests.

5   ON/START key. Used to switch the PowerPlus 1557 on or to start tests.

6   RED test terminal. This terminal is used for Continuity and Insulation tests. Connect to live when performing mains tests and to L1 for phase rotation tests.

7   GREEN test terminal. This terminal is used for connection to earth when performing mains tests and to L2 for phase rotation tests.

8   BLACK test terminal. This terminal is used for Continuity and Insulation tests. Connect to neutral when performing mains tests and to L3 for phase rotation tests.

5 Getting Started

5.1 Charging New Batteries

Before using the PowerPlus 1557 for the first time the rechargeable cells provided will need to be charged.

The first time these newly charged cells are used they should be fully discharged then fully recharged. This should be done in order to get the best possible life out of the cells.

Refer to the instructions supplied with the battery charger and insert the fully charged batteries into the PowerPlus 1557.

5.2 Power On

Switch on the PowerPlus 1557 by pressing, and holding, the green ON/START key. After a couple of seconds the test mode tests will be displayed.

The first time the PowerPlus 1557 is powered up the user will be automatically set to Admin. The Admin user gives full access to all the menus and functionality of the unit.

The PowerPlus 1557 will now be ready to use in test mode. Refer to section 6 for more details.

6 Using the PowerPlus 1557

6.1 Overview

The PowerPlus 1557 is a multifunction installation tester with the following test types;

- Voltage / frequency
- Continuity test
- Insulation test
- PSC / Line Impedance test
- PFC / High current Loop Impedance test
- PFC / Low current Loop Impedance test
- RCD trip time
- Automatic RCD trip time
- RCD Ramp test
- Phase Rotation

6.2 LCD Overview

When the product is performing tests the LCD is broken down into areas.
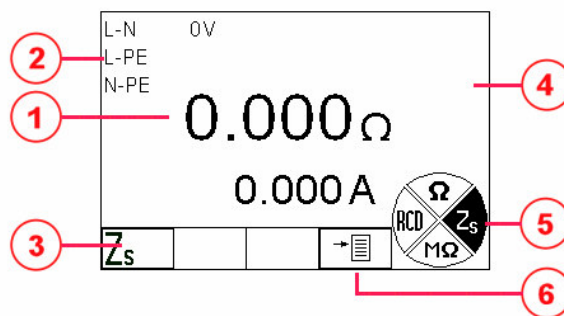
1. Main measurement area. This area is used to display the measurements for the selected test.
2. Mains indications. This area shows the current status of the mains supply connection while mains test types are selected.
3. Softkey test options. During test mode the first three softkeys are used to change the option for the active test type.
4. Special indications. This area of the screen is reserved for special function indicators;

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- • Battery level indication.
- • Bluetooth functionality / connection status.
- • Functional test active indicator.

5. Softkey test selector. During test mode the four arrow softkeys are used to select the required test type. During certificate mode this bottom area is used to show any special functions that the softkeys may provide.

6. F4 Menu softkey. The menu softkey is used to bring up the menu, this option is available for all test types.

Note: In order to measure a voltage simply apply the voltage between the Red and Black test terminals. The PowerPlus 1557 will then enter the voltage measurement mode. In order to leave the voltage measurement mode simply remove the voltage from the terminals.
In order to display a phase rotation indication connect all three test probes to different phases. The PowerPlus 1557 will then enter the phase rotation mode. In order to leave the phase rotation mode simply remove the test probes from the connected phases.
The PowerPlus 1557 will NOT enter either voltage mode or Phase Rotation while a certificate or menu is being displayed.

6.3 Battery Level Indicator

Note: Different tasks performed by the PowerPlus 1557 may require a different level of voltage from the battery supply. Batteries which appear good when the unit is idle or in certificate mode may not be acceptable for performing tests.

While the PowerPlus 1557 is powered on there are periodic checks of the batteries. As the batteries discharge the symbols below will appear on the right side of the LCD.

If no battery symbol is shown then the batteries are good.

Batteries still good, no functionality is disabled.

Batteries still good, no functionality is disabled.

This symbol indicates that the batteries are ready for replacement/re-charge. The unit will still continue to measure voltage and to function in certificate mode but the START key will be disabled.

Batteries need replacing/recharging immediately.

6.4 Bluetooth Connection Indication

The PowerPlus 1557 communicates to external devices using Bluetooth. When Bluetooth is required an icon is displayed in the special indications area of the LCD.

The PowerPlus 1557 cannot communicate with the internal Bluetooth. This icon may appear for a short period of time when the Bluetooth is required.
No Bluetooth connection is made.

The PowerPlus 1557 Bluetooth is performing a task, for example when the Bluetooth module is performing a search.
The PowerPlus 1557 Bluetooth is currently connected to an external device.

6.5 Activity Indication

The PowerPlus 1557 indicates when an action in active.

An animated egg timer icon is shown when the PowerPlus 1557 is performing an action. This icon is also shown while the PowerPlus 1557 is performing tests.

6.6 Menu Key

The menu key will display different options dependant on the current mode of operation. While in manual mode the menu option will allow you access to the certificates and all of the user options.

In certificate mode the menu key will display a different set of options, these include the advanced certificate navigation modes.

6.7 Navigating Menus
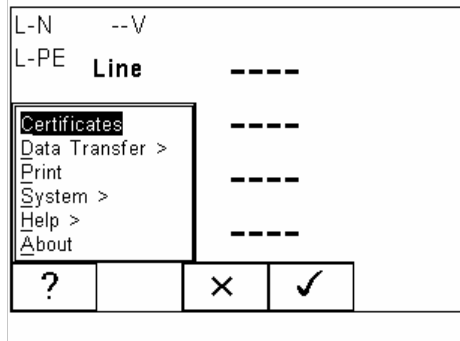
To navigate the menus use the Up and Down keys to highlight the required option and press the accept key (F4) or the Right key. Each menu item also has a shortcut letter which is underlined, pressing the identified letter selects required menu item.

To return to the previous menu press the Left key.

To leave the menu system press the Cancel key (F3).

6.8 Softkey test selector

The softkey test selector uses the arrow keys to quickly change the selected test type. Up will select Continuity, right will select Loop/Line Impedance, down will select Insulation and left will select RCD. When a test type is selected the area of icon for the selected test will be highlighted.

The Voltage and Phase Rotation tests are available at any time, simply connect the voltages to the correct

terminals, the PowerPlus 1557 will enter the correct test mode.

7 Performing Tests

The test types are selected using the Softkey test selector, reference 6.8.

When tests are performed from within certificates the correct test type is pre-selected by the PowerPlus 1557, the Softkey test selector is not displayed.

7.1 Continuity Tests

⚡   Always ensure that the circuit under test is electrically isolated.

⚠   If the test probes are connected across a voltage of >30V then the test is inhibited.

⚠   Measurements can be adversely affected by impedances of additional operating circuits connected in parallel or by transient currents.

In test mode select the Continuity test by pressing the Up arrow key.

The main measurement display area will display the voltage present across the Red and Black test terminals. If the voltage measured is >30V then the Continuity test is disabled.

