Service Manual

Flo-Gard® 6300

Volumetric Infusion Pump

Product Code: 2M8048

Baxter Healthcare Corporation
Deerfield, IL 60015, USA

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Section 1

General Description

1.1 Introduction

This manual provides service information for the Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump (product code 2M8048) for qualified hospital biomedical engineers and Product Service personnel. See the Operator's Manual for the device for detailed operating instructions.

1.2 Features

The Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump is an electromechanical device used for the intravenous infusion of liquids at user-selected rates. The device contains two peristaltic pump heads, allowing it to simultaneously infuse two different solutions. Each pump head is independently programmable and permits infusion of primary and secondary medication programs. The secondary program automatically switches over to the primary program when secondary infusion is complete (automatic piggybacking).

The device operates on standard 115 VAC 60 Hz electrical power, or on its self-contained rechargeable battery. It is portable and has a panel lock-out feature to discourage patient tampering. It is designed for use with Baxter's standard administration sets which contain an "s" as the last character of the code number, for example, 2C5537s. When infusing solutions through a central venous catheter, sets with Luer lock adapter should be used. Sets with a Flashball® device are not recommended in these applications.

The primary rate of infusion is selectable from 1 to 1999 mL/hr. The secondary rate is selectable from 1 to 999 mL/hr. The volume to be infused (VTBI) is also selectable between 1 and 9999 mL.

The total volumes infused from primary and secondary programs are added together and accumulated and can be displayed on demand. The primary and secondary VTBIs are independently decremented and displayed. Upon completion of the primary VTBI, the device automatically switches to a keep vein open (KVO) rate. If the pump is started on a secondary rate and VTBI, the pump will change to the primary rate when the secondary program is

completed. Either pump may be stopped at any time by depressing the appropriate STOP key unless the device is in the lockout mode.

1.2.1 Nurse Call

The COMMUNICATIONS PORT on the rear of the device is equipped with the wiring necessary for a nurse call jack. This feature is an option which enables remote monitoring of the alert and alarm conditions of the device. Specifications for the 9-pin D connector are listed under Technical Specifications.

1.3 Technical Specifications

Item	Characteristic
Catalog Code Number	2M8048
Description	Dual channel linear peristaltic volumetric infusion pump
Administration Set	Baxter's standard administration set with "s" suffix
Keep Vein Open (KVO) rate	5 mL/hr or programmed rate, whichever is less
Battery	12 Volt, 3.2 Ah sealed lead acid
Battery Life	- Approximately 6 hours with one pump running at a rate from 1 to 1400 mL/hr - Approximately 4 hours with both pumps running at rates from 1 to 1400 mL/hr
Battery Recharge	8 hours for complete recharge
AC Power Requirements	110/120V, 60 Hz
Power Cord	2.7 m (9 ft) long, with Hospital Grade plug
Leakage Current	Typically less than 50 microamps (using UL-544 specified test methods)
Power Consumption	50 watts
Weight	8 kg (17.6 lbs)
Dimensions	33 cm W x 21 cm D x 29 cm H (13" W x 8.3" D x 11.4" H)
Nurse Call	9-pin D connector, Pin 1: N/C, Pin 7: N/O Pin 6: Common Contact rating: 0.4 A 30 VAC, 2A at 30 VDC resistive load (internal activation required)

1.4 Controls and Indicators

All controls and indicators are shown in Figures 1-1, 1-2, and 1-3. Service personnel should be familiar with the pump's features and operation before attempting to service the device. Items 1 through 9 are associated with Pump 1. The controls associated with Pump 2 are identical and function in exactly the same manner. Items 10 through 23 are common to the operation of both pumps. When the word "device" is used in this manual, reference is being made to the entire Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump. Generally, the word "pump" is used to refer to either Pump 1 or Pump 2.

Each device's serial number is recorded on a label on the back of the device.

ITEM	FUNCTION
1. Pump 1 ON-OFF/CHARGE Key	Turns Pump 1 on and off. The internal battery charger remains on regardless of the ON-OFF/CHARGE key as long as the device is plugged in.
2. Pump 1 STOP Key	Stops Pump 1. The message ***STOPPED*** appears when the key is pressed. An alert will sound if Pump 1 is stopped for more than two minutes. Clears all programming alerts while pump is running.
3. PUMP 1 Key and indicator	Allows the device to accept keystrokes and other controls common to both pumps for Pump 1 programming. Yellow LED lights to indicate that Pump 1 is selected.
4. Pump 1 Door Latch	Opens and closes Pump 1 door.
5. Pump 1 Main Display	Shows rate, volume to be infused (VTBI) and total volume infused for Pump 1 primary and secondary infusion programs.
6. Pump 1 ALARM LED	Red LED that blinks on and off during a Pump 1 alarm, accompanied by a visual message display and a repeated sequence of three beeps. An alarm indicates that Pump 1 requires immediate attention.
7. Pump 1 PUMPING LED	Green LED which is constantly lit while Pump 1 is pumping.
8. Pump 1 ALERT LED	Yellow LED which lights during Pump 1 alerts, accompanied by a message display and a repeated single beep. An alert indicates that Pump 1 needs routine attention.
9. Pump 1 Message Display	Shows all Pump 1 messages.
10. BACKLIGHT key	Backlights the displays when pressed. Pressing the key again turns the backlight off. If the device is operating on battery power, the backlight remains on for 60 seconds each time the BACKLIGHT key is pressed.

11. SILENCE Key — Temporarily silences an audible alarm or alert on a particular pump for two minutes. All visual alarm or alert information remains displayed.

12. TOT VOL/STATUS Key — Displays total volume delivered and current settings for each pump.

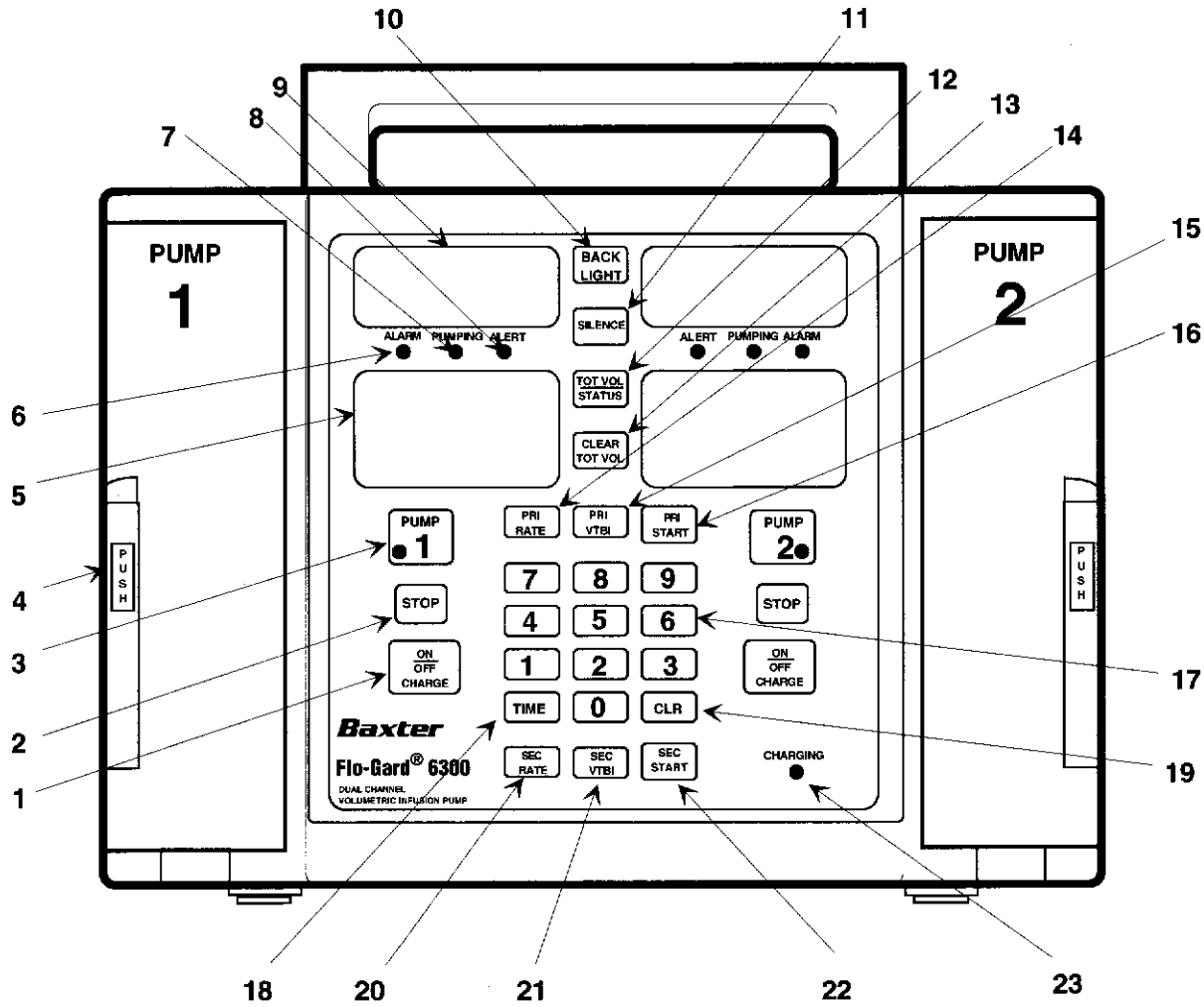

Figure 1-1. Front View

13. CLEAR TOT VOL Key	Resets the selected pump's total volume delivered to zero when the pump is stopped.
14. PRI RATE Key	Allows programming of the primary infusion rate for the selected pump.
15. PRI VTBI Key	Allows programming of the primary VTBI for the selected pump.
16. PRI START Key	Starts the primary infusion for the selected pump.
17. Numerical Keypad	The numerical values for rate, VTBI, and time are entered with these keys.
18. TIME Key	Enters desired time interval for an infusion during Volume-Time programming.
19. CLR Key	Clears any locked in values and programming values currently being entered.
20. SEC RATE Key	Allows programming of the secondary infusion rate for the selected pump.
21. SEC VTBI Key	Allows programming of the secondary VTBI for the selected pump.
22. SEC START Key	Starts the delivery of the secondary solution for the selected pump.
23. CHARGING LED	Green LED, always lit while the device is plugged in and the battery is charging.

Figure 1-2 shows Pump 2 only. Pump 1 has identical features, which function in the same manner.

1. Upstream Occlusion Sensor	Detects a complete tubing restriction upstream of the pump.
2. Pump Mechanism	Linear peristaltic pump mechanism.
3. Downstream Occlusion Sensor	Detects a complete tubing restriction downstream of the pump.

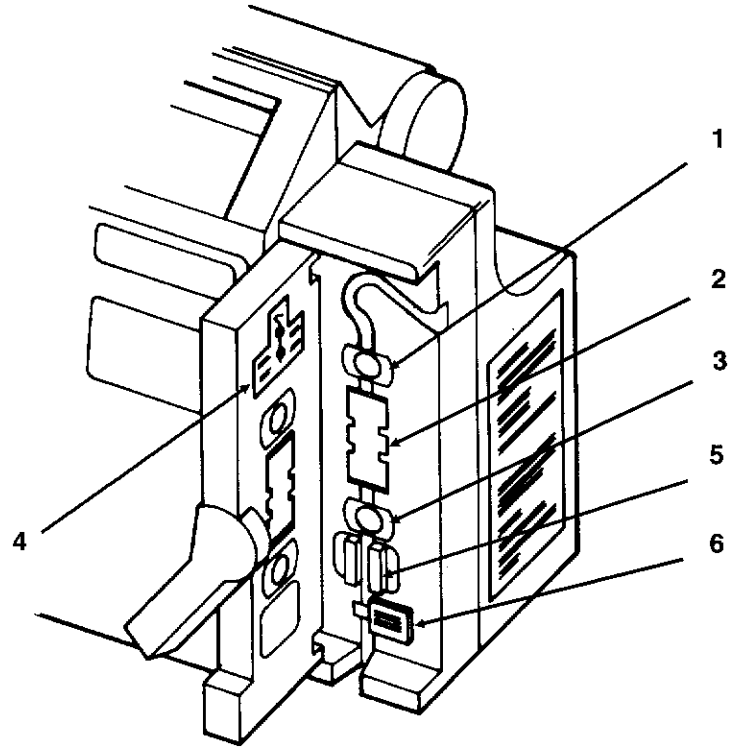

Figure 1-2. Pump With Door Open

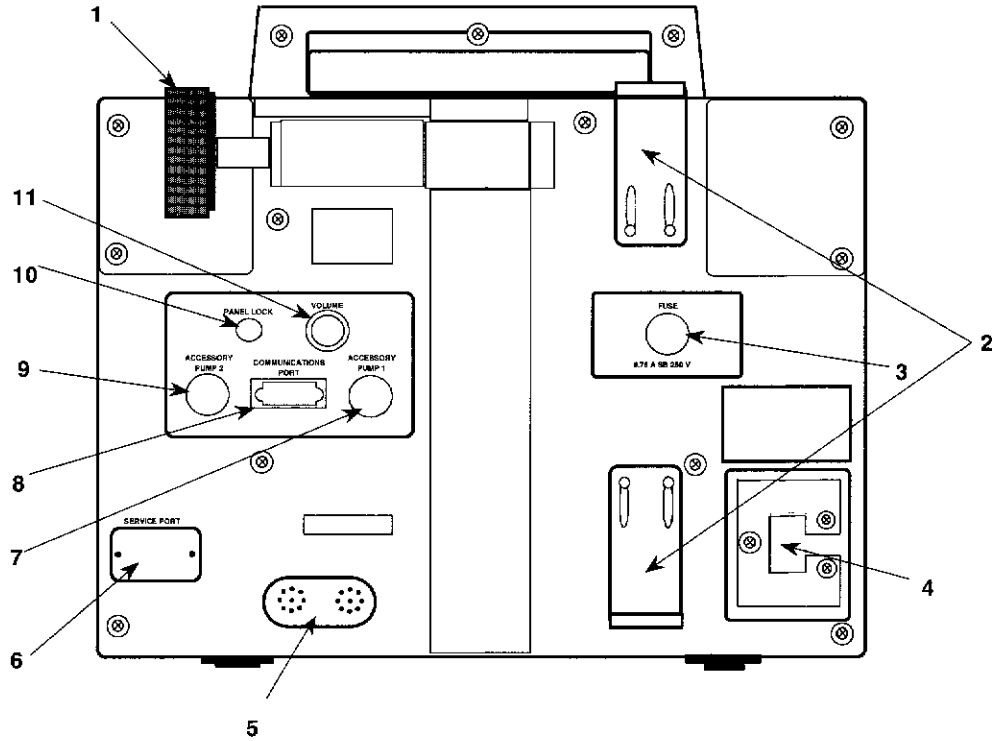

Figure 1-3. Rear View

4. IV Set Loading Diagram	Identifies the IV set loading path in the pump.
5. Air Sensor	Detects air bubbles in the IV set.
6. SAFETY CLAMP	Prevents accidental fluid flow when the IV set is properly loaded and the pump door is opened.

The following items are located on the rear of the device and are shown in Figure 1-3.

1. IV Pole Clamp	Secures the device to the IV pole.
2. Power Cord Clips	Store power cord during battery operation and device storage.
3. FUSE	Fuse compartment.
4. Power Cord	Removable only by authorized service personnel.
5. Audio Speakers	For generation of audible alarm and alert beeps.
6. SERVICE PORT	For authorized service personnel use only.
7. PUMP 1 ACCESSORY Port	Reserved for future use.
8. COMMUNICATIONS PORT	Reserved for future use.
9. PUMP 2 ACCESSORY Port	Reserved for future use.
10. PANEL LOCK Switch	Disables front panel controls when pressed, except BACKLIGHT and TOT VOL/STATUS.
11. VOLUME Knob	Adjusts loudness of audible alarm and alert beeps. The audible alarm cannot be turned completely off.
Battery Compartment (Not shown)	Allows easy access to the battery by authorized service personnel only. Located on the underside of the device.

1.5 Configuration Option Feature

This section describes the configuration option feature of the device, which allows Product Service or the hospital biomedical engineer to inspect and/or modify certain device operating parameters to suit customer requirements.

These parameters and the possible settings are shown in Table 1-1. The settings made at the factory at the time of manufacture are also shown in the table. Although the configuration option data is stored in battery backed-up RAM, it may be lost if CN302 (the main battery connector) is disconnected from the CPU board without turning the device off. The configuration option data is lost if the lithium backup battery connector (CN304) is disconnected while the main battery is disconnected.

To prevent loss of configuration data, the configuration options should be recorded before beginning repair procedures and reset when repairs are complete.

1.5.1 Viewing the Configuration Option Settings

To view the configuration option settings, both pumps must be stopped. Press TIME and TOT VOL/STATUS simultaneously for one second. The message ***CONFIGURE*** will be displayed in the Pump 1 Message Display. The option description will be displayed in the first line of the Pump 2 Message Display, beginning with ***CLR ALARM*** or ***OCCLUSION***. The current setting will be displayed on the second line.

To view the next setting, press the SEC START key. Each press of the SEC START key will cause the device to advance to the next setting, in the order shown in Table 1-1, starting with Occlusion Alarm Level. To exit the inspection mode, press either STOP key or press TIME and TOT VOL/STATUS simultaneously.

1.5.2 Modifying the Configuration Option Settings

1. Turn the device off.

2. While pressing both STOP keys, press either ON-OFF/CHARGE key. The following will occur:
   The message ***MODIFY CONFIGURE*** appears in the left Message Display.
   The parameter descriptor appears in the first line of the right Message Display.
   The current parameter setting appears in the second line of the right Message Display.
   The programming displays are blank.

3. To gain access to the settings, press the SEC START key to advance to the desired setting. The settings appear in the order shown in Table 1-1.

4. To change the settings, enter the desired value on the numeric keyboard. The selected numeric value will be displayed in the Pump 2 Primary Rate display until the value is locked in, or the next setting is displayed by pressing the SEC START key.

   The alarm log for each pump can be cleared independently via the configuration option. See Table 1-1.

5. To lock in the selected value, press the PRI START key. The selected value will then be displayed in the Pump 2 Message Display. To move on to the next setting, press the SEC START key.

6. To exit, press the same ON-OFF/CHARGE key pressed in step 2.

   Configuration settings may be lost if either CN302 (the main battery connector) is disconnected from the CPU board before the device is turned off, or CN304 (the lithium backup battery connector) is disconnected.

   The configuration options must be reset in either case. It is highly recommended that the configuration options be reset whenever a board is replaced.

Table 1-1. Configuration Options

Parameter Description	Setting Options	Factory Settings
1. Alarm Log Clear alarm/failure codes of pump 1 or pump 2. Select 1 or 2 to clear the corresponding pump's alarm log.	N/A	N/A
2. Occlusion Alarm Level The increase in pressure required to trigger a downstream occlusion alarm.	1: LEVEL 1 (approx. 7 psi) 2: LEVEL 2 (approx. 12 psi) 3: LEVEL 3 (approx. 17 psi)	LEVEL 1
3. Audible Switchover Determines whether or not a single audible tone will be generated when either pump switches from its secondary program to the primary program.	1: OFF 2: ON	OFF
4. Number of Automatic Restarts Determines whether or not the pump will automatically restart after a downstream occlusion, and if so, how many restarts can occur before human intervention (pressing the appropriate **START** key) is required. If this parameter is set to anything other than 0, it is enabled. The selected number corresponds to the number of automatic restarts.	0 - 9	3

Parameter Description	Setting Options	Factory Settings
5. Door Open Required Determines if the pump door must be opened after a downstream occlusion alarm to inhibit the user's ability to increase the alarm pressure threshold.	1: OFF 2: ON	OFF
6. Air Bubble Alarm Size Determines the air bubble size which will cause an AIR alarm.	1: MIN (approximately 50 µL) 2: NORM (approximately 75 µL)	NORM
7. Alarm Off Interval Selected setting is equivalent to the number of seconds between each occurrence of the three-beep alarm tone.	1 - 7	1
8. Alert Off Interval Selected setting is equivalent to the number of seconds between each occurrence of the one-beep alert tone.	1 - 7	7
9. Maximum Rate of Infusion Sets the maximum primary infusion rate of both pumps. The maximum secondary rate defaults to the maximum primary rate or 999 mL/hr, whichever is lower.	1 - 1999 mL/hr	1999 mL/hr
10. Maximum VTBI The maximum volume that either pump can be programmed to infuse.	1 - 9999 mL	9999 mL
11. Flow Check Display Determines whether the flow check display will appear during pump operation, or only when the **CLR** and **TOT VOL/STATUS** keys are pressed simultaneously.	1: OFF 2: ON	OFF
12. Close Clamp Message Determines whether or not the ***CLOSE CLAMP*** message appears with the ***DOOR OPEN*** message.	1: OFF 2: ON	ON

1.6 Alarms

The device has a number of built-in safety features. Should a situation occur which requires operator attention or intervention, the device stops infusing and sounds an audible alarm. The following are brief descriptions of these alarms.

AIR An ultrasonic sensor in each pump head detects air in the administration set's tubing. Detection of an air bubble stops the infusion and illuminates the red ALARM LED. ***AIR*** is displayed in the appropriate Message Display and the audible alarm is activated.

OCCLUSION The downstream occlusion sensor senses excessive back-pressure between the patient and the pump, thus indicating occlusion. When an occlusion is sensed, the pump stops, ***OCCLUSION*** is displayed in the appropriate Message Display, the red ALARM LED is illuminated and the audible alarm is activated.

UPSTREAM OCCLUSION The upstream occlusion sensor senses a closed clamp or complete blockage upstream of the pump. When sensed, the pump stops, ***UPSTREAM OCCLUSION*** is displayed in the appropriate Message Display, the red ALARM LED is illuminated, and the audible alarm is activated.

BATTERY LOW When approximately 15 minutes of running time remains during battery operation, ***BATTERY LOW*** is displayed in the right Message Display, the yellow ALERT LED is illuminated, and the audible alert is activated. After approximately 15 minutes have elapsed, the device stops, ***BATTERY LOW*** is displayed in the right Message Display, the red ALARM LED is illuminated, and the audible alarm is activated.

Table 1-2 lists the alarms and the possible causes of each. In all cases, fluid infusion is halted. See Section 5 for an explanation of how to troubleshoot the device.

