TIDAL WAVE Sp

HANDHELD CAPNOGRAPH/OXIMETER

Service Manual

Model 710/715

December 8, 2000

Catalog No. *9110-90-02/9146-90-02*

Novametrix Medical Systems Inc.
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CE 0086

Revision History

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12-Apr-00	Revision 01, R-N746
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Declaration of Conformity with European Union Directives

The authorized representative for Novametrix Equipment is:

European Compliance Services Limited
Oakdene House
Oak Road
Watchfield
Swindon, Wilts SN6 8TD
UK

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Contents

Safety

For maximum patient and operator safety, you must follow the following warnings and cautions.

WARNINGS

Indicates a potentially harmful condition that can lead to personal injury.

- **Explosion Hazard:** *DO NOT* use *TIDAL WAVE Sp* in the presence of flammable anesthetics. Use of this instrument in such an environment may present an explosion hazard.
- **Electrical Shock Hazard:** Always turn *TIDAL WAVE Sp* off and remove any external devices before cleaning it. Refer servicing to qualified service personnel.
- **Failure of Operation:** If the monitor fails to respond as described, do not use it until the situation has been corrected by qualified personnel.
- Do not operate *TIDAL WAVE Sp* if it appears to have been dropped or damaged.
- Do not operate *TIDAL WAVE Sp* or its accessories when it is wet due to spills or condensation.
- Never sterilize or immerse the monitor, sensor or accessories in liquids.
- The monitor does not alert for NO RESPIRATION if the airway adapter is removed from the CAPNOSTAT CO_2 sensor.
- Verify the “No Resp Timer” setting prior to use.
- Do not position any sensor cable in a way that may cause entanglement or strangulation.
- The *TIDAL WAVE Sp* is not intended to be used as a primary diagnostic apnea monitor and/or recording device.
- Patient Safety: Care should be exercised to assure continued peripheral perfusion distal to the SpO_2 sensor site after application.
- Inspect the SpO_2 sensor site often for adequate circulation - at least once every four hours. When applying sensors take note of patient’s physiological condition. For example, burn patients may exhibit more sensitivity to heat and pressure and therefore additional consideration such as more frequent site checks may be appropriate.
- Data Validity: As with all pulse oximeters, inaccurate SpO_2 and Pulse Rate values may be caused by:
    - Incorrect application or use of sensor;
    - Significant levels of dysfunctional hemoglobin; carboxyhemoglobin or methemoglobin;
    - Significant levels of indocyanine green, methylene blue, or other intravascular dyes;
    - Exposure to excessive illumination such as surgical lamps-especially those with a xenon light source, or direct sunlight;
    - Excessive patient movement;
    - Venous pulsations;
    - Electrosurgical interference.
- The external battery charger should NOT be used to recharge the battery near or in close proximity to patients and/or other medical equipment in operation. It is intended for use in service areas only (i.e. nurses station, biomed lab, etc.).
- Connection of an external device (e.g. printer or computer) to the RS232 serial port on the BaseStation may compromise patient safety.

CAUTIONS

Indicates a condition that may lead to equipment damage or malfunction.

- Federal (U.S.A.) law restricts this device to sale, distribution, or use by or on the order of a licensed medical practitioner.
- Use only an external power supply approved by Novametrix for use with this device. Use of any other power supply may damage the *TIDAL WAVE Sp* and void the warranty.
- Do not operate *TIDAL WAVE Sp* or its accessories when it is wet due to spills or condensation.
- Do not operate *TIDAL WAVE Sp* if it appears to have been dropped or damaged.
- Keep *TIDAL WAVE Sp* and its accessories clean.
- Inspect the integrity of the *TIDAL WAVE Sp* and its accessories prior to use.
- Never sterilize or immerse the monitor, sensor or accessories in liquids.
- Do not sterilize or immerse sensors except as directed in this manual.
- Do not apply excessive tension to any sensor cable or pneumatic tubing.
- Do not store the monitor or sensors at temperatures less than 14°F (-10°C) or above 131°F (55°C).
- Do not operate the monitor or sensors at temperatures below 50°F (10°C) or above 104°F (40°C).
- If a Single Patient Use Sampling Adapter becomes occluded, replace and discard the adapter.
- It is recommended that the CAPNOSTAT CO_2 sensor be removed from the circuit whenever an aerosolized medication is delivered. This is due to the increased viscosity of the medications which may contaminate the sensor windows, causing the sensor to fail prematurely.
- Where electromagnetic devices (i.e. electrocautery) are used, patient monitoring may be interrupted due to electromagnetic interference. Electromagnetic fields up to 3V/m will not adversely affect system performance.
- Refer servicing to qualified personnel.

NOTES

Indicates points of particular interest or emphasis for more efficient or convenient operation.

- The *TIDAL WAVE Sp* monitor is intended for operation with Novametrix Single Patient Use airway adapters.
- Operating the *TIDAL WAVE Sp* below 50°F (10°C) will result in longer warm-up time and reduce battery life.
- Components of this product and its associated accessories which have patient contact are free of latex.
- Certain rebreathing circuits, or the presence of artifacts such as cardiogenic oscillations, may cause *TIDAL WAVE Sp* to react to non-respiratory CO_2 fluctuations as if they were breaths. This condition affects only the RESP numerical displays; the capnogram display continues to provide an accurate picture of the CO_2 waveform.
- After the life cycle of our equipment and all accessories has been met, disposal of the equipment should be accomplished following the national requirements. Contact the local Novametrix representative for questions concerning disposal.

Warranty

Equipment manufactured or distributed by Novametrix Medical Systems Inc., is fully guaranteed, covering materials and workmanship, for a period of one year from the date of shipment, except for certain disposable products and products with stated guarantees other than one year. Novametrix reserves the right to perform guarantee service(s) at its factory, at an authorized repair station, or at the customer's installation.

Novametrix' obligations under this guarantee are limited to repairs, or at Novametrix' option, replacement of any defective parts of our equipment, except fuses, batteries, and calibration gasses, without charge, if said defects occur during normal service.

Claims for damages during shipment must be filed promptly with the transportation company. All correspondence concerning the equipment must specify both the model name and number, and the serial number as it appears on the equipment.

Improper use, mishandling, tampering with, or operation of the equipment without following specific operating instructions will void this guarantee and release Novametrix from any further guarantee obligations.

Service Department
For factory repair service, call toll free
1-800-243-3444
In Connecticut, call Collect (203) 265-7701
Facsimile (203) 284-0753
World Wide Web: http://www.novametrix.com
Internet: techline@novametrix.com

Caution: Federal (U.S.A.) law restricts this device to sale, distribution, or use by or on the order of a licensed medical practitioner.

Novametrix manufacturing facility is certified to ISO 9001 and EN46001 (MDD93/42/EEC Annex II). Novametrix Medical Systems Inc. products bear the "CE 0086" mark. The product is certified by Underwriter's Laboratories (UL) to bear the UL mark; certified by TUV Rheinland to IEC601-1 (EN60601-1).

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Service Policy

Novametrix Medical Systems Inc. provides 24-hour a day access to technical support through its Technical Support Department in Wallingford, Connecticut, and company Service Representatives located throughout the United States. (Outside the U.S., primary technical support is handled through our qualified international sales and service distributors.)

Novametrix will provide Warranty Service support within 48 hours of receiving a request for assistance. Contact the Technical Support Department by telephone toll free at 800-243-3444, or 203-265-7701; by facsimile at 203-284-0753; or, by e-mail at techline@novametrix.com. After hours telephone support requests (before 8:00 AM and after 5:00 PM Eastern Time) will be responded to promptly by the Technical Support on-call staff. After hours facsimile and e-mail requests will be answered the next business day. It is suggested that any person calling in for technical support have the equipment available for product identification and preliminary troubleshooting.

Novametrix reserves the right to repair or replace any product found to be defective during the warranty period. Repair may be provided in the form of replacement exchange parts or accessories, on-site technical repair assistance or complete system exchanges. Repairs provided due to product abuse or misuse will be considered “non-warranty” and invoiced at the prevailing service rate. Replaced or exchanged materials are expected to be returned to Novametrix within 10 days in order to avoid (additional) charges. Return materials should be cleaned as necessary and sent directly to Novametrix using the return paperwork and shipping label(s) provided (Transferring return materials to a local sales or dealer representatives does not absolve you of your return responsibility.).

Novametrix manufactures equipment that is generally field serviceable. When repair parts are provided, the recipient can call Technical Support for parts replacement assistance and repair assurance. In the event a replacement part requires increased technical capability, Technical Support may request Biomedical assistance, provide on-site technical support or complete replacement equipment. If the customer requires the return of their original product, the exchange material will be considered “loaner material” and exchanged again after the customer equipment is repaired.

Novametrix promotes customer participation in warranty repairs, should they become necessary. A longer useful product life, and quicker, more cost-effective maintenance and repair cycles—both during and after the warranty period, are benefits of a smooth transition into self-maintenance. The Technical Support Department can provide technical product support at a level appropriate to your protocol and budget requirements.

Please contact Technical Support for information on these additional programs and services:

- Focus Series Technical Training Seminars
- Test Equipment and Test Kits
- Service Contract / Parts Insurance Plans
- On-Site Technical Support
- “Demand Services” including:
  - Flat rate parts exchange
  - Flat rate return for repair
  - Time and material,
  - Full warranty, discounted replacement sensors.

Section 1 General Description

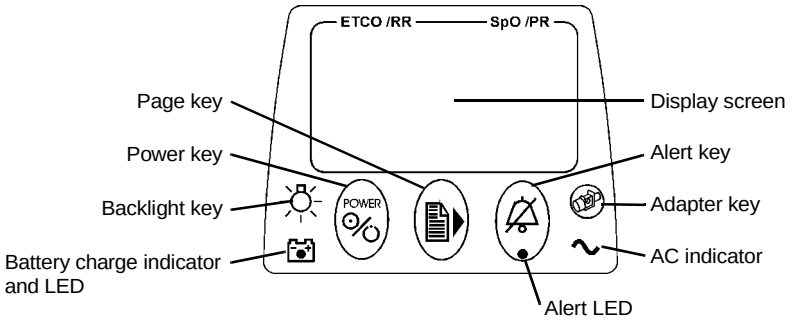
1.1 Indication for use

The Model 710 and Model 715 *TIDAL WAVE Sp* handheld, portable Capnometer/Oximeters are intended to be used for monitoring end tidal CO_2, respiration rate, functional oxygen saturation and pulse rate in monitoring environments such as ventilatory support, emergency and anesthesia. The Model 715 incorporates a miniature vacuum pump to draw expired respiratory gases through the CAPNOSTAT CO_2 Sensor using a sampling airway adapter and nasal cannula. *TIDAL WAVE Sp* is designed to monitor adult, pediatric and neonatal patients. *TIDAL WAVE Sp* is not intended for any other purpose.

NOTE

Components of this product and its associated accessories which have patient contact are free of latex.

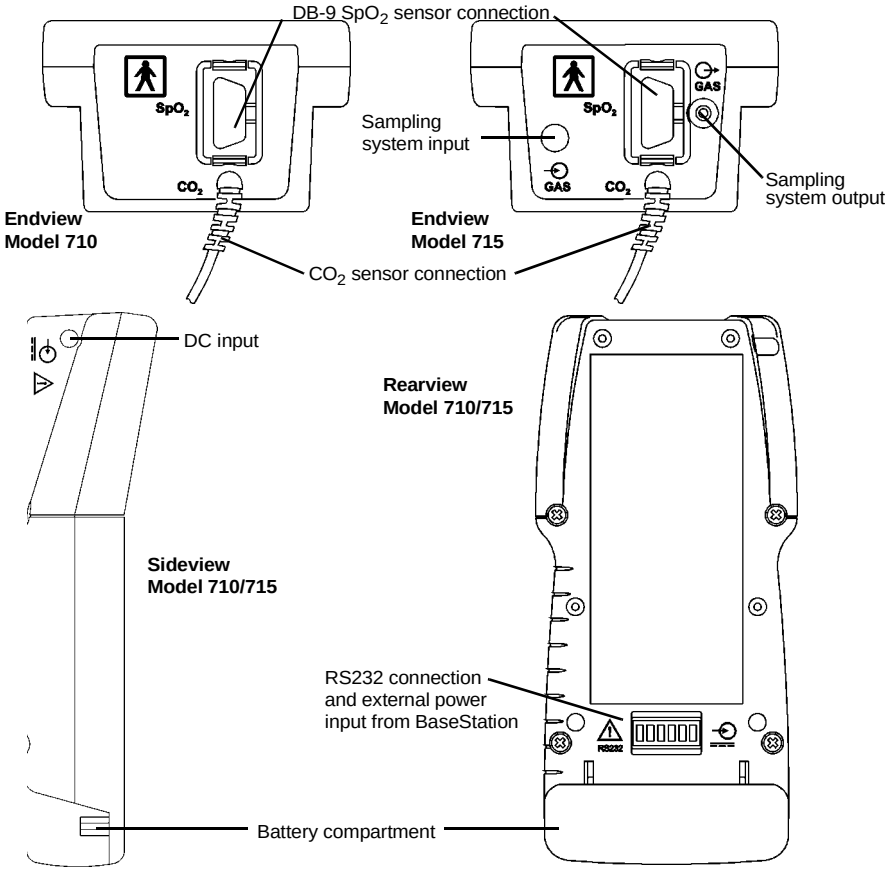
1.2 Keypanel Controls and Indicators



CONTROLS	
	Switches power on/off. With monitor ON, press and hold the POWER key to enter the MONITORING MODE selection menu.
	Sets display screen to Data Display, $EtCO_2$ waveform, plethysmogram, $EtCO_2$ trend or SpO_2 trend. Press and hold to enter the PRINT SELECTION menu (with printing enabled).

	Sets 2 minute silence and displays SET ALERTS menu (3 s timeout). 2 minute silence: icon illuminates. Press again to cancel. Press and hold for 3 seconds to disable audible alerts: icon flashes. Press and hold again to cancel. The Alert Key LED will display the following: Steady yellow: audio silenced for 2 min., no alert in progress. Flashing yellow: audio silenced (no alert in progress). Flashing red/yellow: alert in progress; audio is off or 2 minute silence.
	Sets adapter type. Press and hold for 4 seconds to zero an adapter.
	Turns backlight on/off, or press and hold to adjust contrast.
	Lit when the unit is on battery power. Green; battery is fully charged, slow flashing yellow; battery power is low, Fast flashing red; battery is exhausted.
	Green when the monitor is connected to an AC power source.
ICONS	
	Audible alerts silenced.
	Audible alert silenced for two minutes.
	Alert limits disabled. Select ENABLED or DISABLED in the CONFIGURATION menu.
	Indicates adapter key.
	Set time/date. Press from the CONFIGURATION menu to set time and date.
	Indicates backlight key.
	Displayed beside any Trend screen.
	Sensor not up to temperature icon. Displayed when performing an adapter zero and the sensor is not at operating temperature.
	CO_2 detected icon. Displayed when selecting an adapter zero and the monitor detects breaths.
	Pulse detected icon. Displayed when SpO_2 sensor is attached to patient and the monitor detects a pulse.
	Breaths detected icon. Displayed when CAPNOSTAT CO_2 sensor is attached to patient and breaths are detected.

1.3 Connections and Labeling



SYMBOLS	
	Patient isolation: Identifies connection as type BF
	Attention: Consult manual for detailed information
GAS	Sampling System: Gas output
GAS	Sampling System: Gas input
	DC input. Connect external power supply to this port. Use only Novametrix external power supply, Catalog number 9220-10.
	Recyclable item. This symbol is found on the internal battery and should not concern the common user. Refer to qualified service personnel when battery replacement is required.
	Separate collection. Appropriate steps must be taken to ensure that spent batteries are collected separately when disposed of. This symbol is found on the internal battery and should not concern the common user. Refer to qualified service personnel when battery replacement is required.

1.4 Principle of operation

CO_2

TIDAL WAVE Sp uses the CAPNOSTAT CO_2 sensor to measure CO_2 by using the infrared absorbtion technique, which has endured and evolved in the clinical setting for over two decades and remains the most popular and versatile technique today.

The principle is based on the fact that CO_2 molecules absorb infrared (IR) light energy of specific wavelengths, with the amount of energy absorbed being directly related to the CO_2 concentration. When an IR beam is passed through a gas sample containing CO_2, the electronic signal from the photodetector (which measures the remaining light energy) can be obtained. This signal is then compared to the energy of the IR source and calibrated to accurately reflect CO_2 concentration in the sample. To calibrate, the photodetector's response to a known concentration of CO_2 is stored at the factory in the monitor's memory. A reference channel accounts for optical changes in the sensor, allowing the system to remain in calibration without user intervention.

SpO_2

The *TIDAL WAVE Sp* determines oxygen saturation using sensors that contain red and infrared (660 and 940 nanometer) light sources, called light emitting diodes (LEDs). The light energy from each LED is beamed through a tissue sample—a pulsating vascular bed such as the patient's finger or toe. The remaining light energy not absorbed by the tissue sample reaches a photodiode light receptor in the sensor. Oxygen saturated blood absorbs different amounts of light at each wavelength as compared to desaturated blood. Therefore, the amount of light absorbed by the blood in each pulse can be used to calculate oxygen saturation.

The *TIDAL WAVE Sp* is calibrated to display "functional" saturation. This differs from the "fractional" saturation value displayed by most co-oximeters. Functional saturation is defined as:

$$\text{Functional Saturation} = \frac{HbO_2}{100 - (COHb + METHb)}$$

HbO_2 = Fractional Oxyhemoglobin
COHb = Carboxyhemoglobin
METHb = Methemoglobin

This can be considered to represent the amount of oxyhemoglobin as a percentage of the hemoglobin that can be oxygenated. Dysfunctional hemoglobins (COHb and METHb) are not included in the measurement of functional saturation.

Pulse Rate is calculated by measuring the time interval between peaks of the infrared light waveform. The inverse of this measurement is displayed as pulse rate.

The oxygen saturation and pulse rate values are updated once each second. Presence of a pulse is indicated visibly by a plethysmogram graphic display and audibly by a "beep," when configured.

The *TIDAL WAVE Sp* must be used in conjunction with SuperBright™ Sensors.

Section 2 *Theory of Operation*

The *Tidal Wave Sp*™ is a microprocessor based handheld instrument that measures the clinical parameters of CO_2 production, respiration rate (RR), oxygen saturation (SpO_2), and pulse rate. The electronic theory of operation of the *Tidal Wave Sp* is explained in detail in the subsections that follow. The Model 715 is equivalent to the Model 710 with the exception that the Model 715 has a sidestream sampling option.

2.1 Digital Control System

Refer to 2752-03 schematic sheet 1.

Embedded control for the system is provided by IC1, a Motorola MC68332 integrated microcontroller. In addition to a full 32-bit Central Processing Unit (CPU), this device also contains circuitry for system clock generation, peripheral chip select generation, data control, interrupt generation, a sophisticated timing coprocessor, synchronous serial communication and asynchronous serial communication. In general, functional signals are grouped together into ports, and each signal can be independently programmed by software to be its predefined port function or as discrete I/O. Additionally, the functionality for several ports (Port C, E and F) can be predefined by the state of the data bus on system power-up. A special “background mode” port allows the device to be controlled by an external source for system debugging and testing. Also integrated on-chip are several activity monitors, as well as a software watchdog to ensure proper device and system operation. Refer to table 1.

Table 1: CPU Port Functions

Port	**Defined Function**	**Functionality Control , Data Bus Control (Alt Functions: D pulled low)**
TPU 16 Channels	Timing Signal Generation	Each channel independently user programmable as TPU function or as Discrete I/O
QSM 4 Synchronous Serial Chip Selects & one asynchronous serial channel	Serial Communications Port: QSPI: Queued Serial Peripheral Interface SCI: Serial Communications Interface	QSPI chip selects independently user programmable, can be used as Discrete I/O or decoded to create up to 16 chip selects. SCI transmit can be programmed as Discrete I/O
Background Mode	System debugging	Allows an appropriate external device to control the microprocessor and system

Table 1: CPU Port Functions

C	Chip Selects	D0: CSBOOT* data width, 8 or 16-bit D1: CS1*-CS3* or BR*,BG*,BGACK* D2: CS3*-CS5* or FC0-FC2 D3-D7: CS6*-CS10* or A19-A23
E	Bus Control	D8: Control Signals or discrete I/O
F	MODCK and Interrupts	D9: MODCK & IRQ or discrete I/O

The maximum operating frequency of the integrated processor is 20.97 MHz. The operating frequency is software selectable and generated by an internal VCO operating from Y1, a 32.768KHz watch crystal. The Timing Processor Unit (TPU) coprocessor of the MC68332 provides timing generation derived from the system clock. This feature is utilized to control the precise timing required for the acquisition of the end tidal carbon dioxide ($EtCO_2$) and the oxygen saturation (SpO_2) signals. The TPU is also use to generate the PWM (Pulse Width Modulation) control for the CAPNOSTAT CO_2 sensor case and detector heaters, as well as to provide the frequency generation for the audio tones. See Tables 2 & 3.

Table 2: TPU Timing Generation for the $EtCO_2$ subsystem

Signal Name	Description	Function / Timing
CO2AZ	Auto Zero	Clears the sample/hold circuitry prior to data acquisition. Active high, 2.84 ms
CO2PWENB	Pulse Width Enable	Defines the active time for both phases of the bipolar source pulse, used for pulse width protection circuitry. Active high, 830 µs
SRCDRV0	Source Drive 0	First source drive signal. Active high, 405 µs
CS*/H	Current Sample/Hold	Enables circuitry for source current measurement. Sample is taken when SRCDRV0 is active. Low = sample, 270 µs, High = hold
SRCDRV1	Source Drive 1	Second source drive signal delayed for 30 microseconds after SRCDRV0 ends. Active high, 395 µs
SS*/H	Signal Sample/Hold	Enables circuitry for CO_2 and reference channel data acquisition. Low = sample, 270 µs, High = hold
CASEPWM	Case Heater PWM	PWM control for the case heater servo

Table 2: TPU Timing Generation for the $EtCO_2$ subsystem

DETPWM	Detector Heater PWM	PWM control for the detector heater servo
TONE	Audio Tone Generation	Variable frequency outputs to generate system audio
CASEOT	Case Heater Over Temperature	Case heater over temperature shut down
DETOT	Detector Heater Over Temperature	Detector heater over temperature shut down

Table 3: TPU Timing Generation for the SpO_2 subsystem

Signal Name	Description	Function / Timing
ASAMP*	Auto Zero	Clears the sample/hold circuitry prior to data acquisition. Active low
RDLED*	Red channel LED control pulse	Defines the active time for the red LED
IRLED*	Infra-red channel LED control pulse	Defines the active time for the Infra-Red LED
RSAMP*	Red channel sample/hold	Enables circuitry for the red channel signal measurement. Sample is taken when SRCDRV0 is active. Low = sample, 20 us, High = hold
ISAMP*	Infra-red channel sample/hold	Enables circuitry for the infra-red channel signal measurement. Sample is taken when SRCDRV0 is active. Low = sample, 20 us, High = hold

Ferrite and L-C filters, 100pF capacitors, and 100 ohm resistors have been placed on selected microprocessor signals with fast rise and fall times (including timing, clock, and address & data lines) in order to help reduce and suppress the radiation of electromagnetic interference and decouple unwanted power supply noise. In addition, good EMI/EMC design techniques have been incorporated in the component layout and printed circuit board layout and manufacture.

Table 4 lists the chip select, control and discrete I/O functions for the *Tidal Wave Sp* system module. On power-up, Ports E and F are programmed as discrete inputs by pulling down their controlling data lines, DB8 and DB9. After power-up, the software sets up each pin function individually and performs a series of self tests to check the integrity of the system. The state of configuration inputs on Port E (TST*, CNFG0*, CNFG1*, and CNFG2) are read. These inputs allow the software to identify different operating states such as Test Mode, or different hardware configurations. After the initialization period is complete and all system functions have been set,

the LED output (PF0) toggles at a 1Hz rate switching transistor Q3 which drives the status LED D3, indicating that the system is ready for operation.

Table 4: Chip Select, Control and Discrete I/O

Port	Pin Functions	System Signal Name	I/O	Comments
C	D0 pulled low, D1-D7 pulled high, pins are chip select on power-up			
	CSBOOT*	ROMOE*	O	Program PROM chip select byte wide mode, (8-bits) D0 = LOW
	CS0* / PC0 / BR*	SRAMWR*	O	SRAM write enable
	CS1*/ PC1 / BG*	AUD_CS*	O	Audio attenuation control chip select
	CS2* / PC2 / BGACK*	SRAMRD*	O	SRAM read enable, byte mode
	CS3* / PC3 / FC0	ROMWR*	O	FLASH PROM Write Enable, Byte Mode
	CS4* / PC4 / FC1	DISPCS1*	O	LCD chip select #1
	CS5* / PC5 / FC2	DISPCS2*	O	LCD chip select #2
	CS6* / PC6 / A19	LATCH1_CS*	O	System control signals latch 1 chip select
	CS7* / PC7 / A20	LATCH2_CS*	O	System control signals latch 2 chip select
	CS8* / PC8 / A21	ROMWREN	O	Port C discrete output, prevents unintentional writes to FLASH EPROM. This signal must be asserted before ROMWR* in order to overwrite the flash.
	CS9* / PC9 / A22	PROFILE*	O	Enables software profiling data output latch
	CS10* / ECLK / A23	ECLK	O	Enable clock for the liquid crystal display

Table 4: Chip Select, Control and Discrete I/O

E	D8 pulled low, discrete I/O on power-up			
	DSACK0* / Port E0	TST*	I	Initiate system TEST if low
	DSACK1* / Port E1	DS1*	I	Data and size acknowledge 1*
	AVC* / Port E2	CNFG0*	I	Configuration switch 0
	RMC* / Port E3	CNFG1*	I	Configuration switch 1
	DS* / Port E4	DS*	O	Data strobe
	AS* / Port E5	AS*	O	Address strobe
	SIZ0* / Port E6	CNFG2*	I	Configuration switch 2
	SIZ1* / Port E7	SLP*	I	SpO2 A/D converter sleep signal
	R/W*	WR*	O	Data write strobe
F	D9 pulled low, discrete I/O on power-up			
	MODCK / Port F0	LED	O	LED CPU activity Indicator
	IRQ1* / Port F1	SW1	I	Keypanel switch 1 input
	IRQ2* / Port F2	SW2	I	Keypanel switch 2 input
	IRQ3* / Port F3	SW3	I	Keypanel switch 3 input
	IRQ4* / Port F4	SW4	I	Keypanel switch 4 input
	IRQ5* / Port F5	PWRKEY	I	Power key status input
	IRQ6* / Port F6	EXTDCIN	I	Indicates external AC mains power operation
	IRQ7* / Port F7	NMI	I	Non-maskable interrupt

Background Mode Debugging

External system debugging is possible by connecting an appropriate device (emulator or debugger) to header J401 and momentarily bring the BERR* (J401/2) low. This halts the bus activity and turns control of the system over to the external device. In this mode, internal MPU registers can be viewed and altered, special test features can be invoked and system memory can be read and written to.

System Memory

An 8-bit wide data path is used for FLASH PROM and SRAM transfers. Program code storage is contained in a 1-Meg 5V FLASH or EEPROM (IC2) device. The FLASH PROM is protected from unintentional overwrites of the program code by transistor Q1 and the ROMWREN signal. The ROMWREN line must be high prior to writing new code into the FLASH devices. Nonvolatile data storage is contained in the 1-Meg SRAM (IC3). The SRAM is backed-up to retain it's contents by applying a voltage on VBACKUP generated by BT1 (a 3.0V lithium battery) when power is off or the battery is removed from the monitor. During the battery backup state, transistor Q2 keeps the CS1* control of the SRAM in the inactive state. This forces the data bus to a high impedance state, isolating the SRAM from the rest of the system. True

nonvolatile storage for the bootstrap parameters for the CAPNOSTAT CO_2 sensor are stored in a serial EEPROM (IC2) located on the Interface (2753) board.

Serial Communications

Refer to 2752-03 schematic sheet 6.

The on-chip (IC1) asynchronous serial communications interface (SCI) channel is contained in the MC68332. The signals are level shifted to standard RS232 levels by IC26 which is a Dual RS232 Communications Driver/Receiver. The transmitters in the RS232 level shifter are under software control to minimize the patient leakage current to the rear panel connector (J101) when communication is not active. The signal COMMPWR controls the transmitters operation and is derived from IC9 pin 14 (schematic sheet 2). The serial connection to external, non-patient contact devices is electrically isolated from the patient through the CAPNOSTAT airway adapter and the SpO_2 sensor membrane interface. This connector, J101 is located on the rear panel and is designed to interface with external devices (i.e. computer, printer) when placed in a base station which contains the mating connector. In addition there is a 4 pin connector (J403) available for test and service which offers an internal connection to the serial communications at a TTL level. The data signals ASRxD and ASTxD are logic level signals and are diode protected against over voltage by D22 and D23 should IC26 breakdown from ESD (schematic page 6). Refer to Table 5 for the pinout and signals of serial interface connector J101.

Table 5: Power/Communications 6-pin modular connector J101 located on the rear panel.

Pin Number	Signal	Function
1	RxD	Internal MC68332 UART Receive, RS232 Signal, Level Shifted
2	TxD	Internal MC68332 UART Transmit, RS232 Signal, Level Shifted
3	DGND	Digital Ground
4	DGND	Digital Ground
5		
6	+VCHG	External DC input supply to power unit and battery charger

User Interface Control Circuitry

Refer to 2752-03 schematic sheet 2.

The user interface features a 64 row by 128 column Liquid Crystal Display (LCD) module with an LED backlight. A 5-switch membrane keypanel is provided for operator entry. The user interface also contains three LED's which represent various system conditions.

Control of the user interface is provided by the LATCH1_CS* chip select signal together with the Port F input signals from the microprocessor. SW1-SW4 are inputs which read in the present state of the membrane keys. Depressing a key causes the signal line to be pulled low in contrast to its normally high state. IC9 provides a latched output for controlling the status LED's. The LCD backlight is a series of LED's which are driven by a 5.12kHz clock signal in order to lower the LCD backlight power requirement and is activated by the backlight membrane key. The LITE_CLK signal is a 5.12kHz logic level signal generated by IC7 (sheet 7) which modulates the LED backlight through FET switch Q4 (BKLGHT_OUT) when asserted by IC10 (BACKLIGHT). This signal is capacitively coupled by C42 in order to prevent the backlight from remaining on in the event of a system failure.

Contrast control for the LCD is provided by DAC IC33 (sheet 6) and amplifier IC34A and transistor Q18 (schematic sheet 6). When the CPU detects a press and hold of the backlight membrane key, the CPU sends a digital ramp input to the DAC which causes the output to change accordingly. Inverting amplifier IC34A controls the base current into transistor Q18, which changes the level of the display contrast voltage, VDISP.

Refer to schematic sheet 6.

An audio frequency tone is generated by the TPU (Time Processor Unit) of the MC68332 (TONE). This signal is fed into the divider network consisting of R183 and IC32. IC32 is a 10k ohm E^2 potentiometer whose value (when written to under software control) provides a means for attenuating the signal under CPU control. From the divider output the signal is amplified by IC34B and Q17 which drives the system speaker (LS1) to produce system audio. The AUD_EN line from IC9 controls Q19, when high the input to IC34B is grounded thus muting the audio.

Real Time Clock, Power on RESET Generation and Glue Logic

Refer to 2752-03 schematic sheets 1 and 2.

Time-keeping for date and time stamping of patient trend information is provided by IC8. This device contains a built-in crystal for precise time and date measurement. In the absence of digital power, the time keeping function is maintained by the battery backed supply, VBACKUP which is generated by the 3V lithium backup battery (BT1).

On power-up, the system is forced into a “Reset” state by IC4 (sheet 1). When the supply voltage VDD, approaches 1V, the SRST* line is asserted to prevent undefined operation. IC4 also provides supervision over the VDD logic supply. If the logic supply falls below 4.55V ±120mV then IC4 generates a reset condition until the supply returns to a safe level. Inverter IC5 is used to generate the active high RESET signal.

The *Tidal Wave Sp* makes use of the high level of integration offered by the MC68332. Therefore the glue logic required is a minimum. Chip selection for the serial peripherals is provided by decoding the queued serial module (QSM) (PCS0-PCS3) of the microprocessor IC1 (sheet 1 on schematic) using decoder IC12 (sheet 2) while parallel interface peripherals are selected by the internal chip select registers of Port C (BOOTCS* and CS0*:CS10*). Latch IC10 is used to control the saturation analog signal processing, the LCD backlight, the sidestream sampling pump (Model 715), and to power the monitor off.

2.2 CO_2 System Analog Subsections

CO_2 Source Drive

Refer to 2752-03 schematic page 3 and Table 2 of this document.

The source drive circuitry is designed to drive the source with a bipolar signal to prevent the migration of charges within the source that may result from unidirectional electrical fields. The resistance of the source is monitored constantly to ensure the integrity of the system by sampling the current through the source while it is active.

The SRCDRV0 and SRCDRV1 lines are used to control the bipolar signal that drives the source. The SRCDRV0 signal goes high as soon as the CO2AZ (Auto Zero) line goes low and the CO2PWENB (Pulse Width Enable) line goes high. The duration of SRCDRV0 is 405 us (microseconds), and drives the source in the positive direction. The SRCDRV1 line drives the source with an opposite polarity signal when high for the same duration. There is a 30 us delay from the time the SRCDRV0 line goes low to when the SCRDRV1 line goes high. This delay is

to prevent the possibility of both SRCDRV0 and SRCDRV1 being active at the same time, thus creating a low impedance path between the two supplies (power supply shoot-through). SRCDRV1 steers current through the source in an opposite direction from SRCDRV0.

When SRCDRV0 and CO2INH (Inhibit) are high, the output of MOSFET Driver IC13A pin 7 will go low. This turns the P-Channel half of MOSFET Q5 on. At the same time, the output of MOSFET Driver IC14B pin 6 will be high biasing on the N-Channel half of MOSFET Q6 on. With both Q5B P-Channel and Q6A N-Channel on, current will flow from +VSRC through Q5B to the positive source terminal, then back from the source negative terminal through Q6A, through R97 to -VSRC. When SRCDRV0 returns low, both Q5B and Q6A are turned off and no current flows through the source. After the 30 us delay, SRCDRV1 will go high. The output of IC14A pin 8 will go high, biasing the N-Channel section of MOSFET Q5 on. The output of IC13B pin 5 will go low, turning the P-Channel of Q6 on. Current will now flow from +VSRC through Q6B to the source negative terminal, back from the source positive terminal through Q5A and R97 to -VSRC. Current will cease to flow when SRCDRV1 goes low. The bridge circuit of Q5 and Q6 in effect switches the polarity of the drive signal of the source between +VSRC and -VSRC. CO2PWENB also falls with the falling edge of SCRDRV1, signaling the end of source activity.

