

# ***MECTA***

## ***Service Manual***

***SPECTRUM 5000Q*** ®

***SPECTRUM 4000Q*** ™

***SPECTRUM 5000M*** ™

***SPECTRUM 4000M*** ™

November 4, 2015  
Revision 10

### ***OPTIMIZED 100 Joules Domestic***

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U.S. Patent#5,755,744 - U.S. Patent#6,014,587 - U.K. Patent#GB 2 307 413 B  
Duke U.K. Patent#2 304 196 B - U.S. Patent#5,626,627  
(Under exclusive license from Duke University)  
Foreign Patents Pending

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NM ECT 1

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MEDICAL ELECTRICAL EQUIPMENT  
CLASSIFIED BY UNDERWRITERS LABORATORIES INC.  
WITH RESPECT TO ELECTRIC SHOCK, FIRE AND MECHANICAL  
HAZARDS ONLY IN ACCORDANCE WITH UL2601-1 AND CAN/CSA C22.2 NO.601.1  
19HJ

# Overview

## PURPOSE

This manual provides procedures to technically qualified servicers that describe the use, maintenance and servicing of the MECTA SPECTRUM electroconvulsive therapy device. Other sections include information on overviews, unpacking, diagrams, specifications, technical overview, performance verification procedures, troubleshooting, and display maps.

MECTA Corp cautions readers of this manual that:

- This manual and product specifications may be subject to change without notice.
- Some features described herein may not be available on your model.
- Illustrations of the various display screens are general, standardized representations of how a given screen can appear. They usually depict the lowest or "default" settings. Numbers and data actually displayed may differ from these illustrations.

The terms "SPECTRUM 4000Q", "SPECTRUM 4000M", "SPECTRUM 5000Q", "SPECTRUM 5000M", are trademarks of MECTA Corporation.

## SAFETY ISSUES

**WARNING:** No modification of this equipment is allowed.

**CAUTION:** Federal law restricts this device to sale by or on the order of a physician.

Hospital-grade plug grounding integrity can only be maintained when equipment is connected to a receptacle marked "hospital-grade". A Potential Equalization has been provided to reduce leakage currents if required.

Every user of this product should read and be familiar with the following points of device and electrotherapy safety procedures:

### Patient Safety

- This equipment should only be used in a hospital or equivalent medical environment.
- To ensure patient safety, use only accessories recommended or supplied by MECTA Corp. Accessories must be used according to your hospital's standards, and the manufacturer's recommendations. Always refer to the manufacturer's directions for use.
- Connect no more than one patient to the SPECTRUM patient monitoring inputs at any one time.
- Power up the SPECTRUM, wait for self test and press CLEAR before anesthetizing the patient.
- Do not allow the conductive parts of any accessory, or any EEG/ECG electrodes applied to a patient to come into contact with other conductive parts, such as grounded objects.
- Locate the SPECTRUM where it cannot harm patients or personnel if it should fall.
- Use only parts and accessories supplied (or recommended) by MECTA, and use them only as directed in SPECTRUM's manuals and technical bulletins.
- The Electrocardiograph incorporated in the 5000 series units IS NOT SUITABLE FOR DIRECT CARDIAC APPLICATION. Since it has no alarms, it is intended only for use during ECT treatments.
- During stimulation, keep the discharge electrodes away from ECG or other electrodes, as well as other conductive parts which are in contact with a patient. Also, avoid contact with the OMS (Optical Motion Sensor).

- Never apply the ECT output in such a way that the patient's heart is close to the electrical pathway between the ECT electrodes. When applied in this manner, the ECT output may cause the patient's heart to go into fibrillation. Never use a SPECTRUM to attempt defibrillating a patient.
- Avoid delivering stimulus over or near a defect in the skull of the patient.
- The SPECTRUM produces no alarms or heart-rate indicators that are affected by pacemakers. The presence of a pacemaker will be detectable in the ECG channel, and some artifact may show up in the EEG channels. The attending physician should be aware of these facts, and take them into account when analyzing patient data.
- The MECTA device is safe for use with properly functioning internal cardiac pacemakers. Certain Demand Pacemakers should be converted temporarily to a fixed mode at the time of the treatment, using a magnet. Check with the appropriate medical specialist if there are any questions.
- There should be no non medical equipment within 1.5 meters of the patient.
- There should be no device controls within 1.5 meters of the patient.
- If there are any other connections to the patient (from other equipment), they must be only approved type BF or CF, and it is the users' responsibility to confirm that the total patient leakage current is within safe limits as defined in IEC 60601-1 3rd or subsequent editions.
- In the unlikely event that a patient has a "prolonged seizure" (lasting longer than 3 minutes), hospitals should have a "prolonged seizure protocol" in place as described in the following textbooks: "Clinical Manual of Electroconvulsive Therapy" by Mankad, Beyer, Weiner and Krystal, 2010, pp 154-156, "The Practice of Electroconvulsive Therapy, 2nd Ed an APA Task Force Report", 2001, pp 171-172, 61-62, 75 or "Electroconvulsive Therapy: A Programmed Text", 2nd Ed, Beyer, Weiner, Glenn, 1998, pp 125-127, to terminate the seizure.
- NO part of the SPECTRUM shall be serviced or maintained while connected to a patient.

#### Device/Operator Safety

- Place the unit and accessories in locations where they cannot harm the patient or operator should they fall off their shelf or mount.
- Frequently inspect all power cords, electrode wires, and cables for fraying and/or other damage. Do not use an accessory which shows physical damage.
- Refer malfunctioning, dropped or damaged SPECTRUM devices/accessories only to qualified MECTA service technicians, especially while under warranty.
- Do not autoclave a SPECTRUM or its accessories except as directed. Autoclaving can cause severe damage.
- Do not allow Hand-Held (or other ECT) treatment electrodes to come in contact with any monitoring electrodes.
  - (5000 models only) If a patient must be defibrillated while the SPECTRUM patient monitoring is connected, keep the discharge paddles away from ECG electrodes, as well as from other conductive parts in contact with the patient. During defibrillation, avoid operator contact with any of the SPECTRUM's cables or accessories.
  - EEG/ECG Patient Monitor cables must contain 1K series current-limiting resistors to protect the SPECTRUM unit from damage and possible patient burns during defibrillation. Use only MECTA monitoring cables.
- If a patient is defibrillated while monitoring electrodes and cables from the SPECTRUM are connected, allow 30 seconds for monitoring channels to return to normal functionality.
- Staff holding hand-held electrodes or the patient's head during stimulus should wear non-conductive gloves. Otherwise, staff should take care to keep well clear of stimulus electrodes during the passage of electricity to the patient.
- A product that has been dropped or severely abused should be checked by qualified service personnel to verify proper operation and acceptable risk (leakage) current values.
- If the SPECTRUM detects an unrecoverable problem, an error message appears, containing an error number. If cycling the power OFF/ON does not clear the problem, report such messages to MECTA Corp.

5000 models

- The SPECTRUM is a constant-current device. Therefore, patient impedance affects the output voltage. Please refer to the output wave forms shown in the manual.
- ECG traces are removed from the LCD/Touch Screen and CHART RECORDER when the signal levels are invalid.
- While the device minimizes the risk of burns when used with specified cables and HF surgical equipment, it is strongly advised that electrodes not be placed near an electrocautery site.
- To minimize the possibility of patient burns from poor electrode contact, follow procedure in "ECT Module" Preparing the scalp for stimulus electrode placement in the Instruction manual.
- To avoid operator shock hazard, clean hand-held handles after each use. Make sure there is no gel path from electrodes up to operators' hand on handle.
- If the SPECTRUM unit has been subjected to harsh environments outside of the recommended operating conditions, it should be moved to a suitable environment for 48 hrs and then pass leakage current and functional tests before use. If uncertain of safe operation, it should be returned to the factory for a Quality Control Check.

**NOTE:**

- Within certain governmental jurisdictions, all interconnected accessory equipment must be labeled by an approved testing laboratory. After interconnection with accessory equipment, risk (leakage) current and grounding requirements must be maintained.

**General Safety**

- Do not operate the SPECTRUM in the presence of flammable chemicals/gases (including flammable anesthetics), or an explosion could result.
- When using a computer connected to the SPECTRUM, do not place the computer, its peripherals, or any connecting cables within 1.5 meters of the patient.
- Connect the computer to the same outlet as the SPECTRUM, or verify that the impedance between the PC case and the SPECTRUM is less than 200 milliohms.
- Do not touch the patient and non-medical equipment (such as a computer) at the same time.
- Make sure cuffed distal extremity is restrained, so there is no hazard of harm to patient or operator during seizure motor activity.
- Be sure that the cable connecting the computer and the SPECTRUM is protected from physical damage.
- There should be no bystanders within 1.5 meters of the patient.
- Do not operate the SPECTRUM or any of its cables in an MRI location or in a hyperbaric chamber (or other oxygen-enriched atmosphere). The equipment may be damaged and the patient burned by the cables, or fire may result.
- While delivering treatments, do not touch the conductive (metal) portions of the stimulus electrodes. To ensure patient safety, the conductive parts of any EEG/ECG electrode (including their associated connectors and/or leads), the metal body of the OMS, or other patient-applied parts should not contact other conductive parts, including earth ground, at any time.
- While the SPECTRUM complies with the applicable electromagnetic compatibility standards, operation of cellular telephones or other two-way radios in near proximity to the SPECTRUM may cause measurement errors, interface problems, or equipment malfunctions.
- Stimulus electrodes should be cleaned after each use. Please see Cleaning section in the Instruction manual.
- MECTA Corp. recommends that the functional performance tests (which include safety tests and functional verification) be performed on a bi-annual basis.

## **WARRANTY, REPAIRS and TECHNICAL SUPPORT**

The warranty period of the SPECTRUM is one year. During that period, DO NOT attempt or allow repairs on the SPECTRUM. Call MECTA Technical Support to arrange factory service. It is recommended that only qualified personnel perform any repairs to the SPECTRUM, when the warranty period has elapsed.

WARRANTY WILL BE VOIDED IF THE SPECTRUM IS NOT RETURNED IN ITS ORIGINAL CONTAINER WITH ITS ORIGINAL FOAM PACKING.

- In the U.S. and Canada,  
To access customer, technical, or factory repair support, dial (503) 612-6780, or fax (503) 612-6542.

## **RECOMMENDED SERVICING**














MECTA Corp. recommends that the user perform all functional verifications every six months to one year, or if the unit has been damaged, or there is a suspected malfunction.

MECTA recommends that units be returned to the factory for servicing because there are no user-servicable parts inside the unit, and servicing must be performed by qualified service personnel.

# SYMBOLS

These internationally recognized symbols are defined by the International Electrotechnical Commission, IEC 878 and IEC 417A.

Symbols used on the front and rear SPECTRUM panels may be understood as follows:

	On/Off push button	ms	Pulse width in milliseconds
	For continued fire protection, use only the specified fuse	Hz	Frequency in Hertz
	Signal output	s	Duration in seconds
	Type BF isolated defibrillation protected patient connection	mA	Current in milliAmps
	Type BF isolated patient connection	Gain 1	Chart Channel 1's Gain setting dial.
	Equipotential Post	Gain 2	Chart Channel 2's Gain setting dial.
	See Operating Instructions	CE0197	TÜV Rheinland Annex II, Article 3 ISO 13485:1996 ISO 13485:2000
	Graphical Recorder		"Type tested" in Munich, Germany by TÜVPS.
	Adjustable input		
	Alternating current		
	"On" (only for CHART RECORDER)		
	"Off" (only for CHART RECORDER)		
	Read Operator's Manual		

## 4000 Membrane Switch Symbols



Enter the Menu system.



TIMER Start/Stop or "1" if ALT button pressed at the same time.



Increase brightness or "2" if ALT button pressed at the same time.



Decrease brightness or "3" if ALT button pressed at the same time.



Select ALT button definitions. Changes TIMER to "1", LIGHT to "2", and DARK to "3".



Exit the Menu or DONE with treatment or CLEAR.

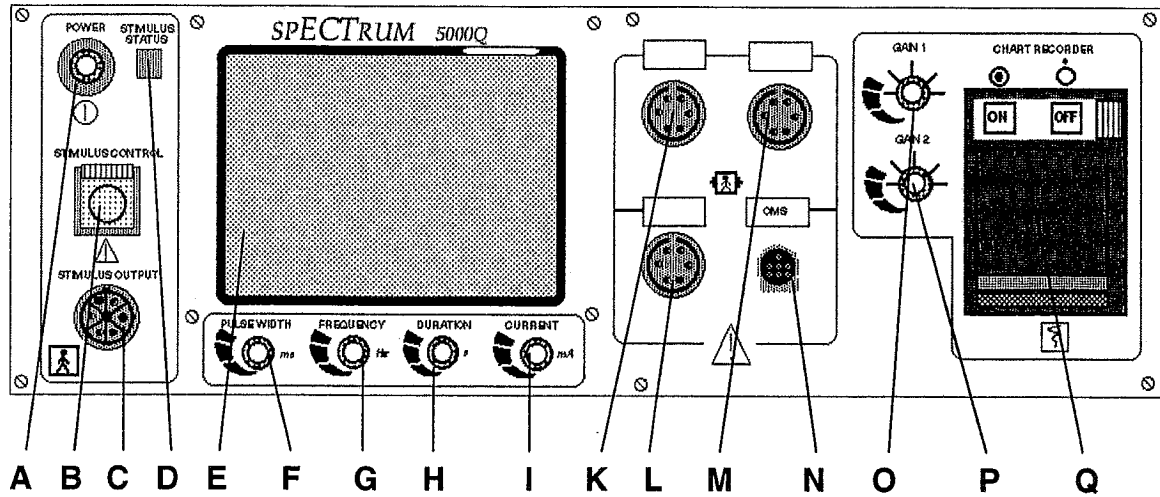


# Unpacking

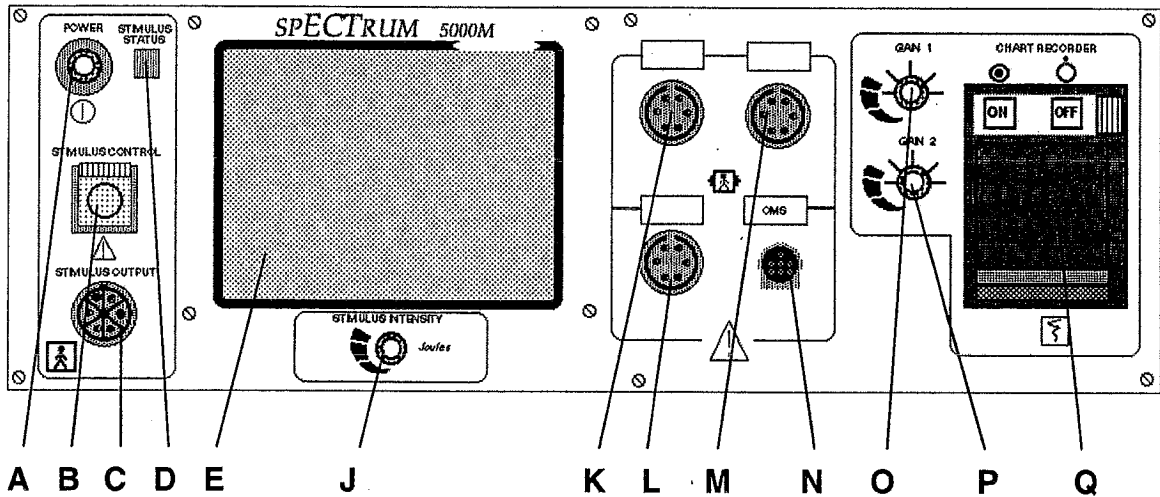
When unpacking the SPECTRUM from its shipping container:

- 1. Find the packing slip and/or list of included items, and ensure that all items listed are included in the shipment.
- 2. If any item is not found,
  - Recheck the shipping container (inside all packing and inserts, etc.)
  - Check with your receiving department.
  - Otherwise, contact MECTA Tech Support.
- 3. Save the shipping container and any packing materials in case you must re-ship the SPECTRUM for service, etc. (Otherwise, the warranty will be voided).
- 4. Perform a visual inspection to note any possible damage that might have occurred during shipment.
  - Check all cables and leads for fraying, cracks or loose connections.
  - Replace any damaged items.

## 5000Q FRONT PANEL DIAGRAM



## 5000M FRONT PANEL DIAGRAM

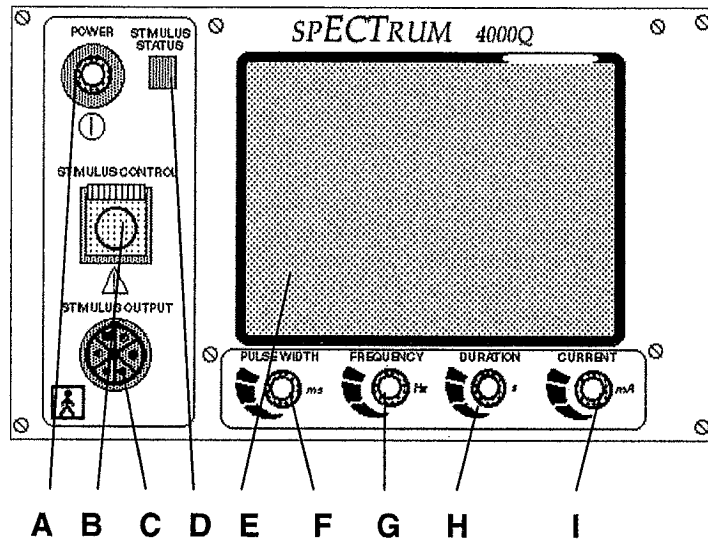


- |  |   |
|--|---|
| <p>A POWER ON/OFF button</p> <p>B STIMULUS CONTROL push button</p> <p>C STIMULUS OUTPUT connector</p> <p>D STIMULUS STATUS indicator</p> <p>E LCD/Touch Screen</p> <p>F PULSE WIDTH knob (milliseconds)</p> <p>G FREQUENCY knob (Hertz)</p> <p>H DURATION knob (seconds)</p> <p>I CURRENT knob (milliAmps)</p> | <p>J STIMULUS INTENSITY knob (M models)</p> <p>K PATIENT INPUT connector</p> <p>L PATIENT INPUT connector</p> <p>M PATIENT INPUT connector</p> <p>N OMS INPUT connector</p> <p>O GAIN 1 knob</p> <p>P GAIN 2 knob</p> <p>Q CHART RECORDER</p> |
|--|---|