When the continuity test is selected the softkeys F1-F4 are used to select the options below:

F1	F2	F3	F4
🔊	🔒	↺Ω↻ Zero	→▤

🔊   **Buzzer (F1)**
When enabled, the Buzzer will sound when the continuity measurement is less than 20 ohms.

🔒   **Test Lock (F2)**
The Test Lock is used to 'lock' the instrument in a continuous measurement mode, with a single press of the START key.

Press the F2 softkey to turn the test lock on and off. When the test lock icon is highlighted the test lock function is enabled, press the START key to start a locked test.

To stop a locked test and disable the lock function press F2.

To stop a locked test but leave the test lock function enabled press the STOP key.

ZERO (F3)

The instrument can automatically compensate for the resistance of the test leads.

Connect the two test probes firmly together, then press and hold the ZERO key. The measured resistance of the test leads is shown in the primary display until a beep is heard and the ZERO icon is highlighted. All subsequent measurements will take into account the test lead resistance compensation until the function is disabled by pressing function key F3.

Note: A maximum test lead resistance of 10 ohms can be taken into account. If the test lead resistance is great than 10 ohms an error beep will indicate that the Lead Zero function has failed.

Note: For ease of use, the PowerPlus 1557 will store the lead compensation when switched off and recall this value when next switched on. The stored value is only applicable to the test leads used when the compensation measurement was made. If the test leads are replaced the ZERO function should be repeated using the replacement test leads.

To make a continuity measurement, press and hold the START key. The resistance between the test probes is displayed until the START key is released. Alternatively, use the Test Lock function to allow measurements to be started or stopped with single press of the START key.

7.2 Insulation Tests

⚡ Always ensure that the circuit under test is electrically isolated.

⚠ If the test probes are connected across a voltage of >30V then the test is inhibited.

In test mode select the Insulation test by pressing the Down arrow key.

The main measurement display area will display the voltage present across the Red and Black test terminals. If the voltage measured is >30V then the Insulation test is disabled.

When the Insulation test is selected the softkeys F1-F4 are used to select the options below:

F1	F2	F3	F4
🔊	🔒	Change test voltage	→▤

🔊 **Buzzer (F1)**
When enabled, the Buzzer will sound when the insulation measurement is less than 1 Mohm.

🔒 **Test Lock (F2)**
The Test Lock is used to 'lock' the instrument in a continuous measurement mode, with a single press of the START key.
Press the F2 softkey to turn the test lock on and off. When the test lock icon is highlighted the test lock function is enabled, press the START key to start a locked test.
To stop a locked test and disable the lock function press F2.
To stop a locked test but leave the test lock function enabled press the STOP key.

Change Test Voltage (F3)
The voltage indicated above the F3 softkey is the test voltage currently selected. Press the F3 softkey will change the voltage selected.

To make an insulation measurement, press and hold the START key. The resistance between the test probes is displayed until the START key is released. Alternatively, use the Test Lock function to allow measurements to be started or stopped with single press of the START key.

7.3   Zs (Earth Loop Impedance / PSC / Line Impedance / PFC)

⚠   The PowerPlus 1557 will only allow the Zs tests to be performed if the correct voltages are detected between line-neutral (L-N illuminated), line-earth (L-PE illuminated) and neutral-earth (N-PE **not** illuminated).

⚠   Leakage currents in the circuit following the residual current protection device may influence the measurement.

Note: The PowerPlus 1557 cannot perform Zs and Zs^{RCD} tests on three phase supplies. PSC tests can be performed on single phase supplies and also from phase to phase.

Note: During a Zs test on a mains system with a large PE impedance it is possible that the local earth could rise to a hazardous voltage. In order to prevent this the PowerPlus 1557 constantly monitors the voltage on the local earth. If the voltage is deemed hazardous the PowerPlus 1557 stop the test immediately and reverts to performing a Zs^{RCD} type test which cannot, by design, raise the local earth to a hazardous voltage. Should this situation rise the test duration will increase from 2 to 6 seconds.

In test mode select the Zs by pressing the Right arrow key.

When the Zs test is selected the softkeys F1-F4 are used to select the options below:

F1	F2	F3	F4
Test Selection	Not used	Not used	→▤

Test Selection (F1)
Pressing the F1 key will rotate around 3 possible options;

Zs High current Loop Impedance, PFC, Line Impedance and PSC test.

Zs^{RCD} Low current Loop Impedance, PFC, high current Line Impedance and PSC test.

PSC High current Line Impedance and PSC test.

To begin the test, press and release the START key.

During the Zs and Zs^{RCD} tests the egg timer is shown to indicate that the test is running. When the test is complete four measurements are displayed, the Loop Impedance, the PFC, the Line Impedance and the PSC.

During the PSC test the egg timer is shown to indicate that the test is running. When the test is complete two measurements are displayed, the Line Impedance and the PSC

7.4 RCD Tests

⚠   The PowerPlus 1557 will only allow the RCD tests to be performed if the correct voltages are detected between line-neutral (L-N illuminated), line-earth (L-PE illuminated) and neutral-earth (N-PE **not** illuminated).

⚠   Leakage currents in the circuit following the residual current protection device may influence the measurement.

Note: The PowerPlus 1557 will determine the fault voltage that may appear on the protective

*conductor during the test. If the fault voltage is greater than 25V the PowerPlus 1557 will indicate >25V on the LCD, but the user may proceed with the test. If the fault voltage is great than 50V, this is indicated on the LCD and the test is inhibited.*

In test mode select the RCD tests by pressing the Left arrow key.

When the RCD test is selected the softkeys F1-F4 are used to select the options below:

F1	F2	F3	F4
RCD Test Type	Test Current	Current Type	→▤

RCD Test Type (F1)
Pressing the F1 softkey changes current multiplier and select the test type.

x ½
↓
x1
↓
x5
↓
◢ Ramp Test
↓
Auto test sequence
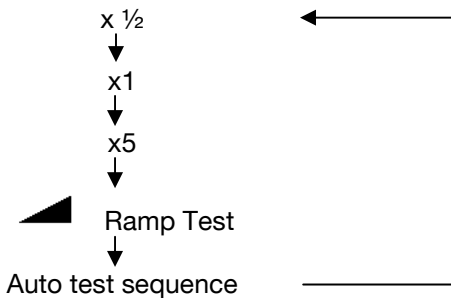
The Ramp Test function is covered in section 7.5.

The Automatic RCD function is covered in section 7.6.

Rated residual operating current IΔn (F2)
The current indicated above the F2 softkey is the test current currently selected. Press the F2 softkey will change the current selected.
The following current and multiplier options are available

	10mA	30mA	100mA	300mA	500mA
½ I∆N	✔	✔	✔	✔	✔ *
1 I∆N	✔	✔	✔	✔	✔ *
5 I∆N	✔	✔	✔ *		

* These tests are only available when the ac test type is selected.