Table 1-2. Alarm Messages

Alarm Message	Possible Cause
AIR	a. Air bubble at sensor. b. Empty fluid container. c. Improper tube loading. d. A **START** key was pressed with no set in pump.
OCCLUSION	a. Closed distal clamp, stopcock, clogged filter, kinked tubing or other blockage downstream of the pump. b. Ambient and/or solution temperature is too low.
UPSTREAM OCCLUSION	a. Closed clamp or other blockage upstream of the pump. b. Pinched or kinked tube loaded in the pump. c. Improper tube loading.
DOOR OPEN	Door must be fully closed with tubing properly loaded for the pump to operate. The door latch must be pushed down completely.
FAILURE with code number	Turn the pump power OFF and back ON to reset. If ***FAILURE*** does not clear, the microprocessor has detected a pump malfunction. After recording the code number, remove the pump from use. The unaffected pump may still be used. However, the device should be serviced at the earliest opportunity.
COMMON FAILURE with code number	Turn both pumps OFF and back ON to reset. If ***COMMON FAILURE*** does not clear, the microprocessor has detected a device malfunction. After recording the code number, remove the device from use for servicing.
BATTERY LOW with rapid three-beep alarm tone	Battery power has been exhausted. Plug device into AC outlet immediately to restore operation.
NO TUBE	Load tubing properly, close door and press appropriate **START** key to reset.

1.7 Alerts

Alert messages call attention to a condition which will require operator intervention in the near future, or indicate that a procedure has been initiated which requires that the operator complete a sequence of keystrokes. These alerts are generally cleared by the operator taking the appropriate action.

Table 1-3 lists the various alerts and possible causes.

Table 1-3. Alert Messages

Alert Message	LED	Flow Status	Key Pressed	Alert Condition
STOPPED	Yellow	No Flow	None	A pump has been left in the STOPPED mode for more than two minutes.
KVO ***PRI VTBI = 0***	Green, Yellow	KVO rate	None	Primary VTBI has been delivered and the pump has switched to 5 mL/hr KVO rate (or programmed rate, whichever is lower).
TITRATE	Green, Yellow	No change until procedure is completed	**PRI** or **SEC RATE**	Primary or Secondary flow rate is being changed while pump is running. Pump will not exit this alert condition until an appropriate **START** key is pressed.
PRI RATE = 0	Yellow	No Flow	**PRI** or **SEC START**	A pump cannot be started without entering a primary flow rate.
BATTERY	Green	No change	None	No AC power. The device is operating on internal battery power.
BATTERY LOW with audible alert	Green, Yellow	No change	None	Battery needs recharging. The device will stop operating in approximately fifteen minutes unless it is plugged into an AC source.
SEC PROGRAM	Green, Yellow	No change	**SEC RATE** or **SEC VTBI**	Secondary (piggyback) information is being programmed into a pump while it is running. Pump will not exit this alert condition until **SEC START** is pressed.
SEC RATE = 0	Yellow	No Flow	**SEC START**	A secondary (piggyback) infusion cannot be started unless a secondary flow rate is input.
SEC VTBI = 0	Yellow	No Flow	**SEC START**	A secondary (piggyback) infusion cannot be started unless a secondary volume to be infused has been input.
FLOW RATE	Yellow	No Flow	**PRI** or **SEC START**	A pump cannot be started when ***Hi*** or ***Lo*** is displayed in a rate display. Enter a rate within the range selected through the configuration option.
CHECK VTBI	Yellow	No Flow	**PRI** or **SEC START**	A pump cannot be started when ***Hi*** is displayed in a VTBI display. Enter a VTBI within the range selected through the configuration option.

Section 2

Hospital Service Procedures

This section contains a table describing preventive maintenance which should be performed on the Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump. The maintenance procedures outlined in this section may be performed in the hospital. If an abnormal condition occurs which is not correctable by performing the following procedures, remove the device from service and troubleshoot it in accordance with Section 5, or return it to Product Service for repair.

2.1 Replacement Of Main Power Fuse

1. Turn the device off by pushing the ON-OFF/CHARGE key(s).

2. Check if the CHARGING LED is illuminated.

3. Remove the power plug from the AC power outlet.

4. Locate the fuse cap on the back of the device, and unscrew with a small screwdriver.

5. Remove the fuse and check it for electrical continuity with an ohmmeter.

6. If necessary, replace with a new fuse of the same value, type and voltage.

7. Replace and tighten the fuse cap with a screwdriver. **Overtightening the fuse cap may cause the fuse holder to break.**

2.2 Cleaning

The pump should be cleaned as soon as possible after each use to minimize the accumulation and hardening of spilled solutions. The case and front panel may be cleaned with a soft cloth or cotton swabs dampened with a cleaning agent listed in Table 2-1.

Be sure to follow the manufacturer's dilution instructions for concentrated cleaners where applicable. Do not spray cleaning agents directly onto the inside of the pump doors, the pump mechanisms, and the front panel film. If these areas require cleaning, wipe carefully with a soft cloth, sparingly dampened with a cleaning agent listed in Table 2-1. If solution spillage onto the pumping mechanism or front panel occurs, it should be cleaned immediately. If necessary, contact Product Service.

Table 2-1. Recommended Cleaning Agents

CLEANER	MANUFACTURER
LpH, Septisol	Vestal Labs, Inc.
Cidex 7	Surgikos Inc.
Super Edisonite	Edison Chemical Co.
Bafix	Hysan Corp.
Tor	Huntington Labs.
Hi-Tor Plus	Huntington Labs.
10% bleach and water	
Soapy water	
Isopropyl alcohol (up to 95%)	

Caution: Attempts to clean or disinfect internal parts, autoclaving or sterilization by ethylene oxide gas will damage the device and void the warranty.

Caution: The following chemicals may damage the plastic front panel: Acetoaldehyde, Acetone, Ammonia, Benzene, Hydroxytoluene, Methylene Chloride, n-Alkyl Dimethyl Ethyl Benzyl Ammonium Chloride, and Ozone.

For a device that has been in an Isolation Area, select those agents from Table 2-1 that both clean and disinfect. Only external parts of the device should be disinfected. The following are procedures for cleaning accessible areas of the device. ***Do not use hard instruments for cleaning.***

1. Lift the door latch to the open position, open the door and press the safety clamp until it locks in the open position.

2. Using a cotton swab dampened with one of the agents listed in Table 2-1, clean all tubing guides and tubing channels from the top of the pump to the exit point below the safety clamp. Clean all surfaces in the pump head which may contact the tubing.

3. Clean all surfaces of the air sensor located just above the safety clamp. This area must be completely dry and free of foreign matter prior to reuse.

2.3 Battery Charging

The battery is recharged whenever the device is plugged in regardless of whether the pumps are on or off. However, it is highly recommended that the battery be recharged with both pumps off. The green CHARGING LED is illuminated whenever the battery is charging. The battery must be stored in a charged condition and must be recharged at least once a month. To charge the battery, simply plug the device into a 115 VAC outlet.

2.4 Preventive Maintenance

Table 2-2 lists preventive maintenance for the device, which should be performed at the intervals shown.

Table 2-2. Preventive Maintenance

CHECK	ACTION
Schedule: As required or at least once a month	
Pump mechanism	Clean with an agent listed in Table 2-1.
Case	Clean with an agent listed in Table 2-1.
Rear Panel Connectors	Clean with an agent listed in Table 2-1. Replace any connector whose shell is damaged. Check that plastic covers are in place.
Back plate and safety clamp	If the safety clamp or back plate do not operate smoothly, clean or replace in accordance with Section 6.3.11 or 6.3.12.
Loose or missing hardware	Replace in accordance with Section 6.
Main Battery	Recharge by plugging into a 115 VAC outlet for at least 8 hours. Check that the CHARGING LED is illuminated during this time.
Schedule: Every 12 months or as required	
Lithium Backup Battery	Check backup battery voltage in accordance with Section 5.3.2. If the backup battery voltage is not within specification, replace it in accordance with Section 6.3.21.
Pole clamp	If operation is not smooth, apply 1 drop of high grade general purpose machine oil to the screw threads.
Pole clamp friction pad	Replace pad (part no. LPLT1020.B) if it is damaged or missing.
Checkout	Perform the Operational Checkout procedures in Section 7.

Section 3

Problem Checklist

Table 3-1 is a list of problems, checks and corrections to aid in the diagnosis of possible pump malfunctions. Corrections contained in the table can be performed without opening the device housing. Review this list whenever a condition exists that does not appear to be normal. Perform the specified checks and corrections. If the problem cannot be corrected, remove the pump from service. Troubleshoot it in accordance with Section 5 and repair it in accordance with Section 6.

Table 3-3. Problem Checklist

PROBLEM	CHECKS	CORRECTIVE ACTION
The CHARGING LED does not illuminate when the device is plugged in, or the ***BATTERY*** message appears when the device is plugged in.	Check the tightness of the power plug into the AC outlet.	Press the power plug firmly into the grounded AC outlet.
	Check the rear power fuse.	Replace the fuse if it has failed and recharge the battery.
	Check the AC outlet for proper voltage.	If the voltage is below 105 VAC, connect the device to the correct supply voltage.
	Check the line cord for continuity.	Connect the power terminals of the power plug to an ohmmeter. The ohmmeter should indicate continuity.
The device fails to run on the internal battery (No LCD displays appear).	Check the battery voltage. See Section 5.3.2.	The battery has been discharged completely. Recharge the battery for 24 hours with the device turned off.
A pump stops with ***BATTERY LOW*** alarm.	Check the battery voltage. See Section 5.3.2.	Recharge the battery.

Table 3-1. Problem Checklist (Continued)

PROBLEM	CHECKS	CORRECTIVE ACTION
A pump door will not open or close smoothly.	Check the positioning and seating of the administration set tubing.	Position the tubing properly and make certain it is seated in the guides and channels with the safety clamp open. Close the pump door.
	Check the administration set for type and code.	Replace with a Baxter's "s" suffix standard administration set if required.
	Check for solution spills (liquids or residues).	Clean all accessible areas with cotton swabs dampened with one of the cleaners listed in Section 2. Remove fibers or foreign particles. **Do not use hard instruments for cleaning.**
The audible alarm volume is not loud enough.		Turn the VOLUME knob on the rear of the device clockwise until the desired volume is obtained.
The interval between audible alarm tones is too long.		Change the interval for alert and/or alarm tones to the desired value through the configuration option.
The backlight is off when the device is running on internal battery power.		Press and hold the **BACKLIGHT** key as long as required to view the pump settings.
A **RATE**, **VTBI**, **START**, or numeric keypad is not accepted.	Check that the appropriate pump is selected (LED in the appropriate **PUMP** key lit).	Before it can be programmed, a pump must be selected by pressing its **PUMP** key.
	Check if the front panel is locked (Loc appears in Main Display).	Press the PANEL LOCK switch to remove the panel lock.
Hi or ***Lo*** is displayed during volume-time programming.	Calculate the rate and verify that it is within the allowable range set by the configuration option.	Reprogram for a rate within the range set by the configuration option or change the maximum rate setting in the configuration option as required.
A flow rate or ***CHECK VTBI*** alarm occurs when **START** is pressed.	Check that the rate or VTBI are within the limits set by the configuration option.	Change the maximum rate and/or maximum VTBI setting through the configuration option.

Table 3-1. Problem Checklist (Continued)

PROBLEM	CHECKS	CORRECTIVE ACTION
An ***AIR BUBBLE*** alarm message occurs with no air in the tubing.	Check the positioning and seating of the tubing.	Position the tubing fully into the air sensor.
	Check the tubing for surface scratches and for tube roundness.	Replace or reposition the tubing if surface scratches are significant or if the tubing has become flattened or oval in shape.
	Check the administration set for type and code.	Replace with a Baxter's "s" suffix standard administration set.
	Check for solution spills (liquids or residues).	Clean the sensor with cotton swabs dampened with one of the agents listed in Table 2-1. Remove fibers or foreign particles. **Do not use hard instruments for cleaning.**
An ***OCCLUSION*** alarm message or an ***UPSTREAM OCCLUSION*** alarm message occurs when the pump door is closed and **START** is pressed.	Check the positioning and seating of the tubing.	Position the tubing properly into the sensor and safety clamp. Correct any pinched or kinked tubing in the pump.
	Check that there are no obstructions upstream or downstream of the pump.	Remove obstructions and/or open the roller clamp.
	Check the administration set for type and code.	Replace with a Baxter's "s" suffix standard administration set if required.
	Check that ambient and solution temperatures are above 60° F.	Raise ambient and/or solution temperatures.
	Check for solution spills (liquids or residues) on the door and base side.	Clean all accessible areas with cotton swabs dampened with one of the cleaning agents listed in Table 2-1. Remove fibers or foreign particles. **Do not use hard instruments for cleaning.**

PROBLEM	CHECKS	CORRECTIVE ACTION
The safety clamp will not latch open.	Make sure the safety clamp pushbutton is in the full open position. Check for solution spills (liquids or residues).	Exercise the safety clamp by opening and closing it several times. Clean with cotton swabs dampened with one of the cleaning agents listed in Table 2-1. Remove fibers or foreign particles. **Do not use hard instruments for cleaning.**

Section 4

Theory of Operation

This section covers the operating principles of the device. The theory of operation does not cover the specific circuitry in great detail, but provides general information needed to perform fault isolation. **Active-low signals on all schematic diagrams in Section 10 are denoted by an exclamation point (!) preceding the signal name.** Figure 10-1 is a block diagram of the major components in the device. The numbers at the upper left of each block refer to the number of the figure in Section 10 in which the major components of that block are shown in greater detail.

4.1 CPU System

4.1.1 CPUs

See Figures 10-6 and 10-7. The device uses two identical CPUs, UI104 and UI151. Each CPU can function as the slave or the master CPU at initial power up. Normally, UI104 and UI151 act as master and slave, respectively.

The master CPU gathers data from the slave CPU, the occlusion detection multiplexer, the universal pulse processor, the power supply, and the interlock switches. It controls two I/O controllers, the decoder, the universal pulse processor, the communication controller, optional nurse call, alert and alarm lamps, the audible alarm and the power cut circuit. It also controls the motors via the slave CPU.

The master CPU also handles RS-232 serial communication with an external computer through the communication controller.

The slave CPU controls the pump motors via the motor drivers. It also controls the alarm and alert lamps, the audible alarms, optional nurse call and power cut circuit, and monitors interlock switches. The slave CPU outputs an interrupt signal to the master CPU through the universal pulse processor after every eight motor pulses to allow the master CPU to check motor rotation. It also sends a 19.2 kHz clock signal to the communication controller.

Both CPUs handle the watchdog function, which is the periodical communication between the CPUs through two serial communication lines.

The CPUs, in conjunction with the two 32K x 8 EPROMs, utilize 16 address lines and eight data lines. The master CPU uses an address decoder to address the universal pulse processor, the communication controller and two I/O controllers.

The slave CPU addresses an EPROM.

The master CPU sends commands for the number of motor pulses, motor start/stop, and deadband speed up signals to the slave CPU.

The software in the EPROMs for master and slave CPUs is exactly the same. Each CPU executes only the appropriate program.

4.1.2 Watchdog Function

The watchdog function is performed by both CPUs as they monitor each other's status. The purpose of the watchdog is to detect a malfunction of either microprocessor and shut down a pump or the device with an alarm. The accompanying audible tone is continuous rather than intermittent. Both CPUs communicate through the two serial communication lines, Tx and Rx. Each CPU has a communication counter which is initialized to a predetermined value by a signal from the other CPU. The counter is then decremented by one count every 32.768 mS. The counters are normally initialized again by the signal from the other CPU before they decrement to zero. If a counter reaches zero, it indicates that the watchdog signal from the other CPU was never received. This indicates a problem with the other CPU. The remaining functional CPU then stops the pumps with visual and audible alarms.

If communication between the CPUs cannot occur, both CPUs stop the pumps with visual and audible alarms.

4.1.3 I/O Controllers

See Figures 10-15 and 10-16. The I/O controller UI601 performs the following functions: Activating audible alarm, pump lamps and backlight, addressing the multiplexer and scanning the LCD drivers. It also controls the occlusion sensors and the power supply circuit.

The other I/O controller, UI602, performs the following functions: scanning the keyboard and PANEL LOCK switches, controlling the air sensors, activating the green PUMPING LEDs, and writing display data from the master CPU into the display drivers.

4.1.4 Multiplexer

See Figure 10-8. The multiplexer selects one of the four occlusion sensor outputs in accordance with the address signals from an I/O controller, and sends it to the master CPU.

4.1.5 Universal Pulse Processor

See Figure 10-12. The universal pulse processor converts the following analog signals into digital signals: air sensor outputs, battery voltages, motor currents and the voltages of master and slave CPUs. The digital signals are periodically read by the master CPU.

The universal pulse processor interrupts the master CPU each time a pulse is received from the motor rotation detectors. It also generates a signal for pulse width modulation control of the motor driver.

4.1.6 Communication Controller

See Figure 10-17. The communication controller allows the device to communicate with an external computer through an RS-232C interface. The clock is supplied by the slave CPU.

4.1.7 Air Sensor Circuit

See Figure 10-13. The air sensor circuits for both pumps are identical. Each circuit consists of an ultrasonic transmitter and receiver, mounted on opposite sides of the tubing path. The transmitter consists of a 500 kHz oscillator and a selector that transfers the oscillator output to two of three transducers. The transducers are selected by the air bubble alarm size setting in the configuration option. The receiver contains a selector that transfers the transducer outputs to an amplifier.

The transducers operate on the principle that air in the tubing transmits ultrasonic energy much less effectively than fluid. This energy is rectified, amplified, applied to the universal pulse processor and then converted into a digital signal. The master CPU monitors the signal and activates an ***AIR*** alarm if it detects the absence of a precise level of energy.

4.1.8 Occlusion Sensors

See Figure 10-8. The downstream occlusion sensor consists of a moving ferrite core inside a mechanically fixed oscillator coil. The moving ferrite core is spring-loaded against the IV set tubing. When pressure downstream of the pump increases, the core moves from its original position, which in turn changes the frequency of the oscillator.

One of the two downstream occlusion sensor outputs is selected by the multiplexer, applied to the master CPU and compared to the occlusion level selected in the configuration option. If the occlusion is sufficient to cause a specific frequency change, the CPU activates an alarm.

There is a maximum expansion of the tubing beyond which the pump will no longer permit operation.

The upstream occlusion sensor is similar to the downstream occlusion sensor (except for the spring) but is not tuned to the same frequency and is controlled by different software.

One of the two upstream occlusion sensor outputs is selected by the multiplexer and applied to the master CPU. Because the tubing collapses somewhat during normal operation, the software looks for a collapse that is faster and/or farther than expected. If the rate of collapse is too fast or too far, the pump will alarm. There is a maximum tubing collapse beyond which the device will no longer permit operation.

The upstream and downstream occlusion sensors operate in a frequency range of 1.2 MHz to 1.35 MHz and 1.3 MHz to 1.45 MHz, respectively.

4.1.9 Battery Low Alert/Alarm Detector

See Figure 10-1. The battery voltage is converted into a digital signal by the universal pulse processor and monitored by the master CPU. The CPU activates the alert or alarm if the battery charge state falls to the levels shown below.

Rate (mL/hr)	Alert Levels (VDC)	Alarm Levels (VDC)
1 - 1700	11.4	10.4
1701 - 1999	11.75	11.4

The ***BATTERY LOW*** Alert is triggered if the battery voltage drops below the specified alert value, which will permit approximately 15 minutes of operation. The ***BATTERY LOW*** Alarm is triggered when battery voltage drops below the specified alarm value, which shuts the device down with an alarm to prevent the battery from being damaged.

4.1.10 Interlock Switch

The interlock switches are reed type, activated by a magnet attached to each pump door latch. The switch opens the circuit when a pump door is opened. Both CPUs monitor both interlock switches, activate the ***DOOR OPEN*** alarm and stop the appropriate pump when its door is opened.

4.1.11 Panel Lock Circuit

See Figure 10-2. The panel lock circuit is initiated by the PANEL LOCK pushbutton switch located on the rear of the device. The switch is connected to an I/O controller. The purpose of this circuit is to prevent patient tampering. After the PANEL LOCK switch is pressed, the message ***Loc*** is displayed in the unused rate windows and no keys except TOT VOL/STATUS and BACKLIGHT are accepted. The panel lock out is removed by pressing the PANEL LOCK switch again.

4.1.12 Keypad

See Figures 10-16 and 10-23. The keypad is a multiplexed 8 x 4 array which is scanned by an I/O controller. One of eight select lines determine which four keys are read. All normal keypad presses are decoded by this matrix except the ON-OFF/CHARGE keys, which have special inputs to the power supply circuit.

4.1.13 Displays

See Figures 10-20 and 10-21. The LCD displays are multiplexed by display drivers, which apply a free-running frequency AC voltage to the segments of the displays when in the ON state, and no AC voltage when in the OFF state. The display drivers are addressed by the master CPU through an I/O controller. The data is sent on the data bus and is coded to update the display periodically. Once addressed, the display driver retains the data until addressed again.

The display is backlit on command by the keyboard BACKLIGHT switch. If the device is running on AC power, the backlight stays on continuously after the switch is pressed. If the device is running on the battery, the backlight stays on for 60 seconds after the switch is pressed to conserve battery life.

4.1.14 Motor Driver

See Figures 10-10 and 10-11. There is a separate motor driver circuit for each pump. Both function identically. Each motor driver receives four separate motor drive signals from the slave CPU, which are effectively ANDed with a pulse width modulation (PWM) signal from the universal pulse processor. The PWM signal controls the current level required for proper motor operation. The motor current levels are converted into digital signals by the universal pulse processor and monitored by the master CPU, which activates an alarm and stops the pump if motor overcurrent is detected.

Snubbing diodes have been added to increase motor efficiency. The motor is shut down when an alarm or a failure occurs. The motor speed range permits infusions from 1 mL/hr to 1999 mL/hr.

4.1.15 Motor Rotation Detectors

See Figure 10-9. The motor rotation detectors assure that pump drive rotation occurs or the pump shuts down. The motor rotation signals are read by the master CPU via the universal pulse processor.

4.2 DC Power Supply and Power Cut Circuit

See Figure 10-4. The DC power supply circuit is a 51 kHz switching type, which provides a regulated 13.8 V output at 1.4A maximum. The circuit will charge the battery as long as the device is connected to a specified AC outlet. The design continues to supply useful output down to a 105.0 VAC input. A 0.75A slow blow replacement fuse is required for AC. A 3.0A fuse is required in the battery circuit. Whenever the supply is activated by AC voltage, the CHARGING LED on the front panel is lit. The DC power supply has over-voltage, over-current, and over-temperature protection.

The power supply circuit on the CPU board (Figure 10-5) generates several DC sources from the 13.8 VAC output of the DC power supply board, (when the device is plugged into a specified AC source) or from the internal battery. The +5 VDC lines are as follows:

a. **V_{mas}**: This line is the output of a DC to DC convertor, HIC301, and is switched by the master CPU. Vmas is the main DC source voltage of the device. **Motor current does not flow while V_{mas} is off.**

b. **V_{slv}**: This line also is the output of the DC to DC convertor and is switched by the slave CPU. It is used for the slave CPU and its peripheral circuitry. V_{slv} is controlled by the slave CPU, which turns off V_{slv} five hours after the device has been turned off.

c. **V_{ref}**: This is the reference voltage regulated by a filter and a zener diode for the A/D convertor in the universal pulse processor. This voltage is generated from V_{oth}, which is switched by the master CPU.

d. **V_{key}**: This is generated either from the output of the DC power supply board, or from the internal battery voltage and is used for monitoring the ON-OFF/CHARGE keys.