When current flows through the source, it will also flow through current sensing resistor R97, creating a differential voltage proportional to the source current:

V_{SRC} = $(V_{SR} / R_{SR}) * R_S * A_{V(DA)}$ where:

V_{SRC} = voltage out of difference amplifier proportional to current through the source element = 24V +/- 0.625V

V_{SR} = differential voltage across the source element

R_{SR} = resistance of the source element

R_S= resistance of the current sensing resistor = 1 ohm

$A_{V(DA)}$= difference amplifier gain = 5

V_{SRC} = [120 (Volts*Ohms) / R_{SR}]

The voltage signal out of difference amplifier IC15B is level shifted through C52 and fed to the sample and hold IC16A via buffer amplifier IC15A. A low level on the CS*/H (Current Sample and Hold) signal allows the source current signal to be sampled. On the rising edge of CS*/H, the present voltage level of the source current signal is held and appears at the input to channel A2 of the Analog to Digital Converter IC6 (sheet 2 on schematic) for processing by the MPU. When CO2AZ is high, the input to the sample and hold of IC16A is grounded to discharge any residual charge that may be on C52.

In order to prevent the source from being driven until the system is up and ready, there is protection circuitry that inhibits the source drive until enabled. During system power-up, the RESET line keeps Q7 on. This causes the CO2INH line to be brought low, preventing source pulses by pulling down SRCDRV0 and SCRDRV1 through D6. Protection circuitry also guards against extended pulse width as well as shortened duty cycle. On the rising edge of CO2PWENB, the trip point of IC17B is exceeded, allowing C55 to charge through R100. If the SRCDRV signals do not turn the Source Pulse off within 200 us after the 830 us pulse period, the trip point for IC17A will be exceeded, pulling the CO2INH line low turning the Pulse off. After the CO2PWENB signal returns low, capacitor C57 discharges through R101, keeping the output of comparator IC17B at the voltage acquired by C55. After approximately 10.4 ms, C57 will have discharged below the comparator trip point. The comparator output goes low, discharging C55 and the circuit is ready for the next source pulse cycle.

CAPNOSTAT Case and Detector Heater Control

Refer to 2752-03 schematic sheet 4.

The temperature of the system directly affects its ability to accurately measure CO_2 and therefore must be precisely maintained at a controlled value. Two separate heaters and control circuitry are used; one regulates the temperature of the detectors for the CO_2 data and reference channels; the other regulates the temperature of the transducer case (and loosely maintains the temperature of the airway adapter). While the purpose of the detector heater is to keep the detectors' sensitivity to infrared radiation constant, the function of the case heater is to keep condensation from forming on the airway windows by elevating the window temperature above the ambient airway temperature. Both heaters use an efficient pulse-width modulation scheme designed to decrease power consumption, with the PWM timing generated by the TPU under microprocessor control. This control loop is run by the CPU which does the calculations and passes the duty cycle to the TPU. For the purpose of describing the regulation loop, the case heater circuitry will be considered. The detector and case heater circuitry are identical.

Inside the CAPNOSTAT, a sensing thermistor is thermally connected to the heater module. Initially, the CAPNOSTAT is at the ambient temperature and the resistance of the thermistor is large. A small current flows through the signal path “CASETHERM” and only a small voltage is developed across R117. The microprocessor programs the TPU to allow a maximum duty cycle of 90% to power the PWM heater circuitry. This causes the heater control MOSFET Q9B to be pulsed on and off with a duty cycle that is under direct control of the program software. As the heater warms up the case, the thermistor's resistance decreases, raising the voltage appearing at the input of the control loop. As described below, the MPU looks at this voltage and decreases the duty cycle of the PWM control circuitry, gradually reducing the power output into the heater. When the desired temperature set point is reached, a balance is struck between the energy delivered to the system and the heat flow out of the system.

The case thermistor is sensed by amplifier IC18A pin 3. The difference between the signal at the non-inverting input and the reference appearing at the inverting terminal generates an error voltage proportional to the sensed temperature at the amplifier's output:

e_o (V) = [83.133V / (R_{th}+3.32K)] - 10.2V where:

e_o = amplifier output voltage

R_{th} = resistance of the thermistor = 4.36933K at 45°C

Temp (°C) = 4.1288 (°C/V) * $e_{o\,(T)}$ V + 41.7321°C

where e_o = amplifier output voltage at temperature T

This error voltage is low pass filtered by amplifier IC20A, sent to the ADC (IC6) and processed by the CPU to regulate the output pulses from the TPU. The TPU PWM signal is buffered by MOSFET Driver IC19A and capacitively coupled to the gate of the heater drive MOSFET, Q9B. Capacitive coupling the signal prevents a system fault that would allow the PWM to be stuck at a level that would cause too high of a heater output. In the absence of a pulse, the gate drive will be pulled high, disabling the output to the heater. The pulsed voltage signal out of the MOSFET is filtered by D12, L6, C68 and C69 to produce a DC output level for the heater. Since the TPU generated PWM signal is based on the system clock, it is synchronized with the generation of the source pulse timing. This minimizes the effect of any random disturbance caused by the heater circuit on the detection of the CO_2 data and reference signals.

The error voltage out of amplifier IC18A also appears at the temperature watchdog comparator IC17C. If the error voltage reaches a voltage equivalent to 56 degrees Celsius, the comparator trips, turning Q10 off. The gate of MOSFET Q9A is pulled high by R116, which turns it off and VHTR is prevented from reaching the source of transistor Q9B. The temperature of the sensor

is also monitored by the MPU which will disable the heater when a temperature of 50 degrees Celsius is exceeded. To shut off the heater, the MPU asserts the CASEOT signal, turning Q11 on which turns Q10 and Q9A off.

CO_2 Input Signal Path

Refer to 2752-03 schematic sheet 5.

The signals from the sensor “CO2DATAIN” (CO_2 Data) and “CO2REFIN” (reference signal) have similar signal paths. The CO2DATAIN passes through a high pass filter with a gain of 3.8 consisting of C80, R148 and buffer amplifier IC21B. The signal is fed to a Butterworth low pass filter IC21A and associated components. This filter has a gain of 2 with a corner frequency of 1.5 KHz. The output from the low pass filter is fed to a 12-bit digital to analog converter IC22. The signal, “CO2DIN” comes into the reference of the DAC, which acts as a programmable gain stage followed internally by an amplifier with a fixed gain of 2. Here under processor control the signal's gain is adjusted to an acceptable level for conversion. The gain setting is adjusted using the digitized signal out of the A/D Converter (IC6) as part of the feedback loop. Similarly, “CO2REFIN” is conditioned by high pass filter IC21D with a gain of 1.75 and low pass filter IC21C with a gain of 2. The equivalent fixed gains for the two input signals are not equal in order to compensate for differences in the output signal levels of the infra-red detectors in the sensor.

The output from IC22 is buffered by IC24A and AC coupled through C91 to IC23A. The “CO2DATAIN” signal received from the sensor is ac coupled prior to the initial gain stage and high pass filtered to remove any DC bias by C80. Prior to sampling CO_2 signal, the “CO2AZ” (Auto Zero) pulse biases Q15 on, causing any residual charge on C91 to discharge to ground. At the start of the source pulse, the “CO2AZ” pulse goes low and the CO_2 signal from the sensor is attained, and appears at the input of the sample and hold amplifier, IC16B. Near the end of the source pulse, the “SS*/H” (Signal Sample and Hold) goes low and the peak signal is acquired on the internal sample and hold capacitor. “SS*/H” returns high at the end of the cycle, and the CO_2 signal on the sample capacitor is held at the peak value. The signal then passes through a low pass filter of R159 and C92 before being converted by the ADC into digital data and analyzed by the processor. The signal “CO2REFIN” follows an identical zeroing and acquisition path.

CAPNOSTAT Interface

Refer to schematics 2752-03 sheet 5 and 2753-03 sheet 1.

Twenty pins of 60 pin connector J404 interface the CAPNOSTAT CO_2 sensor with the system electronics. Ferrite and L-C filters have been placed on selected lines to suppress radiated EMI and reduce susceptibility from external sources of interference.

Barometric Pressure Circuitry

Refer to 2752-03 schematic sheet 6.

IC28 is a piezoresistive differential pressure transducer with port P2 held as close to 0 psi (a perfect vacuum) as is possible. It measures the absolute pressure difference at port P1 relative to the vacuum at port P2. The transducer is calibrated for a full scale output of 0 to 15 psi, has internal temperature compensation and is designed to be driven by a constant voltage source. Instrumentation amplifier IC30 conditions this signal to correspond to the current barometric pressure, which is set by adjusting VR1. The nominal gain of this amplifier is 93.56, which corresponds to an ADC count of 3800 at 760 mmHg. The output signal from IC30 is low pass filtered by IC29A and appears as an input (ABPRESS) to the 12-bit ADC.

Sampling Pump

Refer to 2752-03 schematic sheet 2.

To enable the monitoring of non-intubated patients, a single tapered sampling port is provided on the sensor interface panel. Voltage regulator IC49 adjusts the pump motor speed to set the flow rate of air through the tubing system for 180ml/min. Resistor's R275 and R277 set the voltage to approximately 2.5V. VR2 is a potentiometer in parallel with R277, which can be installed if more accuracy is required for a flow rate adjustment. Pump motor current is sensed by measuring the voltage developed across resistor R278 using amplifier IC50 that provides a gain of 63. This provides an output of 8mA per 1/2 Volt {$V_o = (I_{pump}*R) / Gain$} into the 12-bit ADC, or approximately 2.5 uA per bit resolution {$Vref_{(ADC)} / (2^{12}*Gain)$}* {4mA/V}. A two-pole 31 Hz filter composed of IC29B provides high frequency attenuation. The VPUMP signal is digitally converted by IC6 and monitored by the procesor.

2.3 Saturation Analog Subsections

Sensor LED Drive Circuits

Refer to 2752-03 schematic sheet 7.

When the RDLED* signal from the processor goes low, Q26 turns off and the SPO2VLED signal is divided down by R232 and R236, at IC43a (pin 3). FET Q24 is in turn driven on by IC43a (pin 1). Current will flow through the red LED in the sensor, through Q24, then through R238 to ground.

When RDLED* returns high (logic 1), Q26 is biased on, forcing IC43a pin3 to ground potential, this results in 0 volts at the output of IC43a (pin 1). FET Q24 is biased off, and as a result, the Red LED in the sensor is also off.

The infra-red LED drive circuit operates in the same manner as the red LED drive discussed above. The IRLED* signal activates Q28 which controls IC43b, this in turn controls Q27. The source of Q27 will control the Infrared LED of the sensor.

Refer to 2752-03 schematic sheet 6.

The SPO2VLED line voltage is derived from IC33 which is controlled by the processor. When the SPO2DACCS* line is brought Low IC33 is enabled. The data on line SSD0 now controls the output voltage of IC33 VOUTA based on the CVREF voltage.

Photodiode Return Path

Refer to 2752-03 schematic sheet 7.

Light, from the sensor's red or infra-red LED, shines through the pulsating vascular bed (the patient's finger, toe, etc.) placed between the LEDs and the photodiode. Some of this light emerges from the tissue and impinges on the photodiode, causing the photodiode to conduct current. IC48a is set up as a differential amplifier that converts this input current to a voltage at the amplifier output. The sensors are wired such that photodiode current produces a positive voltage at IC48a.

The voltage at IC48a is presented to an analog switch IC47b. This switch is controlled at pin8 by INSIG* (Input Signal), and will be closed (IC47b pins 6 and 7 connected) except if the monitor is in a probe off patient condition or is undergoing its self-test at system power up. The switch IC47c pins 9-11, controlled from SIGND* (Signal Ground) will be open (no connection between IC47c pins10 and 11) except as noted above for the switch at IC47b pins 6-8. As a

result, the IC47b pin 6 voltage passes undisturbed to the high pass filter consisting of R256 and C189.

The ASAMP* signal is active whenever either sensor LED is turned on. This causes Q29 to turn off and the charge at C189 passes through to IC48b pin 5. The ASAMP* line returns to a logic high when neither LED is being driven, causing Q29 to turn on. With Q29 conducting, any charge at C189 is discharged to ground and the next pulse will charge C189 from a known level. If it were not for Q29, any charge remaining on C189 from the previous pulse or from ambient light reaching the photodiode would be added to the charge from a new pulse—creating measurement errors.

If the signal at IC48b pin 7 is the product of the Red LED being turned on, then RSAMP* will go low and close the switch at IC47d, thereby presenting the signal to a sample and hold circuit consisting of R267 and C202 (that maintains the signal until next sample pulse arrives), a buffer stage, (IC46b), a filter/divider network (C200, R265 and R268), and finally, to the red channel analog-to-digital convertor (ADC) IC45.

If the signal at IC48b is the product of the infra-red LED being turned on, then ISAMP* will go low and close the switch at IC47a, thereby presenting the signal to a sample and hold circuit consisting of R254 and C192 (that maintains the signal until next sample pulse arrives), a buffer stage, (IC46a), a filter/divider network (C185, R253 and R257), and finally, to the Infrared channel Analog-to-Digital Convertor IC44.

Calibrating the 20-Bit A/D Convertors

The 20-bit ADCs are calibrated as part of the system self-test which occurs each time the monitor is turned on. At power up, the microprocessor sets the SPO2CAL line high. The System Calibrations input SPO2SC1 is set high. The ADC will not operate while the SPO2CAL line is high. On the falling edge of the SPO2CAL signal, the ADC will initiate a calibration cycle determined by the state of the SPO2SC1.

The high at SPO2SC1 causes INSIG* to go high and reset SIGND* to a logic low. The high INSIG* opens the switch at IC47b—disconnecting the returning photodiode signal from the rest of the circuitry. The low SIGND* signal closes the switch at IC47c and as a result, the input to the C189-R256 high pass filter (and thus the entire ADC input circuitry) is brought to ground potential.

The SPO2CAL line (which went high at power up) is reset low and ADCs IC44 and IC45 begin their calibration cycles. Because the analog input circuitry is grounded via SIGND*, only circuit offset voltages can be present at the (pin 9 AIN) inputs. The calibration cycle sets the ADC “zero” point to equal this voltage, thus compensating for any circuitry offsets. The ADC then sets its “full scale” point to equal the voltage at its VREF (pin 10) input. This completes the calibration cycle.

The ADC can now start sampling its input and converting it to a 20-bit digital word. The processor resets SPO2SC1 to a logic low, causing IC47c to open and IC47b to close. The photodiode signal can now reach the ADCs.

20-Bit A/D Conversion

Data from the red and infra-red channels is sampled by the 20-bit measurement ADCs, IC45 and IC44 respectively. The analog input at pin 9 is converted to a digital representation with 20-bit resolution based on the input magnitude.

The converter continuously samples its input, converts the value to a digital word, puts the word in its output buffer (overwriting previous buffer contents), then repeats the process by again

sampling its input. The frequency of the sample/convert/overwrite-buffer sequence is based on the 2.6213 MHz clock signal at the ADC pin 3 (ADCCLK) input.

The microprocessor starts a read cycle of the infra-red channel by bringing IC44 pin 16 (Chip Select Channel 1) low. A red channel read starts when IC45 pin 16 (Chip Select Channel 2) is brought low.

On the falling edge of the ADC's CS*, the output word's MSB (most significant bit) appears at pin-20 SDATA (serial data) output. The SDATA line connects directly to the microprocessor's serial input (RXS) pin. The remaining bits (in descending order) are output from SDATA with subsequent falling edges of the serial clock (SCLK) input at pin 19. The SDATA output automatically goes to a 3-state (high impedance) condition after completing a word transmission, thus freeing the data line for other uses (i.e., the other ADC channel).

The serial clock speed is controlled through the digital board. This clock rate is significantly slower than the ADC sampling rate. As a result, the ADC rewrites its output buffer with new information at a faster rate than the data can be read from the buffer. No conflict occurs, however, because while CS* is low (during the read cycle), the ADC does not update its output buffer—the current word is not overwritten. After the processor receives the entire word, it allows the convertor's CS* to return high, and the ADC resumes its sample/convert/overwrite-buffer cycle.

Digital and Analog Control Lines

Refer to 2752-03 schematic sheet 2.

IC10 is enabled by the LATCH2_CS* line from the processor, the D8-D15 data lines then control the following signals:

SPO2CAL	Used to initiate 20 bit A/D calibration
SPO2SC1	Used to determine the type of 20 bit A/D calibration
SPO2LPON	Controls power to SpO_2 sensor LEDs
INSIG	Controls input signal from SpO_2 sensor amplifier
SIGND	Used to discharge SpO_2 signal sample/hold capacitor
BACKLIGHT	Used with LITE_CLK for display's backlight control
POWER_ON	Powers the monitor down (active low)
PUMP_CTRL	Controls sampling pump in models 715

Analog signals in the system are converted to digital values by IC6 then analyzed by the processor.

CO2DATA	CO2 data channel
CO2REF	CO2 reference channel
CO2ISRC	Current through CO2 sensor's source
CO2CASE	CO2 sensor case temperature
CO2DET	CO2 sensor detector temperature
ABPRESS	Barometric pressure
SPO2FEDC	Monitors input from SpO2 sensor
SPO2IRLED	Monitors LED drive for red LED
SPO2IRLED	Monitors LED drive for infra-red LED

VPUMP	Monitors current through the sampling pump
VBATTADC	Battery voltage level

2.4 Power Supply and Battery Charger

Supply and Reference Voltage Generation

Refer to 2752-03 schematic sheet 8.

The monitor operates from either an isolated external DC power supply or from the internal battery. There are two options presently for the internal battery, a Nickel Metal Hydride battery pack (NiMH), or a Disposable AA Lithium cell pack. The NiMH battery pack operates from a nominal voltage of 7.2V down to 6.0V while the AA Lithium pack operates from 10.5V down to 6.0V. This battery voltage range is monitored in hardware by the 12-bit ADC for level and comparator IC37A in order to shut the unit down at approx. 6.0V. The NiMH battery can be charged either externally via a separate charger or internally when the DC input is connected and a NiMH battery is installed. The internal battery charging circuitry is located on the 2753-01 assembly and is described in a later section of this document. The Lithium battery pack has a schottkey diode in series with the positive battery terminal to prevent accidental charging of the Lithium cells.

The core of the power supply design for the system is a 500 KHz switching regulator, IC36, that utilizes a flyback transformer configuration to generate the analog DC supply voltages. The primary of the transformer is designed to accept 6.0 to 13 V DC input and provides secondary outputs of nominally +13.75VDC, and -13.75VDC which are regulated by R204 and R210 off of the +VA supply. These supplies (±VA) feed all of the analog circuitry in the monitor. All supplies are L-C filtered to minimize noise in the analog front end. An additional switching regulator (IC41) generates the 5VDC supply (VDD) which feeds all the logic circuitry in addition to a filtered version (CVDD) which supplies the logic level requirements of the CO_2 signal path (i.e. data converters e.t.c.). The 5V supply is L-C filtered to provide clean logic supplies for the analog sections of the CO_2 (CVDD) system. IC35 and IC40 are linear regulators which provide clean, well regulated supplies (±CVA) for the CAPNOSTAT. IC38 and IC39 are designed as a tracking regulator pair to provide a 24VDC differential voltage for powering the CAPNOSTAT source (+VSRC, -VSRC). Power for the CAPNOSTAT heaters is supplied by VDCIN for maximum efficiency.

Refer to Table 6 for power supply breakdown.

Table 6: Power Supply and Reference Outputs

Signal	Supply	
VDCIN	+6.0 V to +13 VDC	Main DC input generated from external DC input or internal battery.
VBATT	+6.0 V to +10.2 VDC	Internal battery DC input, max level dependent on battery installed.
VBACKUP	+2.5 VDC or +5 VDC	Supply for SRAM and real time clock, either VDD or 2.5V to maintain SRAM data during power down.
VHTR	VDCIN	Supply for the CAPNOSTAT case and detector heaters, supplied by battery or external DC input. When powered by battery heater power follows input power.
VDD	+5 VDC	Regulated digital logic supply .
CVDD	+5 VDC	Regulated and filtered logic supply for CO_2 analog front end.
+VA	+13.75 VDC (nominal)	Tightly regulated +13.75V DC supply.
+CVA	+12 VDC	Linearly regulated and filtered positive supply for the CAPNOSTAT and CO_2 and SpO_2 front ends.
+VSRC	+12 VDC	Linearly regulated and filtered positive supply for the CAPNOSTAT source. Tracks -VSRC to provide a 24V +/- 2.5% differential voltage across the source.
-VSRC	-12 VDC	Linearly regulated and filtered negative supply for the CAPNOSTAT source. Tracked by +VSRC to provide a 24V +/- 2.5% differential voltage across the source.
-VA	-13.75 VDC (nominal)	Loosely regulated off of the +13.75VDC feedback line.
- CVA	-12 VDC	Linearly regulated and filtered negative supply for the CAPNOSTAT and CO_2 and SpO_2 front ends.
CVREF	+2.5 VDC	Buffered reference for the A/D converter.
2CVREF	+5.0 VDC	Buffered reference used in the CAPNOSTAT heater control circuitry.
-2CVREF	-5.0 VDC	Buffered reference used for the contrast control circuitry.
VREFO/2	+1.25 VDC	Buffered reference used for DC excitation for the barometric pressure sensor.
SPO2VLED	0 to 2.5 VDC	12 bit DAC output used to control LED drive levels in the oximetry front end.
VDISP	-6.5 to -11.5 VDC	Negative bias supply for the LCD used to adjust the contrast level.

Refer to 2752-03 schematic sheet 6.

Stable reference voltages for the sensors and analog circuitry are derived from IC25, a precision 2.5V reference generator with low drift. Five (2CVREF) and 2.5 Volt (CVREF) references for the CO_2 circuits are generated by IC27, while a separate –5.0 Volt (-2CVREF)

supply is generated directly from IC31A for –VA and -VD on the 20 bit ADC's for the saturation front end.

Refer to 2753-03 schematic

When the monitor is operated from the DC input power source the green AC ON indicator on the front panel is lit. If DC input power is lost or is not available, the monitor automatically operates from its internal battery without interruption. The AC ON indicator is extinguished and a BATTERY LED on the front panel lights up, indicating the current voltage level of the battery. While on internal DC power, the current state of the battery is monitored by both software and hardware (IC37 2752-03 schematic sheet 8). Should the battery power level get critically low, the monitor software alerts the user. If the monitor is not placed on external DC input power within approximately five minutes, the software will shut the unit off. Should the software fail to turn the monitor off when the low battery alarm sounds, the hardware cutoff (IC37A) activates (+VBATT=6.0V), turning the unit off. The trend memory data stored in SRAM is retained by the presence of VBACKUP power which is generated by a 3 Volt on-board Lithium battery.

Battery Charger Circuitry

Refer to 2753-03 schematic sheet 1.

The internal NiMH battery (7.2V, 3Ahr) will charge when the monitor is connected to the external DC power supply (9220-10) or installed in the Base Station option (PN. 6998-00) with the external adapter connected to the Base Station.

Battery charging is controlled by IC1, a frequency modulated fast charge controller. IC1 monitors temperature, voltage, and time throughout the charging process to safely and effectively charge the internal battery. The charger is configured to terminate charging using the (delta temperature/delta time) method of charge termination. Charging is maintained at the C/4 (750mA) rate while current to the battery is controlled by Q1, Q2, Q3, and the "MOD" output of IC1. Q3 provides base drive for Q1 while Q2 serves to shut Q1 off very quickly on a cycle by cycle basis, allowing the large currents required for charging to pass through Q1 which is a surface mount SOT-23 package PNP transistor capable of 500mW's of power dissipation.

Charge current is monitored at the SNS input (IC1/9) and is set by R13 (I_{REG} = 0.2225V/2*R_{SNS}). Temperature is monitored using the battery's internal thermistor, in conjunction with R9, R10, and R12. R9, R10, and R12 set the deltaT/dt charge termination parameter to 1°C per minute. R7 and R8 set the maximum temperature for charge termination (a safety override) to 45°C.

Battery charging is initiated in one of two ways: either by applying 13.0 VDC to +VCHG, therefore providing VCC (BVDD) to IC1; or by inserting a rechargeable battery into the battery compartment. Resistors R2 and R4 form a divider which sets the battery voltage window. If a battery with a voltage below the lower threshold (V_{EDV}, end discharge voltage, V_{EDV} = 0.4*BVDD +/- 30mV or, 2.04V, +VBATT = 5.26V) is installed, the charger will remain in maintenance mode until the threshold is reached. Conversely, if the battery exceeds the upper threshold for maximum cell voltage (V_{MCV}, maximum cell voltage, V_{MCV} = 0.8*BVDD +/- 30mV or, 4.08V, +VBATT = 10.5V), charging will terminate. After fast charge is terminated, either by deltaT/dt or by time-out, the charger switches over to a maintenance charge of C/64 to keep the battery topped off. BVDD (VCC for IC1 and D4, the AC on indicator) is regulated by D10, a 5.1V zener diode, while R3 keeps D10 operating in the knee region and C5 and C6 provide filtering.

Over-current protection is provided by F1, a 1A slo-blo replaceable fuse. Reverse leakage protection is provided by D5 and D6 which prevent the battery from trying to power BVDD and +VCHG in the battery operation state.

Section 3 *Functional Tests*

The Functional Test verifies overall functional integrity of the monitor and sensor. If the *TIDAL WAVE Sp* monitor does not pass these tests, remove from use and contact the Novametrix Service Department for repair/replacement assistance.

3.1 Equipment Required

1. Single Patient Use Adult Airway Adapter PN: 6063-01
2. Single Patient Use Neonatal Airway Adapter PN: 6312-01
3. SuperBright Finger Sensor with DB-9 connector PN: 9168-00
4. NiMH rechargeable battery pack PN:400043 or equivalent,
   (batteries (7) “AA” 1.5V PN: 400050 and case PN: 6862-01, if supplied)
5. External DC power supply PN: 9220-10 and hospital grade line cord PN: 600026

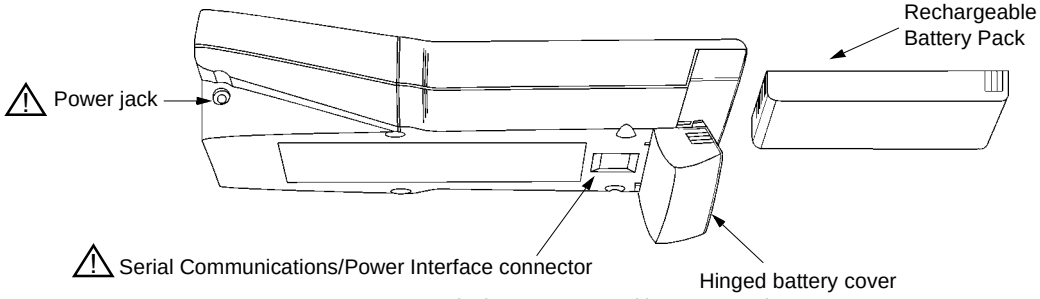
For Models 715:

6. Single Patient Use Sampling Adapter PN: 8954-01
7. Sample line tubing and cannula

3.2 Procedure

Power up

1. Visually inspect the monitor and verify that there is no external damage.
2. Open hinged cover and install the NiMH rechargeable battery pack (fully charged) PN: 400043 into the unit.



WARNING: Do NOT connect to any device not approved by Novametrix.

3. Connect the external DC power supply PN: 9220-10 to an AC outlet using a hospital grade line cord, then plug the other end into the unit under test.
4. Verify the ∿ LED on the keypanel illuminates.
5. Power the unit up by pressing the POWER key on the keypanel. The monitor will display “Novametrix Medical Systems Inc. Model 710/715 Checking System” then the adapter mode that was last selected and the current setting for the alert limits (enabled or disabled). The keypanel LEDs will illuminate in sequence during the power up sequence.
6. Verify the monitor displays “CAPNO WARMING” then “CHECK ADAPTER” at the top of the display. The message “CONNECT SPO2 PRB” will display because no SpO_2 probe is connected.
7. Press both and keys simultaneously to display the configuration settings. Before changing any parameter record the current settings so that the unit may be returned to its’ original configuration. Use the PAGE and SELECT keys to set the following parameters:

GAS COMPENSATION	ROOM AIR
CO2 WAVEFORM SCALE	MEDIUM
CO2 WAVEFORM SPEED	MEDIUM
NO RESP TIMER	20 sec.
CO2 UNITS	mmHg
ALERT VOLUME	HIGH
RS232 INTERFACE	SEIKO 414
WAVEFORM FILL	UNFILLED
ETCO2 AVERAGING	10 SEC
SPO2 AVERAGING	8 SEC
ALET LIMITS	DISABLED
PULSE BEEP VOLUME	HIGH

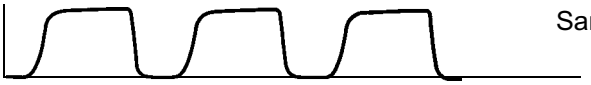
When all the parameters are set press the ADAPTER key to exit.

Capnography Tests

8. Press the ADAPTER key and use the SELECT key to select ADULT, then press EXIT .
9. Connect a Single Pateint Use Adult Airway Adapter PN: 6063-01 to the CAPNOSTAT CO_2 sensor. (Perform adapter zero only if requested by the monitor).

10. Press the PAGE key to display the CO_2 Waveform Screen.

11. Breathe into the airway adapter at a normal breath rate for at least 30 seconds, verify both the readings and the waveform displayed on the unit are acceptable.



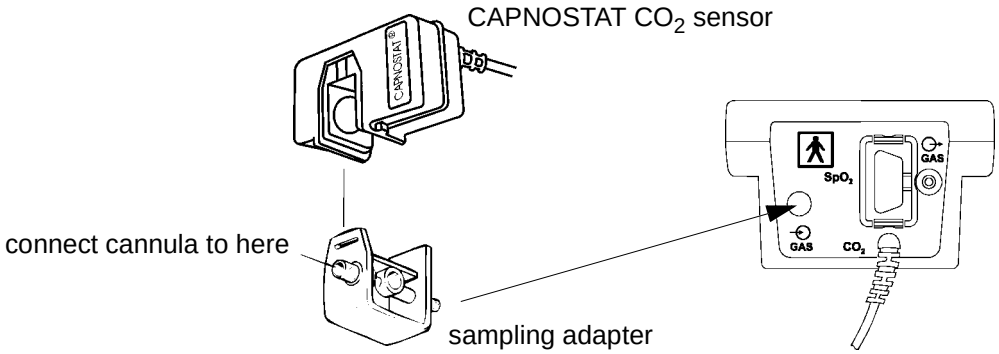
Sample Waveform*

*(Waveform appearance will vary depending upon breath rate and CO_2 waveform speed.)

12. Stop breathing into the adapter and verify an alert condition after approximately 20 seconds (alert LED flashing red and an audio alert). Press the ALERT key and verify the alert tone silences. Verify a 2 minute audio silence is initiated and the LED on this key is flashing red then yellow.
13. Press the PAGE key until the $ETCO_2$ Trend Screen is displayed, verify a trend waveform is present (waveform starts from right).
14. Press the ALERT key.
15. Change the airway adapter on the CAPNOSTAT CO_2 sensor from the adult to the neonatal.
16. Verify that “CHECK ADAPTER” is displayed.
17. Press the ADAPTER key and use the SELECT key to select NEONATAL, press EXIT . Verify the unit is in the Neonatal Mode as indicated by the “NEO” on the screen. (Perform adapter zero only if requested by the monitor).

Sidestream Tests (for Models 715 only)

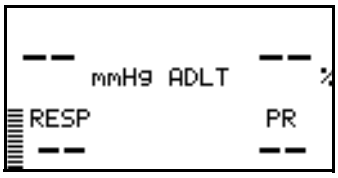
18. Connect a Single Patient Use Sampling Adapter to the CAPNOSTAT CO_2 sensor.



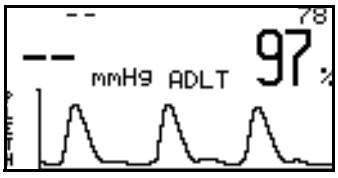
19. Press the ADAPTER key then use the SELECT key to select SAMPLING, press EXIT . Verify the sampling pump turns on.
20. With all sources of CO_2 removed from the adapter and tubing, press and hold the ADAPTER key for 4 seconds, then use the ZERO key to zero the adapter.
21. When the zero is complete, remove the Single Patient Use Sampling Adapter and verify the pump turns off. Attach a Single Patient Use Adult Adapter.
22. Press the ADAPTER key and use the SELECT key to select ADULT, then press EXIT .

Oximeter Tests

23. Connect an SpO_2 Finger sensor to the unit under test. Verify “SPO2 PRB OFF PAT” is displayed.
24. Press the page key until the Data screen is displayed.



25. Apply the finger sensor to your index finger. Verify after several seconds, reasonable Pulse Rate and Saturation (>95%) values are displayed.
26. Check that a pulse tone sounds and the pulse indicator bar on the right rises with each pulse.
27. Press the page key to display the Plethysmogram waveform screen. Check for acceptable waveform display (the unit will automatically scale the waveform for proper screen display).



Miscellaneous Tests

28. Press the Backlight key and verify that the back light turns off. Press the backlight key again and verify the back light turns on.
29. Press and hold the Backlight key and verify that the display contrast is adjustable from light to dark. Set the contrast of the display to a viewable level.
30. Remove the external DC power supply from the unit and verify that the AC ON LED is off and the Battery LED is illuminated (green).
31. Power the unit down then power it back up again. Ensure the monitor functions properly on battery operation.

32. Power the unit down and remove the rechargeable battery pack from the unit.
NOTE: The following steps do not apply if the monitor does not have an “AA” battery pack.
33. Install (7) seven “AA” batteries into the battery case PN:6862-01 ensuring proper polarity.
34. Install the battery case into the unit, power up the unit and ensure it functions properly on battery power.
35. Turn the unit off by pressing the Power key. Remove the battery pack from the unit. Remove the “AA” batteries from the battery case.

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Section 4 *Accuracy Tests*

The Accuracy Test verifies the performance accuracy of the Model 710/715. This test is typically performed in conjunction with (after) the Functional Tests described on page 21. If the monitor does not pass the accuracy test, remove from use and contact the Novametrix Service Department for repair/replacement assistance.

This procedure assumes the technician performs each step as indicated—leaving the monitor in a known state prior to performing the next step. If steps are omitted or performed out of order, be sure that the monitor is set to the correct state before continuing.

4.1 Equipment Required

1. Single Patient Use Adult Airway Adapter, PN: 6063-01
2. NiMH rechargeable battery (fully charged), PN: 400043 or equivalent.
3. External power supply, PN: 9220-10
4. Gas Regulator, PN: 6081-00
5. Precision gas mixture, PN: 8364-10
6. TB500B SpO_2 Sensor Simulator, PN: 5530-00
7. SpO_2 Sensor Adapter, DB-9 to Hypertronics, PN: 9180-00
8. Calibrated Barometer
9. Room thermometer
10. Calculator

4.2 Procedure

1. Visually inspect the monitor and verify that there are no cosmetic defects.
2. Install a fully charged NiMH rechargeable battery pack (PN: 400043) into the unit under test.
3. Plug the external power supply (PN: 9220-10) into an AC outlet, then plug the other end into the unit’s DC input.
4. Press the POWER key then immediately press and hold the and keys until "Resetting Monitor to factory defaults" appears. The monitor will then display “Novametrix Medical Systems Inc. Model 710/715 Checking System”. The keypanel LEDs will illuminate in sequence during the power up sequence.

