CS3101

Clinician Instruction Manual

Interferential Stimulator

Caution

This addendum contains sensitive material discussing the operation of the CS3101 and must be retained by the clinician or health care professional who prescribes this device.

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1 - Introduction

Warning: *To become familiar with the features, benefits, and operation of the CS3101 Interferential Stimulator, please read this entire manual carefully before use.*

Warning: ***KEEP OUT OF THE REACH OF CHILDREN AT ALL TIMES.***

1.1 - Principles of the CS3101's Design

The CS3101 Interferential Stimulator was designed with the latest innovations in technology and user-friendly ergonomic design. The unit incorporates both interferential and NMS protocols. The treatment voltage amplitude may be set with a precision of 1/10 of a Volt (peak), and various pre-programmed protocols may be selected for different types of treatment. The CS3101 utilizes a Touch Proof™ output designed to ensure patient safety. All frequency and amplitude control is provided by an on-board microcontroller. An intuitive membrane keypad and alpha-numeric/graphic LCD provides user input/output. The unit has four memory functions. These memory functions are used to provide storage for custom therapist protocols. Power is provided by rechargeable NiMH batteries, or optionally by use of an AC power adaptor. The AC adapter also doubles as a battery charger.

1.2 - How Interferential Stimulation Works

Two medium frequency currents are applied to the patient simultaneously via two pairs of electrodes which are placed on the patient diagonally around the area to be treated. One pair of electrodes is at a fixed frequency of 4000 Hz. The other pair of electrodes is variable, between 4001 Hz and 4150 Hz. At the point where the two currents cross a beat, or interference frequency results which is the difference of the two currents (1-150 Hz). Since medium frequencies encounter little skin resistance they penetrate deep into the soft tissue and bone to the affected area. This causes the body to secrete endorphins and other natural pain killers to help relieve pain. This type of therapy may be used to provide symptomatic relief and management of chronic pain, and/or as an adjunctive treatment for the management of post-surgical and post-traumatic pain. Interferential Stimulation should not be confused with other forms of neuro-stimulators such as TENS, NMS, or HVGS.

1.3 - What Interferential Therapy Feels Like

Most patients find Interferential Therapy to be extremely beneficial and describe the treatment as a faint "pins and needles" sensation.

1.4 - Benefits of Interferential Therapy

- Symptomatic relief and management of chronic pain and/or
- As an adjunctive treatment for the management of post-surgical and post-traumatic pain.

1.5 - How Neuro-Muscular Stimulation Works

Two medium frequency currents are applied to the patient simultaneously via two pairs of electrodes which are placed on the patient diagonally around the area to be treated. One pair of electrodes is at a fixed frequency of 4000 Hz. The other pair of electrodes is at a fixed frequency of 4048 Hz. At the point where the two currents cross a beat, or interference frequency results at 48 Hz. A sweep of amplitude then causes the treated muscle to contract and relax during the course of treatment.

1.6 - What Neuro-Muscular Stimulation Feels Like

Most patients find Neuro-Muscular Stimulation to be extremely beneficial and describe the treatment as a faint “pins and needles” sensation with the added sensation of muscle contraction and relaxation.

1.7 - Benefits of Neuro-Muscular Stimulation

- Re-educate muscle.
- Promotes muscle tone (prevents disuse atrophy).
- Maintains or increases range of motion.
- Relaxes muscle spasms.
- Increase local blood circulation.
- Immediate post-surgical stimulation of calf muscles to prevent venous thrombosis.

2 - Important Precautions and Warnings

2.1 - INTERFERENTIAL STIMULATION

IMPORTANT: *The CS3101 should only be used under the medical supervision of a qualified practitioner for adjunctive therapy for the treatment of medical diseases and conditions.*

2.1.1 - Indications

The CS3101 Interferential Stimulator may be used, with a physician's prescription, for a variety of reasons. They include:

- Symptomatic relief and management of chronic pain and/or as an adjunctive treatment for the management of post-surgical and post-traumatic pain.
- Interferential Current Therapy Modes (Std, Swp, Back, Cont, or M1-M4).

2.1.2 - Contraindications

- **Carotid Sinus- Do not stimulate over the carotid sinus nerves**, especially if an individual has a known sensitivity to the carotid sinus reflex. Severe spasm to the laryngeal and pharyngeal muscles(throat) may occur when the electrodes are positioned over the neck and mouth. These contractions may be strong enough to close the airway passage in the throat to close or cause difficulty in breathing.
- Patients with a demand-type cardiac pacemaker **should not** use the CS3101.
- The CS3101 should not be applied transcerebrally (across the brain).
- Interferential stimulation should not be used whenever pain syndromes are undiagnosed, until etiology is established.

2.1.3 - Warnings

- The safety of electrical stimulation during pregnancy or delivery has not yet been established.
- Interferential stimulation is not effective for pain of central origin. (This includes headache.)
- Interferential devices should be used only under the continued supervision of a physician.
- Interferential devices have no curative value.
- Interferential current therapy is a symptomatic treatment and as such suppresses the sensation of pain which would otherwise serve as a protective mechanism.
- Electronic monitoring equipment (such as ECG monitors and ECG alarms) may not operate properly when interferential stimulation is in use.

- Stimulus delivered by this device may be sufficient to cause electrocution. Electrical current of this magnitude must not flow through the thorax because it may cause a cardiac arrhythmia.

Caution: *Federal Law (USA) restricts this device to sale by, or on the order of, a practitioner licensed by the state in which he/she practices to use or order the use of the device.*

KEEP OUT OF THE REACH OF CHILDREN.

2.1.4 - Precautions

- Isolated cases of skin irritation may occur at the site of electrode placement following long-term application.
- Effectiveness is highly dependent upon patient selection by a person qualified in the management of pain patients.

2.1.5 - Adverse Effects

- Unusually high sensitivity to electrical stimulation may result in skin irritation and burns beneath the electrodes. If this occurs, discontinue use until the source has been determined and corrected.

2.2 - NEURO-MUSCULAR STIMULATION

2.2.1 - Indications

The CS3101 Interferential Stimulator may be used, with a physician’s prescription, for a variety of reasons. They include:

- Neuro-Muscular Stimulator Modes (Stim or M1-M4).
- Relaxation of muscle spasm, increasing local blood circulation, maintaining or increasing range of motion, preventing or retarding disuse atrophy, muscle re-education, and immediate post-surgical stimulation of calf muscles to prevent venous thrombosis.
- The CS3101 should only be used under the medical supervision of a qualified practitioner for adjunctive therapy for the treatment of medical diseases and conditions.

2.2.2 - Contraindications

Cancer patients or anyone with a demand-type cardiac pacemaker should not use the CS3101.

