MEDI-WAVE MODULE

MEDI-LINK

MODEL 77

CE 0120

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General Information

This manual provides the necessary information for the installation, and operation of the Medi-Wave 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.

Record of Amendments

Medi-Wave Module Model 77

ISSUE	COMMENTS	DATE
1	Initial Issue	30-11-1995
2	CE Marking	24-04-1996
3	Treament Guide Revised	10-12-1996
4	Revised	01-06-1998
5	Revised	17-02-2005
6	Revised Company Name	25-09-2006
7	Revised	01-10-2007

EC Declaration of Conformity

EMS Physio Ltd
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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 Medi-Wave Module
Model Number	77
Signature	
Position	Technical Director
Date first issued	23 January 1996

Contents

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 Medi-Wave module provides a particular form of transcutaneous nerve stimulation which is advocated for use in two main types of application.

Firstly, and similarly to other forms of electrical stimulation, it can be used to provide the patient with a degree of pain relief, and in some instances, anaesthesia. Provided appropriate precautions are taken this can have considerable benefit it its own right.

Secondly, a lower treatment frequency can be used to achieve a strong, but comfortable muscle contraction. This benefits the patient in that it promotes local blood flow and increases the removal of local oedema in addition to pain relief via the opioid mechanisms, thus reducing discomfort and promoting recovery following trauma or musculoskeletal dysfunction.

Principles of Stimulation

The Medi-Wave module produces a biphasic, symmetrical wave with a zero net dc component (see page 10 for a full description of the waveform). The primary target of the stimulation is the sensory and motor nerves, and the effects achieved are secondary to the nerve stimulation. The Medi-Wave output does not directly stimulate muscle, and therefore, should be employed with innervated tissues.

A single Medi-Wave pulse is in fact a twin peaked waveform, the first peak being positive, and the second negative. The time difference between the peaks is 6 ms (6/1000 sec). The second peak will be delivered after the absolute refractory period of the large myelinated nerves (motor and sensory), and if at sufficient intensity, will product a second depolarisation in the nerve. By changing the pulse rate, it is the interpulse (rest) duration which alters (i.e. the time between the pulse pairs), not the relationship between any particular pulse pair. Symmetrical biphasic waveforms are favoured when peripheral nerve excitation is the objective of the treatment (Bowman & Baker 1985).

Higher Frequency Medi-Wave

When considering the modality as a means to achieve pain relief, the delivery of twin peak, biphasic, symmetrical current will produce two depolarisation events per pulse. Therefore, selecting the maximum (60 Hz) stimulation rate will in fact produce nerve stimulation at 120 Hz. This application, Higher Frequency Medi-Wave, serves to activate the spinal pain modulation system in a similar way to TNS and other pain related stimulations (Low & Reed 1994, Barr 1991).

Lower Frequency Medi-Wave

The delivery of Medi-Wave stimulation at the lower treatment frequency (2 Hz) is aimed at stimulation of the motor nerves, producing a visible muscle contraction provided sufficient intensity is achieved. Although the motor nerve will achieve two depolarisation events in response to the twin peak waveform, the contraction resulting from the first depolarisation will not have completely subsided before the second depolarisation arrives at the muscle. The twitch time in postural Type I muscles is in the order of 75 ms and for fast twitch Type II muscles is in the order of 25 ms (Urbscheit 1991) - both of which are longer than the interval between the waveform peaks at 6 ms.

The purpose of such a stimulation is threefold.

Firstly, by activating the muscle electrically, and initiating a contraction, ther will be an increase in the metabolic activity of the muscle(s) concerned. Any increase in muscle contraction activity will result in an increased demand for oxygen and nutrients (Low & Reed 1994). This locally induced physiological demand will result in an increased local blood supply, bringing in the additional material required and removing the metabolic end products of the contraction. The local microcirculation will be stimulated, improving extracellular fluid dynamics, and enhancing the local cellular environment.

A second consequence of the muscle contraction will be to increase the local muscle pump activity. This is an enhancement of a natural physiological phenomenon, but by deliberately enhancing the local macro & micro circulation, whilst simultaneously increasing a rhythmical local mechanical pumping action, there will be an increase in venous and lymphatic return from the region. This will help to stimulate the local microcirculation further which will assist in the removal of excess tissue fluid, plasma proteins in the extracellular spaces and accumulated debris post injury (Alon 1991).

A strong local blood flow is an essential characteristic of tissues in the proliferative phases after injury (Vanable 1989), and the stimulation is enhancing a natural event, not inducing an unnatural one. In this context, it is important that the muscles being stimulated are those which are most appropriate to the lesion in question. On the electrode placement diagrams at the end of this manual, electrode positions are indicated for some common lesions. The aim is to stimulate the largest local skeletal muscles in order to achieve the maximal effect. The greater the muscle bulk involved in the stimulation, the greater the expected effect. There would be no logical advantage in only stimulating a single muscle group where there were more than one available. It is suggested therefore that both channels are employed simultaneously when Lower Frequency Medi-Wave treatments are employed.

It has been suggested (Cook & Barr 1991) that muscle tissue is some 4 times more conductive in its longitudinal direction than its transverse. Electrode placements are presented which attempt to stimulate the muscle longitudinally wherever possible.

The third effect of the low frequency stimulation will be to stimulate an alternative pain relief pathway - that concerned with the opioid mechanisms. In the same way that the high frequency stimulation serves to modulate pain perception by inhibiting noxious sensation at the cord level, low frequency stimulation can be used to activate particular ascending pathways which in turn will activate descending influences, resulting in the release of a natural opioid substance at the relevant segmental level of the cord (Barr 1991, Gersh 1992, Frampton 1996). It has been suggested that it is less critical for this type of sensory stimulation to enter at the same segmental level as the pain input, but the closer the match, the greater the possibility of providing pain relief. The Lower Frequency Medi-Wave stimulation can be compared in this context with low frequency TNS stimulation.

There is a further advantage in using the Lower Frequency Medi-Wave stimulation in relation to pain relief. If the stimulation mode enhances local blood flow and facilitates the removal of oedema and metabolic waste products from the tissues, the local irritation on the nerve endings will be reduced, as will the local hydrostatic pressure. This combination may well help to minimise the generation of painful stimuli in the periphery, therefore reducing the noxious input in addition to modulating the sensation at the CNS level.

Selection of Frequencies for Therapeutic Effects

Clearly from the forgoing discussion, it is possible to treat with either the lower or the higher frequency stimulation parameters. Many patients will have a need or both stimulation forms - Higher Frequency Medi-Wave for pain relief and Lower Frequency Medi-Wave for muscular activation and circulatory effects.

The Medi-Wave unit will not deliver both stimulation types simultaneously, but sequential treatments are effective (they can act physiologically independently) and the effects can, therefore, be combined in a single treatment session.

If BURST is selected, the output is delivered in an interrupted mode. For pulse frequencies in excess of 20 Hz, the burst rate will be 2 Hz. If, for example, the module was set to deliver stimulation at 60 Hz, the patients would receive two bursts per second, during each of which, stimulation would be delivered at 60 Hz, giving approximately 15 waveforms (30 peaks) per burst. The content of the burst (i.e. the 60 Hz stimulation) would serve to stimulate the pain relief

mechanisms as previously identified. In addition each burst would act as a single stimulus for the opioid mechanisms, thereby stimulating pain relief by both mechanisms simultaneously.

Higher Frequency Medi-Wave used in this way would offer a treatment similar to Burst mode TNS. If the module was set at a low treatment frequency (e.g. 2 Hz) in the burst mode, the output would be on for 2.5 seconds, then off for 2.5 seconds repeatedly. Whilst on, the module would deliver stimulation at the 2 Hz rate, giving 5 waveforms (muscle contractions).

In SURGE mode, the module will deliver stimulation at a preset rate of 10 surges per minute. Each surge is ramped, resulting in an increase in intensity during the first part of the stimulation, a sustained period of stimulation, and finally a ramp down, where the intensity of stimulation decreases. It is possible, if appropriate stimulation frequencies are employed, for this type of stimulation to be used for the patient to work with the current (similar to surged Faradism) or for a variety of combined muscle stimulating and pain relieving effects which are currently being evaluated.

References

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Urbscheit, N. (1991), Review of Physiology: Clinical Electrotherapy
Editors: R Nelson & D Currier, Publisher: Appleton & Lange

Vanable, J. (1989), Integumentary Potentials &Wound Healing: Electric Fields in Vertebrate Repair. Editor: R Borgens, Publisher: Alan Liss Inc

Precautions

Medi-Wave stimulation 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.

The output indicator on the Medi-Link shows the output level as a percentage of full output level. The maximum output from the Medi-Wave module at the maximum output frequency, with a load impedance of 1kohm is 10 V rms.

Contraindications

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 or passes directly across the brain.

Technical Specification

Output Waveform	Differentiated pulse with width 6 ms
Output Current	70 mA peak maximum
	less than 10mA rms into 1kohm
Output Voltage	150 V peak maximum
	less than 10V rms into 1kohm
Output Impedance	2 kohms
Pulse Frequency	2 to 60 Hz
Output Modulation	Continuous pulse tran, burst or surge
Treatment Time	1 to 30 minutes
Treatment programs	16 user definable set-ups

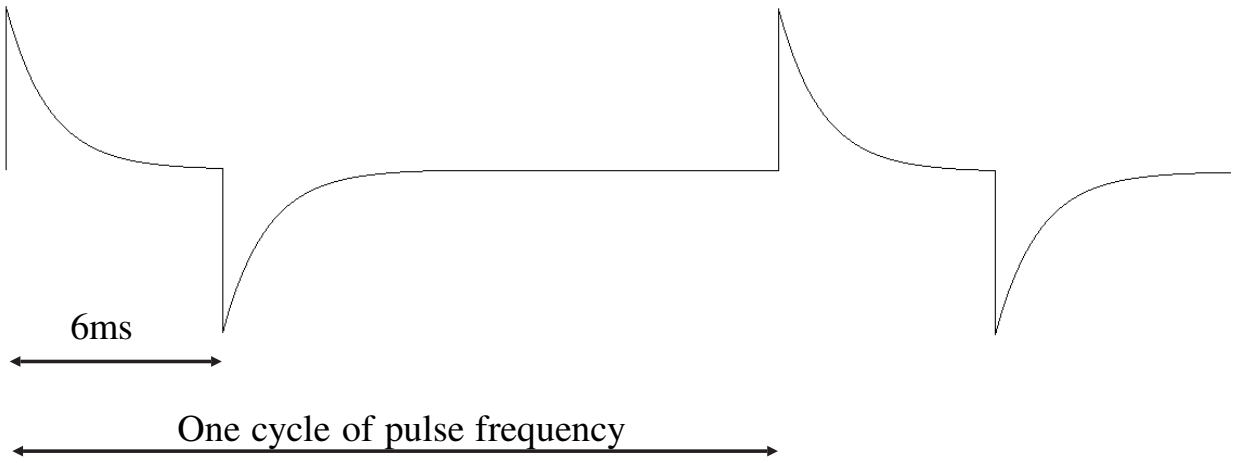
The Medi-Wave module is designed for use only as part of a Medi-Link system.

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

Each Medi-Wave module is supplied with 2 patient leads, a set of 4 self-adhesive electrodes (50 x 50 mm), electrode connection cables and this manual.

The Medi-Link Medi-Wave 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".

Output Waveform



The output waveform is a differentiated pulse with a width of 6ms

The time constant of the exponential decay is approximately

(550+(278 x load resistance in kohms)) microseconds

In Burst mode the burst rate is 2Hz for pulse frequencies greater than 20 Hz and the pulse frequency divided by 10 for frequencies less than 20 Hz. The duty cycle of the burst is 50%.

In surge mode the surge rate is 10 per minute.

Installation

The Medi-Wave Module is a low power therapy module and may be installed in any position in the Medi-Link system. It is recommended, however, that it is installed to the right of any full power therapy modules.

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 Medi-Wave Module next to the Medi-Link system on a flat surface.

4. Push in the button on the front of the Medi-Wave 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. Replace the carrying handle.

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 Medi-Wave 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.

