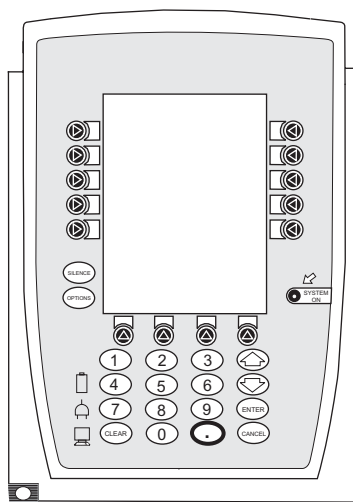


Technical Service Manual

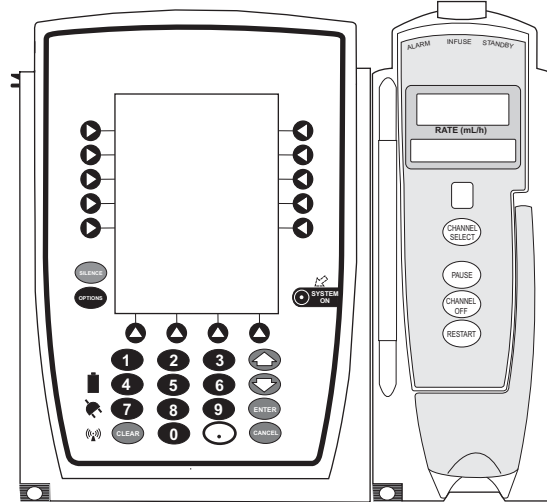
Alaris® PC Unit, Models 8000 and 8015

Alaris® Pump Module, Model 8100

Supports: Guardrails® Suite (v7)
Guardrails® Suite MX (v8)
March 2007



Model 8000



Model 8015

Model 8100

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Chapter 1 – GENERAL INFORMATION

CAUTION

To **avoid damaging the keypad**, do not use sharp objects (such as, pens, pencils) to activate switches.

CAUTION

Any attempt to service this product by anyone other than an authorized Cardinal Health Service Representative, while the product is under warranty, **may invalidate the warranty**.

1.1 INTRODUCTION

This manual describes how to service the PC Unit (Models 8000 and 8015) and Pump Module (Model 8100). It is used in conjunction with the following Alaris® System documents and software:

- Alaris® System Directions for Use (DFU)
- Maintenance software and user manual

This manual is intended for personnel experienced in analysis, troubleshooting and repair of analog/digital microprocessor-based electronic equipment.

Reference the Alaris® System DFU for a product introduction, detailed setup and operation procedures, definitions (including precaution definitions), specifications, and other information related to the use of the Alaris® System.

If the PC Unit or Pump Module requires service while under warranty, it must be serviced only by Cardinal Health authorized service personnel. Reference the "Warranty" and "Service Information" sections in the Alaris® System DFU.

Important: The **SYSTEM ON** key becomes the "Power Off" key anytime the Alaris® System is in a watchdog state. The watchdog state is identified by:

- constant loud audio tone that cannot be silenced
- nonresponsive keypad
- flashing red arrow above **SYSTEM ON** key

Table 1-1. Defined Terms

The following table identifies the defined terms used throughout this document for certain trademarked products and product features.

<u>Product / Feature</u>	<u>Defined Term</u>
Alaris® Auto-ID module	Auto-ID Module
Alaris® EtCO ₂ module	EtCO ₂ Module
Alaris® PCA module	PCA Module
Alaris® PC point-of-care unit	PC Unit
Alaris® PC unit	PC Unit
Alaris® Pump module	Pump Module
Alaris® SpO ₂ module	SpO ₂ Module
Alaris® Syringe module	Syringe Module
Guardrails® data set	Data Set

1.2 ALARMS AND MESSAGES

Alarm messages are displayed on the scrolling Message Display bar. Reference the Alaris® System DFU for detailed information.

An audio alarm and the Alarm Status Indicator flash red when an alarm limit is met or exceeded. All alarms can be temporarily silenced by pressing the **SILENCE** key on the PC Unit.

1.3 BATTERY MANAGEMENT SYSTEM

This section contains general information on the battery management system. Included is information on how the power supply processor monitors and maintains the battery, controls the system on/off for the rest of the instrument and provides support functions for the main processor.

The battery management system consists of the power supply processor IC and various sensors and signal processing circuits.

The power supply processor performs the following functions:

- Controls battery charger.
- Provides a battery status "battery gauge".
- Monitors battery voltage and temperature.
- Controls instrument power source (on/off function).

The power supply processor communicates with the main processor via a serial data channel. The main processor issues commands to the battery manager which then responds with status information and data using this channel.

1.3.1 Battery and Charging Process

The battery pack is a 10-cell (1.2V per cell), high capacity nickel metal hydride (NiMH) type, rated at 12 volts and 4 amp-hours (with a minimum of 500 charge cycles). It has a built-in temperature sensor which allows the battery manager to monitor battery temperature.

1.3 BATTERY MANAGEMENT SYSTEM (Continued)

1.3.1 Battery and Charging Process (Continued)

- Self-resetting thermal fuse at 70° C.
- Self-resetting current limit sense at 5A.

The battery charge circuit charges the battery with a constant current of 2A whenever the power supply processor turns the charger on. The power supply processor regulates average charge current by turning the charger on and off with the appropriate duty ratio. The battery charge cycle consists of 4 modes: fast charge, float charge, terminates charge, and top-up charge.

- **Fast Charge:** Fast charge is initiated whenever the battery is between 10° C and 27° C, and has been discharged by more than 200 amp-seconds through actual use or self discharge. Leaving the instrument unplugged for a day would cause about 200 amp-seconds of self discharge. The charge current is a continuous 2A. The end of a fast charge is detected when the temperature of the battery is at least 30° C and increases at a rate of 0.7° C/min. (or 1.4A depending on system load at 0.6° C/min.) above its temperature at start of charge, or when the battery voltage declines by 50 mV below its peak value, or total charge time exceeds 2.6 hours.
- **Top-Up Charge:** The top-up charge phase begins at the end of the fast charge phase and finishes adding the last few percent of charge to the battery and balances individual cell charges. This phase charges at an average rate of 0.4A.

- **Float Charge:** The float charge phase begins at the end of the top-up phase and helps maintain a fully charged battery. This phase charges at an average rate of 225 mA and 1 second per minute.
- **Terminates Charge:** The power supply processor does not allow charging to begin unless the temperature is 10 - 40° C. The power supply processor terminates charge if battery temperature drops below 10° C or rises above 55° C.

1.3.2 System On/Off

The power supply processor provides the interface between system on/off switch and the main processor. When the instrument is off, the power supply processor interprets either power switch as a turn on command and applies power to the rest of the instrument, informing the main processor the switch was pressed. Once power is on, further presses of a power switch are passed on to the main processor which determines the appropriate response under the existing conditions. If the response is to turn the power off, the main processor requests that the power supply processor remove power from the rest of the instrument.

If an error has been detected which causes the watchdog to be in alarm, a push of either power switch will immediately cause the power to be turned off, without intervention by the power supply processor.

1.3.3 Real Time Clock (RTC) with NVRam Control Lithium Battery-Backed RTC

RTC switches SRAM voltage to prevent memory loss during a power loss.

1.3 BATTERY MANAGEMENT SYSTEM (Continued)

1.3.4 Battery Maintenance

CAUTION

Use only **batteries** approved by Cardinal Health, due to battery manager requirements and the thermostat contained in the battery assembly. If the instrument has been in storage, connect it to AC power before turning it on. One refresh cycle is usually sufficient to restore battery capacity. If necessary, repeat the procedure at 24-hour intervals, 2 or 3 times, to increase capacity.

Several features are included in the battery manager to help properly maintain the battery.

- A battery capacity measurement is available in diagnostic mode.

- A special circuit removes all load from battery when voltage falls too low, preventing damage from over-discharge due to long-term storage.

NiMH batteries can be stored no more than 6 months (3 months in instrument) with no load but will self-discharge from a charged state in about 100 days. This does not damage the battery as it would if it were a lead-acid type battery. Connect the instrument to AC to recharge batteries.

Disposal

There are no federal, state or local laws managing the disposal of NiMH batteries. NiMH batteries are recyclable. To learn about recycling batteries at INMETCO, visit their website at <http://www.inmetco.com>.

Table 1-2. Battery Trip Points

Battery Voltage	Instrument Response
Coulomb Control (I.t)	<ul style="list-style-type: none">• 30 minutes left on gauge• instrument continues to function• warning tone activated• low battery warning
11.20V	<ul style="list-style-type: none">• instrument does not pump• constant alarm• low battery alarm (depletion)
11.0V	<ul style="list-style-type: none">• 1 minute or longer (nominal 5 minutes) after low battery alarm• backup speaker activated• instrument shutdown (5 minutes after alarm)
10.8V	disconnect battery

1.4 BATTERY CAPACITY INFORMATION

All batteries have specific conditions under which they are guaranteed to meet their published specifications. Deviations from these conditions typically result in a reduction of available capacity. Manufacturers of NiMH batteries rate capacities, usually expressed in Ah (Ampere-hours), based on a specified "ideal" charge and discharge condition as well as the use of a new battery.

An ideal charge cycle starts with a fully discharged battery charged at C/10 (C is rated capacity in Ah) constant current for 15 hours while at room temperature. For example, a 1.8 Ah battery would be charged for 15 hours at 180 mA constant current with a room temperature of 23° C.

The ideal discharge starts with a fully charged battery under a C/5 constant current load at room temperature, discharging to a cell voltage of 0.9V. The rated capacity is then calculated as the time to discharge divided by 5. A 1.8 Ah cell would be discharged at 360 mA constant current and not reach 0.9V for at least 5 hours. A given battery type has different capacities based on the load. For example, a battery rated at 1.8 Ah at a 360 mA load may have only 1.6 Ah at a 1600 mA load.

There are many conditions which can affect the battery capacity. The following conditions have the most practical impact on battery capacity delivered in this instrument.

- **Battery Alarm Voltage:** The battery alarm voltage is the voltage at which the instrument stops operating and generates an alarm indicating the instrument needs to be connected to AC power. Under perfect conditions, a battery of 10 cells connected in series reaches the end

of discharge at 9.0V; however, cells are not perfectly matched so some will reach 0.9V before others. The problem occurs when a cell in series with other cells can go below 0.9V and actually go into cell reversal, which permanently damages the particular cell. On the other hand, increasing the alarm voltage to compensate for imperfectly matched cells results in reduced run times with available capacity. The user sees this as premature low battery warnings and alarms. The instrument deals with this by increasing the alarm voltage to guarantee the battery is not damaged and reduce the assumed capacity to below that printed on the battery. The battery gauge is intended to show the minimum run time left on the battery taking all these factors into account.

- **Charge Rate:** The ideal charge rate requires 15 hours to get to full charge, which is undesirable from the user's perspective. The instrument provides a multiphase charge cycle which results in about 80% capacity in the first 2 hours after fast charge. The next charge phase, top-up, is designed to finish the charge and to bring all individual cells to the fully charged state, essentially rematching them. See the "Battery and Charging Process" section in this chapter for "Fast Charge" and "Top-Up Charge" information. If the top-up charge is not completed, the cell mismatch is not reduced and the cumulative capacity reduction occurs. Top-up is a 3-hour charge but the elapsed time to complete it may be over 5 hours, as the charger is turned on and off to keep the battery cool during that time.

1.4 BATTERY CAPACITY INFORMATION (Continued)

- **Cycle Life and Aging:** Batteries wear out as they get older and go through many charge/discharge cycles; the chemicals and materials used to construct the cell break down. The instrument deals with this by assuming that a battery will continually reduce capacity at a rate equivalent to 30% over 4 years and continually reduce capacity at a rate equivalent to 30% per 200 full charge cycles. These calculated values are used to reduce the run time displayed on the battery gauge.
- **Partial Discharge/Recharge:** When a battery is partially discharged and then charged for less than the full time, differences between individual cell capacities result in cells completing charge at different times. If the full charge sequence is not completed, the cell mismatch becomes progressively greater. This is viewed by the user as low apparent run times and premature low battery warning and alarms. The problem is cumulative in that the mismatch increases for every partial cycle. The lowered capacity is not permanent but may require 2-3 full discharge/charge cycles to recover. The instrument deals with this by reducing the run time displayed based on a limited history of partial cycles.
- **Temperature During Charge:** As the effective ambient temperature of the battery increases, the amount of charge that the battery will accept decreases. At an ambient temperature of 35° C, an enclosed battery will temporarily accept only about 90% of the charge it would otherwise accept at 23° C.

1.5 POLE CLAMP FEATURE

The PC Unit's pole clamp adapts to a wide variety of surfaces, to provide versatility. The pole clamp features include:

- Ergonomically designed knob.
- Accommodates diameters from $\frac{5}{8}$ to $1\frac{3}{8}$ inches (15.9 to 34.9 mm).
- Vertical or horizontal orientation, allowing it to adapt to both IV poles and bed rails.

If pole-mounted, the system should be mounted in an upright position during operation, to provide maximum stability and display readability.

1.6 MEMORY

Model 8000:

- Flash 4.5 MB (nonvolatile): It stores boot and application codes for the PC Unit.
- RAM 4 MB (volatile): It stores the Data Set, CQI logs, event logs, error logs, battery logs, and patient data. It is volatile but has a lithium battery on the Logic Board to maintain memory when no other power is applied.

Model 8015:

- Flash 16 MB (nonvolatile): It stores boot and application codes for the PC Unit, CQI logs, event logs, error logs, and battery logs.
- CF Flash 64 MB (nonvolatile): It stores audio tones, the Data Set, and "restorable" patient data.
- SDRAM 128 MB (volatile): It executes transferred application code from flash. It stores patient-specific program and instantaneous information.

Table 1-3. Abbreviations, Acronyms, Symbols

Various abbreviations, acronyms and symbols are used throughout this manual. This table defines those that are not commonly known or easily recognized.

*	"active low" logic signal
/	not - true when signal is low
AIL	air-in-line
AKB	PC Unit keypad processor
DFU	Directions for Use
DS	display
FDSA	Fluid Delivery Subassembly
IUI	inter-unit interface
NMD	nonmaskable interrupt
PSP	power supply processor
PWN	pulse width N (where "N" is width of pulse)
SEC-PRI	secondary-to-primary
TH	thermistor
UCS	upper chip-select
VDAC	voltage DAC
VEE	voltage emitter
VRAW	voltage raw (unregulated voltage)
WDI	watchdog input
WDO	watchdog output

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2 CHECKOUT & CONFIGURATION

Chapter 2 – CHECKOUT AND CONFIGURATION

CAUTIONS

- Should an instrument be **dropped or severely jarred**, remove it from use immediately. It should be thoroughly tested and inspected by qualified service personnel to ensure proper function prior to reuse.
- **Keep the Pump Module door closed** when the instrument is not in use.

NOTE: The PC Unit does not feature a learn/teach function or a default drug list.

2.1 INTRODUCTION

This chapter describes PC Unit and Pump Module initial setup and configuration. Due to product changes over time, configurations described in this chapter may differ from the instrument being serviced.

2.2 NEW INSTRUMENT CHECKOUT

Prior to placing a new instrument in use, perform a check-in procedure using the applicable maintenance software.

When powering up the instrument, verify the instrument beeps and all display LED segments flash. This confirms that the instrument has performed its self test and is operating correctly. During operation, the instrument continually performs a self test, and alarms and displays a message if it detects an internal malfunction.

Contact Cardinal Health authorized service personnel if the instrument has physical damage, fails to satisfactorily pass the startup sequence, fails a self test, or continues to alarm.

2.3 CONFIGURATION OPTIONS AND SETUP - GENERAL

Reference the Alaris® System DFU for the following information:

- System Settings
- Pump Module Settings

2.3.1 Configuration Notes

- Changes to factory default values are retained after a power cycle.
- If **Factory Default** is **Yes**, then all configuration settings are set to their factory default.

CHECKOUT AND CONFIGURATION

2.3 CONFIGURATION OPTIONS AND SETUP - GENERAL (Continued)

2.3.1 Configuration Notes (Continued)

- If **Factory Default** is **No**, then 1 or more of the configuration settings has been changed. If desired, **Factory Default** can be selected and set to **Yes**, which will set all configuration settings to their factory default.
- With Profiles feature enabled, settings are configured independently for each profile. A hospital-defined, best-practice Data Set must be loaded to enable Profiles feature. Date and Time is a system setting and is the same in all profiles.
- If Guardrails® software is being used to load Data Sets into PC Unit, leave configuration settings at factory defaults. When a Data Set is loaded, it overrides configuration settings because each profile has its own individual configuration settings.

2.3.2 Configuration Setup Notes

- Disabling **Profiles** option disables loaded Data Set and allows a configuration option to be changed.
- Pressing **EXIT** soft key while in a **System Configuration - Module** screen immediately powers system down, with no "Powering Down" display.
- Pressing **EXIT** soft key while in a **System Config** screen returns display to main **System Configuration - Module** screen.
- Pressing **CONFIRM** soft key while in a System Configuration option screen:
 - accepts existing setting or setting change

- displays next option setting screen (if applicable) or returns display to **System Config** screen

- Pressing PC Unit's **CANCEL** key while in a System Configuration option screen:
 - leaves setting unchanged
 - returns display to **System Config** screen

2.4 CONFIGURATION SETUP - PC UNIT

2.4.1 Access System Configuration Options

1. Hold **OPTIONS** key at power up.

System Configuration - Module	
Factory default:	No
Shared Infusion Settings	
PC Unit	
Pump Module	
SPO2 Module	
>Select an Option or EXIT	
EXIT	PAGE DOWN

2. Press **PC Unit** soft key. To view additional options, press **PAGE DOWN** soft key.

System Config - PCU 1 of 2	
Alarm audio:	Profile 1
Anesthesia Mode:	Disabled
Battery meter:	Disabled
Clock setup:	09:00
Key click audio:	Enabled
>Select an Option or EXIT	
EXIT	PAGE DOWN

-- Continued Next Page --

2.4 CONFIGURATION SETUP - PC UNIT (Continued)

2.4.1 Access System Configuration Options (Continued)

System Config - PCU 2 of 2	
Max Pt. weight:	500 kg
Patient ID Entry:	Disabled
PM reminder:	Disabled
Profiles:	Disabled
Tamper resist:	Disabled
>Select an Option or EXIT	
PAGE UP	EXIT

2.4.2 Alarm audio

There are 3 different alarm profiles that can be selected to help differentiate between audio alarms in certain hospital environments.

Audio alert patterns ($\pm 5\%$):

Profile 1: 500 ms ON, 1500 ms OFF,
500 ms ON

Profile 2: 100 ms ON, 500 ms OFF,
400 ms ON

Profile 3: 400 ms ON, 500 ms OFF,
400 ms ON

- After accessing **System Config - PCU** options display, press **Alarm audio** soft key.

System Configuration - PCU	
Alarm audio profile selection Select the desired alarm audio patterns. Press Test to hear a sample of the selected profile.	Profile 1
	Profile 2
	Profile 3
	Confirm
	Test

- To change profile selection, press soft key next to desired profile. To hear a sample of selected audio alarm, press **Test** soft key.
- To accept setting, press **Confirm** soft key.

2.4.3 Anesthesia Mode

The Anesthesia Mode allows access to additional drugs in each profile that is appropriate to anesthesiology. This mode also features permanent pause and the ability to set higher air-in-line settings.

- After accessing **System Config - PCU** options display, press **Anesthesia Mode** soft key.

System Configuration - PCU	
Anesthesia Mode	Enable
	Disable
Allows use of the Anesthesia Mode feature.	

- To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.4.4 Battery meter

When **Enable** is selected, the approximate time remaining on the battery is displayed (in a numeric value). The run time depends on the battery charge/condition and the load on the battery at the time. Run time may also be affected by the operating mode, rate, monitoring options and back pressure. The battery meter reading may take up to 5 minutes after starting an infusion to stabilize.

CHECKOUT AND CONFIGURATION

2.4 CONFIGURATION SETUP - PC UNIT (Continued)

2.4.4 Battery meter (Continued)

1. After accessing **System Config - PCU** options display, press **Battery meter** soft key.

System Configuration - PCU	
Battery meter	Enable Disable
Allows the pump to display remaining battery run time to the user.	

2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.4.5 Clock setup

This option is used to set the time and date.

1. After accessing **System Config - PCU** options display, press **Clock setup** soft key.

System Configuration - PCU	
Clock setup	
Current time: 09:00	Change Time
Current date: 1998-12-15	Change Date
>Confirm Time-of-Day and Date	
CONFIRM	

2. To change time:

- a. Press **Change Time** soft key.

System Configuration - PCU	
Clock setup	
Current time: _ : _	Change Time
Current date: 1998-12-15	Change Date
>Enter Time-of-Day	

- b. Enter time.

System Configuration - PCU	
Clock setup	
Current time: 09:30	Change Time
Current date: 1998-12-15	Change Date
>Press CONFIRM	
CONFIRM	

3. To change date:

- a. Press **Change Date** soft key.

System Configuration - PCU	
Clock setup	
Current time: 09:30	Change Time
Current date: yyyy-mm-dd	Change Date
>Enter Current Date	
CONFIRM	

2.4 CONFIGURATION SETUP - PC UNIT (Continued)

2.4.5 Clock setup (Continued)

- b. Enter date.

System Configuration - PCU	
Clock setup	
Current time: 09:30	Change Time
Current date: 2001-01-29	Change Date
>Press CONFIRM	
CONFIRM	

4. To accept settings, press **CONFIRM** soft key.

2.4.6 Key click audio

This option is used to **Enable** or **Disable** the keypress audio feedback.

1. After accessing **System Config - PCU** options display, press **Key click audio** soft key.

System Configuration - PCU	
Key click audio	Enable
Provides an audible sound with each keypress.	Disable

2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.4.7 Max Pt. weight

This option is used to set the maximum patient weight.

1. After accessing **System Config - PCU** options display, page 2, press **Max Pt. weight** soft key.

System Configuration - PCU	
Maximum patient weight adjustment	
Maximum weight: 500 kg	Change value
	Confirm

2. To change maximum weight:
- a. Press **Change value** soft key.

System Configuration - PCU	
Maximum patient weight adjustment	
Maximum weight: _ _ _ _ kg	Change value

- b. Enter new weight.

System Configuration - PCU	
Maximum patient weight adjustment	
Maximum weight: _100 kg	Change value
	Confirm

CHECKOUT AND CONFIGURATION

2.4 CONFIGURATION SETUP - PC UNIT (Continued)

2.4.7 Max Pt. weight (Continued)

3. To accept setting, press **Confirm** soft key.

2.4.8 Patient ID Entry

Enabling the Patient ID feature allows an alphanumeric patient identifier to be entered in the **Patient ID Entry** screen that displays after responding **Yes** to **New Patient?**. When the Patient ID feature is disabled, the **Patient ID Entry** screen can only be accessed through the **Systems Options** menu.

1. After accessing **System Config - PCU** options display, page 2, press **Patient ID Entry** soft key.

System Configuration - PCU	
Patient ID Entry	Enable Disable
Allows the patient ID to be assigned at system start up.	

2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.4.9 PM reminder

Enabling the PM reminder feature allows a **MAINTENANCE REMINDER** message to appear when the PC Unit or attached module is due for routine scheduled preventive maintenance.

1. After accessing **System Config - PCU** options display, page 2, press **PM reminder** soft key.

System Configuration - PCU	
Preventive Maintenance reminder	Enable Disable
Notifies user at power on when modules are due for routine preventive maintenance.	

2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.4.10 Profiles

A profile is a unique set of system configuration settings and best-practice guidelines for a specific patient population or patient type. Profile settings are established prior to system implementation. The **Profiles** option can be enabled only when a Data Set is loaded. Disabling the **Profiles** option disables the loaded Data Set.

1. After accessing **System Config - PCU** options display, page 2, press **Profiles** soft key.

System Configuration - PCU	
Profiles	Enable Disable
Allow the user to select from an institution defined list of Profiles	

2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.4 CONFIGURATION SETUP - PC UNIT (Continued)

2.4.11 Tamper resist

When **Enable** is selected, this mode can be activated or deactivated by pressing and holding the Tamper Resist Switch on the back of the PC Unit for 3 to 4 seconds. Reference the Alaris® System DFU for more detailed information.

Prior to accessing the Tamper resist mode, all modules that are to be operating must be set up.

System Configuration - PCU	
Tamper resistant mode	Enable
	Disable
Allows use of the tamper Resistant Mode feature.	Auth user
	Change override

1. After accessing **System Config - PCU** options display, page 2, press **Tamper resist** soft key.
2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.5 CONFIGURATION SETUP - PUMP MODULE

2.5.1 Access System Configuration Options

1. Hold **OPTIONS** key at power up.

System Configuration - Module	
Factory default:	No
Shared Infusion Settings	
PC Unit	
Pump Module	
SPO2 Module	
>Select an Option or EXIT	
EXIT	PAGE DOWN

2. Press **Pump Module** soft key. To view additional options, press **PAGE DOWN** soft key.

System Config - Pump 1 of 2	
Accumulated air:	Enabled
Air-in-line settings:	75 ^{micro} -liter
Auto-restart attempts:	0
KVO rate adjust:	1 mL/h
Max rate:	999 mL/h
>Select an Option or EXIT	
EXIT	PAGE DOWN

System Config - Pump 2 of 2	
Max VTBI:	9999 mL
Pressure mode:	Pump
SEC-PRI alert:	Enabled
Secondary:	Disabled
>Select an Option or EXIT	
PAGE UP	EXIT

2.5 CONFIGURATION SETUP - PUMP MODULE (Continued)

2.5.2 Accumulated air

When **Disable** is selected, the air-in-line system detects a bolus size of »50, 75 or 250 microliters only. When **Enable** is selected, the air-in-line system detects a bolus size of »50, 75 or 250 microliters and a number of small boluses of a predetermined number, depending on the bolus size selected in the **Air-in-line** settings option.

- After accessing **System Config - Pump** options display, press **Accumulated air** soft key.

System Configuration - Pump	
Accumulated Air-in-line	Enable
	Disable
Detects the presence of multiple small air bubbles.	

- To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.5.3 Air-in-line settings

There are 3 different air-in-line bolus settings that can be selected; 50, 75 or 250 microliters. This is the amount of air allowed to pass through the detector before an air-in-line alarm sounds.

- After accessing **System Config - Pump** options display, press **Air-in-line settings** soft key.

System Configuration - Pump	
Air-in-line detection threshold (in microliters)	50
	75
	250
Sets the upper limit for a single bolus of air to pass without alarm	

- To change setting, press soft key next to applicable option.

2.5.4 Auto-restart attempts

This setting determines the number of attempts (0 to 9) the instrument will make to restart the infusion (following detection of a patient-side occlusion) before it alarms "Occlusion".

- After accessing **System Config - Pump** options display, press **Auto-restart attempts** soft key.

System Configuration - Pump	
Auto-Restart Mode	Increase
	Decrease
Attempts:	Confirm
0	
Determines the number of attempts to restart the infusion following detection of a patient side occlusion before the pump will alarm.	

2.5 CONFIGURATION SETUP - PUMP MODULE (Continued)

2.5.4 Auto-restart attempts (Continued)

2. To set number of attempts, press **Increase** or **Decrease** soft key.
 - When the maximum number of attempts is selected, **Increase** is grayed-out (disabled).

System Configuration - Pump	
Auto-Restart Mode	Increase
Attempts: 3	Decrease
	Confirm
Determines the number of attempts to restart the infusion following detection of a patient side occlusion before the pump will alarm.	

3. To accept setting, press **Confirm** soft key.

2.5.5 KVO rate adjust

This option is used to select the KVO (Keep Vein Open) rate (0.1 to 20 mL/h). This determines the rate of fluid flow after "Infusion Complete" has occurred.

1. After accessing **System Config - Pump** options display, press **KVO rate adjust** soft key.

System Configuration - Pump	
KVO rate adjustment	
KVO rate: 1 mL/h	Change KVO rate
	Confirm

2. To change KVO rate:

- a. Press **Change KVO rate** soft key.

System Configuration - Pump	
KVO rate adjustment	
KVO rate: _ _ mL/h	Change KVO rate

- b. Enter desired rate.

System Configuration - Pump	
KVO rate adjustment	
KVO rate: 5 mL/h	Change KVO rate
	Confirm

3. To accept setting, press **Confirm** soft key.

CHECKOUT AND CONFIGURATION

2.5 CONFIGURATION SETUP - PUMP MODULE (Continued)

2.5.6 Max rate

This option is used to select the maximum rate (0.1 to 999 mL/h).

1. After accessing **System Config - Pump** options display, press **Change value** soft key.

System Configuration - Pump	
Maximum rate adjustment	
Maximum rate: 999 mL/h	Change value Confirm

2. To change rate:

- a. Press **Change value** soft key.

System Configuration - Pump	
Maximum rate adjustment	
Maximum rate: — — — mL/h	Change value Confirm

- b. Enter desired rate.

System Configuration - Pump	
Maximum rate adjustment	
Maximum rate: 99.9 mL/h	Change value Confirm

3. To accept setting, press **Confirm** soft key.

2.5.7 Max VTBI

This option is used to select the maximum VTBI adjustment rate (0.1 to 9999 mL).

1. After accessing **System Config - Pump** options display, page 2, press **Max VTBI** soft key.

System Configuration - Pump	
Maximum VTBI adjustment	
Maximum VTBI: 9999 mL	Change value Confirm

2.5 CONFIGURATION SETUP - PUMP MODULE (Continued)

2.5.7 Max VTBI (Continued)

2. To change rate:
 - a. Press **Change value** soft key.

System Configuration - Pump	
Maximum VTBI adjustment	
Maximum VTBI: ---- mL	Change value

- b. Enter desired rate.

System Configuration - Pump	
Maximum VTBI adjustment	
Maximum VTBI: 999.9 mL	Change value
	Confirm

3. To accept setting, press **Confirm** soft key.

2.5.8 Pressure mode

There are 2 pressure modes available that determine the patient-side occlusion limit. The selected mode can be **Unlocked** or **Locked** after being confirmed.

Pump: Instrument will occlude at approximately 10 psi pressure.

Selectable: Occlusion limit of 50 to 525 mmHg (approximately 1 to 10.2 psi), in 25 mmHg increments, can be selected.

1. After accessing **System Config - Pump** options display, page 2, press **Pressure mode** soft key.

System Configuration - Pump	
Pressure mode selection	Pump
Pressure mode: Pump	Selectable
	Change Lock Status
Lock status: Unlocked	
CONFIRM	

2. To change setting:
 - a. Ensure lock status is **Unlocked**.
 - b. Press soft key next to applicable option (**Pump** or **Selectable**).
 - If Selectable mode is selected, following screen displays.

System Configuration	
Selectable Max Pressure:	Up
	Down
525 mmHg	
Selectable Default Pressure:	Up
	Down
300 mmHg	
CONFIRM	

CHECKOUT AND CONFIGURATION

2.5 CONFIGURATION SETUP - PUMP MODULE (Continued)

2.5.8 Pressure mode (Continued)

3. To change pressure setting:
 - a. Press **Up** or **Down** soft key next to applicable option.
 - When maximum pressure setting is selected, **Up** is grayed-out (disabled). When minimum pressure setting is selected, **Down** is grayed-out (disabled).

System Configuration	
Selectable Max Pressure:	Up
400 mmHg	Down
Selectable Default Pressure:	Up
350 mmHg	Down
CONFIRM	

- b. To accept setting, press **CONFIRM** soft key.

System Configuration - Pump	
Pressure mode selection	Pump
	Selectable
Pressure mode: Selectable 350 mmHg	Change Lock Status
Lock status: Unlocked	
CONFIRM	

- c. To lock selection, press **Change Lock Status** soft key.

System Configuration - Pump	
Pressure mode selection	Pump
	Selectable
Pressure mode: Selectable 350 mmHg	Change Lock Status
Lock status: Locked	
CONFIRM	

4. To accept setting, press **CONFIRM** soft key.

2.5.9 SEC-PRI alert

When **Enable** is selected, an alarm sounds when the instrument switches from Secondary to Primary mode.

1. After accessing **System Config - Pump** options display, page 2, press **SEC-PRI alert** soft key.

System Configuration - Pump	
Secondary to primary transition alert	Enable
	Disable
Causes six audio tones to sound when the infusion transitions from secondary to primary.	

2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.5 CONFIGURATION SETUP - PUMP MODULE (Continued)

2.5.10 Secondary

The Secondary mode is used to deliver 2 different fluids sequentially through the same line.

- After accessing **System Config - Pump** options display, page 2, press **Secondary** soft key.

System Configuration - Pump	
Secondary mode	Enable Disable
Allows use of the secondary feature.	

- To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.6 CONFIGURATION SETUP - SHARED INFUSION

2.6.1 Access System Configuration Options

- Hold **OPTIONS** key at power up.

System Configuration - Module	
Factory default:	No
Shared Infusion Settings	
PC Unit	
Pump Module	
SPO2 Module	
>Select an Option or EXIT	
EXIT	PAGE DOWN

- Press **Shared Infusion Settings** soft key.

System Config - Shared	
Delay Options:	Disabled
Drug Calculation:	Disabled
Multidose:	Disabled
Pressure dynamic:	Disabled
Volume/Duration:	Disabled
>Select an Option or EXIT	
EXIT	

2.6.2 Delay Options

Enabling **Delay Options** allows the system to be programmed to delay the start of an infusion **a)** for up to 120 minutes or **b)** for a specific time up to 23 hours 59 minutes. A callback for a programmed delay can be scheduled to give an alert **Before** an infusion is to be initiated, **After** an infusion is completed, **Before and After** an infusion, or to give no alert (**None**).

In the following procedure, **Delay Options** is changed to **Enable**. Changing the option setting to **Disable** disables the **Callback** soft key, as displayed in step 1.

- After accessing **System Config - Shared** options display, press **Delay Options** soft key.

System Configuration - Shared	
Delay Options	Enable Disable
Callback: None	Callback
Allows use of the Delay Options and Callback features.	
CONFIRM	

CHECKOUT AND CONFIGURATION

2.6 CONFIGURATION SETUP - SHARED MODULE (Continued)

2.6.2 Delay Options (Continued)

- To change setting, press soft key next to applicable option (**Enable** or **Disable**).

System Configuration - Shared	
Delay Options	Enable
	Disable
Callback: None	Callback
Allows use of the Delay Options and Callback features.	
CONFIRM	

- To change callback setting:
 - Press **Callback** soft key.

System Configuration - Shared	
Callback Options	
None	Before
	Before & After
	After
	None
CONFIRM	

- Press soft key next to applicable setting (following example illustrates **Before** as having been selected).

System Configuration - Shared	
Callback Options	
Before	Before
	Before & After
	After
	None
CONFIRM	

- To accept setting, press **CONFIRM** soft key.

2.6.3 Drug Calculation

Enabling **Drug Calculation** allows:

- entry of drug dose (correct flow rate to achieve desired dose is automatically calculated),
- OR
- entry of flow rate (corresponding drug dose is automatically calculated).

In the following procedure, the **Drug Calculation** option is changed to **Enable**. Changing the option setting to **Disable** disables the **Bolus Dose** soft keys, as displayed in step 1.

- After accessing **System Config - Shared** options display, press **Drug Calculation** soft key.

System Configuration - Shared	
Drug Calculation Allows use of the Drug Calculation feature.	Enable
	Disable
Bolus Dose Allows use of the Bolus Dose feature.	Enable
	Disable
CONFIRM	

2.6 CONFIGURATION SETUP - SHARED MODULE (Continued)

2.6.3 Drug Calculation (Continued)

- To change **Drug Calculation** setting, press soft key next to applicable option (**Enable** or **Disable**).

System Configuration - Shared	
Drug Calculation Allows use of the Drug Calculation feature.	Enable Disable
Bolus Dose Allows use of the Bolus Dose feature.	Enable Disable
CONFIRM	

- To change **Bolus Dose** setting, press soft key next to applicable option (**Enable** or **Disable**).

System Configuration - Shared	
Drug Calculation Allows use of the Drug Calculation feature.	Enable Disable
Bolus Dose Allows use of the Bolus Dose feature.	Enable Disable
CONFIRM	

- To accept setting, press **CONFIRM** soft key.

2.6.4 Multidose

Enabling **Multidose** allows 2 to 24 doses to be programmed at equally spaced intervals on the same Pump Module over a 24-hour period. This mode is designed to allow delivery of multiple, equal doses from

the same administration set at regularly scheduled intervals.

In the following procedure, the **Multidose** option is changed to **Enable**. Changing the option setting to **Disable** disables the **Callback** soft key, as displayed in step 1.

- After accessing **System Config - Shared** options display, press **Multidose** soft key.

System Configuration - Shared	
Multidose	Enable Disable
Callback: None	Callback
Allows use of the Multidose and Callback features.	
CONFIRM	

- To change setting, press soft key next to applicable option (**Enable** or **Disable**).

System Configuration - Shared	
Multidose	Enable Disable Callback
Allows use of the Multidose and Callback features.	
CONFIRM	

CHECKOUT AND CONFIGURATION

2.6 CONFIGURATION SETUP - SHARED INFUSION (Continued)

2.6.4 Multidose (Continued)

3. To change callback setting:
 - a. Press **Callback** soft key.

System Configuration - Shared	
Callback Options	
Callback: None	Before
	Before & After
	After
	None
CONFIRM	

- b. Press soft key next to applicable setting (following example illustrates **Before** as having been selected).

System Configuration - Shared	
Callback Options	
Callback: Before	Before
	Before & After
	After
	None
CONFIRM	

4. To accept setting, press **CONFIRM** soft key.

2.6.5 Pressure dynamic

Enabling **Dynamic Pressure Display** graphically displays the current patient-side occlusion pressure set point and patient-side operating pressure for that module.

1. After accessing **System Config - Shared** options display, press **Pressure dynamic** soft key.

System Configuration - Shared	
Dynamic Pressure Display	Enable
	Disable
Allows use of the dynamic pressure display feature.	

2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

2.6.6 Volume/Duration

Enabling **Volume/Duration infusion mode** allows a volume-to-be-infused (VTBI) and duration (infusion time) to be programmed, automatically calculating the flow rate.

1. After accessing **System Config - Shared** options display, press **Volume/Duration** soft key.

System Configuration - Shared	
Volume/Duration infusion mode	Enable
	Disable
Allows the use of the Volume over Duration infusion feature.	

2. To change setting, press soft key next to applicable option (**Enable** or **Disable**).

Chapter 3 – PREVENTIVE MAINTENANCE

WARNING

Failure to perform regular and preventive maintenance inspections may result in improper instrument operation.

3.1 INTRODUCTION

Perform regular and preventive maintenance inspections to ensure that the Alaris® System remains in good operating condition.

- Perform regular inspections before each use.
- Perform preventive maintenance inspections once a year.

Use the applicable maintenance software to check-in, upgrade/repair, diagnose, calibrate and perform preventive maintenance.

Cardinal Health does not recommend the use of automatic testers to check rate accuracy. Generally, these devices collect small samples and the test results may incorrectly indicate a rate accuracy failure. Use of the following Alaris® products is recommended:

- 8100-RCS (Rate Cal Set), to perform rate verification and/or calibration.
- 8100-PCS (Pressure Cal Set), to perform pressure calibration.

These requirements and guidelines are intended to complement the intent of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) requirements.

3.2 CLEANING

Reference the Alaris® System DFU.

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Chapter 4 – PRINCIPLES OF OPERATION

4.1 INTRODUCTION

This chapter describes the principles of operation for the PC Unit and Pump Module.

4.2 PC UNIT

All circuit boards are not field repairable and must be returned to a Cardinal Health Service Center for repair.

4.2.1 Logic Board Assembly - Model 8000

The Logic Board has:

- Field-Programmable Gate Array (FPGA), containing following circuits:
 - DRAM interface and refresh logic
 - protected SRAM interface
 - ISA bus conversion interface
 - audio amplitude PWM and control logic
 - I/O ports (1 input, 2 output)
 - main LCD backlight PWM control source
 - wait-state generation logic
 - 1 Hz display SYNC signal from 32 MHz time base
 - keypad processor clock generation from 14.318 MHz
 - address decoder for ISA bus, display, RTC
 - bus-width control logic
- Flash ROM: Contains main program.
- Keypad control processor: Interfaces keypad to microprocessor.
- Intel microprocessor (25 MHz): Controls all user interface, power distribution, communications, and IUI interfacing.
- PWM: Drives audio speaker.

4.2 PC UNIT (Continued)

4.2.1 Logic Board Assembly - Model 8000 (Continued)

- Real-Time Clock (RTC): Manages timed functions.
- RS-232 communications IC: Allows communications to/from a computer, through RS-232 port on rear of PC Unit.
- RS-485 transceivers: Bidirectional communications with attached module, through an IUI interface.
- SRAM (battery-backed): Stores critical real-time operational data.
- Watchdog circuit: Sounds an alarm if microprocessor stops running or runs at wrong speed.
- Tested main audio circuit.
- Interface bus buffers for 3 expansion slots.
- Keypad backlight driver.
- Graphic LCD controller with 30K byte on board memory, voltage shifter (3.3V logic to 5V logic) for display.
- Software-controlled VPP supply for self-programming of flash ROMs through RS-232 interface.
- Supercap-powered backup audio circuit with self test.
- Digitally controlled contrast (VEE) generator.

I/O:

Latch provides the outputs to the module communications port.

UNIT_ID_ENBL_R is output to the right of the PC Unit, to indicate that the attached modules should try to "ID" themselves, and UNIT_ID_ENBL_L is input from the left for the same reason. Additional output port bits are used to control LEDs on the front panel.

A programmable power supply allows contrast voltage adjustment for proper viewing of the front panel LCD display.

The RTC IC has a battery-backed RAM and includes an electronic serial number. A crystal provides a time base for the RTC. It can maintain time and date information down to 1/100th second. It also includes the chip-select gating for the log-static RAM, which is protected in the event of a power loss.

The keypad processor interface block is implemented using a serial interface.

Main Processor:

The main processor is an Intel microprocessor that provides a 16-bit mP core with a 5-channel interrupt controller, chip-select serial input/output, timers and refresh timing functions, and I/O ports. One serial channel from the microprocessor is connected to the keypad processor. Clocking of the microprocessor is done by a 32 MHz oscillator. The programmable power supply provides a reset pulse to the microprocessor if the Vcc level falls below an acceptable level for operation. The watchdog timer provides a signal to the microprocessor if it fails to pulse the watchdog timer often enough. The signal is also monitored by the PSP and the backup alarm circuit sets PSP to power off the instrument with the **SYSTEM ON** switch during watchdog events.

4.2 PC UNIT (Continued)

4.2.1 Logic Board Assembly - Model 8000 (Continued)

Memory:

The 4.5M byte Flash File type ROM is intended to contain the files needed to operate the system. The address is software-selectable. Information from this memory is used to control or derive all functions. 512K x 16 static RAM is used to hold log information, stack, and other RAM needs of the system. They are supplied with a battery-backed supply voltage and the chip-select is protected by the RTC chip, so that data is not lost during power-down states. Its address is software-selectable using the microprocessor select ports. 1M x 16 DRAM or 4M x 16 is used for system RAM needs.

4.2.2 Logic Board Assembly - Model 8015

The Logic Board has:

- Main audio: Has an audio Coder.Decoder (CODEC) device that converts audio files into an audio signal.
- Auxiliary connector: Provides communication needed to debug PC Unit. Connection is used for Nurse Call Accessory and, if needed, can be used for future options.
- Complex Programmable Logic Device (CPLD): Programmable logic that provides glue logic for compact flash bus. Has miscellaneous logic that allows proper reset to on-board flash, and divides clock associated with DUART.
- Dual Universal Asynchronous Receiver/Transmitter (DUART): Provides a serial communication link to Auto-ID Module through SPARE_A and SPARE_B ports. Interfaces with main processor through Intel bus. These signals are needed on IUI connector.
- Keypad processor: Uses high-end microcontroller. Senses keypad activity and handles IUI communication, and sends this information to main processor. Provides PWM signals that are used to adjust LCD display and keypad LED backlights.
- Compact flash memory: Stores application software, audio wave files, Data Set, and hex files data for operating system software, all needed to operate Alaris® System.
- On-board flash memory: Contains software needed to initially turn on Alaris® System. Stores boot software application, and events, errors and battery logs.
- Intel microprocessor (32-bit): Main processor. Controls all user interface and communications, and provides digital control of LCD display.
- Real-Time Clock (RTC): Manages timed functions. Lithium battery keeps clock running when there is no AC or DC power.
- SDRAM (128 MB): Has volatile memory used primarily to execute application code stored in compact flash memory. Stores variables associated with software and Alaris® System.

4.2 PC UNIT (Continued)

4.2.2 Logic Board Assembly - Model 8015 (Continued)

- Watchdog and backup circuits: A watchdog device is used to ensure proper software operation. Backup circuits are logic that activates backup alarm if software problems occur. Output of backup circuit drives an LED with front panel and a backup speaker at a 0.5 Hz rate. A super cap provides power to this circuit if AC and DC power fails.
- Compact flash bus for wireless connectivity: Interfaces between main processor and compact flash memory card.

4.2.3 Power Supply Board Assembly

The Power Supply Board charges the primary (NiMH) battery and supplies all voltages to run the Alaris® System. All voltages needed by an attached module are supplied by the PC Unit. An attached module does, however, regulate some voltages supplied by the PC Unit for its own use.

The output of the charger section of the Power Supply Board is used to charge the battery. The PC Unit power cord plugs into a hospital grade AC receptacle. AC power is applied to the AC input module in the rear of the PC Unit. The AC input module has a line filter and AC fuse holder built in. The fused and filtered output of the AC input module is applied to the input of an off-line switching power supply having an output of 24 VDC. This is connected to the input, Power Supply Board J3. Certain circuits are powered continually, either from the battery or line power, allowing the System On to be active

even with the power off. This is essential, considering the fact that the PC Unit uses a soft on circuit to power on. When the PC Unit is powered on, unregulated voltage (VRAW) is applied to the input of several regulators through 2 power FETs. The outputs of these regulators supplies the Alaris® System with required voltages. VRAW is supplied directly to +5 nonswitched (NSW), even while the power is off. This allows +5 NSW to be available for the System On circuitry, even with the power off.

Power is obtained from the AC Mains power and self-contained battery. Backup power for alarms and the RTC is located on the PC Unit Logic Board. Further backup power for the RTC is supported by a lithium battery, which is switched-in if all other forms of power are removed or depleted.

Battery charging while on AC Mains is completely separate from power supply conversion and the battery is automatically switched-in when the AC Mains power is removed. The power sources used by the PC Unit are identified in Table 4-1 and voltages supplied by the Power Supply Board are identified in Table 4-2. The charger section of the Power Supply Board is used to charge the NiMH battery.

The PC Unit uses a 12V 4 Ah NiMH battery. The charger uses a constant current (limited to approximately 2.0A) until the battery reaches the end of charge, allowing the charger to quick-charge the battery without undue stress. The NiMH battery is charged from VRAW through a current regulating circuit, assuring that the NiMH battery is charged according to the manufacture's specifications. These voltages (except for battery charge voltage checked at J3 or at battery terminals) may be checked at Power Supply Board J4 or Logic Board J8.

4.2 PC UNIT (Continued)

4.2.4 Power Requirements

- +5V** This supply is generated on the Power Supply Board and is used to power the LCD and keypad backlight, watchdog circuits, and RS-232 communication.
- 3.3V** This supply is generated on the Power Supply Board.
- Model 8000:** Main supply used to power microprocessor, memory, interface, RS-232 converter, RS-485 connectors, keypad controller, and RTC.
- Model 8015:** Main supply used to power microprocessor, memory, interface, RS-485 connectors, keypad controller, wireless card, and main audio.

NSW +5 This supply is generated on the Power Supply Board. It is used to provide power at all times for powering instrument on and to supply voltage for battery-backed RAM (Model 8000 only) and the RTC on the Logic Board. It is regulated to provide 3.3V and is not switched off until AC power is removed and the NiMH battery is fully discharged. Battery-backed RAM (Model 8000 only) and RTC are further backed up by a lithium battery, which is switched-in by the RTC when 3.3V is less than 3.0V.

Power supply communications are provided by the TxD (transmit data) and RxD (receive data) lines, which can be configured to send/receive any information desired.

Table 4-1. Power Sources

Power Source	How Used
+12V AMP @4 Ah NiMH Battery	Powers PC Unit when it is unplugged. Monitored by power supply processor (PSP) to ensure it discharges and charges correctly.
Lithium Battery	Backs up RTC.
Super Capacitor	Provides power to backup alarm.

4.2 PC UNIT (Continued)

Table 4-2. Power Supply Board Voltages

Voltage	Where Used
+3.3 Volts	Supply to Logic Board for all circuits requiring +3.3 volts.
+5 Volts	Supply to Logic Board for all circuits requiring +5 volts, including LCD display.
+5 Volts NSW	Supply to Logic Board to maintain SRAMs and RTC, and to Power Supply Board for System On circuits. Present even with system powered off. Must be there to enable System On circuits or system will not power on.
+8 Volts	Supply to attached modules through IUI interconnects. Powers main audio circuit and LCD backlight circuit.
+12 Volts (nominal)	Battery connection for battery charge and discharge.
+24 Volts (VRAW)	Supply to regulators to supply regulated voltages and to charge NIMH battery. Current-limited for NIMH charge.

4.2.5 Mechanical

The PC Unit is made up of the following subassemblies.

Battery pack and feet.

Front Case Assembly - consists of:

- front case (high impact plastic)
- hardware
- keypad (data entry)
- LCD (displays user information)
- Model 8015: backlight inverter board

Internal Frame Assembly - aluminum and consists of:

- AC input module
- battery discharge resistor
- logic board
- off-line switching power supply
- power supply board
- Model 8015: compact flash memory card

IUI - consists of:

- IUI circuit boards, right and left
- IUI module connectors, right and left
- hardware

See "IUI", "Mechanical Interface" section for a more detailed description.

Pole Clamp Assembly - consists of:

- hardware
- knob
- lead screw
- pole clamp
- pole clamp mounting plate

Power Cord Retainer - consists of:

- brass snap
- hardware
- retainer
- wrap

4.2 PC UNIT (Continued)

4.2.5 Mechanical (Continued)

Rear Case Assembly - consists of:

- backup speaker
- battery interface connector
- gasket
- latch block and hook
- latch spring and release lever
- rear case (high impact plastic)

Serial I/O board - consists of:

- main speaker
- RS-232 interface
- tamper switch

Model 8015: Wireless Network Card Assembly - consists of:

- card cover
- rear panel
- wireless network card

4.3 PUMP MODULE

All circuit boards are not field repairable and must be returned to a Cardinal Health Service Center for repair.

The Pump Module is used to pump fluid to the patient in a controlled manner. The PC Unit supplies the Pump Module with all power requirements and interface logic control. Even though the Pump Module has its own Logic Board, it must receive its commands from a PC Unit to function.

The Pump Module has an internal high-strength frame which supports all internal and external assemblies. When the door is opened, a spring loaded platen swings back with the door, allowing an administration set to be installed. The set interface is visible with the door open and interfaces with the Pump Module through the following devices.

