Service Manual

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Foreword

The **Spectrum®/Spectrum OR™** Service Manual is intended as a guide for technically qualified personnel during repair and calibration procedures.

This publication may have been updated to reflect product design changes and/or manual improvements.

Note

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

Warning

The **Spectrum®/Spectrum OR™** operates on line voltages. Therefore, an electric shock hazard may exist when the instrument covers are removed. Repair and calibration procedures should only be performed by qualified personnel who proceed with care and follow proper servicing techniques. Warnings are given in various Chapters, as well as in other appropriate locations.

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1.0 *Repair Information*

1.1 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 through understanding of the instrument functions as well as understanding the theory of operation.

1.2 Safety Precautions

In the event the instrument covers are removed, observe the following warnings and guidelines.

1. Do not short component leads together.
2. The instrument covers must not be removed by other than qualified technical personnel who have received supplementary instructions regarding maintenance of medical equipment or has equivalent experience in this area.

1.3 Troubleshooting Guidelines

1. **Identify the problem -** Due to the wide variety of potential symptoms certain problems may be more subtle than others. One approach to troubleshooting is to set up the instrument as described in Chapter 4.0. Following the guidelines of the tests will help determine the problem if one exists.
2. **Avoid shorting component leads -** During repair procedures, it can become tempting to make a series of quick measurements. Always turn the power off before connecting and disconnecting the test leads and probes. The accidental shorting of leads can easily stress the components and cause a second failure (aside from the safety risk).
3. **Use the Proper equipment -** The equipment listed below is suggested to fulfill a wide range of troubleshooting requirements. It is imperative to use the designated equipment in order to ensure proper results of any and all test procedures.
4. **Clean up the repair area -** After any repair, especially after any soldering or desoldering, clean off the repair area with alcohol and a stiff brush. This will remove any residual solder flux, in turn allowing the instrument to return to its original appearance.

1.4 Exchange Programs

An exchange program for certain assemblies in the instrument is available. In many cases replacement of the complete assembly will result in the most expedient repairs.

1.5 Special Tools Required

- DVM
- Digital Mercury Manometer - 0 to 300 mmHg
- Safety Analyzer
- Patient Simulator
- Test Chamber / Dummy Cuff (P/N 0138-00-0001-01 (700 cc) or -03 (500 cc)
- BISx Sensor Simulator (P/N 0454-00-0060)

1.6 Disassembly Instructions

Before disassembling the unit, perform the following:

- Power down the unit and remove the line cord
- Remove all cable assemblies from the left side, right side and rear of the unit
- Remove any batteries that were installed
- Perform all work on a properly grounded ESD workstation

Removal of the Front Housing

1. Place the unit face down on a protective surface.
2. Loosen the screw from the Comm-Port or filler Port. Remove the Comm-Port or filler port from the rear of the unit. Remove the eight screws from the rear of the unit.
3. Turn the unit over and carefully remove the front housing assembly.
4. Disconnect the 80 pin ribbon cable from the J1 of the Display / Keypad board mount in the front housing.

Removal of the TFT Panel

1. Remove Display driver Cable assembly from J5.
2. Remove the Inverter cable assembly from J8 and the display itself.
3. Remove the encoder cable assembly from J4.
4. Remove the Speaker cable assembly from J2.
5. Remove the five screws that secure the Panel board to the front housing and place to the side. Lift the board up and out.
6. Remove the Keypad cable assembly from J10.
7. Remove the two screws that secure the Speaker holder assembly. Remove speaker assembly.
8. Remove the two screws that secure the High voltage inverter board to the left rail assembly.
9. Remove the high voltage cable assembly from J2 of the inverter board. Place board assembly to the side.
10. Turn the front assembly over and remove the encoder knob from the front.
11. Remove the nut and washer that secures the encoder to the front housing. Push the encoder out the back of the housing and place to the side.
12. Turn the front housing back over.
13. Remove the two standoffs below the display and place to the side.
14. Remove the four screws that secure the Display assembly to the front housing brackets.
15. Slide the Display to the bottom of the front housing and lift the right side past the bracket to remove the display.

Removal of the Module Interface Board

1. Remove the front housing as stated in "Removal of the Front Housing" on page 1-3.
2. Remove the four screws that secure the board to the main frame.
3. Lift board and remove.

Removal of the Main CPU board (Main Frame)

1. Remove the front housing assembly as stated in "Removal of the Front Housing" on page 1-3.
2. Remove the NIBP Pump assembly and bracket as stated in "Removal of the NIBP Pump" on page 1-4.
3. Remove the eight (8) screws that secures the metal shield to the back housing.
4. Remove the Power Supply assembly from the rear of the unit as stated in "Removal of the Power Supply" on page 1-6. Once the Power Supply is removed carefully lift the Main CPU assembly up (about one inch).
5. Disconnect the Recorder cable from J8.
6. Disconnect the connector J13 (power switch).
7. Disconnect the CO_2 connector from J 23 (CO_2 module)
8. Disconnect the SpO_2 connector from the SpO_2 board assembly (Masimo® or Nellcor®).
9. Disconnect the connector J203. (Panel board).
10. Carefully lift the CPU board assembly from the back housing.
11. Carefully angle and lift the CPU board assembly from the back housing.
12. Disconnect the connector from J202 and remove the SpO_2 assembly.
13. Remove the ten screws that secure the CPU board to the metal frame.

Removal of the NIBP Pump

1. Remove the Front housing assembly as stated in "Removal of the Front Housing" on page 1-3.
2. Disconnect the tubing from the inline pump filter.
3. Disconnect the connector from J8.
4. Remove Pump assembly from holding bracket.

Removal of the NIBP Module.

1. Remove the Front housing assembly as stated in "Removal of the Front Housing" on page 1-3.
2. Remove the NIBP Pump as stated "Removal of the NIBP Pump" on page 1-4.
3. Disconnect the cable from J1.
4. Unfasten the NIBP fitting on the side of the back housing with a 3/8 inch nut driver.
5. Slide the NIBP module from the rear of the unit carefully and remove.

Removal of the Masimo® SpO_2 Module

1. Remove the Front Housing assembly as stated "Removal of the Front Housing" on page 1-3.
2. Remove the Main frame assembly as stated "Removal of the Main CPU board (Main Frame)" on page 1-4.
3. Remove the three screws that secure the Masimo SpO_2 module to the standoffs.
4. Remove the Cable assembly from J3 of the SpO_2 Module.
5. Lift the Masimo SpO_2 Module up and remove.

Removal of the CO_2 Module

6. Remove the front housing assembly as stated "Removal of the Front Housing" on page 1-3.
7. Remove the Main frame assembly as stated "Removal of the Main CPU board (Main Frame)" on page 1-4.
8. Remove the Patient Connector Panel as stated in "Removal of the Patient Connector Panel" on page 1-5.
9. Remove the four screws that secure the CO_2 module to the back housing assembly.
10. Lift the Module up and out of the back housing.

Removal of the Patient Connector Panel

1. Remove the two screws that secure the Patient Connector Panel housing the back housing.
2. Slide the Patient Connector housing toward the back.
3. Swing the housing open and remove the CO_2 exhaust tubing, connector and input connector retainer clip (optional).
4. Disconnect the Ribbon cable assembly from the module.
5. Remove the two screws that secure the SpO_2 connector to the Panel assembly.

Removal of the Recorder Assembly

1. Open the recorder door and unloosen the captive screws in the rear of the recorder.
2. Slide the recorder from the opening and remove.

Removal of Recorder Interface Board

1. Remove the Front Housing as stated in "Removal of the Front Housing" on page 1-3.
2. Remove the Main frame as stated in "Removal of the Main CPU board (Main Frame)" on page 1-4.
3. Remove the recorder assembly as stated in "Removal of the Recorder Assembly" on page 1-5.
4. Remove the Cable assembly from J3.
5. Remove the two screws and pull the board from the unit.

Removal of the Power Supply

1. Insert a narrow flat blade into each of the four slots and release each tab.
2. Ensure not to damage each tab. Remove the plastic cover.
3. Remove the four screws from the corners of the metal housing.
4. **For units with Li-ion batteries only**, a control cable is connected to the power supply as shown in Figure 3-13 on page 3 - 17. The power supply cannot be completely removed without first disconnecting this cable. Slide the power supply out of the rear of the monitor until the control cable connector is exposed. Disconnect the control cable.
5. Slide the power supply out of the opening and remove.

Removal of the Battery Holder Assembly

1. Be sure the batteries are removed from the battery holder assembly.
2. Remove front housing assembly as stated in "Removal of the Front Housing" on page 1-3.
3. Remove the main frame assembly as stated in "Removal of the Main CPU board (Main Frame)" on page 1-4.
4. Remove CO_2 module and CO_2 mounting brackets.
5. Remove the five screws that secure the housing to the back housing.
6. Lift and remove the battery holder assembly.

Removal of the 608 MHz Radio Assembly

1. Remove the 2 screws from the radio assembly base.
2. Pull the assembly back from the monitor and place to the side.

1.7 Nurse Call Cable (3 Pin Circular to Unterminated)

1.7.1 P/N 0012-00-1277-01/-02

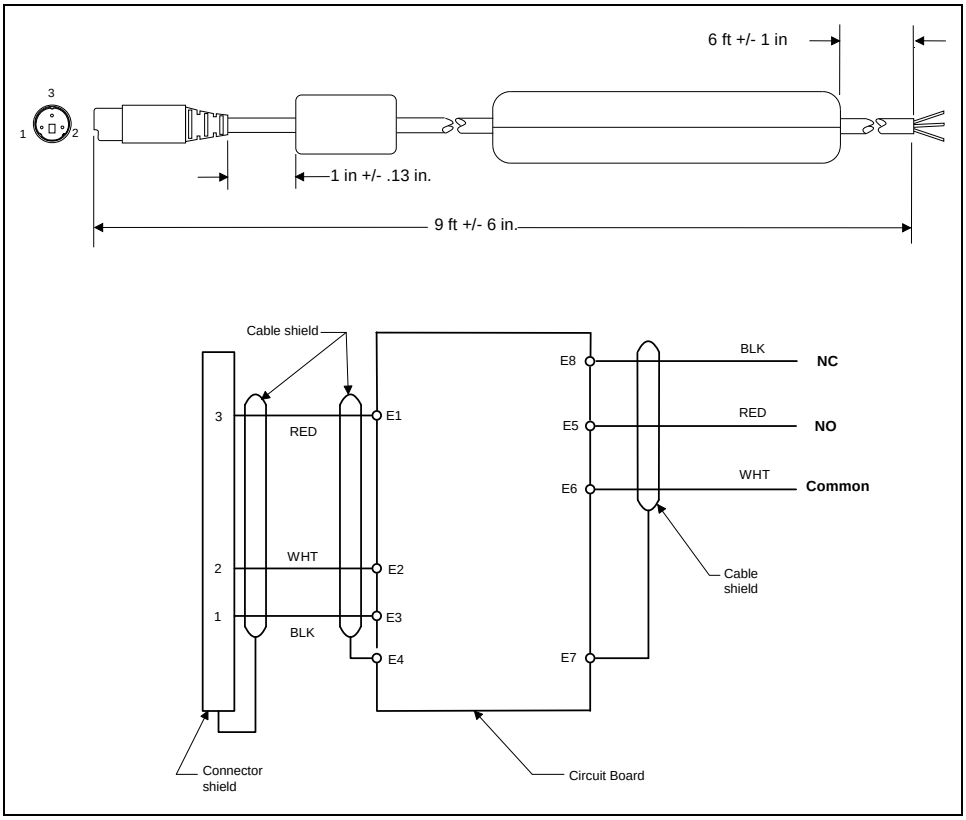


FIGURE 1-1 Nurse Call Cable (3 Pin Circular to Unterminated)

1.8 VGA Extension Cables

1.8.1 Male 15 Pin D-Shell to Female 15 Pin D-Shell and Open Ended to Female 15 Pin D-Shell

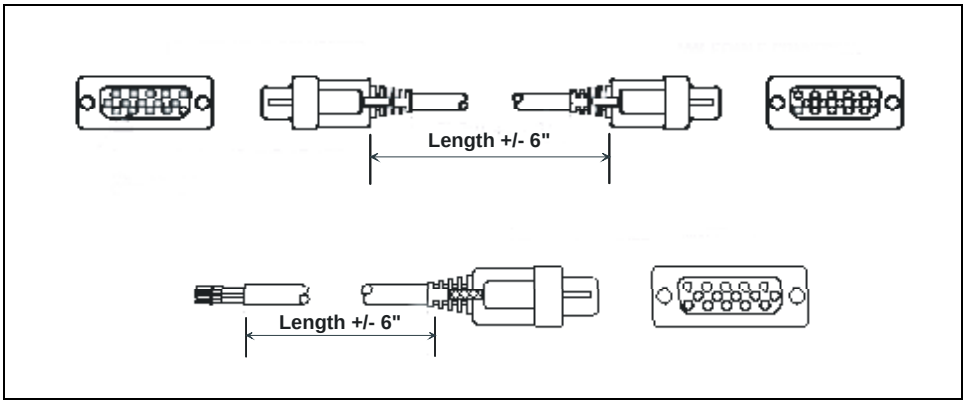


FIGURE 1-2 VGA Extension Cables

DESCRIPTION	PART NUMBER	LENGTH (FT.)
Terminated	0012-00-0852-01	6
Open Ended Unterminated	0012-00-0852-02	25
Open Ended Unterminated	0012-00-0852-03	50
Open Ended Unterminated	0012-00-0852-04	100

1.9 Serial Port to Gas Module II/SE/SE with Spirometry Cable (P/N 0012-00-1276-XX)

-01 12" 9 pin mini D serial to 25 pin D shell

-02 72" 9 pin mini D serial to 25 pin D shell

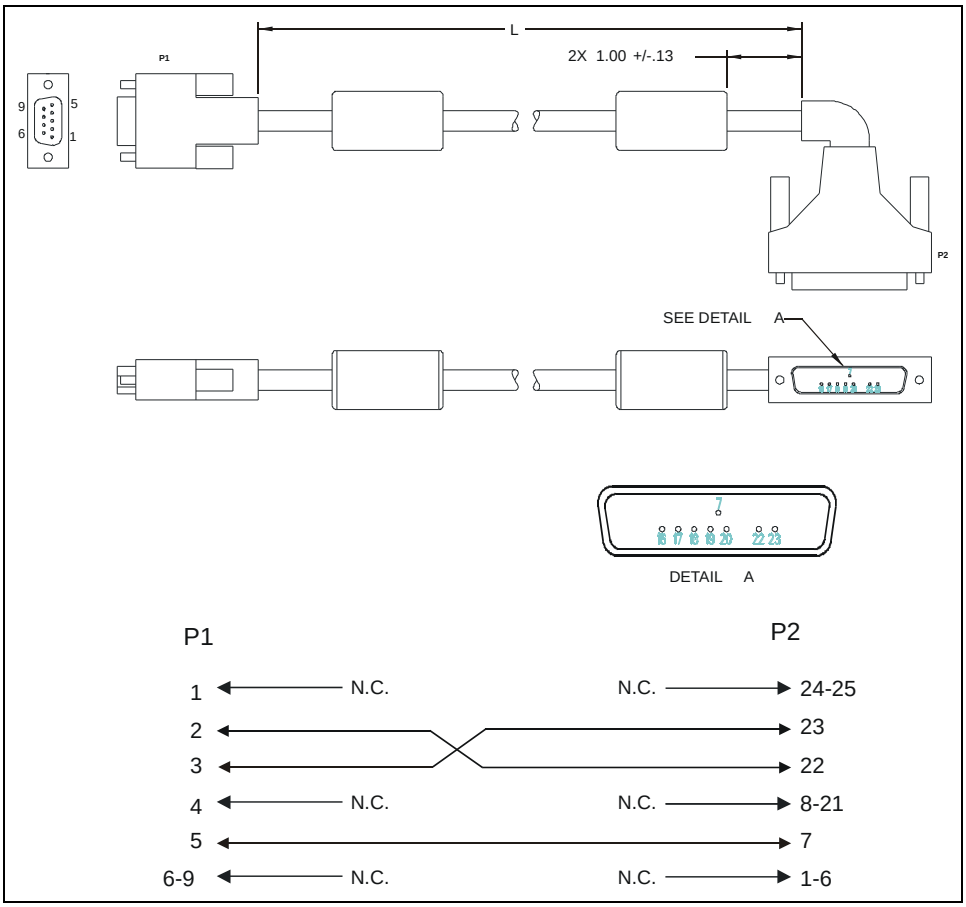


FIGURE 1-3 Serial Port to Gas Module II/SE/SE with Spirometry Cable (P/N 0012-00-1276-XX)

1.10 Serial Port to Serial Port Cable (P/N 0012-00-1275-01)

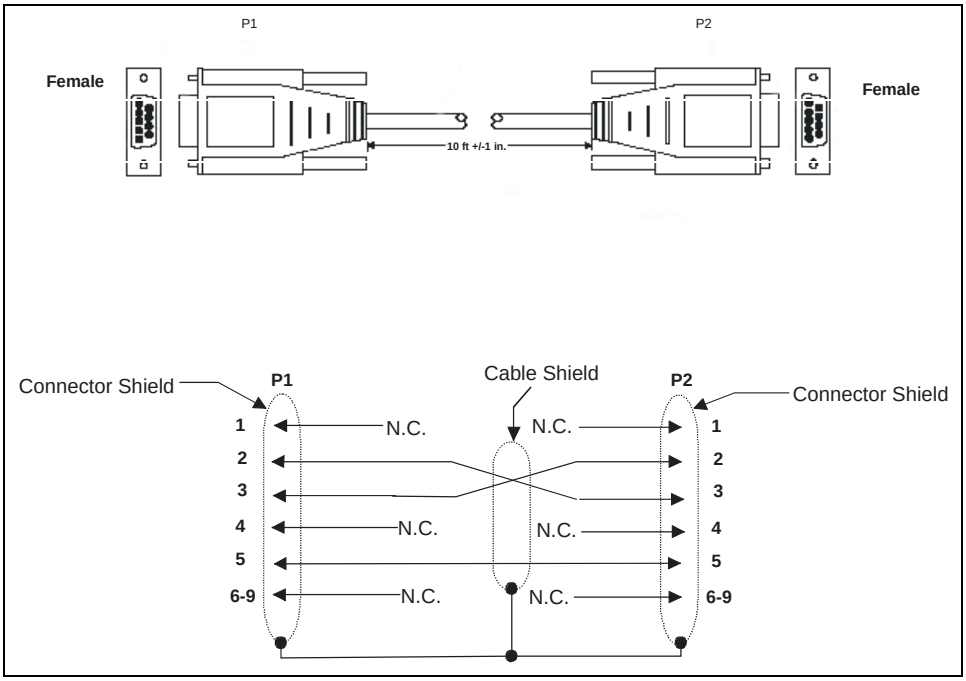


FIGURE 1-4 Serial Port to Serial Port Cable (P/N 0012-00-1275-01)

1.11 26 pin Molex to Mini Phone Plug (DPD Sync Cable)

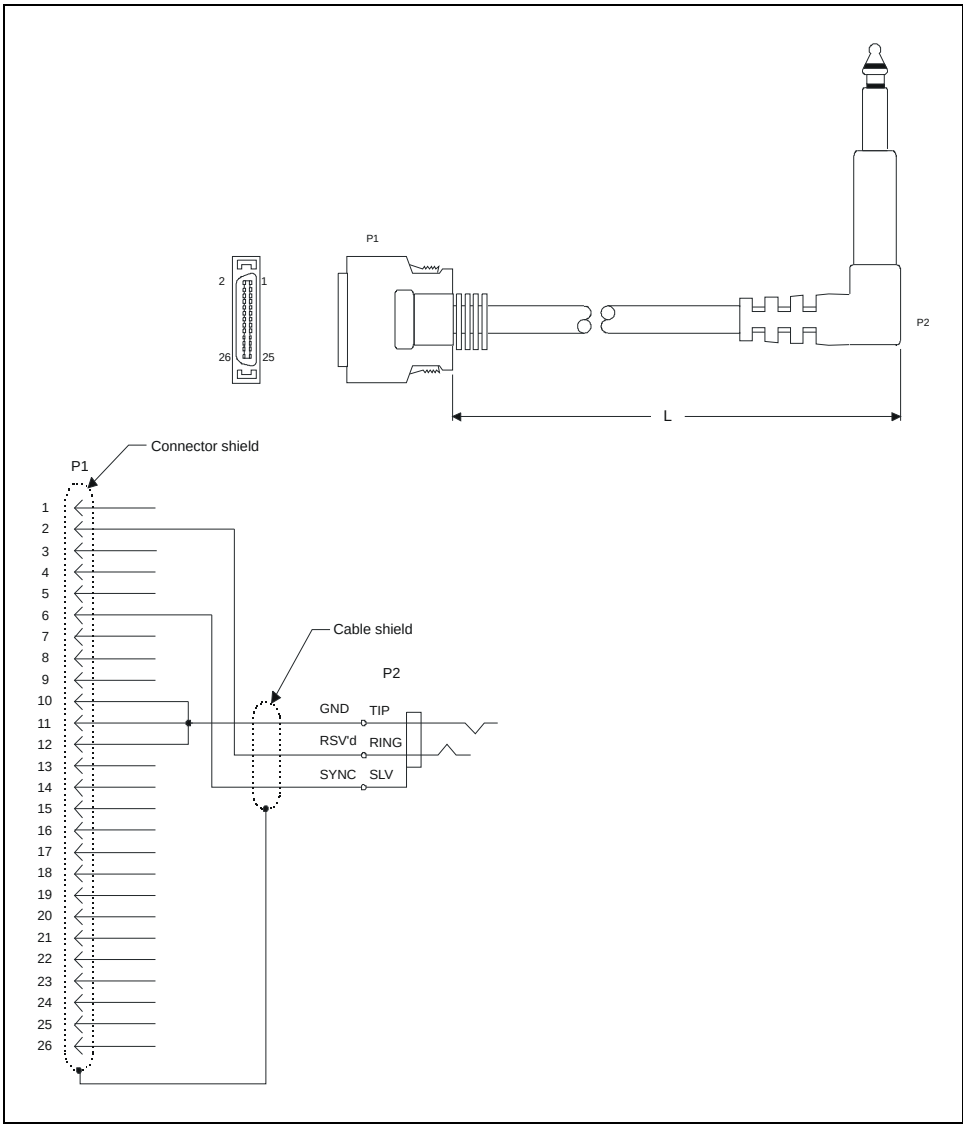


FIGURE 1-5 26 pin Molex to Mini Phone Plug (DPD Sync Cable)

PART NUMBER	LENGTH
0012-00-1301-01	8 in. +/- 1 in.
0012-00-1301-02	10 ft. +/- 6 in.

1.12 ECG Shielded Lead Wires

P/N 0012-00-1262-XX

DESCRIPTION	DASH #
18" pinch 5 lead set Domestic	-01
24" pinch 5 lead set Domestic	-02
40" pinch 5 lead set Domestic	-03
18" pinch 5 lead set International	-04
24" pinch 5 lead set International	-05
40" pinch 5 lead set International	-06
18" pinch 3 lead set Domestic	-07
24" pinch 3 lead set Domestic	-08
40" pinch 3 lead set Domestic	-09
18" pinch 3 lead set International	-10
24" pinch 3 lead set International	-11
40" pinch 3 lead set International	-12
3/40", 2/60" pinch 5 lead set Domestic	-13
3/40", 2/60" pinch 5 lead set International	-14

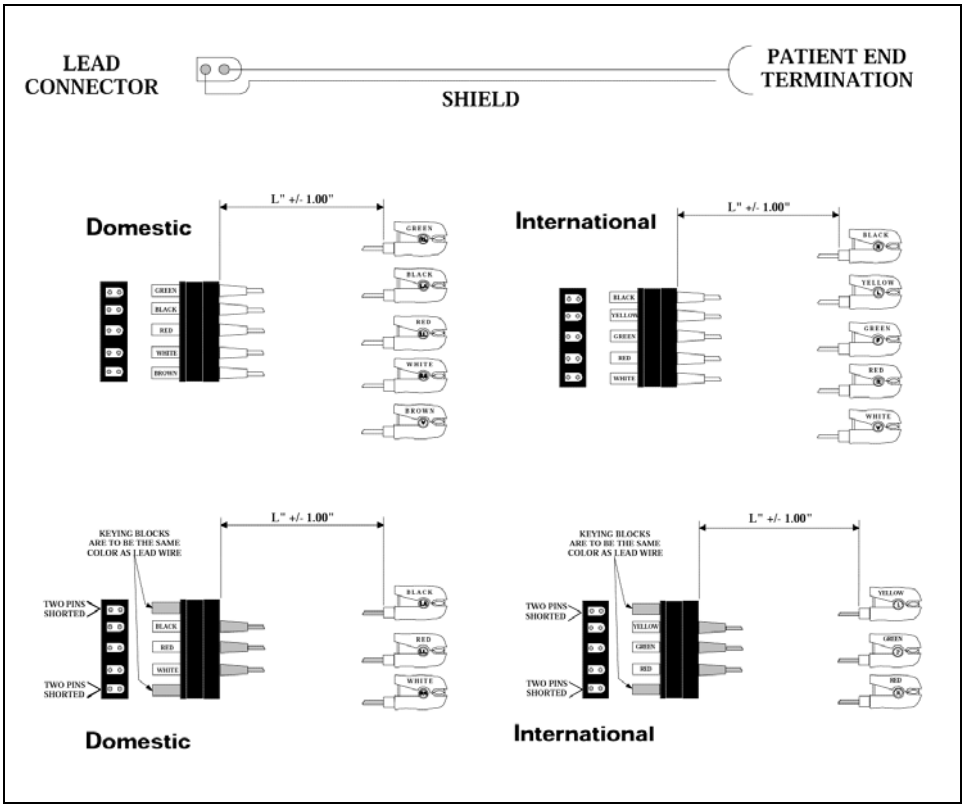


FIGURE 1-6 ECG Shielded Lead Wires

1.13 ECG Shielded Lead Wires

P/N 0012-00-1261-XX

DESCRIPTION	DASH #
18" snap 5 lead set Domestic	-01
24" snap 5 lead set Domestic	-02
40" snap 5 lead set Domestic	-03
18" snap 5 lead set International	-04
24" snap 5 lead set International	-05
40" snap 5 lead set International	-06
18" snap 3 lead set Domestic	-07
24" snap 3 lead set Domestic	-08
40" snap 3 lead set Domestic	-09
18" snap 3 lead set International	-10
24" snap 3 lead set International	-11
40" snap 3 lead set International	-12
3/40", 2/60" snap 5 lead set Domestic	-13
3/40", 2/60" snap 5 lead set International	-14

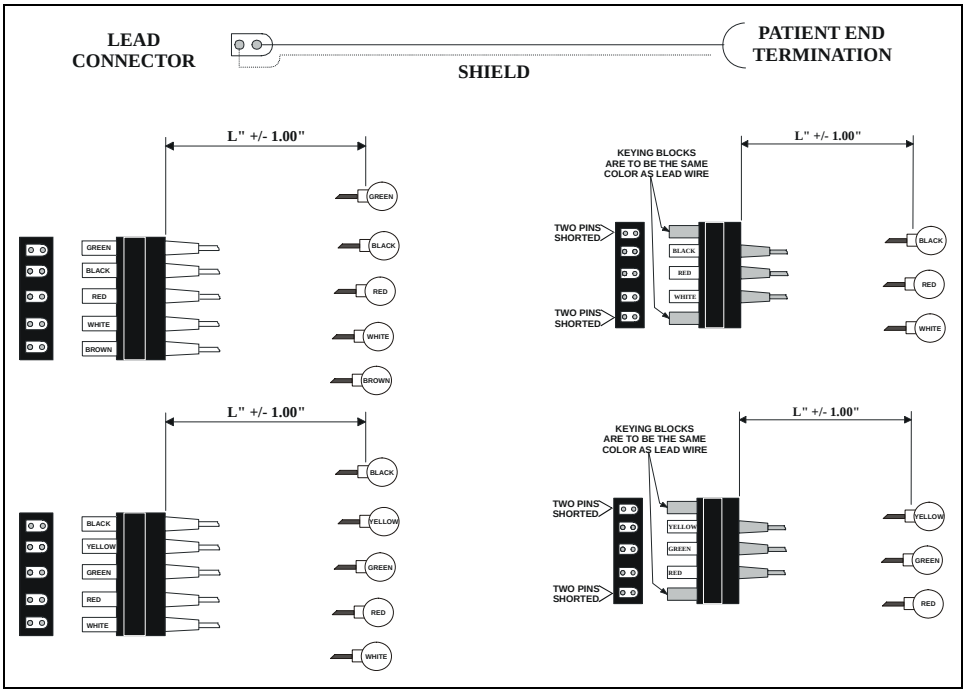


FIGURE 1-7 ECG Shielded Lead Wires

1.14 Panorama Mobility Lead Wires

P/N 0012-00-1503-XX

DESCRIPTION	DASH #
24", snap, 5 lead set, Domestic	-02
24", snap, 3 lead set, Domestic	-05
24", snap, 5 lead set, International	-11
24", snap, 3 lead set, International	-14

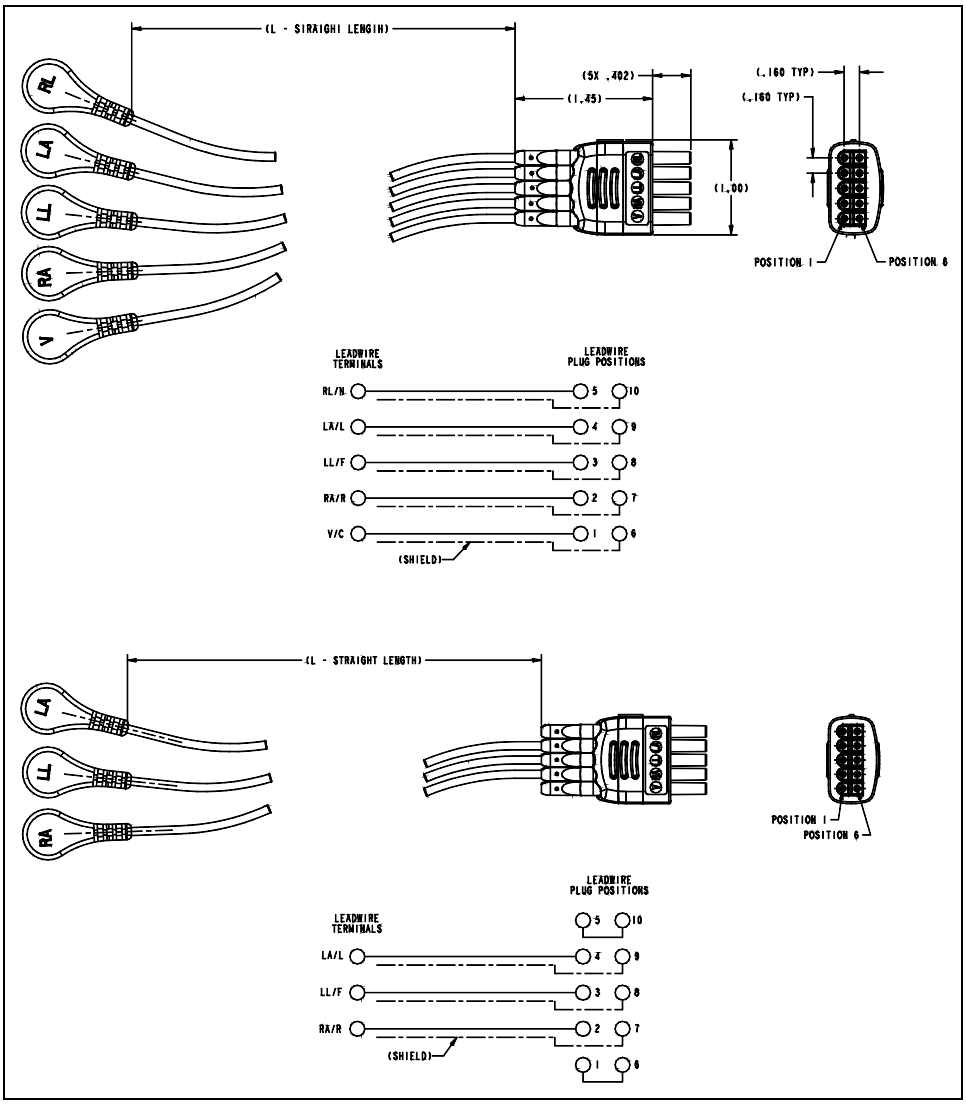


FIGURE 1-8 Panorama Mobility Lead Wires

1.15 ECG Cable ESIS and Non ESIS

P/N 0012-00-1255-XX

DESCRIPTION	DASH #
10′ Straight Non ESIS	-01
20′ Straight Non ESIS	-02
10′ Rt Angle Non ESIS	-03
20′ Rt Angle Non ESIS	-04
10′ Straight ESIS	-05
20′ Straight ESIS	-06
10′ Rt Angle ESIS	-07
20′ Rt Angle ESIS	-08

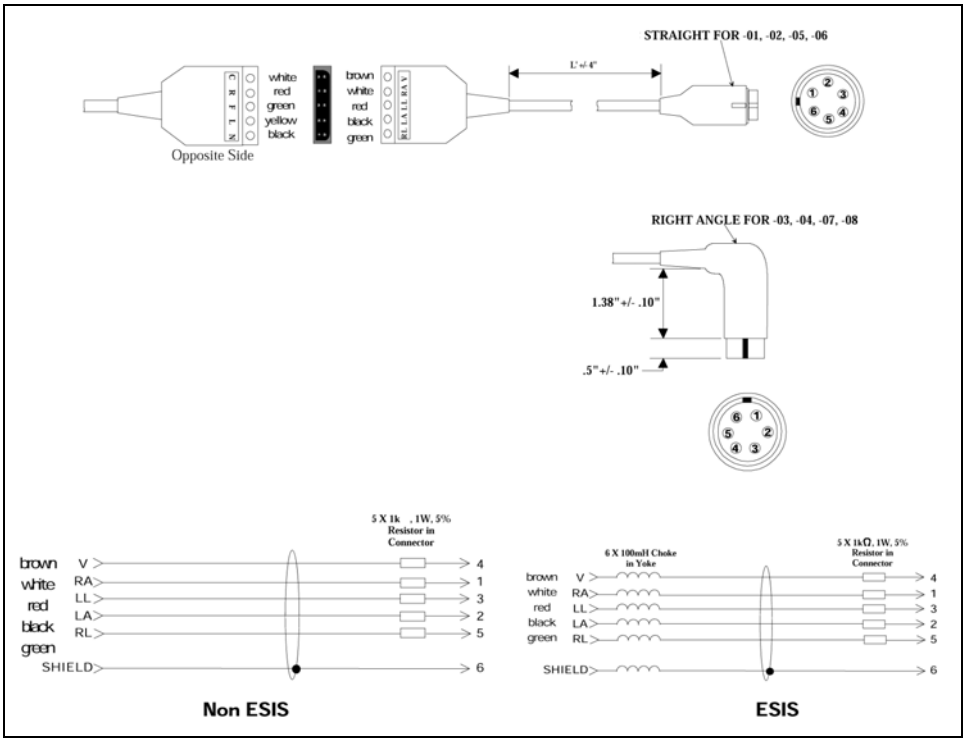


FIGURE 1-9 ECG Cable ESIS and Non ESIS

ANSI/AAMI EC53-1995		IEC CONVENTIONAL STANDARD	
LEAD	**COLOR**	**LEAD**	**COLOR**
V	Brown	Chest (C)	White
Right Arm (RA)	White	Right Arm (R)	Red
Left Leg (LL)	Red	Left Leg (F)	Green
Left Arm (LA)	Black	Left Arm (L)	Yellow
Right Leg (RL)	Green	Right Leg (N)	Black

