SCEPTRE

PC CONTROLLED SPECTRUM ANALYSER

OPERATING INSTRUCTIONS

219A910

Bracken Hill, South West Industrial Estate
Peterlee, Co. Durham, England, SR8 2JJ
Telephone +44 (0)191 586 3511
Fax +44 (0)191 586 0227

Contents

Safety

READ INSTRUCTIONS BEFORE USE !

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.

The SCEPTRE performs electrical tests which involve high voltages. Never touch the appliance being tested while the testing procedure is being followed.

This product is designed for use by suitably trained competent personnel.

WARNING

This equipment operates with a high leakage current. Before use, the following precautions must be observed:

- The supplementary 4mm^2 protective conductor provided must be connected from the earth terminal on the instrument rear panel to the fixed installation protective ground.

- The equipment must be connected to the fixed wiring installation using the BS 4343 plug & and socket supplied (see "Earth Continuity Monitor", below, for wiring information), and satisfactory operation of the internal earth monitoring circuit confirmed.

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

The instrument is not suitable for use on fixed installations protected by RCD's unless supplied from a suitably rated safety isolating transformer.

Earth Continuity Monitor (ECM)

Sceptre incorporates an earth continuity monitoring circuit.

A small current is circulated through a pilot conductor within the mains cable to the fixed installation socket, and back to the instrument via the earth conductor. Should this circuit be broken, the ECM will isolate the Sceptre from the mains supply.

ADDENDUM

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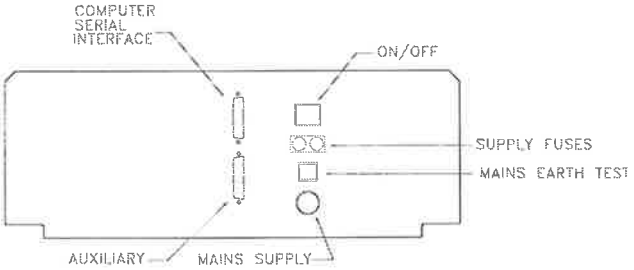
Sceptre - Physical Connection

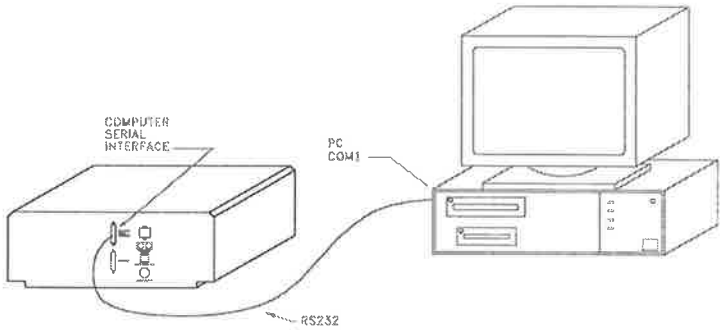
Sceptre is supplied with the following accessories.....

1 x BS4343 plug & socket
1 x RS232 cable interface
1 x BNC to BNC Co-axial cable

The user should connect Sceptre to the mains supply taking note of the instructions on pages 3, 4 & 5 of this manual. The unit can then be switched on by pressing the on/off switch to **ON**.



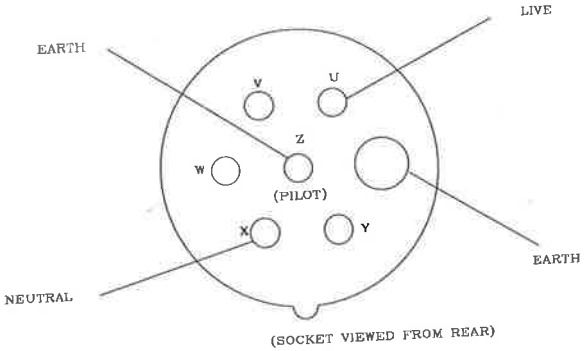
The RS232 cable interface should be connected to the rear of the Sceptre using the port marked **COMPUTER SERIAL INTERFACE**, and connecting to **COM 1** on the users PC.



