Seaward Europa

Portable Appliance Checker

Instruction Manual

277A555 Rev 1.1

June 2000

Issue 1.1

Table of Contents

Limited Warranty & Limitation of Liability

SEAWARD Electronic Limited guarantees this product for a period of 1 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.

Table of Contents

Table of Contents

Table of Contents

Declaration of Conformity

for the

Seaward Europa Portable Appliance Checker

Manufactured by:

Seaward Electronic Ltd, Bracken Hill, South West Industrial Estate

Peterlee, County Durham, SR8 2SW, England

Millennium Statement

This product is Millennium compliant, and conforms fully to the document BSI DISC PD2000-1.

Statement of Conformity

Based on test results using appropriate standards, the product is in conformity with Electromagnetic Compatibility Directive 89/336/EEC and Low Voltage Directive 73/23/EEC

Standards used:

EN 61010-1 (1993) Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

EN 50081-1 (1992) Electromagnetic Compatibility. Generic Emission Standard: EN55022 Class B

EN 50082-1 (1992) Electromagnetic Compatibility. Generic Immunity Standard: IEC1000-4-2, -4-3, -4-4, -4-5

The tests have been performed in a typical configuration.

This Conformity is indicated by the symbol CE, i.e. “Conformité Européenne

Before Starting

Upon receipt of your Europa PAC Tester:-

1. Check that all the component parts are present:-
    - Seaward Europa PAC Tester
    - Mains lead
    - Earth Bond lead
    - 115V adaptor (UK model only)
    - Instruction Manual
    - Carrying Case
2. Read the operating instructions fully before conducting any tests.
3. Contact Seaward Electronic if you need information on training for Portable Appliance Testing. Courses can be arranged at Seaward, or at customer premises.
4. Seaward Electronic Limited can be contacted at:

Bracken Hill
South West Industrial Estate
Peterlee
Co. Durham
SR8 2SW
Tel : +44 (0)191 586 3511
Fax: +44 (0)191 586 0227
sales@seaward.co.uk

Safety

Note

Please read the following Safety Instructions before use !

Safety Precautions

The manual contains specific warning and caution statements where they apply.

A Warning will identify the conditions and actions that pose hazard(s) to the user.

A Caution will identify the conditions and actions that may damage the Tester.

Symbols used within this manual and on the Tester are shown below:

	Risk of electric shock
	Warning of potential hazard
	Conformité Européenne

Use of the instrument in a manner not specified may impair safety. Read the following safety information carefully before attempting to operate the instrument.

Warning

Due to the potential hazards associated with any electrical circuit it is important that the user is familiar with the instructions covering the capabilities and operation of this instrument. The user should ensure that all reasonable safety precautions are followed and if any doubt exists should seek advice before proceeding.

This product is designed for use by suitably trained competent personnel and should be operated strictly in accordance with the instructions supplied.

Failure to comply with these instructions may expose the user to electrical hazard

This Tester performs a number of electrical tests which involve high voltages and high currents. Never touch the appliance being tested, or the test leads, whilst a test is in progress.

Always check all test leads for signs of damage prior to use. Never use damaged or defective leads.

Always ensure the mains supply to the Tester provides an adequate earth.

This manual contains information and warnings which must be heeded to ensure user safety during operation. It is essential that this manual is read fully before proceeding with any tests.

Should the Tester behave abnormally do not continue with the testing. Disconnect immediately and contact Seaward Electronic for servicing (see Chapter 4 - Maintaining the Tester).