Other DC voltages used in the device are as follows:

e. **V_{mtr}:** This is the DC source for the motors. It comes either from the DC power supply output or the internal battery voltage. V_{mtr} does not flow if V_{mas} is off.

f. **V_{oth}**: This is used for air sensors, backlights, and optional nurse call feature. The voltage comes from either the DC power supply output, or the internal battery voltage and is switched by the master CPU.

g. **V_{mem}:** This is the output of the lithium backup battery for the back up memory in the universal pulse processor.

Each DC source is switched as follows:

VOLTAGE	1 or 2 pumps are turned on	Both pumps are turned off	After 5 hour memory mode
V_{mas}	ON	OFF	OFF
V_{slv}	ON	ON	OFF
V_{ref}	ON	OFF	OFF
V_{key}	ON	ON	ON
V_{mtr}	ON	ON	ON
V_{oth}	ON	OFF	OFF
V_{mem}	ON	ON	ON

All the voltages are turned on when an ON-OFF/CHARGE key is pressed while the device is off. However, turning the voltages off can only be accomplished by the appropriate CPU through the power cut circuit.

The master CPU saves necessary data in the back up memory in the universal pulse processor and turns off the V_{mas}, V_{ref} and V_{oth} voltages when both pumps are turned off.

The power cut circuit is contained in a hybrid chip, HIC302, which also includes a circuit to activate the backup audible alarm when the device is shut down by a failure.

Section 5

Troubleshooting

5.1 Introduction

This section describes how to find the cause of device malfunctions. The section consists of the following:

- A description of the device's Failure Identification codes.
- A description of the device's automatic test modes.
- A description of the signals available at the device's service port.
- A table which lists each failure code, its cause, and ways of correcting it.
- A table which describes how to correct problems not represented by failure codes.

Once the cause of a failure had been determined, perform the corrective action given in the table. All disassembly/reassembly and calibration procedures for the device are in Section 6.

5.2 Failure Identification Codes

Specific errors which may occur in the operation of the Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump are represented by Failure Identification codes. When the alarm message ***FAILURE*** or ***COMMON FAILURE*** occurs, it is accompanied by a 2-digit code number. This code is the Failure Identification code. The last 10 Failure Identification codes for each pump (including alarm codes except ***DOOR OPEN*** and ***AIR*** alarms occurring in the STOPPED mode) are stored in the device's memory. The Failure Identification codes can be used to determine the nature of a device failure and to troubleshoot its cause.

To view the stored Failure Identification codes, place the pump(s) in the STOPPED mode. Press and hold the SILENCE and TOT VOL/STATUS keys. The most recent Failure Identification

code will be displayed for the powered on pump(s). The device will display the last detected code in the lower right corner of the appropriate Main Display for as long as the keys are held, plus one second. To scroll back through the previous nine codes that occurred, press the CLEAR TOT VOL key before the one second period elapses. Each failure code will be displayed for one second with a one second off interval after each code. After the last failure code for each pump has been displayed for 1 second, the displays return to normal.

To exit from the Failure Identification code viewing mode, release the SILENCE and TOT VOL/STATUS keys. One second later, the display of the RATE(s) and VTBI(s) data resumes.

There are two types of Failure Identification codes: Alarm (codes 1-19) and Failure (codes 20 and above). Alarm codes report malfunctions generally correctable by the operator. Failure codes may require servicing of the device. A code of 0 indicates normal operation with no failures.

See Table 5-1 for descriptions of all Failure Identification codes and instructions on how to correct each failure. Disassembly/reassembly and calibration procedures are located in Section 6.

During operation, a pump-specific failure is indicated by the message ***FAILURE*** and the failure code number (in the format, F_nn) in the appropriate Message and Main Displays. A device-specific failure is indicated by the message ***COMMON FAILURE*** in the Pump 1 Message Display and the failure code number in the Pump 2 Main Display.

5.3 Automatic Test Modes

The device has five automatic test modes, numbered 1 through 5, and a service port to aid in troubleshooting. The five modes are described in the following paragraphs.

To access the automatic test modes:

1. Turn off the device.

2. Select the desired test mode by pressing and holding the CLEAR TOT VOL key. Then, press and hold the appropriate numeric key while pressing either ON-OFF/CHARGE key.

3. To exit any automatic test mode, press the ON-OFF/CHARGE key that was pressed in step 2.

5.3.1 Automatic Test Mode 1: Calibration mode 1

The purpose of this calibration mode is to check the calibration of the upstream and downstream occlusion sensors, and to check the operation of the internal A/D converter.

1. Place the device on its back. Enter Automatic Test Mode 1.

2. Place the thickness gauge (part no. UKOG1013.B) onto the downstream occlusion sensor.

3. Close the pump head door.

4. Connect the AC plug of the device to a 115 ± 5.0 VAC 60 Hz power source.

5. Check that the value displayed in the PRI VTBI window of the appropriate Main Display is between 3127 and 3199. No calibration is required if the values are within the specification.

6. If the value is out of specification, perform Section 6.4.3, step 2.

7. Place the thickness gauge onto the upstream occlusion sensor.

8. Close the pump head door.

9. Check that the value displayed in the PRI RATE window of the appropriate Main Display is between 3327 and 3399.

10. Remove the thickness gauge, close the door and check that the value is 3180 or less. No calibration is required if the values in step 9 are within the specification.

11. If the value is out of specification, perform Section 6.4.4, steps 2 through 4.

12. An external reference voltage to test the A/D converter is displayed in the SEC RATE window of Pump 1. When no voltage is applied the display is 0000. The applied voltage must be 1.50 to 3.50 VDC and applied to pins 4 (+) and 8 (-) of the Service Port. The pin numbers are 1 through 8, from left to right. Determine if the displayed digital reading equals the actual applied voltage using the following equation:

    Actual Voltage = 0.00488 X Displayed data

13. The tolerance on the displayed data is ± 10.

5.3.2 Automatic Test Mode 2: Calibration mode 2

The purpose of this automatic test mode is to check the calibration of the air sensors and to check the device's internal DC voltages.

1. Connect the AC plug of the device to a 115 ± 5.0 VAC 60 Hz power source. Enter Automatic Test Mode 2.

2. Load a Baxter standard administration set and prime it with fluid. Close the pump head door. **Ambient and solution temperatures must be between 72° and 82° F (22° and 28° C).**

3. Open and close the pump head door two more times.

4. With the pump head door closed, check the NORM value (at PRI RATE window) and the MIN value (at PRI VTBI window). Both values should display between 350 and 650.

5. Remove the tubing from the pump head and check that the NORM and MIN values are both 70 or less. If they are out of specification, perform Section 6.4.2, steps 6 through 21.

6. Check that the voltages specified in each window are within specification:

Descriptor	Window Displayed	Specification	
		S/N 59000016 - 5902693Y	All Others
V_{mas} = MAST	Pump 1 SEC RATE	472 - 552 (a)	472 - 579 (a)
V_{slv} = SLAV	Pump 1 SEC VTBI	472 - 552 (a)	472 - 579 (a)
V_{main} = MB	Pump 2 SEC RATE	688 - 735 (b)	688 - 735 (b)
V_{mem} = BB	Pump 2 SEC VTBI	297 - 419 (c)	565 - 746 (d)

(a) Actual voltage = Displayed data x 0.00976
(b) Actual voltage = Displayed data x 0.01952
(c) Actual voltage = Displayed data x 0.00488 + 1.6
(d) Actual voltage = Displayed data x 0.00488

7. If the MAST and SLAV displays are not within specification, calibrate the device per Section 6.4.1, steps 2 through 4.

8. If the BB display is out of specification, replace the lithium backup battery per Section 6.3.21.

9. If the MB display is out of specification, turn the device off and charge it for 8 hours. Repeat steps 1 and 6. If the MB display is still out of specification, perform the following procedure.

10. Remove the main battery compartment cover by removing 4 screws (Figure 8-5 item 9) on the underside of the device. Disconnect the main battery at the battery terminals and perform steps 1 and 6.

11. If the MB display is out of specification, the DC power supply must be calibrated per Section 6.4.1, steps 3 and 4.

12. If the MB display is within specification as described in Step 11, the main battery should be replaced.

5.3.3 Automatic Test Mode 3: Manufacturing Test Mode

Warning: This is an automatic test mode for testing the device during manufacturing only. This mode must not be used on patients because the downstream occlusion, upstream occlusion and air sensors are disabled.

The PRI RATE/VTBI of both pumps are set to 10/20.
Each pressing of the PRI RATE key will access the following PRI RATE/VTBI combinations:

125/250 250/500 499/998 999/1998 1999/3998

In each combination, the VTBIs can be manually altered. Secondary rates and VTBIs can be manually entered.

5.3.4 Automatic Test Mode 4: Aging Mode

Warning: This is an automatic test mode for testing the device only. This mode must not be used on patients because the upstream occlusion and downstream occlusion sensors are disabled.

PRI RATE/VTBI of both pumps are set to 500/3000. Secondary rates and VTBIs can be manually entered.

5.3.5 Automatic Test Mode 5: Display Check Mode

All the LCD segments turn on sequentially for a visual check.

5.4 Description of Service Port

The following signals are available at the service port located on the rear of the device.

Pin Number	Signal
1	Air sensor calibration voltage for Pump 1
2	Air sensor calibration voltage for Pump 2
3	A/D Reference voltage
4	External voltage input to A/D for testing
5	Motor drive pulse from Pump 1
6	Motor drive pulse from Pump 2
7	Common ground
8	Common ground

5.5 Failure Identification Code Troubleshooting Table

Use Table 5-1 to determine the corrective action necessary to resolve failure codes. The causes of each failure code are listed in the order in which they are most likely to occur. Perform the corrective action items in the order in which they are listed and retest the device after each action. All replacement procedures are contained in Section 6. After completing repairs, perform the Operational Checkout procedures of Section 7 to verify that the problem has been corrected.

Table 5-1. Failure Identification Codes

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
0	No alarms or failures.	No action necessary.	
1	Air bubble detected in a Run mode.	Check for air in tubing. Ensure set is correct type and is properly loaded. Ensure set tubing is not scratched or deformed.	Expel air in tubing. Replace or reposition set if tubing is flattened or scratched. Clean air sensor in accordance with Section 2 if dirty.
		Perform Section 5.3.2 steps 1 through 6 two more times.	If values are not within specification, recalibrate or replace the air sensor.

Table 5-1. Failure Identification Codes (Continued)

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
2	Downstream occlusion was detected: The sensor output increased by a specified value.	Check for scratched or deformed tubing. Verify that solution and ambient temperatures are between 60° and 100° F (15.5° and 37.7° C). Ensure set is correct type and is properly loaded. Check for spilled solution in sensor region. Perform Section 5.3.1 steps 1 through 5.	Remove downstream occlusion and reposition the tubing. Clean occlusion sensors in accordance with Section 2 if dirty. Raise or lower temperatures if necessary. Reading should be between 3127 and 3199. If not, recalibrate or replace the sensor.
3	Downstream occlusion was detected: The sensor output increased to an absolute value (3140).	See Failure Identification code 2.	
4	Upstream occlusion was detected: The sensor output decreased by a specified value.	Check for spilled solution in sensor region. Remove upstream occlusion and reposition tubing. Ensure set is proper type and is properly loaded. Ensure ambient and solution temperatures are between 60° and 100° F (15.5° and 37.7° C). Perform the appropriate steps from Section 5.3.1, related to upstream occlusion.	Clean sensor in accordance with Section 2 if dirty. Raise or lower temperatures. Reading displayed in pump's PRI RATE window must be within 3327 and 3399. If not, recalibrate or replace the sensor.
5	Upstream occlusion was detected: The sensor output decreased to an absolute value (3200).	See Failure Identification code 4.	

Table 5-1. Failure Identification Codes (Continued)

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
6	Low battery voltage (10.4 V or less) was detected.	If Battery Low alarm is on and CHARGING LED is off, check: a. tightness of AC plug b. AC voltage source c. power fuse d. battery fuse Turn device off and recharge for 12 hours.	 a. Plug in firmly. b. If AC voltage is below 105 VAC, connect device to a correct voltage source. c. Replace if it has failed. d. Replace if it has failed. If alarm recurs after recharging, check and repair loose connections at battery terminals. If problem persists, replace battery.
10	No tubing detected by downstream occlusion sensor.	Perform Section 5.3.1, steps 1 through 5.	Reading should be between 3127 and 3199. If not, recalibrate or replace sensor.
12	Upstream occlusion was detected in Revolution Counter Interrupt.	See Failure Identification code 4.	
20	Malfunction in Door Open detection circuitry: P60 or P61 of the Master CPU remains high.	Check that magnet in pump door latch is present.	Replace pump door latch if magnet is missing. Repair or replace CPU board.
21	Malfunction in A/D converter circuitry for occlusion detection: P20 of master CPU remains high.	Check the following connectors for proper connection and continuity: The 18-pin connector of each pump head CN851 (Pump 1) CN852 (Pump 2) CNBUS2	Repair or replace connectors as necessary. Replace CPU board. Replace I/O board.
22	Malfunction in A/D converter circuitry for occlusion detection: P20 of master CPU remains low.	See Failure Identification code 21.	
23	P50 (INT1 interrupt port) remains high.	Check UI104 pin 17 for a high (+5 VDC) signal.	If signal is high, replace CPU board.

Table 5-1. Failure Identification Codes (Continued)

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
24	UP and DOWN occlusion value agree.	Check connector CNBUS2 for proper connection and continuity.	Repair or replace CNBUS2 if necessary. Replace CPU board. Replace I/O board.
25	Pump 1 and Pump 2 occlusion values agree.	Check connector CNBUS2 for proper connection and continuity.	Repair or replace CNBUS2 if necessary. Replace CPU board. Replace I/O board.
28	Four air sensors outputs (NORM and MIN of both pumps) cannot be selected.	Check connector CNBUS2 for proper connection and continuity.	Repair or replace CNBUS2 if necessary. Replace CPU board. Replace I/O board.
29	Four occlusion sensors (UP and DOWN of both pumps) cannot be selected.	Check tightness of connectors on the CPU board.	Replace CPU board. Replace I/O board.
30	Malfunction in A/D converter circuitry for air detection: A/D conversion did not complete in 50 μS.	Turn device off and back on.	If failure recurs, replace CPU board.
31	Malfunction in air MIN detection circuitry: Input to A/D converter remains high.	Turn device off and back on.	If failure recurs, replace CPU board.
32	Malfunction in air NORM detection circuitry: Input to A/D converter remains high.	Turn device off and back on.	If failure recurs, replace CPU board.
33	Malfunction in air MIN detection circuitry: Input to A/D converter is not 0 V although the MIN air transducer is not oscillated.	Check tightness of connectors on the CPU board.	Replace CPU board. Replace I/O board.
34	Malfunction in air NORM detection circuitry: Input to A/D converter is not 0 V although the NORM air transducer is not oscillating.	See Failure Identification code 33.	

Table 5-1. Failure Identification Codes (Continued)

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
35	Panel key other than **ON-OFF/CHARGE** and **BACKLIGHT** was pressed for more than 40 seconds.	Check that key was not inadvertently pressed for 40 seconds.	Turn the device off and back on. If failure code recurs, replace front panel.
37	Either **ON-OFF/CHARGE** key was pressed for more than 5 seconds when device power was off.	Check that the keys were not inadvertently pressed for 5 seconds. Check that both keys are not damaged.	Replace front panel, if necessary.
40	PRCS communication error. The data from pump cannot be received by external personal computer.	Check connections between device and computer. Verify that PRCS software is correctly loaded onto PC.	Reboot computer and try again. If failure code recurs, check internal pump connections to PRCS connector and repair as required. If failure code recurs again, replace CPU board.
50	MASTER CPU received a TRAP interrupt.	Turn device off and back on.	If failure recurs, replace the software (EPROMs). Replace CPU board. Replace I/O board.
51	MASTER CPU received a CMI interrupt.	Turn device off and back on.	If failure recurs, replace CPU board.
52	MASTER CPU received a SWI interrupt.	Turn device off and back on.	If failure recurs, replace CPU board.
53	MASTER CPU received a NMI interrupt.	Turn device off and back on.	If failure recurs, replace CPU board.
54	MASTER CPU received an OCI interrupt.	Turn device off and back on.	If failure recurs, replace CPU board.
55	Maximum SEC RATE setting in memory is greater than 999 mL/hr.	Reset all configuration options in accordance with Section 1.	If failure recurs, replace CPU board.
57	Undefined address for failure code memory was designated by Universal Pulse Processor.	Reset all configuration options in accordance with Section 1.	If failure code recurs, replace CPU board.
58	MASTER CPU's TIMER 1 interrupt does not occur.	Turn device off and back on.	If failure recurs, replace CPU board.
59	Program stuck in BLOCK1 routine.	Turn device off and back on.	If failure recurs, replace CPU board.

Table 5-1. Failure Identification Codes (Continued)

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
60	Malfunction in battery voltage detection circuitry: Input to A/D converter remains high.	Turn device off and back on.	If failure recurs, replace CPU board.
61	Malfunction in battery voltage detection circuitry: Input to A/D converter remains high.	Turn device off and back on.	If failure recurs, replace CPU board.
62	Malfunction in memory back up battery voltage detection circuitry: Input to A/D converter remains high.	Turn device off and back on.	If failure recurs, replace CPU board.
63	Malfunction in memory back up battery voltage detection circuitry: Input to A/D converter remains low.	Check connector CN304 for proper connection and continuity.	Plug CN304 in firmly. Replace CPU board.
64	Malfunction in A/D converter circuitry for battery voltage detection: A/D conversion did not complete in 50 μS.	Turn device off and back on.	If failure recurs, replace CPU board.
65	Malfunction in A/D converter circuitry for memory backup battery voltage detection: A/D conversion did not complete in 50 μS.	Turn device off and back on.	If failure recurs, replace CPU board.
66	Supply voltage of MASTER CPU circuitry is too high.	Turn device off and back on.	If failure recurs, replace CPU board.
67	Supply voltage of MASTER CPU circuitry is too low.	Turn device off and back on.	If failure recurs, replace CPU board.
68	Supply voltage of SLAVE CPU circuitry is too high.	Turn device off and back on.	If failure recurs, replace CPU board.
69	Supply voltage of SLAVE CPU circuitry is too low.	Turn device off and back on.	If failure recurs, replace CPU board.

Table 5-1. Failure Identification Codes (Continued)

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
73	Overcurrent to motor.	Check that connectors CN701 (Pump 1) and CN702 (Pump 2) are seated firmly. Check for loose motor coupler.	Plug CN701 and CN702 in firmly. Apply a trace of Loctite* 211 or 222 to coupling set screws and tighten. Replace CPU board.
74	Motor slipped even though at maximum current to motor.	Check the following connectors for proper connection and continuity: 11-pin connectors of each pump head assembly CN211 (Pump 1) and CN212 (Pump 2) CN701 (Pump 1) and CN702 (Pump 2) Check F201 (Pump 1) and F251 (Pump 2)	Repair or replace the connectors. Repair or replace F201 and/or F251. Replace CPU board.
76	Pulse interrupt from SLAVE CPU was detected, but motor does not rotate (when rate is 1401 mL/hr or more).	See Failure Identification code 74.	
77	No pulse interrupt from SLAVE CPU while the motor is rotating.	Turn device off and back on.	If failure recurs, replace CPU board.
78	Drive defect - overinfusion. High motor rotation against the number of revolution counter interrupts.	Ensure that the encoder disk is properly secured.	Secure encoder disk. Replace CPU board.
79	Drive defect - underinfusion. Low motor rotation against the number of revolution counter interrupts.	Ensure that pump head is clean and rotates freely. Check coupling between pump mechanism and motor. Check encoder disk for secure mounting.	Apply a trace of Loctite* 211 or 222 to coupling set screws and tighten. Secure encoder disk. Replace CPU board.
80	Incorrect response from SLAVE CPU in initial communication.	Turn device off and back on.	If failure recurs, replace CPU board.
81	Both CPUs acted as the same function (master or slave) in initial communication.	Turn device off and back on.	If failure recurs, replace CPU board.

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Table 5-1. Failure Identification Codes (Continued)

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
82	No acknowledgment message from SLAVE CPU for 10 communication trials.	Turn device off and back on.	If failure recurs, replace CPU board.
83	Undefined message received from SLAVE CPU.	Turn device off and on again.	If failure recurs, replace CPU board.
84	CPU mode information sent by SLAVE CPU was not slave.	Turn device off and on again.	If failure recurs, replace CPU board.
85	Incorrect response from SLAVE CPU against four requests to send message.	Turn device off and on again.	If failure recurs, replace CPU board.
86	LVDT reading of downstream occlusion sensor is too low.	Check calibration of downstream occlusion sensors.	See Failure Identification code 10.
87	LVDT reading of upstream occlusion sensor is too low.	Check calibration of upstream occlusion sensors.	See Failure Identification code 4.
88	No tubing detected by downstream occlusion sensor in a Run mode.	Perform Section 5.3.1, steps 1 through 5.	Reading should be between 3127 and 3199. If not, recalibrate or replace the sensor.
89	Malfunction in SLAVE CPU: Communication counter of MASTER CPU has become zero.	Turn the device off and on again.	If failure recurs, replace CPU board.
90	RATE, VTBI and VI data in duplicated memories do not agree.	Reset all of the configuration options in accordance with Section 1.	If failure recurs, replace CPU board.
91	Motor pulse data in duplicated memories does not agree.	Turn device off and back on.	If failure recurs, replace CPU board.
92	Data for five-hour memory in duplicated memories does not agree at initial power up.	Reset all of the configuration options in accordance with Section 1.	If failure recurs, replace CPU board.
93	Write data and read data of HD63140 do not agree.	Turn the device off and on again.	If failure recurs, replace CPU board.

Table 5-1. Failure Identification Codes (Continued)

CODE	CAUSE	CHECKS	CORRECTIVE ACTION
94	Configuration option settings in duplicated memories do not agree.	Reset all of the configuration option settings in accordance with Section 1. Turn the device off and back on again.	If failure recurs, replace CPU board.
95	CPU code from MASTER CPU was not 0AH.	Turn the device off and back on.	If failure recurs, replace CPU board.
96	Communication counter of SLAVE CPU has become zero.	Turn device off and back on.	If failure recurs, replace CPU board.
97	Maximum rate setting in configuration option is greater than 1999 mL/hr.	Check configuration settings in accordance with Section 1.	Reset maximum rate to a value within the limits of the device. If failure recurs, turn the device off and on again. If failure recurs again, replace CPU board.
98	Maximum number of automatic restarts in configuration option is greater than 9.	Check configuration settings in accordance with Section 1.	Reset number of automatic restarts to a value less than 10. If failure recurs, turn the device off and on again. If failure recurs again, replace CPU board.
99	Undefined failure code was received from SLAVE CPU.	Turn the device off and on again.	If failure recurs, replace CPU board.