Due regard should be taken of the relevant warning notices on both Sceptre and the PC. The user should note that the **AUXILIARY PORT** at the rear of Sceptre has been included to accomodate future product developments. At present the **AUXILIARY PORT** has **NO** intrinsic function.

The BNC to BNC Co-axial cable is used, during conducted emissions testing to connect the **LIVE & NEUTRAL RF OUTPUTS to the RF INPUT**. The user should take due notice of the warnings and advice located on the Sceptre front panel.

Satisfactory operation of the ECM may be confirmed by depressing the test button on the rear of the instrument. To ensure correct operation of the ECM, the fixed installation socket must be wired as follows.



(SOCKET VIEWED FROM REAR)

EMC Directive - an overview

From 1 January 1996 The EMC Directive becomes fully effective throughout the European Community and will apply to all products having an electrical/electronic content.

What's in, what's out?

Following the European Commission's explanatory document of 1991 and the UK EMC Regulations of October 1992, we can now see whether or not a product is within the scope of the EMC Directive and know when it applies.

If equipment can be described as being benign from an EMC viewpoint, then it is exempt from the EMC Directive. That is to say, it does not emit unwanted electromagnetic (EM) disturbances and its performance is unaffected by external EM disturbances.
Non-commercial amateur radio equipment is also exempt. Further exemptions are second-hand equipment and equipment for export outside the European Community (EC).

Product specific directives having EMC provisions take precedence over the EMC Directive. Some product specific directives have partial EMC provisions.

The EMC Directive applies to equipment when it is first placed on the market or is taken into service. It covers all equipment that enters the distribution chain after 1 January 1996 and therefore applies to those

products being manufactured now that will still be marketed after this date, as well as to new products. If products comply with the EMC Directive **now**, manufacturers or their agents can mark their products with the **CE mark** and have full access to the Single Market.

The period up to 1996 is called the 'transition period', during which time a manufacturer whose product does not comply may still market it in any member state under the existing national regulations.

However, from January 1996, there will be no option but to comply.

Compliance

Having determined that a product comes under the EMC Directive, it is necessary to demonstrate compliance with its requirements: **equipment should not interfere with the intended function of other electrical or electronics equipment or broadcast services, and it should have intrinsic immunity to external EM disturbances.**

If products can be claimed to conform with standards published in the Official Journal of the European Communities (OJ), then compliance with the EMC Directive has also been demonstrated.

If a product is not covered by a product-specific standard, then it may be possible to apply the generic standards. These apply to a broad range of products that can be used in defined environments.

Conformance with standards really means testing products in accordance with the test methods described in the standards.

Such testing is the responsibility of the manufacturer (or European 'appointed representative' if appropriate) and may be performed in-house or by a third party. So how else may compliance be demonstrated?

A manufacturer may also demonstrate compliance using a technical construction file (TCF). This is prepared by the manufacturer in consultation with a Competent Body and includes a technical description of the product or range of products, along with any necessary drawings, a description of the EMC provisions, and results of any testing or theoretical prediction that has been carried out.
This report is submitted to the Competent Body, which will issue a technical report or certificate if it believes the product(s) to be compliant with the 'protection requirements'.

There is a third route to compliance, which applies to radio transmission or transceiver equipment. This type of equipment must be submitted to a Notified Body for EC type examination.

When compliance has been demonstrated then a manufacturer is in a position to make a Declaration of Conformity. The declaration should identify the product, the standards with which it conforms, or its TCF, or its EC type examination certificate and the signatory binding the manufacturer. The CE (Communaute Europeene) mark can then be affixed to the product or its packaging, allowing the product to be marketed freely throughout the EC (but note that the CE mark can only be affixed if the product complies with **all** the new approach directives that apply to it, e.g. an electronic toy must comply with both the EMC and the Toy Safety directives).