Chapter 1 Introducing the Tester

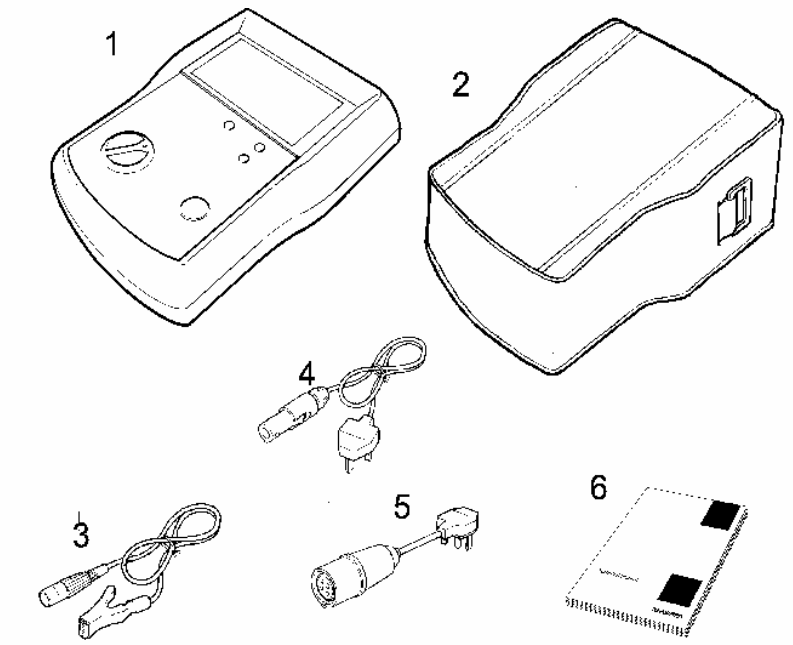
Introduction

The Seaward Europa Portable Appliance Checker is a powerful tool to assist in the analysis of the safety of portable electrical and electronic equipment. A range of tests are provided, with innovative features to aid difficult test situations, which allow testing of a wide variety of equipment.

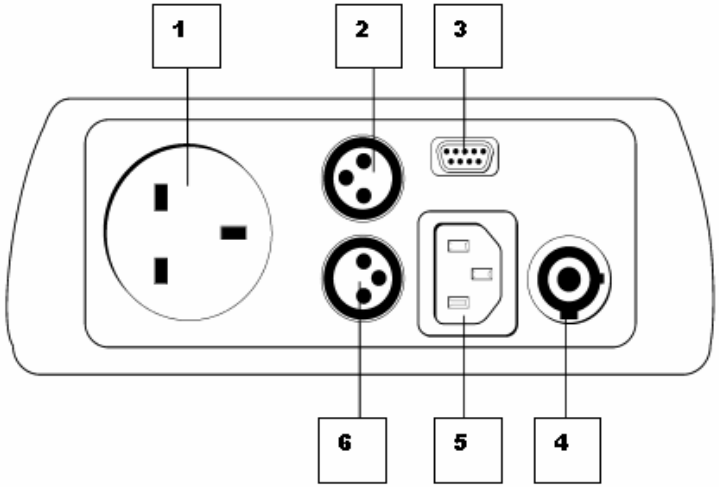
The Tester combines state of the art testability with the following innovative features:-

- Truly portable , multi-voltage tester
- Accurate earth bond and leakage measurement even when multiple earth paths exist
- Tests Information Technology equipment
- Connects to printer to print results
- Fast Start-up
- Large, easy to read digital display
- Easy test selection

Your Portable Appliance Tester



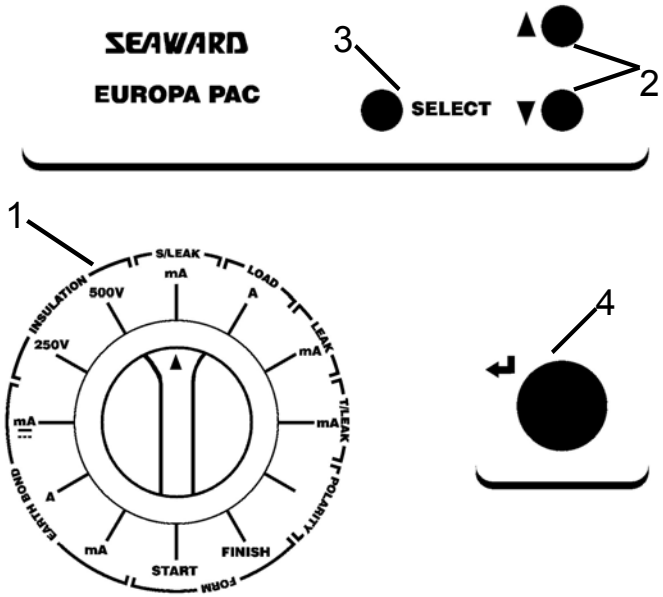
Item Number	Part
1	Europa Appliance Checker
2	Carrying case
3	Earth Bond Lead
4	230V Supply Lead
5	115V Test Lead
6	Manual