2.2.3 - Warnings

- **Carotid Sinus - Do not stimulate over the carotid sinus nerves**, especially if an individual has a known sensitivity to the carotid sinus reflex. Severe spasm to the laryngeal and pharyngeal muscles(throat) may occur when the electrodes are positioned over the neck and mouth. These contractions may be strong enough to close the airway passage in the throat to close or cause difficulty in breathing.
- **Skin Irritation -** The CS3101 should not be used over infected, inflamed, or swollen areas or skin eruptions, e.g., phlebitis, thrombophlebitis, varicose veins.
- **Heart Problems/Epilepsy -** Persons with suspected or diagnosed heart problems, or epilepsy, should consult their physicians before considering the use of electrical muscle stimulation. Caution should be used in the transthoracic application of electrical muscle stimulators in that the introduction of electrical current into the heart may cause arrhythmias.
- Stimulation should not be applied over, or in proximity to, cancerous lesions.
- The CS3101 should not be applied transcerebrally (across the brain).
- Long term effects of chronic electrical stimulation have not yet been established.

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KEEP OUT OF THE REACH OF CHILDREN.

2.2.4 - Precautions

- The safety of electrical stimulation during pregnancy or delivery has not yet been established.
- Caution should be used for patients with suspected or diagnosed heart problems.
- Caution should be used for patients with suspected or diagnosed epilepsy.
- Precautions should be observed in the presence of the following:
  1. When there is a tendency to hemorrhage following acute trauma or fracture.
  2. Following surgical procedures when muscle contraction may disrupt the healing process.
  3. Over the menstruating or pregnant uterus.
  4. Where sensory nerve damage is present by a loss of normal skin sensation.

- Some patients may experience skin irritation or hypersensitivity due to the electrical stimulation or electrical conductive medium. This irritation can usually be reduced by use of an alternate conductive medium, or alternate electrode placement.
- Electrode placement and stimulation settings should be based on the guidance of the prescribing practitioner.
- The CS3101 should be kept out of the reach of children.
- The CS3101 should be used only with the leads and electrodes recommended for use by the manufacturer.
- The CS3101 should not be used while driving, operating machinery, or during any activity in which involuntary muscle contractions may put the user at undue risk of injury.

2.2.5 - Adverse Effects

- Skin irritation and burn beneath the electrodes have been reported with the use of powered muscle stimulators.
- Unusually high sensitivity to electrical stimulation may result in skin irritation and burns beneath the electrodes. If this occurs, discontinue use until the source has been determined and corrected.

3 - Unit Specifications

Waveform - Symmetrical biphasic squarewave with zero net DC component

Carrier Frequency - 4000 Hz

Beat Frequency - 1-150 Hz (+/- 1Hz) fixed frequency, 1-240 Hz (+/- 1 Hz) frequency shift mode

Variable Frequency - 4001-4150 Hz (+/- 1Hz) fixed frequency, 4001-4240 Hz (+/- 1 Hz) frequency shift mode

Output Current - (0-50 milliamps @ 500 Ohms) per channel

Output Voltage - 0-25 volts peak (0-50 volts peak-to-peak) in 0.1V increments, output voltage accurate to +/- 10% of AMP setting

Pulse Width - 125 micro-seconds

Power Source - CS4109 (6) AA, 7.2V NiMH battery pack, or CS1210A UL approved AC power adapter

Dimensions - 3.6”x5.75”x1.125”

Unit Weight (with batteries) - 13 ounces (370 grams)

4 - CS3201 Package Contents

(1) Control Solutions - CS3101 Interferential Stimulator Unit

(1) Pair of Touch Proof electrode wire leads (Red and Black)

(1) QR Code Sheet

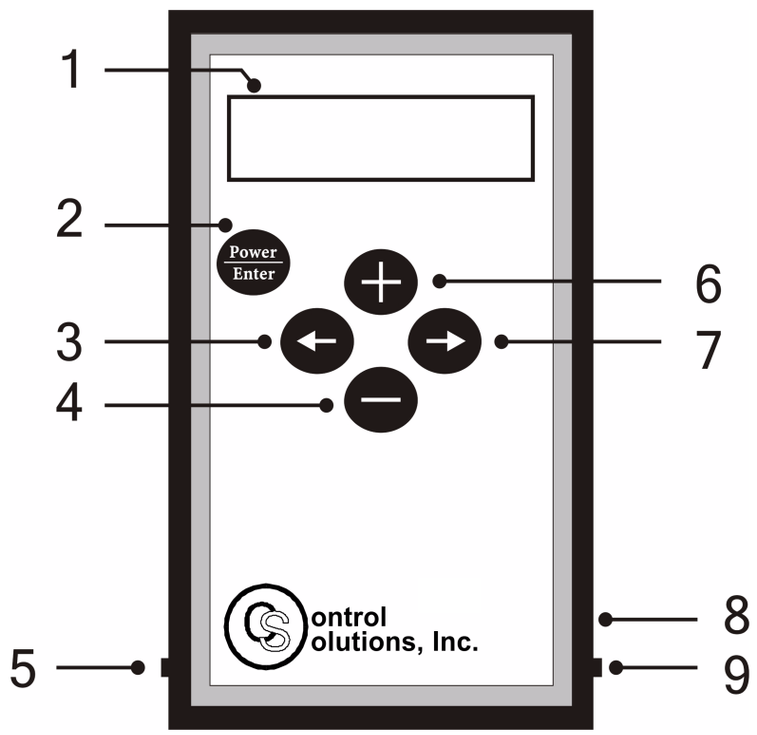
(1) Quick Guide Manual

(1) Carrying Case

(1) CS1210A Wall Adapter (U/L approved)

Warning: *Only use the supplied CS1210A AC wall adapter to charge the CS3101.Using any other unit may damage the CS3101 or shorten its battery life.*
Note: The recommended electrodes to use with the CS3101 are Unipatch #654 RePly 2” x 2”.

5 - Unit Controls



1. **LCD** - a 2 line, 16 character display which shows menu options, parameters, patient treatment timer, battery level, and charging indication.

2. Power Enter - Turns the unit on and off. This button is also serves as an Enter button when the unit is powered up. While treatment is being delivered this button also serves to pause treatment.

3. **-** Selects the previous parameter on the display.

4. **-** Decrements the selected (blinking) parameter, or selects the previous choice for the selected parameter. If this button is held down then the speed at which the selected parameter changes will increase.
5. **CH1** jack located on the lower left side of the unit is the fixed frequency (4000Hz) output, which accepts the right-angle Touch Proof® plug of one set of electrode Black wire lead,(000460A).
6. **-** Increments the selected (blinking) parameter, or selects the next choice for the selected parameter. If this button is held down then the speed at which the selected parameter changes will increase.
7. **-** Selects the next parameter on the display.
8. **DC-IN** jack located on the lower right side of the unit, just above CH2, is the DC input source. This jack accepts the male plug on the CS1210A AC Wall Adapter needed to charge the CS3101. The CS1210A AC Wall Adapter can be used to power the unit or to charge the unit. If the adapter is used to power the unit during treatment the unit will automatically turn off after treatment and recharge the batteries.
9. **CH2** jack located on the lower right side of the unit is the variable frequency (4001 -4150Hz) output, which accepts the right-angle Touch Proof® plug of one set of electrode Red wire lead, (000461A).