Penalties

The penalties included in the UK legislation allow for a £5000 fine and, for certain offences, up to a 3 month prison sentence. However the most

serious deterrent is the possibility of non-compliant products being excluded from the market, and hence the commercial threat to a company's existence.

References

- 89/336/EEC Council Directive 'on the approximation of laws of Member States relating to electromagnetic compatibility', Official Journal of the European Communities, 25 May 1989, 139, pp.19-26
- DTI: 'The Electromagnetic Compatibility Regulations', HMSO, October 1992
- MARSHMAN, C A:'The Guide to the EMC Directive 89/336/EEC' (EPA Press, 1992)

SEAWARD's EMC products

Making sure EMC is integral to product development is the key to cost effective compliance. Few products NOT designed with EMC in mind pass first time and modification increase development cost.
Cost per day at test houses are expensive and depending upon complexity, testing may take from one day to many weeks. SEAWARD's approach has been to develop a low cost in-house testing package:

- EXPERT CONSULTANT - EMC guidance software
- SCEPTRE - Spectrum analyser with in-built LISN
- MACE - Mains interference simulator

See 'Other EMC products' on page 23 for further information.

Introduction to SCEPTRE

This document provides a preliminary guide to the use of the SEAWARD SCEPTRE. It outlines the functions available on the instrument and any restrictions which apply to the settings.

SCEPTRE is a microprocessor PC controlled spectrum analyser, designed to measure radiated and conducted emissions. All controls are set via the PC screen using a proprietary software package operating in a Microsoft Windows environment.

The SCEPTRE software also displays results, graphical information and an integral control panel allows further analysis and interpretation. Complimentary with other Windows based packages it provides the ability to transfer results to final report documents, such as Technical Construction Files.

Specification

- Input Frequency Range 150KHz - 450MHz
- 1MHz, 3db bandwidth
- 9KHz & 120KHz CISPR bandwidths
- Scans of 1MHz, 3MHz, 10MHz, 100MHz, 300MHz
- Gains +20dB, 0dB, -20dB
- 8 Amp LISN standard, other sizes optional
- Quasi Peak Detection
- Averaging Facility
- Peak Hold Facility
- Limit Line Indication
- Cursor Markers

Part numbers SCEPTRE

- SCEPTRE - 230V, UK part number 219A910
- SCEPTRE - 100V, Japan part number 219A912
- SCEPTRE - 240V, Australia part number 204A914
- SCEPTRE - 110V, USA part number 219A915
- SCEPTRE - 230V, Europe + Schuko part number 219A916

WARNING

The input circuitry to the SCEPTRE, in common with all other spectrum analysers, is extremely sensitive to damage from transients which may occur as a result of switching the equipment under test (EUT) on or off whilst the LISN output is connected to the RF input. Therefore the EUT MUST be switched on BEFORE connecting the coaxial cable and switched off AFTER disconnecting the cable.

Further protection will be provided by using a transient limiter between the LISN output and RF input. Any attenuation of the RF voltages (usually 10dB) must be taken into account by the user when noting the amplitudes from the PC screen.

SCEPTRE Setup

The software for the SEAWARD SCEPTRE is provided on a 3.5 inch floppy disk. It should be installed onto the PC hard disk using the following command from the DOS prompt:

win a:setup

(if the floppy drive is b, then the 'a' should be replaced by a 'b').

At the end the installation, the installation a **SEAWARD SCEPTRE** window will appear, containing a **SEAWARD SCEPTRE** icon. To start the software, double click on this icon.

The floppy disk should be removed and stored as a back up.

Note The SCEPTRE should be switched on prior to starting the software.

Using The SCEPTRE

Figure 1 'SCEPTRE Display' shows the SCEPTRE display, detailing the user selectable controls.

