

# LSI System IV

## Interferential with Russian Stimulation

### Owner's Manual



**LSI International**

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# TROUBLESHOOTING

Unit goes into fail mode (MA's blinking -00-, Alarm sounding)	<ol style="list-style-type: none"><li>1. Check electrodes and leadwires.</li><li>2. Electrodes must be attached to the patient in order for the MA's to increase.</li></ol>
Unable to increase intensity	<ol style="list-style-type: none"><li>1. Check programming procedure by viewing training tape and reviewing Owner's Manual.</li><li>2. Vector light must be off in order to increase intensity.</li></ol>
No power to unit (no lights, no sound)	<ol style="list-style-type: none"><li>1. Check to see if cord is plugged securely into the wall and the back of the unit.</li><li>2. Check both fuses in the back of the unit.</li></ol>
Unit is "locked up" and cannot be programmed or unit shuts down during treatment.	<ol style="list-style-type: none"><li>1. Unit is malfunctioning and needs to be returned to LSI for repair.</li></ol>
Unit will not go into Start mode when "Start" button is pressed.	<ol style="list-style-type: none"><li>1. Check to see if there is time entered in Time LED.</li></ol>

## CAUTION

1. NEVER TURN THE UNIT ON OR OFF (**BY MEANS OF THE ON/OFF TOGGLE SWITCH LOCATED ON THE BACK OF THE UNIT**) WHILE A PATIENT IS ATTACHED TO THE UNIT VIA THE LEAD WIRES AND ELECTRODES.
2. NEVER OPERATE UNIT DURING LIGHTENING, THUNDERSTORMS OR ANY CONDITION THAT COULD HAVE AN ADVERSE EFFECT ON CONTINUITY OF POWER FLOW TO THE UNIT.
3. NEVER OPERATE UNIT IN CLOSE PROXIMITY TO ANY TYPE OF DIATHERMY DEVICE.

*The most common operational problems associated with electrotherapy devices center around the lead wires and electrodes. Please read the following information concerning these components.*

### **CARBON RUBBER ELECTRODES**

(Red and black, supplied with your unit)

It is recommended that water soaked sponges always be used between the electrode and the tissue to ensure uniform contact and even disbursement of the current over the entire surface area of the electrode. If water only is used as a conductive agent (no sponge), pooling may occur with resulting dry spot under the electrode. The current then will become intensified at the site of the best conduction, the water pools, with little or no current flow elsewhere. Conductive gels may be used, however, they tend to create a glaze over the electrode surface after long term use which may interfere with current flow. Cleaning with a mild soap and water with a soft brush will remove the glaze. It is not a good practice to use conductive mist sprays as they will not ensure a uniform contact between electrode and tissue and most sprays contain a saline solution which will destroy the carbon and render the electrode useless.

### **ELECTRODE AND LEAD WIRE TEST MODE**

To test for defective lead wires and/or electrodes follow this procedure:

- a. Hold down the STOP key for 5 seconds, until all 8's appear in the Frequency section, 10 appears above Time and 01 appears in both channel 1 and channel 2 output.
- b. Plug lead wire into either channel 1 or channel 2.
- c. Hold the two lead wire pins together and observe the readout in the output LED's above. If the readout is 9 or 10, the lead wire is good. (For further assurance, stress the wire back and forth at the pin and also at the end where it enters the stereo plug. The readout should stay at 9 or 10. A fluctuation would indicate a broken wire making intermittent contact.) If the readout is less than 9 or if it fluctuates, replace the lead wire.
- d. To test electrodes, insert one lead wire pin into an electrode. Touch the other pin to the conductive side of the electrode and observe the output LED. If the output reads 9 or 10 the electrode is good. A reading of 8 or less indicates a defective electrode which should be replaced.

### **SELF-ADHESIVE ELECTRODES**

It is recognized that there are many brands, types, and styles of electrodes available. We recommend the LSI Silver or Gold self-adhesive electrodes only! We do not recommend using foilbacked electrodes. The metal foil can cause changes in the waveform. To ensure maximum life of your electrodes, the skin should always be cleaned before applying the electrode. This can be accomplished by stripping with tape, cleansing with soap and water, or by using an alcohol wipe. Electrodes must also be replaced into the resealable package after use. This will keep them from drying out and losing their adhesive and conductive properties. Additional life may be added to the electrode by the use of Electro-Mist spray. A small amount on the electrode before replacing it in the package may reintroduce some adhesiveness and conductivity. The expected life of the LSI Silver or Gold self-adhesive electrode is 20 uses with proper care. Remember, however, they are "disposable electrodes" and are not intended for indefinite use. If you notice fluctuating delivery of current to the patient, poor adhesiveness or difficulty in getting the amplitude of your unit high enough, discard the electrodes and use a new package.

