GE Healthcare

MAC™ 3500
Resting ECG Analysis System

Version 9D

Service Manual

2021337-036 Revision L

The information in this manual applies only to MAC™ 3500 Resting ECG Analysis Systems with product code **SCA**. It does not apply to earlier software versions. Due to continuing product innovation, specifications in this manual are subject to change without notice.

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1   Introduction

For your notes

Manual Information

Revision History

Each page of the document has the document part number and revision letter at the bottom of the page. The revision letter identifies the document's update level. The revision history of this document is summarized in the table below.

Table 1. Revision History, PN 2021337-036		
Revision	**Date**	**Comment**
A	1 August 2006	Initial release of document.
B	14 December 2006	Added FRUs for MobileLink Silex serial server.
C	1 February 2007	Edited EMC section for IEC 60601-2-51 compliance.
D	10 October 2008	Added -007 board, 009C SD Card and -002 Comm PC board. Included Functional Checkout Procedure.
E	08 January 2010	Added PN 2022328-002 PCB MAC 3500 CAMV2.
F	10 May 2010	Revised security on electronic file.
G	12 December 2010	Revised to add service disclaimer addendum.
H	14 August 2012	Added 2022332-003 to Parts List.
J	19 June 2013	Updated for the new CPU (801212-008), communcations board (2022332-004) , and display assembly (2026799-002).
K	21 February 2014	Updated several part numbers with new ROHS-compliant versions.
L	15 February 2019	• Updated to remove CE markup. • Updated to remove Authorized European representative. • Added the Instructions for Use. • Updated UL symbol.

Manual Purpose

This manual supplies technical information for service representative and technical personnel so they can maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repairs considered field repairable. Where necessary the manual identifies additional sources of relevant information and or technical assistance.

See the operator's manual for the instructions necessary to operate the equipment safely in accordance with its function and intended use.

Intended Audience

This manual is intended for the person who uses, maintains, or troubleshoots this equipment.

Related Documentation

The following documents are referenced in this manual and provide additional information that may be helpful in the installation, configuration, maintenance, and use of this product.

Part Number	Title
2021337-035	MAC™ 3500 Resting ECG Analysis System Operator Manual
2036070-006	Marquette™ 12SL™ ECG Analysis Program Physician's Guide
2020299-021	MobileLink™ Wireless Communications Installation Manual
2025521-001	KISS™ Multilead Operator's Manual
2020299-025	LAN Option for MAC™ Resting ECG Systems Installation and Troubleshooting Guide
2044854–112	Modular MAC™ ECG Trolley Service Manual
2056914–001	Modular MAC™ ECG Trolley Assembly Instructions (US)
2056914–002	Modular MAC™ ECG Trolley Assembly Instructions (Non-US)

Warnings, Cautions, and Notes

The terms danger, warning, and caution are used throughout this manual to point out hazards and to designate a degree or level or seriousness. Familiarize yourself with their definitions and significance.

Hazard is defined as a source of potential injury to a person.

Term	Definition
DANGER	Indicates an imminent hazard which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product/property damage.
NOTE	Provides application tips or other useful information to assure that you get the most from your equipment.

Safety Messages

Additional safety messages may be found throughout this manual that provide appropriate safe operation information.

DANGER

Do not use in the presence of flammable anesthetics.

WARNINGS

This is Class 1 equipment. The mains plug must be connected to an appropriate power supply.

Operate the unit from its battery if the integrity of the protective earth conductor is in doubt.

CAUTIONS

This equipment contains no serviceable parts. Refer servicing to qualified service personnel.

U.S. Federal law restricts this device to the sale by or on the order of a physician.

Responsibility of the Manufacturer

GE Medical Systems *Information Technologies* is responsible for the effects of safety, reliability, and performance only if:

◆ Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by us.

◆ The electrical installation of the relevant room complies with the requirements of the appropriate regulations.

◆ The equipment is used in accordance with the instructions for use.

General

The intended use of this device is to record ECG signals from surface ECG electrodes. This device can analyze, record, and store electrocardiographic information from adult and pediatric populations. This data can then be computer analyzed with various algorithms such as interpretive ECG and signal averaging for presentation to the user.

This device is intended for use under the direct supervision of a licensed health care practitioner.

Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

To ensure patient safety, use only parts and accessories manufactured or recommended by GE Healthcare.

Contact GE Healthcare for information before connecting any devices to this equipment that are not recommended in this manual.

If the installation of this equipment, in the USA, will use 240 V rather than 120 V, the source must be a center-tapped, 240 V, single-phase circuit.

Parts and accessories used must meet the requirements of the applicable IEC 60601 series safety standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.

The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

◆ use of the accessory in the PATIENT VICINITY; and

◆ evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.

Equipment Symbols

The following symbols may appear on the product or its packaging.

Type BF equipment. The acquisition module is protected from defibrillation shocks.

Alternating current.

Equipotential.

Charge the battery. The flashing amber LED next to this symbol indicates you must connect the system to AC power to re-charge the battery.

LAN port for connecting an Ethernet cable with a standard RJ-45 jack.

Internal modem port for connecting a phone line with a standard RJ-11 jack.

Do NOT throw the battery into the garbage.

Recycle the battery.

Consult accompanying documents.

This position of the switch removes battery power from the equipment.

Classified with respect to electric shock, fire, mechanical, and other specified hazards only in accordance with UL 60601-1, CAN/CSA C22.2 No. 601-1, CAN/CSA C22.2 No. 601-2-25, EN 60601-2-25, EN 60601-1-1, IEC 60601-1-2: 2001.

To reduce the risk of electric shock, do NOT remove cover (or back). Refer servicing to qualified personnel.

This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

This product consists of devices that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws. (Within this system, the backlight lamps in the monitor display contain mercury.)

Manufacturer name and address.

Consult instructions for use.

PCT. GOST marking symbolizing conformity with applicable Russian Gosstandart technical and safety standards.

Service Information

Service Requirements

Refer equipment servicing to GE authorized service personnel only. Any unauthorized attempt to repair equipment under warranty voids that warranty.

It is the user's responsibility to report the need for service to GE or to one of their authorized agents.

Equipment Identification

The serial number label is located inside the device as shown in the following illustration.

SERIAL NUMBER
LABEL
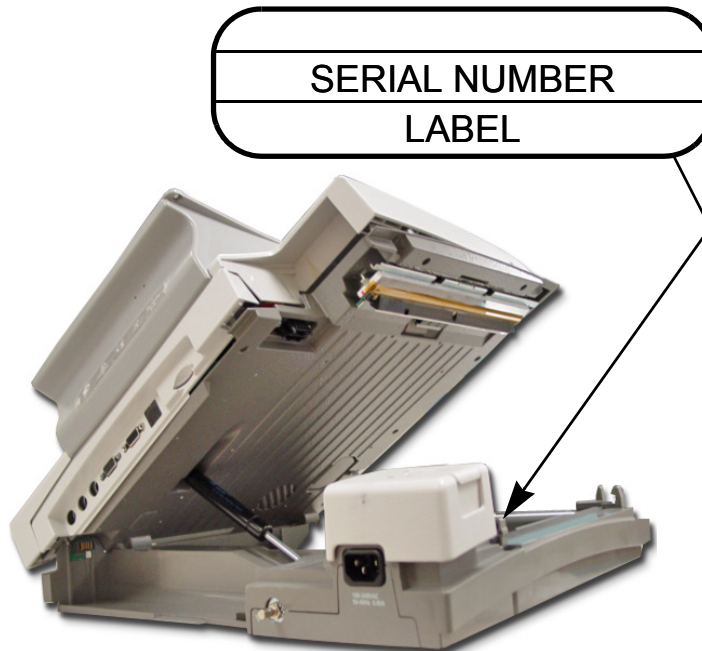
9A

Every GE Healthcare device has a unique serial number for identification. The serial number is formatted as shown in

NOTE

The examples shown are representative only. Your product label may differ.

Serial Number Format

#

A   B   C   D   E   F
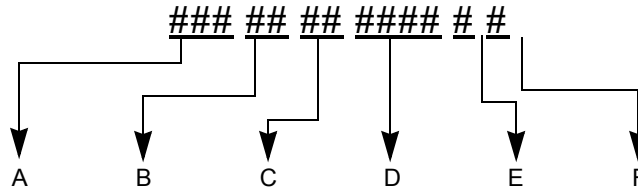
Table 2. Serial Number Format

A	[1]Product code
B	Year manufactured (00-99) 06 = 2006 07 = 2007 (and so on)
C	Fiscal week manufactured
D	Production sequence number
E	Manufacturing site
F	Miscellaneous characteristic

1. The product code for the MAC 3500 described in this manual is **SCA**.

Label Format
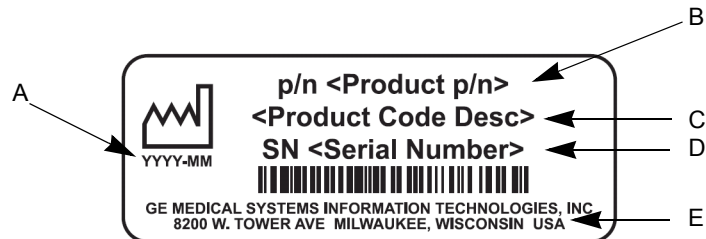
Table 3. Equipment Identification Label

A	Date of manufacture in YYYY-MM format
B	Part number of product
C	Product code description
D	Serial number (described above)
E	Manufacturing site

2   Equipment Overview

For your notes

General Description

The MAC™ 3500 Resting ECG Analysis System is a 12-lead, 12-channel system with a 6.5 inch (165 mm) diagonal display, active patient cable, and battery operation. There are also options for communication capabilities.

Side View
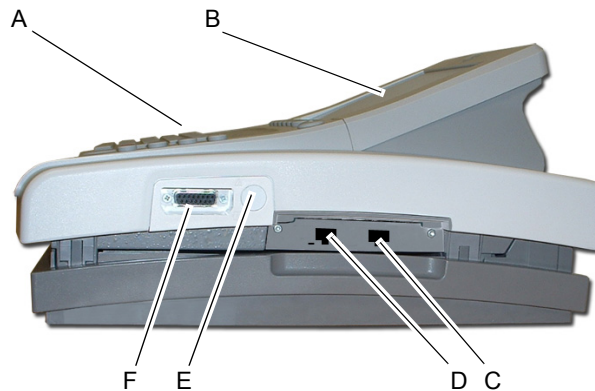
104A

	Name	Description
A	keyboard	Press the keyboard keys to control the system or to enter data.
B	display screen	View the waveform and text data.
C	modem port	Connect the telephone cable here (optional feature)
D	LAN port	Connect to the LAN here (optional feature) ■ The green LED on the right side of this port indicates a good ethernet link. ■ The amber LED on the left side of this port flashes to indicate network traffic.
E	KISS pump connector	Connect the KISS pump here (optional feature).
F	ECG signal input connector	Connect the patient cable here.

Back View
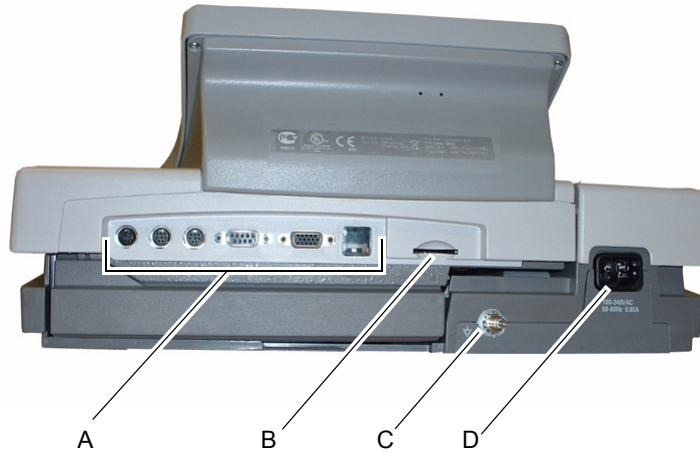
	Name	Description
A	back panel connectors	Connect peripheral devices here.
B	Secure Digital card slot	Insert Secure Digital card for external storage here.
C	ground lug	Connect non-grounded peripheral devices to ensure equipotential.
D	main AC power	Insert the main AC power cable.

Connector Identification

A   B   C   D   E   F   G   H   I
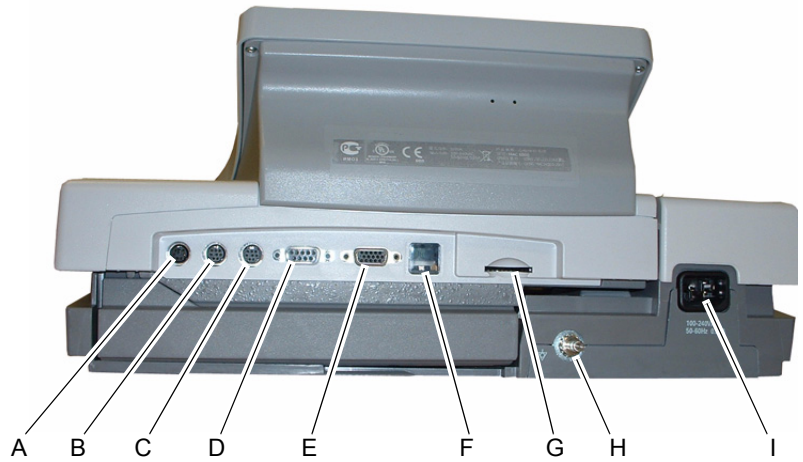
106A

WARNING
LEAKAGE CURRENT – Keep leakage current within acceptable limits when connecting auxiliary equipment to this device.

Total system leakage must not exceed 300 microamperes (United States) or 500 microamperes (international).

Table 4. Back Panel Connectors		
Item	Name	Description
A	**A**	Connect an optional card reader or optional bar code reader
B	**1**	External GE KISS pump connection.
C	**2**	Connect a local transmission cable, serial line, modem, or client bridge (wireless option).
D	**ANA/TTL**	Connect a device requiring analog data or TTL trigger (ultrasound, stress echo, ergometer, analog treadmill, blood pressure units, etc.).
E	**EXT.VID.**	Connect an external video display.
F	**IR**	Point at a MAC 5000, MAC 5500, MAC 3500, or MUSE system's **IR** transceiver to transmit or receive ECG data.
G	card slot	Insert the system card into this slot to archive or restore data from external media or to update software.

Table 4. Back Panel Connectors (Continued)		
H	ground lug	Connect non-grounded peripheral devices to ensure equipotential.
I	main AC power	Insert the main AC power cable.

3   Installation

For your notes

Introduction

This chapter describes how to assemble the MAC 5500 system and optional accessories on the optional MAC Series Trolley, and it identifies the requirements and configurations for using select devices with the ST option.

General Assembly

The following sections describes these tasks:

- Adjusting the trolley height
- Attaching the MAC device to the MAC Series trolley
- Attaching the optional external modem
- Attaching the magnetic card reader
- Attaching the bar code reader

NOTE

These instructions describe the process only for the MAC Series trolley (1). For general assembly instructions for the modular MAC trolley (2), refer to the Modular MAC Trolley Assembly Instructions identified in "Related Documentation" on page 1-4.
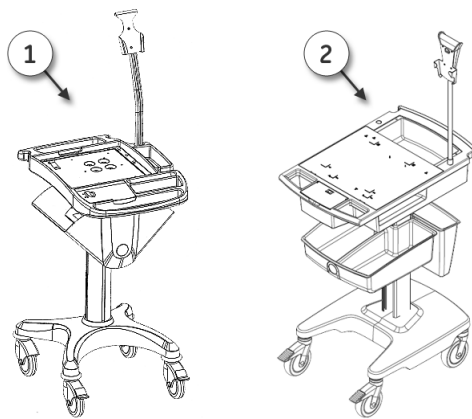
Use the following photograph of a complete assembly as a reference when attaching the optional accessories.

MAC 3500

Patient Cable
Arm and Holder

Front Cover

Trolley
Serial Number

Locking
Casters

Swivel
Casters
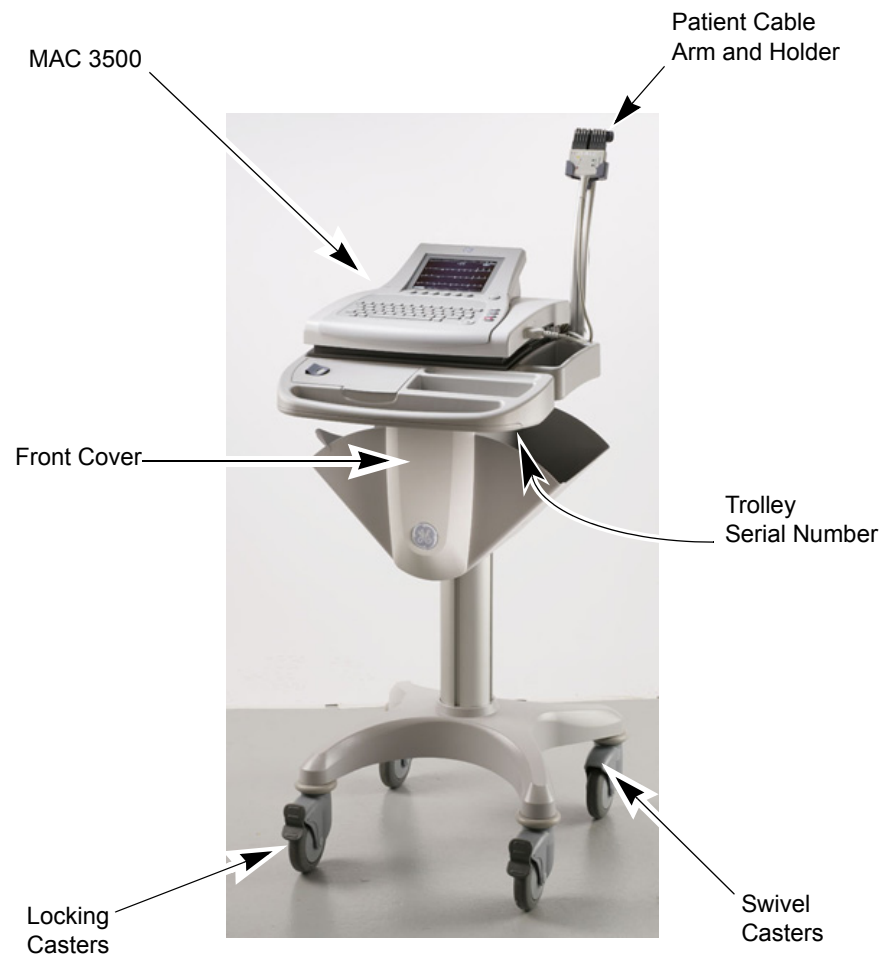
105A

NOTE

Because the optional trolley is made by another vendor for GE, the serial number format is different from that shown in "Serial Number Format" on page 1-10.

Trolley Height Adjustment

The optional MAC 3500 Trolley can be assembled for one of two heights, 92.07 cm (36.25 inches) or 84.45 cm (33.25 inches). The trolley is normally shipped at the 92.07 cm (36.25 inches) height but can be changed to fit your needs. To change to the lower height, use the following steps:

1. Tip the trolley on its side and using a 1/2-inch socket, remove the 4 outer 1/2-inch bolts and slide the base assemble up on the column.
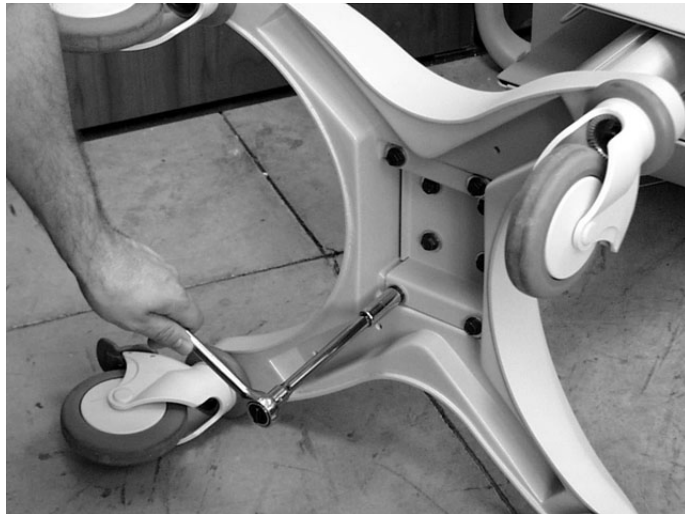
107A

2. Remove the remaining bolts and mounting plate.
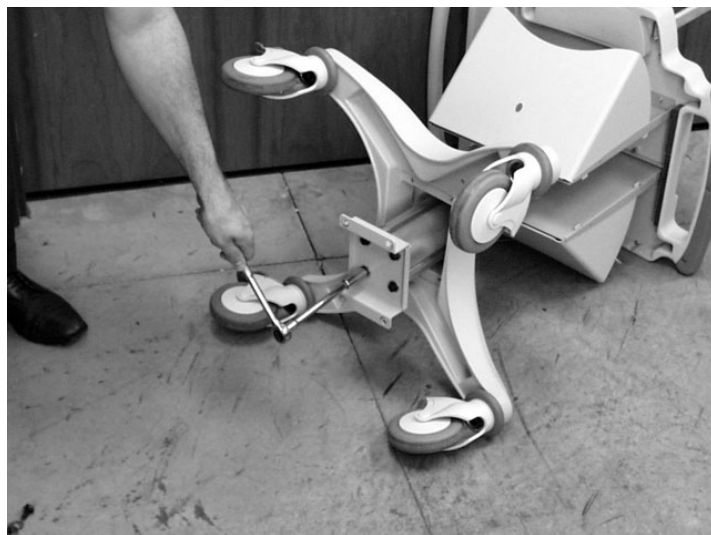
108A

3. Flip the mounting plate and reverse the procedure.

CAUTION

Do not over tighten. Over tightening the bolts may cause them to strip.

109A

110A

Installing the MAC™ 3500 Resting ECG Analysis System

To secure the MAC 3500 to the trolley assembly, follow these steps:

1. Lock the wheels to prevent the trolley from rolling.
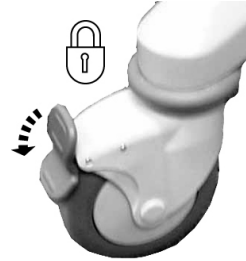
111A

2. Remove the end panel by pulling out and up.

112A

3. Place the unit on the trolley surface, then slide it on until the unit is firmly in place and under the tab at the rear of the on the tray.

4A

4. Secure the MAC 3500 to the trolley by tightening the three captive screws located under the trolley tray.
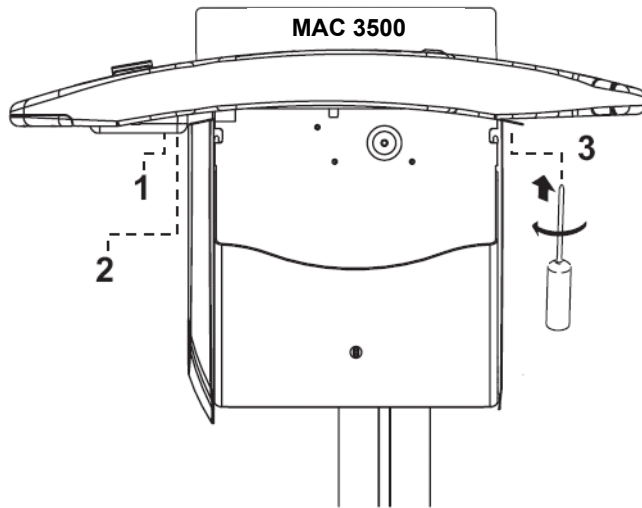
5. Replace the end panel by pushing up and in until you hear a snap.

6. Unlock the wheels to allow free movement of the trolley.
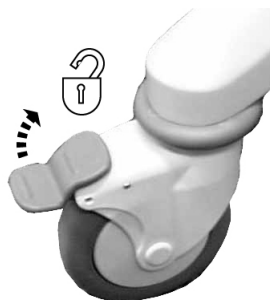
Installing the Optional External Modem Kit

NOTE

The internal modem is standard for the MAC 3500.

The modem and its mounting bracket comes assembled and ready to install on the trolley. To install a modem kit on the trolley, complete the following steps:

1. Find the modem mounting site located under the patient cable arm at the rear of the trolley where the kit is to be installed.
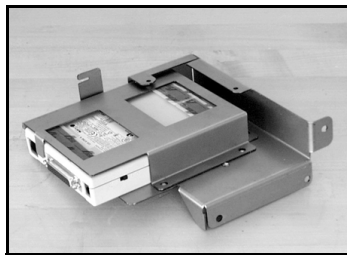
115A, 116A

2. Slide the assembly up in place so that the bracket slot catches on the bracket lip.

117A

3. Tighten the three mounting screws to secure the modem to the trolley.

118A

4. Plug the modem cable into connector port **2** on the MAC 3500.

30A

5. Refer to the operator's manual for information on using the modem.

Magnetic Card Reader Installation

The magnetic card reader and its mounting bracket are assembled and ready to install on the trolley. Parts are included for two different trolley styles. Disregard and do not use the parts indicated in the following illustration.

Do Not Use
These Parts on
new style trolley

Card Reader
Assembly
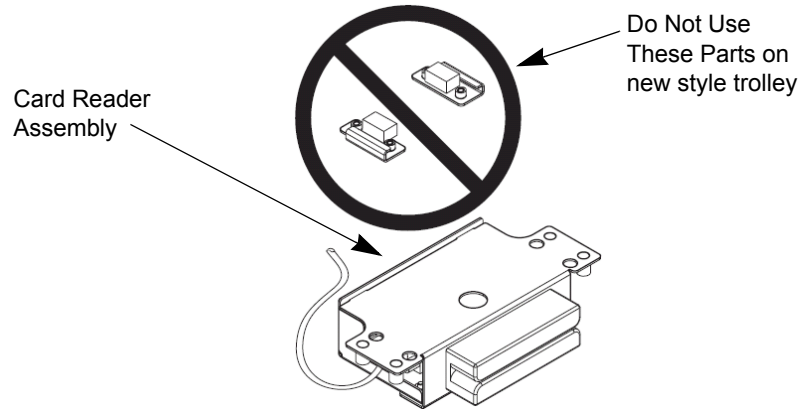
119A

To install the magnetic card reader and its mounting bracket on the trolley, complete the following steps:

1. Remove both end panels by pulling out and up at the bottom.

112A

2. Using a Phillips screw driver, fasten the card reader assembly under the front handle. Align with holes provided under front handle.