Test Current Type, Starting Angle and RCD Type (F3)
Pressing the F3 softkey changes current type (ac/dc), the starting angle and the whether you are testing a selective RCD.
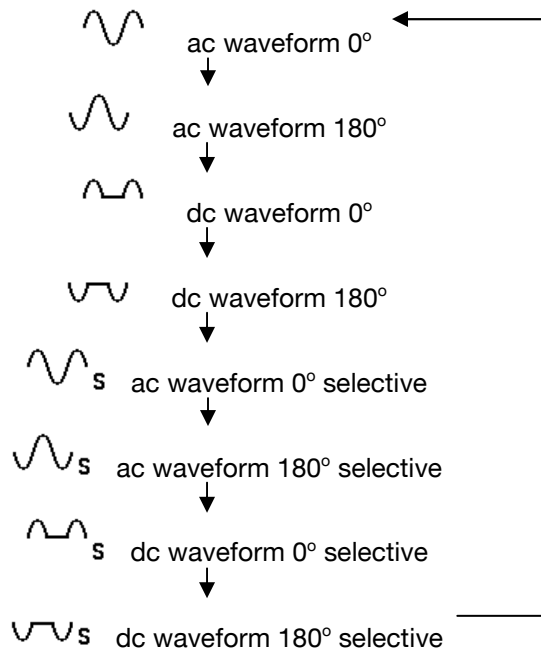
To begin the test, press and release the START key.

7.5 RCD trip current (Ramp) Tests

⚠   The PowerPlus 1557 will only allow the RCD test to be performed if the correct voltages are detected between line-neutral (L-N illuminated), line-earth (L-PE illuminated) and neutral-earth (N-PE **not** illuminated).

⚠ Leakage currents in the circuit following the residual current protection device may influence the measurement.

Note: The PowerPlus 1557 will determine the fault voltage that may appear on the protective conductor during the test. If the fault voltage is greater than 25V the PowerPlus 1557 will indicate >25V on the LCD, but the user may proceed with the test. If the fault voltage is great than 50V, this is indicated on the LCD and the test is inhibited.

Use F1 until the Ramp indication is displayed above the F1 softkey. Refer to section 7.4.

Use F2 to select the I∆N of the RCD under test. Refer to section 7.4.

Use F3 to select test parameters. Refer to section 7.4.

Press the START key to start the Ramp test. At the end of the test the PowerPlus 1557 will indicate the current at which the RCD tripped.

7.6 Automatic RCD Tests

⚠ The PowerPlus 1557 will only allow the RCD test to be performed if the correct voltages are detected between line-neutral (L-N illuminated), line-earth (L-PE illuminated) and neutral-earth (N-PE **not** illuminated).

⚠ Leakage currents in the circuit following the residual current protection device may influence the measurement.

Note: The PowerPlus 1557 will determine the fault voltage that may appear on the protective conductor during the test. If the fault voltage is greater than 25V the PowerPlus 1557 will indicate >25V on the LCD, but the user may proceed with the test. If the fault voltage is great than 50V, this is indicated on the LCD and the test is inhibited.

The Auto RCD test is used to automatically perform a sequence of 6 RCD trip time tests with a single press of the TEST key. Each time the RCD trips, the sequence will automatically continue once the RCD is reset. The sequence comprises of test at:

$$\frac{1}{2}I\Delta n / 0°$$
$$\frac{1}{2}I\Delta n / 180°$$
$$I\Delta n / 0°$$
$$I\Delta n / 180°$$
$$5I\Delta n / 0°$$
$$5I\Delta n / 180°$$

Use F1 until the AUTO indication is displayed above the F1 softkey. Refer to section 7.4

Use F2 to select the $I\Delta N$ of the RCD under test. Refer to section 7.4.

Use F3 to select test parameters. Refer to section 7.4.

Press the START key to start the Automatic RCD test. The PowerPlus 1557 will perform 6 consecutive RCD tests. When the RCD trips the PowerPlus 1557 will indicate RCD adjacent to the next test in the sequence, simply reset the RCD. The PowerPlus 1557 will continue the sequence until all 6 tests have been performed.

7.7 Voltage

To put the PowerPlus 1557 into voltage mode simply connect a voltage between the Red and Black terminals while in test mode.
In Continuity and Insulation mode if the voltage is less than 30V then the voltage will be displayed in the secondary display. When the measured voltage reaches 30V the LCD will change so that the voltage is displayed in the main measurement area.
In mains test types the voltage between the Red and Black terminals will always be displayed next to the L-N mains indicator.

Note: The PowerPlus 1557 will NOT enter voltage mode while certificates or menus are displayed.

7.8 Phase Rotation

To put the PowerPlus 1557 into phase rotation mode simply connect all three phases to the test terminals while in any test mode. The following connections should be made;

L1 to the Red terminal.
L2 to the Green terminal.
L3 to the Black terminal.

When all three phases are present on the terminals then the PowerPlus 1557 will display the phase rotation indication. The PowerPlus 1557 will display the order of the terminal colours with relation to the order of the phase sequencing, for example R-G-B for Red-Green-Black.
If the PowerPlus 1557 does not enter phase rotation then all three phases are either not present or do not meet the specification. When this happens use the voltage mode in order to determine the fault.

Note: The PowerPlus 1557 will NOT enter phase rotation mode while certificates or menus are displayed

8 Working With Certificates

8.1 Overview

⚠ The PowerPlus 1557 will not enter either Voltage mode or Phase Rotation mode while either a menu or a certificate is being displayed. If a voltage is applied to the PowerPlus 1557 while in certificate mode no action will be taken.

When used with PowerPlus PC the PowerPlus 1557 is capable of transferring certificates to and from a PC. Certificates are selected from the Menu.

8.2 Creating a new certificate or modifying an existing certificate

The PowerPlus 1557 can create a new certificate based on an existing certificate template and also modify data within an existing certificate. Refer to section 9 to transfer certificate templates and data between the PowerPlus 1557 and PowerPlus PC.
From the test mode press the menu softkey (F4) and select the **Certificates** option. Press (F4) to view certificates.
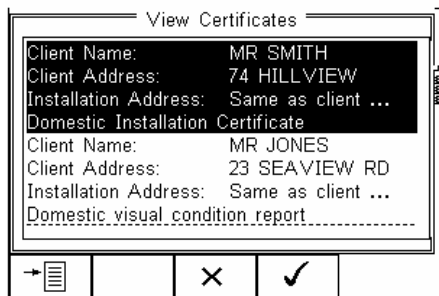
The following options are available;

F1	F2	F3	F4
→▤		✕	✓

⌖ **New Certificate** – Creates a new certificate.

This option is only shown if there are no certificates in the memory.

✦▤   **Menu** – This selects the menu. This option is only shown when there are certificates in memory.

✕   **Cancel** – Returns to the test mode.

✓   **Select Certificate** – Selects the highlighted certificate for editing or viewing. This option is only shown when there are certificates in memory.

