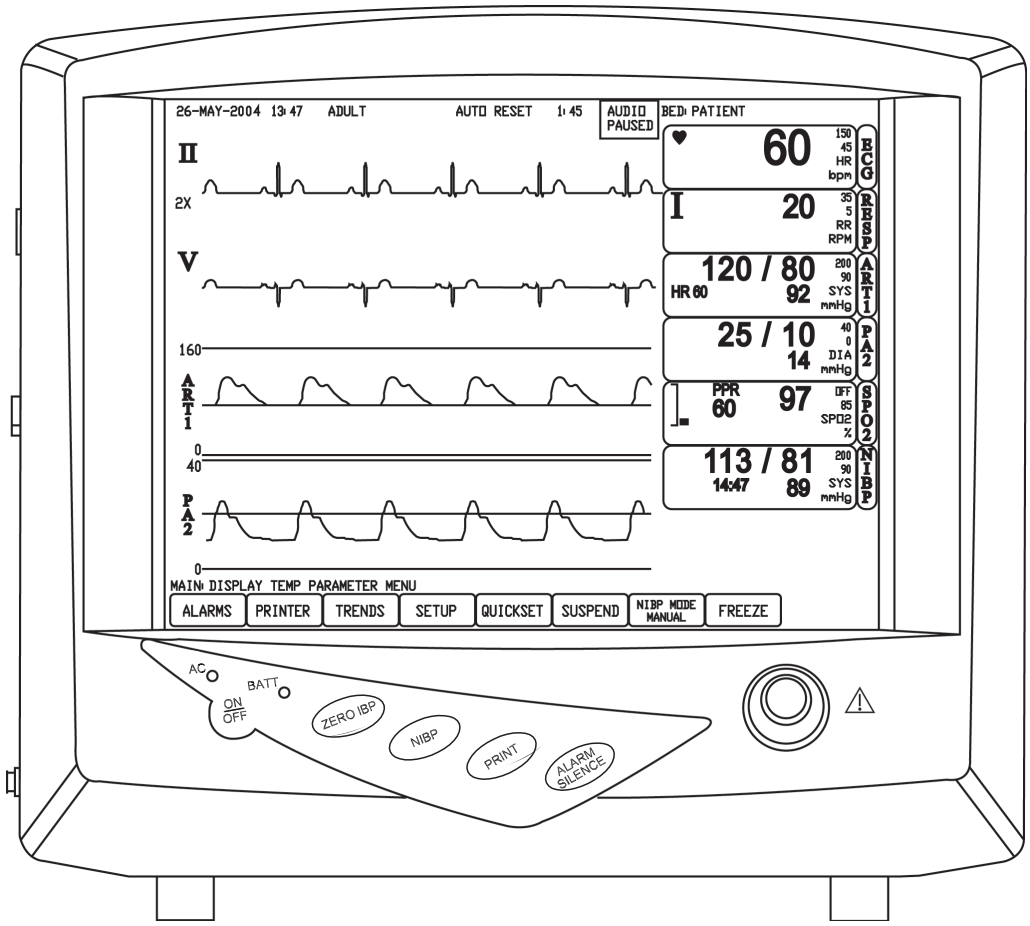
BCI™

Advisor® Vital Signs Monitor

Service Manual



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Version 2, June 2008

smiths medical

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Revision History

REVISION	DATE	COMMENT
Rev. 2	June, 2008	• Added Design frame, Smiths Medical logo and BCI lozenge to front cover. • Added Australian Representative to Warranty section and back cover. • Added WEEE Recycling instructions. • Added warnings about AC Power. • Added warning about the oximeter displaying dashes under certain conditions. • Changed some cautions and notes to warnings. • Added cautions about certain cleaning agents causing brittleness of plastics.

REVISION	DATE	COMMENT
Rev. 1	October, 2006	• Added new Patient Safety checks to Chapter 2: Ground Resistance Check, Enclosure Leakage Current, Patient Leakage Current, and Dielectric Withstand- Hi-pot Test. • Updated HILO Calibration section in chapter 2. • Updated Line Art. • Updated patent and trademark statements. • Moved Warranty and Service Information from Chapter one to new section. • Updated Proprietary Notice in Warranty Section. • Updated Warranty and Service information. • Added CE Notice to Warranty section and back cover. • Updated corporate symbols and definitions. • Updated warnings, cautions, and notes. • Added Dangerous voltage symbols to applicable warnings in Chapter 2. • New page numbering scheme for appendix drawings.

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Warranty and Service Information

Proprietary Notice

Information contained in this document is copyrighted by Smiths Medical PM, Inc. and may not be duplicated in full or part by any person without prior written approval of Smiths Medical PM, Inc. Its purpose is to provide the user with adequately detailed documentation to efficiently install, operate, maintain, and order spare parts for the device supplied. All information contained in this document is believed to be current and accurate as of the date of publication or revision, but does not constitute a warranty.

Warranty

Limited Warranty

Smiths Medical PM, Inc. ("Seller") warrants to the original purchaser that the Product, not including accessories, shall be free from defects in material and workmanship under normal use, if used in accordance with its labeling, for one year from the date of shipment to the original purchaser.

Seller warrants to the original purchaser that the reusable oximeter sensors supplied as accessories, shall be free from defects in materials and workmanship under normal use, if used in accordance with its labeling, for one year from the date of shipment to the original purchaser (USA only).

Disclaimer of Warranties

THE FOREGOING EXPRESS WARRANTY, AS CONDITIONED AND LIMITED, IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Seller disclaims responsibility of the suitability of the Product for any particular medical treatment or for any medical complications resulting from the use of the Product. This disclaimer is dictated by the many elements which are beyond Seller's control, such as diagnosis of patient, conditions under which the Product may be used, handling of the Product after it leaves Seller's possession, execution of recommended instructions for use and others.

Conditions of Warranty

This warranty is void if the Product has been altered, misused, damaged by neglect or accident, not properly maintained or recharged, or repaired by persons not authorized by Seller. Misuse includes, but is not limited to, use not in compliance with the labeling or use with accessories not manufactured by Seller. This warranty does not cover normal wear and tear and maintenance items.

Limitation of Remedies

The original purchaser's exclusive remedy shall be, at Seller's sole option, the repair or replacement of the Product. **THIS IS THE EXCLUSIVE REMEDY. In no event will Seller's liability arising out of any cause whatsoever (whether such cause is based on contract, negligence, strict liability, tort or otherwise) exceed the price of the Product and in no event shall Seller be responsible for consequential, incidental, or special damages of any kind or nature whatsoever, including but not limited to, lost business, revenues, and profits.**

Warranty Procedure

To obtain warranty service in the USA, you must request a Customer Service Report (CSR) number from Technical Service. Reference the CSR number when returning your Product, freight and insurance prepaid, to:

Smiths Medical PM, Inc.,	Phone: 262 542 3100
N7 W22025 Johnson Drive,	Fax: 262 542 0718
Waukesha, WI 53186-1856	Toll Free: 1 800 558 2345 (USA only)

Seller will not be responsible for unauthorized returns or for loss or damage to the Product during the return shipment. The repaired or replaced Product will be shipped, freight prepaid, to Purchaser.

To obtain warranty information outside of the USA, contact your local distributor.

Keep all original packing material, including foam inserts. If you need to ship the device, use only the original packaging material, including inserts. Box and inserts should be in original condition. If original shipping material in good condition is not available, it should be purchased from Smiths Medical PM, Inc.

Damages occurred in transit in other than original shipping containers are the responsibility of the shipper. All costs incurred returning devices for repair are the responsibility of the shipper.

CE Notice

EC REP Marking by the symbol CE 0473 indicates compliance of this device to the Medical Device Directive 93/42/EEC.

Authorized Representative (as defined by the Medical Device Directive):

Smiths Medical International Ltd.	Phone: (44) 1923 246434
Colonial Way, Watford, Herts,	Fax: (44) 1923 240273
WD24 4LG, UK	

Australian Representative:

Smiths Medical Australasia Pty. Ltd.	Tel: +61 (0) 7 3340 1300
61 Brandl Street, Eight Mile Plains,	
QLD 4113, Australia	

Chapter 1: Introduction

About This Manual

This manual is intended for persons trained in service, maintenance, and repair of modern electronic medical equipment. It provides service maintenance, troubleshooting, and detailed electronic circuit descriptions for the Advisor® Vital Signs Monitor. Thorough knowledge of this monitor's operation, as described in the Advisor® Vital Signs Operation Manual, is required before attempting to repair this equipment.

These instructions contain important information for safe use of the product. Read the entire contents of these Instructions For Use, including Warnings and Cautions, before using the Advisor® Vital Signs Monitor. Failure to properly follow warnings, cautions and instructions could result in death or serious injury to the patient.

Replacing Components

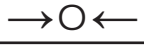
When replacing components, always use parts with the same or better tolerance factors. For example, do not replace a 1% tolerance resistor with a 5% tolerance resistor, or a 10% tolerance capacitor with a 20% tolerance capacitor.

Spare components and subassemblies are available from the manufacturer. See *Parts Lists, Assembly Drawings, and Schematics* for more information.

Conventions

CONVENTION	DESCRIPTION
U14A	IC number U14, gate A as shown on the schematic.
U7-7	IC number 7, pin number 7, as shown on the schematic.

Definition of Symbols

SYMBOL	DEFINITION
Rx ONLY	Caution: Federal (U.S.A.) law restricts this device to sale by or on the order of a physician.
	Defibrillator-proof type CF equipment
	Attention, see instructions for use.
	Dangerous voltage.
	Refer servicing to qualified service personnel.
	Output
	Loudspeaker
	Fuse
	Date of Manufacture
REF	Catalog Number
SN	Serial Number
IPX1	Drip Proof
	Non AP Device
	Graphical Recorder
	Use by
	On/Off *
	IBP Zero All *
	NIBP Start/Stop *
	Print Start/Stop *
	Alarm Silence *
	AC Power LED *
	Battery Charge LED *
* International Symbols	

 Collect separately	**Disposal (EU Countries)** Under the Waste Electrical and Electronic Equipment (WEEE) Directive 2006/96/EC and implementing regulations, all devices and service items within the scope of the Directive purchased new after August 13, 2005 must be sent for recycling when ultimately becoming waste. Devices and items must not be disposed of with general waste. If purchased before that date, they may also be sent for recycling if being replaced on a one-for-one, like-for-like basis (this varies depending on the country). Recycling instructions to customers using Smiths Medical products are published on the internet at: **http://www.smiths-medical.com/recycle**
	**Disposal (other countries)** When disposing of this device, its batteries or any of its accessories, ensure that any negative impact on the environment is minimized. Contact your local waste disposal service and use local recycling or disposal schemes. Separate any other parts of the equipment where arrangements can be made for their recovery; either by recycling or energy recovery. The main batteries are potentially harmful and will require separate disposal according to manufacturer's instructions or local regulations. **Note: If applicable, EU, national or local regulations concerning waste disposal must take precedence over the above advice.**

KEYWORD	DEFINITION
WARNING	Tells you about something that could hurt the patient or hurt the operator
CAUTION	Tells you about something that could damage the monitor
NOTE	Tells you other important information

General Warnings, Cautions, and Notes

WARNING! Do not use this device in the presence of flammable anesthetics.

WARNING! ELECTRICAL SHOCK HAZARD when covers are removed. Unit is not user serviceable.
⚠ Refer servicing to qualified personnel.

WARNING! Do not plug the monitor into an outlet controlled by a wall switch.

WARNING! This device is intended for use by trained healthcare professionals. The operator must be thoroughly familiar with the information in the operation manual before using the device.

WARNING! This monitor is not for apnea detection. The monitor has not been tested or validated for use in apnea detection.

WARNING! This monitor is not for home use.

WARNING! Verify proper operating mode before attaching patient. See *Select the Patient Type* in the *1886R operation manual Chapter 3: Setting Up the Monitor.*

WARNING! Do not use this device in the presence of magnetic resonance imaging (MR or MRI) equipment.

WARNING! Operation of this device may be adversely affected in the presence of computed tomography (CT) equipment.

WARNING! Operation of this device may be affected in the presence of strong portable and mobile communications equipment.

WARNING! In the event that earth ground integrity is lost, the performance of this device and/or other devices nearby may be affected due to excessive RF emissions.

WARNING! The monitor should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor should be observed to verify normal operation in the configuration in which it will be used.

WARNING! Equipment is protected against defibrillator discharge. Rate meters and displays may be temporarily affected during defibrillation, but will rapidly recover.

WARNING! Where HF (diathermy) is used there is no danger of burning to the patient provided recommended components are used. Rate meters may be temporarily affected.

WARNING! This device must be used in conjunction with clinical signs and symptoms. This device is only intended to be an adjunct in patient assessment.

WARNING! If the accuracy of any measurement is in question, check the patient's vital sign(s) by an alternative method and then check the monitor for proper functioning.

WARNING! This monitor will not operate effectively on patients who are experiencing convulsions or tremors.

WARNING! Do not autoclave, ethylene oxide sterilize, or immerse the monitor and other accessories in liquid. Evidence that liquid has been allowed to enter the monitor voids the warranty.

WARNING! Any monitor that has been dropped or damaged should be checked by qualified service personnel to ensure proper operation prior to use.

WARNING! Use only original manufacturer or recommended patient cables. Use of accessories other than those specified may result in increased electro-magnetic (EM) emissions or decreased EM immunity of the device. To avoid potential electro-static discharge interference, do not use cables that incorporate metal or metal-coated connectors.

WARNING! There is no defibrillator synchronization output on the monitor. Make no connections between the monitor and a defibrillator.

WARNING! Medical electrical equipment, including this device, needs special precautions regarding electro-magnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in this manual.