1.16 Panorama Mobility Cable (ESIS and Non ESIS)

P/N 0012-00-1502-XX

DESCRIPTION	DASH #
Non ESIS, 10', USA	-01
Non ESIS, 20', USA	-02
ESIS, 10', USA	-03
ESIS, 20', USA	-04
Non ESIS, 10', International	-05
Non ESIS, 20', International	-06
ESIS, 10', International	-07
ESIS, 20', International	-08

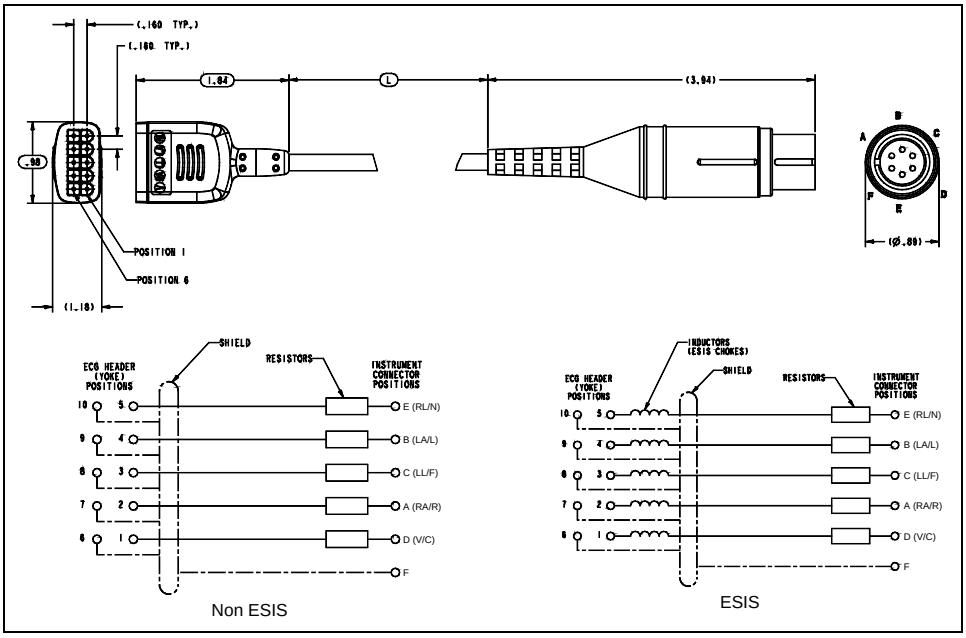


FIGURE 1-10 Panorama Mobility Cable (ESIS and Non ESIS)

ANSI/AAMI EC53-1995		IEC CONVENTIONAL STANDARD	
LEAD	**COLOR**	**LEAD**	**COLOR**
V	Brown	Chest (C)	White
Right Arm (RA)	White	Right Arm (R)	Red
Left Leg (LL)	Red	Left Leg (F)	Green
Left Arm (LA)	Black	Left Arm (L)	Yellow
Right Leg (RL)	Green	Right Leg (N)	Black

1.17 View 12™ Card Assembly

P/N 0992-00-0155-01, Spectrum® Only

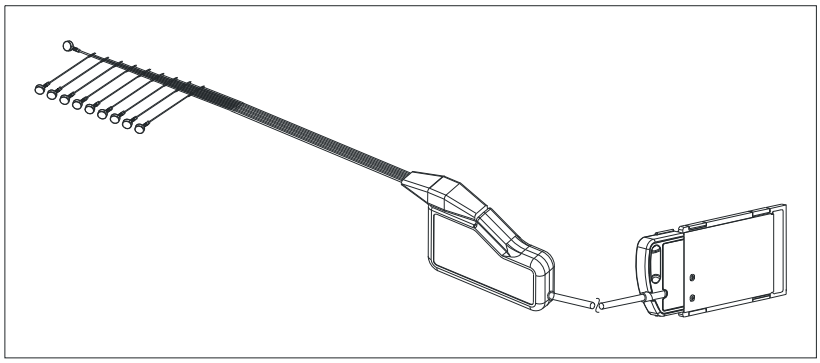


FIGURE 1-11 View 12™ Card Assembly

DESCRIPTION	PART NUMBER	NOTE
Cable Assembly Kit	0040-00-0324	Includes, Cable Assembly, Cover Label
View 12™ PCMCIA Card	0996-00-0065-01	

1.18 12 Lead Wire Set

P/N 0012-00-1411-02 (Domestic) and P/N 0012-00-1411-03 (IEC), Spectrum® Only (Not Included with View 12™ Card Assembly)

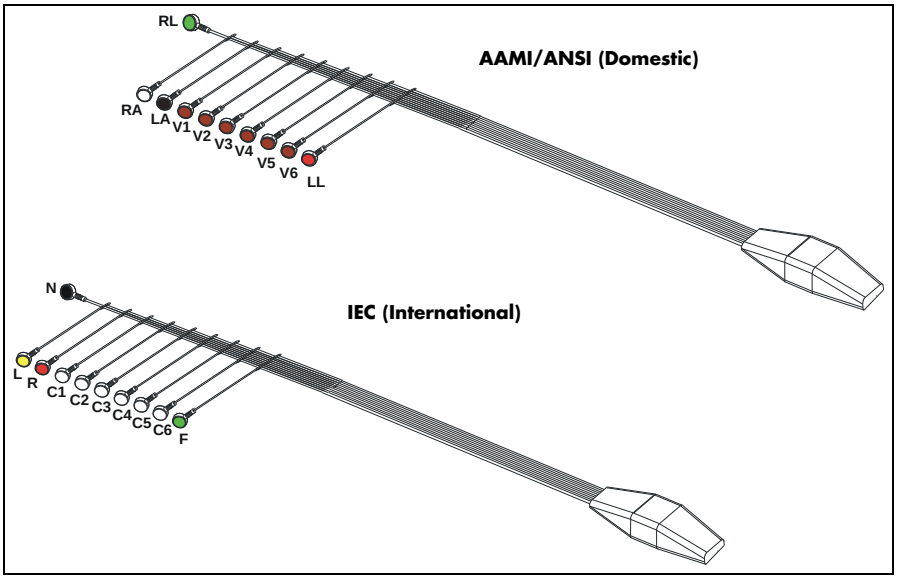


FIGURE 1-12 12 Lead Wire Set

1.19 Cardiac Output Cable

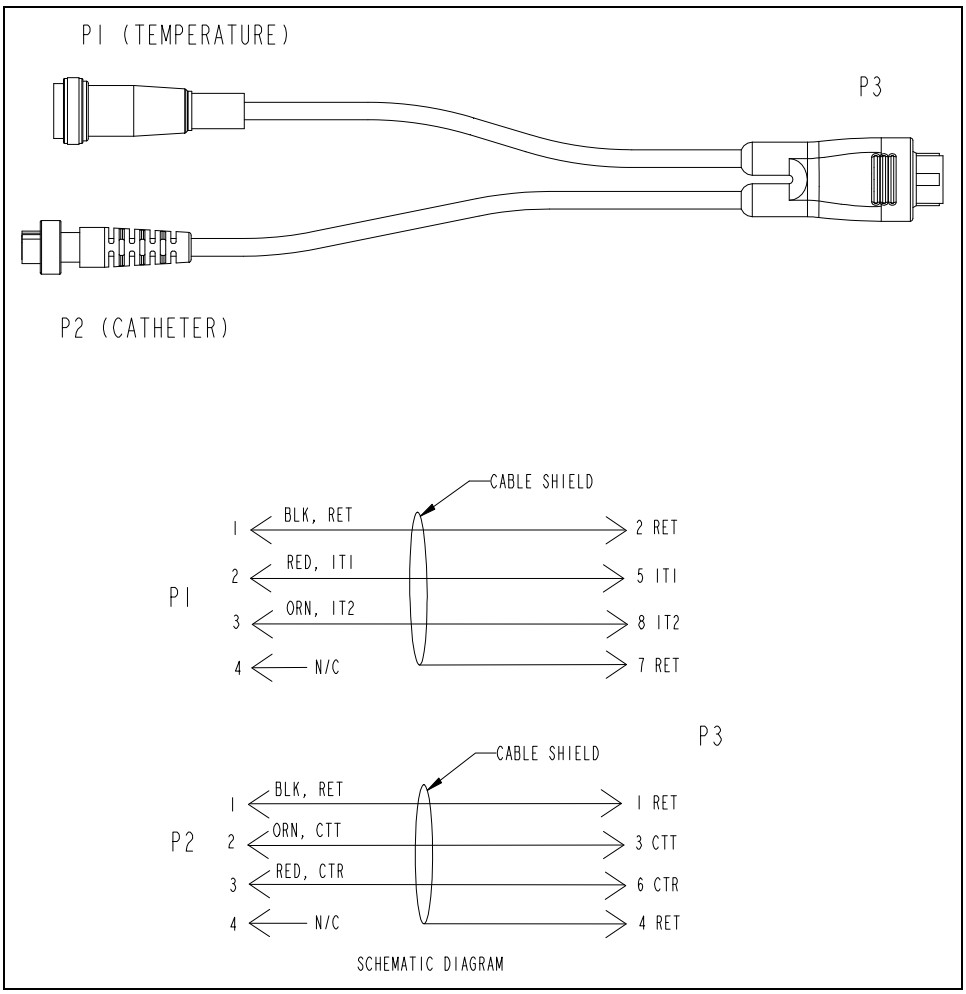


FIGURE 1-13 Cardiac Output Cable (P/N 0012-00-1447-01)

1.20 IABP Cable

1.20.1 ECG Only

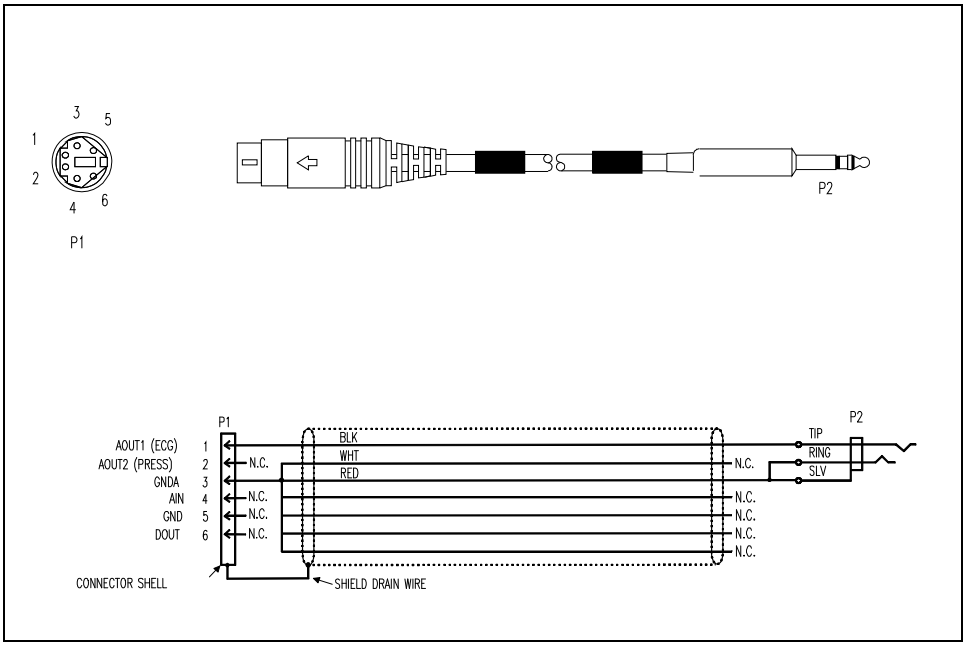


FIGURE 1-14 IABP Cable (ECG Only) (P/N 0012-00-1459-01)

1.20.2 ECG/IBP (only for serial numbers MSXXXXX-K5 and higher)

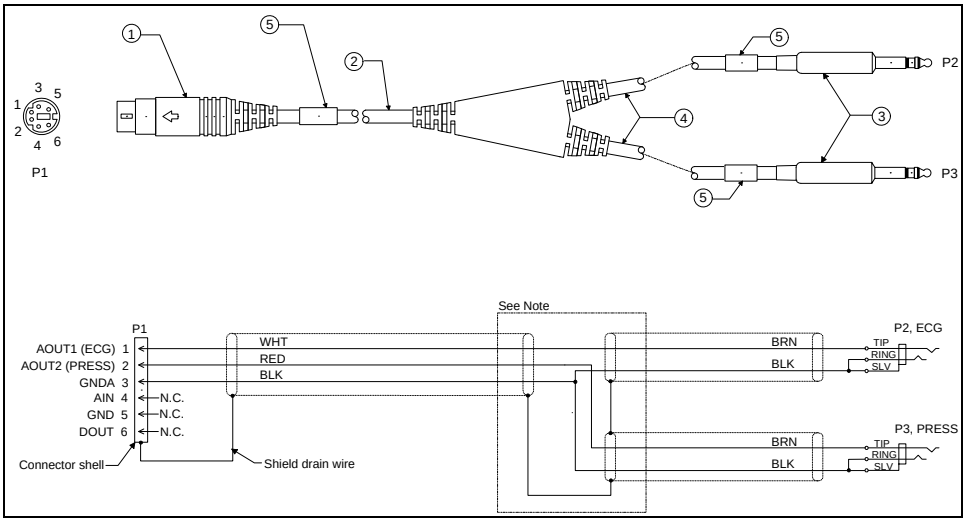


FIGURE 1-15 IABP Cable (ECG/IBP) (P/N 0012-00-1650-01)

1.21 Serial Port to RJ 45 Cable (VISA)

P/N 0012-00-1299-01, Spectrum® only

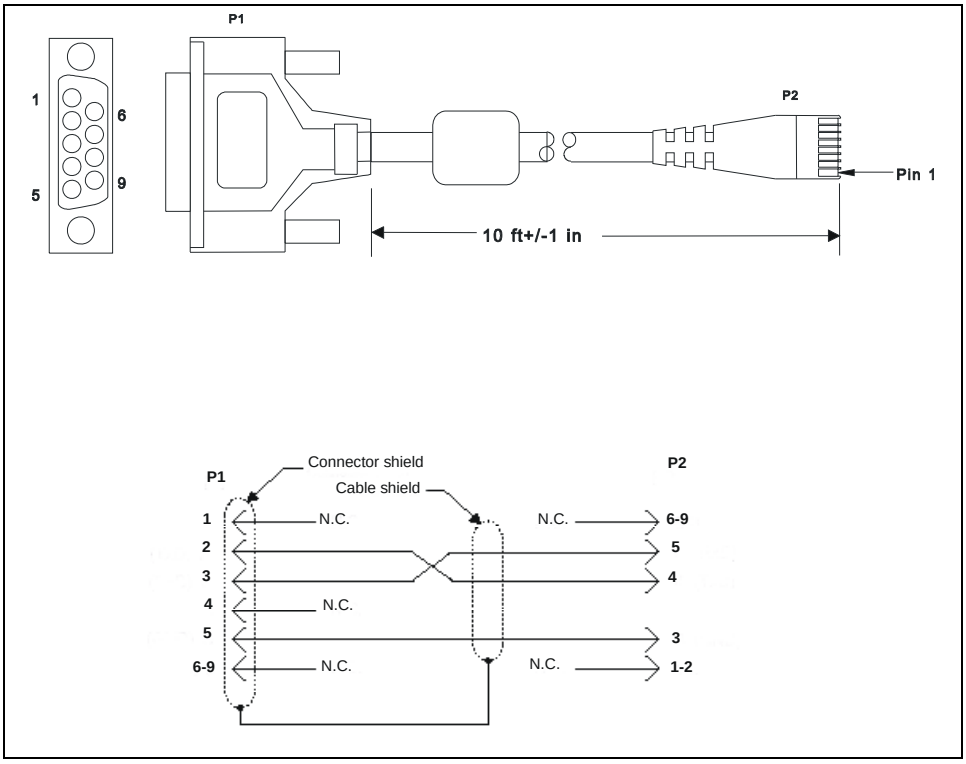


FIGURE 1-16 Serial Port to RJ 45 Cable (VISA)

1.22 BISx Module

P/N 0992-00-0236-01, Spectrum OR™ only

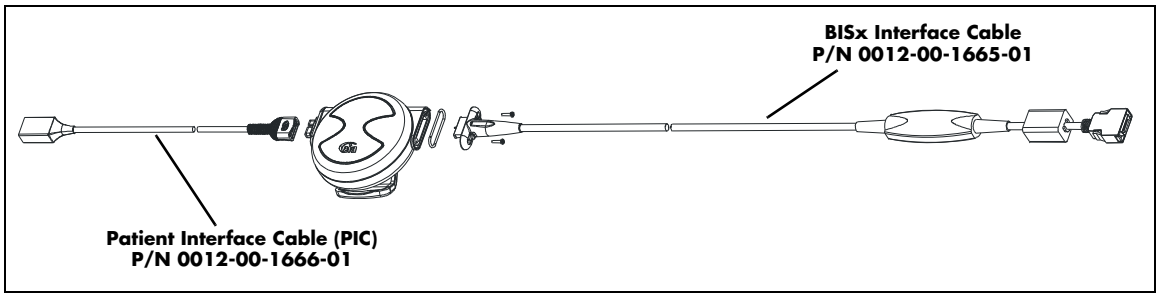


FIGURE 1-17 BISx Module (Front View)

1.23 BISx Sensors

(P/N 0020-00-0491-01, -02 and -03), Spectrum OR™ only

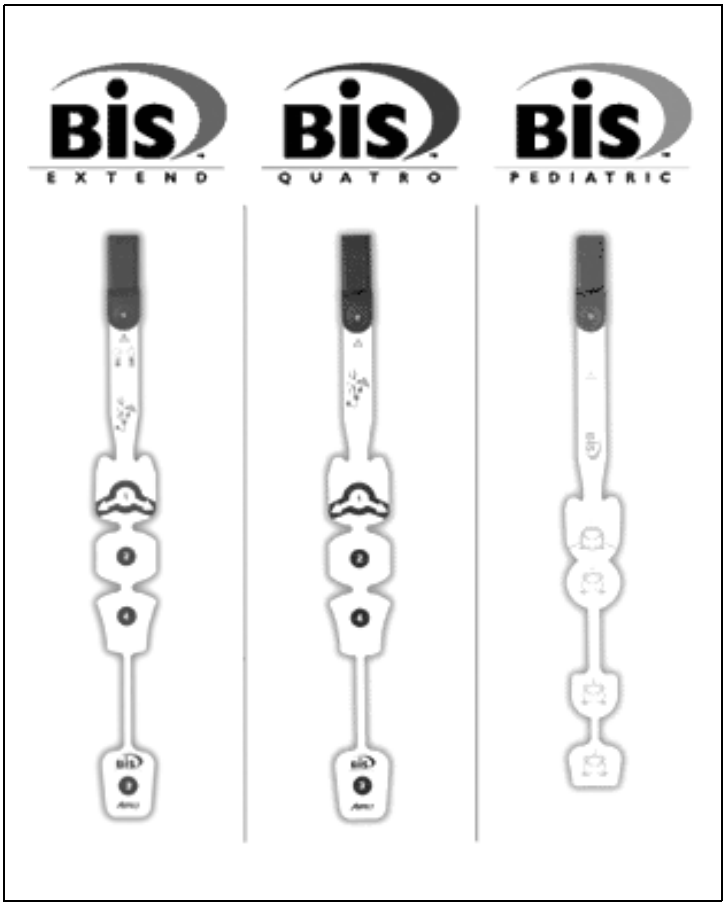


FIGURE 1-18 BISx Sensors

1.24 Beep Tones

The following tables describe the beep tones associated with the **Spectrum**® and **Spectrum OR**™ monitors:

POWER ON (SPECTRUM® AND SPECTRUM OR™)

Normal Operation	1 beep
Runtime Stack Failure	2 beeps
DRAM Memory Failure	3 beeps
PCMCIA Boot Checksum Failure	4 beeps
PCMCIA Image Checksum Failure	5 beeps
Flash Checksum Failure	6 beeps
Flash Programming Error	7 beeps
DRAM Checksum Error	8 beeps

ALARMS (SPECTRUM®)

High Priority	3 beeps/2 beeps/3 beeps/2 beeps, repeated every 10 seconds
Medium Priority	3 beeps, repeated every 30 seconds

NORMAL OPERATION (SPECTRUM®)

CO_2 Occlusion	2 beeps, repeated every 4 seconds
NIBP Unable to Measure	1 beep
Low Battery	2 beeps, repeated every minute
ECG Noise	2 beeps, repeated every 13 seconds

ALARMS (SPECTRUM OR™)

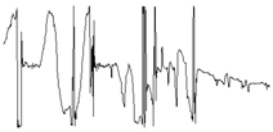
High Priority	3 beeps/2 beeps/3 beeps/2 beeps, repeated every 10 seconds
Medium Priority	3 beeps, repeated every 10 seconds

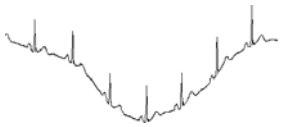
NORMAL OPERATION (SPECTRUM OR™)

CO_2 Occlusion	2 beeps, repeated every 4 seconds
NIBP Unable to Measure	2 beeps with the second beep lower in pitch than the first
Low Battery	2 beeps, repeated every minute
ECG Noise	2 beeps, repeated every 13 seconds
NIBP End Tone	2 beeps with the second beep higher in pitch than the first

1.25 Troubleshooting Menus

1.25.1 ECG Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
Noisy ECG traces 	Loose or dry electrodes.	Apply fresh, moist electrodes.
	Defective electrode wires.	Replace wires as necessary.
	Patient cable or leads are routed too close to other electrical devices.	Eliminate 60Hz interference.
Excessive Electro-surgical Interference	Wrong ECG cable used.	Use ESIS ECG cable with internal filter block. **NOTE:** Respiration monitoring via the ECG electrodes will not be available when using the cable.
Muscle Noise 	Inadequate skin preparation prior to application of electrode, tremors, tense subject, and/or poor electrode placement.	Repeat skin preparation and electrode location procedures. Apply fresh, moist electrodes. Avoid areas of the torso that are very muscular.
Intermittent Signal	Connections not tight and/or properly secured.	Ensure proper connection. (Electrode to lead, lead to cable, cable to monitor).
	Electrodes dry or loose.	Re-prep skin and apply fresh, moist electrodes.
	Cable or lead wires damaged.	Check with continuity tester.
Excessive alarms: heart rate, lead fault	Electrodes dry	Re-prep skin and apply fresh, moist electrodes.
	Alarm limits set too close to patient's normal heart rate.	Readjust
	R-wave wrong size	Must have a higher amplitude than the other ECG waves, like the P and T waves.
	Excessive patient movement or muscle tremor.	Reposition electrodes and secure with tape, if necessary.
Low Amplitude ECG Signal	Gain set too low.	Readjust as required - (Set via the **SIZE** key).
	Electrodes dry / old	Apply fresh, moist electrodes
	Skin improperly prepared	Abrade skin
	This could be the patient's normal QRS complex.	Verify with a 12-lead electro-cardiogram.
	Electrode could be positioned over a bone or muscle mass.	Move ECG patches closer towards each other.

MESSAGE/PROBLEM	REASON	SOLUTION
No ECG Waveform	Gain set too low.	Readjust as required - (Set via the **SIZE** key).
	Lead wires and patient cable not fully or properly inserted.	Check for proper insertion.
	Cable or lead wires damaged.	Check with lead continuity tester.
Base Line Wander 	Patient moving excessively.	Secure lead wires and cable to patient.
	Patient's respiration	Reposition electrodes
	Electrodes dry or loose	Re-prep skin and apply fresh, moist electrodes.
	Static build up around patient.	Check with local biomedical personnel.
	ECG Filter set to "ST" or "Extended" mode.	Set ECG Filter to "Monitor" mode.
"Artifact" Message	The 12-lead ECG is detecting muscle artifact, or electrical interference from auxiliary devices.	Check leads, follow skin preparation procedure.
		Check for electrical interferences, replace wires as necessary.

1.25.2 NIBP Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
NIBP: Idle	Displayed while system is idle. **Note: This is not displayed while in the interval mode.**	Press **START** to take a single measurement. Select an interval and start timed measurements.
NIBP: Deflate	Displayed when a measurement that is in process is stopped by pressing the **STOP** key.	Press **START** to take an immediate measurement and resume timed measurements.
NIBP: Interval	Displayed during the interval between two timed measurements.	Press **STOP** to suspend timed measurements. Change timer to **OFF** to stop timer.
NIBP: Failure	The system has detected an unrecoverable failure of the NIBP system.	Power cycle unit. If message reappears, contact Customer Support.
NIBP: Measuring	Displayed during a measurement. Cuff pressure is also displayed.	Press **STOP** to suspend a measurement and deflate the cuff.
NIBP: Retry Pump Higher	A measurement has been attempted but no reading was possible. This results from inadequate cuff inflation.	Retry will be attempted. Check that appropriate patient size is set. Preset initial inflation pressure.

MESSAGE/PROBLEM	REASON	SOLUTION
NIBP: Retry	A measurement has been attempted but no reading was possible and the retry limit has not been reached.	Retry will be attempted. Check for leaks and quality of peripheral pulses. Decrease patient movement. Switch cuff to another limb.
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. Contact Customer Support.
NIBP: Cuff Overpressure	The hardware overpressure limit has been exceeded.	Power cycle unit. If message reappears, contact Customer Support.
NIBP: Cuff Overpressure/ Press STOP to clear.	The hardware overpressure limit has been exceeded.	Press **STOP** to clear the hardware overpressure. If message reappears, contact Customer Support.
NIBP: Check Calibration	The software has detected that the overpressure transducer is out of calibration.	Have the unit calibrated. If problem persists contact Customer Support.
Unable to obtain a BP	Patient movement	Wait until patient is calm or gently hold limb.
	Cuff or hose NOT attached / leaking	Check all connections.
	HR irregular / arrhythmia present	Check Patient and notify Physician.
	Blood pressure is out of range.	Check Patient and verify BP with manual method.
	Improper cuff size / brand	Measure patient limb. Use only properly sized accessories.
Reading too high or too low	Incorrect cuff size	Measure Patient limb, use correct cuff.
	Patient movement	Wait until patient is calm or gently hold limb.

1.25.3 SpO_2 Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
SpO_2: No Sensor	Sensor is not plugged in to the **Spectrum.**	Plug the sensor into the monitor.
SpO_2: Sensor Off (Masimo SET® Only)	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: No Pulse (Nellcor Only)	No detectable pulse is measured	Check to patient connection and patient status.
SpO_2: Failure	The system has detected an unrecoverable failure of the SpO_2 system.	Power cycle unit. If message reappears, contact Customer Support.
SpO_2: Low Perfusion (Masimo SET Only)	Patient perfusion is low.	Check to patient connection and patient status.
SpO_2: Too Much Light (Masimo SET Only)	There is too much ambient room light for the sensor to function properly	Minimize the room light around the patient. Check sensor.
SpO_2: Unrecognized Sensor (Masimo SET Only)	The sensor is not recognized by the Monitor.	Replace the sensor with a recommended sensor.
SpO_2: Communication Error	The monitor and the SpO_2 modules are not communicating properly.	Power cycle unit. If problem persists, contact Customer Support.
SpO_2: Board Fault	Masimo SET board failed to operate properly.	See Proper Service Menu: Suggestion.
SpO_2: Sensor Fault	Defective Sensor.	Replace Sensor.
SpO_2: Motion (Nellcor Only)	Motion is detected	Decrease patient motion, check sensor.
SpO_2: Check Sensor (Nellcor Only)	The SpO_2 module has sensed a poor connection or a bad sensor	Reconnect the same sensor. If problem persists, replace sensor
Unable to obtain SpO_2 reading	Patient has poor perfusion.	Switch limbs / Notify physician.
	Sensor not on Patient.	Reapply sensor.
	Cables loose / not connected.	Check connections, switch cable.
	Ambient light.	Switch limbs and cover sensor with opaque material.
No SpO_2 waveform	Waveform not selected to Display.	Go to the **Display Setup Menu**, choose to display **Pleth** in the waveform area.
	Cable or sensor not plugged in	Check cable and sensor
Low amplitude SpO_2 signal	SpO_2 sensor on same limb as cuff.	Check sensor placement, move as necessary.
	Patient has poor perfusion.	Switch limb / Notify physician.

1.25.4 Temperature Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
Temperature Probes not Working	Poor contact from probes to body	Check the body surface contact at the probe tip
		Reposition or apply thermoconductive gel
Temperature not displayed	Improper display setup	Check display setup in **Monitor Setup Menu** and change as desired
	Cable not plugged in	Check the cable

1.25.5 Respiration and CO_2 Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
Resp. Waveform Too Large	Scales set inappropriately.	Change lead selection.
		Change Respiration scale.
Resp. Waveform Too Small	Patient breathing is shallow or patient is turned on side.	Change lead selection.
	Scale set inappropriately.	Change respiration scale.
False Apnea Alarm	Apnea delay may be improperly set.	Choose an.other apnea delay
	Patient may be having frequent episodes of CVA.	Reposition electrodes to better detect respirations.
	Scale size may be too low.	Change Respiration scale
No Resp. Waveform or Rate Displayed	Respiration turned **Off.**	Turn respiration **On** (**Off** will be displayed in Resp. window).
	Patient connected using ESIS choke cable.	Check that proper patient cable is used. Use non ESIS patient cable.
	Cable not connected.	Check cable.
CO_2: FilterLine® Disconnected	The FilterLine is not connected to the monitor.	Connect the FilterLine.
CO_2: Warming Up	The CO_2 sensor has not reached its operating temperature.	Wait for the message to go away.
	(The monitor was just turned on).	It takes typically 30 seconds for the sensor to warm up.
CO_2: Auto-zero In Progress	The CO_2 sensor is. performing an auto-zero	Wait for the auto-zero to complete.
CO_2: Auto-zero Requested	An **Auto-zero** was automatically requested by the system.	Wait for the auto-zero to complete.
CO_2: Failure	CO_2 system failure.	Contact Technical Support.

MESSAGE/PROBLEM	REASON	SOLUTION
CO_2: Occlusion	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 if necessary.
		Disconnect and reconnect the FilterLine from the **Spectrum** in order to clear this message.
CO_2: Purge	The system has detected a blocked FilterLine® and has attempted to unblock it by temporarily increasing the flow rate.	Check FilterLine and replace if necessary.
CO_2: Check Flow Rate	The system has detected a high or low flow rate.	Check FilterLine and replace if necessary.
"CHK Lead" Message	Increased impedance caused by one of the following:	
	Chest hair under electrodes.	Prep chest.
	Dried electrode gel.	Change electrodes.
	Electrode off.	Replace electrode.
	Lead off.	Replace lead.
	Cracked lead wires.	Replace lead wires.
	Poor skin prep.	Clean and abrade skin before applying electrodes.
"CVA" Message	Can be caused by shallow breathing or an apnea event.	Check the patient.
	Patient HR and respiratory rate identical.	Adjust scales or leads if necessary.
		Check the patient.

1.25.6 Gas Module Troubleshooting

MESSAGE/PROBLEM	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 five minutes for the device to warm up.
GM: Agent Warming Up	This message appears after the **GM: Warming Up** message disappears. It indicates that the Agent ID Bench is warming up and readings will not be available.	Wait for the message to go away. It takes up 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 contact Customer Support.

MESSAGE/PROBLEM	REASON	SOLUTION
GM: Mixed Agents	Appears 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.	Turn Gas Module and **Spectrum** Off.
	Also may appear when the Gas Module has been turned on without a sample line attached.	Install/check sample lines, filters, water trap and electrical connections.
	Gas Module has been on for a long period of time without the **Spectrum** Monitor being on.	Turn off Gas Module.Turn on Gas Module and **Spectrum** Monitor.
GM: Replace Trap	Indicates residue build-up on the water trap membrane that is decreasing 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, contact Customer Support.
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, contact Customer Support.
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, contact Customer Support.
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, contact Customer Support.
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, contact Customer Support.
GM: Pump Off	Appears when the system has turned off the pump due to a pneumatic error.	Restart the pump from the **Gas Menu**. If problem persists, contact Customer Support.
GM: Agent Mismatch - HAL	Appears when the system detects Halothane as the primary agent and the manually selected agent is not Halothane.	Match the Agent administered with the Agent selected, or select **Agent Auto ID**.
GM: Agent Mismatch - ISO	Appears when the system detects Isoflurane as the primary agent and the manually selected agent is not Isoflurane.	Match the Agent administered with the Agent selected, or select **Agent Auto ID**.

MESSAGE/PROBLEM	REASON	SOLUTION
GM: Agent Mismatch - ENF	Appears when the system detects Enflurane as the primary agent and the manually selected agent is not Enflurane.	Match the Agent administered with the Agent selected, or select **Agent Auto ID**
GM: Agent Mismatch - SEV	Appears when the system detects Sevoflurane as the primary agent and the manually selected agent is not Sevoflurane.	Match the Agent administered with the Agent selected, or select **Agent Auto ID**
GM: Agent Mismatch - DES	Appears when the system detects Desflurane as the primary agent and the manually selected agent is not Desflurane.	Match the Agent administered with the Agent selected, or select **Agent Auto ID**
GM: Unknown Agent	Appears when the system detects a gas that does not match the spectroscopic signatures of the five known anesthetic agents	Use recognized agent
GM: Cannot Zero... RETRYING	Appears when the **Spectrum** requests **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 persist, contact Customer Support.
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, contact Customer Support.
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, contact Customer Support.
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, contact Customer Support.
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, contact Customer Support.
GM: Failed	Appears when the Gas Module detects an unrecoverable error in its own operation	Contact Customer Support.
GM: Disconnected	Appears when the **Spectrum** cannot detect signals being sent by the Gas Module	Ensure Gas Module is turned on and interface cable is properly connected. If problem persists, contact Customer Support.

MESSAGE/PROBLEM	REASON	SOLUTION
Sampling Error	Appears when a sampling error occurs on one or more Gas Module channels during calibration	Repeat calibration procedure. If problem persists, contact Customer Support.
Not Ready For Calibration	Appears when the Gas Module is unable to initialize calibration	Repeat calibration procedure. If problem persists, contact Customer Support.
Calibration Error, Sampling Error	Appears when a sampling error occurs in all four Gas Module channels during calibration	Repeat calibration procedure. If problem persists, contact Customer Support.
Calibration Error, Zeroing Error	Appears when the Gas Module cannot perform a **Zeroing** during calibration	Repeat calibration procedure. If problem persists, contact Customer Support.

1.25.7 IBP Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
Damped Invasive Waveform	Air bubbles in tubing.	Eliminate air from tubing.
	Kinked catheter.	Change position of catheter, check patient.
	Catheter against wall of blood vessel.	Check for leaks at connector, flush catheter.
	Blood in tubing	Pump pressure bag up to 300 mmHg.
	Catheter partially occluded with clot.	Consult physician.
IBP not Displayed / No IBP Waveform	Improper Setup.	Check display setup in monitor setup.
	Cable not plugged in	Check cable.
	Transducer not connected.	Check transducer connection.
	Stopcock turned improperly.	Check transducer.
	Transducer not zeroed.	Check and zero the transducer.
Abnormally High or Low readings	Transducer too HIGH or to LOW.	Check patient adjust transducer rezero.
Unable to Zero	Stopcock not open to atmosphere.	Check transducer.
	Cable/Transducer not plugged in.	Check cable.