The Top Panel

Item Number	Part
1	Mains socket
2	Main Earth Bond/Insulation socket
3	Printer Interface
4	230V Mains socket
5	IEC Lead connector
6	Auxillary Earth Bond socket, for point to point earth bond measurement

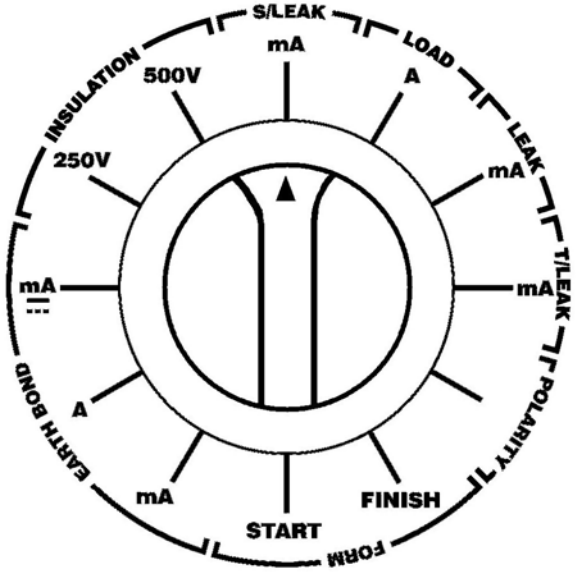
The Keyboard



Item Number	Part
1	Test selection Switch
2	Cursor keys
3	Select button - changes target for Cursor keys
4	Enter ↵ button – starts tests

The user is provided with a custom design Liquid Crystal Display (LCD). The keyboard consists of a 3 push buttons to adjust the operating mode of the tester, and a larger button to initiate tests. A rotary switch selects the test desired.

The Rotary Switch



Definitions

Equipment Under Test (EUT)	The electrical / electronic apparatus which is the subject of testing.
Powered Tests -	The EUT is supplied with mains voltage, with measurements being taken of power consumption, leakage currents etc.
Tester -	The Seaward Europa Portable Appliance Checker
Un-powered Tests -	The EUT is the subject of electrical tests using stimuli generated within the Tester. The EUT is not provided with mains power.
User -	The test technician using the Tester to perform tests on an EUT

Chapter 2 Using the Tester

Introduction

Controls

A rotary switch defines the basic test (or action) to be performed, the tests are arranged on the switch such that a clockwise rotation is needed to perform a normal sequence of tests.

Arrow keys (↑ and ↓) allow for adjustment of test variables, e.g. of the test time. The Select key is used to change the variable to be adjusted.

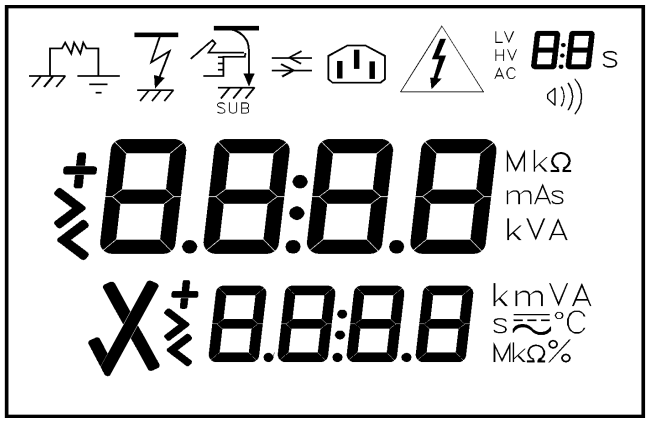
The large ↵ button is used to start a Test.

Display

Test Icons

Primary Display

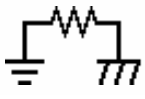
Secondary Display



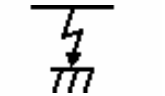
The display consists of a number of Icons to provide visual indication of the tester status, a primary 4 digit, 7 segment display, along with a 4 digit secondary display, and a 2 digit duration time display,

Test Icons

Indicates the test selected,

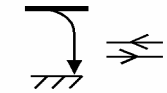


Earth Bond and Earth Screen



Insulation

Substitute Leakage



Leakage

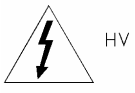
Touch Leakage

Polarity

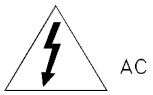
Test in Progress Icon

Indicates test in progress with voltage warning.