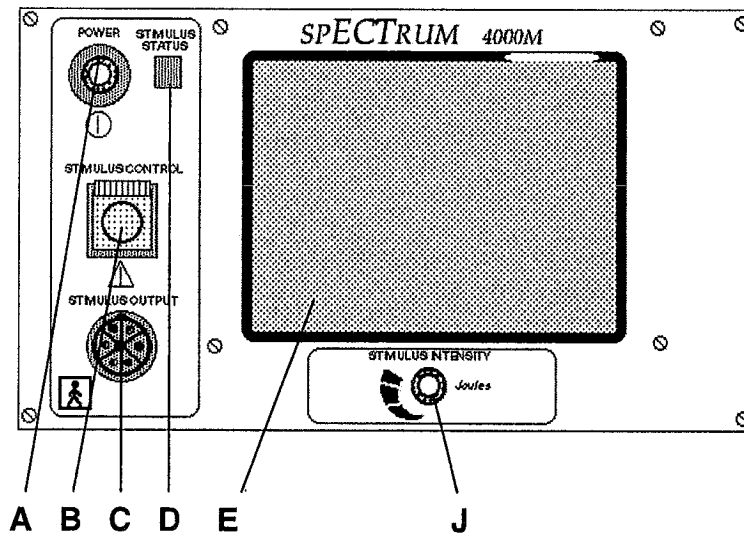
*See pgs. 14-15 for descriptions*

# LCD TOUCH SCREEN MODELS

## 4000Q FRONT PANEL DIAGRAM



## 4000M FRONT PANEL DIAGRAM

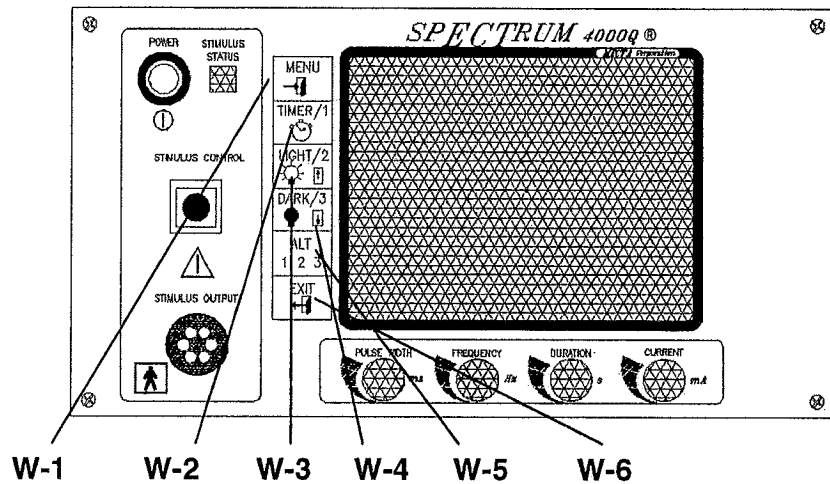


- |                                |                                      |
|--------------------------------|--------------------------------------|
| A POWER ON/OFF button          | F PULSE WIDTH knob (milliseconds)    |
| B STIMULUS CONTROL push button | G FREQUENCY knob (Hertz)             |
| C STIMULUS OUTPUT connector    | H DURATION knob (seconds)            |
| D STIMULUS STATUS indicator    | I CURRENT knob (milliAmps)           |
| E LCD/Touch Screen             | J STIMULUS INTENSITY knob (M models) |

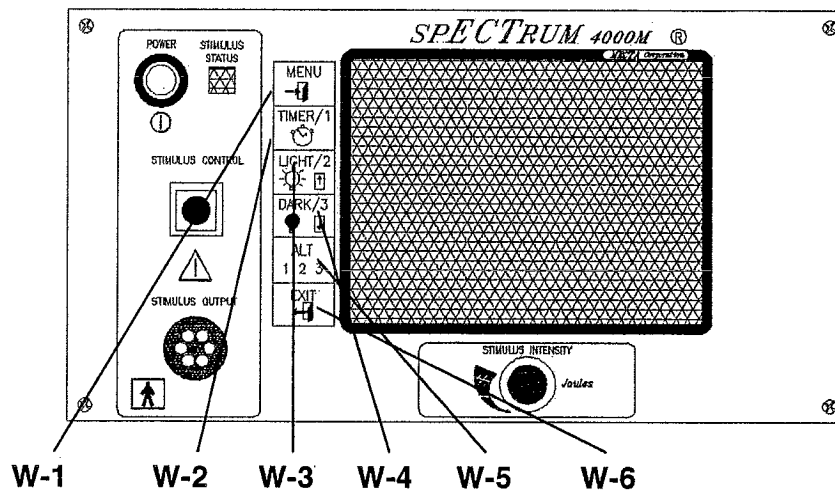
See pgs. 14-15 for descriptions

# MEMBRANE SWITCH MODELS

## 4000Q MEMBRANE SWITCH FRONT PANEL DIAGRAM



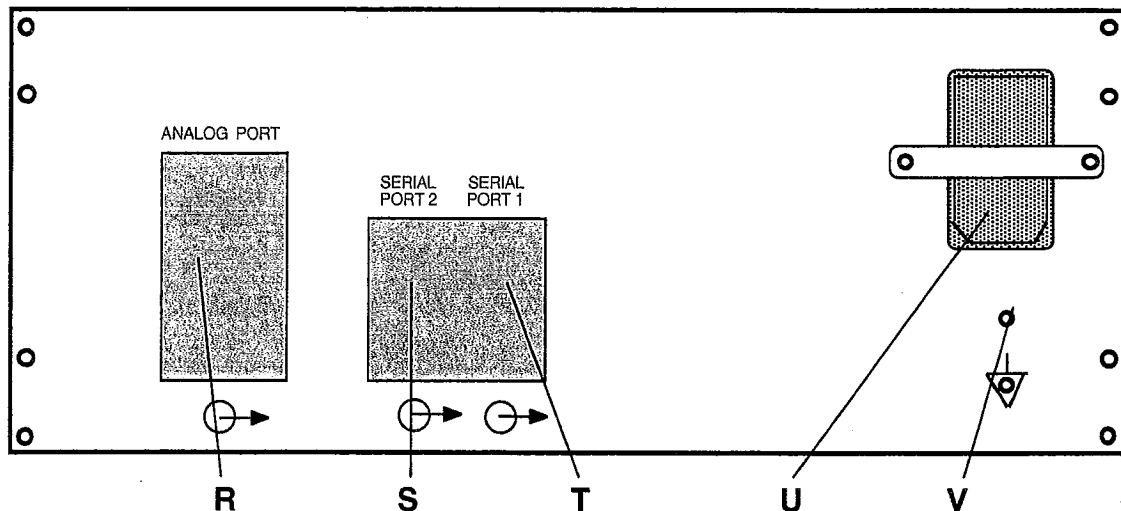
## 4000M MEMBRANE SWITCH FRONT PANEL DIAGRAM



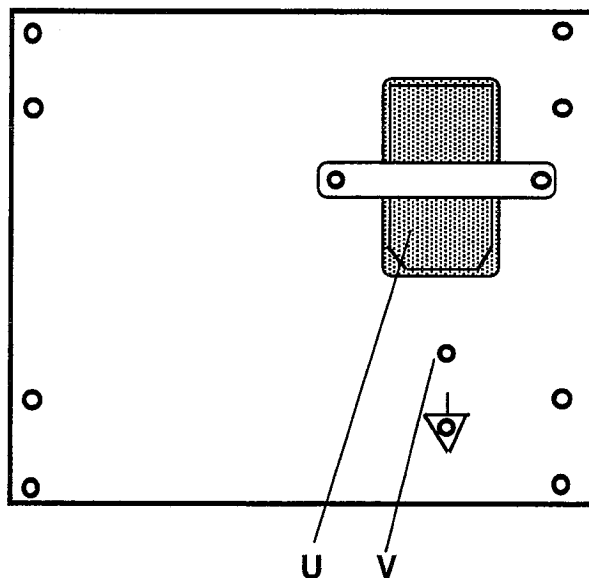
- W-1 MENU Enter the Menu system.
- W-2 TIMER TIMER Start/Stop or "1" if ALT button pressed at the same time.
- W-3 LIGHT Increase brightness or "2" if ALT button pressed at the same time.
- W-4 DARK Decrease brightness or "3" if ALT button pressed at the same time.
- W-5 ALT Select ALT button definitions. Changes TIMER to "1", LIGHT to "2", and DARK to "3".
- W-6 EXIT Exit the Menu or DONE with treatment or CLEAR.

See pg. 15 for descriptions

## 5000 MODEL BACK PANEL DIAGRAM



## 4000 MODEL BACK PANEL DIAGRAM



- 
- R ANALOG SIGNAL OUTPUT Port, DB25
  - S SERIAL OUTPUT Port 2, RS232, DB9
  - T SERIAL OUTPUT Port 1, RS232, DB9
  - U POWER ENTRY module  
w/ user-selectable input voltage (100/115/230 VAC)  
and fuse drawer (5 x 20mm)
  - V Equipotential Post

*See pg. 15 for descriptions*

# PANEL CONTROL/CONNECTOR DESCRIPTIONS

To help familiarize the user with the basic controls of the SPECTRUM, a brief description follows of each control and connector located on the front and back panels.

## Front Panel Diagram

### A. POWER ON /OFF push button

When pushed and released, the push-button turns the unit on or off. The button is green in color when the power is on.

### B. STIMULUS CONTROL push button

Once the SPECTRUM has passed internal diagnostic tests and has determined by the patient Self-Test that static impedance is in an acceptable range, pushing the STIMULUS CONTROL push-button and holding the button down during the delivery tone results in delivery of the pre-selected stimulus.

### C. STIMULUS OUTPUT connector

The source of the electrical stimulus delivered to the patient. The Patient Stimulus Cable or the hand-held electrodes attach to this connector.

### D. STIMULUS STATUS indicator

Indicates the current state of the SPECTRUM.

off = STIMULUS CONTROL disabled

green = STIMULUS CONTROL enabled

yellow = delivery of stimulus

red = stimulus delivery fault.

### E. LCD/Touch Screen (on Models with Touch Screens)

The main interface for system usage and configuration. It provides information throughout the treatment session. Graphical display of up to four patient monitoring signals is also available.

## Q models

### F. PULSE WIDTH knob

Selects the width of the pulses in milliseconds (msec).

### G. FREQUENCY knob

Selects the frequency or rate of pulses in pairs of pulses per second or Hertz (Hz).

### H. DURATION knob

Selects the duration of the total pulse train in seconds (sec).

### I. CURRENT knob

Selects the peak amplitude of the constant current delivered during each pulse in units of milliamperes (mA).

## M models

### J. STIMULUS INTENSITY knob

Selects the stimulus level by simultaneously varying pulse frequency and train duration.

## 5000 models

### K-M. Patient Monitor Input connectors

Connects the patient to the internal instrumentation amplifiers. The Patient Safety Monitor Cable is attached to this connector. In turn, the monitoring electrode leads attach to the Patient Safety Monitor Cable.

**5000 models****N. OPTICAL MOTION SENSOR input connector**

Connects the Optical Motion Sensor to the internal OMS amplifier.

**O. GAIN 1 knob**

Adjusts the amplitude (gain) of the first trace on the Chart Recorder in five steps.

**P. GAIN 2 knob**

Adjusts the amplitude (gain) of the second trace on the Chart Recorder in five steps.

**Q. Chart Recorder**

Prints up to two selected patient monitoring channels and the self-test and treatment data using a thermal array printer and thermally sensitive paper.

Back Panel Diagram**5000 models****R. Analog Output Port, DB25 (ANALOG PORT)**

Provides up to 6 analog output channels of isolated patient monitoring signals and a timing signal for use with external monitoring equipment.

**S. Serial Output Port 2, RS232, DB 9**

A serial port providing digital information necessary to recreate LCD displays on a remote PC (personal computer). Refer to the Remote Monitor (PC) manual.

**T. Serial Output Port 1, RS232, DB 9 (for future development)****U. Power Entry module**

The receptacle for a shielded medical grade power line cord.

**V. Equipotential Post**

Connector for a Potential Equalization Conductor.

**Membrane Switches**Membrane Switch Front Panel Diagram**W-1. to W-6. MEMBRANE SWITCHES**

Switches used for menu navigation and system control.

- W-1 MENU** Enter the Menu system.
- W-2 TIMER** TIMER Start/Stop or "1" if ALT button pressed at the same time.
- W-3 LIGHT** Increase brightness or "2" if ALT button pressed at the same time.
- W-4 DARK** Decrease brightness or "3" if ALT button pressed at the same time.
- W-5 ALT** Select ALT button definitions. Changes TIMER to "1", LIGHT to "2", and DARK to "3".
- W-6 EXIT** Exit the Menu or DONE with treatment or CLEAR.

# SPECTRUM SPECIFICATIONS

All specifications are nominal and subject to change without notice.

## ECT FEATURES

Pulse Configuration	Constant current, bi-directional, square pulses
Internal Tests	Treatment pulses into internal 300 load and checked for pulse width, frequency, duration and energy. Safety features are also self-tested.
Energy Measure	Delivered energy is measured, based on actual current and voltage delivered in each pulse, so as to be inherently correct for entire range of dynamic patient impedance.
Patient Impedance Range (to start)	100-5000 ohms nominally.
Allowed Voltage Range for proper ECT delivery	50-400 volts.
Protection	Protected against paddle-to-paddle or other short-circuit conditions, and open circuit conditions.
Visual Indicator	Three-color LED gives green for Stimulus Control enabled; yellow for Treating; red for Stimulus Delivery fault.
Audible Indicator	Tones provided for pre-treatment and treatment warnings.

## LCD DISPLAY SPECIFICATIONS

Type	Blue and white FSTN with LED backlight
Dimensions	3.4 x 4.6" (5.7" diagonal)
Resolution	240 (v) x 320 (h) pixels
Contrast adjustment	via buttons LIGHT/DARK
Display sweep speed	25mm/second

## POWER REQUIREMENTS

100/115 volts nominally, 50/60 Hz @ .25 A Typical (idle) to 2.7 A max (treat), or 230 volts nominally, 50/60 Hz @ .13 A Typical (idle) to 1.4 A max (treat)

### 4000 DIMENSIONS

Weight	27.5 pounds / 12.5 Kg
Height	6.25 inches / 16.0 cm
Width	10.7 inches / 27.2 cm
Depth	19.35 inches / 48.5 cm

### 5000 DIMENSIONS

Weight	33.0 pounds / 15.0 Kg
Height	6.25 inches / 16.0 cm
Width	20.75 inches / 52.3 cm
Depth	19.35 inches / 48.5 cm

## ENVIRONMENTAL AND REGULATORY SPECIFICATIONS

All devices are Class I, continuous-operation devices. The Stimulus circuits are Type BF; the Patient Monitoring circuits are Type BF defibrillation-protected. The fuses are 5 x 20mm time lag (slo-blo) fuses. 4 amp (T4.0A) for 115VAC and 2 amp (T2.0A) for 230VAC. Users should choose cUL-approved fuses for United States and Canada, and IEC-rated fuses everywhere else.



### OPERATING CONDITIONS

Temperature, operating	41 to 95° F / 5 to 35° C
Relative humidity, operating	30 to 70%, non-condensing

### STORAGE AND TRANSPORTATION CONDITIONS

Temperature	-4 to 140° F / -20 to 60° C
Humidity	10 to 95%, non-condensing
Pressure	220 to 1052 HPa
CHART RECORDER paper roll	Removed

### REGULATORY QUALIFICATIONS

The SPECTRUM 5000 series of products comply with the standards listed when connected to an external personal computer (as verified during EMC testing). If connected to other devices, it is the user's responsibility to confirm that the device still complies with the listed standards.

At the time the SPECTRUM was manufactured, the device complied with all standards required by the EC as set forth in MECTA's Declaration of Conformity (available upon request).

Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards (I.E. IEC 60950 for data processing equipment, and IEC 60601-1 for medical equipment). Furthermore, all configurations shall comply with the system standard IEC 60601-1-1. Everyone who connects additional equipment to the signal input or output ports configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard, IEC 60601-1-1. If in doubt, contact the technical service department, or your local representative.

Declaration of Electromagnetic Immunity, MECTA SPECTRUM 4000 and 5000 series.

The SPECTRUM 4000 and 5000 series units are designed to be used in a hospital/clinical environment as defined below. Use of any cables other than those supplied by MECTA (including the power cord) or operating outside of the defined environment may invalidate this declaration.

Immunity Test	Test Level	Compliance Level	Environment Guidance
ESD IEC 61000-4-2	+/- 8KV – Air +/- 6KV – Contact	No Anomalies	Hospital
Radiated RF IEC 61000-4-3	3V/M, 80MHz to 2.5GHz	No Anomalies	Hospital
EFT/Burst IEC 61000-4-4	+/- 2KV – Mains +/- 1KV – I/O Cables	Pulse visible on OMS only, Self correcting	Typical Mains power
Surge IEC 61000-4-5	+/- 2KV Common +/- 1KV Differential	No Anomalies	Typical Mains power
Conducted RF IEC 61000-4-6	3VRMS, 150KHz to 80MHz	Single spike on monitoring channels Self correcting	Hospital
Dips/Interruptions IEC 61000-4-11	100%, ½ cycle 60%, 5 cycles 30%, 25 cycles 100%, 5 seconds	No Anomalies No Anomalies No Anomalies Re boot, press clear	Typical Mains power
Power Frequency Magnetic Field IEC 61000-4-8	3A/M	No Anomalies	Typical Environment

### Cables used with the SPECTRUM

Power Cord - UL Listed SJT No. 18 AWG, 3 Conductor, Shielded, 3M max

EEG/ECG Monitor Cables - 1W, 1K Resistors molded in Connector, AAMI EC-53 compliant, 3.04 M nominal

OMS Monitor Cable - 3 wire Shielded, 3.65M nominal

Stimulus Cables, MECTA only - 3.65M nominal

## ECT PARAMETERS

### Q Models

	<i>OPTIMIZED DOSING Parameter Sets</i>			<i>FULL SPECTRUM Parameter Set</i>
Four Parameter Sets:	0.3	0.5	1.0**	Set 4**
Pulse Width	0.3-0.37 ms	0.5 ms	1.0 ms	0.3-1.0 ms
Stimulus Duration	0.5-8.0 sec	0.5-8.0 sec	0.5-8.0 sec	0.5-8.0 sec
Frequency	20-120 Hz	20-90 Hz	20-45 Hz	20-120 Hz
Stimulus Current	800 mA	800 mA	800 mA	500-900 mA
Charge	4.8-568 mC	8.0-576 mC	16.0-576 mC	3.0-579 mC
Energy @ 220 ohm patient impedance	0.8-100 joules	1.4-101.4 joules	2.8-101.4 joules	0.3-101.9 joules

### M Models

	<i>OPTIMIZED DOSING Parameter Sets</i>		
Three Parameter Sets:	0.3	0.5	1.0**
Pulse Width	0.3-0.38 ms	0.5 ms	1.0 ms
Stimulus Duration	0.60-8.0 sec	0.36-8.0 sec	0.18-8.0 sec
Frequency	20-120 Hz	20-90 Hz	20-45 Hz
Stimulus Current	800 mA	800 mA	800 mA
Charge	5.8-576.4 mC	5.8-576 mC	5.8-576 mC
Energy @ 220 ohm patient impedance	1.0-101.4 joules	1.0-101.4 joules	1.0-101.4 joules

\*Patent Pending

\*\*EEG Data Analysis enabled

## MONITORING SPECIFICATIONS

### EEG/ECG/OMS PATIENT INPUTS (5000 models only)

Maximum Number of Channels	6
EEG Trace Restoration	Automatic rapid return to display
EEG Lead-Off Detection Current	≈ 30 nA DC
EEG Lead-Off Indication	Trace disappears, Restore button provided when any selected/displayed EEG channel is unhooked
EEG Channel Gain	5000 x from optional analog output (+/- 10%)
EEG Input Range, AC	2mV p-p max.
EEG Input Range, DC	+/- 200mV
EEG Frequency Response	1.4 to 48 Hz band pass (-3dB)
EEG Common Mode Rejection	For 10V RMS, 50/60 Hz input having 200 pF source capacitance, feeding unbalanced 51K/.047 uF input network, resultant signal will be < 1 mV p-p R.T.I. with notch filter off, and < .1 mV p-p R.T.I. with notch filter on.
EEG Noise	≤ 15mV p-p R.T.I. with notch filter on.
EEG Display/CHART RECORDER Gain	(see chart on next page)
EEG Input Impedance	> 2.5 MΩ single-ended @ 10 Hz.
EEG Protection Against ECT Pulses	Provided (requires patient monitor cables w/ 1k series resistors)

ECG Trace Restoration	Automatic rapid return to display
ECG Lead-Off Detection Current	≈ 30 nA DC
ECG Lead-Off Indication	Trace disappears, Restore button provided when any selected/displayed ECG channel is unhooked
ECG Channel Gain	1000 x from optional analog output, +/- 10%
ECG Input Range, AC	10mV p-p max.
ECG Input Range, DC	+/- 300mV
ECG Frequency Response	0.5 to 48 Hz band pass (-3dB)
ECG Common Mode Rejection	For 10V RMS, 50/60 Hz input having 200 pF source capacitance, feeding unbalanced 51K/.047 uF input network, resultant signal will be ≤ 1 mV p-p R.T.I. with notch filter off, and ≤ 0.1 mV p-p R.T.I. with notch filter on.