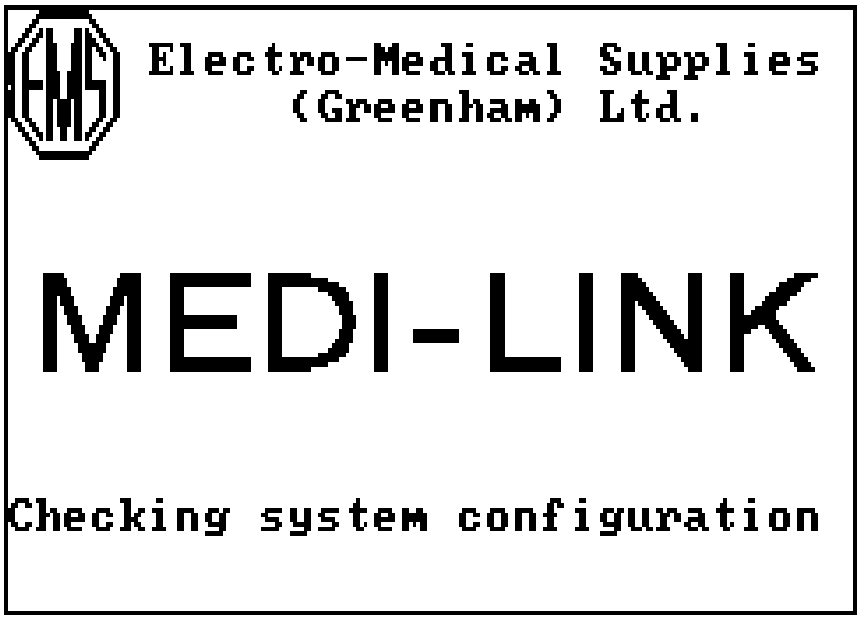


Figure 1 - Logos and Company name

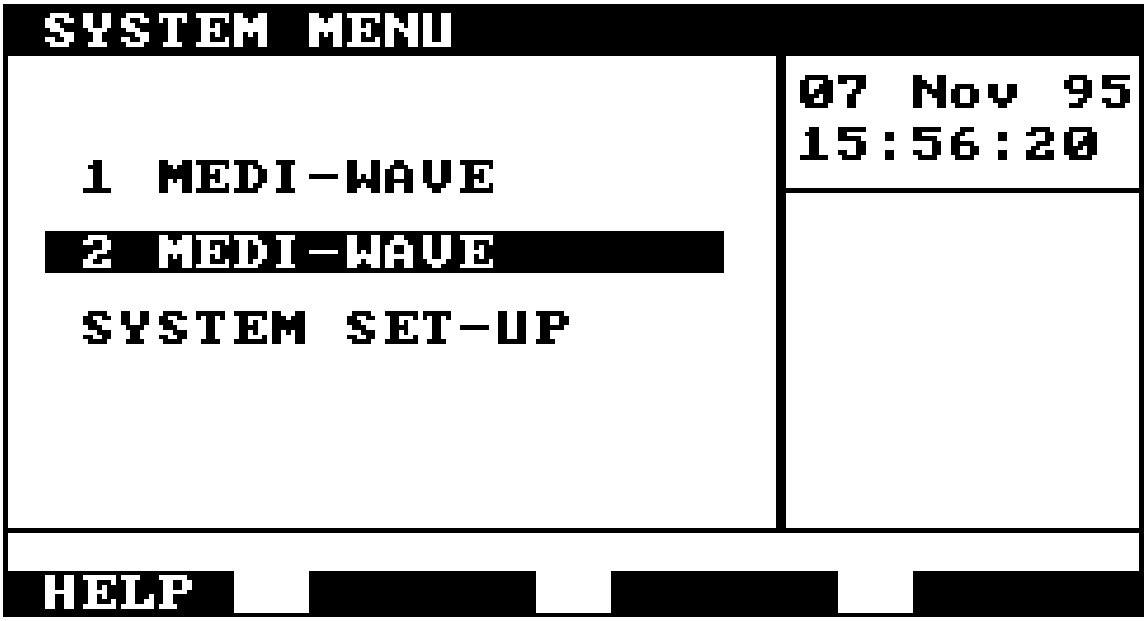
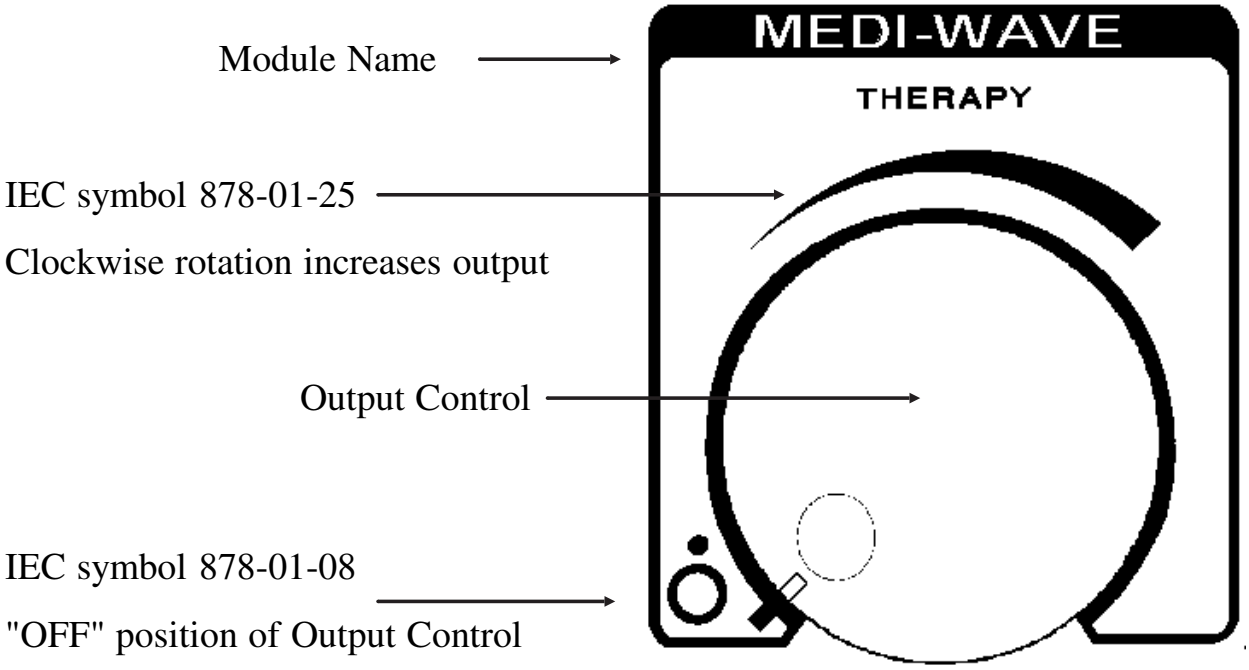


Figure 2 - System Menu

Controls and Markings

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



There are 2 sockets on the front panel of the module marked A and B.

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

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

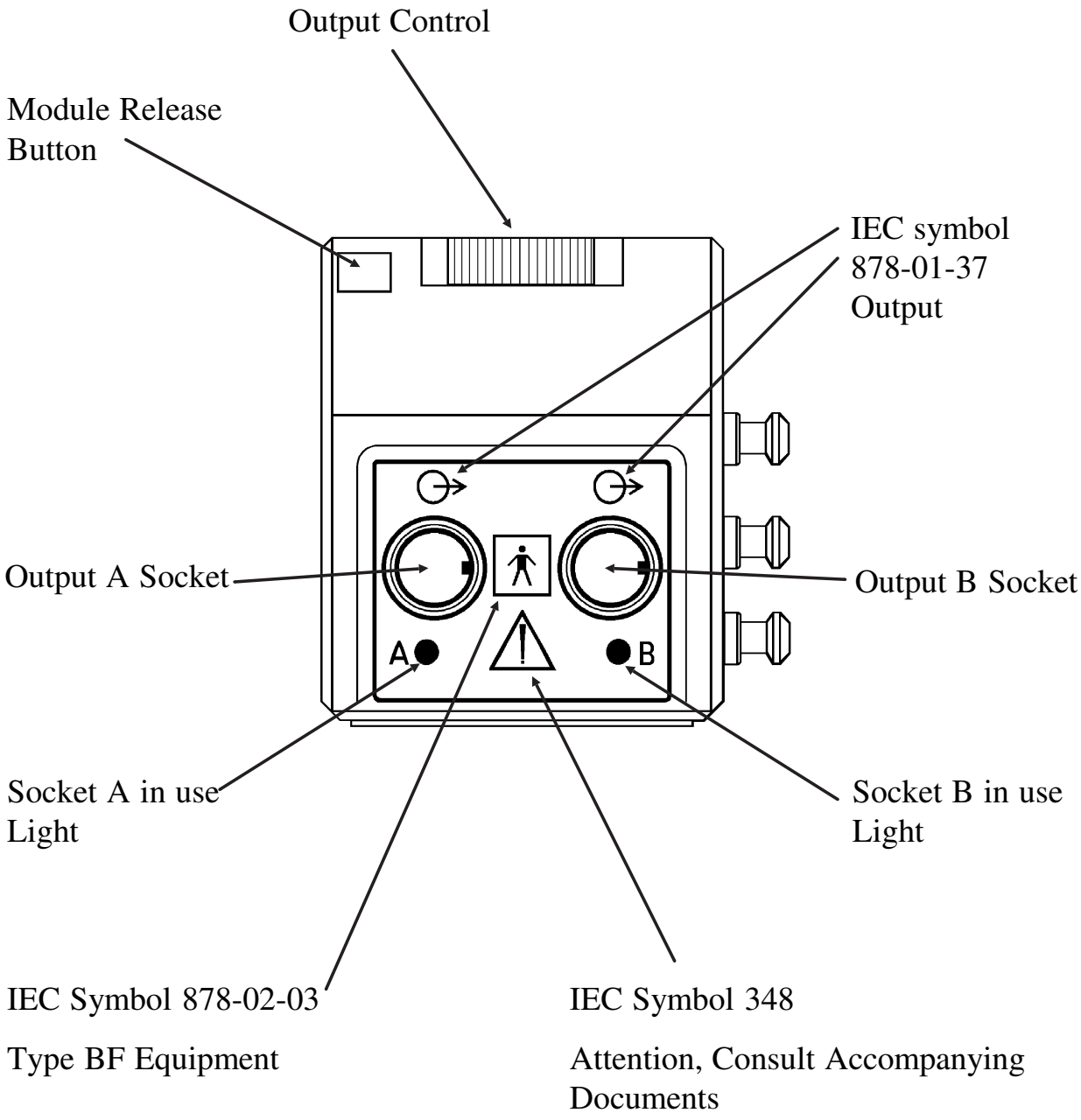


Figure 4 - Medi-Wave Module Front View

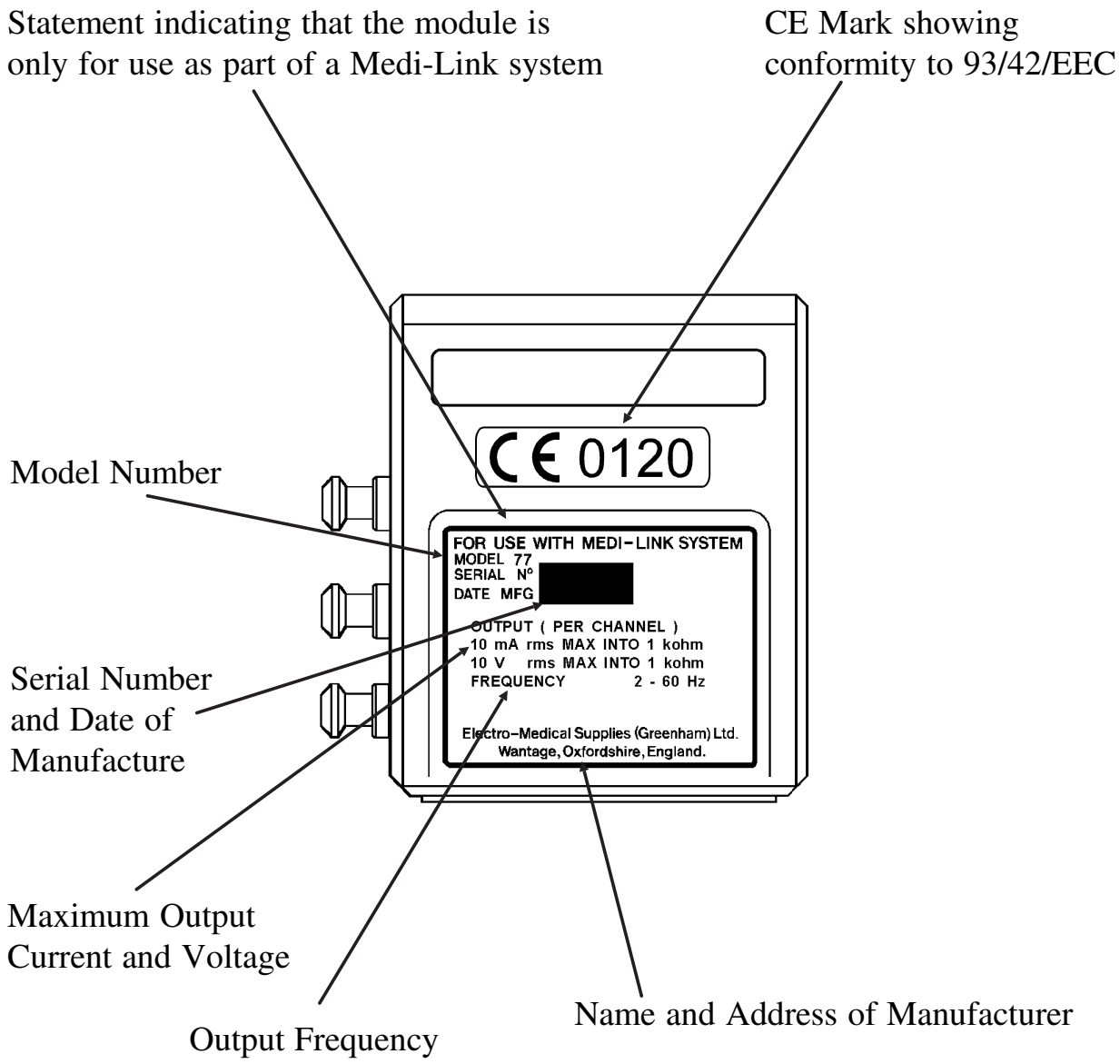


Figure 5 - Medi-Wave Module Rear View

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 Medi-Wave with the up and down arrow keys and then press ENTER.