1.25.8 PAWP Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
Unable to Wedge	Improper catheter position	Check PA catheter, notify physician
	Catheter against wall or blood vessel	Flush catheter, notify physician
PA catheter in Spontaneous Wedge	Catheter in too far	Notify physician immediately
“Overwedging” or dampened PAWP	Balloon overinflated	Deflate balloon, reinflate slowly, notify physician

1.25.9 EPM Cardiac Output Troubleshooting

MESSAGE/ PROBLEM	REASON	SOLUTION
CO value higher / lower than expected	Computation constant incorrect for PA catheter type, injectate temperature, and injectate volume.	Check computation constant and enter correct data.
	Catheter may be kinked or not in proper position.	Notify physician.
No measurement/ Unable to measure	Unstable temperature.	Check injectate temperature.
	No temperature or temperature out of range.	Flush PA catheter.
	Time elapsed for measurement.	Discard bolus fluid.
		Check patient.
		Wait for **Ready** or **Inject when Ready** message to appear. Rebolus when ready.
CO Signal Under Range	Appears if the CO curve is not sufficient for a CO calculation or if a curve is not detected within thirty (30) seconds	Rebolus if necessary
CO Out of Range	Appears if the CO is out of the measurable range (0.2 l/min to 20.0 l/min). Computation constant incorrect for PA catheter type, injectate temperature, and injectate volume.	Check computation constant and enter correct data. Rebolus when ready.
Irregular curve	Improper injection procedure.	Check hospital policy, inject in a smooth and fluid bolus.
	Catheter may be kinked or not in proper position.	Notify physician.
	Patient movement during injection.	Have patient lay still during bolus procedure.
	Measurement displayed if CO curve has multiple peaks, failure to return to baseline or irregularities in curve.	Rebolus when ready
Delayed Injection	Appears if the time between the start of the CO measurement and the onset of the temperature change is more than fifteen (15) seconds	Rebolus when ready.
		Ensure that the CO bolus is initiated within 15 seconds
		Check the temperature of the injectate
Injectate Temp Error	Appears when the temperature of the injectate is too warm (>27°C) or the difference between the injectate and the blood temperature is <8°C.	Check injectate fluid, insure fluid is not under warm lights, near a warming blanket or another warm source.
Noisy Baseline	Cardiac Output waveform baseline is unstable	Rebolus when ready.
Measuring	Appears once an injection is detected during the process of a CO run.	
Injectate Temp. Out of Range	Appears when the temperature of the injectate is too warm (>27°C) or the difference between the injectate and the blood temperature is <8°C.	Check injectate fluid, insure fluid is not under warm lights, near a warming blanket or over-chilled in the ice bath.

MESSAGE/ PROBLEM	REASON	SOLUTION
Inject When Ready	Appears if **Auto Start** is enabled, stable temperatures are detected	Bolus when ready
Ready	Appears if **Auto Start** is not enabled, and stable temperatures are detected	Press **START** when ready
Inject Now	Appears once **START** has been pressed, before bolus is initiated	Bolus when ready
Please Wait	Appears after fluid bolus is initiated and Cardiac Output is being calculated	Wait until message disappears

1.25.10 Vigilance Cardiac Output Troubleshooting

MESSAGE/ PROBLEM	REASON	SOLUTION
CO: Check Vigilance.	This message is displayed when an alert or alarm status has been sent from the Vigilance to the Spectrum.	Refer to the Edwards Vigilance® Monitor Operator's Manual or contact Edwards Lifesciences Corporation for assistance. Within the USA: (800)-424-3278 Outside the USA: (949)-250-2500

1.25.11 BIS Troubleshooting

MESSAGE/ PROBLEM	REASON	SOLUTION
BIS: Check Sensor	Incorrect sensor application.	Read Instructions on sensor package and re-prep sensor.
	Poor sensor connections.	Check sensor connections.
	Sensor Check fails.	Re-prep again or replace sensor. Verify Sensor Check passes.
	Defective PIC.	Replace the PIC.
	Defective BISx.	Replace the BISx.
	Problem is detected relating to sensor ground element. Sensor Overcurrent Sensor is using too much current.	Disconnect and examine sensor connection. Clean any contamination present. Replace sensor if necessary.
BIS: No Sensor	Disconnected sensor.	Connect the sensor.
	Poor or contaminated connection between sensor and PIC.	Connect/clean connection between sensor and PIC.
	Disconnected PIC.	Connect the PIC.
	Defective PIC.	Replace the PIC.
	Defective BISx.	Replace the BISx.
BIS: Artifact	Artifact, such as those generated by motion or eye blinks, is causing loss of EEG recognition. The BIS value and other trend variables that are adversely affected by artifact are not displayed.	Attempt to identify and eliminate artifact source.

MESSAGE/ PROBLEM	REASON	SOLUTION
BIS: Check SQI Level	EMG Bar indicates electrical activity that may be interfering with EEG recognition.	If EMG bar is illuminated, attempt to determine and eliminate cause.
	Defective PIC.	Verify Sensor Check passes. If not, replace PIC.
	Defective BISx.	Replace the BISx.
	NOTE: This message is displayed when the Signal Quality is less than half of the level desirable for optimal monitoring conditions or when the signal quality is too low to accurately calculate a BIS value. This may occur as the result of artifact (non-EEG signal) such as that generated from motion (patient movement or eye blinks) or the presence of electrocautery, warming blankets, or other devices.	
BIS: Invalid Sensor	Poor or contaminated connection between sensor and PIC.	Connect/clean connection between sensor and PIC.
	Defective sensor.	Replace the sensor.
	Defective PIC.	Replace the PIC.
	Defective BISx.	Replace the BISx.
BIS: Noise	The signal from the electrode goes beyond the measurable range	Re-prep the electrodes and check all connections.

1.25.12 Alarm Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
High or Low or No Alarm Sound	Alarm limits not set	Go to **Alarm Setup** and adjust alarms
	Alarm **Mute All, On** time has not expired	Press **MUTE ALL** to reactivate alarms
No Arrhythmia Alarm Sound	Arrhythmia option not installed	Call Sales Rep to purchase option
	Arrhythmia Alarms off	Go to **Monitor Setup** / **Advanced Setup** to activate alarm
	Monitor is in learning mode	Wait until learning is concluded and monitor patient closely
Alarms continue to Sound despite pressing **MUTE**	More than one alarm is active	Press **MUTE** or **MUTE ALL** key to silence
		Check Patient
No Alarm printout with Alarm violation	**Print on Alarm** is set to **Off**	Go to **Print Menu** and set **Print on Alarm** to **On**

1.25.13 Trends Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
No Trends displayed	No Trend triggers set	Go to the **Monitor Setup Menu** and set **NIBP Trend, Trend Interval** or **Alarm Trend** as desired
	Trend page is scrolled	Use scroll button in **Trend Menu** to scroll to top of **Trend Menu**

1.25.14 Printer/Recorder Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
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
Local Printer Door Open	The printer door is not closed	Close the printer door
Local Printer Out Of Paper	Printer out of paper	Replace with a new roll of paper
Printer Busy	Printer received multiple print requests at one time	Wait until the printer is not busy
Local Printer Unable To Print	The system has detected an unrecoverable printer failure	Power cycle unit. If message reappears, contact Customer Support.
Check Laser Printer	Laser printer is busy, disconnected, out of paper or has a fault condition	Check laser printer
No print on Alarm	Alarm printing not active	Go to **Print Setup Menu** and set **Print on Alarm** to **On**
Trends not printing	Print Trend not pressed	Press **PRINT TREND** when trend window is open
	No Trends displayed	Use **scroll** feature to scroll to the top of the trend then press **PRINT TREND**
	No paper	Check / Replace paper

1.25.15 Monitor/Display Troubleshooting

MESSAGE/PROBLEM	REASON	SOLUTION
No trace for a desired parameter	Improper attachment of transducer or cable to monitor	Check transducer / cable connection.
	Faulty transducer or cable.	Try a new transducer or cable.
Trace Not Moving	**FREEZE** key may have been pressed.	Press the **FREEZE** key to unfreeze the trace.
Display Appears to be Off	Mains power switch may not be on.	Check mains power switch on side panel.
	Unit may not be plugged into an AC outlet.	Check power cord (Is it plugged in?)
	If used as a portable, battery pack may be drained.	If battery pack is drained, plug into an AC outlet to recharge the battery
	12-lead card removed without disabling 12-lead.	Always disable 12-lead card prior to removal.
		Power unit back on. Contact Customer Support.
Disabled Alarm Tone	**MUTE** key pressed.	Check for alarm mute symbol and message.
	Beep volume low.	Increase beep volume.
Cooling Fan Failure	The unit running on AC power and the cooling fan is not operational.	Contact Customer Support.
Patient Information did not appear on display	No data entered.	Enter proper patient data.
	Done was not selected from keypad after entering data.	Go to the proper keypad enter data, select **Done** when finished.
Incorrect Date or Time	Data not entered or entered incorrectly.	Follow instructions from **"How to Set the Clock / Date and Time"**.

1.26 Installation Menu

1.26.1 Installation Mode

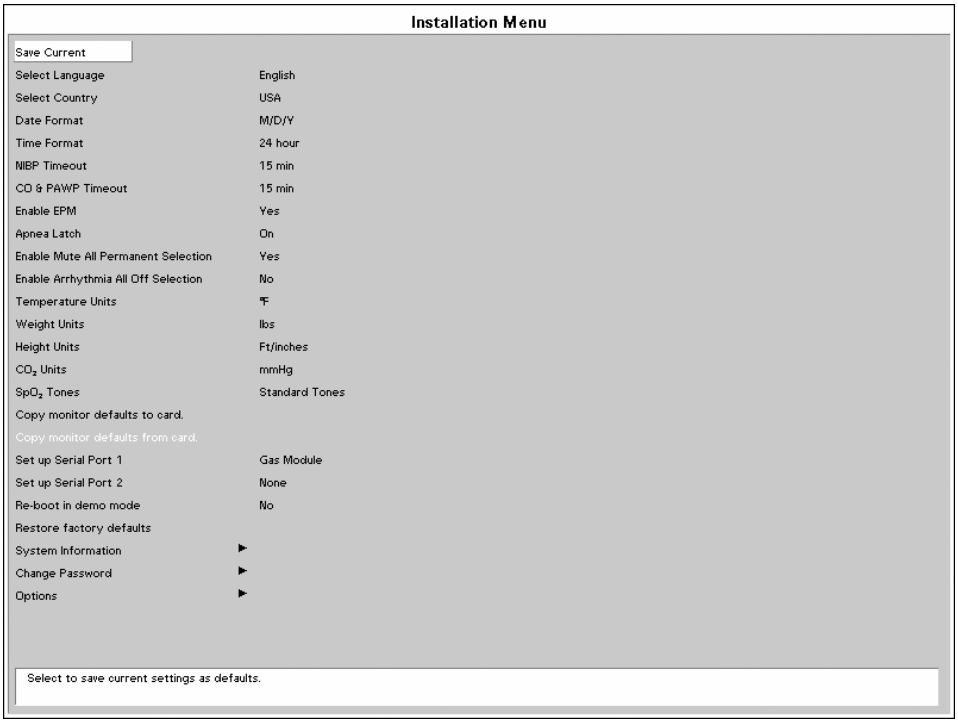


FIGURE 1-19 Installation Menu

The following items are set through the Installation Mode menu: Language, Country, Date Format, Time Format, NIBP Timeout, CO & PAWP Timeout, Enable EPM, Apnea Latch (Spectrum OR only), Enable Mute All Permanent Selection (Spectrum OR only), Enable Arrhythmia All Off Selection (Spectrum OR only), Temperature Units, Weight Units, Height Units, CO_2 Units, SpO_2 Tones (Spectrum OR only), Copy monitor defaults to card, Copy monitor defaults from card, Set up Serial Port 1, Set up Serial Port 2, Re-boot in demo mode, Restore factory defaults, System Information, Change Password (Spectrum OR only), and Options.

1. Enter Installation Mode by pressing and holding the **DISCHARGE** key (**Spectrum**®) or the **TRENDS** key (**Spectrum OR**™) while powering **ON** the monitor.
2. Set each item as necessary. The operation of the menu is the same as that of the normal operating mode. To save all of the selected settings, choose **Save Current** before exiting this menu. To access the normal operation screen, power the unit **OFF** and **ON** again.

The following table describes the Installation Menu structure:

MENU TITLE ON SCREEN	MENU CHOICES	DEFAULT	ACTIONS/ COMMENTS
Save Current			Select to save current settings as defaults
Select Language		Set up at factory	Select to change language
Select Country		Set up at factory	Select to change country
Date Format	M/D/Y, D/Y/M	Per country	Select to change date format
Time Format	12, 24 hour	Per country	Select to change time format
NIBP Timeout	15, 30, 45, 60 mins	15	Selects time old and data is removed from screen
CO & PAWP Timeout	15, 30, 45 mins, 1, 2, 4 hr	15 min	Select to change CO and PAWP timeout.
Enable EPM	Yes, No	No	Select to enable EPM module
Apnea Latch	On, Off	On	Select to turn apnea alarm latching on or off.
Enable Mute All Permanent Selection	Yes, No	Yes	Select to enable or disable the Permanent Audio Off menu selection.
Enable Arrhythmia All Off Selection	Yes, No	No	Select to enable or disable the Arrhythmia All Off menu selection.
Temperature Units	° F, ° C	° F - USA ° C - All others	Select to change temperature units
Weight Units	lbs, kg	lbs - USA kg - All others	Select to change weight units
Height Units	ft/ inches, cm	ft/ inches - USA cm - All others	Select to change height units
CO_2 Units	mmHg, %, kPa	mmHg	Select to change CO_2 units
SpO_2 Tones	Standard Tones, Alternate Tones	Standard Tones	Select to change the SpO_2 tones.
Copy monitor defaults to card.			Select to copy the monitor defaults and settings to a data transfer card inserted into PCM2
Copy monitor defaults from card.			Select to copy the monitor defaults and settings from a data transfer card inserted into PCM2

MENU TITLE ON SCREEN	MENU CHOICES	DEFAULT	ACTIONS/ COMMENTS
Set up Serial Port 1	None, VISA with admit, DIAP, Accutorr, Gas Module, Patient Net (menu choices are present only if options are installed)	None	Select to set up a serial output protocol port
Set up Serial Port 2	None, VISA with admit, DIAP, Accutorr, Gas Module, Patient Net (menu choices are present only if options are installed)	None	Select to set up a serial output protocol port
Re-boot in demo mode	Yes, No	No	Set to **YES** to start the monitor in demonstration mode on next power-up. Normal monitoring will resume after cycling power in demonstration mode.
Restore factory defaults			Select to restore factory defaults
System Information			Select to set up users screen
Change Password			Select to change password.
Options			Select to add/view options

1.26.2 Transferring Monitor Default Settings

When installing several monitors with identical display and alarm settings, a Transfer Card (**Spectrum**® P/N 0996-00-0094-01 only, **Spectrum OR**™ P/N 0996-00-0171-01 only) can be used to copy the settings from monitor to monitor.

1. Insert the Transfer Card into the PCM2 slot on the right side of the source monitor.
2. Access the **Functions** menu, and select **Copy monitor defaults to card** from the menu. A status message will report completion of the transfer.
3. Remove the card and insert it into the PCM2 slot of the receiving monitor.
4. Enter Installation Mode on the receiving monitor by pressing and holding the **DISCHARGE** key (**Spectrum**®) or the **TRENDS** key (**Spectrum OR**™) while powering **ON** the monitor.
5. Select **Copy monitor defaults to card**. A status message will report completion of the transfer.
6. Select **Save Current** and power-cycle the receiving monitor to enter normal monitoring mode.

1.26.3 Option Installation

1. Install option PCMCIA card (P/N 0996-00-0053-XXXXX) into slot PCM2.
2. Select "Install" from the menu selection. Press the Navigator™ knob to activate new option.
3. Verify proper operation as stated in chapter 4.0.

1.27 System Information Menu

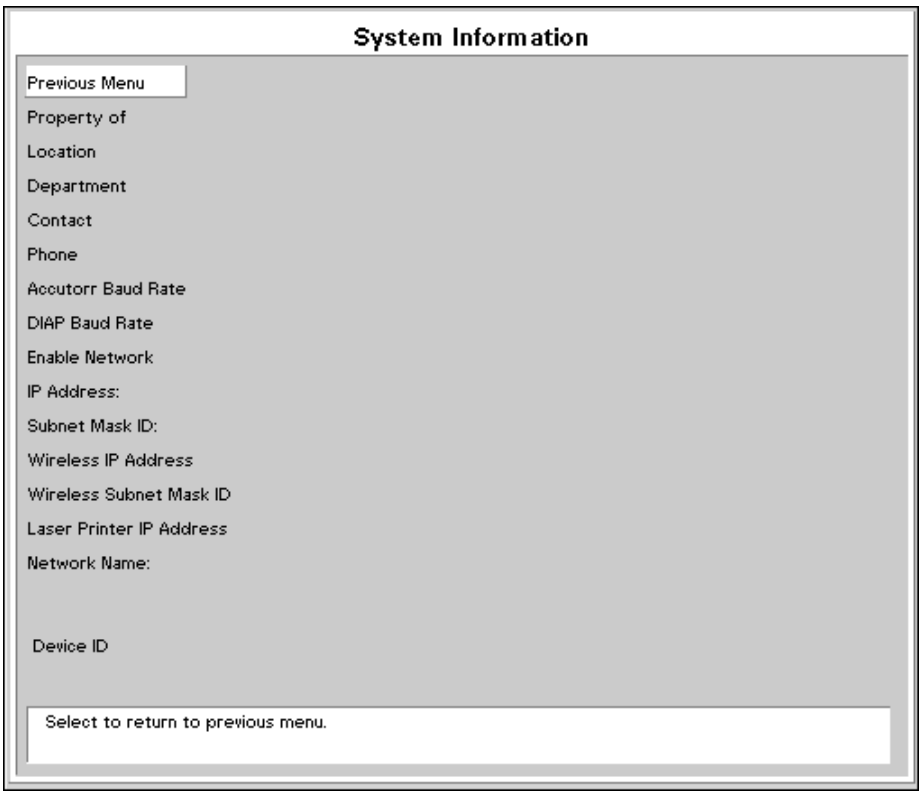


FIGURE 1-20 System Information Menu

This menu is accessed by selecting **System Information** from the **Installation Menu**. Information is entered via a on-screen keyboard. Select each letter using the Navigator™ Knob. When finished, rotate to **Previous Menu** and select using the Navigator Knob.

MENU TITLE ON SCREEN	MENU CHOICES	DEFAULT	TEXT STRINGS
Previous Menu			Select to return to Previous Menu
Property Of			Select to set up Property of name
Location			Select to set up Location
Department			Select to set up Department
Contact			Select to set up Contact
Phone			Select to set up Phone
Accutor Baud Rate (Spectrum only)	9600, 1200		Select to change the Accutorr protocol baud rate
DIAP Baud Rate	9600, 19200		Select to change the DIAP baud rate
Enable Network			Not Used
IP Address:			Select to set up IP Address
Subnet Mask ID:			Select to set up Subnet Mask ID
Wireless IP Address (Spectrum only)			Select to set up Wireless IP Address

MENU TITLE ON SCREEN	MENU CHOICES	DEFAULT	TEXT STRINGS
Wireless Subnet Mask ID (Spectrum only)			Select to set up Wireless Subnet Mask ID
Laser Printer IP Address (Spectrum only)			
Network Name:			Select to set up Network name
Device ID			

1.28 Trend Storage

1.28.1 Installation and Use of the Extended Trend Feature

The **Spectrum®/Spectrum OR™** monitor is capable of storing, in non-volatile memory, up to 120 trend values for each parameter, and for **Spectrum®** only, up to 6 minutes of OXY-CRG data. With the addition of the Extended Trend card (P/N 0996-00-0052-01), the **Spectrum®/Spectrum OR™** is capable of storing up to 500 trend values for each parameter, and for **Spectrum®** only, up to 12 hours of OXY-CRG data.

This feature is added to the **Spectrum®/Spectrum OR™** by inserting the Extended Trend card (P/N 0996-00-0052-01) into slot PCM1 on the right side of the monitor. The card should be inserted before monitor power-up, and never removed during monitor operation. In order to guard against accidental removal, the card slot is designed so that a tool is required to eject the card after insertion.

The Extended Trend feature is automatically enabled when the unit is powered-up following card insertion.

NOTE: All prior trended information is lost upon installation of the Extended Trend feature.

1.29 Software Download

1.29.1 Download Operation

A download flashcard must be installed in PCMCIA slot PCM2 prior to power up. When the unit is powered on, the valid download card will be read and downloaded to the Host CPU module only. While the images are being downloaded a beep will sound approximately once every second until the download is complete. Once complete, the unit will then run automatically, first displaying the **Spectrum®/Spectrum OR™** logo then proceeding to normal runtime mode. A display box will be displayed if it is determined that the images downloaded to the Host CPU module do not match the images in the attached CP and/or Front-end modules and/or EPM modules. This display box, shown below, will indicate the Host CPU software version, the current version on the CP, Front-end and/or EPM modules and the software version being downloaded to the modules. The images will automatically load and the status message **Complete** will appear, after the download is complete.

NOTE: To ensure that the EPM module download is complete, reboot the unit.

Module	Module SW Version	Flash SW Version	Status	Download Percent
The above modules are being downloaded. When the download is complete, press the normal screen button to continue, or reboot.				

FIGURE 1-21 Software Download Status Screen

Status Messages

Pending: This is displayed for a module awaiting download.

Active: This is displayed once a pending module has turned active.

Erasing: This is displayed when an image is being erased.

Loading: This is displayed when an image is being downloaded.

Verify: This is displayed while the checksum is being verified.

Fault: This is displayed if there is a downloading error. If a fault occurs, the module download screen will not be able to be removed. Contact customer service.

Complete: This is displayed for a module when download is complete.

NOTE: If a fault condition occurs, an error message will be recorded in the error log.

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2.0 *Block Diagrams*

2.1 Introduction

The Block Diagrams indicate the internal organization of the instrument. The block diagrams are used to gain both familiarity with the instrument and to locate malfunctioning PC boards as readily as possible.

2.2 Block Diagram

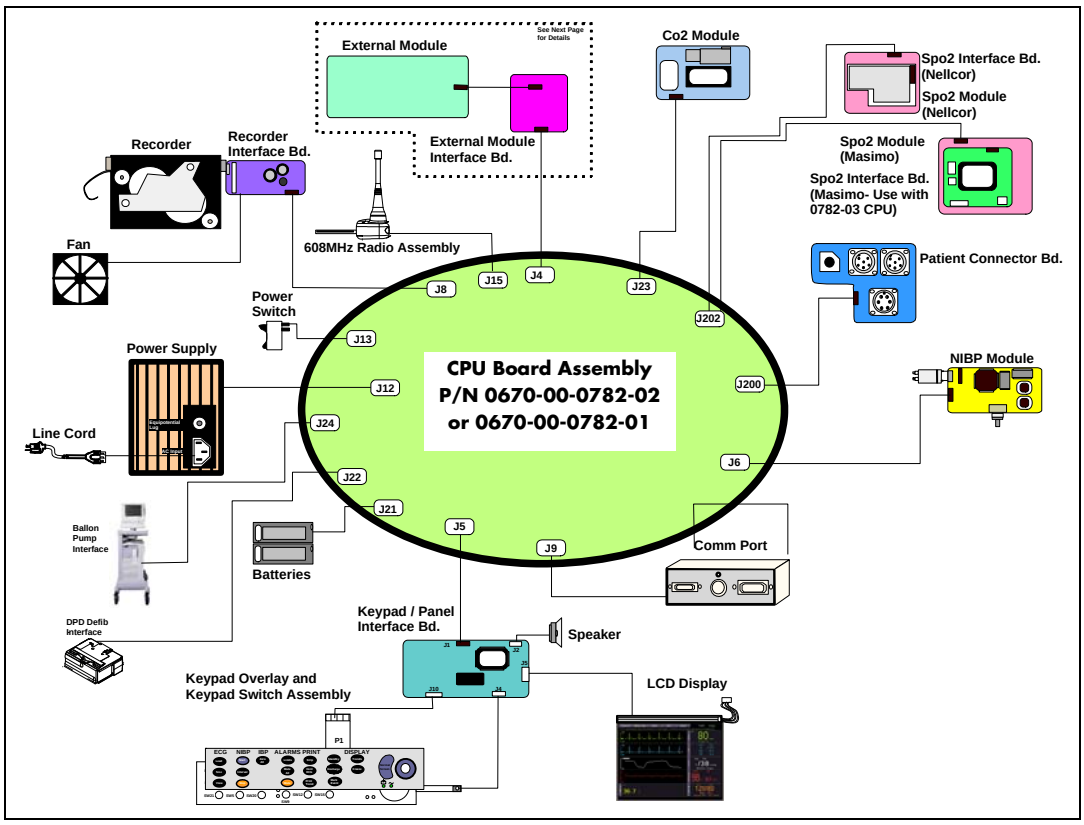

FIGURE 2-1 Spectrum® Block Diagram

DESCRIPTION	PART NUMBER
Recorder Assembly	0683-00-0465-01
Recorder Board	0670-00-0695
Fan	0012-00-1622-01
Power Switch	0012-00-1231
Power Supply	0014-00-0250 or 0014-00-0251
Batteries	0146-00-0043 or 0146-00-0069
Panel / Keypad Board	0670-00-0735
LCD Display	0160-00-0094
Keypad Overlay	0330-00-0037-XX
Keypad	0331-00-0120-XX
Speaker	0012-00-0257-06
608 Radio Kit	0040-00-0361-01
NIBP Board	0670-00-0746-01

DESCRIPTION	PART NUMBER
NIBP Board	0670-00-0798-01
Patient Connector Board	0670-00-0682-01
Patient Connector Board (HP)	0670-00-0680-01
SpO_2 Module (Masimo)	0671-00-0055
SpO_2 Module (Nellcor) Oximax	0671-00-0066
SpO_2 Module (Nellcor)	0671-00-0162
SpO_2 Interface Board (Nellcor)	0670-00-0696 or 0670-00-0785-01, 02
SpO_2 Interface Board (Masimo)	0670-00-0785-03
Oridion MediCO_2 Module Oridion miniMediCO_2 Module	0671-00-0164-03 0671-00-0089-01
Power Cord (Domestic)	0012-25-0001
Power Cord (International)	0012-25-0002
External Module Interface Board	0670-00-1155-01

NOTE: See Isometric Drawings and Parts List for a complete list of Part Numbers.

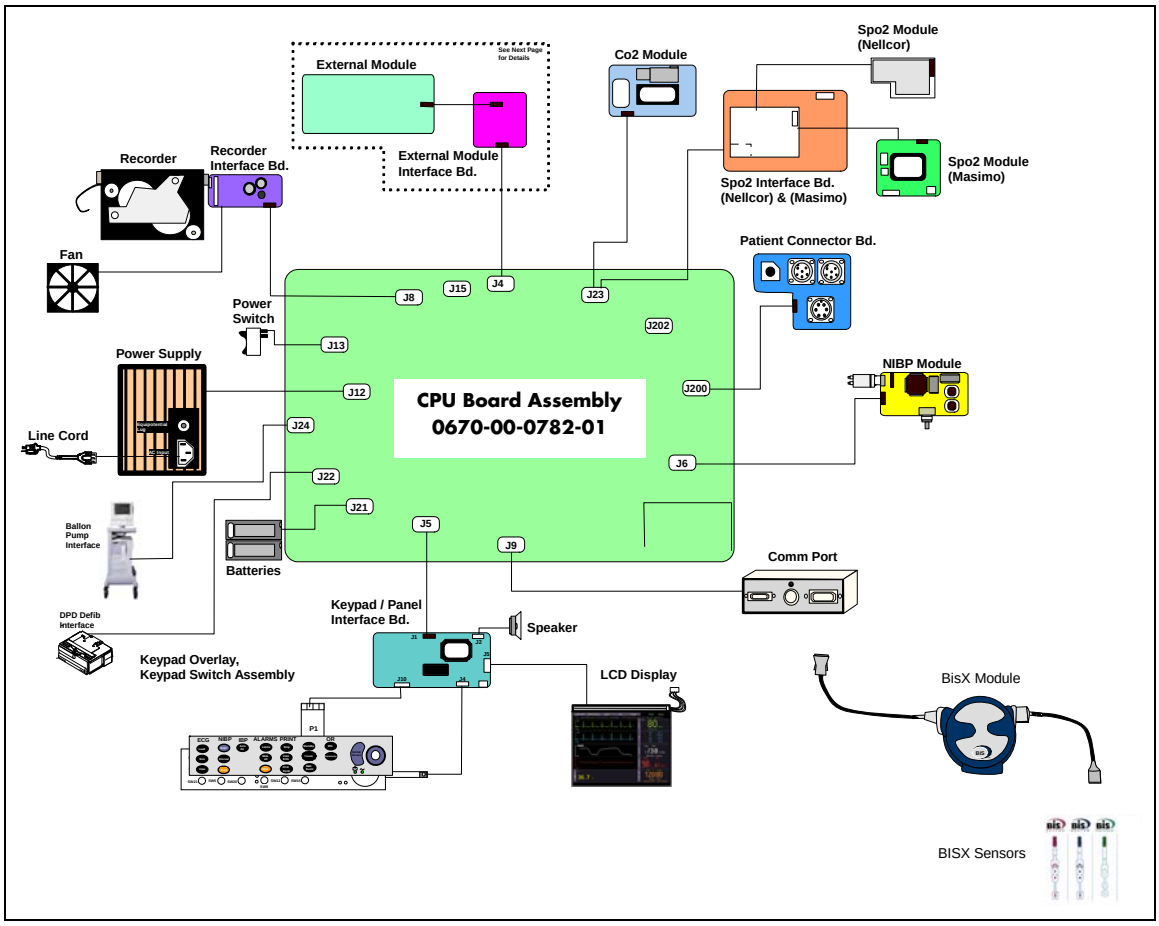

FIGURE 2-2 Spectrum OR™ Block Diagram

DESCRIPTION	PART NUMBER
Recorder Assembly	0683-00-0465-01
Recorder Board	0670-00-0695
Fan	0012-00-1622-01
Power Switch	0012-00-1231
Power Supply	0014-00-0250 or 0014-00-0251
Batteries	0146-00-0043 or 0146-00-0069
Panel / Keypad Board	0670-00-0735
LCD Display	0160-00-0094
Keypad Overlay	0330-00-0037-XX
Keypad	0331-00-0120-XX
Speaker	0012-00-0257-06

DESCRIPTION	PART NUMBER
NIBP Board	0670-00-0746-01
NIBP Board	0670-00-0798-01
Patient Connector Board	0670-00-0682-01
SpO_2 Module (Masimo)	0671-00-0055
SpO_2 Module (Nellcor) Oximax	0671-00-0066
SpO_2 Interface Board (Nellcor)	0670-00-0785-01
SpO_2 Interface Board (Masimo)	0670-00-0785-03
Oridion MediCO_2 Module Oridion miniMediCO_2 Module	0671-00-0164-03 0671-00-0089-01
Power Cord (Domestic)	0012-25-0001
Power Cord (International)	0012-25-0002
External Module Interface Board	0670-00-1155-01

NOTE: See Isometric Drawings and Parts List for a complete list of Part Numbers.

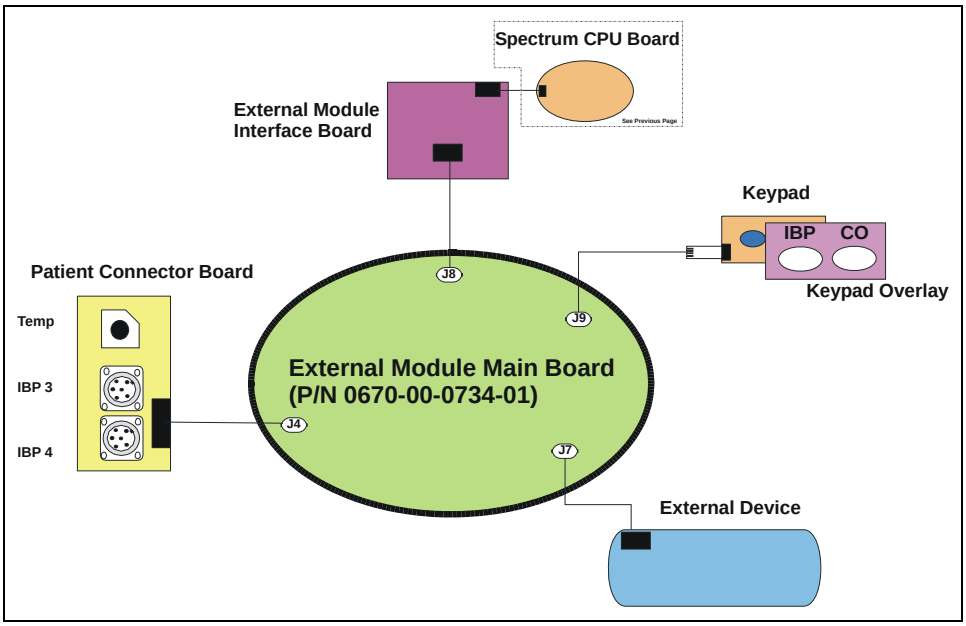

FIGURE 2-3 Block Diagram (External Parameter Module Main Board)

DESCRIPTION	PART NUMBER
External Parameter Module Main Board	0670-00-0734-01
Connector Panel Board	0670-00-0738-01
Keypad	0331-00-0118
Keypad Overlay IBP 3/4, T2	0330-00-0038-XX
Interface Board	0670-00-1155-01

NOTE: **See "Isometric Drawings and Part List" on page 3-1 for a complete list of Part Numbers.**

3.0 *Isometric Drawings and Part List*

3.1 Introduction

This chapter provides information necessary to identify the replacement parts and assemblies of instruments.