5. Press the ☼ and MENU keys simultaneously to enter the configuration mode. Use the PAGE key to select GAS COMPENSATION and verify that ROOM AIR is selected. Press the MENU key to exit.
6. Connect the Single Patient Use Adult Airway Adapter (PN: 6063-01) to the CAPNOSTAT CO_2 sensor.
7. Press and hold the MENU key until ">0<?" appears. Press the ZERO key to zero the sensor.
8. After the zero is complete, press both ☼ and MENU keys simultaneously to enter the configuration mode. Press ☼ four times to display the "CAPNOSTAT SERIAL #" screen. Press the VERIFY ACCURACY key, the instantaneous value should be 0.4 (+.5 -.4 torr). The value may take a few seconds to stabilize.
9. Connect the Model 1298 Gas Calibrator with 5% gas and airway adapter stack to the airway adapter (see instructions with the calibrator).
10. Record the barometric pressure (in mmHg) and temperature (in °C) of the room.
11. Calculate the nominal CO2 reading using the following:

$$N = \frac{(CO_2\%) \cdot (Pbaro)}{1-0.003 \cdot (33-T)}$$

Where:
Pbaro=barometric pressure in mmHg
T=temperature in degrees centigrade
N=the nominal corrected CO_2 value for the given CO_2%
CO_2%=percentage of CO_2 test gas used, e.g. 5% CO_2 test gas = .05

Example:

If T=23 and Pbaro=760
then
$N=((CO_2\%) \cdot 760) / 1-0.003 \cdot 10)$
$N=CO_2\% \cdot 783.505$
N=39.2 (for CO_2%=.05 or 5% test gas)

For N<40; Low=N-2, High=N+2
For 40<N<70; Low=0.95 · N, High=1.05 · N
For N>70; Low=0.92 · N, High=1.08 · N

CO_2%=.05 N=39.2 Low=37.2 High=41.2

12. Flow gas through the adapter for thirty seconds, then verify a reading between the Low and High limits calculated above.
13. Shut the gas flow off. Remove the Model 1298 Gas Calibrator from the airway adapter.
14. Press the EXIT key.
15. Enter the Configuration menus on the unit by pressing both the ADAPTER MENU key and ☼ key simultaneously.
16. Press the ☼ key until CAPNOSTAT SERIAL # appears and VERIFY ACCURACY.

17. Press and hold the ☼ key for three seconds. Verify the following displayed parameters:

SRCI	180-300
CTMP	45.00 ± 0.1
DTMP	45.00 ± 0.1
DCHN	3400 ± 200
RCHN	3400 ± 200

18. Pressing the EXIT key.
19. Connect the SpO_2 Sensor Adapter Cable to the unit, then connect the adapter to the TB500B sensor simulator. Turn the TB500B ON.
20. Set the TB500B switches as follows:

SENSOR TYPE:	87XX
POWER ON:	ON
ATTENUATION:	3
SATURATION:	92

21. Verify a Pulse Rate of 59-61 and Saturation value of 90-94. Verify the Connect SpO_2 PRB message is not displayed.
22. Press both ☼ and simultaneously to enter the configuration menu. Press the PAGE key until the ALERT LIMITS menu is displayed.
23. Press the SELECT key to ENABLE the alert limits.
24. Press the PAGE key until the Pulse Beep Volume menu is displayed.
25. Using the SELECT key, change the pulse beep volume from off to low. Verify an audible pulse beep. Change the pulse beep volume to high. Verify pulse beep volume increases. Change the pulse beep volume to off. Verify the pulse beep turns off.
26. Press the key to exit.
27. Set the TB500B Saturation to 62. Verify the alert LED flashes red, an alarm tone sounds, and the Saturation percentage flashes between 62 ± 2 to arrows pointing down.
28. Press and hold the Alert Off key for three seconds. Verify the alert tone mutes and the alert LED flashes between red and yellow.
29. Set TB500B Saturation to 100. Allow the Saturation value to return to 100 +0/-2. Press the SELECT key. Verify the Saturation percentage stops flashing between numbers and arrows and the alert LED stops flashing.
30. Set the TB500B as indicated in the table below and verify the saturation values listed: Verify the pulse rate is 60 ± 1 bpm for each Sat. setting.

SAT SETTING	**SIGNAL ATTEN:**	**SATURATION %**
100	3	98 -100
92	3	90 - 94

SAT SETTING	SIGNAL ATTEN:	SATURATION %
82	3	80 - 84
72	3	70 - 74
62	3	60 - 64
72	7	68 - 76
82	7	78 - 86
92	7	88 - 96
100	7	98 - 100

31. Set the Signal Attenuation to "**1**", verify SPO2 PRB OFF PAT appears on the display and an alert condition occurs. Reset the TB500B to Signal Attenuation "**3**" and verify the alert resets.
32. Press and hold the **RED** button on the TB500B and verify an alert condition occurs with the message SpO2 PRB FAULTY displayed. Release the button to reset the alert.
33. Press and hold the **INFRARED** button on the TB500B and verify an alert condition occurs with the message SpO2 PRB FAULTY displayed. Release the button to reset the alert.
34. Set the Saturation to "**0**", verify SPO2 LOW STRENGTH appears on the display.
35. Disconnect the TB500B from the SpO_2 sensor adapter and verify an alert condition and that the message CONNECT SpO2 PRB is displayed.
36. Turn the TB500B **OFF**.
37. Remove the external power supply from the unit and verify that unit continues to function properly without interruption and that the Battery LED is illuminated (green).
38. Power the unit down by pressing the  key.
39. Remove the rechargeable battery pack from the unit.
40. The Accuracy Tests are complete.

Section 5 *Electronic Tests*

The Electronic Tests verify the calibration and operation of the electronic circuits within the Model 710/715. These tests DO NOT need to be performed on a regular (preventative) basis. Perform these tests only if the monitor fails to operate as expected or fails the Accuracy Tests or the Functional Tests. The Electronic Tests should be performed only by qualified service personnel. The Electronic Tests require access to the internal components of the monitor. Refer to "Assembly Exchanges" on page 39.

CAUTION

The Model 710/715 contains static sensitive devices. Be sure to follow proper grounding procedures when handling the internal components to avoid damage from static discharge.

5.1 Equipment Required

1. External power supply, PN: 9220-10
2. D.M.M., Fluke Model 8840A or equivalent
3. Oscilloscope, Tektronix Model 2236 or equivalent

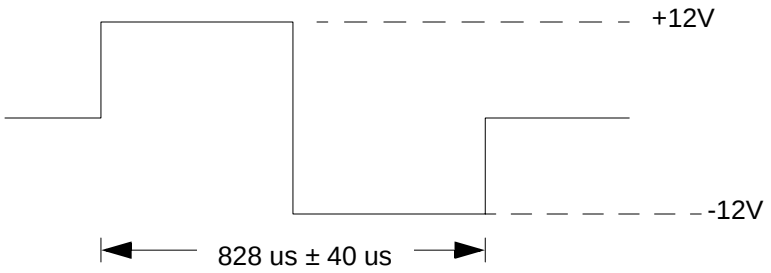
5.2 Test Procedure

1. Remove the battery (trends, date and time will be lost).
2. Disassemble unit to expose circuit boards.
3. Situate the boards so that no shorting can occur. Connect the external DC power supply.
4. Press the POWER key to power up the main board. Verify the proper power up sequence is on the LCD display.
5. Measure the following voltages. Use TP 37 as ground reference.

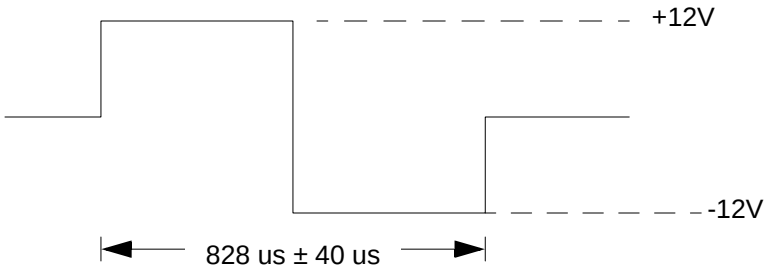
Signal Name	Location	Side	Voltage	Tolerance
VDD	TP 43	Front	5.00 V	± 100 mV
+ VA	TP 31	Front	+ 13.75 V	± 500 mV
- VA	TP 40	Front	- 13.75 V	± 500 mV
+ CVA	IC 35 pin 2	Front	+ 12.00 V	± 500 mV
- CVA	IC 40 pin 3	Front	- 12.00 V	± 500 mV
+ VSRC	IC 38 pin 2	Front	+ 12.00 V	± 500 mV

- VSRC	IC 39 pin 3	Front	- 12.00 V	± 500 mV
VBATTADC	IC 37 pin 3	Front	+ 1.80 V	± 100 mV
VHTR	C148 Positive	Front	+ 8.00 V	± 1.00 V
CVREF	TP 24	Back	+ 2.50 V	± 25 mV
2CVREF	TP 23	Back	+ 5.00 V	± 50 mV
- 2CVREF	TP 26	Back	- 5.00 V	± 50 mV
VBACKUP	IC 8 pin 8	Front	+ 4.60 V	± 150 mV
LEDSRC	TP 45	Back	+ 11.50 V	± 1.00 V

6. Monitor pin 4 of IC36 (or pin 5 of IC41) and insure that a 655 kHz sync frequency is present. Check that pulse amplitude is switching between 0 and 5VDC.
7. Monitor IC13-2 with an Oscilloscope. Verify a positive pulse 405 ± 10 us wide.
8. Monitor IC14-2 with an Oscilloscope. Verify a positive pulse 393 ± 10 us wide.
9. Monitor Q5 pins 5-8 with an oscilloscope. Verify the following waveform:

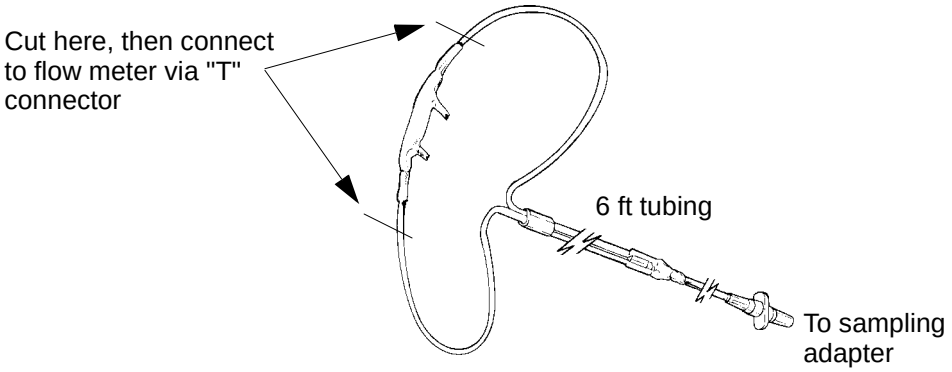


10. Monitor Q6 pins 5-8 with an oscilloscope. Verify the following waveform:



11. Enter the Configuration menus on the unit by pressing and holding the ADAPTER key immediately followed by the ☼ key.
12. Press the ☼ key until CAPNOSTAT SERIAL # appears and VERIFY ACCURACY.
13. Press and hold the ☼ key.
14. Using a calibrated barometer, read the barometric pressure.
15. Adjust VR1 (on the 2752 bd.) until the PB equals the actual barometric pressure ± 2.

16. Connect the Flow Meter to the Nasal Cannula using a "T" connector, then connect the cannula to a sampling adapter.



17. Attach the sampling adapter to the monitor (the CAPNOSTAT CO_2 sensor should be connected to the adapter).
18. Measure the voltage at J402 pin 1 . Verify 0.00V ± 50mV.
19. Press the Adapter key. Verify a Set Adapter Type menu is displayed.
20. Press the Select key until Sampling is selected.
21. Install a Single Patient Use Sampling Adapter and verify the sampling pump turns on and the Flow Meter shows a flow rate of 180 ± 25 (adjusted by VR2).
22. Measure the voltage at J402 pin 1. Verify 2.508V ± 75mV.
23. Press the Zero key to start a Zero calibration. Verify an Adapter Zero in Progress message is displayed with a timer counting down from 20. Verify the calibration completes with no error messages present.
24. Remove the Sampling Adapter and verify the pump turns off.
25. Press the Adapter key. Verify the Set Adapter Type menu is displayed.
26. Press the Select key until Adult is selected. Press the Exit key. Verify the sampling pump turns off and the main screen is displayed.
27. The test is complete.

5.3 Safety Testing

1. Using a leakage test fixture, and with the external DC power supply connected, measure the leakage current:
   - Normal
   - Normal reverse ground
   - Normal ungrounded

   Verify a leakage current <300 uA for 120VAC or <500 uA for 220VAC.

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Section 6 *Maintenance*

6.1 General

This section presents recommended maintenance schedules for the Model 710/715 and information on general maintenance, such as battery and fuse replacement, disassembly and assembly instructions, and system software updates.

6.2 Maintenance Schedules

The electronic circuits within the Model 710/715 handheld capnograph/oximeter do not require scheduled calibration or service. However, in order to maximize battery life, the monitor's internal battery should be tested monthly. Novametrix recommends the following maintenance schedules.[1]

- Cleaning and Sterilization:
  Perform as required. See "Cleaning and Sterilization" on page 35.
- Battery and AC Operation:
  Contains information on use of disposable lithium and rechargeable batteries. See "Battery Maintenance" on page 38.
- Functional Tests:
  The test verifies overall functional integrity of the monitor and sensor. See "Functional Tests" on page 21.
- Accuracy Tests:
  The test verifies the calibration accuracy of the monitor using specified test apparatus. See "Accuracy Tests" on page 27.
- Electronic Tests:
  These tests contain information on testing the electronic circuits within the Model 710/715 and should only be performed if the monitor fails to pass the Functional Tests. Only qualified service personnel should attempt to perform the Electronic Tests. See "Electronic Tests" on page 31.

6.3 Cleaning and Sterilization

Follow the cleaning and sterilization instructions listed below to clean and/or sterilize the monitor and its accessories.

1. At the customer's request, Novametrix will provide repair and calibration services under terms of a Service Contract. Contact the Novametrix Service Department for contract details.

Monitor, BaseStation and External Power Supply

- Turn the monitor off, and unplug the BaseStation and the external power supply from the AC power source before cleaning.
- The monitor, BaseStation and external power supply can be cleaned and disinfected with solutions such as a 70% isopropyl alcohol, 2% glutheralhyde, or 10% bleach solution. Wipe down with a water-dampened clean cloth to rinse. Dry before use.
- Do not immerse the monitor, BaseStation or external power supply.
- Do not attempt to sterilize the monitor, BaseStation or external power supply.

SpO_2 Finger Sensor

- The sensor can be cleaned and disinfected with solutions such as a 70% isopropyl alcohol, 2% glutheralhyde, or 10% bleach solution. Then wipe down with a water dampened clean cloth to rinse. Dry before use.
- Make certain that the finger sensor windows are clean and dry before reuse.
- Do not immerse the finger sensor.
- Do not attempt to sterilize the finger sensor.
- After cleaning the finger sensor, verify that the sensor is physically intact, with no broken or frayed wires or damaged parts. Make certain that the connectors are clean and dry, with no signs of contamination or corrosion. Do not use a broken or damaged sensor or one with wet, contaminated or corroded connectors.
- Perform a “Quick Check” to verify the integrity of the sensor.

SpO_2 Y-Sensor

- Do not immerse connector on the Y-Sensor.
- The Y-Sensor may be immersed—up to, but not including, the connector, in a 2% glutheralhyde solution, or 10% bleach solution. Refer to manufacturer’s instructions and standard hospital protocols to determine recommended times for disinfection and sterilization.
- Rinse thoroughly with water and dry before use (do not rinse the connector).
- Do not attempt to sterilize Y-Sensor except as stated above.
- After cleaning or sterilizing the Y-Sensor, verify that the sensor is physically intact, with no broken or frayed wires or damaged parts. Make certain that the connectors are clean and dry, with no signs of contamination or corrosion. Do not use a broken or damaged sensor or one with wet, contaminated, or corroded connectors.
- Perform a “Quick Check” to verify the integrity of the sensor.

SpO_2 Y-Strip Tapes and Foam Wraps

- Treat Y-Strip Tapes and foam wraps in accordance with hospital protocol for single-patient use items.

Ear Clip

- Do not immerse the ear clip
- Clean the ear clip with a cloth dampened with 70% isopropyl alcohol. After cleaning wipe the ear clip down thoroughly with a clean water dampened cloth to rinse.

CAPNOSTAT CO_2 Sensor

- Clean the sensor surface with a damp cloth.
- Make certain that the sensor windows are clean and dry.
- Do not immerse the CAPNOSTAT CO_2 sensor.
- Do not attempt to sterilize the CAPNOSTAT CO_2 sensor.

Single Patient Use Airway Adapters

- Treat all single patient use airway adapters in accordance with hospital protocol for single-patient use items.

External Sampling System Components (Model 715)

- The Nasal Sampling Cannulas and adapters are for single-patient use.

Internal Sampling System Components (Model 715)

Acceptable fluids for cleaning and sterilizing the internal pneumatic parts of the Sampling System include isopropyl alcohol, Cidex[2] or equivalent, or a 5.25% water solution by weight of sodium hypochlorite (bleach).

CAUTION

Do not attempt to pump cleaning/sterilizing liquid with the sampling pump. This may cause accelerated wear on the pump bearings. Always flush liquids with a syringe as described in the following instructions.

To clean and disinfect the pumping system:

1. Turn the monitor off and disconnect the external power supply (if connected).
2. Remove both the sampling inlet tubing set and the sampling exhaust tubing (if any).
3. Attach an exhaust port line (1/8 inch or 3/16 inch I.D. tubing) from the Sampling Exhaust GAS port to a suitable container located below the bottom level of the monitor.
4. Use a 60 cc catheter tip syringe. Fit it to the Sampling Inlet GAS connector. Flush the sterilizing solution slowly through the pumping system. Push the entire 60 cc of solution through the Sampling Inlet GAS. Repeat this process two more times to use a total of 180 cc of solution.
5. Remove the syringe and leave the cleaning/sterilizing fluid within the sampling pump system for 30 minutes to disinfect the system. Follow sterilant manufacturer's instructions for disinfection.
6. After 30 minutes, fill the syringe with distilled water and flush the system three times. Allow the cleaning/disinfection solution and distilled water to drain through the Sampling Exhaust GAS output.
7. Push several syringes of air slowly through the system to ensure that most of the liquid has been drained.

2. Cidex is a trademark of Arbook, Inc.

8. Follow this with at least three more syringes of distilled water, followed by at least two more syringes of air to make sure that most of the distilled water has been drained.
9. Remove the syringe from the unit. Do not connect the sampling inlet tubing. Connect the external power supply and turn the monitor on. Allow the sampling pump to operate for several minutes. This will help to remove any trapped water.
10. Connect a sampling tubing set to the Sampling Inlet GAS.
11. Block the open end of the tubing with your finger. Alternate blocking and unblocking the tubing end at least ten times. Use a quick, brisk motion when blocking and unblocking the tubing. Keep the tubing blocked and unblocked for several seconds at a time.
12. Repeat the same blocking and unblocking action with your finger on the sampling exhaust GAS port.
13. Allow the sampling system to run for at least 30 minutes without the sampling assembly tubing and the sampling exhaust tubing connected. This will speed dry the system pneumatics.
14. Once these cleaning and disinfection instructions have been completed, normal sampling system operation can be resumed.

6.4 Battery Maintenance

If the monitor has not been used or powered by the external power supply for an extended time[3] (3 months or more) allow the battery to charge before use or replace the battery with a fully charged battery and continue monitoring. The monitor may not power up on battery power if the battery is not sufficiently charged.

NOTE

- New batteries, or batteries stored for extended periods of time, may need to be fully charged and discharged up to five (5) times before performing at full capacity.
- With a new battery, or a battery that has not been used for 30 days, charge the battery for 24 hours prior to use.
- Refer to the instruction sheet packaged with the rechargeable battery for complete operating instructions.

6.5 Maintenance Schedules

When the monitor powers up, a self-test is performed which checks the internal electronics of the monitor. If this self-test fails, remove the monitor from use and contact qualified service personnel.

The monitor should undergo routine inspection and safety checks according to hospital protocol.

3. The internal battery will slowly discharge over long periods of non-use.

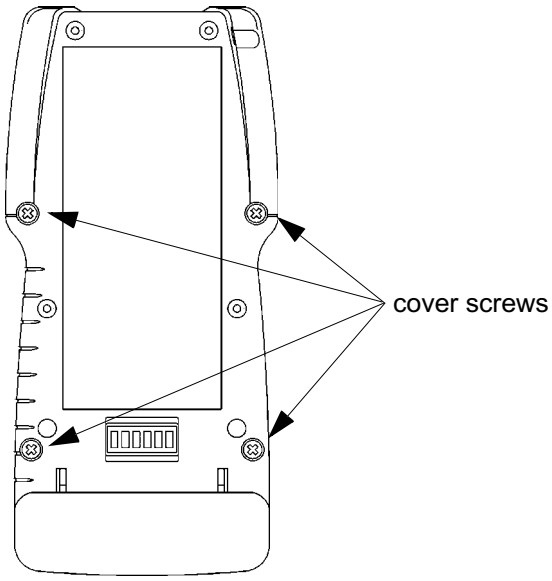
6.6 Assembly Exchanges

The disassembly instructions below are intended as a guide to enable component exchanges if necessary. There are no user serviceable parts inside. Disassembly should be performed by qualified service personnel only.

CAUTION: The Model 710/715 contains static sensitive devices. Be sure to follow proper grounding procedures when handling the internal components to avoid damage from static discharge.

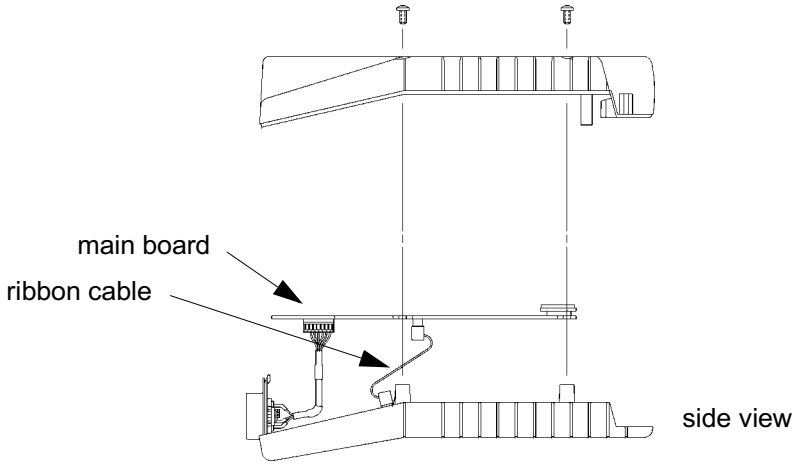
Disassembling the Monitor

1. Ensure that the monitor is OFF. Disconnect the A/C adapter, remove the battery pack.
2. Turn the monitor upside down and remove the four cover screws from the bottom cover.



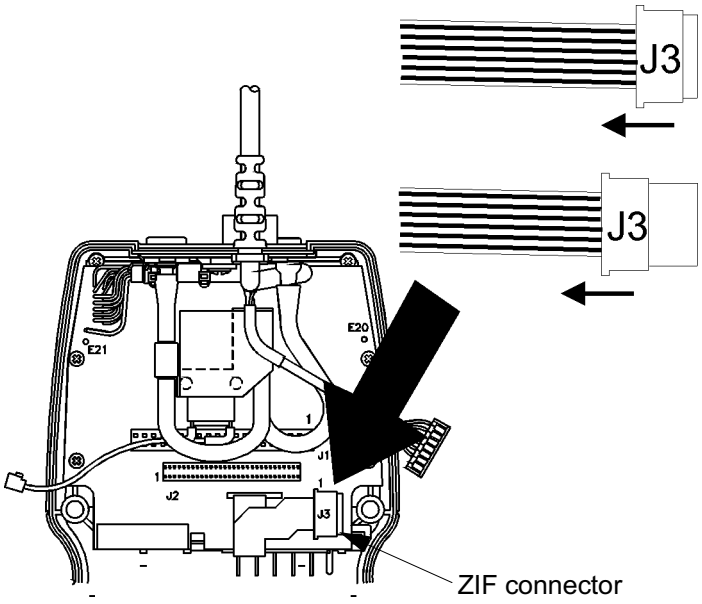
3. Carefully lift the rear cover from the monitor. The separate assemblies of the monitor can now be removed.
4. Lift the Main Board and disconnect ribbon cable from the Sensor Assembly Board by grasping the connector (not the cable) and gently rocking from side to side to loosen.

Be carefule not to bend any pins when pulling the connector off of the header strips.

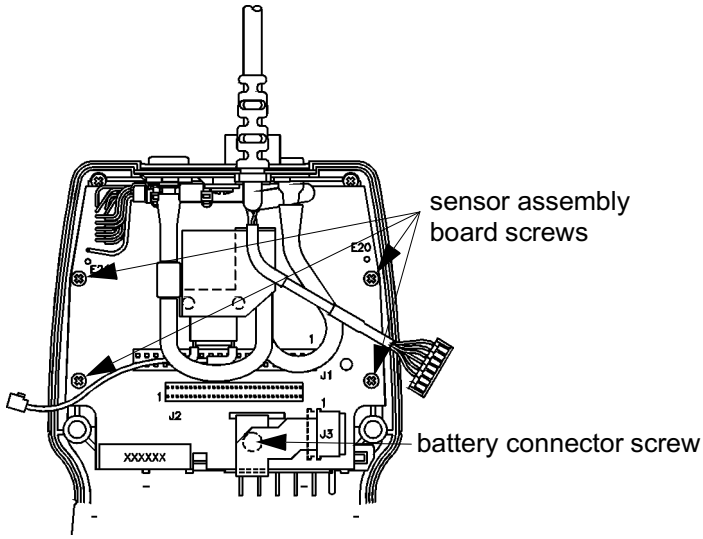


Unplug the pump connector (Model 715 only) and SpO_2 DB9 connector from the main board.

5. Remove the Main Board.
6. The Sensor Assembly Board, Display Board, and battery connector can now be accessed.
7. To disconnect ribbon cable J3, grasp the edge of the ZIF (zero insertion force) connector with one forefinger on either side. Pull gently *sideways* to release the mechanism. Slide the ribbon cable out.

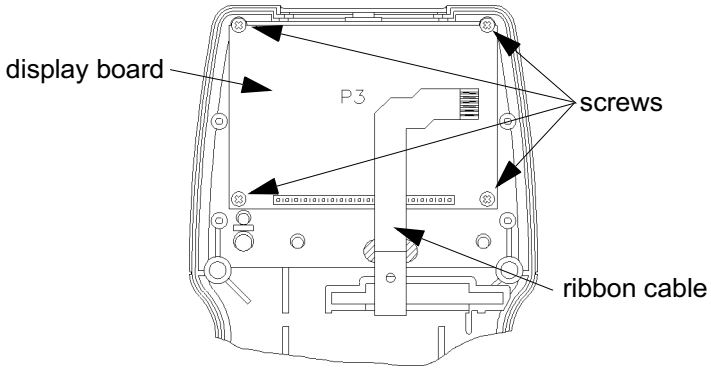


8. Remove four screws from the Sensor Assembly Board, then the screw near the battery connector.



9. Remove the sensor assembly board by gently prying upward, rocking gently to release the header strip J1 which connects through the Sensor Assembly Board from the Display Board below.

10. Remove 4 screws holding the Display Board in place. Do not bend the tabs on the board, the LCD display can not be removed from the board. Be sure not to lose the plastic bezel located in between the LCD display and the display window.



Reassembling the monitor

1. Check the inside of the display window and the LCD display for dirt/finger prints, clean if necessary. Replace the plastic bezel around the display window. Set the Display Board in place and secure with 4 screws.

2. Slide the ribbon cable through the sensor assembly board, align the Sensor Assembly board's J2 connector to the header strip on the display board. Check that the battery connector is aligned to the cover's receptcle. Just before pressing the Sensor Assembly Board into place, use a small screwdriver to set the ground strap from the keypanel into place.

3. Secure the Sensor Assembly Board with 4 screws. Then secure the ground strap with a screw.
4. Slide ribbon cable J3 into the ZIF locking connector, pushing gently to be sure that the cable is as far into the locking mechanism as possible. Push the connector closed to lock in the ribbon cable. Pull lightly on the ribbon cable to ensure that it is secure.
5. Replace the three connections from the Main Board to the Sensor Assembly Board and align the main board with the standoffs.
6. Ensure the battery gasket is set in place, refer to the assembly print 6800-01 (page 3) for placement. Place the back cover on the monitor. Secure with 4 screws.
7. Opened hinged cover and replace the rechargeable battery or battery pack. Battery is keyed to fit in only one direction. When the monitor is powered it will default to the factory default settings.

6.7 Serial Communications/Power Interface Connector

Located on the enclosure rear is a six pin modular contact which provides an RS232 interface as well as a power input for unit operation and battery charging when connected to Novametrix accessories. This connector meets the patient safety requirements of the following agencies: IEC 601-1, UL544, and TUV.

6.8 Software Update Instructions

The following procedure is for updating the monitor's software from a supplied *TIDAL WAVE Sp* Software Update Kit using an IBM-compatible computer and the Base Station (Cat. No. 6998-00). Refer to any instructions that may accompany the software update diskettes for changes in the procedure or other pertinent information.

Equipment Required

1. IBM compatible computer with an unused serial port (COM1 or COM2)
2. Base Station (Cat. No. 6998-00)
3. Serial Communication Cable (PN: 211923)
4. Update diskette PN: 9088-57-XX and/or 9089-57-XX (XX = new firmware version)
5. Reply card

Setup

Connect the serial cable to the Base Station. Connect the other end of the cable to the computer's COM[4] (serial) port. The update software allows use of either COM1 or COM2. When connecting the cable be sure to record which COM port is used, the program will prompt the user for this information before updating the software.

4. The location and availability of the COM ports (COM1, COM2) will vary from computer to computer. Refer to the computer's documentation for more information. The update software can only communicate with the TIDALWAVE Sp through either COM1 or COM2.

Procedure

Turn the *TIDAL WAVE Sp* off, then place it into the base station. Remove the AC adapter/charger connector from the base station if installed. NOTE: All power to the *TIDAL WAVE Sp* must be removed otherwise the update will not operate properly.

Insert the update diskette into the computer's floppy drive (typically drive A).

From DOS: Type A: ↵ (where A is the drive letter where the update diskette is loaded). At the "A:" prompt type **UPDATE** then press ↵ .

From Windows 3.x: Boot to DOS and follow the DOS instruction above.

From Windows 95: Select Start, Run, then type A:update ↵ (where A is the drive letter where the update diskette is loaded)

Follow the install program screen instructions. Verify that the firmware version shown on the computer screen is correct, then press any key to continue.

When the following prompt appears:

```
Select the PC's COM port the instrument is connected to
from the following choices:
     1-COM1
     2-COM2
     any other key - exit
```

Press the 1 key if the serial communications cable is connected to COM 1.
Press the 2 key if the serial communications cable is connected to COM2.
If you are not sure of the process, press any other key and call service or Novametrix Service Department at 1-800-243-3444, in Connecticut call collect (203) 265-7701.

Turn the *TIDAL WAVE Sp* on (connect the AC adapter/charger to the base station if the battery is not fully charged). It is important that the *TIDAL WAVE Sp* is powered off when the update program is started, and is turned on after the program starts to access the monitor.

When the download starts the *TIDAL WAVE Sp* screen will blank and the following message will appear on the computer screen.

```
Validating File
```

then,

```
UPDATING FIRMWARE, DO NOT INTERRUPT. PERCENT DONE: xx%
```

The "xx" will count up from 0% through 100% as the update is completed.

The procedure is complete when the computer displays:

```
***PROGRAM COMPLETE***

F1-exit          Esc-back
```

Press F1 to exit the update program.

Check that the *TIDAL WAVE Sp* restarts and returns to normal operation, if not then perform the update procedure again or call Novametrix Service Department at 1-800-243-3444, in Connecticut call collect (203) 265-7701.

Record the serial number from the *TIDAL WAVE Sp* on the reply card. Fill in the remaining information and return the postage paid card to Novametrix.

Section 7 *Status Messages*

Status messages indicate conditions that should be corrected or monitored; they may or may not be tied to an alert condition. These conditions can be a result of a hardware or sensor fault condition. Status messages are displayed on the screen in the same manner as alert messages. Following is a list of status and alert messages that may appear on the monitor.

7.1 System Messages

Message	Description
PRESSURE FAULTY	The barometric pressure sensor is returning a value which is out of range (<400 mmHg or > 800 mmHg). The monitor will default to 760 mmHg for calculation purposes. Refer servicing to qualified personnel.
EtCO2 AUTO LIMITS SET SpO2 AUTO LIMITS SET	This message is displayed when the monitor has successfully determined and set the auto alert limits for SpO_2 and $ETCO_2$.
RESETTING TO FACTORY DEFAULTS	All setup and alert settings have just been reset to factory default values.
TRENDS ERASED	The trends stored in the monitor's memory have been erased.
CHECK TIME/DATE	Time and date may not be properly set. The time and date can be adjusted in the CONFIGURATION menu by pressing the ☼ Backlight key.
UNKNOWN ERROR	Remove the monitor from use and contact Novametrix service personnel.

7.2 Capnography Messages

Message	Description
CAPNO WARMING	Sensor is under temperature. Wait for the CAPNOSTAT CO_2 sensor to reach operating temperature.

Message	Description
CHECK ADAPTER	Excessive moisture or secretions detected in the adapter: Change adapter. Adapter type has been changed (e.g. adult to neonatal): Zero the adapter. No adapter detected: Place an adapter on the CAPNOSTAT CO_2 sensor.
RESP=0 m : ss	A breath has not been detected for the indicated time (XX seconds). This message appears when the time since the end of expiration of the last detected breath exceeds the NO RESP TIMER setting in the configuration menu.
INSP XX	An inspired CO_2 level of 3 mmHg (or 0.4% or kPa) was detected for 20 consecutive seconds.
ZRO: HOLD ADPT KEY	The current through the CAPNOSTAT CO_2 sensor source emitter has changed or the system is detecting $EtCO_2$ values less than -3.0 mmHg.
CAPNO FAULTY	The following errors may be present: 1. The current through the source is too high or low. 2. The checksum for the CAPNOSTAT calibration data is wrong. 3. The revision of the calibration data in the CAPNOSTAT is not compatible with the software in the *TIDAL WAVE Sp* Monitor. Refer servicing to qualified personnel.
CAPNO HI TEMP	The temperature of the case or detector heater is over 50°C. Refer servicing to qualified personnel.
CAN NOT ZERO CO2	An error was detected which did not allow the system to zero the current adapter being used. Refer servicing to qualified personnel.
CO_2 OUT OF RANGE	The detected waveform value is beyond the measurement range of the monitor (0-100 mmHg, 0-13.2% or kPa).
	A changing level of CO_2 was detected during an adapter zero procedure. Wait 30 seconds and retry.
	The CAPNOSTAT CO_2 sensor has not reached operating temperature while attempting to zero. Wait for the sensor to reach operating temperature.
ADAPTER ZERO IN PROGRESS, TIME REMAINING 0 : XX	An airway adapter zero is in progress. XX indicates the number of seconds remaining.
WARNING: CHANGING CO2 UNITS ERASES STORED TRENDS	Changing CO_2 units (mmHg, %, kPa) in the Configuration menu will cause this message to appear.