3. The Medi-Link will run the Medi-Wave program and the display will change to show the Medi-Wave Set-Up (figure 6). All the current settings of the module are displayed.

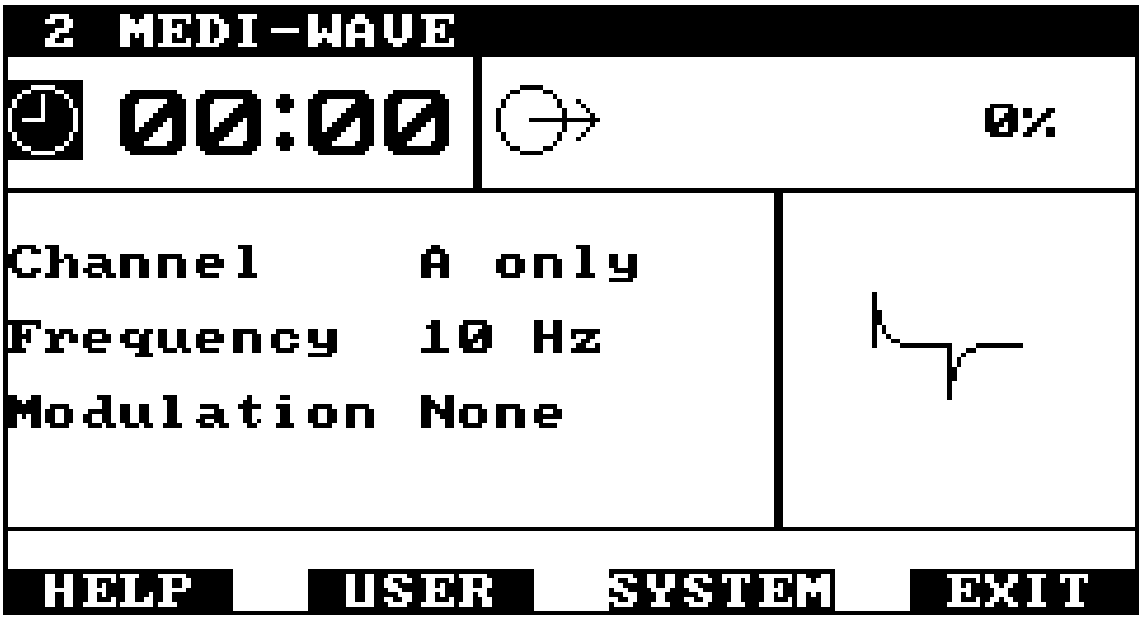


Figure 6 - Medi-Wave Set-Up

4. If the Output Control on the Medi-Wave 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 Medi-Wave Module is returned to the OFF position.

5. To change the settings of the Medi-Wave 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.

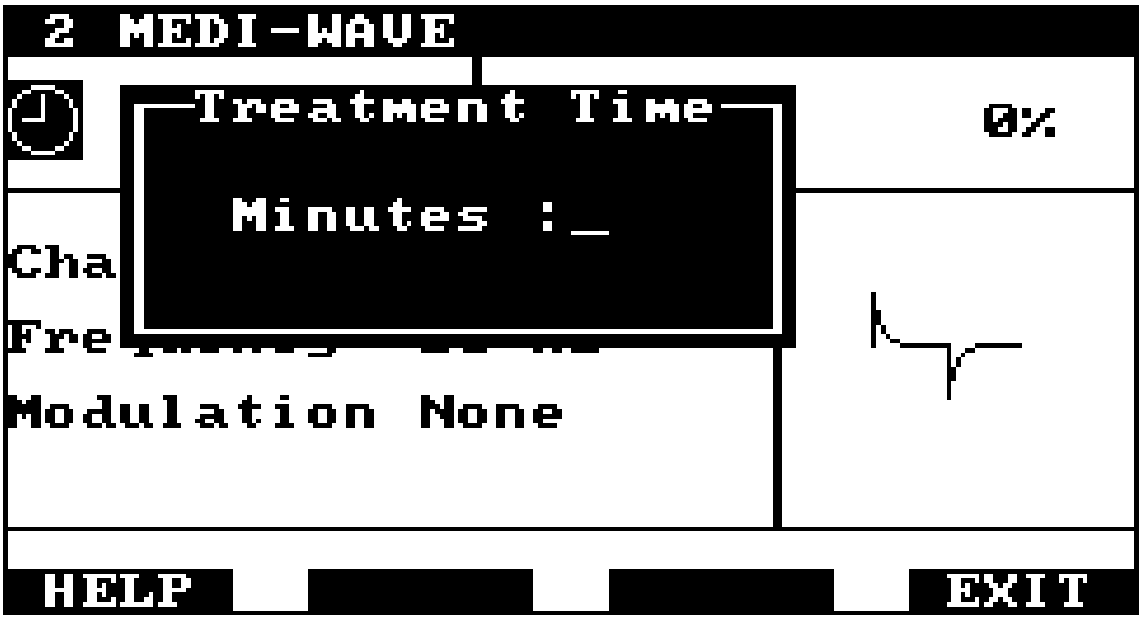


Figure 7 - Setting the Treatment Time

7. **Channel:** There are three channel options for the Medi-Wave module.: Single channel operation from either the A or the B socket and dual channel (A and B). The channel selection may be made in two ways.

When the label channel is highlighted on the Set-Up screen, pressing either the left or right arrow keys will change the selection.

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

Use the Up and Down arrow keys to highlight the required channel selection and confirm by pressing the ENTER key. The system will return to the main Medi-Wave Set-Up screen (figure 6) and update the channel setting.

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

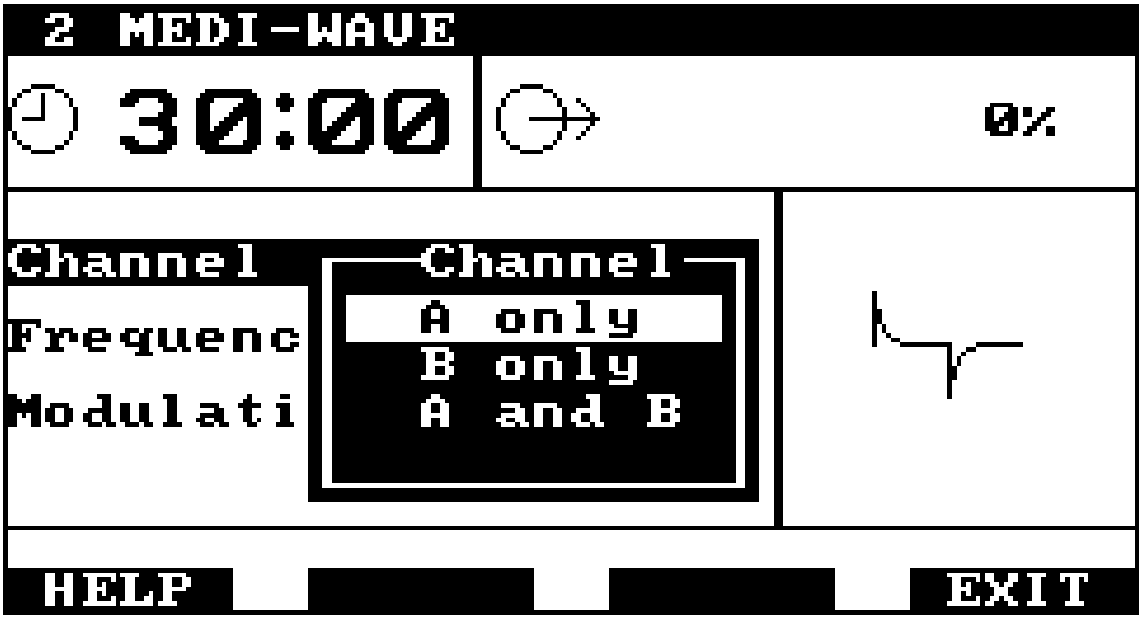


Figure 8 - Channel Selection

8. **Frequency:** The output frequency of the Medi-Wave module may be set between 2 and 60 Hz in 1Hz steps.

To set the frequency, first highlight the label Frequency using the up and down arrow keys. Pressing the left or right arrow keys will decrement or increment the frequency.

Alternatively, press ENTER when the label frequency is highlighted. A sub-window will be displayed for the frequency (see figure 9). The screen cursor is positioned by the Hertz 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 incase the wrong numeric key is pressed. If an invalid frequency is entered (Less than 2 or greater than 60), 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 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 frequency.

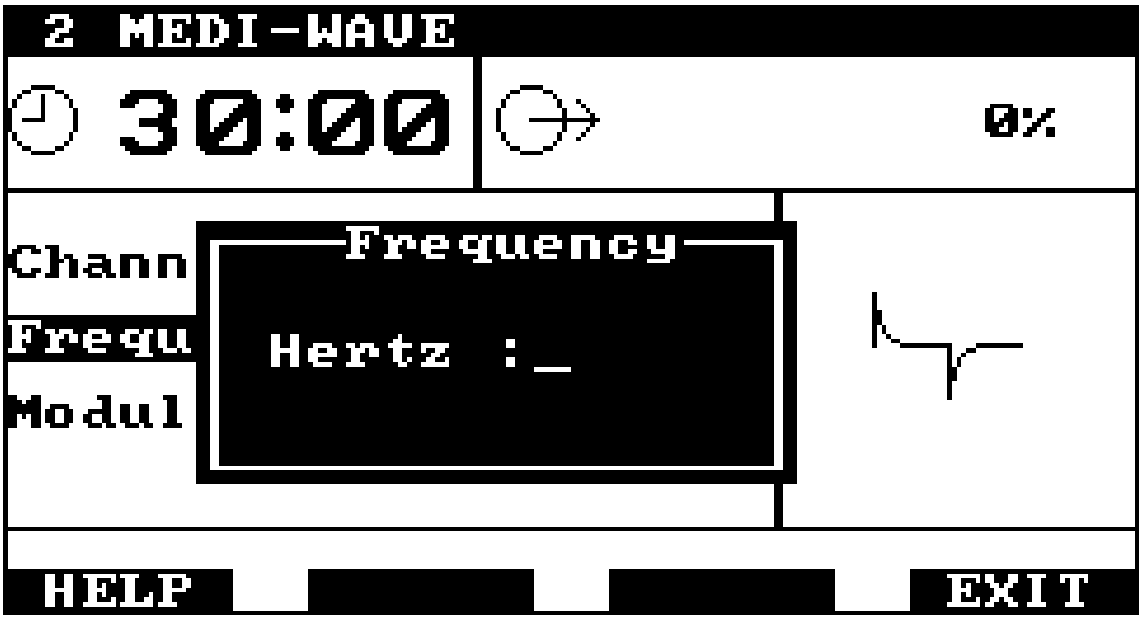


Figure 9 - Setting the Frequency

9. **Modulation:** The Medi-Wave 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 10). 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 Medi-Wave set-up and 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.

10. When all the settings are as required, connect patient output leads to the sockets on the front of the module appropriate to the channels selected.

Attach suitable electrodes to the patient and connect to the output leads 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 Medi-Wave 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.

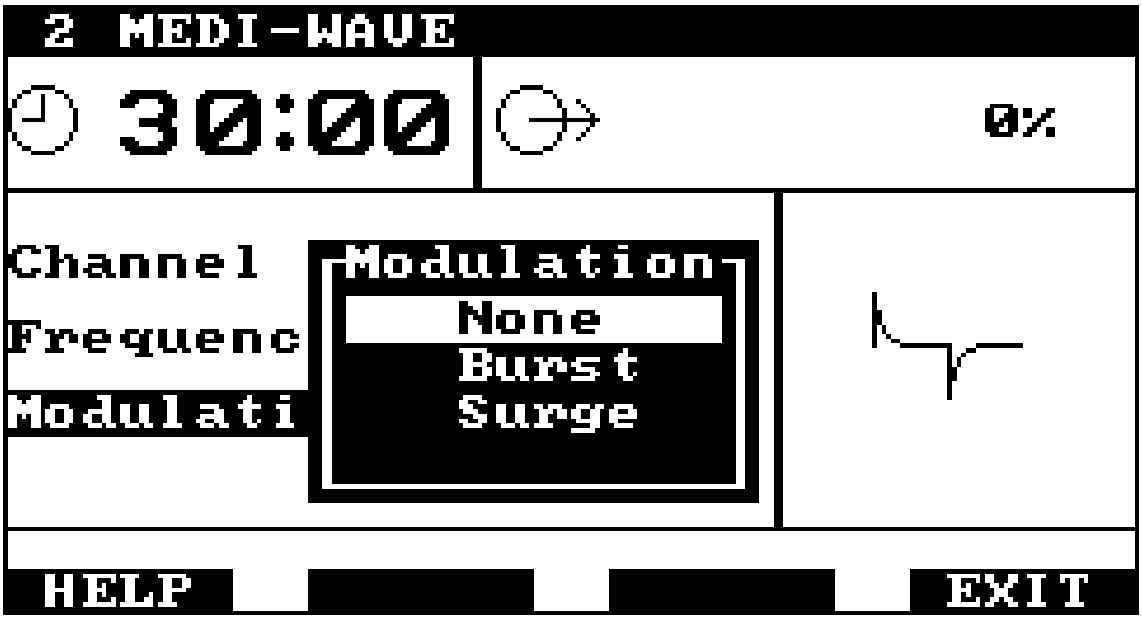


Figure 10 - Setting the Modulation type

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 (figure 11).