3.2 Top Level Assembly

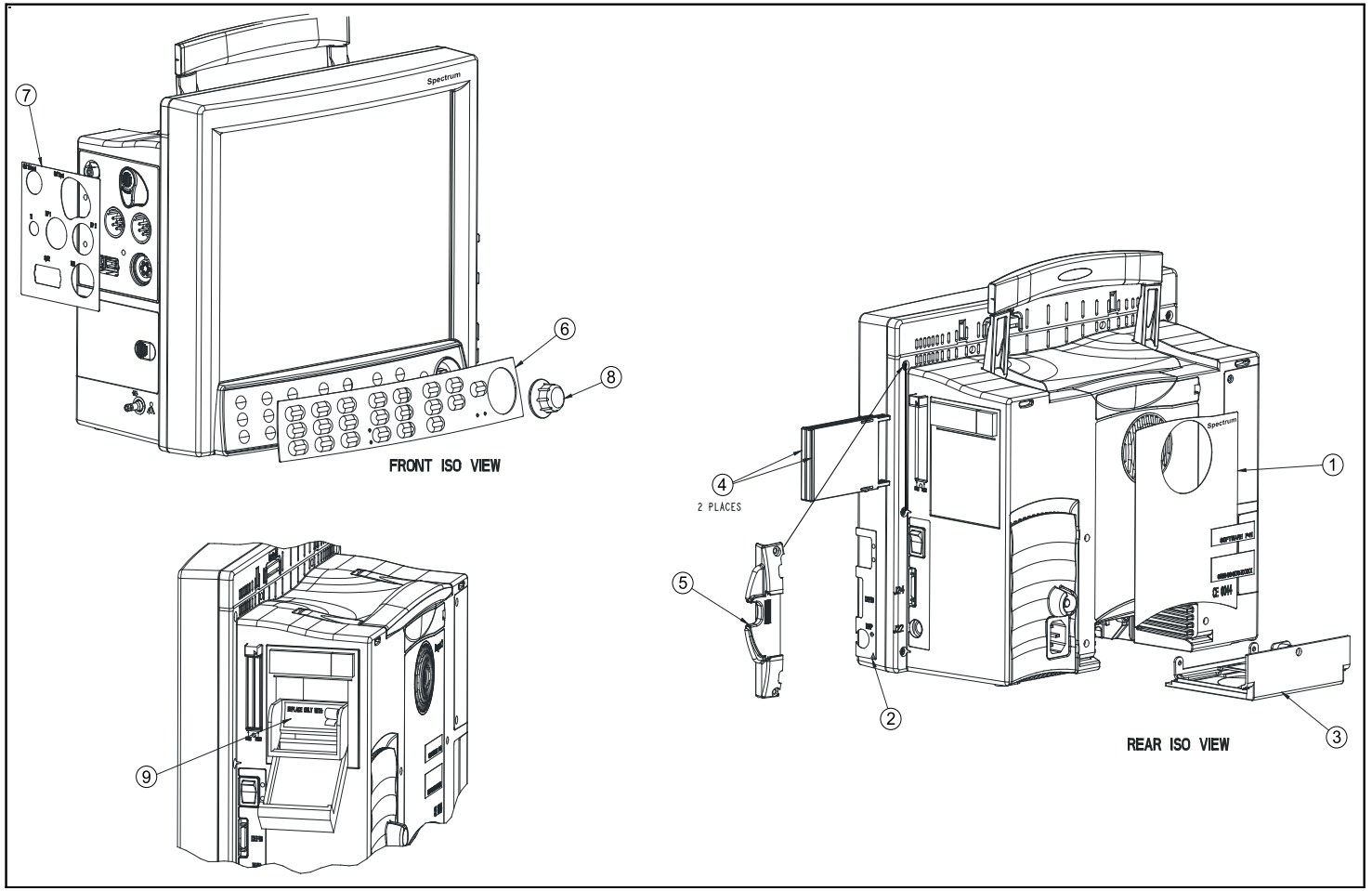

FIGURE 3-1 Top Level Assembly

ITEM NO	DESCRIPTION	PART NUMBER
1	Label, Rear Information, Spectrum®	0334-00-2623
1	Label, Rear Information, Spectrum OR™	0334-00-1724
2	Label, Right Side	0334-00-1528
3	Cover Assembly, Docking Connector	0198-00-0037
4	PCMCIA Card Dummy	0380-00-0372
5	Bracket, View 12™ PCMCIA (Optional)	0380-00-0399-01
6	Keypad Overlay, English, Spectrum®	0330-00-0037-01
6	Keypad Overlay, German, Spectrum®	0330-00-0037-02
6	Keypad Overlay, French, Spectrum®	0330-00-0037-03
6	Keypad Overlay, Spanish, Spectrum®	0330-00-0037-04
6	Keypad Overlay, Italian, Spectrum®	0330-00-0037-05
6	Keypad Overlay, Dutch, Spectrum®	0330-00-0037-06
6	Keypad Overlay, Br. Portuguese, Spectrum®	0330-00-0037-08
6	Keypad Overlay, English, Spectrum OR™	0330-00-0058-01
7	Label, Patient Connector w/CO_2 w/IBP Nellcor®, English	0334-00-1501-001
7	Label, Patient Connector w/CO_2 w/IBP Masimo®, English	0334-00-1501-002
7	Label, Patient Connector no CO_2 w/IBP Nellcor, English, Italian, Br. Portuguese	0334-00-1501-003
7	Label, Patient Connector no CO_2 w/IBP Masimo, English, Italian, Br. Portuguese	0334-00-1501-004
7	Label, Patient Connector w/CO_2 no IBP Nellcor, English	0334-00-1501-005
7	Label, Patient Connector w/CO_2 no IBP Masimo, English	0334-00-1501-006
7	Label, Patient Connector no CO_2 no IBP Nellcor, English, French, Spanish, Italian, Dutch, Br. Portuguese	0334-00-1501-007
7	Label, Patient Connector no CO_2 no IBP Masimo, English, French, Spanish, Italian, Dutch, Br. Portuguese	0334-00-1501-008
7	Label, Patient Connector w/CO_2 w/IBP Nellcor, German	0334-00-1501-011
7	Label, Patient Connector w/CO_2 w/IBP Masimo, German	0334-00-1501-012
7	Label, Patient Connector no CO_2 w/IBP Nellcor, German	0334-00-1501-013
7	Label, Patient Connector no CO_2 w/IBP Masimo, German	0334-00-1501-014
7	Label, Patient Connector w/CO_2 no IBP Nellcor, German	0334-00-1501-015
7	Label, Patient Connector w/CO_2 no IBP Masimo, German	0334-00-1501-016
7	Label, Patient Connector no CO_2 no IBP Nellcor, German	0334-00-1501-017
7	Label, Patient Connector no CO_2 no IBP Masimo, German	0334-00-1501-018
7	Label, Patient Connector w/CO_2 w/IBP Nellcor, French	0334-00-1501-021
7	Label, Patient Connector w/CO_2 w/IBP Masimo, French	0334-00-1501-022
7	Label, Patient Connector no CO_2 w/IBP Nellcor, French, Spanish	0334-00-1501-023
7	Label, Patient Connector no CO_2 w/IBP Masimo, French, Spanish	0334-00-1501-024
7	Label, Patient Connector w/CO_2 no IBP Nellcor, French	0334-00-1501-025
7	Label, Patient Connector w/CO_2 no IBP Masimo, French	0334-00-1501-026
7	Label, Patient Connector w/CO_2 w/IBP Nellcor, Spanish	0334-00-1501-031
7	Label, Patient Connector w/CO_2 w/IBP Masimo, Spanish	0334-00-1501-032
7	Label, Patient Connector w/CO_2 no IBP Nellcor, Spanish	0334-00-1501-035
7	Label, Patient Connector w/CO_2 wo/IBP Masimo, Spanish	0334-00-1501-036

ITEM NO	DESCRIPTION	PART NUMBER
7	Label, Patient Connector w/CO_2 w/IBP Nellcor®, Italian	0334-00-1501-041
7	Label, Patient Connector w/CO_2 w/IBP Masimo, Italian	0334-00-1501-042
7	Label, Patient Connector w/CO_2 no IBP Nellcor, Italian	0334-00-1501-045
7	Label, Patient Connector w/CO_2 no IBP Masimo, Italian	0334-00-1501-046
7	Label, Patient Connector w/CO_2 w/IBP Nellcor, Dutch	0334-00-1501-051
7	Label, Patient Connector w/CO_2 w/IBP Masimo, Dutch	0334-00-1501-052
7	Label, Patient Connector no CO_2 w/IBP Nellcor, Dutch	0334-00-1501-053
7	Label, Patient Connector no CO_2 w/IBP Masimo, Dutch	0334-00-1501-054
7	Label, Patient Connector w/CO_2 no IBP Nellcor, Dutch	0334-00-1501-055
7	Label, Patient Connector w/CO_2 no IBP Masimo, Dutch	0334-00-1501-056
7	Label, Patient Connector w/CO2, w/IBP, Nell, Br. Portuguese	0334-00-1501-081
7	Label, Patient Connector w/CO2, w/IBP, Mas, Br. Portuguese	0334-00-1501-082
7	Label, Patient Connector w/CO2, w/o IBP, Nell, Br. Portuguese	0334-00-1501-085
7	Label, Patient Connector w/CO2, w/o IBP, Mas, Br. Portuguese	0334-00-1501-086
7	Label, Patient Connector w/CO_2 w/IBP Nellcor® Oximax®, English	0334-00-1501-101
7	Label, Patient Connector no CO_2 w/IBP Nellcor® Oximax®, English, Italian, Br. Portuguese	0334-00-1501-103
7	Label, Patient Connector w/CO_2 no IBP Nellcor® Oximax®, English	0334-00-1501-105
7	Label, Patient Connector no CO_2 no IBP Nellcor® Oximax®, English, French, Spanish, Italian, Dutch, Br. Portuguese	0334-00-1501-107
7	Label, Patient Connector w/CO_2 w/IBP Nellcor® Oximax®, German	0334-00-1501-111
7	Label, Patient Connector no CO_2 w/IBP Nellcor® Oximax®, German	0334-00-1501-113
7	Label, Patient Connector w/CO_2 no IBP Nellcor® Oximax®, German	0334-00-1501-115
7	Label, Patient Connector no CO_2 no IBP Nellcor® Oximax®, German	0334-00-1501-117
7	Label, Patient Connector w/CO_2 w/IBP Nellcor® Oximax®, French	0334-00-1501-121
7	Label, Patient Connector no CO_2 w/IBP Nellcor® Oximax®, French, Spanish	0334-00-1501-123
7	Label, Patient Connector w/CO_2 no IBP Nellcor® Oximax®, French	0334-00-1501-125
7	Label, Patient Connector w/CO_2 w/IBP Nellcor® Oximax®, Spanish	0334-00-1501-131
7	Label, Patient Connector w/CO_2 no IBP Nellcor® Oximax®, Spanish	0334-00-1501-135
7	Label, Patient Connector w/CO_2 w/IBP Nellcor® Oximax®, Italian	0334-00-1501-141
7	Label, Patient Connector w/CO_2 no IBP Nellcor® Oximax®, Italian	0334-00-1501-145
7	Label, Patient Connector w/CO_2 w/IBP Nellcor® Oximax®, Dutch	0334-00-1501-151
7	Label, Patient Connector no CO_2 w/IBP Nellcor® Oximax®, Dutch	0334-00-1501-153
7	Label, Patient Connector w/CO_2 no IBP Nellcor® Oximax®, Dutch	0334-00-1501-155
7	Label, Patient Connector w/CO2, w/IBP, Nell MP506, Br. Portuguese	0334-00-1501-181

ITEM NO	DESCRIPTION	PART NUMBER
7	Label, Patient Connector w/CO2, w/o IBP, Nell MP506, Br. Portuguese	0334-00-1501-185
8	Rotary Knob	0366-00-0101
9	Label, Recorder Paper Loading	0334-00-1431

3.3 Front Housing Assembly

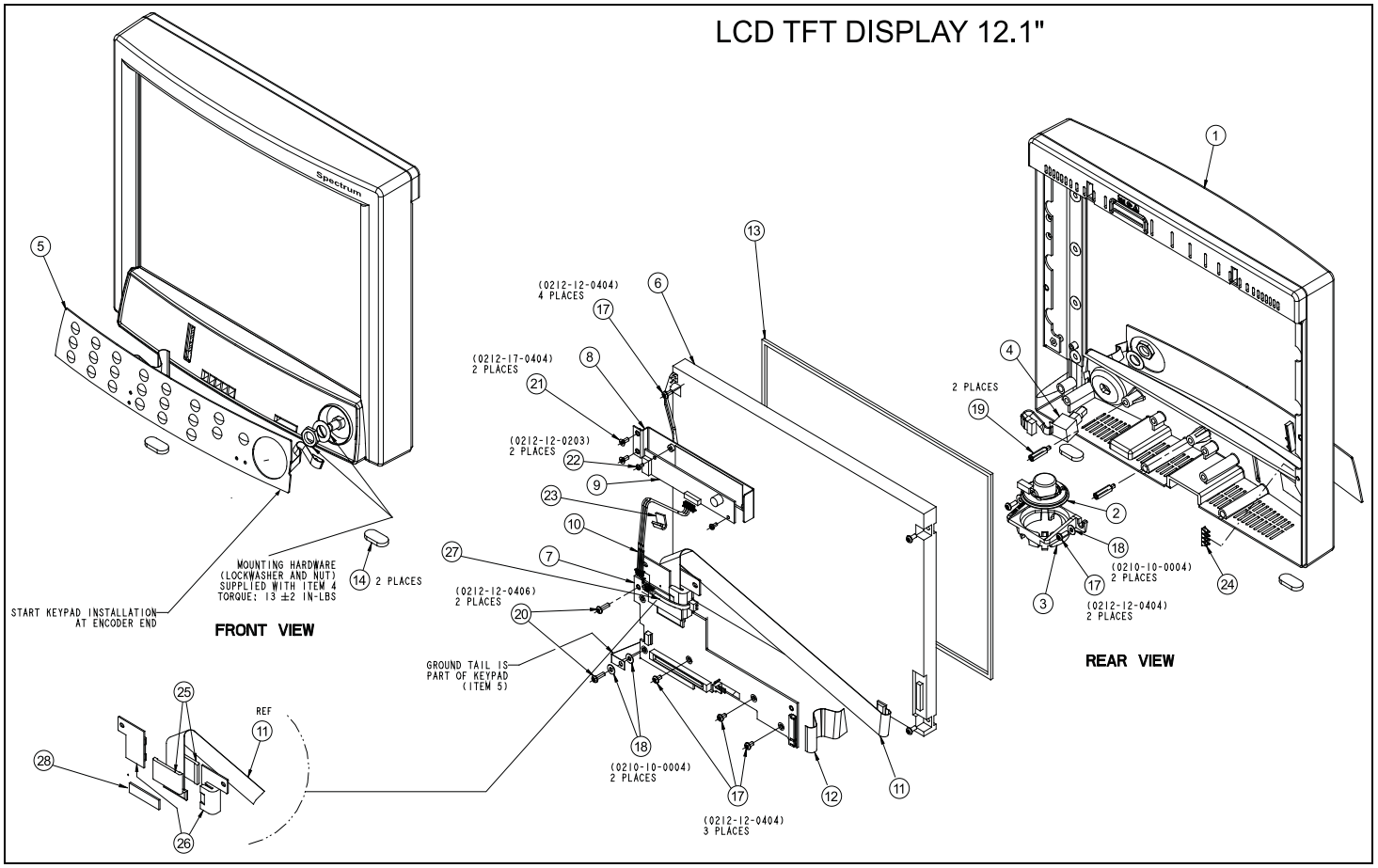

FIGURE 3-2 Front Housing Assembly

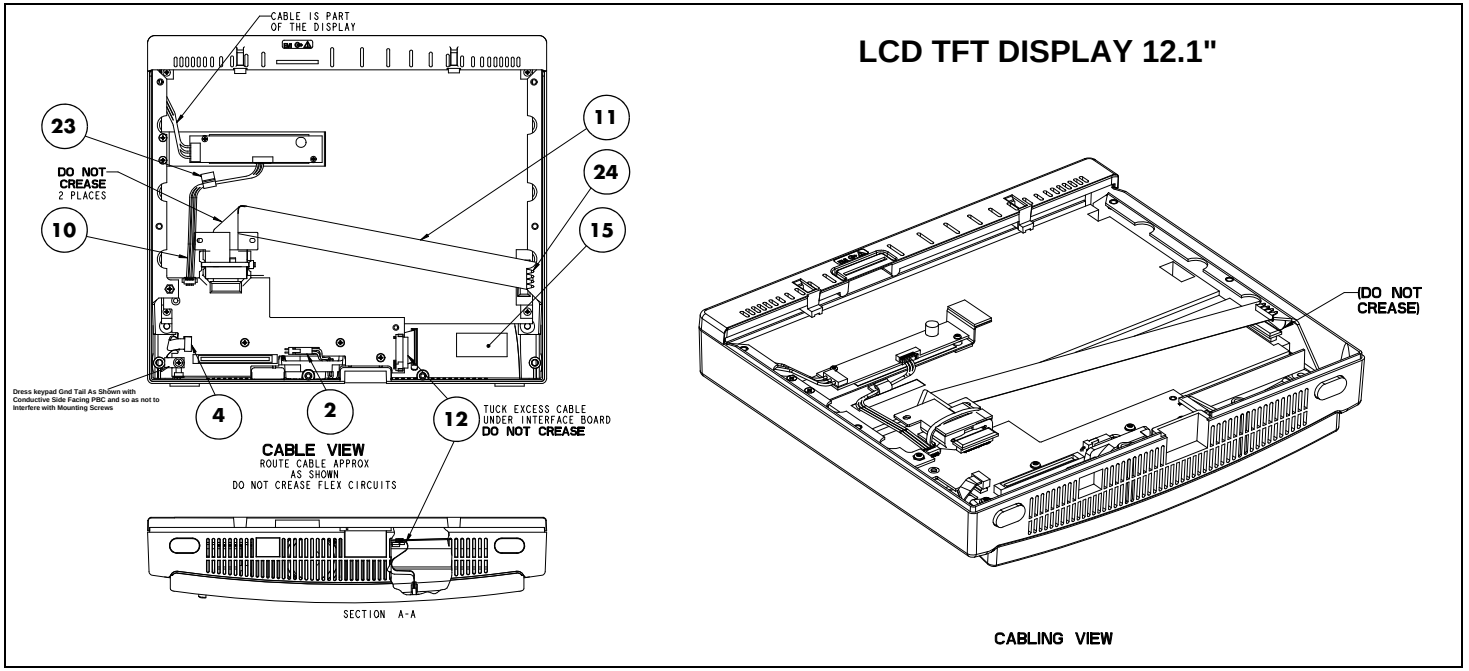

FIGURE 3-3 Front Housing Assembly

ITEM NO	DESCRIPTION	PART NUMBER
1	Front Housing	0380-00-0387-01
1	Front Housing (Spectrum®/Spectrum OR™)	0380-00-0387-02
2	Cable Assembly Speaker	0012-00-0257-06
3	Holder Speaker	0380-00-0352
4	Encoder Optical 32 Position Push button	0311-00-0132
5	Main Keypad	0331-00-0120-01
6	Display TFT Color LCD 12.1	0160-00-0073-01*
6a	Display TFT Color LCD 12.1	0160-00-0094*
7	PCB Assembly Display/Keypad	0670-00-0735
8	Bracket Mounting Inverter	0406-00-0821
8a	Inverter Mounting Bracket	0406-00-0867
9	Inverter Board (OEM)	0671-00-0232
9a	Inverter Board (OEM)	0671-00-0065
10	Cable Assembly Inverter	0012-00-1434
11	Cable Assembly 12.1 TFT Color LCD to Drive PCB	0012-00-1433
12	Cable Assembly Flexible Jumper	0012-00-1443-03
13	Gasket 12.1 Display	0348-00-0201
14	Foot	0348-00-0190
15	Label, Part Number Serial Number	N/A
17	Screw Pan Head Cross Recessed #4-40 X 1/4	0212-12-0404
18	Washer, Flat Large Pattern	0210-10-0004
19	Standoff Hex Male/Female #4-40 X 5/8 Long	0361-30-0625
20	Screw, Pan Head Cross Recessed #4-40 X 3/8	0212-12-0406
21	Screw, 100° Flat Head Cross Recessed 4#-40 X 1/4	0212-17-0404
22	Screw, Pan Head Cross Recessed #2-56 X 3/16	0212-12-0203
23	Clamp Cable 1/8 Dia. Self-Adhering	0343-00-0108
24	Grommet Edging	0348-11-0003
25	Ferrite Flat Cable Split	0108-00-0097-01
26	Clip Flat Ferrite	0344-00-0248-02
27	Cable Tie	0125-01-0003
28	Cushion Ferrite	0348-00-0211

* *Must order a gasket (0348-00-0201) item 13 for each display replacement.*

3.4 Rear Housing Assembly

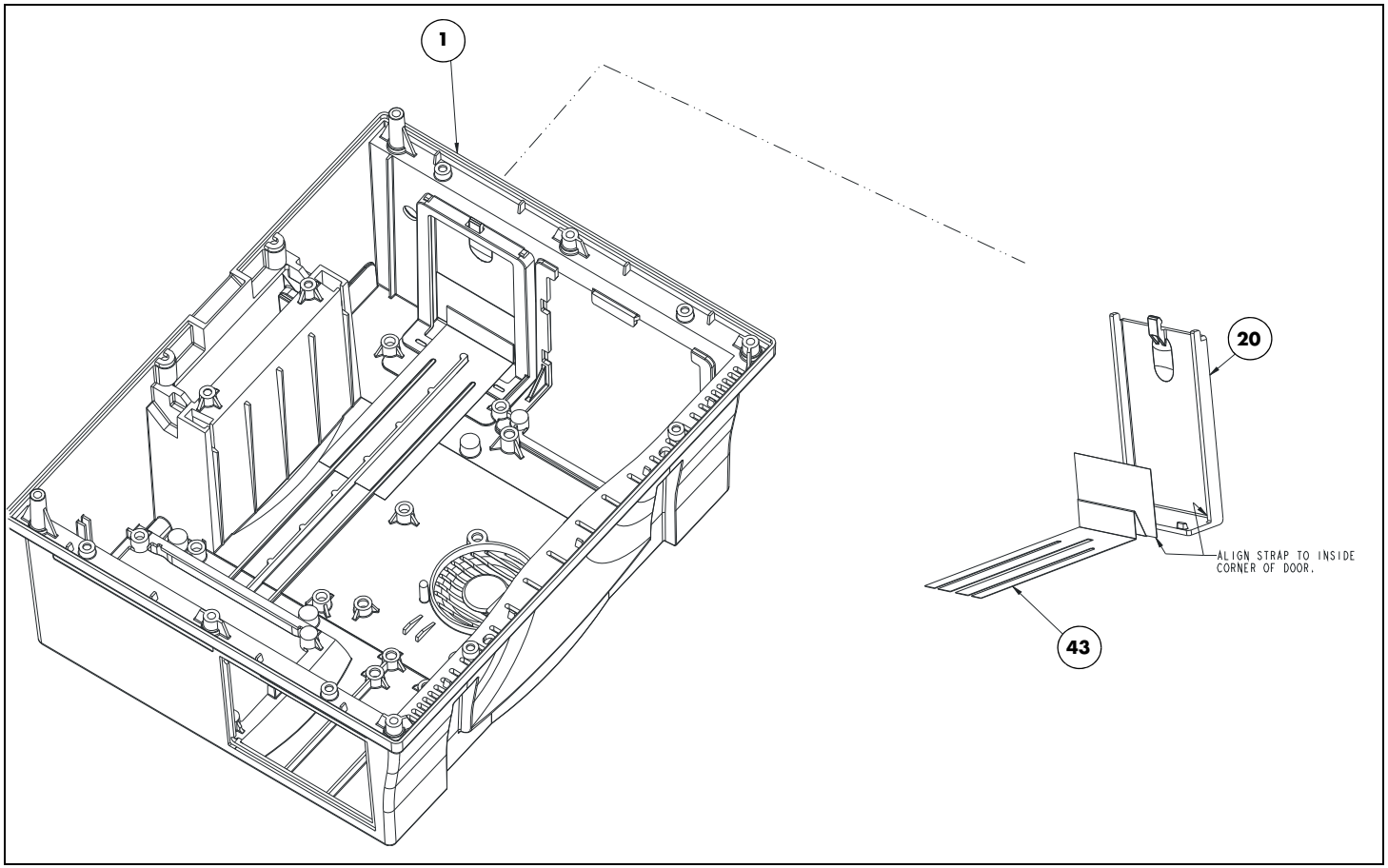

FIGURE 3-4 Rear Housing Assembly

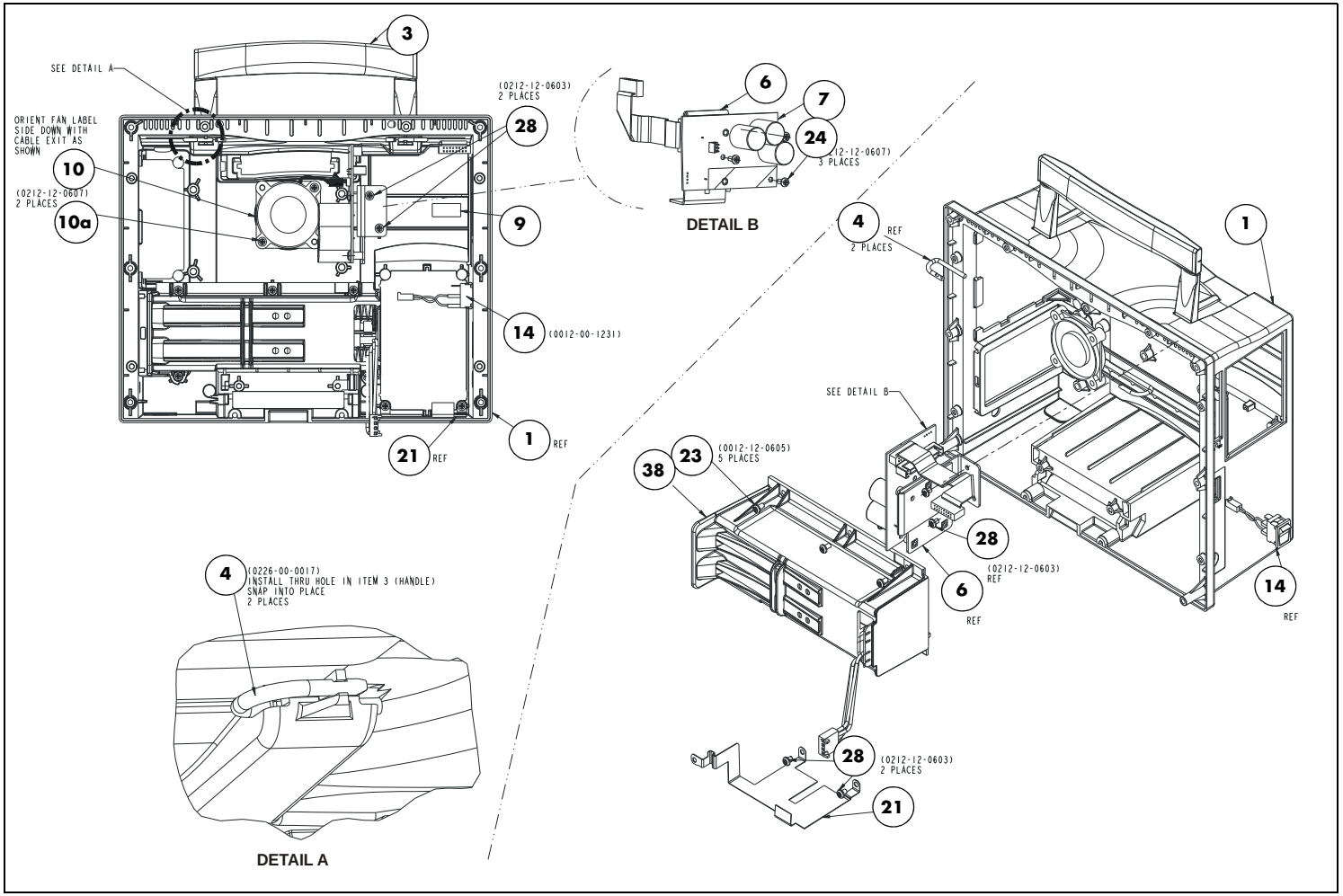

FIGURE 3-5 Rear Housing Assembly (Sealed Lead Acid battery configuration)

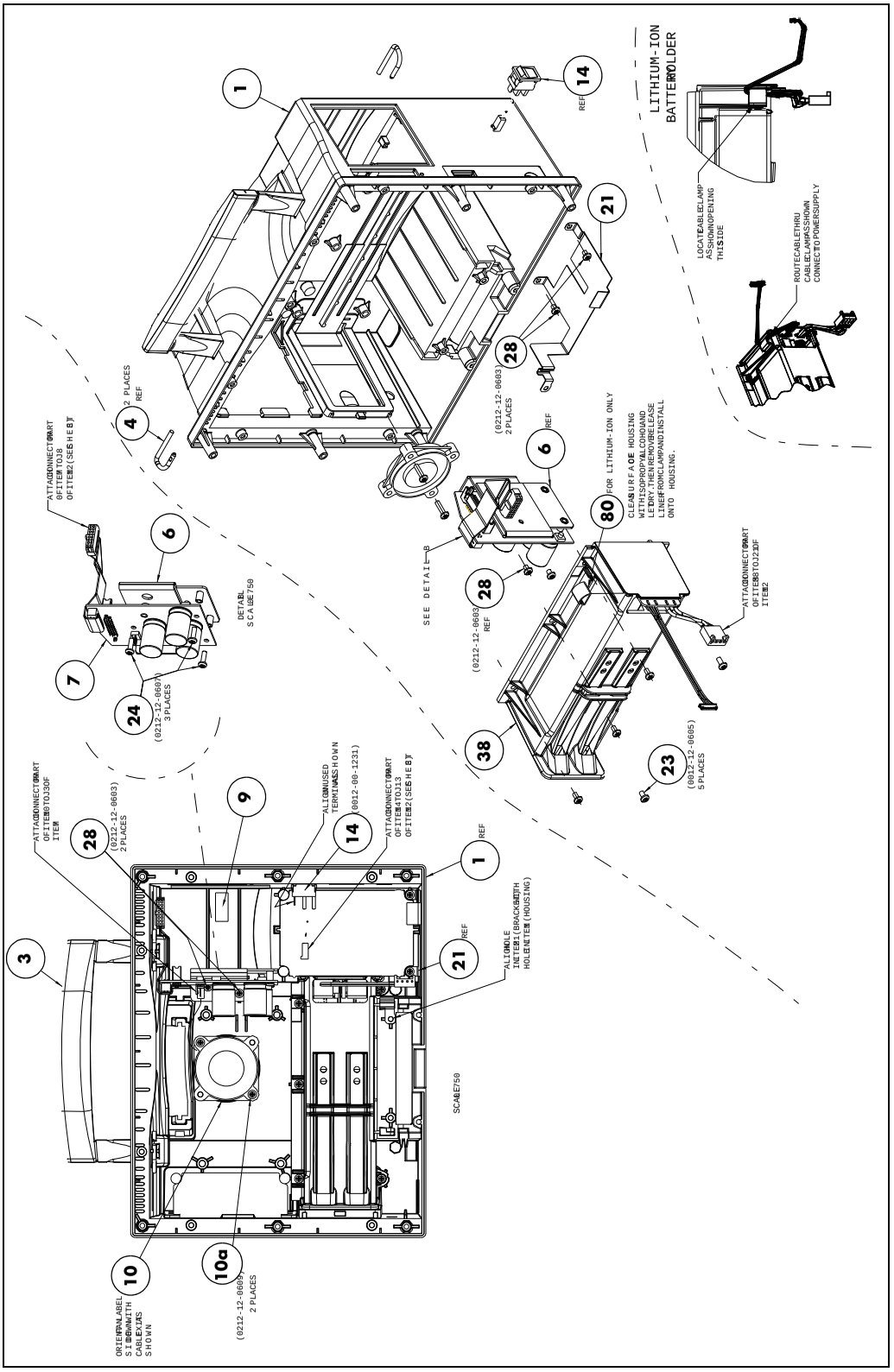

FIGURE 3-6 Rear Housing Assembly (Lithium-Ion battery configuration)

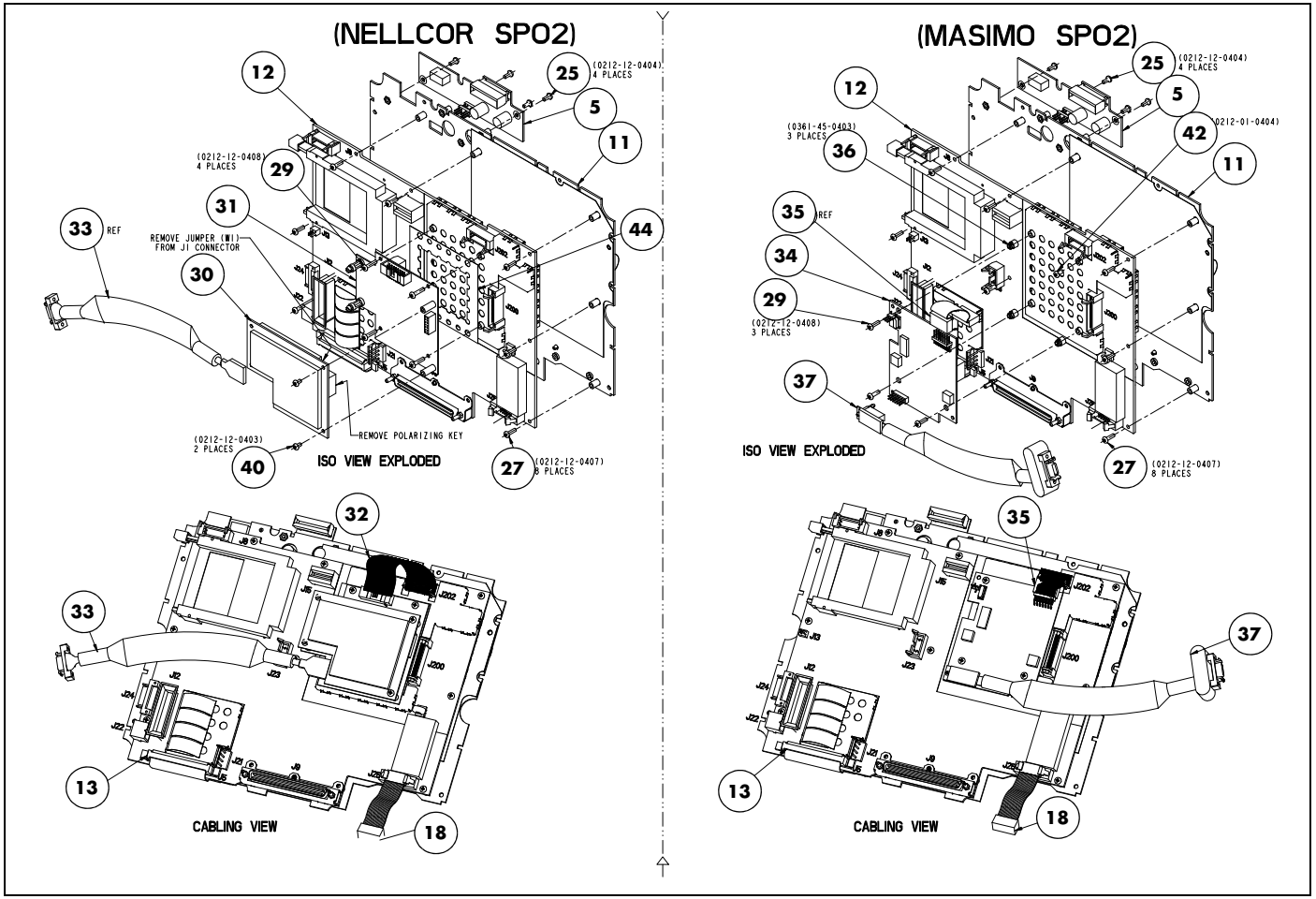

FIGURE 3-7 Rear Housing Assembly (For use with Spectrum P/N 0998-00-1000-XXXXX only)

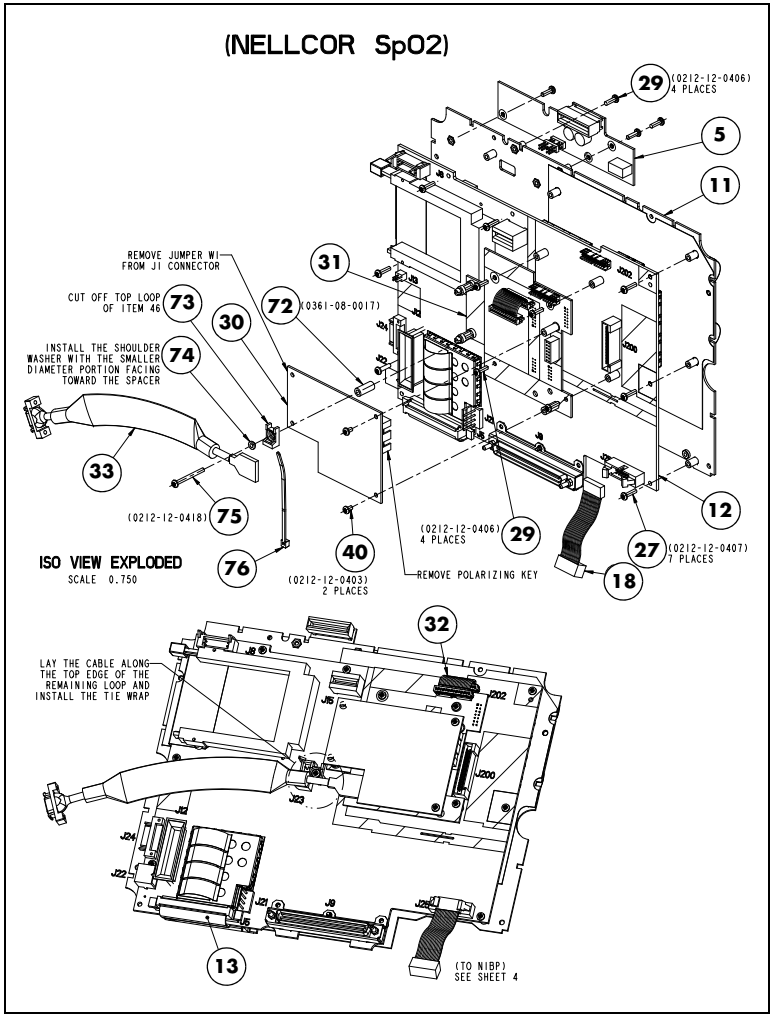

FIGURE 3-8 Rear Housing Assembly
(For use with Spectrum P/N 0998-00-1000-XXXXX only)