- **Air-in-Line Detector:** The air-in-line detector uses 2 sensor assemblies. When the administration set is installed, the lower portion of the set (just below pumping segment) is installed into the air-in-line detector. When the tubing is installed into this detector, the transmitting transducer sends an ultrasonic signal through the tubing. If there is fluid in the tubing, the receiver receives a strong signal and a low signal (through a logic circuit), which indicates to the Logic Board that there is fluid in the tubing and pumping can continue. If there is air in the tubing, the receiver receives a very weak signal and a high signal (through a logic circuit), which indicates to the Logic Board that there is air in the tubing. This prompts the Logic Board to stop pumping and sounds the air-in-line alarm.
- **Door Open Sensor:** This sensor is part of the sensor assembly and is comprised of an LED/phototransistor pair, which are biased by the end of the sear when the door is fully closed.
- **Safety Clamp Detector:** The safety clamp detector has an LED/phototransistor pair that are biased when the safety clamp detector is installed, allowing the Logic Board to determine if a set is installed. When the door is closed on the administration set, the safety clamp detector automatically opens, pump fingers are engaged to stop fluid flow, and the Pump Module is ready to pump fluid. When the door is opened, the safety clamp detector automatically closes and stops fluid flow.

4.3 PUMP MODULE (Continued)

- **Pressure Sensors, Upper and Lower:**
The pressure sensors sense the pressure in the tubing by converting the pressure to a voltage. The Logic Board detects bottle-side as well as patient-side pressures by looking at these voltages. If the voltage (pressure) is high or low enough, the Pump Module signals an occlusion alarm.
- **Pumping Fingers:** There are 4 pumping fingers. Two of these are considered occluders (identified by their small profile), in that their primary function is to prevent fluid flow by the phasing of the 2 pumping fingers. The primary function of the 2 pumping fingers (identified by their larger profile) is to pump fluid.

The fingers cycle toward the tubing to push fluid to the patient and then cycle back to fill the tubing. The occluders cycle toward the tubing to control flow throughout the delivery. The occluders and fingers work together to form 2 chambers. Both occluders and the upper (larger) finger form the upper chamber and the lower occluder, and lower (smaller) finger form the lower chamber, which is open-ended to the patient.

At the start of the pumping cycle:

- Upper occluder is pushed forward, blocking flow.
- Lower occluder is pulled back, allowing flow.
- Upper finger is cycling forward, pushing fluid from upper chamber past lower occluder and lower finger (toward patient).

When the upper finger has cycled forward as far as it can:

- Lower occluder cycles forward to stop flow.
- Lower finger starts to cycle forward to keep fluid flowing from lower chamber toward patient.
- Upper occluder cycles back to allow fluid flow and upper finger cycles back to fill upper chamber.

When the lower finger gets to the point where it can no longer move forward to displace fluid:

- Upper occluder moves forward to stop flow (upper chamber should now be full).
- Lower occluder moves back to allow flow.
- Upper finger starts to move forward to push fluid to patient.
- Lower finger cycles back to fill lower chamber, getting ready for next cycle.

4.3.1 Display Board Assembly

The Display Board interface is a serial communications interface between the microprocessor on the Logic Board and the Display Board controller (through door harness assembly). The interface also provides the SYNC signal to the Display Board and a power-on reset signal for initialization of all Display Board logic. The channel-off signal from the keypad is provided as an input to the microprocessor on the Logic Board.

The Display Board processor is the interface from the keypad to the Logic Board. When a key is pressed on the keypad, it is read by the Display Board processor. The processor then relays this information

4.3 PUMP MODULE (Continued)

4.3.1 Display Board Assembly (Continued)

(through door harness) to the Pump Module microprocessor, which in turn relays this information to the PC Unit main processor (through IUI).

The Display Board has four 7-segment LEDs used to display rate information, 4 discrete LEDs, and 1 alpha-numeric LED capable of displaying a module identification letter (A to H). One white LED is for keypad backlight through fiber optic. The other 3 LEDs are: yellow for **Standby**, green for **Infusing**, red for **Alarm**. The Display Board also has an 8-character 5 x 7 dot-matrix display for displaying information pertaining to that particular Pump Module.

All communications between the Display Board processor and the Pump Module microprocessor is through the door harness assembly. This consists of a serial interface consisting of 2 logic interface lines, TXD and RXD.

Interface:

The Display Board interface is a serial-communications interface between the microprocessor on the Logic Board and the Display Board controller. The interface also provides the SYNC signal to the Display Board and a power-on reset signal for initialization of all Display Board logic. The channel-off signal from the Pump Module keypad is provided as input to the Field-Programmable Gate Array (FPGA) on the Logic Board.

4.3.2 Logic Board Assembly

The Logic Board consists of a processor core using an Intel microprocessor running

at 16 MHz, a 1M x 8 Flash ROM and a 512K x 8 Static RAM. A watchdog timer circuit is used to put the Pump Module into a safe state (puts microprocessor in RESET state) if the microprocessor has a hard failure.

The board also has a safety processor using an Intel controller running at 3.58 MHz, an internal 8K byte ROM and an internal 256 byte static RAM. The safety processor is used to monitor Pump Module operations and is capable of putting the module into a safe state if a failure occurs independent of the microprocessor. The safety processor and microprocessor communicate with each other through a serial interface.

The FPGA uses an Actel IC. This device contains digital logic for controlling the parallel communications interface, analog-to-digital converter (ADC), digital-to-analog converter (DAC), pressure transducers, and sensors circuit interface. It is also used to generate the master RESET signal and provide signals to the Motor Controller Board for driving the motor.

ADC:

A 12-bit ADC is used to monitor various Pump Module analog signals, including pressure sensor and motor signals. It has an 8-bit parallel interface to the main processes data bus and its control signals are generated by the FPGA. It uses an external 2.5V reference, which is buffered by an operational amplifier and is used to drive the DAC reference.

Initially the 1.333 MHz clock must be enabled by the FPGA so that the ADC can perform conversions. The specific ADC input channel is selected by writing the module number to the ADC. To read the voltage of a specific module, a low-going pulse must be

4.3 PUMP MODULE (Continued)

4.3.2 Logic Board Assembly (Continued)

ADC: (Continued)

applied to the /START_CONVERSION signal. The microprocessor monitors the ADC BUSY signal and can read the voltage when the ADC BUSY signal is asserted low.

The ADC contains self calibration and system calibration options to ensure accurate operation over time and temperature. The system calibration calibrates for system offset or system gain errors. To perform an ADC calibration, a low-going pulse is applied to the /ADC_CAL signal.

DAC:

An 8-bit DAC is used to generate the VDAC analog signal for driving the Motor Controller Board. The DAC has an 8-bit parallel interface to the microprocessor's data bus and its control signals are generated by the FPGA. The DAC produces a current output, which is converted to a voltage output by an operational amplifier.

The DAC has an 8-bit input latch that contains data written to it from the microprocessor. The /DAC_WRITE signal from the FPGA is asserted low when this data is written to it. The DAC converts the digital value to a proportional current on its output. This current is then converted to a voltage signal VDAC, which drives the Motor Controller Board.

FPGA:

The FPGA uses an Actel IC. This device contains digital logic for controlling the parallel communications interface, ADC, DAC, and sensor circuit interface. It is also used to generate the master RESET signal

and provide signals to the Motor Controller Board for driving the motor.

The processor interface section of the FPGA produces the signals for controlling the ADC, chip-selects for controlling the digital I/O ports in the FPGA, signals for controlling the parallel communications interface between the safety processor and microprocessor, logic for demultiplexing the address/data bus from the microprocessor, and circuitry to produce the /_188_RESET signal that resets the microprocessor. It also has an input port for reading the SYNC, safety clamp detector, pump encoder, air-in-line, and door sensor signals. The processor interface also uses the 76 MHz system clock to produce a 1.33 MHz clock signal for driving the ADC.

The I/O interface section of the FPGA produces signals for controlling the motor interface section, chip-selects for controlling the output ports in this section, and logic to shut down the motor if the Logic Board has a hardware failure. The chip-selects enable the output ports that produce signals to enable and test the air-in-line detection circuitry, enable the pump encoder, enable the safety clamp detector, and enable the pressure sensor. It also generates signals to control the motor interface to the Motor Controller Board.

The motor interface section of the FPGA produces the various phase signals to the Motor Controller Board in order to drive the motor.

Main Processor:

The Logic Board consists of a processor core using an Intel microprocessor running at 16 MHz, a 1 MB x 8 flash ROM and a 512 Kb x 8 static RAM. A watchdog timer circuit is used to put the Pump Module into a safe state (puts microprocessor in RESET

4.3 PUMP MODULE (Continued)

4.3.2 Logic Board Assembly (Continued)

Main Processor: (Continued)

state) if the microprocessor has a hard failure.

The microprocessor generates the upper chip-select signal (/UCS) in order to enable the flash ROM IC when doing read or write operations, when programming new software into the device. The microprocessor generates the lower chip-select signal (/LCS) in order to enable the static RAM when doing read or write operations.

The address bus is demultiplexed by transparent latches in order to generate the address lines, A0 through A7 and A16 through A19.

On power up, the watchdog timer IC generates the /RESET signal, which is taken by the FPGA, and generates the /_188_RESET signal to reset the microprocessor. The microprocessor then generates the RESET signal that is used to reset the safety processor. The microprocessor must strobe the watchdog timer IC every 1 second or less by generating a low-going pulse on the /WDI signal line, in order to prevent it from timing out. If the watchdog IC times out due to a hardware failure on the Logic Board, the /WDO output of the microprocessor is asserted low. This is applied to the FPGA, which generates a nonmaskable interrupt (NMI) to the microprocessor and asserts the /_188_RESET signal low a few seconds later, in order to put the microprocessor into a safe (RESET) state.

RS-485 IUI Interface:

The Logic Board contains interface circuitry to the IUI. Two RS-485 transceiver chips are used to interface the serial port of the

microprocessor to the IUI. The transmit and receive enable signals to the RS-485 transceiver chips are lines from the I/O port of the microprocessor or DUART.

The microprocessor port2 signals, TE1 and TE2, are used to enable the transmitters. The microprocessor signals, RE1 and RE2, are used to enable the receivers. Data is transmitted and received on the microprocessor serial port when communicating with the Pump Module or PC Unit.

Safety Processor:

The safety processor uses an Intel controller running at 3.58 MHz, an internal 8K byte ROM, and an internal 256 byte static RAM. The safety processor is used to monitor Pump Module operations and is capable of putting the module into a safe state if a failure occurs independent of the microprocessor. The safety processor and microprocessor communicate with each other through a serial interface. The safety processor monitors door sensor, safety clamp detector, pump encoder sensor, and air-in-line sensor. If a failure occurs, the safety processor shuts down the motor in order to put the Pump Module into a safe state.

Sensor Circuit Interface:

The sensor interface consists of signals generated and received by the FPGA: air-in-line, door sensor, safety clamp detector, pressure sensor, and pump encoder.

The air-in-line signal is read by the microprocessor and safety processor. The AIL SUPPLY must be enabled and the /ALE_TEST signal must be asserted low in order to read this signal.

4.3 PUMP MODULE (Continued)

4.3.2 Logic Board Assembly (Continued)

Sensor Circuit Interface: (Continued)

The door sensor signal is read by the microprocessor and safety processor. The DOOR_SENSOR_ENABLE signal must be asserted high in order to read this sensor.

The safety clamp signal is read by the microprocessor and safety processor. The DOOR_SENSOR_ENABLE signal must be asserted high in order to read these signals.

The pressure sensor voltages from the bottle-side and patient-side sensors are read by the microprocessor. The PRESSURE_SENSOR_SUPPLY voltage must be enabled in order to read these sensors. The pump encoder sensor signal is read by the microprocessor and safety processor. The PUMP_ENCODER_LED voltage must be enabled in order to read the encoder.

4.3.3 Motor Controller Board Assembly:

The motor drive logic signals are generated by the Logic Board and fed to the power drive circuits on the Motor Controller Board. These circuits drive the 5-phase stepper motor, which is used to drive a cam shaft that biases the pumping fingers, to generate pressurized fluid flow to the patient (pressure depends on many variables but will not exceed maximum design pressure). The Motor Controller Board also monitors the motor's needs and supplies the correct amount of motor drive voltage, depending on a number of variables, not the least of which is load. This ensures an adequate amount of power is available to the motor at all times. The motor speed is based on the rate settings signal sent by the microprocessor.

4.3.4 Mechanical

The Pump Module consists of the following major assemblies.

Fluid Delivery Subassembly (FDSA) - uses a very high strength plastic frame and mechanically supports following parts:

- air-in-line sensor
- bezel
- bezel seal
- cam shaft
- door hinges (break away)
- encoder sensor (detects motor movement)
- gear train
- hardware
- harnesses
- latch yoke (door catch)
- logic board
- motor
- motor controller board
- platen
- pressure sensors, upper and lower
- pumping and occluding fingers
- safety clamp detector

Door Assembly - attaches to FDSA with 2 hinges and consists of following parts:

- covers, front and rear
- display board
- door lever (latch)
- hardware
- harness
- keypad
- protective lens
- seals

IUI - consists of:

- hardware
- IUI circuit boards, right and left
- IUI module connectors, right and left

See "IUI", "Mechanical Interface" section for a more detailed description.

4.4 POWER CONTROL CIRCUIT

The power control circuitry prevents power from being applied to module connections when a module is not attached to the Alaris® System. The same circuitry connects power to the IUI connections when a module is attached to the Alaris® System (see Table 4-3). Each interface and attached module contains 2 separate power switching circuits to control power to modules attached to the left or right.

Left power circuit: Power to modules on the left is controlled by the module detect left signal (MODDETL) to the gate of field effect transistor (FET). When the MODDETL signal is logically high, power is not applied to the left IUI. When a module is attached to the left, circuitry in the newly attached module pulls the MODDETL signal logically low, and power is connected to the left IUI to operate the newly attached module.

Right power circuit: Power to modules on the right is controlled by the module detect right signal (MODDETR) to the gate of the FET. When the MODDETR signal is logically high, power is not applied to the right IUI. When a module is attached to the right, circuitry in the newly attached module pulls the MODDETR signal logically low, and power is connected to the right IUI to operate the newly attached module.

When a previously attached module is detached from the right or left, the respective module detect signal (MODDETL or MODDETR) changes from the low state (module attached, power applied to IUI) to the high state (no module attached, power not applied to IUI). Software within the PC Unit or remaining attached module detects the high state of the module detect signal and determines that 1 or more

previously attached module is no longer attached.

4.5 INTER-UNIT COMMUNICATIONS CIRCUIT AND CONNECTIONS

Software within the PC Unit and all attached modules provides bidirectional communications between a PC Unit and 1 or more attached module. Two pairs of signal lines are provided in both the left and right IUI connectors for this purpose:

Transmit + (TxD [+])
 Transmit – (TxD [–])
 Receive + (RxD [+])
 Receive – (RxD [–])

Each pair of signals (transmit or receive) is a differential pair, which allows rejection of common mode noise appearing on the signal pairs. The transmit pair originates communications from the PC Unit to 1 or more attached module. The receive pair originates communications from 1 or more attached module to the PC Unit, in response to a communications request from the PC Unit. This allows the PC Unit to coordinate communications from multiple function modules on a common transmit/receive bus.

Bidirectional communications between the PC Unit and each attached module can range from a simple "report status" interaction to an extensive dialogue, to change operational parameters or transfer operating event history. At the start of each attempted dialogue, the PC Unit software sets a timer at the maximum time allowed for the attached module to respond. If the attached module does not respond in the allotted time, the timer expires and the PC Unit software determines a communications failure.

4.5 INTER-UNIT COMMUNICATIONS CIRCUIT AND CONNECTIONS

(Continued)

Software within the PC Unit and attached modules provides for communications during the following times.

Prior to logical unit ID assignment:

Communications consist only of that required to assign unit IDs. The UNIT_ID_ENABLE signals control access to the communication channels.

After logical unit ID assignment:

Communications between the PC Unit and attached modules use the assigned unit ID to communicate to, and receive responses from, 1 attached module at a time.

4.5.1 Software

Software running within the interface and attached module performs the following key aspects of IUI functionality:

- Controls state of unit detect line.
- Reads state of incoming ID_ENABLE_IN line.
- Controls state of outgoing ID_ENABLE_OUT line.
- Performs bidirectional communications between PC Unit and 1 or more attached module.

4.5.2 Unit Detection and Identification Circuitry

Unit (module) detection is required to detect:

- presence of attached modules
- new module attachment
- module detachment

Unit (module) identification is used to:

- identify attached module type
- logically assign module designation based on physical location
- designate inter-unit communications to and from a specific module

A combination of 2 signal lines is used to accomplish module detection and, in conjunction with inter-unit communications, accomplish module identification.

Unit Detect Line:

The unit detect line from the IUI connectors is read by PC Unit software as UNIT_DETECT. This allows the PC Unit to determine when modules are attached to the left or to the right.

The UNIT_DETECT line originates from the PC Unit and passes through each attached module. The UNIT_DETECT signal is normally logically high due to circuitry within the PC Unit. Circuitry connected to the UNIT_DETECT line within each attached module is able to pull the UNIT_DETECT line logically low under control of the microprocessor within the PC Unit. The logical state of the UNIT_DETECT signal is able to be read by the microprocessor to determine if any module attached to the left is pulling the signal low.

ID ENABLE IN Line:

Software within each attached module reads the state of the incoming ID_ENABLE_IN line. The state of this signal is used by the software to determine whether the module can respond to unit ID assignment messages from the PC Unit. If this signal is high, the attached module is able to respond to unit ID assignment messages. If this signal is low, the module is not able to respond to unit ID assignment messages.

4.5 INTER-UNIT COMMUNICATIONS CIRCUIT AND CONNECTIONS (Continued)

4.5.2 Unit Detection and Identification Circuitry (Continued)

ID ENABLE IN Line: (Continued)

The ID_ENABLE line originates from the attached module and passes on to either an operating module or PC Unit attached to the right. Circuitry connected to the ID_ENABLE line within each attached module receives the incoming signal (ID_ENABLE_IN) from the left IUI connector and outputs an outgoing signal (ID_ENABLE_OUT) to the right IUI connector.

The incoming signal (ID_ENABLE_IN) is connected to 1 input of an FPGA and then read by the microprocessor. The ID_ENABLE_IN is also pulled logically high when no module is attached to the left.

The ID_ENABLE_OUT of an attached module is directly connected to the ID_ENABLE_IN of the module on its right. Using this scheme, the microprocessor in the module attached on the left allows the ID_ENABLE_OUT to be high only after the left module has completed its identification with the PC Unit.

4.5.3 IUI

When a module is attached to the PC Unit, it is connected through the IUI. The limit is 4 attached modules per PC Unit. The exception is the Auto-ID Module which can be a fifth module.

The IUI consists of a left connector and a right connector, with spring contacts. These connectors are used to attach a module to a PC Unit or another module, and provide physical support and electrical connections.

Mechanical Interface:

The mechanical interface consists of mechanically supporting electrical connectors, male on 1 module and female on the other. These connectors mechanically interface to attach a module to the PC Unit, or 1 module to another module (for example, when 2 modules are attached to 1 side of PC Unit). In conjunction with these connectors there is a latching mechanism on the bottom of each module that helps secure the 2 modules together. Pushing on the latching mechanism disengages an attached module. Reference the Alaris® System DFU for module attachment and detachment instructions.

Electrical Interface:

The electrical interface between an attached module and the PC Unit is an integral part of the mechanical connector, consisting of 15 gold-plated pins. The pins on the module interface with the pins on the PC Unit, or another module if more than 1 module is attached to the same side of the PC Unit.

Table 4-3 is a snapshot of the IUI connector pin-outs. The electrical portion of the IUI consists of the following elements:

- Power control circuitry and connections.
- Module detection, and identification circuitry and connections.
- Logical module assignment circuitry and connections.
- Inter-unit communications circuitry and connections.
- Spare I/O.

All inter-unit connections are accomplished through the IUI connectors located on the left and right side of each PC Unit and attached module.

4.5 INTER-UNIT COMMUNICATIONS CIRCUIT AND CONNECTIONS

(Continued)

4.5.4 Module Detection and Logical Designation

Three situations may occur within the IUI which require software functionality for the assignment of a logical designation to an attached module, based on its physical position within the Alaris® System:

- System On.
- Attachment of 1 or more module to left after System On.
- Attachment of 1 or more module to right after System On.

Two additional situations may require either reassignment of logical designations and/or enunciation of alarms (see “Module Detachment” section):

- Attachment of 1 or more module to left after System On.
- Attachment of 1 or more module to right after System On.

4.5.5 Unit ID Assignment at System On

The basic scheme for assigning unit (module) position identification at System On involves the following sequence of events:

1. PC Unit and each attached module execute a Power On Self Test (POST), during which each attached module clears its unit ID and, when POST is complete, pulls unit detect line low.
2. As each module completes its POST, it releases unit detect line.
3. When all attached modules have released unit detect line, PC Unit senses unit detect line in high state.

4. PC Unit sends a message to all modules to pull unit detect line low.
5. PC Unit sequentially assigns unit IDs from left to right, starting with "A" and ending when PC Unit senses unit detect line in high state.

When modules are attached on both sides of the PC Unit, the PC Unit controls the UNIT_D_ENABLE_R line to modules on the right until all modules attached to the left have been identified (UNIT_ID_DETECT_L line goes high). The PC Unit then allows the UNIT_ID_ENABLE_R line to go high and sequentially sets unit IDs for modules to the right, still going left to right.

The sequential assignment of the unit ID from left to right makes use of the fact that an attached module only senses a high state on the ID_ENABLE_IN signal (also called CONNECT_SENSE) when:

- Attached module is farthest to left.
OR
- Module to left has completed its unit ID and sets ID_ENABLE_OUT signal.

Tables 4-3 and 4-4 show the IUI signals for logical module assignment in a system with 2 modules attached to the left and 2 modules attached to the right of the PC Unit.

All modules have been identified and the sequence completes when the PC Unit receives the ID complete message from the last module and the unit detect line goes high. This same scheme is used for any configuration of up to 4 modules (exception, Auto-ID Module can be recognized as a fifth module), ranging from all on the left, all on the right, or a mix of left and right modules.

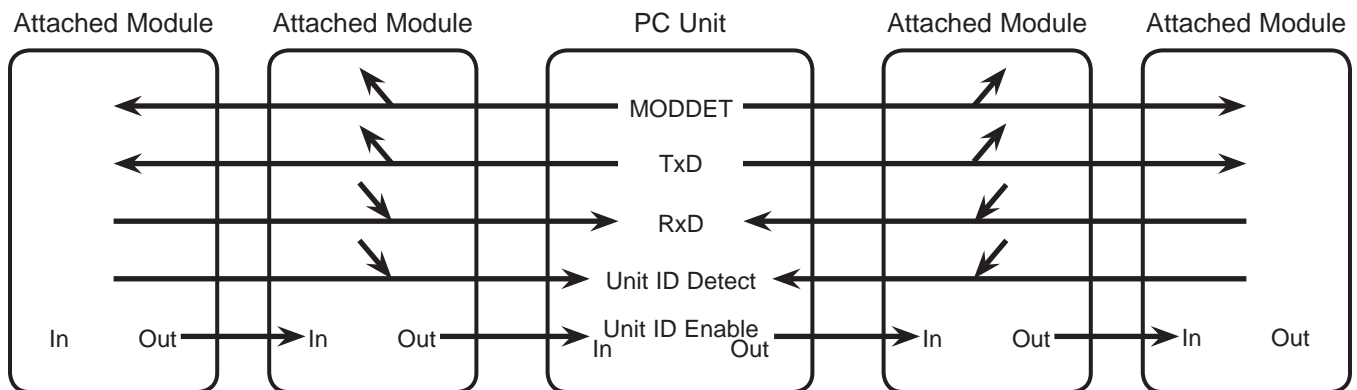
4.5 INTER-UNIT COMMUNICATIONS CIRCUIT AND CONNECTIONS (Continued)

Table 4-3. IUI Logic

Pin #	Left IUI		Right IUI	
1	Common	SYS_GND	Common	SYS_GND
2	+V8	Pwr in/out	+V8	Pwr in/out
3	/MODDETL		Ground	
4	Spare A		Spare A	
5	Unit ID Enable	input	Unit ID Enable	output
6	Common Bus (485) transmit+		Common Bus (485) Receive+	
7	Common Bus (485) transmit –		Common Bus (485) Receive –	
8	Display SYNC LEDs for module	input	Display SYNC	input
9	Common Bus (485) Receive+		Common Bus (485) transmit+	
10	Common Bus (485) Receive –		Common Bus (485) transmit –	
11	Unit ID Detect	output	Unit ID Detect	output
12	Spare B		Spare B	
13	Ground		/MODDETR	
14	+V8	out	+V8	Pwr in/out
15	Common	SYS_GND	Common	SYS_GND

Table 4-4. IUI Signals

The PC Unit only recognizes 4 modules at any 1 time, even though more than 4 modules may be attached. The exception is the Auto-ID Module which can be recognized as a fifth module. The following diagram illustrates the system communications described in detail in the "Inter-Unit Communication Circuit and Connections" section.



4.5 INTER-UNIT COMMUNICATIONS CIRCUIT AND CONNECTIONS (Continued)

4.5.6 Module Attachment After System On

When 1 or more module is attached to the PC Unit after System On, the following events must occur:

- Assignment of logical unit IDs to all newly attached modules.
- Reassignment of all other modules within the system to next logical letter; "A" becomes "B", "B" becomes "C", and so on.

The assignment of logical unit IDs to a module newly attached to the left follows a scheme similar to the power up scheme:

1. Newly attached module pulls UNIT_DETECT line low.
2. Newly attached module executes its POST, during which its unit ID is cleared.
3. When each module completes its POST, it releases UNIT_DETECT line.
4. When all newly attached modules release UNIT_DETECT line, PC Unit senses UNIT_DETECT in high state.
5. PC Unit sends a message to all modules to pull UNIT_DETECT line low.
6. PC Unit assigns a unit ID of "A" to left-most newly attached module.
7. When left-most newly attached module completes setting its unit ID, it sets UNIT_ID_ENABLE line high, which sets ID_ENABLE_OUT high and sends an ID_COMPLETE message to PC Unit.
8. Attached module assigns a unit ID of "B" to next left-most newly attached module.

9. When next module completes setting its unit ID, it sets UNIT_ID_ENABLE line high, which sets ID_ENABLE_OUT high and sends an ID_COMPLETE message to PC Unit.

When all newly attached modules have completed the unit ID, the PC Unit sequentially assigns a logical unit ID to the remaining modules. However, during the ID assignment communications dialogue between the PC Unit and the other attached modules, each attached module notifies the PC Unit that it already had a valid unit ID and that the new unit ID is merely a position reassignment. The PC Unit is therefore able to reassign all historical and operational data from the previous unit ID to the new unit ID, to maintain data continuity.

4.5.7 Module Detachment

If modules are detached while operating, the PC Unit, upon detecting the detachment, gives visual and audible indications requesting verification. If verification is received, the PC Unit reassigns logical unit IDs similar to attaching a new module. If verification is not received within a prescribed time period, the PC Unit places the system into an alarm state with audible and visual alarms. This alarm is detected by the communications time-out between the PC Unit and the detached modules.

4.5.8 Communications Time-Out

After all modules in the system have been identified, the PC Unit begins systematic bidirectional communication with each attached module. These communications can range from a simple "report state" interaction to an extensive dialogue, to change operational parameters or transfer operating event history. In either case, the

4.5 INTER-UNIT COMMUNICATIONS CIRCUIT AND CONNECTIONS

(Continued)

4.5.8 Communications Time-Out (Continued)

PC Unit software initiates communications with each attached module on a periodic basis, to ensure system integrity.

At the start of each attempted dialogue, the PC Unit software sets a timer at the maximum time allowed for the attached module to respond. If the attached module does not respond in the allotted time, the timer expires and the PC Unit software determines a communications failure.

When 1 or more module is detached, the PC Unit detects the detachment as a communications time-out with the detached modules.

PRINCIPLES OF OPERATION

Figure 4-1. Block Diagram - Models 8000 and 8015

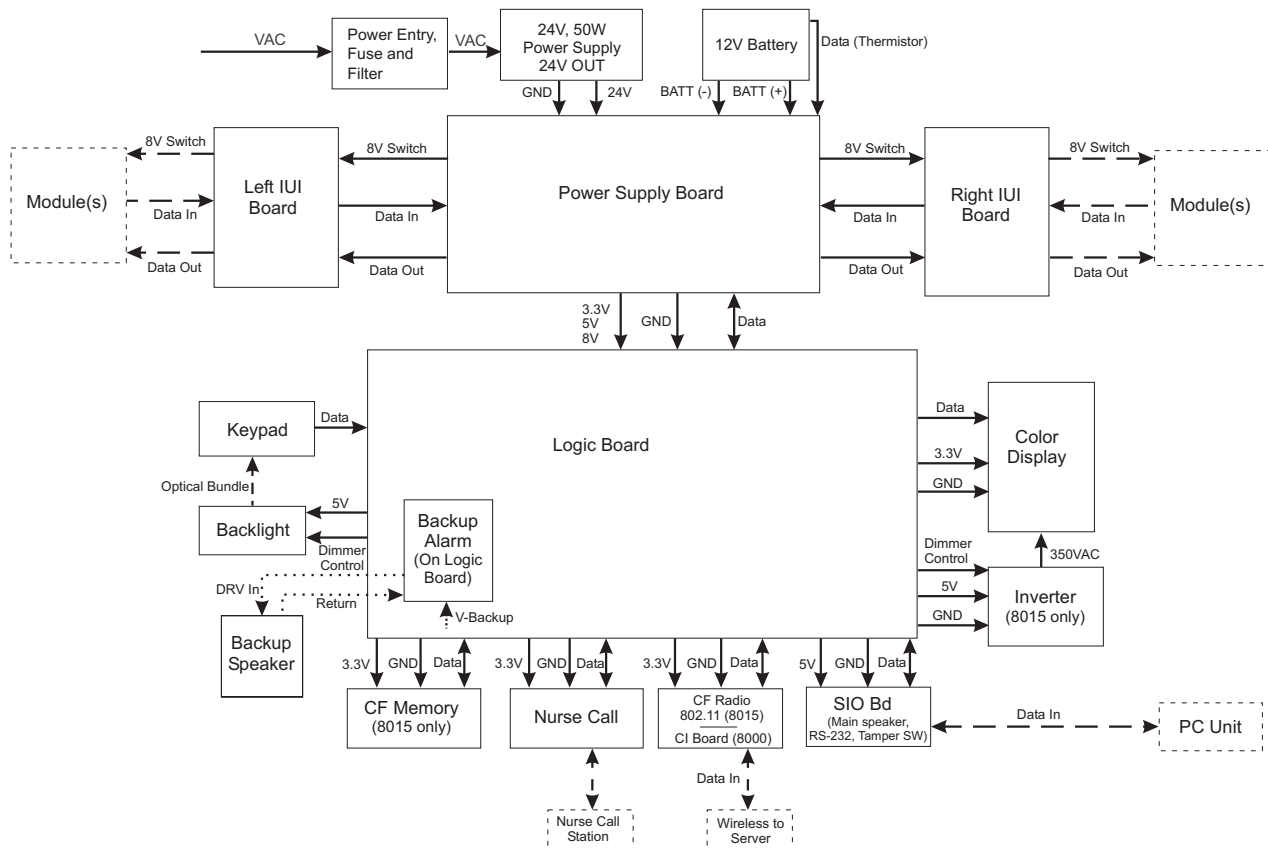
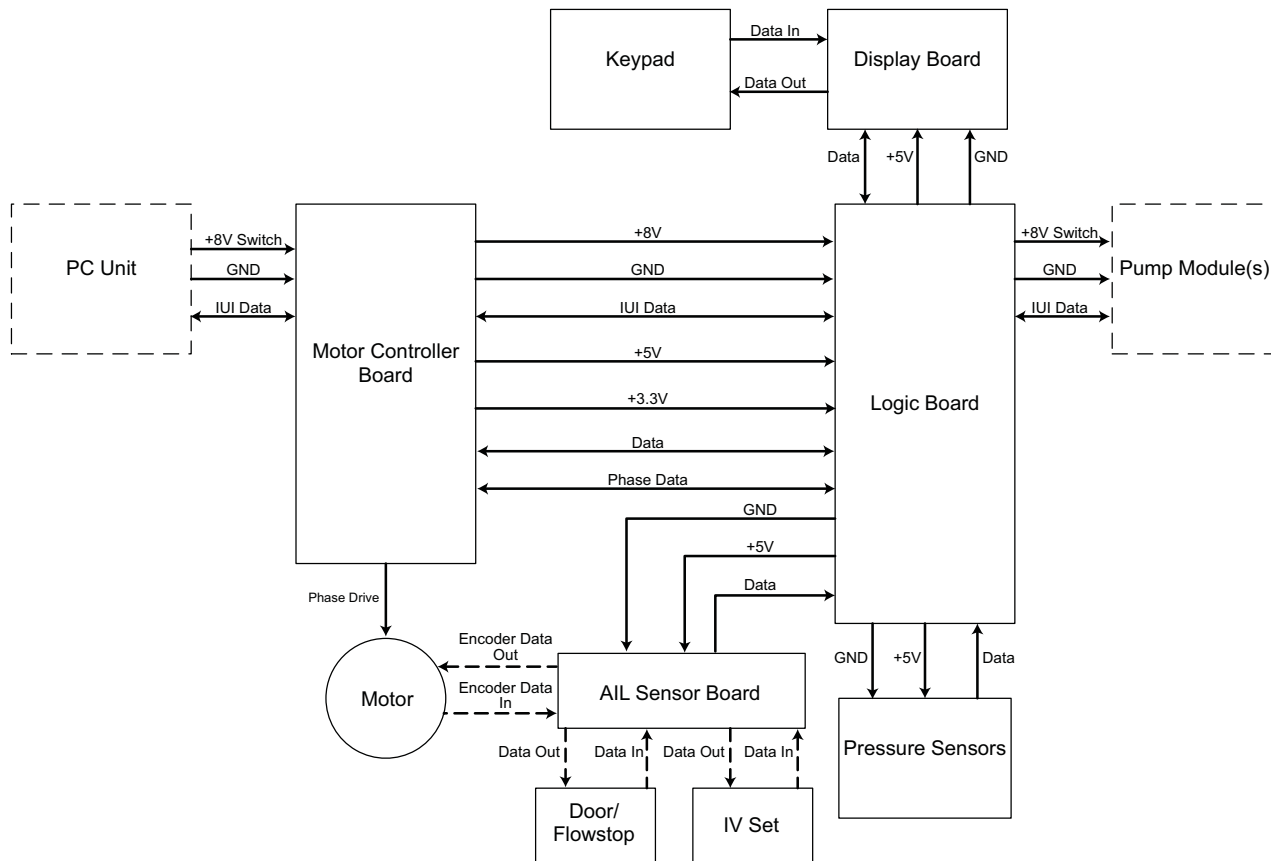


Figure 4-2. Block Diagram - Model 8100



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Chapter 5 – CORRECTIVE MAINTENANCE

WARNING

Disconnect from AC power **prior to performing maintenance**. The instrument case should only be opened by qualified personnel using proper grounding techniques.

CAUTION

CMOS devices are sensitive to static electrical charges and may be damaged during repair if the repair activity is not performed in an electrostatic discharge (ESD) protected environment using approved ESD protective procedures, including personnel grounding.

CAUTION

To avoid the risk of an **electrical hazard or damage** to the instrument circuitry, do not spray fluids directly onto the instrument or allow fluids to enter the instrument.

5.1 INTRODUCTION

This chapter describes how to disassemble and reassemble the PC Unit and Pump Module.

The circuit boards are fitted with surface mount devices and are not field repairable. Return circuit boards to an authorized Cardinal Health Service Center for repair. Attempting circuit board repairs voids all warranties.

For replacement part information, see the "Illustrated Parts Breakdown" chapter. Following any level of maintenance, perform the applicable tests, as identified in the "Level of Testing Guidelines" table.

Due to product changes over time, components/assemblies illustrated in this chapter may differ from the instrument being serviced.

5.2 DISASSEMBLY / REASSEMBLY

The disassembly procedures in this chapter are presented in a sequence that provides the most efficient means of disassembling an instrument. To disassemble, perform the steps in order from the first step. To reassemble, perform the steps in their reverse order.

Before adhering gaskets and labels to the instrument, clean the surface with a cotton swab or soft cloth lightly dampened with 70% Isopropyl Alcohol.

Table 5-1. Required Materials, Supplies and Tools

NOTE: Contact/source information is subject to change.

- Silicone Grease, Dow Corning Molykote 33, or equivalent (<http://www.dowcorning.com>)
- #1 Phillips Screwdriver
- #2 Phillips Screwdriver
- Needle-Nose Pliers
- Small Diagonal Cutters
- Lint-free cloth (such as, Kimwipes or lint-free tissue)

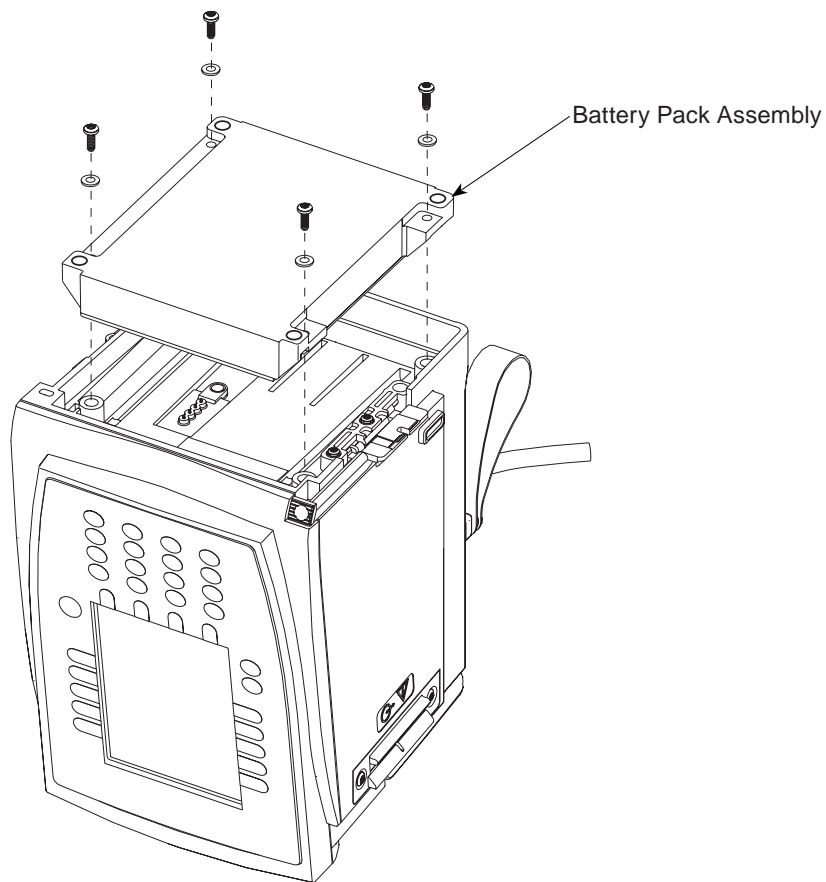
The following items may be purchased from Techni-Tool (800.832.4866; <http://www.techni-tool.com>).

- $\frac{7}{16}$ Nut Driver, TT #272SC036
- $\frac{3}{16}$ Nut Driver, TT #272SC116
- $\frac{1}{4}$ Nut Driver, TT #272SC144
- Torque Screwdriver with a minimum range of 3-15 in/lbs. Recommend torque screwdriver, Micro-Adjustable, TT #844SC5002 or TT #304TO034.

5.3 PC UNIT

5.3.1 Battery Pack Assembly

1. Remove screws (4) from bottom of PC Unit.
2. Remove Battery Pack Assembly.

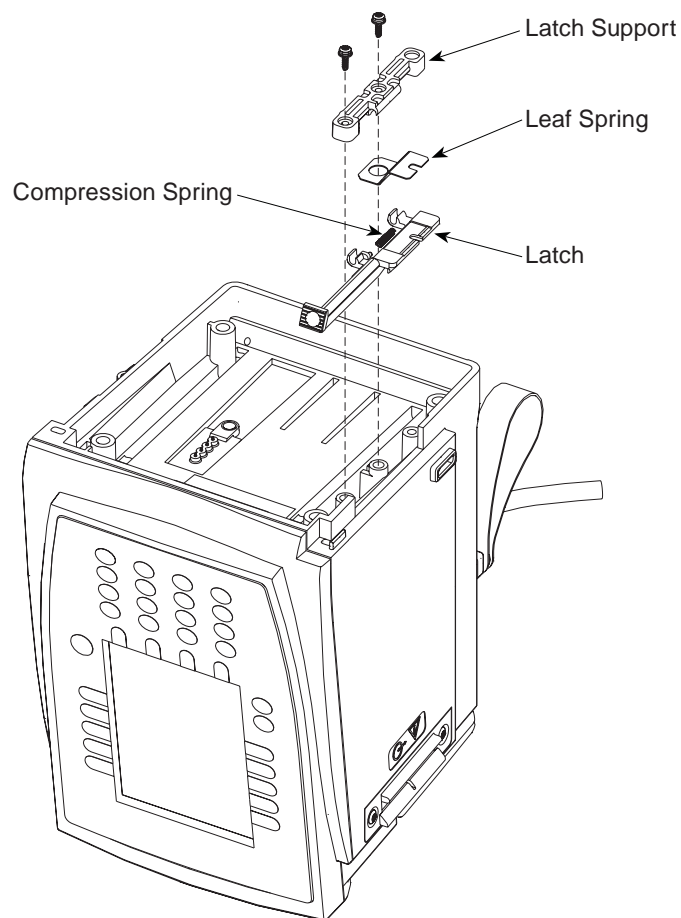


CORRECTIVE MAINTENANCE

5.3 PC UNIT (Continued)

5.3.2 Latch Assembly

1. Remove screws (2) attaching Latch Assembly to bottom of Rear Case.
2. Remove Latch Assembly components from bottom of Rear Case. Pay close attention to Compression Spring location, to ensure proper installation during reassembly.



5.3 PC UNIT (Continued)

5.3.3 Power Cord

1. Remove screw attaching Power Cord Wrap to PC Unit and remove Power Cord Wrap.
2. Remove screw attaching Power Cord Retainer to PC Unit and remove Power Cord Retainer.

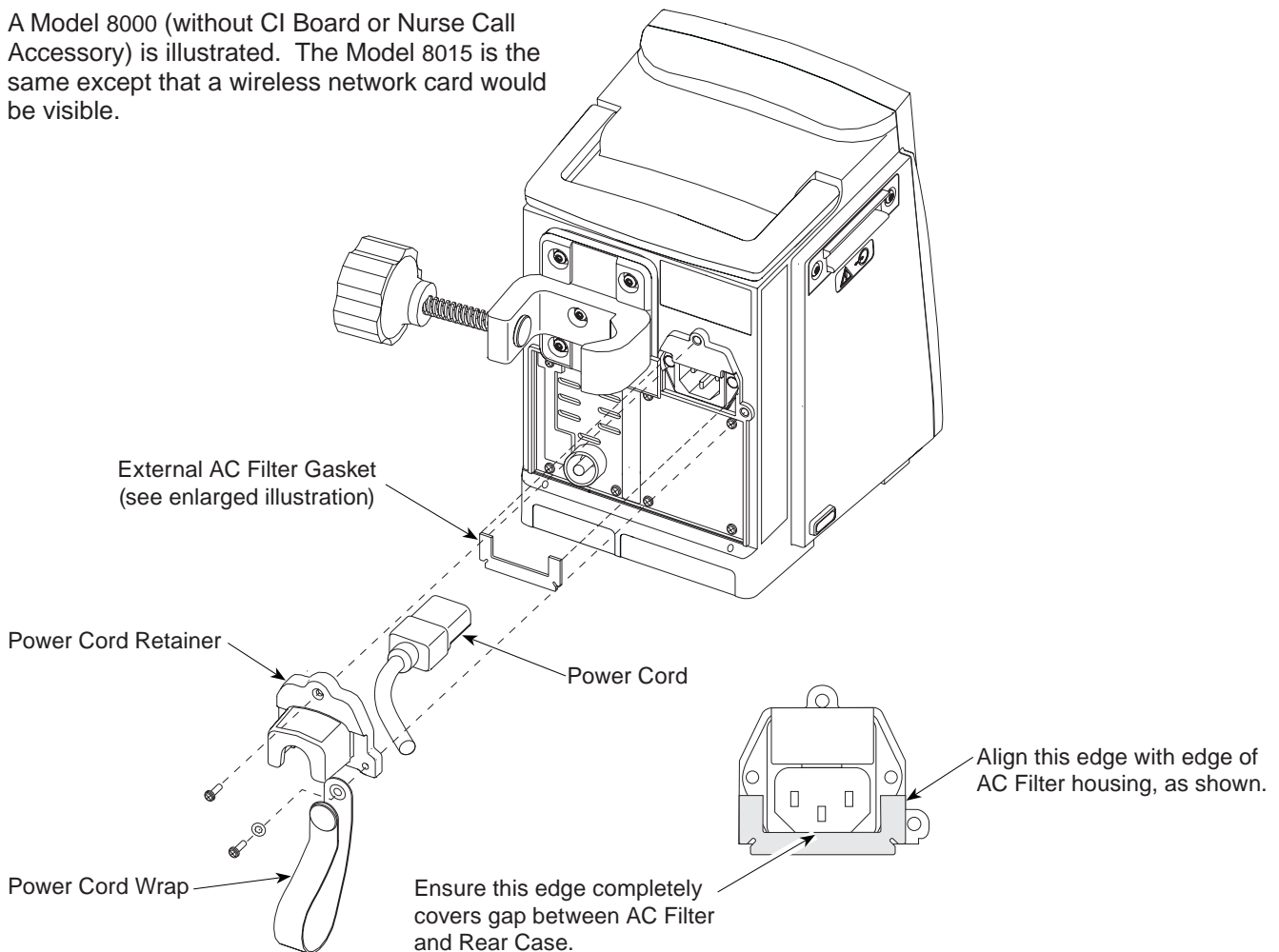
3. Unplug Power Cord from PC Unit and remove.

During Reassembly:

If not present, install AC Filter Gasket.

NOTE: Pole Clamp Assembly may need to be loosened to remove retainer (see "Pole Clamp Assembly").

A Model 8000 (without CI Board or Nurse Call Accessory) is illustrated. The Model 8015 is the same except that a wireless network card would be visible.



5.3 PC UNIT (Continued)

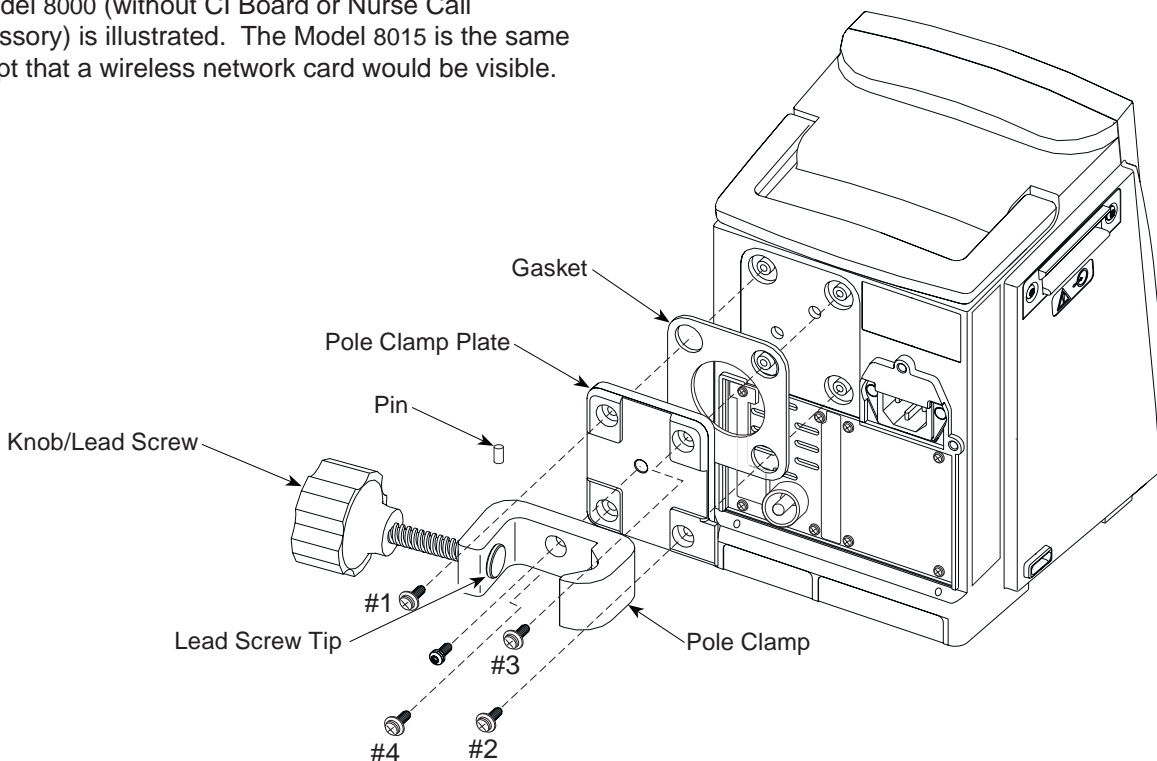
5.3.4 Pole Clamp Assembly

1. Remove screw attaching Pole Clamp to Pole Clamp Plate.
2. Remove screws (4) attaching Pole Clamp Plate to PC Unit.
3. Use a small punch and hammer to drive Pin out of tip of Lead Screw.
4. Remove knob from Pole Clamp.

During Reassembly:

1. Use a small punch and hammer to reinstall Pin in Tip on Knob/Lead Screw.
2. When installing Pole Clamp Plate:
 - a. Use new screws (see Figure 7-15 for ordering options).
 - b. Hand tighten screws in sequence indicated in illustration.
 - c. Torque screws in sequence indicated in illustration.
 - d. Torque screws a second time in sequence indicated in illustration.

A Model 8000 (without CI Board or Nurse Call Accessory) is illustrated. The Model 8015 is the same except that a wireless network card would be visible.



5.3 PC UNIT (Continued)

5.3.5 Rear Panel (Model 8000) and Rear Panel Assembly

1. Remove and discard Gasket Strip.
2. Model 8000: Remove screws (4) securing Rear Panel to Rear Case Frame.

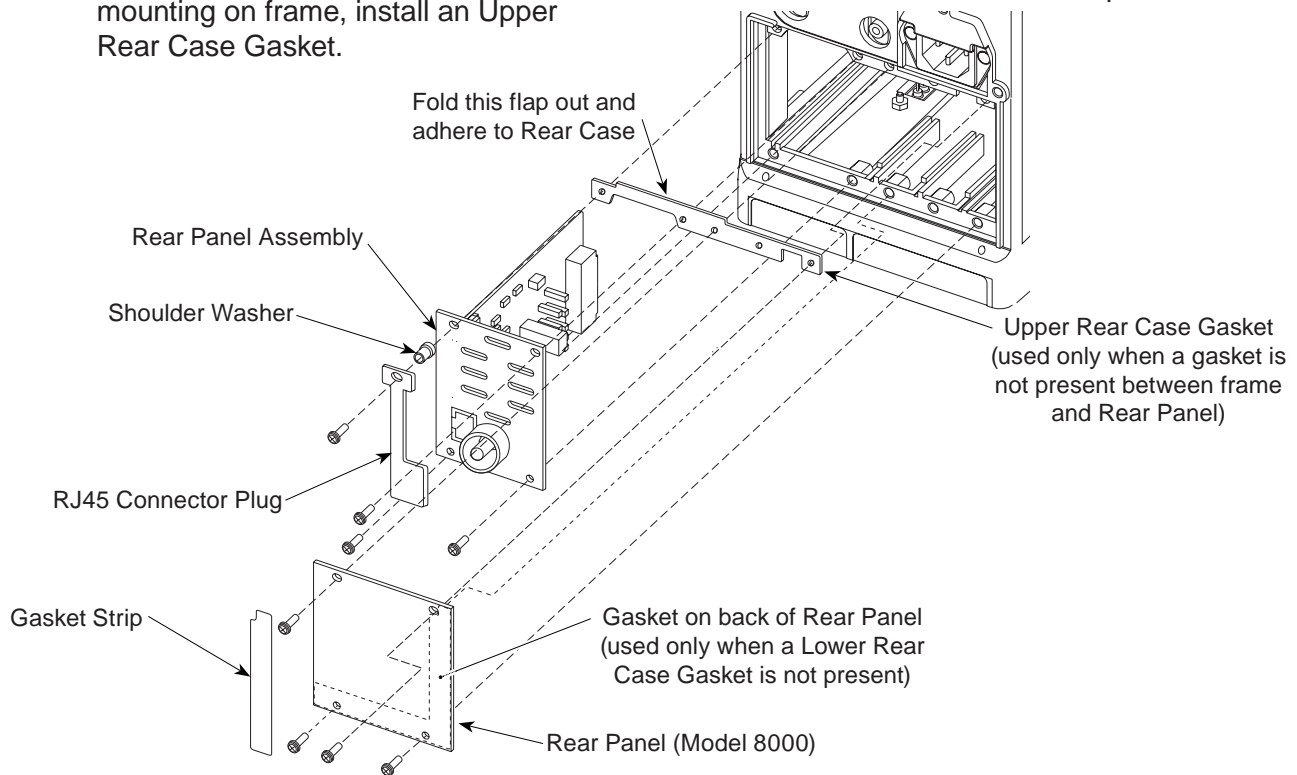
NOTE: To remove CI Board Accessory, Wireless Network Card or Nurse Call Accessory, see applicable disassembly procedure.

