Service Manual

Passport®

5-Lead, 5L, LT, XG

mindray

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Foreword

This Service Manual is intended as a guide for technically qualified personnel during repair and calibration procedures for the Passport 5-Lead, 5L, LT and XG monitors. The information has been divided into the eight main sections as listed in the table of contents. A detailed table of contents of each section is also provided on the first page of each section.

This publication may have been updated to reflect product design changes and/or manual improvements. Any such changes to this manual would be accomplished by supply replacement pages and instructions for inserting them into the manual.

For Passport external communication protocols (Datasette revision T or greater) see Service Manual Supplements: P/N 0070-00-0302, Bedside-to-VISA Communication Protocol; P/N 0070-00-0304, Accutorr Communication Protocol; P/N 0070-00-0306, Passport Communication Protocol (EzEm) and P/N 00700-00-0307, Datascope Improved ASCII Protocol (DIAP).

NOTE: ***In order to ensure the proper performance of your monitoring equipment and to prevent the voiding of the warranty, it is recommended that only parts and accessories provided by Datascope be used with you monitor.***

Warnings, Precautions and Notes

A ***WARNING*** is provided to alert the user to potential serious outcomes (death, injury, or serious adverse events) to the patient or the user.

A ***CAUTION*** is provided to alert the user to use special care necessary for the safe and effective use of the device. They may include actions to be taken to avoid effects on patients or users that may not be potentially life threatening or result in serious injury, but about which the user should be aware. Cautions are also provided to alert the user to adverse effects on this device of use or misuse and the care necessary to avoid such effects.

A ***NOTE*** is provided when additional general information is applicable.

NOTE: ***Unauthorized servicing may void the remainder of the warranty. Check with the factory or with a local authorized Datascope representative to determine the warranty status of a particular instrument.***

Warnings

WARNING: ***The use of remote displays will enlarge all waveforms and may alter aspect ratios depending on the remote device and its set-up.***

WARNING: ***Ensure that the conductive parts of ECG electrodes do not contact other conductive parts including earth ground.***

WARNING: ***Thoracic respiration measurement may interfere with some pacemakers. Refer to the pacemaker's manual.***

WARNING: ***Do not use the following 3-Lead ECG cables with Passport 5L (P/N, 0998-00-0126-xx) and 5L-CE (P/N, 0998-00-0131-xx): 0012-00-0620-05, -06, -07, -08; 0012-00-0722-05, -06, -07, -08; 0012-00-0723-05, -06, -07, -08; 0012-00-0724-05, -06, -07, -08. The above 3-Lead cables contain a jumper wire which connects RL (right leg) to LL (left leg). As a result, when you view aVR, aVL and aVF you will see the appropriate ECG waveforms (even though you are using a 3-lead cable). However, there may be excessive noise on these waveforms which can corrupt the heart rate calculation. See Section 5 in the Operating Instructions for a list of the proper ECG cables.***

WARNING: ***When equipped with Nellcor® SpO_2, use only Nellcor® oxygen transducers including Nellcor® OXISENSOR™ patient dedicated adhesive sensors. Use of other oxygen transducers may cause improper oximeter performance.***

WARNING: ***Tissue damage or inaccurate measurements may be caused by incorrect sensor application or use, such as wrapping it too tightly, applying supplemental tape, failing to inspect the sensor site periodically, or failing to position it appropriately. Carefully read the sensor directions for use, the Passport operating instructions, and all precautionary information before use.***

WARNING: ***Excessive ambient light may cause inaccurate measurements. Cover the sensor site with opaque material.***

WARNING: ***Inaccurate measurements may be caused by incorrect sensor application or use; significant levels of dysfunctional hemoglobins, (e.g., carboxyhemoglobin or methemoglobin); or intra-vascular dyes such as indocyanine green methylene blue; exposure to excessive illumination, such as surgical lamps (especially ones with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight; excessive patient movement; venous pulsations; electro-surgical interference; and placement of a sensor on an extremity that has a blood pressure cuff, arterial catheter, or intra-vascular line.***

WARNING: ***In certain situations in which perfusion and signal strength are low, such as in patients with thick or pigmented skin, inaccurately low SpO_2 readings will result. Verification of oxygenation should be made, especially in preterm infants and patients with chronic lung disease, before instituting any therapy or intervention.***

WARNING: ***Insure that the conductive parts of ECG electrodes do not contact other conductive parts including earth ground.***

WARNING: ***Many patients suffer from poor peripheral perfusion due to hypothermia, hypovolemia, severe vasoconstriction, reduced cardiac output, etc. These symptoms may cause a loss in vital sign readings.***

WARNING: ***The site should be checked at least every eight (8) hours (every four (4) hours with the Adult re-usable finger sensor). Ensure proper adhesion, skin integrity, and proper alignment. Nail polish and fungus may effect readings. Exercise extreme caution with poorly perfused patients. Skin erosion and pressure necrosis can be caused when sensors are not frequently monitored. Assess the site every two (2) hours with poorly perfused patients.***

WARNING: ***Do not use the following 3-Lead ECG cables with Passport XG (P/N's 0998-00-0133-xx, 0998-00-0134-xx and 0998-00-0137-xx): 0012-00-0620-05, -06, -07, -08; 0012-00-0722-05, -06, -07, 08; 0012-00-0723-05, -06, -07, -08; 0012-00-0724-05, -06, -07, -08. The above 3-Lead cables contain a jumper wire which connects RL (right leg) to LL (left leg). As a result, when you view aVR, aVL and aVF you will see the appropriate ECG waveforms (even though you are using a 3-lead cable). However, there may be excessive noise on these waveforms which can corrupt the heart rate calculation. See Section 5 in the Datascope P/N's 0070-00-397, 0070-00-0440, 0070-00-0503 of the Passport Operating Instructions for a list of the proper ECG cables.***

WARNING: ***If the sensor or patient cable is damaged in any way, discontinue use immediately. To prevent damage do not soak or immerse the sensor in any liquid solution. Do not attempt to sterilize.***

WARNING: ***The maximum sampling rate at the nasal cannula is 200 ml/min. This device should not be used on patients whose breathing could be impaired by this vacuum flow rate.***

WARNING: ***Connection of the Passport's exhaust port to the hospital's waste gas scavenge system is recommended to prevent exposure of hospital personnel to the patient's respiratory sample.***

WARNING: ***In an intubated configuration, ensure all tubing connections are tight. If tubing disconnects on the monitor side of the airway adapter, ventilator pressures cause inaccurate CO_2 waveforms and readouts to be displayed.***

WARNING: ***The maximum sampling rate at the nasal cannula is 200 ml/min. This device should not be used on patients whose breathing could be impaired by this vacuum flow rate.***

WARNING: ***Connection of the Gas Module exhaust port (50) to the hospital's waste gas scavenge system is strongly recommended to prevent exposure of hospital personnel to the patient's respiratory sample. Vacuum (negative pressure) should not exceed 1 mmHg at the Gas Module Pump Exhaust fitting (50). Excessive scavenge vacuum may result in damage to the Gas Module's internal pump.***

Cautions

CAUTION: ***Connection of non-isolated devices to the optional RS232 Connector on this unit may cause chassis leakage to exceed the specification standards.***

CAUTION: ***Only use the Abbreviated Operating Check List if you are already familiar with this product. If not, please continue with the remainder of this chapter, Detailed Operating Instructions.***

CAUTION: ***Always attach all desired peripheral equipment prior to powering on the Passport. If required to attach more or change what is connected, turn the Passport off, attach what is needed, and then turn the Passport on again.***

CAUTION: ***Observe extreme caution on all patients (neonates, pediatrics, and adults) when NIBP is set to the Continuous Mode. A 5 minute limit is placed on continuous measurements. After 5 minutes the unit will take a measurement once every 5 minutes. Reports have been made of nerve injury occurring during use of automatically cycled blood pressure cuffs. See the Appendix, "Precautions when Using Automatically Cycled Blood Pressure Cuffs".Observe extreme caution on all patients (neonates, pediatrics, and adults) when NIBP is set to the Continuous Mode. A 5 minute limit is placed on continuous measurements. After 5 minutes the unit will take a measurement once every 5 minutes.***

Reports have been made of nerve injury occurring during use of automatically cycled blood pressure cuffs. See the Appendix, "Precautions when Using Automatically Cycled Blood Pressure Cuffs".

CAUTION: ***It is the users responsibility to confirm correct operation of the Passport with external devices. It is essential that a biomedical engineer verify correct operation of the Passport with an external device. Testing should include verification that the maximum delay for cardioversion synchronization does not exceed 60 ms (monitor and defibrillator). Cable should be labeled with the devices they have been tested for use with.***

CAUTION: ***Do not use this special "Y" shaped power cable for any devices other than the Passport and Gas Module II.***

CAUTION: ***Vacuum (negative pressure) should not exceed 1 mmHg at the Passport Pump Exhaust fitting (39). Excessive scavenge vacuum may result in an "OCCLUSION" message or damage to the Passport's internal pump. The scavenge system if used must be on during calibration.***

CAUTION: ***It is the users responsibility to confirm correct operation of the Passport XG with external devices. Before using this cable it is essential that a biomedical engineer verify correct operation of the Passport XG with an external device using this cable. Testing should include verification that the maximum delay for cardioversion synchronization does not exceed 60 ms (monitor and defibrillator). Cable should be labeled with the devices they have been tested for use with.***

CAUTION: When cleaning sensors do not use excessive amounts of liquid. Wipe the sensor surface with a soft cloth, dampened with the cleaning solution.

CAUTION: Using dark colored soaks may stain the cuffs. Test a single cuff to ensure that no damage will occur. ETO sterilization may also be used.

CAUTION: When ironing or pressing the cuffs, be aware that the Velcro® fasteners can melt at temperatures above 325°F, 162°C.

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1.0 *Operation (5-Lead, 5L, LT and XG)*

Contents of this Chapter ....Page

1.1 Introduction (5-Lead, 5L, LT)

This section of the Service Manual provides general information about the Datascope Passport Monitors 5-Lead, 5L and LT. All functions, standard and optional, are described in this section. The pictures of the unit and the displays should be used as samples and may not be exactly as your unit appears. Table 1-1 on page 1-2 lists the functions available on the Passport 5-Lead / 5L and the Passport LT.

TABLE 1-1

	PASSPORT 5L		PASSPORT LT	
FUNCTIONS*	***STANDARD***	***OPTIONAL***	***STANDARD***	***OPTIONAL***
NIBP	●			●
IBP		●		●
ECG	●		●	
SpO_2 - Datascope		●		●
SpO_2 - Nellcor		●		
Respiration	●		●	
CO_2		●		
Recorder		●		●
Temperature	●		●	

* *For detailed instructions of each function see the Table of Contents for sections and page numbers.*

NOTE: ***Sections 1.2 and 1.3 are included as a review of instrument functions and operation, although the reader is encouraged to refer to the Operating Instructions, P/N 0070-00-0324, for more complete details.***

1.2 Controls, Indicators and Connectors (5-Lead, 5L, LT)

The keys on the front panel of the Passport Monitor are classified as single action, repeat action, or delayed action keys.

A single action key provides one action each time it is pressed, regardless of how long it is held.

A repeat action key provides the an action when pressed, then waits half a second before repeating the action until the key is released.

A delayed action key provides an action, but only after the key has been held pressed for a (key specific) period of time.

1. ▲ and ▼ (Set-up)
2. SELECT (Set-up)
3. END (Set-up)
4. CENTRAL SILENCE (Optional)
5. LEAD (ECG)
6. SIZE (ECG)
7. FREEZE (ECG)
8. ZERO 1 (IBP) (Optional
9. ZERO 2 (IBP) (Optional)
10. START (NIBP)
11. INTERVAL (NIBP)
12. DEFLATE (NIBP)
13. VOLUME (Alarms)
14. CHECK/RETURN (Alarms)
15. MUTE (Alarms)
16. TREND/RETURN (Trends)
17. TIME UP ▲ and DOWN ▼ (Trends)
18. BEEP VOLUME
19. RECORD (Optional)
20. DC INPUT
21. DISPLAY

PARAGRAPH NUMBER	DESCRIPTION	CONTROL/DISPLAY NUMBER	PAGE NUMBER
1.2.1	Front Panel	1 - 21	1-4
1.2.2	Left Side Panel	22 - 30	1-9
1.2.3	Right Side Panel	31 - 34	1-11
1.2.4	Remote Color Display	1-12	12 - 14

1.2.1 Front Panel

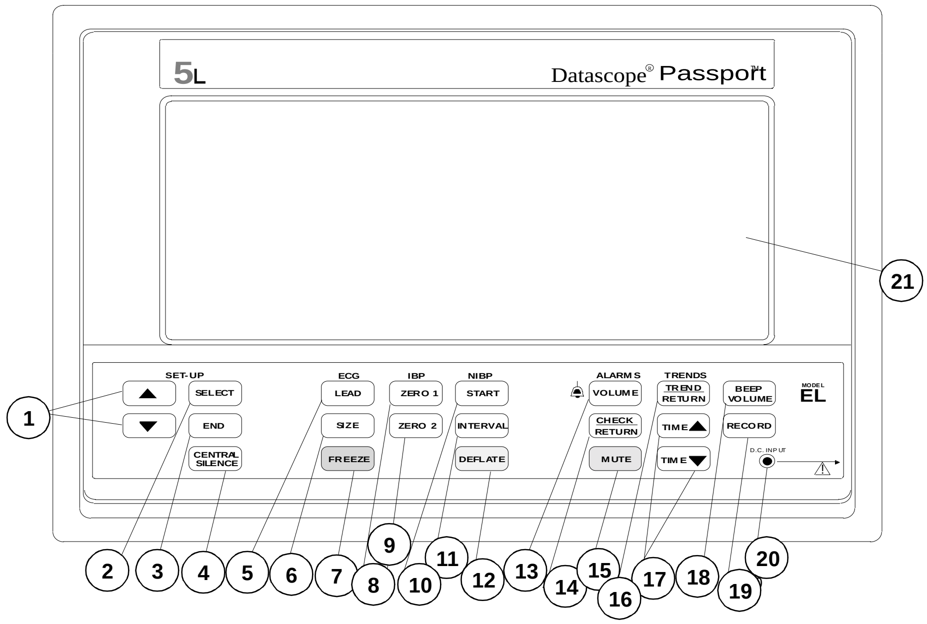


FIGURE 1-1 Front Panel Controls

Introduction

The keys on the front panel of the Passport Monitor are classified as single action, repeat action, or delayed action keys.

A ***single action*** key provides one action each time it is pressed, regardless of how long it is held.

A ***repeat action*** key provides the an action when pressed, then waits half a second before repeating the action until the key is released.

A ***delayed action*** key provides an action, but only after the key has been held pressed for a (key specific) period of time.

NOTE: Only one key function will be recognized at any time. The Passport will ignore multiple key selections.

All key actions are acknowledged by a key click, except for BEEP VOL and ALARM VOL. If a key is not available a double key click will sound.

1. ▲ and ▼ (UP and DOWN) (Set-Up)

Two repeat action keys used to move the highlighted screen cursor or change the setting/ value of a menu item. As the cursor is moved, the highlighted menu window is displayed.

2. SELECT (Set-Up)

A repeat action key used to select the function or value indicated by the highlighted cursor.

3. END (Set-Up)

A single action key which causes the display to return to the main screen display (as specified in the DISPLAY section). This key is always available.

4. CENTRAL SILENCE (Optional)

A single-action key which mutes the alarms of the corresponding channel on the VISA Central Station. The amount of time the alarms are silenced, is determined by the VISA.

5. LEAD (ECG)

A single action key which selects the ECG lead to be displayed. Each depression of the key selects and displays the next ECG lead from the list. The list wraps around after the last entry is selected. Choices are: I, II, III, aVR, aVL, aVF or V.

6. SIZE (ECG)

A single action key which selects the ECG size to be displayed. Each depression of the key selects and displays the next ECG size from the list. The list wraps around after the last entry is selected.

7. FREEZE (Screen)

A single action key which enables or releases the screen freeze function. The freeze key stops or starts the ECG waveform (waveform 1), except when waveform 2 is used for cascaded ECG. When this is the case, pressing the freeze key the first time causes the currently displayed ECG waveform data to be transferred to waveform 2 and frozen. Waveforms 1 and 3 continue to move. Pressing FREEZE again causes waveform 2 to return to cascaded ECG.

8. ZERO 1 (IBP) (Optional)

A delayed action key which zeros the current pressure in the BP1 channel. If the transducer zero process is unsuccessful, “UNABLE TO ZERO” is displayed in the window containing BP value. This key is only available when a pressure transducer is present.

9. ZERO 2 (IBP) (Optional)

A delayed action key which zeros the current pressure in the BP2 channel. If the transducer zero process is unsuccessful, “UNABLE TO ZERO” is displayed in a temporary window within the parameter window. This key is only available when a pressure transducer is present.

10. START (NIBP)

A single action key which initiates an NIBP measurement. This function is not available if a measurement is in progress.

11. INTERVAL (NIBP)

A repeat action key which selects the interval setting for NIBP measurements. Values wrap around at the lowest/highest choices. Choices are: Off, Continuous, 1, 2.5, 5, 10, 15, 20, 30, 60, and 120 minutes. Five seconds after the selection is made and the key is released, the new interval takes effect.

12. DEFLATE (NIBP)

A single action key which stops any NIBP measurement in progress, including any timed measurement sequence, and deflates the cuff. When a timed measurement is stopped an "NIBP: DEFLATE" message followed by an "NIBP: IDLE" message displays in the NIBP message window until the timer mode is restarted by either pressing START or changing the interval.

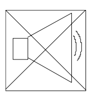
13. VOLUME (Alarms and Alarm LED)

A repeat action key which adjusts the alarm volume in 5 steps. There is no off position for this tone. The tone wraps to the minimum volume once the maximum is reached. The red alarm bell LED illuminates when an alarm condition exists. Refer to "Alarms" on page 1-49.

14. CHECK/RETURN (Alarms)

A single action key which provides access to the alarm menu to view and select alarm values. Press SELECT to change the alarm values. Pressing CHECK/RETURN a second time or the END key, returns the display to the main screen and exits the alarm menu.

15. MUTE (Alarms)



Alarm Mute Symbol

A single action and delayed action key which silences all currently alarming parameters or suspends all alarms. A single key press will silence the current alarm tone for 2 minutes. Any new alarms that occur while the alarm tone is muted will disable the mute and sound the alarm tone. An alarm mute symbol is displayed next to each muted parameter. The word Mute is displayed above the menu selections.

When the key is pressed and held for 3 seconds, all set alarms will be suspended for 2 minutes. This is indicated by the Alarm Mute Symbol and the words All Mute displayed above the menu selections.

When "Aud alm standby" is set to ON (in the User Configuration Menu), and the MUTE key is pressed and held for 4 seconds, all alarms are indefinitely suspended. This is indicated by the Alarm Mute Symbol in all parameter windows and the words Aud Alm Sby flashing above the menu selections.

The All Mute and Aud Alm Sby modes can be exited by pressing the mute key.

NOTE: ***When "Aud alm standby" is set to ON and the unit is power off and then on again, the unit will power up in the Aud alm standby mode.***

16. TRENDS/RETURN (Trends)

A single action and delayed action key which displays and clears trended data. The most recent page of data is displayed when the key is first pressed. Press this key a second time to view additional trended data. Pressing and holding the key for 3 seconds clears all trended data.

17. TIME UP ▲ and ▼ TIME DOWN (Trends)

Two repeat action keys which are used to scroll through the trend data.

18. BEEP VOLUME

A repeat action key which adjusts the beep volume in 5 steps plus OFF. When the maximum volume is reached, the volume will wrap around to OFF, then to the minimum volume

19. RECORD (Optional)

A combination single action and delayed action key which initiates or stops a recording. Pressing the key once initiates a printout. Holding the key pressed for three seconds, when waveforms are displayed, initiates a continuous printing of waveforms. Pressing the key while the printing is in progress, stops the recorder. The recorder prints either waveforms or trend data, depending on what is displayed (i.e. trend data is printed when trend list is displayed.). The Recorder Set-up will determine which waveform or waveforms are printed. The Recorder Set-up will also determine the Record Destination - Local (recording from the Passport), Remote (recording from the VISA, no recording from the Passport), or Both (recording from the Passport and VISA).

NOTE: ***When a remote (VISA) recording is printed, the information that is printed is determined by the set-up in the VISA.***

20. DC INPUT

A green LED used to indicate that the POWER Switch (33) is in the ON position.

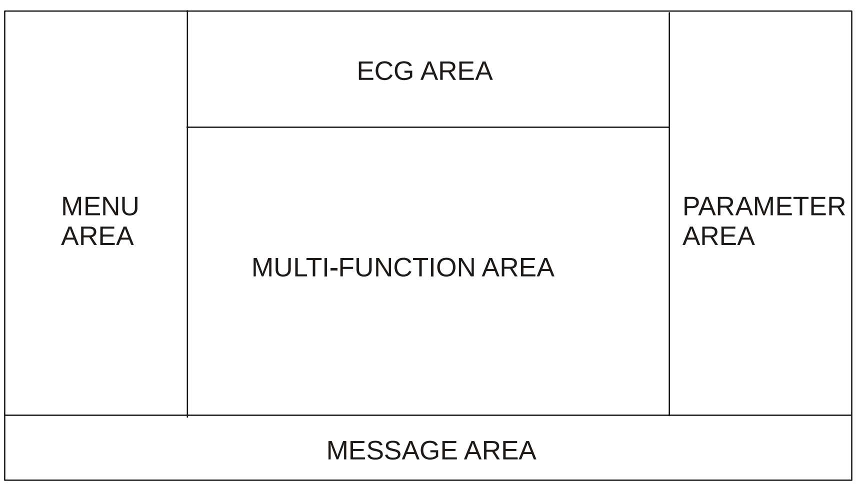


FIGURE 1-2 Display

21. DISPLAY

The Display is used to present information which is divided into 5 graphic display areas. They are:

A. MENU Display Area

B. ECG Display Area

C. PARAMETER Display Area

D. MULTI-FUNCTION Display Area

E. MESSAGE Display Area

NOTE: ***Only one key function will be recognized at any time. The Passport will ignore multiple key selections.***

1.2.2 Left Side Panel

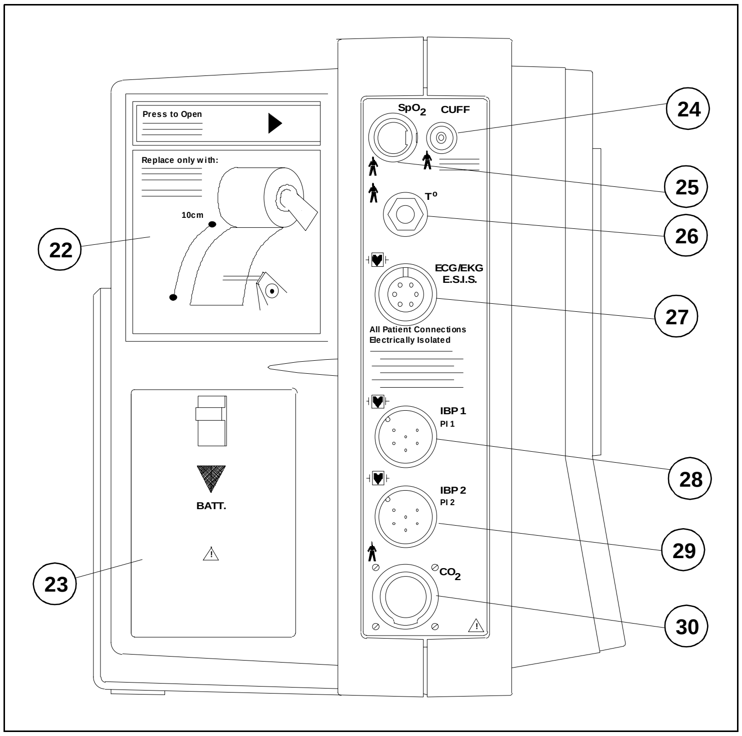


FIGURE 1-3 Left Side Panel with Datascope SpO_2

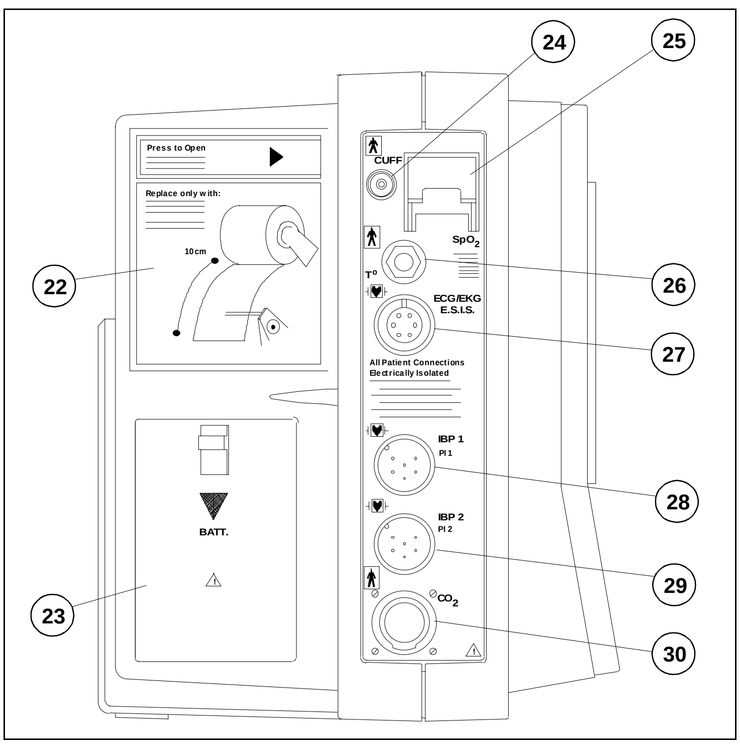


FIGURE 1-4 Left Side Panel with Nellcor® SpO_2

22. RECORDER (Optional)

A two trace thermal strip chart recorder with integral paper spool.

23. BATTERY PACK

Two internal, user replaceable, rechargeable, sealed lead acid batteries that provide power to operate the monitor when not connected to the power pack. The battery packs may be removed and replaced independently while the unit is operating.

24. CUFF

A connector used to attach the NIBP cuff assembly to the monitor.

25. SpO_2

An 8-pin DIN type or 9-pin sub miniature D (Nellcor) type female connector used to attach the SpO_2 sensor assembly to the monitor.

26. T (Temperature)

A standard three wire phone jack used to mate with either the YSI series 400 or 700* temperature probes. The Passport automatically identifies which probe is connected.

27. ECG / EKG

A six-pin AAMI (ECG-D10/75) standard connector (AMP P/N 864900-1; Datascope P/N 0131-00-0079) used for patient cable connections.

**Feature applicable only if available installed in your unit.*

28. IBP1 (Optional)

A six-pin male connector (Datascope P/N 0131-00-0094) used for Datascope specified pressure transducers listed in Chapter 5, Accessories.

29. IBP2 (Optional)

A six-pin male connector (Datascope P/N 0131-00-0094) used for Datascope specified pressure transducers listed in Chapter 5, Accessories.

30. CO_2 (Optional)

A 20 pin connector used to attach the CAPNOSTAT CO_2 sensor to the monitor.

1.2.3 Right Side Panel

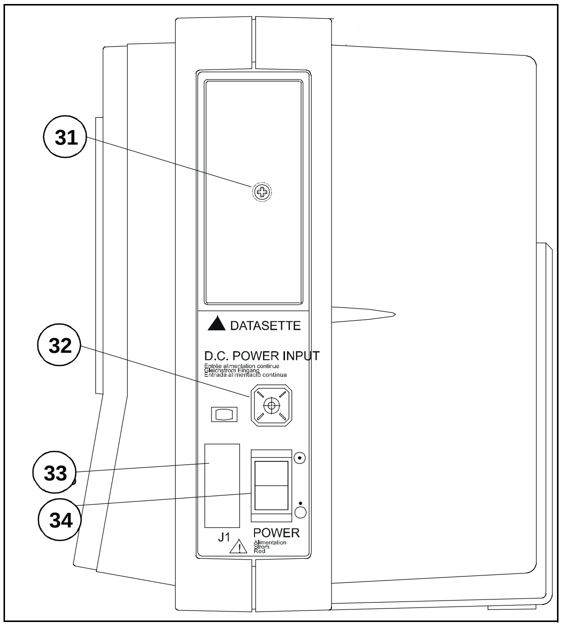


FIGURE 1-5 Right Side Panel

31. DATASETTE

A user replaceable software cartridge used for installing updated software revisions.

32. DC POWER INPUT (CONNECTOR)

A four terminal connector to supply low voltage DC power to the unit and charge the batteries. The power pack provides power to the unit independent of battery installation.

33. J1

A communication interface connector used to connect the Passport to a VISA Central Station Monitor, Remote Color Display, Nurse Call, DPD Defibrillator or other peripheral devices.

34. POWER

A recessed rocker switch which interrupts power to the main unit but does not prevent charging of the batteries.

1.2.4 Remote Color Display

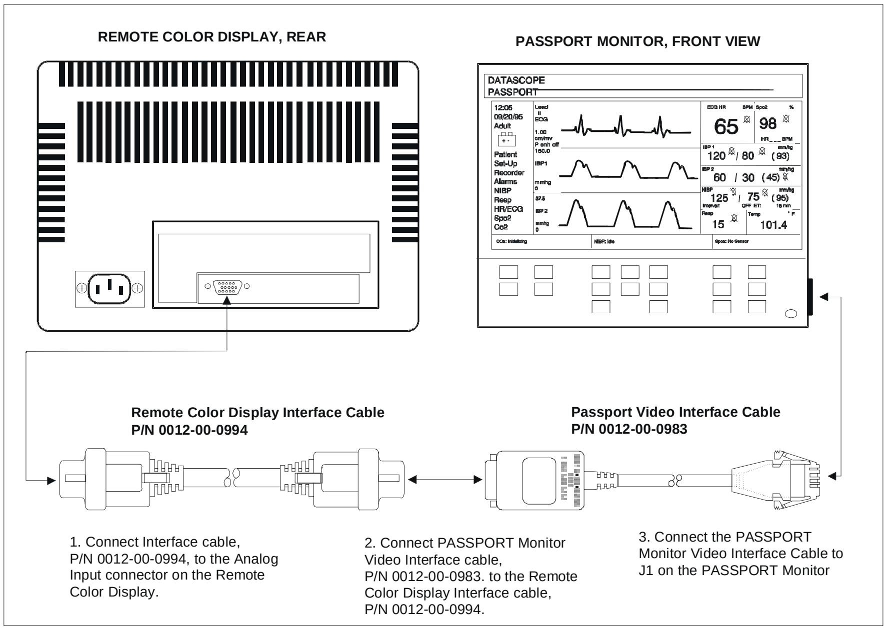


FIGURE 1-6 Remote Color Display

For instructions on mounting the remote display to a wall, refer to Operating Instructions.

WARNING: The use of remote displays will enlarge all waveforms and may alter aspect ratios depending on the remote device and its set-up.

1.3 Operation (5-Lead, 5L, LT)

Abbreviated Operating Check List

CAUTION: ***Only use the Abbreviated Operating Check List if you are already familiar with this product. If not, please continue with the remainder of this chapter, Detailed Operating Instructions.***

A. Setting-Up

1. Set POWER switch to OFF.
2. Connect, if desired, peripheral equipment (i.e., Remote Color Display, P.C., etc.).
3. Attach power pack and/or install charged batteries as needed.
4. Set POWER switch to ON.
5. Using the menus and keyboard, set (when appropriate) the following:

- Patient Size and Trend Clear
- Set Up Information (speed, waveform
- ECG Information
- Resp. Information
- Alarm Volume
- Beep Volume
- HR Information
- SpO_2 Information 2 and 3, etc.)
- Recorder Information (when available)
- Alarm Limits
- NIBP Information
- IBP Information

B. Initiating an NIBP Measurement

1. Select cuff.
2. Attach cuff hose to NIBP connector and place cuff on patient.
3. Select timer interval, if desired.
4. Select cuff pressure, if necessary.
5. Press START to begin an NIBP measurement.
6. Press DEFLATE to suspend measurement.

C. Establishing SpO_2

1. Select the appropriate sensor.
2. Attach sensor to SpO_2 connector and apply to the patient.
3. Set either waveform 2 or 3 in the set-up menu to display the SpO_2 waveform, if desired.

D. Establishing CO_2 / CAPNOSTAT*

1. Plug sensor into the side of the monitor.
2. If a new CAPNOSTAT is used, calibrate the system.
3. Apply sensor to the breathing circuit.
4. Set Waveform 2 or 3 to CO_2.
5. Set the Resp. Source to CO_2.

* *CAPNOSTAT is a trademark of NOVAMETRIX, Inc.*

E. Recording Information

1. Select wave to be recorded through Record Menu or if desired to record tabular trend, press TREND/RETURN.
2. Press Record to start recording function.
3. Press Record again to stop the recording function.

F. Temperature Measurement

1. Attach the desired temperature probe to the Temperature connector on the side of the Passport. The Passport automatically detects which probe is connected, 400 or 700 series.

Detailed Operating Instructions

This section of the Service Manual provides guidelines and step-by-step instructions for proper operation of the monitor. Numbers in parentheses ( ) relate to the displays and controls described in “Controls, Indicators and Connectors (5-Lead, 5L, LT)” on page 1-3

1.3.1 Setting-up / Turning Power On

1. Set the POWER switch (34) to OFF.
2. Attach any peripheral equipment, i.e., Visa Central Station, Remote Color Display.

CAUTION: ***Always attach all desired peripheral equipment prior to powering on the Passport. If required to attach more or change what is connected, turn the Passport off, attach what is needed, and then turn the Passport on again.***

3. Attach the power pack to the DC POWER INPUT connector (32). If battery operation is required, ensure that two fully charged batteries are installed.

NOTE: ***If power pack is connected ensure that the screw is tightened so that the cord does not detach.***

4. Set the POWER switch (34) to ON.
   Internal self tests will run and the display will come on. A “DIAGNOSTIC IN PROGRESS” message will display and once the self tests have been completed a “SELF TEST COMPLETE” message will display. After this the main screen is displayed.

If any failures occur, see “Status Messages” on page 1-57 for further instructions.

1.3.2 Factory - Default Control Settings

The following are the factory initial (default) control settings. This is the state that the unit will power up in unless a “current configuration” has been saved from the set up menu.

TABLE 1-2 Default Settings

MENU	FUNCTION	DEFAULT SETTINGS	
Patient	Size	Adult	
	Clear Trend Memory	No	
	Pacer Enhancement	Off	
Set-up	Speed	25 mm/sec.	
	Resp Speed	12.5 mm/sec.	
	Waveform 2	Cascade ECG	
	Waveform 3	Pleth	
	Resp Source	ECG	
	Powerup Settings	No change	
Record	Wave Selection	ECG	
	Record on Alarm	No	
	Recorder Destination	Local	
Alarms		Low	High
	Heart Rate	Off	Off
	SpO_2	85	Off
	IBP1 Sys	Off	Off
	IBP1 Dia	Off	Off
	NIBP Sys	Off	Off
	NIBP Dia	Off	Off
	IBP2 Mean	Off	Off
	Resp Rate	Off	Off
	Apnea Delay	Off Adult, Off Ped., 10 sec Neonate	
	$ETCO_2$	Off	Off
NIBP	Start Pressure	180 mmHg Adult, 140 mmHg Ped., 120 mmHg Neonate	
IBP	IBP1 Scale Range	150 mmHg	
	IBP2 Scale Range	37.5 mmHg	
Respiration	Scale	3 cm/ohm	
HR	Source	Auto	
SpO_2	Pleth Scale*	3	
CO_2	Scale Range	40 Torr	
Trend	Trigger	NIBP	
	Interval Timer	5 min	
ECG	Lead	II	
	Size	1 cm/mV	
NIBP Interval		Off	
Volume	Beep	Off	
	Alarm	1	

TABLE 1-2 Default Settings (Continued)

MENU	FUNCTION	DEFAULT SETTINGS
Temperature	Scale	ºF**
HrSpO_2 Size	Hr SpO_2 Size	HR small, SpO_2 large
Audio Alarm delay	Audio Alarm delay	Off
Aud alm standby	Aud alm standby	Off
Serial Output Type	Serial Output Type	Visa

Changes can be made and saved to these default settings. The default settings can also be restored. Refer to “Setting-up / Turning Power On” on page 1-14.

* *If your unit is equipped with Nellcor® SpO_2, there is no pleth scale adjustment. This is replaced with operating mode options 1, 2, and 3.*

** *Farhenheit is the default setting for English units only. All other language units default to Centigrade.*

1.3.3 Display

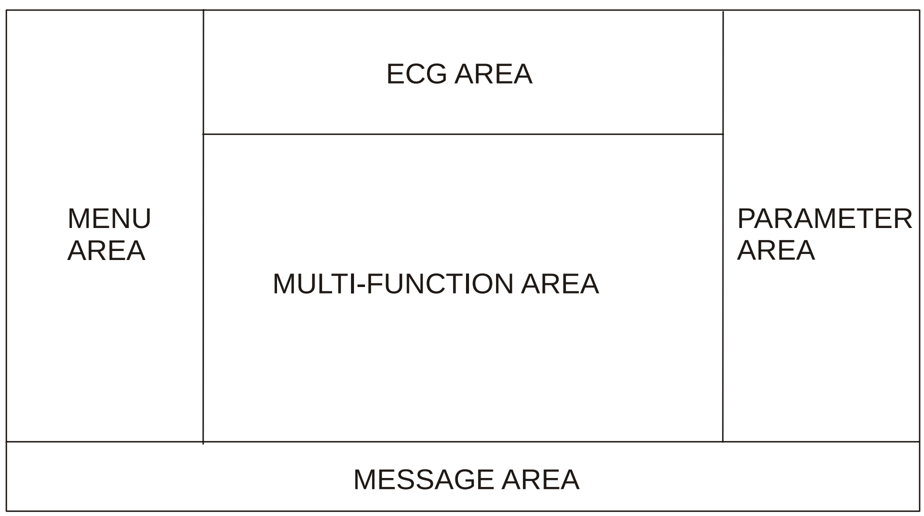


FIGURE 1-7 Window Layout

The Display is divided into five graphic areas as shown above.

MENU Display Area - displays the main menu selections available with the cursor and select keys, the battery symbol and the mute categories.

ECG Display Area - displays the ECG trace, ECG information and pacer enhancement status.

PARAMETER Display Area - displays the current values of patient parameters.

MULTI-FUNCTION Display Area - displays additional waveforms and temporary boxes for menu functions.

MESSAGE Display Area - displays messages relating to NIBP, SpO_2, CO_2 and recorder operation.

1.3.3.1 Menu Display Area

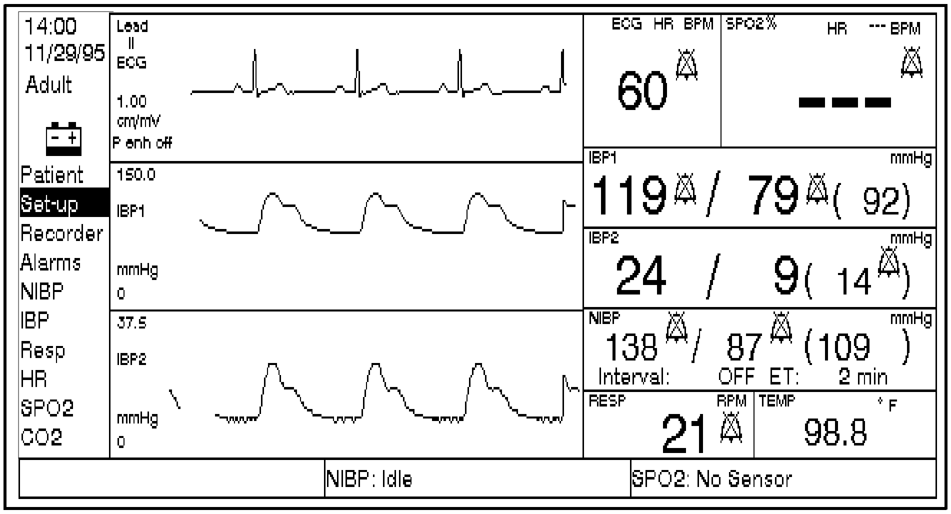


FIGURE 1-8 Window Layout

The menu area displays the main menu selections available. These are accessed by using the UP ▲ and DOWN ▼ arrow keys (1) and SELECT (2) set-up keys. One of the menu item is always highlighted by the cursor. This window also contains the TIME, DATE, PATIENT SIZE and MUTE CATEGORY (when active) information.

For each patient size available there are different choices within the menu selections. Table 1-3 on page 1-18 indicates the choices for each menu set-up and also where there are different selections for each patient size.

A list of all menus and the selections available is provided in Table 1-2 on page 1-15. For a graphic representation of each of these menus, see “Use of Menus” on page 23.

NOTE: ***The “IBP”, “Recorder” and “CO_2” menu items only appear only on models equipped with these options.***

NOTE: ***The display sample shown above may not be an exact representation of your unit.***

TABLE 1-3 Menu List

MENU LIST	MENU ITEM	CHOICES
Patient	Size	Adult, Pediatric, Neonate
	Clear Trend Memory	No, Yes
	Pacer Enhancement	On, Off
Setup	Speed	12.5, 25, 50 mm/sec.
	Resp Source	Off, ECG, CO_2
	Resp Speed	3.125, 6.25, 12.5, 25 mm/sec.
	Waveform 2	BP1, ECG casc., Pleth., Resp., CO_2
	Waveform 3	BP1, BP2, Pleth., Resp., CO_2
	Power up Settings	No Change, Save Current, Restore Factory
Record	Record on Alarm	Yes, No
	Wave Selection	ECG, Pleth., Resp., ECG and BP1, ECG and BP2, BP1 and BP2, ECG and Resp., CO_2
	Record Destination	Local, Remote Both
Alarm	HR	Low (Off, 30-100), High (Off, 100-250) bpm
	SpO_2	Low (50-99), High (Off, 80-100) %
	IBP1 Sys	Adult: Low (Off, 5 - 130), High (Off, 70 - 240) mmHg Ped.: Low (Off, 5-130), High (Off, 40 - 180) mmHg Neo.: Low (Off, 5-130), High (Off, 40 - 180) mmHg
	IBP1 Dia	Adult: Low (Off, 5 - 90), High (Off, 40 - 130) mmHg Ped.: Low (Off, 5 - 50), High (Off, 50 - 100) mmHg Neo.: Low (Off, 5 - 50), High (Off, 50 - 100) mmHg
	NIBP Sys	Adult: Low (Off, 50 - 150), High (Off, 70 - 240) mmHg Ped.: Low (Off, 15 - 130), High (Off, 40-180) mmHg Neo.: Low (Off, 15 - 130), High (Off, 40-180) mmHg
	NIBP Dia	Adult: Low (Off, 30 - 120), High (Off, 40 - 130) mmHg Ped.: Low (Off, 10 - 50), High (Off, 50 - 100) mmHg Neo.: Low (Off, 10 - 50), High (Off, 50 - 100) mmHg
	IBP2 (Mean)	Adult: Low (Off, 2 - 100), High (Off, 5 - 150) mmHg Ped.: Low (Off, 2 - 50), High (Off, 5 - 100) mmHg Neo.: Low (Off, 2 - 50), High (Off, 5 - 100) mmHg
	Respiration	Low (Off, 5 - 50), High (Off, 30 - 200) bpm
	Apnea Delay	Adult Off, 10 -40 secs. Ped. Off, 10 - 30 secs. Neonate 10 - 20 secs.
	$ETCO_2$	Torr: Low (Off, 5 - 60), High (Off, 20 - 100) %: Low (Off, 1 - 8), High (Off, 2 - 11) kPa: Low (Off, 1.0 - 8.0), High (Off, 2.0 - 11.0)
NIBP	Start Pressure	Adult: 100-260 mmHg Ped.: 60-180 mmHg Neonate: 40-120 mmHg
IBP	BP1 Scale Range	37.5, 75, 150, 300 mmHg
	BP2 Scale Range	37.5, 75, 150, 300 mmHg
Resp	Scale	1, 2, 3, 4, 5
HR	HR Source	Auto, ECG, BP1, SpO_2
SpO_2 (Standard)	Pleth Size	1, 2, 3, 4, 5

TABLE 1-3 Menu List (Continued)

MENU LIST	MENU ITEM	CHOICES
SpO_2 (Nellcor)	Response Mode	1, 2, 3
CO_2 (Capnostat)	CO_2 Scale	40, 60, 100 Torr / 5, 8, 12 kPa / 5, 8, 12 %
	Start Zero Calibration	Yes, No
	Start Adapter Calibration	Yes, No
	N_2O Compensation	On, Off
	O_2 Compensation	0, 21, 40, 60, 80, 100

1.3.3.2 ECG Display Area

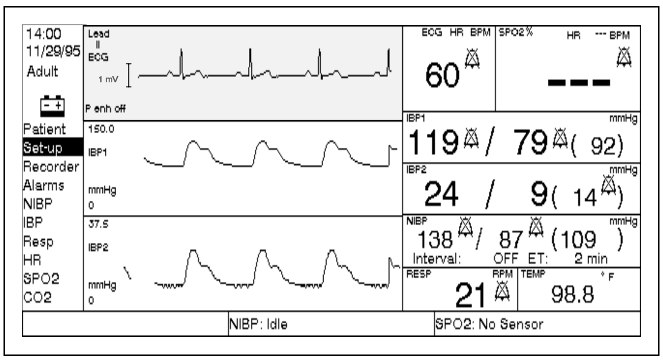


FIGURE 1-9 ECG Display Area

The ECG Display Area contains the ECG waveform, the ECG size, scale, lead information, Pacer Enhancement ON / OFF message, and when appropriate a message indicating there is no ECG waveform available.

- ***ECG SIZE*** - The ECG size displays a vertical bar and a "1 mV" label. The vertical bar is used as a reference to determine the size of the displayed ECG waveform. There are a total of 6 size settings for the vertical bar. Five size settings are 0.25, 0.5, 1, 2, 3 cm. The sixth setting is larger than the ECG waveform window and therefore the "1 mV" label is removed. The size that measures a 1 cm signal on the display is indicated by small line segments added to the top and bottom of the vertical bar (as shown above).
- ***ECG LEAD*** - The ECG lead display shows the current ECG lead selection. The lead display options are I, II, III, aVR, aVF, aVL, and V.
- ***ECG WAVEFORM*** - The display shows the ECG waveform at a user selected speed. This provides 4 seconds of data on the display (at 25mm/sec). The scale of the waveform is determined by the ECG size selected.
- ***LEAD FAULT MESSAGE*** - The lead fault message box displays "ECG Lead Fault" and is positioned over the area where the ECG waveform normally resides.
- ***PACER ENHANCEMENT*** - Factory default is "Pacer enh OFF" (pacer enhancement off). The OFF setting allows any pacer to appear as it normally would on the ECG waveform. When pacer enhancement is turned on via patient menu selection, detected pacers are enhanced and appear as full scale, narrow square waves.
- ***ESU INTERFERENCE MESSAGE-*** When a large high frequency noise component is present on the ECG waveform, the message "ESU Interference" is displayed. If both high frequency and 60 Hz noise are present, the "ESU Interference" message has priority over the "Interference" message to display. The "Artifact" message is also displayed in the Heart Rate window.
- ***INTERFERENCE MESSAGE***- When a large 60 Hz noise component is present on the ECG waveform and the notch filter is enable, the "Interference" massage is displayed. Check the patient electrode connectors and the cable for proper connection. The message may be the result of using inappropriate 3-Lead cables. The "Artifact" message is also displayed in the Heart Rate window.

1.3.3.3 Multi-function Display Area

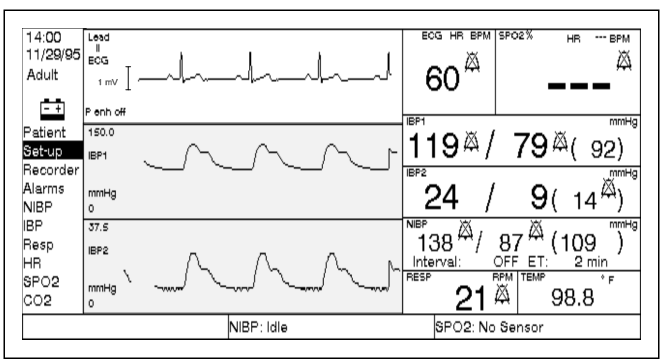


FIGURE 1-10 Multi-Function Display Area

Displayed within the Multi-function Area of the screen are the:

A. Waveforms

B. Trend Lists

Waveforms

The waveform display is the normal display in the multi-function area. The waveforms occupy the entire multi-function area.

This area is divided horizontally in two. These two areas are used for waveforms 2 and 3.

The options for each waveform are listed in Table 1-3 on page 1-18.

The scale information for invasive pressures consists of a 0 at the bottom of each window to represent zero pressure level and the scale range value at the top of the window.

The waveform provides four seconds of data when the selected speed is 25mm/sec.

NOTE: ***The display sample shown above may not be an exact representation of your unit.***

C. Trend Lists

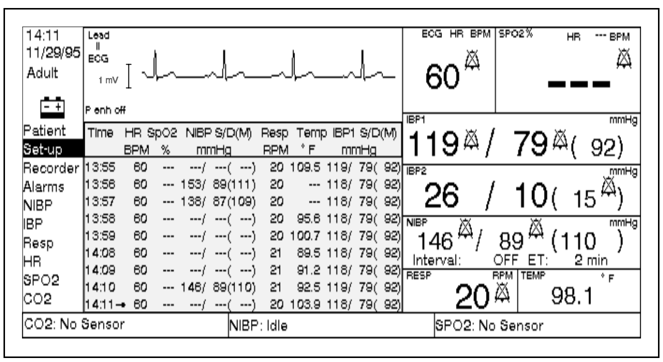


FIGURE 1-11 Trend List Display

Pressing the TREND/RETURN key (15) displays the trend lists, as shown above. The trend lists take up the entire Multi-function area. To display additional parameters press the TREND/RETURN key (15) again. Pressing this key a third time returns the screen to normal. Pressing and holding the TREND/RETURN key (15) for 3 seconds will clear all trended data.

Each entry to the trend list is added to the bottom of list until the page is full. Eleven lines of data can be displayed on each page. The trend data memory is large enough to contain more than one page of data. When the most current page is full and new data is available, the top line of data in the window is removed (but kept in memory), the other lines of data are scrolled up and the new data is added as the last line of data in the window. To scroll through the data that is in memory press the TIME UP ▲ and TIME DOWN ▼ trend keys (16).

The trend lists display consists of a heading that includes the page #, the time, the parameters with their units, and the listed data in columns under the appropriate heading.

If no data is available for a particular column, dashes (—-) are displayed. If an NIBP measurement was attempted and a valid reading was unable to be obtained (xxx) will be displayed in the NIBP column.

If respiration is turned off, “OFF” is displayed in the respiration column.

NOTE: The IBP1 column displays only in models that are equipped with the invasive pressure option.

The Trend Trigger and Interval are set in the User Configuration Trend menu.

To clear the trend data, press and hold the TREND/RETURN key (15) for 4 seconds.

NOTE: Trend data will be stored in memory for 1 hour after the unit has been powered down. After 1 hour the trend data will be cleared.

NOTE: The display sample shown above may not be an exact representation of your unit.

1.3.3.4 Parameters Display Area

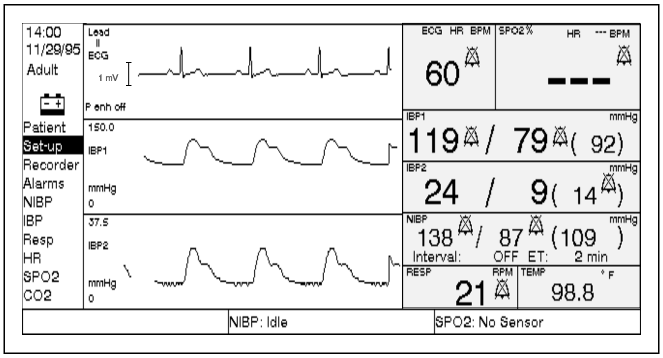


FIGURE 1-12 Parameter Display Area

The parameters display area contains the current values of the patient parameters. The contents and the layout of the parameters area depends on how many invasive blood pressure transducers are connected to the monitor. The example above is with two transducers connected.

Within the NIBP parameter area the interval chosen is displayed and the elapsed time (ET) since the last NIBP measurement was taken is displayed. If another NIBP measurement is not taken within 15 minutes the ET and the NIBP readings will change to dashes.

An “Artifact” message is displayed in the Parameter area (under the ECG Heart Rate) whenever 60 Hz noise or ESU Interference is present on the ECG waveform.

NOTE: ***The display sample shown above may not be an exact representation of your unit.***

1.3.3.5 Message Display Area

This area of the display contains messages relating to NIBP, SpO_2, CO_2 and recorder operation. Refer to “Status Messages” on page 1-57 for a complete list of these messages.

1.3.4 Use of Menus

The main menus are accessed by using the UP ▲ and DOWN ▼ arrow keys (1), SELECT (2), and END (3) keys.The following is an example of how to set the menu options.

1. Using the UP ▲ and DOWN ▼ arrow keys (1), move the cursor to select the desired main menu item.

NOTE: ***As the cursor is moved up and down the list of menu items, view windows for each menu item are displayed.***

2. When the desired menu item is highlighted, (in this case SET-UP has been chosen) press SELECT (2) to enter into the change window.
When SELECT is pressed, the first item in the sub-menu will be highlighted.

3. To change the highlighted item use the UP ▲ and DOWN ▼ arrow keys (1). The choices available are listed in the CHOICES bar. Once the desired choice is displayed, press SELECT (2) to enter it and move the cursor down to the next item in the sub-menu.

If no change is required to the highlighted item, press SELECT to move the cursor down to the next item on the list. Keep pressing SELECT until the required item to change is high-lighted.

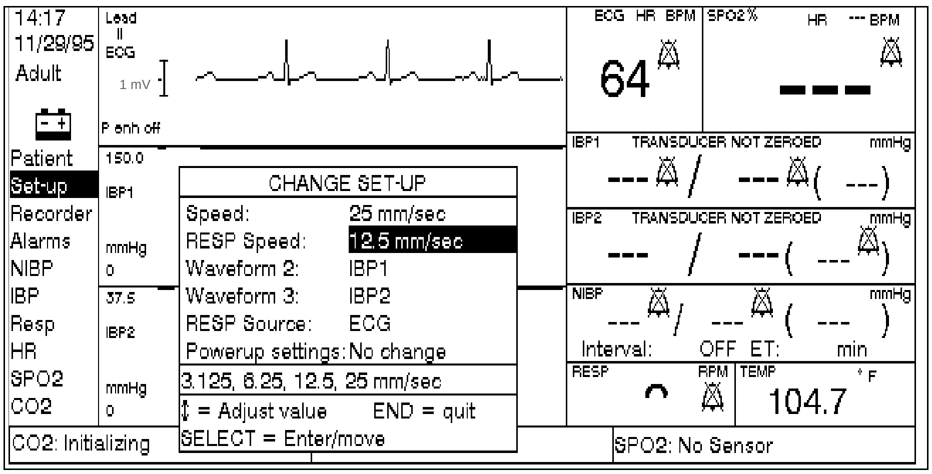


FIGURE 1-13

4. Press the END (3) key to return to the normal monitoring mode when all of the sub-menu items have been set as desired.

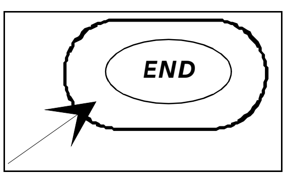


FIGURE 1-14

1.3.5 Initiation of NIBP Measurements

1.3.5.1 Manual Initiation of NIBP Measurements

1. Select a pressure cuff that is appropriate for the size of the patient using the chart below as a guideline.

TABLE 1-4 Cuff Selections

LIMB CIRCUMFERENCE (CM)	DESCRIPTION / CUFF NAME	DATASCOPE PART NUMBER	
		Reusable	***Disposable***
45 - 66	Thigh *	0998-00-0003-05	
30 - 47	Large Adult	0998-00-0003-02	0683-07-0001-01
24 - 36	Adult	0998-00-0003-01	0683-07-0001-02
18 - 27	Child	0998-00-0003-03	0683-07-0001-03
16 - 25	Small Child	0998-00-0003-04	0683-07-0001-04
10 - 19	Infant	0998-00-0003-06	
6 - 11	Newborn	0998-00-0003-07	
11 - 17	Neonatal, Size 3		0683-03-0003-02
9 - 13	Neonatal, Size 2		0683-03-0002-02
7 - 10	Neonatal, Size 1		0683-03-0001-02
6 - 8	Neonatal, Size 0		0683-03-0004-02
COLOR CODED CUFFS*			
46 - 66	Thigh - Brown	0998-00-0003-26	
33 - 47	Large Adult - Grey	0998-00-0003-25	
25 - 35	Adult - Tan	0998-00-0003-24	
18 - 26	Child - Red	0998-00-0003-23	
10 - 19	Infant - Green	0998-00-0003-22	
6 - 11	New Born - Blue	0998-00-0003-21	

* *When using the thigh cuff, this product will not comply with AAMI accuracy standards.*
** *The limb circumferences of the Color Coded Cuffs adhere to the AHA guidelines for size.*

A cuff that is too narrow for the limb will result in erroneously high readings. The correct size of the pressure cuff for a given patient has, among other considerations, a direct bearing on the accuracy of the obtained NIBP measurements. Base your selection of the cuff size on the limb circumference of the patient. Table 1-4 on page 1-25 indicates the available Datascope cuffs for use with the Datascope Passport Monitor. The design dimensions of the cuffs and their intended uses are based on recommendations of the American Heart Association.

NOTE: See Optional Accessories in the Operating Instructions, for a detailed list of cuffs.

NOTE: Cuffs become more supple as they age and sometimes develop permanent folds that can leave temporary marks on the limb. Any cuffs that exhibit this effect should be replaced.

NOTE: Ensure that the pressure tubes are not compressed or restricted.

The pressure on the limb may not fall to zero between measurements if the cuff is wrapped too tightly. Therefore, assure that the cuff is properly applied.

The skin is sometimes fragile (i.e., on pediatrics, geriatrics, etc.). In these cases, a longer timer interval should be considered to decrease the number of cuff inflations over a period of time. In extreme cases, a thin layer of soft roll or webril cotton padding may be applied to the limb in order to cushion the skin when the cuff is inflated. This measure may affect NIBP performance and should be used with caution.

2. Attach cuff hose to NIBP Connector (24).
3. Apply the cuff to the patient. To reduce errors, the cuff should be fitted snugly, with little or no air present within the cuff. Be sure the cuff lies directly against the patient's skin. No clothing should come between the patient and the cuff.

NOTE: ***The NIBP cuff should not be placed on a limb that is being utilized for any other medical procedure. For example, an I.V. catheter or an SpO_2 sensor.***

4. Select Patient Size through the PATIENT MENU as described in "Menus" on page 1-64. Choices are ADULT, PEDIATRIC or NEONATE.
5. If necessary, enter the NIBP parameter menu to change the initial cuff inflation pressure.

   Initial cuff inflation pressures depend on the PATIENT SIZE setting. The choices of cuff inflation are:

TABLE 1-5 Cuff Inflations

PATIENT SIZE SETTING	INITIAL CUFF INFLATION VALUES
Adult	100 - 260 mmHg
Pediatric	60 - 180 mmHg
Neonate	40 - 120 mmHg

6. Press START (9) to begin an NIBP measurement.

NOTE: ***Inflate the cuff only after proper application to the patient's limb. Cuff damage can result if the cuff is left unwrapped and then inflated.***

The cuff begins to inflate to the selected cuff pressure. After reaching the selected value the cuff begins to slowly deflate and the Datascope Passport Monitor collects oscillometric pulsations.

If the initial cuff inflation is found to be inadequate, the unit retries with a higher inflation pressure (+50 mmHg in the adult mode; +30 mmHg in the pediatric and neonate modes).

Have the patient remain still to avoid the introduction of unnecessary motion artifact. After the cuff pressure drops below the diastolic pressure, the results of the measurement are displayed.

If NIBP is the only parameter measured with the Passport, a heart rate can be derived from NIBP. The HR source menu selection must be in the Auto mode (i.e., not selected for ECG, IBP or SpO_2) and no heart rate alarm limits are set. (see "Alarms" on page 1-49).

If NIBP is a selected trend trigger, then NIBP and heart rate values are stored in trend lists. The NIBP and NIBP heart rate will be automatically removed from the display after 15 minutes have elapsed.

If another heart rate source is selected (ECG, IBP or SpO_2)< before the 15 minute display time has elapsed, the NIBP heart rate will be replaced by the heart rate from the selected source.

To display heart rate from NIBP:

- ***a.*** Choose AUTO for HR source.
- ***b.*** Discontinue monitoring of ECG, SpO_2 and IBP.
- ***c.*** Set high and low heart rate alarms to off.
- ***d.*** Make a valid NIBP measurement.

  During or after an NIBP measurement, one of several advisory messages may be displayed. Refer to “Status Messages” on page 1-57, for their explanations.

7. If desired, press DEFLATE (12) to interrupt a measurement. The cuff will deflate.

1.3.5.2 Automatic Initiation of NIBP Measurements

Follow steps 1 - 5 in Section 1.3.5.1 on page 1-25.

6. Press INTERVAL (11) until the desired time displays. The choices are: OFF, continuous, 1, 2.5, 5, 10, 15, 20, 30, 60, and 120 minutes.

7. A measurement will be taken when the selected interval has elapsed. If an immediate measurement is desired, press START (10).

NOTE: ***If the monitor is in the interval mode when it is turned on, no measurement will be taken until the “START” key is depressed. Subsequent measurements are referenced to the time the unit was turned on. See example in Section 1.3.5.5 on page 1-28.***

NOTE: ***When the NIBP continuous interval is chosen, the Passport will continually take back to back blood pressure readings. As a safety precaution, a five minute limit is placed on continuous measurements. After 5 minutes, the NIBP interval will automatically switch to measurements taken every 5 minutes.***

Automatic Adjustment in the Timer Mode

In the timer mode, the unit adjusts the inflation pressure according to the previous reading of the systolic pressure. After the first measurement in the timer mode, the inflation pressure is the previous systolic +50 mmHg in the Adult Mode and +30 mmHg in the pediatric and neonate mode.

Suspension of Automatic NIBP Feature

To suspend an automatically timed measurement sequence or to end a measurement cycle already in progress (deflate cuff):

1. Press DEFLATE (12).

   To take an immediate measurement and resume a suspended timed measurement sequence:

2. Press START (10).

NOTE: ***Press DEFLATE (12) at any time to postpone a scheduled measurement or to terminate a measurement cycle already in progress.***

CAUTION: ***Observe extreme caution on all patients (neonates, pediatrics, and adults) when NIBP is set to the Continuous Mode. A 5 minute limit is placed on continuous measurements. After 5 minutes the unit will take a measurement once every 5 minutes. Reports have been made of nerve injury occurring during use of automatically cycled blood pressure cuffs. See the Appendix, "Precautions when Using Automatically Cycled Blood Pressure Cuffs".*** ***Observe extreme caution on all patients (neonates, pediatrics, and adults) when NIBP is set to the Continuous Mode. A 5 minute limit is placed on continuous measurements. After 5 minutes the unit will take a measurement once every 5 minutes. Reports have been made of nerve injury occurring during use of automatically cycled blood pressure cuffs. See the Appendix, "Precautions when Using Automatically Cycled Blood Pressure Cuffs".***

1.3.5.3 NIBP Pressure Limit Fail Safe

If the cuff pressure is over-pressurized, the cuff will automatically vent to atmosphere and the NIBP message window reads CUFF OVERPRESSURE.

The unit must be turned off and back on again to reset the overpressure switch before any new measurements are taken.

1.3.5.4 Cuff Inflation Time

If the cuff pressure does not attain 20 mmHg within 40 seconds of the start of inflation or if the target pressure is not reached within another 60 seconds, then the cuff is vented and the "RETRY" or "UNABLE TO MEASURE" message will display in the NIBP message window.

1.3.5.5 START and DEFLATE Functions

The START and DEFLATE functions have the following effects on the timed measurement sequence.

- INTERVAL is set and you Press START (10):

An unscheduled measurement is made. Taking this unscheduled measurement does not affect the timing of the interval cycle, therefore, the scheduled measurements will be taken as if there were no interruptions. Only one measurement is taken for each measurement cycle - even if the unscheduled measurement coincides with the scheduled measurement.

- INTERVAL is set and you press DEFLATE (12):

The timed measurement is suspended and the cuff deflates.

- INTERVAL is set and you change the interval:

The measurement cycle is reset with the new interval. A measurement will be taken after the new interval has elapsed.

For example, with the interval set to five minutes:

TABLE 1-6 Interval Sequence

TIME	MODE/TIMER INTERACTION	RESULT
9:45	Unit turned on with interval set to 5 minutes.	No measurement taken
9:52	Start key pressed	Measurement taken
9:55	Timer requests a measurement	Measurement taken
10:00	Not in Deflate mode and timer requests a measurement	Measurement taken
10:04	Deflate mode is entered	Deflate message is displayed on display
10:05	Timer requests a measurement	Measurement is skipped
10:07	Interval is changed to 10 min.	Interval timing is reset
10:17	Timer requests a measurement	Measurement taken

1.3.6 ECG Acquisition

The patient ECG signal is acquired with a patient cable and skin electrodes. The type of skin electrode and technique of applying the electrodes are major factors in determining the quality of the signal obtained. Use high quality, silver-silver chloride electrodes. These are designed to acquire the ECG with excellent base line stability, recovery from defibrillation, and minimum artifact from patient movement.

WARNING: Ensure that the conductive parts of ECG electrodes do not contact other conductive parts including earth ground.

1. For optimal skin contact, thoroughly prep patient skin for electrode placement by doing the following.
   - Shave hair from electrode sites.
   - Cleanse skin thoroughly with alcohol to remove skin oils.
   - Dry with a rough towel or gauze to remove dry skin.
   - Attach electrodes to lead wire first before placing onto patient.

NOTE: Using more than one type of electrode on the same patient should be avoided because of variations in electrical resistance.

2. Use the ESIS choke cable if an electro-surgical device is to be used on the patient.

3. Plug patient cable into the ECG (27) connector.

An ECG waveform should now be present on the screen and the heart rate read-out should now be functional.

4. Select desired lead setting by pressing the front panel ECG LEAD key (5). Lead II is automatically selected at power-up.

5. Select desired ECG size by pressing the front panel ECG SIZE key (6). An ECG of 1cm/mV is automatically selected at power-up.

6. If cascaded ECG is desired in waveform 2, use the Set-up menu, Section 1.3.4, to choose this option.

7. Choose HR source for rate meter from HR menu. Choices are: ECG, BP1, SpO_2, or AUTO. AUTO selects the source from a hierarchy (ECG, IBP1, SpO_2) of what is currently monitored. If no HR source is found, then an alarm tone is sounded.Press BEEP VOLUME (18) to set the volume of the systole beep.

WARNING: Thoracic respiration measurement may interfere with some pacemakers. Refer to the pacemaker's manual.

Messages Associated with ECG Leads

"Lead Off"

- The Passport will display the message "Lead Off" to indicate when ECG monitoring is inoperative.

"ECG Lead Fault"

- When ECG lead I, II or III is being monitored, a lead fault sensed by RA, LA, or LL will cause the "ECG Lead Fault" message to display.
- When lead aVR, aVL, or aVF is being monitored, a lead fault sensed by RA, LA, LL, or RL will cause the "ECG Lead Fault" message to display. When the specified 3-Lead cable is used, the "ECG Lead Fault" message will display because the RL lead is not available.
- When ECG V lead is being monitored, a lead fault sensed on RA, LA, LL, RL or C will cause the "ECG Lead Fault" message to display. When the specified 3-Lead cable is used, the "ECG Lead Fault will display because the RL and C is not available.

WARNING: Do not use the following 3-Lead ECG cables with Passport 5L (P/N, 0998-00-0126-xx) and 5L-CE (P/N, 0998-00-0131-xx): 0012-00-0620-05, -06, -07, -08; 0012-00-0722-05, -06, -07, -08; 0012-00-0723-05, -06, -07, -08; 0012-00-0724-05, -06, -07, -08. The above 3-Lead cables contain a jumper wire which connects RL (right leg) to LL (left leg). As a result, when you view aVR, aVL and aVF you will see the appropriate ECG waveforms (even though you are using a 3-lead cable). However, there may be excessive noise on these waveforms which can corrupt the heart rate calculation. See Section 5 in the Operating Instructions for a list of the proper ECG cables.

1.3.6.1 Adult Electrode Placement

For 5 Lead ECG Monitoring

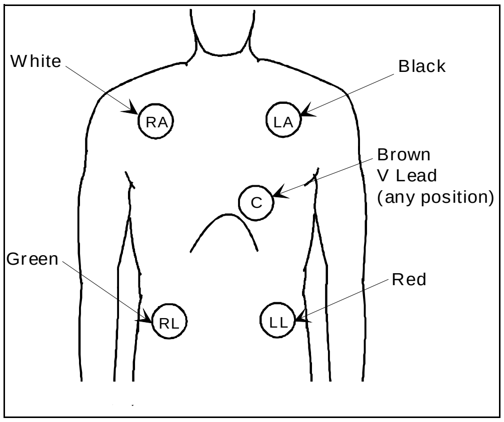


FIGURE 1-15 5-Lead Electrode Placement

- Place black electrode on left shoulder under clavicle.
- Place white electrode on right shoulder under clavicle.
- Place red electrode on lower left abdomen under the sixth rib.
- Place green electrode on lower right abdomen under the ribs.
- Place the brown lead in any one of the V lead (V1 - V6) positions, see Figure 1-17 on page 33.

Description of V-Lead Placement

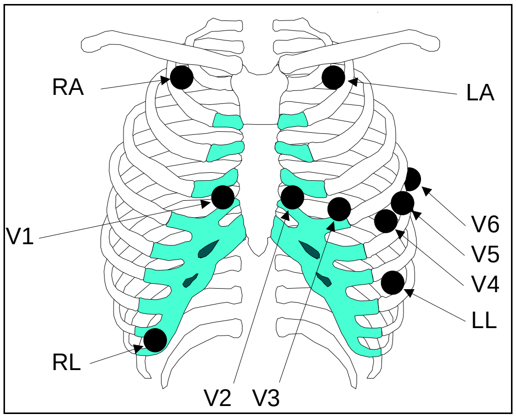


FIGURE 1-16 V-Lead Electrode Placement

- V1-Fourth intercostal space, right sternal border.
- V2-Fourth intercostal space, left sternal border.
- V3-Midway between V2 and V4 on a line joining these 2 locations.
- V4-Fifth interspace in mid-clavicular line.
- V5-Fifth interspace in anterior axillary line.
- V6-Fifth interspace in mid-axillary line.

For Lead II ECG Monitoring

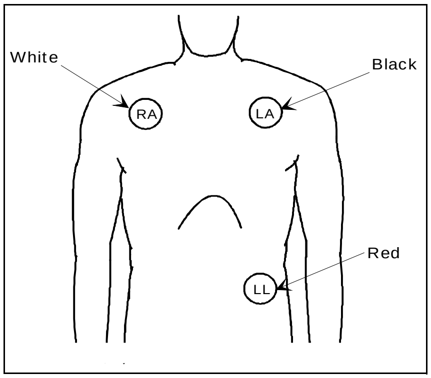


FIGURE 1-17 3-Lead Electrode Placement (standard configuration)

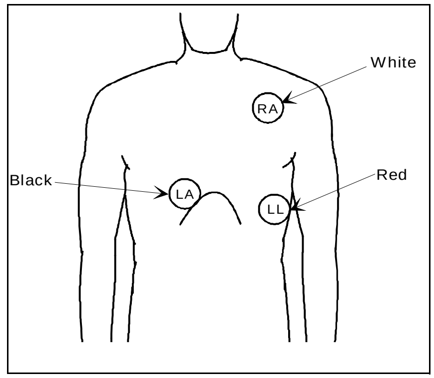


FIGURE 1-18 3-Lead Electrode Placement (for MCL)

For Lead II ECG Monitoring

- Place black electrode on left shoulder under clavicle.
- Place white electrode on right shoulder under clavicle.
- Place red electrode on lower left abdomen under the sixth rib.
- Place lead select on lead II.

For MCL

- Place white electrode on left shoulder under clavicle.
- Place black electrode on right sternal border, 4th intercostal space.
- Place red electrode on midaxillary line, 5th intercostal space.
- Select lead I for monitoring.
- For MCL, select lead II for monitoring.

1.3.6.2 Neonatal Electrode Placement

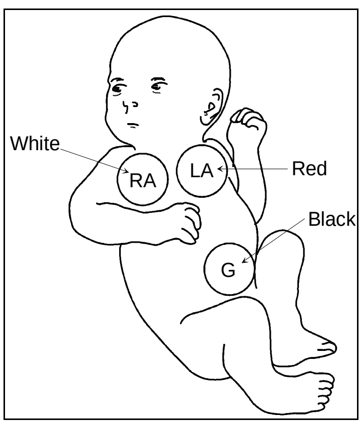


FIGURE 1-19 Neonatal Electrode Placement

Lead placement on the neonate with a three lead set is directed towards obtaining the best respiration waveform. The thoracic impedance is measured between the RA and LA electrodes therefore, the electrodes must be placed across the chest from each other to optimize measurement of chest movement.

1.3.7 Invasive Pressure Acquisition

1. Plug the pressure transducer into the PRESSURE TRANSDUCER connector (28) or (29) on the side panel.
2. To establish a monitoring site introduce an arterial pressure catheter into the patient's artery in accordance with standard hospital procedures. "Best practice," as determined by the medical community, should be observed.

NOTE: ***The arterial pressure catheter should not be used on a limb that is being utilized for any other medical procedure. For example, an I.V. catheter or an SpO_2 sensor.***

3. Connect catheter line with flushing device to the pressure transducer.
4. Zero pressure transducer as follows:

   Initially, a "TRANSDUCER NOT ZEROED" message is displayed in the parameter window, indicating the need to zero the transducer.

   a. Open transducer vent to atmosphere.
   b. Press ZERO (8) or (9) and hold for a minimum of one second.

      After one second has elapsed, an audible click will sound, and the automatic zero process is complete. The pressure display should indicate zeros.

NOTE: ***If the transducer offset should exceed 120 mmHg, it will not be possible to automatically zero the transducer. Pressure values will be —- and an "UNABLE TO ZERO" message replaces the "TRANSDUCER NOT ZEROED" message.***

5. Close the pressure transducer vent from atmosphere and check that the pressure waveform is displayed on the screen.
6. Select the desired pressure scale in the IBP Menu. The choices are: 37.5, 75, 150, or 300 mmHg.
7. Flush arterial line at regular intervals per standard hospital procedure.

NOTE: ***Pressure transducers are protected against the effects of defibrillation and electrocautery.***

1.3.8 Sequence for Establishing SpO_2

To obtain SpO_2 measurements, SpO_2 Heart Rate, and the plethysmographic waveform from the Passport Monitor (including units equipped with Nellcor® SpO_2).

1. Select the appropriate sensor for the patient.

   Guidelines for the selection of Datascope sensors are provided in the Table 1-7 on page 1-38.

2. Plug the patient cable into the SpO_2 Connector (25) on the left side panel.
3. Apply sensor and connect to cable.

NOTE: ***Do not place the sensor on an extremity with an invasive catheter or blood pressure cuff in place.***

4. The digital SpO_2 values and SpO_2 heart rate will be displayed in the SpO_2 parameter window.
5. If a pleth waveform is desired, enter the set-up menu as described in Section 1.3.4, Use of Menus, to display it as waveform 2.
6. To change the size of the waveform displayed select the SpO_2 menu and chose the desired size. Choices are: 1, 2, 3 or 4.
7. Press BEEP VOLUME (18) to set the volume of the SpO_2 beep.

1.3.8.1 Datascope Pulse Oximetry Sensors

A. Introduction

A wide range of Datascope sensors are available for connection to Datascope Passport Monitors equipped with Datascope SpO_2. The sensors cover both short-term and long-term monitoring needs on patients ranging from neonates to large adults.

The DATASENSOR is intended for short-term adult monitoring.

The FLEXISENSOR® SD, available in five different sizes, provides both short-term and long-term monitoring for large adults, adult ear, adults, pediatrics, infants, and neonates. The FLEXISENSOR® SD is used when the DATASENSOR is not convenient or suitable.

The ear sensor is intended for long-term adult monitoring.

A range of disposable bandages are available for use with the FLEXISENSOR® SDs. They are available in 3 styles, SENSOR GUARD™ (used for large adults, adults and pediatrics), Coban with SENSOR GUARD™ (used for infants) and LIGHTGUARD™ (used for neonates).

Use of the sensors does not cause any penetration of the skin, nor is there any electrical contact or transfer of excessive heat to the patient.

The sensor is composed of a light emitting diode (emitter) and a photo diode (detector). The emitter discharges two colors (wave lengths) of light into the patient's extremity (finger, toe, ear). The detector receives that amount of light not absorbed by the blood or tissue components. The Passport then uses the relative absorption of the two light wavelengths to compute and display SpO_2 and Rate measurements

- electrocautery noise (ESU) noise
- tracking of weak peripheral
- rejection of ambient light
- patient isolation
- long term patient comfort
- good motion artifact rejection
- pulse levels
- Can be re-sterilized (ETO sterilization - 3 times)
- ease of application and removal

The key benefits of the sensors are:

- ***Electrocautery Noise (ESU) Rejection*** - The sensor configuration of both the DATASENSOR and the FLEXISENSOR® SD provide uninterrupted monitoring and absence of false alarms during the use of ESU (ESU can be set at any power level). This design prevents electro-surgical noise entering the monitor, via the sensor, and interfering with unit operation.
- ***Monitoring Restless Patients*** - Motion artifact rejection is achieved in several ways.

1. The sensor design used with their recommended bandages assures a snug fit of the sensor to the patient.
2. Light emitting diodes (LEDs) and detectors gather a strong signal from the patient.
3. Software in the Passport evaluates the shape of each pulse and automatically rejects noisy and unreliable pulses.
4. When in the presence of motion, the software adjusts the “averaging-period”, increasing it to a maximum of 15 seconds during motion, and automatically reducing it during quiet periods to obtain a fast response. This combination reduces the number of monitoring interruptions and false alarms from patient motion.

- ***Tracking of Weak Peripheral Pulse Levels*** - Many patients suffer poor peripheral perfusion due to hypothermia, hypovolemia, reduced cardiac output, etc. The Passport is designed to automatically increase its gain to track patients with poor peripheral perfusion.
- ***Rejection of Ambient Light*** - Many monitoring situations involve high levels of ambient light, i.e., operating room lights, neonatal phototherapy, heat warmers, etc. The PASSPORT Monitor, sensors, and bandages each contribute to the rejection of ambient light. The monitor automatically measures and corrects for high levels of ambient light. The enclosed design of the DATASENSOR prohibits the interference of high levels of ambient light on adults with sensor operation. And the opaque material used in the composition of the bandages, which are used with the FLEXISENSOR® SD, helps keep out ambient light.
- ***Patient Comfort*** - The FLEXISENSOR® SD line is designed to work with a disposable bandage of three styles (SENSOR GUARD™, Coban and LIGHTGUARD™) which conform comfortably and safely to the particular patient’s anatomy.

B. Sensor Selection and Application

Selection of a specific sensor is based on the patient’s size, physical condition, and expected monitoring duration. General guidelines for the selection of a sensor are provided in the Table 1-7 on page 1-38. Instructions for the application of a sensor to a patient are provided in each sensor package.

C. Sensor Connection to the Passport Monitor

1. Align the cable connector on the sensor assembly with the SpO_2 Patient Connector (25) on the Passport Monitor.
2. Push the cable connector into the SpO_2 Patient Connector (25). Confirm that the cable connector is securely in place.

NOTE: ***To obtain maximum cable use, do not twist the cable connector when attaching to or disconnecting from the Passport Monitor.***

D. Sensor Inspection

Before use, always inspect sensors, cables, and connectors for damage, i.e., cuts and abrasions. Do not use the sensor, cable or connector if damaged. Replace with a good working sensor.

For long sensor life:

- Do not drop on the floor, or give other sharp shocks to the sensor(s).Between use, store the sensors in the optional FLEXISENSOR® SD Organizer, accessory pouch, or coil the sensor cable and store on the side of the Passport using the optional cable retainer. For accessory part number information see Section 5 in the Operations Manual.
- Avoid running any cart, bed, or any piece of equipment over the sensor cable.
- Avoid strong pulls on the sensor cable (10 lbs/4kg).
- Watch for cracks in the DATASENSOR housing.
- Watch for cracks, cuts, rips, fogging, or signs of moisture in the FLEXISENSOR® SD.

E. Sensor Performance

For the BEST performance of all Datascope sensors:

- DO NOT PLACE any sensor on an extremity with an arterial catheter or blood pressure cuff in place. Placement of an arterial catheter or blood pressure cuff on an extremity may obstruct normal blood flow. False pulse rate information may result if the FLEXISENSOR® SD is placed on that same extremity. Place the sensor on the limb opposite the site of the arterial catheter or blood pressure cuff.
- Encourage the patient to remain still. Patient motion may affect the sensor's performance. If it is not possible for the patient to remain still, replace the sensor bandage on the FLEXISENSOR® SD to assure good adhesion, or change the site of the DATASENSOR.
- Check the DATASENSOR site every 2 hours and check the FLEXISENSOR® SD site every 8 hours on adults and every 4 hours on neonatal patients for indications of skin abrasions, sensor displacement, sensor damage, or circulation impairment. Check the sensor site every 4 hours if the ear clip is used. If necessary, remove and reapply the sensor. If any of the above mentioned indications occur, immediately remove the sensor and find an alternate site.

NOTE: ***Check the sensor site more frequently on infant and active patients.***

- Incorrect placement can also reduce the acquired sensor signal, and therefore compromise performance. Select an alternate site (toe) or use a FLEXISENSOR® SD if the sensor can not be placed on the patient's finger correctly or if the fingernails interfere with the acquisition of a reliable signal.
- Use of the DATASENSOR is not recommended for long-term monitoring (4-6 hours). For monitoring situations exceeding 4-6 hours, either reposition the DATASENSOR every 2-4 hours to a different site (finger/toe) or use a FLEXISENSOR® SD with its appropriate bandage.
- Do not over-tighten the sensor bandages. Excessive pressure on the monitoring site can affect SpO_2 readings and may reduce readings below true SpO_2. Excessive pressure can also result in pressure necrosis and other skin damage.
- Sensor configuration provides uninterrupted monitoring in the following situations: Electro-cautery Noise - ESU rejection is designed into the sensors.

  Motion Artifact - The monitor's software adjusts the "averaging period" increasing it during motion and reducing it during inactivity. This decreases the number of monitoring interruptions and false alarms.

  Weak Peripheral Pulses - The monitor's gain is automatically increased to track pulses on patients with decreased peripheral perfusion.
- SpO_2 measurements may interfere with Magnetic Resonance Imaging (MRI) procedures.
- SpO_2 is calibrated to display functional saturation.

TABLE 1-7 Sensor Selections

SENSORS	LARGE ADULT (LA)	ADULT (A)	PEDIATRIC (P)	INFANT (I)	NEONATE (N)	ADULT EAR (AE)	DATA-SENSOR
Approximate Patient Weight	>80kg/>176 lbs	30 -90kg/ 66 - 198 lbs	10 - 40kg/22 - 88 lbs	4.5 - 10kg/ 10 - 22 lbs	Up to 5kg/Up to 11 lbs	>40kg/>88 lbs	40+ kg/90+ lbs
Where Used	Fingers, Toes	Fingers, Toes	Fingers, Toes	Feet, Palms, Big Toes	Feet, Palms, Heel,Calf	Adult Ear	Fingers, Toes
Long or Short Term Monitoring	Long and Short Term	Long and Short Term	Long and Short Term	Long and Short Term	Long and Short Term	Long and Short Term	Short Term
ESIS	Included	Included	Included	Included	Included	Included	Included
Reusable	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes 6-Months
Bandage Type	Adhesive, Disposable	Adhesive, Disposable	Adhesive, Disposable	Non-Adhesive*, Disposable	Non-Adhesive* Disposable	N/A	N/A
**Part Numbers Sensors	0998-00-0076-06	0998-00-0076-05	0998-00-0076-04	0998-00-0074-03	0998-00-0074-04	0998-00-0074-05	0600-00-0026-01 (3" sensor cable)***
Bandages	0683-00-0409-01	0683-00-0409-02	0683-00-0409-03	0683-00-0415	0683-00-0440	N/A	N/A

* *Non-adhesive bandages are recommended for premature infants to minimize prenatal skin damage.*

** *See Accessories, Chapter 5, for more detailed information*

*** *Additional choices: 0060-00-0026-02 (10' sensor cable) 0020-00-0071-01 (3' sensor cable plus 7' extension cable)*

1.3.9 Sequence for Establishing SpO_2 with Nellcor® Pulse Oximetry *

1. Select the appropriate sensor for the patient (Table 3-1 on page 3-4).
2. Plug the sensor directly into the SpO_2 connector located on the side panel of the monitor or if necessary, use a Nellcor® EC-4 or EC-8 sensor extension cable.

* *This feature applicable only if available / installed in your unit.*

NOTE: ***Do not place the sensor on an extremity with an invasive catheter or blood pressure cuff in place.***

WARNING: ***When equipped with Nellcor® SpO_2, use only Nellcor® oxygen transducers including Nellcor® OXISENSOR™ patient dedicated adhesive sensors. Use of other oxygen transducers may cause improper oximeter performance.***

WARNING: ***Tissue damage or inaccurate measurements may be caused by incorrect sensor application or use, such as wrapping it too tightly, applying supplemental tape, failing to inspect the sensor site periodically, or failing to position it appropriately. Carefully read the sensor directions for use, the Passport operating instructions, and all precautionary information before use.***

WARNING: ***Excessive ambient light may cause inaccurate measurements. Cover the sensor site with opaque material.***

WARNING: ***Inaccurate measurements may be caused by incorrect sensor application or use; significant levels of dysfunctional hemoglobins, (e.g., carboxyhemoglobin or methemoglobin); or intra-vascular dyes such as indocyanine green methylene blue; exposure to excessive illumination, such as surgical lamps (especially ones with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight; excessive patient movement; venous pulsations; electro-surgical interference; and placement of a sensor on an extremity that has a blood pressure cuff, arterial catheter, or intra-vascular line.***

WARNING: ***In certain situations in which perfusion and signal strength are low, such as in patients with thick or pigmented skin, inaccurately low SpO_2 readings will result. Verification of oxygenation should be made, especially in preterm infants and patients with chronic lung disease, before instituting any therapy or intervention.***

3. The digital SpO_2 value will be displayed in the Parameter Window.
4. If a pleth waveform is desired, enter the set-up menu as described in “Use of Menus” on page 23 to display it as Waveform 2.
5. Press the BEEP VOLUME (18) to set the volume of the SpO_2 beep.

1.3.9.1 Nellcor® Sensors

Nellcor® provides a family of sensors suitable for a wide variety of clinical settings and patients. Specific sensors have been developed for neonates, infants, children, and adults. OXISENSOR™ oxygen transducers are sterile adhesive sensors with optical components mounted on adhesive tape. OXIBAND® oxygen transducers and the DURAFORM™ oxygen transducer system are reusable sensors that are applied with disposable adhesive. The DURASENSOR® DS-100A adult digit oxygen transducer is a reusable sensor with its optical components mounted in a plastic casing. The Nellcor® RS-10 reflectance oxygen transducer is an adhesive sensor for application to forehead or temple.

NOTE: ***Nellcor®, OXIBAND® and DURASENSOR® are registered trademarks of Nellcor® Incorporated. OXISENSOR™ and DURAFORM™ are trademarks of Nellcor Incorporated.***

Selecting a Sensor

Sensors are designed for specific sites on patients with designated weight ranges. To select the appropriate sensor, consider the patient’s weight, level of activity, adequacy of perfusion, which sensor sites are available, whether sterility is required, and the anticipated duration of monitoring.

Cleaning and Re-use

Do not immerse any OXISENSOR™, DURASENSOR®, OXIBAND®, or DURAFORM™ oxygen transducer, the Nellcor® RS-10 oxygen transducer, or any Nellcor® adhesive in water or cleaning solution. Clean DURASENSOR®, OXIBAND®, and DURAFORM™ oxygen transducers, and the Nellcor® RS-10 oxygen transducer by wiping with a disinfectant such as 70% alcohol. Do not sterilize by irradiation, steam, or ethylene oxide. Use a new OXIBAND® adhesive wrap or FORM-A adhesive bandage for each patient. Do not re-sterilize OXISENSOR™ oxygen transducers.

Performance Considerations

To ensure optimal performance, use an appropriate sensor, apply it as directed, and observe all warnings and cautions.

If excessive ambient light is present, cover the sensor site with opaque material. Failure to do so may result in inaccurate measurements. Light sources that can affect performance include surgical lights, especially those with a xenon light source, bilirubin lamps, fluorescent lights, infrared heating lamps, and direct sunlight.

If poor perfusion affects instrument performance, and the patient weighs more than 50 kg (110 lbs.), consider using the OXISENSOR™ R-15 adult nasal oxygen transducer. Because the R-15 obtains its measurements from the nasal septal anterior ethmoid artery, an artery supplied by the internal carotid, this sensor may obtain measurements when peripheral perfusion is relatively poor. For low peripheral perfusion, consider using the Nellcor® RS-10 reflectance oxygen transducer, which is applied to the forehead or temple.

If patient movement presents a problem:

- Verify that the sensor is properly and securely applied.
- Use a new sensor with fresh adhesive backing.
- Move the sensor to a less active site.
- Use a type of sensor that tolerates some patient motion, such as the OXISENSOR™ D-25, D-20, N-25, or I20 oxygen transducer.

TABLE 1-8 Nellcor® Sensor Family

SELECTION GUIDE	D25/D25L ADULT	R-15 ADULT	N-25 NEONATAL	I-20 INFANT	D-20 PEDIATRIC	RS-10 ADULT
Patient Size	>30 kg	>50 kg	<3 kg >40 kg	1-20 kg	10-50 kg	>40 kg
Duration of Use	Short or Long Term	Short or Long Term	Short or Long Term	Short or Long Term	Short or Long Term	Short Term
Sterility	Sterile[1]	Sterile[1]	Sterile[1]	Sterile[1]	Sterile[1]	Non-sterile
Patient Activity	Limited Activity	Inactive	Limited Activity	Limited Activity	Limited Activity	Limited Activity
	OXISENSOR adult digit oxygen transducer	OXISENSOR adult nasal oxygen transducer	OXISENSOR neonatal oxygen transducer	OXISENSOR infant digit oxygen transducer	OXISENSOR pediatric digit oxygen transducer	RS-10 reflectance oxygen transducer

1 *In an unopened, undamaged package.*

All Nellcor® accessories and sensors must be purchased form Nellcor® Inc., 25495 Whitehall Street, Hayward, Ca. 94545. To contact Nellcor®, call 1-800-NELLCOR.

1.3.9.2 Special Features

Automatic Calibration

The oximetry subsystem incorporates automatic calibration mechanisms. It is automatically calibrated each time it is turned on, at periodic intervals thereafter, and whenever a new sensor is connected. Also, the intensity of the sensor's LEDs is adjusted automatically to compensate for differences in tissue thickness.

Each sensor is calibrated when manufactured; the effective mean wavelength of the red LED is determined and encoded into a calibration resistor in the sensor plug. The instrument's software reads this calibration resistor to determine the appropriate calibration coefficients for the measurements obtained by that sensor.

Oximetry Operating Modes

The Passport's three operating modes for SpO_2 enable it to make accurate measurements despite differing levels of patient activity. In all three modes, the Passport updates its measurements with every pulse beat. Data from the most recent beat replaces data from the earliest beat and new averages are determined and displayed. The three modes are: 1 (default setting), 2, and 3.

1. the default operating mode, uses a 5 to 7 second averaging time and is useful in situations in which the patient is relatively inactive.

2. this mode uses a 2 to 3 second averaging time and therefore is more affected by patient motion. It is useful for special applications that require a fast response time, such as sleep studies.

3. this mode uses a 10 to 15 second averaging time and consequently is least affected by patient motion. In this mode, pulse rate is not displayed and there is no pulse tone.

Pleth Auto Scaling

The Pleth waveform is automatically scaled when using Nellcor® SpO_2. There is no adjustment that can be made to the pleth waveform size.

Changing Operating Modes

To change from 1 to 2 or 3, select SpO_2 in the menu and toggle through the choices of 1, 2, and 3 using the up and down arrow keys. Press SELECT (2) then END (3) to lock the choice in and return to monitoring mode. See "Use of Menus" on page 23 for details on using menus.

The operating mode will be displayed in the pleth waveform window.

1.3.10 Respiration Monitoring

The Passport Monitor offers two kinds of respiratory monitoring: thoracic impedance and CO_2 waveform. Either method may be used to ensure that the patient in not apneic, and both methods offer certain benefits and limitations.

WARNING: Thoracic respiration measurement may interfere with some pacemakers. Refer to the pacemaker's manual.

1.3.10.1 Thoracic Impedance

The Passport Monitor presents a small electrical signal across the RA and LA ECG limb leads. This signal changes as the patient's chest wall rises and falls during the breath cycle. The advantage of the thoracic impedance method is that respiration is obtained non-invasively and without any extra cost. Disadvantages include loss of signal when "choke blocks" are utilized, possible cardiac interference, and missed apneic events.

Choke blocks are electrical filters that may be used in electro-cautery environments where ECG interference can be substantial. These filters remove the electro-cautery noise, but also block the signal used by the Passport Monitor to measure respiration.

The filling and emptying of the heart chambers can interfere with the thoracic impedance signal, so called cardiovascular artifact (CVA), such that the respiratory signal matches the heart rate. The Passport warns the operator when the respiration value equals the heart rate by displaying the CVA message.

If the patient's airway is obstructed and the patient attempts to breath, then the chest wall can move and create a respiratory signal even though no gas flow is occurring to the patient.

1.3.10.2 CO_2 Waveform

When used with the mainstream CO_2 analyzer the Passport may use the breath waveform to report the respiration rate by measuring the actual breaths per unit time. The advantage of the CO_2 waveform method is that the signal is a direct result of respiration and can only occur if the patient is actually breathing. The disadvantage to the CO_2 waveform method is that intubation is required.

1.3.10.3 Respiration Monitoring on the Passport

1.3.10.3.1 Thoracic Impedance

1. Select the SET-UP menu.
2. Select WAVEFORM 3 and set to RESP (if waveform desired).
3. Select RESP SOURCE and set to ECG.
4. Press the END key (3).

1.3.10.3.2 CO_2 Waveform (requires optional mainstream CO_2)

1. Select the SET-UP menu.
2. Select WAVEFORM 3 and set to CO_2 (if waveform desired).
3. Select RESP SOURCE and set to CO_2.
4. Press the END key (3).

1.3.11 Gas Monitoring

The Passport offers the Capnostat mainstream method of measuring respiratory rate and end tidal CO_2. Capnostat requires a hardware option within the Passport Monitor. It utilizes a large lumen adapter which is placed directly into the endotracheal tube.

1.3.11.1 Sequence for Establishing Capnostat CO_2

1. Plug the CO_2 sensor into the Passport connector. The "Sensor Warming Up" message is displayed.
2. Select CO_2 as the Resp. Source in the Setup Menu.
3. Snap a clean airway adapter into the U-shaped sensor. Align the line on the bottom of the adapter with the line on the bottom of the sensor.
4. Position the airway adapter between the endotracheal tube and the Y-piece of the breathing circuit.
5. After the Passport has detected valid breaths, it will display numbers for $ETCO_2$, Inspired CO_2 and Respiratory Rate.
6. Select the CO_2 waveform to be displayed on Waveform 2 or Waveform 3 using the Setup Menu.
7. If desired the CO_2 waveform scale can be changed by entering the CO_2 menu. See Section 1.3.4, "Use of Menus" for details.
8. The CO_2 menu also has provisions for N_2O and O_2 compensation.

NOTE: ***See "User Configuration Mode" on page 53 for Barometric Pressure and CO_2 Units selection.***

NOTE: ***See "CO_2 Messages (only units equipped with Capnostat CO_2)" on page 60 for more details on messages.***

1.3.11.2 Adapter Calibration

Adapter calibration compensates for the optical differences between the adult and neonatal airway adapters.

Adapter calibration needs to be performed each time the type of airway adapter is switched. For example: if switching from using an adult to a neonatal or neonatal to an adult adapter a calibration is needed (not if switching from an adult adapter to another adult adapter). Adapter calibration should also be performed if the message "Check Adapter" displays.

To perform an adapter calibration:

1. Place the sensor and airway adapter away from all sources of CO_2 (including the patient's and your own exhaled breath, and ventilator exhaust valves).
2. Choose Start Adapter Cal - Yes from the CO_2 menu. (See "Use of Menus" on page 23.)

NOTE: ***If the monitor detects changing CO_2 levels (breaths) during an adapter calibration, an "Adapter Cal Failure" message displays. Remove the source of CO_2 and repeat the calibration.***

1.3.11.3 Adapter Selection

Selection of an airway adapter is based on the diameter of the patient's endotracheal tube. There are two sizes of airway adapters available:

- Adult Airway Adapter (P/N 0103-15-0003). For use on patients with endotracheal tube diameters greater than 4.0 mm.
- Neonatal Airway Adapter (P/N 0103-15-0013). For use on patients with endotracheal tube diameters less than or equal to 4.0 mm.

1.3.11.4 Use of Adult Airway Adapter

The adult airway adapter should be used when monitoring patients with endotracheal tube diameters greater than 4.0 mm.

1. Verify the windows are clean and dry. Clean or replace the adapter if necessary.
2. Snap the airway adapter into the Capnostat® sensor. Align the line on the bottom of the airway adapter with the line on the bottom of the Capnostat®. Press the sensor and airway adapter together until they “click”.
3. If necessary, perform an adapter calibration. See “Adapter Calibration” on page 44.
4. Place the Capnostat® / airway adapter assembly between the elbow and the ventilator circuit wye.

NOTE: ***For optimal results, DO NOT place the airway adapter between the endotracheal tube and the elbow, as this may allow patient secretions to block the adapter windows.***

Position the airway adapter with it's windows in a vertical and NOT a horizontal position. This helps keep patient secretions from “pooling” on the windows.

To prevent “rain-out” and moisture from draining into the airway adapter, DO NOT place the airway adapter in a gravity dependent position.

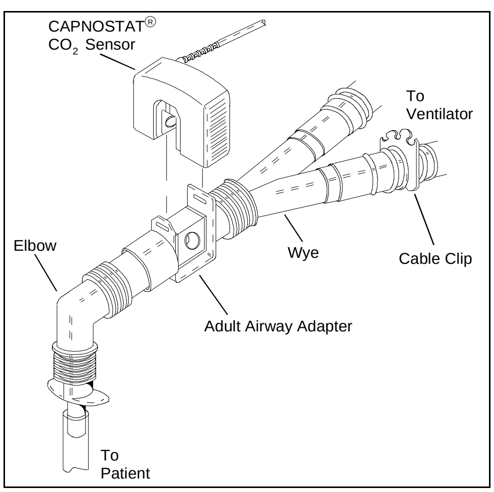


FIGURE 1-20 Adult Airway Adapter

5. Check that the connections have been made correctly by verifying a proper CO_2 waveform (capnogram) on the monitor display.

NOTE: ***The CO_2 waveform is displayed by choosing CO_2 as Waveform 2 or 3 and the Resp. Source in the Setup menu***

6. The sensor cable should face away from the patient. To secure the sensor cable safely out of the way, attach the sensor cable holding clips to the airway tubing, then connect the sensor cable to the clips.

1.3.11.5 Use of Neonatal Airway Adapter

The neonatal airway adapter should be used when monitoring patients with endotracheal tube diameters less than or equal to 4.0 mm.

1. Verify the windows are clean and dry. Clean or replace the adapter if necessary.
2. Snap the airway adapter into the Capnostat® sensor. Align the line on the bottom of the airway adapter with the line on the bottom of the Capnostat®. Press the sensor and airway adapter together until they "click".
3. If necessary, perform an adapter calibration. See "Adapter Calibration" on page 44.
4. Place the Capnostat® / airway adapter assembly between the elbow and the ventilator circuit wye.

NOTE: ***Position the airway adapter with it's windows in a vertical and NOT a horizontal position. This helps keep patient secretions from "pooling" on the windows.***

To prevent "rain-out" and moisture from draining into the airway adapter, DO NOT place the airway adapter in a gravity dependent position.

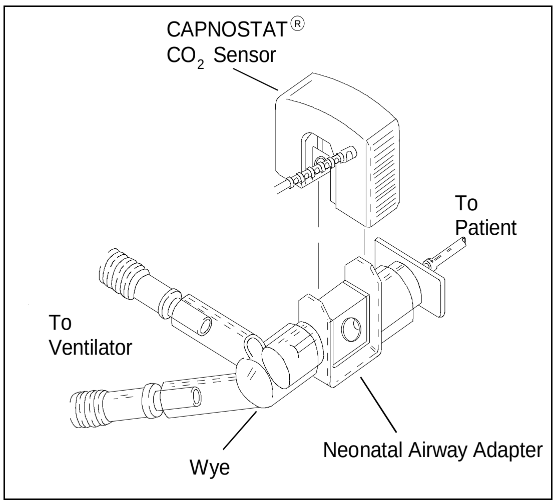


FIGURE 1-21 Pediatric Airway Adapter

For routine maintenance of airway adapter, separate the system between the endotracheal tube and the airway adapter. Lavage and suctioning of the airway can then be performed without fluids and mucous accumulating on the neonatal airway adapter window.

5. Check that the connections have been made correctly by verifying a proper CO_2 waveform (capnogram) on the monitor display.

NOTE: ***The CO_2 waveform is displayed by choosing CO_2 as Waveform 2 or 3 and the Resp Source in the Setup menu.***

6. The sensor cable should face away from the patient. To secure the sensor cable safely out of the way, attach the sensor cable holding clips to the airway tubing, then connect the sensor cable to the clips.

1.3.11.6 CO_2 Sensor Calibration Verification

Calibration can be verified at anytime and should be verified at least once a week.

To verify calibration:

1. Verify the Passport is turned on and the Capnostat® is connected and warmed-up.
2. Place the Capnostat® sensor onto the REF (reference) cell. The reference cell is the one farthest from the side of the monitor. The sensor cable should face away from the Passport.
3. The "Sensor on Reference Cal" message is displayed and the reference value is displayed in the $ETCO_2$ window. The value should be between 36 and 40 Torr.

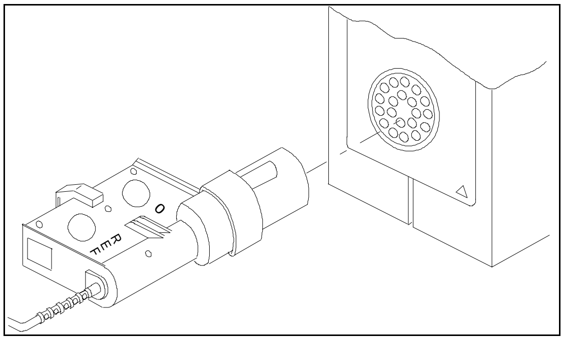


FIGURE 1-22 Reference Cell

1.3.11.7 CO_2 Sensor Calibration

The Capnostat® CO_2 sensor does NOT need to be calibrated at each monitor power up.

Calibration of a sensor is required the first time a particular sensor is connected to a particular monitor and when the monitor requests it.

Once a sensor is calibrated, the Passport can be turned off and on, the sensor can be unplugged and reconnected, without having to recalibrate. However, if a second sensor is connected in place of the original, the second sensor must be calibrated and if the original sensor is used again, it too will have to be recalibrated.

To perform a Capnostat® sensor calibration:

1. Verify the Passport is turned on and the Capnostat® is plugged in and warmed-up.
2. Place the Capnostat® onto the ZERO cell.
3. The “Sensor on Zero Cell” message is displayed.
4. Select Start Zero Cal - Yes from the CO_2 menu. The “Zero Cal in Progress” message is displayed. The "Zero Cal Complete" message is displayed when complete and a 0 value is displayed.
5. Remove sensor from the zero cell and place onto the airway adapter.

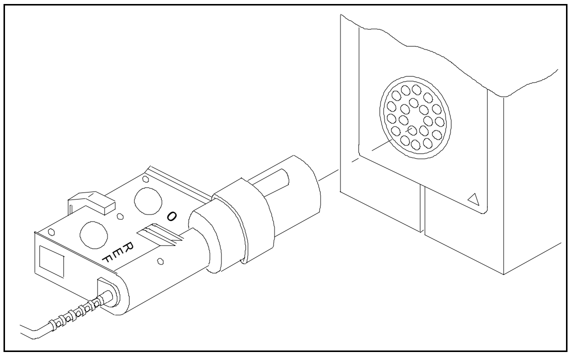


FIGURE 1-23 Zero Cell

1.3.12 Alarms

The Datascope Passport Monitor provides high and low alarm limits for heart rate (HR), systolic pressure (BP1 / NIBP Sys), diastolic pressure (BP1 / NIBP Dia), mean pressure (BP2 Mean), respiration rate, $ETCO_2$, and SpO_2. An alarm for apnea delay is also provided.

1.3.12.1 Setting Parameter Alarm Limits

1. Using the UP ▲ and DOWN ▼ arrow keys (1) select ALARM from the menu window.

   When ALARM is highlighted an ALARM MENU is displayed in the multi-function area. A sample of this alarm menu is shown in Figure 25.

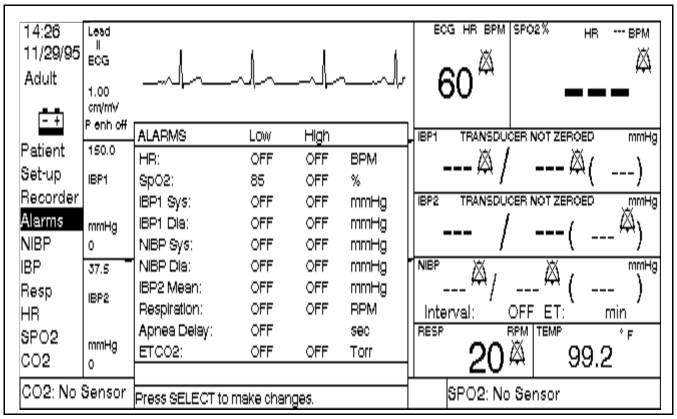


FIGURE 1-24 Alarm Menu

2. Using the UP ▲ and DOWN ▼ arrow keys (1) and SELECT (2) keys (as described in "Use of Menus" on page 23) set parameter limits as desired.

1.3.12.2 Alarm Limits

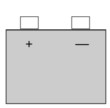
All of the alarm limits have an "OFF" position with the exception of low SpO_2 and apnea in the neonate mode. A separate table of alarm limit settings are maintained for each patient size. When the patient size is changed the appropriate table is automatically used. See Table 1-9 on page 1-50 for alarm ranges.

TABLE 1-9 Alarm Limits

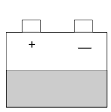
ALARM PARAMETERS				
	HIGH		LO	
PARAMETERS	ADULT	PED/NEONATE	ADULT	PED/ NEONATE
Heart Rate (bpm)	Off, 100-250	Off, 100-250	Off, 30-100	Off, 30-100
IBP1 Sys (mmHg)	Off, 70-240	Off, 40-180	Off, 5-130	Off, 5-130
IBP1 Dia (mmHg)	Off, 40-130	Off, 50-100	Off, 5-90	Off, 5-50
NIBP Sys (mmHg)	Off, 70-240	Off, 40-180*	Off, 50-150	Off, 15-130
NIBP Dia (mmHg)	Off, 40-130	Off, 50-100	Off, 30-120	Off, 10-50
IBP2 Mean (mmHg)	Off, 5-150	Off, 5-100	Off, 2-100	Off, 2-50
SpO_2 (%)	Off, 80-100	Off, 80-100	50*-99	50*-99
Resp Rate (rpm)	Off, 30-200*+	Off, 30-200*+	Off, 5-50	Off, 5-50

* *These alarm parameters may be set outside the accurate measurement range. Refer to the specifications, Chapter 6, for accuracy ranges.*

\+ *Respiration rate measurement range is limited to 2 - 150 rpm when Mainstream CO_2 is selected as the rate source. Values above 150 rpm will be displayed as 150 rpm..*



Full Battery Symbol



Low Battery Symbol

TABLE 1-9 Alarm Limits (Continued)

ALARM PARAMETERS				
	HIGH		LO	
PARAMETERS	ADULT	PED/NEONATE	ADULT	PED/ NEONATE
Apnea Delay (sec)	Off, 10-40	Off, 10-30 (Ped) / 10 - 20 (Neo)	$ETCO_2$ (Torr)	Off, 20-80
Off, 20-100	Off, 5-60	Off, 5-60	$ETCO_2$ (%)	Off, 2-11
Off, 2-11	Off, 1-8	Off, 1-8	$ETCO_2$ (kPa)	Off, 2.0-11.0
Off, 2.0-11.0	Off, 1.0-8.0	Off, 1.0-8.0		

* *These alarm parameters may be set outside the accurate measurement range. Refer to the specifications, Chapter 6, for accuracy ranges.*

\+ *Respiration rate measurement range is limited to 2 - 150 rpm when Mainstream CO_2 is selected as the rate source. Values above 150 rpm will be displayed as 150 rpm..*

NOTE: The alarm parameters that are highlighted in grey are available only in models that are equipped with the invasive pressure option.

The $ETCO_2$ alarm is available only in models that are equipped with the CO_2 option.

1.3.12.3 Alarm Violations

There are three types of alarm situations. They are Parameter Alarms, a Heart Rate Fault Alarm, and an Apnea Alarm.

NOTE: The heart rate alarm tone has a different pitch than other alarms.

A. Parameter Alarms

An alarm condition exists if the parameter is equal to or is outside the high/low limit range. When an alarm limit is violated, the following actions occur:

- The alarm LED (12) flashes.
- The alarm tone is sounded (unless it is muted with the MUTE key (14)).
- The recorder prints the currently selected waveform (if Record On Alarm is selected from the Recorder menu).

NOTE: On the waveform printouts that are caused by alarm situations, a bar is printed above the alarming area. On trend printouts, the value that has caused an alarm is printed with square brackets around it. If the recorder is printing a waveform and an alarm situation occurs, the currently printing waveform will be completed and then the alarm waveform printout will be printed.

- The violated parameter is displayed in reverse graphics in the parameter window.

B. Heart Rate Fault Alarm

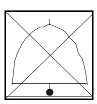
The Heart Rate Fault Alarm occurs if the selected heart rate source is no longer able to detect a heart rate. This may be due to an ECG lead fault, a problem with an SpO_2 sensor, or various other reasons. This alarm is only active if a low heart rate limit is set. The alarm operation is the same as for a parameter alarm. The heart rate value will be dashes (“—-”) and inverted. A further message from a lead fault or SpO_2 fault may be present to help diagnose the problem.

NOTE: ***Only the value displayed in the heart rate window is used to determine heart rate alarm conditions.***

C. Apnea Alarm

The Apnea Alarm is active when the respiration function is enabled. The Apnea Alarm is violated when a breath is not detected for a longer period of time than the apnea delay specified in the Alarm Menu. The alarm operation is the same as for a parameter alarm.

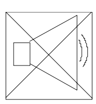
D. General Alarms



- ***ALARMS OFF*** - If alarms are not set on any one parameter, an alarm bell off symbol will be displayed next to the numerical data for that parameter.

NOTE: ***Both the high and low alarm must be set for a particular parameter for the bell symbol to go away.***

- ***VOLUME KEY*** - Increases or decreases the intensity of the alarm.



- ***MUTE*** - Silences all currently alarming parameters for 2 minutes. Any new alarms that occur, while an alarm tone is muted, will disable the mute and sound the alarm. An alarm mute symbol (a loudspeaker with a cross through it) is displayed next to each muted alarm. The word MUTE is displayed above the menu selections area during this time. The alarms may be suspended for 2 minutes by pressing and holding the MUTE key (14) for 3 seconds. Alarms suspended is indicated by displaying the alarm mute symbol in reverse graphics. The words ALL MUTE are displayed above the menu selections area during this time. When the Audio Alarm Standby mode has been enabled and the MUTE key (14) is pressed and held for 4 seconds, all alarms are indefinitely suspended. This is indicated by a flashing alarm mute symbol in all parameter windows and a flashing “AUDIO ALARM STANDBY” message is displayed above the menu selections. Press MUTE to activate alarms.

1.3.12.4 Battery Indicators

When the monitor is powered from the battery, a battery symbol will display.

When the battery charge is low, but not below the cutoff voltage, the low battery symbol will display and a beep is generated every 3 seconds.

NOTE: ***Approximately 15 minutes of operating time remains when the low battery symbol displays.***

Battery recharge time is 16 hours.

NOTE: ***Recorder is not operational when the battery charge is low.***

1.3.13 How to Set the Clock

1. Enter the User Configuration Mode. (See Section 1.3.14.)
2. Use the UP ▲ and DOWN ▼ arrow keys (1) to select Date or Time in the User Configuration Menu. Press the SELECT Key (2) to choose that menu item. The current choice is highlighted.
3. Use the UP ▲ and DOWN ▼ arrow keys (1) to select a new setting. Once the desired choice is highlighted, press the SELECT key (2).
4. To save this setting press the SELECT key (2) and then the END key (3).

Repeat for each menu item that needs to change.

1.3.14 User Configuration Mode

The Trend Configuration, Time/Date, Temperature Scale, Heart Rate/SpO_2 Size Select, Alarm Audio Delay, Audio Alarm Standby, Serial Output Type, and CO_2 settings may changed in the User Configuration Mode. This function is only available at power up and not during normal operation. The User Configuration Mode is accessed via a special power-up sequence.

To enter the User Configuration Mode:

1. Turn the POWER switch (34) ON.
2. After the “DIAGNOSTIC IN PROGRESS” message is displayed, press and hold the FREEZE key (6) until a second beep is heard (approximately 2 seconds). The User Configuration Mode will display.

The operation of the menu system is the same as the operation of the menu system during normal operation (See Section 1.3.4). To access normal operation when user configuration is complete, either time-out (no Set-Up key pressed within 1 minute) or press the END (3) key for 3 seconds. The following table describes the User Configuration Mode menu structure:

TABLE 1-10 User Configuration Menu List

USER CONFIG. MENU	MENU ITEM	CHOICES
Date	Year	0 to 99
	Month	1 to 12
	Day	1 to 31
Time	Hours	0 to 23
	Minutes	0 to 59
Trend	Trigger	Alarms, NIBP*, Interval, NIBP and Interval, Interval and Alarms, Interval and NIBP, Interval and NIBP and Alarms
	Interval	1, 2.5, 5*, 10, 20, 30, 60, 120 mins.
Temperature	Scale	Fahrenheit, Centigrade
CO_2	Barometric Pressure	500 to 800 mmHg
	CO_2 Units	TORR, kPa**, %

TABLE 1-10 User Configuration Menu List

USER CONFIG. MENU	MENU ITEM	CHOICES
HR SpO_2 Size	Size Change	HR Large / SpO_2 Small, HR Small / SpO_2 Large*
Alarm Audio Delay	Delay	Off*, 4, 6, 8 sec.
Audio Alarm Standby	Function	Off*, On
Serial Output Type	Protocol	VISA*, ACCUTORR, Message, DIAP

For a graphic representation of the configuration menus see sections 1.3.19.11 through 1.3.19.19.

* *Factory default settings.*
** *kPa is not available when VISA is selected as the serial output type.*

The Trend Trigger setting is what causes new data to be stored in the trend memory. It may be set to trigger whenever there is an alarm, an NIBP measurement is performed, the trend timer expires (interval), or may be set to trigger at any combination of these items. The trend interval is only used when trend is triggering on interval, and it is used to set the time between interval triggers. The trend interval is independent of the NIBP interval.

The temperature scale can be changed between Fahrenheit and Centigrade.

The HR SpO_2 size change option allows the user to select a large SpO_2 reading compared to HR or vice versa.

The Alarm Audio Standby allows the user to enable (or disable) this feature (see section 3.13.3).

The Serial Output Type allows the user to select the communication protocols for interfacing with other specialized equipment: VISA, ACCUTORR (sends data the same way as an ACCUTORR), message (for diagnostic purposes) with the Passport Monitor.

Once the unit is in the User Configuration Mode, the time and / or date can be changed using the set-up keys as described in Section 1.3.4, “Use of Menus”.

1.3.15 Recorder (optional)

The Datascope Passport Recorder can provide a permanent record of a patient’s: systolic pressure, diastolic pressure, mean pressure, heart rate, SpO_2, CO_2, respiration and temperature. It is a two trace thermal strip chart recorder with an integral paper spool. The recorder uses plain white thermal paper 5 cm wide (see Section 4.7 for replacement instructions).

All grid patterns and data are printed by the recorder.

1.3.15.1 Operation of Printer

1. Using the UP ▲ and DOWN ▼ arrow keys (1) select RECORDER from the main menu.

   When RECORDER is highlighted a RECORDER MENU is displayed in the multi-function area. A sample of this menu is show below.

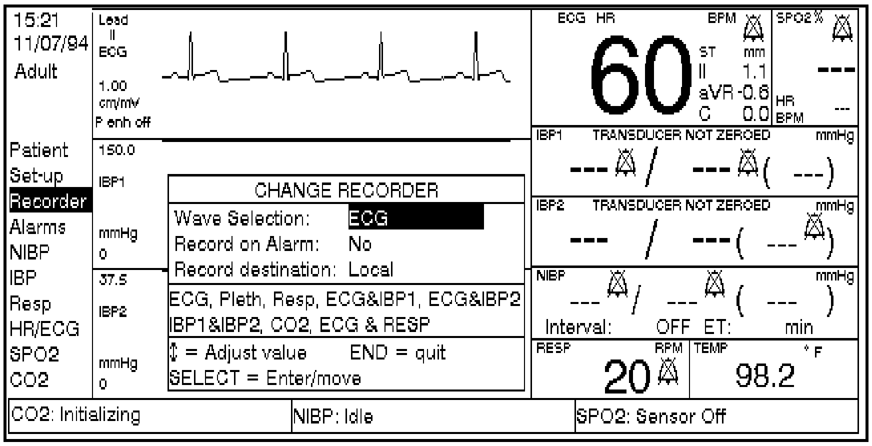


FIGURE 1-25 Recorder Menu

2. Press SELECT (2) to enter the RECORDER MENU.
3. Using the UP ▲ and DOWN ▼ arrow keys (1) and SELECT (2) keys (as described in “Use of Menus” on page 23) set the desired waveforms or trend to be printed.
4. Press RECORD (19) to initiate a printing or stop a printing when one is in progress.

When RECORD (19) is pressed to initiate a printing, a 16 second strip is printed. The 16 second strip consists of 8 seconds of prior and 8 seconds of post waveform from when RECORD (19) is pressed. If a continuous printing is required, press and hold RECORD (19) for 3 seconds (until a beep is heard). Press RECORD again to stop a real time printing.

NOTES:

- When the ECG is frozen and RECORD (19) is pressed, the recorder prints the frozen displayed ECG.
- If the RECORD key (19) is pressed for 3 seconds while the ECG is frozen, the recorder prints a continuous real-time ECG waveform.
- If the RECORD key (19) is pressed while List Trend is displayed (and the ECG waveform is not frozen), the recorder prints the list trend report.
- See Section 4.7, in the Operating Instructions, of paper installation.

1.3.15.2 Printer Formats

Single waveform format:

ECG and pleth waveforms are automatically positioned in the center of the chart paper. Invasive pressure and respiration waveforms are relative to the lower border. The four centimeter waveform area has a grid pattern printed as follows: 100% darkness on 1 cm grid with 50% darkness on 2 mm grid.

The upper and lower borders have the date, time and physiologic parameters currently available as well as the ECG size and lead configuration the recorder is printing. All parameters include their units.

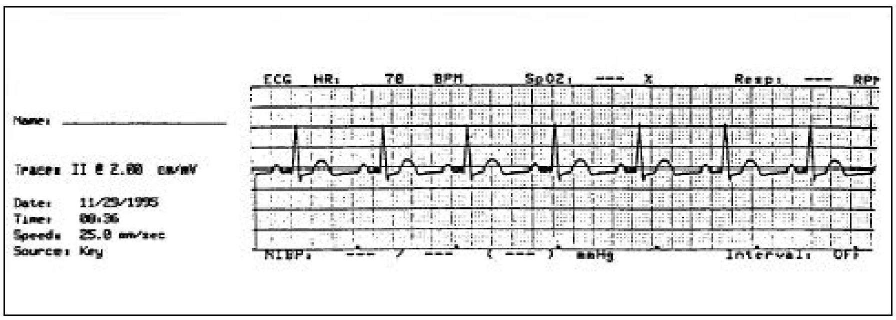


FIGURE 1-26 Sample Printout, Single Waveform

Two waveforms separate field format:

The two waveforms are printed in a separate field format with two centimeters assigned to each waveform. The waveforms do not overlap. Grids are printed as for one waveform.

The upper and lower borders are printed as for the single waveform.

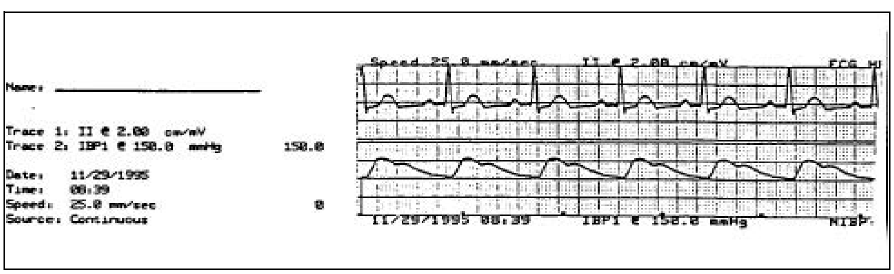


FIGURE 1-27 Sample Printout, Two Waveform

Trend list format:

The list trend data is printed with text running along the length of the strip. If more than one page of data is available then all additional pages are printed along the length of the strip.

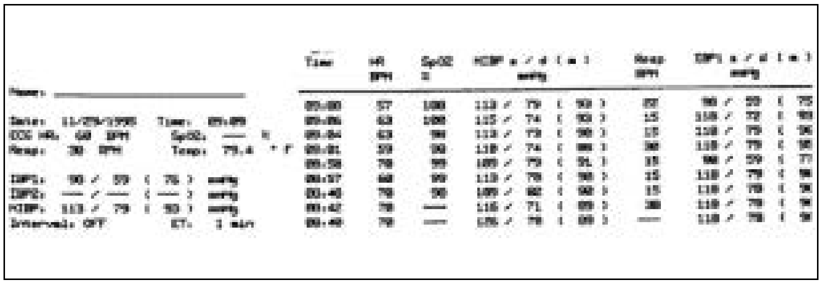


FIGURE 1-28 Sample Printout, Trend List Format

NOTE: ***On waveform printouts that are caused by alarm situations (Record on Alarm must be selected YES in the Recorder menu), a bar is printed above the alarming area. On trend printouts and in annotations, the value that has caused an alarm is printed with square brackets around it. If the recorder is printing a waveform and an alarm situation occurs, the currently printing waveform will be completed and then the alarm waveform printout will be printed.***

NOTE: ***IBP1 and IBP2 data is printed only when models are equipped with the invasive pressure option.***

1.3.16 Status Messages

The monitor uses the Message Display Area to provide messages to the user relating to monitor status. The following lists these messages and a description of the message. The messages are grouped by function.

1.3.16.1 NIBP Measurement Messages

MESSAGE	REASON	SOLUTION
NIBP: IDLE	Displayed while system is idle.	Press START to take a single measurement. Press INTERVAL to select an interval and start timed measurements.
NIBP: DEFLATE	Displayed while the timer mode is stopped, usually by pressing the DEFLATE key.	Press START to take an immediate measurement and resume timed measurements.
NIBP: INTERVAL	Displayed in the interval between two timed measurements.	Press DEFLATE to suspend timed measurements. Press INTERVAL to change timer to OFF to stop timer.
NIBP: INITIALIZING	The NIBP system is being initialized.	Wait until initialization is complete, indicated by NIBP: IDLE message. Initialization may take up to 3 minutes from power up.
NIBP: FAILURE	The NIBP system has detected a potential error.	Power cycle unit. If message reappears, call Service.
NIBP:MEASURING CUFF	Displayed during a measurement to show the cuff pressure.	Press DEFLATE to suspend a measurement and deflate the cuff.
NIBP:RETRY MOTION	Measurement has been attempted but no reading was possible due to detected motion and the retry limit has not been reached.	Retry will be attempted. Have patient remain still.
NIBP:RETRY PUMP HIGHER	A measurement has been attempted but no reading was possible due to pulse detection at highest cuff pressure and the retry limit has not been reached.	Retry will be attempted. Check that appropriate patient size is set. Preset initial inflation pressure.
NIBP:RETRY	A measurement has been attempted but no reading was possible.	Retry will be attempted. Check for leaks and quality of peripheral pulses. Decrease patient movement. Switch cuff to another limb.
NIBP:UNABLE TO MEASURE*	An unsuccessful measurement cycle has been completed.	Switch cuff to another limb. Decrease patient movement. Press START to retry. Be prepared to auscultate BP manually.
NIBP:CUFF OVERPRESSURE	The internal hardware cuff pressure check valve has been tripped.	Power cycle unit. If message reappears, call Service.

- Always have an alternate method of BP verification available.
- On vasoconstricted patients, failure to evacuate air from the cuff can distort BP measurement.
- Do not place cuff on extremity that has an IV.

- Arm should be at heart level.

* *The presence of arrhythmias may increase the time required to complete a measurement and may extend this time to a point where a measurement cannot be completed.*

1.3.16.2 SpO_2 Messages

MESSAGE	REASON	SOLUTION
SpO_2 NO SENSOR	No sensor is connected to the monitor.	Attach sensor cable to the monitor.
SpO_2 SENSOR OFF	Sensor may not be connected to the patient.	Check patient connection.
SpO_2 INTERFERENCE	Noise detected on the pulse signal prevents pulse discrimination.	Decrease patient motion, check sensor.
SpO_2 PULSE SEARCH	Hardware settings are being adjusted in order to discriminate a pulse waveform.	Change to site where pulse is stronger if patient is vasoconstricted. Change or readjust sensor if loose.
SpO_2 WEAK PULSE	Detected patient pulse is marginal.	Change site.
SpO_2 NO PULSE	No detectable pulse is measured.	
CHECK SpO_2 SENSOR	Insufficient light is received by the sensor detector, or the sensor has a malfunction.	Check alignment of emitter and detector or change sensor.
SpO_2 PR UNDER 30	Detected pulse rate is below thirty beats per minute.	Check patient status. Check alignment of sensor. Reapply sensor.
SpO_2 PR OVER 250	Detected pulse rate is above 250 beats per minute.	Check patient status. Decrease patient motion. Reapply sensor.
SpO_2 UNCALIBRATED	Detected SpO_2 falls below calibrated range.	Check patient status. Check sensor.
SpO_2 SYSTEM CHECK	Self test is being performed.	Wait for completion of self test.
SpO_2 FAILURE	ROM checksum fail. RAM test fail. Filter mismatch. Offset mismatch.	Power cycle unit. If message reappears, call Service.

The following messages pertain to Nellcor SpO_2 Operation.

MESSAGE	REASON	SOLUTION
SpO_2 SYSTEM CHECK	Self test is being performed.	Wait for completion of self test.
SpO_2 NO SENOSR	No sensor is connected to the monitor.	Attach sensor cable to the monitor.
SpO_2 PULSE SEARCH	Hardware settings are being adjusted in order to discriminate a pulse waveform.	Change to site where pulse is stronger if patient is vasoconstricted. Change or readjust sensor if loose.
SpO_2 NO PULSE	No detectable pulse is measured.	

MESSAGE	REASON	SOLUTION
SpO_2 FAILURE	ROM checksum fail. RAM test fail.Filter mismatch. Offset mismatch.	Power cycle unit. If message reappears, call Service.
SpO_2 DIAGNOSTIC S	Passport is in Nellcor Diagnostics Mode.	Wait for completion of diagnostics.

- Administration of certain vasoconstrictive drugs, i.e. norepinephrine, may reduce peripheral perfusion to a level that prevents SpO_2 measurements.
- Arterial compression, tricuspid regurgitation, or irregular heart rhythms may reduce perfusion and prevent SpO_2 measurement.
- Intra-vascular dyes, depending on concentration, may affect SpO_2 measurements.

1.3.16.3 Recorder Messages (only units equipped with recorder)

MESSAGE	REASON	SOLUTION
RECORDER DOOR OPEN	The door of the recorder is not closed.	Close recorder door.
RECORDER PAPER OUT	The roll of recorder paper is used up.	Replace with a new roll of paper.

1.3.16.4 CO_2 Messages (only units equipped with Capnostat CO_2)

MESSAGE	REASON	SOLUTION
CO_2: INITIALIZING	This message usually appears at power up. The CO_2 subsystem has been reset and is performing internal self tests prior to operation.	Wait for the message to go away. It takes about 15 seconds for the CO_2 subsystem to initialize.
CO_2: NO SENSOR	No CO_2 sensor is connected to the monitor.	Attach the CO_2 sensor to the CO_2 connector (30).
CO_2: SENSOR WARMING UP	The CO_2 sensor has not reached its operating temperature. Either the monitor was just turned on or the sensor was recently plugged in or the sensor was removed from the adapter or calibration cells.	Wait for the message to go away. It takes up to five minutes for the sensor to
CO_2:CHECK ADAPTER	The CO_2 sensor is not correctly placed on the airway adapter or a different type of airway adapter has been connected or the adapter is dirty or damaged.	Check the installation and condition of the airway adapter. Clean or replace the adapter if necessary. An adapter calibration should be performed if the message persists. This is accessed through the CO_2 menu.
CO_2: CHECK SENSOR	The CO_2 sensor is out of calibration or damaged.	A zero calibration should be performed if the message persists. This is accessed through the CO_2 menu.

MESSAGE	REASON	SOLUTION
CO_2: SENSOR ON REFERENCE CELL	The CO_2 sensor is positioned on the reference cell. This is located on the sensor cable adjacent to the connector. The $ETCO_2$ reading should range from 36 to 40 Torr when on this cell.	The sensor should be removed from the reference cell and placed back on the airway adapter.
CO_2: SENSOR ON ZERO CELL	The CO_2 sensor is positioned on the zero cell. This is located on the sensor cable adjacent to the connector. The $ETCO_2$ reading should be 0 when on this cell.	After completing the calibration, the sensor should be removed from the zero cell and placed back on the airway adapter.
CO_2: ZERO CAL IN PROGRESS	The CO_2 sensor is placed on the zero cell and a CO_2 calibration is in progress. Wait for the zero calibration to complete. Zero calibration takes less than 30 seconds.	CO_2:ADPTER CAL IN PROGRESS
CO_2:ADPTER CAL IN PROGRESS	A CO_2 adapter calibration has been requested and is in progress.	Wait for the adapter calibration to complete. Adapter cal takes less than 30 seconds.
CO_2: ZERO CAL FAILURE	The zero calibration was not completed successfully. The zero calibration may have been requested when the sensor had not completed warming up.	Wait for the unit to complete warming up. Repeat the zero calibration.
CO_2: ADAPTER CAL FAILURE	The adapter calibration was not completed successfully. The adapter calibration may have been requested when the sensor had not completed warming up or the sensor was not correctly installed on the airway adapter.	Wait for the unit to complete warming up or check the installation of the sensor on the airway adapter. Repeat the adapter calibration.
CO_2: CAL FAILED - INSERT ZERO CELL	A zero calibration was attempted while the sensor was not attached to the zero cell.	Attach the sensor to the zero cell and repeat the zero calibration. The zero cell is located on the sensor cable adjacent to the connector.
CO_2: CAL FAILED - INSERT ADAPTER	An adapter calibration was attempted while the sensor was attached to the zero or reference cell.	Remove the sensor from the zero or reference cell and attach it to the air-way adapter. Repeat the adapter cal.
CO_2: ZERO CAL COMPLETE	The zero calibration has been successfully completed.	Remove the CO_2 sensor from the zero cell and place back on the adapter to continue monitoring.
CO_2: ADAPTER CAL COMPLETE	The adapter calibration has been successfully completed.	Normal operation. The message is removed after a few seconds.
CO_2: FAILURE	The CO_2 subsystem has failed.	Cycle the power on the monitor to determine if the problem persists. If the message returns then the unit needs to be serviced.

1.3.16.5 Monitor Operation Messages

The following messages pertain to the operation of the monitor.

MESSAGE	REASON	SOLUTION
DIAGNOSTICS IN PROGRESS	Self test is being performed.	Wait for completion of self-test. See Section 3.1.
SELF TEST COMPLETE	Diagnostics OK.	ESU INTERFERENCE
Poor electrode site preparation. Excessive cautery (ESU) noise.	Excessive high frequency noise.	Check site; rearrange electrodes. Change electrodes. Use ECG cable with choke.
LEAD FAULT	Lead off of patient.	Check electrodes / leads.
INTERFERENCE	Poor electrode site preparation. Improper lead selection.Excessive 50 or 60 Hz noise.Wrong 3-Lead cable may be in use.*	Check site. Change Lead selection. Use proper ECG cable.
ARTIFACT	A 50 or 60 Hz noise is detected on the ECG waveform. The displayed heart rate may not be correct.	Check site. Change Lead selection. Use proper ECG cable.

** See section 1.3.6 for more details on ECG cables.*

1.3.17 Monitor Problem Solving

This guide is provided to establish the possible causes and solutions to some monitoring problems.

PROBLEM	REASON	SOLUTION
No trace for a desired parameter	-Improper attachment of transducer to monitor. -Faulty transducer.	-Check transducer connection.-Try a different transducer.
Wandering ECG	-Respiration artifact.	-Try a different base line lead configuration.
Noisy ECG traces	-Loose or dry electrodes. -Defective electrode wires. -Patient cable or leads are routed too close to other electrical devices.	-Apply new electrodes.-Replace wires as necessary. -Eliminate 60Hz interference. -Use ECG cable with built-in filter block.
Low Amplitude ECG	-Electrode could be positioned over a bone or muscle mass.	-Reposition electrodes. -Press ECG SIZE key.
Excessive Electro-surgical Interference	-Inadequate skin prep prior to application of electrode.	-Repeat skin prep and electrode placement procedures.-Add additional gel to electrodes.
AC Noise	-Gain set too high (set through SIZE key). -Electrodes dry. -Patient cable entwined with cables of other electrical devices.	-Readjust as necessary. -Re-prep skin and apply fresh, moist electrodes. -Separate patient cable from all other cables.
Intermittent Signal	-Connections not tight and properly secured.-Electrodes dry. -Cable or lead wires damaged.	-Ensure proper connection. (Electrode to lead, lead to cable, cable to monitor.) -Re-prep skin and apply fresh moist electrodes. -Check with continuity tester.

PROBLEM	REASON	SOLUTION
Excessive alarms: heart rate, lead fault	-Electrodes dry. -Alarm limits set too close to patient's normal heart rate. -R-wave wrong size.-Excessive patient movement or muscle tremor.	-Re-prep skin and apply fresh, moist electrodes. -Readjust. -Must be twice the amplitude of other part of waveform. -Reposition electrodes and secure with tape if necessary.
Low Amplitude ECG Signal	-Gain set too low. (Set through SIZE key.) -Skin improperly prepared. -Possibly not patient's normal complex. -Electrode could be positioned over a bone or muscle mass.	-Readjust as required. -Abrade skin. -Check with 12 lead electrocardiogram. -Reposition electrodes.
Trace Not Moving	-FREEZE key may have been pressed.	-Press the FREEZE key to unfreeze the trace.
Temperature Probes not Working	-Poor contact from probes to body.	Check the body surface contact at the probe tip. Reposition or apply thermoconductive gel.
Display Appears to be Off	-Mains power switch may not be on.-Unit may not be plugged into an AC outlet. -If used as a portable, battery pack may be drained.	-Check mains power switch on side panel. -Check power cord (Is it plugged in?). -If battery pack is drained, plug into an AC outlet to recharge the battery. A period of 16 hours is required for a full charge.
Disabled Alarm Tone, QRS Tone, or Other Function	-Mute key pressed. -Beep volume low.	-Check for alarm mute symbol. -Increase beep volume.
ECG Base Line With No Waveform	-Gain control not set high enough. Set through SIZE key. -Lead wires and patient cable not fully inserted into proper receptacle. -Cable or lead wires damaged.	-Readjust as required. -Check insertion. -Check with lead continuity tester.
Base Line Wander	-Patient moving excessively. -Patient's respiration. -Electrodes dry. -Static build up around patient.	-Secure lead wires and cable to patient. -Reposition electrodes. -Re-prep skin and apply fresh moist electrodes. -Check with hospital engineer.
Damped Invasive Waveform	-Air bubbles in tubing.-Kinked catheter. -Catheter against will of blood vessel. -Blood in tubing.	-Eliminate air from tubing. -Slightly alter position of catheter. -Check for leaks at connector. -Pump pressure bag up to 300 mmHg.
Recorder Report Appears Totally Blank	-Thermal paper may be installed incorrectly. (up-side down)	-Remove paper and re-install with paper feeding off of the spool from the bottom.
Resp. Waveform Too Large	-Scales set inappropriately.	-Change scale via menu.
Resp. Waveform Too Small	-Patient breathing shallow or turned on side. -Scale set inappropriately.	-Change lead position to better detect respirations. -Change scale.

PROBLEM	REASON	SOLUTION
False Apnea Alarm	-Apnea delay may be improperly set. -Patient may be having frequent episodes of CVA. -Scale size may be too low.	-Choose another apnea delay. -Reposition electrodes to better detect respirations.
“CK Lead” Message	-Due to increased impedance. -Chest hair under electrodes. -Dried electrode gel. -Electrode off. -Lead off. -Cracked lead wires -Poor skin prep.	-Prep chest. -Change electrodes. -Replace electrode. -Replace lead. -Replace lead wires. -Clean and abrade skin before applying electrodes.
“CVA” Message	-Can be caused by shallow breathing or an apnea event.	-Check the patient - adjust scales or leads if necessary.
No Resp. Waveform or Rate Displayed	-Patient not connected to a patient safety cable.-Respiration parameter is “OFF”. -Patient connected using Patient ESIS Choke/Cable.	-Turn respiration on (“OFF” will be displayed in resp. window).Check that proper patient cable is used. -Use 3-lead Patient Cable - non ESIS. (See Accessories, section 5.1.)
Waveform Acquisition Failure	-Front End Failure -External Supply Failure-+12/-23 Volt Board Failure -CPU Board Failure -CO_2 Interface Board Failure (optional)	-Replace Front End Board. -Check External Supply Output voltage. -Replace F1 fuse on +12/-23 Volt Board. -Replace CPU Board. -Replace CO_2 Interface Board

1.3.18 Connection to External Devices

The Passport provides a high level ECG waveform output from the J1 connector (33). The output specifications are listed in section 6.1.

CAUTION: It is the users responsibility to confirm correct operation of the Passport with external devices. It is essential that a biomedical engineer verify correct operation of the Passport with an external device. Testing should include verification that the maximum delay for cardioversion synchronization does not exceed 60 ms (monitor and defibrillator). Cable should be labeled with the devices they have been tested for use with.

1.3.19 Menus

This section contains all the menus used in the Passport. A sample of each menu with each menu item highlighted is provided. For each menu item highlighted, the Choices bar indicates the available selections. The menu Instructions bar indicates the available actions to take. See “Use of Menus” on page 23 for detailed instructions on menu operation.

1.3.19.1 Patient Menu

Size: Changing the patient size will adjust the Passport for monitoring adults, pediatrics or neonates. The alarm limit selections will change accordingly. The Passport displays the patient size in the menu display area.

Clear Trend Memory: Choosing “Yes” deletes all the stored trend data.

Pacer Enhancement: Set to ON to display the pacer signal as a full scale square wave.

CHANGE PATIENT	
Size:	Adult
Clear trend memory:	No
Pacer Enhancement:	OFF
Choices: ADULT, PED, NEO	
↕ = Adjust valve	END = quit
SELECT = Enter/move	

CHANGE PATIENT	
Size:	Adult
Clear trend memory:	No
Pacer Enhancement:	OFF
Choices: Yes, No	
↕ = Adjust valve	END = quit
SELECT = Enter/move	

CHANGE PATIENT	
Size:	Adult
Clear trend memory:	No
Pacer Enhancement:	OFF
Choices: enhance ON/OFF	
↕ = Adjust valve	END = quit
SELECT = Enter/move	

FIGURE 1-29 Patient Menu

1.3.19.2 Set-up Menu

Speed: Sets the speed of the ECG and IBP waveforms.

Resp Speed: Sets the speed of the Respiration waveform.

Waveform 2/3: Set the type of waveform to display.

Resp Source: Set which source will be used for the Respiration information.

Powerup settings: Select save current to keep all configured items for the next time the Passport is powered on. Select restore factory to return to the factory default settings.

FIGURE 1-30 Set-up Menu

1.3.19.3 Recorder Menu

Wave Selection: Set the waveform or waveforms to be printed.

Record on Alarm: Set to ON for a recording to be printed each time an alarm situation occurs.

Record Destination: Set where the print out will occur. Local - from the Passport, Remote - from the Visa, Both - from both the Passport and the Visa.

CHANGE RECORDER	
Wave Selection:	ECG
Record on Alarm:	No
Record Destination	Local
ECG, Pleth, Resp, ECG & IBP1, ECG & IBP2, IBP1 & IBP2, CO2, ECG & RESP	
= Adjust valve SELECT = Enter/move	END = quit

CHANGE RECORDER	
Wave Selection:	ECG
Record on Alarm:	No
Record Destination	Local
Choices: Yes, No	
= Adjust valve SELECT = Enter/move	END = quit

CHANGE RECORDER	
Wave Selection:	ECG
Record on Alarm:	No
Record Destination	Local
Choices: Local, Remote, Both	
= Adjust valve SELECT = Enter/move	END = quit

FIGURE 1-31 Recorder Menu

1.3.19.4 Alarm Menu

The alarm menu provides access to change the settings for all available parameter alarms.

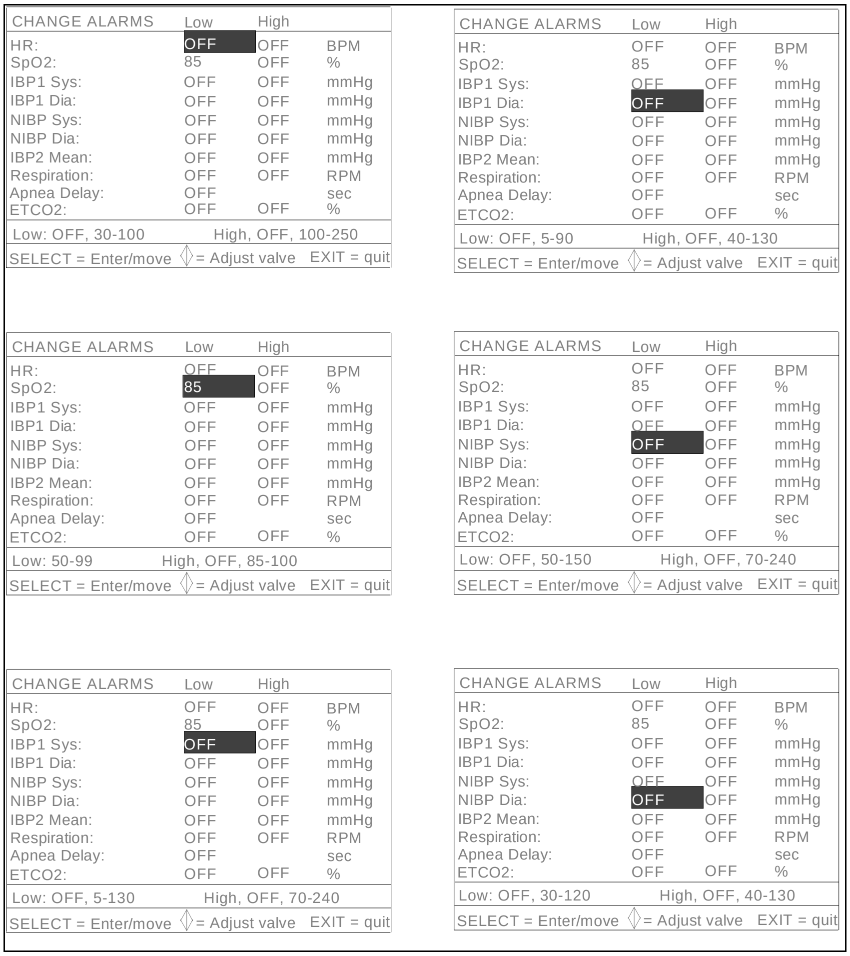


FIGURE 1-32 Alarm Menu

Alarm Menu Continued

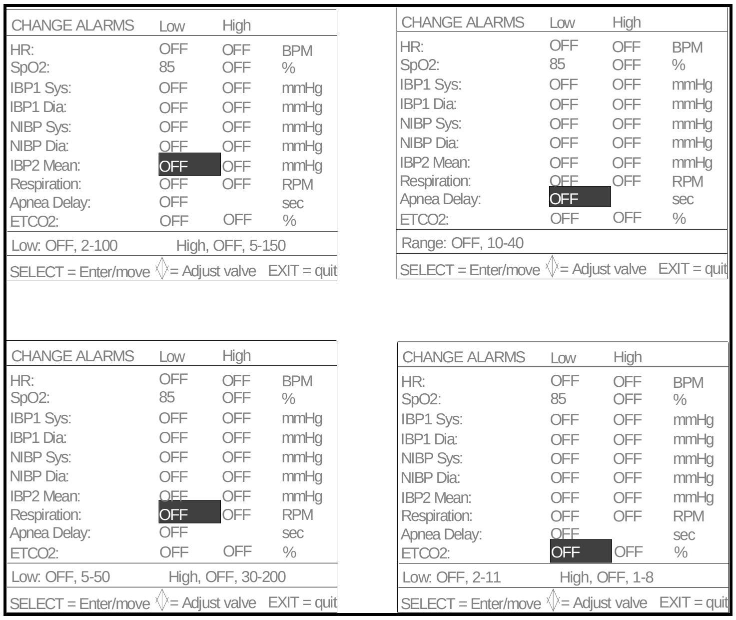


FIGURE 1-33 Alarm Menu

1.3.19.5 NIBP Menu

Start Pressure - Change the start pressure to affect the pump up pressure of the NIBP cuff. The range shown is for the adult patient size. The range for pediatrics is 60-180 mmHg, and the range for neonates is 40-120 mmHg.

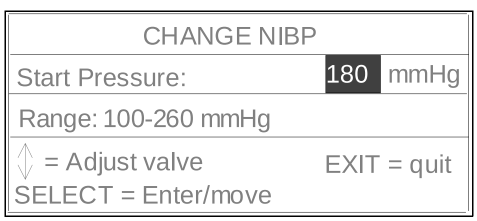


FIGURE 1-34 NIBP Menu

1.3.19.6 IBP Menu

IBP1 Scale, IBP2 Scale - Sets the full scale value of the display.

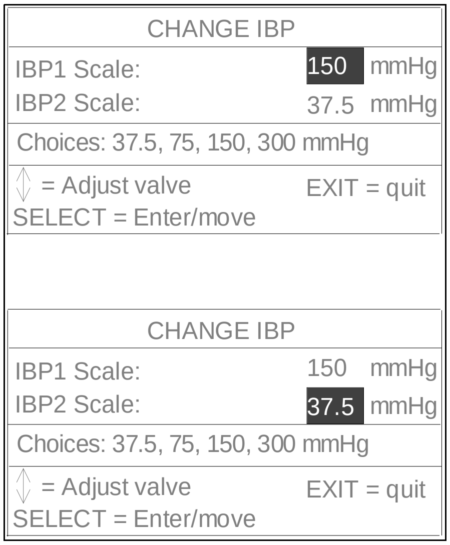


FIGURE 1-35 IBP Menu

1.3.19.7 Resp Menu

Scale - Sets the scale of the Resp waveform.

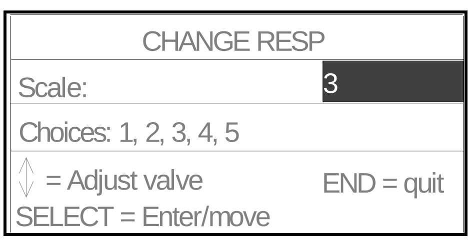


FIGURE 1-36 Resp Menu

1.3.19.8 HR Menu

Source - Select which source is used for the heart rate reading. The Auto selection uses a built in algorithm to automatically choose the strongest heart rate source.

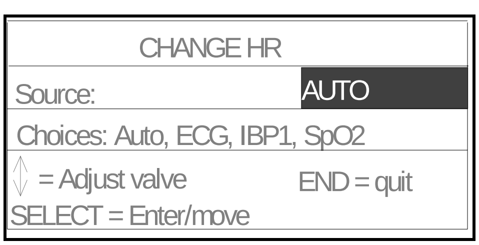


FIGURE 1-37 HR/ECG Menu

1.3.19.9 SpO_2 Menu / Nellcor SpO_2 Menu

Pleth Size - Sets the scale of the plethysmograph waveform.

Mode - Sets the scale of the plethysmograph waveform on units with Nellcor.

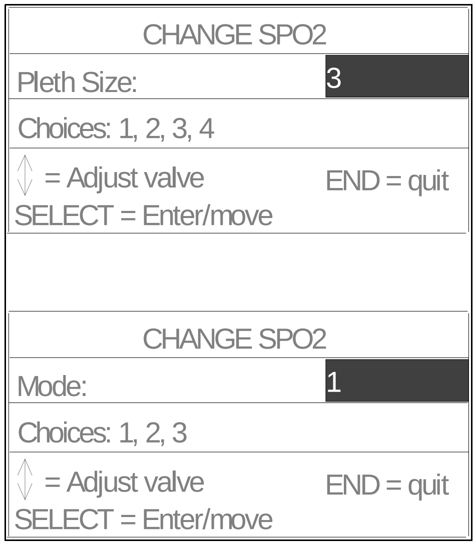


FIGURE 1-38 SpO_2

1.3.19.10 CO_2 Menu

CO_2 Scale - Select the size of the displayed CO_2 waveform.

Start Zero Calibration - Select Yes to initiate the calibration of the sensor.

Start adapter cal - Select Yes to initiate the calibration of the airway adapter with the sensor.

N_2O Compensation - Select ON to compensate for interference caused by nitrous oxide present in the gas being analyzed.

O_2 Compensation - Select ON to compensate for interference caused by oxygen present in the gas being analyzed.