ECG Noise	≤ 30mV p-p R.T.I. with notch filter on.
ECG LCD/CHART RECORDER Gain	(see chart on next page)
ECG Input Impedance	>2.5 MΩ single-ended @ 10 Hz.
ECG Protection Against Defib and ECT Pulses	Provided (requires patient monitor cables w/ 1K series resistors)

OMS Technique	Photoplethysmography
OMS Frequency Response	0.5 to 6.0 Hz (-3 dB) typical
OMS Trace Restoration	Automatic rapid return to display
OMS No-sensor Detection	Trace disappears, Restore button provided when OMS is selected/displayed and disconnected.

### DUAL CHANNEL RECORDER SPECIFICATIONS (5000 models only)

Chart Speed	25 mm/sec
Waveform zone width	48 mm max
Overall paper width	50 mm
Resolution	8 dots/mm vertical x 32 dots/mm horizontal
Printing method	Thermal

### EEG SCREEN GAIN SETTINGS (mV/mm)

Displayed Traces \*

Tr.	LOW	MLOW	MED	MHIGH	HIGH
1.	.0357	.0178	.0071	.0036	.0014
2.	.0732	.0366	.0416	.0073	.0029
3.	.1113	.0557	.0223	.0111	.0045
4.	.1504	.0752	.0301	.0150	.0060

### ECG SCREEN GAIN SETTINGS (mV/mm)

Displayed Traces \*

Tr.	LOW	MLOW	MED	MHIGH	HIGH
1.	.1784	.0713	.0357	.0178	.0089
2.	.3661	.1465	.0732	.0366	.0183
3.	.5565	.2226	.1113	.0557	.0278
4.	.7521	.3008	.1504	.0752	.0376

\* "Displayed traces" means the total number of traces on the LCD screen, including EEG, ECG and OMS.

### EEG CHART GAIN SETTINGS (mV/mm)

Displayed Traces \*\*

Tr.	LOW	MLOW	MED	MHIGH	HIGH
1.	.050	.025	.010	.005	.002
2.	.100	.050	.020	.010	.004

### ECG CHART GAIN SETTINGS (mV/mm)

Displayed Traces \*\*

Tr.	LOW	MLOW	MED	MHIGH	HIGH
1.	.250	.100	.050	.025	.010
2.	.500	.200	.100	.050	.020

\*\* "Displayed traces" means the total number of traces on the Chart Recorder printout, including EEG, ECG and/or OMS.

# Option Specifications

5000 models

## SIGNAL OUTPUT BOARD SPECIFICATIONS

The Signal Output board provides isolated patient monitoring output signals (EEG, ECG, OMS) in both analog and digital formats. These output signals may be connected to external equipment (e.g., chart recorder, oscilloscope, personal computer) for viewing and analysis.

### Analog output signals

The analog output signals are present on a DB25 (female) type connector located on the back panel of the SPECTRUM 5000 models. Refer to Back Panel diagram for location of the analog output connector. These signals have been properly processed (amplified, filtered, and isolated) from the patient sensor electrodes and are available for direct connection to external viewing equipment. See Table A for signal and pinout information, and Table B for signal level information.

Channel Number	Signal Name	Signal Pin Number	Ground Pin Number (See note 1)
0	EEG1	13	25
1	EEG2	11	23
2	ECG1	9	21
3	OMS	7	19
4	EEG3	5	17
5	EEG4	3	16
6	NA	2	15
7	TIME	1	14

Table A

### Notes

- 1) Pin numbers 4,6,8,10,12,14-25 are all connected to ground.
- 2) Signals EEG3 and EEG4 are only available if a second patient sensor board is installed.
- 3) OMS - Optical Motion Sensor
- 4) TIME - This signal is ordinarily zero volts, but goes to -5V during stimulus delivery, and +5V immediately following delivery. It stays at that level until either DONE is touched, or another treatment is initiated by pressing the STIMULUS CONTROL push button.

Signal Type	Input Range	Output Range *
EEG	-1 mV to +1 mV	-5V to +5V
ECG	-5 mV to +5 mV	-5V to +5V
OMS	NA	-5V to +5V

Table B

**5000 models**

**NOTE:** Analog output voltage for any channels that are either not installed, or are installed but not connected to the patient (or to the OMS sensor) will be -5.0V.

**Serial Output port**

Serial output data (standard RS232) is present on a DB9 (male) type connector located on the back panel of the SPECTRUM 5000. Refer to Back Panel diagram for location of the digital output connector. A REMOTE MONITOR OPTION (PC and software) is available for graphical display and data logging functions.

Refer to Table C for signal and pinout information for SERIAL PORT 2. SERIAL PORT 1 is not used at the present time.

Pin Number	Serial Port 2
2	TX2
5	GND

Table C

# Technical Overview

## SYSTEM DESCRIPTIONS

The SPECTRUM is available in four different configurations:

### 5000 models

The SPECTRUM 5000 model provides a stimulus delivery system, and up to six channels of patient physiological monitoring (EEG, ECG and OMS). Additionally, the 5000 model includes a CHART RECORDER and analog and serial output ports.

A serial output port allows the user to display and store up to six channels of physiological monitoring and LCD/Touch Screen display data on a remote PC. The analog serial port enables the user to display or record data with external analog recording equipment.

### 4000 models

The SPECTRUM 4000 model is identical to the 5000 model technically, but without patient monitoring. Some newer models have Membrane Switches to the left of the LCD Screen, and have no Touch Screen. No date or time appears on these models. Use the EXIT button in place of DONE or CLEAR on these models.

Both 4000 and 5000 models offer the choice of:

### Q models

- the Q model, which has four controls to independently set the frequency, pulse width, current, and duration, or

### M models

- the M model, which uses only one knob to select pre-configured choices.

All models may be set to operate either from 115V or 230V nominal power.

The electronics for the SPECTRUM consist of the power supply in the rear chassis assembly, ECT module, processor module, LCD/Touch Screen in the front panel assembly, sensor module, CHART RECORDER assembly, signal output board, backplane board and ADSP-2101 digital signal processor.

1. The power supply in the rear chassis assembly includes a line EMI filter, 50/60 Hz stepdown transformer, multi-output switching power supplies, startup logic, and protection circuits. It provides isolation from mains circuits, plus additionally-isolated power for all patient-connected circuits and the signal output board.
2. The ECT module contains three circuit boards. It contains a power amplifier, output transformer, isolated control and output sensor circuits, control for the status LED, and all hardware safety circuits for the ECT section. It also measures the patient electrode impedance, and provides remote control functions for the Hand-Held electrodes.
3. The processor module contains two boards, and includes two microprocessors (an 80386 SX microprocessor, and an 87C592 microcontroller), a clock circuit, ROM, RAM, and an A/D. They provide messages to the LCD/Touch Screen and CHART RECORDER, as well as perform self-tests of all software and most of the hardware.
4. The front panel assembly contains an LCD backlit display, an input device which may be a transparent Touch Screen over the LCD or a Membrane Switch Assembly to the left of the LCD, and the front panel board and related electronics. It contains one 8751 microcontroller, and the stimulus parameter controls.

## 5000 models

5. The sensor module contains high-gain signal amplifiers, Leads Off Indication circuits, trace restore circuits, isolated power supplies and isolated control circuits. It provides display signals for displaying waveforms of the patient's EEG, ECG, and OMS waveforms.
6. The CHART RECORDER uses a hot Thermal Array printhead to print on thermally sensitive paper at 25mm per second.
7. The Signal Output board provides high-level analog outputs, and digital outputs of patient waveform signals, all electrically isolated from all other circuits.
8. The chassis assembly contains the backplane board, and has an ADSP-2101 digital signal processor which conditions signals from the sensor module in preparation for display, printing and EEG analysis.



# 5000Q Functional Performance Verification

**ALL WARRANTY REPAIRS MUST BE RETURNED TO MECTA CORP.  
(OR LOCAL DISTRIBUTOR OUTSIDE OF U.S. OR CANADA)  
OR PARTS AND LABOR WARRANTY WILL BE VOIDED!!!**

The functional performance checkout procedures ensure proper operation of the SPECTRUM unit and its options. These procedures should be performed every time the device is serviced, or whenever there is a question about the accuracy or safety of its functions. If the SPECTRUM does not pass these tests, contact the MECTA Corporation Service Department for repairs or calibration. Outside of the U.S. and Canada, contact your local distributor.

Warranty will be voided if the SPECTRUM is not returned in its original container, with its original foam packing.

## REQUIRED EQUIPMENT 5000Q

This equipment is needed to perform functional check-out tests:

### Power up tests

- \_\_\_ · SPECTRUM with power cord

### Treatment delivery tests

- \_\_\_ · SPECTRUM with power cord
- \_\_\_ · Patient Stimulus cable
- \_\_\_ · Oscilloscope (Storage type preferred)
- \_\_\_ · Load Box (300 Ohm 20 Watt resistor. Also has a 301:1 Divider) with BNC style connector. Static Impedance will read approximately 1880 Ohm. Dynamic Impedance will read approximately 300 Ohm.
- \_\_\_ · BNC to BNC cable

### Sensor tests

- \_\_\_ · SPECTRUM with power cord
- \_\_\_ · Function Generator (5 to 60 Hz range required)
- \_\_\_ · BNC to BNC cable
- \_\_\_ · Patient Safety Monitor Cable (EEG & ECG cable)
- \_\_\_ · Sensor Input strip
- \_\_\_ · Optical Motion Sensor (OMS) (if OMS option is present)

### Printer tests

- \_\_\_ · SPECTRUM with power cord
- \_\_\_ · 1 roll of CHART RECORDER paper

### Safety tests

- \_\_\_ · SPECTRUM with power cord
- \_\_\_ · Safety Analyzer such as Dynatech Nevada model 432HD (Neurodyne-Dempsey model 431F-Mod1 or equivalent).
- \_\_\_ · Patient Safety Monitor Cable (EEG & ECG cable)
- \_\_\_ · Patient Stimulus cable

When reading the steps described below, refer to the front and back panel diagrams as necessary.

Completing the following functional checks will ensure the SPECTRUM and associated cabling are ready for treatment sessions (refer to the screen descriptions of the Instruction Manual if needed).

## POWER-UP TESTS 5000Q

### Loading Thermal Paper in CHART RECORDER.

(See also the graphic instructions on the next page)

#### NOTE:

- If paper is protruding from the CHART RECORDER, this step can be skipped.

- \_\_\_ 1. Push the CHART RECORDER door latch (the ribbed button at the top right corner of the printer unit). It will fall open in "tailgate" fashion.
- \_\_\_ 2. Insert a roll of SPECTRUM thermal paper. Insert it between the two cupped uprights. Make sure the roll is placed so that paper spools off the underside of the roll.
- \_\_\_ 3. Pull out a few inches and lay it over the container door's top edge. It does not need to be threaded through any slots or assemblies.
- \_\_\_ 4. Simply lift the door and push it shut, leaving a bit of paper feeding over the top of the door.

### Power-up Steps

- \_\_\_ 1. Connect the SPECTRUM's power cord to the Power Entry Module. Read the voltage selector value in the window of the Power Entry Module. Do not connect any other cables at this time.
- \_\_\_ 2. Connect the SPECTRUM's power cord to a power source that is compatible with the voltage indicated in the window of the Power Entry Module.
- \_\_\_ 3. Press the POWER ON/OFF push button. Ensure that the green indicator is now visible.

On power-up the SPECTRUM unit first conducts internal tests. The INTERNAL TEST display will appear, followed by a series of internal clicks and chirps as it processes and verifies the status of software and hardware readiness. The CHART RECORDER prints out a narrow vertical black bar and the Initial Power-up printout. Inspect the black bar and verify that it is continuous. If it is not, this indicates a problem with the CHART RECORDER. The date and time are also printed on the CHART RECORDER. If they are not correct, press the MENU button on the LCD/Touch Screen and select DATE & TIME, enter the correct information and exit the MENU system.

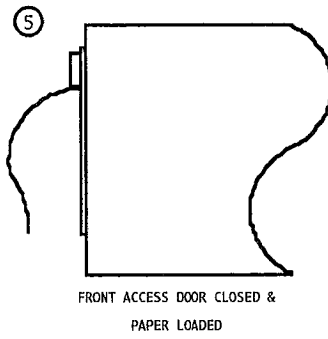
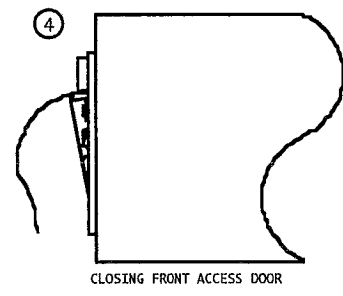
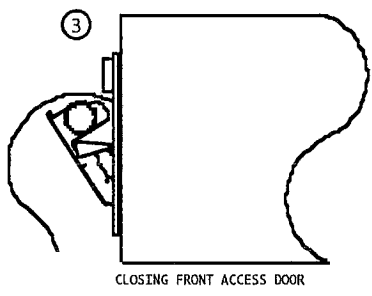
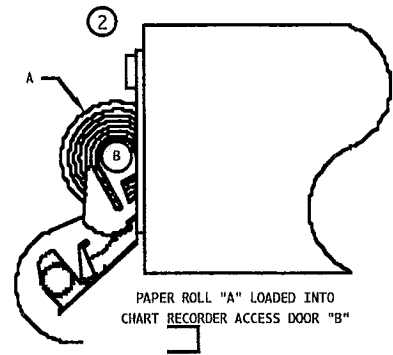
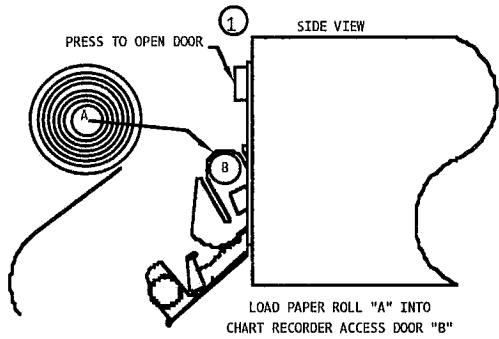
### Contrast Adjustment

#### NOTE:

- To activate the LCD/Touch Screen in the following tests (and in normal use), touch the display firmly but not excessively (as if you were typing on a keyboard). A very light touch will not activate the LCD/Touch Screen, yet too hard a touch may damage it.

When the SPECTRUM is powered up, the LCD/Touch Screen may appear darker or lighter than necessary for comfortable use. The COPYRIGHT display (pictured below) provides contrast control buttons (LIGHT and DARK) that allow 11 steps of contrast adjustment settings.

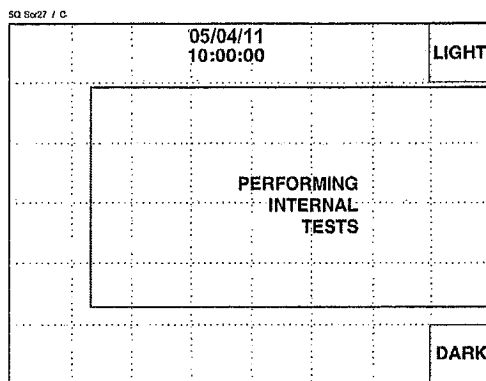
LOADING PAPER INTO CHART RECORDER



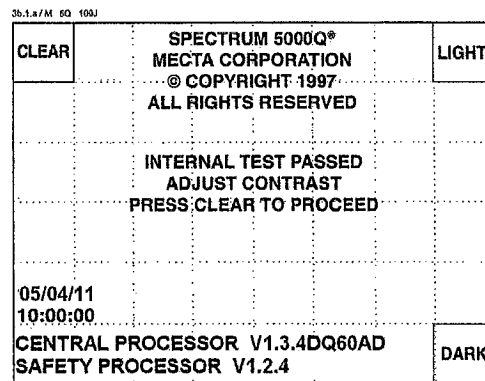
E

Touch LIGHT to lighten the display, or touch DARK to darken it, until desired contrast is reached.

INTERNAL TEST RESULTS - After the power-up steps have been completed, the display will show a message stating that internal tests have passed. Location of CLEAR button varies.



Internal Test display



Copyright display

Touch the CLEAR button.

## TREATMENT DELIVERY TESTS 5000Q

### Turning CHART RECORDER OFF

- \_\_\_ 1. Select the MAIN MENU display by touching the MENU button.
- \_\_\_ 2. Select the CHART OPTIONS button in the MAIN MENU, and touch the CHART OFF button. Then touch the EXIT button.
- \_\_\_ 3. Power-down the SPECTRUM and disconnect all cables, except the power cord.
- \_\_\_ 4. Power-up the SPECTRUM; verify that the CHART RECORDER does not activate or print.
- \_\_\_ 5. Touch the CLEAR button to move to the TREATMENT READY display.
- \_\_\_ 6. Push the CHART RECORDER's ON push button, and verify that the CHART RECORDER is not active.

### Stimulus Delivery Procedures

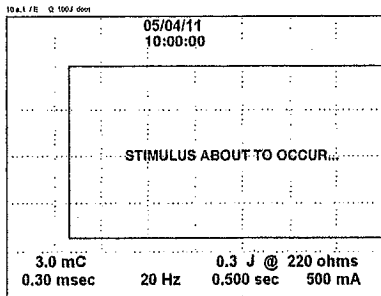
The stimulus output delivered during treatment is a constant current bipolar pulse wave. The four parameters that govern the waveform include: PULSE WIDTH, FREQUENCY, DURATION, and CURRENT. The actual voltage of the pulses will depend on the patient impedance at the time of treatment. Treatment parameters are selected by adjusting the knobs below the LCD/Touch Screen.

Stimulus output is initiated by the STIMULUS CONTROL push button on the front panel.

- \_\_\_ 1. Connect the Patient Stimulus cable to the STIMULUS OUTPUT connector located on the front panel. Connect the other end of that cable to the load box (300 ohm 20 Watt 5% resistor).
- \_\_\_ 2. Select MENU then PARAMETER SELECTION. Select the fourth Parameter Set (0.3, 20, 0.500, 500) then EXIT twice. Set the parameter controls to minimum settings (rotate CCW until the parameters shown on the LCD/Touch Screen no longer change).