WARNING! The vital signs monitor is suitable for use within the patient environment IEC 60950 approved equipment must be placed outside of the patient environment. The patient environment is defined as any volume in which intentional or unintentional contact can occur between the patient and parts of the system or between the patient and other persons touching parts of the system.

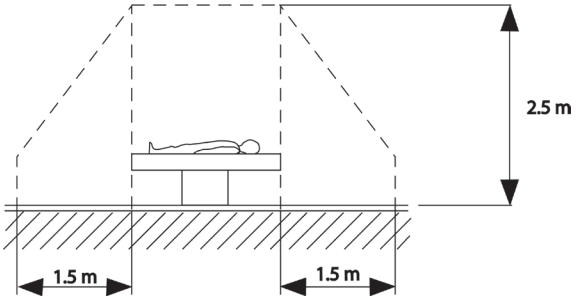


Figure 1.1: Patient Environment (side)
The dimensions are not prescriptive.

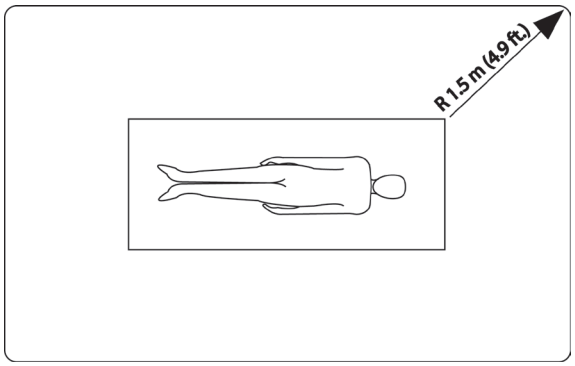


Figure 2.1: Patient Environment (top)
The dimensions are not prescriptive.

WARNING! When connecting this monitor to any instrument, verify proper operation before clinical use. Use only equipment meeting specifications given in this manual. Refer to the instrument's user manual for full instructions. Accessory equipment connected to the monitor's data interface must be certified according to the respective IEC standards, i.e. IEC 60950 for data processing equipment or IEC 60601-1 for electro medical equipment. All combinations of equipment must be in compliance with IEC 60601-1-1 systems requirements. Anyone connecting additional equipment to the signal input port or signal output port configures a medical system, and therefore, is responsible that the system complies with the requirements of the system standard IEC 60601-1-1.

WARNING! Disconnect the AC power supply from the outlet before disconnecting it from the monitor. Leaving the AC power supply connected to an AC power outlet without being connected to the monitor may result in a safety hazard.

WARNING! Do not allow any moisture to touch the AC power supply connectors or a safety hazard may result. Ensure that hands are thoroughly dry before handling the AC power supply.

WARNING! Do not place the monitor in the patient's bed or crib. Do not place the monitor on the floor.

WARNING! Failure to place the monitor away from the patient may allow the patient to turn off, reset, or damage the monitor, possibly resulting in the patient not being monitored. Make sure the patient cannot reach the monitor from their bed or crib.

WARNING! If there is a risk of the AC power supply becoming disconnected from the monitor during use, secure the cord to the monitor several inches from the connection.

WARNING! Ensure the monitor's AC rating is correct for the AC voltage at your installation site before using the monitor. The monitor's AC rating is shown on the rear panel rating plate. If the rating is not correct, do not use the monitor.

WARNING! It is the operator's responsibility to set alarm limits appropriately for each individual patient.

WARNING! Default alarm limits are provided for convenience. Verify that alarm limits are appropriate for given patient and condition, and adjust according to institutional policy.

CAUTION! Do not allow water or any other liquid to be spilled onto the monitor. Unplug the AC power cord from the monitor before cleaning or disinfecting the monitor.

CAUTION! This unit contains a lithium ion battery and a rechargeable alkaline battery. These batteries are not user replaceable. ⚠ Refer servicing to qualified personnel.

CAUTION! This unit may contain a nickel-metal-hydride battery. Disposal of this battery should be conducted in accordance with local or federal guidelines. Smiths Medical PM, Inc. cannot dispose of this battery.

CAUTION! Pressing front panel keys with sharp or pointed instruments may permanently damage the keypad. Press the front panel keys only with your finger.

CAUTION! Blocking the ventilation holes on the monitor's rear panel can prevent air circulation inside the monitor, possibly resulting in damage to the monitor. Leave an air gap behind the monitor to allow air to circulate through the ventilation holes.

CAUTION! If the device becomes wet, wipe off all moisture and allow sufficient time for drying before operating.

CAUTION! The monitor should be operated from its internal power source (if fitted) if the integrity of the protective earth conductor is in doubt.

CAUTION! Chemicals used in some cleaning agents may cause brittleness of plastic parts. Follow cleaning instructions in this manual.

CAUTION! Follow local governing ordinances and recycling instructions regarding disposal and recycling of device components and packaging.

NOTE! All user and patient accessible materials are non-toxic.

NOTE! Each input and output connection of the monitor is electrically isolated. Connection of this monitor to other equipment will not increase leakage current.

ECG Warnings, Cautions, and Notes

WARNING! PACEMAKER PATIENTS: Rate meters or rate detection software may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker patients under close surveillance. See this manual for disclosure of the pacemaker pulse rejection capability of this instrument.

WARNING! PACEMAKER PATIENTS: If PACE DETECT is not turned on when monitoring pacemaker patients, the heart rate readouts derived from the ECG patient connections are likely to display erroneous high or erratic rates. Keep pacemaker patients under close surveillance. For pacemaker patients, it may be advisable to select the SpO2 parameter as the primary heart rate source.

WARNING! Connect only three-lead or five-lead ECG lead wires from the patient to the ECG patient cable. Do not connect any other signal source to the ECG patient cable.

WARNING! False low heart rate indicators or false Asystole calls may result with certain pacemakers because of electrical overshoots.

WARNING! Reliable monitoring of pacemaker patients can only occur with PACE DETECT on.

WARNING! The pacemaker pulse marker shape and size is not to be diagnostically interpreted.

WARNING! Keep pacemaker patients under close observation. Rate detection in the software may continue to count the pacemaker rate during cardiac arrest and/or arrhythmia conditions. Therefore, do not rely solely on rate detection alarms.

WARNING! This monitor does not identify or interpret arrhythmia events. The indication of heart rate may be adversely affected by the presence of cardiac arrhythmias.

CAUTION! A three-lead ECG cable must be used if 3-Lead processing is selected. A five-lead ECG cable must be used if 5-Lead processing is selected. Using the incorrect cable for the selected mode might lead to a floating reference or additional noise on the ECG signal.

NOTE! Follow institutional standards when applying ECG electrodes. Silver/Silver Chloride disposable electrodes are strongly recommended to avoid polarization effects that result in large input offset potentials. Use of "squeeze bulb" type electrodes is not recommended.

NOTE! Use only standard AAMI three-lead or five-lead ECG cables.

NOTE! Line isolation monitor transients may resemble actual cardiac waveforms and thus inhibit heart rate alarms.

Impedance Respiration Warnings, Cautions, and Notes

WARNING! This monitor is not for apnea detection. The monitor has not been tested or validated for use in apnea detection.

WARNING! Electrodes of dissimilar metals should not be used.

WARNING! The monitor may not detect all episodes of inadequate breathing.

CAUTION! Ensure conductive parts, including electrodes of the patient cable, do not come into contact with any conductive surfaces or earth parts.

CAUTION! The respiration parameter is disabled when the monitor is in the neonate operating mode.

NOTE! Follow institutional standards when applying ECG electrodes.

NOTE! The ECG/Respiration cable uses a standard AAMI three-lead or five-lead ECG/Respiration connector. Use only standard AAMI three-lead or five-lead ECG wires.

NOTE! The ECG/Respiration patient circuit is electrically isolated.

NOTE! The monitor is protected against damage from defibrillator, diathermy, and electrocautery discharge.

Oximetry Warnings, Cautions, and Notes

WARNING! Prolonged use or the patient's condition may require changing the sensor site periodically. Change the sensor site and check skin integrity, circulatory status, and correct alignment at least every 4 hours.

WARNING! When attaching sensors with Microfoam® tape, do not stretch the tape or attach the tape too tightly. Tape applied too tightly may cause inaccurate readings and blisters on the patient's skin (lack of skin respiration, not heat, causes the blisters).

WARNING! Using a damaged sensor may cause inaccurate readings, possibly resulting in patient injury or death. Inspect each sensor. If a sensor appears damaged, do not use it. Use another sensor or contact your authorized repair center for help.

WARNING! Using a damaged patient cable may cause inaccurate readings, possibly resulting in patient injury or death. Inspect the patient cable. If the patient cable appears damaged, do not use it. Contact your authorized repair center for help.

WARNING! If any of the integrity checks fail, do not attempt to monitor the patient. Use another sensor or patient cable, or contact the equipment dealer for help if necessary.

WARNING! Use only SpO_2 sensors supplied with, or specifically intended for use with, this device.

WARNING! Tissue damage may result from overexposure to sensor light during photodynamic therapy with agents such as verteporphin, porfimer sodium and meta-tetrahydroxyphenylchlorin (mTHPC). Change the sensor site at least every hour and observe for signs of tissue damage. More frequent sensor site changes or inspections may be indicated depending upon the photodynamic agent used, agent dose, skin condition, total exposure time or other factors. Use multiple sensor sites.

WARNING! Under certain clinical conditions, pulse oximeters may display dashes if unable to display SpO_2 and/or pulse rate values. Under these conditions, pulse oximeters may also display erroneous values. These conditions include, but are not limited to: patient motion, low perfusion, cardiac arrhythmias, high or low pulse rates or a combination of the above conditions. Failure of the clinician to recognize the effects of these conditions on pulse oximeter readings may result in patient injury.

WARNING! Optical cross-talk can occur when two or more sensors are placed in close proximity. It can be eliminated by covering each site with opaque material.

WARNING! SpO_2 measurements may be adversely affected in the presence of high ambient light. Shield the sensor area (with a surgical towel, for example) if necessary.

WARNING! Dyes introduced into the bloodstream, such as methylene blue, indocyanine green, indigo carmine, patent blue V (PBV), and fluorescein may adversely affect the accuracy of the SpO_2 reading.

WARNING! Significant levels of dysfunctional hemoglobins, such as carboxyhemoglobin (as with CO-poisoning) or methemoglobin (as with sulfonamide therapy), will affect the accuracy of the SpO_2 measurement.

WARNING! Any condition that restricts blood flow, such as use of a blood pressure cuff or extremes in systemic vascular resistance, may cause an inability to determine accurate SpO_2 and pulse rate readings.

WARNING! Remove fingernail polish or false fingernails before applying SpO_2 sensors. Fingernail polish or false fingernails may cause inaccurate SpO_2 readings.

WARNING! Failure to carefully route the cable from the sensor to the monitor may allow the patient to become entangled in the cable, possibly resulting in patient strangulation. Route the cable in a way that will prevent the patient from becoming entangled in the cable. If necessary, use tape to secure the cable.

CAUTION! Unplug the sensor from the monitor before cleaning or disinfecting.

CAUTION! Do not autoclave, ethylene oxide sterilize, or immerse the monitor and other accessories in liquid. Evidence that liquid has been allowed to enter the monitor voids the warranty.

NOTE! Obstructions or dirt on the sensor's red light or detector may cause a sensor failure. Make sure there are not obstructions and the sensor is clean.

NOTE! If the oximeter parameter is being monitored, the pitch of the pulse beep is determined by the SpO_2 value. The higher the SpO_2 value, the higher the pulse beep pitch; the lower the SpO_2 value, the lower the pulse beep pitch.

NOTE! The low SpO_2 alarm limit minimum test value is 85. If you change the low SpO_2 alarm limit to a value less than 85 and then change the patient type, add a new patient, or power down/power up the monitor, a minimum value of 85 takes the place of the value you entered.

Non-invasive Blood Pressure Warnings, Cautions, and Notes

WARNING! Blood pressure measurements may be inaccurate if cuffs and/or hoses other than those specified by Smiths Medical PM, Inc. are used.

WARNING! Repeated use of STAT mode for periods longer than 15 minutes should be avoided to reduce the patient's risk for soft tissue or nerve damage. When using the monitor for long periods of time, select the longest clinically appropriate measurement interval and periodically examine the patient for signs of injury and ensure proper cuff placement.

WARNING! Make sure that hoses are not kinked, compressed, or restricted.

WARNING! Check that operation of the equipment does not impair the circulation of the monitored patient.

WARNING! Blood pressure measurements may not be accurate for patients experiencing arrhythmias.

WARNING! Do not verify the Non-Invasive Blood Pressure calibration while the cuff is attached to a patient.

WARNING! Verify cuff size is correct for the selected patient mode on the monitor.

CAUTION! To ensure that the unit remains in calibration, perform a calibration verification on a yearly basis.

CAUTION! Extremity and cuff motion should be minimized during blood pressure determinations.

CAUTION! Proper blood pressure cuff size and placement are essential to the accuracy of the blood pressure determination.

CAUTION! Any blood pressure recording can be affected by the position of the patient, his or her physiologic condition, and other factors.

CAUTION! Blood pressure measurements should be interpreted by a clinician.

NOTE! There are no user-serviceable adjustments for the Non-Invasive Blood Pressure calibration verification. If the monitor appears to be out of calibration, contact your authorized repair center for help.

NOTE! Systolic and diastolic blood pressure measurements determined with this device are equivalent to those obtained by the trained observer using the cuff/stethoscope auscultation method, within the limits prescribed by the American National Standard, *Electronic or Automated Sphygmomanometers*. AAMI SP10-1992

NOTE! Mean arterial blood pressure measurements determined with this device are equivalent to those obtained by an intra-arterial blood pressure measurement device as determined by Smiths Medical PM, Inc.

NOTE! Clinical validation studies are available upon request.

Invasive Blood Pressure Warnings, Cautions, and Notes

WARNING! Avoid conductive connection with any metal parts.