120A

3. Route the cable around the trolley column towards the rear as shown below.

Cable Routing

Rear View
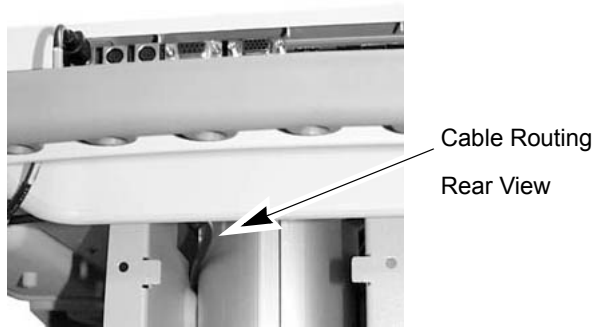
34A

4. At the front, hold the cable to the side so it clears the front panel as you replace the panel.

77A

5. Plug the cable connector into port **A** then replace the back panel.

70A

6. Refer to the MAC 3500 Operator's Manual for information on using the Magnetic Card Reader.

Barcode Reader Installation

The barcode reader and its mounting bracket are ready to install on the trolley. To install the Bar Code Reader and its cable mounting bracket on the trolley, complete the following steps:

Barcode Reader

Cable Clamp

Cable Clamp Bracket
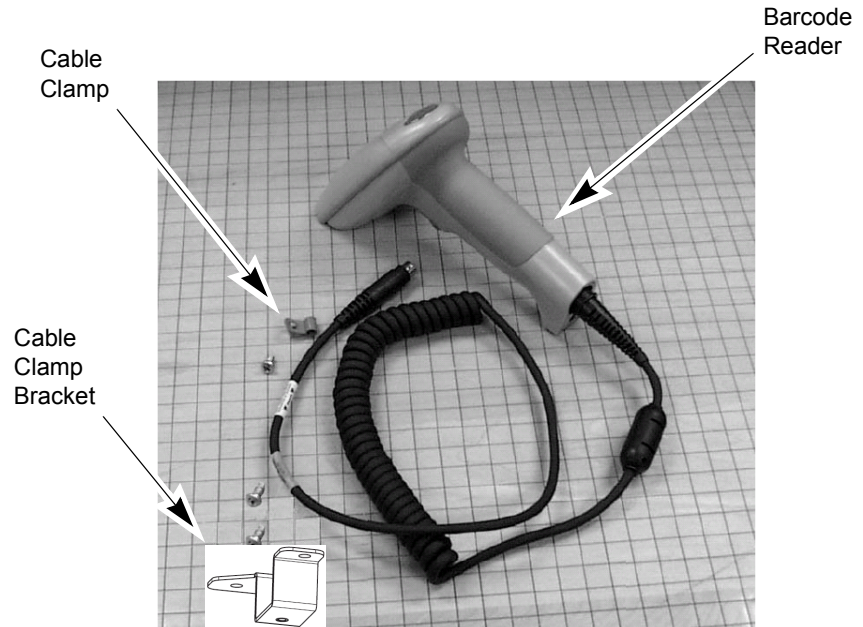
71A, 72A

1. Fasten the cable clamp bracket to the underside of the rear handle using a Phillips screw driver and the self-tapping screws provided.

   NOTE

   DO NOT overtighten. Overtightening the screw may cause the screw to strip and clamp to fail.

Cable Clamp Bracket
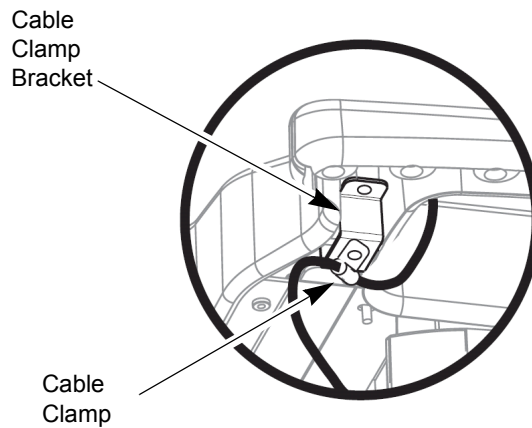
Cable Clamp

73A

2. Press the internal access button to open the MAC 3500, then plug the cable connector into port **A.** Opening the MAC 3500 before attaching the cable clamp allows you to place the correct amount of slack to free the cable from stress when the MAC 3500 needs to be re-opened.

Port A

Internal Access Button

9A

3. Next fasten the cable and clamp to the clamp bracket, then close the MAC 3500. Observe that there is enough slack to allow free movement of the cable when re-opening the MAC 3500.

Correct amount of cable slack.

Not enough cable slack.

4. Refer to the MAC 3500 Operator's Manual for information on how to use the barcode reader.

For your notes

MAC™ 3500 Resting ECG Analysis System
2021337-036

4   Troubleshooting

For your notes

Assembly Descriptions

The troubleshooting information in this chapter helps you narrow service problems to one of the replaceable assemblies. These assemblies, illustrated in the following diagrams, are discussed in more detail in the remainder of the chapter along with replacement procedures.

PCB Block Diagram

The following diagram illustrates the logical relationship of the system components.
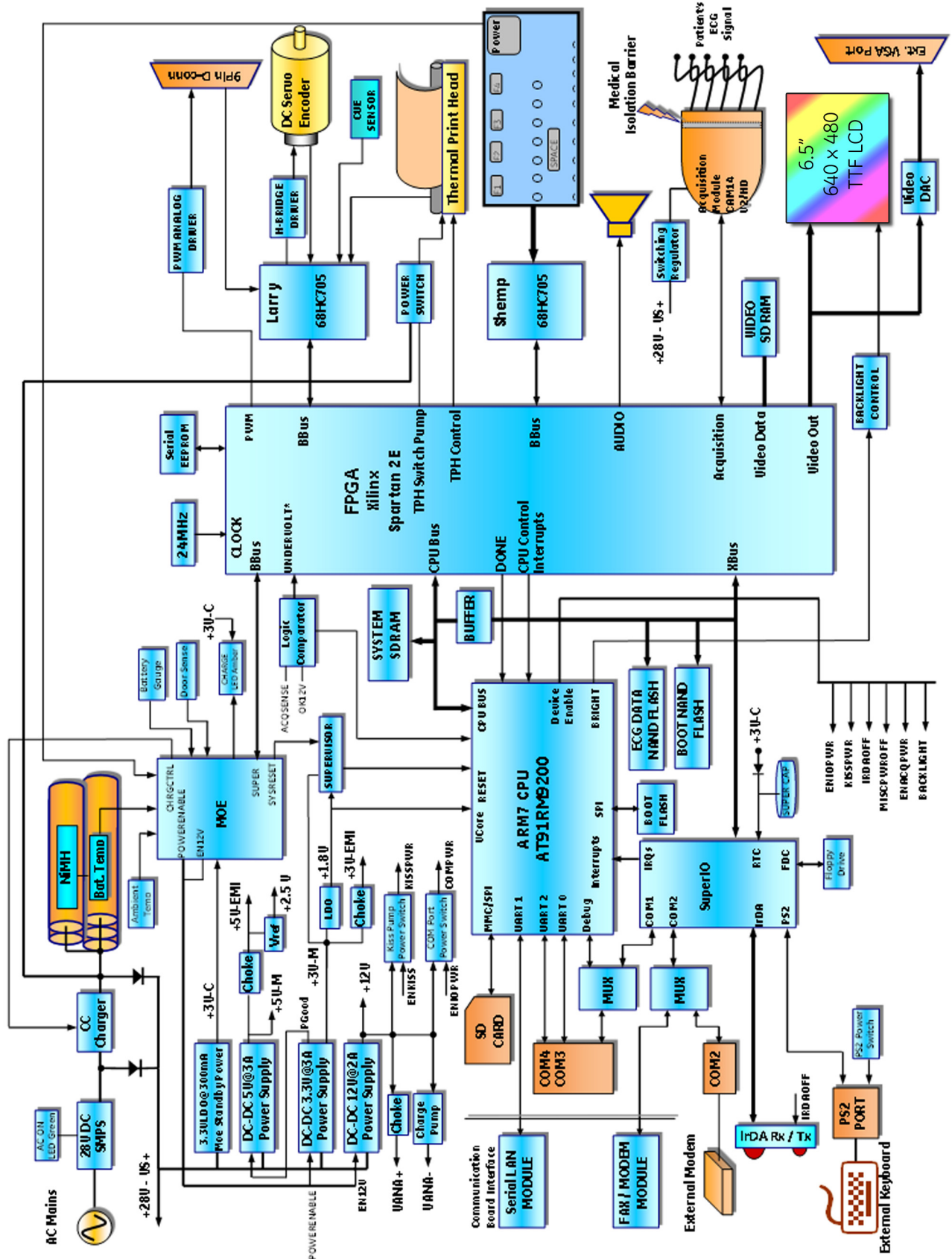
Connection Diagrams

The following diagram illustrates the physical I/O connections between the PCB and external devices.
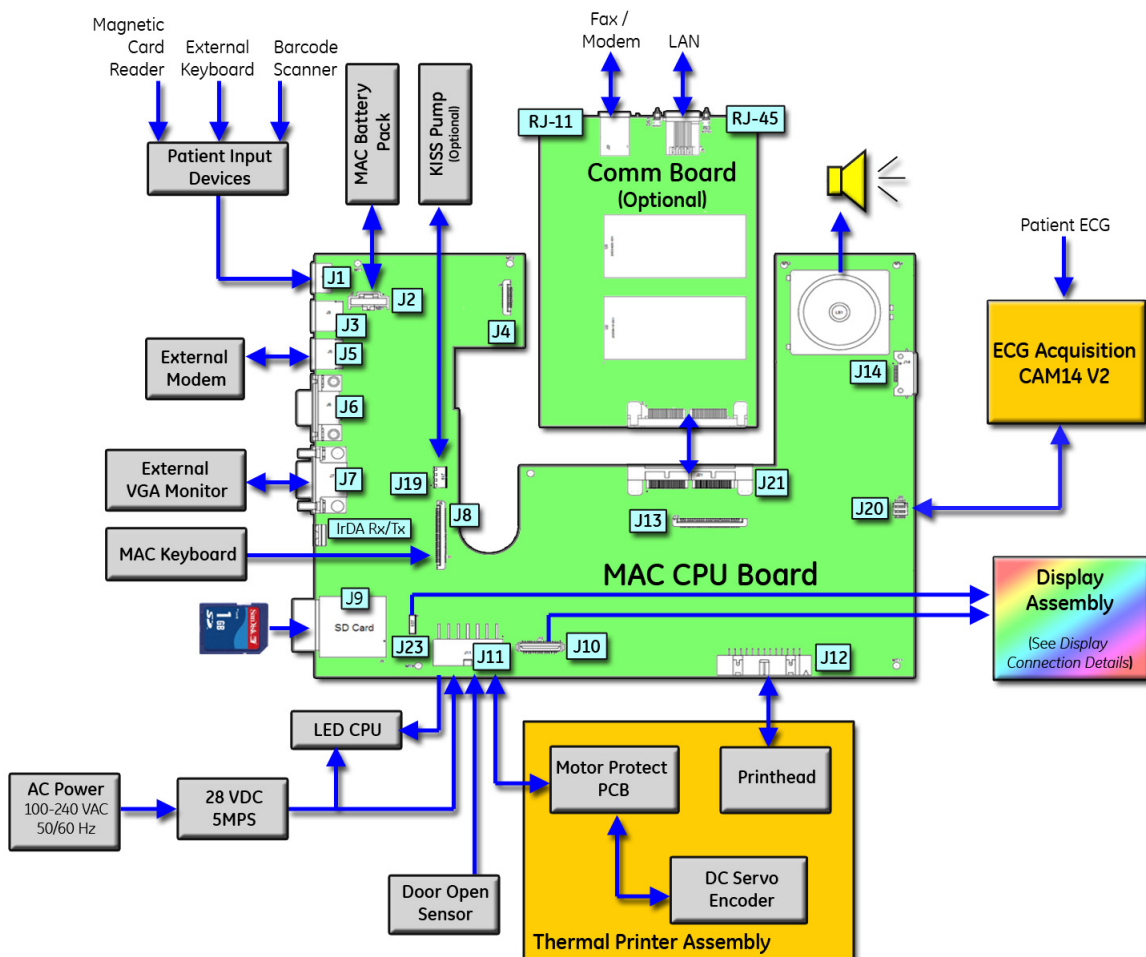
The following diagrams provide a detailed look at the connection between the PCB and the LVDS/LED display assembly.
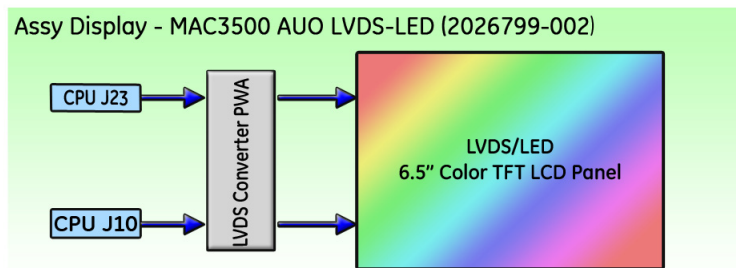
LED/LVDS Display Assembly Diagram

The following illustration diagrams the connections for the LVDS/LED display assembly (2026799-002), and the table that follows it identifies those connections.
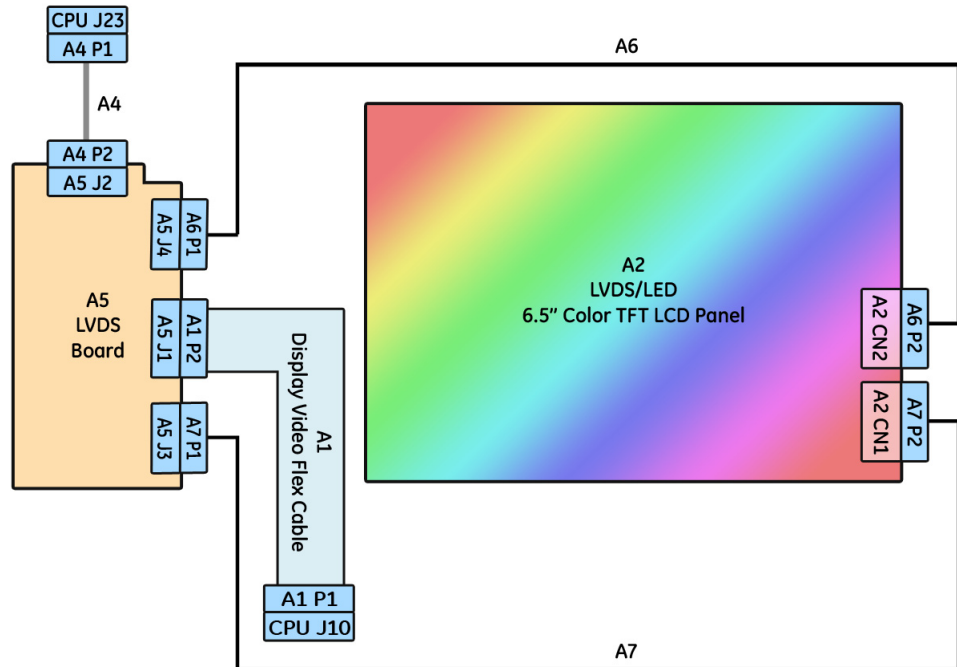
Item	GE Part Number	Desciption
A1	2024701-001	ASSY DISPLAY CABLE MAC3500 (CMOS)
A2	2062075-001	LVDS/LED LCD PANEL
A4	2024701-001	MAC3500 PWR CABLE MAIN BOARD TO LVDS
A5	2061540-001	PWA MAC5500 LVDS DRV BRD ROHS
A6	2059277-001	ASSY MAC3500 BACKLIT CABLE-AUO
A7	2059322-001	MAC3500 LCD CABLE

General Fault Isolation

Power-up Self-test

See the MAC 3500 Operator's Manual, Chapter 2, "Equipment Overview: Getting Started" to verify operation.

On power-up, the system automatically runs an internal self-test. If all circuits test good, the start up screen displays. If the equipment is not working properly, ask yourself the following questions.

- Is the unit turned on?
- Have there been any changes in the use, location, or environment of the equipment that could cause the failure?
- Has the equipment hardware or software been modified since last use?
- Is operator error the cause of the problem? Try to repeat the scenario exactly and compare that to the proper operation of the equipment described in the manual.
- Is the battery installed?
- When connected to the AC wall outlet, does the green AC power light glow?
- Is the writer door closed?

Power-up Flow Chart

```
Press ON key
Sh20

3VC

* RESET → Micro-Controller
          "MOE"
          Sh16 pin 5

NO → AC present?
     Sh16 pin 13
     Battery OK?
     Sh16 pin17

YES

"MOE" enables
+3VM and +5VM

NO → Stabilization
     period over?

YES

"MOE" releases
SysReset *
Sh16 pin10
```

```
ATMEL loads the primary boot code
from Data Flash into internal SRAM
Sh2

ATMEL executes the primary boot
code and configures FPGA &
SDRAM controller

ATMEL loads the remaining code
into SDRAM from internal program
flash   Sh1

ATMEL
running? → NO → "MOE" disables
                +3VM and +5VM

YES

Run application software

Start-up screen displayed

End
```

YES

60B

Poor Quality ECGs

Poor quality ECGs can be caused by factors in the environment, inadequate patient preparation, hardware failures related to the acquisition module, leadwires, cables, or problems in the unit.

Use a simulator to obtain an ECG report. If the report is good, the problem is external to the unit.

Visual Inspection

A thorough visual inspection of the equipment can save time. Small things—disconnected cables, foreign debris on circuit boards, missing hardware, loose components—can frequently cause symptoms and equipment failures that may appear to be unrelated and difficult to track.

NOTE

Take the time to make all the recommended visual checks before starting any detailed troubleshooting procedures.

Table 1. Visual Inspection List	
Area	**Look for the following problems**
I/O Connectors and Cables	Fraying or other damage Bent prongs or pins Cracked housing Loose screws in plugs
Fuses	Type and rating. Replace as necessary.
Interface Cables	Excessive tension or wear Loose connection Strain reliefs out of place
Circuit Boards	Moisture, dust, or debris (top and bottom) Loose or missing components Burn damage or smell of over-heated components Socketed components not firmly seated PCB not seated properly in edge connectors Solder problems: cracks, splashes on board, incomplete feedthrough, prior modifications or repairs
Ground Wires/Wiring	Loose wires or ground strap connections Faulty wiring Wires pinched or in vulnerable position
Mounting Hardware	Loose or missing screws or other hardware, especially fasteners used as connections to ground planes on PCBs
Power Source	Faulty wiring, especially AC outlet Circuit not dedicated to system (Power source problems can cause static discharge, resetting problems, and noise.)

Diagnostic Tests

Verify that the MAC 3500 resting ECG analysis system operates properly by running the diagnostic tests. These tests check the operation of the display screen, speaker, keyboard, thermal writer, battery, and communication. Detailed information displays on screen.

Loading the *System Diagnostics* Menu

1. Select *Main Menu* on the Resting screen.

2. Select *System Setup*.

3. At the prompt type the word **system**, the password set at the factory, then press the **Enter** key. If the password was not changed, the *System Setup* menu appears. If the menu does not appear, use the master password.

    NOTE
    If the system's unique password is inaccessible, create one following the instructions in "Substitute Master Password" on page 4-26.

4. When the *System Setup* menu displays, hold down **Shift** and press **F5** (**Shift** + **F5**).

5. Type **prod** at the service password prompt.

6. The *System Diagnostics* menu appears.
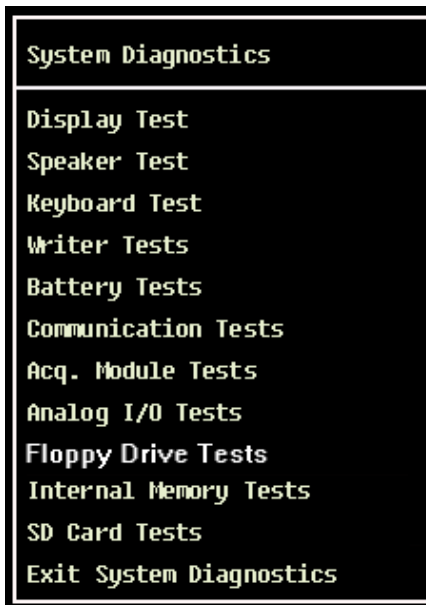
```
System Diagnostics

Display Test
Speaker Test
Keyboard Test
Writer Tests
Battery Tests
Communication Tests
Acq. Module Tests
Analog I/O Tests
Floppy Drive Tests
Internal Memory Tests
SD Card Tests
Exit System Diagnostics
```
13B

NOTE
The *Floppy Drive Tests* option does not apply to the MAC 3500 system.

■ For information on *Display Test*, go to "Display Test" on page 4-12.

- For information on *Speaker Test*, go to "Speaker Test" on page 4-13.
- For information on *Keyboard Tests*, go to "Keyboard Test" on page 4-13.
- For information on *Writer Tests*, go to "Writer Test" on page 4-14.
- For information on *Battery Test*, go to "Battery Test" on page 4-16.
- For information on *Communication Test*, go to "Communication Test" on page 4-18.
- For information on *Acq. Module Tests*, go to "Acq. Module Tests" on page 4-21.
- For information on *Analog I/O Tests*, go to "Analog I/O Tests" on page 4-22.
- For information on *SD Card Tests*, go to "SD Card Tests" on page 4-25.

Display Test

The purpose of the test is to verify that all the screen pixels are working and that the brightness and contrast samples are within the normal range.

```
Display Test

Pixel Verification Test
Gray Scale Test Patterns
Return
```
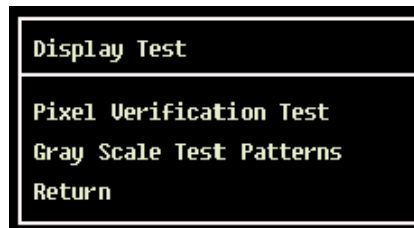
14A

- *Pixel Verification Test*. Select the *Pixel Verification Test* and press **F1** to see whether any of the pixels are defective. Loss of pixels may require replacement of the LCD display.

```
Pixel Verification Test

Use the <TRIM PAD ARROW> keys
to move the bar across the
display. Verify that all the
pixels on the display are
working properly.

Toggle the <F1> key for a full
screen display.
Press the <TRIM PAD ENTER> or
<RETURN> Key to exit.
```

16A

- *Gray Scale Test Patterns*. This test is for manufacturing use only.

Speaker Test

The two available tone options are *Loud* and *Soft*. Select either of the tones and press **Enter**. The tone level difference is minimal.
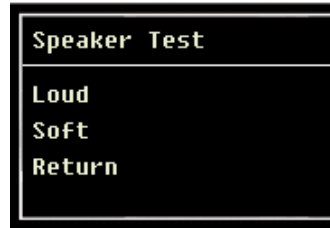
15A

Select *Return* and press **Enter** to return to the *System Diagnostics* menu.

Keyboard Test

The *Keyboard Test* screen is shown below.

The MAC 3500 keyboard does not have these keys.

See **NOTE** below.
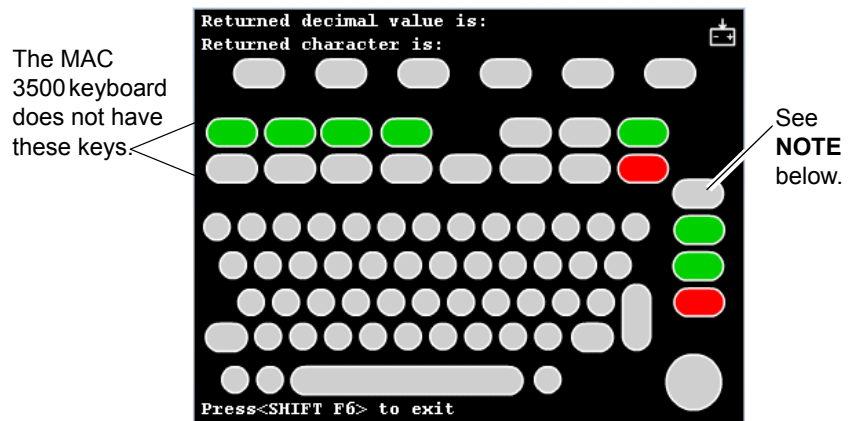
17A

NOTE
> Pressing the **Leads** key on the MAC 3500 keyboard will display the word *Copy* if the key is functioning properly.

■ To verify if all keys are functioning properly, press each key and verify that its value is highlighted on the screen and displayed at the top. The numeric value that is displayed at the top of the screen is the scan code representation of the pressed key. It is normal for the background value for the key to remain on the screen after it is pressed so you know it has been checked. Check all keys.

■ Check both the **Shift** keys by pressing each in combination with a letter to display a capital letter. For example pressing **Shift** + **a** will return a capital **A**.

Trim Pad Control Test

37A

Trim Pad Control

Use the following steps to verify operation of the trim pad control.

■ Press the center of the trim pad control and verify that the word **IN** is displayed on the screen.

■ Press arrow keys to change the displayed arrow position. A beep sound is generated with each arrow press.

■ Press **Shift** + **F6** to exit the test.

Writer Test

The purpose of writer tests is to check the motor speed control, paper speed, paper tracking, paper cueing, and print head quality.

During the tests, make the following general checks.

■ The first character printed should not be distorted.

■ The writer should not skew or crush either edge of the paper.

■ The large triangles and diagonal lines printed across the pages should be straight and uniform, without curves or wavering.

■ The perfs should align with the tear bar on the door after cueing.

■ The paper travel should be smooth.

■ The speed tests might indicate a mechanical problem. There is no adjustment for the speed, but it indicates that a pulley or gear is slipping.


```
Writer Test

C-Scan Test 1
C-Scan Test 2
C-Scan Test 3
50 mm/s Test Pattern I
25 mm/s Test Pattern I
 5 mm/s Test Pattern I
Roller Test
Test Pattern II
Test Pattern II Continuous
Continuous Run Out Paper
Main Menu
```
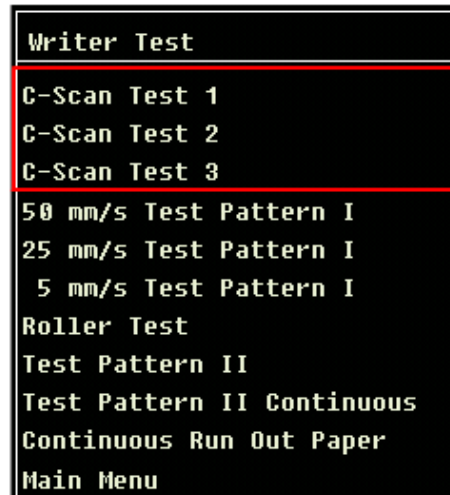
18A

■ *C-Scan Test 1*, *C-Scan Test 2*, *C-Scan Test 3*. These tests are for writer vendor use only.

■ *50 mm/s Test Pattern I, 25 mm/s Test Pattern I, and 5 mm/s Test Pattern I*. Test patterns are used to check the paper speed control. Run each test pattern and check for the following:

◆ The length of the printout from start to finish measures 250 mm ± 5 mm. Use the grids located on the top and bottom of the page for reference. If the printout is outside of range, paper speed is too fast or too slow. Replace thermal writer assembly. See "Writer Roller/Carriage Assembly Replacement" on page 5-33

◆ Check that the long diagonal lines across the test pattern are straight. If lines are wavy or curved, the paper speed is not constant or the roller is out of round, replace thermal writer assembly. See "Writer Roller/Carriage Assembly Replacement" on page 5-33

◆ Check that the test pattern printing is consistent. A white or black line across the pattern indicates a defective or missing print head dot. See "Printhead Assembly Replacement" on page 5-18

■ *Roller Test*. During the check, perform the following general checks:

◆ After cueing, printing should start at approximately 13-14 mm on the page.

◆ The pattern will appear as diagonal light and dark wavy bands.

◆ Isolated light spots indicate a flat spot on the roller.

◆ A white line across the length of the page indicates a missing print head dot.

◆ Dark lines across the width of the page indicate gear tolerance problems.

◆ Lines too close together at the start of the test indicate an incorrect start-up speed.

NOTE

Uneven darkness can appear if AC power is on during this test.

■ *Test Pattern II*. This test is not needed. It is a combination of Test Pattern I and Roller Tests. The first three pages consist of a series of triangular waveforms and various hashmarks. The fourth page is a partial Roller Test.

■ *Test Pattern II Continuous*. This test is not needed. *Test Pattern II* runs continuously until stop is pressed.

■ *Continuously Run Out Paper*. This test is for manufacturing use only. It tests how well the unit self-corrects tracking problems.