3. Remove screws (4) securing Rear Panel Assembly to Rear Case Frame.
4. Gently slide Rear Panel Assembly out of instrument.

During Reassembly:

1. If a gasket is not visible along upper mounting on frame, install an Upper Rear Case Gasket.

2. If a Lower Rear Case Gasket is not present [see "Model 8000: Nurse Call Accessory (Model 8010)" for gasket location]:
 - Ensure a Rear Panel Gasket is installed (see "Rear Panel Assembly Parts" for gasket location).
 - Model 8000: Ensure Rear Panel Gasket is installed.
3. Slide Rear Panel Assembly along left guide, raising it slightly as necessary to align board connection and pushing it into Logic Board connector. Connector is fully seated when panel is flush with mounting frame.
4. Ensure panels are flush to Rear Case and tighten mounting screws.
5. Install a new Gasket Strip.



5.3 PC UNIT (Continued)

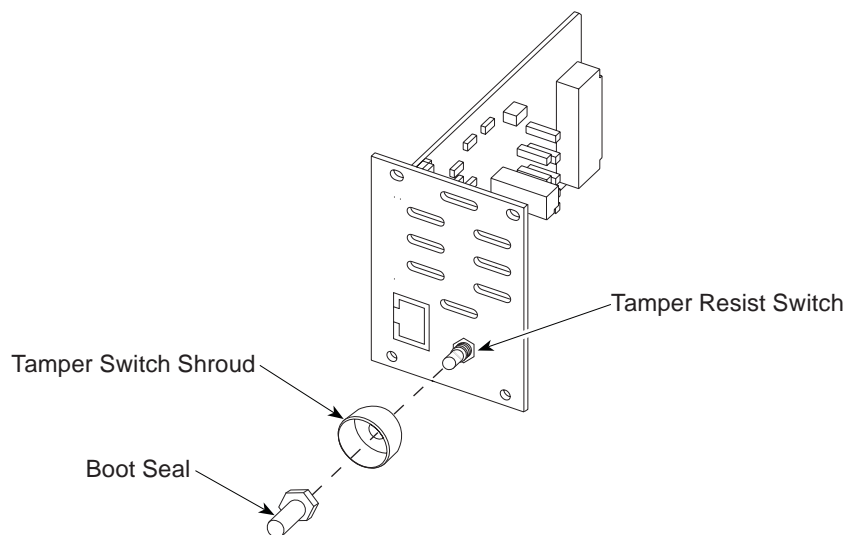
5.3.6 Rear Panel Assembly Parts

1. Cut cable tie holding Speaker and Tamper Resist Switch wiring together.
2. Unscrew Boot Seal from Tamper Resist Switch.
3. Remove Tamper Switch Shroud.
4. Disconnect Tamper Resist Switch from RS-232 Board (J4).
5. Remove Tamper Resist Switch.
6. Disconnect Speaker from Isolated RS-232 Board (J2).
7. Remove screws (2) from RS-232 Board.
8. Remove RS-232 Board, Speaker Bracket and Speaker.
10. Remove and discard Speaker Gasket.

During Reassembly:

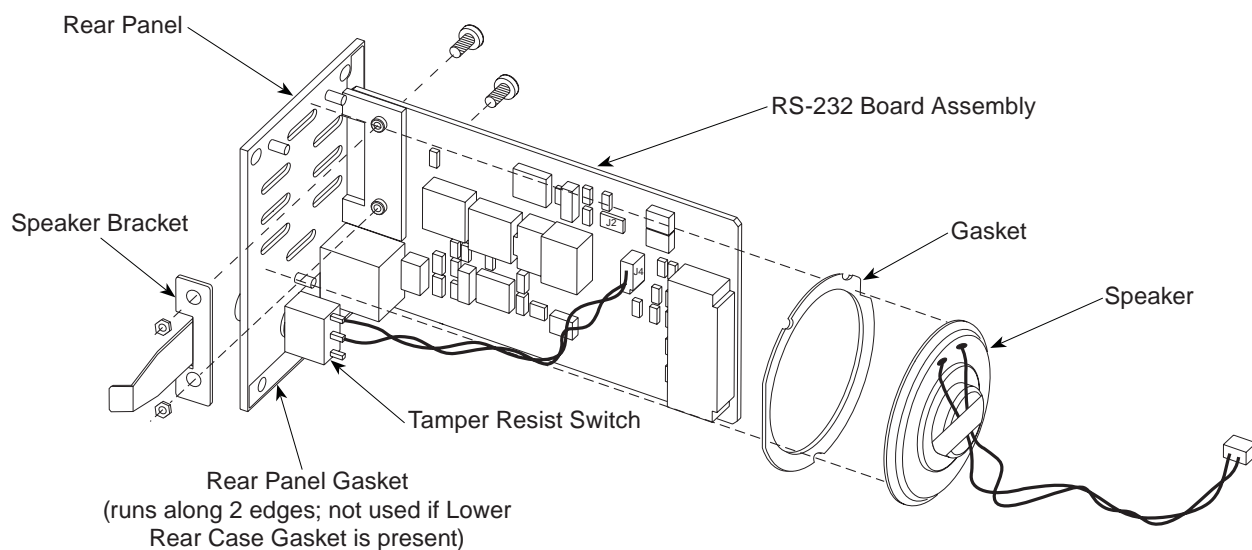
1. Install Speaker Gasket:
 - a. Remove protective backing from side facing Rear Panel.
 - b. Orient notches to line up with standoffs on Rear Panel.
 - c. Adhere to Rear Panel.
2. Remove remaining protective backing from Speaker Gasket and adhere Speaker to gasket.
3. Tie Speaker and Tamper Resist Switch wiring together with a cable tie.

NOTE: The Speaker Gasket is adhered to both the Speaker and Rear Panel.



5.3 PC UNIT (Continued)

5.3.6 Rear Panel Assembly Parts (Continued)



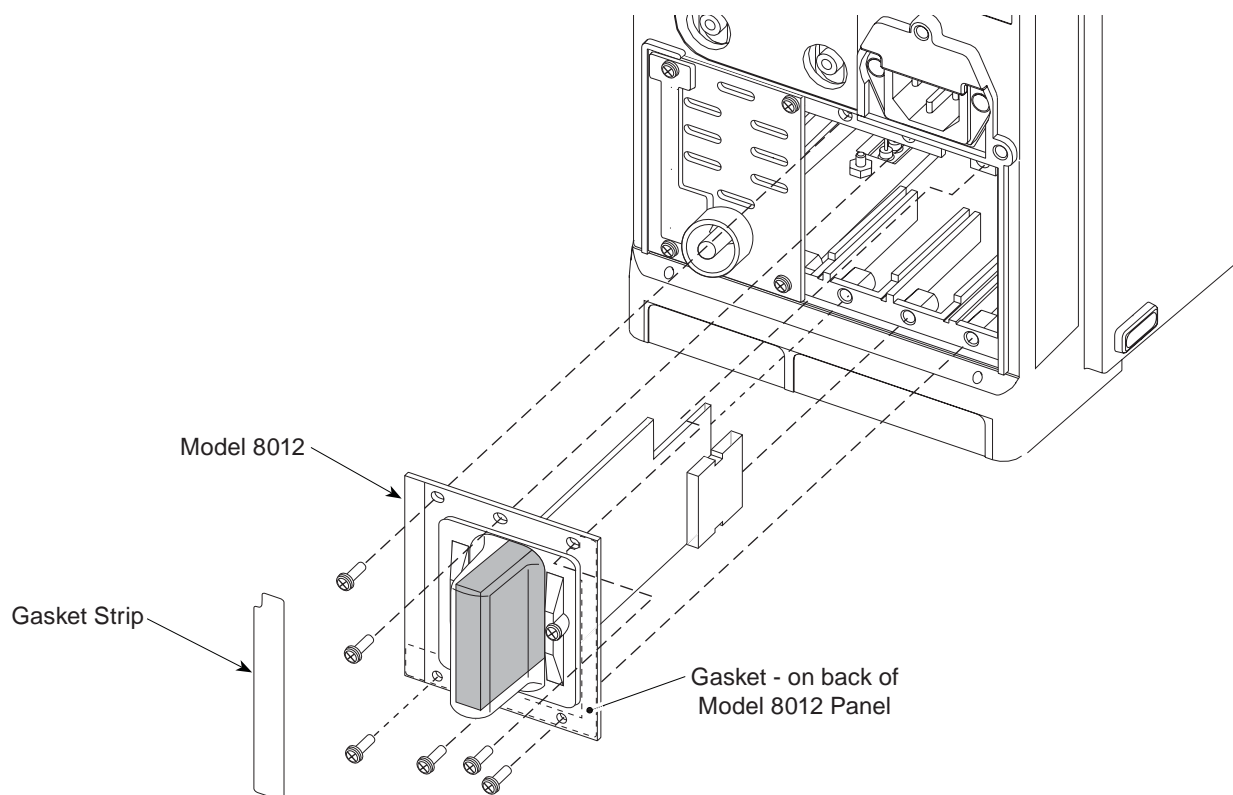
5.3 PC UNIT (Continued)

5.3.7 Model 8000: CI Board Accessory (Model 8012)

1. Remove and discard Gasket Strip.
2. Remove screws (6) securing Model 8012 to Rear Case Frame.
3. Gently slide Model 8012 out of instrument.

During Reassembly or Installation:

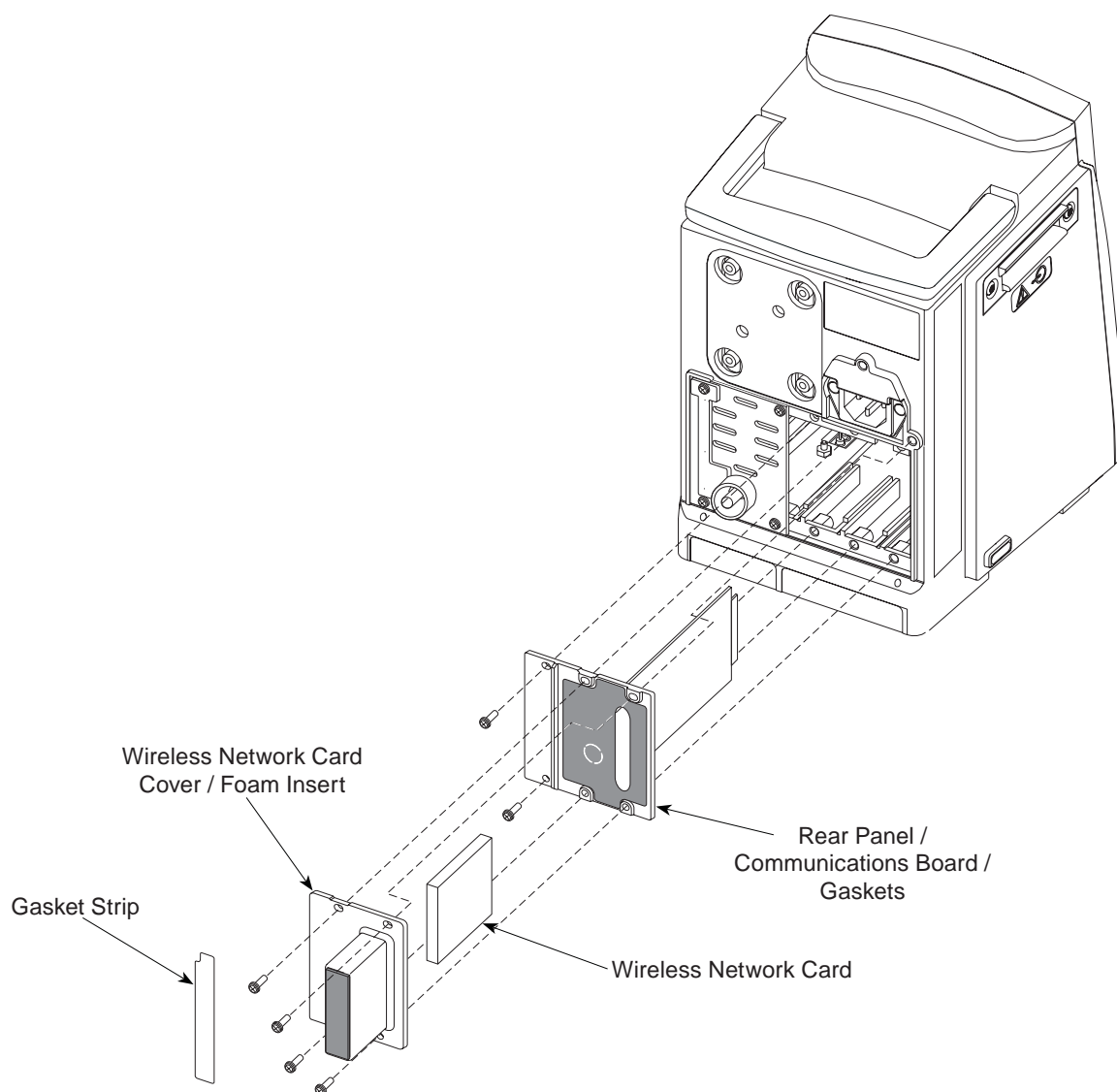
1. If a gasket is not visible along upper mounting on frame, remove Rear Panel Assembly and install an Upper Rear Case Gasket [see "Rear Panel (Model 8000) and Rear Panel Assembly" for gasket location].
2. If Model 8012 is being installed for first time and a Lower Rear Case Gasket is present [see "Model 8000: Nurse Call Accessory (Model 8010)"], remove gasket from Model 8012.
3. Slide Model 8012 along right guide, raising it slightly as necessary to align board connection and pushing it into Logic Board connector. Connector is fully seated when panel is flush with mounting frame.
4. Prior to tightening mounting screws, ensure Model 8012 Plate is flush to Rear Case.
5. Install a new Gasket Strip.



5.3 PC UNIT (Continued)

5.3.8 Model 8015: Wireless Network Card Assembly

1. Remove and discard Gasket Strip.
2. Remove screws (4) securing Wireless Network Card Cover to accessory Rear Panel and Rear Case Frame.
3. Remove Wireless Network Card Cover.
4. Remove Wireless Network Card.
5. Remove screws (2) securing accessory Rear Panel to Rear Case Frame.



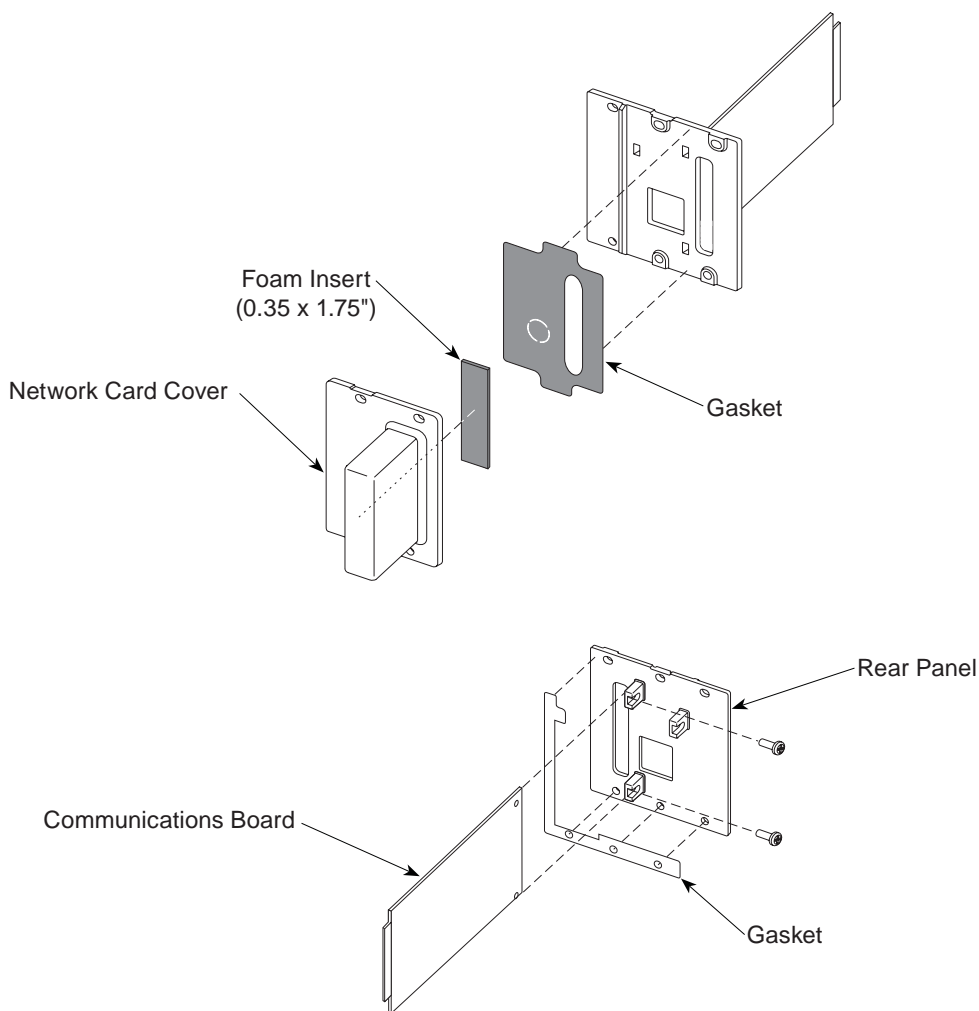
5.3 PC UNIT (Continued)

5.3.8 Model 8015: Wireless Network Card Assembly (Continued)

6. Remove Foam Insert (if present) from Wireless Network Card Cover.
7. Remove accessory Rear Panel / Communications Board Assembly.
8. Remove screws (2) securing Communications Board to accessory Rear Panel.

During Reassembly:

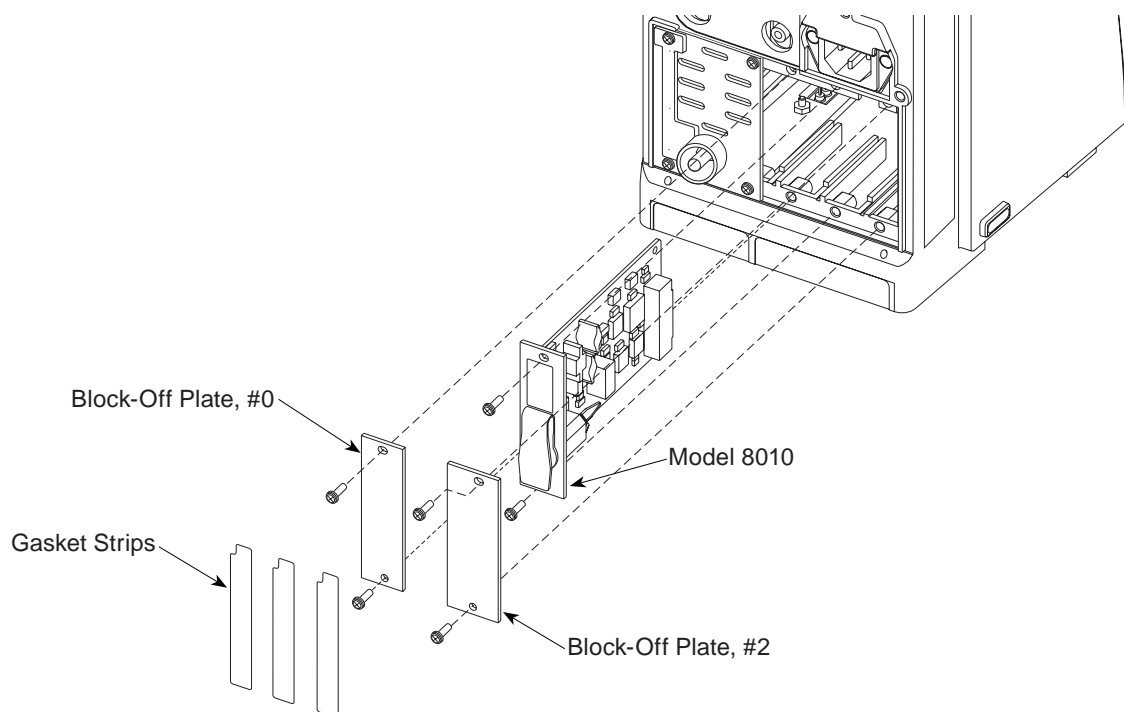
1. If a noticeable gap is visible between Network Card and Cover, ensure Foam Insert is installed. For example, Symbol Network Card requires use of Foam Insert but AmbiCom Network Card does not.
2. Prior to tightening mounting screws, ensure assembly is flush to Rear Case.
3. Install a new Gasket Strip.



5.3 PC UNIT (Continued)

5.3.9 Model 8000: Nurse Call Accessory (Model 8010)

1. Remove and discard Gasket Strips (3).
2. Remove screws (4) securing Block-Off Plates (2) to Rear Case Frame.
3. Remove screws (2) securing Model 8010 to Rear Case Frame.
4. Gently slide Model 8010 out of instrument.

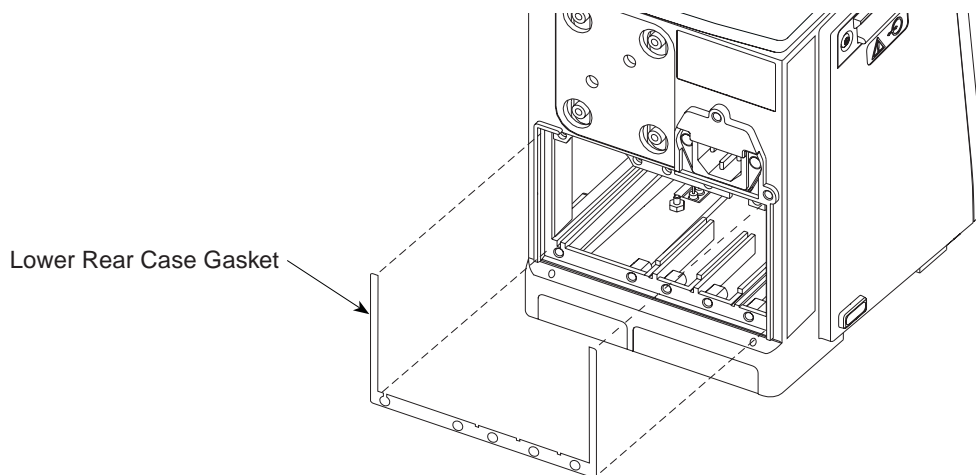


5.3 PC UNIT (Continued)

5.3.9 Model 8000: Nurse Call Accessory (Model 8010) (Continued)

During Reassembly:

1. If a gasket is not visible along upper mounting on frame, remove Rear Panel Assembly and install an Upper Rear Case Gasket [see "Rear Panel (Model 8000) and Rear Panel Assembly" for gasket location].
2. If Model 8010 is being installed for first time:
 - a. Remove Rear Panel Assembly.
 - b. If present, remove and discard Rear Panel Gasket (see "Rear Panel Assembly Parts" for gasket location).
 - c. Install a Lower Rear Case Gasket.
- d. Reinstall Rear Panel Assembly. Do not tighten screws.
- e. Attach #0 Block-Off Plate next to Rear Panel Assembly and #2 Block-Off Plate to far right. Do not tighten screws.
3. Slide Model 8010 along guide rail, raising it slightly as necessary to align board connection and pushing it into Logic Board connector. Connector is fully seated when panel is flush with mounting frame.
4. Ensure Model 8010 Plate, both Block-Off Plates, and Rear Panel Assembly are flush to Rear Case. Tighten all mounting screws.
5. Install new Gasket Strips.



5.3 PC UNIT (Continued)

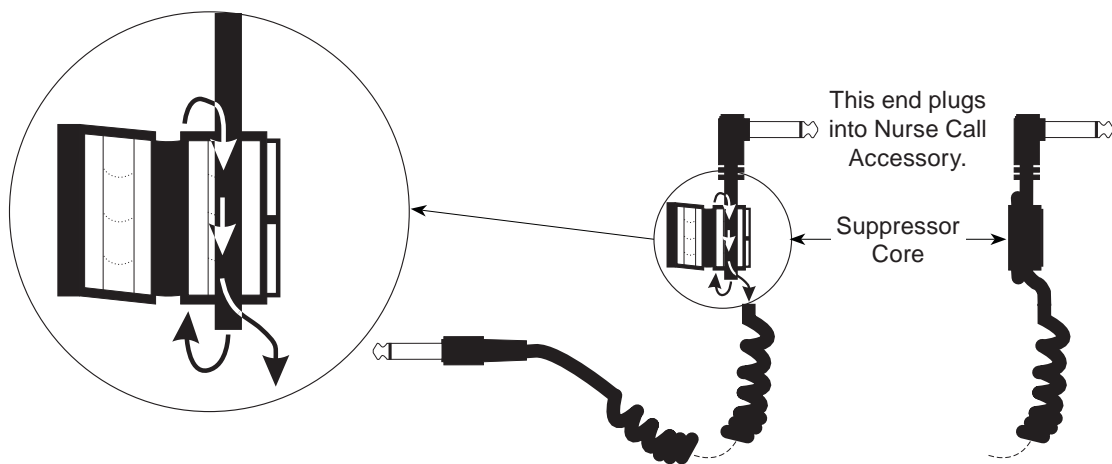
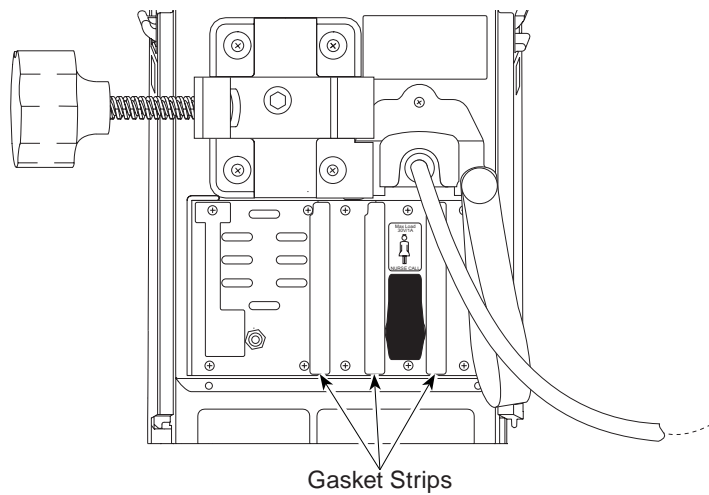
5.3.9 Model 8000: Nurse Call Accessory (Model 8010) (Continued)

6. If Fair-Rite Suppressor Core is being installed for first time:

- a. Open Fair-Rite Suppressor Core.

- b. Route Model 8010 cable (plug end) down along recessed area on right half of suppressor core, and then loop cable around and down through suppressor core.

- c. Close and securely latch suppressor core.



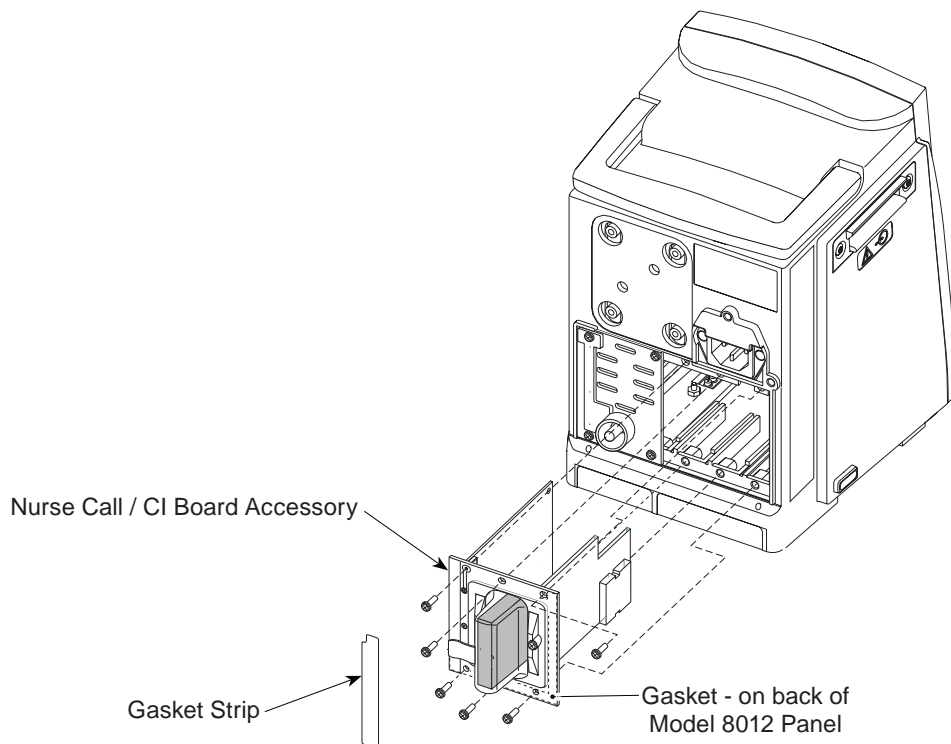
5.3 PC UNIT (Continued)

5.3.10 Model 8000: Nurse Call / CI Board Accessory

1. Remove and discard Gasket Strip.
2. Remove screws (6) securing Accessory to Rear Case Frame.
3. Gently slide Accessory out of instrument.

During Reassembly or Installation:

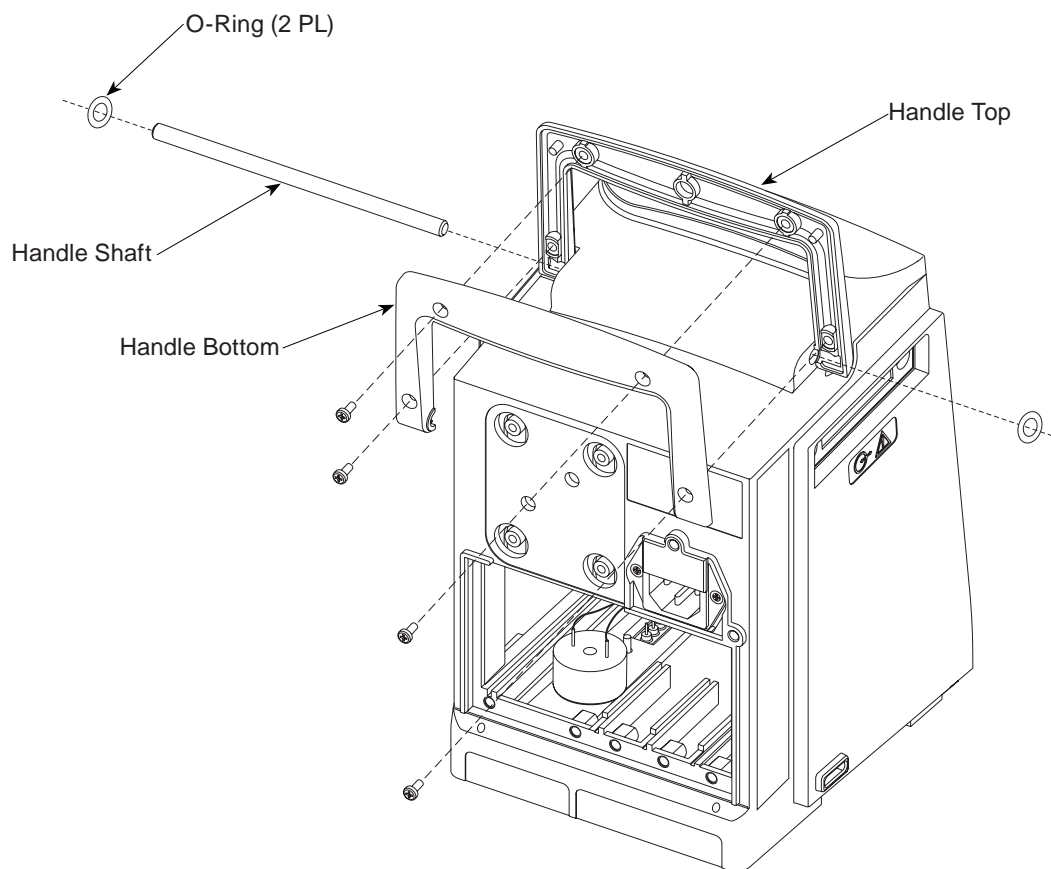
1. If a gasket is not visible along upper mounting on frame, remove Rear Panel Assembly and install an Upper Rear Case Gasket [see "Rear Panel (Model 8000) and Rear Panel Assembly" for gasket location].
2. If Accessory is being installed for first time and a Lower Rear Case Gasket is present [see "Model 8000: Nurse Call Accessory (Model 8010)"], remove gasket from back of Accessory panel.
3. Slide Accessory along left guide, raising it slightly as necessary to align board connections and pushing it into Logic Board connector. Connector is fully seated when panel is flush with mounting frame.
4. Prior to tightening mounting screws, ensure Accessory panel is flush to Rear Case.
5. Install a new Gasket Strip.



5.3 PC UNIT (Continued)

5.3.11 Handle

1. Remove screws (4) attaching handle halves to each other.
2. Remove Handle Top and Bottom.
3. Remove Handle Shaft and O-Rings by sliding shaft to one side.



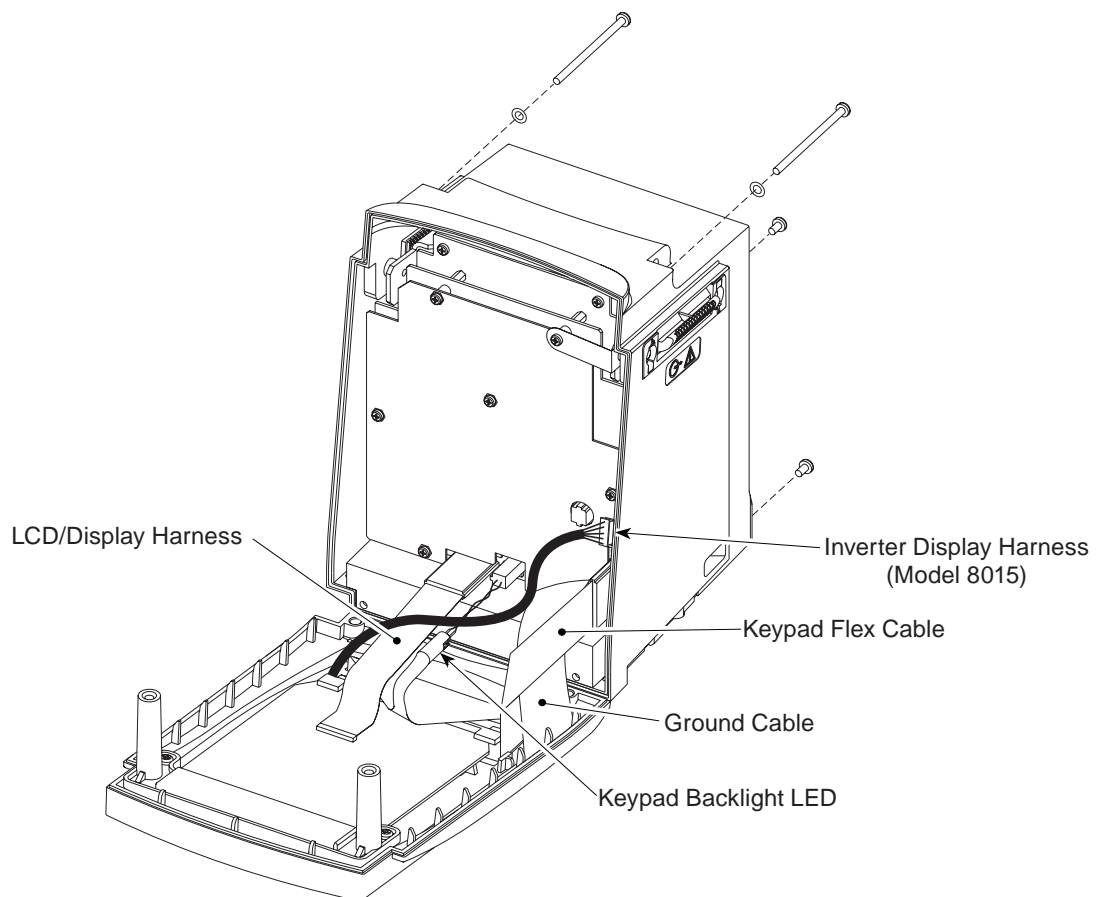
5.3 PC UNIT (Continued)

5.3.12 Front and Rear Case Separation

1. Remove screws (4) attaching Front Case to Rear Case.
2. Carefully disconnect Keypad Backlight LED connector from Logic Board (J9)
3. Disconnect harnesses/cables.
 - LCD/Display - Logic Board J3 (8000) / J7 (8015)
 - Keypad - Logic Board J2 (8000) / J4 (8015)
 - Ground - Ground Plate
 - Inverter Display (8015) - Logic Board J9

During Reassembly:

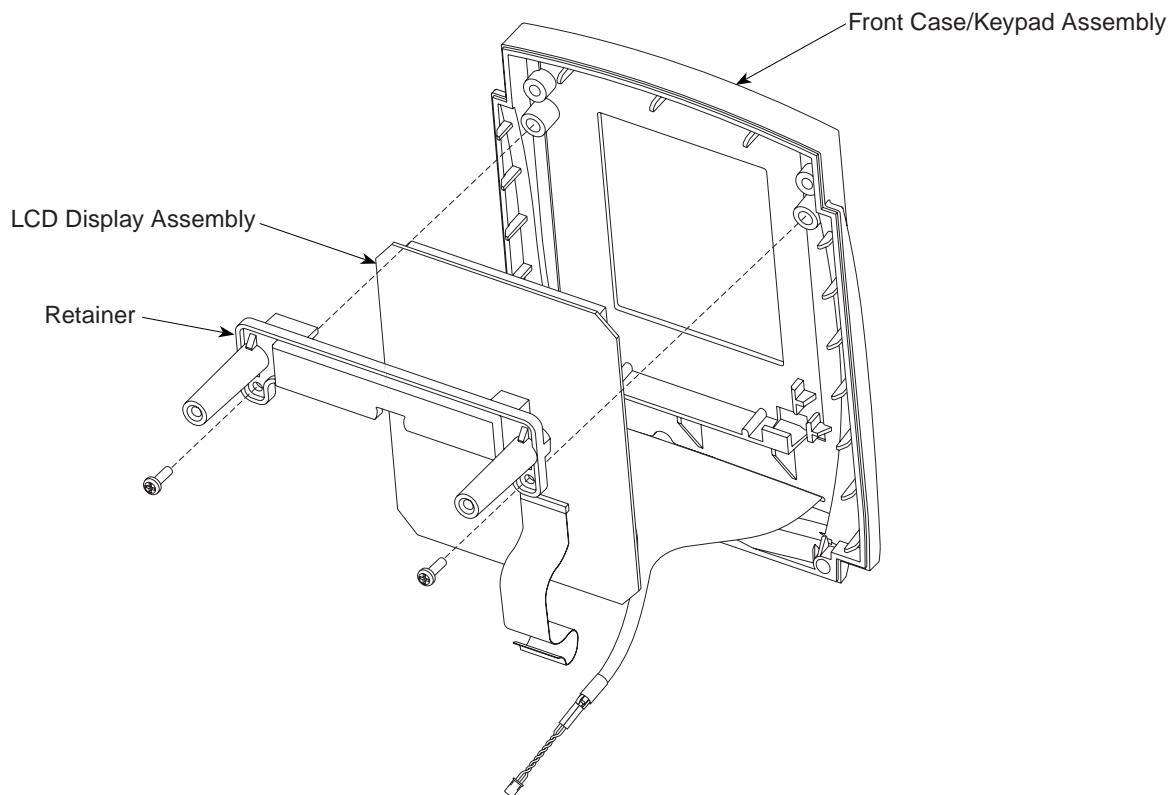
Ensure Silicone Tubing is in place and not damaged. (See Figure 7-3)



5.3 PC UNIT (Continued)

5.3.13 Model 8000: Display and Retainer

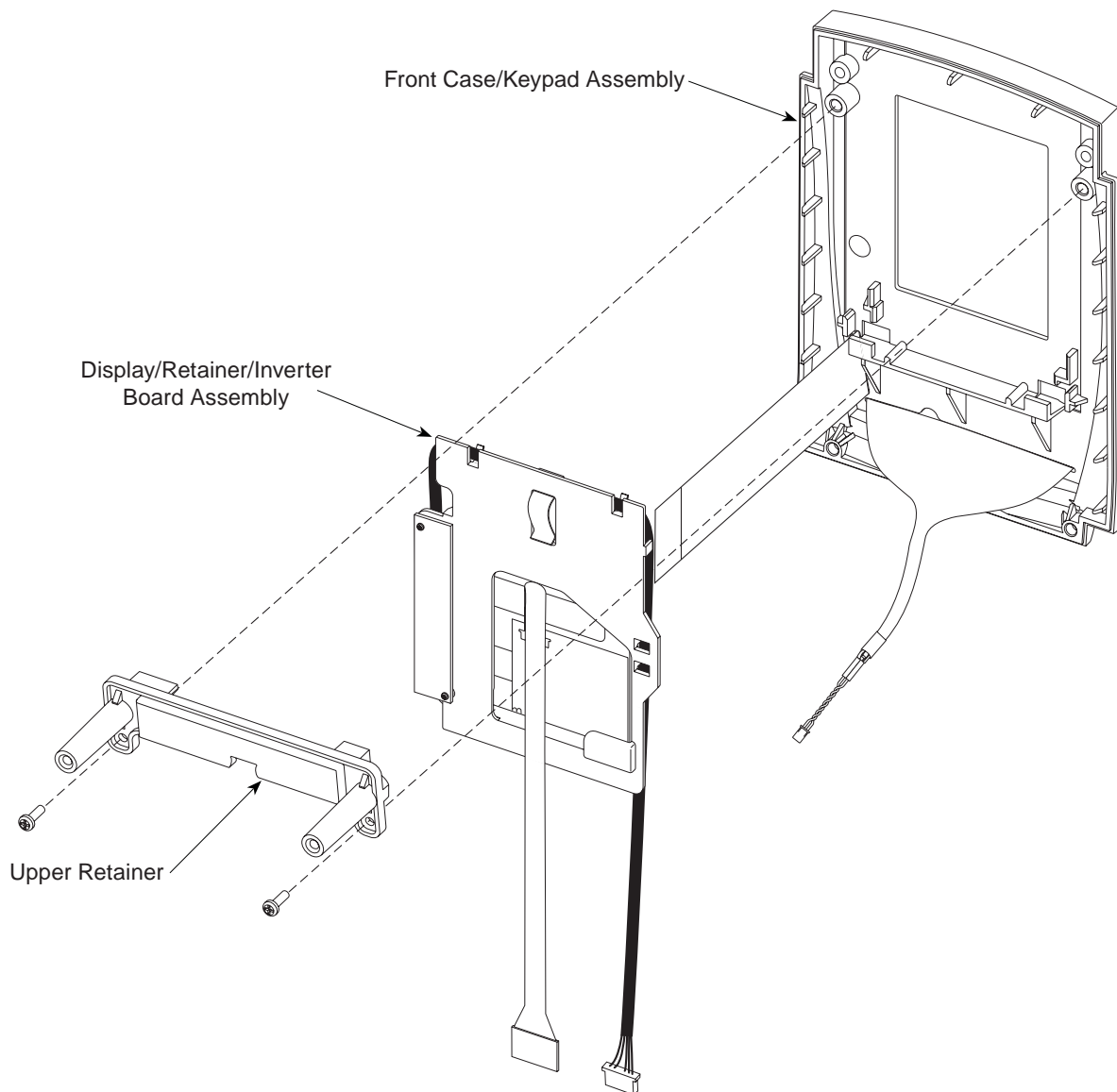
1. Remove screws (2) from Retainer.
2. Remove Retainer and LCD Display from Front Case.



5.3 PC UNIT (Continued)

5.3.14 Model 8015: Display, Retainers, and Inverter Board

1. Remove screws (2) from Upper Retainer.
2. Remove Display/Retainer/Inverter Board Assembly from Front Case.



5.3 PC UNIT (Continued)

5.3.14 Model 8015: Display, Retainers, and Inverter Board (Continued)

3. Disconnect Display Harness and Inverter Display Harness from Inverter Board.
4. Separate Display from Retainer/Inverter Board Assembly.
5. Remove screws (2) securing Inverter Board to Retainer and separate board from Retainer.

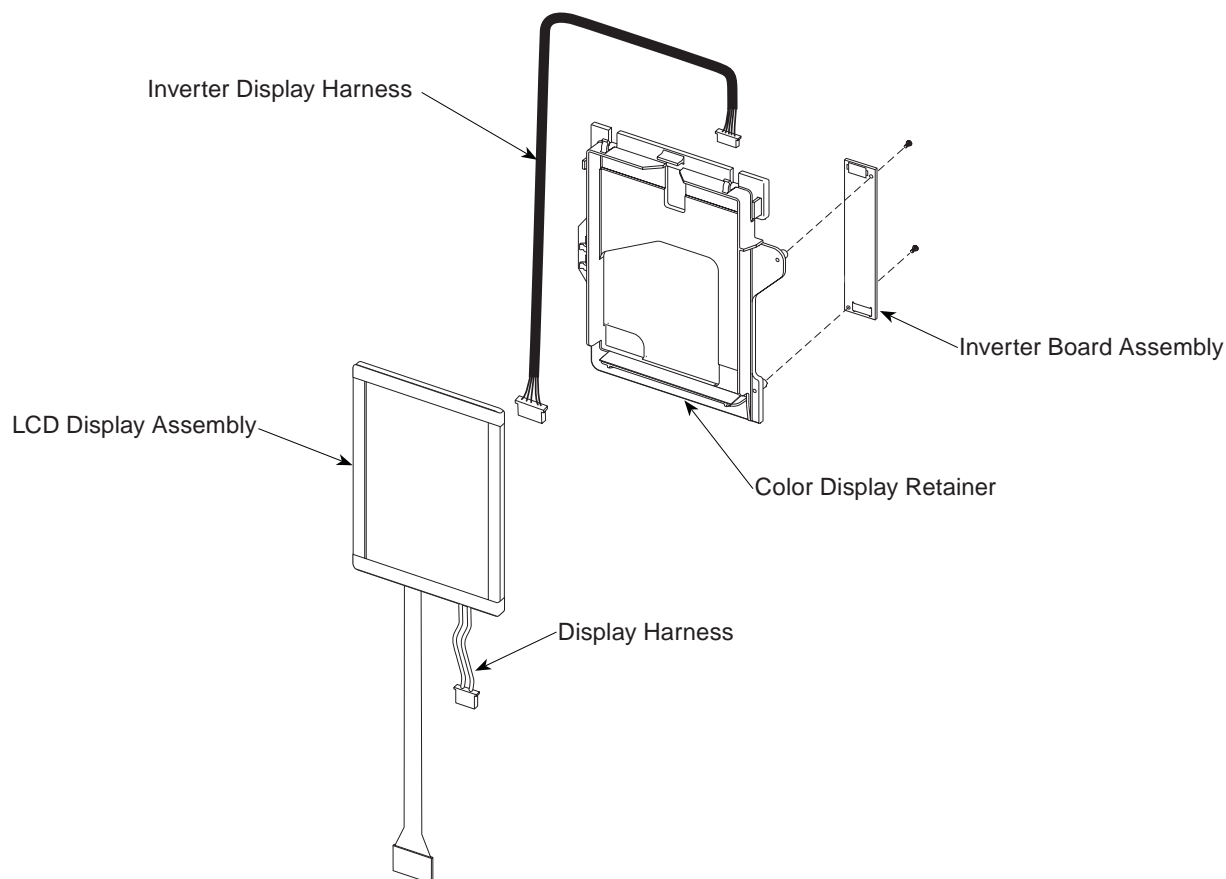
During Reassembly:

1. When placing Display in Retainer route Display cable and harness through Retainer opening.

CAUTIONS

- **Do not touch** LCD screen with fingers.
- Use care to not pinch or crease **flex cables**.

2. After connecting Inverter Display Harness to Inverter Board, route Harness around retainer edge.



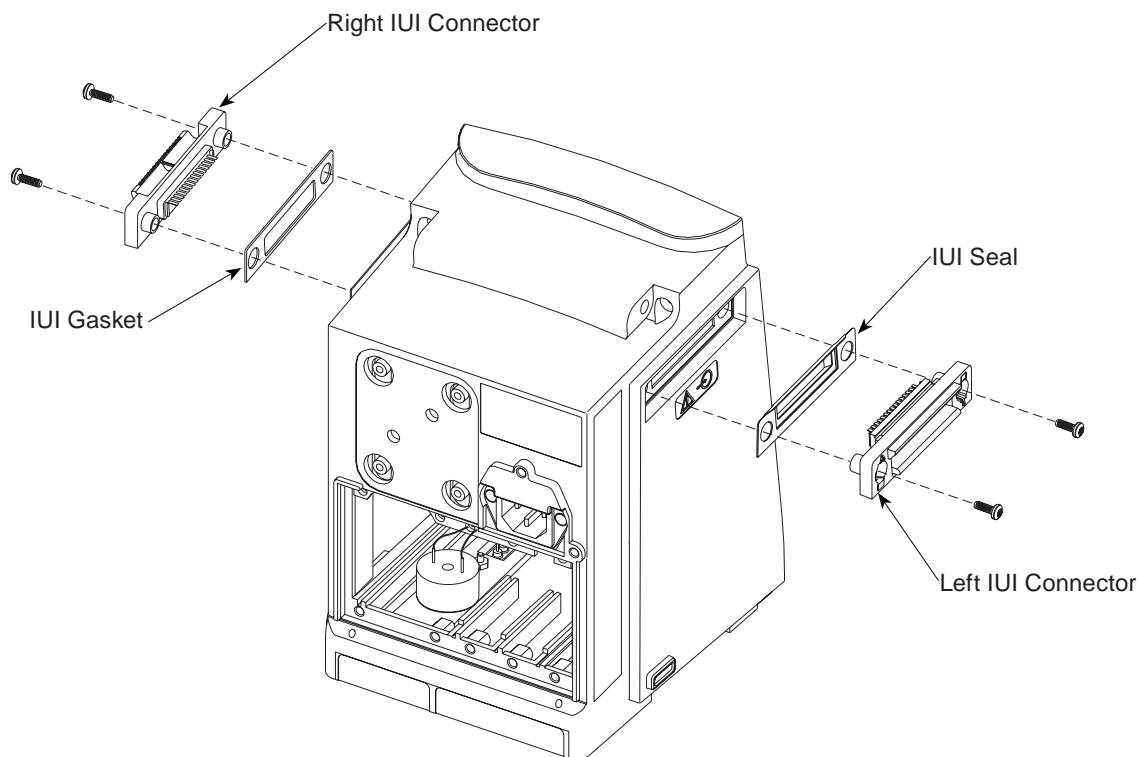
5.3 PC UNIT (Continued)

5.3.15 IUI Connectors

1. Remove screws (2) attaching each IUI (left and right) to PC Unit.
2. Remove IUI Connectors and Gaskets.

During Reassembly:

- Ensure ground clips are still installed on both IUI connectors.
- To install Right IUI Connector Gasket, remove protective backing and adhere to IUI Connector.
- To install Left IUI Connector Seal, position seal on one end of connector and stretch to other end to conform to connector body. Gently press on seal to seat completely. Use lint-free swab to apply alcohol to top, sides, and bottom of seal for lubrication while installing to Rear Case. Do not apply alcohol to contacts or connector.



