

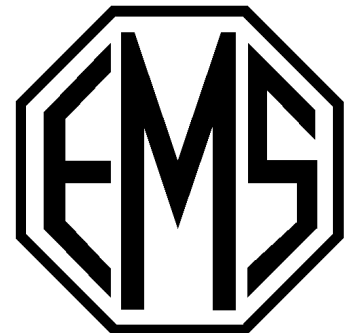
INTERFERENTIAL MODULE

MEDI-LINK

MODEL 71

CE 0120

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England.
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General Information

This manual provides the necessary information for the installation and operation of the Interferential Module.

These instructions must be studied before putting the module into operation.

The output of this module could prove to be hazardous to both patient and operator if used contrary to the best physiotherapy practices.

The information contained in this manual is subject to change without notice.

No part of this manual may be photocopied, reproduced, or translated into another language without the prior written consent of EMS Physio Ltd.

Record of Amendments

Interferential Module Model 71

ISSUE	COMMENTS	DATE
1	Initial Issue	17-03-1994
2	Revised	01-10-1994
3	CE Marking	05-02-1996
4	Revised	01-06-1998
5	Revised	12-09-2001
6	Revised	17-02-2005
7	Revised Company Name	04-10-2006
8	Revised	01-10-2007

EC Declaration of Conformity

EMS Physio Ltd
Grove Technology Park
Wantage
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United Kingdom

Declares that the following medical device is in conformity with the essential requirements and provisions of Council Directive 93/42/EEC and is subject to the procedure set out in Annex 2 of Directive 93/42/EEC under the supervision of Notified Body Number 0120, SGS United Kingdom Ltd.

Product Name Medi-Link Interferential Module

Model Number 71

Signature

A handwritten signature in black ink, appearing to be 'D. With', written over a horizontal line.

Position Technical Director

Date first issued 5 February 1996

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Warranty

EMS Physio Ltd (hereinafter called the company) product is warranted against defects in materials and workmanship for a period of two years from the date of shipment. The Company will at its option, repair or replace components which prove to be defective during the warranty period, provided that the repairs or replacements are carried out by the Company or its approved agents.

The Company will consider itself responsible for the effects on safety, reliability and performance of the product:-

only if assembly operations, re-adjustments, modifications or repairs are carried out by persons authorised by it,

only if the product is used in accordance with the instructions for use,

only if the electrical installation of the relevant room complies with the appropriate national requirements.

Should the product be returned to the Company for repair it must be sent carriage paid.

Consumable items, for example, self-adhesive electrodes, sponge electrode covers and batteries, are excluded from the above warranty.

Introduction

The Interferential Module generates medium frequency currents used for 2 and 4-pole interferential therapy.

Prior to the introduction of interferential therapy in the mid 1950s, low frequency stimulation was used for pain relief, muscle re-education etc. These currents, however, have the disadvantage that normal human skin has a relatively high impedance at such frequencies. In order to overcome the skin impedance a larger voltage has to be used to achieve the desired current, resulting in a more uncomfortable treatment for the patient. In addition, the penetration depth of these currents is poor and in part is limited by the discomfort to the patient.

Interferential therapy overcomes the problem of skin impedance. At 50 Hz (faradic current) the impedance for a 100 cm² of skin is approximately 3000 ohms. At 4000 Hz (medium frequency) the skin impedance of the same area is around 50 ohms. This means that a much lower voltage signal can be used to produce the desired current, resulting in less skin sensation and a more comfortable treatment. This medium frequency is, however, well outside of the normal biological frequency range (0.1 to 250 Hz). In order to produce the required stimulation, two medium frequencies are used. A constant frequency of, say, 4000 Hz is applied to one pair of electrodes and a slightly different frequency of say 3900 Hz is applied to the other pair. These two frequencies 'interfere' to produce an amplitude modulated medium frequency (beat frequency) in the tissue. The tissue responds to the cyclic rise and fall in the current intensity. It is the amplitude modulation frequency (AMF) that is within the normal biological frequency range and not the medium frequency (carrier).

In addition to the interferential currents, the Interferential Module also provides TENS (Transcutaneous Electrical Nerve Stimulation) currents and Russian Stimulation currents.

Precautions

Interferential therapy is a safe and effective modality. The therapist must, however, be aware of the following precautions and potential hazards.

Simultaneous connection of a patient to high frequency surgical equipment may result in burns at the site of the stimulator electrodes and possible damage to the stimulator itself.

Operation in close proximity (less than 1 metre) to shortwave or microwave therapy equipment may produce instability in the stimulator output.

Consideration must be given to the current densities for any electrode used with the Interferential Module. Current densities greater than 2 mA rms/cm² are not recommended because of the risk of an interferential burn. The small size EMS conductive rubber electrodes (NC3051 70 x 50 mm) have an area of 35 cm² and should, therefore, only be used with output currents up to 100 mA peak (70 mA rms). All other standard EMS conductive rubber electrodes may be used up to the maximum output of the module without exceeding this figure. When using other electrodes, the maximum safe output current should be assessed before use. First estimate the effective contact area of the electrode in square cm, and then apply the following formula:-

Maximum peak output current (mA) = Area of electrode (cm²) x 2.8

The factor of 2.8 is the maximum recommended rms output current multiplied by the ratio of the peak current to the rms current for a sinusoidal waveform.

The output indicator on the Medi-Link shows the peak output current in mA. For sinusoidal currents the rms current is approximately 70% of the peak value.

Patients with implanted electronic devices (eg cardiac pacemaker) should not be subjected to stimulation unless specialist medical opinion has first been obtained.

Contraindications

There are comparatively few absolute contraindications to interferential therapy.

Acute Sepsis, due to the risk of spreading infection.

Tumours, due to the risk of increased growth or metastatic activity.

Pregnancy, do not treat the lower abdomen, back or pelvis.

Menstruation, do not treat lower back or abdomen due to risk of increased bleeding or pain.

Cardiac conditions, do not treat the chest area or near the cervical ganglion.

Cardiac pacemakers, especially demand type, or any other implanted electronic device.

Febrile conditions

Large open wounds in treatment area

Dermatological conditions in treatment area

Thrombosis

Hypersensitivity or fear of electrical treatments

Any patient who cannot understand the nature of the treatment, for example, young children, very old or senile patients who cannot report back adequately or understand the potential dangers. This may apply equally to persons who do not speak the same language as the therapist.

Severe hypotension/hypertension, do not treat in the region of the lower cervical spine.

If in doubt the patient's physician should be consulted.

Electrodes should never be placed so that the applied current crosses the chest.

Technical Specification

The Interferential Module generates interferential currents at two different carrier frequencies, TENS currents and Russian currents.

Interferential Therapy

Carrier frequency	2 or 4 kHz
AMF	0 - 250 Hz
Swing patterns	1/1, 6/6, 6/6 or user defined
Vector	Fast, Slow or user defined
Surge	10, 6, 3 /minute or user defined

TENS

Pulse width	50 - 400 us
Frequency	1 - 250 Hz
Modes	Continuous, burst and surge
Waveforms	Asymmetric, Symmetric and Sequential pulses

Russian Stimulation

Frequency	2.5 kHz
Burst Frequency	1 - 100 Hz
Burst Ratio	1:1 - 1:9

General

Output Type	Constant current
Output Current	0-140 mA peak into 500 Ohms
Treatment Programs	16 User definable programs
Optional	Remote Output Control
Size (H x W x D)	100 x 80 x 210 mm
Weight	1 kg

The Interferential module is designed for use only as part of a Medi-Link system.

All information on model, serial number, and month/year of manufacture is located on the rear panel.

Each Interferential module is supplied with 2 and 4 pole patient leads, 4 medium (100 x 70 mm) rubber pad electrodes, 4 medium sponge covers, electrode connection cables, 2 sizes of elasticated stretch bandages and this manual.

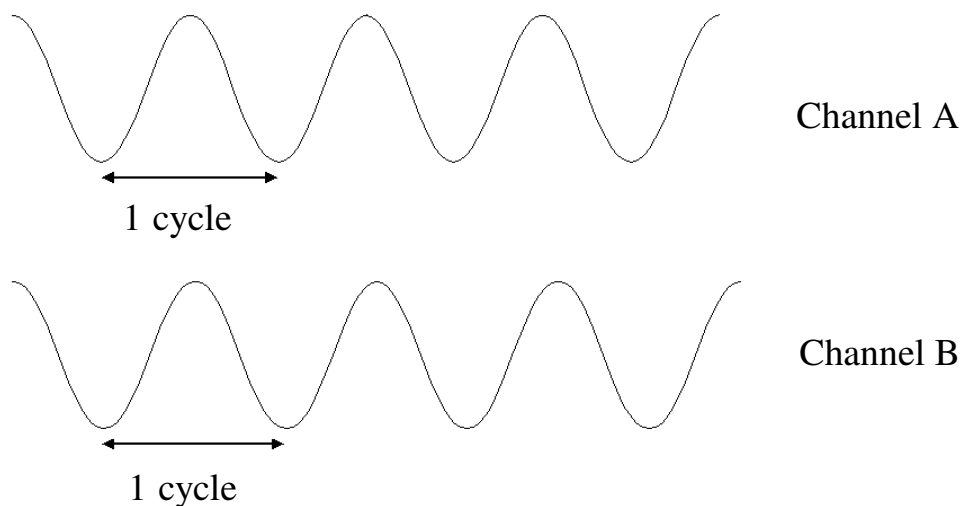
The Medi-Link Interferential module has been designed to meet the requirements of IEC 601-1:1988 (BS5724:Part 1:1989) "Medical Electrical Equipment, Part 1:General requirements for Safety", and IEC601-2-10:1987 (BS5724:Section 2.10:1988) "Specification for nerve and muscle stimulators".

In all operating modes maximum output current is 140 mA peak and the maximum output voltage is 60 V peak.

The maximum load impedance in ohms at any given output current is given by:

$$\text{Maximum Impedance} = 60000/(\text{peak output current in mA})$$

4 Pole Interferential Waveform

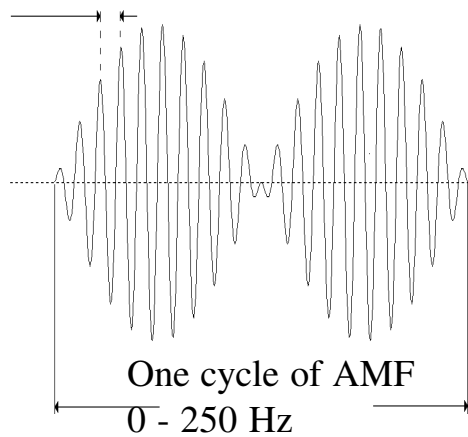


Carrier	Channel A		Channel B	
	Frequency	Period	Frequency	Period
2 kHz	2 kHz	500 us	1.75-2 kHz	572-500 us
	4 kHz	250 us	3.75-4 kHz	267-250 us

2 pole Interferential Waveform

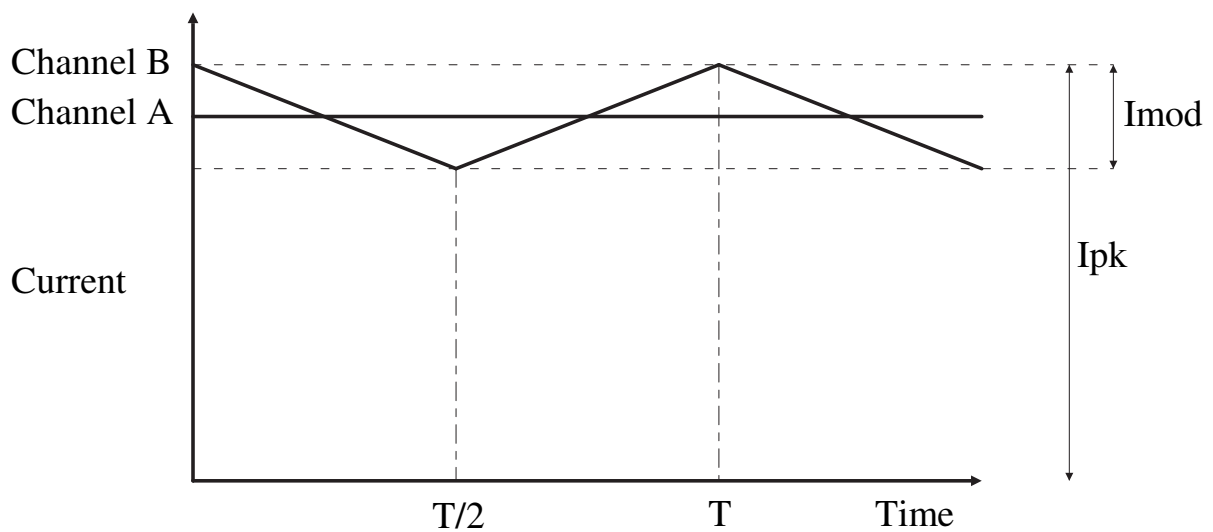
One cycle of Carrier
2 or 4 kHz

OV reference



Vector

When Vector is selected Channel A is held at a constant value determined by the output control and Channel B is slowly varied (see graph below).