Low Voltage



High Voltage



Applying Mains Power

Test Duration Counter

Indicates the timing of the test. This will count down, when the counter reaches zero if the Europa is still taking a measurement the counter will flash.

Primary Display

Indicates test result

Secondary Display

Before and during a test this display Indicates test output e.g. voltage or current specified. After a test, this display compares the test result with standard limits.

Connecting the Tester

The Tester must be powered by a 230V supply and will test both 230V and 110V appliances. (see Testing 110v appliances)

The supply to the tester must include an earth connection (e.g. via a 3 pin plug).

When switched on, the Tester will carry out a short self-test procedure (approximately 4 seconds). During this test, all display segments will be lit to allow verification of correct operation of the display

Once the start-up procedure of the Tester has been completed, the tester is ready for operation. The display will depend on the rotary knob position.

Performing a Test

All tests are performed in a similar way - Rotate the switch to the appropriate test. The test time will be flashing in the top left corner. Press the arrow keys to change the test time if required.

If an AC Earth Bond test is selected, and a different test current is required, press Select, which will cause the test current to flash, and use the arrow keys to adjust the current as desired.

When satisfied with the test conditions, press the ↵ button to start the test

After a Test

After the Tester completes the selected test, the measured value continues to be displayed until a button is pressed, or a different test is selected. The Secondary display provides a comparison with standard test values.

Abort Actions

A test can Aborted at any time by rotating the rotary switch. Note however that due to the functionality of the Load, Leakage and Touch Leakage tests the rotary knob must be rotated beyond these tests before they will be aborted.

UL Test

Test Times can be set to unlimited (UL), this allows tests to run until they are stopped by the user. UL tests are stopped by pressing the ↵ button.

Printing Results

Rotating the switch to the **START FORM** position and pressing the ↵ button will send data to a connected printer to allow the headings of a results print-out to be made.

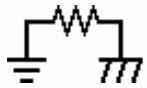
After this has been done, all test results are then printed until the switch is placed in the **STOP FORM** position and the ↵ button pressed to initiate the final part of the results print-out .

The user is required to manually enter such items as the appliance number, date etc, and to sign off the printout where necessary. It is also necessary for the user to manually determine whether the EUT has passed all tests.

NOTE Due to the functionality of the Load, Leakage and Touch Leakage tests the only result to be printed will be result displayed when the test stops. To get all three results to be printed three separate tests must be performed.

AC Earth Bond Tests

Switch Position ---------- **Earth Bond A**

Test Icon Displayed --- 

Class 1 (earthed) appliances

Plug EUT into tester outlet socket, use Earth Bond lead from Main socket to appliance metal part.

Class 2 (unearthed) appliances

This test cannot be performed since no earth connection is present in the appliance plug.

Point to Point

Use Earth Bond leads from both Main and Auxillary sockets.

If a different test current is required, press Select, which will cause the selected test current to flash, and use the arrow keys to adjust the current as desired.

This test is to ensure that the connection between the earth pin in the mains plug of the appliance and the metal casing of the appliance is satisfactory and of sufficiently low resistance.

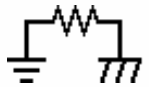
The test current is applied between the earth pin of the mains supply plug and the earth bond test lead clip.

A high current is normally used to stress the connection under fault conditions. The length of the test should be limited to prevent damage due to overheating. Tests of 4A,10A,and 25Aac are available.

DC Earth Bond Tests

Switch Position ---------- **Earth Bond** mA

Test Icon Displayed ---



Class 1 (earthed) appliances

Plug EUT into tester outlet socket, use Earth Bond lead from Main socket to appliance metal part.

Class 2 (unearthed) appliances

This test cannot be performed since no earth connection is present in the appliance plug.

Point to Point

Use Earth Bond leads from both Main and Auxillary sockets.

The first press of the Start button will generate a +200mA test, and once thisis complete, a second press of the Start button will generate a –200mA test.

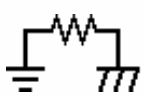
This test is to ensure that the connection between the earth pin in the mains plug of the appliance and the metal casing of the appliance is satisfactory and of sufficiently low resistance.