5.3 PC UNIT (Continued)

5.3.16 Rear Case Assembly Parts

1. Remove screw from Ground Plate.
2. Gently slide assembly partially out of rear case.
3. Disconnect harnesses.
 - Battery Connector Assembly - Logic Board J4
 - Backup Speaker - Logic Board J701
 - Battery Discharge - Power Supply Board J5
 - DC Output - Power Supply Board J3
4. Remove screw attaching Ground Strap to Ground Plate.
5. Remove screws (2) from Power Supply Board.
6. Separate board/ground plate assembly from Chassis Assembly.
7. Remove remaining screws (4) from Ground Plate.
8. Separate and remove Ground Plate, Logic Board and Power Supply Board.
9. If Rear Case is being replaced:
 - a. Remove Backup speaker (adhered to inside of Rear Case).
 - b. Remove screw attaching Battery Connector Assembly to bottom of Rear Case and remove connector assembly.
 - c. Retain Backup speaker and Battery Connector Assembly for use with new Rear Case.
 - d. Make note of model/reference number and serial number found on serial number label.

During Reassembly:

WARNING

To maintain EMC compatibility:

- When installing a Rear Case on a Model 8000, ensure the case is shielded (metallized).
- When installing a Power Supply Board in a Model 8015, ensure the board is shielded in 2 places (see Figure 7-25).

To ensure EMC compatibility:

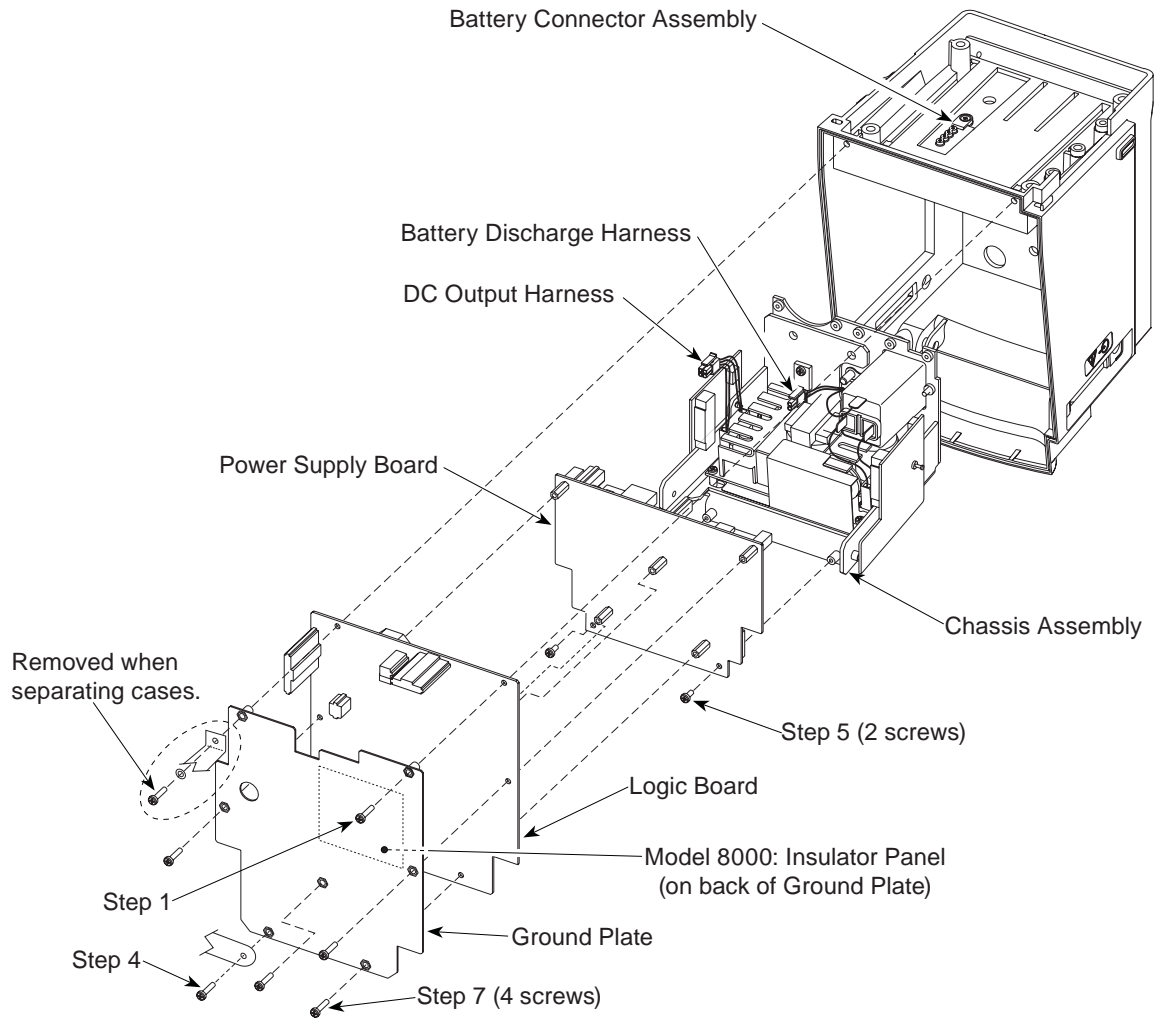
- Replacement Rear Case Kits have a metallized Rear Case.
- Replacement Power Supply Board is shielded.
- Non-metallized Rear Cases and an unshielded Power Supply Board are not available as field replacement parts.

If Rear Case has been replaced:

1. Adhere Backup Speaker to gasket on inside of Rear Case.
2. Using permanent black ink, print instrument's model/reference number and serial number on Serial Number Replacement Label.
3. Apply Serial Number Replacement Label to instrument.
4. Adhere transparent label over Serial Number Replacement Label.

5.3 PC UNIT (Continued)

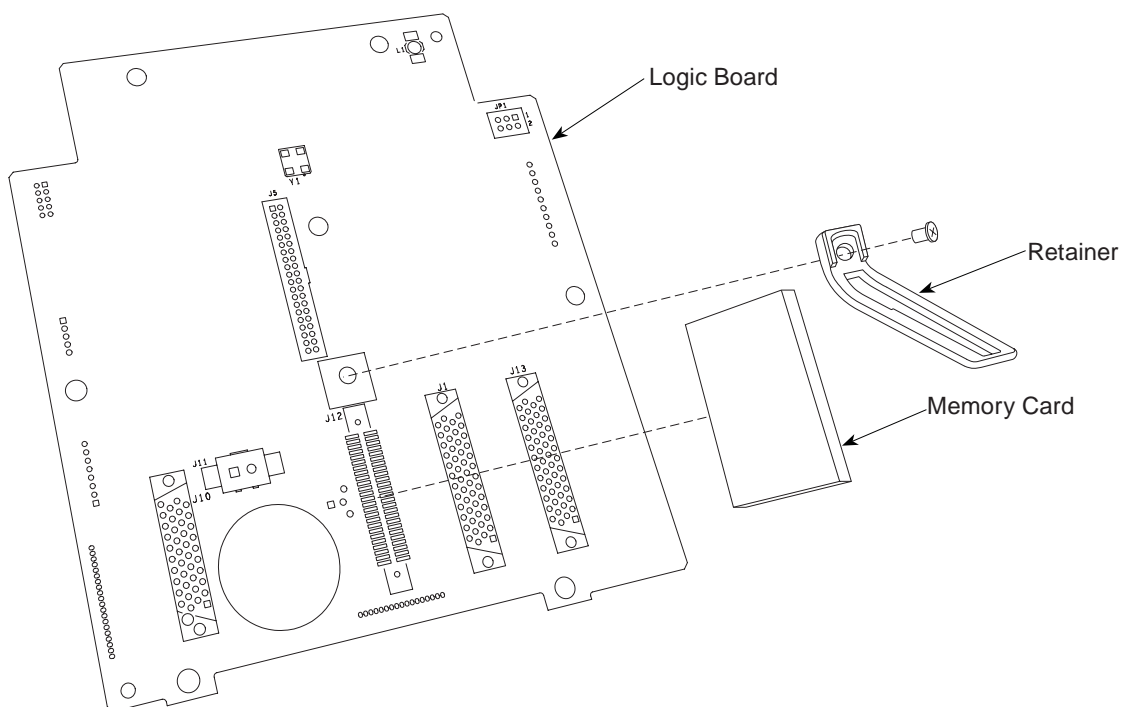
5.3.16 Rear Case Assembly Parts (Continued)



5.3 PC UNIT (Continued)

5.3.17 Model 8015: Memory Card

1. Remove screw from Retainer and remove Retainer from Logic Board.
2. Remove Memory Card.



5.3 PC UNIT (Continued)

5.3.18 Chassis Assembly Parts

1. Use small diagonal cutters to lift and remove Snap Rivets from Left and Right IUI Board Assemblies, and remove board assemblies.

CAUTION

Do not cut **rivet**.

2. Cut cable tie securing Ferrite Bead to Power Supply.
3. Disconnect AC Filter from Power Supply J1.
4. Remove lock washers (2) and screw securing AC Filter ground wire to Frame Assembly.
5. Remove screws (2) attaching AC Filter to Frame Assembly and remove AC Filter.
6. To access fuses, remove Fuse Holder from AC Filter. If fuses need replacing, Power Supply must also be replaced.

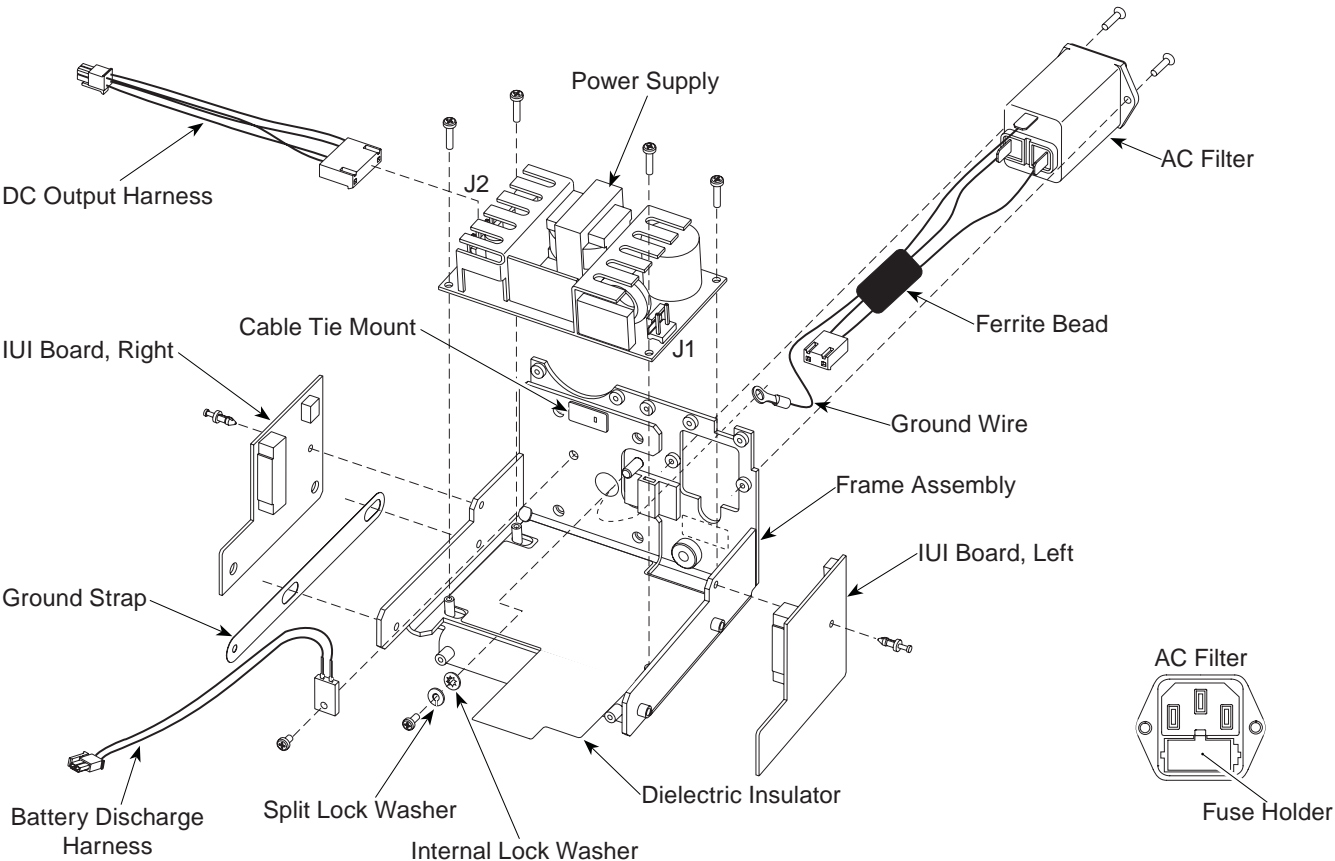
7. Cut cable tie securing Battery Discharge Harness Assembly to Frame Assembly.
8. Remove screw attaching Battery Discharge Harness Assembly to Frame Assembly and remove harness.
9. Remove screws (4) attaching Power Supply to Frame Assembly and remove Power Supply.

During Reassembly:

1. Install AC Filter with 2 AC wire connectors oriented toward Power Supply.
2. Angle Ground Wire toward AC Filter prior to applying torque.
3. Cable tie Ferrite bead over Cable Tie Mount or cooling fins, depending on type of Power Supply installed.
4. Tuck Dielectric Insulator between Ferrite Bead and Power Supply.
5. Cable tie Battery Discharge Harness over Cable Tie Mount.

5.3 PC UNIT (Continued)

5.3.18 Chassis Assembly Parts (Continued)



5.4 PUMP MODULE

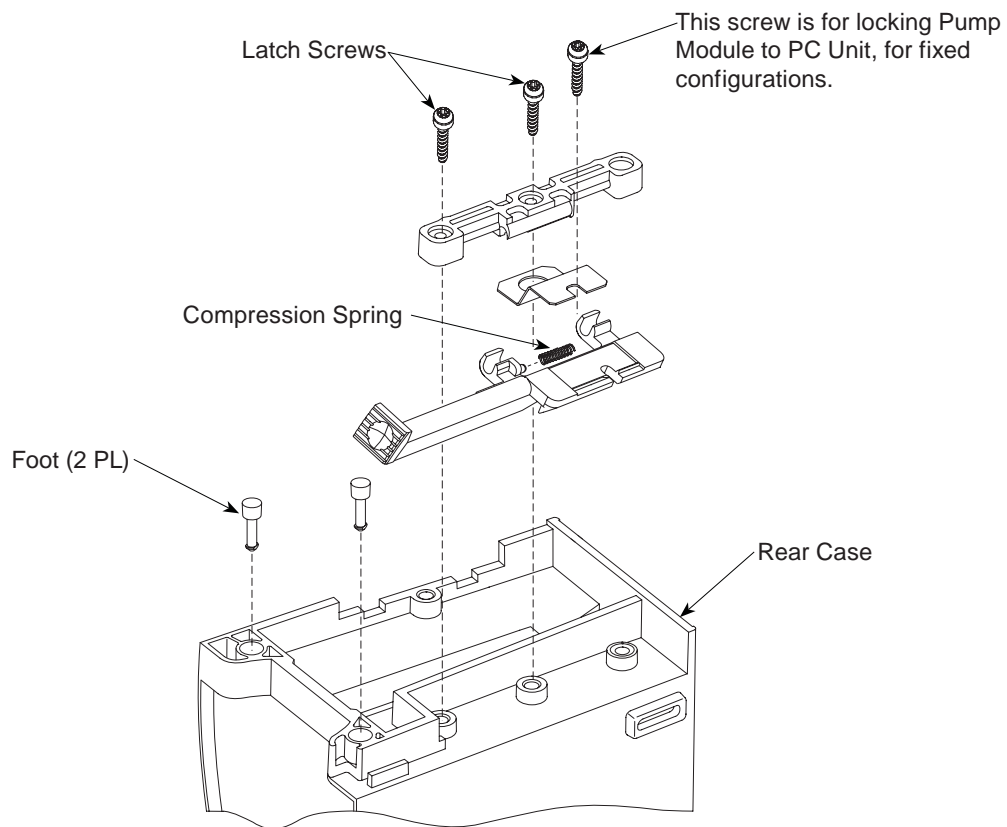
5.4.1 Latch Assembly and Feet

1. Remove screws (2) attaching Latch Assembly to bottom of Rear Case.
2. Remove Latch Assembly components. Pay close attention to Compression Spring location, to ensure proper installation during reassembly.
3. Pull Feet (2) from underside of module.

During Reassembly:

Apply thin layer of Dow Corning Molykote 33 (or equivalent) silicone grease to Feet.

NOTE: The feet press-fit into the module.



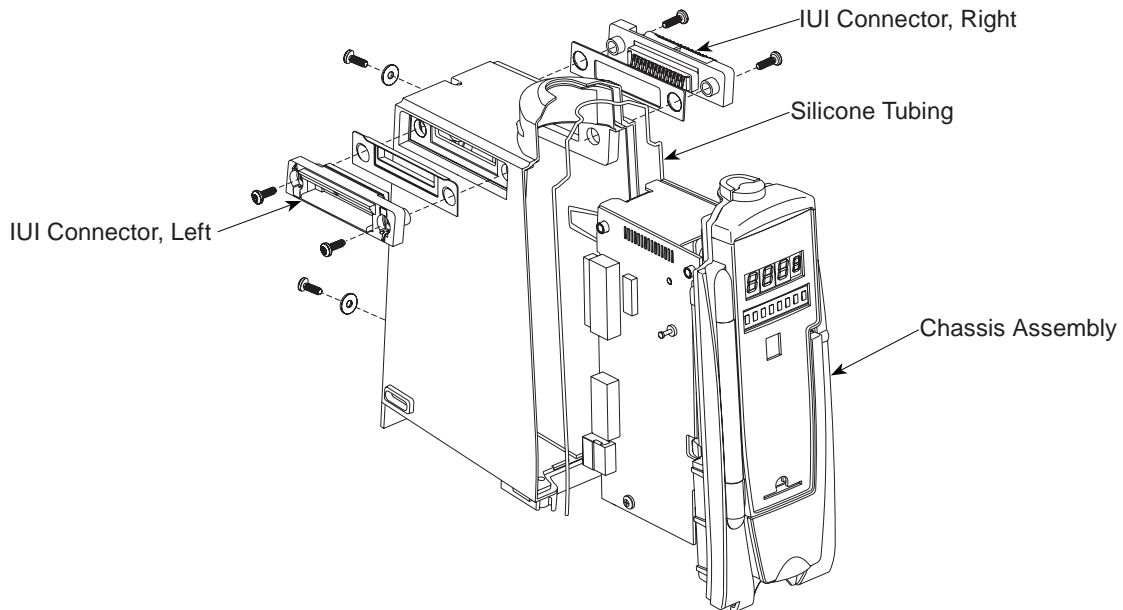
5.4 PUMP MODULE (Continued)

5.4.2 IUI Connectors and Rear Case

1. Remove screws (2) attaching each IUI (left and right) to module.
2. Remove IUI Connectors and Gaskets.
3. Remove screws (2) and associated washers attaching Rear Case to Chassis Assembly.
4. Remove Rear Case by pulling it away from Chassis Assembly.
5. If Rear Case is being replaced, make note of model/reference number and serial number found on serial number label.

During Reassembly:

- Ensure ground clips are still installed on both IUI connectors.
- To install Right IUI Connector Gasket, remove protective backing and adhere to IUI Connector.
- To install Left IUI Connector Seal, position seal on one end of connector and stretch to other end to conform to connector body. Gently press on seal to seat completely. Use lint-free swab to apply alcohol to top, sides, and bottom of seal for lubrication while installing to Rear Case. Do not apply alcohol to contacts or connector.
- Ensure Silicone Tubing in Rear Case is in place and not damaged.
- If Rear Case has been replaced:
 - a. Using permanent black ink, print instrument's model/reference number and serial number on Serial Number Replacement Label.
 - b. Apply Serial Number Replacement Label to instrument.
 - c. Adhere transparent label over Serial Number Replacement Label.



5.4 PUMP MODULE (Continued)

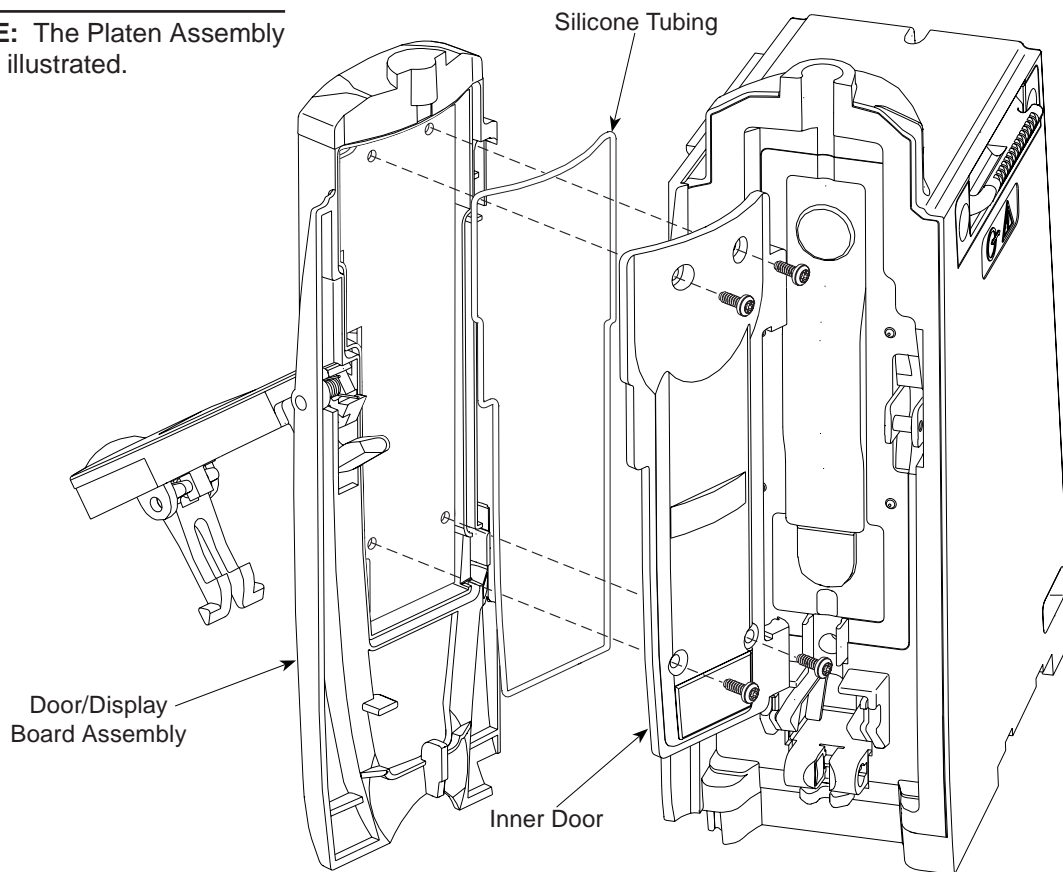
5.4.3 Door/Display Board Assembly

1. Remove screws (4) from Inner Door and remove Inner Door from Door/Display Board Assembly.
2. Disconnect Door Harness (not illustrated) from Display Board J2 and J4.
3. Remove Door/Display Board Assembly.

During Reassembly:

Ensure Silicone Tubing is in place and not damaged.

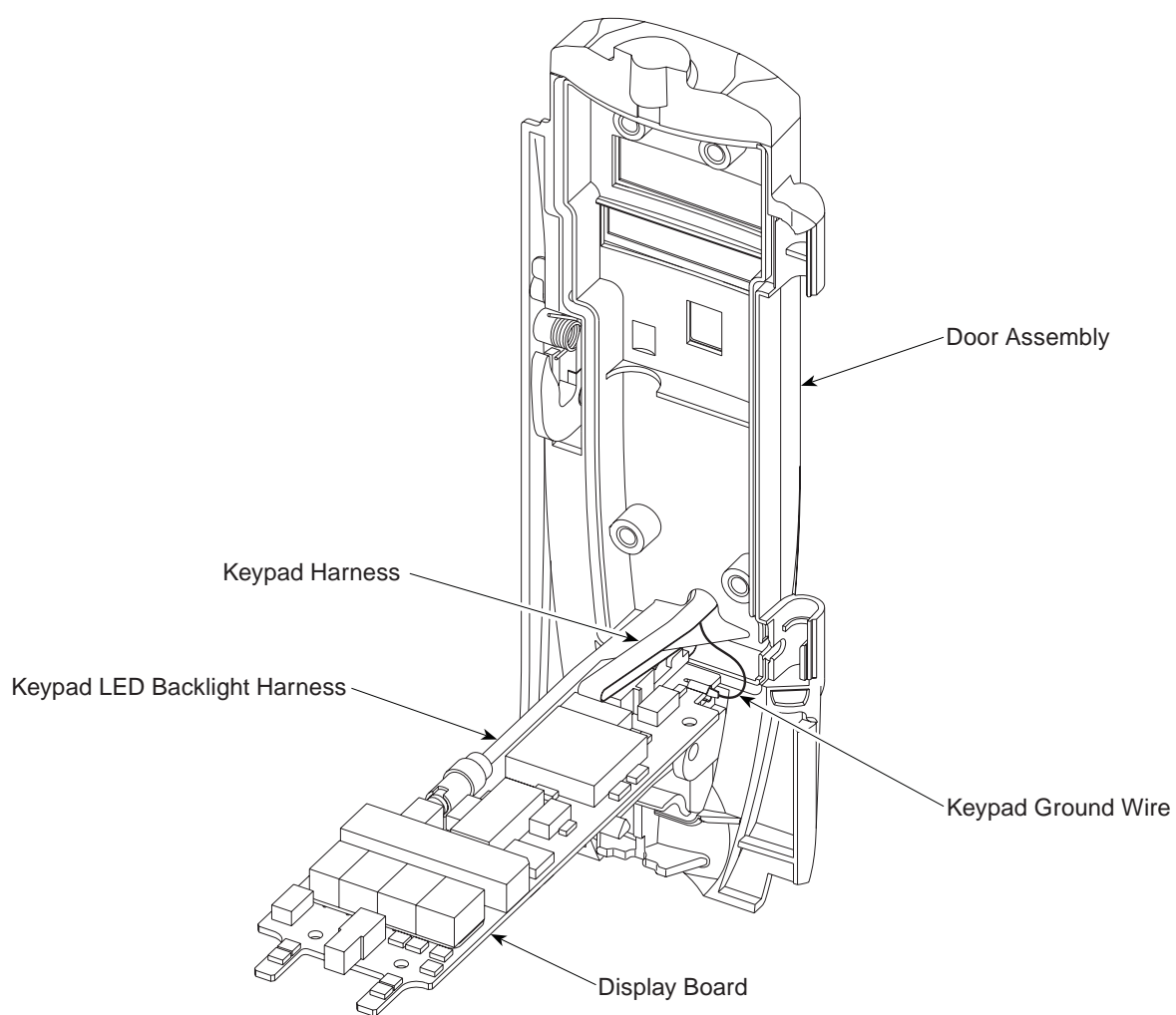
NOTE: The Platen Assembly is not illustrated.



5.4 PUMP MODULE (Continued)

5.4.4 Display Board Assembly

1. Disconnect harnesses from Display Board:
 - Keypad LED Backlight - D8
 - Keypad Connector - J1
 - Keypad Ground - J3
2. Remove Display Board.



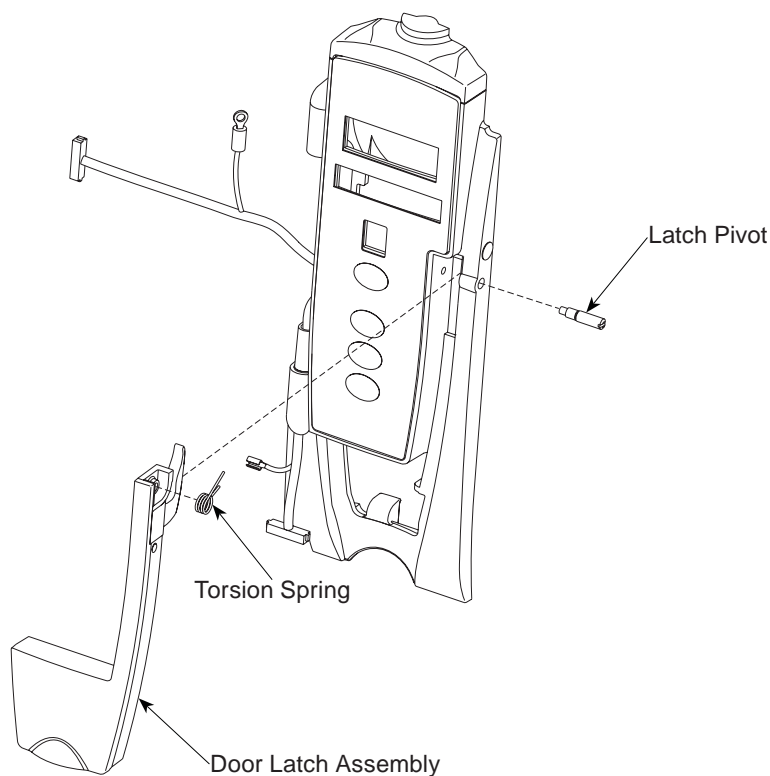
5.4 PUMP MODULE (Continued)

5.4.5 Door Latch Assembly

1. Slowly (Torsion Spring is loaded) remove Latch Pivot from Door Assembly and discard.
2. Remove Door Latch Assembly
3. Retain Torsion Spring, if not being replaced.

During Reassembly:

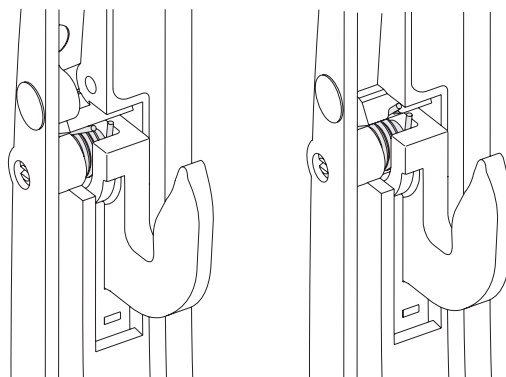
- If Torsion Spring has been replaced, use wire cutters to cut off excess length after installation.
- Tighten Latch Pivot to torque value specified in Table 5-3 (important to ensure Door Latch Assembly is securely installed).



Door Latch Assembly Installed

Old Door

New Door
(Groove for Spring)



5.4 PUMP MODULE (Continued)

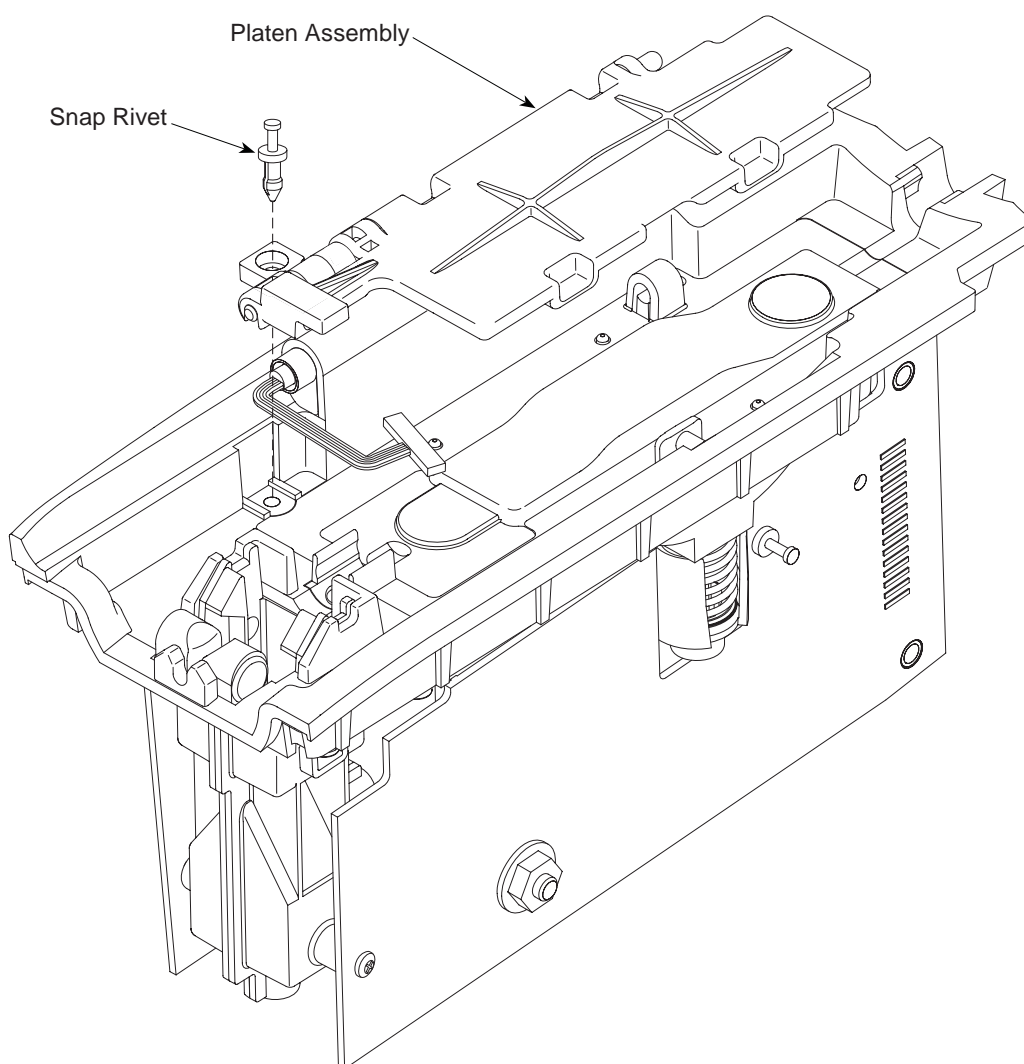
5.4.6 Platen Assembly

1. Use small diagonal cutters to lift and remove Snap Rivet from hinge block.

CAUTION

Do not cut **rivet**.

2. Remove Platen Assembly.



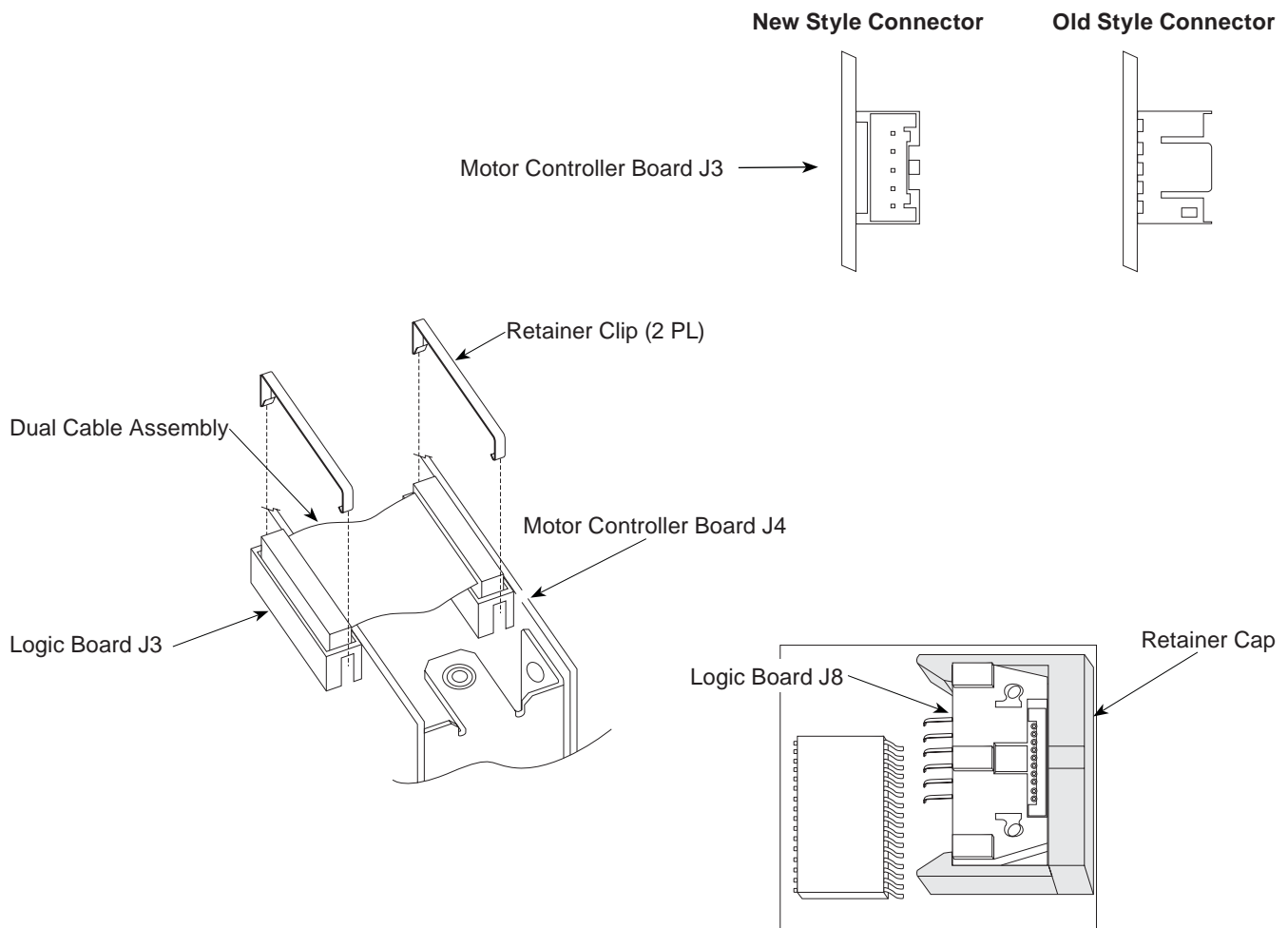
5.4 PUMP MODULE (Continued)

5.4.7 Logic and Motor Controller Board Assemblies

If the Motor Controller Board is being replaced, identify the connector type (see illustration) before ordering the replacement (see "Illustrated Parts Breakdown", "Table 7-2").

<u>Style</u>	<u>Replacement</u>
old	Motor Controller Board / Motor Kit
new	Motor Controller Board with new style connector

1. Remove Retainer Clips from Dual Cable Assembly.
2. Disconnect Dual Cable Assembly from Logic Board J3 and Motor Controller Board J4.
3. Remove Retainer Cap from Logic Board J8 connection.
4. Remove screw securing Door Ground to Logic Board (near J4).



5.4 PUMP MODULE (Continued)

5.4.7 Logic and Motor Controller Board Assemblies (Continued)

5. Disconnect harnesses:

- AIL Sensor Assembly - Logic Board J8
- Door - Logic Board J2
- Pressure Transducer - Logic Board J7
- Motor - Motor Controller Board J3

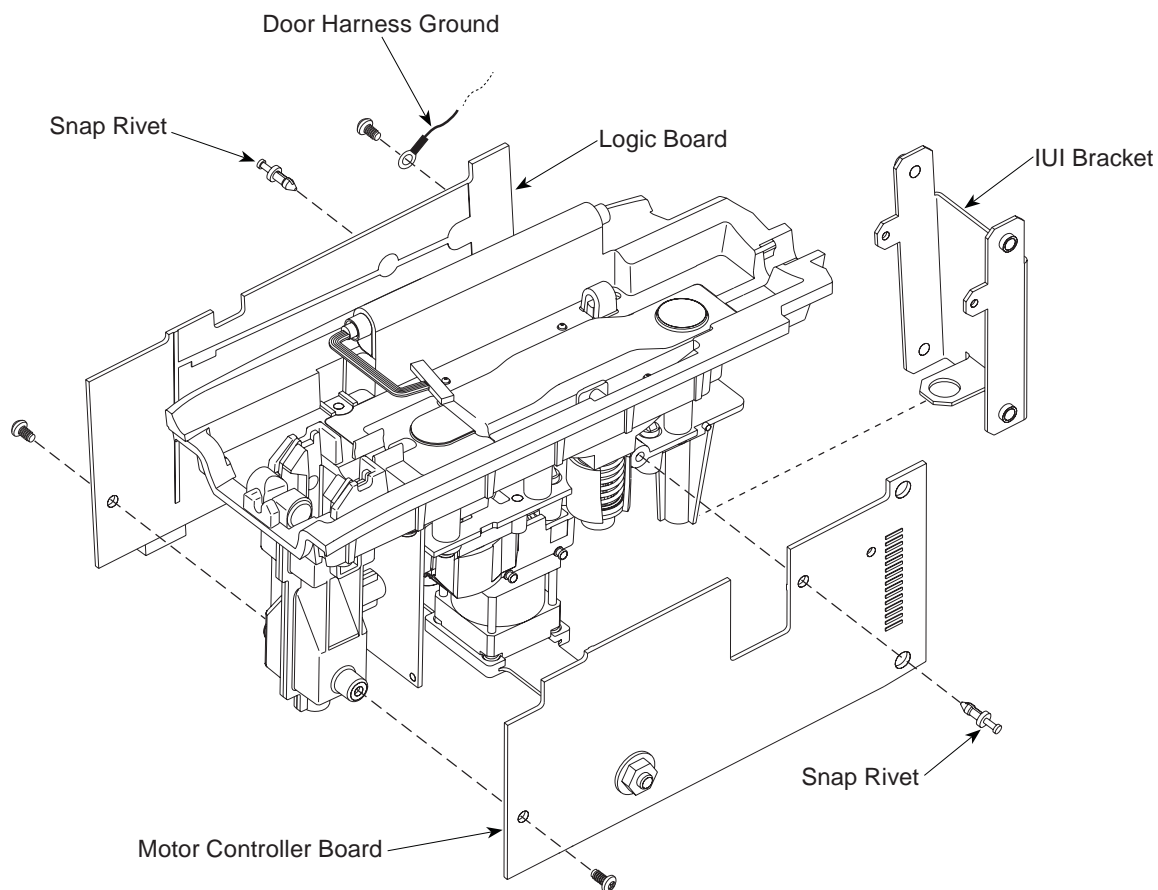
6. Use small diagonal cutters to lift and remove Snap Rivets (2) from Logic and Motor Controller Boards.

CAUTION

Do not cut **rivet**.

7. Remove screws (3) from Logic and Motor Controller Boards.

8. Remove Logic and Motor Controller Boards.



5.4 PUMP MODULE (Continued)

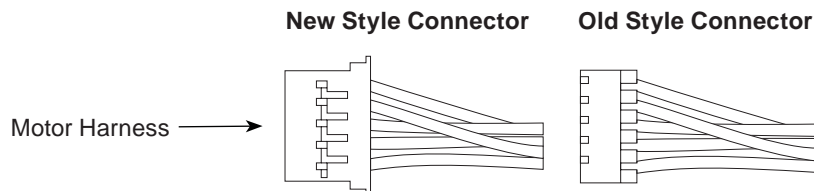
5.4.8 Motor, Air-in-Line (AIL) Sensor Assembly, and Bezel Assembly

If the Motor is being replaced, identify the connector type (see illustration) before ordering the replacement (see "Illustrated Parts Breakdown", "Table 7-2"). The replacement must have the same style connector as the existing Motor.

1. Remove Hex Standoff from AIL Sensor Assembly.
2. Remove screws (4) from AIL Sensor Assembly.
3. Remove Motor Mount from Gear Box and Motor.
4. Remove Motor from Bezel Assembly.

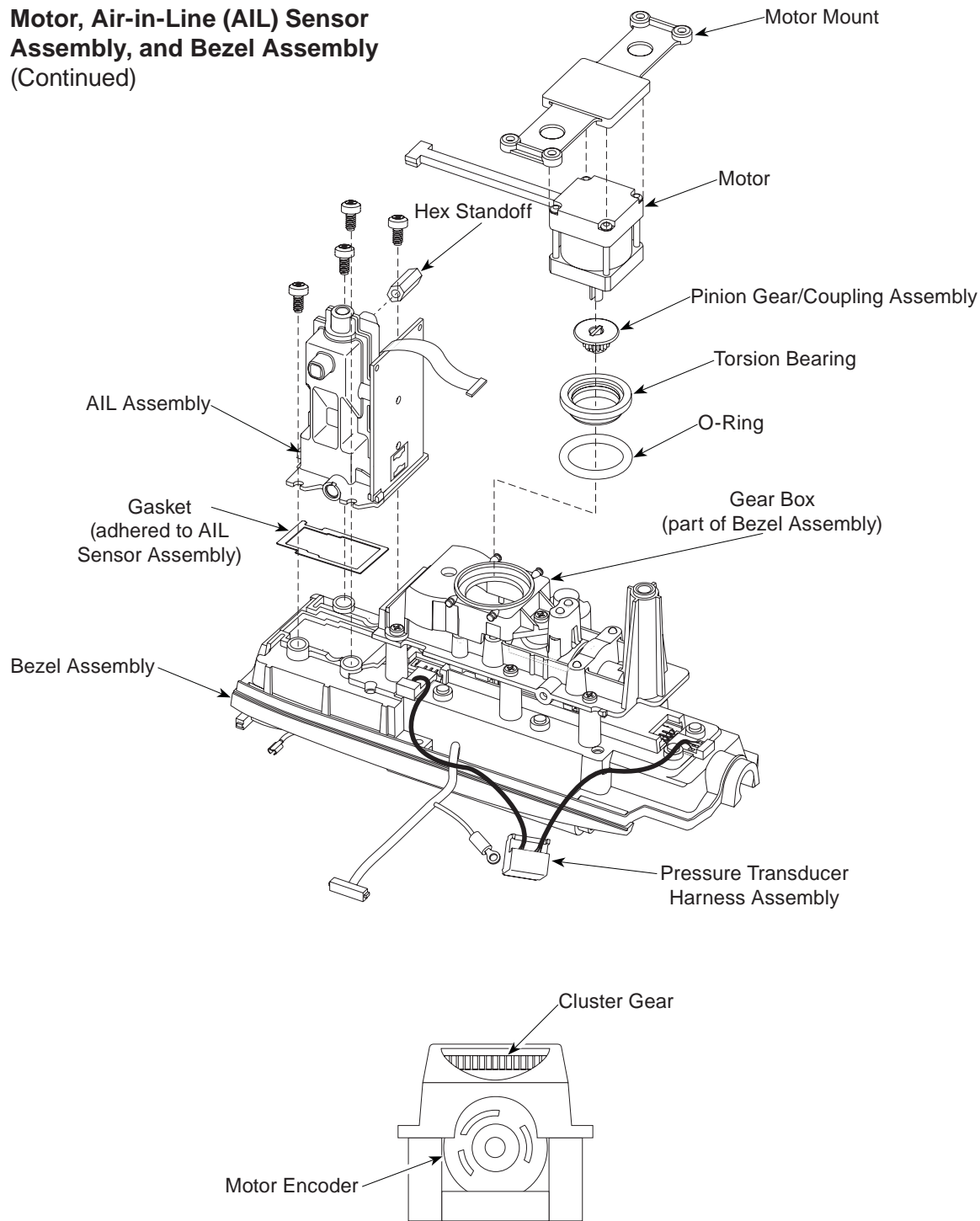
During Reassembly:

1. Secure Motor Mount to 4 mounting pins on Gear Box.
2. Prior to installing AIL Sensor Assembly:
 - a. Ensure Pinion Gear is properly installed by rotating Cluster Gear by hand and feeling for a vibration as Motor steps through its rotation.
 - b. To prevent LED damage, rotate Cluster Gear until Motor Encoder is in illustrated position.



5.4 PUMP MODULE (Continued)

5.4.8 Motor, Air-in-Line (AIL) Sensor Assembly, and Bezel Assembly (Continued)



5.4 PUMP MODULE (Continued)

5.4.9 Membrane Frame Assembly and Pressure Sensors

1. Disconnect Pressure Transducer Harness Assembly from Pressure Sensors.
2. Remove screw from Membrane Frame Assembly.
3. Use small diagonal cutters to lift and remove Snap Rivet from Membrane Frame Assembly.

CAUTION

Do not cut **rivet**.

4. Remove Membrane Frame Assembly from Bezel by releasing snaps and hooks.
5. Push on Pressure Sensor release tabs and remove Pressure Sensors from Bezel.

CAUTION

To **avoid Pressure Sensor damage**, do not apply pressure to the center of the Pressure Sensors.