5.6 Troubleshooting Chart

Table 5-2 identifies specific failures by symptoms rather than Failure Identification codes.

Table 5-2. Troubleshooting Chart

SYMPTOM	CHECKS	CORRECTIVE ACTION
One or both pumps cannot be turned on.	Check front panel cables for short circuits. Check CNBUS1 and CN601 for proper connection and continuity.	Replace front panel film. Replace CPU board. Replace I/O board.
One or both pumps cannot be turned off.	Check front panel cables for short circuits. Check CNBUS1 and CN601 for proper connection and continuity.	Replace front panel film. Replace CPU board. Replace I/O board.
All front panel keys other than **BACKLIGHT** and **TOT VOL/STATUS** are disabled.	Does ***Loc*** appear in the main display?	Press and release the PANEL LOCK switch on the rear panel. ***Loc*** in the main display should disappear.
One or more front panel keys are not accepted.	Power the device off and back on and try the key again. Check front panel cables for proper connection and continuity.	Replace front panel film. Replace I/O board. Replace Display board.
PANEL LOCK switch is not accepted.	Check the operation of the switch. Check CNLOCK, CNBUS2 and CNI/F for proper connection and continuity.	Replace PANEL LOCK switch. Replace I/O board. Clean and lubricate Lock Out Switch with a cleaner/lubricant.
Key does not beep when pressed.	Check CNBUS1 for proper connection and continuity.	Replace CPU board. Replace I/O board.
The device does not run on AC but runs on internal battery.	Check CN301 and CNBUS2 for proper connection and continuity. Check that the AC power cord is firmly connected.	Repair or replace power cord. Replace CPU board. Replace I/O board.
The device displays ***BATTERY*** while running on AC.	Check AC fuse. Check connectors CN301 and CNBUS2 for proper connection and continuity.	Replace AC fuse with same type and rating if it has failed. Replace CPU board. Replace I/O board.
The device does not display ***BATTERY*** while running on internal battery.	Turn the device off and back on.	If failure recurs, replace CPU board. Replace I/O board.

Table 5-2. Troubleshooting Chart (Continued)

SYMPTOM	CHECKS	CORRECTIVE ACTION
The LCDs are blank, indicate irrational display or have missing segments.	Check ICP301, ICP302, and CNDISP for proper connection and continuity.	Replace CPU board. Replace I/O board. Replace Display board.
The backlight does not light.		Replace Display board.
The backlight cannot be turned off.		Replace I/O board. Replace Display board.
The device or a pump turns off or stops with audible alarm for no apparent reason.	Check ICP301, F302 and F303. Check CNBUS1 for proper connection and continuity. Check front panel cables for short circuits.	Replace ICP301, F302 or F303. Repair or replace CNBUS1. Replace front panel film. Replace I/O board. Replace Display board.
ALARM lamp(s) always on.	Turn the device off and back on.	If problem recurs, replace CPU board. Replace Display board.
ALARM lamp(s) will not turn on.	Check CNDISP and CNBUS2 for proper connection and continuity.	Replace CPU board. Replace Display board.
ALERT lamp(s) always on.	Check CNBUS1 for proper connection and continuity.	Replace CPU board. Replace Display board.
ALERT lamp(s) will not turn on.	Check CNDISP for proper connection and continuity.	Replace CPU board. Replace Display board.
PUMPING lamp(s) always on.	Check CNDISP for proper connection and continuity.	Replace I/O board. Replace Display board.
PUMPING lamp(s) will not turn on.	Check CNDISP for proper connection and continuity.	Replace I/O board. Replace Display board.
PUMP lamp(s) always on.	Turn device off and back on.	If problem recurs, replace I/O board. Replace Display board.
PUMP lamp(s) will not turn on.	Check CNDISP for proper connection and continuity.	Replace I/O board. Replace Display board.
Audible alarm is always on.	Check F302 and ICP301 or IPC302. Check the following connectors for proper connection and continuity: CNBUS2 CN302 CN753 CNI/F CNB2	Replace F302 , ICP301 or ICP302, and/or connectors as required. Replace CPU board.
Audible alarm does not sound.	Turn device off and back on.	If problem recurs, replace CPU board. Replace I/O board.

Table 5-2. Troubleshooting Chart (Continued)

SYMPTOM	CHECKS	CORRECTIVE ACTION
Beep does not sound when a key is pressed.	Turn device off and back on.	If problem recurs, replace CPU board. Replace I/O board.
DOOR OPEN alarm occurs while the door is closed, or does not occur when the door is opened.	Check magnet on door latch. Check CN801 and CN802.	Replace door latch if magnet is missing. Replace CPU board.
Optional nurse call is always on.	Check CNBUS2 and CNIPM for proper connection and continuity.	Repair or replace CNBUS2 or CNIPM as required. Replace CPU board. Replace I/O board. Replace Terminal board.
Optional nurse call is always off.	Check CNBUS2 and CNIPM for proper connection and continuity.	Repair or replace CNBUS2 or CNIPM as required. Replace CPU board. Replace I/O board.
Configuration option cannot be set by optional PRCS.	Check the cable connections between the computer and the device. Check that PRCS software is properly loaded onto the computer. Check compatibility of device software version and PRCS version. Check CNBUS1 and CNIPM for proper connection and continuity.	Repair connections between computer and device. Restart PRCS program. Obtain compatible version of PRCS. Repair or replace CNBUS1 and CNIPM as required. Replace CPU board. Replace I/O board.
The noise level of a pump is higher than normal.	Check administration set for proper type and code. Check for solution spills on the fingers and around the back plate. Check the tightness of the motor mounting bracket screws. Check proper seating of the springs under the motor. Check for a PC board or other assembly vibrating against the inside of the case.	Replace with a Baxter's "s" suffix standard administration set if required. Clean in accordance with Section 2. Tighten as required. Seat springs properly. Ensure all internal assemblies are securely fastened.

Table 5-2. Troubleshooting Chart (Continued)

SYMPTOM	CHECKS	CORRECTIVE ACTION
The rear clamp fails to hold the device on the IV pole.	Check for worn or missing friction pad (part no. LPLT1020.B). Check the clamp for worn threads and other worn or defective parts.	Replace worn or defective parts on the clamp as necessary.
Free flow occurs when the door is closed.	Check administration set for proper type and code. Check position and seating of the tubing. Check that ambient and solution temperatures are between 60° and 100° F (15.5°and 37.7° C). Check for cracks in the door hinges. Check for deformation of the coil spring of the back plate. Check for worn cams and fingers.	Replace with a Baxter's "s" suffix standard administration set if required. Position tubing properly, without stretching or slack. Raise or lower the temperatures. Replace the the pump head, as described in Section 6.3.6. Replace the springs if required. Replace worn parts as required.
Free flow occurs when the door is opened.	Check administration set for proper type and code. Check for solution spills on and around safety clamp. Check position and seating of tubing. Check that ambient and solution temperatures are between 60° and 100°F (15.5° and 37.7°C). Check for broken torsion spring and/or loosened or broken safety clamp screws.	Replace with a Baxter's "s" suffix standard administration set if required. Clean in accordance with Section 2. Position tubing properly and make certain it is seated in guides and channels. Raise or lower the temperatures. Replace broken parts if required.

Section 6

Disassembly and Calibration

6.1 Introduction

This section of the manual includes a list of tools and test equipment required for performing maintenance, procedures for removing and replacing subassemblies once the cause of a malfunction has been determined, and procedures for calibration after component or circuit board replacement. Detailed exploded views of the device are provided in Section 8.

6.2 Preparation for Maintenance

6.2.1 Tools and Test Equipment

The following tools and test equipment are required to perform the procedures contained in this section. **Since all fasteners on this device are metric, ensure that all tools used are for metric fasteners. Tightening torques on certain screws are specified in kg-cm and in-lb for your convenience. The values in in-lb are approximate.**

Test Equipment	Tools
Digital Voltmeter	Razor blade
DC Ammeter	Metric Phillips-head screwdriver, #0
Electronic load device or a fixed, 5 ohm, 20W resistor with variable load (see Figure 6-1)	Metric Phillips-head screwdriver, #1
Thickness gauge, part number UKOG1013.B	Metric Phillips-head screwdriver, #2
Grounded wriststrap	Torque screwdriver, 0-15 kg-cm or 0-20 in-lb
Anti-static mat or other anti-static worksurface	Metric ball point Allen wrench, 2.5 mm
Precision 0.1 µL gas-tight syringe, part no. S9662-81 (or equivalent)	Metric ball point Allen wrench, 1.25 mm
Precision .25 µL gas-tight syringe, part no. S9662-82 (or equivalent)	Soldering Iron, temperature-regulated, 600° - 700°F, 20 - 48 Watts, 1/32" tip
Calibration tubing, part no. 3-2-92-479	
Oscilloscope (dual trace)	

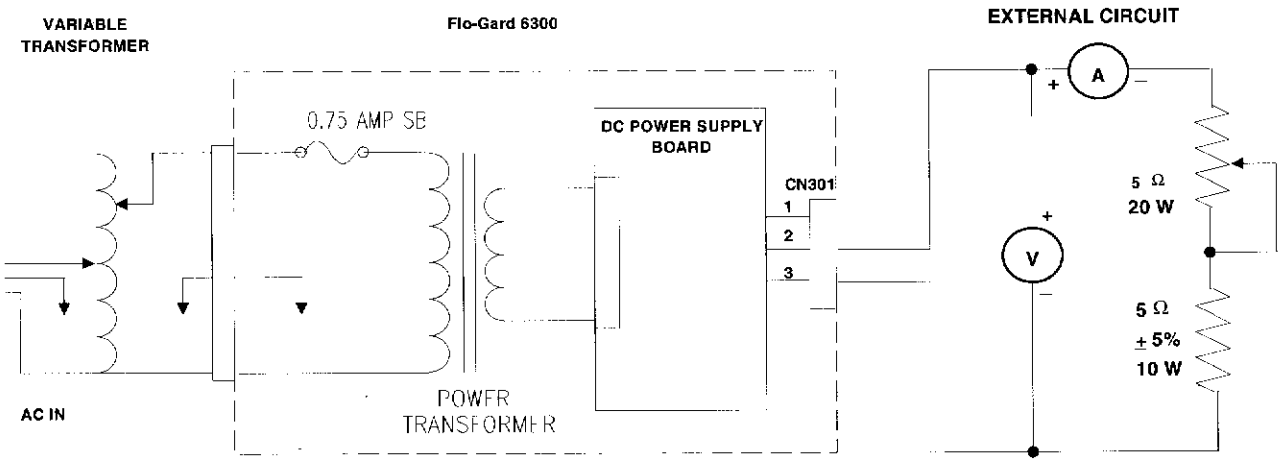


Figure 6-1. DC Line Voltage Calibration Set Up

6.2.2 Recording the Configuration Option Settings

It is necessary to record the configuration option settings and the alarm log data before beginning maintenance procedures so that the device can be reconfigured properly when maintenance is completed.

Caution: When the battery, EPROMs, or a printed circuit board (PCB) is/are disconnected or replaced, or a calibration is performed, all configuration options must be reset. See Section 1.5.

1. Turn on Pump 2. Enter the configuration inspection mode by pressing the TIME and TOT VOL/STATUS keys simultaneously. Hold the keys for 1 second.

2. Press the SEC START key to access each parameter sequentially. Record the configuration settings.

3. Exit the configuration inspection mode by pressing TIME and TOT VOL/STATUS again (or press the Pump 2 STOP key).

4. Record the contents of the alarm logs by pressing the SILENCE and TOT VOL/STATUS keys simultaneously while both pumps are on. Within one second, press the CLEAR TOT VOL key to bring up the rest of the failure codes for each pump.

6.3 Disassembly/Reassembly

Disassembly of the Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump is limited to the mechanical components and PCBs. It is recommended that electrical problems be corrected by replacing entire PCBs unless circumstances warrant component repair. Use only the replacement parts listed in Section 8.

Please read all steps in the procedure before beginning. The procedures are given in order of disassembly. Disassemble the device only as far as required to complete repair. **All fastening components such as screws, washers and nuts used in the device are metric. Be sure to use metric tools and replace only with metric components.**

Caution: The device is sensitive to electrostatic discharge damage (ESD). Always wear a grounded wriststrap when performing maintenance on the device to prevent damage to components.

Warning: Always make sure the device is unplugged and that both pumps are turned off before disassembling. Failure to do so can result in personal injury and/or damage to the device.

6.3.1 Separation of Front and Rear Housings

1. Turn the device off and place it face down on an anti-static mat or worksurface. Take care not to lay the device face down on components (such as screws) which could damage the front panel.

2. Remove 12 screws that secure the rear housing to the front housing. (Figure 8-6, items 2 and 3.)

3. Remove the two screws that secure the battery compartment frame to the front housing (item 4).

4. Stand the device upright and separate the front and rear housings by pulling the front half forward.

5. While the device is standing, disconnect CN301 (3-pin connector located in the front half of the device) from the CPU board.

6. Reassemble the front and rear housings in reverse order. If major repairs were performed, follow the next steps to properly route the wire harnesses.

7. Replace all disconnected connectors except 3-pin connector CN301.

8. Replace the connectors of the pump head harnesses as close as possible to the appropriate pump head.

9. Insert the fuse holder into the retainer on top of the battery compartment.

10. Route the ground wire between the front and rear housings so that it will not be pinched by the bosses when the two housings are closed.

11. Press down on the ribbon cable connector (CN/IF) of the I/O PCB to secure the connection between the I/O PCB and Terminal Board.

12. Route the ribbon cable so that it is located in front of the battery compartment. Keep it away from the boss.

13. Stand up the front housing and connect CN301.

14. Route the battery harness so that it is located over the battery compartment. Keep it away from the boss.

15. Close the two housings by slightly lifting and moving the rear housing toward the front housing.

16. Plug the power cord into an AC outlet and check that the CHARGING LED is lit. If it is not, check for proper connection of CN301.

17. Press an ON-OFF/CHARGE key and check that the self test is performed correctly as described in Section 7.3.2.2.

18. When assembling the case halves, be sure that the front and rear housing surfaces are flush before tightening. Replace nine screws (Figure 8-6, item 3) and tighten them to 9 kg-cm (8 in-lb) with a torque screwdriver in the order shown in Figure 6-2.

19. Replace 3 screws at the handle and the 2 screws that secure the battery compartment frame to the front housing (items 2 and 4). Tighten screws to 9 kg-cm (8 in-lb) with a torque screwdriver.

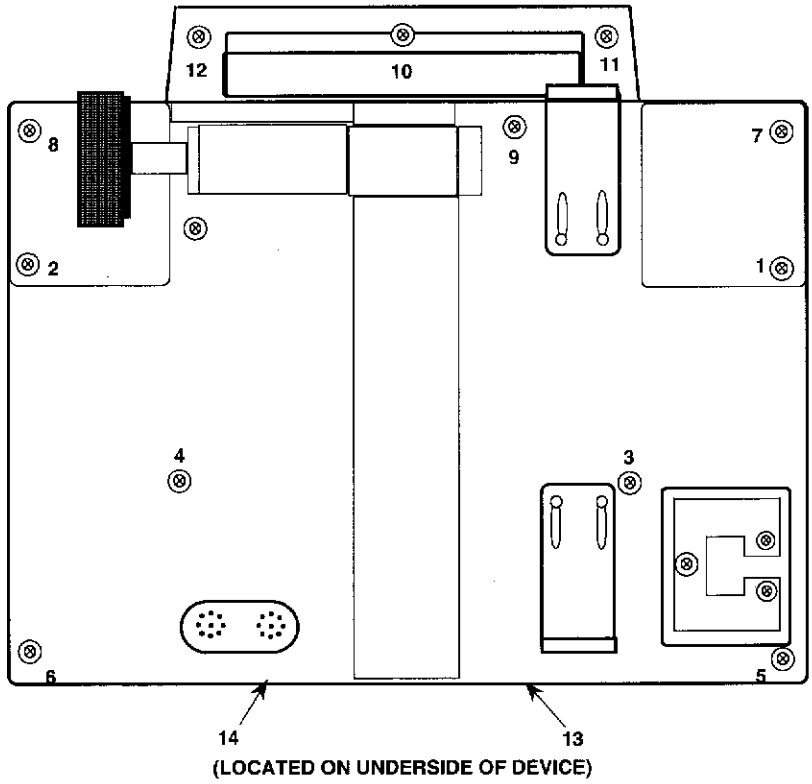


Figure 6-2. Screw Tightening Sequence

6.3.2 Replacement of Front Panel Film

1. Separate the front and rear housings (Section 6.3.1).

2. Disconnect CN302 (2-pin connector located in the front half of the device) from the CPU board. **Audible alarm will be activated.**

3. Remove one screw (located between the two flat cables) that grounds the front panel film. (Figure 8-1, item 20.)

4. Disconnect the two connectors (CN601 and CN602) of the front panel film from the I/O PC board.

5. Remove the front panel film from the front housing with a razor blade or similar device. **Caution: Do not damage the front housing or the EMI plating with the tool. Do not reuse the removed front panel.**

6. Reassemble in reverse order. Be sure to reconnect all the removed connectors. Tighten the front panel film ground screw (item 20) to 7 kg-cm (6in-lb). **Press firmly around front panel film edges and ensure that the film is securely attached to the device with no gaps.**

7. Perform the Operational Checkout procedures in Section 7.

8. Seal the edges of the new front panel as follows:

   a. Lay the device on its back and apply a strip of masking tape along the bottom edge of the front panel, approximately .38 to .64 mm (0.015 to 0.025") from the bottom edge of the panel.

   b. Using a dispenser with a small-diameter tip, apply a bead of Toray Dow* Silicone SE 9189 L (part no. UPAS0002.A) along the bottom edge of the panel. Apply the bead uniformly, within 40 to 50 seconds. **The center of the bottom edge of some front panels floats freely. In this case, carefully lift the edge of the panel with a dental pick or similar tool and allow the bead of silicone to enter under the panel. Be careful not to peel the panel away from the case.**

   c. Remove the masking tape before the silicone starts to form a skin.

   d. Using the same procedure, apply silicone to the left, top, and right edges of the panel in that order.

   e. Keep the device on its back for 30 - 45 minutes

6.3.3 Replacement of Pump Head Door Cover

1. Open the pump head door.

2. Remove five screws that secure the pump head door cover to the pump head door (Figure 8-7 and Figure 8-9, item 160). Do not remove the screw in the recess at the bottom of the door (item 161).

3. Reassemble the cover in reverse order. Tighten each of the five screws to 5 kg-cm (4.5 in-lb) with a torque screwdriver.

6.3.4 Replacement of Pump Door Latch

1. Remove the pump door cover in accordance with Section 6.3.3.

2. Close the pump door.

3. Remove the E-ring (Figure 8-7 and 8-9, item 151) that secures the door latch.

*Toray Dow Corning

4. Lift the door latch and carefully pull it out of the pump door. **Use caution to avoid losing the associated parts on the door latch pin.**

5. To replace the latch, lay the device on its back.

6. Place one thin washer (item 154), the spring (item 155), and the other thin washer (item 154) on the door latch pin.

7. Insert the pin into the hole in the pump door.

8. Open the pump door slightly.

9. Press the door latch in toward the pump door so that the spring is compressed.

10. Install 4 mm washer (item 152) onto the pin.

11. Install the E-ring (item 151) onto the pin.

12. Perform the Operational Checkout procedures in Section 7.

6.3.5 Replacement of the Pump Door or Pump Door Assembly

1. Remove the pump door cover in accordance with Section 6.3.3.

2. Remove the two set screws (Figure 8-7 or 8-9, item 150)

3. Slide the hinge pins (Figure 8-7 or 8-9, item 126) toward each other and remove the door.

4. Install the replacement door or door assembly in reverse order. Note the alignment of the hinge pins and make sure that the tapered ends are pointed toward each other.

5. Calibrate the air sensor in accordance with Section 6.4.2.

6. Calibrate the downstream sensor in accordance with Section 6.4.3.

7. Calibrate the upstream sensor in accordance with Section 6.4.4.

8. Perform the Operational Checkout procedures in Section 7.

6.3.6 Replacement of Pump Head Assembly

1. Remove the pump head door cover (Section 6.3.3).

2. Open the pump door and remove one black flathead screw at the top of pump head assembly (Figure 8-1 inset, item 22).

3. Close the door and remove two black flat head screws on the door hinge side that secure the pump head assembly to the front housing (item 22). These screws are accessible only when the door is closed.

Caution: Opening the pump door with the black flat head screws partially unscrewed can damage the door. Always completely remove the screws.

4. Grasp the pump head assembly ribs at upper and lower part of the pump head assembly, lift it slightly and pull it out of the front housing. **Do not use tools on the pump door ribs.**

Caution: Do not remove the gasket (Figure 8-1 item 10) or spacers (item 12) from the pump case.

If resistance is felt, do not force the assembly out. Do not stretch pump head wire harnesses. If pump head assembly cannot be removed, separate front and rear housings (Section 6.3.1) and remove tangled wiring harnesses.

5. Disconnect the two connectors (Figure 8-7 and Figure 8-9, item 14) from pump head assembly and ground wire.

6. Reassemble the pump head assembly in reverse order.

Caution: (1) The wire harnesses must be positioned at the back of the pump head assembly before the assembly is replaced in the front housing.

(2) Check that three spacers are located properly in the holes of the gasket (Figure 8-1, item 12).

(3) Be sure not to pinch wires and gasket between the front housing and the pump head assembly when reinstalling the pump head assembly.

(4) The three black screws (Figure 8-1, item 22) must go through the three spacers. Tightening torque must be 7 kg-cm (6.0 in-lb).

7. Perform the Operational Checkout procedures in Section 7.

6.3.7 Replacement of Upstream Occlusion Sensor Assembly

1. Remove pump door cover in accordance with Section 6.3.3.

2. Remove pump head assembly in accordance with Section 6.3.6.

3. Remove screw (Figure 8-7 and 8-9, item 92) and washer (item 93) securing ground wire (item 73) attached to the sensor housing (item 86).

4. Desolder black and white wires from sensor. **Use caution to avoid contacting any plastic parts with the soldering iron.**

5. Remove two Phillips screws (item 95) which secure the sensor to the pump door and remove the sensor.

6. Install replacement sensor and reassemble in reverse order. Tightening torque for item 95 is 2 kg-cm (1.7 in-lb). Tightening torque for item 92 is 1.5 kg-cm (1.3 in-lb).