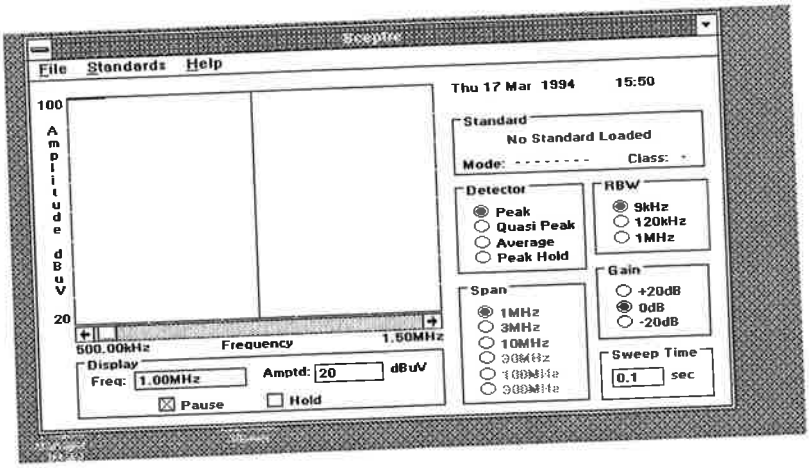


Figure 1 *SCEPTRE Display*

Span Selection

To select a particular span, simply use the mouse to click on the radio button adjacent to the required span. The span, resolution bandwidth and detectors all interact and not all spans are always available to be selected. For a given resolution bandwidth and detector, the valid spans are shown in bold. Those not selectable are shown in grey. Consequently in Figure 'SCEPTRE Display' the 1MHz, 3MHz and 10MHz spans are available for selection.

Table 1 'Valid selections of span and RBW' below shows the valid spans (for peak detection) for the three resolution bandwidths.

RBW/span(MHz)	1	3	10	30	100	300
9kHz	–	–	–	X	X	X
120kHz	X	–	–	–	–	X
1MHz	X	X	X	X	–	–

Table 1 *Valid selections of span and RBW*

Additionally the 9kHz RBW can only be set up to a centre frequency of 60MHz (depending upon span setting).

Resolution Bandwidth

This sets the relevant filters inside the SCEPTRE. A smaller resolution bandwidth (RBW) makes a given emission on the screen look narrower and hence other signals nearby can be resolved.

To select a particular RBW, simply use the mouse to click on the radio button adjacent to the required RBW. The selection of the RBW restricts the spans which can be selected.

Detectors

To select a particular detector, simply use the mouse to click on the radio button adjacent to the required method of detection.

Peak Detector

The peak detector is the most commonly used detector as it allows the measurements to be done quicker than other detectors. It responds to the almost instantaneous peak value of the signal and discharges rapidly.

The peak detector can be used with any RBW, but the span is restricted by the RBW setting (see Table 1 'Valid selections of span and RBW').

Peak Hold Detector

The peak hold detector performs essentially the same operation as the peak detector, except that instead of overwriting the previous trace with a new trace each time a sweep is made, it compares the amplitude at each frequency with that measured previously. The screen is then only updated if the new value is higher in amplitude than the previous one.

This facility is particularly useful if the emission levels are varying significantly as it allows the user to determine the absolute maximum level The same restrictions apply as for peak detection.

Quasi-Peak Detector

The quasi-peak (QP) detector is a peak detector with weighted charge and discharge times. These correct for the subjective human response to pulse type interference. Interference at low pulse repetition frequencies (PRF) is subjectively less annoying on radio reception than at high PRFs. The QP detector therefore reduces the peak response at low PRFs. It is one of the detector types required when carrying out emission measurements to European Standards.

Due to the method of operation of the QP detector, it is inherently slow. Its speed is proportional to the span over which the measurement is made and therefore QP measurements should only be made using small spans. The valid spans for QP measurements are shown in Table 2 'Valid selections of span and RBW for QP detection'.

RBW/span(MHz)	1	3	10	30	100	300
9kHz	–	–	X	X	X	X
120kHz	X	–	–	–	X	X
1MHz	X	X	X	X	X	X

Table 2 *Valid selections of span and RBW for QP detection*

Average Detection

The average detector, as the name implies, measures the average value of the signal. For a continuous wave signal ie an unmodulated carrier signal, the average value will be the same as the peak value, but a pulsed or modulated signal will have an average signal lower than the peak. The effect is to penalise continuous emissions with respect to pulsed interference.