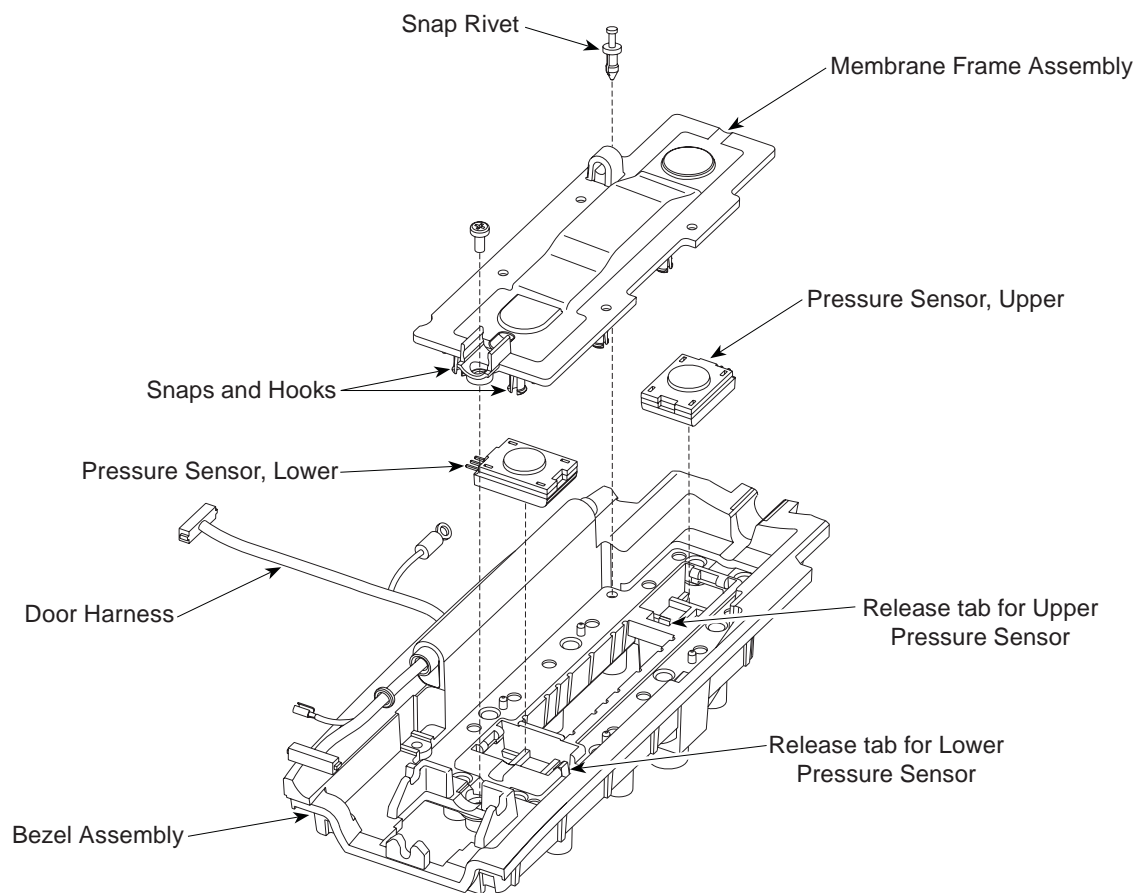


Table 5-2. Torque Values - Models 8000 and 8015

Functional Application	Item Description	Torque Value
FINAL ASSEMBLY		
Battery Pack	6-32 x $\frac{7}{16}$	6 in-lb
Block-Off Plate (Model 8010)	4-40 x $\frac{1}{4}$	6 in-lb
Carry Board (Model 8015)	4-40 x $\frac{5}{16}$	6 in-lb
Communications Board Assembly (Model 8012)	4-40 x $\frac{5}{16}$	6 in-lb
Ground Cable (Front Case - Ground Plate)	4-40 x $\frac{5}{16}$	6 in-lb
Handle	4-40 x $\frac{1}{4}$	6 in-lb
I/O Rear Panel Assembly	4-40 x $\frac{1}{4}$	6 in-lb
Network Card Cover (Model 8012)	4-40 x $\frac{5}{16}$	6 in-lb
Network Card Cover (Model 8015)	4-40 x $\frac{1}{2}$	6 in-lb
Nurse Call Accessory (Model 8010)	4-40 x $\frac{1}{4}$	6 in-lb
Pole Clamp (to plate)	$\frac{1}{4}$ -20 x $\frac{1}{2}$	150 in-lb
Pole Clamp Plate	8-32 x $\frac{5}{8}$	16 in-lb
Power Cord Retainer	4-40 x $\frac{1}{2}$	6 in-lb
Power Cord Wrap	4-40 x $\frac{1}{2}$	8 in-lb
Rear Panel (Model 8000)	4-40 x $\frac{1}{4}$	6 in-lb
RJ45 Connector Plug	4-40 x $\frac{1}{2}$	6 in-lb
FRONT CASE		
Inverter Board Assembly (Model 8015)	2 x $\frac{5}{16}$	3 in-lb
Retainer, LCD Upper Display	6-32 x $\frac{7}{16}$	6 in-lb
INTERNAL SUPPORT FRAME		
AC Filter Assembly	4-40 x $\frac{1}{2}$	6 in-lb
AC Filter Ground Wire	10-32	12 in-lb
Battery Discharge Harness Assembly	4-40 x $\frac{5}{16}$	6 in-lb
Ground Strap	4-40 x $\frac{9}{16}$	6 in-lb
Logic Board Assembly - Ground Plate	4-40 x $\frac{9}{16}$	6 in-lb
Power Supply	4-40 x $\frac{1}{2}$	6 in-lb
Power Supply Board Assembly	4-40 x $\frac{1}{2}$	6 in-lb
Retainer, Memory Card (Model 8015)	4-40 x $\frac{1}{4}$	6 in-lb
Standoffs to Power Supply Board Assembly	4-40 x $\frac{1}{4}$	6 in-lb
REAR CASE		
Battery Connector Assembly	4-40 x $\frac{1}{4}$	6 in-lb
Internal Support Frame Assembly	4-40 x $\frac{9}{16}$	6 in-lb
IUI Connectors	6-32 x $\frac{7}{16}$	12 in-lb
Latch Mechanism	4-40 x $\frac{5}{16}$	6 in-lb
Rear Case (lower mountings)	6-32 x $\frac{1}{4}$	12 in-lb
Rear Case (upper mountings)	6-32 x $2\frac{3}{8}$	12 in-lb
REAR PANEL		
I/O Rear Panel	4-40 x $\frac{1}{4}$	6 in-lb
RS-232 Board Assembly	4-40 x $\frac{5}{16}$	6 in-lb
Speaker Bracket	kep nuts	6 in-lb
Tamper Switch	Boot Seal	6 in-lb

CORRECTIVE MAINTENANCE

Table 5-3. Torque Values - Model 8100

Functional Application	Item Description	Torque Value
CHASSIS ASSEMBLY		
AIL Sensor Assembly	4-40 x $\frac{3}{16}$	6 in-lb
Logic Board Assembly	4-40 x $\frac{1}{4}$	6 in-lb
Membrane Frame Assembly	4-40 x $\frac{3}{16}$	3 in-lb
Motor Controller Board Assembly	4-40 x $\frac{1}{4}$	6 in-lb
FINAL ASSEMBLY		
Chassis to Rear Case Assembly	6-32 x $\frac{7}{16}$	12 in-lb
Door Cover	4-40 x $\frac{3}{8}$	6 in-lb
Door Harness Ground to IUI Bracket	4-40 x $\frac{1}{4}$	6 in-lb
Door Latch Pivot	----	10 in-lb
IUI Connector	6-32 x $\frac{7}{16}$	12 in-lb
Latch Mechanism	4-40 x $\frac{5}{16}$	6 in-lb

Table 5-4. Level of Testing Guidelines - Models 8000 and 8015

Use the applicable maintenance software to perform testing.

Perform →												
● = Required ✕ = Optional Blank = Not Applicable												
Repair/Replacement of: ↓	Alarm Test	Battery Runtime	Channel ID/UI Connectors Test	Charge Battery	Configuration Setup	Display Test	Ground Leakage Test	Keypad Test	Network Connectivity (if installed)	Nurse Call Option Test	Upload Data Set	Instrument Inspection
Battery			●	●								●
Battery Connector				✕		●		●				●
Front Case/Keypad Assembly			●	✕		●		●				●
IUI Boards				✕	●	●	●	●			●	●
Logic Board			●	✕	●	●	●	●			●	●
Main LCD Module			●	✕		●		●				●
Pole Clamp				✕								●
Power Supply			●	✕		●	●	●			●	●
Power Supply Board				●	●	●	●	●			●	●
Rear Case			●	✕		●	●	●				●
Speaker				✕				●				
Tamper Resist Switch				✕				●				
Miscellaneous: ↓												
Instrument Dropped			●	✕	●	●	●	●			●	●
New Instrument Check-in			●	●	●	●	●	●			●	●
No Fault Found			●	✕	●	●	●	●			●	●
Software Flashed				✕	●						●	

NOTE: If the Battery is removed, recharge it ½ to 1 hour to reset the charge timer.

CORRECTIVE MAINTENANCE

Table 5-5. Level of Testing Guidelines - Model 8100

Use the applicable maintenance software to perform testing and calibration.

Perform →													
● = Required Blank = Not Applicable													
Repair/Replacement of: ↓	Air-in-Line Sensor Test	Alarm Test	Channel ID/UI Connectors Test	Configuration Setup	Display Test	Door Ajar/Safety Clamp Sensors Test	Fluid Side Occlusion Test	Keypad Test	Patient Side Occlusion/Pressure Verification	Pressure Calibration	Rate Accuracy Verification	Rate Calibration	Instrument Inspection
Air-in-Line Assembly	●		●			●							●
Bezel Assembly	●		●		●	●		●	●		●		●
Display Board					●			●	●		●		●
Door/Keypad Assembly					●	●		●	●		●		●
IUI Connectors			●										●
Logic Board			●		●					●		●	●
Membrane Frame Assembly									●		●		●
Motor			●		●				●		●		●
Motor Controller Board			●		●				●		●		●
Platen Assembly									●		●		●
Pressure Sensors									●		●		●
Rear Case			●										●
Miscellaneous: ↓													
Instrument Dropped	●		●		●	●		●	●		●		●
New Instrument Check-in	●		●	●	●	●		●	●		●		●
No Fault Found	●		●		●	●		●			●		●
Software Flashed				●									●

Chapter 6 – TROUBLESHOOTING

6.1 INTRODUCTION

This chapter contains possible technical problems that can occur while using the Alaris® System. Refer to this chapter before attempting to service the PC Unit or Pump Module. Reference the applicable module's service manual before attempting to service another module attached to the Alaris® System.

To facilitate troubleshooting when an operating malfunction occurs, the instrument alarms and displays an error message and/or error code. Use the information in this chapter to help diagnose and correct technical problems. Use the applicable maintenance software to perform preventive maintenance, calibration, and verification procedures.

6.2 ERRORS

Through the use of diagnostic hardware testing and software error trapping, the Alaris® System ensures that all hardware and software errors are logged and the appropriate action is taken. The Error Log, in contrast to all other logs, is required to take steps that ensure logging still proceeds correctly in the face of a compromised software system. There is provision made in the Error Log for the storage of a small amount of error-specific data. All errors are recorded in this log; specifically, soft faults, system and channel errors, audio failure, and rate display failure.

Errors fall into two broad categories, software and hardware. All software errors (soft faults) are considered very serious because they indicate that the system has become unstable and cannot be relied on to execute the software correctly, or the

6.2 ERRORS (Continued)

software has detected an illegal software condition and the software system has been compromised. A hardware error is external to the CPU or memory, and does not indicate an unstable computing environment. The integrity of the software is still sound and it can be relied on to handle or report the error condition.

6.2.1 Error Numbering Scheme

All errors share a common numbering system:

<u>Subsystem Code</u>	<u>Failure Code</u>
XXX	.XXXN

XXX represents the three-digit code that identifies the hardware subsystem to which the error appears most closely related, such as, logic board or pressure sensor.

XXXN represents the subcode that describes the subsystem failure. N represents the numeral that indicates whether the error was detected at the Power On Self Test (POST) (1) or at run time (0 - zero), or if it is a log only event (5). The system monitors and logs "log only" events, which do not affect the overall operation of the Alaris® System. These non-malfunction events are logged to enable the PC Unit characteristic in instrument populations to be tracked. All error events which end with a value of 5 or 5.5 fall into the log only category (for example, 100.6075 or 100.6075.5). A soft fault error code cannot happen in POST and in this case the subcode is defined as the domain that logged the fault.

There are two additional 32-bit data items associated with errors. This data is displayed only in debug builds but is always logged.

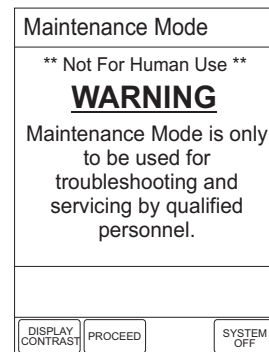
6.3 MAINTENANCE MODE

When in the Maintenance Mode:

- To exit, power system off.
- To return to a previous screen, press **EXIT** soft key.
- Pressing **EXIT** soft key in **Maintenance Mode** option screen powers system off immediately, with no "Powering Down" display.

To access Maintenance Mode options:

1. Hold down Tamper Resist switch on rear of PC Unit during power-up. (Reference Alaris® System DFU for an illustration showing Tamper Resist switch location.)



6.3 MAINTENANCE MODE (Continued)

2. Press **PROCEED** soft key.

Maintenance Mode
External Communications
Standalone Test/Maintenance
Display Contrast
>Select an Option or EXIT
EXIT

6.3.1 External Communications

Access **Maintenance Mode** options and press **External Communications** soft key.

Maintenance Mode
>Initiate Communication With Host Computer
EXIT

- Data download/upload can now be initiated.

6.3.2 Calibration Parameters

1. Access **Maintenance Mode** options and press **Standalone Test/Maintenance** soft key.

Maintenance Mode
Configuration Setup
Hardware Tests
Log File Maintenance
>Select an Option or EXIT
EXIT

2. Press **Configuration Setup** soft key.

Maintenance Mode
Calibration Parameters
Clock setup: 09:00
>Select an Option or EXIT
EXIT

3. Press **Calibration Parameters** soft key.

Maintenance Mode
Calibration Parameters
Module A: 8100-03653801
Module B: 8100-03630501
Module C: 8100-03630501
Module D: 8100-03630501
>Select a Module or EXIT
EXIT

6.3 MAINTENANCE MODE (Continued)

6.3.2 Calibration Parameters (Continued)

- Select a channel by pressing soft key next to applicable **Module** identifier (**A**, **B**, **C** or **D**).

Maintenance Mode Calibration Parameters
Module A 8100-03653801
Reading parameters.
EXIT

Maintenance Mode Calibration Parameters
Module A 8100-03653801
VPC UnitR = 0.160
Upstream Preload = 1.500
Downstream Preload = 1.700
Downstream Gain = 1.800
EXIT

6.3.3 Clock Setup

- Access **Maintenance Mode** options and press **Standalone Test/ Maintenance** soft key.
- Press **Configuration Setup** soft key.
- Press **Clock setup** soft key.

Maintenance Mode	
Clock setup	
Current time: 09:00	Change Time
Current date: 2006-12-15	Change Date
CONFIRM	

- To accept current settings, press **CONFIRM** soft key.

OR

To make a change, continue with following steps.

- To change **Current time**:
 - Press **Change Time** soft key.

Maintenance Mode	
Clock setup	
Current time: _:	Change Time
Current date: 2006-12-15	Change Date
CONFIRM	

- Enter new time and press **ENTER** key on PC Unit.

Maintenance Mode	
Clock setup	
Current time: 09:30	Change Time
Current date: 2006-12-15	Change Date
CONFIRM	

6.3 MAINTENANCE MODE (Continued)

6.3.3 Clock Setup (Continued)

- c. To accept current settings, press **CONFIRM** soft key.

OR

To change **Current date**, continue with following step.

6. To change **Current date**:

- a. Press **Change Date** soft key.

Maintenance Mode	
Clock setup	
Current time: 09:30	Change Time
Current date: yyyy-mm-dd	Change Date
CONFIRM	

- b. Enter new date and press **ENTER** key on PC Unit.

Maintenance Mode	
Clock setup	
Current time: 09:30	Change Time
Current date: 2006-09-26	Change Date
CONFIRM	

- c. To accept current settings, press **CONFIRM** soft key.

Maintenance Mode	
Calibration Parameters	
Clock setup:	09:30
>Select an Option or EXIT	
EXIT	

6.3.4 Battery Conditioning Test

1. Access **Maintenance Mode** options and press **Standalone Test/ Maintenance** soft key.
2. Press **Hardware Tests** soft key.

Maintenance Mode	
Battery Conditioning Test	
Keypad Test	
Display Test	
>Select an Option or EXIT	
EXIT	

2. Press **Battery Conditioning Test** soft key.

Maintenance Mode	
Battery Conditioning Test	
Fast Conditioning	
Optimal Conditioning	
>Select an Option or EXIT	
EXIT	

6.3 MAINTENANCE MODE (Continued)

6.3.4 Battery Conditioning Test (Continued)

3. Press **Fast Conditioning** soft key.
 - Fast Conditioning is preferred due to its being more time efficient. Optimal Conditioning may take up to 20 hours to complete.

Maintenance Mode Battery Conditioning Test
Warning: Battery Conditioning Test may take 12 hrs to complete.
During the process, do not disconnect AC power.
CONFIRM

6.3.5 Keypad Test

1. Access **Maintenance Mode** options and press **Standalone Test/ Maintenance** soft key.
2. Press **Hardware Tests** soft key.
3. Press **Keypad Test** soft key.

Maintenance Mode Keypad Test
>Press Keys To Test, or CANCEL Twice Exits

- As each key is pressed, it appears on screen. Pump Module keys give a double beep when pressed.

6.3.6 Display Test

1. Access **Maintenance Mode** options and press **Standalone Test/ Maintenance** soft key.
2. Press **Hardware Tests** soft key.
3. Press **Display Test** soft key.

Maintenance Mode Display Test
PC Unit: 8100-03653801
Module A: 8100-03630501
Module B: 8100-03630504
Module C: 8100-03630502
Module D: 8100-03630503
>Select a Module or EXIT
EXIT

4. Select PC Unit by pressing **PC Unit** soft key, or select an attached module by pressing soft key next to applicable **Module** identifier (**A**, **B**, **C** or **D**).

Maintenance Mode Display Test
PC Unit: 8100-03653801
Test 1
Test 2
EXIT

5. To perform display test, press applicable soft key (test takes approximately 10 seconds to complete):
 - PC Unit (LCD test):
 - Test 1:** Checkerboard pattern test.
 - Test 2:** Gray scale pattern test.

-- Continued Next Page --

6.3 MAINTENANCE MODE (Continued)

6.3.6 Display Test (Continued)

Maintenance Mode Display Test
(Screen test has temporary control of display)
EXIT

Maintenance Mode Display Test
PC Unit: 8100-03653801
Test 1
Test 2
Test is complete.
EXIT

- Attached module (LED test):
Test 1: Light in sequence.
Test 2: Light in a pattern.

Maintenance Mode Display Test
Module A: 8100-03630501
Test 1
Test 2
Test is running.
EXIT

Maintenance Mode Display Test
Module A: 8100-03630501
Test 1
Test 2
Test is complete.
EXIT

6.3.7 Display Error Log

- Access **Maintenance Mode** options and press **Standalone Test/Maintenance** soft key.
- Press **Log File Maintenance** soft key.

Maintenance Mode Display Error Log
>Select an Option or EXIT
EXIT

- Press **Display Error Log** soft key.

Maintenance Mode Display Error Log
PC Unit: 8100-03653801
Module A: 8100-03630501
Module B: 8100-03630504
Module C: 8100-03630502
Module D: 8100-03630503
>Select a Module or EXIT
EXIT

TROUBLESHOOTING

6.3 MAINTENANCE MODE (Continued)

6.3.7 Display Error Log (Continued)

4. Select a channel by pressing soft key next to applicable **Module** identifier (**A**, **B**, **C** or **D**).

Maintenance Mode	
Display Error Log	1 of 4
PC Unit: 8100-03653801	
0	02-02-02 Software Fault
1	02-02-02 System Malfunction
2	02-02-02 System Malfunction
3	02-01-02 State Machine Error
4	02-01-02 Attached Unit Error
5	02-01-02 Call Stack
6	02-01-02 Call Stack
7	02-01-02 Software Fault
>Select an Error Log or EXIT	
EXIT	GO TO PAGE DOWN

- To move between first and last error log entry, press **GO TO** soft key and select **First** or **Last**.
- To view additional error logs, press **PAGE DOWN** soft key.

Maintenance Mode	
Display Error Log	2 of 4
PC Unit: 8100-03653801	
8	01-31-02 Software Fault
9	01-30-02 System Malfunction
10	01-29-02 System Malfunction
11	01-29-02 State Machine Error
12	01-29-02 State Machine Error
13	01-25-02 Attached Unit Error
14	01-22-02 Attached Unit Error
15	01-01-02 Attached Unit Error
>Select an Error Log or EXIT	
PAGE UP	EXIT GO TO PAGE DOWN

- To view previous or additional error logs, press **PAGE UP** or **PAGE DOWN** soft key.
5. To view expanded error log data, press soft key next to applicable error log.
 - Each error log soft key is associated with 2 error logs. Most recent logs are displayed first.

Maintenance Mode	
Display Error Log	
PC Unit: 8100-03653801	
Error 0	
Time: 17:38:32	
Date: 2006-02-02	
Event: xxxx	
ID: xx-xx-xx-xx	
Error 1	
Time: 16:30:22	
Date: 2006-02-02	
Event: xxxx	
ID: xx-xx-xx-xx	
>Press EXIT	
EXIT	GO TO PAGE DOWN


Maintenance Mode	
Display Error Log	
PCU: 8000-01540349	
Error 2	
2000-01-01 00:00:00	
Type: State Machine Error	
Object: 1-0	
Current State: 5 Event: 4	
Error 3	
2000-01-01 00:00:00	
Type: System Error	
Error: 1000.100 (FATAL)	
Field1: 0x00ABCDEF	
Field2: 0x00ABCDEF	
>Press EXIT	
PAGE UP	EXIT GO TO PAGE DOWN

6.3.8 Display Contrast

1. Access **Maintenance Mode** and press **DISPLAY CONTRAST** soft key.

OR

Access **Maintenance Mode** options and press **Display Contrast** soft key.

Maintenance Mode	
Display Contrast	
	Lighter
	Darker
>Adjust Display to Desired Contrast	
EXIT	

2. To adjust contrast, press **Lighter** or **Darker** soft key until desired contrast is obtained.

Table 6-1. Technical Troubleshooting Guide

Perform the steps in the order they are listed until the problem/fault is corrected. Before making a final diagnosis, visually inspect the instrument for damage. Following repair, use the applicable maintenance software to perform the required tests.

PC Unit

Problem	Remedy
Battery Depleted Battery Low	<ol style="list-style-type: none"> 1. Plug into AC power. 2. Recondition battery with 2 or 3 charge/discharge/charge cycles. 3. Replace battery. 4. Replace Logic Board. 5. Return to factory.
Display Problem	<ol style="list-style-type: none"> 1. Check cable connections. 2. Replace display. 3. Replace Logic Board. 4. Return to factory.
Instrument Malfunction	<ol style="list-style-type: none"> 1. Turn instrument off and back on to see if problem clears. 2. Reference alarm history for fault detected, and see "Error Codes" table.
Intermittent Operation	<ol style="list-style-type: none"> 1. Check connections to Logic Board. 2. Replace Logic Board in PC Unit. 3. Replace Logic Board in affected module. 4. Return to factory.
Key Stuck Alarm	<ol style="list-style-type: none"> 1. Turn instrument off and back on to see if problem clears. 2. Replace Keypad Assembly. 3. Replace Logic Board. 4. Return to factory.
LCD Contrast is Dark or Light	<ol style="list-style-type: none"> 1. Change contrast setting or tilt instrument to help view. 2. Replace main LCD. 3. Replace Logic Board. 4. Return to factory.
Will Not Turn On	<ol style="list-style-type: none"> 1. Plug instrument into AC. 2. Check and/or replace battery. 3. Check fuses. 4. Replace Off-Line Switcher. 5. Replace Power Supply Board. 6. Return to factory.

Table 6-1. Technical Troubleshooting Guide (Continued)

Pump Module

Problem	Remedy
Accuracy Verification Fails	<ol style="list-style-type: none"> 1. Check for mechanical damage and proper administration set installation. 2. Perform rate calibration. 3. Replace mechanism. 4. Return to factory.
Air-in-Line	<ol style="list-style-type: none"> 1. Remove air from administration set or press RESET to move air through line. 2. Change AIL setting. 3. Clean AIL transmitter/receiver. 4. Check connector. 5. Replace AIL Assembly. 6. Return to factory.
Check IV Set	<ol style="list-style-type: none"> 1. Ensure administration set is correctly installed. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Select Diagnose under Reason for maintenance. b. Select Door Ajar/FLO-Stop Sensor test and perform test. c. Select Patient Side Occlusion and perform test. Perform sensor calibration. d. Select Fluid Side Occlusion and perform test. Perform calibration if needed or replace pressure sensor. 3. Return to factory.
Close Door	<ol style="list-style-type: none"> 1. Close door. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Select Diagnose under Reason for maintenance. b. Select Door Ajar/FLO-Stop Sensor test and perform test. c. Perform identified repairs and/or calibrations. 3. Return to factory.
Door Open Alarm	<ol style="list-style-type: none"> 1. Check for proper administration set installation. 2. Verify latch is closed and moves easily. 3. Verify door sear is intact. 4. Replace AIL Assembly. 5. Return to factory.
Downstream Occlusion	<ol style="list-style-type: none"> 1. Check setup and tubing (such as, kinked or clogged filter). 2. Perform pressure verification.
Flo-Stop Open - Close Door	<ol style="list-style-type: none"> 1. Close roller clamp on administration set or close door. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Select Diagnose under Reason for maintenance. b. Select Door Ajar/FLO-Stop Sensor test and perform test. c. Perform identified repairs and/or calibrations. 3. Return to factory.

Table 6-1. Technical Troubleshooting Guide (Continued)

Pump Module (Continued)

Problem	Remedy
Occluded - Fluid Side/Empty Container	<ol style="list-style-type: none"> 1. Clear occlusion on fluid side of instrument. If necessary, refill drip chamber. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Select Diagnose under Reason for maintenance. b. Select Fluid Side test. Perform calibration and/or replace pressure sensor. 3. Return to factory.
Occluded - Patient Side	<ol style="list-style-type: none"> 1. Clear occlusion. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Select Diagnose under Reason for maintenance. b. Select Patient Side test. Perform calibration and/or replace pressure sensor. 3. Return to factory.
Pump Chamber Blocked	<ol style="list-style-type: none"> 1. Open door and inspect pump chamber. To open blockage, as required, massage tubing. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Select Diagnose under Reason for maintenance. b. Select Patient Side Occlusion and perform test. Perform calibration and/or replace pressure sensor. c. Select Fluid Side Occlusion and perform test. Perform calibration and/or replace pressure sensor. 3. Return to factory.

Table 6-1. Technical Troubleshooting Guide (Continued)

PCA Module and Syringe Module

Problem	Remedy ^①
Channel Disconnected	<ol style="list-style-type: none"> 1. Reconnect module to PC Unit. Syringe Module only: reprogram infusion setup. 2. Visually inspect IUIs on module and PC Unit. If necessary, replace IUI connector. 3. Return to factory.
Channel Errors	<ol style="list-style-type: none"> 1. See "Error Codes" table to diagnose and correct problem. 2. Perform applicable preventive maintenance, calibration, and verification. 3. Return to factory.
Check Syringe	<ol style="list-style-type: none"> 1. Check drivearm and syringe travel. 2. Lower plunger head onto syringe. 3. Close Barrel Clamp over syringe. 4. Ensure flange detect sensor is engaged. 5. Using applicable maintenance software, perform Binary Switches Test. <p>Open module to perform following steps.</p> <ol style="list-style-type: none"> 6. Check force sensor harness connection to drive head. If necessary, reconnect harness or replace Force Sensor Assembly. 7. Check Syringe Size Sensor Assembly harness connection to J4 on IUI Board. If necessary, reconnect harness or replace Force Sensor Assembly. 8. Check Linear Sensor harness connection to J12 on Logic Board. If necessary, reconnect harness or replace Force Sensor Assembly. 9. Return to factory.
Drive Not Engaged	<ol style="list-style-type: none"> 1. Using applicable maintenance software, perform Binary Switch Test and calibrate if necessary. If necessary, replace Force Sensor Assembly. 2. Replace Lower Housing/Carriage Assembly. 3. Rotate Actuator Knob and slide plunger head up and down, to check for full plunger head travel and Cam Lock engagement and disengagement. Repair or replace Lower Housing/Carriage Assembly if necessary. 4. Return to factory.
Occlusion	<ol style="list-style-type: none"> 1. Check for proper set installation. Check tubing to ensure there are no obstructions (such as kinked or pinched tubing or a clogged filter). 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Binary Switches Test. b. Perform Pressure Disc Verification; calibrate if necessary. If necessary, replace Pressure Sensor Board and/or Pressure Sensor Harness. c. Perform Plunger Force Accuracy Verification and if necessary, calibrate. Replace Force Sensor Assembly or Lower Housing/Carriage Assembly if necessary. 3. Return to factory.
PCA Handset Stuck (PCA Module only)	<ol style="list-style-type: none"> 1. Verify handset is correctly connected to PCA Module. 2. Replace handset and return original to factory.

Table 6-1. Technical Troubleshooting Guide (Continued)**PCA Module and Syringe Module (Continued)**

Problem	Remedy ^①
Syringe Drive-Head Error	<ol style="list-style-type: none"> 1. Remove drivetrain blockage. If necessary, repair or replace Lower Housing/Carriage Assembly. 2. Rotate Actuator Knob and slide plunger head up and down, to check for full plunger head travel and Cam Lock engagement and disengagement. If necessary, repair or replace Lower Housing/Carriage Assembly. 3. Return to factory.
Syringe Empty	<ol style="list-style-type: none"> 1. Using applicable maintenance software, perform Binary Switches Test. Replace Force Sensor Assembly or Linear Sensor if necessary. 2. Rotate Actuator Knob and slide plunger head up and down, to check for full plunger head travel and Cam Lock engagement and disengagement. Repair or replace Lower Housing/Carriage Assembly if necessary. 3. Return to factory.
Syringe Not Recognized	<ol style="list-style-type: none"> 1. Replace syringe with a compatible syringe (reference Alaris® System DFU). 2. Using applicable maintenance software, perform Binary Switches Test. Replace Syringe Size Sensor Assembly if necessary. 3. Replace Logic Board and flash with appropriate software version. 4. Return to factory.

- ① Replacing the Force Sensor Assembly or Logic Board Assembly in a PCA Module or Syringe Module with version 7 or earlier software must be performed at the depot. Reference the PCA Module / Syringe Module Service Manual for further information.

Table 6-1. Technical Troubleshooting Guide (Continued)

SpO₂ Module

Problem	Remedy
Bad Sensor	<ol style="list-style-type: none"> 1. Check sensor and patient cable. Confirm correct sensor and patient cable are chosen. 2. Using applicable maintenance software, perform Patient Cable Alarm Test. 3. Replace patient cable. 4. Return to factory.
Check Sensor - Electrical or Optical Interference	<ol style="list-style-type: none"> 1. Check sensor. Identify source of external interference if other than sensor. 2. Using applicable maintenance software, perform Patient Cable Alarm Test. 3. Replace patient cable. 4. Return to factory.
Check Sensor - Excessive Ambient Light (Model 8210)	<ol style="list-style-type: none"> 1. Check sensor. Remove or reduce lighting. Cover or reposition sensor. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.
Check Sensor - High Pulse Amplitude (Model 8210)	<ol style="list-style-type: none"> 1. Check sensor. Relocate sensor to a site with less artifact interference. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.
Check Sensor - Light (Model 8220)	<ol style="list-style-type: none"> 1. Check sensor. Remove or reduce lighting. Cover or reposition sensor. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.
Check Sensor - Low Perfusion (Model 8220)	<ol style="list-style-type: none"> 1. Check sensor. Move sensor to a better perfused site. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.
Check Sensor - Low Signal I.Q. (Model 8220)	<ol style="list-style-type: none"> 1. Check sensor. Confirm correct sensor placement. Move sensor to a better perfused site. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.
Check Sensor - Motion Interference (Model 8210)	<ol style="list-style-type: none"> 1. Check sensor. Move sensor to a site with less motion. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.

Table 6-1. Technical Troubleshooting Guide (Continued)**SpO₂ Module (Continued)**

Problem	Remedy
Check Sensor - No Signal (Model 8210)	<ol style="list-style-type: none"> 1. Attach sensor to patient cable or attach patient cable to SpO₂ Module. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.
Check Sensor - Weak Pulse (Model 8210)	<ol style="list-style-type: none"> 1. Check sensor. Move sensor to a better perfused site. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.
Check Sensor - Weak Signal (Model 8210)	<ol style="list-style-type: none"> 1. Check sensor. Confirm correct sensor placement. Move sensor to a better perfused site. 2. Using applicable maintenance software: <ol style="list-style-type: none"> a. Perform Pulse Rate/Saturation and Patient Cable Alarm Test. b. Use corrective action called out in test, calibrate, or replace patient cable. 3. Return to factory.
Display Problem	<ol style="list-style-type: none"> 1. Check cable connections. 2. Replace Display. 3. Replace Logic Board. 4. Return to factory.
Intermittent Operation	<ol style="list-style-type: none"> 1. Check connections to Logic Board. 2. Replace Logic Board. 3. Return to factory.
Instrument Malfunction	<ol style="list-style-type: none"> 1. Turn instrument off and back on to see if problem clears. 2. Reference alarm history for fault detected, and see "Error Codes" table.
Key Stuck Alarm	<ol style="list-style-type: none"> 1. Turn instrument off and back on to see if problem clears. 2. Replace keypad assembly. 3. Replace Logic Board. 4. Return to factory.
No Sensor	<ol style="list-style-type: none"> 1. Attach sensor to patient cable or attach patient cable to SpO₂ Module. 2. Using applicable maintenance software, perform Patient Cable Alarm Test. 3. Replace patient cable. 4. Return to factory.
No Signal	<ol style="list-style-type: none"> 1. Check sensor. Confirm correct sensor placement. 2. Using applicable maintenance software, perform Patient Cable Alarm Test. 3. Replace patient cable. 4. Return to factory.

TROUBLESHOOTING

Table 6-1. Technical Troubleshooting Guide (Continued)

SpO₂ Module (Continued)

Problem	Remedy
Sensor Off	<ol style="list-style-type: none">1. Reattach sensor to patient.2. Using applicable maintenance software, perform Patient Cable Alarm Test.3. Replace patient cable.4. Return to factory.
Will Not Turn On	<ol style="list-style-type: none">1. Check fuses.2. Replace Off-Line Switcher.3. Replace Power Supply Board.4. Check IUI Connectors.5. Replace Front Case Assembly.6. Return to factory.

Table 6-1. Technical Troubleshooting Guide (Continued)**EtCO₂ Module**

Problem	Remedy
Autozero (in progress)	Wait for instrument to complete its auto-zeroing function. After auto-zero cycle is complete, instrument begins measurement again. No intervention is required.
Channel Error	<ol style="list-style-type: none"> 1. Respond as appropriate for error code (see "Error Codes" table). 2. Return to factory.
Clearing Disposable	<ol style="list-style-type: none"> 1. Check Microstream® Disposable. Wait for purging to complete. 2. Using applicable maintenance software, perform Disposable Connected test. Perform all identified repairs or calibrations. 3. Return to factory.
Display Problem	<ol style="list-style-type: none"> 1. Check cable connections. 2. Replace Display. 3. Replace Logic Board. 4. Return to factory.
Disposable Disconnected	<ol style="list-style-type: none"> 1. Attach Microstream® Disposable to instrument. 2. Using applicable maintenance software, perform Disposable Connected test. Perform all identified repairs or calibrations. 3. Return to factory.
Instrument Malfunction	<ol style="list-style-type: none"> 1. Turn instrument off and back on to see if problem clears. 2. Reference alarm history for fault detected, and see "Error Codes" table.
Intermittent Operation	<ol style="list-style-type: none"> 1. Check connections to Logic Board. 2. Replace Logic Board. 3. Return to factory.
Key Stuck Alarm	<ol style="list-style-type: none"> 1. Turn instrument off and back on to see if problem clears. 2. Replace keypad assembly. 3. Replace Logic Board. 4. Return to factory.
Patient Not Detected	<ol style="list-style-type: none"> 1. Check disposable. 2. Using applicable maintenance software, perform Disposable Connected test. Perform all identified repairs or calibrations. 3. Return to factory.

Table 6-2. Subsystem Codes

PC Unit Codes

100	Main Safety System
110	Keypad Processor Safety System
111	Keypad Processor Comm Safety System
120	Power Supply Processor Safety System
121	Power Supply Processor Comm Safety System
130	Keypad Safety System
131	Display Safety System
132	Tamper Switch Safety System
133	Audio Safety System
150	IUI Safety System
151	Comm Safety System
152	Nurse Call Safety System
160	Power Supply Safety System
161	Battery Safety System

Pump Module, PCA Module, Syringe Module Codes

200	Main Safety System
210	Keypad Processor Safety System
211	Keypad Processor Comm Safety System
220	Safety Processor Safety System
221	Safety Processor Comm Safety System
222	Safety Processor Cross-check Safety System
230	Keypad Safety System
231	Channel INFO Display Safety System
232	Rate Display Safety System
240	Bottle Pressure Safety System
241	Patient Pressure Safety System
242	Motor Encoder Safety System
243	Air In Line Safety System
244	Flow Stop Safety System
245	Door Sensor Safety System
246	ADC Safety System
250	IUI Safety System
260	Power Supply Safety System

PCA Module and Syringe Module Codes

350	Keypad Processor Safety System
351	Motor Safety System
352	Plunger Force Safety System
353	Plunger Position Safety System
354	Patient Pressure Safety System
355	Syringe Size Safety System
356	Digital Sensor Safety System
357	Keypad Processor Comm Safety System
358	Comm Safety System

SpO₂ Module Codes

400	Main Safety System
410	Keypad Processor Safety System
411	Keypad Processor Comm Safety System
430	Keypad Safety System
450	IUI Safety System
460	Power Supply Safety System
470	Board Safety System
471	Board Comm Safety System

EtCO₂ Module Codes

500	Main Safety System
510	Keypad Safety System
511	Comm Safety System
530	Keypad Safety System
550	IUI Safety System
560	Power Supply Safety System
570	Board Safety System
571	Board Comm Safety System

CI Board and Auto-ID Module Codes

600	CI Board Safety System
610	Bar Code Scanner Safety System

PC Unit (Model 8015) Codes ^①

800	Operating System Safety System
810	POLO Safety System

① POLO refers to the operating system software after boot up (power up sequence).

Table 6-3. Failure Codes ^①

1000	General Failure	3030	Power Supply Failure
1010	CPU Failure	4000	General Rate Failure
1020	ROM Failure	4010	High Rate Failure
1030	RAM Failure	4020	Low Rate Failure
1040	Flash Failure	4030	Motor Stall Failure
1050	Timebase Failure	4040	Sync Failure
1060	Watchdog Failure	4050	AIL Check Failure
1070	Watchdog Test Failure	4060	Over Infused Failure
1080	Protected RAM Failure	4070	Sensor Test Failure
1090	DRAM Failure	4080	ADC 3 Volt Low Voltage Failure
1100	SRAM Failure	4090	ADC 3 Volt High Voltage Failure
1110	Flash File Failure	4100	ADC 5 Volt Low Voltage Failure
1120	Flash Boot Failure	4110	ADC 5 Volt High Voltage Failure
1130	Timer Stall Failure	4120	Sensor Supply Low Voltage Failure
1140	Timer Range Failure	4130	Sensor Supply High Voltage Failure
1150	Time Base Failure	4140	Sensor Broken Low Failure
1160	Internal RAM Failure	4150	Sensor Broken High Failure
1170	External RAM Failure	4160	Safety Switch Test Failure
1180	Timer Sync Failure	4170	Parameter Range Failure
1200	UNINIT Interrupt Failure	4180	Door or Safety Clamp State Failure
1210	Option Board Multiple ID	4190	Safety Switch State Failure
1220	Processor Exception	4200	Illegal Motion Failure
1230	Processor Reset	4310	Low 24V Failure
1240	Processor Power On Reset	4320	High 24V Failure
1250	Option Board Unknown Type	4330	Low NSW 5V Failure
2000	Comm Failure	4340	High NSW 5V Failure
2010	Comm Watchdog Failure	4350	Low 5V Failure
2020	Comm Incorrect Response Failure	4360	High 5V Failure
2030	Comm Corrupted Response Failure	4370	Low 8V Failure
2040	Comm Unexpected Response Failure	4380	High 8V Failure
2050	Comm Bad Command	4390	Low 3P3V Failure
2060	Comm Heartbeat Failure	4400	High 3P3V Failure
2070	Comm No Response Failure	4410	Low Backup Voltage Failure
2080	Comm Poll Sync Failure	4420	High Backup Voltage Failure
2090	Comm Too Many Units Failure	4430	Low Battery Voltage Failure
2100	Comm Transmit Failure	4440	High Battery Voltage Failure
2200	Comm Break Interrupt	4450	Low WD3P3V Failure
2210	Comm Timer Interrupt	4460	High WD3P3V Failure
2230	Comm Modem Interrupt	4470	Power Supply Processor Parameter Failure
2300	Comm Lost End of Interrupt	4490	Power Supply Processor Set Charge Level Failure
3000	Stuck Closed Failure	4500	Power Supply Processor Charge Level High Failure
3010	Stuck Open Failure		
3020	Bad Unpowered State Failure		

TROUBLESHOOTING

Table 6-3. Failure Codes ^① (Continued)

4510	Power Supply Processor Missing Battery Failure	6160	Unexpected Hardware Interrupt Failure
4520	Power Supply Processor Precharge Failure	6170	Charger Battery Temp Too High Failure
4530	Power Supply Processor Charge Voltage High Failure	6180	Charger Battery Box Temp Too High Failure
4540	Power Supply Processor Watchdog Failure	6190	Hospital Profile Data Integrity Failure
4550	Low VREF Plus Failure	6200	CBIT Failure
4560	High VREF Plus Failure	6210	Comm Down Failure
4570	Low VREF Minus Failure	6220	Config Settings Failure
4580	High VREF Minus Failure	6230	Received Value Out of Range
4590	Low VREF Average Failure	6240	Missing Sensor Status
4600	High VREF Average Failure	6300	Shorted Segment in 7-Segment Display
4610	Power Supply Processor Charge Level Low Failure	6310	Open Segment in 7-Segment Display
4620	Power Supply Processor Charge Voltage Low Failure	6320	Shorted Alarm LED
4630	Power Supply Processor Charger FET Error	6330	Open Alarm LED
4700	ADC Calibration Timeout Failure	6340	7-Segment Failure
4710	ADC Conversion Timeout Failure	6350	7-Segment Failure Clear
5000	Hardware-Software Compatibility Failure	6400	CBIT General Failure
5010	Software Version Compatibility Failure	6500	Serious Module Error
5020	Peripheral Version Response Failure	6510	Module Error Requires Power Cycle
5030	Unknown Device Type	6520	Module Error Requires Reset
5040	Module Software Version Compatibility Failure	6530	Transient Error
5050	Duplicate Serial Number Failure	6540	Informational Report
5060	Unsupported Module Type Failure	6550	Digital Error
5070	Invalid Software Access Key Failure	6560	Module-Specific Error
5080	Module Software Version Timeout Failure	6570	Warmer Error
6000	Post General Failure	6580	Unknown Error
6010	Post RAM Failure	6600	Syringe Module Motor Watchdog Test Failure
6020	Keypad Failure	6610	Syringe Module Watchdog Failure
6030	Alarm LED Failure	6630	Syringe Plunger Force Not Tracking Pressure
6040	Display Failure	6640	Syringe Plunger Force Sensor Failure
6050	Encoder Failure	6650	Syringe Plunger Position Sensor Failure
6060	ADC Failure	6660	Syringe Plunger Position Failure
6070	RTC Battery Failure	6670	Syringe Pressure Disc Sensor Failure
6080	Backup Speaker Failure	6680	Syringe Timebases Out of Sync
6090	Main Speaker Failure	6690	Syringe Pressure Sensor Current Monitor Failure
6100	Backup Speaker Power Supply Failure	6700	Syringe Force Sensor Circuit Test Failure
6110	Compliance Timeframe Failure	6710	Syringe Digital Sensors Illegal State
6120	Data Integrity Failure	6720	Syringe Module Motor Step Rate Failure
6130	System Configuration Data Integrity Failure	6730	Syringe Module Motor Step Sample Too Many Steps
6140	Unexpected Interrupt or Exception Failure	6740	Syringe Nut Disengaged
6150	Operating System Error	6750	Syringe Nut Engage Failure
		6760	Syringe Module Not Calibrated

Table 6-3. Failure Codes ^① (Continued)

6770	Syringe Module Pressure Sensor Circuit Test Failure	7130	Auto-ID External Version Compatibility Failure
6780	PCA Handset Stuck	7200	Syringe Plunger Position Sensor Contaminated
6800	Wireless Network POST Failure	7210	Syringe Plunger Position Reset Calibration
6810	Wireless Network Not Configured	7220	Syringe Plunger Position Sensor Illegal Motion
6820	Wireless Network Initialization Failure	7500	Invariant Time Failure
6830	Wireless Network Configuration Failure	8000	Model 8015 General Operating System Failure
6840	Wireless Network Connect Failure	9000	POLO General Failure
6850	Wireless Network Not Responding	9010	POLO ELF File Not Found
6860	Wireless Network Disconnect Failure	9020	POLO ELF File Invalid
6870	Wireless Network Communication Error	9030	POLO ELF File CRC Error
6880	Wireless Network Hardware Failure	9040	POLO Parameter File Not Found
6900	Wireless Network Data Link Went Down	9050	POLO Parameter File Update Error
6910	Wireless Network Communication Timed Out	9060	POLO Incompatible Board
6920	Wireless Network Rebooted	9070	POLO Compact Flash Card Missing
7000	Auto-ID Module Message Corrupted	9080	POLO Compact Flash Card Not Ready
7010	Auto-ID Comm Error	9090	POLO Compact Flash Card Invalid
7020	Auto-ID Interrupt Error	9100	POLO Compact Flash Card Not Supported
7030	Auto-ID General Error	9110	POLO Compact Flash Card Initialization Failure
7040	Auto-ID Command Buffer Error	9120	POLO Compact Flash Card Mount Failure
7050	Auto-ID Internal Command Error	9130	POLO Compact Flash Card Configuration Error
7060	Auto-ID External Command Error	9140	POLO Compact Flash Card Functional ID Error
7070	Auto-ID Internal Not Responding	9150	POLO Make Directory Failure
7080	Auto-ID External Not Responding	9160	POLO Watchdog Test Failure
7090	Auto-ID POST General Error	9170	POLO Read Tuple Failure
7100	Auto-ID Keypad Failure		
7110	Auto-ID Software Version Compatibility Failure		
7120	Auto-ID Internal Version Compatibility Failure		

^① POLO refers to the operating system software after boot up (power up sequence).

TROUBLESHOOTING

Table 6-4. Error Codes

If the error is repeatable, perform the response steps in the order they are listed until the error is corrected. Following repair, use the applicable maintenance software to perform the required tests.

PC Unit

Error Code	Subsystem	Explanation	Response
100.1010	Logic Board	Error detected during CPU test.	Replace Logic Board.
100.1070	Logic Board	Hardware watchdog test failure.	Replace Logic Board.
100.1080	Logic Board	Data written to I/O-protected RAM not verifying correctly.	Replace Logic Board.
100.1090	Logic Board	Error detected during DRAM test. First parameter contains error address.	Replace Logic Board.
100.1100	Logic Board	Error detected during SRAM test. First parameter contains error address.	Replace Logic Board.
100.1110	Logic Board	Flash file device containing application failed CRC test. First parameter contains CRC calculated by test routine, and second parameter contains CRC contained in device.	Replace Logic Board.
100.1120	Logic Board	Boot flash device containing boot code failed CRC test. First parameter contains CRC calculated by test routine, and second parameter contains CRC contained in device.	Replace Logic Board.
100.1130	Logic Board	Time read from battery-backed RTC not changing.	Replace Logic Board.
100.1140	Logic Board	Time read from RTC not changing.	Replace Logic Board.
100.1180	Logic Board	RTC differs from operating system clock by more than 1 minute.	Replace Logic Board.
100.1210	Logic Board	Option board ID conflict. Multiple option boards responded with same ID.	Replace Logic Board.

Table 6-4. Error Codes (Continued)**PC Unit** (Continued)

Error Code	Subsystem	Explanation	Response
100.1220	Logic Board	Processor exception or corrupted code.	Replace Logic Board.
100.1230	Logic Board	Power supply or auxiliary processor unexpectedly reset.	Replace Logic Board.
100.1240	Logic Board	Power supply lost power.	Replace Logic Board.
100.1250	Logic Board	Unknown board type detected in option board slot.	1. Remove option board. 2. Replace option board. 3. Replace Logic Board.
100.2070	Logic Board	Power lost.	Replace Logic Board.
100.5010	Logic Board	Boot block software version not compatible with software flashed into PC Unit.	1. Reflash PC Unit. 2. Replace Logic Board.
100.5020	Logic Board	One or more 8051 processors not reporting software version data immediately after System On. 8051 missing, failed, or flashed with version that does not support reporting software version.	1. Reflash PC Unit. 2. Replace Logic Board.
100.5070	Logic Board	Powered on in system configuration mode and software access key invalid.	1. Reflash PC Unit. 2. Power up in system configuration mode.
100.6010	Logic Board	Failed attempt to write to battery-backed RAM.	1. Replace SRAM battery (lithium). 2. Replace Logic Board.
100.6020	Logic Board	Critical value data integrity failure.	Replace Logic Board.
100.6110	Logic Board	Time/date reported by operating system exceeds maximum RTC date.	1. Reset date. 2. Replace SRAM battery (lithium). 3. Replace Logic Board.
100.6130	Logic Board	Powered on in normal mode and configuration data invalid.	Power up in system configuration mode.

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

PC Unit (Continued)

Error Code	Subsystem	Explanation	Response
100.6160	Logic Board	Unexpected hardware interrupt in main processor or keypad processor.	Replace Logic Board.
100.6190	Logic Board	Current facility Data Set damaged.	1. Load new data. 2. Replace Logic Board.
100.6400	Logic Board	General CBIT failure, not specifically tied to another malfunction code.	Replace Logic Board.
100.8000	Logic Board	Operating system error.	Replace Logic Board.
110.1010	Keypad Processor	CPU failure detected during POST.	Replace Logic Board.
110.1020	Keypad Processor	ROM failure detected during POST.	Replace Logic Board.
110.1160	Keypad Processor	Internal RAM failure detected during POST.	Replace Logic Board.
110.2000	Keypad Processor	Communication error.	Replace Logic Board.
110.2040	Keypad Processor	Unknown message type.	Replace Logic Board.
110.3000	Keypad Processor	Key or tamper switch stuck closed.	Replace keypad or tamper switch.
110.5010	Keypad Processor	8051 software version not compatible with software flashed into PC Unit.	1. Reflash PC Unit. 2. Update keypad processor. 3. Replace Logic Board.
110.5020	Keypad Processor	Processor not reporting software version data immediately after System On. Processor missing, failed, or flashed with version that does not support reporting software version.	1. Reflash PC Unit. 2. Update keypad processor. 3. Replace Logic Board.
110.6000	Keypad Processor	One or more failures detected during POST.	Replace Logic Board.
110.6010	Keypad Processor	RAM failure detected during POST.	Replace Logic Board.
110.6020	Keypad Processor	Keypad failure detected during POST.	1. Replace keypad. 2. Replace Logic Board.

Table 6-4. Error Codes (Continued)**PC Unit** (Continued)

Error Code	Subsystem	Explanation	Response
110.6110	Keypad Processor	Projected life span of device exceeded. System time rolled over past maximum date possible in device.	Replace Logic Board.
111.2000	Keypad Processor Communications	Communication error. Keypad Processor quit responding.	Replace Logic Board.
120.1010	Power Supply Processor	CPU failure detected during POST.	Replace Logic Board.
120.1020	Power Supply Processor	ROM failure detected during POST.	Replace Logic Board.
120.1160	Power Supply Processor	Internal RAM failure detected during POST.	Replace Logic Board.
120.4310	Power Supply Processor	Off-Line Switcher defective; low voltage on 24V supply line.	Replace Power Supply.
120.4320	Power Supply Processor	Off-Line Switcher defective; high voltage on 24V supply line.	Replace Power Supply.
120.4330	Power Supply Processor	Low voltage on nonswitched 5V supply line.	Replace Power Supply Board.
120.4340	Power Supply Processor	High voltage on nonswitched 5V supply line.	Replace Power Supply Board.
120.4350	Power Supply Processor	Low voltage on 5V supply line.	Replace Power Supply Board.
120.4360	Power Supply Processor	High voltage on 5V supply line.	Replace Power Supply Board.
120.4370	Power Supply Processor	Low voltage on 8V supply line.	Replace Power Supply Board.
120.4380	Power Supply Processor	High voltage on 8V supply line.	Replace Power Supply Board.
120.4390	Power Supply Processor	Low voltage on 3.3V supply line.	Replace Power Supply Board.
120.4400	Power Supply Processor	High voltage on 3.3V supply line.	Replace Power Supply Board.
120.4410	Power Supply Processor	Low backup voltage at capacitor used to power backup alarm.	Replace Logic Board.
120.4420	Power Supply Processor	High backup voltage at capacitor used to power backup alarm.	Replace Logic Board.