NOTE! The IBP ZERO NEEDED message is displayed when the monitor is turned on, when the site label is changed, or when the transducer is connected to the monitor (even if the same transducer is disconnected then reconnected to the monitor).

NOTE! Use only invasive pressure transducers and interface cables specifically intended for use with this device and its side panel connectors.

NOTE! The IBP1 and IBP2 waveforms must be visible and adjacent in order to be overlaid.

NOTE! When IBP1 and IBP2 are overlaid, the scale settings for IBP1 and IBP2 are changed to the higher of the two scales.

NOTE! Dual channel simulators may affect verification of IBP operation. Use only single channel simulators.

NOTE! All specified transducers were tested for immunity to radiated radio frequency electromagnetic fields at a level of 3V/m in accordance with IEC 60601-2-34:2000. Additional validation at levels of 10V/m was performed using the pvb Critical Care GmbH xtrans® and Edwards Lifesciences TruWave transducers.

Temperature Warnings, Cautions, and Notes

NOTE! Use only temperature sensors and interface cables specifically intended for use with this device.

Capnograph Warnings, Cautions, and Notes

WARNING! The capnograph contains no compensation for barometric pressure; therefore, readings in mmHg and kPa are correct only under the pressure at which the capnograph is calibrated. Manual compensation can be made by performing a low calibration (low cal).

WARNING! Use of accessories other than those supplied by or recommended by the manufacturer may result in inaccurate readings, altered measurement response times or erroneous occlusion messages.

CAUTION! Pump motors in the capnograph may adversely affect other medical equipment such as ECG tracings.

CAUTION! Use of the monitor during continuous nebulized medication delivery will result in damage to the monitor which is not covered by the factory warranty. Disconnect the $ETCO_2$ sample line from the patient circuit or power off during medication delivery.

NOTE! All user and patient accessible materials are non-toxic.

NOTE! During the auto zero calibration (autocal) sampling, the CO_2 waveform and digits will disappear for 1-5 seconds. After this, breath detection restarts. This should happen only during extreme temperature changes, and not during normal patient monitoring or changes of ambient pressure.

NOTE! The auto zero calibration (autocal) is similar to a low calibration (low cal), excluding ambient pressure so as not to stop the pump.

NOTE! Capnometer patient attachments and sample lines are disposable, single-patient use items. Use a new patient attachment and sample line for each new patient.

NOTE! Discard and replace the patient attachment if it becomes occluded. If an air leak is noted, check all patient connections. If the air leak persists, discard and replace the patient attachment.

Chapter 2: Routine Maintenance

General Cleaning

The LCD and all external surfaces may be cleaned with a mild, diluted soap and a damp, soft cloth. Do not use soutions that contain chlrine, ammonia, fluoro-carbons, or hydrocarbons. Do not use abrasive cleaners or high fiber wipes that may scratch the surface. Do not allow cleaners to remain on the system surfaces, wipe off immediately

NOTE! Before cleaning the unit, ensure that the monitor is off and the mains power cord is disconnected.

NOTE! Do not allow liquid to enter the case or submerge any part of the system. Allow components to dry thoroughly before reconnecting the system to AC power. Evidence that liquid has been allowed to enter the monitor voids the warranty.

Performance and Safety Checks

RECOMMENDED MAINTENANCE	FREQUENCY	INSTRUCTIONS
General Cleaning	As needed	
Inspect the system, cables, and cords	Before use	See page 2-1.
Safety checks, in accordance with IEC 60601-1	Annually	See page 2-7.
Non-invasive Blood Pressure calibaration verification	Annually	See page 2-2.
ECG calibaration verification	Annually	See page 2-3.
CO_2 HILO calibration	Monthly	See page 2-5.
Critical Failure Alarm (CFA) verification	Annually	See page 2-6.

System, Cables, and Cords Inspection

Examine the exterior for cleanliness and general physical condition. Ensure that the housing is intact, hardware is present and secure, and labeling is legible.

Examine the power cord for damage. Ensure that the prongs of the plug are secure in the casing, and that no damage is present in the cord itself.

Inspect all patient cables, leads, and sensors.

Non-invasive Blood Pressure Calibaration Verification

Verify the calibration of the NIBP parameter annually, or if doubt exists about the accuracy of the digital manometer's readings or the measured values.

You will need:

- Advisor® Vital Signs Monitor
- Standard mercury manometer (Baum 661-300 or equivalent)
- Adult-sized non-invasive blood pressure cuff

To verify that the NIBP parameter is calibrated:

1. Remove the NIBP cuff from the patient.

WARNING! Do not verify the non-invasive blood pressure calibration while the cuff is attached to a patient.

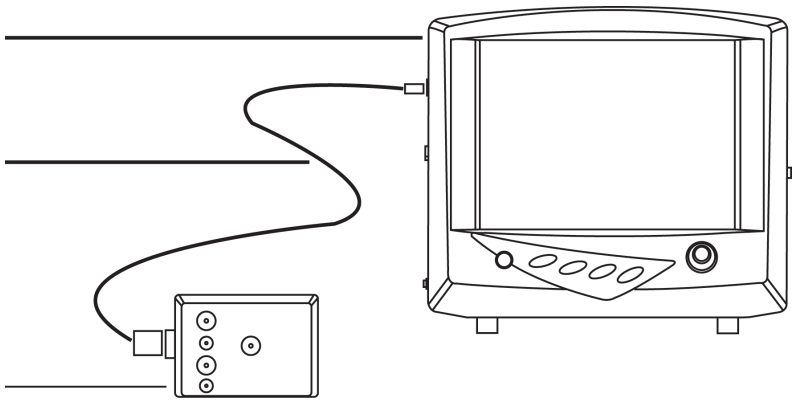
NOTE! There are no user-serviceable adjustments for the NIBP calibration. If the monitor appears to be out of calibration, contact your authorized repair center for help.

2. Make sure the patient type is set to ADULT.
3. Secure the NIBP cuff to a rigid fixture, about the size of an adult arm.
4. "Tee-in" the standard mercury manometer with the NIBP cuff.
5. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
6. Highlight SERVICE MENU and push the knob to access the service menu.
   - The service menu is password protected. To enter your password:
     a. Turn the rotary knob to access the password box and push the knob to select the first character field.
     b. Turn the rotary knob to highlight the desired character and push the knob to select. The factory-installed password is ADVISOR.
     c. Push the knob to select the next character field.
     d. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps b and c until each character in the password is selected.
     e. Highlight ENTER and push the knob to select.
   - If you correctly selected the password, the service menu will appear on the lower left corner of the display.
   - If you did not select the correct password, ***Invalid Password; please re-enter*** will be displayed in the message line. Try to access the service menu again.
7. On the service menu, highlight VERIFY NIBP CALIBRATION and push the knob to select.
8. Highlight YES and push the knob to select.
   - The monitor will automatically inflate the cuff to a pressure of about 180 mmHg, then stabilize. The pressure will be maintained so the readings can be compared.
   - The digital manometer reading and the mercury manometer reading should agree to within ±3 mmHg or 2%, whichever is greater. The pressure may decrease over time due to air leakage, but should not exceed the limit of 6 mmHg/minute.
9. When calibration verification is complete, press the NIBP key ( ) on the monitor.

ECG Calibration Verification

Verify the calibration of the ECG parameter annually, or if doubt exists about the accuracy of measured values.

Figure 2.1: Verify ECG Calibration



You will need:

- Advisor® Vital Signs Monitor
- BCI® 1606 SpO2 /ECG Patient Simulator
- BCI® 3311 Oximetry Cable

To verify that the ECG parameter is calibrated:

1. Disconnect all cables and sensors from the monitor.
2. Press the On/Off key (⏻) on the front of the monitor to turn it on.
3. Set RATE SOURCE to ECG.
   a. Turn the rotary knob on the monitor to move the cursor. Highlight the ECG parameter box name and push the knob to access the ECG parameter menu.
   b. Highlight RATE SRC and push the knob to select.
   c. Choose ECG and push the knob to select.
   d. Highlight MAIN MENU and push the knob to select.
4. Select 3-LEAD ECG processing:
   a. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
   b. Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
   c. Highlight ECG LEADS PROCESSING and push the knob to select.
   d. Highlight 3-lead and push the knob to select.
   e. Highlight MAIN or PREVIOUS and push the knob to select.
5. Connect the BCI® 3111 Oximetry Cable to the BCI® 1606 SpO_2 /ECG Patient Simulator.

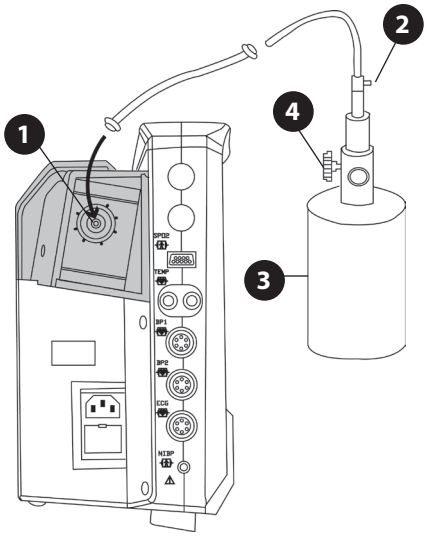
6. Connect the oximetry cable to the oximetry connector (SpO_2) on the side of the monitor.
   a. The simulator will automatically turn on and the Pulse LED will flash to indicate that it is operating.
   b. A measured value of 97-99 % SpO_2 should be displayed in the SpO_2 parameter box, and a measured value of 79-81 beats per minute (bpm) should be displayed in the SpO_2 parameter box.
   c. If the Pulse LED does not light or if the measured values in the SpO_2 parameter box are incorrect, replace the 9V transistor battery in the simulator.
7. Connect the RA, LA, and LL leads to the simulator.
8. Connect the ECG cable to the monitor. A simulated ECG waveform should appear in Waveform 1.
9. Press and hold the SpO_2 OFF button on the simulator to momentarily disable the oximetry reading.
10. If the ECG parameter is functioning properly an ECG waveform will be displayed and a measured value for heart rate of 79-81 beats per minute (bpm) will appear in the ECG parameter box.
    - You can change the primary ECG lead (to I, II, or III) to verify that each waveform is accurately displayed.
      a. On the ECG waveform menu, turn the rotary knob to highlight PRIMARY LEAD and push the knob to access the ECG leads IDs submenu.
      b. Highlight the desired primary ECG lead and push the knob to select. See the following tables for the primary lead configuration.

ECG 3-LEAD CONFIGURATION		
I	Lead I Configuration	RA-LA
II	Lead II Configuration	RA-LL
III	Lead III Configuration	LA-LL

      c. Highlight MAIN or PREVIOUS and push the knob to select.
      - You can remove any one of the ECG leads from the simulator to verify that the LEADS FAIL alarm is reliable.
11. Disconnect the simulator from the monitor. The simulator will automatically turn off.

CO_2 HILO Calibration

Figure 2.2: HILO CAL



1 Gas inlet

2 T connector

3 Calibration gas

4 Flow control valve

NOTE! A HILO CAL procedure should be performed after the capnography parameter has been on for at least 15 minutes.

NOTE! Remove the device from the patient before performing a high/low calibration procedure.

To perform a HILO CAL:

1. If the patient is attached to the capnography module, disconnect the sample line tubing from the monitor by unscrewing the filter luer from the module on the left side of the monitor.
2. If you are using a standard pneumatics module, remove the moisture filter and attach the calibration adapter (BCI® part number 8223) to the gas inlet.
3. Connect one end of the "T" assembly to the regulator on the gas canister. Connect the second end of the "T" assembly to the gas inlet on the monitor. Leave the third end of the "T" assembly open to room air.
4. Turn the rotary knob on the monitor to move the cursor. Highlight the CO_2 parameter box name and push the knob to select.
5. Highlight HILO CAL and push the knob to select.
6. Turn the rotary knob to highlight YES and push the knob to select. TURN GAS ON will be displayed in the CO_2 parameter box.
7. Quickly open the flow control valve on the calibration gas canister. The valve must be fully opened in less than 30 seconds.
8. When TURN GAS OFF is displayed in the CO_2 parameter box, close the flow control valve of the calibration gas canister.
9. When the calibration procedure is finished, CAL DONE will be displayed in the CO_2 parameter box.
10. Change the units of measurement for CO_2 to percent concentration (%) as follows.
    a. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight **SETUP** and push the knob to select.
    b. Highlight **PARAMETER OPTIONS** and push the knob to access the parameter options submenu.
    c. Highlight **CO2 UNITS** and push the knob to select.
    d. Highlight the desired unit and push to select.
    e. Highlight **MAIN** or **PREVIOUS** and push the knob to select.
11. Verify the accuracy of the calibration by opening and closing the flow control valve on the calibration gas canister at a rate approximately 15 Hz (on for two seconds, off for two seconds). Repeat this for 4-8 on/off cycles.
12. Verify that the $ETCO_2$ reading in the CO_2 parameter box indicates 10.0% CO_2 0.4 (9.6-10.4%)
13. Disconnect the calibration gas fixture. If you are using a standard pneumatics module, remove the calibration adapter and reconnect the moisture filter.

- If the calibration procedure is unsuccessful, a message will be displayed in the CO_2 parameter box. The capnography parameter will revert to the last successful calibration data and resume operation.

Critical Failure Alarm (CFA) Verification

This alarm should be tested annually:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.

2. Highlight SERVICE MENU and push the knob to access the service menu.

   - The service menu is password protected. To enter your password:

     a. Turn the rotary knob to access the password box and push the knob to select the first character field.

     b. Turn the rotary knob to highlight the desired character and push the knob to select. The factory-installed password is ADVISOR.

     c. Push the knob to select the next character field.

     d. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps b and c until each character in the password is selected.

     e. Highlight ENTER and push the knob to select.