Within the **Menu** the following options are available:

New – this allows the user to create a new certificate and select the certificate format and type.

```
╔══════════ Select Certificate ══════════╗
║                                         ║
║ Authority           [    BS7671    ][<>]║
║                                         ║
║ Certificate Type                        ║
║ [      Electrical Installation    ][<>] ║
║                                         ║
║ Colour              [            ][<>]   ║
║                                         ║
║ Full / Continuation [ Full Certificate ][<>]║
║                                         ║
╠═══════════╦═══════╦═══════╣
║           ║   ✕   ║   ✓   ║
╚═══════════╩═══════╩═══════╝
```

The user can choose between a **Full** certificate or a **Continuation Sheet(s)**. The **Continuation Sheet(s)** option creates a continuation sheet or sheets containing client name and address, occupier, certificate reference and test results for distribution boards and associated circuits. Continuation sheets with the same client details and certificate reference from multiple PowerPlus 1557 instruments can then download data to a single certificate on the PowerPlus PC software without information being overwritten.

Delete – this will delete the highlighted certificate.

Download – selecting this option presents two further options; Current and All. Selecting the required option will either download the highlighted certificate or all of the certificates respectively.

8.3 Navigating around certificates

Certificates are spread across several screens. In order to make navigating around certificates quick and easy the following options are provided;

F1	F2	F3	F4
⇦	⇨		→▤

   ⇦   **Previous Page** – Returns to the previous page in the certificate

   ⇨   **Next Page** – Proceeds to the next page in the certificate

  →▤   **Menu** – This selects the menu.

Within the Menu (F4) the following options are available;

Go to section – allows you to jump to a specific section within the certificate.

Go to page – allows you to jump to a specific page within the certificate.

Check – allows you to check the entire certificate for blank fields.

Save - Saves the current certificate, this option will only save and not exit the certificate.

Print – this will take you to the print menu.

Exit – Save and changes and exit the certificate

Where several text fields are shown on the screen at the same time the up and down direction keys are used to select between these fields.

8.4 Entering and modifying data with certificates

```
┌────────────────────────────────────────┐
│  Characteristics of primary supply     │
│  overcurrent protective device         │
│              BS (EN) │   n/a   │ ◆◆ │  │
│                 Type │         │       │
│     Rated current (A)│   n/a   │ <> │  │
│  Short cct capacity (kA)│ n/a  │ <> │  │
│                                        │
│  ┌────┐ ┌────┐      ┌─────┐            │
│  │ ⇦  │ │ ⇨  │      │ →☰  │  6 / 40    │
│  └────┘ └────┘      └─────┘            │
└────────────────────────────────────────┘
```

8.4.1   Text Boxes

When a text field is highlighted the keypad can be used
to enter data. When text is being entered the softkeys
have the following functions;

F1	F2	F3	F4
⇧	⌫	✗	✓

⇧ **Character set** – This allows the user to
change between upper and lower case
characters and symbols.

⌫ **Backspace** – This deletes the character to the
left of the cursor.

✗ **Abort text entry** – This aborts the current text
entry mode and deletes any modifications
which have made in the text field.

✓ **Confirm text entry** – This accepts any
modifications which have been made to the
text field and moves onto the next text field.

The right arrow key can be used to insert spaces into
the text.

When entering data into a text field where a result is
expected the F1 softkey becomes a decimal point.

8.4.2 List Boxes

Some fields are setup as list boxes, these fields already
contain all of the available options as a list. These are

identified by the ◇ symbol to right of the list box. To select the correct option use the left and right direction keys. Some list boxes will simply change the displayed option when either the left or right direction key is pressed, others may display a full list. If a full list is displayed use the up and down direction to select the required option.
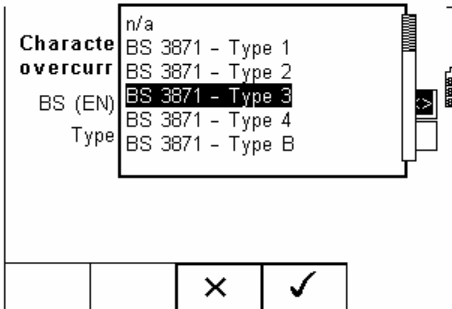
Press the F4 softkey to accept the highlighted option.

8.4.3 Combi Boxes

A Combi box is similar to a list box but also allows you to enter text the same as a text box.

8.4.4 Multi option tick boxes
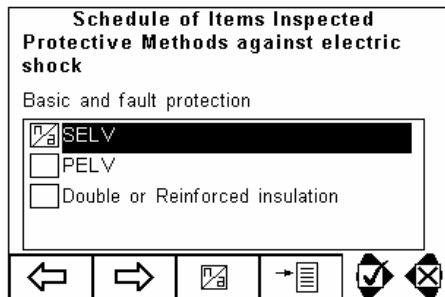
When entering data into the multi-option tick boxes the softkeys have the following options.

F1	F2	F3	F4
⇦	⇨	Enter option	→▤

    ⇦   **Previous Page**– Returns to the previous page in the certificate

    ⇨   **Next Page** – Proceeds to the next page in the certificate

  →▤   **Menu** – This selects the menu.

Enter Option (F3)

Pressing F3 will enter the indicated option into the highlighted tick box and move onto the next tick box. The following options are available;

☐   ☑   ☒   ▨   ⌷LIM⌷   ⌷Yes⌷   ⌷No⌷   ⌷N/C⌷   ⌷¹⁄ₖ⌷

Please note that not all of the options will be available for all of the certificates.

In order to change the tick box option use the left and right direction softkeys, this is shown by the icon in the bottom right hand side of the LCD. This icon will change to show what option will be highlighted next should the left of right softkeys be pressed.

8.5 Performing tests from within certificates
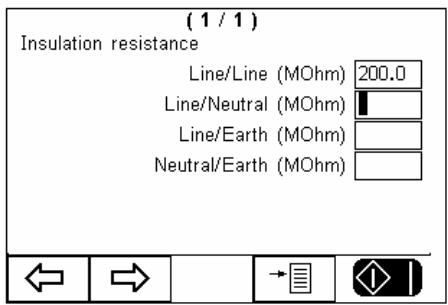
 When you enter a text field which is intended to hold a result an icon, which represents the start key, flashes in the bottom right hand side of the LCD. In order to obtain a test result by performing an electrical test press the Green key. The tester will enter the required test mode.

During this test mode the PowerPlus 1557 works as described in section 5 with the F4 softkey becoming an abort option. When a result has been obtained by the test type the result is copied into the text field previously selected and the tester moves onto the next text field.

If the measurement value is already known this can be typed directly into the text field using the numeric keypad. When entering data into a text field where a result is expected the F1 softkey becomes a decimal point.

8.6 Validate a certificate

The PowerPlus 1557 can check the certificate is complete. In order to check the certificate press the menu softkey (F4) and select Validate and then choose from the following options:

Blank Field Check – the entire certificate is checked. If the certificate is incomplete the PowerPlus 1557 will take you to the first blank field within the certificate.

Blank Result – only fields containing measured values are checked. If the certificate is incomplete the PowerPlus 1557 will take you to the first blank field within the certificate.

Blank check from here - the certificate is checked from the current position onwards. If the certificate is incomplete the PowerPlus 1557 will take you to the first blank field within the certificate.