Always advance the control slowly.

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 output control setting as a percentage of full output.

Remember that if a surged output or a low frequency burst has been selected, the output control should only be advanced when the full effect of the current surge has been felt.

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.

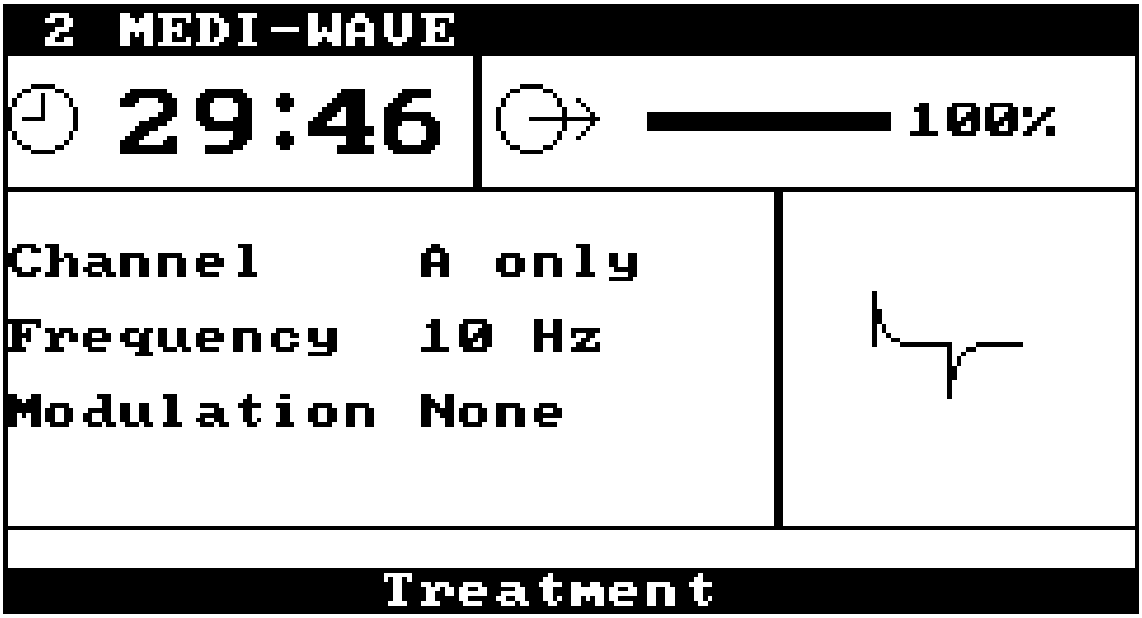


Figure 11 - Display during treatment

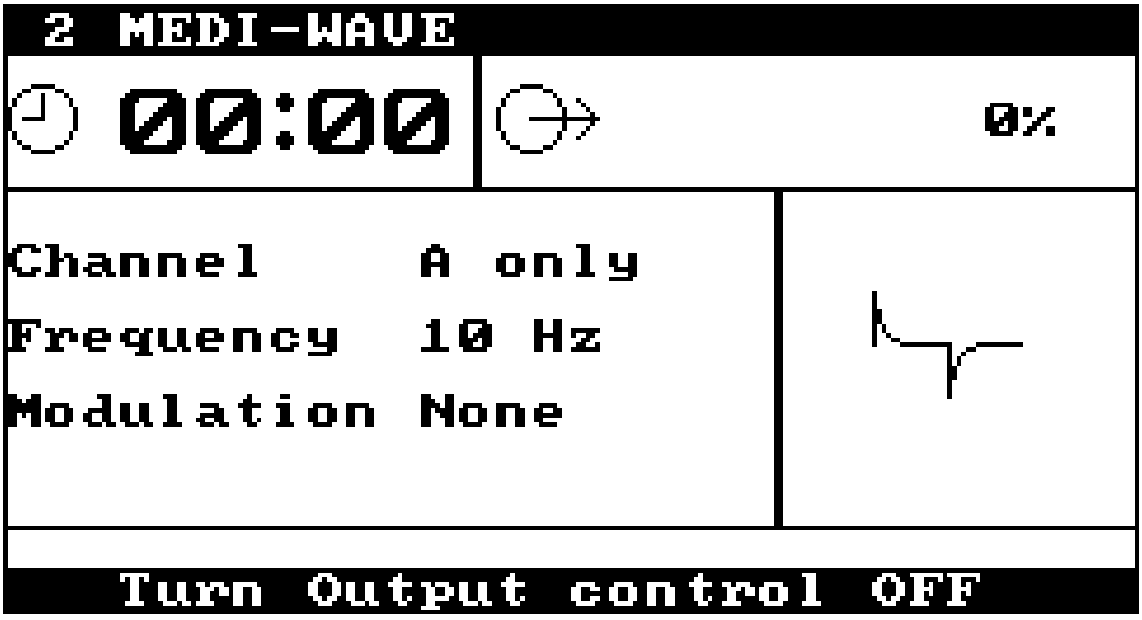


Figure 12 - Display at end of treatment

11. **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 13) . 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.

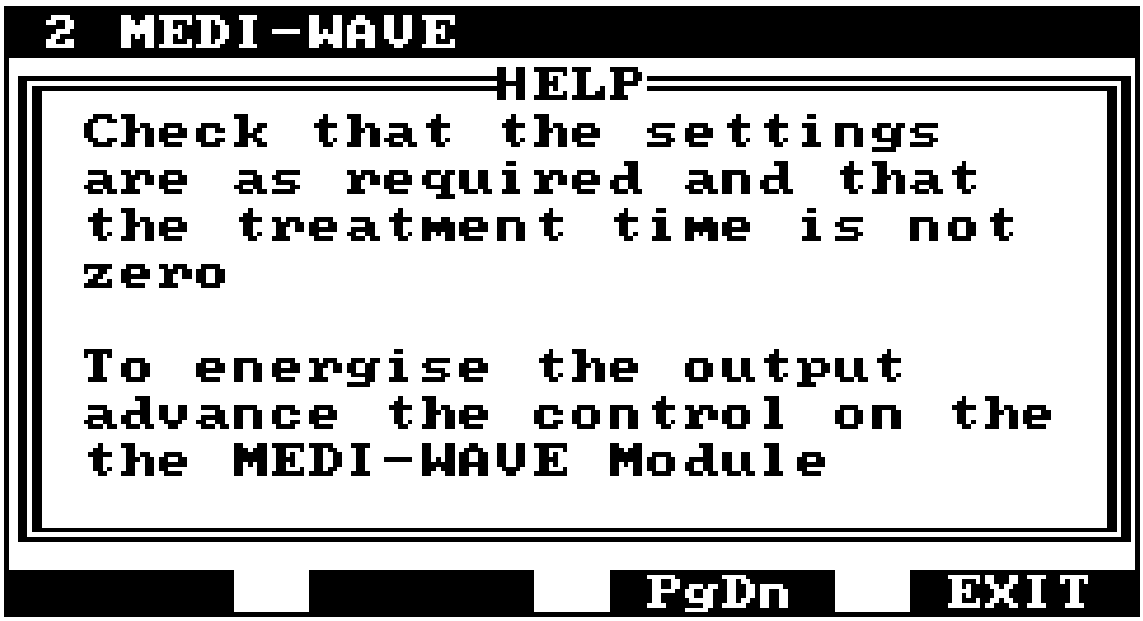


Figure 13 - Help Text Display

12. **F2 - USER:** In order to save time setting up the Medi-Wave 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.

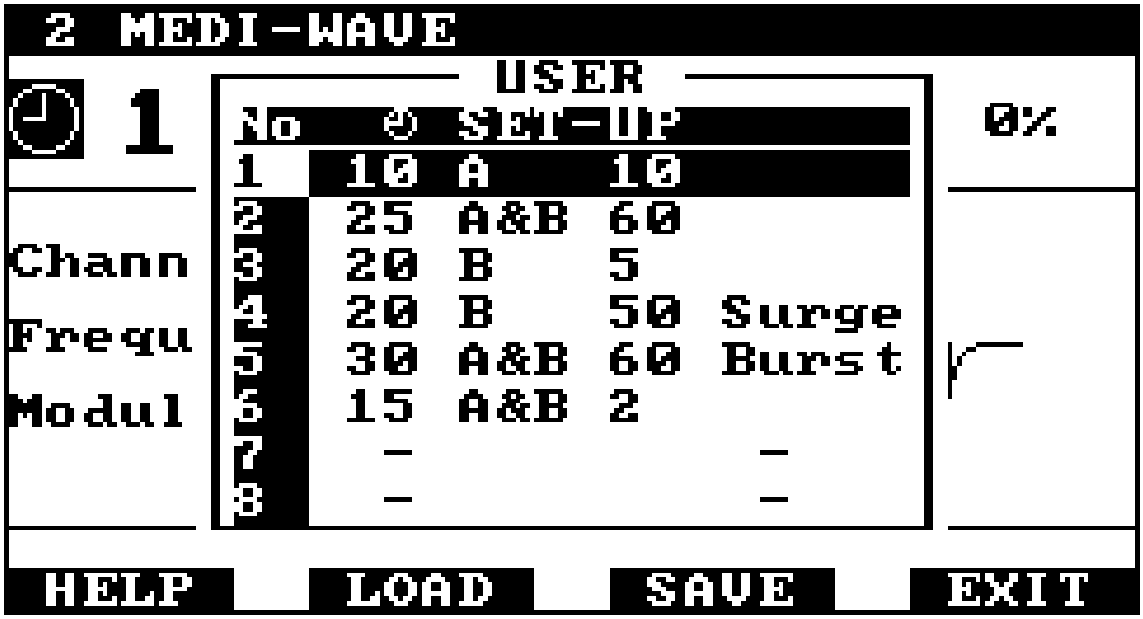


Figure 14 - User Program Display

The system will recall previously saved programs and display them as in figure 13. Programs shown as dashes, for example, programs 7 and 8 in figure 14, 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.

13. **F3 - SYSTEM:** Pressing F3 - SYSTEM returns the user back to the System Menu, but without stopping the Medi-Wave program running. This enables the user to run another application, for example, an Ultrasound program for combination therapy. When F3 - SYSTEM is selected the Medi-Wave set-up is shown as an inset screen to the right of the display (see figure 15).

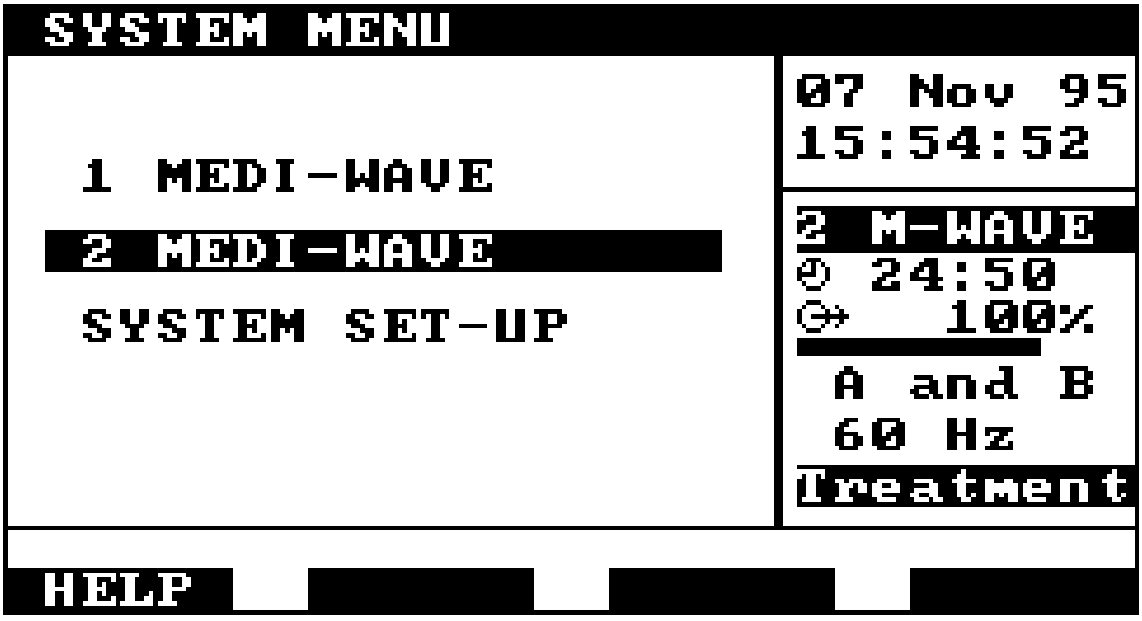


Figure 15 - Medi-Wave Module as inset screen

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 Medi-Wave Module Set-Up display will terminate the Medi-Wave program and return to the System Menu. When the Medi-Wave 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 Medi-Wave Module. A range of single-patient-use, self-adhesive electrodes, as well as three sizes of conductive rubber electrodes, are available. Replacement sponge covers are available for each size of conductive rubber electrode.