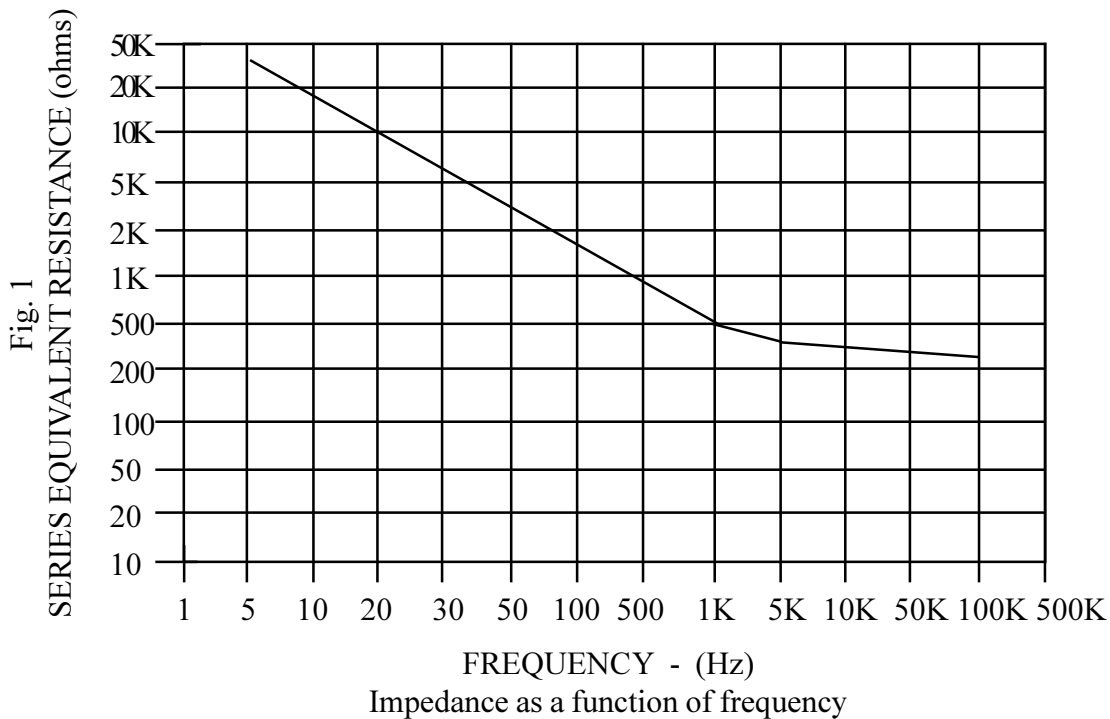
# INTRODUCTION

## PRINCIPLES OF INTERFERENTIAL THERAPY

Interferential therapy was first developed by Dr. Hans Nemeck of Vienna, Austria in the early 1950's. Its use has grown dramatically since its introduction in the United States in the 1970's.

Three prerequisites are necessary for interferential current therapy: a) medium frequency current (1000 to 10,000 Hz), b) two independent current generators and c) alternating current. By crossing two currents within the tissue, they "interfere" with each other and form a "beat frequency" in the deeper tissue.

It has been established that by increasing the frequency of any alternating current, the skin resistance (measured in ohms) is reduced. (see fig. 1)

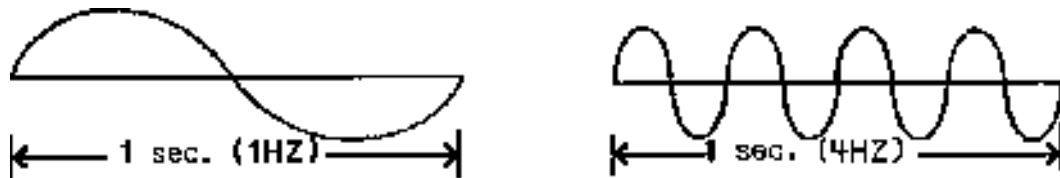


Burton and Maurer, 1974. Pain Suppression by Transcutaneous Electronic Stimulation. IEEE Transaction on Biomedical Engineering.

Interferential current therapy may be produced by two different methods. They are commonly referred to as the "Frequency Defference" method and the "Premodulated" method. The LSI System IV unit is capable of producing interferential current through either of these methods.

It is necessary to have a working knowledge of terms such as “frequency”, “carrier frequency”, “burst frequency” and “premodulation” in order to understand Frequency Difference and Premodulated interferential currents.

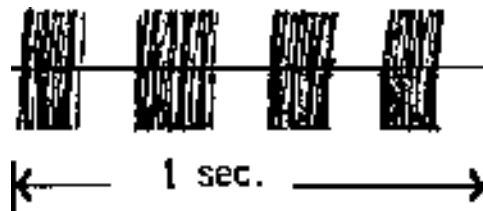
Frequency is synonymous with pulses per second, cycles per second and hertz. In an alternating current (AC) there is both a positive and a negative component which together form one cycle. The number of these cycles produced in one second therefore, determine the frequency (or hertz, or pulses per second or cycles per second).