6 - General Operating Instructions

6.1 - Preparing Electrodes

- Use only the leads and electrodes provided with the unit by the manufacturer.
- Careful maintenance and electrodes is strongly encouraged. This includes the lead wires as well as the pads. Worn cables and/or poor pads (or the wrong size pads) can have a significant impact upon treatment results.
- Ensure the entire surface of the electrode is in contact with the skin.
- Preparation of the skin prior to electrode application may be necessary. This includes cleaning and thoroughly drying the skin. Shaving may be necessary depending upon the density of hair. Failure to provide for maximum current conduction efficiency could result in skin irritation related to increase current at the electrode placement site.
- Using reusable electrodes for longer periods of time than recommended by the electrode manufacturer could result in ineffective treatment or cause skin irritation.
- Apply electrodes on clean, dry and unbroken skin only.

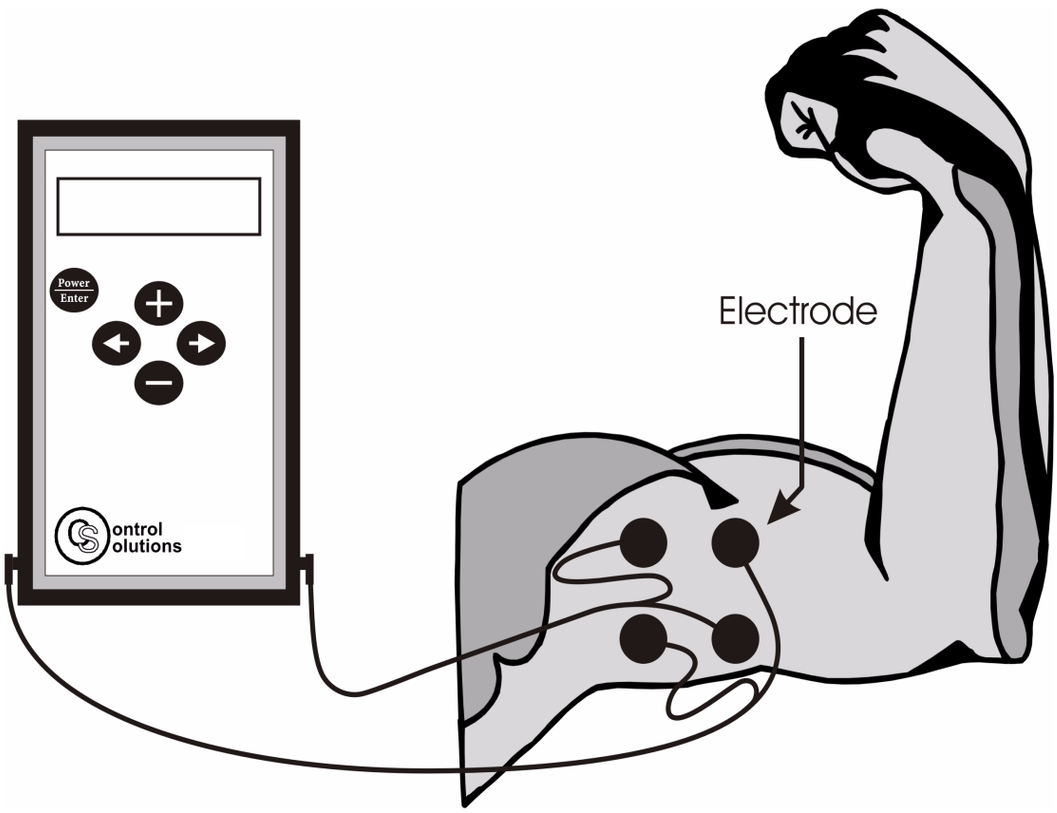
6.2 - Securing Electrodes To Patient

1. Review contradictions, warnings, precautions and adverse effects.
2. The patient should be suitably positioned ensuring maximum comfort and suitable exposure of the body part to be treated.
3. The points where the electrodes are to be placed should be marked.
4. The electrodes should be applied on the marked points. There are two core lead wires. Each lead wire uses 2 electrodes. One lead wire is CH1 and the other CH2.
5. It should be explained to the patient about the subjective sensory motor feeling that will be experienced. The patient should experience a sensation of deep, sufficiently strong but pleasant vibrations at rhythmical frequencies and a pleasant tingling sensation.
6. It should be explained to the patient to immediately inform the therapist of any unpleasant sensation or discomfort.

6.3 - Set-up

Warning: *Do not use the unit while enclosed in the carrying case.*

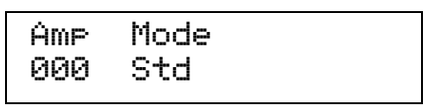
1. Check to ensure the unit is off before use. This is indicated by a blank display on the LCD.
2. Connect the wire leads to the electrodes and place the electrodes firmly onto the skin at the site to be treated. In general the electrodes will be placed in a criss-cross pattern around the area to be treated as follows:



3. Insert the wire lead plugs into the CS3101 CH1 and CH2 jacks ***making sure that they firmly snap in.***

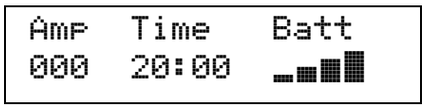
6.4 - Treatment Using Standard Built-In or Memory Modes

1. Turn on the CS3101 by pressing the Power Enter button.After the initial “splash” screen, the LCD will display:



2. As directed use the → button to select the **Mode** parameter. It will be blinking when selected. Use either the + or − buttons to change the mode as needed.

3. If Mode is selected in the previous step then use the ← button to select the **Amp** parameter. It will be blinking when selected. The output intensity (amplitude) of the electrodes can be increased by using the + button. Set the intensity to the appropriate level. As a safety precaution the **Amp** parameter is reset to zero whenever the **Mode** is changed. The number in the display represents tenths of a volt. (i.e. 000 = 0V, 100 = 10.0V, 155 = 15.5V, 250 = 25.0V). If the stimulation is uncomfortable for any reason, the intensity can be turned down by using the — button. However, turning down the amplitude while using Stim mode may reduce the effectiveness of muscle stimulation. If no stimulation is felt, please refer to **"Troubleshooting The CS3101" on page 23**. Note that treatment will not begin until **Amp** is set to a value greater than zero.
4. After the **Amp** and **Mode** settings have been made, treatment will start. As a safety precaution the unit will prevent the user from changing the treatment mode after 10 seconds. At this time the LCD will display amplitude (Amp), patient treatment timer (Time), and power source (Batt or AC) along with a power source indicator:



5. While receiving treatment the keypad buttons have the following function:

Key	Function
Power / Enter	Pressing this button pauses the treatment. This does not affect the total time of the treatment since the treatment timer does not count down while in the pause mode. The patient can resume the treatment by pressing the of the other buttons. Pressing this button while in the pause mode turns the unit off. To conserve power the unit will turn off if paused for 5 minutes.
+	Increases the amplitude. Set the intensity to the appropriate level. If the stimulation is uncomfortable for any reason, the intensity can always be turned down.
—	Decreases the amplitude. If the amplitude is decreased to zero then treatment will pause. Increasing the amplitude will resume treatment. Decreasing the amplitude while using STM mode may reduce the effectiveness of muscle stimulation.