Since the aim of Medi-Wave Stimulation 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.

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.

Self-Adhesive electrodes: Remove the electrode from the release liner and press firmly in place on the skin. Adhesion improves as the electrodes reach skin temperature. These are supplied with the Medi-Wave for speed of application and to enable precise positioning of the electrodes. These electrodes are for single patient use only.

Conductive Rubber electrodes: 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. Electrodes should be cleaned and disinfected between patients.

Connect the electrodes to the stimulator output with the cables provided.

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 stimulation current crosses the chest, passes near the heart or directly across the brain.

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

Principles of Electrode placements

The guidelines which follow are suggestions only. The principles outlined in the introduction to this manual make the modality applicable to any appropriate lesions.

Placement for Stimulation / Pain Relief

For simplicity of operation, it is recommended that the electrode placement is the same for both the lower-frequency (muscle stimulation) and higher frequency (pain relief) therapies. However, it is for the therapist to determine the most efficacious electrode placements depending on the assessment findings and particular clinical profile with which the patient presents. It may, therefore, be necessary to re-position the electrodes for optimum effect.

Specific Placement for Pain Relief

The primary intention when stimulating for pain relief is to achieve electrical stimulation input at the same segmental level as that which the pain enters the cord (in a similar way to TNS and Interferential therapy).

The most direct route for this stimulation is to place the electrodes either side of the tissue giving rise to the pain - ensuring that the current passes through the target tissue. The electrodes can be placed on the same tissue surface for more superficial lesions (e.g. lower medial thigh and upper medial leg for a medial knee pain derived from ligamentous or other superficial tissue). Alternatively, for deeper seated pains, it maybe more effective to place the electrodes on opposite sides of the limb, therefore, promoting the passage of the treatment current through the deeper conducting tissues. For example, for a patient who describes their ankle pain as deep in the joint rather than isolated to a superficial ligament region, it maybe preferable to place the electrodes either side of the joint line, medially and laterally, giving a relatively deeper current passage.

For deeper seated lesions, it will be necessary to increase the current intensity to ensure adequate stimulation levels. The absolute intensity (mA) is not prescribed, as it is dependent on the subjective comments from the patient. For the high frequency stimulation, the current strength needs to be sufficient to produce a strong yet tolerable sensation. For some subjects this may be at a few mA whilst for others, it may be considerably greater.

This variation is expected both between individuals and also for the same individual at different treatment sessions - a reflection of the changing sensitivity of the tissues as recovery occurs.

For a patient with a particularly intense or diffuse pain, the Medi-Wave module can be set to deliver two High-Frequency currents simultaneously. As with other dual channel pain relief stimulations (e.g. TNS) it maybe advantageous to cross these currents in the tissues to achieve the maximal effect.

It is not suggested however that there are cross over (or interference) effects as with interferential therapy - the technique simply serves to increase the number of sensory nerves stimulated and therefore to increase the volume of sensory nerve traffic passing to the appropriate segmental level of the cord. It has been suggested (e.g. Cook & Barr 1991) that wider placement of the electrodes (for any electrical stimulation technique) will increase the depth of effect - the current has a greater choice of conductive routes and this will lead to greater current dispersion in the tissues. The therapist will need to make adjustments to the treatment intensity if this approach is adopted because the increased dispersion of the current through the tissues will result in a lower average current density. Sufficient density will need to be achieved to ensure adequate depolarisation of the sensory and/or motor nerves. The disadvantage of wider electrode placement to achieve increased stimulation depth is that the current intensity required to achieve significant stimulation may reach unacceptable levels for the superficial nerves (where the current concentration will be greatest), and the patient may experience a painful sensation rather than a tolerable paraesthesia. This is not a phenomenon unique to Medi-Wave therapy, but is an important element to consider in relation to electrode placement for any electrical stimulation modality.

Specific Placement for Muscle Stimulation / Blood Flow Changes

The intention of using the lower frequency stimulation is to achieve visible contractions of the major muscle groups around the area in question. The first set of electrodes in the illustrative diagrams are placed on the largest group, and the second electrode set on the next largest. For any particular patient, the position of these electrodes should be adjusted such that the largest muscles in proximity to the lesion are activated, provided that the lesion itself is not compromised by the contraction. It is the responsibility of the therapist to determine the most appropriate placements for their patient on each treatment occasion.

Wherever possible, the electrodes should be positioned such that the current will pass longitudinally through the muscle tissue ensuring maximal effect with minimal current all else being equal.

This is not a simple task when stimulating large muscle groups, but reasonable attempts should be made in order to maximise treatment efficacy.

Treatment session combinations

In many instances it will be appropriate to treat the patient for both the pain relief and the muscle stimulation / oedema reduction components. In these circumstances, the therapist should decide which is the primary aim and make it the initial target. However, if the patient finds that the lower frequency Medi-Wave muscle stimulating current produces some discomfort, it is quite reasonable, given adequate precaution, to treat with the pain relief component first with higher frequency Medi-Wave. The precautions relate to the risk of providing the patient with pain relief and then following it with further potentially painful treatment. So long as both the patient and the therapist are aware that some, possibly a significant amount of their pain has been masked, then it is safe to continue with the treatment. Should the patient experience pain following the muscle stimulation, is would be appropriate to use the higher frequency stimulation following the lower frequency stimulation to reduce the discomfort.

If a patient is in pain when they first attend for treatment, it is suggested that it would be appropriate to commence treatment with 10 minutes of higher frequency Medi-Wave, followed by 10 - 20 minutes of lower frequency Medi-Wave, and if necessary, to complete the session with a further 10 minutes of higher frequency Medi-Wave, if the pain were still present

If a patient's pain is not the dominant feature of the presenting symptoms, it would be more appropriate to commence with the lower frequency Medi-Wave and follow with the higher frequency Medi-Wave if required.

It is suggested that a combined treatment time of 20 minutes should be the minimum in acute conditions, though with more severe pain, or for patients who are less able to tolerate a higher current intensity, a more prolonged session may be required.

Chronic lesions will be less energy sensitive (the threshold to stimulation effects will rise) and treatments may need to be delivered at greater intensity and possibly for more prolonged periods (though treatments in excess of 60 minutes are not recommended). It is suggested that treatment times are started at the lower end of the range and progressed if no substantial effect is achieved. It is further suggested that once a substantial therapeutic effect has been achieved, the treatment parameters remain constant until that effect is no longer produced.

General Guidelines on Applying the Medi-Wave

It is important to decide which is the most dominant treatment feature of an injury and concentrate treatment accordingly.

If pain relief is the primary concern, the Medi-Wave should be used in the higher frequency mode initially, followed by the lower frequency treatment if required.

If swelling and / or fluid diffusion is the predominant presentation then the Medi-Wave therapy should be at the lower frequency level. This can be followed by a short treatment at the higher frequency, if this is considered to be beneficial for the comfort of the patient.

Self-adhesive electrodes are supplied with the Medi-Wave. It is recommended that these are used as they provide good contact and are easy to position. Before applying the electrodes, remember to clean the skin to ensure good contact and optimum patient comfort.

Having chosen the treatment regime and applied the electrodes, **slowly** advance the output control allowing the patient time to accommodate to the Medi-Wave therapy.

LOWER FREQUENCY

- Slowly increase the output until a strong pulsation is felt (this should be clearly visible or palpable unless there is extensive oedema or swelling).
- Allow 1 - 2 minute for the patient to adjust to the sensation.
- Increase the output slowly, in steps if necessary, always ensuring that the patient is comfortable.
- The higher the output, the more effective is the treatment (but this must always be determined by patient comfort levels). If possible, aim for 70 - 90% intensity.

  NOTE: At the first treatment session, it may not be possible to achieve 70% intensity. This is quite normal as the patient is adjusting to the 'pumping' sensation. It should be possible to achieve 70% + at subsequent sessions, as the patient will know what to expect from the Medi-Wave therapy.

HIGHER FREQUENCY

- Slowly increase the output until the patient feels a tingling sensation - not dissimilar to 'pins and needles'
- Allow a short period for the patient to accommodate to the sensation.
- Increase the output slowly, in steps if necessary, until the patient feels a strong but comfortable sensation.
- The strength of the output will depend very much upon the type of patient, but in most cases it is likely to be 50% or greater.

  NOTE: At the first treatment session, it may not be possible to achieve 50% intensity. This is quite normal as the patient is adjusting to the sensation. It should be possible to achieve 50% or greater at subsequent treatment sessions.

The patient should be either sitting up with the back and head well supported, or lying down in a comfortable position. On very rare occasions - as with other electrotherapy modalities - patients have experienced faintness or nausea during treatment. If this occurs, treatment should be stopped immediately and the blood distribution levels of the patient allowed to normalise before continuing treatment.

Examples of Possible Treatment Programmes

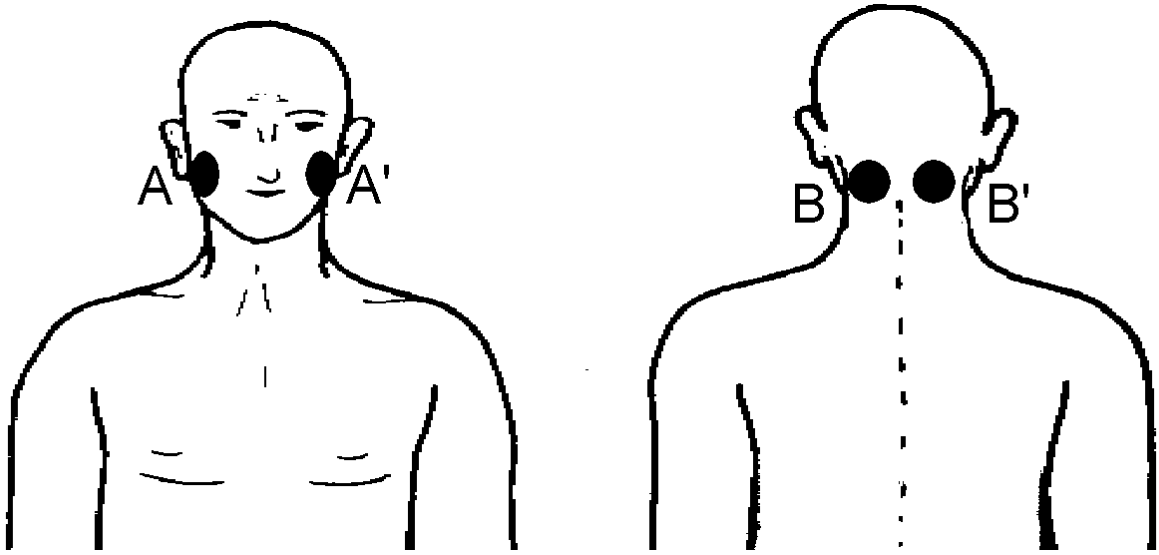
The following pages are illustrative examples of positioning the Medi-Wave electrodes, based on the preceding information. They are not intended to be prescriptive treatment plans, as the therapist should employ the modality on the basis of the individual patient clinical assessment findings and the presenting clinical profile.

Electrodes should be positioned on the belly of the muscle and, whenever possible, the electrodes should be positioned such that the current will pass longitudinally through the muscle tissue, ensuring maximal effect with minimal current.

Although generally the suggested electrode placements will be effective for both lower and higher frequency therapy, it is worth spending some time experimenting to find the optimum electrode positions, to gain either maximum muscle contraction or most effective pain relief. With experience, the best electrode positions will be recognised.

To obtain greater stimulation of activity, particularly through a specific injury site, cross-placement of electrodes can be adopted. In this case, channels A-A' and B-B' are positioned to cross-fire through an injury. At the higher frequency this will intensify pain relief at the seat of the injury (alternatively, follow the pain path and apply the electrodes accordingly). At the lower frequency, this will produce maximum stimulation of blood and lymph flow through the area - particularly useful when treating limbs.

1. Headache / TMJ



Position of electrodes for headache, temparo-mandibular joint spasm and post-operative surgery of the face

NOTE: To avoid possible dental damage, it is advisable to place a wad of gauze between the upper and lower teeth on both sides.

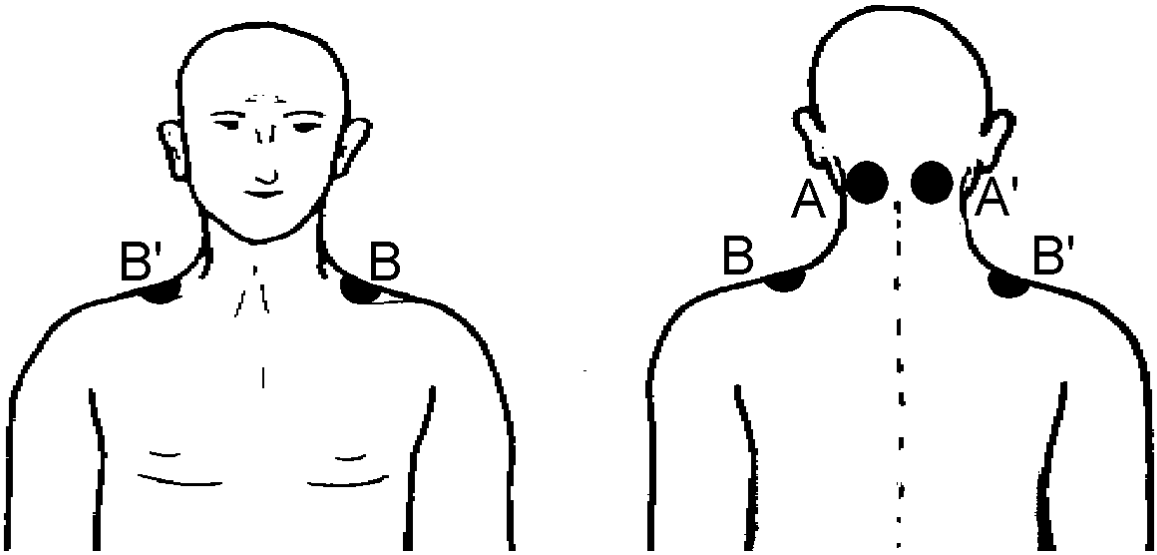
Electrode Placement:

A-A' - the temparo-mandibular joints on both sides of the face

B-B' - the upper attachment of the trapezius

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

2. Neck / Cervical



Electrode placement for neck and cervical damage (including whiplash), muscular injuries to upper back, degenerative spinal and upper thoracic problems.