7. Perform the Operational Checkout procedures in Section 7.

6.3.8 Replacement of Downstream Occlusion Sensor Assembly

1. Remove pump door cover in accordance with Section 6.3.3.

2. Remove pump head assembly in accordance with Section 6.3.6.

3. Remove two Phillips screws (Figure 8-7 and 8-9, item 95) which secure the sensor to the pump door and remove the sensor.

4. Remove screw (item 92) and washer (item 93) securing ground wire (item 54) attached to the sensor housing (item 86).

5. Desolder black and white wires from sensor. **Use caution to avoid contacting any plastic parts with the soldering iron.**

6. Install replacement sensor and reassemble in reverse order. Tightening torque for item 95 is 2 kg-cm (1.7 in-lb). Tightening torque for item 92 is 1.5 kg-cm (1.3 in-lb).

7. Perform the Operational Checkout procedures in Section 7.

6.3.9 Replacement of Air Sensor

1. Remove pump door cover in accordance with Section 6.3.3.

2. Remove pump head assembly in accordance with Section 6.3.6.

3. Cut the tie wrap near the motor which holds the motor wires and the brown and gray insulated wires, or remove the wire securing spring.

4. Remove the two Phillips screws (Figure 8-7 and 8-9, item 95) which secure the sensor to the pump door and remove the sensor.

5. Record the color of each wire and its soldering point. Desolder **only** the IC socket leads and the ground wire if necessary and remove the air sensor assembly. **Use caution to avoid contacting any plastic parts with the soldering iron.**

6. Reassemble in reverse order, ensuring that the notch on the sensor aligns with the notch on the base plate. Tightening torque for item 95 is 2 kg-cm (1.7 in-lb). Replace the tie wrap if it was cut and removed in step 3.

7. Perform the Operational Checkout procedures in Section 7.

6.3.10 Replacement of Pump Motor

1. Remove pump door cover in accordance with Section 6.3.3.

2. Remove pump head assembly in accordance with Section 6.3.6.

3. Close the pump head door.

4. Carefully place the pump head assembly face down on the work surface.

5. Remove the lower motor fixing bracket screw with three ground wires (Figure 8-7 and 8-9, item 56).

6. Remove two socket head cap screws (items 57 and 58), washers (item 21) and spring washers (item 22) securing the other side of the lower motor fixing bracket. Removing item 57 also releases the standoff (item 59).

7. Remove two set screws (item 37) closest to the motor.

8. Remove 2 screws (item 53) and washers (item 22) securing the motor to the lower motor fixing bracket and remove the motor.

9. To install the motor, place the upper motor fixing bracket onto the springs (item 42). Ensure that the springs are properly situated on top of the spring guides (item 43).

10. Install motor shaft through hole in center of upper fixing bracket. **Be sure that the motor is oriented so that the side with the wires faces away from the front of the pump head.**

11. Push motor shaft into motor coupling (item 36). Install set screws (item 37). **Do not tighten them at this time.**

12. Install the lower motor fixing bracket onto the motor and secure with 2 screws (item 53) and lock washers (item 22). Tighten the screws to 6 kg-cm (5 in-lb).

13. Install lower motor fixing bracket using socket head cap screws (items 57 and 58). **Take care not to strip screws when using ballpoint screwdriver at an angle.** Tightening torque for the screws is 6 kg-cm (5 in-lb).

14. Install 3 ground wires onto Phillips screw (item 56) and install screw. Tightening torque for the screw is 6 kg-cm (5 in-lb).

15. Apply a trace of Loctite* 211 or 222 to the set screws (item 37) and tighten to 5 kg-cm (4.5 in-lbs).

16. Install pump head assembly into case in accordance with Section 6.3.6.

17. Install pump door cover in accordance with Section 6.3.3.

18. Perform the Operational Checkout procedures in Section 7.

6.3.11 Replacement of Safety Clamp

1. Remove pump door cover in accordance with Section 6.3.3.

2. Remove pump head assembly in accordance with Section 6.3.6.

3. Remove motor in accordance with Section 6.3.10.

*Loctite, Inc.

4. Open the safety clamp and remove two screws (Figure 8-7 and 8-9, item 85) on the underside of the safety clamp pushbutton (item 84) and remove the pushbutton.

5. Remove two screws (items 112 and 113) securing the safety clamp assembly to the rear of the pump.

6. **Note orientation of safety clamp lever and safety clamp seal (item 110) before removal.** Remove the safety clamp assembly.

7. Open the safety clamp, install replacement safety clamp assembly into rear of pump door assembly and secure with two screws (items 112 and 113). **Make sure safety clamp seal (item 110) is in place.** Tightening torque for the two screws is 6 kg-cm (5 in-lb).

8. Install the motor in accordance with Section 6.3.10.

9. Install the safety clamp pushbutton. Tightening torque for the pushbutton securing screws (item 85) is 1 kg-cm (0.8 in-lb).

10. Install the pump head assembly in the case in accordance with Section 6.3.6.

11. Install the pump door cover in accordance with Section 6.3.3.

12. Perform the Operational Checkout procedures in Section 7.

6.3.12 Replacement of Back Plate

1. Remove the pump door cover in accordance with Section 6.3.3.

2. Remove the back plate cover (Figure 8-7, item 10) by removing the screw inside the door (item 161). Then remove the 6 screws (Figure 8-7 or 8-9, item 174) from the outside of the door. **Perform this step carefully to avoid losing springs (item 172).**

3. Remove the 5 springs (item 172) and the back plate (item 10).

4. Install the replacement back plate. Ensure that the back plate is clean and not worn. Ensure that the notch in the back plate aligns with the tongue in the door. Ensure that all 5 springs (item 172) are in place and perpendicular to the back plate cover.

5. Install the back plate cover (item 10) in reverse order. Apply pressure to the back plate cover and install the screws (items 174 and 161) working from the outside edges to the center. That is, install the top and bottom corner screws first, followed by the screws in the center of the back plate cover. Before tightening these screws, press the back plate a few times from the inside of the door to ensure smooth operation. Tighten these screws to 6 kg-cm (5 in-lb).

6. Replace pump door cover in accordance with Section 6.3.3.

7. Perform the Operational Checkout procedures in Section 7.

6.3.13 Replacement of Battery

1. Turn off the device and lay it down on the Pump 2 side on an anti-static mat or work surface.

2. Remove the four larger screws (Figure 8-6, item 4) on the battery compartment cover. See Figure 6-3 for the location of the various screws associated with the battery compartment.

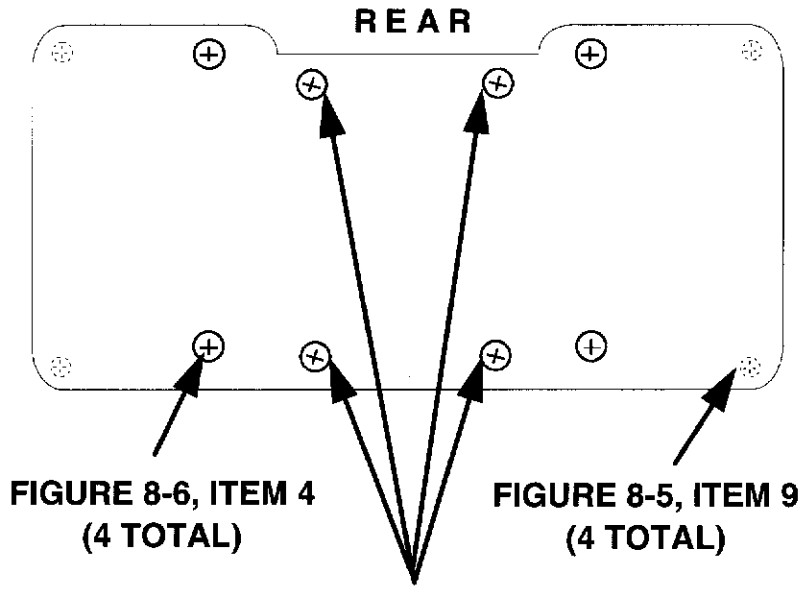


Figure 6-3. Battery Compartment Screws

3. Incline the device slightly until the battery compartment subassembly (Figure 8-5) comes out.

4. Place the battery compartment subassembly on the bench. Disconnect CN752 from the Audible Alarm PCB and the battery connector, and release the fuse holder from the retainer on top of the battery compartment.

5. Remove the four screws (Figure 8-5, item 9) that secure the battery compartment to battery compartment cover, and remove the battery compartment.

6. Disconnect the two female connectors from the battery terminals.

7. Release one end of each of the two battery straps(Figure 8-5, items 2). Remove the two screws (Figure 8-5, items 10), one for each of the straps, then remove the battery.

8. Reassemble the battery into the device in reverse order. **See Figure 8-5 for the proper orientation of the battery on the cover.** Tightening torque for all screws is 7 kg-cm (6 in-lb).

Caution: Be careful with the polarities of the female connectors. Red wires (+) must be connected to red marked (+) battery terminal. See the battery label on the outside of the battery compartment.

(1) The wires must be routed in the battery compartment so that they run alongside the battery strap closest to the battery terminals and then to the channel in the battery compartment. Be careful not to pinch wires between the compartment and the cover.

(2) The large red wire must not be stretched when the fuse holder is placed back in the retainer.

(3) The battery harness must be placed under the power transformer before replacing the battery compartment into the device.

(4) The harness must run through the channel in the battery compartment frame. Be careful not to pinch wires between the battery compartment cover and the frame.

9. Perform the Self Test procedure in Section 7.3.3.

10. Turn off the device and charge the battery for at least 16 hours before putting the pump in service.

6.3.14 Replacement of CPU Board

Important: If the CPU board is being replaced, you may need to replace the software to maintain compatibility. See the table below to determine whether replacement of the software is necessary. See Appendix A if you need instructions for determining the software version.

	Part Number I/O Board CPWBN102.E	Part Number I/O Board CPWBN102.G
Part Number CPU Board CPWBN102.i	Compatible with software version(s) 2.nn	Compatible with software version(s) 2.nn and 3.nn

Caution: The device is sensitive to electrostatic discharge damage (ESD). Always wear a grounded wriststrap when performing maintenance on the device to prevent damage to components.

1. Separate front and rear housings in accordance with Section 6.3.1.

2. Place the front housing face down on an anti-static mat or work surface.

3. The CPU board is located in the front housing. Unplug the following connectors: CN851, CN701, CN211, CN801, CN811, CN812, CN304, CN302, CN212, CN702, and CN852.

4. Remove five Phillips head securing screws (Figure 8-2, item 6, one in each corner and one in the center of the CPU board). Each screw has one washer (item 8) and one plastic insulator (item 9).

5. Grasp CPU board under bottom edge and gently lift it until the two connectors located on the underside of the board come loose. Remove the board.

6. Install the CPU board by performing this procedure in reverse order. Tightening torque for the five Phillips head securing screws (item 6) is 7 kg-cm (6 in-lb).

Caution: Please ensure that the pins of the connectors located on the underside of the CPU board are properly aligned before pressing down on the board.

7. Perform the Operational Checkout procedures in Section 7.

6.3.15 Replacement of Display Board and I/O Board

These two boards are removed together and then separated once they have been removed from the housing.

1. Separate front and rear housings in accordance with Section 6.3.1.

2. Remove the CPU board in accordance with Section 6.3.14.

3. Remove five Phillips head screws (Figure 8-2, item 6), washers (item 8), and plastic insulators (item 9) securing the Display board to the housing.

4. Remove four screws, washers and insulators securing the I/O board to the housing.

5. Disconnect CN601, CN602, and CNI/F from the I/O board.

6. Remove the Display board and the I/O board from the housing.

7. Carefully separate the Display board and the I/O board by pulling them apart.

8. Reassemble in reverse order. Tightening torque for all PC board securing screws is 7 kg-cm (6 in-lb).

9. Perform the Operational Checkout procedures in Section 7.

6.3.16 Replacement of Terminal Board

1. Separate the front and rear housings in accordance with Section 6.3.1. The Terminal board is located in the rear housing (Figure 8-3, item 3).

2. Remove four screws (item 27) securing the Terminal board to the housing.

3. Disconnect the following:
   CNI/F, CNIPM, CNDROP, CNTEST, CNBZ, and CNLOCK.
   Remove the Terminal board.

4. Reassemble in reverse order. Tighten the four screws securing the Terminal board to the housing to 7 kg-cm (6 in-lb).

5. Perform the Operational Checkout procedures in Section 7.

6.3.17 Replacement of Power Supply Board

1. Separate the front and rear housings in accordance with Section 6.3.1.

2. Remove the battery compartment in accordance with Section 6.3.13.
3. Remove four securing screws (Figure 8-3, item 33) from the Power Supply board.
4. Disconnect the 2-pin ACIN connector.
5. Disconnect ground strap at ground plate end and remove Power Supply board.
6. Replace power supply fuse if necessary.
7. Reassemble in reverse order. Tighten power supply securing screws to 7 kg-cm (6 in-lb).
8. Perform the Operational Checkout procedures in Section 7.

6.3.18 Replacement of Audible Alarm/Alert Board

1. Separate the front and rear housings in accordance with Section 6.3.1.
2. Remove the battery compartment in accordance with Section 6.3.13.
3. Remove two securing screws (Figure 8-3, item 33) from the board (item 2).
4. Disconnect CN751 and CN752.
5. Remove the Audible Alarm/Alert board.
6. Reassemble in reverse order. Tightening torque for item 33 is 7 kg-cm (6 in-lb).
7. Perform the Operational Checkout procedures in Section 7.

6.3.19 Replacement of Power Transformer

1. Separate the front and rear housings in accordance with Section 6.3.1.
2. Disconnect the 2-pin ACIN connector from the Power Supply board.
3. Desolder the black and white wires from the transformer at the fuse holder and AC inlet.
4. Remove the transformer by removing 2 securing screws (Figure 8-3, item 32).

5. Reassemble in reverse order. Tightening torque for item 32 is 9 kg-cm (8 in-lb).

6. Perform the Operational Checkout procedures in Section 7.

6.3.20 Replacement of PANEL LOCK Switch

1. Separate front and rear housings in accordance with Section 6.3.1.

2. Unscrew red pushbutton on rear of device while holding the body of the switch from the inside of the rear housing.

3. Desolder red and brown wires from switch.

4. Remove hex nut and lock washer securing the switch and remove it.

5. Reassemble in reverse order.

6. Perform the Operational Checkout procedures in Section 7.

6.3.21 Replacement of Lithium Backup Battery

The lithium backup battery provides backup voltage to the device's memory when the main battery is disconnected. **To avoid loss of configuration option settings, record the settings and ensure that the main battery is connected before beginning this procedure.**

1. Separate front and rear housings in accordance with Section 6.3.1.

2. Remove 2 screws (Figure 8-2, item 7) securing the lithium battery compartment (item 4) and remove the compartment.

3. Disconnect connector CN304 and remove the lithium battery (item 5).

4. Install replacement battery in reverse order.

5. Verify that the configuration option is set as desired and modify if necessary.

6. Perform the Operational Checkout procedures in Section 7.

6.3.22 Software Upgrades

Software for the 6300 Dual Channel Infusion Pump is stored in two EPROMS. Due to the delicate nature of the circuitry, the removal and replacement of these EPROMS for software upgrades must be performed by qualified service personnel.

The device uses one of three basic versions of software, 1.XX, 2.XX, or 3.XX, as appropriate to its hardware configuration. As a result, it is important to ensure that the correct EPROMS are used for the upgrade, as follows:

Pumps Using Software Version...	Must Be Upgraded With Part Number...
1.XX	139EPROM
2.XX	239EPROM
3.XX	339EPROM

Equipment, Parts, and Supplies Required

1 pair of EPROMs containing the software version appropriate to the pump, as follows:
Electric Safety Analyzer
IC extraction tool
IC insertion tool
Specification tubing or a Baxter's "s" suffix standard administration set
Intravenous bag of water

The following items are required only if steps 2g. through 2m. are to be performed.
Soldering iron and 60/40 rosin core solder
2 Zener diodes, part number VHERD20F.A
Red Glpt* varnish

EPROM Replacement

Caution: The EPROMs used in the procedure make use of CMOS circuitry. This circuitry can be damaged by the discharge of static electricity. Therefore, take all appropriate steps to avoid possible damage from electrostatic discharge. This includes the use of a grounded wrist strap as well as a grounded work surface.

1. Make sure that both pumps are powered off and press the SILENCE key and press either ON/OFF CHARGE key. Record the software version number displayed on the PUMP 2 secondary VTBI display.

2. Record all configuration settings as described in Section 6.2.2.

3. Make sure the device is disconnected from AC power.

*GC Electronics

4. Separate the pump case halves as described in Section 6.3.1.

5. Disconnect the battery from the CPU PCB by disconnecting CN302 at the top of the circuit board. This causes an audible alarm to sound.

6. Silence the alarm by disconnecting CN751 from the top of the Audible Alarm PCB behind the battery compartment.

Note: Perform steps 7 through 13 on devices with serial numbers 5007693X and lower, that do NOT have a dot of red Glpt* varnish above the "N" in the number N1024MC0x (where x=1 or 2) silk screened on the circuit board.

7. Disconnect all remaining connectors from the CPU PCB.

8. The CPU PCB is held in place by five Phillips head screws; there is one screw in each corner and one in the center. Each screw has one washer and a plastic insulator. Remove these screws.

9. Grasp the CPU board under its bottom edge and gently lift it until the two connectors on the under side of the board come loose. Remove the board.

10. Remove ZD201 and ZD251 from the CPU PCB. These zener diodes are located next to connectors CN701 and CN702. Use caution to avoid heat damage to the circuit board and nearby components when desoldering the diodes.

11. Replace the two diodes with part number VHERD20F.A. Be sure to orient both with their cathodes (black band) toward the microprocessors. Use caution to avoid heat damage to the circuit board and nearby components when soldering the diodes.

12. Apply a dot of red Glpt* varnish to the circuit board directly above the "N" in the N1024MC0x (where x=1 or 2) number on the board.

13. Reassemble the CPU PCB into the front case half, by following steps 7 through 9 in reverse.

14. Use an IC extraction tool to remove EPROMs I152 and I105 from their sockets and replace them with their counterpart upgrade EPROMs. When installing the replacement EPROMs, use an IC insertion tool and make sure that the notched end of each matches the silk screened notch on the circuit board and that ALL pins are properly seated in the socket.

*GC Electronics

15. Reconnect the battery to the Audible Alarm circuit board by connecting plug CN751, at the top of the board behind the battery compartment. This should activate the audible alarm.

16. Reassemble the two case halves following the instructions in Section 6.3.1.

17. Follow the procedure in Section 6.2.2. to reset the configuration.

18. Record all configuration settings in the data sheet in Appendix B, if they have not already been recorded.

19. Perform the Operational Checkout procedures in Section 7.

20. Prime and load an infusion set into Pump 1. Program and run it at 1999 mL/hr for several minutes. The device should operate without an alarm. If failure code F 73 occurs, check to ensure that zener diodes ZD201 and ZD251 are properly installed.

21. Repeat step 20 on Pump 2.

6.4 Calibration

Read all steps in this procedure prior to calibration of the device. Be sure that all of the necessary equipment is available before beginning calibration procedures.

The device should be powered off for at least two hours before attempting to perform calibration. All calibration procedures should be performed in ambient temperatures of 22°C to 28°C (72°F to 82°F).

6.4.1 DC Line Voltages

Verify DC line voltages prior to performing other calibrations. (Further calibrations will not be reliable if DC line voltages are out of specification.) If the DC voltages are not within specification, check the appropriate DC power supply circuit.

1. Perform Section 5.3.2 steps 1 and 7 to check DC calibration.

2. Press Pump 2's ON-OFF/CHARGE key to turn off the device.

3. If the values are out of specification, calibrate the voltages using the following procedure.

Calibrating DC Line Voltages

A variable transformer, digital voltmeter, DC ammeter, an electronic load device or a fixed 5 ohm, 20 W resistor and a variable load (see Figure 6-1) are required for this procedure.

a. Separate the front and rear housings in accordance with Section 6.3.1.

b. Take out the battery compartment by removing the four screws securing the frame to the rear housing (Figure 8-3 item 31).

c. Ensure that CN301 is disconnected from the CPU board and plug the variable transformer into a 115 ± 5.0 VAC, 60 Hz power source.

d. Connect the external circuit shown in Figure 6-1, leaving the electronic load or the load resistor disconnected.

e. Ensure the AC power plug of the device is connected to the variable transformer.

f. Connect the external circuit to the plug removed from connector CN301 on the CPU board. The electronic load device must be set to 1.4 A or the load resistor must be set to 10 ohms for the following test.

g. Turn potentiometers VR1 and VR2 on the DC power supply board fully counterclockwise.

h. Power the variable transformer ON and adjust the output to 120 VAC.

i. Slowly turn VR2 counterclockwise until the voltage between pin 2 (+, red) and pin 3 (-, black) is 13.8 ± 0.1 V.

j. Check that the voltage between pin 1 (+, yellow) and pin 3 (-, black) is between 13.8 and 14.5 V.

k. Disconnect the external circuit and check that the voltage between pins 2 and 3 at no load is within 13.9 ± 0.1 V. Turn off the variable transformer.

l. Connect the external circuit to plug removed from connector CN301 on the CPU board. The electronic load device must be set to 1.6 A or the load resistor must be set to 6.9 ohm for the following test.

m. Power the variable transformer ON and adjust the output to 100 VAC.

n. Slowly turn VR1 counterclockwise until the voltage between pin 2 (+, red) and pin 3 (-, black) is 11.0 ± 0.5 V.

o. Adjust the output of the variable transformer to 135 VAC, adjust the load resistor until the ammeter reading becomes 1.6 A and check that the voltage is 13.8 ± 0.1 V.

p. Disconnect the external circuit. Turn off and reassemble the device.

6.4.2 Air Sensor

1. Connect the AC plug of the device to a 115 ± 5.0 VAC 60 Hz power source. Enter Automatic Test Mode 2 as follows:

   a. Turn off the device.

   b. Press and hold the CLEAR TOT VOL and 2 keys, while pressing either ON-OFF/CHARGE key.

2. Load a piece of calibration tubing (part no. 3-2-92-479), prime it with fluid and close the pump door. **Ambient and solution temperatures must be between 72° and 82° F (22° and 28° C).**

3. Open and close the pump head door two more times.

4. With the pump head door closed, check the NORM value (at PRI RATE window) and the MIN value (at PRI VTBI window). Both values should display between 350 and 650.