   - If you correctly selected the password, the service menu will appear on the lower left corner of the display.

   - If you did not select the correct password, ***Invalid Password; please re-enter*** will be displayed in the message line. Try to access the service menu again.

3. On the service menu, highlight TEST CFA ALARM and push the knob to select.

4. Highlight YES and push the knob to select.

5. Verify that the alarm sounds.

6. To silence the critical failure alarm (CFA), press the alarm silence key (🔕) or highlight NO under TEST CFA ALARM and push the knob to select.

If the alarm does not sound, contact your authorized repair center for help.

Performing Patient Safety Checks

The tests described are recommended to be performed as part of a comprehensive preventative maintenance program.

- Ground Resistance Test
- Enclosure Leakage Current

All tests can be performed using commercially available Safety Analyzer test equipment. You will need:

- Advisor® Vital Signs Monitor
- Safety Analyzer, capable of the following
  a. Ground Bond tester capable of providing up to 40 Amps continuous duty test current.
  b. 220VAC Leakage Tester
  c. Hi-pot Testing with Current Limit: 5mA for 1.5 kVAC and 1 mA for 4 kVAC.
- Patient I/O "Shorting" plugs. These are simply patient cable ends that have all the pins shorted together. For example, the oximeter shorting plug would simply be a male DB9 connector that can plug into the female oximeter patient connector on the monitor. Contact the service department for additional information.

General Requirements

- Test Personnel must wear a grounded wrist strap or equivalent while handling any circuit boards. Anti-static procedures and work areas are to be used throughout.
- Test equipment must be calibrated and maintained to NIST traceable standards.

If you have questions or need additional assistance, please contact the Service Department.

Ground Resistance Check

NOTE! The equipotential ground pin is the rotary encoder. Remove the rotary knob to access the rotary encoder.

Inspect the power cord for cracks and wear.

A comprehensive ground resistance measurement may be performed using a Safety Analyzer. Follow the instructions provided by the Safety Analyzer manufacturer when performing the ground resistance check using the Safety Analyzer.

The impedance between the protective earth terminal and the rotary encoder during this test must not exceed 0.1Ω.

Enclosure Leakage Current

NOTE! When performing Enclosure Leakage Current test using the Safety Analyzer, follow the instructions provided by the instrument manufacturer.

CAUTION! Please note there is considerable hazard in performing this test. Use precautionary measures to avoid contact with the line voltage. In addition, any time that the ground connection has been opened, do not touch the chassis or patient cable during the test.

Perform all of the following tests with the correct shorting plug inserted into the patient connections.

1. Connect the 220 VAC power cord from the Safety Analyzer into the unit. Verify that the monitor is on.
2. Apply the flying test lead from the Safety Analyzer to the earth ground (rotary encoder). Verify that the leakage current is less than 100 µA.
3. Induce the following single fault conditions: open ground, open neutral. Verify that the leakage current is always less than 500 µA.
4. Reverse the polarity of main supply (reverse hot/neutral lines) and repeat steps 2 and 3.

Patient Leakage Current

NOTE! When performing Patient Leakage Current test using the Safety Analyzer, follow the instructions provided by the instrument manufacturer.

CAUTION! Please note there is considerable hazard in performing this test. Use precautionary measures to avoid contact with the line voltage. In addition, any time that the ground connection has been opened, do not touch the chassis or patient cable during the test.

Perform all of the following tests with the correct shorting plug inserted into the patient connections.

1. Connect the 220 VAC power cord from the Safety Analyzer into the unit. Verify that the monitor is off.
2. Connect patient I/O "Shorting" plugs to all of installed parameter connectors (ECG, IP, TEMP, Oximeter).
3. Apply the flying test lead from the Safety Analyzer to each patient connection. Verify that the leakage current from each patient connection to ground is less than 10 µA.
4. Induce the following single fault conditions: open ground, open neutral. Verify that the leakage current is always less than 50 µA.
5. Reverse the polarity of main supply (reverse hot/neutral lines) and repeat steps 7 and 8.
6. Turn off the monitor and apply Mains voltage to the ECG connector.
7. Measure the leakage current from the ECG connector to ground. Verify that the leakage current is less than 50 µA.
8. Induce the following single fault conditions: open ground, open neutral. Verify that the leakage current is always less than 50 µA.
9. Reverse the polarity of main supply (reverse hot/neutral lines) and repeat steps 11 and 12.

Dielectric Withstand - Hi-pot Test

The following test described is NOT recommended to be performed as part of a comprehensive preventive maintenance program.

CAUTION! Dielectric Withstand Voltage / Hi-pot Testing is degradable to the monitor. Performing this test may result in monitor failure.

1. Install shorting plugs in all patient connectors.
2. Attach the Advisor® unit to the Safety Analyzer by connecting the "red" lead to both prongs on the unit's power cord, and the "black" lead to the unit's enclosure (shaft of the rotary encoder, remove knob for test).
3. Verify that no breakdown occurs at 1500 VAC for a period not more than 1 minute 6 seconds or less than 1 minute.
4. Move the "black" lead to the shorting plug on the ECG connector.
5. Verify that no breakdown occurs at 4000 VAC for a period not more than 3 seconds or less than 2 seconds.
6. Repeat steps 4 and 5 for the oximeter, both IP channels (if installed), and both Temp channels (if installed).
7. Move the "black" lead to the shorting plug on the serial port (if installed).
8. Verify that no breakdown occurs at 1500 VAC for a period not more than 1 minute 6 seconds or less than 1 minute.

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Chapter 3: Block Level Description

Advisor® Vital Signs Monitor Product Description

This vital signs monitor is intended to be used in the ICU, CCU, OR, ER, RR, Labor and Delivery rooms, special procedure labs and other areas of a hospital or clinic where low-end monitoring systems are needed. The Advisor is a factory configurable monitor offering many combinations of monitoring parameters for adult, pediatric, and neonatal patients (some optional parameters are not intended for neonatal use). Standard parameters are 3-lead Electro-cardiography (ECG), Non-Invasive Blood Pressure (NIBP), and Pulse Oximetry (SpO_2). Optional parameters include 5-lead ECG, Impedance Respiration (adult and pediatric modes only), dual Invasive Blood Pressure (IBP), dual Temperature (TEMP), and Sidestream Capnography (adult and pediatric modes only). Other system options include an internal rechargeable backup battery and battery charger, a graphical thermal printer, and a serial communications port.

The Advisor uses a 10.4" color Liquid Crystal Display (LCD) at 640 x 480 pixel resolution. The user controls include five dedicated pushbutton keys and a general-purpose rotary encoder for highlighting and selecting onscreen menu areas. The internal AC to DC power supply accepts universal AC mains voltage by way of a medical grade industry standard IEC-320 connector that provides external access to fuses on both Line and Neutral circuits, as well as two spares.

The standard Advisor (configured for standard parameters) contains seven circuit board assemblies: the AC Power Entry Board, the universal AC to DC Power Supply Assembly, the DC Power Interconnect Board, the Pulse Oximetry Board, the NIBP Board, and the LCD Backlight Inverter Board and the Main Board. All non-standard parameters and system options are added to the Advisor Vitals Signs Monitor by way of additional circuit board assemblies. The optional boards are: IBP/Temperature Board, Impedance Respiration Board, Printer Adapter Board, Serial Interface Board, Battery Charger Board, and CO_2 Module.

The Main Board is the largest circuit board and provides the majority of the Advisor functionality: power on/standby control, power distribution, patient isolation, parameter signal acquisition, parameter signal processing, internal and external serial data communications, user control interface, LCD display control, realtime clock and trend memory battery backup, speaker driver, and critical failure monitoring.

AC Power Entry Board

WARNING! Shock Hazard. This circuit board assembly operates at AC mains potential and is energized whenever the power cord is plugged into the mains supply, regardless if the Advisor® is on or in the STANDBY/OFF mode. Never service this equipment while AC power is connected to the monitor.

The AC Power Entry Board brings AC mains voltage into the rear half of the chassis, performs Electro-Magnetic Compatibility (EMC) filtering, and provides connection points for internal protected earth wiring. All components on this circuit board assembly can be considered critical components; meaning replacement parts must be identically rated. The AC mains connector (PE1) is a medical-grade IEC-320 power input receptacle that fuses both the LINE and the NEUTRAL inputs. Two spare fuses are also stored in the fuse compartment. Be sure to replace fuses with the exact replacement fuses indicated on the rear of the unit. The output of this board is a two-wire harness (J1 is line and J2 is neutral), at AC line potential, which connects to the input of the Universal AC to DC power supply (TB1).

Universal AC to DC Power Supply Assembly

WARNING! Shock Hazard. This circuit board assembly operates at AC mains potential and is energized whenever the power cord is plugged into the mains supply, regardless if the Advisor® is on or in the STANDBY/OFF mode. Never service this equipment while AC power is connected to the monitor. Be sure to reattach the protective earth wire (green with a yellow stripe) to the power supply chassis after servicing.

The Universal AC to DC Power Supply is a medical grade power supply. It accepts AC mains (at TB1) from the AC Power Entry Board and outputs +12 VDC (TB2) to either the DC Power Interconnect Board or the Battery Charger Board when the rechargeable backup battery option is installed. The universal aspect allows operation from 100 to 240 VAC mains at either 50 or 60 Hertz. This assembly provides the main +12VDC power distribution within the Advisor. This assembly is considered a critical component; meaning it must be replaced by identically the same power supply.

DC Power Interconnect Board

The DC Power Interconnect Board contains two connectors which route DC power from the universal AC to DC power supply (J1) (rear chassis half) to the Main Board (J2) (front chassis half). When the rechargeable battery backup option is installed, the DC Power Interconnect Board is replaced by the Battery Charger Board.

Battery Charger Board (Rechargeable Battery Option)

The Battery Charger Board controls the routing of power to the Main Board when the rechargeable battery option is present. When powered from the AC mains, the universal AC to DC power supply powers the Main Board. When AC mains voltage is not present, the rechargeable backup battery powers the Main Board. In either case, this board is powered whenever the AC mains voltage is connected and/or the backup battery is present (D2 and U1), regardless if the Advisor is on or in the standby/off mode. The battery charger micro controller, (U6), monitors both the presence of AC power (via voltage detector U7) and the charge status or presence of the rechargeable battery (connected at J4). It then determines which source will be used to power the Main Board. When AC mains is present, the battery charger micro controller powers the Main Board from the output of the universal AC to DC power supply (via mosfet Q6) and disconnects the battery (via Q7). It also controls the charging of the rechargeable battery when needed (via U2). When AC power is disrupted the battery charger micro controller automatically switches over to the rechargeable backup battery (via mosfet Q7) for uninterrupted operation. The Battery Charger Board supports a Nickel-Metal-Hydride (NiMH) battery chemistry. Battery short circuit / overload conditions are protected by way of the self-resetting fuse F1 which will remain open circuited as long as the short circuit / overload condition persists. Mosfet Q8 provides reverse battery protection. The micro controller reports battery status to the Main Board and controls the front-panel BATTERY LED by way of J5. When AC mains is disconnected, this LED will remain off. When AC mains is present, the BATTERY LED blinks when charging the battery and remains constantly on when the rechargeable battery is fully charged. The Battery Charger Board also controls the AC LED by way of J5. If AC power is not detected then the Battery Charger Board will turn off the AC LED by turning Q2 on. If AC power is detected then the Battery Charger Board will turn on the AC LED by turning Q2 off.

SpO_2 (Pulse Oximetry) Board

SpO_2 (Pulse Oximetry) Board is connected to the patient-isolation side of the Main Board which provides isolated power and isolated bi-directional TTL serial communications directly to the ARM7 microprocessor. The SpO_2 Board provides a header connector for the cable harness to the SpO_2 probe connector mounted on the side of the Advisor. The Board also provides a ribbon cable connector for connection to the patient-isolation side of the Main Board (J14). Several versions of SpO_2 boards are compatible with the Advisor. Each are uniquely identified at power-up and reported on the power-up screen as well in the "SOFTWARE VERSION" menu.

Non-Invasive Blood Pressure (NIBP) Assembly

The Non-Invasive Blood Pressure (NIBP) Assembly consists of three components, each mounted separately below the Main Board: the pump, the valve / manifold assembly, and the NIBP Board assembly. The NIBP Board assembly connects to the Main Board via connector (J2), supplying +12VDC power and bi-directional TTL serial communications directly to the ARM7 microprocessor. Inverter IC (U12 on board 80002B1) provides 3.3 to 5.0 V logic translation for the +5V logic needed by the NIBP Board.

LCD Backlight Inverter Board

WARNING! The LCD Backlight Inverter Board operates at voltages in excess of 1000 VAC and may arc to items in close proximity.

The LCD display panel is backlit with cold cathode filament lamps powered by the LCD Backlight Inverter Board. The board converts +12VDC to an approximate 44kHz, 1400 VAC drive for the lamps. The LCD Backlight Inverter Board is mounted directly below the LCD panel, sandwiched between the front half of the case and the internal mounting plate for the LCD and Main Board. The Inverter Board is connected to the Main Board by way of connector J6. The ARM7 microprocessor has direct control of switching power to the LCD Backlight Inverter Board by way of mosfets Q6 & Q7.

Printer Adapter Board (Printer Option)

When the optional graphics printer is installed, a small Printer Adapter Board connects directly to the printer and is secured to the same internal mounting bracket as the printer. The Printer Adapter Board also provides a ribbon cable connector for connection to the Main Board as well as a large filter capacitor to help supply peak currents required by the thermal print-head when printing. The Printer Adapter Board assembly connects to the Main Board via connector (J21), supplying +12VDC power, +5VDC power, and bi-directional TTL serial communications to the ARM7 microprocessor via UART (U74).