7.3 Oxygen Saturation Messages

Message	Description
SPO2 LOW STRENGTH	The pulse strength as detected by the sensor is too small for proper monitor operation. This message will disappear when the problem is corrected.
INSUFF LIGHT	Sensor is placed on a site too thick (opaque) for adequate light transmission. Move sensor to a different site.
PULSE RANG ERR	Pulse must be within 30-250 beats per minute, inclusive.
SHIELD SPO2 PRB	Ambient light source (sunlight, warming lights, etc.) are interfering with sensor operation. Shield sensor from these light sources.
SPO2 PRB FAULTY	Remove sensor from use and contact qualified service personnel.
SPO2 BAD SIGNAL	Monitor not receiving valid signals from the sensor. May be caused by excessive motion, cardiac arrhythmia or other situations leading to poor signal.
CONNECT SPO2 PRB	Sensor not connected to unit.
SPO2 PRB OFF PAT	Sensor not on patient.
MONITOR FAULTY	Remove the monitor from use and contact qualified service personnel.

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Section 8 *Specifications*

8.1 General

Specifications for the Novametrix *TIDAL WAVE Sp* Monitor, Model 710/715, are listed for informational purposes only, and are subject to change without notice.

8.2 Capnograph

- Principle of Operation: Non-Dispersive Infrared (NDIR) absorption, dual wavelength ratiometric-single beam optics
- Sensor Type: “Mainstream” (no gas sample drawn from breathing circuit)
- Initialization Time: Capnogram in 15 seconds, full specifications in 60 seconds.
- Response Time: 60 ms
- Gas Compensation - Room Air, O_2 > 60%, N_20 > 60%: Operator selectable in configuration screen.
- Barometric Pressure Compensation: Automatic (range 400-800 mmHg)
- CAPNOSTAT CO_2 Sensor and Airway Adapter:
  Weight: Less than 18 g without cable
  Sensor Size: 1.3 x 1.67 x .85 inches (3.30 x 4.24 x 2.16 cm), 6 foot cable (2.44 m)
  Construction: Durable high performance plastic, ultra-flexible cable
  Shock Resistant: Sensor will withstand a 6 foot drop to a tile floor
- Airway Adapter: Single Patient Use, less than 5 cc deadspace, meets ANSI Z-79

$EtCO_2$ Section (Mainstream)

- Range 0-150 mmHg, CO_2 partial pressure
- Accuracy[1]: 0-40 mmHg ±2 mmHg, 41-70 mmHg 5% of reading, 70-100 mmHg ±8% of reading.
- Warm-up Time: Operational in 15 seconds, 1 minute to full specifications
- Step Response Time: 60 ms, adult; less than 50 ms, neonate
- Averaging Time: 1 breath, 10 seconds (default), 20 seconds, instantaneous
- Display Resolution: 0-25, 0-50, and 0-99 mmHg in 31 pixels
- Alerts: The Model 710 will have user selectable alert limits for $EtCO_2$.

Respiratory Rate (Mainstream)

- Range 0-150 breaths/min.

1. Allows for halogenated anesthetic agents which may be present at normal clinical levels. The presence of desfluane in the exhaled breath beyond normal levels (5-6%) may positively bias Carbon Dioxide values by up to an additional 2-3 mmHg.

- Accuracy: ±1 breaths/min.
- Alerts: The Model 710/715will have user selectable alert limits for Respiratory Rate.
- Averaging Time: 8 seconds

$EtCO_2$ Section (Sidestream)

- Range 0-150 mmHg, CO_2 partial pressure
- Accuracy: 0-40 mmHg ±2 mmHg, 41-70 mmHg 5% of reading, 70-100 mmHg ±8% of reading.
- Warm-up Time: Operational in 15 seconds, 1 minute to full specifications
- Step Response Time: less than 200 ms; Sampling Rate - 180 cc/min.
- Averaging Time: 1 breath, 10 seconds (default), 20 seconds, instantaneous
- Display Resolution: 0-25, 0-50, and 0-99 mmHg in 31 pixels
- Alerts: The Model 715 will have user selectable alert limits for $EtCO_2$.

Respiratory Rate (Sidestream, Model 715)

- Range 0-70 breaths/min
- Accuracy: ±1 breaths/min.
- Alerts: The Model 715 will have user selectable alert limits for Respiratory Rate.
- Averaging Time: 8 seconds

8.3 SpO_2 Section

- Range 0-100%
- Accuracy: ±2% SpO_2 (for 80-100% SpO_2) (1 standard deviation for 68% of readings within claim) unspecified for 0-79% SpO_2
- Display Resolution: 1%
- Averaging Time: menu-selectable times of 2 and 8 seconds (default is 8 seconds)
- Audible SpO_2 Trend Feature: Pitch of (user selectable) pulse rate “beep” tracks the SpO_2 values (i.e. decreasing SpO_2 values are signaled by lower pitched “beeps”).
- Settling Time: Display settles to within 1% of final reading less than 15 seconds after the sensor is properly applied.
- Alerts: The Model 710/715 will have user selectable alert limits for SpO_2.

8.4 Pulse Rate Section

- Range: 30-250 beats per minute (bpm)
- Accuracy: (1 standard deviation), 1% of full scale
- Display Resolution: 1 bpm
- Averaging Time: menu-selectable times of 2 and 8 seconds (default is 8 seconds)
- Settling Time: Display settles to within 1% of final reading less than 15 seconds after the sensor is properly applied.
- Alerts: The Model 710/715 will have user selectable alert limits for Pulse Rate.

8.5 Monitor Specifications

- Classification (IEC601-1): Class II/internal power source, type BF, enclosure protection rating of IPX1[2]. Operating Environment: 50 to 104° F (10 to 40° C), 0-90% relative humidity (non-condensing)
- Transport/Storage:
  short term: 14° to 122° F (-10 to 50° C) with NiMH battery
  long term: 14° to 95° F (-10 to 35° C) with NiMH battery
  storage: 14° to 131° F (-10° to 55° C) without NiMH battery
- Size: 7.9" x 3.25" x 1.5"
- Weight: 24 ounces
- Power: 100-250 VAC, .38A, 50-60 Hz
- Battery: Rechargeable NiMH battery pack (Cat. No. 400043) or equivalent; AA lithium batteries - Energizer L91 or equivalent.
- Battery Life: Approximately 4.5 hours of continuous use with fully charged NiMH rechargeable battery pack. Approximately 4.0 hours with sample pump in operation.
- Display: LED backlit 2.5" x 1.25" LCD, adjustable contrast
- LED indicators for: Low battery, adapter type, audio/alert status (indicates audio off, 2 minute silence, active alert), and external power.
- Electromagnetic Emissions: Conforms to EMC Directive 89/336/EEC, CISPR Class A. Tested to EN55011 (1991) and CISPR11 (1990).
- Electromagnetic Immunity: Conforms to EMC Directive 89/336/EEC, EN50082-1 (1992). Tested to IEC801-3 (1984) Radiated Immunity. Conforms to Medical Device Directive 93/42/EEC EN60601-1-2 (1992). Tested to IEC801-2 (1991) ESD, IEC801-4 (1988) EFT, and IEC1000-4-5 (1995) Surge Immunity.

8.6 Additional Features

- Audible SpO_2 Trend Feature: Pitch of Pulse Rate "beep" tracks the SpO_2 value, user selectable volume.
- Alert Limits: Automatic or menu selected high and low limits for $ETCO_2$, Respiratory Rate, SpO_2 and Pulse Rate. NO RESPIRATION alert selectable between 20, 40 and 60 seconds. Visible and audible alerts are immediate.
- 2-Minute Silence: When key is pressed, audible alerts are deactivated for two minutes. Indicated by yellow 2 minute LED and flashing bell icon
- Audio Off: Press and hold key for 3 seconds to deactivate audible alerts. Indicated by flashing yellow Audio Off LED and flashing bell icon.
- Trend Memory: 24 hour trend memory capacity, battery backed. On-screen 30 minute trends for $ETCO_2$ and SpO2. Other parameters are stored internally and can be downloaded to a PC.
- Digital Data Output: Serial (RS232), connect only to Novametrix approved devices.
- Sampling System (Model 715): Standard. Allows gas sampling of non-intubated patients
- Internal Battery-backed Real Time Clock

2. External power supply excluded.

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Section 9 *Accessories*

Catalog No.	Description
	CO_2 AIRWAY ADAPTERS and ACCESSORIES
6063-00	Pediatric/Adult Single Patient Use Airway Adapters (10 per box)
6063-25	Pediatric/Adult Single Patient Use Airway Adapters (25 per box)
6421-00	Pediatric/Adult Single Patient Use Airway Adapters with mouthpiece (10 per box)
6421-25	Pediatric/Adult Single Patient Use Airway Adapters with mouthpiece (25 per box)
6312-00	Neonatal/Pediatric Single Patient Use Airway Adapters (10 per box)
6312-25	Neonatal/Pediatric Single Patient Use Airway Adapters (25 per box)
8751-00	CAPNOSTAT CO_2 Sensor Cable Holding Clips (50 per box)
	SAMPLING ADAPTERS and ACCESSORIES
8954-00	Single Patient Use Sampling Adapters (10 per box)
8954-25	Single Patient Use Sampling Adapters (25 per box)
8955-00	Single Patient Use Adapter w/ Nasal CO_2 Sampling Cannula—Adult (10 per box)
8955-25	Single Patient Use Adapter w/ Nasal CO_2 Sampling Cannula—Adult (25 per box)
8956-00	Single Patient Use Adapter w/ Nasal CO_2 Sampling Cannula—Pediatric (10 per box)
8956-25	Single Patient Use Adapter w/ Nasal CO_2 Sampling Cannula—Pediatric (25 per box)
8957-00	Single Patient Use Adapter w/ Nasal CO_2 Sampling and O_2 Delivery Cannula—Adult (10 per box)
8957-25	Single Patient Use Adapter w/ Nasal CO_2 Sampling and O_2 Delivery Cannula—Adult (25 per box)
8958-00	Single Patient Use Adapter w/ Nasal CO_2 Sampling and O_2 Delivery Cannula—Pediatric (10/box)
8958-25	Single Patient Use Adapter w/ Nasal CO_2 Sampling and O_2 Delivery Cannula—Pediatric (25/box)
8908-00	Nafion® Dehumidification Tubing (10 per box)
	Reusable DB-9 SpO_2 SENSORS
9168-00	SuperBright Finger Sensor with DB-9 connector, 3 ft.
9169-00	SuperBright Y-Sensor with DB-9 connector, 3 ft.
	SINGLE PATIENT USE SpO_2 SENSORS AND CABLES
6455-00	Pediatric/Adult Single Patient Use SpO_2 Sensor Terminates in DB-9 connector (10 per box)

Catalog No.	Description
6455-25	Pediatric/Adult Single Patient Use SpO_2 Sensor Terminates in DB-9 connector (25 per box)
6480-00	Neonatal/Pediatric Single Patient Use SpO_2 Sensor Terminates in DB-9 connector (10 per box)
6480-25	Neonatal/Pediatric Single Patient Use SpO_2 Sensor Terminates in DB-9 connector (25 per box)
Y-STRIP TAPES, FOAM WRAPS and EAR CLIPS (for use with the Y-Sensor)	
8828-00	20mm Wrap Style Y-Strip Taping System (100 per box) Use on neonatal foot and hand, or on pediatric toe or finger 20mm tapes use Blue color coded liners
8829-00	25mm Wrap Style Y-Strip Taping System (100 per box) Use on neonatal foot and hand 25mm tapes use Green color coded liners
8831-00	20mm Finger Style Y-Strip Taping System (100 per box) Use on pediatric finger or on small adult finger 20mm tapes use Blue color coded liners
8832-00	25mm Finger Style Y-Strip Taping System (100 per box) Use on adult finger 25mm tapes use Green color coded liners
8836-00	Non-Adhesive Foam Wraps (25 per box) For use with Y-Sensor
8943-00	Neonatal/Pediatric Non-Adhesive Foam Wraps (25 per box)) For use with Y-Sensor
6929-00	Adhesive Foam Wraps (25 per box) For use with Y-Sensor
6968-00	Neonatal/ Pediatric Adhesive Foam Wraps (25 per box) For use with Y-Sensor
6131-50	Ear Clips For use with Y-Sensor (5 per box)
6131-25	Ear Clips For use with Y-Sensor (25 per box)
8700	Adhesive Dots (250 per box)
EXTENSION CABLES FOR SpO_2 SENSORS	
9174-00	4.5 Foot Extension Cable, DB-9 to DB-9 Receptacle
9175-00	4.5 Foot Extension Cable, DB-9 to OxySnap
9180-00	6 Inch Adapter Cable, DB-9 to Hypertronics Receptacle
6998-00	BaseStation (External Power Supply and/or computer cable not included)
9220-10	External DC Power Supply (power cord not included)
6862-00	AA Lithium Battery Pack (requires 7 batteries)
400050	AA Lithium Battery (7 required)
400043	NiMH Rechargeable Battery
400049	Battery Charger, w/ AC Adapter, Universal Input Voltage, for type NiMH battery. Power cord included.

Catalog No.	Description
140084	Pole/shelf mount kit
315127	Transport Pouch
6065-00	*NovaCARD for Windows*, Data Archive Software (3½" diskette)
600026	Power Cord (N. America only)
600075	Cable, BaseStation to Personal Computer (with 9-pin connector)
9086-00	Cable, BaseStation to Seiko DPU-414 Printer
9140-00	Seiko DPU-414 Thermal Printer w/Battery
400052	AC Adapter for Seiko DPU-414 Printer, 120 VAC
300017	Thermal Printing Paper, Seiko DPU-414 (5 rolls per box)
6081-00	Gas regulator, for use with precision gas mixture, Cat. No. 8364-10
8364-10	Precision gas mixture for validation

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Section 10 *Parts*

9110-00 FINAL ASSEMBLY MODEL 710

Item	Part No	Description	Qty
001	6874-32	LABEL, SERIAL NO	1
002	6886-13	CARTON, SHIPPING	1
003	6965-32	REGULATORY LABEL UL MARK	1
004	9026-32	LABEL, 'MANUFACTURED IN USA'	1
005	9110-01	MAIN ASSY, MODEL 710	1
007	9110-09	OVERALL WIRING DIAGRAM	1
008	9110-23	USERS MANUAL, MODEL 710	1
013	9351-32	QUICK GUIDE LABEL, 710	1
014	9341-32	WARNING LABEL, AC POWER SUPPLY	1
018	240059	SCREW COVER, BLK, PVC	3
019	315033	POUCH, PLASTIC, ZIP LOCK	3

9110-01 MAIN ASSEMBLY MODEL 710

Item	Part No	Description	Qty
001	2752-01	MAIN BD ASSY, 710 & 715	1
002	6680-26	BOTTOM COVER	1
003	6685-16	BATTERY DOOR	1
004	6823-10	FILLER, KEYPANEL	1
005	6838-10	GASKET, BATTERY DOOR	1
006	6839-10	GASKET, BATTERY	1
007	9157-27	MEMBRANE KEYPANEL	1
008	9181-01	TOP COVERS	1
009	9203-10	INSULATING SHIELD, BOTTOM	1
010	9208-01	TRANSDUCER ASSY, CAPNOSTAT	1
011	9212-01	END PANEL ASSY, MODEL 710	1
017	161102	ADHESIVE, RTV162, SILICON	1
018	281211	SCREW, 2-56 X 1/4L	1
019	286223	SCREW, 6-32 X 3/8 IN. L	1
020	482605	LCD DISPLAY	1
021	600076	RIBBON CABLE, 60 PIN	1

9146-00 FINAL ASSEMBLY MODEL 715

Item	Part No	Description	Qty
001	6874-32	LABEL, SERIAL NO.	1
002	6886-13	CARTON, SHIPPING	1
003	6965-32	REGULATORY LABEL, UL MARK	1
004	9026-32	LABEL, “MANUFACTURED IN USA"	1
005	9146-01	MAIN ASSY, MODEL 715	1
007	9146-09	OVERALL WIRING DIAGRAM	1
008	9146-23	USERS MANUAL, MODEL 715	1
013	9357-32	QUICK GUIDE LABEL, 715	1
014	9341-32	WARNING LABEL, AC POWER SUPPLY	1
018	240059	SCREW COVER, BLK, PVC	3
019	315033	POUCH, PLASTIC, ZIP LOCK	3

9146-01 MAIN ASSEMBLY MODEL 715

Item	Part No	Description	Qty
001	2752-01	MAIN BD ASSY, 710 & 715	1
002	6680-26	BOTTOM COVER	1
003	6685-16	BATTERY DOOR	1
004	6823-10	FILLER, KEYPANEL	1
005	6838-10	GASKET, BATTERY DOOR	1
006	6839-10	GASKET, BATTERY	1
007	9157-27	MEMBRANE KEYPANEL	1
008	9181-01	TOP COVER WITH HOT STAMP	1
009	9203-10	INSULATING SHIELD,	1
010	9208-01	TRANSDUCER ASSY, CAPNDSTAT	1
011	9213-01	END PANEL ASSY, MODEL 715	1
012	9187-10	TOP FOAM PAD, PUMP,	1
013	9201-10	BOTTOM FOAM PAD, PUMP	1
017	161102	ADHESIVE, RTV162, SILICON NA	1
018	281211	SCREW, 2-56 X 1/4L	1
019	286223	SCREW, 6-32 X 3/8 IN	1
020	482605	LCD DISPLAY	1
021	600076	RIBBON CADLE, 60 PIN	1
022	250166	PUMP	1
023	282024	SCREW, M2 X .4 X 8MM L	2
024	285050	SHOULDER WASHER, NYLON	2

9208-01 TRANSDUCER ASSEMBLY, CAPNOSTAT CO_2 SENSOR

Item	Part No	Description	Qty
001	2753-01	INTERFACE BOARD ASSY	1
002	9208-09	OVERALL WIRING DIAGRAM	1
003	9369-01	CABLE ASSY, XDCR	1
004	7125-32	LABEL, SERIAL NUMBER	1
005	7143-16	RETAINING CAP, KEVLAR	1
006	7168-01	INTEGRATED SUBASSY (ISA)	1
007	7187-26	TRANSDUCER HOUSING	1
008	7188-13	TRANSDUCER HOUSING SHIELD	1
014	161060	EPOXY, 2 PART (5/7), GRAY	1
015	161098	TAPE, KAPTON, 3/8 N X .00	1
016	280210	0-RING, .239 ID X .025 WI	1
017	280211	0-RING, .472 ID X .024 WI	1
017	280226	0-RING, .472 ID X .024 WI	1
018	280232	SPRING CONTACT, SELF-ADHV	2
019	320039	SOLDER, 63% TIN-37% LEAD	1
020	608001	CABLE TIE, .094 X 3.62L,	1
021	608007	TUBING, HEAT SHRINK, 1/4	1
022	608005	TUBING, HEAT SHRINK, 1/16	1
023	315097	BAG, STATIC SHIELDING	1
024	315098	LABEL, ESD, REUSABLE	1

9212-01 END PANEL ASSEMBLY, MODEL 710

Item	Part No	Description	Qty
001	9134-01	CABLE ASSY, SPO2	1
002	9212-26	END PANEL WITH PAD PRINTING	1
007	284217	SCREW, 4-40 X 3/16	1
008	285046	WASHER, FLAT, NO. 6 SAE	1

9213-01 END PANEL ASSEMBLY, MODEL 715

Item	Part No	Description	Qty
001	5835-10	FEMALE LUER W 1/8 BARB	1
002	9134-01	CABLE ASSY, SP02	1
003	9213-26	END PANEL WITH PAD PRINTING	1
008	161068	ADHESIVE, 290	1
009	281519	NUT, HEX, 1/4-32UNEF-2B	1
010	284217	SCREW, 4-40 X 3/16	1
011	285046	WASHER, FLAT, NO. 6 SAE	1
012	250167	FILTER, IN-LINE, 25 MICRON	1

Item	Part No	Description	Qty
013	608130	TUBING, POLYURETHANE	1

Section 11 *Drawings and Schematics*

Drawing No.	Code	Description	Sheets
9146	09	Overall Wiring Diagram, Model 715	1
9110	09	Overall Wiring Diagram, Model 710	1
9146	00	$ETCO_2$ with SpO_2 & Sidestream, Model 715	1
9146	01	Main Assy, Model 715	3
9110	00	$ETCO_2$ with SpO_2, Model 710	1
9110	01	Main Assy, Model 710	3
9212	01	End Panel Assy, Model 710	1
9213	01	End Panel Assy, Model 715	1
9208	01	Transducer Assy, CAPNOSTAT III, Model 710/715	3
2752	01	Main Board Assy, Model 710/715	3
2752	03	Main Board Schematic	8
2753	01	Interface Board Assy, Model 710/715	1
2753	03	Interface Board Schematic, Model 710/715	1

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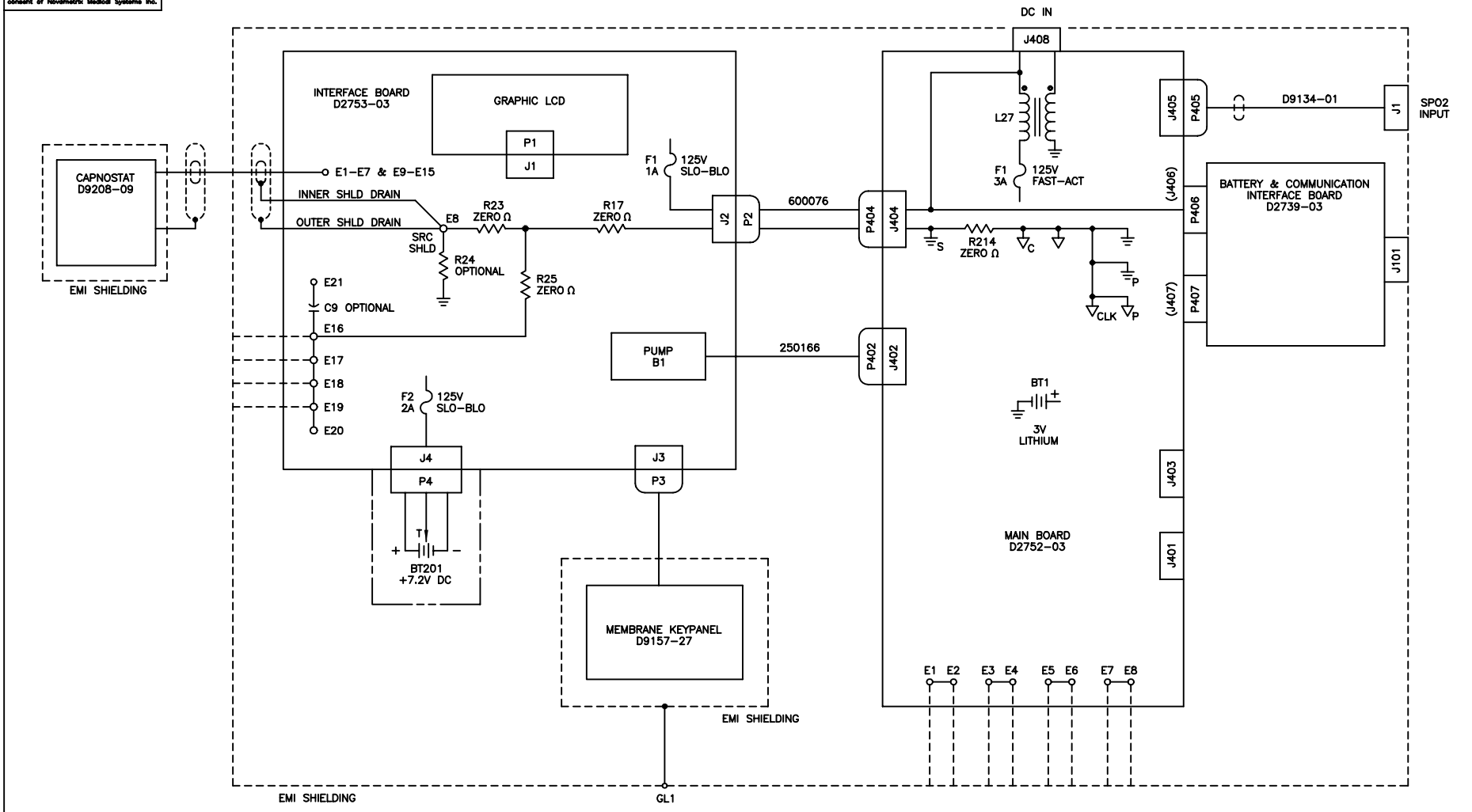

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES	TITLE: OVERALL WIRING DIAGRAM, MODEL 715 – TIDAL WAVE SP	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492		
			.X ±.02 .XX ±.01 .XXX ±.005 .XXXX ±.0025 TOLERANCES FRAC ±1/64 ANG ±1/4°	DRAWN BL 130ct98	CHECKED MRL	SIZE D	DRAWING NO. 9146	CODE 09	REV 01
			MATERIAL ~	MFG ENGR TJC 140ct98	APPROVED AJE 140ct98		
01	N631	1Feb99	FINISH ~	USED ON: D9146-00		SCALE: NONE	SHEET 1 OF 1
REV	R NO.	DATE					

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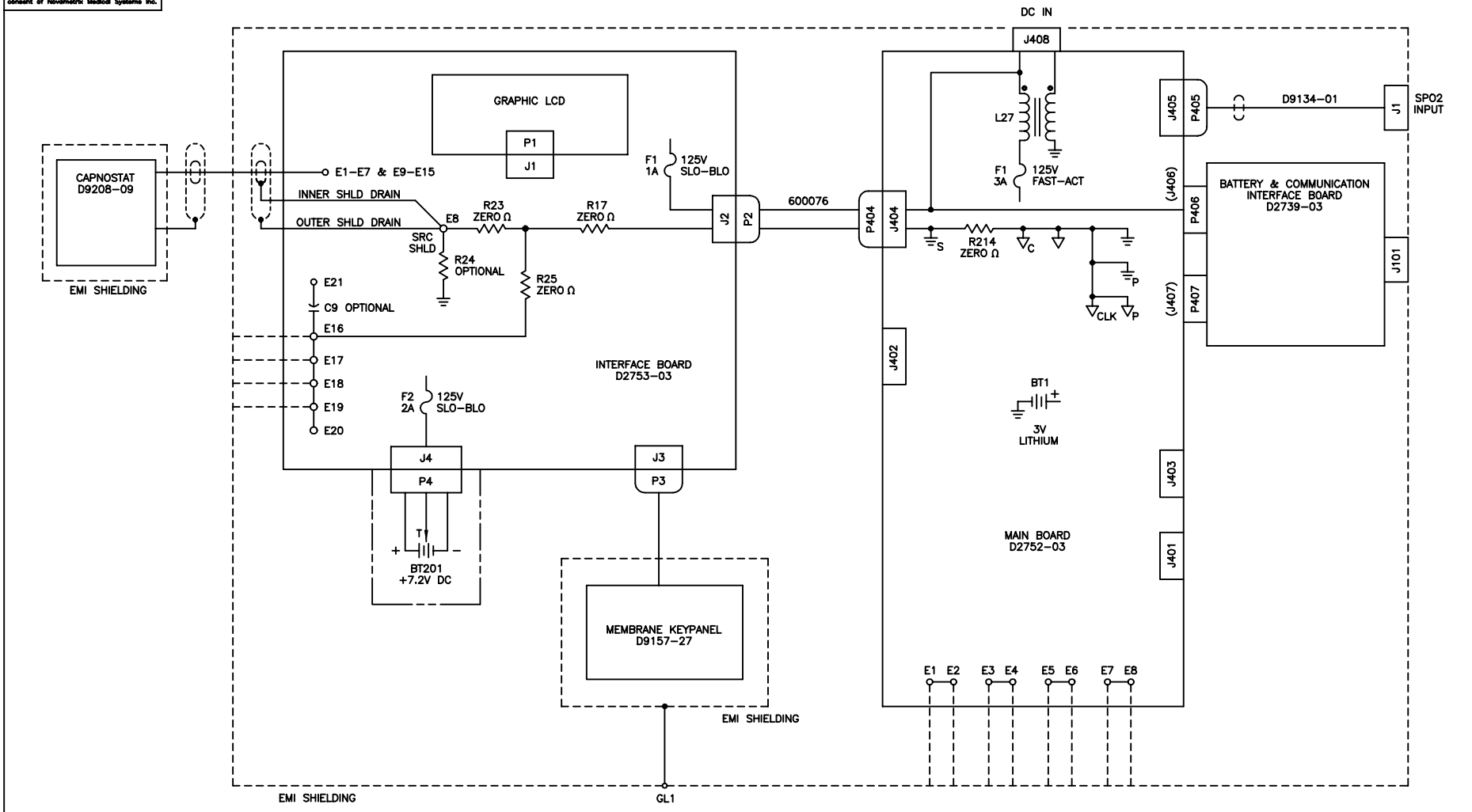

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES	TITLE: OVERALL WIRING DIAGRAM, MODEL 710 – TIDAL WAVE SP	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492		
			.X ±.02 .XX ±.01 .XXX ±.005 .XXXX ±.0025 TOLERANCES FRAC ±1/64 ANG ±1/4°	DRAWN BL 12Oct98	CHECKED MRL	SIZE D	DRAWING NO. 9110	CODE 09	REV 01
			MATERIAL ~	MFG ENGR TJC 14Oct98	APPROVED AJE 14Oct98		
01	N631	1Feb99	FINISH ~	USED ON: D9110-00		SCALE: NONE	SHEET 1 OF 1
REV	R NO.	DATE					

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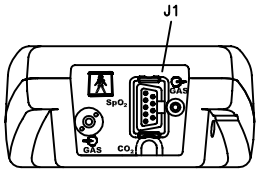
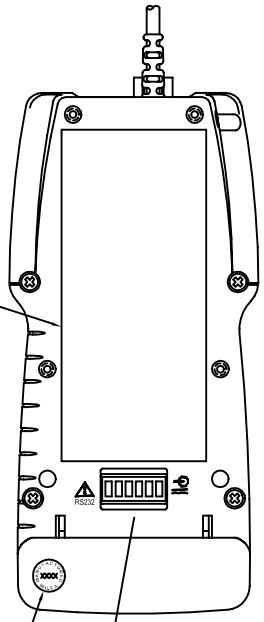
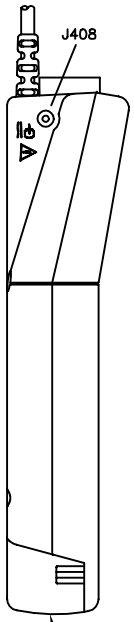


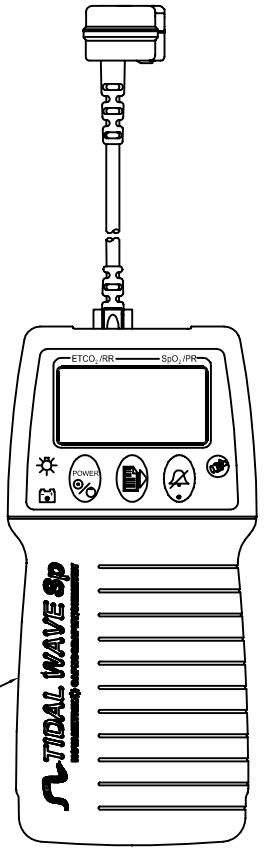


LOCATE QUICK GUIDE LABEL (13) ON BOTTOM COVER. NOTE ORIENTATION

LOCATE MANUFACTURED IN USA LABEL ON BOTTOM COVER APPROX AS SHOWN. (4)

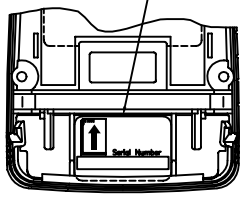


SEE DETAIL A FOR SN LABEL LOCATION



MAIN ASSY (5)

(1) LOCATE SN LABEL INSIDE BOTTOM COVER NOTE ORIENTATION



DETAIL A

NOTES:

1. FOR SYSTEM TEST PROCEDURE SEE A9146-04.
2. FOR QA TEST PROCEDURE SEE A9146-70.
3. FOR OVERALL WIRING DIAGRAM SEE D9146-09.
4. THE FOLLOWING ITEMS ARE TO BE INCLUDED WITH MONITOR. REFER TO SHIPPING INSTRUCTIONS.
   A. ITEM 8: USERS MANUAL; QTY: 1
   B. ITEM 14: INSTRUCTION SHEET WARNING LABEL, AC POWER SUPPLY; QTY: 1

REV	R NO.	DATE
04	N657	21Apr99
03	N639	9Feb99
02	N639	8Feb99
01	N631	27Jan99

DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES
TOLERANCES
X ±.06
.XX ±.01
.XXX ±.005
.XXXX ±.0010
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