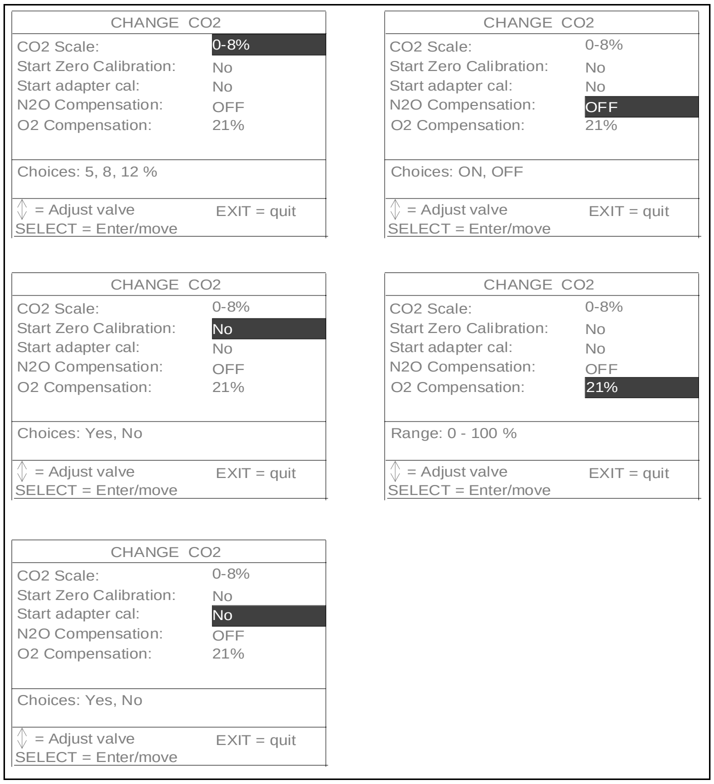


FIGURE 1-39 CO_2 Menu

User Configuration Menu

The User Configuration Menu is accessed during the power-up sequence. See “User Configuration Mode” on page 53 for complete details.

1.3.19.11 User Configuration - Date Menu

Year, Month, Day - Use the up and down arrow keys (1) to set each item to the appropriate number.

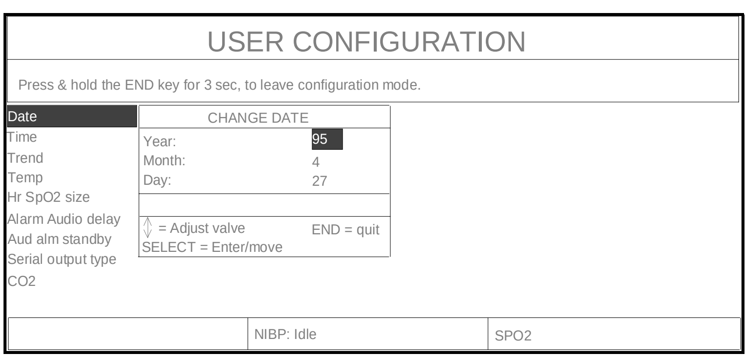


FIGURE 1-40 Date Menu

1.3.19.12 User Configuration - Time Menu

Hours, Minutes - Use the UP ▲ and DOWN ▼ arrow keys (1) to set each item to the appropriate number.

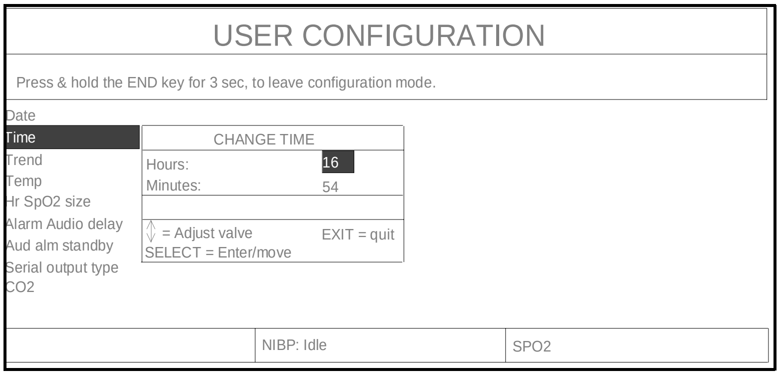


FIGURE 1-41 Time Menu

1.3.19.13 User Configuration - Trend Menu

Trend Trigger - Choose the events that when they occur causes the current parameter information to be stored in the trend memory. The selections for multiple triggers are: (Interval, NIBP, and Alarms), (Interval and NIBP), (Interval and Alarms) or (NIBP & Alarms).

Interval - Each time the selected time interval has elapsed, the parameter information is stored in the trend memory.

NOTE: ***Interval or multiple triggers must be selected as the trend trigger. The selections within the range are: 1, 2.5, 5, 10, 20, 30, 60 or 120 minutes.***

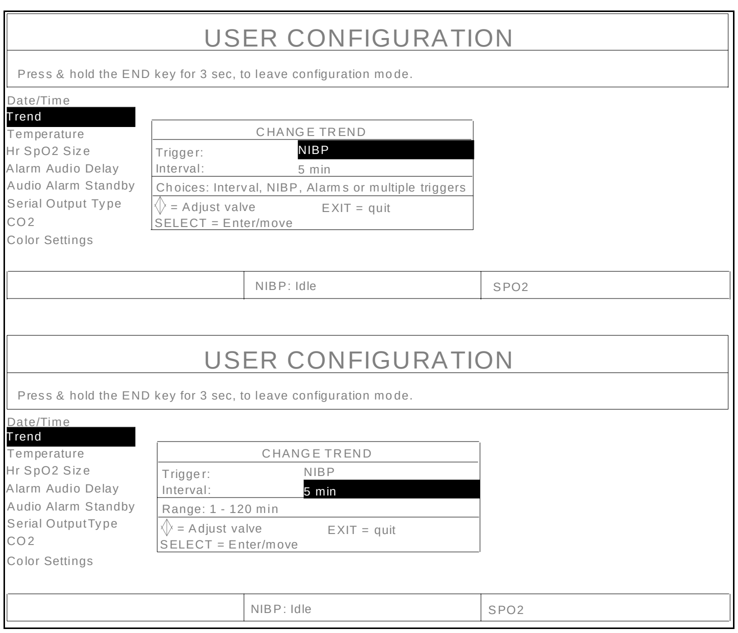


FIGURE 1-42 Trend Menu

1.3.19.14 User Configuration - Temperature Menu

Temperature Scale - Select the temperature to be measured in fahrenheit or centigrade units.

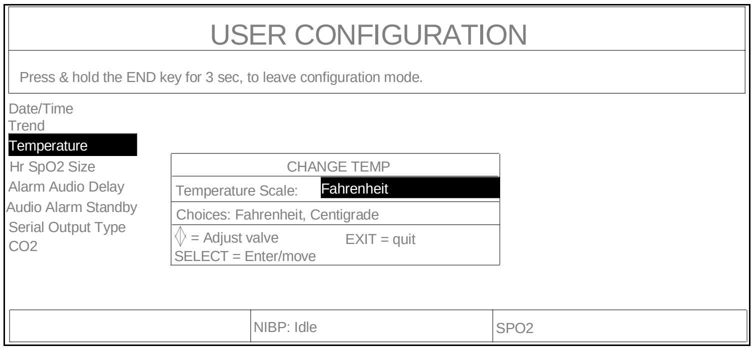


FIGURE 1-43 Temperature Menu

1.3.19.15 User Configuration - HR SpO_2 Size Menu

Hr SpO_2 size - Re-sizes the HR and SpO_2 display areas.

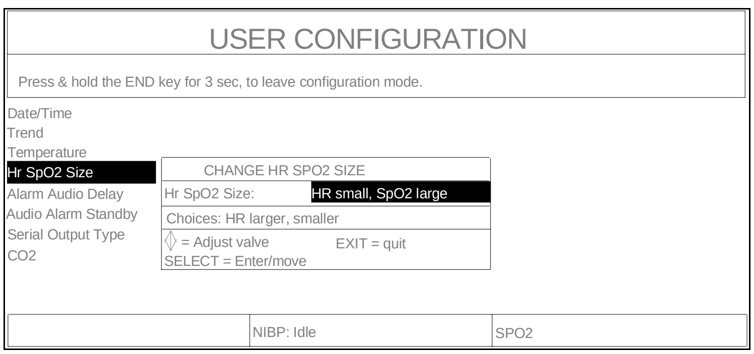


FIGURE 1-44 Hr SpO_2 Size Menu

1.3.19.16 User Configuration - Alarm Audio Delay Menu

Alarm Audio delay - Set to 4, 6 or 8 seconds to delay the tone of an alarm for the selected amount of time.

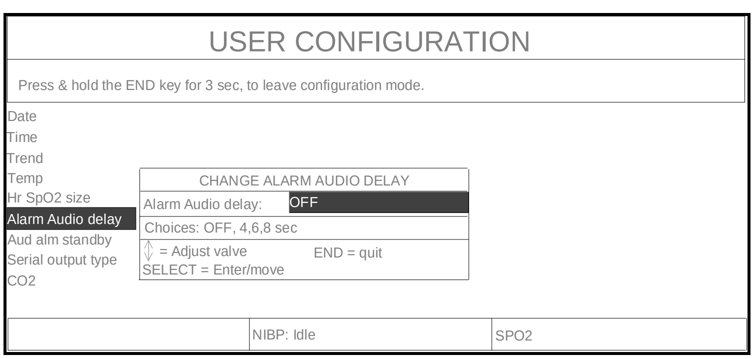


FIGURE 1-45 Audio Alarm delay Menu

1.3.19.17 User Configuration - Audio Alarm Standby Menu

Aud alm standby - When this function is set to ON, pressing and holding the MUTE key for 4 seconds will indefinitely suspend the alarms.

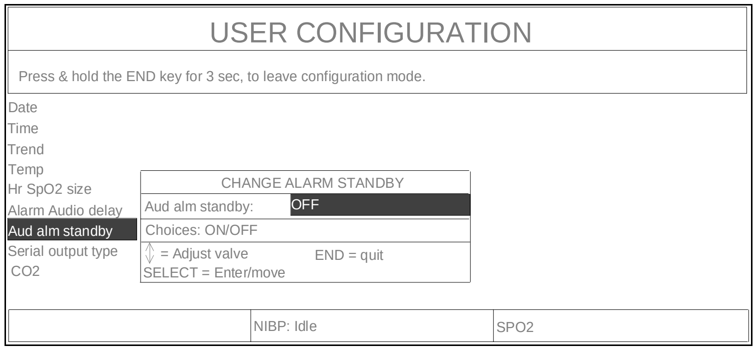


FIGURE 1-46 Audio Alarm Standby Menu

1.3.19.18 User Configuration - Serial Output Type Menu

Serial output type - Select the communication protocols for interfacing with other specialized equipment.

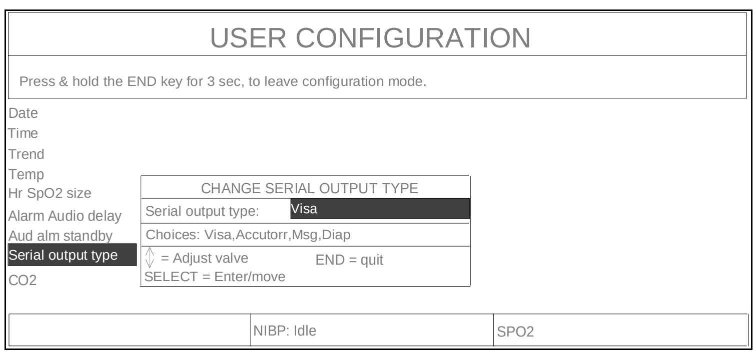


FIGURE 1-47 Serial Output Type Menu

1.3.19.19 User Configuration - CO_2 Menu

Barometric Pressure - Allows the facility to adjust to the current pressure.

CO_2 Units - Allows the facility to select the units of measure.

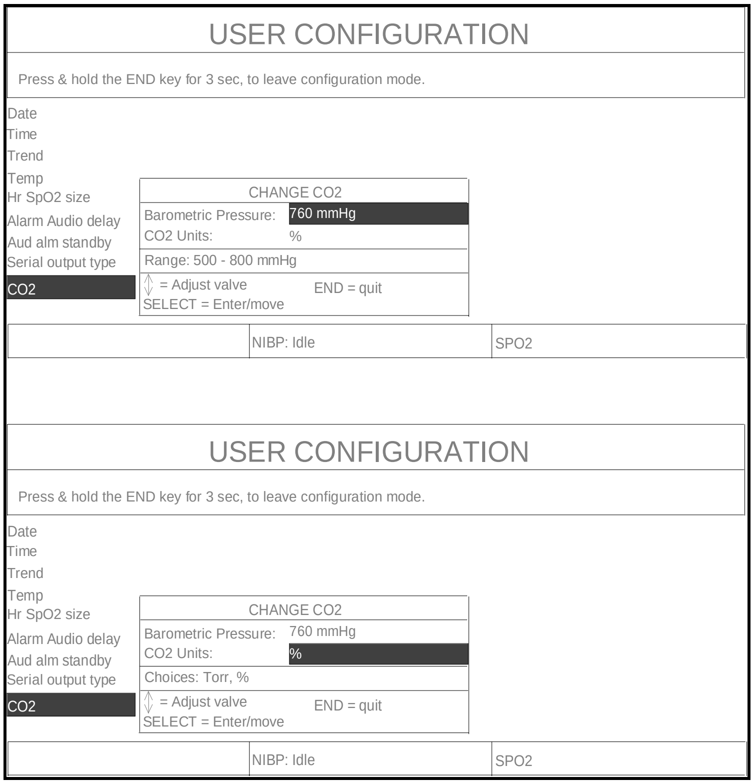


FIGURE 1-48 CO_2 Menu

1.4 Introduction (XG)

This section of the Service Manual provides general information about the Datascope Passport XG Monitor.

Section 1.5 on page 1-77 and Section 1.6 on page 1-97 are included as a review of instrument functions and operation, although the reader is encouraged to refer to the Operating Instructions, P/N 0070-00-0397, for more complete details.

1.5 Controls, Indicators and Connectors (XG)

This section of the Operating Instructions identifies and describes each control and display of the Datascope Passport XG Monitor.

Refer to the paragraph and page numbers listed below for the location of specific controls and displays.

Step-by-step instructions for operation of the monitor are provided in "Operation (XG)" on page 1-97.

The following is a list of all the controls, connectors and indicators and their item numbers. The item number refers to the call outs on the drawings within this chapter of the manual. If looking for a particular item, locate it on this list and then use the table below to determine the page where it can be found.

1. ▲ and ▼ (Set-up)	***9.*** FREEZE (ECG)	***17.*** LIMITS (Alarms)
2. SELECT (Set-up)	***10.*** ZERO 1 (IBP) (Optional)	***18.*** MUTE (Alarms)
3. EXIT (Set-up)	***11.*** ZERO 2 (IBP) (Optional)	***19.*** DISPLAY (Trends)
4. ADMIT (Central) (Optional)	***12.*** CO_2 PUMP (Optional)	***20.*** ▲ and ▼ (Trends)
5. DISCHARGE (Central) (Optional)	***13.*** START (NIBP)	***21.*** BEEP VOLUME
6. SILENCE (Central) (Optional)	***14.*** INTERVAL (NIBP)	***22.*** PRINT (Optional)
7. LEAD (ECG)	***15.*** DEFLATE (NIBP)	***23.*** BATTERY CHARGING LED
8. SIZE (ECG)	***16.*** VOLUME (Alarms/Alarms LED)	***24.*** DISPLAY

PARAGRAPH NUMBER	***DESCRIPTION***	***CONTROL/DISPLAY NUMBER***	***PAGE NUMBER***
1.5.1	Front Panel	1-24	1-79
1.5.2	Left Side Panel	25 - 34	1-87
1.2.3	Right Side Panel	35 - 39	1-90
1.5.4	Rear Panel	40	1-91
1.5.5	Remote Color Display (optional)		1-92
1.5.6	Gas Module (Optional)- Front Panel	41-43	1-93
1.5.7	Gas Module (Optional)- Rear Panel	44-51	1-95

1.5.1 Front Panel

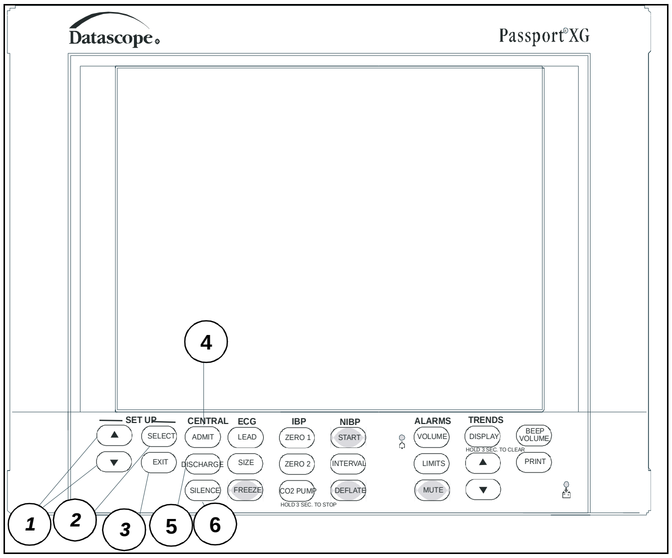


FIGURE 1-49 Front Panel Controls

Introduction

The keys on the front panel of the Passport XG Monitor are classified as single action, repeat action, or delayed action keys.

A ***single action*** key provides one action each time it is pressed, regardless of how long it is held.

A ***repeat action*** key provides an action when pressed, then waits half a second before repeating the action until the key is released.

A ***delayed action*** key provides an action, but only after the key has been held pressed for a (key specific) period of time.

NOTE: Only one key function will be recognized at any time. The Passport XG will ignore multiple key selections.

All key actions are acknowledged by a key click, except for BEEP VOLUME and ALARM VOLUME. If a key is not available a double key click will sound.

1. ▲ and ▼ *(UP and DOWN) (Set-Up)*

Two repeat action keys used to move the highlighted screen cursor or change the setting/ value of a menu item. As the cursor is moved, the highlighted menu window is displayed.

2. SELECT (Set-Up)

A repeat action key used to select the function or value indicated by the highlighted cursor.

3. EXIT (Set-Up)

A single action key which causes the display to return to the main screen display (as specified in the DISPLAY section). This key is always available.

4. ADMIT (Central) (Optional)

A single action key which transmits an admit command to the VISA Central Station.

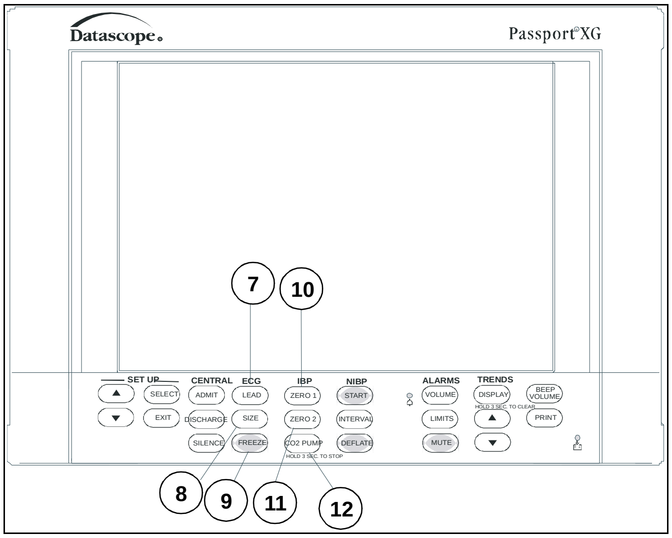
5. DISCHARGE (Central) (Optional)

A single action key which transmits a discharge command to the VISA Central Station.

6. SILENCE (Central) (Optional)

A single-action key which mutes the alarms of the corresponding channel on the VISA Central Station. The amount of time the alarms are silenced, is determined by the VISA.

Front Panel (Continued)



7. LEAD (ECG)

A single action key which selects the ECG lead to be displayed. Each depression of the key selects and displays the next ECG lead from the list. The list wraps around after the last entry is selected. Choices are: I, II, III, aVR, aVL, aVF or V.

8. SIZE (ECG)

A single action key which selects the size of the displayed ECG waveform. Each press of the key selects and displays the next ECG size which wraps around after the last size is selected. A vertical bar is placed in front of the ECG waveform. This vertical bar is used as a reference to determine the size of the displayed ECG waveform.

9. FREEZE (Screen)

A single action key which enables or releases the screen freeze function. The freeze key stops or starts all waveforms, except when waveform 2 is used for cascaded ECG. When this is the case, pressing the freeze key the first time causes the currently displayed ECG waveform data to be transferred to waveform 2 and frozen. Waveforms 1 and 3 continue to move. Pressing FREEZE again causes waveform 2 to return to cascaded ECG. The freeze key is also used to enter the user configuration menu. See “User Configuration Mode” on page 1-153 for further details.

10. ZERO 1 (IBP) (Optional)

A delayed action key which zeros the current pressure in the BP1 channel. If the transducer zero process is unsuccessful, “UNABLE TO ZERO” is displayed in the IBP1 data window. This window is only available when a pressure transducer is present.

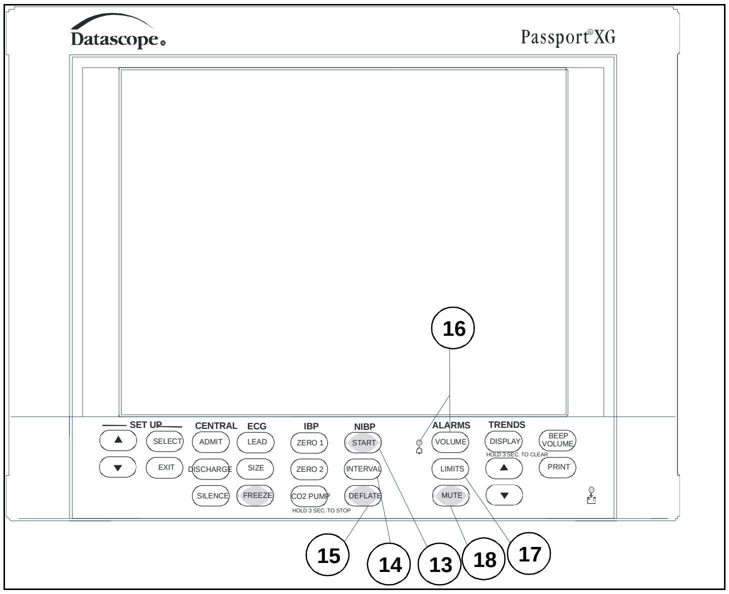
11. ZERO 2 (IBP) (Optional)

A delayed action key which zeros the current pressure in the BP2 channel. If the transducer zero process is unsuccessful, “UNABLE TO ZERO” is displayed in the IBP2 data window. This window is only available when a pressure transducer is present.

12. CO_2 PUMP (Optional)

A single action key which turns on the sidestream CO_2 pump and initiates an adapter and pump calibration. Holding this key for 3 seconds turns the pump off.

Front Panel (Continued)



13. START (NIBP)

A single action key which initiates an NIBP measurement. This function is not available if a measurement is in progress.

14. INTERVAL (NIBP)

A repeat action key which selects the interval setting for NIBP measurements. Values wrap around at the lowest/highest choices. Choices are: Off, Continuous, 1, 2.5, 5, 10, 15, 20, 30, 60, and 120 minutes. Five seconds after the selection is made and the key is released, the new interval takes effect.

15. DEFLATE (NIBP)

A single action key which stops any NIBP measurement in progress, including any timed measurement sequence, and deflates the cuff. When a timed measurement is stopped an “NIBP: DEFLATE” message followed by an “NIBP: IDLE” message displays in the NIBP message window until the timer mode is restarted by either pressing START or changing the interval.

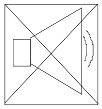
16. VOLUME (Alarms and Alarm LED)

A repeat action key which adjusts the alarm volume in 5 steps. There is no off position for this tone. The tone wraps to the minimum volume once the maximum is reached. The red alarm bell LED illuminates when an alarm condition exists. See “Alarms” on page 1-149 for detailed information on alarm situations.

17. LIMITS (Alarms)

A single action key which provides access to the alarm menu to view and select alarm values. Press SELECT to change the alarm values. Press the LIMITS key again to access additional alarm parameters (when the Gas Module is installed). To return the display to the main screen, press the EXIT key.

18. MUTE (Alarms)



Alarm Mute Symbol

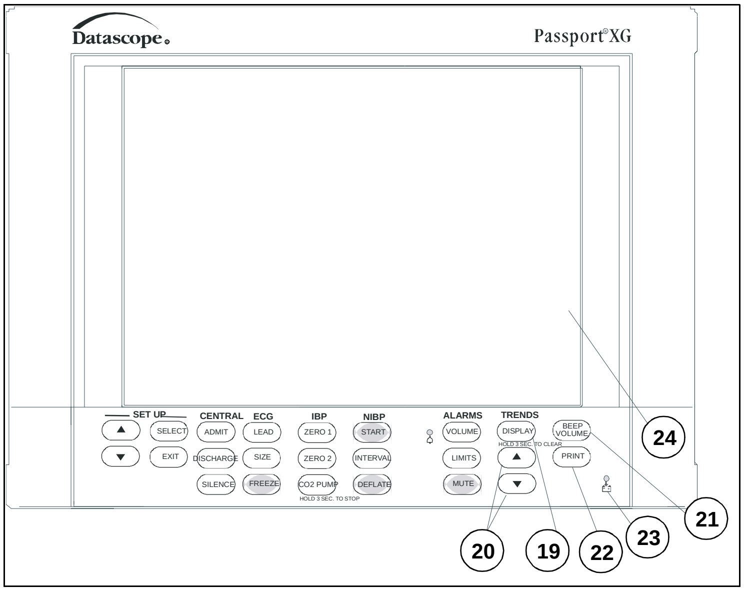
A single action and delayed action key which silences all currently alarming parameters or suspends all alarms. A single key press will silence the current alarm tone for 2 minutes. Any new alarms that occur while the alarm tone is muted will disable the mute and sound the alarm tone. An alarm mute symbol is displayed next to each muted parameter. The word Mute is displayed above the menu selections.

When the key is pressed and held for 3 seconds, all set alarms will be suspended for 2 minutes. This is indicated by the Alarm Mute Symbol and the words All Mute displayed above the menu selections.

When “Audio alarm standby” is set to ON (in the User Configuration Menu), and the MUTE key is pressed and held for 4 seconds, all audio alarms are indefinitely suspended. This is indicated by the Alarm Mute Symbol in all parameter windows and the words Aud Alm Sby flashing above the menu selections.

NOTE: ***When “Aud alm standby” is set to “ON and active on power up,” the unit will power up in the Aud alm standby mode. All audio alarms will be muted.***

Front Panel (Continued)



19. DISPLAY (Trends)

A single action and delayed action key which displays and clears trended data. The most recent page of data is displayed when the key is first pressed. Press this key a second time to view additional trended data. Pressing and holding the key for 3 seconds clears all trended data.

20. ▲ and ▼ (Trends)

Two repeat action keys which are used to scroll through the trend data.

21. BEEP VOLUME

A repeat action key which adjusts the beep volume in 5 steps plus OFF. When the maximum volume is reached, the volume will wrap around to OFF, then to the minimum volume.

22. PRINT (Optional)

A combination single action and delayed action key which initiates or stops a recording. Pressing the key once initiates a printout. Holding the key pressed for three seconds, when waveforms are displayed (see Section 1.6.18 on page 1-155), initiates a continuous printing of waveforms. Pressing the key while the printing is in progress, stops the recorder. The recorder prints either waveforms or trend data, depending on what is displayed (i.e. trend data is printed when trend list is displayed.). The Recorder Set-up will determine which waveform or waveforms are printed. The Recorder Set-up will also determine the Record Destination - Passport (recording from the Passport), Central (recording from the VISA, no recording from the Passport), or Both (recording from the Passport and VISA).

NOTE: ***When a remote (VISA) recording is printed, the information that is printed is determined by the set-up in the VISA.***

23. BATTERY CHARGING LED

A green LED used to indicate that the batteries are charging.

24. DISPLAY

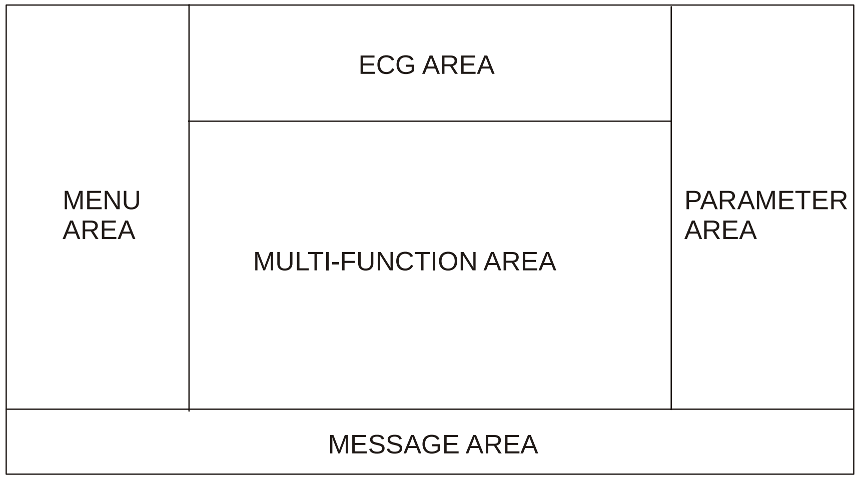


FIGURE 1-50 Display

The Display is used to present information which is divided into 5 graphic display areas. They are:

A. MENU Display Area

B. ECG Display Area

C. PARAMETER Display Area

D. MULTI-FUNCTION Display Area

E. MESSAGE Display Area

See Section 1.6.3 on page 1-102 for details.

1.5.2 Left Side Panel

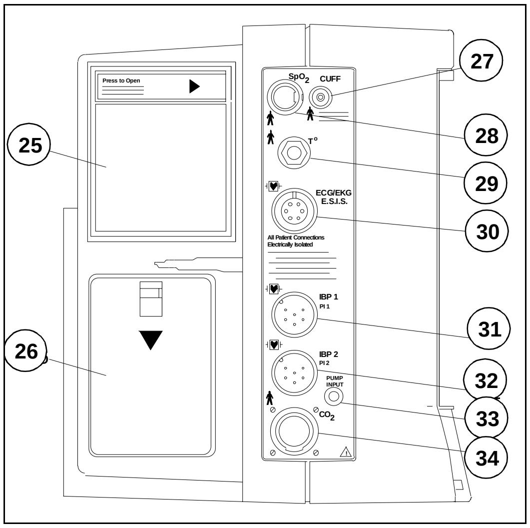


FIGURE 1-51 Left Side Panel with Datascope SpO_2

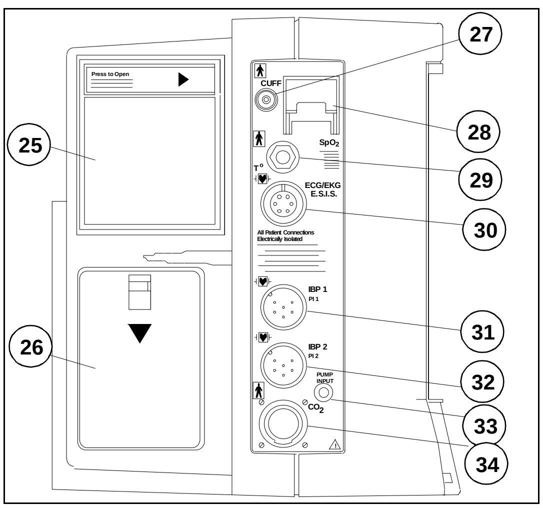


FIGURE 1-52 Left Side Panel with Nellcor® SpO_2

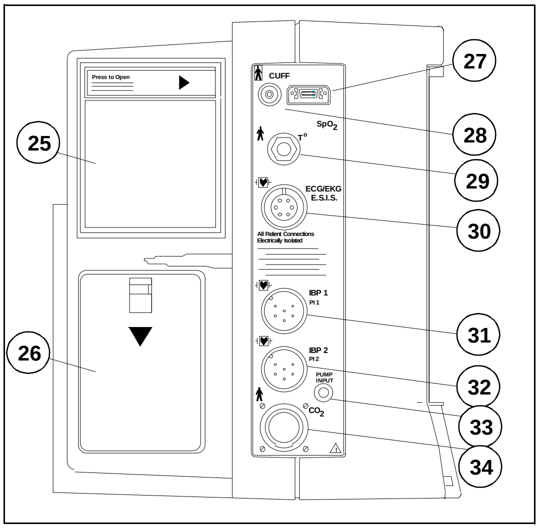


FIGURE 1-53 Left Side Panel with Masimo SpO_2

25. RECORDER (Optional)

A two trace thermal strip chart recorder with integral paper spool.

26. BATTERY PACK

Two internal, user replaceable, rechargeable, sealed lead acid batteries that provide power to operate the monitor when not connected to the power pack. The battery packs may be removed and replaced independently while the unit is operating.

27. CUFF

A connector used to attach the NIBP cuff assembly to the monitor.

28. SpO_2

An 8-pin DIN type, 9-pin sub miniature D (Nellcor) type female connector or 14-pin sub miniature D (Massimo) type female connector used to attach the SpO_2 sensor assembly to the monitor.

29. T (Temperature)

A standard three wire phone jack used to mate with either the YSI series 400 or 700 temperature probes. The Passport XG automatically identifies which probe is connected.

30. ECG / EKG

A six-pin AAMI (ECG-D10/75) standard connector used for patient cable connections.

31. IBP1 (Optional)

A six-pin male connector used for Datascope specified pressure transducers listed in Chapter 5, Accessories of the Passport Operating Instructions Manual.

32. IBP2 (Optional)

A six-pin male connector used for Datascope specified pressure transducers listed in Chapter 5, Accessories of the Passport Operating Instructions Manual.

33. PUMP INPUT (Optional)

This is used to connect the sampling tubing for Sidestream CO_2.

34. CO_2 (Optional)

A 20 pin connector used to attach the CAPNOSTAT® CO_2 sensor to the monitor.

1.5.3 Right Side Panel

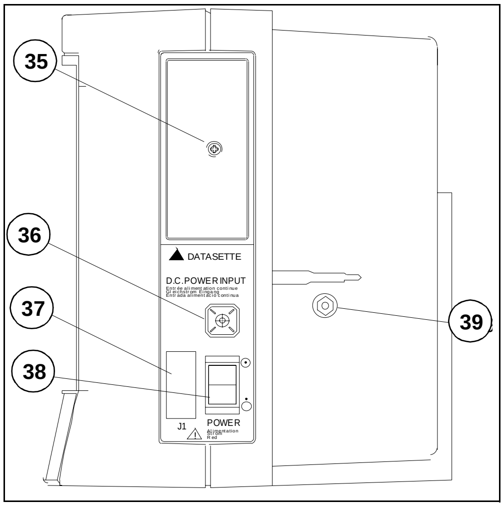


FIGURE 1-54 Right Side Panel

35. DATASETTE

A user replaceable software cartridge used for installing updated software revisions.

36. DC POWER INPUT (Connector)

A four terminal connector to supply low voltage DC power to the unit and charge the batteries. The power pack provides power to the unit independent of battery installation.

37. J1 (Optional)

A communication interface connector used to connect the Passport to a VISA Central Station Monitor, Remote Color Display, Nurse Call, DPD Defibrillator, Gas Module, or other peripheral devices.

NOTE: ***The VISA Central Station and Gas Module cannot be used at the same time.***

38. POWER

A recessed rocker switch which interrupts power to the main unit but does not prevent charging of the batteries.

39. PUMP EXHAUST (Optional)

This panel mount coupling is used for attaching a gas scavenging system.

1.5.4 Rear Panel

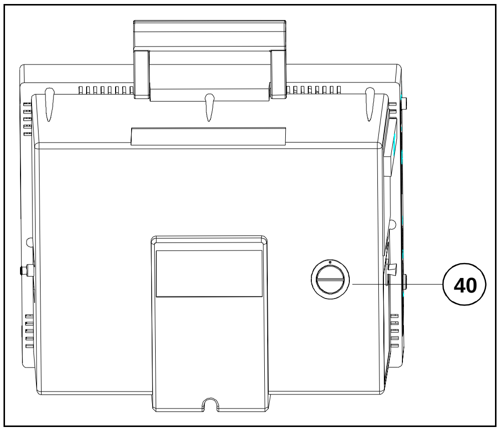


FIGURE 1-55 Rear Panel

40. CO_2 Filter Housing

Passport CO_2 filter (P/N 0103-00-0452) is located inside this housing. This filter should be replaced at least once a year. This filter is not part of the optional Gas Module.

1.5.5 Remote Color Display (optional)

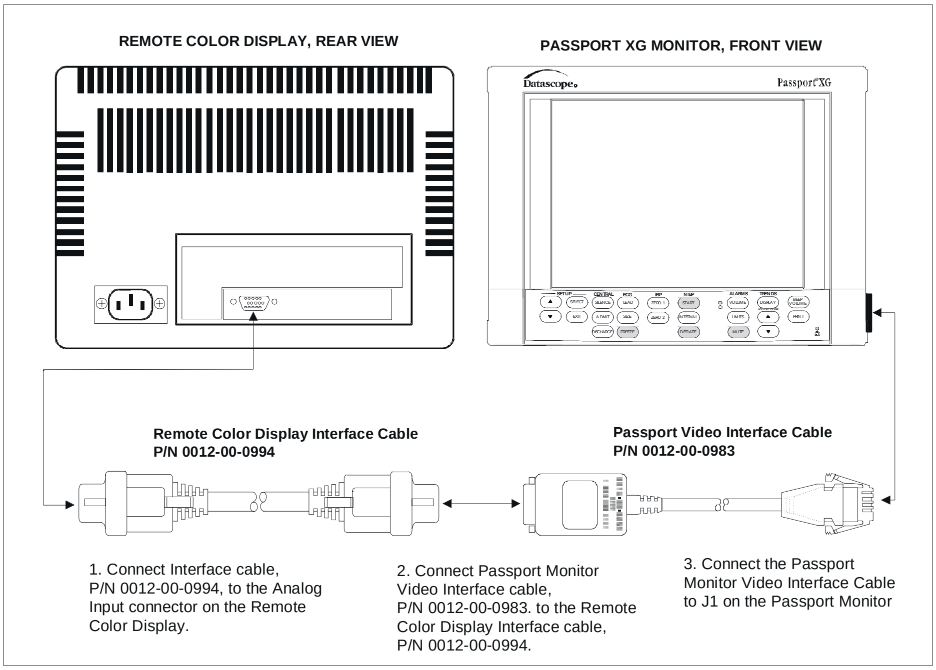


FIGURE 1-56 Remote Color Display

For instructions on mounting the remote display to a wall, see Chapter 5 in Datascope P/N's 0070-00-0397, 0070-00-0440, and 0070-00-0503 of the Passport Operating Instructions Manual.

WARNING: The use of remote displays will enlarge all waveforms and may alter aspect ratios depending on the remote device and its set-up.

1.5.6 Gas Module (Optional)- Front Panel

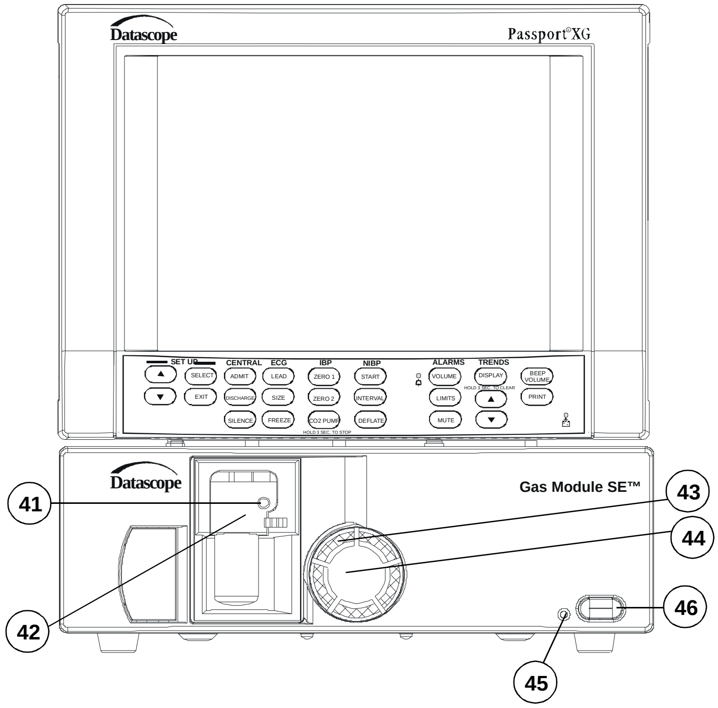


FIGURE 1-57 Gas Module Front Panel

NOTE: ***This Manual refers to the Gas Module II and the Gas Module SE as Gas Module. All illustrations represent the Gas Module SE. Any parts or descriptions unique to either product will be identified as such.***

41. Input Port

This port is used to connect the sampling tubing to the Gas Module.

42. Water Trap Assembly (includes Water Trap Reservoir)

The Water Trap Assembly (P/N 0202-00-0129 and 0202-00-0134) is used to capture moisture drawn in with the patient sample. The Water Trap Reservoir must be emptied and rinsed (with water only) whenever more than half full or whenever changing patients. To remove push latch to left. Refer to section 4.11 of the Passport Operating Instructions for more details.

43. Dust Filter

The Dust Filter (P/N 0378-00-0040) protects the Gas Module from airborne dust. It should be removed and cleaned on a regular basis. Refer to section 4.11 of the Passport Operating Instructions for more details.

44. Dust Filter Cover

The Dust Filter Cover is removed to access the filter.

45. Power Indicator Lamp

This lamp illuminates when power is applied to the Gas Module and the power switch is turned on.

46. Power Switch

A switch used to power the unit on and off. It is located on the front of the Gas Module SE and on the back of the Gas Module II.

1.5.7 Gas Module (Optional)- Rear Panel

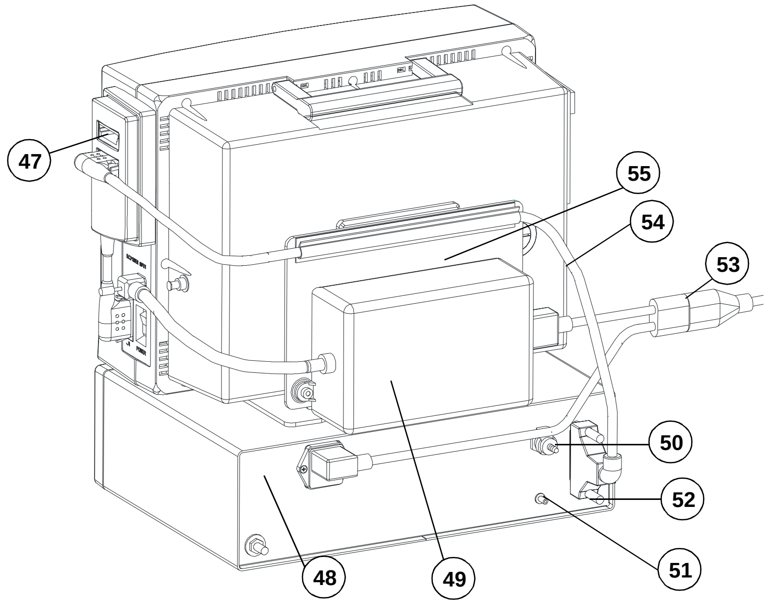


FIGURE 1-58 Gas Module Rear Panel

47. J1 Expansion Box

This expansion box (P/N 0997-00-00396) allows the user to connect up to three devices at one time to the J1 port.

NOTE: ***The Visa Central Station cannot be used in conjunction with the Gas Module II option.***

48. AC Power Input

This input is used to attach the special “Y” Shaped Power Cord.

49. AC/DC Power Pack

This AC/DC Power Pack (P/N 0014-00-0173-04, with 9" cable) provides DC voltage to the Passport. When used with the Gas Module the Y-Shaped cord (53) is plugged into both the rear of the Gas Module and into the AC/DC Power Pack as shown.

50. Exhaust Port

This panel mount coupling is used for attaching a gas scavenging system (P/N 0997-00-0923 or P/N 0997-00-0984) to the Gas Module.

51. Reference Port

This port is used only to measure room air. This port is not to be connected to anything. Do not block this port.

52. External Interface Port

A communication interface port used to connect the Gas Module to the Passport XG.

53. "Y" Shaped Power Cable

This special "Y" shaped power cable (P/N 0012-00-1081-XX) allows the Gas Module and Passport XG to be connected to an AC power source via one cable.

CAUTION: Do not use this special "Y" shaped power cable for any devices other than the Passport and Gas Module II.

54. External Interface Cable

This cable (P/N 0012-00-1082) is used to interface the Gas Module to the J1 port on the Passport XG.

55. Gas Module II Mounting Bracket

This bracket (P/N 0406-00-0729-01) mounts the Gas Module and Passport XG together. The Passport XG Power Pack can be mounted to the rear of this bracket as well.

1.6 Operation (XG)

Abbreviated Operating Check List

CAUTION: ***Only use the Abbreviated Operating Check List if you are already familiar with this product. If not, please continue with the remainder of this chapter, Detailed Operating Instructions.***

A. Setting-Up

1. Set POWER switch to OFF.
2. Connect, if desired, peripheral equipment (i.e., Remote Color Display, P.C., etc.).
3. Attach power pack and/or install charged batteries as needed.
4. Set POWER switch to ON.
5. Using the menus and keyboard, set (when appropriate) the following:

- Patient Size
- Set Up Information (speed, waveform 2 and 3, Auto Display, etc.)
- Recorder Information (when available)
- Alarm Limits
- NIBP Information
- IBP Information
- HR Information (Speed and Source)
- SpO_2 Information
- ECG Information
- Resp. Information
- Alarm Volume
- Beep Volume
- Trend Clear (hold down Display key for 3 seconds)
- CO_2 Information
- Gas Module Information

B. ECG

1. Press ***LEAD*** to change viewed lead type (I,II, III, aVR, aVF, or V).
2. Press ***SIZE*** to change ECG waveform size.
3. Press the ***FREEZE*** key to freeze all waveforms. If the “Cascade ECG” waveform is chosen as the second waveform, only the ECG waveform will be frozen.

C. Initiating an NIBP Measurement

1. Attach cuff hose to NIBP connector and place cuff on patient.
2. If necessary, set cuff pressure through NIBP menu.
3. Press ***START*** to immediately initiate NIBP measurement.
4. To enable automatic measurements, press ***INTERVAL*** key to set desired period. The NIBP measurement will start when the ***INTERVAL*** time has expired.
5. Press ***DEFLATE*** to suspend measurement. This also stops interval measurements.

D. Initiating an IBP Measurement

1. Open the transducer stop-cock to atmosphere.

2. Press and hold ZERO1 or ZERO2 for 1 second until “beep” sounds.

3. Turn stop-cock to patient to begin monitoring.

E. Establishing SpO_2

1. Select the appropriate sensor.

2. Attach sensor to SpO_2 connector and apply to the patient.

3. Set either waveform 2 or 3 in the set-up menu to display the SpO_2 waveform, if desired.

*F. Establishing CO_2 / CAPNOSTAT®**

1. Plug sensor into the side of the monitor.

2. If a new CAPNOSTAT is used, calibrate the system.

3. Apply sensor to the breathing circuit.

4. Set Waveform 2 or 3 to CO_2 or Auto Display CO_2 to Waveform 2 or 3.

5. Set the Resp. Source to CO_2/ECG.

* *CAPNOSTAT® is a trademark of NOVAMETRIX, Inc.*

G. Recording Information

1. Select wave to be recorded through Record Menu. Press PRINT to start Recording.

2. Press PRINT again to stop the recording in process.

3. If a printout of a tabular trend is desired, press DISPLAY followed by PRINT.

H. Temperature Measurement

1. Attach the desired temperature probe to the Temperature connector on the side of the Passport XG. The Passport XG automatically detects which probe is connected, 400 or 700 series.

I. CO_2, O_2, N_2O and Agent Monitoring with the Gas Module

1. Connect nasal cannula (non-intubated) or sample line (intubated) to the Patient.

2. Connect other end of nasal cannula or sample line to Gas Module.

3. Empty and clean water trap if more than half full or whenever changing Patients.

4. Set Waveform 2 or 3 to CO_2, Agent or O_2 or Auto Display CO_2 to Waveform 2 or 3.

5. Set the Resp. Source to CO_2/ECG.

J. Setting Alarms

1. To access the Alarms Limits menu press the Alarms LIMITS key.
2. Using the UP and DOWN and SELECT keys set parameter limits as desired. Press SELECT key again to enter the chosen limits.
3. Press the LIMITS key again to access further alarm parameters (when the Gas Module is installed).
4. Press the EXIT key to return to the main menu.

Detailed Operating Instructions

This section of the Operating Instructions provides guidelines and step-by-step instructions for proper operation of the monitor. Numbers in parentheses ( ) relate to the displays and controls described in “Controls, Indicators and Connectors (XG)” on page 1-77.

1.6.1 Setting-up / Turning Power On

1. Set the POWER switch (38) to OFF.
2. Attach any peripheral equipment (i.e., Visa Central Station, Remote Color Display).

CAUTION: ***Always attach all desired peripheral equipment prior to powering on the Passport. If required to attach more or change what is connected, turn the Passport off, attach what is needed, and then turn the Passport on again.***

3. Attach the power pack to the DC POWER INPUT connector (36). If battery operation is required, ensure that two fully charged batteries are installed.

NOTE: ***If power pack is connected ensure that the screw is tightened so that the cord does not detach.***

4. Set the POWER switch (38) to ON.Internal self tests will run and the display will come on. A “DIAGNOSTICS IN PROGRESS” message will display and once the self tests have been completed a “SELF TEST COMPLETE” message will display. After these messages the main screen is displayed.

If any failures occur, see “Status Messages” on page 1-158 for further instructions.

1.6.2 Factory - Default Control Settings

The following are the factory initial (default) control settings. These are the settings that the unit will power up in unless a “current configuration” has been saved from the set up menu. Changes can be made and saved to these default settings. The default settings can also be restored. Refer to the “Set-up Menu” on page 1-176.

MENU	FUNCTION	DEFAULT SETTINGS
Patient	Size	Current setting
	Admit*	No
	Discharge*	No
	Full Disclosure*	Off
	Arrhythmia*	Off

* *This item only appears if the serial output type is set to Visa or Visa w/ Admit.*
** *These items only appear if the related function is installed.*

MENU	FUNCTION	DEFAULT SETTINGS	
	Pacer Enhancement	Off	
Set-up	Waveform 2	Cascade ECG	
	Waveform 3	Pleth	
	Auto Display IBP1**	Waveform 2	
	Auto Display IBP2**	Waveform 3	
	Auto Display CO_2**	Waveform 3	
	Powerup Settings	No change	
Recorder	Wave Selection	ECG	
	Record on Alarm	No	
	Recorder Destination*	Passport	
Alarms	Alarms:	***Low***	***High***
	HR	Off	Off
	SpO_2	85	Off
	IBP1 Sys**	Off	Off
	IBP1 Dia**	Off	Off
	NIBP Sys	Off	Off
	NIBP Dia	Off	Off
	IBP2 Mean**	Off	Off
	Respiration	Off	Off
	Apnea Delay	Off Adult, Off Ped., 10 sec Neonate	
	$ETCO_2$**	Off	Off
Alarms (Gas Module only)	Resp Rate	Off	Off
	ET CO_2	Off	Off
	INS CO_2		Off
	ET O_2	Off	Off
	INS O_2	Off	Off
	INS N_2O		Off
	ET ISO	Off	Off
	INS ISO	Off	Off
	ET ENF	Off	Off
	INS ENF	Off	Off
	ET DES	Off	Off
	INS DES	Off	Off
	ET SEV	Off	Off
	INS SEV	Off	Off
	ET HAL	Off	Off
	INS HAL	Off	Off
NIBP	Start Pressure	180 mmHg Adult, 140 mmHg Ped., 120 mmHg Neonate	
IBP**	IBP1 Scale Range	150 mmHg	

* *This item only appears if the serial output type is set to Visa or Visa w/ Admit.*

** *These items only appear if the related function is installed.*

MENU	FUNCTION	DEFAULT SETTINGS
	IBP2 Scale Range	37.5 mmHg
Resp	Resp Speed	12.5 mm/sec.
	Scale	3
	Resp Source	CO_2/ECG or ECG if CO_2 not installed
HR/ECG	Trace Speed	25 mm/sec.
	Source	Auto
SpO_2 (Datascope)**	Pleth Size	3
	Sensor-Off Audio	On
SpO_2 (Nellcor)**	Response Mode	3
	Sensor-Off Audio	On
SpO_2 (Masimo)**	Sensor-Off Audio	On
	Sensitivity Mode	Normal
	Post Average Time (sec)	8
CO_2**	Scale	60 Torr
	Start Zero Calibration	No
	Start Adapter Cal	No
	N_2O Compensation	Off
	O_2 Compensation	21%
ECG	Lead	II
	Size	1
NIBP Interval		Off
Gases**	CO_2 Scale	0 - 60 Torr
	Resp Speed	12.5 mm/sec
	Start Zero	No
	Start Calibration	No
	Restart Pump	No
	Agent Selection	Auto
	Agent Scale	10%
	O_2 Scale	18 - 30%
Volume	Beep	Off
	Alarm	1

* *This item only appears if the serial output type is set to Visa or Visa w/ Admit.*
** *These items only appear if the related function is installed.*

1.6.2.1 User Configuration Menu Items

The following are the initial factory settings for the User Configuration Menu. These settings can only be changed within this menu. Initial factory settings can be changed within the User Configuration Menu only.

MENU	FUNCTION	DEFAULT SETTINGS
Trend	Trigger	NIBP
	Interval Timer	5 mins
Temperature	Scale	Fahrenheit*
HrSpO_2 Size	HrSpO_2 Size	HR small, SpO_2 large
Alarm Audio Delay	Alarm Audio Delay	Off
Audio Alarm Standby	Audio Alarm Standby	On
Serial Output Type	Serial Output Type	Visa
	Accutorr Baud Rate	1200 bps
CO_2	Barometric Pressure	760 mmHg
	CO_2	Torr
Color Settings	ECG Color	White
	NIBP Color	White
	SpO_2 Color	Green
	Gases Color	Green
	IBP1 Color	Red
	IBP2 Color	Red
	Resp Color	Red
	Temp Color	Red
Gas Monitor	CO_2 Units	mmHg

* *Fahrenheit is the default setting for English units only. All other language units default to Centigrade.*

1.6.3 Display

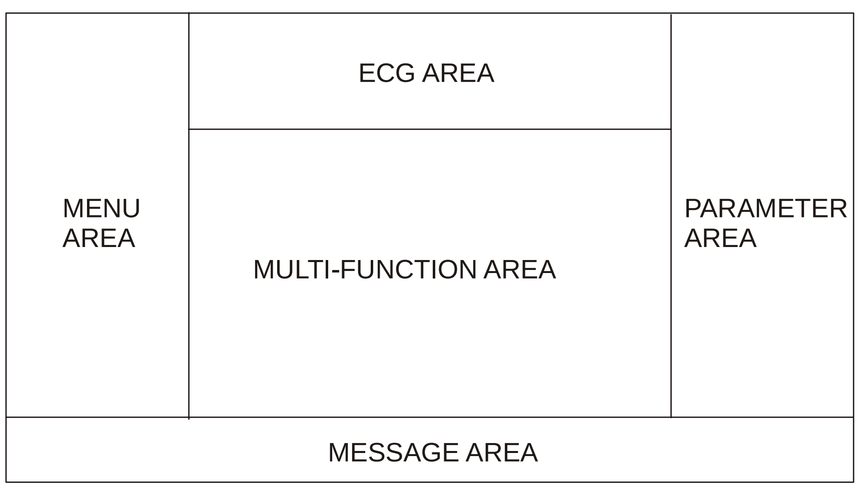


FIGURE 1-59 Window Layout

The Display is divided into five graphic areas as shown above.

MENU Display Area - displays the main menu selections available with the cursor and select keys, the battery symbol and the mute categories.

ECG Display Area - displays the ECG trace, ECG information and pacer enhancement status.

PARAMETER Display Area - displays the current values of patient parameters.

MULTI-FUNCTION Display Area - displays additional waveforms and temporary boxes for menu functions.

MESSAGE Display Area - displays messages relating to NIBP, SpO_2, CO_2, Gas Module and recorder operation.

1.6.3.1 Menu Display Area

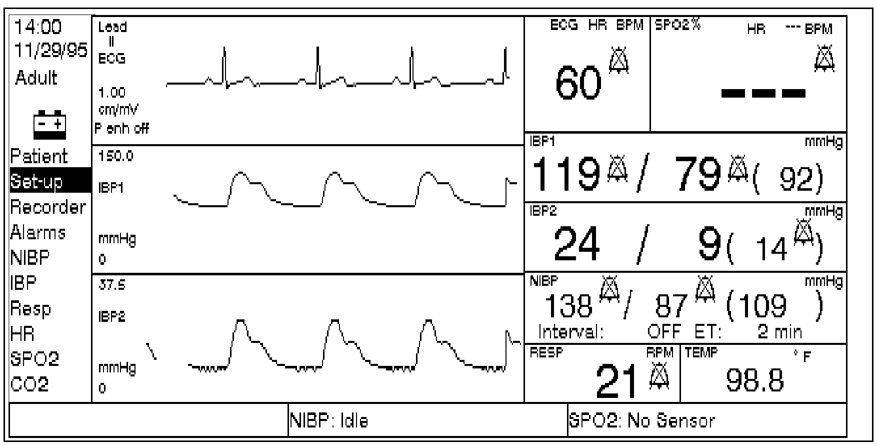


FIGURE 1-60 Window Layout

The menu area displays the main menu selections available. These are accessed by using the UP ▲ and DOWN ▼ arrow keys (1) and SELECT (2) set-up keys. See “Use of Menus” on page 1-109 for details on using these keys. One menu item is always highlighted by the cursor. This window also contains the TIME, DATE, PATIENT SIZE and MUTE status (when active) information.

For each patient size available there are different choices within the menu selections. The following table indicates the choices for each menu set-up and also where there are different selections for each patient size. For a graphic representation of each of these menus see “Use of Menus” on page 1-109.

NOTE: ***The “IBP”, “Recorder”, “CO_2” and “Gas Module” (Gases) menu items only appear on models equipped with these options.***

NOTE: The sample display shown may not be an exact representation of your unit.

MENU LIST	*MENU ITEM*	*CHOICES*
Patient	Size	Adult, Pediatric, Neonate
	Admit*	Yes, No
	Discharge*	Yes, No
	Full Disclosure*	On, Off
	Arrhythmia*	On, Off
	Pacer Enhancement	On, Off
Setup	Waveform 2	IBP1, Cascade ECG, Pleth, Resp, CO_2, Agent**, O_2**
	Waveform 3	IBP1, IBP2, Pleth, Resp, CO_2, Agent**, O_2**
	Auto Display IBP1**	Waveform 2, Waveform 3, Off
	Auto Display IBP2**	Waveform 3, Off
	Auto Display CO_2**	Waveform 2, Waveform 3, Off
	Power up Settings	No Change, Save Current, Restore Factory
Recorder	Wave Selection	ECG, Pleth., Resp., ECG & IBP1, ECG & IBP2, IBP1 & IBP2, CO_2, ECG & Resp., CO_2 & O_2**, CO_2 & Agent**
	Record on Alarm	Yes, No
	Record Destination	Passport, Central, Both
NIBP	Start Pressure	Adult: 100-260 mmHg Ped.: 60-180 mmHg Neonate: 40-120 mmHg
IBP*	BP1 Scale Range	37.5, 75, 150, 300 mmHg
	BP2 Scale Range	37.5, 75, 150, 300 mmHg
Resp	Resp Speed	1.3.125, 6.25, 12.5, 25 mm/sec.
	Scale	1, 2, 3, 4, 5
	Resp Source	Off, ECG (If CO_2 is installed) Off, ECG/CO_2/Off, CO_2/ECG
HR/ECG	Trace Speed	12.5, 25, 50 mm/sec.
	HR Source	Auto, ECG, IBP1, SpO_2
SpO_2*(Datascope)	Pleth Size	1, 2, 3, 4, 5
	Sensor-Off Audio	On, Off, Cont.
SpO_2*(Nellcor)	Response Mode	1, 2, 3
	Sensor-Off Audio	On, Off, Cont.
SpO_2*(Masimo)	Sensor-Off Audio	ON, OFF, CONT
	Sensitivity Mode	Normal, High
	Post Average Time (sec)	4,6,8,10,12,14,16
CO_2*(Capnostat)	CO_2 Scale	40, 60, 100 Torr / 5, 8, 12 kPa / 5, 8, 12 %
	Start Zero Calibration	Yes, No
	Start Adapter Calibration	Yes, No

* *These items only appear if the related function is installed.*

** *This item only appears if the Gas Module option is installed and serial output is set to Gas Module.*

MENU LIST	MENU ITEM	CHOICES
	N_2O Compensation	On, Off
	O_2 Compensation	0, 21, 40, 60, 80, 100
Gases **	CO_2 Scale	40, 60, 100 mmHg
	Resp Speed	1.3.125, 6.25, 12.5, 25 mm/sec.
	Start Zeroing	Yes, No
	Start Calibration	Yes, No
	Restart Pump	Yes, No
	Agent Selection	Iso, Enf, Des, Sev, Hal, Auto
	Agent Scale	1, 2.5, 5, 10, 20%
	O_2 Scale	18-30%, 18-60%, 18-100%

* *These items only appear if the related function is installed.*

** *This item only appears if the Gas Module option is installed and serial output is set to Gas Module.*

1.6.3.2 ECG Display Area

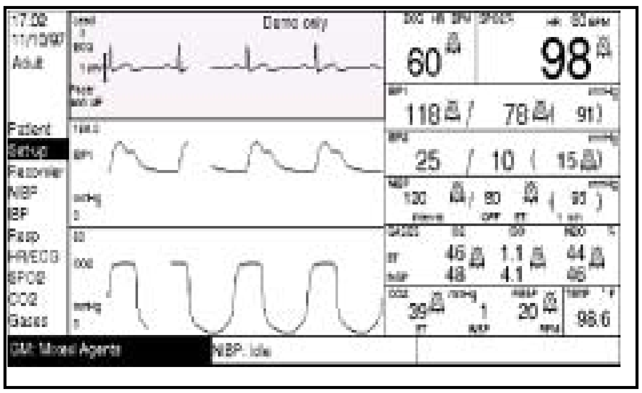


FIGURE 1-61 ECG Display Area

The ECG Display Area contains the ECG waveform, the ECG size, scale, lead information, Pacer Enhancement ON/OFF message, and when appropriate a message indicating there is no ECG waveform available.

- ***ECG SIZE*** - The ECG size displays a vertical bar and a "1 mV" label. The vertical bar is used as a reference to determine the size of the displayed ECG waveform. There are a total of 6 size settings for the vertical bar. Five size settings are 0.25, 0.5, 1, 2, 3 cm. The sixth setting is larger than the ECG waveform window and therefore the "1 mV" label is removed. The size that measures a 1 cm signal on the display is indicated by small line segments added to the top and bottom of the vertical bar (as shown above).

NOTE: ***Changing the ECG SIZE only changes the display scale not the ECG amplitude.***

- ***ECG LEAD*** - The ECG lead display shows the current ECG lead selection. The lead display options are I, II, III, aVR, aVF, aVL, and V.
- ***ECG WAVEFORM*** - The display shows the ECG waveform at a user selected speed. This provides 4 seconds of data on the display (at 25mm/sec). The

vertical scale of the waveform is determined by the ECG size selected.

- ***LEAD FAULT MESSAGE*** - The lead fault message box displays “ECG Lead Fault” and is positioned over the area where the ECG waveform normally resides.
- ***PACER ENHANCEMENT*** - Factory default is “Pacer enh OFF” (pacer enhancement off). The OFF setting allows any pacer to appear as it normally would on the ECG waveform. When pacer enhancement is turned on via patient menu selection, detected pacers are enhanced and appear as full scale, narrow square waves.

WARNING: Thoracic respiration measurement may interfere with some pacemakers. Refer to the pacemaker’s manual.

- ***INTERFERENCE MESSAGE***- When large 60 Hz noise component is present on the ECG waveform and the notch filter is enabled, the “Interference” message is displayed. The “Artifact” message will also be displayed in the Parameter Display area. Check the patient electrode connectors and the cable for proper connection. This message may be the result of using inappropriate 3-Lead cables.
- ***ESU INTERFERENCE MESSAGE***- When a large high frequency noise component is present on the ECG waveform, the message “ESU Interference” is displayed. If both high frequency and 60 Hz noise are present, the “ESU Interference” message and the Artifact message are displayed.

1.6.3.3 Multi-function Display Area

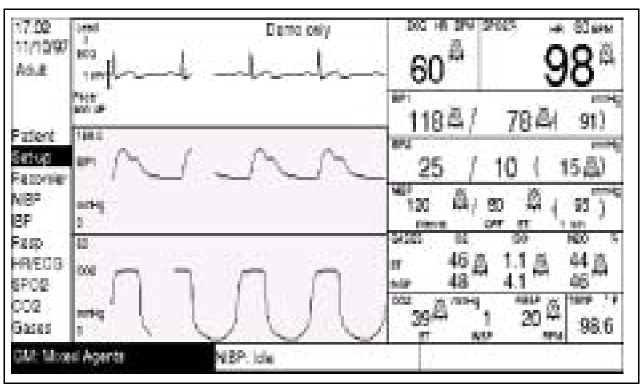


FIGURE 1-62 Multi-Function Display Area

Displayed within the Multi-function Area of the screen are the:

A. Waveforms

B. Trend Lists

A. Waveforms

The waveform display is the normal display in the multi-function area. The waveforms occupy the entire multi-function area.This area is divided horizontally in two. These two areas are used for waveforms 2 and 3.

The options for each waveform are listed in Table 1-4, page 1-23.

The scale information for invasive pressures consists of a 0 at the bottom of each window to represent zero pressure level and the scale range value at the top of the window.

The waveform provides four seconds of data when the selected speed is 25mm/sec.

NOTE: ***The sample display shown may not be an exact representation of your unit.***

B. Trend Lists

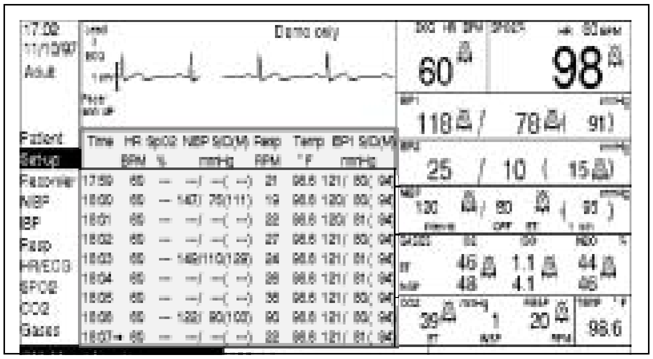


FIGURE 1-63 Trend List Display

Pressing the DISPLAY key (19) displays the trend lists, as shown above. The trend lists take up the entire Multi-function area. To view additional parameters press the DISPLAY key (19) again. Pressing this key a third time returns the screen to normal. Pressing and holding the DISPLAY key (19) for 3 seconds will clear all trended data.

Each entry to the trend list is added to the bottom of the list until the page is full. Nine lines of data can be displayed on each page. The trend data memory is large enough to contain more than one page of data. When the most current page is full and new data is available, the top line of data in the window is removed (but kept in memory). The other lines of data are scrolled up and the new data is added as the last line of data in the window. To scroll through the data that is in memory press the ▼ and ▲ trend keys (20).

The trend lists display consists of a heading that includes the page #, the time, the parameters with their units, and the listed data in columns under the appropriate heading.

If no data is available for a particular column, dashes (—) are displayed. If an NIBP measurement was attempted and a valid reading was unable to be obtained (xxx) will be displayed in the NIBP column.

If respiration is turned off, “OFF” is displayed in the respiration column.

NOTE: ***The IBP1, CO_2 and Gas Module columns display only in models that are equipped with these options. If CO_2 is being monitored, the CO_2 trend will replace the Temp trend. All Gas Module trends will be on a separate page.***

The Trend Trigger and Interval are set in the User Configuration Trend menu. See “User Configuration Mode” on page 1-153.

To clear the trend data, press and hold the DISPLAY key (19) for 3 seconds.

NOTE: ***Trend data will be stored in memory for 1 hour after the unit has been powered down. After 1 hour the trend data will be cleared.***

NOTE: ***The sample display shown may not be an exact representation of your unit.***

1.6.3.4 Parameters Display Area

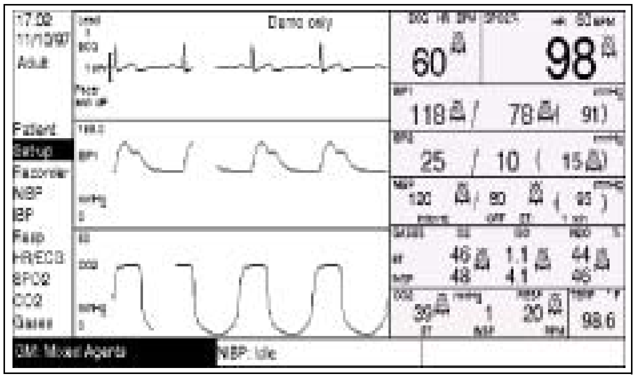


FIGURE 1-64 Parameters Display Area

The parameters display area contains the current values of the patient parameters. The contents and the layout of the parameters area depends on how many invasive blood pressure transducers are connected and whether or not the Gas Module option is installed to the monitor. The example above is with two transducers connected and with the Gas Module configured.

Within the NIBP parameter area the interval chosen is displayed and the elapsed time (ET) since the last NIBP measurement was taken is displayed. If another NIBP measurement is not taken within 15 minutes the ET and the NIBP readings will change to dashes.

An “Artifact” message is displayed in this area, under the ECG Heart Rate, whenever 60 Hz noise is present on the ECG waveform.

NOTE: ***The sample display shown may not be an exact representation of your unit.***

1.6.3.5 Message Display Area

This area of the display contains messages relating to NIBP, SpO_2, CO_2, Gas Module and recorder operation. See “Status Messages” on page 1-158 for a complete list of these messages.

1.6.4 Use of Menus

The main menus are accessed by using the UP ▲ and DOWN ▼ arrow keys (1), SELECT (2), and EXIT (3) keys.

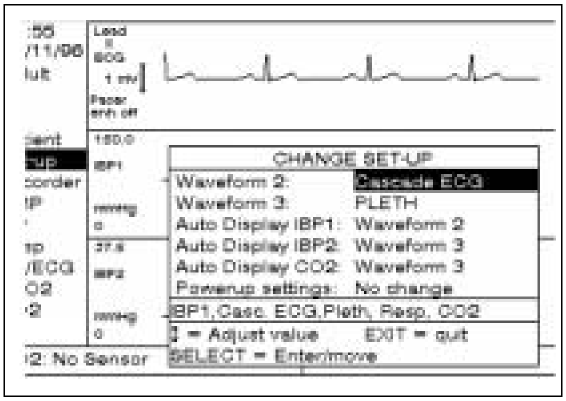


FIGURE 1-65

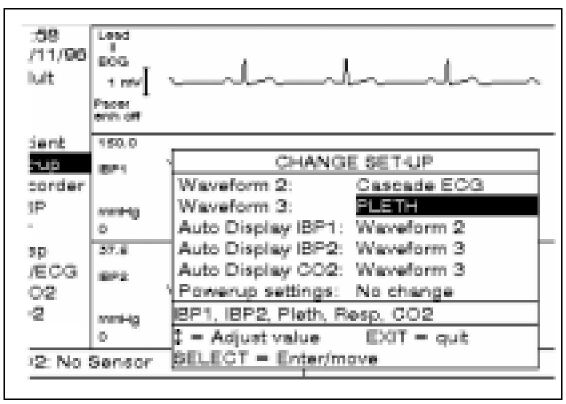


FIGURE 1-66

The following is an example of how to set the menu options.

1. Using the UP ▲ and DOWN ▼ arrow keys (1), move the cursor to select the desired main menu item.

NOTE: ***As the cursor is moved up and down the list of menu items, view windows for each menu item are displayed.***

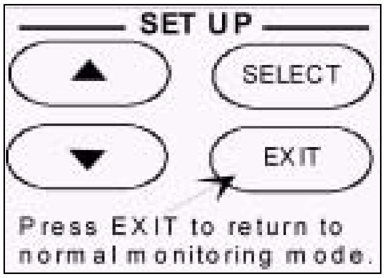
2. When the desired menu item is highlighted, (in this case SET-UP has been chosen) press SELECT (2) to enter into the change window. When SELECT is pressed, the first item in the sub-menu will be highlighted.

3. To change the highlighted item use the UP ▲ and DOWN ▼ (1) keys. The choices available are listed in the CHOICES bar. Once the desired choice is displayed, press SELECT (2) to enter it and move the cursor down to the next item in the sub-menu.

If no change is required to the highlighted item, press SELECT to move the cursor down to the next item on the list. Keep pressing SELECT until the required item to change is highlighted.

NOTE: ***The sample display shown may not be an exact representation of your unit.***

4. Press the EXIT (3) key to return to the normal monitoring mode when all of the sub-menu items have been set as desired.



1.6.5 Initiation of NIBP Measurements

1.6.5.1 Manual Initiation of NIBP Measurements

1. Select a pressure cuff that is appropriate for the size of the patient using the chart below as a guideline.

LIMB CIRCUMFERENCE (CM)	***DESCRIPTION / CUFF NAME***	***DATASCOPE PART NUMBER***	
		Reusable	***Disposable***
45 - 66	Thigh *	0998-00-0003-05	
30 - 47	Large Adult	0998-00-0003-02	0683-07-0001-01
24 - 36	Adult	0998-00-0003-01	0683-07-0001-02
18 - 27	Child	0998-00-0003-03	0683-07-0001-03
16 - 25	Small Child	0998-00-0003-04	0683-07-0001-04
10 - 19	Infant	0998-00-0003-06	
6 - 11	Newborn	0998-00-0003-07	
11 - 17	Neonatal, Size 3		0683-03-0003-02
9 - 13	Neonatal, Size 2		0683-03-0002-02
7 - 10	Neonatal, Size 1		0683-03-0001-02
6 - 8	Neonatal, Size 0		0683-03-0004-02
Color Coded Cuffs*			
46 - 66	Thigh - Brown	0998-00-0003-26	
33 - 47	Large Adult - Grey	0998-00-0003-25	
25 - 35	Adult - Tan	0998-00-0003-24	
18 - 26	Child - Red	0998-00-0003-23	
10 - 19	Infant - Green	0998-00-0003-22	
6 - 11	New Born - Blue	0998-00-0003-21	

A cuff that is too narrow for the limb will result in erroneously high readings. The correct size of the pressure cuff for a given patient has, among other considerations, a direct bearing on the accuracy of the obtained NIBP measurements. Base your selection of the cuff size on the limb circumference of the patient. The table above indicates the available Datascope cuffs for use with the Datascope Passport XG Monitor. The design dimensions of the cuffs and their intended uses are based on recommendations of the American Heart Association.

NOTE: ***See Accessories section in P/N's 0070-00-00397, 0070-00-0440, and 0070-00-0503 for a detailed list of cuffs.***

NOTE: ***Cuffs become more supple as they age and sometimes develop permanent folds that can leave temporary marks on the limb. Any cuffs that exhibit this effect should be replaced.***

NOTE: ***Ensure that the pressure tubes are not compressed or restricted.***

* *When using the thigh cuff, this product will not comply with AAMI accuracy standards.*
** *The limb circumferences of the Color Coded Cuffs adhere to the AHA guidelines for size.*

The pressure on the limb may not fall to zero between measurements if the cuff is wrapped too tightly. Therefore, insure that the cuff is properly applied.

The skin is sometimes fragile (i.e., on pediatrics, geriatrics, etc.). In these cases, a longer timer interval should be considered to decrease the number of cuff inflations over a period of time. In extreme cases, a thin layer of soft roll or webril cotton padding may be applied to the limb in order to cushion the skin when the cuff is inflated. This measure may affect NIBP performance and should be used with caution.

2. Attach cuff hose to CUFF Connector (27).
3. Apply the cuff to the patient. To reduce errors, the cuff should be fitted snugly, with little or no air present within the cuff. Be sure the cuff lies directly against the patient's skin. No clothing should come between the patient and the cuff.

NOTE: ***The NIBP cuff should not be placed on a limb that is being utilized for any other medical procedure. For example, an I.V. catheter or an*** SpO_2 ***sensor.***

4. Select Patient Size through the PATIENT MENU as described in “Use of Menus” on page 1-109. Choices are ADULT, PEDIATRIC or NEONATE.
5. If necessary, enter the NIBP parameter menu to change the initial cuff inflation pressure. Initial cuff inflation pressures depend on the PATIENT SIZE setting. The choices of cuff inflation are:

PATIENT SIZE SETTING	***INITIAL CUFF INFLATION VALUES***
Adult	100 - 260 mmHg
Pediatric	60 - 180 mmHg
Neonate	40 - 120 mmHg

6. Press START (13) to begin an NIBP measurement.

NOTE: ***Inflate the cuff only after proper application to the patient’s limb. Cuff damage can result if the cuff is left unwrapped and then inflated.***

The cuff begins to inflate to the selected cuff pressure. After reaching the selected value the cuff begins to slowly deflate and the Datascope Passport XG Monitor collects oscillometric pulsations.

If the initial cuff inflation is found to be inadequate, the unit retries with a higher inflation pressure (+50 mmHg in the adult mode; +30 mmHg in the pediatric and neonate modes).

Have the patient remain still to avoid the introduction of unnecessary motion artifact. After the cuff pressure drops below the diastolic pressure, the results of the measurement are displayed.

If NIBP is the only parameter measured with the Passport XG, a heart rate can be derived from NIBP. The HR source menu selection must be in the Auto mode (i.e., not selected for ECG, IBP or SpO_2) with no heart rate alarm limits set. (See “Alarms” on page 1-149, for details).

If NIBP is a selected trend trigger (see “User Configuration Mode” on page 1-153 for details on user configuration), then NIBP and heart rate values are stored in trend lists. The NIBP and NIBP heart rate will be automatically removed from the display after 15 minutes have elapsed.

If another heart rate source is available, the NIBP heart rate will be replaced by the heart rate from the selected source.

To display heart rate from NIBP:

a. Chose AUTO for HR source.
b. Discontinue monitoring of ECG, SpO_2 and IBP.
c. Set high and low heart rate alarms to off.
d. Make a valid NIBP measurement.

During or after an NIBP measurement, one of several advisory messages may be displayed. Refer to “Status Messages” on page 1-158, for their explanations.

7. If desired, press DEFLATE (15) to interrupt a measurement. The cuff will deflate.

1.6.5.2 Automatic Initiation of NIBP Measurements

Follow steps 1 - 5 in the "Automatic Initiation of NIBP Measurements" on page 1-113.

6. Press INTERVAL (14) until the desired time displays. The choices are: OFF, continuous, 1, 2.5, 5, 10, 15, 20, 30, 60, and 120 minutes.

7. A measurement will be taken when the selected interval has elapsed. If an immediate measurement is desired, press START (13).

NOTE: ***If the monitor is in the interval mode when it is turned on, no measurement will be taken until the "START" key is pressed. Subsequent measurements are referenced to the time the unit was turned on. See example in "Start and Deflate Functions" on page 1-114.***

NOTE: ***When the NIBP continuous interval is chosen, the Passport XG will continually take back to back blood pressure readings. As a safety precaution, a five minute limit is placed on continuous measurements. After 5 minutes, the NIBP interval will automatically switch to measurements taken every 5 minutes.***

Automatic Adjustment in the Timer Mode

In the timer mode, the unit adjusts the inflation pressure according to the previous reading of the systolic pressure. After the first measurement in the timer mode, the inflation pressure is the previous systolic +50 mmHg in the Adult Mode and +30 mmHg in the pediatric and neonate mode.

Suspension of Automatic NIBP Feature

To suspend an automatically timed measurement sequence or to end a measurement cycle already in progress (deflate cuff):

1. Press DEFLATE (15).
   To take an immediate measurement and resume a suspended timed measurement sequence:
2. Press START (13).

NOTE: ***Press DEFLATE (15) at any time to postpone a scheduled measurement or to terminate a measurement cycle already in progress.***

CAUTION: ***Observe extreme caution on all patients (neonates, pediatrics, and adults) when NIBP is set to the Continuous Mode. A 5 minute limit is placed on continuous measurements. After 5 minutes the unit will take a measurement once every 5 minutes. Reports have been made of nerve injury occurring during use of automatically cycled blood pressure cuffs. See the Appendix, "Precautions when Using Automatically Cycled Blood Pressure Cuffs".Observe extreme caution on all patients (neonates, pediatrics, and adults) when NIBP is set to the Continuous Mode. A 5 minute limit is placed on continuous measurements. After 5 minutes the unit will take a measurement once every 5 minutes. Reports have been made of nerve injury occurring during use of automatically cycled blood pressure cuffs. See the Appendix, "Precautions when Using Automatically Cycled Blood Pressure Cuffs".***

1.6.5.3 NIBP Pressure Limit Fail Safe

If the cuff pressure is over-pressurized, the cuff will automatically vent to atmosphere and the NIBP message window reads CUFF OVERPRESSURE.

The unit must be turned off and back on again to reset the overpressure switch before any new measurements are taken.

1.6.5.4 Cuff Inflation Time

If the cuff pressure does not attain 20 mmHg within 40 seconds of the start of inflation or if the target pressure is not reached within another 60 seconds, then the cuff is vented and the "RETRY" or "UNABLE TO MEASURE" message will display in the NIBP message window.

1.6.5.5 Start and Deflate Functions

The START and DEFLATE functions have the following effects on the timed measurement sequence.

- INTERVAL is set and you Press START (13):
  An unscheduled measurement is made. Taking this unscheduled measurement does not affect the timing of the interval cycle, therefore, the scheduled measurements will be taken as if there were no interruptions. Only one measurement is taken for each measurement cycle - even if the unscheduled measurement coincides with the scheduled measurement.
- INTERVAL is set and you press DEFLATE (15):
  The timed measurement is suspended and the cuff deflates.
- INTERVAL is set and you change the interval:
  The measurement cycle is reset with the new interval. A measurement will be taken after the new interval has elapsed.

For example, with the interval set to five minutes:

TIME	***MODE/TIMER INTERACTION***	***RESULT***
9:45	Unit turned on with interval set to 5 minutes.	No measurement taken
9:52	Start key pressed	Measurement taken
9:55	Timer requests a measurement	Measurement taken
10:00	Not in Deflate mode and timer requests a measurement	Measurement taken
10:04	Deflate mode is entered	Deflate message is displayed on display
10:05	Timer requests a measurement	Measurement is skipped
10:07	Interval is changed to 10 min.	Interval timing is reset
10:17	Timer requests a measurement	Measurement taken

1.6.6 ECG Acquisition

The patient ECG signal is acquired with a patient cable and skin electrodes. The type of skin electrode and technique of applying the electrodes are major factors in determining the quality of the signal obtained. Use high quality, silver-silver chloride electrodes. These are designed to acquire the ECG with excellent base line stability, recovery from defibrillation, and minimum artifact from patient movement.

WARNING: ***Insure that the conductive parts of ECG electrodes do not contact other conductive parts including earth ground.***

1. For optimal skin contact, thoroughly prep patient skin for electrode placement by doing the following.

- Shave hair from electrode sites.
- Cleanse skin thoroughly with alcohol to remove skin oils.
- Dry with a rough towel or gauze to remove dry skin.
- Attach electrodes to lead wire first before placing onto patient.

NOTE: ***Using more than one type of electrode on the same patient should be avoided because of variations in electrical resistance.***

2. Use the ESIS choke cable if an electro-surgical device is to be used on the patient.
3. Plug patient cable into the ECG (30) connector.

   An ECG waveform should now be present on the screen and the heart rate read-out should now be functional.
4. Select desired lead setting by pressing the front panel ECG LEAD key (7). Lead II is automatically selected at power-up.
5. Select desired ECG size by pressing the front panel ECG SIZE key (8). An ECG of 1cm/mV is automatically selected at power-up.
6. If cascaded ECG is desired in waveform 2, use the Set-up menu (see "Use of Menus" on page 1-109), to choose this option.

NOTE: ***Set the Auto Display for IBP1 and CO_2 to either waveform 3 or Off. If either of these functions are set to waveform 2, they will have a higher priority to display, if they are detected.***

7. Choose HR source for rate meter from HR menu. Choices are: ECG, BP1, SpO_2, or AUTO. AUTO selects the source from a hierarchy (ECG, IBP1, SpO_2) of what is currently monitored.
8. Press BEEP VOLUME (21) to set the volume of the systole beep.

WARNING: ***Thoracic respiration measurement may interfere with some pacemakers. Refer to the pacemaker's manual.***

"ECG Lead Fault" Message

- The Passport XG will display the message "ECG Lead Fault" to indicate when ECG monitoring is inoperative.
- When ECG lead I, II or III is being monitored, a lead fault sensed by RA, LA, or LL will cause the "ECG Lead Fault" message to display.
- When lead aVR, aVL, or aVF is being monitored, a lead fault sensed by RA, LA, LL, or RL will cause the "ECG Lead Fault" message to display. When the specified 3-Lead cable is used, the "ECG Lead Fault" message will display because the RL lead is not available.
- When ECG V lead is being monitored, a lead fault sensed on RA, LA, LL, RL or C will cause the "ECG Lead Fault" message to display.
- When the specified 3-Lead cable is used, the "ECG Lead Fault will display because the RL and C is not available.

WARNING: ***Do not use the following 3-Lead ECG cables with Passport XG (P/N's 0998-00-0133-xx, 0998-00-0134-xx and 0998-00-0137-xx): 0012-00-0620-05, -06, -07, -08; 0012-00-0722-05, -06, -07, 08; 0012-00-0723-05, -06, -07, -08; 0012-00-0724-05, -06, -07, -08. The above 3-Lead cables contain a jumper wire which connects RL (right leg) to LL (left leg). As a result, when you view aVR, aVL and aVF you will see the appropriate ECG waveforms (even though you are using a 3-lead cable). However, there may be excessive noise on these waveforms which can corrupt the heart rate calculation. See Section 5 in the Datascope P/N's 0070-00-397, 0070-00-0440, 0070-00-0503 of the Passport Operating Instructions for a list of the proper ECG cables.***

1.6.6.1 Adult Electrode Placement

For 5 Lead ECG Monitoring

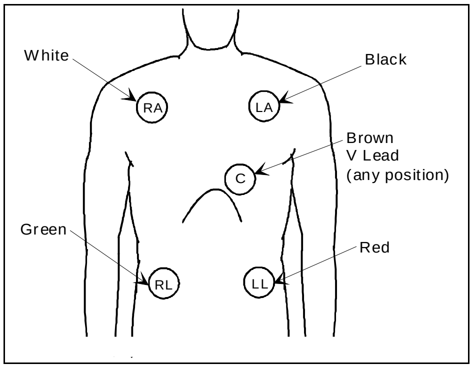


FIGURE 1-67 5 Lead Electrode Placement

- Place black electrode on left shoulder under clavicle.
- Place white electrode on right shoulder under clavicle.
- Place red electrode on lower left abdomen under the sixth rib.
- Place green electrode on lower right abdomen under the ribs.
- Place the brown lead in any one of the V lead (V1 - V6) positions, see

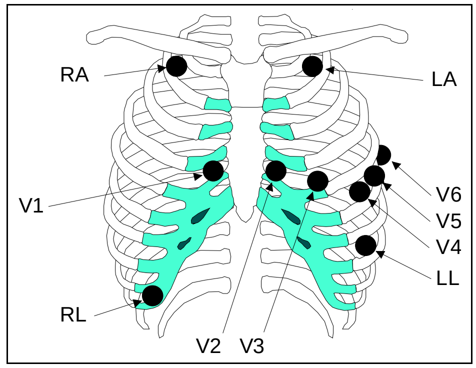


FIGURE 1-68 V-Lead Electrode Placement

- V1-Fourth intercostal space, right sternal border.
- V2-Fourth intercostal space, left sternal border.
- V3-Midway between V2 and V4 on a line joining these 2 locations.
- V4-Fifth interspace in mid-clavicular line.
- V5-Fifth interspace in anterior axillary line.
- V6-Fifth interspace in mid-axillary line.

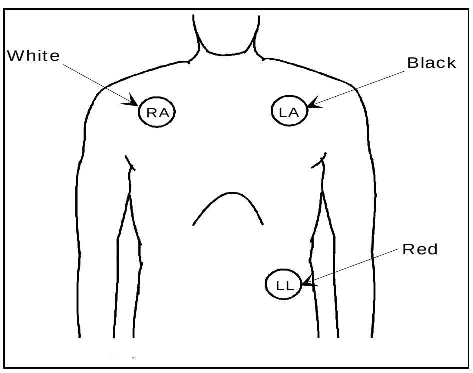


FIGURE 1-69 3 Lead Electrode Placement (standard configuration)

- Place black electrode on left shoulder under clavicle.
- Place white electrode on right shoulder under clavicle.
- Place red electrode on lower left abdomen under the sixth rib.

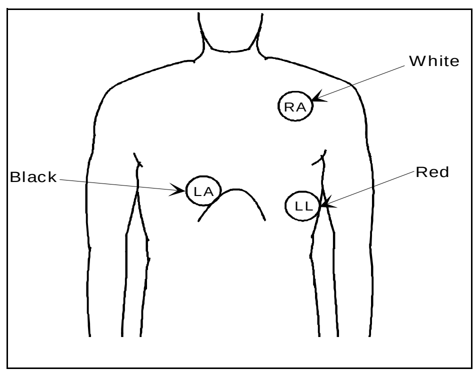


FIGURE 1-70 3-Lead Electrode Placement (for MCL)

- Place white electrode on left shoulder under clavicle.
- Place black electrode on right sternal border, 4th intercostal space.
- Place red electrode on midaxillary line, 5th intercostal space.

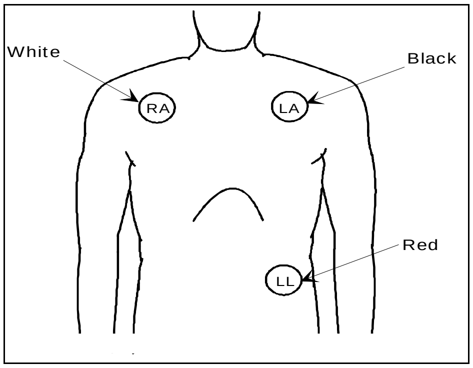


FIGURE 1-69 3 Lead Electrode Placement (standard configuration)

- Place black electrode on left shoulder under clavicle.
- Place lead select on lead II.

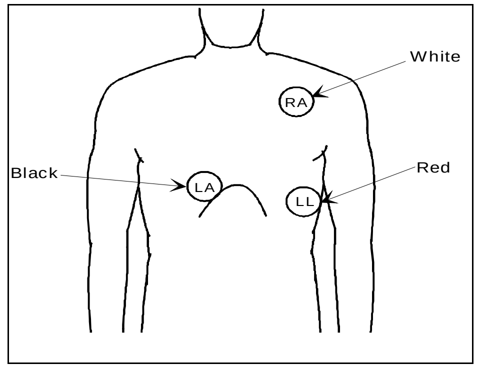


FIGURE 1-70 3-Lead Electrode Placement (for MCL)

- Place white electrode on left shoulder under clavicle.
- Select lead I for monitoring.
- For MCL, select lead II for monitoring.

1.6.6.2 Neonatal Electrode Placement

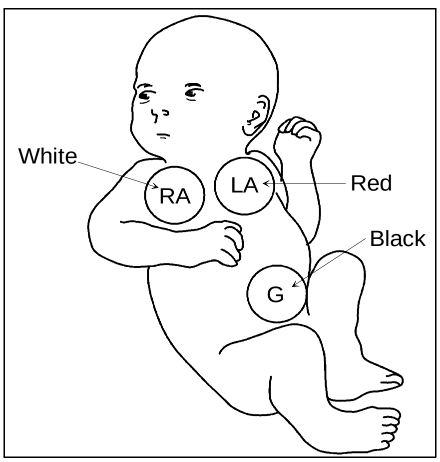


FIGURE 1-71 Neonatal Electrode Placement

Lead placement on the neonate with a three lead set is directed towards obtaining the best respiration waveform. The thoracic impedance is measured between the RA and LA electrodes therefore, the electrodes must be placed across the chest from each other to optimize measurement of chest movement.

1.6.7 Invasive Pressure Acquisition

1. Plug the pressure transducer into the PRESSURE TRANSDUCER connector (31) or (32) on the side panel.

2. To establish a monitoring site introduce an arterial pressure catheter into the patient's artery in accordance with standard hospital procedures. "Best practice," as determined by the medical community, should be observed.

NOTE: ***The arterial pressure catheter should not be used on a limb that is being utilized for any other medical procedure. For example, an I.V. catheter or an SpO_2 sensor.***

3. Connect catheter line with flushing device to the pressure transducer.
4. Zero pressure transducer as follows:

   Initially, a "TRANSDUCER NOT ZEROED" message is displayed in the parameter window, indicating the need to zero the transducer.

   a. Open transducer vent to atmosphere.
   b. Press ZERO (10) or (11) and hold for a minimum of one second.

      After one second has elapsed, an audible click will sound, and the automatic zero process is complete. The pressure display should indicate zeros.

NOTE: ***If the transducer offset should exceed 120 mmHg, it will not be possible to automatically zero the transducer. Pressure values will be —- and an "UNABLE TO ZERO" message replaces the "TRANSDUCER NOT ZEROED" message.***

5. Close the pressure transducer vent from atmosphere. If an IBP waveform is desired, use the Set-up menu (see "Use of Menus" on page 1-109), to assign a waveform window to display IBP. If the Auto Display function is used to display an IBP waveform, ensure that the Auto Display CO_2 is not set to the same waveform as Auto Display IBP. The Auto Display feature assigns a higher priority to the CO_2 function than IBP. Also, IBP1 has a higher priority than IBP2.
6. Select the desired pressure scale in the IBP Menu. The choices are: 37.5, 75, 150, or 300 mmHg.
7. Flush arterial line at regular intervals per standard hospital procedure.

NOTE: ***Pressure transducers are protected against the effects of defibrillation and electrocautery.***

1.6.8 Sequence for Establishing SpO_2

To obtain SpO_2 measurements, SpO_2 Heart Rate, and the plethysmographic waveform from the Passport Monitor: (see "Sequence for Establishing SpO_2 with Masimo® Pulse Oximetry" on page 1-124 for units with Masimo® SpO_2 and "Sequence for Establishing SpO_2 with Nellcor® Pulse Oximetry" on page 1-127 for units with Nellcor SpO_2)

1. Select the appropriate sensor for the patient.
   Guidelines for the selection of Datascope sensors are provided in Table 1-1 on page 1-124.
2. Plug the patient cable into the SpO_2 Connector (28) on the left side panel.
3. Apply sensor and connect to cable.

NOTE: ***Do not place the sensor on an extremity with an invasive catheter or blood pressure cuff in place.***

4. The digital SpO_2 values and SpO_2 heart rate will be displayed in the SpO_2 parameter window.
5. If a pleth waveform is desired, enter the set-up menu as described in “Use of Menus” on page 1-109, to display it as waveform 2.

NOTE: ***Set the Auto Display for IBP1 and CO_2 to either waveform 3 or Off. If either of these functions are set to waveform 2, they will have a higher priority to display, if they are detected.***

6. To change the size of the waveform displayed select the SpO_2 menu and chose the desired size. Choices are: 1, 2, 3 or 4.
7. Press BEEP VOLUME (21) to set the volume of the SpO_2 beep.
8. Set the “Sensor -Off Audio”, in the SpO_2 menu to the desired setting. Set to "OFF", the Passport will not give an audio beep when the SpO_2 sensor is off the patient. Set to “ON”, the Passport will give a one time series of 5 triple beeps. Set to “CONT”, the Passport will give a series of 5 triple beeps every 30 seconds.

1.6.8.1 Datascope Pulse Oximetry Sensors

A. Introduction

A wide range of Datascope sensors are available for connection to the Datascope Passport XG Monitor equipped with Datascope SpO_2. The sensors cover both short-term and long-term monitoring needs on patients ranging from neonates to large adults.

The DATASENSOR is intended for short-term adult monitoring.

The FLEXISENSOR® SD, available in five different sizes, provides both short-term and long-term monitoring for large adults, pediatrics, infants, and neonates. The FLEXISENSOR® SD is used when the DATASENSOR is not convenient or suitable.

An adult ear sensor is also available. It is intended for long-term adult monitoring.

A range of disposable bandages are available for use with the FLEXISENSOR® SDs. They are available in 3 styles, SENSOR GUARD™ (used for large adults, adults and pediatrics), Coban with SENSOR GUARD™ (used for infants) and LIGHTGUARD™ (used for neonates).

Use of the sensors does not cause any penetration of the skin, nor is there any electrical contact or transfer of excessive heat to the patient.

The sensor is composed of a light emitting diode (emitter) and a photo diode (detector). The emitter discharges two colors (wave lengths) of light into the patient’s extremity (finger, toe, ear). The detector receives that amount of light not absorbed by the blood or tissue components. The Passport then uses the relative absorption of the two light wavelengths to compute and display SpO_2 and Rate measurements.

The key benefits of the sensors are:

- electrocautery noise (ESU) rejection
- good motion artifact rejection
- tracking of weak peripheral pulse levels
- rejection of ambient light
- Can be re-sterilized (ETO sterilization - 3 times)
- patient isolation
- ease of application and removal
- long term patient comfort

- ***Electrocautery Noise (ESU) Rejection*** - The sensor configuration of both the DATASENSOR and the FLEXISENSOR® SD provide uninterrupted monitoring and absence of false alarms during the use of ESU (ESU can be set at any power level). This design prevents electro-surgical noise entering the monitor, via the sensor, and interfering with unit operation.
- ***Monitoring Restless Patients*** - Motion artifact rejection is achieved in several ways.
  1. The sensor design used with their recommended bandages assures a snug fit of the sensor to the patient.
  2. Light emitting diodes (LEDs) and detectors gather a strong signal from the patient.
  3. Software in the Passport evaluates the shape of each pulse and automatically rejects noisy and unreliable pulses.
  4. When in the presence of motion, the software adjusts the “averaging-period”, increasing it to a maximum of 15 seconds during motion, and automatically reducing it during quiet periods to obtain a fast response. This combination reduces the number of monitoring interruptions and false alarms from patient motion.
- ***Tracking of Weak Peripheral Pulse Levels*** - Many patients suffer poor peripheral perfusion due to hypothermia, hypovolemia, reduced cardiac output, etc. The Passport is designed to automatically increase its gain to track patients with poor peripheral perfusion.
- ***Rejection of Ambient Light*** - Many monitoring situations involve high levels of ambient light, i.e., operating room lights, neonatal phototherapy, heat warmers, etc. The Passport Monitor, sensors, and bandages each contribute to the rejection of ambient light. The monitor automatically measures and corrects for high levels of ambient light. The enclosed design of the DATASENSOR prohibits the interference of high levels of ambient light on adults with sensor operation. And the opaque material used in the composition of the bandages, which are used with the FLEXISENSOR® SD, helps keep out ambient light.
- ***Patient Comfort*** - The FLEXISENSOR® SD line is designed to work with a disposable bandage of three styles (SENSOR GUARD™, Coban and LIGHTGUARD™) which conform comfortably and safely to the particular patient’s anatomy.

B. Sensor Selection and Application

Selection of a specific sensor is based on the patient’s size, physical condition, and expected monitoring duration. General guidelines for the selection of a sensor are provided in the Sensor Selection Table, page 1-44. Instructions for the application of a sensor to a patient are provided in each sensor package.

C. Sensor Connection to the Passport Monitor

1. Align the cable connector on the sensor assembly with the SpO_2 Patient Connector (28) on the Passport XG Monitor.

2. Push the cable connector into the SpO_2 Patient Connector (28). Confirm that the cable connector is securely in place.

NOTE: ***To obtain maximum cable use, do not twist the cable connector when attaching to or disconnecting from the Passport XG Monitor.***

D. Sensor Inspection

Before use, always inspect sensors, cables, and connectors for damage, i.e., cuts and abrasions. Do not use the sensor, cable or connector if damaged. Replace with a good working sensor.

For long sensor life:

- Do not drop on the floor, or give other sharp shocks to the sensor(s). Between use, store the sensors in the optional FLEXISENSOR® SD Organizer, accessory pouch, or coil the sensor cable and store on the side of the Passport using the optional cable retainer. For accessory part number information see Section 5 in Datascope P/N's 0070-00-0397, 0070-00-0440, 0070-00-0503 of the Passport Operating Instructions.
- Avoid running any cart, bed, or any piece of equipment over the sensor cable.
- Avoid strong pulls on the sensor cable.
- Watch for cracks in the DATASENSOR housing.
- Watch for cracks, cuts, rips, fogging, or signs of moisture in the FLEXISENSOR® SD.

E. Sensor Performance

For the BEST performance of all Datascope sensors:

- DO NOT PLACE any sensor on an extremity with an arterial catheter or blood pressure cuff in place. Placement of an arterial catheter or blood pressure cuff on an extremity may obstruct normal blood flow. False pulse rate information may result if the FLEXISENSOR® SD is placed on that same extremity. Place the sensor on the limb opposite the site of the arterial catheter or blood pressure cuff.
- Encourage the patient to remain still. Patient motion may affect the sensor's performance. If it is not possible for the patient to remain still, replace the sensor bandage on the FLEXISENSOR® SD to assure good adhesion, or change the site of the DATASENSOR.
- Check the DATASENSOR site every 2 hours and check the FLEXISENSOR® SD site every 8 hours on adults and every 4 hours on neonatal patients for indications of skin abrasions, sensor displacement, sensor damage, or circulation impairment. Check the sensor site every 4 hours if the ear clip is used. If necessary, remove and reapply the sensor. If any of the above mentioned indications occur, immediately remove the sensor and find an alternate site.

NOTE: ***Check the sensor site more frequently on infant and active patients.***

- Incorrect placement can also reduce the acquired sensor signal, and therefore compromise performance. Select an alternate site (toe) or use a FLEXISENSOR® SD if the sensor can not be placed on the patient's finger correctly or if the fingernails interfere with the acquisition of a reliable signal.
- Use of the DATASENSOR is not recommended for long-term monitoring (4-6 hours). For monitoring situations exceeding 4-6 hours, either reposition the DATASENSOR every 2-4 hours to a different site (finger/toe) or use a FLEXISENSOR® SD with its appropriate bandage.
- Do not over-tighten the sensor bandages. Excessive pressure on the monitoring site can affect SpO_2 readings and may reduce readings below true SpO_2. Excessive pressure can also result in pressure necrosis and other skin damage.
- Sensor configuration provides uninterrupted monitoring in the following situations:

  Electro-cautery Noise - ESU rejection is designed into the sensors.

  Motion Artifact - The monitor's software adjusts the "averaging period" increasing it during motion and reducing it during inactivity. This decreases the number of monitoring interruptions and false alarms.

  Weak Peripheral Pulses - The monitor's gain is automatically increased to track pulses on patients with decreased peripheral perfusion.
- SpO_2 measurements may interfere with Magnetic Resonance Imaging (MRI) procedures.
- SpO_2 is calibrated to display functional saturation.

SENSORS	***LARGE ADULT (LA)***	***ADULT (A)***	***PEDIATRIC (P)***	***INFANT (I)***	***NEONATE (N)***	***ADULT EAR (AE)***	***DATASENSOR***
Approximate Patient Weight	>80kg/>176 lbs	30 -90kg/ 66 - 198 lbs	10 - 40kg/ 22 - 88 lbs	4.5 - 10kg/ 10 - 22 lbs	Up to 5kg/ Up to 11 lbs	>40kg/>88 lbs	40+ kg/90+ lbs
Where Used	Fingers, Toes	Fingers, Toes	Fingers, Toes	Feet, Palms, Big Toes	Feet, Palms, Heel,Calf	Adult Ear	Fingers, Toes
Long or Short Term Monitoring	Long & Short Term	Long & Short Term	Long & Short Term	Long & Short Term	Long & Short Term	Long & Short Term	Short Term
ESIS	Included	Included	Included	Included	Included	Included	Included
Reusable	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes Up to 20 Uses	Yes 6-Months
Bandage Type	Adhesive, Disposable	Adhesive, Disposable	Adhesive, Disposable	Non-Adhesive*, Disposable	Non-Adhesive* Disposable	N/A	N/A
**Part Numbers Sensors	0998-00-0076-06	0998-00-0076-05	0998-00-0076-04	0998-00-0074-03	0998-00-0074-04	0998-00-0074-05	0600-00-0026-01 (3" sensor cable)***
Bandages	0683-00-0409-01	0683-00-0409-02	0683-00-0409-03	0683-00-0415	0683-00-0440	N/A	N/A

* *Non-adhesive bandages are recommended for premature infants to minimize prenatal skin damage.*

** *See Accessories, Chapter 5, for more detailed information.*

*** *Additional choices: 0060-00-0026-02 (10' sensor cable) 0020-00-0071-01 (3' sensor cable plus 7' extension cable)*

1.6.9 Sequence for Establishing SpO_2 with Masimo® Pulse Oximetry *

1. Select the appropriate sensor for the patient from the table below. All sensors below are non-sterile and can be used during patient movement.

TABLE 1-1 Masimo® Sensor Family

SELECTION	PART NUMBER	PATIENT SIZE	DISPOSABLE / REUSABLE
LNOP® - Adt Adult Disposable Finger Sensor	0600-00-0043-01	> 30 kg.	Disposable
LNOP® -Pdt Pediatric/Slender Digit Disposable Sensor	0600-00-0044-01	10 to 50 kg.	Disposable
LNOP® - Neo Neonatal Disposable Sensor	0600-00-0045-01	> 2000 gm.	Disposable
LNOP® - Neo Pt Neonatal Pre-term Disposable Sensor	0600-00-0046-01	< 2000 gm.	Disposable
LNOP® - DC1 Adult Reusable Finger Sensor	0600-00-0047	> 30 kg.	Reusable
LNOP® DCSC Adult Reusable Spot Check Sensor	0600-00-0077	> 30 kg.	Reusable
LNOP® YI Multisite Reusable Sensor	0600-00-0078	> 1 kg.	Reusable
LNOP® EAR Reusable Ear Sensor	0600-00-0079	> 30 kg.	Reusable

2. Attach the PC12 Patient Cable (P/N 0012-00-1099-02) to the sensor and plug the other end of the patient cable into the SpO_2 connector (28) located on the left side panel of the monitor.

* *This feature applicable only if available / installed in your unit.*

NOTE: The PC12 Patient Cable is not used with the LNOPDCSC Sensors.

NOTE: Do not place the sensor on an extremity with an invasive catheter or blood pressure cuff in place.

NOTE: Ensure proper routing of patient cable to avoid entanglement and/or strangulation.

WARNING: When equipped with Nellcor® SpO_2, use only Nellcor® oxygen transducers including Nellcor® OXISENSOR™ patient dedicated adhesive sensors. Use of other oxygen transducers may cause improper oximeter performance.

WARNING: Tissue damage or inaccurate measurements may be caused by incorrect sensor application or use, such as wrapping it too tightly, applying supplemental tape, failing to inspect the sensor site periodically, or failing to position it appropriately. Carefully read the sensor directions for use, the Passport operating instructions, and all precautionary information before use.

WARNING: Excessive ambient light may cause inaccurate measurements. Cover the sensor site with opaque material.

WARNING: Inaccurate measurements may be caused by incorrect sensor application or use; significant levels of dysfunctional hemoglobins, (e.g., carboxyhemoglobin or methemoglobin); or intra-vascular dyes such as indocyanine green methylene blue; exposure to excessive illumination, such as surgical lamps (especially ones with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight; excessive patient movement; venous pulsations; electro-surgical interference; and placement of a sensor on an extremity that has a blood pressure cuff, arterial catheter, or intra-vascular line.

WARNING: In certain situations in which perfusion and signal strength are low, such as in patients with thick or pigmented skin, inaccurately low SpO_2 readings will result. Verification of oxygenation should be made, especially in preterm infants and patients with chronic lung disease, before instituting any therapy or intervention.

WARNING: Many patients suffer from poor peripheral perfusion due to hypothermia, hypovolemia, severe vasoconstriction, reduced cardiac output, etc. These symptoms may cause a loss in vital sign readings.

WARNING: The site should be checked at least every eight (8) hours (every four (4) hours with the Adult re-usable finger sensor). Ensure proper adhesion, skin integrity, and proper alignment. Nail polish and fungus may effect readings. Exercise extreme caution with poorly perfused patients. Skin erosion and pressure necrosis can be caused when sensors are not frequently monitored. Assess the site every two (2) hours with poorly perfused patients.

WARNING: If the sensor or patient cable is damaged in any way, discontinue use immediately. To prevent damage do not soak or immerse the sensor in any liquid solution. Do not attempt to sterilize.

3. The digital SpO_2 value will be displayed in the Parameter Window.
4. If a pleth waveform is desired, enter the set-up menu as described in “Use of Menus” on page 1-109, to display it as Waveform 2.

NOTE: Set the Auto Display for IBP1 and CO_2 to either waveform 3 or Off. If either of these functions are set to waveform 2, they will have a higher priority to display, if they are detected.

5. Press the BEEP VOLUME (21) to set the volume of the SpO_2 beep.
6. Set the “Sensor -Off Audio”, in the SpO_2 menu to the desired setting. Set to "OFF", the Passport will not give an audio beep when the SpO_2 sensor is off the patient. Set to “ON”, the Passport will give a one time series of 5 triple beeps. Set to “CONT”, the Passport will give a series of 5 triple beeps every 30 seconds.

1.6.9.1 Masimo® Sensors and Patient Cable

Masimo® provides a family of sensors suitable for a wide variety of clinical settings and patients. Specific sensors have been developed for neonates, infants, children, and adults. All sensors are indicated for continuous noninvasive monitoring of arterial oxygen saturation (SpO_2) and pulse rate. The LNOP DCSC Adult Reuable Spot Check Sensor is used for ‘‘Spot Check’’ applications. The LNOP® - DC1 Adult Re-usable Finger Sensor can also be used for “spot check” applications if needed. All sensors are intended for “single-patient use only” unless indicated as ‘‘reusable’’.

Selecting a Sensor

Sensors are designed for specific sites on patients with designated weight ranges. To select the appropriate sensor, consider the patient’s weight, level of activity, adequacy of perfusion, which sensor sites are available and the anticipated duration of monitoring.

Cleaning And Re-use

The sensor may be reattached to the same patient if the emitter and detector windows are clear and the adhesive still adheres to the skin. The adhesive can be partially rejuvenated by wiping with an alcohol wipe and allowing the sensor to thoroughly air dry prior to replacement on the patient.

Performance Considerations

To insure optimal performance, use an appropriate sensor, apply it as directed, and observe all warnings and cautions.

If excessive ambient light is present, cover the sensor site with opaque material. Failure to do so may result in inaccurate measurements. Light sources that can affect performance include surgical lights, especially those with a xenon light source, bilirubin lamps, fluorescent lights, infrared heating lamps, and direct sunlight.

In the event that you are unable to get any reading, or the reading you get is inaccurate, consider the following:

- If your patient is poorly perfused, try applying the sensor to another site - such as a different finger or toe.
- Check that the sensor is properly aligned.
- In electrosurgery, make sure sensor is not too close to ESU devices or cables.
- Check to make sure the site area is clean/non-greasy, clean site and sensor if needed. Nail polish and fungus should be removed.
- Excessive patient motion can affect readings and may cause a “SpO_2 Interference” message to be displayed. Encourage the patient to remain still. If this is not possible try moving the sensor to another site.

If patient movement presents a problem:

- Verify that the sensor is properly and securely applied.
- Use a new sensor with fresh adhesive backing.
- Move the sensor to a less active site.
- Ensure proper sensors are used for the proper application. For instance, LNOP® - Adt Adult Disposable Finger Sensors are not intended for use across a child's hand or foot.

1.6.9.2 Special Features

Automatic Calibration

The oximetry subsystem incorporates automatic calibration mechanisms. It is automatically calibrated each time it is turned on, at periodic intervals thereafter, and whenever a new sensor is connected. Also, the intensity of the sensor's LEDs is adjusted automatically to compensate for differences in tissue thickness.

Each sensor is calibrated when manufactured; the effective mean wavelength of the red LED is determined and encoded into a calibration resistor in the sensor plug. The instrument's software reads this calibration resistor to determine the appropriate calibration coefficients for the measurements obtained by that sensor.

Oximetry Sensitivity Modes and Post Average Time

The Passport has two sensitivity modes for SpO_2, normal and high. The user should choose the sensitivity mode depending upon signal quality and patient motion. In most cases, the normal setting will be appropriate. If the patient motion is limited, high sensitivity can be used. High sensitivity will provide a better reading, however detection of a "SpO_2 SENSOR OFF" condition will be less.

The Passport has the ability to change the averaging of the Saturation, Pulse Rate, and Signal Strength measurements for SpO_2. The post average time can be changed to 4,6,8,10,12,14 or 16 seconds.

Pleth Auto Scaling

The Pleth waveform is automatically scaled when using Masimo® SpO_2. There is no adjustment that can be made to the pleth waveform size.

Changing Sensitivity Modes

To change the sensitivity mode, select SpO_2 in the menu and toggle the sensitivity mode choices for normal and high. Press SELECT (2) and EXIT (3) to lock in the choice and return to monitoring mode. See "Use of Menus" on page 1-109.

Changing Post Average Time

To change the post average time, select SpO_2 in the menu and set the post average time between 4 and 16. Press SELECT (2) and EXIT (3) to lock in the choice and return to monitoring mode. See "Use of Menus" on page 1-109.

1.6.10 Sequence for Establishing SpO_2 with Nellcor® Pulse Oximetry *

1. Select the appropriate sensor for the patient see table on page 1-51.

2. Plug the sensor directly into the SpO_2 connector (28) located on the left side panel of the monitor or if necessary, use a Nellcor® EC-4 or EC-8 sensor extension cable.

NOTE: ***Do not place the sensor on an extremity with an invasive catheter or blood pressure cuff in place.***

WARNING: ***When equipped with Nellcor® SpO_2, use only Nellcor® oxygen transducers including Nellcor® OXISENSOR™ patient dedicated adhesive sensors. Use of other oxygen transducers may cause improper oximeter performance.***

WARNING: ***Tissue damage or inaccurate measurements may be caused by incorrect sensor application or use, such as wrapping it too tightly, applying supplemental tape, failing to inspect the sensor site periodically, or failing to position it appropriately. Carefully read the sensor directions for use, the Passport operating instructions, and all precautionary information before use.***

WARNING: ***Excessive ambient light may cause inaccurate measurements. Cover the sensor site with opaque material.***

WARNING: ***Inaccurate measurements may be caused by incorrect sensor application or use; significant levels of dysfunctional hemoglobins, (e.g., carboxyhemoglobin or methemoglobin); or intra-vascular dyes such as indocyanine green methylene blue; exposure to excessive illumination, such as surgical lamps (especially ones with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight; excessive patient movement; venous pulsations; electro-surgical interference; and placement of a sensor on an extremity that has a blood pressure cuff, arterial catheter, or intra-vascular line.***

WARNING: ***In certain situations in which perfusion and signal strength are low, such as in patients with thick or pigmented skin, inaccurately low SpO_2 readings will result. Verification of oxygenation should be made, especially in preterm infants and patients with chronic lung disease, before instituting any therapy or intervention.***

WARNING: ***If the sensor or patient cable is damaged in any way, discontinue use immediately. To prevent damage do not soak or immerse the sensor in any liquid solution. Do not attempt to sterilize.***

3. The digital SpO_2 value will be displayed in the Parameter Window.

4. If a pleth waveform is desired, enter the set-up menu as described in “Use of Menus” on page 1-109, to display it as Waveform 2.

NOTE: ***Set the Auto Display for IBP1 and CO_2 to either waveform 3 or Off. If either of these functions are set to waveform 2, they will have a higher priority to display, if they are detected.***

5. Press the BEEP VOLUME (21) to set the volume of the SpO_2 beep.
6. Set the “Sensor -Off Audio”, in the SpO_2 menu to the desired setting. Set to "OFF", the Passport will not give an audio beep when the SpO_2 sensor is off the patient. Set to “ON”, the Passport will give a one time series of 5 triple beeps. Set to “CONT”, the Passport will give a series of 5 triple beeps every 30 seconds.

* *This feature applicable only if available / installed in your unit.*

1.6.10.1 Nellcor® Sensors

Nellcor® provides a family of sensors suitable for a wide variety of clinical settings and patients. Specific sensors have been developed for neonates, infants, children, and adults. OXISENSOR™ oxygen transducers are sterile adhesive sensors with optical components mounted on adhesive tape. OXIBAND® oxygen transducers and the DURAFORM™ oxygen transducer system are reusable sensors that are applied with disposable adhesive. The DURASENSOR® DS-100A adult digit oxygen transducer is a reusable sensor with its optical components mounted in a plastic casing. The Nellcor® RS-10 reflectance oxygen transducer is an adhesive sensor for application to forehead or temple.

NOTE: Nellcor®, OXIBAND® and DURASENSOR® are registered trademarks of Nellcor® Incorporated. OXISENSOR™ and DURAFORM™ are trademarks of Nellcor Incorporated.

Selecting a Sensor

Sensors are designed for specific sites on patients with designated weight ranges. To select the appropriate sensor, consider the patient's weight, level of activity, adequacy of perfusion, which sensor sites are available, whether sterility is required, and the anticipated duration of monitoring.

Cleaning and Re-use

Do not immerse any OXISENSOR™, DURASENSOR®, OXIBAND®, or DURAFORM™ oxygen transducer, the Nellcor® RS-10 oxygen transducer, or any Nellcor® adhesive in water or cleaning solution. Clean DURASENSOR®, OXIBAND®, and DURAFORM™ oxygen transducers, and the Nellcor® RS-10 oxygen transducer by wiping with a disinfectant such as 70% alcohol. Do not sterilize by irradiation, steam, or ethylene oxide. Use a new OXIBAND® adhesive wrap or FORM-A adhesive bandage for each patient. Do not re-sterilize OXISENSOR™ oxygen transducers.

Performance Considerations

To insure optimal performance, use an appropriate sensor, apply it as directed, and observe all warnings and cautions.

If excessive ambient light is present, cover the sensor site with opaque material. Failure to do so may result in inaccurate measurements. Light sources that can affect performance include surgical lights, especially those with a xenon light source, bilirubin lamps, fluorescent lights, infrared heating lamps, and direct sunlight.

If poor perfusion affects instrument performance, and the patient weighs more than 50 kg (110 lbs.), consider using the OXISENSOR™ R-15 adult nasal oxygen transducer. Because the R-15 obtains its measurements from the nasal septal anterior ethmoid artery, an artery supplied by the internal carotid, this sensor may obtain measurements when peripheral perfusion is relatively poor. For low peripheral perfusion, consider using the Nellcor® RS-10 reflectance oxygen transducer, which is applied to the forehead or temple.

If patient movement presents a problem:

- Verify that the sensor is properly and securely applied.
- Use a new sensor with fresh adhesive backing.
- Move the sensor to a less active site.
- Use a type of sensor that tolerates some patient motion, such as the OXISENSOR™ D-25, D-20, N-25, or I20 oxygen transducer.

TABLE 1-1 Nellcor® SENSOR FAMILY

SELECTION GUIDE	D25/D25L ADULT	R-15 ADULT	N-25 NEONATAL	I-20 INFANT	D-20 PEDIATRIC	RS-10 ADULT
Patient Size	>30 kg	>50 kg	<3 kg >40 kg	1-20 kg	10-50 kg	>40 kg
Duration of Use	Short or Long Term	Short or Long Term	Short or Long Term	Short or Long Term	Short or Long Term	Short Term
Sterility	Sterile1	Sterile1	Sterile1	Sterile1	Sterile1	Non-sterile
Patient Activity	Limited Activity	Inactive	Limited Activity	Limited Activity	Limited Activity	Limited Activity
	OXISENSOR adult digit oxygen transducer	OXISENSOR adult nasal oxygen transducer	OXISENSOR neonatal oxygen transducer	OXISENSOR infant digit oxygen transducer	OXISENSOR pediatric digit oxygen transducer	RS-10 reflectance oxygen transducer

1 *In an unopened, undamaged package.*

All Nellcor® accessories and sensors must be purchased form Nellcor® Inc., 25495 Whitehall Street, Hayward, Ca. 94545. To contact Nellcor®, call 1-800-NELLCOR.

1.6.10.2 Special Features

Automatic Calibration

The oximetry subsystem incorporates automatic calibration mechanisms. It is automatically calibrated each time it is turned on, at periodic intervals thereafter, and whenever a new sensor is connected. Also, the intensity of the sensor's LEDs is adjusted automatically to compensate for differences in tissue thickness.

Each sensor is calibrated when manufactured; the effective mean wavelength of the red LED is determined and encoded into a calibration resistor in the sensor plug. The instrument's software reads this calibration resistor to determine the appropriate calibration coefficients for the measurements obtained by that sensor.

Oximetry Operating Modes

The Passport's three operating modes for SpO_2 enable it to make accurate measurements despite differing levels of patient activity. In all three modes, the Passport updates its measurements with every pulse beat. Data from the most recent beat replaces data from the earliest beat and new averages are determined and displayed. The three modes are: 1 (default setting), 2, and 3.

1. The default operating mode, uses a 5 to 7 second averaging time and is useful in situations in which the patient is relatively inactive.

2. This mode uses a 2 to 3 second averaging time and therefore is more affected by patient motion. It is useful for special applications that require a fast response time, such as sleep studies.

3. This mode uses a 10 to 15 second averaging time and consequently is least affected by patient motion. In this mode, if SpO_2 has been selected as the source for pule rate information, pulse rate is not displayed and there is no pulse tone.

Pleth Auto Scaling

The Pleth waveform is automatically scaled when using Nellcor® SpO_2. There is no adjustment that can be made to the pleth waveform size.

Changing Operating Modes

To change from 1 to 2 or 3, select SpO_2 in the menu and toggle through the choices of 1, 2, and 3 using the up and down arrow keys. Press SELECT (2) then EXIT (3) to lock the choice in and return to monitoring mode. See “Use of Menus” on page 1-109 for details on using menus.

The operating mode will be displayed in the pleth waveform window.

1.6.11 Respiration Monitoring

The Passport XG Monitor offers two kinds of respiratory monitoring: thoracic impedance and CO_2 waveform. Both methods offer certain benefits and limitations. A respiration source must be selected, see “Resp Menu” on page 1-179.

WARNING: Thoracic respiration measurement may interfere with some pacemakers. Refer to the pacemaker’s manual.

1.6.11.1 Thoracic Impedance

The Passport XG Monitor presents a small electrical signal across the RA and LA ECG limb leads. This signal changes as the patient’s chest wall rises and falls during the breath cycle. The advantage of the thoracic impedance method is that respiration is obtained non-invasively and without any extra cost. It is important to use cables with internal resistors for Thoracic Impedance, see Section 5 in the Datascope P/N’s 0070-00-0397, 0070-00-0440, 0070-00-0503 Passport Operating Instructions for a list of cables.

Choke blocks are electrical filters that may be used in electro-cautery environments where ECG interference can be substantial. These filters remove the electro-cautery noise, but also block the signal used by the Passport XG Monitor to measure respiration.

The filling and emptying of the heart chambers can interfere with the thoracic impedance signal, so called cardiovascular artifact (CVA), such that the respiratory signal matches the heart rate. The Passport XG warns the operator when the respiration value equals the heart rate by displaying the CVA message.

If the patient’s airway is obstructed and the patient attempts to breath, then the chest wall can move and create a respiratory signal even though no gas flow is occurring to the patient.

1.6.11.2 CO_2 Waveform

When used with the optional mainstream/sidestream CO_2 or optional Gas Module the Passport XG may use the breath waveform to report the respiration rate by measuring the actual breaths per unit time. The advantage of the CO_2 waveform method is that the signal is a direct result of respiration and can only occur if the patient is actually breathing. Refer to Section 1.6.12 on page 1-134 through Section 1.6.14 on page 1-146 for more details on the above options for CO_2 monitoring.

1.6.11.3 Respiration Monitoring on the Passport XG

1.6.11.3.1 Thoracic Impedance

1. Select the SET-UP menu.
2. Select WAVEFORM 3 and set to RESP (if waveform desired).

NOTE: ***Set the Auto Display for IBP1, IBP2 and CO_2 to either waveform 2 or Off. If any of these functions are set to waveform 3, they will have a higher priority to display, if they are detected.***

3. Press the SELECT key (2), then the EXIT key (3).
4. Select RESP menu, choose RESP SOURCE and set to ECG.
5. Press the SELECT key (2), then the EXIT key (3).

1.6.11.3.2 CO_2 Waveform (requires optional mainstream/sidestream CO_2 or Gas Module)

1. Select the SET-UP menu.
2. Select Auto Display CO_2 and set to waveform 3 (if waveform desired).
3. Press the SELECT key (2), then the EXIT key (3).
4. Select RESP menu, choose RESP SOURCE and set to CO_2/Off or CO_2/ECG.
5. Press the SELECT key (2), then the EXIT key (3).

NOTE: ***Refer to "Resp Menu" on page 1-179 for further information on RESP SOURCE settings.***

1.6.12 Mainstream CO_2 Gas Monitoring

The Passport XG offers the Capnostat® mainstream and sidestream method of measuring respiratory rate and end tidal CO_2. (For Sidestream CO_2 information, see "Sidestream CO_2 Gas Monitoring" on page 1-139) Capnostat® requires a hardware option within the Passport XG Monitor. It utilizes a large lumen adapter which is placed directly into the endotracheal tube.

1.6.12.1 Sequence for Establishing Mainstream Capnostat® CO_2

1. Plug the CO_2 sensor into the Passport XG CO_2 connector (34). The "Sensor Warming Up" message is displayed.

NOTE: ***The CO_2 waveform displays while the sensor is warming up, however numeric data will not be available until the "Sensor Warming Up" message disappears.***

2. Select CO_2 / Off or CO_2 / ECG as the Resp. Source in the Resp Menu.
3. Snap a clean airway adapter into the U-shaped sensor. Align the arrow on the bottom of the adapter with the arrow on the bottom of the sensor.
4. Position the airway adapter between the endotracheal tube and the Y-piece of the breathing circuit.
5. When the Passport XG has detected valid breaths, numeric data will display for $ETCO_2$, Inspired CO_2 and Respiratory Rate.
6. Using the Setup Menu, select the "Auto Display CO_2" waveform to be displayed on Waveform 2 or Waveform 3.
7. If desired, the CO_2 waveform scale can be changed by entering the CO_2 menu. See "Use of Menus" on page 1-109 for details. The CO_2 menu also has provisions for N_2O and O_2 compensation.

NOTE: ***See "User Configuration Mode" on page 1-153 for Barometric Pressure and CO_2 Units selection.***

NOTE: ***See "CO_2 Messages (only units equipped with Capnostat CO_2)" on page 1-162 for more details on messages.***

1.6.12.2 Adapter Calibration

Adapter calibration compensates for the optical differences between the adult and neonatal airway adapters for mainstream CO_2 operation.

Adapter calibration needs to be performed each time the type of airway adapter is switched. For example: if switching from using a re-usable adult to a neonatal or neonatal to a re-usable adult adapter, a calibration is needed (not if switching from a re-usable adult adapter to another re-usable adult adapter). Adapter calibration should also be performed if the message "Check Adapter" displays.

NOTE: ***In order to perform an accurate adapter calibration, the "Sensor Warming Up" message must not be displayed.***

To perform an adapter calibration:

1. Place the sensor and airway adapter away from all sources of CO_2 (including the patient's and your own exhaled breath, and ventilator exhaust valves).

2. Choose Start Adapter Cal - Yes from the CO_2 menu. (See "Use of Menus" on page 1-109.)

NOTE: ***If the monitor detects changing CO_2 levels (breaths) during an adapter calibration, a "Breaths Detected ... Retry" message displays, and then an "Adapter Cal Failure" message will display. Remove the source of CO_2 and repeat the calibration.***

1.6.12.3 Adapter Selection

Selection of an airway adapter is based on the diameter of the patient's endotracheal tube. There are two sizes of airway adapters available:

Adult (For use on patients with endotracheal tube diameters > 4.0 mm):

- Re-useable Adult Airway Adapter (P/N 0103-15-0003).
- Disposable Adult Airway Adapters (P/N 0103-00-0410-02 for 10 piece package or P/N 0103-00-0410-03 for 25 piece package).

Neonatal (For use on patients with endotracheal tube diameters â 4.0 mm):

- Re-usable Neonatal Airway Adapter (P/N 0103-15-0013). Disposable
- Neonatal Airway Adapters are not available at this time.

1.6.12.4 Use of Adult Airway Adapter

The adult airway adapter should be used when monitoring patients with endotracheal tube diameters greater than 4.0 mm.

1. Verify the windows are clean and dry. Clean or replace the adapter if necessary.
2. Snap the airway adapter into the Capnostat® sensor. Align the arrow on the bottom of the airway adapter with the arrow on the bottom of the Capnostat®. Press the sensor and airway adapter together until they “click”.
3. If necessary, perform an adapter calibration. See “Adapter Calibration” on page 1-135.
4. Place the Capnostat® / airway adapter assembly between the elbow and the ventilator circuit wye.

NOTE: ***For optimal results, DO NOT place the airway adapter between the endotracheal tube and the elbow, as this may allow patient secretions to block the adapter windows.***

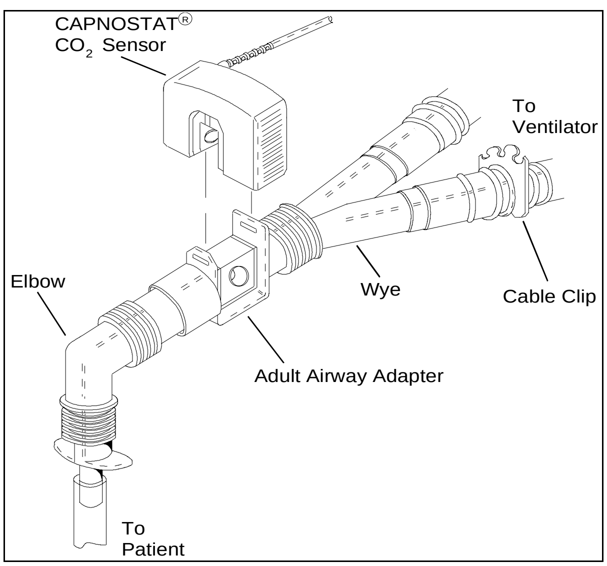


FIGURE 1-72 Adult Airway Adapter

NOTES: For optimal results, DO NOT place the airway adapter between the endotracheal tube and the elbow, as this may allow patient secretions to block the adapter windows.

Position the airway adapter with it's windows in a vertical and NOT a horizontal position. This helps keep patient secretions from "pooling" on the windows.

5. Check that the connections have been made correctly by verifying a proper CO_2 waveform (capnogram) on the monitor display.

NOTE: ***The CO_2 waveform is displayed by choosing Auto Display CO_2 as Waveform 2 or 3 and the Resp. Source as CO_2/Off or CO_2/ECG in the Resp menu.***

6. The sensor cable should face away from the patient. To secure the sensor cable safely out of the way, attach the sensor cable holding clips to the airway tubing, then connect the sensor cable to the clips.

1.6.12.5 Use of Neonatal Airway Adapter

The neonatal airway adapter should be used when monitoring patients with endotracheal tube diameters less than or equal to 4.0 mm.

1. Verify the windows are clean and dry. Clean or replace the adapter if necessary.
2. Snap the airway adapter into the Capnostat® sensor. Align the arrow on the bottom of the airway adapter with the arrow on the bottom of the Capnostat®. Press the sensor and airway adapter together until they "click".
3. If necessary, perform an adapter calibration. See "Adapter Calibration" on page 1-135.
4. Place the Capnostat® / airway adapter assembly between the elbow and the ventilator circuit wye.

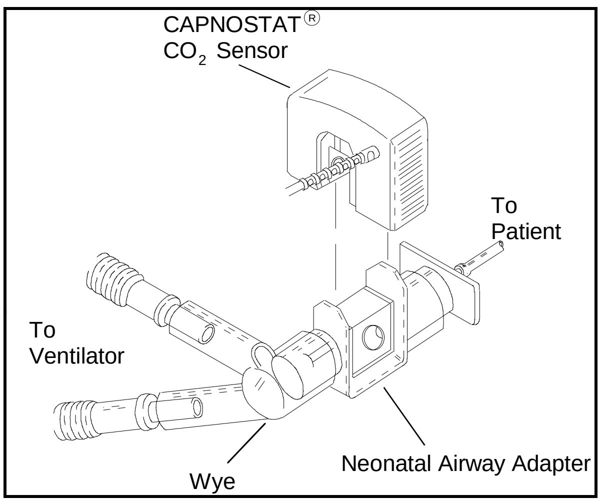


FIGURE 1-73 Neonatal Airway Adapter

NOTES: For optimal results, DO NOT place the airway adapter between the endotracheal tube and the elbow, as this may allow patient secretions to block the adapter windows.

Position the airway adapter with it's windows in a vertical and NOT a horizontal position. This helps keep patient secretions from "pooling" on the windows.

5. Check that the connections have been made correctly by verifying a proper CO_2 waveform (capnogram) on the monitor display.

NOTE: ***The CO_2 waveform is displayed by choosing Auto Display CO_2 as Waveform 2 or 3 and the Resp Source as CO_2/Off or CO_2/ECG in the Setup menu.***

6. The sensor cable should face away from the patient. To secure the sensor cable safely out of the way, attach the sensor cable holding clips to the airway tubing, then connect the sensor cable to the clips.

1.6.12.6 CO_2 Sensor Calibration Verification

Calibration can be verified at anytime and should be verified at least once a week.

To verify calibration:

1. Verify the Passport is turned on and the Capnostat® is connected and warmed-up.
2. Place the Capnostat® sensor onto the reference cell labeled REF.

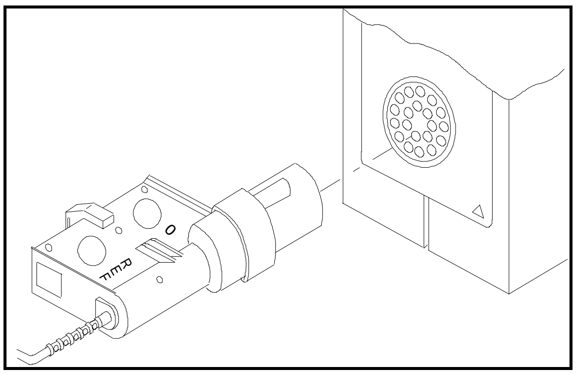


FIGURE 1-74 Reference Cell

3. The “Sensor on Reference Cell” message is displayed and the reference value is displayed in the $ETCO_2$ window. The value should be between 36 and 40 Torr.

1.6.12.7 CO_2 Sensor Calibration

The Capnostat® CO_2 sensor does NOT need to be calibrated at each monitor power up.

Calibration of a sensor is required the first time a particular sensor is connected to a particular monitor and when the monitor requests it.

Once a sensor is calibrated, the Passport XG can be turned off and on, the sensor can be unplugged and reconnected, without having to recalibrate. However, if a second sensor is connected in place of the original, the second sensor must be calibrated and if the original sensor is used again, it too will have to be recalibrated.

NOTE: ***In order to perform an accurate Sensor calibration, the “Sensor Warming Up” message must not be displayed.***

To perform a Capnostat® sensor calibration:

1. Verify the Passport XG is turned on and the Capnostat® is plugged in and warmed-up.

2. Place the Capnostat® onto the ZERO cell.

3. The "Sensor on Zero Cell" message is displayed.

4. Select Start Zero Cal - Yes from the CO_2 menu. The "Zero Cal in Progress" message is displayed. The" Zero Cal Complete" message is displayed when complete and a 0 value is displayed.

5. Remove sensor from the zero cell and place onto the airway adapter.

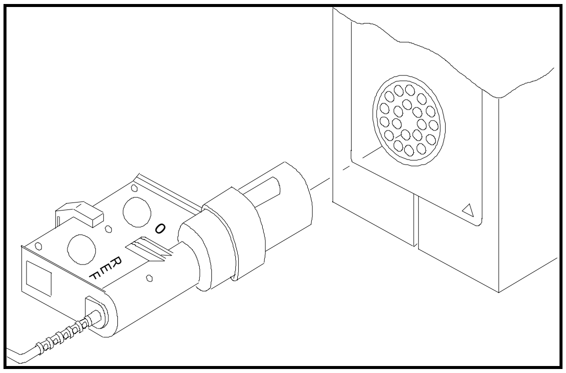


FIGURE 1-75 Zero Cell

1.6.13 Sidestream CO_2 Gas Monitoring

Sidestream Capnography is a technique used for measuring the CO_2 in the respiration of adult and pediatric patients. Sidestream capnography can be acquired via a nasal cannula (non-intubated) or through a sampling line connected to a breathing circuit (intubated).

WARNING: The maximum sampling rate at the nasal cannula is 200 ml/min. This device should not be used on patients whose breathing could be impaired by this vacuum flow rate.

WARNING: Connection of the Passport's exhaust port to the hospital's waste gas scavenge system is recommended to prevent exposure of hospital personnel to the patient's respiratory sample.

The sidestream application has an inherent start-up delay. For situations where time to waveform is critical the mainstream application is quicker.

The sidestream application has an inherent CO_2 measurement delay caused by the time the sample takes to travel from the monitoring site to the sampling airway adapter. The longer and/or wider the sampling tube, the longer the delay.

NOTE: The pump must be turned-off before any change is made to the tubing configuration, including nasal cannula, nafion tubing, filter or airway adapter with sample tube. After the changes are made, start the pump as described in step 6 in Section Section 1.6.13.1 on page 1-140.

NOTE: For sidestream operation, always set the apnea and CO_2 alarms.

1.6.13.1 Sequence for Establishing Sidestream Capnostat® CO_2 for Non-Intubated Patients

1. Plug the Capnostat® CO_2 sensor into the Passport XG CO_2 connector (34). The "CO_2: Sensor Warming Up" message is displayed. The CO_2 numeric data and waveform will not be available until the "CO_2: Sensor Warming Up" message disappears.

NOTE: ***The CO_2 waveform is displayed by choosing Auto Display CO_2 as Waveform 2 or 3 in the setup menu and the Resp. Source as CO_2/Off or CO_2/ECG in the Resp menu.***

2. Select CO_2/Off or CO_2/ECG as the Resp. Source in the Resp Menu.
3. Snap a clean airway adapter with tubing into the U-shaped Capnostat® CO_2 sensor. Align the arrow on the bottom of the adapter with the arrow on the bottom of the sensor. See Figure 1-29 on page 65.

NOTE: ***Position the airway adapter with it's windows in a vertical and NOT a horizontal position. This helps keep patient secretions from "pooling" on the windows.***

4. Connect the sampling tubing to the CO_2 Pump Input connector (33).

NOTE: ***Ensure all tubing connections are secure. When required, connect to a waste gas scavenging system to the Pump Exhaust fitting (39) via a 1/8" barbed insert P/N 0103-00-0454-02.***

CAUTION: ***Vacuum (negative pressure) should not exceed 1 mmHg at the Passport Pump Exhaust fitting (39). Excessive scavenge vacuum may result in an "OCCLUSION" message or damage to the Passport's internal pump. The scavenge system if used must be on during calibration.***

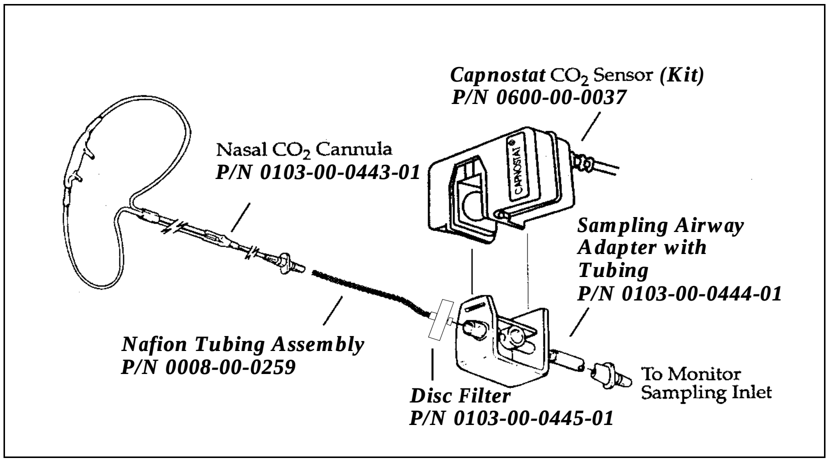


FIGURE 1-76 Adult/Pediatric Airway Adapter (Non-Intubated)

5. Connect a disc filter (optional), nafion tubing (optional-recommended for high humidity situations), and nasal cannula to the patient side of the airway adapter. This is the side that has the Capnostat® name.

NOTE: ***Ensure all tubing connections are secure. Ensure that the nasal cannula is away from all sources of CO_2 (including the patient's and your own exhaled breath and ventilator exhaust valves).***

NOTE: ***Connecting the optional disc filter and tubing is recommended when high humidity exists or during lengthy monitoring periods. However, to maintain specified accuracy for breath rates over 50, the disc filter should be removed.***

6. Press the CO_2 PUMP key (12), then the SELECT key (2), to turn the sampling pump on and to initiate a pump calibration. When the pump calibration is complete, the message "CO_2: Pump Cal Complete" displays. See "Sidestream CO_2 Messages (on Passports with Sidestream CO_2 only)" on page 1-164 for additional CO_2 messages.

NOTE: ***This pump calibration also calibrates the adapter. It is not necessary to perform a separate adapter calibration at this time.***

7. After the pump calibration is complete, place the nasal cannula on the patient.
8. When the Passport XG has detected valid breaths, numbers will display for $ETCO_2$, Inspired CO_2 and Respiratory Rate (if enabled for CO_2 as source).
9. If not already set, use the Setup Menu, to select "Auto Display CO_2"waveform to be displayed on Waveform 2 or Waveform 3.
10. If desired, the CO_2 waveform scale can be changed by entering the CO_2 menu. See "Use of Menus" on page 1-109" for details. The CO_2 menu also has provisions for N_2O and O_2 compensation.

NOTE: ***See "User Configuration Mode" on page 1-153 for Barometric Pressure and CO_2 Units selection. On units with sidesteam CO_2 capability, there is automatic compensation for barometric pressure.***

NOTE: ***See "Sidestream CO_2 Messages (on Passports with Sidestream CO_2 only)" on page 1-164 for more details on messages.***

1.6.13.2 Sequence for Establishing Sidestream Capnostat® CO_2 for Intubated Patients

WARNING: ***In an intubated configuration, ensure all tubing connections are tight. If tubing disconnects on the monitor side of the airway adapter, ventilator pressures cause inaccurate CO_2 waveforms and readouts to be displayed.***

When Sidestream is used to monitor CO_2 in an intubated configuration, the aspired gas within the intubation line is sampled and used to measure the CO_2 level. This setup procedure is described below.

1. Plug the Capnostat® CO_2 sensor into the Passport XG CO_2 connector (34). The "CO_2: Sensor Warming Up" message is displayed. The CO_2 numeric dataand waveform will not be available until the "CO_2: Sensor Warming Up" message disappears.

NOTE: ***The CO_2 waveform is displayed by choosing Auto Display CO_2 as Waveform 2 or 3 in the setup menu and the Resp. Source as CO_2/Off or CO_2/ECG in the Resp menu.***

2. Select CO_2/Off or CO_2/ECG as the Resp. Source in the Resp Menu.

3. Snap a clean airway adapter with tubing into the U-shaped Capnostat® CO_2 sensor. Align the arrow on the bottom of the adapter with the arrow on the bottom of the sensor. See Figure 1-30.

NOTE: ***Position the airway adapter with it's windows in a vertical and NOT a horizontal position. This helps keep patient secretions from "pooling" on the windows.***

4. Connect the sampling tubing to the CO_2 Pump Input connector (33).

NOTE: ***Ensure all tubing connections are secure. When required, connect a waste gas scavenging system to the Pump Exhaust fitting (39) via a 1/8" barbed insert (P/N 0103-00-0454-02).***

CAUTION: ***Vacuum (negative pressure) should not exceed 1 mmHg at the Passport Pump Exhaust fitting (39). Excessive scavenge vacuum may result in an "OCCLUSION" message or damage to the Passport's internal pump. The scavenge system if used must be on during calibration.***

5. Connect the disc filter to the airway adapter.

NOTE: ***The disc filter is not recommended for breath rates over 18 bpm, due to the increased dead space.***

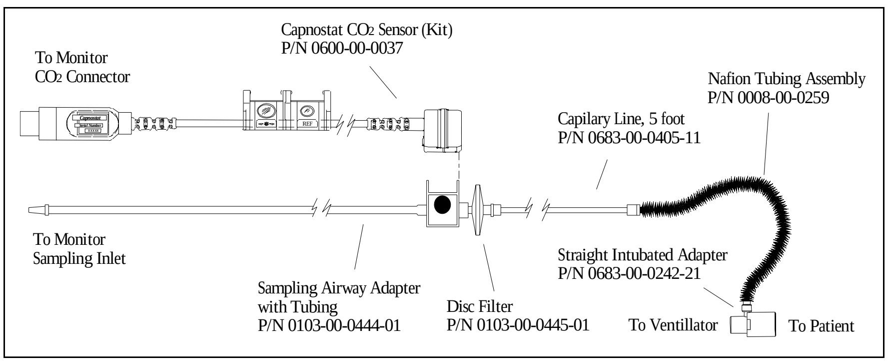


FIGURE 1-77 Adult/Pediatric Airway Adapter (Intubated)

6. Connect the five foot capillary tubing to the filter.

7. Connect the Nafion tube to the capillary tube. Nafion is recommended for high humidity situations.

8. Press the CO_2 PUMP key (12), then the SELECT key (2), to turn the sampling pump on and to initiate a pump calibration. When the pump calibration is complete, the message "CO_2: Pump Cal Complete" displays. See "Sidestream CO_2 Messages (on Passports with Sidestream CO_2 only)" on page 1-164 for additional CO_2 messages.

NOTE: ***This pump calibration also calibrates the adapter. It is not necessary to perform a separate adapter calibration at this time.***

NOTE: The sampling tube must NOT be attached to a patient at this time and must be away from all sources of CO_2 (including the patient's and your own exhaled breath, and ventilator exhaust valves). If the monitor detects changing CO_2 levels (breaths) during a pump calibration, a "Breaths Detected ... Retry" message displays and then a "Pump Cal Failure" message will display. To continue, remove the source of CO_2, wait 30 seconds and repeat the calibration.

9. Connect the sampling tube to the patient airway and observe the capnogram on the monitor's display.

NOTE: The bed clip may be used to secure the assembly to a convenient place. Use the plastic twist clips to connect the sensor cable and sample tubing together for easy identification.

10. When the Passport XG has detected valid breaths, numbers will display for $ETCO_2$, Inspired CO_2 and Respiratory Rate (if enabled for CO_2 as source).
11. If not already set, use the Setup Menu, to select "Auto Display CO_2"waveform to be displayed on Waveform 2 or Waveform 3.
12. If desired, the CO_2 waveform scale can be changed by entering the CO_2 menu. See "Use of Menus" on page 1-109 for details. The CO_2 menu also has provisions for N_2O and O_2 compensation.

NOTE: See "User Configuration Mode" on page 1-153 for Barometric Pressure and CO_2 Units selection. On units with sidesteam CO_2 capability, there is automatic compensation for barometric pressure.

NOTE: See "Sidestream CO_2 Messages (on Passports with Sidestream CO_2 only)" on page 1-164 for more details on messages.

1.6.13.3 Pump Calibration

Pump calibration is necessary when the tubing configuration or sampling cell airway adapter is changed. This calibration enables the unit to determine when an occlusion is present in the tubing.

To perform a pump calibration:

1. Plug the Capnostat® CO_2 sensor into the Passport XG CO_2 connector (34). The "CO_2: Sensor Warming Up" message is displayed. The pump calibration cannot be performed until the "CO_2: Sensor Warming Up" message disappears.
2. Press the CO_2 PUMP key (12). A "Warning" message displays. Ensure that the sampling tubing is correctly connected and that the nasal cannula is clear of all sources of CO_2 (including the patient's and your own exhaled breath, and ventilator exhaust valves). Press SELECT to turn the sampling pump on and to initiate the calibration.
3. The "CO_2: Pump Cal in Progress" and "CO_2: Pump On" messages alternately display. When the pump calibration is complete, the message "CO_2: Pump Cal Complete" displays and then the "CO_2: Pump On" message displays. The "CO_2: Pump On" message will continue to display as long as the pump is on. See "Sidestream CO_2 Messages (on Passports with Sidestream CO_2 only)" on page 1-164 for additional CO_2 messages.

NOTE: ***This pump calibration also calibrates the adapter. It is not necessary to perform a separate adapter calibration at this time, unless the message "Check Adapter" displays.***

NOTE: ***If the monitor detects changing CO_2 levels (breaths) during a pump calibration, a "Breaths Detected ... Retry" message displays and then a "Pump Cal Failure" message will display. Remove the source of CO_2 and repeat the calibration.***

1.6.13.4 Adapter Calibration

Performing a Pump Calibration automatically calibrates the adapter. An Adapter Calibration is necessary whenever the sampling cell airway adapter is replaced or when the "Check Adapter" message displays.

To perform an adapter calibration:

1. Plug the Capnostat® CO_2 sensor into the Passport XG CO_2 connector (34). The "CO_2: Sensor Warming Up" message is displayed. The adapter calibration cannot be performed until the "CO_2: Sensor Warming Up" message disappears.
2. Ensure that the nasal cannula is away from all sources of CO_2 (including the patient's and your own exhaled breath, and ventilator exhaust valves).
3. Choose Start Adapter Cal - Yes from the CO_2 menu. (See "Use of Menus" on page 1-109.)

NOTE: ***If the monitor detects changing CO_2 levels (breaths) during an adapter calibration, a "Breaths Detected ... Retry" message displays, and then an "Adapter Cal Failure" message will display. Remove the source of CO_2 and repeat the calibration.***

1.6.13.5 CO_2 Sensor Calibration Verification

Calibration can be verified at anytime and should be verified at least once a week.

To verify calibration:

1. Verify the Passport is turned on and the Capnostat® is connected and warmed-up.
2. Place the Capnostat® sensor onto the reference cell. The reference cell is labeled REF. The sensor cable should face away from the Passport.
3. The “Sensor on Reference Cal” message is displayed and the reference value is displayed in the $ETCO_2$ window. The value should be between 36 and 40 Torr.

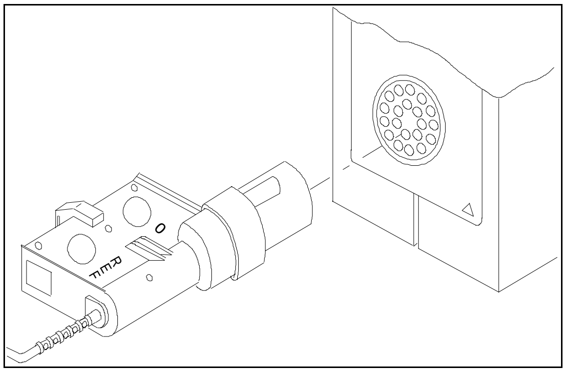


FIGURE 1-78 Reference Cell

1.6.13.6 CO_2 Sensor Calibration

The Capnostat® CO_2 sensor does NOT need to be calibrated at each monitor power up.