Battery Test

Battery tests check the current battery status, battery discharge rate and battery charge rate. Test results are stored in memory and can be printed out. The graphic displayed shows the *Battery Test* menu. Each test is covered in detail below.
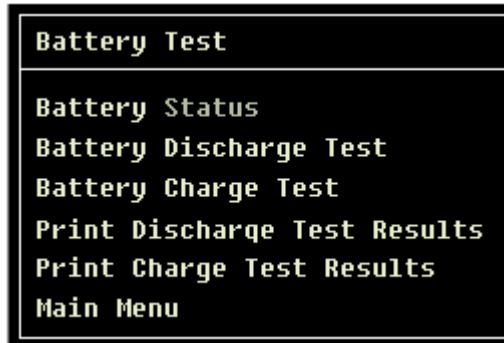
```
Battery Test

Battery Status
Battery Discharge Test
Battery Charge Test
Print Discharge Test Results
Print Charge Test Results
Main Menu
```
19A

■ *Battery Status*. This test displays and constantly updates current information on the battery voltage, battery current, percent of charge remaining and battery temperature.
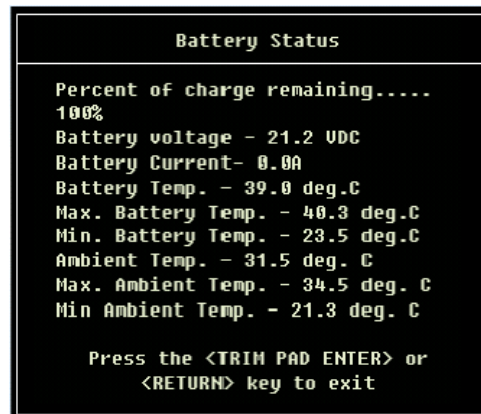
```
Battery Status

Percent of charge remaining.....
100%
Battery voltage - 21.2 UDC
Battery Current- 0.0A
Battery Temp. - 39.0 deg.C
Max. Battery Temp. - 40.3 deg.C
Min. Battery Temp. - 23.5 deg.C
Ambient Temp. - 31.5 deg. C
Max. Ambient Temp. - 34.5 deg. C
Min Ambient Temp. - 21.3 deg. C

Press the <TRIM PAD ENTER> or
<RETURN> key to exit
```
20A

◆ *Battery Voltage*. With a reading of 80% or more for the percent of charge remaining, the battery voltage should be between 15 and 24 volts. If battery voltage is below 15 volts, the battery may need to be replaced.

◆ *Battery Current*. Disconnect AC power. If the battery current is less than -0.7 amps, the main CPU may need to be replaced. For example if current is -0.8 amps, consider replacing CPU. See "Main CPU Board Replacement" on page 5-22.

◆ *Battery Temperature*. A temperature reading over 45° C indicates a failure. If battery temperature is more than 10° C over the ambient temperature consider replacing battery.

◆ *Ambient Temperature*. Indicates the temperature inside the unit. The temperature displayed is accurate to within ±5°C in the range of 0°C to 50°C. Ambient temperatures not within this range cannot be displayed.

■   *Battery Discharge Test*. This test monitors a full discharge cycle. This test will take several hours to run.

◆   To run test:
Select *Battery Discharge Test*; plug unit into AC power and allow battery to fully charge. Remove AC power when prompted. Select *OK* and reselect *Battery Discharge Test*. Allow battery to fully discharge. Unit will automatically shut off.

◆   To view test results:
Connect MAC 3500 to AC power; return to the *Battery Test* menu and select *Print Battery Discharge Test*. Test results remain in memory until the *Battery Discharge Test* is run again.
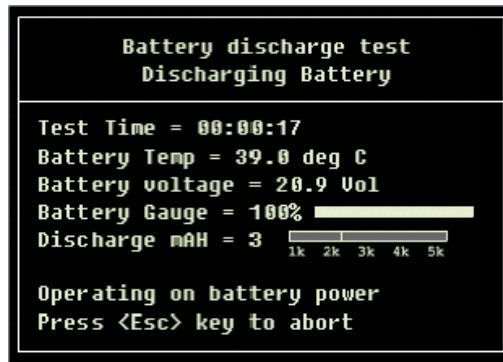
```
          Battery discharge test
            Discharging Battery

    Test Time = 00:00:17
    Battery Temp = 39.0 deg C
    Battery voltage = 20.9 Vol
    Battery Gauge = 100% ████████
    Discharge mAH = 3    ▐▌▌▌▌
                        1k  2k  3k  4k  5k

    Operating on battery power
    Press <Esc> key to abort
```
                                                                        21A

***Battery Discharge Test* window**

NOTE

Consider replacing the battery if discharge capacity is less than 2000 (2k) mAH.

■   *Battery Charge Test*. This test completely discharges the battery and monitors a charge cycle. This test can take up to six hours to run. Select *Print Battery Charge Test* to view test results.

NOTE

The *Battery Discharge Test* takes less time to run and is a better indicator of battery condition.

◆   To run test:
Select *Battery Charge Test*; unplug unit and allow battery to completely discharge; when prompted, plug unit into AC power and select *OK*. Allow battery to fully charge until test is complete.

◆   To view test results:
Return to the *Battery Test* menu and select *Print Battery Charge Test*. Test results remain in memory until the *Battery Charge Test* is run again.

Communication Test

Communication tests are available for the COM ports, external modem, internal modem and Ethernet. The *Communication Test* menu is shown below:

```
Communication Test

Com Port Loopback Test
External Modem Test
Internal Modem Test
Ethernet Module Test
Main Menu
```
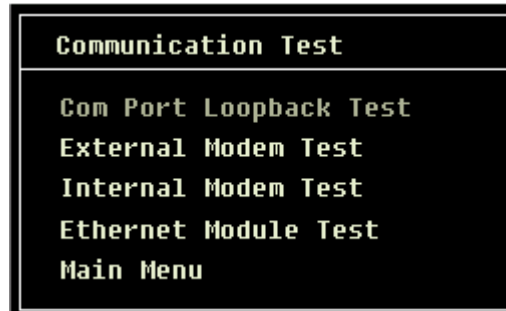
22A

■   *COM Port Loopback Test*. The Communications (COM) Port Loopback test sends various ASCII characters out from the COM Port's transmit lines and expects the same character to return to its receiving lines. Perform test for both COM 1 and COM 2 ports. COM 3 and COM 4 are not included on the MAC 3500.

To run test, connect pin 3 to pin 5 using a jumper and then press any key to start. The test will return a pass/fail for several baud rates.
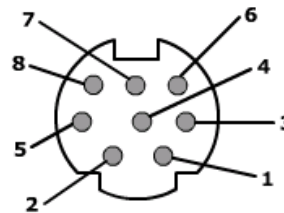
PIN	Name
1	RTS
2	CTS
3	TxD
4	Ground
5	RxD
6	DTR
7	+12V
8	DSR

```
              Com Port Loopback Test

  COM1 connections: Connect TX (Pin 3) to RX
  (Pin 5) of SERIAL OUT 1

  Testing COM 1 at 1200 Baud      Passed 375/375
  Testing COM 1 at 2400 Baud      Passed 375/375
  Testing COM 1 at 4800 Baud      Passed 375/375
  Testing COM 1 at 9600 Baud      Passed 375/375
  Testing COM 1 at 19200 Baud     Passed 375/375
  Testing COM 1 at 38400 Baud     Passed 375/375
  Testing COM 1 at 57600 Baud     Passed 375/375
  Testing COM 1 at 115200 Baud    Passed 375/375

  Setting 2400 Baud
  Setting 4800 Baud
  Setting 9600 Baud
  Setting 19200 Baud
  Setting 38400 Baud
  Setting 57600 Baud
  Setting 115200 Baud
  Closing port

    Test Completed. Press any key to exit      24A
```

Com Port Loopback Test **Results Window**

NOTE

To repair a defective COM port, replace the CPU board. (See "Main CPU Board Replacement" on page 5-22.)

■ *External Modem Test*. Connect a modem to the COM 2 port and select the *External Modem Test*. The test communicates with the modem and returns the modem ID number, firmware rev, and current parameter settings, if any. If communication with the modem is unsuccessful, the ID and firmware rev will display N/A.

NOTE

Although COM 2 is also used to connect the wireless client bridge, this test is designed to check a modem only. It cannot be used to test the wireless client bridge.

■ *Internal Modem Test*. Select the *Internal Modem Test*. The test returns the modem ID number, firmware rev, and current parameter settings. If communication with the modem is unsuccessful, the ID and firmware rev display N/A.

```
            Internal Modem Interrogation

ID Number: LT V.82 1.0 MT5634SMI-V92 Data/Fax
Modem Version 1.280K
Firmware Rev: 7394                        OK
Current Parameters:


                Test Completed
```
25A

NOTE

If the test fails, consider replacing the communication board.

■ *Ethernet Module Test*. Select the *Ethernet Module Test*. The test returns IP address, subnet mask, and MAC Address settings for the Ethernet module. If communication with the Ethernet module is unsuccessful, the IP address, subnet mask, and MAC address will display N/A.

```
Model :      MTXCSEM
Version :    3.01

IP:          10.168.0.152
Subnet Mask: 255.255.255.0
Gateway:     10.168.0.254
Port Number: 3002
MAC Address: 00:08:00:d2:15:e6

                        Test Completed
```
26A

NOTE

If the test fails, consider replacing the communication board. See "COMM Board Replacement" on page 5-30 for more information.

If the LAN connection on the communication board returns information but network communication problems still exist, use the LED status indicators on the LAN connection to see if the connection to the network is active. You can also use a ping command from the MUSE server to see if the MUSE system can find the unit on the network.

Acq. Module Tests

To check the internal acquisition board, connect all leads to the RL lead on the patient cable and keep them separated and away from any external power source.

NOTE

One way of doing this is to connect all leads to a patient simulator and leave the simulator turned off.

Displays the acquisition board noise floor

Acq. Module Tests
Connect leads to RL. Keep leads separated and away from all other power sources!

Noise test for lead I	PASS	Noise test for lead II	PASS
Noise test for lead V1(C1)	PASS	Noise test for lead V2(C2)	PASS
Noise test for lead V3(C3)	PASS	Noise test for lead V4(C4)	PASS
Noise test for lead V5(C5)	PASS	Noise test for lead V6(C6)	PASS
Noise test for lead A1(H)	DISCONNECTED	Noise test for lead A2(E)	DISCONNECTED
Noise test for lead A3(I)	DISCONNECTED	Noise test for lead A4(M)	DISCONNECTED

Front End Comm Test: PASS
Acquiring Data: 9
Press a button to highlight the corresponding number
Button Pressed: 1 2 3

Loader ver: 1a   Controller ver: 2   Acq. software ver: 1d

Press any key to exit

27A

Tests if the acquisition board is communicating.

Displays the software version of the acquisition board

NOTE

The *Button Pressed* test does not apply to the MAC 3500 system.

Analog I/O Tests

The *Analog I/O Tests* option checks the ANA/TTL connection and consists of four different tests.

```
Analog I/O Tests

Analog Output Test
Analog Input Test
DCOut Loopback Test
ECGOut/QRSTrigger Loopback Test
Main Menu
```
28A

- *Analog Output Test*. The *Analog Output Test*. This test involves monitoring of analog outputs using an oscilloscope.

```
                    Analog Output Test

Connect an Oscilloscope or voltmeter to the appropriate
ANA/TTL port pins
to verify the boxed conditions.
Power: pin 1      DCOut: pin 2        ECGOut: pin 8
GND  : pin 4,5    DCOut: pin 6        QRSTigger: pin 3
During all tests power-12V and QRSTrigger-5V-10Hz square
wave
ECGOut:  0V         DCOut1,DCOut2:  0V
ECGOut: 10V         DCOut1,DCOut2:  5V
ECGOut:-10V         DCOut1,DCOut2: 10V
ECGOut:-10V to 10V wave DCOut1,DCOut2:0 to 10V wave

     Use <TRIM PAD> to select test, press <ESC> to exit
```
20A

Follow the on-screen prompts to run the *Analog Output Test*.

- *Analog Input Test*. This test involves connecting a DC voltage to the DC input pins of the ANA/TTL connector. The voltage of the DC input is displayed.

```
                    Analog Input Test

Connect signal generator to the appropriate ANA/TTL port pins:
Analog In 1: pin 7    Analog In 2: pin 9     GND: pins 4,5
Note: Maximun Input voltage: 10V
Analog In Channel 1 (V): 0.0
Analog In Channel 2 (V): 0.3




                    Press any key to exit
```

Follow the on-screen prompts to run the *Analog Input Test*.

■ *DCOut Loopback Test*. This involves connecting the DC Outputs to the DC Inputs. The test sends all possible values out the DC Outputs and confirms that correct values are read from the DC Inputs. A pass/fail result is displayed at the end of the test.

```
                      DCOut Loopback Test

           Connect DCOut (pin 2) to Analog Input 1 (pin 7).
           Connect DCOut (pin 6) to Analog Input 2 (pin 9).

DCOut to Analog Input 1                  DCOut to Analog Input 2


           Passed                                  Passed
```

31A

To run the test, connect DCOut1 (pin2) to Analog Input (pin 7) and DCOut2 (pin 6) to Analog Input (pin 9).

PIN	Name	Pin	Name
1	+12v	6	DC Output 2
2	DC Output 1	7	DC Input 1
3	*TTL Trigger Output	8	ECG Output
4	Ground	9	DC Input 2
5	Ground		

* also called "QRS Trigger"
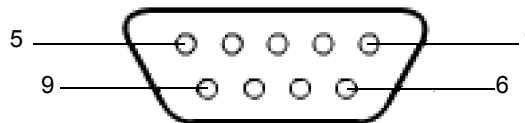
NOTE

If test fails you may need to replace the CPU board.
(See "Main CPU Board Replacement" on page 5-22)

■ *ECGOut/QRSTrigger Loopback Test*. This involves connecting the ECG Output and TTL Trigger Output to the DC Inputs. The test sends all possible values out the ECG Output and a square wave out the TTL Trigger Output. It confirms that correct values are read from the DC Inputs. A pass/fail result is displayed at the end of the test. If test fails you may need to replace the CPU board. (See "Main CPU Board Replacement" on page 5-22.)

```
                   ECGOut/QRSTrigger Loopback Test

           Connect ECGOut (pin 8) to Analog Input 1 (pin 7).
          Connect QRS Trigger (pin 3) to Analog Input 2 (pin 9).

ECGOut to Analog Input 1               QRSTrigger to Analog Input 2


           Passed                                  Passed
```

33A

To run test, connect ECGOut1 (pin 8) to Analog Input (pin 7) and QRSTrigger (pin 3) to Analog Input (pin 9).

PIN	Name	Pin	Name
1	+12v	6	DC Output 2
2	DC Output 1	7	DC Input 1
3	*TTL Trigger Output	8	ECG Output
4	Ground	9	DC Input 2
5	Ground		

* also called "QRS Trigger"
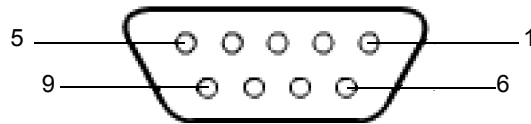
NOTE

If test fails you may need to replace the CPU board. (See "Main CPU Board Replacement" on page 5-22.)

Floppy Drive Tests

This option does not apply to the MAC 3500 system.

Internal Memory Tests

The *Internal Memory Test* checks for bad blocks and amount of free memory. After the test is completed you are given the option of reformatting the internal memory.

CAUTION

Reformatting will erase all data in memory, including patient data. Reformatting will not affect the system software or the *System Setups*.

```
               Internal Memory Tests


  Number of Bad Blocks: 0
  Free Memory: 31400Bytes


     Test Completed. Press any key to exit.
```
35A
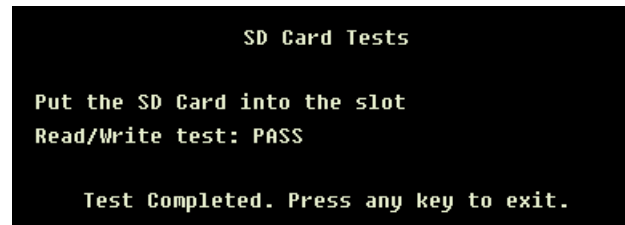
Follow on-screen prompts to perform the *Internal Memory Tests*.

SD Card Tests

The *SD Card Tests* option performs a read/write test on the SD card currently installed. Responds with a *PASS* or *FAIL*.

```
                  SD Card Tests

  Put the SD Card into the slot
  Read/Write test: PASS


     Test Completed. Press any key to exit.
```
36A

Follow on-screen prompts to perform the *SD Card Tests*.

If card is not formatted correctly, an error message will appear at the bottom of the screen.

NOTE

To format a card, insert the SD card and copy data to the card using the *Copy All* command from *File Manager.* The MAC 3500 software will then prompt you to format the card. Follow on-screen prompts. Refer to the MAC 3500 Operator's Manual for details.

Substitute Master Password

If you do not have access to the system's password, you can create a master password as follows.

1. At the prompt for the system password, enter **meimac**. A random 6-digit number displays on the screen. (For example, 876743.)

2. Write the number down and create a new 6-digit number by adding alternating digits from the random number as follows. Add:

   ◆ first and third digits,
   ◆ second and fourth digits,
   ◆ third and fifth digits,
   ◆ fourth and sixth digits,
   ◆ fifth and first digits, and
   ◆ sixth and second digits.

   Disregard the 10's column when adding the digits. The new number from the example above would be **440020**.

3. Enter the new number, then press the **Enter** key. The *System Setup* menu displays. This process only works once, so you should reprogram the password permanently.

4. Go to the *Basic System* menu.

5. Select *Miscellaneous Setup*.

6. Select the *System password* line and type the new password in the space.

7. Press the **Enter** key.

8. Select *Save Setup* from the *System Setup* menu.

9. Select *To system*.

Equipment Problems

ECG Data Noise
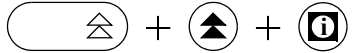
If the acquired ECG data displays unacceptable noise levels:

■ When troubleshooting noise or signal quality, be sure the problem is not being caused by poor skin preparation, or placement and condition of electrodes. Careful skin preparation is the key to an interference-free ECG. Signal quality is indicated using Hookup advisor. Click here to learn more about Hook-up Advisor. Hookup Advisor can be turned on or off in the ECG menu. Select *System Setup → ECG → ECG Acquisition.*

■ Check for defective or date expired electrodes.

■ Check for defective, broken, or disconnected leadwires.

■ Run the Acquisition Module Tests in the Diagnostic menu and make sure all lead wires pass the noise test.

System Errors

The following errors may occur while you are operating this system. You may be required to perform some action.

If you perform the recommended actions and the condition still remains, contact authorized service personnel. See "How to Reach Us" to find out how to contact GE.

Problem	Cause	Solution
⊠ appears on the screen.	No battery is installed in the system.	Install a battery and connect the system to an AC wall outlet to charge the battery.
⊟ flashes intermittently.	The battery charge is low.	Connect the system to an AC wall outlet to charge the battery.
⬗ appears on the screen.	The writer door is open.	Close the writer door.
The system does not power up when operating from battery power.	The battery is empty.	Connect the system to an AC wall outlet to charge the battery.
The system shuts down when operating from battery power.	Battery is empty, or the *Automatic Shutdown* feature is enabled.	Connect the system to an AC wall outlet to charge the battery, or power on the system.
"X" Lead disconnected message appears.	Electrode(s) disconnected.	Reconnect the electrode(s).
MODEM ERROR. The remote device is not responding. Would you like to retry?	Modem not connected. (If wireless option, client bridge not connected.)	Connect and retry.
	(Wireless option only) MAC 3500 is not within range of access point.	Relocate MAC 3500 to within range of access point and retry transmission.
Cannot use the system because *Device Password* does not work.	*Device Password* has been changed or has not been adequately communicated to the staff.	Override the *Device Password* prompt by pressing the following keys at the same time: ⬆ + ⬆ + ⓘ

63A, 64A, 65A

NOTE

For information about troubleshooting the MobileLink Standard Security option, see "MobileLink Installation & Troubleshooting Guide" (PN 2002783-060).

For information about troubleshooting the MobileLink Ultra High Security option, see "MobileLink UHS Installation & Troubleshooting Guide" (PN 2020300-051).

Frequently Asked Questions
Maintenance

NOTE

See Operator's Manual for complete *System Setup* information.

Save Setups

Q: How do I save changes I have made to the System Setups?

A: Check the following:

◆ Return to Menu by pressing the **esc** key or selecting *More* from the menu until you see *System Setup*.

◆ Select *System Setup*.

◆ Select *Save Setup*.

◆ Select *To System*.

◆ You can select *Main Menu* to exit *System Setup*.

Storing ECGs

Q: Why won't any of the ECGs I perform save to the SD card?

A: Check the following:

◆ Check that the SD card is fully inserted into the drive.

◆ Make sure you are using 64 MB SD cards.

◆ Verify that the SD card is not write-protected.

◆ Try a new SD card.

◆ If your system is not set up to automatically save records, you must manually save by pressing *Store*.

Format an SD Card

Q: How do I format an SD card in the MAC 3500?

A: Most secure digital cards do not require formatting. In the event an unformatted SD card is used with the system, the following message will display:

This SD Card cannot be read and requires formatting. Formatting will destroy all data on this SD Card. Are you sure you want to format?

Select *Yes* to format the SD card.

Cleaning

Q: Should I clean the MAC 3500?

A: Clean the exterior surfaces of all the equipment and peripheral devices monthly, or more frequently if needed.

◆ Use a clean, soft cloth and a mild dishwashing detergent diluted in water.

◆ Wring the excess water from the cloth. Do NOT drip water or any liquid on the writer assembly, and avoid contact with open vents, plugs, and connectors.

◆ Dry the surfaces with a clean cloth or paper towel.

Battery Capacity

Q: What is the capacity of the battery?

A: We recommend that the MAC 3500 be plugged into a wall outlet whenever it is not in use. However, the life of the battery is approximately 100 ECGs and one-page reports or six hours of continuous operation (without printing).

System Setup

Location Number

Q: When entering in the patient data, how do I get the Location field to automatically populate with the same number?

A: The *Location* number can be set in *System Setup* to save you from entering it for each test.

◆ Go to *System Setup*.
◆ Select *Basic System*.
◆ Select *Miscellaneous Setup*.
◆ Arrow down to *Location* and type in the number you want set as your default. Then press **Enter**.
◆ Press the **esc** key until you return to *System Setup*.
◆ Select *Save Setup*.
◆ Select *To System*.
◆ You can select *Main Menu* to exit *System Setup*.

Patient Questions

Q: How do I change what questions I see when I am entering the patient data?

A: The patient questions you see on the *Patient Data* window when starting a test were set up in *System Setup*.

◆ Go to *System Setup*.
◆ Select *Basic System*.
◆ Select *Patient Questions*.
◆ Select the patient questions you want to include when entering the patient data for a test.
◆ Press the **esc** key until you return to *System Setup*.
◆ Select *Save Setup*.
◆ Select *To System*.
◆ You can select *Main Menu* to exit *System Setup*.

Passwords

Q: Can you set up a password for the *Delete* function that is different than the *System Setup* password?

A: No. The password for the *System Setup* and the *Delete* function are the same.

Clinical
Report Format

Q: How do I change the way an ECG looks when it prints out?

A: Do the following steps.

■ Go to *System Setup*.
■ Select *ECG*.
■ Select which type of ECG report you want to change:
■ Select unconfirmed reports from the menu.
■ Find the report type you want the MAC 3500 to print.
■ Place the number of copies you want in the appropriate column.
■ If you want the MAC 3500 or 12SL interpretation included on the ECG, put the number of copies you want in the "with" column.
■ If you do not want the MAC 3500 interpretation to print on the ECG, put the number of copies you want in the "without" column.
■ Click view report type, to see the examples of the report formats.
■ Press the **esc** key until you return to *System Setup*.
■ Select *Save Setup*.
■ Select *To System*.
■ You can select *Main Menu* to exit *System Setup*.

Editing

Q: Can you edit the interpretation at the MAC 3500, and then transmit the edited record to the MUSE system as an unconfirmed record?

A: If you edit demographic information only the record is still transmitted to the MUSE system as an unconfirmed record. However, if you edit the interpretation, the data will not be saved unless the record is confirmed at the MAC 3500. The record is transmitted to the MUSE system as a confirmed record as well.

Entering Patient Data

Q: Do I have to enter all the Information I see on the Patient Data screen?

A: In *System Setup → Basic System → Patient Questions* you can require that the patient identification number, or medical record number) be entered. It is not a requirement to enter any other data. However, we recommend that you enter the patient name and identification number, at the least. If you are transmitting to the MUSE system you will want to enter the *Location* number as well. If an emergency situation dictates that you must complete the test. without entering the patient data, make sure you edit the record to add the missing information before you transmit it to the MUSE system.

Transmission

Losing Fields When Transmitting

Q: Why do I lose the Referring MD and Technician names off of my reports when I transmit records to the MUSE system?

A: Your MAC 3500 may be transmitting to the SDLC modem on the MUSE system instead of the CSI modem. Check in System Setup to make sure you are transmitting to the MUSE system CSI phone number.

Input and Output Connectors

The following pages detail the input/output signals for those connectors. The pin-by-pin descriptions identify the signal names and pin outs for each connector on the unit.