The Period of the Vector is T

The depth of the Vector is I_{mod}/I_{pk}

For "Slow" vectoring the period is 30 seconds and the depth is 30%

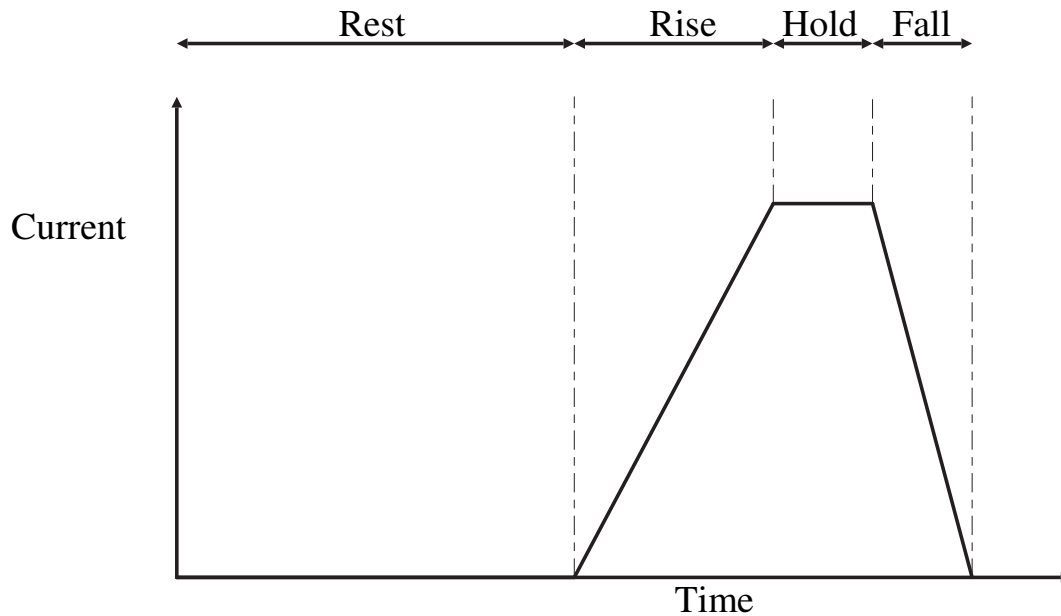
For "Fast" vectoring the period is 5 seconds and the depth is 25%

These parameters may be defined by the user to be any value from 1 to 100 seconds for the period and 1 to 100% for the depth.

Surge

When surge is selected both channels are varied together from zero output to the level set by the output control.

Graph show current in each channel. The Rest, Rise, Hold and Fall time are given in the table but may be defined by the user (any section may be from 1 to 100 seconds).

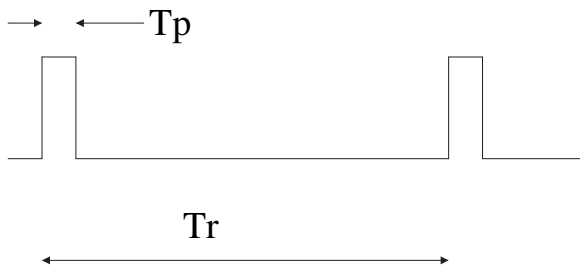


Rate	Rest	Rise	Hold	Fall
10	3	1	1	1
6	5	2	2	1
3	10	4	4	2

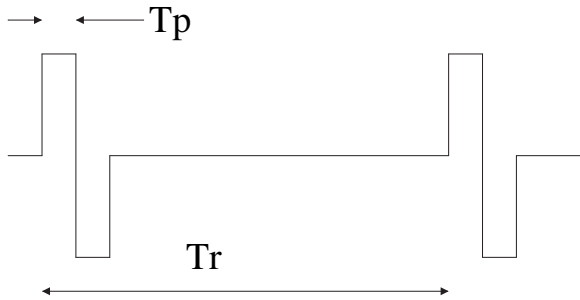
Rates are in surges per minute

Times for each section are in seconds.

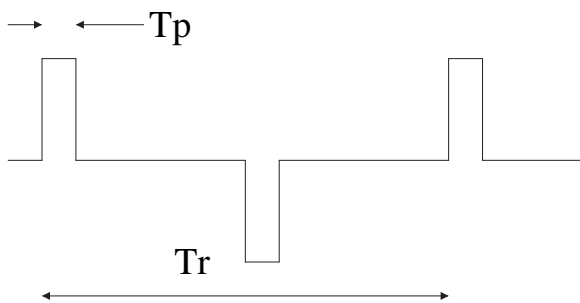
TENS Waveforms



Asymmetric Waveform



Symmetric Waveform



Sequential Waveform

For all waveforms the pulse width (T_p) may be set from 50 to 400 μ s and the repetition frequency ($1/T_r$) from 1 to 250 Hz. All waveforms have no direct current component.

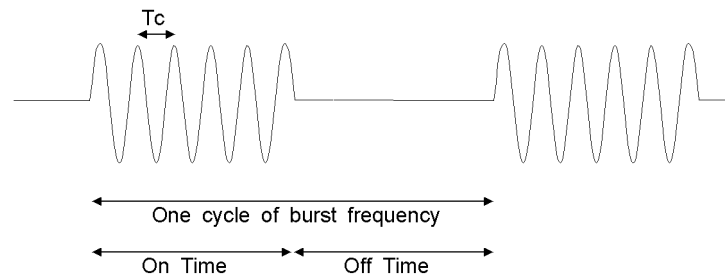
TENS Burst Mode

For pulse frequencies greater than 20 Hz the TENS output is on for 1/4 second and off for 1/4 second (2 Hz burst frequency). For frequencies less than 20 Hz then on and off times are 5 pulse periods (T_r above).

TENS Surge Mode

For pulse frequencies greater than 5 Hz the TENS output is zero for 2 seconds (rest period); the pulse width then increases to its set value during then next second (rise) and remains at the set value for 0.5 seconds (hold), finally returning to zero during the next 0.5 seconds (fall). The surge rate is, therefore, 15 per minute. At frequencies below 5 Hz, the rest, rise, hold and fall times are 10, 5, 2 and 2 pulse periods respectively.

Russian Stimulation Waveform



The period of the carrier, T_c , is 400 microseconds (frequency 2.5 kHz).

The burst frequency may be from 1 to 100 Hz.

The on time to off time ratio may be from 1:1 to 1:9.

Installation

The Interferential Module is a therapy module and should be installed in a Medi-Link system either adjacent to the Control Module, or next-but-one to the Control Module.

1. Turn OFF the Medi-Link system and remove the mains cable.
2. If fitted remove the carrying handle from the system. This is done by pushing the release button on the handle away from the system and pulling the handle upwards until it disengages from the three fixings on the right of the system.
3. Place the Interferential Module next to the Medi-Link system on a flat surface.
4. Push in the button on the front of the Interferential Module and slide the module onto the three fixings on the end of the Medi-Link system.
5. When in position release the button and the module should latch onto the system. If this does not occur, pressing the modules together should result in the latching action. Although the modules may simply be pressed together, use of the release button is recommended.
6. DO NOT attempt to add or remove a module when the system is on.
7. Connect the mains cable to the socket on the rear of the Control Module, release and position the display, and switch on the Medi-Link system.
8. The system will display the EMS logo, Company name and MEDI-LINK followed by the message "Checking system configuration" (see figure 1). The Medi-Link will detect the presence of the Interferential Module, give a short beep and display the messages "Configuration has changed" and "Loading application programs". The Medi-Link will then take between 15 and 45 seconds to re-configure itself and load the new application.
9. On successfully loading the application programs the display will show the System Menu screen (see figure 2).
10. Note that the next time the system is switched on there will be no need for the Medi-Link system to re-load the application programs. On switching on the display will show the EMS logo, Company name, MEDI-LINK and the "Checking system configuration" message for approximately 2 seconds followed by the System Menu.



**Electro-Medical Supplies
(Greenham) Ltd.**

MEDI-LINK

Checking system configuration

Figure 1 - Logos and Company name

SYSTEM MENU	
1 INTERFERENTIAL	22 Oct 94
2 ULTRASOUND	14:25:00
SYSTEM SET-UP	
HELP	

Figure 2 - System Menu

Controls and Markings

With the exception of the output current, all other settings for the Interferential Module are input from the Medi-Link Control Module. The Output Level Control is located at the top of the module (see figure 3)

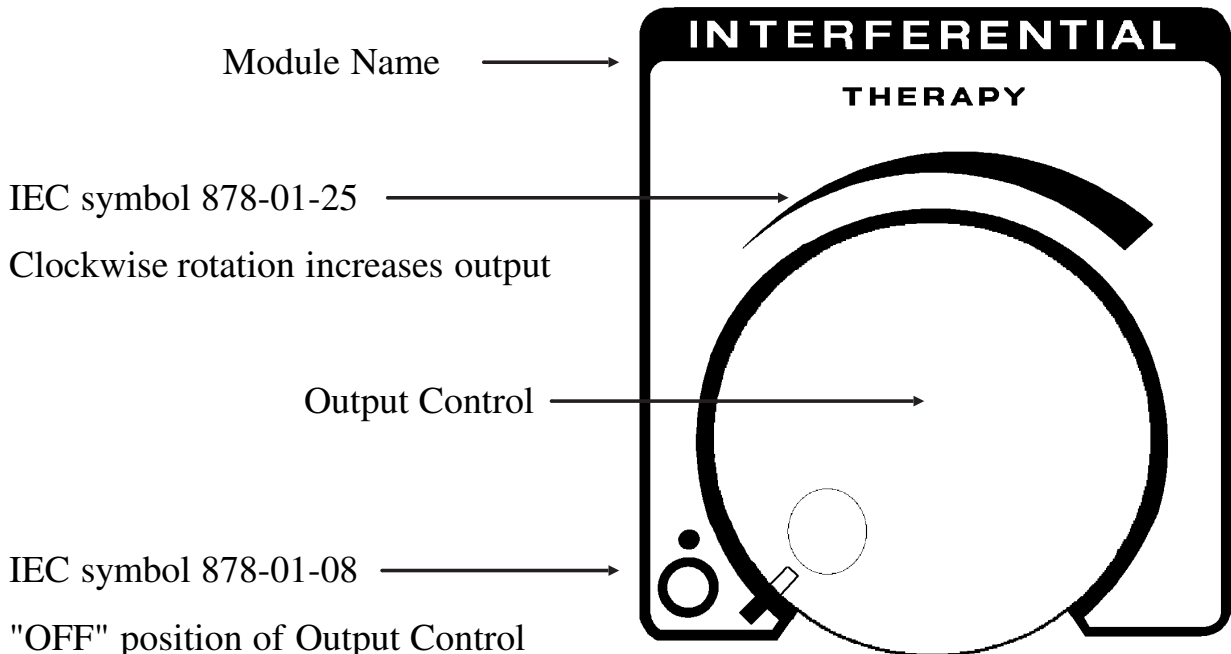


Figure 3 - Output Control

There are 2 sockets on the front panel of the module. The right hand socket is the Output Socket for connection of patient leads. The left hand socket is for the optional Remote Control. Beneath each socket is an indicator light showing when each socket is active (See figure 4).

Model number, serial number and date of manufacture are located on the rear of the module (see figure 5).

The rated output current and the output frequency are also shown on the rear panel.