Calibration of a sensor is required the first time a particular sensor is connected to a particular monitor and when the monitor requests it.

Once a sensor is calibrated, the Passport XG can be turned off and on, the sensor can be unplugged and reconnected, without having to recalibrate. However, if a second sensor is connected in place of the original, the second sensor must be calibrated and if the original sensor is used again, it too will have to be recalibrated.

To perform a Capnostat® sensor calibration:

1. Plug the Capnostat® CO_2 sensor into the Passport XG CO_2 connector (34). The “CO_2: Sensor Warming Up” message is displayed. The sensor calibration cannot be performed until the “CO_2: Sensor Warming Up” message disappears.
2. Place the Capnostat® onto the ZERO cell.
3. The “Sensor on Zero Cell” message is displayed.
4. Select Start Zero Cal - Yes from the CO_2 menu. The “Zero Cal in Progress” message is displayed. The" Zero Cal Complete" message is displayed when complete and a 0 value is displayed.
5. Remove sensor from the zero cell and place onto the airway adapter.

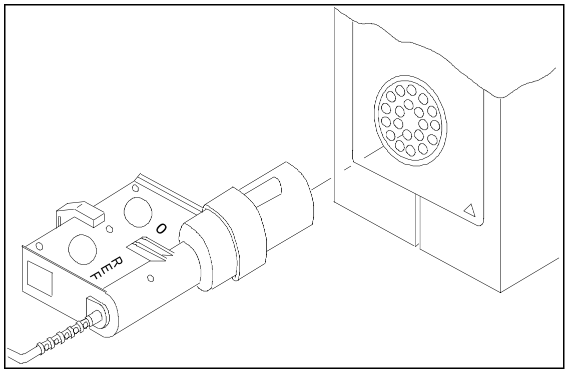


FIGURE 1-79 Zero Cell

1.6.14 Gas Module Option

The Gas Module option allows for the measurement of anesthetic gases, O_2, N_2O and CO_2 levels. Measurement can be acquired via a nasal cannula (non-intubated) for oxygen and CO_2 only, or through a sampling line connected to a breathing circuit (intubated).

WARNING: The maximum sampling rate at the nasal cannula is 200 ml/min. This device should not be used on patients whose breathing could be impaired by this vacuum flow rate.

1.6.14.1 Sequence for Monitoring Anesthetic Gases, O_2, N_2O and/or CO_2

1. For non-intubated patients, apply the nasal cannula to the patient. For intubated patients connect the sample line to the breathing circuit. Refer to instruction provided in the packets.
2. Connect the other end of the nasal cannula or sample line to the Gas Module at the Input Port (41). Refer to Figure 1-57 on page 93. Do not connect anything to Reference Port (51), Figure 1-58 on page 95, on the rear of the unit. This port is used to monitor the room air only. Ensure all tubing connections are tight.

WARNING: Connection of the Gas Module exhaust port (50) to the hospital’s waste gas scavenge system is strongly recommended to prevent exposure of hospital personnel to the patient’s respiratory sample. Vacuum (negative pressure) should not exceed 1 mmHg at the Gas Module Pump Exhaust fitting (50). Excessive scavenge vacuum may result in damage to the Gas Module’s internal pump.

3. Turn on the Gas Module and Passport XG, and configure the Passport XG to be used with the Gas Module. Set alarms as desired.

NOTE: ***Refer to "User Configuration - Serial Output Type Menu" on page 1-188, "Gas Module Menu" on page 1-182 and "Alarm Limits" on page 1-150.***

4. Check for a clean water trap. If cleaning is necessary, "Safety Precautions" on page 4-1 for details.
5. Select CO_2/Off or CO_2/ECG as the Resp. Source in the Resp Menu.
6. Observe the capnogram on the monitor's display. When the Passport XG has detected valid breaths, numbers will display for CO_2, O_2, Agent, N_2O and Respiratory Rate.

NOTE: ***The Gas Module must be warmed up a minimum of two minutes for accurate CO_2, O_2 and N_2O readings and five minutes for agent readings.***

7. If not already set, use the Setup Menu, to select "Auto Display CO_2" waveform to be displayed on Waveform 2 or Waveform 3.
8. If desired, the Gases waveform scale and speed can be changed by entering the Gases menu. See "Use of Menus" on page 1-109 for details.

NOTE: ***See "Gas Module Messages (on Passports with Gas Module installed only)" on page 1-164 for more details on messages.***

1.6.14.2 Gas Monitor Calibration

Accuracy verification of the Gas Module is recommended at six (6) month intervals or whenever gas readings appear to be in error. The date of the last successful mixture calibration appears at the bottom of the "Gases" menu. The operator may elect to perform a Zero calibration (lasting approximately 10 seconds) or a Span calibration (lasting approximately 2 minutes) at any time. During the calibration session gas readings and all other gas functions are not available.

Zero calibration is a single action command that compensates all gas channels for the effects of offset drift. Zero calibration may be performed on command and also takes place automatically at preset intervals. To manually perform a Zero cal, choose 'YES' from the Zero calibration gas menu (refer to "Gas Module Menu" on page 1-182).

Span calibration is a set of prompted commands that enables the operator to align the gas display(s) to specific gas concentration(s) within the Datascope Calibration Gas canister. Span calibration can be initiated by the operator any time the gas module's readings are suspected to be inaccurate. Span calibration should be performed if after performing a Zero cal, the gas readings do not display the accurate valves.

Always verify accuracy using a full canister of Datascope approved precision calibration gas, after calibration is performed. Never use calibration gas that has expired, has a different concentration, or a canister that is indicating low pressure. The pressure indicator on the Datascope gas regulator must operate in the green zone during the entire calibration session.

NOTE: ***The Gas Module must be fully warmed up before performing a gas calibration. For maximum accuracy, a warm-up time of 30 minutes is recommended.***

1. Select Start Calibration and “Yes” within the Gas Module Menu (refer to “Gas Module Menu” on page 1-182). The menu shown on the next page will appear:

CHANGE CAL GAS
CalGas Selection: Mixture Calibrate: No
Choices: Mixture, 5% CO2, 55% O2, 33% N20, 2% DES
↕ = Adjust value EXIT = Quit SELECT = Enter/move

FIGURE 1-80 Start Calibration Menu

2. Select the calibration gas type from the choices, and “Yes” to start calibration.

3. If Mixture has been selected, the following window will appear:

CALIBRATION DATA
CO2: O2: N2O: DES:
Zero In Progress
EXIT = Cancel Calibration

FIGURE 1-81 Calibration Data

4. At the start of the calibration, the Gas Module will zero the gas channels. After a successful zeroing, the Gas Module will request the calibration gas.

NOTE: ***If the Gas Module cannot zero, a “zeroing error” will be displayed and the previous calibration data will be restored. Repeat the calibration procedure from step 1. If problems persist, call for service.***

5. The message “Feed Calibration Gas” will appear. At this point, attach the calibration gas canister to the regulator and turn it on. Increasing gas values will appear in the window as the Gas Module samples the calibration gas.

6. When sampling is complete, a “Continue?” message will appear. If the values are acceptable, press the SELECT key. If for any reason, it is desired to cancel calibration, press EXIT to re-install the previous calibration values. The entire calibration must be accepted as a whole or not at all.

NOTE: ***To avoid premature emptying of the gas canister, always remove the regulator at the end of the procedure, prior to storage.***

7. The message “Calibration Complete” will appear when all the channel(s) have been successfully calibrated. Any channel that has been adjusted will display “Adj”.

CALIBRATION DATA		
CO2:	5.0%	ADJ
O2:	33%	ADJ
N2O:	55%	ADJ
DES:	2.0%	ADJ
Calibration Complete		
EXIT = Quit		

FIGURE 1-82 Calibration Completed

NOTE: ***If any channel cannot be calibrated due to a sampling error, the “Sampling Error” message will appear under the “Continue?” message and “ERR” will be displayed next to any channels with a sampling error. Pressing select will calibrate only those channels that do not have a sampling error.***

If any channel fails calibration, the gas value will be “XXX”. These channels will appear as “XXX” in the normal run mode as well. Repeat procedure from step 1. If problems persist, call for service.

1.6.15 Alarms

The Datascope Passport XG Monitor provides high and low alarm limits for heart rate (HR), systolic pressure (IBP1 / NIBP Sys), diastolic pressure (IBP1 / NIBP Dia), mean pressure (IBP2 Mean), respiration rate, $ETCO_2$, and SpO_2. An alarm for apnea is also provided. If the optional Gas Module is installed, a second and third page of alarm limits is added.

1.6.15.1 Setting Parameter Alarm Limits

1. To access the Alarms Limits menu press the Alarms Limits key (17).

2. Using the UP ▼ and DOWN ▲ arrow keys (1) and SELECT (2) keys, (see “Use of Menus” on page 1-109) set parameter limits as desired.

3. Press the limits key again to access further alarm parameters (when the Gas Module is installed) or press the exit key to return to the main menu.

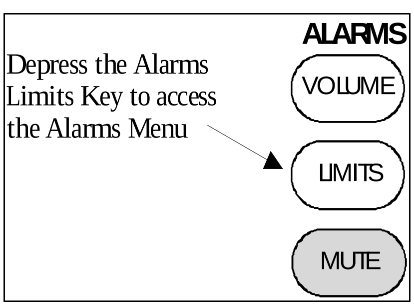


FIGURE 1-83 Alarm Menu

1.6.15.2 Alarm Limits

All of the alarm limits have an "OFF" position with the exception of low SpO_2 and apnea in the neonate mode. A separate table of alarm limit settings is maintained for each patient size. When the patient size is changed, the appropriate table is

automatically used. See table below for alarm ranges.

ALARM PARAMETERS

	HIGH		***LO***	
Parameters	Adult	Ped / Neonate	Adult	Ped / Neonate
Heart Rate (bpm)	Off, 100-250	Off, 100-250	Off, 30-100	Off, 30-100
IBP1 Sys (mmHg)	Off, 70-240	Off, 40-180	Off, 5-130	Off, 5-130
IBP1 Dia(mmHg)	Off, 40-130	Off, 50-100	Off, 5-90	Off, 5-50
NIBP Sys(mmHg)	Off, 70-240	Off, 40-180*	Off, 50-150	Off, 15-130
NIBP Dia(mmHg)	Off, 40-130	Off, 50-100	Off, 30-120	Off, 10-50
IBP2 Mean (mmHg)	Off, 5-150	Off, 5-100	Off, 2-100	Off, 2-50
SpO_2 (%)	Off, 85-100	Off, 85-100	50*-99	50*-99
Resp Rate (rpm)	Off, 30-200* ◆	Off, 30-200* ◆	Off, 5-50	Off, 5-50
Apnea Delay (sec)	Off, 10-40	Off, 10-30 (Ped) / 10 - 20 (Neo)		
$ETCO_2$ (Torr)	Off, 20-100	Off, 20-100	Off, 5-60	Off, 5-60
$ETCO_2$ (%)	Off, 2-11	Off, 2-11	Off, 1-8	Off, 1-8
$ETCO_2$ (kPa)	Off, 2.0-11.0	Off, 2.0-11.0	Off, 1.0-8.0	Off, 1.0-8.0

NOTE: ***The alarm parameters that are highlighted in grey are available only in models that are equipped with the invasive pressure option.***

NOTE: ***The $ETCO_2$ alarm is available only in models that are equipped with the CO_2 or Gas Module option.***

* *These alarm parameters may be set outside the accurate measurement range. Refer to the specifications, Chapter 3, for accuracy ranges.*

◆ *Respiration rate measurement range is limited to 2 - 150 rpm when Mainstream CO_2 is selected as the rate source. Values above 150 rpm will be displayed as 150 rpm.*

NOTE: ***When equipped with the optional Gas Module, a second and third page of alarm limits are available by pressing the limit key a second and third time. These Alarm Limits are not patient size dependent. If the patient size is changed the Alarm Limits do not change.***

TABLE 1-1 Alarm Parameters (Gas Module Only)

PARAMETERS	HIGH	LO
Resp Rate*	Off, 20 - 60	Off, 5 - 40
ET CO_2 (kPa or %)	Off, 6.0 - 15.0	Off, 0.5 - 9
ET CO_2 (Torr or mmHg)	Off, 50 - 115	Off, 5 - 70

* *This Alarm Limit is found on page one of the Alarm Limit Menus, since it applies whether the Gas Module is configured or not. However, when the Gas Module is configured this Alarm parameter will have different ranges and it will be saved separately.*

TABLE 1-1 Alarm Parameters (Gas Module Only)

PARAMETERS	HIGH	LO
INS CO_2 (kPa or %)	Off, 1, 2, 3	
INS CO_2 (Torr or mmHg)	Off, 8, 16, 24	
ET O_2	Off, 40 - 100 %	Off, 10 - 60 %
INS O_2	Off, 40 - 100 %	Off, 18 - 60 %
INS N_2O	Off, 82 %	
ET ISO	Off, 3.0 - 6 %	Off, 0.5 - 4 %
INS ISO	Off, 3.0 - 6 %	Off, 0.5 - 4 %
ET ENF	Off, 3.0 - 6 %	Off, 0.5 - 4 %
INS ENF	Off, 3.0 - 6 %	Off, 0.5 - 4 %
ET DES	Off, 8.0 - 20 %	Off, 0.5 - 12 %
INS DES	Off, 8.0 - 20 %	Off, 0.5 - 12 %
ET SEV	Off, 3.0 - 8 %	Off, 0.5 - 5.0 %
INS SEV	Off, 3.0 - 8 %	Off, 0.5 - 5.0 %
ET HAL	Off, 3.0 - 6 %	Off, 0.5 - 4 %
INS HAL	Off, 3.0 - 6 %	Off, 0.5 - 4 %

* *This Alarm Limit is found on page one of the Alarm Limit Menus, since it applies whether the Gas Module is configured or not. However, when the Gas Module is configured this Alarm parameter will have different ranges and it will be saved separately.*

1.6.15.3 Alarm Violations

There are three types of alarm situations. They are Parameter Alarms, a Heart Rate Fault Alarm, and an Apnea Alarm.

NOTE: ***The heart rate alarm tone has a different pitch than other alarms.***

A. Parameter Alarms

An alarm condition exists if the parameter is equal to or is outside the high/low limit range. When an alarm limit is violated, the following actions occur:

- The alarm LED (16) flashes.
- The alarm tone is sounded (unless it is muted with the MUTE key (18)).
- The recorder prints the currently selected waveform (if Record On Alarm is selected from the Recorder menu).

NOTE: ***On the waveform printouts that are caused by alarm situations, a bar is printed above the alarming area. On trend printouts, the value that has caused an alarm is printed with square brackets around it. If the recorder is printing a waveform and an alarm situation occurs, the currently printing waveform will be completed and then the alarm waveform printout will be printed.***

- The violated parameter is displayed in reverse graphics in the parameter window.

B. Heart Rate Fault Alarm

The Heart Rate Fault Alarm occurs if the selected heart rate source is no longer able to detect a heart rate. This may be due to an ECG lead fault, a problem with an SpO_2 sensor, or various other reasons. This alarm is only active if a low heart rate limit is set. The alarm operation is the same as for a parameter alarm. The heart rate value will be dashes (“—-”) and inverted. A further message from a lead fault or SpO_2 fault may be present to help diagnose the problem.

NOTE: ***Only the value displayed in the heart rate window is used to determine heart rate alarm conditions.***

C. Apnea Alarm

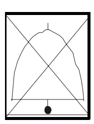
The Apnea Alarm is active when the respiration function is enabled. The Apnea alarm is violated when a breath is not detected for a longer period of time than the apnea delay specified in the Alarm Menu. The alarm operation is the same as for a parameter alarm.

D. General Alarms

- ***ALARMS OFF*** - If alarms are not set on any one parameter, an alarm bell off symbol will be displayed next to the numerical data for that parameter.

NOTE: ***Both the high and low alarm must be set for a particular parameter for the bell symbol to go away.***

- ***VOLUME KEY*** - Increases or decreases the intensity of the alarm.
- ***ALARM MUTES*** - One or more alarms can be muted for either a period of 2 minutes or indefinitely. The following is a description of how to enable the different mute modes.



Alarm Bell Off Symbol

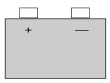
SINGLE MUTE - Any current alarm can be muted for 2 minutes by pressing the MUTE key (18). Any new alarms that occur, while in this mode, will disable the mute and sound the alarm. An alarm mute symbol (a loudspeaker with a cross through it) is displayed next to each muted alarm. The word MUTE is displayed above the menu selections area during this time. This mode will expire after 2 minutes or by pressing the mute key again.

ALL MUTE - All alarms can be suspended for 2 minutes by pressing and holding the MUTE key (18) for 3 seconds. Any new alarms that occur, while in the all mute mode, will not sound the alarm. All alarms suspended is indicated by displaying the alarm mute symbol in reverse graphics. The words ALL MUTE are displayed above the menu selections area during this time. This mode will expire after 2 minutes or by pressing the mute key again.

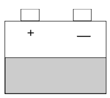
AUDIO ALARM STANDBY MODE - This feature can only be enabled in the User Configuration Menu. Refer to the table below for a description of the three choices “OFF”, “ON”, or “ON and ACTIVE on Power up”. This feature allows alarms to be suspended indefinitely by pressing and holding the MUTE key for 4 seconds. This is indicated by a flashing alarm mute symbol in all parameter windows and a flashing “Aud Alm Sby” message is displayed above the menu selections. When in this mode, press MUTE to re-activate alarms.

AUDIO ALARM STANDBY SETTING	ENABLE INDEFINITE SUSPENSION OF ALARMS	POWER UP MUTE CONDITION
OFF	No	Audio Alarms Active
ON	Yes	Audio Alarms Active
ON and ACTIVE on Power up	Yes	Audio Alarms Suspended Indefinitely

1.6.15.4 Battery Indicators



Full Battery Symbol



Low Battery Symbol

When the Passport XG is powered from the battery, a battery symbol will display. When the battery charge is low, but not below the cutoff voltage, the low battery symbol will display and a beep is generated every 3 seconds.

NOTE: ***Less than 15 minutes of operating time remains depending upon the number of functions that are operational when the low battery symbol displays.***

Battery recharge time is 16 hours.

NOTE: ***Recorder is not operational when the battery charge is low.***

1.6.16 How to Set the Clock

1. Enter the User Configuration Mode. (See “User Configuration Mode” on page 1-153.)
2. Use the UP▲ and DOWN ▼ arrow keys (1) to select Date/Time in the User Configuration Menu. Press the SELECT Key (2) to choose that menu item. The current choice is highlighted.
3. Use the UP▲ and DOWN ▼ arrow keys (1) to select a new setting. Once the desired choice is highlighted, press the SELECT key (2).
4. To save this setting press the SELECT key (2) and then the EXIT key (3).

Repeat for each menu item that needs to change.

1.6.17 User Configuration Mode

The Trend Configuration, Date/Time, Temperature Scale, Heart Rate/SpO_2 Size Select, Alarm Audio Delay, Audio Alarm Standby, Serial Output Type, CO_2, Color settings and Gas Module settings may be changed in the User Configuration Mode. This function is only available at power up and not during normal operation. The User Configuration Mode is accessed via a special power-up sequence.

To enter the User Configuration Mode:

1. Turn the POWER switch (34) ON.

2. After the "DIAGNOSTICS IN PROGRESS" message is displayed, press and hold the FREEZE key (9) until a second beep is heard (approximately 2 seconds). The User Configuration Mode will display.

The operation of the menu system is the same as the operation of the menu system during normal operation (see "Use of Menus" on page 1-109). To access normal operation when user configuration is complete, either time-out (no Set-Up key pressed within 1 minute) or press the EXIT (3) key for 3 seconds. The following table describes the User Configuration Mode menu structure:

USER CONFIG. MENU	MENU ITEM	CHOICES
Date/Time	Year	0 to 99
	Month	1 to 12
	Day	1 to 31
	Hours	0 to 23
	Minutes	0 to 59
Trend	Trigger	Alarms, NIBP*, Interval, NIBP & Alarms, Interval & Alarms, Interval & NIBP, Interval & NIBP & Alarms
	Interval	1, 2.5, 5*, 10, 20, 30, 60, 120 mins.
Temperature	Scale	Fahrenheit*, Centigrade
HR SpO_2 Size	Size Change	HR Large/SpO_2 Small, HR Small/SpO_2 Large*
Alarm Audio Delay	Delay	Off*, 4, 6, 8 sec.
Audio Alarm Standby	Function	Off*, On, On and Active on Powerup
Serial Output Type***	Serial Output Type	VISA*, VISA with Admit, Accutorr, Message, DIAP, Gas Monitor
	Accutorr Baud Rate	1200bps*, 2400bps, 4800bps, 9600bps
CO_2	Barometric Pressure**	500 to 800 mmHg, 760 mmHg*
	CO_2 Units	TORR, kPa, %
Color Settings	ECG Color	White*, Green, Red
	NIBP Color	White*, Green, Red
	SpO_2 Color	White, Green*, Red
	Gases Color	White, Green*, Red
	IBP1 Color	White, Green, Red*
	IBP_2 Color	White, Green, Red*
	Resp Color	White, Green, Red*
	Temp Color	White, Green, Red*
Gas Monitor***	CO_2 Units	TORR, mmHg, kPa, %

* *Initial Factory settings*
** *On units with sidesteam CO_2 capability, there is automatic compensation for barometric pressure.*
*** *Only applicable if J1 connector is installed.*

The Trend Trigger setting is what causes new data to be stored in the trend memory. It may be set to trigger whenever there is an alarm, an NIBP measurement is performed, the trend timer expires (interval), or may be set to trigger at any combination of these items. The trend interval is only used when trend is triggering on interval, and it is used to set the time between interval triggers. The trend interval is independent of the NIBP interval.

The Temperature scale can be changed between Fahrenheit and Centigrade.

The HR SpO_2 size change option allows the user to select a large SpO_2 reading compared to HR or vice versa.

The Alarm Audio Standby allows the user to enable (or disable) this feature (see "* This Alarm Limit is found on page one of the Alarm Limit Menus, since it applies whether the Gas Module is configured or not. However, when the Gas Module is configured this Alarm parameter will have different ranges and it will be saved separately." on page 1-150).

The Serial Output Type allows the user to select the communication protocols for interfacing with other specialized equipment: VISA, VISA with Admit from bedside feature, Accutorr (uses the same data protocol as an Accutorr), message (for diagnostic purposes), Gas Module (optional) with the Passport XG Monitor. The baud rate for the Accutorr protocol can be set for 1200, 2400, 4800 or 9600 bps.

Once the unit is in the User Configuration Mode, the time and / or date can be changed using the set-up keys as described in "Use of Menus" on page 1-109.

1.6.18 Recorder (optional)

The Datascope Passport XG Recorder can provide a permanent record of a patient's: systolic pressure, diastolic pressure, mean pressure, heart rate, SpO_2,CO_2, O_2, Agent, respiration and temperature. It is a two trace thermal strip chart recorder with an integral paper spool. The recorder uses plain white thermal paper 5 cm wide (see "Recorder Paper Replacement" on page 8-5 for replacement instructions).

All grid patterns and data are printed by the recorder.

1.6.18.1 Operation of Printer

1. Using the UP ▼ and ▼ DOWN arrow keys (1), select RECORDER from the main menu.When RECORDER is highlighted a RECORDER MENU is displayed in the multi-function area. A sample of this menu is shown to the right.
2. Press SELECT (2) to enter the RECORDER MENU.
3. Using the UP ▼ and ▼ DOWN arrow keys (1) and SELECT (2) keys, (see "Use of Menus" on page 1-109) set the desired waveforms or trend to be printed.
4. Press PRINT (22) to initiate a printing or stop a printing when one is in progress.

When PRINT (22) is pressed to initiate a printing, a 16 second strip is printed. The 16 second strip consists of 8 seconds of prior and 8 seconds of post waveform from when PRINT (22) is pressed. If a continuous printing is required, press and hold PRINT (22) for 3 seconds (until a beep is heard). Press PRINT again to stop a real time printing.

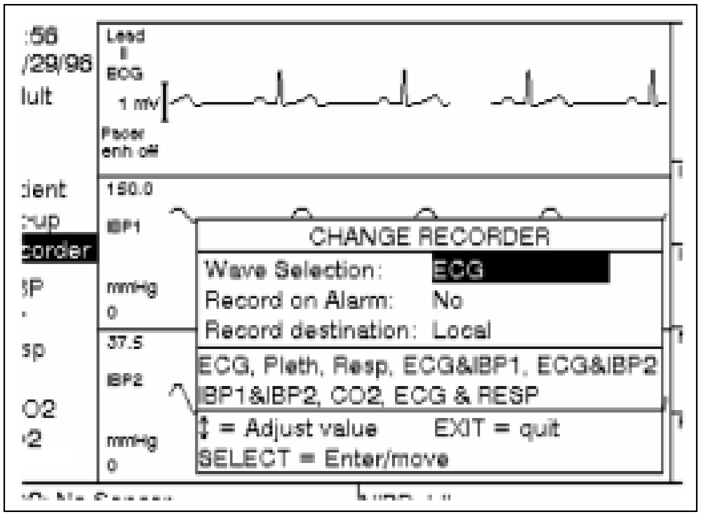


FIGURE 1-84 Recorder Menu

NOTES:

- When the ECG is frozen and PRINT (22) is pressed, the recorder prints the frozen displayed ECG.
- If the PRINT key (22) is pressed for 3 seconds the recorder prints a continuous real-time ECG waveform.
- If the PRINT key (22) is pressed while List Trend is displayed (and the ECG waveform is not frozen), the recorder prints the list trend report.
- See “Recorder Paper Replacement” on page 8-5 for paper installation

1.6.18.2 Printer Formats

Single waveform format:

ECG and pleth waveforms are automatically positioned in the center of the chart paper. Invasive pressure and respiration waveforms are relative to the lower border. The four centimeter waveform area has a grid pattern printed as follows: 100% darkness on 1 cm grid with 50% darkness on 2 mm grid.

The upper and lower borders have the date, time and physiologic parameters currently available as well as the ECG size and lead configuration the recorder is printing. All parameters include their units.

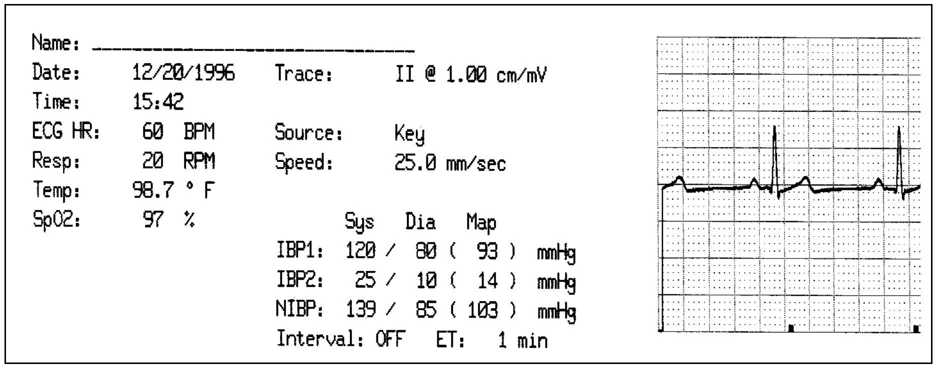


FIGURE 1-85 Sample Printout, Single Waveform

Two waveforms separate field format:

The two waveforms are printed in a separate field format with two centimeters assigned to each waveform. The waveforms do not overlap. Grids are printed as for one waveform.

The upper and lower borders are printed as for the single waveform.

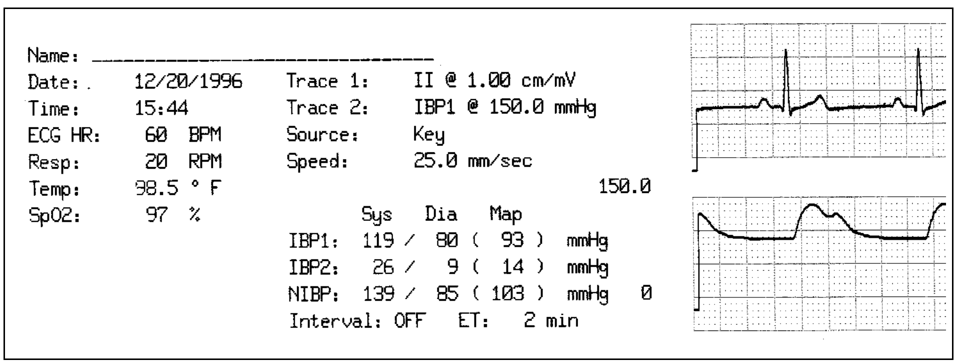


FIGURE 1-86 Sample Printout, Two Waveform

Trend list format:

The list trend data is printed with text running along the length of the strip. If more than one page of data is available then all additional pages are printed along the length of the strip.

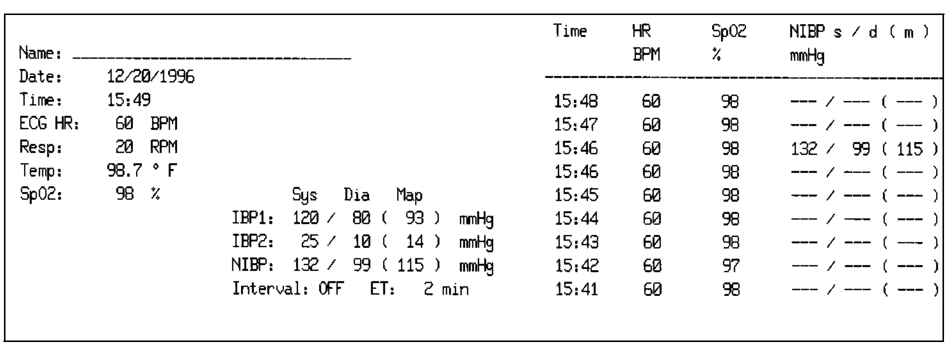


FIGURE 1-87 Sample Printout, Trend List Format

NOTE: ***On waveform printouts that are caused by alarm situations (Record on Alarm must be selected YES in the Recorder menu), a bar is printed above the alarming area. On trend printouts and in annotations, the value that has caused an alarm is printed with square brackets around it. If the recorder is printing a waveform and an alarm situation occurs, the currently printing waveform will be completed and then the alarm waveform printout will be printed.***

NOTE: ***IBP1, IBP_2, CO_2, and Gas Module data is printed only when models are equipped with these options.***

1.6.19 Status Messages

The monitor uses the Message Display Area to provide messages to the user relating to monitor status. The following lists these messages and a description of the message. The messages are grouped by function.

1.6.19.1 NIBP Measurement Messages

MESSAGE	REASON	SOLUTION
NIBP: IDLE	Displayed while system is idle.	Press START to take a single measurement. Press INTERVAL to select an interval and start timed measurements.
NIBP: DEFLATE	Displayed while the timer mode is stopped, usually by pressing the DEFLATE key.	Press START to take an immediate measurement and resume timed measurements.
NIBP: INTERVAL	Displayed in the interval between two timed measurements.	Press DEFLATE to suspend timed measurements. Press INTERVAL to change timer to OFF to stop timer.
NIBP: INITIALIZING	The NIBP system is being initialized.	Wait until initialization is complete, indicated by NIBP: IDLE message. Initialization may take up to 3 minutes from power up.
NIBP: FAILURE	The NIBP system has detected a potential error.	Power cycle unit. If message reappears, call Service.
NIBP:MEASURIN G CUFF	Displayed during a measurement to show the cuff pressure.	Press DEFLATE to suspend a measurement and deflate the cuff.
NIBP:RETRY MOTION	Measurement has been attempted but no reading was possible due to detected motion and the retry limit has not been reached.	Retry will be attempted. Have patient remain still.
NIBP:RETRY PUMP HIGHER	A measurement has been attempted but no reading was possible due to pulse detection at highest cuff pressure and the retry limit has not been reached.	Retry will be attempted. Check that appropriate patient size is set. Preset initial inflation pressure.
NIBP:RETRY	A measurement has been attempted but no reading was possible.	Retry will be attempted. Check for leaks and quality of peripheral pulses. Decrease patient movement. Switch cuff to another limb.
NIBP:UNABLE TO MEASURE*	An unsuccessful measurement cycle has been completed.	Switch cuff to another limb. Decrease patient movement. Press START to retry. Be prepared to auscultate BP manually.
NIBP:CUFF OVERPRESSURE	The internal hardware cuff pressure check valve has been tripped.	Power cycle unit. If message reappears, call Service.

* *The presence of arrhythmias may increase the time required to complete a measurement and may extend this time to a point where a measurement cannot be completed.*

- Always have an alternate method of BP verification available.
- On vasoconstricted patients, failure to evacuate air from the cuff can distort BP

measurement.

- Do not place cuff on extremity that has an IV.
- Cuff should be at heart level.

1.6.19.2 SpO_2 Messages

MESSAGE	REASON	SOLUTION
SpO_2 NO SENSOR	No sensor is connected to the monitor.	Attach sensor cable to the monitor.
SpO_2 SENSOR OFF	Sensor may not be connected to the patient.	Check patient connection.
SpO_2 INTERFERENCE	Noise detected on the pulse signal prevents pulse discrimination.	Decrease patient motion, check sensor.
SpO_2 PULSE SEARCH	Hardware settings are being adjusted in order to discriminate a pulse waveform.	Change to site where pulse is stronger if patient is vasoconstricted. Change or readjust sensor if loose.
SpO_2 WEAK PULSE	Detected patient pulse is marginal.	Change site.
SpO_2 NO PULSE	No detectable pulse is measured.	
SpO_2 CHECK SENSOR	Insufficient light is received by the sensor detector, or the sensor has a malfunction.	Check alignment of emitter and detector or change sensor.
SpO_2 PR UNDER 30	Detected pulse rate is below thirty beats per minute.	Check patient status. Check alignment of sensor. Reapply sensor.
SpO_2 PR OVER 250	Detected pulse rate is above 250 bpm.	Check patient status. Decrease patient motion. Reapply sensor.
SpO_2 UNCALIBRATED	Detected SpO_2 falls below calibrated range.	Check patient status. Check sensor.
SpO_2 SYSTEM CHECK	Self test is being performed.	Wait for completion of self test.
SpO_2 FAILURE	ROM checksum fail. RAM test fail. Filter mismatch. Offset mismatch.	Power cycle unit. If message reappears, call Service.

The following messages pertain to Nellcor SpO_2 Operation.

MESSAGE	REASON	SOLUTION
SpO_2 SYSTEM CHECK	Self test is being performed.	Wait for completion of self test.
SpO_2 NO SENSOR	No sensor is connected to the monitor.	Attach sensor cable to the monitor.
SpO_2 PULSE SEARCH	Hardware settings are being adjusted in order to discriminate a pulse waveform.	Change to site where pulse is stronger if patient is vasoconstricted. Change or readjust sensor if loose.
SpO_2 NO PULSE	No detectable pulse is measured.	

MESSAGE	REASON	SOLUTION
SpO_2 FAILURE	ROM checksum fail. RAM test fail. Filter mismatch. Offset mismatch.	Power cycle unit. If message reappears, call Service.
SpO_2 DIAGNOSTICS	Passport is in Nellcor Diagnostics Mode.	Wait for completion of diagnostics.

The following messages pertain to Masimo SpO_2 Operation.

MESSAGE	REASON	SOLUTION
SpO_2 SYSTEM CHECK	Self test is being performed.	Wait for completion of self test.
SpO_2 NO SENSOR	No sensor is connected to the monitor.	Attach sensor cable to the monitor.
SpO_2 PULSE SEARCH	Hardware settings are being adjusted in order to discriminate a pulse waveform.	Change to site where pulse is stronger if patient is vasoconstricted. Change or readjust sensor if loose.
SpO_2 NO PULSE	No detectable pulse is measured.	
SpO_2 FAILURE	ROM checksum fail. RAM test fail. Filter mismatch. Offset mismatch.	Power cycle unit. If message reappears, call Service.
SpO_2 SENSOR OFF	Sensor may not be connected to the patient.	Check patient connection.
SpO_2 INTERFERENCE	Noise detected on the pulse signal prevents pulse discrimination.	Decrease patient motion, check sensor.
SpO_2 CHECK SENSOR	Insufficient light is received by the sensor detector, or the sensor has a malfunction.	Check alignment of emitter and detector or change sensor.
SpO_2 LOW PERFUSION	Poorly perfused patients may cause this message.	Move sensor to another monitoring site.
SpO_2 AMBIENT LIGHT	There is too much ambient light.	Cut down on ambient light.
SpO_2 UNKNOWN SENSOR	Sensor is not recognized.	Use only Datascope approved sensors.

- Administration of certain vasoconstrictive drugs, i.e., norepinephrine, may reduce peripheral perfusion to a level that prevents SpO_2 measurements.
- Arterial compression, tricuspid regurgitation, or irregular heart rhythms may reduce perfusion and prevent SpO_2 measurement.
- Intra-vascular dyes, depending on concentration, may affect SpO_2 measurements.
- SpO_2 measurements may be difficult on patients undergoing IABP treatments.

This monitor measures functional hemoglobin.

1.6.19.3 Recorder Messages (only units equipped with recorder)

MESSAGE	REASON	SOLUTION
RECORDER DOOR OPEN	The door of the recorder is not closed.	Close recorder door.
RECORDER PAPER OUT	The roll of recorder paper is used up.	Replace with a new roll of paper.

1.6.19.4 CO_2 Messages (only units equipped with Capnostat CO_2)

MESSAGE	REASON	SOLUTION
CO_2: INITIALIZING	This message usually appears at power up. The CO_2 subsystem has been reset and is performing internal self tests prior to operation.	Wait for the message to go away. It takes about 15 seconds for the CO_2 subsystem to initialize.
CO_2: NO SENSOR	No CO_2 sensor is connected to the monitor.	Attach the CO_2 sensor to the CO_2 connector (30).
CO_2: SENSOR WARMING UP	The CO_2 sensor has not reached its operating temperature. Either the monitor was just turned on or the sensor was recently plugged in or the sensor was removed from the adapter or calibration cells.	Wait for the message to go away. It takes up to five minutes for the sensor to warm up.
CO_2: CHECK ADAPTER	The CO_2 sensor is not correctly placed on the airway adapter or a different type of airway adapter has been connected or the adapter is dirty or damaged.	Check the installation and condition of the airway adapter. Clean or replace the adapter if necessary. An adapter calibration should be performed if the message persists. This is accessed through the CO_2 menu.
CO_2: CHECK SENSOR	The CO_2 sensor is out of calibration or damaged.	A zero calibration should be performed if the message persists. This is accessed through the CO_2 menu.
CO_2: SENSOR ON REFERENCE CELL	The CO_2 sensor is positioned on the reference cell. This is located on the sensor cable adjacent to the connector. The $ETCO_2$ reading should range from 36 to 40 Torr when on this cell.	The sensor should be removed from the reference cell and placed back on the airway adapter.
CO_2: SENSOR ON ZERO CELL	The CO_2 sensor is positioned on the zero cell. This is located on the sensor cable adjacent to the connector. The $ETCO_2$ reading should be 0 when on this cell.	After completing the calibration, the sensor should be removed from the zero cell and placed back on the airway adapter.
CO_2: ZERO CAL IN PROGRESS	The CO_2 sensor is placed on the zero cell and a CO_2 calibration is in progress.	Wait for the zero calibration to complete.

MESSAGE	REASON	SOLUTION
CO_2: ADAPTER CAL IN PROGRESS	A CO_2 adapter calibration has been requested and is in progress.	Wait for the adapter calibration to complete. It takes less than 30 seconds.
CO_2: ZERO CAL FAILURE	The zero calibration was not completed successfully. The zero calibration may have been requested when the sensor had not completed warming up.	Wait for the unit to complete warming up. Repeat the zero calibration.
CO_2: ADAPTER CAL FAILURE	The adapter calibration was not completed successfully. The adapter calibration may have been requested when the sensor had not completed warming up or the sensor was not correctly installed on the airway adapter.	Wait for the unit to complete warming up or check the installation of the sensor on the airway adapter. Repeat the adapter calibration.
CO_2: CAL FAILED - INSERT ZERO CELL	A zero calibration was attempted while the sensor was not attached to the zero cell.	Attach the sensor to the zero cell and repeat the zero calibration. The zero cell is located on the sensor cable.
CO_2: CAL FAILED - INSERT ADAPTER	An adapter calibration was attempted while the sensor was attached to the zero or reference cell.	Remove the sensor from the zero or reference cell and attach it to the air-way adapter. Repeat the adapter cal.
CO_2: ZERO CAL COMPLETE	The zero calibration has been successfully completed.	Remove the CO_2 sensor from the zero cell and place back on the adapter. Perform an adapter zero.
CO_2: ADAPTER CAL COMPLETE	The adapter calibration has been successfully completed.	Normal operation. The message is removed after a few seconds.
CO_2: FAILURE	The CO_2 subsystem has failed.	Cycle the power on the monitor to determine if the problem persists. If the message returns then the unit needs to be serviced.

1.6.19.5 Sidestream CO_2 Messages (on Passports with Sidestream CO_2 only)

MESSAGE	REASON	SOLUTION
CO_2: PUMP ON	The CO_2 sidestream pump is on.	Message will display at all times when the CO_2 sidestream pump is on.
CO_2: PUMP CAL IN PROGRESS	The CO_2 sidestream pump is turned on and a pump calibration has been requested.	Message will clear when cal is complete.
CO_2: BREATHS DETECTED...RETRY	Breaths are detected while the CO_2 sidestream pump calibration is in progress or an adaptor calibration is in progress.	Move the sensor/ adapter away from any source of CO_2.
CO_2: PUMP CAL FAILURE	The CO_2 sidestream pump calibration was not completed successfully. The pump calibration could have been requested when the sampling line was not attached correctly.	Check sampling line for correct assembly. Retry calibration. If message persists refer to technical service personnel.
CO_2: PUMP FAILURE	The CO_2 sidestream pump failed.	Refer to technical service personnel.
CO_2: OCCLUSION-CHECK SYSTEM	The CO_2 hardware is indicating the sampling pump line is blocked while the CO_2 sidestream pump is on.	Check sampling line and filter for blockage, clear sampling line if possible. Replace sampling line and/or filter if necessary. If sampling cell is replaced, perform a pump calibration.
CO_2: NO SSCO_2 ON NEONATE	The patient size is set to Neonate and the CO_2 sidestream pump is on, or when the patient size is set to Neonate and the user presses the CO_2 pump key.	Do not have the patient size set to Neonate and press the CO_2 pump key.
CO_2: PUMP CAL COMPLETE	The pump calibration has been successfully completed.	Message will clear automatically.

1.6.19.6 Gas Module Messages (on Passports with Gas Module installed only)

MESSAGE	REASON	SOLUTION
GM: WARMING UP	Appears when the system has been turned on, and the sensors have not reached their stable operating temperature.	Wait for the message to go away. It takes up to two minutes for the device to warm up.
GM: AGENT WARMING UP	This message appears after the GM: WARMING UP message disappears. It indiactes that the Agent ID Bench is warming up and readings will not be available.	Wait for the message to go away. It takes ups to five minutes from power-up for the Agent ID Bench to warm up.
GM: EXHAUST BLOCKED	Appears when the system detects a blockage at the exhaust gas outlet, as indicated by an increase in internal pressure.	Remove waste gas scavenging assembly, check if message disappears. Check exhaust line for blockage and clear if possible. If message persists call for service.

MESSAGE	***REASON***	***SOLUTION***
GM: MIXED AGENTS	Appears in Inverse Video when more than one anesthetic agent is detected by the system.	Message will disappear when a single agent is detected again.
GM: AIR LEAK	Appears when the system detects a pneumatic leak. Also may appear when the Gas Module has been turned on without a sample line attached or if the Gas Module has been on for a long period of time without the Passport Monitor being on.	Turn Gas Module and Passport off. Install / check sample lines, filters, water trap and electrical connections. Turn on Gas Module and Passport Monitor.
GM: REPLACE TRAP	Indicates residue build-up on the water trap membrane. This decreases air flow.	Replace water trap reservoir.
GM: OCCLUSION	Appears when the system detects an obstruction in the sampling line or the water trap bottle is full.	Empty and rinse water trap. Change water trap if necessary. Check sampling line and filter for blockage, clear sampling line if possible. Replace sampling line and / or filter if necessary. If problem persists call for service.
GM: ZERO IN PROGRESS	Appears when the system is zeroing all of it's channels. This appears whether initiated by the user or is automatic.	This is Normal Operation. Wait for message to clear.
GM: CO_2 ZERO ERROR	Appears when the system has been unable to successfully zero the CO_2 sensor.	Manually start zeroing the system again. If problem persists call for service.
GM: O_2 ZERO ERROR	Appears when the system has been unable to successfully zero the O_2 sensor.	Manually start zeroing the system again. If problem persists call for service.
GM: N_2O ZERO ERROR	Appears when the system has been unable to successfully zero the N_2O sensor.	Manually start zeroing the system again. If problem persists call for service.
GM: AGENT ZERO ERROR	Appears when the system has been unable to successfully zero the Anesthetic Agent sensor.	Manually start zeroing the system again. If problem persists call for service.
GM: PUMP OFF	Appears when the system has turned off the pump due to a pneumatic error.	Restart pump from Gas Module menu. Refer to "Gas Module Menu" on page 1-182. If problem persists, call for service.
GM: AGENT MISMATCH - HAL	Appears in Inverse Video when the system detects Halothane as the primary agent and the manually selected agent is neither Halothane nor the detected secondary agent.	Match the Agent administered with the Agent selected, or select Agent Auto ID.
GM: AGENT MISMATCH - ISO	Appears in Inverse Video when the system detects Isoflurane as the primary agent and the manually selected agent is neither Isoflurane nor the detected secondary agent.	Match the Agent administered with the Agent selected, or select Agent Auto ID.

MESSAGE	***REASON***	***SOLUTION***
GM: AGENT MISMATCH - ENF	Appears in Inverse Video when the system detects Enflurane as the primary agent and the manually selected agent is neither Enflurane nor the detected secondary agent.	Match the Agent administered with the Agent selected, or select Agent Auto ID.
GM: AGENT MISMATCH - SEV	Appears in Inverse Video when the system detects Sevoflurane as the primary agent and the manually selected agent is neither Sevoflurane nor the detected secondary agent.	Match the Agent administered with the Agent selected, or select Agent Auto ID.
GM: AGENT MISMATCH - DES	Appears in Inverse Video when the system detects Desflurane as the primary agent and the manually selected agent is neither Desflurane nor the detected secondary agent.	Match the Agent administered with the Agent selected, or select Agent Auto ID.
GM: UNKNOWN AGENT	Appears in Inverse Video when the system detects a gas that does not match the spectroscopic signatures of the five known anesthetic agents.	Rectify situation.
GM: CANNOT ZERO ... RETRYING	Appears when the Passport requests a Zeroing (either on the automatic cycle or by a user request), and the Gas Module is unable to initialize the cycle.	Allow system to retry without intervention. If problem persists call for service.
GM: RESP HIGH	Appears when the respiration rate is greater than or equal to the value set for the Resp High Alarm.	Check patient.
GM: RESP LOW	Appears when the respiration rate is less than or equal to the value set for the Resp Low Alarm.	Check patient.
GM: ET CO_2 HIGH	Appears when the End Tidal CO_2 measurement is greater than or equal to the value set for the ET CO_2 High Alarm.	Check patient.
GM: ET CO_2 LOW	Appears when the End Tidal CO_2 measurement is less than or equal to the value set for the ET CO_2 Low Alarm.	Check patient.
GM: INSP CO_2 HIGH	Appears when the $FiCO_2$ measurement is greater than or equal to the value set for the INSP CO_2 High Alarm.	Check patient.
GM: ET O_2 HIGH	Appears when the End Tidal O_2 measurement is greater than or equal to the value set for the ET O_2 High Alarm.	Check patient.
GM: ET O_2 LOW	Appears when the End Tidal O_2 measurement is less than or equal to the value set for the ET O_2 Low Alarm.	Check patient.
GM: INSP O_2 HIGH	Appears when the FiO_2 measurement is greater than or equal to the value set for the INSP O_2 High Alarm.	Check patient.
GM: INSP O_2 LOW	Appears when the FiO_2 measurement is less than or equal to the value set for the INSP O_2 Low Alarm.	Check patient.
GM: INSP N_2O HIGH	Appears when the Inspired N_2O measurement is greater than or equal to the value set for the INSP N_2O High Alarm.	Check patient.
GM: ET AGENT HIGH	Appears when the End Tidal Anesthetic Agent measurement is greater than or equal to the value set for the ET Agent High Alarm.	Check patient.

MESSAGE	***REASON***	***SOLUTION***
GM: ET AGENT LOW	Appears when the End Tidal Anesthetic Agent measurement is less than or equal to the value set for the ET Agent Low Alarm.	Check patient.
GM: INSP AGENT HIGH	Appears when the Inspired Agent measurement is greater than or equal to the value set for the INSP Agent High Alarm.	Check patient.
GM: INSP AGENT LOW	Appears when the Inspired Agent measurement is less than or equal to the value set for the INSP Agent Low Alarm.	Check patient.
GM: CO_2 UNCALIBRATED	Appears after an unsuccessful calibration attempt of the CO_2 sensor. The numeric data for CO_2 will appear as - - -, and the CO_2 waveform will be a flatline.	Ensure proper gas mixture is attached tightly and regulator is on. Repeat calibration procedure. If problem persists, call for service.
GM: O_2 UNCALIBRATED	Appears after an unsuccessful calibration attempt of the O_2 sensor. The numeric data for O_2 will appear as - - -, and the O_2 waveform will be a flatline.	Ensure proper gas mixture is attached tightly and regulator is on. Repeat calibration procedure. If problem persists, call for service.
GM: N_2O UNCALIBRATED	Appears after an unsuccessful calibration attempt of the N_2O sensor. The numeric data for N_2O will appear as - - -, and the N_2O waveform will be a flatline.	Ensure proper gas mixture is attached tightly and regulator is on. Repeat calibration procedure. If problem persists, call for service.
GM: AGENTS UNCALIBRATED	Appears after an unsuccessful calibration attempt of the Agent sensor. The numeric data for all agents will appear as - - -, and the agent waveform will be a flatline.	Ensure proper gas mixture is attached tightly and regulator is on. Repeat calibration procedure. If problem persists, call for service.
GM: FAILED	Appears when the Gas Module detects an unrecoverable error in its own operation.	Call for Service.
GM: DISCONNECTED	Appears when the Passport cannot detect signals being sent by the Gas Module.	Ensure Gas Module is turned on and interface cable is properly connected. If problem persists, call for service.
SAMPLING ERROR	Appears when a sampling error occurs on one or more Gas Module channels during calibration.	Repeat calibration procedure. If problem persists, call for service.
CALIBRATION NOT STARTED	Appears when the Gas Module is unable to initialize calibration.	Repeat calibration procedure. If problem persists, call for service.
CALIBRATION ERROR SAMPLING ERROR	Appears when a sampling error occurs in all four Gas Module channels during calibration.	Repeat calibration procedure. If problem persists, call for service.
CALIBRATION ERROR ZEROING ERROR	Appears when the Gas Module cannot perform a Zero during calibration.	Repeat calibration procedure. If problem persists, call for service.

1.6.19.7 Monitor Operation Messages

The following messages pertain to the operation of the monitor.

MESSAGE	REASON	SOLUTION
DIAGNOSTICS IN PROGRESS	Self test is being performed.	Wait for completion of self-test. Refer to "Setting-up / Turning Power On" on page 1-99.
SELF TEST COMPLETE	Diagnostics OK.	
ESU INTERFERENCE	Poor electrode site preparation. Excessive cautery (ESU) noise.Excessive high frequency noise.	Check site; rearrange electrodes. Change electrodes. Use ECG cable with choke.
LEAD FAULT	Lead off of patient.	Check electrodes / leads.
INTERFERENCE	Poor electrode site preparation. Improper lead selection. Excessive 50 or 60 Hz noise.Wrong 3-Lead cable may be in use.*	Check site. Change Lead selection. Use proper ECG cable.
ARTIFACT	A 50 or 60 Hz noise is detected on the ECG waveform. The displayed heart rate may not be correct.	Check site. Change Lead selection. Use proper ECG cable.

* *See Section 5 in the Datascope P/N's 0070-00-397, 0070-00-0440, and 0070-00-0503 of the Passport Operating Instructions for a list of the proper ECG cables.*

1.6.20 Monitor Problem Solving

This guide is provided to establish the possible causes and solutions to some Monitoring problems.

PROBLEM	REASON	SOLUTION
No trace for a desired parameter	-Improper attachment of transducer to monitor. -Faulty transducer.	-Check transducer connection. -Try a different transducer.
Wandering ECG	-Respiration artifact.	-Try a different base line lead configuration.
Noisy ECG traces	-Loose or dry electrodes. -Defective electrode wires. -Patient cable or leads are routed too close to other electrical devices.	-Apply new electrodes.-Replace wires as necessary. -Eliminate 60Hz interference. -Use ECG cable with built-in filter block.
Low Amplitude ECG	-Electrode could be positioned over a bone or muscle mass.	-Reposition electrodes. -Press ECG SIZE key.
Excessive Electro-surgical Interference	-Inadequate skin prep prior to application of electrode.	-Repeat skin prep and electrode placement procedures. -Add additional gel to electrodes.

PROBLEM	***REASON***	***SOLUTION***
AC Noise	-Gain set too high (set through SIZE key). -Electrodes dry. -Patient cable entwined with cables of other electrical devices.	-Readjust as necessary. -Re-prep skin and apply fresh, moist electrodes. -Separate patient cable from all other cables.
Intermittent Signal	-Connections not tight and properly secured.-Electrodes dry. -Cable or lead wires damaged.	-Ensure proper connection. (Electrode to lead, lead to cable, cable to monitor.) -Re-prep skin and apply fresh moist electrodes. -Check with continuity tester.
Excessive alarms: heart rate, lead fault	-Electrodes dry. -Alarm limits set too close to patient's normal heart rate. -R-wave wrong size. -Excessive patient movement or muscle tremor.	-Re-prep skin and apply fresh, moist electrodes. -Readjust. -Must be twice the amplitude of other part of waveform. -Reposition electrodes and secure with tape if necessary.
Low Amplitude ECG Signal	-Gain set too low. (Set through SIZE key.) -Skin improperly prepared. -Possibly not patient's normal complex. -Electrode could be positioned over a bone or muscle mass.	-Readjust as required. -Abrade skin. -Check with 12 lead electrocardiogram. -Reposition electrodes.
Trace Not Moving	-FREEZE key may have been pressed.	-Press the FREEZE key to unfreeze the trace.
Temperature Probes not Working	-Poor contact from probes to body.	Check the body surface contact at the probe tip. Reposition or apply thermoconductive gel.
Display Appears to be Off	-Mains power switch may not be on. -Unit may not be plugged into an AC outlet. -If used as a portable, battery pack may be drained.	-Check mains power switch on side panel. -Check power cord (Is it plugged in?). -If battery pack is drained, plug into an AC outlet to recharge the battery. A period of 16 hours is required for a full charge.
Disabled Alarm Tone, QRS Tone, or Other Function	-Mute key pressed. -Beep volume low.	-Check for alarm mute symbol. -Increase beep volume.
ECG Base Line With No Waveform	-Gain control not set high enough. Set through SIZE key. -Lead wires and patient cable not fully inserted into proper receptacle. -Cable or lead wires damaged.	-Readjust as required. -Check insertion. -Check with lead continuity tester.

PROBLEM	REASON	SOLUTION
Base Line Wander	-Patient moving excessively. -Patient's respiration. -Electrodes dry. -Static build up around patient.	-Secure lead wires and cable to patient. -Reposition electrodes. -Re-prep skin and apply fresh moist electrodes. -Check with hospital engineer.
Damped Invasive Waveform	-Air bubbles in tubing. -Kinked catheter. -Catheter against wall of blood vessel. -Blood in tubing.	-Eliminate air from tubing. -Slightly alter position of catheter. -Check for leaks at connector. -Pump pressure bag up to 300 mmHg.
Recorder Report Appears Totally Blank	-Thermal paper may be installed incorrectly. (up-side down)	-Remove paper and re-install with paper feeding off of the spool from the bottom.
Resp. Waveform Too Large	-Scales set inappropriately.	-Change scale via menu.
Resp. Waveform Too Small	-Patient breathing shallow or turned on side. -Scale set inappropriately.	-Change lead position to better detect respirations. -Change scale.
False Apnea Alarm	-Apnea delay may be improperly set. -Patient may be having frequent episodes of CVA. -Scale size may be too low.	-Choose another apnea delay. -Reposition electrodes to better detect respirations.
"CHK Lead" Message	-Due to increased impedance. -Chest hair under electrodes. -Dried electrode gel.-Electrode off. -Lead off. -Cracked lead wires -Poor skin prep.	-Prep chest. -Change electrodes. -Replace electrode. -Replace lead. -Replace lead wires. -Clean and abrade skin before applying electrodes.
"CVA" Message	-Can be caused by shallow breathing or an apnea event.	-Check the patient-adjust scales or leads if necessary.

PROBLEM	***REASON***	***SOLUTION***
No Resp. Waveform or Rate Displayed	-Patient not connected to a patient safety cable.-Respiration parameter is "OFF". -CO_2/Off and no CO_2. -Patient connected using Patient ESIS Choke/Cable.	-Turn respiration on ("OFF" will be displayed in resp. window).Check that proper patient cable is used.-Use 3-lead Patient Cable - non ESIS.
Waveform Acquisition Failure	-Front End Failure-External Supply Failure -+12/-23 Volt Board Failure-CPU Board Failure -CO_2 Interface Board Failure (optional)	-Replace Front End Board. -Check External Supply Output voltage. -Replace F1 fuse on +12/-23 Volt Board. -Replace CPU Board. -Replace CO_2 Interface Board

1.6.21 Connection to External Devices (optional)

The Passport XG provides a high level ECG waveform output from the J1 connector (37). To facilitate connection of the Passport to external devices requiring an ECG waveform for synchronization, Datascope provides interface cable:

- P/N 0012-00-0753-01 cable which is terminated with a Hewlett Packard (HP) 8 pin round connector, commonly used for ECG input on HP defibrillators.

This cable attenuates the high level ECG waveform output from the Passport XG Monitor to a low level output and is intended to provide a means to synchronize compatible external devices with an ECG signal. An example of such a device is a defibrillator for cardioversion synchronization.

CAUTION: ***It is the users responsibility to confirm correct operation of the Passport XG with external devices. Before using this cable it is essential that a biomedical engineer verify correct operation of the Passport XG with an external device using this cable. Testing should include verification that the maximum delay for cardioversion synchronization does not exceed 60 ms (monitor and defibrillator). Cable should be labeled with the devices they have been tested for use with.***

1.6.22 Using the Passport XG with the Visa Central Station (optional)

The Passport XG must be connected, either through hardwire or telemetry, to the VISA Central Station. This connection allows the Passport XG to communicate with the VISA to ADMIT, DISCHARGE, SILENCE and PRINT. The serial output type in the User Configuration Menu must be set to either “VISA” or “VISA WITH ADMIT”.

NOTE: ***The VISA Central Station cannot be used in conjuction with the Gas Module option.***

If set to “VISA”, the passport XG can be used to mute alarms and print waveforms on the VISA. However, the ADMIT and DISCHARGE features will be disabled.

If set to “VISA WITH ADMIT”, the Passport XG can be used to help ADMIT and DISCHARGE patients to and from the VISA, as well as mute alarms and print waveforms on the VISA.

NOTE: ***See the VISA Operating Instructions, P/N 0070-00-0245, for more details on VISA operation with the Passport XG.***

The keys that are used on the Passport XG in conjunction with the VISA are: ADMIT (4), DISCHARGE (5), SILENCE (6) and PRINT (22).

Admit (4)

When a new patient is being monitored by the Passport XG, press the ADMIT (4) key to receive that patient's information on the corresponding channel on the VISA Central Station. A patient can also be admitted using the patient menu. The following "Warning" message displays:

Warning: Admit Selected
To admit, you will discharge last patient. This will erase last patient's data at Central.
Press SELECT to admit Press EXIT to cancel

FIGURE 1-88 VISA Admit

When you press SELECT to admit, the following "Warning" message displays:

Warning
Verify admit selections at Central.
Press EXIT to continue

FIGURE 1-89 Verify VISA Admit

Along with the ADMIT request the current settings for Full Disclosure and Arrhythmia are sent to the VISA Central Station for processing. Full Disclosure "ON" requests that all patient data be stored at the VISA. Arrhythmia "ON" requests Arrhythmia detection to be enabled at the VISA. The newly admitted channel on the VISA Central Station will change color and a beep tone will be generated every 30 seconds until the admit is confirmed on the VISA. To confirm the admit on the VISA either click on the yellow tile with the mouse or tap on the tile if the VISA has a touch screen.

Discharge (5)

To discharge a patient from the corresponding channel on the VISA Central Station, press the DISCHARGE key (5). A patient can also be discharged using the setup menu. The following "Warning" message displays:

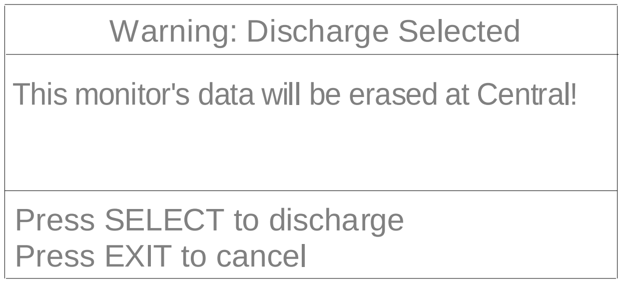


FIGURE 1-90 VISA Discharge

When SELECT is chosen, the following "Warning" message displays:

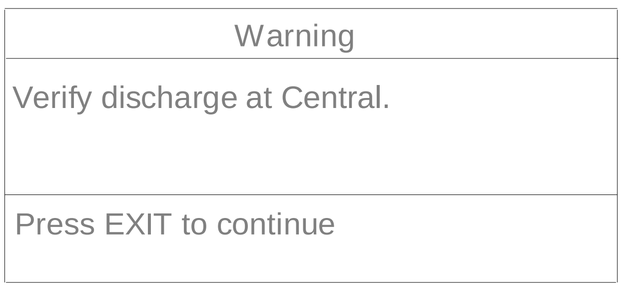


FIGURE 1-91 Verify VISA Discharge

NOTE: ***If "VISA WITH ADMIT" is not selected as the serial output type in the user configuration mode, and Admit or Discharge is selected, the following "Warning" message displays:***

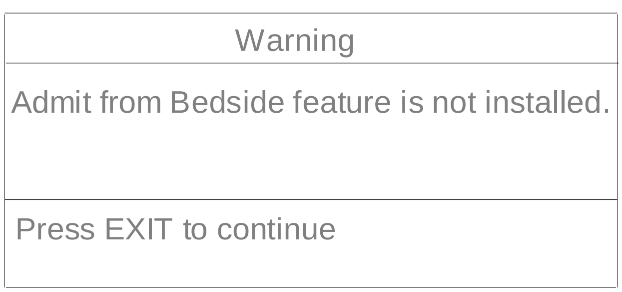


FIGURE 1-92 VISA with Admit not Installed

Silence (6)

Press the SILENCE key (6) to mute alarms that are initiated from the Passport and sent to the VISA Central Station. The amount of time the alarms are silenced, is determined through the VISA.

Print (22)

If the record destination in the record menu (see “Recorder Menu” on page 1-177) is set to either remote or both, then pressing the print key will initiate a waveform printing on the VISA central station.

1.6.23 Menus

This section contains all the menus used in the Passport XG. A sample of each menu with each menu item highlighted is provided. For each menu item highlighted, the Choices bar indicates the available selections. The menu Instructions bar indicates the available actions to take. See “Use of Menus” on page 1-109 for detailed instructions on menu operation.

1.6.23.1 Patient Menu

Size: Changing the patient size will adjust the Passport XG for monitoring adults, pediatrics or neonates. The alarm limit selections will change accordingly. The Passport displays the patient size in the menu display area.

The following four options are available only if the Serial Output Type is set to “VISA with Admit”:

Admit: Choosing “Yes” transmits an admit message to the VISA Central Station.

Discharge: Choosing “Yes” transmits a discharge message to the VISA Central Station.

Full Disclosure: If ON is desired, it must be selected prior to selecting Admit “YES”. Full Disclosure “ON” requests that all patient data be stored at the VISA.

Arrhythmia: If ON is desired, it must be selected prior to selecting Admit “YES”. Arrhythmia “ON” requests Arrhythmia detection to be enabled at the VISA.

Pacer Enhancement: Set to ON to display the pacer signal as a full scale square wave.

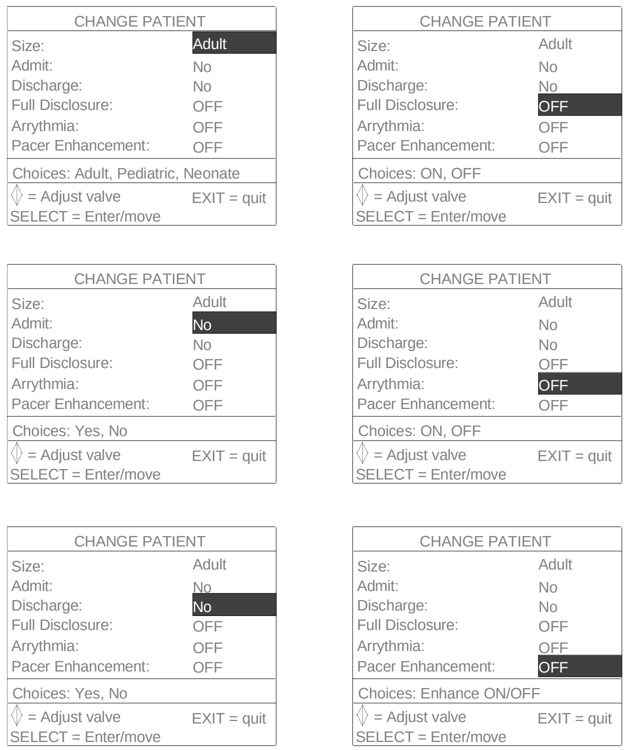


FIGURE 1-93 Patient Menu

1.6.23.2 Set-up Menu

Waveform 2/3: Set the type of waveform to display.

Auto Display IBP1 / IBP2 / CO_2: When these are set to waveform 2 or 3, and information for these parameters is available, the waveform for the corresponding parameter will automatically be displayed, regardless of what is chosen in "Waveform 2" and "Waveform 3".

NOTE: ***If Auto Display for is set with two or more functions set on the same waveform, CO_2 takes the highest priority, then IBP1 and then IBP2.***

Powerup settings: Select "Save Current" to keep all configured items for the next time the Passport XG is powered on. Select "Restore Factory" to return to the factory default settings.

NOTE: ***The choices for Waveform 2 and Waveform 3 only include the Agent and O_2 selections when the Gas Module is installed and configured.***

FIGURE 1-94 Set-up Menu

1.6.23.3 Recorder Menu

Wave Selection: Set the waveform or waveforms to be printed.

Record on Alarm: Set to ON for a recording to be printed each time an alarm situation occurs.

Record Destination: Set where the print out will occur. Passport - from the Passport XG, Central - from the Visa, Both - from both the Passport XG and the Visa.

NOTE: ***Choices for Wave Selection only include the CO_2, IBP1, IBP2, and Gas Module selections when these items are installed and configured.***

NOTE: ***Record Destination is only displayed when Serial Output Type is set to "VISA" or "VISA WITH ADMIT".***

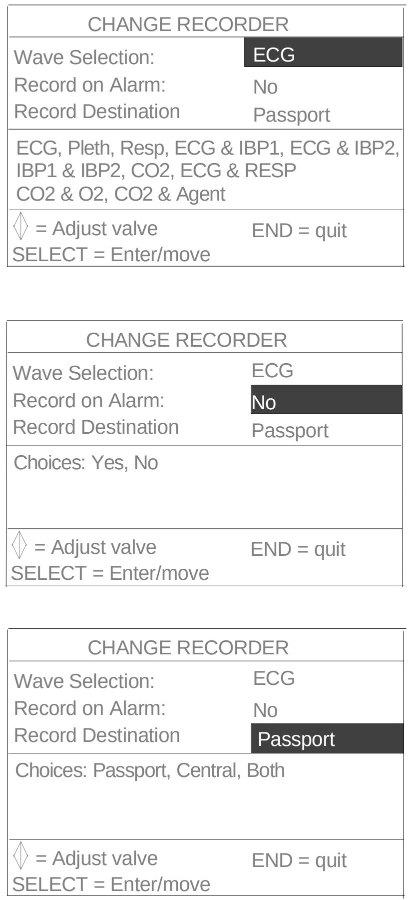


FIGURE 1-95 Recorder Menu

1.6.23.4 NIBP Menu

Start Pressure: Change the start pressure to affect the pump up pressure of the NIBP cuff. The range shown is for the adult patient size. The range for pediatrics is 60-180 mmHg, and the range for neonates is 40-120 mmHg.

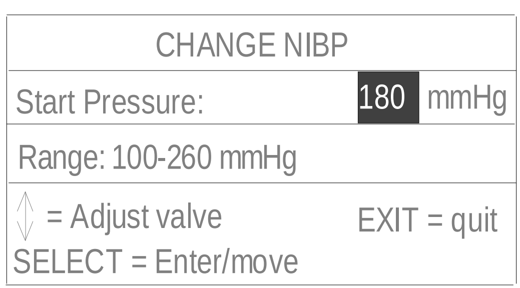


FIGURE 1-96 NIBP Menu

1.6.23.5 IBP menu

IBP1 Scale, IBP2 Scale: Sets the full scale value of the display.

CHANGE IBP		
IBP1 Scale:	150	mmHg
IBP2 Scale:	37.5	mmHg
Choices: 37.5, 75, 150, 300 mmHg		
↕ = Adjust valve SELECT = Enter/move	EXIT = quit	

CHANGE IBP		
IBP1 Scale:	150	mmHg
IBP2 Scale:	37.5	mmHg
Choices: 37.5, 75, 150, 300 mmHg		
↕ = Adjust valve SELECT = Enter/move	EXIT = quit	

FIGURE 1-97 IBP Menu

1.6.23.6 Resp Menu

Resp Speed: Sets the speed of the respiration waveform. This may be set either in this menu or in the Gas Module Menu (if installed).

Scale: Sets the scale of the Resp waveform.

Resp Source: Sets the source of the respiration information. “CO_2 / OFF” sets the source to CO_2, if CO_2 is present. If CO_2 is not present, the Resp Source is OFF. “CO_2 / ECG” sets the source to CO_2, if CO_2 is present. If CO_2 is not present, the Resp Source is set to ECG. If CO_2 option is not installed, Resp Source choices are OFF or ECG.

CHANGE RESP
Resp Speed: 12.5 mm/sec
Scale: 3
Resp Source: CO2/ECG
Choices: 3.125, 6.25, 12.5, 25 mm/sec
⇕ = Adjust valve EXIT = quit
SELECT = Enter/move

CHANGE RESP
Resp Speed: 12.5 mm/sec
Scale: 3
Resp Source: CO2/ECG
Choices: Off, ECG, CO2/Off, CO2/ECG
⇕ = Adjust valve EXIT = quit
SELECT = Enter/move

CHANGE RESP
Resp Speed: 12.5 mm/sec
Scale: 3
Resp Source: CO2/ECG
Choices: 1, 2, 3, 4, 5
⇕ = Adjust valve EXIT = quit
SELECT = Enter/move

FIGURE 1-98 Resp Menu

1.6.23.7 HR/ECG Menu

Trace Speed: Sets the speed of the ECG, IBP1, IBP2, CO_2 and Pleth waveforms.

Source: Select which source is used for the heart rate reading. The Auto selection uses a built in algorithm to automatically choose the strongest heart rate source. The order of priority starts with ECG, then IBP, then SpO_2, and then NIBP.

CHANGE HR/ECG
Trace Speed: 25 mm/sec
Source: AUTO
Choices: 12.5, 25, 50 mm/sec
⇕ = Adjust valve EXIT = quit
SELECT = Enter/move

CHANGE HR/ECG
Trace Speed: 25 mm/sec
Source: AUTO
Choices: Auto, ECG, IBP1, SpO2
⇕ = Adjust valve EXIT = quit
SELECT = Enter/move

FIGURE 1-99 HR/ECG Menu

1.6.23.8 SpO_2 Menu / Nellcor SpO_2 / Masimo SpO_2 Menu

Pleth Size: Sets the scale of the plethysmograph waveform.

Sensor-Off Audio: Set to Off - no beep tone from the Passport. Set to ON - a one time series of 5 triple beeps upon recognition of a SpO_2 sensor off condition. Set to CONT - a series of 5 triple beeps every 30 seconds.

Mode (Nellcor SpO_2 only): Sets the averaging time of the plethysmograph waveform on units with Nellcor. Scaling is automatic, refer to “Special Features” on page 1-131.

Sensitivity Mode (Masimo SpO_2 only): Sets the sensitivity mode depending upon signal quality.

Post Average Time (Masimo SpO_2 only): Changes averaging time for Saturation, Pulse Rate, and Signal Strength measurements for SpO_2.

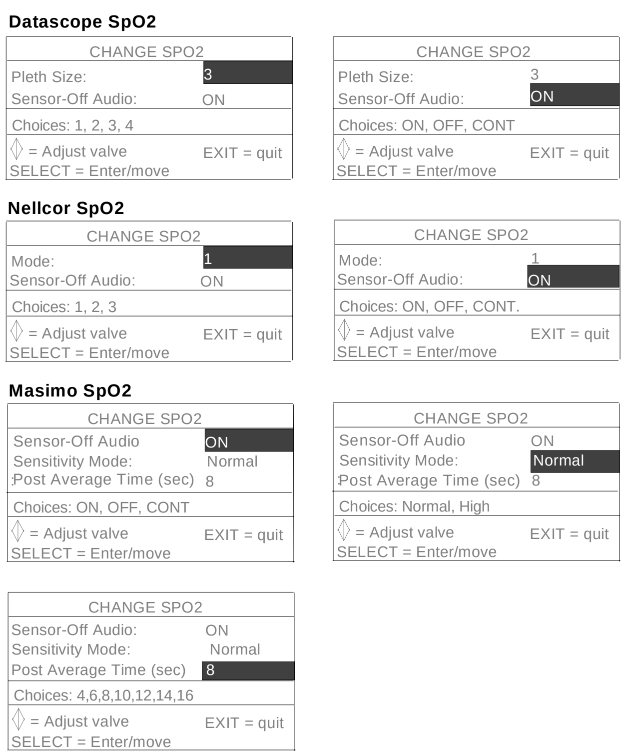


FIGURE 1-100 SpO_2 Menu

1.6.23.9 CO_2 Menu

CO_2 Scale: Select the size of the displayed CO_2 waveform.

Start Zero Calibration: Select Yes to initiate the calibration of the sensor.

Start adapter cal: Select Yes to initiate the calibration of the airway adapter with the sensor.

N_2O Compensation: Select ON to compensate for interference caused by nitrous oxide present in the gas being analyzed.

O_2 Compensation: Select % to compensate for interference caused by oxygen present in the gas being analyzed.

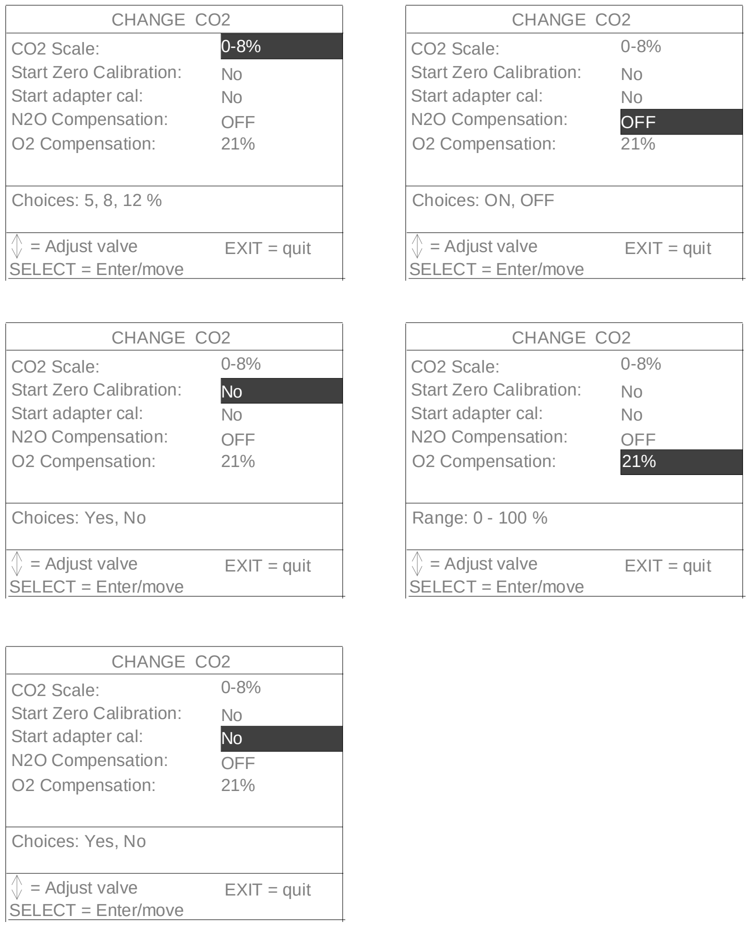


FIGURE 1-101 CO_2 Menu

NOTE: ***If the Gas Module is installed and configured, a message will appear asking the user to re-configure the Serial Output in the User Configuration.***

1.6.23.10 Gas Module Menu

CO_2 Scale: Select the size of the displayed CO_2 waveform.

Resp Speed: Sets the speed of the respiration waveform. This may be set either in this menu or in the Resp Menu (see “Resp Menu” on page 1-179).

Start Zeroing: Select Yes to manually initiate re-zeroing of the Agent, CO_2, and N_20 Gas Module parameters.

Start Calibration: Select Yes to initiate the Gas Module calibration routine. See “Gas Module Option” on page 1-146 for more details.

Restart Pump: Select Yes to manually restart the Gas Drive Pump.

Agent Selection: Auto ID is the default. Manual override is allowed. If an agent other than the one selected is detected, a message indicating an agent mismatch will appear.

Agent Scale: Select the scale of the Agent.

O_2 Scale: Select the scale of the O_2.

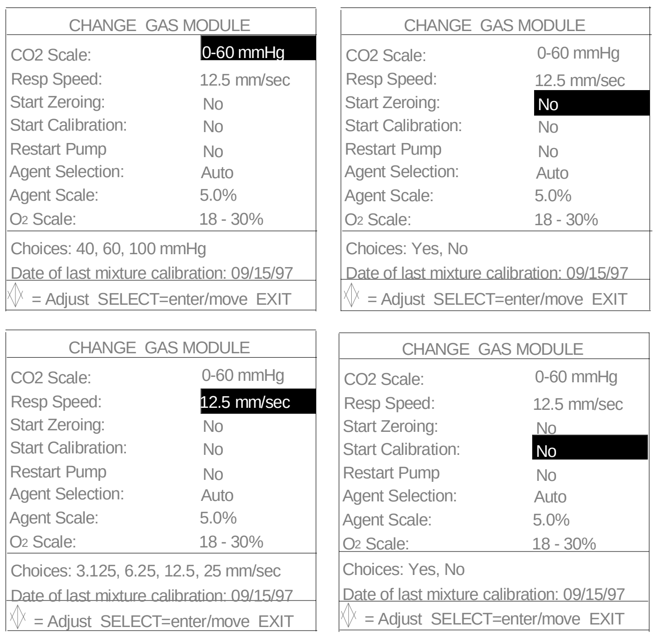


FIGURE 1-102 Gas Module Menu

Gas Module Menu Continued

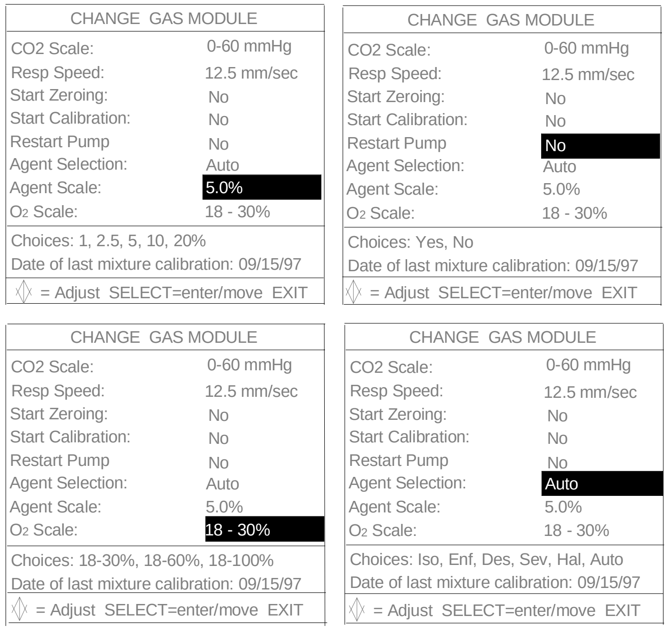


FIGURE 1-103 Gas Module Menu, continued

1.6.23.11 Alarm Menu

This menu is accessible by pressing the "LIMITS" key, see "Alarms" on page 1-149 for more details.

The alarm menu provides access to change the settings for all available parameter alarms. The following illustrates a sample of what may be displayed depending on the options installed.

NOTE: ***IBP1, IBP2, Gas Module and CO_2 are optional and will not appear on menu if not installed.***

NOTE: ***When the Gas Module is installed and configured, two more pages with additional alarm limits become available, refer to "Alarm Limits" on page 1-150 for complete details on limits.***

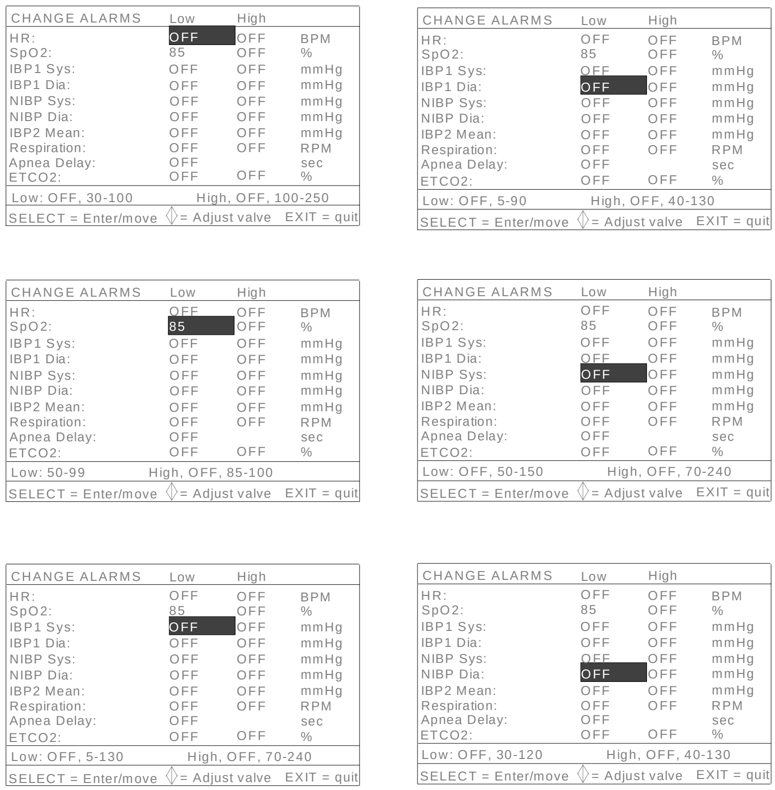


FIGURE 1-104 Alarm Menu

Alarm Menu continued

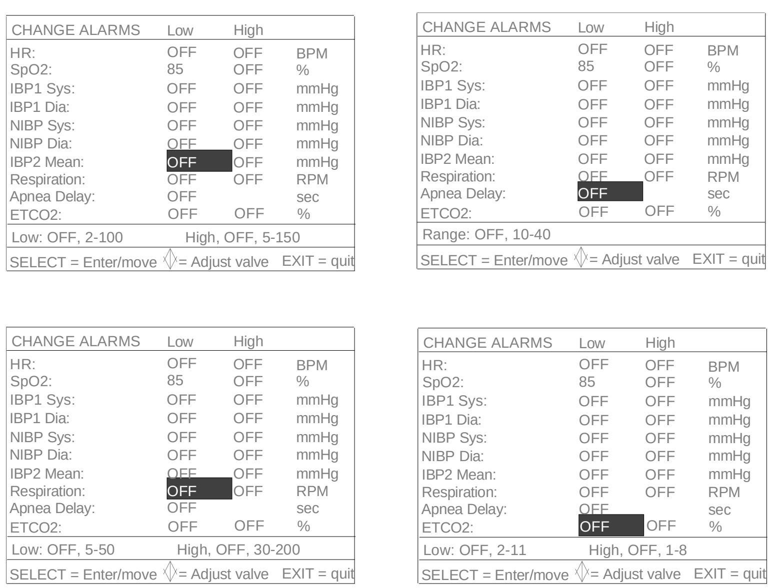


FIGURE 1-105 Alarm Menu, continued

User Configuration Menu

The User Configuration Menu is accessed during the power-up sequence. See “User Configuration Mode” on page 1-153 for complete details.

1.6.23.12 User Configuration - Date/Time Menu

Year, Month, Day, Hours, Minutes - Use the UP ▼ and ▼ DOWN arrow keys (1) to set each item to the appropriate number.

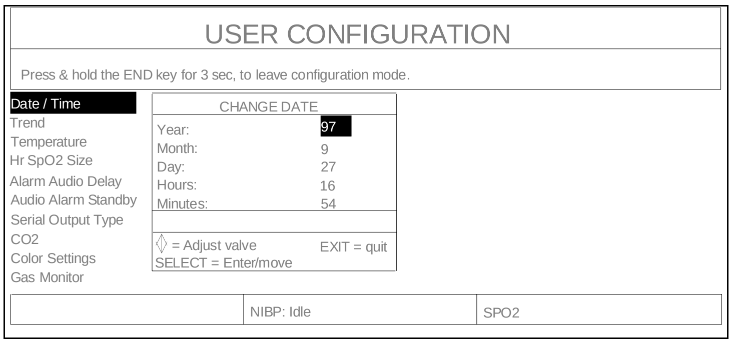


FIGURE 1-106 Date/Time Menu

1.6.23.13 User Configuration - Trend Menu

Trend Trigger: Choose the events that when they occur cause the current parameter information to be stored in the trend memory. The selections for triggers are: (Interval), (NIBP), (Alarms), (Interval, NIBP, & Alarms), (Interval & NIBP), (Interval & Alarms) or (NIBP & Alarms).

Interval: Each time the selected time interval has elapsed, the parameter information is stored in the trend memory. The selections within the range are: 1, 2.5, 5, 10, 20, 30, 60 or 120 minutes.

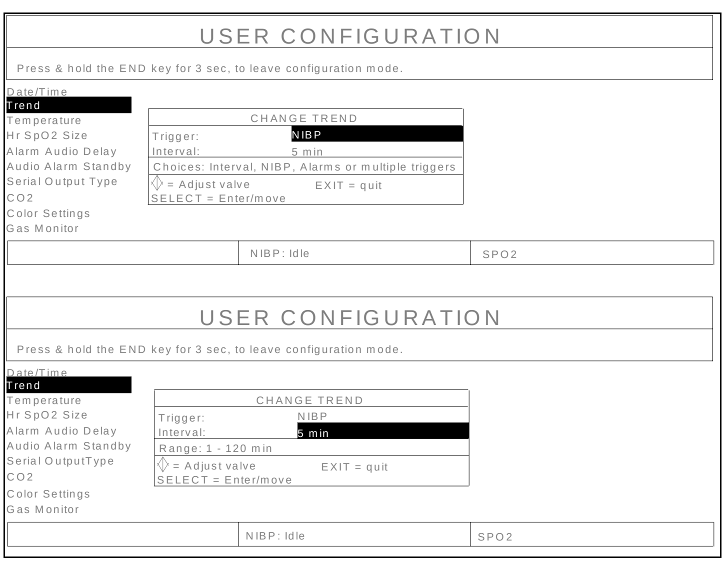


FIGURE 1-107 Trend Menu

1.6.23.14 User Configuration - Temperature Menu

Temperature Scale: Select the temperature to be measured in Fahrenheit or Centigrade units.

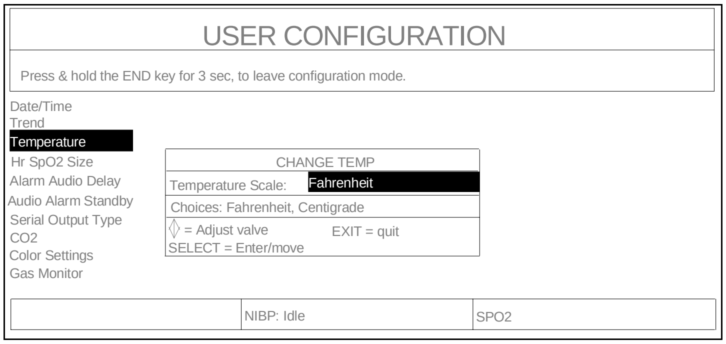


FIGURE 1-108 Temperature Menu

1.6.23.15 User Configuration - Hr SpO_2 Size Menu

Hr SpO_2 size: Re-sizes the Hr and SpO_2 display areas.

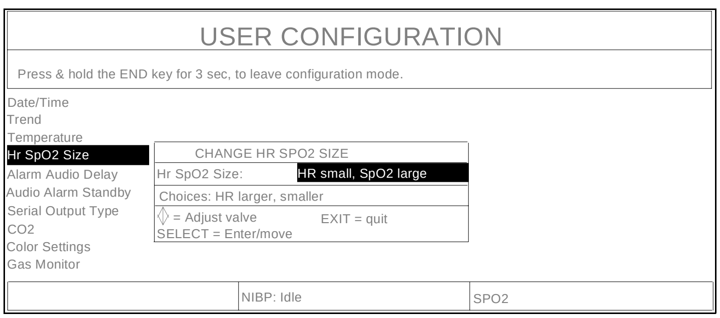


FIGURE 1-109 HR SpO_2 Menu

1.6.23.16 User Configuration - Alarm Audio Delay Menu

Alarm Audio delay: Set to 4, 6 or 8 seconds to delay the tone of an alarm for the selected amount of time.

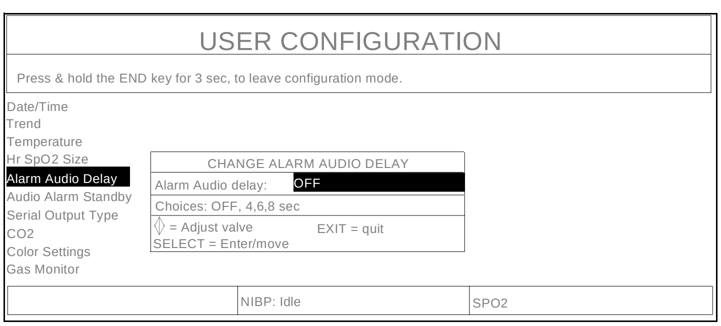


FIGURE 1-110 Alarm Audio Delay Menu

1.6.23.17 User Configuration - Audio Alarm Standby Menu

Aud alm standby: When this function is set to ON, pressing and holding the MUTE key for 4 seconds will indefinitely suspend the alarms. When set to “Active on Powerup”, the Audio Alarm Standby mode is automatically set on powering up the unit. This indefinitely suspends alarms. To deactivate the Audio Alarm Standby mode, press the MUTE key. When this function is set to OFF, alarms cannot be indefinitely suspended.

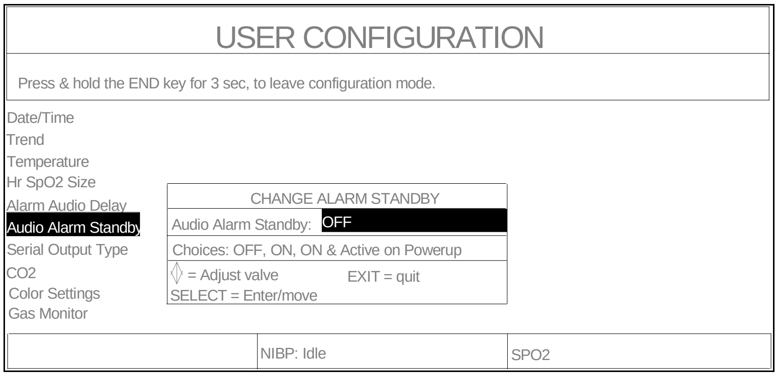


FIGURE 1-111 Audio Alarm Standby Menu

1.6.23.18 User Configuration - Serial Output Type Menu

Serial Output Type: Select the communication protocols for interfacing with other specialized equipment. Six options are available. The VISA with Admit option should be selected when the VISA Central Station supports the “Admit from Bedside” feature. The Gas Module option should be selected when the Passport XG is to be used with the optional Gas Module.

The Serial Output Type allows the user to select the communication protocols for interfacing with other specialized equipment: VISA, VISA with Admit from bedside feature, Gas Module (optional), Accutorr (uses the same data protocol as an Accutorr), message (for diagnostic purposes) with the Passport XG Monitor. The baud rate for the Accutorr protocol can be set for 1200, 2400, 4800 or 9600 bps.

NOTE: ***The VISA Central Station cannot be used in conjunction with the Gas Module option.***

FIGURE 1-112 Serial Output Type Menu

1.6.23.19 User Configuration - CO_2 Menu

Barometric Pressure: Allows the facility to adjust to the current pressure. Units equipped with Sidestream CO_2 read this value from monitor and adjusts automatically. The user does not need to change this value.

CO_2 Units: Allows the facility to select the units of measure.

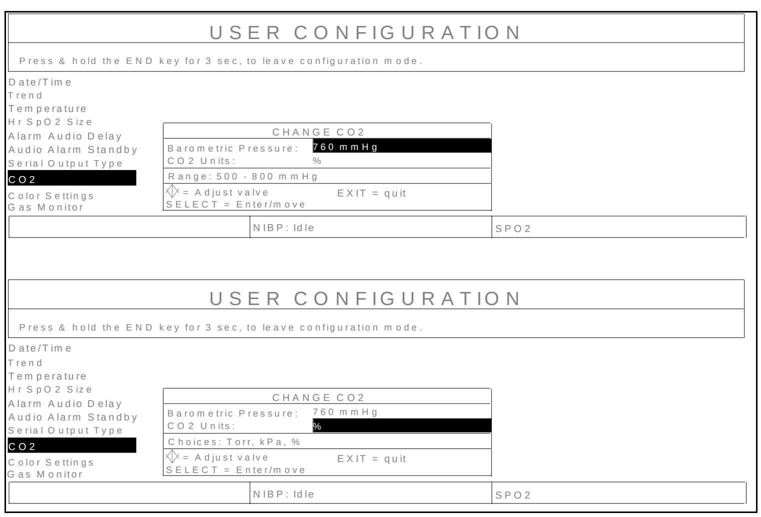


FIGURE 1-113 CO_2 Menu

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2.0 *Theory of Operation*

The Theory of Operation provides block diagrams, an overview of each board, and a detailed circuit description of each board. The circuit descriptions are included to assist service personnel while repairing the printed circuit board on a component level. Refer to the schematic diagrams in Chapter 2 when reading the Detailed Circuit Descriptions.

2.1 Block Diagrams

The Block Diagrams indicate the internal organization of the instrument. It depicts several circuit boards, numerous connectors and the cathode ray tube. The block diagrams are used to gain both familiarity with the instrument and locate malfunctioning PC boards as readily as possible. To avoid clutter, the number of PC board interconnects is minimized. The interconnects shown represent major or essential signal flow and clock connections. Also, the power supply connections for each board are shown.

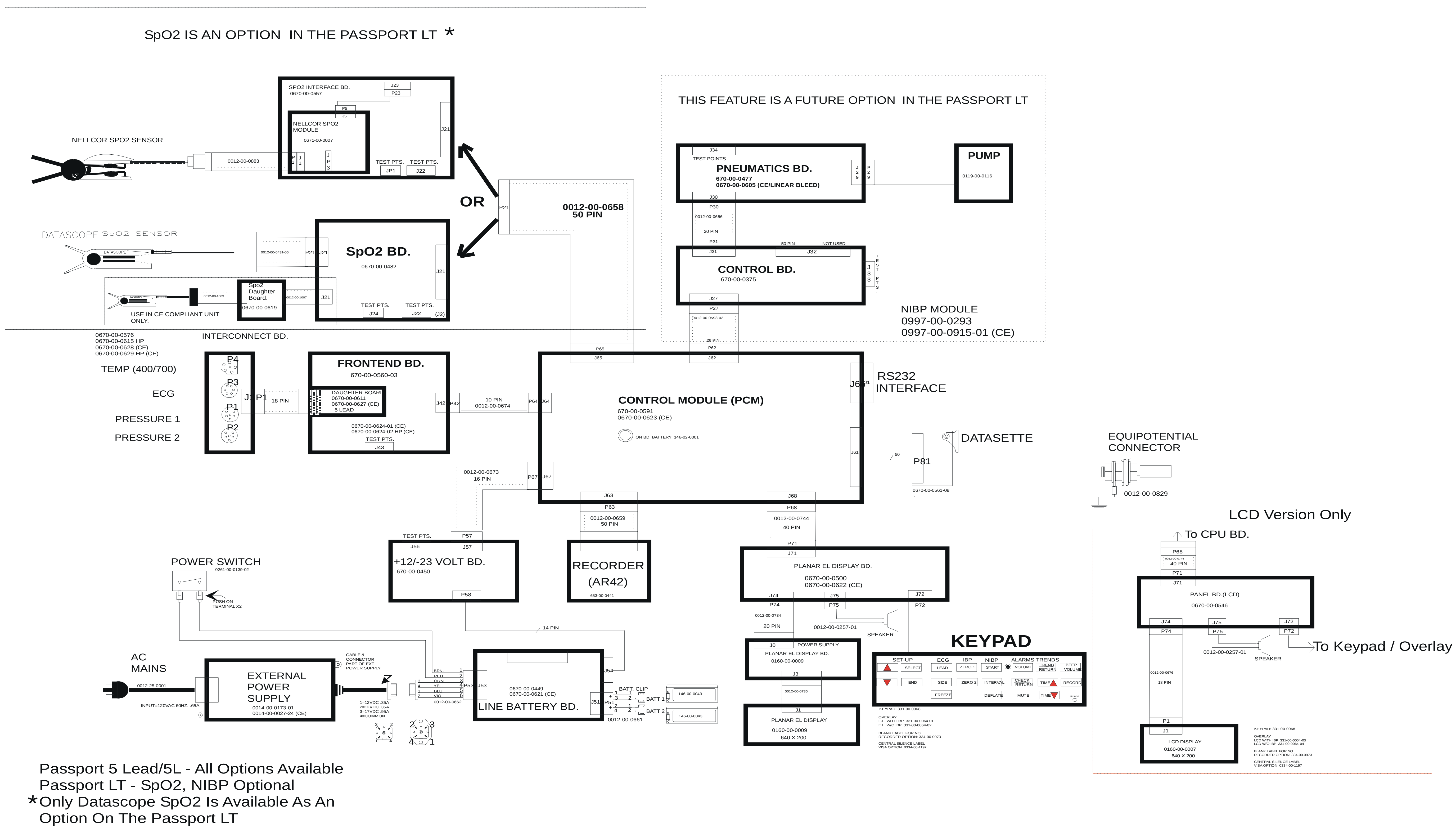

FIGURE 2-1 Passport 5L/LT Block Diagram

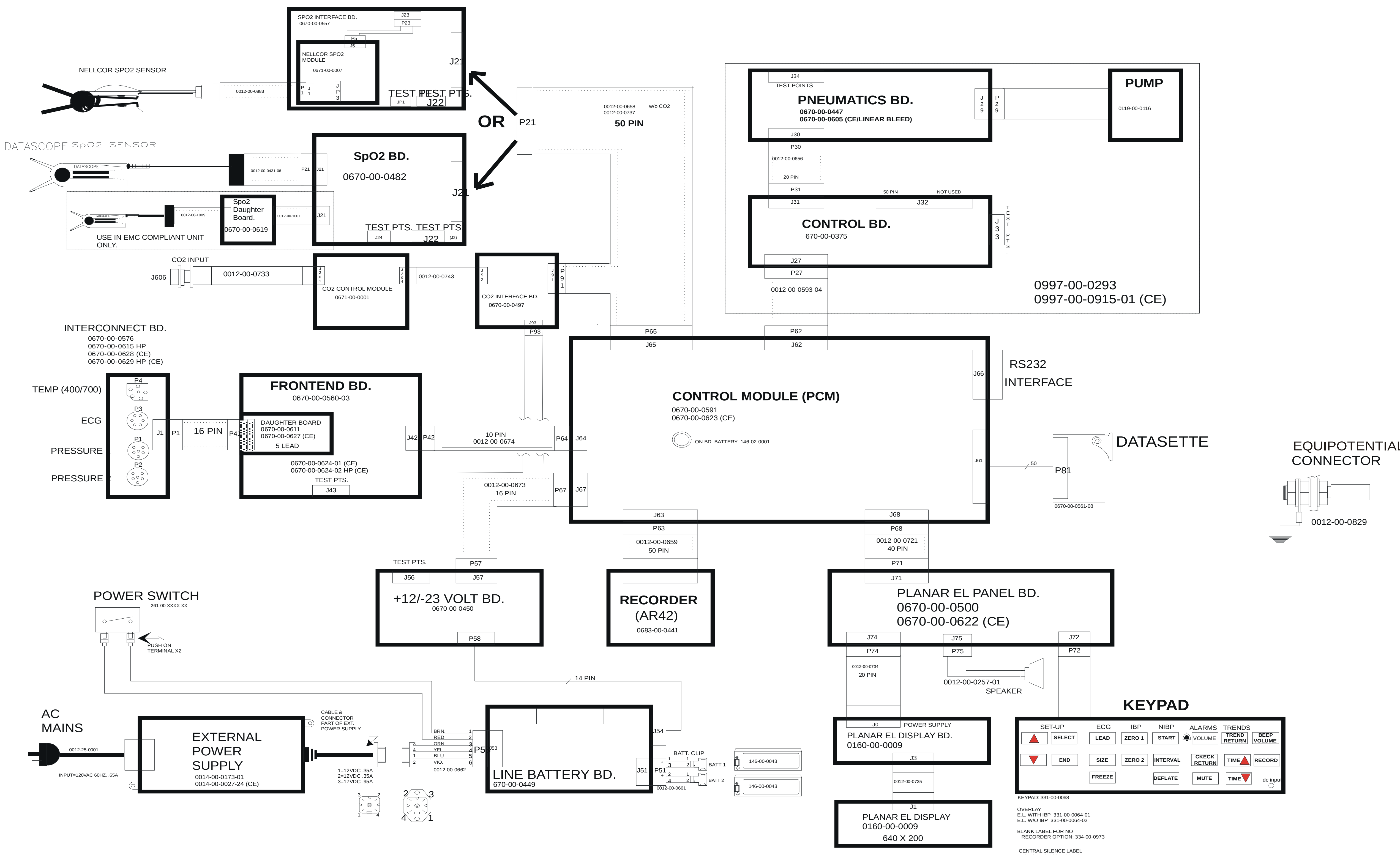

FIGURE 2-2 Passport 5L with CO_2 Block Diagram

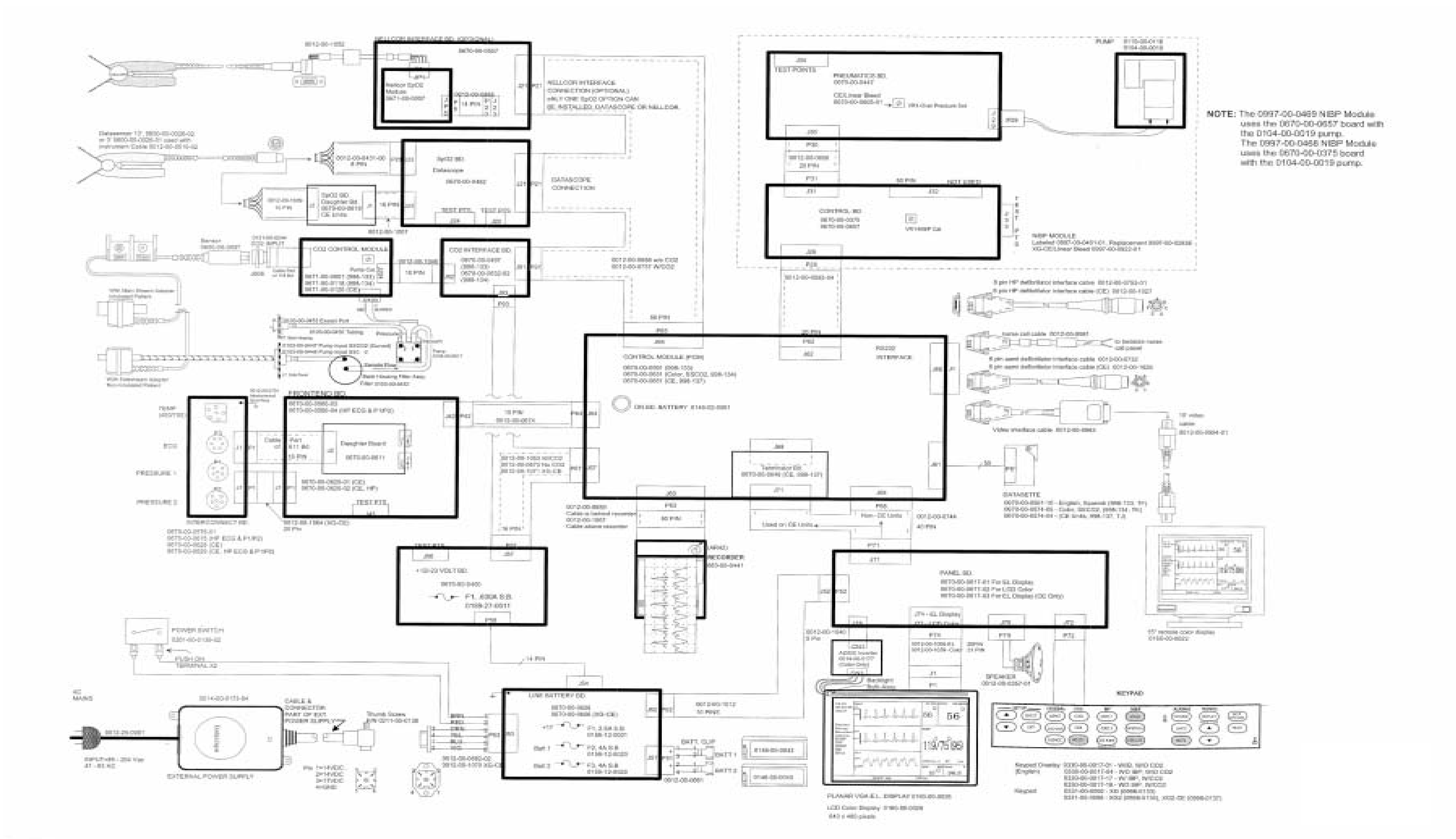

FIGURE 2-3 Passport XG Block Diagram

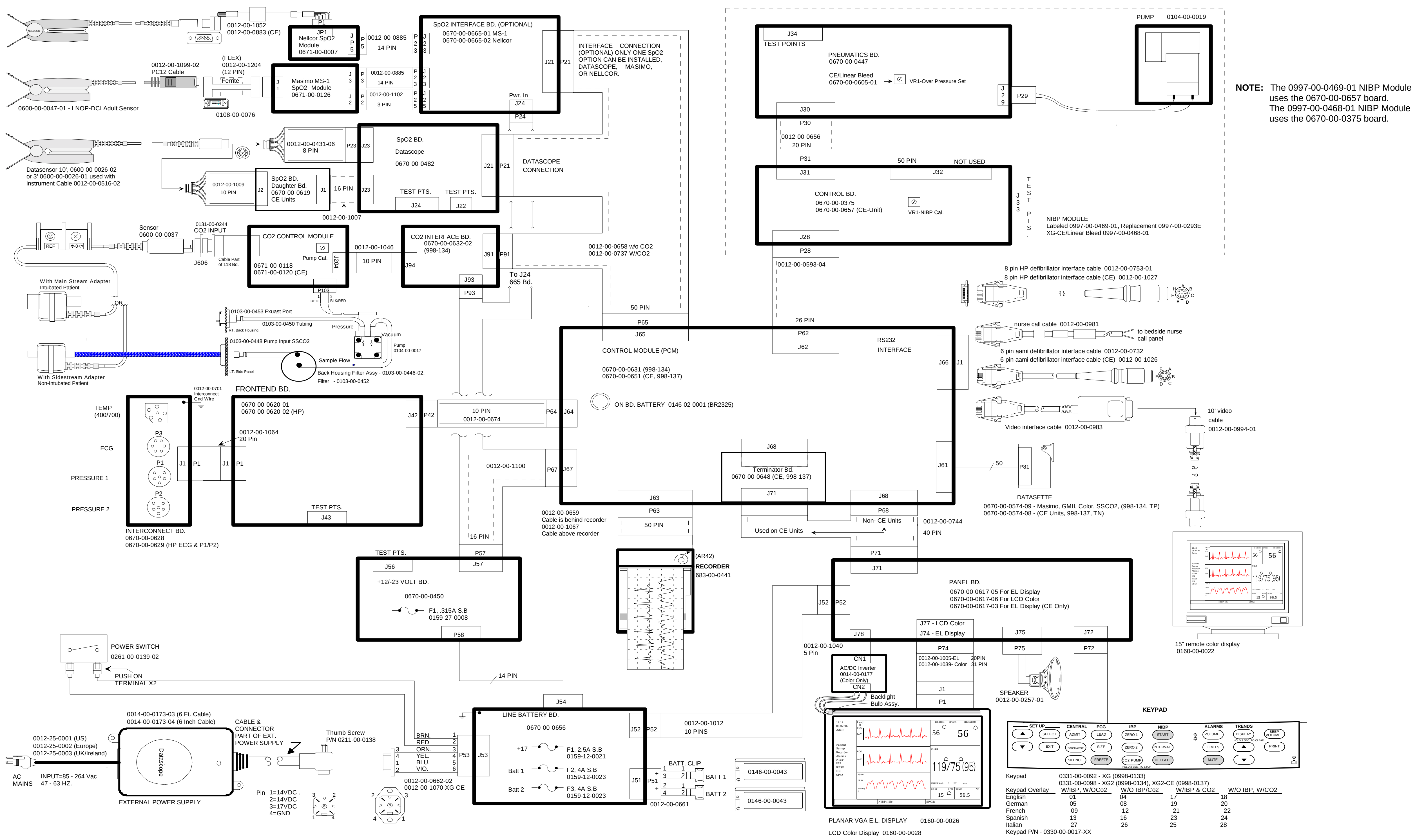

FIGURE 2-4 Password XG, (Masimo) Block Diagram

2.2 Detailed Circuit Descriptions

This section of the manual describes the operation of each circuit block. Refer to the schematic diagrams in Chapter 2.

Included are descriptions for the following Circuit Board Assemblies:

2.2.1 Interconnect Board

Overview

The Passport Interconnect module is a hardware interface which provides the physical connection between the patient connected cables, and the preamplifiers and signal conditioning circuitry of the Front End Module. It incorporates ESD and defibrillator voltage suppression circuitry, along with spark-gap connection to non-isolated system common.

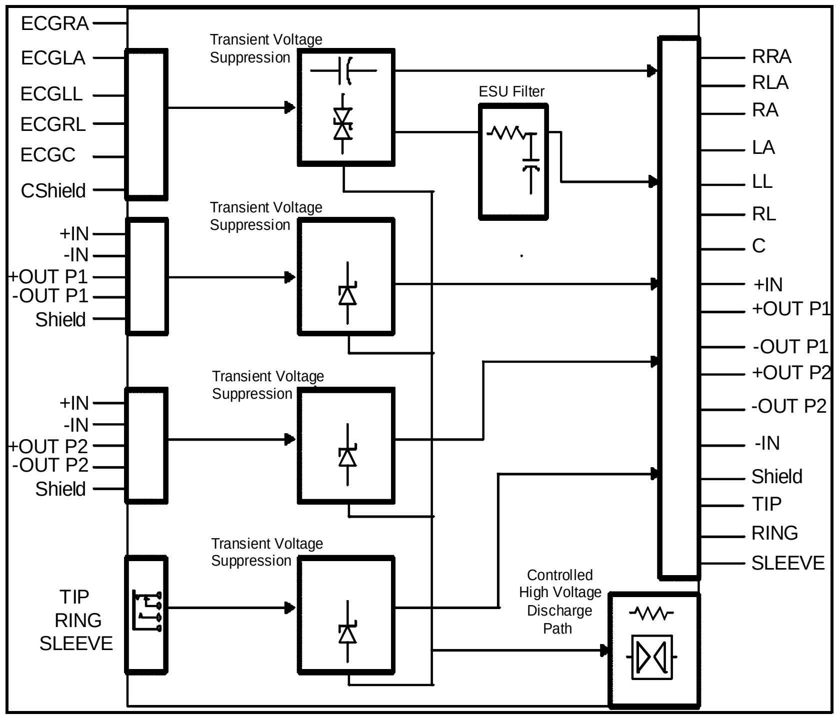

FIGURE 2-5 Interconnect Board Block Diagram

Detail

Refer to the block diagram (Figure 2-5 on page 2-8), and complete circuit schematics, while reading the following operation description.

The Interconnect Board can be viewed simply as the hardware connection between the monitors external patient connectors for ECG, respiration, invasive pressure, and temperature, and the internal signal processing circuitry. As it does this, it also provides high voltage transient suppression.

ECG

Connection to the patient is made by ECGRA, ECGLA, ECGRL, ECGLL, and ECGC, via P3, a standard ECG connector. Transient high voltage suppression is provided by R1, R2, R3, R9, R10, CR1, CR2, CR3, CR10, and CR11. The resistors act as current limiting devices, while the bidirectional transorbs limit the output signal voltages of RA, LA, RL, LL, and C, to 200 volts differential to “Shield” potential. “Shield” is ultimately connected to isolated ground on the Front End Module.

After the high voltage suppression stage, each ECG leadwire's signal enters a separate RC filter to attenuate electro-surgical frequencies, as well as the respiration carrier generated on the Front End Module. The five RC filters are R11-C6, R6-C9, R8-C7, R5-C10, and R7-C8.

Respiration

Connection to the patient is made by ECGRA, and ECGLA, via J3. High voltage protection, up to 6000 volts differentially, is provided by capacitors C1 and C2. The patient signal is finally routed to the Front End Module as RRA and RLA, via J1.

Pressure

This monitor incorporates two invasive pressure transducer channels. Connection to the patient for the P1 channel is via connector P1, and for the P2 channel, connector P2. Voltage excitation for the transducers is provided by the +IN and -IN signals which is a 5v supply (-IN is connected to isolated ground on the Front End Module). Transducer output is carried differentially on the +OUT and -OUT (P1 and P2) signals to the Front End Module. High voltage electrostatic discharge protection is provided by suppressors CR8 through C12.

Temperature

Both Series 400 and Series 700 type sensors can be connected to the monitor using the connector jack J4. The input signals are protected by transient voltage suppressor CR9. EMI and RFI suppression is provided by common mode choke L1, and C3, C4, and C5. TIP, RING, and SLEEVE signals are sent to the Front End Module via J1.

Controlled High Voltage Discharge

The Interconnect board provides a specific path to bleed off slowly accumulated static energy to non isolated monitor ground, through R4, a 100 MW resistor. Rapid accumulation of charge (voltage) at levels of over approximately 5500 volts, are discharged through DG1, a gas spark gap device to non isolated monitor ground potential. The connection to the non isolated monitor ground is via a direct wire strap from the resistor and spark gap combination non isolated side, to the monitor's internal center chassis structure.

2.2.2 Frontend Board/Daughter Board

Overview

The Passport Frontend Module consists of nine major blocks: the ECG, pressure, respiration, temperature, isolated power supply, A/D converter, isolated microcontrollers, non-isolated microcontroller, and data isolation sub-systems.

The ECG channel has five lead capability. It has an analog gain of 390, incorporates pacer detect/reject processing, and electrosurgery interference detection function.

The dual invasive pressure channels each provide for a linear input range of -20 to +300 mmHg and can reject up to 120 mmHg of offset. The P1 channel systolic trigger level is fixed at approximately 18 mmHg.

Patient respiration monitoring is accomplished using standard impedance pneumography, actively driving a patient through the RA and LA ECG leads with several hundred microamperes at 114kHz. Respiration can be measured over a range of 50 to 2000 ohms equivalent body impedance. The circuitry outputs a signal representing a modulation of this impedance, up to a maximum of 10 ohms.

The temperature preamplifier is capable of measuring with either 400 or 700 series thermistor sensors. Measurement is valid over the range of 15 to 45 degrees C. Integral calibration is provided internally at an equivalent temperature of 37.5 degrees C.

The Frontend Module creates its own isolated power from the system's bulk power source, which is either an unregulated 11 to 18 volt supply, or a battery supply of 11 to 14 volts. The power conversion is implemented with a switch mode forward converter, to provide an isolated supply of approximately 8 volts. Regulated +5 volts for circuitry and pressure transducers is accomplished using series linear regulators.

Analog to digital conversion is implemented with a 12 bit converter, having 11 multiplexed analog inputs and a serial digital data output. This function is controlled by an isolated microcontroller, which also controls the configuration and operation of the various sub-circuits. This processor is an 8 bit low power microcontroller with parallel I/O capability. The isolated microcontroller communicates in a serial format with the non-isolated microcontroller via opto-couplers, from which it receives its operational information, and to which it sends the patient data and circuit status.

The non-isolated microcontroller is a high-performance 32 bit integrated processor with direct memory access.

Daughter Board

The daughter board connects to the front end board at the existing J41 header, and also at a new connector installed in the location formerly occupied by multiplexer U3. The J41 header was the original attachment for the interconnect board in the 3-lead version. The respiration, pressure and temperature signals simply pass through the daughter board from the interconnect board to their original pins on J41. The ECG signals, however, are intercepted to provide the 5-lead functions. Certain signals not available on J41, such as power and the lead selection lines, are obtained from the connector installed in place of U3.

Each of the leadwires RA, LA, LL, RL and C, is brought from the interconnect board through J2. The active leads (RA, LA, LL and C) are passed through an ESIS filter, consisting of two cascaded R-C stages. For RA, this consists of R2-C1 and R19-C5, while identical circuits are provided in the remaining leadwires. Each signal is then buffered by one section of quad opamp U1, which is connected as a voltage follower. The buffer amplifier is used to provide a bootstrapped lead bias for lead fault detection. Again using RA as a example, the series connected diode pair CR1 and resistor R26 produce a level shifted version of the buffered RA signal. This level shifted signal will always track two diode drops, or about 1.2 volts, more negative than the RA signal. Bias resistor R1 is connected from this level shifted signal to the RA lead input. Therefore, regardless of the voltage at the RA input (within range) a bias current equal to (1.2 volts)/R1, or about 55 nA, flows as the lead bias. This bias current is negative, meaning that the buffered lead signal will assume a strong negative voltage (near the negative supply rail) when the leadwire is disconnected. Each of the active leads has an identical circuit.

The RL lead has a different circuit, because it is used only as a drive lead, and never as an active (input) lead. When displaying any lead except, I, II or III, a 5-wire cable is needed, and RL is the drive lead. However, to allow compatibility with 3-wire cables when displaying leads I, II or III, the LL, LA and RA wires (respectively) are used as the drive. The selection of the drive lead is performed by multiplexer IC U4. Resistor R32 is used to attenuate the drive signal (supplied from the front end board) so that it cannot exceed the +5 volt supply rail of U4. Were this to occur, U4 would malfunction, and lead fault would not be reliably detected.

The buffered active lead signals are applied to a conventional Wilson network, consisting of resistors R11, R13, R16, R17, R21, R23, R24, R27 and R29. These resistors provide the weighted leadwire signals when displaying leads aVR, aVL and aVF, as well as the "Wilson Central Terminal" (WCT) for display of lead C. For example, lead aVR is defined as 50% each of the LL and LA signals taken as one ECG amplifier input, and RA as the other. Resistors R11 and R17 perform the 50% weighting of signals LL and LA. Similarly, the C lead is defined as the voltage on the C leadwire, measured against the average of the RA, LA and LL voltages, known as the WCT. Resistors R13, R21 and R27 develop the WCT voltage. The correct points for each lead display are picked off of the Wilson network by multiplexers U2 and U3. The outputs of these multiplexers are called ECG+ and ECG-, corresponding to the positive and negative inputs of the ECG amplifier on the front end board. They are carried to the front end board on pins 4 and 10 of J1, which mates with the connector installed in the former site of U3 of the front end board. On the front end board, jumpers installed in position U4 carry these signals to lines F and G, which are the inputs of ECG differential amplifier U33.

The lead select multiplexers, U2 and U3, as well as the drive multiplexer, U4, are controlled by three select lines, which select one of 7 leads or the ECG calibrate function. The lines LSEL0 and LSEL1 correspond to the original LS0 and LS1 lines used in the 3-lead version. An additional line, LSEL2, has been added to allow selection of the added leads. The network R14-C11 in this line provides isolation between the microcontroller and the ECG multiplexers, and is identical to the networks found in the LS0 and LS1 lines on the front end board.

Lead fault detection is performed by measuring the DC voltage of the ECG+ and ECG- signals. Resistors R33 and R34, together with diodes CR5 and CR6, select the lower (more negative) of the two voltages on these points, and routes it to signal A, which is passed to the lead fault comparator on the front end board. The operation of the lead fault detection takes into account simulators which may short the ECG and pressure circuits together. The Passport will not show a spurious lead fault with most such simulators, although it may fail to detect certain lead faults when the pressure is connected to the simulator. Since this is a different operating mode than the original Passport lead fault detection, the lead fault comparator has been modified, as is discussed below.

Front End Board

The ECG section of the front end board has been modified from the previous 3-lead system. The ESIS filters and lead bias resistors have been removed entirely. U3 has been replaced by a connector which mates with the daughter board. Multiplexer U4 has been replaced by two jumper wires, which allow the ECG signal from the daughter board to pass to the ECG amplifier U33, as has been discussed previously. The additional lead selection line has been added by connecting pin 27 of U38 to pin 1 of the connector used in place of U3. This line is activated when enhanced microcontroller and Datasette software is used. In order to allow the software to be backwards compatible with the 3-lead system, the 5-lead board is identified by grounding pin 21 of the microcontroller, which is high on the 3-lead systems.

The drive amplifier signal is attenuated, as discussed above, by R32 on the daughter board, and R12 on the front end board. To restore the drive gain to a higher value, R160 has been increased to 30.1 K. To facilitate the new lead fault detection scheme, the bias point of the drive amplifier has been changed slightly be changing R161 and R162. The lead fault sensing voltage arrives from the daughter board by pin 5 of the connector installed in place of U3. The signal is buffered by voltage follower U34, and then processed by the lead fault comparator, U24. Lead fault is indicated when this signal becomes too negative. Therefore, the comparator, which was originally configured as a window comparator, has been modified to detect only negative voltages. When a simulator having a connection between the ECG and pressure is used, the lead fault voltage is driven in a positive direction, and will therefore not indicate lead fault. The modification of the comparator consists of omitting diode D30 and resistor R166. A noise filter has been constructed by installing a 22.1 k resistor in place of D37, and a 0.1 uF capacitor in place of R165. The threshold voltage of the comparator has been adjusted by changing R168 and R214. When the leads are attached, the voltage applied to the comparator is roughly -0.4 volts. When lead fault occurs, this voltage becomes more negative, passing the approximately -1.3 volt threshold set by R168 and R214.

Because the lead fault is detected from the output of the lead select multiplexer, only those leadwires actually involved in producing the displayed lead are monitored for lead fault. Therefore, only RA, LA and LL are considered in lead I, II or III; additionally RL is considered in aVR, aVL and aVF; and all leadwires are considered in C. However, because the aVR, aVL, aVF and C lead selections involve averaging the voltage on two or three electrodes, the lead fault indication is less strong on these lead selections. This is because the bias voltage of the disconnected lead may become averaged with the voltage of a lead which is still attached. Therefore, the lead fault comparator will see a voltage nearly equal to the negative supply rail if a fault occurs in leads I, II or III, but will see a voltage as little as -2 volts if one of LA, RA or LL is detached in lead C.

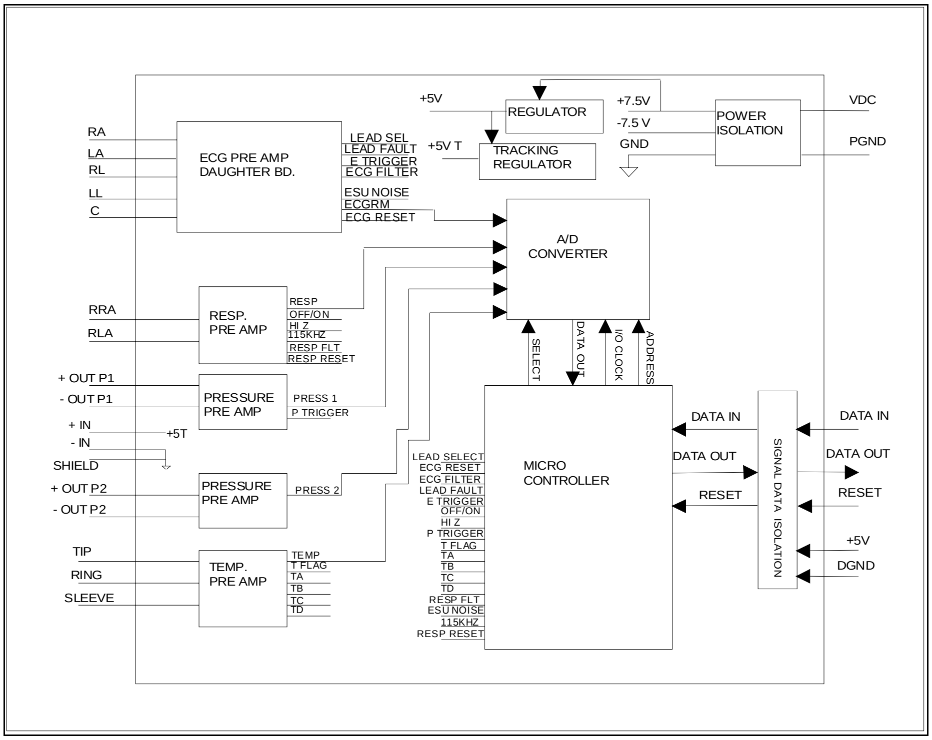

FIGURE 2-6 Overall Front End Block Diagram

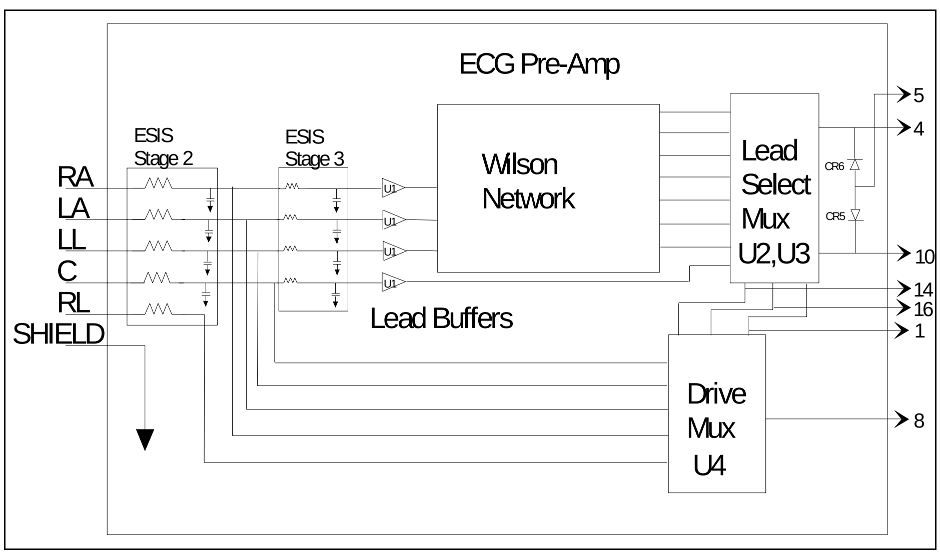

FIGURE 2-7 ECG Pre-Amp Block Diagram

Respiration

In Fig. 2-8, the connection to the patient is made through two leads marked RRA and RLA, which ultimately become RA and LA on the body. A 114 KHz, 500 microamp RMS sinewave is applied to the patient through the electrodes (which are positioned more to either side of the chest than usual while doing a 3 lead ECG). The signal is applied to the electrodes through a small isolation Transformer (T2) and the respiration signal is reflected back through this same transformer. The purpose of the isolation is not for patient safety (that barrier is elsewhere) but to eliminate other stray return paths for the signal and thus an error in the signal.

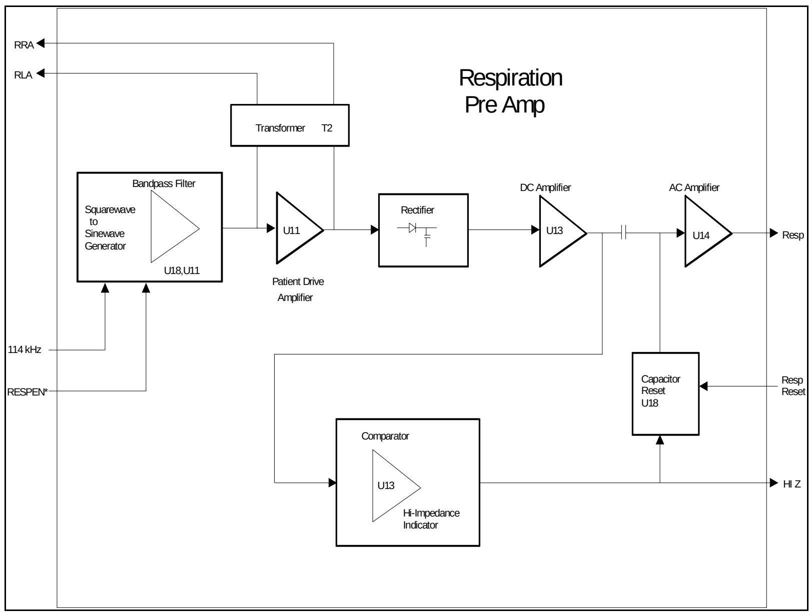

FIGURE 2-8 Respiration Preamp Block Diagram

Generation of the patient drive starts at U18, which chops between a 5 volt reference and ground to produce a 114 kHz square wave of a precision amplitude with respect to the analog to digital converter (i.e., the same 5 volt reference is used for the A/D reference). The respiration drive can be disabled by a logic high on the RESPEN* signal, which inhibits U18. A second order Bandpass Filter, U11 and associated parts, transforms this square wave into an approximation of a sinewave, approximately 4 volts peak to peak, centered on 0 volts. This sinewave drives the inverting input of U11, the Patient Drive Amplifier, through R91. Thus, the current in Transformer T2's primary (being in the feedback loop of U11) is constrained to be the sinewave voltage divided by the value of R75, resulting in approximately 500 microamperes. The secondary signal, which is the same as the primary, because the transformer has a 1:1 winding ratio, is applied to the electrodes via resistors and capacitors on the Interconnect board. The capacitors behave as a short to the 114 kHz sinewave carrier, but as a very high (greater than 5 megohms at 10 Hz) shunting impedance to the ECG electrodes so as not to attenuate the ECG signal.

The patient's resistance variation due to respiration (.05 ohm to 5 ohms, out of 50 ohms to 2K Ω unmodulated impedance) reflects back through the transformer and results in a voltage variation at Patient Drive Amplifier U11 pin 7 of approximately 69 microvolts to 6.9 millivolts. This modulated voltage sits on a carrier of approximately 3 to 8 volts. The above modulation and carrier values assume zero cable capacitance shunting the patient impedance. For typical cable capacitances (325 pf for 10' patient cable) and reasonable patient impedances of less than 1 kilohm, this attenuation is not appreciable, nor is any noise created by moving the patient leads. Even for the smallest of modulated signals (about 70 microvolts), the carrier amplitude at the output of U11 is sufficient (about 3 volts p-p, centered around 0 volts) to forward bias rectifier CR35. After halfwave rectification, the signal amplitude is roughly 700 microvolts per ohm. The carrier portion of the signal ranges from approx. +0.9 to +3.4 volts (which is half the voltage less a .6 volt diode drop). Differenced with +2.5 volts and amplified by DC Amplifier U13, this yields a carrier range of -2.2 to +4.2 volts at U13 pin 1. Increased cable capacitance would serve to make these values more negative. With as much as a 500 pf cable capacitance (325pf +/-25% is more realistic), the largest patient impedance of 2000 ohms will receive the greatest attenuation resulting in a carrier at U13 pin 1 of -1.5 volts. At the other extreme, a patient impedance of 200 ohms, the same cable yields approximately -2.2 volts.

The signal from U13 pin 1 is AC coupled at approximately 0.1 Hz by C5 and R176, then amplified with a gain of 580 by AC Amplifier U44 for a net gain of 1 volt per ohm (at zero cable capacitance). This amplifier rolls off at about 4 Hz. Combined with the high frequency cutoff of the demodulator and the AC Amplifier, this results in an overall low pass corner frequency cutoff of about 3Hz.

Comparator U13 compares the voltage at U13 pin 1 with a 2.3 volt reference in order to generate a " Hi Impedance " or "lead off" indicator signal, causing a Capacitor Reset to be initiated by an analog switch in U18 and R103. This speeds up the signal's return to within the active range of the opamps. After being clipped to 5 volt level by CR41, the indicator signal is delayed by resistor R184 and C11 just long enough for C5 to sample and capture the proper voltage following restoration of an open lead. The lead off threshold is set just beyond the maximum patient impedance, or approximately 2200 ohms at the leads (assuming zero cable capacitance; greater with shunting capacitance).

The impedances of capacitors on the Interconnect Board connected to the RRA and RLA wires, along with the clamping of CR32, CR38, and shield in T2, protect U11 from defibrillator discharges.

Pressure

The Pressure Preamplifier (Figure 2-9 on page 2-17) is comprised of two channels of identical Differential Amplifiers. The P1 channel amp is comprised of U20 and associated components. The amp has a gain of 195 at DC, a bandwidth of approximately 15 Hz (the -3 dB point), an output biased of 1.8 volts. This biasing is necessary to allow for transducers that have positive or negative offsets as large as 120 millimeters of mercury (mmHg). Full scale output is limited to 300 mmHg positive pressure, relative to atmosphere, and is scaled at 4.88 millivolts (one A/D lsb) per mmHg, assuming a transducer scale factor of 5 microvolts per volt excitation per mmHg.

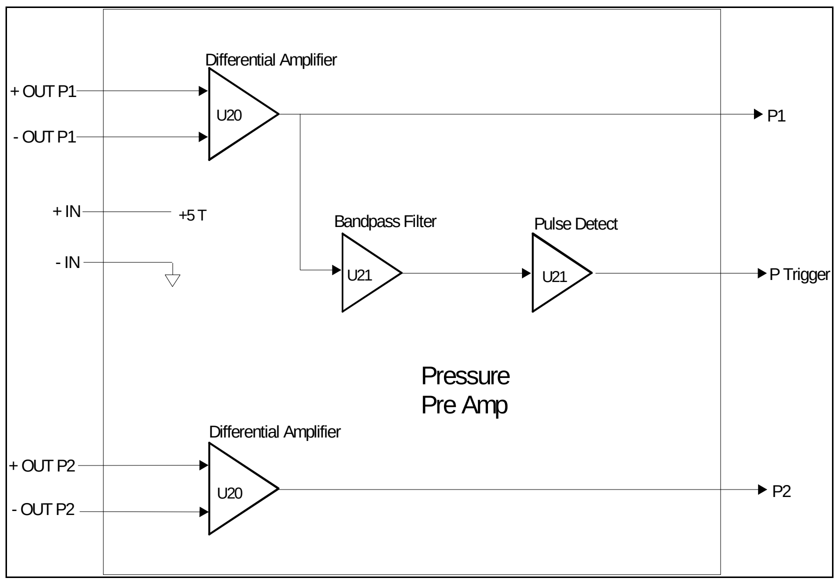

FIGURE 2-9 Pressure Preamp Block Diagram

This amplifier will accept, as an input, a standard invasive pressure transducer which appears as a resistive bridge, with each leg being approximately 350 ohms, excited using +5 volts and ground. This excitation voltage is provided via the +IN and -IN wires, while the transducer output is input to the amplifier via the +OUTP1 and -OUTP1 wires at approximately a +2.5 volt common mode voltage. Sensor disconnect indication, a permanent full scale output, is created by the input resistors R13 and R21 when no transducer is attached.

The operation of the second channel, P2, is identical to the above description of P1 (with different input and output labels), using U20 and associated components. The P1 and P2 signals are measured by the analog to digital converter, U21.

The P1 channel output is used for generating a systolic trigger, for heart rate measurement purposes. The P1 pressure signal is fed through a Bandpass Filter, comprised of U21 and associated components, to remove the mean pressure level and noise, and to set the appropriate amplitude detection scaling. The signal is then measured by the Pulse Detect comparator, U21, which has a minimum threshold of 189 mmHg, set by the hysteresis created by R133 and R148. Its output, P-Trigger, is a variable duty cycle square wave whose rise and fall is coincident with the systolic and diastolic portions of the pressure waveform. This systolic trigger “logic” is detected by the microcontroller and communicated to the Control Module.

Temperature

The temperature channel is designed to measure temperatures from 15°C to 45°C using Yellow Springs series 400 or series 700 thermistor probes. The probes exhibit temperature/resistance characteristics described by the relation 1/T = a+b(Ln R) + (Ln R)3 where T is given in degrees Kelvin. The constants a, b and c are unique for each probe series. The channel measures the probe resistance by a ratiometric method described below. The CPU then determines the temperature by evaluating the given equation.

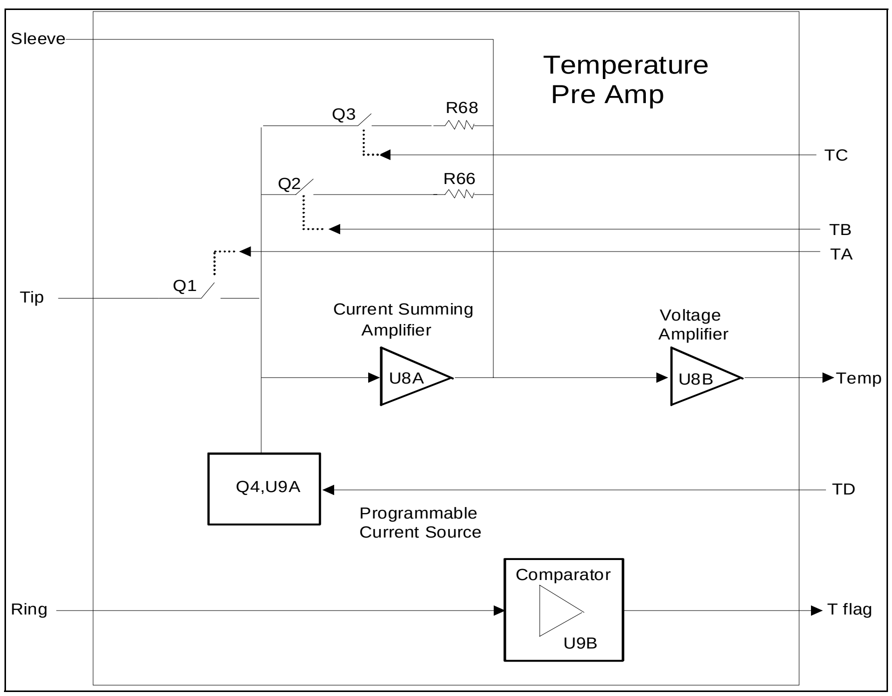

FIGURE 2-10 Temperature PreAmp Block Diagram

The voltage output of U48B is proportional to the resistance placed in the feedback loop of U48A. By turning on one of the switches Q8, Q9, or Q10 the resistance selected will be either the probe or one of the resistors, R2 or R3. These are precision resistors used as standards for accurate determination of the probe resistance. Resistor R2 is used with probe series 400. Its value, 3539 ohms 0.025% is equal to series 400 probe at 15ÉC (bottom of measuring range). Similarly, R3 is used with probe series 700. The CPU “knows” which probe is plugged in (explained later) and selects the appropriate standard resistor. Following is the measuring sequence for probe series 400. The probe is selected, by signal TA and Q8, resulting voltage Up4 at the output of U48B. The voltage is digitized by the 12 bit A/D converter (U21) and stored by the CPU. Then the standard resistor R2 is measured by turning Q8 off and enabling Q9 with TB, resulting in voltage Us4. The CPU then calculates the probe resistance: Rp4 = R2 ! Up4/Us4. Assuming that the circuit gain and measuring current are stable through the brief measuring period, accuracy of the probe resistance determination is limited by the A/D conversion process. Using a 12 bit converter, accurate to ½ LSB, worst case error in terms of temperature is 0.12°C.

Series 700 probes have two thermistors, Th1 and Th2. The first one is used to measure the temperature, in the same way as described for series 400. The second thermistor is used to determine which probe series is plugged in as follows: Op-amp U47B compares the voltage on the ring terminal of the input jack with a threshold of 0.7 volts, from R193 and R177. When a series 400 probe is plugged in, the ring is shorted to the sleeve contact, which in turn is tied to the output of U48A. With the switches Q7, Q8 and Q9 off and Q10 on, the ring voltage is about 1.2 volts and the output of U47B is high. When a series 700 probe is connected, thermistor Th2, connected between the ring and the sleeve, forms a voltage divider with R152 at the positive input of U47B. With the switches in the same state as before, the ring voltage is 0.5 volt or lower and the output of the comparator is low. The probe type information is used to select the correct set of constants for the temperature calculation, correct standard resistor and for the selection of the probe measuring current. The current is adjusted to approximately 330 microamps for series 400 and to 125 microamps for series 700, by means of switch Q7, activated by signal TD. This is done for optimal utilization of the A/D dynamic range.

The probe jack, located off board, is arranged to short the tip and sleeve terminals when the probe is unplugged. This provides a zero A/D converter reading as an indication of sensor disconnect. Primary ESD protection is in the form of a zener diode located at the jack. Additional protection is achieved by the R106 and C92, as well as the 100 ohm damping resistors on the gates of Q7-Q10. Because the probe cable capacitance is present at the summing node of U48A, C7 is used, in conjunction with resistors R92 and R120, to provide local AC feedback to isolate U48A from the capacitance and ensure stability.

Calibration of the circuit is performed by measuring the two precision resistors R2 and R3 for equivalent temperature determination. R2 replaces the probe and R3 serves as the standard. Resulting ratio is R2/R3 = 3539/9428 = 0.37537. Nominally this ratio corresponds to 37.48ÉC. Assuming worst case errors, this number will be 37.5, ±0.1°C.

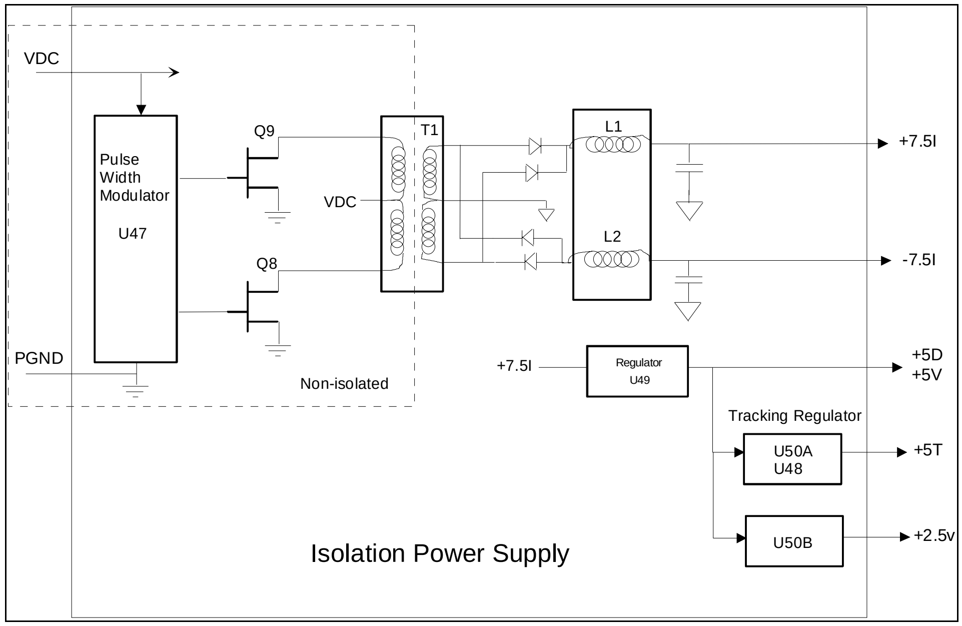

FIGURE 2-11 Power Supply Block Diagram

Power Supply

The Frontend Module is essentially an electrically isolated data acquisition system. The only portion of this module that is directly connected to the host system is the non-isolated part of the optoisolators (U15, U17, and U18) used for communications, and the switch mode, forward converter, isolated power supply.

The isolated power supply (Fig. 2-11) is built around a switch mode converter integrated circuit, U11. This device outputs two pulse width modulated signals (at pins 11 and 14) to drive the power transformer T1 with FETs Q1 and Q2. Each of the pulses occurs during its own respective half cycle of one full period. The half cycle timing is set by R178 and C83. The modulation of the FET drive pulses is executed by comparing the bulk power voltage VDC, with a percentage (set by R138 and 179) of the reference voltage on U11 pin 16. In short, the modulator outputs wide (83% of a half cycle) pulses for low VDC values, and narrow (35% of each half cycle) pulses for high values of VDC. The range of VDC is specified at 9 volts minimum to 18 volts maximum. The voltage being switched across the primary of T1 (pins 1, 2, and 3) is transferred to the secondary windings (pins 4, 5, and 6), and filtered to a DC voltage by components CR30,31,33,36, L1 and L2, and C169 and C171. The isolated DC voltage will vary between approximately 7.1 volts and 9.3 volts, depending on VDC and the secondary load current requirement.

This isolated voltage is used as is to supply the analog portion of the module. The digital circuitry is provided with +5 volts (+5V) generated from the “+7.5" using a simple regulator, U14. This voltage is also used to produce a +2.5v voltage, created by U13B, R19, and R34, which is used as a reference throughout the module. The pressure transducer +5T excitation voltage is generated by a tracking regulator, comprised of U13A, U12, and associated parts. This voltage "tracks" the +5v used as the reference voltage for the analog to digital converter. As a result of doing this, variations of the reference and excitation voltage do not impact the gain sensitivity (and therefore the measurement) of the pressure transducers, because the conversion process of the analog to digital converter is linked ratiometrically to it.

Isolated Microcontroller

For clarity, the isolated microcontroller block as well as the A/D converter and signal isolation blocks, have been drawn together in the detailed block diagram of Fig. 10. This has been done because of the close interaction of these blocks. The isolated microcontroller block on the detailed block diagram consists of a 68HC05 device designated U22. This device is entirely self-contained, requiring only power, clock and reset for operation. A 3.686 MHz clock is derived from crystal Y2, bias resistor R46, and loading capacitors C46 and C59, together with the internal oscillator circuit in U22. The internal processor clock is actually this frequency divided by two. The crystal frequency is made available to other devices on the board. The processor has an internal power-on reset circuit, although its action is augmented by an external reset. The external reset signal is passed through the isolation block. The microcontroller can drive its own reset input pin with an internal open-drain device. This must be kept in mind when monitoring reset (pin 1 of U22). In this application, the processor will attempt to drive the pin low when the internal reset circuit is activated, which will occur for a brief time after power is applied. Internal detection of certain failures can also cause the pin to be driven. However, the current software has these detection mechanisms (COP and clock monitor) disabled.

The device has no external bus, but does feature four general purpose I/O ports. Of these, port A is programmed as all outputs, and generates the temperature and ECG control lines. Port B is set to all inputs, and samples the signals supplied by the level shift block. Port C is set to six outputs and two inputs. The four uppermost bits control the respiration function. The lower 2 bits are dedicated to the ADC interface. Because all of the on-chip peripherals are enabled, none of the lines in port D are used for general purpose I/O. Four of these lines, designated MISO, MOSI, SCK and SS comprise the synchronous serial interface known as the SPI, which is used to communicate with the A/D converter. Two of the lines, IRXD and ITXD, carry the serial data received from and transmitted to the isolation block.

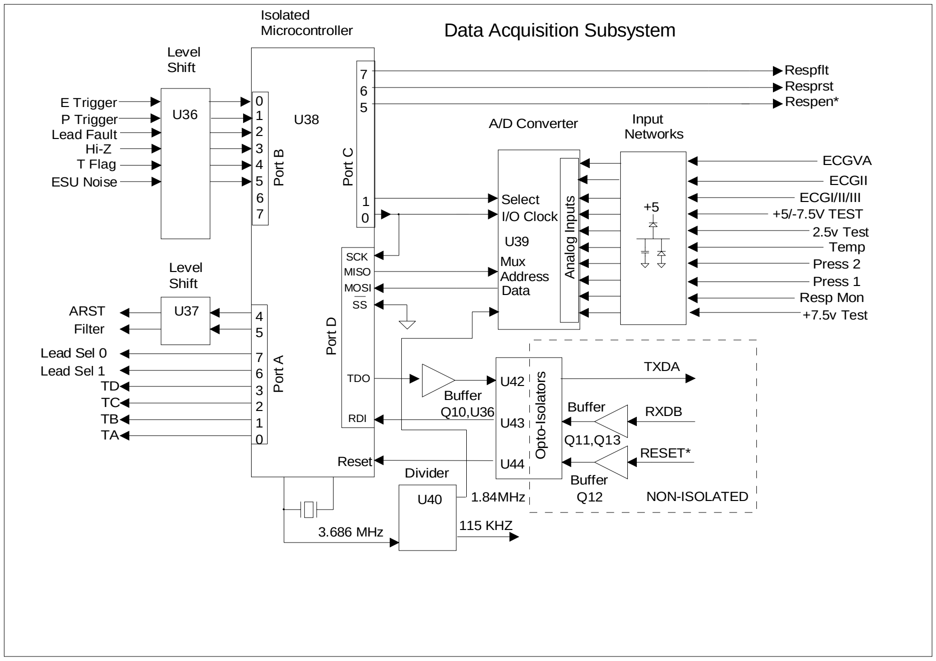

FIGURE 2-12 Data Acquistion System Block Diagram

Port A Function

The outputs in port A are controlled by the software. The software supports a command format in which groups of 4 bits can be changed. The lower four bits of port A contain all of the temperature mode control lines. When a temperature mode control command is received by the microcontroller, the four bits of data imbedded in this command are asserted on the lower 4 bits of port A. These four signals are then used by the temperature block to control analog switches. The upper 4 bits of port A support the ECG function. Upon receipt of an ECG mode control command, the microcontroller asserts the 4 data bits contained in the command on the upper 4 bits of port A. The lead select lines pass directly to the ECG block, while the reset and filter lines are level-shifted, without inversion, by dual comparator U37 and associated pullup resistors, which provide a nominal rail-to-rail swing between the +7.5 and -7.5 volt supplies. The +2.5 volt supply, which is at the midpoint of the logic swing, is used as the comparator’s reference. Diode D41 allows ORing of the reset signal originating at the microcontroller with that generated by the ECG subsystem internally. Resistor R249 provides isolation between the comparator and the 2.5 volt supply.