The test current is applied between the earth pin of the mains supply plug and the earth bond test lead clip.

Earth Screen Test (100mA)

Switch Position ---------- **Earth Bond mA**

Test Icon Displayed ---



This test is to check the earth screen connection in the same manner as the Earth Bond tests above, but using a low current which will prevent damage that may be caused by testing using high currents. This is often required by sensitive electronics such as computers and other Information Technology (IT) equipment, as a substitute for an Earth Bond test.

A low voltage of approximately 100mV AC RMS is applied between the earth pin of the mains supply plug and the Earth Bond test lead clip. A current of 100mA is allowed to flow for the duration of the test.

Insulation Tests

Switch Positions ---------- **INSULATION**
250V and **500V**

Test Icon Displayed ---

Warning

250 or 500V d.c. test voltage

Class 1 (earthed) appliances

Plug EUT into tester outlet socket

Class 2 (unearthed) appliances

Plug EUT into tester outlet socket, use Earth Bond lead from Main socket to appliance metal part.

This test is used to verify that adequate insulation exists between the mains supply pins and earth.

During the insulation test, a 500V DC voltage is applied between the earth pin and both the live and neutral pins of the appliance mains supply plug. The Tester displays the resistance measured and allows the user to confirm sufficient insulation exists.

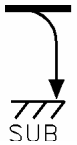
For Class 2 appliances, the Earth Bond Test clip can be used for an earth return lead.

For appliances which incorporate over-voltage protection, and hence produce a false failure condition when 500v insulation tests are used, a 250V switch position is also provided to allow a reading to be taken without the protection devices generating a false failure.

Substitute Leakage Test

Switch Position ---------- **S/LEAK mA**

Test Icon Displayed ---



Class 1 (earthed) appliances

Plug EUT into tester outlet socket

Class 2 (unearthed) appliances

Plug EUT into tester outlet socket, use Earth Bond lead from Main socket to appliance metal part.

This test is not available when using the 110V test adapter.

The substitute leakage test applies a nominal voltage of 40V AC RMS to the appliance and is applied between the earth pin and both the live and neutral pins of the supply plug. For Class II appliances, connect the Earth Bond test clip to the appliance as a substitute for the Earth.

The Tester measures the current that flows and scales the result to display a guide to the current that would flow if the test voltage had

been the nominal mains supply voltage, scaled for the applicable socket.

Please note that values for Substitute Leakage may differ substantially from that of conventional Earth Leakage tests because of the way that the test is performed (e.g. it will be affected by the presence of Neutral-to-Earth suppression capacitors).

This test can prove useful in situations where conventional Insulation tests are unacceptable methods of testing the insulation of the appliance.

Powered Tests

 **Warning**

Mains voltage applied to appliance

The following powered tests differ from the previous tests in that they apply mains supply voltage to the appliance to perform their functions:-

- Load (Operation) Test
- Leakage Test
- Touch Leakage Test

The Tester performs an initial low voltage test to establish that the appliance can be safely powered.

These tests are not available when using the 110v test adapter.

When the rotary switch is rotated through the different power tests the power supply is not interrupted but the test counter is reset. This allows the user to obtain result from all three tests without having to interrupt the power. To abort a power test rotate the knob beyond the power tests.

 **Warning**

It is important that the user verifies that an appliance with moving parts (e.g. an electric drill) is safely mounted to allow movement without causing damage to equipment or personnel.

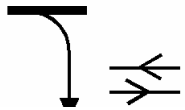
If the potential load current is too high, a warning message appears, allowing the user to continue. This message will be displayed if a Live to Neutral short exists, and if tests are continued the tester's fuses will blow.

If the potential load current is low, a warning message appears to allow the user to check that the appliance is switched on, and all fuses are intact.

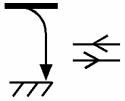
The Tester also performs an internal safety test to verify that internal relays are properly set before applying full mains supply to the appliance.

Load Test

Switch Position ----------



Test Icon Displayed ---



Warning

Mains voltage applied to appliance

All Appliances

Plug EUT into tester outlet socket

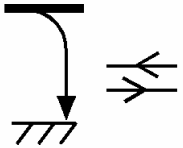
The Power test supplies the equipment under test (appliance), connected to 230V test sockets, with the rated voltage of that socket.