Spectrum analysers generally do not incorporate average detectors but use the control of the video bandwidth to produce a form of averaging. Whilst it is not a true form of averaging as defined in the standards, it provides a useful pre-compliance tool for making average measurements.

Average measurements are generally only made when carrying out conducted emission measurements which are in the range 150kHz-30MHz. Therefore when average detection is selected this forces the selection of a 9kHz RBW. A 1,3,10,30 and 100MHz span is then available for measurement.

Average measurements are inherently slow and it is recommended that such measurements be made only over the minimum required span.

Gain

The SCEPTRE incorporates a series of gain settings. To select a particular gain, simply use the mouse to click on the radio button adjacent to the required setting.

The selection of a gain does not affect the amplitude readings on the screen as this is taken into account before the data is displayed, however it does result in the amplitude values which correspond to the top and bottom of the screen changing. Table 3 'Screen amplitude range for different gain settings'
indicates the ranges.

Gain (dB)	Range (dBuV)
+20	0 to 80
0	20 to 100
-20	40 to 120

Table 3 *Screen amplitude range for different gain settings*

Cursor

The cursor can be used to measure both the frequency and amplitude of any emission on the screen. Simply use the mouse and click on the top of the emission. A vertical line indicates the frequency position and a horizontal line indicates the amplitude position. This is particularly useful

as it indicates whether or not the top of the emission has been selected by the cursor.

By holding down the mouse button the cursor can be dragged across the screen and this can be used to fine tune its position. The measured frequency and amplitude are shown in labelled boxes directly below the display.

Pause

This facility allows the screen to be frozen when it is selected. It is useful if a print of the measurement is to be made or if a particular feature of the measurement is required to be stored and/or printed. The cursor facility is still available during the pause sequence. Selection of any other parameters e.g. changing span or RBW results in the pause being unlocked and the data will be lost.

The pause is automatically invoked when any of the application files at the top of the screen are selected.

Hold

This facility allows a trace to be held in the background so that another trace can be compared with it. To use this, select hold when the required trace is available. This is then held on screen, but in a grey colour so that it is effectively in the background. A new 'live' trace can then be made as normal and can be visually compared with the held trace.

Standards

The SCEPTRE contains a number of standards files which when selected will place the relevant limit lines on the screen.

To select a standard, select the ***standard*** menu option. This will produce a pull down menu as shown in figure 2 'Standard Pull Down Menu' .

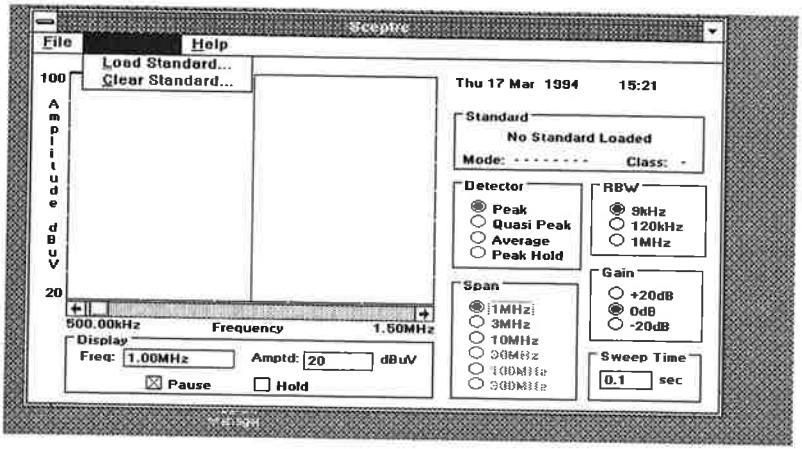


Figure 2 *'Standard' Pull Down Menu*

To load a standard, select ***load standard*** from the menu. The menu will show the available standards. Figure 3 'Example of available standards' shows this. Select the required standard.