Carrier frequency is the number of cycles per second a generator produces. Most interferential units, including the LSI System IV, operate at a carrier frequency of 4000Hz.



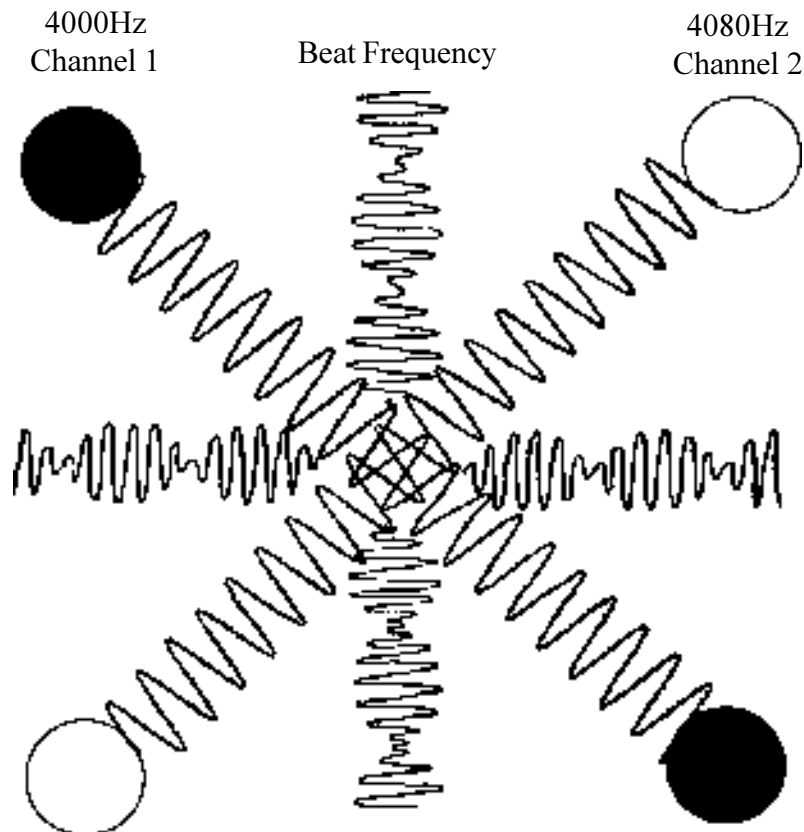
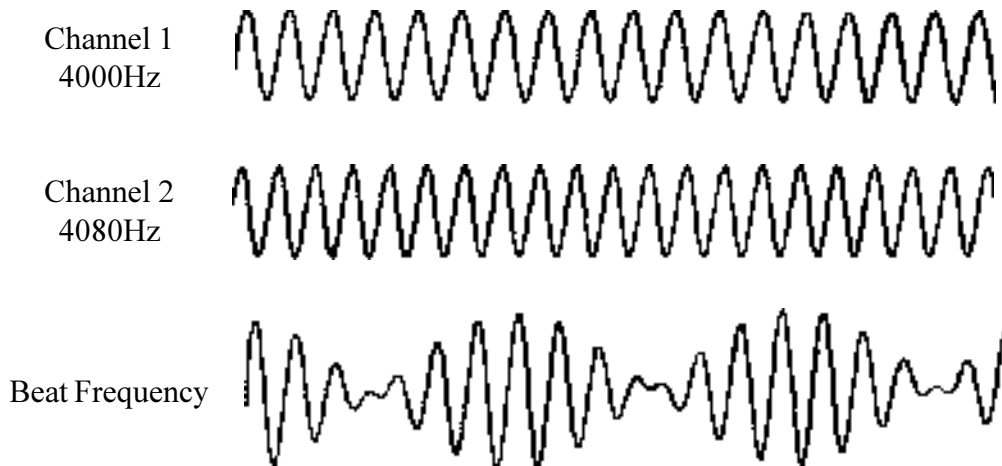
Burst frequency or Pre-modulation is the act of taking the carrier frequency and “bursting” it into a predetermined number of bursts or packages per second without changing the carrier frequency.



In the above example, the carrier frequency of 4000Hz has been burst or pre-modulated into 4Hz with each burst still containing the carrier frequency at the rate of 4000Hz. By maintaining the carrier of 4000Hz, the advantage of reduced tissue resistance to the current is preserved.