NOTE: If pain path is down the arm, apply electrodes as shown. If the pain path is down the spine, the B - B' electrodes may be positioned at the inferior angles of the scapulae.

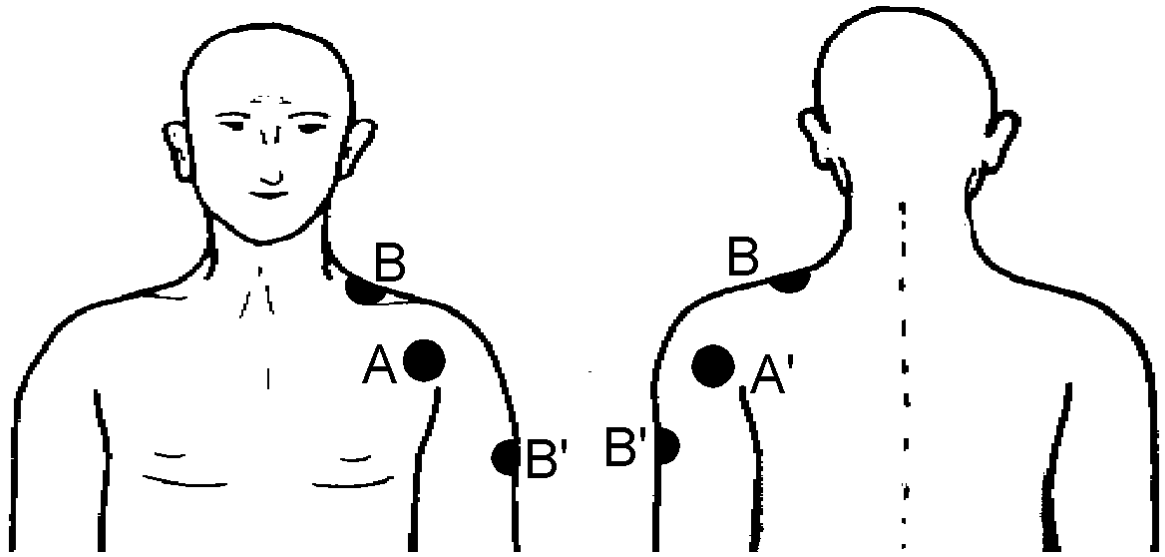
Electrode Placement:

A-A' - the upper attachment of the trapezius

B-B' - the upper fibres of the trapezius (or inferior angles of the scapulae - see above)

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

3. Shoulder / Capsular



Electrode placement for shoulder injuries, capsular problems, arthritis, bursitis, 'frozen shoulder', post-operative treatments.

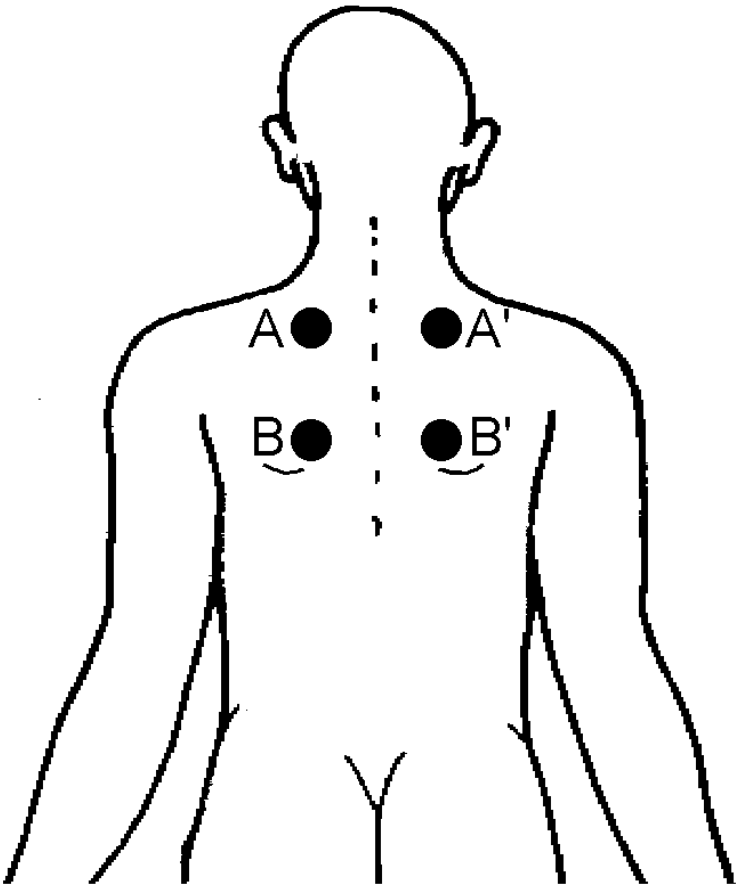
Electrode Placement:

A-A' - the anterior and posterior deltoids

B-B' - the upper fibres of the trapezius and the lower mid-deltoid

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

4. Upper Back



Electrode placement for upper back conditions and pain between the scapulae

NOTE: Cross-fire technique may be beneficial where there is a specific point of pain or injury. For more effective stimulation, adjust the positioning of A-A' and B-B' to suit the condition

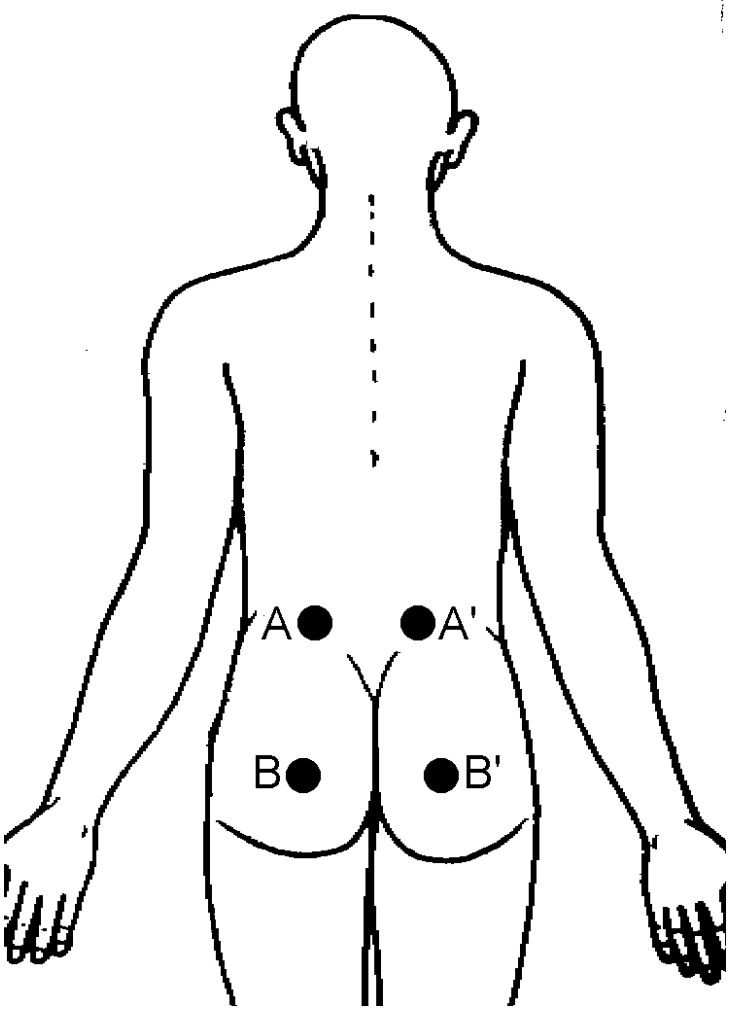
Electrode Placement:

A-A' - the trapezius above the scapulae, left and right

B-B' - the inferior angles of the scapulae

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

5. Lower Back



Electrode placement for lower back problems - arthritis of the hip and lower spine, sciatica and acute low back pain.

NOTE: If sciatic pain is experienced predominantly down one leg, the B-B' electrodes can be positioned longitudinally down the posterior of the thigh to increase the effectiveness

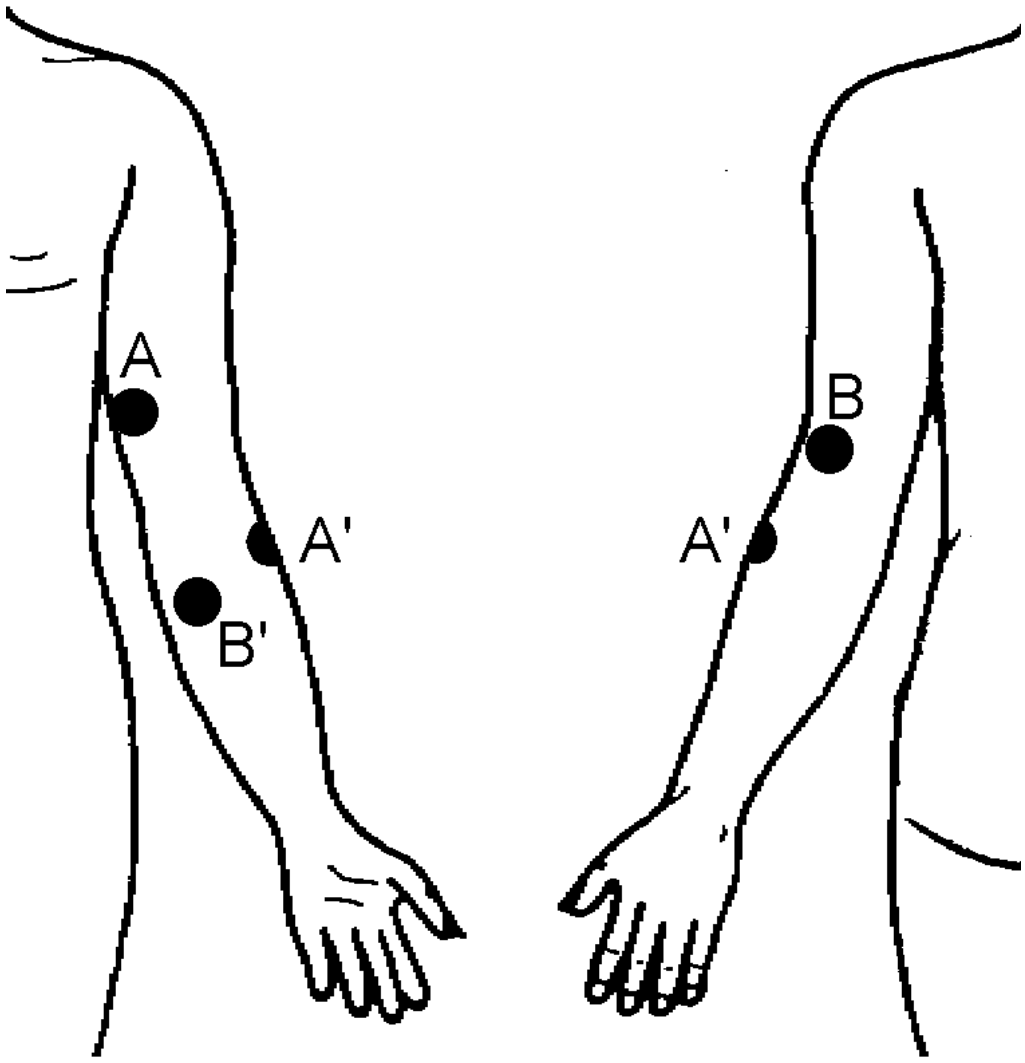
Electrode Placement:

A-A' - the fasciae at the appropriate spinal level

B-B' - the gluteus maximae (or gluteus maximus / biceps femoris)

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

6. Elbow



Electrode placement for elbow damage, including arthritis of the elbow joint, tendonitis, forearm pain.