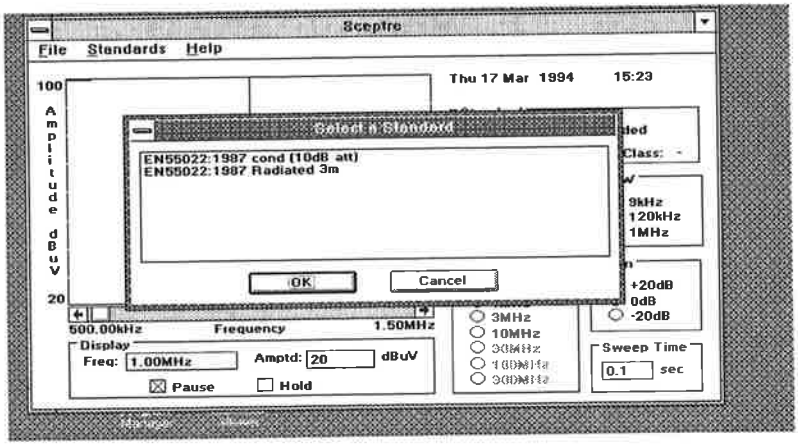


Figure 3 *Example of available standards*

The conducted emission standards generally contain two limit lines; these being for quasi-peak and average detection. The average detection is always the lower of the two limit lines.

The radiated emission standards may contain one or two limit lines. They both relate to quasi-peak detection, but may contain both Class A and Class B (the lower line) limits.

Printing

Measurements made with the SCEPTRE can be printed on any printer which is supported by Windows. To print the file, select the ***file*** menu and select ***print*** from it. This process is shown in Figure 4 'Example of file menu'. Please refer to your Windows manual for more information.

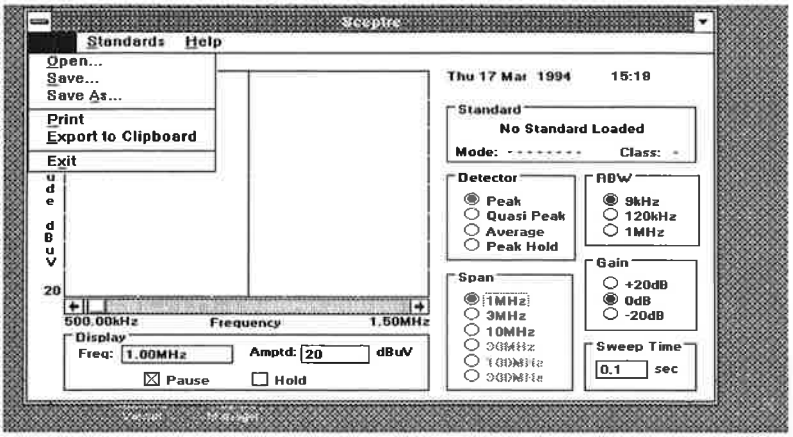


Figure 4 *Example of file menu*

Exporting and Saving Files

Measurements made on the SCEPTRE can be exported to Windows supported word processor packages such as Microsoft Word, using the clipboard facility shown in the ***file*** menu in Figure 4 'Example of file menu'.

If it is required to save a measurement, then it should be exported to a document and saved in it. Please refer to your Windows manual for more information.

Saving and Recalling Analyser Settings

Parameter settings (eg span, RBW etc) for measurements made on the SCEPTRE can be stored **(save as)** and recovered **(open)** for use at a later date. Only the set-up will be stored, no data. This facility is available in the ***file*** menu as shown in Figure 4 'Example of file menu'.

LISN

A Line Impedance Stabilisation Network (LISN) is used when making conducted emission measurements. It provides two functions. Firstly, it provides a defined impedance across which the RF voltages are measured and therefore removes the uncertainty of the impedance of the mains supply which would result in a wide range of measured voltages. Secondly, it effectively removes the RF voltages from the mains conductors leading from the piece of equipment under test. This allows only these (and not the mains voltages) to be measured.