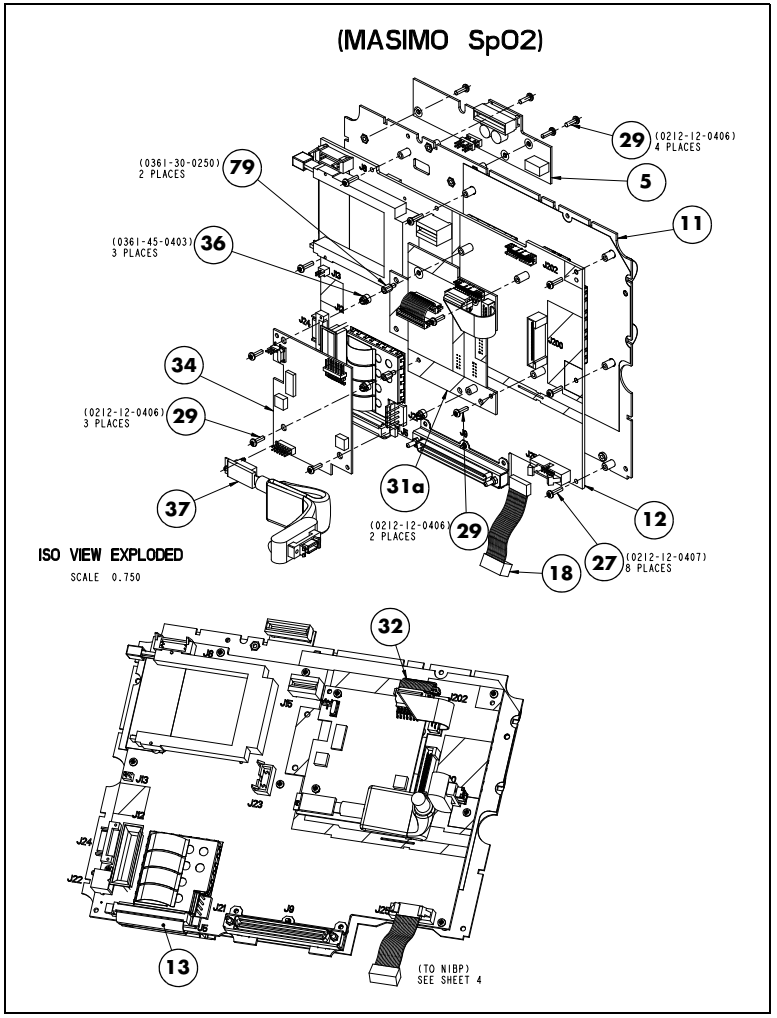

FIGURE 3-9 Rear Housing Assembly
(For use with Spectrum P/N 0998-00-1000-XXXXX and
Spectrum OR P/N 0998-00-1500-XXXXX)

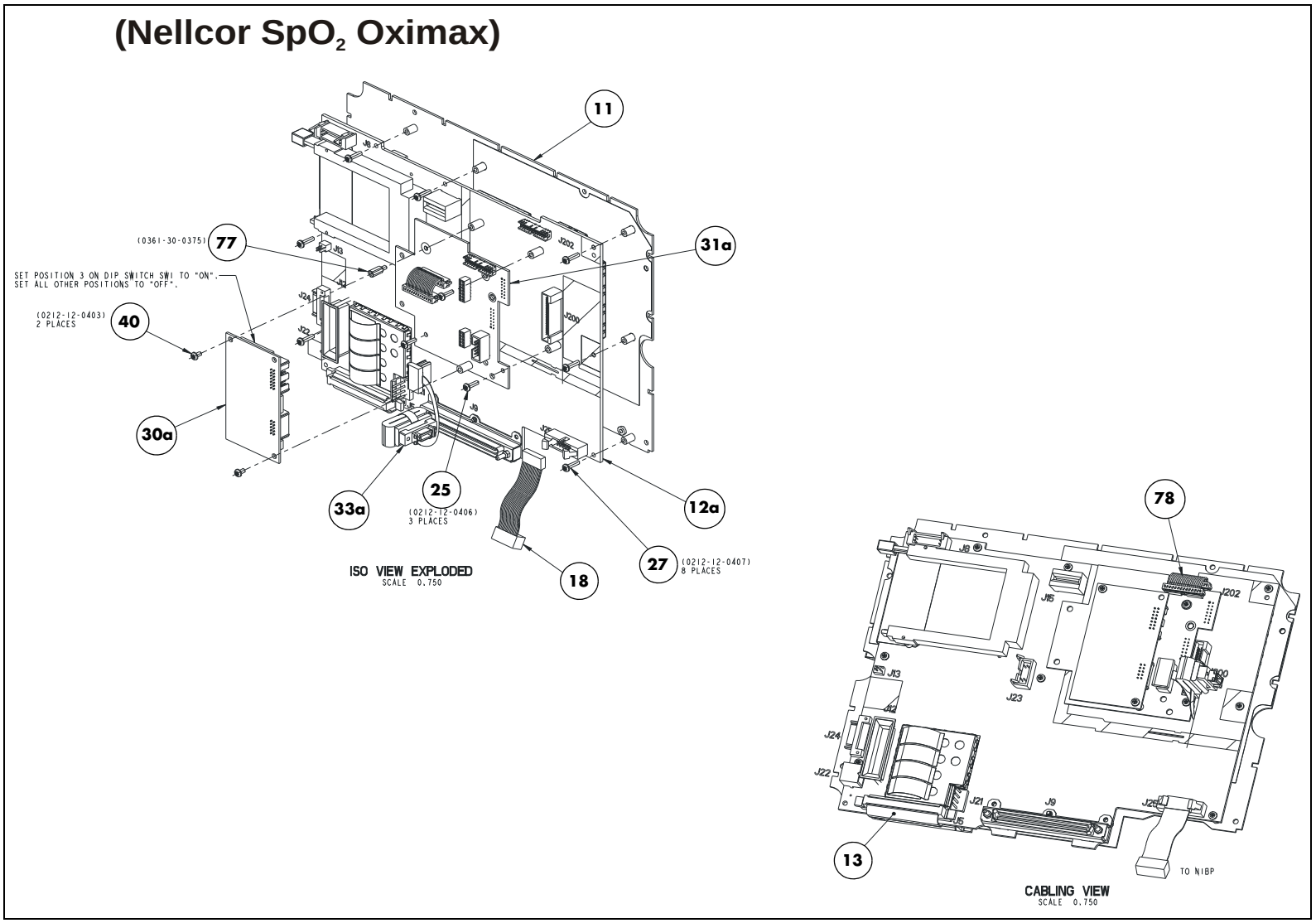

FIGURE 3-10 Rear Housing Assembly
(For use with Spectrum P/N 0998-00-1000-XXXXX and Spectrum OR P/N 0998-00-1500-XXXXX)

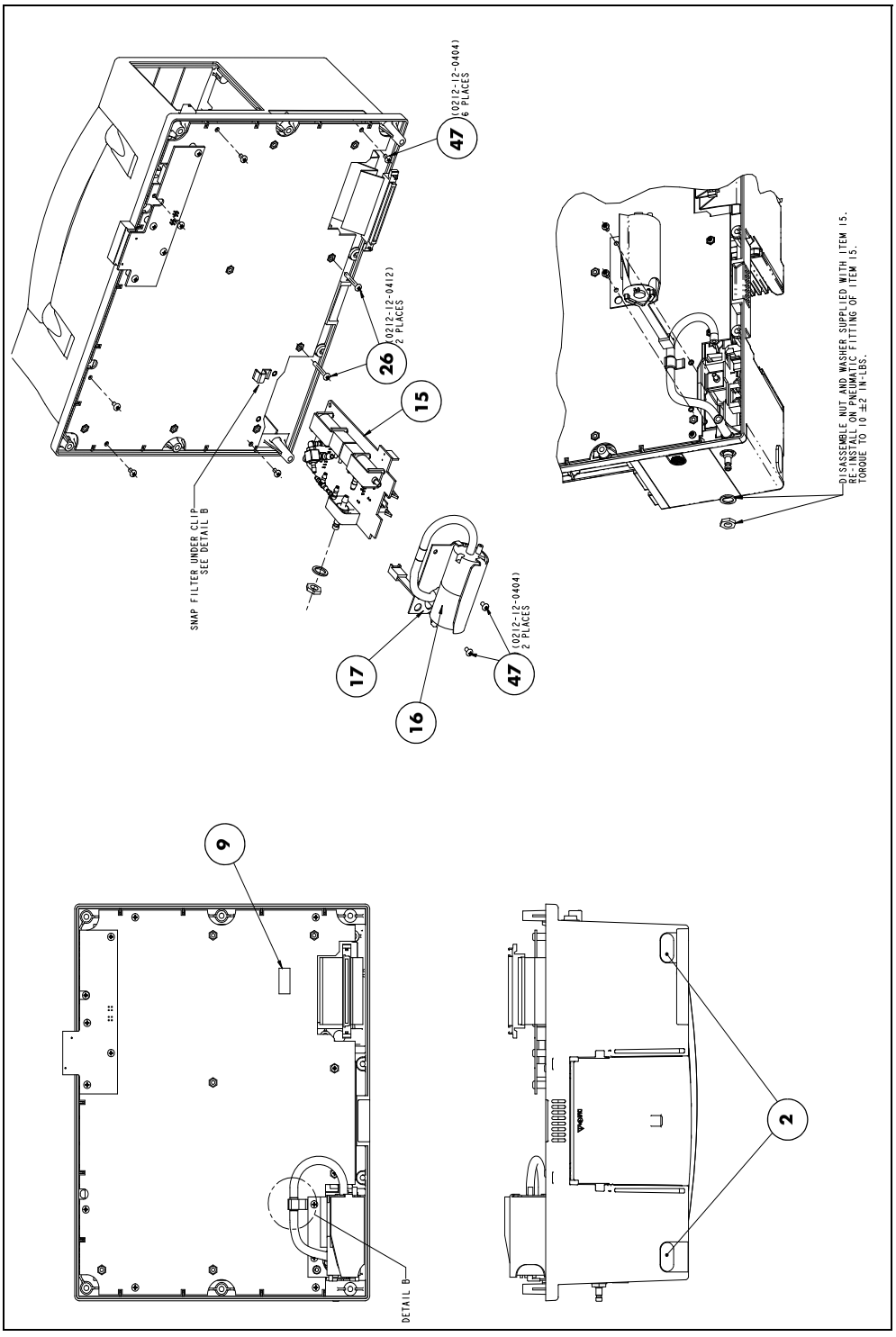

FIGURE 3-11 Rear Housing Assembly

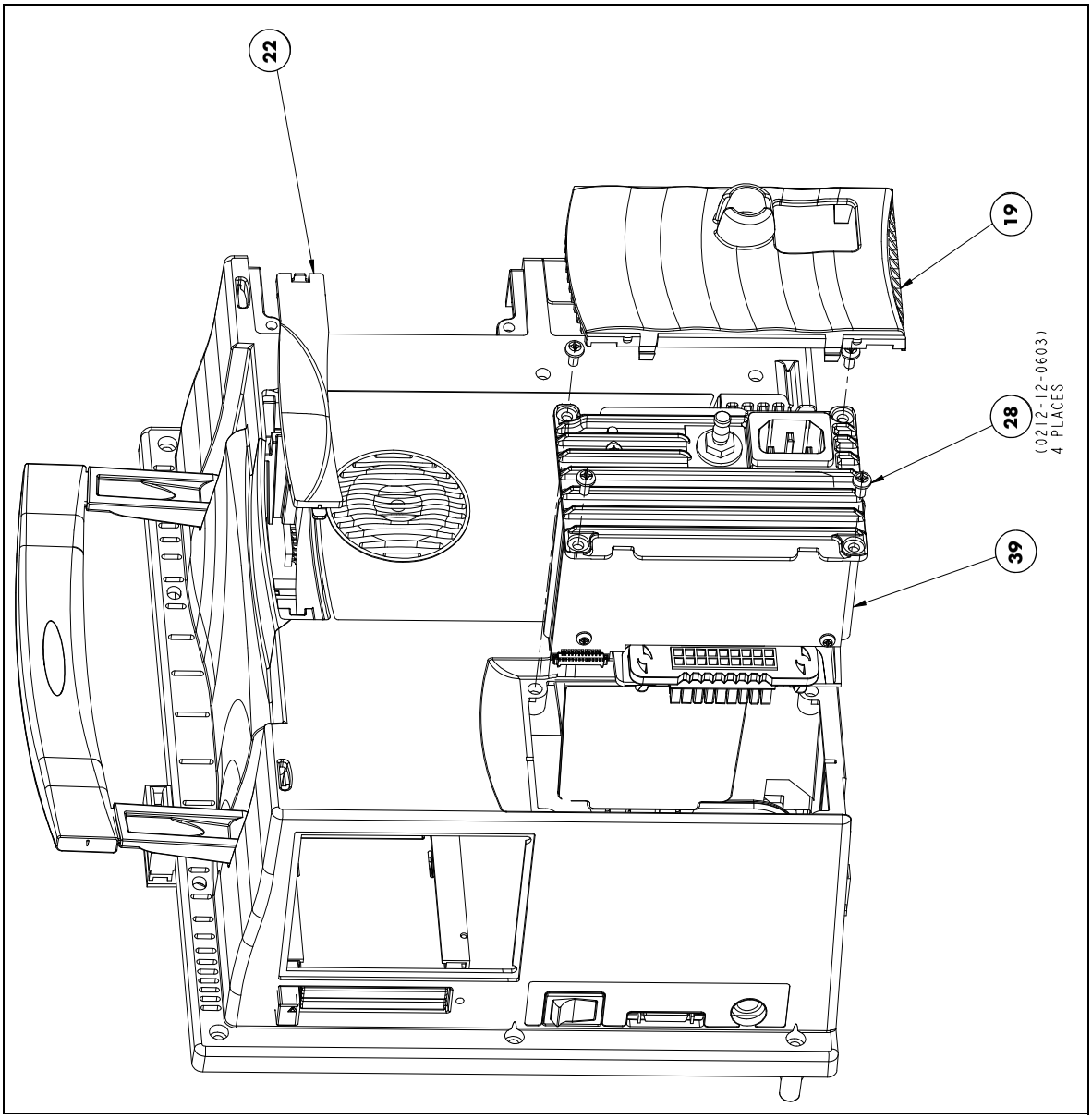

FIGURE 3-12 Rear Housing Assembly (Sealed Lead Acid battery configuration)

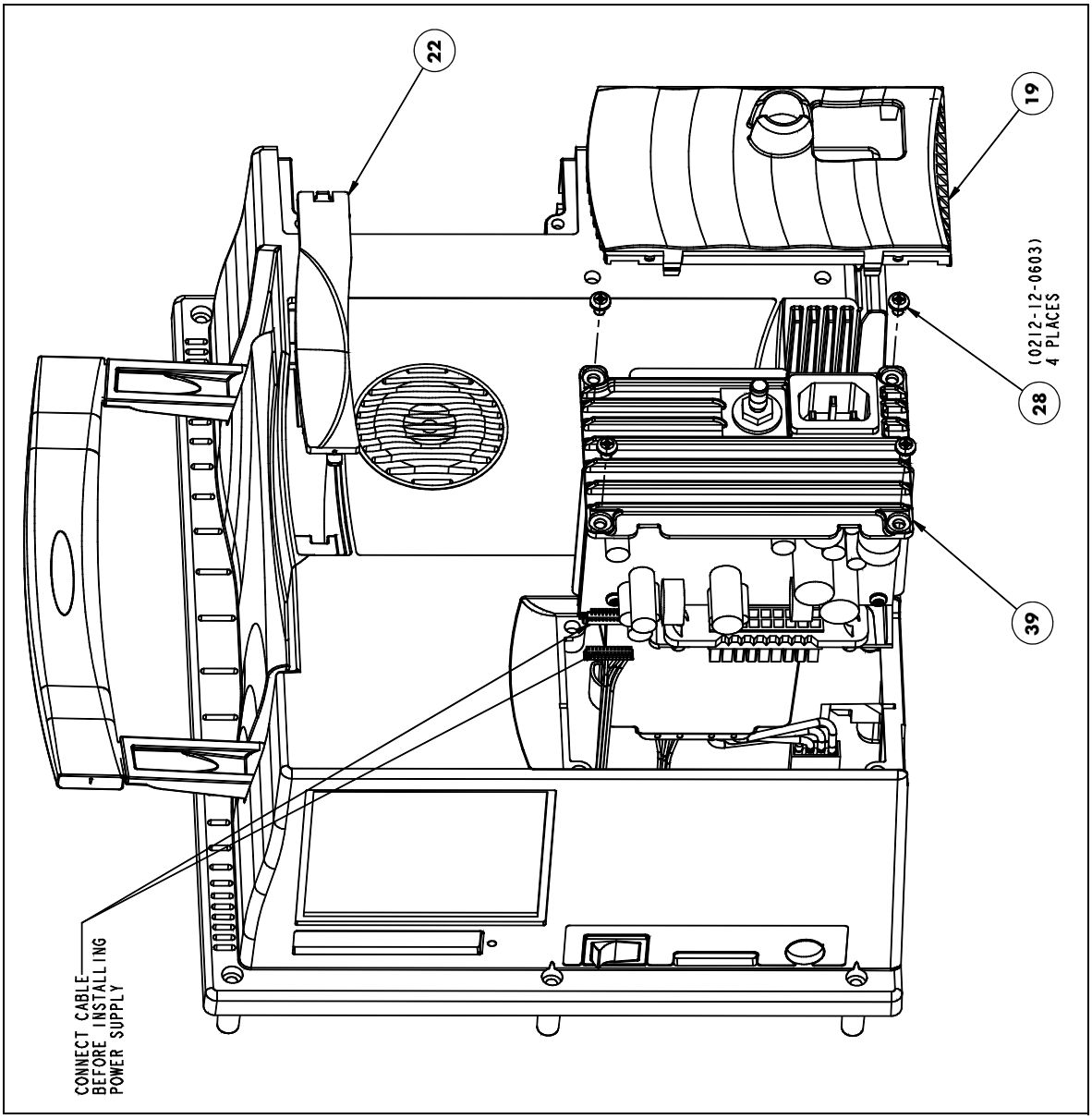

FIGURE 3-13 Rear Housing Assembly (Lithium-Ion battery configuration)

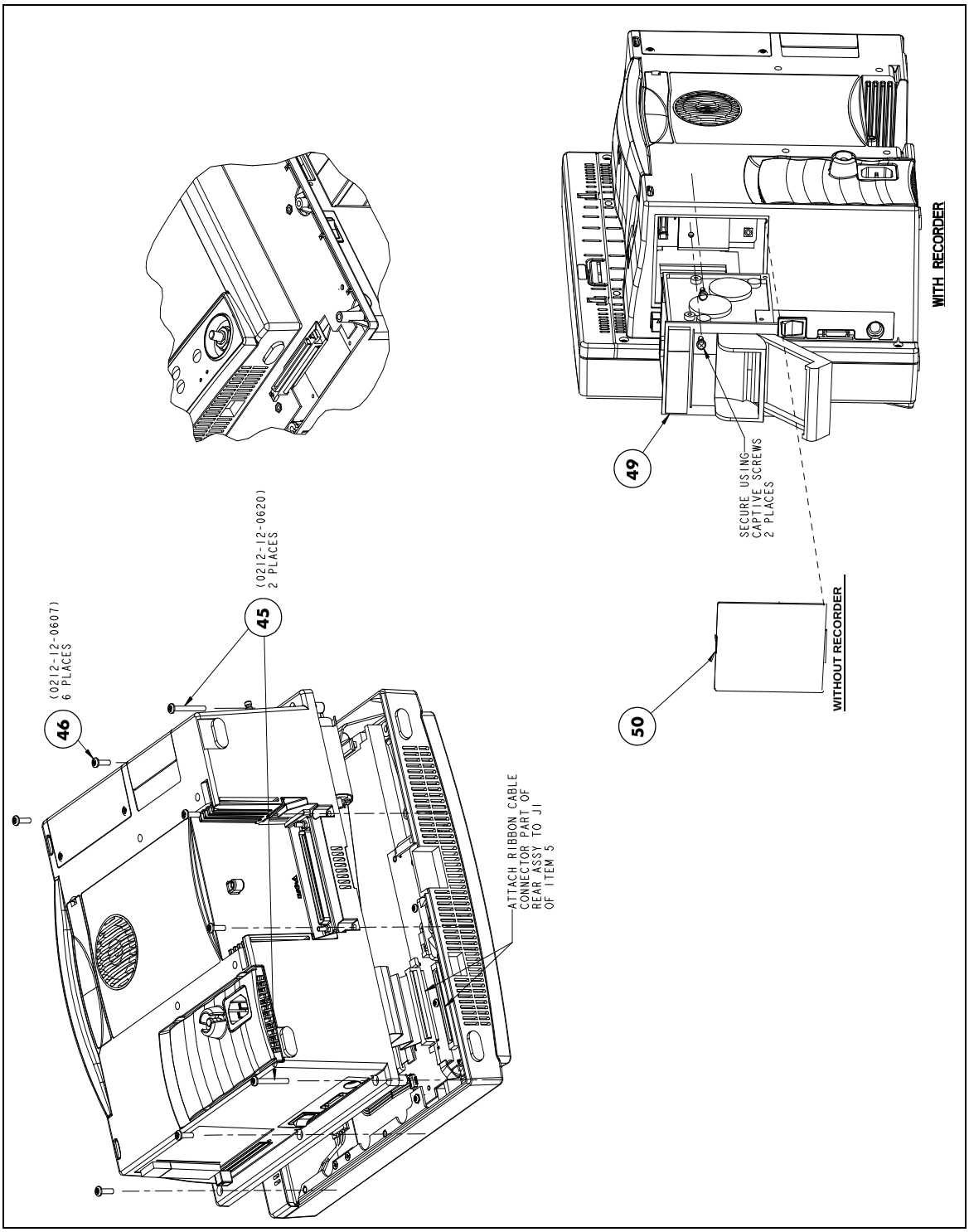

FIGURE 3-14 Rear Housing Assembly

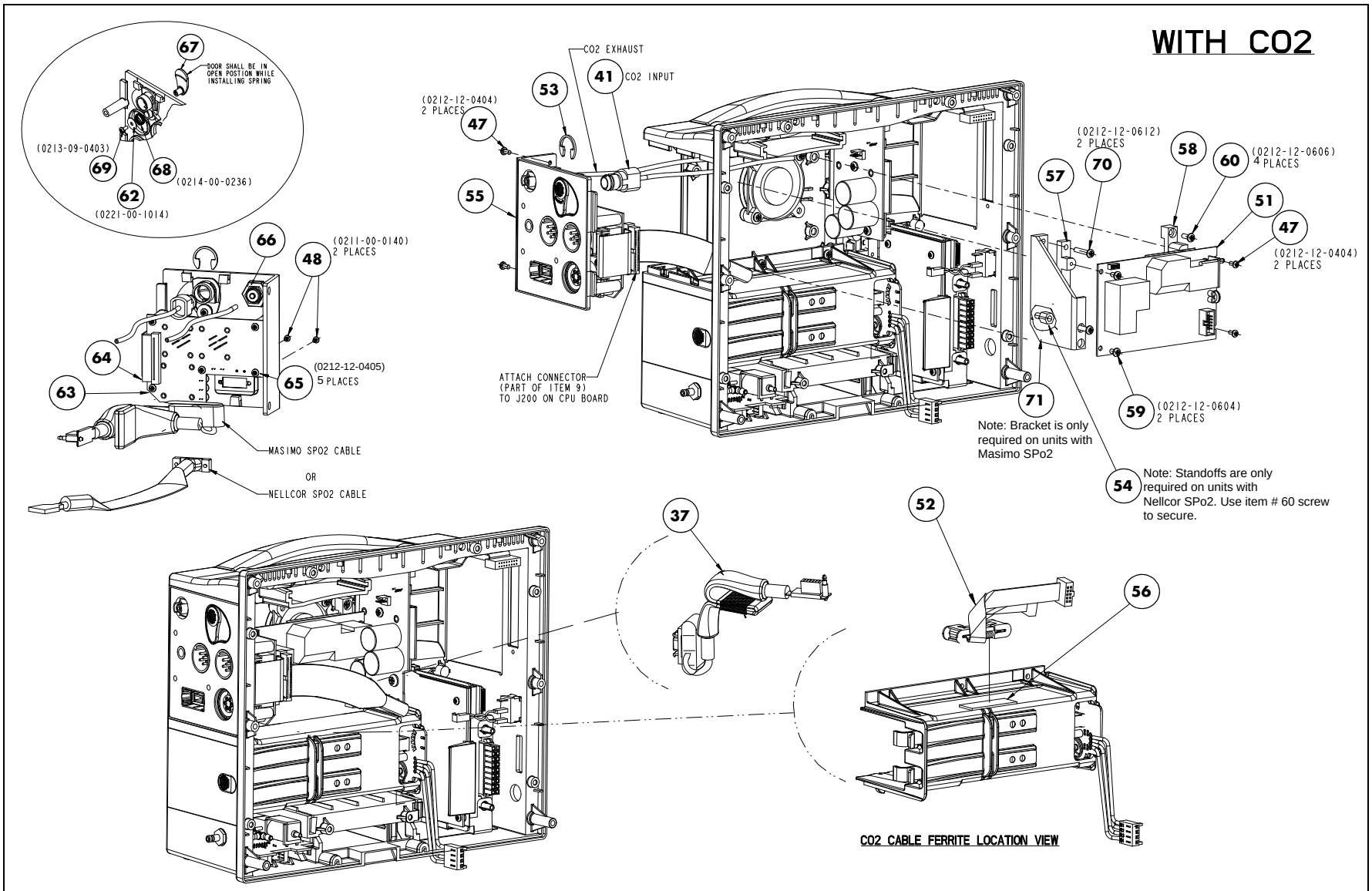

FIGURE 3-15 Rear Housing Assembly (Sealed Lead Acid battery configuration)

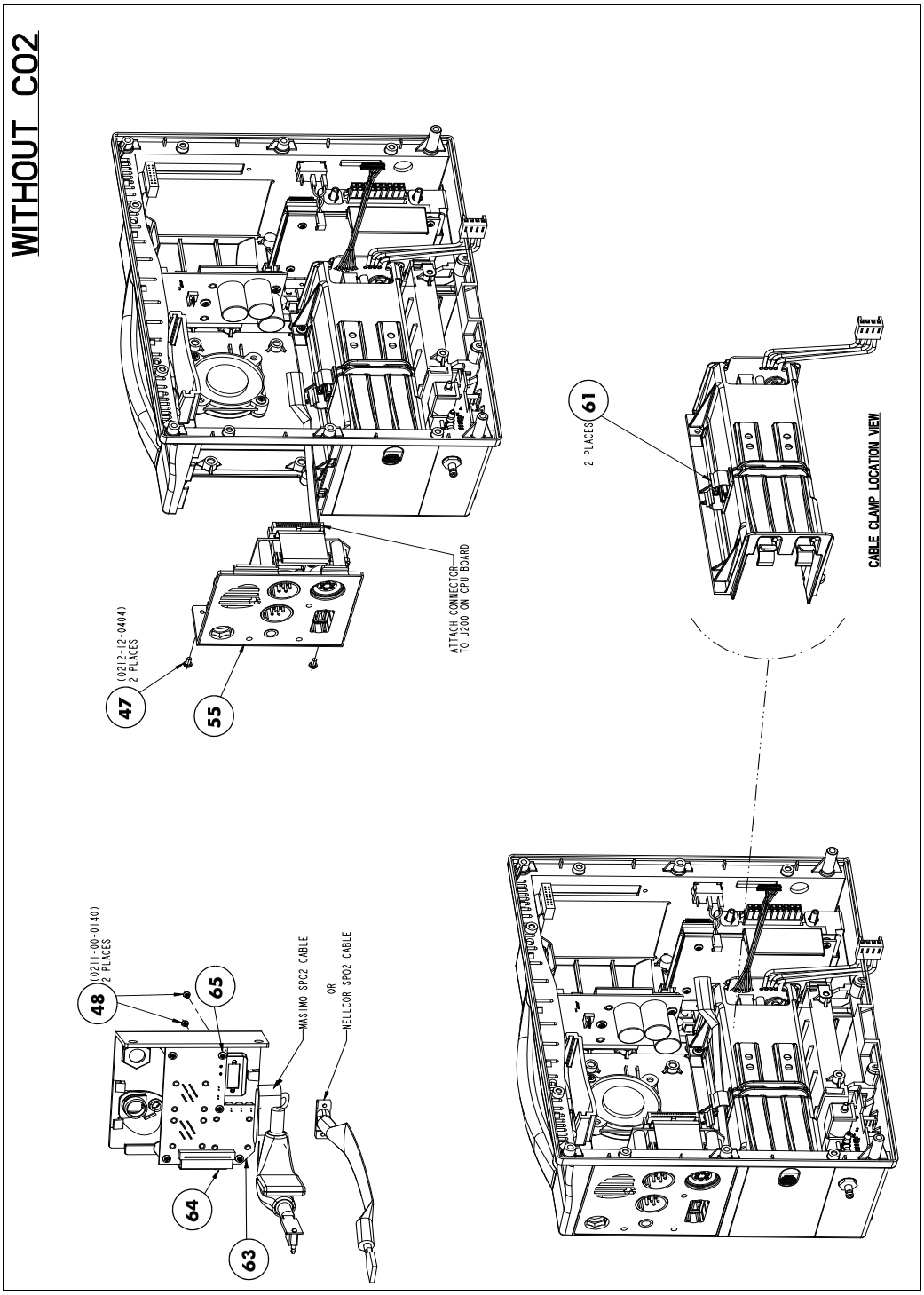

FIGURE 3-16 Rear Housing Assembly (Sealed Lead Acid battery configuration)

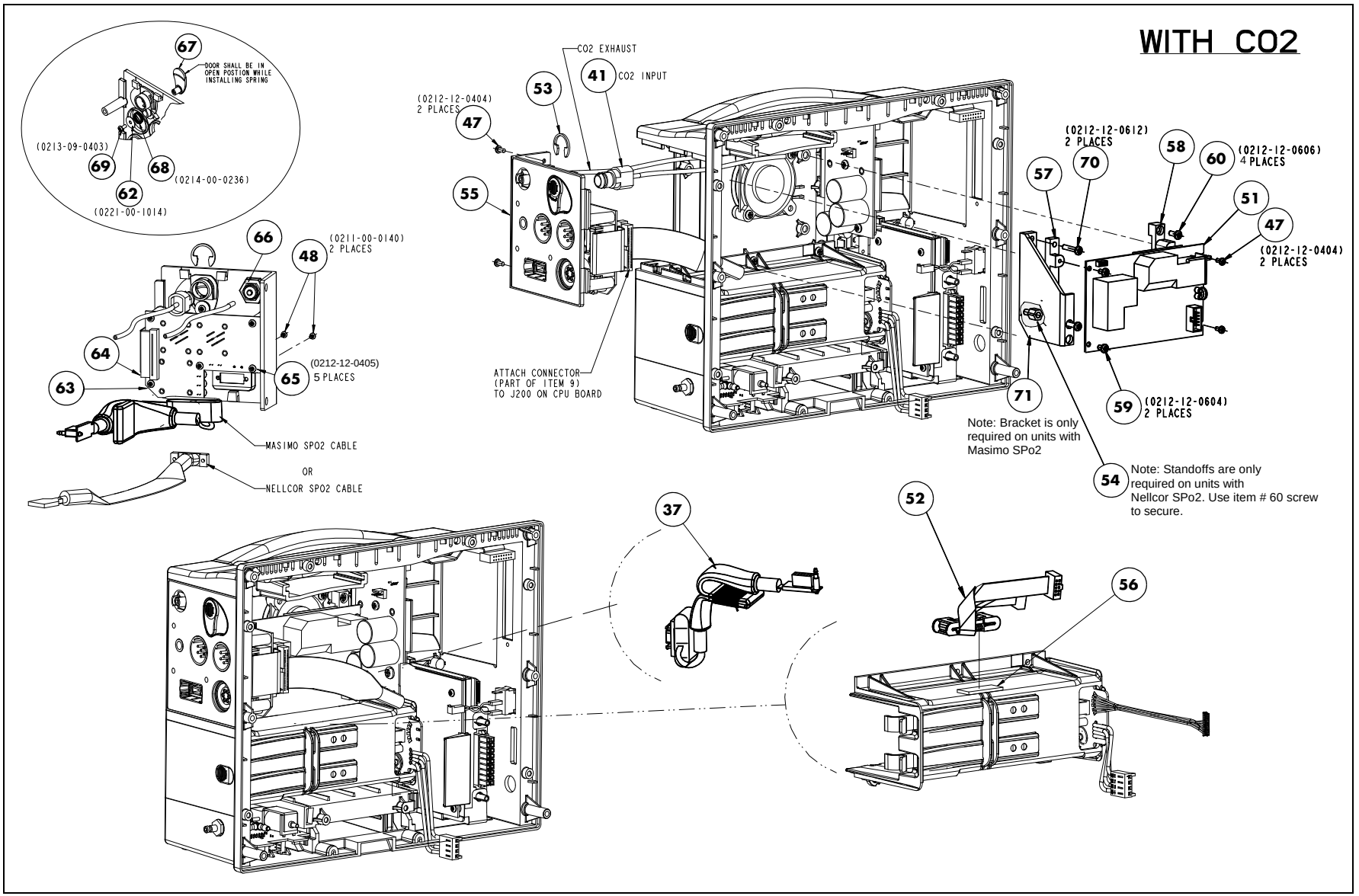

FIGURE 3-17 Rear Housing Assembly (Lithium-Ion battery configuration)