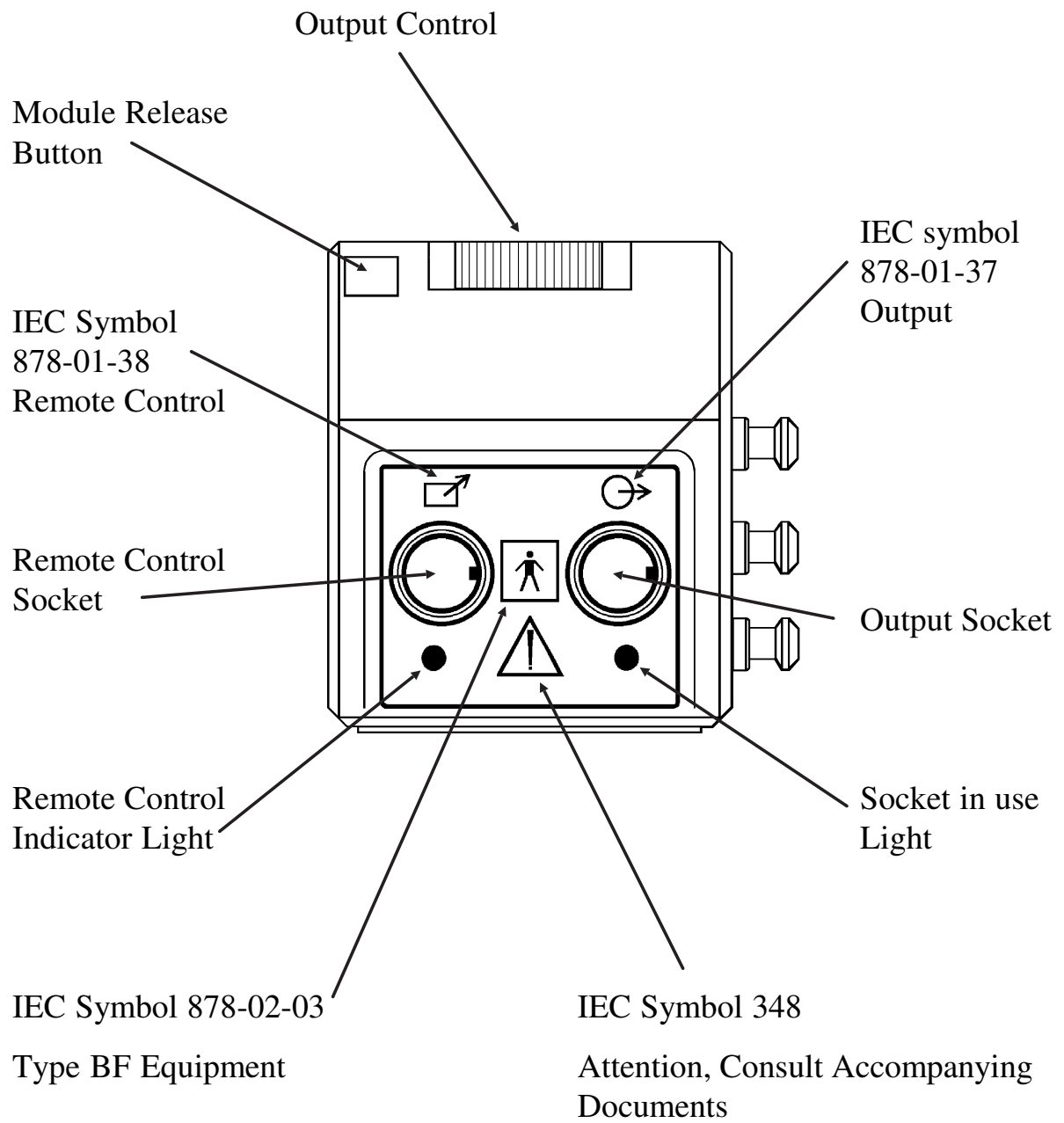


Figure 4 - Interferential Module Front View

Statement indicating that the module is only for use as part of a Medi-Link system

CE Mark showing conformity to 93/42/EEC

Model Number

Rated Output Current

Serial Number and Date of Manufacture

Output Frequency

Name and Address of Manufacturer

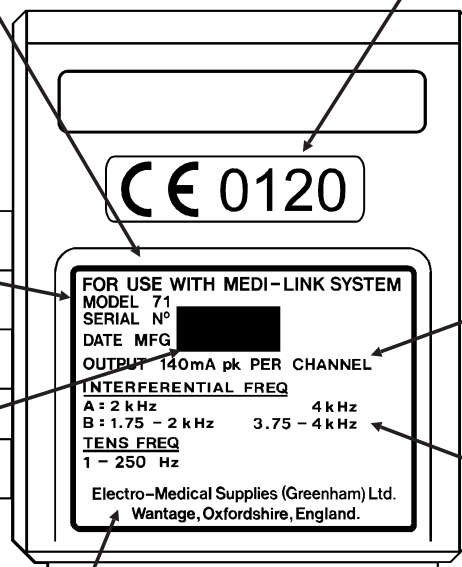


Figure 5 - Interferential Module Rear View

Operating Instructions

1. Having connected the Medi-Link system to a suitable mains supply and positioned the display at a suitable angle, switch on using the power switch on the Control Module. The mains indicator on the Control Module will light and the display will show the title screen (figure 1) and after approximately two seconds, the System Menu will appear (see figure 2).
2. Move the highlighted bar to Interferential with the up and down arrow keys and then press ENTER.
3. The Medi-Link will run the Interferential program and the display will change to show the Interferential Set-Up (figure 6). All the current settings of the module are displayed and in the box on the right of the display is a small graphic representation of the current waveform.

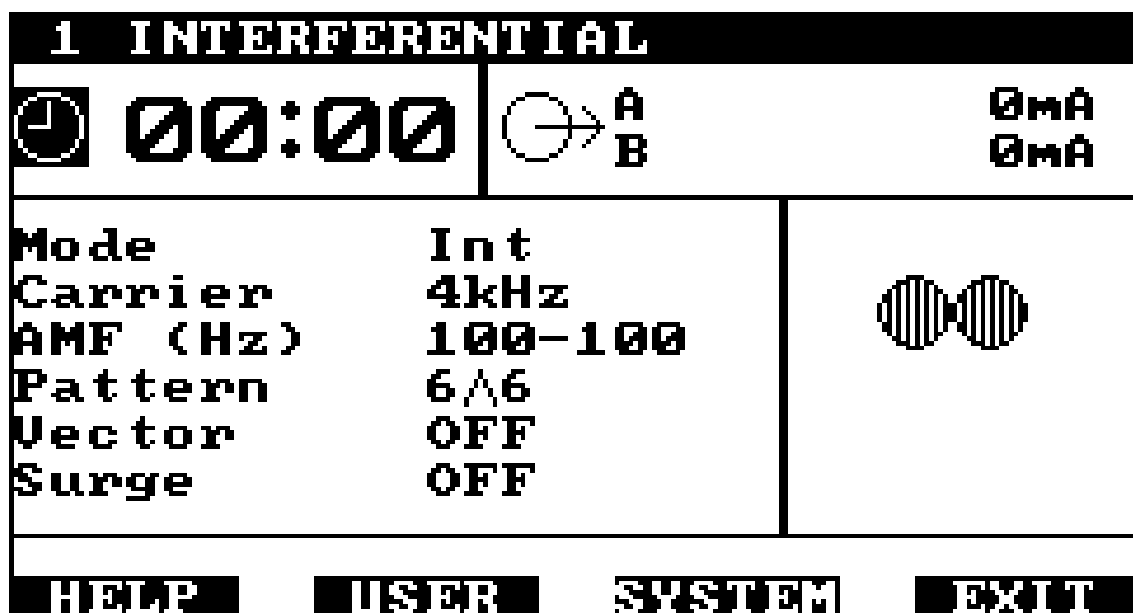


Figure 6 - Interferential Set-Up

4. If the Output Control on the Interferential Module is in the OFF position then the bottom of the screen will show the options available with the four function keys (F1-F4). If the Output Control is not in the OFF position, the message "Turn Output control Off" will flash at the bottom of the screen and an intermittent alarm will sound. The Medi-Link will not allow the user to proceed until the Output Control on the Interferential Module is returned to the OFF position.
5. To change the settings of the Interferential Module use the up and down arrow keys to highlight the parameter to be changed.

6. **Time:** The maximum Treatment Time is 30 minutes. The Treatment Time can be set in two ways.

When the clock symbol is highlighted, the Treatment Time may be incremented by 1 minute at a time by pressing the right arrow key, or decremented by pressing the left arrow key.

Alternatively, if the ENTER key is pressed when the clock symbol is highlighted, a sub-window will appear (see figure 7). The Treatment Time may now be entered from the numeric keypad, confirming the entry with the ENTER key. If F4 is pressed while the Treatment Time sub-window is displayed, the system will return to the Set-Up display without updating the time. If an invalid Treatment Time is entered (greater than 30 minutes) the system will give a short beep, clear the entry and wait for the user to enter another value. Pressing ENTER without entering a numeric value, will set the Treatment Time to zero.

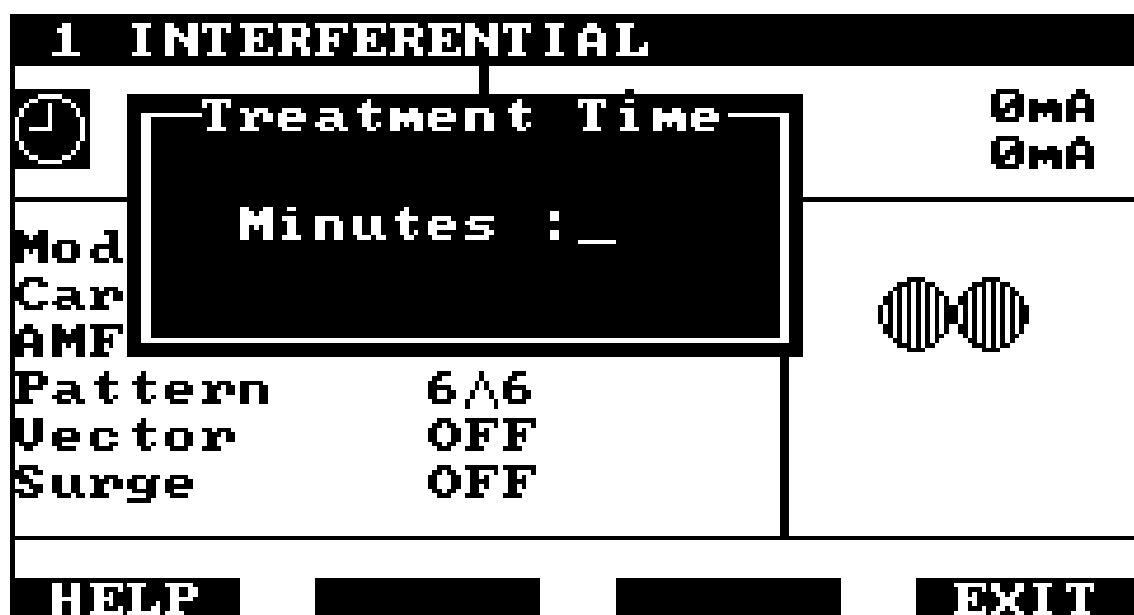


Figure 7 - Setting the Treatment Time

7. **Mode:** There are three modes of operation of the Interferential Module: Interferential, TENS and Russian currents. The mode may be set in two ways.

When the label Mode is highlighted on the Set-Up screen, pressing either the left or right arrow key will change the mode.

Alternatively, if the ENTER is pressed when the label Mode is highlighted, a sub-window will appear (see figure 8). The available options will be displayed in the sub-window with the current mode highlighted.

If F4 is pressed while the Mode sub-window is displayed, the system will return to the Set-Up screen without changing the mode.

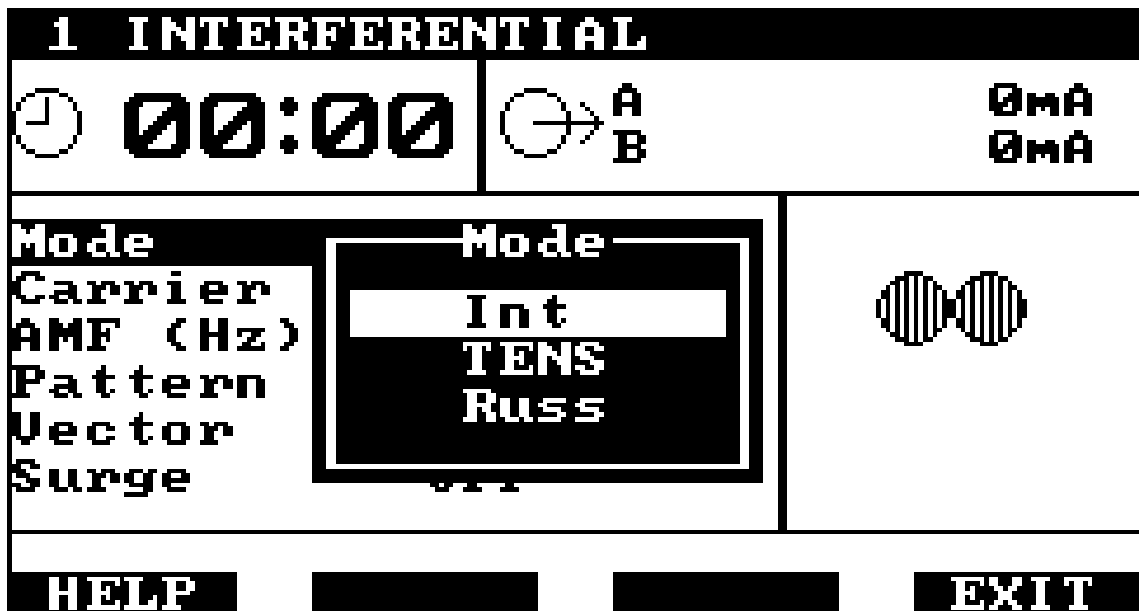


Figure 8 - Setting the Mode

Use the up and down arrow keys to highlight the required mode and then press ENTER. The system will then display a second sub-window (figure 9).