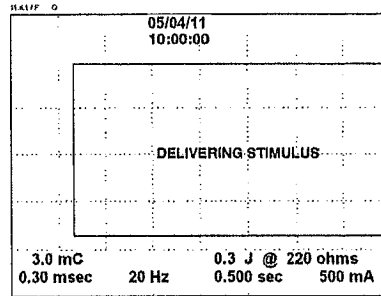
- Push and HOLD the STIMULUS CONTROL push button. You will then hear three warning tones followed by a lower-pitched continuous tone. These messages will appear on the LCD/Touch Screen:

GREEN



Stimulus Warning display

YELLOW

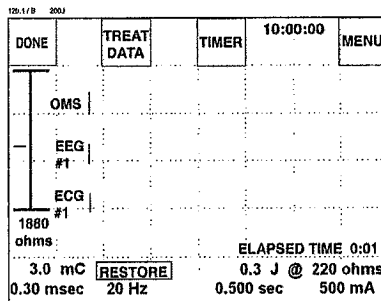


Stimulus Delivery display

- Release the STIMULUS CONTROL push button when the tones stop. If the STIMULUS CONTROL push button is pushed and released before the stimulus is completed, a STIMULUS CONTROL RELEASED PREMATURELY message appears.
- Touch the DONE button. After performing a series of internal tests, the TREATMENT READY display will re-appear.

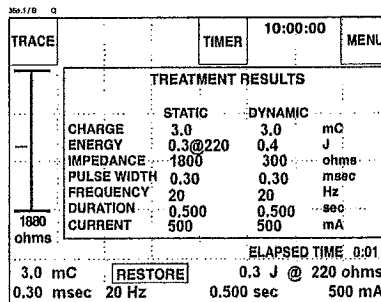
**Treatment Delivery checkout**

- Set EEG DATA to OFF in the EEG DATA MENU. (If unit is equipped with this feature)
- Push and hold the STIMULUS CONTROL push button. The three-beep warning will sound, followed by a continuous tone signaling the delivery of the stimulus. When stimulus delivery is complete, the POST-TREATMENT TRACE display will appear (possibly with a different number of trace labels, and with a RESTORE button if traces are disconnected):



Post-Treatment Trace display

- Touch the TREAT DATA button to see the TREATMENT RESULTS display:



Treatment Results display

- Touch TRACE to return to the POST-TREATMENT TRACE display.

**5000Q**

**NOTE:**

- The energies displayed on the STATIC and DYNAMIC columns ordinarily will be different. The DYNAMIC energy will be higher by the ratio of the DYNAMIC IMPEDANCE to 220 ohms.  $DYNAMIC = STATIC \times (300/220)$ .

12b.1/B 200J

DONE	TREAT DATA	TIMER	10:00:00	MENU
OMS				
EEG #1				
ECG #1				
1880 ohms				
3.0 mC		RESTORE	0.3 J @ 220 ohms	
0.30 msec		20 Hz	0.500 sec 500 mA	
ELAPSED TIME 0:01				

5. Touch DONE and the INTERNAL TESTS and TREATMENT READY displays will appear:

5G 9a27 / C

05/04/11		LIGHT
10:00:00		
PERFORMING INTERNAL TESTS		
		DARK

Internal Tests display

06b.1/A

		TIMER	10:00:00	MENU
ECG #1				
EEG #1				
OMS				
1880 ohms				
3.0 mC		RESTORE	0.3 J @ 220 ohms	
0.30 msec		20 Hz	0.500 sec 500 mA	

Treatment Ready display

**Stimulus Output Parameter Testing**

1. Connect the patient stimulus cable to the STIMULUS OUTPUT connector.
2. Connect the other end of the cable to the load box (300 ohm 20 Watt 5% resistor).
3. Connect an oscilloscope to the load box, with a BNC-to-BNC cable. Set the oscilloscope input coupling to DC. The load box's BNC output is 1 volt/amp of delivered current.
4. Go to the MAIN MENU and select the fourth parameter set on the PARAMETER SELECTION MENU. Exit the MENU system.

PARMS Q DOM / D

EXIT	PARAMETER SELECTION MENU			
	MINIMUM PARAMETER SETTINGS			
	PW	FREQ	DUR	CUR
→	0.3	20	0.500	800
→	0.5	20	0.500	800
→	1.0	20	0.500	800
→	0.3	20	0.500	500

5000Q

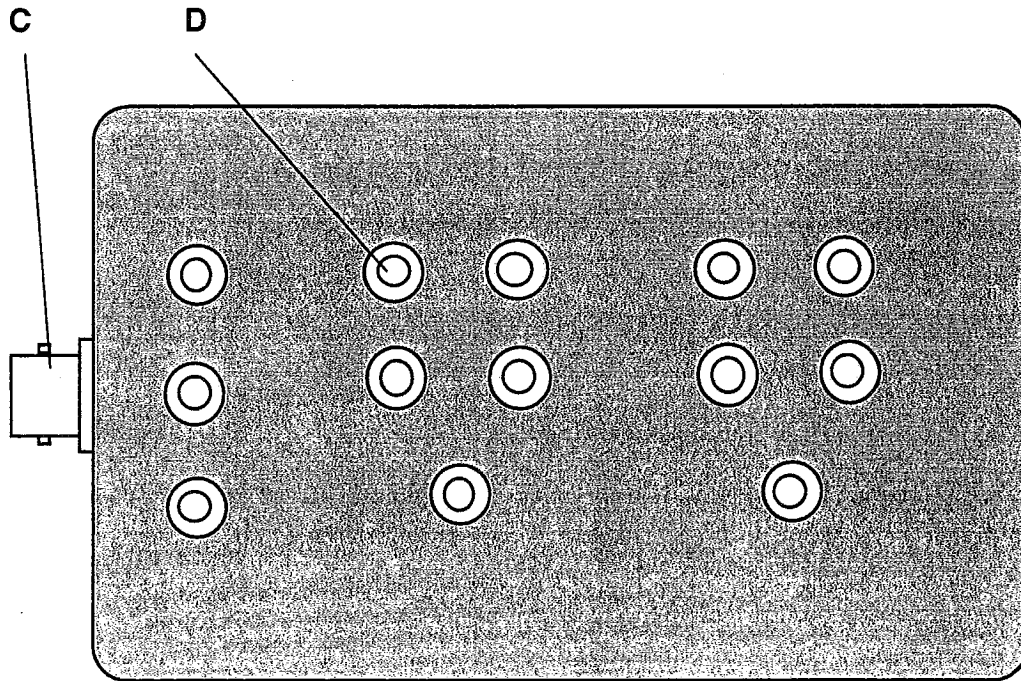
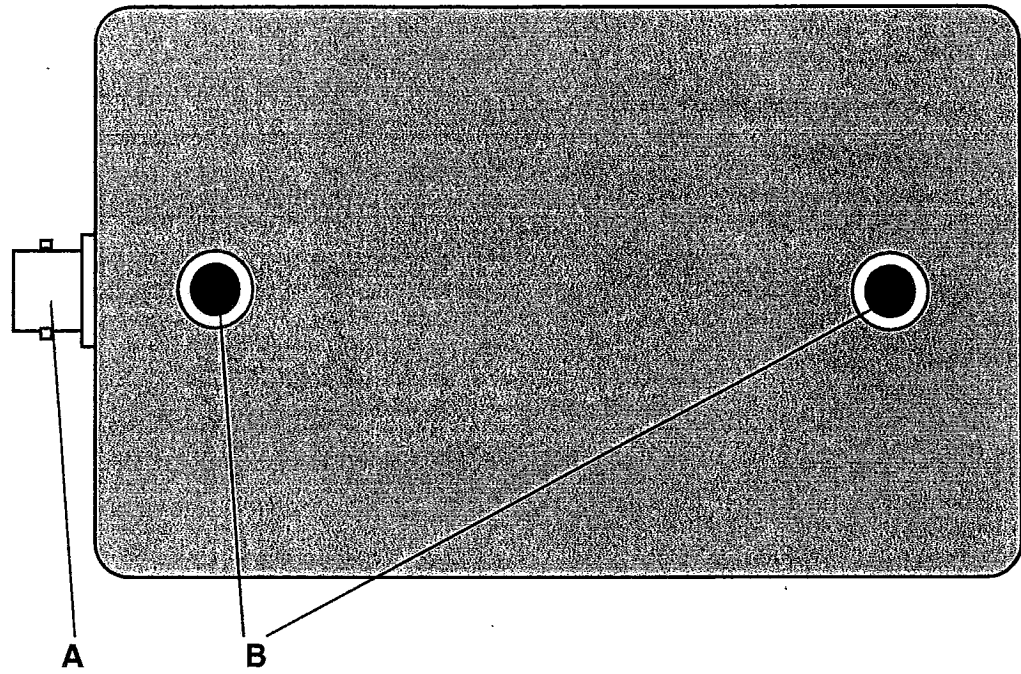
5. Set the Stimulus Parameter controls to these levels:
- |     |             |   |                  |
|-----|-------------|---|------------------|
| ___ | PULSE WIDTH | = | 0.3 milliseconds |
| ___ | FREQUENCY   | = | 60 Hertz         |
| ___ | DURATION    | = | 4.0 seconds      |
| ___ | CURRENT     | = | 500 milliAmps    |
6. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. Each pulse width (at the 50% amplitude point) should be within 10% of the PULSE WIDTH settings. Repeat this step for each of the following PULSE WIDTH settings.
- |     |                  |
|-----|------------------|
| ___ | 1.0 milliseconds |
| ___ | 0.8 milliseconds |
| ___ | 0.3 milliseconds |
7. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. Bipolar pulse frequencies should be within 10% of the FREQUENCY control setting. (Prematurely releasing the STIMULUS CONTROL push button will cause early termination of the Stimulus Output.) Repeat this step for each of the following FREQUENCY settings:
- |     |           |
|-----|-----------|
| ___ | 20 Hertz  |
| ___ | 40 Hertz  |
| ___ | 60 Hertz  |
| ___ | 90 Hertz  |
| ___ | 120 Hertz |
8. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. The duration of each pulse train should be within 10% of the Duration setting. (Prematurely releasing the STIMULUS CONTROL push button will cause early termination of the Stimulus Output.) Repeat this step for each of the following DURATION settings:
- |     |               |
|-----|---------------|
| ___ | 8.000 seconds |
| ___ | 4.000 seconds |
| ___ | 2.000 seconds |
| ___ | 1.000 seconds |
| ___ | 0.500 seconds |

**NOTE:**

- Stimulus Duration starts with the first output pulse, not when the treatment button is first pushed.

9. Push the STIMULUS CONTROL push button while observing the waveform to the load box on the oscilloscope. Amplitude of the bipolar pulses should be within 10% of the setting of the CURRENT control. Repeat this step for each of the CURRENT settings.
- |     |                       |
|-----|-----------------------|
| ___ | 500 mAmps (0.5 volts) |
| ___ | 600 mAmps (0.6 volts) |
| ___ | 700 mAmps (0.7 volts) |
| ___ | 800 mAmps (0.8 volts) |
| ___ | 900 mAmps (0.9 volts) |
10. Set the Stimulus Parameter controls to:
- |     |             |   |                  |
|-----|-------------|---|------------------|
| ___ | PULSE WIDTH | = | 1.0 milliseconds |
| ___ | FREQUENCY   | = | 45 Hertz         |
| ___ | DURATION    | = | 8.000 seconds    |
| ___ | CURRENT     | = | 500 mAmps        |
11. Push and HOLD the STIMULUS CONTROL push button. When the SPECTRUM finishes computing the treatment results, they will be displayed by touching the TREAT DATA button. Dynamic values displayed should read within 20% of 300 ohms and within 30% of 50.0 Joules.

# DYNAMIC LOAD BOX and SENSOR INPUT BOX

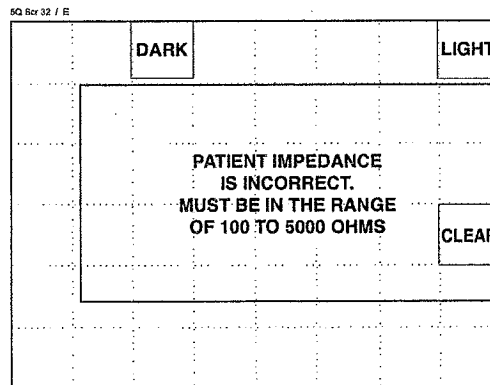


- A - Test Out point
- B - Input jacks
- C - Signal Input connector
- D - Safety snap



**5000Q**

- \_\_\_ 12. Set the Stimulus Parameter controls to:
- \_\_\_ PULSE WIDTH = 0.79 milliseconds
  - \_\_\_ FREQUENCY = 120 Hertz
  - \_\_\_ DURATION = 3.000 seconds
  - \_\_\_ CURRENT = 900 mAmps
- \_\_\_ 13. Push and HOLD the STIMULUS CONTROL push button. Select the TREAT DATA button. Dynamic values displayed should read within 20% of 300 ohms and within 30% of 138.3 Joules.
- \_\_\_ 14. Set the Stimulus Parameter controls to:
- \_\_\_ PULSE WIDTH = 1.0 milliseconds
  - \_\_\_ FREQUENCY = 90 Hertz
  - \_\_\_ DURATION = 4.000 seconds
  - \_\_\_ CURRENT = 800 mAmps
- Push and HOLD the STIMULUS CONTROL push button. The delivery should complete with no error conditions.
- \_\_\_ 15. Disconnect one lead to load box (open circuit). As soon as the lead is disconnected, the STIMULUS STATUS indicator should go out. Push the STIMULUS CONTROL push button. The LCD/Touch Screen should show the following display:



### Remote Treat Option

The STIMULUS OUTPUT connector also provides remote control capability when connected to the optional Hand-Held electrodes. On the end of one Hand-Held electrode is a REMOTE TREAT push button. Pushing the REMOTE TREAT push button will cause the SPECTRUM to deliver the Stimulus Output to the patient. (Note that the front panel's STIMULUS CONTROL push button is disabled while a set of Hand-Held electrodes is connected.)

- \_\_\_ 1. Turn the SPECTRUM off, then back on again, to clear any results from any previous test procedures. Once the SPECTRUM has completed the power-on sequence, connect the Hand-Held stimulus cable to the STIMULUS OUTPUT connector (located on the front panel).
- \_\_\_ 2. Set the parameter controls to minimum settings. Place the Hand-Held electrodes on top of the banana jacks on the LOAD BOX.
- \_\_\_ 3. Push and hold the REMOTE TREAT push button. The Output Stimulus should be delivered to the load box.

## SENSOR TESTS 5000Q

Printing of treatment results by the CHART RECORDER depends on whether the CHART RECORDER is set for the CHART ON or CHART OFF mode. The default condition of the SPECTRUM is the ON mode. IF THE SPECTRUM DOES NOT HAVE ECG PATIENT MONITORING, THEN REPLACE ECG1 WITH EEG2 IN THE FOLLOWING TESTS.

**5000Q**

### Patient Monitoring tests

- \_\_\_ 1. Power-up the SPECTRUM with no Patient Monitor or OMS cables connected.
- \_\_\_ 2. Go to the LCD TRACE MENU. Set up the menu selections so that you will display each trace in your selection list (on the right side of the LCD TRACE MENU). If you have more than four, select four now and repeat the tests for the remaining channels.
- \_\_\_ 3. Go to the CHART OPTIONS MENU and touch CHART OFF. Exit the menu system.
- \_\_\_ 4. Connect the Patient Monitor cables for the channels you have selected to the appropriate connectors on the SPECTRUM front panel:
  - \_\_\_ Connect the OMS sensor to the OMS connector on the front panel.
  - \_\_\_ Connect EEG or ECG electrode safety leads to each Patient Monitor cable.
  - \_\_\_ Snap the safety leads of the Patient Monitor cables onto the appropriately matched snaps of the Sensor Input strip.
- \_\_\_ 5. Connect and power-up the signal generator and set it for 2 volts peak-to-peak sine wave at 3 Hz.
- \_\_\_ 6. Verify that all traces are present on the LCD/Touch Screen, and that there is no RESTORE button visible.
- \_\_\_ 7. Remove one of the leads from the Sensor Input strip and notice that the correct trace disappears, and that the RESTORE button appears. Reconnect the lead and repeat for each of the leads except the Ref leads.
- \_\_\_ 8. From the LCD GAINS MENU, vary the waveform trace gains to obtain EEG and ECG traces that are big enough to view nicely, but which are not clipped.
- \_\_\_ 9. If the OMS option is installed, wrap the OMS sensor with the metal side of the sensor on the nail side of a knuckle. Flex that knuckle to verify that its LCD/Touch Screen trace responds. Adjust the OMS trace gain to a suitable level for viewing as required.
- \_\_\_ 10. Check the appropriate analog signal outputs at the analog port on the rear panel. See the OPTIONS SPECIFICATION section of this manual for the pinout of the connector. Note that the gain controls for traces displayed on the LCD/Touch Screen do not affect the analog output signals.
- \_\_\_ 11. Exit the MENU system.
- \_\_\_ 12. Unplug the OMS from the front panel connector and verify that its trace disappears on the LCD/Touch Screen.
- \_\_\_ 13. If more than four channels are available, go to the LCD TRACE MENU. Set up the system to show only the remaining untested channels. Exit the MENU system.
- \_\_\_ 14. Repeat the above procedures, beginning with step 2.

# CHART RECORDER TESTS 5000Q

## CHART RECORDER ON checkout

5000Q

- \_\_\_ 1. Touch the MENU button, then touch the CHART OPTIONS button. On the CHART OPTIONS MENU, touch the CHART ON button, then exit the MENU system.
- \_\_\_ 2. Go to the CHART TRACE MENU, set CHART TRACES to 2 and set trace 1 to EEG1 and Trace 2 to ECG1. Exit the MENU system.
- \_\_\_ 3. Power-down, then power-up the SPECTRUM, and verify that the CHART RECORDER prints the narrow vertical test bar.
- \_\_\_ 4. After the internal test sequence, the COPYRIGHT display should appear. Unplug all the patient monitor cables and the Patient Stimulus cable.
- \_\_\_ 5. Touch CLEAR, and verify that the system goes to the TREATMENT READY display, that the OVER message appears, and that the RESTORE button appears.
- \_\_\_ 6. Plug the Patient Monitor cables into the front panel connectors. Connect the leads of these cables onto the snaps of the Sensor Input strip. Connect and power-up the Signal Generator and set it for 2 volts peak-to-peak sine wave at 3 Hz.
- \_\_\_ 7. Push the ON button located on the CHART RECORDER. Verify that the CHART RECORDER prints the EEG1 signal from the generator, and whatever second channel was selected.
- \_\_\_ 8. Push the RECORDER's OFF push button, and verify that the trace printing stops.
- \_\_\_ 9. Go back to the CHART TRACES MENU and change CHART TRACES to 1. Exit the menu system. Set the Gain 1 knob (on the front panel) to its lowest setting (full CW).
- \_\_\_ 10. Push the RECORDER's ON push button. Verify that the CHART RECORDER prints the EEG1 signal.
- \_\_\_ 11. Push the RECORDER's OFF push button, and verify that the printing stops. Verify that the sine wave fills the full CHART RECORDER range.
- \_\_\_ 12. Push again the RECORDER's ON push button. While printing is going on, push the RECORDER's paper container door latch so that the paper door opens.
- \_\_\_ 13. Verify that a DOOR OPEN message appears on the LCD/Touch Screen.
- \_\_\_ 14. Close the door. Verify that the trace printing resumes.
- \_\_\_ 15. Push the RECORDER's OFF button again to stop printing.