Port B Function

The inputs in port B are read each time a data pocket is sent by the microcontroller, at a nominal 286 Hz rate. Not all of the signals to be sampled are at proper CMOS logic levels. Therefore, a level shift network is employed. This consists of a 47K resistor network RN2 and CMOS inverting buffer U36. The series resistance of RN2 allows this protection network to clip the input signals, which may swing between the 7.5 volt rails, to a level acceptable to the buffer. The input protection network will then carry a current of about 150 A, which is well below the level needed to induce latching. The output of the buffer is then a clean 0 to 5 volt swing.

The software inverts the data at port B, to compensate for the inversion of the level shifter. The bits are then transmitted in raw form in a data byte known as STATUS within each packet. The E-trig signal is additionally subject to special processing. The software detects a rising edge of this signal and reports it in a separate bit in STATUS.

Port C Function

All bits in port C are configured as outputs. The upper three bits support control of the respiration function. When the microcontroller receives a respiration mode command, the upper three of the four data bits associated with the command are asserted on the upper three lines of port C. These three lines control analog switches in the respiration circuit providing the off/on, reset and filter control functions. The lower two lines of port C are used as part of the A/D converter interface, and will be discussed in conjunction with the SPI.

Asynchronous Serial Port (SCI)

The TDO and RDI lines in port D provide the asynchronous serial communication interface (SCI) between the front end and the rest of the monitor, via the isolation block. The transmission format has a start bit, nine data bits, no parity, one stop bit, and a baud rate of 115.2K. The nine bit format is somewhat unique to Motorola products. It consists of eight normal data bits, plus one extra bit sometimes referred to as the “address mark” bit. It was originally intended to designate addressing information in multidrop configurations. In this monitor, it is used as a means of marking the end of a packet. Each character thus contains a total of 11 bits, and is transmitted in nominally 96 s. Packets sent from the microcontroller to the CPU have a variable number of bytes, and consist of several data items followed by a checksum and terminator. Each data item is internally identified as to its contents. Packets received by the microcontroller always consist of two bytes, a single command byte followed by a confirmation.

Aynchronous Serial Interface (SPI)

The synchronous serial port, known as the SPI (Serial Peripheral Interface) is used to interface the A/D converter. The SPI signals are provided in four of the lines in port D. The interface consists of a shift register with both serial and parallel I/O. In operation, parallel data is first written to the register, internally in the microcontroller. The generation of eight clock pulses shifts this data out of the register and into an external peripheral. If this peripheral generates data, it can be simultaneously shifted into the register. A parallel read of the register will then provide the input data to the microcontroller. The A/D converter has a serial interface which is nominally compatible, with the SPI. Note that the clock inputs of the SPI as well as the A/D converter are connected to port C bit 0. The converter chip select is connected to port C bit 1. The SS line of the SPI, which enables operation when in the slave mode, is hardwired active low. In operation, the software loads the data to be sent to the ADC (multiplexer address) into the SPI register. The chip select line is then brought active low, and software pulses port C bit 0 eight times, generating eight clocks. This transfers the data from the SPI to the ADC, and loads the eight ADC msb's into the SPI. The software then reads these bits from the SPI, saves them, and generates 2 more clocks. The chip select line is then made inactive, as the ADC has received its exact 10 clocks. Then, with the ADC disabled, six more clocks are generated, so that the SPI receives a second complete set of eight. At this point, the SPI contains the two msb's from the ADC, as well as six undefined bits, which are discarded.

A/D Converter

The data interface to the A/D converter has been described above, in conjunction with the microcontroller SPI. The data output line of the A/D converter (U39) is provided with a pullup resistor (R88) because it becomes tristated whenever the A/D chip select in inactive. In addition to the digital signals required by the data interface, a clock signal is required for the actual conversion process. This is obtained from CMOS counter U40, which divides the microcontroller oscillator by 2, providing a clock of nominally 1.84 MHz. The counter also provides the oscillator frequency divided by 32. This signal, at nominally 115 KHz, is used by the respiration block for developing patient RF drive.

The analog inputs are selected by an internal multiplexer. Only eight of the eleven possible channels are used, with the remainder being grounded. This configuration allows pin-compatibility with a 12 bit converter IC. Five of the inputs monitor the patient ECG, respiration, temperature, and the two pressures. The blocks supplying these signals can swing beyond the 0 to +5 volt input range of the A/D converter, and must therefore be limited to prevent malfunction or even destruction of the device. This is provided by a series of diodes which are connected between each of these signals and both +5 and ground. These diodes clip the signals to the safe levels. The signal sources have series resistors of 2.2K or greater, which satisfy this requirement.

The A/D converter is of the successive approximation charge redistribution type. It features an internal capacitor ladder network which is charged from the signal source when the multiplexer samples a signal.

The three remaining A/D converter inputs are used for self-test functions. Input 0 is connected to a 2:1 ratio voltage divider (R10 and R11) which monitors the +7.5 volt supply, providing a nominal 3.75 volt test point. The software monitors this input for a low supply condition (-10%) only. The -7.5 volt rail is monitored with a divider, consisting of R8 and R9, connected from the +5 volts to the -7.5 volt rail. This provides a nominal +.83 volt test point, which is monitored by A/D converter input 7. The software is designed to sense a 10% drop in the -7.5 volt rail. Both of these A/D converter inputs have diode protection, and are furnished with small capacitors to filter any transients. The +2.5 volt supply is directly connected to input 6, and is tested by the software for both high and low conditions. The A/D converter also generates an internal, half-scale, test voltage, which is similarly monitored. A failure of any of these supply voltage tests is reported in the STATUS field of the data packets. Because extreme accuracy is not needed in these measurements, the software checks only the upper 8 data bits. Significant measurement uncertainties can result from the resistor tolerances, converter input leakage current, input charge, and reference (+5 volt supply) tolerance. These factors are taken into account in the setting of the limits, to prevent false reporting of errors. Additionally, a supply fault must be detected by the software on two successive tests before it is reported.

The A/D converter has a pipelined structure. Each time the SPI communicates with the converter, it writes the multiplexer address for the next conversion to the converter, and reads the result of the previous conversion. The next conversion starts as soon as the address is written. The software then engages in other activities while waiting for the conversion to finish. Thus, the data read from the A/D converter lags one sample behind the current multiplexer address. The software takes this delay into account when formatting the data.

The A/D converter has two +5 volt and two ground connections. Although these eventually connect to common points, they are run on separate traces to minimize noise and errors due to trace impedance and interaction with other loads. Operating power for the A/D converter, on pins 10 and 20, is supplied from the digital branch of the +5 volt rail, and returned via the digital portion of the ground plane. Capacitor C 120 directly bypasses these points. The reference voltage, at pins 14 and 13, is supplied from the analog branch of the +5 volt rail and the analog ground plane half. The same reference is used excite the pressure transducer bridge. The temperature function makes use of the ratio of two A/D converter readings and is thus independent of the exact reference value.

Signal Data Isolation

The signal data isolation block provides communication across the patient isolation barrier. Serial data originating at the microcontroller's TDO pin is inverted by one section of U36. It is then buffered, and inverted again, by transistor Q10 and R230, which operate as a saturated switch. The collector circuit of Q10 includes the LED of optocoupler U42 and current limiting resistor R229. The TDO pin idles at a logic high state, and has bursts of low level pulses during actual data transmission, which occurs at a low duty cycle. The driver configuration used results in the LED being "off" most of the time, conserving power. The optocoupler, U42, provides the actual isolation. The optocoupler features a separate photodiode and amplifier transistor, providing the good high frequency response required to support the 115.2 K baud data rate. On the non-isolated side, the open-collector output of U42, together with pullup resistor R233, produce a CMOS logic compatible signal. This signal has the same polarity as that on the TDO pin, and is routed to the Control Module CPU via J42 pin 3.

Serial data originating at the Control Module CPU is connected to J42 pin 4. Transistor Q13, R235, and R238 are used to invert this data, which is then buffered and inverted again by Q11. The collector circuit of Q11 contains the LED of optocoupler U43 and current limiting resistor R234. Note that U43 is driven in the same way as U42, described above. On the isolated side, the open collector output of U43, together with pullup resistor R231, produce a CMOS compatible signal, which is connected to the RDI input of the microcontroller, U38.

The Control Module CPU can cause a reset of the front end microcontroller by asserting a logic high level on J42 pin 5. Via R237, this signal will saturate Q12. The collector circuit of Q12 contains the LED of optocoupler U14 and current limiting resistor R236. Thus, the optocoupler is turned "on" when the reset signal is asserted. On the isolated side, the optocoupler transistor then pulls the RESET pin of the microcontroller low, against pullup resistor R232. When the Control Module CPU returns J42 pin 5 to a low level, the RESET pin will go high and microcontroller operation will begin.

2.2.3 SpO_2 Board

Overview

SpO2 board consists of analog and digital sections. Analog section provides all the patient finger probe excitation and analog signal processing. Digital section controls the operation of analog part of the board and shares its RAM with an external processor via ISA bus.

A pulsatile arterial saturated oxygen monitor detects the oxygenation level of the blood in the body's arterial circulation. It is used to continuously monitor the effectiveness of the pulmonary system (lungs). Specifically the device, within limits, determines the fraction of hemoglobin molecules carrying oxygen from the lungs to the body cells. Termed % SPO2, this fraction is normally about 97 percent.

The device measures the relative attenuation of two specific wavelengths of light (red and infrared) by the arterial blood. A sensor from the instrument contains two sets of LED's to illuminate a portion of the body (e.g., a fingertip), and a single photo-detector to sense the amount of light which exits. The two sets of LED's are alternately pulsed so that the circuitry can discriminate the infrared light. Each time the heart pulses arterial blood into the finger, the photo-detector's signals return to their original level. The electronic instrumentation processes only this changing portion of the photo-detector's outputs.

The determination is based upon the assumption that hemoglobin and oxyhemoglobin are the only two significant attenuators of light in the arterial blood. The device exploits the difference in their optical attenuation characteristics. But since the detector's signal is sensitive to the combined attenuation of both molecules, the device must use two different wavelengths to discriminate their individual contributions, and thus their relative concentration.

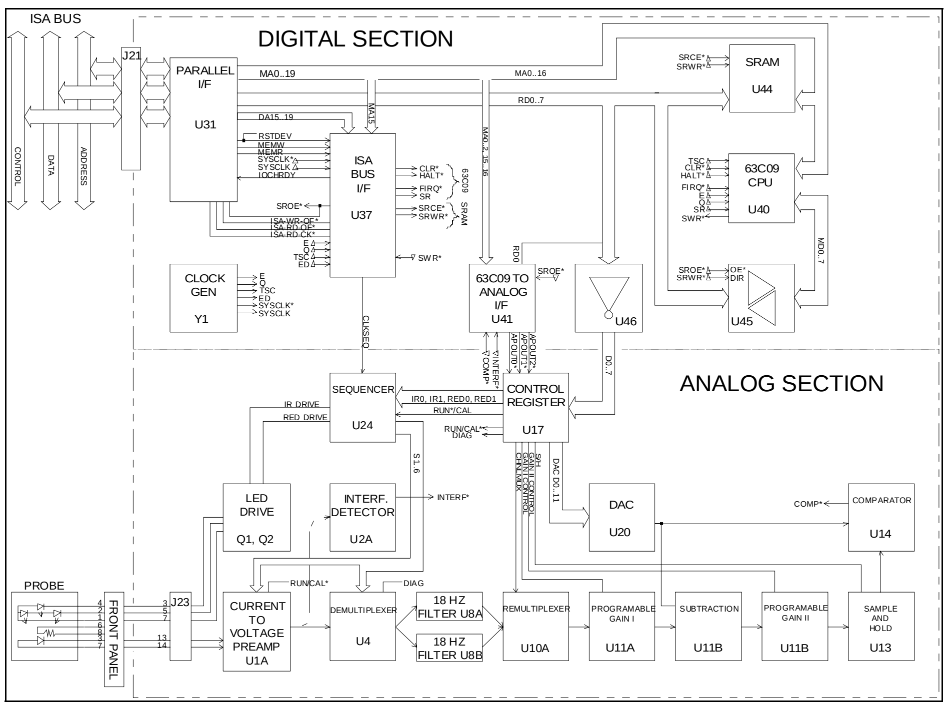

FIGURE 2-13 SpO_2 Block Diagram

Analog Section

The operation of the analog section is controlled by the digital part of the board by:

- Supplying ***CLKSEQ*** clock signal to the sequencer.
- Latching signals D0..7, into control register with strobe signals ***APOUT0***, ***APOUT1***, and ***APOUT3***.
- Monitoring ***COMPOUT**** and ***INTERF**** signals.

Sequencer controls the front end of analog section. It provides ***RED DRV*** and ***IR DRV*** signals for led drive circuit which in turn alternately drive red and infrared LED emitters in the probe. A single photo-detector on the opposite side of the finger produces current pulses proportional to the amount of light received. Sequencer also sets the gain of the current to voltage pre-amp and controls the demultiplexer. Gain values for current to voltage pre-amp are derived from control register signals ***IR0***, ***IR1***, ***RED0***, and ***RED1***. The fact that the sequencer has synchronous control of led drive, gain of current to voltage pre-amp, and demultiplexer makes it possible to set different current to voltage gain values for infrared and red signals.

Control register provides data for the DAC and sets gain values of dc gain (***DCG0***, ***DCG1***) , ac gain (***ACG0***, ***ACG1***), and current to voltage pre-amp (***IR0***, ***IR1***, ***RED0***, ***RED1***) stages. Wide gain range gives the board enough flexibility to acquire signals from fingers spanning a wide range of thicknesses or alternatively from other sites of the body such as ears, noses or toes. It also controls the remultiplexer (***CHNLMUX***) and provides calibration signal ***RUN/CAL***, which is used by the sequencer to determine the operation mode, and test signal ***DIAG***, which supplies a fixed voltage source at demultiplexer input for circuit diagnostics. Again because control register can synchronously control the remultiplexer and gain values for ac and dc gain stages, different gain settings can be selected for red and infrared signals.

Interference detector monitors the output of current to voltage preamp for voltages less than -7.2 V in amplitude. This information is sent to the digital section through ***INTERF**** signal.

The probe patient signal enters the board as current pulses in the range of .48 - 64 A. After signal goes through current to voltage preamp stage it is separated by the demultiplexer circuit, which steers each voltage pulse to one of two signals A and B. In addition, the circuit sends a negatively amplified version of the signal level between LED pulses to both channels. This residual signal is caused by ambient light on the photo-detector and offset voltages from the preceding circuitry. The negative amplification sets-up cancellation of the extraneous effect of the residual signal by the filter circuits that follow.

Signals ***A*** and ***B*** are then filtered identically by two parallel and matched filters. Filters also reduce the effect of any noise source, which might interfere with the measurement, such as an electro-surgical unit.

After going through filter blocks red and infrared signals and are alternately selected by the remultiplexer for further processing. Next signal is amplified by the dc gain stage. Having the ability to apply a different gain to the two components, this block functions as a coarse equalization of the multiplexed signal.

An offset voltage, determined by the DAC, is then subtracted by the subtraction circuit. The plethysmographic waveform consists of a small component varying along with the physiological pulse, sitting on top of a larger pedestal. Subtraction circuit pulls off most of this pedestal. Subtraction circuit also helps to maintain the resultant signal in the amplifier linear region.

The residual multiplexed signal is once again processed through a microprocessor controlled ac gain block. One of a few discrete gains is chosen for each of the two components, such that the peak to peak size of the physiologically varying components is large enough to be digitized with sufficient resolution.

After going through the ac gain stage the signal is sampled by sample and hold and held for amplitude digitization. The digitization is performed under the microprocessor control of the digital to analog converter. The DAC voltage is successively altered by the microprocessor until it zones in on the signal being digitized. Comparator then compares signal and DAC voltages and sends ***COMPOUT*** signal to the digital section.

The DAC thus performs a dual function. It is used in both the subtraction and the comparator blocks. Every 1/240 of a second, the circuit's control functions are flipped to process the alternate component of the multiplexed signal. The multiplexer switches signals, the two microprocessor controlled gains are changed, if necessary, and a new digital code is sent to the DAC for use in the subtraction circuit. After settling to it's new value, the signal at the input of the comparator is frozen by sample and hold circuit. The DAC is now available to be used in the digitization. At the next 1/240 second interval, all the control signals revert to the previous values.

Digital Section

Digital section of the board performs two distinct functions: analog section control and ISA bus interface.

First is based on 63C09 microprocessor. Analog section is accessed by writing data into control register. Address decoding for generating control register strobes ***APOUT0***, ***APOUT1***, and ***APOUT2*** is done by 63C09 to analog interface. The same interface is also responsible for monitoring status lines ***COMPOUT**** and ***INTERF****. 63C09 can observe the status of these lines by reading RD0 from the assigned memory location.

ISA bus interface allows an external processor to access SRAM and to halt and clear the 63C09 processor. Shared SRAM control is achieved by allowing 32Kx8 SRAM to be accessed by 63C09 as well as an external processor through ISA Bus. Address bus is shared by using 63C09 TSC signal. TSC (Tri-State Control) causes 63C09 address, data, and R/W* buffers to assume a high-impedance state. When a valid ISA bus access cycle is detected it is synchronized using ISA IOCHRDY signal. Because ISA access cycle is synchronized to 63C09 clock, 63C09 always has SRAM access priority over ISA bus cycle.

ISA bus processor can control 63C09 operations by accessing ***CLR**** (63C09 reset), ***HALT**** (6309 halt), and ***FIRQ**** (63C09 fast interrupt request) signals. These signals are set by writing to an assigned address location and reset by reading from the same location (See). Although hardware assures proper powerup conditions of these signals, they should still be initialized by external processor software.

Control Register

Control Register consist of three 74C374 octal D flip flops (U17, U18, and U19). When data is written into corresponding memory address space one of three strobe signals (APOUT0, APOUT1, or APOUT3) is activated and data is latched to the output control signals. Only 63C09 processor can access the control register. Table II, and Table III show how data lines are mapped to the control register outputs.

STROBE NAME		APOUT0
INPUT	***OUTPUT***	***DESTINATION***
D0	DIAG	Demultiplexer
D1	RUN/CAL*	Sequencer, Current to Voltage Preamp
D2	IR0	Sequencer (CV Preamp Intrared Gain)
D3	IR1	Sequencer (CV Preamp Intrared Gain)
D4	RED0	Sequencer (CV Preamp Red Gain)
D5	RED1	Sequencer (CV Preamp Red Gain)
D6	S/H	Sample and Hold
D7	CHNLMUX	Remultiplexer

STOBE NAME		APOUT1
INPUT	***OUTPUT***	***DESTINATION***
D0	BIT 12 (LSB)	DAC Bit 0
D1	BIT 11	DAC Bit 1
D2	BIT 10	DAC Bit 1
D3	BIT 9	DAC Bit 1
D4	BIT 8	DAC Bit 1
D5	BIT 7	DAC Bit 1
D6	BIT 6	DAC Bit 1
D7	BIT 5	DAC Bit 1

STOBE NAME		APOUT2
INPUT	***OUTPUT***	***DESTINATION***
D0	BIT 4	DAC Bit 8
D1	BIT 3	DAC Bit 9
D2	BIT 2	DAC Bit 10
D3	BIT 1	DAC Bit 11
D4	ACG0	AC GAIN
D5	ACG1	AC GAIN

STOBE	NAME	APOUT2
D6	DCG0	DC GAIN
D7	DCG1	DC GAIN

Sequencer

The primary function of the sequencer is to synchronize the LED drive signals with those that control the sequential demodulation of the photodetector's amplified output.

The sequencer also directly controls the switches U3A, U3B, and U3C, which set the current to voltage preamp gain. Since the gain required for the transmitted red light may differ from that required for the transmitted infrared light, synchronization of the gain control switches with the drive signals is also required.

Finally the last function of the sequencer is to cancel the residual signal and any low frequency signal noise. The sequential demodulation process for each wave-length subtracts from the detector's signal when the LED is activated, the residual signal that exists when the LED is not activated. This cancellation process works only for residual signals at frequencies significantly lower than the drive frequencies of the LED's (about 1.3 kHz). The interfering signals it works against are primarily:

The sequencer is composed of an EPROM U24, a counter U23 and a latch U25. The eight bits of the counter are fed to the eight least significant address bits of the EPROM. The microprocessor provides the five most significant address bits trough the control register.

The five control signals are changed infrequently but the counter increments every 16 s at the falling edge of the ***CLKSEQ*** clock. Thus the EPROM may be thought of as containing 32 (25) sequencer programs. The one chosen by the five microprocessor signals is cycled in a continuous loop.

The program length would be constrained to be 256 steps if not for the counter reset logic (U26A and U26D). Counter is reset whenever address bit 5 and red drive are both active. Reset logic allows flexibility in the choice of cycle length.

The outputs of the EPROM are the control signals for the LED drivers (***RED DRV*** and ***IR DRV***), sequential demodulation process in the preamp (S3, S4, S5, and S6), and the gain setting for the current to voltage preamp (S1 and S2). They are latched by the rising edge of the CLKSEQ clock signal for precise timing relationships.

LED Drive

LED Drive circuit interfaces TTL LED drive signals (***IR DRV*** and ***RED DRV***) to red and infrared LEDs. It consists of two circuits: LED voltage source and LED driver switch.

LED voltage source provides voltage to anodes of both LEDs and acts as intermittent short circuit protection device. Under normal operation Q1 is “ON” and Q4 is “OFF”. When a short circuit condition occurs higher current will cause larger voltage drop across the resistor R24. This will turn Q4 “ON” and Q1 “OFF”, cutting off the voltage supply to the sensor.

LED driver switch consists of two similar circuits one for each red and infrared LEDs. TTL pulses are limited to 3.35V by combination of CR5/R29 (CR6/R30). This is done to assure undeviating LED current. Signal is then AC coupled by C18 (C19) and is used to switch Q2 (Q1). Transorbs CR10 and CR11 are used to provide ESD protection.

Current to Voltage Preamp

The function of Current to voltage preamp is to convert current pulses from sensor's photodetector elements to voltage pulses. It is based on U1A and U2B. Preamp gain value is selected by 63C09 processor through the control register and sequencer (). Signals S1 and S2 are used to control the switches U3A, U3B, and U3C, which change the U1A feedback resistor value.

Demultiplexer

Under sequencer's control, demultiplexer separates the signal into red and infrared components and subtracts DC offset and low frequency noise from the signal. Switches U5A and U5D route the direct and inverted output of current to voltage preamplifier into red channel (A). Switches U5B and U5C perform the same function for infrared channel (B). U6 and U7 are configured as integrators, which average inverted and noninverted signals.

Matched 18 Hz Filters

Two identical low pass filters, based on U8 and U9, provide noise rejection for LED and demultiplexer switching noise (f1.366 KHz) and ESU noise (f500 KHz). Each filter consists of two equivalent dual pole low pass filters, which when cascaded, provide 80 db per decade roll off with f018.9 Hz.

Remultiplexer

Remultiplexer is controlled by 63C09 processor by toggling the CHNLMUX signal (See). This signal regulates switches U10A and U10D, which steer either red or infrared signals into Programmable Gain I stage.

Programmable Gain I (DC Gain)

Programmable Gain I block is also controlled by the 63C09 processor through the Control Register. U11A is configured as noninvering amplifier with the gain selected by state of signals DCG0 and DCG1 (See). This stage amplifies both AC component of the signal and it's DC pedestal.

Subtraction and Programmable Gain II (AC Gain)

In this block U11B is configured as an inverting summing amplifier. Two inputs to the amplifier are red/infrared signal and output of the Digital to Analog Converter. This configuration allows the output signal of the DAC to be subtracted from the red/infrared signal. Subtraction function is used to get rid of most of the signal's DC pedestal. The circuit then amplifies the resulting signal according to the gain set with signals ACG0 and ACG1.

Sample and Hold

Sample and Hold consists of U13. The purpose of this circuit is to hold the signal at a constant level, while the signal digitization is in progress. Sample and Hold is controlled using the signal S/H according to below. Hold capacitor C35 is selected to provide acquisition time 20 sec and droop rate 3mV/sec.

Comparator

Comparator is based on U14. It compares the signal held by sample and hold to the output of the DAC. Output of the Comparator is a signal COMPOUT* (See). 63C09 processor writes a value into the DAC and then checks the status of this signal. The procedure is repeated until signal is digitized with the acceptable resolution.

Digital to Analog Converter (DAC)

Digital to Analog Converter consists of U20 and U21. 63C09 processor can access 12 digital inputs by writing into the control register. The analog output signal is connected to input of sample and hold and subtraction input of Programmable Gain II block.

Interference Detector

Interference Detector monitors the output of Current to Voltage Preamp. U2A configured as a comparator, which detects voltage levels more negative than -7.2 V. When this level is detected ***INTERF**** line goes “low”. 63C09 CPU monitors this line to detect when Current to Voltage Preamp is saturated.

Clock Generator

Clock Generator consists of 11.0592 MHz crystal oscillator Y1 and five D flip-flops U42, U43, and U47. 11.0592 MHz OSC clock is divided in half by U47A, which outputs two complementary clock signals: ***SYSCLK*** and ***SYSCLK****. These two clocks are used as a baseline for digital section timing.

Parallel Interface

Parallel Interface consists of input buffers U31, U32, U33, and U34, output buffer/register U35, and Q6. It’s function is to buffer the signals to/from ISA bus connector J1. Tri-state signals of ISA address buffers U31 and U32 are controlled by the signal SROE, data input buffer U34 is enabled by ISA-WR-OE*, and data output buffer/register is enabled by ISA-RD-OE* and clocked by ISA-RD-CK*. All of these signals are generated by ISA Bus Interface.

ISA Bus Interface

ISA Bus Interface performs several distinct functions:

- ***ISA Bus Address Decoder***

Address decoder section of ISA Bus Interface generates SRAM control signals (SRCE* and SRWR*) and 63C09 processor signals HALT*, CLR*, and FIRQ*. SRAM signals are derived from inputs SA16 through SA19 according to timing relationship described later in the document. 63C09 signals are asynchronously set (disabled) when a valid write cycle is detected and reset (enabled) during the read cycle.

- ***CLKSEQ Counter***

CLKSEQ signal is used by the Sequencer. To generate this signal E clock divided by 22, which produces CLKSEQ frequency of 62.836 KHz. Signals BIT0, BIT1, BIT2, and BIT3 are used internally for the counter.

- ***ISA Access Timing Control***

This section is based on U37 PLD. It is responsible address and data bus arbitration and SRAM signal timing. In order to understand system timing, it is necessary to know how 63C09 TSC signal works. TSC (Tri-State Control), when enabled, causes 63C09 address, data, and R/W buffers to assume high impedance state. When TSC is enabled these signals are tri-stated after the next falling edge of E clock (See and). 63C09 signals resume valid levels after TSC has been disabled.

When a valid ISA access occurs (MEMW* or MEMR* active during a valid address) IOCHRDY signal is asynchronously disabled. Access is then synchronized to system clock and, when busses are available, ISA address buffers are enabled (using signal SROE). SRAM (SRCE* and SROE*) and data bus buffer (ISA-RD-OE*, ISA-RD-CK*, and ISA-WR-OE*) control signals are generated next. Finally IOCHRDY is enabled, completing ISA access cycle.

63C09 to Analog Interface

This section is based on U41 PLD. It is responsible for generating APOUT0* through APOUT2* Control Register strobes and monitoring the status of COMPOUT* and INTERF* signals according to the 63C09 memory map (see). It also generates the ISA IRQ5 signal, which is always disabled. It is pulled up on CPU board and is used to detect whether SPO2 board is present.

Static RAM

32 K x 8 Static RAM is shared by 63C09 and external processors. Software code for 63C09 processor is downloaded into SRAM via ISA bus. Static RAM is then used by 63C09 processor to fetch instructions, store data, and communicate with the external processor.

63C09 CPU

Main function of 63C09 CPU is supervision of analog signal processing and digitization. This is accomplished by manipulating gains of C/V, AC, and DC amplification blocks and by controlling Sequencer, DAC, Remultiplexer, and Sample and Hold sections, while monitoring COMPOUT* and INTERF* outputs. Control of the blocks mentioned above is achieved through Control Register.

2.2.3.1 Masimo/Nellcor SpO2 Interface Board

Overview

The Passport Masimo / Nellcor SPO2 Interface Module, (0670-00-0665-01= Masimo, -02 = Nellcor) or PM / NIM, provides the electrical interface between the Passport monitor and a Masimo or Nellcor OEM Pulse Oximetry Module. The PM / NIM provides both buffered data communications as well as power supplies for the Masimo or Nellcor Module.

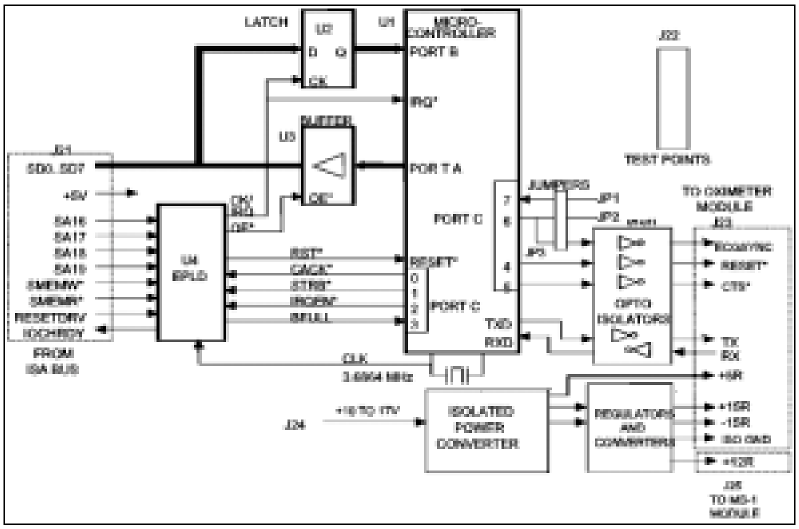

FIGURE 2-14 Masimo / Nellcor SpO_2 Interface Module Block Diagram

An overall block diagram of the PM / NIM is shown above. Bus interface logic, consisting of a programmable logic device, an octal register, and an octal buffer, connects to the Passport's pseudo-ISA bus. This bus is shared with the CO2 module. Therefore, bus resources have been allocated to avoid conflicts. This interface logic implements two read-write registers, one for data and the other for control or status. A 68HC705 microcontroller operates as an intelligent, buffered UART. The serial port of the microcontroller provides the data interface to the SpO2 Module. All microcontroller data and control lines interfaced to the SpO2 Module are opto isolated. Power to the SpO2 Module is isolated by a DC-DC converter module with its input coming directly from the Line / Battery Supply Module.

The SpO2 Modules communicate serially at 9600 baud. A microcontroller is used as a "smart" UART. A microcontroller can be programmed to understand either the Masimo protocol or the Nellcor protocol, and can thus buffer the data in an intelligent manner.

When serial data is received from the Oximeter Modules, the microcontroller buffers the data until a complete packet has been received. The packet is then validated by means of a checksum. If valid, the microcontroller makes the first byte available to the bus interface logic, and interrupts the Passport CPU. The Passport responds by reading the first byte. A flag indicating the availability of data (first and subsequent bytes) is provided in the status register. By polling this flag bit in a tight loop, the CPU is able to read the subsequent bytes. The CPU is able to identify the packet's byte count based on the first byte read, and therefore knows how many additional bytes to read by polling.

A similar procedure is used to transmit serial data. The CPU polls a busy flag in the status register. When this flag is clear, one byte of data is written to the PM/NIM. The busy flag becomes immediately set. As soon as the microcontroller accepts and buffers this data, the busy flag is cleared by the microcontroller, so that the CPU can write the next byte. This process continues until an entire packet has been written. When an entire packet has been written, the PM/NIM validates the packet by means of the checksum, and proceeds to serially transmit it to the SpO2 Module.

It is possible to assert or remove reset to the microcontroller by writing to the control register. Whenever the ISA bus signal RESETDRV is active, the microcontroller reset will be asserted, and will remain asserted after RESETDRV is no longer active. Internal power-on-reset logic in the EPLD asserts reset in a similar way. . As the microcontroller passes from the reset to the active state, it activates the SpO2 Module reset line and enters a data echo mode. Only after receiving a command from the host will it exit the echo mode and release the SpO2 Module reset. This insures a coordinated start-up of the PM/NIM and SpO2 Module.

Read-Write Logic

The figure below shows the portion of the EPLD, U4, which provides the read and write logic. The four most significant ISA address lines, SA16..SA19, are decoded. Two ports are needed, one for control and one for data. The selected port addresses are at ISA 80000 hex for data and ISA 90000 hex for control/status. These correspond to 900000 hex and 920000 hex, respectively, in the Passport CPU address space. The address assignments are unique to allow the Passport to easily determine on bootup which modules are connected to the ISA bus. The Passport software accomplishes this by attempting to address the module. If it is not present, a bus exception occurs indicating the absence of a working PM/NIM. When an OEM SpO2 module is used in the Passport a Software command is used to determine whether a Masimo SpO2 Module or Nellcor SpO2 Module is present.

When a write is made to the status port address, the inverted state of D0 is latched in flip-flop F/F 3 inside the EPLD, U4 (Figure 2-14 on page 2-35).

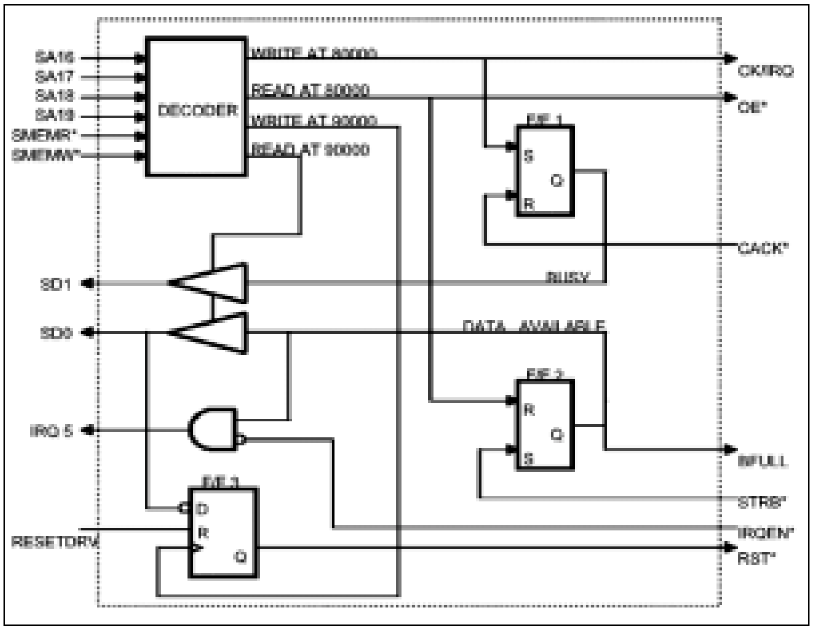

FIGURE 2-15 EPLD, U4 Block Diagram

The output of F/F 3 drives the microcontroller's active-low reset line. Thus, if D0 is high during this write, the microcontroller will be placed in reset. Conversely, if zero is written, microcontroller operation will begin. This flip-flop is also cleared by RESETDRV as well as the EPLD's internal power-on reset logic. Thus, at power-up, the microcontroller will be held reset until zero is written to the status port, allowing an orderly start-up. The RESETDRV signal is filtered by R3 and C11 to minimize the possibility of false triggering due to ESD events.

When a write is made to the data port, a decoded write pulse (CK/IRQ) clocks U2, latching the data from the bus. This same pulse also interrupts the micro-controller (U1), telling it that new data has arrived. Also, flip-flop F/F 1 inside U4 becomes set (see figure on previous page). The Q output of F/F 1 can be read on data bus line D1 when a read is made to the status port address. When the microcontroller responds to the interrupt, it clears F/F 1 by pulsing CACK* low. Thus, bit D1 at the status address acts as a "busy" flag, which becomes set immediately after data is written, and is cleared when the microcontroller has assimilated the data.

When the microcontroller has data to be transferred to the ISA host, it presents the data via port A to the tristate buffer U3. It then pulses the line STRB* low, setting F/F 2 in U4. The Q output of this flip-flop can be read in bit position D0 of the status port. Thus, the ISA host can poll to determine when data is available. A 1K resistor, R2, limits the current when the CO2 module drives the line high.

When the host polls the D0 bit and finds it active, it then reads the PM/NIM data address. The EPLD decodes this into a read pulse (OE*) which enables the tristate buffer, U3, driving the data on the bus. This action also clears F/F 2, so that IRQ 5 (were it enabled), as well as the data available bit in the status port, are immediately dropped. The data available flag is also available to the microcontroller as BFULL, which is connected to port C. After the microcontroller asserts new data, it waits for the BFULL line to become low, indicating that the host has accepted the data, before asserting the next byte.

IOCHRDY Logic

The pseudo-ISA bus in the Passport differs from a true ISA configuration in the implementation of IOCHRDY. In the Passport, a rising edge must appear on IOCHRDY while SMEMR* or SMEMW* is active in order to complete the bus cycle. A steady high level is not sufficient. The EPLD contains the logic shown in figure below for generation of IOCHRDY.

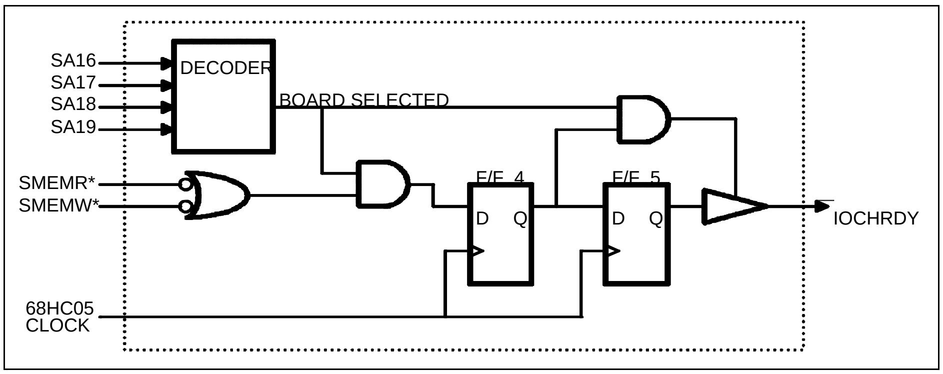

FIGURE 2-16 IOCHRDY Logic Diagram

The address lines SA16..SA19 are decoded to generate a signal whenever either port (data or control) on the board is selected. The D input of F/F 4 is high whenever a read or write occurs and the board is selected. Before a bus cycle begins, the outputs of F/F 4 and F/F 5 are both low. These flip-flops are clocked by an on board crystal oscillator, at 3.6864 MHz.

Microcontroller

The microcontroller manages the flow of data between the host and the SpO2 Module. It consists of a 68HC705 single chip microcontroller. It operates at an oscillator frequency of 3.6864 MHz, obtained from an on board crystal oscillator. The oscillator also provides clocking for U4.

When it is brought out of reset, an internal self test is performed, which verifies the PROM contents and RAM operation. During this self test period, lasting several ms, bit 4 of port C, SRST*, is configured as an output and driven low. This asserts reset to the SpO2 Module. The PM/NIM then enters a data echo mode.

Any data written to the PM/NIM data port is accepted by the microcontroller on port B. Data to be sent to the host is asserted on port A. Communications with the SpO2 Module take place by a CMOS level asynchronous serial link in J23. The parameters are 8 data bits, even parity, one start bit, one stop bit, with the data having “true” polarity. The baud rate is selectable under U1 software control as 9600 baud.

SCTS* on port C bit 5 is used to enable the Flash Programming voltage on the Interface board. To allow the in-system programming for the MS-1 SpO2 Module this signal should be set High. SCTS* on port C bit 5 also allows U1 to suspend transmissions from the Nellcor Module.

Power Supplies

The Power for the OEM SpO2 module and Interface board is derived from a combination of the system +5V and the Switch_Bulk_OUT supply. The isolated voltages for the OEM SpO2 board is derived from the Switch_Bulk_Out supply, this bypasses one DC/DC convertor and its associated inefficiencies. The power consumption of the OEM SpO2 board and Interface board should be similar to that of the Datascope SpO2 module.

The Masimo SpO2 module requires four isolated voltages: +5V, +/-15V, and +12V.

The Nellcor Module requires four isolated voltages; +5 volts, +/-15 volts and -6 to -15 volts. The latter voltage is tied directly to the -15V supply on the PM/NIM by connecting J23 pin 6 and 7. This prevents the need for jumper JP4 on the Nellcor Module which would otherwise accomplish the same task. Also, the additional power needed to drive this voltage with -15 volts versus -6 volts (if it were available) is negligible since the maximum current needed for it is only 5.3mA.

The isolated +5 voltage is generated and isolated by DC-DC converter, VC1. The +/-15V is derived from the isolated +5V convertor and is generated by a Boost Switching regulator. A N-Channel Mosfet controls the +5V voltage level seen by the SpO2 board. The Gate of the Mosfet is connected to the +15V Regulator and the +5V is connected to the Drain. This allows the +/-15V source to always lead the +5V by at least +0.3V as required by the Nellcor Module power supply sequencing requirements. An additional 5K ohm load was added to the +15V to assure that the +/-15V switching regulator will stay in the continuous mode when lightly loaded by the Nellcor module.

Additionally there is a +12V switched capacitor supply on board to supply the Flash programming voltage and current required for in-system software updates for the Masimo SpO2 module. The +12V supply derives its input from the isolated +5V supply. The +12V supply is controlled by the SCTS* output of the micro-controller. This voltage should normally be turned off to give added protection against the flash memory being overwritten, and to eliminate load and noise from this supply. In order to disable this supply voltage, the SCTS* line must be taken to a logic level Low.

Signal Isolation

The interface signals to and from the Oximeter Modules are isolated by five optocouplers, U7 through U11. The low duty cycles of the signals holds the power requirements to reasonable levels.

Schmitt trigger inverters are used at the optocoupler outputs due to the slow rise and fall times of the couplers. This provides a clean output edge with no bouncing and reduces timing skew. The U11 output requires no such Schmitt buffer due to debouncing hardware built into the U1 microcontroller. Other inverters are used in the circuits to provide the necessary inversions for proper signal polarity and to force the optocouplers normally off.

All of the U1 signals to and from the Nellcor Module to be normally high with the exception of CTS*. This signal should be normally active low and only become inactive if Nellcor Module data transmissions must be suspended.

2.2.4 CPU Board

Overview

The Passport CPU board is the central controller for the Passport transport monitor. The functions that this module must support are: Front end and NIBP serial communications, LCD control, Trend functions, Alarm functions, SpO2 parallel communications, Recorder interface, Speaker, Real time clock, Keypad monitoring, RS-232 interface, D/A, and miscellaneous diagnostics.

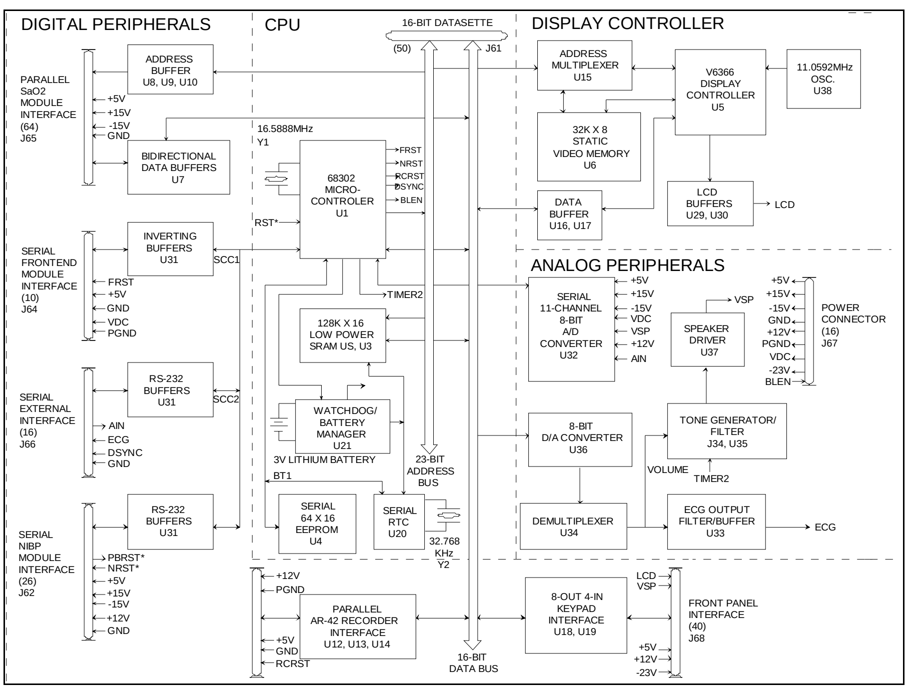

FIGURE 2-17 CPU Board Block Diagram

CPU

Device U1 is an MC68302, which contains a 68000 core CPU and much of the peripherals used in the Passport PCM board. The CPU contains a 24-bit address bus and a 16-bit data bus. Along with Y1, and a resistor/capacitor network, U1 shall operate at a clock speed of 16.5888MHz. This clock rate is the highest clock rate that the MC68302 can operate while being a multiple of the baud rate of 115.2Khz for Front End communications.

There are 4 programmable chip select/wait state control groups. They are listed in below.

CHIP SELECT GROUP	DESCRIPTION	WAIT STATES
CS0	ROM	1
CS1	NON-VOLATILE RAM	1
CS2	VIDEO RAM	EXTERNAL SELECT
CS3	PERIPHERALS	3

Datasette

The Datasette provides program memory and data storage for the main CPU module in the Passport.

The Datasette contains two 512Kx8 FLASH ROM ICs and two 128Kx8 Static RAM ICs. They are accessed by the host CPU via two chip select lines; even (CSL*) and odd (CSH*). Both of these chip select signals should be decoded for the first 4 megabyte of the host’s memory address space. The host module must decode the A0 address line to generate the even and odd chip selects. Further decoding is provided by U5. The address space which is allocated by the host CPU module consists of 2x2 megabyte regions. The first region (000000-0x1FFFFF) is allocated for ROM use. Only one megabyte of FLASH ROM is used, therefore the ROM is mirrored in the first and second megabyte of the address space. The upper 2 megabyte region (0x200000-03FFFFF) can be subdivided into 8x256K or 4x512K regions. The 256K of RAM on the Datasette is decoded to respond in the upper half of each of the 512K regions.

A jumper, J1 has been added to the module to allow for use in a commercial PROM programmer. Most PROM programmers have the capability of obtaining manufacturer and device IDs from the device. This is possible by applying a higher than normal voltage at the input address pin, A9. This voltage may be alright for the FLASH ROMs on the Datasette, but it will cause damage to the static RAMs on the Datasette. To prevent this possible damage from occuring the jumper J1 was added. When J1 is installed the address signal A10 is connected to the A9 input pin of the SRAMs. This is necessary when the Datasette is operating inside a Passport. This jumper must be removed if the Datasette is to be used in a PROM programmer.

The CPU module operating at 16.5888Mhz will necessitate the use of 1 wait state to access SRAM and 0 wait states to access FLASH ROM.

Non-Volatile RAM

This memory made up of two 128Kx8 120 nsec. SRAMs, U2 and U3. The memories are non-volatile due to the circuitry of Micromanager U21, Battery BT1, R17, and D4. The initial start address of the RAMs is at 400000H and is mapped to a 2M byte space. Chip select line 1 is used by the CPU, and will have a wait state of one cycle. Initially only 256K bytes should be enabled.

Video RAM

The video memory consists of a 32Kx8 120 nsec. SRAM, that is initially mapped to 64K bytes starting at 600000H. Only the lower byte of the video memory is used (8 bit bus mode). The LCD is a 640x200 display that will be supported with the current memory size. The memory can be expanded to a maximum of 128K bytes for larger size displays.

This memory is dual-ported to the CPU and the display controller. A variable number of wait states will be inserted because of the asynchronous nature of the CPU accesses to video memory. The SCT bit in Bank Address 23H, data bit D7 of the display controller should be set to a 1 to minimize wait time.

Display Controller

The display controller, U5, is a Yamaha V6366. The clock is provided by U38, an 11.0592MHz oscillator. The LCD that is being used on the Passport project can accommodate a 4-bit parallel data bus. Therefore, U5 is set up for 4-bit display operation. At the clock rate, and parallel data transmission, a transaction will last for 361 nsecs., which will meet the minimum LCD cycle time of 330 nsecs.

The display controller outputs, CSY, BLA*, BST, AC, LD.0 are used to drive a 640x200 LCD. The display interface signals can be disabled by the LDEN* signal (port B bit 1, U1-109). On power-up or reset, this bit is default to an input, which will automatically disable the display, thus preventing unorganized or old data to be displayed.

Another signal BLEN* (port B bit 2, U1-110) is provided to disable the LCD bias voltage, VEE. This signal should not be active (low) until the display controller has been initialized, assuring proper timing signals for the LCD. This signal works similarly to the LDEN* signal, in that on power-up or reset, the LCD is automatically disabled. Upon a power-up/reset situation, the display controller should be initialized as soon as possible.

The display controller outputs VSY, HSY, and LD.4 are also connected to the external interface connector , but are not used at this time.

Interrupt Controller

The interrupt controller is controlled by addresses 812H to 81CH within the 4K peripheral control block. In addition to the 16 on-chip interrupt sources (on priority level 4), 3 external interrupts are supported (on levels 7,6, and 1). The external interrupts should be programmed to be dedicated level-triggered mode interrupts. Currently IRQ1* is used (for the AR-42 Recorder error line); IRQ6* and IRQ7*, which is non-maskable, is not used. The interrupt acknowledge and autovector mode feature is not used; the interrupt controller should be programmed to provide the interrupt vector. The upper 3 vector bits can be programmed to anything other than 000 and 001, such that the interrupts are mapped into user interrupt vector space.

The external and internal interrupts can be summarized as follows:

PRIORITY	***INTERRUPT SOURCE DESCRIPTION***
7 (Highest)	IRQ7* (not used)
6	IRQ6* (not used)
5	Not available
4	PB11 interrupt (SpO2) (PAR)
	PB10 interrupt (not used) (RTC)
	SCC1 (Front end) (52/80)
	SDMA Channels Bus Error (SERIAL DMA)
	IDMA Channel
	SCC2 (external RS-232) (53/54)
	Timer 1 (system timer) (EECS)
	SCC3 (NIBP RS-232)
	PB9 interrupt (recorder sync) (RSYNC)
	Timer 2 (audio frequency)
	SCP (ADC channel)
	Timer 3 (auxiliary timer)
	SMC1 (not used)
	SMC2 (not used)
	PB8 interrupt (keypad) (KPS*)
	Error
3	Not available
2	Not available
1	IRQ1* (recorder error)

8-bit D/A Converter

The 8-bit D/A converter, U36, is connected to the upper byte of the data bus. The address of the D/A converter is set to 720000H for byte access. This mapping is such that it falls under the chip select 3 timing. This device requires a 240 nsec. write pulse. This is the worst case timing on chip select 3. With 3 wait states inserted, the pulse with respect to UDS* is 241 nsec., which is barely met.

The output of the 8-bit D/A converter is multiplexed to two outputs: the external analog output and the volume control voltage. The multiplexing is controlled by two sample and hold control signals: ANEN* and VLEN*, controlled by port A bits 4 and 5 of the CPU respectively. A zero in those bits will sample the voltage from the D/A converter and a one will hold that voltage at the sample and hold.

Analog Output

The external analog output is used to output the ECG waveform. It is biased to be a bipolar signal (+/-5V) by U36, U33, and R16/C78 bias network. A 00H code would output -5V and an FFH code would correspond to +5V. The update rate should be 286Hz. The 10-bit ECG sample from the front end should be scaled down to 8-bits (truncating the lower order two bits) and output directly to the D/A. In order for the voltage at U34-6 to reach the 8 bit lsb accuracy of the D/A, the switch should be held closed for at least 20 usecs. No other writes to the D/A should occur within 20 usecs. Since the ECG is updated at a rate of 286 Hz (3.5 ms), there should be no problem from this half of the converter.

An analog simulation of the circuitry shows that it shall meet the specification of .5 to 40 Hz @ -3db.

Speaker Driver

The volume voltage is unipolar. A 00H code would be lowest volume (silence) and FFH would be highest volume. The loudness perception is not necessarily linear and some trial and error may be needed to yield the corresponding sound levels desired for presets.

The digital switch for the speaker driver circuitry shall be held closed for at least 912 usecs. in order to get the accuracy as discussed earlier.

The operation of the sample and hold should be as follows:

- Turn off both sample and holds (ANEN* and VLEN* high)
- Output volume value to D/A converter
- Turn on volume S/H (VLEN* low)
- Wait at least 912 usec
- Turn off volume S/H (VLEN* high)
- Output ECG value to D/A converter
- Turn on analog output S/H (ANEN* low)
- Wait at least 20 usec until starting again (S/H can be left on)

The EXEN* signal, controlled by port B bit 0, controls whether an exponential decay exists on the volume signal (0 to enable decay). This mode is used only in beeps where an exponential decay is desired. In this mode, the volume signal is enabled only at the start of the beep and the volume will be allowed to decay by not updating the sample and hold.

Keypad Interface

The keypad interface consists of a matrix of 8 output lines and four input lines. A maximum of 32 keys can be supported with this arrangement. The 8 output lines, KD.0, are connected to the upper byte of the data bus. Their address can be set to 740000H for byte access. The four input lines, KI.0, are also connected to the upper byte of the data bus.

During the scanning of the keypad, a marching 0 is shifted through the 8 normally high output lines. When a key on the active low output line is pressed, a corresponding 1 (note inversion) on the normally low input lines would be generated. All key presses need to be debounced in software.

The keypad interface can be programmed to function in an interrupt driven mode. The KPS* signal (port B bit 8 line) is active when there are any keys pressed. This is generated by the use of the PAL, U24. This bit can be programmed to generate an interrupt to the microcontroller. The operation should be as follows:

- Set all keypad output lines to 0.
- Wait for KPS* to interrupt processor. (Respond before key released, dms)
- Debounce KPS*.
- Scan keypad output lines via marching 0 for key identification.
- Start key time-out for key held down mode.
- After time-out, reset all keypad output lines to 0, clear all pending interrupts and re-enable KPS* interrupt. (If key is still pressed, another interrupt will be generated immediately.)

Recorder Interface

The recorder is a General Scanning AR-42. Detailed programming information is contained in the AR-42 user's manual.

The RERR signal is recorder error. It is pulled up (RP3-5) and inverted by U11 to form RERR*. This signal is then connected to U1-97, which is interrupt 1. Anytime RERR* is active, the program should service the interrupt and determine what action to take. This can be an error or this can determine if a recorder is not available. A read of the recorder status lines at 740000H will determine what case it is. The recorder interface is a 16-bit parallel interface mapped to 760000H. In writing to the recorder, the lower byte contains the data. The lower 5 bits of the upper byte contains the address for combination commands. The recorder can operate in either a header command / data mode when the address bits are all one's, or a combined command / data mode in which the address bits indicate which command is to be performed. When possible, the combined commands should be used to minimize data transfer.

In writing to the recorder, the processor should check the SYNC* and WRRDY* lines from the recorder to make sure that the recorder is ready to accept data.

In reading from the recorder, the lower byte contains readback information from the recorder.

There are two operation modes of the recorder: a trace mode and a graphics mode. In the trace mode, the recorder prints at a fixed rate (e.g. 25mm/sec). And it will request data at its own rate. If no data is supplied, the previous points will be repeated by the recorder.

Since the recorder needs data at a fairly high rate in trace mode, (up to 800 points per second), the data rate will be controlled by the CPU. In other words, the CPU will only send data to the recorder when it so chooses. The recorder will repeat points when it does not receive data. In trace mode, the CPU should output data to the recorder at the front end sampling rate: 286Hz.

Due to the relatively slow response time of the recorder (several microseconds), the IDMA controller can be set up to control the writing of the recorder on a cycle steal basis. The WRRDY* line is wired to the DREQ* line of the micro-controller. In other words, a DMA cycle would be requested every time the recorder is ready to accept new data. When the programmed number of transfers are complete, any further request from DREQ* would be ignored. Note that the software must keep track of how much actual print data the recorder can accept in text or graphics mode. This information is contained in the RSYNC* line (buffer empty). In other words, the recorder interface software can only print on a line by line basis via DMA.

The RCRST signal is used to reset the recorder. On power-up or reset, the signal would by default put the recorder in a reset state.

Analog Front End Interface

The analog front end interface is an opto-isolated serial channel with data to and from the front end processor. It currently runs at 115.2 K baud. This interface is connected to SCC1. This is done to make the analog front end possess the highest priority interrupt. The CPU can independently reset the front end processor using the FERST signal (port A bit 11). On power-up or reset, the signal would by default put the front end processor in a reset state.

The analog front end is programmed to transfer a burst of analog data to the CPU at a sampling rate of 286Hz. This rate is chosen to be a even multiple of the screen waveform update rate (71.5 samples per second to give 25mm/sec). This sampling rate should be high enough to capture the details of the ECG waveform.

External RS-232 Interface (optional)

Since the external RS-232 interface connects to external instruments, the communication features, such as baud rate, parity, etc. are going to be programmable by the user. No CTS and RTS signals are provided.

Optionally, an RS-485 interface can be installed. (A cut on the board is only necessary to disconnect the RS-232 receive line.) The differential RS-485 lines are connected via a bidirectional transceiver as a party line. The receiver is always enabled; the transmitter is enabled by SEREN (port B pin 7). This line should normally be low to disable the transmitter.

This interface is connected to SCC2.

NIBP Module Interface

The NIBP module interface is also an RS-232 interface, currently running at 2400 baud, eight data bits and no parity. Only the RxD and TxD data lines are used. This interface is connected to SCC3. The CPU can independently reset the NIBP module using the NRST signal (port A bit 7). On power-up or reset, the I/O port is default to input, causing the NRST signal to be pulled up to reset the NIBP module. There is also a reset acknowledge signal from the NIBP module that can be read from the recorder status register.

8-bit A/D Converter SCP Interface

The A/D converter is a 12 channel (one is used for internal diagnostic) 8-bit serial A/D converter. It is connected to the SCP interface on the microcontroller. To initiate a conversion, the CPU writes the A/D channel address to the upper bits of the SCP transmit buffer. When 8-bit that is read back at the same time would contain the result of the previous A/D conversion. The clock invert bit in the SCP control register needs to be set to 0 to obtain the proper clock polarity.

The definition of the A/D channels are as follows:

CHANNEL #	SIGNAL DESCRIPTION	NOMINAL	TOLERANCE
0	+5V	7FH	
1	+15V	9CH	
2	-15V	2FH	
3	Speaker Voltage		
4	Raw DC Voltage		
5	+12V	7DH	
6	DAC output voltage		
7	External analog input		
8	Reserved		
9	Reserved		
10	Reserved		
11	ADC diagnostic voltage	7FH	7DH-83H

Most of the inputs are used for diagnostic purposes. In diagnostic mode, all the power supply levels will be read and displayed. In run time, some of these voltages would also be checked for proper operation (especially +/-15V). The run-time check should be very robust in that it should not generate false alarms due to noise or other transients (e.g. ESD episodes). A wide tolerance with probably some form of averaging would be performed.

The raw DC voltage can be checked for whether unit is running on battery (if the voltage is greater than a certain threshold). When the unit is running on battery, the raw DC voltage would indicate the battery voltage. A low battery condition exists when the voltage is below a certain threshold. The proper levels and cutoffs are yet to be defined.

The DAC voltage input can be used to check the operation of the DAC. The ADC diagnostic voltage can be used to check the operation of the ADC.

The external analog input signal is currently not used.

Timers

Timer 1 is designated as the system timer.

Timer 2 is used to generate the variable tone frequency to the audio circuit. The frequency ranges from 500Hz to 1500Hz. The operation of the audio circuit should be that when no tone is desired, timer 2 should be turned off (rather than just setting volume to be zero).

Timer 3 is used as an auxiliary timer.

External Watchdog Timer

An external watchdog timer is implemented with a DS1236, U21. The WDOG* signal is used to strobe the watchdog (port B bit 3; normally high). The minimum watchdog timer period is 100 ms. Thus the software needs to force a high to low transition on the WDOG* line at least every 100 ms. The typical timeout is 400 ms and the maximum is 600 ms.

EEPROM Interface

A serial 1K bit EEPROM, U4, organized as 64 x 16 (ICT93C46) is connected to port A bits 14, 15 and port B bits 5 and 4. The interface signals are data in (EEDI), data out (EEDO), clock (EESK), and chip select (EECS). All data clocking and shifting will be performed in software. Consult the 93C46 data sheet for interface information.

RTC Interface

The RTC is a Dallas DS1202, U20. The RTC has a bidirectional data line (EEDI), a clock (EESK), and a reset (RTC) line. The data line and clock line are shared with the EEPROM interface (port A bit 14 and port B bit 5). An active high signal RTC (port B bit 10) is used to enable the RTC for interface. Watch crystal, Y2, is a 32.768KHz clock that is connected to inputs X1 and X2 of U20. This provides the necessary accuracy for time and date.

SpO_2 Interface

A parallel interface similar to the ISA bus is implemented. The parallel interface is only 8 bits wide. It is attached to the lower byte of the data bus. The 8-bit ISA address space is 1Mword addressable. Thus 2M bytes address space are needed to access this space. This is mapped into address space starting at 800000H. Currently this parallel interface is only used to access the SpO_2 module. The SpO_2 module appears as a block of shared memory to the CPU. Port B, bit 11 is currently connected to the SpO_2 module. Consult the SpO_2 module documentation for interface information.

Miscellaneous Inputs and Outputs

Two signals are reserved to drive LED's: LED0* and LED1* (port A bits 2 and 3). They are active low. Currently only LED0* is used. It drives the alarm LED.

A defib sync output DSYNC (port A bit 11) is used to provide the external defib sync signal. This signal should be normally high. The E trigger obtained from the analog front end should be output to this signal as soon as possible.

2.2.5 Line Battery Board

Overview

The Line/Battery module provides four different power functions.

- Selects "raw" DC power from either an external regulated line supply of 17V, or from two sealed 12V lead acid batteries. The order of selection is A) 17V external power, B) Two 12V batteries, C) One 12V battery.
- Generates +15V @ 250 mA, -15V @ 250 mA, and +5V @ 1.5A.
- Allows the charging of lead acid batteries to occur.
- Monitors "raw" DC battery power and turns off system when battery voltage drops below 10.5V.
- Provides the battery voltages, the charging voltages and the external +17V for the Battery Charging LED function on the VGA/EL Panel Board. The Battery Charging LED function compares the battery voltage to the charging voltage. When the batteries are charging, no matter what position the power-on switch is in, the green LED is lit.

Once the batteries discharge to a level of approximately 11 volts (for more than 20 seconds), the unit is automatically shut OFF with enough hysteresis that the main power switch must be cycled to re-initiate a turn-ON. The hysteresis is necessary because when the system load is removed from the battery, the terminal voltage of the battery will float back up to the voltage of a charged battery. After the cutoff circuit is activated, a load greater than 100K (@ 12 volts) remains on the battery to avoid excessive discharge and therefore sulfation of the battery. The low battery cutoff comparator controls a small oscillator that generates an isolated voltage. This voltage is capacitively coupled via a full wave rectification circuit. This "floating" supply controls the gate of a very low ON resistance power FET. This FET controls power to the switching supplies to generate system voltages.

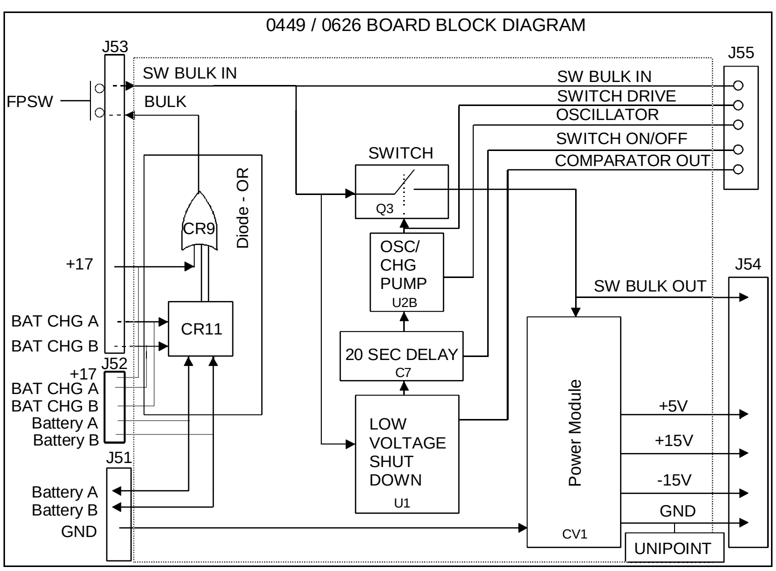

FIGURE 2-18 Line/Battery Block Diagram

Detail

The reader should refer to the Line/Battery block diagram , sub-circuit diagrams, and complete circuit schematics while reading the following operation descriptions.

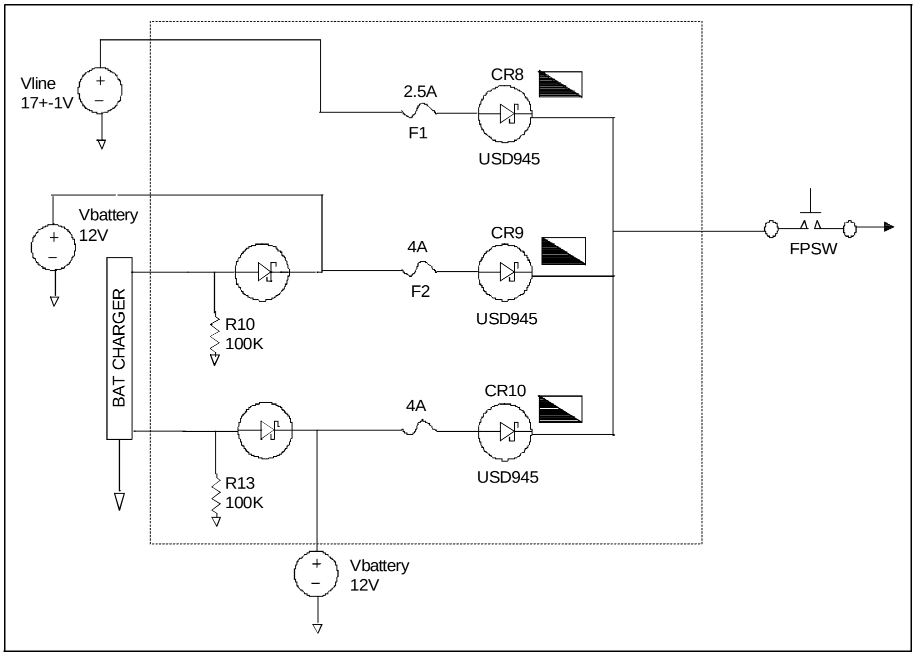

FIGURE 2-19 Diode OR Circuit

Diode - "OR"

Immediately upon entering this module, the three voltage sources are fused. The 17V line input is tied to fuse F1 which is rated for 2.5 A and is a slow-blow type fuse. Fuses F3 & F4 are 4 A fuses and are also slow-blow type fuses. The selected fuses are a common 5 X 20 mm size and are approved for both Domestic and International use.This block provides power entry selection where the line voltage will always be selected before battery power is selected. The "OR-ing" function is provided by diodes CR8-CR10. These Schottky diodes are used because of their low forward drop. If the line voltage is available (+17V), CR8 will forward conduct and CR9 and CR8 will be reversed biased. When line power is removed, a smooth transition will be made to battery power through CR9 and CR10. The output from the diode OR (system power) exits this module and returns through the main power switch.

When the system is off, diodes CR11 and CR12 allow a charging path from the battery charger to each battery. Resistors R10 and R13 provide a path to ground, to bleed accumulated charge from CR11 and CR12.

Low Voltage Shut Down Comparator / 20 Second Delay Circuit

When the battery drops to 11 volts (10.5 V after the USD945 diode drop and fuse), the low current comparator will trip. Hysteresis on the comparator circuit will prevent the unit from turning back ON until the supply reaches 15 V. The purpose of hysteresis is to prevent the power from toggling ON and OFF when the battery is low and monitor functions are enabled and disabled.

This circuit employs a low power OP-AMP U1(LM4250) as a voltage comparator. This OP-AMP allows the designer to operate the amplifier at a unique operating point established by R6. In this application, R6 biases the comparator at 1Ua. This equates to approximately 10Ua of supply current drain at 10V. Another low power device, the LT1004-1.2 (CR1) is a zener diode used to develop a precision voltage reference at the negative terminal of the comparator. This device is specified to “zener” at 1.2V with only 10Ua of current. The 10Ua zener current is provided by R3. A precision resistor divider consisting of R1, R2, and R4 apply the appropriate voltage to the positive input terminal of the comparator. If the supply voltage is greater than 10.5 V, the divider voltage will be greater than the reference, and the output will jump towards the positive rail. When this occurs, CR2 will forward conduct causing the combination of U2C and U2A to turn Q1 (2N7000) “ON” In turn, Q2 (2N7000) will be forced OFF to eliminate R4 from altering the divider circuit. This state is the normal state for proper operation. However, if the supply dips below 10.5 V , the following events happen.

The positive input to the comparator will be less than the reference. This will cause the comparator output to jump towards the negative rail. When this occurs, CR2 will reverse bias and the rail voltage on C7 will discharge through R12. If the supply does not rise above 10.5 V in a period of time greater than approximately 15 seconds (exponential decay of C7 and R12 to the trip point of U2C) Q1 2N7000 will turn OFF. Q2 the 2N7000 transistor will now turn ON causing R4 to modify the resistor divider and force the divider input voltage to fall further below the reference. The circuit will remain in this state until the power switch is toggled or the supply voltage exceeds 15 V.

Turn On:

Capacitor C1 and R8 forces Q1 to turn “ON” and Q2 to turn “OFF” during power-up. This is to insure that the hysteresis resistor R4 will not be connected during power up, to establish the proper state for normal operation.

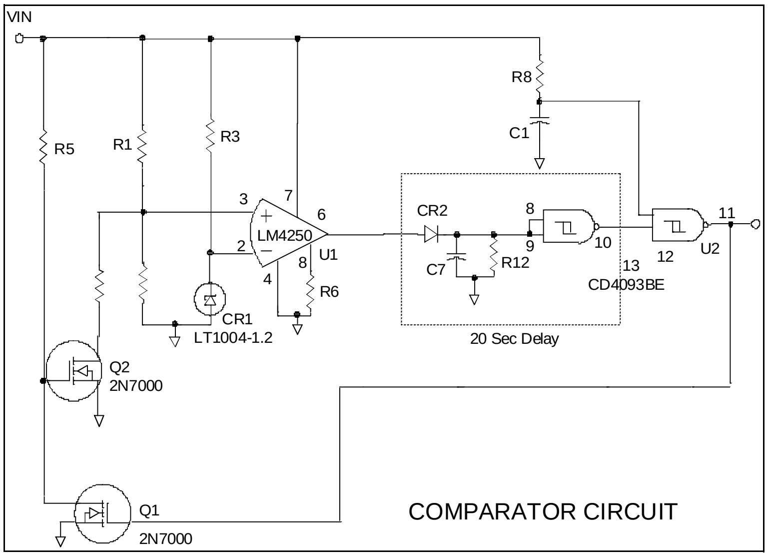

FIGURE 2-20 Comparatory 20 Second Delay Circuit

Oscillator / Charge Pump Circuit

An oscillator is formed from the R11 - C4 combination around U2 (CD4093 Schmitt trigger nand gate). The second input to the Nand gate from the comparator circuit provides an ON/OFF switch to the oscillator. This oscillator, at a frequency of 200 KHz, is tied to another Schmitt trigger to form complementary outputs. The two output signals are coupled to the system power (FET) switch " gate" through a pair of .01Uf capacitors (C5 and C6) and a bridge rectifier (CR3-CR6) that converts ac voltage to dc. This circuit forms an approximate voltage doubler. Therefore at a cutoff supply voltage of about 9.5V, this circuit will provide 9.5 volts at the gate of this FET. This FET needs a Gate to Source voltage of 5V at a Drain current of 4A (the system only requires 1A), providing a safety factor of almost two.

CR7 clamps the input to U2 from going higher than the supply rail. This component offers protection to the IC U2. R9 bleeds charge off of capacitors C5 and C6 to shut off the FET when the oscillator is disabled. R14 limits current to the FET gate when the FET is initially turned "ON".

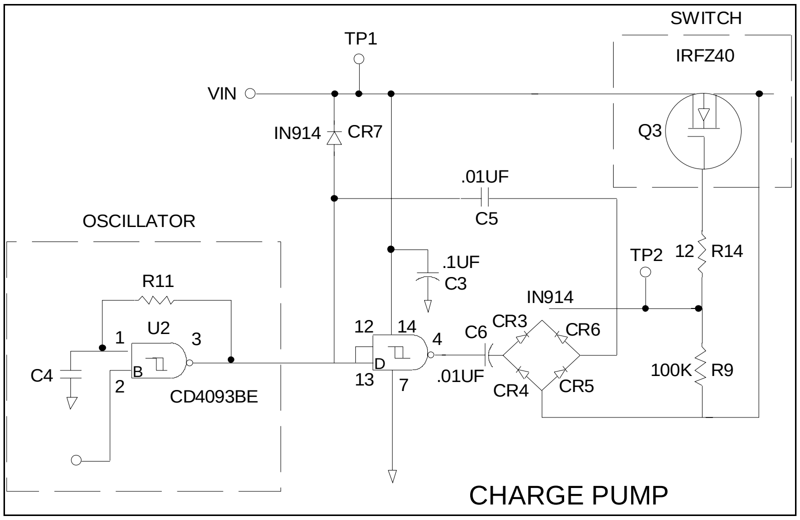

FIGURE 2-21 Oscillator / Charge Pump Circuit

Power Module

This module is a “self contained” 15W DC / DC converter that provides three regulated outputs. This module will accept input voltages ranging from 9V DC to 18V DC and produces outputs of 5V (@1.5A), 15V (@250ma) and -15V (@250ma).

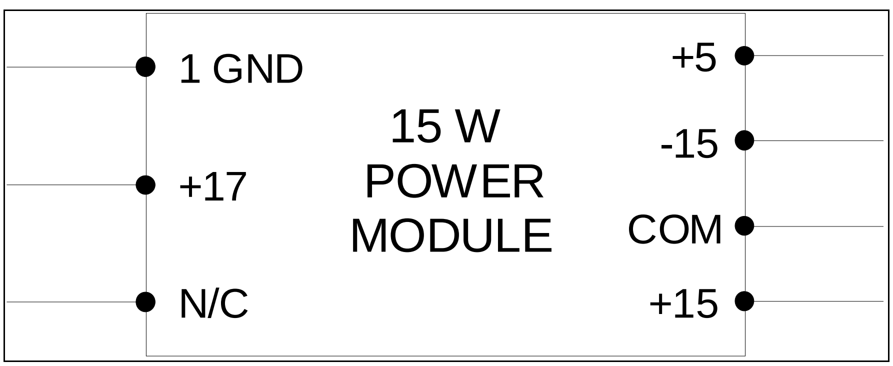

FIGURE 2-22 Power Module Diagram

2.2.6 +12 / -23.5 Volt Converter Board

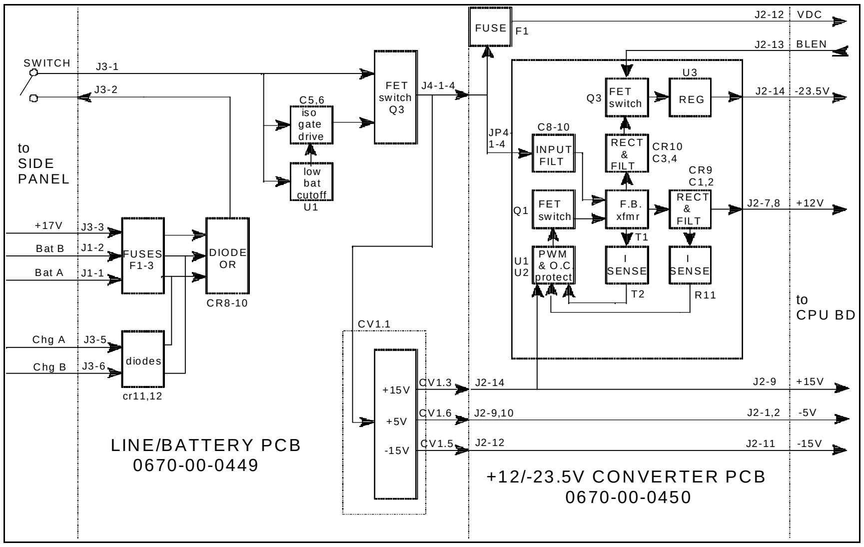

FIGURE 2-23 Internal Power Supply Block Diagram

Detail

This flyback converter runs at 100 KHz and generates +12 volts (to power loads with large step load changes) and -23.5 volts (a low current supply for the display). A 2843 PWM (U1) drives a power fet (Q1) which switches the primary of the flyback transformer (T1). C9 and C10 are low esr aluminum electrolytics which provide the instantaneous pulsitile power required locally by the input of the converter. L1, L2 and C8 filter converter high frequency (100 KHz) noise from the input power line. CR1,C11 and R10 snub energy stored in the primary leakage inductance of T1. L5 and L6 are lossy ferites which damp high frequency (10's of MHz) oscillations in the primary switching loop. CR6 does not function in normal coarse of operation of the converter, but clamps voltage spikes which might occur at the drain of Q1 for short circuit conditions of the converter's main output. Likewise, CR5 does not function in the course of normal operation, but clamps any abnormal voltage spikes which might couple thru Q1's drain gate capacitance. CR4 decouples Q1's gate from the capacitance of CR5 so as not to slow down the switching time of the fet. R9 keeps the fet turned off for times when U1-6 is not active. C18 and R8 provide a high speed, yet damped, switching path between U1-6 and the gate of Q1. R3 and R4 form a feedback voltage divider from the 12 volt output back to the inverting input (U1-2) of the error amp in the pwm. R5, C14, and C13 provide compensation for the voltage feedback loop. C12 and C16 locally decouple Vcc and Vref of the pwm respectively. R6 and C15 are the timing components for the internal oscillator of the pwm. T2 provides primary current mode feedback to the pwm. The positive going current ramps are passed by CR2 and scaled by T2 and R7 to give a corresponding voltage waveform of roughly .12 volts / amp in the primary. C17 filters leading edge spikes from the reconstructed current waveform due primarily to discharge of Q1's drain capacitance. CR3 allows enough voltage backswng to reset T2's core and yet clamps the voltage so as not to destroy Q1.

On the secondary side, CR9 and C1 and C2 rectify and filter the 12 volt output. Likewise CR10 and C3 rectify and filter the -23.5 volt output. L3, L4 and C4 provide additional filtering. R1 and C5 damp energy in the 12 volt secondary leakage inductance. Likewise R2 and C6 damp energy in the -23.5 volt secondary leakage inductance. U3, R12 and R13 make up a linear regulator for the -23.5 volt output (input to the regulator is typically about 3 volts higher than the output). Q3, R14, Q4, R16 and R15 are used to gate power into the linear regulator via a 5 volt logic control signal.

R11 senses the current in the 12 volt secondary. R17,C19,R8,R19, and C20 filter this signal prior to sense by comparitor U2B. The 5 volt reference of U1, R8 and R19 offset the input of the comparitor such that it will trip at approx. 1.9 amps. CR8 and C21 add hystersis and a “hiccup” time constant to the comparitor. U2A buffers the output of U2B prior to resetting the soft start circuit R24 and C23. Q2 functions as a follower which buffers the soft start RC prior to pulling down the output of the pwm error amp (U1-1).

2.2.7 Planar EL Panel Board

Overview

The panel board locates physically the visible indicators in reference to the front panel of the monitor. It contains the LED driving circuits and buffers for the EL data lines. Due to its location in the assembly, it provides convenient means for interconnection between the CPU board, the EL panel, the DC/DC converter, the front panel keyboard, and the speaker.

Functional Description

The LEDs provide two indicating functions: power on - green, alarm on - red.

When activated, the alarm LED is flashing at a 3 Hz rate and 50% duty cycle. The speaker produces all the required tones (i.e. heart rate beeps, alarm and alert tones). The alarm LED control and the speaker signals are generated on the CPU board.

A 40 lead ribbon cable from the CPU brings the required voltages and logic signals for the EL panel, the indicators and the keyboard. Four lines control and provide data for the EL panel. Eight output and four input lines interconnect the 8 by 4 keyboard matrix. Detailed description of the signals and power leads is given in Chapter 3 on page 3. The DC/DC converter generates the power for the EL panel.

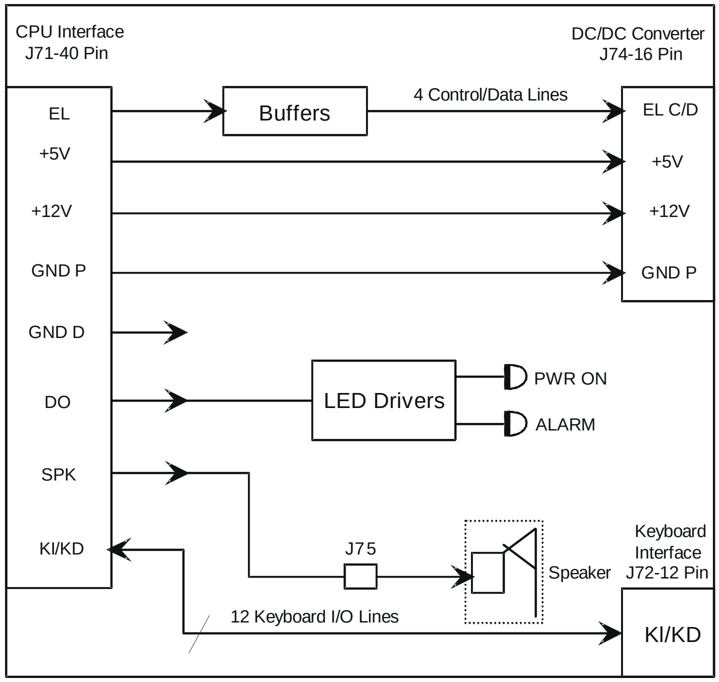

FIGURE 2-24 Planar EL Panel Board Block Diagram

EL Panel Circuits

The EL panel board circuit consists of signal through lines, data line buffers, and a LED drive circuit. The display is a 30fL pixel, electroluminescent flat panel. It has a display matrix of 640 by 200 addressable pixels. The data lines and supply voltages are connected to the EL's DC/DC converter through J74. The supply voltages (+12V and +5V) come from the microprocessor board via J71 on the panel board. The supply voltages are then converted to the voltages used by the EL panel.

LED Indicator Circuits

The alarm indicator D1 is implemented by a high intensity red LED, HP type HLMP K101 or equivalent. It is driven by the FET Q1, type 2N7000 which is controlled by the signal LED0 form the CPU board. Power On is indicated by the green LED HP type HLMP 1790 or equivalent. It is driven directly from Vcc through the current limiting resistor R6.

Keyboard Interconnections

The four input lines K10 through K13 and the eight output lines KD0 through KD7 provide the interconnection between the CPU board and the 8 by 4 keyboard matrix.

Speaker Interconnections

The speaker signals for alarm and beep tone are interconnected between the CPU board and the loudspeaker.

2.2.8 CO2 Interface Module

The CO2 Interface Module, or CIM, provides the electrical interface between the Passport monitor and the Novametrics CO2 Control Modules. Some CO2 Interface Modules support Mainstream CO2 monitoring only while others support Sidestream and Mainstream CO2 monitoring. The CIM provides both buffered data communications as well as power supplies for the Capnostat.

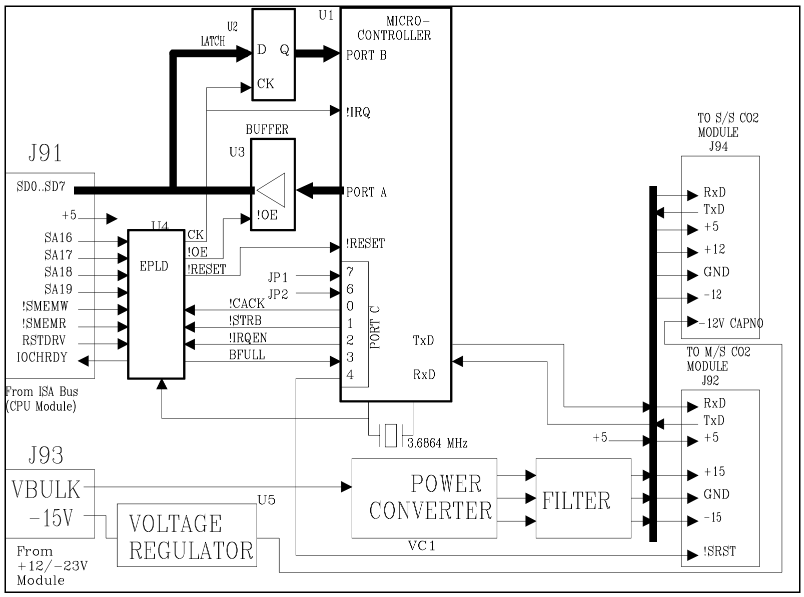

FIGURE 2-25 CO_2 Interface Module Block Diagram

Overview

An overall block diagram of the CIM is shown in figure. Bus interface logic, consisting of a programmable logic device, an octal register, and an octal buffer, connects to the Passport's pseudo-ISA bus. This bus is shared with the SpO2 module. Therefore, bus resources have been allocated to avoid conflicts. This interface logic implements two read-write registers, one for data and the other for control or status. A microcontroller, type 68HC705, operates as an intelligent, highly buffered UART. The serial port of the microcontroller provides the data interface to the Mainstream and Sidestream CO2 control modules. The Mainstream CO2 requires 5 volt and dual 15 volt power for operation. The Sidestream CO2 requires 5 volt and dual 12 volt power supplies for operation. The 5 volt power is supplied directly from the pseudo-ISA connector. However, the dual 15 volt and 12 volt requirements exceed the capabilities of the Passport power converter, due to the presence of large pulsations in load current. Therefore, the CIM contains an additional DC-DC converter to supply these requirements from the bulk supply. A filter is used to assist in handling the pulsatile load component. Due to even more stringent power supply requirements, the Sidestream CO2 control module requires an additional cleaner -12 volt supply (-12V capnostat on the block diagram).

Microcontroller

The microcontroller manages the flow of data between the host and the Novametrics Capnostat. It consists of a 68HC705 OTP single chip microcontroller. It operates at an oscillator frequency of 3.6864 MHz, obtained from the network including crystal Y1, bias resistor R1, and loading capacitors C1 and C2. The oscillator also provides clocking for U4.

When it is brought out of reset, an internal self test is performed, which verifies the PROM contents and RAM operation. During this self test period, lasting several ms, bit 4 of port C is configured as an output and driven low. This asserts reset to the Capnostat. At the conclusion of the self test, this pin is reconfigured as an input, releasing the Capnostat reset, which is designed for an open-collector interface. The start-up of the Capnostat and CIM are thus synchronized.

Any data written to the CIM data port is accepted by the microcontroller on port B. Data to be sent to the host is asserted on port A. Communications with the Capnostat take place by a CMOS level asynchronous serial link in J92. The parameters are 9600 baud, 8 data bits, no parity, and one stop bit, with the data having “true” polarity.

Two locations for optional jumper links are provided. They can be read on bits 6 and 7 of port C. Jumper JP2 is reserved for future options. If JP1 is present a special test code is invoked immediately after reset.

Power Converter

The CIM also supplies operating power to the Capnostat. Power connections are made via J92 and J94. The +5 volts and digital ground obtained from the ISA bus are used to supply logic power. The +5 rail used to power the Capnostat II through a dropping resistor R2, also powers a heater in the Capnostat. The Capnostat II and III also requires dual 15 volt and 12 volt supplies respectively. However, it draws large transient currents from these rails, making it undesirable to operate the Capnostat from the host’s 15 volt analog supplies. Therefore, the CIM includes a commercial DC-DC converter module, VC1, which supplies these requirements. The converter is powered from the raw bulk supply, obtained from J93. Capacitor C10 reduces the reflected load transients. A converter capable of supplying the peak Capnostat load currents would be quite large. For this reason, the converter is sized closer to the average requirements, with a filter consisting of C9 and L2 providing smoothing of these peaks. The Capnostat III also requires a -12V linear supply. This is derived from a -12V regulator, U5.

Interface Connectors

The CIM is capable of interfacing to either a Capnostat II or III. Unfortunately, the 2 modules’ interface connector have different signal definitions. In order to prevent the possibility of the wrong module being plugged into the CIM, 2 connectors were specified. One is for the Capnostat II (J92) and one is for the Capnostat III (J94). They differ in that the Capnostat II uses a 15 V supply and also has a separate 5V heater supply, while the Capnostat III uses a dual 12V supplies.

2.2.9 NIBP Module: NIBP Pneumatic Board

0670-00-0447-XX, 0670-00-0605-xx (Linear Bleed) and Control Board 0670-00-0375

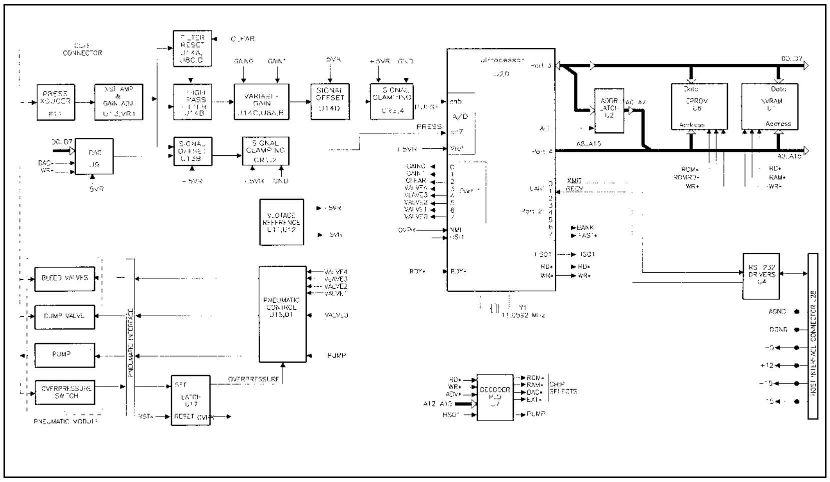

FIGURE 2-26 NIBP Module Block Diagram

Overview

The NIBP module consists of two boards interconnected by a 20 pin cable: the control board that contains most of the electronic circuitry ; and a pneumatic board that contains all the pneumatic parts.

The CPU

The electronics are built around a 16 bit microcontroller (80C196). Built into the 80C196, in an 8-channel 10-bit A/D converter, five 8-bit I/O ports, pulse width modulators, high-speed inputs and outputs, an UART, a watchdog timer, and two 16-bit counter/timer.

An 11.0592MHz crystal is connected to the on-chip oscillator of the 80C196. This frequency is chosen for accurate generation of standard baud rates (the on-chip UART has an integral baud rate generator). An RC circuit, R1 and C1, resets the 80C196 on power-up. The microcontroller can also be reset from an external, open-collector, active low reset signal from Pin 8 of connecter J28.

The non-maskable interrupt, NMI, of the 80C196 is used to detect the overpressure (OVPR) condition. A low to high transition on the OVPR signal will cause the microcontroller to sense the overpressure condition. The OVPR signal is also connected to the high speed input bit 1 of the microcontroller for it to verify the overpressure condition.

The BUSWIDTH input is tied low since the eight bit data bus mode is used for external memory access. The EA/ pin is tied low since external EPROM and static RAM are used for program and data memory.

Address Decoder

The 80C196 address decoding is controlled by an EP320 EPLD (U7). Two different decoding is possible, depending on the state of the signal PIB (OPT2). In the module mode, PIB is high.

In the module mode, (module mode = DSBP module used in any product other than ACCUTORR 3/4) when the bank bit BANK, (U5 pin 33) is set high, the lower 32K bytes (0-32K) are mapped to the on-board EPROM; the next 8K bytes (32K-40K) are mapped to non-volatile RAM; the next 16K bytes (40K-56K) are not used; and the last 8K bytes (56K-64K) are mapped to I/O, the only I/O available being the quad DAC, U9.

When the bank bit is set low, the lower 8K bytes (0K-8K) are still mapped to the on-board EPROM; but the next 24K (8K-32K) bytes are mapped to nonvolatile RAM; the remaining RAM and I/O space remain the same.

The address decoder EPLD, U7 also disables the pump when the overpressure condition OVPR is set and buffers the reset signal to the 80C196 microcontroller.

The Pressure and Pulse Channel Amplifiers

The normal pressure transducer installed is a Sensym BP01. The output of the pressure transducer is amplified by an instrumental amplifier implemented by U13A, C, and D. The gain can be adjusted by trimpot VR1. The output is then buffered, low pass filtered and offset adjusted by U13B and sent to the 80C196 A/D channel 7 at the pressure signal. The offset is automatically corrected by adjusting the voltage level of OFFSET from the output channel 1 of the quad DAC U9. The gain of the amplifier is such that the output at U13 pin 7 is about 68.27mmHg/V.

The pulse channel signal is obtained by AC coupling and amplifying the pressure signal (U13B-7). The pulse channel output can be reset by activating the CLEAR signal. This signal can be activated when there is disturbance at the pulse output during pneumatic switch-overs or severe motion artifacts. There are two gain switches controlled by U8A and U8B, implementing four possible gain settings. The nominal gain settings for the pulse channel are about 28, 56, 111, or 222. The default gain for adult mode is 28 and the default gain for neonate mode is 111. The pulse signal is connected to the 80C196 A/D channel 5.

U11, U21B and U21C are not used at this time.

Reference voltages +5VR and -5VR are generating by amplifying a 2.5V reference generator U12 by a factor of 2 and -2 respectively.

The sampling rate of the 80C196 A/D is about 250 Hz.

Pneumatic and Miscellaneous Control

The five MSB's of I/O port 1 of the 80C196 are used to control the air valves. All the valves are of the normally open type. In case of loss of power, the valves will open VALVE0 is the dump valve, which lets air out of the cuff when the measurement is complete. VALVE1, VALVE2, VALVE3, and an optional VALVE4 controls valves that have different orifice openings. They are used to control the bleed rate of the pressure in the cuff during a measurement. The valve control signals are buffered by U15, an ULN2003. U21D implements an optional linear valve driver that is driven by channel A of U9, the AD7226 quad DAC. It is currently not used.

The pump is controlled by a pulse width modulated output from bit 1 of the high speed out put section of the 80C196 (U5 pin 29). In adult mode, the pump runs at full speed; in neonate mode, the pump is pulse width modulated to moderate the pump speed. The pump signal is active high and the high speed outputs reset to a zero state. On power-up, the pump is turned off.

An overpressure switch will close when the pressure in the cuff is 375 mmHg +/-5%. This will set the latch implemented by U17A and U17B which cause the OVPR signal to go high. This, in turn, will force VALVE 0 to open and the pump to stop. This condition can only be reset by resetting the entire module. This is done by power-cycling the unit.

Pneumatic and Miscellaneous Control - Linear Bleed

The pneumatics board consists of two valves, and EMI filter and connector for a chassis mounted pump, an overpressure transducer and detection scheme, and control logic to operate the linear bleed system. The pump is used to inflate the cuff at the beginning of each measurement cycle. Inflation pressure is regulated by software monitoring a pressure transducer located on the companion control board. In the event of a runaway condition of the pump, the patient size sensitive overpressure circuitry will completely open the linear valve and close the dump valve, fully venting the cuff while at the same time blocking the pump from further inflating the manifold. At the onset of the actual measurement phase, the bleed valve (V2) opens to provide a gradual reduction of the cuff pressure. This is a so-called proportional solenoid valve. Rather than providing only "on-off" control, it can be opened to a variable degree, in proportion to the current flowing in the valve coil. Note that this valve is a normally closed type; coil current must be supplied to cause the valve to open. A servo control loop maintains the pressure bleed down rate at a nominal 6 mmHg per second, regardless of the cuff pressure or system volume. During the measurement phase, the pressure signal acquired by the transducer on the control board is processed to extract the oscillometric blood pressure data. At the conclusion of the measurement phase, the dump valve (V1) is opened, in addition to the bleed valve, to rapidly exhaust the residual cuff pressure.

The pump control is provided by the MOTOR signal, generated on the companion control board and routed to the pneumatic board through connector J30. Power to the motor is supplied by means of a decoupling network L2/C12 from the host's +12 volt bus. A common mode coil, L1, provides further attenuation of the motor brush noise.

The dump valve is controlled by the DVEN signal. This signal drives MOSFET Q1, which switches the valve coil voltage. This is a normally vented valve, meaning that air flow occurs from the manifold to the atmosphere while blocking the pump when the coil is de-energized. This corresponds to a logic low on the DVEN signal. Should an overpressure condition occur, the valve defaults to the vented state. The DVEN signal is gated in U3 to protect against a single fault failure which would cause the dump valve to remain in the energized (non-vented) state. In order for the dump valve to be energized, two dump valve enable signals must agree. One signal is generated by the microprocessor on the companion control board, and the other from microcontroller U1 on the pneumatics board.

The overpressure circuitry identifies two separate patient types; adult and neonatal. The neonatal mode is inferred from the existing conditions during pump-up. If the motor is running and a valve is open, then the neonatal mode is identified and NEO is set low by U1. The over pressure comparator in U6 compares the output of the overpressure transducer with the output of a voltage divider. If the pressure transducer voltage is higher than the output of the voltage divider, OPS is brought low. A single overpressure trip point can be exactly calibrated by adjusting potentiometer R1, presumably the neonatal point. This reduces any error caused by resistor tolerances and inexact transducer readings. NEO is compared to a threshold by a second comparator in U6, and if low, resisterR15 is shunted across resistor R25. This reduces the effective resistance in the grounded resistor in the voltage divider, causing a lower overpressure trip point in the neonatal mode.

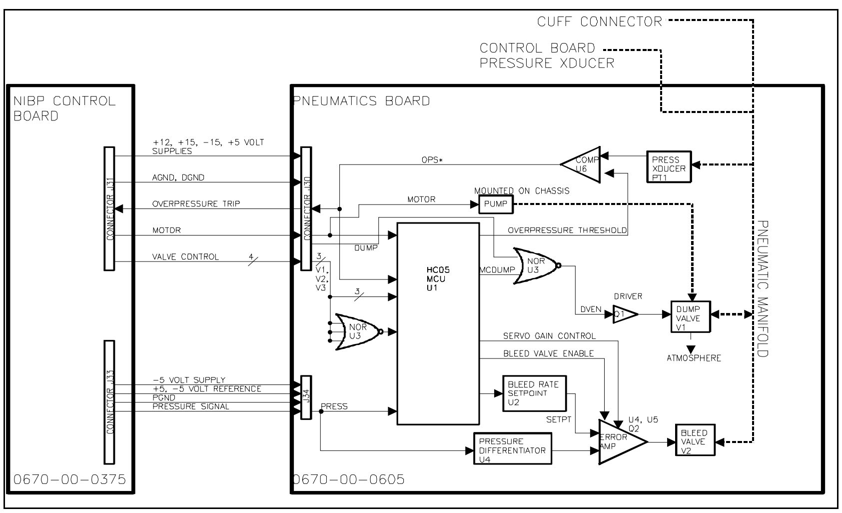

FIGURE 2-27 Linear Bleed Block Diagram

2.2.10 Panel Board / Display Interface

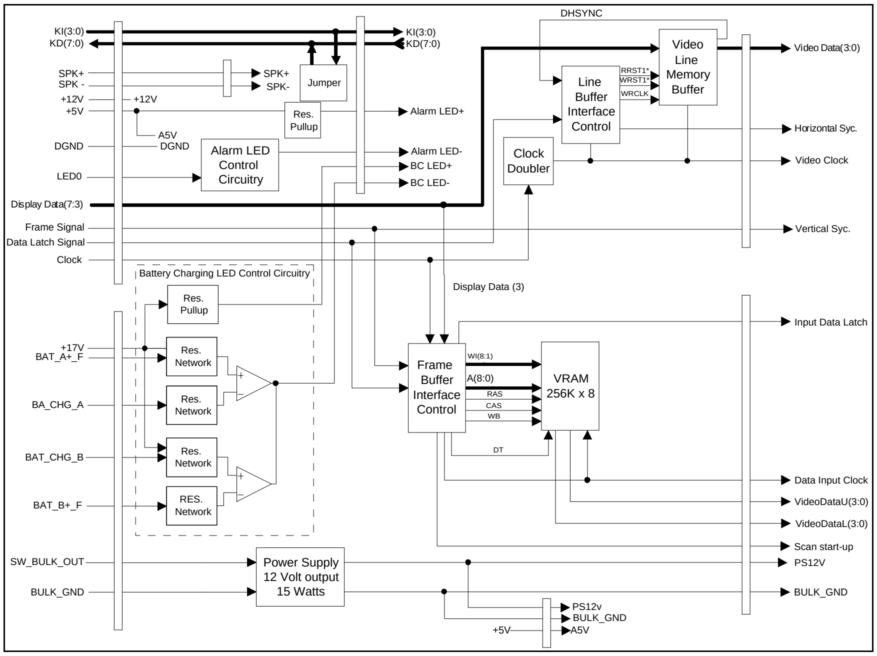

FIGURE 2-28 Panel Board Block Diagram

Overview

The Front Panel Board contains a frame buffer converter that takes a video data stream formatted as 640x240 at 60Hz and converts it to a 640x480 format at 120Hz. The single video bit stream is also converted to a dual scan LCD type 8-bit parallel interface required by the EL panel. Appropriate timing signals are also generated to control the EL panel.

An optional alternate interface circuit is included to drive an alternate color LCD panel. Three color signals (RGB) at 640x240 format at 60Hz and I signal are double scanned using a video line buffer memory to drive the color LCD panel with a 640x480 format at 60Hz.

Monochrome EL Interface

The monochrome EL panel interface (0670-00-0617-03) consists of two control EPLD's (U1,U2) and a dual-port VRAM. The two EPLD's in essence perform the functions of a simple video display controller. The input video data is written into the video memory; the output video data is simultaneously accessed and sent to the EL panel.

The parallel access port of the VRAM is used to write the input video data into memory. As such, the parallel data port is used only in the write mode. On the other hand, the serial access port is used only in the read mode to access the video output data. To simplify the video output logic and timing, the input video data is formatted appropriately before it is written into the VRAM, while the output video data is clocked directly from the VRAM to the EL panel.

Only 640x240 bits of memory storage is required, so very little of the much larger available VRAM is actually used. Refresh of the memory that is being used is automatically performed as the video data is constantly being written to.

The VRAM parallel access address is controlled by the input horizontal and vertical video counters. The horizontal counter counts the 912 columns of the display format (640 of which are displayed data, the remaining columns are used for horizontal retrace). The horizontal counter is used to drive the column address of the VRAM. The horizontal counter is clocked by the video dot clock VCLK/ and cleared by the rising edge of the input horizontal sync signal.

Since the 8-bit input data is formatted as 4 bits for the upper split screen and 4 bits for the lower split screen, only 4 bits of input video data is written to the VRAM in each access. Since the video data is written in 4-bit chunks, the lower two bits of the horizontal counter is not sent to the VRAM address.

Depending on whether the input video data is from the top 120 lines or the bottom 120 lines, the input video data is written to the lower 4 bits or the upper 4 bits of the 8-bit VRAM input data path respectively. Since the input video format is single bit serial, a 4-bit shift register is used to convert the input video data to a 4-bit parallel format. An 8-bit multiplexer directs the 4-bit shift register (double-buffered to accommodate the VRAM timing) to the appropriate half of the VRAM parallel data input.

The write-per-bit feature of the VRAM is used to mask the appropriate 4-bits of the VRAM parallel data input such that only the corresponding 4-bits of video information is being written. A mask of either 00001111 or 11110000 is used depending on whether the input video data is from the upper screen or the lower screen. The mask is written to the VRAM on the following edge of RAS/ during the block write cycle. This mask data is selected by the same 8-bit multiplexer that controls the VRAM parallel input data.

Since the VRAM may not necessarily power up in the correct mask mode, a CBR (CAS/ before RAS/) refresh cycle needs to be performed periodically to reset the VRAM in the default masking mode (new mask mode) for the mask data to work properly. This is done at the beginning of every input horizontal scan line. If a output start line address clock cycle is not needed, then a CBR cycle is initiated in its place, before the pixel data of the horizontal scan line is written into the VRAM.

The lower 3 bits of the horizontal counter actually forms a state machine that controls the VRAM memory cycles. The first 3 states (S0,S1, and S2) are used to strobe in the appropriate row address of the output video stream when the need arises (the data transfer signal DT/ and the write control signal WB/ are changed accordingly). The last 5 states are used to write two 4-bit chunks of input video data into the VRAM.

The vertical video counter is used to count the 262 rows of the display format (240 of which are displayed, the remaining are used for vertical retrace.) The vertical video counter is clocked by the rising edge of the input horizontal sync and cleared by the input vertical sync signal. The vertical video counter wraps at count 120, which demarcates the upper and lower halves of the screen. This is used to toggle the signal TOP/, which indicates which half of the screen the video data is in. The vertical counter is used to drive the row address of the VRAM.

Because of the timing requirements of the EL panel, the vertical line timing of the output video need to be different than the input line timing. To accommodate this, a separate horizontal and vertical output counters are used to determine when the appropriate row address should be strobed into the VRAM to initiate another row of output video data. After this row address is strobed in the VRAM by the RAS/ signal, the CAS/ signal strobe in the column start tap point, which, in this case, is always zero. An address multiplexer is used to select the appropriate input and output row and column counters respectively.

The EL panel timing is such that the input video clock of 14.318MHz is divided by 2.5 to generate the output video clock. A new vertical sync is generated at 120Hz, as well as a new horizontal sync.

EL and Color LCD Interface

The EL and Color LCD Panel Boards (670-00-0617-XX) has a built-in frame buffer and the interface is regular timing at a 60Hz rate. Therefore, the interface requirements are much simpler. All that is necessary is each input horizontal scan line needs to be doubled to convert the 640x240 input format to the 640x480 output format.

A 910x8 bit video line memory buffer is used to temporarily store each incoming video line and clocked out twice as fast to double the video line. The input video clock of 14.318MHz is doubled by a clock doubler circuit. The input horizontal sync signal is doubled simply by feeding it to the video line buffer and clocking out twice as fast. The RGBI input color video signals are also fed directly into the video line buffer and clocked out twice as fast directly to the EL or LCD panel.

The main function of the PAL is to fit the 912 input columns into the 910 bit video line buffer by effectively deleting two input clock cycles. It also generates miscellaneous control signals required by the video line buffer.

Battery Charging LED

The EL or Color LCD Panel Board controls the Battery Charging LED (Color: Green). The LED is lit when the batteries are charging no matter what position the power switch on the Passport is in. Two comparators are use to compare the Battery Charging voltage to the Battery voltage. When the charging voltage is greater than the battery voltage, the output of the comparators is low which turns on the LED. The function is powered by an external +17 V which improves the internal power management and allows the system only to work when the external power supply is plugged in.

Alarm LED

The Alarm LED is a high intensity red LED. It is driven by a FET, a 2N7000 which is controlled by the signal LED0 from the CPU.

Speaker Interconnections

The EL/LCD Panel Board provides connection from the CPU board to the speakers.

Keyboard Interconnections

The four input lines KI0 through KI3 and the eight output lines KD0 through KD7 provide interconnection between the CPU board and the 8 by 4 matrix keyboard. A jumper on line KI3 to KD3 and KD4 is used to indicate which display is being used.

DC/DC Converter

The power supply on the Panel Board is a DC/DC converter. The input voltages to the power supply is from the Line Battery Board which improves the power management of the system. The input voltage range for the DC/DC converter is 9 to 18 Volts. The power supply provides a +12V @ 1.250 Amps Max. for the monochrome EL display.

2.2.11 Termination Board

Overview

The Termination Board's function is to help reduce emissions from high speed EL/LCD display signal outputs and 5 VDC power from the CPU board (P/N 0670-00-0651) in the Passport. The Termination board is inserted between the output connector J68 on the CPU board and the ribbon cable (P/N 0012-00-0744) that connects to the EL/LCD Panel board (P/N 0670-00-0617).

Common Mode Choke

The common mode choke is a ferrite device that reduces conducted emissions on signal or power lines without affecting transmission. The ferrite acts as an attenuator to high frequency signals by absorbing extraneous and unwanted energy. Low frequency and DC signals see only the conductor and are unimpeded without any loss. High frequency signals encounter inductive resistance due to the ferrite providing the insertion loss for dissipating EMI. Since this choke is common mode it attenuates unwanted common signals on both the power and digital ground.

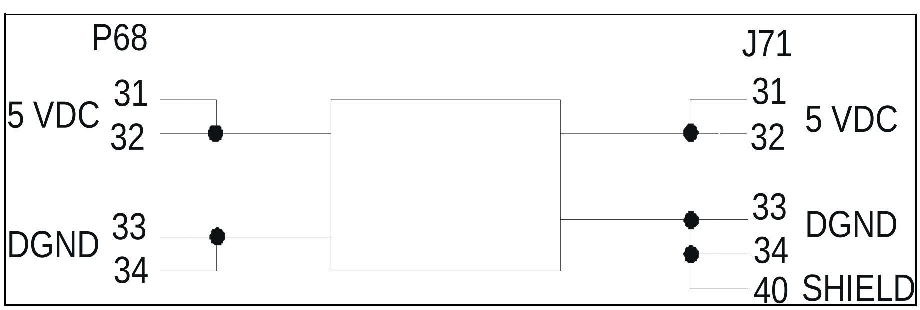

FIGURE 2-29 Termination Board Choke Assembly

Termination Resistors

Series 75 ohm termination resistors were inserted on the nine highest frequency EL/LCD data, clock and sync signals. This was necessary because these signals are generated from high speed CMOS logic devices whose outputs are under damped and ring. This is shown in Figure 2-30 below:

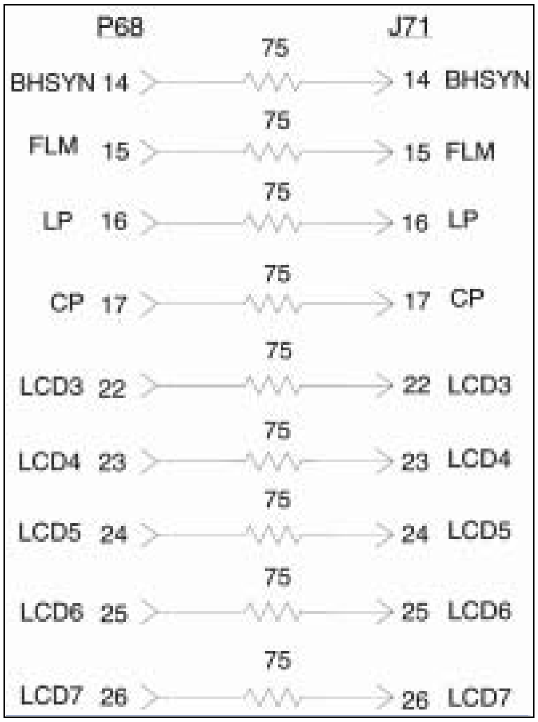

FIGURE 2-30 Termination Board Terminated Signals

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3.0 Specifications

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3.1 Performance Specifications

- ***ECG***

Leads:	I, II, III, aVR, aVL, aVF, V
Display Sensitivity:	0.25, 0.5, 1.0, 2.0, 3.0, 4.0 cm/mV ±10%
Frequency Response to Screen: ESU Filter Out:	0.5 to 40 Hz, -3db max @ 1 mVpp input (notch filter disabled).
ESU filter in:	0.5 to 20 Hz -3db max @ 1 mVpp input
CMRR:	90 dB min. maximum output of 1 mV p-p (RTI) over 60 second period with a 51 K ohm lead imbalance and ± 300 mV dc offset. ANSI/AAMI EC13-1992.
Defibrillator Overload Protection:	Withstand Lown and trapezoidal or Edmark waveform up to 400 joules applied to 100 ohm load and electrode at 20 second intervals. As per ANSI/AAMI EC13-1983 par. 3.2.2.2.
Recovery Time:	Time for trace to return to screen from defibrillator mono pulse 3 sec. maximum

- ***IBP***

Range to Digital Display	Systolic/Diastolic/Mean -20 to +300 mmHg
Accuracy:	2 mmHg or 2%, whichever is greater to numerical display position
Scales to Display:	0 to +37.5 mmHg 0 to +150 mmHg 0 to +75.0 mmHg 0 to +300 mmHg
Zero Accuracy:	± 1 mmHg
Zero Range:	± 120 mmHg min at nominal gain.
Input Sensitivity:	5.0 uV/V/mmHg ± 1.5%
Frequency Response:	DC to 15 Hz, +/-2 Hz (+0/-3db) for 1 cm of deflection

- ***Heart Rate Meter***

Range:	30-300 bpm ADULT/CHILD 30-350 bpm NEONATAL
Accuracy:	30-250 bpm, ±3 bpm or ±3%, whichever is greater
Pacer Rejection:	Rejects all pulses of amplitude ± 2.0mV to ±700 mV and duration 0.1ms to 2 ms with no tail. Rejects all pulses ±2.0mV to ±700mV and duration 0.1ms to 2 ms with 100ms T.C. tail <0.8mV or 25 ms T.C. tail <0.4mV
Display Update:	2 seconds ± .1 sec.
Noise Rejection:	Rejects noise less than or equal to 0.1mVp.p at 50/60 Hz RFI as per AAMI draft standard CMD-3/80.

- ***Non-invasive BP (fixed orifice)***

Technique:	Oscillometric
Systolic Range:	Adult/Ped mode: 50 to 250 mmHg
Neonatal mode:	15 to 150 mmHg
Diastolic Range:	Adult/Ped mode: 30 to 200 mmHg
Neonatal mode:	10 to 150 mmHg
Systolic Accuracy:	Mean error less than 7 mmHg, standard deviation less than 8 mmHg (adult/pediatric) Mean error less than 3 mmHg, standard deviation less than 13 mmHg (neonatal)
Diastolic Accuracy	Mean error less than 7 mmHg, standard deviation less than 8 mmHg (adult/pediatric) Mean error less than 4 mmHg, standard deviation less than 7 mmHg (neonatal)
Heart Rate Meter Range:	30--250 bpm

Heart Rate Meter Accuracy	±3 bpm or ±3%, whichever is greater
Pressure Transducer Range:	0-320 mmHg
Pressure Transducer Measurement System Accuracy:	3 mmHg or 2% whichever is greater
Maximum Cuff Pressure:	Two means of limiting cuff pressure are provided: 1) a hardware over pressure switch which limits the pressure to a maximum of 375 ±5,-10% for all other versions; and 2) a software monitor which vents if the pressure exceeds 290 mmHg. The software monitor is disabled in the CAL mode. If the over pressure switch is tripped in normal operation then the power must be cycled to reset the switch.

- ***Non-Invasive BP (Linear Bleed)***

Technique:	Oscillometric
Systolic Range:	Adult/Ped mode: 55 to 235 mmHg
Neonatal mode:	45 to 120 mmHg
Diastolic Range:	Adult/Ped mode: 30 to 200 mmHg
Neonatal mode:	25 to 100 mmHg
Accuracy:	Mean error less than 5 mmHg, standard deviation less than 8 mmHg. (Reference ANSI/AAMI SP10-1992)
Heart Rate Meter Range:	30-250 bpm
Heart Rate Meter Accuracy:	±3 bpm or ±3%, whichever is greater
Pressure Transducer Range:	0-320 mmHg
Pressure Transducer Measurement System Accuracy:	±3 mmHg or ±2% whichever is greater from 20 to 250 mmHg (ANSI/AAMI SP10-1992)
Maximum Cuff Pressure:	Two means of limiting cuff pressure are provided: 1) a hardware over pressure switch which limits the maximum pressure to 330 mmHg for Adult/Ped, and 165 mmHg for Neonates; and 2) a software overpressure monitor which vents if the pressure exceeds 290 mmHg for Adult/Ped, and 150 mmHg for Neonate. The software monitor is disabled in the CAL mode. If the hardware over pressure switch is tripped in normal operation then the power must be cycled to reset the switch.

- ***Pulse Oximetry (with Datascope SpO_2)***

Pulse Oximeter displays functional saturation.

Accuracy:	70-100%, ±2% SpO2 (1 S.D.) 60-69%, ±4% SpO2 (1 S.D.) 0-59% Unspecified
Response Time:	13 seconds to 95% of final step change of % SpO2 value from 60-95% (at 72 bpm)

- ***Pulse Oximetry (with Nellcor® SpO2)****

Saturation Accuracy:	Nellcor® determines module accuracy by comparisons with NELLCOR® N-100 and N-200 pulse oximeters, using NELLCOR® OXISENSOR™, OXIBAND®, and DURASENSOR® oxygen transducers only. For accuracy specifications when used with each of the above sensors, refer to the sensor's labeling and instructions. Accuracy, when used with the OXISENSOR™ D-25 and N-25 sensors, is as follows:

**This feature applicable only if available / installed in your unit.*

TABLE 3-1

SENSOR	PATIENT	RANGE	ACCURACY
D-25	Adult	70 to 100%	±2 digits
D-25	Adult	50 to 69%	±3 digits
D-25	Adult	0 to49%	unspecified
N-25	Neonate	70 to 95%	±3 digits
Nellcor® SpO2 Response Time			
Response Mode 1	5 to 7 seconds averaging		
Response Mode 2	2 to 3 seconds averaging		
Response Mode 3	10 to 15 seconds averaging		

- ***Plethysmograph Pulse Rate***

Display Range:	30-230 bpm Adult/Child 30-250 bpm Neonate 30-239 bpm (Masimo only) Adult/Child/Neonate
Pulse Rate Accuracy:	±3 bpm or ±3%, whichever is greater
Response Time:	12 seconds to 95% of final step change of pulse value (rate from 60-120 bpm)

- ***Temperature***

Scale:	Selectable ºC or ºF
Range:	15 ºC to 45 ºC 59 ºF to 113 ºF

Accuracy at 25 °C ambient following 90 second warmup:	±0.1°C 15 to 45 °C - (Plus Probe Error) ±0.2 °F 59 to 113 °F - (Plus Probe Error)

- ***With Masimo SpO_2****

SpO2 Accuracy - Saturation during no motion conditions:	Adult: 70 - 100 % ±2 digits SpO2 (1 S.D.)*** 0 - 69 % Unspecified Neonatal: 70 - 100 % ±3 digits
SpO_2 Accuracy - Saturation during motion conditions**:	Adult: 70 - 100 % ±3 digits SpO2 (1 S.D.) 0 - 69 % Unspecified
Drift:	None
SpO2 Response Time:	18 seconds to 95% of final step change of % SpO2 value from 60 - 95% (at 72 bpm) and with Post Average Time set to 8 seconds

* *This feature applicable only if available / installed in your unit.*

** *The Masimo option and LNOP-Adt sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions at 2 to 4 Hz at an amplitude of 1 to 2 cm and a non-repetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70 to 100 % SpO2 against a laboratory co-oximter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.*

*** *The SPO_2 accuracy during motion conditions is not specificed for the LNOP Ear Sensors. The LNOP Ear Sensors have an SPO_2 accuracy of 70% to 100% ± 3.5% for adults during no motion conditions, however since the monitor cannot display 1/2 digits, the accuracy shall be rounded to ± 4 digits.*

- ***Respiration (ECG)***

Rate Range:	4-200 bpm
Rate Accuracy:	±2 bpm or ±2%, whichever is greater
Minimum Breath Detected:	Function of Display Scale. Minimum breath height detected is 0.1 ohm

- ***Recorder***

Speed: 50, 25, 12.5, 6.25, 3.125 mm/sec ± 5%

NOTE: 6.25 and 3.125 are for Respiration only.

Chart Size: 50 mm ± 2 mm

- ***Battery Performance (Passport 5-Lead, 5L & LT)***

Run Time: (5-Lead, 5L, & LT)	2 hours from full charge of new battery at 25 °C with SpO2, 1 NIBP every 15 minutes and no recording.

Run Time:	
(XG)	2 hours from full charge of new battery at 25 °C with SpO_2, 1 NIBP every 15 minutes, no recorder, with color display only.
Cycle Service Life:	150 cycles, 100% to 20% of capacity 400 cycles, 100% to 40% of capacity
Battery Type:	Sealed Lead Acid
Number of Batteries:	2
Battery Voltage:	12 VDC
Battery Capacity:	2.3 AH each
Recharge Time:	16 hours max.
Low Battery Warning:	11.6 ± 3.5% (measured at battery term.)
Low Battery Cutoff:	11.0 ± 2.8% (measured at battery term.)

- ***Real Time Clock***

Accuracy :	± 1 minute / week
Display Format :	24 hours
Battery Life:	4 year minimum
Power Requirements:	The RTC keeps time whether the rest of the system has power or not. A dedicated battery provides stand by power for the clock circuit.

** *For Sidestream Intubated configurations, the in-line disc filter must be removed for breath rates above 18 bpm. The increased dead space could compromise the accuracy specification.*

- ***CO2 - Mainstream (all units except for 0998-00-0134-XX and 0998-00-0137-XX)***

Range:	0 - 76 TORR
Accuracy:	±4 TORR (0 - 40 TORR) 10% of actual (41 - 76 TORR)
Respiration Rate Range:	1-150 bpm (mainstream)
Respiration Rate Accuracy:	±1 bpm
CO2 waveform recognition:	1 minute for waveform only
Time to meet full specs:	20 minutes to meet specification
Sensor warmup time:	Less than 15 minutes
Barometric Pressure Error:	±2 Torr max additional, 564 to 760 mmHg
Reference Cell Reading:	36 to 40 TORR
Sensor on Zero Cell:	0 ± 1 TORR
Zero Calibration:	Less than 30 seconds
Adapter Calibration:	Less than 30 seconds

- ***CO2 - Mainstream and Sidestream (0998-00-0134-XX, 0998-00-0137-XX units only)***

Range:	0-100 TORR, CO_2 partial pressure
Mainstream / Sidestream (Non-Intubated) Accuracy:	±2 TORR (0-40 TORR) ±5% (41-70 TORR) ±8% (71-100 TORR)
Sidestream (Intubated) Accuracy*:	±5 Torr (0 - 40 Torr) ±13% (41 - 100 Torr)
Respiration Rate Range:	1-150 bpm (mainstream) 1-50 bpm (sidestream**)
Respiration Rate Accuracy:	±1 bpm
CO_2 waveform recognition	15 seconds for waveform
Time to meet full specs:	1 minute to meet spec
Sensor warmup time:	Less than 5 minutes
Barometric Pressure Error:	±2 Torr max additional, 564 to 760 mmHg

* *Test conditions as follows:*
8 to 18 bpm with 1000cc tidal volume with max PEEP of 15cm-H2O
18 to 30 bpm with 400cc tidal volume with max PEEP of 15cm-H2O
30 to 50 bpm with 70cc tidal volume with max PEEP of 5cm-H2O

Sidestream Flow Rate:	180 ±20 cc/minute:
Reference Cell Reading:	36 to 40 TORR
Sensor on Zero Cell:	0 ±1 TORR
Zero Calibration:	Less than 30 seconds
Adapter Calibration:	Less than 30 seconds
Pump Calibration:	Less than 30 seconds

3.2 Power Pack Electrical Ratings

An AC to DC power pack provides all power requirements for the monitor. The unit must operate normally from the power pack while charging two discharged batteries.

Voltage Input:	100-240 (± 10%)
Mains Frequency:	50-60 Hz (± 3Hz)
Power Consumption:	2.0 - 0.8A

3.3 Environmental Conditions

Storage:

Temperature	-20 °C to +60 °C
Humidity	5 to 95%, non-condensing
Operating Altitude:	Sea level to 8,000 feet.
Operating Temperature:	10 °C to 35 °C
Operating Humidity:	5 to 90%, non-condensing

3.4 Physical Characteristics

Size:	9.5" height x 13" width x 8" long max
Weight:	13lbs max without batteries 15.2lbs max without batteries (Passport XG only) 16lbs max without batteries (Passport XG-CE only)

3.5 Agency Compliance

The Passport 5L and XG are designed to comply with the following industry standards:

CSA C22-2 No. 125-M 1984	IEC 601-2-30: 1995
UL 544, Third Edition	IEC 601-2-34: 1994
IEC 601-1: 1988/EN60601-1:1990	ISO 9919: 1992
IEC 601-2-27: 1994	ISO 9918: 1993

The Passport 5L-CE and XG-CE are designed to comply with the following industry standards:

CSA C22-2 No. 125-M 1984	IEC 601-2-30: 1995
UL 544, Third Edition	IEC 601-2-34: 1994
IEC 601-1: 1988/EN60601-1:1990	ISO 9919: 1992
IEC 601-2-27: 1994	ISO 9918: 1993
	EN60601-1-2: 1995

The Passport 5L, 5L-CE and XG, XG-CE are registered with the following agencies:

UL-USA

CSA-Canada

The Passport 5L-CE and XG-CE comply with the requirements of the medical device directive 93/42/EEC.

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4.0 Repair Information

Contents of this Chapter ....Page

4.1 Introduction

This chapter of the Service Manual provides the necessary technical information to perform repairs to the instrument. The most important prerequisites for effective troubleshooting are a thorough understanding of the instrument functions, as well as an understanding of the theory of operation. Therefore, if necessary, refer to the Operating Instructions (P/N 0070-00-0324 for 5L units or P/N 0070-00-0397 for XG units) which describes the instrument functions and features, and refer to Chapter 2 of this manual which provides a theory of operation.

4.2 Safety Precautions

In the event that the instrument covers are removed, observe the following warnings and general guidelines.

A. Do not short component leads together.

B. The troubleshooting charts are not intended as a rapid course on how to repair devices of this type. Rather, they are intended as a guide for qualified technical personnel only. The instrument covers must not be removed by other than technically qualified personnel who have received supplementary instructions regarding maintenance of medical electronic equipment or have has equivalent experience in this area.

4.3 Troubleshooting Guidelines

In an instrument as complex as this, it is virtually impossible to list each and every potential problem and appropriate action. Any given problem, however, can be effectively identified through an understanding of the instrument features and the theory of operation. These are prerequisites for repair. If necessary, read the Operating Instructions Manual and study the theory of operation presented in Chapter 2.0 of this manual. The time spent reading and absorbing this information is generally realized by a reduction in repair time and, ultimately, in the overall experience of service personnel.

NOTE: ***The numbers in parentheses () refer to the isometric drawings.***

General Troubleshooting Guidelines

1. ***Identify The Problem***. Due to the wide ranges of potential symptoms, certain problems may be more subtle than others. One approach to trouble-shooting is to set-up the instrument for testing as described in Chapter 7 and attempt testing. If successful, there is a reasonable assurance that there is no problem. By contrast, the fact that a particular test is not successful is generally indicative of a failure in that specific area.

   The cause of the symptom can now be further isolated by referring to Chapter 2. Section 2-5 contains a listing of specific circuits or areas in the instrument, each of which is dedicated to provide a specific function. Once the operation of that circuit is understood, trouble-shooting can be completed by making measurements in that circuit to determine which component(s) is at fault.
2. ***Avoid Shorting Component Leads***. During repair procedures, it can become tempting to make a series of quick measurements. Always turn off the power before connecting and disconnecting test leads and probes. The accidental shorting of component leads can easily over stress components, resulting in a second unnecessary failure (aside from creating a possible safety risk).
3. ***Use The Proper Equipment***. This equipment listed in “Equipment and Special Tools Required” on page 4-3 is suggested to fulfill a wide range of troubleshooting requirements. Use a soldering iron the appropriate wattage for a given job. For example, use a pencil-type iron (25 watts max.) for repairs to printed wiring boards and a pistol-grip (75 watts) for repairs requiring this much power. Do not use the high powered iron to repair the printed wiring boards as the conductors will lift from the board under the extreme heat, thus ruining it.
4. ***Clean The Repair Area***. After soldering operations, clean off the repaired area with alcohol and a stiff hair brush. This will remove residual solder flux, making the repaired area more visible for inspection and returning the instrument to its original, neat appearance. Removal of the flux will also facilitate making electrical measurements in the affected area.

Exchange Program

Datascope offers an exchange program for certain assemblies in the instrument. In many cases, replacement of the complete assembly will result in the most expedient repairs. See “Exchange Program” on page 6-2 for details concerning the exchange program.

4.4 Equipment and Special Tools Required

Description	***Specification***
DVM	
Standard Mercury Column	0-300 mmHg
Test Chamber (Dummy Cuff)	0138-00-0001-01
Safety Analyzer	Dempsey Model or equivalent
Finger Sensor Probe	ACCUSAT Compatible
Oscilloscope	
Metric Ruler	
Patient Simulator	
Flow meter / Siera Instruments	

(Model 822-13-001-001-01) or equivalent 0-300 cc/min.

4.5 Disassembly Instructions

Before disassembling the unit, perform the following:

1. Power down the Passport and remove the DC power cable.
2. Remove all cables from the left and right side panels.
3. Remove any batteries that are installed.
4. Perform work on anti-static mat.

NOTE: ***The numbers in parentheses () refer to the isometric drawings.***

A. Removal of the Front Housing (3)

1. Place the Passport with the display down, on a protective surface.

NOTE: ***Special care should be taken to insure that the front panel and glare screen are not scratched.***

2. Remove the eight screws (31) from the back housing (30).
3. Turn the Passport over, and slowly lift the front housing up and forward.
4. Disconnect the 40 pin ribbon cable (10), J71 from the Panel Board (16) mounted in the front housing.

B. Removal of the 5L and LT Planar E.L. Assembly (121)

NOTE: ***The E.L. assembly consists of the E.L. display (121) and The E.L. Power Supply Board (121).***

1. Place the front housing, with the E.L. display down on a protective surface.

2. Remove the four screws at the corner of the E.L. display.
3. Remove EMC shield (120) from the Front Panel EL Display.
4. Disconnect the 26 pin ribbon cable J1, from the display.
5. Lift the E.L. assembly up and out of the front housing.
6. Remove the four screws at the corners of the E.L. Power Supply Board (121). (This board is mounted on the E.L. Planner Board and is not supplied with the Panel Board.)
7. Disconnect the 16 pin ribbon cable, J74, from the Panel Board and remove the power supply.

C. Removal of the XG Planar E.L. Assembly (131)

1. Place the front housing, with the E.L. display down on a protective surface.
2. Remove the four screws (138) at the corner of the XG screen bracket.
3. Lift the shield (128) and disconnect the 20 pin ribbon cable from the E.L. display, the keypad connector J72 from the Panel board (16), and remove the keypad ground screw (139) from the Panel board. Remove the shield from the front panel assembly.
4. Remove the four screws (141) at the corners of the E.L. display (131) and lift the E.L. display out if of the front panel assembly.

D. Removal of Panel Board (16)

1. Remove the six screws (39) securing the Panel Board.
2. Disconnect the keypad cable, J72, from the Panel Board.
3. Lift the Panel Board up and out of the front housing.

E. Removal of the 5L and LT Planar E.L. Panel Board

1. Remove the four screws (39) securing the Panel Board.
2. Disconnect the keypad cable, J72, from the Panel Board and lift the Panel Board out of the front housing.

F. Removal of the XG Planar E.L. Panel Board (16)

1. Remove the six remaining screws (139) that are securing the Panel Board.
2. Disconnect the speaker connector, J75, from the Panel Board.
3. Lift the Panel Board up and out of the front housing.

G. Removal of the Passport XG LCD Color Display

1. Place the front housing with the LCD color display down on a protective surface.

2. Unfasten the four captive screws at the corners of the shield (128).
3. Lift the shield (128) from the front housing assembly. Disconnect the cable connectors J77 and J78 from the Panel board (16). Remove the keypad ground screw (39) from the panel board. Disconnect the cable assembly J72 connector from the Panel board and place the Panel board assembly aside.
4. Remove the four screws (138) that secure the left (145) and right (146) brass brackets to the front panel assembly. Remove the assembly from the casing.
5. Disconnect the cable assembly from the High Voltage Power Supply (153)mounted to the front housing. remove the four screws (39) from the four corners of the LCD Color Display assembly (131). Lift the LCD Color Display (131) and remove.

H. Removal of the Keypad (32)

NOTE: ***The keypad is not reusable. Discard keypad once it is removed.***

1. Remove the Panel Board (16).
2. Using a blunt instrument (comparable to a electricians knife) lift the corners of the keypad.
3. Carefully peel the keypad back from both sides towards the cable which protrudes through the front housing.
4. When the keypad is completely loosened, pull cable and ground strap through the front housing to remove.

I. Installing a New Keypad (41)

The keypad consists of two parts, the membrane switch keypad (41) and the printed graphic overlay (1).

1. Remove the protective coating from the back of the keypad (do not remove protective cover from the front side of the keypad).
2. Insert P72 and the ground strap through the cutout in the front housing (3) and stick the keypad in place.
3. Remove the protective coating from the front of the keypad.
4. Place the correct overlay onto the keypad being careful to align printed graphics to the membrane switches.

NOTE: ***The overlay is option dependent.***

J. Removal / Installation of the Glare Screen (2)

1. Remove the LCD/EL assembly.
2. Peel back the four corners of the glare screen to remove.
3. Install a new glare screen by removing the protective coating from the adhesive tape already mounted on the glare screen and press in place inside the front housing.
   Removal of the Board Sub-Assembly (A)

NOTE: The sub-assembly includes the following boards:

- Passport Control Module (PCM) (52)
- Datasette (51)
- Front End Board
- SpO2 Board
- Interconnection Board (7)
- CO2 Control Board (98)
- CO2 Interface Board (94)

1. Remove the two screws which secure the sub-assembly to the rear housing (30).

2. Disconnect P62, 63, 64, 65, and 67 from the PCM Board (52) and the ground wire from the board frame.

NOTE: P63 has side locking tabs. To remove, apply pressure from the side of the plug while pulling towards the top of the Passport. J65 has side locking tabs. To remove, push the locking tabs to the side, then pull plug toward the rear of the Passport. When reinstalling P65, insure locking tabs are in the locked position. P63 is self locking.

3. Remove the Datasette door (77) and remove the Datasette (51).

4. Lift the sub-assembly up far enough to disconnect the NIBP hose and P93 from the CO2 Interface Board. Lift the sub-assembly up and out of the rear housing. The right side panel (69) stays with the rear housing and the left side panel (19) comes out with the sub-assembly.

a. Removal of the CO2 Control Board (98)

1. Disconnect P201 and P204 from the CO2 Board.

2. Remove the four screws at the corners of the CO2 Board.

3. Remove board.

b. Removal of the CO2 Interface Board (94)

1. Disconnect P91 and P92 from the CO2 Interface Board.

2. Remove the four screws securing the Interface Board.

3. Remove the Interface Board.

c. Removal of the Passport Control Module

1. Remove the four screws on the corners of the PCM Board and lift the board from the sub-assembly.

d. Removal of the Datascope SpO2 Board

1. Remove the four screws at the corner of the shield (99).

2. Disconnect P21 and P23.

3. Remove the four screws at the corner of the SpO2 Board and lift the board from the sub-assembly.

NOTE: For removal of the Interconnection Board and Front End Board, note the position of any mylar shields for proper placement during reassembly.

e. Removal of the SpO2 Daughter Board

1. Disconnect the cables from P1 and P2 connectors.

2. Remove the four screws at the corner of the SpO2 Daughter Board and lift the board from the shield.

f. Removal of the Nellcor SpO2 Board

1. Remove the four screws at the corner of the shield (99).

2. Disconnect JP1 (5) and P21 (38).

3. Remove the four screws at the corner of the SpO2 Interface Board and lift the board from the sub-assembly.

4. Remove the three screws from the Nellcor Board (106) and lift it from the assembly.

g. Removal of the SpO2 Interface bd. and Masimo MS-1 or Nellcor module.

1. Disconnect P94 from the CO2 control bd. and P606 from the CO2 input connector.

2. Remove the four screws that secure the CO2 mounting plate. Remove the mounting plate with CO2 module and shield.

3. To remove the Interface bd. disconnect P21, P23, and P25,and remove the four hex standoffs that secure the Interface bd. and lift it from the assembly.

4. To remove the MS1 or Nellcor module disconnect cables form module and remove four screws that secure module and lift it from the assembly.

h. Removal of the Interconnection Board (7)

1. Disconnect P23 (5) from the SpO2 Board and P1 from the Interconnection Board.

2. Remove the two screws securing ground straps to the board frame (26).

3. Disconnect NIBP hose (61) from the left side panel (19).

4. Remove the left side panel from the board sub-assembly.

WARNING: ***Extreme caution should be used when handling the flexible Interconnection Board. Do not try to bend or straighten components on this board, damage may occur to the flexible circuit board!***

5. Release the two board standoffs.

WARNING: ***In the next step, do not straighten the Interconnection Board! Use screw access holes located on the Interconnection Board.***

6. Remove the six screws holding the IBP and ECG connectors and the one nut securing the temperature connector. Remove board from the left side panel.

i. Removal of the Front End Board

1. Remove the four screws securing the Front End cover (42) to the board frame (48).

2. Remove the four screws (26) at the corners of the Front End Board.

NOTE: ***When installing the Front End and Interconnection Boards, make sure all mylar shields are reinstalled.***

j. Removal of the Front End Daughter Board

1. Remove the four screws (39) securing the Front End cover (42) to the board frame.
2. Remove the cable from the Interconnect Board at P3, lift board upward and remove.

A. Removal of the Power Supply, Line Battery and +12/-23 Volt Boards (75&76)

1. Remove the board sub-assembly.
2. Disconnect P51 (35) and P53 (32) from the Line Battery Board (76).
3. Lift both the line battery and the +12/-23 Volt Board out of the rear housing. The two boards can be pulled apart by disconnecting J54/P58.
4. When reinstalling the Power Supply Boards check the following
   - The two boards are placed in the rear housing card guides.
   - The foam block, that holds the top of the power supply, located on the board frame, is in place.

A. Removal of the NIBP Module (B)

1. Remove the board sub-assembly (A).
2. Remove, the four snap rivets (57) holding the NIBP module (25) to the module brackets (18 & 19).
3. Slide the module towards the top of the Passport and lift to remove.
   a. Removal of the Control Board (51) from the NIBP Module
      1. Use a small flat blade screwdriver to lift the center pin of the four snap rivets.
      2. Lift the Control Board up and remove P31 (61) and the transducer hose from the transducer.
   b. Removal of the Pump Assembly (60) from the NIBP Module
      1. Remove the Control Board.
      2. Disconnect P29 from the Pneumatic Board.
      3. Disconnect the hose from the pumps pressure port.
      4. Turn module over and punch out pump assembly by tapping pump mounting plate. Do not force screwdriver between the black velcro.This will damage the velcro and reduce holder strength.
   c. Removal of the Pneumatic Board (65) from the NIBP Module
      1. Remove the Control Board.
      2. Remove one screw (39) located near J34.
      3. Slide and lift the Pneumatic Board from the chassis.

B. Removal of the Battery Can Assembly (35)

1. Remove the board sub-assembly.
2. Remove the three screws (88) holding the battery assembly to the rear housing.
3. Disconnect P51 from the line battery board (76).
4. Lift the battery can from the rear housing.

C. Removal of the Recorder Assembly (23)

1. Open the recorder paper door and remove paper roll, if installed.

2. Locate the two screws behind the recorder door (towards the back).

3. Loosen the two screws and slide the recorder out of the rear housing.

4. Disconnect the ribbon cable (33) from the recorder and remove recorder.

D. Removal / Installation of the Sidestream CO_2 Pump Assembly (162)

1. Remove the board sub-assembly.

2. Disconnect the pump cable connector from J103 of the CO_2 Module (98).

3. Disconnect the tubing (155) from the input and output ports of the pump. Unfasten the two shock mount brass screws (163) from the left NIBP bracket (28). Remove the pump (162) and bracket assembly (165) from casing. Remove the two pan head screws (139) from the pump bracket assembly. Attach the new pump to the pump bracket with the two pan head screws.

4. Place the pump assembly and bracket onto the NIBP bracket. secure the pump assembly with the two shock mount brass screws. Connect the hose from the filter housing assembly to the input port of the pump. Connect the hose that attaches the scavenging system to the output port of the pump.

5. Connect the pump connector to J103 of the CO2 module (98).

E. Removal / Installation of the Passport XG Color LCD Backlight Tube

WARNING: The following precautions should be observed before replacing the backlight:

1. Replacement of the backlight involves the handling of High Voltage circuits. If replacement was done incorrectly, the display could present a shock, fire, or other hazard, both during and after the replacement procedure. Make certain that the Passport is turned OFF, the external power supply is disconnected, and all batteries have been removed. Also, since the High Voltage power supply can hold a charge, be sure to wait some time after switching the power OFF before starting any work.

2. Since the backlight tube and the High Voltage power supply can be HOT after use, there is a danger of injury by burning. Therefore, be sure to wait some time after switching the power OFF before starting any work.

3. The fluorescent lamp of the backlight is glass and may in some cases be damaged. Take adequate care not to injure yourself while doing this procedure. Moreover, if the lamp is damaged inside, apart from safety considerations, quality problems may occur, such as uneven brightness from pieces of broken glass left inside the display. In this case we recommend that you return the unit to Datascope for repair.

4. Since the backlight uses a cold cathode fluorescent lamp, dispose of it in accordance with the regulations in effect in your area.

5. Since the display can be easily damaged, take care not to scratch, mar, chip, etc., the front surface.

6. Static electricity (ESD) can damage the display. When handling the display take adequate precautions to eliminate static electricity (grounded wrist strap, ionized air blower, conductive mat on work surface, etc.).

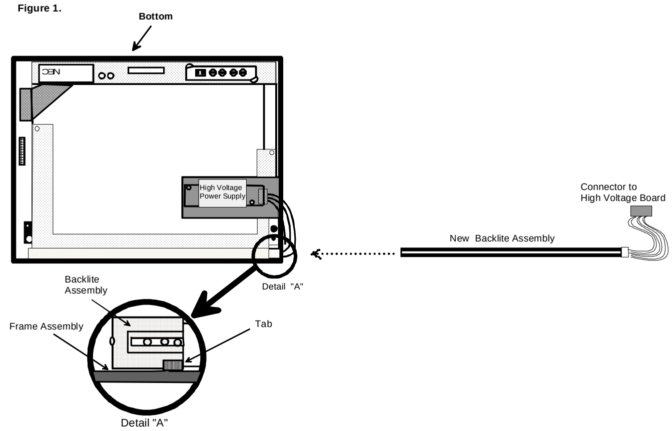
7. Do NOT touch the reflective surfaces inside the backlight holder, or the fluorescent lamp, or any connector contacts with your bare hands. Oil and other contaminants on your hands can damage these surfaces and contacts.

8. To prevent the optical surfaces from attracting dust, dirt, and scratches, we recommend that the backlight replacement be performed in a dust free environment.

9. Customers replacing the backlight do so at their own risk. Datascope will not assume any liability, and will not warrant any displays which have been modified by the customer, including replacement of the backlight, even when the following procedure is used and all of the necessary precautions have been taken. Replacing the backlight can cause a lowering of the quality (performance). Even if the replacement work is performed in accordance with the following procedure, Datascope can not guarantee the resulting quality.

1. Perform the steps outlined in “Removal of the Passport XG LCD Color Display” on page 4-4.
2. Taking care not to scratch the front of the display, place it face down on the flat static free work surface.
3. Looking at the back of the display, locate the metal backlight holder by following the high voltage wires to the side of the backlight tube.
4. Using round tipped tweezers, or an equivalent tool, release the backlight holder by carefully pressing down on the small plastic tab that latches it in place. See Figure 1, Detail “A” Side View.
5. Slowly, gently, and in a straight line pull the backlight and holder out of the side of the display. If the fluorescent lamp was broken inside the display, carefully pull out the backlight. If pieces of the glass remain inside the display, carefully remove them.
6. Once the old backlight and holder have been removed, slowly, gently, and in a straight line push in the new backlight (P/N 0149-00-0009) until the small plastic tab latches it in place.
7. Reassembly of the display into the Passport is the reverse of the disassembly.

Figure 1.



4.6 Mounting Instructions

4.6.1 Rolling Stand Assembly Instructions

(See Figure 4-1)

1. Press the steel column firmly into the base.
2. Lock the column into the base by screwing supplied bolt through the supplied lock washer, large flat washer, and base into bottom of column.
3. Remove the column screw from the top of the column. Insert the swivel head on top of the column and replace the column screw.
4. Use clamp to secure basket to rolling stand column.

4.6.2 Bedrail Hook Mount

(See Figure 4-2)

1. Secure the hook mount (P/N 0436-00-0062) to the rear of the Passport using four #8-32 x .38 flat head screws (P/N 0212-14-806).
2. Place the Passport over any bedrail with a diameter of less than 1.25".

4.6.3 Bed Mount

(See Figure 4-3)

1. Secure the mounting plate (P/N 0386-00-0156) to the rear of the Passport using four #8-32 x .38 flat head screws (P/N 0212-14-0806).
2. Place the two lower clamps (P/N 0343-00-0064) into the slots at the bottom of the bed mount (P/N 0997-00-0297) and secure using the two knobs (P/N 0366-00-0080).
3. Place bed mount over lower bedrail and secure in place by positioning the lower clamps against bedrail and tightening the two knobs.

4.6.4 Passport Mounting - Rolling Stand/Wall Mount

(See Figure 4-4)

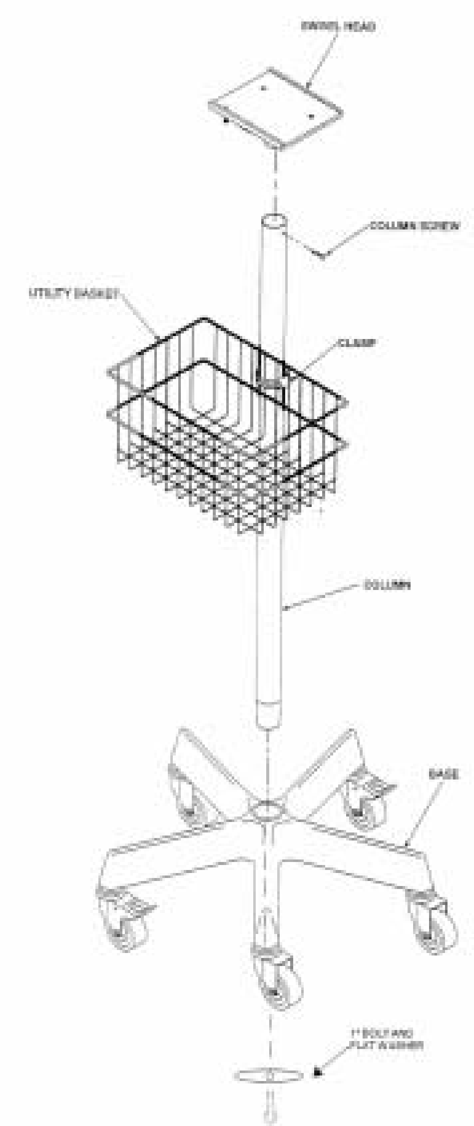
1. Secure the mounting plate (P/N 0386-00-0156) to the rear of the Passport using four #8-32 x .38 flat head screws (P/N 0212-14-0806).
2. While pulling down on the spring lock, slide the holding bracket into the swivel head of the rolling stand or the wall mount.
3. Place the Passport into the slots in front holding bracket.

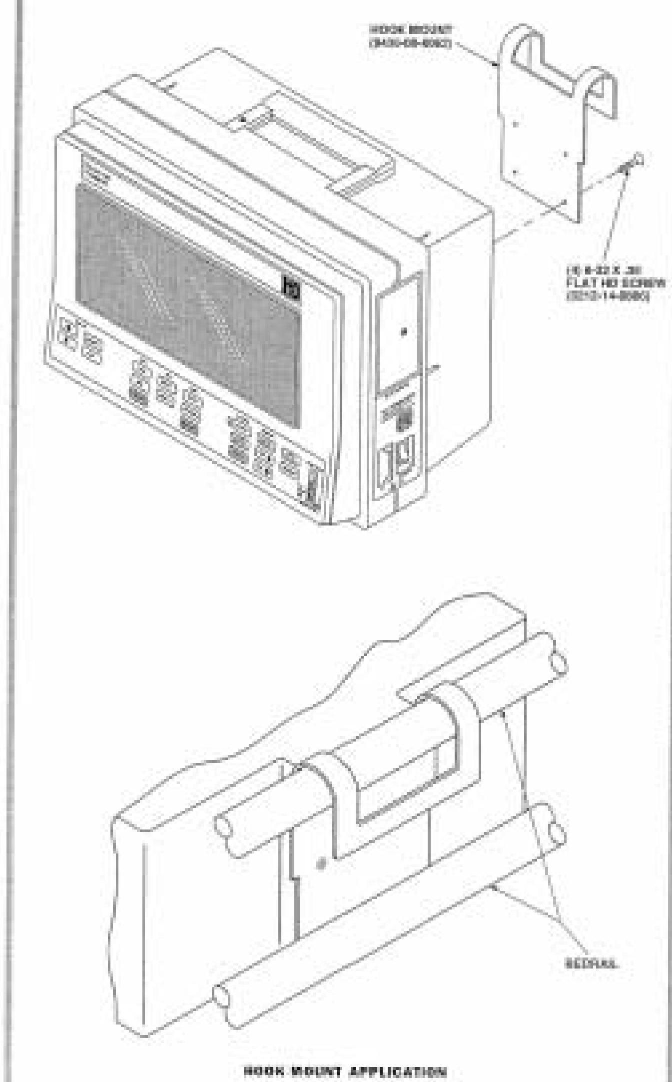
4.6.5 Power Supply Mounting

(See Figure 4-5)

1. Secure the Mounting Plate (P/N 0386-00-0156) to the power supply bracket (P/N 0406-00-0544) using the four #8-32 x .38 flat head screws (P/N 0212-14-0806).

2. Insert the line cord into the cable clamp (P/N 0343-00-0101-06). Close the cable clamp, then position it between the mounting tab on the power supply and the power supply bracket (P/N 0406-00-0544).
3. Secure the power supply and the cable clamp (P/N 0343-00-0101-06), with the line cord, to the power supply bracket (P/N 0406-00-0544) using the two #6-32 x .5 pan head screws (P/N 0212-12-0608). Ensure that when the cable clamp is secured to the power supply bracket the line cord can be put into a service loop approximately 2 inches (5 cm) in diameter.
4. Place the power supply into the slots in the back of the holding bracket.