5. Remove the tubing from the pump head and check that the NORM and MIN values are both 70 or less.

Calibrating the Air Sensor

If the values are out of specification, calibrate the sensor as follows:

6. Separate the front and rear housings (see Section 6.3.1) and connect CN301 (3-pin connector) to the CPU board.

7. Repeat steps 1 through 4.

8. Calibrate VR801 (for Pump 1) or VR802 (for Pump 2) so that for a given pump, the lesser of the NORM value (at PRI RATE window) and MIN value (at PRI VTBI window) is 510 ± 40.

9. Exit Automatic Test Mode 2 by pressing the same ON-OFF/CHARGE key that was pressed to enter the test mode.

Verifying the Air Sensor Calibration

The following procedures confirm that the calibration is correct.

10. Load a segment of calibration tubing (part no. 3-2-92-479) and prime it with fluid.

11. With a precision gas-tight syringe (part no. S9662-81 or equivalent), introduce an air bubble (85 μL for MIN setting or 110 μL for NORM setting) into the tubing just above the pump door. Open the safety clamp and allow the air bubble to travel to just above the air sensor and then close the pump door.

12. Turn on the pump, press the appropriate PUMP key, set the Primary Rate to 200 mL/hr and Primary VTBI to 1000 mL and start the pump.

13. Ensure that the air alarm is activated, the pump is stopped, and will not start. Turn off the pump.

14. Change tubing segment and repeat steps 11 through 13 three times.

15. If the air bubble passes undetected, repeat the calibration procedure.

16. Using the precision syringe, introduce an air bubble (25 μL for MIN setting or 50 μL for NORM setting) into tubing just above the pump head door. Open the safety clamp and allow the air bubble to travel to just above the air sensor and then close the pump door.

17. Turn on the pump, press the appropriate PUMP key, set the Primary Rate to 30 mL/hr and Primary VTBI to 1000 mL and start the pump.

18. Ensure that this bubble passes without an alarm.

19. Change tubing segment and repeat steps 16 to 18 three times.

20. If the air bubble is detected, repeat the calibration procedures. If the air sensor cannot be calibrated, turn the device off. Replace the sensor in accordance with Section 6.3.8.

21. Turn off and reassemble the device.

6.4.3 Downstream Occlusion Sensor Calibration

1. Check calibration as described in Section 5.3.1, steps 1 through 5.

2. If the value is out of specification, calibrate the sensor as follows:

   a. Remove the pump head door cover as described in Section 6.3.3. Loosen and remove the occlusion sensor button (Figures 8-7 and 8-9, item 175). If the button is stuck, apply a small amount of isopropyl alcohol to the threads. Wipe the threads clean.

   b. Tighten 3 screws (Figure 8-1 item 22) to 5 kg-cm (4.5 in-lb).

   c. Apply Loctite* 211 or 222 to the screw threads of the occlusion sensor.

   d. Repeat Section 5.3.1, steps 1 through 4. Replace the button in the pump head door and slowly turn it with a screwdriver until the value displayed in the PRI VTBI window of the appropriate Main Display is between 3158 and 3162. Allow the threadlock to set.

   e. Remove the thickness gauge and place the device upright. Turn the device off.

6.4.4 Upstream Occlusion Sensor Calibration

1. Connect the AC plug of the device to a 115 ± 5.0 VAC 60 Hz power source. Enter Automatic Test Mode 1 and check calibration as described in Section 5.3.1, steps 6 through 11.

2. If the value is out of specification, calibrate the sensor using the following procedures:

   a. Remove the pump head door cover, see Section 6.3.3.

   b. Loosen and remove the occlusion sensor button (Figures 8-7 and 8-9, item 175). If it is stuck, apply a small amount of isopropyl alcohol to the threads. Wipe the threads clean.

   c. Place the thickness gauge onto the upstream occlusion sensor, close the pump door and position the device on its rear.

*Loctite, Inc.

d. Apply Loctite* 211 or 222 to the threads and reinstall the button in the door. Slowly turn it with a screwdriver until the value in the PRI RATE window of the appropriate Main Display is between 3358 and 3362. Allow the threadlock to set.

e. Remove the thickness gauge and stand the device upright. Turn the device off.

3. The following procedures will confirm that the calibration is correct.

a. Load a Baxter's "s" suffix standard administration set, prime it with fluid and close the pump head door. **Ambient and liquid temperatures should be between 72° and 82° F (22° and 28° C).**

b. Apply an upstream occlusion.

c. Turn the pump ON and set Primary Rate to 125 mL/hr and Primary VTBI to 50 mL.

d. Start the pump and ensure that an upstream occlusion alarm occurs.

e. Press and hold the SILENCE and TOT VOL STATUS keys until a Failure Identification code appears in lower right corner of the appropriate Main Display. The Failure Identification code should be 4, 5 or 12.

4. Turn off the device and reassemble the pump head door cover.

Section 7

Checkout

7.1 Introduction

The Operational Checkout procedures in this section determine if the pump operates properly after it has been repaired and as preventive maintenance checks. If the pump fails any part of the Operational Checkout, the fault must be corrected prior to placing the pump in service. Please become familiar with all the checkout procedures before beginning.

The following test equipment is required to perform the Operational Checkout procedures:

Baxter Continu-Flo® administration set with at least one Y-site
Secondary administration set
Solution containers (distilled/sterile water, D5W, 0.9% sodium chloride, etc.)
100 µL precision gas-tight syringe (part no. S9662-81, or equivalent)
250 µL precision gas-tight syringe (part no. S9662-82, or equivalent
Thickness gauge (part no. UKOG1013.A)
Tape measure or yardstick

7.2 Maintenance Flowchart

Figure 7-1 is a flowchart illustrating the maintenance procedures for this device. The Operational Checkout should be performed after any repairs are performed on the device. Any problems discovered while performing the Operational Checkout should be corrected using the troubleshooting procedures given in Section 3 (Problem Checklist) and Section 5 (Troubleshooting). Once a problem has been isolated to a single assembly, replace and calibrate it as described in Section 6.

Appendix B is a data sheet which may be reproduced and used to record the device's configuration settings, calibration checks, and the results of the Operational Checkout procedures.

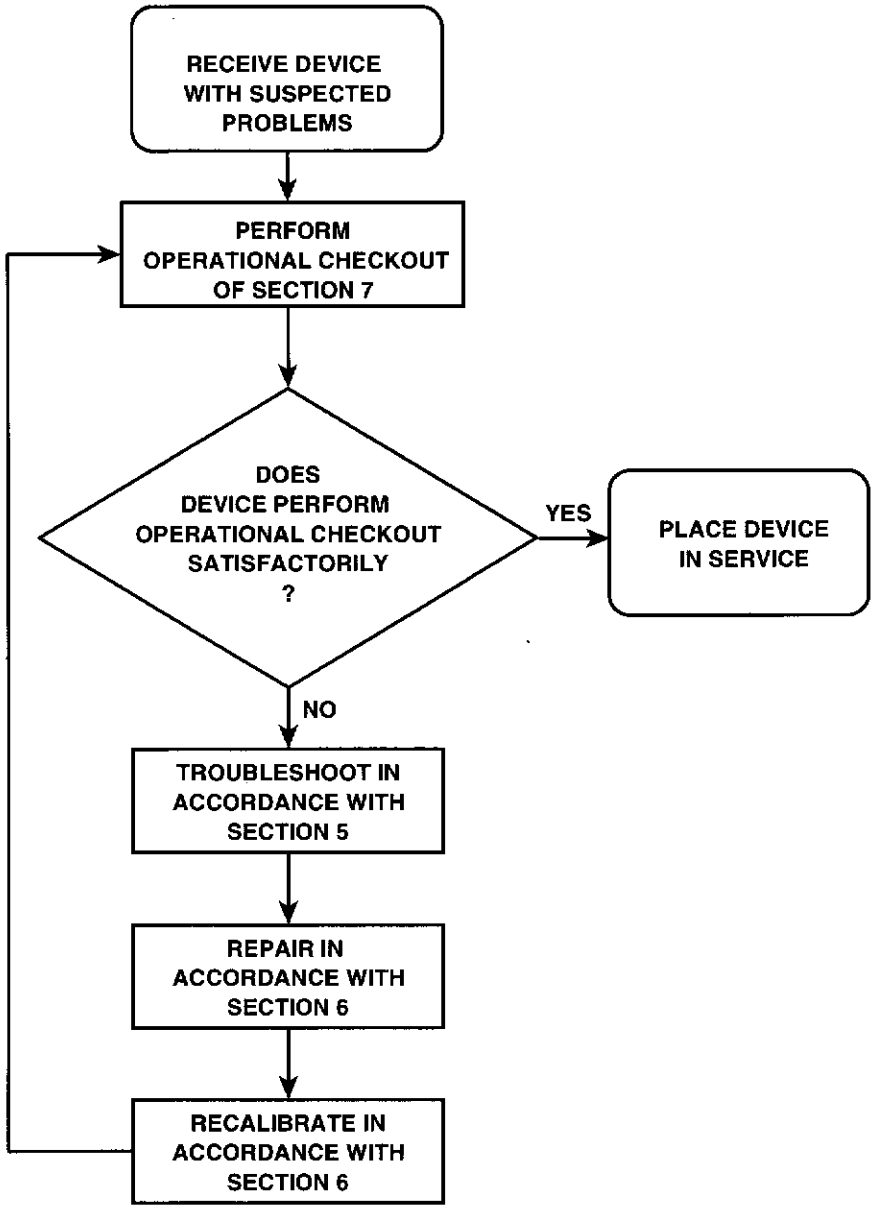


Figure 7-1. Maintenance Flowchart

7.3 Operational Checkout

7.3.1 Administration Set Placement

To avoid the possibility of fluids contacting the air sensor and pump mechanism, the solution container should be spiked and the set primed before opening a pump door. The container should also be placed low enough to permit a loop in the tubing to the side of the device. Position the container so that accidental spillage onto the device will be minimized. Do not stretch the set when removing it from the packaging.

7.3.2 Functional Testing

Ensure that you become familiar with the device operating procedures in the Operator's Manual. The procedures in this section are designed to check the ability of the device to pump primary and secondary infusions prior to testing the effectiveness of its alarms. **If either pump fails to perform as described or stops with a failure code alarm, troubleshoot it in accordance with Section 5 and repair it in accordance with Section 6 before attempting to place the device in service.**

7.3.2.1 Preparation for Testing

1. Using a solution container (distilled/sterile water, 0.9% sodium chloride, or D5W) and a Baxter Continu-Flo® administration set with at least one Y-site, prepare the administration set according to instructions accompanying the set.

2. Spike the solution container and fully prime the set. Remove all trapped air bubbles from all set components. Hang the solution container such that the fluid level is a minimum of 18" above the top of the device handle throughout the test.

Note: **Make sure that the tubing is clean and dry before placing it in the pump. Make sure that the tubing is placed and seated properly in the guide channel, pump mechanism, sensors and safety clamp. Ensure that there is no slack in the tubing and that it is not kinked or pinched before closing the pump door.**

3. Load the set into the pump. Close the pump door. If excessive resistance is felt, check that the set is loaded properly through the tubing guides. Never use tools or excessive force to close a pump door.

4. Place the distal end of the administration set in a container or sink to dispose of pumped solution.

7.3.2.2 Self-Test

1. Plug in the pump and turn on Pump 1 on by pressing appropriate ON/OFF CHARGE key. Check that the device performs the following self-test:

   a. The ALARM, PUMPING and ALERT LEDs for both channels illuminate momentarily.

   b. All segments of the Pump 1 and Pump 2 Message Displays illuminate momentarily. All segments of the Main Display of the powered-on pump illuminate momentarily.

   c. The occlusion detection level is momentarily displayed in the Pump 1 Message Display (***LEVEL 1, 2*** or ***3***). If the Audible Switchover configuration option is selected, the message ***AUDIB SWI*** appears in the Pump 2 Message Display at the same time.

   d. If both Auto Restart and Flow Check are selected through the configuration option, the message ***AUTO RESTART*** appears for one second following the Occlusion Detection Level Display in the Pump 1 Message Display.

   e. Three separate audible tones sound.

   f. The ALARM, ALERT, PUMPING and pump select key LEDs should light momentarily. The CHARGING LED should also be illuminated.

2. Turn on Pump 2 by pressing its ON-OFF/CHARGE key. Check that the following steps occur:

   a. All segments of the Main Display illuminate momentarily.

   b. One audible tone sounds.

   c. Four LEDs illuminate momentarily.

7.3.2.3 Primary Infusion Test

1. With an administration set loaded into Pump 1 per Section 7.3.2.1, press the PUMP 1 key to select Pump 1.

2. Press the PRI RATE key and enter a flow rate of 100 mL/hr.

3. Press the PRI VTBI key and enter a volume to be infused (VTBI) of 10 mL.

4. Open the flow control clamp on the administration set.

5. Start infusion by pressing the PRI START key. **If the pump stops with an alarm, see Table 3-1, Problem Checklist.** Let the pump continue to run and proceed to the next step.

6. Repeat steps 1-5 on Pump 2. While the pumps are running, check for normal operation without upstream or downstream occlusion alarms and that no air bubbles are seen in the tubing.

7. When the pumps have delivered the selected volume, each pump activates an audible alert, illuminates the ALERT LED, and switches to a KVO (Keep Vein Open) rate.

8. To stop the infusion, press the appropriate STOP key.

7.3.3 Door Open Alarm Testing

Perform the following steps to ensure proper operation of the ***DOOR OPEN*** alarm.

1. Prime and load a Baxter's "s" suffix standard administration set as described in Section 7.3.2.1.

2. Press the appropriate pump select key and START key.

3. Open the pump door. The following should occur:

   a. ***DOOR OPEN*** is displayed in the Message Display. ***CLOSE CLAMP*** may also be displayed if it is configured on.

   b. The red ALARM LED flashes.

   c. The audible alarm is activated.

Warning: If these indications do not occur, remove the device from service. Troubleshoot in accordance with Section 5 and repair in accordance with Section 6.

4. Close the pump door. Stop the pump by pressing the appropriate STOP key.

5. Open the door and verify that the following occurs:

a. ***DOOR OPEN*** is displayed in the Message display. ***CLOSE CLAMP*** may also be displayed if it is configured on.

b. The red ALARM LED flashes.

c. The audible alarm does NOT activate until after approximately two minutes.

6. Repeat the procedure for the other pump.

7.3.4 Air Alarm Testing

Each pump is designed to detect air bubbles passing through the set. The air bubble size for air detection is selectable through the configuration option and is factory set to NORM. See Section 1.5 for an explanation of the configuration option. **If a pump fails to detect air, remove it from service and repair and recalibrate it.**

1. Prime and load a Baxter's "s" suffix standard administration set with one Y-site above the device as described in Section 7.3.2.1.

2. Using a precision gas-tight syringe (part no. S9662-81 or S9662-82 or equivalent), introduce an air bubble into the administration set through the Y-site above the pump. If the air sensor is set to NORM, the bubble should be 110 microliters. If the air sensor is set to MIN, the bubble should be 85 microliters.

3. Open the pump door and slightly press the safety clamp to position the air bubble below the pump fingers and above the air sensor.

4. Close the door and start the pump. When the intact air bubble reaches the air sensor the following should occur:

a. ***AIR*** is displayed in the Message Display.

b. The red ALARM LED flashes.

c. The audible alarm is activated.

d. The pump stops.

e. If the pump does not alarm, verify that the bubble did not break up before reaching the sensor and repeat the test.

5. Press the PUMP 1 or PUMP 2 key as appropriate and the appropriate START key. The pump should not start when air is present.

6. Open the pump door, press the safety clamp lever and purge the air from the tube. Close the pump door and press the appropriate pump select key and START key. The pump should now begin operation.

Warning: If these indications do not occur, remove the device from service. Troubleshoot in accordance with Section 5 and repair in accordance with Section 6.

7. Repeat steps 1 through 6 for the other pump.

7.3.5 Downstream Occlusion Testing

Each pump is designed to detect an occlusion downstream of the pump. If a pump fails to detect a downstream occlusion, the device should be removed from service and repaired. Perform the following steps at room temperature to ensure proper operation of the downstream occlusion sensor.

1. Prime and load a Baxter's "s" suffix standard administration set as described in Section 7.3.2.1.

2. Start the pump at a rate of 125 mL/hr with a VTBI of 10 mL and run for 1 minute.

3. Pinch the tubing just below the pump. ***OCCLUSION*** should be displayed on the Message display, the red ALARM LED should flash, the audible alarm should sound, and the pump should stop.

4. Repeat for the other pump.

Warning: If either pump does not respond as described, remove the device from service. Troubleshoot in accordance with Section 5 and repair in accordance with Section 6.

7.3.6 Upstream Occlusion Testing

The device is designed to detect a closed clamp upstream of the pump head. Perform the following steps to ensure the performance of the upstream occlusion sensor.

1. Prime and load a Baxter's "s" suffix standard administration set as described in Section 7.3.2.1.

2. Pinch off the tubing with a set clamp or hemostat above the pump head.

3. Set a rate of 125 mL/hr with a VTBI of 10 mL and start the pump.

4. Within three minutes of starting, the following should occur:

   a. The pump stops.

   b. The red ALARM LED flashes.

   c. The message ***UPSTREAM OCCLUSION*** is displayed in the appropriate Message Display.

   d. The audible alarm is activated.

Warning: If these indications do not occur, remove the device from service. Troubleshoot in accordance with Section 5 and repair in accordance with Section 6.

5. Repeat for the other pump.

7.3.7 Battery Check

Disconnect the device from AC. Load a primed Baxter's "s" suffix standard administration set, such as 2C5545s into both pumps and start them at 125 mL/hr with a VTBI of 10 mL. Verify that ***BATTERY*** is displayed and that the unit runs for at least five minutes or pumps 10 mL. Plug the device into AC and verify that ***BATTERY*** disappears from the message display.

1. Battery Test (Optional)

Note: Charge the battery for at least 16 hours before conducting this test.

   a. Load a primed set into each pump. Set each pump's PRI RATE to 1401 mL/hr and PRI VTBI to 3503 mL and start the pump.

   b. Unplug the device while it is running. No change in pumping should occur, but the message ***BATTERY*** should be displayed within a few seconds in the Message Display to indicate battery-powered operation. The battery requires charging when ***BATTERY LOW*** is displayed in the Message Display, the audible alarm or alert is activated and the appropriate LED is illuminated.

c. Operate the device on battery power for 2.5 hours. Make sure that the device does not initiate a ***LOW BATTERY*** alert before the KVO alert occurs.

d. If the unit fails this test, perform the Battery Charging Voltage Check.

e. If the device operates satisfactorily on battery power, plug it back in. Operation should continue without interruption and the ***BATTERY*** message should turn off. Recharge the battery by allowing the device to remain connected to AC power for a minimum of 16 hours.

2. Battery Charging Voltage Check (Optional)

Perform this check to determine the charging voltage is correct.

a. Disconnect and remove the battery from the device. Connect a voltmeter to the device leads and measure the charging voltage while both pumps are in the KVO mode. It should be between 13.7 and 13.9 VDC. If it is and the device failed the battery test, replace the battery in accordance with Section 6.3.13.

b. If the charging voltage is NOT between 13.7V and 13.9VDC, check the other power supply voltages as described in Section 6.4.1 and repair and/or calibrate the device as necessary.

7.3.8 Panel Lock Test

1. With the pump(s) running without an alert, press the PANEL LOCK pushbutton, on the rear of the device.

2. Verify that ***Loc*** is displayed on the Main Display of the powered-on pumps.

3. Attempt to enter an infusion rate. The pump should not accept input from any keys except TOT VOL/STATUS and BACKLIGHT.

4. Press PANEL LOCK again. The ***Loc*** message should disappear and input from all front panel keys should be accepted.

5. If any of these indications fail to occur, troubleshoot the device in accordance with Section 5 and repair it in accordance with Section 6.

7.3.9 Safety Clamp Test

1. With the administration set loaded into the pump, and the pump not running, elevate the solution container to a head height of 0.7 meters (27 inches) or higher, as measured from the midpoint of the device to the level of solution in the container.

2. Close the pump door and observe the distal end of the set for 60 seconds after closing the door.

3. Verify that no more than 1/2 mL of fluid is allowed to flow in the first 60 seconds, and that no gravity flow occurs after 60 seconds.

4. Repeat the procedure for the other pump.

Warning **If either pump fails to prevent free flow, remove the device from service. Troubleshoot it in accordance with Section 5 and repair it in accordance with Section 6.**

7.3.10 Alarm Volume

1. Induce an alarm by any convenient means.

2. Rotate the VOLUME knob on the rear of the unit. Verify that the sound level increases as the knob is rotated clockwise and decreases as the VOLUME knob is rotated counterclockwise. The alarm/alert sound should be audible at any VOLUME knob position.

3. Set the volume to maximum upon completion of this test.

7.3.11 Electrical Safety Tests

1. Test the device's leakage current and ground impedance in accordance with UL 544. Leakage current should not exceed 50 microamps. Ground impedance should be measured at the COMMUNICATION PORT housing on the rear of the device and should not exceed 0.1 Ω using a 25 amp, UL-specified test circuit, or 0.15 Ω using an NFPA-99 or equivalent test circuit. **If the device fails to meet these requirements, remove it from service, troubleshoot it in accordance with Section 5 and repair it in accordance with Section 6.**

2. Thoroughly inspect the power cord for signs of wear or damage. Replace it if any pins are bent or broken or the insulation is damaged.

Section 8

Illustrated Parts Breakdown

This section includes illustrations and parts lists required to identify any replaceable part in the Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump. Each illustration is keyed to a parts list, which lists each component shown in the figure by part number and description. The quantity per assembly is also shown. The level of assembly is indicated by the number of dots preceding the description. For example, one dot indicates a top-level assembly, two dots indicates a second level subassembly, three dots the third level of subassembly, and so on.

The diagrams reflect the most current configuration at the time of publication.