## FREQUENCY DIFFERENCE METHOD

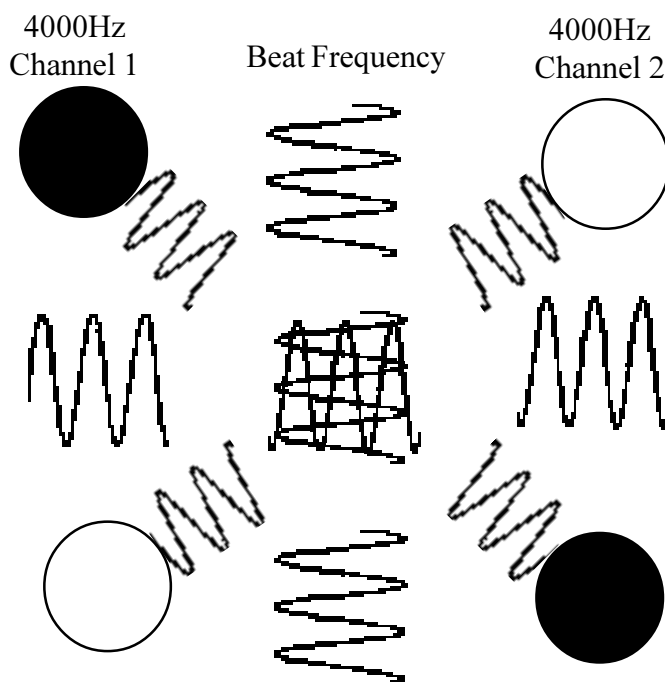
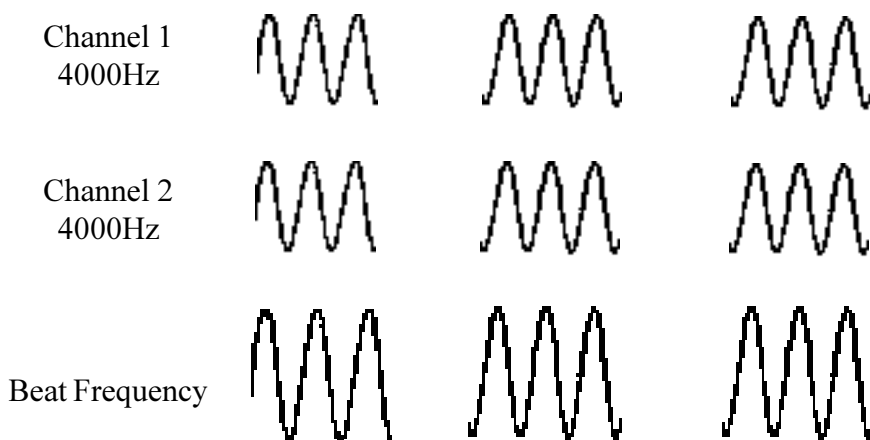
With this method, both channels produce uninterrupted medium frequency current but of a slightly different frequency. As an example, channel 1 produces 4000Hz and channel 2 produces 4080Hz. The difference between the two frequencies produces a 'beat frequency' of 80Hz (the difference between the two channels). This beat frequency is created because the two channels will be in phase 80 times per second, thus adding their respective amplitudes together for intensified stimulation.



With Frequency Difference interferential, the uninterrupted frequency output from channel 1 and 2 will create Widensky Inhibition (nerve block) between the corresponding electrodes. This is due to the fact that the large diameter sensory fibers will tend to depolarize at this higher constant frequency and block nerve conduction completely. The “beat frequency” therefore, becomes the frequency the clinician utilizes for a therapeutic result.

PREMODULATED METHOD

With the premodulated method, both output channels produce the identical carrier frequency of 4000Hz. However, the modulation or bursting occurs within the unit and is delivered to the tissue in a burst frequency as selected by the clinician. Since both channels are synchronized and always in phase, the beat frequency will be the same as the pre-modulated frequency.



## PRINCIPLE OF ACCOMODATION

Both motor and sensory accommodation may easily occur when electrical stimulation is applied at a constant frequency. The LSI System IV Interferential unit allows the clinician the opportunity to lessen accommodation by the use of the "SWEEP" mode. In the Premodulated mode (PREMOD light on) the burst frequency will "sweep" within the preselected range (i.e. 3 to 5 Hz, 80 to 120 Hz or 1 to 150 Hz). If the operator selects a specific frequency, 70 Hz as an example, the sweep will be 20% plus and minus from the 70 Hz.

In the Frequency Difference interferential mode (PREMOD light off), channel 2 will sweep between the preselected range (i.e. 4003 to 4005 Hz, 4001 to 4015 Hz, 4080 to 4120 Hz or 4001 to 4150 Hz). If the operator selects a specific frequency, 70 Hz as an example, channel 2 will sweep 20% plus and minus from the 4070 Hz.

## USE OF THE VECTOR

With the amplitude of both channels set at the same milliamps of current, the interference or beat frequency current will be positioned between the flow of current created by each channel. This is referred to as a static or stationary position. The interference current will be drawn nearer to the stronger current output of either channel 1 or channel 2. In order to move or rotate the interference current within the tissue, the VECTOR mode is utilized. The VECTOR mode automatically changes the intensity of channel 1 and 2, alternately, from their preset output. Each channel will alternately drop 20% in output and then return to the preset output. This effect pulls the interference or beat frequency current back and forth to effectively provide coverage of all tissue within the four electrode field.