Normally the Interferential Module monitors the impedance between each pair of electrodes during treatment. If it detects an impedance too high to be able to deliver the required output current, then the output of the module is terminated and an error reported on the display (see figure 10). Before proceeding the Output Control must be returned to the OFF position.

For some applications, for example, combination therapy, it is desirable to disable the electrode monitor.

The electrode monitor will always default to on. To confirm that the electrode monitor is on, press the ENTER key. To turn off the electrode monitor use the up or down arrow key to highlight the off message and press ENTER. The system will return to the Set-Up display and update the mode. Note that the set-up display for each mode is different, and that the graphic representation of the output waveform on the right of the display will also be updated. If the electrode monitor has been turned off then an exclamation mark will appear after the mode as a warning that extra care should be taken.

If F4 is pressed while the Electrode Monitor sub-window is displayed, the system will return to the Set-Up screen without changing the mode.

If the mode is changed by using the left and right keys when the Mode label is highlighted, the electrode monitor will always be on.

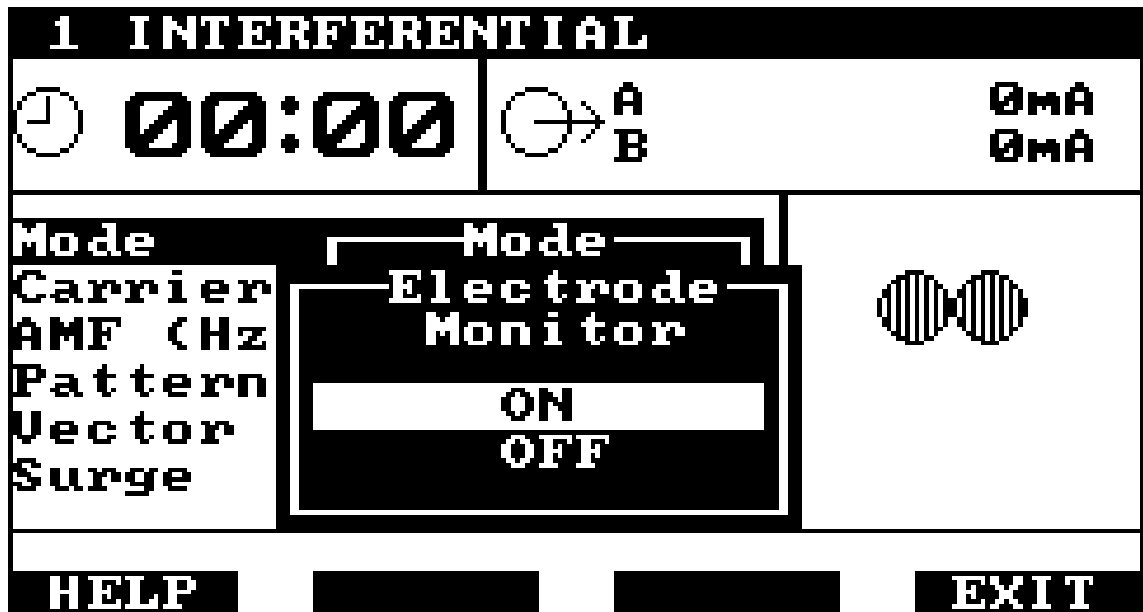


Figure 9 - Setting the Electrode Monitor

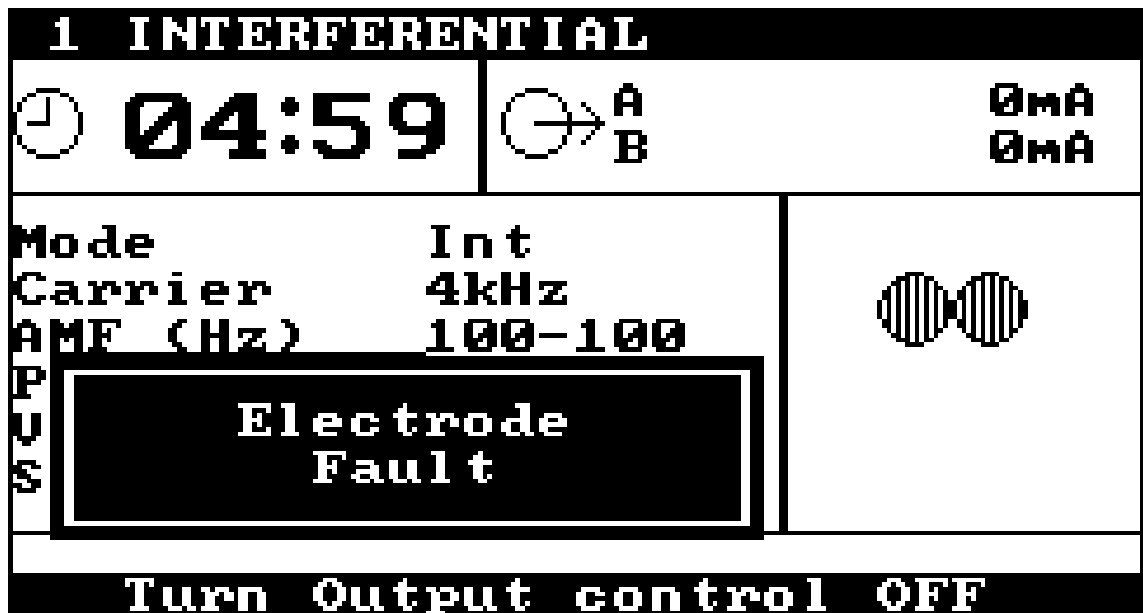


Figure 10 - Electrode Fault Display

Other options on the setup screen depend on the mode selection. When the mode is changed the list of options below the mode will be updated.

Interferential Mode

8. Carrier: There is a choice of two carrier frequencies: 2 kHz and 4 kHz. Channel A will provide an output at the chosen carrier frequency and channel B at the carrier frequency minus the AMF (Amplitude Modulation Frequency).

To change the carrier frequency, first use the up and down arrow keys to highlight the label Carrier. Then press either the left or right arrow key to change the carrier frequency.

Alternatively, if the ENTER key is pressed when the label Carrier is highlighted, a sub-window will appear (figure 11). The available options will be displayed in the sub-window with the current setting highlighted. Use the up and down arrow keys to highlight the required carrier frequency and confirm the selection by pressing the ENTER key. The system will return to the main Interferential mode set-up screen (figure 6) and display the new carrier frequency. If F4 is pressed while the Carrier sub-window is displayed, the system will return to the set-up screen without changing the carrier frequency.

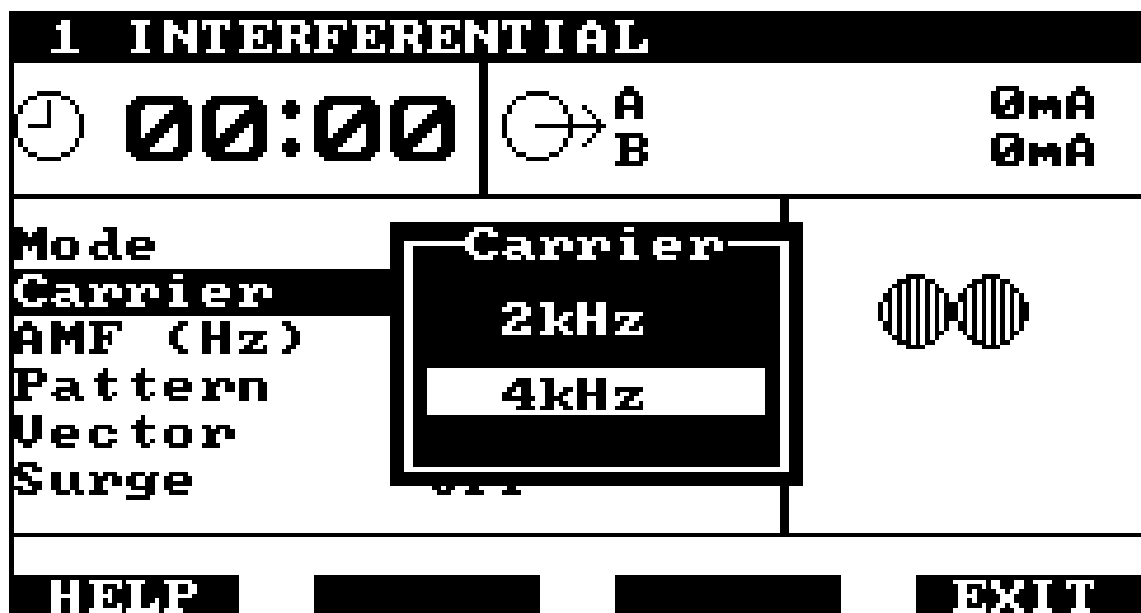


Figure 11 - Setting the Carrier Frequency

9. AMF: The Amplitude Modulation Frequency or beat frequency is set as a Base and Peak Frequency. The AMF sweeps between the Base to the Peak frequency at a rate determined by the set Pattern. If the Base and Peak frequencies are set to the same value then a constant AMF is produced.

To set the AMF press the ENTER key when the AMF label is highlighted. A sub-window will be displayed for the entry of Base and Peak frequencies (see figure 12). The screen cursor is positioned by the Base label. Enter the desired frequency using the numeric keypad, confirming the entry with the ENTER key. The left arrow key acts as a backspace in case the wrong numeric key is pressed. The screen cursor will now move down to the Peak label. If an invalid frequency is entered (greater than 250 Hz), the system will give a short beep, clear the entry and wait for the user to enter another value.

The Peak frequency is entered in exactly the same way. When ENTER is pressed following the Peak frequency entry, the system returns to the Set-Up display and the new AMF is shown. If F4 is pressed when the AMF sub-window is displayed the system will return to the Set-Up screen without changing the current AMF setting.

The Base and Peak frequencies may be set to any value from 0 to 250 Hz in 1 Hz increments. If a Peak frequency is set which is lower than the Base frequency then the system will exchange the values.



Figure 12 - Setting the AMF

10. Pattern: The pattern determines the rate at which the AMF sweeps between the Base and Peak frequencies. Three standard patterns are available. The 1|1 pattern gives 1 second at the base frequency followed by 1 second at the peak frequency. The 6|6 pattern gives 5 seconds at the base frequency, sweeps linearly to the peak frequency in 1 second, followed by 5 seconds at the peak frequency and finally sweeps back to the base frequency in 1 second. The 6^6 pattern sweeps from the base to the peak frequency in 6 seconds and then back to the base frequency in 6 seconds. The user pattern allows the base-to-peak, peak hold, peak-to-base and base hold times to be defined individually in 1 second increments.

To change the pattern, first use the up and down arrow keys to highlight the label Pattern. Then press either the left or right arrow key to change the pattern.

Alternatively, if the ENTER key is pressed when the label Pattern is highlighted, a sub-window will appear (figure 13). The available options will be displayed in the sub-window with the current setting highlighted. Also the times for base-to-peak, peak hold, peak-to-base and base hold times in seconds for the current selection are shown in a highlighted bar just above the function key labels. Use the up and down arrow keys to highlight the required pattern and confirm the selection by pressing the ENTER key. If one of the standard patterns has been selected, the system will return to the main Interferential mode set-up screen (figure 6) and display the new pattern.

If User is selected then a second sub-window will appear (figure 14).