## CHART RECORDER Printout checkout

- \_\_\_ 1. Connect the 300-ohm, 20 Watt load box to the STIMULUS OUTPUT connection. (Use the Patient Stimulus cable's banana plugs to plug into the 300 $\Omega$  load).
- \_\_\_ 2. In the CHART TRACE MENU, set Chart Traces to 2; Trace 1 to EEG1 and Trace 2 to ECG1. (At least the leads for EEG1, ECG1 and one REF must be connected to appropriately-labeled snaps on the Sensor Input strip).

- \_\_\_ 3. Connect the signal generator to the Sensor Input strip.
  - \_\_\_ 4. Turn on the signal generator, and set it to provide a 2-volt peak-to-peak 3 Hz sine wave.
  - \_\_\_ 5. In the CHART OPTIONS MENU, confirm that CHART RECORDER is still set to ON.
  - \_\_\_ 6. Set all other chart options to YES.
  - \_\_\_ 7. In the EEG DATA MENU, set EEG DATA to ON. Exit the MENU system. (If unit is equipped with this feature)
  - \_\_\_ 8. Push the RECORDER's ON button. Verify that the RECORDER prints two traces.
  - \_\_\_ 9. Verify that changing the RECORDER's GAIN 1 knob changes the upper trace gain.
  - \_\_\_ 10. Verify that changing the RECORDER's GAIN 2 knob changes the lower trace gain.
- 5000Q** \_\_\_ 11. Push the RECORDER's OFF button, and verify that the paper stops.
- \_\_\_ 12. Give a treatment at whatever settings are currently set, and verify:
    - \_\_\_ that the RECORDER prints out a Self Test Results report,
    - \_\_\_ that the RECORDER then prints two traces of data continuously.
    - \_\_\_ that the DONE button triggers the PERFORMING INTERNAL TESTS display, stops the RECORDER's trace printing and triggers the Treatment Results printout, then stops printing.
    - \_\_\_ that the system returned to the TREATMENT READY display, and
    - \_\_\_ that the STIMULUS STATUS indicator light comes on, signaling readiness for further treatment.

## SAFETY TESTS 5000Q

Prior to shipping each unit from the factory, the following tests are done:

- \_\_\_ a risk leakage current safety check,
- \_\_\_ a dielectric strength integrity (Hipot) test.

The results of these tests are available on request. If required, safety verification (leakage and chassis ground tests) can be performed as an incoming verification in Biomedical Engineering. These tests ensure that patients are electrically isolated from the power circuits.

### Leakage Current

This equipment is needed to perform Leakage Current tests:

- DNI Nevada 232D or Neurodyne-Dempsy model 431F Mod-1 or Equivalent Safety Analyzer
- Patient Stimulus Cable
- Patient Safety Monitor and Safety Lead Set
- Power Cord
- Banana Plug to Alligator Clip Test Lead
- 230V step up (2:1, 115VAC to 230VAC, 600VA) transformer (signal transformer model M4L-2-6 or equivalent). Only required if the SPECTRUM input power is 230VAC and the safety analyzers input power voltage is 115VAC only.

Chassis Leakage Tests

1. If the SPECTRUM is a 230V unit, the safety analyzer must be set for 230V operation.
2. Plug the SPECTRUM's power cord into the test receptacle on the safety analyzer. Connect the case connection lead of the safety analyzer to the SPECTRUM Equipotential post for all tests. Do not connect any other cables.
3. Turn on power to SPECTRUM.
4. Set the Mode to Case Leakage, Ext Lead (case leakage position) on the safety analyzer. Perform the chassis leakage tests (described in the safety analyzer manual). The chassis leakage current shall not be more than 100uA for the "normal" condition and "normal reversed" condition.

Line Voltage \_\_\_\_\_ Normal \_\_\_\_\_ Normal Reversed \_\_\_\_\_

5. The chassis leakage current shall not be more than 500uA for all "single fault" conditions.

Open Neutral \_\_\_\_\_ Open Neutral Reversed \_\_\_\_\_  
 Open Ground \_\_\_\_\_ Open Ground Reversed \_\_\_\_\_

Patient Sink and Source Current Leakage Tests

5000Q

1. Connect the Patient Monitor Cable to the EEG1 front panel connector and Safety Leads to the Safety Analyzer ECG lead inputs (usually labeled RA, RL, LA, LL and C or V1). Set the Mode to ECG and the leads switch to all (set up of ECG leakage, all leads). The leakage current shall be less than 10uA for both "normal" conditions and 50uA for all other conditions of test.

Normal \_\_\_\_\_ Normal Reversed \_\_\_\_\_  
 Open Neutral \_\_\_\_\_ Open Neutral Reversed \_\_\_\_\_  
 Open Neutral \_\_\_\_\_ Open Neutral Reversed \_\_\_\_\_

2. Leave the Mode switch in ECG and set the Leads switch to Isolation Test (ECG sink current test). Press the ISO Test Button to apply mains voltage to the ECG leads. The current shall be between 10uA and 100uA.

Patient Monitor Sink Current \_\_\_\_\_

3. Remove the patient monitor cable and safety leads from the safety analyzer, and connect the Patient Stimulus Cable to the SPECTRUM and to any two ECG lead input connectors of the analyzer. Set the mode switch to ECG and the leads switch to all leads. **CAUTION: STARTING A TREATMENT WHILE IN THIS SETUP WILL DAMAGE THE SAFETY ANALYZER!** The leakage current shall be less than 10uA for both "normal" conditions and 50uA for all other conditions.

Normal \_\_\_\_\_ Normal Reversed \_\_\_\_\_  
 Open Neutral \_\_\_\_\_ Open Neutral Reversed \_\_\_\_\_  
 Open Neutral \_\_\_\_\_ Open Neutral Reversed \_\_\_\_\_

4. Set the leads switch to isolation test, and press the ISO test button. The value shall be under 100uA.

Signal Output Sink Current Test

1. For this test, connect any ECG lead input to the metal shell of any one of the three connectors of the Signal Output Board (on the rear panel) using the banana plug to alligator clip test lead. Set the mode to ECG and leads to Isolation Test and press the ISO test button. The maximum allowed current is 300uA.

Signal Output Sink Current \_\_\_\_\_

2. Set the Safety Analyzer test mode to Ohms. Connect the Safety Analyzer's ohm meter leads to the Equipotential Post of the SPECTRUM. Connect the other ohm meter lead to the ground lead of the SPECTRUM power cord, and record the ohm meter measurement.

\_\_\_\_\_ Ground Impedance Resistance (less than .1 ohms)

Ground Tests

This equipment is needed to perform the safety ground tests:

- Rod-L 30 AMP Ground tester or equivalent - Confirm cal OK \_\_\_\_\_
- Power Cord

**5000Q**

Chassis Ground Test

1. Plug the SPECTRUM's power cord into the front of the ground tester. Connect the Chassis Ground Sense wire from the ground tester to the SPECTRUM equipotential post. With the ground tester mode switch in the "GND" position, press the start button on the ground tester. The maximum resistance for both tests is 100 milliohms.

Chassis Ground Test: Pass \_\_\_\_\_ Fail \_\_\_\_\_

2. With the power cord still connected to the ground tester, connect the Chassis Ground Sense lead to one of the front panel screws and press the start button on the ground tester.

Front Panel Ground Test: Pass \_\_\_\_\_ Fail \_\_\_\_\_

This completes the 5000Q functional checkout.

# 5000M Functional Performance Verification

**ALL WARRANTY REPAIRS MUST BE RETURNED TO MECTA CORP.  
(OR LOCAL DISTRIBUTOR OUTSIDE OF U.S. OR CANADA)  
OR PARTS AND LABOR WARRANTY WILL BE VOIDED!!!**

When reading the steps described below, refer to the front and back panel diagrams as necessary. Completing the following functional checks will ensure the SPECTRUM and associated cabling are ready for treatment sessions (refer to the screen descriptions of the Instruction Manual if needed).

Warranty will be voided if the SPECTRUM is not returned in its original container, with its original foam packing.

## REQUIRED EQUIPMENT 5000M

This equipment is needed to perform functional check-out tests:

### Power up tests

\_\_\_ · SPECTRUM with power cord

### Treatment delivery tests

\_\_\_ · SPECTRUM with power cord

\_\_\_ · Patient Stimulus cable

\_\_\_ · Oscilloscope (Storage type preferred)

\_\_\_ · Load Box (300 Ohm 20 Watt resistor . Also has a 301:1 Divider) with BNC style connector.

\_\_\_ · BNC to BNC cable

### Sensor tests

\_\_\_ · SPECTRUM with power cord

\_\_\_ · Function Generator (5 to 60 Hz range required)

\_\_\_ · BNC to BNC cable

\_\_\_ · Patient Safety Monitor Cable (EEG & ECG cable)

\_\_\_ · Sensor Input strip

\_\_\_ · Optical Motion Sensor (OMS) (if OMS option is present)

### Printer tests

\_\_\_ · SPECTRUM with power cord

\_\_\_ · 1 roll of CHART RECORDER paper

### Safety tests

\_\_\_ · SPECTRUM with power cord

\_\_\_ · Safety Analyzer such as Dynatech Nevada model 432HD (Neurodyne-Dempsey model 431F-Mod1 or equivalent).

\_\_\_ · Patient Safety Monitor Cable (EEG & ECG cable)

\_\_\_ · Patient Stimulus cable

When reading the steps described below, refer to the front and back panel diagrams as necessary.

**5000M**

## **POWER-UP TESTS 5000M**

Loading Thermal Paper in CHART RECORDER. (See also the graphic instructions on the next page)

NOTE: If paper is protruding from the CHART RECORDER, this step can be skipped.

- \_\_\_ 1. Push the CHART RECORDER door latch (the ribbed button at the top right corner of the printer unit). It will fall open in "tailgate" fashion.
- \_\_\_ 2. Insert a roll of SPECTRUM thermal paper. Insert it between the two cupped uprights. Make sure the roll is placed so that paper spools off the underside of the roll.
- \_\_\_ 3. Pull out a few inches and lay it over the container door's top edge. It does not need to be threaded through any slots or assemblies.
- \_\_\_ 4. Simply lift the door and push it shut, leaving a bit of paper feeding over the top of the door.

### Power-up Steps

- \_\_\_ 1. Connect the SPECTRUM's power cord to the Power Entry Module. Read the voltage selector value in the window of the Power Entry Module. Do not connect any other cables at this time.
- \_\_\_ 2. Connect the SPECTRUM's power cord to a power source that is compatible with the voltage indicated in the window of the Power Entry Module.
- \_\_\_ 3. Press the POWER ON/OFF push button. Ensure that the green indicator is now visible.

On power-up the SPECTRUM unit first conducts internal tests. The INTERNAL TEST display will appear, followed by a series of internal clicks and chirps as it processes and verifies the status of software and hardware readiness. The CHART RECORDER prints out a narrow vertical black bar and the Initial Power-up printout. Inspect the black bar and verify that it is continuous. If it is not, this indicates a problem with the CHART RECORDER. The date and time are also printed on the CHART RECORDER. If they are not correct, press the MENU button on the LCD/Touch Screen and select DATE & TIME, enter the correct information and exit the MENU system.

### Contrast Adjustment

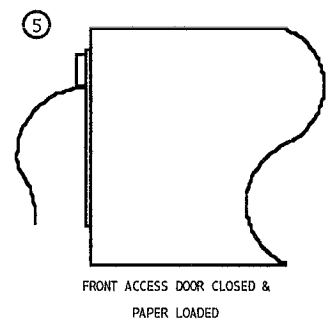
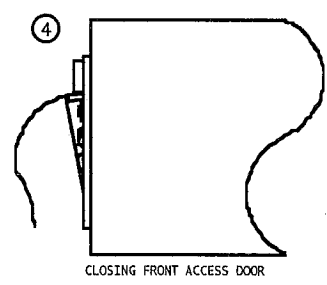
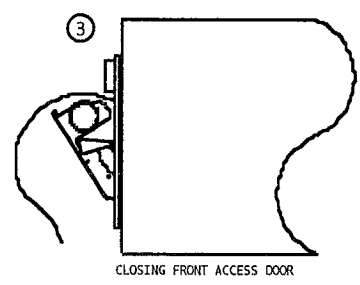
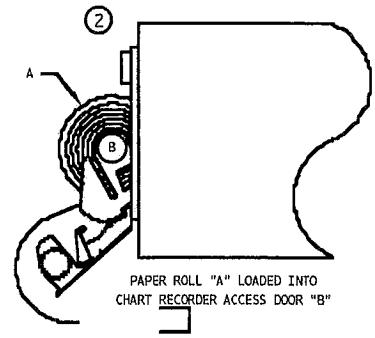
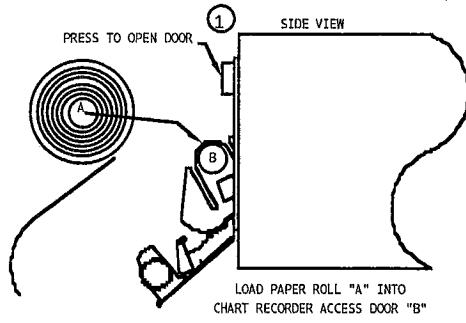
NOTE:

- To activate the LCD/Touch Screen in the following tests (and in normal use), touch the display firmly but not excessively (as if you were typing on a keyboard). A very light touch will not activate the LCD/Touch Screen, yet too hard a touch may damage it.

When the SPECTRUM is powered up, the LCD/Touch Screen may appear darker or lighter than necessary for comfortable use. The COPYRIGHT display (pictured below) provides contrast control buttons (LIGHT and DARK) that allow 11 steps of contrast adjustment settings.



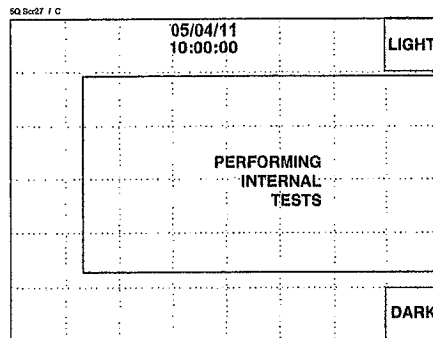
LOADING PAPER INTO CHART RECORDER



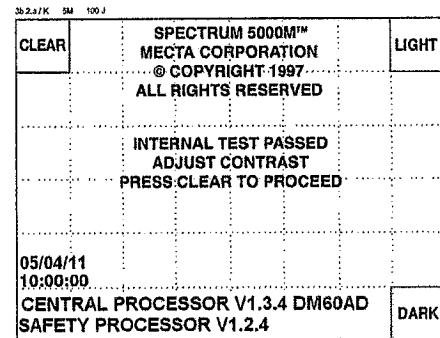
Touch LIGHT to lighten the display, or touch DARK to darken it, until desired contrast is reached.

### INTERNAL RESULTS TEST

After the power-up steps have been completed, the display will show a message stating that internal tests have passed. Location of CLEAR button varies.



Internal Test display



Copyright display

Touch the CLEAR button.

## TREATMENT DELIVERY TESTS 5000M

### Turning the CHART RECORDER OFF

- \_\_\_ 1. Select the MAIN MENU display by touching the MENU button.
- \_\_\_ 2. Select the CHART OPTIONS button in the MAIN MENU, and touch the CHART OFF button. Then touch the EXIT button.
- \_\_\_ 3. Power-down the SPECTRUM and disconnect all cables, except the power cord.
- \_\_\_ 4. Power-up the SPECTRUM; verify that the CHART RECORDER does not activate or print.
- \_\_\_ 5. Touch the CLEAR button to move to the TREATMENT READY display.
- \_\_\_ 6. Push the CHART RECORDER's ON push button, and verify that the CHART RECORDER is not active.

### Stimulus Delivery Procedures:

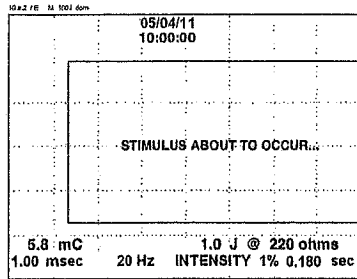
The stimulus output delivered during treatment is a constant current bipolar pulse wave. The four parameters that govern the waveform are: PULSE WIDTH, FREQUENCY, DURATION, and CURRENT. On the 5000M model, the CURRENT is fixed at 800mA. The actual voltage of the pulses will depend on the patient impedance at the time of treatment. Treatment parameters are selected by adjusting the STIMULUS INTENSITY knob below the LCD/Touch Screen.

Stimulus output is initiated by the STIMULUS CONTROL push button on the front panel.

- \_\_\_ 1. Connect the Patient Stimulus cable to the STIMULUS OUTPUT connector located on the front panel. Connect the other end of that cable to the load box (300 ohm 20 Watt 5% resistor).
- \_\_\_ 2. Select MENU then PARAMETER SELECTION. Select the third Parameter Set (1.0, 20, 0.180, 800) and press EXIT twice. Set the STIMULUS INTENSITY knob to 1% (rotate CCW until the Intensity is 1%).

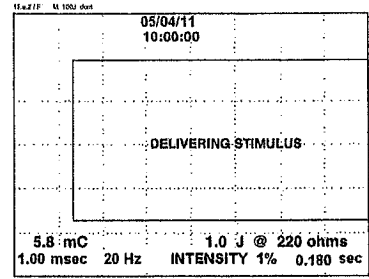
- 3. Push and HOLD the STIMULUS CONTROL push button. You will then hear three warning tones followed by a lower-pitched continuous tone. These messages will appear on the LCD/Touch Screen:

**GREEN**



Stimulus Warning display

**YELLOW**

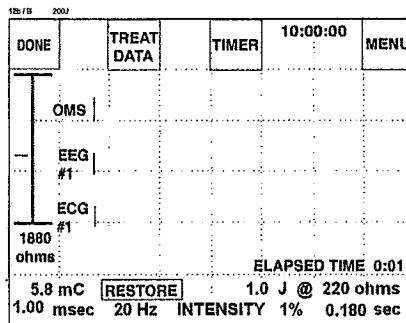


Stimulus Delivery display

- 4. Release the STIMULUS CONTROL push button when the tones stop. If the STIMULUS CONTROL push button is pushed and released before the stimulus is completed, a STIMULUS CONTROL RELEASED PREMATURELY message appears.
- 5. Touch the DONE button. After performing a series of internal tests, the TREATMENT READY display will re-appear.

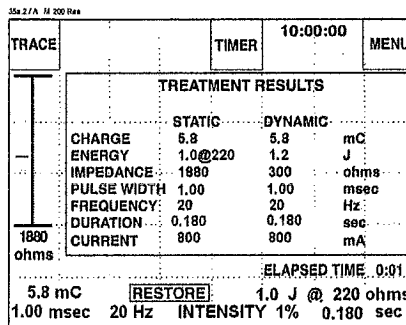
**Treatment Delivery checkout**

- 1. Set EEG DATA to OFF in the EEG DATA MENU. (If unit is equipped with this feature)
- 2. Push and hold the STIMULUS CONTROL push button. The three-beep warning will sound, followed by a continuous tone signaling the delivery of the stimulus. When stimulus delivery is complete, the following display will appear (possibly with a different number of trace labels, and with a RESTORE button if traces are disconnected):



Post-Treatment Trace display

- 3. Touch the TREAT DATA button to see the TREATMENT RESULTS display:



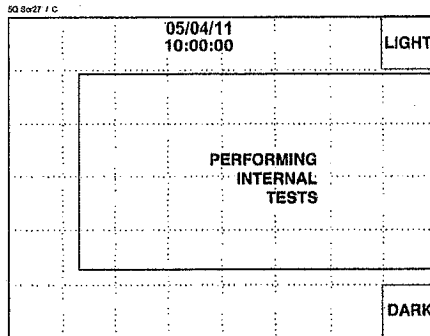
- 4. Touch TRACE to return to the POST-TREATMENT TRACE display.