## MUSCLE STIMULATION

Medium frequency current, pre-modulated in the range of 40 to 60 Hz, produces smooth, comfortable, asynchronous contraction in normal innervated muscle. Such contractions have been utilized for edema reduction, muscle spasm reduction and muscle strengthening (also referred to as Russian Stimulation).

## EDEMA REDUCTION

By utilizing the 10/10 mode (10 seconds of contraction alternating with 10 seconds of rest), with the current intensity set to produce gentle movement of the involved joint, the body's natural muscle pumping action is simulated.

## MUSCLE SPASM REDUCTION

By also utilizing the 10/10 mode, (10 seconds of contraction alternating with 10 seconds of rest), with the current intensity set to produce gentle movement of the involved joint, the body's natural muscle pumping action is simulated.

## MUSCLE SPASM REDUCTION

By also utilizing the 10/10 mode, with the current intensity set to produce strong contractions of the involved muscle, the muscle will fatigue over a period of minutes due to the short rest time and depleting of ATP.

## MUSCLE STRENGTHENING

In this procedure, the 10/50 mode is used to provide 10 seconds of contraction followed by 50 seconds of rest.

## RAMPING

The LSI System IV Interferential has a built in ramping effect when the 10/10 or 10/50 modes are in use. As the 10 second cycle begins, the current will slowly “ramp up” over a period of 2.5 seconds to the present intensity. As the 10 second on cycle ends, the current will “ramp down” over a 2 second period. This allows for a gently onset and completion of contraction cycle.

## CONTRAINDICATIONS AND PRECAUTIONS

- 1) Federal law restricts this device to the use or sale to a physician or other practitioner in the state or province in which said person is licensed and practices.
- 2) Do not use this device when treating electrically susceptible patients such as those with pacemakers, etc.
- 3) Use extreme caution when treating areas of impaired sensory response or patients unable to report discomfort and pain.
- 4) Do not apply electrodes transthoracically or in the vicinity of the eyes or carotid sinus nerves or transcerebrally.
- 5) This device is not recommended for patients that are pregnant or that suffer from heart disease.
- 6) This device should not be used to relieve chronic pain until etiology has been established.
- 7) Application of electrical stimulation can produce irritations at the stimulation site. This may be caused by the electrodes, taped and other media in contact with the skin. Determine the cause of the irritation and replace the item as necessary.
- 8) Electrical stimulation should only be applied with an effective coupling medium. LSI recommends the use of the carbon electrodes and sponges included with your unit or a good quality reusable self-adhesive electrode.
- 9) Electrical stimulation is contraindicated in the case of malignant tumors, cancerous lesions, acute or sever inflammation, circulatory insufficiency or the danger of hemorrhage.
- 10) Do not use simultaneously in the same treatment area with cold packs or heat therapy.
- 11) Keep this device out of the reach of children.

## **PRECAUTIONS**

Do not use in general area where high powered frequency transmitting units are being operated.

Shortwave diathermy should not be turned on or used at the same time, as it may interfere with the proper operation of the LSI System IV Interferential.

Do not use the same power outlet or line with whirlpool, traction machines, and any other heavy electrical machines or motors.

This unit requires a grounded outlet. If you have any doubts as to the quality of the electrical wiring in your clinic, please have it checked and verified by a professional.

**NOTE:** In order to ensure proper and safe operation of your LSI unit, it is absolutely necessary that only LSI DIN PIN leadwires like those supplied with this unit be used.