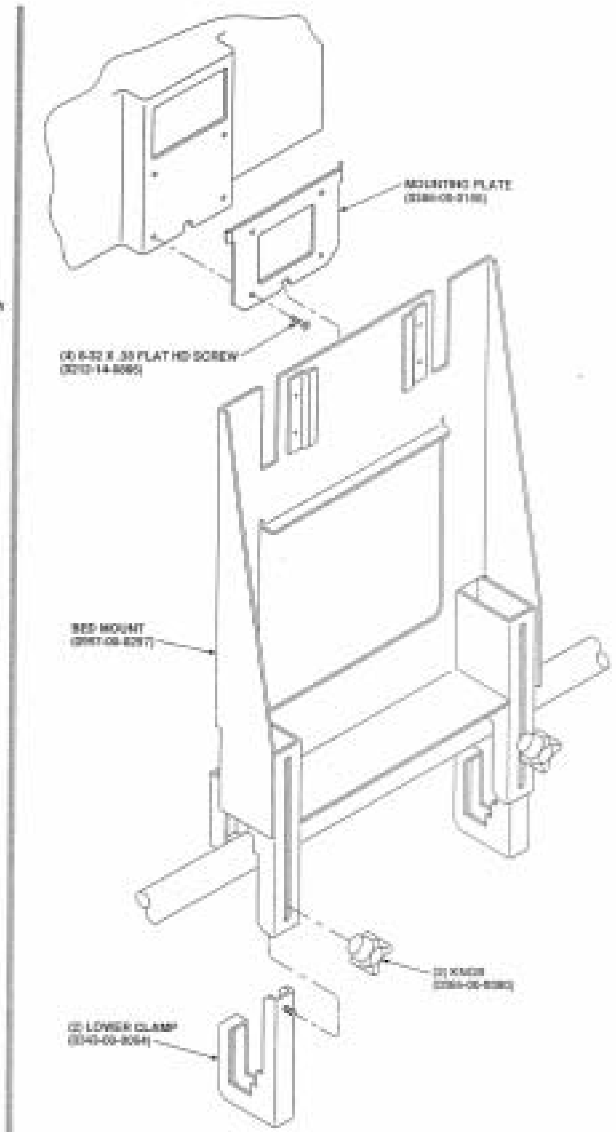


FIGURE 4-1 Rolling Stand
0040-00-0121-02

FIGURE 4-2 Bedrail Hook Mount

FIGURE 4-3 Bed Mount
0040-00-0121-04

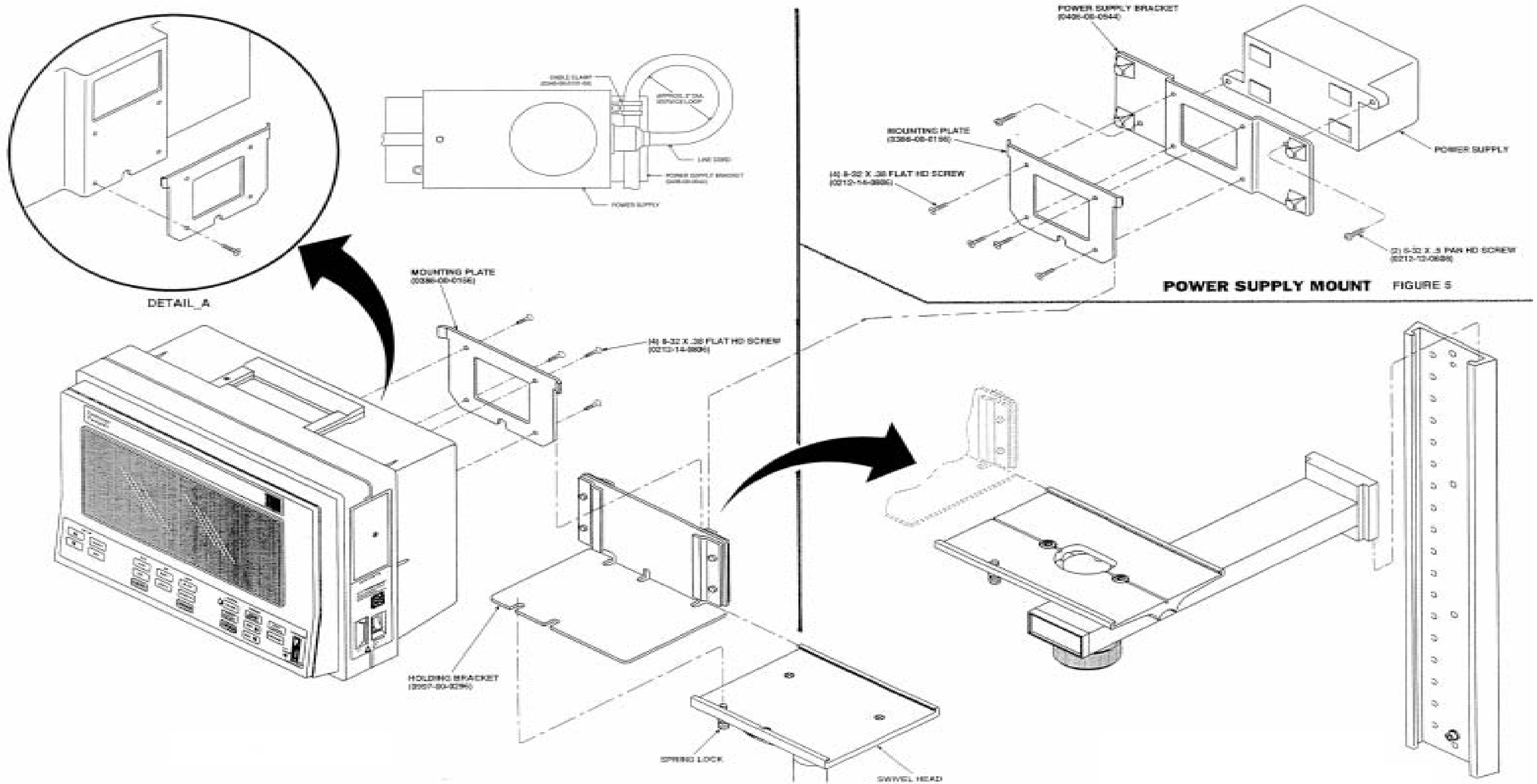


FIGURE 4-4 Passport Mounting

FIGURE 4-5 Wall Mount

4.7 How to Use the Remote Color Display Mounting Kit

(P/N 0020-00-0419)

1. Assemble and mount the Wall Mounting Kit (P/N 0020-00-0420).
2. Remove the swivel base plate on the Remote Color Display (retain these 2 screws).
3. Place the Remote Color Display (RCD) onto the two CRT Mounting Brackets. (These brackets are attached to the CRT Mounting Plate.
4. Attach the CRT Mounting Plate (P/N 0386-00-0220) using the 2 screws that were removed in step 2.
5. Attach the Arm Mounting Plate (P/N 0406-00-0631) to the bottom of the CRT Mounting Plate using the 4 screws (P/N 0212-00-0806).
6. Slide the assemble RCD with Mounting Kit onto the Arm Plate of the Wall Mount. Ensure that the monitor has clicked into place.

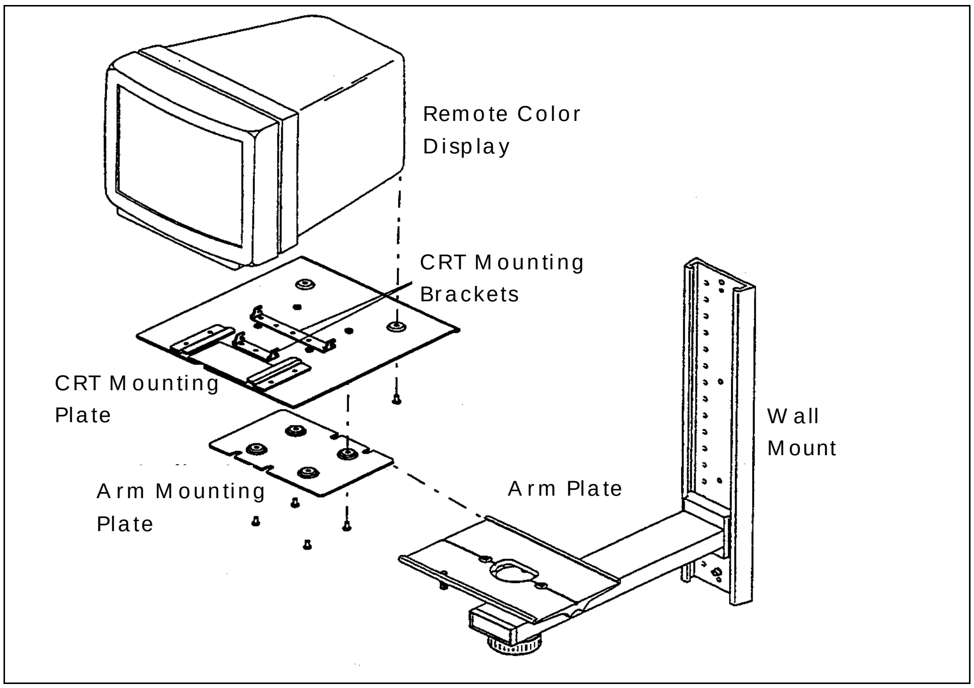
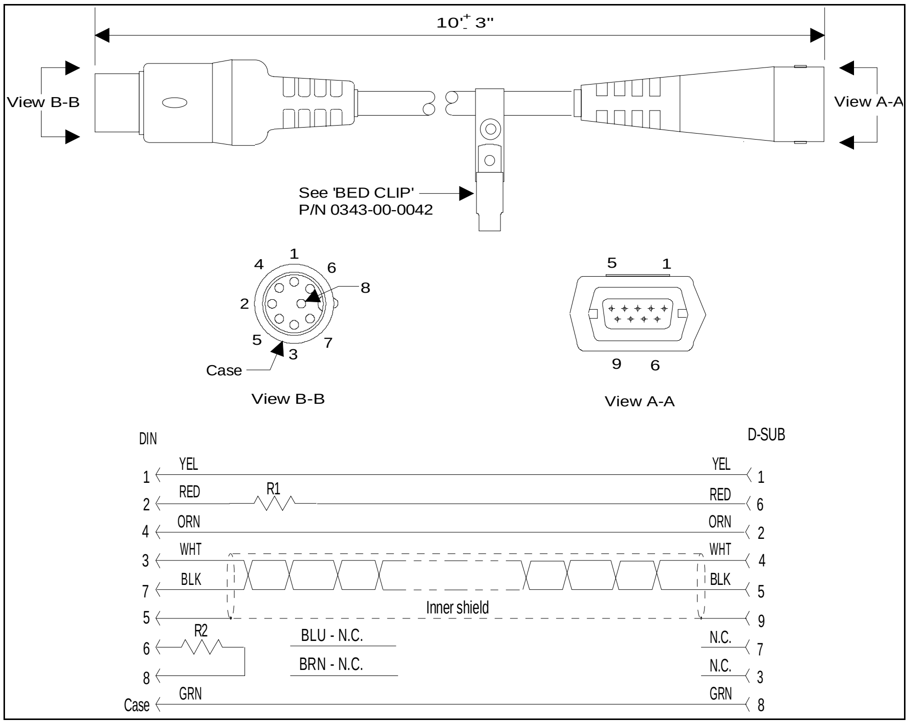


FIGURE 4-6 Remote Monitor with Wall Mount

4.8 Cable Assembly Details

SpO_2 Instrument Cable - 0012-00-0516-XX (A)



PART NUMBER	DESCRIPTION
0012-00-0516-01	Normal duty outer jacket
0012-00-0516-02	Heavy duty outer jacket

Resistor

R1:; 22.1 Ω 1 %, type RN55D. Refer to Datascope P/N: 0309-00-22X1.

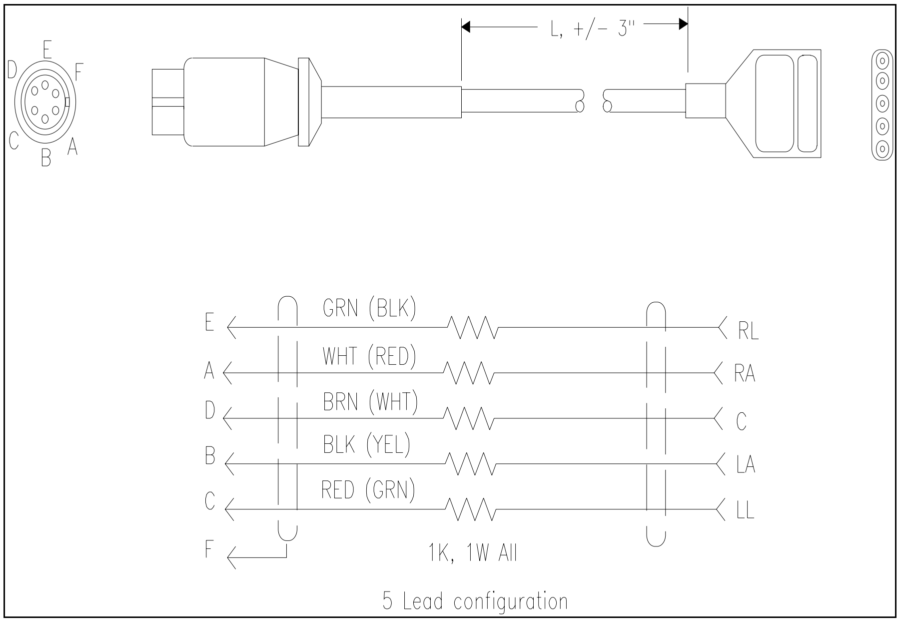
Resistor shall be located inside DIN plug and connected in series with Pin 2 and the RED wire. The splice between the red wire and resistor shall be mechanically secure and suitably insulated.

R2: 47.5 Ω 1%, type RN55D. Reference Datascope P/N: 0309-00-4752.

Resistor shall be located inside DIN plug and connected between Pin 6 and Pin 8. Resistor shall be mechanically secure and suitably insulated.

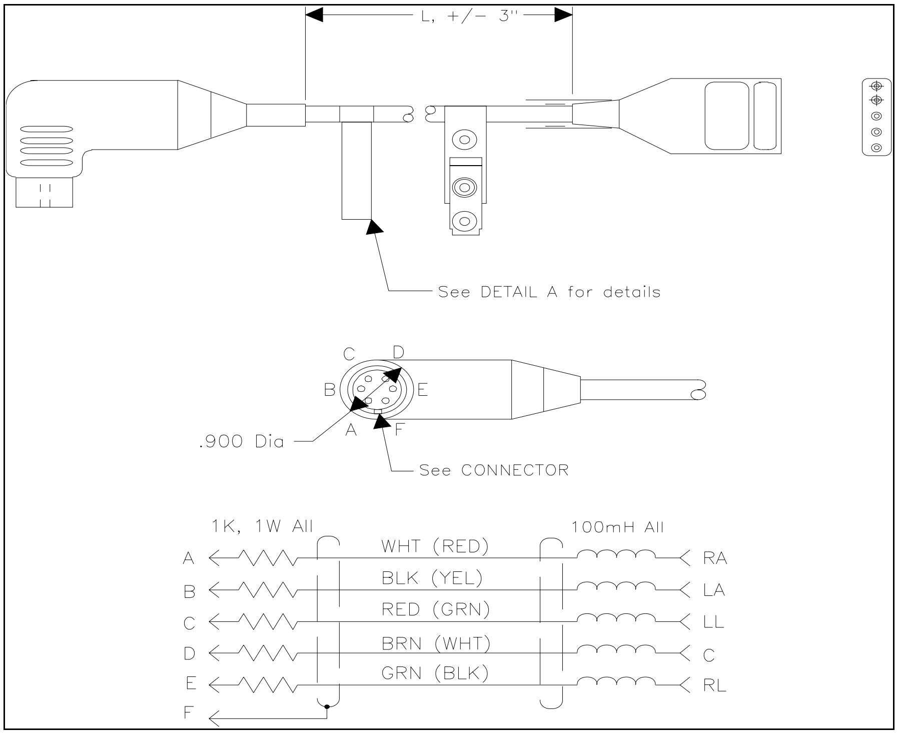
Bed Clip: Each cable assembly shall include a bed clip, Datascope P/N: 0343-00-0042.

Cable, ECG Patient With Internal Resistors - 0012-00-0620-XX (A)



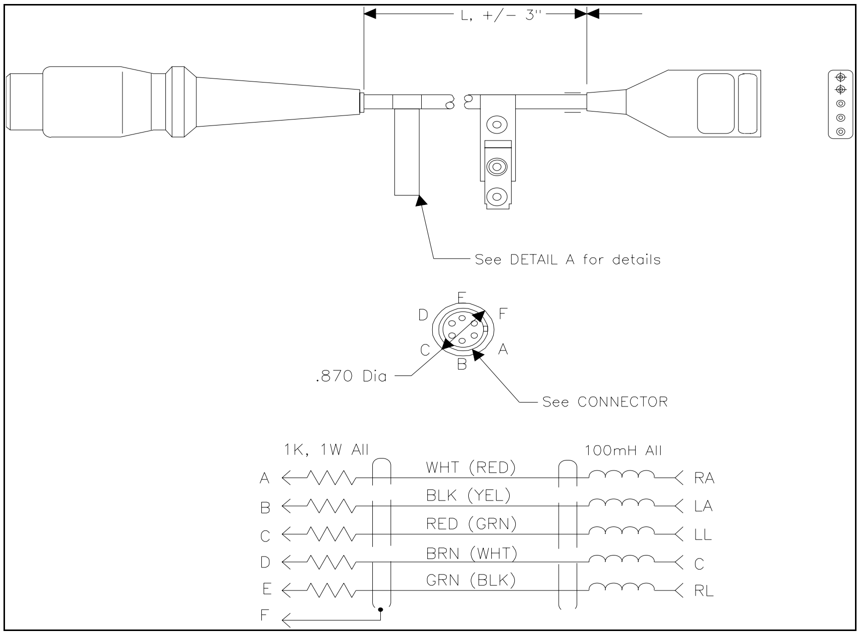
PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0620-01	5 Wire, 10 Foot, USA (AHA)
0012-00-0620-02	5 Wire, 20 Foot, USA (AHA)
0012-00-0620-03	5 Wire, 10 Foot, International (IEC)
0012-00-0620-04	5 Wire, 20 Foot, International (IEC)

Right Angle Safety ECG Patient With Choke Block-0012-00-0722-XX



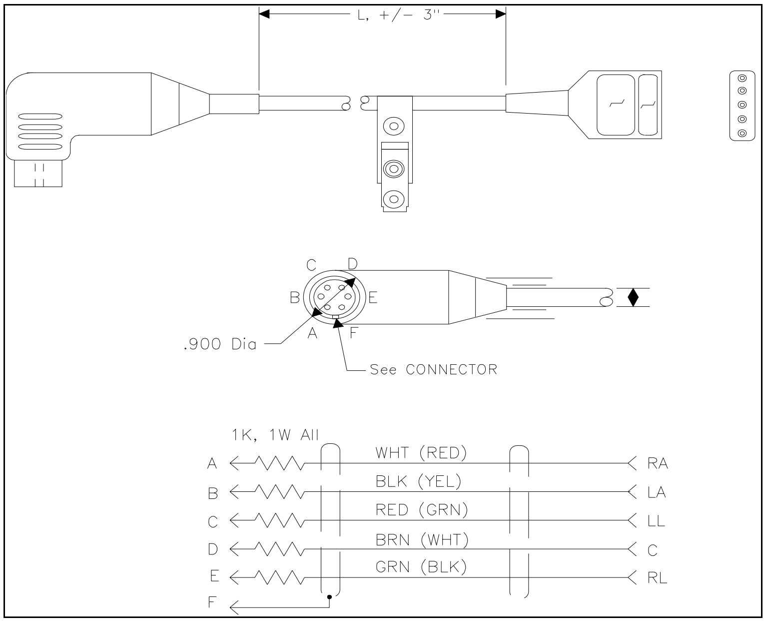
PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0722-01	5 Wire, 10 Foot, USA (AHA)
0012-00-0722-02	5 Wire, 20 Foot, USA (AHA)
0012-00-0722-03	5 Wire, 10 Foot, International (IEC)
0012-00-0722-04	5 Wire, 20 Foot, International (IEC)

Cable, ECG Patient with Choke Block - 0012-00-0723-XX (A)

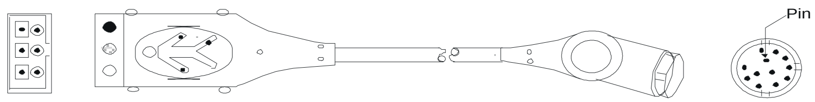


PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0723-01	5 Wire, 10 Foot, USA (AHA)
0012-00-0723-02	5 Wire, 20 Foot, USA (AHA)
0012-00-0723-03	5 Wire, 10 Foot, International (IEC)
0012-00-0723-04	5 Wire, 20 Foot, International (IEC)

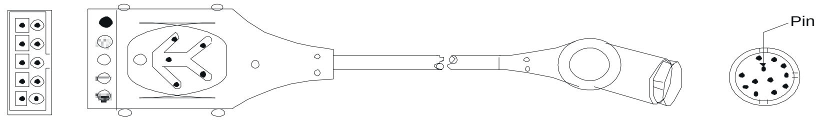
Right Angle Safety ECG Patient with Choke Block-0012-00-0724-XX



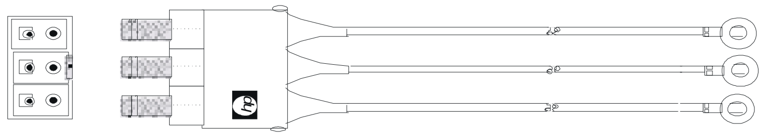
PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0724-01	5 Wire, 10 Foot, USA (AHA)
0012-00-0724-02	5 Wire, 20 Foot, USA (AHA)
0012-00-0724-03	5 Wire, 10 Foot, International (IEC)
0012-00-0724-04	5 Wire, 20 Foot, International (IEC)



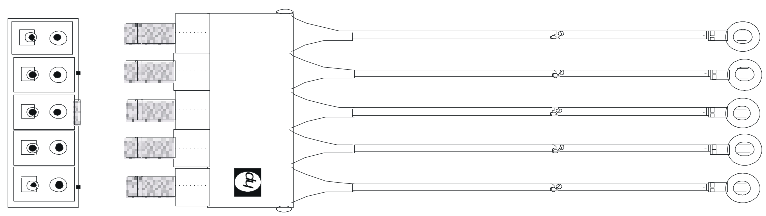
ECG Cable Assembly HP 3 Lead - 0012-00-0846



ECG Cable Assembly HP 5 Lead - 0012-00-1002-01

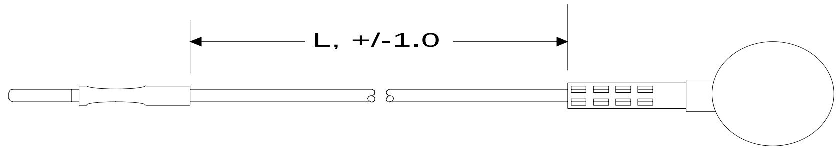


3 Lead HP ECG Lead Wired - 0012-00-0847



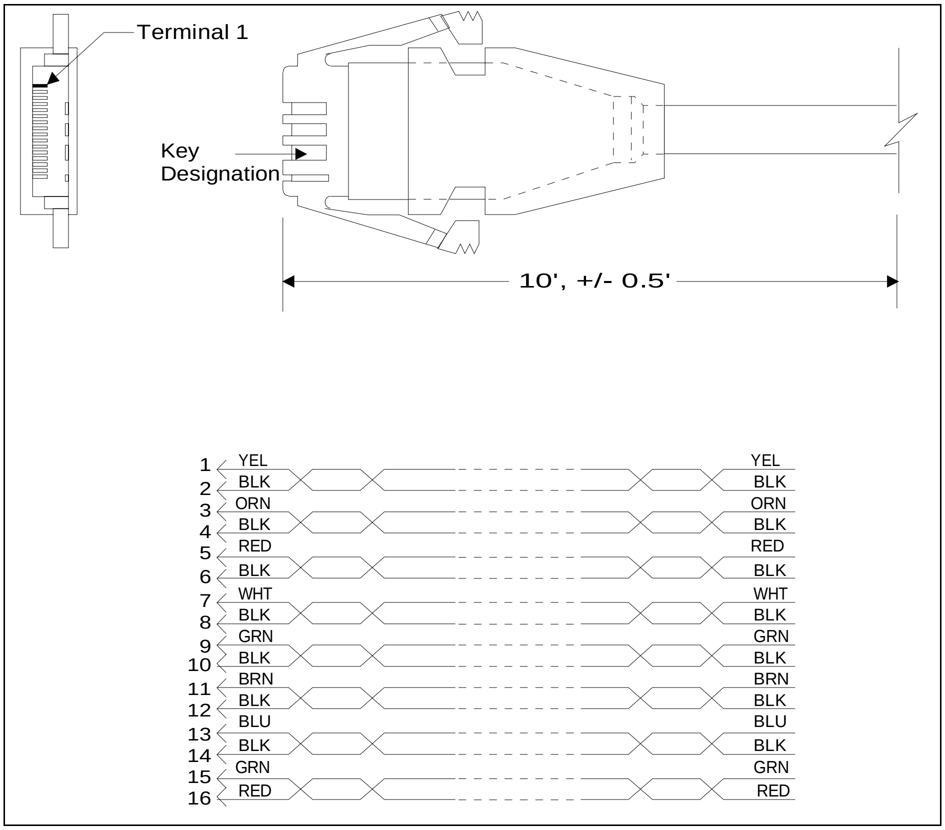
5 Lead HP ECG Lead Wired - 0012-00-1003-01

Cable, Safety Patient Leads - 0012-00-0622-XX (A)



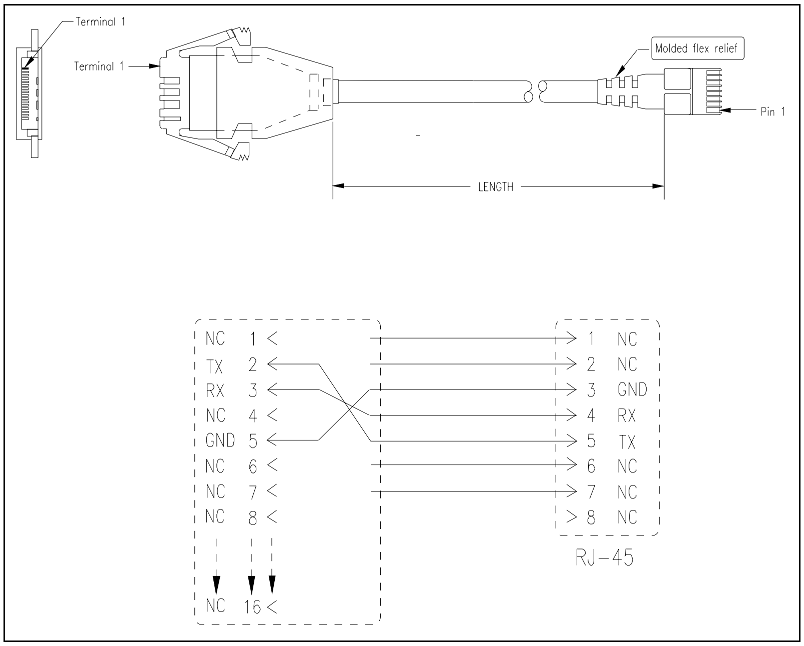
DASH NO.	LENGTH	COLOR
-01	18"	Black, White, Red
-03	18"	Black, White, Red, Brown, Green,Yellow
-05	24"	Black, White, Red, Brown, Green,Yellow
-07	40"	Black, White, Red, Brown, Green,Yellow

Data Link, Shielded, 16 Pin - 0012-00-0715 (A)
Data Link, Shielded, 16 Pin (XG-CE) - 0012-00-1028 (A)*



* *This version cable is exactly the same as the other except it also has a ferrite on it for CE approval.*

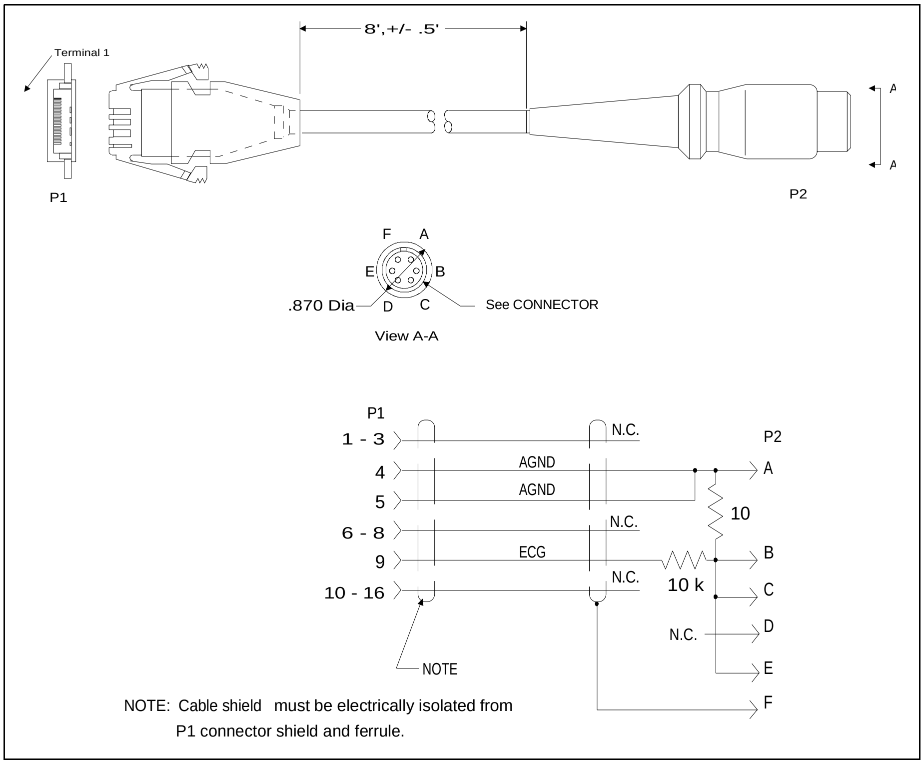
Passport to VISA/Wall Plate - 0012-00-0718-XX (A)
Passport to VISA/Wall Plate (XG-CE) - 0012-00-1031-XX (A)*



PART NUMBER	LENGTH
0012-00-0718-01	7’ ± .5’
0012-00-0718-02	50’ ± .5’
0012-00-1031-01	7’ ± .5’
0012-00-1031-02	50’ ± .5’

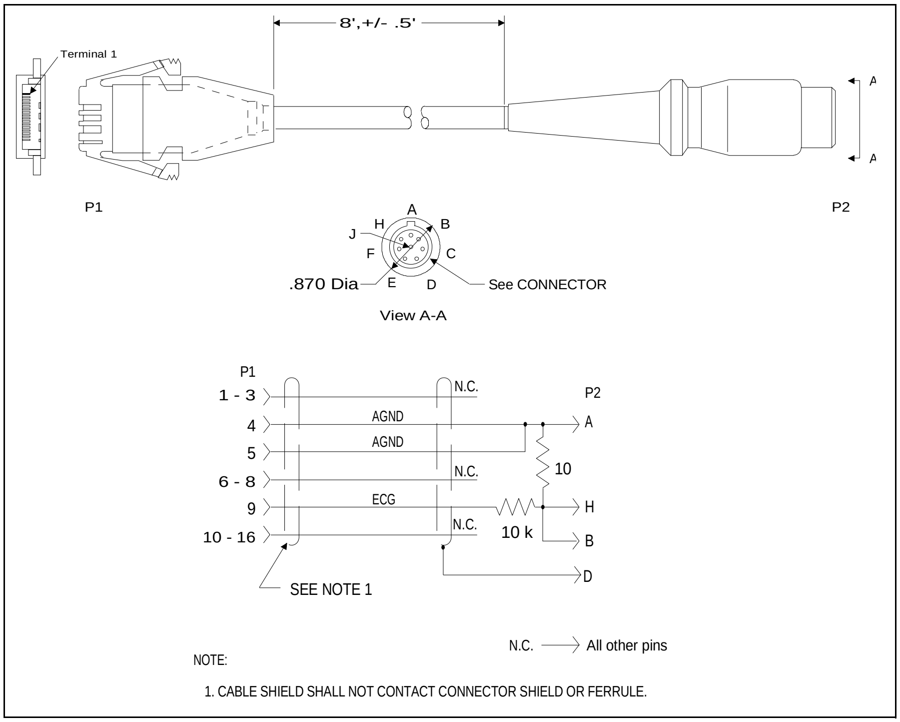
* *This version cable is exactly the same as the other except it also has a ferrite on it for CE approval.*

AAMI ECG/ECG Interface - 0012-00-0732
AAMI ECG/ECG Interface (XG-CE) - 0012-00-1026*



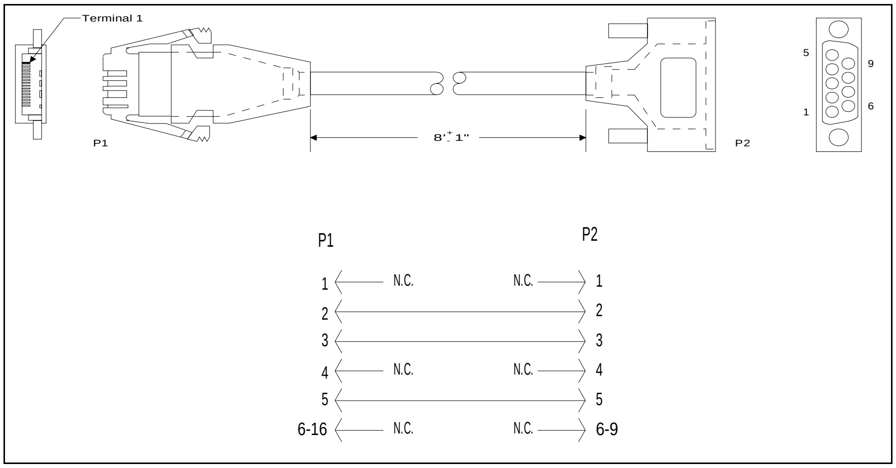
* *This version cable is exactly the same as the other except it also has a ferrite on it for CE approval.*

HP ECG/ECG Interface - 0012-00-0753-01 (A)
HP ECG/ECG Interface (XG-CE)- 0012-00-1027 (A)*



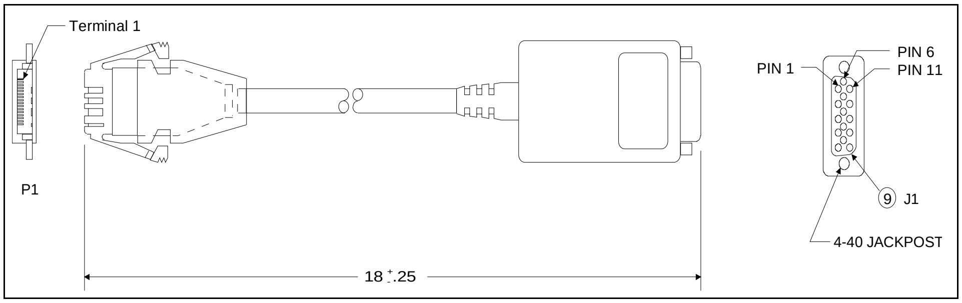
* *This version cable is exactly the same as the other except it also has a ferrite on it for CE approval.*

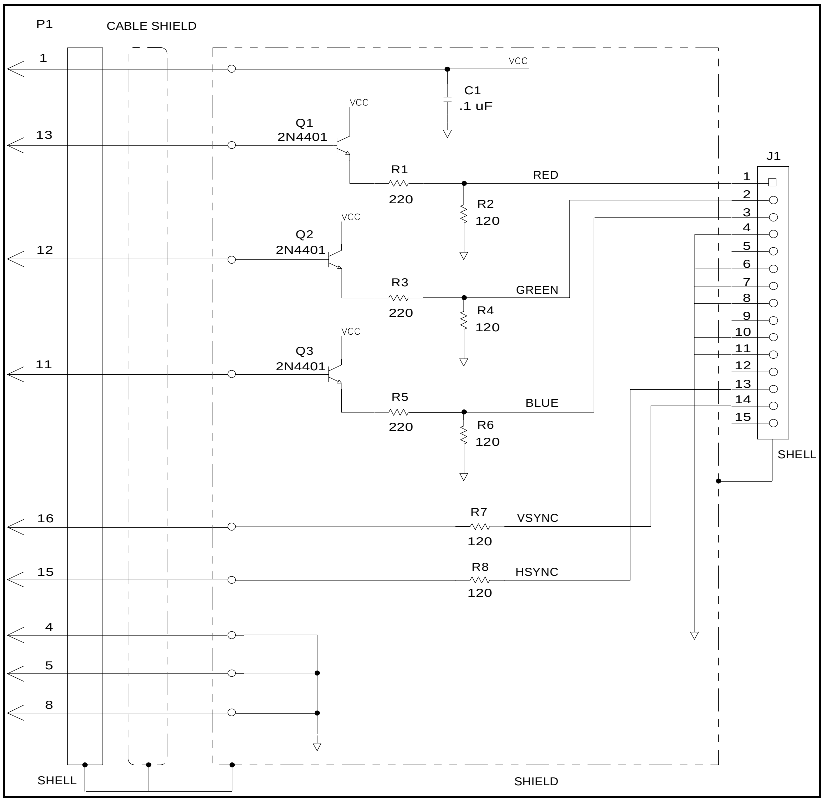
Passport To Corometrics Monitor - 0012-00-0844 (A)
Passport To Corometrics Monitor (XG-CE) - 0012-00-1029 (A)*



* *This version cable is exactly the same as the other except it also has a ferrite on it for CE approval.*

Passport Video Interface 0012-00-0983 (A)





Passport Video Interface - 0012-00-0983 (Continued)

Passport Connection, P1:

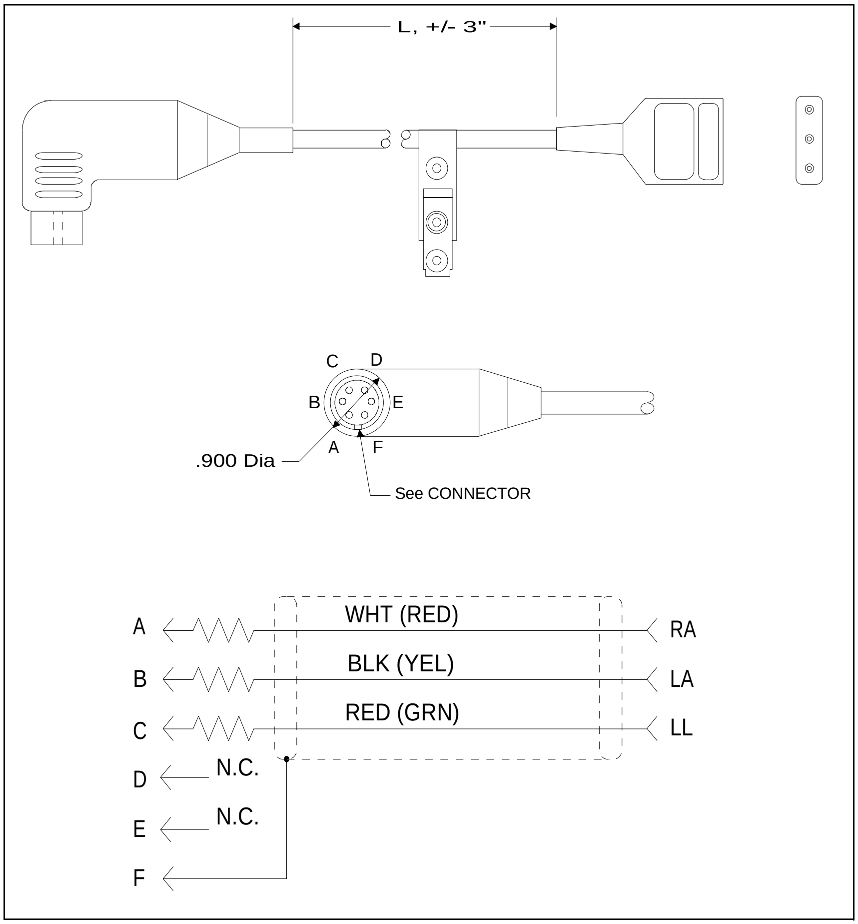
NOTE: Pins not assigned are reserved for existing Passport functions and must not be connected.

PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	VCC,Positive supply voltage	Shell	Cable and inner shield
4	Ground	15	Input, Horizontal sync, positive
5	Ground	14	Input, Vertical sync, negative
8	Display ID, Ground	13	Input, Red video
11	Input, Blue video	12	Input, Green video

Monitor Connection, J1:

PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	Output, Red video	Shell	Cable and inner shield
2	Output, Green video	15	N.C. (No connection)
3	Output, Blue video	14	Output, Vertical sync
4	Ground	13	Output, Horizontal sync
5	N.C. (No connection)	12	N.C. (No connection)
6	Ground, Red video return	11	Ground
7	Ground, Green video return	10	Ground
8	Ground, Blue video return	9	N.C. (No connection)

Right Angle Safety ECG Patient with Internal Resistors - 0012-00-0990-XX (A)



AHA CONVENTIONAL STANDARD

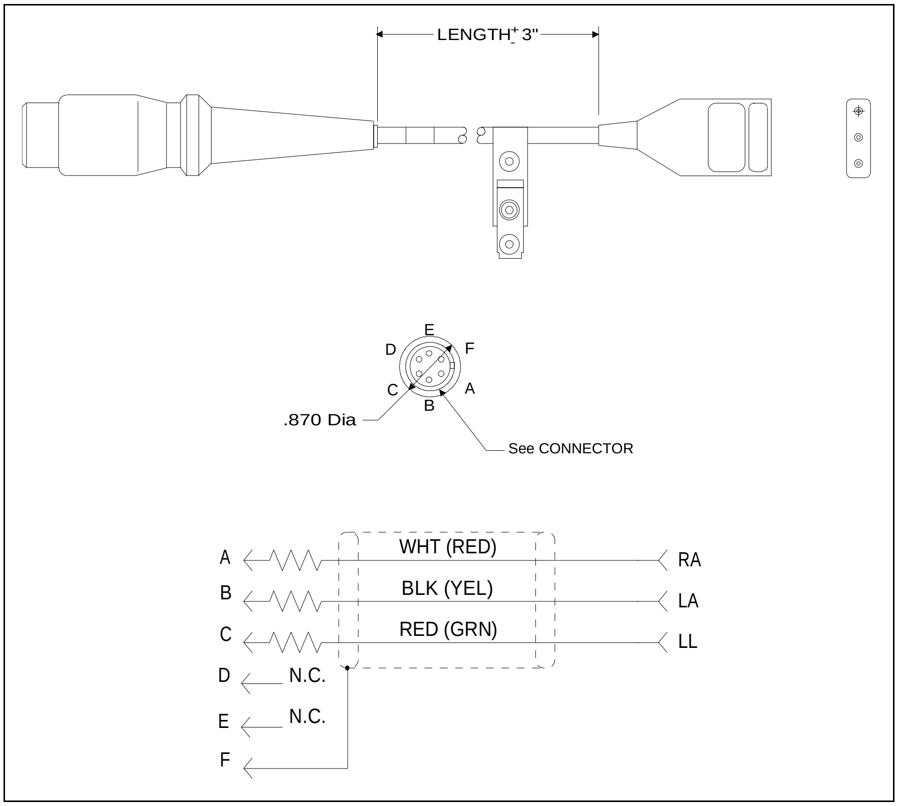
LEAD	COLOR
RA	White
LA	Black
LL	Red

IEC CONVENTIONAL STANDARD

LEAD	COLOR
R	Red
L	Yellow
F	Green

PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0990-01	3 Lead, 10 Foot, USA (AHA)
0012-00-0990-02	3 Lead, 20 Foot, USA (AHA)
0012-00-0990-03	3 Lead, 10 Foot, International (IEC)
0012-00-0990-04	3 Lead, 20 Foot, International (IEC)

ECG Patient With Internal Resistors - 0012-00-0991-XX (A)

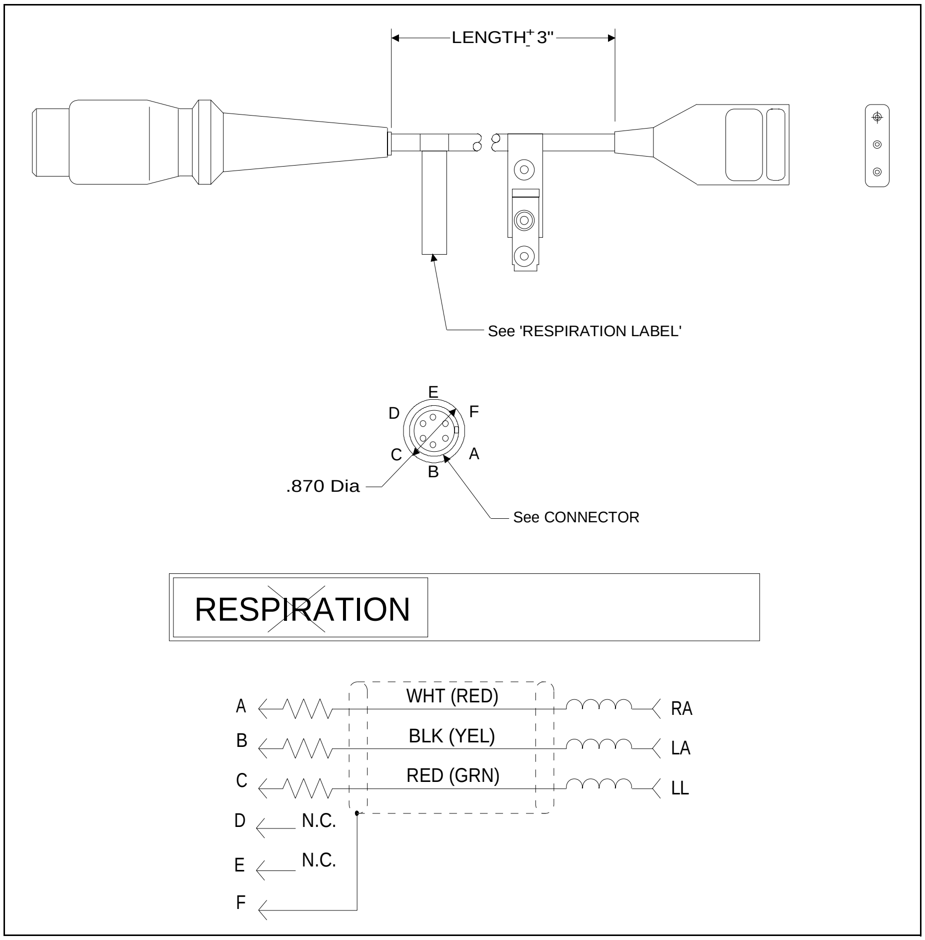


AHA CONVENTIONAL STANDARD	
LEAD	COLOR
RA	White
LA	Black
LL	Red

IEC CONVENTIONAL STANDARD	
LEAD	COLOR
R	Red
L	Yellow
F	Green

PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0991-01	3 Lead, 10 Foot, USA (AHA)
0012-00-0991-02	3 Lead, 20 Foot, USA (AHA)
0012-00-0991-03	3 Lead, 10 Foot, International (IEC)
0012-00-0991-04	3 Lead, 20 Foot, International (IEC)

ECG Patient With Internal Resistors And Choke Block - 0012-00-0992-XX (A)

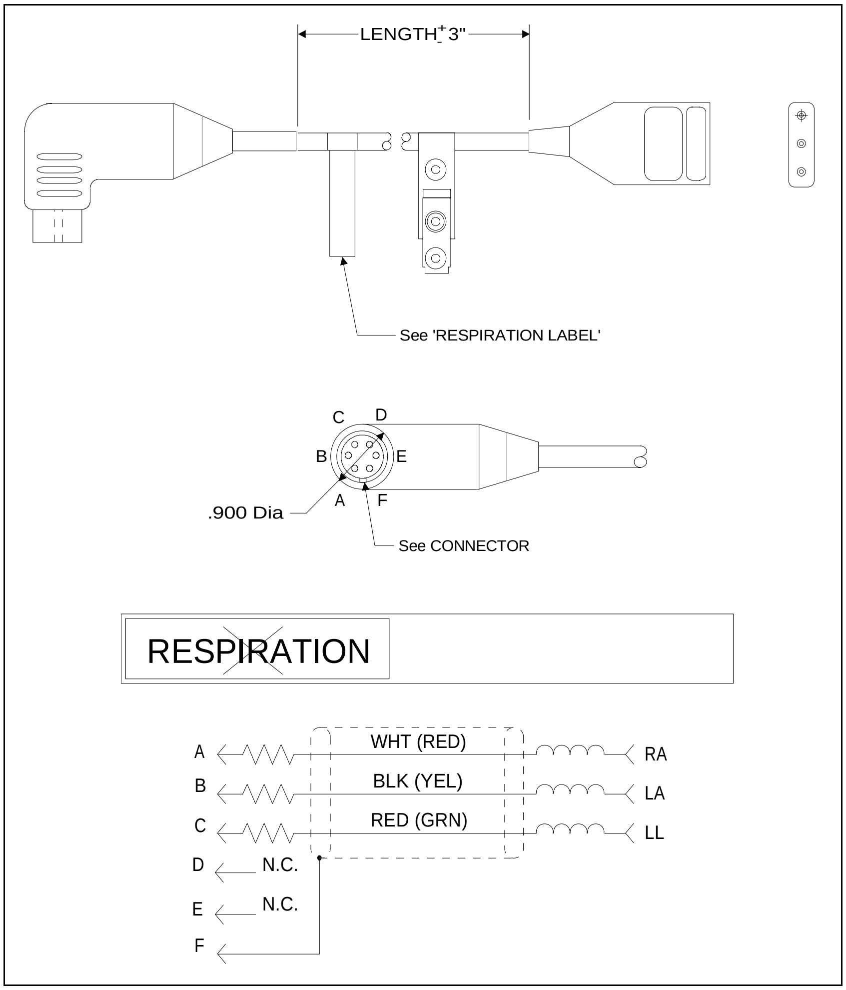


AHA CONVENTIONAL STANDARD	
LEAD	COLOR
RA	White
LA	Black
LL	Red

IEC CONVENTIONAL STANDARD	
LEAD	COLOR
R	Red
L	Yellow
F	Green

PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0992-01	3 Lead, 10 Foot, USA (AHA)
0012-00-0992-02	3 Lead, 20 Foot, USA (AHA)
0012-00-0992-03	3 Lead, 10 Foot, International (IEC)
0012-00-0992-04	3 Lead, 20 Foot, International (IEC)

Right Angle ECG Patient With Internal Resistors And Choke Block - 0012-00-00993-XX (A)

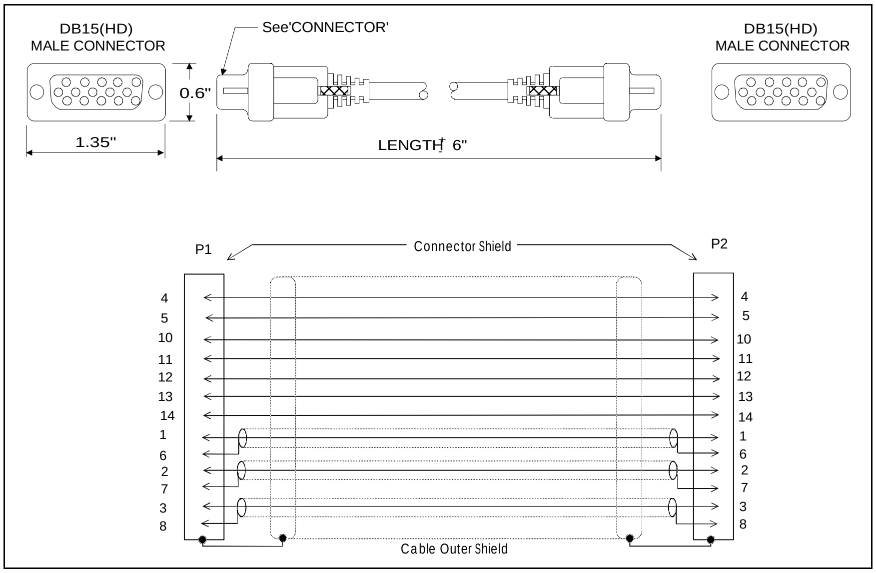


AHA CONVENTIONAL STANDARD	
LEAD	**COLOR**
RA	White
LA	Black
LL	Red

IEC CONVENTIONAL STANDARD	
LEAD	**COLOR**
R	Red
L	Yellow
F	Green

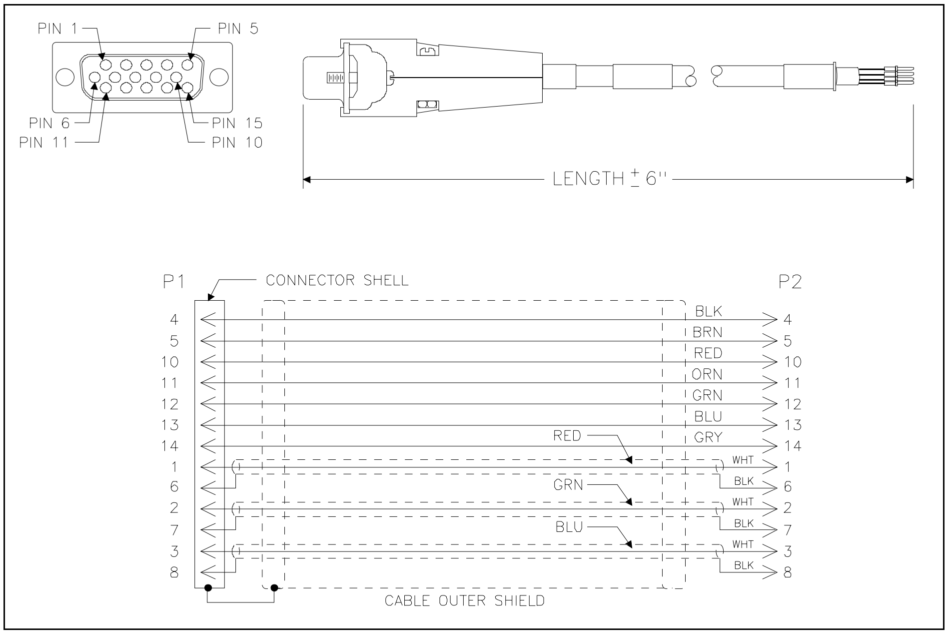
PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0993-01	3 Lead, 10 Foot, USA (AHA)
0012-00-0993-02	3 Lead, 20 Foot, USA (AHA)
0012-00-0993-03	3 Lead, 10 Foot, International (IEC)
0012-00-0993-04	3 Lead, 20 Foot, International (IEC)

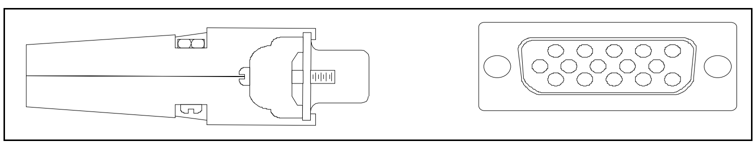
Male To Male VGA - 0012-00-0994-XX



PART NUMBER	DESCRIPTION AND LENGTH
0012-00-0994-01	Male to Male, 10 foot, Terminated
0012-00-0994-02	Male to Male, 25 foot, Terminated
0012-00-0994-03	Male to Male, 50 foot, Terminated
0012-00-0994-04	Male to Male, 75 foot, Terminated

Male to Male VGA, Unassembled - 0012-00-1010-XX

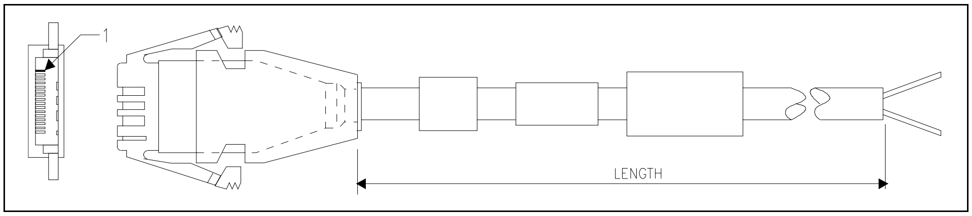


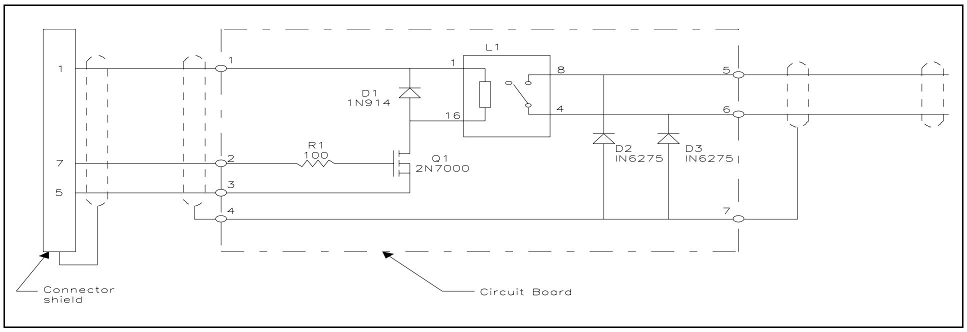


NOTE: ***Connector, connector shell, screws, nuts, insertion tool, and instructions are included.***

PART NUMBER	DESCRIPTION AND LENGTH
0012-00-1010-02	Male to Male, 25 foot, Unterminated
0012-00-1010-03	Male to Male, 50 foot, Unterminated
0012-00-1010-04	Male to Male, 75 foot, Unterminated

Nurse Call Cable Assembly - 0012-00-0981

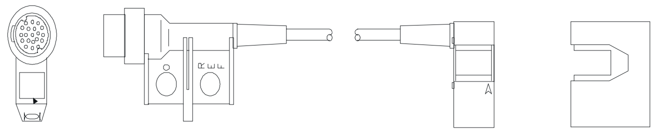




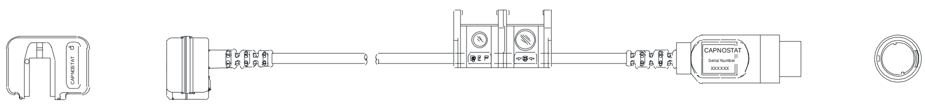
Parts Listing for circuit board contained within nurse call cable:

ITEM	REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER AND MANUFACTURER
1	D1	Diode	IN914, IN914A, National Semi., Phillips, Semiconductor Technology
2	D2, D3	Diode, Zener	IN6275, Motorola, General Semiconductor
3	L1	Relay, DPDT	DS2E-S-DC12V, Aromat
4	Q1	MOSFET	2N7000, Siliconix, Intersil
5	R1	Resistor, 100 ohms	5%, carbon film, 1/4 watt

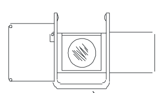
Sidestream CO2 Starter Kit - 0020-00-0112-02



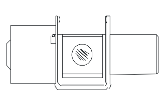
CO_2 Capnostat II Sensor and Cable Assembly - 0600-00-0025



CO_2 Capnostat III Sensor and Cable Assembly - 0600-00-0036

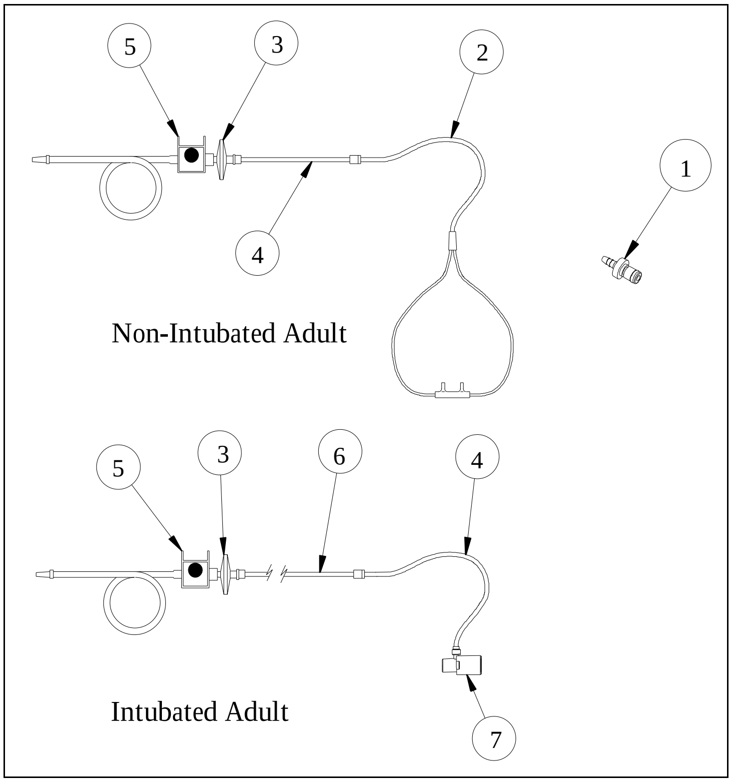


ADULT AIRWAY ADAPTERS
- 0103-15-0003 (Reusable)
- 0103-00-0410-02 (Disposable 10 pcs.)
- 0103-00-0410-03 (Disposable 25 pcs.)



NEONATAL AIRWAY ADAPTER - 0103-15-0013 (Reusable)

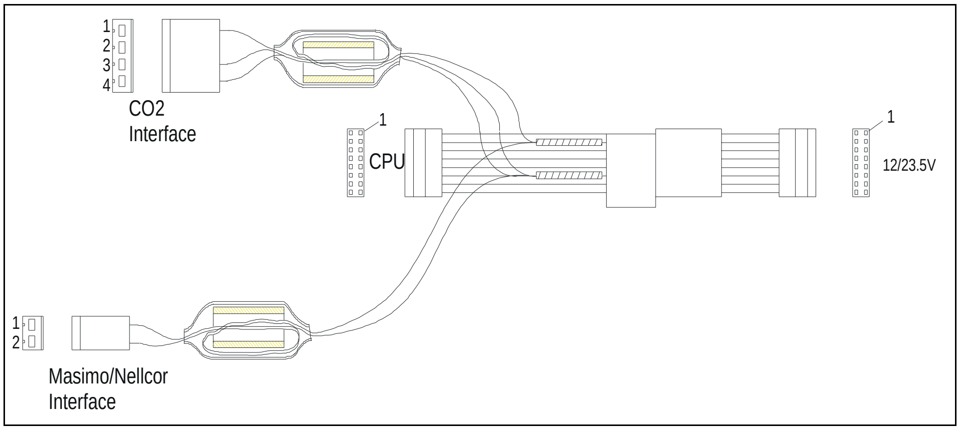
Sidestream CO2 Starter Kit - 0020-00-0112-02



Sidestream CO2 Starter Kit Bill of Materials:

ITEM	DESCRIPTION	PART NUMBERS
1	Insert, 1/8" Barbed (waste gas scavenging)	0103-00-0454-02
2	Nasal Cannula	0103-00-0443-01
3	Disc Filter, 5 Micron, External	0103-00-0445-01
4	Nafion Tubing Assembly	0008-00-0259
5	Airway Adapter with Tubing (SSCO2)	0103-00-0444-01
6	Capilary Line, 5 ft.	0683-00-0405-11
7	Intubated Adapter, Straight	0683-00-0242-21

CPU to SPO2 Interface Board Cable - 0012-00-1100



CABLE PINOUTS				COLOR	REFERENCE
CPU	***12/23.5V***	***CO2 INTERFACE***	***MASIMO/ NELLCOR INTERFACE***		
1	1	—	—	Brown	+5
2	2	—	—	Red	+5
3	3	3	—	Orange	D Ground
4	4	—	—	Yellow	D Ground
5	5	—	—	Blue	P Ground
6	6	—	—	Violet	P Ground
7	7	—	—	Gray	+12
8	8	—	—	White	+12
9	9	—	—	Black	+15
10	10	—	—	White/Brown	A Ground
11	11	4	—	White/Red	-15
12	12	1	—	White/ Orange	Sw/Bulk
13	13	—	—	White/Yellow	BLEN
14	14	—	—	White/Blue	-23.5
15	15	—	—	—-	KEY
16	16	—	—	White/Violet	—-
—-	—-	2	—	—-	Spare
—-	12	—	1	White/ Orange	SW/Bulk
—-	3	—	2	Orange	D Ground

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5.0 Assembly and Schematic Diagrams

Schematic drawings and accompanying assembly drawings of printed circuit boards are provided in the remainder of this chapter.

The following is a list of the drawings and the corresponding drawing number (if available) and the page where it can be found.

NOTE: EMC/CE = Electromagnetic Compatible/European Conformity

DRAWING NAME	DRAWING PART NUMBER	PAGE
NIBP Board	0670-00-0375	5-5
NIBP Control Board	0387-00-0375 0387-00-0657	5-6 through 5-8
Pneumatics Board	0670-00-0447-01/English	5-9
Pneumatics Board	0387-00-0447-01/English	5-10
Pneumatic Board	0670-00-0605 CE	5-11
Pneumatic Board	0387-00-0605 CE	5-12
Line Battery Board	0670-00-0449 0670-00-0621 (5L-CE)	5-13
Line Battery Board	0387-00-0449 0387-00-0621 (5L-CE)	5-14
+12/23 Volt Board	0670-00-0450	5-15
+12/23 Volt Board	0387-00-0450	5-16
$Sp0_2$ Board	0670-00-0482	5-17
SpO_2 Board	0387-00-0482	5-18 through 5-21
CO_2 Interface Module	0670-00-0497	5-23
CO_2 Interface Module Board	0387-00-0497	5-24
CO_2 Interface Module	0670-00-0632	5-25
CO_2 Interface Module Board	0387-00-0632	5-26

DRAWING NAME	DRAWING PART NUMBER	PAGE
Planar E.L. Panel Board	0670-00-0500 0670-00-0622 (CE)	5-27
Planar E.L. Panel Board	0387-00-0500 0387-00-0622 (CE)	5-28
Panel Board	0670-00-0546	5-29
Panel Board	0387-00-0546	5-30
SpO_2 Interface Board Nellcor	0670-00-0557	5-31
SpO_2 Interface Board Nellcor	0387-00-0557	5-32 through 5-34
Front End Board	0670-00-0560-03/04 (5L-CE) 0670-00-0624-01/02 (5L-CE)	5-35
Front End Board	0387-00-0560-XX 0387-00-0624-XX (5L-CE)	5-36 through 5-44
Datasette Board	0670-00-0561	5-51
Datasette Board	0387-00-0561	5-52
Datasette Board	0670-00-0574-01 0670-00-0574-03 0670-00-0574-04 0670-00-0574-05	5-53
Datasette Board	0387-00-0574-01 0387-00-0574-03 0387-00-0574-04 0387-00-0574-05	5-54
Interconnect Board	0670-00-0615 0670-00-0629 (CE)	5-55
Interconnect Board	0670-00-0576 0670-00-0628 (CE)	5-55
Interconnect Board	0387-00-0576 0387-00-0628 (CE)	5-56
Interconnect Board HP	0387-00-0615 0387-00-0629 (CE)	5-57
CPU Board	0670-00-0591 0670-00-0623 (5L-CE) 0670-00-0631	5-59
CPU Board	0387-00-0591 0387-00-0623 (5L-CE) 0387-00-0631 0387-00-0688	5-60 through 5-63
CPU Board	0670-00-0651 (XG-CE)	5-65
CPU Board	0387-00-0651 (XG-CE) 0387-00-0689	5-66 through 5-69
Front End Daughter Board	0670-00-0611 0670-00-0627 (5L-CE)	5-71
Front End Daughter Board	0387-00-0611 0387-00-0627 (5L-CE)	5-72
SpO_2 Daughter Board	0670-00-0619	5-73
SpO_2 Daughter Board	0387-00-0619	5-74
VGA/EL Panel Board/VGA/LCD Panel Board Display Interface Assembly (XG)	0670-00-0617-02 0670-00-0617-03	5-75
VGA/EL Panel Board/VGA/LCD Panel Board Display Interface Assembly (XG)	0387-00-0617-02 0387-00-0617-03	5-76 through 5-77

DRAWING NAME	DRAWING PART NUMBER	PAGE
Line Battery Board (Top and Bottom)	0670-00-0626	5-79
Line Battery Board	0387-00-0626 0387-00-0656	5-80
Termination Board (Top and Bottom)	0670-00-0648	5-81
Termination Board	0387-00-0648	5-82
SpO_2 Interface Board Masimo / NellcorSpO_2 Interface Board Masimo / Nellcor	0670-00-0665-01 (Masimo) 0670-00-0665-02 (Nellcor)(	5-83
SpO_2 Interface Board Masimo / Nellcor	0387-00-0665-01 (Masimo) 0387-00-0665-02 (Nellcor)	5-84 through 5-85

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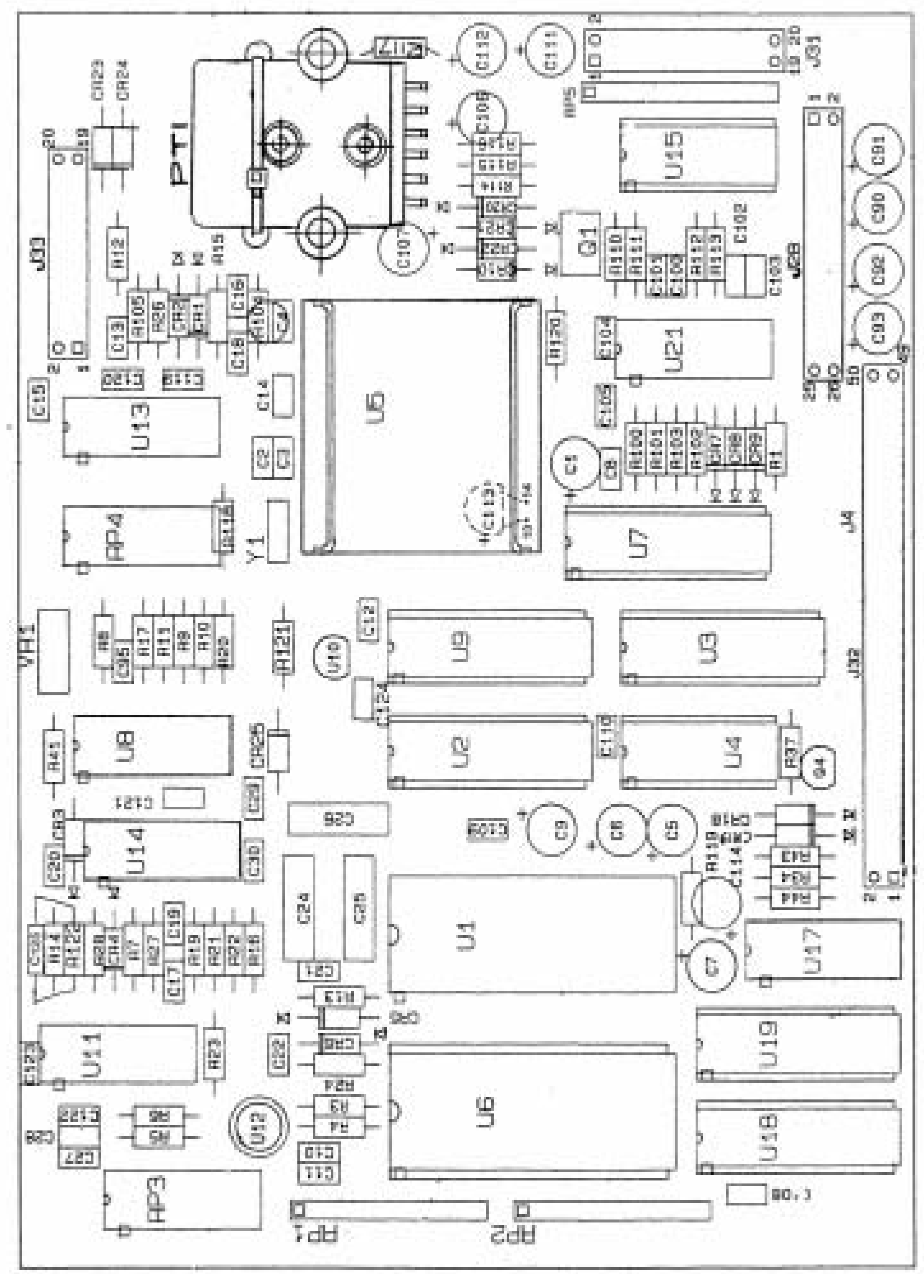

FIGURE 5-1 NIBP Board
0670-00-0375

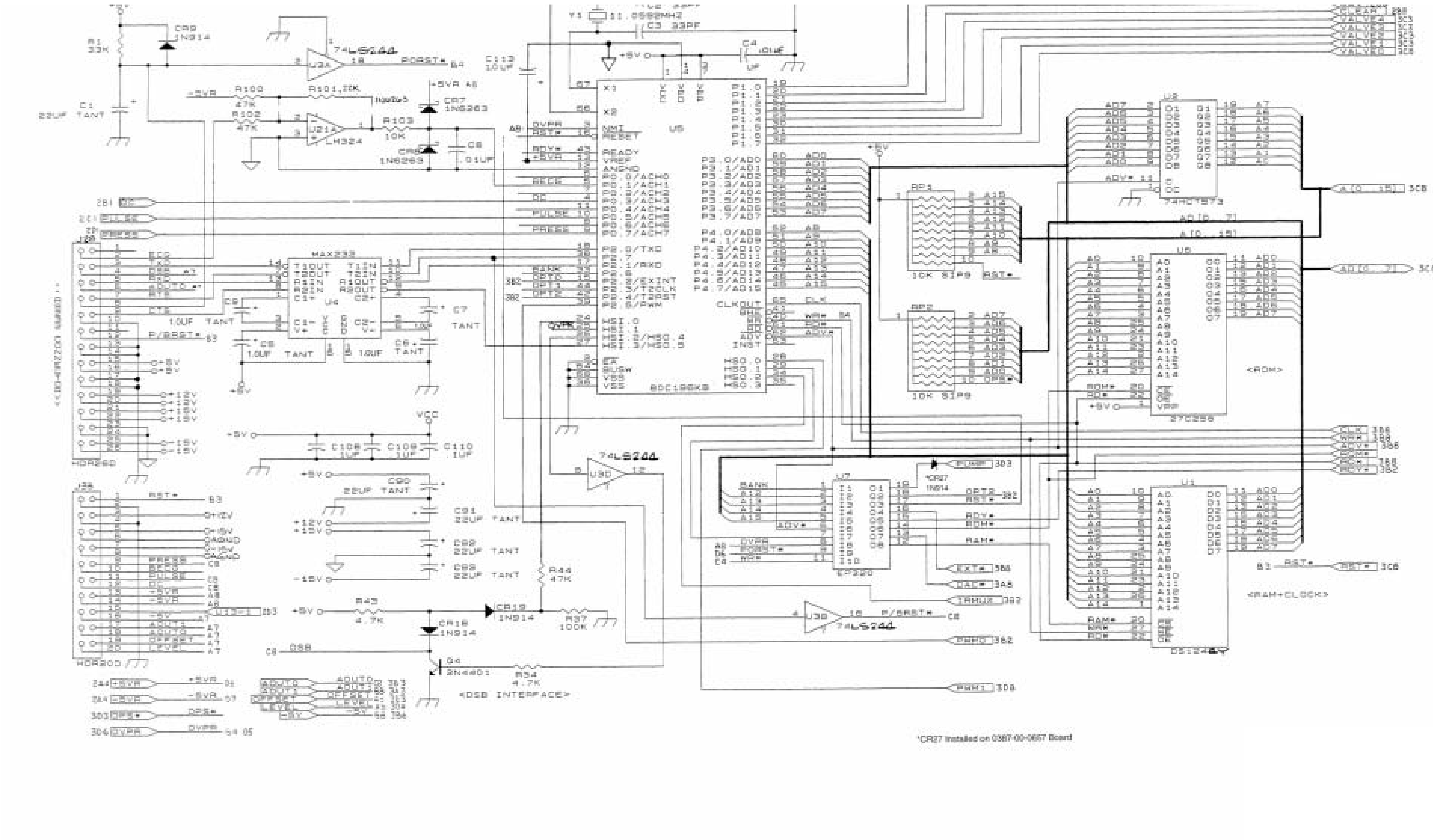

FIGURE 5-2 NIBP Control Board
0387-00-0375
0387-00-0675
Sheet 1 of 3

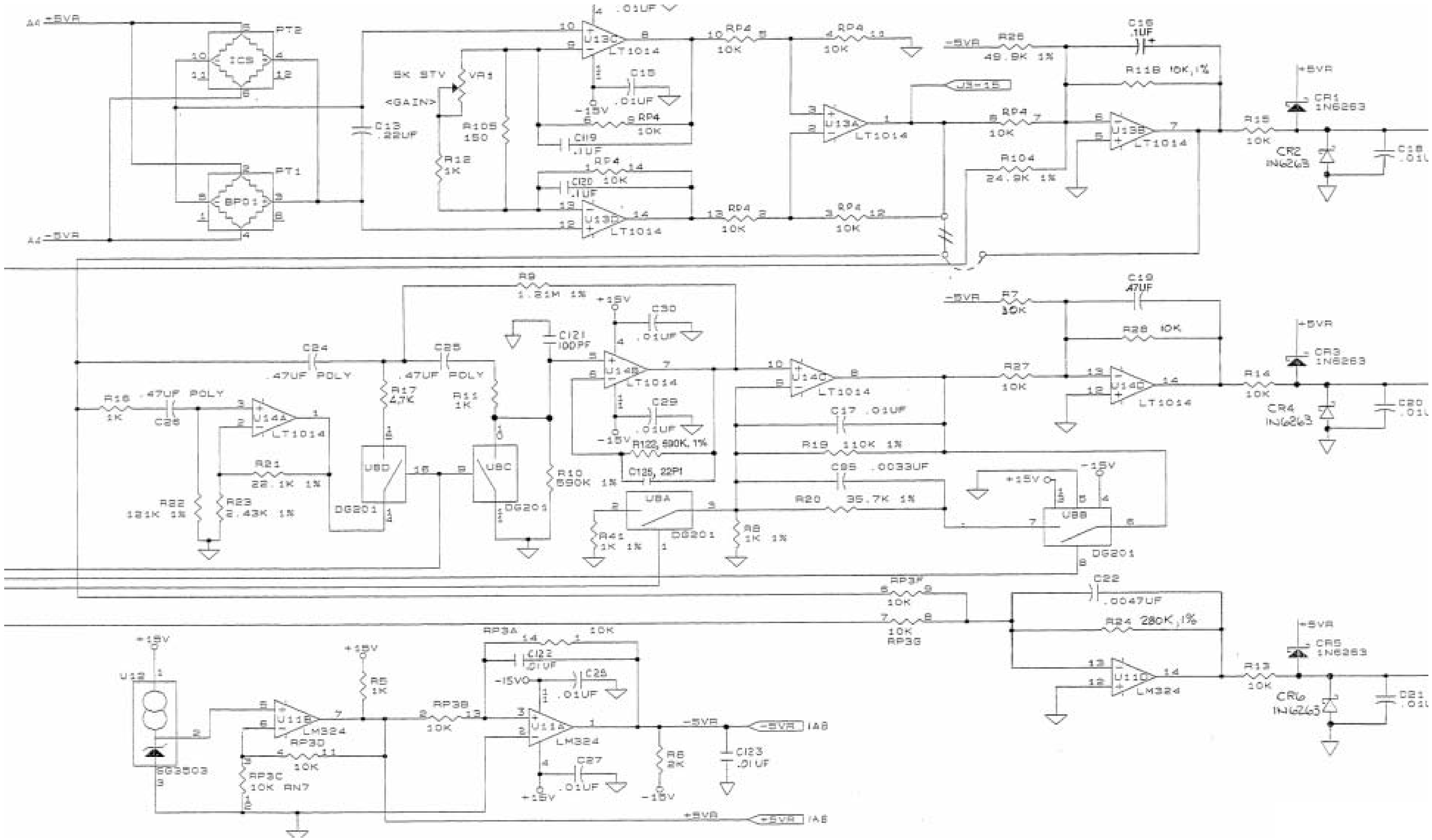

FIGURE 5-3 NIBP Control Board
0387-00-0375
0387-00-0657
Sheet 2 of 3

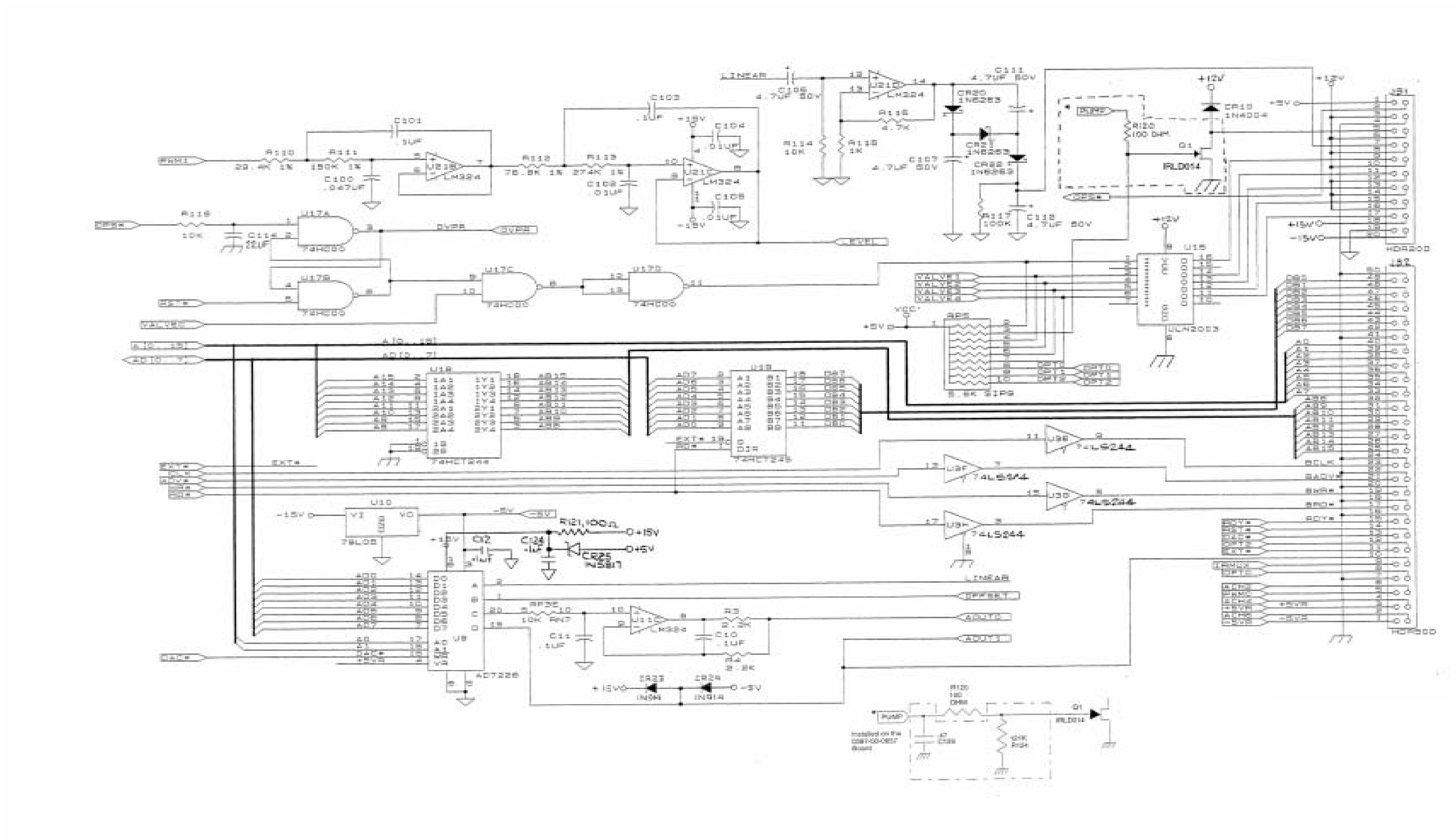

FIGURE 5-4 NIBP Control Board
0387-00-0375
0387-00-0657
Sheet 3 of 3

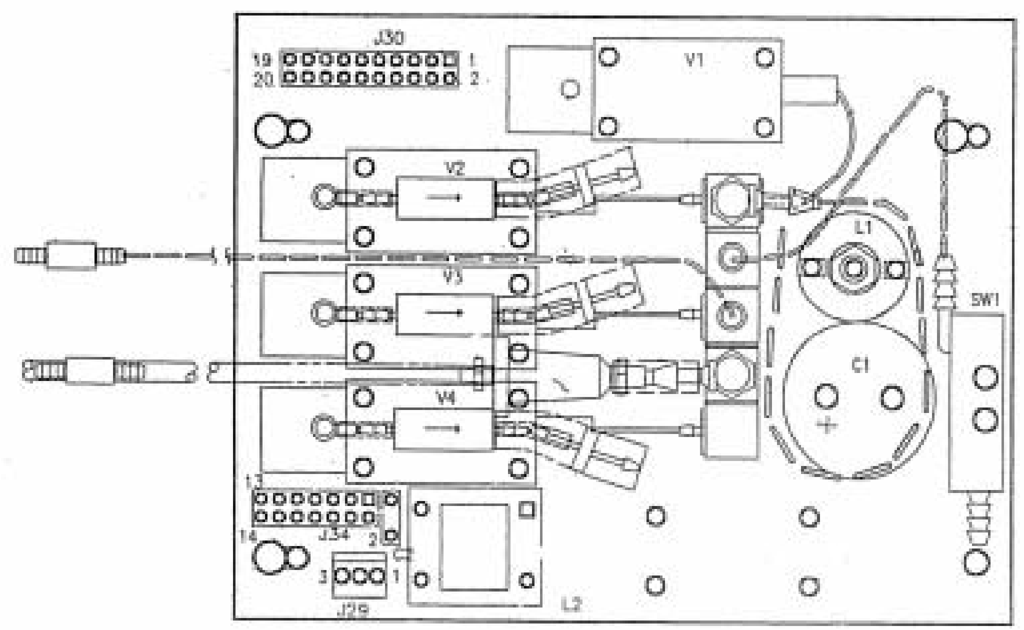

FIGURE 5-5 Pneumatics Board
0670-00-0447-01 / English

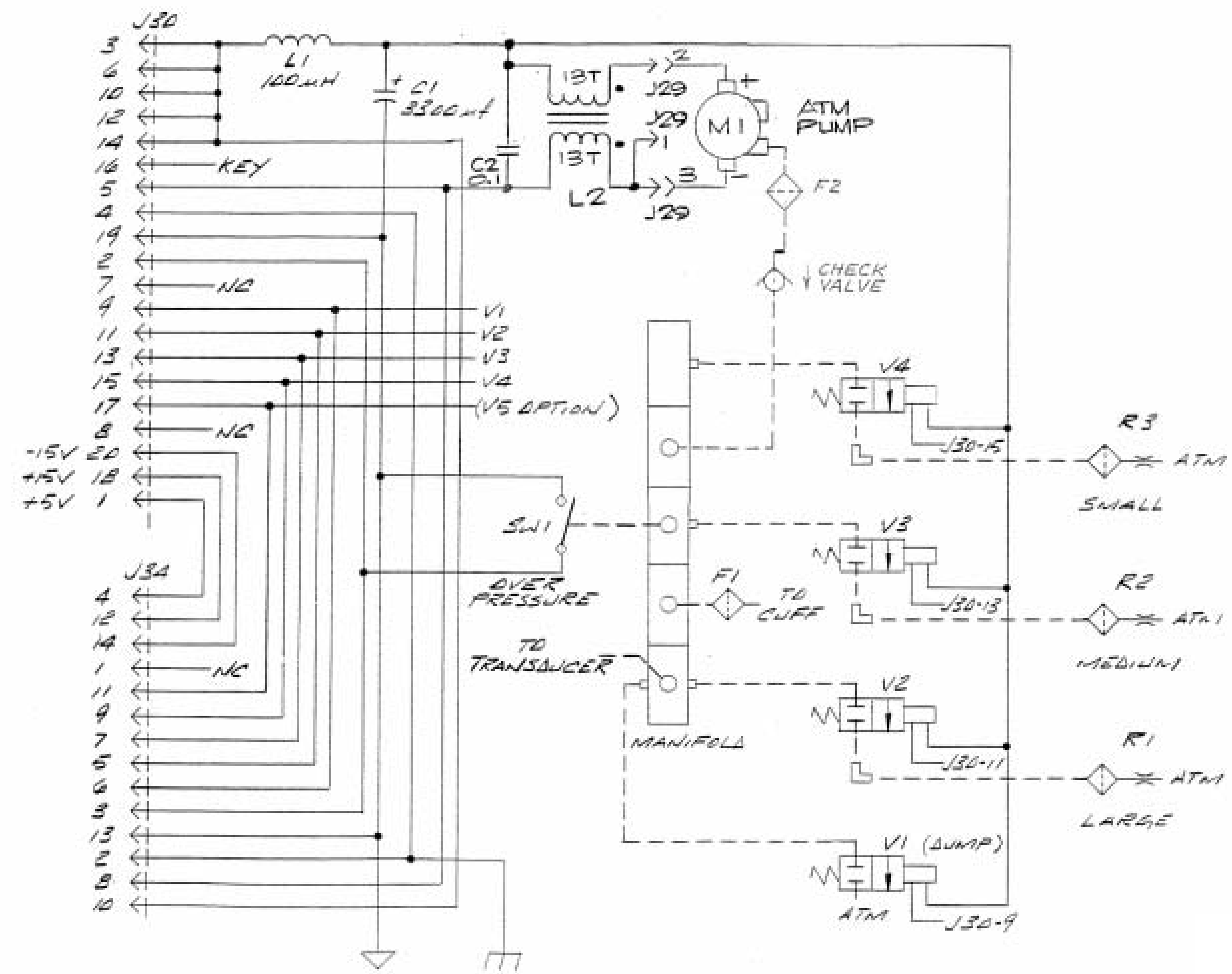

FIGURE 5-6 Pneumatics Board
0387-00-0447-01/English

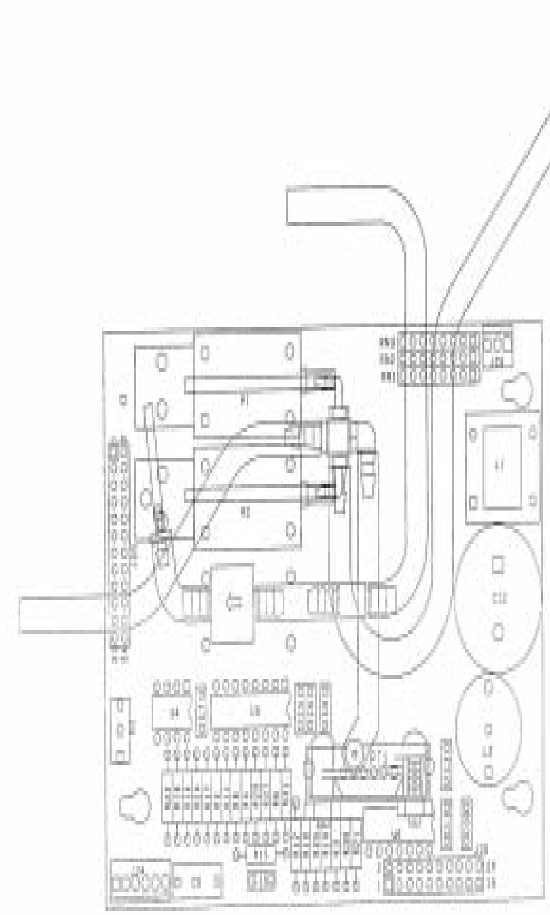

FIGURE 5-7 Pneumatic Board
0670-00-0605 CE

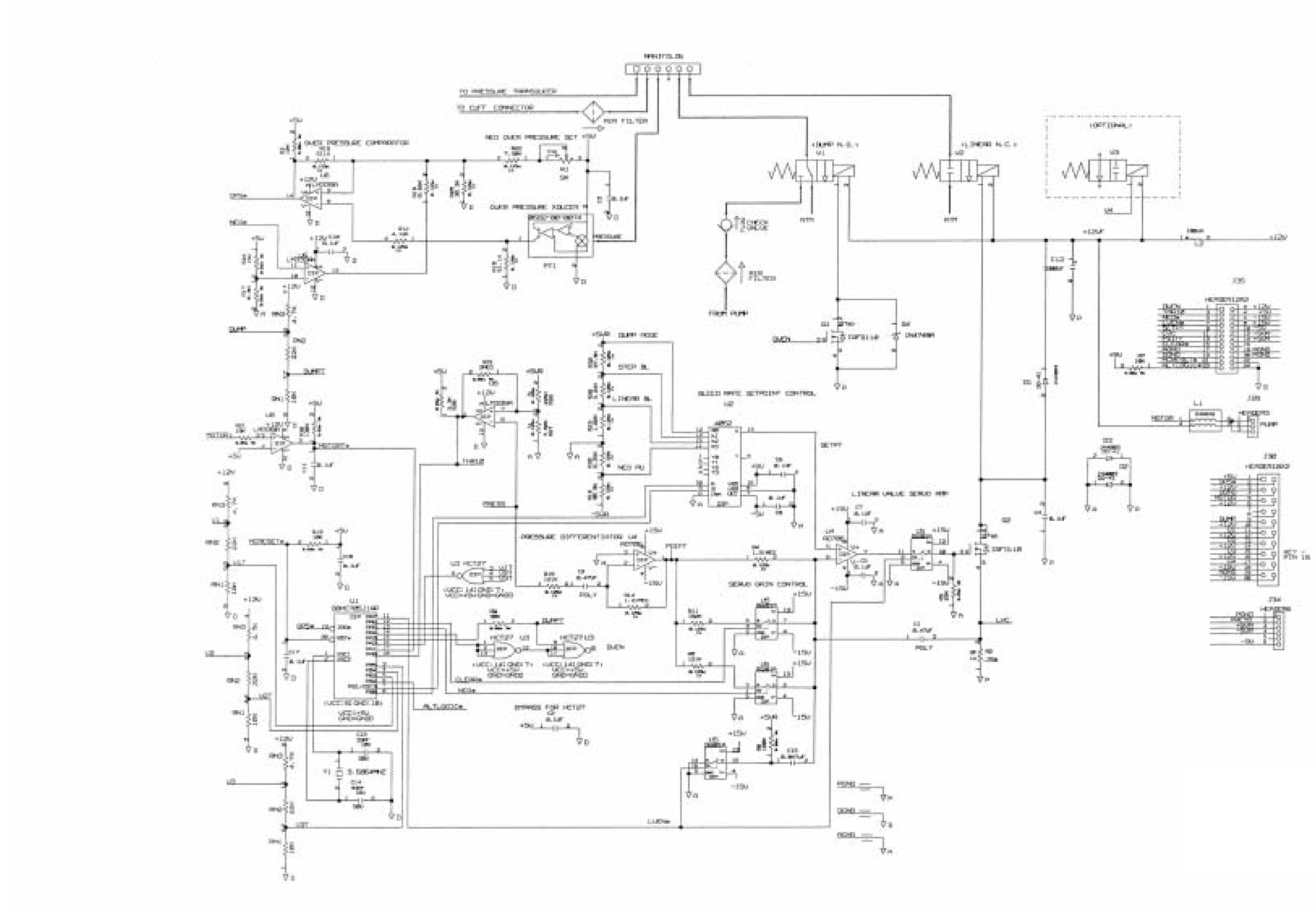

FIGURE 5-8 Pneumatic Board
0387-00-0605 CE

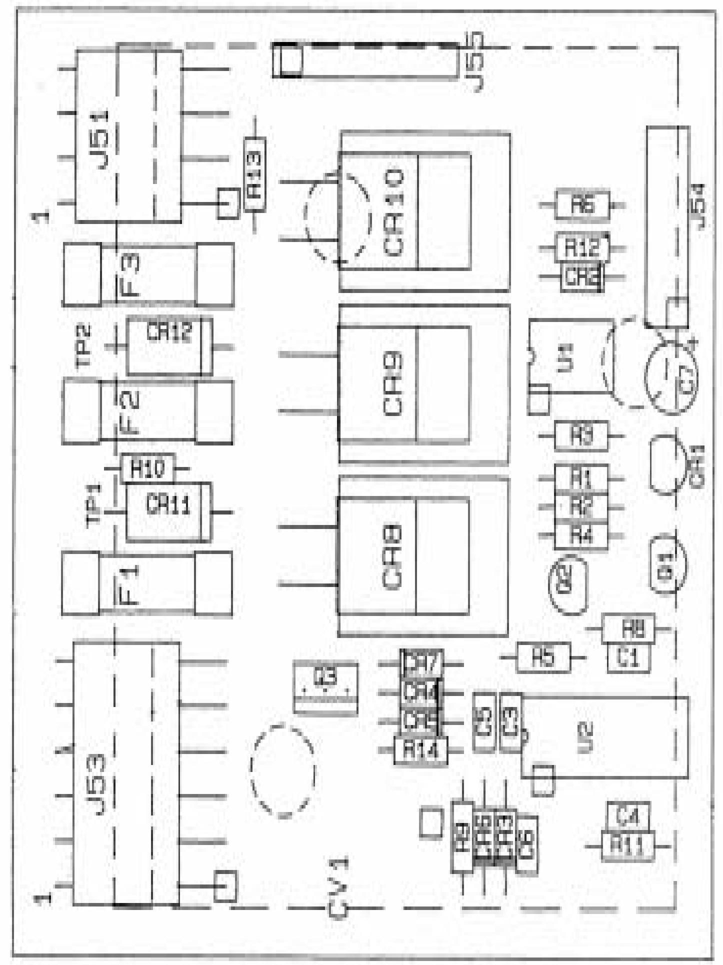

FIGURE 5-9 Line Battery Board
0670-00-0449
0670-00-0621 (5L-CE)

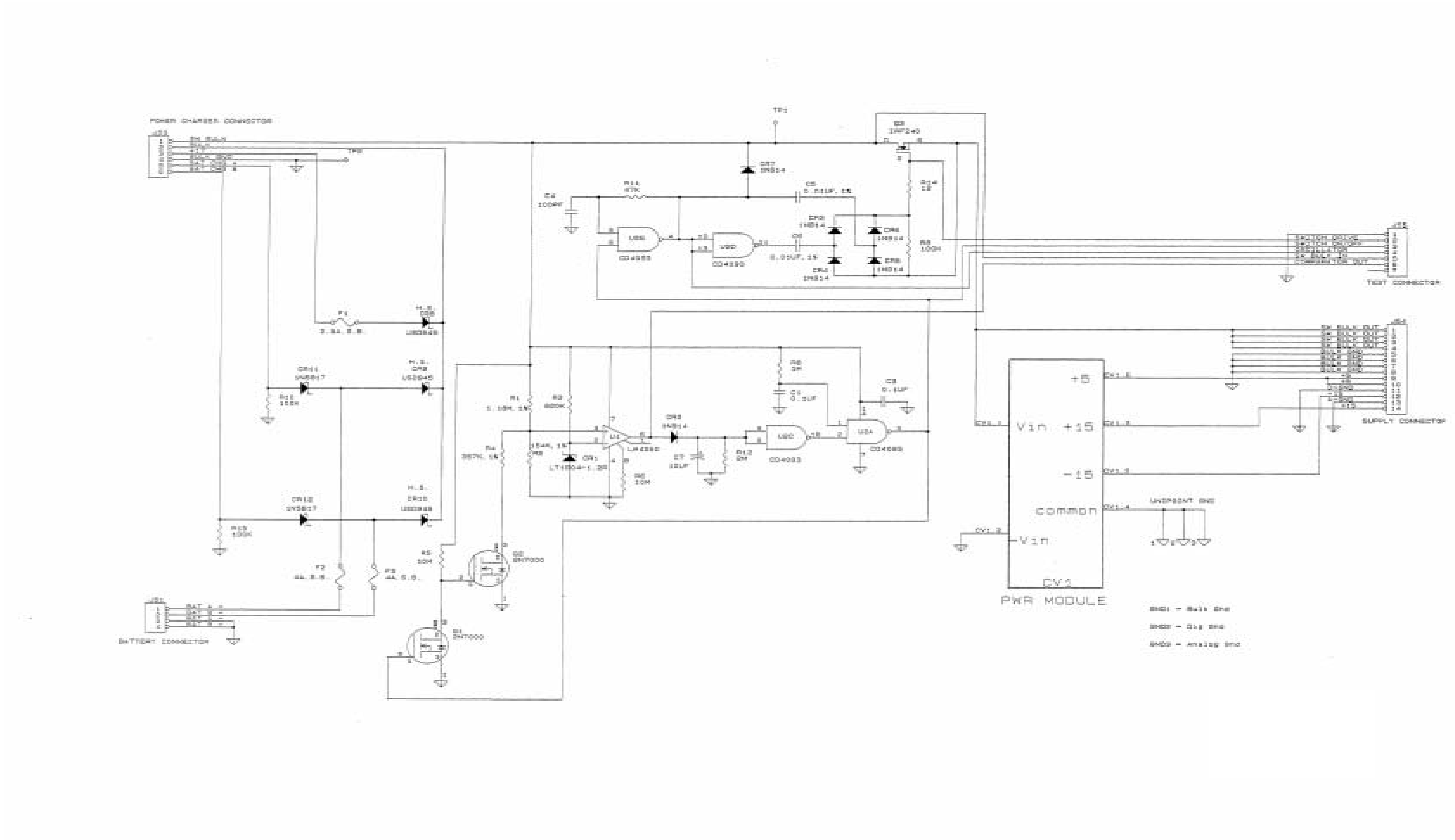

FIGURE 5-10 Line Battery Board
0387-00-0449
0387-00-0621 (5L-CE)

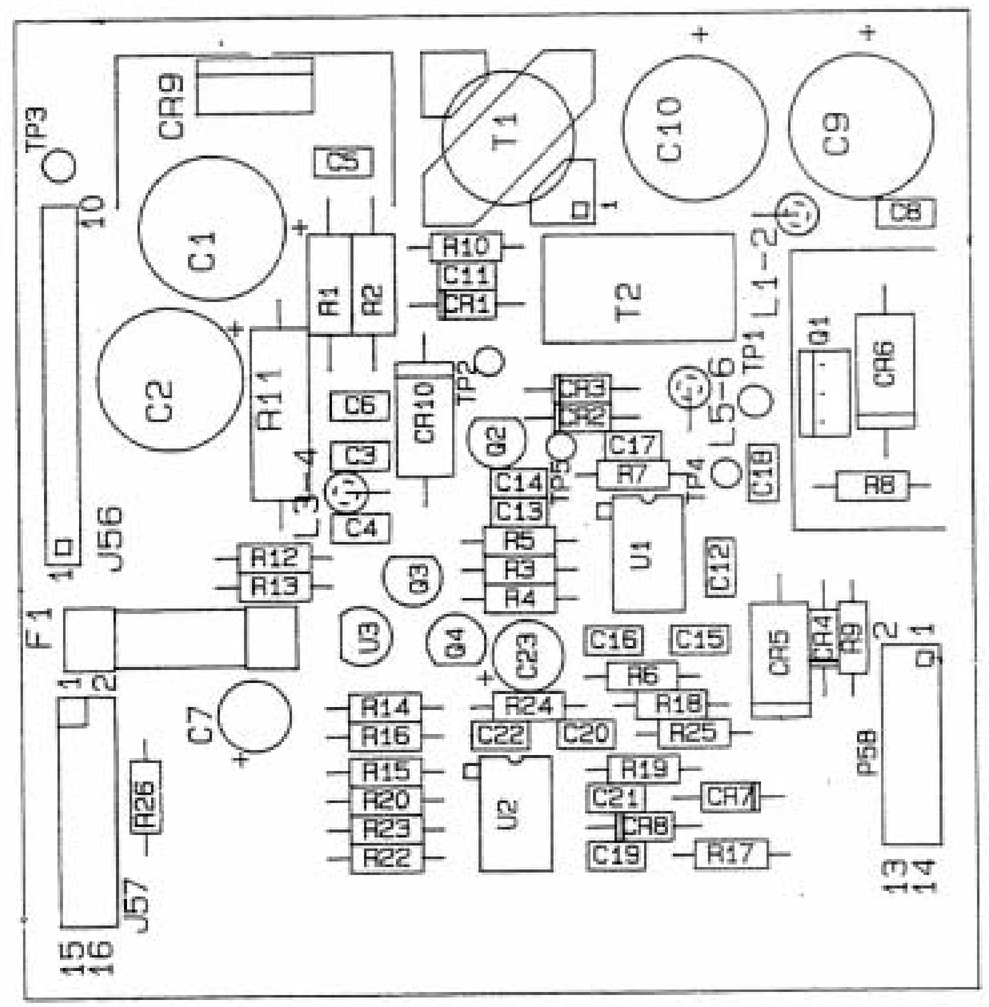

FIGURE 5-11 +12 / 23 Volt Board
0670-00-0450

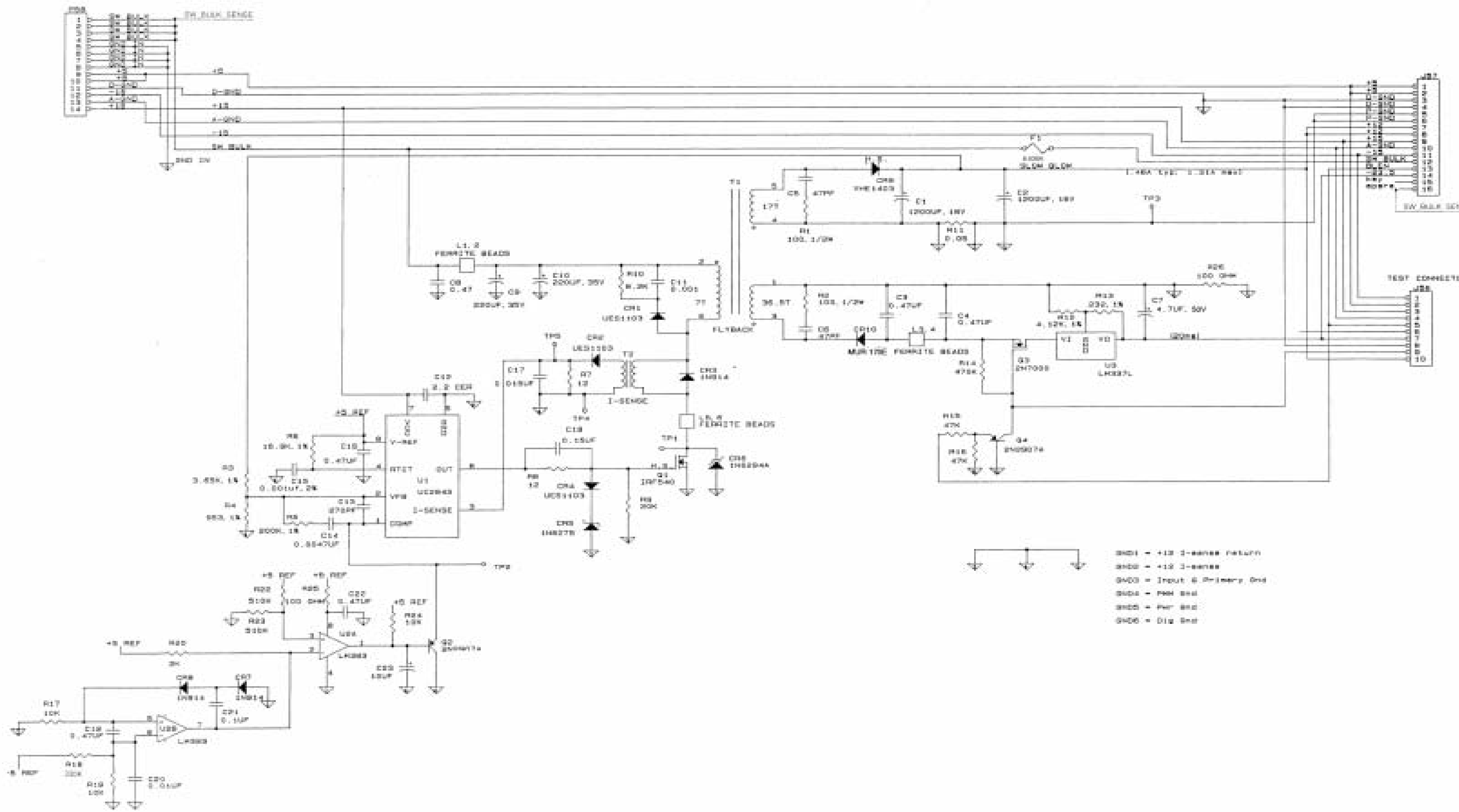

FIGURE 5-12 +12 / 23 Volt Board
0387-00-0450

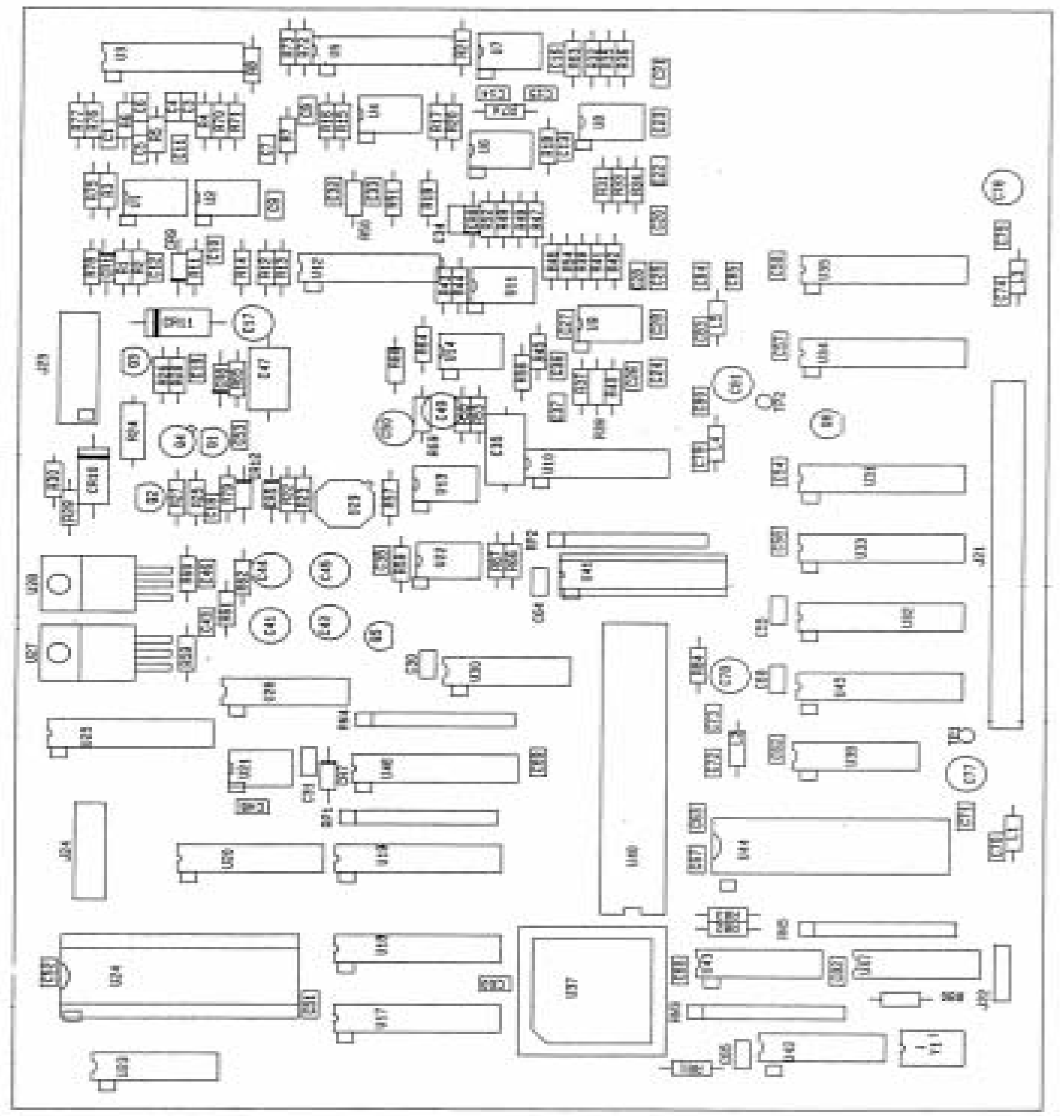

FIGURE 5-13 SpO_2 Board
0670-00-0482

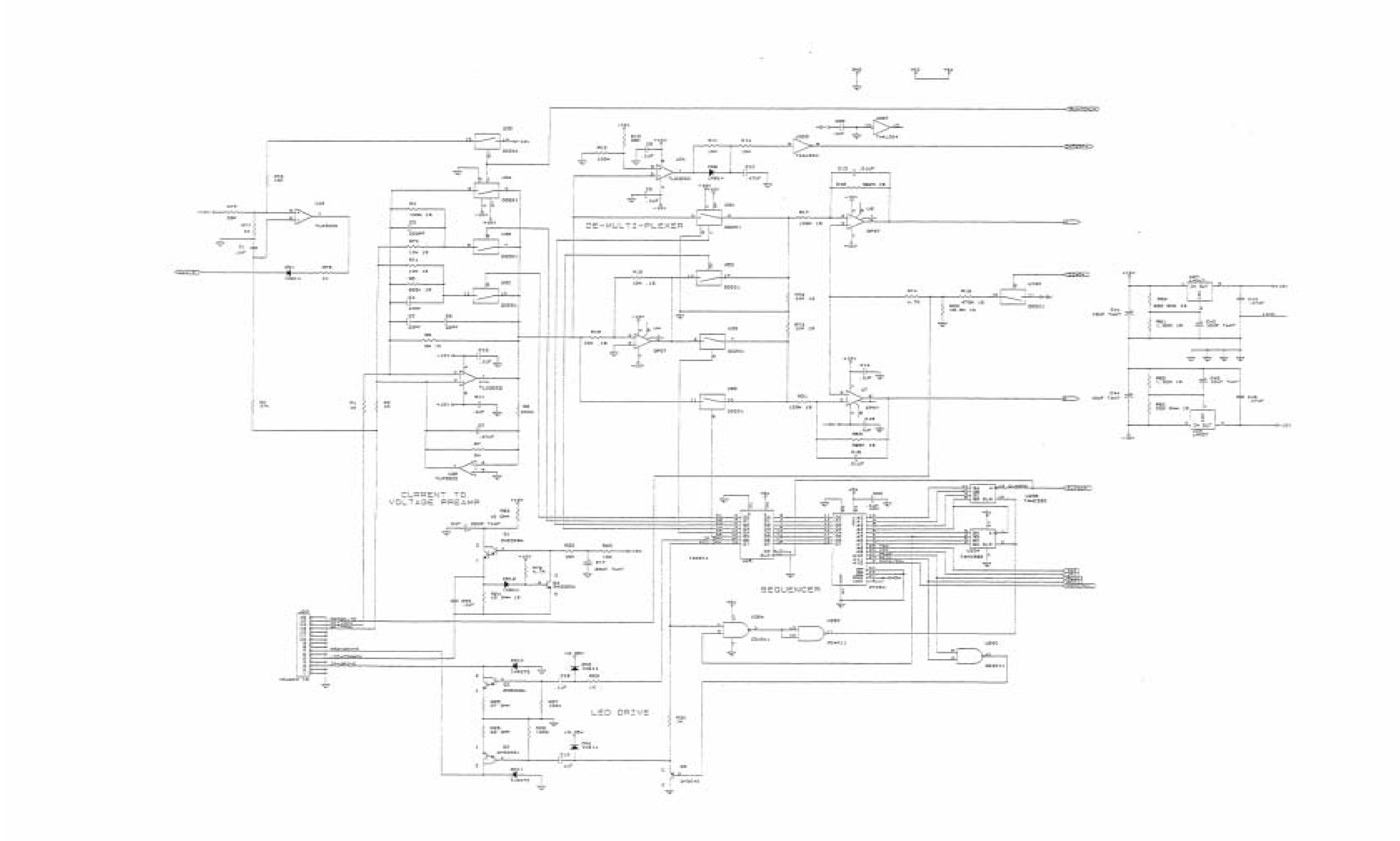

FIGURE 5-14 SpO_2 Board
0387-00-0482
Sheet 1 of 4

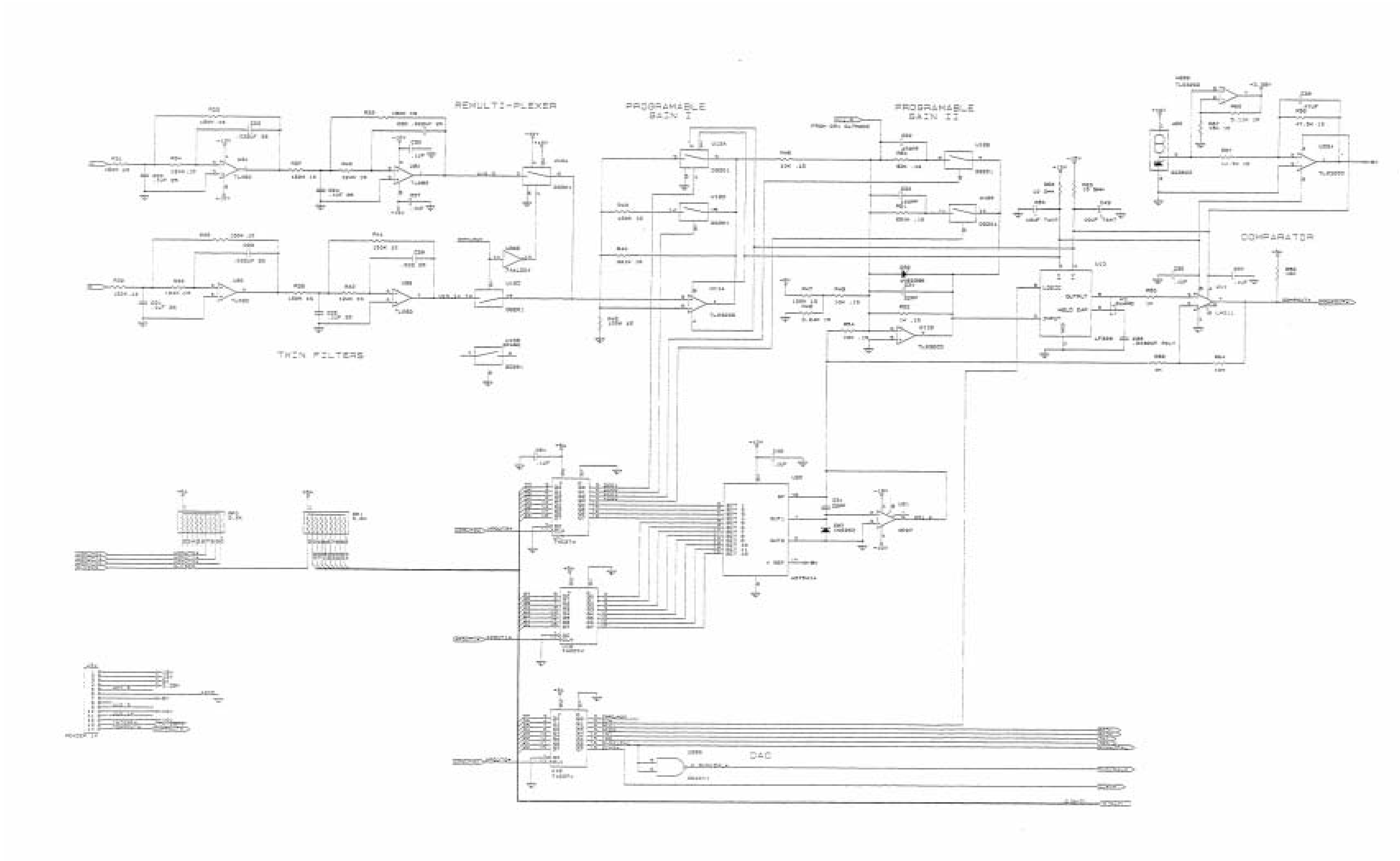

FIGURE 5-15 SpO_2 Board
0387-00-0482
Sheet 2 of 4

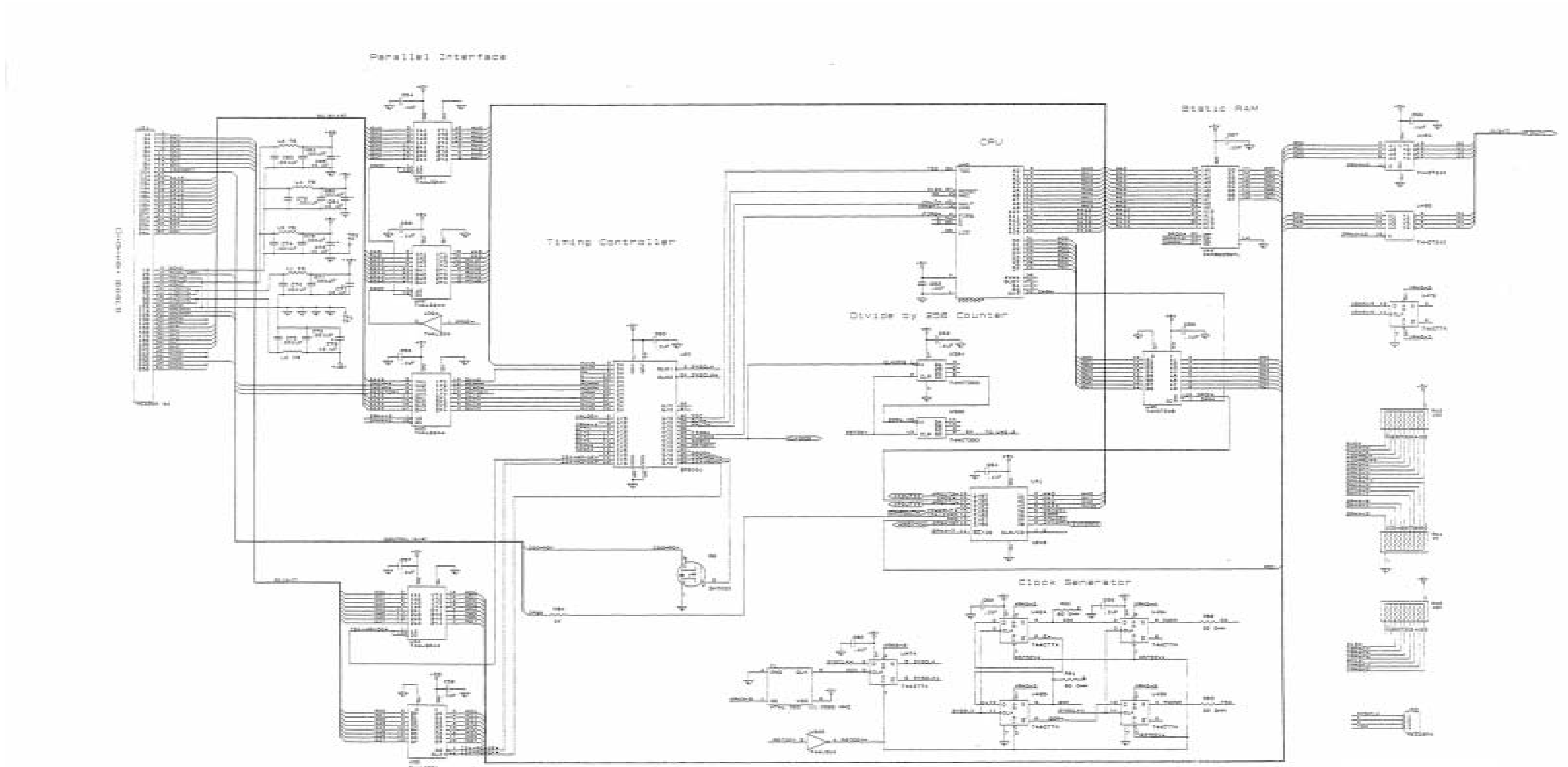

FIGURE 5-16 SpO_2 Board
0387-00-0482
Sheet 3 of 4

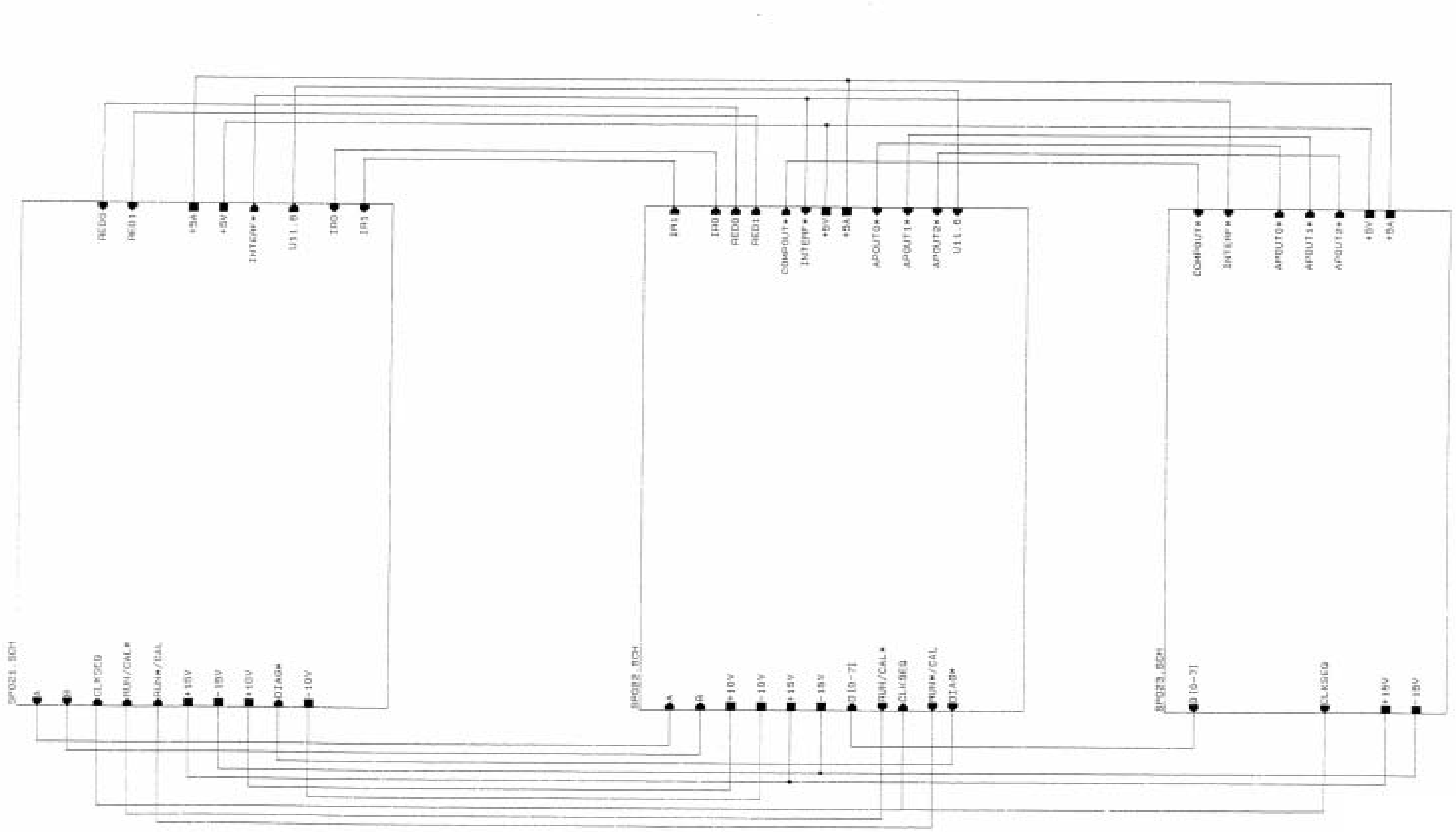

FIGURE 5-17 SpO_2 Board
0387-00-0482
Sheet 4 of 4

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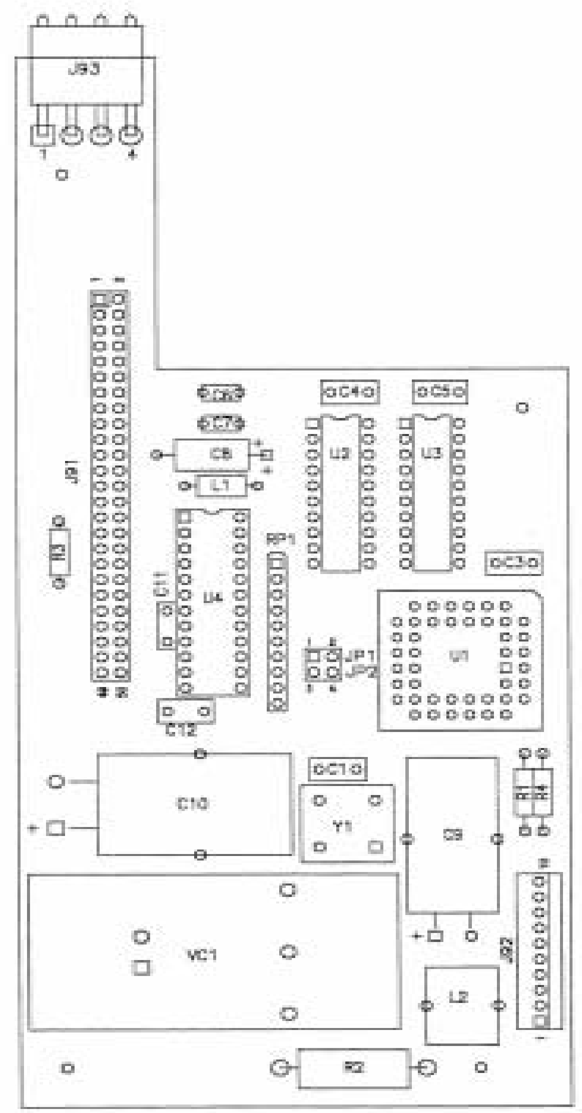


FIGURE 5-18 CO_2 Interface Module
0670-00-0497

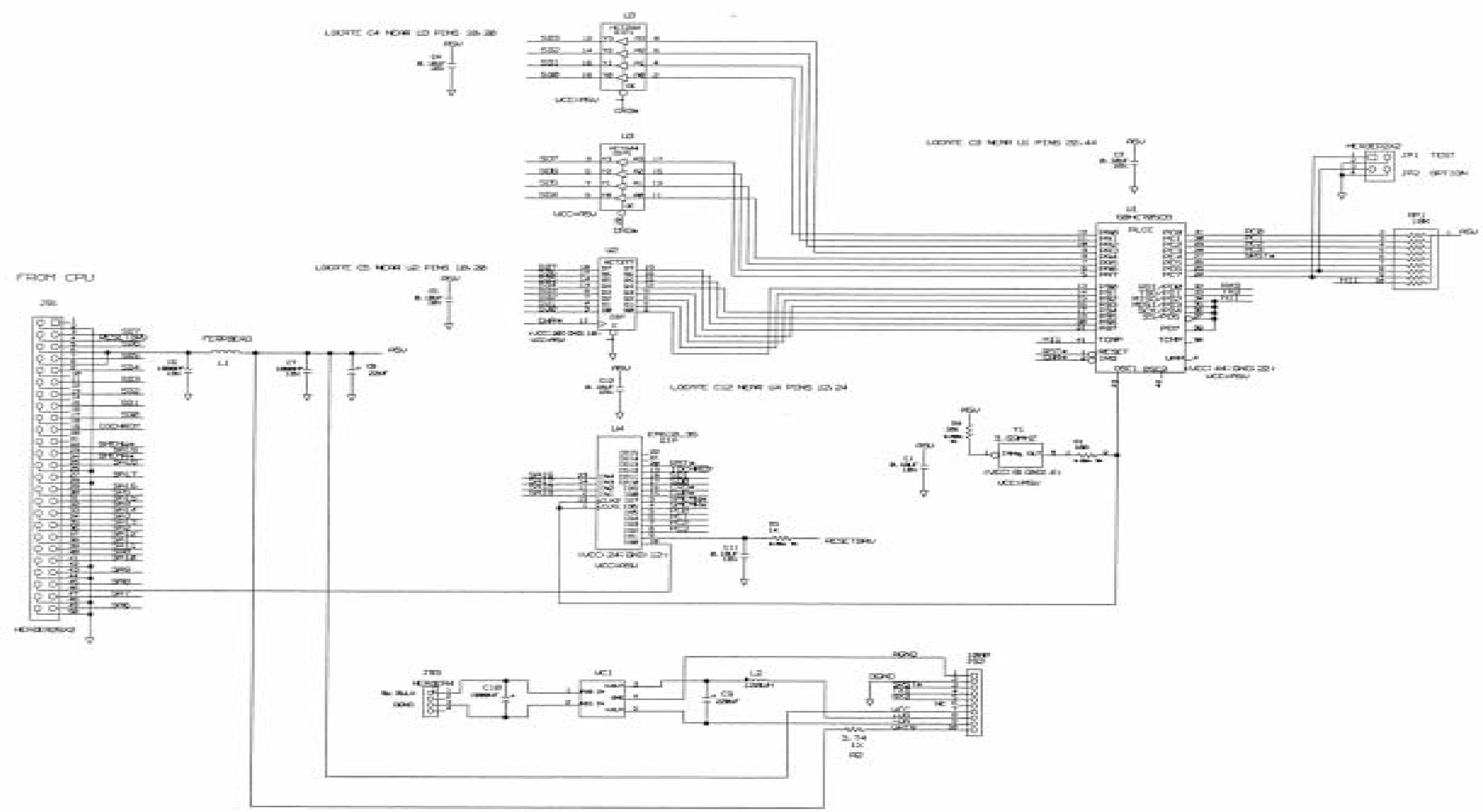


FIGURE 5-19 CO_2 Interface Module Board
0387-00-0497

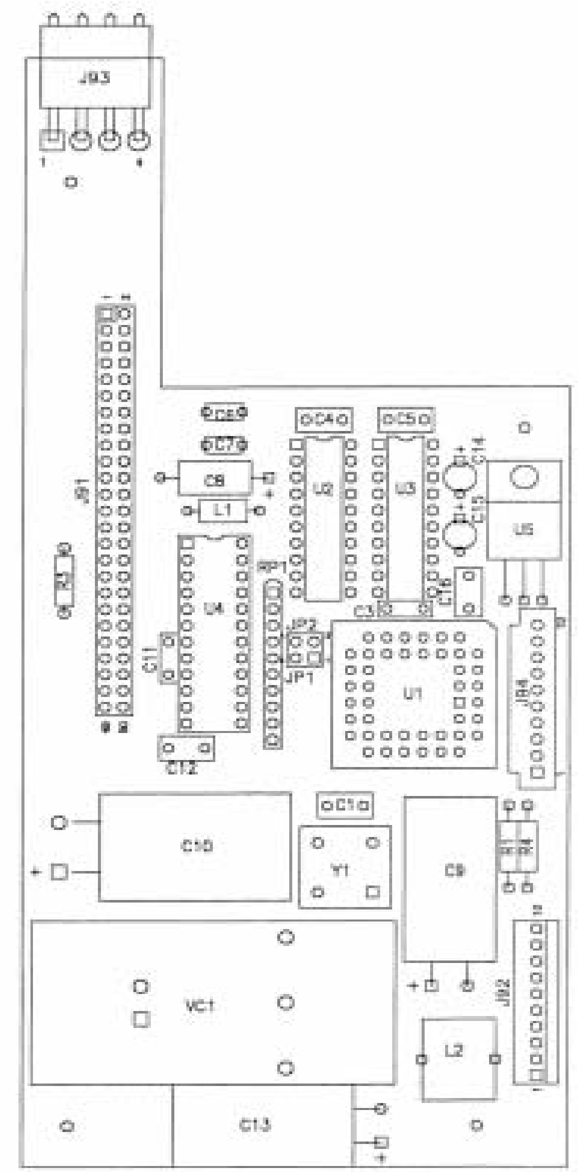


FIGURE 5-20 CO_2 Interface Module
0670-00-0632

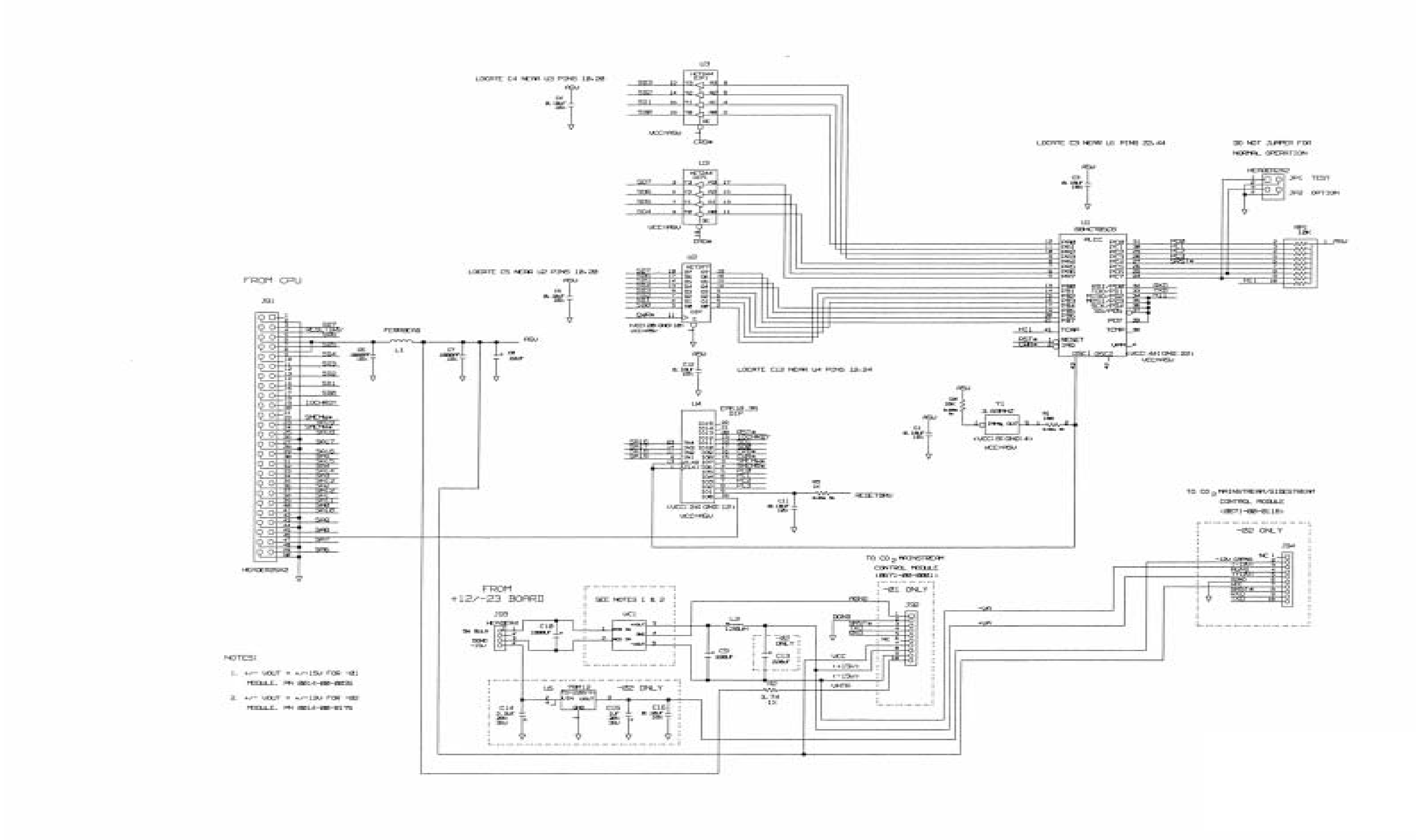


FIGURE 5-21 CO_2 Interface Module Board
0387-00-0632

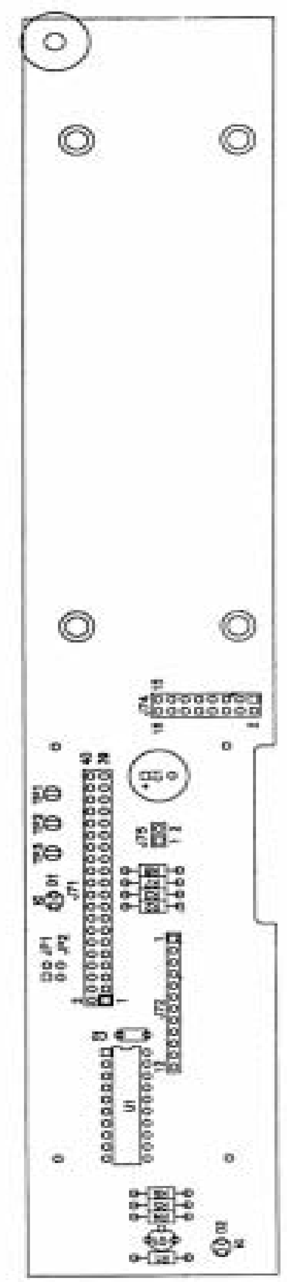


FIGURE 5-22 Planar E.L. Panel Board
0670-00-0500
0670-00-0622 (CE)

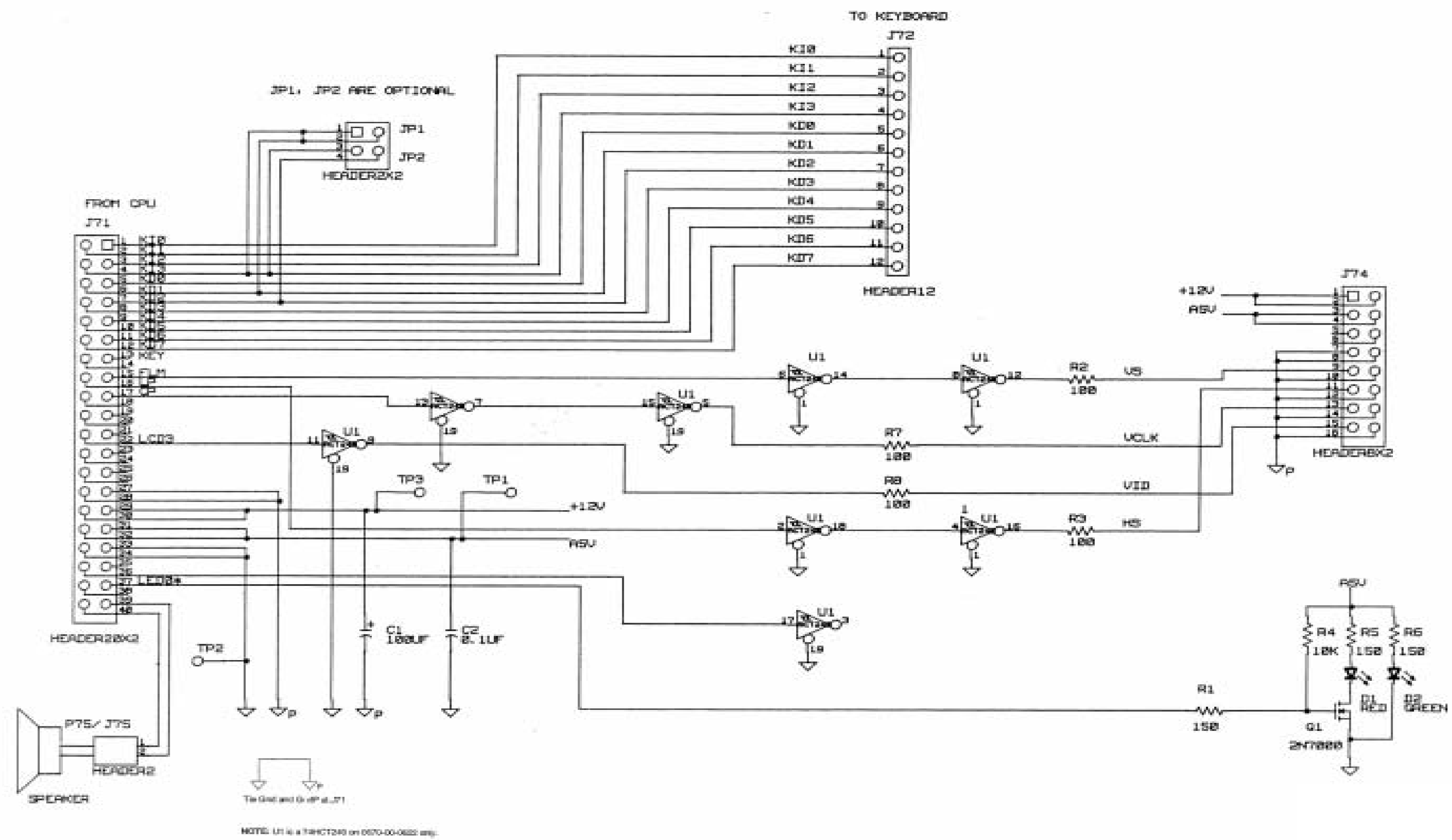


FIGURE 5-23 Planar E.L. Panel Board
0387-00-0500
0387-00-0622 (CE)