During a validation the function keys operate as follows:

Next (F2) – jump to next blank field
X (F3) – cancel validation

9 Transferring Data

The PowerPlus 1557 transfer certificates to and from a PC running PowerPlus PC. All communication is done using Bluetooth.

The PowerPlus PC is supplied with a Bluetooth USB Adapter. This device can be used to add Bluetooth connectivity to a PC or Laptop which is not already Bluetooth enabled.

Before proceeding ensure that the Bluetooth dongle has been correctly installed on the PC which is running PowerPlus PC.
For help on installing and setting up the Bluetooth dongle on a PC please refer to the Bluetooth dongle documentation.

Note: The adapter must not be plugged into the USB port until specifically requested to do so by the install program.

The PC running the PowerPlus PC software must also be setup as the Computer under the Bluetooth Favourites menu on the PowerPlus 1557.

9.1 Transferring Certificates

There are two different ways to select download. The first method is to select the menu from the test mode. From the menu select the Data Transfer option and then the Certificate Data option. Using this method you cannot select individual certificates to download.

The second method is to download certificates from the View Certificates menu, reference section 8.2. From the View Certificates menu select the Menu option and then select the Download option. From here you can select to download the certificate which is highlighted or to download all of the certificates currently in memory.

9.1.1 Establishing a Bluetooth connection

Before certificates can be transferred to and from a PC a connection must be made using Bluetooth.

The PowerPlus 1557 will now try and connect with the PC selected under the Bluetooth favourites. See section 11.2.
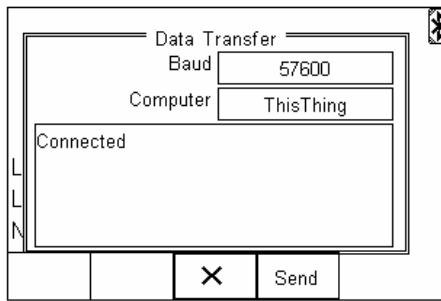
Once the Bluetooth connection between the PowerPlus 1557 and the PC has been established the Bluetooth icon is displayed in the top right hand corner of the display, you can now start to transfer certificates.

9.1.2   Uploading a certificate to the tester

Ensure that a Bluetooth connection has been made before continuing.

In order to upload a certificate to the PowerPlus 1557 find the certificate you wish to transfer within PowerPlus PC and right mouse click, this will show the options for the certificate.
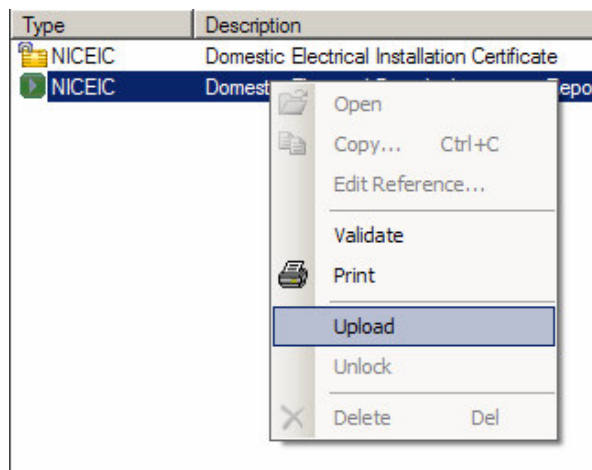
Select the Upload option from the menu. PowerPlus PC will ask which communications port should be used for the transfer, select the com port assigned to the Bluetooth and select the OK button.
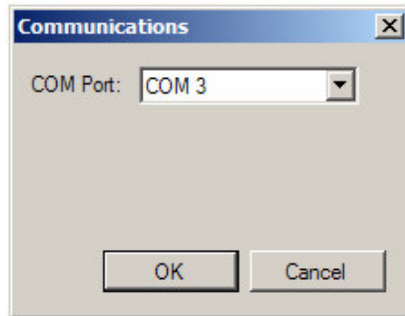
The selected certificate will then be transferred to the PowerPlus 1557.
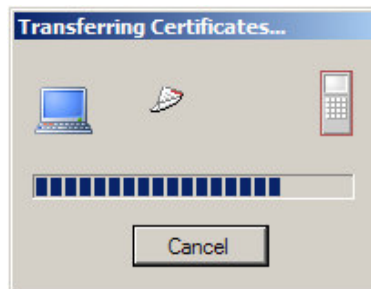
In order to transfer another certificate simply repeat the procedure described in this section.

9.1.3   Downloading Certificates

Ensure that a Bluetooth connection has been made before continuing.

In order to download the certificates from the PowerPlus 1557 select the Download option on PowerPlus PC, this can be found under the Tools menu and as icon on the icon bar.
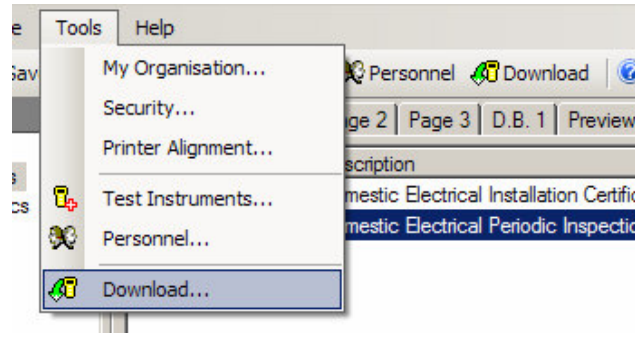
PowerPlus PC will ask which communications port should be used for the transfer, select the com port assigned to the Bluetooth and select the OK button.
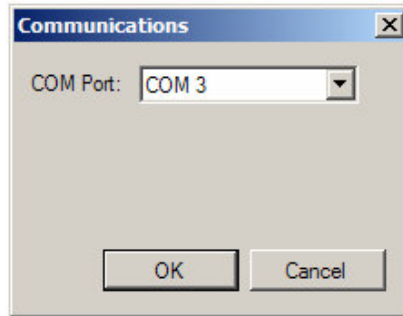
Select the Send option on the PowerPlus PC. All of the certificates within the PowerPlus 1557 will be transferred to the PowerPlus PC program.

- 43 -
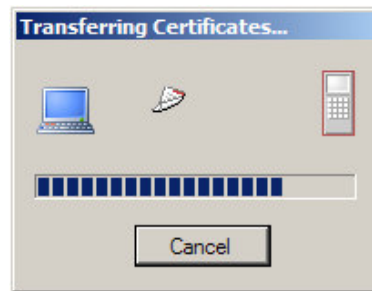
9.1.4   Certificate status when uploading and downloading

When a certificate has been uploaded to a PowerPlus 1557 the status is changed to show that the certificate is checked out and is therefore locked for editing. Certificates which are locked and checked out are identified by the closed padlock icon and the description in the Check Status column.

Once a certificate has been downloaded back into PowerPlus PC the certificate status is changed to Checked In and is available for editing. Certificates which are checked in are identified by the open padlock icon and the description in the Check Status column.