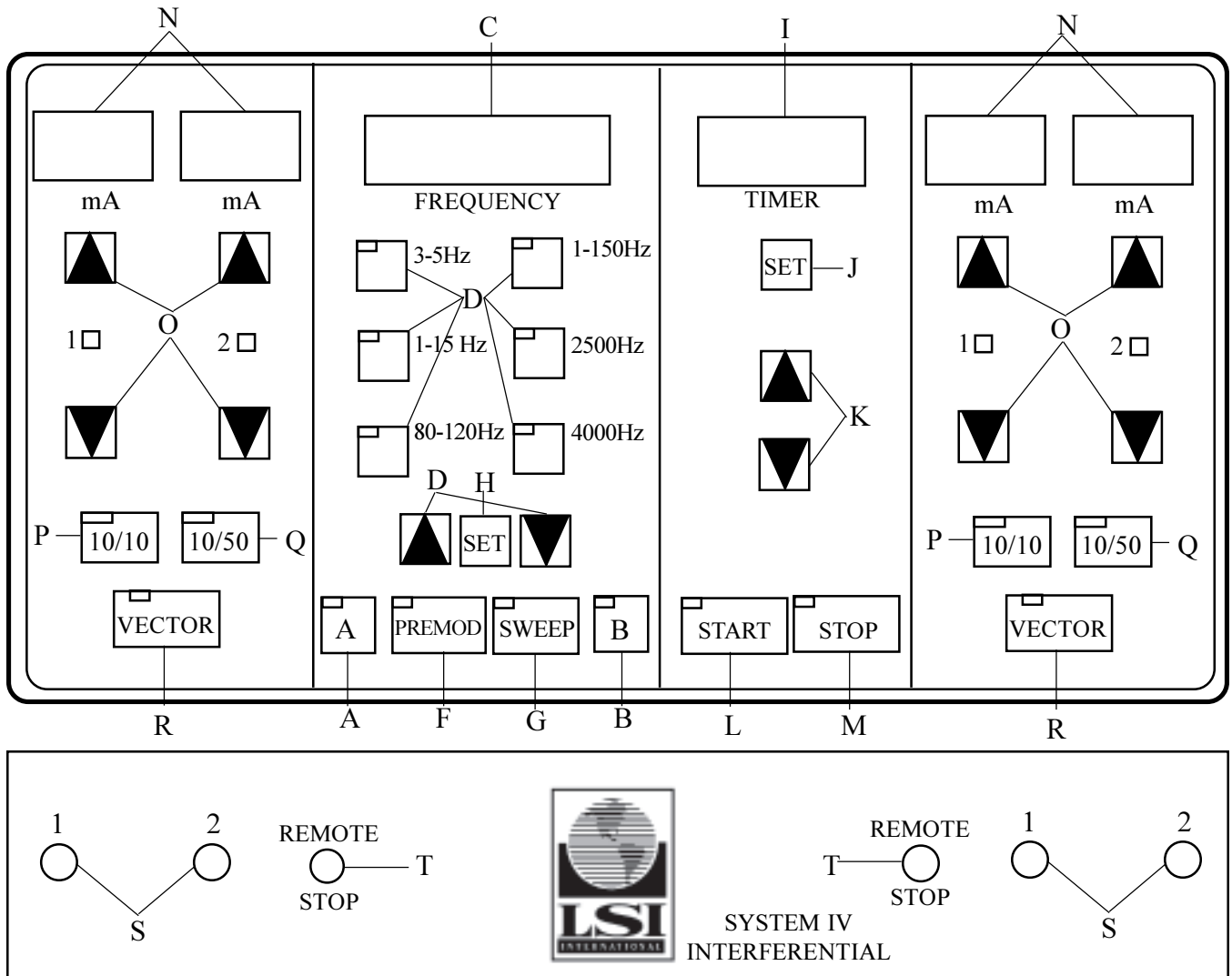
## **MAINTENANCE AND TROUBLE SHOOTING**

Maintenance of the LSI System IV Interferential is limited to the periodic cleaning of the unit and patient applied accessories with a damp cloth or sponge and a solution of mild soap and water. Any other cleaning solution may potentially damage the finish of the unit and /or the efficiency of the leads and electrodes.

If the LSI System IV Interferential unit does not seem to be operating properly, check the line cord and fuse, turn the unit and check for proper operation. Check the lead wires by utilizing the electrode test function.

The LSI System IV Interferential contains no user repairable parts. Servicing and repair should be referred to authorized service personnel only. For servicing information, contact:

LSI International  
Service Department  
8849 Bond • Overland Park, 66214  
(Local) 913-894-4493  
(Toll free) 800-832-0053  
(Fax) 913-894-1980  
(Website) [www.lsiinternational.com](http://www.lsiinternational.com)



### FEATURES

The LSI System IV contains a current test feature which senses the quality of the electrode contact. If your electrodes are making poor contact with the tissue, the unit will emit a beeping tone and the LED's on the mA output will drop to 0 and flash. If this occurs, recheck your electrodes and lead wires to ensure proper contact and again increase intensity with the intensity keypads.

- A- SELECTOR FOR SIDE A: When light is on, the programming feature shown above pertains to side A.
- B- SELECTOR FOR SIDE B: When light is on, the programming feature shown above pertains to side B.  
Note: Side A & B can be programmed simultaneously when both are lit.
- C- FREQUENCY READOUT: Indicates frequency the unit is set at. Will read actual burst frequency when in PREMOD mode and will read difference between channel 1 and 2 in frequency difference mode. (PREMOD light off).