The Tester measures the power used by the appliance and displays the reading in kVA..

Earth Leakage Test

Switch Position ---------- **LEAK mA**

Test Icon Displayed ---



Warning

Mains voltage applied to appliance

All Appliances

Plug EUT into tester outlet socket

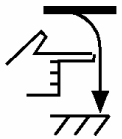
The Leakage Test shows the current being lost through Leakage as the difference in the currents flowing in the Live and the Neutral conductors. This difference is the total leakage away from the appliance, and is generally equivalent to the current flow through the earth lead of the appliance, and displays the result in milliamps (mA).

This differential method of determining leakage will show the full leakage of an appliance in-situ, so if the appliance has an extra earth point, i.e. water pipe, then the Tester will show the full and true appliance leakage. This is also known as Enclosure or Differential Leakage.

Touch Leakage Test

Switch Position ---------- **T/LEAK mA**

Test Icon Displayed ---



Warning

Mains voltage applied to appliance

All Appliances

Plug EUT into tester outlet socket, use Earth Bond lead from Main socket to appliance metal part.

The Touch Test displays the current that would flow if the appliance was touched by a person. This is based on a 'body model' of 2kΩ resistance. The Tester detects any current flowing in the Earth Bond Lead (attached to an appropriate point on the appliance) and indicates the potential leakage through a metal panel. The Tester displays the result in milliamps (mA).

IEC Lead Polarity Test

Switch Position ---------- **POLARITY**

Test Icon Displayed --- 

Plug the lead into tester outlet socket, and also into the tester IEC socket.

The IEC test performs a continuity and polarity check on the Live and Neutral conductors and confirms that there are no breaks or cross wiring in these conductors.

Note that Earth Bond and Insulation tests also need to be made to confirm the electrical safety of IEC leads.

Testing 110v appliances

The 110v adaptor lead is used to connect 110v appliances to the tester outlet socket. Earth Bond and Insulation measurements can be made.

The Adaptor lead is wired to prevent power tests being performed, since this would supply full mains voltage (230v) to the EUT.

Chapter 3 Tips & Troubleshooting

Power On Self tests:

When the tester is powered on, a number of messages can possibly appear as the tester performs safety tests on itself and the mains power supply. If a fault is identified, the primary (large) display will scroll a message across the 4 digits, while the secondary display shows an error number.

If any of the self tests fail, then one of the following display will be seen.

INTERNAL FAULT

Err1

Return the unit to Seaward for correction of the fault.

Err4

The unit be HOT, allow the tester to cool before trying again. If the message appears when the unit is cold then return to Seaward for correction of the fault.

If a voltage greater than 30V is detected on the neutral input line or the earth is missing then the following display will be seen.

L N REVERSED

Err2

Check for incorrect wiring on supply. The user can proceed by pressing the ↵ button if it has been established that it is safe to do so.

The next test will check for an earth connection. If there is no Earth connection to the tester, the following display will be seen.

FLOATING EARTH

Err3

Check for incorrect wiring on supply.

The Tester will fail the earth check if it is being supplied with a balanced supply (e.g. 115V - 0 - 115V) since it will detect phase voltage on both L and N supply connections. Only continue if certain that the supply is balanced and the earth on the Tester connection is secure.

If all the above is checked the Europa maybe faulty, contact Seaward for repair

Safety Tests during operation

The Tester performs self-tests during normal operation. An internal earth bond test and a low voltage test are performed prior to applying mains power to any EUT (including Load/Leakage and Touch Leakage tests).

If the internal earth bond test is failed, the following message will be seen:-

INTERNAL FAULT

Err4

The unit be HOT, allow the tester to cool before trying again. If the message appears when the unit is cold then return to Seaward for correction of the fault.

If the low voltage test fails, then either of the following warnings will be displayed:-

LOAD TOO GREAT

Err5

It is possible that the appliance under test will draw more than 18A and could therefore damage the Europa. User discretion is required. If in doubt do not test and seek advice.

LO LOAD, OC FUSE?