Type	Description	Check Status
NICEIC	Domestic Electrical Installation Certificate	Checked In
NICEIC	Domestic Electrical Periodic Inspection Rep…	Checked Out
NICEIC	Domestic Visual Condition Report	Checked Here

Certificates which have not yet been transferred to a PowerTest 1557 have the status Checked Here.

9.2 Transferring the Test n Tag logo

The PowerPlus 1557 can be used with the Test n Tag printer to produce socket and cable identification labels, it is possible to add a logo to these labels. To print labels with a logo the logo must first be transferred to the PowerPlus 1557.

On the PowerPlus 1557 select the Data Transfer option from the menu then select the Load TnT Logo.

9.2.1   Establishing a Bluetooth connection

Before a logo can be transferred to the PowerPlus 1557 a connection must be made using Blue tooth. The PowerPlus 1557 will try and connect with the PC list under the Bluetooth favourites.

Once the Bluetooth connection between the PowerPlus 1557 and the PC has been established you can start to transfer certificates.

9.2.2   Transferring the Test'n'Tag logo

A bitmap logo can be transferred to the PowerPlus 1557 for use with the Seaward Test 'n' Tag print system.

The logo must be in .BMP with a maximum size of 320 pixels by 240 pixels.
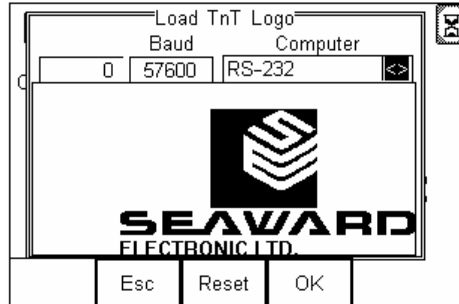
The PowerPlus 1557 is now ready to receive data. The amount of data received is shown numerically on the top left of the display (0 in the screen shot above).

Note: *The file transfer can be made using the Seaward DataTransfer.exe application, or any suitable terminal emulator.*

Once the logo has been transferred it will be displayed in the window. Please note that due to the limited resolution of the display only part of the logo will be displayed however the full logo will be printed.

10 Printing

The PowerPlus 1557 can be used with the Test n Tag printer to print test and identification labels.

Before printing can be performed the Test'n'Tag printer which you wish to print to must be setup as the printer in the Bluetooth favourites.

There are two different ways to select print. First select the Menu from the Test mode. From the menu select the Print option.

The second method is to select Print from with certificates. From with a certificate press the menu softkey (F4), from this menu select Print.

10.1 Establishing a Bluetooth connection

Once the print option has been selected the PowerPlus will attempt to connect to the TestnTag printer defined in the Bluetooth favourites.

10.2 Changing the output format

There are two printout formats. These can be selected by pressing the Change Format (F1) key.

10.3 Modifying the printout

The two formats can be customised further. In order to customise the print outputs press the Setup (F3) key.

From here options such as printing the uploaded TestnTag logo, label sizes and the Retest Period can be defined.

11 System Options

11.1 Overview

The system menu is used to configure the PowerPlus 1557.
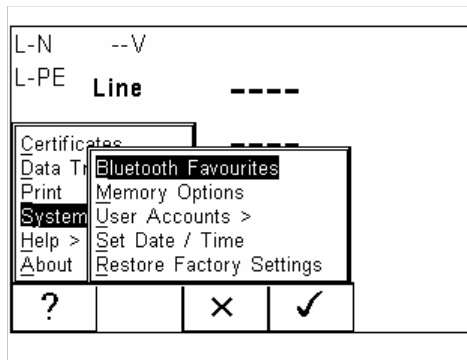
11.2 Bluetooth Favourites

The PowerPlus 1557 uses Bluetooth to communicate with PCs and its peripherals. Before the PowerPlus 1557 can communicate with an external device a Bluetooth connection must be established between the PowerPlus 1557 and the device to communicate, identifying the devices to communicate with is configured through the Bluetooth Favourites menu.

From the menu select the System option and then the Bluetooth Favourites option.

11.2.1 Searching for Bluetooth enabled devices

From new the PowerPlus 1557 will not have any favourites set. Using the Up and Down keys select the type of device you wish to search for, once the device type is selected press the configure key (F3). This will take you to the Setup menu.

To perform a new search press the F1 key, the PowerPlus 1557 will now perform a search for Bluetooth enabled devices. After the search is complete use the left or right keys to display a list of all of the located devices. Highlight the required device and press the Accept key (F4).

To add the selected device to the favourites list press the **+** key (F3). The device PIN number can now be entered.

When searching for printers you will also need to identify type from the Printer Type options.

Press the Accept key (F4) to accept the changes.

Repeat this action to add further Bluetooth enabled devices.

Note: *The changes made must be saved as described in section 11.2.2.*

11.2.2 Selecting Bluetooth Favourites

Once the required devices have been added to PowerPlus 1557 you now need to identify which devices will be set as your favourites. From the Bluetooth Favourites menu highlight which favourites require changing and press the Left or Right keys in order to list the available devices. Highlight the required device and press the Accept key (F4) to accept the selection.

```
┌─────── Bluetooth Favourites ───────┐
│                                    │
│   Barcode [                   ] <> │
│   Printer [      SELPC027      ] <> │
│  Computer [                   ] <> │
│                                    │
│    ┌──────┬──────┬──────┐          │
│    │  ✕   │ ⚙    │ 🖫   │          │
└────┴──────┴──────┴──────┴──────────┘
```
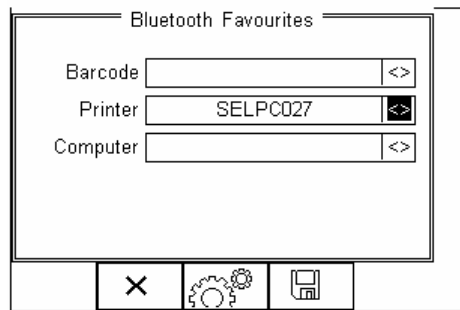
Once you have selected the required favourites press the Save key (F4) to save your selection.

All Transfer Data requests will communicate directly with the PC in the Computer field and all print requests will be sent to the printer in the Printer field.

11.3 Memory Options

The Memory options displays the memory used and the memory remaining. Press the F4 softkey to erase the memory.

```
┌─────────── Memory Options ───────────┐
│                                      │
│      Memory used        12  %        │
│      Memory remaining   88  %        │
│                                      │
│         ┌──────┬──────┐              │
│         │ Esc  │Erase │              │
└─────────┴──────┴──────┴──────────────┘
```
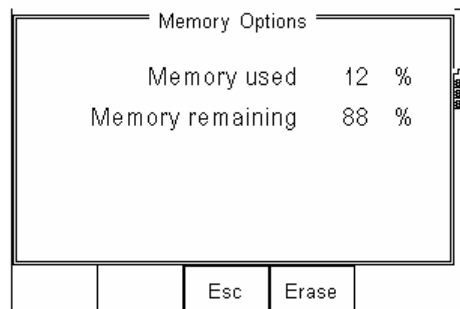
11.4 User Accounts

Within the User Accounts Option are three further options;
1.   User Preferences
2.   Change User
3.   Change Password

11.4.1 User Preferences

This allows the current user to change the following options;

Set Contrast – Sets the contrast on the LCD. There are 30 levels of contrast, 1 being high contrast, 30 being low. The LCD will update the contrast as the level is changed.