6.5 - Modes Of Operation

Mode	Treatment Time	Frequency 1 (Low Beat) Default	Frequency 2 (Highest Beat) Default	Sweep Time Default
Std - Standard	20 min.	1 Hz	10 Hz	6 sec.
Swp - Sweep	30 min.	1 Hz	150 Hz	6 sec.
Back - Back	60 min.	1 Hz	10 Hz	6 sec.
Cont - Continuos	60 min.	100 Hz	N/A	N/A
Stim - Muscle Stimulation	20 min.	48 Hz	N/A	N/A
Mem1	Programmed treatment by clinician			
Mem2				
Mem3				
Mem4				

Std (Standard Mode): The unit provides a beat frequency of 1 Hz for 6 seconds and then supplies a beat frequency of 10 Hz for 6 seconds. This therapy is repeated for 10 minutes. After the initial 10 minute treatment the unit produces a beat frequency that sweeps from 80 to 150 Hz within 6 seconds and then repeats. This second treatment continues for another 10 minutes. After the total 20 minute treatment the unit will turn off.

Swp (Sweep Mode): The unit provides a beat frequency that sweeps from 1 Hz to 150 Hz within 6 seconds. The treatment lasts for 30 minutes and then the unit will turn off.

Back (Back Mode): The unit provides a beat frequency of 1 Hz for 6 seconds and then a frequency of 10 Hz for 6 seconds. The treatment lasts for 60 minutes and then the unit will turn off.

Cont (Continuous Mode): The unit provides a beat frequency of 100 Hz for the full treatment time of 60 minutes and then the unit will turn off.

Stim (Stimulator Mode): The unit provides a beat frequency of 48 Hz for 6 seconds followed by a ramp down to 0 amplitude that lasts for 6 seconds. This phase is followed by a ramp back to the original amplitude where the cycle is repeated. The treatment lasts for 20 minutes and then the unit will turn off.

Mem 1,2,3,4 (Memory Locations): The unit provides the therapy programmed into these memory locations.

6.6 - After Treatment Care

6.6.1 - Reusable Electrode Care

1. After use grasp the corner of the electrode and gently remove it from the skin. Do not pull on the electrode snap or wire connection.
2. Reapply the release liner to the adhesive side of the electrode.
3. Store the electrode in a resealable pouch or plastic bag.
4. To prolong the life span of the electrodes, remoisten them by applying a few drops of water when they show signs of drying out or losing their adhesive. After repeated usage, reusable electrodes begin to lose their adhesive and therefore deliver less stimulation and shorten battery life. Replace reusable electrodes as needed.

6.6.2 - CS3101 Unit Care

1. Make sure the CS3101 is turned off by pressing the Power Enter button. The display will blank indicating the unit is off.
2. Unplug the wire leads from the CS3101 by firmly grasping the plug housing and pulling it straight out of the jack. Do not pull on the wire because damage may occur.
3. Carefully remove the electrodes from the wire leads by firmly grasping each side of the connector and pulling it straight apart. Do not pull on the wires because damage may occur. Place the electrodes on their plastic sheet and return them to their resealable plastic bag.
4.

When the units display indicates less than 20% battery capacity left, the unit must be recharged. If the BATT indicator reaches 0%, the unit will automatically shut-off to prevent discharging the battery below the battery manufacturer's recommended level. The CS3101 will function per specifications over the entire 0-100% battery capacity range. However, available treatment time may be limited depending on treatment timer setting, output amplitude, load, and battery capacity. Before charging the CS3101 make sure the unit is off. Use the wall adapter included in the carrying case and plug it into the DC-IN jack on the unit. Plug the wall adapter into an unused AC wall outlet. While charging, the CS3101 will display:

This indicates the unit is charging properly. A completely drained battery will take approximately 2.5 hours to charge.

5. Charging after every use, although not required, is good for the batteries. Overcharging of the batteries is not possible due to smart charging methods.
6. Please refer to **"Care and Maintenance" on page 22** for further care instructiontions.

Note: If any numbers are displayed under the **Chrg** symbol instead of the sequencing bargraph, unplug the wall adapter and call the manufacturer at the number listed at the back of this document.

6.7 - Clinician Functions

6.7.1 - Access Codes

In some cases a code is required to gain access to various menu's and functions.

While the initial splash screen is displayed, press the ← button. You will be prompted to enter a code from 000 000 to 255 255. All codes and functions are listed as follows:

001 005 - Clinician Menu's (factory set, non-changeable)
015 000 - Compliance Menu's (default value, changeable)

6.7.2 - Clinician's Menu

Display	Represents	Units	Value/Range	Default
Amp	Amplitude	.1 Volt	0 - 250	0
Mode	Treatment Mode	N/A	Std/Swp/Back/Cont/Stim	Std
Frq1	Low Beat Frequency	Hertz	1 - 150	†
Frq2	High Beat Frequency	Hertz	1 - 250	†
Swpt	Sweep Time	Seconds	1 - 63	6
OnT	On Time	Seconds	1 - 63	†
Time	Treatment Time	Minutes	0 - 100	†
Tmts	Number Of Treatments	Number	1 - 255	1
Save	Location To Save Treatment	N/A	Mem1/Mem2/Mem3/Mem4	Mem1
IdlH	Idle Hours	Hours	0 - 255	0
IdlM	Idle Minutes	Minutes	0 - 59	30
MAmp	Maximum Amplitude	.1 Volt	0 - 250	N/A
MHrs	Maximum Hours	Hours	1 - 255	N/A
MTmt	Maximum Minutes	Minutes	1 - 255	N/A

† The default for this parameter is dependant on the mode selected.

6.7.3 - Compliance Menu

Display	Description
Clr	Resets saved modes, compliance timers, compliance log and clinicians access code.
Hrs	Compliance Hours: Displays how many hours the unit has been in operation since last compliance reset.
Min	Compliance Minutes: Displays any fractional part of any hour the unit has been in operation since last compliance reset.
Trmt	Treatment Counter: Displays the number of treatments delivered since last clinician reset.
MCod	Modify Compliance Code: Change the code used to gain access to the Compliance Menu.