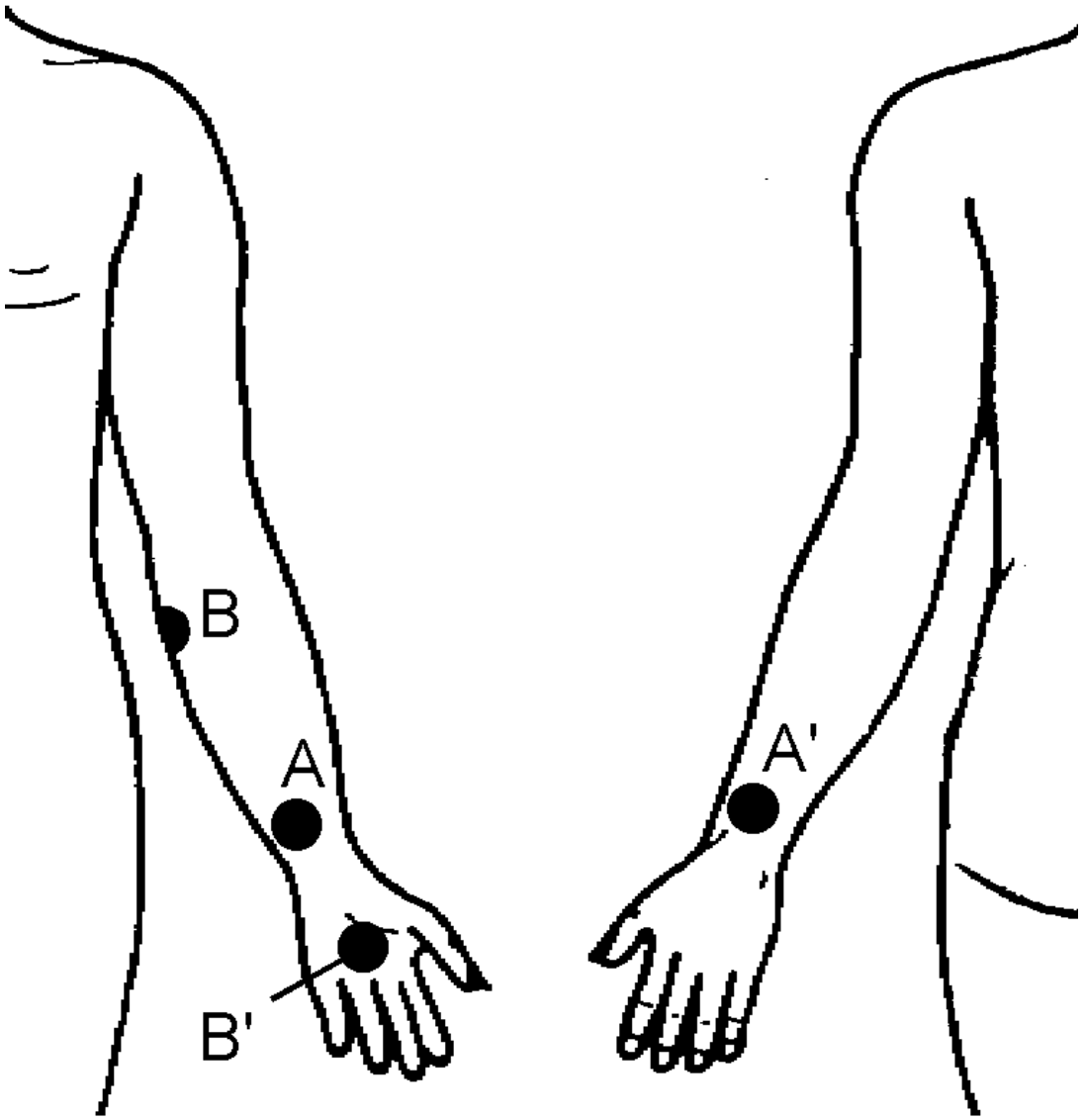
Electrode Placement:

A-A' - the medial mid-arm and the brachioradialis

B-B' - the lower end of the triceps and the upper medial forearm

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

7. Wrist / Hand



Electrode placement for wrist / hand conditions, including arthritis of the wrist, carpal tunnel syndrome and acute wrist injuries

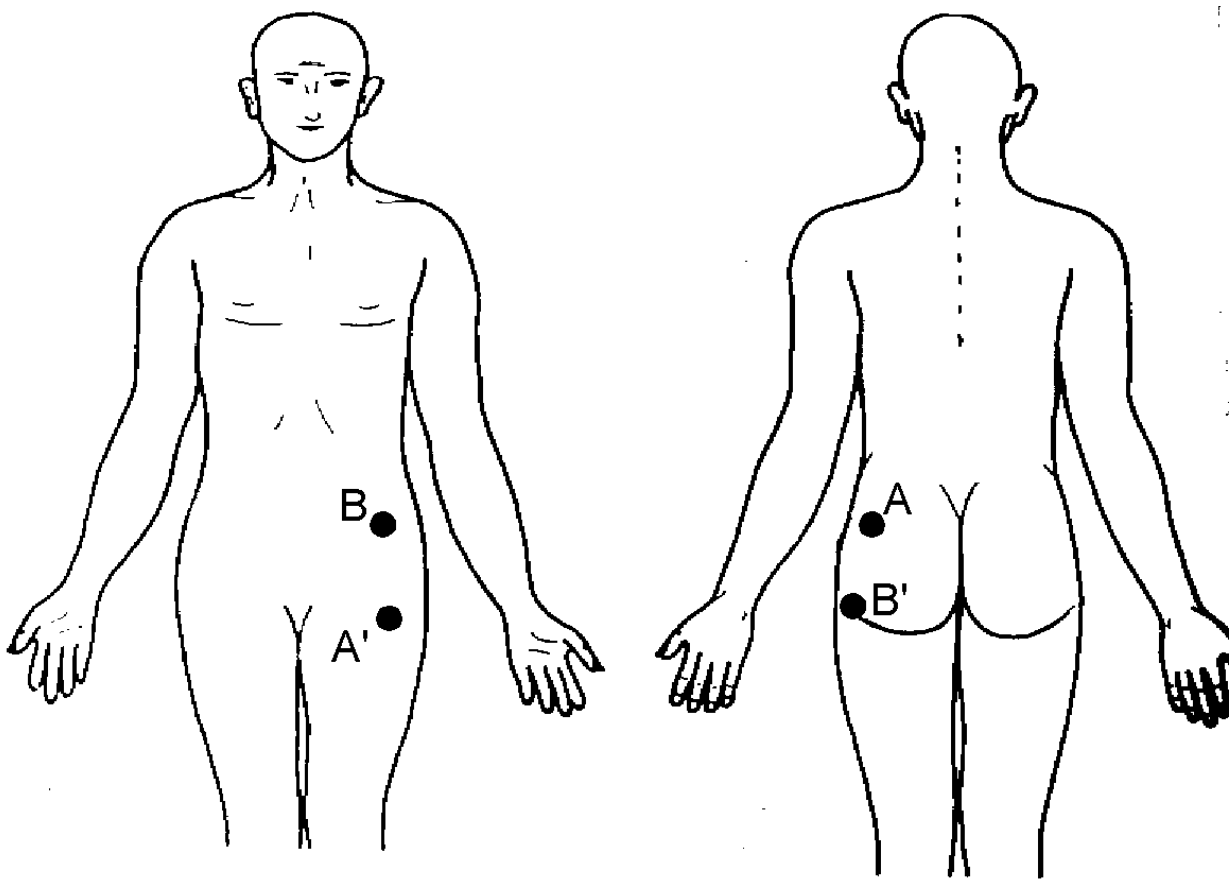
Electrode Placement:

A-A' - the anterior and posterior aspects of the wrist

B-B' - the upper medial forearm and the palmer aspect of the hand

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

8. Hips



Electrode placement for hip conditions, including arthritis, damage to the pelvis, sacrum or coccyx, localised pain or post-operative hip replacement

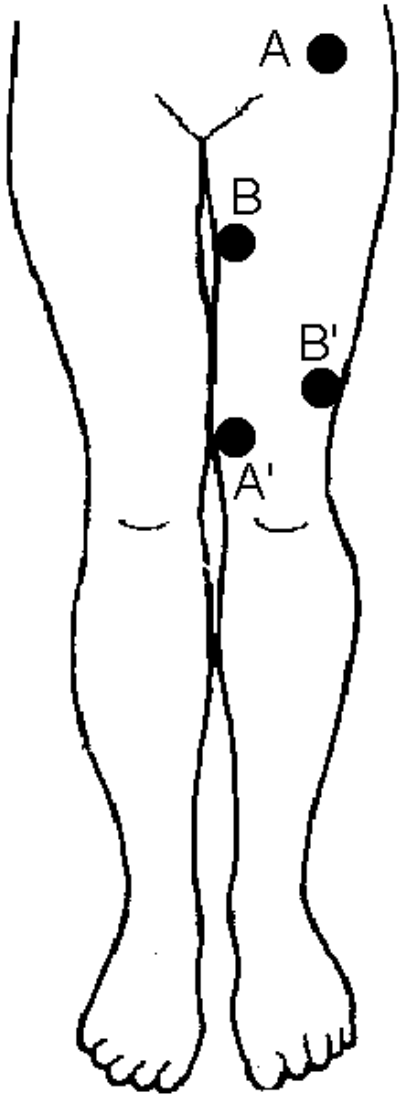
Electrode Placement:

A-A' - the top of the gluteus maximus and the upper anterior thigh

B-B' - the supra-inguinal (lower abdominal) and upper posterior thigh

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

9. Anterior Thigh



Electrode placement for upper leg - anterior conditions including groin injury, muscle damage and muscle stiffness

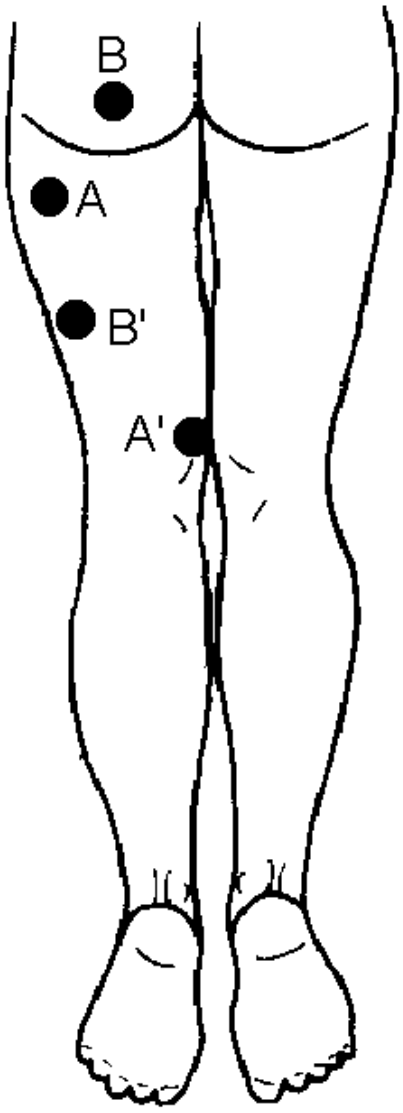
Electrode Placement:

A-A' - the mid-groin and vastus medialis

B-B' - the mid-adductor and the vastus lateralis

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

10. Posterior Thigh



Electrode placement for upper leg - posterior damage including hamstring lesions and muscular stiffness

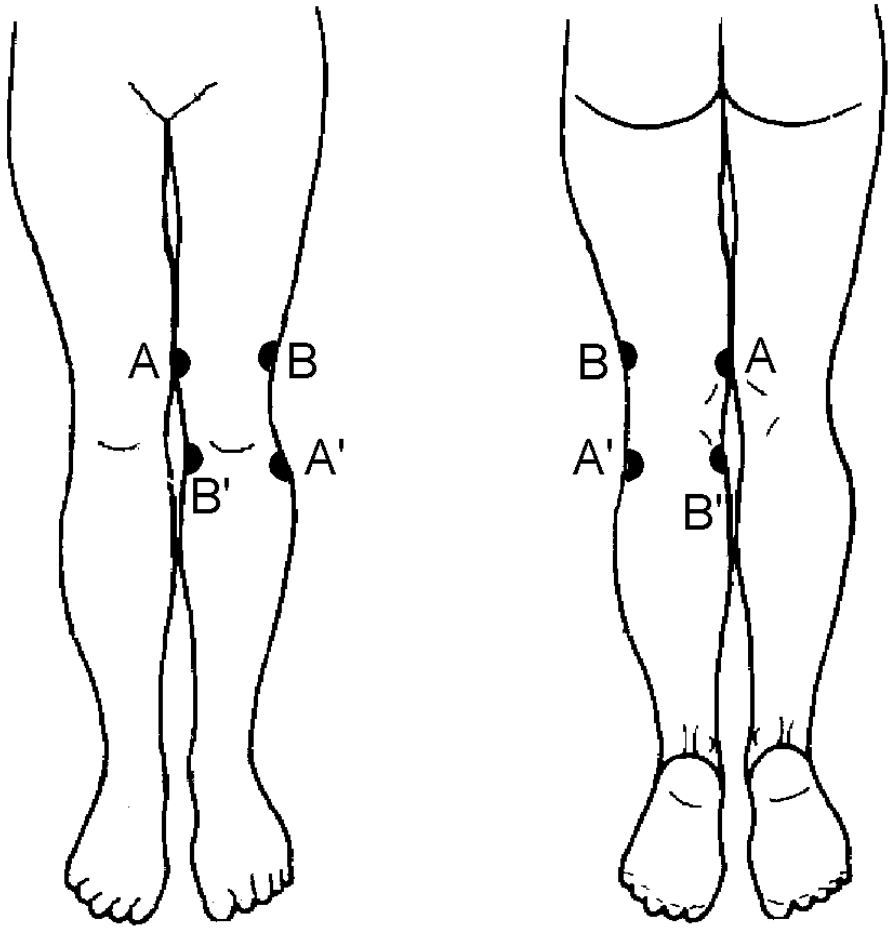
Electrode Placement:

A-A' - the lower gluteus maximus and the lower medial thigh

B-B' - the gluteus maximus and the lateral upper thigh

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

11. Knee



Electrode placement for knee conditions including post-operative knee treatments, knee ligament strains and muscle lesions

NOTE: Cross-fire technique should encompass the anterior and posterior cruciate ligament damage - adjustment of electrode positions may be required for optimal effect. For more effective lower frequency stimulation, move A-A' and B-B' further apart and on to the belly of the muscles (see anterior thigh and posterior thigh positions)

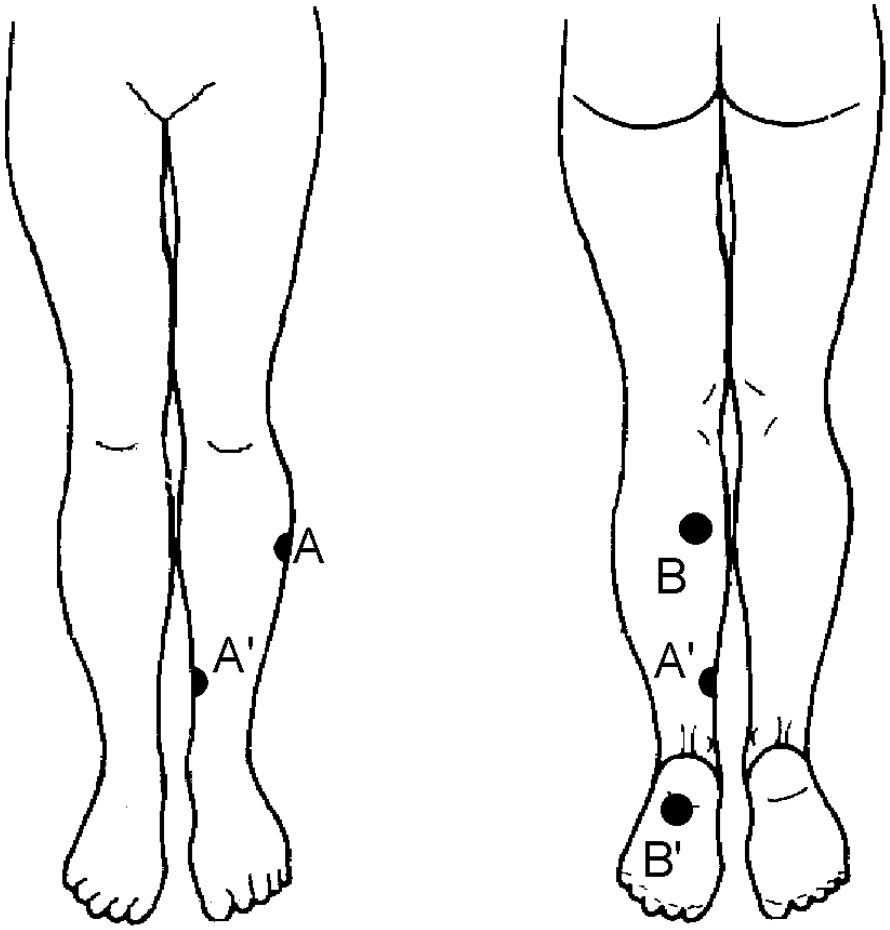
Electrode Placement:

A-A' - above and below the knee joint bilaterally

B-B' - above and below the knee joint bilaterally

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

12. Lower Leg



Electrode placement for lower leg problems including damage to the calf muscles

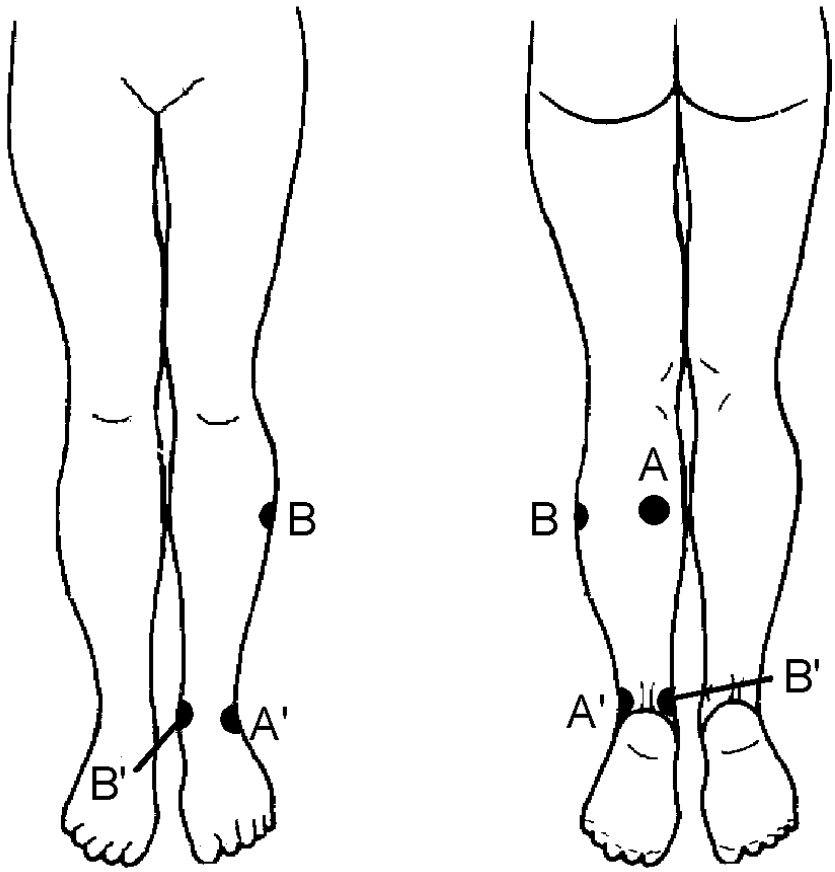
Electrode Placement:

A-A' - below the neck of the fibula and the medial lower leg

B-B' - the medial aspect of the upper calf and the plantar aspect of the foot

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

13. Ankle and Achilles Tendon



Electrode placement for ankle damage including oedema, sprain and stiffness of the ankle, arthritis, achilles tendon problems and post-operative achilles tendon treatment.

NOTE: For injuries to the ankle, it is important to place the B electrode just below the neck of the fibula (ie over the common peroneal nerve). When treating achilles tendon, move the distal electrodes up to either side of the tendon, just behind the malleolae

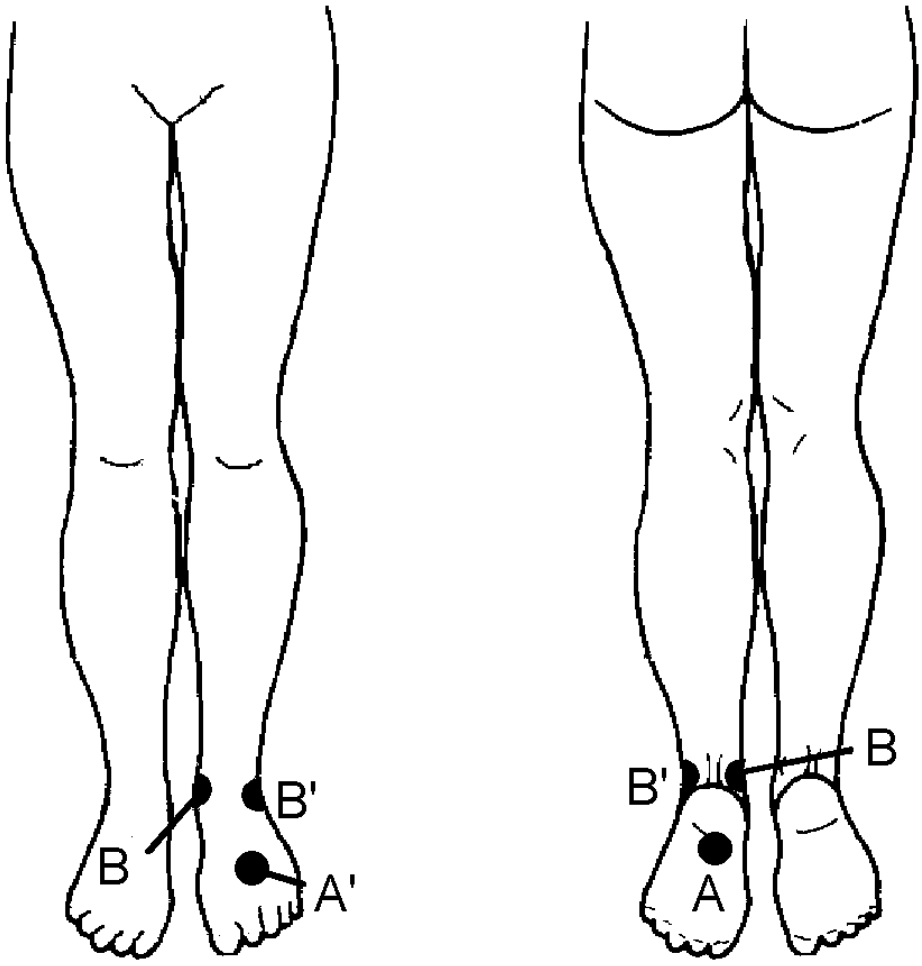
Electrode Placement:

A-A' - the upper medial calf and just below the lateral malleolus

B-B' - below the neck of the fibula and just below the medial malleolus

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

14. Foot



Electrode placement for foot conditions including arthritis, post-operative surgery and plantar fascitis

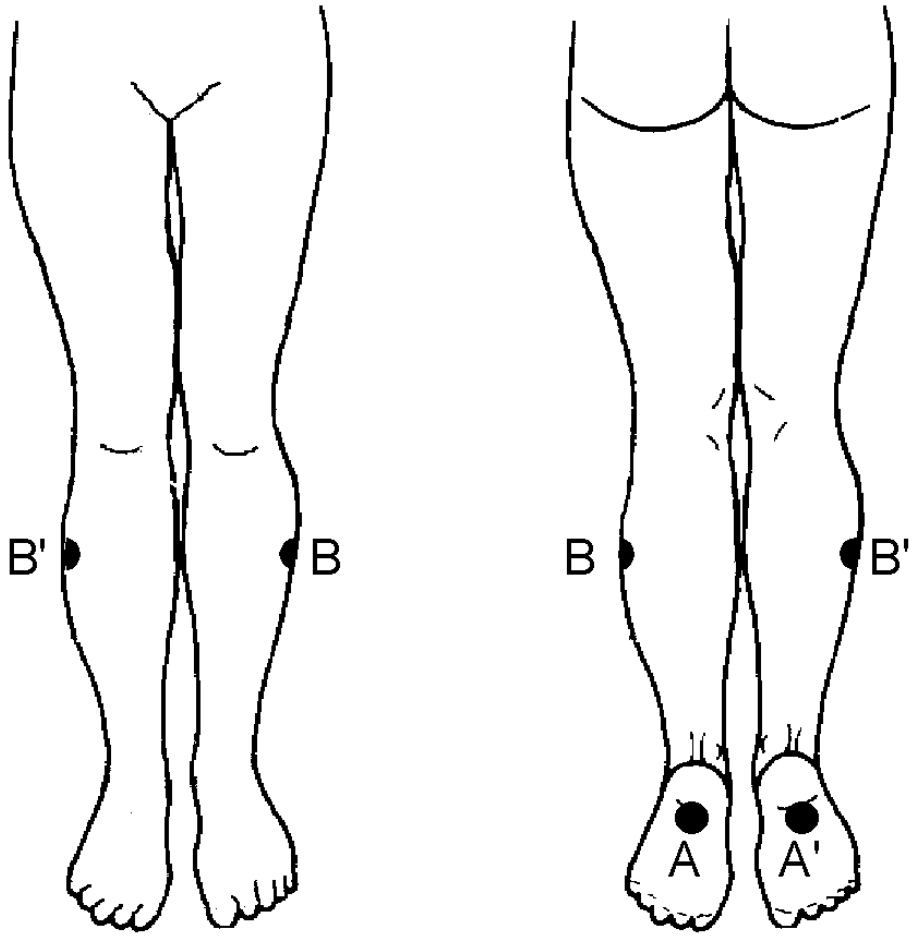
Electrode Placement:

A-A' - plantar and dorsal aspects of the foot

B-B' - lateral and medial aspects of the ankle immediately below the malleolae

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

15. Bilateral Leg / Foot



Electrode placement for treatment of general stiffness or muscle tightness in both legs (after extensive exercise) and for reducing swelling or soreness of the feet

NOTE: The patient should be lying down and might find comfort improves if both legs are raised and supported under the knees and ankles

Electrode Placement:

A-A' - plantar aspect of each foot

B-B' - below the neck of the fibula of each leg

Remember: It is worth adjusting the electrode positions to find the optimal maximum muscle contraction when using the lower frequency therapy mode. At the higher frequency, it may prove beneficial to place the electrodes over the pain path to obtain maximum pain relief.

Maintenance

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.