TITLE: ETCO2 WITH SPO2 & SIDESTREAM, MODEL 715 - TIDAL WAVE Sp

DRAWN BL 11Aug98 | CHECKED MRL
MFG ENGR TJC 120ct98 | APPROVED AJE 120ct98
USED ON ~

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	9146	00	04

SCALE: 1/1 SHEET 1 OF 1

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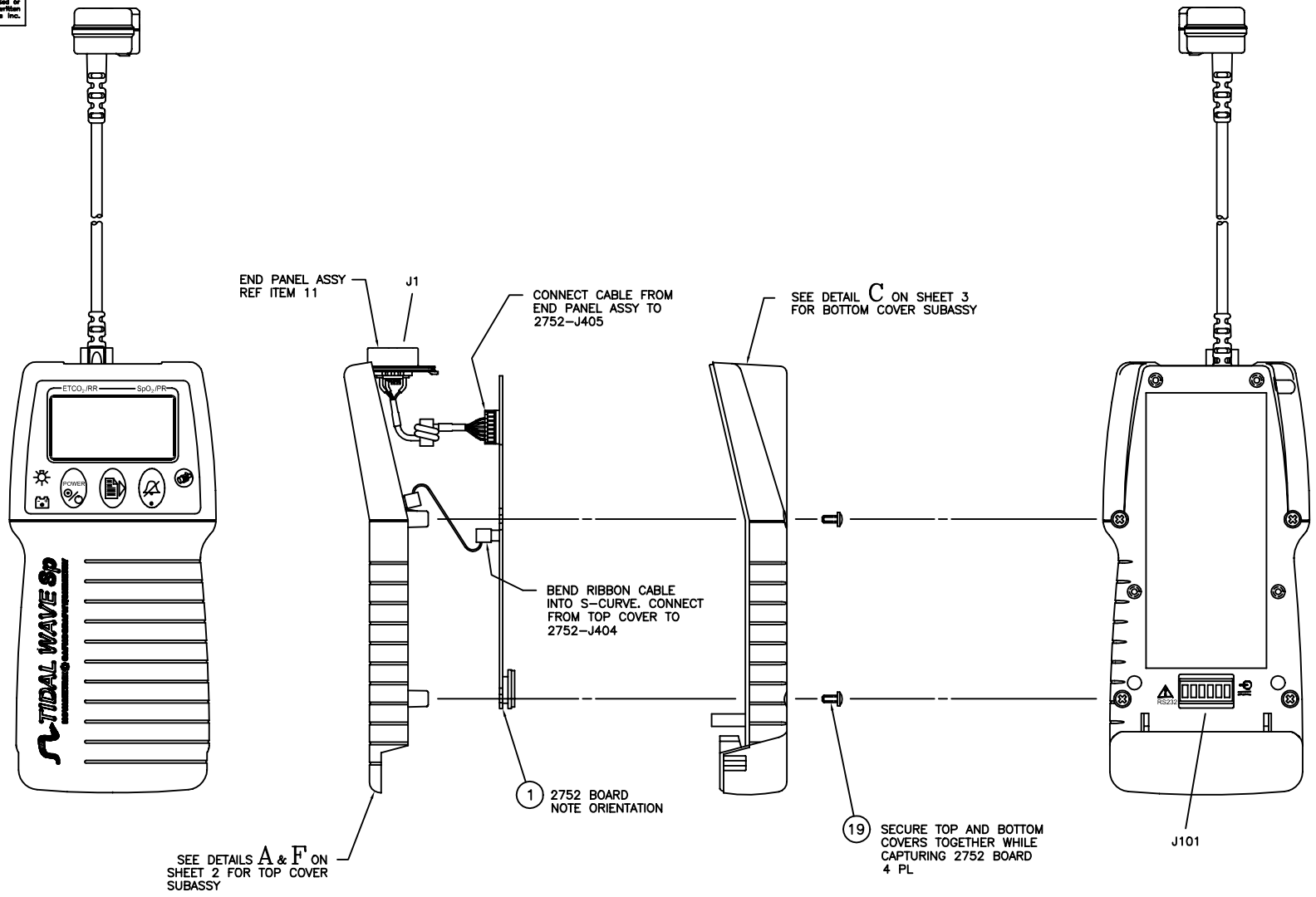

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES	TITLE: MAIN ASSY, MODEL 715 – TIDAL WAVE Sp	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492
			TOLERANCES: X ±.02; .XX ±.01; .XXX ±.005; .XXXX ±.0010; FRAC ±1/64; ANG ±1/4°	DRAWN BL 11Aug98; CHECKED JHT 10/12/98	
			MATERIAL: ~	MFG ENGR MJC 10/12/98; APPROVED AJE 12Oct98	SIZE D; DRAWING NO. 9146; CODE 01; REV 01
01	N631	1Feb99	FINISH: ~	USED ON: D9146–00	SCALE: 1/1; SHEET 1 OF 3
REV	R NO.	DATE			

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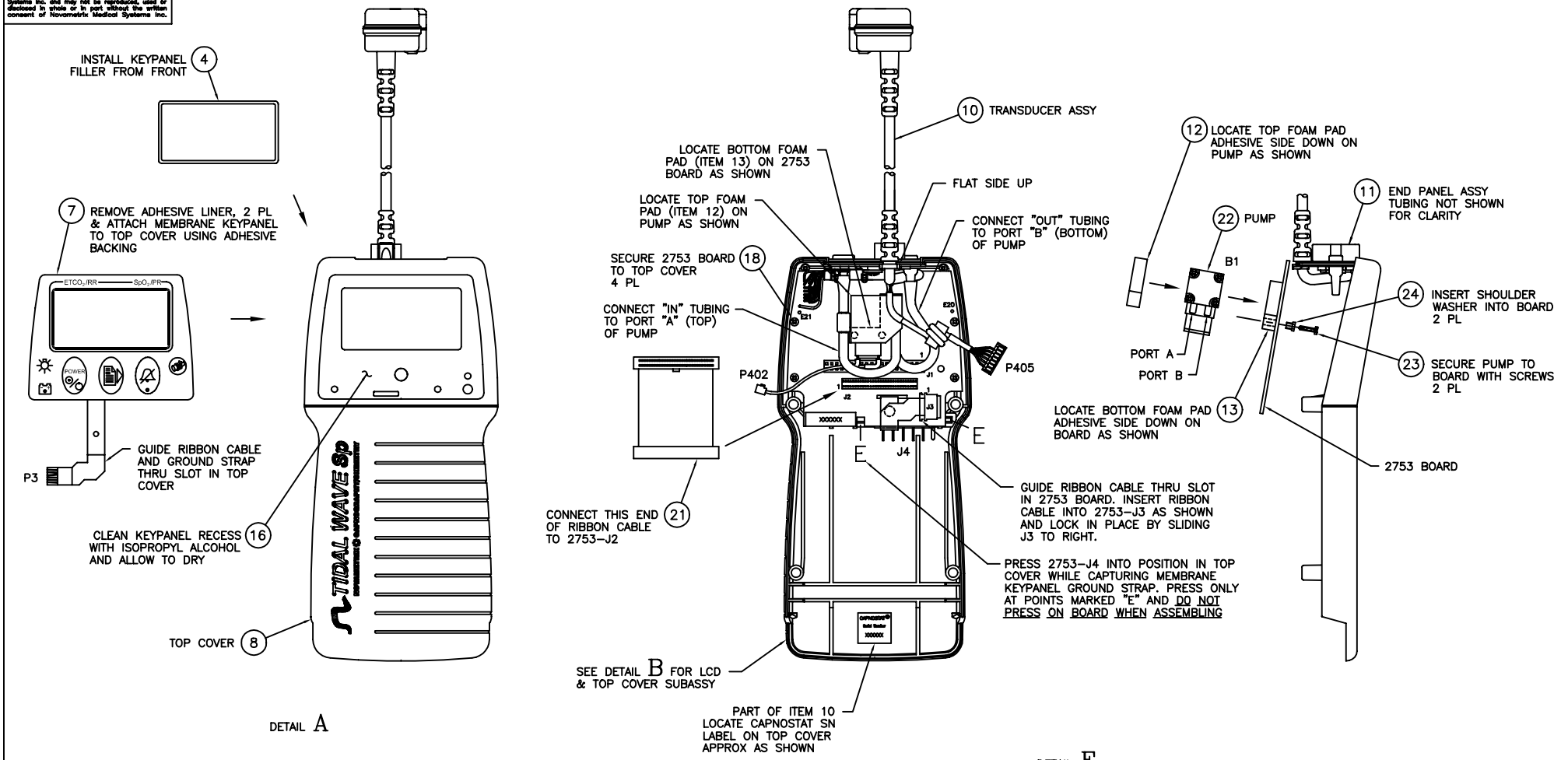

01	N631	1Feb99
REV	R NO.	DATE

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
TOLERANCES
X ±.02
.XX ±.01
.XXX ±.005
.XXXX ±.0010
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

TITLE: MAIN ASSY, MODEL 715 – TIDAL WAVE Sp

DRAWN BL 17Jun98 | CHECKED JHT 10/12/98
MFG ENGR MJC 10/12/98 | APPROVED AJE 12Oct98
USED ON: D9146-00

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	9146	01	01

SCALE: 1/1 SHEET 2 OF 3

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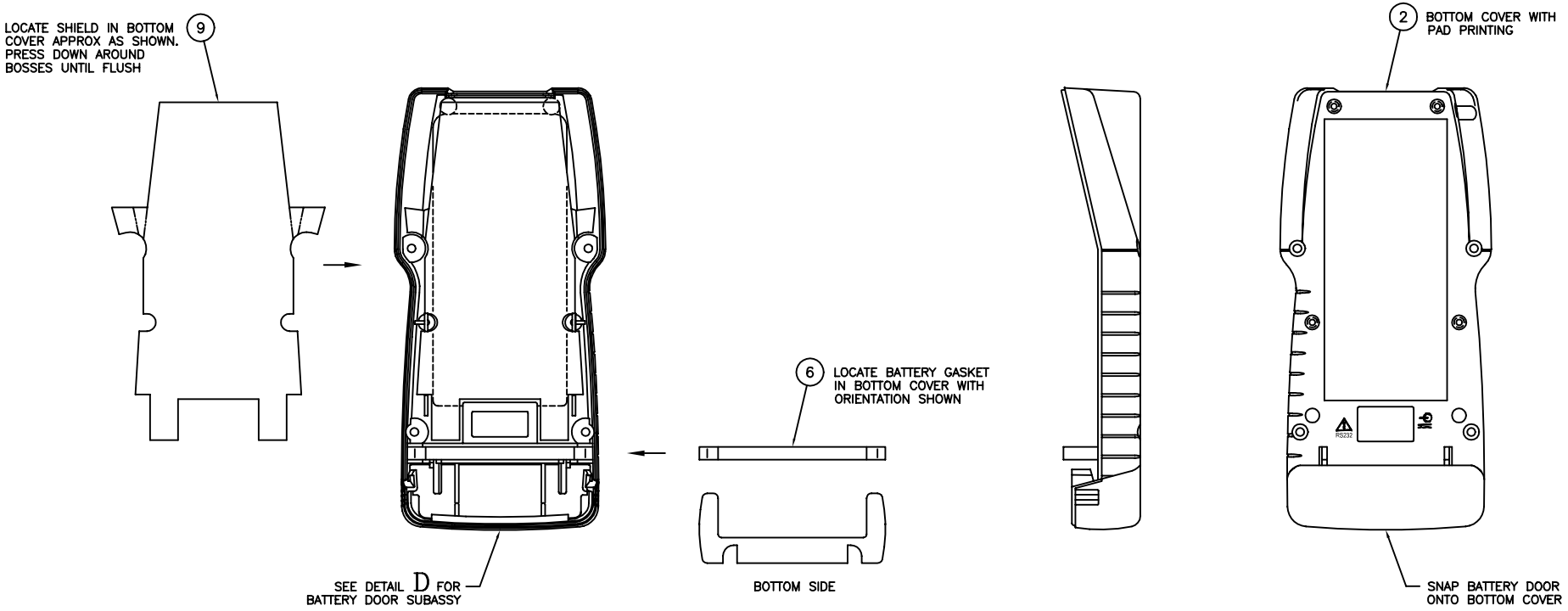
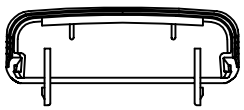
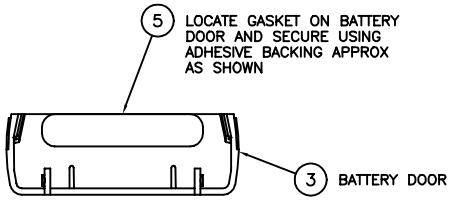




DETAIL C



DETAIL D

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES	TITLE: MAIN ASSY, MODEL 715 – TIDAL WAVE Sp	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492
			TOLERANCES: X ±.02, .XX ±.01, .XXX ±.005, .XXXX ±.0010, FRAC ±1/64, ANG ±1/4°	DRAWN BL 11Aug98; CHECKED JHT 10/12/98; MFG ENGR MJC 10/12/98; APPROVED AJE 12Oct98	SIZE D; DRAWING NO. 9146; CODE 01; REV 01
			MATERIAL: ~		
01	N631	1Feb99	FINISH: ~	USED ON: D9146-00	SCALE: 1/1; SHEET 3 OF 3
REV	R NO.	DATE			

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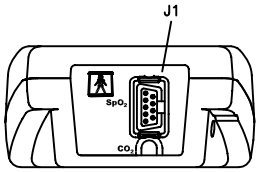
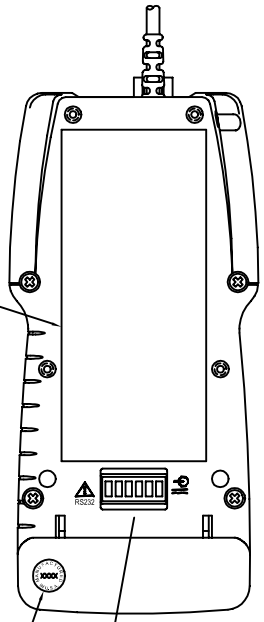
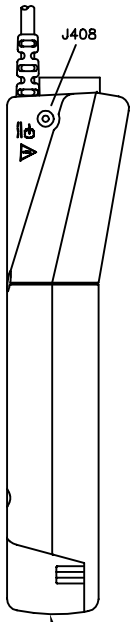


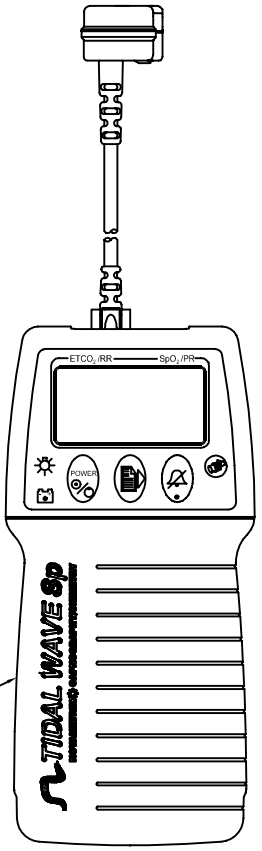


LOCATE QUICK GUIDE LABEL (13) ON BOTTOM COVER. NOTE ORIENTATION

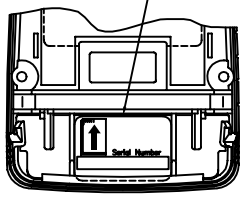
LOCATE MANUFACTURED IN USA LABEL ON BOTTOM COVER APPROX AS SHOWN. (4)



SEE DETAIL A FOR SN LABEL LOCATION



MAIN ASSY (5)



(1) LOCATE SN LABEL INSIDE BOTTOM COVER NOTE ORIENTATION

DETAIL A

NOTES:

1. FOR SYSTEM TEST PROCEDURE SEE A9110-04.
2. FOR QA TEST PROCEDURE SEE A9110-70.
3. FOR OVERALL WIRING DIAGRAM SEE D9110-09.
4. THE FOLLOWING ITEMS ARE TO BE INCLUDED WITH MONITOR. REFER TO SHIPPING INSTRUCTIONS.
   A. ITEM 8: USERS MANUAL; QTY: 1
   B. ITEM 14: INSTRUCTION SHEET WARNING LABEL, AC POWER SUPPLY; QTY: 1

REV	R NO.	DATE
04	N657	21Apr99
03	N639	9Feb99
02	N639	8Feb99
01	N631	27Jan99

DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES
TOLERANCES
X ±.06
.XX ±.01
.XXX ±.005
.XXXX ±.0010
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

TITLE: ETCO2 WITH SPO2, MODEL 710 – TIDAL WAVE Sp

DRAWN BDG 18Jun98 | CHECKED JAT 10/12/98
MFG ENGR TJC 120ct98 | APPROVED AJE 120ct98
USED ON: ~

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	9110	00	04

SCALE: 1/1 SHEET 1 OF 1

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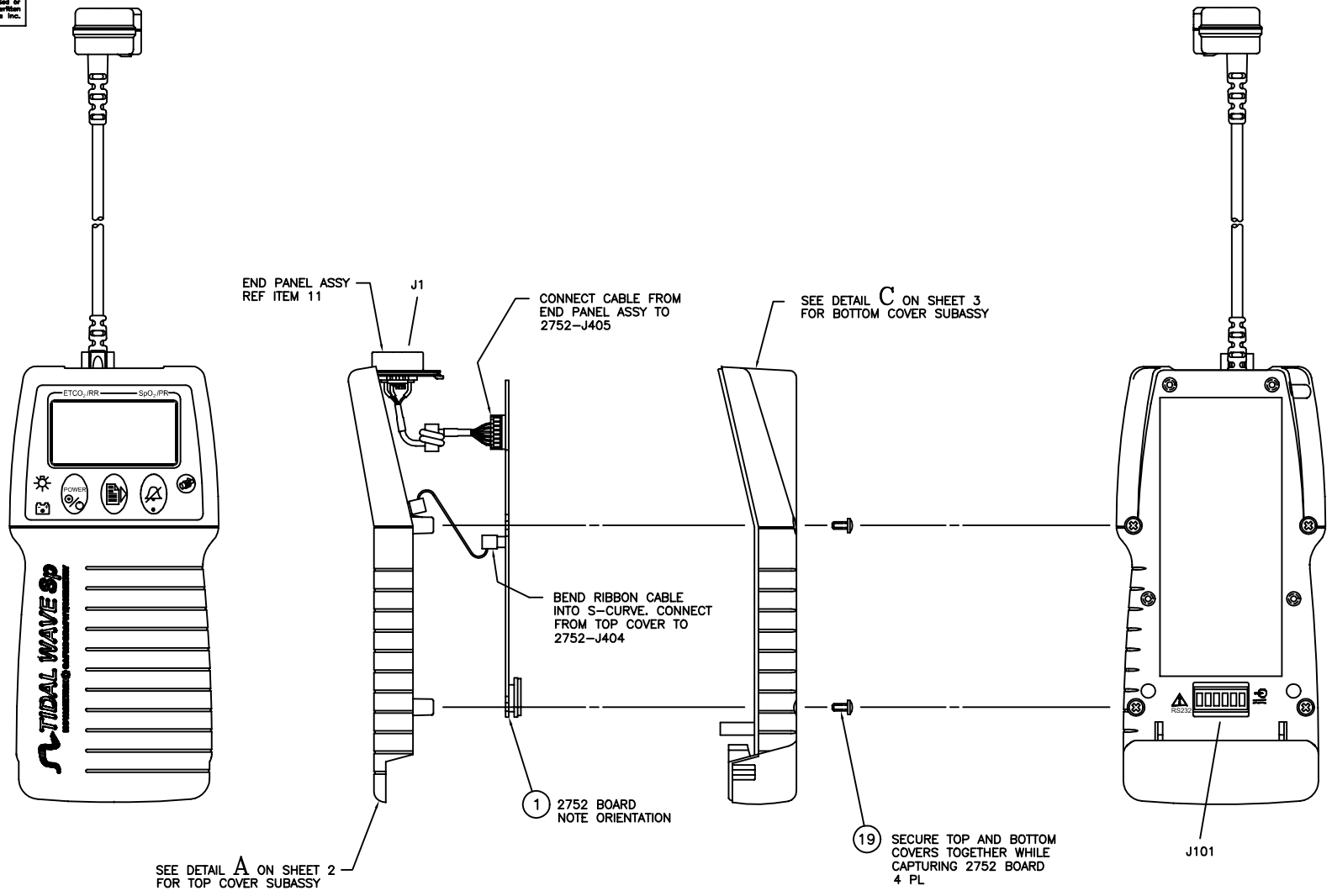

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES	TITLE: MAIN ASSY, MODEL 710 – TIDAL WAVE Sp	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492
			TOLERANCES: X ±.02, .XX ±.01, .XXX ±.005, .XXXX ±.0010, FRAC ±1/64, ANG ±1/4°	DRAWN BGS 17Jun98 / CHECKED JHT 10/12/98	
			MATERIAL: ~	MFG ENGR TJC 120ct98 / APPROVED AJE 120ct98	SIZE D / DRAWING NO. 9110 / CODE 01 / REV 01
01	N631	1Feb99	FINISH: ~	USED ON: D9110-00	SCALE: 1/1 / SHEET 1 OF 3
REV	R NO.	DATE			

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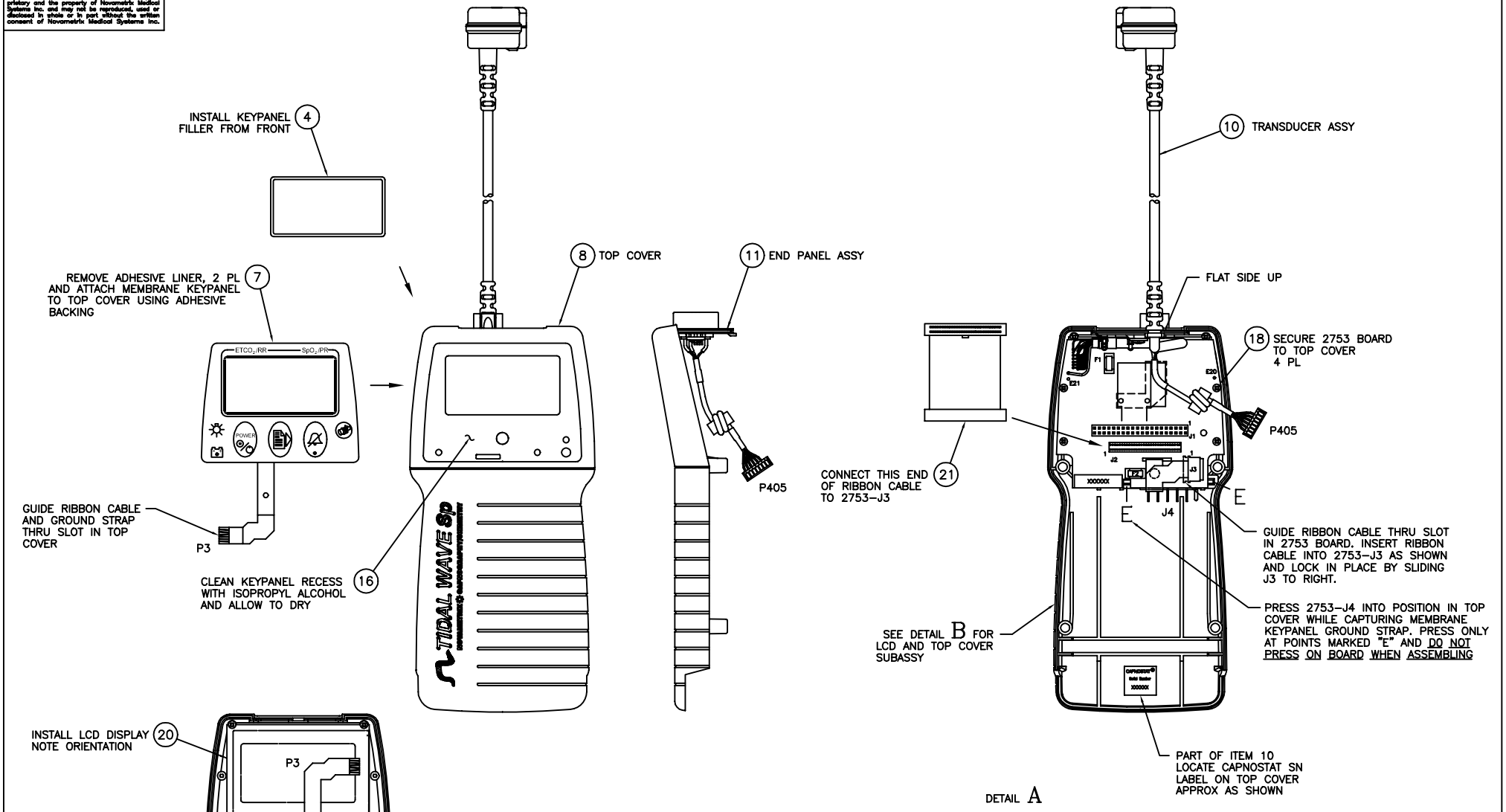

01	N631	1Feb99
REV	R NO.	DATE

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
TOLERANCES
X ±.02
.XX ±.01
.XXX ±.005
.XXXX ±.0010
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

TITLE: MAIN ASSY, MODEL 710 – TIDALWAVE Sp

DRAWN: BGG 17Jun98 | CHECKED: JAT 10/12/98
MFG ENGR: TJC 120ct98 | APPROVED: AJE 120ct98
USED ON: D9110-00

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	9110	01	01

SCALE: 1/1 SHEET 2 OF 3

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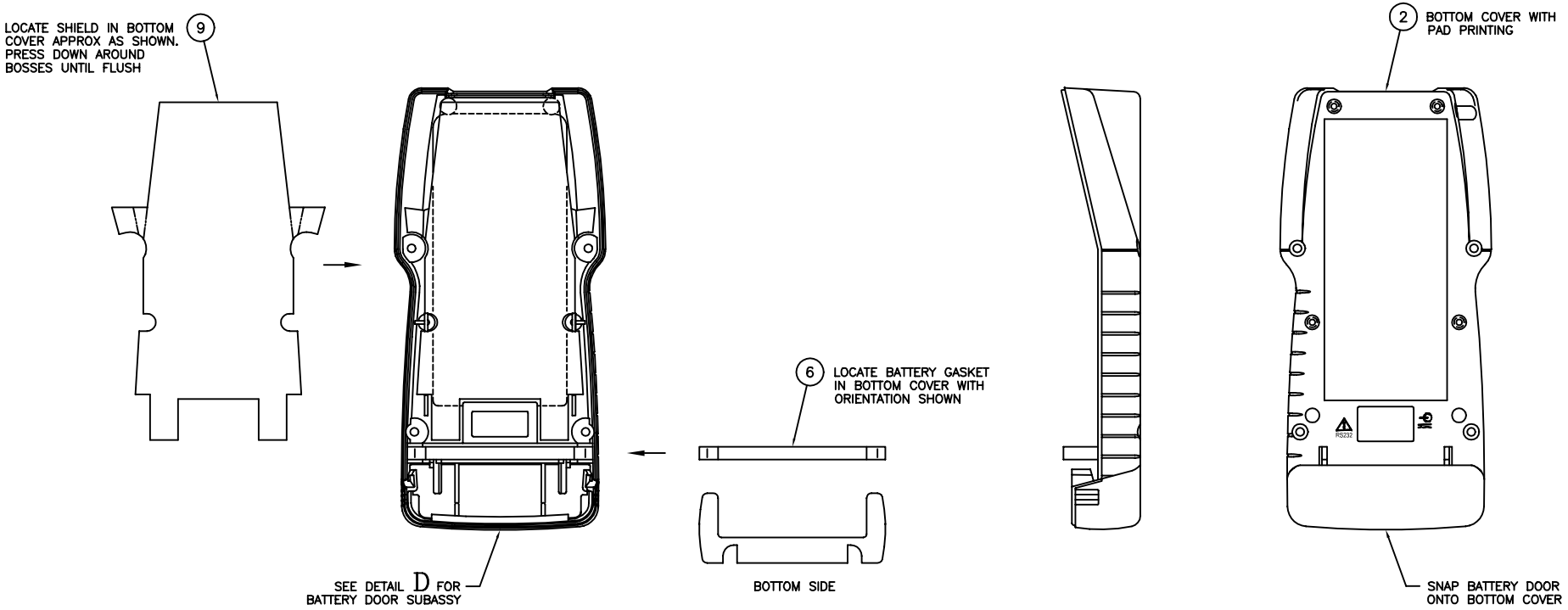
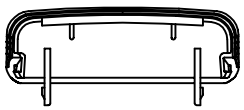
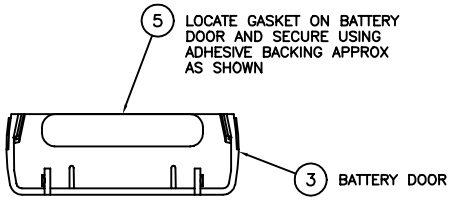




DETAIL C



DETAIL D

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES	TITLE: MAIN ASSY, MODEL 710 – TIDAL WAVE Sp	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492
			TOLERANCES: X ±.02, .XX ±.01, .XXX ±.005, .XXXX ±.0010, FRAC ±1/64, ANG ±1/4°	DRAWN: BGS 17Jun98 / CHECKED: JHT 10/12/98	
			MATERIAL: ~	MFG ENGR: TJC 120ct98 / APPROVED: AJE 120ct98	SIZE: D / DRAWING NO.: 9110 / CODE: 01 / REV: 01
01	N631	1Feb99	FINISH: ~	USED ON: D9110-00	SCALE: 1/1 / SHEET 3 OF 3
REV	R NO.	DATE			

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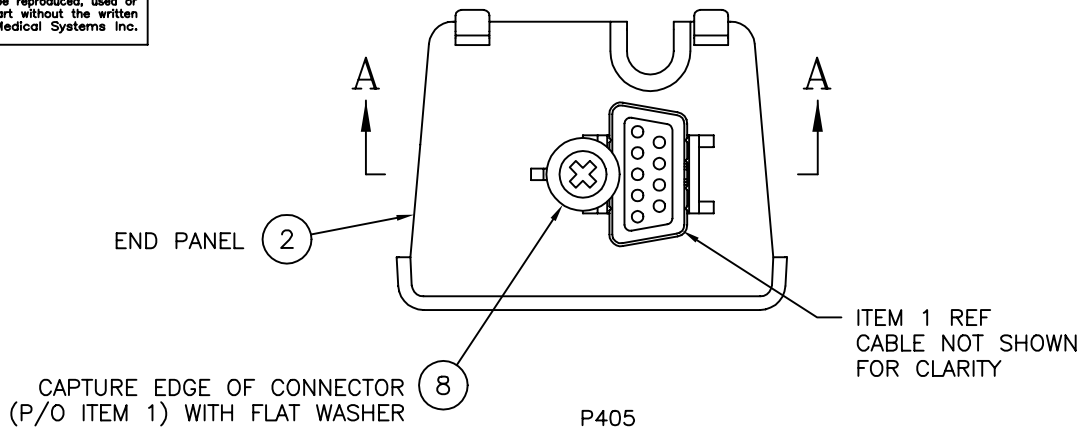

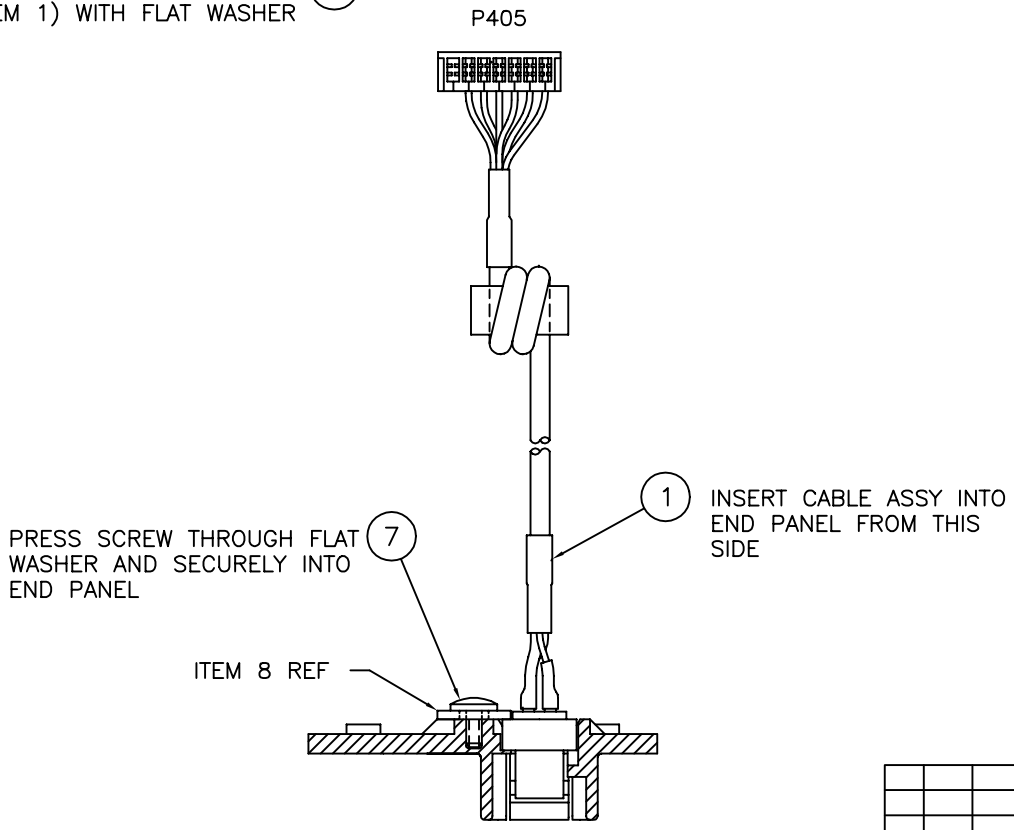

SECTION A—A

01	N631	1Feb99
REV	R NO.	DATE

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
.X ±.02 TOLERANCES
.XX ±.01
.XXX ±.005 FRAC ±1/64
.XXXX ±.0010 ANG ±1/4°

MATERIAL ~

FINISH ~

TITLE
END PANEL ASSY,
MODEL 710 – TIDAL
WAVE Sp

DRAWN RGG 22Jun98	CHECKED MRL 21Aug98
MFG ENGR TJC 27Aug98	APPROVED AJE 21Aug98
USED ON: D9110-01	

NOVAMETRIX
MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
C	9212	01	01

SCALE: 2/1 SHEET 1 OF 1

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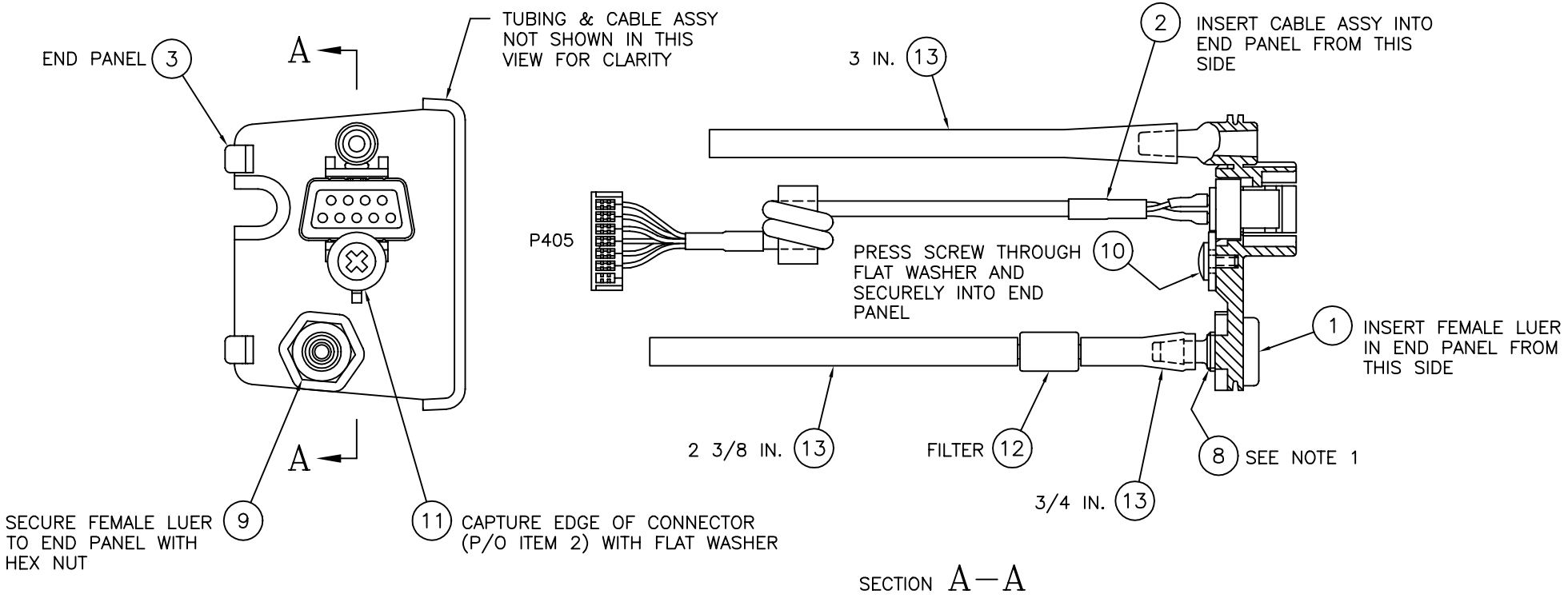

SECTION A–A

NOTES:

1. AFTER SECURING FEMALE LUER TO END PANEL, APPLY A SMALL DROP OF ADHESIVE (ITEM 8) TO THE EXPOSED THREADS OF FEMALE LUER (ITEM 1). DO NOT ALLOW ADHESIVE TO COME IN CONTACT WITH END PANEL.