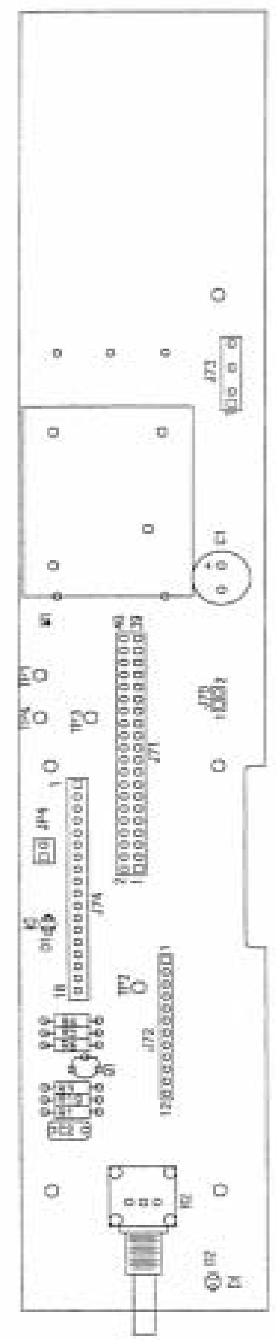


FIGURE 5-24 Panel Board
0670-00-0546

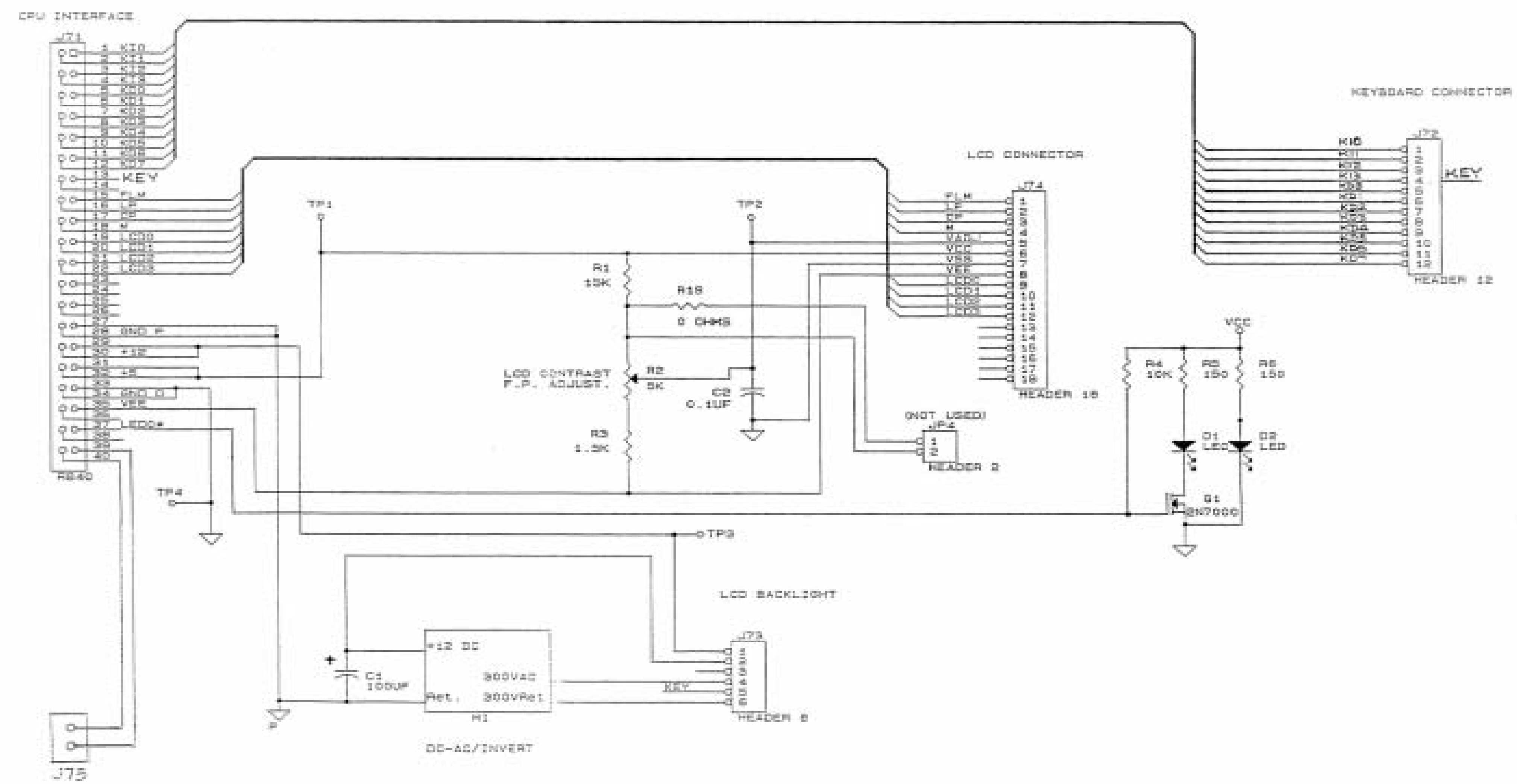


FIGURE 5-25 Panel Board
0387-00-0546

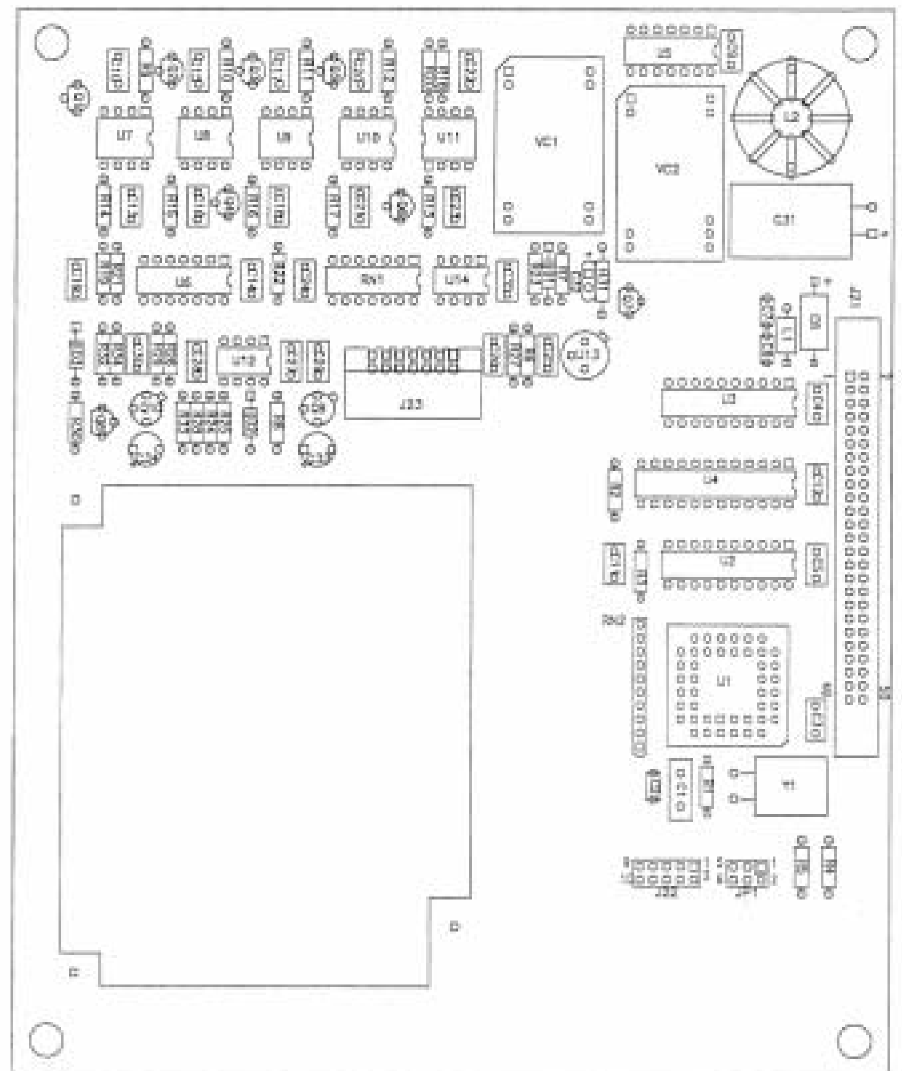


FIGURE 5-26 SpO_2 Interface Board Nellcor
0670-00-0557

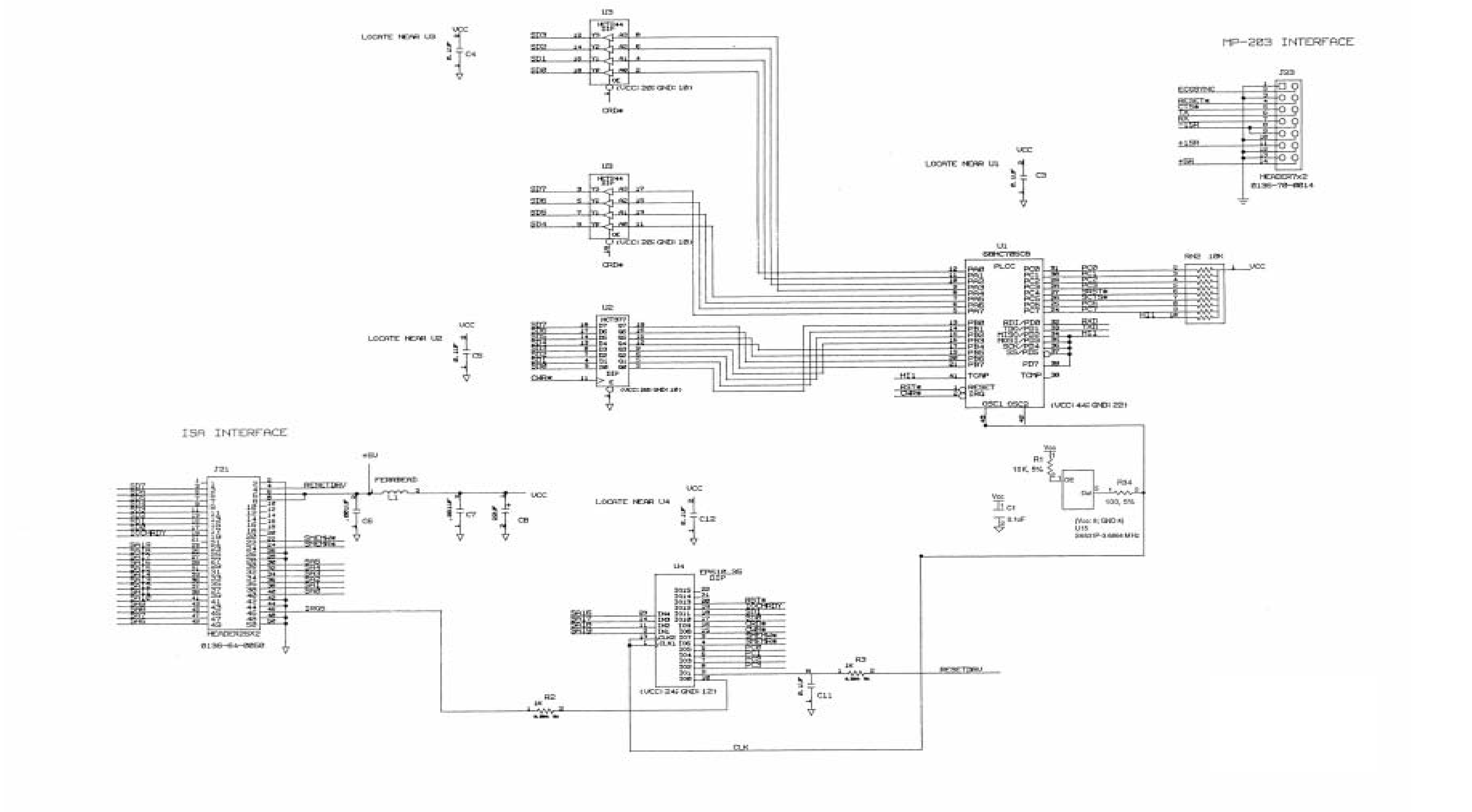


FIGURE 5-27 SpO_2 Interface Board Nellcor
0387-00-0557
Sheet 1 of 3

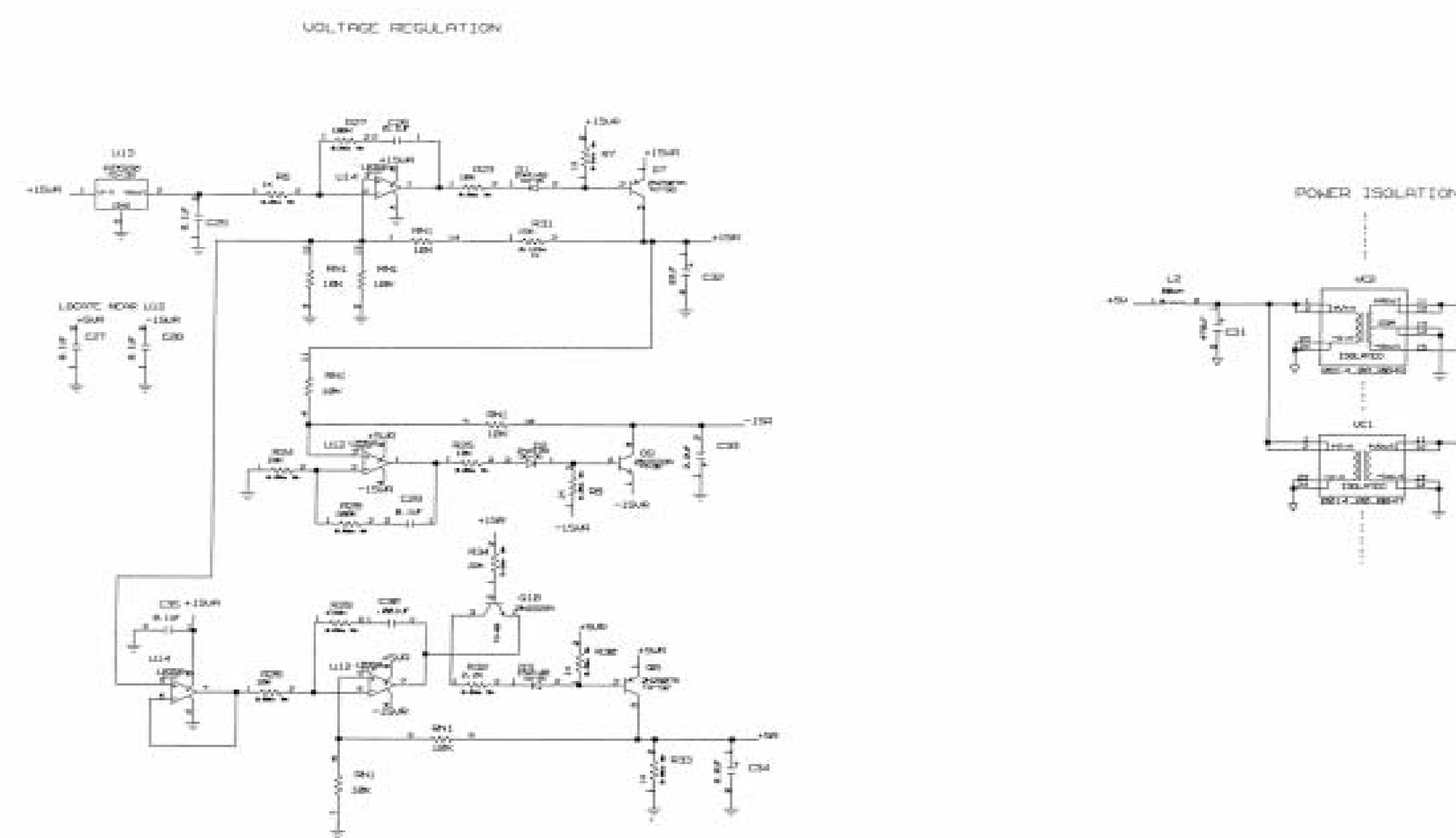


FIGURE 5-28 SpO_2 Interface Board Nellcor
0387-00-0557
Sheet 2 of 3

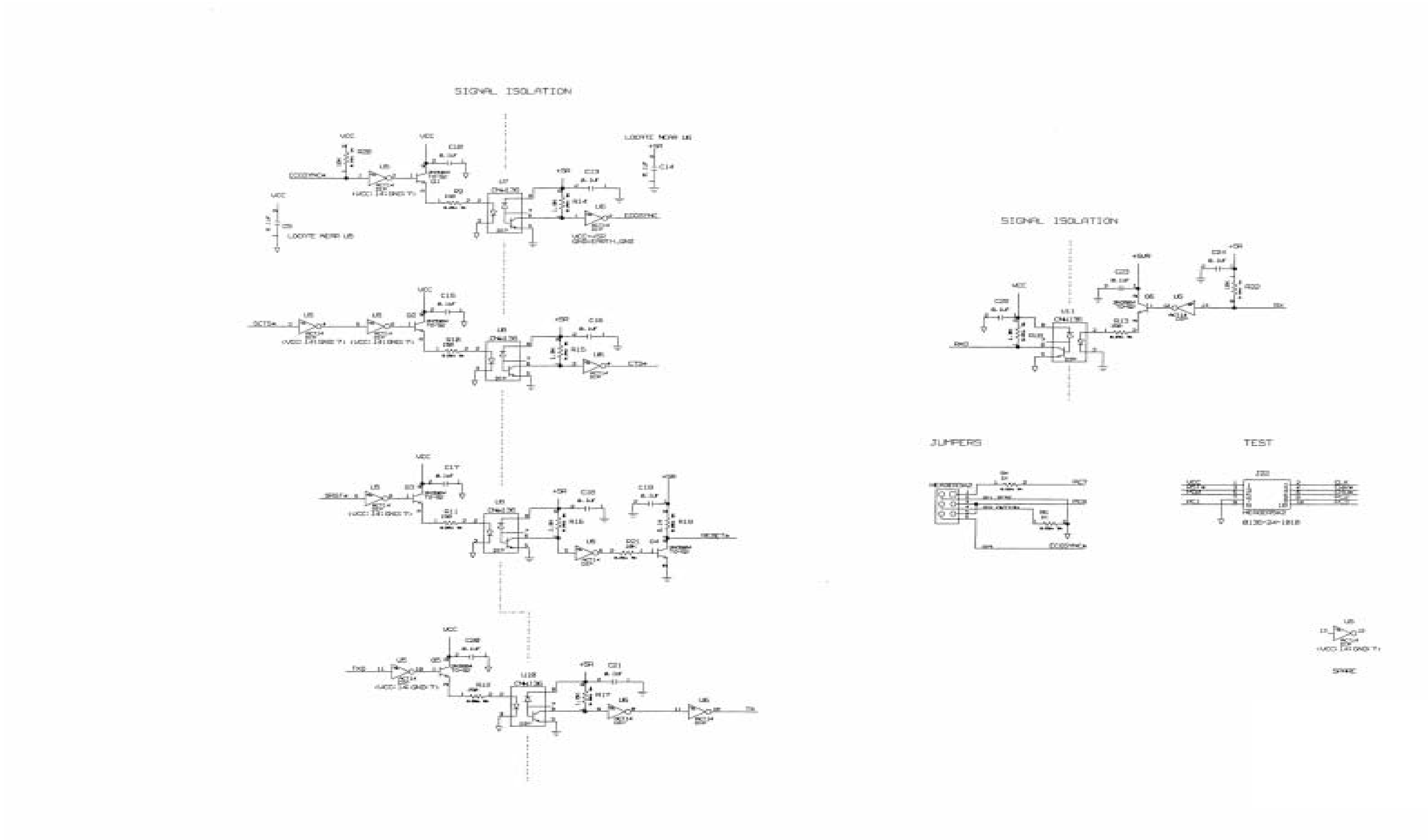


FIGURE 5-29 SpO_2 Interface Board Nellcor
0387-00-0557
Sheet 3 of 3

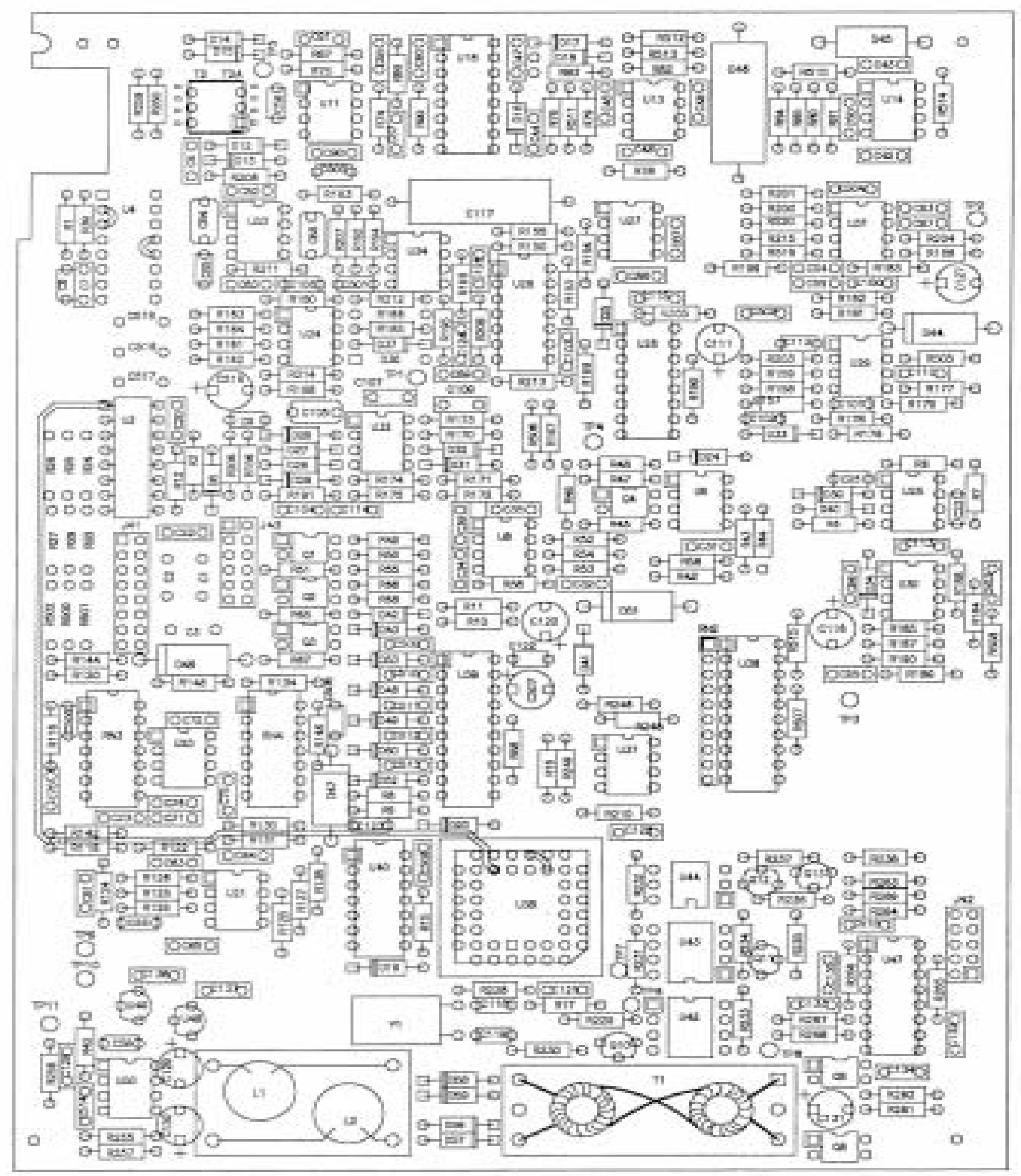


FIGURE 5-30 Front End Board
0670-00-0560-03 / 04 (5L-CE)

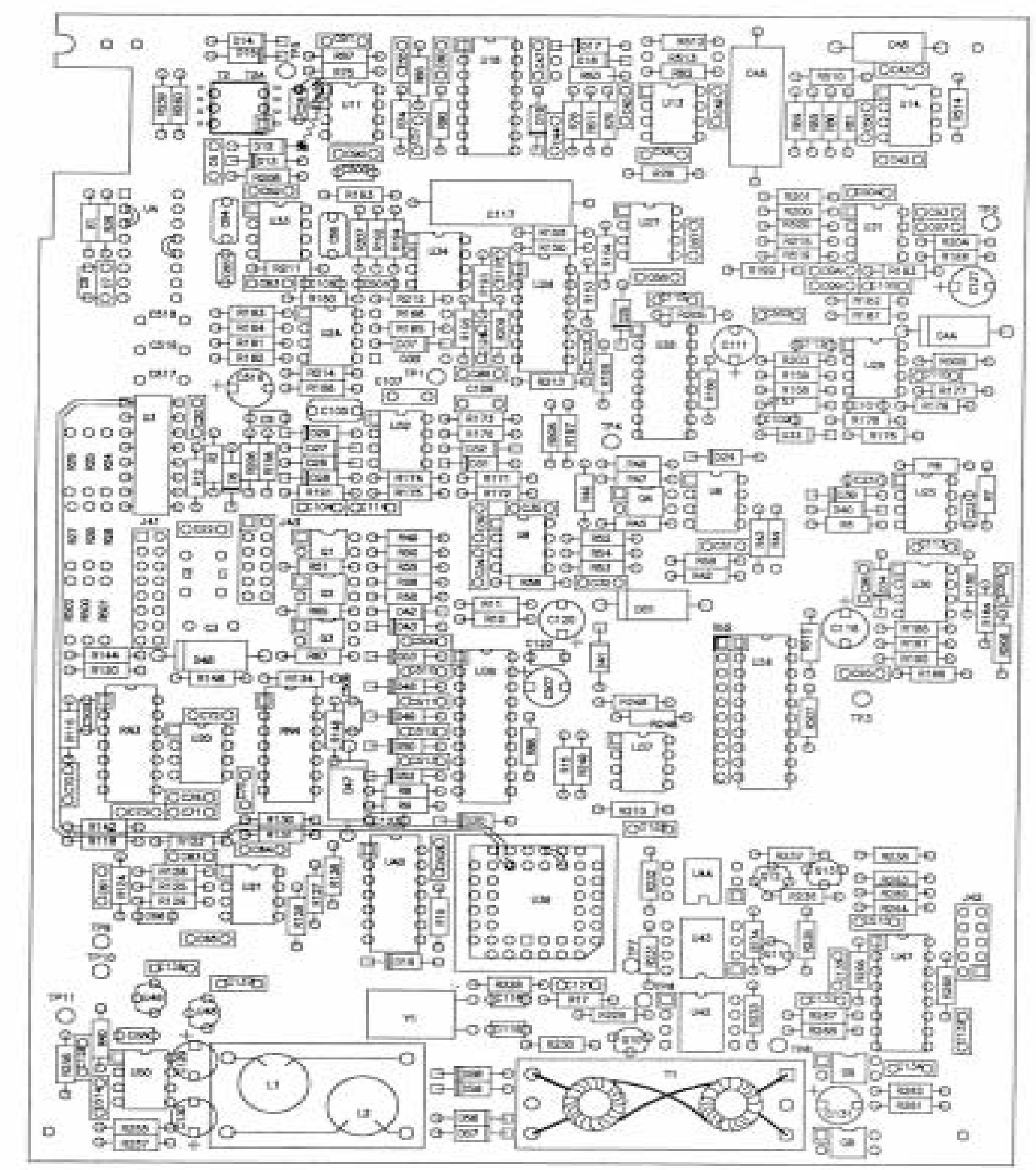
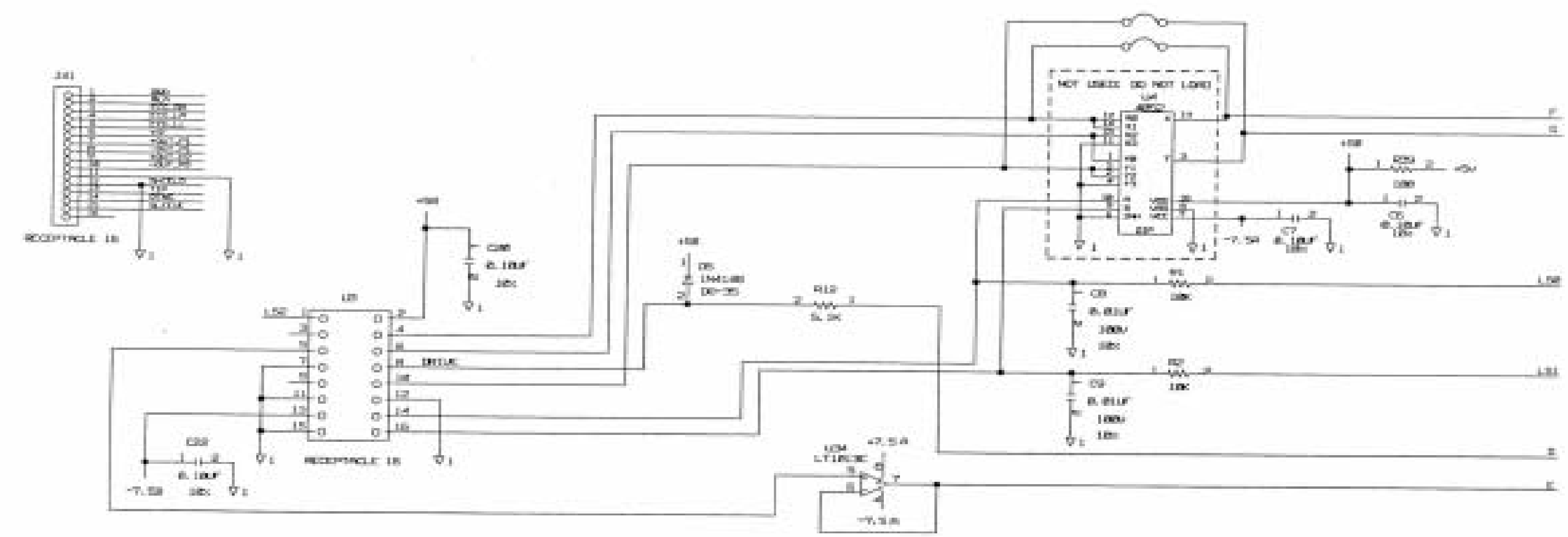


FIGURE 5-31 Front End Board
0670-00-0624-01 / 02 (5L-CE)



NOTE: Additional parts specific to 0870-00-0624-XX Board only are noted.

FIGURE 5-32 Front End Board
0387-00-0560-XX
0387-00-0624-XX (5L-CE)
Sheet 1 of 7

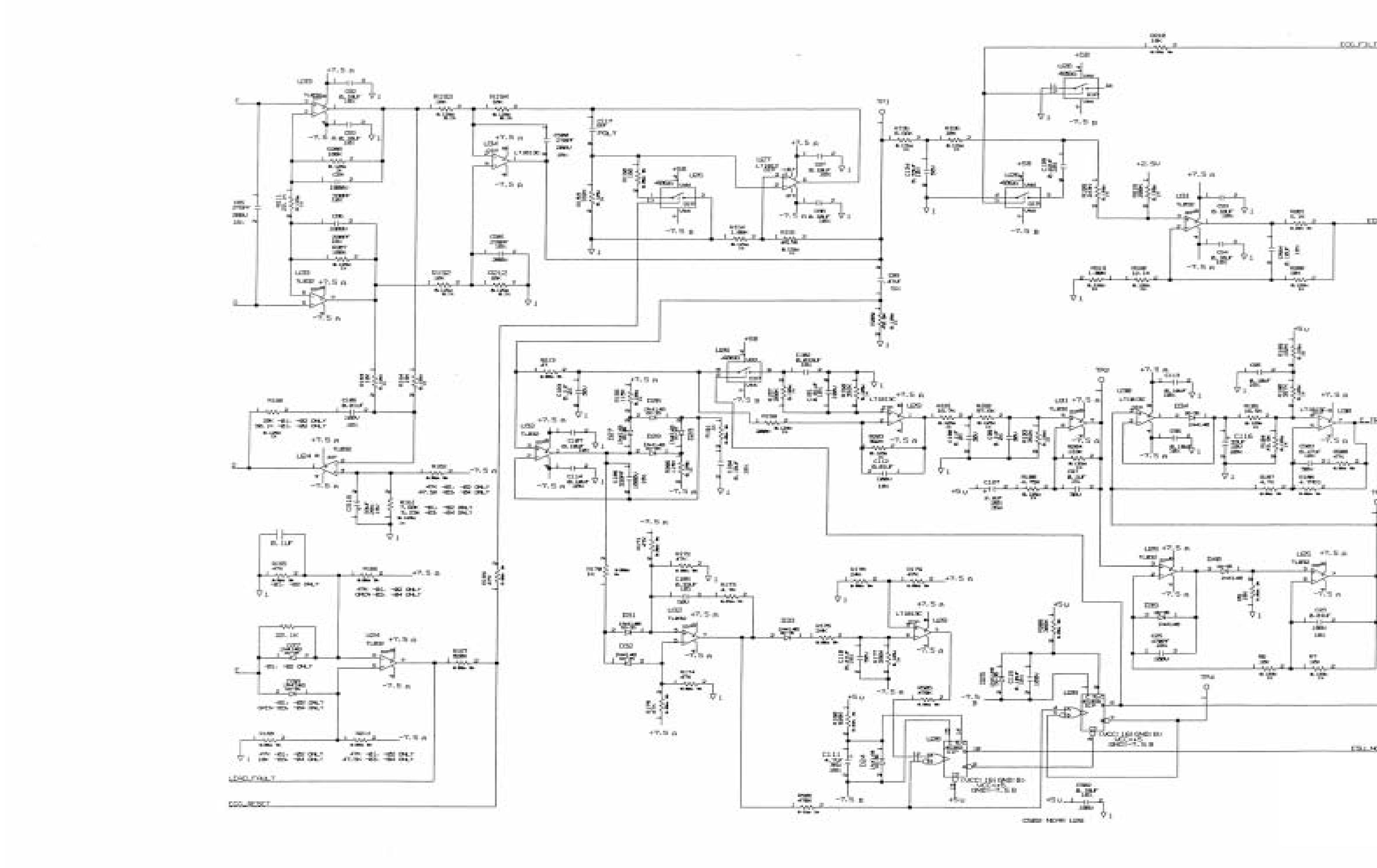


FIGURE 5-33 Front End Board
0387-00-0560-XX
0387-00-0624-XX (5L-CE)
Sheet 2 of 7

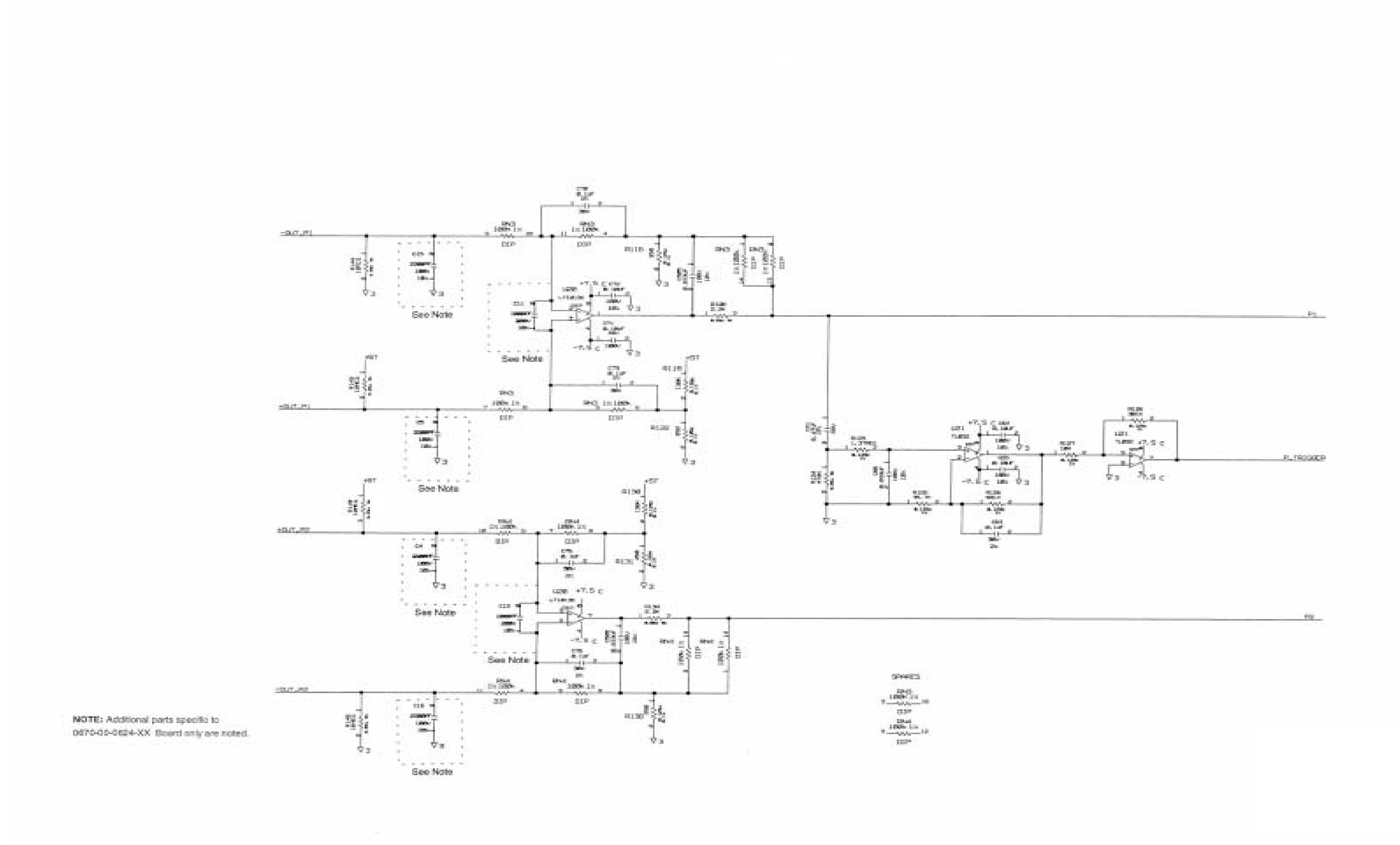


FIGURE 5-34 Front End Board
0387-00-0560-XX
0387-00-0624-XX (5L-CE)
Sheet 3 of 7

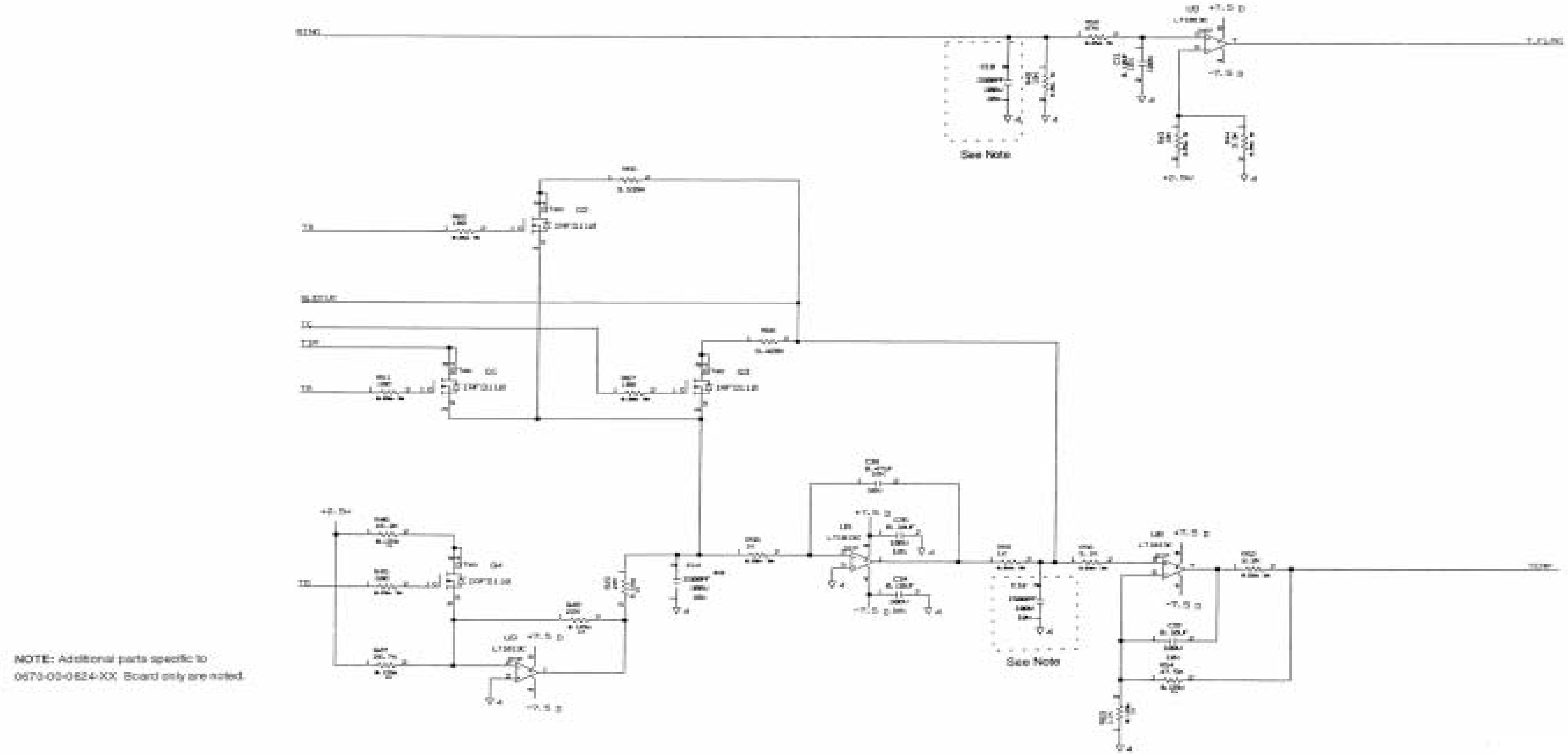


FIGURE 5-35 Front End Board
0387-00-0560-XX
0387-00-0624-XX (5L-CE)
Sheet 4 of 7

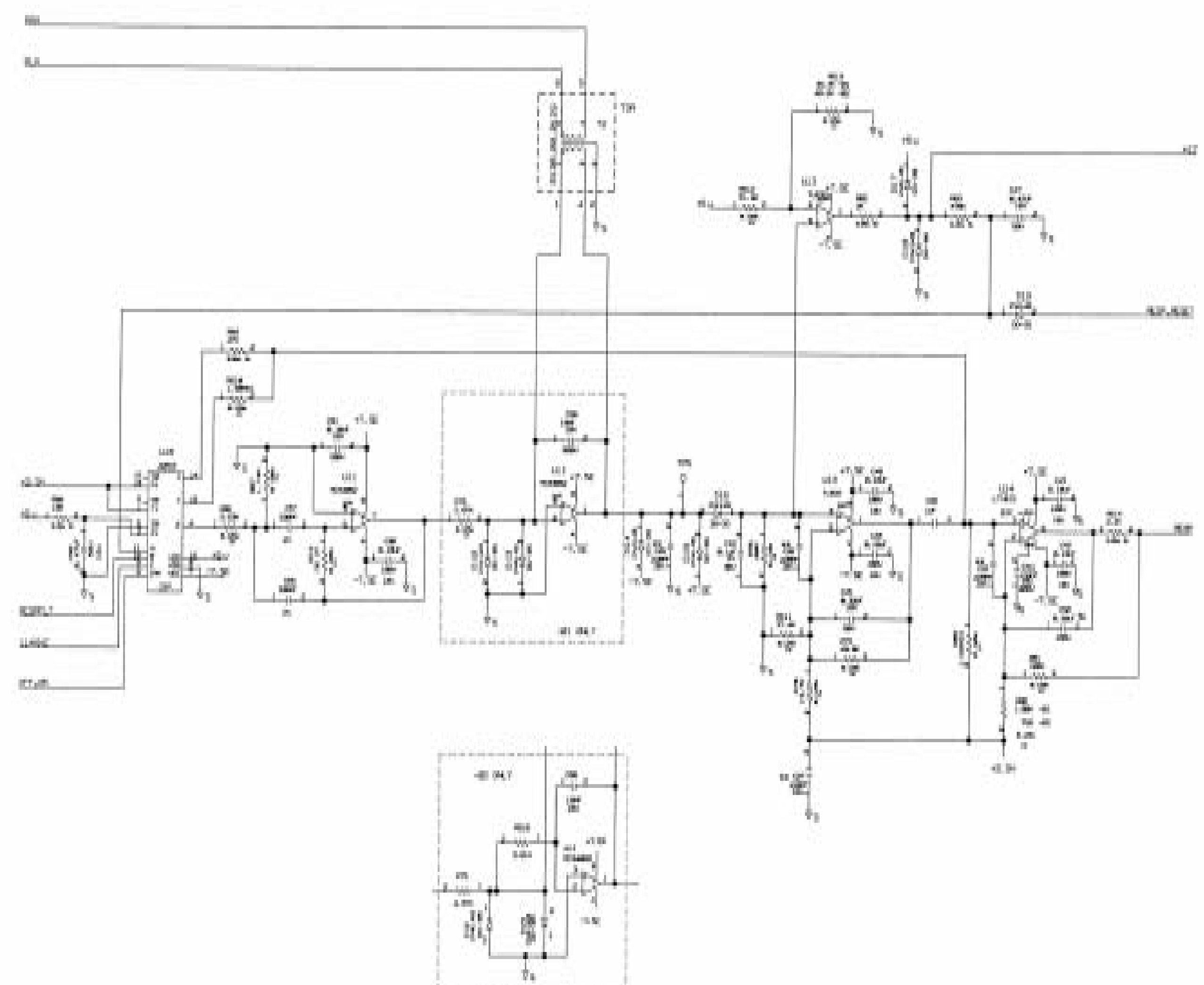


FIGURE 5-36 Front End Board
0387-00-0560-XX
0387-00-0624-XX (5L-CE)
Sheet 5 of 7

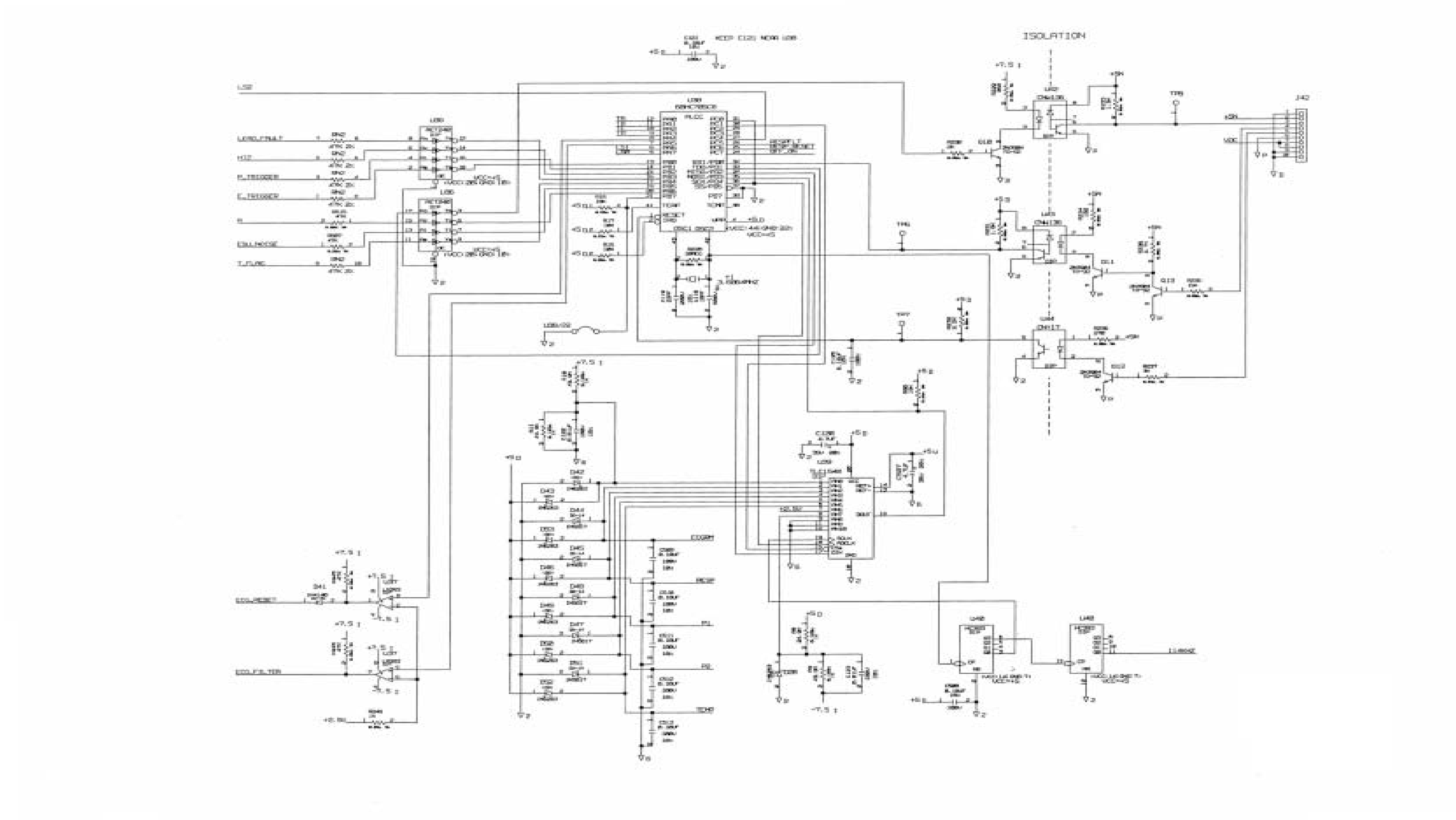


FIGURE 5-37 Front End Board
0387-00-0560-XX
0387-00-0624-XX (5L-CE)
Sheet 6 of 7

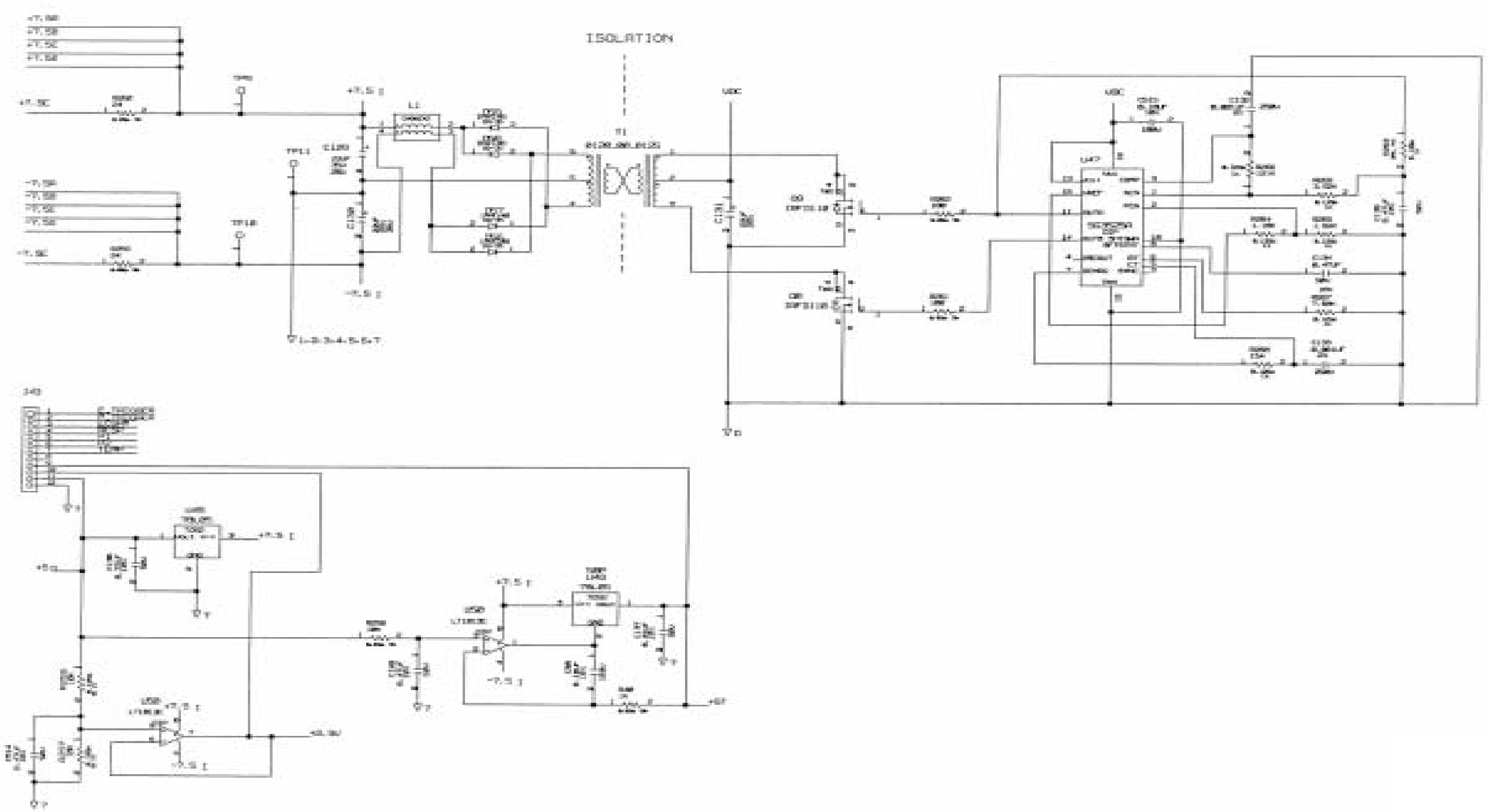
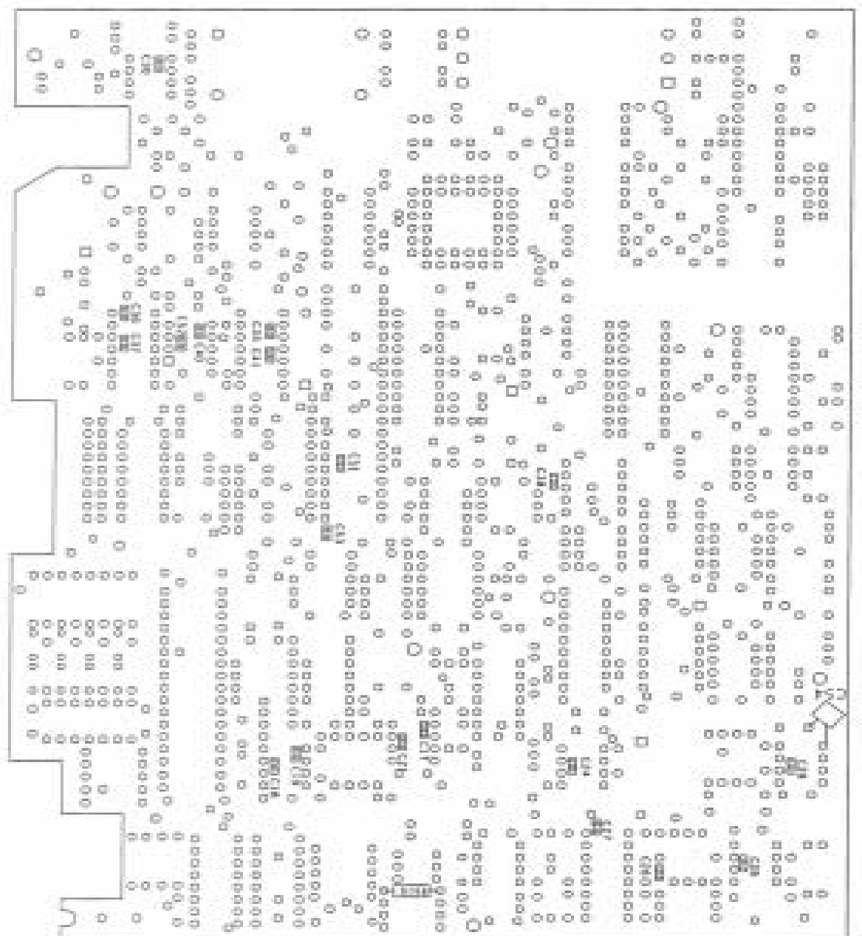
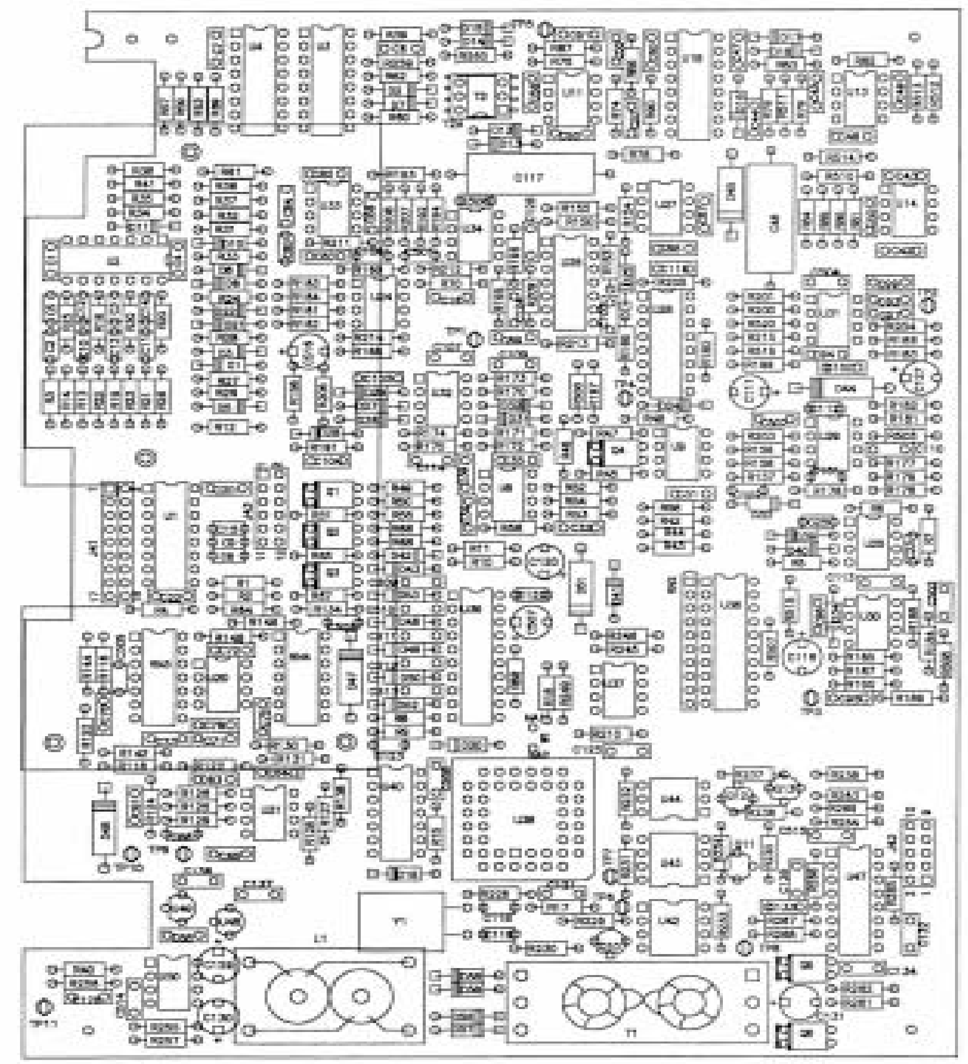


FIGURE 5-38 Front End Board
0387-00-0560-XX
0387-00-0624-XX (5L-CE)
Sheet 7 of 7



Bottom Side



Top Side

FIGURE 5-39 Front End Board
0670-00-0620-01/02 (XG-CE)

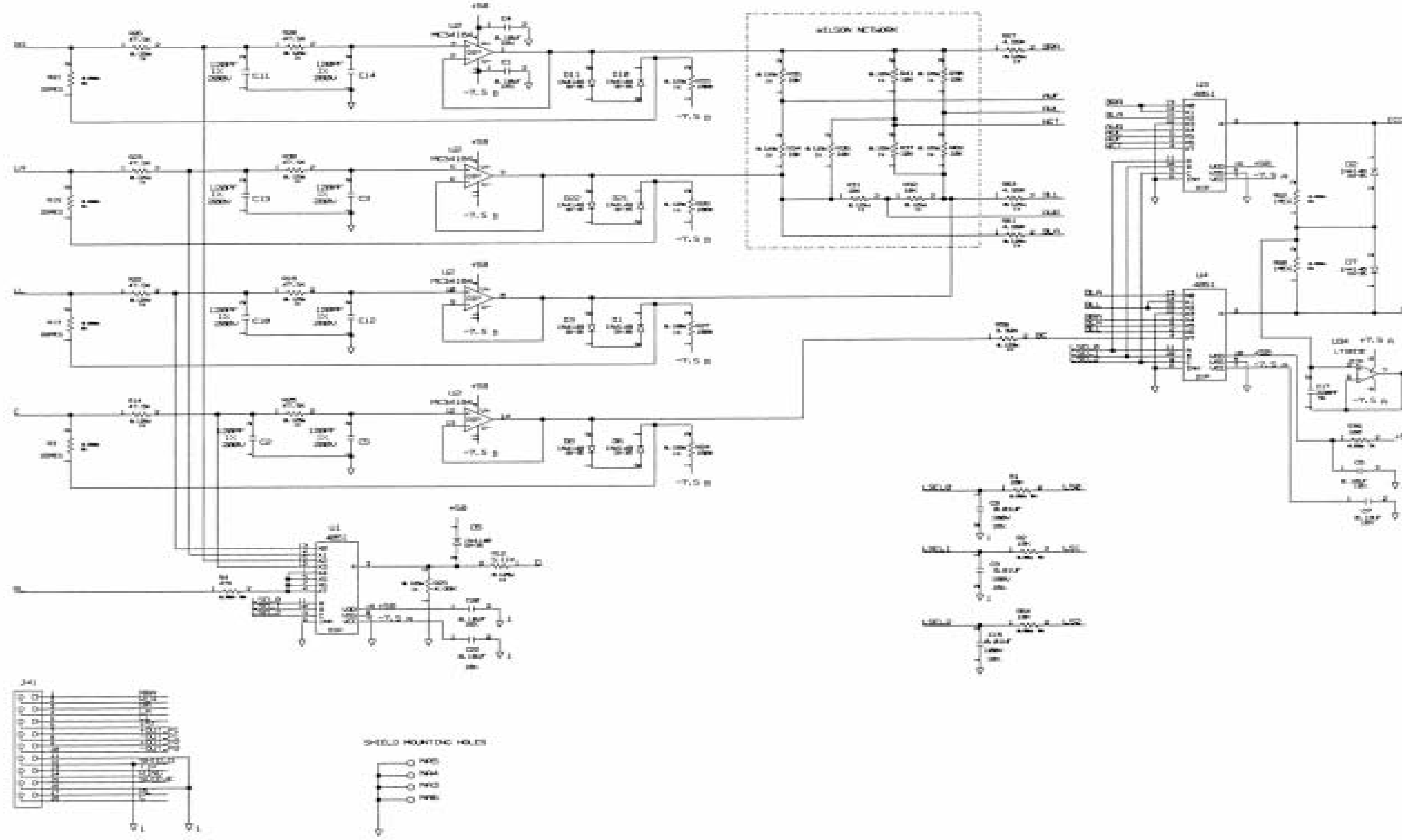


FIGURE 5-40 Front End Board
0387-00-0620-XX (XE-CE)
Sheet 1 of 7

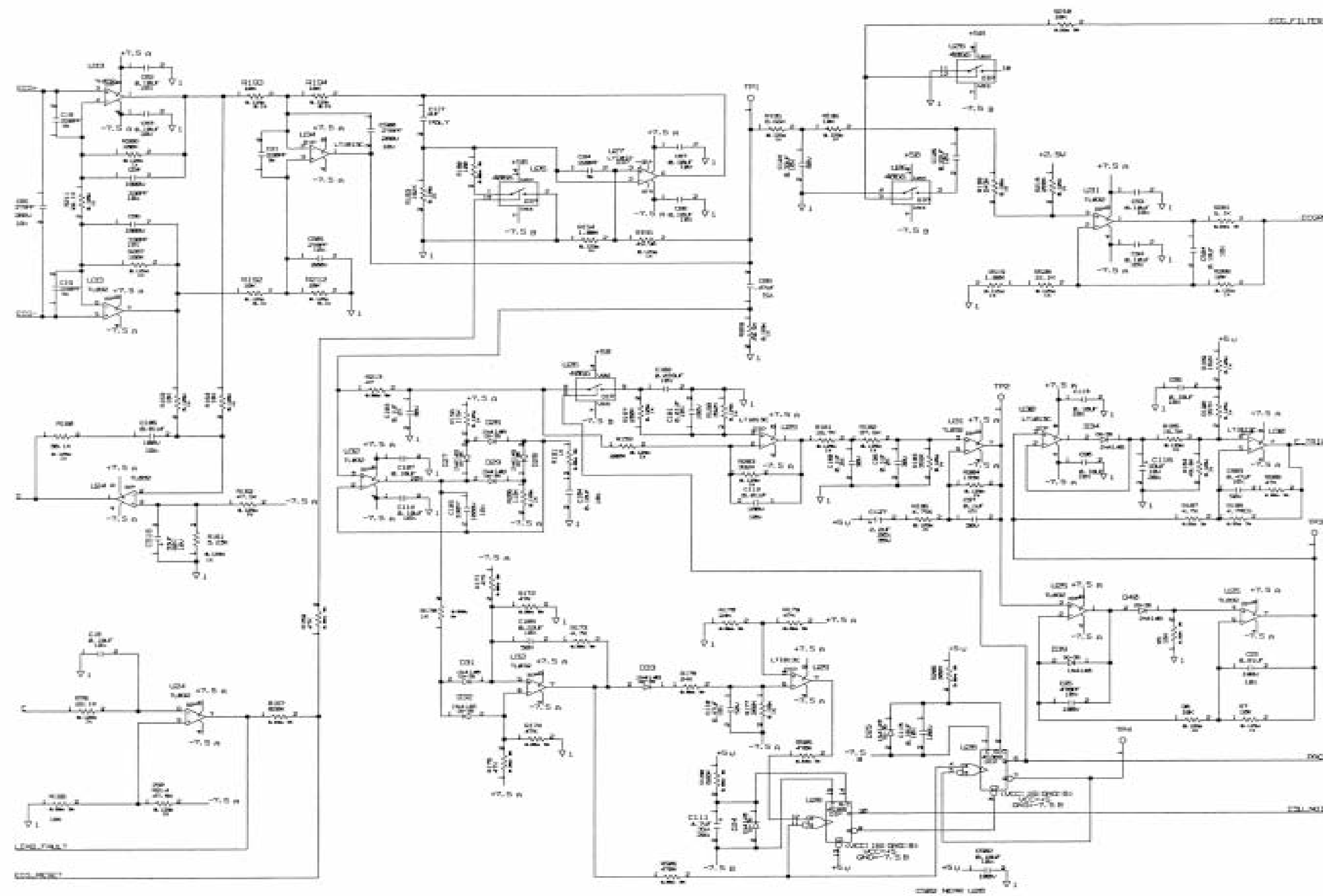


FIGURE 5-41 Front End Board
0387-00-0620-XX (XE-CE)
Sheet 2 of 7

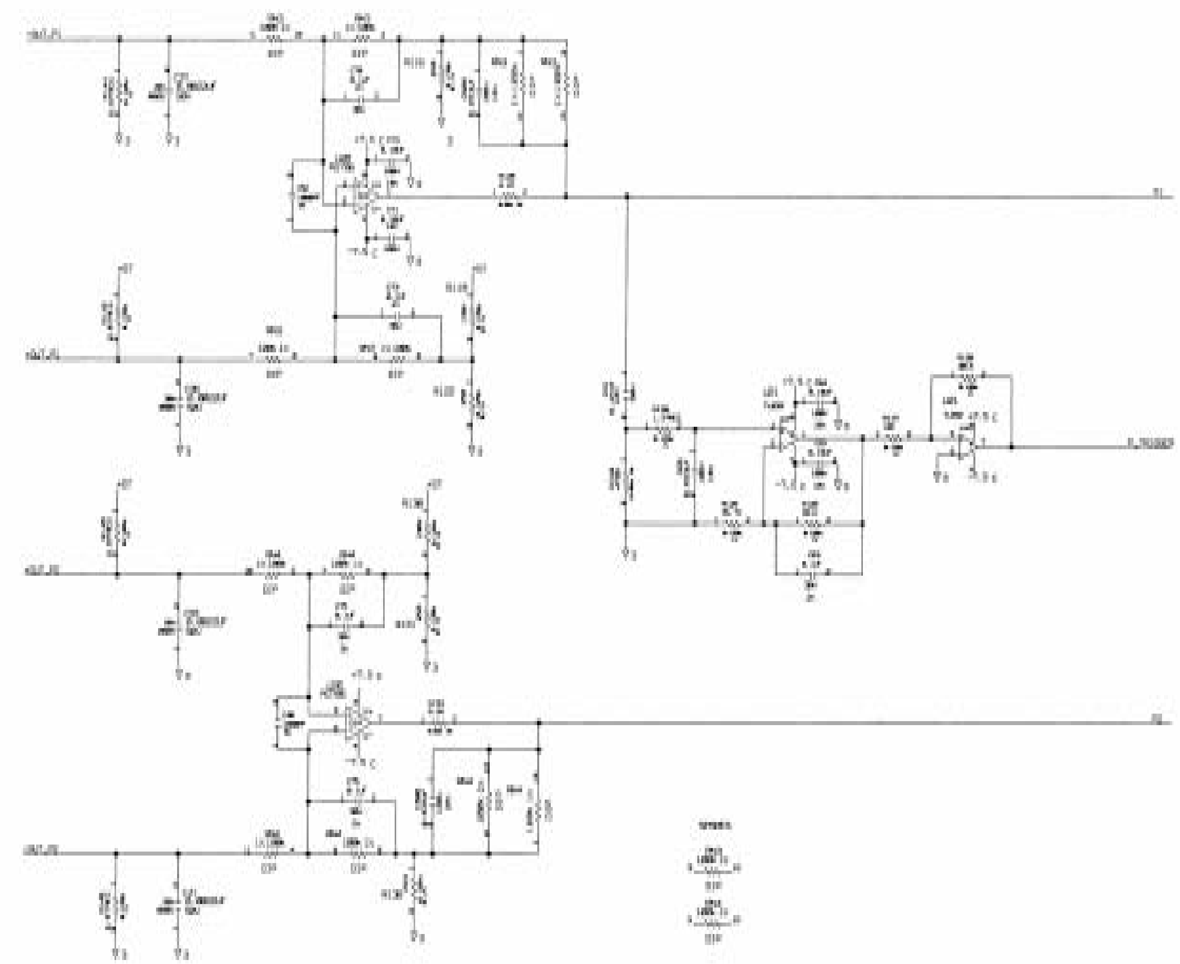


FIGURE 5-42 Front End Board
0387-00-0620-XX (XE-CE)
Sheet 3 of 7

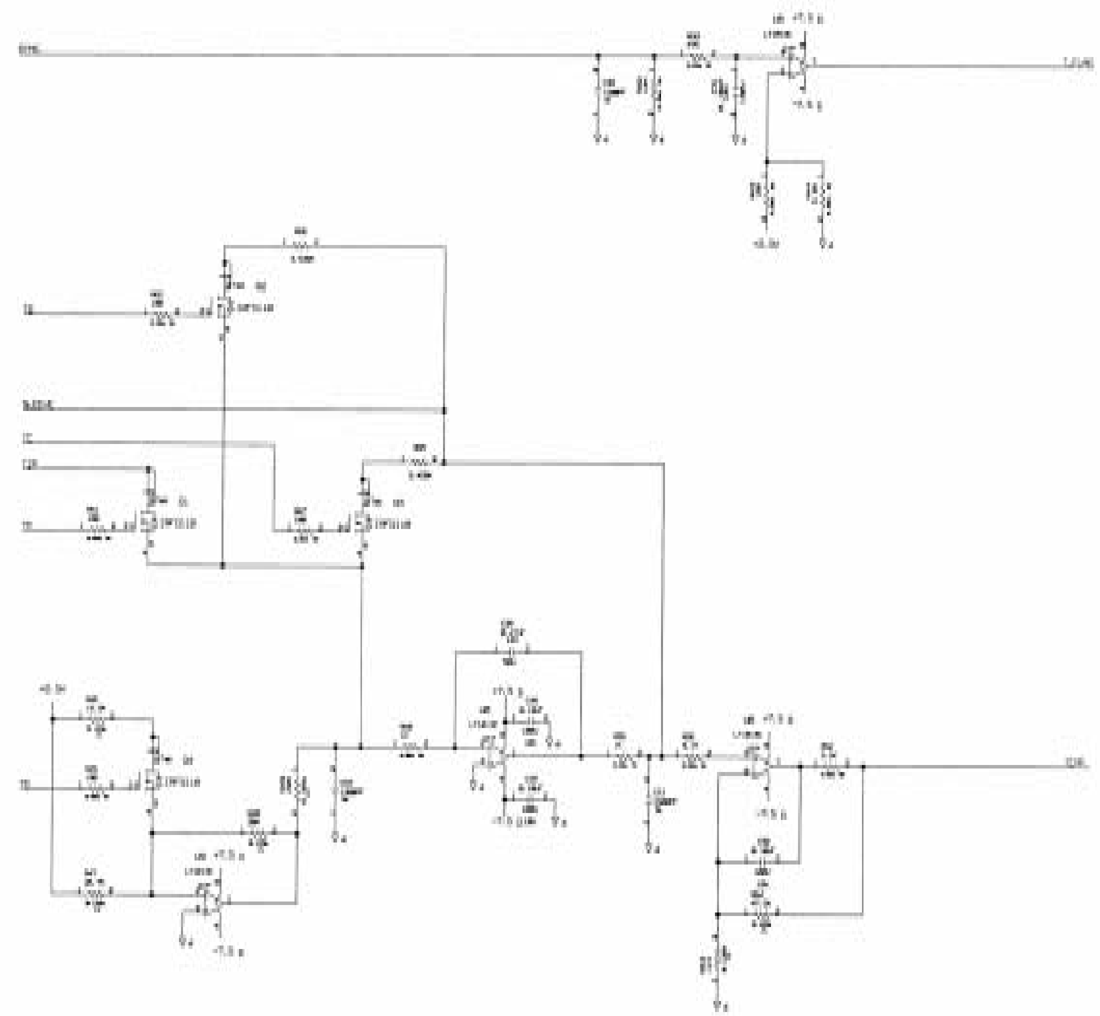


FIGURE 5-43 Front End Board
0387-00-0620-XX (XE-CE)
Sheet 4 of 7

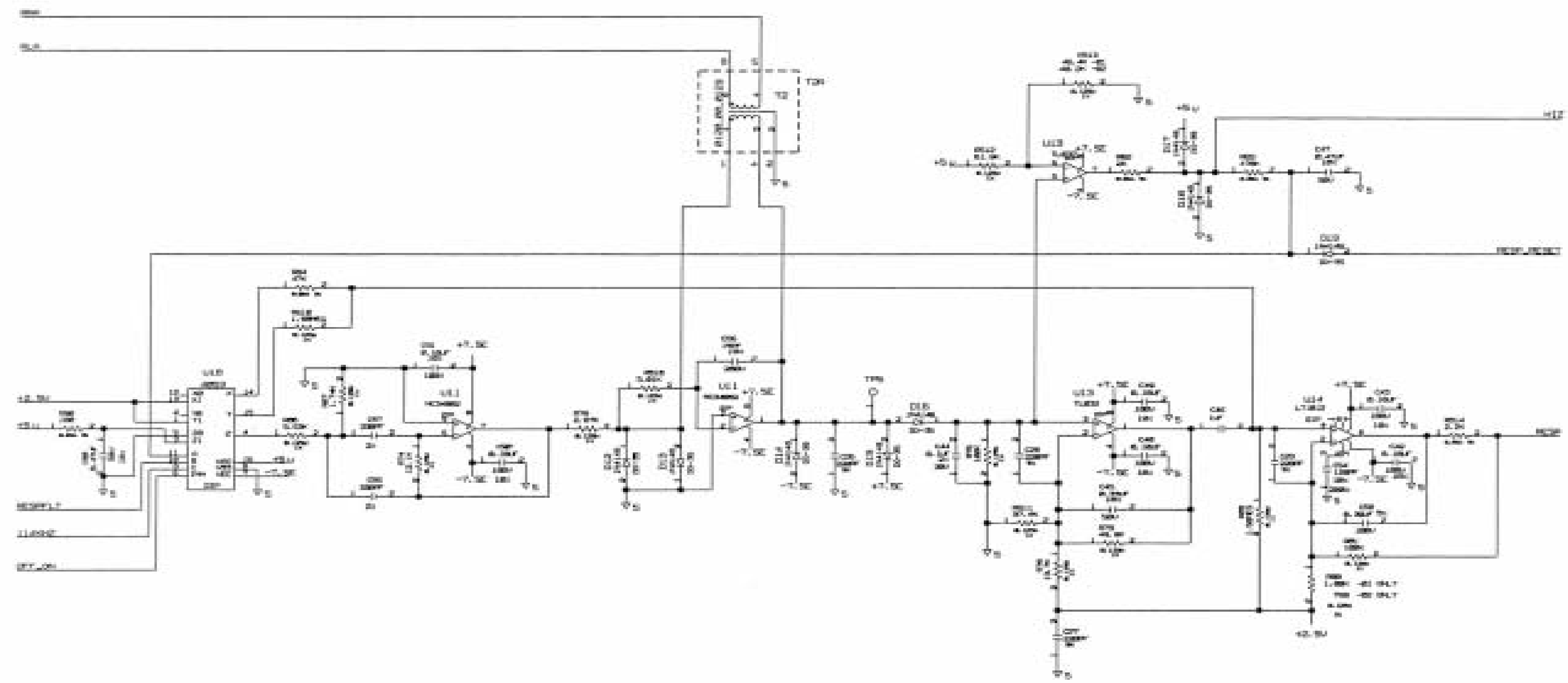


FIGURE 5-44 Front End Board
0387-00-0620-XX (XE-CE)
Sheet 5 of 7

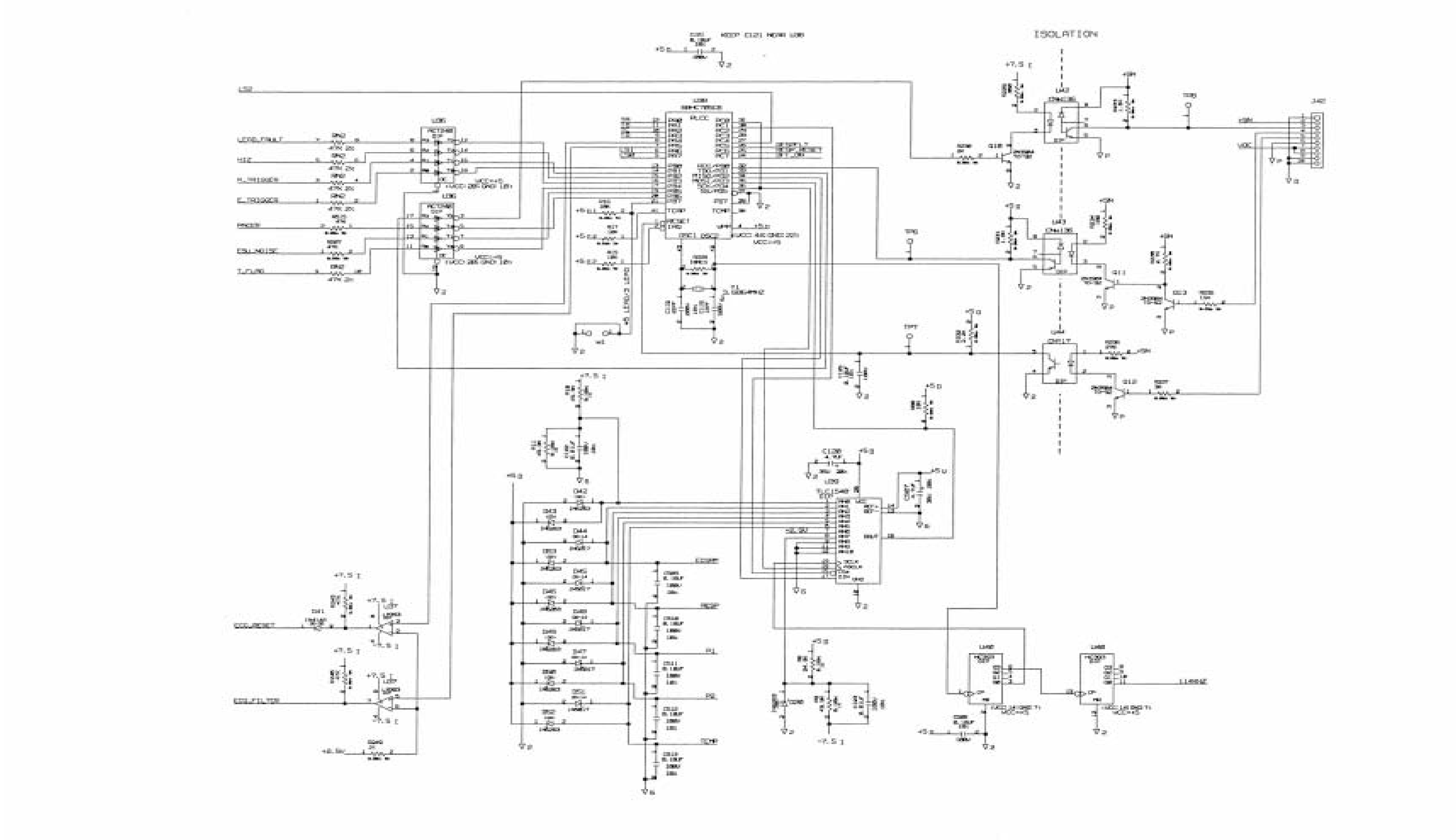


FIGURE 5-45 Front End Board
0387-00-0620-XX (XE-CE)
Sheet 6 of 7

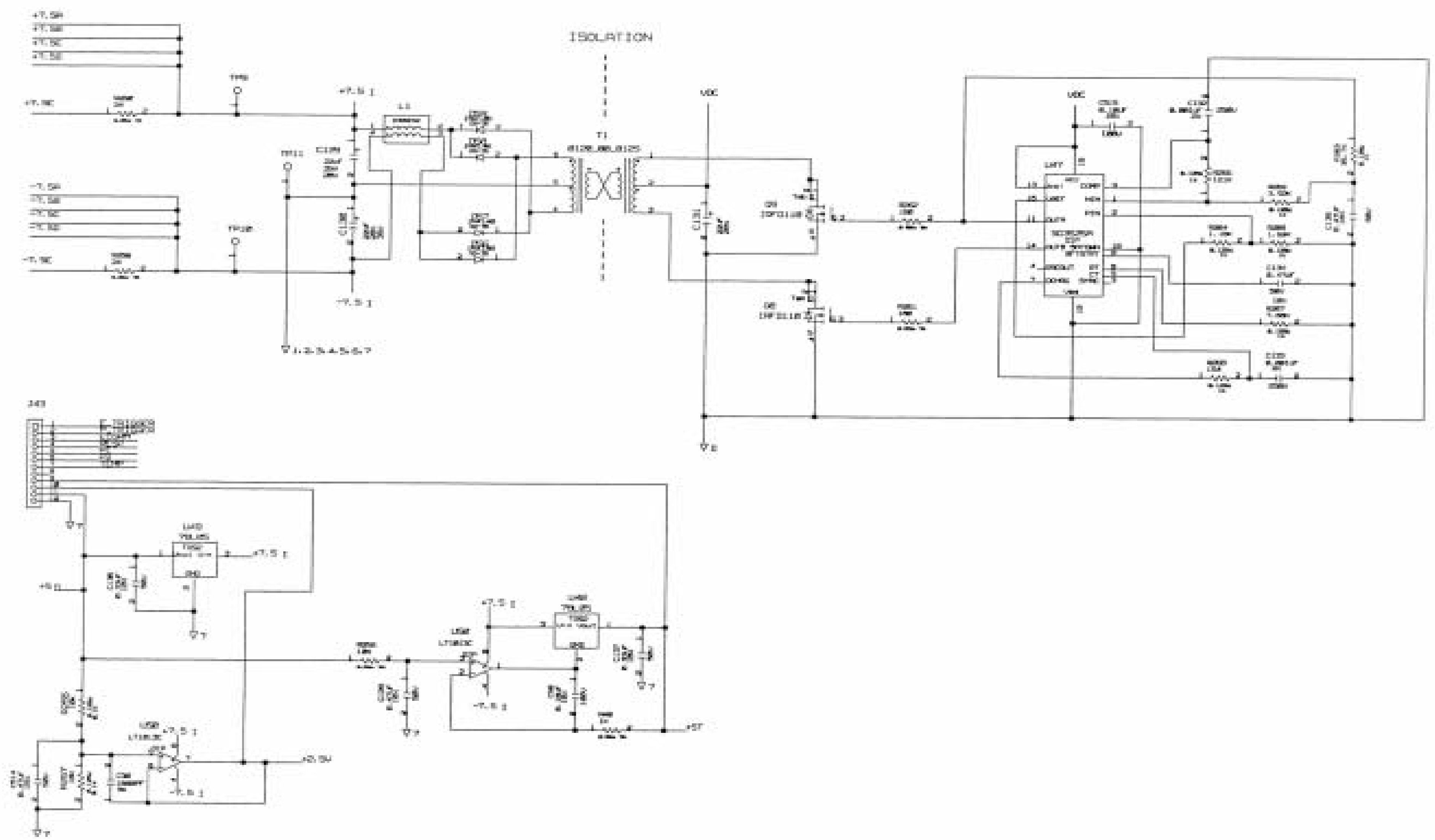


FIGURE 5-46 Front End Board
0387-00-0620-XX (XE-CE)
Sheet 7 of 7

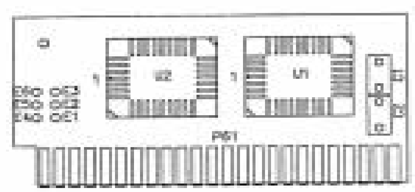


FIGURE 5-47 Datasette Board
0670-00-0561

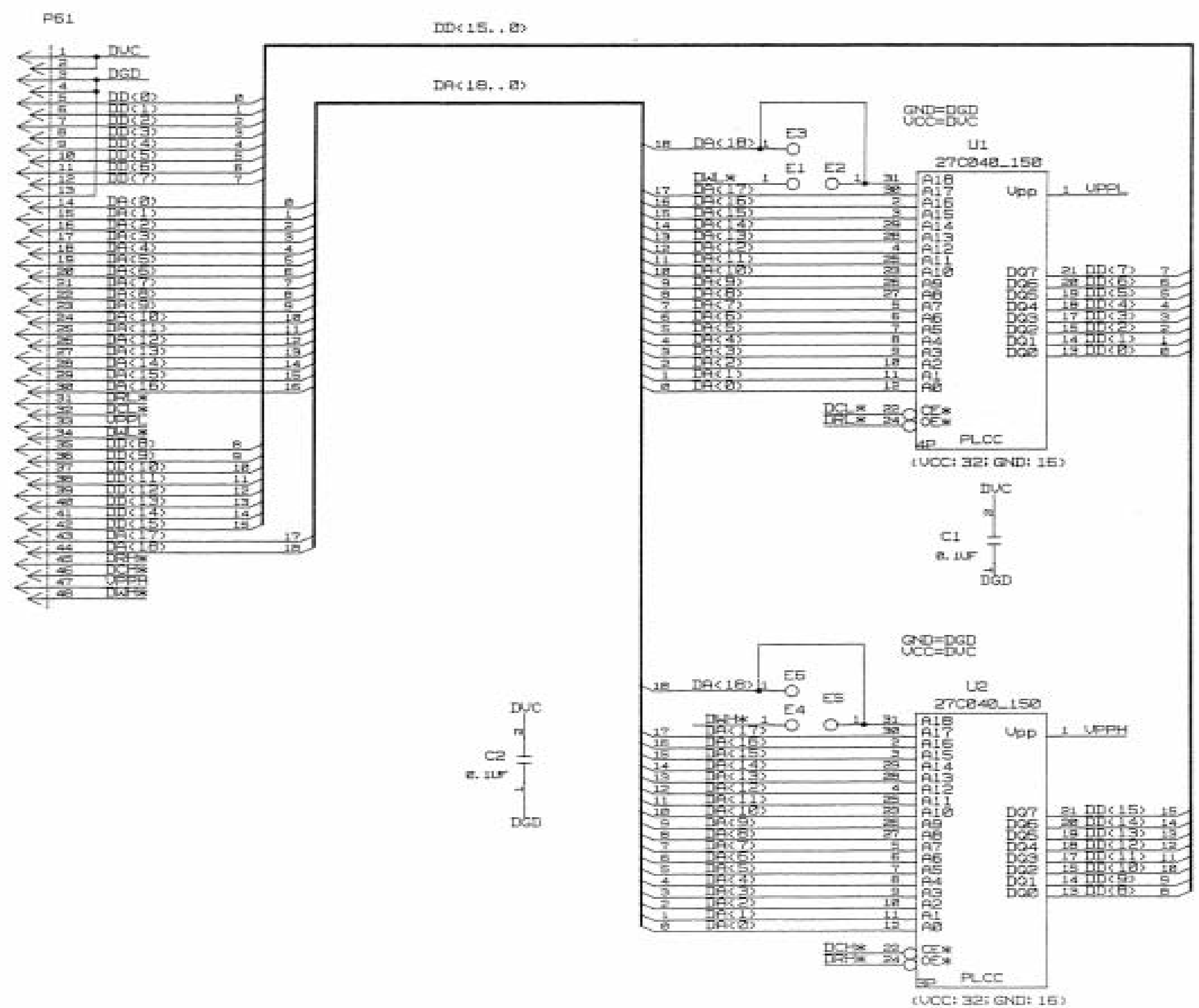


FIGURE 5-48 Datasette Board
0387-00-0561

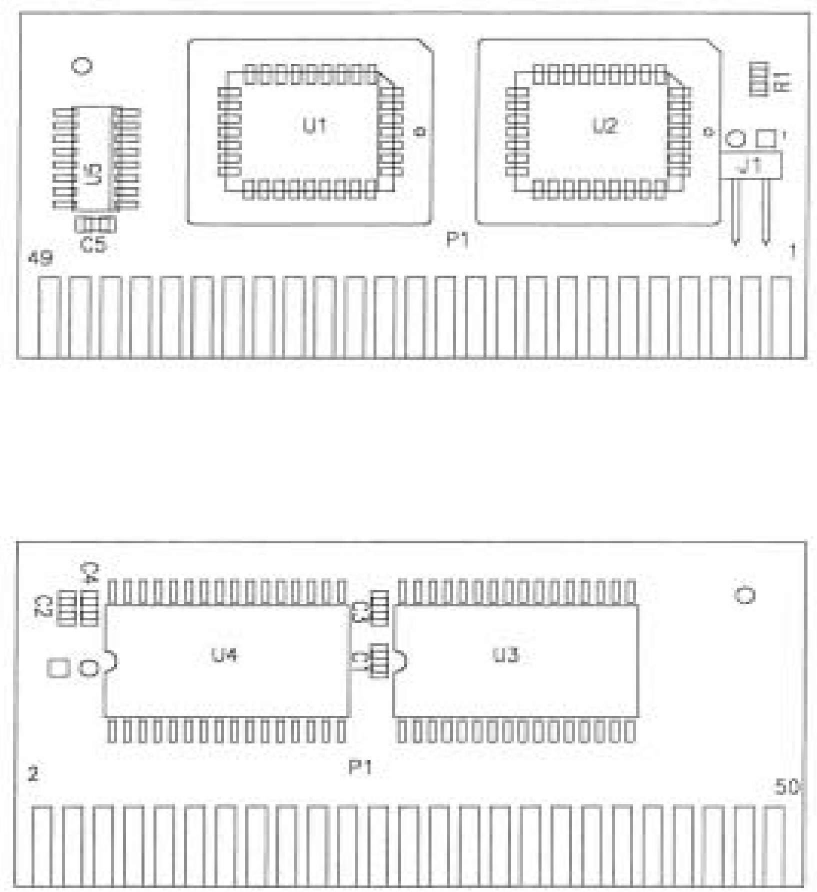


FIGURE 5-49 Datasette Board
0670-00-0574-01
0670-00-0574-03
0670-00-0574-04
0670-00-0574-05

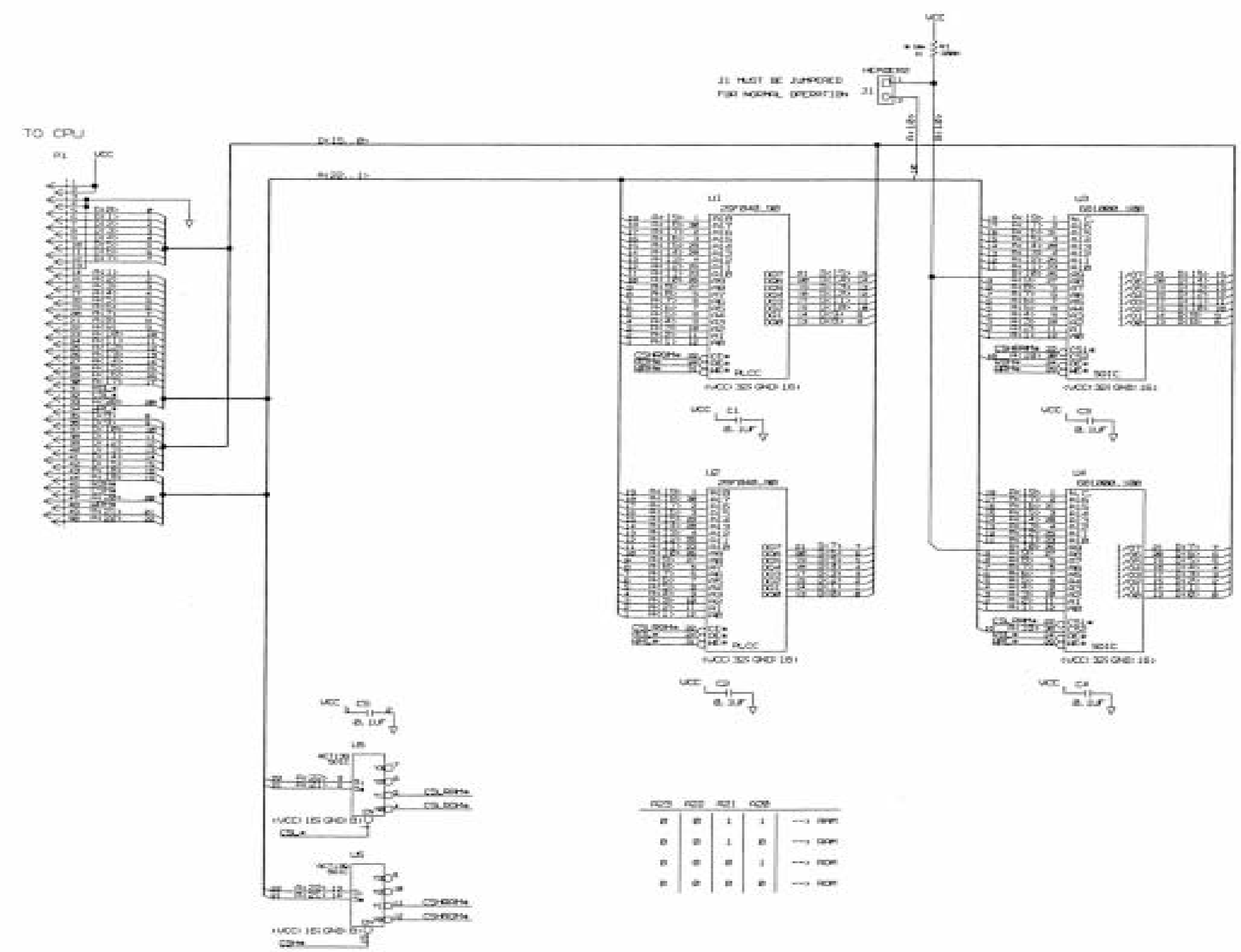


FIGURE 5-50 Datasette Board
0387-00-0574-01
0387-00-0574-03
0387-00-0574-04
0387-00-0574-05

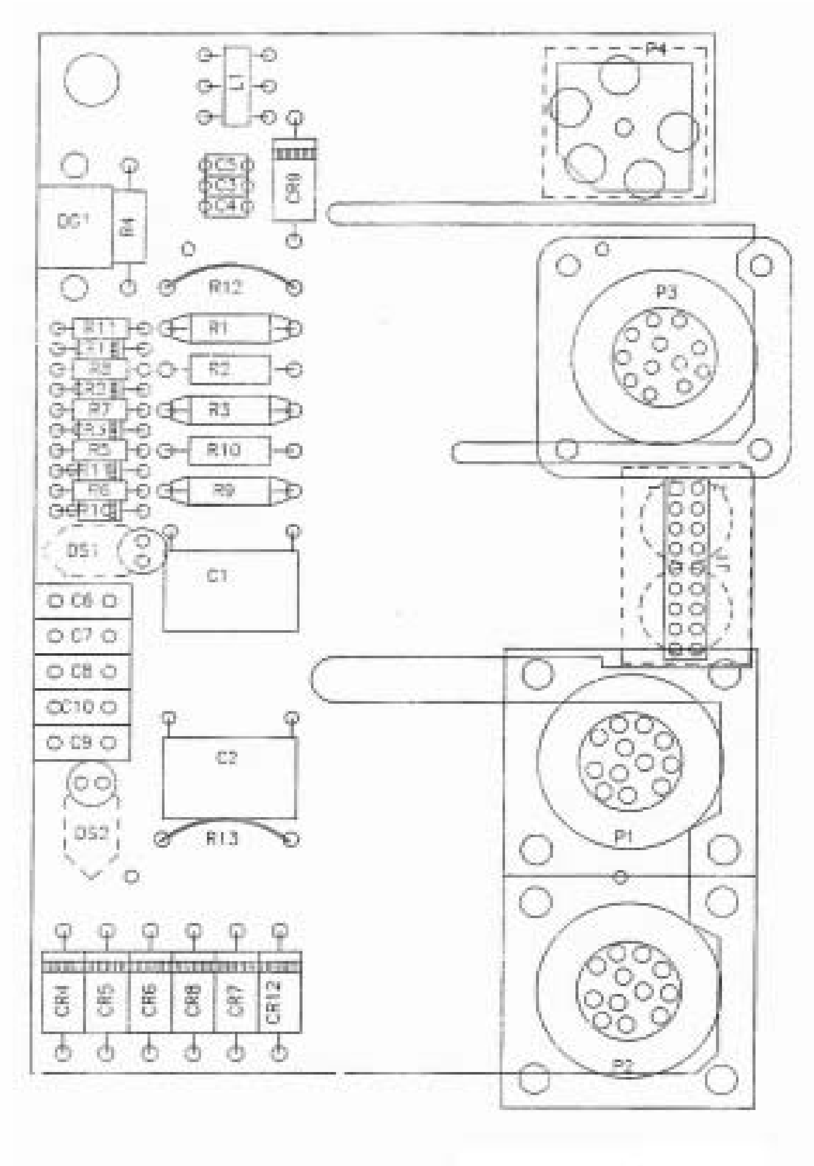


FIGURE 5-51 Interconnect Board

0670-00-0615
0670-00-0629 (CE)

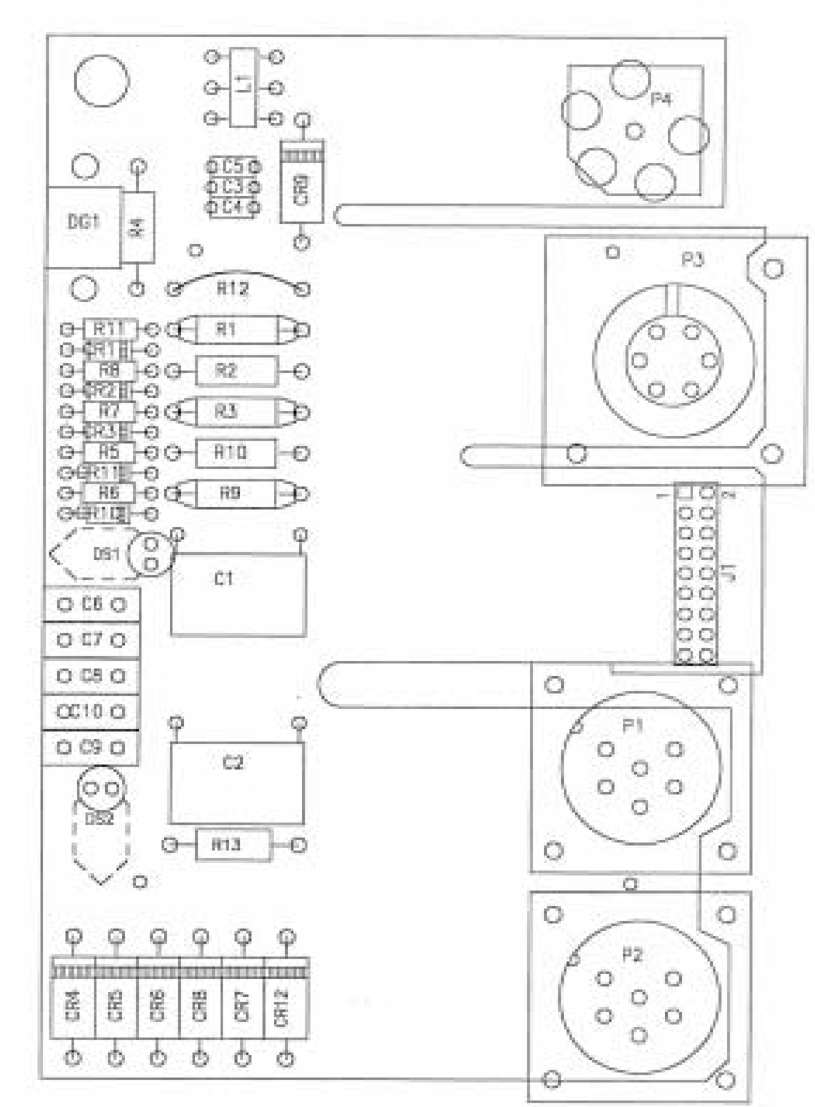
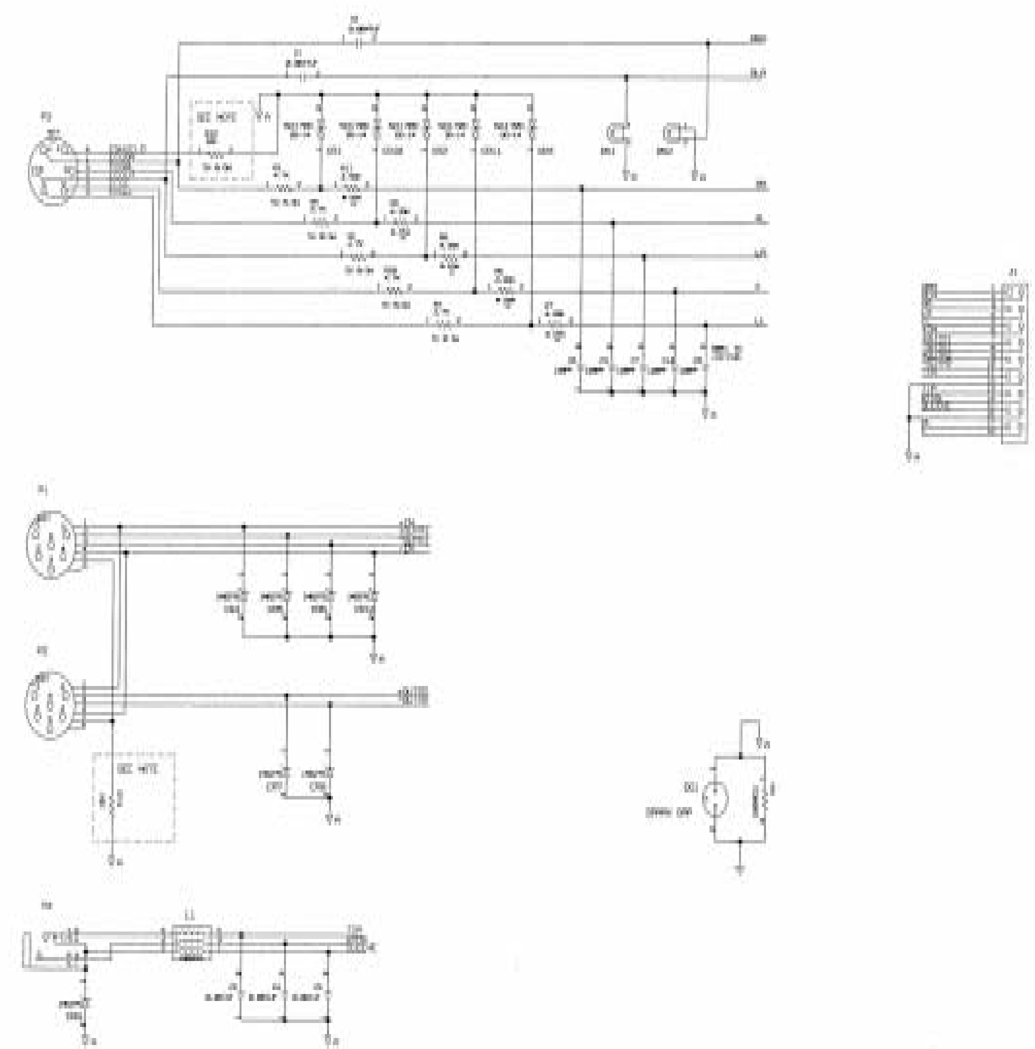


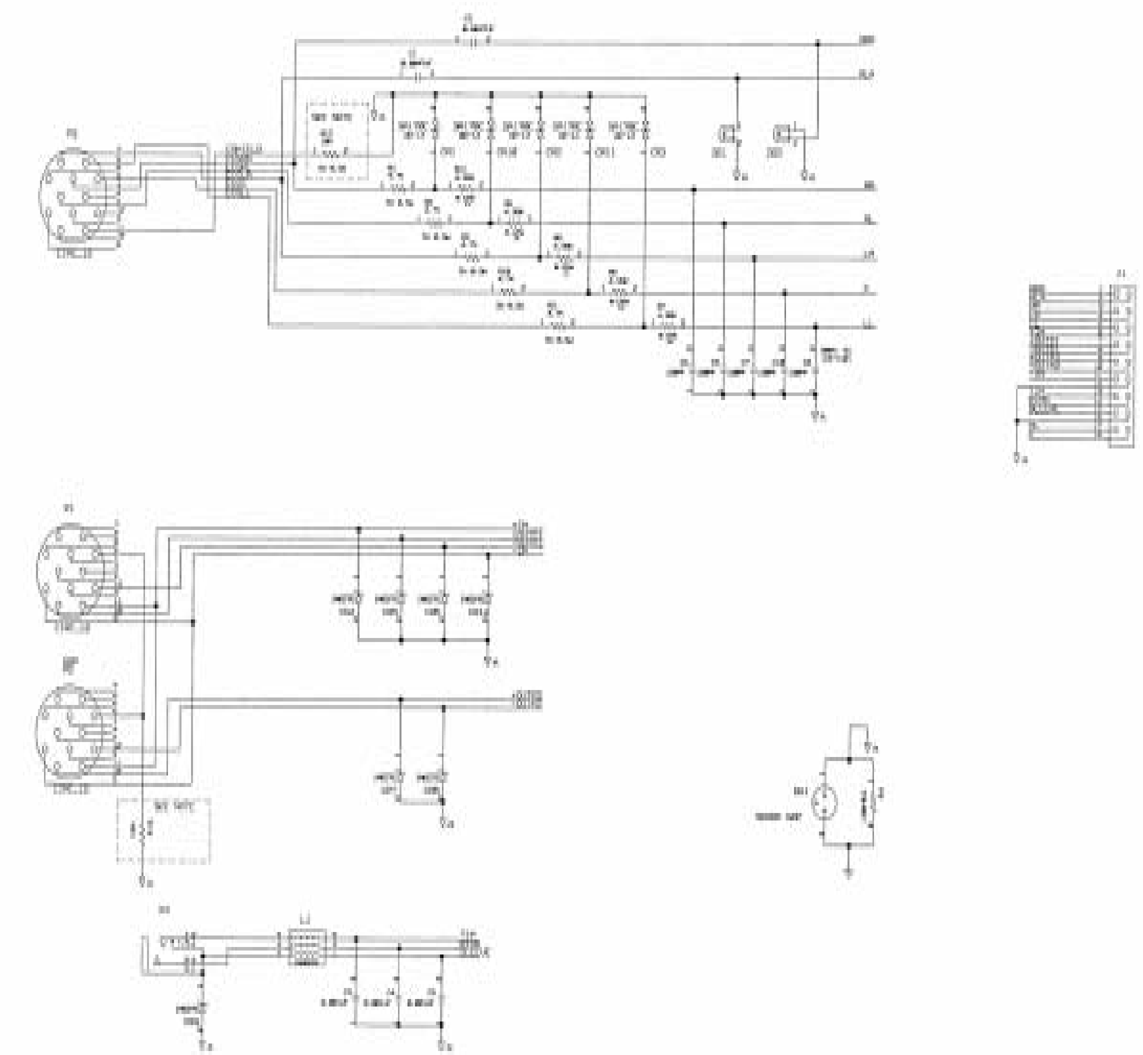
FIGURE 5-52 Interconnect Board

0670-00-0576
0670-00-0628 (CE)



NOTE: R12 and R13 are replaced with jumpers on 0070-00-0628 only.

FIGURE 5-53 Interconnect Board
0387-00-0576
0387-00-0628 (CE)



NOTE: R12 and R13 are replaced with jumpers on 0070-00-0629 only.

FIGURE 5-54 Interconnect Board HP
0387-00-0615
0387-00-0629 (CE)

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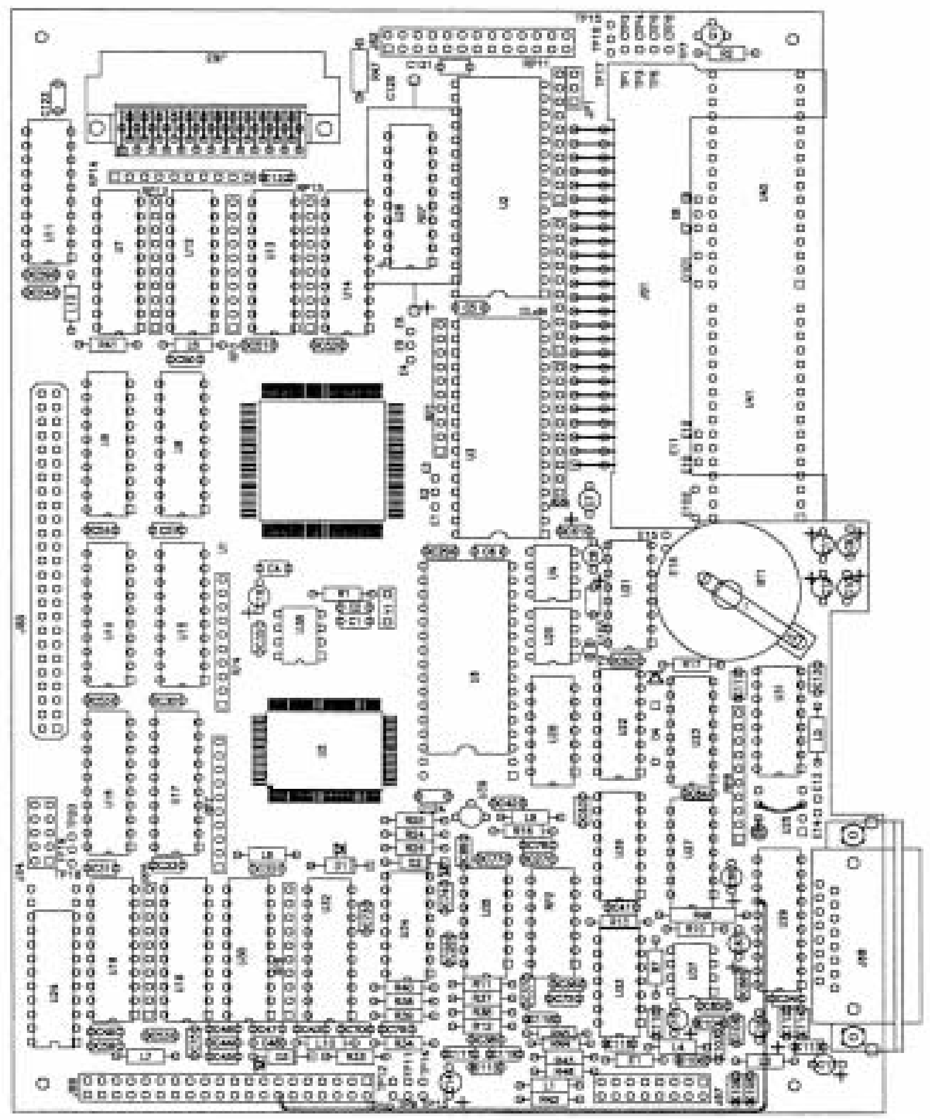

FIGURE 5-55 CPU Board
0670-00-0591
0670-00-0623 (5L-CE)
0670-00-0631

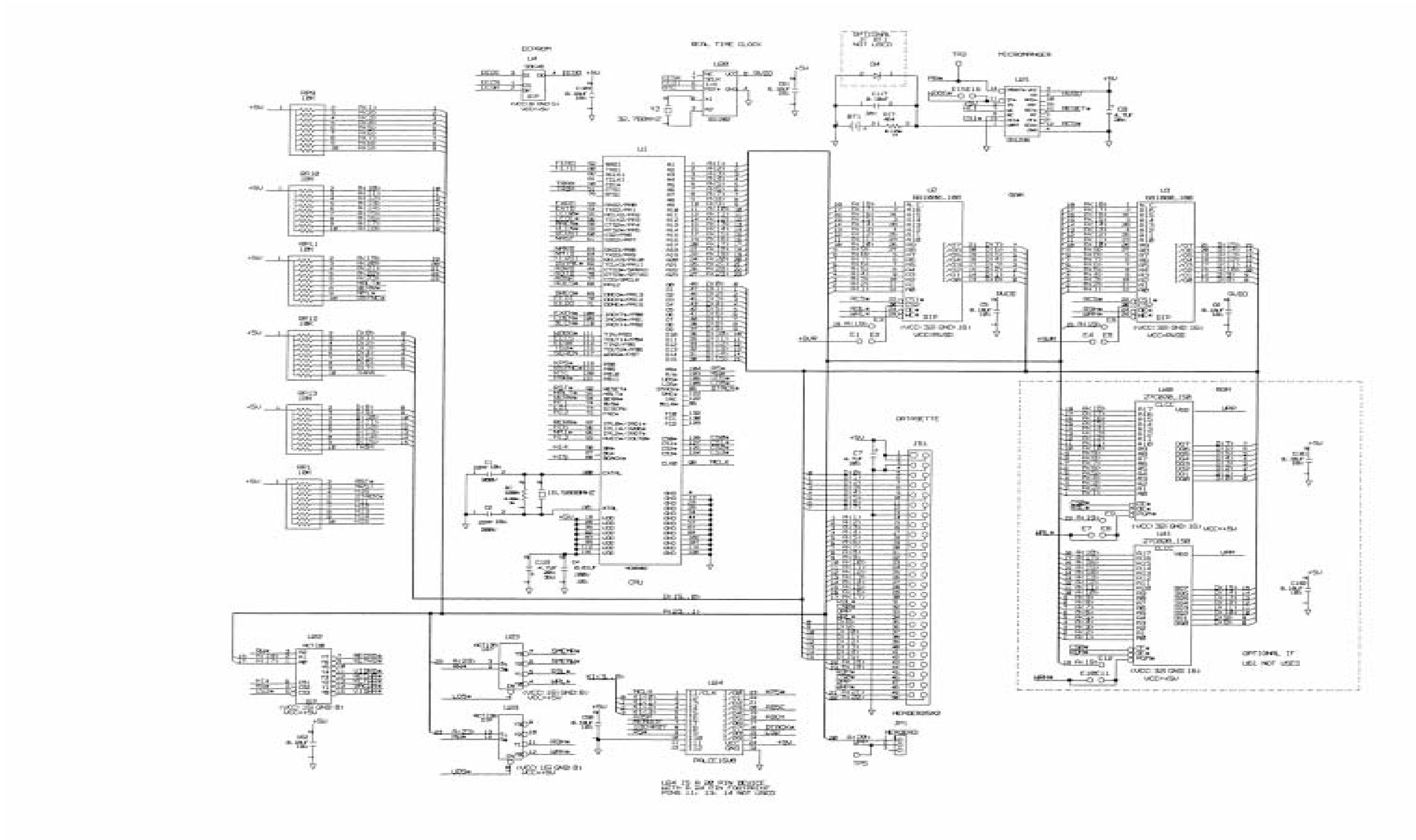

FIGURE 5-56 CPU Board
0387-00-0591
0387-00-0623 (5L-CE)
0387-00-0631
0387-00-0688
Sheet 1 of 4

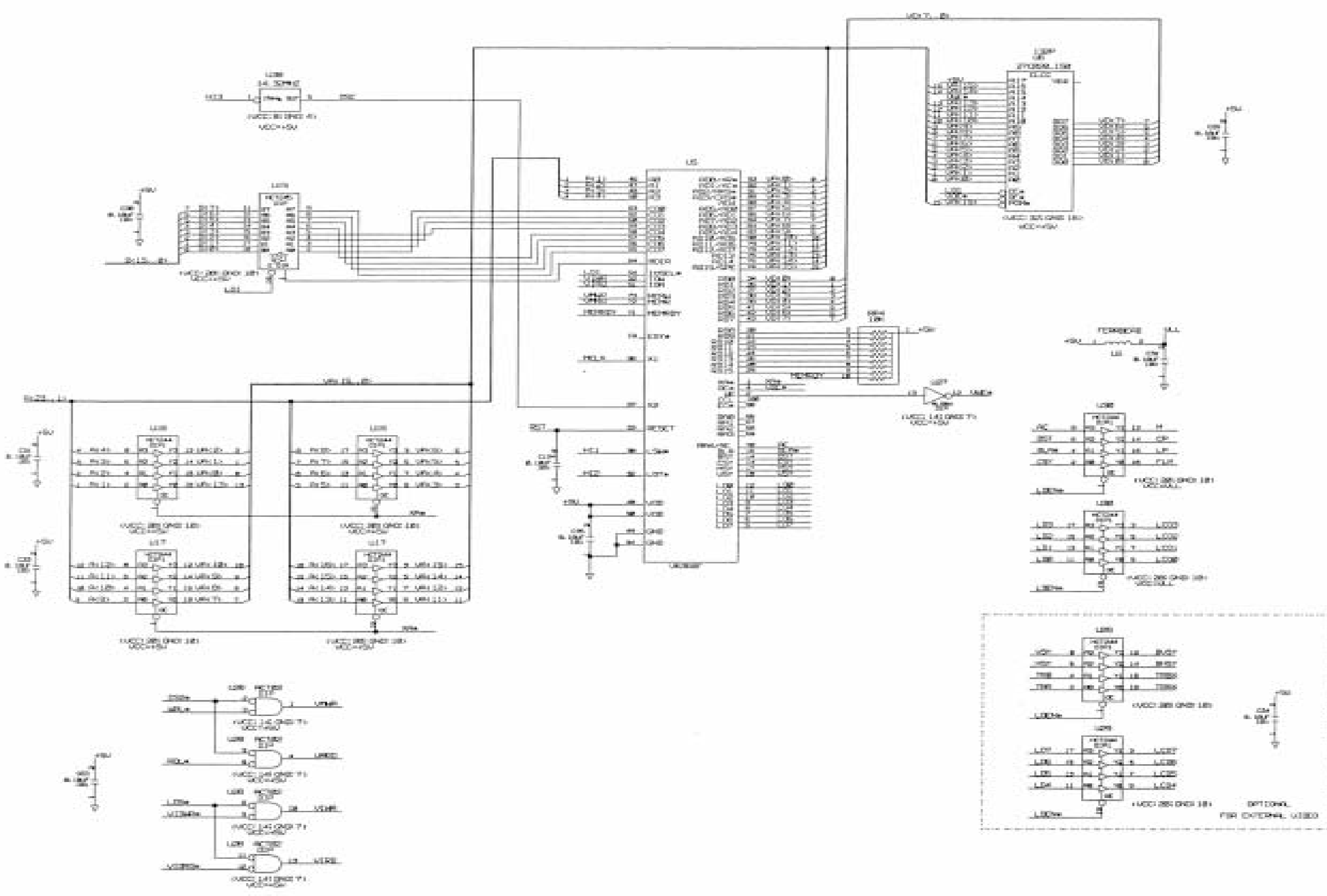

FIGURE 5-57 CPU Board
0387-00-0591
0387-00-0623 (5L-CE)
0387-00-0631, 0387-00-0688
Sheet 2 of 4

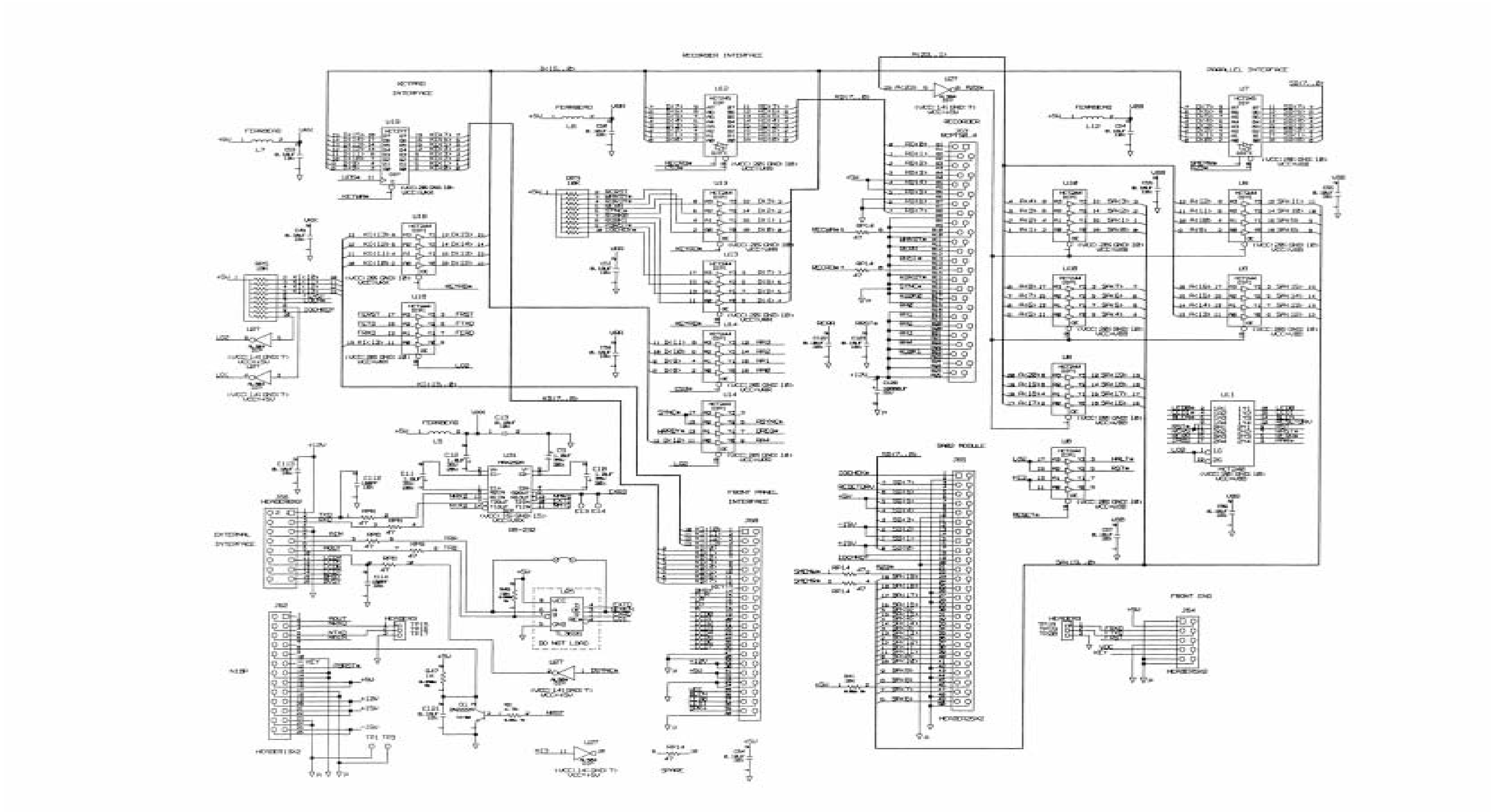

FIGURE 5-58 CPU Board
0387-00-0591
0387-00-0623 (5L-CE)
0387-00-0631
0387-00-0688
Sheet 3 of 4

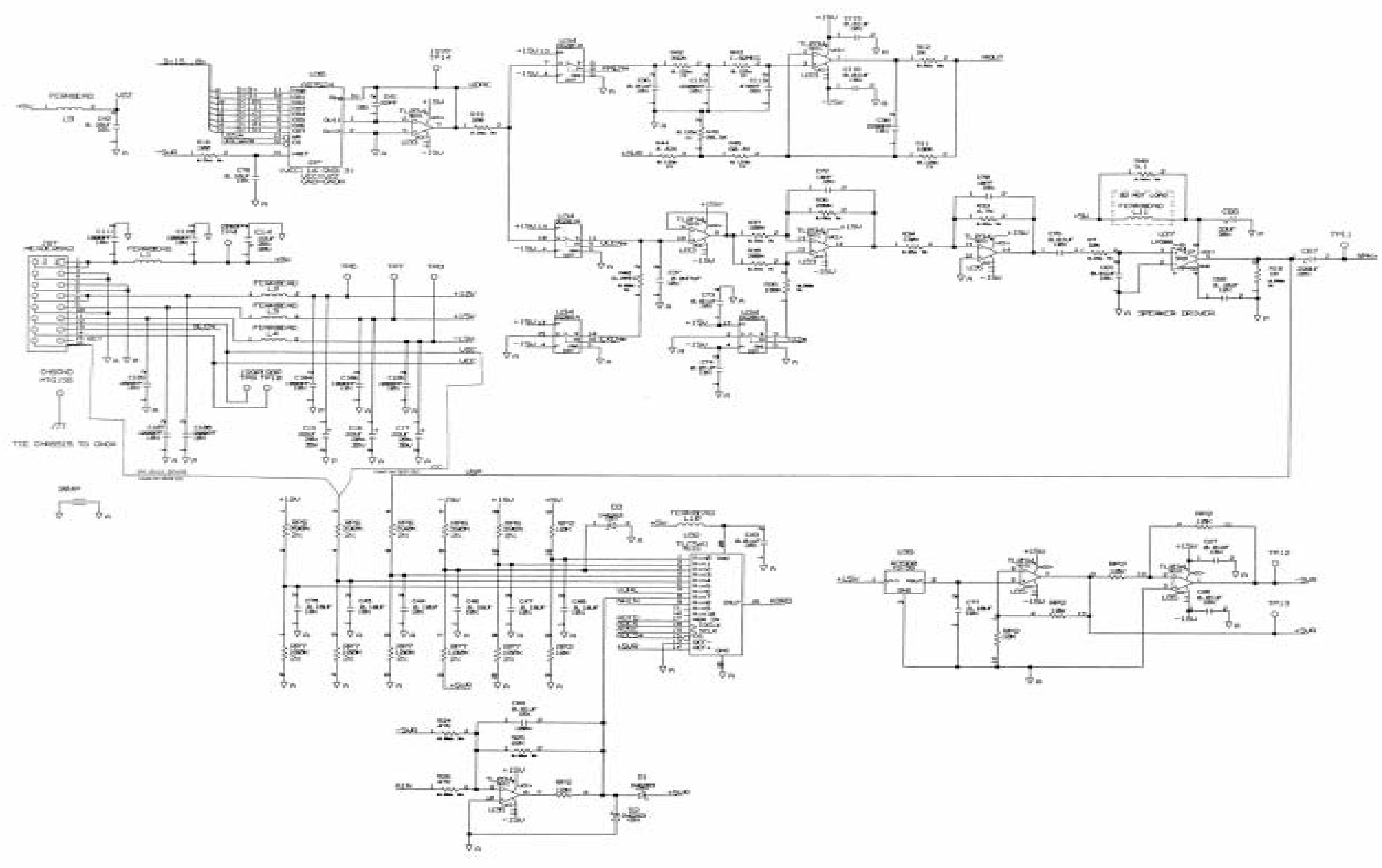

FIGURE 5-59 CPU Board
0387-00-0591
0387-00-0623 (5L-CE)
0387-00-0631
0387-00-0688
Sheet 4 of 4

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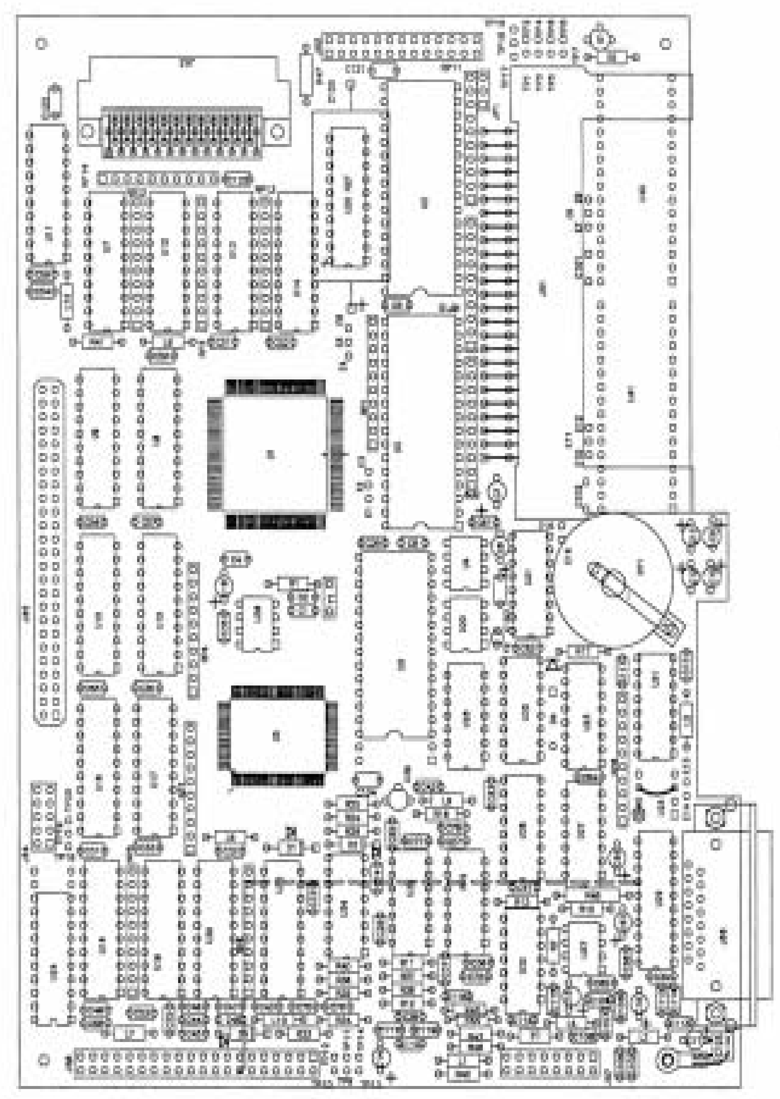

FIGURE 5-60 CPU Board
0670-00-0651 (XG-CE)

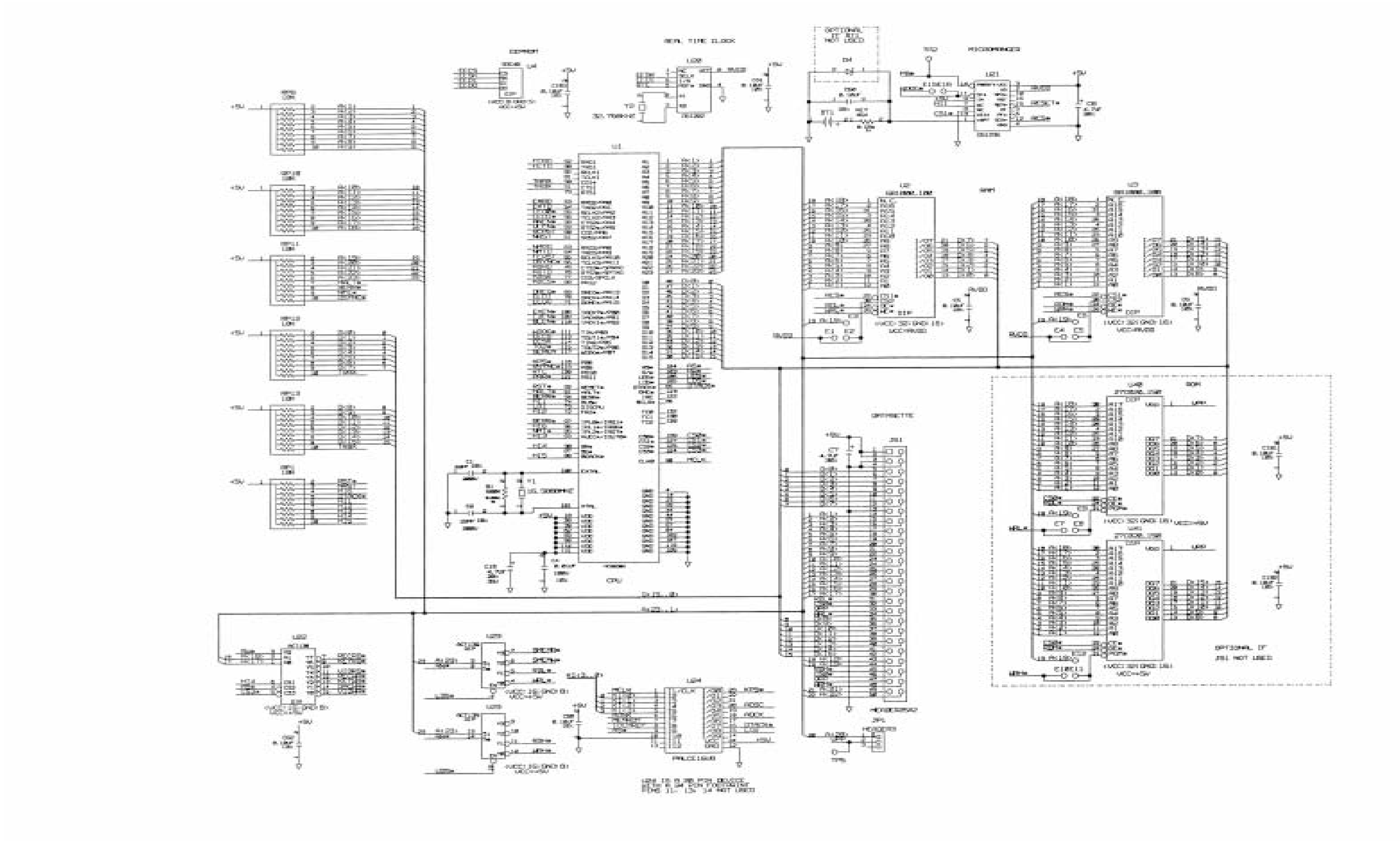

FIGURE 5-61 CPU Board
0387-00-0651 (XG-CE)
0387-00-0689
Sheet 1 of 4

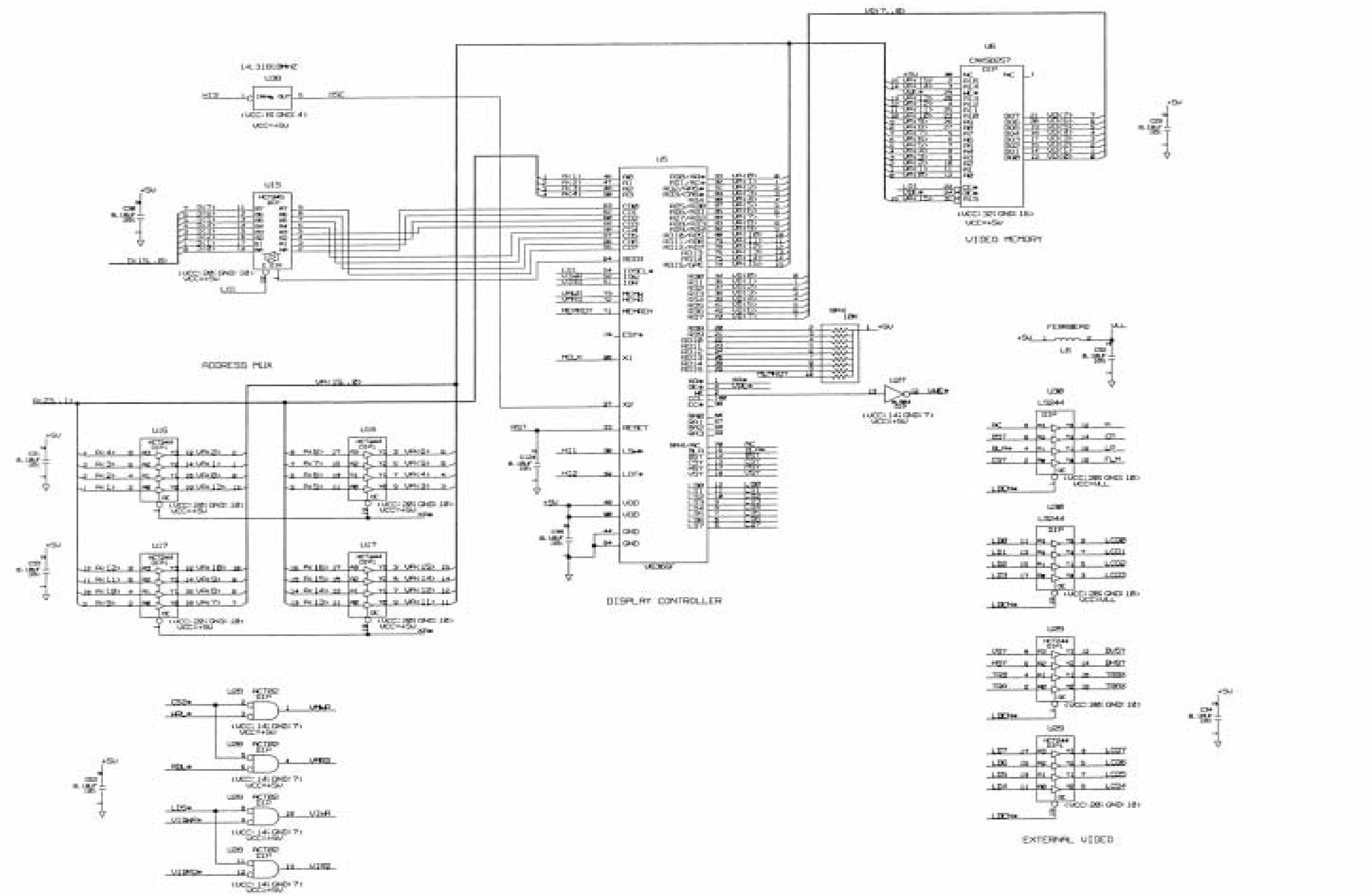

FIGURE 5-62 CPU Board
0387-00-0651 (XG-CE)
0387-00-0689
Sheet 2 of 4

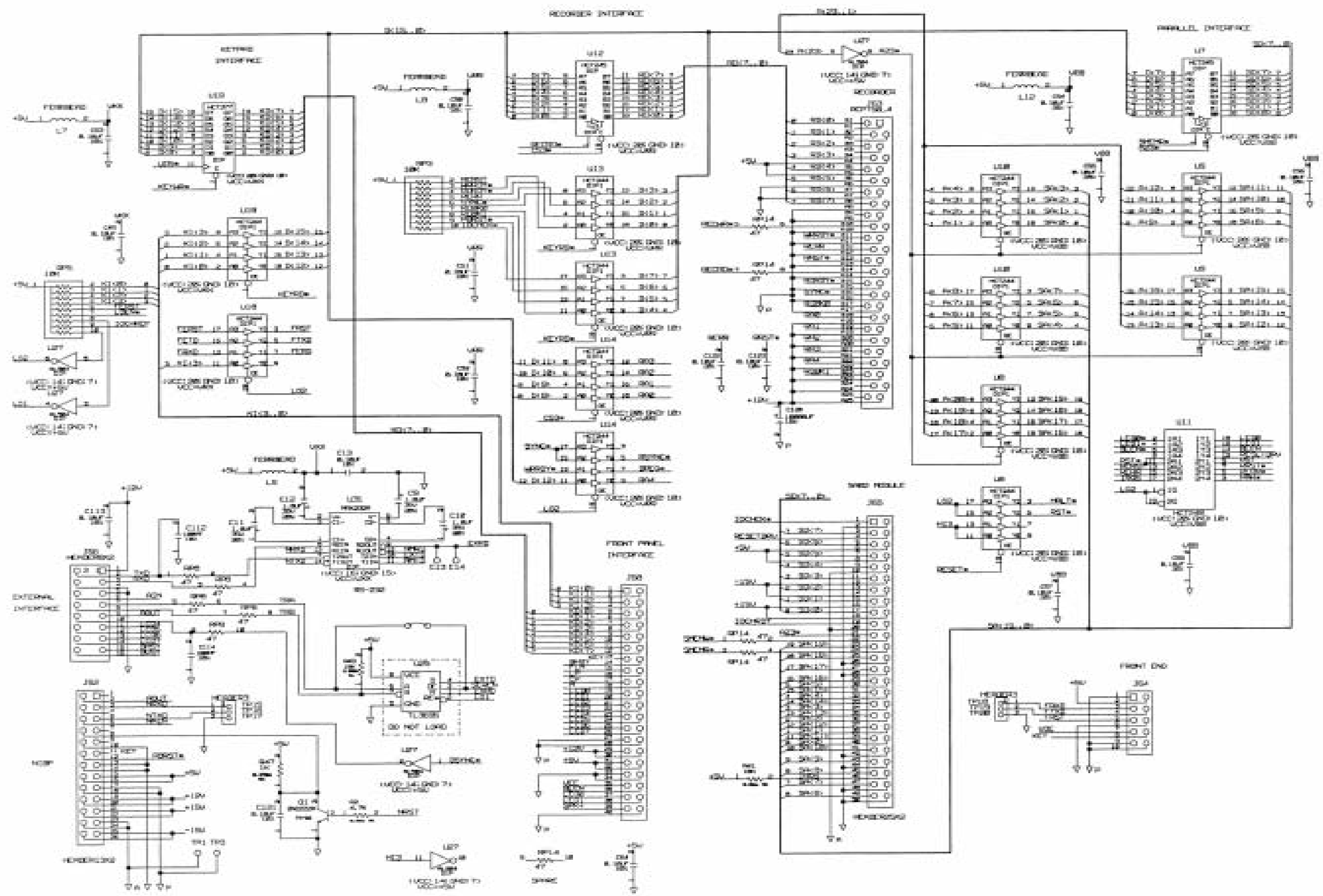

FIGURE 5-63 CPU Board
0387-00-0651 (XG-CE)
0387-00-0689
Sheet 3 of 4

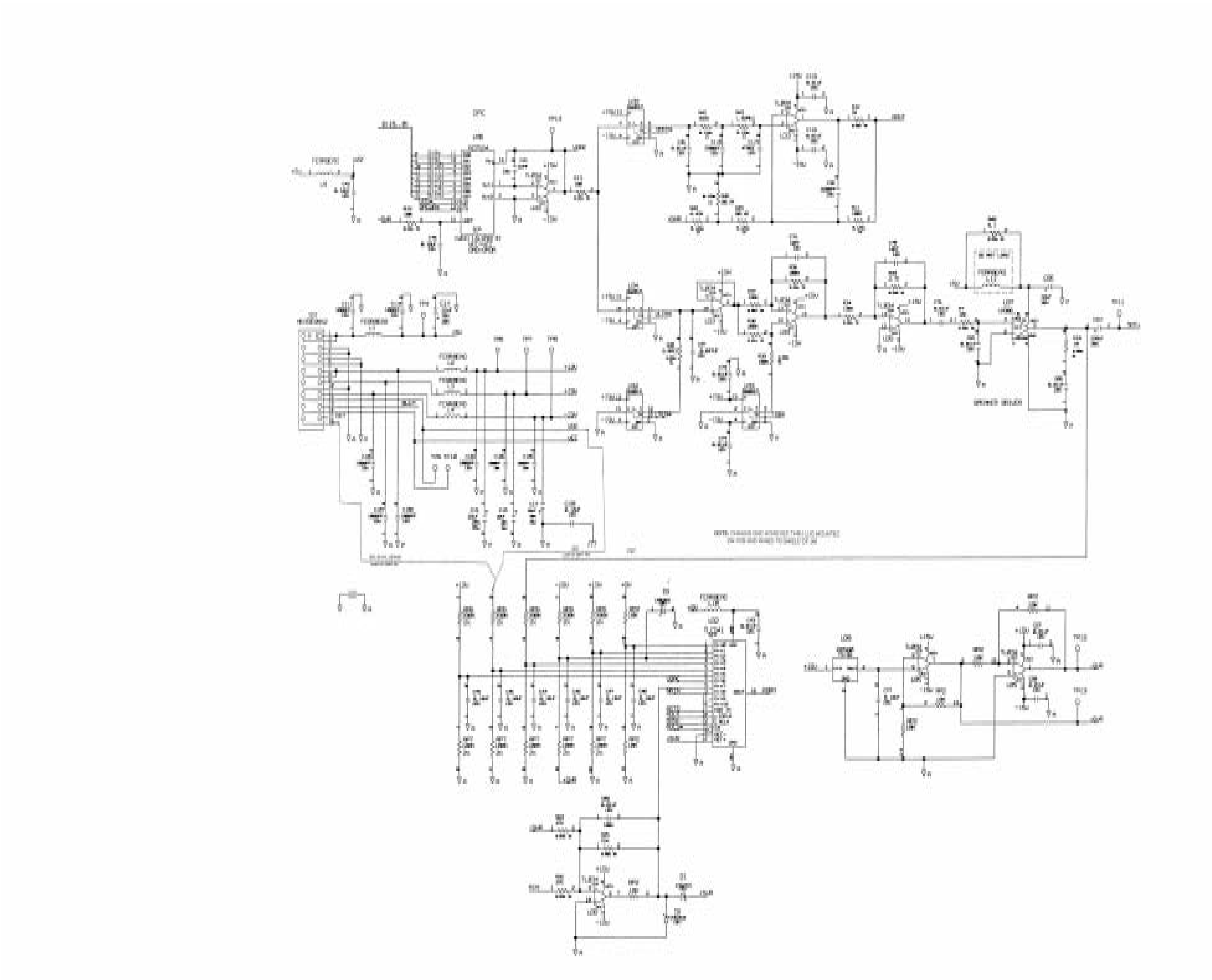

FIGURE 5-64 CPU Board
0387-00-0651 (XG-CE)
0387-00-0689
Sheet 4 of 4

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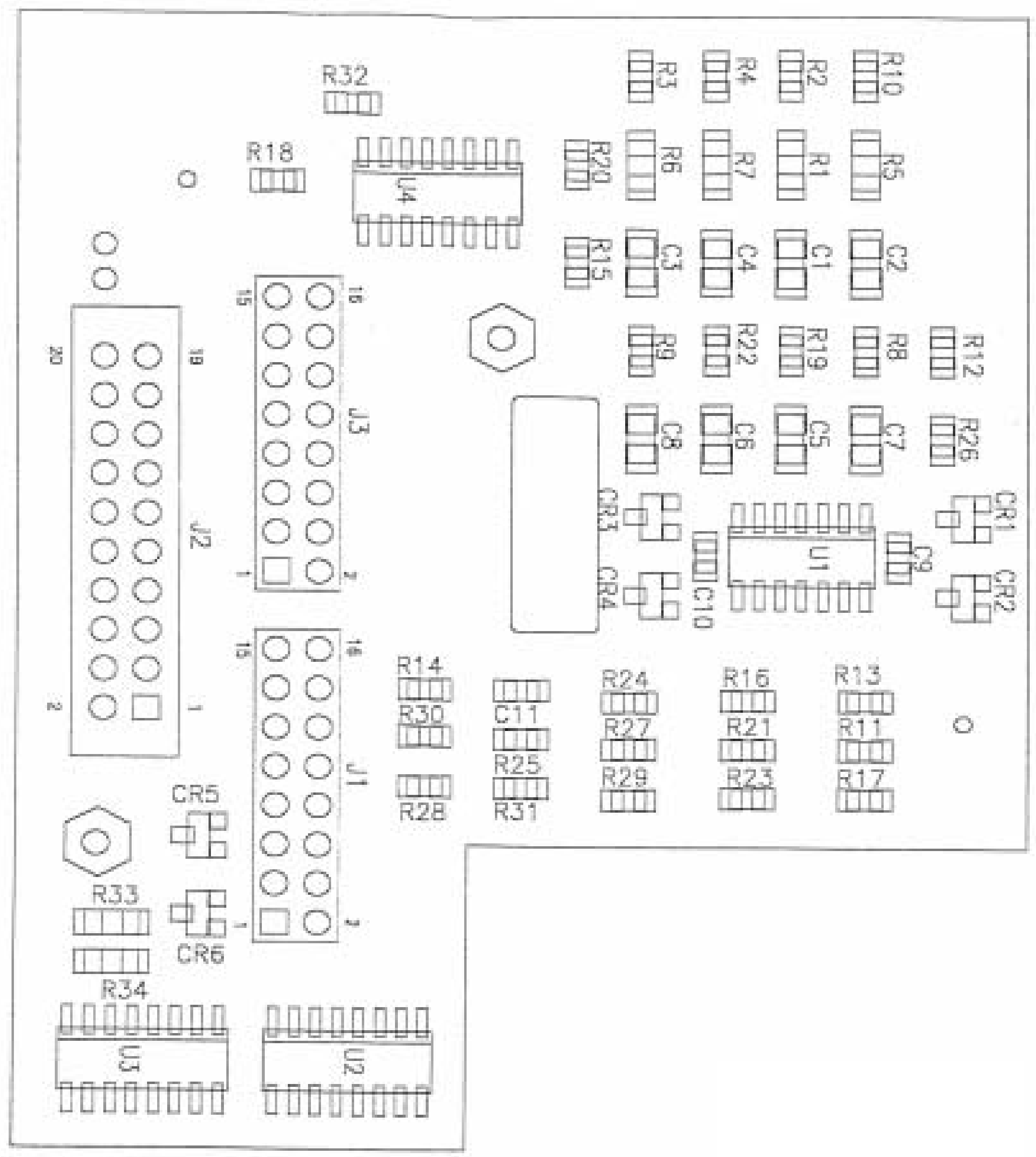
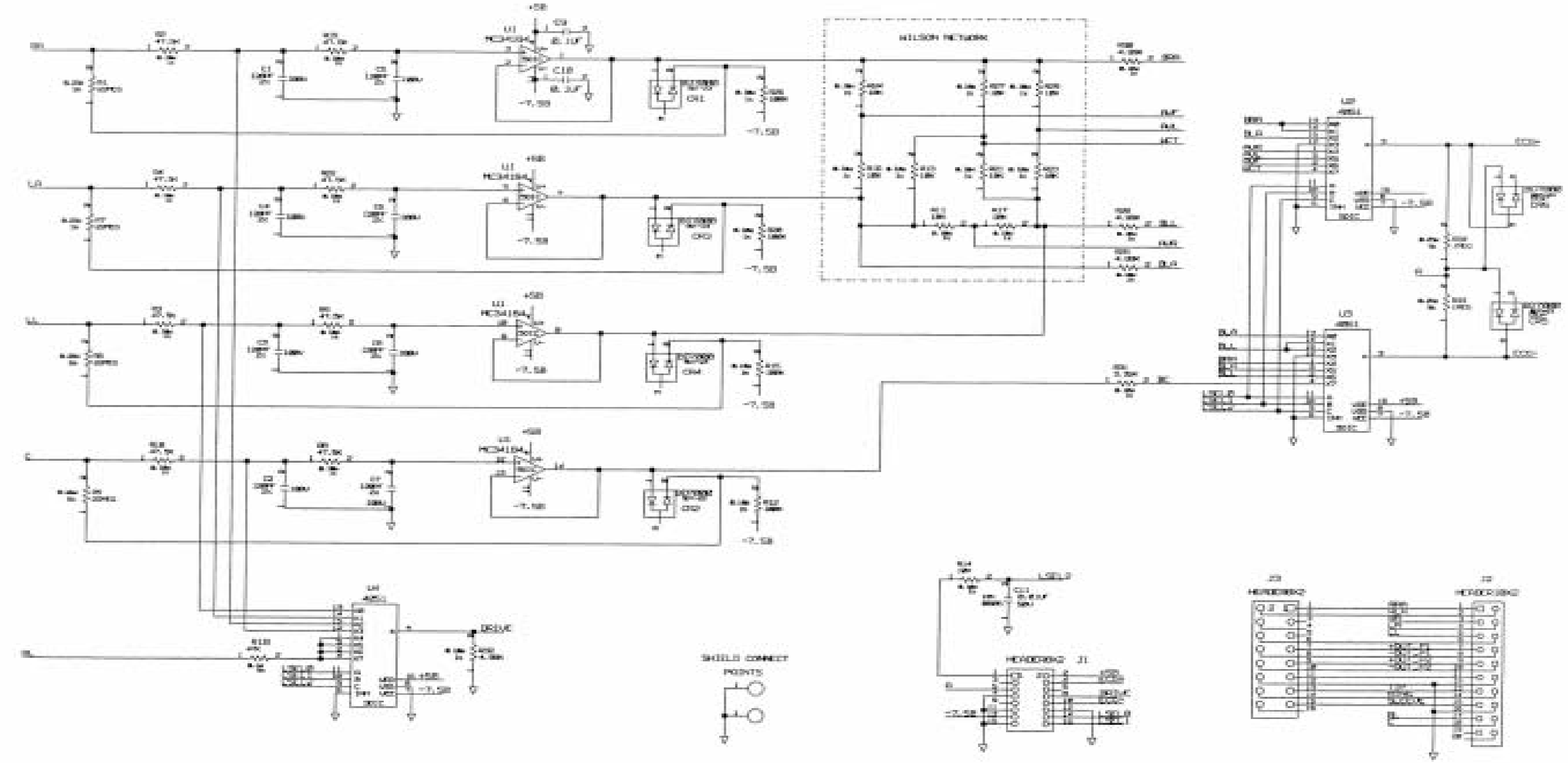


FIGURE 5-65 Front End Daughter Board
0670-00-0611
0670-00-0627 (5L-CE)



NOTE: 1. J1 mates with U3 on Front End Board
2. J2 cable mates with J1 on Interconnect Board
3. J3 mates with J41 on Front End Board
4. J2 cable with Ferrite Installed is used on 0670-00-0627 only

FIGURE 5-66 Front End Daughter Board
0387-00-0611
0387-00-0627 (5L-CE)