- D- FREQUENCY SELECTION: Use the frequency range of your choice. Frequency readout will show top of range selected prior to activation of SWEEP mode.
- E- FREQUENCY ADJUST: Use to set a specific frequency. As an example, to set 50 Hz, first set Frequency Selection at the 1-15 Hz range, then press up the keypad to increase frequency to 50 Hz.
- F- PREMOD: When off (no light), channel 1 will operate at an uninterrupted 4000Hz and channel 2 will operate at 4000Hz plus the frequency selected on function A (Frequency Readout). When on (light on), both channels will operate at a carrier frequency of 4000Hz and both channels will be synchronized to deliver the frequency as shown in function A.
- G- SWEEP: Frequency will sweep between the range indicated in function B ( Frequency Selection) or if a specific frequency is selected (function C), frequency will sweep plus and minus 20%. Press keypad to activate light and this function.
- H- SET: This control is used for a special programming option. Please refer to page 10.
- I- TIMER: Indicates treatment time remaining.
- J- TIMER SET: Set keypad automatically enters 10 minutes to timer.
- K- TIME ADJUST: By pressing the up or down keypad, the treatment time may be raised or lowered from the 10 minutes which is set automatically.
- L- START: Activates timer and outputs to channels 1 and 2.
- M- STOP: Stops timer and output to channels 1 and 2.
- N- MILLIAMPS OUTPUT: Indicates the correct, measured in milliamps, which is actually being delivered to the tissue.
- O- CURRENT OUTPUT CONTROLS: Keypads will increase or decrease the delivered current to channels 1 and 2.
- P- 10/10 MODE: Activates the 10 second on and 10 second off function. When activated, the off portion of the cycle will precede the on portion. Automatic ramping of 2.5 seconds up and 2.0 seconds down is provided.
- Q- 10/50 MODE: Activates the 10 second on and 50 second off function. When activated, the off portion of the cycle will precede the on portion. Automatic ramping of 2.5 seconds up and 2.0 seconds down is provided.

- R- VECTOR: When activated, channel 1 and 2 will alternately drop 20% from their preset output and return to the preset figure.

NOTES CONCERNING FUNCTIONS O, P, Q, and R: As a safety feature, output cannot be changed while the 10/10 or 10/50 functions are in the off cycle or when the VECTOR light is on. Also, since there is no reason to utilize the VECTOR while the 10/10 or 10/50 functions are in use, the unit will not allow dual activation. If attempted, a tone will sound alerting the operator that the unit will not accept dual activation.

- S - OUTPUT JACKS: Output jacks for channel 1 and 2.

- T - REMOTE STOP: Depressing the button on the remote control will stop all output of the unit. A repeating tone will sound, signaling the operator that the patient has activated the switch.

### SPECIAL PROGRAMMING OPTIONS

The LSI System IV allows for several special programming options.

- 1- To create a frequency range: (Example: 70 to 100Hz)
  - a. Select 80 - 120Hz range.
  - b. Use down arrow on frequency adjust to lower readout to 100Hz, then push SET control in frequency section.
  - c. 80Hz will now appear in a flashing mode. Use down arrow on frequency to lower readout 70Hz, then push the set control again.
  - d. 10 will now flash in the timer section. You can either change the timer with the arrows under the timer SET control or leave the timer at 10. To set the timer selected again push the SET control in the frequency section.

When SWEEP and START are activated, the frequency will sweep between 70 and 100Hz. Any range 1Hz to 250Hz can be established.

- 2- To change on and off times and ramp times under the 10/10 and 10/50 controls:
  - a. Select 2500Hz. This will automatically activate the 50Hz premodulated settings. THE FOLLOWING EXAMPLES USES THE 10/10 CONTROL. THE PROCEDURE IS THE SAME FOR 10/50.
  - b. Push 10/10 control. 10 and 10 will appear above the mA. This signifies 10 seconds on (left LED) and 10 seconds off (right LED). On and off times can be changed by pressing up or down arrows. When new on and off times are selected, press 10/10 again. Now ramp times are displayed with ramp up on the left LED and ramp down on the right LED. These can be changed in .5 second increments by using up or down arrows. Push the 10/10 control again. The new times are now programmed in. Push START, increase mA output to desired contraction, then push 10/10 to begin on and off sequence.
- 3- To program two treatments back to back:

Some clinicians have desired to treat the same area with two different frequencies, one treatment following the other without resetting the unit. As an example, you may want to treat at 80-120Hz for 6 minutes followed by 3 - 5 Hz for another 6 minutes. This can be accomplished as follows.

  - a. Select PREMOD and/or SWEEP functions.
  - b. Select 1st treatment range (i.e. 80 - 120Hz)

- c. Press SET (in frequency adjustment section) to accept 120.
- d. The 120 will change to 80 and flash.
- e. Press SET again to accept the 80 Hz setting.
- f. The 10 will now flash in the timer selectio. To lower the time to 6 minutes use the down arrow until 6 appears.
- g. Press SET again (in frequency adjustment section). The first treatment of 80 - 120Hz for 6 minutes has now been entered.
- h. Now press the 3 - 5Hz setting.
- i. Press SET to accept the 5Hz, 3 will now flash.
- j. Press SET to accept the 3Hz, 10 will now flash in the timer section.
- k. Push the down arrow under the timer to lower the time to 6 minutes.
- l. Press SET again (in the frequency adjustment section) to enter the 6 minute treatment time. Both treatments have now been stored.
- m. Press START and increase the intensity to patient comfort. After the first treatment (80 - 120Hz for 6 minutes) has been completed, the second treatment (3 - 5Hz for 6 minutes) will automatically begin.