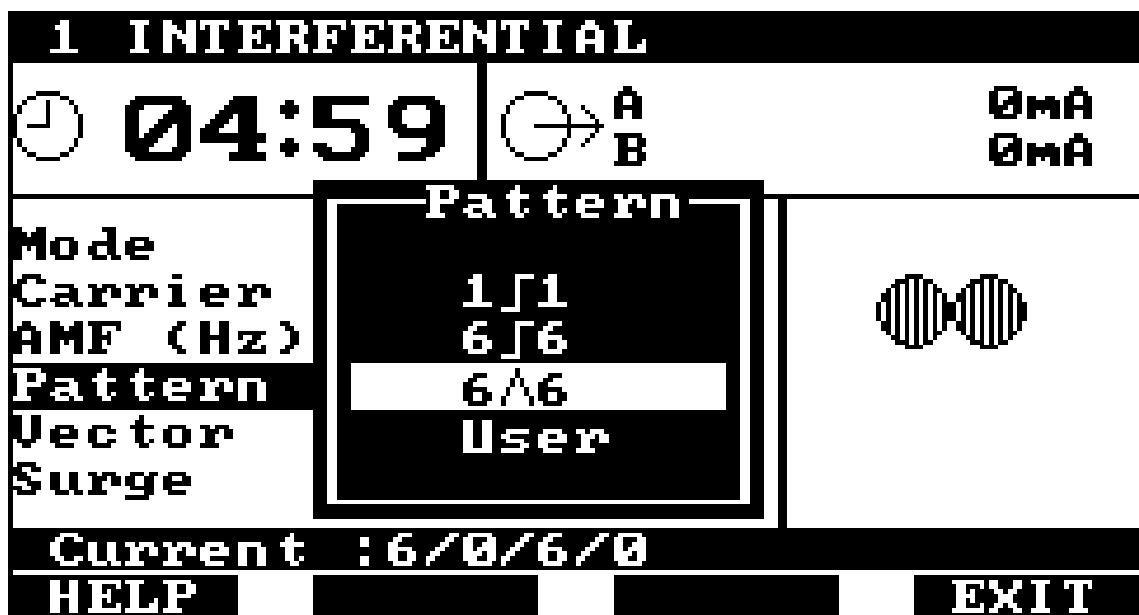


Figure 13 - Setting the Pattern

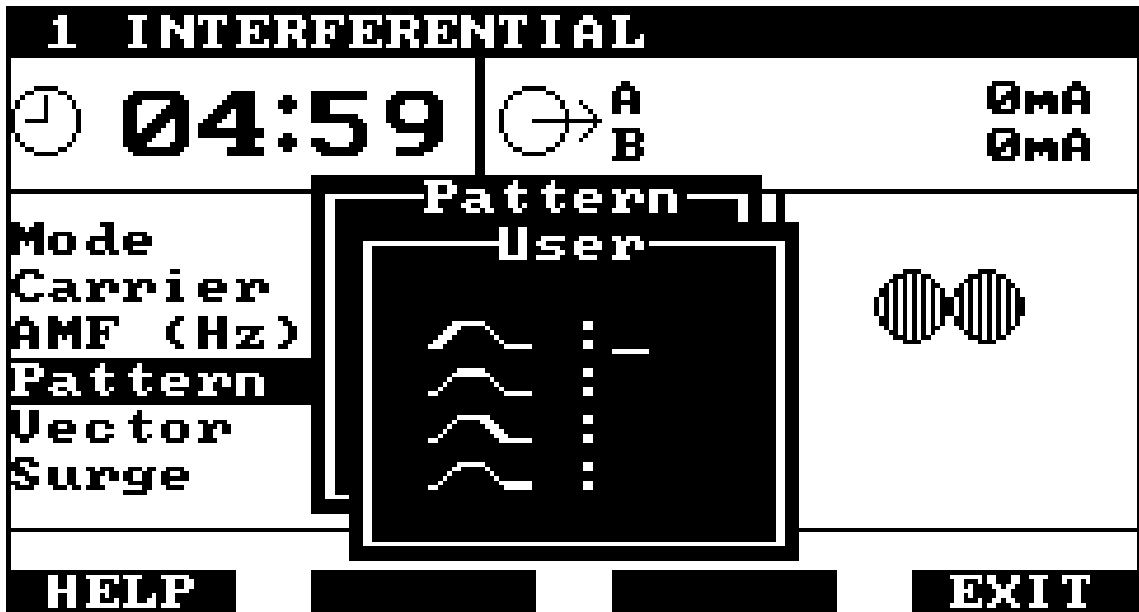


Figure 14 - Setting a User-defined Pattern

The base-to-peak, peak hold, peak-to-base and base hold times may be set individually.

Enter in turn the time in seconds for each section of the pattern using the numeric keypad. Each entry may be from 1 to 250 seconds and is confirmed by pressing the ENTER key. The left arrow key acts as a backspace if the wrong numeric key is pressed. If an invalid value (zero or greater than 250 seconds) is entered the system will give a short beep, clear the entry and wait for the user to enter another value. When the value for the final section is entered, the display will return to the main Interferential set-up screen and the pattern will be shown as User.

If F4 is pressed while the User sub-window is displayed, the system will return to the pattern sub-window display (figure 13).

If F4 is pressed while the Pattern sub-window is displayed, the system will return to the set-up screen without changing the pattern.

11. Vector: There are four vector options, off, fast, slow and user. When off is selected channels A and B give equal output currents. When one of the other options is selected channel B output current is slowly varied while channel A is set halfway between the minimum and maximum value of channel B. Details of the fast and slow options are given on page 10 of this manual.

To change the vector setting first use the up and down arrow keys to highlight the label Vector. Then press either the left or right arrow key to change the vector selection.

Alternatively, if the ENTER key is pressed when the label Vector is highlighted, a sub-window will appear (figure 15). The available options will be displayed in the sub-window with the current setting highlighted. Use the up and down arrow keys to highlight the required vector setting and confirm the selection by pressing the ENTER key. If one of the three standard options has been selected, the system will return to the main Interferential mode set-up screen (figure 6) and display the new selection.

If User is selected then a second sub-window will appear (figure 16). The modulation depth and the time (period) of the vector may now be entered using the numeric keypad. The depth may be set from 1 to 100 % and the time from 1 to 100 seconds. Each entry is confirmed by pressing the ENTER key. If an invalid number is entered (zero or greater than 100) then the system will give a short beep, clear the entry and wait for the user to enter another value. When the Time entry is confirmed the system will return to the main Interferential set-up screen and display the vector as a percentage and time in seconds.

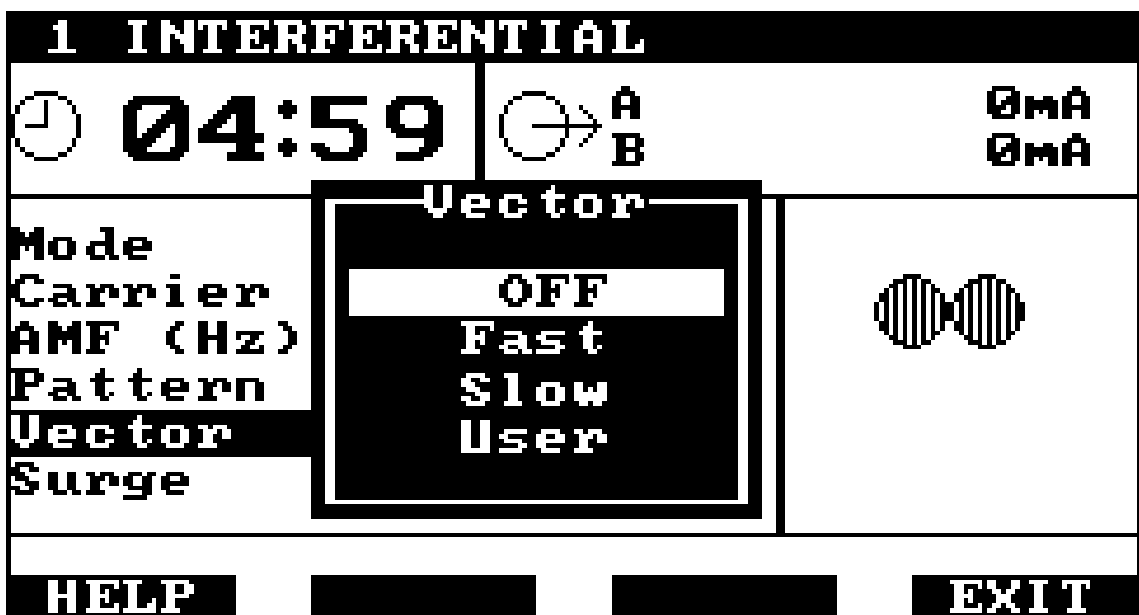


Figure 15 - Setting Vector

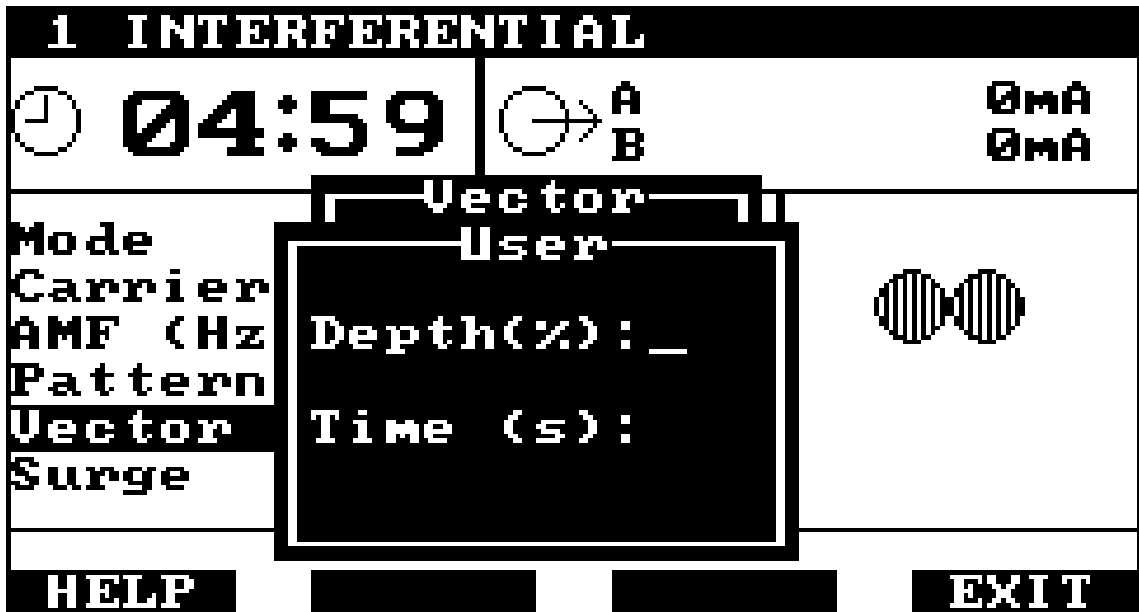


Figure 16 - Setting a User-defined Vector

If F4 is pressed while the User sub-window is displayed, the system will return to the vector sub-window display (figure 15).

If F4 is pressed while the Vector sub-window is displayed, the system will return to the set-up screen without changing the Vector setting.

12. Surge: There are five surge options, off, 10 /minute, 6 /minute, 3 /minute and user. When surge is not set to off, both channels are varied together from zero output to the level set by the output control. Detail of the standard surge rates are given on page 11 of this manual.

To change the surge setting first use the up and down arrow keys to highlight the label Surge. Then press either the left or right arrow key to change the surge selection.

Alternatively, if the ENTER key is pressed when the label Surge is highlighted, a sub-window will appear (figure 17). The available options will be displayed in the sub-window with the current setting highlighted. Also the times for the rise, hold, fall and rest times in seconds for the current selection are shown in a highlighted bar just above the function key labels. Use the up and down arrow keys to highlight the required surge and confirm the selection by pressing the ENTER key. If one of the four standard options has been selected, the system will return to the main Interferential mode set-up screen (figure 6) and display the new selection.

If User is selected then a second sub-window will appear (figure 18). A surge pattern may now be defined in terms of rise, hold, fall and rest times. Enter the time in seconds for each section of the surge using the numeric keypad.