A Pins (J1)
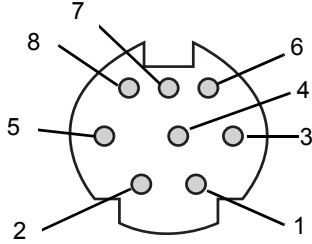
Pin	Name	
Table 2. A Pins (J1)		
1	Data	
2	NC	
3	Ground	
4	+5V	
5	Clock	
6	NC	

COM1 (COM3/4) Pins (J3)

Pin	COM1 Signal	COM3/4 Signal	
Table 3. COM1 (COM3/4) Pins (J3)			
1	RTS	COM3 TxD	
2	CTS	COM3 RxD	
3	TxD		
4	Ground		
5	RxD		
6	DTR	COM4 TxD	
7	+12V		
8	DSR	COM4 RxD	

COM2 Pins (J5)
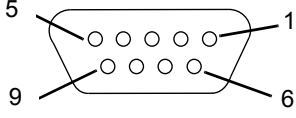
Table 4. COM2 Pins (J5)		
Pin	**Name**	
1	RTS	
2	CTS	
3	TxD	
4	Ground	
5	RxD	
6	DTR	
7	+12V	
8	DSR	
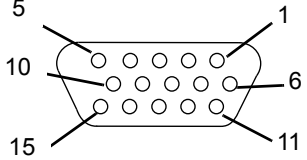
Analog Pins (J6)

Table 5. Acquisition Module Connector (J6)		
Pin	**Name**	
1	+12V	
2	DC Output 1	
3	TTL Trigger Output	
4	Ground	
5	Ground	
6	DC Output 2	
7	DC Input 1	
8	ECG Output	
9	DC Input 2	

EXT. VID. Pins (J7)

Table 6. External VGA Video (J7)		
Pin	**Name**	
1	Red Video	
2	Green Video	
3	Blue Video	
4	Ground	
5	Ground	
6	Ground	
7	Ground	
8	Ground	
9	NC	
10	Ground	
11	Ground	
12	NC	
13	Horizontal Sync	
14	Vertical Sync	
15	NC	

68A

CPU PCB Input/Output Signals

Battery Pack/Monitor, J2	
Pin No.	**Signal**
1	18V Battery Power
2	18V Battery Power
3	Battery Temperature Sense
4	3V Temperature Sense Power
5	Battery Ground
6	Battery Ground

LCD Backlight, J4	
Pin No.	**Signal**
1	12V Power
2	12V Power
3	12V Power
4	Ground
5	Ground
6	Brightness Select
7	Backlight Enable
8	NC
9	Ground
10	Ground

Keyboard, J8	
Pin No.	**Signal**
1	NC
2	NC
3	NC
4	NC
5	NC
6	Sense4
7	Sense2
8	Sense1
9	Sense0

Keyboard, J8 (Continued)	
10	Sense3
11	Sense5
12	Sense6
13	Sense7
14	Drive0
15	Drive1
16	Drive2
17	Drive3
18	Drive4
19	Ground
20	Power Key
21	Drive5
22	Drive6
23	Drive7
24	Drive8
25	Drive9
26	Drive10

LCD, J10	
Pin No.	**Signal**
1	Ground
2	Pixel Clock
3	Hsync
4	Vsync
5	Ground
6	R0 (LSB)
7	R1
8	R2
9	R3
10	R4
11	R5 (MSB)
12	Ground
13	G0 (LSB)
14	G1
15	G2
16	G3

LCD, J10 (Continued)	
17	G4
18	G5 (MSB)
19	Ground
20	B0 (LSB)
21	B1
22	B2
23	B3
24	B4
25	B5 (MSB)
26	Ground
27	Data Enable
28	3V Power
29	3V Power
30	NC
31	NC

Power Supply/Motor, J11	
Pin No.	**Signal**
1	Motor Encoder B
2	5V Power
3	Motor A
4	Motor Encoder A
5	Ground
6	Motor B
7	NC
8	28V Power
9	Ground
10	Battery Charge LED
11	28V Power
12	Ground
13	Door Open Detect
14	Ground

Thermal Printer, J12	
Pin No.	**Signal**
1	Thermal Printer Power
2	Thermal Printer Power
3	Thermal Printer Power
4	Thermal Printer Power
5	Thermal Printer Power
6	Thermal Printer Power
7	Thermal Printer Power
8	Ground
9	Ground
10	Ground
11	Ground
12	Ground
13	Ground
14	Ground
15	Cue Sense
16	NC
17	5V Main Power
18	Ground
19	Data Strobe
20	Data Strobe
21	Data Strobe
22	Data Strobe
23	Data Load
24	Data Clock
25	Print Head Temperature
26	Pixel Data

Floppy Disk Drive, J13	
(for floppy drive — not installed	
Pin No.	**Signal**
1	5V Power
2	Index
3	5V Power
4	Drive Select 0
5	5V Power
6	Disk Change
7	NC
8	Media Sense 0
9	Media Sense 1
10	Motor Select 0
11	NC
12	Direction
13	NC
14	Step
15	Ground
16	Write Data
17	Ground
18	Write Gate
19	Ground
20	Track 0
21	Ground
22	Write Protect
23	Ground
24	Read Data
25	Ground
26	Head Select

Acquisition Module, J14	
Pin No.	**Signal**
1	Power
2	Ground
3	TX+ (RS485)
4	TX- (RS485)
5	RX+ (RS485)
6	RX- (RS485)
7	NC
8	NC
9	NC
10	NC

KISS Pump, J19	
Pin No.	**Signal**
1	KISS Pump Power (12V DC)
2	NC
3	GND
4	GND

Acquisition Module, J20	
Pin No.	**Signal**
1	TX- (RS485)
2	TX+ (RS485)
3	RX- (RS485)
4	RX+ (RS485)
5	GND
6	Power 12V
7	NC
8	NC
9	NC
10	NC

LCD Backlight, J23	
Pin No.	**Signal**
1	GND
2	GND
3	Power 5V DC
4	Power 5V DC
5	Relay Port 1 (Resistance)
6	Relay Port 2 (Resistance)

5   Maintenance

For your notes

Introduction

Recommended Maintenance

Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

> **WARNING**
> Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

Required Tools and Supplies

In addition to a standard set of hand tools, you will need the items listed in the table below.

Table 1. Tools and Supplies	
Item	**Part Number**
#10 Torx driver	
#6 Torx driver	
Phillips screw driver	
Leakage current tester	MT-1216-02AAMI (for 220V) MT-1216-01AAMI (for 110V)
Multifunction micro-simulator	MARQ 1
Precision dust remover	
Lint-free soft cloth	TX609
PS2 style keyboard (Japan only)	

Inspection and Cleaning

Visual Inspection

Perform a visual inspection of all equipment and peripheral devices daily. Turn off the unit and remove power before making an inspection or cleaning the unit.

- Check the case and display screen for cracks or other damage.
- Regularly inspect all cords and cables for fraying or other damage.
- Verify that all cords and connectors are securely seated.
- Inspect keys and controls for proper operation and check that toggle keys do not stick in one position. If necessary, perform the keyboard test described in the Chapter 5 of this manual.

Exterior Cleaning

Clean the exterior surfaces monthly, or more frequently if needed.

1. Use a clean, soft cloth and a mild dish washing detergent diluted in water.

2. Wring the excess water from the cloth. Do not drip water or any liquid on the equipment, and avoid contact with open vents, plugs, or connectors.

3. Dry the surfaces with a clean cloth or paper towel.

Interior Cleaning

General

Check for dust buildup on the surfaces of the interior circuit boards, components, and power supply. Use commercially available compressed air to blow away the accumulated dust. Follow the manufacturers directions.

Thermal Printhead Cleaning

Clean the thermal printhead every three months or more often with heavy use. A build-up of thermal paper coating on the printhead can cause light or uneven printing.

Use a solution containing alcohol on a nonwoven, nonabrasive cloth such as Techni-Cloth to wipe off the printhead. Do not use paper toweling, as it can scratch the printhead.

Thermal
Printhead

1A

Checking Electrical Safety

The device should be checked annually for current leakage and ground continuity. For details, see "Electrical Safety Checks" on page 5-38.

FRU Replacement Procedures

Disassembly Guidelines

Prior to performing any disassembly procedures, perform the following:

■ If possible, process any ECGs remaining in storage.

■ If possible, print out set-up for future reference.

■ Disconnect the unit from the AC wall outlet and remove the power cord from the unit.

■ Remove the battery as described in "Battery Replacement".

■ If the MAC 3500 system is mounted to the trolley, remove it from the trolley as described in "Remove MAC 3500 System From Trolley".

■ Remove the writer paper.

■ Take strict precautions against electrostatic discharge damage.

Battery Replacement

1. Press the writer button to open the unit.

writer button

12A

2. Slide the battery release button in the direction of the arrow and lift the battery out.

2A

NOTE

Once the maintenance procedures are complete, reverse these steps to replace the battery.

Remove MAC 3500 System From Trolley

If your MAC system is mounted on a trolley, you must remove it from the trolley before servicing it. The method for removing the device depends on the type of trolley.

MAC Series Trolley

1. Lock the wheels, remove the rear trolley panel then loosen the three captive screws located under the trolley.
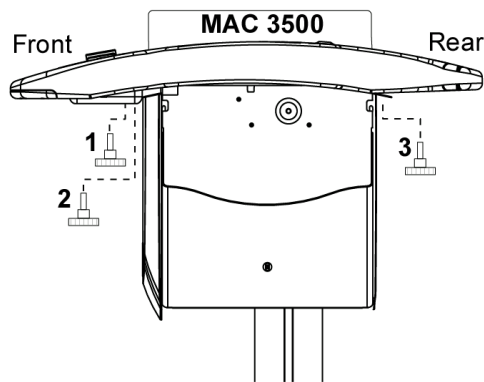
5A

2. Pull the MAC 3500 up toward you.

4A

3. Lift the unit from the trolley.

> **NOTE**
>
> > Once the maintenance procedures are complete, reverse these steps to re-assemble the MAC 3500 system to the trolley.

Type-S Trolley

To dismount the MAC 5500 from the Type-S trolley, follow the steps shown in the following illustration.
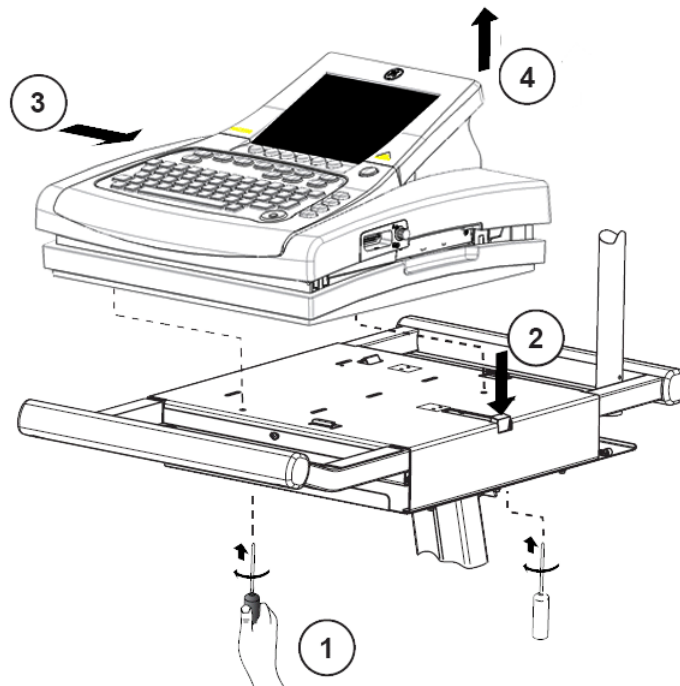
Modular MAC Trolley

To remove the device from the modular MAC trolley, perform the following steps.
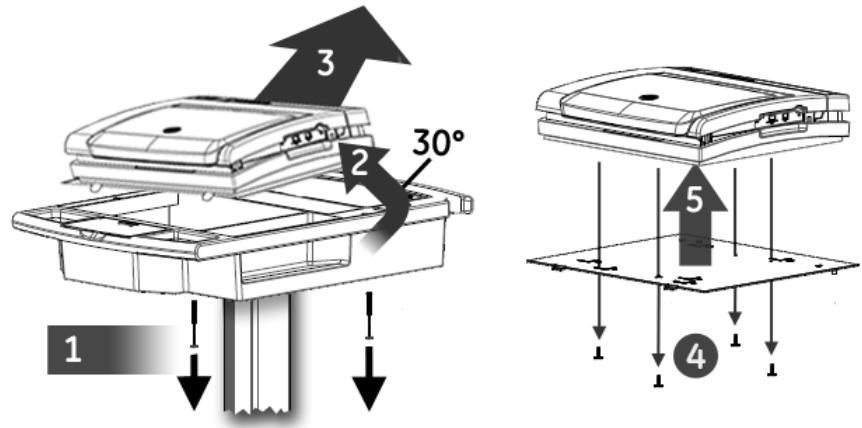
1. Remove the bolts connecting the mounting tray to the trolley top.

2. Tilt the rear of the device and mounting tray to a 30° angle.

3. Slide the device and mounting tray toward the back of the trolley to remove them.

4. Remove the screws securing the device to the mounting tray.

5. Lift the device from the mounting tray.

   The device is now ready to be serviced.

Power Supply Replacement

1. Turn the unit over so the bottom side is up.

2. Using a #10 Torx driver, remove the three fasteners holding the power supply in place.

3 fasteners

7A
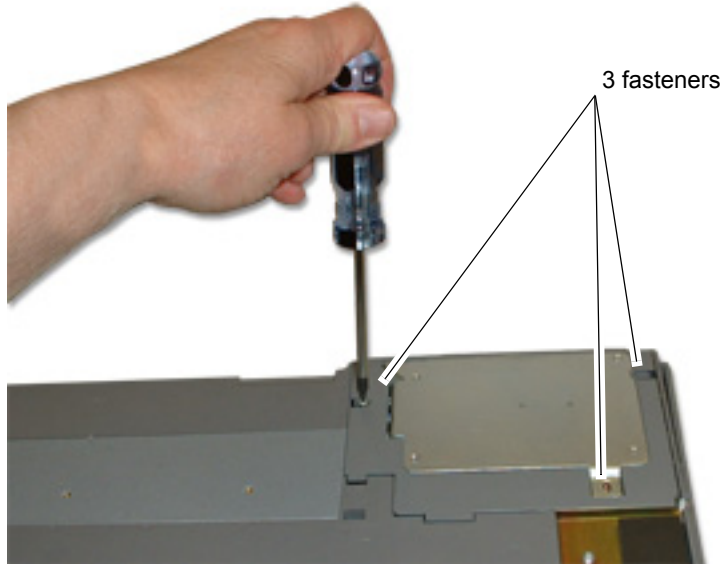
3. Lift the power supply to expose the wiring harness and ground wire.

4. Remove P2 from J2 on the power supply assembly and the ground wire connection from the power supply chassis.

Wiring Harness

Ground Wire

6A
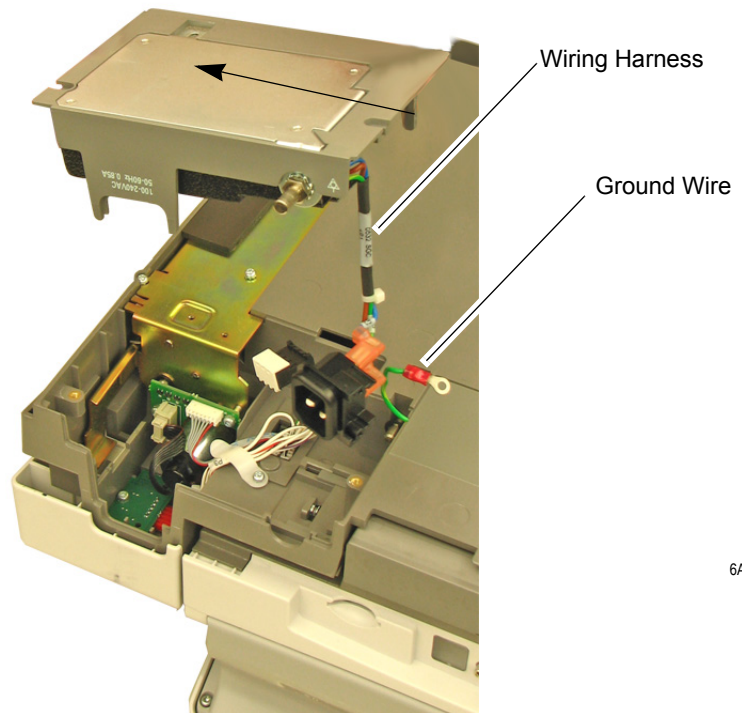
5. Reassemble the power supply reversing the steps for removal. Before replacing the screws, ensure that the ground wire is routed through the notch in the plastic and not pinched.

Keypad Replacement

1. Remove the three fasteners from under the top cover at the front of the unit.

3 fasteners

92A

2. Remove the two fasteners that secure the display panel cover at the back of the unit and then remove the display cover.

93A

3. Remove the two fasteners holding the top of the keypad.

94A

2 fasteners

4. Pull up on the keypad assembly to release it from the top cover. You will hear a snapping noise as each of the eight plastic standoffs is released.

NOTE

The eight plastic standoffs should remain with the keyboard. However, if any do remain in the top cover, use a small pliers to extract from the top cover. Do not damage the rubber cover which is permanently affixed to the top cover.

5. Using a small pliers, remove the eight plastic standoffs that remained in the top cover.

6. Place new keyboard in place on top cover. Be sure you align the eight plastic standoffs with the appropriate holes in the top cover.

7. Once the keyboard has been properly aligned with the top cover, push down on keyboard at each of the eight standoff locations until it snaps into place on the top cover.

Reverse the procedures for removal of the keyboard, replacing all fasteners which were removed previously.

Keyboard/Top Cover Assembly Removal & Reassembly

Removal of Keyboard/Top Cover Assembly

NOTE

Removal of the keyboard/top cover assembly is required in order to replace the following:

◆ Printhead assembly (Refer to "Printhead Assembly Replacement" on page 4 5-18.)

◆ Main PCB board (Refer to "Main CPU Board Replacement" on page 4 5-22.)

◆ Acquisition PCB (Refer to "Acquisition Board Replacement" on page 4 5-19.)

1. Remove the battery as described in "Battery Replacement".

2. Turn the unit over so the bottom side is up and remove the two Torx fasteners shown in the figure below.
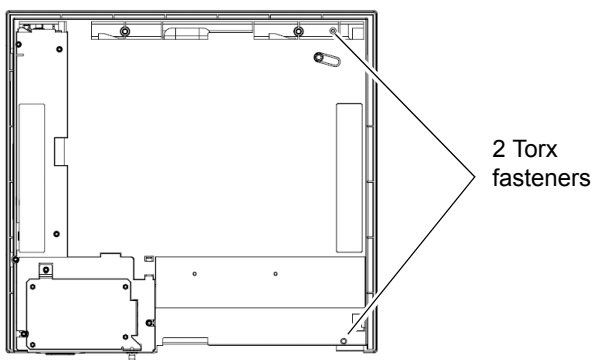
3. Turn the unit right side up and press the writer button and raise the top of the unit.

4. Remove the five Torx fasteners from inside the paper tray.

Five Torx
fasteners
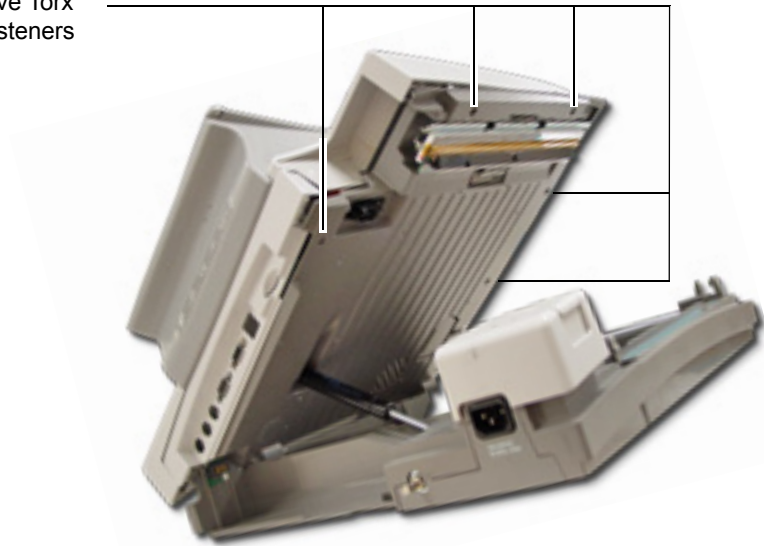
9A

5. Remove the two fasteners that secure the display panel cover at the back of the unit and then remove the display cover.

93A

6. Remove the two fasteners holding the two ground wires on either side of the display.

7. Remove the two fasteners at the top of the display panel bracket.

8. Pivot the display up to access the cable connections on the main PCB.

   NOTE

   If a KISS pump is installed, it must be removed at this point in order to access the display panel connectors from the main board. See "KISS Pump Replacement Procedures" for details.

9. Disconnect the blue ribbon cable from the main PCB board.

10. Disconnect the display light cable from the main PCB board.

11. Disconnect the keyboard ribbon cable from the main PCB.
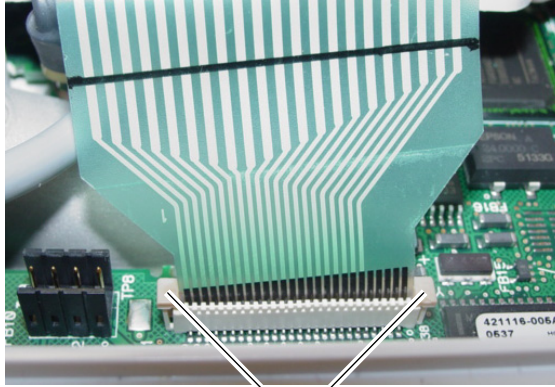
96A

plastic locking bar

NOTE

> Do not force the cable from its connector. Raise both ends of the plastic locking bar and gently pull the ribbon cable from the connector.

12. Lift upper cover from the assembly.

NOTE

> The back bezel covering the rear connections will fall off as you lift the off the cover.

Replacing the LVDS Converter Board

Use the following procedure to replace the LVDS converter board required by the AUO LCD Display (P/N 2062075-001).

1. Remove the display assembly from the device.

   See "Removal of Keyboard/Top Cover Assembly" on page 5-14 for instructions.

2. Disconnect all calbes from the LVDS converter board.
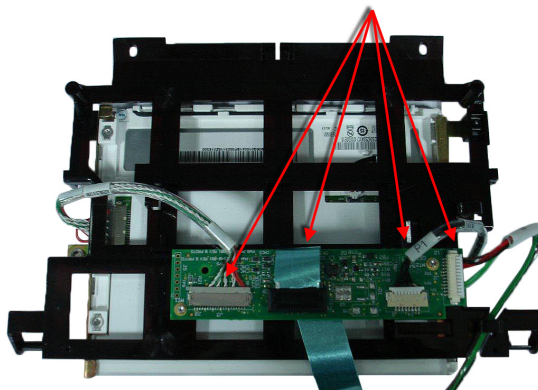
3. Remove the screws fastening the LVDS converter board to the display assembly.
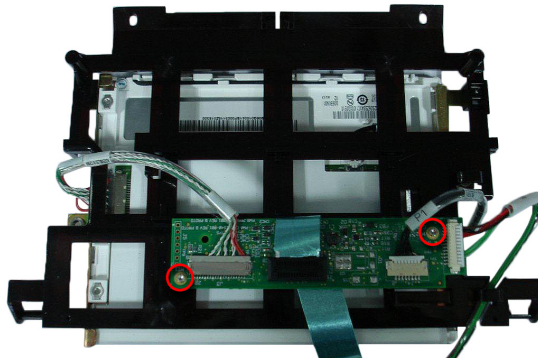
NOTE

Dispose of the old LVDS converter board in compliance with all applicable local and federal laws.

4. Attach the new LVDS converter board to the display assembly using the two screws removed in step 3.

5. Reconnect all the cables that were disconnected in step 2.

6. Reattach the display assembly to the device.

See "Keyboard/Top Cover Assembly Reassembly" on page 5-17 for instructions.

Keyboard/Top Cover Assembly Reassembly

Reverse the removal procedures to reassemble the keyboard/top cover assembly.

NOTE

When reconnecting the keyboard ribbon cable to its connector on the main PCB, lift both ends of the plastic locking bar as you insert the ribbon cable. Once the ribbon cable has been inserted, push down on the both sides of the locking bar to secure the cable.
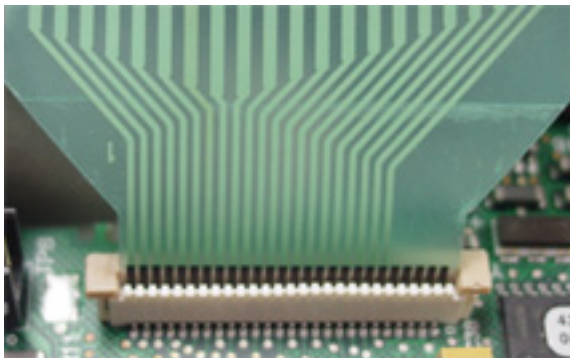
Also, be sure to pull the two ground cables through so they can be reconnected to the display panel. If the unit has a KISS pump, you will also need to ensure that the KISS pump suction tube and the KISS pump power supply cable are pulled through as well.

Printhead Assembly Replacement

1. Remove the battery as described in "Battery Replacement" on page 5-6.

2. Remove the top cover as described in "Keyboard/Top Cover Assembly Removal & Reassembly".

3. Disconnect the ribbon cable from the connector on the printhead.

4. Close the top of the unit until it snaps into place.

5. Remove E-ring from the steel pin which holds the printhead assembly in place and set it aside for printhead reassembly.
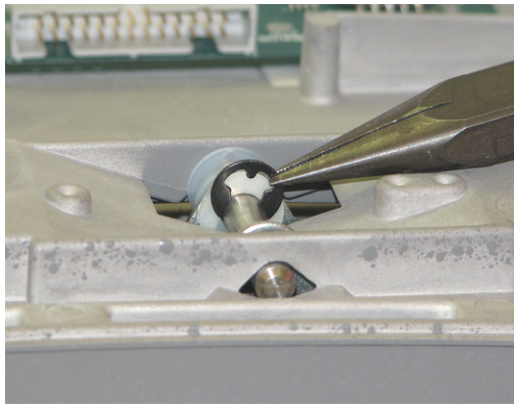
98A

6. Slide the steel pin out of the assembly.

   NOTE

   Set aside the steel pin, the three flat plastic washers, the compression spring, and the blade spring for printhead reassembly. The relative order of each component is shown below. Use this as a reference during reassembly.
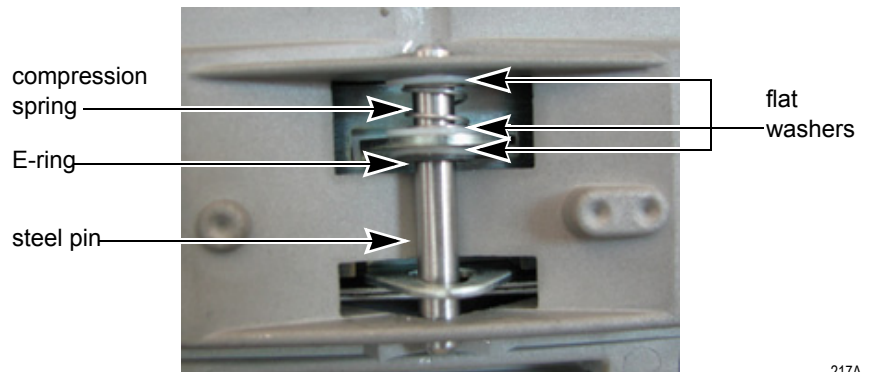
217A

7. Push the access button to open the unit and remove the printhead.

8. Reverse the disassembly procedures to reassemble the printhead.

   NOTE

   Paper tracking problems may result if these components are not reassembled properly.

Acquisition Board Replacement

1. Remove the battery as described in "Battery Replacement" on page 5-6.

2. Remove the top cover as described in "Keyboard/Top Cover Assembly Removal & Reassembly".

3. Remove the two Phillips head screws holding the acquisition connector bracket to the acquisition board.

acquisition connector bracket

102A

4. Remove the three fasteners holding the acquisition board to it's mounting bracket.

5. Pull up on cable connector to disconnect it from the main CPU board.

6. Remove acquisition board from the unit.

7. Reassemble by reversing the disassembly procedures.

Display Assembly Replacement Procedures

1. Remove the battery as described in "Battery Replacement" on page 5-6.

2. Remove the two fasteners that secure the display panel cover at the back of the unit and then remove the display cover.


93A

3. Remove the two fasteners holding the two ground wires on either side of the display.

4. Pivot the display up to access the cable connections on the main PCB.

   NOTE

   If a KISS pump is installed, it must be removed to access the display panel connectors from the main board. See "KISS Pump Replacement Procedures".

5. Disconnect the blue ribbon cable from the main PCB board.

6. Disconnect the display light cable from the main PCB board.

7. Push back on each of the tabs holding the display assembly to the pivot as shown below. Gently pull the display assembly free.
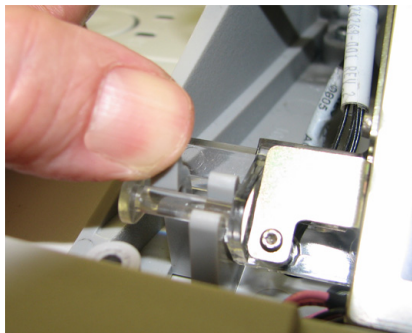
95A

8. Reverse disassembly procedures with a new display assembly.

KISS Pump Replacement Procedures

NOTE

The KISS pump is an optional accessory.

1. Remove the battery as described in "Battery Replacement".

2. Remove the two fasteners at the back of the unit that secure the display panel cover in place.

3. Remove the two fasteners from the top of the display panel.

4. Disconnect the two ground wires on either side of the display.

5. Pivot the display up to gain access to the pump assembly.

6. Press clip at the suction line connection and separate suction line from KISS pump assembly.

7. Disconnect the two exhaust lines.

8. Disconnect the pump power cable from the pump.

9. Using a #10 Torx driver remove the four fasteners holding the KISS pump bracket in place and remove the KISS pump assembly.

10. Reverse the removal procedures to replace the KISS pump.

Main CPU Board Replacement

Removal of CPU Board

NOTE

Before you begin, save the current *System Setups* to an SD card and print *System Setup* report. This will be used to restore the system setups after replacement of the CPU board.