6.7.4 - How To Reset Unit From Compliance Menu

1. To reset the compliance timers (Hrs & Min), compliance treatment count (Trmt), and compliance log use the ← or → buttons to select **Clr**.
2. Use the + button to select "Yes" and then press the Power/Enter button.
3. "Memory has been reset" will be displayed to confirm the reset.

6.7.5 - How To Change Compliance Menu Access Code

1. In the Compliance Menu use the ← or → buttons to select **MCod**.
2. Use the + button to select “Yes” and then press the Power Enter button. “New Comp” will be displayed.
3. Enter the new compliance access code and press the Power Enter button. “Vrfy Comp” will be displayed.
4. Re-enter the same access code to confirm it and press the Power Enter button. “Compliance code changed” will be displayed if the change is successful. The unit will return to the Compliance Menu.
5. If “Code entry error CODE NOT CHANGED” is displayed then the unit will return to the Compliance Menu and the steps in this section must be followed to enter a new code again.

6.7.6 - How To Access Clinician Menu From Compliance Menu

1. In the Compliance Menu use the + or − buttons to select **Clr**. Verify that “No” is displayed under Clr.
2. Press the Power Enter button.
3. “Clinician Menu’s selected” will be displayed.

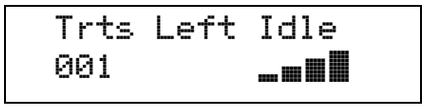
7 - Additional Features

7.1 - Auto Shut-Off

In order to control the maximum treatment given to a patient and to extend battery life, an automatic shut-off feature is incorporated into the CS3101. A treatment will last for 20, 30, or 60 minutes, or a variable time limit. After the patient treatment timer reaches zero, the output amplitude of both channels is reduced to zero and the unit remains in an idle state. After 5 minutes in the idle state, the unit automatically turns off to conserve battery power and prevent inadvertent operation.

7.2 - Multiple Treatments

The unit may be programmed (via Mem1, Mem2, Mem3, Mem4) to deliver multiple treatments during a session using the **Tmts** parameter. In this case the unit will deliver the first treatment and then become idle for a time as programmed by the physician or therapist. The unit will display:



indicating that it is idle and the number of treatments left in the session. At the end of the idle period the next treatment will begin. While receiving treatment the keypad buttons operate as described in the table on page 15. After all treatments during a session have been delivered the unit will automatically turn off.

7.3 - Patient Compliance Meter

The patient compliance meter monitors the length of time the CS3101 has been operating since the last compliance timer reset. It can record up to 255 hours and 59 minutes in 1 minute increments. This data is only retrievable by the clinician and can be found in the “Compliance Menu’s”. Refer to the “Compliance Menu” on page 19 for more details.

8 - Care and Maintenance

Warning: *This unit does not contain any consumer serviceable parts.*

The CS3101 is easy to maintain if cared for properly. Follow these steps to ensure long lasting performance:

1. The CS3101 unit may be cleaned by wiping gently with a damp cloth moistened with water, or with a mild soapy solution if the unit is soiled. Never use an abrasive cloth on the clear LCD window as it will reduce the visibility of the LCD. Never immerse or splashed the unit with water or other liquids.
2. Wipe the lead wires with a damp cloth if they become soiled.
3. Always store the CS3101 unit in its carrying case whenever it is not being used. This will prevent inadvertent damage.
4. After repeated uses of the reusable electrodes, they may lose their conductive property and the gel may begin to separate from the rest of the electrode. If this happens, they should be replaced. To prolong the life of the electrodes, store them between uses on their plastic sheet and reseal them in the plastic bag from which they came.

9 - Troubleshooting The CS3101

Problem	Probable Cause	Possible Solution
Unit does not turn on while plugged in.	AC adapter is not securely plugged into the unit.	If the unit is receiving power from the AC adapter it will display **Chrg** along with the charging indicator. If not: • Ensure that the mini-plug end of the AC adapter is firmly pushed all the way into the DC-IN jack located on the right side of the unit. • Ensure that the wall outlet that the AC adapter is plugged into is providing power by plugging a lamp into the wall outlet.
Unit does not turn on when running on battery.	Discharged battery.	Plug AC Adapter firmly into unit and AC adapter into known good wall outlet. If the unit is receiving power from the AC adapter it will display **Chrg** along with the charging indicator. The unit should now turn on. If it doesn't then return the unit for repair or replacement.
Unit turns on, but no stimulation felt.	Lead wires not fully inserted.	• Ensure the lead wires are snapped firmly into CH1 & CH2 jacks. • Ensure the lead wires are properly connected to the electrodes.
	Electrode Placement	• Ensure the electrodes are arranged and placed as directed by a physician or therapist. • Ensure the electrodes are firmly attached to the body.
	Amplitude Level	Check the **Amp** (intensity) level: • The amplitude level may be too low, increase it to the appropriate level. • Amplitude is set to zero. Treatment will not be delivered if Amplitude is set to zero.
	Broken Lead wire	Replace lead wire.

Problem	Probable Cause	Possible Solution
Unit is not charging.	Not receiving power from AC wall adapter.	If the unit is receiving power from the AC adapter it will display **Chrg** along with the charging indicator. If not: • Ensure that the mini-plug end of the AC adapter is firmly pushed all the way into the DC-IN jack located on the right side of the unit. (see “Unit Controls” on page 11). • Ensure that the wall outlet that the AC adapter is plugged into is providing power by plugging a lamp into the wall outlet.
Stimulation felt when unit is “off”.	Defective Unit	**Discontinue use** and return the unit to where it was obtained from for repair or replacement.

10 - Output Waveforms

The following waveforms were captured with a digital camera. The Oscilloscope used in these tests is a Tektronix TDS320. The maximum specified load of 500 Ohms, amplitude of 25Vpk, & the same unit were used for all tests.

Channel 1 of the oscilloscope represents CH1 of the **CS3101's** output.
Channel 2 of the oscilloscope represents CH2 of the **CS3101's** output.