Parts list for Figure 8-1

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-1-			. FRONT HOUSING ASSEMBLY	1
-1	F039120001	F039120001	.. FRONT HOUSING SUBASSEMBLY	1
-2	DUNT1227.A	S048719	... PUMP HEAD 1 ASSEMBLY	1
-3	DUNT1228.A	S048720	... PUMP HEAD 2 ASSEMBLY	1
-4	GCABA103.A	F031624001	... FRONT HOUSING	1
-5	GLEGG100.B	F034630001	... RUBBER FEET	2
-6	HPNL1023.B	5002474004	... FRONT PANEL FILM	1
-7	LPLTM103.C	F034222005	... GROUND PLATE, Main	1
-8	LPLTM104.C	F034222007	... GROUND PLATE, Front panel film	1
-10	PGUMR101.B	F034630005	... GASKET, Pump head	2
-11	PSPAA102.A	4004340002	... SPACER, Pump head outside bottom corner	2
-12	PSPAA102.B	4004340001	... SPACER, Pump head gasket	6
-13	QCNW1048.A	F034140014	... WIRE HARNESS, Pump head main	2
Note:	**The following wire harnesses are not shown in Figure 8-1.**			
-14	QCNW1043.B	F044140001	... WIRE HARNESS, Ground to rear housing	1
-15	QCNW1049.A	F034140006	... WIRE HARNESS, Pump head 1 air sensor	1
-16	QCNW1051.A	F034140007	... WIRE HARNESS, Pump head 2 air sensor	1
-17	QCNW1055.A	F034140011	... WIRE HARNESS, between grounding plates	1
-20	XBPBN30P.C	4009310029	... SCREW, Ground front panel film	1
-21	XBPBN40P.E	4009310003	... SCREW, Ground	6
-22	XBSUF40P.A	4009310015	... SCREW, Pump head	6
-23	XUPSD30P.B	4009310020	... TAPPING SCREW	1

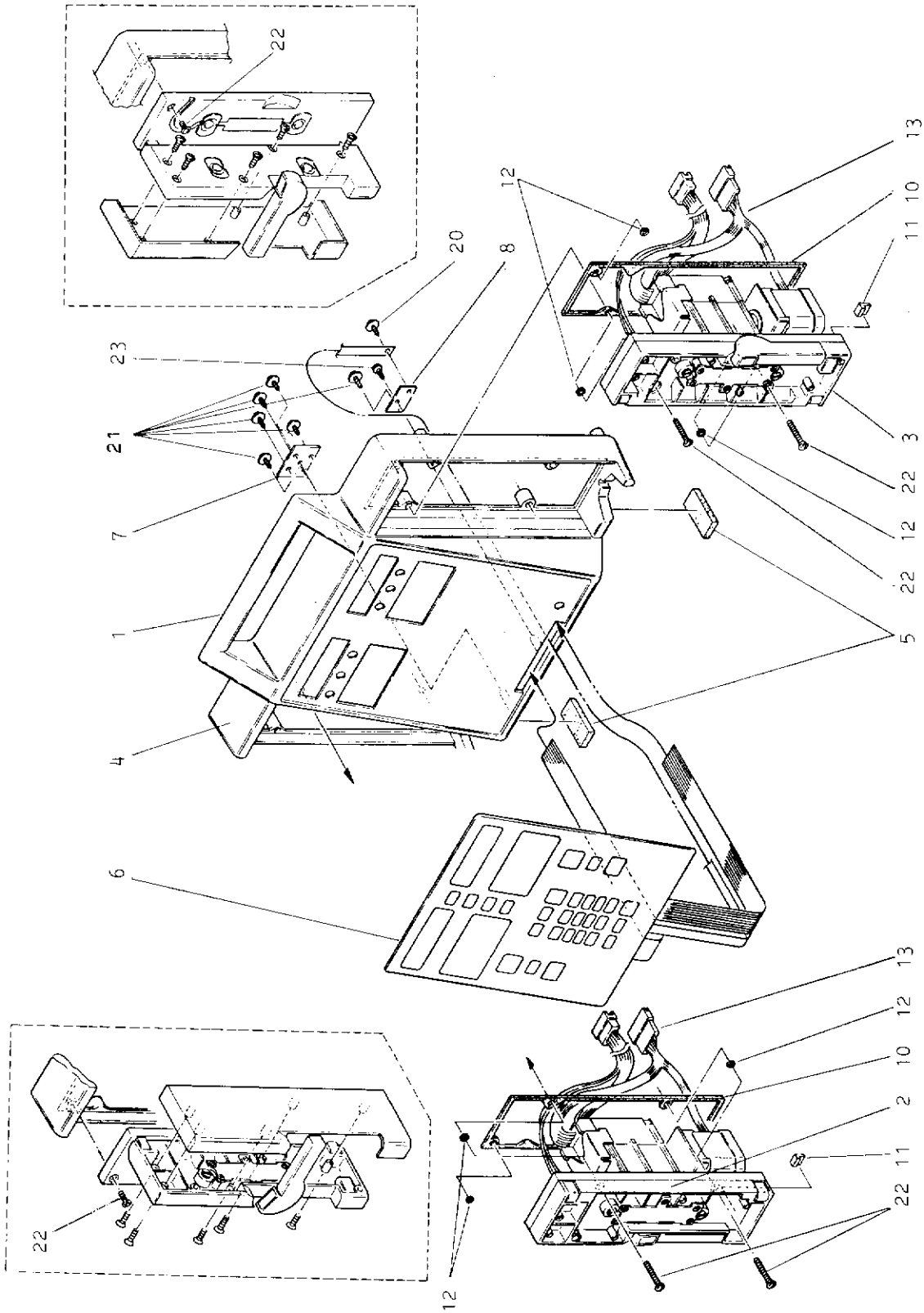


Figure 8-1. Top Assembly

Parts list for Figure 8-2

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-2-			. FRONT HOUSING ASSEMBLY	1
		F039120001	.. FRONT HOUSING SUBASSEMBLY	1
-1	CPWBN102.i	F039130011	... CPU PCB ASSEMBLY*	1
-2	CPWBN102.D	F033130003	... LCD DISPLAY PCB ASSEMBLY	1
-3	CPWBN102.G	F033130005	... I/O CONTROL PCB ASSEMBLY	1
-4	PCOVP100.C	F034620002	... BATTERY COMPARTMENT, Lithium battery	1
-5	UBATL100.A	5009480002	... BATTERY, Lithium	1
-6	XUPSD30P.D	4009310066	... TAPPING SCREW, PCB assemblies	14
-7	XUPSD30P.F	4009310067	... TAPPING SCREW, Battery compartment	2
-8	XWHBN300.A	4009330017	... WASHER	14
-9	XWHNZ300.C	4009330015	... NYLON WASHER	14
-10	PGUMR101.A	F034630004	... O-RING SEAL, Housings	1
-11	LSUB1006.A	F034220002	.. REINFORCING PLATE, Handle	1

* If the CPU board is being replaced, you may need to replace the software to maintain compatibility. See 6.3.14 or call 1-800-THE-PUMP for details.

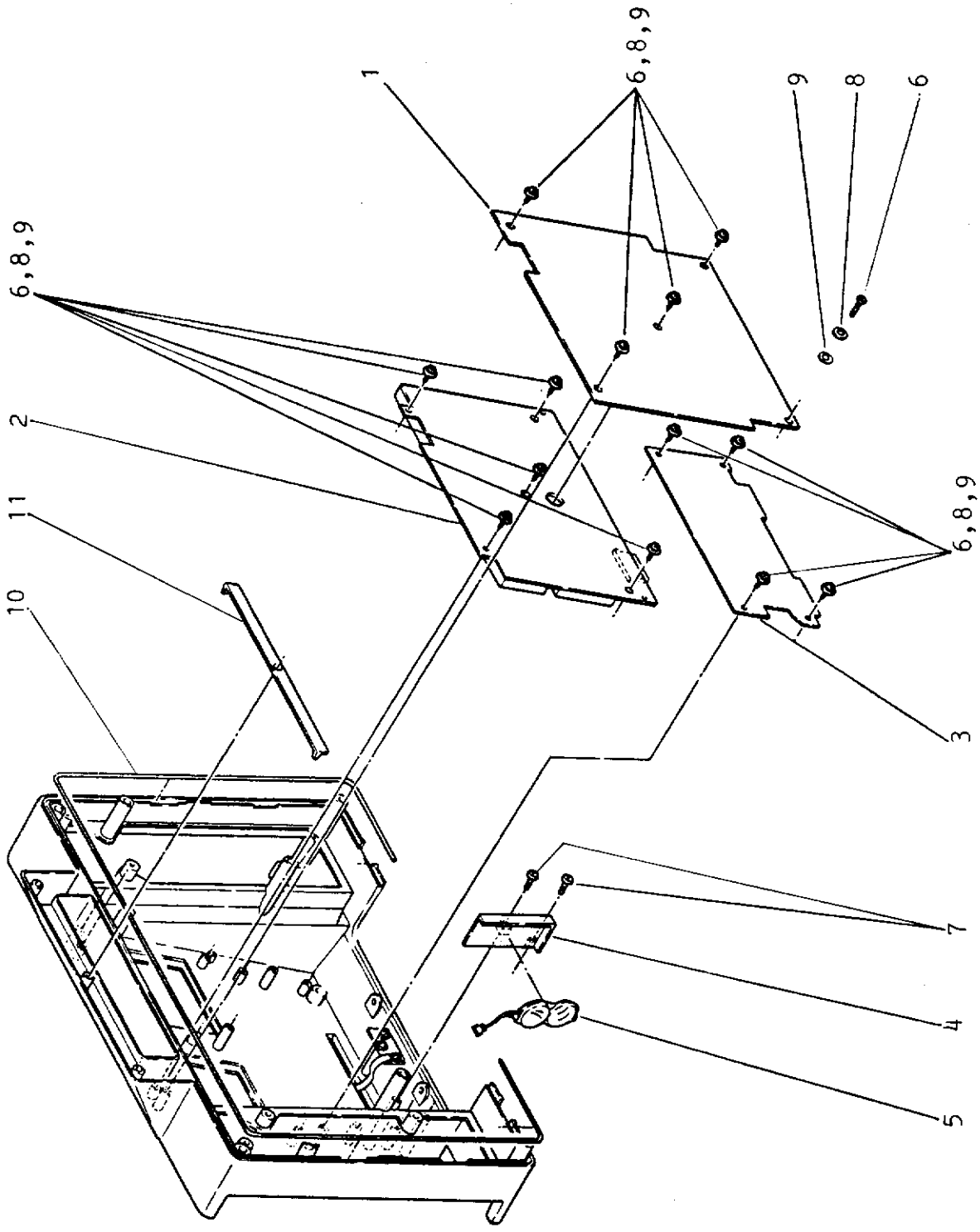


Figure 8-2. Front Housing Assembly

Parts list for Figure 8-3

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-3-			. REAR HOUSING ASSEMBLY	1
-1	F039120002	F039120002	.. REAR HOUSING SUBASSEMBLY	1
-2	CPWBN102.H	F034130006	... AUDIBLE ALARM PCB ASSEMBLY	1
-3	CPWBF103.A	F034130007	... TERMINAL PCB ASSEMBLY	1
-4	GCABB104.B	F031624002	... REAR HOUSING	1
-5	GWAKP100.A	F032624006	... FRAME, Battery compartment	1
-6	LANGK101.A	F034222001	... TRANSFORMER MOUNTING PLATE	1
-7	LANGK101.B	F034222002	... TERMINAL PCB MOUNTING BRACKET	2
-8	LPLTM103.A	F034222003	... GROUND STRAP, Pole clamp	1
-9	LPLTM103.C	F034222005	... GROUND PLATE	2
-10	LPLTM104.B	F034222006	... GROUND STRAP, AC inlet	1
-11	PGUMM101.A	F034620003	... RUBBER HORN, Audible alarms	1
-12	QCNW1047.A	F033140002	... WIRE HARNESS, Service port	1
Note:	**The wire harnesses and ground wires are not shown in Figure 8-3.**			
-14	QCNW1040.A	F023140007	... WIRE HARNESS, Audible alarms	1
-15	QCNW1044.A	F034140004	... WIRE HARNESS, Drop sensor	1
-16	QCNW1046.A	F034140005	... WIRE HARNESS, PANEL LOCK switch	1
-17	QCNW1052.B	F034140008	... GROUND WIRE, Ground plate	1
-18	QCNW1053.A	F034140009	... GROUND WIRE, Nurse call	1
-19	QCNW1054.A	F034140010	... GROUND WIRE, Drop sensor	2
-20	QCNW1058.A	F044140002	... GROUND WIRE, Power receptacle	1
-21	QCNW1059.A	F034140013	... GROUND WIRE, Power transformer	1
-22	5009410047	5009410047	... POWER RECEPTACLE	1
-23	RCORF100.C	5009430002	... TOROIDAL CORE, Wire harness (Not shown)	1
-24	RDENC100.C	F039130008	... POWER SUPPLY PCB ASSEMBLY	1
-25	RTRNP100.C	5009462007	... POWER TRANSFORMER	1

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
-26	3009035001	3009035001	... TIE WRAP (Not shown)	7
-27	XBPBN30P.A	4009310001	... SCREW, Terminal PCB	4
-28	XBPBN40P.E	4009310003	... SCREW, Ground	10
-29	XBPBN40P.D	4009310031	... SCREW, Pole clamp ground	1
-30	XBPSD30P.A	4009310041	... SCREW, Power receptacle	2
-31	XBPSD40P.F	4009310049	... SCREW, Battery compartment frame	4
-32	XBPSD40P.D	4009310050	... SCREW, Power transformer	2
-33	XUPSD30P.B	4009310020	... TAPPING SCREW, M3, L8	10
-34	XUPSD40P.A	4009310021	... TAPPING SCREW, Transformer mounting plate	4

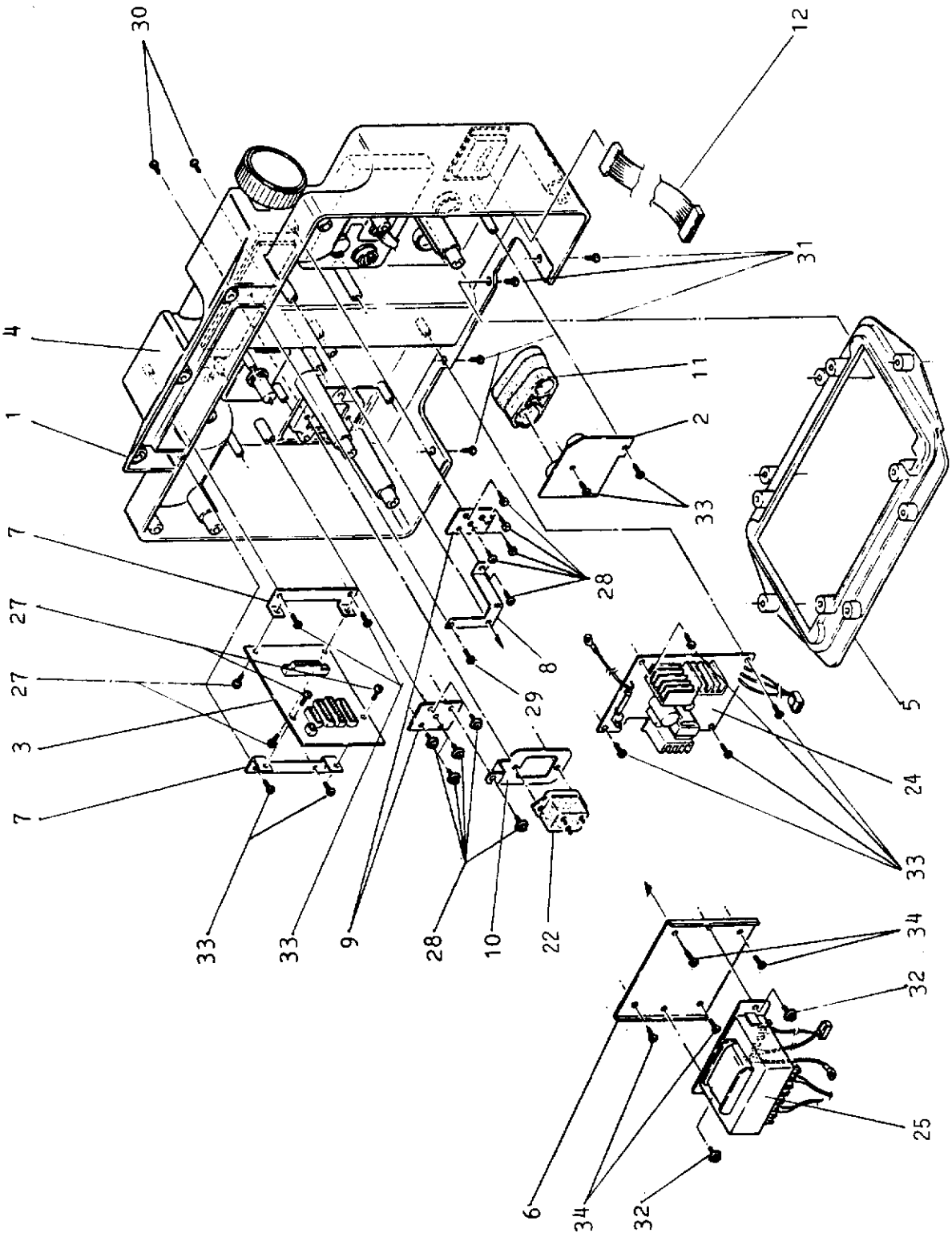


Figure 8-3. Rear Housing Assembly

Parts list for Figure 8-4

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-4-			. REAR HOUSING ASSEMBLY	1
	F039120002	F039120002	.. REAR HOUSING SUBASSEMBLY	1
-1	CCRA0128.C	F024120001	... POLE CLAMP ASSEMBLY	1
	LPLT1020.B	F024630013	.... POLE CLAMP FRICTION PAD (Not shown)	1
-2	GCOVH100.C	4009390001	... COVER, Communications port	1
-3	GLEGG100.C	F034630002	... RUBBER FOOT	2
-4	HiNDP100.D	07-26-06-027A	... LABEL, Pump rear components	1
-5	JKNBZ100.C	F049620011	... KNOB, Audible alarm	1
-6	LANGT100.A	F024220002	... POLE CLAMP MOUNTING PLATE	1
-7	LPLTM103.B	F034222004	... GROUND STRAP, PANEL LOCK switch	1
-8	LXNZ1003.A	F049211002	... INSERT NUT, Communications port	2
-9	PHAG1002.A	F034624007	... CORD HOOK	2
-10	QCNW1042.A	F034140003	... WIRE HARNESS, Nurse call	1
-11	QCNCW100.A	5009410033	... JACK, DROP SENSOR	2
-12	QFSH3220.A	5009425001	... MAIN FUSE, 250 V, 0.75 A, SB	1
-13	QFSHN000.B	5009425013	... FUSE HOLDER	1
-14	QSWZ1002.B	5009470001	... PANEL LOCK SWITCH	1
-15	JKNBZ100.D	F039622001	.... KNOB, PANEL LOCK switch	1
-16	RVRC1350.A	2501003200	... AUDIBLE ALARM VOLUME CONTROL	1
-17	072606028	07-26-06-028	... LABEL, Fuse	1
-18	XBPBN26P.A	4009310006	... SCREW, Communications port	2
-19	XBPSD30P.R	4009310009	... SCREW, Cord hook	4
-20	XBPSD40P.H	4009310050	... SCREW, Pole clamp ground plate	2
-21	GCOVH100.A	F034624003	.. COVER, Service port	1
-22	GCOVH100.B	F034624004	..COVER, Power cord	1
-23	PCAP1008.A	F029620001	..CAP, Drop sensor	2

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
-24	QACCD761.D	5009410001	.. POWER CORD with receptacle	1
-25	TCAUS101.B	07-26-06-019 Rev. A	.. LABEL, Warning	1
-26	TCAUS101.A	07-26-06-018	.. LABEL, Directions for Use	1
-27	072601098	07-26-01-098	.. PLATE, Serial number	1
-28	TLABZ104.A	07-26-06-020	.. LABEL, Service port	1
-29	072701018	07-27-01-018 Rev. A	.. LABEL, 24 Hour Service	1
-30	072606030	07-26-06-030	.. TAG, Battery recharging (Not shown)	1
-31	XBBSD26P.A	4009310077	.. SCREW, Service port	2
-32	XUPSD40P.C	4009310069	.. SCREW, Power cord cover	3

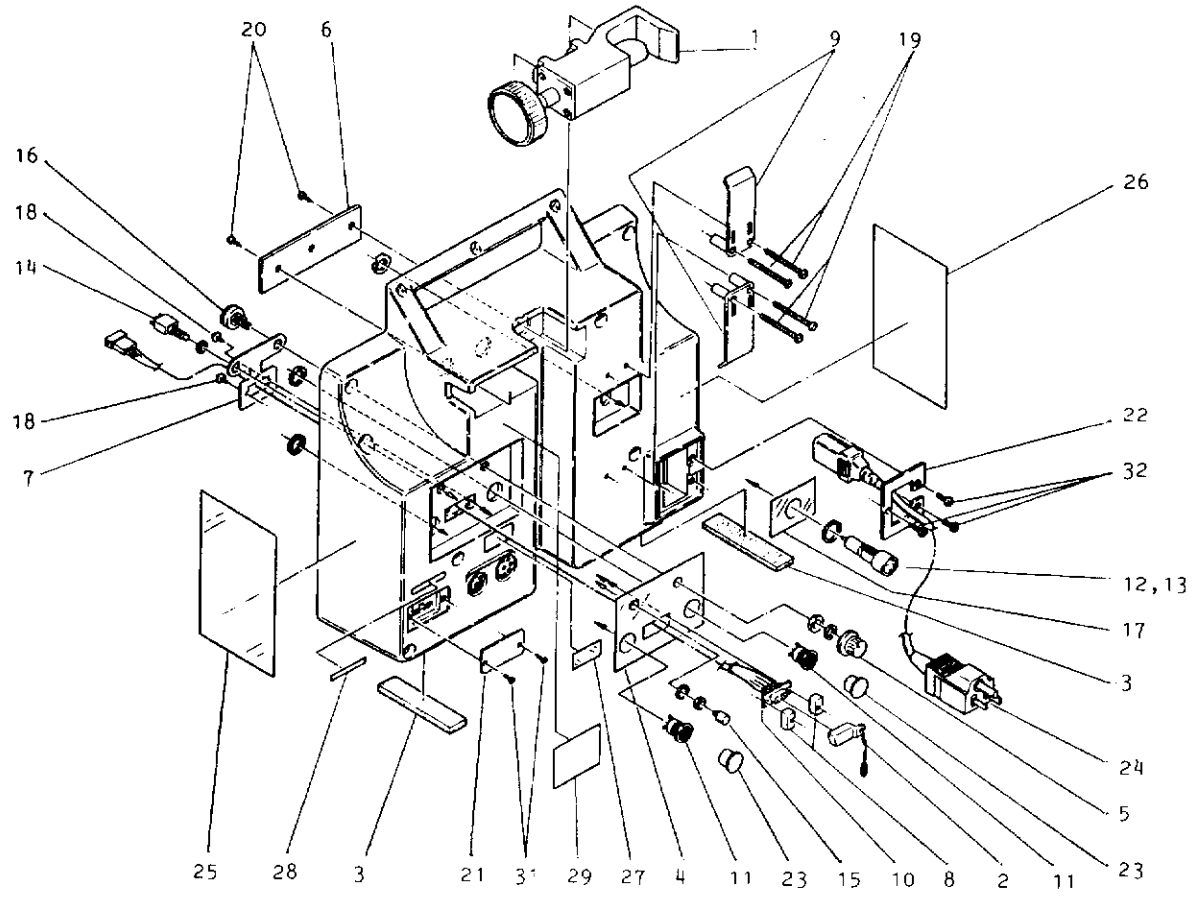


Figure 8-4. Rear Housing Assembly

Parts list for Figure 8-5

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-5	F039120002	F039120002	.. BATTERY COMPARTMENT SUBASSEMBLY	1
-1	GFTAB100.A	F032624005	... COVER, Battery compartment	1
-2	LBNDK100.B	F034220001	... STRAP, Battery	2
-3	PCASB100.A	F032620001	... BATTERY COMPARTMENT	1
-4	PGUMR101.C	F034630006	... SEAL, Battery compartment cover	1
-5	QCNW1056.B	F039140012	... WIRE HARNESS, Battery	1
-6	QFSB1006.A	5009425007	... BATTERY FUSE, 3 A, 125 V	1
-7	TLABP104.A	07-26-06-026	... LABEL, Battery	1
-8	See Note	5009480005	... RECHARGEABLE BATTERY, 12 V, 3.2 AH	1
-9	XBPSD26P.A	4009310035	... SCREW, Battery compartment	4
-10	XBPSD30P.K	4009310041	... SCREW, Battery strap	4
-11	QFSH5100.A	5009425014	... FUSE, 0.1A, 250 V (Not shown)	1

Note: **Use UBAT1008.A when replacing Yuasa batteries.**
Use UBAT1008.S when replacing Sonnenschien batteries.