1. Remove the battery. See "Battery Replacement" on page 5-6.

2. Remove the top cover. See "Keyboard/Top Cover Assembly Removal & Reassembly" on page 5-14.

3. Remove COMM board. See "COMM Board Replacement" on page 5-30.

4. Pull up on the brown ribbon cable to disconnect it from the main CPU board.

5. Remove the three fasteners holding the acquisition board to the acquisition board bracket and remove the acquisition board.

6. Remove the four Torx fasteners holding the acquisition board mount in place and remove the acquisition board mount.

7. Remove the two grounding straps by removing the fasteners holding them to the standoffs.

8. Using a 5.5mm socket wrench or small pliers, carefully remove the two ground standoffs.

9. Disconnect the battery cable (**J2**), the power cable (**J11**), and the printhead cable (**J12**) from the main CPU board.

10. Remove the nine Torx fasteners holding the CPU board in place.

Two 5.5mm standoffs (grounding straps)

Nine Torx fasteners
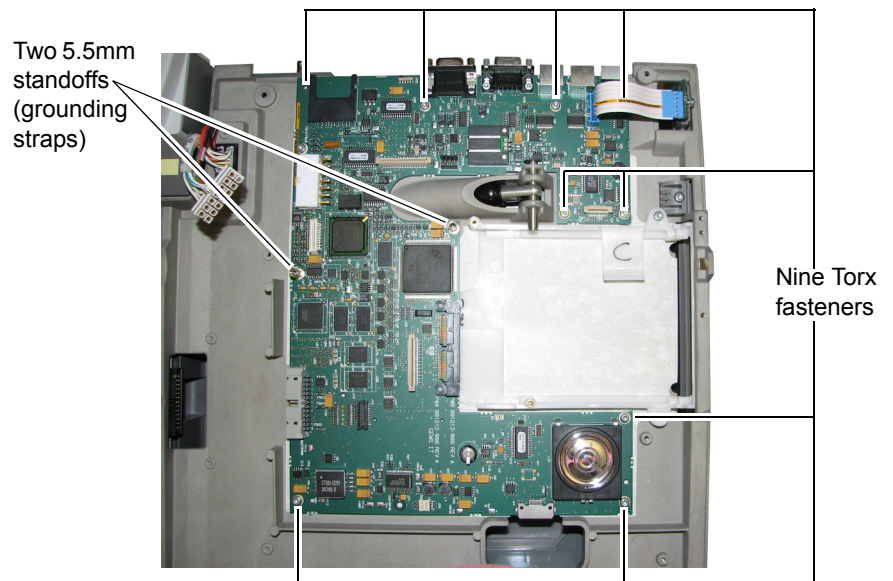
11. Lift the board off the lower frame.

Reassembly of CPU Board

1. Insert the new CPU board in place and mount using the fasteners set aside during disassembly.

    NOTE

    When replacing the fasteners which hold the two grounding straps in place, be sure to route the grounding straps as shown below.
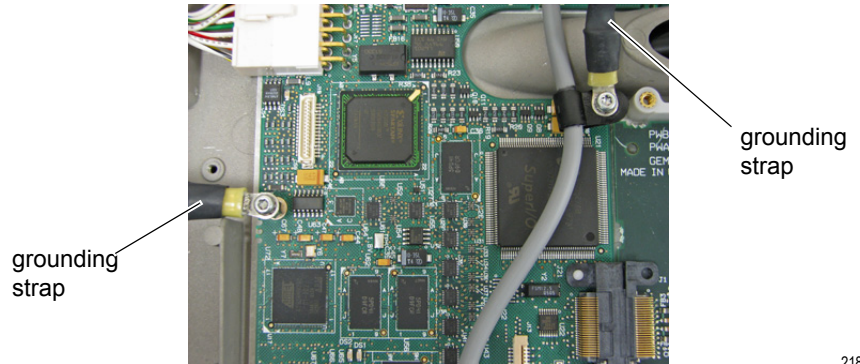
2. Reassemble the top cover and display/keyboard assemblies by reversing the steps for removal.

3. Replace the battery and proceed with software, serial number, and system setups as described in "Software, System Setups, and Option Activation" on page 5-24.

Software, System Setups, and Option Activation

Installing the Software

After replacing the CPU, you need to install or update the software on the board. Two methods exist for installing software. The standrd method uses prompts displayed on the user interface to indicate installation status. A special method is available for when the user interface is unavailable; it uses LEDs on the PCB to indicate installation status.

NOTE

Before applying a software update, do the following:

◆ Confirm the update is compatible with the main board in your device.

  ◆Updates with boot code version B4 or higher cannot be applied to devices with the -007 main board (P/N 801212-007).

  ◆Updates with software version 10A, 9C, or earlier cannot be applied to devices with the -008 main board (P/N 801212-008).

◆ Connect the device to AC power.

  Keep the device connected to AC power and do not power off the device during the update.

Installing the software with the user interface

Use the following procedure to install the software using the user interface:

1. Press **Power** to turn on the system.

2. From the *Main Menu*, select *System Setup*.

3. Enter the system password. and press **Enter**.

4. Press **Shift** + **F3**.

   The following message is displayed.

   > *Please Insert SD Card*
   > *Press 'Esc' to cancel*

5. Insert the SD card.

   The following message is displayed.

   > *Current Version: xx.xx*
   > *New Software Version: yy.yy*
   > *Press 'Enter' to start update*

6. Press **Enter**.

   NOTE

   If the device is not connected to AC power, the message *Please switch to AC power* is displayed. Connect the device to an AC outlet.

   A series of messages flash on the screen to indicate the installation progress. When it is done, one of two things will happen:

◆ If the boot code on the device and the boot code on the SD card are the same version, the following meesages are displayed:

```
Programming Over
System will shut down
Press any key to continue…
```

Press any key to shut down the device. Skip to step 8.

◆ If the boot code on the device and boot code on the SD card are different versions, the following messages are displayed.

```
Current Boot Version: xx.xx
New Boot Version: yy.yy
Press 'Enter' to start installation
```

Proceed to step 7.

7. Do one of the following:

◆ To cancel the update to the boot code, press any key other than **Enter**. The following messages are displayed:

```
Boot code not updated.
Can update later from service setup
```

◆ To update the boot code, press **Enter**. The following messages are displayed:

```
Programming Primary Boot
Programming Over
System will shut down
Press any key to continue…
```

Press any key to shut down the device.

8. After the device shuts down, press **Power** to restart the device.

9. On the *Resting ECG* screen, verify the software version has been updated.

Installing the software when the user interface is unavailable

Use this method to install the software application on devices on which the user interface is not available. This will typically be in cases where the application software cannot be found on the device.

On device boot up, the boot loader program built into the **ATMEL AT91RM9200** processor fetches the primary boot code from the SPI data flash. The primary boot code contains a small application that updates the main software application in the device's **NAND FLASH** memory.

If the primary boot code cannot find a valid software application in the **NAND FLASH**, or even if it can, it looks for a special SD card with a dummy file named *update.com* in the card's root directory. If it detects the SD card, it downloads the software application code from the SD card to the **NAND FLASH** and shuts down

the device. If the primary boot code cannot detect a valid code within 2 minutes and 6 seconds, the device shuts down.

Because the device's display is not available when the software application cannot be found, the onboard LEDs, **DS1** (Red) and **DS2** (Green), flash status codes to indicate progress. To ensure the LEDs are visible, the device's top cover must be removed before you begin the installation.

NOTE

A copy of the primary boot program (pages with ID "Bn" where n is the 3-bit PCB ID code 1-8) is kept in **NAND FLASH**. This is updated when the software is updated. For 006 and 007 boards, the FPGA image is X3 and the primary boot code image is B3. For 008 board, the FPGA image is X4 and the primary boot code image is B4.

1. To prevent the system from shutting down during the update, reset the system's timeout controller by doing the following:

   a. Disconnect the device from AC power.

   b. Remove and reinsert the battery.

       See "Battery Replacement" on page 5-6 for instructions.

2. Remove the top cover.

   This is required to make the on-board LEDs visible. See "Removal of Keyboard/Top Cover Assembly" on page 5-14 for details.

3. Connect the device to AC power.

   Keep the device connected to AC power during the software update.

4. Insert the SD card with the required application software.

   Before inserting the SD card, confirm that the dummy file *update.com* is located in the card's root directory.

5. Power on the device.

   NOTE

   Do not power off the device during the update.

   The on-board LEDs flash a series of codes to indicate installation progress. Refer to the following table for a description of those status codes.

DS1 (Red)	DS2 (Green)	Status
Off	Flashing	No SD card detected for software updated.
Off	On	Copying image files from SD card to SDRAM.
Off	Off	Erasing and/or formatting the NAND FLASH. Applicable only during the software update process.
On	Off	Programming the NAND FLASH.
Flashing	Flashing	Successful completion of programming.
Flashing	Off	Error — Could program all the image files but error in programming the status page 'Z0'

DS1 (Red)	DS2 (Green)	Status
On	On	Error — Could not program all the image files as well as the status page 'Z0'.
On	Flashing	Error — Could not program all the image files but the status page 'Z0' updated successfully.

When the installation completes successfully, both LEDs will begin to flash.

6. Do one of the following:

    ◆ Wait for the device to shut down.
      After the installation is complete, the Watch Dog Timer (WDT) will eventually timeout and shut down the device.

    ◆ Manually shut down the device.
      If you do not want to wait for the device to timeout, you can manually power down the device.

7. Remove the SD card.

8. Power on the device.

    The device should now boot back up with the updated software. On the Resting ECG screen, verify the new software.

Service Only Setups

1. From the *Main Menu*, select *System Setup*.

2. Enter the system password.

3. Press **Shift** + **F2** at the *System Setup* menu.

4. Enter the service password and press **Enter**.

5. The *Service Only Setup* window is displayed.

```
Service Only Setup

Serial number          _ _ _ _ _ _ _ _ _ _ _ _ _
Update Primary Boot    _ _ _ _
Print head resistance  _ _ _
Keyboard               _ _ _ _ _ _ _ _ _ _


Return
```
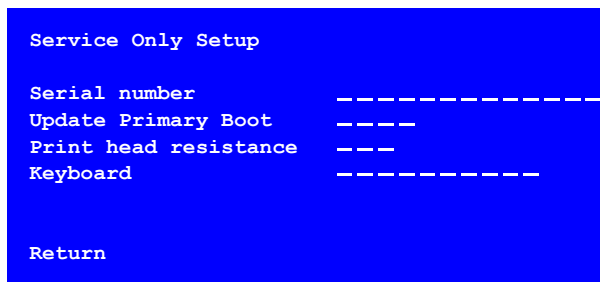
6. Enter the serial number of the system.

    NOTE
    This is the number which was used when the option codes for this system were generated. The number entered here must match the serial number on the label of the system.

7. Select/verify that *No* is selected for *Update Primary Boot*.

8. Enter the *Print head resistance*. This number can be found on the printhead label.

9. Select the appropriate language in the *Keyboard* menu.

10. Select *Return*.

Restore System Setups

1. Power up the cart.

2. From the *Main Menu*, select *System Setup*.

3. Enter the *System Password* and press **Enter**.

4. Select *Restore Setup* from the *System Setup* menu.

5. Select *From SD Card* from the *Restore Setup* menu.

Restore Options

Using the option activation codes for the system, restore the options which had been installed on the board which was removed. These options are printed on a label located on the bottom of the paper tray.

NOTE

Use the activator codes shown on the label on your system. The activator codes shown in the figure below are examples only.

Serial # SCA05470001PZ1A	
Opcode	Activator Code
DIAG	957362488412
MODM	587350173313
GN12	326723656817
COLR	392923487788
WIFI	186387493976
ELAN	636214512544
CTDG	834229765431
CSIP	239465342568
EXST	751153048267
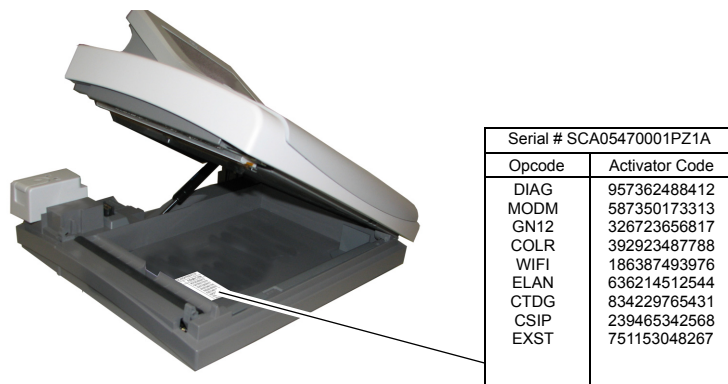
213A

1. Power on the cart.

2. Within the *System Setup* function, select *Basic System*.

3. Select *Option Activation* to activate options.

4. Type the 12-digit option activation code and press the **Enter** key.

   NOTE

   An asterisk (*) appears next to each option after it has been activated.

5. Repeat the previous step for each option to be activated on the new system.

6. Highlight *Return* and press **Enter** to return to the *Basic System* menu.

Disable Options

It is possible to disable an option. In the rare instance you may need this functionality, follow these steps:

1. From the *Main Menu*, select *System Setup > Basic System > Option Activation.*

2. In the *Option Code* field, type **x** followed by the option's existing activation code.

   The corresponding option will then be disabled.

   NOTE

   To re-enable the option, reenter the activation code (without the **x**).

3. Repeat for each option to be disabled.

COMM Board Replacement

1. Remove the battery as described in "Battery Replacement" on page 5-6.

2. Using a #10 Torx driver, remove the fasteners from the panel surrounding the LAN and modem ports.

100A

3. Grasp the side edges of the COMM board. Rock the board side to side in the slot as you pull it out along its rails.

101A

4. Insert the new COMM board as shown below. Slide it onto the rails until it is seated in place.

11A

5. Replace the panel surrounding the LAN and modem ports.

Setting up LAN Communications

Use the following procedure to set up the system's LAN communications after switching the COMM board. For more information, refer to the *LAN Option for MAC™ Resting ECG Systems Installation and Troubleshooting Guide*.

NOTE:

Before beginning this process, acquire the IP address, gateway, and subnet mask from the network administrator.

1. Power on the MAC system.

2. From the *Main Menu*, select *System Setup*.

3. If prompted, enter the system password.

4. From the *System Setup* menu, select *Basic System > Network Setup*.

   The *Network Setup* window opens.

5. Enter the *IP Address, Subnet Mask,* and *Gateway* provided by the network administrator

6. Enter the *Port Number* used by the MUSE system.

7. Select *Return* and press *Enter*.

   The *Network Settings* window closes.

8. On the *Basic System* menu, select *Transmission* and press **Enter**.

   The *Transmission* window opens.

9. Enter the following information.

Field	Value
Use IR for serial line	No
Serial line baud rate	115.2K
Default location	Ethernet (MUSE)

10. Select *Return* and press *Enter*.

    The *Transmission* window closes.

11. On the *Basic System* menu, select *Return* and press *Enter*.

    The *Basic System* menu closes.

12. On the *System Setup* menu, select *Save Setup >To System*.

    This saves the settings to the communication board and displays the following message:

Please wait.

    This should take approximately 16 to 19 seconds. If it takes less than 16 seconds, the settings were not saved successfully. Repeat a second time.

13. Wait at least 10 minutes and verify the MAC device can communicate with the MUSE system.

    Windows File Server 2000/2003 has an ARP cache that regenerates the MAC Address/Physical Address table every 10 minutes. When you replace the communications board, you change the MAC Address/Physical Address. By waiting at least 10 minutes, you allow the MUSE operating system to regenerate the MAC Address/Physical Address cache so the MAC device is able to communicate again with the MUSE system.

    NOTE

    If the MAC device cannot communicate with the MUSE system after 10 minutes, cycle the power on the MAC device and wait another 10 minutes to reverify the device can communicate with the MUSE system. Cycling the power ensures the network settings are reread from the communications board.

14. Perform all necessary functional checkouts.

    See "Functional Checkout Procedures" on page 5-35.

Writer Roller/Carriage Assembly Replacement

1.   Remove the battery as described in "Battery Replacement" on page 5-6.

2.   Remove the power supply assembly as described in "Power Supply Replacement" on page 5-10.

3.   Inside the power supply compartment, disconnect the cable that connects to the writer assembly to the power supply.

4.   Open the unit to access the paper compartment.

5.   Move the paper size bracket to the **A4** position to expose one of the writer assembly mounting screws.

6.   Remove the screw and return the paper size bracket to the **STD** (8.5 x 11) position.

7.   Close the unit and turn it over so the bottom side is up.

8.   Remove the four screws located on the underside of the writer roller/carriage assembly and lift the writer from the bottom of the unit.

9.   Reassemble the writer roller/carriage assembly by reversing the above procedures.

   NOTE

   Be sure to replace ALL fasteners and screws that were removed during disassembly. Failure to replace the screw which holds the paper size bracket in place (step 6) above could result in paper tracking problems.

Leakage Tests

The leakage tests are safety tests to ensure that the equipment poses no electrical health hazards. Use the table below to determine which tests apply to the unit under test and the maximum allowable leakage currents. For international leakage limits, refer to the internal standards agencies of that particular country.

If the unit under test fails the leakage tests, do not allow the customer to use the equipment. Call Tech Support for assistance. (See the "How to Reach Us" page in the front of the manual.)

We recommend that you perform these tests:

◆ Before applying power for the first time

◆ Annually as part of routine maintenance

◆ Whenever internal assemblies are serviced

NOTE

The accuracy of the leakage tests depends on the properly-wired wall outlet. Do not proceed until you verify the integrity of the power source.

WARNING

Total system leakage must not exceed 300 microamperes (United States) or 500 microamperes (international).

Table 2. Leakage Tests and Maximum Allowable Leakage Currents	
Test	**Maximum Current[1] (µA)**
1. Ground-wire-leakage-to-ground	300 (United States) 500 (international)
2. Chassis-leakage-to-ground	100
3. Patient-cable-leakage-to-ground	100
4. Patient-cable-leakage-into-patient-leads-from-120 V ac	500

1. Per UL 60601-1 (United States) and IEC 60601-1 (International)

Functional Checkout Procedures

This checkout procedure applies to all MAC 3500 systems.

NOTE

The FRU checkout procedure for any listed FRU also applies to its internal PCBs and components. Perform the applicable product or product configuration dependant procedures when an asterisk * is listed.

Table 3. FRU Repairs			
FRU Description	**Tools**	**Visual Inspection**	**Checkout Procedure(s)**
Battery Pack	1,5	5	1,3,11
Shock Cylinder	1,2,4,5	9	1,3
Motherboard	1,2,3,4,5	3,5,9,10	1,2,3,4,13,20 *5 through 9
Roller Assy	1,2,4,5	9	1,2,3,15
Writer Assy	1,2,4,5	9	1,2,3,15
Display Assy	1,2,4,5	3,7,9	1,2,3,12
Keyboard Assy	1,2,4,5	3,9	1,2,3,14
Power Supply Assy	1,2,3,4,5	9,10	1,2,3
Plastics	1,2,3,4,5	7,9,10	1,3, *20 *Bottom Plastic Replacement Only
Trolley or Casters	2,5	6,9	10
AC Power Cord	3,5	4	1,3
Non-Listed FRUs	1,2,4,5	9,10	1,2,3,4,20 *5 through 9

Table 4. Option Repairs			
FRU / Option	**Tools**	**Visual Inspection**	**Checkout Procedure(s)**
External Modem	1,2,5	9	1,3,5,17
Internal Modem (Comm PCB)	1,2,4,5	9	1,3,5,17
SD Card Storage	1,5,6	N/A	1,3,4,18
Wireless Serial Server	1,2,5	9	1,3,5
LAN (Comm PCB)	1,2,5	9	1,3,5,19
Barcode Reader	1,2,5	9	1,3,8

Table 4. Option Repairs (Continued)			
FRU / Option	**Tools**	**Visual Inspection**	**Checkout Procedure(s)**
Mag Card Reader	1,2,5	9	1,3,9
Treadmill or Ergometer I/F Cable	1,2,5	9	1,3,6
Blood Pressure Monitor	1,2,5	9	1,3

Table 5. Non-FRU Repairs			
Description	**Tools**	**Visual Inspection**	**Checkout Procedure(s)**
No Parts Replaced	1,5	1,2,3,4,5,6,7	1,3,4 *5 through 9
Software Update	1,5,6	N/A	1,2,3,4 *5 through 9
Hardware Upgrade	1,2,4,5	9,10	1,2,3,4,20 *5 through 9
Annual Electrical Safety Checkout	1,2,3,5	7,9,10	20, 1,2,3

Tools

1. ECG Simulator

2. Standard hand tools including a #10 and a #6 Torx Driver

3. Current Leakage Tester

4. Anti-static wrist strap

5. Applicable Service and/or Operator Manual as needed for reference

6. Floppy Diskette or SD Card

Visual Inspection

Inspect the following for excess wear and or any visual signs of damage.

1. Passed check for defective or broken patient cable/leadwires and out of date electrodes?

2. Discussed electrode placement, skin prep, and patient related requirements with ECG Tech?

3. Keyboard/LCD passed inspection?

4. AC Power cord passed inspection?

5. Battery (swollen or leaky) passed inspection?

6. Trolley and casters passed inspection?

7. External surfaces passed inspection?

8. FUSE type and rating passed inspection?

9. Fasteners replaced and secured?

10. All harnesses' and internal wiring has been secured?

Checkout Procedures

Perform the applicable checkout procedure.

Operational Checks

1. Power-up self-test passed?

2. Simulated recorded rhythm strip successful?

3. Simulated recorded ECG successful?

4. Simulated ECG stored on media successful?

5. Simulated ECG data transmitted successfully to MUSE?

6. Exercise device successfully communicates with MAC5500/5000?

7. Blood pressure monitor successfully communicates with MAC5500/5000?

8. Barcode reader successfully communicates with MAC5500/5000?

9. Magnetic card reader successfully communicates with MAC5500/5000?

10. Trolley casters lock successfully?

Diagnostic Tests

11. Battery Status Test meets Battery Current expectation?

12. Display diagnostic test successful?

13. Speaker test successful?

14. Keyboard test successful?

15. Writer diagnostic tests successful?

16. Read/Write Floppy Diagnostic Test successful? (Accurate test does not have to be performed)?

17. External/Internal Modem Test successful?

18. SD Card Test successful?

19. Ethernet Module Test successful?

Electrical Safety Checks

20. Current leakage and ground continuity test results meet requirements?

Perform electrical safety checks when indicated. All indicated electrical safety checks require a pass/fail indication for steps performed. Record the measurement values in your debrief.

Table 6. Electrical Safety Checks					
Step		**[1]Condition**	**[2]UUT - ON**	**Result**	**Leakage Current Limits**
Earth Leakage Current					
1.	Forward Polarity	NC	_____ µA	Pass/Fail	300 µA
2.	Neutral open, Forward Polarity	SFC	_____ µA	Pass/Fail	1,000 µA
3.	Neutral open, Reverse Polarity	SFC	_____ µA	Pass/Fail	1,000 µA
4.	Reverse Polarity	NC	_____ µA	Pass/Fail	300 µA
Enclosure Leakage Current					
1.	Forward Polarity	NC	_____ µA	Pass/Fail	100 µA
2.	Neutral open, Forward Polarity	SFC	_____ µA	Pass/Fail	300 µA
3.	Ground open, Forward Polarity	SFC	_____ µA	Pass/Fail	300 µA
4.	Ground open, Reverse Polarity	SFC	_____ µA	Pass/Fail	300 µA
5.	Neutral open, Reverse Polarity	SFC	_____ µA	Pass/Fail	300 µA
6.	Reverse Polarity	NC	_____ µA	Pass/Fail	100 µA
Patient Leakage Current to Ground					
1.	Forward Polarity	NC	_____ µA	Pass/Fail	10 µA
2.	Neutral open, Forward Polarity	SFC	_____ µA	Pass/Fail	50 µA
3.	Ground open, Forward Polarity	SFC	_____ µA	Pass/Fail	50 µA
4.	Ground open, Reverse Polarity	SFC	_____ µA	Pass/Fail	50 µA
5.	Neutral open, Reverse Polarity	SFC	_____ µA	Pass/Fail	50 µA
6.	Reverse Polarity	NC	_____ µA	Pass/Fail	10 µA
Patient Leakage Current Mains on Applied Part[3]					
1.	Forward Polarity Neutral / Ground Closed	SFC	_____ µA	Pass/Fail	5000 µA
2.	Reverse Polarity Neutral / Ground Closed	SFC	_____ µA	Pass/Fail	5000 µA

Table 6. Electrical Safety Checks					
Step		**^{1}Condition**	**^{2}UUT - ON**	**Result**	**Leakage Current Limits**
Ground Continuity					**Resistance**
1.	AC mains power cord ground prong to exposed metal surface (ground lug)	N/A	_____ Ω	Pass/Fail	Less than 200mΩ

1. NC = Normal Condition
   SFC = Single Fault Condition
   N/A = Not Applicable
2. UUT = Unit Under Test
3. All SIPs/SOPs grounded.

6 Parts Lists

For your notes

Ordering Parts

The FRU parts lists in this chapter supply enough detail for you to order parts for the assemblies, stand-alone FRUs, and FRU kits considered field serviceable. Only items, assemblies, and kits which have part numbers given in this chapter are available as FRUs. To order parts, contact your GE Healthcare service representative.