Err6

The appliance under test is switched off or the fuse may be open circuit. This message will also appear if the appliance is not expected to consume more than approximately 60W,

Temperature monitoring

The tester is provided with internal temperature monitors to ensure sensitive components are not overheated. High rates of testing may cause this situation, especially with long Earth Bond tests. Setting Earth Bond test times to 2 secs will increase operating time. If the following message appears, leave the tester to cool down before pressing Enter to continue testing.

HOT

Err7

Multiple Earth connections:

In general, multiple earth connections to an EUT (e.g. water pipe connections to a water heater) can cause difficulties in measurement. This has previously needed the additional earth connections to be isolated.

The Europa PAC tester is capable of testing earth connections in the presence of additional earth paths. This is done automatically by performing a point to point measurement of the earth connection, and measurement of the differential leakage current, rather than the earth lead current. Measurements are thus assured without special precautions.

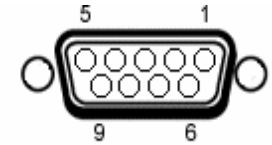
Interfacing

The Tester provides a single 9 way connector for a serial interface to a printer:-

The Connector pinouts for Serial port are shown below:-

Serial Port

The serial port uses a standard 9-way D-type connector



Pin	Description
1.	N.C.
2.	RX
3.	TX
4.	DTR
5.	0V
6.	N.C.
7.	0V
8.	N.C.
9.	+5V

Baud Rate:	9600
Start Bits:	2
Data Bits	8
Stop Bits:	1
Parity:	None

Chapter 4 Maintaining the Tester

Cleaning the Tester

The Tester case can be cleaned with a damp cloth, with if necessary, a small amount of mild detergent. Prevent excessive moisture around the socket panel or in the lead storage area.

Do not allow liquid inside the Tester, or near the sockets. Do not use abrasives, solvents, or alcohol.

If any liquid is spilt into the Tester case, the Tester should be returned for repair, stating the cause of the defect.

User Maintenance

The Tester is a rugged quality instrument. However, care should always be taken when using, transporting and storing this type of equipment. Failure to treat the product with care will reduce both the life of the instrument and its reliability.

If the Tester is subject to condensation, allow the Tester to completely dry before use.

- Always check the Tester and all test leads for signs of damage and wear before use.
- Do not open the Tester under any circumstances.
- Keep the instrument clean and dry.
- Avoid testing in conditions of high electrostatic or electromagnetic fields.
- Maintenance should only be performed by authorised personnel.
- There are no user replaceable parts in the Tester.
- The unit should be regularly calibrated (at least annually).
- For repair or calibration return the instrument to:-

Seaward Electronic Limited.
Bracken Hill
South West Industrial Estate
Peterlee
Co. Durham
SR8 2SW
Tel : +44 (0)191 586 3511
Fax: +44 (0)191 586 0227
sales@seaward.co.uk

Chapter 5 Accessories

A series of standard and optional accessories are available for the Seaward Europa PAC Tester. The standard accessories are supplied with the Tester.

Standard Accessories

Accessory	Part Number
Earth Bond Test Lead	249A908
Mains Lead	270A025
115V Adaptor Lead	270A076
Carry Case	270A950
Manual	277A555

Optional Accessories

Accessory	Part Number
Calibration Checkbox	283A951
Thermal Label Printer	283A954
Serial Printer Lead	283A955
Serial to Parallel adaptor	270A954
Pass Labels (500)	91B038

Chapter 6 Specifications

AC Earth Bond Test

Test Voltage *.. .....6V rms nominal (no load)

Test Current *.... .....4A, 10A, 25A (into s/c load)

Range..... 40mΩ - 19.99Ω

Resolution. 0.01Ω

Accuracy..... .+/- 5% of reading, +/- 2 digits

Pass Levels. ..... <0.1R, >0.1R, >0.5R

Misc.. .....4-wire measurement, floating earth

DC Earth Bond Test

Test Voltage *. .....4V dc nominal (no load)

Test Current * .....+200mA, -200mA (into s/c load)

Range . ..... .40mΩ - 19.99Ω

Resolution. 0.01Ω

Accuracy..... ..+/- 5% of reading, +/- 2 digits

Pass Levels. .....<0.1R, >0.1R, >0.5R

Misc. .....4-wire measurement, floating earth

Earth Screen Test

Test Voltage * .....100mV nominal (no load)