CO_2 Module (Optional)

The CO_2 Module can be installed on the back of the monitor. It is based on Smiths Medical PM 1410 Gas Module (see Smiths Medical PM Document 57700TEC for description of 1410 Module).

Module attachment to the monitor in the advanced mode is shown on the drawing (see 57692A2).

The round mini-DIN connector located on the back plate of the monitor supplies power and serial communication lines to the Module. Inside the monitor, mini-DIN connector is connected to J4 (power) and J6 (communications) on the Main Board.

As long as 1410 Module is installed, Main Monitor Software recognizes it and enables CO_2 parameter box and CO_2 waveform.

Main Board

The Main Board provides the majority of the Advisor Vital Signs Monitor functions: patient signal acquisition, patient isolation (safety), user control interface, LCD display and backlight control, audio sound generator, realtime clock and battery-backup memory, program memory, printer control, communications output, and an independent self-powered critical failure alarm. The Advisor subsystems are detailed below.

Main Board - Microprocessor

The main processor (U21) is an ARM7, 32-bit RISC microprocessor, running from an external 14.7456 MHz spread-spectrum clock source (U20, X3), but internally clocked at 77+MHz. The chip is a highly integrated controller packaged in a low-pitch 176-pin LQFP package. On-chip integrated peripherals include an LCD video display controller, memory controller, DMA controller, UART and synchronous serial interfaces, reset and power control, PWM controllers, and a JTAG interface (J11). The microprocessor has an external 32-bit data bus and a 26-bit address bus. The processor core runs on a 1.8 VDC supply (U17) and a 3.3 VDC supply (U15) to power input / output (I/O).

Main Board - Reset System

The reset system is controlled by supervisory IC (U7). This IC monitors the main logic supply (Vcc), handles switch-over to a lithium coin cell battery backup (BAT1), and provides a voltage comparator that is used to signal the imminent loss of the main power source (UNSW_POWER). The supervisor IC and coin battery maintain a backup power source (VRAM) to the Static Ram (SRAM) trend memory (U25) and the realtime clock IC (U2) at all times.

Main Board - Clocks

The ARM7 microprocessor is clocked from an external 14.7456 MHz spread-spectrum clock source (U20, X3), but internally is clocked-multiplied to 77+MHz. The spread-spectrum approach helps reduce EMC emissions by spreading the emitted energy over a wider frequency band. Several other clock signals generated in the main processor are derived from the main clock; the LCD display (LCD_CLK), SDRAM memory (SDCLK), and Programmable Logic Device (PLD_CLK). This same 14.7456 MHz spread-spectrum clock source is used to clock the Programmable Logic Device (U1). A 14.7456 MHz clock source is used to clock dual UART IC (U74). Realtime clock controller (U2) uses its own 32.768 KHz watch crystal. The DSP uses a 18.432MHz clock.

Main Board - System Programmable Logic Device (PLD)

The Main Board consolidates the majority of its glue-logic in a Programmable Logic Device (U1). This PLD is an Altera EPM3064A in a 100-pin LQFP package. The PLD is involved in the following functions: front keypad interface (J8), rotary knob interface (J9), realtime clock (U2) serial communication, audio ON/OFF, Communications Port & Smart Media interface (J20), memory bus control, rechargeable battery status, and peripherals reset. The PLD can be in-circuit programmed through connector J1.

Main Board - Memory

The five memory spaces are as follows:

- Mbytes x 16 bit Flash memory (U22). This memory IC is the non-volatile, program memory space. At power up, the contents of U22 is transferred to faster access SDRAM (U23, U24), from which program code is executed.
- Mbytes x 32 bit SDRAM, comprised of two 4 Mbytes x 16 bit chips (U23, U24). This RAM has fast access and is used to execute program code, refresh the video display, and other scratch-pad functions.
- 56 kbytes x 8 bit of battery backed-up Static RAM (SRAM). The power to this memory space is backed-up by supervisory IC (U7) and lithium coin cell battery (BAT1). This memory space is used for data that must be retained at power down and/or during a system power failure.
- 56 kbytes x 8 bits EPROM (U26). This memory IC holds the program for the DSP. At power up the contents of the EPROM are loaded into the DSP (U28)
- Realtime clock IC (U2) contains 31 bytes of battery backed-up Static RAM (SRAM). The power to this memory space is backed-up by supervisory IC (U7) and lithium coin cell battery (BAT1). This memory space is used for data that must be retained at power down and/or during a system power failure.

Main Board - Video Generation

The ARM7 microprocessor has an on-chip LCD controller which generates all of the necessary signaling to the LCD panel by way of connector J7. All signals to this connector have series ferrite chip beads to help reduce EMC emissions. The controller is setup for 640 x 480 resolution, 25.126MHz pixel clock, 31.5KHz horizontal frequency and 70 Hz vertical field rate.

Main Board - Audio Generation

The Main Board generates tone, volume, and speaker drive for audible alarms and other audible features. Audio tone and volume control signals originate as Pulse Width Modulated (PWM) signals from the main processor (U21). The signals are further signal-conditioned by U72 then amplified by a class-D audio amplifier (U14) to efficiently drive an off-board 8-ohm speaker connected to J5. The speaker is mounted to the rear-half of the unit.

Main Board - Logic Power and Patient Isolation Power

The Main Board accepts DC power input on connector J10. Approximately +12 VDC is present at TP12 (J10-1,3,5) regardless if the unit is on or in standby/off mode. The source of the input DC voltage is either the output of the universal AC to DC power supply or the rechargeable backup battery (if that option is installed and AC power is off or not connected). Mosfet Q11 controls power to the rest of the Main Board by way of mosfet (Q5) and keypad ON detection flip-flop (U6). Once Q11 is turned on, the PWM DC to DC controller IC (U19) soft-starts and converts the input voltage to a regulated +5 VDC (TP22) by way of mosfet Q8, transformer T1, rectifier D2, and capacitors C171 & C173. This voltage supply is the source for all logic supplies on the non-isolated Secondary Extra Low Voltage (SELV) side of the Main Board. Segmented secondary windings on transformer T1 (pins 6, 8, and 10) create the power for the patient-isolation side of the Main Board. The secondary windings meet UL2601 / EN60601 creepage and clearance requirements to provide the required patient-isolation. Rectifiers D3 & D4, and capacitors C168 & C169 create the unregulated isolated supplies at TP3 and TP4 and are nominally +/- 8 VDC. Transformer T1 and capacitor C175 are critical components which should be replaced with identical parts.

Main Board - Thermal Printer Interface (Optional)

The Advisor uses the XE-50 graphical thermal printer from GSI Lumionics when the printer option is installed. The printer uses 2-inch wide paper and is capable of printing all numerical and graphical patient data. Internally, a Printer Adapter Board connects directly to the printer and serves as an interconnect board for a ribbon cable connection to the Main Board at J21. Portions of logic inverters U10 & U11 translate 5 V logic from the printer to 3.3 V logic for the Main Board UART (U74).

Main Board - Communications Port (Optional) and Smart Media Interface

The Main Board provides a multi-purpose header connector (J20). This connector supports an optional serial communications interface board or a Smart Media (Flash) interface board. The serial communications board provides an isolated RS-232 interface operating at 115.2K Baud, 8-bit data, No parity, 1-start bit, and 1-stop bit. The output connector is a standard male sub-D DB-9 located at the rear of the Advisor. The service menu allows selection of several output formats. The service menu also allows new software to be loaded on to the advisor's Flash though the serial board.

The Smart Media interface board can also be connected to J20 to update the Advisor's Flash program memory (software update). If a serial communications interface option is installed, it must be temporarily removed in order to perform the software update and then reinstalled afterwards. Both interface boards are electronically coded so that at power-up, the main processor can recognize which if any are present and proceeds accordingly. When the Smart Media interface board is detected at power-up, the software update contained in the Smart Media Flash card is written to the Main board program flash (U22).

Main Board - Front Panel Interface

Signals from the menu knob and pushbuttons on the front of the Advisor are filtered by special hardware, debounced in the PLD, and passed on to the ARM, either as interrupts or readable data. All signals undergo Schmitt trigger filtering in addition to RF filtering. The ON/OFF button is routed to the system power supply where it is used to manually power on the unit.

The battery LED is turned on and off by the Battery Charger Board. The AC LED is powered by the unswitched power the main board receives. The Battery Charger Board can turn the LED on or off depending on if the unswitched power is being supplied by AC power or the battery.

Main Board - Critical Failure Alarm System

WARNING! The AAA battery (BAT2) is a rechargeable alkaline battery. Improper operation and possible long-term damage may occur if an ordinary alkaline battery (non-rechargeable) is used. Replace with identical type battery.

The Critical Failure Alarm (CFA) System is a self-sufficient section of circuitry on the Main Board Assembly. During normal operation, this circuitry maintains its own AAA rechargeable alkaline battery (BAT2), monitors the ARM7 microprocessor for proper operation, and monitors the main +12 Volt power source from which all circuitry is ultimately powered. An unintentional loss of power (non-user initiated standby/shutdown), or improper ARM7 microprocessor execution (or lack thereof) results in a constant tone audio alarm signal. This technical alarm state will persist for at least 20 minutes with a fully charged battery. The alarm state is cleared when power is restored, or the front-panel audio silence key is activated, or the battery is completely discharged.

The CFA micro controller (U63) handles the monitoring and battery charging functions. ARM7 microprocessor activity is conveyed to the CFA micro controller (U63-4) by signal ARM_COMM. A user-initiated standby/shutdown is communicated in advance to the CFA micro controller so that the CFA will properly interpret the subsequent loss of ARM7 activity as an intended standby/shutdown state. During normal operation, if the CFA detects an unintended loss of ARM7 microprocessor activity, the CFA initiates an alarm. The main +12 Volt power source (UNSW_PWR) is scaled by R252 and R250, buffered by op amp (U62A), and monitored by the CFA micro controller (U63-7). If the +12V power source falls below approximately 9Volts DC, the CFA initiates an alarm. The CFA micro controller initiates an alarm by asserting a logic high to Q21-1, which is latched by NAND gates U66 and U67. The latched alarm state can be cleared (reset) by the CFA micro controller or the front-panel audio silence button by asserting a logic low at voltage detector input U65-2.

The AAA rechargeable alkaline battery state is monitored by way op amp U62B and when necessary, charged by pulsing Q22. Mosfet Q26 provides reverse battery protection should a replacement battery be installed backwards. Voltage regulator U61 supplies 3.3V power while voltage detector U64 acts as power supply supervisor, resetting the CFA micro controller if the 3.3V power falls below 2.7 Volts DC.

Main Board - Digital Signal Processor (Isolated Side)

The main board uses a DSP to acquire and filter data from the following parameters: ECG, IBP, Temperature, and Impedance Respiration. The DSP has a supervisory chip (U27) that can reset the DSP program. The DSP operates from 1.8V and 3.3V. The 1.8V is used internally on the DSP. The 3.3 is used for the DSP I/O ports. U30 through U33 convert the 3.3V signals from the DSP to 5V signals used elsewhere on the isolated side of the board. U29 is used to convert 5V signals to 3.3V signals that the DSP reads. The DSP is clocked by X4, which runs at 18.432MHz.

Main Board - Patient Signal Acquisition (Isolated Side)

The patient signal acquisition is performed by U35. U35 is a 16bit Successive Approximation Register (SAR) analog-to-digital converter (ADC). This on board ADC will acquire the following parameters: ECG (leads I, II, III, and V), both Temperature channels, and both IBP channels. An 8x1 multiplexer will be used select which parameter will be read by the ADC. Three controls lines from the DSP control the multiplexer. The signal from the multiplexer is passed through a unity gain amplifier before it reaches the ADC. Two control lines from the DSP will acquire the data from the ADC. The ADC has one control line that informs the DSP when data is ready to be read. The input range of the ADC is ±2.048V. Data is acquired from the ADC at 240Hz.

$$\frac{4.096\ \text{V}}{2^{16}\ \text{counts}} = \frac{62.5\ \text{uV}}{\text{count}}$$

Main Board - ECG (Isolated Side)

J19 is the input connector that brings the signals in from the side panel mounted ECG cable. There are 5 signal lines that come from the patient. They are left arm (LA), right arm (RA), left leg (LL), right leg (RL) and the chest (V) leads. RL is the signal reference and the other 4 leads provide the ECG signals. Each of the leads that come in J19 and are protected with ½ watt 20KW carbon composition resistors and the MMDB1503A high conductance diode packs. The 56pF capacitors and 20kW resistors provide a single pole low pass filter at 142kHZ. A second low pass filter follows the first low pass filter and it consists of a 110kW resistor and a 330pF capacitor. The second low pass filter provides a single pole at 4.4kHz. The two series 22MW resistors provide a soft pull up that will raise the input signal to +2V if an ECG electrode comes off the patient. The TLC2274 op amps (U44) provide a unity gain buffer stage for each signal lead. The outputs of the op amps feed a series of instrumentation amplifiers, it also provides the lead fail signal. These instrumentation amps generate the ECG leads lead I (LA-RA), lead II (LL-RA), lead III (LL-LA), and V (C-(LA+RA+LL)/3). The instrumentation amplifiers also provide a gain of 5.76. The outputs of the instrumentation amplifiers are passed through a series of low pass filters and gained again by 17.15, (U42 plus surrounding circuitry). The resulting signals are then sent to the ADC.

The ADG612 switch (U38) is used to provide 3 lead ECG support by selectively shorting one of the leads RA, LA, or LL.

The CD4052 4x1 multiplexer (U41) is used to select which signal will be tested for lead fail. Two control lines from the DSP are used select which lead is tested. The output of the multiplexer is sent to a voltage comparator (U46). If a lead voltage is above 1.2V then the output of one of the voltage comparators will be high, indicating a lead fail condition. If a lead voltage is below -1.2V then the output of the other voltage comparators will be high, indicating a lead fail condition.