Auto Off Time (mins) – Sets the time duration, in minutes, that the unit will sit idle before powering off. Options are N/A, 1, 2, 3, 4, 5 and 10.

Backlight Mode – Sets the back light mode. Options are Always Off, Always On and Power Save.

Beep on key press – Sets whether the PowerPlus 1557 will beep on a key press. Options are Yes and No.

Auto Save Time – Sets the time duration, in minutes, between each automatic save when a certificate is open. Options are Off, 2 and 5.

11.4.2 Change User

The PowerPlus 1557 has a password protected User system to prevent unauthorised modifications to the configuration.

There are two levels of access. When logged in as Admin full access is available to all configuration options as shown below.

When new only the Admin user account is setup.

11.4.3 Change Password

This allows the current user to change their password. To change the password you must enter the current

users password and the new password twice. Once the passwords have been entered press the F4 softkey to accept.

11.5 Set Date / Time

The PowerPlus 1557 is equipped with a real-time clock. To alter this select the values to be changed using the arrow keys, enter the required value using the keypad and press the F4 softkey.

Note: *Use F1 ':' to separate the hours and minutes.*

```
Set Date / Time
      Day      [6      ]
      Month     [  Nov   ] <>
      Year     [2008    ]
      Time     [16:16   ]

              |   ×   |   ✓   |
```

11.6 Restore Factory Settings

This option will restore all of the factory defaults. This includes;
1. Deletes all of the current users and re-creates the Admin user if it has been deleted.
2. Resets all of the user settings associated with the Admin account.

12 Online Documentation

12.1 Online Help

The PowerPlus 1557 comes with a simple set of help
guidelines and diagrams.
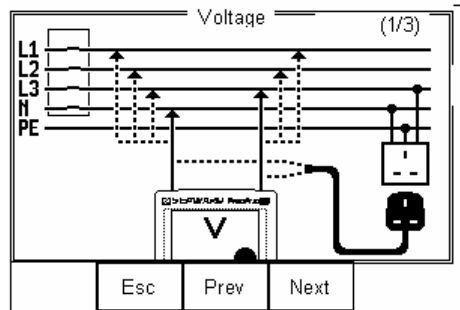
These help pages are not intended to instruct the user
how to perform tests but how to connect the PowerTest
1557 in order to perform tests.
To access the online help select the Help option from
the menu.

When the menus are displayed the F1 key may show
the **?** icon. Pressing F1 will display a help page for the
highlighted menu item.

12.1 About

The About option displays information such as the
technical support telephone number, serial number,
firmware and hardware versions.

To access the About screens select the About option
from the menu.

13 Electrical Specifications

13.1 Earth Continuity

Test Voltage Open Circuit	>4V <25V
Test Current into 2Ω	>200mA
Display Range	0.00Ω - 1.99Ω
	2.0Ω – 19.9Ω
	20Ω - 200Ω
Measuring Range	0.01Ω – 1.99Ω
(EN 61557-4)	2.0Ω – 19.9Ω
	20Ω – 200Ω
Resolution	0.01Ω maximum
Accuracy	±2% ±5 digits
Number of repeat tests as per IEC61557-4	Approx 1500

13.2 Insulation Resistance

Test Voltage Specification	-0% +20% (open circuit)
Test Voltage @ 1mA	>1mA into U_N x (1000Ω/V)
Test Current Short Circuit	<2mA
Display Range	0.00MΩ - 1.99MΩ
	2.0MΩ – 19.9MΩ
	20MΩ - 200MΩ
Measuring Range	0.05MΩ – 1.99MΩ
(EN 61557-2)	2.0MΩ – 19.9MΩ
	20MΩ – 200MΩ
Resolution	0.01MΩ maximum
Accuracy	±5% ±5 digits
Voltage Indication Accuracy	±5%
Number of repeat tests as per IEC61557-2	Approx 1500

13.3 Low Current Earth Loop Impedance

Supply Voltage	195 – 253V, 45Hz – 65Hz
Nominal Test Current	<15mA
Display Range	0.00Ω - 1.99Ω
	2.0Ω – 19.9Ω
	20Ω - 2000Ω
Measuring Range	1.00Ω - 1.99Ω
(EN 61557-3)	2.0Ω – 19.9Ω
	20Ω - 2000Ω
Resolution	0.01Ω maximum
Accuracy	±5%±12d (1.00Ω - 1.99Ω)
	±5%±5d (>2.0Ω)
PFC Range	0 – 26kA

13.4 High Current Earth Loop Impedance

Supply Voltage	195 – 253V, 45Hz – 65Hz
Nominal Test Current	3A peak
Display Range	0.00Ω - 1.99Ω
	2.0Ω – 19.9Ω
	20Ω - 2000Ω
Measuring Range	0.10Ω - 1.99Ω
(EN 61557-3)	2.0Ω – 19.9Ω
	20Ω - 2000Ω
Resolution	0.01Ω maximum
Accuracy	±5%±12d (0.10Ω - 1.99Ω)
	±5%±5d (>2.0Ω)
PFC Range	0 – 26kA

13.5 Line Impedance

Supply Voltage	195V – 440V, 45Hz – 65Hz
Nominal Test Current	3A peak
Display Range	0.00Ω - 1.99Ω
	2.0Ω – 19.9Ω
	20Ω - 2000Ω
Measuring Range	0.10Ω - 1.99Ω
	2.0Ω – 19.9Ω
	20Ω - 2000Ω
Resolution	0.01Ω maximum
Accuracy	±5%±12d (0.10Ω - 1.99Ω)
	±5%±5d (>2.0Ω)
PFC Range	0kA – 26kA

13.6 RCD

Supply Voltage	195V – 253V, 45Hz – 65Hz
Nominal Test Currents	10mA, 30mA, 100mA, 300mA, 500mA
Test Current Accuracy	-0% +10% at IΔn and 5IΔn -10% +0% at ½ IΔn
Trip Time Ranges	0ms – 2000ms, ½ IΔn 0ms – 300ms, IΔn General 0ms – 500ms, IΔn Selective 0ms – 40ms, 5IΔn
Trip Time Accuracy	±5% ±2 digits
Ramp Current Range	½ IΔn to 1.1 IΔn
Trip Current Measurement Accuracy	10%

13.7 Voltage

Display Range	0V – 440V
Voltage Measuring Range	0V – 440V
Resolution	1V
Accuracy	±5% ±2 digits
Frequency Range	45Hz – 65Hz
Frequency Accuracy	Indication only

13.8 Phase Rotation

Display Range	Indicates order of phases starting with Red.
Frequency Accuracy	Indication only

14 Environmental Conditions

The PowerPlus 1557 has been designed to perform tests and measurements in a dry environment.

Maximum barometric elevation for making measurements is 2000M.