REV	R NO.	DATE
01	N631	1Feb99

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
TOLERANCES
.X ±.02
.XX ±.01
.XXX ±.005
.XXXX ±.0010
FRAC ±1/16
ANG ±1/4°

MATERIAL ~

FINISH ~

TITLE
END PANEL ASSY, MODEL 715 – TIDAL WAVE Sp

DRAWN	CHECKED
RGG 31Jul98	JAT 9/9/98
MFG ENGR TJC 09Sep98	APPROVED AJE 09Sep98

USED ON: D9146-01

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
C	9213	01	01

SCALE: 2/1 SHEET 1 OF 1

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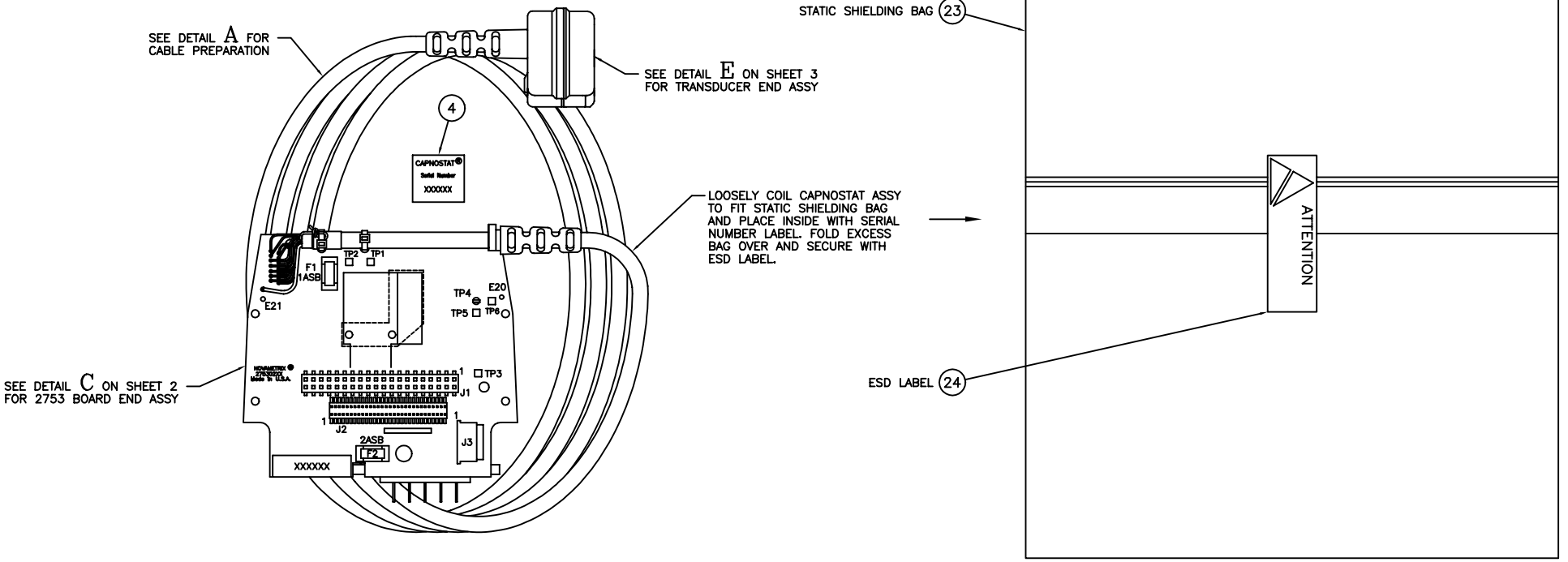

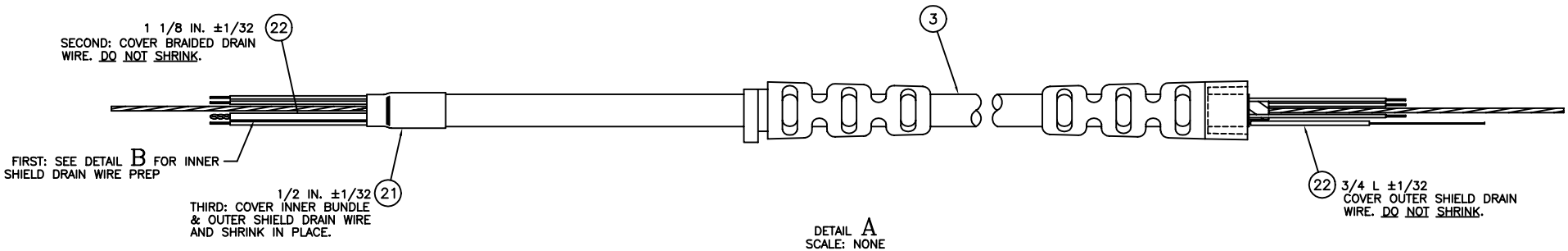

DETAIL A
SCALE: NONE

TWIST THE OUTER AND INNER SHIELD DRAIN WIRES TOGETHER ALONG THEIR ENTIRE LENGTH. TIN THE TIP APPROX 1/8 AND TRIM THE DRAIN WIRE TO THE SAME LENGTH AS OTHER WIRES

DETAIL B
SCALE: NONE

NOTES:
1. FOR OVERALL WIRING DIAGRAM SEE D9208-09.
2. FOR TEST PROCEDURE SEE A9208-04.

REV	R NO.	DATE
01	N657	21Apr99

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
TOLERANCES
X ±.02
.XX ±.01
.XXX ±.005
.XXXX ±.0010
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

TITLE
TRANSDUCER ASSY, CAPNOSTAT III, MODEL 710 & 715

DRAWN BGS 23May98
CHECKED MRL
MFG ENGR TJC 20Aug98
APPROVED AJE 20Aug98
USED ON: 9110-01 & 9146-01

NOVAMETRIX
MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	9208	01	01

SCALE: NONE
SHEET 1 OF 3

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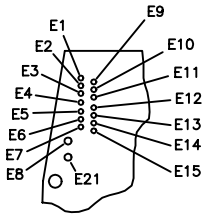
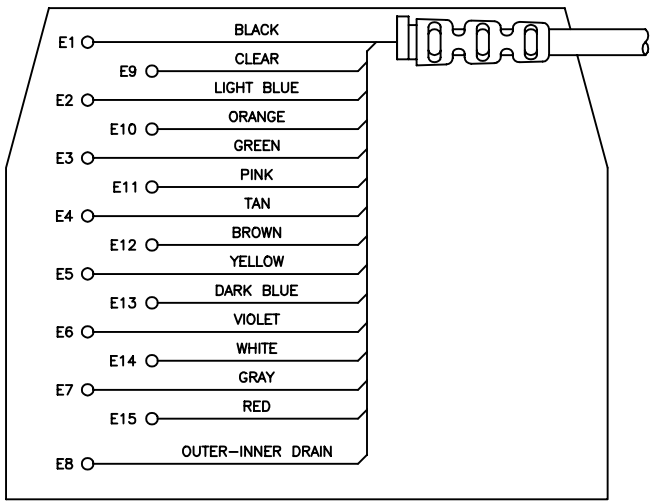
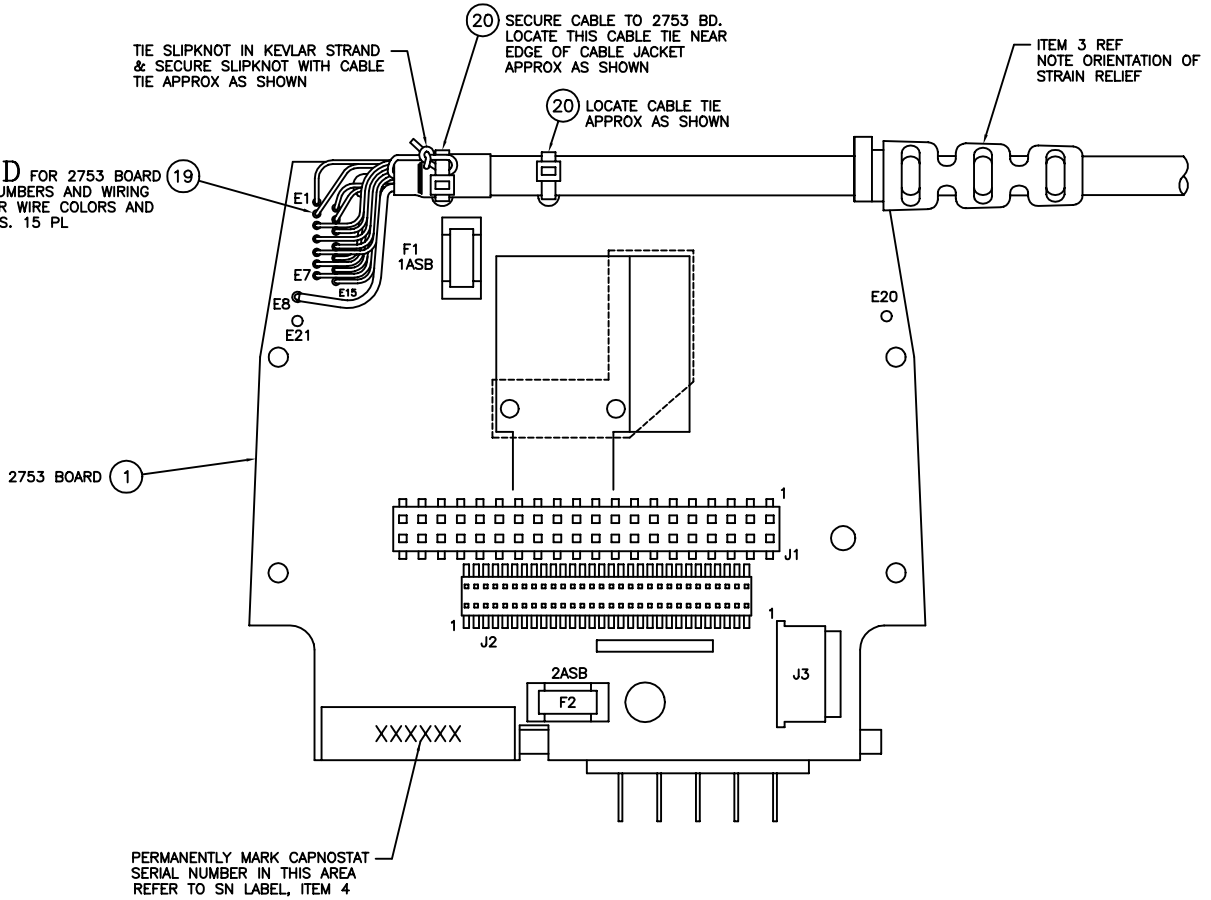


DETAIL D
SCALE: NONE



WIRING DIAGRAM



DETAIL C
SCALE: NONE

01	N657	21Apr99
REV	R NO.	DATE

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
TOLERANCES
X ±.02
.XX ±.01
.XXX ±.005
.XXXX ±.0010
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

TITLE
TRANSDUCER ASSY, CAPNOSTAT III, MODEL 710 & 715

DRAWN BGS 29May98
CHECKED MRL
MFG ENGR TJC 20Aug98
APPROVED AJE 20Aug98
USED ON 9110-01 & 9146-01

NOVAMETRIX
MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	9208	01	01

SCALE: NONE
SHEET 2 OF 3

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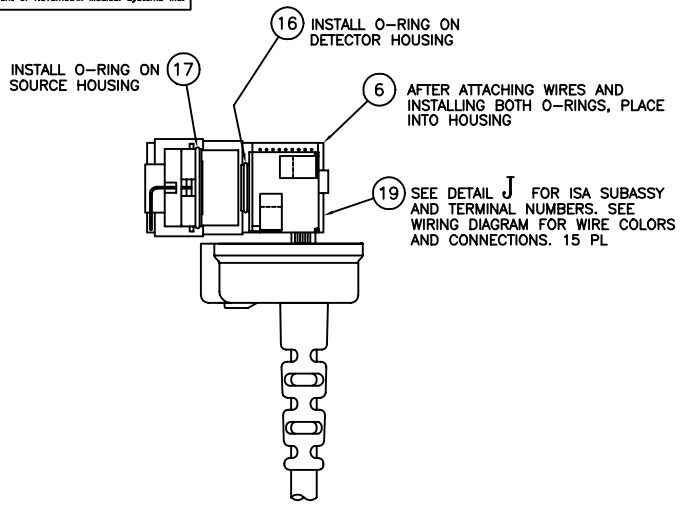
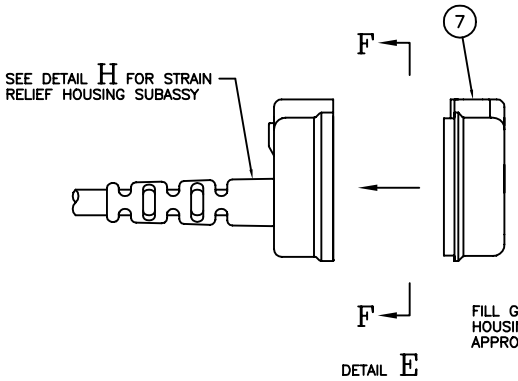
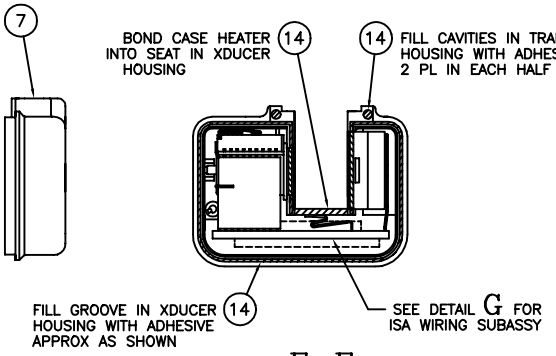


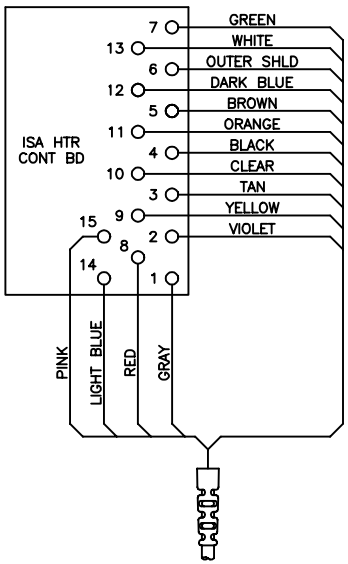
DETAIL G



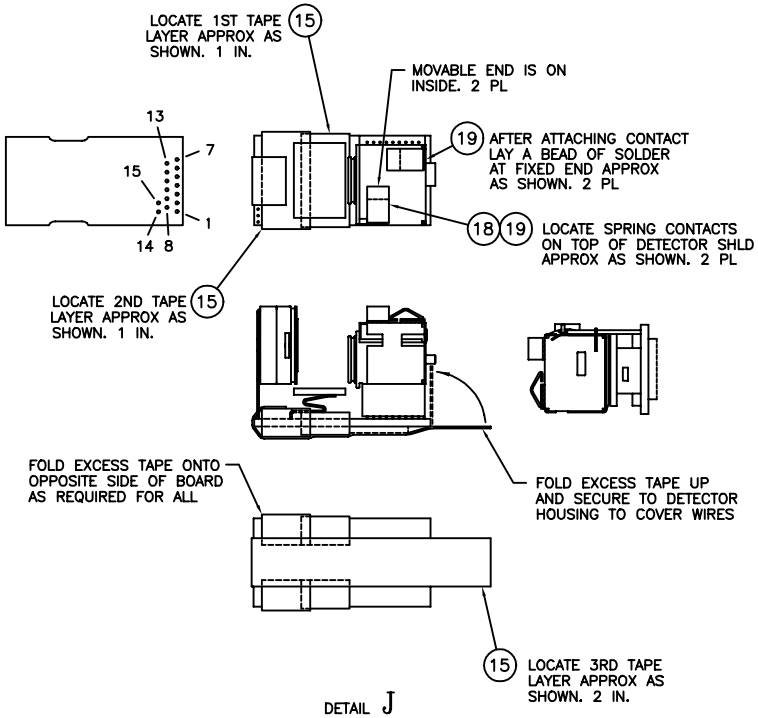
DETAIL E



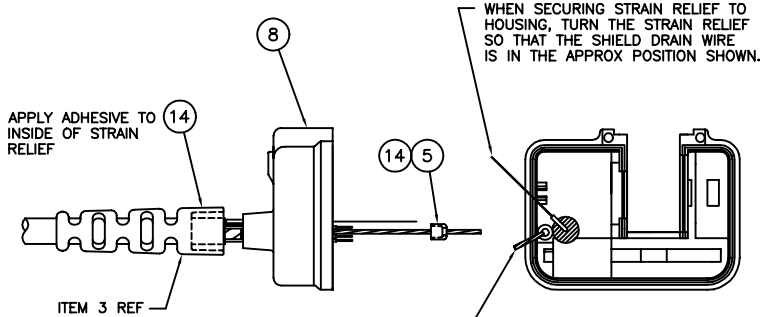
VIEW F-F



WIRING DIAGRAM



DETAIL J



DETAIL H

NOTE: SOME WIRES NOT SHOWN FOR CLARITY.

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES TOLERANCES DEC ± ~ (mm) (± ~) FRAC ± ~ (mm) (± ~) HOLES +.007 -.003 (mm) (± ~) ANG ± ~	TITLE: TRANSDUCER ASSY, CAPNOSTAT III, MODEL 710 & 715		NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492	
				DRAWN BGS 23May98	CHECKED MRL		
			MATERIAL ~	MFG ENGR TJC 20Aug98	APPROVED AJE 20Aug98	SIZE D	DRAWING NO. 9208 CODE 01 REV 01
01	N657	21Apr99	FINISH ~	USED ON: 9110-01 & 9146-01		SCALE: 2/1	SHEET 3 OF 3
REV	R NO.	DATE					

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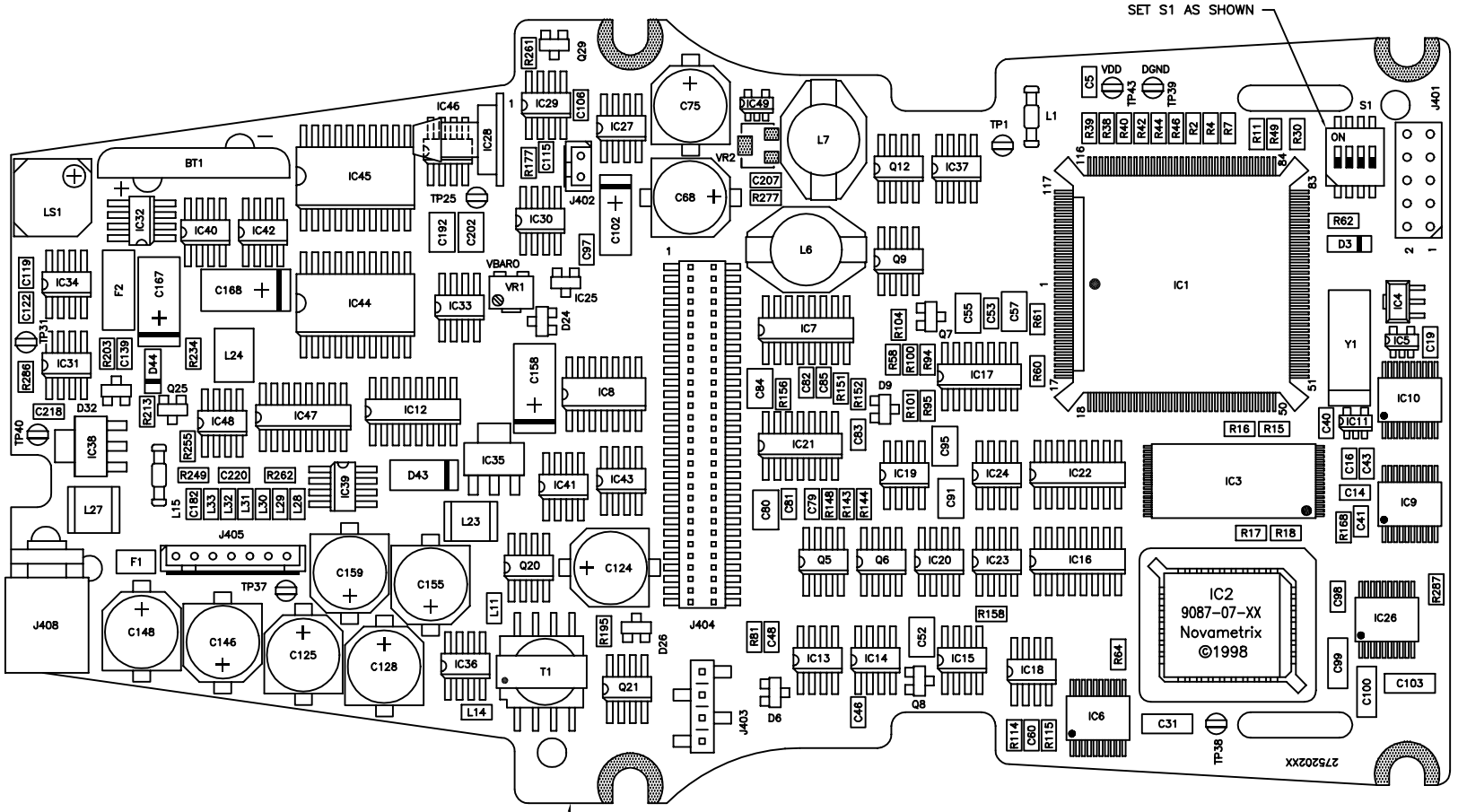

NOTES:
1. COMPONENTS NOT FITTED: D44, J401, R279, R280, R288, VR2.
2. FOR TEST PROCEDURE SEE A2752-04.

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES	TITLE: MAIN BOARD ASSY, MODEL 710 & 715 - TIDAL WAVE SP	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492		
			TOLERANCES: .X ±.05, .XX ±.01, .XXX ±.005, .XXXX ±.0025, FRAC ±1/64, ANG ±1/2°	DRAWN: BL 13May98	CHECKED: MRL 18Sep98	SIZE: D	DRAWING NO.: 2752
			MATERIAL: ~	MFG ENGR: ~	APPROVED: AJE 9/18/98	CODE: 01	REV: 01
01	N617	6Nov98	FINISH: ~	USED ON: 9110-01 9146-01	SCALE: 4/1	SHEET 1 OF 3	
REV	R NO.	DATE					

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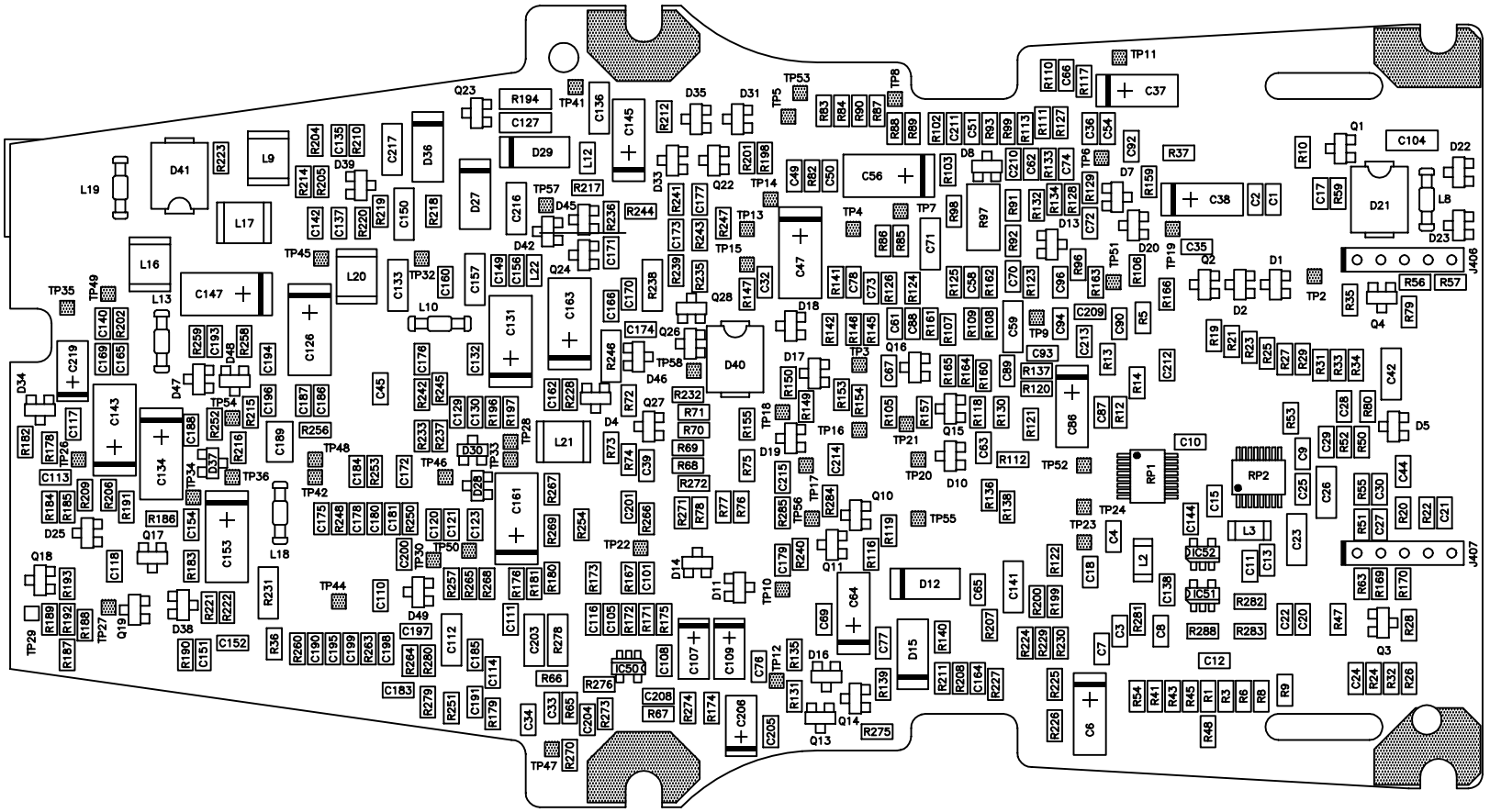

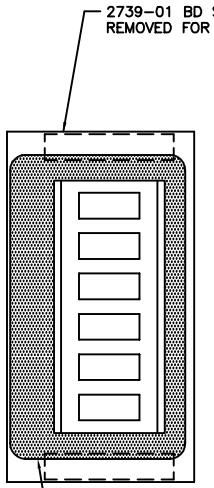

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
TOLERANCES
X ±.06
.XX ±.01
.XXX ±.005
.XXXX ±.0025
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

REV	R NO.	DATE
01	N617	6Nov98

TITLE
MAIN BOARD ASSY,
MODEL 710 & 715 -
TIDAL WAVE SP

DRAWN BL 13May98
CHECKED MRL 18Sep98
MFG ENGR ~
APPROVED AJE 9/18/98
USED ON 9110-01 9146-01
SCALED 4/1
SHEET 2 OF 3

NOVAMETRIX
MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	2752	01	01

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PN	DESCRIPTION	REF DES
B2739-01	BATTERY & COMM INTERFACE BOARD ASSY	(FOR J406, J407)
2752-02	FAB, MAIN BOARD, MODEL 710 & 715	~
B2752-03	SCHEMATIC, MAIN BOARD	~
A2752-04	TEST PROCEDURE, MAIN BOARD	~
B6837-10	GASKET, CONNECTOR CRADLE	(FOR 2739-J101)
A9087-07	PROGRAM, FLASH PEROM W BOOT CODE & SYS	IC2
130017	TRANSDUCER, AUDIO, 2300 Hz, 3V, 70mA	LS1
152096	CAPACITOR, 220uF, 35V, 20%, ELECTROLYTIC	C68, C75, C124, C125, C128, C146, C148, C155, C159
154072	CAPACITOR, .1uF, 50V, 10%, X7R	C23, C26, C31, C42, C59, C71, C99, C100, C103, C104, C112, C127, C133, C136, C141, C150, C157, C203
154079	CAPACITOR, 10uF, 25V, 10%, TANTALUM	C6, C37, C38, C64, C86, C102, C145
154081	CAPACITOR, 100pF, 100V, 10%, CERAMIC	C216, C217
154086	CAPACITOR, 4.7uF, 10VDC, 20%, TANTALUM	C107, C109, C206, C219
154093	CAPACITOR, 68uF, 16VDC, 10%, TANTALUM	C47, C56, C131, C153, C158, C161, C163, C167, C168
154095	CAPACITOR, 22uF, 20VDC, 10%, TANTALUM	C126, C147
154103	CAPACITOR, .001uF, 50VDC, 10%, X7R	C51, C139
154104	CAPACITOR, .01uF, 50VDC, 10%, X7R	C25, C41, C48, C49, C54, C60, C66, C70, C72, C74, C77, C78, C81, C83, C85, C92, C95, C105, C108, C114, C118, C140, C162, C172, C173, C176, C177, C201
154105	CAPACITOR, 47pF, 50VDC, 5%, NPO	C90, C94, C171, C174, C182, C193
154106	CAPACITOR, 22pF, 50VDC, 5%, NPO	C27, C30
154108	CAPACITOR, 100pF, 50VDC, 5%, MULTILAYER	C1-C5, C11-C15, C18, C20, C22, C24, C28, C29, C212-C215, C220
154111	CAPACITOR, .1uF, 16VDC, 5%, 1210 CASE	C52, C55, C57, C80, C84, C91, C95, C189, C192, C202
154112	CAPACITOR, .047uF, 16VDC, 10%, X7R	C7-C10, C16, C17, C19, C21, C32-C36, C39, C40, C43-C46, C50, C53, C58, C61-C63, C65, C67, C69, C73, C76, C79, C82, C87-C89, C93, C97, C98, C101, C106, C110, C111, C113, C115-C117, C119-C123, C129, C130, C132, C135, C138, C142, C144, C149, C151, C152, C154, C156, C160, C164-C166, C169, C170, C175, C178-C181, C183-C188, C190, C191, C194-C200, C204, C205, C208-C211, C218
154113	CAPACITOR, 4700pF, 50VDC, 10%, X7R	C137, C207
154116	CAPACITOR, 10uF, 35V, 10%	C134, C143

PN	DESCRIPTION	REF DES
180020	INDUCTOR, 100uH, 10%	L24
180022	INDUCTOR, 10uH, 10%	L9, L16, L17, L20, L21, L23
180029	INDUCTOR, 50M Hz CUT-OFF FREQUENCY	L2, L3
180030	INDUCTOR-CAP, 4700pF, 50VDC, 2A, 3 TERMINAL	L1, L8, L10, L13, L15, L18, L19
180043	FERRITE BEAD, 30 OHMS @ 100M Hz	L11, L12, L14, L22
180045	INDUCTOR, 220uH, 20%, .53 OHM, 15% DCR	L6, L7
180054	INDUCTOR, 1.5k OHMS @ 100M Hz, 1.5A	L27
180056	FERRITE BEAD, 120 OHMS @ 100M Hz	L28-L33
☆210141	CONNECTOR, DC POWER JACK	J408
☆211233	CONNECTOR, 2 PIN, HEADER, .079 SPACING	J402
211425	CONNECTOR, 4 PIN, HEADER, STRAIGHT, .1 SP	J403
☆211721	CONNECTOR, 7 PIN, HEADER, .079 SPACING	J405
213900	CONNECTOR, 60 PIN, HEADER, .05 X .1 SPACING	J404
215073	SOCKET, PLCC, 32 PIN, .05 SPACING	(FOR IC2)
☆216029	TEST POINT, SPRING LOADED, 475'C MAX	TP1, TP25, TP31, TP37-TP40, TP43
230024	CRYSTAL, 32.768k Hz	Y1
☆400047	BATTERY, 3V, 190m AH, LITHIUM, VERTICAL	BT1
474194	RESISTOR, 2.2M OHM, 1/16W, 5%	R121, R137
474197	RESISTOR, 49.9k OHM, 1/16W, 1%	R92, R103, R111, R113, R127, R129, R141, R142, R151, R152, R195, R198, R217
474198	RESISTOR, 2.49k OHM, 1/16W, 1%	R108, R109, R125, R126
474199	RESISTOR, 16.5k OHM, 1/16W, 1%	R192
474204	RESISTOR, 11.5k OHM, 1/16W, 1%	R232, R241
474213	RESISTOR, 10.2k OHM, 1/16W, 1%	R277
474222	RESISTOR, 10 OHM, 1/16W, 1%	R167, R191, R248, R250, R260, R263
474224	RESISTOR, 100 OHM, 1/16W, 1%	R1-R4, R6-R9, R11-R19, R21, R23, R25, R27, R29, R31, R33-R35, R37, R38, R39, R47, R50, R52, R63, R66, R96, R98, R104-R106, R114, R122, R132, R139, R157, R159, R163, R166, R173, R175, R179, R185, R190, R193, R209, R240, R256, R269, R270-R272, R281, R284-R286
474225	RESISTOR, 499 OHM, 1/16W, 1%	R81, R82, R123, R140, R160, R164, R202
474227	RESISTOR, 1k OHM, 1/16W, 1%	R36, R74-R79, R147, R155, R169, R170, R196, R218, R219, R239, R247, R252, R255, R258, R276, R287
474229	RESISTOR, 2.05k OHM, 1/16W, 1%	R62, R203, R205, R206
474230	RESISTOR, 3.32k OHM, 1/16W, 1%	R117, R134, R254, R267
474231	RESISTOR, 4.99k OHM, 1/16W, 1%	R20, R22, R107, R124, R228
474233	RESISTOR, 10k OHM, 1/16W, 1%	R40-R46, R48, R49, R53, R54, R56-R61, R68-R72, R83-R91, R100, R102, R168, R171, R172, R174, R178, R182, R183, R185, R189, R201, R211, R223, R234, R253, R265, R275
474234	RESISTOR, 20.5k OHM, 1/16W, 1%	R115, R133
474235	RESISTOR, 24.9k OHM, 1/16W, 1%	R93, R112, R130, R184, R187, R235, R243, R266