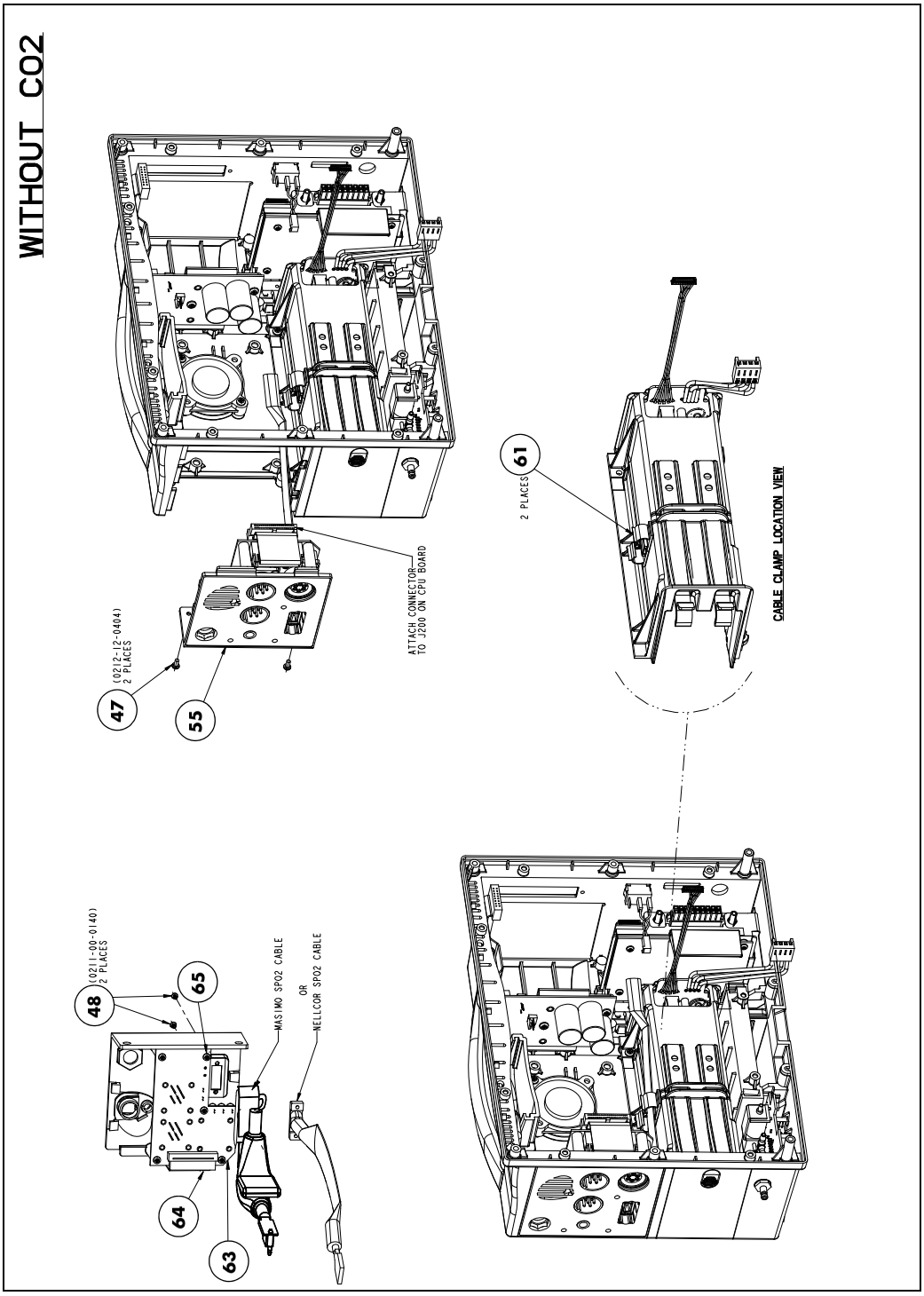

FIGURE 3-18 Rear Housing Assembly (Lithium-Ion battery configuration)

ITEM NO	DESCRIPTION	PART NUMBER
1	Rear Housing	0380-00-0339-04
2	Foot	0348-00-0190
3	Handle	0367-00-0061
4	Pin Handle	0226-00-0017
5	PCB Assembly, Module Interface	0670-00-1155-01
6	Bracket Recorder Mounting (AR-42)	0406-00-0741
7	PCB Assembly, Recorder Interface	0670-00-0695
9	Label, Part Number/Serial Number	N/A
10	Fan Assembly w/Cable 9.89 CFM	0012-00-1622-01
10a	Screw, Pan Head Cross Recessed #6-32 x 9/16	0012-12-0609
11	Plate Ground	0386-00-0290
12	PC Board Assembly Main/CPU TFT (Use with S/N MM XXXX-XX)	0670-00-0782-02
12a	PC Board Assembly Main/CPU TFT (Use with S/N MS XXXX-J5 or above)	0670-00-0782-01
13	Cable Main Board to Interconnect Board	0012-00-1210
14	Cable Assembly Power Switch	0012-00-1231
15	PCB Assembly, NIBP module	0670-00-0746-01
15	NIBP Module Assembly	0670-00-0798-01
16	Cable Assembly Pump NIBP	0012-00-1249
17	Bracket Pump	0406-00-0750
18	Cable NIBP to Main Board	0012-00-1211
19	Cover Power Supply	0198-00-0051
20	Door Battery Access	0380-00-0349
21	Strap Grounding Plastic Battery Holder	0346-00-0049
22	Cover Transceiver	0198-00-0027
23	Screw, Pan Head Cross Recessed #6-32 x 5/16	0212-12-0605
24	Screw, Pan Head Cross Recessed #6-32 x 7/16	0212-12-0607
25	Screw, Pan Head Cross Recessed #4-40 x 3/8	0212-12-0406
26	Screw, Pan Head Cross Recessed #4-40 x 3/4	0212-12-0412
27	Screw, Pan Head Cross Recessed #4-40 x 7/16	0212-12-0407
28	Screw, Pan Head Cross Recessed #6-32 x 3/16	0212-12-0603
29	Screw, Pan Head Cross Recessed #4-40 x 1/2	0212-12-0408
30	SpO_2 Board Assembly Nellcor® 304P	0671-00-0162
30a	SpO_2 Board Assembly Nellcor® OxiMax	0671-00-0066
31	PCB Assembly Nellcor Interface	0670-00-0696
31a	PCB Assembly Masimo/Nellcor Interface Bd (use with CPU Bd 0670-00-0782-XX only)	0670-00-0785-XX
32	Cable, Nellcor SpO_2 Interface Bd to Main Bd	0012-00-1233
33	Cable Assembly, Nellcor SpO_2	0012-00-1356
33a	Cable Assembly, Nellcor SpO_2 OxiMax	0012-00-1634
34	SpO_2 Board Assembly Masimo® MS-3	0671-00-0055
35	Cable, Masimo SpO_2 to Main Board	0012-00-1201
36	Spacer Nylon Richco	0361-45-0403

ITEM NO	DESCRIPTION	PART NUMBER
37	Cable Assembly, Masimo SpO_2 with Choke	0012-00-1308
38	Battery Holder Assembly, Plastic, Sealed Lead Acid	0997-00-0972-01
38	Battery Holder Assembly, Plastic, Lithium-Ion	0997-00-0972-02
39	Power Supply/Charger (Sealed Lead Acid)	0014-00-0250
39	Power Supply/Charger (Lithium-Ion)	0014-00-0251
40	Screw, Pan Head Cross Recessed #4.40 x 3/16	0212-12-0403
41	CO_2 Input Assembly	0012-00-1400
42	Screw, Pan Head, Nylon #4.40 x 1/4	0212-01-0404
43	Strap, Battery Door	0346-00-0047
44	Insulator, Nellcor SpO_2, Interface Board	0349-00-0322
45	Screw, Pan Head Cross Recessed #6.32 x 1 1/4	0212-12-0620
46	Screw, Pan Head Cross Recessed #6.32 x 5/8	0212-12-0610
47	Screw, Pan Head Cross Recessed #4.40 x 1/4	0212-12-0404
48	Screw, Metric Flat Head	0211-00-0140
49	Recorder Thermal Array (AR-42 Special)	0683-00-0465-01
50	Recorder Plate, Blank	0370-00-0017-03
51	$MediCO_2$ Module Assembly (Oridion) $miniMediCO_2$ Module Assembly (Oridion)	0671-00-0164-03 0671-00-0089-01
52	Cable CO_2 to Main Board ($MediCO_2$)	0012-00-1200
52	Cable CO_2 to Main Board ($miniMediCO_2$)	0012-00-1683-01
53	Retainer CO_2 Connector	0226-00-0018
54	Standoff Hex Male/Female #6.32 x 0.250 long	0361-27-0250
55	Connector Panel Masimo w/CO_2	0380-00-0348-01
55	Connector Panel Masimo w/o CO_2	0380-00-0348-02
55	Connector Panel Nellcor w/CO_2	0380-00-0348-03
55	Connector Panel Nellcor w/o CO_2	0380-00-0348-04
55	Connector Panel Nellcor Oximax w/ CO_2	0380-00-0348-05
55	Connector Panel Nellcor Oximax w/o CO_2	0380-00-0348-06
56	Tape Double-sided 5/8 wide	0215-00-0115
57	Bracket CO_2 Mounting Thru-Hole End ($MediCO_2$)	0406-00-0783
57	Bracket CO_2 Mounting Upper ($miniMediCO_2$)	0406-00-0879
58	Bracket CO_2 Mounting Slotted End ($MediCO_2$)	0406-00-0805
58	Bracket CO_2 Mounting Lower ($miniMediCO_2$)	0406-00-0885
59	Screw, Pan Head Cross Recessed #6.32 x 1/4	0212-12-0604
60	Screw, Pan Head Cross Recessed #6.32 x 3/8	0212-12-0606
61	Clamp Cable 3/16 Self Adhesive	0343-00-0007
62	Washer, Flat 0.470 OD, 0.119 ID	0221-00-1014
63	PC Board Assembly Patient Connector AAMI w/IBP	0670-00-0682-01
63	PC Board Assembly Patient Connector AAMI w/o IBP	0670-00-0682-02
63	PC Board Assembly Patient Connector HP	0670-00-0680-01
64	Cable Panel to Main Board	0012-00-1206-01
65	Screw, Pan Head Cross Recessed #4.40 x 5/16	0212-12-0405
66	Pneumatic Fitting Male Panel Mount	0103-00-0489

ITEM NO	DESCRIPTION	PART NUMBER
67	Door, CO_2 Connector	0380-00-0355
68	Spring Door	0214-00-0236
69	Screw, Self-Tapping #4-40 x 3/16	0213-09-0403
70	Screw Pan Head Cross Recessed #6 x 3/4	0212-12-0612
71	Bracket Magnetic Shield	0406-00-0833
72	Standoff Plastic	0361-08-0017
73	Cable Tie Anchor	0125-00-0023
74	Washer Shoulder .140 OD, -115 ID	0221-00-1026
75	Screw Pan Head	0212-12-0418
76	Cable Tie	0125-01-0001
77	Standoff Plastic	0361-30-0375
78	Cable, Interface to Main CPU Board for 0998-00-1000-XXXX	0012-00-1596
79	Standoff	0361-30-0250
80	Clip, Plastic	0343-05-0001

3.5 External Parameter Module

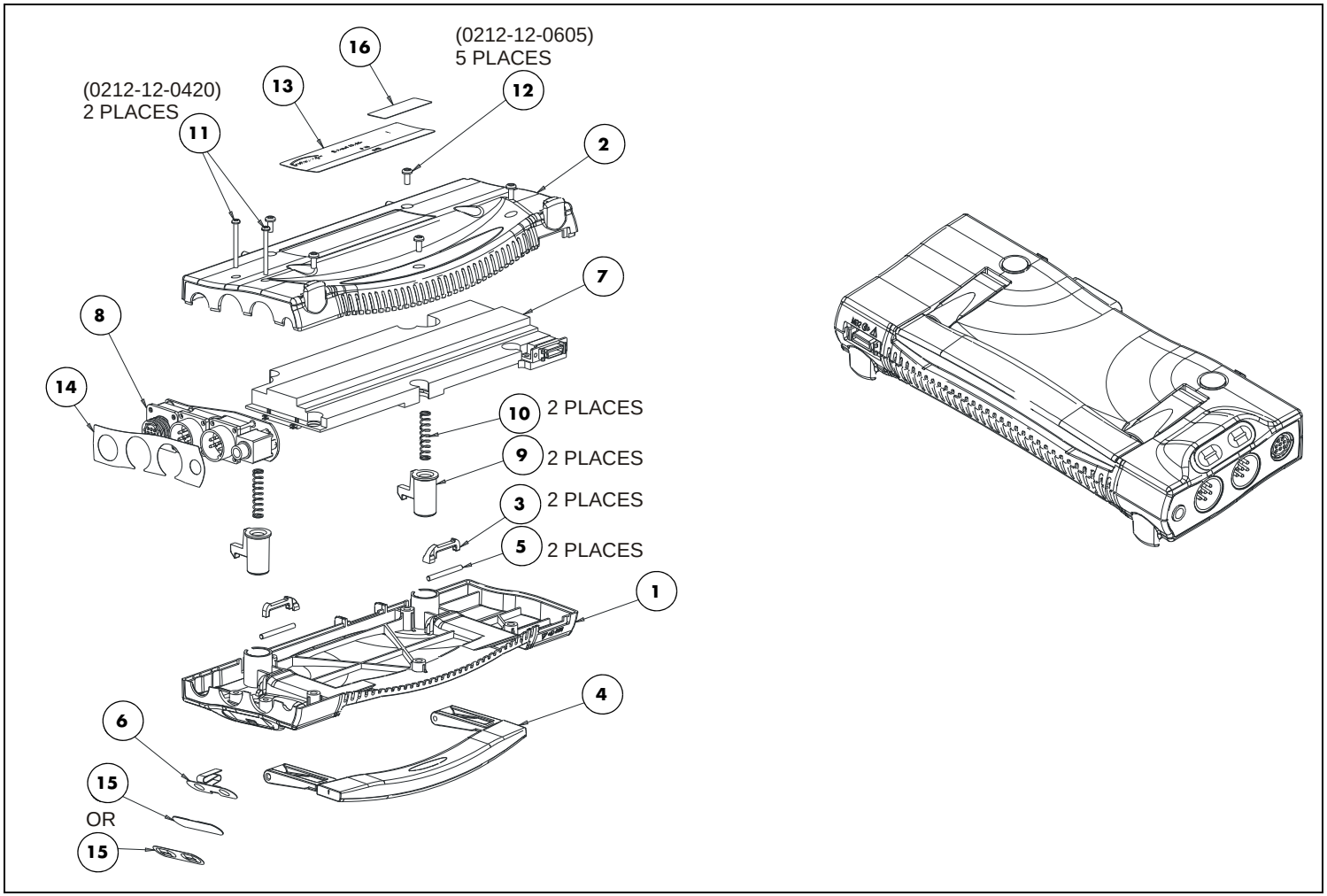

FIGURE 3-19 External Parameter Module

ITEM NO	DESCRIPTION	PART NUMBER
1	Housing, Top, External Module	0380-00-0413
2	Housing, Bottom, External Module	0380-00-0414
3	Gasket Handle	0380-00-0416
4	Handle	0367-00-0061
5	Shaft Precision Increment 1/8 Dia X 1.250 Long	0226-04-0420
6	FFC Assembly Keypad	0331-00-0118
7	PCB Assembly, Main, External Module	0670-00-0734-01
8	PCB Assembly, Connector Panel, External Module	0670-00-0738-01
9	Button Latch External Module	0380-00-0415
10	Spring Compression	0214-00-0234
11	Screw, Pan Head Cross Recessed #4-40 X 1.25	0212-12-0420
12	Screw, Pan Head Cross Recessed #6-32 X 5/16	0212-12-0605
13	Label, Information External Module	0334-00-2583
14	Label, Patient Connector (T2, IBP3, IBP4, CO) English, Japanese, Br. Portuguese	0334-00-2582-001
14	Label, Patient Connector (T2, IBP3, IBP4) English, German, Italian, Japanese, Br. Portuguese	0334-00-2582-002
14	Label, Patient Connector (T2, CO) English, Dutch, Japanese, Br. Portuguese	0334-00-2582-003
14	Label, Patient Connector (T2) English, German, French, Spanish, Italian, Dutch, Japanese, Br. Portuguese	0334-00-2582-004
14	Label, Patient Connector (T2, IBP3, IBP4, CO) German	0334-00-2582-006
14	Label, Patient Connector (T2, CO) German	0334-00-2582-008
14	Label, Patient Connector (T2, IBP3, IBP4, CO) French	0334-00-2582-011
14	Label, Patient Connector (T2, IBP3, IBP4) French	0334-00-2582-012
14	Label, Patient Connector (T2, CO) French	0334-00-2582-013
14	Label, Patient Connector (T2, IBP3, IBP4, CO) Spanish	0334-00-2582-016
14	Label, Patient Connector (T2, IBP3, IBP4) Spanish	0334-00-2582-017
14	Label, Patient Connector (T2, IBP3, IBP4, CO) Italian	0334-00-2582-021
14	Label, Patient Connector (T2, CO) Spanish, Italian	0334-00-2582-023
14	Label, Patient Connector (T2, IBP3, IBP4, CO) Dutch	0334-00-2582-026
14	Label, Patient Connector (T2, IBP3, IBP4) Dutch	0334-00-2582-027
15	Label, Keypad Filler	0334-00-2624
16	Label, Part Number/Serial Number	N/A

3.6 Comm-Port

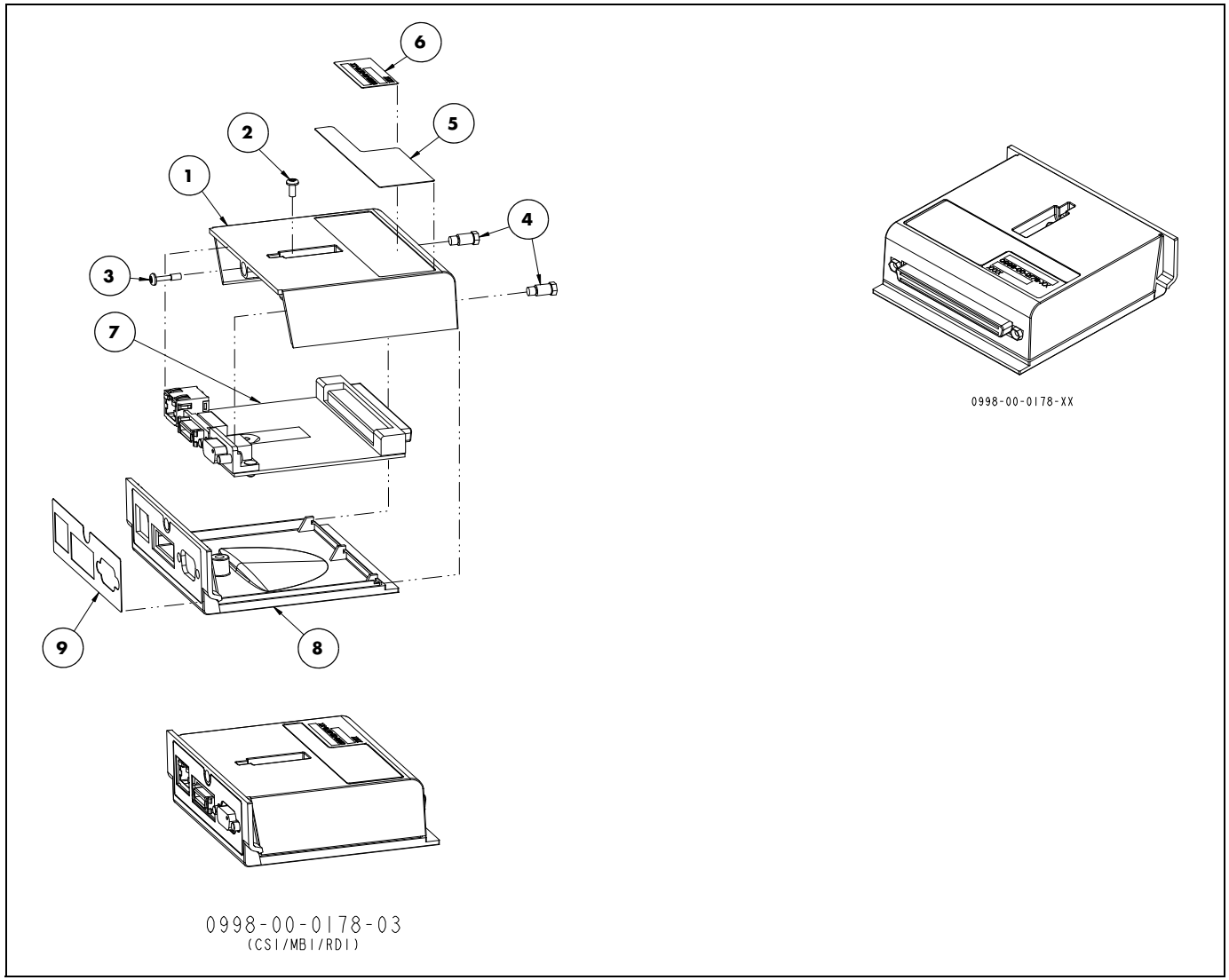

FIGURE 3-20 Comm-Port

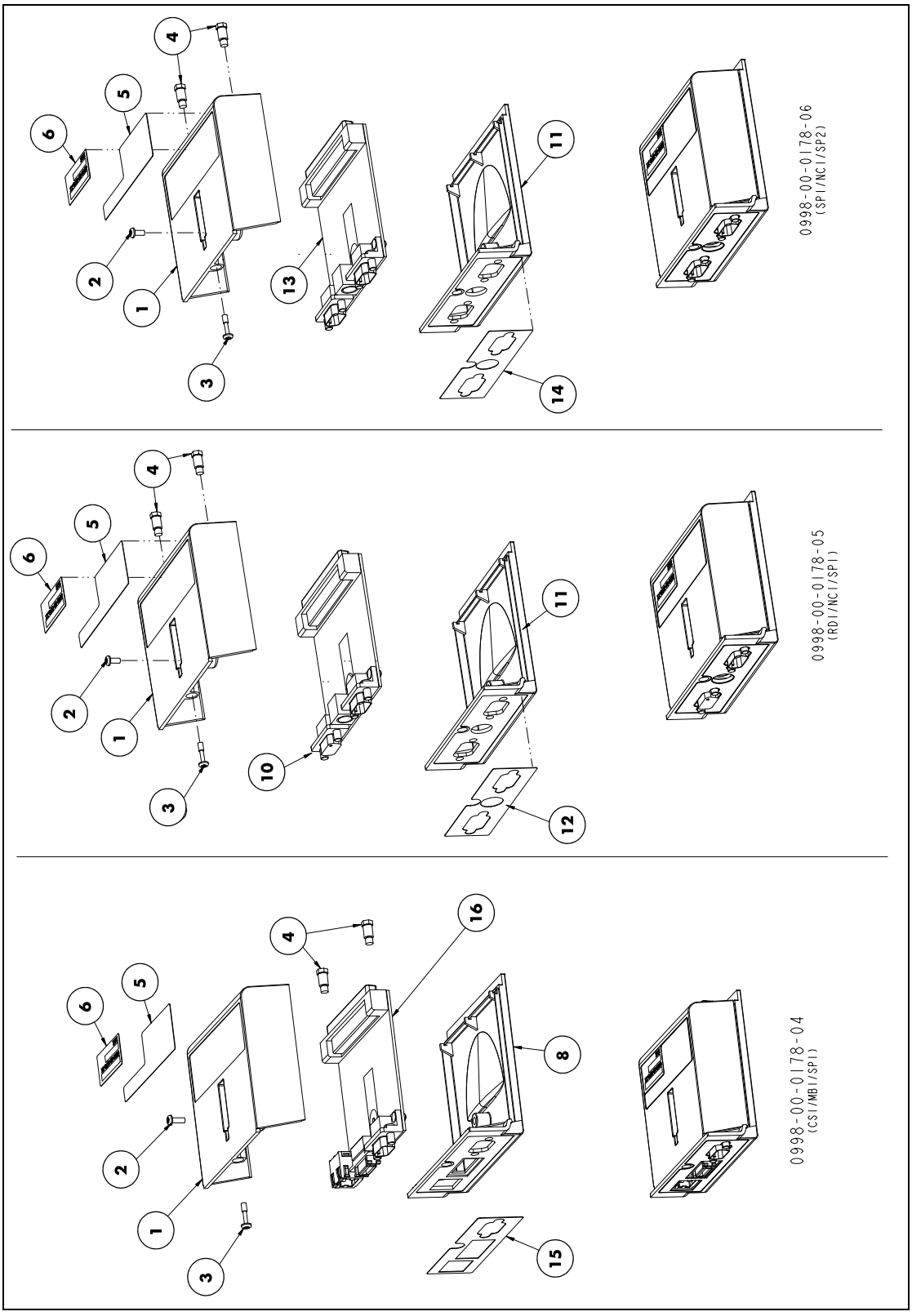

FIGURE 3-21 Comm-Port

ITEM NO	DESCRIPTION	PART NUMBER
1	Housing, Top, Comm-Port	0380-00-0346
2	Screw, Pan Head, #4-40 X 5/16	0212-12-0405
3	Screw, Captive, Pan Head, Cross Recessed	0217-02-0004
4	Socket, Guide, Docking Connector	0132-00-0077
5	Label, Information, Comm-Port	0334-00-1533
6	Label	N/A
7	PCB Assembly, Comm-Port, CS1/MB1/RD1	0670-00-0690
8	Housing, Bottom, Comm-Port, -03 and -04	0380-00-0347-03
9	Label, "CS1, MB1, RD1", Comm-Port	0334-00-1536
10	PCB Assembly, Comm-Port, RD1/NC1/SP1	0670-00-0692
11	Housing, Bottom, Comm-Port, -05 and -06	0380-00-0347-04
12	Label, "RD1, NC1, SP1", Comm-Port	0334-00-1573
13	PCB Assembly, Comm-Port, SP1/NC1/SP2	0670-00-1140
14	Label, "SP1, NC1, SP2", Comm-Port	0334-00-2521
15	Label, "CS1, MB1, SP1", Comm-Port	0334-00-1541
16	PCB Assembly, Comm-Port, CS1/MB1/SP1	0670-00-0684-01

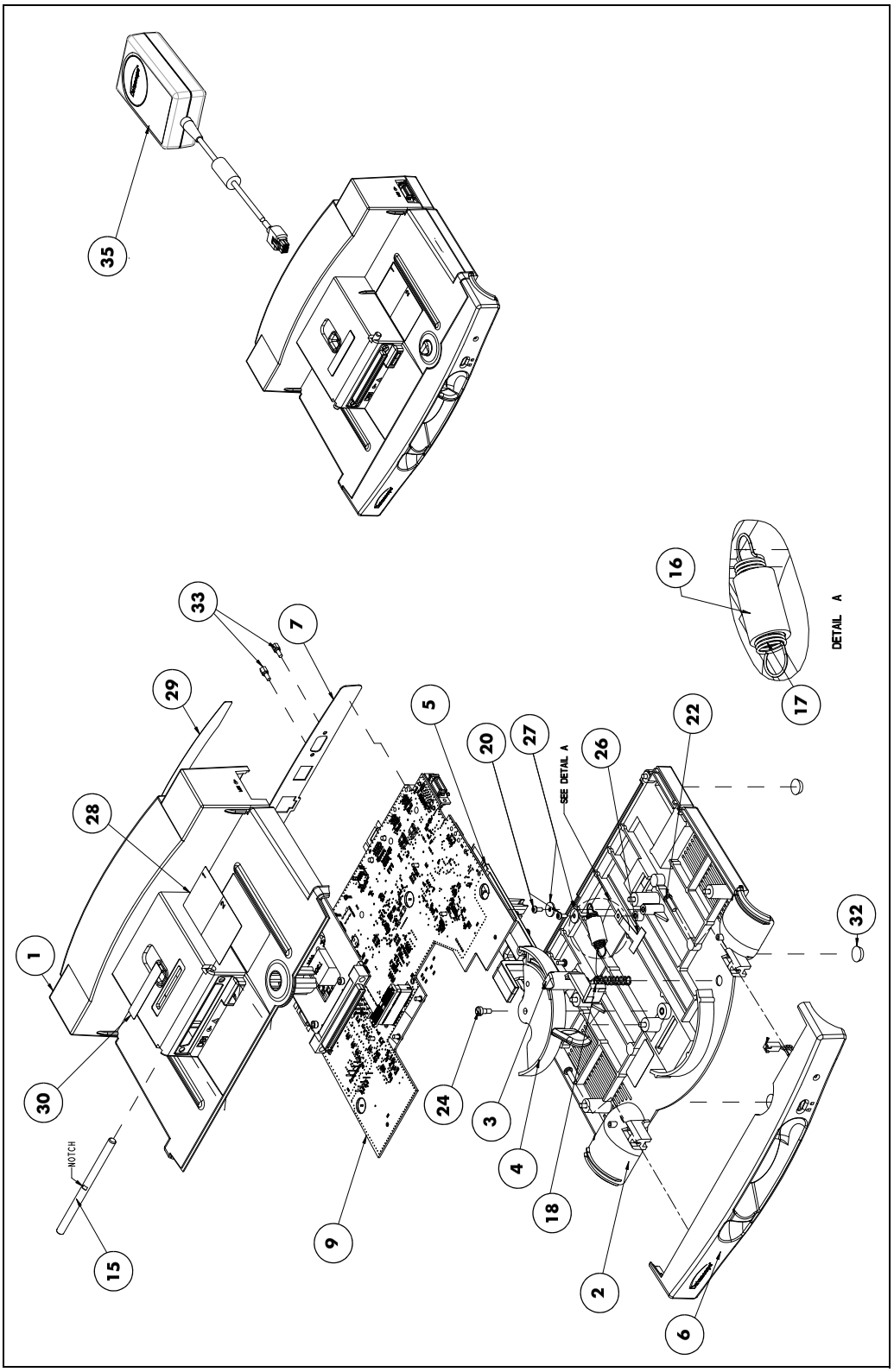

FIGURE 3-22 Base Station

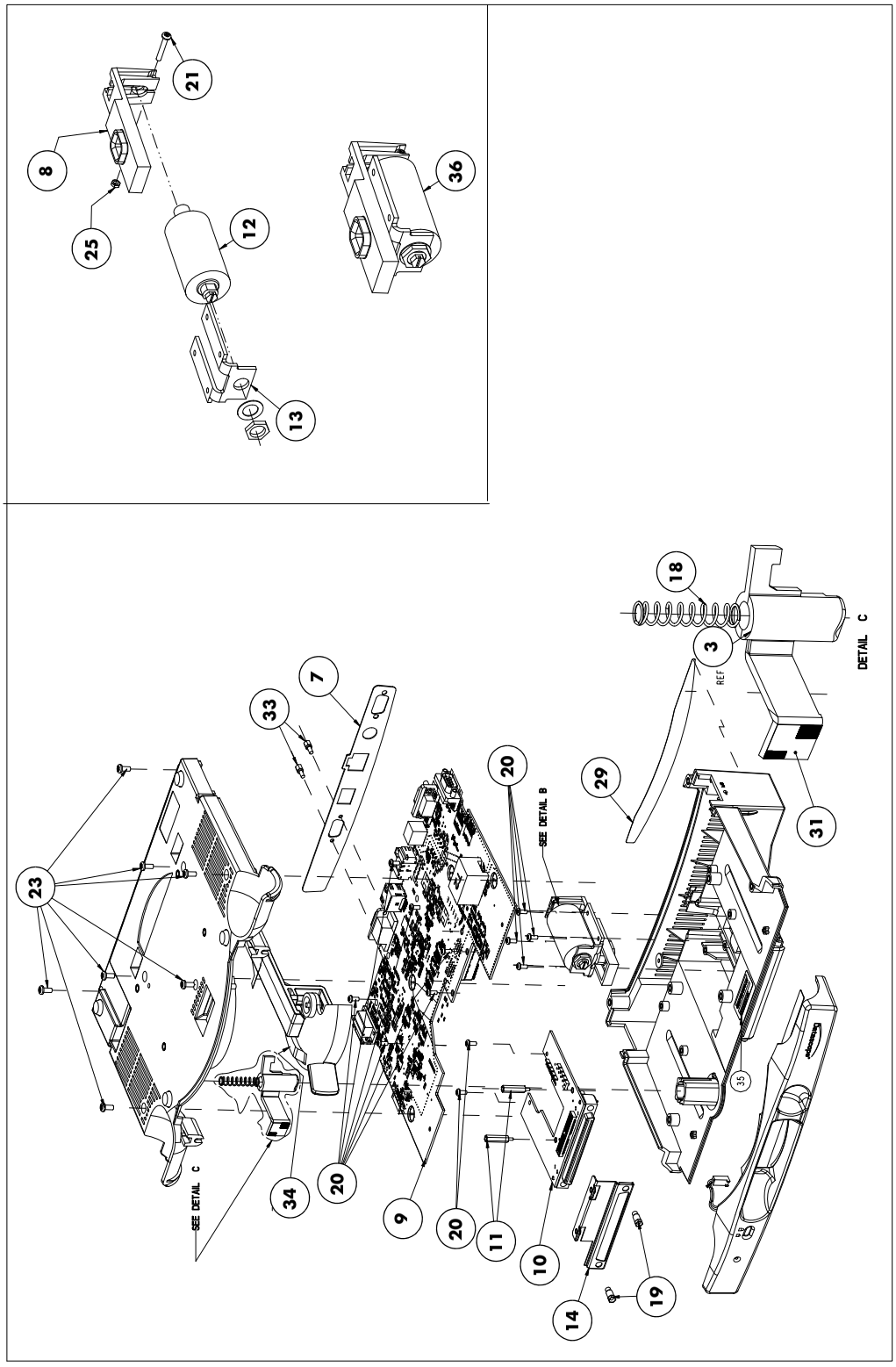

FIGURE 3-23 Base Station Assembly

ITEM NO	DESCRIPTION	PART NUMBER
1	Housing Top Base Station	0380-00-0340
2	Housing Bottom Base Station	0380-00-0341
3	Latch Base Station	0380-00-0342
4	Lever Base Station	0380-00-0343
5	Carriage Base Station	0380-00-0344
6	Bezel Base Station	0380-00-0323
7	Connector Panel Rear	0386-00-0323
8	Slide Dashpot (Plastic Part)	0406-00-0737
9	PCB Assy Main Board	0670-00-0758-01
10	PCB Assy Daughter Board	0670-00-0759-01
11	Standoff Hex Male/Female (4-40 x .748 Lg)	0361-00-0182
12	Dashpot	0103-00-0466
13	Bracket Mounting Dashpot Base Station	0406-00-0738
14	Bracket Main Connector Ground	0406-00-0841
15	Pin Monitor Guide	0226-00-0016
16	Tubing Silicone Rubber 3/8 I.D. X 1/16 Wall	0008-00-0321
17	Spring Extension .375 Dia. 1.5 Length	0214-00-0235
18	Spring Compression .296 Dia. 1.281 Length	0214-00-0234
19	Socket Guide Docking Connector	0132-00-0077
20	Screw Pan Hd 4-40 x .25 Lg	0212-12-0404
21	Screw Pan Hd 4-40 x .75 Lg	0212-12-0412
22	Screw Pan Hd 6-32 x .50 Lg	0212-12-0608
23	Screw Pan Hd 6-32 x .31 Lg	0212-12-0605
24	Screw Shoulder #6 Thread .156 Dia x 0.187 Height	0217-00-0012
25	Nut Plain Hex #4 Small Pattern	0223-02-0004
26	Washer Snubbing Mylar	0221-00-1016
27	Washer Flat Large O.D. #4	0221-00-1010
28	Label Function Diagram Base Station	0334-00-1511
29	Label Information Base Station	0334-00-1497
30	Label Dashpot Adjustment	0334-00-1618
31	Label, Latch, Locked/Unlocked	0334-00-2514
32	Bumper (Feet Base Station)	0348-03-0001
33	Standoff Hex Male/Female With Lock Washer	0361-00-0164
34	Label Part Number Serial Number	N/A
35	Power Supply Assembly	0014-00-0070
36	Dashpot Assembly	0103-00-0465
NS	MB1 Connector Shroud	0334-00-1668

N.A. Not Available

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4.0 *Calibration Procedure*

4.1 Introduction

The following procedures are provided to verify the proper operation of the **Spectrum®/ Spectrum OR™** Monitor. Service Diagnostics provide the capability of diagnosing problems within the **Spectrum®/Spectrum OR™** hardware. A menu driven interface similar to that of the **Spectrum®/Spectrum OR™** User Interface, is used to execute all tests.

CAUTION: Calibration is not to be performed while monitoring a patient.

4.2 Warning and Guidelines

In the event that the instrument covers are removed, observe the following warnings and general guidelines:

1. Do not short component leads together.
2. Perform all steps in the exact order given.
3. Use extreme care when reaching inside the opened instrument. Do not contact exposed metal parts which may become electrically active.
4. Read and understand each step of the procedure prior to beginning the step.