Field Replaceable Units (FRUs)

Upper Level Assembly Drawings
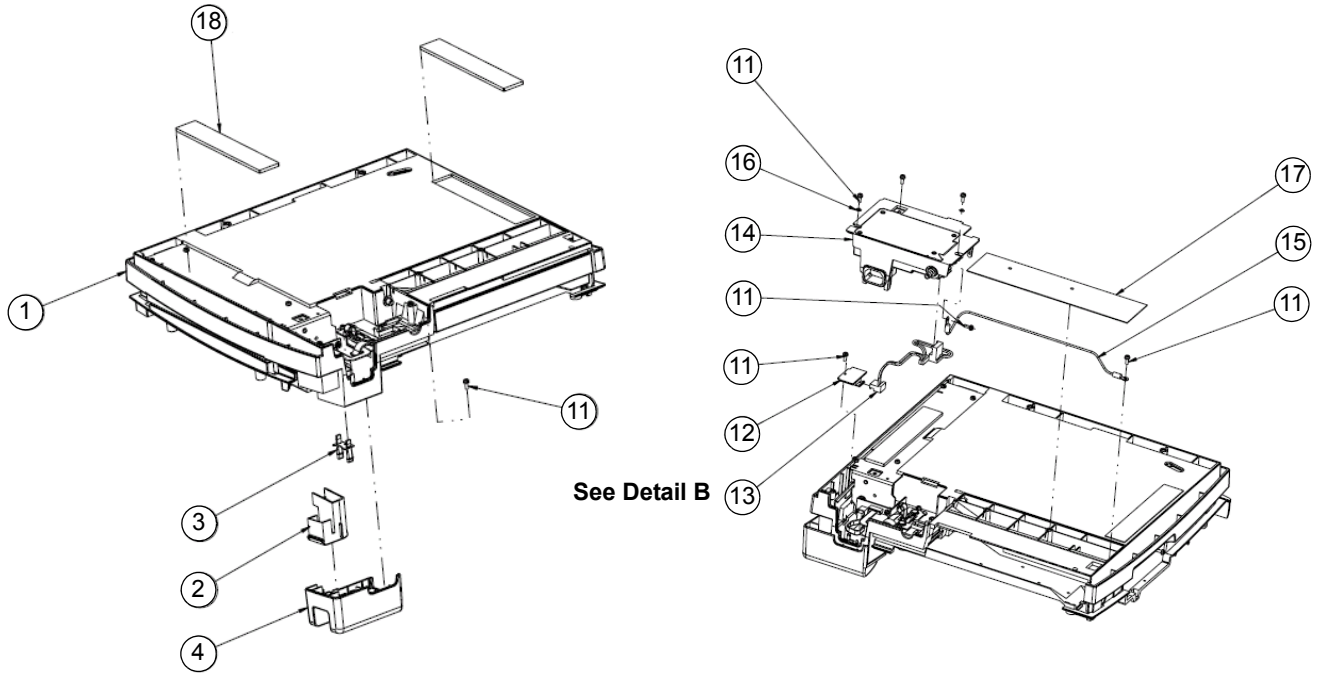
See Detail B

Detail B

See Detail A
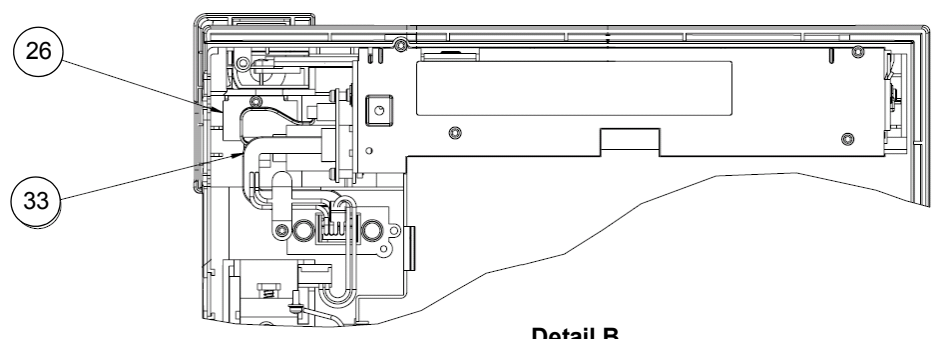
Detail A   66A, 68A, 69A, 70A, 71A

**KISS Pump Option
(See Detail C)**

110.3±1

Detail C

91A

SOLID BLACK WIRE
REF: MOTOR

STRIPED WHT/BLK WIRE
REF: POWER

Detail D

93 ADD E-CLIP
TO SHOCK PIN

11

95

98

96
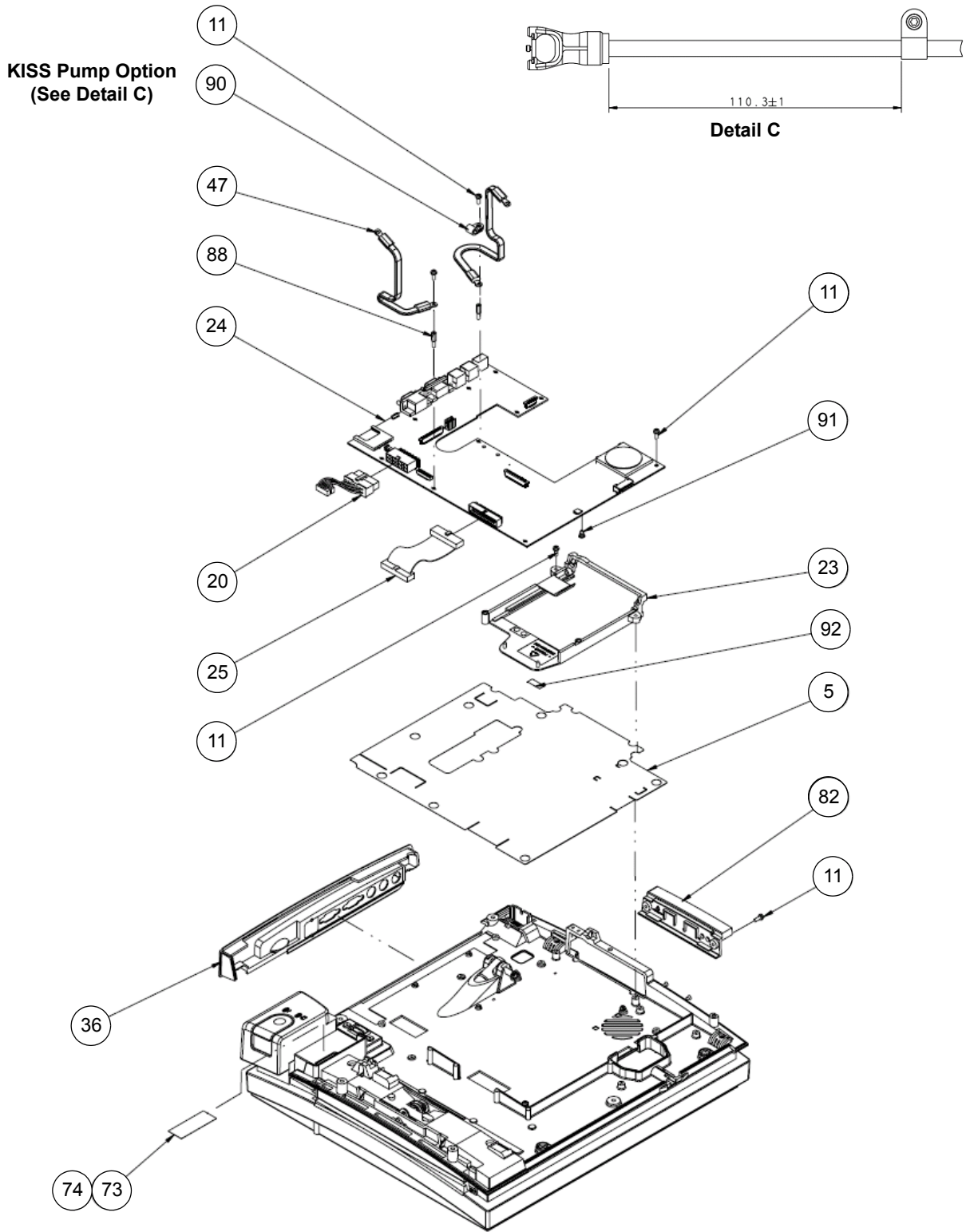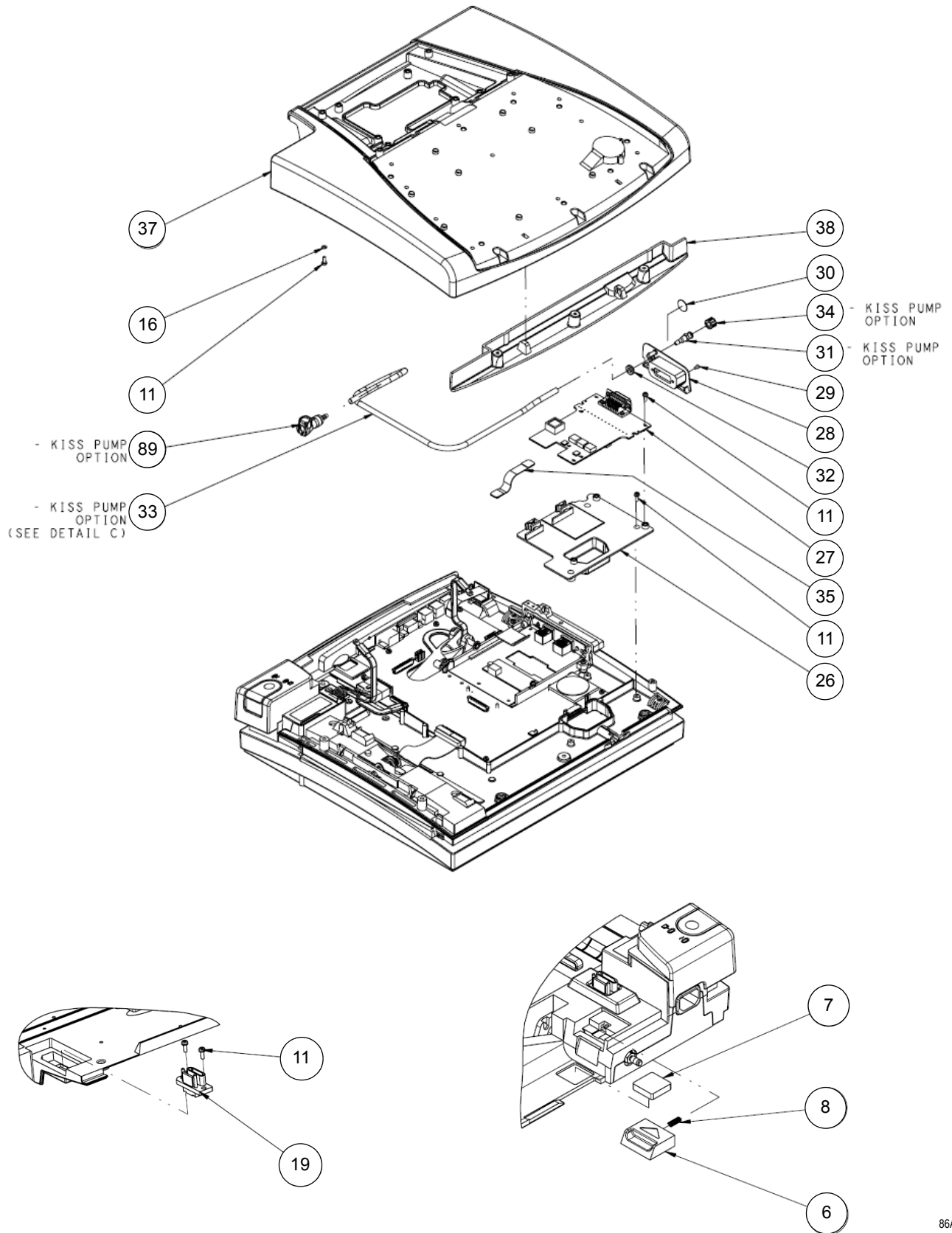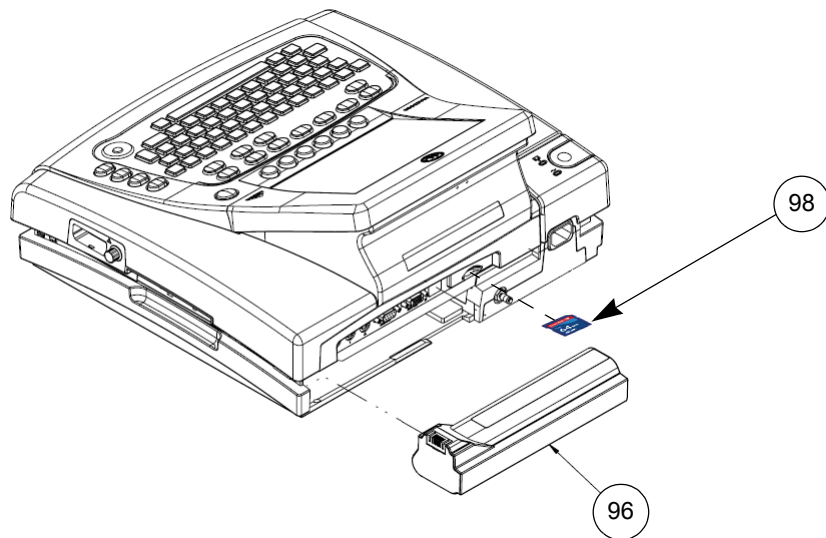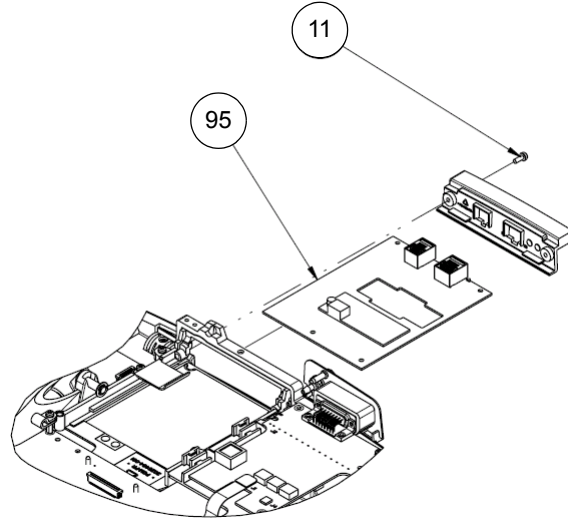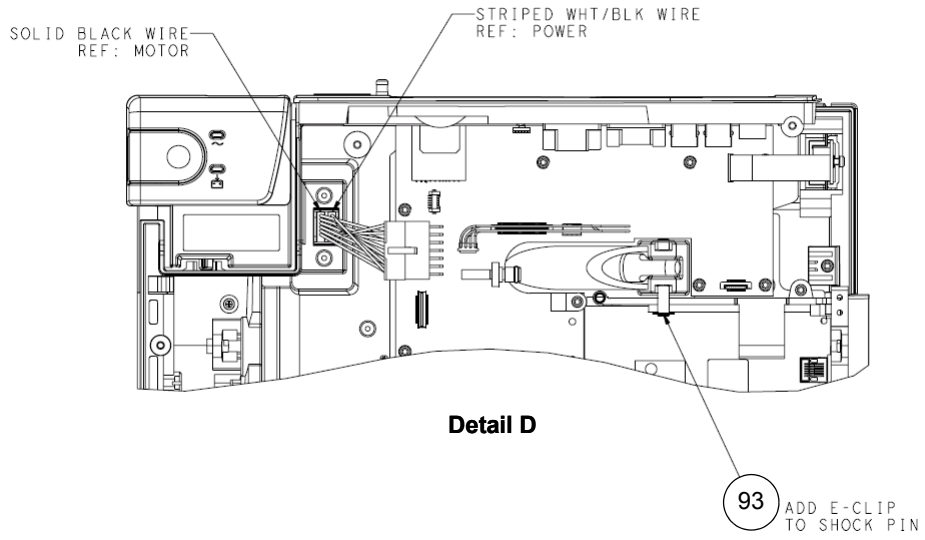
85A, 90A

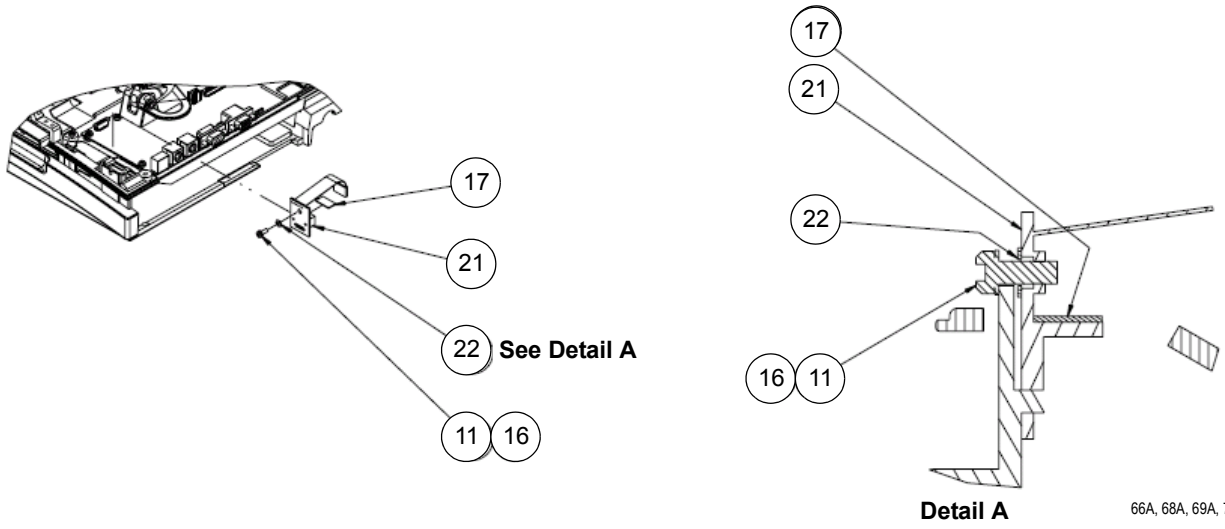|		Table 1. Upper Level Assembly Drawings
Item	**Part Number**	**Item Description**
1		PRINTER THERMAL MAC3500 (See "Universal Writer Kit, pn 2031810-002" on page 6-14 for more detailed information.)
2		BTN 3500 WRITER (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
3		LIGHT PIPE MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
4		HLDR BUTTON MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
5	419759-002	INSULATOR BD MAC SERIES
6	416298-001	BUTTON BATTERY MAC SERIES
7	419752-001	SPRING BATTERY MAC SERIES
8	419753-001	SPRING, BAT. BUTTON MAC
11		M3 X 8MM TORX SEMS (Not available as "stand-alone" FRU. See "Hardware Kit for MAC 3500, pn 2030869-001" on page 6-24)
12	801222-002	PCB LED BOARD MAC 5000
13	700645-010	HARNESS PS/LED/MOTOR
14	421117-002	ASSY POWER SUPPLY MAC 5000
15	700686-001	HARNESS GROUND MAG MAC 5000
16	4520-004	WASHER FLAT SS #4,
17	420016-001	LABEL SET MAC5000 BOTTOM COVER
18	419755-002	PAD BOTTOM MAC SERIES
19	419957-001	CONN VERT MINI-DRAWER 14P
20	700682-001	HARNESS PWR TO CPU BD
21	801220-002	PCB MAC 5000 BATTERY TRANS
22	4550-014	WASH NYL .28 OD .12 ID .03THK
23		RAIL COMMUNICATION BOARD (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
24	801212-008	PCB ASSY MAC CPU ROHS This board works on MAC 3500 and MAC 5500 devices running MAC software versions 9D and 10B or later. It does not work on MAC 5000 devices. It is loaded with factory software that is not intended for patient use. If you are replacing a previous CPU, you must order an SD card with the appropriate software version; attempting to install earlier versions on a system with this board will cause the system to fail. Always reload the same or newer version of the software. Do not downgrade the software to a lower version.
25	700687-002	CABLE ASSY PRTHD SNSR W/O FER

Item	Part Number	Item Description
26		PLASTIC BRACKET, ACQ BOARD (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
27	2022328-002	PCB MAC3500 ACQUISITION BOARD V2 NOTE: This board is backwards compatible with MAC3500s shipped with the Version 1 MAC3500 Acquisition board, 2022328-001
28		PLASTIC CONNECTOR COVER (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
29	80177736	SCR FH #4-40X1/4" ZINC AHNL.DIN965
30		LABEL LUER MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
31		CONNECTOR LUER FEMALE (Not available as "stand-alone" FRU. See "MAC 3500 KISS Pump Hardware Kit, pn 2030872-002" on page 6-29)
32		NUT LOCK (Not available as "stand-alone" FRU. See "MAC 3500 KISS Pump Hardware Kit, pn 2030872-002" on page 6-29)
33	82204620	TUBING PVC 3X1 GREY
34		PLUG LUER MALE (Not available as "stand-alone" FRU. See "MAC 3500 KISS Pump Hardware Kit, pn 2030872-002" on page 6-29)
35		FLEX CKT ASSY CAM (Not available as "stand-alone" FRU. See "Harness Kit for MAC 3500, pn 2030871-002" on page 6-28)
36		PANEL REAR MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
37		PLASTIC TOP COVER (Not available as "stand-alone" FRU. See "MAC 3500 Top Cover Kit, pn 2030899-001" on page 6-27)
38		PLATE TOP COVER MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Top Cover Kit, pn 2030899-001" on page 6-27)
39		KYBD UNIVERSAL MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Top Cover Kit, pn 2030899-001" on page 6-27)
40		COVER KISS PUMP MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
47		HARN LCD DISPLAY GROUND (Not available as "stand-alone" FRU. See "Harness Kit for MAC 3500, pn 2030871-002" on page 6-28)
65	2026801-001	ASSY DISPLAY BEZEL MAC 3500
70		PLASTIC KEYBOARD BEZEL (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
72		LABEL CE/UL MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
73	[1]	LABEL PRODUCT/SERIAL/MFG LOCATION SIZE A
74	*	LABEL CLEAR OVERLAMINATE

Table 1. Upper Level Assembly Drawings (Continued)

		Table 1. Upper Level Assembly Drawings (Continued)
Item	Part Number	Item Description
75	*	BAG POLY 22X22X47IN ANTI-STATIC
76	*	PACKAGING CARTON 524 X 270 X 444.5
77	*	LABEL CARTON MAC3500
78	*	FILLER RH FOAM END CAP
79	*	FILLER LH FOAM END CAP MAC3500
82		PANEL BLANK COMMUNICATION MAC3500 (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
86	2026799-002	ASSY DISPLAY- MAC 3500 AUO LVDS-LED (See "MAC 3500 Display Assembly, pn 2026799-002" on page 6-11 for more detailed information.)
87	2022882-002	PUMP KISS ASSY MAC 3500 (See "MAC 3500 KISS Pump Assembly, pn 2022882-002" on page 6-13 for more detailed information.)
88		SPACER MALE/FEMALE M3 X 10 HEX (Not available as "stand-alone" FRU. See "Hardware Kit for MAC 3500, pn 2030869-001" on page 6-24)
89		FITTING PNEU 1/8" QUICK FEMALE (Not available as "stand-alone" FRU. See "MAC 3500 KISS Pump Hardware Kit, pn 2030872-002" on page 6-29)
90		CLAMP CABLE 4.78MM ID BLK NYL (Not available as "stand-alone" FRU. See "MAC 3500 KISS Pump Hardware Kit, pn 2030872-002" on page 6-29)
91		SNAP RIVET NYLON .124 DIA (Not available as "stand-alone" FRU. See "Hardware Kit for MAC 3500, pn 2030869-001" on page 6-24)
92		ADHESIVE BEZEL CORNER (Not available as "stand-alone" FRU. See "MAC 3500 Plastics Kit, pn 2030898-001" on page 6-25)
93		FSTNR E-RING (Not available as "stand-alone" FRU. See "Hardware Kit for MAC 3500, pn 2030869-001" on page 6-24)
94	*	PACKAGING BOX ACCESSORIES MAC3500
95	2022332-004	PCB ASSY MAC5500 XM COMM BOARD ROHS **NOTE:** This board is compatible with software version 9D and 10B or later. When replacing an earlier board, you must order an SD card with the appropriate software version. This board is compatible with CPU board 801212-008. It is not compatible with CPU boards 801212-007 or 801212-006.
96	900770-001	BATTERY PACK ASSY MAC PAC
98	2026831-007	PROGRAMMED SD CARD MAC V9D
	2027268-005	SD card for external storage (2 GB)
	2027268-004	SD card for external storage (512 MB)
	2027268-003	SD card for external storage (256 MB)
	2027268-002	SD card for external storage (128 MB)

1 Part not available as a stand-alone FRU. This part is only available as part of the entire assembly.

Sub-Assemblies

MAC 3500 Display Assembly, pn 2026799-002
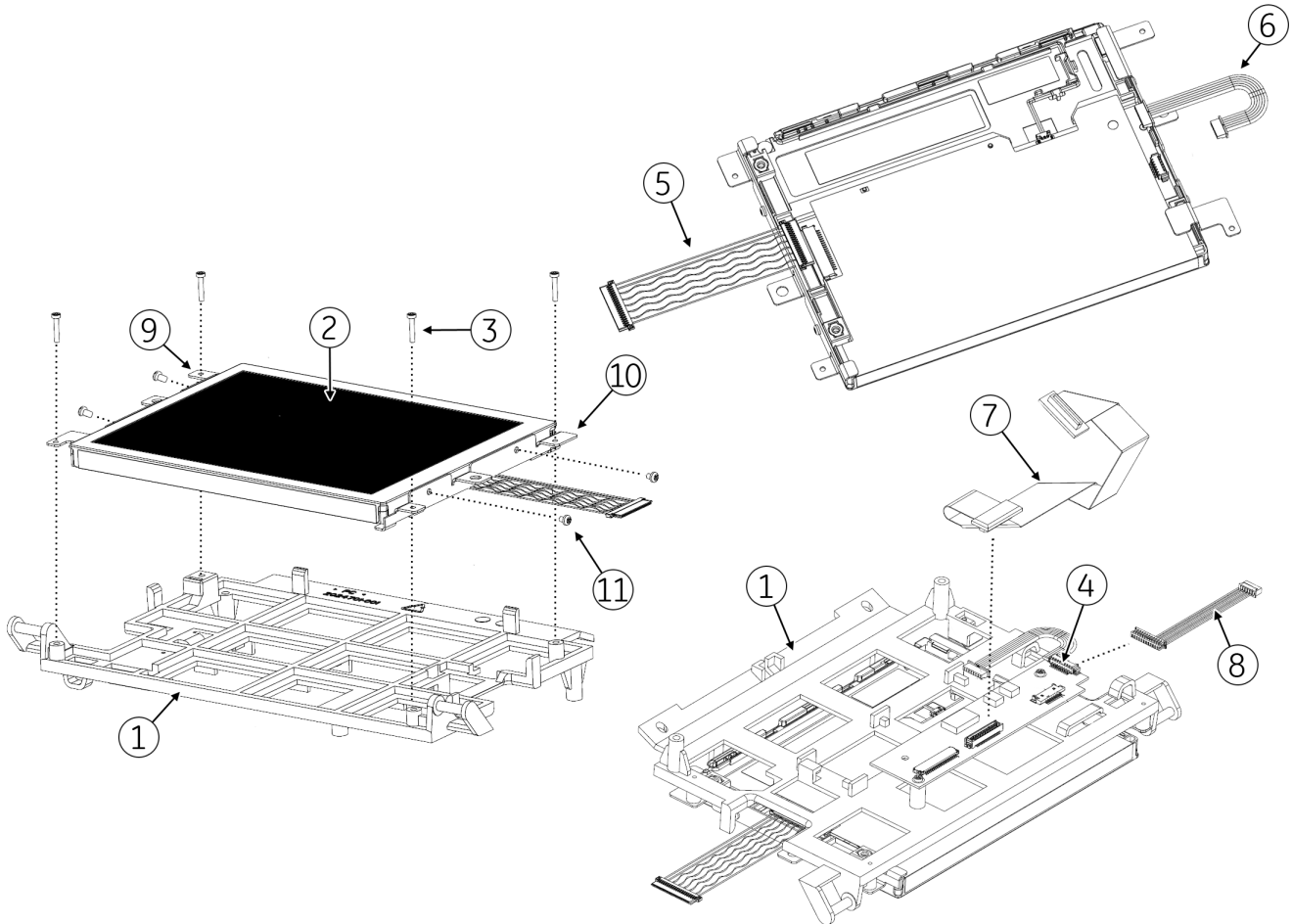
	Table 2. MAC 3500 Display Assembly, pn 2026799-002	
Item	**Part Number**	**Item Description**
1	2024701-001	BRACKET DISPLAY MAC3500
2	2062075-001	AUO DISPL LCD 6.5 G065VN01 - V2 AUO
3	417866-002	SCREW 1 x .375 PNHD TORX 6
4	2061540-001	LVDS CONVERTER BOARD
5	2059322-001	MAC3500 LCD CABLE Available only in a FRU kit. See "Harness Kit for MAC 3500, pn 2030871-002" on page -28 for more information.