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Table 6-4. Error Codes (Continued)

PC Unit (Continued)

Error Code	Subsystem	Explanation	Response
120.4430	Power Supply Processor	Low battery voltage at capacitor used to power backup alarm.	Replace Logic Board.
120.4440	Power Supply Processor	High battery voltage at capacitor used to power backup alarm.	Replace Logic Board.
120.4450	Power Supply Processor	Low watchdog 3.3 supply voltage.	1. Replace Power Supply Board. 2. Replace Logic Board.
120.4460	Power Supply Processor	High watchdog 3.3 supply voltage.	1. Replace Power Supply Board. 2. Replace Logic Board.
120.4470	Power Supply Processor	Error updating processor charging parameter.	1. Replace Power Supply Board. 2. Replace Logic Board.
120.4490	Power Supply Processor	Processor could not set charge current.	1. Replace Power Supply Board. 2. Replace Logic Board.
120.4500	Power Supply Processor	Processor charge current too high for present charge level setting on charger chip.	1. Replace Power Supply Board. 2. Replace Logic Board.
120.4510	Power Supply Processor	Battery missing or disconnected during use.	1. Replace Battery. 2. Replace Power Supply Board.
120.4520	Power Supply Processor	Battery did not respond appropriately to precharge current.	1. Replace Battery. 2. Replace Power Supply Board.
120.4530	Power Supply Processor	Battery voltage exceeded safe limits.	1. Replace Battery. 2. Replace Power Supply Board.
120.4540	Power Supply Processor	Charger chip could not be turned off by its watchdog.	Replace Power Supply Board.
120.4550	Power Supply Processor	ADC failed. Incorrect low positive reference voltage self-test value.	1. Replace Battery. 2. Replace Power Supply Board.

Table 6-4. Error Codes (Continued)**PC Unit** (Continued)

Error Code	Subsystem	Explanation	Response
120.4560	Power Supply Processor	ADC failed. Incorrect high positive reference voltage self-test value.	1. Replace Battery. 2. Replace Power Supply Board.
120.4570	Power Supply Processor	ADC failed. Incorrect low negative reference voltage self-test value.	1. Replace Battery. 2. Replace Power Supply Board.
120.4580	Power Supply Processor	ADC failed. Incorrect high negative reference voltage self-test value.	1. Replace Battery. 2. Replace Power Supply Board.
120.4590	Power Supply Processor	ADC failed. Incorrect low average reference voltage self-test value.	1. Replace Battery. 2. Replace Power Supply Board.
120.4600	Power Supply Processor	ADC failed. Incorrect high average reference voltage self-test value.	1. Replace Battery. 2. Replace Power Supply Board.
120.4610	Power Supply Processor	Processor charge current too low for present charge level setting on charger chip.	1. Replace Battery. 2. Replace Power Supply Board.
120.4620	Power Supply Processor	Battery voltage too low when charging.	1. Replace Battery. 2. Replace Power Supply Board.
120.4630	Power Supply Processor	Battery voltage too high.	Replace Power Supply Board.
120.5010	Power Supply Processor	8051 software version not compatible with software flashed into PC Unit.	1. Reflash PC Unit. 2. Replace Power Supply Board. 3. Replace Logic Board.
120.5020	Power Supply Processor	Processor not reporting software version data immediately after System On. Processor missing, failed, or flashed with version that does not support reporting software version.	Replace Power Supply Board.
120.6000	Power Supply Processor	One or more failures detected during POST.	1. Replace Battery. 2. Replace Power Supply Board.

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

PC Unit (Continued)

Error Code	Subsystem	Explanation	Response
120.6010	Power Supply Processor	RAM failure detected during POST.	Replace Power Supply Board.
120.6170	Power Supply Processor	Battery not being charged and compartment temperature too high.	1. Replace Battery. 2. Replace Power Supply Board.
120.6180	Power Supply Processor	Battery not being charged and temperature too high.	1. Replace Battery. 2. Replace Power Supply Board.
121.2000	Power Supply Processor Communications	Processor quit responding.	Replace Power Supply Board.
133.6080	Audio	Backup speaker failed.	Replace backup speaker.
133.6090	Audio	Main speaker failed.	Replace main speaker.
133.6100	Audio	Backup speaker power supply failed.	Replace Logic Board.

Table 6-4. Error Codes (Continued)**PC Unit Model 8015** ①

Error Code	Subsystem	Explanation	Response
800.8000	Operating System	Software fault.	Contact Cardinal Health Technical Support.
810.9000	Logic Board	Software fault or operating system error occurred while running POLO.	1. Reflash POLO. 2. Replace Logic Board.
810.9010	Logic Board	POLO not able to boot - nonexistent application ELF file.	1. Reflash application. 2. Replace compact flash card and reflash application. 3. Replace Logic Board.
810.9020	Logic Board	POLO not able to boot - invalid application ELF file.	1. Reflash application. 2. Replace compact flash card and reflash application. 3. Replace Logic Board.
810.9030	Logic Board	POLO not able to boot - application ELF file has invalid checksum.	1. Reflash application. 2. Replace compact flash card and reflash application. 3. Replace Logic Board.
810.9340	Logic Board	POLO parameter file could not be opened while processing an update request. Occurs only while executing BOOT or LOAD shell commands.	1. Reflash application. 2. Reflash POLO. 3. Replace compact flash card and reflash application. 4. Replace Logic Board.
810.9050	Logic Board	Error occurred while updating POLO parameter file. Occurs only while executing BOOT or LOAD shell commands.	1. Reflash application. 2. Reflash POLO. 3. Replace compact flash card and reflash application. 4. Replace Logic Board.
810.9060	Logic Board	POLO running on a Logic Board it is not configured for.	1. Reflash POLO. 2. Replace Logic Board.
810.9070	Logic Board	POLO did not detect presence of internal compact flash card in slot B.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.
810.9080	Logic Board	POLO could not reset and access internal compact flash card in slot B.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

PC Unit Model 8015 ^① (Continued)

Error Code	Subsystem	Explanation	Response
810.9090	Logic Board	Compact flash card in slot B not a disk type card.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.
810.9100	Logic Board	Compact flash card in slot B not supported by POLO.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.
810.9105	Logic Board	Wireless card not supported by POLO.	1. Replace wireless card. 2. Replace wireless card extension board. 3. Replace Logic Board.
810.9110	Logic Board	POLO could not initialize ATA driver for a disk type card in one of compact flash card slots.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.
810.9120	Logic Board	POLO could not mount volume on a disk type card in one of compact flash card slots.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.
810.9130	Logic Board	Configuration tuple read from compact flash card in slot B incorrect.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.
810.9135	Logic Board	Configuration tuple read from card in wireless card slot.	1. Replace wireless card. 2. Replace wireless card extension board. 3. Replace Logic Board.
810.9140	Logic Board	Function ID tuple read from compact flash card in slot B incorrect.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.
810.9145	Logic Board	Function ID tuple read from wireless card incorrect.	1. Replace wireless card. 2. Replace wireless card extension board. 3. Replace Logic Board.
810.9150	Logic Board	POLO not able to create POLO directory in internal FFX file system.	1. Reflash POLO. 2. Replace Logic Board.
810.9160	Logic Board	Watchdog timer test failed while POLO was booting an application.	Replace Logic Board.

Table 6-4. Error Codes (Continued)**PC Unit Model 8015** ^① (Continued)

Error Code	Subsystem	Explanation	Response
810.9170	Logic Board	POLO unable to read attribute tuples from compact flash card.	1. Replace compact flash card and reflash application. 2. Replace Logic Board.
810.9175	Logic Board	POLO unable to read attribute tuples from wireless card.	1. Replace wireless card. 2. Replace wireless card extension board. 3. Replace Logic Board.

^① POLO refers to the operating system software after boot up (power up sequence).

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

Pump Module			
Error Code	Subsystem	Explanation	Response
200.1010	Logic Board	Error detected during CPU test.	Replace Logic Board.
200.1030	Logic Board	64K to flash file DRAM test failed.	Replace Logic Board.
200.1040	Logic Board	Unable to write into flash memory chip used for logging.	Replace Logic Board.
200.1060	Logic Board	Watchdog failure.	Replace Logic Board.
200.1070	Logic Board	Hardware watchdog test failure.	Replace Logic Board.
200.1110	Logic Board	Flash file device containing application failed CRC test.	Replace Logic Board.
200.1120	Logic Board	Boot flash file device containing boot code failed CRC test.	Replace Logic Board.
200.1200	Logic Board	Uninitialized interrupt occurred. Default handler called.	Replace Logic Board.
200.4160	Logic Board	Motor shutoff safety switch test failed.	Replace Logic Board.
200.5010	Logic Board	Boot block software version not compatible with software flashed into Pump Module.	1. Reflash Pump Module. 2. Replace Logic Board.
200.5020	Logic Board	One or more 8051 processors not reporting software version data immediately after System On. 8051 missing, failed, or flashed with version that does not support reporting software version.	Replace Logic Board.
200.5030	Logic Board	Serial number reported by Pump Module not a recognized type.	Replace Logic Board.
200.5040	Logic Board	Pump Module software version not compatible with software flashed into PC Unit.	Reflash PC Unit or Pump Module.
200.6120	Logic Board	Critical value data integrity failure.	Replace Logic Board.
210.1010	Keypad Processor	CPU failure detected during POST.	Replace Logic Board.
210.1020	Keypad Processor	ROM failure detected during POST.	Replace Logic Board.

Table 6-4. Error Codes (Continued)**Pump Module** (Continued)

Error Code	Subsystem	Explanation	Response
210.1160	Keypad Processor	Internal RAM failure detected during POST.	Replace Logic Board.
210.2040	Keypad Processor	Response message received when not expected.	Replace Logic Board.
210.4040	Keypad Processor	Clear Display BSYNC failure detected during POST.	Replace Logic Board.
210.5010	Keypad Processor	8051 software version not compatible with software flashed into Pump Module.	Reflash PC Unit.
210.5020	Keypad Processor	Processor not reporting software version data immediately after System On. Processor missing, failed, or flashed with version that does not support reporting software version.	Replace Logic Board.
210.6000	Keypad Processor	One or more failures detected during POST.	Replace Logic Board.
210.6010	Keypad Processor	RAM failure detected during POST.	Replace Logic Board.
210.6020	Keypad Processor	Keypad failure detected during POST.	Replace Keypad.
210.6030	Keypad Processor	Alarm LED failure detected during POST.	Replace defective alarm LED.
210.6040	Keypad Processor	Display failure detected during POST.	Replace defective display.
211.2000	Keypad Processor Communications	Unspecified communication error.	Replace Logic Board.
220.1000	Safety Processor	Internal error.	Replace Logic Board.
220.1010	Safety Processor	CPU failure detected during POST.	Replace Logic Board.
220.1020	Safety Processor	ROM failure detected during POST.	Replace Logic Board.
220.1160	Safety Processor	Internal RAM failure detected during POST.	Replace Logic Board.

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

Pump Module (Continued)

Error Code	Subsystem	Explanation	Response
220.5010	Safety Processor	8051 software version not compatible with software flashed into Pump Module.	Replace Logic Board.
220.5020	Safety Processor	Processor not reporting software version data immediately after System On. Processor missing, failed, or flashed with version that does not support reporting software version.	Replace Logic Board.
220.6000	Safety Processor	One or more failures detected during POST.	Replace Logic Board.
220.6010	Safety Processor	RAM failure detected during POST.	Replace Logic Board.
221.2000	Safety Processor Communications	Unspecified communication error.	Replace Logic Board.
221.2010	Safety Processor Communications	Timely response to watchdog message not received.	Replace Logic Board.
221.2020	Safety Processor Communications	Incorrect response message received.	Replace Logic Board.
221.2030	Safety Processor Communications	Corrupted response message received.	Replace Logic Board.
221.2040	Safety Processor Communications	Response message received when not expected.	Replace Logic Board.
221.2050	Safety Processor Communications	Received command that cannot be interpreted.	Replace Logic Board.
221.2060	Safety Processor Communications	Not receiving heartbeat messages in a timely manner.	Replace Logic Board.
222.1000	Safety Processor Cross-Check	Measured illegal or inaccurate action by main processor - reason undetermined.	Replace Logic Board.
222.2030	Safety Processor Cross-Check	Corrupted response message received.	Replace Logic Board.

Table 6-4. Error Codes (Continued)**Pump Module** (Continued)

Error Code	Subsystem	Explanation	Response
222.2040	Safety Processor Cross-Check	Response message received when not expected.	Replace Logic Board.
222.4010	Safety Processor Cross-Check	High infusion rate detected.	<ol style="list-style-type: none"> 1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Motor Controller Board. 3. Replace Logic Board.
222.4020	Safety Processor Cross-Check	Low infusion rate detected	<ol style="list-style-type: none"> 1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Motor Controller Board. 3. Replace Logic Board.
222.4030	Safety Processor Cross-Check	Motor stall detected.	<ol style="list-style-type: none"> 1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Motor Controller Board. 3. Replace Logic Board.
222.4040	Safety Processor Cross-Check	Detected encoder out of sync with motor pulses.	<ol style="list-style-type: none"> 1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Logic Board.
222.4050	Safety Processor Cross-Check	Excessive air-in-line detected.	<ol style="list-style-type: none"> 1. Replace AIL Assembly. 2. Replace Logic Board.
222.4060	Safety Processor Cross-Check	Over-infusion state detected (infusion past VTBI limit).	<ol style="list-style-type: none"> 1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Motor Controller Board. 3. Replace Logic Board.
222.4160	Safety Processor Cross-Check	Motor shutoff safety switch test failed.	Replace Logic Board.

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

Pump Module (Continued)

Error Code	Subsystem	Explanation	Response
222.4170	Safety Processor Cross-Check	Detected infusion parameter out-of-range. Parameter possibilities include: rate, VTBI, AIL limit, VPMR, burst rate threshold, maintenance mode flag, infuse all flag, check air-in-line flag.	Replace Logic Board.
222.4180	Safety Processor Cross-Check	Improper door and/or flow stop state detected during infusion.	1. Replace AIL Assembly. 2. Replace Door Assembly.
222.4190	Safety Processor Cross-Check	Received command to open safety switch when switch is already open, or to close when already closed.	Replace Logic Board.
222.4200	Safety Processor Cross-Check	Motor activity detected when motor should be idle.	1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Motor Controller Board. 3. Replace Logic Board.
240.4140	Bottle-Side Pressure Sensor	Voltage too low. Sensor may be broken.	Replace bottle-side pressure sensor.
240.4150	Bottle-Side Pressure Sensor	Voltage too high. Sensor may be broken.	Replace bottle-side pressure sensor.
241.4140	Patient-Side Pressure Sensor	Voltage too low. Sensor may be broken.	Replace patient-side pressure sensor.
241.4150	Patient-Side Pressure Sensor	Voltage too high. Sensor may be broken.	Replace patient-side pressure sensor.
242.4000	Motor/Encoder	Encoder feature not recognized; software unable to determine whether mechanism rotation is too slow or too fast.	1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Motor Controller Board. 3. Replace Logic Board.

Table 6-4. Error Codes (Continued)**Pump Module** (Continued)

Error Code	Subsystem	Explanation	Response
242.4010	Motor/Encoder	Fluid delivery mechanism turning too quickly (infusion rate high).	<ol style="list-style-type: none"> 1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Motor Controller Board. 3. Replace Logic Board.
242.4020	Motor/Encoder	Fluid delivery mechanism turning too quickly (infusion rate low).	<ol style="list-style-type: none"> 1. Replace AIL Assembly (motor encoder is part of this assembly). 2. Replace Motor Controller Board. 3. Replace Logic Board.
242.4030	Motor/Encoder	Motor stall detected.	<ol style="list-style-type: none"> 1. Ensure motor connector is securely connected. 2. Replace AIL Assembly (motor encoder is part of this assembly). 3. Replace Motor Controller Board. 4. Replace Logic Board.
243.4070	Air-in-Line	Failed self test.	Replace AIL Assembly.
244.3020	Safety Clamp	Safety clamp read in safe state (CLOSED) when sensor was unpowered and should have read in unsafe (OPEN) state.	<ol style="list-style-type: none"> 1. Replace AIL Assembly (safety clamp is part of this assembly). 2. Replace Logic Board.
245.3020	Door	Door sensor read in safe state (CLOSED) when sensor was unpowered and should have read in unsafe (OPEN) state.	<ol style="list-style-type: none"> 1. Replace AIL Assembly (door sensor is part of this assembly). 2. Replace Logic Board.
260.4080	Power Supply	3.3V AD voltage at least 8.4% lower than voltage in specification.	Replace Motor Controller Board.
260.4090	Power Supply	3.3V AD voltage at least 8.4% higher than voltage in specification.	Replace Motor Controller Board.
260.4100	Power Supply	5V AD voltage at least 8.4% lower than voltage in specification.	Replace Logic Board.

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

Pump Module (Continued)

Error Code	Subsystem	Explanation	Response
260.4110	Power Supply	5V AD voltage at least 8.4% higher than voltage in specification.	Replace Logic Board.
260.4120	Power Supply	Pressure Sensor voltage at least 8.4% lower than voltage in specification.	Replace Logic Board.
260.4130	Power Supply	Pressure Sensor voltage at least 8.4% higher than voltage in specification.	Replace Logic Board.
2XX.2080	Communications	Module poll not in odd/even sequence.	1. Replace IUI connectors. 2. Replace Logic Board.
2XX.2090	Communications	Seventh or greater module attached.	None
2XX.3000	Keypad Processor	Keypad key stuck closed.	Replace Keypad.
2XX.4700	ADC	ADC failed to calibrate itself within specified time.	Replace Logic Board.
2XX.4710	ADC	ADC failed to complete a conversion within specified time.	Replace Logic Board.
2XX.5080	Communications	Module's version data not validated by PC Unit within specified time.	None
2XX.6400	Logic Board or Display Board	General CBIT failure, not specifically tied to another malfunction code.	Replace Logic Board or Display Board.

Table 6-4. Error Codes (Continued)**PCA Module and Syringe Module**

Error Code	Subsystem	Explanation	Response ^①
350.6600	Logic Board	Watchdog circuit failed POST.	Replace Logic Board.
350.6630	Force Sensor	Pressure not tracked by force sensor.	Replace Force Sensor Assembly.
350.6680	Logic Board	Timer bases; clock frequency out of sync.	Replace Logic Board.
351.6610	Motor Watchdog	Unexpected countdown interrupt.	Replace Motor and/or Logic Board.
351.6660	Linear Sensor	Movement error; predicted change in Linear Sensor inconsistent with expected position.	Replace Linear Sensor.
351.6720	Motor Logic Board	Motor steps accumulating too fast or too slow.	Replace Motor and/or Logic Board.
351.6730	Motor Logic Board	Too many steps in motor step sample.	Replace Motor and/or Logic Board.
351.6740	Engagement Nut	Nut not engaged during infusion; lever not opened.	Replace Logic Board, and/or nut engagement sensor or engagement nut.
351.6750	Engagement Nut	Attempt to engage nut timed out before engaging.	Replace Logic Board, and/or nut engagement sensor or engagement nut.
351.6760	Module	Calibration flag not set. Module not calibrated.	Calibrate, as required.
351.6770	Pressure Sensing Disc Logic Board (Syringe Module)	Pressure sensing disc circuit test failed during POST.	Replace pressure sensing disc and/or Logic Board.
352.6640	Force Sensor	Force sensor output is zero or is outside acceptable range.	Replace Force Sensor Assembly.
352.6700	Logic Board Force Sensor	Force sensor circuit check failure.	Replace Logic Board or Force Sensor Assembly.
353.6650	Linear Sensor	Linear Sensor output is zero or is outside acceptable range.	Replace Linear Sensor.
354.6670	Pressure Sensing Disc (Syringe Module)	Pressure sensor output is outside acceptable range.	Replace pressure sensing disc.

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Table 6-4. Error Codes (Continued)

PCA Module and Syringe Module (Continued)

Error Code	Subsystem	Explanation	Response ^①
354.6690	Logic Board	Pressure Sensor current outside acceptable range.	Replace Logic Board or Pressure Sensor.
356.6710	Digital Sensor	Digital sensor outside acceptable range during no-power test.	Replace digital sensor.
356.6780	PCA Handset	System detected PCA Handset Key stuck at power-up.	Replace PCA Handset.
3XX.2080	Communications	Module poll not in odd/even sequence.	1. Replace IUI connectors. 2. Replace Logic Board.
3XX.2090	Communications	Seventh or greater module attached.	None
3XX.3000	Keypad	Keypad key stuck closed.	Replace Keypad.
3XX.4700	Logic Board	ADC failed to calibrate itself within specified time.	Replace Logic Board.
3XX.4710	Logic Board	ADC failed to complete a conversion within specified time.	Replace Logic Board.
3XX.5080	Communications	Module's version data not validated by PC Unit within specified time.	None
3XX.6400	Display Board	General CBIT failure, not specifically tied to another malfunction code.	Replace Logic Board or Display Board.
3XX.7200	Linear Sensor	Plunger position Linear Sensor readings indicate potentiometer wiper is making intermittent contact with resistive surface (log only).	Replace Linear Sensor.
3XX.7210	Logic Board Linear Sensor	Plunger position sampler cleared module's calibrated flag because sensor readings indicate possible contamination continuously for 1.08 mm of motion (log only).	1. Calibrate Linear Sensor. 2. Replace Linear Sensor. 3. Replace Logic Board.
3XX.7220	Logic Board Linear Sensor	Motor running and plunger about to contact lower mechanical stop.	1. Calibrate Linear Sensor. 2. Replace Linear Sensor. 3. Replace Logic Board.

^① Replacing the Force Sensor Assembly or Logic Board Assembly in a PCA Module or Syringe Module with version 7 or earlier software must be performed at the depot. Reference the PCA Module / Syringe Module Service Manual for further information.

Table 6-4. Error Codes (Continued)**SpO₂ Module**

Error Code	Subsystem	Explanation	Response
4XX.2080	Communications	Module poll not in odd/even sequence.	1. Replace IUI connectors. 2. Replace Logic Board.
4XX.2090	Communications	Seventh or greater module attached.	None
4XX.3000	Keypad Processor	Keypad key stuck closed.	Replace Keypad.
4XX.5080	Communications	Module's version data not validated by PC Unit within specified time.	None
4XX.6200	SpO ₂ Board	Failed "continuous built-in tests".	1. Cycle power. 2. Replace SpO ₂ Board.
4XX.6210	SpO ₂ Board	Communications error.	1. Cycle power. 2. Replace SpO ₂ Board. 3. Replace cable between Logic Board and SpO ₂ Board. 4. Replace Logic Board.
4XX.6220	SpO ₂ Board	Configurations error.	1. Cycle power. 2. Replace SpO ₂ Board.
4XX.6230	SpO ₂ Board	Received value "out of range".	1. Replace Sensor. 2. Cycle power. 3. Replace SpO ₂ Board.
4XX.6240	SpO ₂ Board	Missing sensor status.	1. Replace Sensor. 2. Cycle power. 3. Replace SpO ₂ Board.
4XX.6300	Display Board	Shorted segment in 7-segment display.	Replace Display Board.
4XX.6310	Display Board	Open Segment in 7-Segment Display.	Replace Display Board.
4XX.6320	Display Board	Shorted alarm LED.	Replace Display Board.
4XX.6330	Display Board	Open alarm LED.	Replace Display Board.
4XX.6400	Display Board	General CBIT failure, not specifically tied to another malfunction code.	Replace Display Board.
4XX.6500	SpO ₂ Board	Serious module error.	Replace SpO ₂ Board.

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

SpO₂ Module (Continued)

Error Code	Subsystem	Explanation	Response
4XX.6510	SpO ₂ Board	Module error requires power to be cycled.	Replace SpO ₂ Board.
4XX.6520	SpO ₂ Board	Module error requires it to be reset.	Replace SpO ₂ Board.
4XX.6530	SpO ₂ Board	Transient error.	Replace SpO ₂ Board.
4XX.6560	SpO ₂ Board	Power-on test error.	Replace SpO ₂ Board.
4XX.6580	SpO ₂ Board	Unknown error.	Replace SpO ₂ Board.

Table 6-4. Error Codes (Continued)**EtCO₂ Module**

Error Code	Subsystem	Explanation	Response
5XX.2080	Communications	Module poll not in odd/even sequence.	1. Replace IUI connectors. 2. Replace Logic Board.
5XX.2090	Communications	Seventh or greater module attached.	None
5XX.3000	Keypad Processor	Keypad key stuck closed.	Replace Keypad.
5XX.5080	Communications	Module's version data not validated by PC Unit within specified time.	None
5XX.6200	EtCO ₂ Board	Failed continuous built-in tests.	Replace EtCO ₂ Board.
5XX.6210	EtCO ₂ Board	Communications error.	1. Replace EtCO ₂ Board. 2. Replace cable between Logic Board and EtCO ₂ Board. 3. Replace Logic Board.
5XX.6220	EtCO ₂ Board	Configuration error.	Replace EtCO ₂ Board.
5XX.6230	EtCO ₂ Board	Received value out of range.	1. Replace Microstream® Disposable device. 2. Replace EtCO ₂ Board.
5XX.6240	EtCO ₂ Board	Missing sensor status.	1. Replace Microstream® Disposable device. 2. Replace EtCO ₂ Board.
5XX.6400	Display Board	General CBIT failure, not specifically tied to another malfunction code.	Replace Display Board.
5XX.6500	EtCO ₂ Board	EtCO ₂ Board took too long to perform an action.	Replace EtCO ₂ Board.

TROUBLESHOOTING

Table 6-4. Error Codes (Continued)

Communications Interface (CI) Board

Error Code	Subsystem	Explanation	Response
600.6800	CI Board	CI Board failed POST test.	Replace CI Board.
600.6820	CI Board	CI Board initialization failure.	<ol style="list-style-type: none">1. Load network parameters.2. Replace radio card.3. Flash CI Board.4. Replace CI Board.
600.6830	CI Board	CI Board configuration failure.	Load network parameters.
600.6840	CI Board	CI Board to server connect failure.	<ol style="list-style-type: none">1. Check network signal strength.2. Load network parameters.3. Replace radio card.
600.6850	CI Board	CI Board not responding.	<ol style="list-style-type: none">1. Flash CI Board.2. Load network parameters.3. Replace radio card.4. Replace CI Board.
600.6860	CI Board	CI Board to server disconnect failure.	Replace CI Board.
600.6870	CI Board	CI Board communications error.	Replace radio card.

Table 6-4. Error Codes (Continued)**Log Only**

Error Code	Explanation
2100	Lost interrupt check response.
2200	2892 and 16x50 serial devices.
2300	Model 800 cleanup task recorded interrupt acknowledge lost.
3010	Nurse Call switch open when expected to be closed.
6070	PC Unit RTC battery failure.
6140	Unexpected interrupt or exception, after which a software fault is signaled.
6150	Operating system error, after which a software fault is signaled.
6340	7-segment display status report.
6350	7-segment display status report.
6540	SpO ₂ informational reports.
6570	SpO ₂ warmer error.
7500	Report that system time cannot be corrected by adding skew, after which a software fault is signaled.

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7 ILLUSTRATED PARTS BREAKDOWN

Chapter 7 – ILLUSTRATED PARTS BREAKDOWN

7.1 INTRODUCTION

The illustrated parts breakdown is divided into major assemblies and individual parts.

7.2 ILLUSTRATIONS

The exploded views serve as visual aids for identifying the parts of each assembly. If a part/assembly is identified with an item number (appearing in a bubble), that number corresponds with the item number on the parts list. If a part/assembly is not identified with an item number, it is available only as part of a higher assembly or kit.

Due to product changes over time, components/assemblies illustrated in this chapter may differ from the instrument being serviced.

7.3 PARTS LIST

The parts list provides the following information for saleable parts and assemblies:

Item: This number corresponds with number in illustration.

Part Number: This is the Alaris® product number needed when placing an order.

When a part number is not provided, that part is either not sold by Cardinal Health, is provided as part of a kit or higher assembly, or can only be replaced/repaired by Cardinal Health authorized service personnel.

Description: Descriptive information that may be helpful when placing an order.

QTY: Total number of each item used.

7.4 ORDERING PARTS

Parts can be ordered by writing or calling Cardinal Health Customer Care (see "General Contact Information" at beginning of this manual). When requesting a part, provide the following information:

- Product name and model number (for example, PC Unit, Model 8015).
- Instrument software version. Reference Alaris® System DFU for directions on how to view software version.
- Part number.
- Part description, as provided in parts list.
- For labels, specify required language.

Table 7-1. Parts List - Models 8000 and 8015

If the part description does not identify a model usage, the part is for both Models 8000 and 8015.

NOTE: An "assembly" is a preassembled group of parts. A "kit" is a group of unassembled parts.

Item	Part Number	Description	QTY
002	TC10003916	Board Assembly, External Communications (Model 8015)	1
004	10012641	Memory Card (Model 8015)	1
005	10015156	Board Assembly, Inverter (Model 8015)	1
006	TC10003666	Network Card Cover (Model 8015)	1
009	TC10003655	Memory Card Retainer (Model 8015)	1
011	TC1004650	Harness Assembly, Inverter Display (Model 8015)	1
012	321119	Wireless Network Card (Model 8015)	1
018	TC10003750	Front Case / Keypad Assembly (Model 8015)	1
019		CI Board / Nurse Call Accessory (Model 8000): (Consists of: CI Board / Nurse Call Accessory and all parts needed to install it.)	
	10014082	v7 Alaris® System	
	10014843	v8 Alaris® System	
020	TC10004547	Display Retainer (Upper)	1
030	10012918	Screw, 2 x ⁵ / ₁₆ , PHL PNH (Model 8015)	2
031	321033	Screw, 6-32 x ⁷ / ₁₆ , PHL PNH	4
032	300345	Screw, 4-40 x ¹ / ₄ , PHL PNH (zinc plated steel)	Model 8000 6 Model 8015 6
050	145997-101	Battery Pack Assembly	1
060	10015197	Ground Clip (Model 8015)	1
085	145442-000	Shaft, Handle	1
088	806200	O-Ring, Handle Shaft	2
110	142787-002	Rear Panel, RS-232 Assembly	1
113	147466-000	Gasket, RS-232 Assembly Rear Panel	1
120	146622-101	Board Assembly, Isolated RS-232	1
121	147449-000	Gasket Strip, Rear Panel (part of item 2027)	Model 8000 3 Model 8010 3 Model 8015 1

ILLUSTRATED PARTS BREAKDOWN

Table 7-1. Parts List - Models 8000 and 8015 (Continued)

Item	Part Number	Description	QTY
122	144422-100 TC10004232	Switch Assembly, Tamper Model 8000 Model 8015	1
124	147450-000	Plug, RJ45 Connector	1
125	141117	Speaker	1
127	320937	Boot Seal	1
128	147780-000	Shroud, Tamper Switch	1
130	142788-000 TC10003654	Rear Panel Model 8000 Model 8015	1
131	TC10003665	Gasket, Rear Panel (for Model 8015 Communications Board Panel)	1
133	147467-000 148124-000	Gasket, Rear Panel Model 8000 Models 8015 and 8012	1
134	147744-001	Bracket, Speaker Retaining	1
135	300045	Nut, Kep 4-40	3
138	320911	Washer, Shoulder	1
140	146383-000	Retainer, Power Cord	1
150	834031	Cable Tie, 4" Auto Feed	4
151	10014440	Foam Insert (Model 8015)	1
155	304297	Cable Tie Mount	1
160	142791-000	Pole Clamp (part of item 2010)	1
170	142792-004	Pole Clamp Mounting Plate (part of item 2000)	1
180	142793-000	Knob / Lead Screw (part of item 2010)	1
182	139900	Lead Screw Tip (part of item 2010)	1
184	305414	Pin - for Lead Screw Tip (part of item 2010)	1
186	143360-000	Pole Clamp Gasket (part of item 2000)	1
195	320840	Standoff, 4-40 x $\frac{3}{16}$ Hex, F-F, $\frac{1}{2}$ "	5
210	145882	Board Assembly, Left IUI	1
215	146735-000	Ground Strap	1
220	145889	Board Assembly, Right IUI	1

Table 7-1. Parts List - Models 8000 and 8015 (Continued)

Item	Part Number	Description	QTY
230	TC10004298 TC10004669	Board Assembly, Logic Model 8000 Model 8015	1
235	320133	Battery, Lithium (Model 8000)	1
240	TC10004709	Board Assembly, Power Supply	1
245	TC10003872	Plate, Ground	1
280	146500-100	AC Filter Assembly	1
285	320140-020	Fuse, 2.0 Amp, Slow Blow	2
304	143359-100	Harness Assembly, Battery Discharge	1
320	TC10003316	Harness Assembly, Battery Connector	1
363	320167	Washer, Flat, 0.125 x 0.312 x 0.032 Thick	1
375	144424-100	LED Assembly, Keypad Backlight	1
432	806112	Snap Rivet, 0.125 Diameter, Black Nylon	2
468	146574-100	Harness Assembly, DC Output	1
470	10014743	Power Supply	1
472	148452-000	Power Cord, North American	1
473	980-1015-1	Wrap Assembly, Power Cord	1
474	809061	Snap, Eyelet Stud	1
476	10026281	Washer, #4 Internal Tooth Locking	1
600	125569	Serial Number Replacement Label	1
620	123273	Label, Ground Symbol (part of item 2007)	1
630	144350-000	Label, Battery Identification (part of item 2007)	1
635	144351-000	Label, Fuse Rating (part of item 2007)	1
645	144353-000	Label, Keypad Lockout/RS-232 (part of item 2007)	1
665	144357-000	Label, Power Cord (part of item 2007)	1
670	10012610	Label, Patent	1
800	320854	Screw, 6-32 x ¼, PHL PNH	2
805	320856	Screw, 6-32 x 2 ³ / ₈ , PHL PNH	2
810	304319	Screw, 4-40 x ¼, PHL PNH (stainless steel)	Model 8000 18 Model 8010 6 Model 8015 10

ILLUSTRATED PARTS BREAKDOWN

Table 7-1. Parts List - Models 8000 and 8015 (Continued)

Item	Part Number	Description	QTY
815	320853	Screw, 4-40 x ½, PHL FLH	4
825	320851	Screw, 4-40 x 5/16, PHL PNH	Model 8000 5 Model 8012 6 Model 8015 6
826	300346	Screw, 4-40 x ½, PHL PNH	Model 8000 7 Model 8015 7
827	304576	Screw, 4-40 x ½, TRH PHL	4
830	320855	Screw, 6-32 x 7/16, PHL PNH	8
833	320908	Washer, Flat, 0.146 x 0.27 x 0.03 Thick	6
835	10016025	Screw, 8-32 x 5/8, with lock washer	4
840	320169	Screw, ¼-20 x ½ Cap	1
842	320852	Screw, 4-40 x 9/16, PHL PNH	7
843	803215	Washer, Split Lock	1
844	803204	Washer, Internal Tooth Locking	1
845	147456-000	Screw, 10-32 x 0.37	1
847	147765-000	Gasket, Lower Rear Case	11
848	320086	Fuse Block, 3.5A 125V SMD3820 (F1)	1
2000	147074-101	Pole Clamp Mounting Plate Kit (Consists of: items 170, 186, 835)	1
2001	147075-100	Backup Speaker / Gasket Kit	1
2003	147077-100	IUI Connector / Gasket Kit, Right	1
2004	147078-100	IUI Connector / Seal Kit, Left	1
2005	147079-100	Display Assembly Model 8000 (Adhesive Foam / LCD Display Assembly) Model 8015 (Adhesive Foam / Ground Clip / LCD Display Assembly)	1
2006	147080-100	Latch Kit (Consists of: Compression Spring, Latch, Leaf Spring, Support)	1
2007	147081-100	Label Kit (Consists of: items 620, 630, 635, 645, 665)	1

Table 7-1. Parts List - Models 8000 and 8015 (Continued)

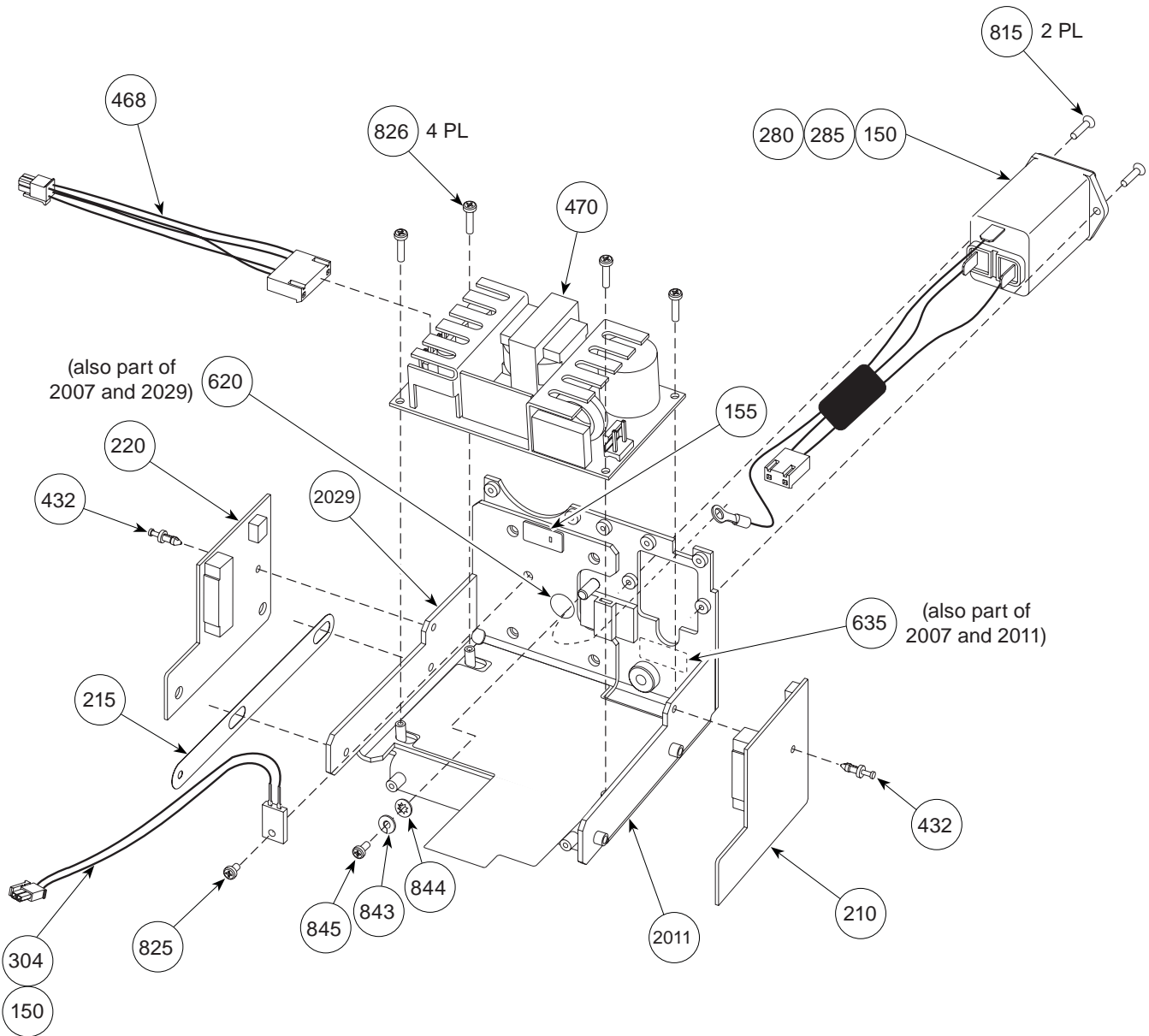
Item	Part Number	Description	QTY
2008	147092-100	Hardware / Parts Kit (Consists of various quantities of most commonly used parts and hardware.)	1
2009	147093-100	Silicone Tubing (10 Ft) (This 10-foot length of tubing is enough for 4 PC Units.)	1
2010	147124-100	Pole Clamp Assembly (Consists of: items 160, 180, 182, 184, 835. All items are assembled except item 835.)	1
2011	147125-100	Support Frame Assembly Kit, Left (Consists of: Fuse Rating Label, Line Filter Gasket, Left Support Frame Assembly, and item 835. All items are assembled except item 835.)	1
2012	10013669	Front Case / Keypad Assembly (Model 8000)	1
2025	148315-100	Handle Kit (Consists of: Bottom Handle, Top Handle, 4 Screws)	1
2027	10016096	Gasket Kit, Rear Case: (Consists of: AC Filter Gasket, Speaker Gasket, Upper Rear Case Gasket, and item 121)	1
2028	10016082	Pole Clamp Plate Screws (qty. 8) Kit	1
2029	10016083	Support Frame Assembly Kit, Right (Consists of: Cable Tie Mount, Dielectric Insulator, Ground Symbol Label, Right Support Frame Assembly, and item 835. All items are assembled except item 835.)	1
2030	10016037	Display Retainer Assembly (Model 8015) (Adhesive Foam / Display Retainer Assembly)	1
2031	10016038	Rear Panel / Gaskets Assembly (Model 8015)	1
8043		Rear Case Assembly Kit: (Consists of: Metallized Rear Case, Backup Speaker Gasket, Battery Identification Label, Nameplate Label, and items 600, 645, 670, 835, 2009. All items are attached except items 600 and 835.)	1
	10013278	Model 8000	
	10016035	Model 8015	
----	8010	Nurse Call Accessory (Model 8000) (Consists of: Nurse Call Accessory and all parts needed to install it.)	

ILLUSTRATED PARTS BREAKDOWN

Table 7-1. Parts List - Models 8000 and 8015 (Continued)

Item	Part Number	Description	QTY
----	8012	Communications Interface (CI) Board Accessory (Model 8000) (Consists of: CI Board Accessory and all parts needed to install it.)	
----		Maintenance Software:	
		v7 Alaris® System:	
	10013678	Software (includes User Manual on CD)	
	10013552	User Manual, Printed Copy	
		v8 Alaris® System:	
	10014583	Software (includes User Manual on CD)	
	10012637	User Manual, Printed Copy	
----		Quick Reference Guide:	
	10010882	v7 Model 8000	
	10014673	v8 Models 8000 and 8015	
----		Directions for Use	
		v7 Model 8000	
	10010899	Printed Copy	
		v8 Model 8000	
	10014676	Printed Copy	
	10014677	Electronic (CD) Copy	
		Model 8015	
	10014674	Printed Copy	
	10014675	Electronic (CD) Copy	

Figure 7-1. Models 8000 and 8015 - Chassis Assembly



ILLUSTRATED PARTS BREAKDOWN

Figure 7-2. Model 8015 - Memory Card

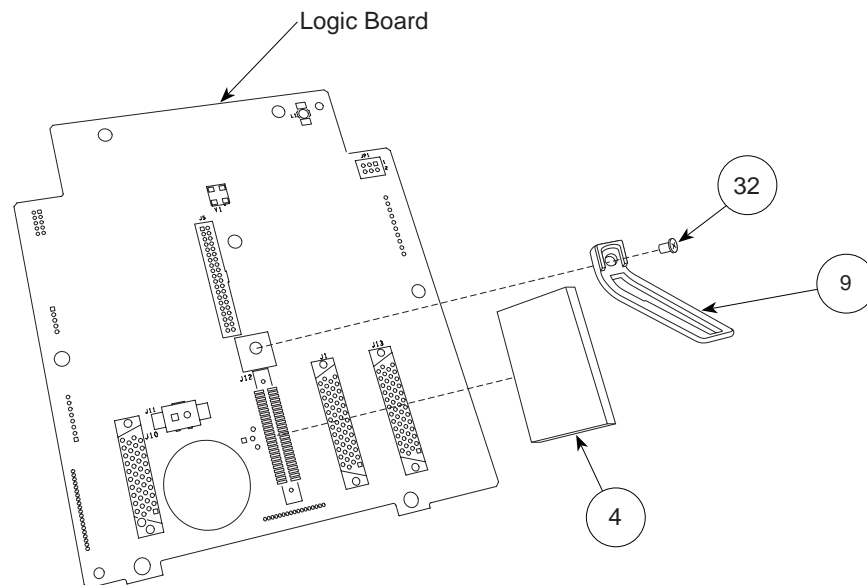
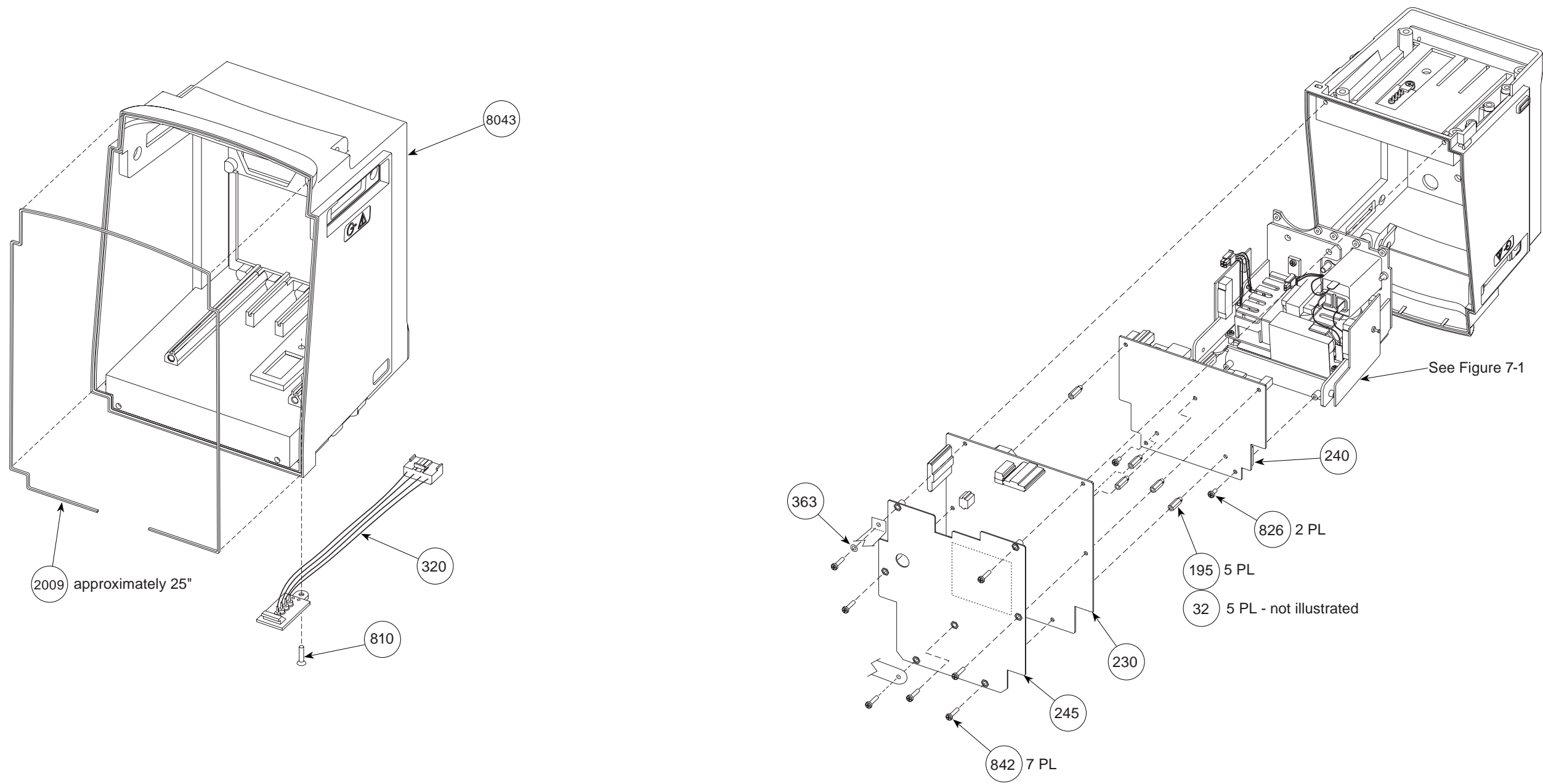
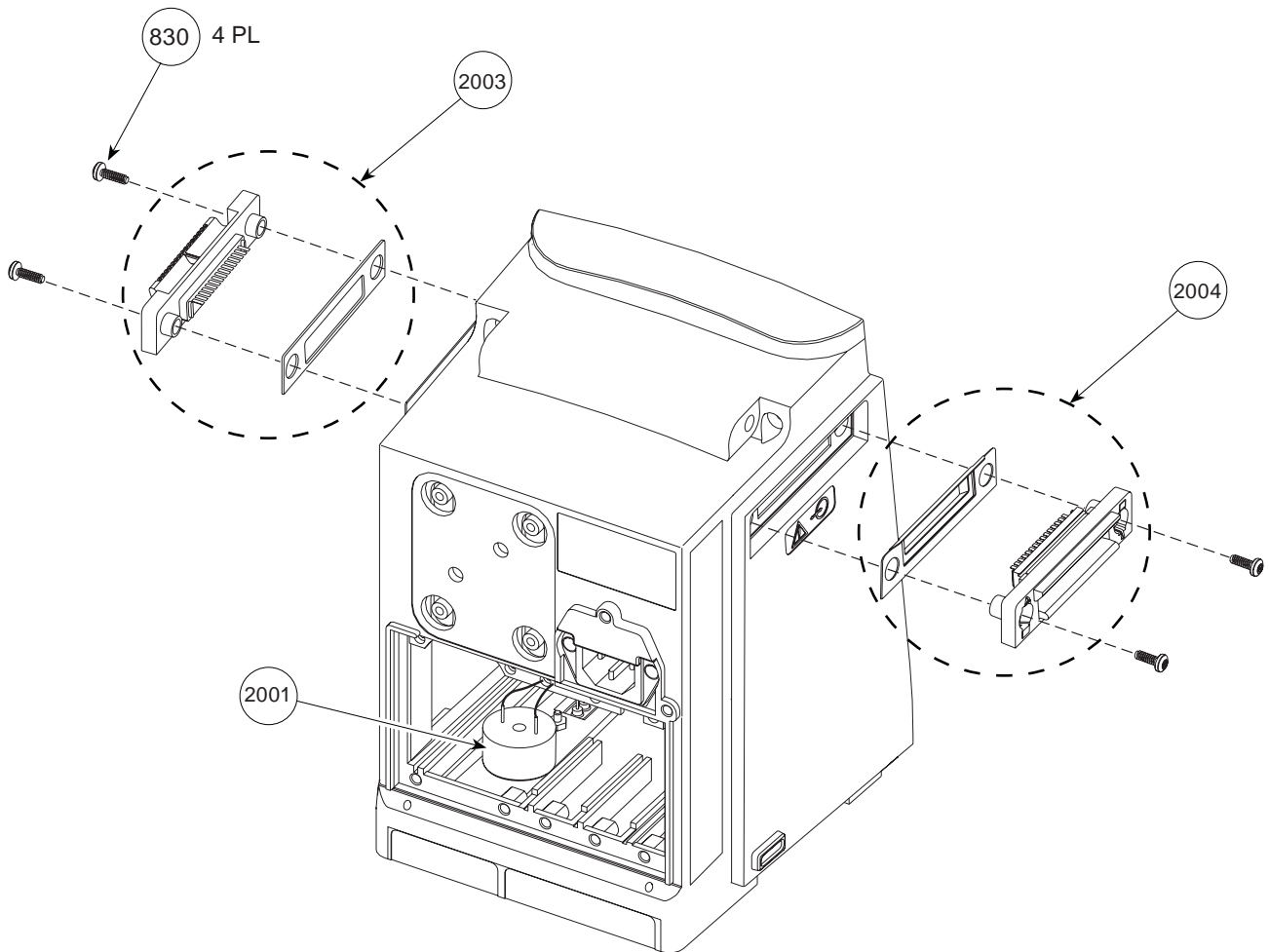