The ECG circuitry also provides pacemaker detection capability. The output of the differential amplifiers (U75 to U78) feeds a multiplexer. One of the leads is selected for pacemaker detection. The chosen lead signal appears at the output of the multiplexer and is low pass filtered at 8.6kHz by the circuitry surrounding U43. The signal is differentiated and clamped at approximately 0.5V by U43 and the supporting circuitry. The output of this stage is gained by 7. The output of this stage drives two comparators. The comparators have thresholds of +0.45V and -0.45V. A pace pulse passing through the detection circuitry will cause one of the comparators to go low. The comparators interrupt the DSP to mark the time of a pacemaker pulse.

Main Daughter Board - Impedance Respiration Option (Isolated Side)

Respiration is calculated by measuring the rate of change in AC resistance at 48 kHz across two ECG electrodes. A 48 kHz sine wave is generated by U10 and resistors R23 – R29. It is high pass filtered by C30 and R30 and amplified by U9 and the surrounding circuitry. The resulting signal is sent out the RA connection. The sine wave signal is inverted and also sent out either LA or LL. The DSP selects which lead to drive. The MMBD1503A diode packs and 10k carbon composition resistors protect the output stages from defibrillators. The pair of 2.2nF capacitors AC couple the sine wave signal and the 10 K resistors transform the sine wave excitation signal into a current.

The respiration receiver circuitry measures the voltage amplitude of the 48kHz sine wave that is created when the current from the transmitter is passed through the body. As the patient breathes, the amplitude of the received 48kHz sine wave voltage fluctuates. Leads LA, RA, and LL are processed. The 20K carbon composition resistors and MMBD1503A diodes protect the front end circuitry from defibrillators. The 20K resistors and 56pF capacitors form a single pole low pass filter. The signal coming from RA is buffered and drives one leg of an instrumentation amp U3. The other input to the instrumentation amp is driven by LA or LL. The signal LDII controls the CMOS switch and selects which lead to pass to the instrumentation amp. The instrumentation amplifier is running with a gain of 2. The output of this stage is AC coupled and buffered by C25, R8 and U4. The next stage in the receiver circuitry is a synchronous demodulator. The output of the demodulator is proportional to the amplitude of the 48kHz sine wave feeding it. The demodulator is simply a stage that alternates its gain from +1 to –1. The signal RCLK48KHZ (48kHz) controls the switching of signal gain from +1 to –1. Capacitor C3 filters the rectified sine wave output and creates a slow moving baseband signal that fluctuates at the rate of respiration. The output of the demodulator is converted to a digital value by the sigma delta converter U6 at a rate of 30 Hz.

Main Daughter Board - IBP & Temperature Option (Isolated Side)

The IBP/Temperature board has two channels of invasive blood pressure acquisition circuitry. The two circuits are independent and identical. The blood pressure transducer is a bridge style strain gauge with an output sensitivity of 5mV/mmHg. The transducer is excited with a DC voltage of +4.096V. U6 (ADR292) generates the excitation voltage. The excitation voltage is passed through an op-amp (U8 and U9) that acts as a short circuit protection device. If the board senses a short circuit on the excitation voltage then the op-amp will shut down and remove power from the excitation pin. The excitation voltage is also divided by 2, through circuitry around (U8 and U9), which provides the input instrumentation amplifier and ADC with a reference voltage based on each channels excitation voltage.

The excitation voltage is applied from one side of the bridge to ground. The other two legs of the bridge provide the input signal to the circuit board. These signals come in on J1 pins 2 and 3 for channel one and J1 pins 7 and 8 for channel two. They are protected by MMBD1503A diode packs. The input signals fed into an instrumentation amplifier, U2 and U3. The instrumentation amplifiers gain the signal by 100. The output of the instrumentation amplifier is referenced to half of the excitation voltage. The signal then goes into a 72Hz low pass Bessel filter. The output of the Bessel filter feeds the signal to the main board ADC.

The IBP/Temperature board provides two channels of temperature monitoring. The circuitry is designed to interface with YSI series 400 thermistor based temperature probes manufactured by Yellow Springs Incorporated. Connector J1 pins 11 and 13 are used to bring the temperature probe signals onto the board. The signals are protected by MMBD1503A diode packs. A multiplexer is used to select which temperature probe or calibration resistor is read by the main board ADC. The DSP has control of the multiplexer and it will select which thermistor or calibration resistor will be read by the ADC. An additional DSP line will select between two calibration resistors that are sent to the multiplexer. The board has three calibration resistors, R38-R40, that have a tolerance of 0.1%. After the multiplexer an amplifier is used to gain the signals by 3.5. A constant voltage source of 3.8V is used to drive the thermistors and calibration resistors. The voltage source is generated by U12 plus surrounding circuitry.

Main Board - Isolated Power Supply

The patient connected side of the main board where all the instrumentation, A/D converter, and DSP controller resides is electrically isolated from the rest of the system by an isolation barrier. An isolated power supply supplies power across the barrier. The isolated power supply converts the +12V supply generated by the power supply to +5V, ISO_+POWER and ISO_-POWER. The isolated power is then regulated down to +5ISO, ANA+5, ANA-5, +3.3ISO, and +18ISO.

The supply is designed to run at a constant frequency of 115kHz. The non-isolated side of the board generates this clocking signal.

Main Board - Isolated Communications

The analog section to digital section communications is provided across the isolation barrier using optocouplers. Five data lines cross the isolation barrier, they are ~REST, SpO_2_RX, DSP_RX, SpO_2_TX, and DSP_TX. The ~RESET line is used to reset the DSP and the SpO_2 board, U55. Communication between the main processor and the SpO_2 board is done with SpO_2_RX (U54) and SpO_2_TX (U51). Communication between the main processor and the DSP is done with DSP_RX (U52) and DSP_TX (U50).

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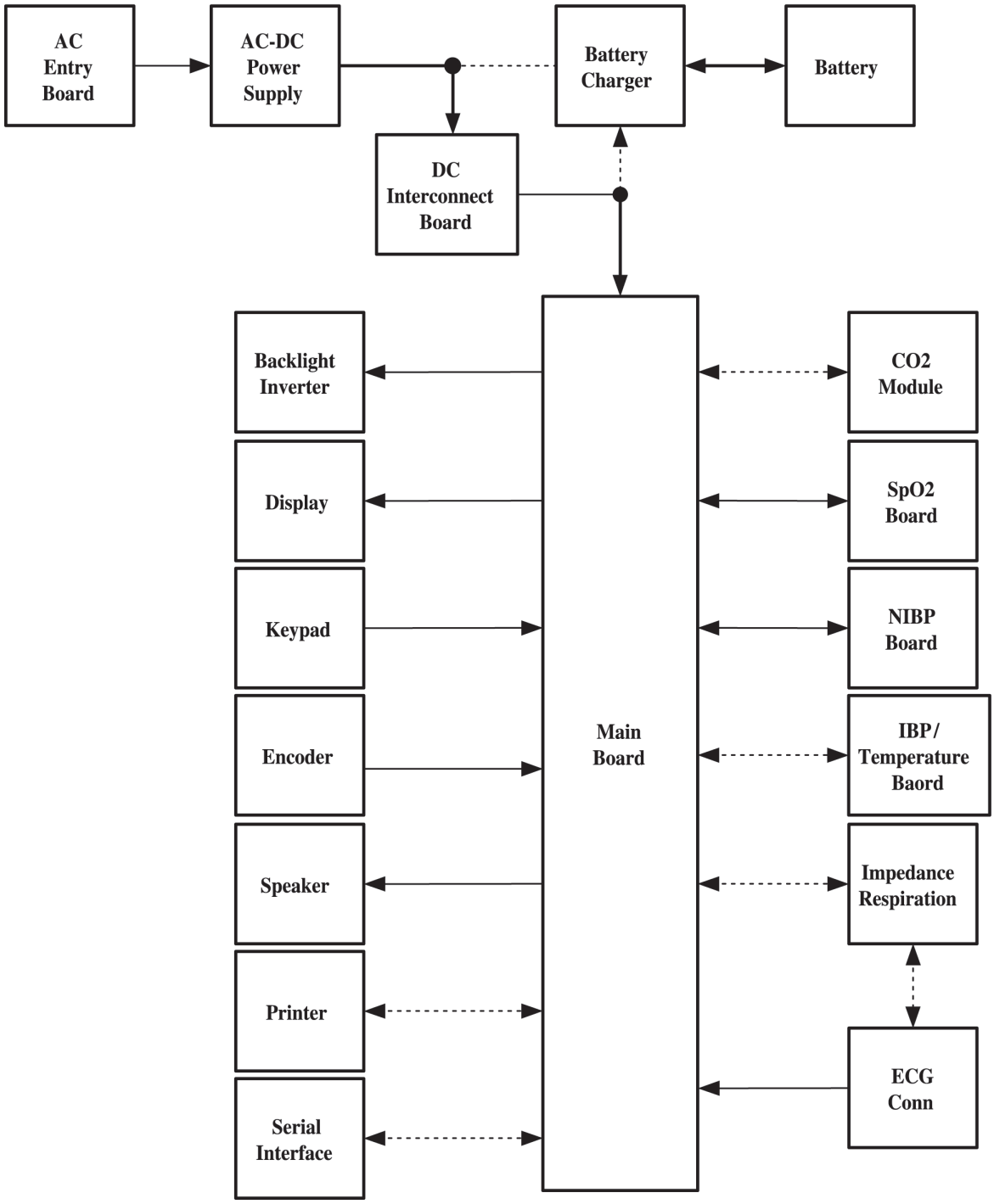
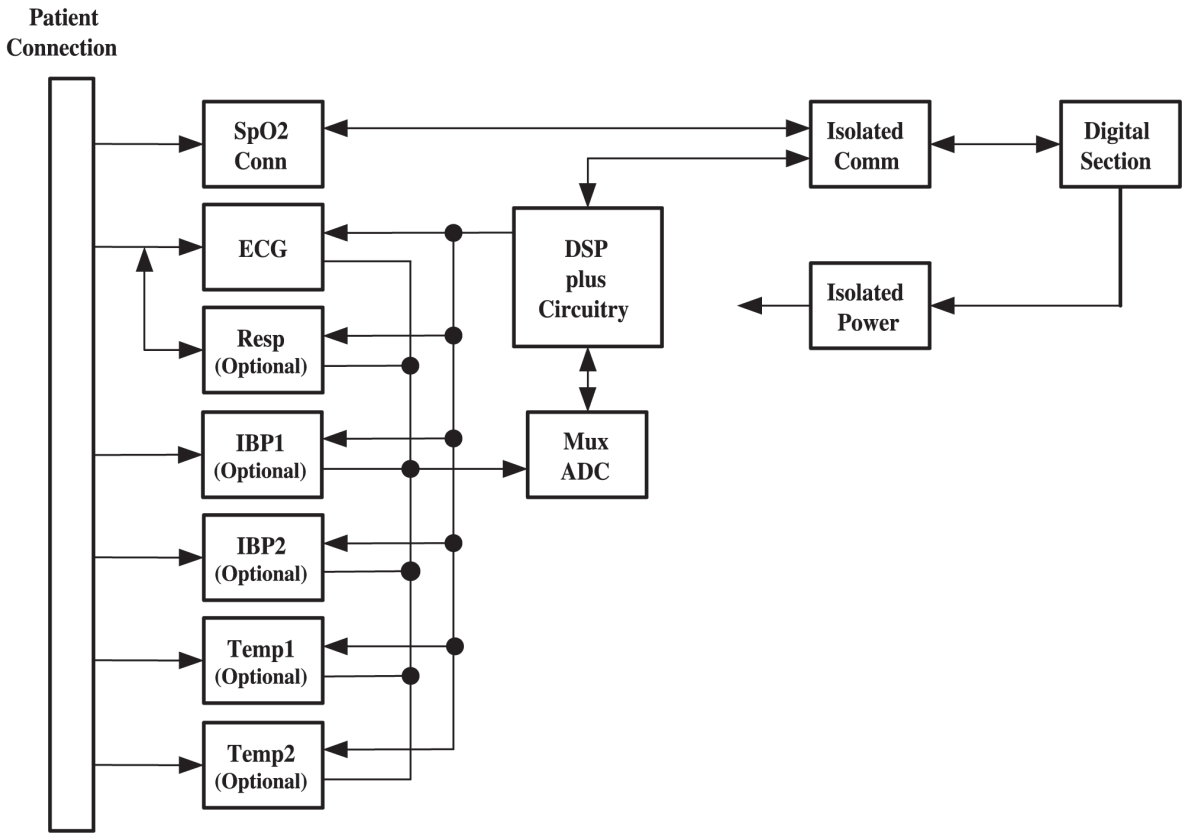
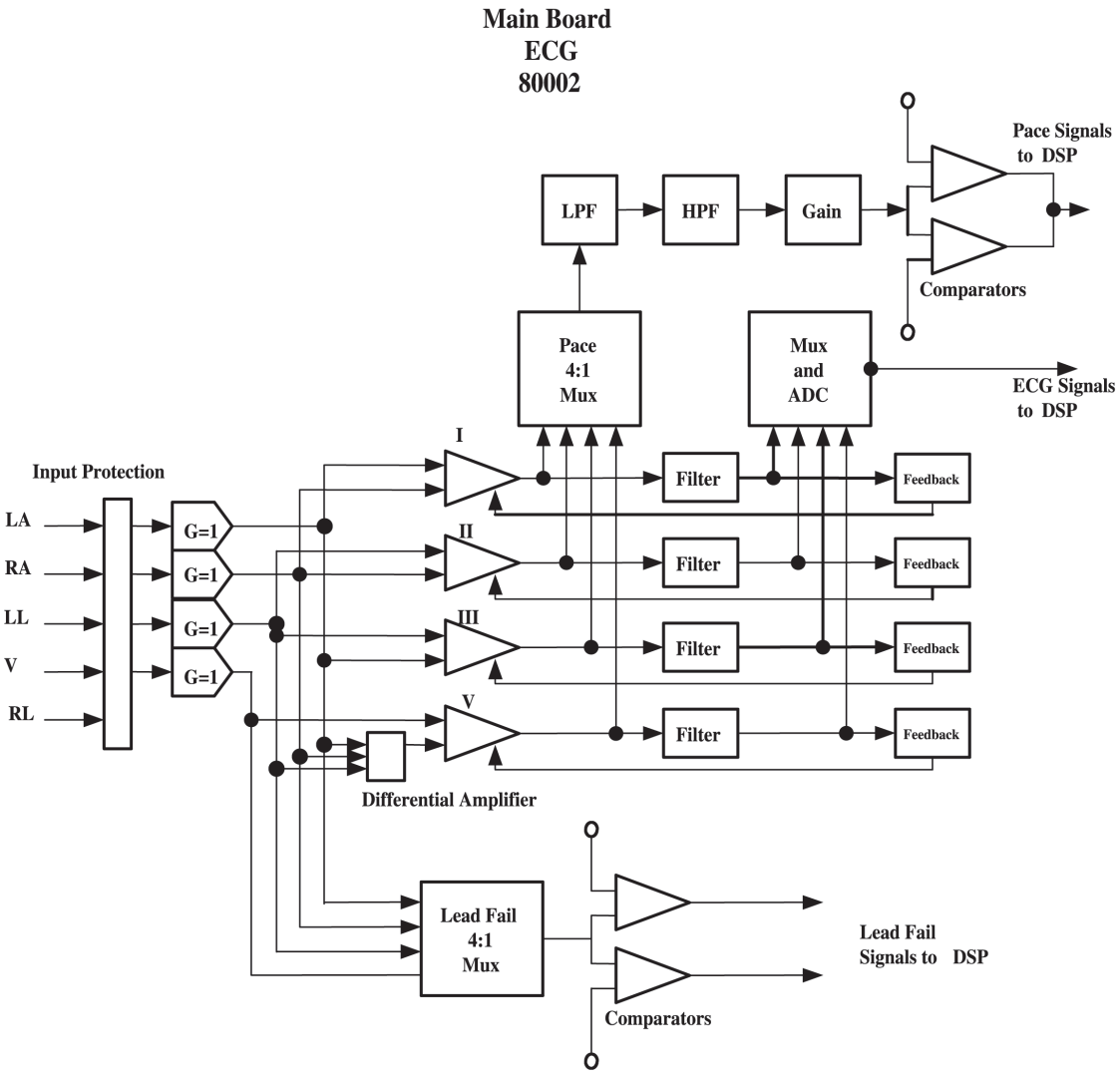
Chapter 4: Diagrams