5000M

**NOTE:**

- The energies displayed on the STATIC and DYNAMIC columns ordinarily will be different. The DYNAMIC energy will be higher by the ratio of the DYNAMIC IMPEDANCE to 220 ohms.  
 $DYNAMIC = STATIC \times (300/220)$ .

\_\_\_ 5. Touch DONE and the following display will appear:



Internal Tests display

When the internal tests complete, the TREATMENT READY display will appear.

**Stimulus Output Parameter Testing**

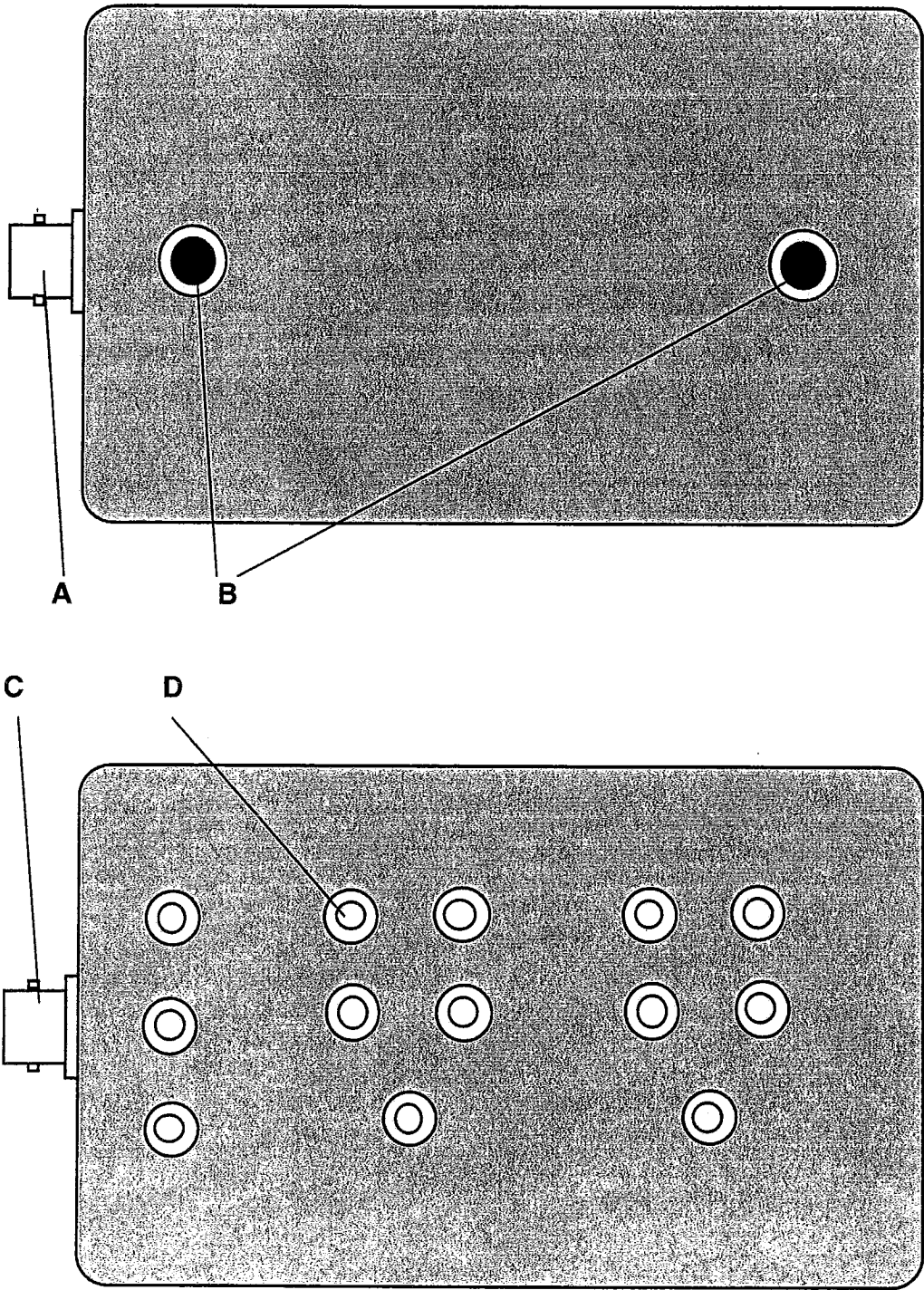
- \_\_\_ 1. Connect the patient stimulus cable to the STIMULUS OUTPUT connector.
- \_\_\_ 2. Connect the other end of the cable to the load box (300 ohm 20 Watt 5% resistor).
- \_\_\_ 3. Connect an oscilloscope to the load box, with a BNC-to-BNC cable. The load box's BNC output is 1 volt/amp of delivered current.
- \_\_\_ 4. From the TREATMENT READY display, select the MENU button, the PARAMETER SELECTION button, and select the third parameter set. Exit the MENU System.

PARAMETER SELECTION MENU				
EXIT	MINIMUM PARAMETER SETTINGS			
	PW	FREQ	DUR	CUR
→	0.3	20	0.600	800
→	0.5	20	0.360	800
→	1.0	20	0.180	800

- \_\_\_ 5. Set the STIMULUS INTENSITY control to 1%. This corresponds to
 

___ PULSE WIDTH	=	1.0 millisecond
___ FREQUENCY	=	20 Hertz
___ DURATION	=	0.180 seconds
___ CURRENT	=	800 milliAmps
- \_\_\_ 6. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. Each pulse width (at the 50% amplitude point) should be within 10% of the PULSE WIDTH indicated.
  - \_\_\_ 1.0 milliseconds

DYNAMIC LOAD BOX and SENSOR INPUT BOX

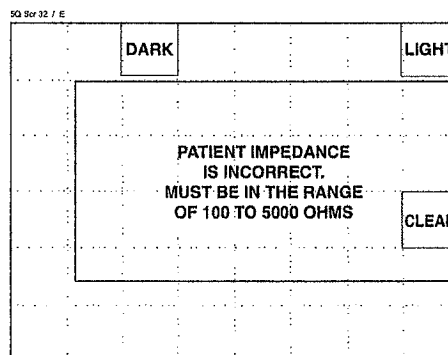


A - Test Out point  
B - Input jacks  
C - Signal Input connector  
D - Safety snap

7. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. Bipolar pulse frequencies should be within 10% of the FREQUENCY shown below. (Prematurely releasing the STIMULUS CONTROL push button will cause early termination of the Stimulus Output and generate an error.) Repeat this step for each of the following STIMULUS INTENSITY settings:
- \_\_\_ 1%, 20 Hertz
  - \_\_\_ 50%, 23 Hertz
  - \_\_\_ 100%, 45 Hertz
8. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. The duration of each pulse train should be within 10% of the DURATION shown below. (Prematurely releasing the STIMULUS CONTROL push button will cause early termination of the Stimulus Output.) Repeat this step for each of the following STIMULUS INTENSITY settings:

**NOTE:**

- Stimulus Duration starts with the first output pulse, not when the treatment button is first pushed.
    - \_\_\_ 1%, 0.180 seconds
    - \_\_\_ 50%, 7.830 seconds
    - \_\_\_ 100%, 8.000 seconds
9. With the STIMULUS INTENSITY knob set to 100%, push the STIMULUS CONTROL push button while observing the waveform to the load box on the oscilloscope. Amplitude of the bipolar pulses should be within 10% of the CURRENT shown below.
- \_\_\_ 800 mAmps (0.8 volts)
10. When the SPECTRUM finishes the treatment, the treatment results may be displayed by touching the TREAT DATA button. Dynamic values displayed should read within 20% of 300 ohms and within 30% of 138.3 Joules (when set at 100% intensity).
11. Re-set the STIMULUS INTENSITY knob to 1%. Disconnect one lead to the load box (open circuit). As soon as the lead is disconnected, the STIMULUS STATUS indicator should go out. Push the STIMULUS CONTROL push button. The LCD/Touch Screen should show the following display:

**Remote Treat Option**

The STIMULUS OUTPUT connector also provides remote control capability when connected to the optional Hand-Held electrodes. On the end of one Hand-Held electrode is a REMOTE TREAT push button. Pushing the REMOTE TREAT push button will cause the SPECTRUM to deliver the Stimulus Output to the patient. (Note that the front panel's STIMULUS CONTROL push button is disabled while a set of Hand-Held electrodes is connected.)

**5000M**

- \_\_\_ 1. Turn the SPECTRUM off, then back on again, to clear any results from any previous test procedures. Once the SPECTRUM has completed the power-on sequence, connect the Hand-Held stimulus cable to the STIMULUS OUTPUT connector (located on the front panel).
- \_\_\_ 2. Set the STIMULUS INTENSITY to 1%. Place the Hand-Held electrodes on top of the banana jacks on the LOAD BOX.
- \_\_\_ 3. Push and hold the REMOTE TREAT push button. The Output Stimulus should be delivered to the load box.

### **SENSOR TESTS 5000M**

The 5000M Sensor tests are identical to those for the 5000Q. Please refer to that section to complete these tests.

### **CHART RECORDER TESTS 5000M**

The 5000M CHART RECORDER tests are identical to those for the 5000Q. Please refer to that section to complete these tests.

### **SAFETY TESTS 5000M**

The 5000M Safety tests are identical to those for the 5000Q. Please refer to that section to complete these tests.

# 4000Q Functional Performance Verification

**ALL WARRANTY REPAIRS MUST BE RETURNED TO MECTA CORP.  
(OR LOCAL DISTRIBUTOR OUTSIDE OF U.S. OR CANADA)  
OR PARTS AND LABOR WARRANTY WILL BE VOIDED!!!**

The functional performance checkout procedures ensure proper operation of the SPECTRUM unit and its options. These procedures should be performed every time the device is serviced, or whenever there is a question about the accuracy or safety of its functions. If the SPECTRUM does not pass these tests, contact the MECTA Corporation Service Department for repairs or calibration. Outside of the U.S. and Canada, contact your local distributor.

Warranty will be voided if the SPECTRUM is not returned in its original container, with its original foam packing.

## REQUIRED EQUIPMENT

This equipment is needed to perform functional check-out tests:

### Power up tests

- \_\_\_ · SPECTRUM with power cord

### Treatment delivery tests

- \_\_\_ · SPECTRUM with power cord
- \_\_\_ · Patient Stimulus cable
- \_\_\_ · Oscilloscope (Storage type preferred)
- \_\_\_ · Load Box (300 Ohm 20 Watt resistor. Also has a 301:1 Divider) with BNC style connector.
- \_\_\_ · BNC to BNC cable

### Safety tests

- \_\_\_ · SPECTRUM with power cord
- \_\_\_ · Safety Analyzer such as Dynatech Nevada model 432HD (Neurodyne-Dempsey model 431F-Mod1 or equivalent).
- \_\_\_ · Patient Stimulus cable

When reading the steps described below, refer to the front and back panel diagrams as necessary.

Completing the following functional checks will ensure the SPECTRUM and associated cabling are ready for treatment sessions (refer to the screen descriptions of the Instruction Manual if needed).

## POWER-UP TESTS 4000Q

### Power-up Steps

- \_\_\_ 1. Connect the SPECTRUM's power cord to the Power Entry Module. Read the voltage selector value in the window of the Power Entry Module. Do not connect any other cables at this time.
- \_\_\_ 2. Connect the SPECTRUM's power cord to a power source that is compatible with the voltage indicated in the window of the Power Entry Module.
- \_\_\_ 3. Press the POWER ON/OFF push button. Ensure that the green indicator is now visible.



**4000Q**

On power-up the SPECTRUM unit first conducts internal tests. The INTERNAL TEST display will appear, followed by a series of internal clicks and chirps as it processes and verifies the status of software and hardware readiness.

**Contrast Adjustment****Touch Screen****NOTE:**

- To activate the touch screen in the following tests (and in normal use), touch the display firmly but not excessively (as if you were typing on a keyboard). A very light touch will not activate the LCD/Touch Screen, yet too hard a touch may damage it.

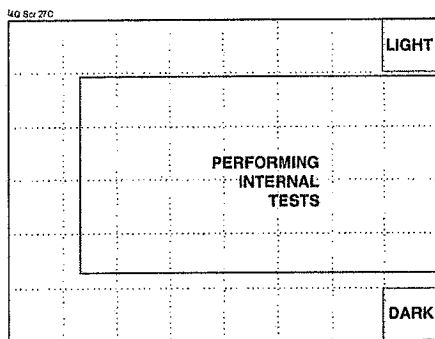
**Membrane Switches****NOTE:**

- To activate the Membrane Switches in the following tests (and in normal use), press the switch firmly but not excessively.

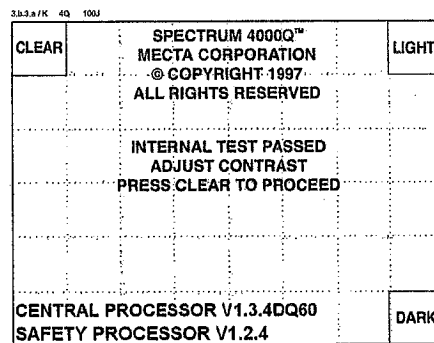
When the SPECTRUM is powered up, the LCD Screen may appear darker or lighter than necessary for comfortable use. The COPYRIGHT display (pictured below) provides contrast control buttons (LIGHT and DARK) that allow 11 steps of contrast adjustment settings.

Touch LIGHT to lighten the display, or touch DARK to darken it, until desired contrast is reached.

INTERNAL RESULTS TEST - After the power-up steps have been completed, the display will show messages stating that internal tests have passed.



Internal Test display



Copyright display

**TREATMENT DELIVERY TESTS 4000Q****Stimulus Delivery Procedures**

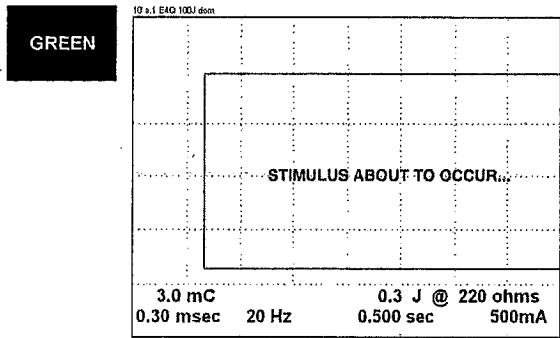
The stimulus output delivered during treatment is a constant current bipolar pulse wave. The four parameters that govern the waveform include: PULSE WIDTH, FREQUENCY, DURATION, and CURRENT. The actual voltage of the pulses will depend on the patient impedance at the time of treatment. Treatment parameters are selected by adjusting the knobs below the LCD.

Stimulus output is initiated by the STIMULUS CONTROL push button on the front panel.

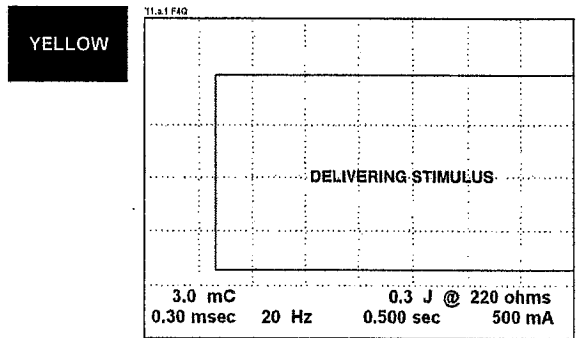
1. Connect the Patient Stimulus cable to the STIMULUS OUTPUT connector located on the front panel. Connect the other end of that cable to the load box (300 ohm 20 Watt 5% resistor).
2. Go to the MAIN MENU and select the fourth Parameter Set on the PARAMETER SELECTION. Exit the MENU system.

PARAMETER SELECTION MENU				
EXIT	MINIMUM PARAMETER SETTINGS			
	PW	FREQ	DUR	CUR
→	0.3	20	0.500	800
→	0.5	20	0.500	800
→	1.0	20	0.500	800
→	0.3	20	0.500	500

3. Set the parameter controls to minimum settings (rotate CCW until the display no longer changes).
4. Push and HOLD the STIMULUS CONTROL push button. You will then hear three warning tones followed by a lower-pitched continuous tone. These messages will appear on the LCD Screen:



Stimulus Warning display



Stimulus Delivery display

5. Release the STIMULUS CONTROL push button when the tones stop. If the STIMULUS CONTROL push button is pushed and released before the stimulus is completed, a STIMULUS CONTROL RELEASED PREMATURELY message appears.
6. On the TREATMENT RESULTS display, touch the DONE or EXIT button. After performing a series of internal tests, the 4000 model TREATMENT READY display will re-appear.

35b.1 / A Q

DONE	TIMER		MENU
TREATMENT RESULTS			
	STATIC	DYNAMIC	
CHARGE	3.0	3.0	mC
ENERGY	0.3@220	0.4	J
IMPEDANCE	1880	300	ohms
PULSE WIDTH	0.30	0.30	msec
FREQUENCY	20	20	Hz
DURATION	0.500	0.500	sec
CURRENT	500	500	mA
ELAPSED TIME 0:01			
3.0 mC 0.30 msec 20 Hz 0.3 J @ 220 ohms 0.500 sec 500 mA			

4G 6sr 319A

TIMER		MENU
PRESS STIMULUS BUTTON FOR TREATMENT		
3.0 mC 0.30 msec 20 Hz 0.3 J @ 220 ohms 0.500 sec 500 mA		

1. Push and hold the STIMULUS CONTROL push button. The three-beep warning will sound, followed by a continuous tone signaling the delivery of the stimulus. When stimulus delivery is complete, the following display will appear:

DONE	TIMER	MENU
TREATMENT RESULTS		
	STATIC	DYNAMIC
CHARGE	3.0	3.0 mC
ENERGY	0.3@220	0.4 J
IMPEDANCE	1880	300 ohms
PULSE WIDTH	0.30	0.30 msec
FREQUENCY	20	20 Hz
DURATION	0.500	0.500 sec
1880 ohms	CURRENT	500 mA
ELAPSED TIME 0:01		
3.0 mC	0.3 J @ 220 ohms	
0.30 msec	20 Hz	0.500 sec 500 mA

**NOTE:**

- The energies displayed on the STATIC and DYNAMIC columns ordinarily will be different. The DYNAMIC energy will be higher by the ratio of the DYNAMIC IMPEDANCE to 220 ohms.  $DYNAMIC = STATIC \times (300/220)$ .

2. Touch DONE or EXIT on the TREATMENT RESULTS display. The following display will appear:

LIGHT
PERFORMING INTERNAL TESTS
DARK

Internal Tests display

When the internal tests are complete, the TREATMENT READY display will appear.

**Stimulus Output Parameter Testing**

1. Connect the patient stimulus cable to the STIMULUS OUTPUT connector.
2. Connect the other end of the cable to the load box (300 ohm 20 Watt 5% resistor).
3. Connect an oscilloscope to the load box, with a BNC-to-BNC cable. Set the oscilloscope input coupling to DC. The load box's BNC output is 1 volt/amp of delivered current.
4. From the TREATMENT READY display, select the MENU button, the PARAMETER SELECTION BUTTON, and select the fourth parameter set. On 4000 Membrane Switch models, the MENU button takes you directly to Parameter Selection. Exit the MENU system.