Overvoltage category IEC 60664/IEC 61010, 300V Category III.

Pollution degree 2 according to IEC 61010-1.

Protective system IP40 according to IEC 60529.

Electromagnetic compatibility (EMC). Interference immunity and emitted interference conforming to IEC 61326-1.

Operating temperature range of 0°C to 40°C, without moisture condensation.

The PowerPlus 1557 can be stored at any temperature in the range -25°C to +65°C (relative humidity up to 90%). The batteries should be taken out of the instrument for storage.

Operating Altitude 0 to 2000 metres

15 Maintenance

⚠ Warning: Always ensure that the PowerPlus 1557 is disconnected from all voltage sources before maintenance work is carried out.

15.1 Preparing to work on the PowerPlus 1557.

Make the PowerPlus 1557 voltage free as follows, before opening the instrument;

Power the unit off using the red OFF button.

Disconnect all of the test leads from the PowerPlus 1557.

15.2 Securing the PowerPlus 1557

Under certain conditions safe operation of the PowerPlus 1557 can no longer be assumed:

Visible damage of the instrument case.

Incorrect measurement results.

Recognisable abuse to the instrument due to prolonged storage under improper conditions.

Recognisable abuse to the instrument due to extraordinary transportation stress.

In these cases, the PowerPlus 1557 should be immediately switched off, disconnected from any test or measurement function and secured to prevent any further use.

15.3 Cleaning

Clean the external case of the PowerPlus 1557 with a clean dry cloth.

Avoid using solvents and abrasive scouring agents to clean the external case of the PowerPlus 1557.

Check the battery contacts and compartment are free of electrolytic contamination.

Any contamination of the battery contacts or compartment should be cleaned with a dry cloth.

15.4 Battery Replacement/Charging

⚡ Warning: Always ensure that the PowerPlus 1557 is disconnected from all voltage sources before maintenance work is carried out.

⚡ Never place non-rechargeable cells in the battery charger.

Although the PowerPlus 1557 is supplied with re-chargeable NiMH cells it will work with non re-chargeable Alkaline cells. Removal and replacement procedure for both types of cell is the same:

1. Power the unit off using the red OFF button.
2. Disconnect all of the test leads from the PowerPlus 1557.
3. Position the PowerPlus 1557 face down and release the captive screw in the battery compartment cover.
4. Remove the battery compartment cover.
5. Remove the discharged batteries from the compartment.
6. Fit the discharged batteries (NiMH only NOT Alkaline) into the supplied charger – charging time is around 8 hours.
7. Insert the newly charged set of batteries into the battery compartment ensuring that the battery polarity matches the marking on the inside of the battery compartment.
8. Relocate the battery cover over the battery compartment and fasten in position with the battery cover captive screw.

⚠ This unit will contain Nickel Metal Hydride (NiMH) batteries. Do not dispose of these batteries with other solid waste. Used batteries should be disposed of by a qualified recycler or hazardous materials handler.

15.5 Replacing the Fuse.

If, during one of the tests, a message appears stating that the internal fuse has blown this should be checked and replaced where necessary.

⚡ Warning: Always ensure that the PowerPlus 1557 is disconnected from all voltage sources before maintenance work is carried out.

⚠ Attention: Replacement fuses must be in accordance with the specified type, rating and size as stated on the battery compartment cover on the rear of the PowerPlus 1557.

Power the unit off using the red OFF button.

Disconnect all of the test leads from the PowerPlus 1557.

Position the PowerPlus 1557 face down and release the captive screw in the battery compartment cover.

Remove the battery compartment cover.

Lift one end of the fuse out of the fuse holder with the help of a flat bladed screwdriver.

Lift the defective fuse completely out of the fuse holder.

Insert a new fuse as described and specified by the text on the battery compartment cover.

Ensure that the new fuse is seated and centred in the fuse holder.

Relocate the battery cover over the battery compartment and fasten in position with the battery cover captive screw.

15.6 Service and Calibration.

To maintain the specified accuracy of the measurement results, the instrument must be recalibrated at regular intervals by either the manufacturer or an authorised Seaward Service Agent. We recommend a recalibration period of one year.

If a period of greater than 1 year has elapsed since the last calibration/validation date a warning message will appear on the display when the it is powered up. Options are available to disable the warning for a set period of time.

In order to help speed up any service / support request please have all the information from the "About" screen available when you call.

15.7 Spare Parts.

	Seaward Part No.
Test lead set	328A950
UK Mains lead	328A951
Cordless Probe	328A952
500mA 1000V 1¼'	27B098

For help or advice on Service and Calibration contact:

Service Department
Seaward Electronic
Bracken Hill
South West Industrial Estate
Peterlee
Co Durham SR8 2SW
England

Tel: 0191 5878739 / 0191 5878737
Email: service@seaward.co.uk

Appendix A

IEC61557-2: Insulation		
Intrinsic error or influence quantity	Reference conditions or specified operating range	Designation code
Intrinsic error	Reference conditions	A
Position	Reference position ±90˙	E_1
Supply voltage	At the limits stated by the manufacturer	E_2
Temperature	0˙C and 40˙C	E_3
Operating Error	$B=\pm(\lvert A\rvert+1.15\sqrt{E_1^2+E_2^2+E_3^2}\,)$	

IEC61557-3: Loop Impedance		
Intrinsic error or influence quantity	Reference conditions or specified operating range	Designation code
Intrinsic error	Reference conditions	A
Position	Reference position ±90˙	E_1
Supply voltage	At the limits stated by the manufacturer	E_2
Temperature	0˙C and 40˙C	E_3
Phase Angle	At a phase angle 0˙ to 18˙	E_6
System frequency	99% to 101% of the nominal frequency	E_7
System voltage	85% to 110% of the nominal voltage	E_8
Operating Error	$B=\pm(\lvert A\rvert+1.15\sqrt{E_1^2+E_2^2+E_3^2+E_6^2+E_7^2+E_8^2}\,)$	

IEC61557-4: Resistance of earth connection and equipotential bonding		
Intrinsic error or influence quantity	Reference conditions or specified operating range	Designation code
Intrinsic error	Reference conditions	A
Position	Reference position ±90˙	E_1
Supply voltage	At the limits stated by the manufacturer	E_2
Temperature	0˙C and 40˙C	E_3
Operating Error	$B=\pm(\lvert A\rvert+1.15\sqrt{E_1^2+E_2^2+E_3^2}\,)$	

IEC61557-6: Residual current devices (RCD) in TT and TN systems		
Intrinsic error or influence quantity	Reference conditions or specified operating range	Designation code
Intrinsic error	Reference conditions	A
Position	Reference position ±90	E_1
Supply voltage	At the limits stated by the manufacturer	E_2
Temperature	0°C and 40°C	E
Resistance of the probes	Within the limits stated by the manufacturer	E_3
System voltage	85% to 110% of the nominal voltage	E_8
Operating Error	$B=\pm(|A|+1.15\sqrt{E_1^2+E_2^2+E_3^2+E_5^2+E_8^2}\,)$	