Advisor Block Diagram

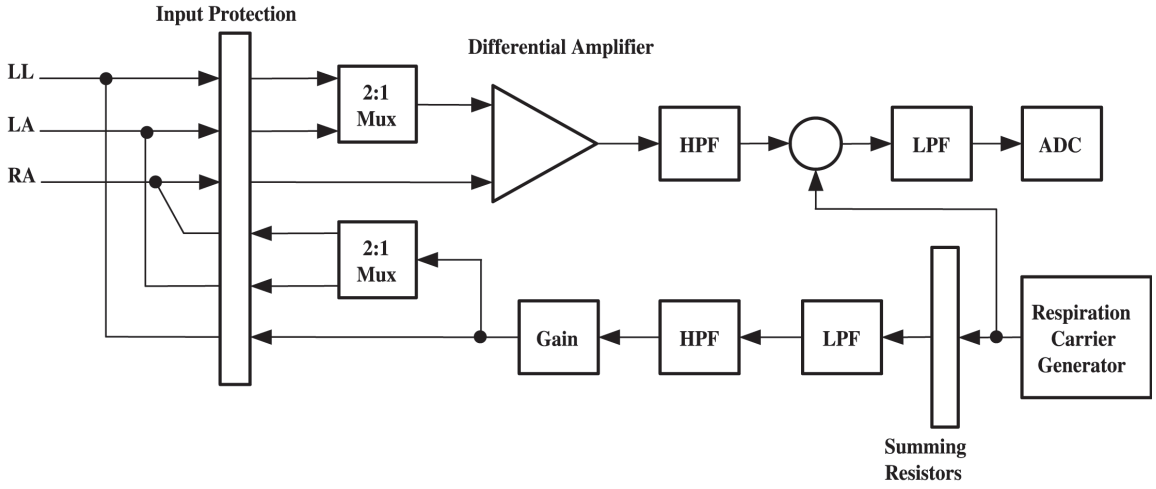


Main Board
Analog Section
80002

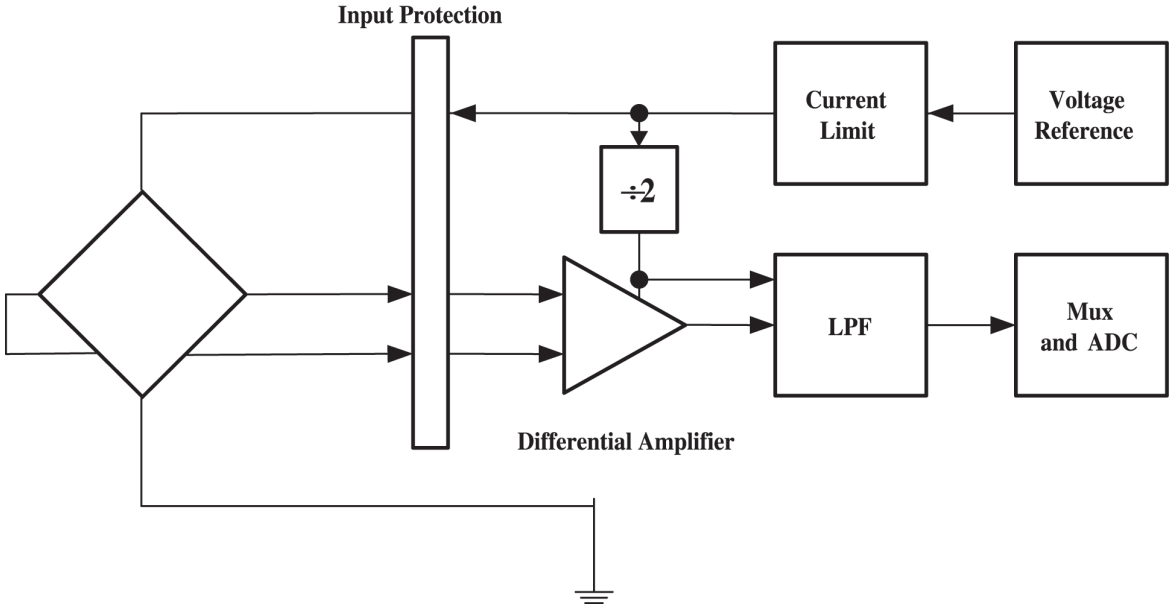



Main Board
ECG
80002
Pace Signals
to DSP
LPF
HPF
Gain
Comparators
Pace
4:1
Mux
Mux
and
ADC
ECG Signals
to DSP
Input Protection
LA
RA
LL
V
RL
G=1
G=1
G=1
G=1
I
II
III
V
Filter
Filter
Filter
Filter
Feedback
Feedback
Feedback
Feedback
Differential Amplifier
Lead Fail
4:1
Mux
Lead Fail
Signals to DSP
Comparators