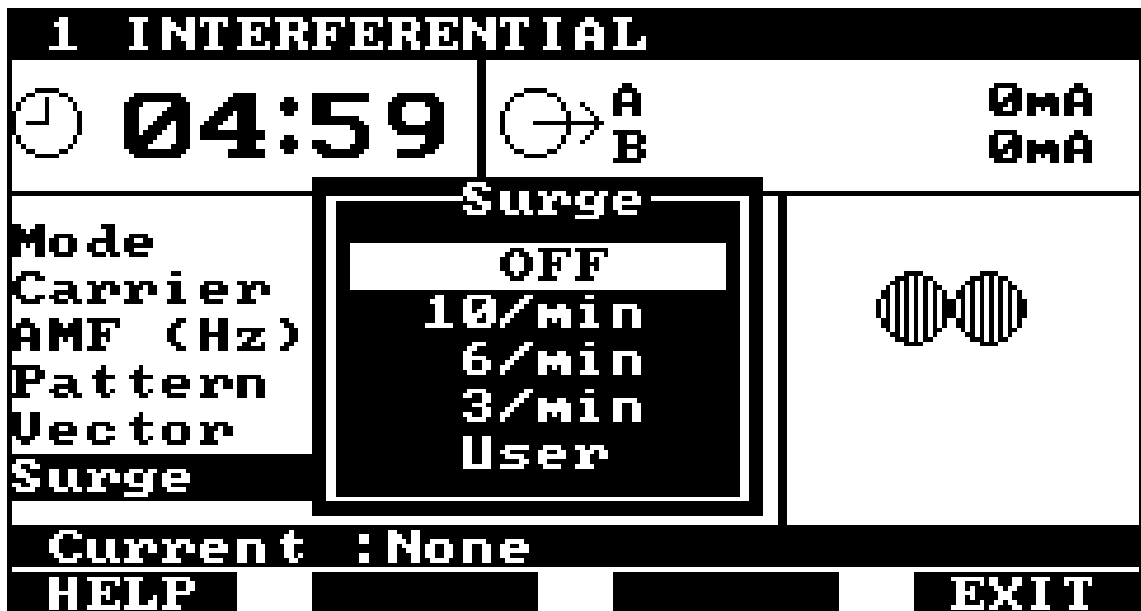


Figure 17 - Setting a Surge

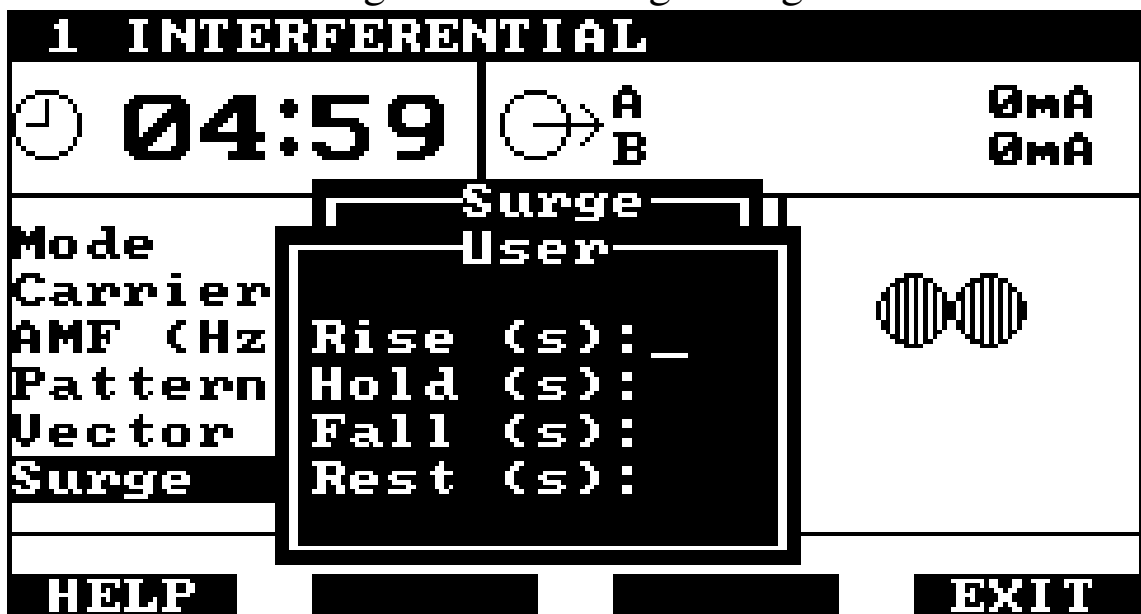


Figure 18 - Setting a User-defined Surge

Each entry may be from 1 to 100 seconds and is confirmed by pressing the ENTER key. The left arrow key acts as a backspace if the wrong numeric key is pressed. If an invalid value (zero or greater than 100 seconds) is entered the system will give a short beep, clear the entry and wait for the user to enter another value. When the value for the Rest is entered, the display will return to the main Interferential set-up screen and the pattern will be shown as User.

If F4 is pressed while the User sub-window is displayed, the system will return to the surge sub-window display (figure 13).

If F4 is pressed while the surge sub-window is displayed, the system will return to the set-up screen without changing the surge.

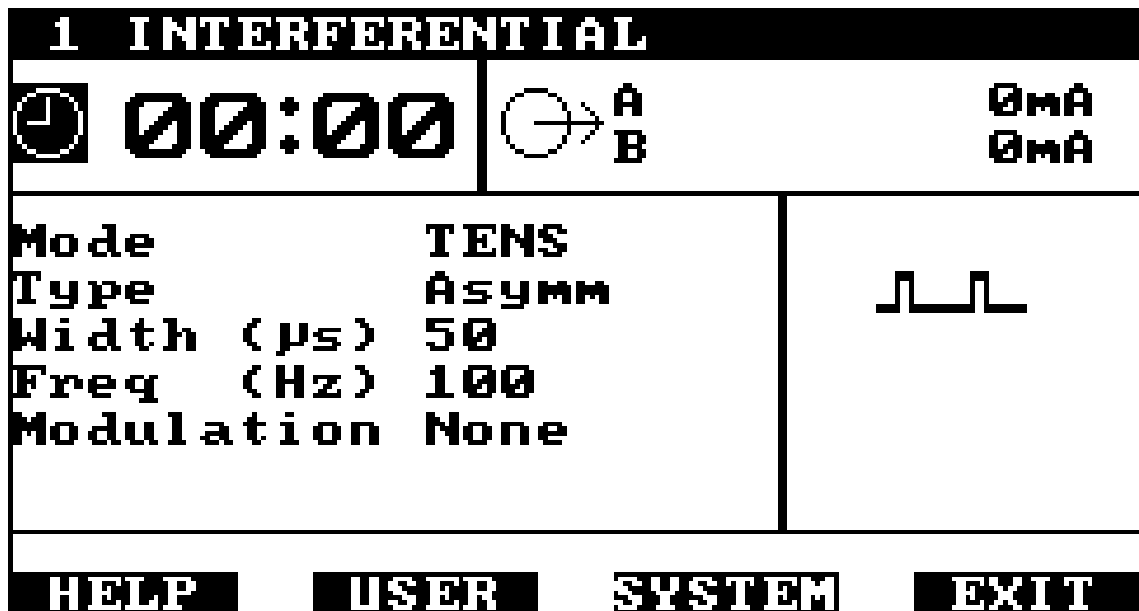


Figure 19 - TENS Set-up

TENS Mode

13. Type: Three types of TENS waveforms are available: asymmetrical biphasic (Asymm), symmetrical biphasic (Symm) or sequential pulses (Seq) (see page 12).

To change the TENS type, first use the up and down arrow keys to highlight the label Type. Then press either the left or right arrow key to change the TENS waveform type.

Alternatively, if the ENTER key is pressed when the label Type is highlighted, a sub-window will appear (figure 20). The available options will be displayed in the sub-window with the current setting highlighted. Use the up and down arrow keys to highlight the required type and confirm the selection by pressing the ENTER key. The system will return to the main TENS set-up screen (figure 19), display the new type and update the graphic representation of the waveform on the right of the screen.

If F4 is pressed while the Type sub-window is displayed, the system will return to the set-up screen without changing the setting.

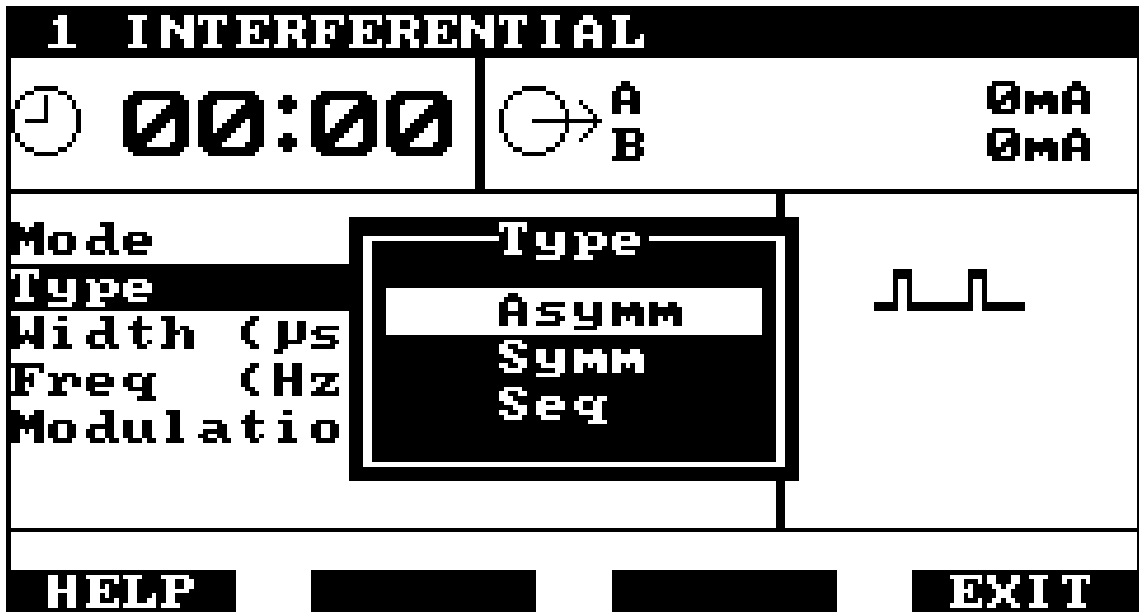


Figure 20 - Selecting the TENS waveform

14. Width (us): To set the TENS pulse width, first highlight the label Width using the up and down arrow keys and then press ENTER. A sub-window will be displayed for the pulse width (see figure 21). The screen cursor is positioned by the Width label. Enter the desired pulse width in microseconds using the numeric keypad, confirming the entry with the ENTER key. The left arrow key acts as a backspace incase the wrong numeric key is pressed. If an invalid width is entered (less than 50 or greater than 400), the system will give a short beep, clear the entry and wait for the user to enter another value.

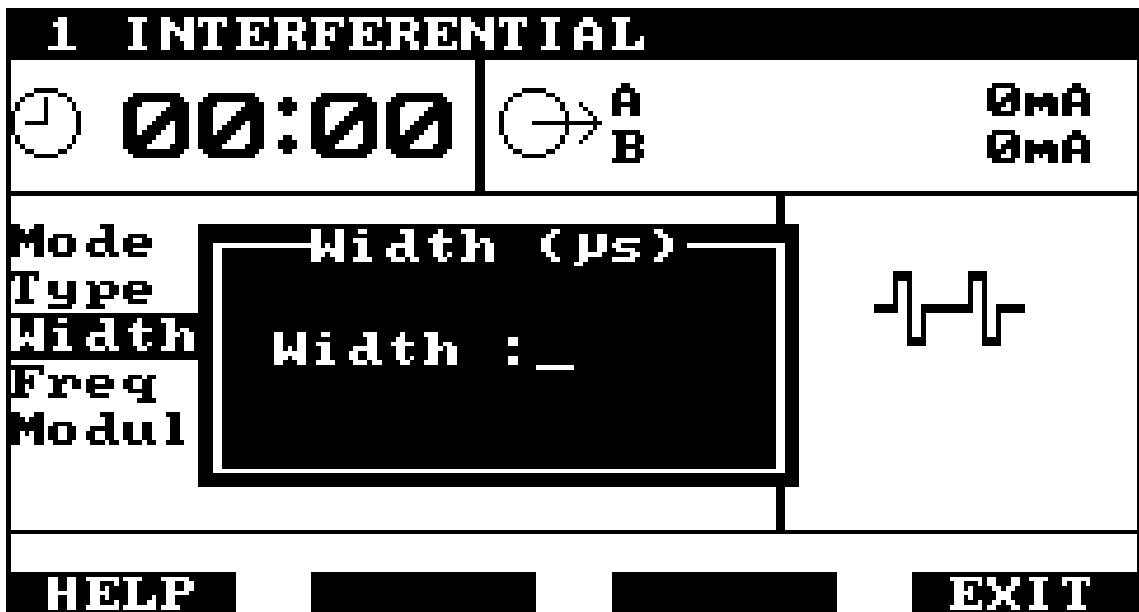


Figure 21 - Setting the TENS Pulse Width

Pulse widths are available in 5 microsecond increments from 50 to 400 us. If a value is entered that is not a multiple of 5 then the system will round the entry up to the next available width.

When the width has been entered the system will return to the main TENS set-up screen and display the new width.

If F4 is pressed while the Width sub-window is displayed, the system will return to the set-up screen without changing the setting.

15. Freq (Hz): The TENS frequency may be set to values between 1 and 250 Hz in 1 Hz increments.

To set the TENS frequency, first highlight the label Freq using the up and down arrow keys and then press ENTER. A sub-window will be displayed for the frequency (see figure 22). The screen cursor is positioned by the Freq label. Enter the desired frequency in Hz using the numeric keypad, confirming the entry with the ENTER key. The left arrow key acts as a backspace in case the wrong numeric key is pressed. If an invalid frequency is entered (0 or greater than 250), the system will give a short beep, clear the entry and wait for the user to enter another value.

When the frequency has been entered the system will return to the main TENS set-up screen and display the new value.

If F4 is pressed while the frequency sub-window is displayed, the system will return to the set-up screen without changing the setting.