The front panel of the SCEPTRE contains two output BNC connectors from the LISN. These are labelled **Live** and **Neutral** and refer to the mains conductors from which the RF voltages have been removed. To measure these emissions, connect a 50Ω coaxial lead from the required output to the RF input at the right hand side of the front panel.

Other EMC products

SEAWARD's EMC low cost in-house testing package consists of :

- SCEPTRE - Spectrum analyser with in-built LISN
- MACE - Mains interference simulator
- EXPERT CONSULTANT - EMC guidance software

MACE - MAINS INTERFERENCE SIMULATOR

MACE is a microprocessor controlled mains interference simulator. Designed in general with prEN50 093 (IEC 1000-4-11), IEC 801-4 and IEC 801-2. MACE is capable of applying Voltage Dip, Fast Transient and Electrostatic Discharge (ESD).

The MACE is a cost-effective precompliance test unit. An alpha numeric dot matrix LCD and membrane keypad allows testing in both annual and automatic modes. An ESD probe is included within the MACE package. MACE is available for all international single phase voltages.

Specification MACE

Voltage dip - pr EN50 093 (IEC 1000-4-11)

- Voltage dips 30%, 60% and 100%
- Dip Duration times 0.5, 5, 10, 25, 50 cycles
- 3 voltage dips are initiated at 10 second intervals

Fast transients - IEC801-4

- Output Voltages 0.5KV, 1KV, 2KV, 4KV

- Positive and negative transient
- Repetition rate 2.5KHz or 5.0KHz
- Connection to any combination of Live, Neutral and Earth
- Test times between 0 and 6 minutes in 0.1 second steps

Electrostatic discharge (ESD) - IEC801-2

- Utilising Air Discharge ESD probe
- Output Voltages 0.5KV, 1KV, 2KV, 4KV, 8KV
- Positive and negative polarities

Part numbers MACE

MACE - 230V, UK	part number 204A910
MACE - 100V, Japan	part number 204A913
MACE - 240V, Australia	part number 204A914
MACE - 110V, USA	part number 204A915
MACE - 230V, Europe & Schucko	part number 204A916
ESD Probe - as separate	part number 204A912

EXPERT CONSULTANT

SEAWARD's EXPERT CONSULTANT is a Microsoft Windows based software package which not only identifies the relevant standard for any product for both emissions and susceptibility, but also guides the user to choose the most appropriate route towards compliance.

Containing summaries of all the relevant standards and utilising the knowledge of the country's leading experts and the technology of major UK Universities, SEAWARD have developed a package that provides a professional EMC knowledge base for those involved in electrical or electronic product design, manufacturer or sale.

Features include

Level 1: identification

- Identifies the route to achieve compliance with EMC directive
- Identifies and explains the appropriate standards
- Defines actions required to compile Technical Construction File

Level 2: diagnostics

- Describes the EMC tests and measurement methods defined by the standards
- Provides interpretation of the results obtained from using EMC assessment instrumentation
- Provides diagnostics to enable effective EMC countermeasures to be incorporated within a design

System requirements

- IBM compatible PC, 386sx 25MHz minimum
- IBM VGA or other graphics card compatible with Microsoft Windows 3.1 or higher with 800 x 600 pixel capability
- Microsoft MS-DOS 5.0 and Microsoft Windows 3.1 or higher
- Hard disk drive with 10M byte free space (15 M byte needed for installation)

Part number EXPERT CONSULTANT

- EXPERT CONSULTANT part number 224A910

Maintenance

There are no user replaceable parts in the SCEPTRE.
For repair or calibration return the instrument to:

SEAWARD Electronic LTD
Bracken Hill
South West Industrial Estate
Peterlee
Co. Durham
SR8 2JJ
Tel : +44 (0)91 - 586 3511
Fax: +44 (0)91 - 587 0157