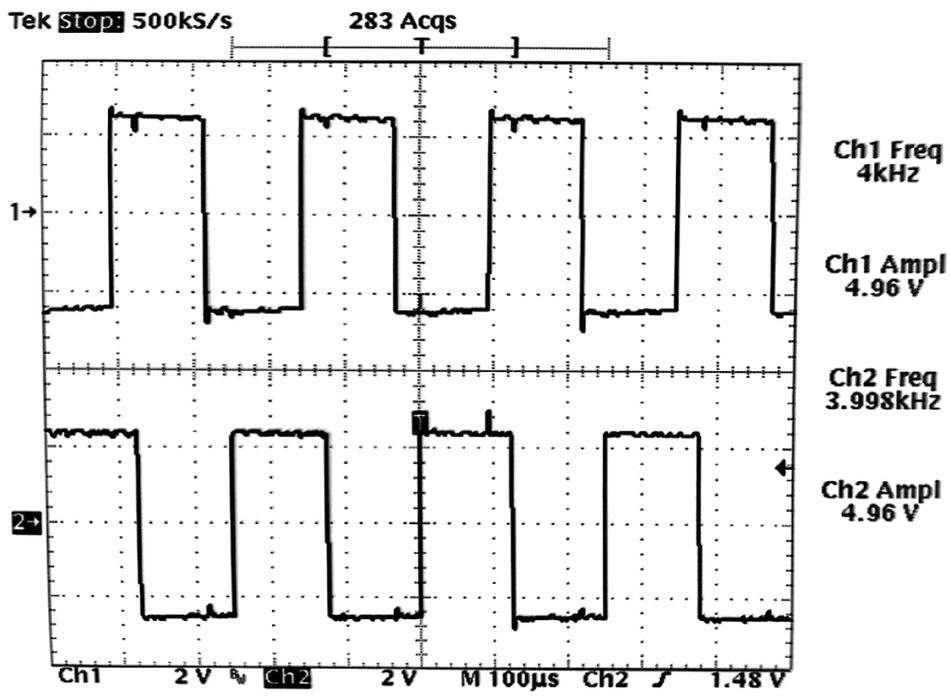
X10 probes were used on both Channels of the oscilloscope. Therefore, the voltage measurements displayed by the oscilloscope are actually ten times less than actual voltages and need to be multiplied by 10.

Voltage scale is indicated next to each CH1/CH2 reference on the bottom of the scope screen. Time base scale is indicated on the bottom of the scope screen next to the 'M'.

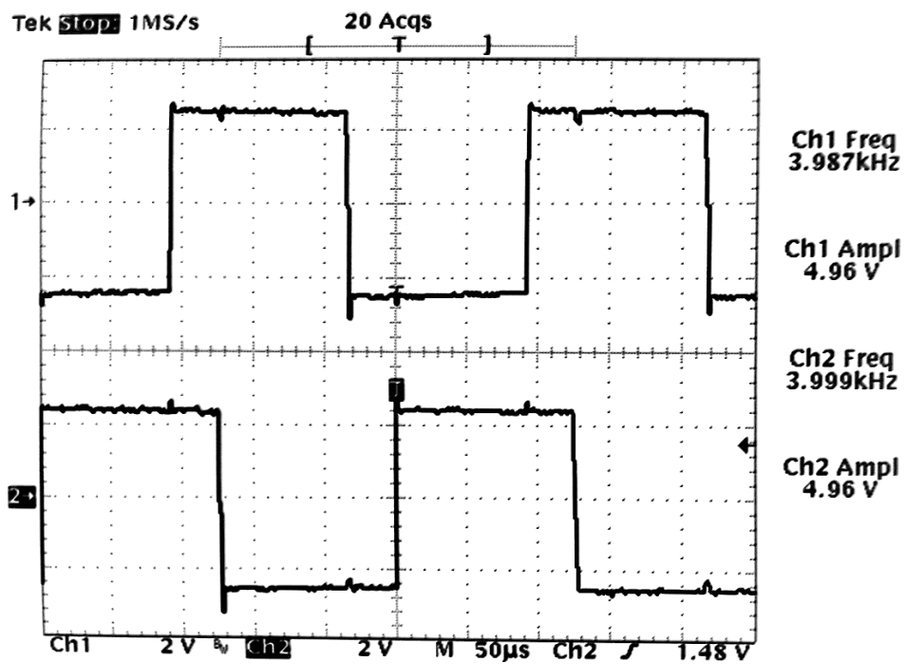
Frequency and Peak-to-Peak Amplitude measurements have been displayed on the oscilloscope when appropriate. Keep in mind the tolerance of beat frequencies generated by the CS3101 is +/- 2Hz when comparing displayed frequencies to specified frequencies. Also note that the TDS320 does not have anti-aliasing algorithms. Therefore, it tries to regenerate the 4000-4150Hz signals at a time base of 2.5s/div. Since the sample rate at 2.5s/div is much lower than at 100µs/div, the oscilloscope tries to reconstruct the signal with only 20 samples per second, when it really needs 500k samples per second to be viewed properly as found with a time base of 100µs/div. This lower sample rate will result in a waveform that does not truly represent the original, thus the term "alias" has been attributed to this effect. This will be seen in the BURST waveform views where a mode or a function is ramping or abruptly shifting from one frequency to another. Even though these diagrams cannot accurately reference the frequencies of CH1 and CH2 of the CS3101, they have been included to reference when in time these frequency changes occur*. Time markers and text have been added to these images to aid in the waveform explanation.

* Note that BURST waveforms that ramp between one frequency and another may also be difficult to tell when in time those frequencies change. However, they've been included in this manual with time markers and text to visually display the operation of these modes and functions.

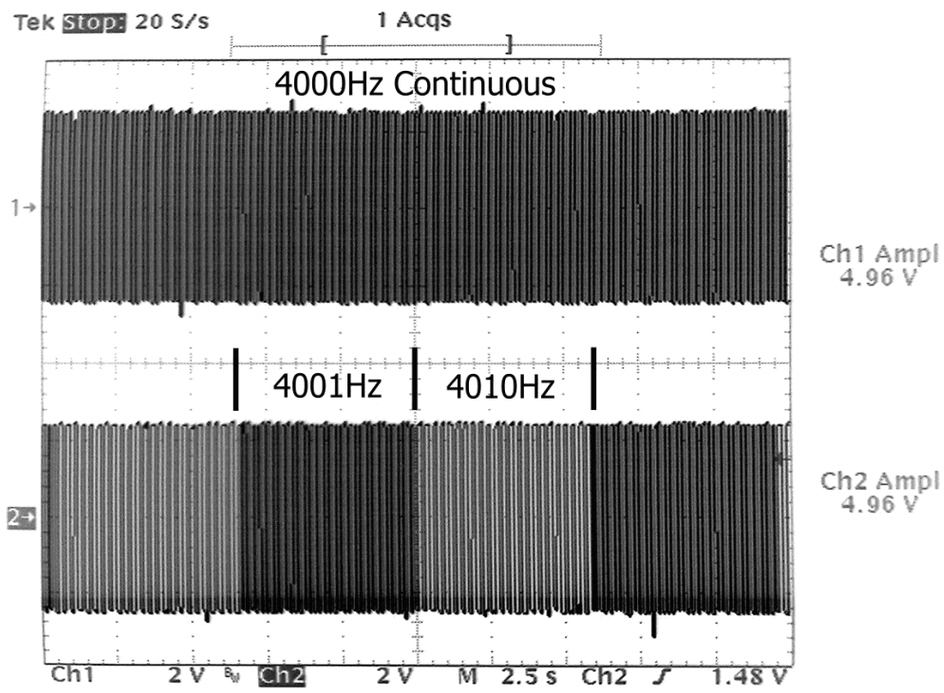
Std, Swp, & Back (beat freq. of 1Hz)