EXIT	PARAMETER SELECTION MENU			
	MINIMUM PARAMETER SETTINGS			
	PW	FREQ	DUR	CUR
→	0.3	20	0.500	800
→	0.5	20	0.500	800
→	1.0	20	0.500	800
→	0.3	20	0.500	500

4000Q

5. Set the Stimulus Parameter controls to these levels:
- |     |             |   |                  |
|-----|-------------|---|------------------|
| ___ | PULSE WIDTH | = | 0.3 milliseconds |
| ___ | FREQUENCY   | = | 20 Hertz         |
| ___ | DURATION    | = | 0.500 seconds    |
| ___ | CURRENT     | = | 500 milliAmps    |
6. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. Each pulse width (at the 50% amplitude point) should be within 10% of the PULSE WIDTH settings. Repeat this step for each of the following PULSE WIDTH settings.
- |     |                  |
|-----|------------------|
| ___ | 0.3 milliseconds |
| ___ | 0.5 milliseconds |
| ___ | 1.0 milliseconds |
7. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. Bipolar pulse frequencies should be within 10% of the FREQUENCY control setting. (Prematurely releasing the STIMULUS CONTROL push button will cause early termination of the Stimulus Output.) Repeat this step for each of the following FREQUENCY settings:
- |     |           |
|-----|-----------|
| ___ | 120 Hertz |
| ___ | 90 Hertz  |
| ___ | 60 Hertz  |
| ___ | 40 Hertz  |
| ___ | 20 Hertz  |
8. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. The duration of each pulse train should be within 10% of the Duration setting. (Prematurely releasing the STIMULUS CONTROL push button will cause early termination of the Stimulus Output.) Repeat this step for each of the following DURATION settings:

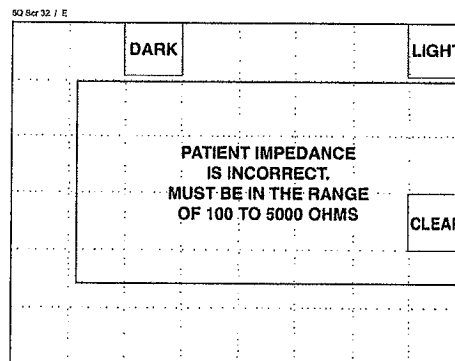
**NOTE:**

- Stimulus Duration starts with the first output pulse, not when the treatment button is first pushed.

- |     |               |
|-----|---------------|
| ___ | 8.000 seconds |
| ___ | 4.000 seconds |
| ___ | 2.000 seconds |
| ___ | 1.000 seconds |
| ___ | 0.500 seconds |
9. Push the STIMULUS CONTROL push button while observing the waveform to the load box on the oscilloscope. Amplitude of the bipolar pulses should be within 10% of the setting of the CURRENT control. Repeat this step for each of the CURRENT settings.
- |     |                       |
|-----|-----------------------|
| ___ | 500 mAmps (0.5 volts) |
| ___ | 600 mAmps (0.6 volts) |
| ___ | 700 mAmps (0.7 volts) |
| ___ | 800 mAmps (0.8 volts) |
| ___ | 900 mAmps (0.9 volts) |
10. Set the Stimulus Parameter controls to:
- |     |             |   |                  |
|-----|-------------|---|------------------|
| ___ | PULSE WIDTH | = | 1.0 milliseconds |
| ___ | FREQUENCY   | = | 45 Hertz         |
| ___ | DURATION    | = | 8.000 seconds    |
| ___ | CURRENT     | = | 500 mAmps        |

**4000Q**

- \_\_\_ 11. Push and HOLD the STIMULUS CONTROL push button. When the SPECTRUM finishes computing the treatment results, they will be displayed on the TREATMENT RESULTS display. Dynamic values displayed should read within 20% of 300 ohms and within 30% of 54.0 Joules.
- \_\_\_ 12. Set the Stimulus Parameter controls to:
- |     |             |   |                   |
|-----|-------------|---|-------------------|
| ___ | PULSE WIDTH | = | 0.79 milliseconds |
| ___ | FREQUENCY   | = | 120 Hertz         |
| ___ | DURATION    | = | 3.000 seconds     |
| ___ | CURRENT     | = | 900 mAmps         |
- \_\_\_ 13. Push and HOLD the STIMULUS CONTROL push button. On the TREATMENT RESULTS display, dynamic values displayed should read within 20% of 300 ohms and within 30% of 138.3 Joules.
- \_\_\_ 14. Set the Stimulus Parameter controls to:
- |     |             |   |                  |
|-----|-------------|---|------------------|
| ___ | PULSE WIDTH | = | 1.0 milliseconds |
| ___ | FREQUENCY   | = | 90 Hertz         |
| ___ | DURATION    | = | 4.000 seconds    |
| ___ | CURRENT     | = | 800 mAmps        |
- Push and HOLD the STIMULUS CONTROL push button. The delivery should complete with no error conditions.
- \_\_\_ 15. Disconnect one lead to load box (open circuit). As soon as the lead is disconnected, the STIMULUS STATUS indicator should go out. Push the STIMULUS CONTROL push button. The LCD Screen should show the following display:



Touching CLEAR or EXIT will return the system to the TREATMENT RESULTS display, where touching DONE or EXIT will end the test.

### Remote Treat Option

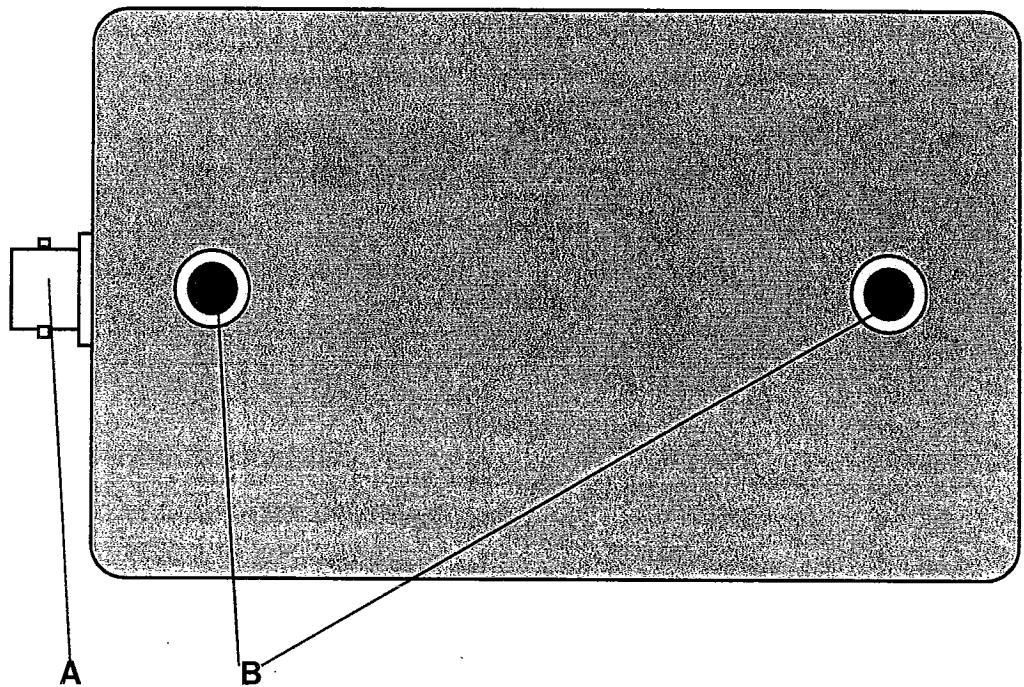
The STIMULUS OUTPUT connector also provides remote control capability when connected to the optional Hand-Held electrodes. On the end of one Hand-Held electrode is a REMOTE TREAT push button. Pushing the REMOTE TREAT push button will cause the SPECTRUM to deliver the Stimulus Output to the patient. (Note that the front panel's STIMULUS CONTROL push button is disabled while a set of Hand-Held electrodes is connected.)

- \_\_\_ 1. Turn the SPECTRUM off, then on again, to clear any results from any previous tests. Once the SPECTRUM has completed the power-on sequence, connect the Hand-Held stimulus cable to the STIMULUS OUTPUT connector (located on the front panel).

**4000Q**

- \_\_\_ 2. Set the parameter controls to minimum settings. Place the Hand-Held electrodes on top of the banana jacks on the LOAD BOX.
- \_\_\_ 3. Push and hold the REMOTE TREAT push button. The Output Stimulus should be delivered to the load box.

### DYNAMIC LOAD BOX



**A - Test Out point**

**B - Input jacks**

## SAFETY TESTS 4000Q

Prior to shipping each unit from the factory, the following tests are done:

- \_\_\_\_\_ a risk leakage current safety check,
- \_\_\_\_\_ a dielectric strength integrity (Hipot) test.

The results of these tests are available on request. If required, safety verification (leakage and chassis ground tests) can be performed as an incoming verification in Biomedical Engineering. These tests ensure that patients are electrically isolated from the power circuits.

### Leakage Current

This equipment is needed to perform Leakage Current tests:

- DNI Nevada 232D or Neurodyne-Dempsey model 431F Mod-1 or Equivalent Safety Analyzer
- Patient Stimulus Cable
- Power Cord
- Banana Plug to Alligator Clip Test Lead
- 230V step up (2:1, 115VAC to 230VAC, 600VA) transformer (signal transformer model M4L-2-6 or equivalent). Only required if the SPECTRUM input power is 230VAC and the safety analyzers input power voltage is 115VAC only.

### Chassis Leakage Tests

1. If the SPECTRUM is a 230V unit, the safety analyzer must be set for 230V operation.
2. Plug the SPECTRUM's power cord into the test receptacle on the safety analyzer. Connect the case connection lead of the safety analyzer to the SPECTRUM Equipotential post for all tests. Do not connect any other cables.
3. Turn on power to SPECTRUM.
4. Set the Mode to Case Leakage, Ext Lead (case leakage position) on the safety analyzer. Perform the chassis leakage tests (described in the safety analyzer manual). The chassis leakage current shall not be more than 100uA for the "normal" condition and "normal reversed" condition.
 

Line Voltage_____	Normal_____	Normal Reversed_____
-------------------	-------------	----------------------
5. The chassis leakage current shall not be more than 500uA for all "single fault" conditions.
 

Open Neutral_____	Open Neutral Reversed_____
Open Ground_____	Open Ground Reversed_____

### Patient Sink and Source Current Leakage Tests

1. Connect the Patient Stimulus Cable to the SPECTRUM and to any two ECG lead input connectors of the analyzer. Set the mode switch to ECG and the leads switch to all leads. **CAUTION: STARTING A TREATMENT WHILE IN THIS SETUP WILL DAMAGE THE SAFETY ANALYZER!** The leakage current shall be less than 10uA for both "normal" conditions and 50uA for all other conditions.
 

Normal_____	Normal Reversed_____
Open Neutral_____	Open Neutral Reversed_____
Open Neutral_____	Open Neutral Reversed_____
2. Set the leads switch to isolation test, and press the ISO test button. The value shall be under 100uA.

**4000Q**

Ground Continuity Test

1. Set the Safety Analyzer test mode to Ohms. Connect the Safety Analyzer's ohm meter leads to the Equipotential Post of the SPECTRUM. Connect the other ohm meter lead to the ground lead of the SPECTRUM power cord, and record the ohm meter measurement.

\_\_\_\_\_ Ground Impedance Resistance (less than .1 ohms)

Ground Tests

This equipment is needed to perform the safety ground tests:

- Rod-L 30 AMP Ground tester or equivalent - Confirm cal OK \_\_\_\_\_
- Power Cord

Chassis Ground Test

1. Plug the SPECTRUM's power cord into the front of the ground tester. Connect the Chassis Ground Sense wire from the ground tester to the SPECTRUM equipotential post. With the ground tester mode switch in the "GND" position, press the start button on the ground tester. The maximum resistance for both tests is 100 milliohms.

Chassis Ground Test:                      Pass \_\_\_\_\_                      Fail \_\_\_\_\_

2. With the power cord still connected to the ground tester, connect the Chassis Ground Sense lead to one of the front panel screws and press the start button on the ground tester.

Front Panel Ground Test:                      Pass \_\_\_\_\_                      Fail \_\_\_\_\_

This completes the 4000Q functional checkout.



# 4000M Functional Performance Verification

**ALL WARRANTY REPAIRS MUST BE RETURNED TO MECTA CORP.  
(OR LOCAL DISTRIBUTOR OUTSIDE OF U.S. OR CANADA)  
OR PARTS AND LABOR WARRANTY WILL BE VOIDED!!!**

When reading the steps described below, refer to the front and back panel diagrams as necessary. Completing the following functional checks will ensure the SPECTRUM and associated cabling are ready for treatment sessions (refer to the screen descriptions of the Instruction Manual if needed).

Warranty will be voided if the SPECTRUM is not returned in its original container, with its original foam packing.

## REQUIRED EQUIPMENT

This equipment is needed to perform functional check-out tests:

### Power up tests

\_\_\_\_ · SPECTRUM with power cord

### Treatment delivery tests

\_\_\_\_ · SPECTRUM with power cord

\_\_\_\_ · Patient Stimulus cable

\_\_\_\_ · Oscilloscope (Storage type preferred)

\_\_\_\_ · Load Box (300 Ohm 20 Watt resistor. Also has a 301:1 Divider) with BNC style connector.

\_\_\_\_ · BNC to BNC cable

### Safety tests

\_\_\_\_ · SPECTRUM with power cord

\_\_\_\_ · Safety Analyzer such as Dynatech Nevada model 432HD (Neurodyne-Dempsey model 431F-Mod1 or equivalent).

\_\_\_\_ · Patient Stimulus cable

When reading the steps described below, refer to the front and back panel diagrams as necessary.

Completing the following functional checks will ensure the SPECTRUM and associated cabling are ready for treatment sessions (refer to the screen descriptions of the Instruction Manual if needed).

## POWER-UP TESTS 4000M

### Power-up Steps

- \_\_\_\_ 1. Connect the SPECTRUM's power cord to the Power Entry Module. Read the voltage selector value in the window of the Power Entry Module. Do not connect any other cables at this time.
- \_\_\_\_ 2. Connect the SPECTRUM's power cord to a power source that is compatible with the voltage indicated in the window of the Power Entry Module.
- \_\_\_\_ 3. Press the POWER ON/OFF push button. Ensure that the green indicator is now visible.

**4000M**

On power-up the SPECTRUM unit first conducts internal tests. The INTERNAL TEST display will appear, followed by a series of internal clicks and chirps as it processes and verifies the status of software and hardware readiness.

Contrast Adjustment

**Touch Screen**

**NOTE:**

- To activate the touch screen in the following tests (and in normal use), touch the display firmly but not excessively (as if you were typing on a keyboard). A very light touch will not activate the LCD/Touch Screen, yet too hard a touch may damage it.

**Membrane Switches**

**NOTE:**

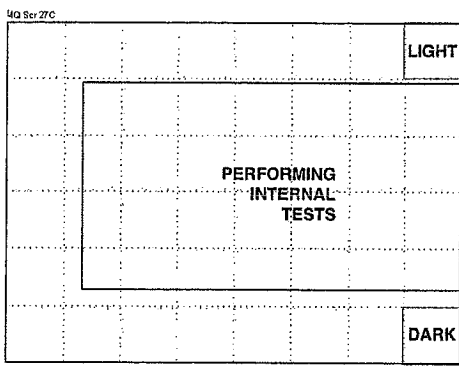
- To activate the Membrane Switches in the following tests (and in normal use), press the switch firmly but not excessively.

When the SPECTRUM is powered up, the LCD Screen may appear darker or lighter than necessary for comfortable use. The COPYRIGHT display (pictured below) provides contrast control buttons (LIGHT and DARK) that allow 11 steps of contrast adjustment settings.

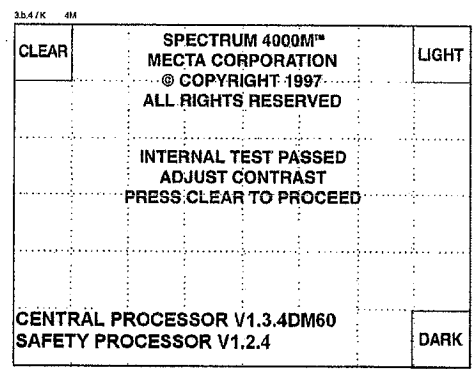
Touch LIGHT to lighten the display, or touch DARK to darken it, until desired contrast is reached.

INTERNAL RESULTS TEST

After the power-up steps have been completed, the display will show messages stating that internal tests have passed.



Internal Test display



Copyright display

**TREATMENT DELIVERY TESTS 4000M**

Stimulus Delivery Procedures:

The stimulus output delivered during treatment is a constant current bipolar pulse wave. The four parameters that govern the waveform are: PULSE WIDTH, FREQUENCY, DURATION, and CURRENT. On the 4000M model, the CURRENT is fixed at 800mA. The actual voltage of the pulses will depend on the patient impedance at the time of treatment. Treatment parameters are selected by adjusting the STIMULUS INTENSITY knob below the LCD.

Stimulus output is initiated by the STIMULUS CONTROL push button on the front panel.

1. Connect the Patient Stimulus cable to the STIMULUS OUTPUT connector located on the front panel. Connect the other end of that cable to the load box (300 ohm 20 Watt 5% resistor).

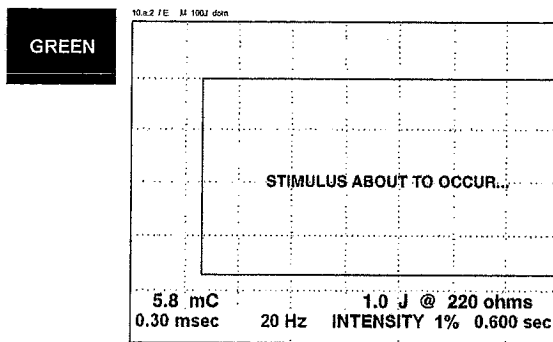
**4000M**

- Go to the MAIN MENU and select the third parameter set (1.0 PW) on the PARAMETER SELECTION MENU. Exit the MENU system.

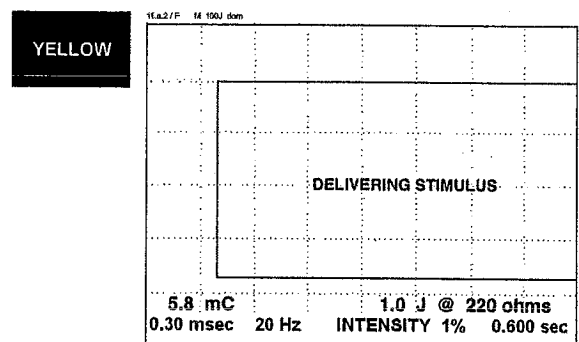
PARAM 100J/C

PARAMETER SELECTION MENU				
EXIT	MINIMUM PARAMETER SETTINGS			
	PW	FREQ	DUR	CUR
->	0.3	20	0.600	800
->	0.5	20	0.360	800
->	1.0	20	0.180	800

- Set the STIMULUS INTENSITY knob to minimum setting (rotate CCW until the Stimulus Intensity is 1%).
- Push and HOLD the STIMULUS CONTROL push button. You will then hear three warning tones followed by a lower-pitched continuous tone. These messages will appear on the LCD Screen:



Stimulus Warning display



Stimulus Delivery display

- Release the STIMULUS CONTROL push button when the tones stop. If the STIMULUS CONTROL push button is pushed and released before the stimulus is completed, a STIMULUS CONTROL RELEASED PREMATURELY message appears.
- From the TREATMENT RESULTS display, touch the DONE or EXIT button. After performing a series of internal tests, the 4000 model TREATMENT READY display will reappear.