Figure 7-3. Models 8000 and 8015 - Rear Case Assembly



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Figure 7-4. Models 8000 and 8015 - IUI Connectors and Backup Speaker



ILLUSTRATED PARTS BREAKDOWN

Figure 7-5. Model 8000 - LED Display Assembly

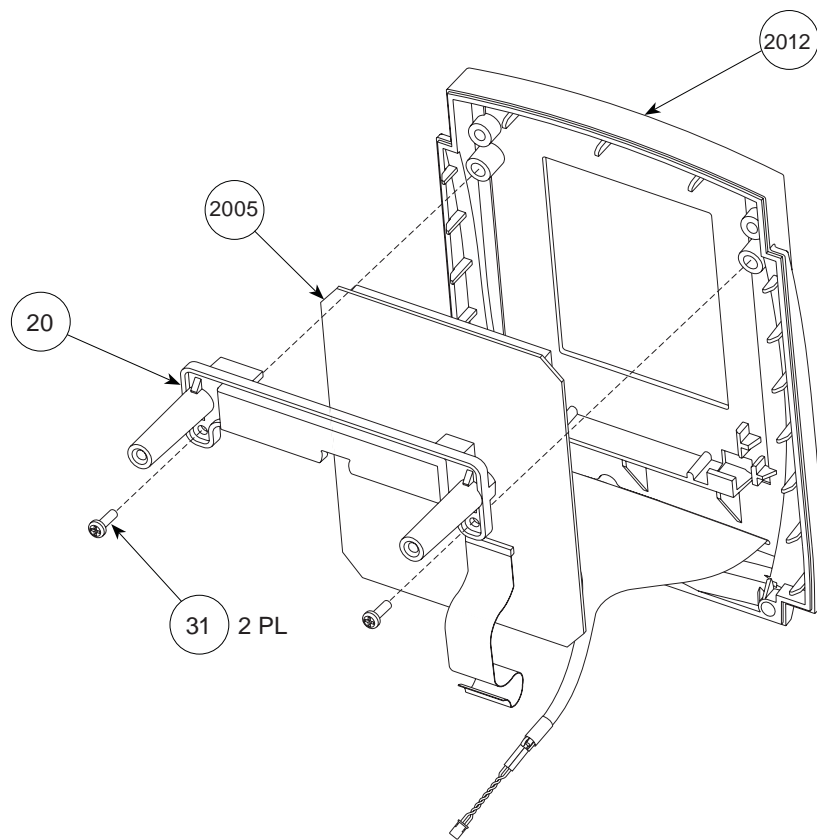
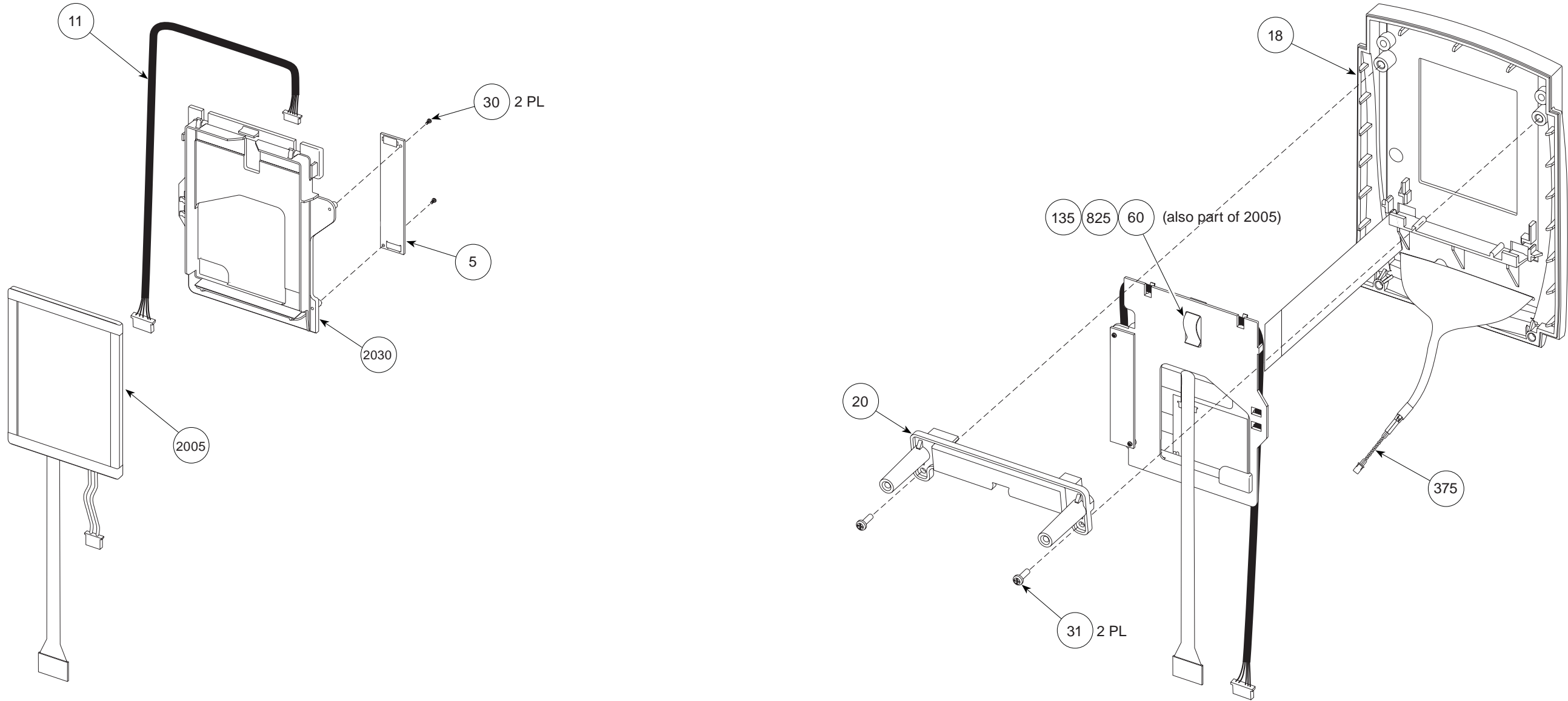
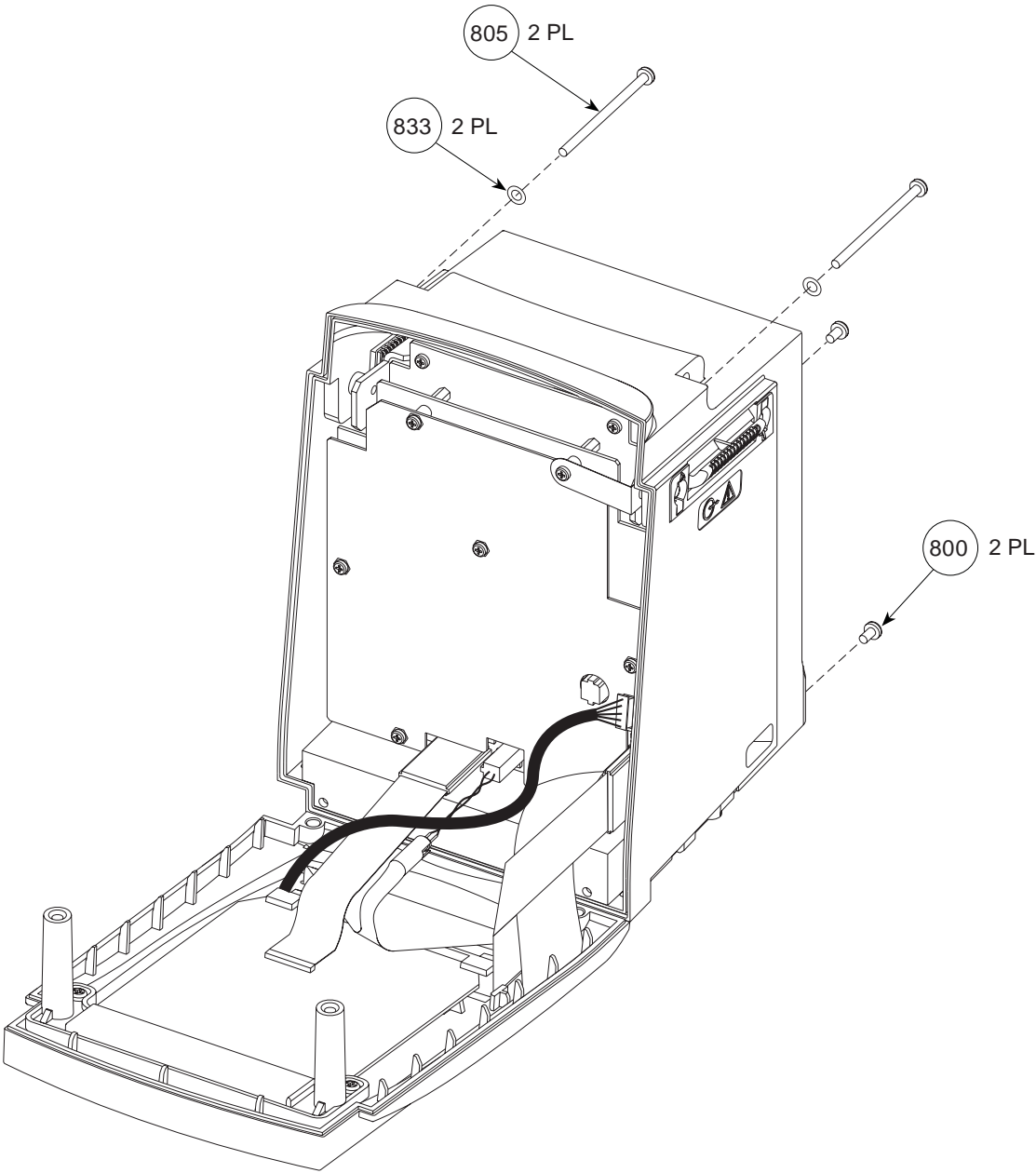


Figure 7-6. Model 8015 - LED Display Assembly



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Figure 7-7. Models 8000 and 8015 - Front to Rear Case Assembly



ILLUSTRATED PARTS BREAKDOWN

Figure 7-8. Models 8000 and 8015 - Handle Assembly

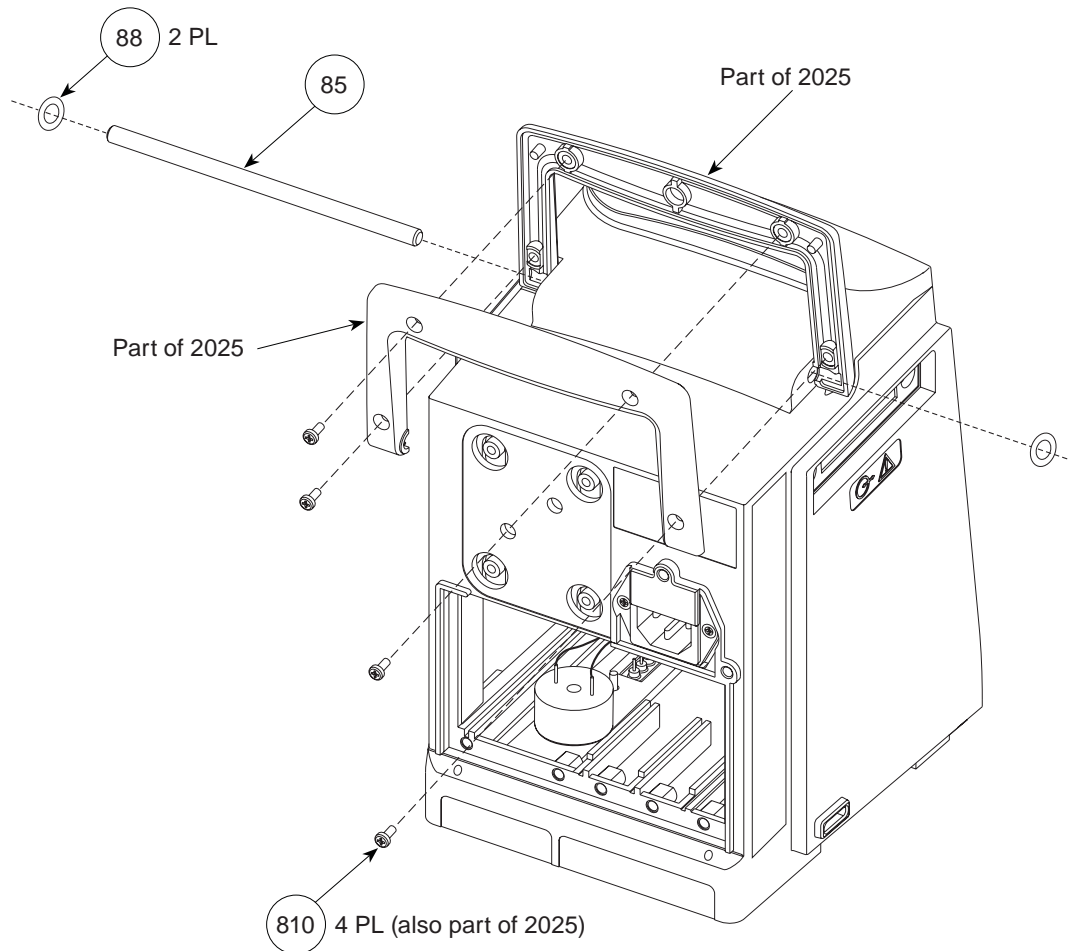
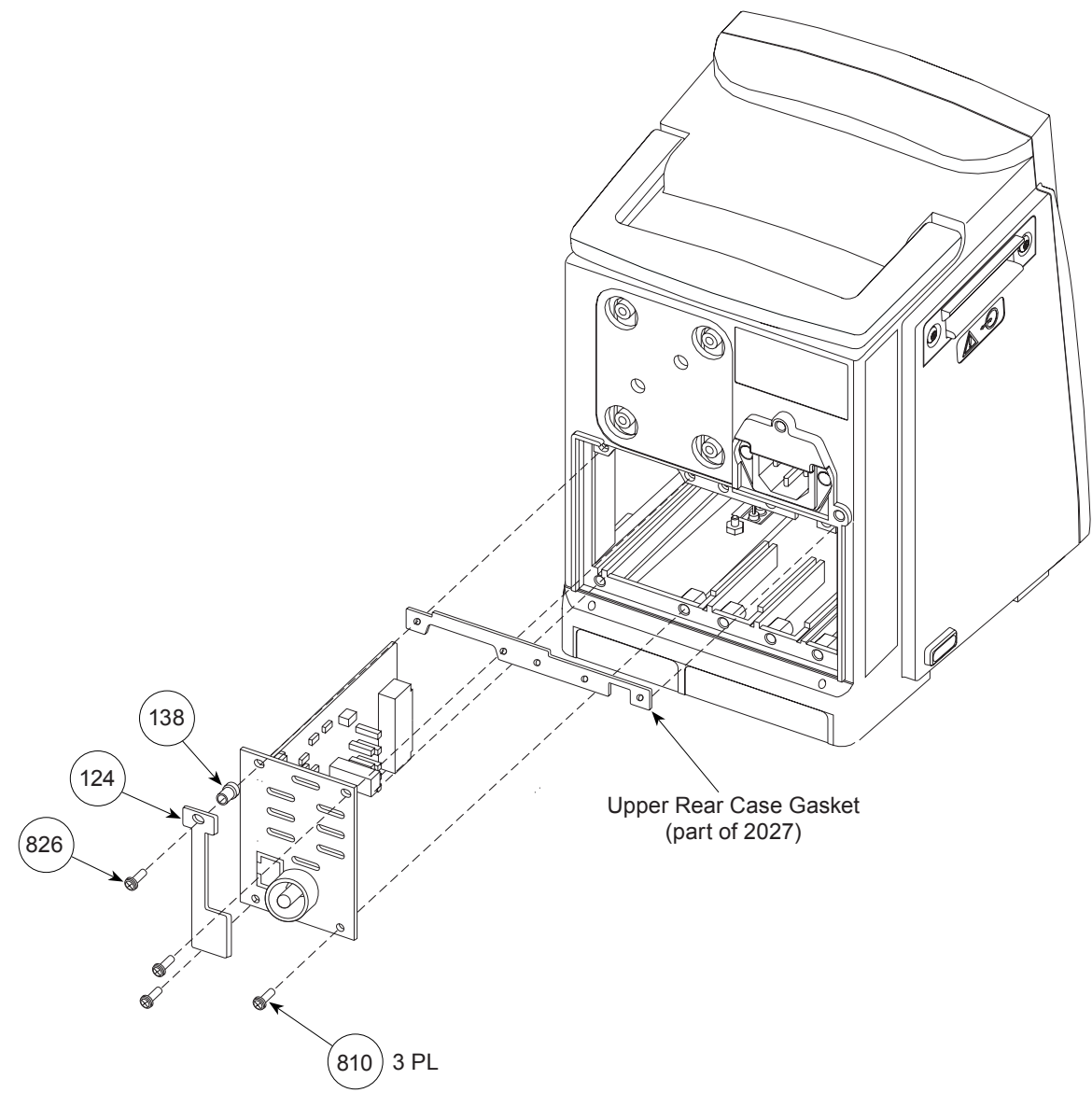
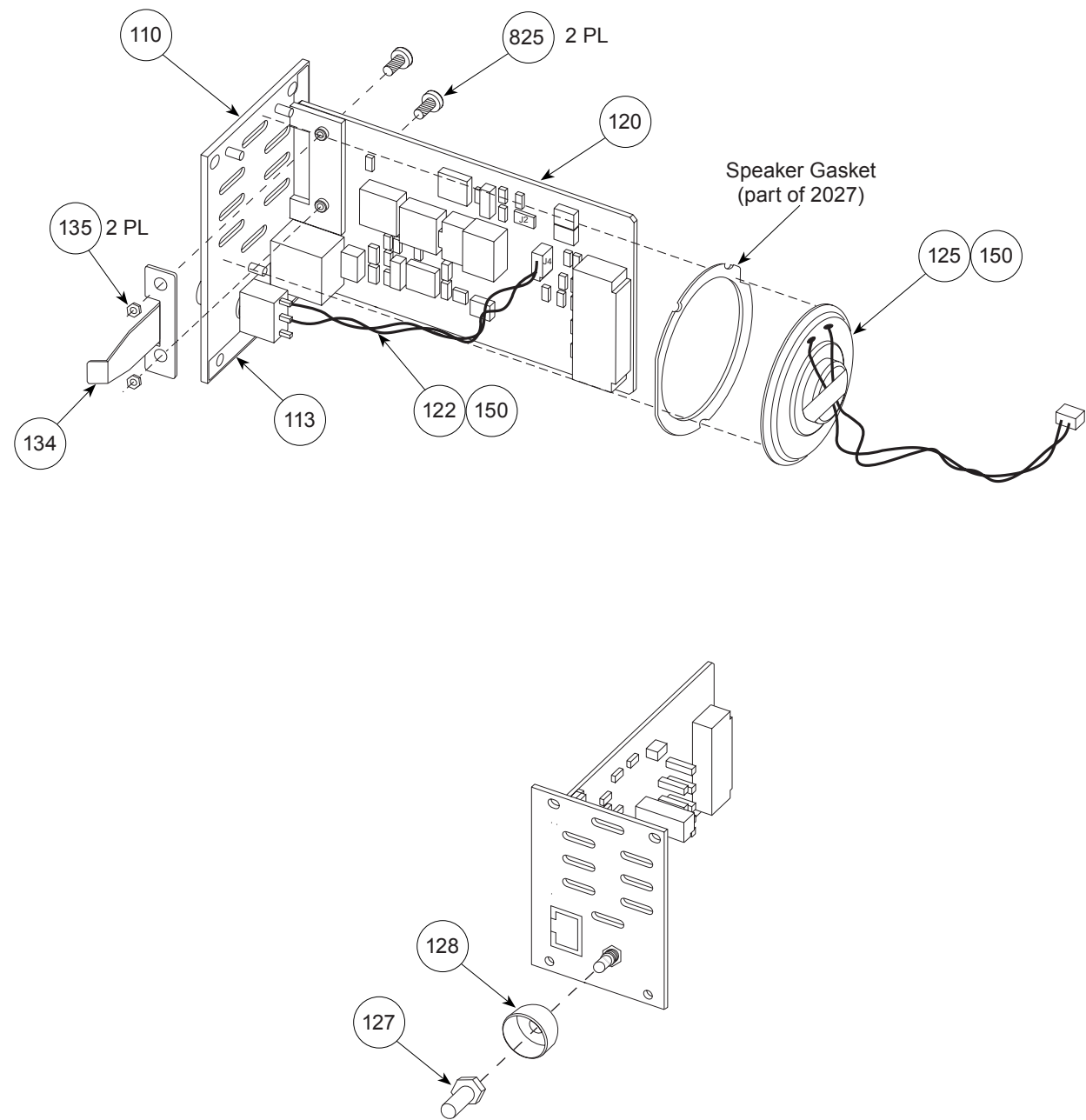
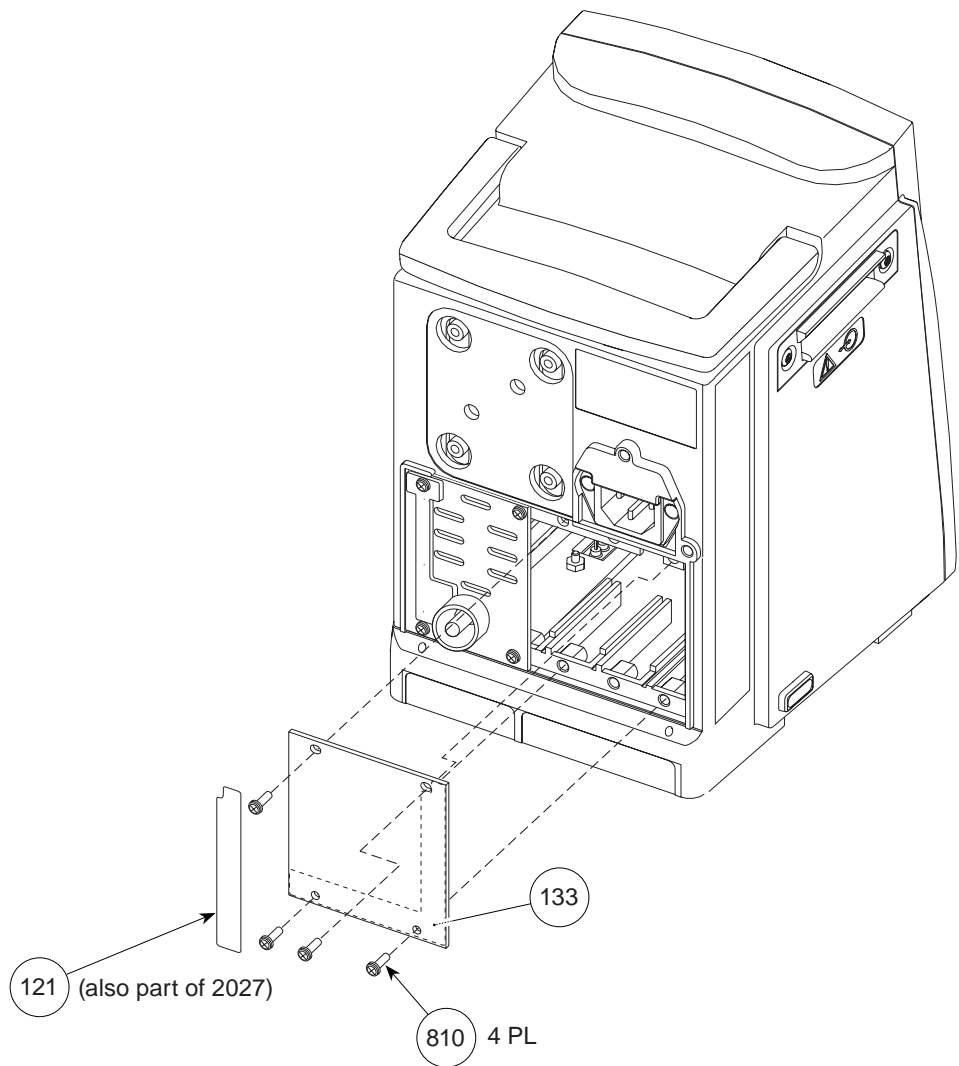


Figure 7-9. Models 8000 and 8015 - Rear Panel Assembly



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Figure 7-10. Model 8000 - Rear Plate Assembly



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Figure 7-11. Model 8015 - Wireless Network Assembly

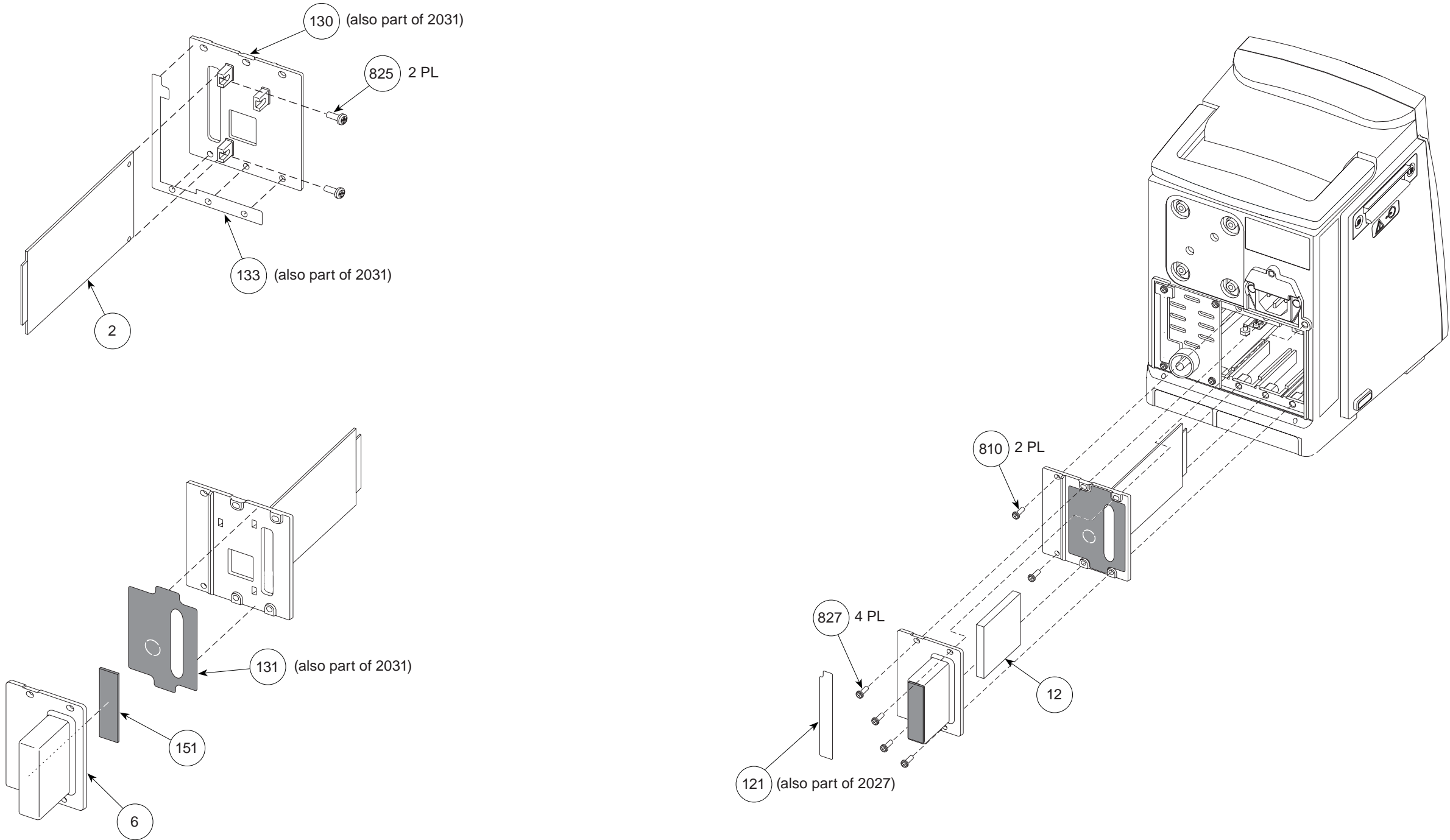


Figure 7-12. Model 8000 - Model 8010 Nurse Call Accessory

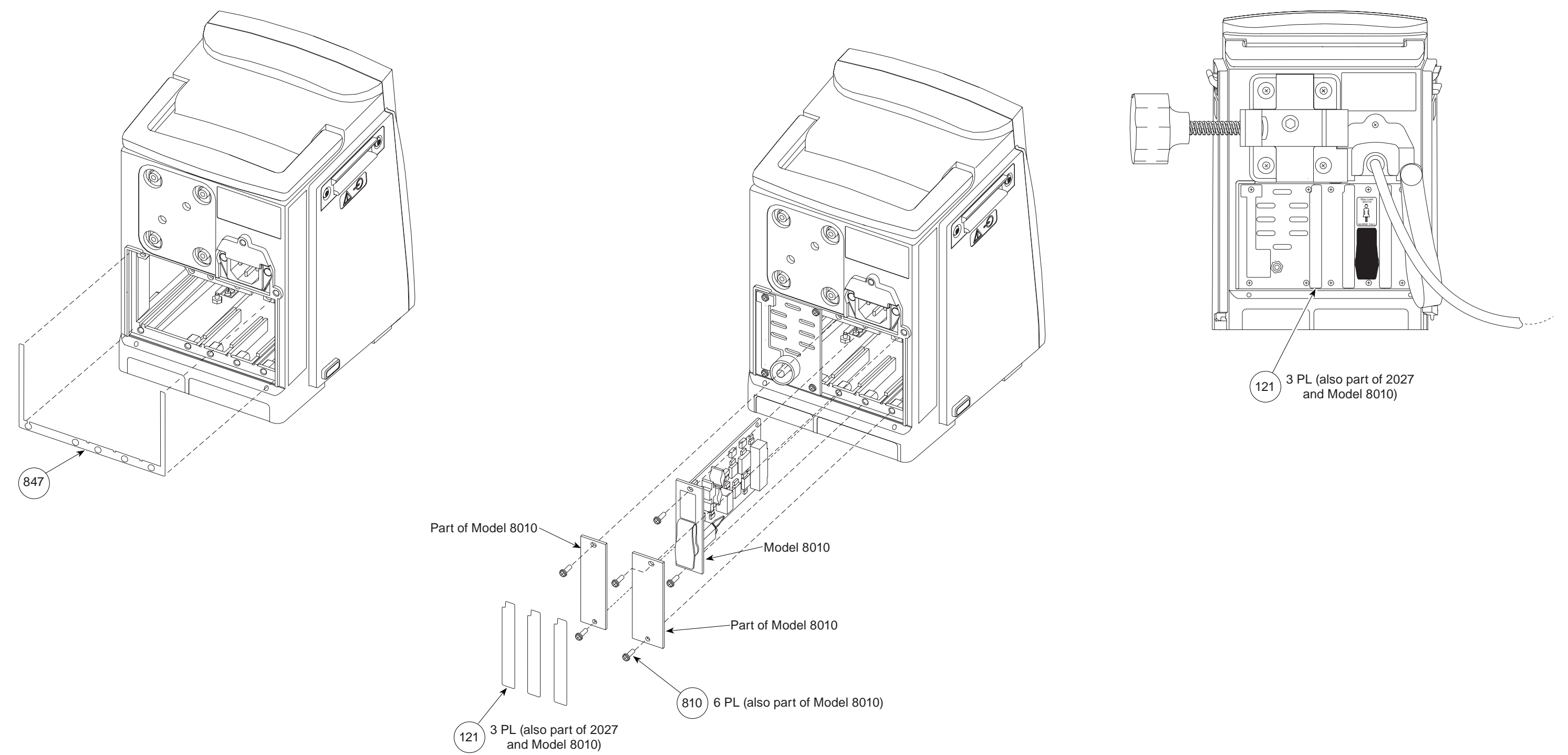
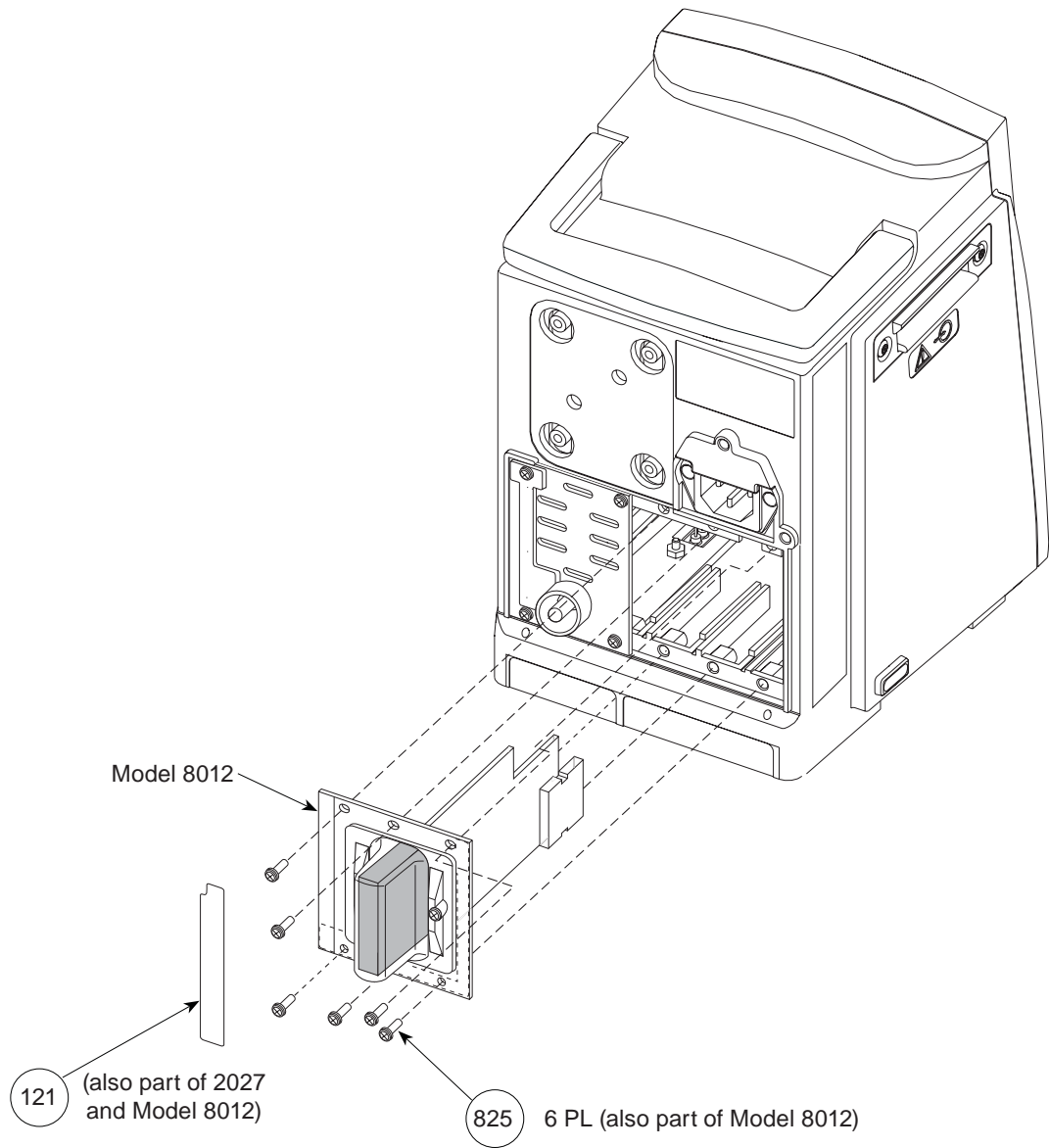


Figure 7-13. Model 8000 - Model 8012 Communications Interface Accessory



ILLUSTRATED PARTS BREAKDOWN

Figure 7-14. Model 8000 - Communication Interface Board / Nurse Call Accessory

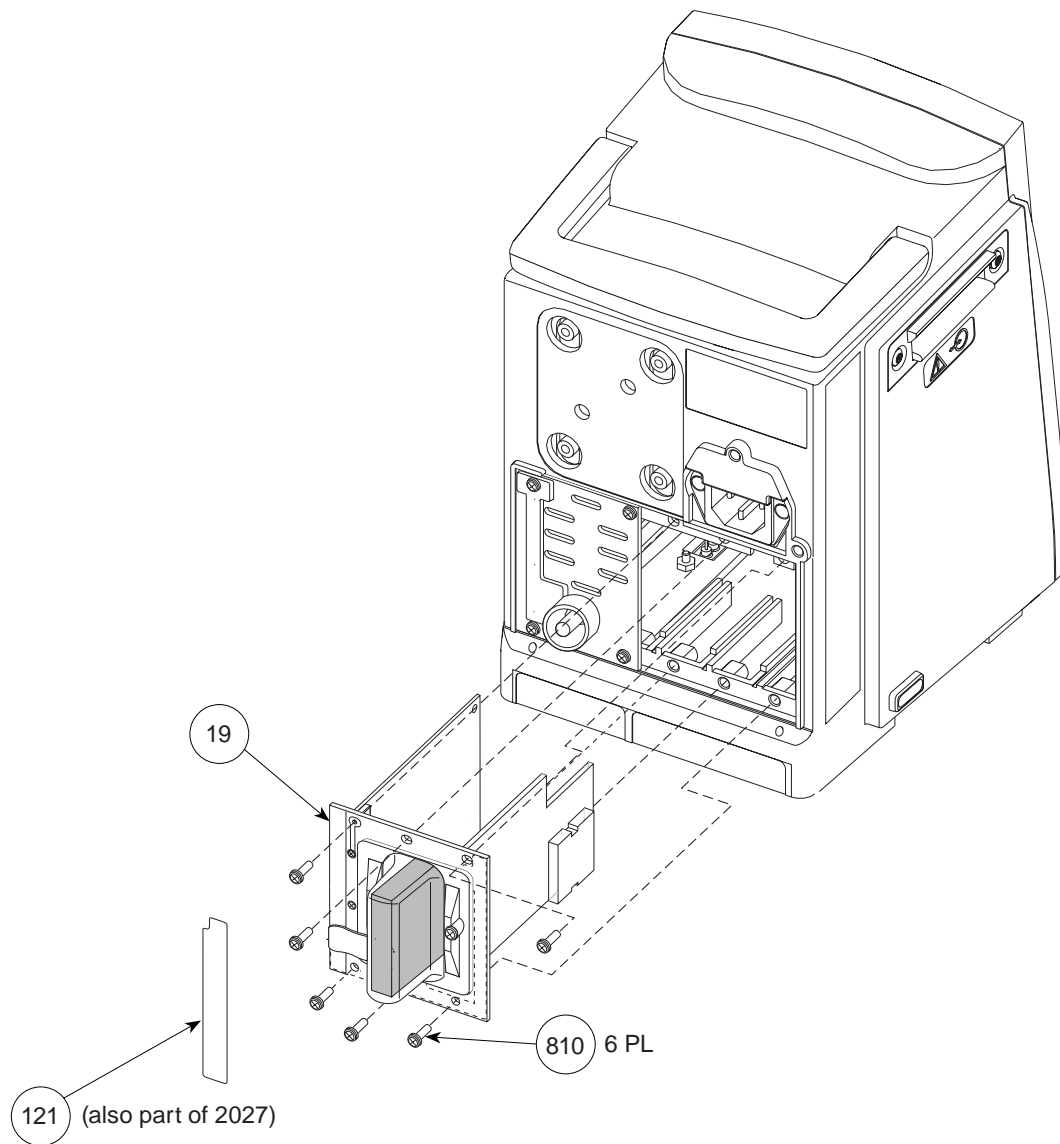
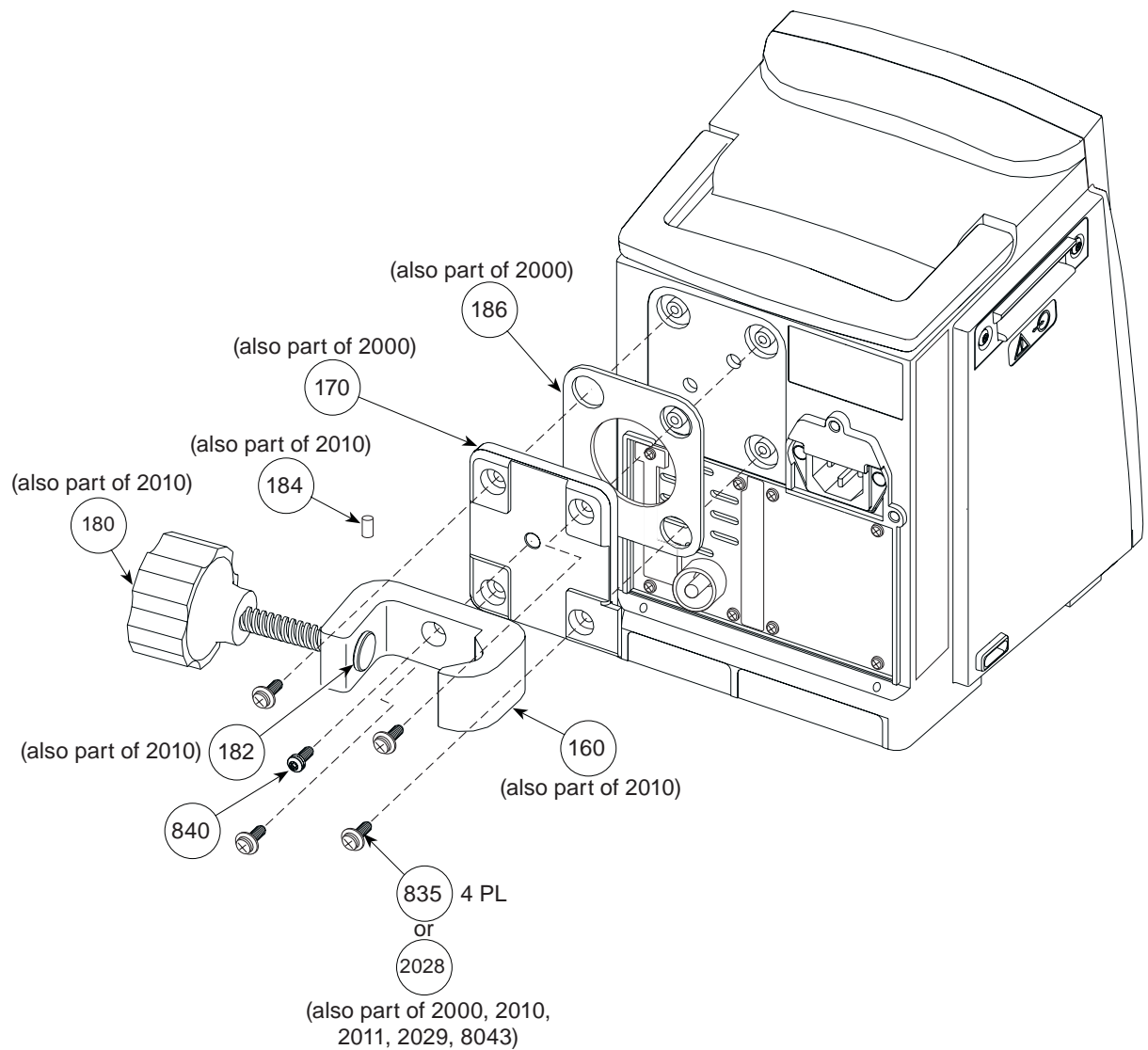


Figure 7-15. Models 8000 and 8015 - Pole Clamp Assembly



ILLUSTRATED PARTS BREAKDOWN

Figure 7-16. Models 8000 and 8015 - Power Cord Assembly and Labels



Nameplate Label, which has a regulatory mark, is not field replaceable as an individual item. It is available only as part of Rear Case Assembly Kit (item 8043).

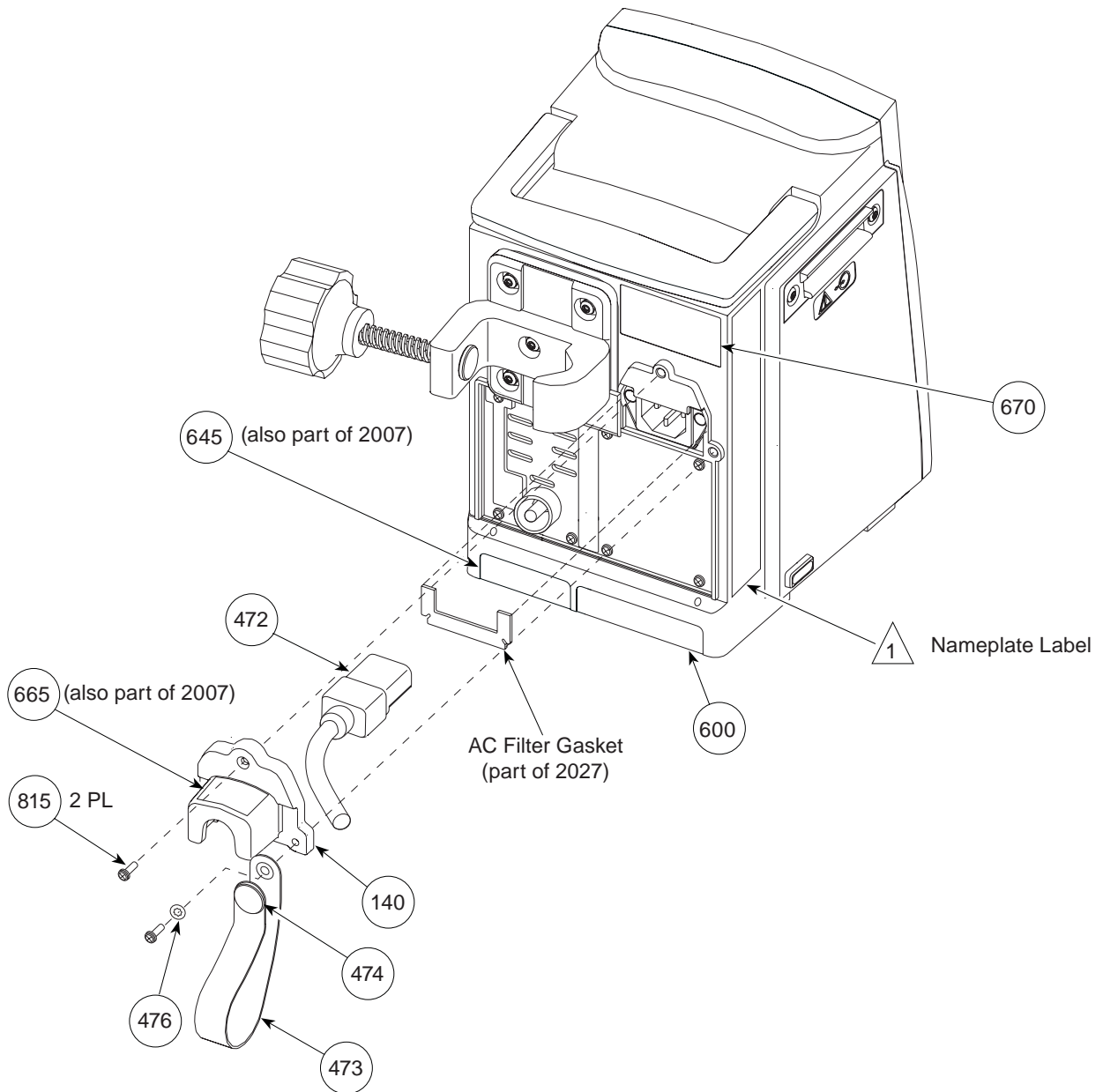
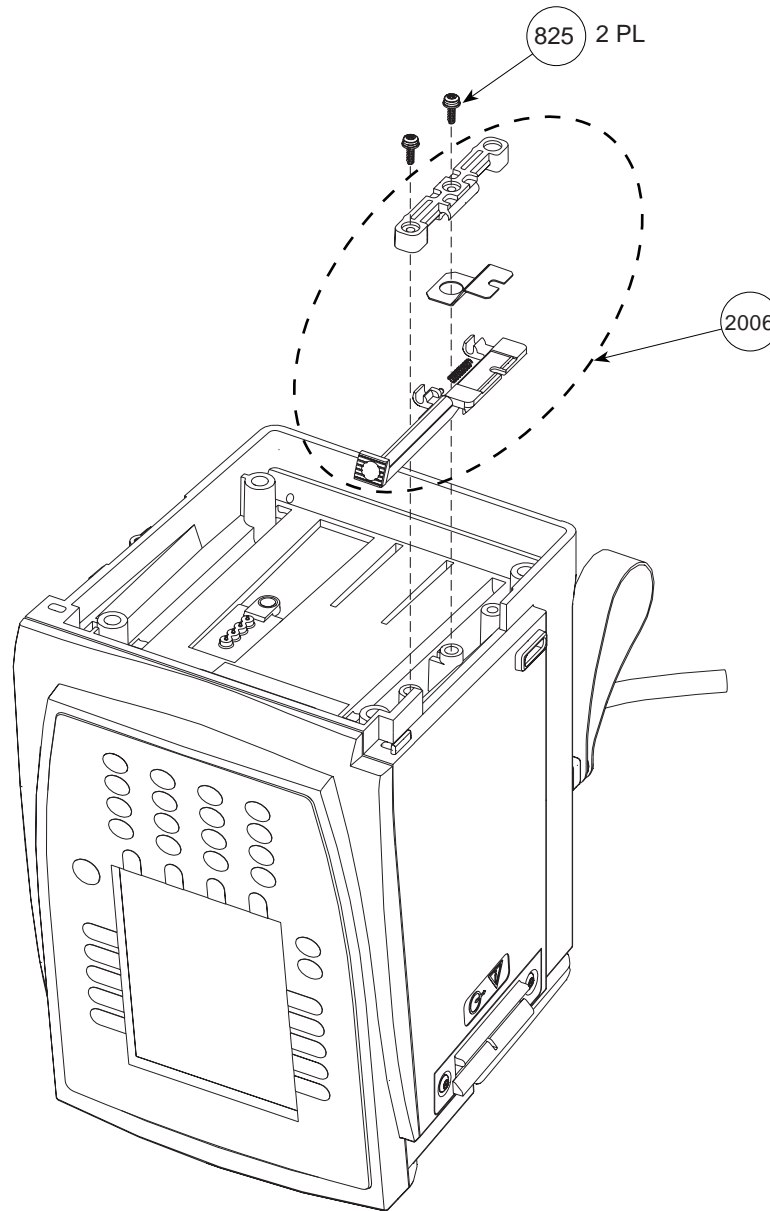


Figure 7-17. Models 8000 and 8015 - Latch Assembly



ILLUSTRATED PARTS BREAKDOWN

Figure 7-18. Models 8000 and 8015 - Battery Pack Assembly

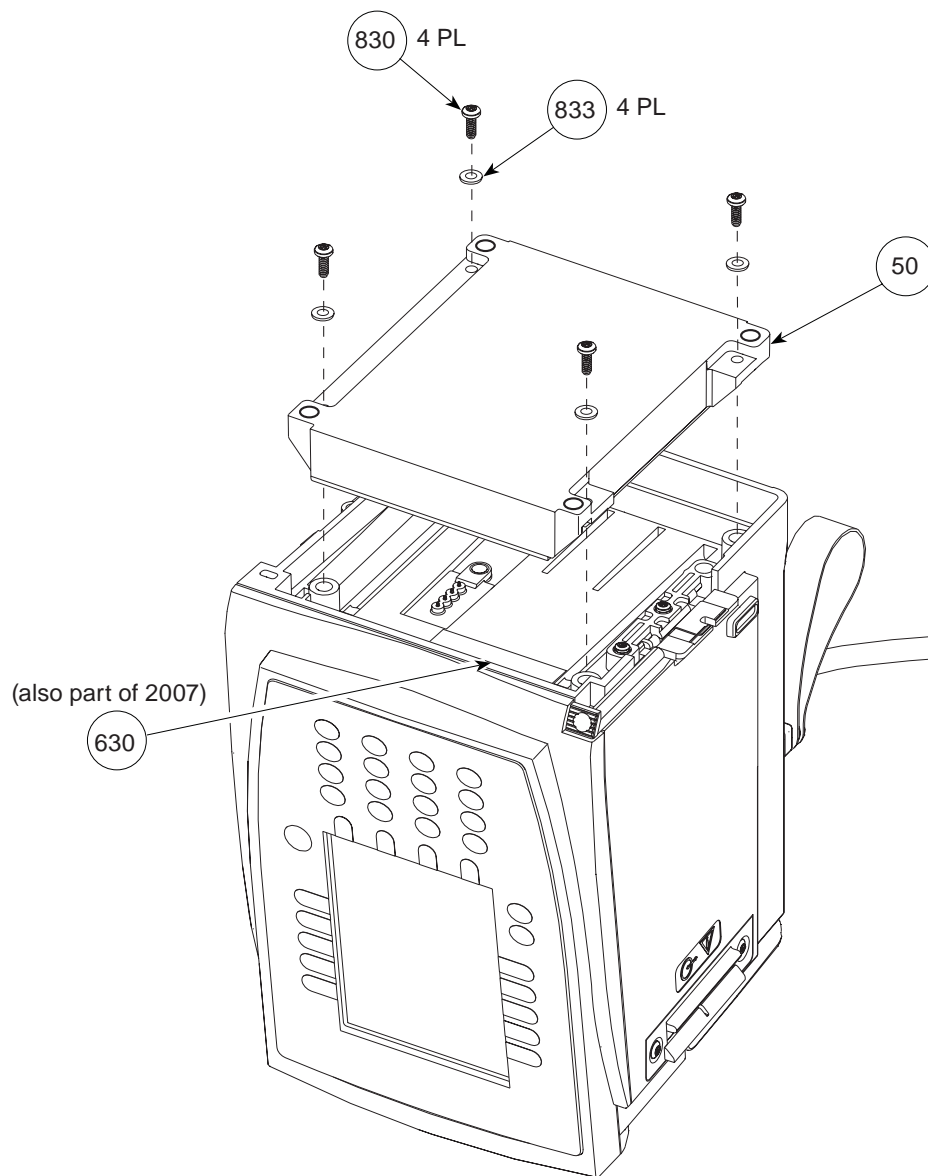
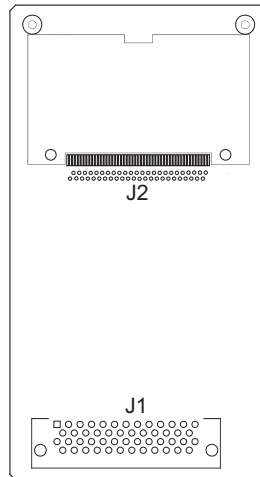


Figure 7-19. Model 8015 - Communications Board

This illustration is for board identification purposes only and does not represent the board's component layout.