	Table 2. MAC 3500 Display Assembly, pn 2026799-002 (Continued)	
Item	**Part Number**	**Item Description**
6	2059255-001	ASSY MAC3500 BACKLIT CABLE - AUO Available only in a FRU kit. See "Harness Kit for MAC 3500, pn 2030871-002" on page -28 for more information.
7	2024271-002	ASSY DISPLAY CABLE MAC3500 Available only in a FRU kit. See "Harness Kit for MAC 3500, pn 2030871-002" on page -28 for more information.
8	2034900-003	MAC3500 PWR CABLE MAIN BOARD TO LVDS Available only in a FRU kit. See "Harness Kit for MAC 3500, pn 2030871-002" on page -28 for more information.
9	2027896-010	BRACKET - LF
10	2027897-010	BRACKET MTG RIGHT - 18D
11	411508-002	SCREW METRIX PH M2 x 3 W/COAT

MAC 3500 KISS Pump Assembly, pn 2022882-002
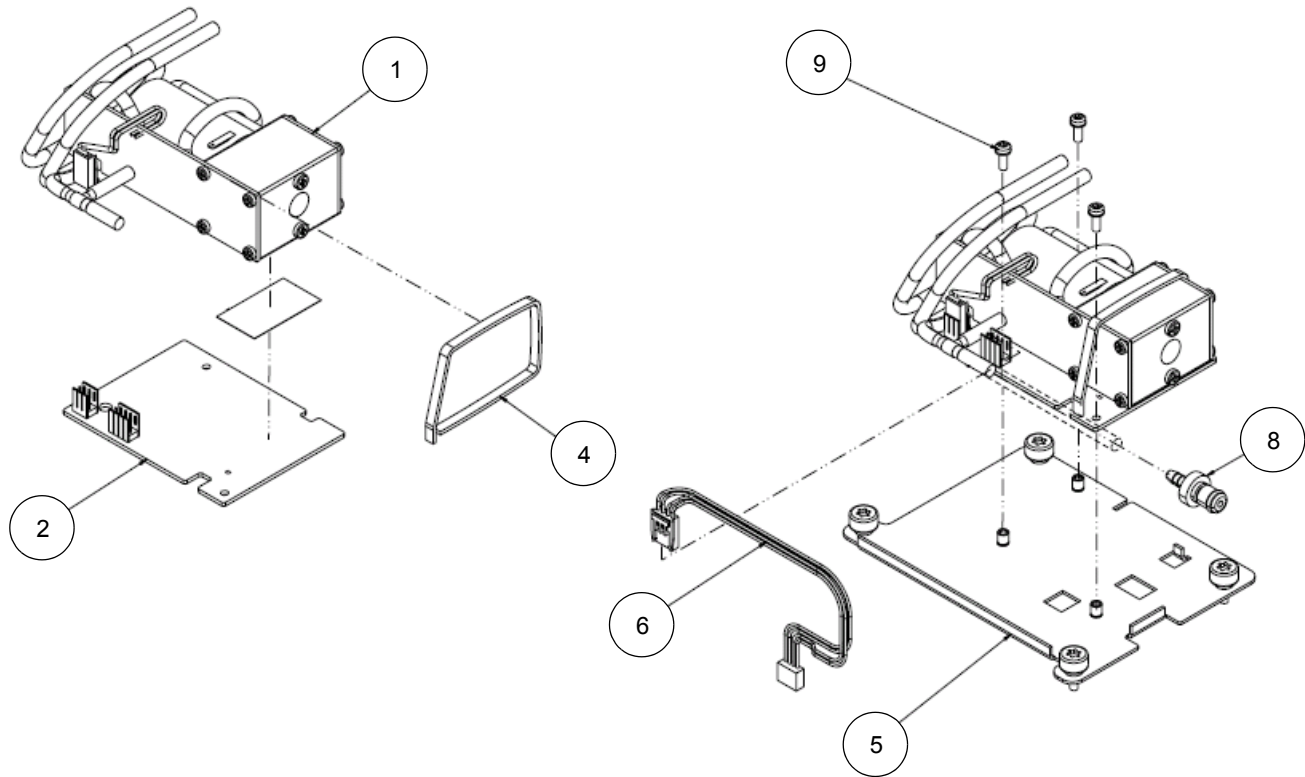
Table 3. MAC 3500 KISS Pump Assembly, pn 2022882-002		
Item	**Part Number**	**Item Description**
1	1	ASSY KISS PUMP
2	*	PCB HOLDER PUMP
4	*	CABLE STRIP 293 X 4,8 MM
5		BRACKET KISS PUMP MAC3500 (Only available in a FRU kit. See "MAC 3500 KISS Pump Hardware Kit, pn 2030872-002" on page 6-29)
6		ASSY WIRE SET KISS PUMP MAC3500 (Only available in a FRU kit. See "MAC 3500 KISS Pump Hardware Kit, pn 2030872-002" on page 6-29)
8		FITTING PNEU 1/8" QUICK MALE (Only available in a FRU kit. See "MAC 3500 KISS Pump Hardware Kit, pn 2030872-002" on page 6-29)
9		M3 X 8MM TORX SEMS (Only available in a FRU kit. See "Hardware Kit for MAC 3500, pn 2030869-001" on page 6-24)

1 Part not available as a stand-alone FRU. This part is only available as part of the entire assembly.

Universal Writer Kit, pn 2031810-002
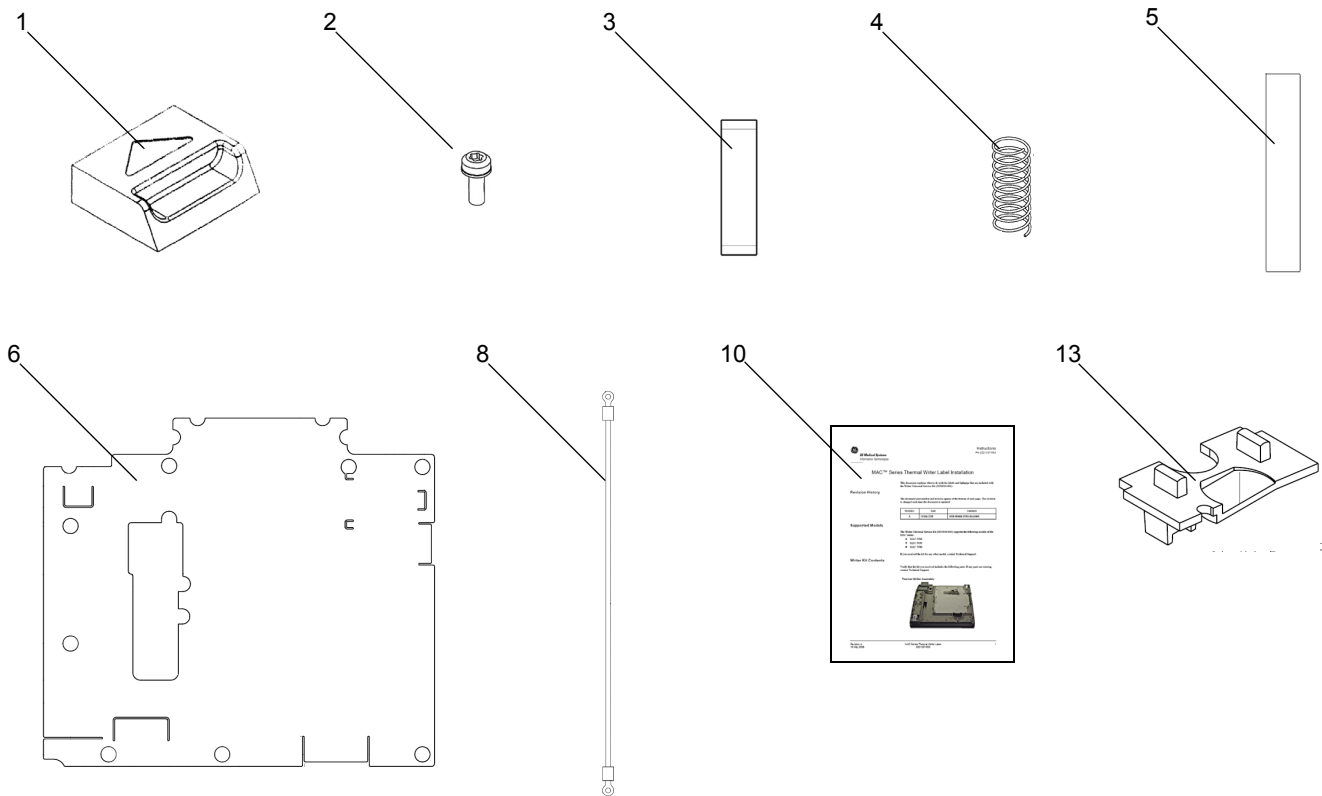
Table 4. Universal Writer Kit, pn 2031810-002		
Item	**Description**	**Qty**
1	BUTTON BATTERY MAC SERIES	1
2	M3 X 8MM TORX SEMS	1
3	SPRING BATTERY MAC SERIES	1
4	SPRING, BAT. BUTTON MAC	1
5	PAD BOTTOM MAC SERIES	2
6	INSULATOR BD MAC SERIES	1
7	PRINTER THERMAL MAC3500 (See "Thermal Writer Assembly" on page 6-16)	1
8	HARNESS GROUND MAG MAC 5000	1
9	LABEL SET MAC5000 BOTTOM COVER [1]	1
10	INSTALLATION INSTRUCTIONS	1
11	LABEL LED MAC SERIES [*]	1
12	LABEL CE/UL MAC5000 [*]	1

	Table 4. Universal Writer Kit, pn 2031810-002 (Continued)	
Item	**Description**	**Qty**
13	LIGHTPIPE MAC 5000	1
14	ADHESIVE LIGHTPIPE MAC SERIES *	1
15	LABEL PHYSICIAN MAC5000 *	1
16	BAG ANTI-STATIC 6 X 8 *	1

1 Not shown in figure above.

Thermal Writer Assembly
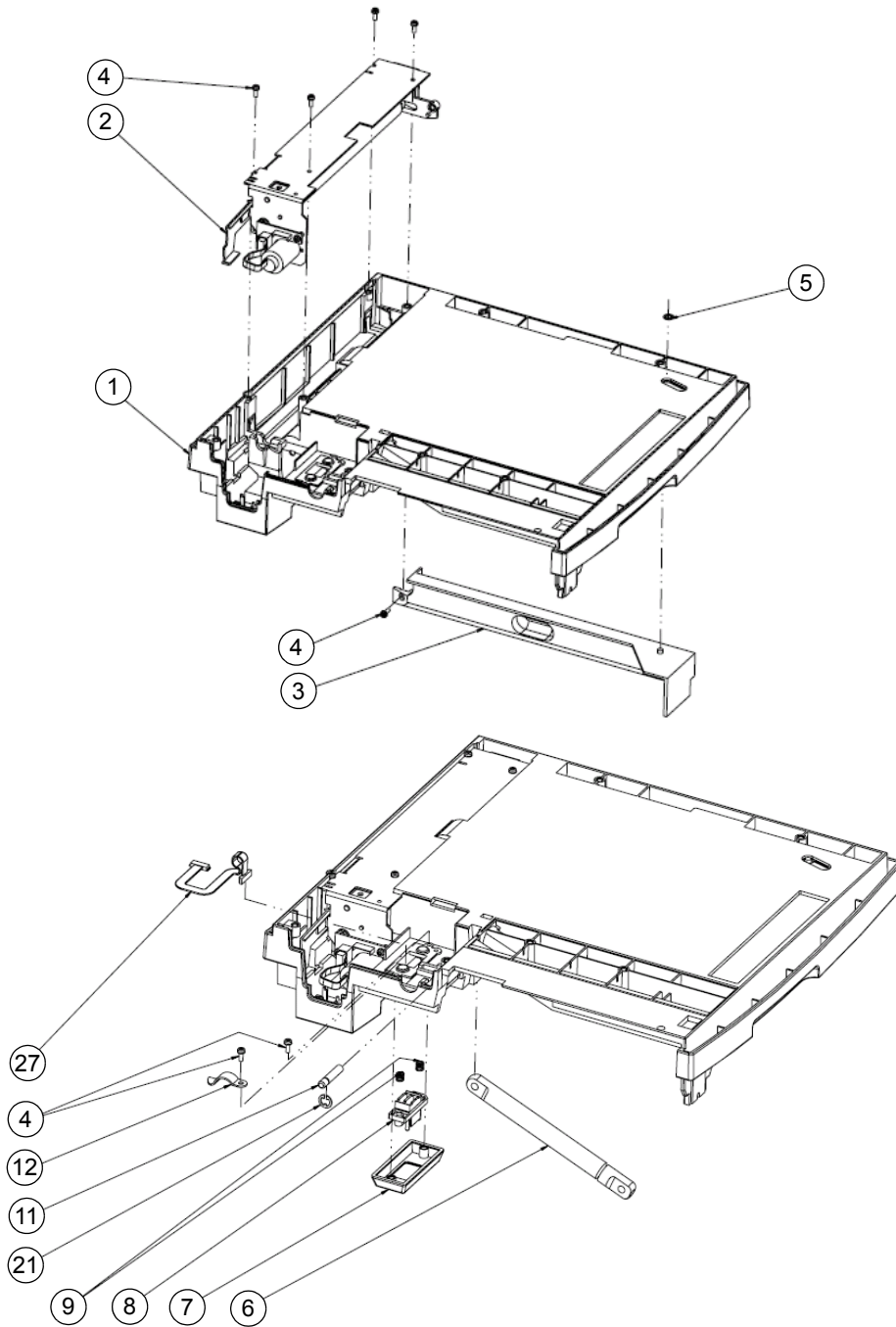
Table 5. Thermal Writer Assembly		
Item	**Part Number**	**Item Description**
1	1	BASE, WRITER MAC SERIES
2	422396-003	ASSY ROLLER MAC SERIES WRITER
3	*	SPACER PAPER MAC SERIES
4		M3 X 8MM TORX SEMS (Not available as "stand-alone" FRU. See "Hardware Kit for MAC 3500, pn 2030869-001" on page 6-24)
5	*	CLIP, INT. STAR
6	416015-001	SHOCK CYLINDER
7	*	COVER AMP CONNECTOR MAC SERIES
8	*	CONN VERT MINI-DRAWER 14P
9	*	SPRING, CONNECTOR MAC
11	*	PIN SHOCK
12	*	FSTNR WIRE CLIP
13	2029559-001[2]	PRINTHEAD MAC SERIES WRITER
14	*	FRAME WRITER
15	*	HINGE FRT MAC SERIES
16	*	HINGE RR MAC SERIES
17	*	WSHR NYLON 6.4 ID
18	*	PIN SHOCK UPPER
19	*	SPRING CPRSN HEADPIN
20	*	WSHR NYLON -PRINTHEAD
21		FSTNR E-RING (Not available as "stand-alone" FRU. See "Hardware Kit for MAC 3500, pn 2030869-001" on page 6-24)
22	*	PIN PRINTHEAD
23	*	STATIC BRUSH 1212
24	*	SPRING PRINTHEAD
25	*	PRINTHEAD WELDMENT
26	*	SCR MACH PNHD M3 X 6 SIMS
27	*	CABLE ASSY RBN MOTOR PCB

1 Part not available as a stand-alone FRU. This part is only available as part of the entire assembly.

2 Part Number 422397-001 can be substituted for this part if available.

Keyboards
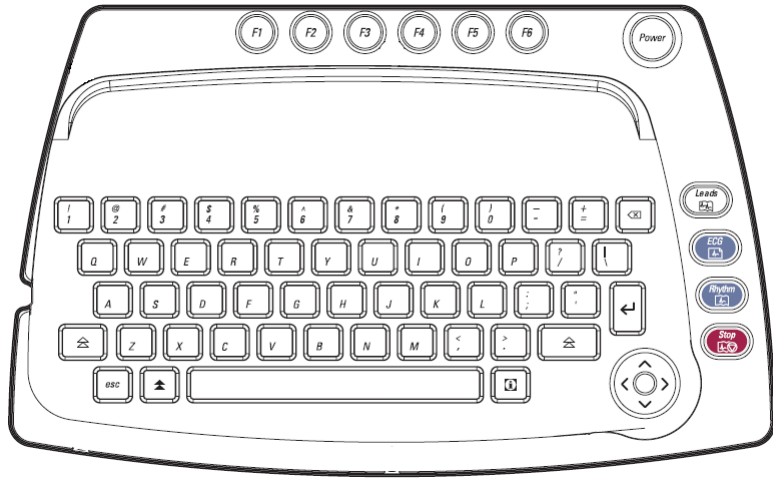
56A

MAC 3500 Keyboard (English)

Table 6. MAC 3500 Keyboards	
Part Number	**Description**
2022885-001	KYBD MAC 3500
2022885-002	KYBD GER MAC3500
2022885-003	KYBD FRE MAC3500
2022885-004	KYBD SPA MAC3500
2022885-005	KYBD SWE MAC3500
2022885-006	KYBD ITA MAC3500
2022885-007	KYBD JAP MAC3500
2022885-008	KYBD DUT MAC3500
2022885-009	KYBD NOR MAC3500
2022885-010	KYBD DAN MAC3500
2022885-011	KYBD CZE MAC3500
2022885-013	KYBD CHN MAC3500
2022885-014	KYBD HUN MAC3500
2022885-015	KYBD POL MAC3500

Barcode Scanners

57A

2D Barcode Scanner

Table 8. MAC 3500 Barcode Scanners (Model 4600)	
Part Number	**Description**
2031240-001	KIT 2D BARCODE IMAGER MAC5000 ENGLISH
2031240-002	KIT 2D BARCODE IMAGER MAC5000 GERMAN
2031240-003	KIT 2D BARCODE IMAGER MAC5000 FRENCH
2031240-004	KIT 2D BARCODE IMAGER MAC5000 SPANISH
2031240-005	KIT 2D BARCODE IMAGER MAC5000 SWEDISH
2031240-006	KIT 2D BARCODE IMAGER MAC5000 ITALIAN
2031240-009	KIT 2D BARCODE IMAGER MAC5000 NORWEGIAN
2031240-010	KIT 2D BARCODE IMAGER MAC5000 DANISH
2031240-011	KIT 2D BARCODE IMAGER MAC5000 CZECH
2031240-014	KIT 2D BARCODE IMAGER MAC5000 HUNGARIAN
2031240-015	KIT 2D BARCODE IMAGER MAC5000 POLISH

Card Readers
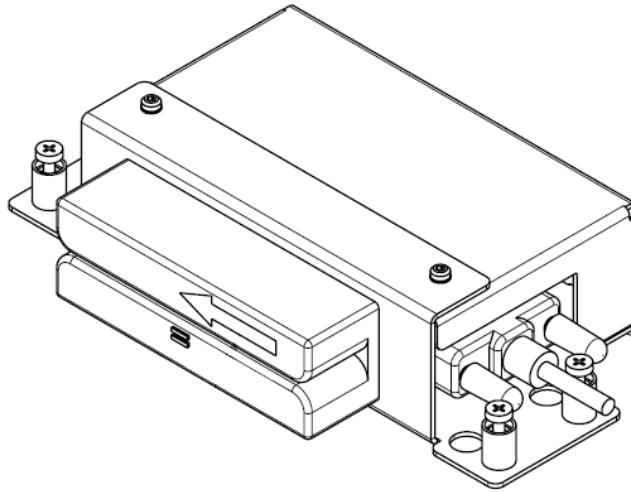
59A

MAC 3500 Card Reader

Table 9. MAC 3500 Card Readers	
Part Number	**Description**
2018627-001	KIT MAG CARD READER MAC5000 ENGLISH
2018627-002	KIT MAG CARD READER MAC5000 GERMAN
2018627-003	KIT MAG CARD READER MAC5000 FRENCH
2018627-004	KIT MAG CARD READER MAC5000 SPANISH
2018627-005	KIT MAG CARD READER MAC5000 SWEDISH
2018627-006	KIT MAG CARD READER MAC5000 ITALIAN
2018627-009	KIT MAG CARD READER MAC5000 NORWEGIAN
2018627-010	KIT MAG CARD READER MAC5000 DANISH

Modems

Table 10. MAC 3500 Modems	
Part Number	**Description**
2005264-001	KIT MAC 5000 EXT MODEM 56K US
2005264-002	KIT MAC 5000 GLOBAL EXT MODEM 56K
2005264-003	KIT MAC 5000 EXT MODEM 56K ASTL
2005264-004	KIT MAC 5000 EXT MODEM 56K CZEC
2005264-005	KIT MAC 5000 GLOBAL EXT MODEM 56K
2005264-006	KIT MAC 5000 EXT MODEM 56K JAP
2005264-007	KIT MAC 5000 EXT MODEM 56K NZEA

Wireless Option

Table 11. Wireless Option	
Part Number	**Description**
2026821-001 [1]	ASSY WIRELESS TROY SERVER USA
2026821-002 [2]	ASSY WIRELESS TROY SERVER EUROPE
2034530-001	ASSY WIRELESS SILEX SERVER USA
2034530-002	ASSY WIRELESS SILEX SERVER EUROPE
2026825-002	PWR SPLY MAC5000 WIRELESS TROY/SILEX

1 Replaced by and compatible with 2034530-001 (Silex Server USA)
2 Replaced by and compatible with 2034530-002 (Silex Server Europe)

Power Cords

Table 12. Power Cords	
Part Number	**Description**
401855-001	PWR CRD CONT EURO 10A 250V 8FT
401855-002	PWR CORD BRITISH 10A 250V 8FT
401855-003	PWR CORD ITALIAN 10A 250V 8FT
401855-004	PWR CORD ISRAELI 10A 250V 8FT
405535-006	PWR SPLY CRD RA HOSP GRD 13A 125V 10FT
401855-007	PWR CORD SWISS 10A 250V 8FT
401855-008	PWR CORD INDIAN 10A 250V 8FT
401855-010	PWR CORD AUSTRALN 10A 250V 8FT
401855-012	PWR SPLY CRD RA CHINA 10A 250V 2.5M

Trolley

MAC 3500 Trolley
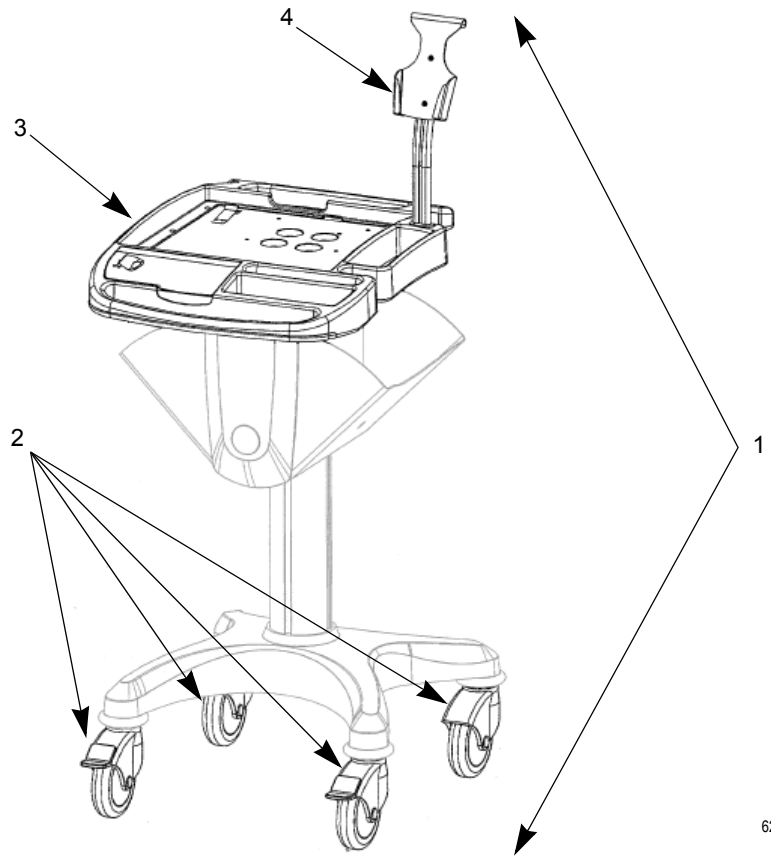
Item	Part Number	Description
**Table 13. MAC 3500 Trolley, Components, & Accessories**
1	2017210-001	TROLLEY MAC SYSTEM
2	2024418-001	KIT UPGRADE CONDUCTIVE WHEEL
3	2028153-001	FRU TOP REPLACEMENT KIT FOR TROLLEY
4	2026528-001	FRU ACQUISITION HOLDER FOR TROLLEY
*	2031407-001	BRACKET ACQ CABLE MULTI-LINK
*	2031408-001	BRACKET ACQ CABLE NEHB
*	2020510-001	KIT PAPER TRAY MAC TROLLEY
*	30344353	TRIPOD KISS MAC5000
*	30344377	ARM KISS
*	30344753	BRACKET TRIPOD KISS

* Not shown in figure.

Field Replaceable Unit Kits

Hardware Kit for MAC 3500, pn 2030869-001
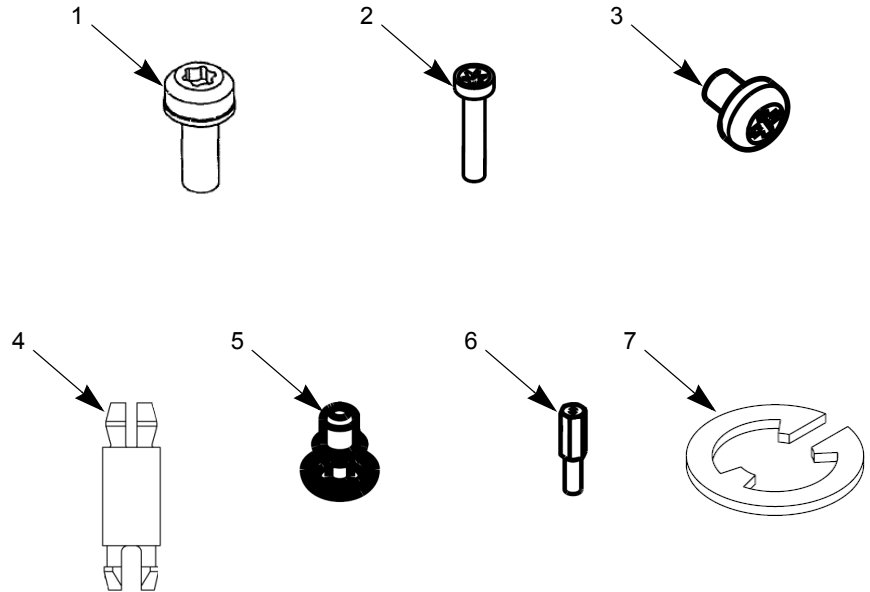
Table 14. Hardware Kit, pn 2030869-001		
Item	**Item Description**	**Qty**
1	M3 X 8MM TORX SEMS	40
2	SDREW 1 X .375 TORX T-6 FHP	6
3	SCREW METRIC PH M2 X 3 W/COAT	4
4	STANDOFF PLASTIC SNAP	8
5	SNAP RIVET NYLON .124 DIA	1
6	SPACER MALE/FEMALE M3 X 10 HEX	2
7	FSTNR E-RING	1

NOTE

Items in the kit are not available as individual FRUs. They can be obtained by purchasing the entire FRU kit.

Items shown above are not drawn to relative scale. Figures are provided for reference only.