4.3 Test Equipment and Special Tools Required

- Digital Mercury manometer with bulb and valve 0-500 mmHg - Netech Digimano - Accuracy 0.25% Full Range
- Test Chamber/ Dummy Cuff — P/N 0138-00-0001-01 (700 cc) or -03 (500 cc)
- DVM
- Patient Simulator
- Digital Flow Meter
- Safety Analyzer — Dempsy Model or equivalent
- BISx — BIS Sensor Simulator P/N 0454-00-0060

4.4 Diagnostics

To enter the diagnostic mode:

1. Turn the power OFF.
2. Pressing and hold the **FREEZE** key (**Spectrum**®) or the **SPIROMETRY** key (**Spectrum OR**™) while powering **ON** the monitor. The **Diagnostics Main Menu** will appear on screen. Release the **FREEZE** key or the **SPIROMETRY** key.
3. Rotate the Navigator™ Knob to move the cursor within the **Diagnostics Main Menu**. Pressing the Navigator knob will select the desired test and open the second test menu.

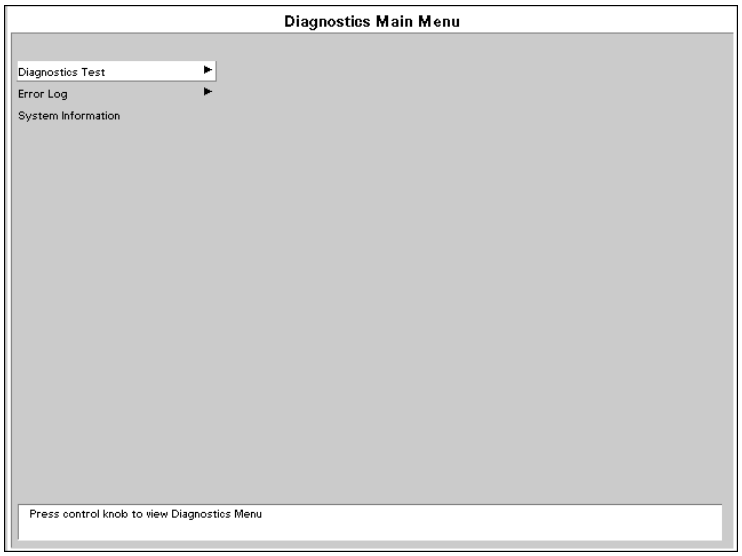


FIGURE 4-1 Diagnostics Main Menu

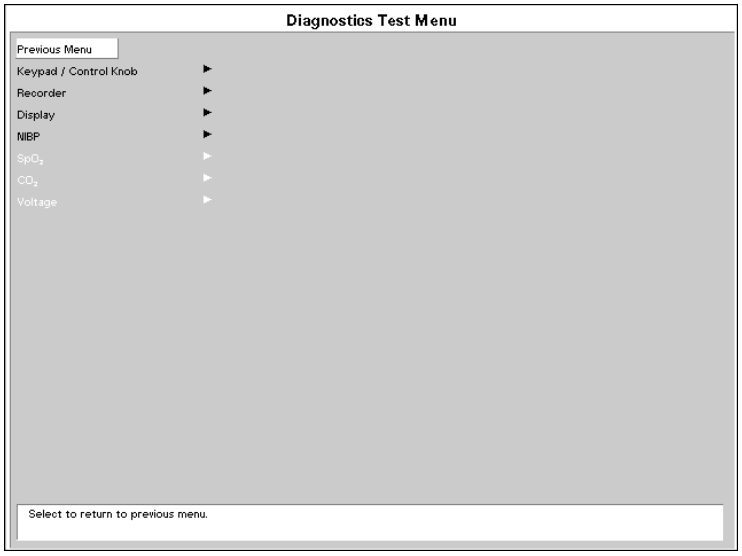


FIGURE 4-2 Diagnostics Test Menu

4.4.1 Keypad / Control Knob Test

When this menu is selected the unit will perform an echo test by displaying the name of the key that was pressed.

1. A blank key name will appear on screen
2. When a key is pressed the name of that key will be displayed in the key name window.
3. Exercise each key to verify proper operation.
4. A second window with blank boxes will be displayed on screen.
5. When rotating the control knob the blank boxes will illuminate with each active detent.
6. Press the **PRINT** key to print the test result via the internal recorder.
7. Press the **NORMAL** key and hold to return to the **Diagnostics Test Menu**.

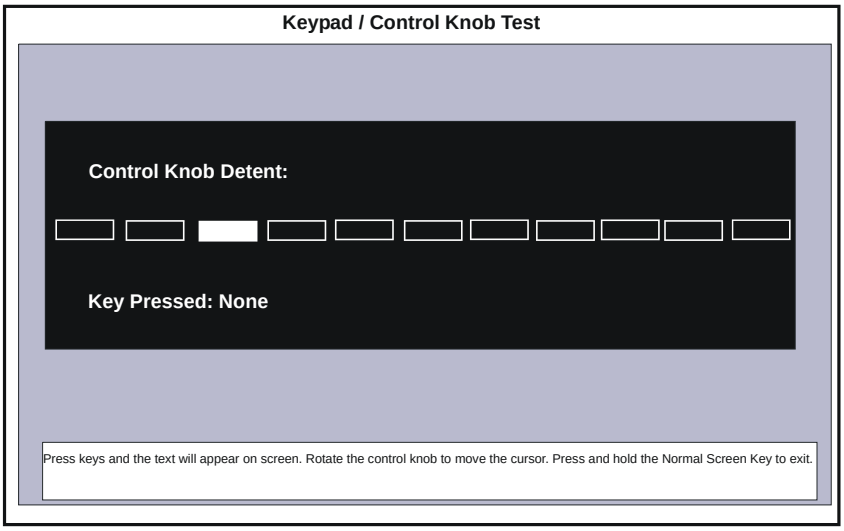


FIGURE 4-3 Keypad / Control Knob Test

4.4.2 Recorder Test

Select the Chart Grid ASCII Characters menu.

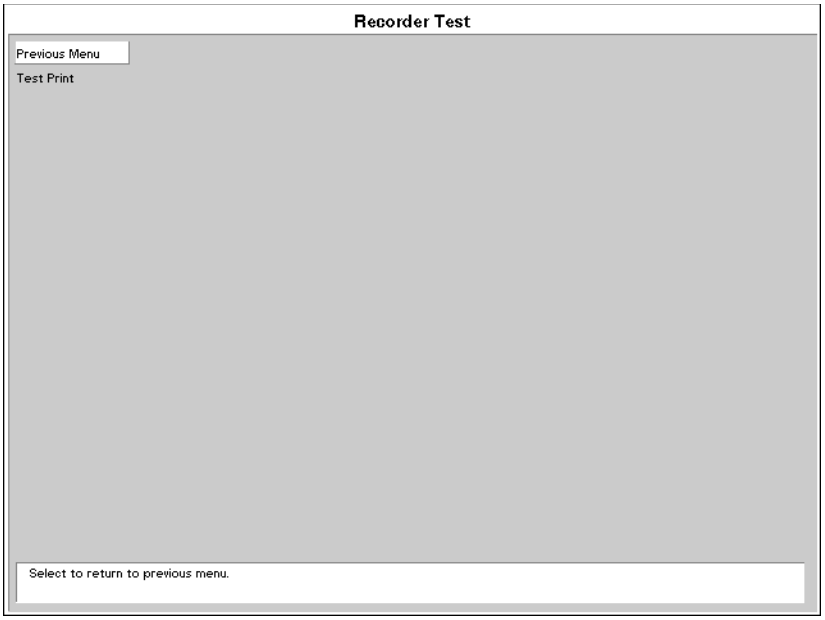


FIGURE 4-4 Recorder Test Menu

The printer will print the Recorder Test pattern as shown in the figure below.

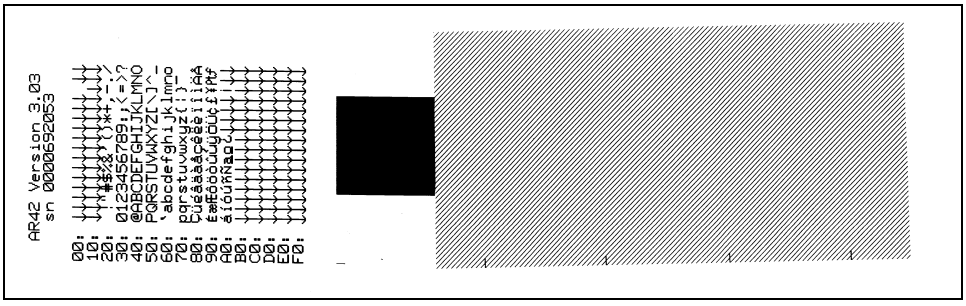


FIGURE 4-5 Recorder Test Strip

4.4.3 Display Tests

The display test offers the choice of a **Pixel Test** or a **Color Test**.

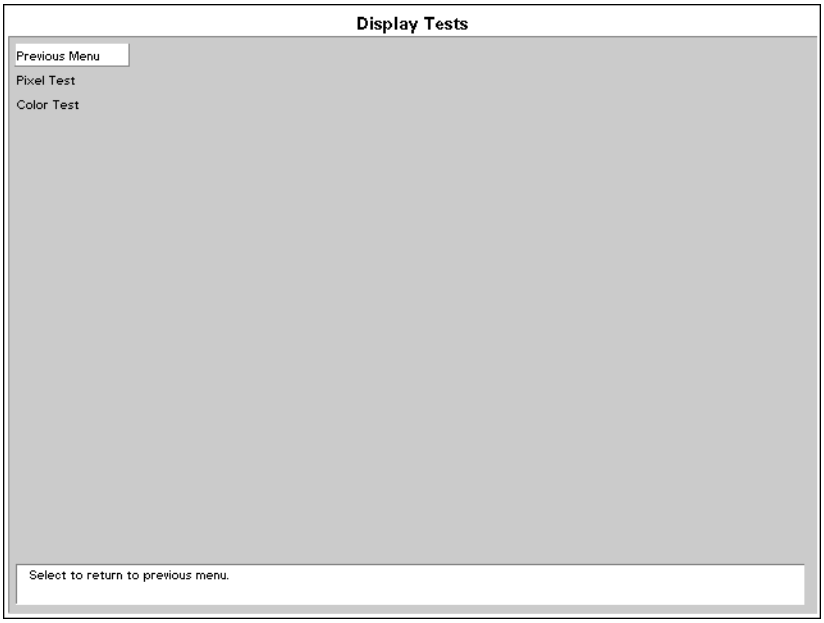


FIGURE 4-6 Display Tests Menu

4.4.4 Pixel Test

The pixel test will verify the proper operation the display. On screen one half of the screen will be illuminated, the second half will be black. Pressing the Navigator™ knob will illuminate the second half of the screen, the first half will be black. Pressing the Navigator knob a third time will activate the **Display Test Menu** screen.

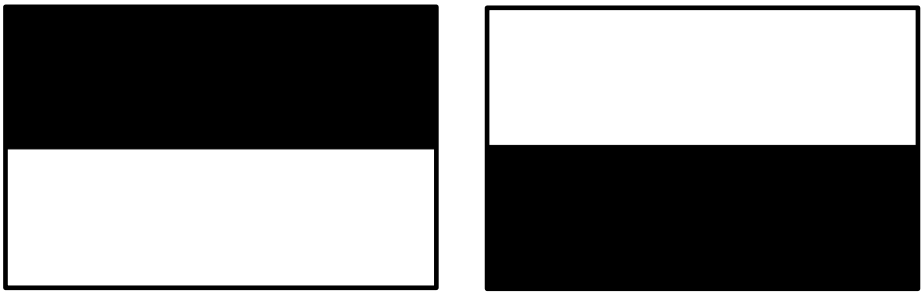


FIGURE 4-7 Pixel Test Menu

4.4.5 Color Test

The color test will verify the four basic colors of the display. Press the Navigator™ knob to view the selected color screens in full illumination. The colors are Red, Blue, Green and White.

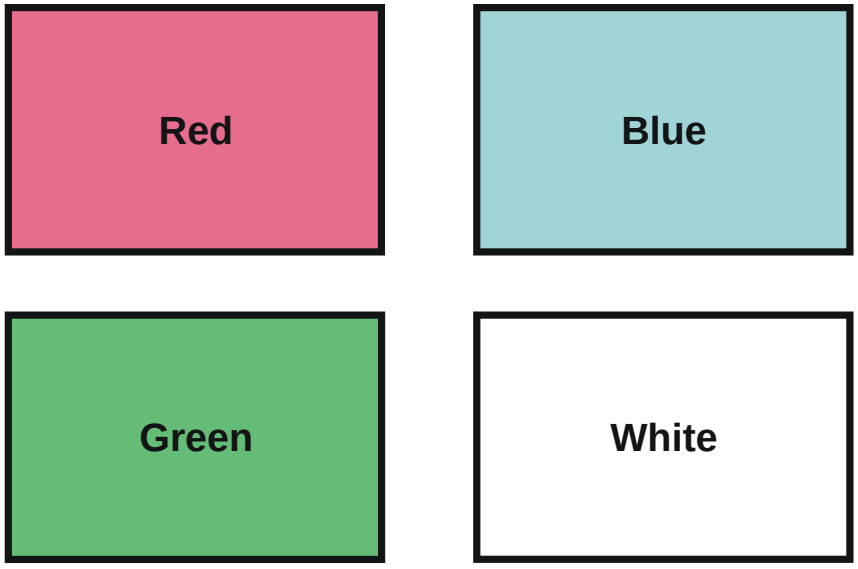


FIGURE 4-8 Color Test

4.4.6 NIBP Tests

The **NIBP Test** offers the choice of Overpressure Voltage Setpoint, Static Pressure Calibration, Motor Pump Test, Leak Tests, Bleed Rate Test, and Overpressure Tests. The tests mentioned above require an approved 700 cc Test Chamber (P/N 0138-00-0001-01) or 500 cc Test Chamber (P/N 0138-00-0001-03) to ensure proper test results.

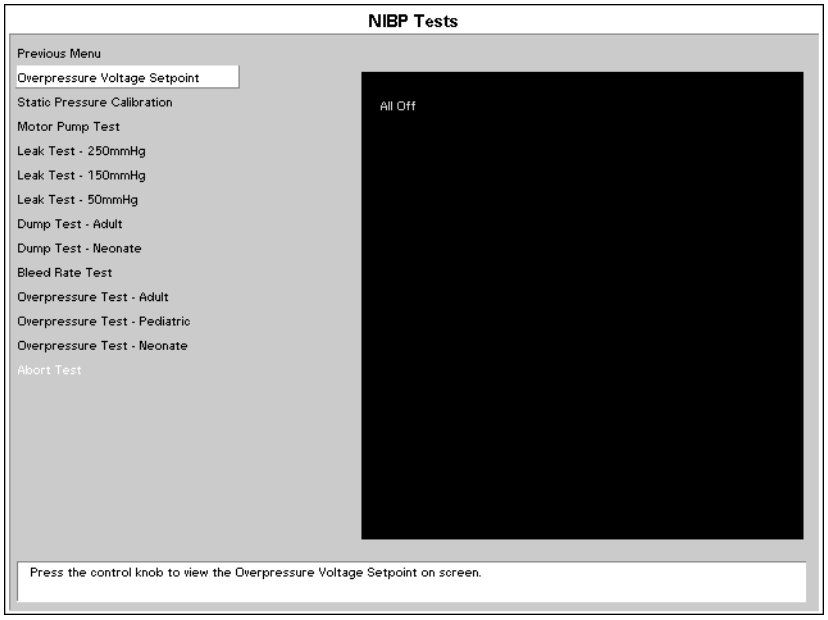


FIGURE 4-9 NIBP Tests Menu

4.4.6.1 Over Pressure Voltage Set Point

No manual adjustment is required. The voltage set point is controlled by software. If **Check Calibration/Cuff Overpresssure** appears in message area of the screen, replace the NIBP module accordingly.

Specifications: .030 to .170 volts

4.4.6.2 Static Pressure Calibration

The purpose of this test is to verify the pressure transducer sensitivity for optimal accuracy.

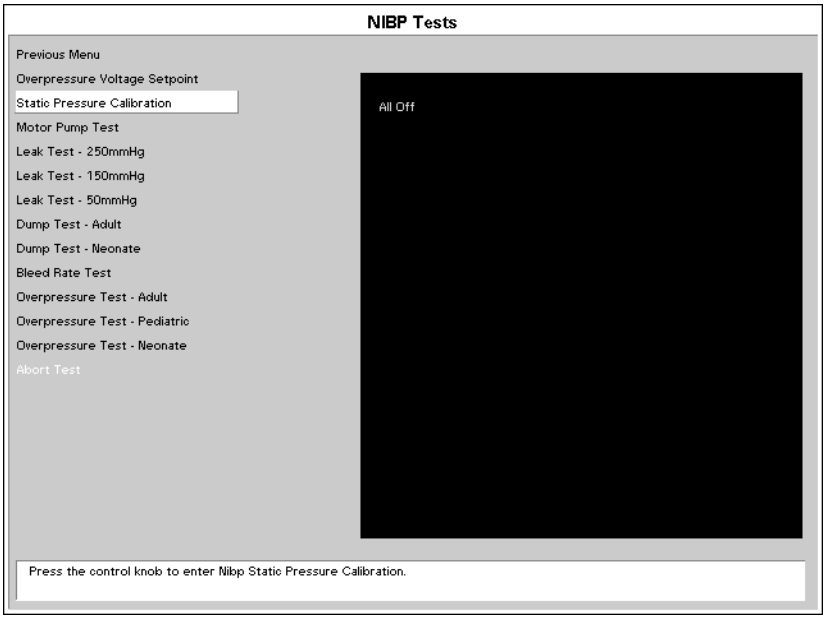


FIGURE 4-10 NIBP Tests Menu

1. Connect the dummy cuff / test chamber to the side panel fitting.
2. Use the Navigator™ knob to select **Static Pressure Calibration** and activate the test.
3. Use a bulb and valve to manually inflate the chamber to 150 mmHg. (150 mmHg is the middle of the specified range)
4. Verify the pressure displayed on screen matches the pressure viewed on a Digital Mercury Manometer.

Specifications: 0 to 300 mmHg +/- 3 mmHg

If the readings do not match, proceed with the following steps:

1. Turn unit off.
2. Remove the eight screws from the rear of the unit and separate the front and rear housing.
3. Remove the NIBP Pump assembly and bracket from the Main Assembly. Be sure to reattach NIBP pump cable to module before next step.
4. Locate R81 on the NIBP Module. Turn unit on and enter the Diagnostic Mode as stated in section 4.4. Reenter the diagnostics menu and select the **Static Pressure Calibration Menu**.
5. Manually inflate the chamber to 150mmHg.

6. Adjust R81 potentiometer and verify the linearity accordingly. See Figure 4-11.

Specifications **150 mmHg +/- .1%**

7. Reassemble unit and verify the following static pressure points to ensure proper calibration.

Specifications **30 mmHg,100 mmHg, 150 mmHg, 190 mmHg and 250 mmHg. +/-3 mmHg**

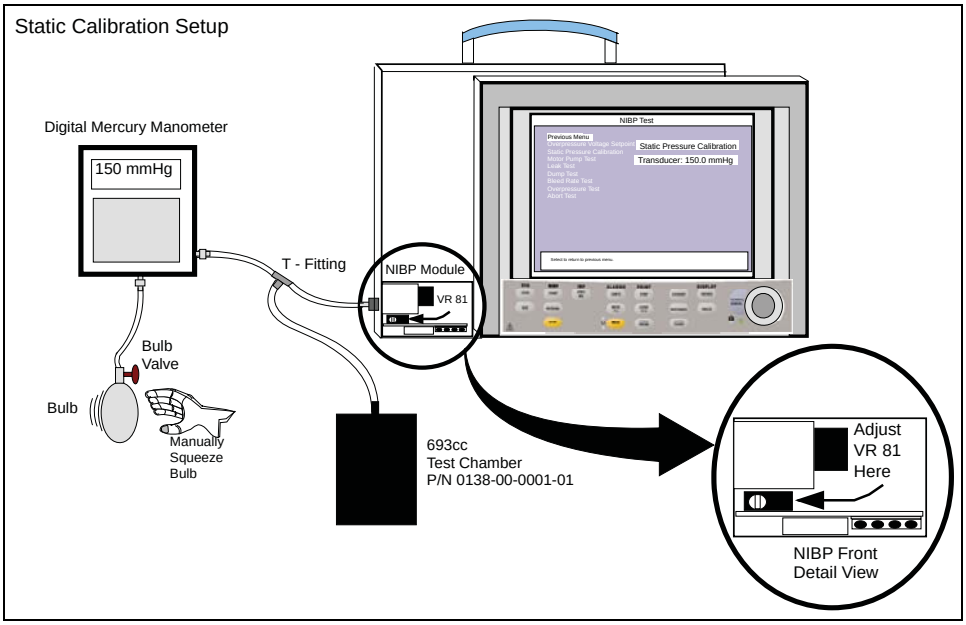


FIGURE 4-11 Static Calibration screen

4.4.6.3 Motor Pump Test

The purpose of this test is to determine if the output of the pump is adequate.

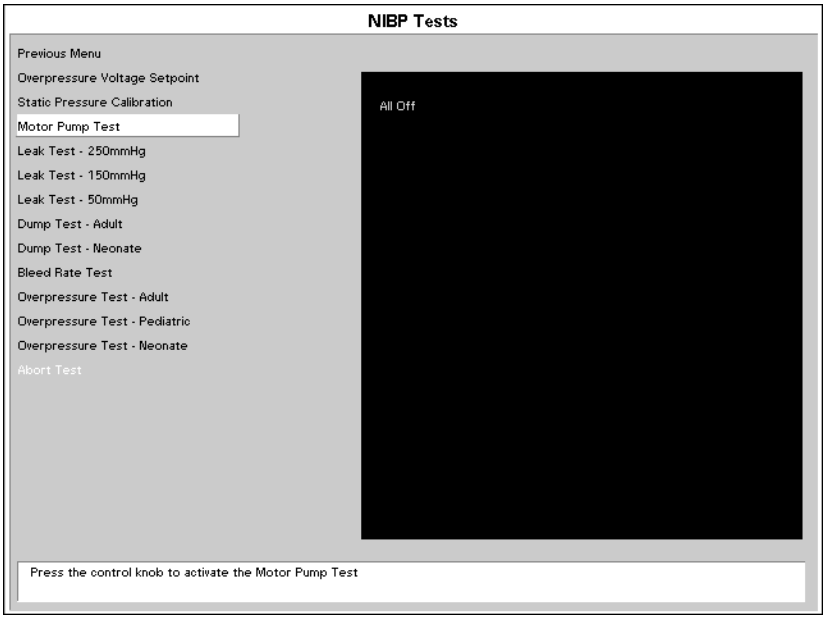


FIGURE 4-12 Motor Pump Test

1. Connect the dummy cuff / test chamber to the side panel fitting.
2. Select the **Motor Pump Test** using the Navigator™ control knob to activate the test.
3. Target pressure of 300 mmHg will be displayed on the screen. The time required to pump to 300 mmHg will also be displayed on screen.

Specifications **Pump to 300 mmHg in < 35.0 seconds. – 500 cc test chamber**

Specifications: **Pump to 300 mmHg in < 49.0 seconds – 700 cc test chamber**

4.4.6.4 Leak Test (250 mmHg, 150 mmHg, 50 mmHg)

The purpose of the leak test is to verify the leak rate of the pneumatic components.

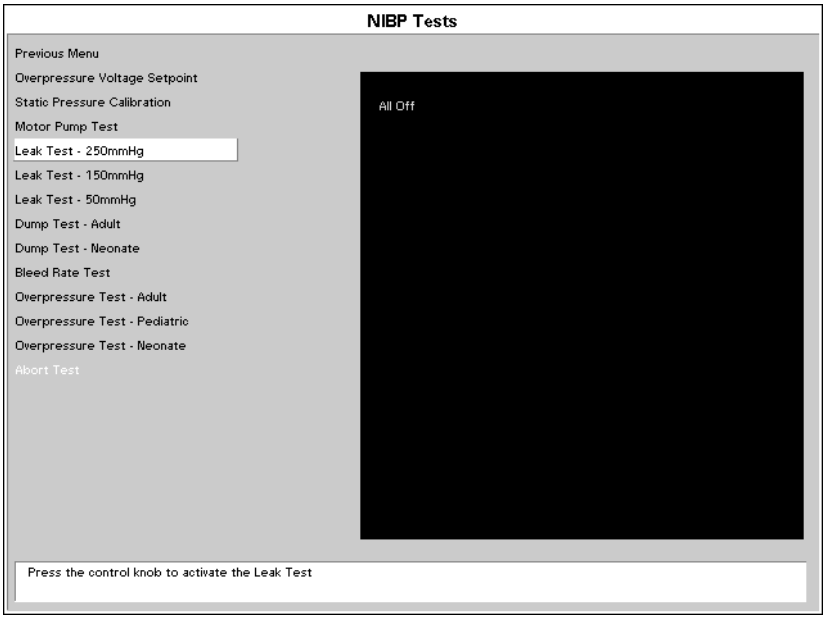


FIGURE 4-13 Leak Test

1. Connect the dummy cuff / test chamber to the side panel fitting.
2. Select the **Leak Test** using the Navigator™ knob to activate the test.
3. The chamber inflates to 250, 150 or 50 mmHg of pressure. After ten (10) seconds the pressure on screen the pressure is released. During this ten second period the monitor will determine the leak rate and display the total drop in pressure for that time period.

Specifications: **Leak rate should not exceed 10mmHg / 10 seconds for the target values of 250, 150 and 50 mmHg. – 500 cc test chamber**

Specifications: **Leak rate should not exceed 10mmHg / 10 seconds for the target values of 250, 150 and 50 mmHg. – 500 cc test chamber**

4.4.6.5 Dump Test (Adult, Neonate)

The purpose of this test is to verify the valve that controls the dump rate is functioning properly.

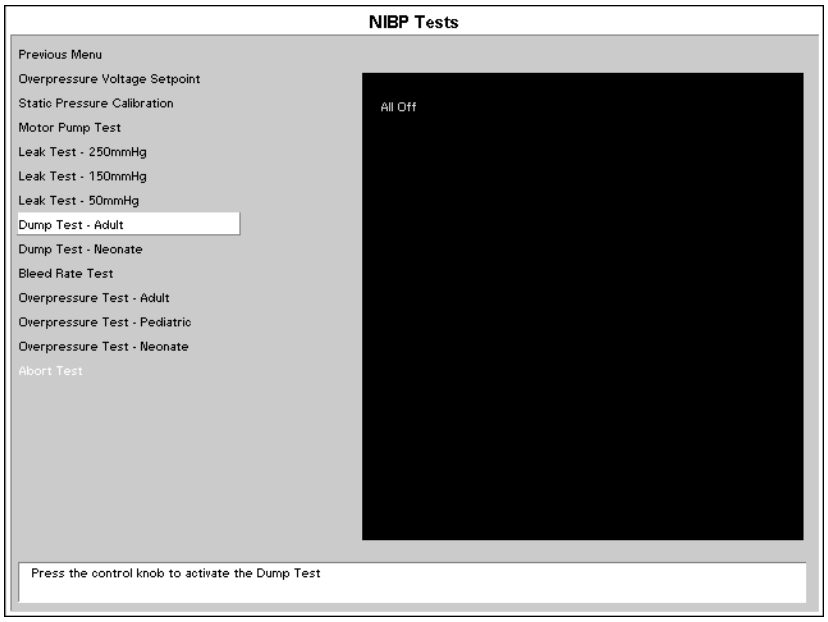


FIGURE 4-14 Dump Test

1. Connect the dummy cuff / test chamber to the side panel fitting.
2. Select **Dump Test** using the Navigator™ knob to activate the test.
3. (Adult) or 5 seconds (Neonate) the unit will dump the pressure to approximately 15 mmHg (adult) or 5 mmHg (Neonate). The result of the test will be displayed on the screen.

	ADULT	
The chamber will inflate to:	270 mmHg	170 mmHg
The dump valve will start to deflate at:	260 mmHg	150 mmHg
After 10 seconds:	15 mmHg	5 mmHg

Specifications: **Dump Rate – 260 to 15mmHg / 10sec or less – Adult – 500cc test chamber**
Dump Rate – 150 to 5mmHg / 5sec or less - Neonate – 500cc test chamber

Specifications: **Dump Rate – 260 to 15mmHg / 14sec or less – Adult – 700cc test chamber**
Dump Rate – 150 to 5mmHg / 7sec or less - Neonate – 700cc test chamber

4.4.6.6 Bleed Rate Test

The purpose of this test is to verify the valves, that control the bleed rate, are functioning properly.

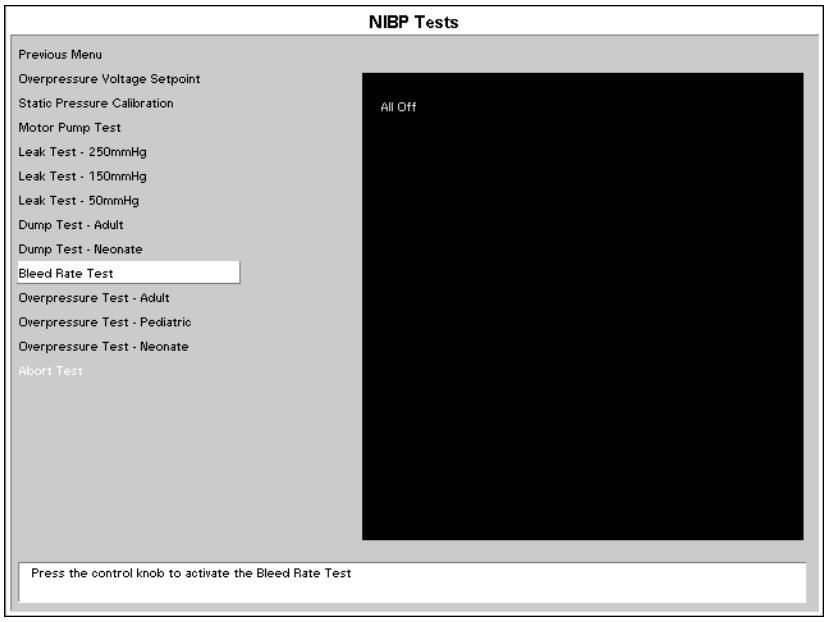


FIGURE 4-15 Bleed Rate Test

1. Connect the dummy cuff / test chamber to the side panel fitting.
2. Select the **Bleed Rate** using the Navigator™ knob to activate the test.
3. The chamber will inflate to 220 mmHg of pressure. The bleed rate valve will open and deflate the pressure for 10 seconds. The result of the test will be displayed on the screen.

Specifications: **Bleed Rate = 6.0mmHg / sec ± 20% - 500cc test chamber**

Specifications: **Bleed Rate = 6.0mmHg / sec ± 20% - 700cc test chamber**

4.4.6.7 Overpressure Test (Adult, Pediatric, Neonate)

The purpose of this test is to verify the hardware overpressure sensor is functioning properly.

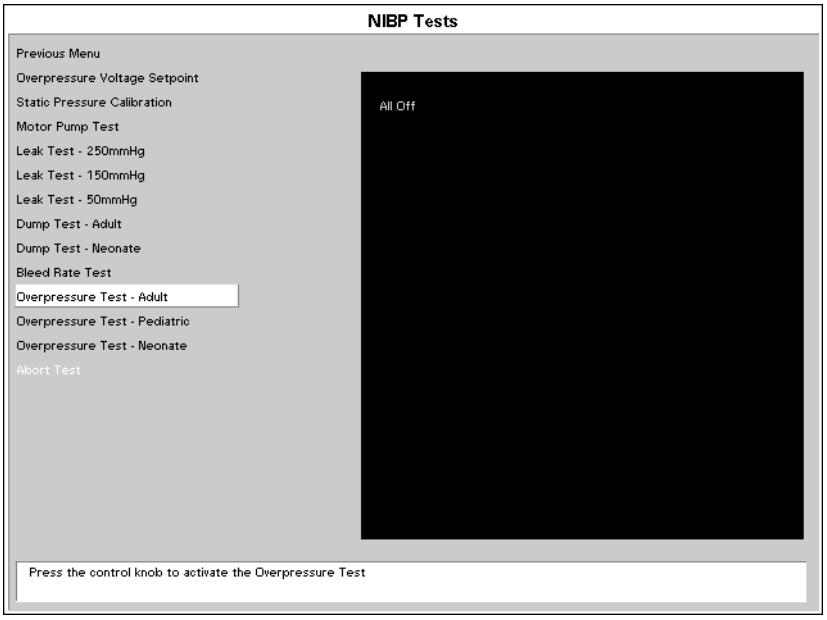


FIGURE 4-16 Overpressure Test

1. Connect the dummy cuff / test chamber to the side panel fitting.
2. Select **Overpressure Test** using the Navigator™ knob to activate the test.

Software Trip points

Specifications: Adult < or = 300 mmHg
Pediatric < or = 200 mmHg
Neonate < or = 150.0 mmHg

Hardware Trip points

Specifications: Adult < or = 330 mmHg
Pediatric < or = 220 mmHg
Neonate < or = 165 mmHg

NOTE: **For Spectrum only, due to safety conditions, the unit must be reset after each Overpressure Test (with software G.10 or lower.)**

3. Press the print key to send the test result to the local printer.

4.4.7 Error Log

Refer to section 4.4 to enter the Diagnostic Main Menu.

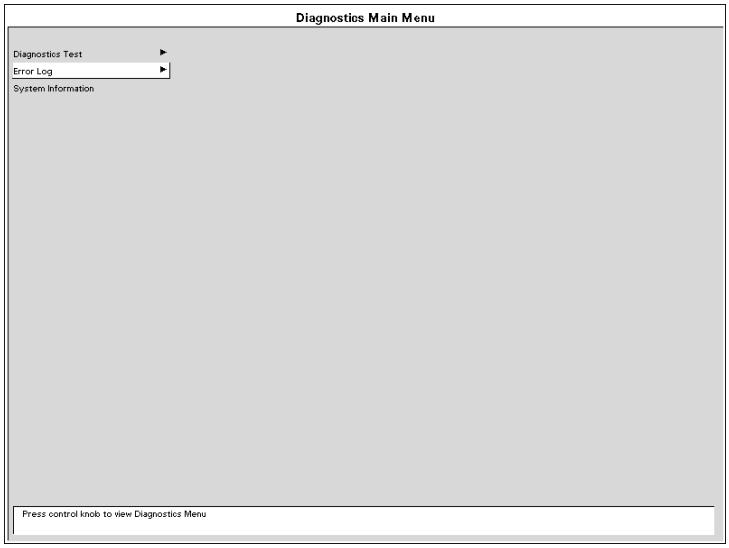


FIGURE 4-17 Error Log

4.4.7.1 Error Log in Memory

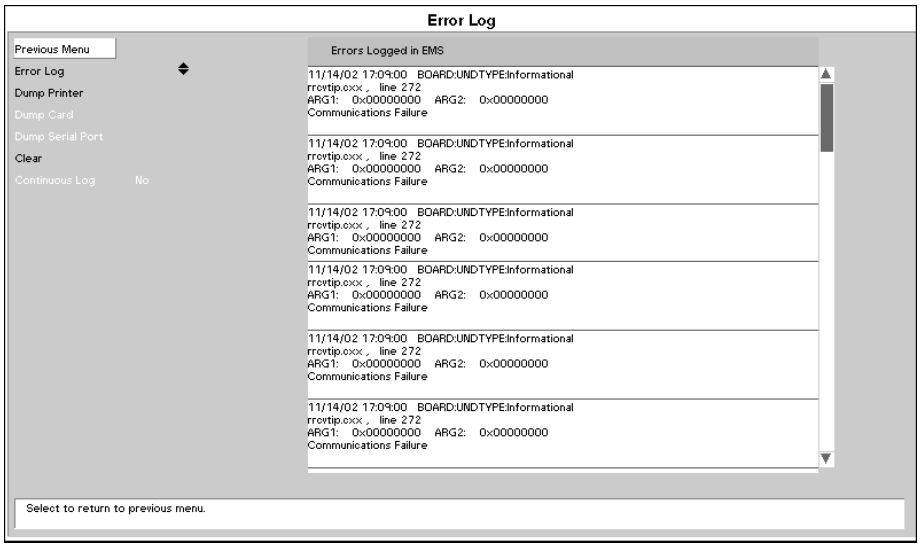


FIGURE 4-18 Error Log in Memory

1. Select **Error Log** using the Navigator™ knob.
2. Errors logged in the memory will appear on screen. A maximum of 30 entries will appear with the most recent errors at the beginning of the log. Each error is time stamped and dated.
3. Use the Navigator Knob to move the cursor within the list of errors.
4. To clear all data from the error log, use the Navigator knob to select **Clear**.