ILLUSTRATED PARTS BREAKDOWN

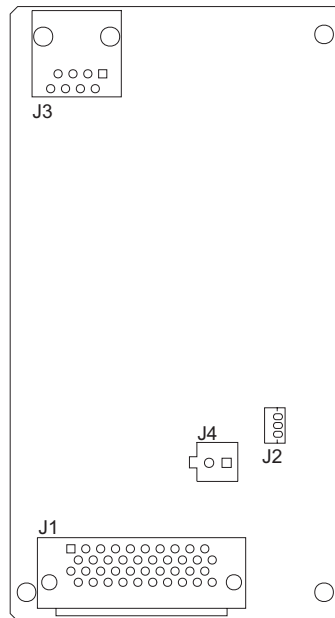
Figure 7-20. Model 8015 - Inverter Board

This illustration is for board identification purposes only and does not represent the board's component layout.



Figure 7-21. Models 8000 and 8015 - Isolated RS-232 Board

This illustration is for board identification purposes only and does not represent the board's component layout.

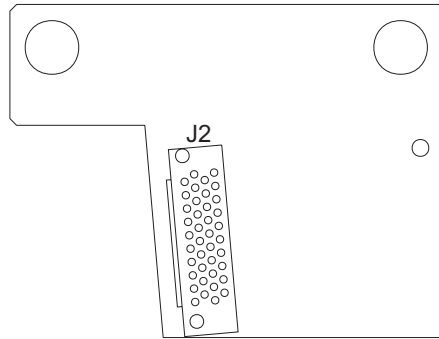


ILLUSTRATED PARTS BREAKDOWN

Figure 7-22. Model 8000 and 8015 - IUI Boards

This illustration is for board identification purposes only and does not represent the board's component layout.

Left



Right

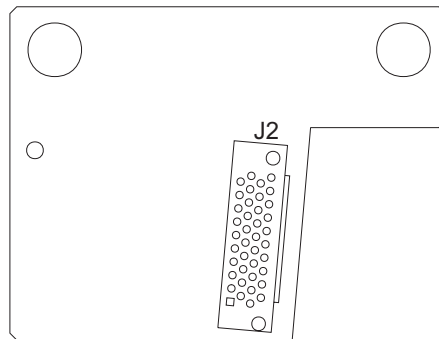
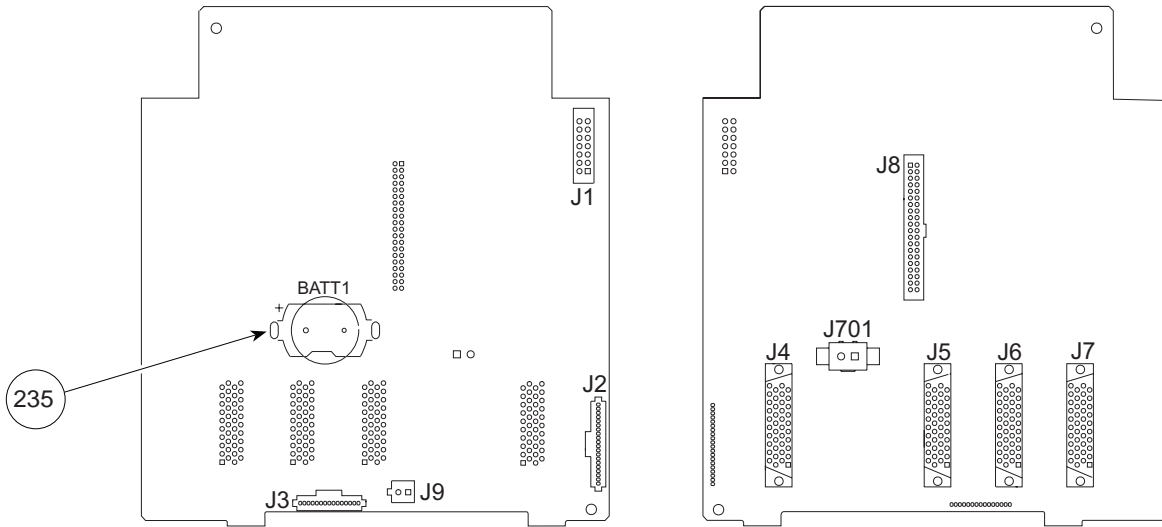


Figure 7-23. Model 8000 - Logic Board

This illustration is for board identification purposes only and does not represent the board's component layout.



ILLUSTRATED PARTS BREAKDOWN

Figure 7-24. Model 8015 - Logic Board

This illustration is for board identification purposes only and does not represent the board's component layout.

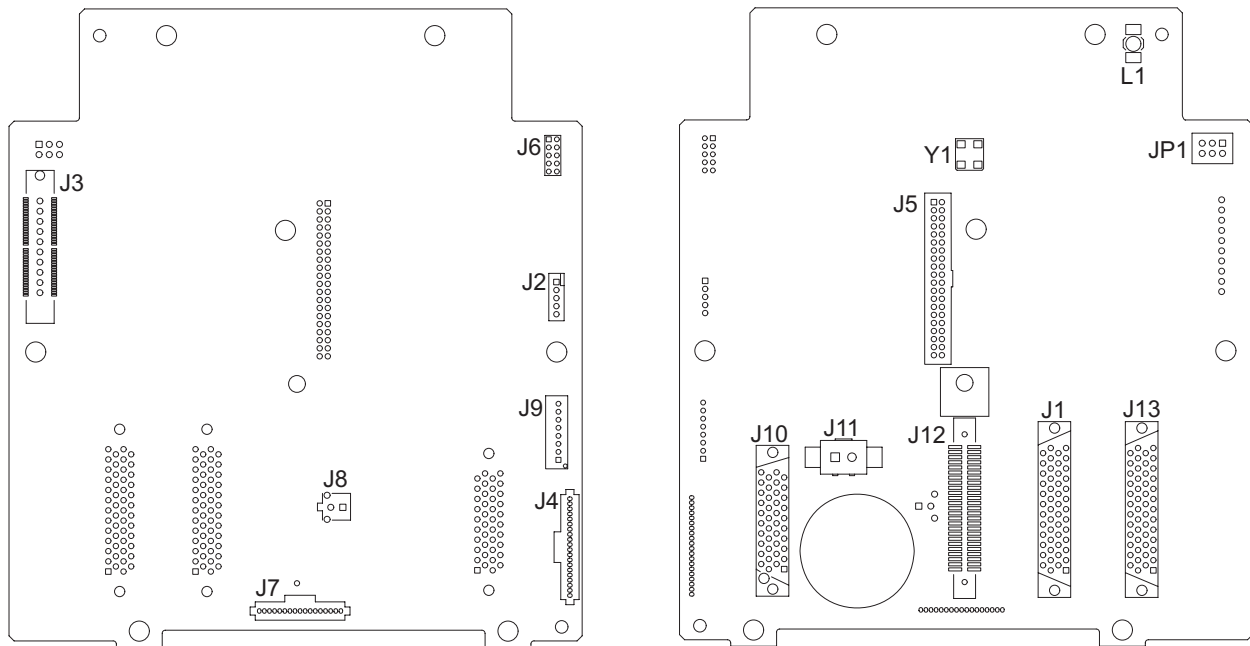
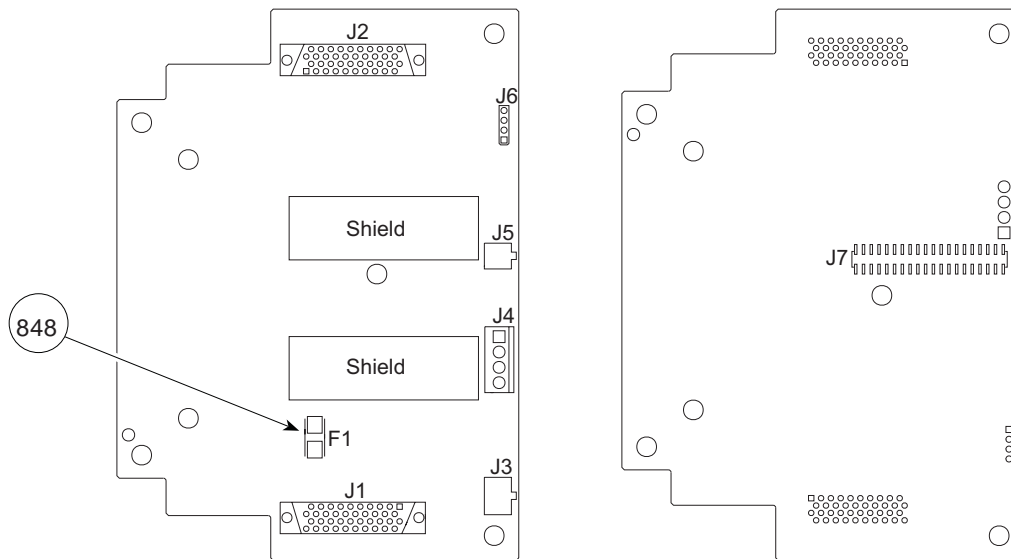


Figure 7-25. Models 8000 and 8015 - Power Supply Board

This illustration is for board identification purposes only and does not represent the board's component layout.



When replacing a Power Supply Board, ensure the replacement board is shielded (as illustrated above).

ILLUSTRATED PARTS BREAKDOWN

Table 7-2. Parts List - Model 8100

If the part description does not identify a model usage, the part is for both Models 8000 and 8015.

NOTE: An "assembly" is a preassembled group of parts. A "kit" is a group of unassembled parts.

Item	Part Number	Description	QTY
018	142794-000	Foot, Rubber	2
220	TC10003056	Harness Assembly, Door	1
221	TC10004247	Latch Pivot	1
261	320108	O-Ring, 0.859 x 0.139, 40 Durometer	1
280	146195-000	Motor Mount	1
370	147930-000	Door Cover	1
410	146173-001	IUI Bracket	1
412	TC10004632	Board Assembly, Display	1
414	806112	Snap Rivet, 0.125 Diameter, Black Nylon	4
420	320129	Cable, 50-Pin Dual Assembly	1
421	320789	Standoff, $\frac{3}{16}$ Hex, 4-40, F-F, 1.67"	1
422		Board Assembly, Motor Controller ①	1
	145496-101	Motor Controller Board (new style connector)	
	148300-100	Motor Controller Board / Motor Kit (new style connector)	
423	148035-001	Retainer Clip	2
442	10013081	Membrane Frame Assembly	1
443	321112	Retainer Cap (Logic Board J8 Connection)	1
444	146332-100	Harness Assembly, Pressure Transducer	1
445	148052-000	Washer, Custom	1
451	320907	Torsion Spring, Latch	1
470	TC10003553	Board Assembly, Logic	1
480	143404-000	Torsion Bearing	1
482		Motor Assembly ①	1
	146465-000	Motor Assembly (old style connector)	
	146465-001	Motor Assembly (new style connector)	
488	②	Silicone Grease, Dow Corning Molykote (or equivalent)	As Required
525	142815-000	Gasket, AIL Sensor Assembly	1
600	125569	Serial Number Replacement Label	1

Table 7-2. Parts List - Model 8100 (Continued)

Item	Part Number	Description	QTY
643	10012610	Label, Patent	1
750	143715-100	Pressure Sensor Assembly	1
800	320851	Screw, 4-40 x ⁵ / ₁₆ , PHL PNH	2
815	320849	Screw, 4-40 x ³ / ₁₆ , PHL PNH	1
825	320850	Screw, 4-40 x ³ / ₈ , PHL PNH	4
830	320855	Screw, 6-32 x ⁷ / ₁₆ , PHL PNH	6
831	304319	Screw, 4-40 x ¹ / ₄ , PHL PNH (stainless steel)	3
832	320848	Screw, 4-40 x ³ / ₁₆ , PHL Truss Head	4
833	320908	Washer, Flat, 0.146 x 0.27 x 0.03 Thick	1
2000	147082-100	Hardware / Parts Kit (Consists of various quantities of most commonly used parts and hardware.)	1
2001	147083-102	Air-in-Line (AIL) Assembly / Gasket Kit	1
2002	147093-100	Silicone Tubing (10 Ft) (This 10-foot length of tubing is enough for 3 Pump Modules.)	
2003	147085-100	Door Latch Kit (Consists of: Door Latch Assembly, Latch Pivot, Torsion Spring)	1
2004	147086-102	Door Assembly (Keypad / Status Indicator / Door Harness / Door Assembly)	1
2005	147087-100	Pinion Gear / Coupling Assembly	1
2007	10015248	Bezel Assembly (Camshaft Assembly / Mechanism Frame Assembly / Bezel Assembly)	1
2015	148438-100	Platen / Spring Hinge Assembly	1
2104	10013325	Rear Case Assembly Kit (Consists of: Rear Case, Nameplate Label, Kapton Tape, and items 600, 643, 2002. All items are attached except item 600.)	1
2105	147080-100	Latch Kit (Consists of: Compression Spring, Latch, Leaf Spring, Support)	1
2106	320079	Fuse Block, 7.5A 125V SMD3820 (F1)	1
2107	147077-100	IUI Connector / Gasket Kit, Right	1
2108	147078-100	IUI Connector / Seal Kit, Left	1

ILLUSTRATED PARTS BREAKDOWN

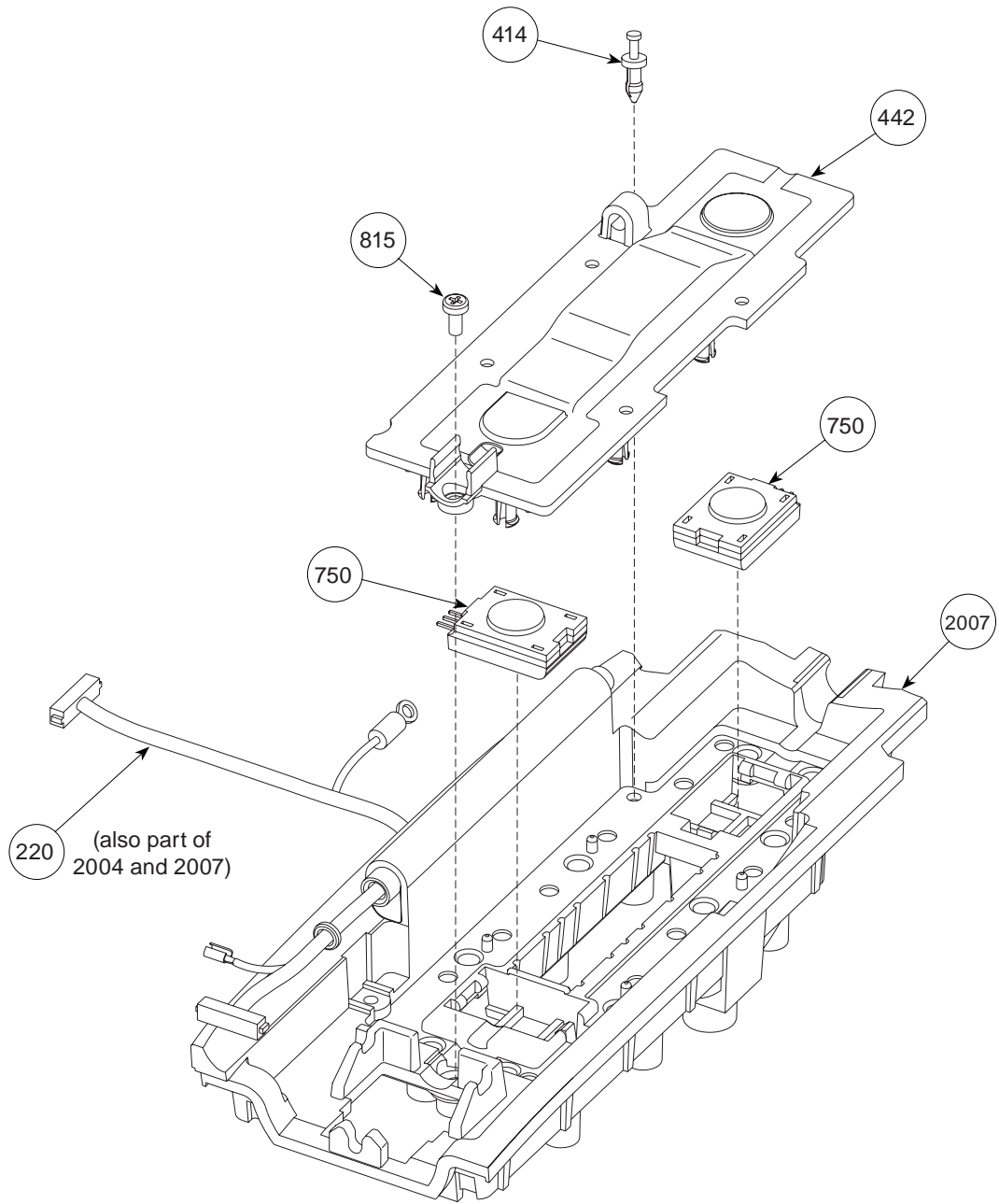
Table 7-1. Parts List - Model 8100 (Continued)

Item	Part Number	Description	QTY
----	147192-001	Set Compatibility Card	
----		Maintenance Software:	
		v7 Alaris® System:	
	10013678	Software (includes User Manual on CD)	
	10013552	User Manual, Printed Copy	
		v8 Alaris® System:	
	10014583	Software (includes User Manual on CD)	
	10012637	User Manual, Printed Copy	
----		Directions for Use:	
		v7 Model 8100:	
	10010716	Printed Copy	
		v8 Alaris® System with Model 8000:	
	10014676	Printed Copy	
	10014677	Electronic (CD) Copy	
		v8 Alaris® System with Model 8015:	
	10014674	Printed Copy	
	10014675	Electronic (CD) Copy	

① Before ordering, see "Corrective Maintenance" chapter for interchangeability information.

② Not sold by Cardinal Health.

Figure 7-26. Model 8100 - Membrane to Bezel Assembly



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Figure 7-27. Model 8100 - Motor and AIL Sensor Assembly

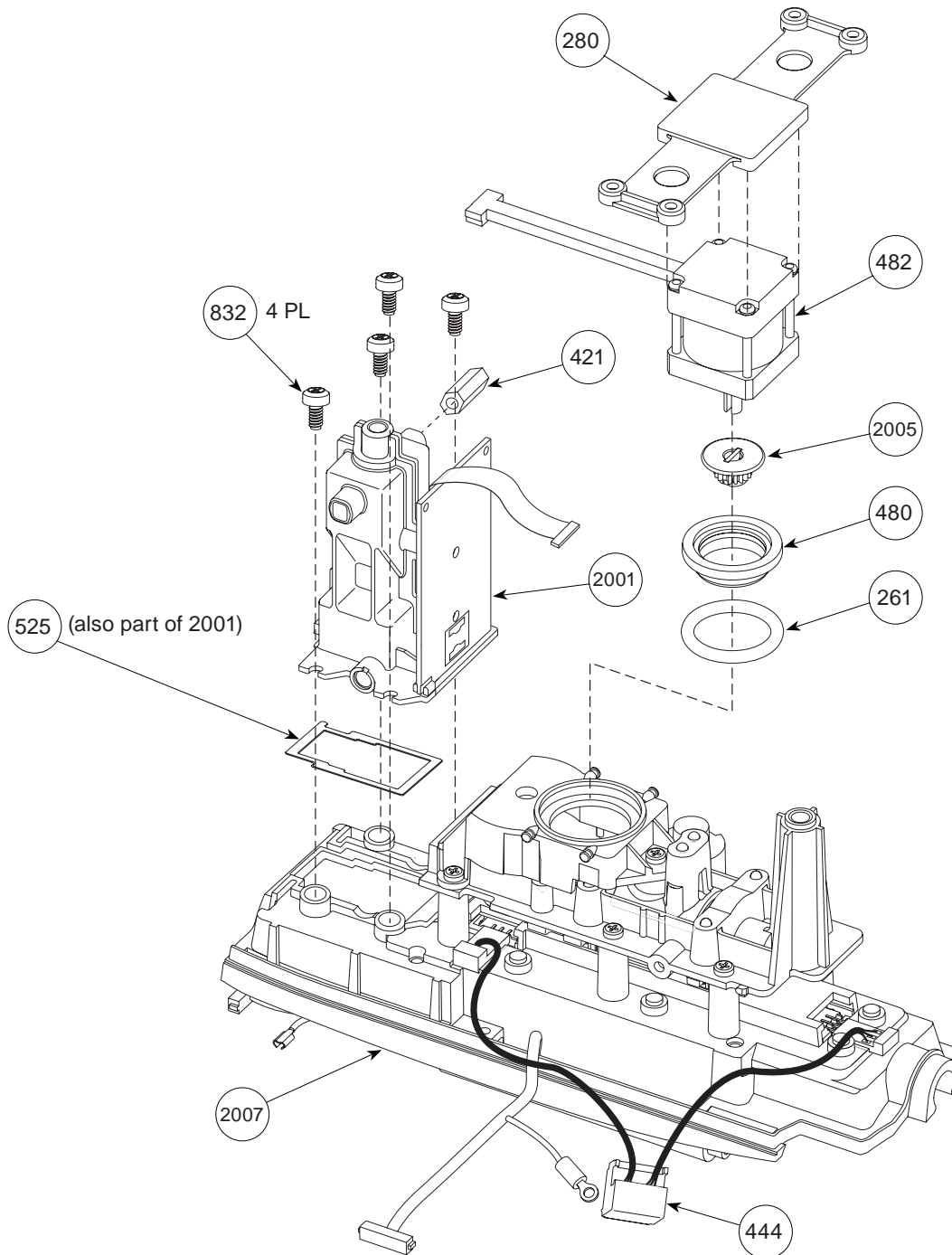


Figure 7-28. Model 8100 - Logic Board and Motor Controller Board Assembly

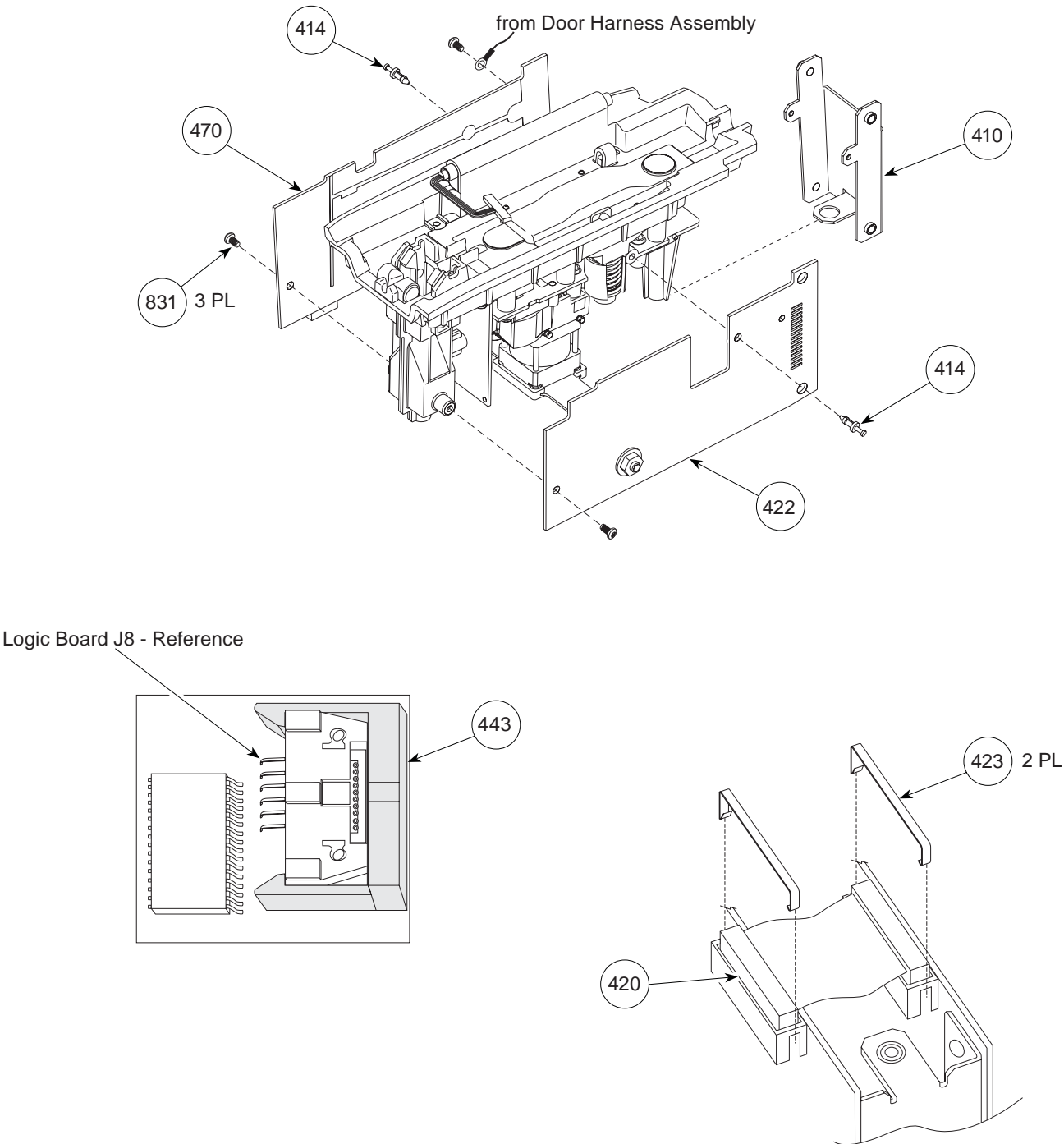


Figure 7-29. Model 8100 - Platen Assembly

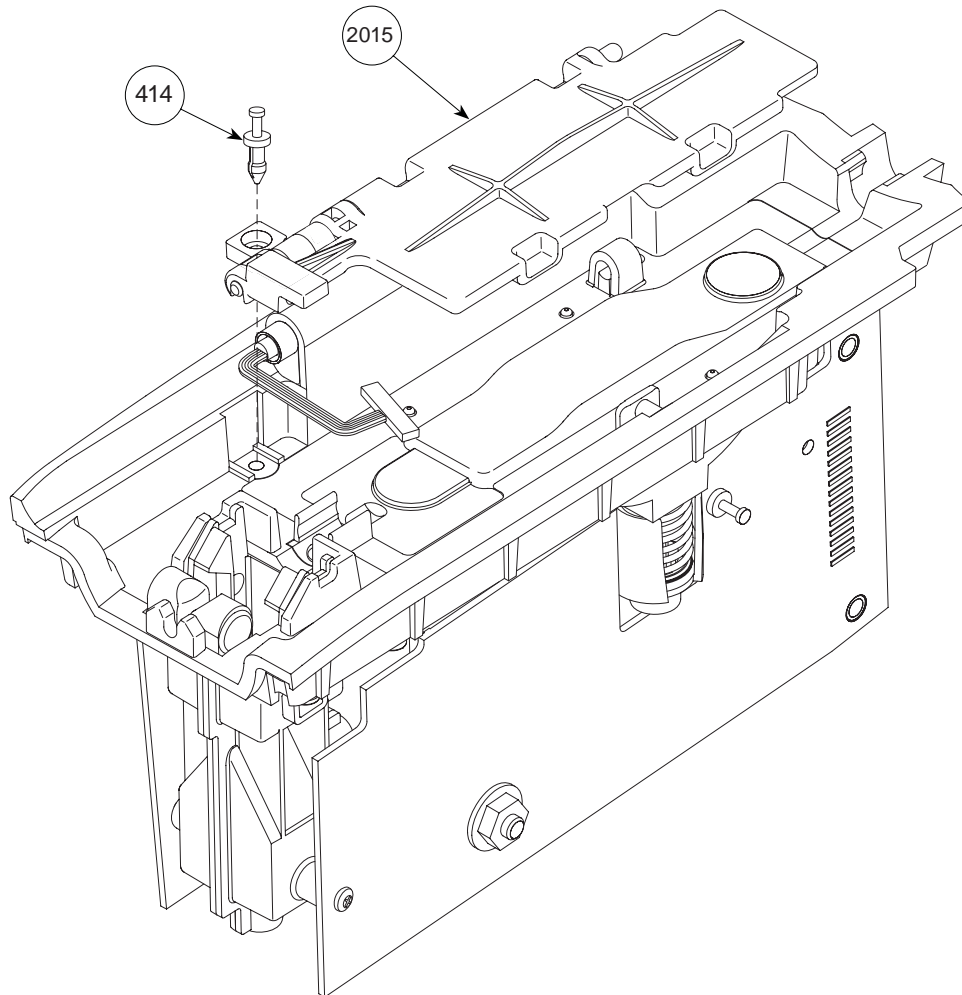
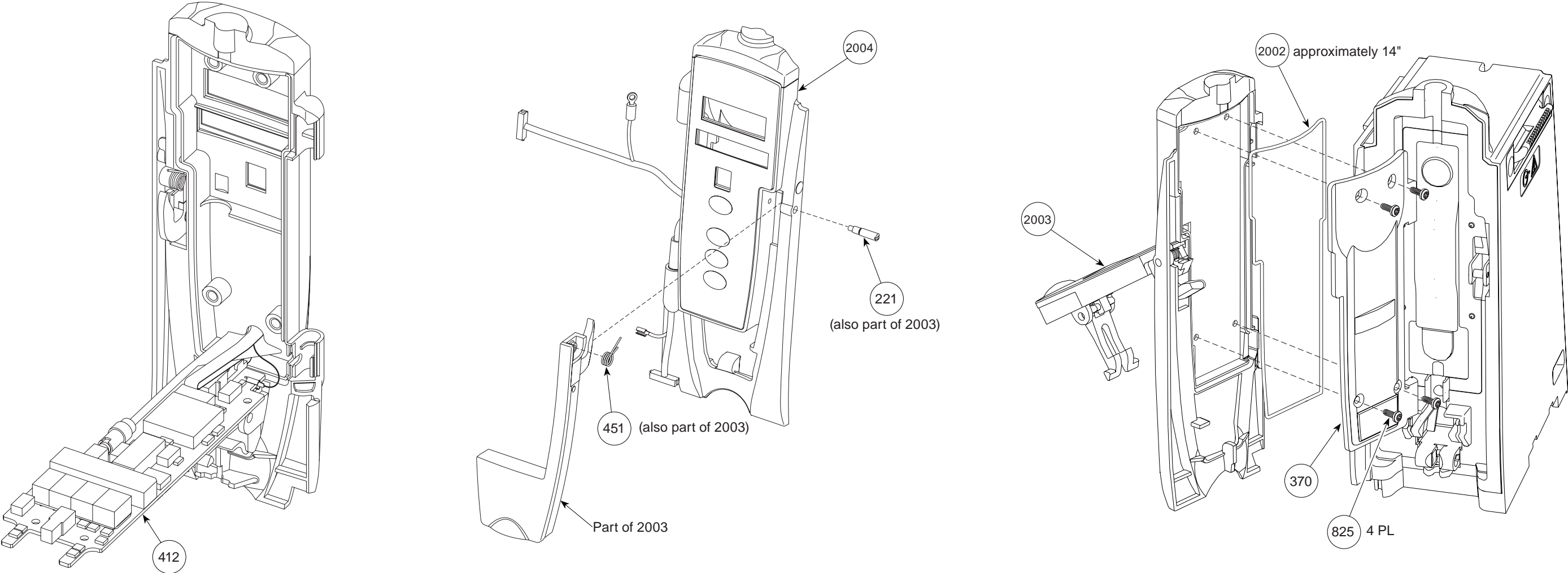
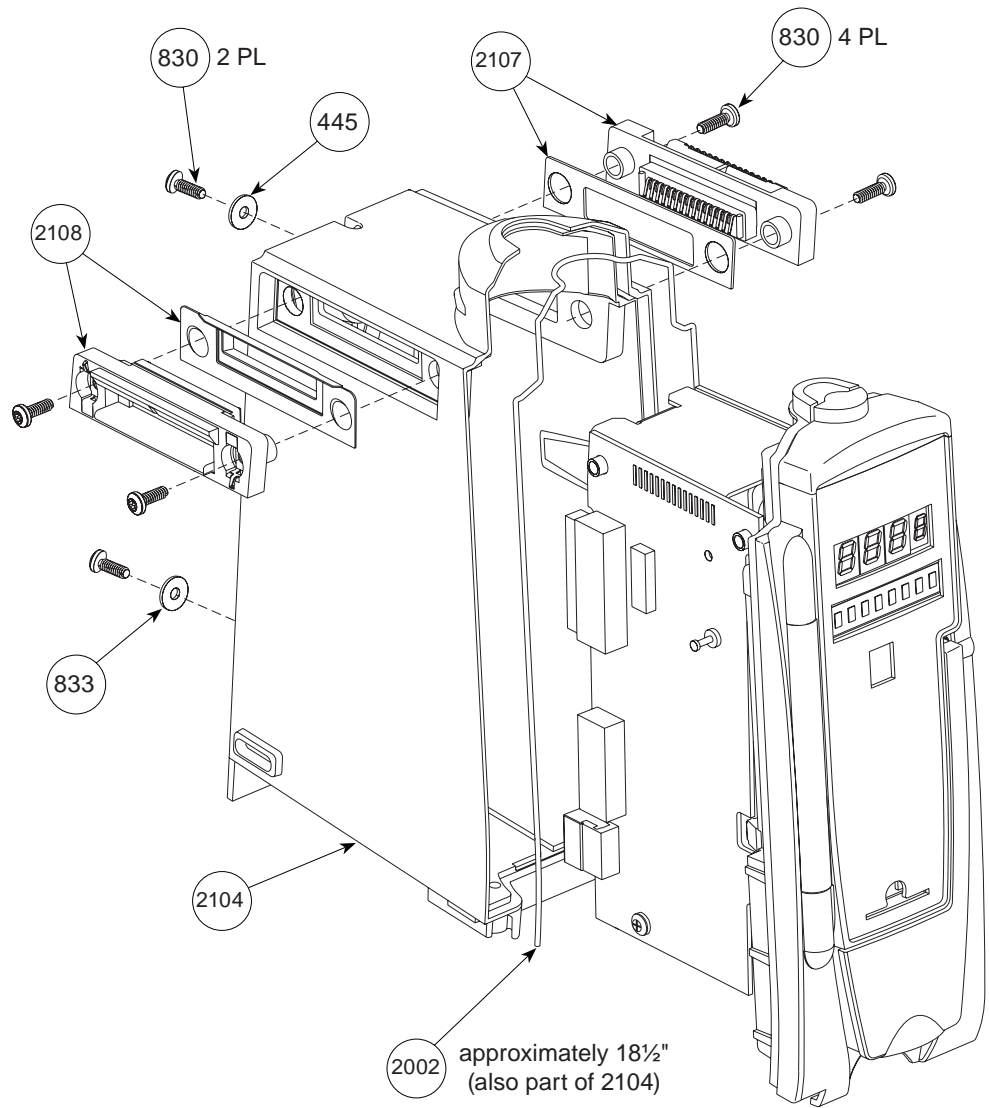


Figure 7-30. Model 8100 - Door and Display Board Assembly



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Figure 7-31. Model 8100 - Rear Case and UII Connectors



ILLUSTRATED PARTS BREAKDOWN

Figure 7-32. Model 8100 - Latch and Feet Assembly

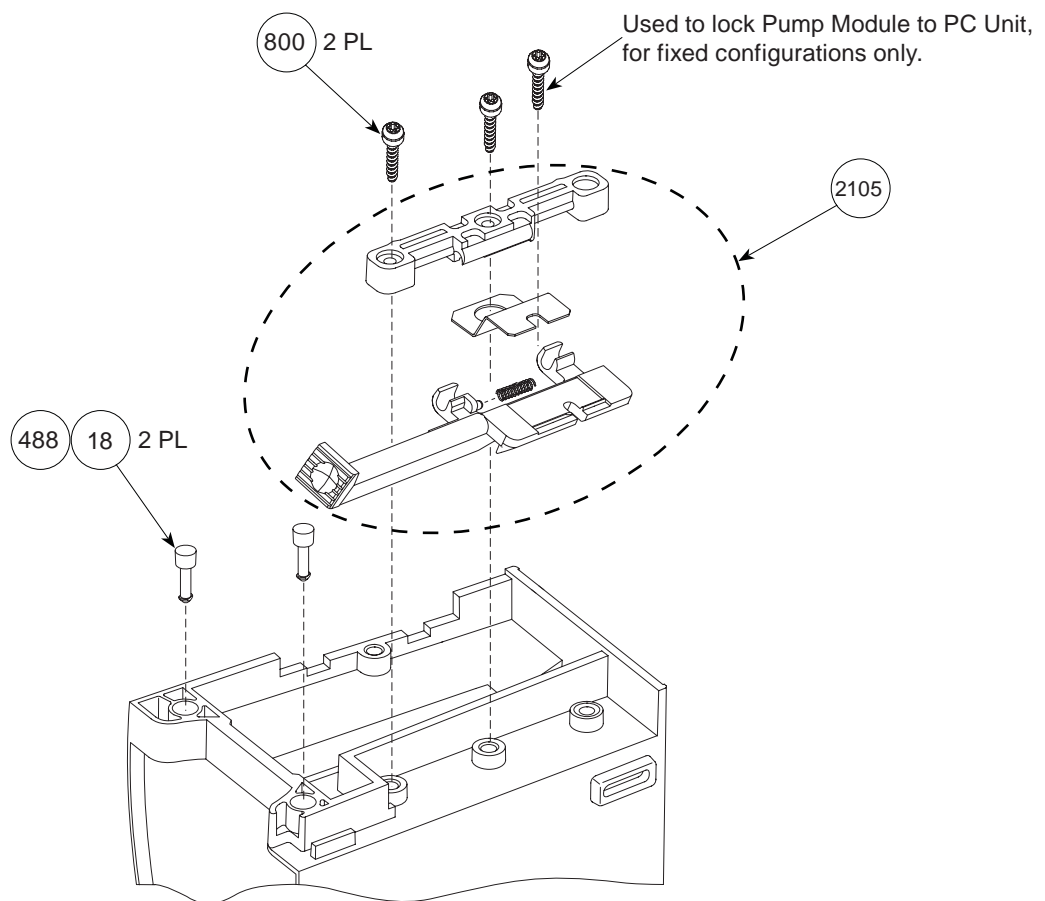
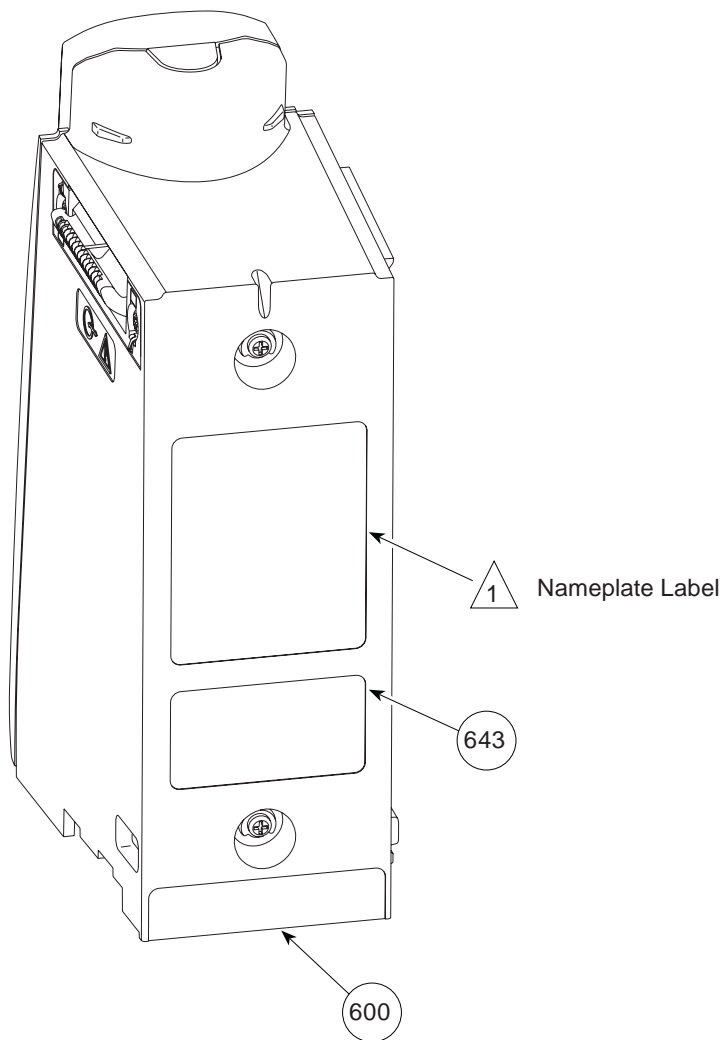


Figure 7-33. Model 8100 - Label Locations

- 1 Nameplate Label, which has a regulatory mark, is not field replaceable as an individual item. It is available only as part of Rear Case Assembly Kit (item 2104).



ILLUSTRATED PARTS BREAKDOWN

Figure 7-34. Model 8100 - AIL Board

This illustration is for board identification purposes only and does not represent the board's component layout.

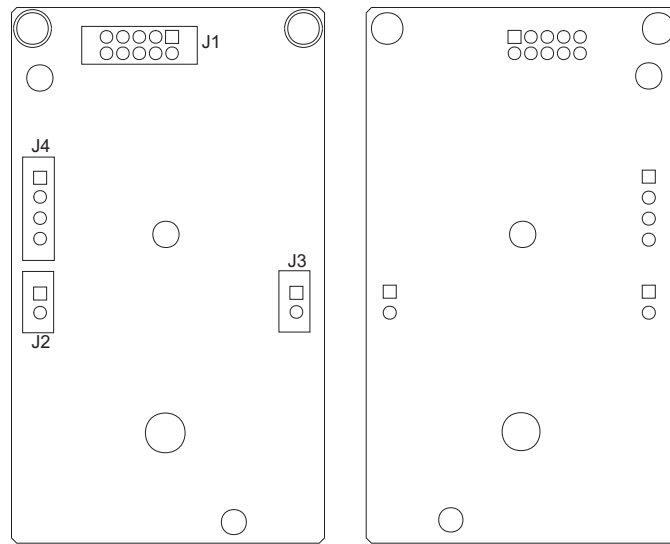
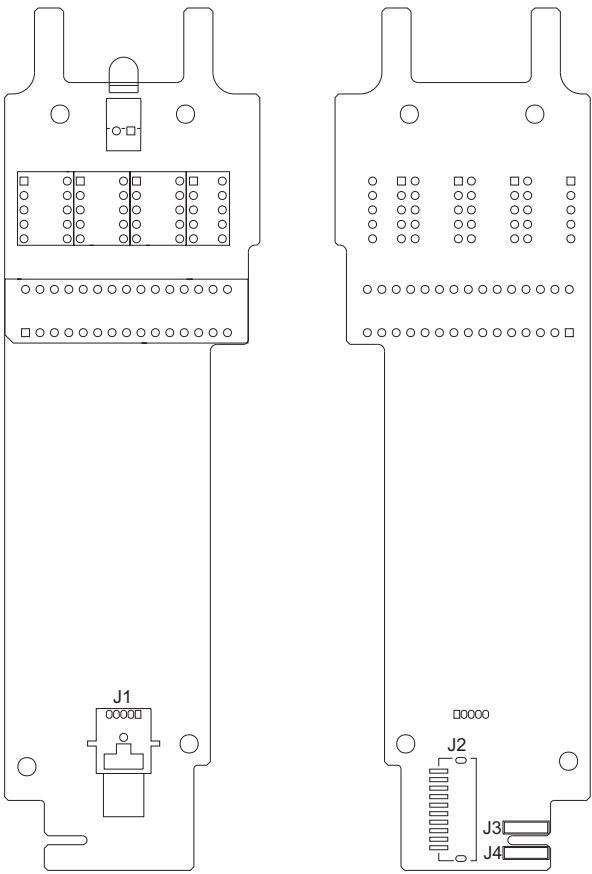


Figure 7-35. Model 8100 - Display Board

This illustration is for board identification purposes only and does not represent the board's component layout.



ILLUSTRATED PARTS BREAKDOWN

Figure 7-36. Model 8100 - Logic Board

This illustration is for board identification purposes only and does not represent the board's component layout.

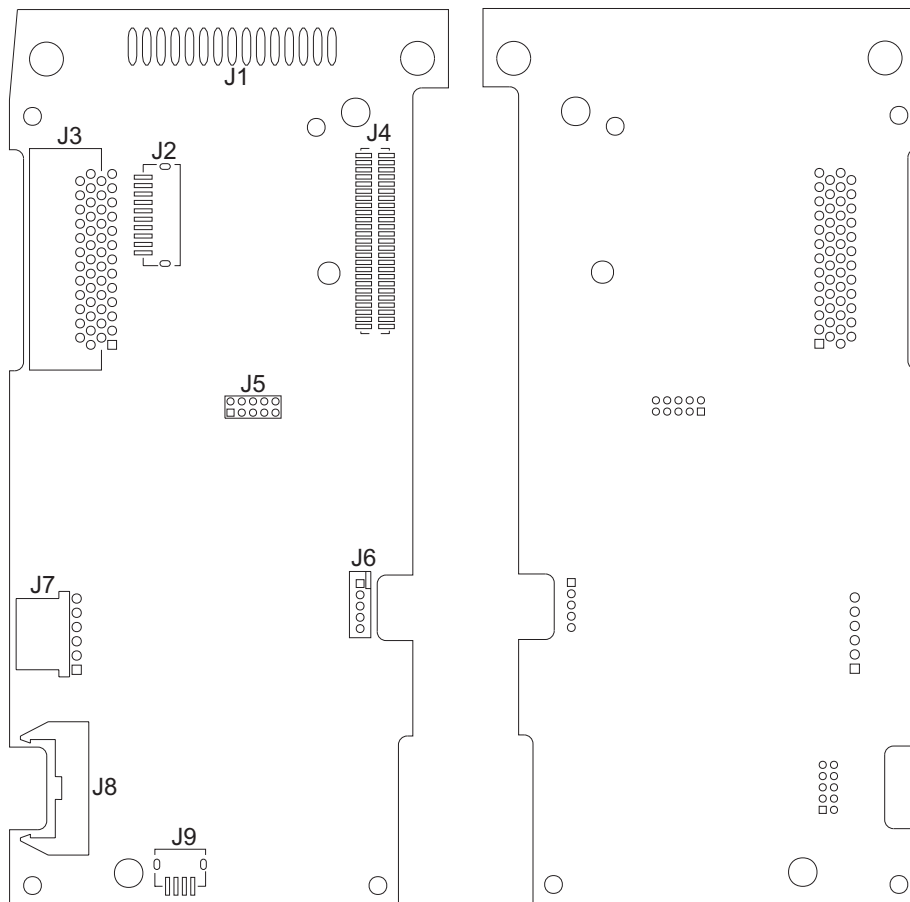
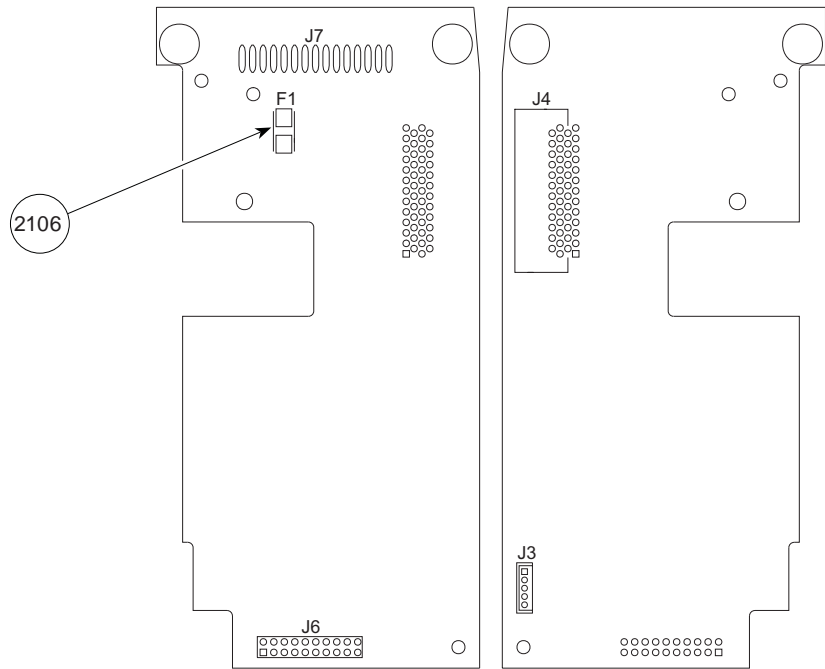


Figure 7-37. Model 8100 - Motor Controller Board

This illustration is for board identification purposes only and does not represent the board's component layout.



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