MAC 3500 Plastics Kit, pn 2030898-001
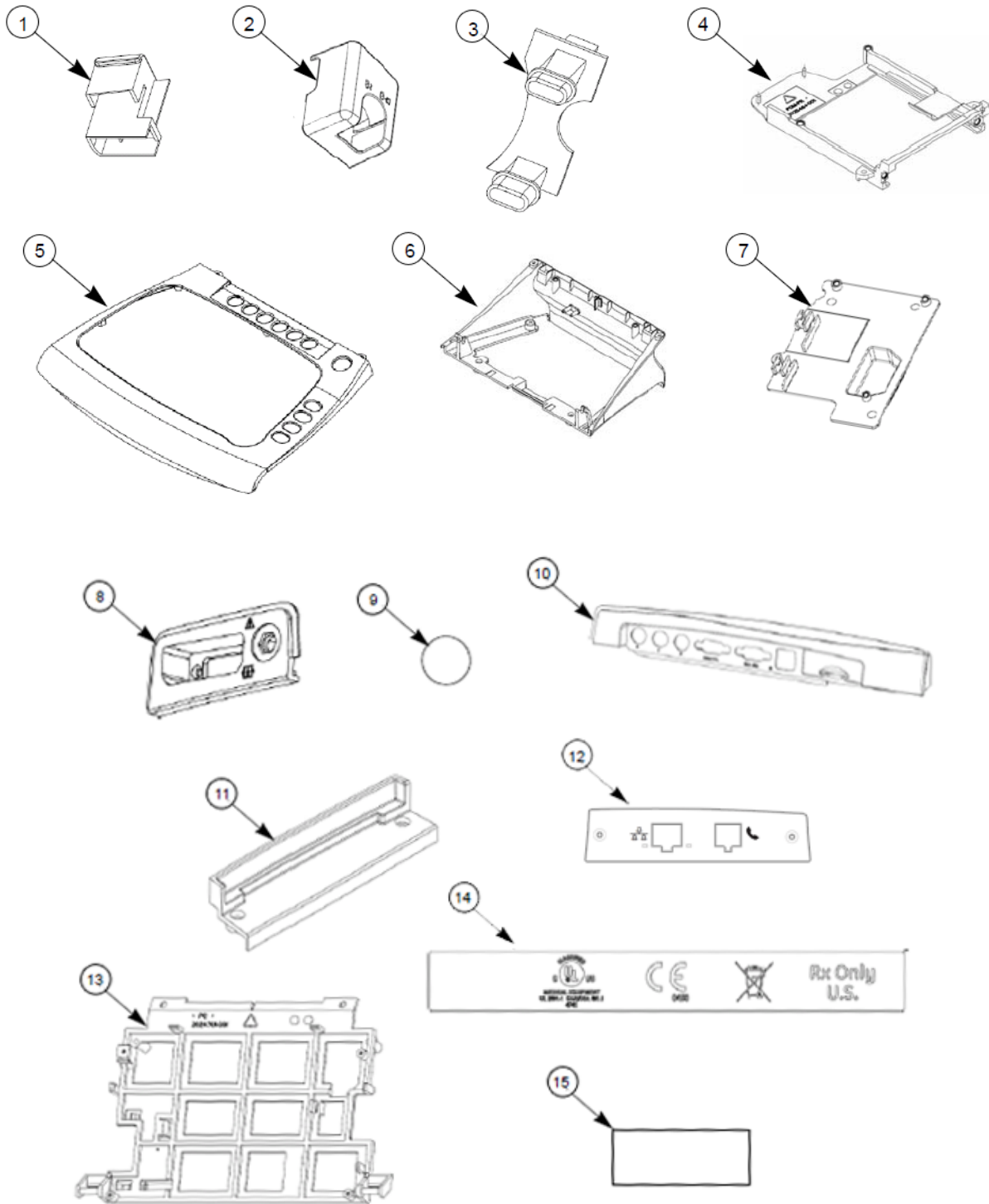
	Table 15. MAC 3500 Plastics Kit, pn 2030898-001	
Item	**Item Description**	**Qty**
1	BTN 3500 WRITER	1
2	HLDR BUTTON MAC3500	1
3	LIGHT PIPE MAC3500	1
4	RAIL COMMUNICATION BOARD	1
5	PLASTIC KEYBOARD BEZEL	1
6	COVER KISS PUMP MAC3500	1
7	PLASTIC BRACKET, ACQ BOARD	1
8	PLASTIC CONNECTOR COVER	1
9	LABEL LUER MAC3500	1
10	PANEL REAR MAC3500	1
11	PANEL BLANK COMMUNICATION MAC3500	1
12	PANEL COMMUNICATION MAC3500	1
13	BRACKET DISPLAY MAC3500	1
14	LABEL CE/UL MAC3500	1
15	ADHESIVE BEZEL CORNER	1

MAC 3500 Top Cover Kit, pn 2030899-001
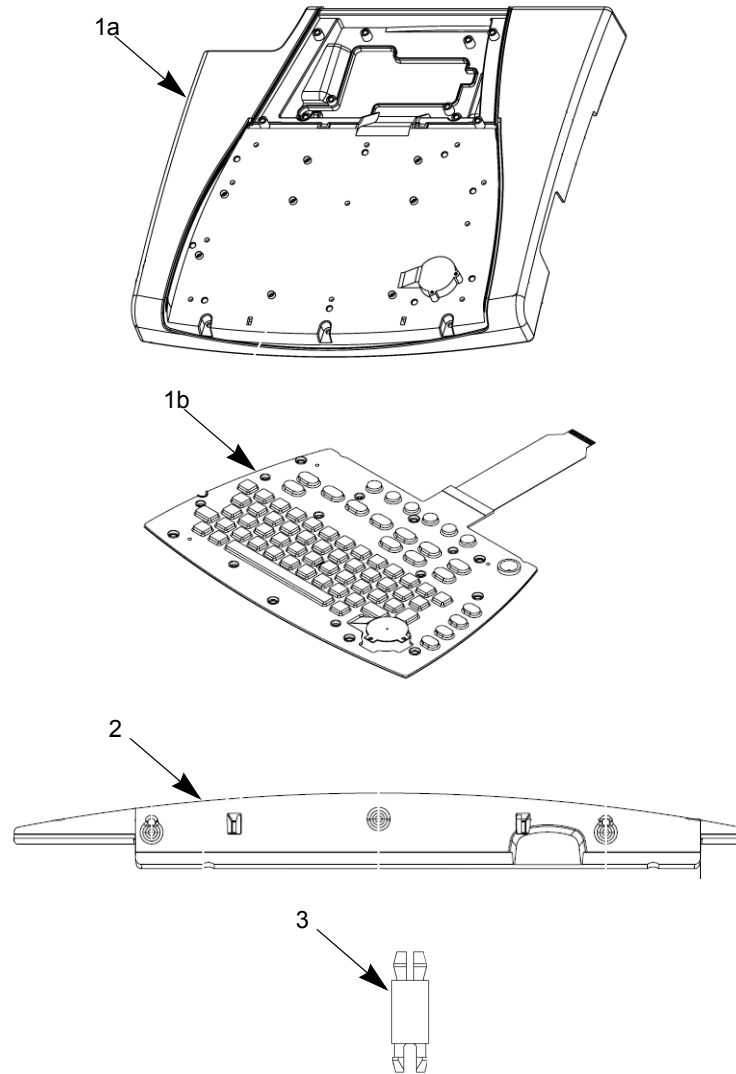
Table 16. MAC 3500 Top Cover Kit, pn 2030899-001		
Item	**Item Description**	**Qty**
1a [1]	PLASTIC TOP COVER	1
1b *	KYBD UNIVERSAL MAC3500	1
2	PLATE TOP COVER MAC3500	1
3	STANDOFF PLASTIC SNAP	8

1 Items 1a and 1b comprise a single assembly.

Harness Kit for MAC 3500, pn 2030871-002
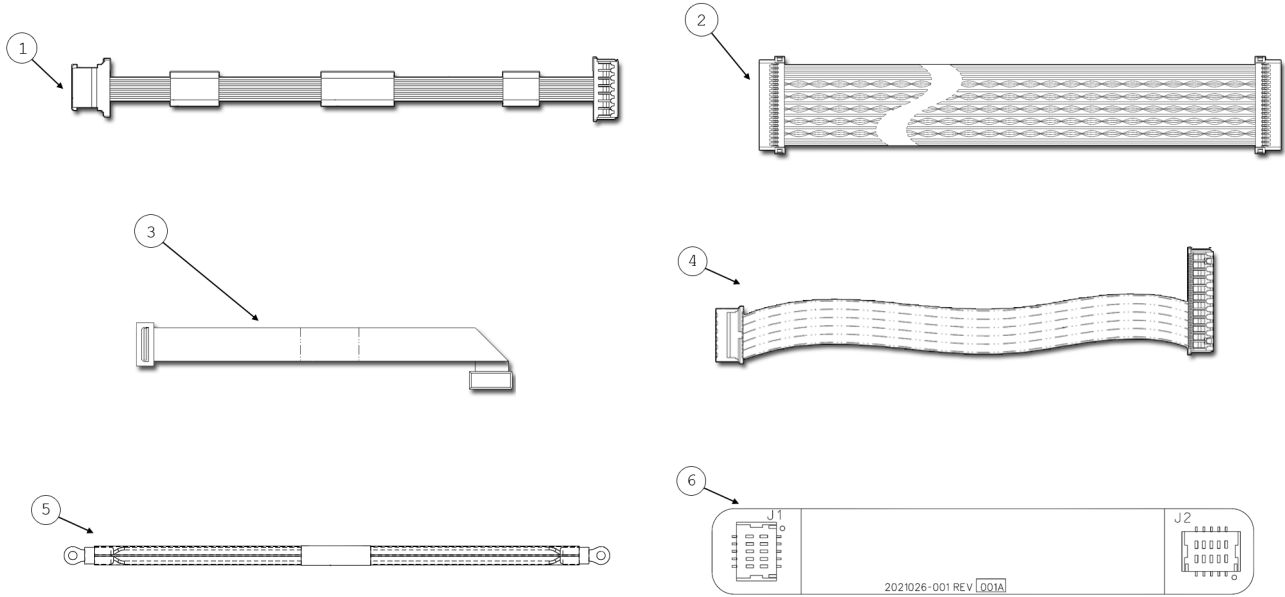
Table 17. Harness Kit, pn 2030871-002		
Item	**Item Description**	**Qty**
1	ASSY MAC3500 BACKLIT CABLE-AUO	1
2	MAC3500 LCD CABLE	1
3	ASSY DISPLAY CABLE MAC3500	1
4	MAC3500 POWER CABLE MAIN BOARD TO LVDS	1
5	HARN LCD DISPLAY GROUND	2
6	FLEX CKT ASSY CAM	1

NOTE

This kit is used only for MAC 3500 Display Assembly p/n 2026299-002. It does not work with MAC 3500 Display Assembly p/n 2026799-001. If you need a harness kit for 2026799-001, order Harness Kit 2030871-001.

MAC 3500 KISS Pump Hardware Kit, pn 2030872-002
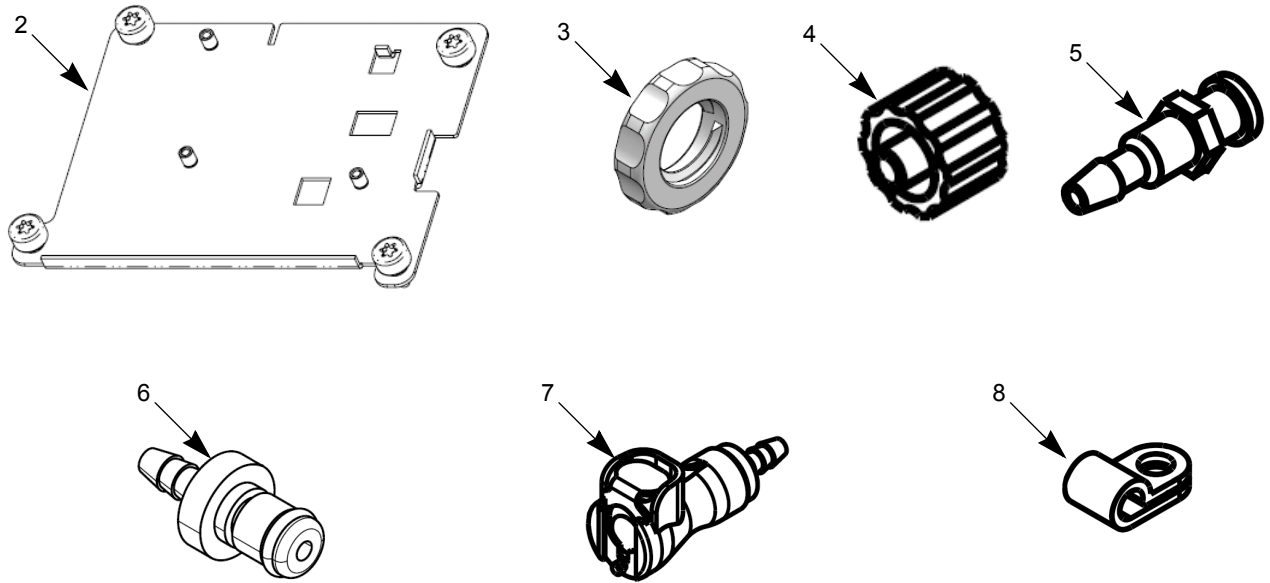
Table 18. MAC 3500 KISS Pump Hardware Kit, pn 2030872-002		
Item	**Item Description**	**Qty**
1	ASSY WIRE SET KISS PUMP MAC3500	1
2	BRACKET KISS PUMP MAC3500	1
3	NUT LOCK	1
4	PLUG LUER MALE	1
5	CONNECTOR LUER FEMALE	1
6	FITTING PNEU 1/8" QUICK MALE	1
7	FITTING PNEU 1/8" QUICK FEMALE	1
8	CLAMP CABLE 4.78MM ID BLK NYL	1

A   Technical Specifications

For your notes

Instrument Type

Item	Description
Instrument type	Microprocessor augmented automatic electrocardiograph;
Leadwire configurations	10-leadwire acquisition with programmable lead configuration 12-leadwire acquisition with NEHB configuration.

Processing

Item	Description
ECG Interpretation:	GE Marquette 12SL ECG Analysis Program for Adults and Pediatrics
Computerized measurements:	12-lead analysis
ECG storage:	50 ECGs in internal memory
External archiving:	Optional secure digital card for 50 ECGs max Supports 64 MB to 1 GB SD cards
Digital sampling rate:	4,000 samples/second/channel
Pre-acquisition:	Provides 10 seconds of instantaneous ECG acquisition
Dynamic Range:	AC Differential $\pm$ 5mV DC offset $\pm$320 mV
Frequency response:	– 3 dB @ 0.01 to 150 Hz
Common mode rejection:	>140 dB (123 dB with AC filter disabled)
Digital sampling rate:	4,000 samples/second/channel
Pre-acquisition:	Provides 10 seconds of instantaneous ECG acquisition
Input impedance:	>10MΩ @ 10 Hz, defibrillator protected
Patient leakage:	<10 μA
Pace detect:	Orthogonal LA, LL, and V6; 750 μV @ 50 μs
Special acquisition functions:	Disconnected lead detection, electrode impedance, excessive, AC noise, baseline wander and muscle tremor messages
Heart rate meter:	30 to 300 BPM ±10% or 5 BPM, whichever is greater. Heart rates outside this range will not be displayed.

Communications with MUSE System

Item	Description
Optional:	
Infrared	
Serial cable	
Internal modem/fax	Fax compatibility Class 2 Group 3
External modem fax	Fax compatibility Class 2 Group 3
Fax	
Wireless (MobileLink)	[1] MobileLink uses WEP security protocols and (in some countries) Cisco LEAP authentication/security.
LAN	[1] Communication with MUSE system over LAN through internal RJ-45 jack. (Requires additional MUSE software and installation.)

1. Requires additional MUSE software and installation.

Display

Item	Description
Display type:	6.5 in (165 mm) diagonal graphics backlit AM LCD (color optional)
Display resolution:	640 x 480 pixels with waveform enhancement
Display data:	Heart rate, patient name, ID, clock, waveforms, lead labels, speed, gain and filter settings, warning messages, prompts, and help messages. 6 leads maximum.

Writer

Item	Description
Writer technology:	Thermal dot array
Writer speeds:	5, 12.5, 25, & 50 mm/s (same as displayed)
Number of traces:	3, 6, or 12 user selectable (same as displayed)
Writer sensitivity/gain:	2.5, 5, 10, 20, 10/5 (split calibration) mm/mV (same as displayed)
Writer speed accuracy:	$\pm 2\%$
Writer amplitude accuracy:	$\pm 5\%$
Writer resolution:	Horizontal 1000 dpi @ 25 mm/s, 200 dpi vertical

Writer (Continued)

Item	Description
Paper type:	Thermal, Z-fold, perforated, fan fold, 300 sheets/pack
Paper size:	A Size: 8.45 in x 11 in, (214.63 mm x 280 mm) A4 Size: 8.27 in x 11.7 in (210 mm x 297.5 mm)

Keyboard

Item	Description
Type:	Sealed elastomer with soft function keys, alphanumeric keys, writer controls, and TrimPad cursor controls

Electrical

Item	Description
Power supply:	AC or battery operation
Voltage:	100 to 240 VAC +10, –15%
Current:	0.5A @ 115 VAC, 0.3A @ 240 VAC, typical
Frequency:	50 to 60 Hz ±10%
Battery type:	User-replaceable, 18V @ 3.5 AH±10% rechargeable NiMH
Battery capacity:	100 single page reports, (typical) or 6 hours continuous display (without printing)
Battery charge time:	Approximately 4.5 hours from total discharge (with display off)

Physical ^{1}

Item	Description
Height	7.6 in (19.3 cm)
Width	15.0 in (38.1 cm)
Weight	Approximately 7.0 kg (15.5 lbs) *including battery without paper Approximately 7.4 kg (16.3 lbs) * including KISS pump and battery without paper

1. without trolley

Environmental

Item	Description

Temperature:
    Operating
    Transport/storage
	50° to 104°F (10° to 40°C)
	–40° to 158°F (ñ40×to 70×C)

Humidity
    Operating
    Transport/storage
	20% to 95% RH non-condensing
	15% to 95% RH non-condensing

Pressure
    Operating
    Transport/storage
	700 to 1060 hPA
	500 to 1060 hPA

Trolley

Item	Description

Dimensions:
    Height:
    Width:
    Depth:
	39 in (99 cm)
	21 in (54 cm)
	28 in (72 cm)

Height with acquisition module holder	52.5 in (134 cm)
Weight:	55 lbs. (25 kg)

Magnetic Card Reader

Item	Description
Character set	ANSI/ISO ALPHA alphanumeric characters and ANSI/ISO BCD (subset of ASCII (ISO 646 IRV:1991))

Dimensions:
    Height
    Length
    Width
	1.17 in (28 mm)
	3.94 in (100 mm)
	1.34 in (34 mm)

Temperature range operating:	50°F to 104°F (10°C to 40°C)
Humidity:	10% to 90% humidity
Agency conformance:	Complies with FCC Class A.
CE:	The system has been tested to and conforms with the provisions within89/336/EEC, Electromagnetic Compatibility directive (EMC)

Barcode Scanner

Item	Description
Symbologies	Code 39 (extended), PDF-417, Code 128, Data Matrix, Interleaved 2 of 5.

Dimensions:
    Width
    Length
	
	2.02 in. (51.3 mm)
	4.26 in. (108.2 mm)

Illumination LEDs	526 nm visible red LED

Temperature ranges:
    Operating
    Storage
	
	32°F to +122°F (0°C to 50°C)
	-40°F to +158°F (-40°C to +70°C)

Humidity	95%, non-condensing at +50°C (122°F)
Rotational Sensitivity	360 degrees
Min X Dimension	0.17 mm (6.6 mils)
Reading Distance	Up to 22.6 cm (8.9 in), assuming a 13 mil barcode element
Ambient	Total darkness to 100,000 Lux (sunlight)
Communications	RS-232 up to 115.2K baud
Power Supply	5 VDC +/- 5%
Scanning Current	450 mA
Idle Current	50 mA
Agency compliance	RoHS and WEEE Compliant

For your notes

B Software/Hardware Compatibility

For your notes

Introduction

Before ordering software upgrades or replacement CPUs, communication boards, or display assemblies, you need to know which components are compatible.

Display Compatibility

The following display assemblies are interchangeable and compatible with 801212–006, 801212–007, and 801212–008 circuit boards. However, the components used to construct the display assemblies are not interchangeable.

Table 1. Compatible Display Assemblies

Part Number	Description	Display Type (10.5")		
		Make	Model	Type
2017484–001	Display Assembly MAC 5500/MAC 5000	NEC	-64E	CCFL/CMOS
2017484–002	Display Assembly MAC 5500/MAC 5000	NEC	-59D	CCFL/CMOS
2017484–003	Display Assembly MAC 5500/MAC 5000	AUO	-V0	CCFL/CMOS
2017484–004	Display Assembly MAC 5500/MAC 5000	AUO	-V1	LED/LVDS

Table 2. Compatible Display FRU Kits

Part Number	Description	Display Type (10.5")		
		Make	Model	Type
2019106–002	FRU Display MAC5000 PROD CODE MH	NEC	-59D	CCFL/CMOS
2019106–003	FRU Display MAC5000 PROD CODE MP/WT	NEC	-64E	CCFL/CMOS
2019106–004	FRU Kit Display AUO	AUO	-V0	CCFL/CMOS
2019106–005	FRU Kit Display AUO	AUO	-V0	CCFL/CMOS
2019106–007	FRU Kit Display AUO	AUO	-V1	LED/LVDS

Circuit Board Compatibility Matrix

Not all supported software versions are compatible with all CPU/Comm board combinations. You must know which software versions are compatible with which CPU and Comm boards before you replace either board or upgrade your software.

The following table identifies which software versions are compatible with which CPU/Comm board combinations.

Table 3. Supported Hardware/Software Combinations

Main Board	Primary Board Boot Code	Software Application	Comm Boards		
			-002	-003	-004
-008	B4	10B	✓	✓	✓
		9D	✓	✓	✓
-007	B3	10B	✓	✓	✓
		10A	✓	✓	✗[1]
		9D	✓	✓	✓
		9C	✓	✓	✗[2]
-006	B3	10B	✓	✓	✓
		10A	✓	✓	✗[1]
		9D	✓	✓	✓
		9C	✓	✓	✗[2]

[1]   The 2022332–004 Comm Board is not compatible with the version 10A software. If you need to upgrade to this comm board on a device with version 10A software, you must upgrade to software version 10B.

[2]   The 2022332–004 Comm Board is not compatible with the version 9C software. If you need to upgrade to this comm board on a device with 9C software, you must upgrade to software version 9D.

Supported Software Update Paths

The following table identifies the supported software update paths for each supported main board. Attempting any unlisted update could result in issues either with the update process itself or with the device after the update is complete.

Table 4. Supported Software Update Paths

Main Board	Upgrade	
	From	To
-008	v9D	v10B
	v10B	v9D
-007	v10A	v10B
	v10A	v9D
	v9C	v10B
	v9C	v9D
-006	v10A	v10B
	v10A	v9D
	v9C	v10B
	v9C	v9D

Software Compatibility with the -008 CPU

The 801212–008 main board is NOT compatible with versions 9C or 10A. The -008 board has a new Numonyx (Micron), 512MB NAND Flash chip that requires boot code version B4 and software versions 9D or 10B.

The boot code will prevent you from installing version 9C or 10A on a device with the 801212–008 main board.

C   Electromagnetic Compatibility

For your notes

Electromagnetic Compatibility (EMC)

Changes or modification to this system not expressly approved by GE Healthcare could cause EMC issues with this or other equipment. This system is designed and tested to comply with applicable regulation regarding EMC and needs to be installed and put into service according to the EMC information stated as follows.

WARNING
Use of portable phones or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation.

WARNING
The equipment or system should not be used adjacent to, or stacked with, other equipment. If adjacent or stacked use is necessary, the equipment or system should be tested to verify normal operation in the configuration in which it is being used.

Guidance and Manufacturer's Declaration - Electromagnetic Emissions

The MAC 3500 resting ECG analysis system is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the MAC 3500 system is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment - Guidance
RF emissions EN 55011	Group 1	The equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions EN 55011	Class A	Class A Equipment is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions EN 61000-3-2	Class A	
Voltage fluctuations/ Flicker emissions EN 61000-3-3	Complies	

Guidance and Manufacturer's Declaration - Electromagnetic Immunity

The MAC 3500 system is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the MAC 3500 system is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrostatic discharge (ESD) EN 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst EN 61000-4-4	± 2 kV for power supply lines ±1 kV for input/output lines	± 2 kV for power supply lines ±1 kV for input/output lines	Mains power should be that of a typical commercial or hospital environment.
Surge EN 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines EN 61000-4-11	<5% Ut (>95% dip in U_t) for 0.5 cycles 40% Ut (60% dip in U_t) for 5 cycles 70% Ut (30% dip in U_t) for 25 cycles <5% Ut (>95% dip in U_t) for 5 sec	<5% Ut (>95% dip in U_t) for 0.5 cycles 40% Ut (60% dip in U_t) for 5 cycles 70% Ut (30% dip in U_t) for 25 cycles <5% Ut (>95% dip in U_t) for 5 sec	Mains power should be that of a typical commercial or hospital environment. If the user of the MAC 3500 requires continued operation during power mains interruptions, it is recommended that the MAC 3500 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field EN 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristics of a typical location in a typical commercial or hospital environment.

NOTE

Ut is the AC mains voltage prior to application of the test level.

Guidance and Manufacturer's Declaration - Electromagnetic Immunity

The MAC 3500 is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the MAC3500 is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Conducted RF EN 61000-4-6 Radiated RF EN 61000-4-3	3 Vrms 150 KHz to 80 MHz 3 V/m 80 MHz to 2.5 GHz	2.2 Vrms 3 V/m	Portable and mobile RF communications equipment should not be used closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz where **P** is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, and **d** is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. Interference may occur in the vicinity of equipment marked with the following symbol: (((•)))
NOTE 1:At 80 MHz and 800 MHz, the higher frequency range applies. **NOTE 2**:These guidelines may not apply in all situations. Electromagnetic propagation is affected by reflection from structures, objects, and people. [a]Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the equipment. [b]Over the frequency range 150 KHz to 80 MHz, field strengths should be less than 3 V/m.			

Recommended Separation Distances

The table below provides the recommended separation distances (in meters) between portable and mobile RF communication equipment and the MAC 3500 system.

The MAC 3500 system is intended for use in the electromagnetic environment on which radiated RF disturbances are controlled. The customer or the user of the MAC 3500 system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the MAC 3500 system as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter in Watts	Separation Distance in Meters (m) According to Frequency of Transmitter			
	150 kHz to 80 MHz outside ISM bands $d = 1.2\sqrt{P}$	150 kHz to 80 MHz in ISM bands $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.12	0.23
0.1	0.38	0.38	0.38	0.73
1	1.2	1.2	1.2	2.3
10	3.8	3.8	3.8	7.3
100	12	12	12	23
NOTE 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.				

For transmitters rated at a maximum output power not listed above, the recommended separation distance [**d**] in meters (m) can estimated using the equation applicable to the frequency of the transmitter, where **P** is the maximum output power rating of the transmitter in watts (w) according to the transmitter manufacturer.

NOTE

These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people

EMC-Compliant Cables and Accessories

WARNING

The use of accessories, transducers and cables other than those specified may result in increased emissions or decreased immunity performance of the equipment or system.

The table below lists cables, transducers, and other applicable accessories with which GE Healthcare claims EMC compliance.

NOTE

Any supplied accessories that do not affect EMC compliance are not included.

Table 1. Compliant Cables and Accessories	
Part Number	**Description**
21612113	Electrode Application system KISS, 10 leads without pump
22340305	Patient Trunk cable, 12 wire NEHB, IEC
22341808	Patient Trunk Cable, IEC, 10 Wire
22341809	CABLE TRUNK 10-LEAD MAC500/1200 ML AHA
38401765	SET LEADWIRE 4MM 10/SET IEC
38401766	SET of Electrode Leads (2 pcs) 4 mm, plug (IEC) NEHB, Resistor
38401816	SET LEADW ML 4MM 10-LEAD 0.7M/1.3M IEC
38401817	SET LEADW ML 4MM 10-LEAD 0.7M/1.3M AHA
21612202	Electrode Application system KISS, 12 leads without pump
400073-001	Serial Comm cable 8 pin mini din
900770-001	MAC PAC Battery
416070-001	External Video Cable
700520-002	Analog/TTL Interface cable
405535-006	Power Supply Cord US 13 A 125 V
401855-001	Power Supply Cord European 10 A 250V
401855-002	Power Supply cord British 10 A 250 V
401855-003	Power Supply cord Italian 10 A 250 V
401855-004	Power Supply cord Israeli 10 A 250 V
401855-007	Power Supply cord Swiss 10 A 250 V
401855-008	Power Supply cord Indian 10 A 250V
401855-010	Power Supply cord Australian 10 A 250 V

Table 1. Compliant Cables and Accessories (Continued)	
Part Number	**Description**
2005264-XXX	MAC 5000 External Modem Kit
2018626-XXX	MAC 5000 Barcode Scanner Kit
2018627-XXX	MAC 5000 Magnetic Card Reader Kit
2014403-XXX	MAC 5000 Wireless Kit
2023922-XXX	MAC 5000 Secure Wireless Kit

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For your notes

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