350.2 B, AM

DONE	TIMER	MENU
TREATMENT RESULTS		
	STATIC	DYNAMIC
CHARGE	5.8	5.8 mC
ENERGY	1.0@220	1.0 J
IMPEDANCE	1880	300 ohms
PULSE WIDTH	1.0	1.0 msec
FREQUENCY	20	20 Hz
DURATION	0.180	0.180 sec
CURRENT	800	800 mA
ELAPSED TIME 0:01		
5.8 mC 1.0 J @ 220 ohms 1.00 msec 20 Hz INTENSITY 1% 0.180 sec		

4M Scr 318, A

TIMER	MENU
PRESS STIMULUS BUTTON FOR TREATMENT	
5.8 mC 1.0 J @ 220 ohms 1.00 msec 20 Hz INTENSITY 1% 0.180 sec	

Treatment Delivery checkout

- \_\_\_ 1. Push and hold the STIMULUS CONTROL push button. The three-beep warning will sound, followed by a continuous tone signaling the delivery of the stimulus. When stimulus delivery is complete, the following display will appear:

39 23 AM		DONE	TIMER	MENU
TREATMENT RESULTS				
	STATIC	DYNAMIC		
CHARGE	5.8	5.8	mC	
ENERGY	1.0@220	1.0	J	
IMPEDANCE	1880	300	ohms	
PULSE WIDTH	1.0	1.0	msec	
FREQUENCY	20	20	Hz	
DURATION	0.180	0.180	sec	
1880 ohms	CURRENT	800	800	mA
				ELAPSED TIME 0:01
5.8 mC		1.0 J @ 220 ohms		
1.00 msec	20 Hz	INTENSITY 1% 0.180 sec		

**NOTE:**

- The energies displayed on the STATIC and DYNAMIC columns ordinarily will be different. The DYNAMIC energy will be higher by the ratio of the DYNAMIC IMPEDANCE to 220 ohms.  $DYNAMIC = STATIC \times (300/220)$ .

- \_\_\_ 2. Touch DONE or EXIT from the TREATMENT RESULTS display and the INTERNAL TESTS display will appear:

40 Ser 2C		LIGHT
PERFORMING INTERNAL TESTS		
		DARK

When the internal tests complete, the TREATMENT READY display will appear.

Stimulus Output Parameter Testing

- \_\_\_ 1. Connect the patient stimulus cable to the STIMULUS OUTPUT connector.
- \_\_\_ 2. Connect the other end of the cable to the load box (300 ohm 20 Watt 5% resistor).
- \_\_\_ 3. Connect an oscilloscope to the load box, with a BNC-to-BNC cable. The load box's BNC output is 1 volt/amp of delivered current.
- \_\_\_ 4. From the TREATMENT READY display, select the MENU button, the PARAMETER SELECTION BUTTON, and select the first parameter set. On 4000 Membrane Switch models, the MENU button takes you directly to Parameter Selection. Exit the MENU system.

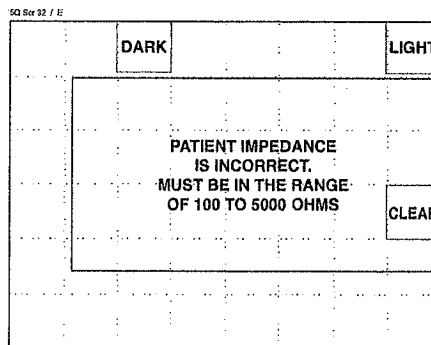
4000M

- \_\_\_ 5. Set the STIMULUS INTENSITY control to 1%. This corresponds to
- |                 |   |                 |
|-----------------|---|-----------------|
| ___ PULSE WIDTH | = | 0.3 millisecond |
| ___ FREQUENCY   | = | 20 Hertz        |
| ___ DURATION    | = | 0.600 seconds   |
| ___ CURRENT     | = | 800 milliAmps   |
- \_\_\_ 6. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. Each pulse width (at the 50% amplitude point) should be within 10% of the PULSE WIDTH indicated.
- \_\_\_ 0.3 milliseconds
- \_\_\_ 7. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. Bipolar pulse frequencies should be within 10% of the FREQUENCY shown below. Repeat this step for each of the following STIMULUS INTENSITY settings:
- \_\_\_ 1%, 20 Hertz
- \_\_\_ 50%, 76 Hertz
- \_\_\_ 100%, 120 Hertz
- \_\_\_ 8. Push the STIMULUS CONTROL push button while observing the waveform across the load box on the oscilloscope. The duration of each pulse train should be within 10% of the DURATION shown below. Repeat this step for each of the following STIMULUS INTENSITY settings:
- \_\_\_ 1%, 0.600 seconds
- \_\_\_ 50%, 7.900 seconds
- \_\_\_ 100%, 7.900 seconds

**NOTE:**

- Stimulus Duration starts with the first output pulse, not when the treatment button is first pushed.

- \_\_\_ 9. With the STIMULUS INTENSITY knob set to 100%, push the STIMULUS CONTROL push button while observing the waveform to the load box on the oscilloscope. Amplitude of the bipolar pulses should be within 10% of the CURRENT shown below.
- \_\_\_ 800 mAmps (0.8 volts)
- \_\_\_ 10. When the SPECTRUM finishes the treatment, the treatment results will be displayed. Dynamic values displayed should read within 20% of 300 ohms and within 30% of 138.3 Joules (when set at 100% intensity).
- \_\_\_ 11. Reset the STIMULUS INTENSITY knob to 1%. Disconnect one lead to load box (open circuit). As soon as the lead is disconnected, the STIMULUS STATUS indicator should go out. Push the STIMULUS CONTROL push button. The LCD should show the following display:



Touching CLEAR or EXIT will return the system to the TREATMENT RESULTS display, where touching DONE or EXIT will end the test.

## 4000M Remote Treat Option

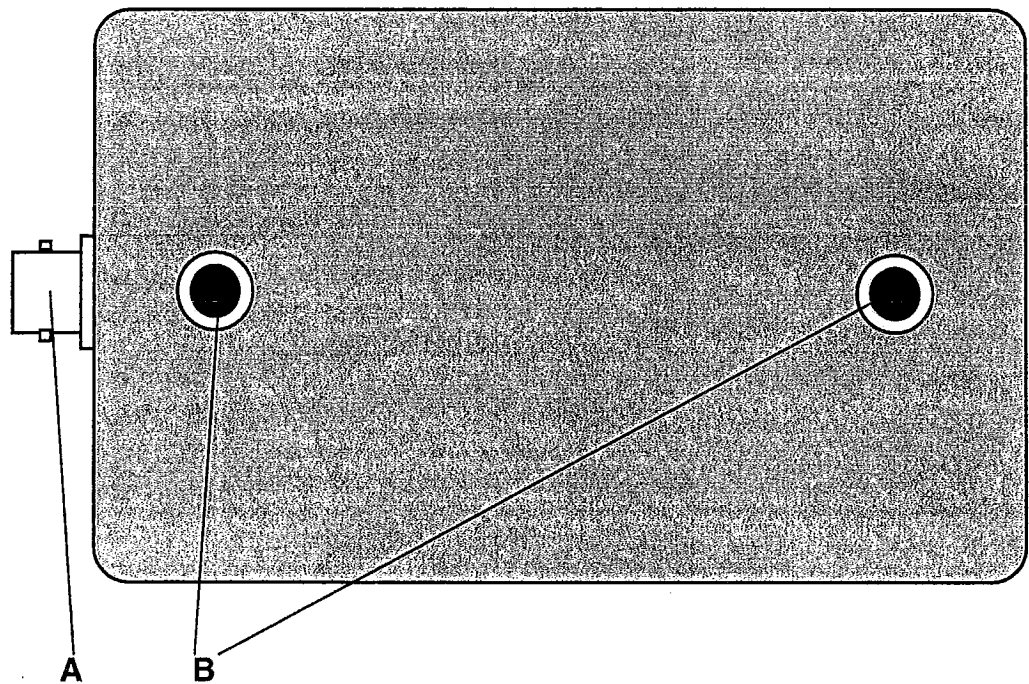
The STIMULUS OUTPUT connector also provides remote control capability when connected to the optional Hand-Held electrodes. On the end of one Hand-Held electrode is a REMOTE TREAT push button. Pushing the REMOTE TREAT push button will cause the SPECTRUM to deliver the Stimulus Output to the patient. (Note that the front panel's STIMULUS CONTROL push button is disabled while a set of Hand-Held electrodes is connected.)

- \_\_\_ 1. Turn the SPECTRUM off, then back on again, to clear any results from any previous test procedures. Once the SPECTRUM has completed the power-on sequence, connect the Hand-Held stimulus cable to the STIMULUS OUTPUT connector (located on the front panel).
- \_\_\_ 2. Set the STIMULUS INTENSITY to 1%. Place the Hand-Held electrodes on top of the banana jacks on the LOAD BOX.
- \_\_\_ 3. Push and hold the REMOTE TREAT push button. The Output Stimulus should be delivered to the load box.

## SAFETY TEST 4000M

The Safety Test for the 4000M is identical to the Safety Test for the 4000Q, and is found at the end of the 4000Q section.

## DYNAMIC LOAD BOX



**A - Test Out point**

**B - Input jacks**

# Troubleshooting

See also the section on Error Messages in the Instruction Manual for additional input on identifying and clearing problems. Machines will need servicing mainly for errors that users cannot clear by themselves. These will appear as numbered errors, and the user will need to consult the factory for assistance.

Problem Description	Possible Problem or Solution
SPECTRUM does not operate.	No line voltage connected and/or fuse may be blown. Verify that: <ol style="list-style-type: none"> <li>Fuses are OK,</li> <li>Power switch is ON,</li> <li>Unit is plugged into a proper outlet, and cord is fully seated in power entry module.</li> <li>Outlet works for other equipment.</li> <li>Power entry module is set for correct line voltage.</li> </ol>
Chart Recorder does not operate at all.	Make sure Chart Recorder is turned on in the CHART OPTIONS MENU, paper is properly loaded, recording module is fully seated, and its door is fully closed.
STIMULUS CONTROL does not work when the STIMULUS STATUS INDICATOR is Green.	STIMULUS CONTROL push button is disabled if Hand-held electrodes are connected to the STIMULUS OUTPUT connector.
Static impedance indicates OVER, or gets PATIENT IMPEDANCE INCORRECT message.	Scalp electrodes have insufficient contact area, or insufficient electrode gel, or are not connected to the patient, or cable is broken.
RESTORE button appears.	<ol style="list-style-type: none"> <li>Ensure all selected leads are displaying traces.</li> <li>De-select disconnected leads in the LCD and CHART TRACE MENUS.</li> <li>Lead connections to cables are scrambled or defective.</li> <li>A non-SPECTRUM type cable is used.</li> <li>Cable is plugged into wrong connector.</li> <li>A very old electrode is being used.</li> <li>OMS is unplugged, or defective.</li> </ol>

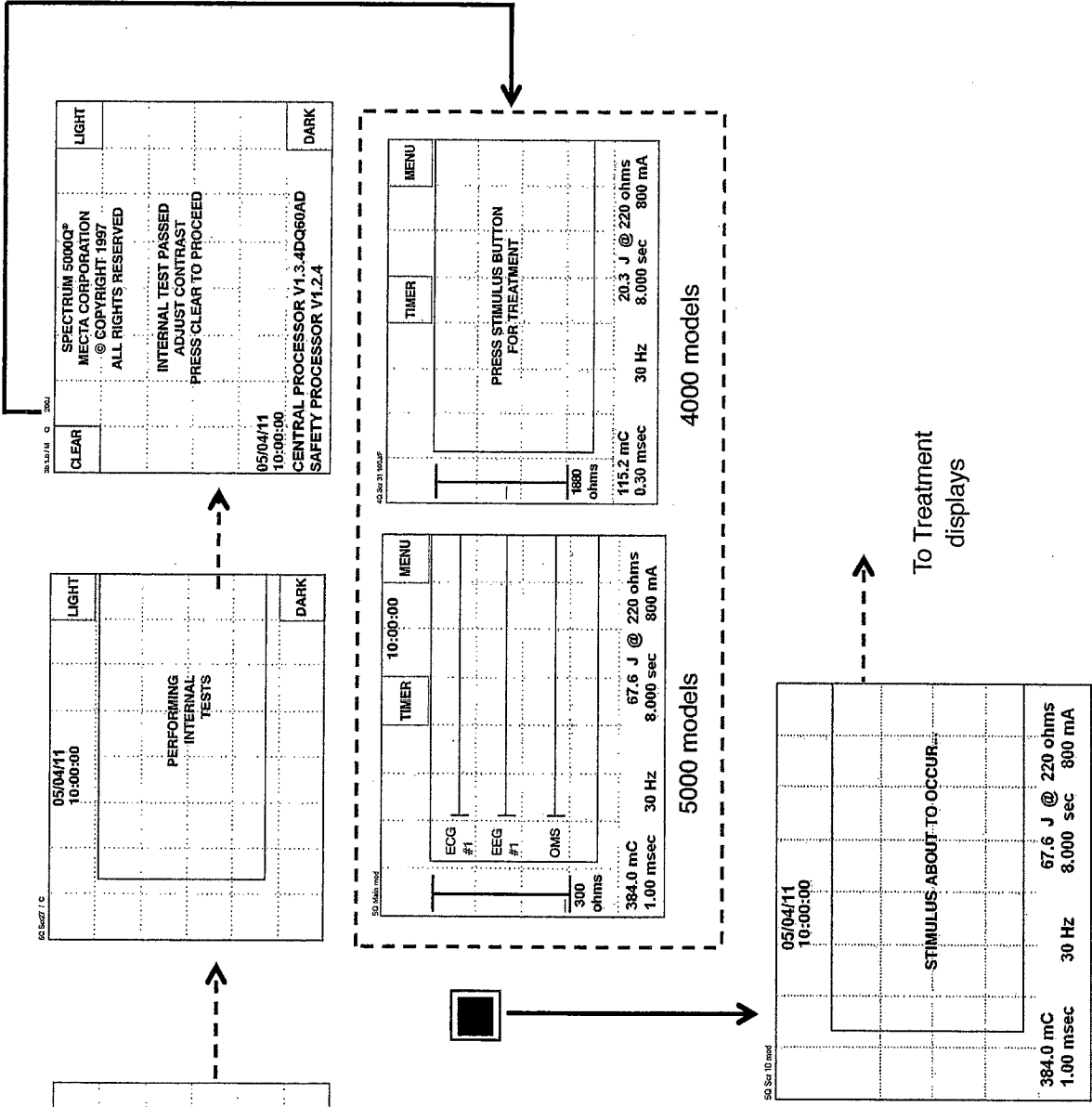
Problem Description	Possible Problem or Solution
Paper prints from Chart Recorder, but no printout is produced.	Check to see that paper roll is so inserted that paper feeds off underside of the roll, and is laid over the top of the recorder door. Thermal paper will print only on one side. Scraping thermal paper rapidly with a finger nail should leave a black mark.
LCD is too dark/too light.	Use the contrast control buttons on the COPYRIGHT and MAIN MENU displays to lighten or darken the display.
LCD or Chart Recorder trace data is not displaying.	Check the appropriate lead for good connections from the SPECTRUM to the patient.
Touch Screen buttons do not work.	If the unit has Membrane Switches to the left of the LCD, use those instead. (there is no touch screen).
DOSAGE EXCEEDED message appears.	Change the parameter settings until the message disappears. This occurs when the energy delivery requested is too high (decrease one or more parameters) or the rate of energy delivery requested is too high (decrease PULSE WIDTH, FREQUENCY, or CURENT).



# Pre-Treatment Displays Map

These maps depict the routine display sequences on the sPECTRUM Q-model.  
 M-model displays will show different parameter configurations.  
 Error message displays and most variations are not shown.

# DISPLAY MAPS



# Treatment & Post-Treatment Displays Map

From Pre-Treat display



05/04/11 10:00:00

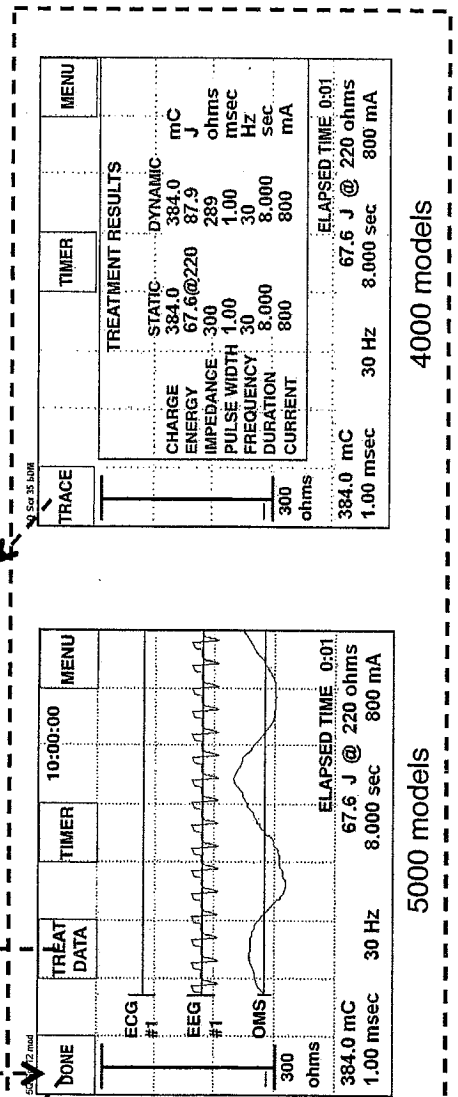
DELIVERING STIMULUS

384.0 mC 30 Hz 67.6 J @ 220 ohms  
1.00 msec 8.000 sec 800 mA

Activates further treatments

To Pre-Treat displays

To Pre-Treat displays



05/04/11 10:00:00

TRACE

TREAT DATA

10:00:00 MENU

EEG DATA

STIM. ADEQ. 70% LIKELY

384.0 mC 30 Hz 67.6 J @ 220 ohms  
1.00 msec 8.000 sec 800 mA

ELAPSED TIME 0:45

05/04/11 10:00:00

TRACE

SZ DATA

10:00:00 MENU

TREATMENT RESULTS

STATIC 384.0 mC  
DYNAMIC 384.0 J

CHARGE 67.6@220 289 ohms  
ENERGY 300 msec  
IMPEDANCE 1.00 Hz  
PULSE WIDTH 30 sec  
FREQUENCY 8.000  
DURATION 800 mA

384.0 mC 30 Hz 67.6 J @ 220 ohms  
1.00 msec 8.000 sec 800 mA

ELAPSED TIME 0:01

05/04/11 10:00:00

TRACE

TREATMENT RESULTS

STATIC 384.0 mC  
DYNAMIC 384.0 J

CHARGE 67.6@220 289 ohms  
ENERGY 300 msec  
IMPEDANCE 1.00 Hz  
PULSE WIDTH 30 sec  
FREQUENCY 8.000  
DURATION 800 mA

384.0 mC 30 Hz 67.6 J @ 220 ohms  
1.00 msec 8.000 sec 800 mA

ELAPSED TIME 0:01

(If EEG monitoring menu option is set to OFF, then only this display appears. No EEG Data screen is then available.)

# Menu Displays Map

All sub-menus EXIT to the main menu, which then EXITs to whatever display accessed the menu system.

On 4000 models with Touch Screens, the Date and Time and Parameter Selection menus are the only display options available.