PN	DESCRIPTION	REF DES
474236	RESISTOR, 33.2k OHM, 1/16W, 1%	R118, R136, R188, R237, R245
474238	RESISTOR, 37.4k OHM, 1/16W, 1%	R213
474239	RESISTOR, 75k OHM, 1/16W, 1%	R67, R150, R180, R181, R273
474240	RESISTOR, 100k OHM, 1/16W, 1%	R5, R10, R24, R26, R28, R30, R32, R73, R95, R110, R116, R120, R128, R131, R138, R148, R149, R156, R226, R230, R233, R242, R249, R257, R259, R261, R262, R268
474241	RESISTOR, 150k OHM, 1/16W, 1%	R65, R101, R177, R215, R221, R229, R251, R264
474242	RESISTOR, 249k OHM, 1/16W, 1%	R51
474243	RESISTOR, 324k OHM, 1/16W, 1%	R216, R222
474245	RESISTOR, 1M OHM, 1/16W, 1%	R99, R119, R135, R161, R165, R225
474247	RESISTOR, 10M OHM, 1/16W, 5%	R55
474249	RESISTOR, 215 OHM, 1/16W, 1%	R176
474250	RESISTOR, 43.2k OHM, 1/16W, 1%	R143
474251	RESISTOR, 61.9k OHM, 1/16W, 1%	R94, R204, R274
474256	RESISTOR, 0 OHM, 0603 STYLE	R158, R162, R214, R282, R283
474257	RESISTOR, 1 OHM, .5W, 1%, 2010 SIZE	R97
474259	RESISTOR, 15k OHM, 1/16W, 1%	R80, R146, R154, R220
474261	RESISTOR, 7.5k OHM, 1/16W, 1%	R145, R153, R236, R244
474265	RESISTOR, 1 OHM, 1/4W, 1%	R278
474266	RESISTOR, 4.75k OHM, 1/8W, 1%	R194
474269	RESISTOR, 121k OHM, 1/16W, 1%	R144
474270	RESISTOR, 200k OHM, 1/16W, 1%	R64, R207, R224, R227
474283	RESISTOR, 392k OHM, 1/16W, 1%	R212
474284	RESISTOR, 115 OHM, 1/16W, 1%	R197
474294	RESISTOR, 237k OHM, 1/16W, 1%	R200
474295	RESISTOR, 5.62 OHM, 1/8W, 1%	R246
474296	RESISTOR, 3.32 OHM, 1/8W, 1%	R238
474297	RESISTOR, 26.7 OHM, 1/8W, 1%	R231
474298	RESISTOR, 34k OHM, 1/16W, 1%	R208
474299	RESISTOR PACK, 10k OHM, 15 RESISTOR	RP1, RP2
474332	RESISTOR, 6.04k OHM, 1/16W, 1%	R210
474333	RESISTOR, 210k OHM, 1/16W, 1%	R199
475045	E2 POTENTIOMETER, 10k OHM, 20%	IC32
475052	POTENTIOMETER, 1k OHM, 10%, MULTI-TURN	VR1
481546	DIODE, MMBD914L, SWITCHING	D4, D5, D7, D25, D26, D30-D35, D37, D39, D42, D45, D46
481547	DIODE, BAT54, HOT CARRIER SCHOTTKY	D1, D2, D8, D9
481549	DIODE, MBRS140T3, RECTIFIER	D12, D15, D27, D29, D36, D43
481552	DIODE, MBRS340T3, SCHOTTKY, 40V, 3A	D21, D40, D41
481554	DIODE, BAV70LT1, DUAL COMMON CATHODE, 70V	D6, D10, D17, D20, D49
481555	DIODE, MMBD7000LT1, DUAL SWITCHING	D11, D13, D14, D16, D18, D19, D22-D24, D28, D38, D47, D48
482551	LED, RED, WITH LENS	D3

PN	DESCRIPTION	REF DES
483019	TRANSISTOR, MMBT2907ALT1, PNP, SOT-23	Q18
484080	TRANSISTOR, MMBT3904T, NPN	Q17
484061	TRANSISTOR, MMBT2222ALT1, NPN	Q25
484541	VOLTAGE REGULATOR, LM317LD	IC42
484562	IC, LT1175CS8-ADJ, MICROPOWER REGULATOR	IC39, IC40
484563	IC, LT1117CST, VOLTAGE REGULATOR, ADJUSTABLE	IC35, IC38
484567	VOLTAGE REGULATOR, LT1372CS8, 35V, 8 PIN	IC36
484569	VOLTAGE REGULATOR, LT1375CS8-5, 8 PIN	IC41
484573	VOLTAGE REGULATOR, MIC5205BM5, 150mA	IC49
485532	TRANSISTOR, 2N7002T1, N-CHAN ENHAN MODE	Q1-Q4, Q7, Q8, Q10, Q11, Q13-Q16, Q19, Q22, Q23, Q26, Q28, Q29
485541	TRANSISTOR, SI4947DY, MOSFET, DUAL P-CHAN	Q9, Q12, Q20
485543	TRANSISTOR, SI9939DY, MOSFET, N-CH & P-CH	Q5, Q6, Q21
485546	TRANSISTOR, VN0605T, N-CHAN ENHAN MODE	Q24, Q27
486049	IC, MC68332GCFC20, 20M Hz, 132 PIN	IC1
486051	IC, TC551001BFL-85L, 131k X 8 BIT RAM	IC3
486321	IC, SN74HC138D, 3-LINE TO 8-LINE DECODER	IC12
486324	IC, DG444DY, QUAD SPST CMOS ANALOG SWITCH	IC47
486332	IC, AD7703BR, 20-BIT A TO D CONVERTER	IC44, IC45
486346	IC, TC7S00FTE85L, 2-IN NAND GATE, CMOS	IC5, IC11, IC51, IC52
486348	IC, MM74HC4040M, 12-STAGE BINARY COUNTER	IC7
486359	IC, LT1384CG, RS232 TRANSCEIVER, 20 PIN	IC26
486360	IC, SN74AHCT573DB, OCTAL D-TYPE LATCH	IC9, IC10
486781	IC, TL072CD, JFET INPUT OP AMP, LOW NOISE	IC43
486785	IC, LP339M, QUAD VOLTAGE COMPARATOR	IC17
486790	IC, TLE2022CD, DUAL OP AMP, HI SPEED, L PWR	IC15, IC24, IC27, IC34
486796	IC, TLC2272CD, DUAL OP AMP, RAIL TO RAIL	IC18, IC20
486805	IC, LM393M, DUAL VOLTAGE COMP, LOW PWR	IC37
486807	IC, SMP04ES, QUAD SAMPLE & HOLD AMP	IC16
486823	IC, LT1490CS8, RAIL TO RAIL OP AMP, 14 PIN	IC23, IC29, IC31
486825	IC, LMC7101BIM5X, OP AMP, LOW POWER	IC50
486826	IC, LTC1448CSB, DUAL 12-BIT D TO A CONV	IC33
486827	IC, TLC2543CDB, 12-BIT A TO D CONV	IC6
486828	IC, LT1460HCS3-2.5, uPOWER SERIES REF	IC25
486829	IC, LTC1590CS, DUAL 12-BIT X D TO A CONV	IC22
486830	IC, TL034ACD, QUAD OP AMP, LOW POWER	IC21
487078	IC, AD712JR, DUAL BIFET OP AMPLIFIER	IC46, IC48
487100	IC, TC1426COA, INV DUAL MOSFET DRVR, 1.2A	IC19
487103	IC, TC4405COA, DUAL OD FET DRVR, NON-INV	IC14
487104	IC, TC4404COA, DUAL OD FET DRVR, INV, 1.5A	IC13
487115	IC, AD620BR, INSTR AMPLIFIER, L POWER, 8 PIN	IC30
487129	IC, CPC15AFH, ABSOLUTE PRESSURE SNSR, 15PSI	IC28
487132	IC, TL7757CPK, SUPPLY VOLTAGE REGULATOR	IC4
487133	IC, RTC-4553B, REAL TIME CLOCK, 14 PIN	IC8
513010	SWITCH, SLIDE, SPDT, 4 SWITCHES, .050 SPACING	S1
515077	FUSE, 1/16A, 125V, VERY FAST-ACTING	F2
515092	FUSE, 3A, 32V, VERY FAST-ACTING, 1206 STYLE	F1
560009	TRANSFORMER, 10uH 20% @ .1VRMS, 100k Hz	T1

☆ DENOTES THRU HOLE COMPONENTS

REV	R NO.	DATE
01	N617	6Nov98

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
TOLERANCES
X ±.02
.XX ±.01
.XXX ±.005
.XXXX ±.0025
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

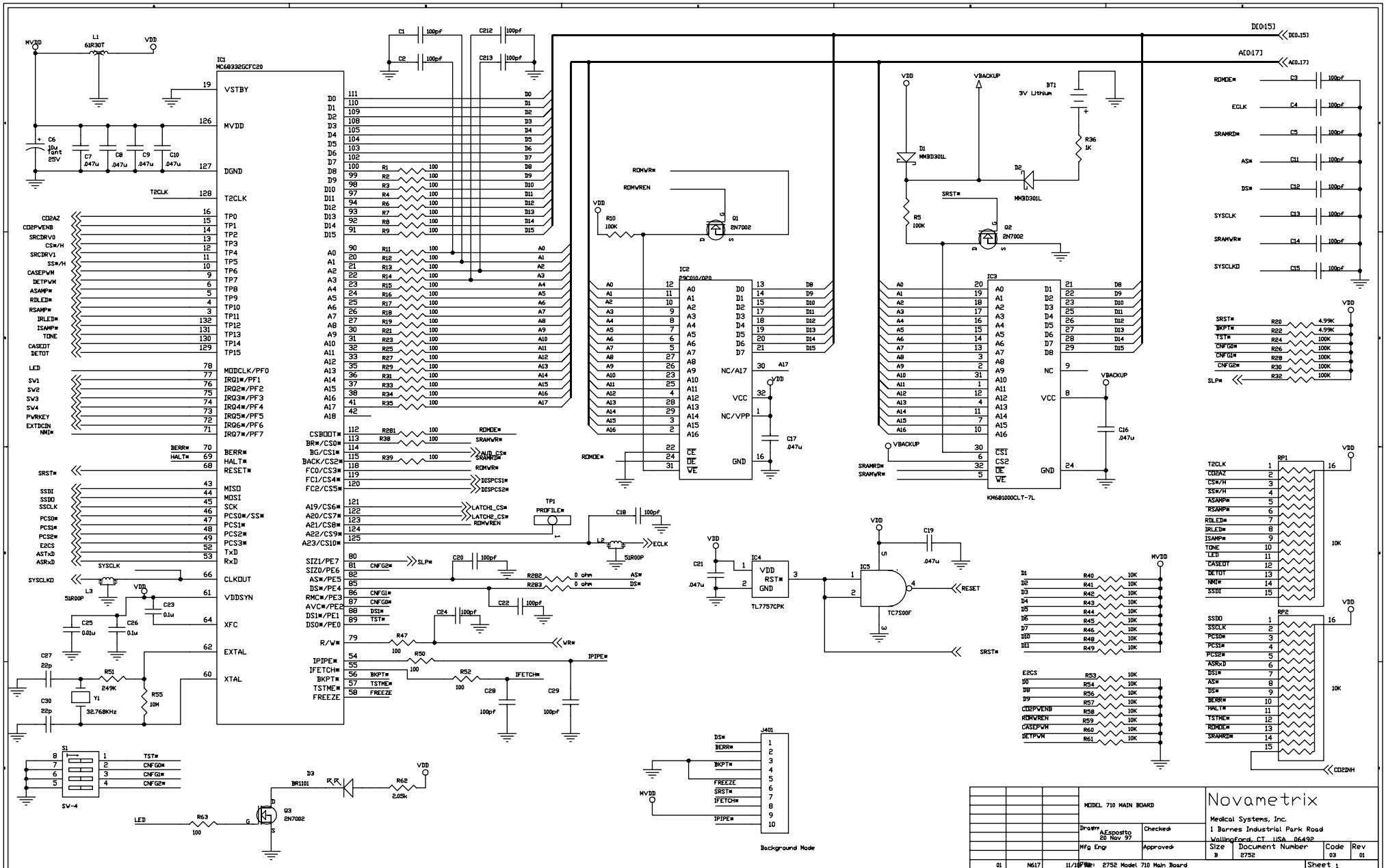
TITLE: MAIN BOARD ASSY, MODEL 710 & 715 - TIDAL WAVE SP

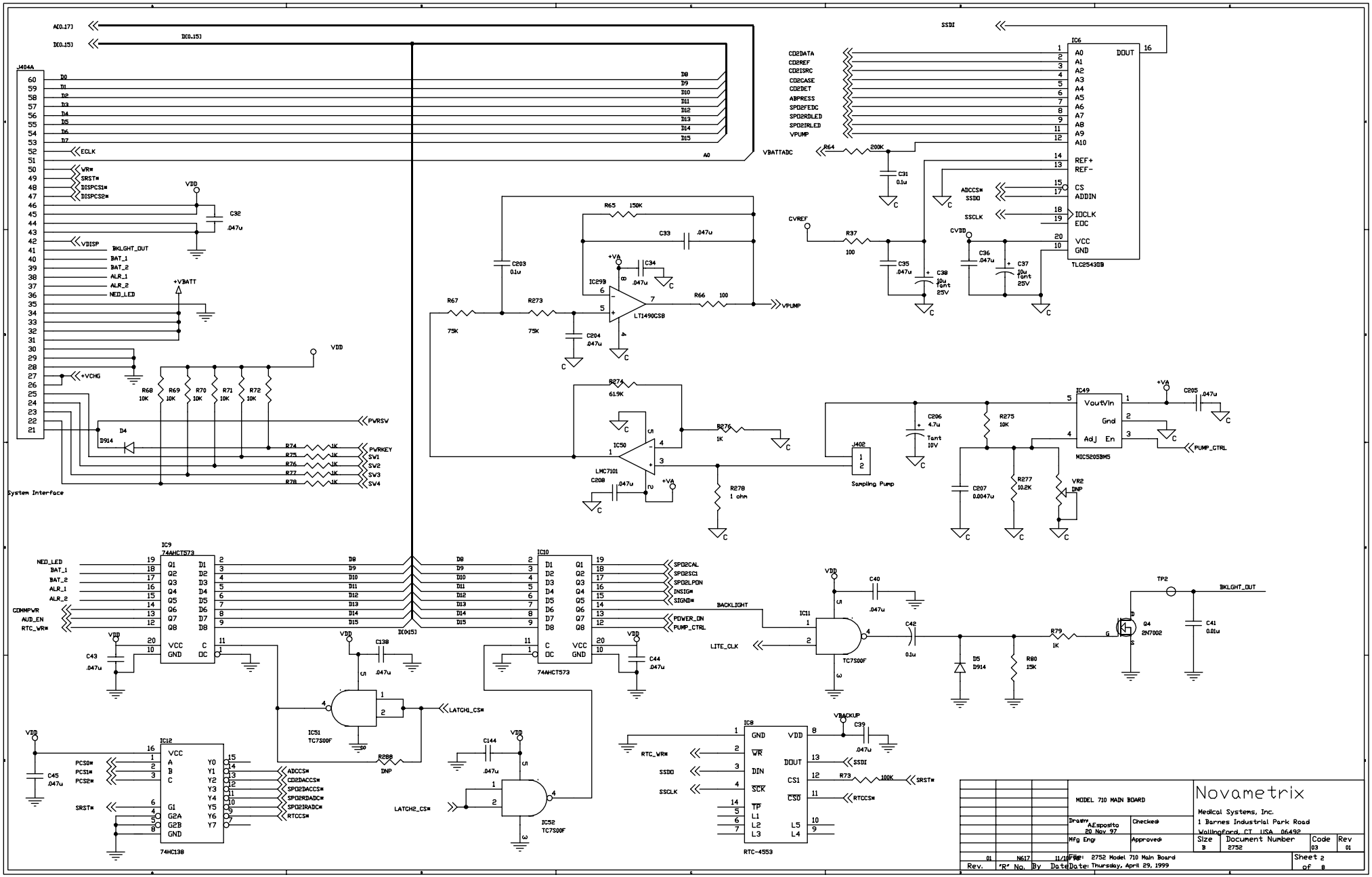
DRAWN BL 13May98 | CHECKED MRL 18Sep98
MFG ENGR ~ | APPROVED AJE 9/18/98
USED ON: 9110-01 9146-01

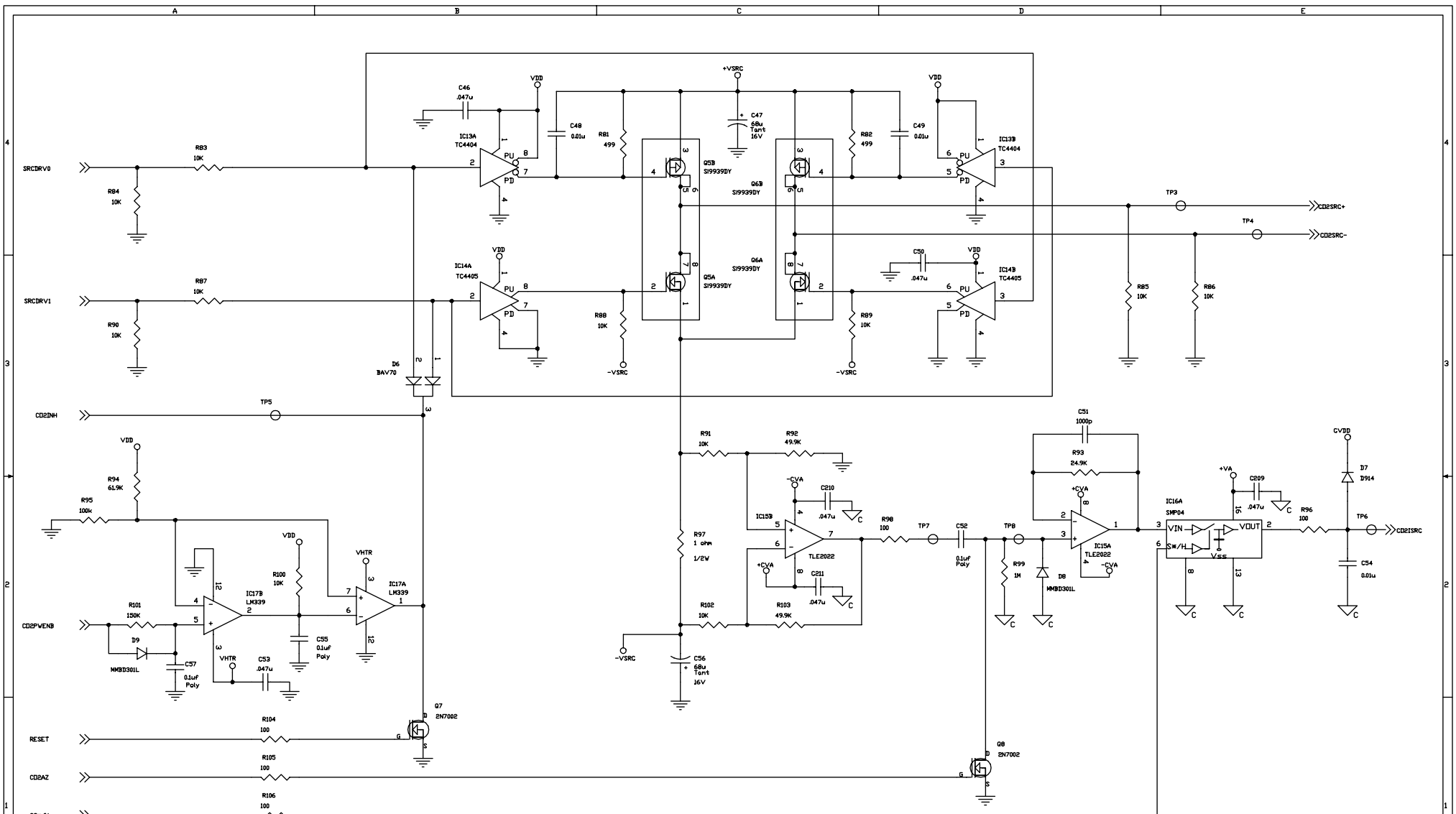
NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

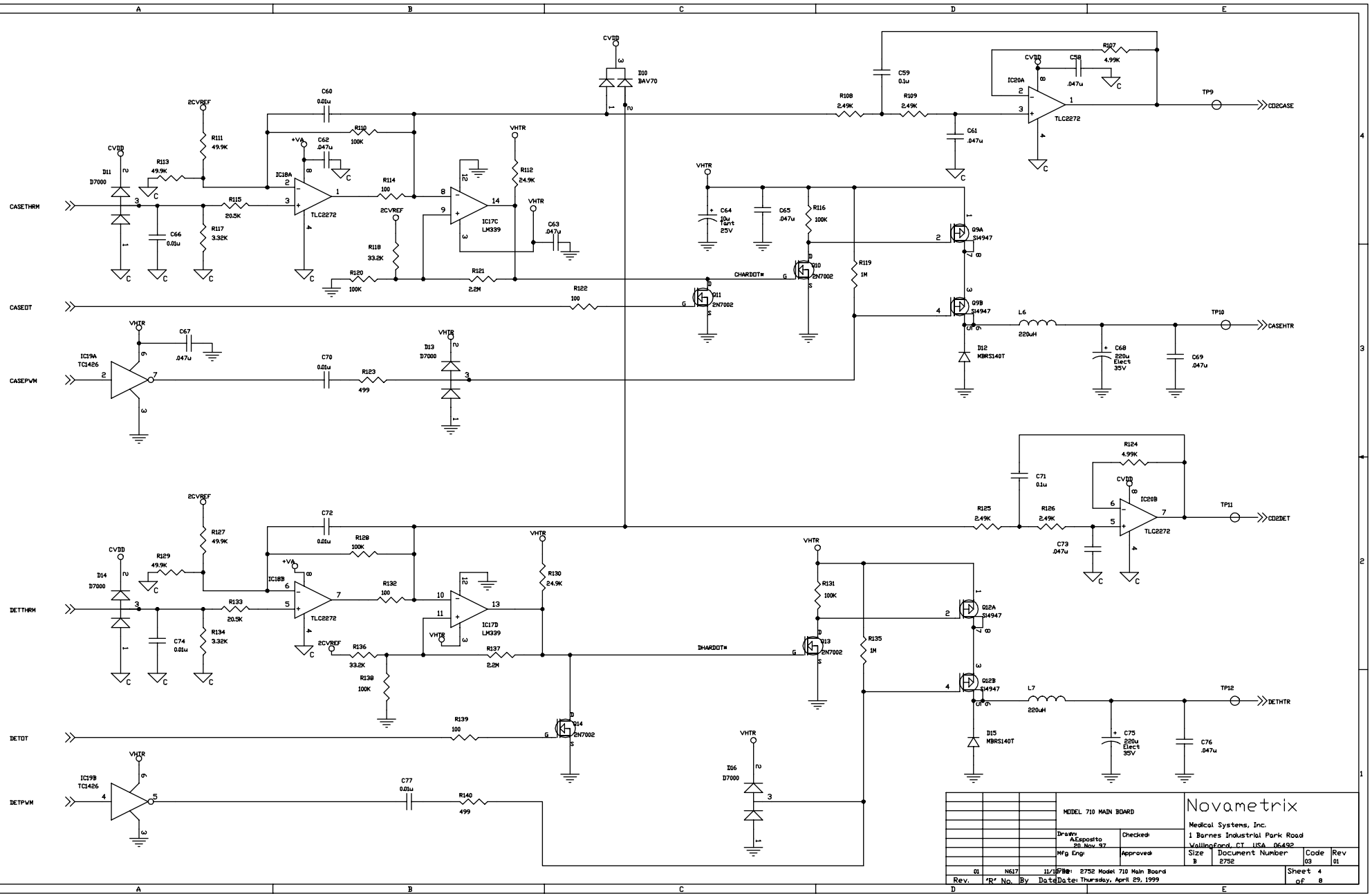
SIZE	DRAWING NO.	CODE	REV
D	2752	01	01

SCALE: NONE | SHEET 3 OF 3


MODEL 710 MAIN BOARD
Novametrix
Medical Systems, Inc.
1 Barnes Industrial Park Road
Wallingford, CT USA 06492
Drawn AEsposito 20 Nov 97
Checked
Mfg Eng
Approved
Size B
Document Number 2752
Code 03
Rev 01
Rev. 01 "R" No. N617 By 11/10/98 Date: 2752 Model 710 Main Board
Date: Thursday, April 29, 1999
Sheet 1 of 8
IC1 MC68332EGFC20
IC2 29C010/020
IC3 KM681000CLT-7L
IC4 TL7757CPK
IC5 TC7S00F
SW-4
Background Mode


A0..17]
D0..15]
J404A
ECLK
VR#
SRST#
DISPCS1#
DISPCS2#
VDISP
BKLGHT_OUT
BAT_1
BAT_2
ALR_1
ALR_2
NED_LED
+VBATT
+VCHG
PWRSW
PWRKEY
SW1
SW2
SW3
SW4
System Interface
IC6
TLC2543DB
SSDI
SSDO
SSCLK
ADCCS#
RTCCS#
VBATTADC
CVREF
CVDD
VPUMP
IC29B
LT1490CS8
IC50
LMC7101
Sampling Pump
IC49
MIC5205BM5
PUMP_CTRL
IC9
IC10
74AHCT573
SPD2CAL
SPD2SCL
SPD2LPDN
INSIG#
SIGND#
POWER_ON
PUMP_CTRL
IC11
TC7S00F
BACKLIGHT
LITE_CLK
Q4
2N7002
TP2
IC12
74HC138
PCS0#
PCS1#
PCS2#
ADCCS#
CD2DACCS#
SPD2RDADC#
SPD2IRADC#
RTCCS#
IC51
IC52
LATCH1_CS#
LATCH2_CS#
IC8
RTC-4553
RTC_WR#
SSDO
SSCLK
SSDI
SRST#
RTCCS#
VBACKUP
Novametrix
Medical Systems, Inc.
1 Barnes Industrial Park Road
Wallingford, CT USA 06492
MODEL 710 MAIN BOARD
Drawn: AEsposito 20 Nov 97
Checked:
Mfg Eng:
Approved:
Size: B
Document Number: 2752
Code: 03
Rev: 01
Rev. 01 'R' No. N617 By 11/10 Date
File: 2752 Model 710 Main Board
Date: Thursday, April 29, 1999
Sheet 2 of 8


SRCDRV0
SRCDRV1
CD2INH
CD2PWENB
RESET
CD2AZ
CS#/H
R83 10K
R84 10K
R87 10K
R90 10K
R88 10K
R89 10K
R85 10K
R86 10K
R81 499
R82 499
C46 .047u
C48 0.01u
C49 0.01u
C47 68u Tant 16V
C50 .047u
IC13A TC4404
IC13B TC4404
IC14A TC4405
IC14B TC4405
Q5B SI9939DY
Q6B SI9939DY
Q5A SI9939DY
Q6A SI9939DY
D6 BAV70
+VSRC
-VSRC
VDD
TP3
TP4
CD2SRC+
CD2SRC-
TP5
R91 10K
R92 49.9K
R97 1 ohm 1/2W
R102 10K
R103 49.9K
C56 68u Tant 16V
C210 .047u
C211 .047u
IC15B TLE2022
IC15A TLE2022
-CVA
+CVA
R98 100
TP7
C52 0.1uF Poly
TP8
R99 1M
D8 MMBD301L
C51 1000p
R93 24.9K
IC16A SMP04
VIN
VOUT
S/H
Vss
+VA
C209 .047u
CVDD
D7 D914
R96 100
TP6
CD2ISRC
C54 0.01u
R94 61.9K
R95 100k
R100 10K
R101 150K
IC17B LM339
IC17A LM339
VHTR
C55 0.1uF Poly
C53 .047u
D9 MMBD301L
C57 0.1uF Poly
Q7 2N7002
Q8 2N7002
R104 100
R105 100
R106 100
MODEL 710 MAIN BOARD
Novametrix
Medical Systems, Inc.
1 Barnes Industrial Park Road
Wallingford, CT USA 06492
Drawn: A Esposito 26 Nov 97
Checked:
Mfg Eng:
Approved:
Size B
Document Number 2752
Code 03
Rev 01
Title: 2752 Model 710 Main Board
Date: Thursday, April 29, 1999
Sheet 3 of 8
Rev. 'R' No. By Date
01 N617 11/17