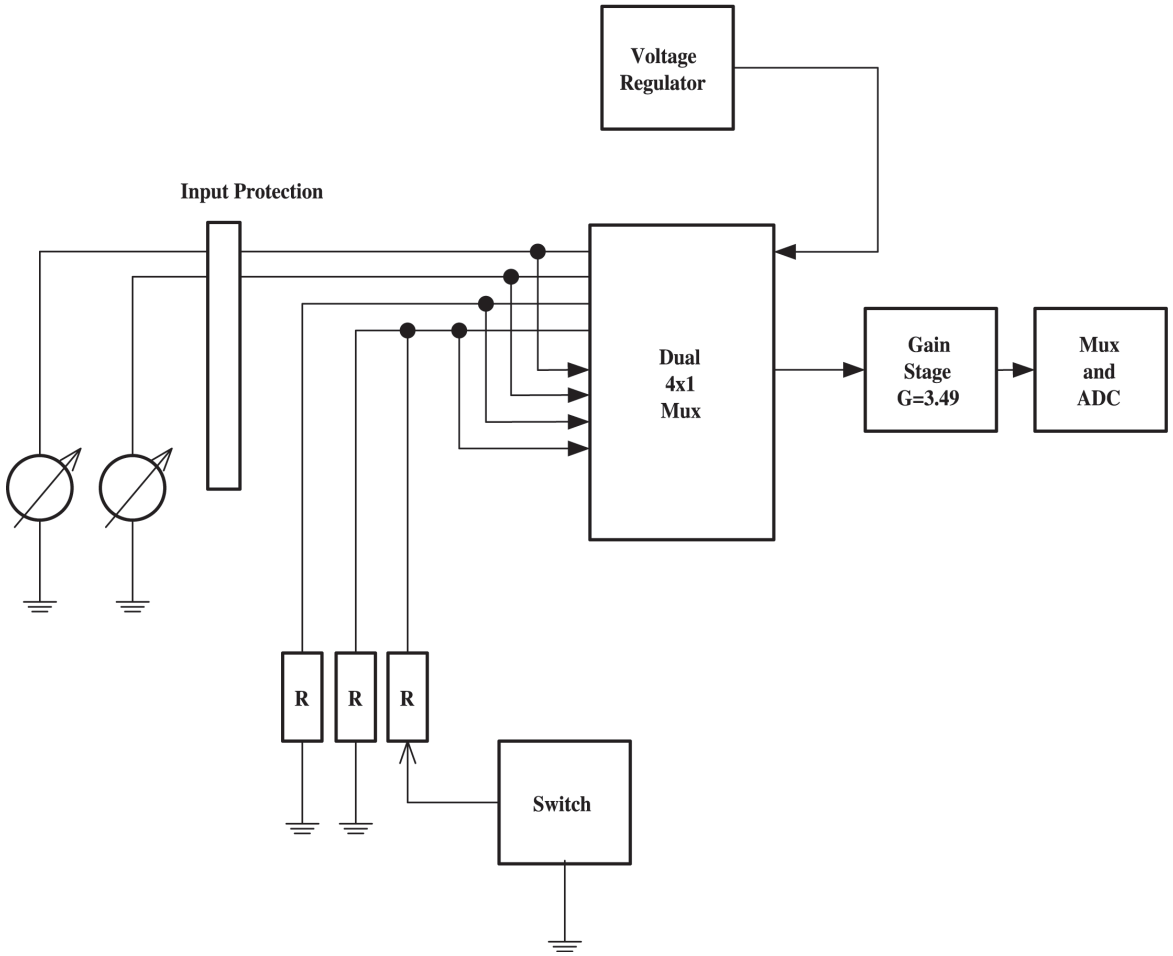
Impedance Respiration
Board
80004



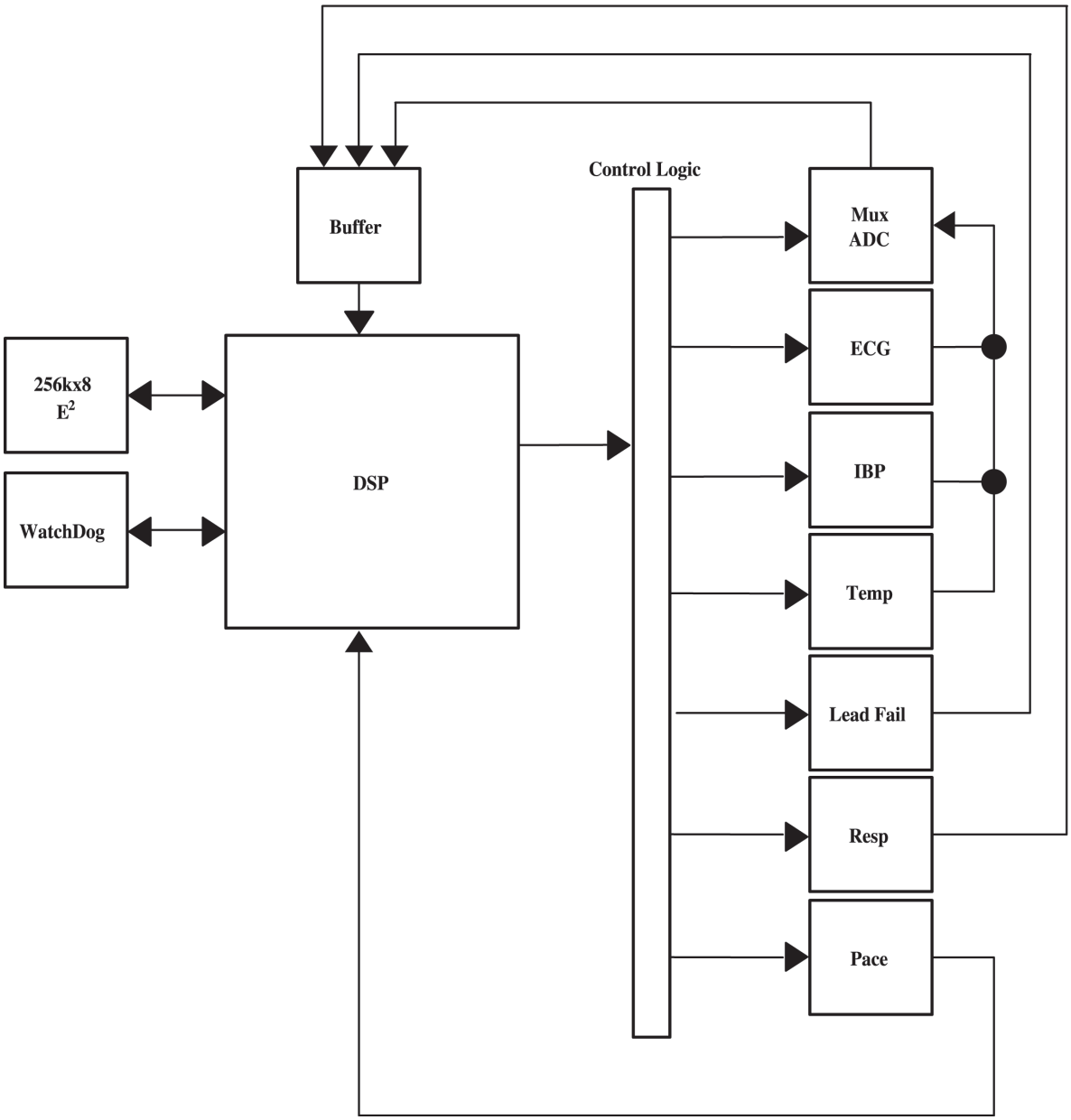
IBP /Temperature Board
IBP
80006



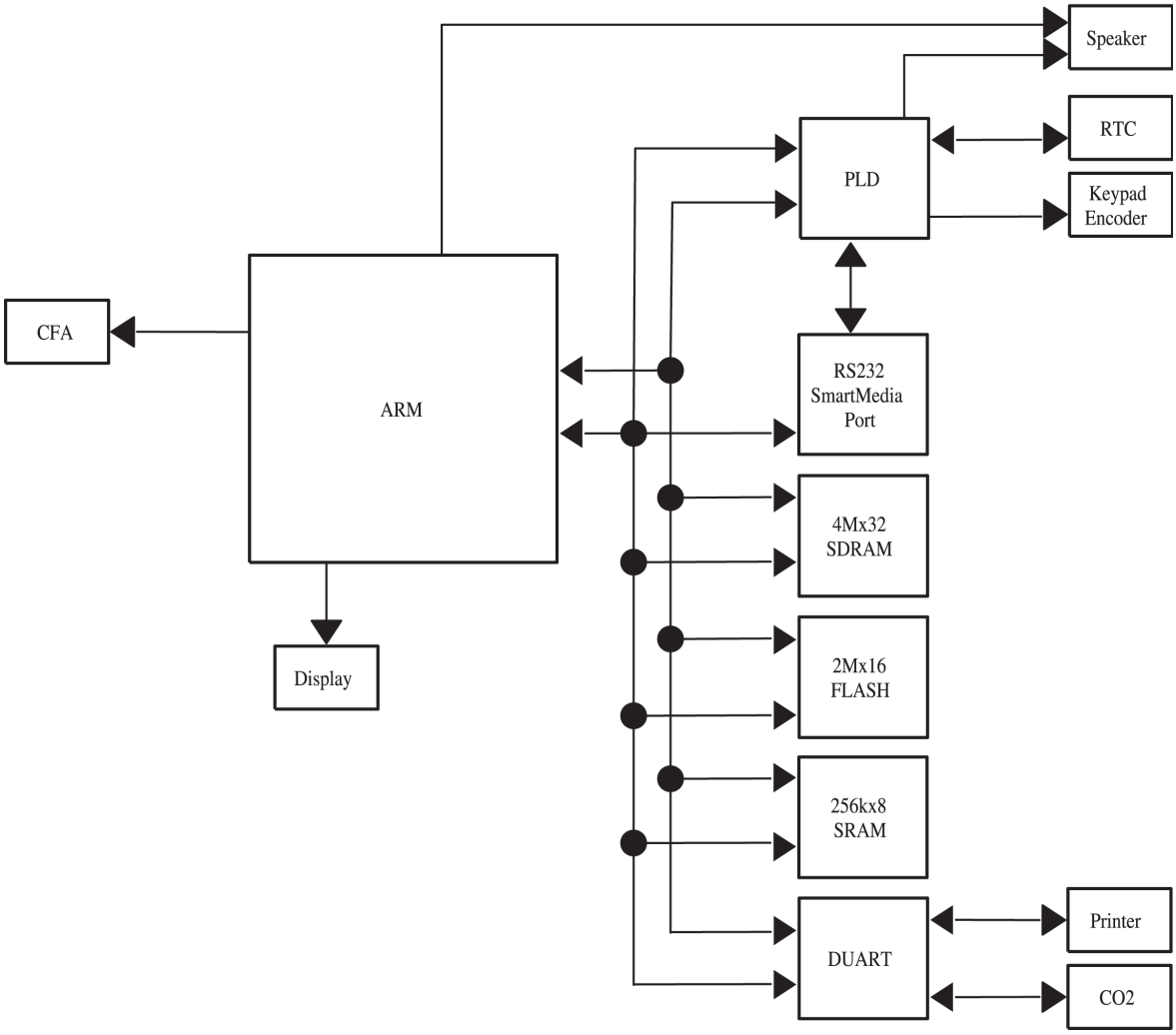
IBP /Temperature Board
Temperature
80006



Main Board
DSP Section Block Diagram
80002



Main Board
Digital Section Block Diagram
80002



Chapter 5: ECG Technical Reference

Respiration Leadoff Sensing and Active Noise Suppression

Leadoff is determined by the presence of excessive DC offset. No AC waveform is associated with this function.

Tall T-Wave Rejection Capability

With a standard 1 mV p-p QRS having a T-wave amplitude of 0 to 1.2 mV (0 to 120% of R-wave height), the displayed heart rate remains correct.

Heart Rate Averaging Method and Display Update Rate

The rate digit display is updated every second. Rate averaging is accomplished using a "box car" method as follows:

- Let *n* = the averaging interval 8 seconds. Each second, the oldest 1/*n* data points are discarded and replaced with the latest 1/*n* points. Then, all the points are summed and divided by *n*. The resulting average is the value displayed.

Heart Rate Meter Accuracy and Response to Irregular Rhythm

Reference EC-13 Test Specifications

WAVEFORM	DESCRIPTION	RATE
Figure 3a	Ventricular Bigeminy	40 bpm
Figure 3b	Slow Alternating Ventricular Bigeminy	30 bpm
Figure 3c	Rapid Alternating Ventricular Bigeminy	120 bpm
Figure 3d	Bi-directional Systoles	90 bpm

Response Time of Heart Rate Meter to Change in Heart Rate

From 80 to 120 bpm, response ranges from 6.0 to 7.0 seconds, average 6.8 seconds. From 80 to 40 bpm, the response range is 8 to 9 seconds, average 8.8 seconds.

Time to Alarm for Tachycardia

Reference EC-13 Test Specifications

WAVEFORM	DESCRIPTION	AMPLITUDE	RESPONSE TIME (SECONDS)	
			Range	Average
Figure 4a	Ventricular tachycardia (HR = 206)	1.0 mV	6 to 7	6.6
		0.5 mV	4 to 5	4.8
		2.0 mV	5 to 9	6.8
Figure 4b	Ventricular tachycardia (HR = 195)	4.0 mV	2 to 4	2.6
		1.0 mV	7 to 8	7.6
		2.0 mV	3 to 4	3.4

Display Aspect Ratio

The 2X option meets the aspect ratio requirements of EC13 (0.4± 0.08 s/mV).

$$\frac{8.73 \text{ mm/mV}}{25.15 \text{ mm/s}} = 0.35 \text{ s/mV}$$

Pacemaker Pulse Rejection Capability

Pacemaker pulses without over/undershoot:

- All pulses with amplitudes +/- 2 mV and +/- 700 mV with pulse widths 0.1 ms and 2.0 ms are detected and rejected.
- The displayed HR for pacemaker pulses alone for all combinations of the specified pulse parameters is 0 bpm.
- For pace pulses with a normally paced QRS-T at 60 bpm, the displayed HR is 60 bpm.
- For a normally paced QRS-T at 60 bpm with atrial and ventricular pacing pulses, the displayed HR is 60 bpm.
- For atrial and ventricular pace pulses alone, the displayed HR is 0 bpm.
- For atrial and ventricular pace pulses at 80 bpm with an ineffectively paced QRS-T at 30 bpm, the displayed HR is 30 bpm.
- For pace pulses at 80 bpm with an ineffectively paced QRS-T at 30 bpm, the displayed HR is 30 bpm.

Pacemaker pulses with over/undershoot:

- The above tests were repeated for pace pulses with an over/undershoot of 1 mV for the +/- 700 mV pace pulses, and over/undershoot of 0.08 mV to 0.125 mV for +/- 2 mV pace pulses.
- For the over/undershoot, the recharge time constant was 4 ms to 8 ms.
- For all cases, the displayed HR was identical to the applied HR, and all pace pulses were detected and rejected.

Audible Alarms

An audible alarm is located at the bedside. Alarm sounds and amplitudes conform to the EC-13 specifications.

Visual Alarms

Visual alarms are located at the bedside. Visual alarms consist of a flashing parameter value in the parameter box, which is in alarm and an alarm message at the top of the display. The word 'ALARM' flashes in red at the top of the display at a 2 Hz rate. The word 'ALARM,' as it appears on the display, is 15.3 mm long X 3 mm high. Alarm messages that are displayed in the ECG parameter box are 3 mm high. Visual alarms cannot be disabled. All alarm conditions are checked once each second and the display is updated to indicate the alarm status.

Line Isolation Transients

See the warnings, cautions, and notes in *Chapter 7: ECG* in the Advisor® Operation Manual for proper operating conditions and lead placement.

Electrode Polarization

See the warnings, cautions, and notes in *Chapter 7: ECG* in the Advisor® Operation Manual for proper operating conditions and lead placement.

Auxiliary Outputs (Optional)

RS-232 serial outputs are provided. Electrical protection to 1.5 KV is provided on all I/O. The Advisor® Vital Signs Monitor is considered a DTE device.

Audible Alarm Silencing

Audible alarms may be silenced in three ways. To manually re-enable the alarms, press the alarm silence key (🔕) on the front of the monitor.

An audible alarm may be temporarily silenced for two minutes. To temporarily silence an alarm, press the alarm silence key (🔕). AUDIO PAUSED will be displayed on the upper right side of the display. The audible alarm will be re-enabled if any new alarm condition occurs, or in two minutes if no new alarm condition occurs. To manually re-enable the audible alarm, press the alarm silence key (🔕) again.

Audible alarms may be indefinitely silenced. Press and hold the alarm silence key (🔕) for about three seconds, until AUDIO PAUSED is displayed on the upper right side of the display. If any new alarm condition occurs while audible alarms are indefinitely silenced, the audible alarm will be re-enabled.

Audible alarms may be permanently silenced. Press and hold the alarm silence key (🔕) for about six seconds, until AUDIO OFF is displayed on the upper right side of the display. The audible alarm will not be re-enabled if a new alarm condition occurs. This condition is possible only if dual alarm silence is allowed and indefinite is enabled.

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Appendix

Parts Lists, Assembly Drawings, and Schematics

PART NUMBER	DESCRIPTION	ITEM	NUMBER OF PAGES
9200II	Final Assembly Bill of Material	A1	1
9200II	Final Assembly Drawing	A2	3
80002B1	Main Board Drawing	A3	3
80002B1	Main Board Parts List	A4	6
80002S1	Main Board Schematic	A5	21
80004B1	Impedance Respiration Board Drawing	A6	2
80004B1	Impedance Respiration Board Parts List	A7	2
80004S1	Impedance Respiration Board Schematic	A8	3
80006B1	IBP/Temperature Board Drawing	A9	1
80006B1	IBP/Temperature Board Parts List	A10	3
80006S1	IBP/Temperature Board Schematic	A11	4
80010B1	DC Interconnect Board Drawing	A12	1
80010B1	DC Interconnect Board Parts List	A13	1
80010S1	DC Interconnect Board Schematic	A14	1
80014B1	Battery Charger Board Drawing	A15	1
80014B1	Battery Charger Board Parts List	A16	2
80014S1	Battery Charger Board Schematic	A17	1
80028B1	AC Entry Board Drawing	A18	1
80028B1	AC Entry Board Parts List	A19	1
80028S1	AC Entry Board Schematic	A20	1
80032B1	Serial Communications Board Drawing	A21	1
80032B1	Serial Communications Board Parts List	A22	1
80032S1	Serial Communications Board Schematic	A23	1
80033A1	Display Panel Assembly Drawing	A24	2
80033A1	Display Panel Assembly Bill of Materials	A25	2
80034A1	Bezel Assembly Drawing	A26	1
80034A1	Bezel Assembly Bill of Materials	A27	1
80035A1	Assembly Back Drawing	A28	3
80035A1	Assembly Back Bill of Materials	A29	2
57692A1	Assembly Drawing CO_2 Module Standard Pneumatics	A30	2
57692A1	ASM CO_2 Module Standard Pneumatics Bill of Materials	A31	2
57692A2	Assembly Drawing CO_2 Module Advanced Pneumatics	A32	2
57692A2	ASM CO_2 Module Advanced Pneumatics Bill of Materials	A33	2
57700A5	APC Board ASM Drawing CO_2 Standard Pneumatics	A34	1
57700A5	APC Board ASM CO_2 Standard Pneumatics BOM	A35	1
57700A6	APC Board ASM Drawing CO_2 Advanced Pneumatics	A36	1
57700A6	APC Board CO_2 Advanced Pneumatics BOM	A37	1
57702B2	PWB ASM Drawing Agents/Capno Standard/Advanced	A38	1
57702B2	PWB ASM Parts List /Capno Standard/Advanced	A39	3
20496A9	Detector ASM Water Level Advanced Pneumatics	A40	1
20496A9	Detector ASM Water Level Advanced Pneumatics BOM	A41	1

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CE
0473

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