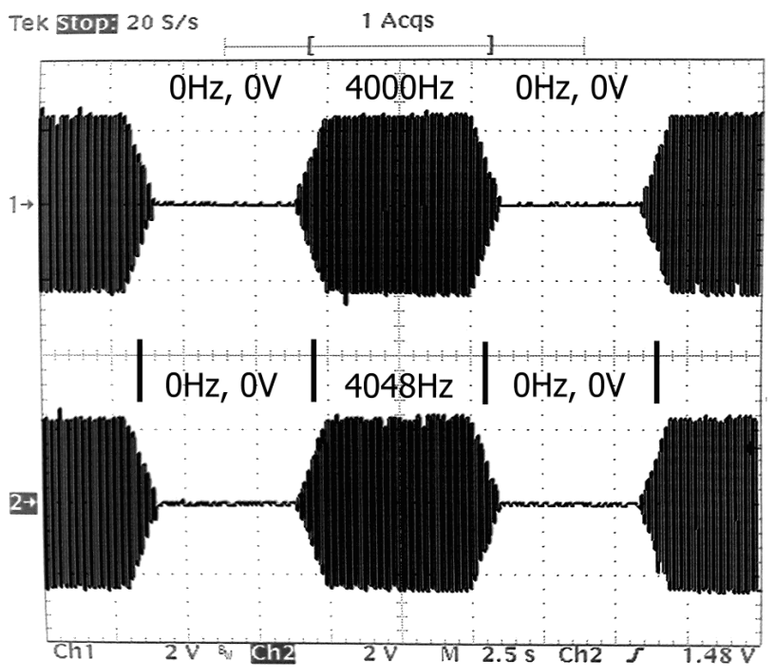
Std & Back (beat freq. of 10Hz)



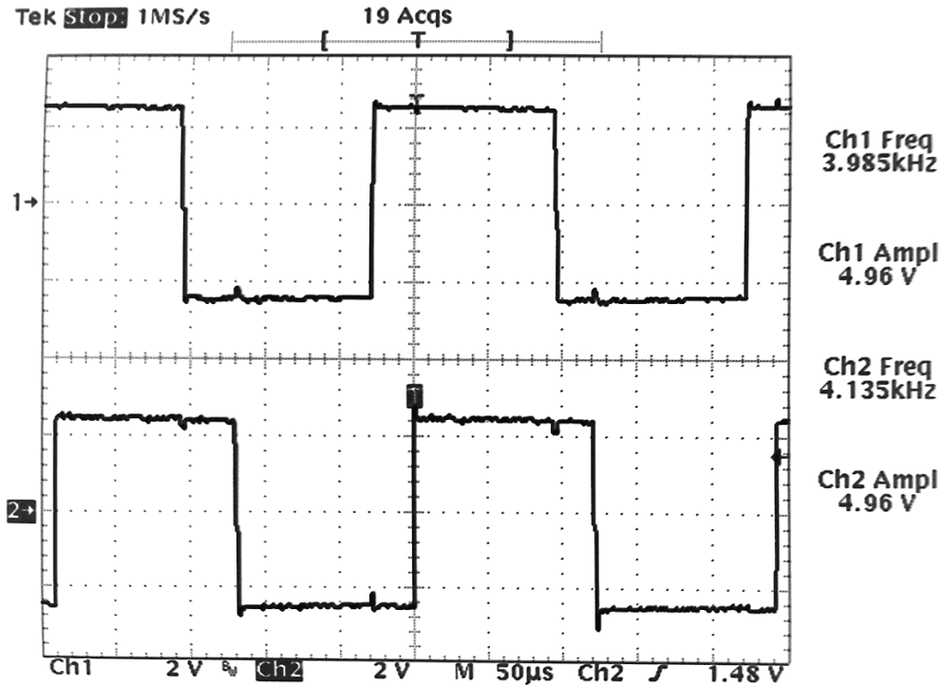
Std burst (beat freq. of 1Hz for 6s, abrupt shift to beat freq. of 10Hz for 6s, repeat)



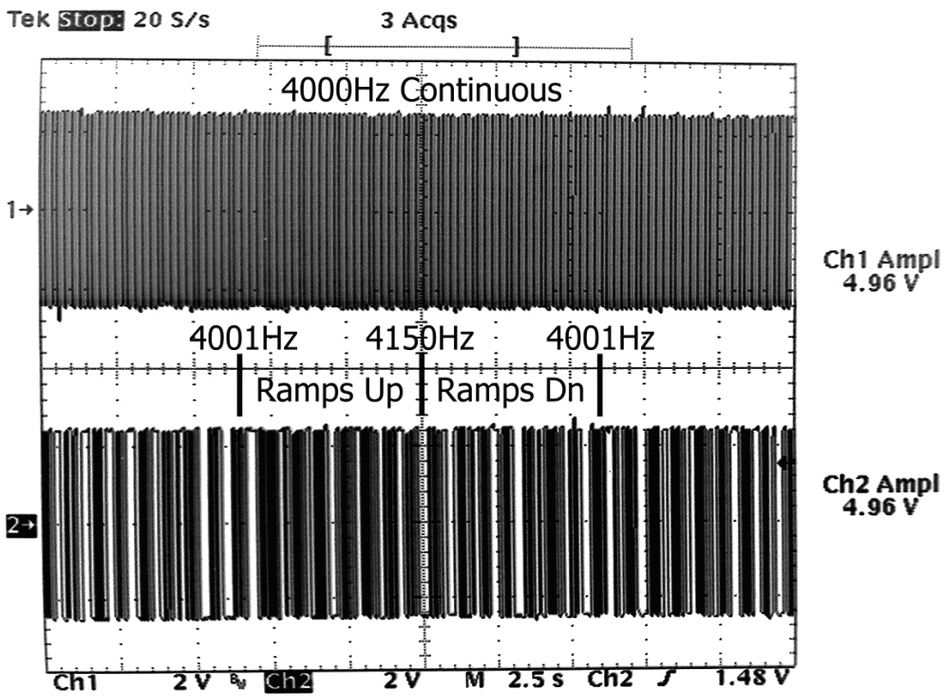
Std burst (when 1/2 treatment time left, beat freq. of 80Hz for 6s, smooth ramp to beat freq. of 150Hz for 6s, repeat).