Test Current * .....100mA (into s/c load)

Range..... 40mΩ - 19.99Ω

Resolution.. ..... 0.01Ω

Accuracy.....+/- 5% of reading, +/- 2 digits up to 5.00Ω

Pass Levels.. .....<0.1R, >0.1R, >0.5R

Misc.....4-wire measurement, floating earth

Insulation Test

Test Voltage * ..... 500V d.c. or 250V d.c. nominal (0.5MΩ load)

Short Circuit Current .....2mA d.c. maximum

Range..... 100kΩ - 100 MΩ

Resolution .....0.01 MΩ (<100 MΩ)

Accuracy..... .+/- 5% of reading, +/- 2 digits (100kΩ - 20MΩ)

Pass Levels. ..... . <0.50MΩ,<1.0MΩ,<2.0MΩ,

..... <4.0MΩ, <7.0MΩ, >7.0MΩ

Substitute Leakage Test

Test Voltage * ..... 40V a.c. o/c

Display Range..... 0.1 - 20.0 mA a.c.

Resolution. 0.01mA

Accuracy..... +/- 10% of reading, +/- 2 digits 1.00 - 20mA

Pass Levels. ..... <7.0mA, >7.0mA, >15.0mA

Leakage

Range.....0.1mA - 10.0mA

Resolution.. .....0.01mA

Accuracy..... +/- 5% of reading, +/- 2 digits

Pass Levels .....<0.25mA,> 0.25mA, >0.75mA, >3.5mA

Touch Leakage

Range. ..0.1mA - 2.0mA

Resolution. ..0.01mA

Accuracy..... +/- 10% of reading, +/- 2 digits

Pass Levels. ..... <0.25mA, >0.25mA, >0.5mA

Load Test

Socket .....230V BS 1363

Measured Voltage..... 90 - 300V (Indication only)

Measured Load .....0 - 4kVA (Indication only)

IEC Lead Test

Test * ..... 250V d.c., 1mA nominal

Detects..... Open, Short, Good, Reverse

* - Test stimulus based on mains supply of 230V, varies with supply voltage.

Mechanical

Size..... 450mm x 410mm x 155mm

Weight..... 3.5kg

Environmental

Operating ..... . 0ºC to 40ºC (non condensing)

Storage ..... -10ºC to 50ºC (non condensing)

Maximum R.H 90%

Supply Rating..... .230V +/- 10%, 50/60Hz

Max Output Current 16A

Appendix

Test Limits

The following test values are recommended by the Institute of Electrical Engineers as suitable limits for in-service testing in most applications. Note that these are for guidance only, test engineers must use their knowledge and comon sense in each practical application.

Earth Bond /Continuity Limits

Construction Standard	Resistance between earth pin of plug to earthed metal parts (Ω)
BS3456 Household electrical appliances	0.1 + R*
BS4533 Luminaires	0.5
BS2769 Hand held motor operated tools	0.1+R*
BS415 Mains operated electronic and related apparatus	0.5+R*
BSEN 60950 Information technology equipment	0.1+R*

* R is the resistance of the mains cable earth wire –cables of 2 metre or less should be less than 0.1Ω

Note that actual readings depend on good conection to the Earth Bond Clip and to the Earth Pin

In-Service Insulation Limits

Construction Standard	Resistance between live parts and the body of a class I appliance (MΩ)	Resistance between live parts and the body of a class II appliance (MΩ)
BS3456 Household electrical appliances	0.5	1.0
BS4533 Luminaires	0.5	1.0
BS2769 Hand held motor operated tools	0.5	1.0
BS415 Mains operated electronic and related apparatus	0.5	1.0
BSEN 60950 Information technology equipment	0.5	1.0
Information technology equipment not constructed to BSEN 60950	May be damaged by insulation tests – use Earth leakage readings	

Earth Leakage Limits

Earth leakage current (mA) with rated supply voltage applied	
Class I	Class II
3.5	0.25

Copies of the IEE 'Code of Practice for in-service Inspection and Testing of Electrical Equipment ' may be obtained from:

The Institution of Electrical Engineers
P.O. Box 96
Stevenage,
Herts SG1 2SD
ISBN 0 85296 844 2