Figure 22 - Setting the TENS Frequency

16. Modulation: The TENS output may be continuous, in bursts or surged (see page 12). To set the modulation type, first use the up and down arrow keys to highlight the label Modulation. Then press either the left or right arrow key to change the modulation type.

Alternatively, if the ENTER key is pressed when the label Modulation is highlighted, a sub-window will appear (figure 23). The available options will be displayed in the sub-window with the current setting highlighted. Use the up and down arrow keys to highlight the required type and confirm the selection by pressing the ENTER key. The system will return to the main TENS set-up screen (figure 19), display the new modulation type.

If F4 is pressed while the modulation sub-window is displayed, the system will return to the set-up screen without changing the setting.

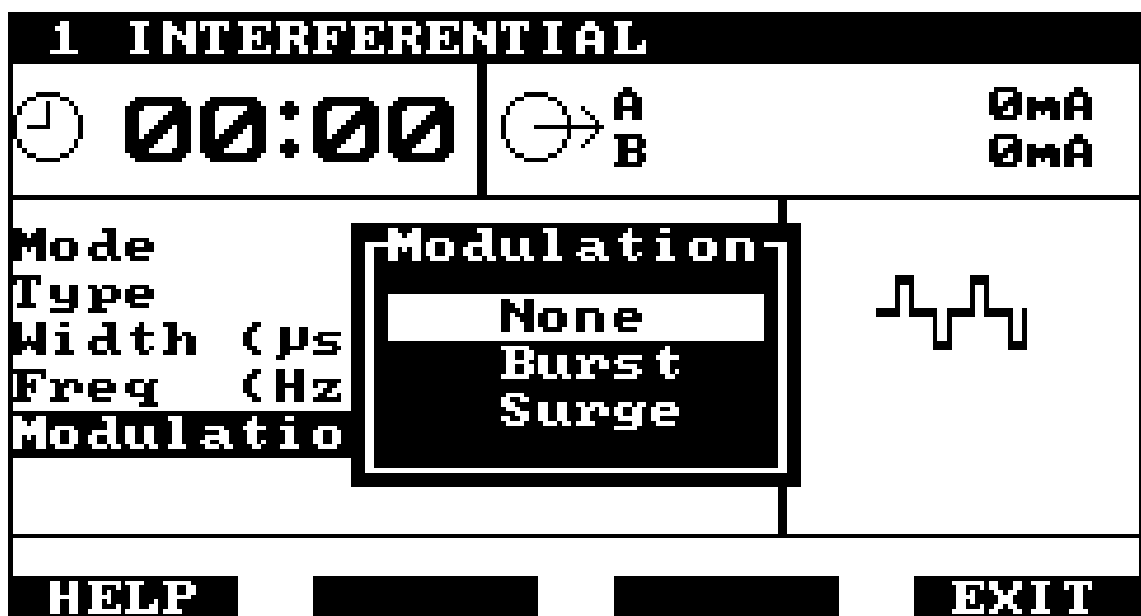


Figure 23 - Setting the TENS Modulation

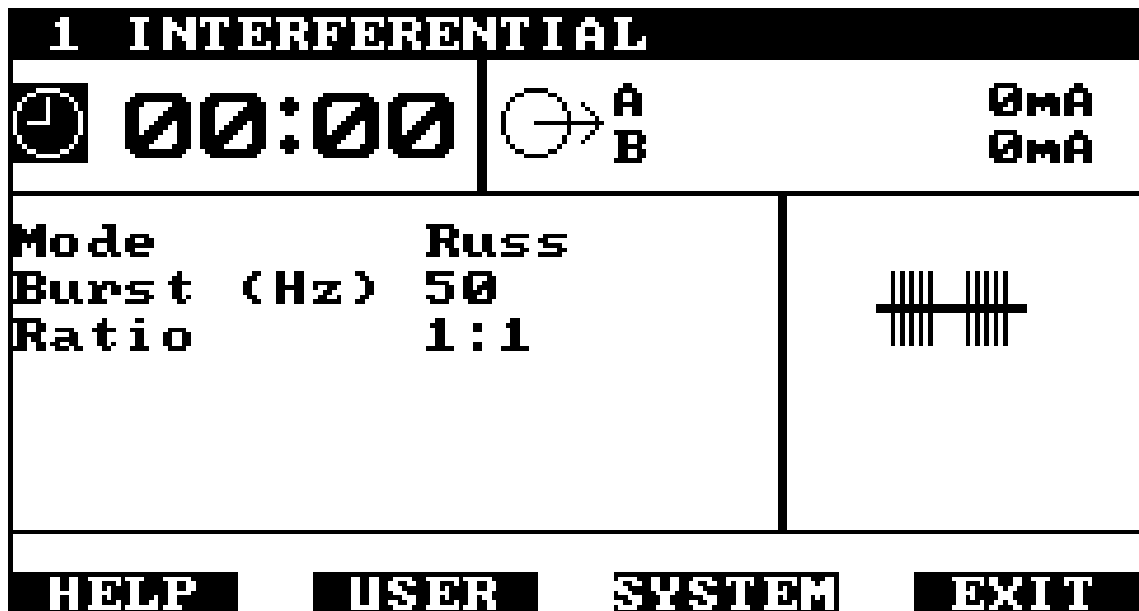


Figure 24 - Russian Set-up

Russian Mode

17. Burst (Hz): The burst frequency of the Russian stimulation waveform may be set to values between 1 and 100 Hz in 1 Hz increments.

To set the burst frequency, first highlight the label Burst (Hz) using the up and down arrow keys and then press ENTER. A sub-window will be displayed for the frequency (see figure 25). The screen cursor is positioned by the Freq label. Enter the desired frequency in Hz using the numeric keypad, confirming the entry with the ENTER key. The left arrow key acts as a backspace in case the wrong numeric key is pressed. If an invalid frequency is entered (0 or greater than 100), the system will give a short beep, clear the entry and wait for the user to enter another value.

When the frequency has been entered the system will return to the main Russian set-up screen and display the new value.

If F4 is pressed while the frequency sub-window is displayed, the system will return to the Russian set-up screen without changing the setting.



Figure 24 - Setting the Russian Burst Frequency

18. Ratio: The burst ratio of the Russian waveform (on:off ratio) may be from 1:1 to 1:9.

To set the ratio first use the up and down arrow keys to highlight the label Ratio. Then press either the left arrow key to decrease the ratio or the right arrow key to increase the ratio.

Alternatively, if the ENTER key is pressed when the label Ratio is highlighted, a sub-window will appear (figure 25). The screen cursor is positioned by the Burst 1: label. Enter the desired ratio using the numeric keypad, confirming the entry with the ENTER key. The left arrow key acts as a backspace in case the wrong numeric key is pressed. If an invalid ratio is entered (0 or greater than 9), the system will give a short beep, clear the entry and wait for the user to enter another value.

When the ratio has been entered the system will return to the main Russian set-up screen and display the new value.

If F4 is pressed while the ratio sub-window is displayed, the system will return to the set-up screen without changing the setting.

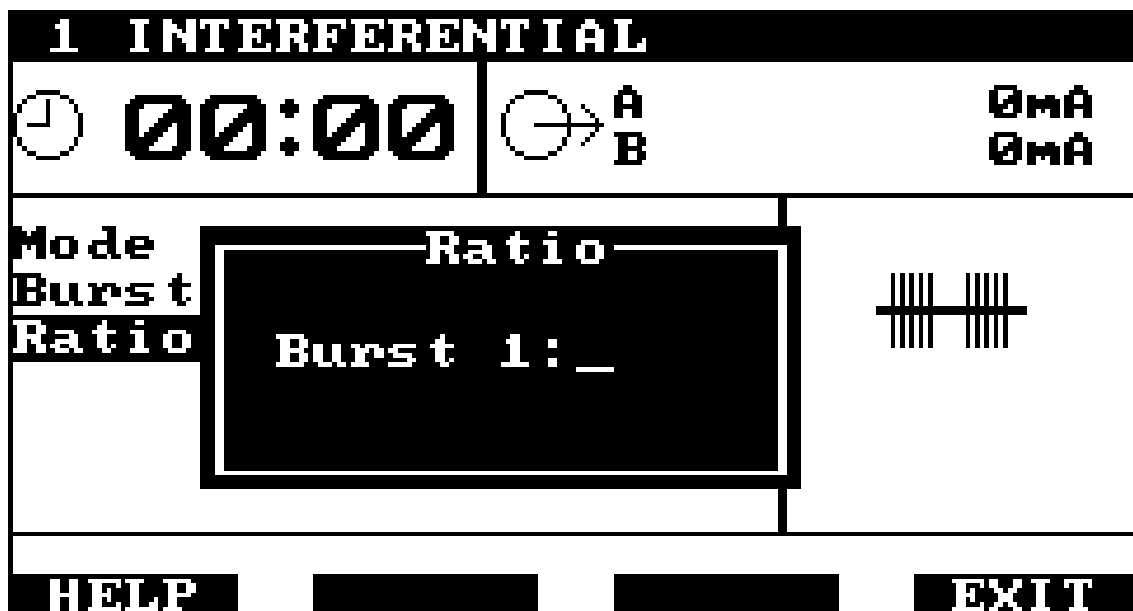


Figure 25 - Setting the Russian Burst Frequency

19. When all the settings are as required, select either the 2-way output lead for 2-pole interferential therapy or 4-way output lead and connect it to the output socket on the front of the module (see figure 4).

When using TENS or Russian stimulation, both A and B channels are energised. If only one channel is required still use the 4-pole lead and either disable the electrode monitor or short circuit the unused channel to prevent unwanted electrode faults terminating the treatment.

Attach suitable electrodes to the patient and connect to the output lead using the blue and yellow cables provided. See section on Electrodes for further advice on applying these.

20. Slowly advance the Output Control (see figures 3 and 4) located on the Interferential Module. It will be felt to click on. If the Treatment Time is zero, then the message "Turn Output control Off" will flash at the bottom of the display and the system will give an intermittent alarm until the control is returned to its OFF position.

If all settings are valid then the word "Treatment" will flash at the bottom of the display and the Treatment Time will begin to count down from its set value.

Always advance the control slowly. If the control is advanced too quickly initially then the Interferential module will not energise its output and the message "Output Error" will be displayed (figure 26). Turn off the Output Control and try again.

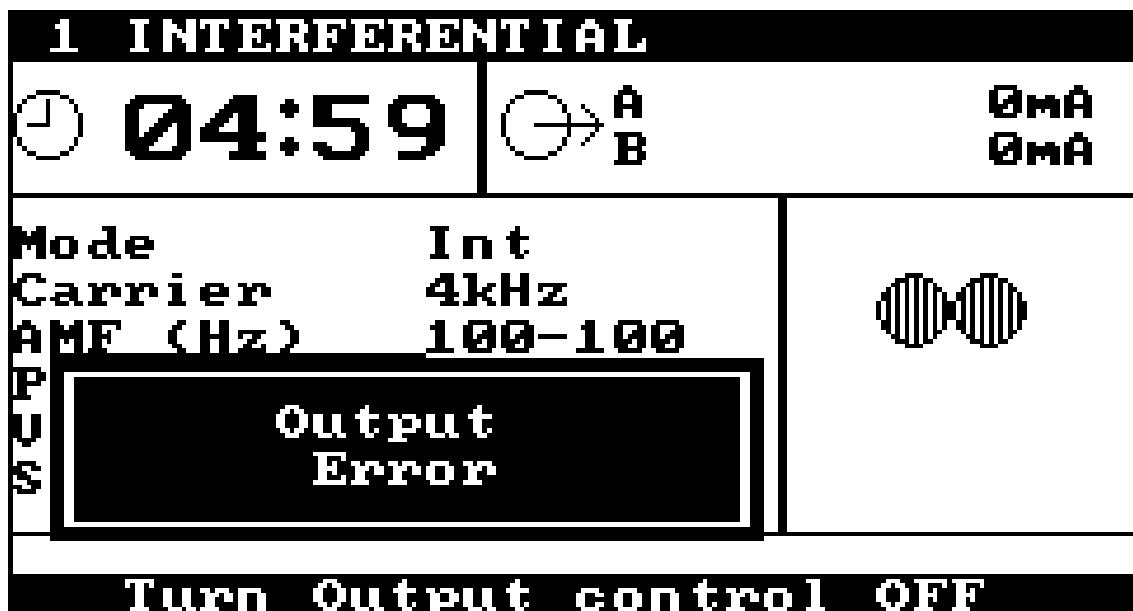


Figure 26 - Output Error Display

Slowly advance the Output Control until the patient feels the effect of the applied current. The output display at the top right, will show the peak currents in each channel together with the adjacent bar graphs (see figure 27).