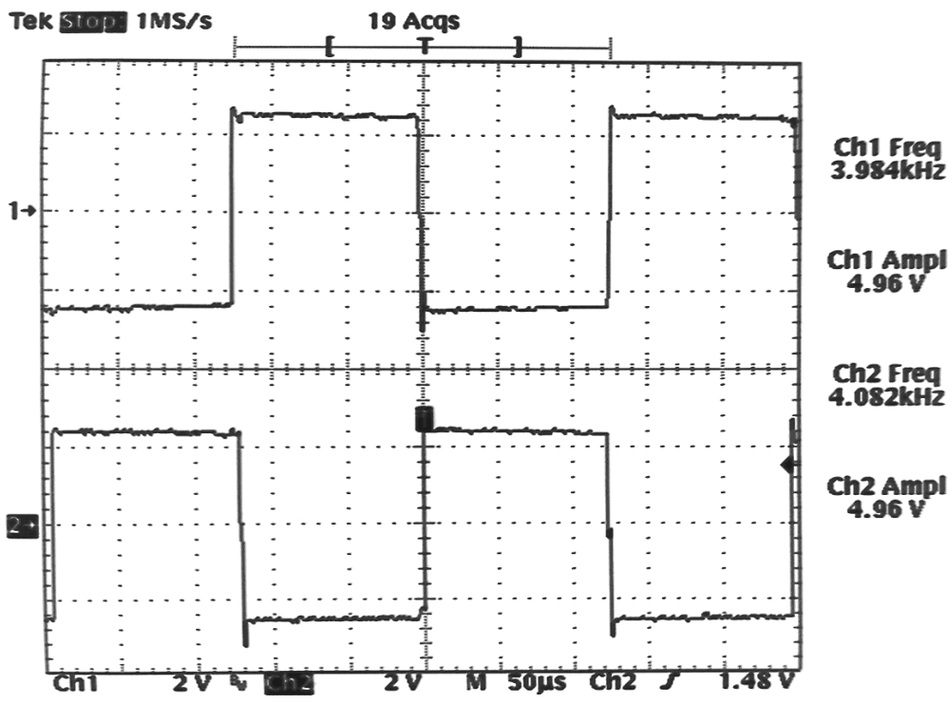
Swp (beat frequency of 150Hz)



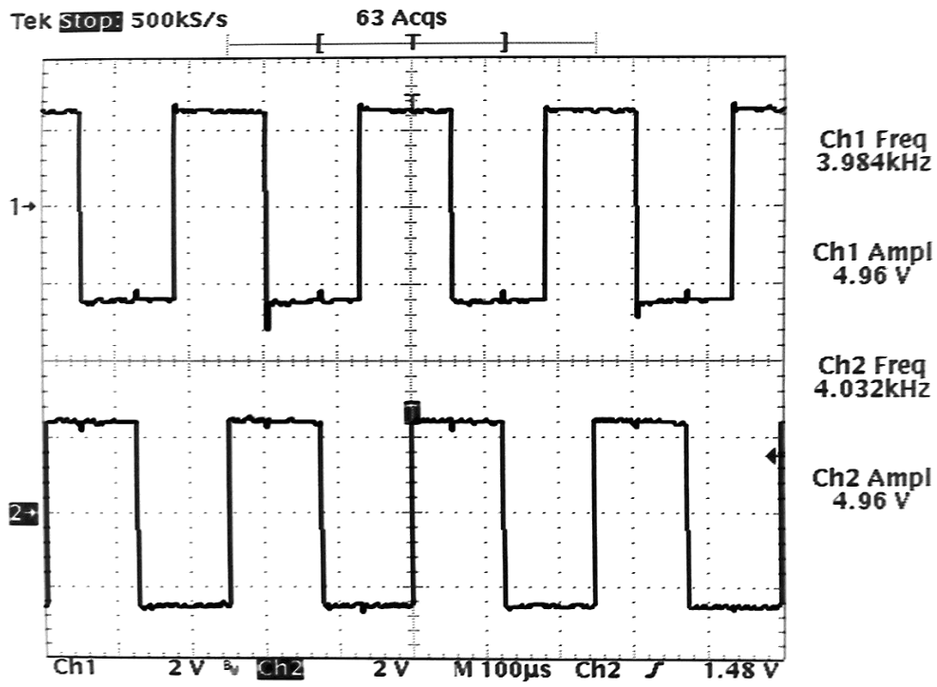
Swp burst (beat freq. of 1Hz for 6s, smooth ramp to beat freq. of 150Hz for 6s, repeat)



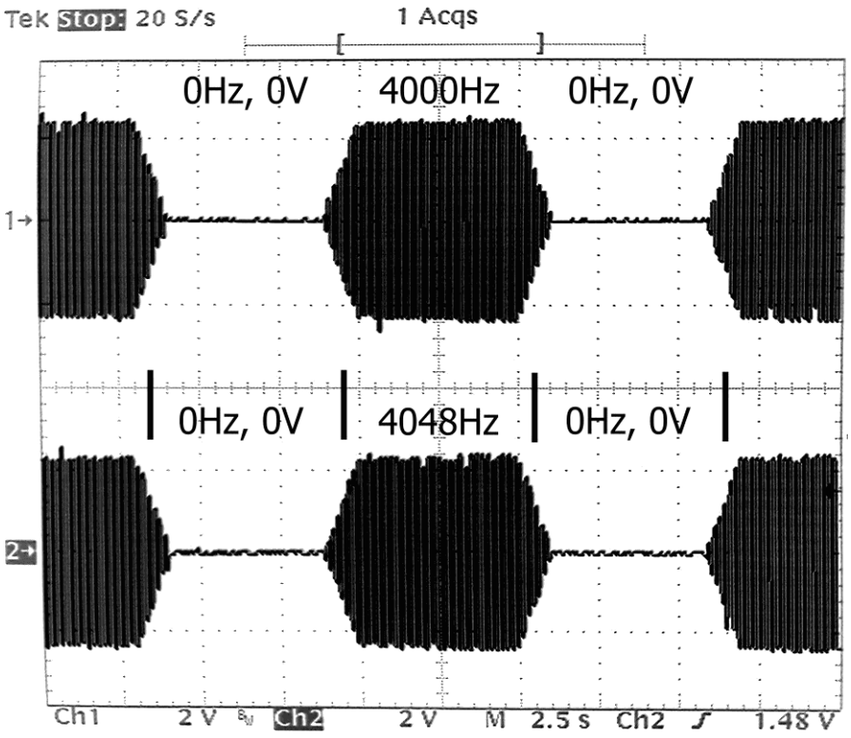
Cont (beat freq. of 100Hz)
Cont burst (N/A)



Stim (beat freq. of 48Hz)



Stim burst (beat freq. of 48Hz for 6s, smooth ramp output down to 0V, output at 0V for 6s, smooth ramp output up to set amplitude, repeat)



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Warranty

For warranty information please refer to the following website: http://www.controls.com/index.php/support/warranty

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