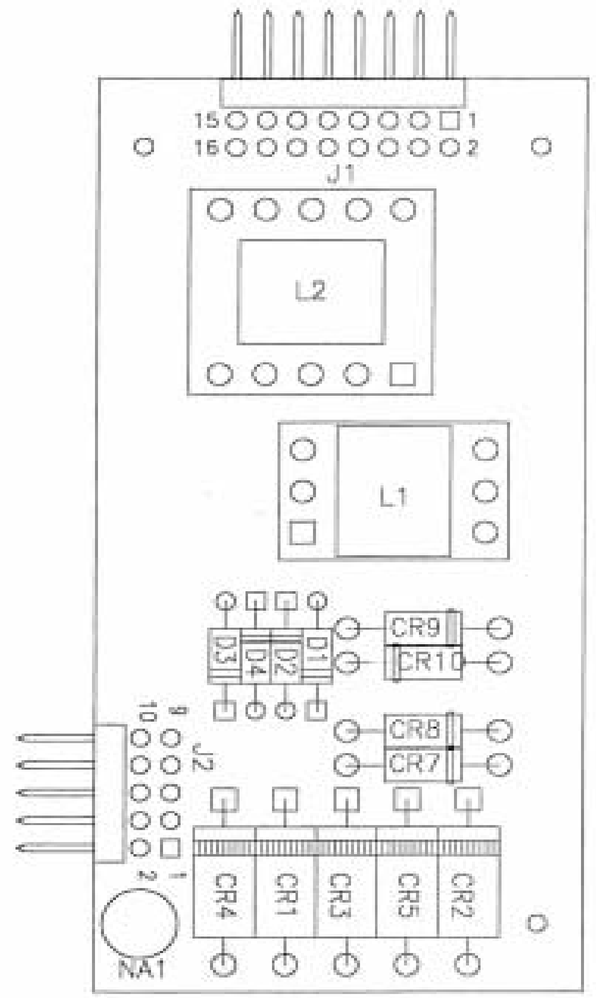


FIGURE 5-67 SpO_2 Daughter Board
0670-00-0619

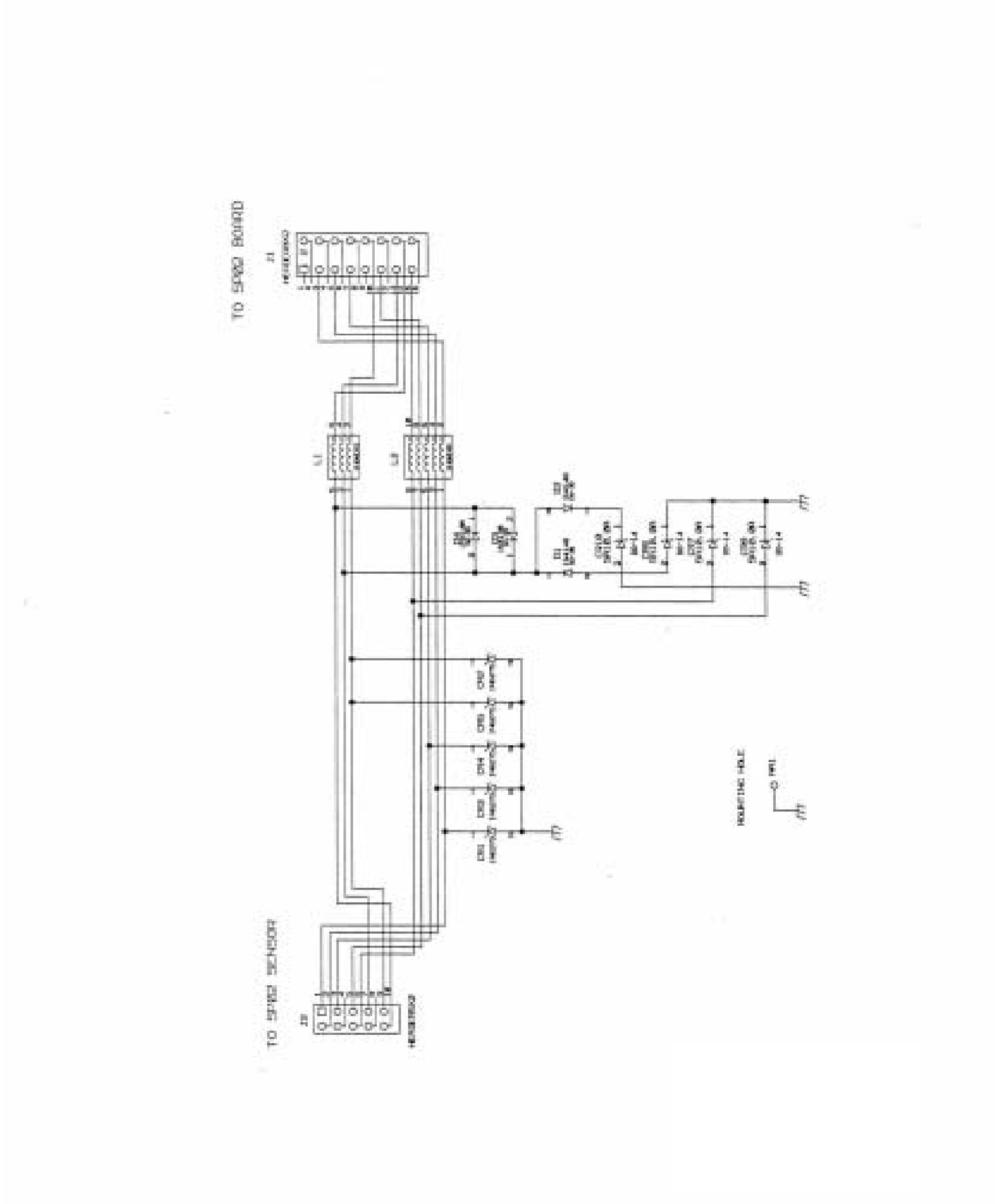


FIGURE 5-68 SpO$_2$ Daughter Board
0387-00-0619

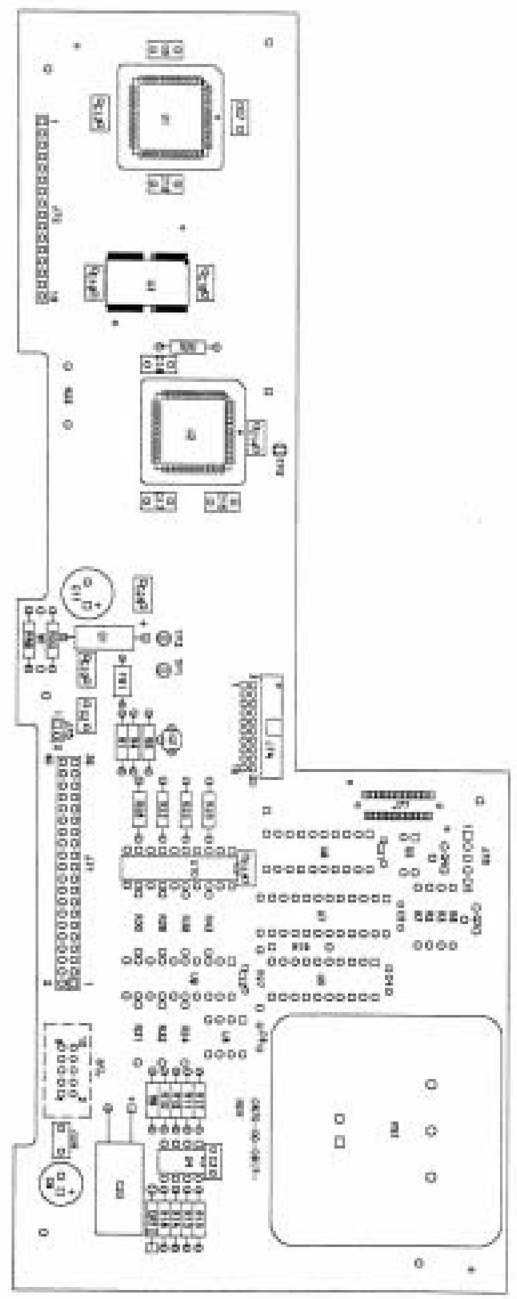


FIGURE 5-69 VGA / EL Panel Board / VGA / LCD Panel Board Display Interface Assembly (XG)
0670-00-0617-02
0670-00-0617-03

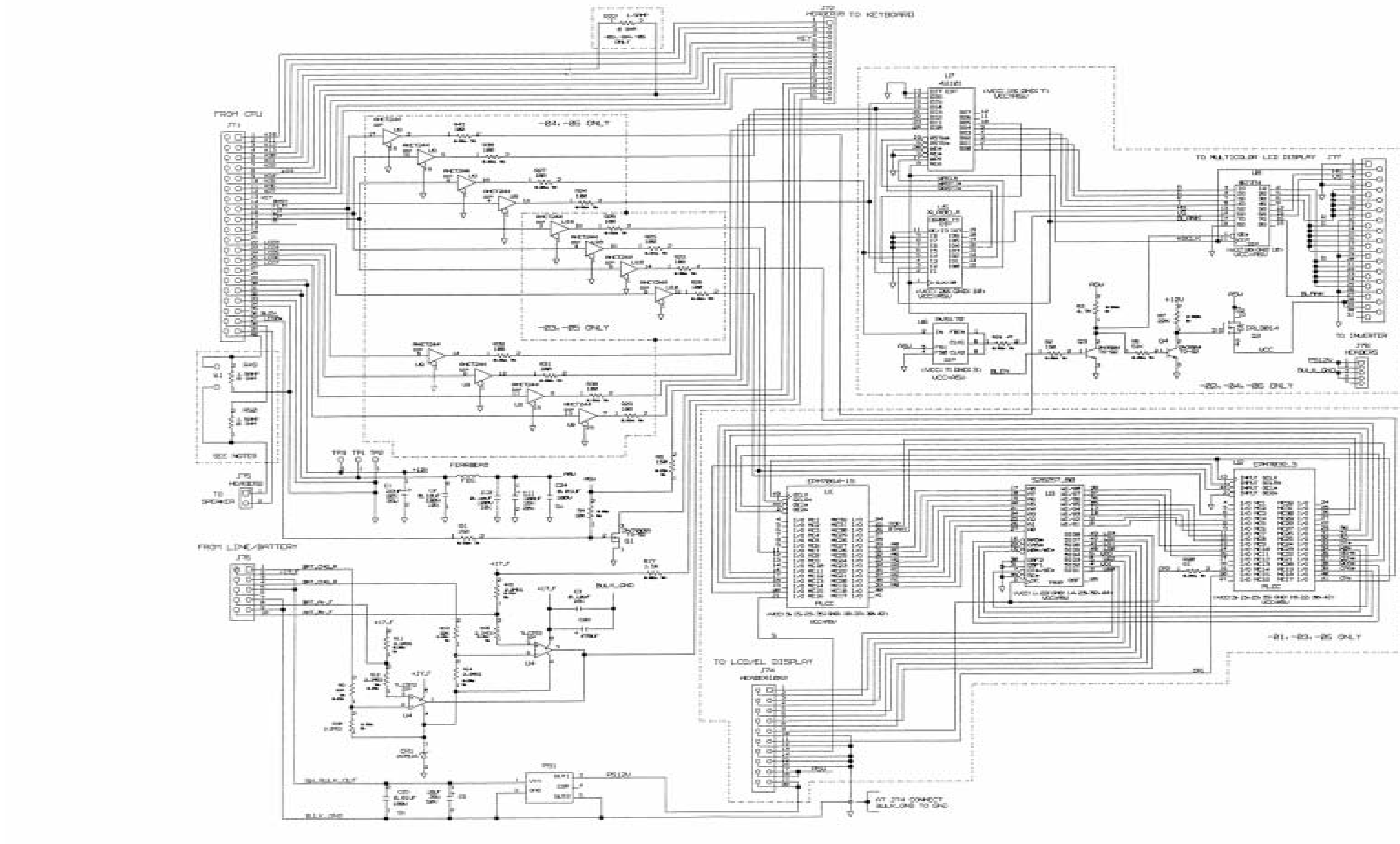


FIGURE 5-70 VGA / EL Panel Board / VGA / LCD Panel Board Display Interface Assembly (XG)
0387-00-0617-02
0387-00-0617-03
Sheet 1 of 2

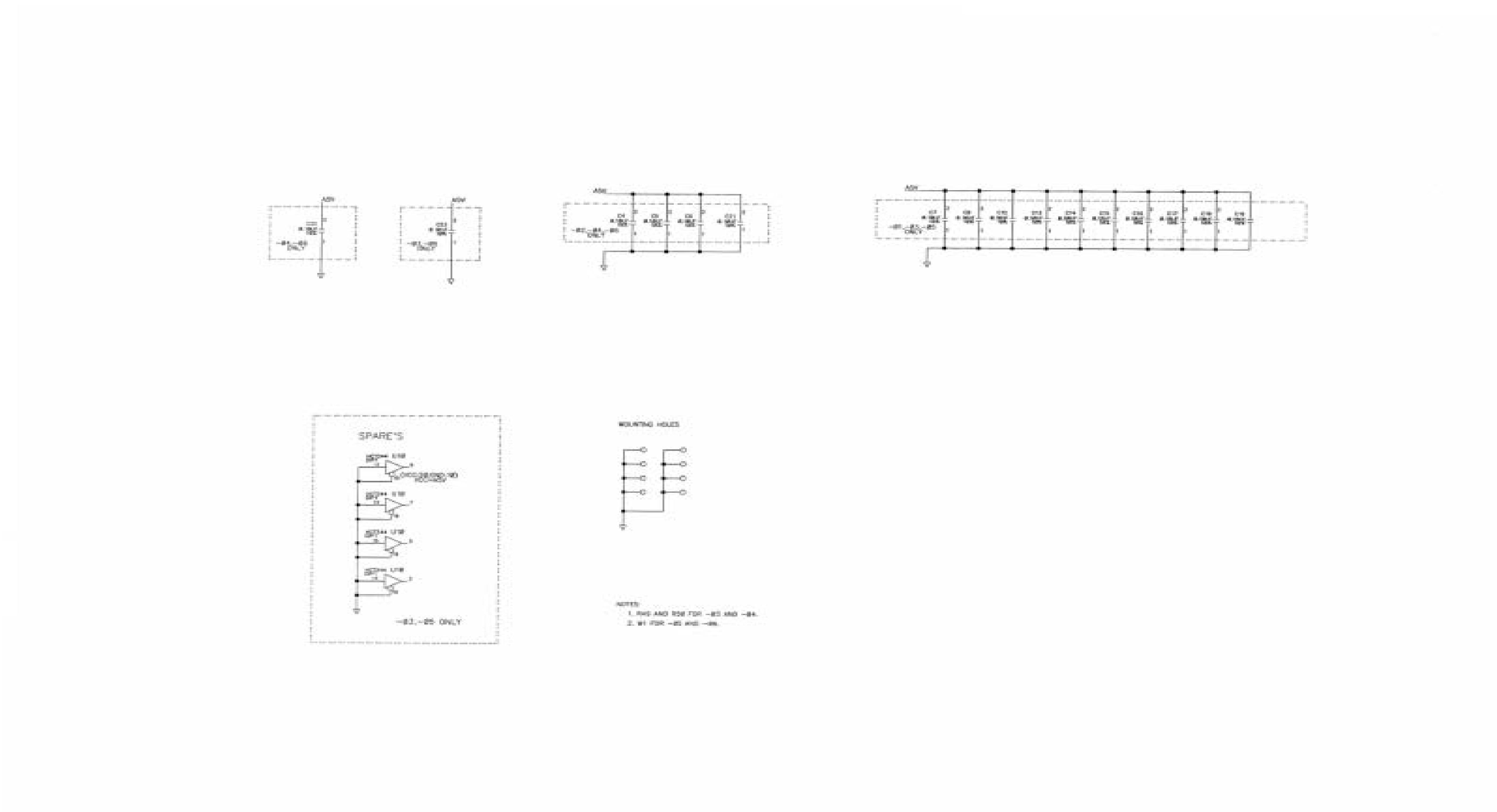


FIGURE 5-71 VGA/EL Panel Board/VGA/LCD Panel Board Display Interface Assembly (XG)
0387-00-0617-02
0387-00-0617-03
Sheet 2 of 2

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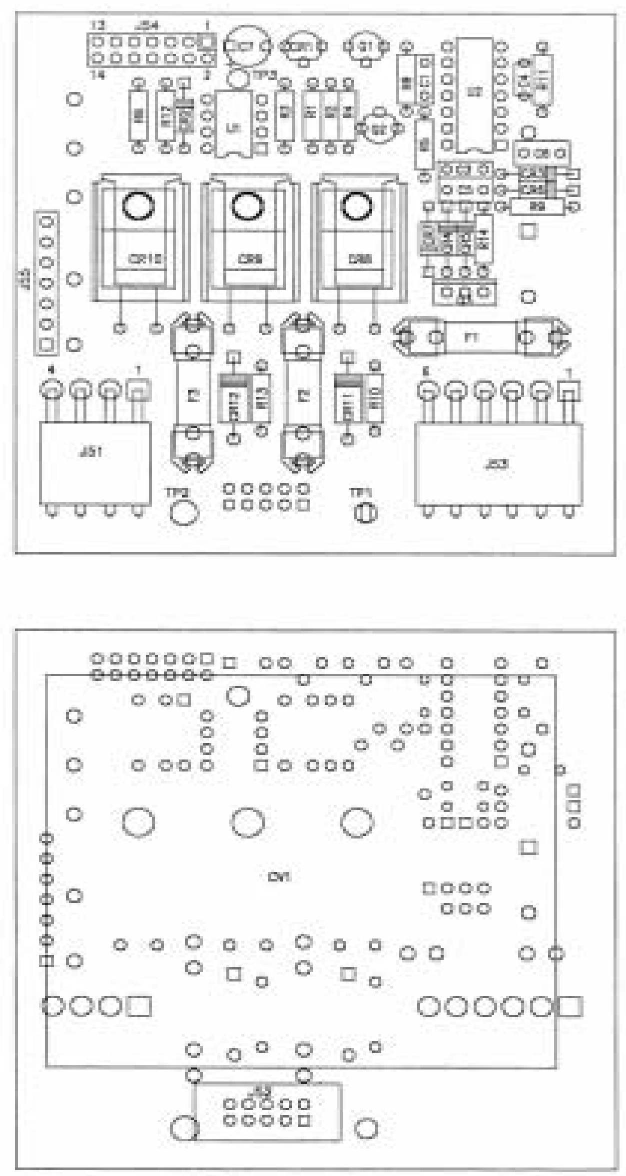

FIGURE 5-72 Line Battery Board (Top and Bottom)
0670-00-0626
0670-00-0656

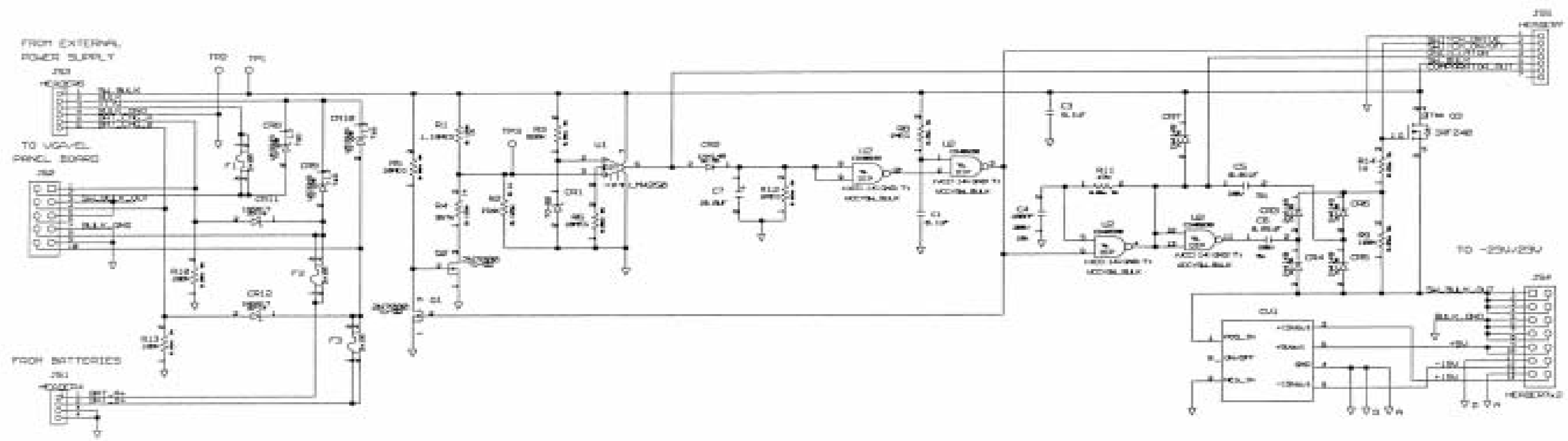

FIGURE 5-73 Line Battery Board
0387-00-0626
0387-00-0656

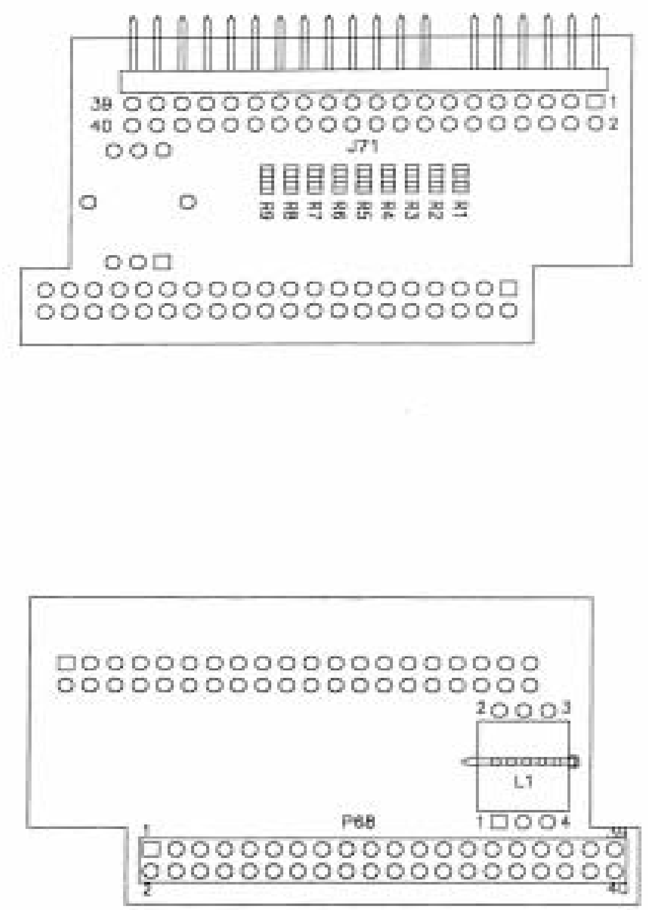

FIGURE 5-74 Termination Board (Top and Bottom)
0670-00-0648

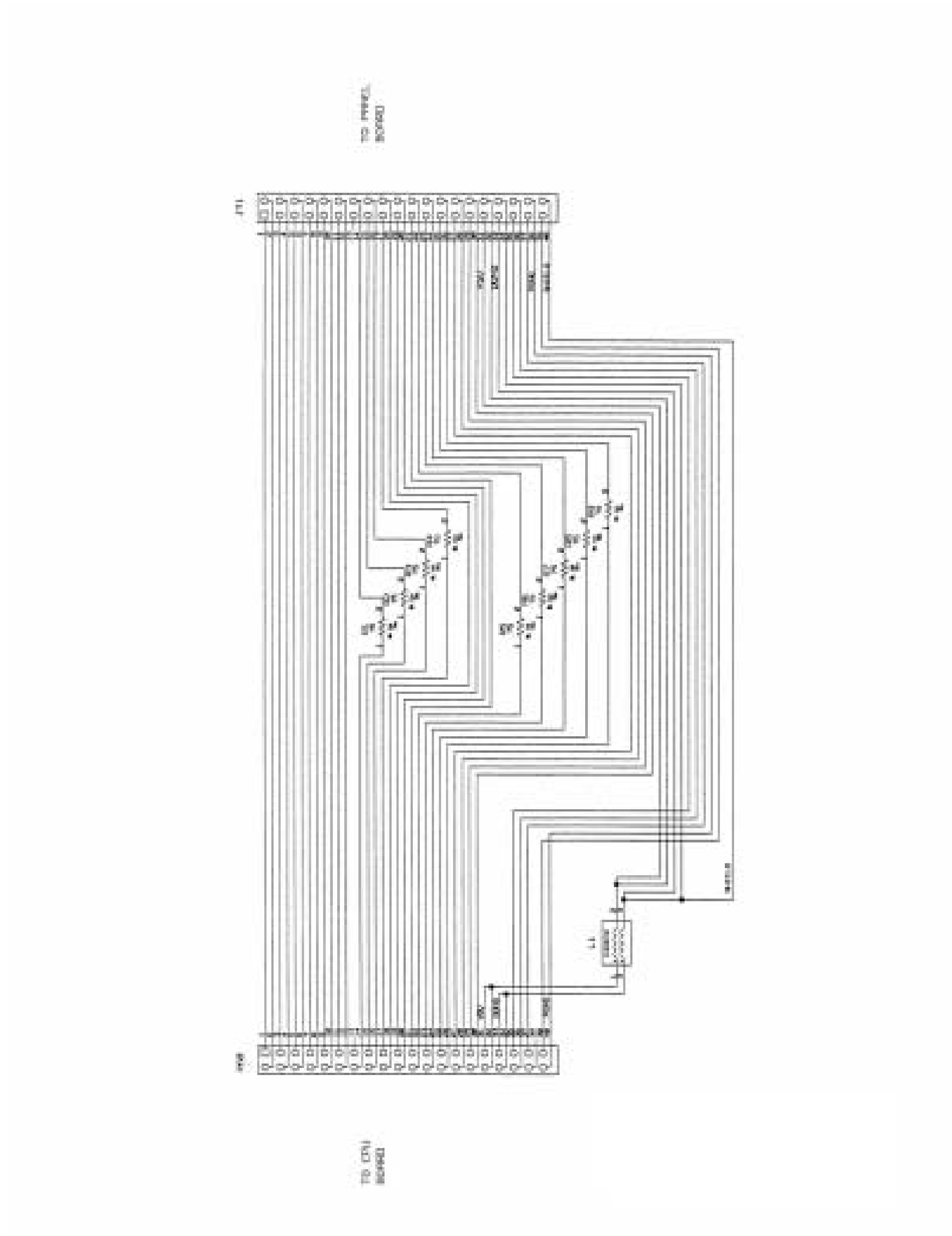

FIGURE 5-75 Termination Board
0387-00-0648

6.0 *Replacement Parts*

Contents of this Chapter ....Page

6.1 Introduction

This chapter of the Service Manual provides information necessary to identify the replacement parts and assemblies of the instrument.

6.2 Available Replacement Parts and Sub-Assemblies

The parts listings which follow are divided into two sections. The Isometric Drawings and the accompanying parts lists identify the available chassis mounted components. A listing for the components on each circuit board then follows.

6.3 Product Variations and Options

Product variations, due to differences for various line voltages, may require different components. These variations are reflected, where necessary, on the parts lists.

6.4 Exchange Program

Datascope offers an exchange policy for most of the printed circuit board assemblies. This program may provide the most expedient method of servicing the equipment. A standard charge for this service is made. Contact the Datascope Service Department for details concerning this exchange program.

Many circuit boards make extensive use of multilayer technology and high density packaging. Individual component replacement is not recommended on these boards unless the technician is properly equipped to repair multilayer circuit boards.

Circuit boards, returned as parts of the exchange program, that show evidence of improper repair techniques and are damaged in the process are not considered for exchange. Damaged boards will be invoiced at full value and no exchange credit will be applied.

6.5 Replacement Parts Pricing Information

Current parts prices and exchange charges can be determined by contacting Datascope, Order Entry Department.

6.6 Ordering Information

Replacement parts and assemblies are available from Datascope Corp., and in Europe from Datascope B.V. Please follow these guidelines when ordering replacement items for the instrument.

1. Include the Model and Serial Number of the instrument.
2. Include the Datascope Part Number exactly as it appears in the Parts List under the column, "Datascope Part Number."
3. Include a description of the item.

Example Orders:

1. ea. P/N 0331-00-0064-01
   Label, Keypad Overlay (w/IBP1 & 2),
   Serial No. XXXX

2. ea. P/N 0212-12-0404
   Screw, #4-40 x .25 lg. Pan Head,
   Serial No. XXXX

NOTES:

Datascope Corp. maintains a policy of continuous development for product improvement and reserves the right to change materials, specifications, and prices without notice.

Many components are described with sufficient detail to permit procurement through local commercial channels. This applies to hardware, such as screws and fasteners, as well as to certain electronic components, such as resistors, capacitors, certain integrated circuits and transistors. However, in some cases, components are selected by Datascope to meet special performance criteria above and beyond the component manufactures specifications. This may apply to solid state components, relays and batteries. The use of other than Datascope components in these applications may result in degradation of reliability or instrument performance characteristics.

6.7 Abbreviations

The following abbreviations may appear in the parts listings which follow and/or through the manual.

ABBREVIATION	***TERM***
A/D	Analog to Digital
AMP	Amplifier
BUF	Buffer
CAP	Capacitor
CC	Carbon Composition
CER	Ceramic
CERM	Ceramic
CNTR	Counter
CONN	Connector
CONT	Controller
CONV	Converter
CPU	Central Processing Unit
DCDR	Decoder
DIFF	Differential
DIA	Diastolic
DIO	Diode
D/A	Digital to Analog
ELEC	Electrolytic
EPROM	Erasable Programmable Read Only Memory
FXD	Fixed
I.C.	Intergrated Circuit
INT. CKT.	Intergrated Circuit
KYBD	Keyboard
LED	Light Emitting Diode
MF	Metal Film
MONO	Monostable
MYLR	Mylar
NTWK	Network
OP	Operational
PB	Push Button
PIA	Peripheral Interface Adaptor
POT	Potentiometer
PRESS	Pressure
PWR	Power
RAM	Random Access Memory
REC	Receiver
STG	Stage
STK	Stacked
SUP	Supply

ABBREVIATION	***TERM***
SW	Switch
SYST	Systolic
TANT	Tantalum
TRANS	Transistor
TRANSIS	Transistor
VAR	Variable
VIA	Versatile Interface Adapter
XDCR	Transducer
XFMR	Transformer
XSTL	Crystal
XSTR	Transistor

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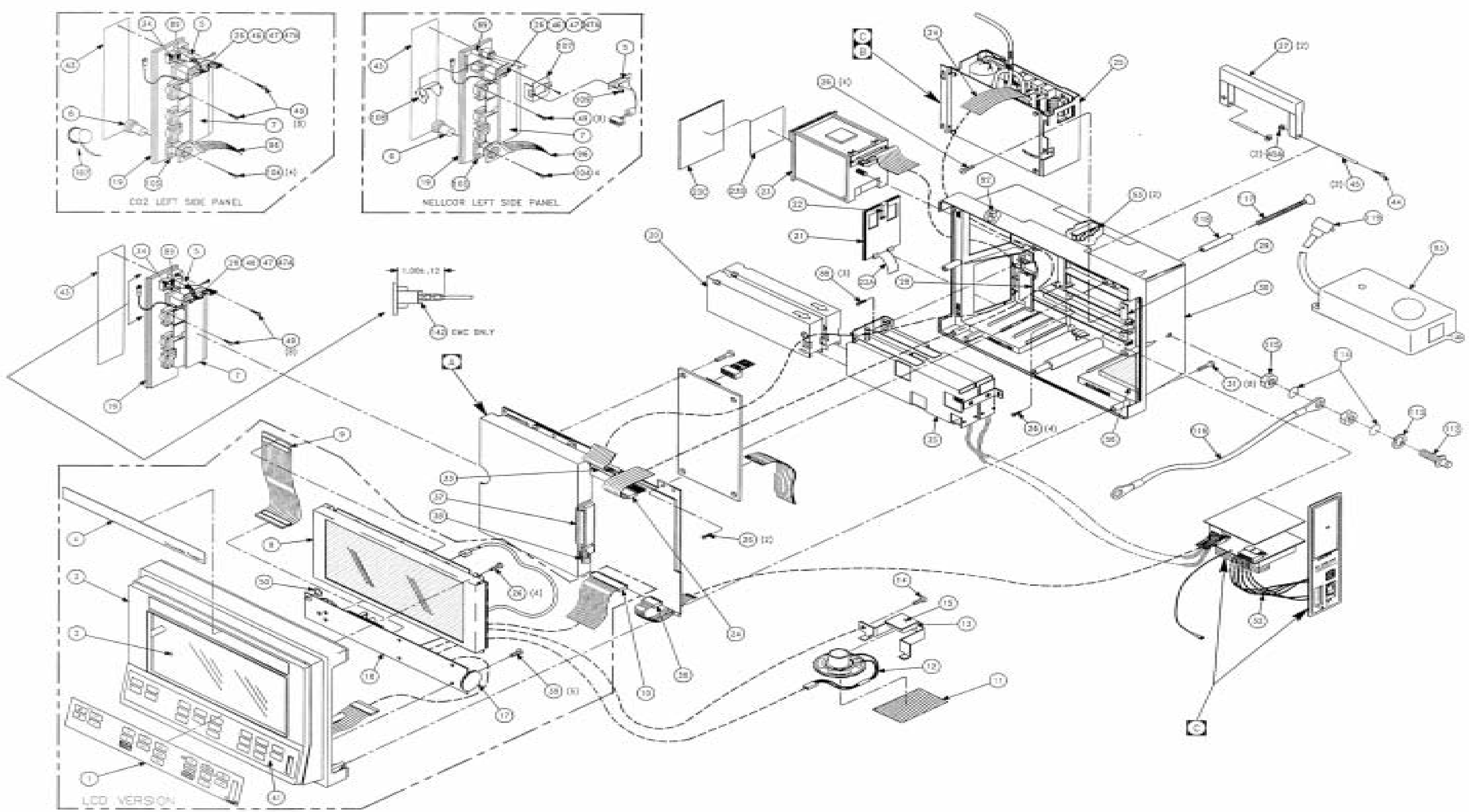

FIGURE 6-1 Main Assembly

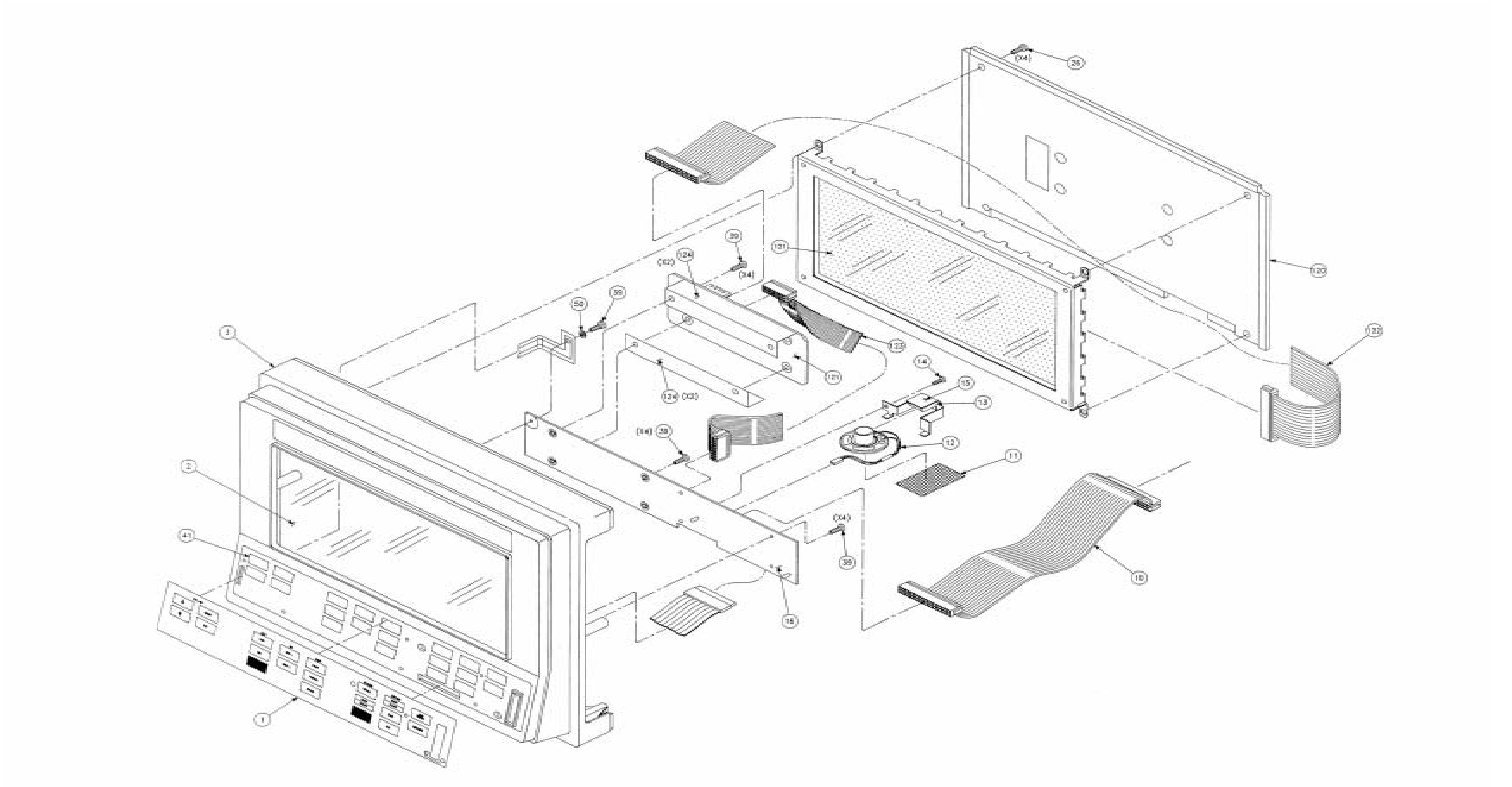

FIGURE 6-2 Planar Display Assembly

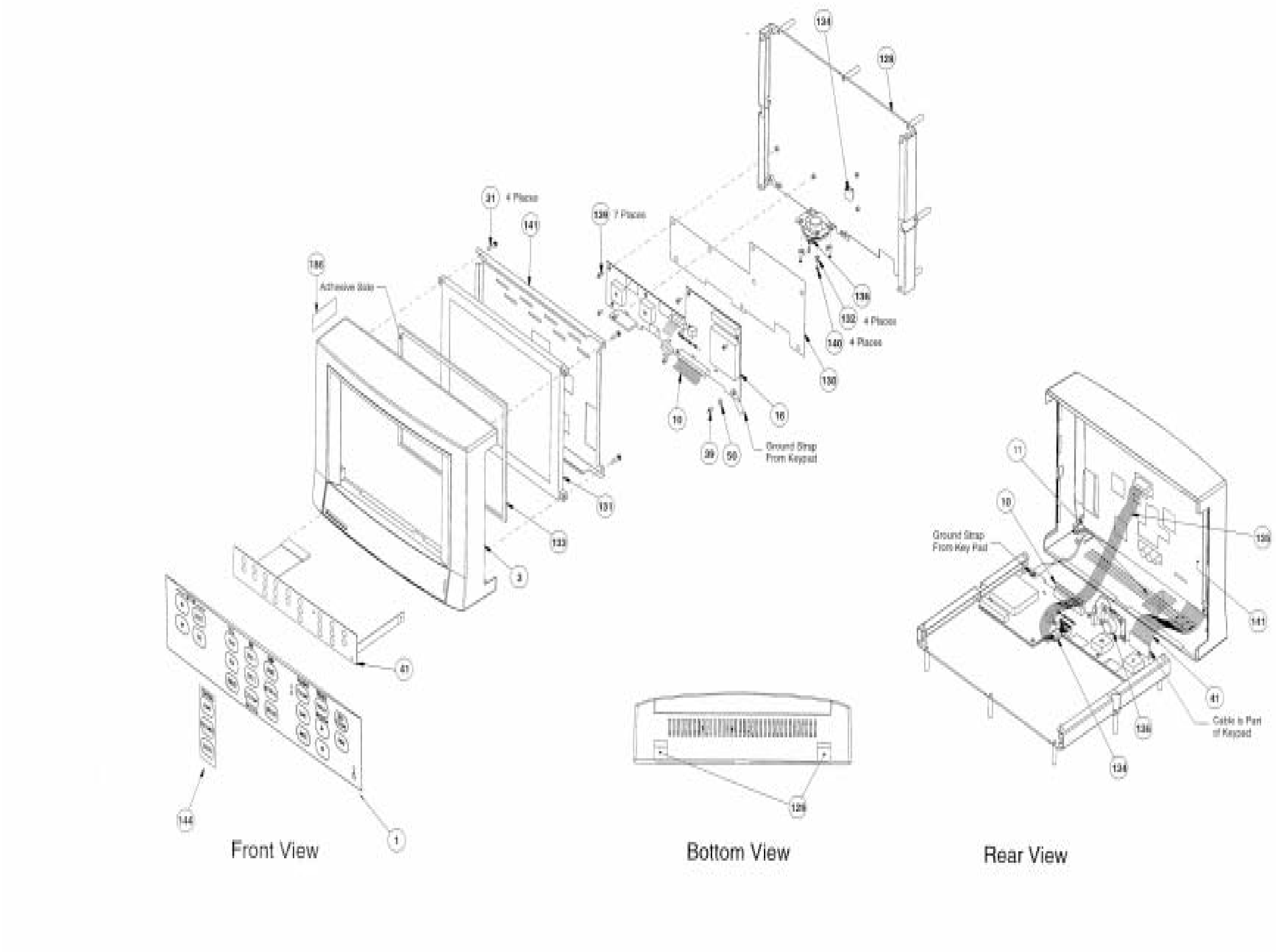

FIGURE 6-3 XE El Display Assembly

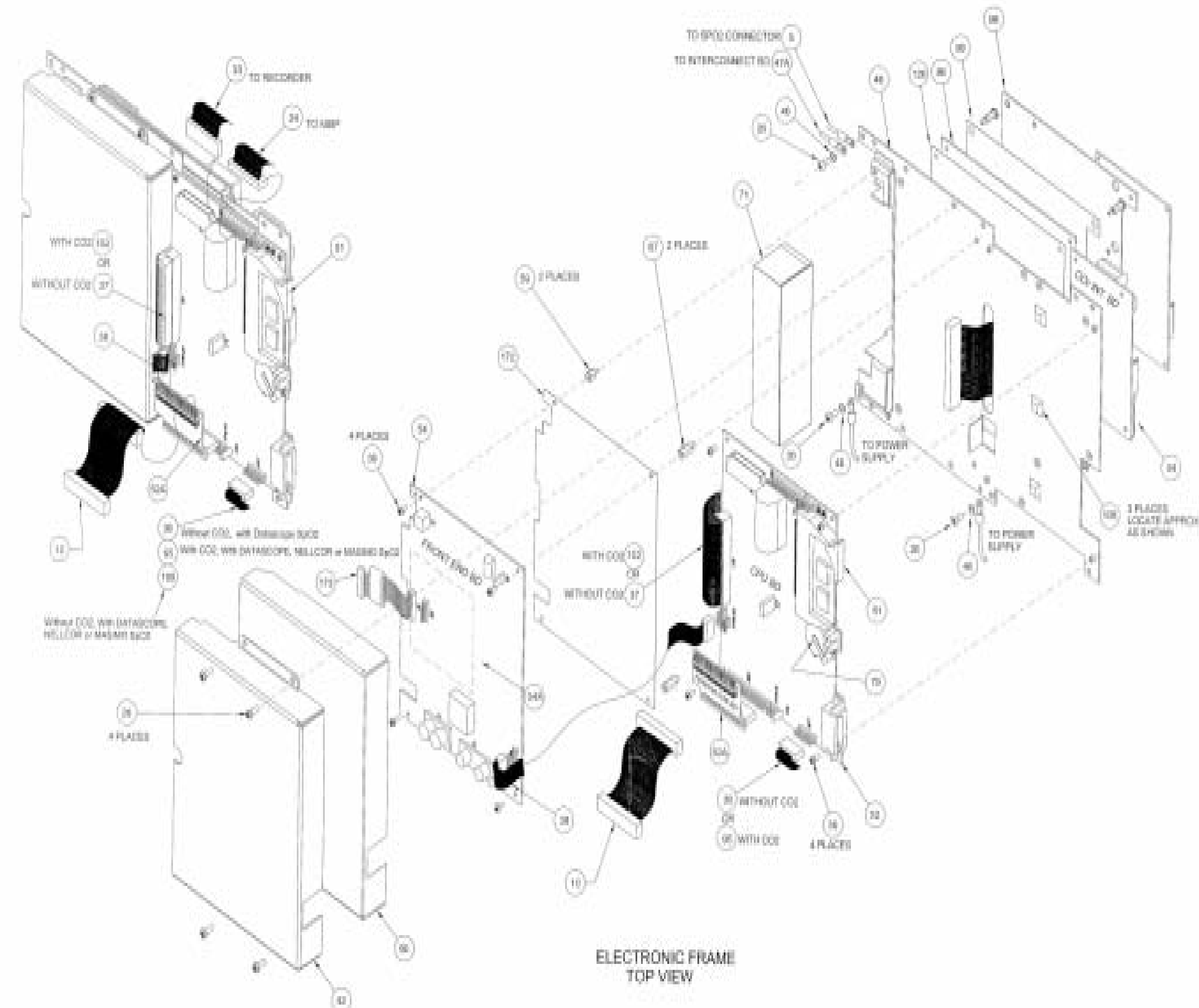

FIGURE 6-4 Detail A
Electronic Frame - Top View

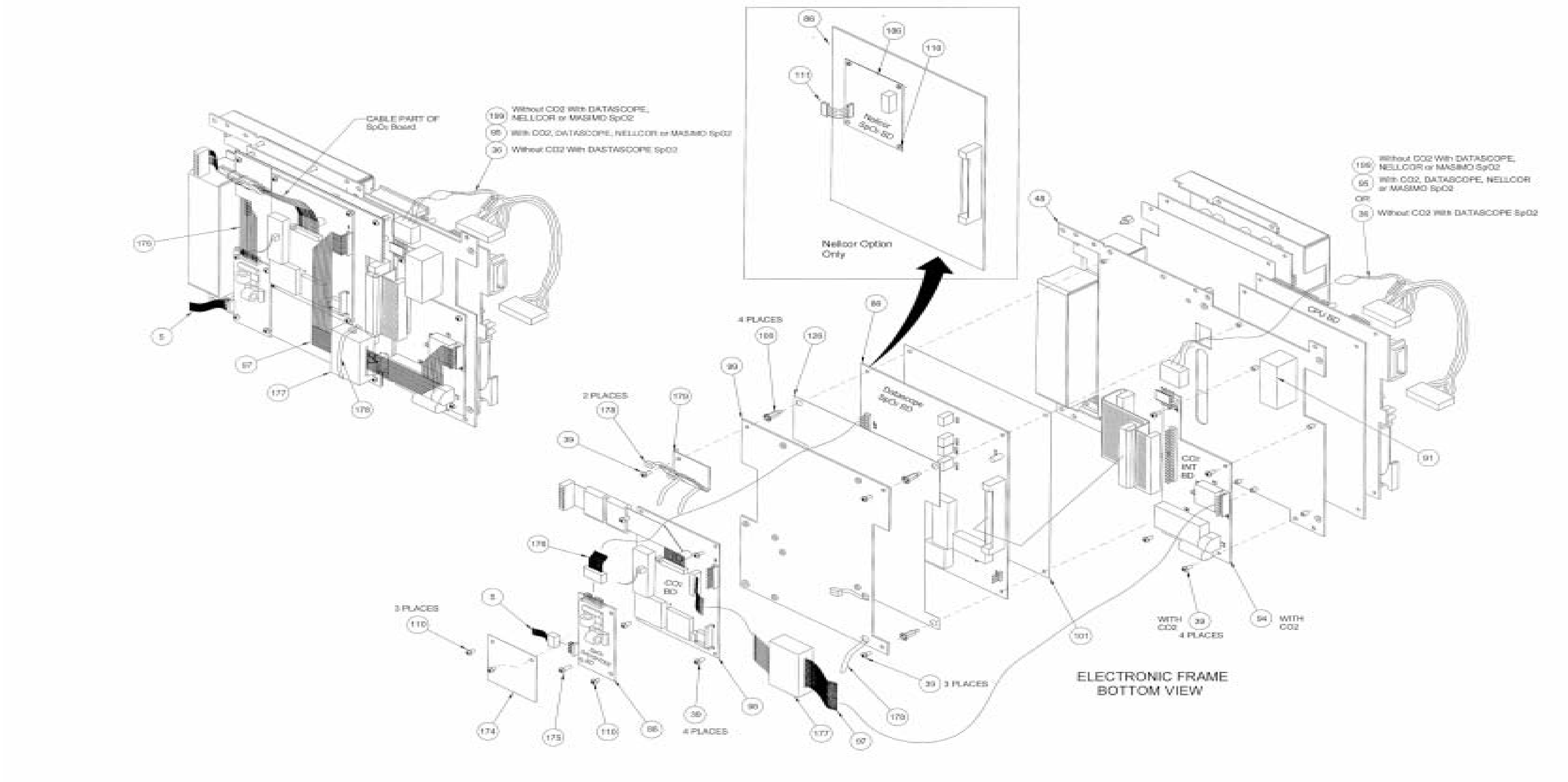

FIGURE 6-5 Detail A
Electronic Frame - Bottom View
With Datascope or Nellcor SpO_2

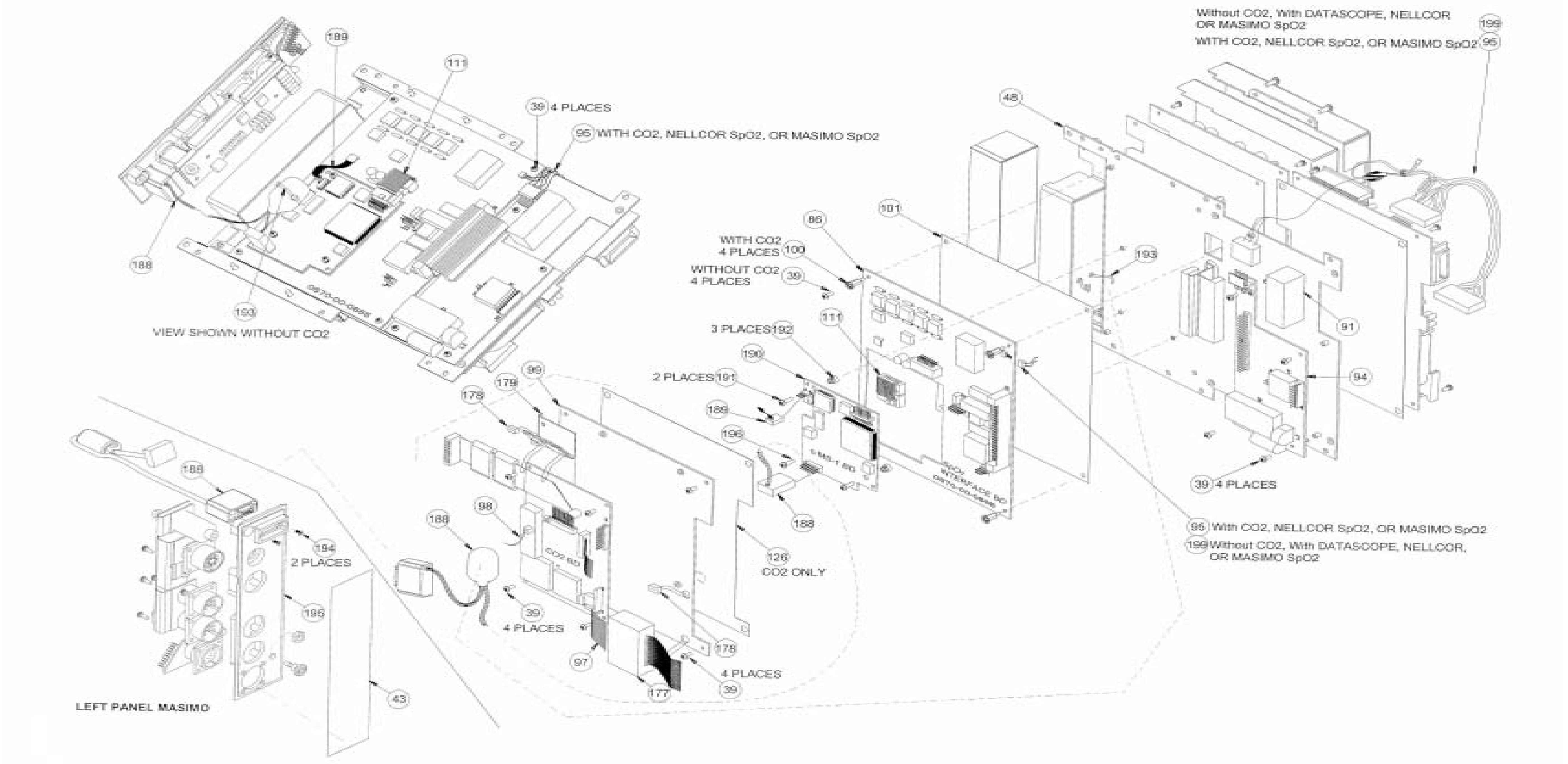

FIGURE 6-6 Detail A
Electronic Frame - Bottom View
With Datascope or Masimo SpO_2

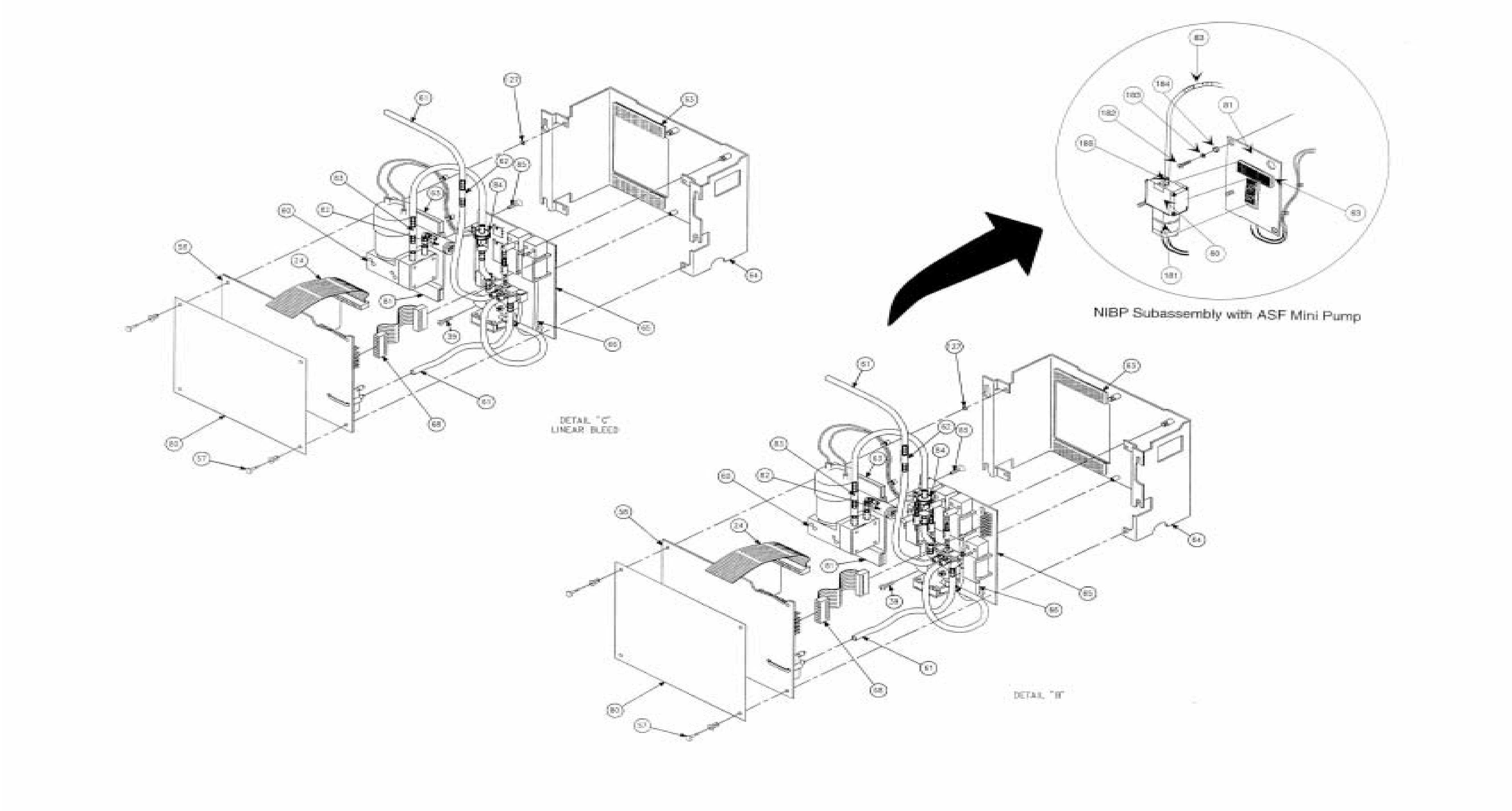

FIGURE 6-7 Detail B/C
NIBP Subassembly

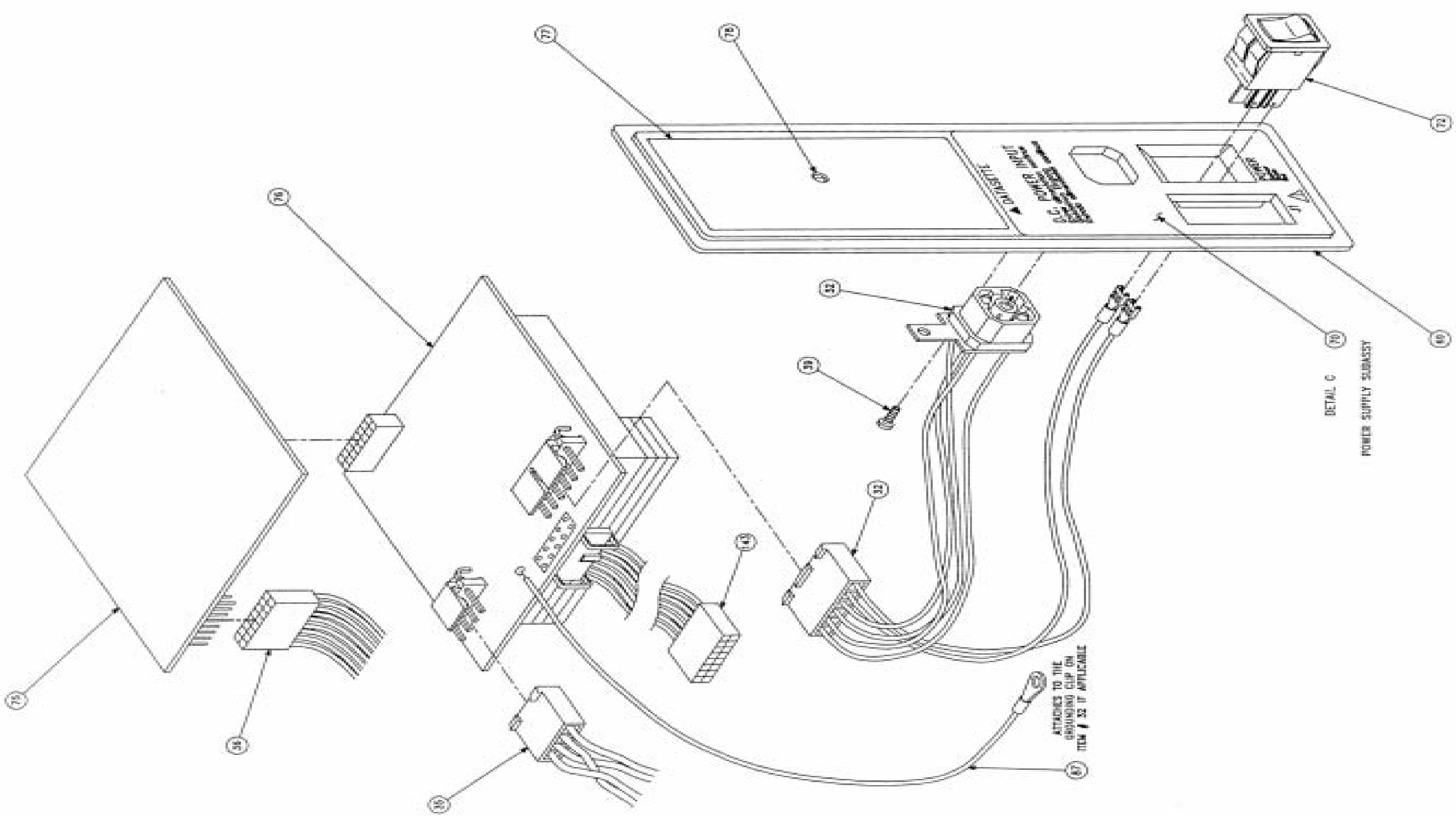

FIGURE 6-8 Detail C
Power Supply Subassembly

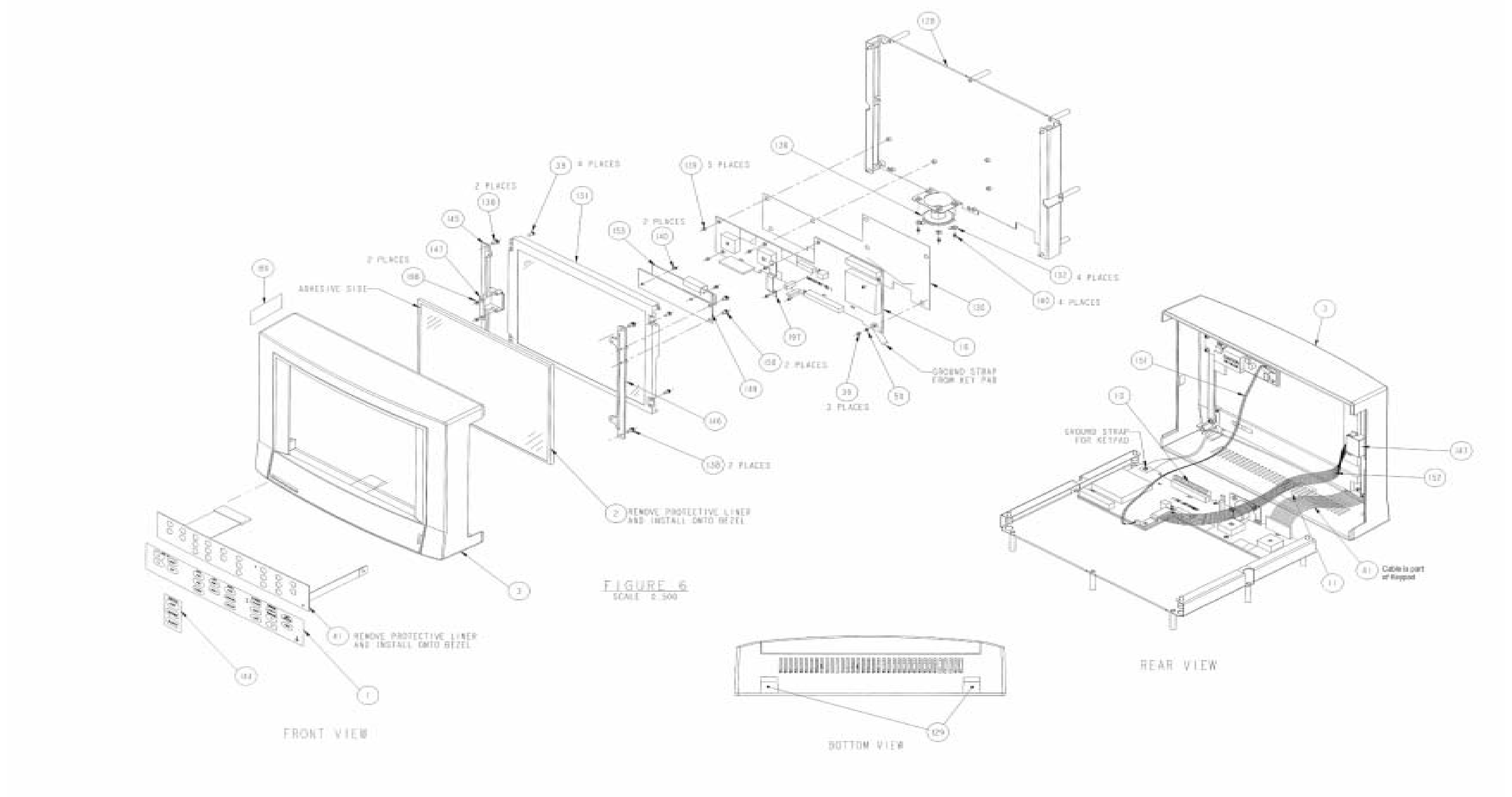

FIGURE 6-9 XG Color LCD Assembly

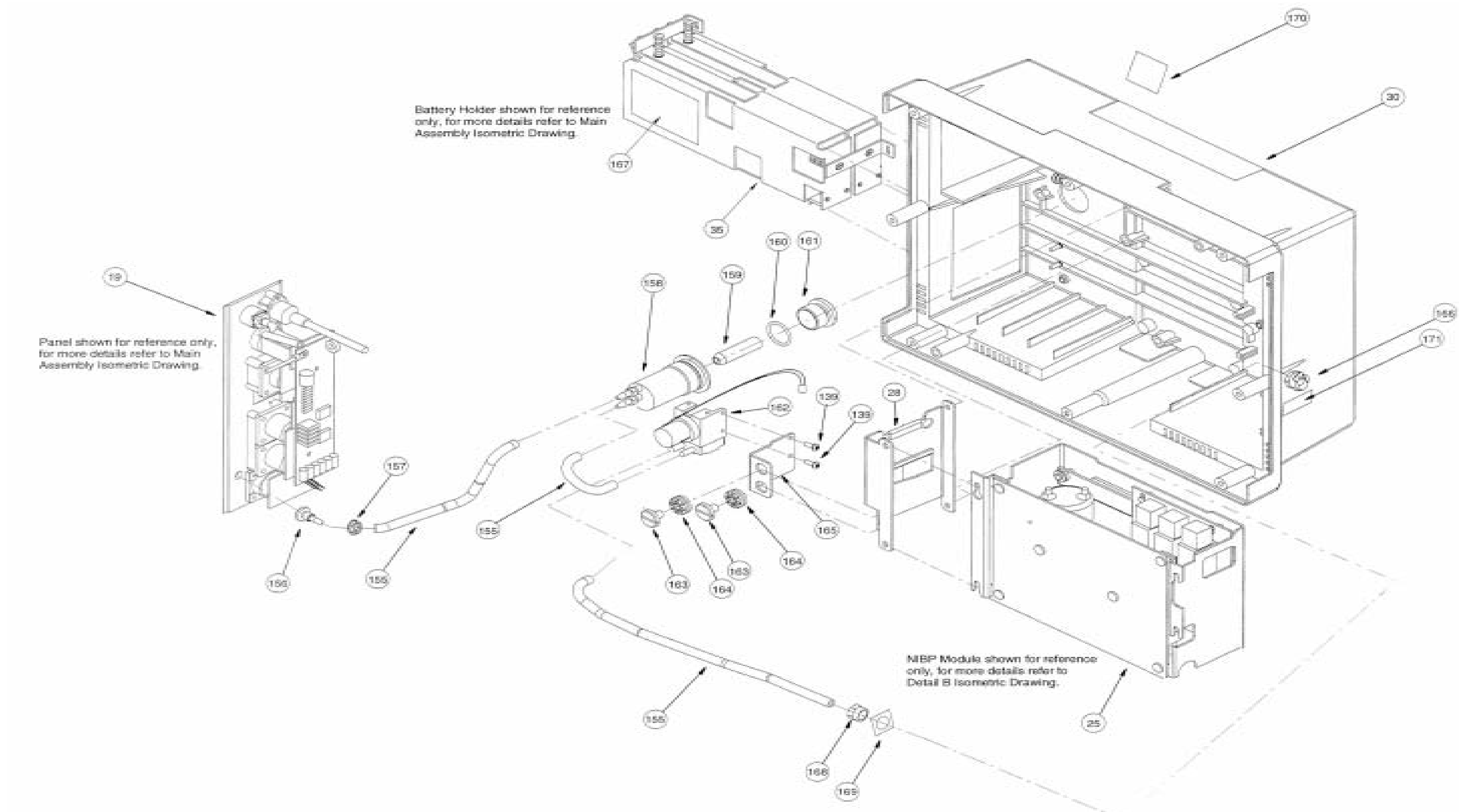

FIGURE 6-10 XG Rear Housing with Sidestream Parts

TABLE 6-1 Replacement Parts

FIGURE NO.	DESCRIPTION	PART NO.
1	Label, Keypad Overlay, 5L & LT	0331-00-0064-XX*
1	Label, Keypad Overlay, XG	0330-00-0017-XX*
N/S	Label, Amber Mute Overlay Key	0334-00-1347
N/S	Label, Blank, (Used w / no Recorder option)	0334-00-0973
2	LCD Filter Glare Screen	0378-00-0033
2	E.L. Filter Glare Screen	0378-00-0035
2	Color LCD Filter Glare Screen	0378-00-0038
3	LCD Front Housing (LT,5L)	0380-00-0187-02
3	E.L. Front Housing (LT,5L)	0380-00-0205-02
3	XG, Front Housing	0380-00-0298
3	XG, Front Housing (0998-00-0134-83-84-95-96) 0380-00-0298-02	
3	XG, Front Housing (CE)	0380-00-0332-01
4	Label, Front Housing Logo (5 Lead)	0334-00-1341
4	Label, Front Housing Logo (LT)	0334-00-1354
5	Cable Assy., SpO2 patient Connector	0012-00-0431-06
5	Cable Assy; SpO2 patient connector (CE)	0012-00-1009
5	Cable Assy; SpO2 patient connector (Nellcor)	0012-00-1052
6	Cap, CO2 plug (CE)	0200-00-0311
7	PCB, Interconnect Bd.	0670-00-0576-01
7	PCB, Interconnect Bd. H/P Style	0670-00-0615
7	PCB, Interconnect Bd, (CE)	0670-00-0628
7	PCB, Interconnect Bd, HP (CE)	0670-00-0629
N/S	Standoff, Pcb, 3/16"lg.	0361-41-0001
N/S	Standoff, Pcb, 3/8" lg.	0361-41-0002
8	LCD Display	0160-00-0007
9	Cable, LCD to Panel bd.	0012-00-0676
10	Cable, CPU to Panel Bd.	0012-00-0744
11	Plastic Mesh	0349-00-0173
12	Cable, Speaker	0012-00-0257-01
13	Tape, Self Adhesive	0348-00-0152
14	Screw, #4-40 x .312 Lg. Pan Hd.	0121-04-0405
15	Bracket, Speaker	0406-00-0561
16	Panel Bd. (LCD Version, 5L & LT)	0670-00-0546
16	Panel Bd. (E.L. Version, 5L & LT)	0670-00-0500
16	VGA/EL Panel Bd. (XG)	0670-00-0617-01
16	VGA/LCD Panel Bd. (XG-Color LCD)	0670-00-0617-02
16	VGA/EL Panel Bd. (XG-CE)	0670-00-0617-03
17	Knob, Panel Board	0366-00-0079

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

TABLE 6-1 Replacement Parts

FIGURE NO.	*DESCRIPTION*	*PART NO.*
19	Panel, Left Side	0380-00-0207-02
19	Panel, Left Side (Nellcor input)	0380-00-0254-02
20	Battery (single battery) (2 req.)	0146-00-0043
21	Door, Battery	0370-00-0016-02
22	Latch, Battery Door	0105-00-0075
22A	Strap, Battery Door	0346-00-0033
23	Recorder	0683-00-0441
23B	Label, Loading Recorder's Paper	0334-00-1431
23C	Door, Filler Plate (No recorder Version)	0370-00-0017-02
24	Cable, Assy., NIBP Module to CPU Bd.	0012-00-0593-04
25	NIBP Module Assy.	0997-00-0469
25	NIBP Module Assy. (5L-CE)	0997-00-0915-01
25	NIBP Module Assy. (XG-CE)	0997-00-0468
26	SCR, #6-32 x .312 lg. PN HD	0212-12-0605
27	Handle (1 piece)	0367-00-0052
28	Bracket, NIBP, Left	0406-00-0543
28	Bracket, NIBP, Left (SSCO2)	0406-00-0721
28	Bracket, NIBP, Left (CE)	0406-00-0703
29	Bracket, NIBP, Right(CE)	0406-00-0704
29	Bracket, NIBP, Right	0406-00-0541
30	Back Housing English / French	0380-00-0186-02
30	Back Housing English (Sidestream)	0380-00-0186-03
30	Back Housing German (5L)	0380-00-0236-02
30	Back Housing (XG-CE with Sidestream)	0380-00-331-01
30	Back Housing (XG-CE without Sidestream)	0380-00-331-02
31	SCR, #6-32 x .50 lg PN HD	0212-12-0608
N/S	Label, Caution (top under handle)	0334-00-1428
N/S	Clamp, cable, Adhesive Backed	0343-05-0002
N/S	Label, Inside Datasette Door	0334-00-1429
N/S	Label, Serial Number (blank number)	0334-00-1358
32	Cable Assy, Line Battery to Power Connector And Switch	0012-00-0662-02
32	Cable Assy, Line Battery to Power Connector and Switch (5L-CE)	0012-00-1008
32	Cable Assy, Line Battery to Power Connector and Switch (XG-CE)	0012-00-1070
33	Cable Assy, Recorder to CPU	0012-00-0659
33	Cable Assy, Recorder to CPU (XG-CE)	0012-00-1067
34	Plate, Luer	0386-00-0162
35	Battery Holder Assy.	0997-00-0292

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

TABLE 6-1 Replacement Parts

FIGURE NO.	DESCRIPTION	PART NO.
36	Cable Assy., CPU to +12/-23.5 V Supply Bd.	0012-00-0673
37	Cable Assy., SpO2 to CPU Bd.	0012-00-0658
38	Cable Assy., Frontend to CPU Bd.	0012-00-0674
39	SCR #4-40 x 1/4 lg. PN HD Mach.	0212-12-0404
40	Insulator Front End Board	0349-00-0140
41	Keypad, Switch Membrane (5L & LT)	0331-00-0068
41	Keypad, Switch Membrane (XG)	0331-00-0092
41	Keypad, Switch Membrane (XG-Color LCD)	0331-00-0098
42	Cover, Frontend	0200-00-0284
43	Label, w/Datascope SpO2	0334-00-1044-XX*
43	Label, w/Nellcor SpO2	0334-00-1161-XX*
43	Label, w/Masimo SpO2	0334-00-1457-XX*
44	SCR, #8-32 x 3/16 lg, Set Hex	0212-05-0806-21
45	Pin, Handle 1/8" Dia. (2 required)	0226-00-0015
45A	Washer, .03 Thick White Rubber (2 required)	0221-00-0116
46	Washer , Lock Internal Tooth	0210-09-0006
47	Nut, Hex 6-32 (used to secure cable to Interconnect Bd.)	0223-00-0006
47A	Cable Interconnect GND	0012-00-0701
48	Frame, Board Mount	0426-00-0061
49	Screw, #4, 5/16 lg. PH Self Tapping	0213-09-0405
49	Screw, #4-40 x 7/16 Lg. PH Self Tapping	0213-08-0407
49A	Spacer, Nylon	0361-09-0004
50	Washer, Internal Tooth #4	0210-09-0004
51	Datasette, (Table 6-1 on page 6-17)	0670-00-0561-XX
51	Datasette, (Table 6-1 on page 6-17)	0670-00-0574-XX
52	CPU Bd. Assy. (0998-00-0126-XX, 0998-00-0133-XX, w/o battery)	0670-00-0591
52	CPU Bd Assy. (0998-00-0131-XX, 5L-CE w/o battery)	0670-00-0623
52	CPU Bd Assy. (0998-00-0134-XX, 5L, XG w/o battery)	0670-00-0631
52	CPU Bd Assy. (0998-00-0137-XX, XG-CE w/o battery)	0670-00-0651
52	CPU Bd. Assy. (0998-00-0134-XX, 5L, XG w/o battery) 5L-S/N 10000 and above, XG-S/N 15000 and above	0670-00-0688
52	CPU Bd. Assy. (0998-00-0137-XX, XG-CE w/o battery) S/N 15000 and above	0670-00-0689
52A	Termination Bd. (loc. J68 on CPU Bd), XG-CE	0670-00-0648
53	Cable , Clamp (White)	0343-00-0066
54	PCB, Front End Bd.	0670-00-0560-03

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

TABLE 6-1 Replacement Parts

FIGURE NO.	*DESCRIPTION*	*PART NO.*
54	PCB, Front End Bd. H/P option	0670-00-0560-04
54	PCB, Front End Bd (5L-CE)	0670-00-0624-01
54	PCB, Front End Bd HP (5L-CE)	0670-00-0624-02
54	PCB, Front End Bd (XG-CE, 54A not used)	0670-00-0620-01
54	PCB, Front End Bd HP (XG-CE, 54A not used)	0670-00-0620-02
54A	Daughter Bd.	0670-00-0611
54A	Daughter Bd (5L-CE)	0670-00-0627
56	Tape, Closed Cell Vinyl 1.8" thick	0215-00-0093-01
57	Rivet, Snap	0225-00-0001
58	PCB, Control Board	0670-00-0375
58	PCB, Control Board	0670-00-0657
59	Standoff, Hex MF Nylon #4-40	0361-32-0250
60	NIBP Pump, w/o Cable Assembly	0119-00-0116
60	NIBP Pump, w/o Cable Assembly (used with 0997-00-0468 & 0469 NIBP Modules)	0104-00-0019
61	Tubing, Silicone 1/8" ID x 1/4" OD	0008-10-0408
62	Filter, 43uF	0378-02-0002
63	Tape , Interconnecting	0215-08-0001
64	Chassis, NIBP Module	0441-00-0067
65	PCB, Pneumatic Assy.	0670-00-0447
65	PCB, Pneumatic Assy. CE (Linear Bleed)	0670-00-0605-01
66	Tubing, Silicone 1/16" ID x 1/8" OD	0008-10-0204
67	Standoff, Hex Metal #4-40 (CE)	0361-30-0437
67	Standoff, Hex Nylon #4-40	0361-32-0500
68	Cable Pneumatic Bd. to Control Bd.	0012-00-0656
69	Panel, Right Side (Power Input)	0380-00-0184-02
70	Label, Power Input	0334-00-0968
70	Label, Power Input w/o J1 conn. (0998-00-0134-83,-84,-95,-96)	0334-00-0968-04
71	Insulator, Frame (for interconnect Bd.)	0349-00-0132
72	Switch, Curved Rocker	0261-00-0139-02
75	PCB, +12/-23.5 V Supply Bd.	0670-00-0450
76	PCB, Line Battery Supply Bd.	0670-00-0449
76	PCB, Line Battery Bd (5L-CE)	0670-00-0621
76	PCB, Line Battery Bd (XG)	0670-00-0626
76	PCB, Line Battery Bd (XG-CE)	0670-00-0656
77	Door, Datasette	0370-00-0015-02
78	Screw, #4-40 x .437 lg. Captive	0217-00-0005
N/S	Washer, Captive Split, #4	0221-00-0114
79	Battery, CPU Bd.	0146-02-0001

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

TABLE 6-1 Replacement Parts

FIGURE NO.	DESCRIPTION	PART NO.
80	Shield, Mylar	0349-00-0122
81	Plate, Pump (used with 0997-00-0468 and 0997-00-0469 NIBP Modules)	0386-00-0225
81	Plate, Pump	0386-00-0154
82	Muffler	0103-00-0329
83	Filter, 5um	0378-02-0001
84	Check Valve	0103-00-0457
85	Screw, Mach, Metric Flat Hd. Cross Recessed M4 - 0,7 x 8 Lg	0211-27-0001
86	PCB, SpO2 Bd. (Datascope)	0670-00-0482
86	PCB, SpO2 Interface Bd. Nellcor	0670-00-0557
86	PCB, SpO2 Interface Bd. (MS-1)	0670-00-0665-01
86	PCB, SpO2 Interface Bd. (Nellcor)	0670-00-0665-02
N/S	Bumper (3 req. on back of bd.)	0348-00-0154
87	Wire, 18 ga.	0006-02-1854
N/S	Ring Terminal	0210-19-0006
88	PCB SpO2 Daughter Bd. (CE)	0670-00-0619
89	Pneumatic fitting, Luer Male(w/ washer & nut)	0103-00-0223
90	Insulator Cover	0349-00-0131
90	Insulator Cover (XG-CE)	0349-00-0289
91	Spacer, P/S Bd	0361-00-0153
92	Clamp, Cable, 3/16, Self Adhesive	0343-00-0007
93	Ault Power Supply (External Power Supply) 120V, 5L-CE Units only	0014-00-0027-22
93	Ault Power Supply (External Power Supply) 220V, 3L, 5L, LT	0014-00-0027-23
93	Ault. Power Supply, 3L, 5L, LT	0014-00-0173-01
93	Ault. Power Supply, XG	0014-00-0173-04
N/S	Line Cord (Domestic)	0012-25-0001
N/S	Line Cord (Europe)	0012-25-0002
94	CO2 Interface Bd. (0998-00-0126-XX, 0998-00-0131-XX,0998-00-0133-XX)	0670-00-0497
94	CO2 Interface Bd. (0998-00-0134-XX, 0998-00-0137-XX)	0670-00-0632-02
95	Cable, CPU to +12/-23v Bd. to CO2 Interface Bd.(5L-CE)	0012-00-0738
95	Cable, CPU to +12/-23v Bd. to CO2 Interface Bd. (XG)	0012-00-1053
95	Cable, CPU to +12/-23v Bd. to CO2 Interface Bd. (XG-CE)	0012-00-1071
95	Cable, CPU to + 1/2v/-23v Bd. To CO2 Interface Bd. And SpO2 Interface Bd.	0012-00-1100
96	Cable with CO2 Left side Connector	0012-00-0733
96	Cable with CO2 Left side Connector (5L-CE)	0012-00-1006

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

TABLE 6-1 Replacement Parts

FIGURE NO.	*DESCRIPTION*	*PART NO.*
96A	CO_2 Left side Panel Connector	0131-00-0243
96B	CO_2 Left side Panel Connector (XG-CE w/GND)	0131-00-0244
97	Cable, CO_2 Control Bd. to CO_2 Interface Bd.	0012-00-0743
97	Cable, CO_2 Contr. Bd. to CO_2 Interface Bd. (XG)	0012-00-1046
98	CO_2 Control Module (0998-00-0126-XX, 0998-00-0131-XX,0998-00-0133-XX)	0671-00-0001
98	CO_2 Control Module (0998-00-0134-XX)	0671-00-0118
98	CO_2 Control Module (0998-00-0137-XX)	0671-00-0120
99	Plate, CO_2 Mounting (Nellcor SpO_2, 5L-CE)	0426-00-0052
99	Plate, CO_2 Mounting (5L-CE)	0386-00-0221
99	Plate, CO_2 Mounting (Nellcor SpO_2, $SSCO_2$)	0386-00-0230
99	Plate, CO_2 Mounting (XG-CE)	0386-00-0230
99	Plate, CO_2 Mounting (XG w/Nellcor, Masimo)	0386-00-0234
100	Standoff, #4-40 x .43 Lg Hex	0361-30-0180
101	Insulator, Spo2 Bd.	0349-00-0141
101	Insulator, SpO_2 Interface Bd.	0349-00-0300
102	Cable, CPU to CO_2 Interface to SpO_2 Bd.	0012-00-0737
103	Clamp, CO_2 Connector	0343-00-0070
104	Screw, #2-56 x .375 Mach FH 82 Degree	0212-16-0206
105	Bumper	0348-00-0161
106	PCB, Nellcor, Pulse Oximetry Module	0671-00-0007
107	Bracket, Connector Nellcor	0406-00-0635
108	Door, Connector, Nellcor	0307-00-0021
109	Nut Fastener Nellcor	0220-07-0002
110	Screws	0212-04-0403
111	Cable Assy, SpO_2 Interface/Nellcor	0012-00-0885
112	Terminal, Equipotential	0124-00-0104-01
113	Washer, German Green-Yellow	0124-00-0104-02
114	Washer, 1/4 Lock	0124-00-0104-03
115	Nut, M6 x 1.00 Thread	0124-00-0104-04
116	Cable Assy., German Ground	0012-00-0829
117	Screw, #6-32 x 1 1/2" LG (German ver, Only)	0212-14-0624
118	Spacer, Round Nylon (German Ver. Only)	0361-08-0014
119	Thumb Screw	0211-00-0138
120	Shield, E.L. Display (CE)	0337-00-0098
121	E.L. Display w/ Power Supply Bd. (Planar)	0160-00-0009
122	Cable, Power Supply to E.L. Display	0012-00-0735
123	Cable, Power Supply to E.L. Panel Bd.	0012-00-0734
123	Cable, Power Supply to E.L. Panel bd. (CE)	0012-00-1007
124	Mylar Insulator, E.L. Power Supply	0349-00-0172

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

TABLE 6-1 Replacement Parts

FIGURE NO.	DESCRIPTION	PART NO.
125	SCR # 4-40 x 1/4 Lg. PN HD Mach.	0212-12-0404
126	Mylar Insulator, CO2 Frame (Masimo)	0349-00-0268
126	Mylar Insulator, CO2 Frame (Nellcor, CE)	0349-00-0284
127	Washer, Nylon	0210-07-0004
128	Bracket, XG Screen	0406-00-0694
128	Bracket, XG-CE Screen	0406-00-0726
129	Feet	0348-00-0182
130	Insulator, XG Front Panel Bd.	0349-00-0266
131	XG E.L. Display	0160-00-0044
131	XG Color LCD Display	0160-00-0028
N/S	Backlight, Color Display	0149-00-0009
132	Bracket, XG Speaker	0870-00-0038
133	Gasket, Display	0348-00-0181
134	Clamp, Cable	0343-05-0001
135	Cable, Monochrome 20 Pin	0012-00-1005
136	Cable, Speaker	0012-00-0257-01
137	Insulator, Plastic Mesh	0349-00-0173
138	Scr #6-32 x 1/4 Lg. Pan Hd	0212-12-0604
139	Scr #4-40 x 3/16 Lg. Pan Hd	0212-12-0403
140	Scr #2-56 x 3/16 Lg. Pan Hd	0212-12-0203
141	Shield, EMC, EL Display (XG-CE)	0337-00-0109
142	Tubing, Heat Shrink (CE)	0008-01-0009
143	Connector	0012-00-1012
144	Label, Passport XG, Central Silence	0334-00-1381-01
144	Label, Passport XG, Central Silence (Spanish)	0334-00-1381-02
144	Label, Passport XG, Central Silence (German)	0334-00-1381-03
144	Label, Passport XG, Central Silence (French)	0334-00-1381-04
144	Label, Passport XG, Central Silence (Italian)	0334-00-1381-05
144	Label, Passport XG, Admit/Discharge/Silence	0334-00-1382-01
144	Label, Passport XG, Admit/Discharge/Silence (Spanish)	0334-00-1382-02
144	Label, Passport XG, Admit/Discharge/Silence (German)	0334-00-1382-03
144	Label, Passport XG, Admit/Discharge/Silence (French)	0334-00-1382-04
144	Label, Passport XG, Admit/Discharge/Silence (Italian)	0334-00-1382-05
144	Label, Passport 3L and 5L, Central Silence	0334-00-1197
145	Mounting Rail, Left	0436-00-0179
146	Mounting Rail, Right	0436-00-0180
147	Bracket, Cable	0406-00-0795
149	Bracket, Board Mtg	0406-00-0700
150	Scr #6-32 x 3/16 Lg. Pan Hd	0212-12-0603

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

TABLE 6-1 Replacement Parts

FIGURE NO.	DESCRIPTION	PART NO.
151	Cable, Assy DC/AC Inverter	0012-00-1040
152	Cable, Assy Signal Driver	0012-00-1039
153	High Voltage Power Supply Bd. (XG- Color LCD)	0014-00-0177
155	Tubing, Input Fitting to Filter 7.25”	0103-00-0450
155	Tubing, Filter to Pump Inlet 2.25”	0103-00-0450
155	Tubing, Pump Output to Exhaust Fitting	0103-00-0450
156	Luer, Female Input (bent)	0103-00-0447
156	Luer, Female Input (straight, XG-CE)	0103-00-0448
157	Nut, 1/4 - 32 NEF-2B	0220-00-0089
158	Filter Housing Assembly (includes items 159,160 and 161)	0103-00-0446-02
159	Filter	0103-00-0452
160	O-Ring	0354-00-0050
161	Cap	0200-00-0318
162	Pump, Assembly	0104-00-0017
163	Screw, Shock Mount	0217-00-0010
164	Shock Mount, Grommet	0348-00-0184
165	Bracket, Pump Assembly	0406-00-0719
166	Coupling Panel Mount	0103-00-0453
167	Label, Service Diagram For Internal Tubing	0334-00-1413
168	Nut, Exhaust Coupling	0220-00-0090
169	Nut Plate, Exhaust Coupling	0386-00-0229
170	Label, Filter	0334-00-1407
171	Label, Pump Exhaust	0334-00-1408
172	Insulator, Front end Bd.	0349-00-0287
173	Cable, Interconnect to Front End Bd. (XG-CE)	0012-00-1064**
174	Insulator, SpO2 ESD Bd.	0349-00-0273
175	Screw, 4-40 X .375 PN HD	0212-12-0406
176	Cable, SpO2 Daughter Bd. to SpO2 Bd., 16 pin	0012-00-1007
177	Inductor, Split Core (XG-CE)	0108-00-0088
178	Tie wrap	0125-02-0001
179	Bracket, CO2 Input Cable	0406-00-0725
180	Insulator, CPU Board	0349-00-0296
181	Tie Wrap	0125-01-0004
182	Screw, Pan Hd, 4-40 x 7/16	0212-12-0407
183	Washer, #4	0221-00-0004
184	Insulator	0432-02-0001
185	Clamp, Hose	0343-00-0067
186	Masimo Set Label	0334-00-1466
187	Cover, CO2 Connector	0200-00-0311

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

TABLE 6-1 Replacement Parts

FIGURE NO.	*DESCRIPTION*	*PART NO.*
188	Cable, Masimo SpO2	0012-00-1204
188a	Ferrite (for Masimo SpO2 cable)	0108-00-0076
189	Cable, Masimo (J2)	0012-00-1102
190	PCB, Masimo MS-1 Board	0671-00-0126
191	Screw, #4-40 x .375 Lg. NYL	0212-01-0406
192	Spacer, Retainer	0361-00-0440
193	Tie wrap	0125-01-0003
194	Screw, Metric (M 2.5 x 5)	0211-00-0140
195	Panel, Left side Masimo	0380-00-0336
196	Screw, 4-40 x . 563 Long PNHD	0212-12-0409
N/S	Cable, Tie with Screw Hole	0125-00-0018
197	Bracket, cable Mount (Panel Bd)	0406-00-0752
198	Screw #4-40 x 1/4 Lg 82 Flat Head	0212-14-0404
199	Cable, CPU to +12 V/-23 V Bd. To SpO2 Interface Bd. (Non-CO2 units)	0012-00-1380

N/S = Not Shown

* *See tables on page 6-26 for the part numbers of various versions of the keypad overlays.*

** *This cable is part of the Daughter Bd. for all other versions other than XG-CE.*

Passport LT Keypad Overlays

	LT - LCD	*LT - E.L.*
English	0331-00-0064-17	0331-00-0064-18
Spanish	0331-00-0064-21	0331-00-0064-22

Passport 5L & LT with Optional Paks Keypad Overlays

	LCD WITH IBP 1 & 2	*LCD WITHOUT IBP 1 & 2*	*E.L. WITH IBP 1 & 2*	*E.L. WITHOUT IBP 1 & 2*
English	0331-00-0064-01	0331-00-0064-02	0331-00-0064-03	0331-00-0064-04
German	0331-00-0064-05	0331-00-0064-06	0331-00-0064-07	0331-00-0064-08
Spanish	0331-00-0064-09	0331-00-0064-10	0331-00-0064-11	0331-00-0064-12
French	0331-00-0064-13	0331-00-0064-14	0331-00-0064-15	0331-00-0064-16

Passport XG Keypad Overlays

	XG WITH & IBP WITHOUT CO2 PUMP	*XG WITHOUT IBP & WITHOUT CO2 PUMP*	*XG WITH IBP & WITH CO2 PUMP*	*XG WITHOUT IBP & WITH CO2 PUMP*
English	0330-00-0017-01	0330-00-0017-04	0330-00-0017-17	0330-00-0017-18
German	0330-00-0017-13	0330-00-0017-16	0330-00-0017-23	0330-00-0017-24
Spanish	0330-00-0017-05	0330-00-0017-08	0330-00-0017-19	0330-00-0017-20
French	0330-00-0017-09	0330-00-0017-12	0330-00-0017-21	0330-00-0017-22
Italian	0330-00-0017-25	0330-00-0017-26	0330-00-0017-27	0330-00-0017-28

Passport 5 Lead, 5L, LT, XG Datasettes

DATASETTE PART NUMBER	5 LEAD, 5L, LT (0126-XX)	5-CE (0131-XX)	XG (0134 -XX)	XG (0134 -XX)	XG-CE (0137 -XX)	
0670-00-0561-08	X		X			
0670-00-0561-09		X				
0670-00-0561-10						Spanish Only
0670-00-0561-11		X				French Only
0670-00-0574-03	X*			X		Allows Admit from Bedside
0670-00-0574-08					X	5 Languges, CO2 kPa units w/ VISA & Gas Module II/ Masimo SpO2 x/ XG2 Units only
0670-00-0574-09	X		X	X		Nellcor “Sensor Off” Audio, CO2 kPa units w/ VISA & Gas Module II/ Masimo SpO2 w/ XG2 units only

* *This datasette provides an upgrade for 5 Lead, 5L, LT units to allow Admit from Bedside feature.*

Left Side Panel with Datascope SpO_2 or Units without SpO_2

	CO2	IBP	SPO2	NIBP	SSCO2
0334-00-1044-01	X	X	X	X	
0334-00-1044-02		X	X	X	
0334-00-1044-03			X	X	
0334-00-1044-04	X		X	X	
0334-00-1044-05				X	
0334-00-1044-06			X		
0334-00-1044-07					
0334-00-1044-08		X		X	
0334-00-1044-11	X	X	X	X	X
0334-00-1044-12	X		X	X	X

Left Side Panel Label with Nellcor $Sp0_2$

0334-00-1161-03			X	X	
0334-00-1161-04	X		X	X	
0334-00-1161-05	X	X	X	X	
0334-00-1161-06	X		X	X	X
0334-00-1161-07	X	X	X	X	X
0334-00-1161-08		X	X	X	

Left Side Panel Label with Masimo $Sp0_2$

0334-00-1457-01	X	X	X	X	X
0334-00-1457-02		X	X	X	
0334-00-1457-03			X	X	
0334-00-1457-04	X		X	X	X

NIBP BOARD ASSEMBLY			**0670-00-0375** **0670-00-0657**
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0388-00-0375	PCB, NIBP	
2			
3			
4			
5	0315-00-0333	RES, 33K 5%, 1/4W	R1
6	0315-00-0222	RES, 2.2K 5%, 1/4W	R3, R4
7	0315-00-0102	RES, 1K 5%, 1/4W	R5, R11, R12, R16, R115
8	0315-00-0202	RES, 2K 5%, 1/4W	R6
9	0315-00-0303	RES, 30K 5%, 1/4W	R7
10	0309-00-1001	RES, 1K 1%, 1/8W	R8, R41
11	0309-00-1214	RES, 1.21M 1%, 1/8W	R9
12	0309-00-5903	RES, 590K 1%, 1/8W	R10, R122
13	0309-00-0103	RES, 10K 5%, 1/4W	R13-15, R27, R28, R103, R114, R119
14	0309-00-0101	RES, 100W 5%, 1/4W	R120, R121
15	0309-00-1103	RES, 110K 1%, 1/8W	R19
16	0309-00-3572	RES, 35.7K 1%, 1/8W	R20
17	0309-00-2212	RES, 22.1K 1%, 1/8W	R21
18	0309-00-1213	RES, 121K 1%, 1/8W	R22
19	0309-00-2431	RES, 2.43K 1%, 1/8W	R23
20	0309-00-2803	RES, 280K 1%, 1/8W	R24
21	0309-00-4992	RES, 49.9K 1%, 1/8W	R26
22	0315-00-0472	RES, 4.7K 5%, 1/4W	R17, R34, R43, R116
23	0315-00-0104	RES, 100K 5%, 1/4/W	R37, R117
24	0315-00-0473	RES, 47K 5%, 1/4W	R44, R100, R102
25	0315-00-0223	RES, 22K 5%, 1/4W	R101
26	0309-00-2492	RES, 24.9K 1%, 1/8W	R104
27	0315-00-0151	RES, 150W 5%,1/4W	R105
28	0309-00-2942	RES, 29.4K 1%, 1/8W	R110
29	0309-00-1503	RES, 150K 1%, 1/8W	R111
30	0309-00-7682	RES, 76.8K 1%, 1/8W	R112
31	0309-00-2743	RES, 274K 1%, 1/8W	R113
32	0309-00-1002	RES, 10K 1%, 1/8W	R118
33			
34			
35	0307-06-2103	RES NET, 10K, 10 PIN SIP	RP1, RP2
36	0307-00-0029	RES NET, 10K, 14 PIN DIP	RP3, RP4

* *This component is used on the 0670-00-0657 board only.*

NIBP BOARD ASSEMBLY (CONTINUED)			0670-00-0375 0670-00-0657
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
37	0307-00-0020	RES NET, 5.6K, 10 PIN SIP	RP5
38	0311-05-0502	RES ADJ, 5K 10%, S.T.	VR1
39			
40			
41	0290-02-3226	CAP, TANT, 22uF, 20%, 35V	C91, C92, C93
42	0283-05-0220	CAP, 22Pf 10%, 200V	C125
43	0290-02-1226	CAP, TANT, 22uF, 20%, 20V	C1, C90, C114
44	0283-05-0330	CAP, 33pF 10%, 200V	C2, C3
45	0283-05-0103	CAP, .01uF 10%, 00V	C4, C8, C14, C15, C17, C18, C20, C21, C27-30, C102, C104, C105, C122, C123
46	0283-04-0104	CAP, .1uF 10%, 100V	C10, C11, C12, C16, C101, C103, C108, C109, C110, C119, C120, C124
47	0283-04-0224	CAP, .22uF 10%, 50V	C13
48	0283-05-0472	CAP, .0047uF 10%, 100V	C22
49	0285-00-0055	CAP POLY, .47uF	C24, C25, C26
50	0283-05-0332	CAP, .0033uF 10%, 100V	C95
51	0283-04-0473	CAP, .47uF 10%, 100V	C100
52	0290-00-0110	CAP, TANT. 4.7uF 20%, 50V	C106, C107, C111, C112
53	0283-05-0101	CAP, 100pF 10%, 200V	C121
54	0283-04-0474	CAP, 0.47uF 10%, 50V	C19
55	0290-02-3105	CAP, TANT. 1.0uF	C113, C5-C7, C9
56	0153-00-0085	DIODE, IN6263	CR1-8, CR20-22
57	0153-00-0014	DIODE, IN914	CR9, CR18, CR19, CR23, CR24, CR27*
58	0153-00-0098	DIODE, IN4004	CR10
59	0153-00-0069	DIODE, IN5817	CR25
60			
61			
62			
63	0151-00-0195	XSTR, IRLD014 PWR MOSFET	Q1
64	0151-00-0052	XSTR, 2N4401	Q4
65			
66			
67	0155-00-0205	IC, 74LS244 OCTAL BUFFER	U3
68	0155-00-0440	IC,DS1244Y, 32K x 8	U1

* *This component is used on the 0670-00-0657 board only.*

NIBP BOARD ASSEMBLY (CONTINUED)			0670-00-0375 0670-00-0657
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
69	0155-00-0439	IC, 74HCT573, OCTAL D LATCH	U2
70	0155-00-0426	IC, 74HCT244, OCTAL BUFFER	U18
71	0155-00-0400	IC, MAX 232, DUAL CHNL RS232	U4
72	0155-00-0442	IC, 80C196KB, uCNTLR	U5
73	0155-90-0111	IC, NIBP U6, EPROM	U6
74	0155-90-0112	IC, NIBP U7, EPLD	U7
75	0155-00-0404	IC, DG201, ANALOG SW	U8
76	0155-00-0424	IC, AD7226, QUAD 8-BIT DAC	U9
77	0151-00-0068	IC, 79L05, -5V REG	U10
78	0155-00-0053	IC, LM324, LO PWR OP-AMP	U11, U21
79	0153-00-0093	IC, SG3503, VOLTAGE REF	U12
80	0155-00-0443	IC, LT1014, QUAD OP-AMP	U13, U14
81	0151-00-0100	IC, ULN2003, XSTR ARRAY	U15
82	0155-00-0213	IC, 74HCOD, QUAD 2 IN NAND	U17
83	0155-00-0438	IC, 74HCT245, OCTAL BUS XCVR	U19
84			
85			
86			
87	0158-01-0024	CRYSTAL	Y1
88	0682-00-0059	SENSOR BLOOD PRESSURE	PT1
89			
90			
91	0136-24-1026	HEADER, DUAL 13, 26 PIN	J28
92	0136-24-1020	HEADER, DUAL 10, 20 PIN	J31, J33
93	0136-24-1050	HEADER, DUAL 25, 50 PIN	J32
94	0136-57-0068	SOCKET, IC PLCC 68 PIN	XU5
95	0136-01-1028	SOCKET, IC, 28 PIN	XU6
96	0136-01-1020	SOCKET, IC, 20 PIN	XU7, XU9
97	0432-01-0002	MOUNTING PAD	
98	0214-00-0074	INSULATOR BEAD	
99			

* *This component is used on the 0670-00-0657 board only.*

NIBP BOARD ASSEMBLY (CONTINUED) — 0670-00-0375, 0670-00-0657

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
100	0125-01-0001	CABLE TIE WRAP	
101	0285-10-0474	CAP, 0.47uF, 2%, 50V	*C126
102	0307-00-1213	RES, 121K, 1%, 1/8W	*R124

* *This component is used on the 0670-00-0657 board only.*

PNEUMATICS BOARD ASSEMBLY			0670-00-0447
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
1	0670-00-0447-01	Pneumatics Board English	
2	0670-00-0447-02	Pneumatics Board German	
3	0670-00-0447-03	Pneumatics Board French	
4	0670-00-0447E	Exchange Board	
5	0290-11-0001	Cap., 3300uF, 25V	C1
6	0108-00-0065	Cap., 0.1uF, 100V, 10%	C2
7	0136-50-0003	Header, 3P	J29
8	0136-24-1020	Header, 20P	J30
9	0136-24-1014	Header, 14P	J34
10	0108-06-1000	Choke	L1
11	0108-00-0065	Inductor, Dual Winding	L2
12	0262-00-0005	Switch, Pressure	SW1
13	0119-00-0130	Valve	V1
14	0119-00-0130	Valve	V2
15	0119-00-0130	Valve	V3
16	0119-00-0130	Valve	V4
17	0119-00-0131	Valve	V5
18	0212-12-0418	Screw, PH,#4-40 x 1.12 Lg	
19	0223-00-0004	Nut, Hex, #4	
20	0215-00-0093-01	Tape, Close Cell, .25 x 1.6 (2 PCS)	
21	0103-00-0333	Manifold	
22	0103-00-0331	Transition Barb	
23	0103-00-0475	Restrictor / Filter	
24	0103-00-0476	Restrictor / Filter	
25	0103-00-0477	Restrictor / Filter	
26			
27	0008-10-0204	Tubing, Silicone, 1/16 x 1/8	
28	0008-10-0408	Tubing, Silicone 1/8 x 1/4	
29	0378-00-0002	Filtler, (43mm) 1/8 Barb	
30			
31	0103-00-0200	Adapter, 1/16 - 1/8	
32	0103-00-0457	Check Valve	
33	0103-00-0298	T - Adapter	

LINE BATTERY BOARD ASSEMBLY — ***0670-00-0449*** ***0670-00-0621*** ***(5L-CE)***

ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0124-00-0064	Test Point, Loop	TP1
2	0131-07-0004	CONN., 4 pin single row rt angle 0.156	J51
3	0131-07-0006	CONN., 6 pin single row rt angle 0.156	J53
4	0136-17-0007	CONN., 7 pin single row header 0.125	J55
5	0151-00-0115	TRANS., 2N7000	Q1, Q2
6	0151-00-0181	TRANS., IRFZ40	Q3
7	0153-00-0014	DIO., 1N4148	CR2-7
8	0153-00-0069	DIO., 1N5817	CR11, CR12
9	0153-08-0004	DIO., USD945	CR8-10
10	0155-00-0030	IC, LM4250	U1
11	0155-00-0578	VOLT REF., LT1004-1.2	CR1
12	0155-00-0587	IC, CD4093BE	U2
13	0159-12-0021	FUSE, 2.5A, 5x20mm, TIME LAG	F1
14	0159-12-0023	FUSE, 4A, 5x20mm, TIME LAG	F2, F3
15	0283-05-0101	CAP., 100pf, 10%, 200V CER	C4
16	0283-05-0104	CAP., 0.1uF, 10%, 100V, CER.	C1, C3
17	0283-10-1103	CAP., 0.01uF, 5%, 100V,CER.	C5, C6
18	0290-02-2106	CAP., 10uF, 20%, 25v, TANT	C7
19	0309-00-1543	RES., 154K, 1%, 1/8W	R2
20	0309-00-3573	RES., 357K,1%, 1/8W	R4
21	0315-00-0104	RES., 100K, 5%, 1/4W	R9, R10, R13
22	0315-00-0105	RES., 1M, 5%, 1/4W	R8
23	0315-00-0106	RES., 10M, 5%, 1/4W	R5, R6
24	0315-00-0120	RES., 12 OHM, 5%, 1/4W	R14
25	0315-00-0205	RES., 2M, 5%, 1/4W	R12
26	0315-00-0473	RES., 47K, 5%, 1/4W	R11
27	0315-00-0824	RES., 820K, 5%, 1/4W	R3
28	0348-00-0154	BOARD PAD	
29	0352-00-0026	FUSE CLIP	
30	0373-00-0047	HEAT SINK	
31	0309-00-1184	RES., 1.18M, 1%, 1/8W	R1
32	0136-28-0007	CONN., 14 pin double row .10	J54
34	0388-00-0449-B	PCB	
35	0014-00-0028	Power Supply, DC/DC Converter	
36	0210-20-0002	Terminal, Crimp Ring, 22-16 AWG, #6	
37	0006-05-1854	Wire, Stranded GRN/YEL	

LINE BATTERY BOARD ASSEMBLY (CONTINUED) — ***0670-00-0449 0670-00-0621 (5L-CE)***

ITEM NO.	*PART NUMBER*	*DESCRIPTION*	*REFERENCE*
38	0214-00-0074	Insulator Bead used on C1, C3 and C4, two each	
39	0210-20-0004	Terminal Crimp Ring, 22-16 AWG, #4	Use on 0670-00-0621 only

+12/-23 VOLT BOAD ASSEMBLY ***0670-00-0450***

ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0315-00-0334	RES. 330K 5% 1/4W	R18
2	0315-00-0101	RES. 100 ohm 5% 1/4W	R25, 26
3	0315-00-0822	RES. 8.2K 5% 1/4W	R10
4	0315-00-0202	RES 2K 5% 1/4W	R20
5	0315-00-0103	RES. 10K 5% 1/4W	R17, 19, 24
6	0315-00-0203	RES. 20K 5% 1/4W	R9
7	0315-00-0473	RES 47K 5% 1/4W	R15, 16
8	0315-00-0474	RES. 470K 5% 1/4W	R14
9	0315-00-0514	RES. 510K 5% 1/4W	R22, R23
10	0309-00-2320	RES. 232 ohm 1% 1/8W	R13
11	0309-00-9530	RES. 953 ohm 1% 1/8W	R4
12	0309-00-3651	RES. 3.65K 1% 1/8W	R3
13	0309-00-4121	RES. 4.12K 1% 1/8W	R12
14	0309-00-1692	RES. 16.9K 1% 1/8W	R6
15	0309-00-2003	RES. 200K 1% 1/8W	R5
16	0301-00-0101	RES. 100 ohm 5% 1/2W	R1, 2
17	0322-01-X050	RES. .05 ohm 1% 3W	R11
18	0283-05-0470	CAP. 47PF 10% 200V	C5, 6
19	0283-05-0271	CAP. 270PF 10% 200V	C13
20	0283-05-0102	CAP. .001mF 10% 200V	C11
21	0285-00-0052	CAP. Poly .001mF 2%	C15
22	0283-03-0472	CAP. .0047mF 10% 100V	C14
23	0283-05-0103	CAP. .01mF 10% 100V	C20
24	0283-04-0153	CAP. .015mF 10% 100V	C17
25	0283-04-0104	CAP. .1mF 10% 100V	C21
26	0283-04-0154	CAP. .15mF 10% 50V	C18
27	0283-04-0474	CAP. .47mF 10% 50V	C3, 4, 8, 16, 19, 22
28	0285-12-5225	CAP. 2.2mF CER	C12
29	0290-09-4R76	CAP. AL El 4.7mF 50 VDC	C7
30	0290-02-2106	CAP TANT 10mF 25V	C23
31	0290-17-3221	CAP. 220mF 35V	C9, 10
32	0290-00-0119	CAP. 1200mF +/- 20% 16V	C1, 2
33	0153-00-0130	Diode MUR170E	CR10
34	0153-00-0014	Diode 1N914	CR3, 7, 8
35	0153-00-0086	Diode UES1103	CR1, 2, 4
36	0153-00-0096	Diode VHE 1403	CR9
37	0153-00-0091	Diode 1N6275	CR5
38	0153-07-0091	Diode 1N6294A	CR6
39	0151-00-0101	XSTR IRF 540	Q1
40	0151-00-0073	XSTR 2N2907A	Q2, 4

+12/-23 VOLT BOAD ASSEMBLY (CONTINUED)			0670-00-0450
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
41	0151-00-0115	XSTR 2N7000	Q3
42	0155-00-0577	IC LM337L	U3
43	0155-00-0098	IC LM393	U2
44	0155-00-0395	IC UC2843	U1
45	0108-00-0014	Ferrite Bead Smal	L1 thr L6
46	0214-00-0074	Insulator Bead	L1 & L2, L3 & L4, L5 & L6
47	0007-02-0022	Buswire AWG 22	Install through T2, L1, L2, L3, L4, L5, L6
48	0120-00-0130	XFMR Flyback	T1
49	0108-00-0031	XFMR Current Sense	T2
50	0373-00-0032	Heat Sink	XQ1, CR9
51	0136-17-0010	10 Pin Header	J56
52	0124-00-0064	Test Pin	TP1, TP2, TP3, TP4, TP5
53	0136-24-1016	16 Pin Header	J57
54	0136-00-0152	14 Pin Header	P58
55	0349-00-0056	Insulator, transistor	Q1, CR9
56	0388-00-0450-A	PCB	
57	0159-27-0011	Fuse, Super Time Lag, 5 x 20mm, .630A	F1
58	0352-00-0026	Fuse Clip	
59	0214-00-0155	Washer, sholder, nylon	Q1, CR9
60	0212-12-0404	Screw, 4-40 x .25 lg	Q1, CR9
61	0223-00-0004	Nut, 4-40	Q1, CR9
62	0315-00-0120	RES. 12 ohm 5% 1/4 W	R7, 8
63	0006-04-2800	20 AWG, Wire Blk	

SPO2 BOARD ASSEMBLY			0670-00-0482
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0108-00-0058	CHOKE	L1, L2, L3, L4, L5
2	0124-00-0064	TERMINAL TURRET	TP1, TP2
3	0134-07-0004	CONN HDR 4P PC 100CX120H	J22
4			
5	0136-01-1018	IC SOCKET 18 PIN	XU20
6	0136-01-1020	IC SOCKET 20 PIN	XU41
7	0136-01-1028	IC SOCKET 28 PIN	XU24, XU44
8	0136-01-1040	IC SOCKET 40 PIN	XU40
9	0136-24-1014	CONNECTOR 14 PIN	J24
10	0136-24-1016	CONNECTOR HEADER, 16 PIN	J23
11	0136-57-0044	SOCKET, 44 PIN	XU37
12	0136-64-0050	CONNECTOR PC, HEADER, STRAIGHT	J21
13	0151-00-0037	XSTR 2N3645A	Q5
14	0151-00-0061	XSTR 2N2222A	Q4
15	0151-00-0086	XSTR 2N5308	Q1, Q2, Q3
16	0151-00-0115	MOSFET, 2N7000, N CHANNEL	Q6
17	0153-00-0010	DIODE ZENER 9.1V 1N5239B	CR8
18	0153-00-0014	DIODE IN 914/4148	CR1, CR5, CR6, CR9, CR12
19	0153-00-0085	DIODE IN6263	CR7
20	0153-00-0091	DIODE ZENER IN-6275	CR10, CR11
21	0153-00-0093	DIODE AD580/ SG3503T	U29
22	0155-00-0059	IC CD4011AE	U26
23	0155-00-0107	IC, VOLTAGE COMPARTOR LM 311N	U14
24	0155-00-0129	IC TRI-STATE OCTAL 74C374	U17, U18, U19, U25
25	0155-00-0151	IC TL082	U1
26	0155-00-0159	IC, PRECISION OP-AMP	U6, U7
27	0155-00-0166	IC LM 337T	U28
28	0155-00-0194	IC LM317T	U27
29	0155-00-0210	IC CMOS DUAL 8I CMTR 74HC393	U23
30	0155-00-0392	IC LOW NOICE PRCN OP-AMP OP-27	U4, U21
31	0155-00-0393	IC 12 BIT MULTI. DAC AD7541	U20

SPO2 BOARD ASSEMBLY (CONTINUED) 0670-00-0482

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
32	0155-00-0394	IC BI-FET SMP-HLD LF398N	U13
33	0155-00-0591-02	IC CMOS MICROPROCESSOR 63X09E	U40
34	0155-00-0404	IC DG201 QUAD SPST ANALOG SW	U3, U5, U10, U12
35	0155-00-0498	IC HEX INVERTER 74HCT04	U30
36	0155-00-0590-02	IC 32KX8 STATIC RAM	U44
37	0155-00-0438	IC 74HCT245 DIG, OCT. BUS XCVER	U45
38	0155-00-0473	IC., 74ACT74	U42, U43, U47
39	0155-00-0515	OCTAL BUFFER & LINE DRIVERS	U46
40	0155-00-0526	74HCT393 IC., U39	
41	0155-00-0625	IC FLIP-FLOP 74HCT374	U35
42	0155-00-0426	IC OCTAL BUFFER 74HCT244	U31, U32, U33, U34
43	0155-90-0061	EPROM ASSY, SEQUENCER, ACCUSAT	U24
44	0155-90-0161	U41 PLD ASSY	U41
45	0155-90-0162	U37 PLD ASSY	U37
46	0158-05-0002	CRYSTAL, CLOCK OSCILLATOR	Y1
47	0215-03-0002	FOAM TAPE 3/4	XU27, XU28
48	0283-04-0104	CAP.,CERM.,.1UF	C1, C8, C9, C11, C12, C14, C15, C18, C19, C27, C29, C30, C36, C37, C48, C51, C52, C53, C54, C55, C56, C57, C58, C60, C62, C63, C64, C65, C66, C67, C68, C69, C82
49	0283-04-0474	CAP .47 UF 50V 10% CER	C7, C10, C38, C43, C46
50	0283-05-0101	CAP 100PF 200V 10% CER	C33
51	0283-05-0102	CAP., CER., .001UF, 10% 200V	C70, C71, C72, C73, C74, C75, C79, C80, C83, C84
52	0283-05-0103	CAP .01 UF 100V 10% CER	C13, C16
53	0283-05-0220	CAP 22P 200V 10% CER	C5, C6, C31, C34
54	0283-05-0221	CAP 220-PF 200V 10% CER	C3

SPO2 BOARD ASSEMBLY (CONTINUED)			0670-00-0482
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
55	0283-05-0470	CAP 47 PF 200V 10% CERM	C4
56	0283-05-0471	CAP 470 PF 100V 10% CER	C32
57	0285-08-8201	CAP .0082MF	C35
58	0285-15-0104	AP., .1UF 50V 2%	C20, C21, C24, C25
59	0285-15-0223	CAPACITOR .022 UF	C22, C23, C26, C28
60	0290-01-2220	CAP 22 UF 25V 50% ALUM	C47
61	0290-02-1226	CAP 22 UF 20V 20% TANT	C17
62	0290-02-2106	CAP 10 UF 25V 20% TANT	C41, C42, C44, C45, C49, C50, C76, C81, C85
63	0307-06-2102	RES. NET 1K ,10 PIN	RN4
64	0307-06-2103	RESISTOR NETWORK, 10K OHM	RN3, RN5
65	0307-06-2562	RES. NETWK 5.6K	RN1, RN2
66	0309-00-1002	RES 10K 1/W 1% MF	R70, R71, R72, R73
67	0309-00-1003	RES. 100K 1/8W 1% FXD	R17, R21, R45, R47
68	0309-00-1243	RESISTOR 124K 1/8W 1%	R40, R42
69	0309-00-1333	RESISTOR 133K 1/8W 1% FX	R4
70	0309-00-1472	RES. 14.7 1/8W 1% MF	R57
71	0309-00-1502	RESISTOR 15K 1/8W 1% FX	R67
72	0309-00-1503	RESISTOR 150K 1/8W 1% FX	R37, R38, R39, R41, R43
73	0309-00-1621	RESISTOR 1.62K 1/8W 1%	R61, R62
74	0309-00-1652	REX 16.5K 1/8W 1% MF	R20
75	0309-00-2004	RES. 2M 1%, 1/8W	R6
76	0309-00-2320	RESISTOR 232 OHM 1/8W 1%	R59, R60
77	0309-00-3013	RESISTOR 301K 1/8W 1% FX	R44
78	0309-00-3241	REX 3.24K 1/8W 1% MF	R48
79	0309-00-3923	RESISTOR 392K 1/8W 1% FX	R18, R63
80	0309-00-4752	RESISTOR 47.5K 1/8W 1% FX	R58
81	0309-00-4753	RES. 475 K 1%, 1/8W	R19

SPO2 BOARD ASSEMBLY (CONTINUED) 0670-00-0482

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
82	0309-00-5111	RES. 5.11K 1/8W 1% FX	R66
83	0309-00-6653	RES 665K 1% 1/8W	R5
84	0310-00-0100	RES. 10 OHM 1%	R24
85	0315-00-0100	10 OHM 1/4W 5%	R65, R68, R69
86	0315-00-0102	RES. CF 1K 1/4W 5%	R1, R2, R29, R30, R53, R55, R77, R78, R84
87	0315-00-0103	RES. CF 10K 1/4W 5%	R11, R14, R22, R23, R56, R76
88	0315-00-0104	RES. CF 100K 1/4W 5%	R12, R27, R28
89	0315-00-0106	RES. CF 10M 1/4W 5%	R64
90	0315-00-0204	RES. CF 200K 1/4W 5%	R8
91	0315-00-0205	RES. CF 2M 1/4W 5%	R7
92	0315-00-0220	RES. CF 22 1/4W 5%	R26
93	0315-00-0270	RES. CF 27 1/4W 5%	R25
94	0315-00-0393	RES. CF 39K 1/4W 5%	R13, R75
95	0315-00-0472	RES. CF 4.7K 1/4W 5%	R74, R79
96	0315-00-0473	RES CF 47K 1/4W 5%	R3
97	0315-00-0820	RES., CF 82 1/4W 5%	R80, R81, R82, R83
98	0320-00-1002	RES. METAL FILM, 10K., .1%, 50PPM	R15, R16, R46, R49, R54
99	0320-00-1004	RES., 1 MEG., .1% 1/8W. MF	R52
100	0320-00-2913	RES. 291K. .1%, 1/8W MF	R51
101	0320-00-5302	RES. 53.OK, .1%, 1/8W, MF	R50
102	0388-00-0482-A	PCB	
103	0432-01-0002	BASE TRANS MTG PAD TO-5	XU29
104	0155-00-0572	IC, DUAL JFET OPAMP, TL032C	U2, U8, U9, U11, U22
105	0214-00-0074	INSULATOR BEAD	
106	0320-00-1243	RES. MF 124K 0.1% 50PPM	R34, R36
107	0320-00-1503	RES. MF 150K 0.1% 50PPM	R31, R32, R33, R35
108	0290-02-3106	CAP,10 MF 35V 20% TANT	C77, C78

CO2 INTERFACE			0670-00-0497
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
1	0014-00-0035	POWER MODULE, DUAL OUTPUT,±15V	VC1
2	0060-00-0304-01	PASSPORT CO2 INTERFACE MODULE, MODULE SPECIFICATION	
3	0060-00-0304-02	PASSPORT CO2 INTERFACE MODULE, DESIGN DOCUMENTATION	
4	0060-00-0304-03	PASSPORT CO2 INTERFACE MODULE, WORST CASE ANALYSIS	
5	0060-00-0304-04	PASSPORT CO2 INTERFACE MODULE, RELIABILITY ANALYSIS	
6	0060-00-0304-05	PASSPORT CO2 INTERFACE MODULE, VALIDATION TEST PLAN	
7	0060-00-0304-06	PASSPORT CO2 INTERFACE MODULE, TEST SPECIFICATION	
8	0108-00-0038	INDUCTOR, 120UH, 2A	L2
9	0108-00-0058	CHOKE, FERRITE BEAD	L1
10	0131-07-0004	CONN,FRICTION LOCK,RA,4PIN	J93
11	0136-82-0010	HEADER, .100 CTR STR LOCKING/POLARIZING-10 PIN	J92
12	0136-24-1004	HEADER,DOUBLE ROW,ST,4 PIN	JP1/JP2
13	0136-56-1324	SOCKET,DIP,24PIN, 0.3 WIDE	U4
14	0136-57-0044	SOCKET, PLCC 44	U1
15	0136-24-1050	HEADER,DOUBLE ROW,ST,50 PIN	J91
16			
17	0155-00-0426	IC, 74HCT244, OCTAL BUFFER	U3
18	0155-00-0516	IC, 74HCT377, OCTAL D-TYPE FLIP-FLOP	U2
19	0155-90-0211	IC, MICROCONTROLLER, PGM'D	U1
20	0155-90-0212	IC,EP600,EPLD,PGM'D	U4
21	0158-01-0023	CRYSTAL, 3.6864MHz	Y1
22			
23	0215-03-0001	TAPE, DOUBLE COATED FOAM	Used under C9,C10
24	0283-01-5180	CAP, MICA,18PF,500v,5%	C1
25	0283-04-0104	CAP, CER,0.1UF,100v,10%	C3,C4,C5,C11,C12

CO2 INTERFACE (CONTINUED)			0670-00-0497
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
26	0283-05-0102	CAP,CER, 0.001UF,200v,10%	C6,C7
27	0283-05-0220	CAP, CER,22PF,200v,10%	C2
28	0290-00-0070	CAP, ALUM ELEC,1000UF,25V, 20%,LOW ESR	C10
29	0290-01-2220	CAP,ALUM ELEC,22UF,25v, -10 / +50%	C8
30	0290-17-3221	CAP,ALUM ELEC, 220UF, 35V, 20%,LOW ESR	C9
31			
32	0307-00-0082	RES, 3.74 OHM, 2W, 1%	R2
33	0307-06-2103	RES NTWK,10K, SIP,9 ELEMENT	RP1
34	0315-00-0102	RES,CF, 1K, 1/4W, 5%	R3
35	0315-00-0106	RES, CF,10M, 1/4W, 5%	R1
36	0387-00-0497	SCHEMATIC, CO2 INTERFACE MODULE	
37	0388-00-0497	DRILL & FAB, , CO2 INTERFACE MODULE	PC BOARD
38			
39	0530-00-0021	HOT MELT GLUE	USE UNDER L2

			0670-00-0500 0670-00-0622
E.L. PANEL BOARD ASSEMBLY			**(5L-CE)**

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0290-00-1015	CAP, 100uF, Alum. 35V 20%	C1
2	0283-04-0104	CAP, 0.1uF 100V 10%	C2
3	0153-00-0162	LED Red, Tinted, Diffused	D1
4	0153-05-0033	LED Green, Tinted, Diffused	D2
5	0315-00-0151	RES, 150, 1/4W 5%	R1, R5, R6
6	0315-00-0101	RES, 100, 1/4W 5%	R2, R3, R7, R8
7	0315-00-0103	RES, 10K, 1/4W 5%	R4
8	0155-00-0239	IC, 74ACT240, Octal Inverting Buffer	U1
9	0151-00-0115	FET, N-Channel 2N7000	Q1
10	0136-24-1040	Header, 40 Pin St. Double Row	J71, Key Pin 13
11	0136-22-0012	Header, 12 Pin St. Single Row	J72, Key Pin 4
12	0136-24-1016	Header, 16 Pin St. Double Row	J74, Key Pin 5
13			
14	0136-22-0002	Header, 2 Pin St. Single Row	J75
15	0124-00-0064	Terminal, Turret PC	TP1, TP2, TP3
16	0388-00-0500	Printed Circuit Board	
17	0361-09-0402	Standoff, Broaching Type,, PCB	#4-40 x .125 LG.
18	0155-00-0515	IC, 74HCT240, Octal Inverting Buffer	U1 - use on 0670-00-0622 only

PANEL BOARD ASSEMBLY			***0670-00-0546***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0388-00-0546-A	Printed Wiring Board	
2	0290-09-1015	CAP, 100UF, Alum. 35V, 20%	C1
3	0283-06-0104	CAP, 0.1UF,Cer., 100 V, 1%	C2
4	0153-00-0162	LED Red, Tinted, Diffused	D1
5	0153-05-0033	LED Green, Tinted, Diffused	D2
6	0136-24-1040	Header, 40 pin	J71
7	0136-22-0018	Header18	J74
8	0136-22-0012	Header 12	J72
9	0136-00-0151	Header 6	J73
10	0136-22-0002	Header, 2 pin ST Single Row	J75
11	0151-00-0115	FET,N-Channel 2N7000	Q1
12	0315-00-0153	RES, 15K, 1/4W 5%	R1
13	0311-00-0126	5K Pot. 10% Lin.	R2
14	0315-00-0152	RES, 1.5K, 1/4W 5%	R3
15	0315-00-0103	RES, 10K, 1/4W 5%	R4
16	0315-00-0151	RES, 150, 1/4W 5%	R5,R6
17	0014-00-0029	DC/AC Inverter	M1
18	0366-00-0079	Knob	
19	0124-00-0064	Test point terminal	TP1,TP2,TP3,TP4

SPO2 NELLCOR INTERFACE BOARD ASSEMBLY			0670-00-0557
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
1	0014-00-0047	DC-DC Converter, +5V to +5V, Isolated	VC1, Burr Brown PWR1300A
2	0014-00-0048	DC-DC Converter, +5V to æ15V, Isolated	VC2, Burr Brown PWR1305A
3	0108-00-0070	Inductor, 60uH, 3A	L2
4	0108-00-0058	Choke, Ferrite Bead	L1
5	0136-24-1006	Header,Double Row, ST, 6 PIN	JP1/JP2/JP3
6	0136-24-1010	Header,Double Row, ST, 10 PIN	J22
7	0136-64-0050	Header, Double Row, Latching, ST,50 PIN	J21
8	0136-56-1324	Socket, DIP, 24 PIN, 0.3 Wide	U4
9	0136-57-0044	Socket, PLCC 44	U1
10	0136-70-0014	Header, 14 Pin, Double Row, Right-Angle, 0.100 Center, Shrouded	J23, AMP 103310-2
11	0151-00-0035	Transistor, 2N3904	Q1, Q2, Q3, Q4, Q5, Q6
12	0151-00-0061	Transistor, 2N2222A	Q9, Q10
13	0151-00-0073	Transistor, 2N2907A	Q7, Q8
14	0153-00-0014	Diode, 1N914	D1, D2, D3
15	0153-00-0093	SG3503T, 2.5V Reference	U13
16	0155-00-0049	LM358, Dual Op Amp	U12, U14
17	0155-90-0272	IC,EP600,EPLD, Programmed	U4 (0155-00-0396)
18	0155-00-0426	IC, 74HCT244, Octal Buffer	U3
19	0155-00-0516	IC, 74HCT377, Octald-Type Flip-Flop	U2
20	0155-00-0570	CNW136, Opto Isolator	U7, U8, U9, U10, U11
21	0155-90-0271	IC, Microcontroller	U1 (0155-00-0573)
22	0155-00-0835-01	74ACT14, Hex Inverter, Schmitt Trigger	U5, U6
23	0158-05-0011	Oscillator, 3.6864 MHz	U15
24	0283-04-0104	CAP, MICA,0.1pF,100v,5%	C1
25	0283-04-0104	CAP, CER,0.1UF,100v,10%	C3, C4, C5, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C35
26	0283-05-0102	CAP,CER, 0.001UF,200v,10%	C6,C7,C30
27			
28	0290-00-0106	22uF, 25V, Tantalum	C32

SPO2 NELLCOR INTERFACE BOARD ASSEMBLY (CONTINUED) 0670-00-0557

ITEM NO.	*PART NUMBER*	*DESCRIPTION*	*REFERENCE*
29	0290-01-2220	CAP,ALUM ELEC,22UF,25v, -10 / +50%	C8
30	0290-02-3225	2.2uF, 35V, Tantalum	C33, C34
31	0290-08-4733	Capacitor, 470uF, 16V, Al Electrolytic	C31
32	0307-00-0029	Resistor Network, 10K, 0.5%, T.F.	RN1, 785-3-R10K
33	0307-06-2103	RES NTWK,10K, SIP,9 Element	RN2
34	0309-00-1502	RES, MF, 15.0K, 1/8W, 1%	R31
35	0315-00-0102	RES,CF, 1K, 1/4W, 5%	R2, R3, R4, R5, R6, R7, R8, R30, R33
36	0315-00-0103	RES,CF, 10K, 1/4W, 5%	R20, R21, R22, R23, R24, R25, R26
37	0315-00-0104	RES,CF, 100K, 1/4W, 5%	R27, R28
38	0315-00-0103	RES, CF,10K, 1/4W, 5%	R1
39	0315-00-0151	RES,CF, 150 ohm, 1/4W, 5%	R9, R10, R11, R12, R13
40	0315-00-0182	RES,CF, 1.8K, 1/4W, 5%	R14, R15, R16, R17, R18
41	0315-00-0222	RES,CF, 2.2K, 1/4W, 5%	R32
42	0315-00-0512	RES,CF, 5.1K, 1/4W, 5%	R19
43	0388-00-0557	PCB, Passport Nellcor SPO2 Interface Module	
44	0215-03-0001	Tape, Double Coated Foam	Use under Y1
45	0220-02-0002	Nut, Broaching-Type	PEM KFS2-440
46	0315-00-0101	RES,CF,10 ohm, 1/4W,5%	R34
47	0315-00-0474	RES, CF, 470K, 1/4W, 5%	R29

FRONT END BOARD ASSEMBLY			***0670-00-0560***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0285-10-0102	CAP,POLYCARB .001UF 2% 250V	C132,C133
2	0283-05-0103	CAP,.01UF 100V 10%	C8,C9,C23,C101,C106, C112,C122,C123
3	0283-04-0333	CAP,.033UF 100V 10%	C66, C102, C505, C506
4			
5	0283-04-0104	CAP,.1UF 100V 10%	C6,C7,C20,C22,C58, C121, C508, C509,C64,C65,C71,C7 2,C82, C510, C511, C512,C83,C87,C88,C9 0,C91,C93,C502, C504, C94, C95,C104,C107,C515, C113, C114, C115, C31,C32,C34,C35,C42, C43,C48,C49,C96,C51 3, C125 (add capacitor to R165 designation for -03, -04)
6	0285-10-0104	CAP, .1UF 2% 30V	C73, C75, C76, C99, C100, C103,C44, C70, C97, C63
7	0283-04-0224	CAP,.22UF 50V 10%	C109, C126
8	0283-04-0334	CAP,.33UF 50V 10%	C124,C45,C136,C137
9	0283-04-0474	CAP, .47UF 50V 10%	C39, C47, C61, C110, C128, C134, C503, C60, C514, C135
10	0283-01-5180	CAP, 18PF 500V 5%	C118
11	0285-09-0039	CAP,POLYCARBONATE 2UF 50V 10%	C117
12	0283-05-0220	CAP,22PF 200V 10%	C119
13	0290-02-1226	CAP,22UF TANT. 20V 20%	C129,C130
14	0283-05-0331	CAP,330PF 1000V,10%	C84,C86,C105
15	0290-02-0336	CAP,33UF TANT 10V 20%	C116,C516
16			
17	0290-02-3475	CAP,4.7UF TANT 35V 20%	C120,C111, C507
18	0283-05-0471	CAP,470PF 100V 10%	C25
19	0153-00-0085	1N6263 SCHOTTKY DIODE	D20,D42,D43,D46,D49, D50,D52,D53

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0560
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
20	0153-00-0014	DIODE, 1N914 D5,D12,D13,D14,D15, D16,D17,D18,D19,D2 4,D25,D26,D27,D28, D29,D30,D31,D32,D3 3,D34,D37,D39,D40,D 41,D56,D57,D58,D59 (D30, D37 for -01, -02)	
21	0155-00-0089	Dual 4 Channel Analog MUX	U3, U4
22	0155-00-0086	2 Channel Analog Multiplexer	U18
23	0155-00-0075	Quad Bilateral Switch	U26
24	0155-00-0112	Dual Monostable Multivibrator	U28
25	0155-00-0210	Dual 4 Bit Binary Counter	U40
26	0155-00-0098	Dual Comparator	U37
27	0155-00-0407	MC34082 AP, JFET OP AMP	U11
28	0151-01-0010	XSISTOR, HEXFET IRFD110	Q1, Q2, Q3, Q4, Q8, Q9
29	0315-00-0182	RES,1.8K 1/4W 5%	R231, R233
30	0315-00-0101	RES,100 OHM 1/4W 5%	R39, R45, R51, R65, R67, R90, R150
31	0307-00-0070	RES,MF NTWRK 100K 1/8W .1%	RN3, RN4
32	0309-00-1003	RES,100K 1/8W 1%	R76, R81 ,R207, R208
33	0315-00-0103	RES,10K 1/4W 5%	R1, R2, R5, R15, R42, R43, R88, R210, R256, R16, R17
34	0320-00-1002	RES,10K 1/8W .1%	R192, R193, R194, R212, R255, R257
35	0309-00-1002	RES,10K 1/8W 1%	R6,R7, R127, R163, R164, R196, R200 (add R160 for -01, -02), (add R168 for -03, -04)
36	0315-00-0106	RES,10M 1/4W 5%	R142, R144, R146, R148, R228
37	0309-00-1153	RES,115K 1/8W 1%	R156, R206
38	0309-00-1212	RES,12.1K 1/8W 1%	R74, R520
39	0309-00-3742	RES, 37.4K 1/8W 1%	R511
40	0309-00-1102	RES, 11K 1/8W 1%	R53
41	0309-00-1540	RES, 154 OHM 1/8W 1%	R268
42	0309-00-2002	RES, 20K 1/8W 1%	R48, R49
43	0309-00-1622	RES,16.2K 1/8W 1%	R46
44	0309-00-1652	RES,16.5K 1/8W 1%	R185

FRONT END BOARD ASSEMBLY (CONTINUED) ***0670-00-0560***

ITEM NO.	*PART NUMBER*	*DESCRIPTION*	*REFERENCE*
45	0309-00-1823	RES,182K 1/8W 1%	R189, R153
46	0315-00-0102	RES,1K 1/4W 5%	R40, R50, R55, R170, R191, R249 (add R12 for -01, -02)
47	0309-00-1001	RES,1K 1/8W 1%	R80 (-01,03 ONLY), R154, R519
48	0315-00-0222	RES,2.2K 1/4W 5%	R232, R52, R514, R120, R134
49	0309-00-1181	RES, 1.18K 1/8W 1%	R264
50	0309-00-2003	RES,200K 1/8W 1%	R157, R159, R177, R215
51			
52	0309-00-2212	RES,22.1K 1/8W 1%	R211 (add D37 for -03, -04)
53	0315-00-0240	RES, 24 OHM 1/4W 5%	R259, R260
54	0309-00-2492	RES,24.9K 1/8W 1%	R8
55	0309-00-3013	RES,301K, 1/8W, 1%	R128
56	0315-00-0243	RES,24K 1/4W 5%	R176, R178
57	0315-00-0202	RES,2K 1/4W 5%	R82, R230
58			
59	0309-00-9531	RES,9.53K 1/8W 1%	R86
60	0315-00-0304	RES, 300K 1/4W 5%	R205
61	0315-00-0104	RES, 100K 1/4W 5%	R27, R28, R29
62	0309-00-3573	RES,357K 1/8W 1%	R190
63	0309-00-3923	RES,392K 1/8W 1%	R158, R183, R203
64	0309-00-0768	RES, 768 OHM 1/8W, 1%	R80
65	0309-00-4751	RES,4.75K 1/8W 1%	R186
66	0315-00-0472	RES,4.7K 1/4W 5%	R173, R187
67	0315-00-0475	RES,4.7M 1/4W 5%	R188
68	0315-00-0470	RES,47 OHM 1/4W 5%	R213
69	0309-00-4752	RES,47.5K 1/8W 1%	R54, R24, R25, R26 (for -01, -02) : R54, R162, R214 (for -03, -04)
70	0315-00-0474	RES,470K 1/4W 5%	R83, R124, R505, R506
71	0315-00-0473	RES,47K 1/4W 5%	R58, R84, R162, R166, R169, R171, R172, R174, R175, R179, R214, R245, R246, R507, R508, R515, R165, R168 (R162, R165, R166, R168, R214 for -01, -02)
72	0309-00-3012	RES,30.1K 1/8W 1%	R160
73	0309-00-4992	RES,49.9K 1/8W 1%	R9, R10, R11, R79, R155, R184, R209

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0560
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
74	0309-00-6813	RES,681K, 1/8W, 1%	R126
75	0315-00-0824	RES,820K 1/4W 5%	R167, R180
76	0120-00-0125	TRANSFORMER,PWR ISOLATION	T1
77	0155-00-0568	OP-AMP, LT1012	U14, U27
78	0155-00-0571	OP-AMP, LT1013C	U20, U29, U30, U34, U50, U8, U9
79	0155-00-0572	IC,OP-AMP TL032C	U21, U24, U32, U33, U13, U25, U31
80	0283-01-5121	CAP, 120 PF, 500V	C1, C2, C3, C517, C518, C519
84	0285-09-0010	CAP,1UF,50V,5%	C46
85	0283-05-1394	CAP,.39UF,100V,5%	C50
86	0283-05-2331	CAP,330PF,100V,2%	C55, C57
87	0283-05-0470	CAP,47PF,200V,10%	C56
88	0283-04-1474	CAP,.47UF,50V,5%	C89
89	0214-00-0074	INSULATOR BEAD	
90			
91	0290-02-3225	CAP,2.2UF,35V,20%	C127
92	0136-24-1016	16 PIN HEADER	J41
93	0136-24-1010	10 PIN HEADER	J42
94	0136-24-1012	12 PIN HEADER	J43
95	0108-00-0063	DUAL INDUCTOR,2MH,25%	L1,L2
96	0151-00-0035	TRANSISTOR,2N3904	Q10,Q11,Q12,Q13
97	0315-00-0392	RES,3.9K,1/4W,5%	R44
98	0309-00-2672	RES,26.7K,1/8W,1%	R47
99	0315-00-0912	RES, 9.10K, 1/4W,5%	R56
100	0307-00-0072	RES,SPECIAL 3.539K, 0.01%, 2PPM	R66
101	0307-00-0073	RES,SPECIAL 9.428K, 0.01%, 2PPM	R68
102	0309-00-2871	RES,2.87K,1/8W,1%	R75
103	0309-00-1584	RES,1.58M,1/8W,1%	R85,R510
104	0309-00-1741	RES,1.74K,1/8W,1%	R87
105	0320-00-2580	RES,258 OHM,1/8W,.1%	R116,R138,R122,R131
106	0320-00-1383	RES,138 K,1/8W,.1%	R118,R130
108	0309-00-3572	RES,35.7K, 1/8W, 1%	R125, R263
110	0307-01-0473	RES NTWRK,47K,2%	RN2
111	0309-00-1872	RES,18.7K,1/8W,1%	R181
112	0309-00-9762	RES,97.6K,1/8W,1%	R182
113	0309-00-1374	RES,1.37M,1/8W,1%	R129
114			

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0560
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
115	0315-00-0181	RES,180 OHM,1/4W,5%	R234, R261, R262
116	0315-00-0271	RES,270 OHM,1/4W,5%	R236
117	0315-00-0302	RES,3K,1/4W,5%	R237
118			
119	0120-00-0129	TRANSFORMER,RESPIRATION	T2
120	0124-00-0064	TERMINAL	TP1,TP2,TP3,TP4,TP5,TP6, TP7,TP8,TP9,TP10,TP11
121	0315-00-0272	RES. 2.7K, 1/4W,5%	R238
122	0315-00-0153	RES. 15K, 1/4W, 5%	R235
123	0155-00-0239	OCTAL BUFFER	
124	0155-90-0166	MICROCONTROLLER	U38
125	0155-00-0574	A/D CONVERTER,10 BIT	U39
126	0155-00-0570	OPTO ISOLATOR	U42,U43
127	0155-00-0576	OPTO ISOLATOR	U44
128	0155-00-0575	REGULATING PWM	U47
129	0151-00-0072	VOLTAGE REGULATOR	U48,U49
130	0158-01-0023	CRYSTAL,3.6864 MHZ	Y1
131	0315-00-0226	RES, 22M, 1/4W, 5%	R500,R501,R502
132			
133	0283-05-0271	CAP, 270PF, 200V, 10%	C85,C500,C501
134	0309-00-8661	RES, 8.66K, 1/8W, 1%	R195
135			
136	0315-00-0512	RES, 5.1K, 1/4W, 5%	R201 (add R12 for -03, -04)
137	0136-57-0044	SOCKET,44pin PLCC	SOCKET for U38
138	0309-00-1372	RES, 13.7K, 1/8W, 1%	R78
139	0309-00-5492	RES, 54.9K, 1/8W, 1%	R512
140	0309-00-4642	RES, 46.4K, 1/8W, 1%	R513
141	0309-00-1621	RES, 1.62K, 1/8W, 1%	R265
142	0315-00-0361	RES, 360 OHM, 1/4W, 5%	R229
143	0388-00-0560-B	PCB	
144	0309-00-2433	RES, 243K, 1/8 W, 1%	
145	0215-03-0003	Tape, Double Coated, Foam	R199 Use on Y1
146	0309-00-7681	RES, 7.68K, 1/8W, 1%	R267 (add R161 for -01, -02)
147	0309-00-1333	RES, 133K, 1/8W, 1%	R204
148	0153-00-0069	DIODE, IN5817	D44, D45, D47, D48, D51

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0560
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
149	0309-00-4022	RES, 40.2K 1/8W, 1%	R513
150	0309-00-2942	RES, 29.4K 1/8W, 1%	R513
151	0309-00-1213	RES, 121K,1/8W, 1%	R266
152	0309-00-3921	RES, 3.92K,1/8W,1%	R269
153	0290-02-3226	CAP, 22UF,TANT, 35V, 20%	C131
154			
155	0309-00-5231	RES, 5.23K, 1/8W, 1%	R161
156			
157	0136-97-1008	CONN, 16 PIN Low Profile-Top entry	J41
158	0136-97-3008	CONN, 16 PIN Low Profile-Pass through entry	U3
159	0215-00-0029	INSULATOR	for U3
160	0006-04-2800	Wire, 28 gauge, BLK	
161	0283-05-0150	CAP, 15PF, 200V, 10%	C56
162	0309-00-6192	RES, 61.9K, 1/8W, 1%	R512
163	0309-00-3011	RES, 3.01K 1/8W, 1%	R516

INTERCONNECT BOARD ASSEMBLY — 0670-00-0576, 0670-00-0628 (CE)

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0388-00-0576	PCB	
2	0301-00-0472	RES, CC, 4.7K, 5%,1/2 W	R1, R2, R3, R9, R10
3	0307-00-0089	RESISTOR SPECIAL,1/2W, 5%, 100 MEG OHM	R4
4	0283-00-0055	CAP, .0047 UF, 3KV, 10%	C1, C2
5	0153-00-0091	DIODE, ZENER 1N6275	CR4-9, CR12
6	0153-00-0160	DIODE, SA170C	CR1, CR2, CR3, CR10, CR11
7	0167-00-0007	SPARK GAP	DG1
8	0136-00-0149	CONN, PATIENT 6 PIN	P3
9	0136-00-0150	CONN, PRESS 6 PIN	P1, P2
10	0131-00-0227	CONN, Phone, 1/4" Plastic Bushing	P4
11	0136-24-1018	HEADER, DBL ROW 18 PIN	J1
12			
13	0283-05-0102	CAP,.001uF,200v,10%	C3,C4,C5
14	0108-00-0028	TORROID	L1
15	0006-04-2299	Wire Solid, 22 AWG	L1
17	0309-00-4991	RES, 4.99K, 1%, 1/8 W RN55	R5, R6, R7, R8, R11
18	0283-01-5121	CAP, 120pF, 5%	C6, C7, C8, C9, C10
19	0349-00-0174-02	Insulator, Connector	For P4
20	0349-00-0174-01	Insulator, Connector	For J1
21	0008-01-0005	Tubing, Heatshrink	For R1, R3, R9
22	0149-00-0001	Neon Bulb	DS1, DS2
23	0315-00-0103	RES, 10k, 5%, 1/4 W	R13
24	0006-04-2800	Wire, 28 gauge, Blk	R12, (R13 on 0670-00-0628 only)
25	0348-00-0054-03	Bumper, Molded Polyurethane (Black)	

CPU BOARD ASSEMBLY			0670-00-0591
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0108-00-0058	CHOKE	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L12
2	0315-00-051X	RESISTOR, FIXED, CARBON FILM, 1/4 WATT 5.1 OHM	R48
3	0136-00-0142	CONN PC, 16 PIN, SIDE ENTRY	J66
4	0136-00-0144	50 PIN RIGHT ANGLE	J63
5	0136-00-0228	Conn, PC, 50 Position w/ guide, w/o key	J61
6	0136-22-0003	HEADER CONNECTOR, 3 PIN	TP15, TP16, TP17, TP18, TP19, TP20, JP1
7	0136-24-1006	HEADER DOUBLE ROW, 6 PIN	TP9, TP10, TP11, TP12, TP13, TP14
8	0136-24-1008	HEADER DOUBLE ROW, 8 PIN	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8
9	0136-24-1010	HEADER DOUBLE ROW, 10 PIN	J64
10	0136-24-1016	HEADER DOUBLE ROW, 16 PIN	J67
11	0136-24-1026	HEADER DOUBLE ROW, 26 PIN	J62
12	0136-24-1040	HEADER DOUBLE ROW, 40 PIN	J68
13	0136-87-0050	CONN PC,SHROUDED STR HDR W/ EJECTO	J65
14	0151-00-0061	TRANSISTOR 2N2222A	Q1
15	0153-00-0085	DIODE, SCHOTTKY, 1N626	D1, D2, D3
16	0153-00-0093	VOLTAGE REF, SG3503	U39
17	0388-00-0438-B	CPU PCB	
18	0155-00-0078	IC, LOW VOLT AUDIO POWER AMPLIFIER, LM386	U37
19	0155-00-0201	IC 8-BIT MULT D/A, AD7524	U36
20	0155-00-0400	IC, DUAL RS-232 TRANSMITTER/ RECEIVER MAX 232	U31
21	0155-00-0404	IC QUAD SPST ANALOG SWITCH, DG201	U34
22	0155-00-0590-01	IC, 32K X 8 STATIC RAM	U6
23	0155-00-0426	IC, OCTAL BUFFER/ LINE DRIVER, 74HCT244	U8, U9, U10, U13, U14, U16, U17, U18, U29, U30

CPU BOARD ASSEMBLY (CONTINUED)			0670-00-0591
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
24	0155-00-0438	IC, DIGITAL, OCTAL BUS TRANSCEIVER, 74HCT245	U7, U12, U15
25	0155-00-0470	IC, 93C46, SERIAL EEPROM	U4
26	0155-00-0515	IC, OCTAL INVERTING BUFFER/ LINE DRIVER, 74HCT240	U11
27	0155-00-0516	IC, OCTAL D-TYPE FF, 74HCT377	U19
28	0155-00-0518	IC, INTEGRATED MULTIPROTOCOL PROCESSOR, MC68302	U1
29	0155-00-0519	IC, 8 BIT A/D CONVERTER W/11 CHANNEL MULTIPLEX	U32
30	155-00-0520	IC, DISPLAY CONTROLLER, V6366F	U5
31	0155-00-1184	IC, DIGITAL, SERIAL TIMEKEEPER, DS1202	U20
32	0155-00-0522	IC, DIGITAL MICROMANAGER, DS1236	U21
33	0155-00-0523	IC, OP AMP, LOW POWER JFET, TL034	U33, U35
34	0155-00-0524	IC, DUAL 1-OF-4 DECODER/ DEMULTIPLEXER, 74ACT139	U23
35	0155-00-0525	IC, QUAD 2 INPUT NOR GATE, 74ACT02	U28
36	155-00-0529	IC, HEX INVERTER, 74ALS04	U27
37	0155-00-0530-04	IC, STATIC RAM, CMOS, 1 MEG	U2, U3
38	0155-00-0579	IC, 1-OF-8 DECODER/ DEMULTIPLEXER, 74ACT138	U22
39	0155-90-0165	CPU PAL, PASSPORT	U24
40	0158-00-0010	CRYSTAL,TUNING FORK, 32.768 KHZ	Y2
41	0158-01-0025	MICROPROCESSOR QUARTZ CRYSTAL, 16.5888 MHZ	Y1
42	0158-05-0001	CRYSTAL, CLOCK OSCILLATOR, 14.31818 MHZ	U38

CPU BOARD ASSEMBLY (CONTINUED)			0670-00-0591
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
43	0283-04-0104	CAP, CERAMIC, .1UF 100V 10%	C5, C6, C13, C29, C30, C31, C32, C33, C35, C42, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C68, C75, C77, C78, C103, C113, C121, C122, C123, C124
44	0283-04-0473	CAP, CERAMIC, .047UF 100V 10%	C37
45	0283-05-0100	CAP, CERAMIC, 10PF 200V 10%	C70, C72
46	0283-05-0101	CAP, CERAMIC, 100PF 200V 10%	C112, C114
47	0283-05-0102	CAP, CERAMIC, .001UF 200V 10%	C104, C105, C106, C107, C108, C109, C110, C111
48	0283-05-0103	CAP, CERAMIC, .01UF 100V 10%	C4, C27, C28, C36, C43, C65, C69, C73, C74, C76, C115, C116
49	0283-05-0220	CAP, CERAMIC, 22PF 200V 10%	C1, C2, C41
50	0283-05-0222	CAP, CERAMIC, .0022UF 200V 10%	C118, C38
51	0283-05-0471	CAP, CERAMIC, 470PF 100V 10%	C119
52	0290-02-3105	CAP, FIXED, 1UF TANT. 35V 20%	C9, C10, C11, C12
53	0290-02-3475	CAP, FIXED, 4.7UF TANT 35V 20	C7, C8, C18
54	0290-07-1053	CAP, FIXED ELECT., 10000 UF	C120
55	0307-00-0029	RESISTOR NETWORK, DIP 14 PIN, 10K .5% 7 Resistors	RP2
56	0307-01-0104	RESISTOR NETWORK, SIP 10 PIN, 100K	RP7
57	0307-01-0394	RESISTOR NETWORK, SIP 10 PIN, 390K	RP6
58	0307-01-0470	RESISTOR NETWORK, SIP 10 PIN, 47 OHM	RP8, RP14
59	0307-06-2103	RESISTOR NETWORK, SIP 10 PIN, 10K 2%	RP1, RP3, RP4, RP5, RP9, RP10, RP11, RP12, RP13
60	0309-00-2052	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 20.5K	R46

CPU BOARD ASSEMBLY (CONTINUED)			0670-00-0591
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
61	0309-00-1003	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 100K	R11
62	0309-00-4421	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 4.42K	R44
63	0309-00-4640	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 464 OHM	R17
64	0309-00-6042	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 60.4K	R45
65	0315-00-0100	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 10 OHM	R10
66	0315-00-0101	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 100 OHM	R13, R16
67	0315-00-0103	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 10K	R7, R41, R49
68	0315-00-0104	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 100K	R37, R39
69	0309-00-3923	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 392K	R42
70	0315-00-0202	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 2K	R12
71	0315-00-0204	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 200K	R36, R38
72	0309-00-1824	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 1.82M	R43
73	0315-00-0223	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 22K	R25
74	0315-00-0472	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 4.7K	R2, R33
75	0315-00-0473	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 47K	R24, R26
76	0315-00-0684	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 680K	R1
77	0352-00-0029	HOLDER BATTERY (COIN TYPE)	XBT1

CPU BOARD ASSEMBLY (CONTINUED)		0670-00-0591	
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
78	0388-00-0438-B	DRILL & FAB, CPU BOARD	
79	0136-56-1324	SOCKET, LOW PROFILE, 24 PIN SLIM DIP	XU24
80	0432-01-0002	PAD, MOUNTING	XU39
81	0315-00-0685	RESISTOR, FIXED, CARBON FILM, 1/4W, 6.8M	R40
82	0290-02-0227	CAP, FIXED, 220UF TANT. 10V 20%	C67
83	0315-00-0134	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 130K	R34
84	0315-00-0102	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 1K	R47
85	0290-02-0336	CAP, FIXED, 33UF TANT. 35V 20%	C66
86	0290-02-3226	CAP, FIXED, 22UF TANT. 10V 20%	C14-C17
87	006-04-2800	Wire, 28 AWG, Blk	
88	0212-10-0406	Screw, 4-40, Nylon	
89	0220-00-0037	Nut, Hex, 4-40, Nylon	
90	0136-00-0391-01	Adapter, SMT-to-DIP	XU20