### ELECTRODE AND LEAD WIRE TEST MODE

To test for defective lead wires and/or electrodes follow this procedure.

- a. Hold down the STOP key for 5 seconds, until all 8's appear in the Frequency section, 10 appears above Timer and 01 appears in both channel 1 and channel 2 output.
- b. Plug lead wire into either channel 1 or channel 2.
- c. Hold the two lead wire pins together and observe the readout in the output LED's above. If the readout is 9 or 10, the lead wire is good. (For further assurance, stress the wire back and forth at the pin and also at the end where it enters the stereo plug. The readout should stay at 9 or 10. A fluctuation would indicate a broken wire making intermittant contact.) If the readout is less than 9 or if it fluctuates, replace the lead wire.
- d. To test electrodes, insert one lead wire pin into an electrode. Touch the other pin to the conductive side of the electrode and observe the output LED. If the output reads 9 or 10 the electrode is good. A reading of 8 or less indicates a defective electrode which should be replaced.

### HIGH RESISTANCE INDICATOR

The LSI System IV is designed to indicate when excessive resistance (high ohms reading) is present. This is normally due to using sponges which are only damp rather than wet or using an electrode which is conducting poorly. If, while increasing the intensity by pressing the up arrow, the output stops at a reading of less than 60mA and the readout begins to flash off and on, you have encountered resistance too high for normal operation of the unit. While the output is flashing, the Frequency LED's will indicate the actual resistance in ohms. If this occurs, check for dry sponges, too little pressure on the sponge and electrode or defective electrodes and/or lead wires.

## TECHNICAL SPECIFICATIONS

- Outputs** Sinusoidal AC  
0-200 Volts peak to peak  
0-60 mA RMS  
Delivered current displayed for each output
- Frequency** 4000-4250Hz continuous or burst modulated form 1 - 250 with a 50% duty cycle.  
Vector Sweep provides amplitude modulation of Output 1 and 2 from -20% to preset intensity over an eight second period.  
Frequency Adjust provides selectable output frequency of 4000-4250Hz.
- Timer** Digital countdown from 1-99 minutes with interrupt and reset capability.
- Safety** Stimulation output is inhibited each time the STOP key is actuated. Output is automatically reset to 0 each time the patient remote stop is depressed or when the timer counts down to no time remaining.
- Line Leakage** Patient cables to line - less than 10 uA.

### Accessories

#### **Kit 1:**

- 2 - Red 6' DIN to two .080" pin leadwires
- 2 - Black 6' DIN to two .080" pin leadwires
- 4 - 3" Red carbon electrodes
- 4 - 3" Black carbon electrodes
- 2 - 2" Red carbon electrodes
- 2 - 2" Black carbon electrodes
- 2 - 18" elastic wraps
- 2 - 48" elastic wraps
- 8 - 3" electrode sponges
- 4 - 2" electrode sponges
- 1 - line cord
- 2 - remote stop
- 1 - operator manual
- 1 - pad placement
- 1 - quick reference guide
- 2 - training videos

#### **Kit 2:**

- 2 - Red 6' DIN to two .080" pin leadwires
- 2 - Black 6' DIN to two .080" pin leadwires
- 8 - packages of small self-adhesive electrodes
- 8 - packages of large self-adhesive electrodes
- 1 - line cord
- 2 - remote stop
- 1 - operator manual
- 1 - pad placement
- 1 - quick reference guide
- 2 - training videos

WARRANTY

LSI warrants the LSI System IV Interferential unit when properly registered against defects in workmanship, materials, and construction under normal use and service for a period of six years from the original date of purchase. Under this warranty, our obligation is limited to repairing or replacing any defective parts. This warranty includes transportation costs to and from the factory in the continental United States and use of a loaner until while your unit is being repaired.

LIMITATIONS AND EXCLUSIONS

This warranty does not apply to any equipment which has been tampered with in any way, or which has been misused or damaged by accident or negligence, or which has the serial number removed, altered or effaced. Accessories for the unit are warranted for the first ninety days from purchase.

FOR WARRANTY SERVICE

Liability under this warranty covers servicing of the unit returned to the factory. To implement the warranty, first notify LSI International concerning suspected defects. Then, if so instructed, ship the unit to LSI International by normal UPS delivery.

For authorization to return your unit or to inquire about possible malfunctions, call LSI International at 913-894-4493 or 1-800-832-0053.

**DO NOT SEND YOUR UNIT TO THE FACTORY WITHOUT FIRST SECURING AUTHORIZATION TO DO SO AND OBTAINING A RETURN AUTHORIZATION NUMBER.**

SERIAL NUMBER: \_\_\_\_\_ SOLD TO: \_\_\_\_\_

DATE SOLD: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

This warranty is non-transferable.