If the module detect a high electrode impedance at any time during treatment then the output of the Interferential Module is immediately terminated and the error is displayed (see figure 10). Turn the Output Control off and check that the electrodes are secure, and the sponges are damp. Also, check all interconnecting leads before re-applying the output to the patient. Note that in soft water areas it may be necessary to add a small amount of bicarbonate of soda to the water used to wet the sponges to achieve adequate contact.

During the last 5 seconds of any treatment the output is smoothly reduced to zero.

When the Treatment Time reaches zero, then the message "Turn Output control Off" will flash at the bottom of the display and the system will give an intermittent alarm until the control is returned to its OFF position.

21. Remote Control: An optional Remote Control is available for use with the Interferential Module. This Remote Control is connected via the socket on the front of the Module (See figure 4).

The output controls on the Interferential Module and Remote Control can only be used individually. If both of the output controls are turned on at the same time then the "Output Error" message will be displayed (see figure 26) and **both** controls must be returned to their OFF positions before proceeding.

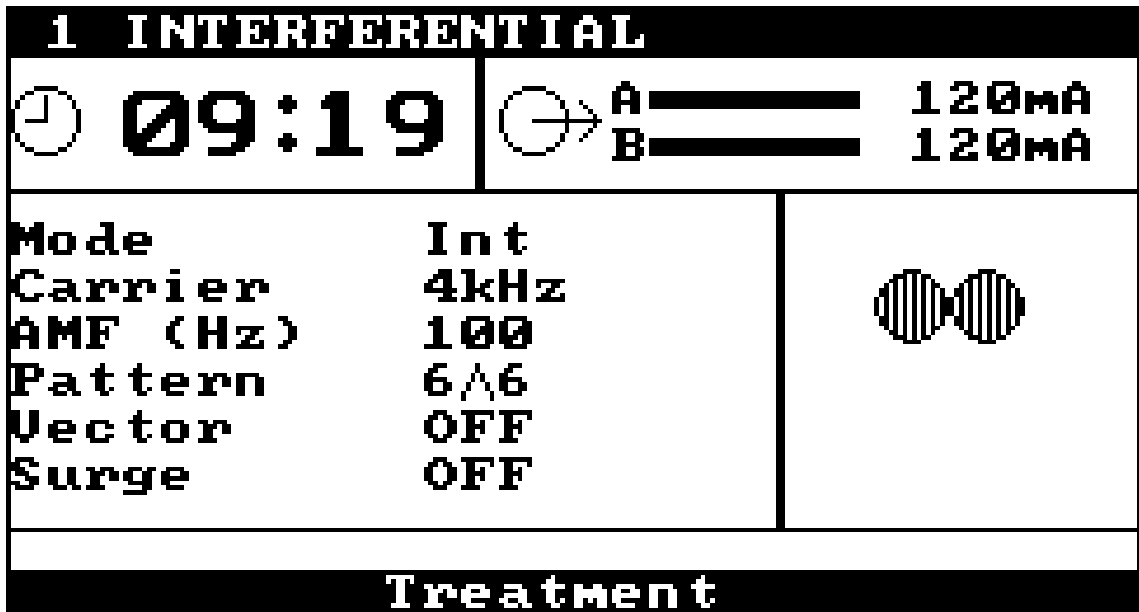


Figure 27 - Display during treatment

22. **F1 - HELP:** When the label for function key F1 is HELP, pressing F1 will suspend the current activity and the display will show help text relevant to the current display or activity (see figure 28) . If the help text is more than can be displayed at one time, it may be scrolled up or down, one line at a time using the up and down arrow keys, or one screen full at a time by pressing F2 - PgUp or F3 - PgDn. To exit from HELP, press F4.

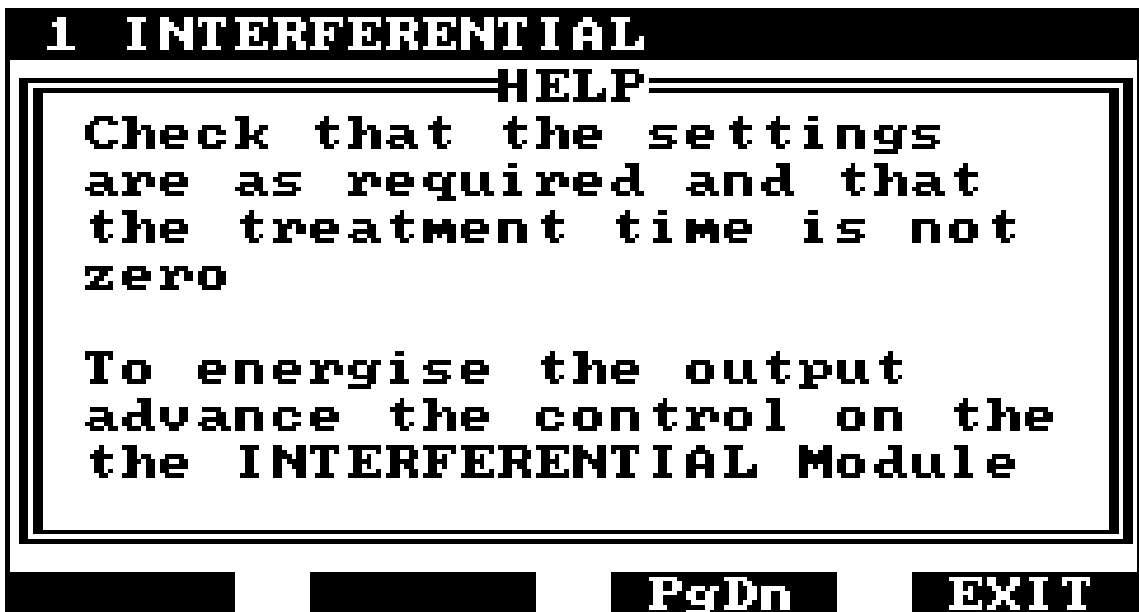




Figure 28 - Help Text Display

23. **F2 - USER:** In order to save time setting up the Interferential Module up to 16 individual set-ups can be saved as "User Defined Programs". To save the current set-up as a user defined program, press F2-USER from the main Set-Up display. The system will recall previously saved programs and display them as in figure 29.

1 INTERFERENTIAL		USER		0mA
 1 <hr/> Mode Type Width Freq Modul	No	SET-UP	0mA	
	1	15 4kHz 100-100		
	2	20 2kHz 1-100		
	3	20 4kHz 50-100		
	4	20 4kHz 1-10		
	5	20 4kHz 100-100		
	6	10 TENS 200/35		
	7	-	-	
	8	-	-	

HELP LOAD SAVE EXIT

Figure 29 - User Program Display

Programs shown as dashes, for example, programs 7 and 8 in figure 29, have not been used and are blank.

Use the up and down arrow keys to highlight the program to which the current set-up is to be saved. Note that only 8 programs are displayed at a time, and when the highlight bar reaches the bottom of the user sub-window, pressing the down key will cause the programs to scroll giving access to all 16 programs.

To save the current set-up, press F3 - SAVE. The system will save the set-up and return to the main Set-Up display.

To recall a previously saved program, again press F2 - USER to display the user defined programs. Use the up and down arrow keys to highlight the program to be recalled.

To recall the program press F2 - LOAD. The system will return to the Set-Up display and update the settings to those of the recalled program. If an undefined program is selected the system will give a short beep and wait for the user to make another selection.

To exit from the user sub-window without loading or saving a user defined program, press F4 - EXIT.

24. **F3 - SYSTEM:** Pressing F3 - SYSTEM returns the user back to the System Menu, but without stopping the Interferential program running. This enables the user to run another application, for example, an Ultrasound program for combination therapy. When F3 - SYSTEM is selected the Interferential set-up is shown as an inset screen to the right of the display (see figure 30).

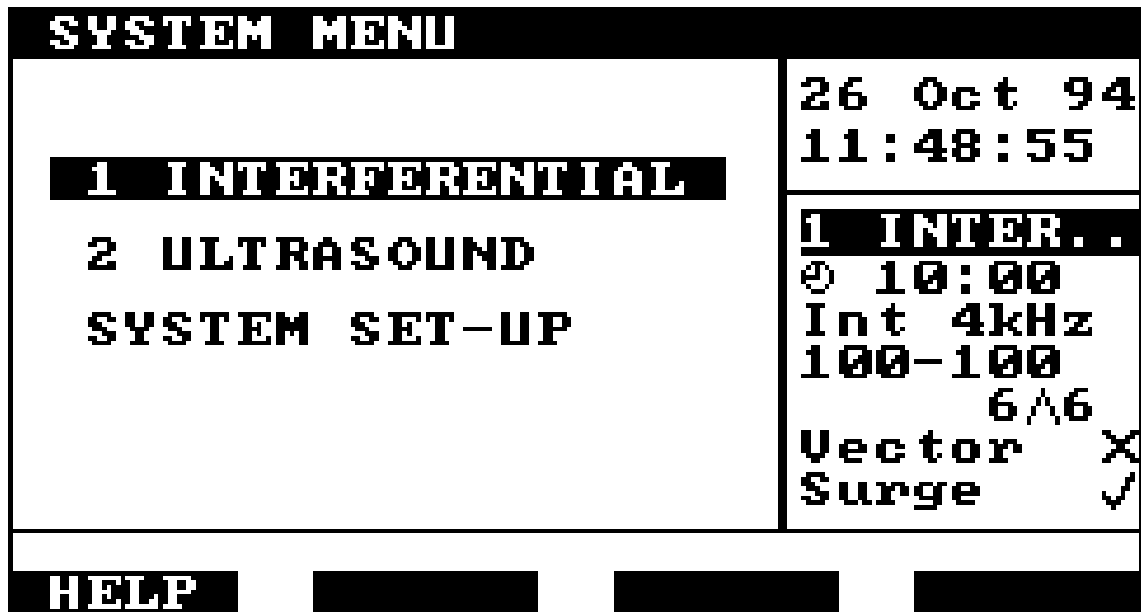


Figure 16 - Interferential Module as inset screen

When running as an inset screen, the output may be turned on in exactly the same way as when the full screen display is available, and all electrode faults and output errors are still reported as before. The only restriction is that the keys on the Control Module are now assigned to another program. All set-up must be done in full screen mode. Then select the SYSTEM option before turning the output on. Another module may then be selected and set-up for treatment.

25. **F4 - EXIT:** Pressing F4 - EXIT at the Interferential Module Set-Up display will terminate the Interferential program and return to the System Menu. When the Interferential program is re-run from the System Menu the settings will be as they were when F4 - EXIT was pressed unless the system has been switched off.

Electrodes

It is recommended that only electrodes supplied by EMS Physio are used with the Interferential Module. Three sizes of conductive rubber electrodes are available, or alternatively the unit may be used with a Suction Unit.

The three sizes available are small (70 x 50 mm), medium (100 x 70 mm) or large (130 x 100 mm). Replacement sponge covers are available for each electrode.

Since the aim of interferential therapy is to excite as many sensory receptors and peripheral nerves as possible, it is sensible to use as large an electrode as is practical for the area of the body being treated. This will also reduce the possibility of any adverse effects at the site of the electrode due to high current density.

Inspect the area to be treated to ensure there are no open wounds, areas of infection, abrasions etc. Wash the skin in warm soapy water to minimise skin impedance and remove any creams or gels that may have been used.

Explain to the patient what is being done and what is going to happen.

Soak the sponge electrode covers in warm water. In a soft water area it may be necessary to add a small amount of bicarbonate of soda to the water to ensure low contact impedance for the electrodes. Fit the rubber electrodes into the sponge covers.

Apply the electrodes to the patient using the elasticated bandages supplied. The bandages must cover the whole of the electrode and maintain an even pressure in order to achieve a uniform current flow. A piece of polythene may be used between the top surface of the sponge cover and the elasticated bandage to prevent the bandage becoming wet.

It is important to ensure that the patient feels the expected sensation in the required area during treatment, otherwise the electrodes should be relocated.

The electrodes must never be placed so that the stimulating current crosses the chest or passes near the heart.

Electrodes should be cleaned and disinfected between patients.

See the current EMS catalogue / price list for the full range of accessories and electrodes.

Maintenance

The conductive rubber electrodes and sponge covers may be disinfected using a 70% v/v aqueous solution of isopropyl alcohol. They are NOT suitable for steam sterilisation or by disinfectants containing sodium hypochlorite.

N.B. Isopropyl alcohol is flammable and should be kept away from naked flames. Isopropyl alcohol must not be brought into contact with eyes or mouth.

The module may be cleaned by wiping over with a damp cloth.

Regularly inspect all treatment leads and cables for signs of damage.

There are no user serviceable parts inside the module and it should not be opened.

Full servicing instructions are available on request.