4.5 Microstream® CO_2 Calibration

In order to provide accuracy verification of the Microstream CO2, calibration is required every 4000 operating hours or once a year, whichever comes first. In addition, to achieve the most accurate CO2 readings possible, it is advised that the first calibration be performed after 1200 operating hours. The date of the last successful calibration appears on the **CO_2 Calibration Menu**.

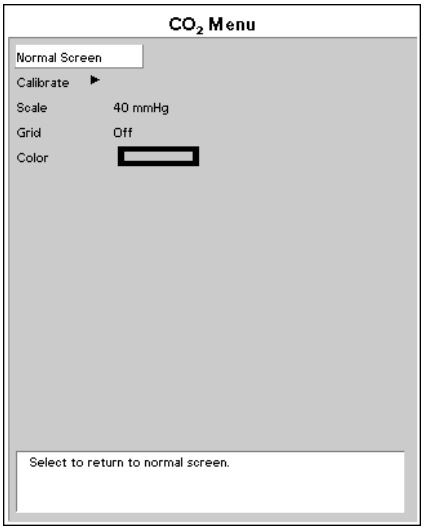


FIGURE 4-19 CO_2 Menu

NOTE: For maximum accuracy during calibration, a 20 minute warm-up time is recommended.

1. Connect the tubing that comes with the calibration gas to the gas canister and to the FilterLine®. Use calibration gas, (P/N 0075-00-0033-01) and a Microstream FilterLine. Attach the gas / tubing assembly to the CO_2 input port on the **Spectrum®/Spectrum OR™**.
2. Select the **CO_2 Parameter Tile** using the Navigator™ Knob.
3. Select the **CO_2 Menu**. The same menu can be accessed by using the **Parameters Menu** and selecting **CO_2**.
4. Select **Calibrate** and press the button on the gas canister to begin releasing the gas mixture.

NOTE: Auto zero occurs at the start of the CO_2 monitoring session and periodically throughout the monitoring session. Auto zero will last approximately 15 seconds.

5. Select **Start** from the **Calibration Menu**. Once the **Start** option has been selected, no CO_2 waveform data will be displayed.
6. The message **Calibrating, continue to apply 5% CO_2** will appear in the **Calibration Menu**.

NOTE: **If no gas is being delivered, or the mixture does not contain 5% CO_2, the message "Calibration error. Caused by no gas or wrong gas concentration" will appear. Obtain a new gas canister and return step 1.**

7. When the proper gas mixture is applied, the message **Calibrating, continue to apply 5% CO_2** will appear in the **Calibration Menu** window. When the calibration is complete, the message will change to **Calculating, calibration gas can be removed**. Release the button, on the canister, and remove the connector.

8. After a moment, the message will change to **Calibration Completed Successfully**. The date and time of the successful calibration will appear in the **Calibration Menu**.

9. Use the Navigator™ Knob to select **Previous Menu**.

10. Use the Navigator Knob to select **Normal Screen** and return to the monitor's normal display screen.

11. When the **Spectrum®/Spectrum OR™** has detected valid breaths, data will display for the **CO_2**, **Inspired CO_2** and **Respiratory Rate**.

12. The CO_2 respiration waveform and data will automatically replace the ECG respiration waveform and data on the display. If respiration wave or data is not displayed, use the **Display Setup Menu** to select **RESP** or **CO_2** to be displayed as desired.

13. The CO_2 waveform scale can be changed by accessing the **CO_2 Menu**.

NOTE: **Microstream® CO_2 waste and CO_2 FilterLine® should be treated as biohazardous waste.**

4.6 Verification

4.6.1 Initial Set-up

1. Using a patient simulator, connect the ECG, IBP1, IBP2 and temperature cables to the left side connector panel. Set the ECG simulator for 60 bpms, 1mv QRS signal.

2. Set up the **Patient Menu** for **Adult** (Patient Size) as follows:

A. Monitor Setup

1. Display Setup – 3 Waveforms
2. ECG Speed – 25 mm/sec
3. IBP Speed – 25 mm/sec (optional)
4. Respiration / Gas Speed – 12.5 mm/sec
5. EEG Speed – 25 mm/sec

B. Print Setup

1. Waveform 1 – ECG 1
2. Waveform 2 – ECG 2
3. Select Printer – Local

C. Parameters

1. ECG:
- **a.** ECG 1 – II
- **b.** ECG 2 – I
- **c.** ECG 3 – III
- **d.** ECG 1 thru 6 Size - 1 cm/mV (12 Lead) Page 1
- **e.** ECG 1 - I
- **f.** ECG 2 - II
- **g.** ECG 3 - III
- **h.** ECG 4 - AVR
- **i.** ECG 5 - AVL
- **j.** ECG 6 - AVF (12 Lead) Page 2
- **k.** ECG 1 - V1
- **l.** ECG 2 - V2
- **m.** ECG 3 - V3
- **n.** ECG 4 - V4
- **o.** ECG 5 - V5
- **p.** ECG 6 - V6

NOTE: 12 Lead applies to Spectrum only.

D. NIBP

1. Set Start Pressure – 180 mmHg
Interval – 5 minutes

2. IBP1 – Scale 0 to 160 mmHg

3. IBP2 – Scale 0 to 80 mmHg

4. SpO_2

a. Averaging mode – 2

b. Sensor Off Audio – off

5. CO_2 (optional)

a. Apnea Delay – 60

b. Scale 40 mmHg

6. Respiration

a. Resp lead – II

b. Apnea Delay – 60

c. Resp source – Auto

d. Scale – 3

7. Gases (optional)

a. Select agent – Auto

b. O_2 scale - 100%

c. N_20 Scale – 10%

8. Spirometry Verification (optional)

a. Select display loops - pressure volume

b. Paw Scale - 0-40

c. Volume scale - 0- 900

d. Flow Scale - -40 -+40

9. BISx Verification (optional)

a. Expand view - no

b. EEG setup menu - -25uV to +25uV

c. Sensor Check

- Pass or Fail
- High impedance
- Noise
- Lead off

4.6.2 ECG Tests

4.6.2.1 Initialization

1. Observe that the trace display sweeps across the waveform 1 screen in five (5) seconds. There should be five (5) complete ECG cycles. The same display and timing should be seen on the Waveform 2 screen.
2. Check the following sweep speeds for the appropriate displays:
   12.5 mm/sec – 10 second sweep/window

4.6.2.2 Leads OFF

1. Disconnect one lead at a time RA, RL, LL, LA, and C (V) from the simulator and observe that the message **Lead OFF** appears on the display
2. Set the ECG simulator to **Short Leads**. Verify that the resolution does not exceed one pixel.

4.6.2.3 Pacer Detect

1. Set the Pacer Enhancement feature to **ON** in the **ECG Setup Menu**.
2. Set the ECG simulator to **Ventricular Pacer**.
3. Verify the pacer pulse (yellow line) is displayed before the R wave of the QRS signal.

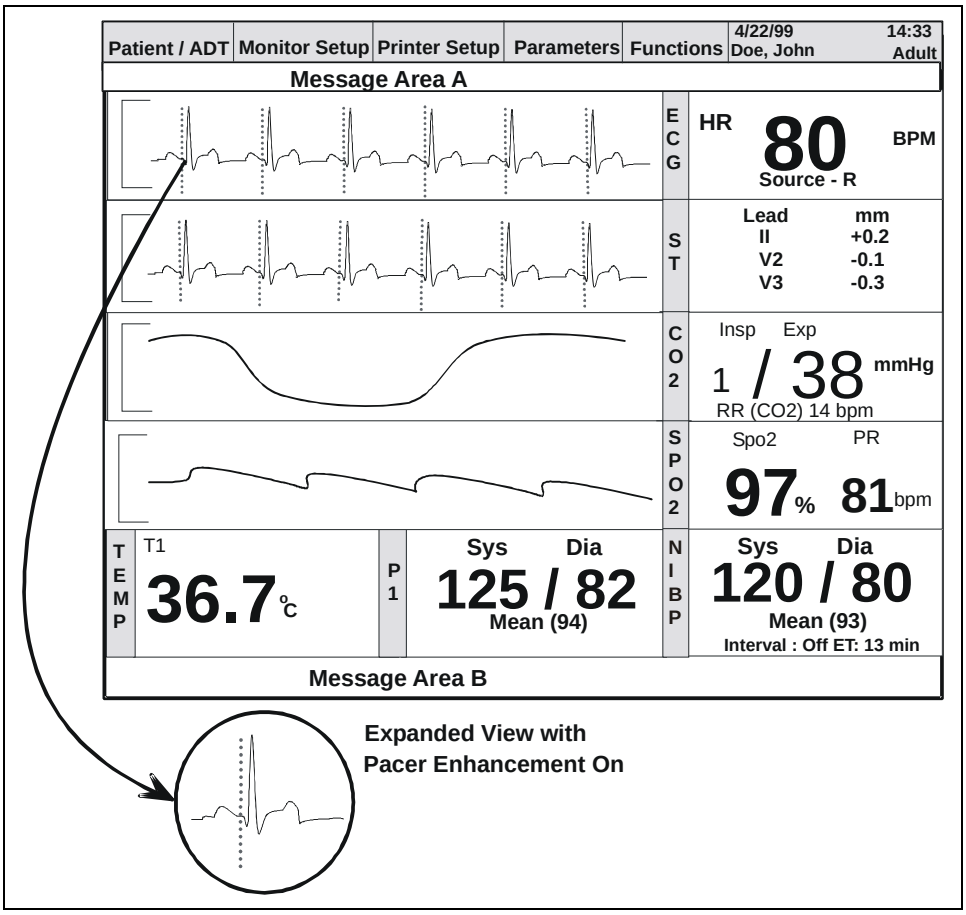


FIGURE 4-20 Pacer Setup Menu

Heart Rate

1. Set the ECG simulator to **ECG QRS Waveform**. Set the rate to **251 bpm**.
2. Verify the Rate display is 251 ± 5 bpm.
3. Decrease the rate to 30 bpm and allow signal to stabilize. Verify that the rate display is 30 bpm ± 3 bpm.

Alarms

1. Set the simulator to **1mv ECG QRS signal**, rate set to **60 bpm**
2. Set to **Print on Alarm**, install paper in the recorder, and set the Low HR alarm to **50 bpm**, and High alarm to **120 bpm**.
3. Increase the HR to 125 and verify the following:
   - **a.** The high alarm violates with an audio tone and red LED on keypad.
   - **b.** The recorder is initiated and prints the ECG strip displaying the ECG information.
   - **c.** Verify the overall width of the grid is 40 mm ± 2 cm.
   - **d.** Mute the alarm by pressing the **MUTE ALL** key.
   - **e.** Verify that the **Mute Alarm** message is displayed in the Message Area "A" and the alarm is silent.
4. Press the **MARK EVENT** key. Press the **TREND** key and examine the trend data. The high HR rate should be red (LCD) indicating the High HR was violated.

4.6.3 IBP 1, IBP 2, IBP 3 and IBP 4 (Optional) Verification

1. Set the simulator to **0** mmHg for both IBP 1 and IBP2.
2. Press the **ZERO ALL** key. Verify the systolic, diastolic and mean values display as **0** ± 1mm /Hg.
3. Apply 50,150, and 300 mmHg and verify that Sys/ Dia /Mean parameters agree.
4. Apply a 120/80/mmHg signal into IBP - 1 and 3 apply a 60 / 20/ mmHg signal into IBP 2 and 4 and verify that the correct waveforms are displayed on the screen.

4.6.4 Temperature Verification

400 Series Probe

1. Set the Simulator to 37° C. Connect to the monitor using a 400 series probe.
2. Verify the temperature is 37° ± 2°C.

700 Series Probe

1. Repeat same test for 700 series probe.

4.6.5 SpO_2 Verification

1. Set the display waveform 4 as **Pleth**. Set the HR source to **Auto**.
2. Verify that the SpO_2 message is displaying **SpO_2 No Sensor** in Message area "B".
3. Connect the SpO_2 sensor to the panel connector. Verify the SpO_2 message changes to **Sensor Off** or **SpO_2 Initializing**.
4. Apply sensor to finger.
5. Verify SpO_2 displays the pleth waveform, and the SpO_2 indicates a valid reading. Verify the HR source is SpO_2 and a beep tone is present.

4.6.6 NIBP Verification

1. Connect the Adult cuff connector to the NIBP hose. Attach the NIBP hose to the Cuff connection the left side on the monitor.
2. Apply cuff and press the **START** key.
3. Verify the pump motor starts to pump and inflates the cuff to 180 mmhg (Adult).

   The cuff will begin to deflate and obtain a blood pressure reading of Sys/ Dia/ Mean in about 20 to 30 seconds after peak pressure is obtained.
4. Verify the reading on screen.

4.6.7 Battery Operation Verification

1. If batteries are installed in the unit remove them.
2. Verify the unit functions on Line power correctly.
3. Install the two batteries in the appropriate slots located on the left side of the monitor.
4. Remove the line cord from the unit. Verify the unit operation is not interrupted.
5. Remove one of the batteries and verify the unit still operates. Verify the second battery operates, if installed alone.

4.6.8 Battery Back-up Verification

1. Select **Monitor Setup** menu
2. Select **Advanced Setup**
3. Set **Date** and **Time**
4. Select **Save Current** settings
5. Select **Normal Screen**
6. Verify correct **Date** and **Time** is displayed
7. Power unit **OFF**
8. Remove AC power cord and 12V (11.1V Li) batteries if installed
9. After 2 minutes plug unit back in, reinstall batteries, and power **ON**
10. Verify that correct **Date** and **Time** is retained

4.6.9 CO_2 Operation Verification

1. Connect the FilterLine® Short Term assembly to the input port of the CO_2 connector on the left side of the monitor.

2. Attach a can of Calibration Gas (P/N 0075-00-0033-01) to the Filterline Short Term assembly. Feed gas into monitor and verify the $ETCO_2$, Inspired CO_2 and respiration readings are displayed on the screen.

4.6.10 Cardiac Output Verification

Setup

1. Access the Installation Menu by pressing and holding the **DISCHARGE** key (**Spectrum**®) or the **TRENDS** key (**Spectrum OR**™) while powering **ON** the monitor.
2. Select **Enable EPM** and change to **Yes**.
3. Select the weight units to **kgs**.
4. Select the height units to **cms**.
5. Save the current settings and turn unit **OFF**.

Operation

1. Turn the **Spectrum®/Spectrum OR™** monitor on.
2. Set the Patient Size to Adult.
3. Press the **CO** button on the **Spectrum®/Spectrum OR™** monitor to bring up the Cardiac Output menu.
4. Select the CO Setup menu. Select the Injectate Temp sensor to **Inline**. Optional - Set the Patient Size (72.0 in) and Weight (200 lbs) accordingly.
5. Connect the Cardiac Output cable P/N 0012-00-1447-01 (P3) to the **Spectrum®/ Spectrum OR™**.
6. Connect the appropriate connectors (P1- temp and P2- catheter) to the simulator (Netech Cardiac Output Microsim). Turn on the simulator.
7. Set the Cardiac Output rate to 5 liters/min.
8. Set the blood temperature to 38° C (98.6°F).
9. Set the injectate temperature to 20°C. Press the Previous Menu key.
10. Wait for "Inject When Ready" on screen. Verify that the **Spectrum®/Spectrum OR™** monitor displays 38.0 +/-0.2°C (98.6+/-.2°F) for blood temperature (Tblood) in the Temp tile.
11. When the **Spectrum®/Spectrum OR™** displays the prompt **Inject When Ready** select the **Start CO** on screen. Press the up arrow button on the simulator.
12. Verify the **Spectrum®/Spectrum OR™** displays 5.0 +/-0.5 L/min for Cardiac Output (CO) and 2.5 +/-0.5 L/min/m^2 for Cardiac Index (CI) in the CO tile.
13. Repeat the above steps three times and verify no deviations occur.

4.6.11 BISx Verification

Setup

1. Connect the BISx sensor simulator to the BISx module via the patient interface cable.

2. Enter the BISx Sensor Test menu by pressing the **BIS** key and selecting sensor check from the **BIS** menu.
3. Allow the sensor to test the impedance of each electrode for approximately 15 to 20 seconds.
4. Verify on screen the following values.
   - **a.** Electrode #1 = 4 - 6 k ohms
   - **b.** Electrode #2 = 8 - 17 k ohms
   - **c.** Electrode #4 = 3 - 5 k ohms
   - **d.** Electrode #3 = 2 - 4 k ohms

NOTE: **Do not bend BISx Sensor Simulator. Bending could result in damage to the components and could compromise the functionality of this tool.**

4.6.12 Leakage Current Tests

1. Plug the line cord of the unit into the safety analyzer. Connect the case ground lead of the analyzer to the equipotential lug of the monitor on the rear of the monitor.
2. Perform the tests under the following conditions:
   a. Case Grounded:
      Normal polarity
      Normal polarity with open neutral
   b. Case ungrounded:
      Normal polarity
      Normal polarity with open neutral
      Reverse polarity

Specifications: **Verify the current reading of the test is less than 100 µA under normal operating conditions**

Less than 300 µA under a single fault condition for 120 VAC and less than 500 µA under a single fault condition for 230 VAC

Patient Leakage

1. Lead to ground: Sink Current Patient circuit (Test V Model 431 Dempsey; patient leakage with line voltage on leads).
2. Connect the ground wire from the safety analyzer to the equipotential lug of the monitor.
3. Connect the ECG cable from the Analyzer to the monitor.
4. On the safety analyzer depress the **Apply 115 VAC** button and note the reading.
5. Repeat the test for normal and open ground polarity combinations.

Specifications: **Verify the current readings of the test are below 50µA under a single fault condition. (Including 12 Lead for Spectrum only)**

5.0 *Preventative Maintenance*

5.1 Preventative Maintenance Schedule

The following is a list of activities required for periodic maintenance of the **Spectrum®/ Spectrum OR™** monitor. The physical inspection, replacement of consumable items and performance checks should be performed at the recommended intervals stated below. Manufacturer is not responsible for component failure or loss resulting from the use of stated consumable items beyond their recommended replacement interval.

5.1.1 Mechanical / Physical / Visual Inspection - Perform At Twelve Month Intervals

Suggested Inspections for Wear and Abuse:

1. Outercase, Line Cords, Rolling Stands, Wall Mounts, Modular Accessories and Interconnecting Cables.
2. Patient Interface Connections (ECG, IBP, SpO_2, Temp, CO_2 and NIBP)

5.1.2 Perform Verification and NIBP Calibration – Annually

1. See NIBP Verification in Section 4.6.6 for test outline.
2. In order to minimize unexpected failure of the NIBP assembly, consider proactively replacing the pump assembly, P/N 0012-00-1249 after seven years of regular operation (see “Disassembly Instructions” on page 1-3 and see “Removal of the NIBP Pump” on page 1-4 for instructions to remove and replace the NIBP Pump assembly).

5.1.3 Perform Verification and CO_2 Calibration

1. See CO2 Operation Verification in Section 4.6.9 test outline.

2. See Microstream® CO2 Calibration in Section 4.5 for calibration outline.

3. Replace the CO_2 assembly after 20,000 operating hours or as required by the service code.

5.1.4 Perform Battery Back-Up Verification - Annually

- Refer to Battery Back-up Verification in Section 4.6.8.

5.2 User Preventative Maintenance Introduction

This section of the manual outlines routine user maintenance guidelines.

The **Spectrum®/Spectrum OR™** Monitor is designed for stable operation over long periods of time. Under normal circumstances the monitor should not require technical maintenance beyond that described in this section. However, routine maintenance, calibration and safety checks are recommended at least once a year or more often as required by local statutory or hospital administration practice.

5.3 Care and Cleaning of the 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 screen, carefully brush dust and dirt particles with a soft sponge moistened with cleaning solution or a fine, soft-hair brush. DO NOT use abrasive cleaning materials. Remove fingerprints and stains with a liquid lens cleaner and a soft cloth. DO NOT wipe a dry screen or use alcohol or solvents containing chlorinated hydrocarbon.

5.4 Decontamination of the Monitor

WARNING: Perform the decontamination process with the unit powered down and power cord removed.

Decontamination of a unit that has come in contact with a biological material can be performed using LpH SE Germicidal detergent. Apply a small amount of detergent to a disposable wipe (paper based) and wipe down the outside of the unit. Discard the wipe appropriately. After waiting 10 minutes, use a clean dry wipe to dry the unit.

CAUTION: During the decontamination process, do not get the LpH SE Germicidal detergent into any vent openings.

5.5 Care and Cleaning of SpO_2 Sensors

NOTE: Refer to the individual instruction sheets that are packaged with each sensor.

- Check sensors and cables daily for signs of damage. Replace as required.
- Sensors should be cleaned before and after each new patient.
- 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.
- Allow the sensor to 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 cleaning solution. Do not attempt to sterilize.

5.5.1 Cleaning and Re-use of a Nellcor® Sensor

Sensors 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.

Do not immerse any Oxisensor®, OxiMax®, Durasensor®, Oxiband®, or Duraform® oxygen transducers, the Nellcor® RS-10 or Max-Fast® oxygen transducers, or any Nellcor® adhesive in water or cleaning solution. Clean Durasensor®, Oxiband®, and Duraform® oxygen transducers, and the Nellcor® RS-10 or Max-Fast® oxygen transducers by wiping with a disinfectant such as a solution containing 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® or OxiMax® oxygen transducers.

5.6 Cleaning CO_2 Sensors, Adapters and Sampling Components

Oridion CO_2 patient monitoring accessories are designed for single patient use and should not be cleaned or reused.

5.7 Sterilization and Cleaning of Reusable Cuffs

5.7.1 Reusable Cuffs with Bladders

Take out the bladder before cleaning and disinfecting the cuff.

Cleaning

The cuff can be hand washed or machine washed in warm water or with mild detergent. The bladder can be cleaned with a damp cloth. Air dry the cuff thoroughly after washing.

NOTE: Machine washing may shorten the service life of the cuff.

Disinfection

The cuff may be disinfected with a damp cloth with 70% ethanol or 70% isopropanol. It may also be disinfected with ultraviolet. The bladder can only be disinfected with ultraviolet.

NOTE: Prolonged use of disinfectant may cause discoloration of the cuff.

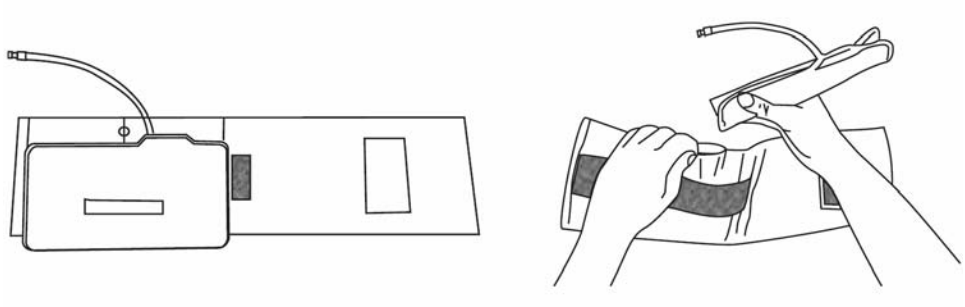
Replace the bladder after cleaning and disinfecting the cuff, as follows:

1. Place the bladder on the top of the cuff, as the figure shows.

2. Roll the bladder lengthwise and insert it into the large opening. See the figures below.

3. Hold the hose and the cuff and shake the complete cuff until the bladder is in position.

4. Thread the hose from inside the cuff, and out through the small hole under the internal flap.



CAUTION: **Do not dry clean the cuff.**
Do not press the cuff with a hot iron.
Do not use detergent and disinfectant other than 70% ethanol or 70% isopropanol.
Clean and disinfect the cuff according to the instructions.

5.7.2 Reusable Bladderless Cuffs

Clean cuffs with warm water and a mild detergent. Do not use a detergent containing hand conditioners, softeners, or fragrances.

NIBP cuffs can be sterilized with gamma sterilization without effecting the repeated performance of the cuff. Steam sterilization is not recommended. Use of a washing liquid containing bleach is not recommended because chlorine will chemically break down the urethane on the inside of the cuff.

Antimicrobial Definition

Bladderless cuffs are treated with an antimicrobial coating. Antimicrobial technology effectively controls a broad spectrum of bacteria, fungi, algae and yeasts on a wide variety of treated substrates.

5.7.3 Disposable Blood Pressure Cuffs

Disposable cuffs are intended for single patient use only. Once a cuff is used on a patient it should be discarded. Do not use the same cuff on any other patient. Do not sterilize or use an autoclave on disposable cuffs.

CAUTION: **Disposable cuffs can be cleaned using a mild soap solution and dried with a clean cloth.**

5.8 Care and Cleaning of Gas Module

1. The Gas Module 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 Gas Module. DO NOT apply large amounts of liquid. DO NOT use abrasive cleaning agents or organic solvents.

CAUTION: Do not clean the Gas Module while it is on and/or plugged in.

CAUTION: The internal sampling system of the Gas Module does not need to be cleaned or sterilized. There is no reverse flow back to the patient. If the internal sampling system is suspected to be clogged or dirty, the module should be serviced by an authorized service person only.

2. The fan dust filter should be checked and cleaned on a regular basis, at least once every two months.

- Locate fan on front panel.
- Remove the filter by pulling the dust filter cover.
- Remove the dust from the filter.
- Let the filter soak in a mild detergent solution.
- Rinse the filter and let dry completely before re-installing.

CAUTION: If the Gas Module dust filter cannot be cleaned or is damaged, replace it with the replacement dust filter part number 0378-00-0040. Use of another type filter may decrease the cooling effectivity and cause damage to the Gas Module.

3. The Water Trap Reservoir must be checked and emptied whenever changing patients or if it is more than half full.

- To remove the water trap, push the water trap latch to the right. The water trap is spring loaded and will pop out. An **Air Leak** message will be displayed. The monitor will suspend sampling.
- Detach the reservoir from the water trap assembly by pulling it down carefully.
- Empty the reservoir and rinse with water only.
- Re-attach the reservoir to the assembly tightly.
- Re-install the whole unit into the Gas Module making sure the latch is set. Check that the **Air Leak** message disappears and monitoring resumes.

NOTE: Do not disinfect or open the water trap. If an occlusion message appears it may be necessary to replace the water trap assembly part number 0202-00-0129.

4. The Water Trap Assembly must be replaced every two months.

5.9 Care and Cleaning of 3 and 5-lead ECG Cables and Leadwires

Recommended cleaning method of ECG cables and leadwires is a cloth wipe using ordinary alcohol-free hand soap or USP green soap tincture. When disinfection is required, a cloth wipe using disinfectants such as isopropyl alcohol, chlorine bleach in water (1:10 mixture) or 2% Glutaraldehyde solution (i.e., Cidex) is recommended. After cleaning, the ECG cables and leadwires should be wiped with water using a clean damp cloth then dried with a clean dry cloth.

CAUTION: To avoid permanent damage, do not expose metal components (pins, sockets, snaps) to disinfectants, soaps or chemicals.

NOTE: ECG cables and leadwires must never be immersed, soaked in any fluids, and they should not be cleaned with harsh chemicals such as acetone or non-diluted bleach.

NOTE: Do not autoclave, radiation or steam sterilize ECG cables or leadwires.

NOTE: Extended exposure to Ethylene Oxide gas may shorten life of the ECG cables and leadwires, leading to poor signal quality.

5.10 Care and Cleaning of View 12™ ECG Analysis Module

Clean cables and leadwires using a cloth wipe and warm water. Use a dry, clean cloth to dry leadwires and cables before placing them on a patient. Do not use alcohol to clean the View 12 ECG Analysis Module. Alcohol or other harsh chemicals will cause the cables and leadwires to become brittle or harden, causing damage.

NOTE: The View 12 ECG Analysis Module must never be immersed or soaked in any fluids.

5.11 Battery Replacement and Maintenance

5.11.1 Battery Replacement

1. Open battery compartment door, on left side of unit, by pressing the finger grip area and sliding the door to the left.
2. Press the release button, located on the right side of the installed battery. This will eject the battery. Slide out old battery.
3. Slide in replacement battery until it clicks into place.
4. Close battery compartment door by sliding the door to the right until it firmly clicks into place.

CAUTION: Replace sealed lead acid batteries with P/N 0146-00-0043 ONLY. Replace lithium-ion batteries with P/N 0146-00-0069 ONLY.

5.11.2 Battery Maintenance

The batteries 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.

CAUTION: Recharge batteries in the Spectrum®/Spectrum OR™.

CAUTION: Remove the batteries if the Spectrum®/Spectrum OR™ is not likely to be used for an extended period of time.

Sealed Lead Acid

Due to the self-discharge characteristics of sealed lead acid batteries, it is imperative that they are charged after 3 months of storage (or unit not in use). If not, permanent loss of capacity may occur as a result of sulfation. Charge retention at 20ºC is 6 months to 83%.

Lithium-Ion

Storage of the lithium-ion batteries depends on temperature, time period and the degree of cell charging state. After 6 months of storage at 23ºC, fully charged lithium-ion batteries have a retention capacity of 93%.

5.12 Recorder Paper Replacement

The instructions below describe the replacement of recorder paper. Use only recommended recorder paper, part number 0683-00-0422-XX. This ensures that the print quality is acceptable and reduces print head wear.

1. Open the recorder door by pressing the paper eject button.
2. Remove the empty paper spool.
3. Insert a 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 roller.
6. Holding the paper in place, close the 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.

5.12.1 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 is 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/26° C and 80% humidity) should be avoided.

- Solvent Reactions

Do not store the recordings in plastic bags, acetate sheet protectors, or 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 five years.

5.13 Warranty Statements

Mindray DS USA, Inc. warrants that components within the monitor unit will be free from defects in workmanship and materials for the number of years shown on the invoice. Under this extended warranty, Mindray DS USA, Inc. will repair or replace any defective component at no charge for labor and/or materials. This extended warranty does not cover consumable items such as, but not limited to batteries, displays, external cables and sensors.

Recommended preventative maintenance, as prescribed in the service manual, is the responsibility of the user, and is not covered by this warranty.

Except as otherwise provided herein, the terms, conditions and limitations of Mindray DS USA, Inc.'s standard warranty will remain in effect.

5.13.1 USA, Canada, Mexico, and Puerto Rico

Mindray DS USA, Inc. warrants that its products will be free from defects in workmanship and materials for a period of one (1) year from the date of purchase except that disposable or one-time use products are warranted to be free from defects in workmanship and materials up to a date one year from the date of purchase or the date of first use, whichever is sooner. This warranty does not cover consumable items such as, but not limited to, batteries, external cables, sensors, cuffs, hoses, or mounts.

Mindray DS USA, Inc. will not be liable for any incidental, special, or consequential loss, damage, or expense directly or indirectly arising from the use of its products, liability under this warranty and the buyer's exclusive remedy under this warranty is limited to servicing or replacing at Mindray DS USA, Inc.'s option at the factory or at an authorized Distributor, any product which shall under normal use and service appear to the Company to have been defective in material or workmanship.

No agent, employee, or representative of Mindray DS USA, Inc. has any authority to bind Mindray DS USA, Inc. to any affirmation, representation, or warranty concerning its products, and any affirmation, representation or warranty made by any agent, employee, or representative shall not be enforceable by buyer.

This warranty is expressly in lieu of any other express or implied warranties, including any implied warranty or merchantability or fitness, and of any other obligation on the part of the seller.

Damage to any product or parts through misuse, neglect, accident, or by affixing any non-standard accessory attachments or by any customer modification voids this warranty. Mindray DS USA, Inc. makes no warranty whatever in regard to trade accessories, such being subject to the warranty of their respective manufacturers.

A condition of this warranty is that this equipment or any accessories which are claimed to be defective be returned when authorized by Mindray DS USA, Inc., freight prepaid to Mindray DS USA, Inc., Mahwah, New Jersey 07430. Mindray DS USA, Inc. shall not have any responsibility in the event of loss or damage in transit.

Calibration may be performed without the need to disassemble the instrument. It is the responsibility of the purchaser to perform calibration as necessary, in accordance with the instructions provided in this manual.

5.13.2 International (excluding North America)

Mindray DS USA, Inc. warrants that its products will be free from defects in workmanship and materials for a period of two (2) years from the date of purchase except that disposable or one-time use products are warranted to be free from defects in workmanship and materials up to a date one year from the date of purchase or the date of first use, whichever is sooner. This warranty does not cover consumable items such as, but not limited to, batteries, external cables, sensors, cuffs, hoses, or mounts.

Mindray DS USA, Inc. shall not be liable for any incidental, special, or consequential loss, damage, or expense directly or indirectly arising from the use of its products, liability under this warranty and the buyer's exclusive remedy under this warranty is limited to servicing or replacing at Mindray DS USA, Inc.'s option at the factory or at an authorized Distributor, any product which shall under normal use and service appear to the Company to have been defective in material or workmanship.

No agent, employee, or representative of Mindray DS USA, Inc. has any authority to bind Mindray DS USA, Inc. to any affirmation, representation, or warranty concerning its products, and any affirmation, representation or warranty made by any agent, employee, or representative shall not be enforceable by buyer.

This warranty is expressly in lieu of any other express or implied warranties, including any implied warranty or merchantability or fitness, and of any other obligation on the part of the seller.

Damage to any product or parts through misuse, neglect, accident, or by affixing any non-standard accessory attachments or by any customer modification voids this warranty. Mindray DS USA, Inc. makes no warranty whatever in regard to trade accessories, such being subject to the warranty of their respective manufacturers.

A condition of this warranty is that this equipment or any accessories which are claimed to be defective be returned when authorized by Mindray DS USA, Inc., freight prepaid to Mindray DS USA, Inc., Mahwah, New Jersey 07430. Mindray DS USA, Inc. shall not have any responsibility in the event of loss or damage in transit.

Calibration may be performed without the need to disassemble the instrument. It is the responsibility of the purchaser to perform calibration as necessary, in accordance with the instructions provided in this manual.

5.14 Phone Numbers and How To Get Help

Prior to requesting service, perform a complete operational check of the instrument to verify proper control settings. If operational problems continue to exist, contact the Service Department (800) 288-2121or (201) 995-8000 for assistance in determining the nearest field service location.

Please include the instrument model number, the serial number, and a description of the problem with all requests for service.

Any questions regarding the warranty should be directed to the closest authorized location. A list of international offices, along with their phone numbers, is provided at the end of this manual.

5.15 Manufacturer's Responsibility

The manufacturer is responsible for the effects on safety, reliability and performance of the equipment only if:

- **a.** assembly operations, extensions, readjustments, modifications or repairs are carried out by persons authorized by the manufacturer; and
- **b.** the electrical installation of the relevant room complies with the appropriate requirements; and
- **c.** the equipment is used in accordance with the instructions for use.

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