PNEUMATICS BOARD (CE)			***0670-00-0605***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0008-10-0204	Tubing, 1/16	"N/A
2	0008-10-0408	Tubing, 1/8	"N/A
3	0103-00-0200	Adapter 1/16" to 1/8	"N/A
4	0103-00-0457	CHECK VALVE	N/A
5	0103-00-0331	Transition Barb, Rt Angle	N/A
6	0103-00-0419	MANIFOLD, PNEUMATIC	N/A
7	0104-00-0005	MAGNETIC COMPONENT, VALVE, 12 VDC, 3 WAY, N.C., 2W (dump)V1	
8	0104-00-0006	PNEUMATIC COMPONENT ACTIVE, Proportional Valve	V2
9	0108-00-0065	Inductor, Dual winding	L1
10	0108-08-1000	IND, 100 uH	L2
11	0136-01-1020	SOCKET, 20 pin DIP	Socket for U1
12	0136-24-1020	CONNECTOR, 20 pin, dual row header	J30
13	0136-24-1024	CONNECTOR, 24 pin, dual row header	J35
14	0136-92-0003	CONNECTOR PC, Header, straight locking and polarized, 3 pin	J29
15	0136-92-0006	CONNECTOR PC, Header, straight locking and polarized, 6 pin	J34
16	0151-01-0010	TRANSISTOR, IRFD110 FET	Q1 Q2
17	0153-00-0001	DIODE, IN4003	D1 D2 D3
18	0153-00-0193	DIODE, 1N4749A	D4
19	0155-00-0073	IC, LM339A COMPARATOR	U6
20	0155-00-0089	IC, MC14052B MUX	U2
21	0155-00-0404	IC, DG201A ANALOG SWITCH	U5
22	0155-00-0805-02	IC, Dual picoamp input current OpAmp, AD706	U4
23	0155-90-0335	IC, MC68HC705J1A microcontroller	U1
24	0155-00-0909-01	IC, 74HCT27 Triple 3-input NOR gate	U3
25	0158-01-0023	3.6864MHz crystal	Y1
26	0210-07-0003	Washer, Nylon	mounting for L2
27	0212-12-0418	Screw, #4-40 1.123 Lg. PH	mounting for L2

PNEUMATICS BOARD (CE) (CONTINUED) ***0670-00-0605***

ITEM NO.	*PART NUMBER*	*DESCRIPTION*	*REFERENCE*
28	0223-00-0004	Nut, Hex, #4-40	mounting for L2
29	0215-03-0001	Tape, Double Coated Foam	Use under Y1
30	0283-04-0104	CAP, 0.1 uF, 10% 100V ceramic	C2 C3 C4 C5 C6 C7 C8 C10 C11 C16 C17
31	0283-05-0330	CAP, 33 pF, 10% 50V ceramic	C13 C14
32	0285-00-0055	CAP, 0.47 uF, 5% metal polycarb	C1 C9
33	0285-15-0473	CAP, 0.047 uF, 5% metal polycarb	C15
34	0290-11-0001	AP, 3300 uF 20% 25V elect	C12
35	0307-04-0103	RES NET,10K, 5%, 8 Pin Sip	RN1
36	0307-04-0223	RES NET, 22K, 5%, 8 Pin Sip	RN2
37	0307-04-0472	RES NET, 4.7K, 5%, 8 Pin Sip	RN3
38	0309-00-1021	RESISTOR, 1.02K, 1/8 W, 1%	R23
39	0309-00-1213	RESISTOR, 121K, 1/8 W, 1%	R8 R19
40	0309-00-1214	RESISTOR, 1.21MEG, 1/8 W, 1%	R4 R14
41	0309-00-1823	RESISTOR, 182K, 1/8 W, 1%	R11
42	0309-00-2263	RESISTOR, 226K, 1/8 W, 1%	R29
43	0309-00-3241	RESISTOR, 3.24K, 1/8 W, 1%	R26
44	0309-00-3832	RESISTOR, 38.3K, 1/8 W, 1%	R25
45	0309-00-4121	RESISTOR, 4.12K, 1/8 W, 1%	R12
46	0309-00-5112	RESISTOR, 51.1K, 1/8 W, 1%	R10
47	0309-00-5113	RESISTOR, 511K, 1/8 W, 1%	R18
48	0309-00-7501	RESISTOR, 7.5K, 1/8 W, 1%	R22, R27
49	0309-00-8251	RESISTOR, 8.25K, 1/8 W, 1%	R20
50	0309-00-8661	RESISTOR, 8.66K, 1/8 W, 1%	R15
51	0309-00-9092	RESISTOR, 90.9K, 1/8 W, 1%	R16

PNEUMATICS BOARD (CE) (CONTINUED)			0670-00-0605
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
52	0309-00-9762	RESISTOR, 97.6K, 1/8 W, 1%	R32
53	0310-00-0100	RESISTOR, 10 ohm, 1/4 W, 1%	R2
54	0311-01-2502	RES ADJ, 5K	R1
55	0315-00-0103	RESISTOR, 10K, 1/4 W, 5%	R3 R7 R13 R21
56	0315-00-0104	RESISTOR, 100K, 1/4 W, 5%	R6
57	0315-00-0134	RESISTOR, 130K, 1/4 W, 5%	R30
58	0315-00-0153	RESISTOR, 15K, 1/4 W, 5%	R24
59	0315-00-0205	RESISTOR, 2MEG, 1/4 W, 5%	R31
60	0315-00-0223	RESISTOR, 22K, 1/4 W, 5%	R5
61	0315-00-0303	RESISTOR, 30K, 1/4 W, 5%	R9
62	0315-00-0332	RESISTOR, 3.3K, 1/4 W, 5%	R28
63	0315-00-0682	RESISTOR, 6.8K, 1/4 W, 5%	R17
64	0343-00-0067	CLAMPS, TUBING	N/A
65	0212-10-0608	SCREW NYLON	for PT1
66	0378-02-0004	AIR FILTER, 25 um, 1/8 barb	N/A
67	0388-00-0605	Pneumatics PCB	N/A
68	0406-00-0781	TRANSDUCER BRACKET	for PT1
69	0682-00-0086	TRANSDUCER, 7 PSIG with signal conditioning	PT1
70	0220-22-0632	NUT, NYLON	for PT1

PANEL BOARD			0670-00-0611 0670-00-0627 (5L-CE)
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0012-00-0985	Cable Assembly	J2
2	0136-98-0208	Header, 8x2, low profile	J1, J3
3	0012-00-1024	Cable Assembly	J2 w/Ferrite Bead (0627 Bd only)
4	0388-00-0611	PCB	
5			
6	0153-00-0171	Diode, Dual, BD7000	CR1, CR2, CR3, CR4, CR5, CR6
7			
8			
9			
10	0155-00-0785	IC, CMOS mux, 4051	U2, U3, U4
11	0155-00-0789-01	IC, quad op-amp, MC34184	U1
12			
13			
14	0283-00-0056	CAP., 0.1uF, 20%	C9, C10
15	0286-03-3121	CAP., 120 pF, 2%	C1, C2, C3, C4, C5, C6, C7, C8
16	0287-00-1103	CAP., 0.01uF, 10%	C11
17			
18			
19	0324-00-0105	RES, 1.0M 5% .25W	R33, R34
20	0324-00-0226	RES, 22M 5% .25W	R1, R5, R6, R7
21	0326-01-4752	RES, 47.5K 1% .1W	R2, R3, R4, R8, R9, R10, R18, R19, R22
22	0326-01-1003	RES, 100K 1% .1W	R12, R15, R20, R26
23	0326-01-1002	RES, 10.0K 1% .1W	R11, R13, R14, R16, R17, R21, R23, R24, R27, R29
24	0326-01-3321	RES, 3.32K 1% .1W	R31
25	0326-01-4991	RES, 4.99K 1% .1W	R25, R28, R30, R32
26			
27			
28	0361-04-0010	Standoff, nylon, female/female	
29	0361-32-0250	Standoff, nylon, male/female	
30	0337-00-0095	Shield, EMI	
31	0007-02-0022	Wire, Bus, Solid 22 AW	
32	0215-00-0087	Kapton tape, 1/2 inch wide	

INTERCONNECT BOARD ASSEMBLY HP			*0670-00-0615*
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0388-00-0615	PCB Revision A	
2	0301-00-0472	RES, CC, 4.7K, 5%,1/2 W	R1, R2, R3, R9, R10
3	0307-00-0089	RESISTOR SPECIAL,1/2 W, 5%, 100 MEG OHM	R4
4	0283-00-0055	CAP, .0047 UF, 3KV, 10%	C1, C2
5	0153-00-0091	DIODE, ZENER 1N6275	CR4-9, CR12
6	0153-00-0160	DIODE, SA170C	CR1, CR2, CR3, CR10, CR11
7	0167-00-0007	SPARK GAP	DG1
8	0131-00-0232	CONN, 12 Pin Receptacle HP ECG	P3
9	0131-00-0231	CONN, 12 Pin Receptacle HP Press	P1, P2
10	0131-00-0227	CONN, Phone, 1/4" Plastic Bushing	P4
11	0136-24-1018	HEADER, DBL ROW 18 PIN	J1
12			
13	0283-05-0102	CAP,.001uF,200v,10%	C3,C4,C5
14	0108-00-0028	TORROID	L1
15	0006-04-2299	Wire Solid, 22 AWG	L1
16			
17	0309-00-4991	RES, 4.99K, 1%, 1/8 W RN55	R5, R6, R7, R8, R11
18	0283-01-5121	CAP, 120pF, 5%	C6, C7, C8, C9, C10
19	0349-00-0174-02	Insulator, Connector	For P4
20	0349-00-0174-01	Insulator, Connector	For J1
21	0008-01-0005	Tubing, Heatshrink	For R1, R3, R9
22	0149-00-0001	Neon Bulb	DS1, DS2
23	0315-00-0103	RES, 10k, 5%, 1/4 W	R13
24	0006-04-2800	Wire, 28 gauge, Blk	R12
25	0348-00-0054-03	Bumper, Molded Polyurethane (Black)	
26	0007-02-0022	Solid Buss Wire, 22 AWG	For P1, P2

PANEL BOARD			***0670-00-0617***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0290-08-1033	CAP, 100uF, Alum, 16V 20%	C11
2	0283-04-0104	CAP, 0.1uF 100V 10%	-01 (C2,C3,C7,C8,C10,C12-C18,C19) -03 & -05 (C2,C3,C7,C8,C10,C12-C18,C19,C23) -02 (C2,C3,C4,C5,C6,C10,C21) -04 & 06 (C2,C3,C4,C5,C6,C10,C21,C22)
3			
4	0108-00-0058	lead, Leaded Ferrite	FB1
5	0315-00-0151	RES, 150, 1/4W 5%	R1, R2, R5
6	0290-08-1026	CAP, 10uF, 50V 20%	C9
7	0315-00-0103	RES, 10K, 1/4W 5%	R4
8	0315-00-0470	RES, 47, 1/4W 5% R19	
9	0151-00-0115	FET, N-Channel 2N7000	Q1
10	0136-24-1040	Header, 40 Pin St. Double Row	J71, Key Pin 13
11	0136-22-0016	Header, 16 Pin St. Single Row	J72, Key Pin 4
12	0136-00-0234	Header, 20 Pin St. Double Row, Right Angle	J74
13			
14	0136-22-0002	Header, 2 Pin St. Single Row	LS1 (J75)
15	0124-00-0064	Terminal, Turret PC	TP1, TP2, TP3
16	0388-00-0617-D	Printed Circuit Board	
17			
18	0136-87-0010	Header / ejector, 10 Pin St. Double Row	J76
19	0315-00-0152	RES, 1.5K, 1/4W,5%	R17
20	0315-00-0223	RES,22K,1/4W,5%	R7,R9,R13
21	0315-00-0225	RES,22MEG,1/4W,5%	R10,R11,R12,R14,R15, R16
22	0155-00-0893-01	Dual Comparator	U4
23	0153-00-0040	5.1V, Zener Diode	CR1
24	0155-90-0342-A	IC, Programmed FBCON, EPM7064	U1
25	0155-90-0343-A	IC, Programmed FBDATA, EPM7032	U2

PANEL BOARD (CONTINUED) ***0670-00-0617***

ITEM NO.	*PART NUMBER*	*DESCRIPTION*	*REFERENCE*
26	0155-00-0910-12	IC, 528257, Multiple Video Ram, 256K x 8-bits	U3
27	0014-00-0055	Power Supplies,DC/DC Converter, 15 Watts	
28	0136-76-0005	Header, 5 Pin St. single Right angle	
29	0136-00-0237	Header, 31 Pin St. Double SMT	J77
30	0155-00-0906-01	IC, AV9170,Clock Synchronizer	U6
31	0155-00-0907-01	IC, 42101,Line Buffer	U7
32	0155-90-0351	IC, Programmed PALE16V8-15	U5
33			
34	0136-01-1020	Socket, low Profile, 20 Pin Slim Dip	XU5
35			
36	0151-00-0195	FET, IRLD014	Q2
37	0155-00-0839-02	IC, 74BCT374 Octal D-Register	U8
38	0151-00-0035	Transistor, NPN, 2N3904	Q3, Q4
39	0315-00-0513	RES, 51K, 1/4W, 5%	R6
40	0315-00-0472	RES, 4.7K, 1/4W, 5%	R3
41	0670-00-0617		
41	0290-18-2205	CAP,FIXED,22uF TANT. 35V 20%	C1
42	0290-00-0112	Cap, 470uF, 25V	C20
43	0307-07-0001	RES, zero ohms	-01 (R21,R49) -02 (R22,R49) -03 (R21,R49,R50) -04 (R22,R49,R50) -05 (R21, W1) -06 (R22, W1)
44	0136-00-0166	44 Pin SMD PLCC Socket	XU1, XU2
45	0315-00-0510	Res, 51, 1/4W, 5%	R20
46	0315-00-0101	RES, 100, 1/4W, 5%	-03 (R23,R25,R26,R28) -04 (R24,R27,R29-R32,R38,R43)
47	0155-00-0937-01	IC, Buffer AHCT244	-03 (U10) -04 (U9)
48	0283-10-1103	CAP, 0.01UF, 100V, 10%	C24,C25
49	0215-03-0001	TAPE, DOUBLE COATED FOAM	Used under C20

FRONT END BOARD ASSEMBLY			0670-00-0620-XX
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
1	0388-00-0620	PCB Revision B	
2	0108-00-0063	INDUCTOR, FIXED, L1/L2 ASSEMBLY, 2MH, 25%	L1,L2
3	0120-00-0125	TRANSFORMER, POWER ISOLATION	T1
4	0120-00-0129	TRANSFORMER, RESPIRATORY PATIENT DRIVE	T2
5	0124-00-0064	TERMINAL	TP1-TP11
6	0136-24-1010	10 PIN HEADER	J42
7	0136-24-1012	12 PIN HEADER	J43
8	0136-24-1018	18 PIN HEADER	J41
9	0151-00-0035	TRANSISTOR, 2N3904, NPN, general purpose	Q10-Q13
10	0151-00-0072	VOLTAGE REGULATOR, 78L05	U48,U49
11	0151-01-0010	XSISTOR, HEXFET IRFD110	Q1-Q4,Q8,Q9
12	0153-00-0014	DIODE, 1N914, General purpose highspeed switching	D1-D3,D5-D8,D10-D19,D21,D22,D24-D29,D31-D34,D39-D41,D56,D59
13	0153-00-0069	DIODE, 1N5817	D44,D45,D47,D48,D51
14	0153-00-0085	1N6263 SCHOTTKY DIODE	D20,D42,D43,D46,D49,D50,D52,D53
15	0155-00-0075	CD4066, Quad Bilateral Switch	U26
16	0155-00-0086	CD4053, 2 Channel Analog Multiplexer	U18
17	0155-00-0112	CD4538B, Dual Monstable Multivibrator	U28
18	0155-00-0122	CD4051, CMOS MUX	U1,U3,U4
19	0155-00-0173	LM393A, Dual Comparator	U37
20	0155-00-0210	HC393, Dual 4 Bit Binary Counter	U40
21	0155-00-0239	ACT240, OCTAL BUFFER	U36
22	0155-00-0407	MC34082 AP, JFET OP AMP	U11
23	0155-00-0568	IC, ANALOG, PRECISION OPAMP, LT1012	U14,U27
24	0155-00-0570	IC, OPTOISOLATOR, CNW136	U42,U43
25	0155-00-0571	IC, Dual Precision OpAmp, LT1013C	U8,U9,U29,U30,U34,U50
26	0155-00-0572	IC, DUAL JFET OPAMP, TL032C	U13,U21,U24,U25,U31-U33

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0620-XX
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
27	0155-00-0574	IC, 10 Bit Analog to Digital Converter w/Serial Control and 11 Inputs, TLC1540	U39
28	0155-00-0575	IC, REGULATING PULSE WIDTH MODULATOR, SG3525A	U47
29	0155-00-0576	IC, OPTOISOLATOR, CNY173	U44
30	0155-00-0789-02	IC, OpAmp, Quad low powerJFET, MC34184	U2
31	0155-90-0339	MICROCONTROLLER, Rev C.3.1	U38
32	0158-01-0023	CRYSTAL, QUARTZ, MICROPROCESSOR	Y1
33	0283-01-5180	CAP, 18PF, 500V, 5%	C118
34	0283-04-0104	CAP, 0.1UF, 100V 10%	C1, C4, C6, C7, C16, C20, C22, C31, C32, C34, C35, C42, C43, C48, C49, C58, C64, C65, C71, C72, C82, C83, C87, C88, C90, C91, C93-C96, C104, C107, C113-C115, C121, C125, C502, C504, C508-C513, C515
35	0283-04-0224	CAP, 0.22UF 50V, 10%	C109, C126
36	0283-04-0333	CAP, 0.033UF 100V 10%	C66, C102, C505, C506
37	0283-04-0334	CAP, 0.33UF 50V 10%	C45, C124, C136, C137
38	0283-04-0474	CAP, 0.47UF 50V 10%	C39, C47, C60, C61, C110, C128, C134, C135, C503, C514
39	0283-04-1474	CAP, 0.47UF 50V 5%	C89
40	0283-05-0103	CAP 0.01UF 100V 10%	C8, C9, C15, C23, C101, C106, C112, C122, C123
41	0283-05-0150	CAP 15PF 200V 10%	C56
42	0283-05-0220	CAP 22PF 200V 10%	C119
43	0283-05-0271	CAP 270PF 200V 10%	C85, C500, C501
44	0283-05-0331	CAP 330PF 1000V 10%	C84, C86, C105
45	0283-05-0471	CAP 470PF 100V 10%	C25
46	0283-05-1394	CAP 0.39UF 100V 5%	C50
47	0283-05-2331	CAP 330PF 100V 2%	C55, C57
48	0283-12-3121	CAPACITOR CERAMIC, NPO, 200 V 120PF 2%	C2, C3, C5, C10-C14
49	0285-09-0010	CAP 1UF 50V 5%	C46
50	0285-09-0039	CAP POLYCARBONATE 2UF 50V 10%	C117
51	0285-10-0102	CAP POLYCARBONATE 0.001UF 2% 250V	C132, C133

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0620-XX
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
52	0285-10-0104	CAP 0.1UF 2% 30V	C44, C63, C70, C73, C75, C76, C97, C99, C100, C103
53	0286-00-2102	CAPACITOR, SMD,0805, Ceramic, 100 V, 1000PF	C30,C40,C52
54	0286-00-2152	CAPACITOR, SMD,0805, Ceramic, 100 V 1500PF	C38,C51,C53
55	0286-00-2221	CAPACITOR, SMD,0805, Ceramic, 100 V 220PF	C17-C19, C21, C24, C26-C29
56	0287-00-0222	CAPACITOR, SMD,0805, Ceramic, X7R 2200PF	C33, C36, C37, C4
57	0290-02-0336	CAPACITOR, FIXED, Dipped Tantalum 33UF 10V 20%	C116, C516
58	0290-02-3225	CAPACITOR, FIXED, Dipped Tantalum 2.2UF 35V 20%	C127
59	0290-02-3226	CAPACITOR, FIXED, Dipped Tantalum 22UF 35V 20%	C129-C131
60	0290-02-3475	CAPACITOR, FIXED, Dipped Tantalum 4.7UF 35V 20%	C111,C120,C507
61	0307-00-0070	RESISTOR NETWORK, 14 PIN, 100K	RN3,RN4
62	0307-00-0072	RESISTOR, SPECIAL, 3.539 k ± .025%, 10 ppm	R66
63	0307-00-0073	RESISTOR, SPECIAL, 9.428 k ± .025%, 10 ppm	R68
64	0307-01-0473	RESISTOR NETWORK, 10 PIN SIP 47K 2%	RN2
65	0309-00-1001	RESISTOR, Metal film, 1/8 W, 1% 1K R80(-01 ONLY)	R154,R519
66	0309-00-1002	RESISTOR, Metal film, 1/8 W, 1% 10K	R6,R7,R31,R32,R34-R38,R41,R69,R127,R163,R164,R196,R200
67	0309-00-1003	RESISTOR, Metal film, 1/8 W, 1% 100K	R24,R27,R28,R33,R76,R81,R207,R208
68	0309-00-1102	RESISTOR, Metal film, 1/8 W, 1% 11	KR53
69	0309-00-1153	RESISTOR, Metal film, 1/8 W, 1% 115K	R156,R206
70	0309-00-1181	RESISTOR, Metal film, 1/8 W, 1% 1.18K	R264
71	0309-00-1212	RESISTOR, Metal film, 1/8 W, 1% 12.1K	R74,R520
72	0309-00-1213	RESISTOR, Metal film, 1/8 W, 1% 121K	R266
73	0309-00-1333	RESISTOR, Metal film, 1/8 W, 1% 133K	R204
74	0309-00-1372	RESISTOR, Metal film, 1/8 W, 1% 13.7K	R78

FRONT END BOARD ASSEMBLY (CONTINUED) 0670-00-0620-XX

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
75	0309-00-1374	RESISTOR, Metal film, 1/8 W, 1% 1.37M	R129
76	0309-00-1540	RESISTOR, Metal film, 1/8 W, 1% 154 OHM	R268
77	0309-00-1584	RESISTOR, Metal film, 1/8 W, 1% 1.58M	R85,R510
78	0309-00-1621	RESISTOR, Metal film, 1/8 W, 1% 1.62K	R265
79	0309-00-1622	RESISTOR, Metal film, 1/8 W, 1% 16.2K	R46
80	0309-00-1652	RESISTOR, Metal film, 1/8 W, 1% 16.5K	R185
81	0309-00-1741	RESISTOR, Metal film, 1/8 W, 1% 1.74K	R87
82	0309-00-1823	RESISTOR, Metal film, 1/8 W, 1% 182K	R153,R189
83	0309-00-1872	RESISTOR, Metal film, 1/8 W, 1% 18.7K	R181
84	0309-00-2002	RESISTOR, Metal film, 1/8 W, 1% 20K	R48,R49
85	0309-00-2003	RESISTOR, Metal film, 1/8 W, 1% 200K	R157,R159,R177,R215
86	0309-00-2212	RESISTOR, Metal film, 1/8 W, 1% 22.1K	R70,R211
87	0309-00-2433	RESISTOR, Metal film, 1/8 W, 1% 243K	R199
88	0309-00-2492	RESISTOR, Metal film, 1/8 W, 1% 24.9K	R8
89	0309-00-2672	RESISTOR, Metal film, 1/8 W, 1% 26.7K	R47
90	0309-00-2871	RESISTOR, Metal film, 1/8 W, 1% 2.87K	R75
91	0309-00-3011	RESISTOR, Metal film, 1/8 W, 1% 3.01K	R516
92	0309-00-3012	RESISTOR, Metal film, 1/8 W, 1% 30.1K	R160
93	0309-00-3013	RESISTOR, Metal film, 1/8 W, 1% 301K	R128
94	0309-00-3321	RESISTOR, Metal film, 1/8 W, 1% 3.32K	R59
95	0309-00-3572	RESISTOR, Metal film, 1/8 W, 1% 35.7K	R125,R263
96	0309-00-3573	RESISTOR, Metal film, 1/8 W, 1% 357K	R190
97	0309-00-3742	RESISTOR, Metal film, 1/8 W, 1% 37.4K	R511
98	0309-00-3921	RESISTOR, Metal film, 1/8 W, 1% 3.92K	R269

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0620-XX
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
99	0309-00-3923	RESISTOR, Metal film, 1/8 W, 1% 392K	R158,R183,R203
100	0309-00-4642	RESISTOR, Metal film, 1/8 W, 1% 46.4K	R513
101	0309-00-4751	RESISTOR, Metal film, 1/8 W, 1% 4.75K	R186
102	0309-00-4752	RESISTOR, Metal film, 1/8 W, 1% 47.5K	R14,R18,R20,R22,R23,R25, R26,R30,R54,R162,R214
103	0309-00-4991	RESISTOR, Metal film, 1/8 W, 1% 4.99K	R29,R57,R61,R63
104	0309-00-4992	RESISTOR, Metal film, 1/8 W, 1% 49.9K	R9-R11,R79,R155,R184,R209
105	0309-00-5231	RESISTOR, Metal film, 1/8 W, 1% 5.23K	R161
106	0309-00-6192	RESISTOR, Metal film, 1/8 W, 1% 61.9K	R512
107	0309-00-6813	RESISTOR, Metal film, 1/8 W, 1% 681K	R126
108	0309-00-7681	RESISTOR, Metal film, 1/8 W, 1% 7.68K	R267
109	0309-00-8661	RESISTOR, Metal film, 1/8 W, 1% 8.66K	R195
110	0309-00-9531	RESISTOR, Metal film, 1/8 W, 1% 9.53K	R86
111	0309-00-9762	RESISTOR, Metal film, 1/8 W, 1% 97.6K	R182
112	0315-00-0101	RESISTOR, FIXED, Carbon film, 1/4 W, 5% 100 OHM	R39,R45,R51,R65,R67,R90, R150
113	0315-00-0102	RES, FIXED, Carbon film, 1/4 W, 5% 1K	R40,R50,R55,R170,R191,R249
114	0315-00-0103	RES, FIXED, Carbon film, 1/4 W, 5% 10K	R1, R2, R5, R15-17, R42, R43, R64, R88, R168, R210, R256
115	0315-00-0105	RES, FIXED, Carbon film, 1/4 W, 5% 1.0M	R60, R62
116	0315-00-0106	RES, FIXED, Carbon film, 1/4 W, 5% 10M	R228
117	0315-00-0153	RES, FIXED, Carbon film, 1/4 W, 5% 15K	R235
118	0315-00-0181	RESISTOR, FIXED, Carbon film, 1/4 W, 5% 180 OHM	R234, R261, R262
119	0315-00-0182	RES, FIXED, Carbon film, 1/4 W, 5% 1.8K	R231,R233
120	0315-00-0202	RES, FIXED, Carbon film, 1/4 W, 5% 2K	R82, R230
121	0315-00-0222	RES, FIXED, Carbon film, 1/4 W, 5% 2.2K	R52, R120, R134, R232, R514
122	0315-00-0226	RES, FIXED, Carbon film, 1/4 W, 5% 22M	R3, R13, R19, R21

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0620-XX
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
124	0315-00-0243	RES, FIXED, Carbon film, 1/4 W, 5% 24K	R176, R178
125	0315-00-0271	RES, FIXED, Carbon film, 1/4 W, 5%	270 OHM
126	0315-00-0272	RES, FIXED, Carbon film, 1/4 W, 5%	2.7K
127	0315-00-0302	RES, FIXED, Carbon film, 1/4 W, 5%	3K
128	0315-00-0304	RES, FIXED, Carbon film, 1/4 W, 5%	300K
129	0315-00-0361	RES, FIXED, Carbon film, 1/4 W, 5%	360 OHM
130	0315-00-0392	RES, FIXED, Carbon film, 1/4 W, 5%	3.9K
131	0315-00-0470	RES, FIXED, Carbon film, 1/4 W, 5%	47 OHM
132	0315-00-0472	RES, FIXED, Carbon film, 1/4 W, 5%	4.7K
133	0315-00-0473	RES, FIXED, Carbon film, 1/4 W, 5%	47K
134	0315-00-0474	RES, FIXED, Carbon film, 1/4 W, 5%	470K
135	0315-00-0475	RES, FIXED, Carbon film, 1/4 W, 5%	4.7 M
136	0315-00-0512	RES, FIXED, Carbon film, 1/4 W, 5%	5.1K
137	0315-00-0824	RES, FIXED, Carbon film, 1/4 W, 5%	820K
138	0315-00-0912	RES, FIXED, Carbon film, 1/4 W, 5%	9.10K
139	0320-00-1002	RESISTOR, Metal Film, 0.1%, 1/8 W	10K
140	0320-00-1383	RES, Metal Film, 0.1%, 1/8 W 138K	R118, R130
141	0320-00-2580	RES, Metal Film, 0.1%, 1/8 W 258	OHM
142	0309-00-5111	RESISTOR, Metal Film, 1%, 1/8 W	5.11K
143	0214-00-0074	Insulator Bead	
144	0136-57-0044	Socket, 44pin PLCC	Socket for U38
145	0309-00-4022	RES, 40.2K, 1/8W, 1%	R513
146	0309-00-7680	RES, 768 OHM, 1/8W, 1%	R80
147	0215-03-0003	Tape, Double Coated Foam	Use on Y1
148			
149	0309-00-2674	RESISTOR, Metal film, 1/8 W, 1% 2.67M	R142, R144, R146, R148
150	0155-00-0938-01	IC, Dual Precision OpAmp, AD706JN	U20

FRONT END BOARD ASSEMBLY (CONTINUED)			0670-00-0620-XX
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
151	0337-00-0108	SHIELD, EMI (FRONT-END PCB)	
152	0361-00-0438	Spacer, Round, Nylon	
153	0210-00-0125	PIN,.025 Square, Electrical	
154	0283-05-0121	CAP 120PF 200V 10%	C54

CPU BOARD ASSEMBLY			0670-00-0623 (5L-CE)
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0108-00-0058	CHOKE	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L12
2	0315-00-051X	RESISTOR, FIXED, CARBON FILM, 1/4 WATT 5.1 OHM	R48
3	0136-00-0142	CONN PC, 16 PIN, SIDE ENTRY	J66
4	0136-00-0144	50 PIN RIGHT ANGLE	J63
5	0136-00-0228	Conn, PC, 50 Position w/ guide, w/o key	J61
6	0136-22-0003	HEADER CONNECTOR, 3 PIN	TP15, TP16, TP17, TP18, TP19, TP20, JP1
7	0136-24-1006	HEADER DOUBLE ROW, 6 PIN	TP9, TP10, TP11, TP12, TP13, TP14
8	0136-24-1008	HEADER DOUBLE ROW, 8 PIN	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8
9	0136-24-1010	HEADER DOUBLE ROW, 10 PIN	J64
10	0136-24-1016	HEADER DOUBLE ROW, 16 PIN	J67
11	0136-24-1026	HEADER DOUBLE ROW, 26 PIN	J62
12	0136-24-1040	HEADER DOUBLE ROW, 40 PIN	J68
13	0136-87-0050	CONN PC,SHROUDED STR HDR W/ EJECTO	J65
14	0151-00-0061	TRANSISTOR 2N2222A	Q1
15	0153-00-0085	DIODE, SCHOTTKY, 1N626	D1, D2, D3
16	0153-00-0093	VOLTAGE REF, SG3503	U39
17	0388-00-0438-B	CPU PCB	
18	0155-00-0078	IC, LOW VOLT AUDIO POWER AMPLIFIER, LM386	U37
19	0155-00-0201	IC 8-BIT MULT D/A, AD7524	U36
20	0155-00-0400	IC, DUAL RS-232 TRANSMITTER/ RECEIVER MAX 232	U31
21	0155-00-0404	IC QUAD SPST ANALOG SWITCH, DG201	U34

CPU BOARD ASSEMBLY (CONTINUED)			0670-00-0623 (5L-CE)
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
22	0155-00-0590-01	IC, 32K X 8 STATIC RAM	U6
23	0155-00-0426	IC, OCTAL BUFFER/ LINE DRIVER, 74HCT244	U8, U9, U10, U13, U14, U16, U17, U18, U29, U30
24	0155-00-0438	IC, DIGITAL, OCTAL BUS TRANSCEIVER, 74HCT245	U7, U12, U15
25	0155-00-0470	IC, 93C46, SERIAL EEPROM	U4
26	0155-00-0515	IC, OCTAL INVERTING BUFFER/ LINE DRIVER, 74HCT240	U11
27	0155-00-0516	IC, OCTAL D-TYPE FF, 74HCT377	U19
28	0155-00-0518	IC, INTEGRATED MULTIPROTOCOL PROCESSOR, MC68302	U1
29	0155-00-0519	IC, 8 BIT A/D CONVERTER W/11 CHANNEL MULTIPLEX	U32
30	155-00-0520	IC, DISPLAY CONTROLLER, V6366F	U5
31	0155-00-0521	IC, DIGITAL, SERIAL TIMEKEEPER, DS1202	U20
32	0155-00-0522	IC, DIGITAL MICROMANAGER, DS1236	U21
33	0155-00-0523	IC, OP AMP, LOW POWER JFET, TL034	U33, U35
34	0155-00-0524	IC, DUAL 1-OF-4 DECODER/ DEMULTIPLEXER, 74ACT139	U23
35	0155-00-0525	IC, QUAD 2 INPUT NOR GATE, 74ACT02	U28
36	155-00-0529	IC, HEX INVERTER, 74ALS04	U27
37	0155-00-0530-04	IC, STATIC RAM, CMOS, 1 MEG	U2, U3
38	0155-00-0579	IC, 1-OF-8 DECODER/ DEMULTIPLEXER, 74ACT138	U22
39	0155-90-0165	CPU PAL, PASSPORT	U24

CPU BOARD ASSEMBLY (CONTINUED) ***0670-00-0623 (5L-CE)***

ITEM NO.	*PART NUMBER*	*DESCRIPTION*	*REFERENCE*
40	0158-00-0010	CRYSTAL,TUNING FORK, 32.768 KHZ	Y2
41	0158-01-0025	MICROPROCESSOR QUARTZ CRYSTAL, 16.5888 MHZ	Y1
42	0158-05-0001	CRYSTAL, CLOCK OSCILLATOR, 14.31818 MHZ	U38
43	0283-04-0104	CAP, CERAMIC, .1UF 100V 10%	C5, C6, C13, C29, C30, C31, C32, C33, C35, C42, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C68, C75, C77, C78, C103, C113, C121, C122, C123, C124
44	0283-04-0473	CAP, CERAMIC, .047UF 100V 10%	C37
45	0283-05-0100	CAP, CERAMIC, 10PF 200V 10%	C70, C72
46	0283-05-0101	CAP, CERAMIC, 100PF 200V 10%	C112, C114
47	0283-05-0102	CAP, CERAMIC, .001UF 200V 10%	C104, C105, C106, C107, C108, C109, C110, C111
48	0283-05-0103	CAP, CERAMIC, .01UF 100V 10%	C4, C27, C28, C36, C43, C65, C69, C73, C74, C76, C115, C116
49	0283-05-0220	CAP, CERAMIC, 22PF 200V 10%	C1, C2, C41
50	0283-05-0222	CAP, CERAMIC, .0022UF 200V 10%	C118, C38
51	0283-05-0471	CAP, CERAMIC, 470PF 100V 10%	C119
52	0290-02-3105	CAP, FIXED, 1UF TANT. 35V 20%	C9, C10, C11, C12
53	0290-02-3475	CAP, FIXED, 4.7UF TANT 35V 20	C7, C8, C18
54	0290-07-1053	CAP, FIXED ELECT., 10000 UF	C120
55	0307-00-0029	RESISTOR NETWORK, DIP 14 PIN, 10K .5% 7 Resistors	RP2
56	0307-01-0104	RESISTOR NETWORK, SIP 10 PIN, 100K	RP7

CPU BOARD ASSEMBLY (CONTINUED)			0670-00-0623 (5L-CE)
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
57	0307-01-0394	RESISTOR NETWORK, SIP 10 PIN, 390K	RP6
58	0307-01-0470	RESISTOR NETWORK, SIP 10 PIN, 47 OHM	RP8, RP14
59	0307-06-2103	RESISTOR NETWORK, SIP 10 PIN, 10K 2%	RP1, RP3, RP4, RP5, RP9, RP10, RP11, RP12, RP13
60	0309-00-2052	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 20.5K	R46
61	0309-00-1003	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 100K	R11
62	0309-00-4421	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 4.42K	R44
63	0309-00-4640	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 464 OHM	R17
64	0309-00-6042	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 60.4K	R45
65	0315-00-0100	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 10 OHM	R10
66	0315-00-0101	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 100 OHM	R13, R16
67	0315-00-0103	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 10K	R7, R41, R49
68	0315-00-0104	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 100K	R37, R39
69	0309-00-3923	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 392K	R42
70	0315-00-0202	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 2K	R12
71	0315-00-0204	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 200K	R36, R38
72	0309-00-1824	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 1.82M	R43
73	0315-00-0223	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 22K	R25

CPU BOARD ASSEMBLY (CONTINUED)			0670-00-0623 (5L-CE)
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
74	0315-00-0472	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 4.7K	R2, R33
75	0315-00-0473	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 47K	R24, R26
76	0315-00-0684	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 680K	R1
77	0352-00-0029	HOLDER BATTERY (COIN TYPE)	XBT1
78	0388-00-0438-B	DRILL & FAB, CPU BOARD	
79	0136-56-1324	SOCKET, LOW PROFILE, 24 PIN SLIM DIP	XU24
80	0432-01-0002	PAD, MOUNTING	XU39
81	0315-00-0685	RESISTOR, FIXED, CARBON FILM, 1/4W, 6.8M	R40
82	0290-02-0227	CAP, FIXED, 220UF TANT. 10V 20%	C67
83	0315-00-0134	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 130K	R34
84	0315-00-0102	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 1K	R47
85	0290-02-0336	CAP, FIXED, 33UF TANT. 10V 20%	C66
86	0290-02-3226	CAP, FIXED, 22UF TANT. 35V 20%	C14-C17
87	006-04-2800	Wire, 28 AWG, Blk	
88	0212-10-0406	Screw, 4-40, Nylon	
89	0220-00-0037	Nut, Hex, 4-40, Nylon	
90	N/A	CAP, 10uF, 10%	C125
91	0210-00-0124	Ground Lug	
92	0006-02-2000	20 Gauge Stranded Wire, Blk	

FRONT END BOARD ASSEMBLY			0670-00-0624(5L-CE)
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0285-10-0102	CAP,POLYCARB .001UF 2% 250V	C132,C133
2	0283-05-0103	CAP,.01UF 100V 10%	C8,C9,C23,C101,C106,C112,C122,C123
3	0283-04-0333	CAP,.033UF 100V 10%	C66, C102, C505, C506
4			
5	0283-04-0104	CAP,.1UF 100V 10%	C6,C7,C20,C22,C58, C121, C508, C509,C64,C65,C71,C72,C82, C510, C511, C512,C83,C87,C88,C90,C91,C93,C502, C504, C94, C95,C104,C107,C515, C113, C114, C115, C31,C32,C34,C35,C42,C43,C48,C49,C96,C513, C125, R165
6	0285-10-0104	CAP, .1UF 2% 30V	C73, C75, C76, C99, C100, C103,C44, C70, C97, C63
7	0283-04-0224	CAP,.22UF 50V 10%	C109, C126
8	0283-04-0334	CAP,.33UF 50V 10%	C124,C45,C136,C137
9	0283-04-0474	CAP, .47UF 50V 10%	C39, C47, C61, C110, C128, C134, C503, C60, C514, C135
10	0283-01-5180	CAP, 18PF 500V 5%	C118
11	0285-09-0039	CAP,POLYCARBONATE 2UF 50V 10%	C117
12	0283-05-0220	CAP,22PF 200V 10%	C119
13	0290-02-1226	CAP,22UF TANT. 20V 20%	C129,C130
14	0283-05-0331	CAP,330PF 1000V,10%	C84,C86,C105
15	0290-02-0336	CAP,33UF TANT 10V 20%	C116,C516
16			
17	0290-02-3475	CAP,4.7UF TANT 35V 20%	C120,C111, C507
18	0283-05-0471	CAP,470PF 100V 10%	C25
19	0153-00-0085	1N6263 SCHOTTKY DIODE	D20,D42,D43,D46,D49,D50,D52,D53
20	0153-00-0014	DIODE, 1N914	D5,D12,D13,D14,D15, D16,D17,D18,D19,D24,D25,D26,D27,D28, D29, D31,D32,D33,D34, D39,D40,D41,D56,D57,D58,D59

FRONT END BOARD ASSEMBLY			***0670-00-0624(5L-CE)***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
21			
22	0155-00-0086	2 Channel Analog Multiplexer	U18
23	0155-00-0075	Quad Bilateral Switch	U26
24	0155-00-0112	Dual Monostable Multivibrator	U28
25	0155-00-0210	Dual 4 Bit Binary Counter	U40
26	0155-00-0098	Dual Comparator	U37
27	0155-00-0407	MC34082 AP, JFET OP AMP	U11
28	0151-01-0010	XSISTOR, HEXFET IRFD110	Q1,Q2,Q3,Q4,Q8,Q9
29	0315-00-0182	RES,1.8K 1/4W 5%	R231,R233
30	0315-00-0101	RES,100 OHM 1/4W 5%	R39,R45,R51,R65,R67, R90,R150
31	0307-00-0070	RES,MF NTWRK 100K 1/8W .1%	RN3,RN4
32	0309-00-1003	RES,100K 1/8W 1%	R76,R81,R207,R208
33	0315-00-0103	RES,10K 1/4W 5%	R1,R2,R5,R15,R42,R43, R88,R210,R256,R16, R17
34	0320-00-1002	RES,10K 1/8W .1%	R192,R193,R194,R212, R255,R257
35	0309-00-1002	RES,10K 1/8W 1%	R6,R7,R127,R163,R164, R196,R200, R168
36	0315-00-0106	RES,10M 1/4W 5%	R142,R144,R146,R148, R228
37	0309-00-1153	RES,115K 1/8W 1%	R156,R206
38	0309-00-1212	RES,12.1K 1/8W 1%	R74,R520
39	0309-00-3742	RES, 37.4K 1/8W 1%	R511
40	0309-00-1102	RES, 11K 1/8W 1%	R53
41	0309-00-1540	RES, 154 OHM 1/8W 1%	R268
42	0309-00-2002	RES, 20K 1/8W 1%	R48,R49
43	0309-00-1622	RES,16.2K 1/8W 1%	R46
44	0309-00-1652	RES,16.5K 1/8W 1%	R185
45	0309-00-1823	RES,182K 1/8W 1%	R189,R153
46	0315-00-0102	RES,1K 1/4W 5%	R40,R50,R55,R170,R19 1,R249
47	0309-00-1001	RES,1K 1/8W 1%	R80 (-01, ONLY), R154, R519
48	0315-00-0222	RES,2.2K 1/4W 5%	R232,R52,R514,R120,R 134
49	0309-00-1181	RES, 1.18K 1/8W 1%	R264
50	0309-00-2003	RES,200K 1/8W 1%	R157,R159,R177,R215

FRONT END BOARD ASSEMBLY ***0670-00-0624(5L-CE)***

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
51	0309-00-4022	RES, 40.2K, 1/8W, 1%	R513
52	0309-00-2212	RES,22.1K 1/8W 1%	R211, D37
53	0315-00-0240	RES, 24 OHM 1/4W 5%	R259,R260
54	0309-00-2492	RES,24.9K 1/8W 1%	R8
55	0309-00-3013	RES,301K, 1/8W, 1%	R128
56	0315-00-0243	RES,24K 1/4W 5%	R176,R178
57	0315-00-0202	RES,2K 1/4W 5%	R82,R230
58			
59	0309-00-9531	RES,9.53K 1/8W 1%	R86
60	0315-00-0304	RES, 300K 1/4W 5%	R205
61	0309-00-3011	RES, 3.01K, 1/8W, 1%	R516
62	0309-00-3573	RES,357K 1/8W 1%	R190
63	0309-00-3923	RES,392K 1/8W 1%	R158,R183, R203
64	0309-00-7680	RES, 768 OHM 1/8W, 1%	R80
65	0309-00-4751	RES,4.75K 1/8W 1%	R186
66	0315-00-0472	RES,4.7K 1/4W 5%	R173,R187
67	0315-00-0475	RES,4.7M 1/4W 5%	R188
68	0315-00-0470	RES,47 OHM 1/4W 5%	R213
69	0309-00-4752	RES,47.5K 1/8W 1%	R54, R162, R214
70	0315-00-0474	RES,470K 1/4W 5%	R83,R124,R505,R506
71	0315-00-0473	RES,47K 1/4W 5%	R58,R84, R169,R171,R172,R174, R175,R179, R245,R246,R507,R508, R515
72	0309-00-3012	RES,30.1K 1/8W 1%	R160
73	0309-00-4992	RES,49.9K 1/8W 1%	R9,R10,R11,R79,R155,R184,R209
74	0309-00-6813	RES,681K, 1/8W, 1%	R126
75	0315-00-0824	RES,820K 1/4W 5%	R167,R180
76	0120-00-0125	TRANSFORMER,PWR ISOLATION	T1
77	0155-00-0568	OP-AMP, LT1012	U14,U27
78	0155-00-0571	OP-AMP, LT1013C	U20,U29,U30,U34,U50,U8,U9
79	0155-00-0572	IC,OP-AMP TL032C	U21,U24,U32,U33,U13,U25, U31
80			
84	0285-09-0010	CAP,1UF,50V,5%	C46
85	0283-05-1394	CAP,.39UF,100V,5%	C50
86	0283-05-2331	CAP,330PF,100V,2%	C55,C57
87			

FRONT END BOARD ASSEMBLY			0670-00-0624(5L-CE)
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
88	0283-04-1474	CAP,.47UF,50V,5%	C89
89	0214-00-0074	INSULATOR BEAD	
90			
91	0290-02-3225	CAP,2.2UF,35V,20%	C127
92			
93	0136-24-1010	10 PIN HEADER	J42
94	0136-24-1012	12 PIN HEADER	J43
95	0108-00-0063	DUAL INDUCTOR,2MH,25%	L1,L2
96	0151-00-0035	TRANSISTOR,2N3904	Q10,Q11,Q12,Q13
97	0315-00-0392	RES,3.9K,1/4W,5%	R44
98	0309-00-2672	RES,26.7K,1/8W,1%	R47
99	0315-00-0912	RES, 9.10K, 1/4W,5%	R56
100	0307-00-0072	RES,SPECIAL 3.539K, 0.01%, 2PPM	R66
101	0307-00-0073	RES,SPECIAL 9.428K, 0.01%, 2PPM	R68
102	0309-00-2871	RES,2.87K,1/8W,1%	R75
103	0309-00-1584	RES,1.58M,1/8W,1%	R85,R510
104	0309-00-1741	RES,1.74K,1/8W,1%	R87
105	0320-00-2580	RES,258 OHM,1/8W,.1%	R116,R138,R122,R131
106	0320-00-1383	RES,138 K,1/8W,.1%	R118,R130
108	0309-00-3572	RES,35.7K, 1/8W, 1%	R125, R263
110	0307-01-0473	RES NTWRK,47K,2%	RN2
111	0309-00-1872	RES,18.7K,1/8W,1%	R181
112	0309-00-9762	RES,97.6K,1/8W,1%	R182
113	0309-00-1374	RES,1.37M,1/8W,1%	R129
114			
115	0315-00-0181	RES,180 OHM,1/4W,5%	R234, R261, R262
116	0315-00-0271	RES,270 OHM,1/4W,5%	R236
117	0315-00-0302	RES,3K,1/4W,5%	R237
118			
119	0120-00-0129	TRANSFORMER,RESPIRATION	T2
120	0124-00-0064	TERMINAL	TP1,TP2,TP3,TP4,TP5,TP6,TP7,TP8,TP9,TP10,TP11
121	0315-00-0272	RES. 2.7K, 1/4W,5%	R238
122	0315-00-0153	RES. 15K, 1/4W, 5%	R235
123	0155-00-0239	OCTAL BUFFER	U36
124	0155-90-0339	MICROCONTROLLER, Rev C.3.1	U38

FRONT END BOARD ASSEMBLY			***0670-00-0624(5L-CE)***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
125	0155-00-0574	A/D CONVERTER,10 BIT	U39
126	0155-00-0570	OPTO ISOLATOR	U42,U43
127	0155-00-0576	OPTO ISOLATOR	U44
128	0155-00-0575	REGULATING PWM	U47
129	0151-00-0072	VOLTAGE REGULATOR	U48,U49
130	0158-01-0023	CRYSTAL,3.6864 MHZ	Y1
131			
133	0283-05-0271	CAP, 270PF, 200V, 10%	C85,C500,C501
134	0309-00-8661	RES, 8.66K, 1/8W, 1%	R195
135			
136	0315-00-0512	RES, 5.1K, 1/4W, 5%	R201, R12
137	0136-57-0044	SOCKET,44pin PLCC	SOCKET for U38
138	0309-00-1372	RES, 13.7K, 1/8W, 1%	R78
139			
140	0309-00-4642	RES, 46.4K, 1/8W, 1%	R513
141	0309-00-1621	RES, 1.62K, 1/8W, 1%	R265
142	0315-00-0361	RES, 360 OHM, 1/4W, 5%	R229
143	0388-00-0560-B	PCB	
144	0309-00-2433	RES, 243K, 1/8 W, 1%	R199
145	0215-03-0003	Tape, Double Coated, Foam	Use on Y1
146	0309-00-7681	RES, 7.68K, 1/8W, 1%	R267
147	0309-00-1333	RES, 133K, 1/8W, 1%	R204
148	0153-00-0069	DIODE, IN5817	D44, D45, D47, D48, D51
149			
150			
151	0309-00-1213	RES, 121K,1/8W, 1%	R266
152	0309-00-3921	RES, 3.92K,1/8W,1%	R269
153	0290-02-3226	CAP, 22UF,TANT, 35V, 20%	C131
154			
155	0309-00-5231	RES, 5.23K, 1/8W, 1%	R161
156	0530-00-0023	ADHESIVE, HOT MELT	XU3
157	0136-97-1008	CONN, 16 PIN Low Profile-Top entry	J41
158	0136-97-3008	CONN, 16 PIN Low Profile-Pass through entry	U3
159	0215-00-0029	INSULATOR	for U3
160	0006-04-2800	Wire, 28 gauge, BLK	

FRONT END BOARD ASSEMBLY			***0670-00-0624(5L-CE)***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
161	0283-05-0150	CAP, 15PF, 200V, 10%	C56
162	0309-00-6192	RES, 61.9K, 1/8W, 1%	R512
163	0283-05-0102	CAP, 1000PF, 200V, 10%	C11, C13
164	0283-05-0152	CAP, 1500PF, 100V, 10%	C10, C12, C14
165	0283-05-0222	CAP, 2200PF, 100V, 10%	C4, C5, C15, C16
166	0283-05-0021	CAP, 220PF, 200V, 10%	C17, C18, C19, C21, C24, C26, C27, C28, C29
167	0283-05-0121	CAP, 120PF, 200V, 10%	C51

LINE BATTERY BOARD ***0670-00-0626*** ***0670-00-0656 (XG-CE)***

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0124-00-0064	Test Point, Loop	TP1
2	0131-07-0004	CONN., 4 pin single row rt angle 0.156	J51
3	0131-07-0006	CONN., 6 pin single row rt angle 0.156	J53
4	0136-17-0007	CONN., 7 pin single row header 0.125	J55
5	0151-00-0115	TRANS., 2N7000	Q1, Q2
6	0151-00-0181	TRANS., IRFZ40	Q3
7	0153-00-0014	DIO., 1N4148	CR2-7
8	0153-00-0069	DIO., 1N5817	CR11, CR12
9	0153-08-0004	DIO., USD945	CR8-10
10	0155-00-0030	IC, LM4250	U1
11	0155-00-0578	VOLT REF., LT1004-1.2	CR1
12	0155-00-0587	IC, CD4093BE	U2
13	0159-12-0021	FUSE, 2.5A, 5x20mm, TIME LAG	F1
14	0159-12-0023	FUSE, 4A, 5x20mm, TIME LAG	F2,F3
15	0283-05-0101	CAP., 100pf, 10%, 200V cer	C4
16	0283-05-0104	CAP., 0.1uF, 10%, 100V, CER.	C1, C3
17	0283-10-1103	CAP., 0.01uF, 5%, 100V,CER.	C5, C6
18	0290-02-2106	CAP., 10uF, 20%, 25v, TANT	C7
19	0320-00-1543	RES., 154K, 0.1%	R2
20	0309-00-3573	RES., 357K,1%, 1/8W	R4
21	0315-00-0104	RES., 100K, 5%, 1/4W	R9, R10, R13
22	0315-00-0105	RES., 1M, 5%, 1/4W	R8
23	0315-00-0106	RES., 10M, 5%, 1/4W	R5, R6
24	0315-00-0120	RES., 12 OHM, %5, 1/4W	R14
25	0315-00-0205	RES., 2M, 5%, 1/4W	R12
26	0315-00-0473	RES., 47K, 5%, 1/4W	R11
27	0315-00-0824	RES., 820K, 5%, 1/4W	R3
28	0348-00-0154	BOARD PAD	
29	0352-00-0026	FUSE CLIP	
30	0373-00-0047	HEAT SINK	
31	0309-00-1184	RES., 1.18M, 1%, 1/8W	R1
32	0136-28-0007	CONN., 14 pin double row .10	J54

LINE BATTERY BOARD			*0670-00-0626* *0670-00-0656 (XG-CE)*
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
33	0388-00-0626	PCB REV A	
34	0014-00-0028	Power Supply, DC/DC Converter	
35	0210-20-0002	Terminal, Crimp Ring, 22-16 AWG,	#6
36	0006-05-1854	Wire, Stranded GRN/YEL	
37	0136-87-0010	Conn., 10 pin double row .10	J52

INTERCONNECT BOARD ASSEMBLY HP			0670-00-0629 (CE)
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0388-00-0615	PCB Revision A	
2	0301-00-0472	RES, CC, 4.7K, 5%,1/2 W	R1, R2, R3, R9, R10
3	0307-00-0089	RESISTOR SPECIAL, 1/2W, 5%, 100 MEG OHM	R4
4	0283-00-0055	CAP, .0047 UF, 3KV, 10%	C1, C2
5	0153-00-0091	DIODE, ZENER 1N6275	CR4-9, CR12
6	0153-00-0160	DIODE, SA170C	CR1, CR2, CR3, CR10, CR11
7	0167-00-0007	SPARK GAP	DG1
8	0131-00-0232	CONN, 12 Pin Receptacle HP ECG	P3
9	0131-00-0231	CONN, 12 Pin Receptacle HP Press	P1,P2
10	0131-00-0227	CONN, Phone, 1/4" Plastic Bushing	P4
11	0136-24-1018	HEADER, DBL ROW 18 PIN	J1
12	0136-24-1016	HEADER, DBL ROW 16 PIN	J1
13	0283-05-0102	CAP,.001uF,200v,10%	C3,C4,C5
14	0108-00-0028	TORROID	L1
15	0006-04-2299	Wire Solid, 22 AWG	L1
17	0309-00-4991	RES, 4.99K, 1%, 1/8 W RN55	R5, R6, R7, R8, R11
18	0283-01-5121	CAP, 120pF, 5%	C6, C7, C8, C9, C10
19	0349-00-0174-02	Insulator, Connector	For P4
20	0349-00-0174-01	Insulator, Connector	For J1
21	0008-01-0005	Tubing, Heatshrink	For R1, R3, R9
22	0149-00-0001	Neon Bulb	DS1, DS2
23			
24	0006-04-2800	Wire, 28 gauge, Blk	R12, R13
25	0348-00-0054-03	Bumper, Molded Polyurethane (Black)	
26	0007-02-0022	Solid Buss Wire, 22 AWG	for P1, P2

CO2 INTERFACE MODULE BOARD			***0670-00-0632-02***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0014-00-0035	POWER MODULE, DUAL OUTPUT, +/- 15V	VC1
2	0014-00-0176	POWER MODULE, DUAL OUTPUT,+/- 12V	VC1
3	0108-00-0038	INDUCTOR, 120UH, 2A	L2
4	0108-00-0058	CHOKE, FERRITE BEAD	L1
5	0131-07-0004	CONN,FRICTION LOCK,RA,4PIN	J93
6			
7	0136-24-1004	HEADER,DOUBLE ROW,ST,4 PIN	JP1/JP2
8	0136-56-1324	SOCKET,DIP,24PIN, 0.3 WIDE	U4
9	0136-57-0044	SOCKET, PLCC 44	U1
10	0136-24-1050	HEADER,DOUBLE ROW,ST,50 PIN	J91
11			
12	0155-00-0426	IC, 74HCT244, OCTAL BUFFER	U3
13	0155-00-0516	IC, 74HCT377, OCTAL D-TYPE FLIP-FLOP	U2
14	0155-90-0211	IC, MICROCONTROLLER, PGM'D	U1
15	0155-90-0212	IC,EP600,EPLD,PGM'D	U4
16	0158-05-0011	OSCILLTOR, 3.6864 MHz	Y1
17			
18	0215-03-0001	TAPE, DOUBLE COATED FOAM	Used under C9,C10,C13,U5
19			
20	0283-04-0104	CAP, CER,0.1UF,100v,10%	C1, C3, C4, C5, C11, C12 (-02 only) C16
21	0283-05-0102	CAP,CER, 0.001UF,200v,10%	C6,C7
22			
23	0290-00-0070	CAP, ALUM ELEC,1000UF,25V, 20%,LOW ESR	C10
24	0290-01-2220	CAP,ALUM ELEC,22UF,25v, -10 / +50%	C8
25	0290-17-3221	CAP,ALUM ELEC, 220UF, 35V, 20%,LOW ESR	C9 (-02 only) C13

CO2 INTERFACE MODULE BOARD			***0670-00-0632-02***
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
26	0315-00-0103	RES, CF, 10K, 1/4W, 5%	R4
27			
28	0307-06-2103	RES NTWK,10K, SIP,9 ELEMENT	RP1
29	0315-00-0102	RES,CF, 1K, 1/4W, 5%	R3
30			
31	0155-00-0922-01	-12V REGULATOR, 79M12	(-02 only) U5
32	0315-00-0101	RES, CF, 100, 1/4W, 5%	R1
33	0388-00-0632	DRILL & FAB, , CO2 INTERFACE MODULE	PC BOARD
34			
35	0530-00-0021	HOT MELT GLUE	USE UNDER L2
36	0290-02-3225	CAP, TANT, 2.2UF, 35V, 20%	(-02 only) C14
37	0290-02-3105	CAP, TANT, 1UF, 35V, 20%	(-02 only) C15
38	0136-82-0010	HEADER, .100 CTR STR LOCKING/ POLARIZING-10 PIN	(-01 only) J92
39	0136-00-0238	EADER, .100 CTR STR LOCKING/ POLARIZING-10 PIN	(-02 only) J94

TERMINATION BOARD			*0670-00-0648*
ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
1	0388-00-0648	PWB, Termination Board	
2	0136-00-0241	Connector PC, Receptacle Elelevated, 40 Pin Dual Row, .100 Pitch	P68 Samtec, ESW-120-23-G-D
3	0136-20-1040	Header, Dual Row, Rt. Angle	J71 Samtec, TSW-120-08-G-D-RA
4	0108-00-0086	Inductor Fixed, Choke Common Mode	L1
5	0326-00-0750	Resistor, 75 Ohm, SMD, Thick Film, 1/10W, 5%	R1-R9 KOA, RM73-B-2A-750-J
6	0125-00-0021	Beaded Tie	Tie around L1

CPU BOARD ASSEMBLY			0670-00-0651
ITEM NO.	PART NUMBER	**DESCRIPTION**	**REFERENCE**
1	0108-00-0058	CHOKE	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L12
2	0315-00-051X	RESISTOR, FIXED, CARBON FILM, 1/4 WATT 5.1 OHM	R48
3	0136-00-0142	CONN PC, 16 PIN, SIDE ENTRY	J66
4	0136-00-0144	50 PIN RIGHT ANGLE	J63
5	0136-00-0228	Conn, PC, 50 Position w/ guide,w/o key	J61
6	0136-22-0003	HEADER CONNECTOR, 3 PIN	TP15, TP16, TP17, TP18, TP19, TP20, JP1
7	0136-24-1006	HEADER DOUBLE ROW, 6 PIN	TP9, TP10, TP11, TP12, TP13, TP14
8	0136-24-1008	HEADER DOUBLE ROW, 8 PIN	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8
9	0136-24-1010	HEADER DOUBLE ROW, 10 PIN	J64
10	0136-24-1016	HEADER DOUBLE ROW, 16 PIN	J67
11	0136-24-1026	HEADER DOUBLE ROW, 26 PIN	J62
12	0136-24-1040	HEADER DOUBLE ROW, 40 PIN	J68
13	0136-87-0050	CONN PC,SHROUDED STR HDR W/ EJECTOR	J65
14	0151-00-0061	TRANSISTOR 2N2222A	Q1
15	0153-00-0085	DIODE, SCHOTTKY, 1N6263	D1, D2, D3
16	0153-00-0093	VOLTAGE REF, SG3503	U39
17	0388-00-0438-B	CPU PCB	
18	0155-00-0078	IC, LOW VOLT AUDIO POWER AMPLIFIER, LM386	U37
19	0155-00-0201	IC 8-BIT MULT D/A, AD7524	U36
20	0155-00-0400	IC, DUAL RS-232 TRANSMITTER/ RECEIVER MAX 232	U31
21	0155-00-0404	IC QUAD SPST ANALOG SWITCH, DG201	U34
22	0155-00-0590-01	IC, 32K X 8 STATIC RAM	U6
23	0155-00-0426	IC, OCTAL BUFFER/ LINE DRIVER, 74HCT244	U8, U9, U10, U13, U14, U16, U17, U18, U29

CPU BOARD ASSEMBLY (CONTINUED)			0670-00-0651
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
24	0155-00-0438	IC, DIGITAL, OCTAL BUS TRANSCEIVER, 74HCT245	U7, U12, U15
25	0155-00-0470	IC, 93C46, SERIAL EEPROM	U4
26	0155-00-0515	IC, OCTAL INVERTING BUFFER/ LINE DRIVER, 74HCT240	U11
27	0155-00-0516	IC, OCTAL D-TYPE FF, 74HCT377	U19
28	0155-00-0518	IC, INTEGRATED MULTIPROTOCOL PROCESSOR, MC68302	U1
29	0155-00-0519	IC, 8 BIT A/D CONVERTER W/11 CHANNEL MULTIPLEX	U32
30	0155-00-0520	IC, DISPLAY CONTROLLER, V6366F	U5
31	0155-00-0521	IC, DIGITAL, SERIAL TIMEKEEPER, DS1202	U20
32	0155-00-0522	IC, DIGITAL MICROMANAGER, DS1236	U21
33	0155-00-0523	IC, OP AMP, LOW POWER JFET, TL034	U33, U35
34	0155-00-0524	IC, DUAL 1-OF-4 DECODER/ DEMULTIPLEXER, 74ACT139	U23
35	0155-00-0525	IC, QUAD 2 INPUT NOR GATE, 74ACT02	U28
36	0155-00-0529	IC, HEX INVERTER, 74ALS04	U27
37	0155-00-0530-02	IC, STATIC RAM, CMOS, 1 MEG	U2, U3
38	0155-00-0579	IC, 1-OF-8 DECODER/ DEMULTIPLEXER, 74ACT138	U22
39	0155-90-0165	CPU PAL, PASSPORT	U24
40	0158-00-0010	CRYSTAL,TUNING FORK, 32.768 KHZ	Y2
41	0158-01-0025	MICROPROCESSOR QUARTZ	CRYSTAL, 16.5888 MHZ
42	0158-05-0001	CRYSTAL, CLOCK OSCILLATOR, 14.31818 MHZ	U38

CPU BOARD ASSEMBLY (CONTINUED) ***0670-00-0651***

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
43	0283-04-0104	CAP, CERAMIC, .1UF 100V 10%	C5, C6, C13, C29, C30, C31, C32, C33, C35, C42, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C68, C75, C77, C78, C103, C113, C121, C122, C123, C124, C125
44	0283-04-0473	CAP, CERAMIC, .047UF 100V 10%	C37
45	0283-05-0100	CAP, CERAMIC, 10PF 200V 10%	C70, C72
46	0283-05-0101	CAP, CERAMIC, 100PF 200V 10%	C112, C114
47	0283-05-0102	CAP, CERAMIC, .001UF 200V 10%	C104, C105, C106, C107, C108, C109, C110, C111
48	0283-05-0103	CAP, CERAMIC, .01UF 100V 10%	C4, C27, C28, C36, C43, C65, C69, C73, C74, C76, C115, C116
49	0283-05-0220	CAP, CERAMIC, 22PF 200V 10%	C1, C2, C41
50	0283-05-0222	CAP, CERAMIC, .0022UF 200V 10%	C118, C38
51	0283-05-0471	CAP, CERAMIC, 470PF 100V 10%	C119
52	0290-02-3105	CAP, FIXED, 1UF TANT. 35V 20%	C9, C10, C11, C12
53	0290-02-3475	CAP, FIXED, 4.7UF TANT 35V 20%	C7, C8, C18
54	0290-07-1053	CAP, FIXED ELECT., 10000 UF	C120
55	0307-00-0029	RESISTOR NETWORK, DIP 14 PIN, 10K .5% 7 Resistors	RP2
56	0307-01-0104	RESISTOR NETWORK, SIP 10 PIN, 100K	RP7
57	0307-01-0394	RESISTOR NETWORK, SIP 10 PIN, 390K	RP6
58	0307-01-0470	RESISTOR NETWORK, SIP 10 PIN, 47 OHM	RP8, RP14
59	0307-06-2103	RESISTOR NETWORK, SIP 10 PIN, 10K 2%	RP1, RP3, RP4, RP5, RP9, RP10, RP11, RP12, RP13
60	0309-00-2052	RESISTOR, FIXED, METAL FILM,	1% 1/8W, 20.5K
61	0309-00-1003	RESISTOR, FIXED, METAL FILM,	1% 1/8W, 100K

CPU BOARD ASSEMBLY (CONTINUED)			*0670-00-0651*
ITEM NO.	PART NUMBER	***DESCRIPTION***	***REFERENCE***
62	0309-00-4421	RESISTOR, FIXED, METAL FILM,	1% 1/8W, 4.42K
63	0309-00-4640	RESISTOR, FIXED, METAL FILM,	1% 1/8W, 464 OHM
64	0309-00-6042	RESISTOR, FIXED, METAL FILM,	1% 1/8W, 60.4K
65	0315-00-0100	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 10 OHM
66	0315-00-0101	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 100 OHM
67	0315-00-0103	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 10K
68	0315-00-0104	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 100K
69	0309-00-3923	RESISTOR, FIXED, METAL FILM,	1% 1/8W, 392K
70	0315-00-0202	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 2K
71	0315-00-0204	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 200K
72	0309-00-1824	RESISTOR, FIXED, METAL FILM,	1% 1/8W, 1.82M
73	0315-00-0223	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 22K
74	0315-00-0472	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 4.7K
75	0315-00-0473	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 47K
76	0315-00-0684	RESISTOR, FIXED, CARBON FILM,	1/4 WATT, 680K
77	0352-00-0029	HOLDER BATTERY (COIN TYPE)	XBT1
78	0388-00-0438-B	DRILL & FAB, CPU BOARD	
79	0136-56-1324	SOCKET, LOW PROFILE, 24 PIN SLIM DIP	XU24
80	0432-01-0002	PAD, MOUNTING	XU39
81	0315-00-0685	RESISTOR, FIXED, CARBON FILM, 1/4W, 6.8M	R40
82	0290-02-0227	CAP, FIXED, 220UF TANT. 10V 20%	C67
83	0315-00-0134	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 130K	R34
84	0315-00-0102	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 1K	R47

CPU BOARD ASSEMBLY (CONTINUED)			***0670-00-0651***
ITEM NO.	PART NUMBER	***DESCRIPTION***	***REFERENCE***
85	0290-02-0336	CAP, FIXED, 33UF TANT. 10V 20%	C66
86	0290-02-3226	CAP, FIXED, 22UF TANT. 35V 20%	C14-C17
87	0006-04-2800	Wire, 28 AWG, Blk.	
88	0210-00-0124	Ground Lug	
89	0006-02-2000	20 Gauge Stranded Wire, BLK	
90	0212-10-0406	SCREW, 4-40, NYLON	
91	0220-00-0037	NUT, HEX, 4-40, NYLON	
92	0155-00-0954-01	IC, OCTAL BUFFER/ LINE DRIVER, 74LS244	U30

CPU BOARD ASSEMBLY **0670-00-0688/0689**

ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
1	0108-00-0058	CHOKE	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L12
2	0315-00-051X	RESISTOR, FIXED, CARBON FILM, 1/4 WATT 5.1 OHM	R48
3	0136-00-0142	CONN PC, 16 PIN, SIDE ENTRY	J66
4	0136-00-0144	50 PIN RIGHT ANGLE	J63
5	0136-00-0228	Conn, PC, 50 Position w/ guide, w/o key	J61
6	0136-22-0003	HEADER CONNECTOR, 3 PIN	TP15, TP16, TP17, TP18, TP19, TP20, JP1
7	0136-24-1006	HEADER DOUBLE ROW, 6 PIN	TP9, TP10, TP11, TP12, TP13, TP14
8	0136-24-1008	HEADER DOUBLE ROW, 8 PIN	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8
9	0136-24-1010	HEADER DOUBLE ROW, 10 PIN	J64
10	0136-24-1016	HEADER DOUBLE ROW, 16 PIN	J67
11	0136-24-1026	HEADER DOUBLE ROW, 26 PIN	J62
12	0136-24-1040	HEADER DOUBLE ROW, 40 PIN	J68
13	0136-87-0050	CONN PC,SHROUDED STR HDR W/ EJECTOR	J65
14	0151-00-0061	TRANSISTOR 2N2222A	Q1
15	0153-00-0085	DIODE, SCHOTTKY, 1N6263	D1, D2, D3
16	0153-00-0093	VOLTAGE REF, SG3503	U39
17	0388-00-0438-B	CPU PCB	
18	0155-00-0078	IC, LOW VOLT AUDIO POWER AMPLIFIER, LM386	U37
19	0155-00-0201	IC 8-BIT MULT D/A, AD7524	U36
20	0155-00-0400	IC, DUAL RS-232 TRANSMITTER/ RECEIVER MAX 232	U31
21	0155-00-0404	IC QUAD SPST ANALOG SWITCH, DG201	U34
22	0155-00-0590-01	IC, 32K X 8 STATIC RAM	U6
23	0155-00-0426	IC, OCTAL BUFFER/LINE DRIVER, 74HCT244	U8, U9, U10, U13, U14, U16, U17, U18
24	0155-00-0438	IC, DIGITAL, OCTAL BUS TRANSCEIVER, 74HCT245	U7, U12, U15

CPU BOARD ASSEMBLY			0670-00-0688/0689
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
25	0155-00-0470	IC, 93C46, SERIAL EEPROM	U4
26	0155-00-0515	IC, OCTAL INVERTING BUFFER/ LINE DRIVER, 74HCT240	U11
27	0155-00-0516	IC, OCTAL D-TYPE FF, 74HCT377	U19
28	0155-00-0518	IC, INTEGRATED MULTIPROTOCOL PROCESSOR	U1
29	0155-00-0519	IC, 8 BIT A/D CONVERTER W/11 CHANNEL MULTIPLEX	U32
30	0155-00-0520	IC, DISPLAY CONTROLLER, V6366F	U5
31	0155-00-1184	IC, DIGITAL, SERIAL TIMEKEEPER, DS1202	U20
32	0155-00-0522	IC, DIGITAL MICROMANAGER, DS1236	U21
33	0155-00-0523	IC, OP AMP, LOW POWER JFET, TL034	U33, U35
34	0155-00-0524	IC, DUAL 1-OF-4 DECODER/ DEMULTIPLEXER, 74ACT139	U23
35	0155-00-0525	IC, QUAD 2 INPUT NOR GATE, 74ACT02	U28
36	0155-00-0529	IC, HEX INVERTER, 74ALS04	U27
37	0155-00-0530-04	IC, STATIC RAM, CMOS, 1 MEG	U2, U3
38	0155-00-0579	IC, 1-OF-8 DECODER/ DEMULTIPLEXER, 74ACT138	U22
39	0155-90-0165	CPU PAL, PASSPORT	U24
40	0158-00-0010	CRYSTAL,TUNING FORK, 32.768 KHZ	Y2
41	0158-01-0025	MICROPROCESSOR QUARTZ CRYSTAL, 16.5888 MHZ	Y1
42	0158-05-0001	CRYSTAL, CLOCK OSCILLATOR, 14.31818 MHZ	U38

CPU BOARD ASSEMBLY ***0670-00-0688/0689***

ITEM NO.	***PART NUMBER***	***DESCRIPTION***	***REFERENCE***
43	0283-04-0104	CAP, CERAMIC, .1UF 100V 10%	C5, C6, C13, C29, C30, C31, C32, C33, C35, C42, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C68, C75, C77, C78, C103, C113, C121, C122, C123, C124, C125
44	0283-04-0473	CAP, CERAMIC, .047UF 100V 10%	C37
45	0283-05-0100	CAP, CERAMIC, 10PF 200V 10%	C70, C72
46	0283-05-0101	CAP, CERAMIC, 100PF 200V 10%	C112, C114
47	0283-05-0102	CAP, CERAMIC, .001UF 200V 10%	C104, C105, C106, C107, C108, C109, C110, C111
48	0283-05-0103	CAP, CERAMIC, .01UF 100V 10%	C4, C27, C28, C36, C43, C65, C69, C73, C74, C76, C115, C116
49	0283-05-0220	CAP, CERAMIC, 22PF 200V 10%	C1, C2, C41
50	0283-05-0222	CAP, CERAMIC, .0022UF 200V 10%	C118, C38
51	0283-05-0471	CAP, CERAMIC, 470PF 100V 10%	C119
52	0290-02-3105	CAP, FIXED, 1UF TANT. 35V 20%	C9, C10, C11, C12
53	0290-02-3475	CAP, FIXED, 4.7UF TANT 35V 20 %	C7, C8, C18
54	0290-07-1053	CAP, FIXED ELECT., 10000 UF	C120
55	0307-00-0029	RESISTOR NETWORK, DIP 14 PIN, 10K .5% 7 Resistors	RP2
56	0307-01-0104	RESISTOR NETWORK, SIP 10 PIN, 100K	RP7
57	0307-01-0394	RESISTOR NETWORK, SIP 10 PIN, 390K	RP6
58	0307-01-0470	RESISTOR NETWORK, SIP 10 PIN, 47 OHM	RP8, RP14
59	0307-06-2103	RESISTOR NETWORK, SIP 10 PIN, 10K 2%	RP1, RP3, RP4, RP5, RP9, RP10, RP11, RP12, RP13
60	0309-00-2052	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 20.5K	R46
61	0309-00-1003	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 100K	R11

CPU BOARD ASSEMBLY			0670-00-0688/0689
ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE
62	0309-00-4421	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 4.42K	R44
63	0309-00-4640	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 464 OHM	R17
64	0309-00-6042	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 60.4K	R45
65	0315-00-0100	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 10 OHM	R10
66	0315-00-0101	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 100 OHM	R13, R16
67	0315-00-0103	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 10K	R7, R41, R49
68	0315-00-0104	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 100K	R37, R39
69	0309-00-3923	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 392K	R42
70	0315-00-0202	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 2K	R12
71	0315-00-0204	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 200K	R36, R38
72	0309-00-1824	RESISTOR, FIXED, METAL FILM, 1% 1/8W, 1.82M	R43
73	0315-00-0223	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 22K	R25
74	0315-00-0472	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 4.7K	R2, R33
75	0315-00-0473	RESISTOR, FIXED, CARBON FILM	R24, R26
76	0315-00-0684	RESISTOR, FIXED, CARBON FILM	R1
77	0352-00-0029	HOLDER BATTERY (COIN TYPE)	XBT1
78	0388-00-0438-B	DRILL & FAB, CPU BOARD	
79	0136-56-1324	SOCKET, LOW PROFILE, 24 PIN SLIM DIP	XU24
80	0432-01-0002	PAD, MOUNTING	XU39
81	0315-00-0685	RESISTOR, FIXED, CARBON FILM, 1/4W, 6.8M	R40
82	0290-02-0227	CAP, FIXED, 220UF TANT. 10V 20%	C67

CPU BOARD ASSEMBLY			0670-00-0688/0689
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**REFERENCE**
83	0315-00-0134	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 130K	R34
84	0315-00-0102	RESISTOR, FIXED, CARBON FILM, 1/4 WATT, 1K	R47
85	0290-02-0336	CAP, FIXED, 33UF TANT. 10V 20%	C66
86	0290-02-3226	CAP, FIXED, 22UF TANT. 35V 20%	C14-C17
87	0006-04-2800	Wire, 28 AWG, Blk	
88	0210-00-0124	Ground Lug	
89	0006-02-2000	20 Guage Stranded wIRE, bLK	
90	0212-10-0406	Screw, 4-40, Nylon	
91	0220-00-0037	Nut, Hex, 4-40, Nylon	
92	0155-00-0954-01	IC,OCTAL BUFFER/LINE DRIVER, 74LS244	U30 (for 0670-00-0689 only)
93	0006-04-2800	20 AWG, Wire Blk	
94	0155-00-0426	IC, OCTAL BUFFER/LINE DRIVER	U30 (for 0670-00-0688 only)
95	0155-00-0426	IC, OCTAL BUFFER/LINE DRIVER	U29 (for 0670-00-0689 only)
96	0155-00-1169	IC, OCTAL BUFFER/LINE DRIVER	U29 (for 0670-00-0688 only)
97	0136-00-0391-01	Adapter, SMT-to-DIP	XU20

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7.0 Calibration

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Diagnostic Menu Tree

Main Menu	1st Sub Menu	2nd Sub Menu	Test Results & Specifications
NIBP Diagnostics	Pneumatic Test	Motor Pump Test	Pump to 250mmhg < 16.0 sec
		Bleed Rate Test	**Fixed Orifice NIBP** Orifice #1: 5.6 - 11 mmHg/sec Orifice #2: 1.0 - 1.9 mmHg/sec Orifice #3: 0.5 - 0.9 mmHg/sec Orifice #4: 50 mmHg or greater **Linear Bleed NIBP** Orifice #1: 4.8 - 7.2 mmHg/sec Orifice #2: 4.8 - 7.2 mmHg/sec Orifice #3: 4.8 - 7.2 mmHg/sec Orifice #4: 50 mmHg or greater
		Leak Test	Leak should not exceed 10.0 mmHg/min
		Overpressure Test	**Linear Bleed NIBP Overpressure Test** Adult Sensor was tripped at 315 mmHg, +/- 5% Neonate Sensor was tripped at 157.5 mmHg, +/- 5% **Fixed Orifice NIBP Overpressure Test** Adult Sensor was tripped at 375 mmHg, +5%, -10% Neonate Sensor was pumped to 190 mmHg without tripping sensor
	Pulse Channel Test		Offset / Noise Gain 1: 1.5 -1.83 / <30mv Gain 2: 1.5 - 1.83 / <60mv Gain 3: 1.5 - 1.83 / <90mv
	Pressure Cal.	Low Range	+/- 3mmhg
		Mid Range	+/- 3mmhg
		High Range	+/- 3mmhg
Error Journal			Prints to Recorder/Displays on Screen
Exception Stack Frame			Prints to Recorder/Displays on Screen
Communication	Front End Comm. Test		Internal: Pass - Intermittent - Failed Echo: Pass - Intermittent - Failed
	External Comm. Test		Internal: Pass - Failed External: Pass - Failed
	NIBP Comm. Test		Internal: Pass - Failed
Recorder			See Printer Strip
Voltage Test	External Voltage Test		15.6 - 17.6
	Battery Voltage Test		12v DC Nominal Low Battery Warning <11.29 +/- .4V System Shutdown <10.69 +/- .3V
Display Test	Pixel Test		Pattern 1 Pattern 2 Pattern 3 Pattern 4 Pattern 5 (XG Color LCD Only) Pattern 1 Pattern 2 Green Pattern 3 Red
	Video Controller Test		Vertical Bars
Keyboard Test			**Key Pressed is Displayed on Screen**
Spo2 Diagnostics	Accuracy Test		85% +/-1
	DAC Test		J24-5 -5s
	Shared Ram Test	Memory Test 1	Pass/Fail
		Memory Test 2	Pass/Fail
		Memory Test 3	Pass/Fail

7.1 Introduction

The following procedures are provided to verify the proper operation of the Passport 5 Lead/ 5L/LT Monitor. Service diagnostics provide the capabilities of diagnosing problems in the Passport hardware in the field. A menu driven interface, with the same "look and feel" as that of the online Passport user interface, is used to execute all tests. The Diagnostic Menu Tree (located on page 7-3) is provided for reference once familiar with these procedures.

7.2 Warnings and Guidelines

In the event that the instrument covers are removed, observe these following warnings and general guidelines:

- Do not short component leads together.
- Perform all steps in the exact order given.
- Use extreme care when reaching inside the opened instrument. Do not contact exposed metal parts which may become live.
- Read through each step in the procedure so it is understood prior to beginning the step.

7.3 Test Equipment and Special Tools Required

DESCRIPTION	*SPECIFICATION*
Standard Mercury Column	0 - 300 mmHg
Dummy Cuff/Test Chamber	Datascope P/N 0138-00-0001-01
Safety Analyzer	Dempsey Model or equivalent
Finger Sensor Probe	Accusat Comparable
DVM	
Oscilloscope	
Metric Ruler	
Patient Simulator	
Flow meter / Siera Instruments	
(Model 822-13-001-001-01) or equivalent	0-300 cc/min.

7.4 Inputs

User input is provided through the following keys:

- UP ARROW
- DOWN ARROW
- SELECT
- END
- RECORD (only when printable test results are displayed)
- DEFLATE (for NIBP diagnostics only)

7.5 Diagnostics and Calibration Procedure

To enter the Service Diagnostic mode:

1. Turn the power off.
2. Turn the power on. After approximately six seconds the message “Diagnostics in Progress” followed by “Selftest Complete” will appear on the display. When "Selftest Complete" appears press and hold the HIDDEN KEY located between the FREEZE and DEFLATE keys. (For the Passport XG the HIDDEN KEY is located between the EXIT and SIZE keys.) When the Diagnostics Menu appears, (see Figure 7-1) release the HIDDEN KEY.

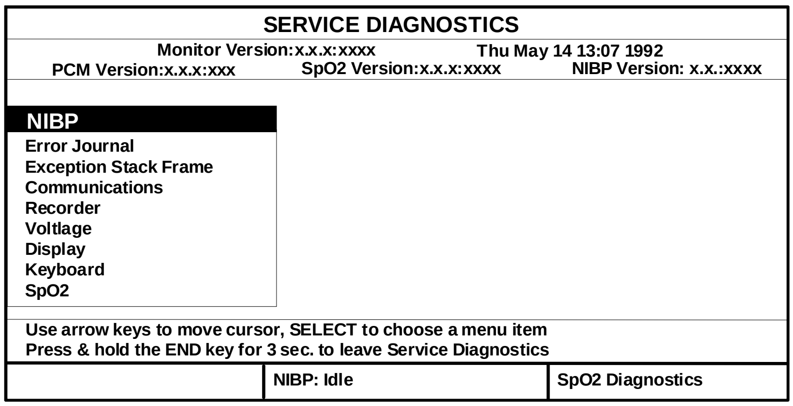


FIGURE 7-1 Main Diagnostics Menu

3. One of the items will be displayed in reverse graphics. When the ARROW KEYS are pressed the cursor moves up and down in the Service Menu, and when the SELECT key is pressed the selected diagnostic test is performed. If the END key is pressed and held for three seconds when the Main Diagnostics Menu is displayed, the diagnostic mode is ended, and the unit goes into a normal monitoring mode.

NOTE: ***The x.x.x:xxxx represents the software revision for the Datasette, SpO$_2$, and NIBP code. The tests available may vary with Datasette revision level. hen entering the Service Diagnostics Mode, note the Datasette revision (PCM Version) and reference the correct specifications and test results.***

7.5.1 NIBP Diagnostics

When this menu option is selected the Main Menu is covered by the NIBP Diagnostics Menu. The NIBP Diagnostics consists of three separate sub menus as shown in Figure 7-2. These tests are performed to check the pneumatics components of the unit.

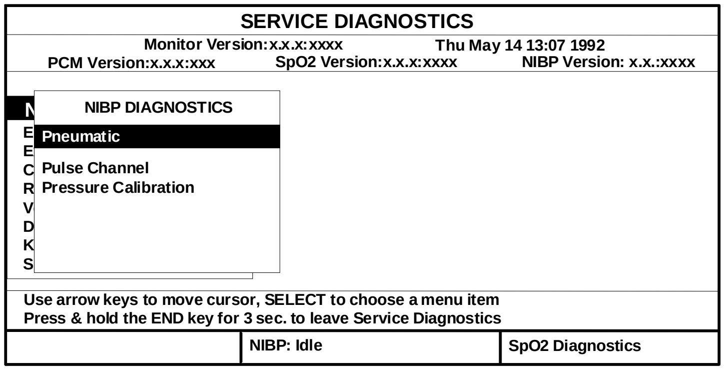


FIGURE 7-2 NIBP Diagnostics Menu

Move the cursor to the desired menu option and press SELECT to perform that function. Press END to return to the Main Menu.

7.5.1.1 Pneumatics Test

When this diagnostics is selected the NIBP diagnostics menu is covered by the pneumatics test menu. This menu contains four items as shown in Figure 7-3.

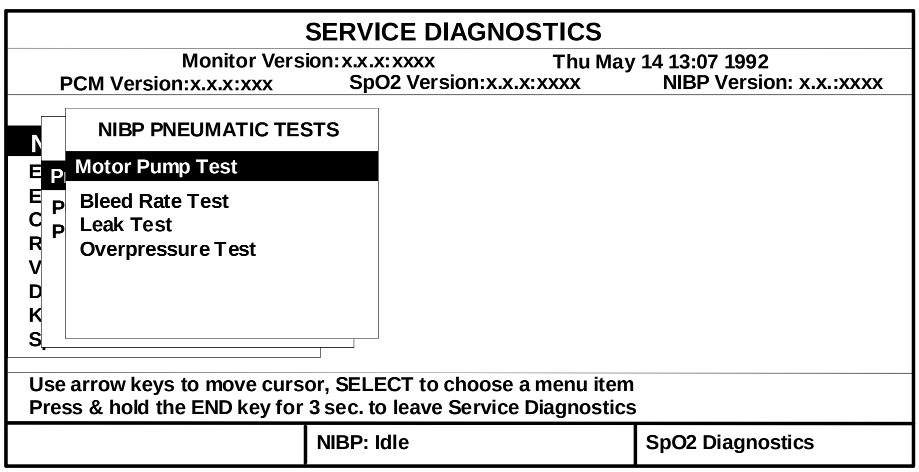


FIGURE 7-3 NIBP Pneumatics Test Menu

NOTE: ***The pneumatics test is performed with the 700 cc dummy cuff/test chamber connected. If the DEFLATE key is pressed during any pneumatic test, the test will be aborted and the valves in the NIBP module will open to release the pressure in the test chamber.***

NOTE: ***The NIBP hose with a safety leak fitting cannot be used, otherwise the test results are invalid.***

1. Motor Pump Test

The purpose of this test is to determine if the output of the pump is adequate.

a. Connect the dummy cuff/test chamber to the side panel luer fitting.

NOTE: ***The dummy cuff/test chamber must be used for this test, otherwise the test results are invalid.***

b. Highlight the Motor Pump Test option and press the SELECT key to start the test. The pump will start and inflate the chamber to 250 mmHg, then pressure is released. During the inflation/deflation cycle the current pressure is displayed in the pressure window. The time required to reach the target pressure will be displayed in units of xx.x seconds as shown in Figure 7-4.

Specification

Pump to 250 mmHg < 16.0 seconds

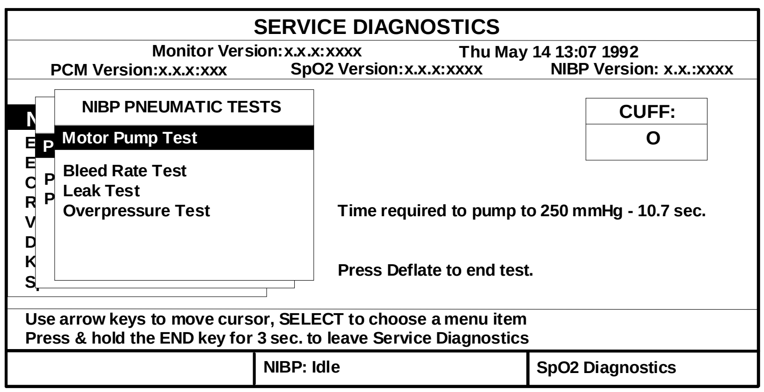


FIGURE 7-4 Motor Pump Test Display

2. Bleed Rate Test

The purpose of this test is to determine if the solenoids and orifices are performing properly.

a. Connect the dummy cuff/test chamber to the side panel luer fitting.

NOTE: ***The dummy cuff/test chamber must be used for this test, otherwise the test results are invalid.***

NOTE: ***The NIBP hose with a safety leak fitting cannot be used, otherwise the test results are invalid.***

b. Highlight the Bleed Rate Test option and press the SELECT key to start the test.

Selecting this option causes the pump motor to inflate the test chamber to 170 mmHg. The largest orifice is then opened. The time required for the pressure to drop from 150 mmHg to 130 mmHg is counted. The test is repeated for the middle and smallest orifice. The chamber is then inflated to 250 mmHg. This time the dump valve is opened and the time required for the pressure to drop from 250 mmHg to 20 mmHg is counted. The pressure is then released and the bleed rate for each orifice is displayed in units of xx.x mmHg/sec. The current pressure is displayed in the pressure window during the entire test. The format for displaying the test results is shown in Figure 7-5.

Display	Fixed Orifice NIBP Bleed Rate Specification
Orifice #1 xxx.x mm/sec	5.6 - 11.0 mmHg/sec
Orifice #2 xxx.x mm/sec	1.0 - 1.9 mmHg/sec
Orifice #3 xxx.x mm/sec	0.5 - 0.9 mmHg/sec
Orifice #4 xxx.x mm/sec	50 mmHg/sec or greater

Display	Linear Bleed NIBP Bleed Rate Specification
Orifice #1 xxx.x mm/sec	4.8 - 7.2 mmHg/sec
Orifice #2 xxx.x mm/sec	4.8 - 7.2 mmHg/sec
Orifice #3 xxx.x mm/sec	4.8 - 7.2 mmHg/sec
Orifice #4 xxx.x mm/sec	50 mmHg/sec or greater

c. Press the RECORD key to obtain a printout of the test results.

d. Press the DEFLATE key and then the SELECT key to repeat the Bleed Rate Test, or press the DEFLATE key to quit the test and return to the NIBP Pneumatic Test Menu.

3. Leak Test

The purpose of the leak test is to check the leak rate of all the pneumatic components.

a. Connect the dummy cuff/test chamber to the side panel luer fitting.

NOTE: ***The dummy cuff/test chamber must be used for this test, otherwise the test results are invalid.***

NOTE: ***The NIBP hose with a safety leak fitting cannot be used, otherwise the test results are invalid.***

b. Highlight the Leak Test option and press the SELECT key to start the test.

The chamber is inflated to about 200 mmHg. After waiting five seconds for the pressure to settle, the pressure is noted and then held for one minute. The ending pressure is noted and then the pressure is released. The current pressure is displayed in the PRESSURE window during the entire test. The total pressure drop during the one minute holding period is displayed as the leak rate as shown in Figure 7-6.

Display	Leak Test Specification
Leak Rate = xx.mmHg/min.	The lead should not exceed 10.0 mmHg/min.

FIGURE 7-5 Leak Test Results

c. Press the RECORD key to obtain a printout of the test results.

d. Press the DEFLATE key and then the START key to repeat the LEAK TEST, or press the DEFLATE key to quit the test and return to the NIBP Pneumatic Test Menu.

4. Overpressure Test
The purpose of this test is to determine whether the overpressure sensor is operating properly. This sensor prevents an overpressure condition in the event that the normal sensing circuit fails.

a. Connect the dummy cuff/test chamber to the side panel luer fitting.

WARNING: If there is an external mercury column connected, the test may exceed the pressure rating of the mercury column.

b. Highlight the Overpressure Test Option and press the SELECT key to start the test.

When this option is selected the pump is started in an attempt to pump up to a pressure of 395 mmHg. The test indicates the maximum pressure reached and indicates whether the overpressure sensor was activated as shown in Figure 7-7.

Sensor was tripped at xxx.mmHg

Or

Pumped to xxx.mmHg without tripping sensor..

Fixed Orifice NIBP Overpressure Specification

Adult Sensor: 337 to 395 mmHg

Linear Bleed NIBP Overpressure Specification

Adult Sensor: 300 to 330 mmHg

Neonate Sensor: 150 to 165 mmHg

c. Press the RECORD key to obtain a printout of the test results.

d. Press the DEFLATE key and then the SELECT key to repeat the OVERPRESSURE TEST, or press the DEFLATE key to quit the test and return to the NIBP Pneumatic Test Menu.

NOTE: Neonate overpressure test will occur in units with Rev TA software only.

NOTE: The NIBP hose with a safety leak fitting cannot be used, otherwise the test results are invalid.

7.5.1.2 Pulse Channel Test

The purpose of this test is to measure the DC offset and average noise in the pulse channel of the NIBP module for each of the three possible gain settings. During the test the cuff connector should be open.

a. Highlight the Pulse Channel Test option from the NIBP DIAGNOSTICS menu and press the SELECT key to start the test. The test results will be displayed as shown in Figure 7-8.

b. Press the RECORD key to obtain a printout of the test results

c. Press the DEFLATE key and then the SELECT key to repeat the PULSE CHANNEL TEST, or press the DEFLATE key to quit the test and return to the NIBP Pneumatic Test Menu.

7.5.1.3 Pressure Calibration

The purpose of this test is to adjust the sensitivity of the transducer circuit for optimal accuracy and for checking the linearity at three separate pressure points.

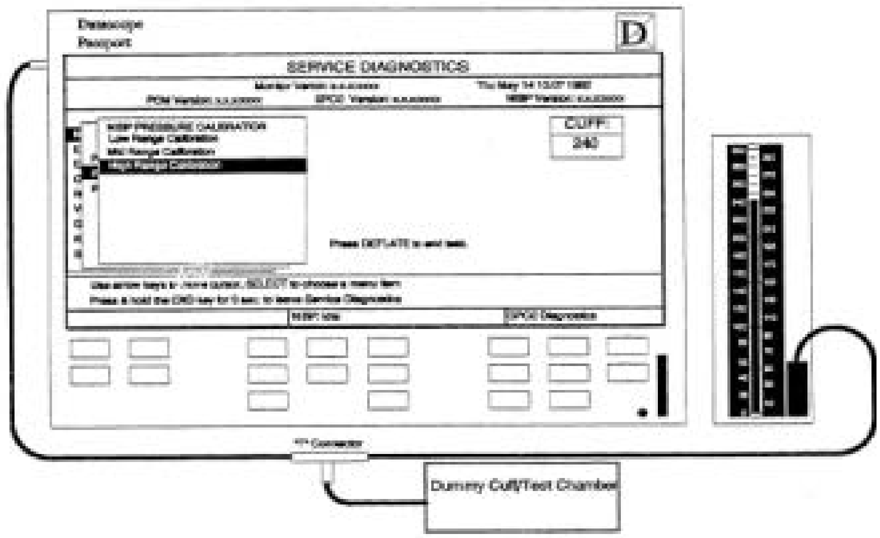


FIGURE 7-6 Setup for Pressure Calibration

a. Connect the dummy cuff/test chamber and manometer as shown in Figure 7-9. (If a test chamber is not available, an adult cuff wrapped around a towel may be substituted to perform the pressure calibration.)

b. Highlight the Pressure Calibration Test Option for the NIBP Diagnostics Menu and press the SELECT key. The NIBP Diagnostics Menu is covered by the Pressure Calibration Menu. This menu contains three items: Low Range Calibration, Mid Range Calibration, and High Range Calibration.

c. Highlight one of the options and press the SELECT key to start the test.

The dummy cuff/test chamber (cuff) will inflate approximately to the target pressure (50 mmHg for low, 150 mmHg for mid, and 250 mmHg for high). During the test the pressure will be displayed in the pressure window and the message “Press DEFLATE to End Test” will be displayed. After the target pressure is reached, the pump will turn off and the pressure will be held until the user presses the DEFLATE key.

d. Compare the pressure window display on the unit under test with the reading on the manometer for each of the pressure ranges. If the readings do not match, adjust VR1 on the NIBP Control Board. Adjust the calibration tolerance as listed below.

Calibration Specification

+/-3 mmHg - Low Range

+/-3 mmHg - Mid Range

+/4 mmHg - High Range

NOTE: ***The next two items (Error Journal and Exception Stack Frame) are not intended for interpretation in the field. There are hundreds of different messages which could be recorded, and the messages vary with software revision. Also, not all recorded messages indicate an error. If you suspect a problem with the unit, the error journal and exception stack frame should be printed out to the recorder (if installed) and forwarded to a Datascope Service Representative or Datascope Technical Support department.***

7.5.2 Error Journal

When this diagnostic is selected, the service menu will be replaced by a textual display of all errors recorded by the monitor. All errors will be automatically printed out on the recorder as they are displayed on the screen, provided the unit is equipped with a recorder. The DOWN ARROW key causes the display to clear, and the next page of messages to be displayed. Continue to press the DOWN ARROW key until the message “Journal Empty” is displayed.

NOTE: ***There is no buffering of the error journal messages, therefore, once an error message is displayed, it will be lost if the DOWN ARROW or END key is depressed.***

7.5.3 Exception Stack Frame

When this diagnostic is selected, the Service Menu will be replaced by a textual display of information pertaining to the main processor’s exception stack frame. This information is useful in determining where a bus or address error occurred, and includes information such as program counter value at the time of the exception and the offending address.

7.5.4 Communication Test

When this test is selected, the Main Service Menu is covered by the Communication Test Menu, which offers three different diagnostic tests as shown in Figure 7-10.

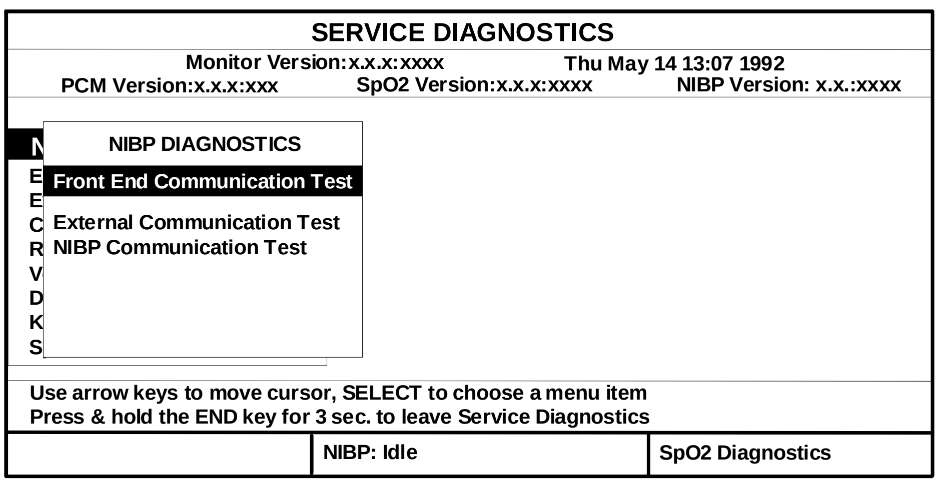


FIGURE 7-7 Communication Test Menu

7.5.4.1 Front End Communication Test

When this test item is selected, the following tests and test results are executed and displayed as follows:

1. Internal Loop Test

a. Highlight the Front End Communication Test and press the SELECT key to start the test.

The results of the power up internal loop test for the front end communication channel on the CPU Board are displayed. This test consists of putting the front end communication channel into a loop mode and transmitting data, and verifying that the correct data is read back.

Internal Loop Test Specification

Pass	When data is read back correctly on first attempt.
Intermittent	When first attempt fails, test is repeated and data is read back correctly on second attempt.
Failed	When data is not received correctly on the second attempt.

The communication channel on the Front End Board is placed in the echo mode and a test is run which sends an ASCII character to the Front End, and verifies that the character echoed back is the same character which was sent. The test is repeated for the entire ascii character set.

Echo Test Specification

Pass	When every character is echoes back correctly
Intermittent	When some character, but not all, are echoed back correctly.
Failed	When every character is echoed back incorrectly

b. Press the RECORD key to obtain a printout of the test results.

c. Press the END key to return to the Communications Menu.

7.5.4.2 External Communication Test

1. Jumper pins 2 and 3 together on optional J1 interface connector.

2. Highlight the External Communication Test and press the SELECT key to start the test. The following tests are executed.

Internal Loop Test

The results of the power up Internal Loop Test for the external communication channel on the CPU Board are displayed. This test consists of putting the external communication channel into the loop mode and transmitting data, and verifying that the correct data is read back.

External Loop Test

Data is transmitted to the external communication channel while in the normal operation mode. Since pins 2 to 3 are shorted, the data is transferred back for reading and verification.

External Communication Test Specification

Pass	When every character is echoed back correctly
Failed	When any character is echoed back incorrectly

3. Press the RECORD key to obtain a printout of the test results.

4. Press the END key to return to the Communications Menu.

7.5.4.3 NIBP Communication Test

Highlight the NIBP Communication Test and press the SELECT key to start the test. The following test is executed.

Internal Loop Test

The results of the power up internal loop test for the NIBP communication channel on the CPU Board are displayed. The test consists of putting the NIBP communication channel into loop mode and transmitting data, and verifying that the correct data is read back.

NIBP Communication Test Specification

Pass	When every character is echoed back correctly
Failed	When any character is echoes back incorrectly

a. Press the RECORD key to obtain a printout of the test results.

b. Press the END key to return to the Communication Menu.

7.5.5 Recorder

1. Highlight the Recorder Test from the Main Service Menu and press the SELECT key to start the test.

When this test is selected a recorder request is sent to the recorder, causing it to print out a test pattern as shown in Figure 7-11.

7.5.6 Voltage Test

When this test is selected the external DC power input voltage or the battery voltage is continuously displayed.

7.5.6.1 External Voltage

a. Connect the external DC Power Supply.

b. Highlight the Voltage Test from the Main Service Menu and press the SELECT key to start the test.

c. The display will continuously update the external power supply's output voltage.

External Voltage Specification
15.6 - 17.6 Volts

7.5.6.2 Battery Voltage

a. Confirm that batteries are installed.

b. Disconnect the external DC Power Supply.

c. Highlight the Voltage Test from the Main Service Menu and press the SELECT key to start the test.

d. The display will continuously update the battery voltage.

Battery Voltage Specification
12 V DC nominal
Low Battery Warning Voltage < 11.29V +/- .4V (Warning Beep Tone Starts)
System Shutdown < 10.69 +/- .3V

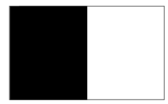
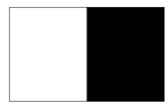
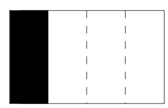
e. Press the END key to return to the Main Diagnostics Menu.

7.5.7 Display Test

When this test is selected the Main Service Menu is covered by the Display Tests Menu, which offers a choice of two different diagnostic tests.

7.5.7.1 Pixel Test (5L, LT, XG - EL)

This test will display various patterns dependant upon the version of unit and software installed.

Pattern	Description	Display	Unit	
			5L, LT	XG
1	All pixls are "ON" in the left side of the display area. All Pixels are "OFF" on the right side of the display area.		X	
2	All pixels are "OFF" in the left side of the display area. All Pixels are "ON" on the right side of the display area.		X	
3	All pixels are "ON" for the entire display		X	
4	All pixels are "ON" in 1/4 of the display area. Pressing the Select key will move the active pixels to the next quadrant.		X	X

a. Highlight the Pixel Test from the Display Tests Menu and press the SELECT key to start the test.

b. Pressing the SELECT key advances to the next available pattern.

c. Press the END key (5L, LT), EXIT key (XG) to return to the Display Tests Menu.

NOTE: ***Pattern #4 will appear when version "Y" software or higher is installed.***

7.5.7.2 Pixel Test (XG - Color LCD)

This test will display three different patterns as described below:

PATTERN	DESCRIPTION	
1	All pixels in color white.	
2	All pixels in color green.	Green
3	All pixels in color red.	Red

7.5.7.3 Video Controller Test

If no display is present in the operating mode or during the pixel test, but the unit appears to be functioning, (beep tone functions for the “R” wave, NIBP pump starts, etc.) there could be a problem with either the CPU Board or the Display Assembly. A pixel pattern consisting of vertical bars shown on the display will appear when the test is active. This will produce a square wave output on the four bits (LCD0-3) driving the video controller which can help identify a faulty CPU Board.

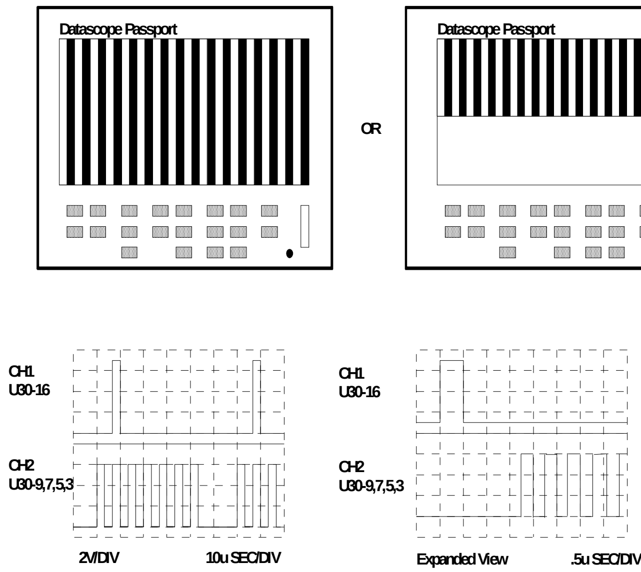


FIGURE 7-8 Video Controller Test

a. Highlight the Video Controller Test from the Display Tests Menu and press the SELECT key to start the test. The vertical bars will either fill the entire screen or half the screen dependant upon the version of software installed.

b. Connect an oscilloscope, channel 1 to U30 pin 16 and channel 2 to U30 pin 9 of the CPU board. Set the scope for 10usec/div, sync on channel 1. The waveforms are shown in Figure 7-12.

c. Confirm that the correct signals are present on the four bits LCD0-3 as shown in Figure 7-12.

d. If the above signals are not present, disconnect the display cable J68. If the signals are now present the display is possibly loading the signals, otherwise the CPU Board is possibly defective.

e. Press the END key (5L, LT), EXIT key (XG) to return to the Display Tests Menu.

7.5.8 Keyboard Test

a. When this menu option is selected the unit performs a test on the front panel touch switches by displaying the name of the key which was pressed.

b. Highlight the Keyboard Test from the Main Diagnostic Test Menu and press the SELECT key to start the test.

c. A blank key name window will appear on the display.

d. Whenever a key is pressed the name of the key will be displayed in the key name window.

e. Exercise each key to verify correct operation.

f. Press the END key for three seconds to exit test and return to the Main Diagnostic Menu.

7.5.9 SpO_2 Diagnostics (Datascope SpO_2 Installed)

When this diagnostic is selected the Main Menu will be covered by the SpO2 Diagnostic Menu which offers four different choices as shown in Figure 7-13. These tests verify the subsystem of the SpO2 module as well as the accuracy of the selected SpO2 sensor.

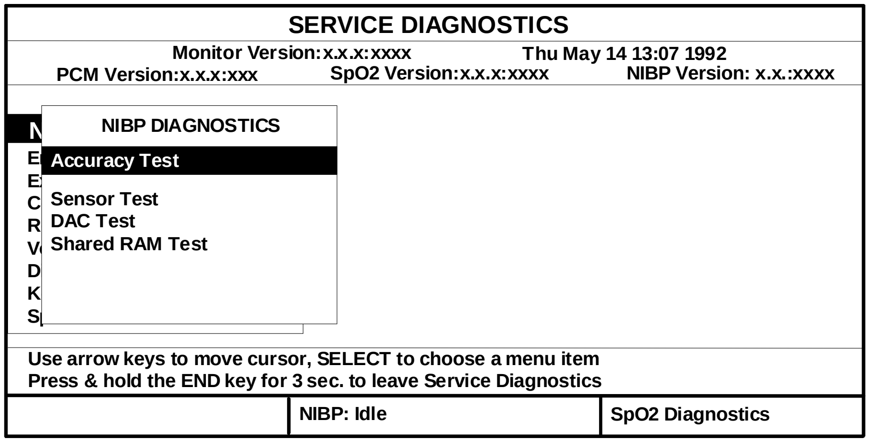


FIGURE 7-9 Main Diagnostics Menu

7.5.9.1 Accuracy Test

The purpose of this test is to verify that the SpO2 Board performs accurately with any selected SpO2 sensor. The test sends the infrared light output signal through both the red and infrared channels. This produces a 1:1 ratio which corresponds to an SpO2 value of 85%. The successful completion of this test signifies that the SpO2 Board can transmit and receive light through the monitored sight, processing unit can successfully display the parameters. A display of 85% means that the SpO2 Board can accurately display SpO2 over the entire monitoring range.

a. Highlight the Accuracy Test from the SpO2 Diagnostic Menu and press the SELECT key to start the test.

b. Shortly after the sensor is placed on a finger the SpO2 value is displayed along with the operator's pulse rate.

Accuracy Test Specification
% SpO2 = 85%

Press the RECORD key to obtain a printout of the test results.

c. Press the END key to return to the SpO2 Test.

7.5.9.2 DAC Test

The purpose of this test is to verify the performance of the AC on the SpO2 Board.

a. Connect an oscilloscope to J24 pin 5 of the SpO2 Board. The signal should appear as shown in Figure 7-14. Make sure the saw signal is smooth and does not jump or drop suddenly which would indicate a fault DAC bit.

b. Press the END key to return to the SpO2 Test Menu.

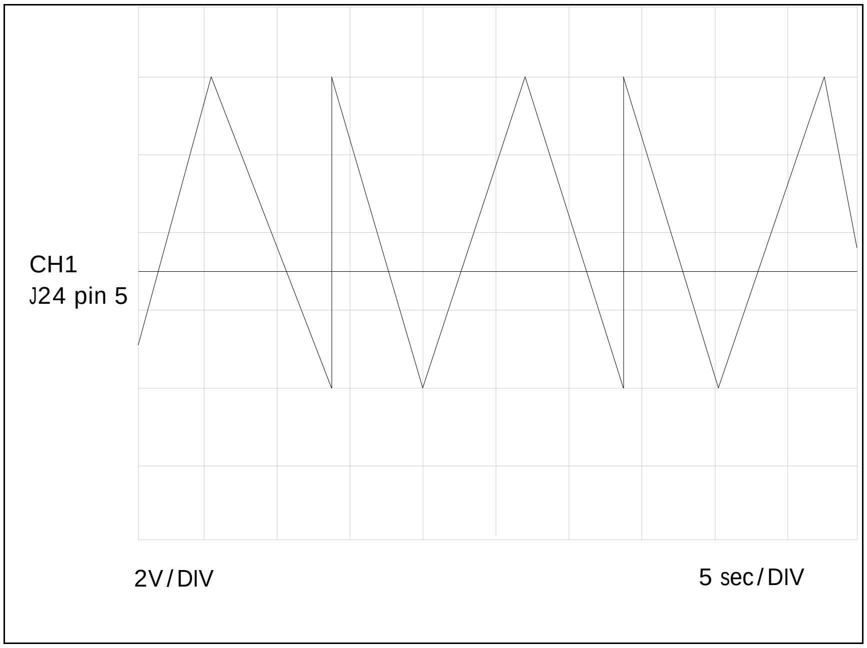


FIGURE 7-10 DAC Waveform

7.5.9.3 Shared RAM Test

When this diagnostic is selected the SpO2 menu will be covered by the Shared RAM Test Menu which offers a choice of three different SpO2 RAM Test;Memory Test 1 (00H,FFH), Memory Test 2 (Walking Ones), and Memory Test 3 (Address Test).

NOTE: ***This test erases the normal operating code that was downloaded to the shared RAM that enables the other SpO2 tests. After performing any of the memory tests the unit must re-power the Run, the Accuracy, Sensor, or DAC tests.***

Memory Test 1 (Basic RAM Test): The main processor will perform the basic write/read test to each memory location with data pattern 0 and 0xFF to verify the integrity of the RAM.

Memory Test 2 (Databus Test): The main processor will write a bit pattern of walking one's (8-bit) to each memory location and read it back to verify that the data bus is not cross talking.

Memory Test 3 (Address Test): The main processor will write the entire memory address to their corresponding memory location, then read them back to verify that the address bus is not cross taking.

a. Highlight one of the memory test from the SpO2 shared RAM test menu and press the SELECT key to start the test.

b. Each test is continuously performed until the END key is pressed. The completion pass number is constantly updated on the display. The test is halted when a failure occurs and address and write/read data patterns are displayed.

c. Press the RECORD key to obtain a printout of the test results.

d. Press the END key to return to halt the test.

7.5.10 SpO2 Diagnostics (Nellcor SpO_2 Installed)

The purpose of this test is for factory testing only. This test is not intended for field use.

7.5.11 SpO2 Diagnostics (Masimo SpO_2 Installed)

When this diagnostic is selected, the service menu will be replaced by a textual display of all SpO2 errors recorded by the monitor. All errors will be automatically printed out on the recorder as they are displayed on the screen, provided the unit is equipped with a recorder. The DOWN ARROW key causes the display to clear, and the next page of messages to be displayed. Continue to press the DOWN ARROW key unitl the message “Journal Empty” is displayed.

NOTE: ***There is no buffering of the error journal messages, therefore once an error message is displayed, it will be lost if the DOWN ARROW or END key is depressed.***

The Masimo Diagnostic Journal is not intended for interpretation in the field. There are hundreds of different messages which could be recorded, and the messages vary with software revision. Also, not all recorded messages indicate an error. If you suspect a problem with the unit, the Masimo Diagnostic Journal should be printed out to the recorder (if installed) and forwarded to a Datascope Service Representative or Datascope Technical Support department.

7.6 Power-Up Verification

1. Plug the Power Supply Module into an appropriate power source and connect the D.C. plug into the right side panel of the Passport.

2. Turn on the Passport. Check for the following to occur:

- The LCD display is bright blue for approximately 5-8 seconds, followed by the message:

Diagnostic in Progress

Selftest Complete

- At the end of the download, verify unit sets up display screens for signal inputs.

NOTE: ***If no display is observed when unit is powered up, adjust front panel “contrast ” control.***

3. Verify proper range of the front panel contrast control:

- When the contrast is positioned full up, the LCD display should be completely white.
- When the contrast is positioned full down, the LCD display should be completely blue.
- Set contrast for optimum visibility.

4. Check the upper Left side of the LCD display for the correct time and date. If incorrect, follow the steps below top enter the user configuration menu.

- Turn PASSPORT off, and then back on.
- At the moment the LCD displays the message “Selftest Complete”, depress and hold the “FREEZE” KEY. The LCD displays the USER CONFIGURATION menu.
- Use the SETUP UP ARROW/DOWN ARROW keys to select options, then press select. Follow the on screen directions to change the date, time and trend setup as required. Exit the configuration menu by pressing and holding the END key for three seconds.

7.7 Initial Set-Up

1. Using a patient simulator, connect the ECG, IBP1, IBP2 and temperature cables to the left side panel. Set the ECG simulator for 60 bpm, 1mv, QRS signal.

2. Setup the Passport as follows:

- Adult mode (Patient option)
- Lead 1
- ECG size to 1.0cm/mv.
- Speed to 50mm/sec (Setup option)
- Waveform 2 to Cascade. (Setup Option)

7.8 ECG Tests

1. Observe that the trace display sweeps across the Waveform 1 screen in two seconds. There should be two complete ECG cycles. The same display and timing should be seen in the Waveform 2 screen.

2. Check the following sweep speeds for appropriate displays:

12.5mm/sec - 8 second sweep/window
5.0mm/sec - 4 second sweep/window

3. Disconnect one ECG lead at a time (RA, RL, LL, LA, and C) from the simulator and observe that the ECG signal changes to a flat line and the message “LEAD OFF: (RA, RL, LL, LA, and C)” appears on the EL display.

4. Set ECG simulator to SHORT LEADS. Verify noise does not exceed one pixel resolution.

5. Set ECG simulator to Ventricular Pacer (waveform = VP). Verify a pacer pulse is displayed before the R wave of the QRS signal.

6. Set ECG simulator to 5 HZ , 1mv sine wave.
The Passport should be set to lead 1 and size to 1cm/mv.

7. Press the FREEZE key and verify that the signal displayed on the LCD is 10 mm (p-p) +/- 1 mm, with an overall trace length of 10 cm +/- 2mm.

8. Adjust the output amplitude of the ECG simulator and the Passport’s size as shown below and verify the display for each setting.

INPUT AMPLITUDE	***SIZE SETTING***	***DISPLAY (P-P)***
2mv	.025 cm/mv	5 mm (+/- 1 mm)
2mv	0.5 cm.mv	10 mm (+/- 1 mm)
1mv	1.0 cm/mv	10 mm (+/- 1 mm)
1mv	2.0 cm/mv	20 mm (+/- 2 mm)
1mv	3.0 cm/mv	30 mm (+/- 3 mm)
0.25mv	4.0 cm/mv	10 mm (+/- 1 mm)

9. Set the ECG simulator to ECG QRS waveform. Set rate to 252 bpm.

Verify RATE display is 252 +/- 8 bpm.
Decease the RATE to 30 bpm and allow signal to stabilize (May take 30 seconds to display rate). Verify RATE display is 30 bpm +/- 3 bpm.

10. Set simulator to 1mv ECG QRS signal , rate to 60 bpm.

Set the Passport to PRINT ON ALARM, install paper in recorder and set LO HR ALARM to 50 bpm and HI HR ALARM to 120 bpm.

Increase ECG HR to 125 bpm and verify the following:

- The HI ALARM violates with audio tone and RED LED active.
- The recorder (if installed) prints a strip showing the ECG information
- Measure the GRID width and verify overall width of 40 mm +/-2 mm.
- Measure the GRID length and verify overall length of 40 cm +/- 2 cm. (There should be 16 one second tic marks present)

Mute the alarm by pressing the MUTE key.

- Verify that the “ALARM MUTE” symbol is displayed next to HR display on the LCD display and the alarm is silent.

Decrease the ECG HR to 45 bpm. The ALARM should sound. Then set the ECG HR to 60 bpm and verify the alarm condition is canceled.

Press the TREND/RETURN key and examine the trend data. The high heart rate value should be in reverse video indicating the high HR alarm was violated.

7.9 IBP1 and IBP2 Verification

1. Set the simulator to 0 mmHg for both IBP1 and IBP2.

   Set the Passport to display IBP 1 in WINDOW 2 and IBP 2 in WINDOW 3 using the SETUP menu. Set the pressure scale to 300 mmHg for both IBP 1 and 2.
2. Zero IBP 1 by pressing the ZERO 1 key. Verify that the systolic, diastolic, and mean display changes from “dashed lines” to zero +/- 1 mmHg within 2 seconds and the “TRANSDUCER NOT ZEROED” message is removed. Zero IBP 2 and verify proper operation.
3. Apply 50, 150 and 300 mmHg and verify that the following parameters SYS/MEAN/DIA agree.

Applied Pressure	***Readout***
50 mmHg	48 - 52
150 mmHg	147 - 153
300 mmHg	294 - 306

4. Apply a 120/80 mmHg signal to IBP 1 and 60/20 mmHg to IBP 2.

   Verify that the reading in the IBP 1 window is 120/80 mmHg +/- 3 mmHg and 60/20 mmHg +/- 2 mmHg in the IBP 2 window. Verify the correct waveforms are displayed on the LCD display.

7.10 Temperature Verification

1. Set the simulator to 37º C, 700 series probe.
2. Verify that the temperature displays is 37.0º +/-0.3.
3. Set the simulator to 37º C, 400 series probe.
4. Verify that the temperature displays is 37.0º +/-0.3.

NOTE: ***If temperature exceeds 45ºC or is below 0ºC, the temperature display goes to “dashed lines”.***

7.11 SpO_2 Verification

1. Set the Passport to display the PLETH waveform in window 3 and HR source to AUTO.

2. Verify the Passport is displaying the message "NO SpO2 SENSOR".

3. Connect the SpO2 sensor to the left side panel connector.

4. Verify the message changes to "SpO2 SENSOR OFF" and the red LED in the probe is illuminated.

5. Apply sensor to finger.

6. Verify window 3 displays the pleth waveform, the SpO2 % window displays a valid reading ,the ECG HR is replaced by the SpO2 HR and a beep tone is present for the SpO2 HR.

7.12 NIBP Verification

1. Connect the cuff to the left side panel luer connector and set PATIENT SIZE to ADULT.

2. Apply cuff and press the START key.

- Verify the pump motor starts and the cuff begins to inflate.
- Verify that the MEASURING CUFF window begins to indicate a pressure increase as the cuff begins to inflate.
- Verify the pump stops when the MEASURING CUFF window reads180 mmHg +/-10 mmHg. (When initial cuff pressure is set to 180 mmHg).
- The cuff should begin to deflate and in about 20 seconds should display SYS/DIA/MEAN reading in the NIBP window.

7.13 Mainstream CO_2 Adapter Calibration

Adapter calibration compensates for the optical differences between the adult and neonatal airway adapters for mainstream CO_2 operation.

Adapter calibration needs to be performed each time the type of airway adapter is switched. For example: if switching from using a re-usable adult to a neonatal or neonatal to a re-usable adult adapter, a calibration is needed (not if switching from a re-usable adult adapter to another re-usable adult adapter). Adapter calibration should also be performed if the message "Check Adapter" displays.

NOTE: ***In order to perform an accurate adapter calibration, the "Sensor Warming Up" message must not be displayed.***

To perform an adapter calibration:

1. Place the sensor and airway adapter away from all sources of CO_2 (including the patient's and your own exhaled breath, and ventilator exhaust valves).

2. Choose Start Adapter Cal - Yes from the CO_2 menu. (See "Use of Menus" on page 109.)

NOTE: ***If the monitor detects changing CO2 levels (breaths) during an adapter calibration, a "Breaths Detected ... Retry" message displays and then an "Adapter Cal Failure" message displays. Remove the source of CO_2 and repeat the calibration.***

7.13.1 Mainstream CO_2 Sensor Calibration Verification

Calibration can be verified at anytime and should be verified at least once a week.

To verify calibration:

1. Verify the Passport is turned on and the Capnostat® is connected and warmed-up.
2. Place the Capnostat® sensor onto the reference cell labeled REF.

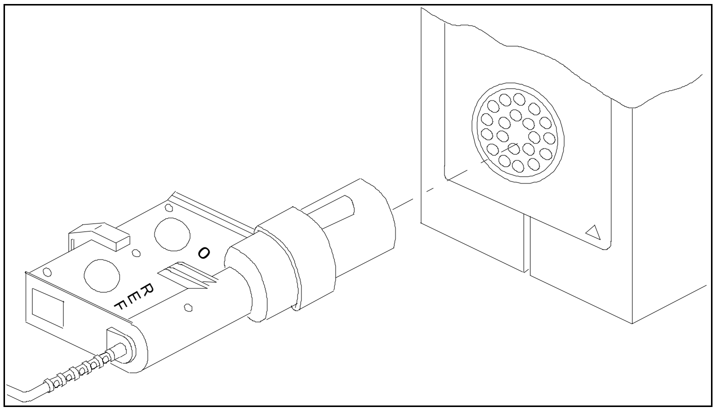


FIGURE 7-11 Reference Cell

3. The "Sensor on Reference Cell" message is displayed and the reference value is displayed in the $ETCO_2$ window. The value should be between 36 and 40 Torr.

7.13.2 Mainstream CO_2 Sensor Calibration

The Capnostat® CO_2 sensor does NOT need to be calibrated at each monitor power up.

Calibration of a sensor is required the first time a particular sensor is connected to a particular monitor and when the monitor requests it.

Once a sensor is calibrated, the Passport XG can be turned off and on, the sensor can be unplugged and reconnected, without having to recalibrate. However, if a second sensor is connected in place of the original, the second sensor must be calibrated and if the original sensor is used again, it too will have to be recalibrated.

NOTE: ***In order to perform an accurate Sensor calibration, the "Sensor Warming Up" message must not be displayed.***

To perform a Capnostat® sensor calibration:

1. Verify the Passport XG is turned on and the Capnostat® is plugged in and warmed-up.

2. Place the Capnostat® onto the ZERO cell.
3. The “Sensor on Zero Cell” message is displayed.
4. Select Start Zero Cal - Yes from the CO_2 menu. The “Zero Cal in Progress” message is displayed. The" Zero Cal Complete" message is displayed when complete and a 0 value is displayed.
5. Remove sensor from the zero cell and place onto the airway adapter.

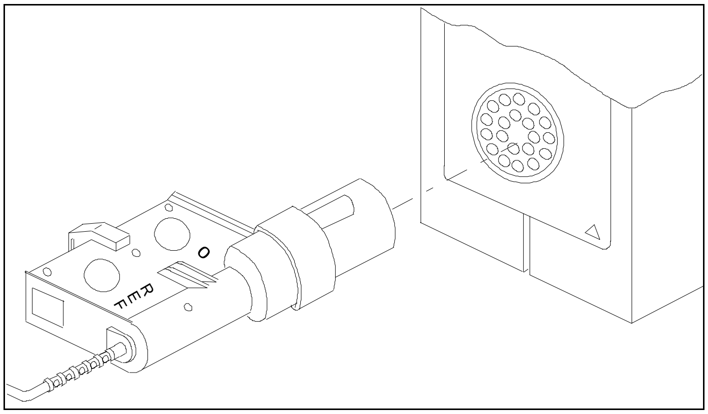


FIGURE 7-12 Zero Cell

7.14 Sidestream Pump Calibration

Pump calibration is necessary when the tubing configuration or sampling cell airway adapter is changed. This calibration enables the unit to determine when an occlusion is present in the tubing.

To perform a pump calibration:

1. Plug the Capnostat® CO_2 sensor into the Passport XG CO_2 connector (34). The “CO2: Sensor Warming Up” message is displayed. The pump calibration cannot be performed until the “CO2: Sensor Warming Up” message disappears.
2. Press the CO_2 PUMP key (12). A “Warning” message displays. Ensure that the sampling tubing is correctly connected and that the nasal cannula is clear of all sources of CO_2 (including the patient’s and your own exhaled breath, and ventilator exhaust valves). Press SELECT to turn the sampling pump on and to initiate the calibration.
3. The “CO2: Pump Cal in Progress” and “CO2: Pump On” messages alternately display. When the pump calibration is complete, the message “CO2: Pump Cal Complete” displays and then the “CO2: Pump On” message displays. The “CO2: Pump On” message will continue to display as long as the pump is on. See “CO_2 Messages (only units equipped with Capnostat CO_2)” on page 60 for additional CO2 messages.

NOTE: ***This pump calibration also calibrates the adapter. It is not necessary to perform a separate adapter calibration at this time, unless the message “Check Adapter” displays.***

NOTE: ***If the monitor detects changing CO_2 levels (breaths) during a pump calibration, a “Breaths Detected ... Retry” message displays, and then a “Pump Cal Failure” message will display. Remove the source of CO_2 and repeat the calibration.***

7.14.1 Sidestream CO_2 Pump Verification / Calibration Procedure

This test is to verify the proper flow rate of the Sidestream CO_2 Pump.

1. Turn power switch to the on position and wait for the unit to power up in the normal operating mode.
2. Assemble the CO_2 Sidestream pump calibration parts as shown in Figure 7-13 and attach to the Passport monitor.
3. Verify zero cc/min, ±1 cc/min on flow meter before turning the CO_2 pump on. Press the CO_2 pump key and measure the flow rate of the pump. Allow at least two minutes for the flow meter to settle before any adjustment is made.
4. Adjust VR2 on the CO_2 Control Module P/N 0670-00-0118 to achieve a flow rate of 180 cc/min, ±20 cc/min. Refer to Figure 7-14.

Occlusion Test:

1. To simulate an occlusion, take a pair of Hemostats and crimp the tubing at the intake port. An OCCLUSION message should appear in the lower left window.

REQUIRED PARTS FOR SIDESTREAM CO2 PUMP CALIBRATION

ITEM	*PART NUMBER*	*DESCRIPTION*
1	0103-00-0443-01	Airway Adapter with Tubing
2	0008-00-0259	Nafion Tubing Assembly
3	0683-00-0405-11	Capillary Line 5 Feet
4	0103-00-0445-01	Filter

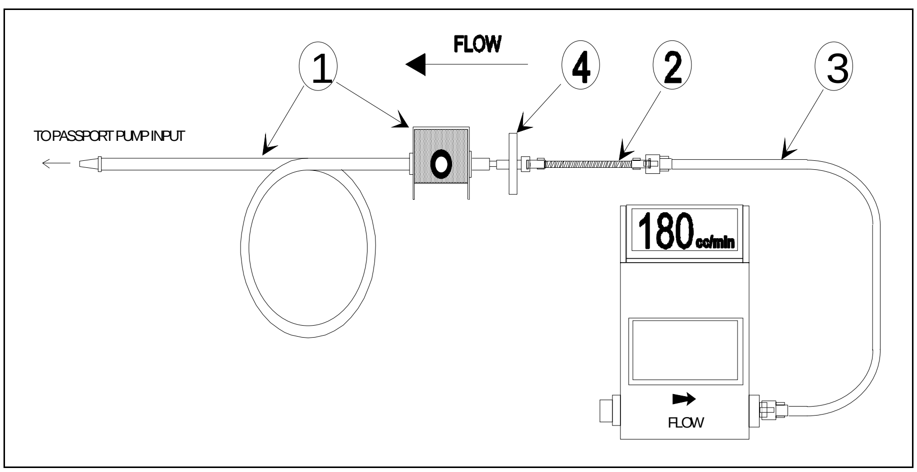


FIGURE 7-13 Sidestream CO_2 Pump Calibration Kit

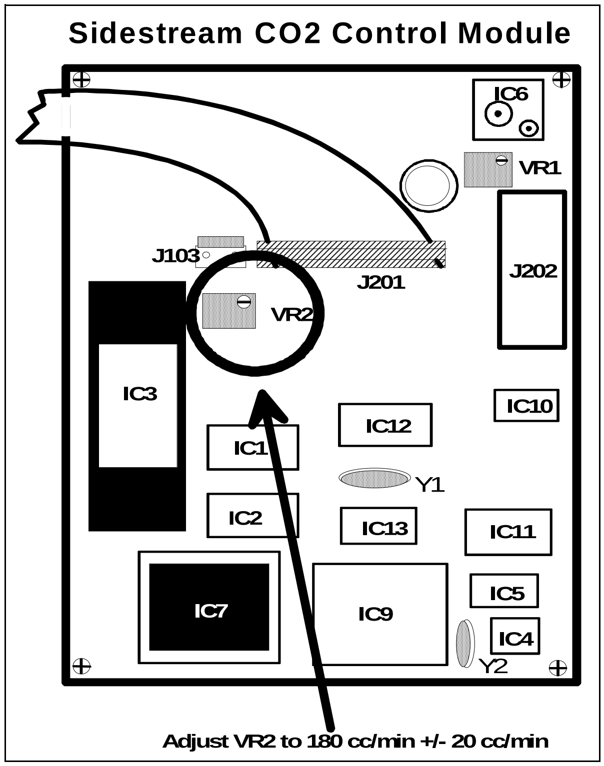


FIGURE 7-14 Sidestream CO_2 Control Module

7.14.2 Sidestream Adapter Calibration

Performing a Pump Calibration automatically calibrates the adapter. An Adapter Calibration is necessary whenever the sampling cell airway adapter is replaced or when the “Check Adapter” message displays.

To perform an adapter calibration:

1. Plug the Capnostat® CO_2 sensor into the Passport XG CO_2 connector (34). The “CO2: Sensor Warming Up” message is displayed. The adapter calibration cannot be performed until the “CO2: Sensor Warming Up” message disappears.
2. Ensure the nasal cannula is away from all sources of CO_2 (including the patient’s and your own exhaled breath, and ventilator exhaust valves).
3. Choose Start Adapter Cal - Yes from the CO_2 menu. (See “Use of Menus” on page 109.)

NOTE: ***If the monitor detects changing CO2 levels (breaths) during a adapter calibration, a “Breaths Detected ... Retry” message displays, and then an “Adapter Cal Failure” message will display. Remove the source of CO2 and repeat the calibration.***

7.14.3 Sidestream CO_2 Sensor Calibration Verification

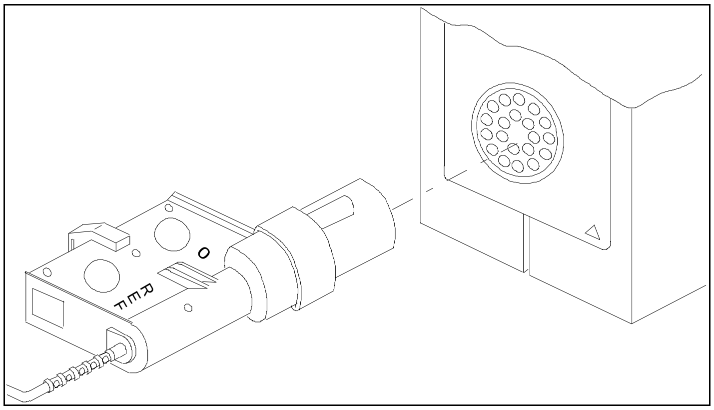


FIGURE 7-15 Reference Cell

Calibration can be verified at anytime and should be verified at least once a week.

To verify calibration:

1. Verify the Passport is turned on and the Capnostat® is connected and warmed-up.
2. Place the Capnostat® sensor onto the reference cell. The reference cell is labeled REF. The sensor cable should face away from the Passport.
3. The “Sensor on Reference Cal” message is displayed and the reference value is displayed in the $ETCO_2$ window. The value should be between 36 and 40 Torr.

7.14.4 Sidestream CO_2 Sensor Calibration

The Capnostat® CO_2 sensor does NOT need to be calibrated at each monitor power up.

Calibration of a sensor is required the first time a particular sensor is connected to a particular monitor and when the monitor requests it.

Once a sensor is calibrated, the Passport XG can be turned off and on, the sensor can be unplugged and reconnected, without having to recalibrate. However, if a second sensor is connected in place of the original, the second sensor must be calibrated and if the original sensor is used again, it too will have to be recalibrated.

To perform a Capnostat® sensor calibration:

1. Plug the Capnostat® CO_2 sensor into the Passport XG CO_2 connector (34). The “CO2: Sensor Warming Up” message is displayed. The sensor calibration cannot be performed until the “CO2: Sensor Warming Up” message disappears.

2. Place the Capnostat® onto the ZERO cell.
3. The "Sensor on Zero Cell" message is displayed.
4. Select Start Zero Cal - Yes from the CO_2 menu. The "Zero Cal in Progress" message is displayed. The" Zero Cal Complete" message is displayed when complete and a 0 value is displayed.
5. Remove sensor from the zero cell and place onto the airway adapter.

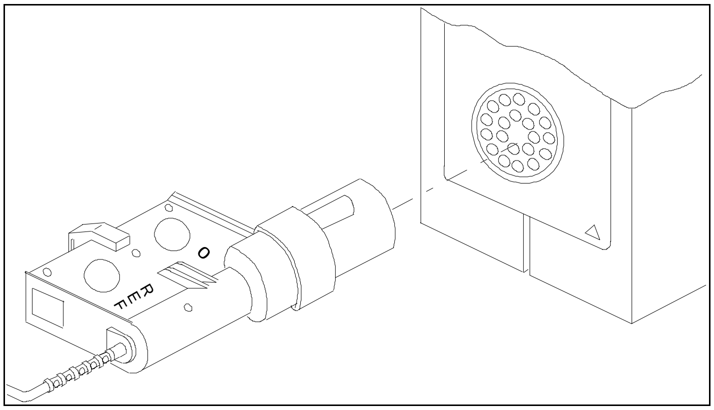


FIGURE 7-16 Zero Cell

7.15 Battery Operation Verification

1. Insure that the Power Supply Module is connected to an appropriate power source and that the D.C. plug is connected to the D.C Power Input of the Passport.
2. If batteries are installed, remove the batteries.
3. Turn on the Passport and verify unit powers up correctly.
4. Install two batteries on the left side of the unit
5. Remove the D.C. power cable from the right side panel.
   - Verify that unit operation is not interrupted.
6. Remove one of the batteries and verify unit continues to operate.
7. Install the battery that was removed in the previous step and remove the other battery. Unit should continue to operate without interruption.

7.16 Leakage Current Test

NOTE: ***The Passport Monitor is not considered double insulated because it has provisions for grounding via the three conductor line cord to U-blade ground through the external supply. The external supply is considered a recognized/ certified component by the UL/CSA and is part of the monitor. However, the monitor does not have any accessible exposed conductive metal. The U-blade connection is not carried through the external supply into the monitor itself, the DC voltage is only provided. NFPA 99 section 7-5.1.3.2 does not apply because no metal on the monitor can become line energized. The Passport was evaluated with the external supply by UL and CSA with no grounding impedance verification. If you check U-blade resistance, the safety analyzer will read "open".***

A. Source Current, Chassis Case to Ground Leakage (Test 1 on Model 431 Dempsey).

1. Connect the ground wire from the safety analyzer to the SpO_2 ground ring.

2. Connect the power module to the Passport's DC input.

3. Perform the test under the following conditions, with the Passport ON:

a. Case Grounded:

1. Polarity Normal

2. Polarity Normal with open neutral

b. Case Ungrounded

1. Polarity Normal

2. Polarity Normal with open neutral

3. Reverse Polarity

4. Verify the current reading for any test is less then 100uA.

C. Lead to Ground - Sink Current patient circuit (Test V on Model 431 Dempsey; patient leakage with line voltage on leads)

1. Connect the ground wire from the safety analyzer to the SpO_2 ground ring.

2. Connect the ECG cable from the safety analyzer to the Passport.

3. Connect the power module to the Passport's DC input.

4. On the Safety Analyzer depress the "APPLY 115VAC" button and note the reading.

5. Repeat the test for normal and open ground and reverse polarity combinations. Verify the current reading for any test is less then 20uA.

7.17 Cosmetic Checks

1. Clean the instrument enclosure with a mild soap and water solution or ammoniated window cleaner. Do not apply large amounts of liquid; do not use abrasive cleaning agents or organic solvents.

   Check unit for any obvious signs of physical damage, (e.g., bent/cracked frames or scratches) and replace as required.
2. The front panel should be cleaned carefully in order to prevent scratches. Dust, dirt particles, finger-prints and stains may be removed by using a soft cloth. Do not wipe a dry screen. Do not use alcohol or chlorinated hydrocarbon solvents. Inspect the front panel for scratches and other physical damage, replace if required.
3. Check all panel hardware for looseness and panel clearance.
4. Check line cord for wear, damage and proper strain relief.
5. Check all graphics and labeling for wear and scratches.

7.18 Special Options Menu

To enter the Special Options Menu:

1. Power the unit on and wait for the normal power up procedure to be completed.
2. Once in the operating mode press and hold the HIDDEN KEY located as follows:
   - **a.** Between the FREEZE and DEFLATE keys on all 3L/5L/LT units
   - **b.** Between the EXIT and SIZE keys on XG units with Rev Y.04 software
   - **c.** The exit key on XG units with Rev TB or higher software

   Release the HIDDEN KEY when the Special Options Menu appears on screen.

SPECIAL OPTIONS	
Screen Blank:	OFF
Notch Filter:	Enabled
ESU Filter:	AUTO
Pump Status:	0x2 0000000
Pump Current:	0.0 mA
Bar. Press:	770 mmHg
Choices: ON, OFF	
↕ = Adjust value	EXIT = quit
SELECT = Enter/move	

FIGURE 7-17 Special Options Menu

Screen Blank:

1. The first menu that appears in reverse graphics is the Blank Screen Menu. Press the UP or DOWN arrow key to turn the Blank Screen Menu on or off. Press the Select key to choose the selection. when the Blank Screen Menu is turned on, the display will be blank until a key is pressed or power is cycled.

Notch Filter:

1. Press the Select key to get to the Notch Filter menu. Press the UP or DOWN key to enable or disable the Notch Filter. when the Notch Filter is disabled the 50 hz or 60 hz frequency filter is not active.

ESU Filter:

1. Press the Select key to get to the ESU Filter Menu. Press the UP or DOWN key to disable the ESU Filter or place the filter in the Auto mode. When the ESU Filter is disabled the Electrosurgical Unit filter is not active.

Pump Status (XG Sidestream units only):

1. This menu is non-selectable. Pump Status displays the status of the Sidestream CO_2 in Bytecode.

NOTE: ***Pump status is not intended for interpretation in the field. If a problem is suspected with CO_2 pump operation, copy the pump status bytecode and forward to Datascope Technical Support Department.***

Pump Current (XG Sidestream units only):

1. This menu is non-selectable. Pump Current displays the amount of current drawn by the Sidestream CO_2 pump assembly when activated.

Barometric Pressure (XG Sidestream units only):

1. This menu is non-selectable. Barometric Pressure is displayed in mmHg's and is updated as per real time pressure.

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8.0 *Preventive Maintenance*

Contents of this Chapter .... Page

8.1 Preventive Maintenance Schedule

The following is a list of activities required for periodic maintenance of the Passport monitor. The physical inspections, replacements of consumable items and performance checks are suggested to be performed at the recommended intervals stated below. Datascope is not responsible for component failure or loss resulting from the use of stated consumable items beyond their recommended replacement interval.

8.2 Mechanical / Physical / Visual Inspection

Perform At Six Month Intervals

Suggested Inspections for Wear and Abuse:

1. Outercase, AC and DC Line Cords, External Power Supply, Rolling Stands, Wall Mounts.
2. Interface Cables (Visa, Defib. Sync, Interpreter, External Power Supply, Remote Color Display).
3. Patient Interface Connections (ECG, IBP, Temp, SpO2, CO_2, NIBP).

8.3 Preventive Maintenance Kit - Install Kit Annually

Passport P/M Kit - P/N 0040-00-0130 (Installation Instructions Included).

8.4 Perform Verification and NIBP Calibration - Annually

1. Perform test as outlined in “Power-Up Verification” on page 7-20 through “Cosmetic Checks” on page 7-32.
2. Perform NIBP calibration as described in “Diagnostics and Calibration Procedure” on page 7-5.

8.5 Perform Verification and CO_2 Pump Calibration - Annually

Perform test as outlined in “Sidestream CO_2 Pump Verification / Calibration Procedure” on page 7-27.

8.6 User Preventive Maintenance Introduction

This section of the manual outlines routine maintenance that should be performed by the user.

The Passport XG Monitor is designed for stable operation over long periods of time and under normal circumstances should not require technical maintenance beyond that described in this section. However, it is recommended that routine maintenance calibration and safety checks be performed at least once a year, or more often as required by local statutory or hospital administration practice.

8.6.1 Care and Cleaning of Monitor

The monitor enclosure may be cleaned with a mild soap and water solution or ammoniated window cleaner. Apply cleaning solution to the cloth, not directly onto the monitor. DO NOT apply large amounts of liquid. DO NOT use abrasive cleaning agents or organic solvents.

WARNING: Do not clean the monitor while it is on and/or plugged in.

To prevent scratches on the front panel display screens, blow or carefully brush dust and dirt particles with a soft sponge moistened with cleaner solution; or a fine, soft-hair brush. DO NOT use abrasive cleaning materials. Fingerprints and stains may be removed by using a liquid lens cleaner and a soft cloth. DO NOT wipe a dry screen or use alcohol or chlorinated hydrocarbon solvents.

8.6.2 Care and Cleaning of Datascope Flexisensors and Datasensors

NOTE: If your unit is equipped with Nellcor* SpO2 or Masimo* SpO2, refer to sections 1.3.9 (Nellcor) or 1.3.10 (Masimo) and/or the individual instruction sheets that are packaged with each sensor.

* *This feature applicable only if available / installed in your unit.*

- Daily, check the sensors and cables for signs of damage. Replace as required.
- Check for proper operation of the spring mechanism on the DATASENSOR.
- The sensors should be cleaned before and after each patient's use.
- Clean and disinfect the sensors. Wipe the patient contact area using a soft cloth with mild soap and water solution or isopropyl alcohol. Hydrogen peroxide can be used to remove dried blood on all accessible surfaces.
- Let the sensor completely dry before using.

CAUTION: ***When cleaning sensors do not use excessive amounts of liquid. Wipe the sensor surface with a soft cloth, dampened with the cleaning solution.***

8.6.3 Cleaning CO_2 Sensors and Adapters

CO_2 Sensor:

The Sensor, Calibrator and Cable Assembly can be damp wiped with soapy water, Cidex, Sproiciden, 70% isopropyl alcohol or a 10% bleach solution. It should then be wiped dry with a soft cloth. Immersion into any liquid bath is not recommended. ETO and steam autoclaving is not recommended.

Adult and Neonate Reusable Adapters:

These adapters can be disinfected by soaking in any of the above mentioned solutions. In addition, they can be ETO and steam autoclave sterilized following the sterilizer manufactures' recommended procedures.

8.6.4 Cleaning External CO_2 Sampling Components

- The Nasal Sampling Cannulas are single patient use only.
- The Sampling Airway Adapter with tubing may be cleaned by rinsing in a warm soapy solution, followed by soaking in a liquid disinfectant. It should then be rinsed off with sterile water and dried.

8.6.5 Cleaning Internal CO_2 Sampling Components

The CO_2 Sampling Components should be cleaned on a yearly basis or if the filter is clogged.

Equipment Needed:

60 cc Syringe	0103-00-0026
Tubing (2) 4" BY 1/8" ID	0103-00-0450
Slip type Luer Fitting	0103-00-0451
1/8" Barb Connector	0103-00-0454-02
Distilled Water	
Sodium Hypochlorite (5.25% by weight)	

WARNING: ***Sidestream waste material and CO_2 filter should be treated as biohazard material. It is recommended that gloves be worn while performing this procedure.***

1. Shut off the monitor and disconnect the external power supply.

2. Remove all tubing from the inlet and exhaust ports.
3. While taking precaution not to touch any liquid that may leak out, keep the unit in an upright position and remove the CO_2 filter cap from the CO_2 housing (located on the rear panel of the Passport).
4. Clean the CO_2 housing with Sodium Hypochlorite and remove any sediments.After cleaning, pull the old filter off the CO_2 cap and screw the cap back onto the CO_2 housing. Do not use a filter at this time.
5. Attach one 4" by 1/8" ID tubing using the 1/8" Barb Connector to the exhaust port and place the other end of the tubing in an empty container located below the exhaust port.
6. Attach the other 4" by 1/8" ID tubing to a 60 cc syringe. On the opposite end of the tubing use a slip type luer fitting and attach it to the inlet port on the side of the monitor.
7. Use light to moderate pressure on the syringe to flush 120 cc (two 60 cc intervals) of sterilizing solution (Sodium Hypochlorite, 5.25% by weight) into the inlet of the monitor.
8. Apply light to moderate pressure on the syringe to flush another 60 cc of sterilizing solution and leave the solution in the monitor for approximately 30 minutes.
9. Repeat step 7 with distilled water.
10. Repeat step 7 using air.
11. While taking precaution not to touch any liquid that may leak out remove the CO_2 filter cap from the CO_2 housing, and repeat step 7 using air until all liquid within the monitor is removed.
12. Place a new CO_2 filter (P/N 0103-00-0452) into the CO_2 filter housing (beveled end first) and place the CO2 filter cap back on.
13. Remove the syringe and tubing from both the inlet and exhaust. Connect the external power supply and turn on the monitor. Without any accessories attached to the inlet or exhaust ports, turn on the CO_2 pump. Let the pump run until no precipitation is felt out of the exhaust.

8.6.6 Sterilization and Cleaning of Reusable Cuffs

Remove the latex bag from the cuff. The cuff and latex inflation bags may be cleaned with an alcohol wipe, a disinfectant wipe, or by sponging with a damp cloth. Both may be sterilized with commercially available disinfectant soaks.

CAUTION: ***Using dark colored soaks may stain the cuffs. Test a single cuff to ensure that no damage will occur. ETO sterilization may also be used.***

Hand washing will enhance the service life of the cuff. Remove the latex bag and hand wash the cuff in warm, soapy water; then rinse thoroughly. Allow the cuff to air dry, then insert the latex inflation bag.

CAUTION: ***When ironing or pressing the cuffs, be aware that the Velcro® fasteners can melt at temperatures above 325°F, 162°C.***

8.6.7 Battery Replacement and Maintenance

Battery Replacement

1. Open battery compartment door, on left side of unit, by sliding the tab down.
2. Press the release button, located above the battery, to eject the battery. Slide out old battery.
3. Slide in replacement battery until it clicks into place.
4. Close battery compartment door.

Battery Maintenance

Due to the self-discharge characteristics of this type of battery, it is imperative that it is charged after 6 to 9 months of storage (or unit not in use). If not, permanent loss of capacity may occur as a result of sulfation. Charge retention at 20^{o}C is 6 months to 83%.

The batteries used in the Passport XG Monitor are of sealed lead acid construction. This battery type may be subject to local regulations regarding disposal. At the end of the battery life, dispose of the batteries in accordance with any local regulations.

8.6.8 Recorder Paper Replacement

The instructions below describe the replacement of recorder paper. Use only recommended recorder paper, P/N 0083-00-0422. This ensures that the print quality is acceptable and reduces print head wear.

1. Open recorder door by pressing the paper eject button (upper right corner with paper roll icon on it).

NOTE: ***If the recorder's door does not open completely, carefully pull it until it is completely open.***

2. Remove empty paper spool by pulling it out gently.
3. Insert new paper roll between the two rounded tabs of the paper holder with the sensitive (shiny) side of the paper facing the print head at the top of the recorder (paper feeding off of the spool from the bottom).
4. Unroll approximately 4 inches of paper.
5. Align the paper across the top of the metal bar.
6. Holding the paper in place, close recorder door.
7. To ensure that the paper is aligned properly and has not been pinched in the door, pull the loose edge out a couple of inches. If the paper jams, open the door and return to step 5.

8.6.9 Care and Storage of Thermal Chart Paper

Thermal Chart Paper is chemically treated and the permanency of a recording is affected by storage and handling conditions. These conditions are:

- Ultraviolet Light

We recommend storing the recordings in a filing cabinet within a few days of printing. Long term exposure to natural or artificial U.V. sources may be detrimental.

- Storage Temperature and Humidity

Keep the recordings in a cool and dry area for a longer lasting image. Extreme temperature and humidity (above 80° F and 80% Humidity) should be avoided.

- Solvent Reactions

Do not store the recordings in plastic bags, acetate sheet protectors, and similar items made from petroleum products. These products emit a small amount of vapor which will, over a period of time, deteriorate the image on the chart paper.

- Adhesive Tape

Never place adhesive tape over recordings. The reaction between the adhesive compound and the Chemical/Thermal paper can destroy the image within hours.

- Archives

We recommend that if long term archives are required, make a photocopy of the recordings as back-up. Under normal office filing conditions the recordings should retain acceptable image quality for about 5 years.

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