CVDD
D10
BAV70
2CVREF
R111
49.9K
C60
0.01u
R110
100K
C62
.047u
VHTR
R112
24.9K
C63
.047u
R113
49.9K
D11
D7000
CASETHRM
R115
20.5K
R117
3.32K
C66
0.01u
IC18A
TLC2272
R114
100
IC17C
LM339
R118
33.2K
R120
100K
R121
2.2M
R122
100
CASEDT
C59
0.1u
R108
2.49K
R109
2.49K
C61
.047u
IC20A
TLC2272
C58
.047u
R107
4.99K
TP9
CD2CASE
C64
10u
Tant
25V
C65
.047u
R116
100K
CHARDOT#
Q10
2N7002
Q11
2N7002
R119
1M
Q9A
SI4947
Q9B
SI4947
L6
220uH
TP10
CASEHTR
D12
MBRS140T
C68
220u
Elect
35V
C69
.047u
IC19A
TC1426
CASEPVM
C67
.047u
C70
0.01u
R123
499
D13
D7000
R124
4.99K
C71
0.1u
IC20B
TLC2272
R125
2.49K
R126
2.49K
C73
.047u
TP11
CD2DET
R127
49.9K
C72
0.01u
R128
100K
R129
49.9K
D14
D7000
DETTHRM
R133
20.5K
R134
3.32K
C74
0.01u
IC18B
TLC2272
R132
100
IC17D
LM339
R130
24.9K
R136
33.2K
R138
100K
R137
2.2M
DHARDOT#
R131
100K
Q13
2N7002
R135
1M
Q12A
SI4947
Q12B
SI4947
L7
220uH
TP12
DETHTR
D15
MBRS140T
C75
220u
Elect
35V
C76
.047u
DETDT
Q14
2N7002
R139
100
IC19B
TC1426
DETPVM
C77
0.01u
R140
499
D16
D7000
MODEL 710 MAIN BOARD
Novametrix
Medical Systems, Inc.
1 Barnes Industrial Park Road
Wallingford, CT USA 06492
Drawn: AEsposito 20 Nov 97
Checked:
Mfg Eng:
Approved:
Size B
Document Number 2752
Code 03
Rev 01
Rev. 01 'R' No. N617 By 11/19/99 Date
Title: 2752 Model 710 Main Board
Date: Thursday, April 29, 1999
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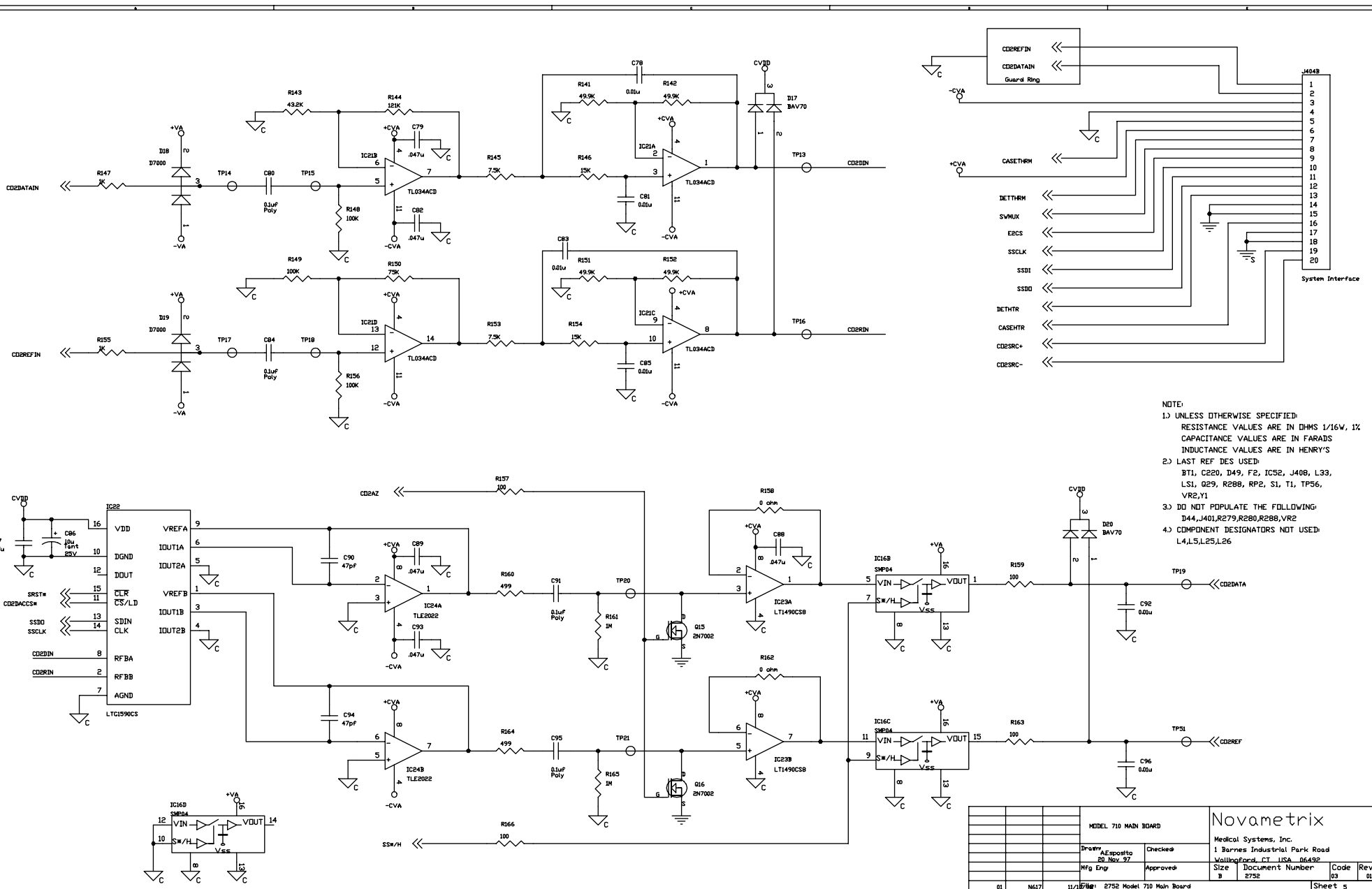
CD2REFIN
CD2DATAIN
Guard Ring
J404B
System Interface
CASETHRM
DETTHRM
SWMUX
E2CS
SSCLK
SSDI
SSDO
DETHTR
CASEHTR
CD2SRC+
CD2SRC-
CD2DATAIN
CD2REFIN
CD2DIN
CD2RIN
TL034ACD
IC21A
IC21B
IC21C
IC21D
D17 BAV70
D18 D7000
D19 D7000
R143 43.2K
R144 121K
R145 7.5K
R146 15K
R147 1K
R148 100K
R149 100K
R150 75K
R151 49.9K
R152 49.9K
R153 7.5K
R154 15K
R155 1K
R156 100K
C78 0.01u
C79 .047u
C80 0.1uF Poly
C81 0.01u
C82 .047u
C83 0.01u
C84 0.1uF Poly
C85 0.01u
TP13
TP14
TP15
TP16
TP17
TP18
CD2DIN
CD2RIN
CD2AZ
SS#/H
IC22
LTC1590CS
VDD
DGND
DOUT
CLR
CS/LD
SDIN
CLK
RFBA
RFBB
AGND
VREFA
IOUT1A
IOUT2A
VREFB
IOUT1B
IOUT2B
SRST#
CD2DACCS#
SSDO
SSCLK
CD2DIN
CD2RIN
C86 10u tant 25V
C87 .047u
C90 47pF
C91 0.1uF Poly
C93 .047u
C94 47pF
C95 0.1uF Poly
C88 .047u
C89 .047u
R157 100
R158 0 ohm
R159 100
R160 499
R161 1M
R162 0 ohm
R163 100
R164 499
R165 1M
R166 100
IC24A TLE2022
IC24B TLE2022
IC23A LT1490CS8
IC23B LT1490CS8
IC16B SMP04
IC16C SMP04
IC16D SMP04
Q15 2N7002
Q16 2N7002
D20 BAV70
TP19
TP20
TP21
TP51
CD2DATA
CD2REF
C92 0.01u
C96 0.01u
NOTE:
1.) UNLESS OTHERWISE SPECIFIED:
RESISTANCE VALUES ARE IN OHMS 1/16W, 1%
CAPACITANCE VALUES ARE IN FARADS
INDUCTANCE VALUES ARE IN HENRY'S
2.) LAST REF DES USED:
BT1, C220, D49, F2, IC52, J408, L33, LS1, Q29, R288, RP2, S1, T1, TP56, VR2,Y1
3.) DO NOT POPULATE THE FOLLOWING:
D44,J401,R279,R280,R288,VR2
4.) COMPONENT DESIGNATORS NOT USED:
L4,L5,L25,L26
MODEL 710 MAIN BOARD
Novametrix
Medical Systems, Inc.
1 Barnes Industrial Park Road
Wallingford, CT USA 06492
Drawn: AEsposito 20 Nov 97
Checked:
Mfg Eng:
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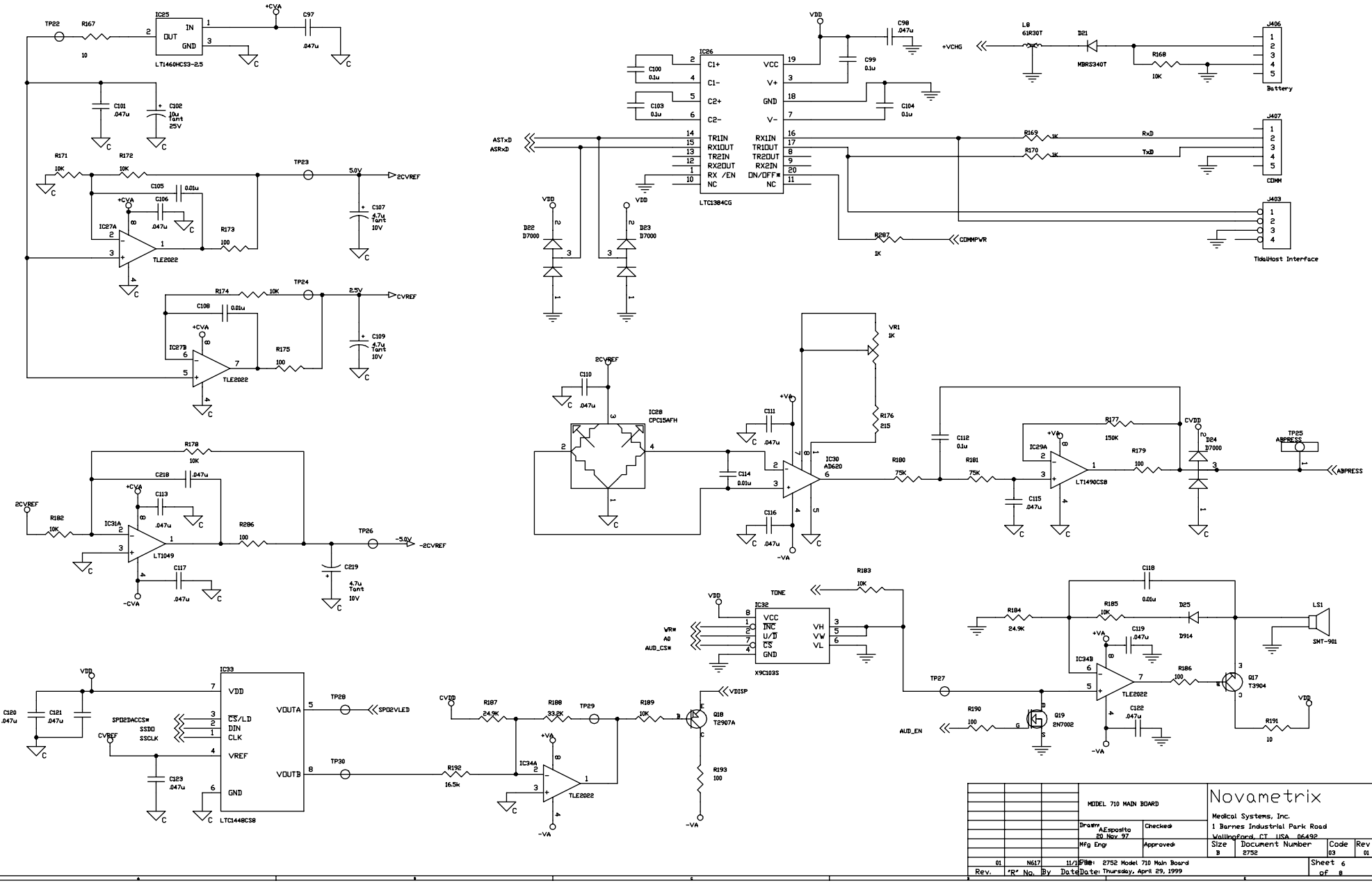
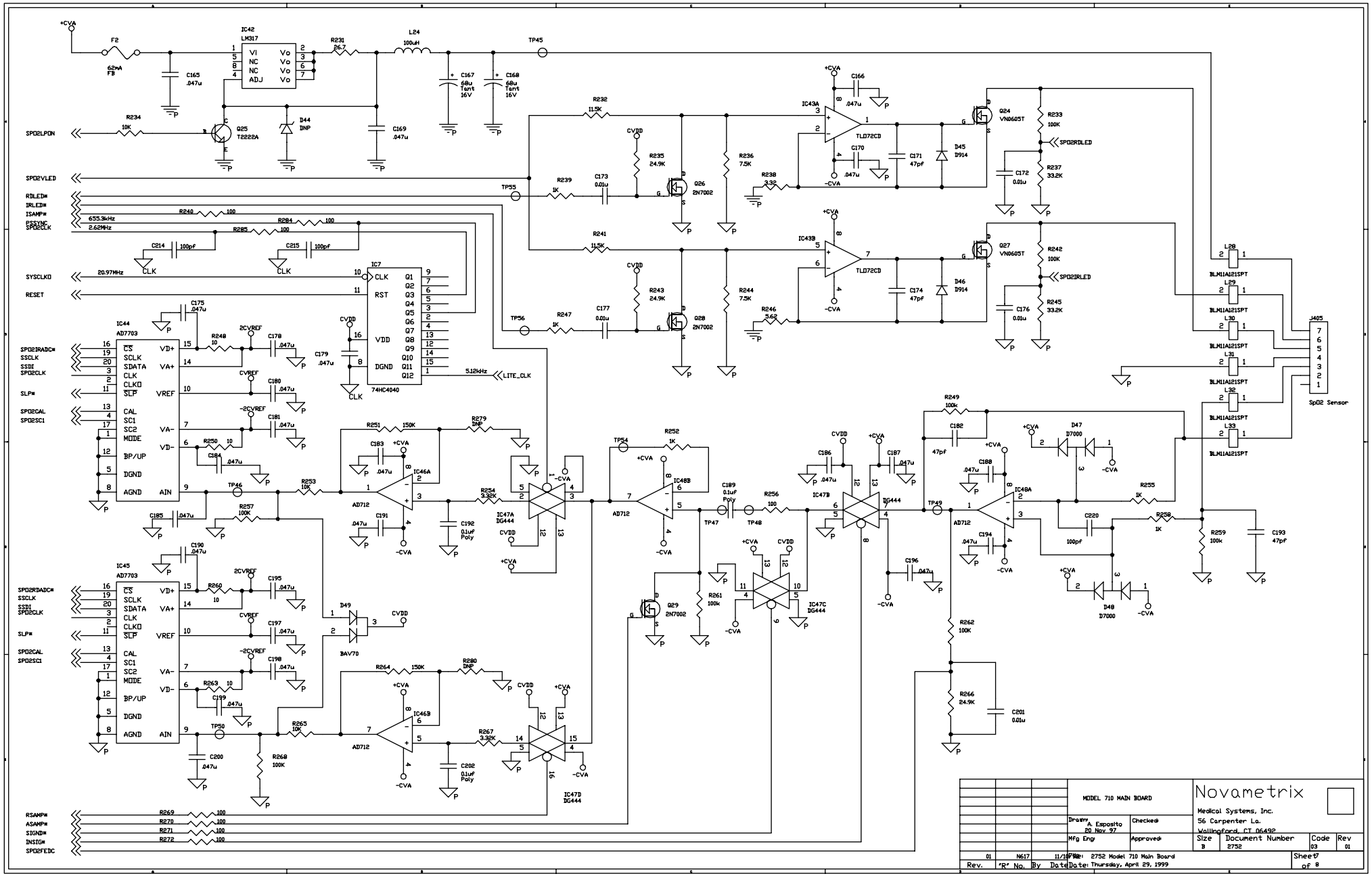
Size B
Document Number 2752
Code 03
Rev 01
Title: 2752 Model 710 Main Board
Date: Thursday, April 29, 1999
Sheet 5 of 8
Rev. 01
'R' No. N617
By
Date: 11/19/98


TP22
R167
10
IC25
IN
OUT
GND
LT1460HCS3-2.5
+CVA
C97
.047u
C101
.047u
C102
10u
tant
25V
R171
10K
R172
10K
TP23
5.0V
2CVREF
C105
0.01u
C106
.047u
IC27A
TLE2022
R173
100
C107
4.7u
Tant
10V
R174
10K
TP24
2.5V
CVREF
C108
0.01u
IC27B
TLE2022
R175
100
C109
4.7u
Tant
10V
R178
10K
C218
.047u
C113
.047u
2CVREF
R182
10K
IC31A
LT1049
R286
100
TP26
-5.0V
-2CVREF
C219
4.7u
Tant
10V
C117
.047u
-CVA
VDD
IC33
VDD
CS/LD
DIN
CLK
VREF
VOUTA
VOUTB
GND
LTC1448CS8
C120
.047u
C121
.047u
SPI2DACCS*
SSDO
SSCLK
CVREF
C123
.047u
TP28
SPI2VLED
TP30
R192
16.5k
CVDD
R187
24.9K
R188
33.2K
TP29
R189
10K
Q18
T2907A
VDISP
R193
100
IC34A
TLE2022
-VA
IC26
C1+
C1-
C2+
C2-
TR1IN
RX1OUT
TR2IN
RX2OUT
RX /EN
NC
VCC
V+
GND
V-
RX1IN
TR1OUT
TR2OUT
RX2IN
ON/OFF*
NC
LTC1384CG
C100
0.1u
C103
0.1u
C99
0.1u
C104
0.1u
C98
.047u
ASTxD
ASRxD
D22
D7000
D23
D7000
R287
1K
COMMPWR
+VCHG
L8
61R30T
D21
MBRS340T
R168
10K
J406
Battery
R169
1K
R170
1K
RxD
TxD
J407
COMM
J403
TidalHost Interface
VR1
1K
R176
215
IC28
CPC15AFH
C110
.047u
C111
.047u
IC30
AD620
C114
0.01u
C116
.047u
C112
0.1u
R180
75K
R181
75K
C115
.047u
IC29A
LT1490CS8
R177
150K
R179
100
CVDD
D24
D7000
TP25
ABPRESS
ABPRESS
WR*
A0
AUD_CS*
TONE
IC32
VCC
INC
U/D
CS
GND
VH
VW
VL
X9C103S
R183
10K
TP27
AUD_EN
R190
100
Q19
2N7002
C118
0.01u
R184
24.9K
R185
10K
D25
D914
LS1
SMT-901
C119
.047u
IC34B
TLE2022
R186
100
Q17
T3904
C122
.047u
R191
10
MODEL 710 MAIN BOARD
Drawn: AEsposito 20 Nov 97
Checked:
Mfg Eng:
Approved:
Novametrix
Medical Systems, Inc.
1 Barnes Industrial Park Road
Wallingford, CT USA 06492
Size: B
Document Number: 2752
Code: 03
Rev: 01
Sheet 6 of 8
Rev. 01 'R' No. N617 By 11/15/99 Date
Title: 2752 Model 710 Main Board
Date: Thursday, April 29, 1999


+CVA
F2
62mA FB
IC42 LM317
C165 .047u
R231 26.7
L24 100uH
TP45
C167 68u Tant 16V
C168 68u Tant 16V
C169 .047u
R234 10K
Q25 T2222A
D44 DNP
SPD2LPDN
SPD2VLED
RDLED#
IRLED#
ISAMP#
FSSYNC
SPD2CLK
655.3kHz
2.62MHz
SYSCLKO
20.97MHz
RESET
R240 100
R284 100
R285 100
C214 100pF
C215 100pF
IC7 74HC4040
CLK
RST
VDD
DGND
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
C179 .047u
5.12kHz
LITE_CLK
R232 11.5K
R235 24.9K
R236 7.5K
R238 3.32
IC43A TL072CD
C166 .047u
C170 .047u
C171 47pf
D45 D914
Q24 VN0605T
R233 100K
SPD2RLED
R237 33.2K
C172 0.01u
R239 1K
C173 0.01u
Q26 2N7002
TP55
R241 11.5K
R243 24.9K
R244 7.5K
R246 3.32
IC43B TL072CD
C174 47pf
D46 D914
Q27 VN0605T
R242 100K
SPD2IRLED
R245 33.2K
C176 0.01u
R247 1K
C177 0.01u
Q28 2N7002
TP56
L28 BLM11A121SPT
L29 BLM11A121SPT
L30 BLM11A121SPT
L31 BLM11A121SPT
L32 BLM11A121SPT
L33 BLM11A121SPT
J405
SpO2 Sensor
IC44 AD7703
SPD2IRADC#
SSCLK
SSDI
SPD2CLK
SLP#
SPD2CAL
SPD2SCI
CS
SCLK
SDATA
CLK
CLKO
SLP
CAL
SC1
SC2
MODE
BP/UP
DGND
AGND
VD+
VA+
VREF
VA-
VD-
AIN
C175 .047u
R248 10
2CVREF
C178 .047u
C180 .047u
-2CVREF
C181 .047u
R250 10
C184 .047u
C185 .047u
R257 100K
TP46
R253 10K
R251 150K
R279
C183 .047u
IC46A AD712
C191 .047u
C192 0.1uF Poly
IC47A DG444
R254 3.32K
TP54
R252 1K
IC48B AD712
C189 0.1uF Poly
TP47
R256 100
TP48
IC47B DG444
C186 .047u
C187 .047u
R249 100K
C182 47pF
D47 D7000
C188 .047u
IC48A AD712
R255 1K
C220 100pF
R258 1K
R259 100K
C193 47pF
C194 .047u
C196 .047u
TP49
IC45 AD7703
SPD2RADC#
R260 10
C195 .047u
C197 .047u
-2CVREF
C198 .047u
R263 10
C199 .047u
C190 .047u
TP50
C200 .047u
R268 100K
R265 10K
D49 BAV70
R264 150K
R280 DNP
IC46B AD712
C202 0.1uF Poly
R267 3.32K
IC47D DG444
IC47C DG444
Q29 2N7002
R261 100K
R262 100K
R266 24.9K
C201 0.01u
D48 D7000
RSAMP#
ASAMP#
SIGND#
INSIG#
SPD2FEDC
R269 100
R270 100
R271 100
R272 100
MODEL 710 MAIN BOARD
Novametrix
Medical Systems, Inc.
56 Carpenter La.
Wallingford, CT 06492
Drawn: A. Esposito 20 Nov 97
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Document Number 2752
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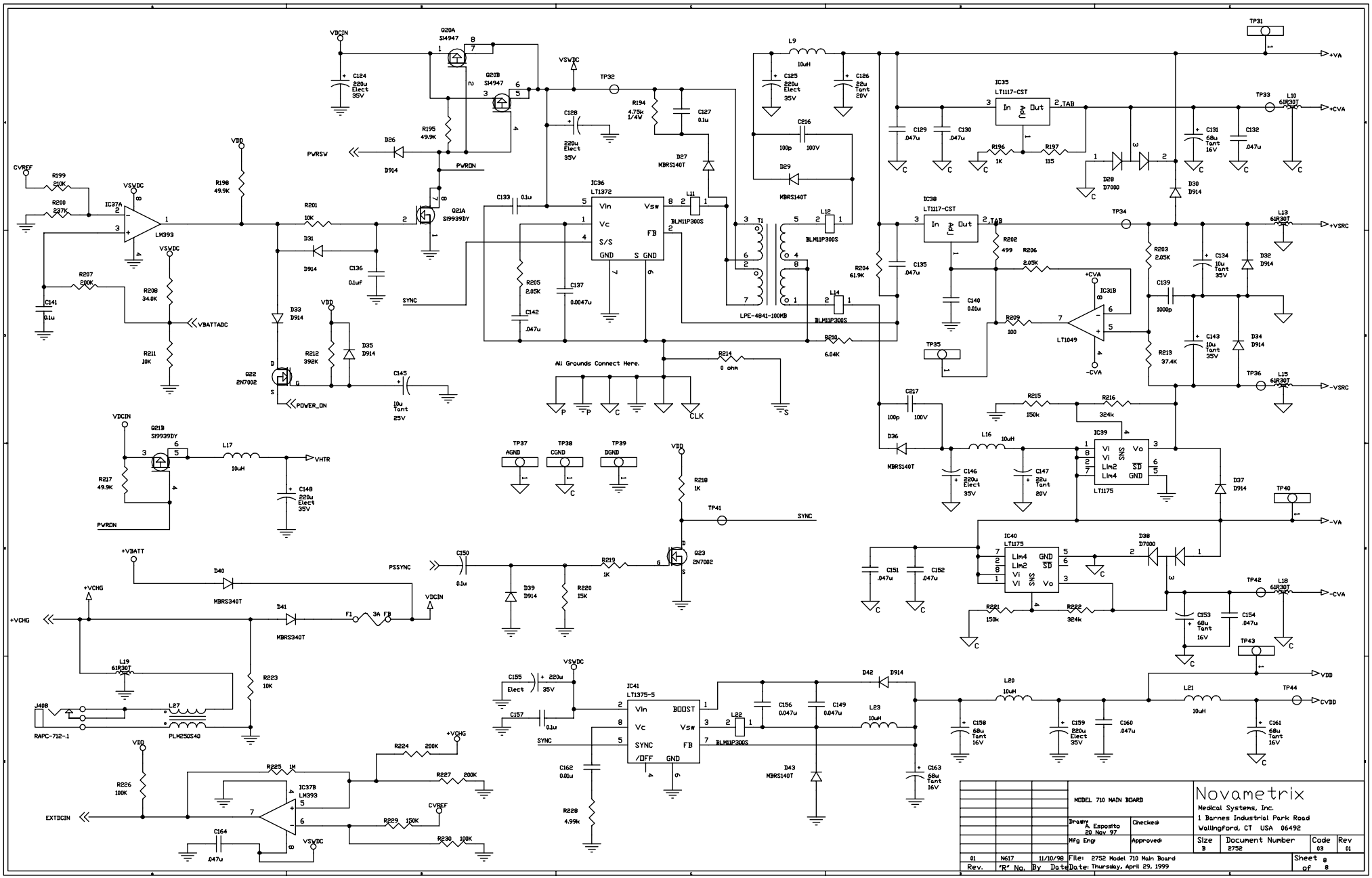
Rev 01
Rev. 01
"R" No. N617
By
Date 11/19/98
Title: 2752 Model 710 Main Board
Date: Thursday, April 29, 1999
Sheet 7 of 8


MODEL 710 MAIN BOARD
Novametrix
Medical Systems, Inc.
1 Barnes Industrial Park Road
Wallingford, CT USA 06492
Drawn: A Esposito 20 Nov 97
Checked:
Mfg Eng:
Approved:
Size: B
Document Number: 2752
Code: 03
Rev: 01
Sheet 8 of 8
01 N617 11/10/98 File: 2752 Model 710 Main Board
Rev. 'R' No. By Date Date: Thursday, April 29, 1999
All Grounds Connect Here.
VDCIN
VSWDC
VDD
+VA
+CVA
+VSRC
-VSRC
-CVA
VHTR
+VBATT
+VCHG
EXTDCIN
CVDD
VBATTADC
PWRSW
PWRON
SYNC
PSSYNC
POWER_ON
CVREF
LM393
LT1117-CST
LT1049
LT1175
LT1372
LT1375-5
SI9939DY
SI4947
2N7002
MBRS340T
MBRS140T
LPE-4841-100MB
BLM11P300S
RAPC-712-1
PLH250S40

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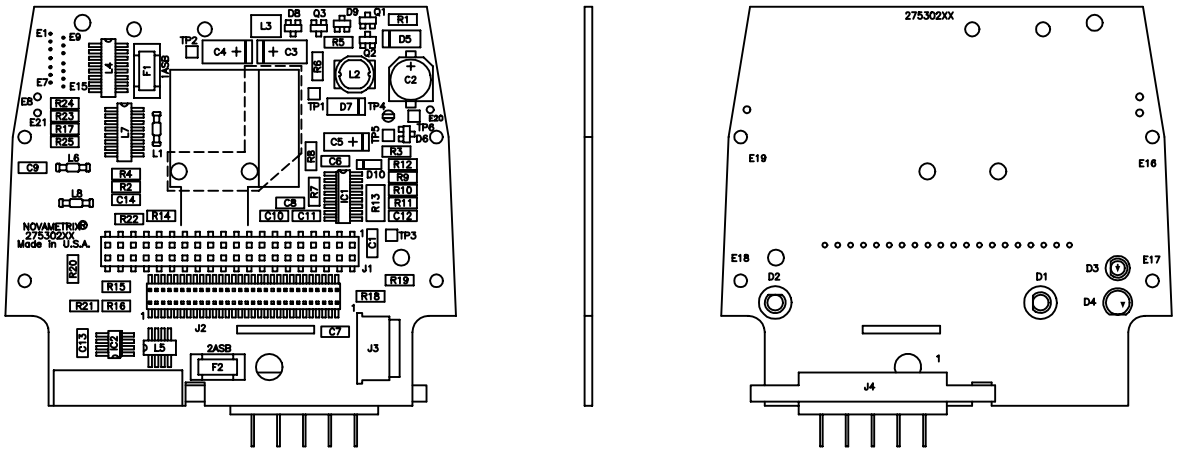


PN	DESCRIPTION	REF DES
2753-02	FAB, INTERFACE BOARD, MODEL 710 & 715	~
D2753-03	SCHEMATIC, INTERFACE BOARD, 710 & 715	~
A2753-48	ASSY FIXTURE, BATTERY CONNECTOR	(FOR J4)
152096	CAPACITOR, 220uF, 35V, 20%, ELECTROLYTIC	C2
154072	CAPACITOR, .1uF, 50V, 10%	C1, C6-C8, C10, C11, C13, C14
154078	CAPACITOR, 1000pF, 50VDC, 10%, NPO	C12
154079	CAPACITOR, 10uF, 25V, 10%, TANTALUM	C5
154116	CAPACITOR, 10uF, 35V, 10%	C3, C4
180022	INDUCTOR, 10uH, 10%	L3
180030	INDUCTOR-CAP, 4700pF, 50VDC, 2A, 3 TERMINAL	L1, L6, L8
180034	FERRITE FILTER, 4 LINE, EMI SUPPRESSION	L5
180035	FERRITE FILTER, 8 LINE, EMI SUPPRESSION	L4, L7
180046	INDUCTOR, 18uH @ 2.5MHz, +25% -15%	L2
☆ 211518	CONNECTOR, 5 PIN, RIGHT ANGLE	J4
☆ 211639	CONNECTOR, 6 PIN, RECEPTACLE, ZIF, R ANGLE	J3
213411	CONNECTOR, 40 PIN, RECEPTACLE, STRAIGHT	J1
213900	CONNECTOR, 60 PIN, HEADER, .05 X .1 SPACING	J2
☆ 216029	TEST POINT, SPRING LOADED, 475°C MAX	TP4
280233	SPACER, LED, FOR 2 LEADS, .2 DIA X .1 LONG	(FOR D4)
280234	SPACER, LED, FOR 3 LEADS, .255 DIA X .185 L	(FOR D1, D2)
280235	SPACER, LED, FOR 2 LEADS, .25 DIA X .2 LONG	(FOR D3)
474136	RESISTOR, 1k OHM, 1/8W, 1%	R1, R5, R11
474181	RESISTOR, 5.9k OHM, 1/8W, 1%	R9
474170	RESISTOR, 301k OHM, 1/8W, 1%	R10, R14
474174	RESISTOR, 332 OHM, 1/8W, 1%	R15, R16, R18-R21
474182	RESISTOR, 150k OHM, 1/8W, 1%	R4
474220	RESISTOR, ZERO OHM, 1/4W, 5%	R17, R22, R23, R25
474263	RESISTOR, 28k OHM, 1/8W, 1%	R8
474277	RESISTOR, .15 OHM, 1/2W	R13
474278	RESISTOR, 237k OHM, 1/8W, 1%	R2
474279	RESISTOR, 562 OHM, 1/8W, 1%	R3
474280	RESISTOR, 243 OHM, 1/8W, 1%	R6
474281	RESISTOR, 71.5k OHM, 1/8W, 1%	R7
474282	RESISTOR, 4.64k OHM, 1/8W, 1%	R12
481045	DIODE, ZENER, 5.1V	D10
481546	DIODE, SWITCHING	D6, D8, D9
481549	DIODE, RECTIFIER	D5, D7
☆ 482601	LED, YELLOW, ROUND, .100 SPACING	D3
☆ 482602	LED, GREEN, ROUND, .100 SPACING	D4
☆ 482603	LED, BICOLOR, RED/YELLOW, ROUND, 3 LEAD	D1
☆ 482604	LED, BICOLOR, RED/GREEN, ROUND, 3 LEAD	D2
483020	TRANSISTOR, PNP, SOT23 CASE	Q1
484060	TRANSISTOR, NPN	Q2, Q3
486042	IC, SERIAL 4k EEPROM, 8 PIN	IC2
486820	IC, FAST CHARGE, 16 PIN	IC1
515085	FUSE WITH FUSEHOLDER, 2A, 125V, SLO-BLO	F2
515087	FUSE WITH FUSEHOLDER, 1A, 125V, SLO-BLO	F1

NOTES:
1. D2753-01 SPECIFICATIONS:
   A. COMPONENTS NOT FITTED: C9, R24
   B. ☆ DENOTES THRU HOLE COMPONENTS.
   C. TRIM COMPONENT LEADS FLUSH WITH PC BOARD.
   D. FOR J4 ASSY FIXTURE USE 2753-48.

REV	R NO.	DATE
01	N631	29Jan99

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES
TOLERANCES
X ±.02
.XX ±.01
.XXX ±.005
.XXXX ±.0010
FRAC ±1/64
ANG ±1/4°
MATERIAL ~
FINISH ~

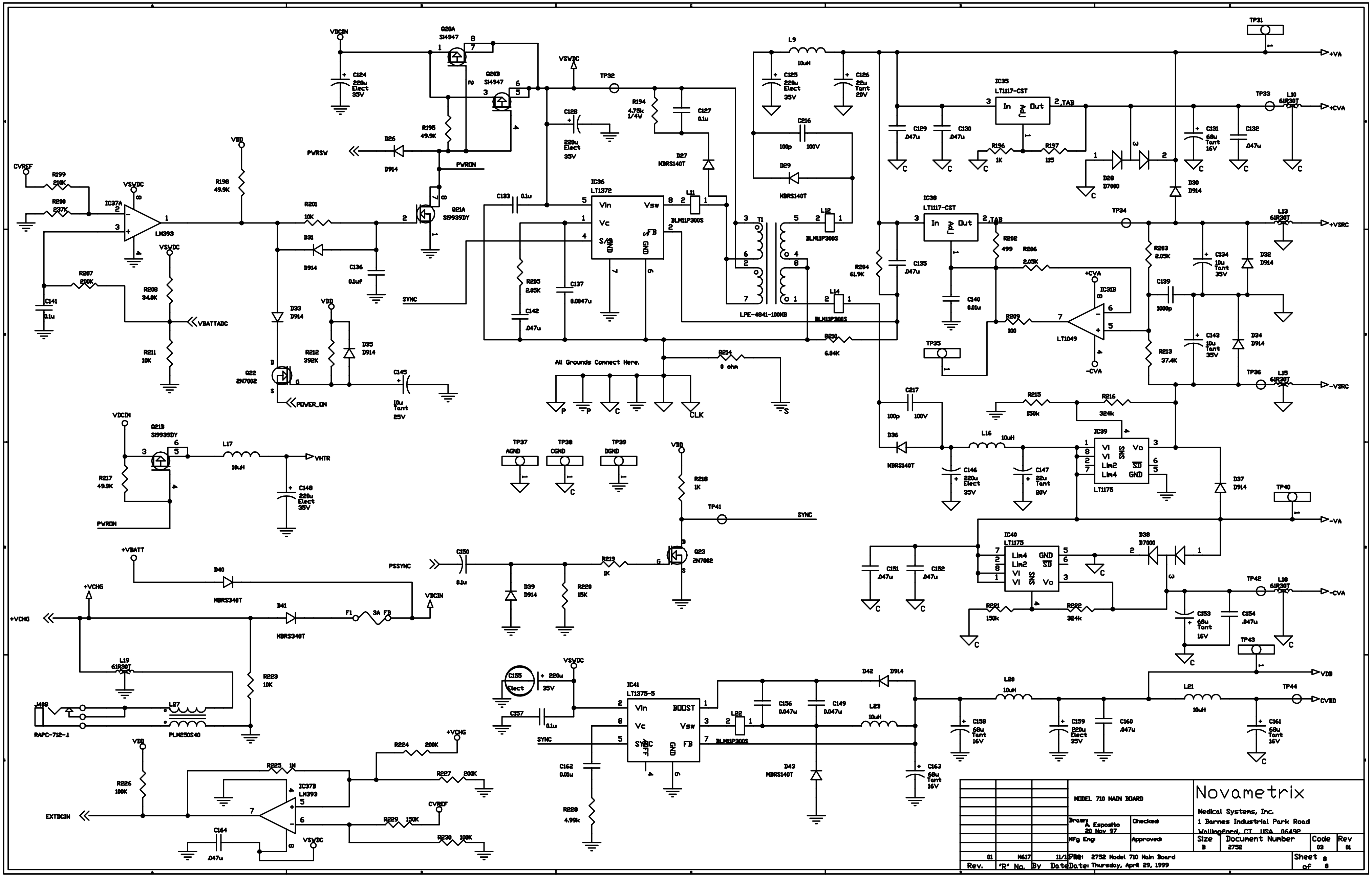
TITLE: INTERFACE BOARD ASSY, MODEL 710 & 715 - TIDAL WAVE SP

DRAWN BL 14May98 | CHECKED MRL 22Sep98
MFG ENGR TJC 23Sep98 | APPROVED AJE 30Sep98
USED ON: D9208-01

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	2753	01	01

SCALE: 2/1 | SHEET 1 OF 1


VDCIN
C124 220u Elect 35V
Q20A SI4947
Q20B SI4947
VSVDC
TP32
R194 4.75k 1/4V
C127 0.1u
L9 10uH
C125 220u Elect 35V
C126 22u Tant 20V
TP31
+VA
IC35 LT1117-CST
In Adj Out
TAB
TP33
L10 61R30T
+CVA
C129 .047u
C130 .047u
R196 1K
R197 115
C131 68u Tant 16V
C132 .047u
D28 D7000
D30 D914
CVREF
R199 210K
R200 237K
IC37A
LM393
VDD
R198 49.9K
R201 10K
R195 49.9K
PWRSV
D26
D914
PWRON
Q21A SI9939DY
C128 220u Elect 35V
D27 MBRS140T
C216 100p 100V
D29 MBRS140T
C133 0.1u
IC36 LT1372
Vin Vsw Vc S/S GND FB
L11 BLM11P300S
T1
L12 BLM11P300S
L14 BLM11P300S
LPE-4841-100MB
R204 61.9K
C135 .047u
IC38 LT1117-CST
R202 499
R206 2.05K
TP34
L13 61R30T
+VSRC
R203 2.05K
C134 10u Tant 35V
D32 D914
C139 1000p
R208 34.0K
VBATTADC
R207 200K
C141 0.1u
R211 10K
D31 D914
C136 0.1uF
SYNC
R205 2.05K
C137 0.0047u
C142 .047u
C140 0.01u
+CVA
IC31B
R209 100
LT1049
-CVA
TP35
R210 6.04K
R213 37.4K
C143 10u Tant 35V
D34 D914
TP36
L15 61R30T
-VSRC
D33 D914
R212 392K
D35 D914
Q22 2N7002
POWER_ON
C145 10u Tant 25V
All Grounds Connect Here.
R214 0 ohm
P P C CLK S
C217 100p 100V
R215 150k
R216 324k
D36 MBRS140T
L16 10uH
C146 220u Elect 35V
C147 22u Tant 20V
IC39 LT1175
VI VI Lim2 Lim4 SNS Vo SD GND
D37 D914
TP40
-VA
VDCIN
Q21B SI9939DY
L17 10uH
VHTR
R217 49.9K
C148 220u Elect 35V
PWRON
TP37 AGND
TP38 CGND
TP39 DGND
R218 1K
TP41
SYNC
+VBATT
D40 MBRS340T
PSSYNC
C150 0.1u
R219 1K
Q23 2N7002
D39 D914
R220 15K
IC40 LT1175
Lim4 Lim2 VI VI GND SD SNS Vo
D38 D7000
C151 .047u
C152 .047u
R221 150k
R222 324k
TP42
L18 61R30T
-CVA
C153 68u Tant 16V
C154 .047u
+VCHG
D41 MBRS340T
F1 3A FB
VDCIN
R223 10K
L19 61R30T
J408
RAPC-712-1
L27
PLM250S40
C155 220u Elect 35V
C157 0.1u
IC41 LT1375-5
Vin BOOST Vc Vsw SYNC SHDN GND FB
L22 BLM11P300S
C156 0.047u
C149 0.047u
D42 D914
L23 10uH
D43 MBRS140T
C162 0.01u
R228 4.99k
C163 68u Tant 16V
TP43
VDD
L20 10uH
C158 68u Tant 16V
C159 220u Elect 35V
C160 .047u
L21 10uH
TP44
CVDD
C161 68u Tant 16V
R224 200K
+VCHG
R225 1M
IC37B LM393
R227 200K
R226 100K
EXTDCIN
CVREF
R229 150K
R230 100K
C164 .047u
VSVDC
MODEL 710 MAIN BOARD
Novametrix
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1 Barnes Industrial Park Road
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Drawn A. Esposito 20 Nov 97
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