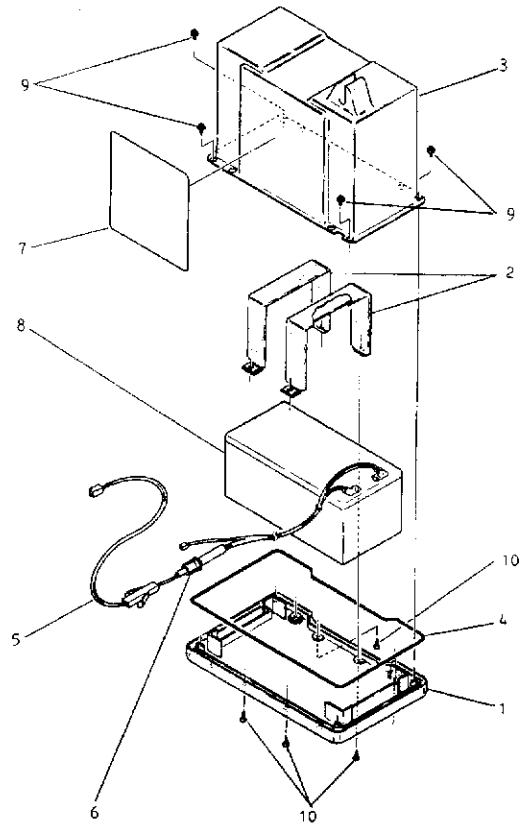


Figure 8-5. Battery Compartment Subassembly

Parts list for Figure 8-6

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-6-			. REAR HOUSING ASSEMBLY	1
-1	QCNW1041.A	F034140001	.. WIRE HARNESS, Ribbon cable	1
-2	XBBSD30P.A	4009310078	.. SCREW, Handle	3
-3	XBBSD40P.B	4009310027	.. SCREW, Housing	9
-4	XBPSD40P.F	4009310049	.. SCREW, Battery compartment frame and cover	6

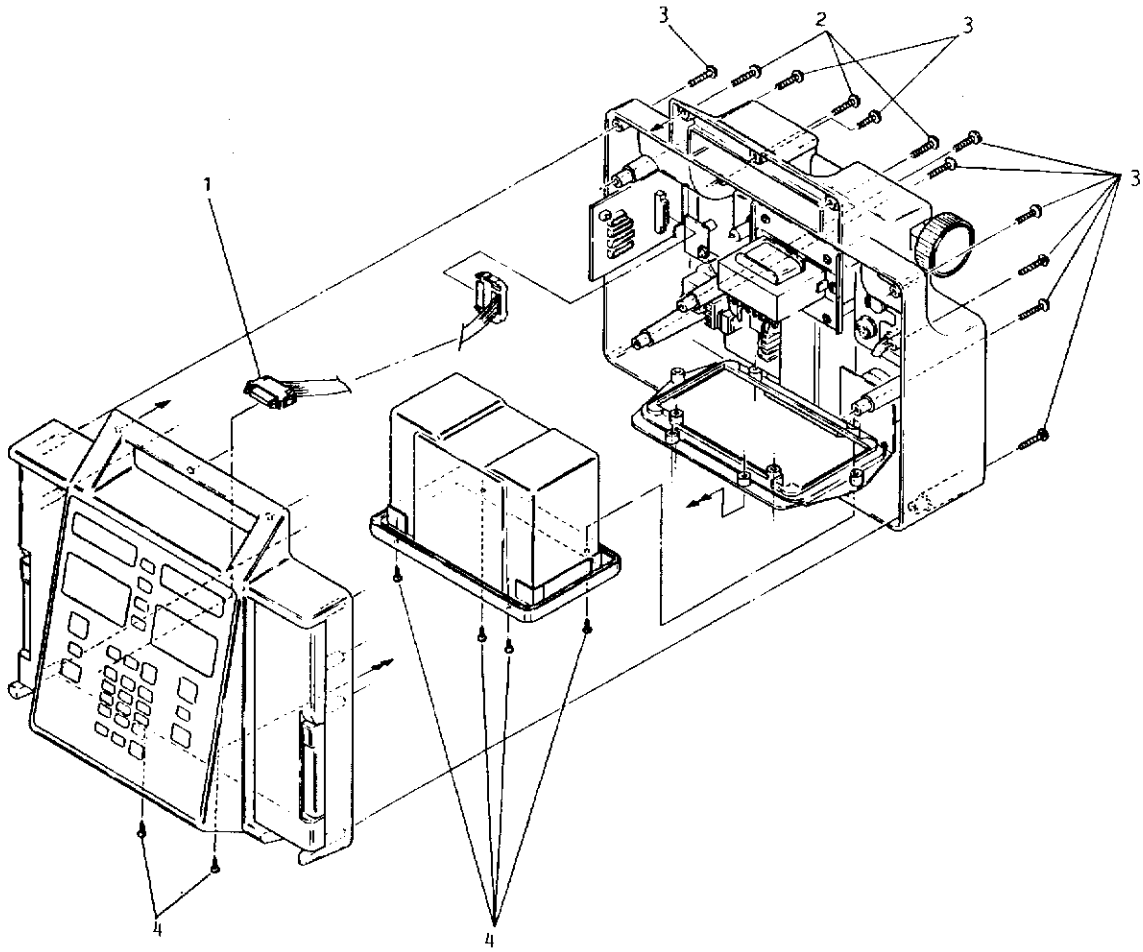


Figure 8-6. Case Hardware Details

Parts list for Figure 8-7

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-7-	DUNT1227.A	S048719	... PUMP HEAD 1 ASSEMBLY	1
-1	GCOVA100.A	S048724	.... PUMP HEAD COVER, Pump 1	1
-2	CDOR1002.A	S047948	.... DOOR ASSEMBLY, Pump 1	1
-3	GDOR1002.A	S048723	..... PUMP HEAD DOOR, Pump 1	1
-4	CHNDP100.B	S047868	..... DOOR LATCH ASSEMBLY, Pump 1	1
-5	LPLTP105.A	S048741	..... PLATE, Label	1
-6	TLABZ104.B	S048764	..... LABEL, PUSH (7-26-6-29)	1
-7	PMAGT100.B	S048498	..... MAGNET	1
-8	LPiN1011.A	S048778	..... PIN	1
-9	TLABZ104.E	S048759	..... LABEL,Tube loading instruction, Pump 1(7-26-6-22)	1
-10	LPLTM105.A	S048795	..... BACK PLATE COVER, Pump 1	1
-11	LANGF102.A	S048797	.... FIXING BRACKET, Finger cover, Pump 1	1
-12	LPLTM105.C	S048705	.... FIXING BRACKET, Finger cover, Pump 1	1
-13	LANGK101.C	S048790	.... HOLDING BRACKET, Motor bottom, Pump 1	1
-14	QCNW1073.A	S048782	.... WIRE HARNESS, Pump 1 ground	1

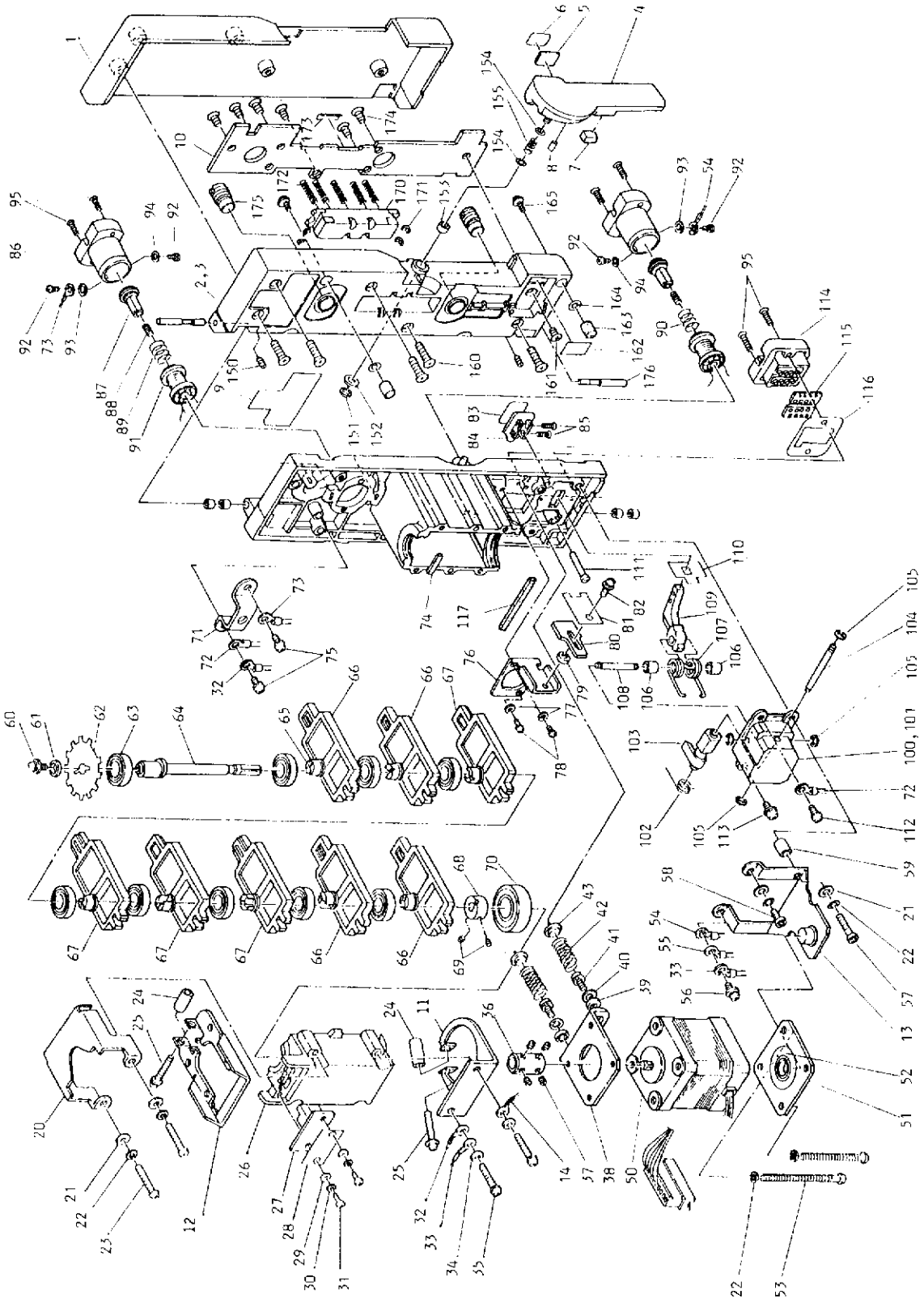


Figure 8-7. Pump Head 1 Assembly

Parts list for Figures 8-7 and 8-9

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
Note:	**The following parts are common to both pumps. The number in the Qty. column is the total quantity for both pumps.**			
8-7/9-			... PUMP HEAD ASSEMBLY	1
-20	PCOVP101.A	S048739	.... COVER, Encoder	2
-21	XWHSD300.C	S048892	.... WASHER, M3	8
-22	XWSSD300.B	S048899	.... SPRING WASHER, M3	12
-23	XBPSD30P.S	4009310045	.... PAN HEAD SCREW, M3 X 22	4
-24	S048707	S048707	.... SPACER, Fixing bracket for finger box	4
-25	XBPSD30P.Q	4009310044	.... PAN HEAD SCREW, M3 X 20	4
-26	PCOVP100.D	S048728	.... COVER, Finger box	2
-27	CPWBN103.B	S047870	.... OPTO COUPLER PCB ASSEMBLY	2
-28	PZETE100.B	S048792	.... INSULATION SHEET	2
-29	OiCMP32T.F	S048894	.... WASHER, M2	4
-30	XWSSD200.A	4009330008	.... SPRING WASHER, M2	4
-31	XJPSF20P.A	4009310063	.... PAN HEAD SCREW, M2 X 6	4
-32	QCNW1071.A	S048774	.... GROUND WIRE, Ground terminal	2
-33	QCNW1089.A	S048708	.... GROUND WIRE, Motor holding bracket	2
-34	OiCMP32T.K	S048898	.... WASHER,M3	4
-35	XBPSD30P.T	4009310046	.... PAN HEAD SCREW, M3 X 35	4
-36	MJNTM100.A	S048786	.... COUPLING, Motor	2
-37	XXXSP26L.A	S048889	.... SET SCREW, M2.6 X 3	8
-38	LBRC1003.A	S048734	.... FIXING BRACKET, Motor	2
-39	PGiDH101.B	S048788	.... GUIDE, Spring	4
-40	OiCMP32T.G	S048895	.... WASHER, M3	4
-41	XBPSD30P.B	4009310037	.... PAN HEAD SCREW, M3 X 5	4
-42	MSPRD101.A	S048784	.... SPRING, Upper motor fixing bracket	4

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
-43	PGiDH101.A	S048787	.... GUIDE, Spring	4
-50	RMOTP100.A	S048798	.... STEPPER MOTOR	2
-51	LBRC1004.A	S048735	.... FIXING BRACKET, Motor bottom	2
-52	PSPA1022.A	S048785	.... BEARING SUPPORTER	2
-53	XBPSD30P.U	4009310047	.... PAN HEAD SCREW, M3 X 55	4
-54	QCNW1070.A	S048773	.... GROUND WIRE, Downstream occl. LVDT	2
-55	QCNW1088.A	S048505	.... GROUND WIRE, Air sensor	2
-56	XBPBN30P.C	4009310029	.... PAN HEAD SCREW, M3 X 8 w/brass washer assy	2
-57	OiCMP32T.D	S048888	.... HEXAGON SOCKET HEAD, M3 X 18	2
-58	OiCMP32T.C	S048887	.... HEXAGON SOCKET HEAD, M3 X 6	2
-59	PSPA1027.A	S048704	.... SPACER, Motor holding bracket	2
-60	XBPSD30P.D	4009310005	.... PAN HEAD SCREW, M3 X 6	2
-61	PSPAB102.A	S048496	.... SPACER, Encoder	2
-62	LPLTM104.D	S048488	.... ENCODER	2
-63	NBRGY100.B	S048511	.... BALL BEARING, Cams	18
-64	NSFTZ101.A	S048733	.... FINGER SHAFT	2
-65	MCAMP100.A	S048483	.... ECCENTRIC CAM	16
-66	LPLTP104.A	S048484	.... FINGER, #1, 2, 7, 8	8
-67	LPLTP104.B	S048485	.... FINGER, #3, 4, 5, 6	8
-68	S048497	S048497	.... CAM STOPPER	2
-69	XXXSP30L.A	4009310071	.... SET SCREW, M3 X 3	4
-70	NBRGY100.C	S048512	.... BALL BEARING	2
-71	S048781	S048781	.... GROUND TERMINAL	2
-72	QCNW1072.A	S048775	.... GROUND WIRE, Safety clamp	2
-73	QCNW1069.A	S048772	.... GROUND WIRE, Upstream occl. LVDT	2
-74	PSPAZ101.B	S048491	.... SEAL, Finger box top	2
-75	4009310039	4009310039	.... PAN HEAD SCREW, M3 X 6	4
-76	LANGT101.A	S048737	.... FIXING BRACKET, DOOR SWITCH PCB	2
-77	XWHSD200.A	S048891	.... WASHER, M2	4
-78	XBPSD20P.A	4009310032	.... PAN HEAD SCREW, M2 X 5	4

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
-79	S048746	S048746	.... SPACER, Door switch PCB	2
-80	CPWBN103.A	S047871	.... DOOR SWITCH PCB ASSEMBLY	2
-81	PZETE101.A	S048793	.... INSULATION FILM, Door switch PCB	2
-82	XBPSD26.B	4009310036	.... PAN HEAD SCREW, M2.6 X 8	2
-83	TLABH100.B	S048777	.... LABEL, Safety clamp	2
-84	PCOVP100.E	S048732	.... KNOB, Safety clamp	2
-85	OiCMP32T.B	S048922	.... FLAT HEAD SCREW, M1.7 X 8	4
-86	PCASD100.A	S048743	.... HOUSING, Occlusion LVDT	4
-87	NSFTZ102.A	S048012	.... ACTUATOR, Occlusion LVDT	4
-88	RCORF100.B	S048013	.... CORE, Occlusion sensor	4
-89	MSPR1002.A	S048014	.... SPRING, Upstream occlusion sensor	2
-90	MSPR1001.A	S048672	.... SPRING, Downstream occlusion sensor	2
-91	CCiLZ100.A	S047872	.... COIL ASSEMBLY, Occlusion sensor	4
-92	OiCMP32T.A	S048928	.... PAN HEAD SCREW, M1.7 X 4.5	8
-93	OiCMP32T.J	S048901	.... WASHER, M2	4
-94	OiCMP32T.E	S048893	.... WASHER, M1.7	4
-95	XBSUF20P.A	4009310058	.... FLAT HEAD SCREW, M2	12
-100	CCRA1004.A	S047947	.... SAFETY CLAMP SUBASSEMBLY	2
-101	S048729	S048729	..... HOUSING, Safety clamp	2
-102	S048758	S048758	..... SPRING, Safety occluder cylinder	2
-103	S048731	S048731	..... SAFETY OCCLUDER CYLINDER	2
-104	S048755	S048755	..... SHAFT, Safety occluder cylinder	2
-105	S048881	S048881	..... E-RING, M2	8
-106	S048744	S048744	..... BUSHING, Safety clamp	4
-107	S048757	S048757	..... SPRING, Safety occluder arm	2
-108	S048754	S048754	..... SHAFT, Safety occluder arm	2
-109	S048730	S048730	..... SAFETY OCCLUDER ARM	2
-110	S048740	S048740	..... SEAL, Safety clamp	2
-111	S048745	S048745	.... PIN, Safety clamp	2
-112	XBPSD30P.K	4009310040	.... PAN HEAD SCREW, M3 X 8	2

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
-113	XBPSD30P.i	4009310041	.... PAN HEAD SCREW, M3 X 8	2
-114	RDTC1003.A	S048696	.... AIR SENSOR	2
-115	QPWBN103.A	S048776	.... AIR SENSOR PCB	2
-116	PSPA1026.B	S048794	.... SPACER, Air sensor	2
-117	PSPAZ101.A	S048490	.... SEAL, Finger box bottom	2
	See individual pumps for part number.		.... DOOR ASSEMBLY	1
-150	XXXSP30L.B	4009310072	..... SET SCREW, M3 X 4, Door hinge	4
-151	LXRZ1003.B	S048882	..... E-RING, M3	2
-152	OiCMP32T.H	S048896	..... WASHER, M4	2
-153	LBSHZ101.C	S048502	..... BUSHING, Door latch	2
-154	OiCMP32T.L	S048897	..... WASHER, M4.2, 0.1 t	4
-155	MSPRC101.D	S048500	..... SPRING, Door latch	2
-160	XBSUZ30P.E	4009310079	..... FLAT HEAD SCREW, M3 X 15	10
-161	XBSUZ30P.C	4009310059	..... FLAT HEAD SCREW, M3 X 8, SUS	2
-162	S048738	S048738	..... PLATE, Safety clamp	2
-163	LBSHZ101.A	S048489	..... BUMPER, Door	4
-164	OiCMP32T.i	S048900	..... SPACER	4
-165	XBPSD20P.B	4009310033	..... PAN HEAD SCREW, M2 X 6	4
-170	LPLTM104.A	S048493	..... BACK PLATE	2
-171	PCUSG101.A	S048504	..... BUMPER, Door	8
-172	MSPRC101.C	S048499	..... SPRING, Back plate	10
-173	PZETE100.C	S048506	..... INSULATION SHEET	2
-174	XBSSD30P.A	4009310056	..... FLAT HEAD SCREW, M3 X 6	12
-175	PAJS1002.A	S048494	..... BUTTON, Occlusion sensor	4
-176	LPIN1010.A	S048756	..... PIN, Door hinge	4
Note:	**The wire harnesses are not shown in the figures.**			
-180	S048765	S048765	.... WIRE HARNESS, Door switch PCB	2
-181	S048766	S048766	.... WIRE HARNESS, Door switch PCB	2
-182	S048767	S048767	.... WIRE HARNESS, Opto-coupler PCB	10
-183	S048768	S048768	.... WIRE HARNESS, Upstream occl. LVDT	2

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
-184	S048769	S048769	.... WIRE HARNESS, Downstream occl. LVDT	2
-185	S048770	S048770	.... WIRE HARNESS, Air sensor receiver	2
-186	S048771	S048771	.... WIRE HARNESS, Air sensor transmitter	2
-187	LBNDJ200.A	S048514	.... TIE WRAP	14

Parts list for Figure 8-8

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8- 8	DUNT1227.A	S048719	... PUMP HEAD 1 ASSEMBLY	1
	CDOR1002.A	S047948	.... DOOR ASSEMBLY, Pump 1	1
-1	LPLTP103.E	S048721	..... BASE PLATE	1
-2	PGiDM100.D	S048486	..... TUBING GUIDE, Safety clamp	2
-3	XJSUF20P.A	4009310064	..... SCREW, Tubing guide	2
-4	PGiDM100.E	S048487	..... TUBING GUIDE, Tubing channel	4
-5	TLABZ105.C	S048763	..... DECAL, Tubing channel at outlet	1
-6	TLABZ105.A	S048761	.... DECAL, Tubing channel at inlet	1
-7	TLABZ106.A	S048779	..... DECAL, Upper tubing channel	1
-8	LBSHZ101.B	S048501	..... BUSHING, Door hinge	4

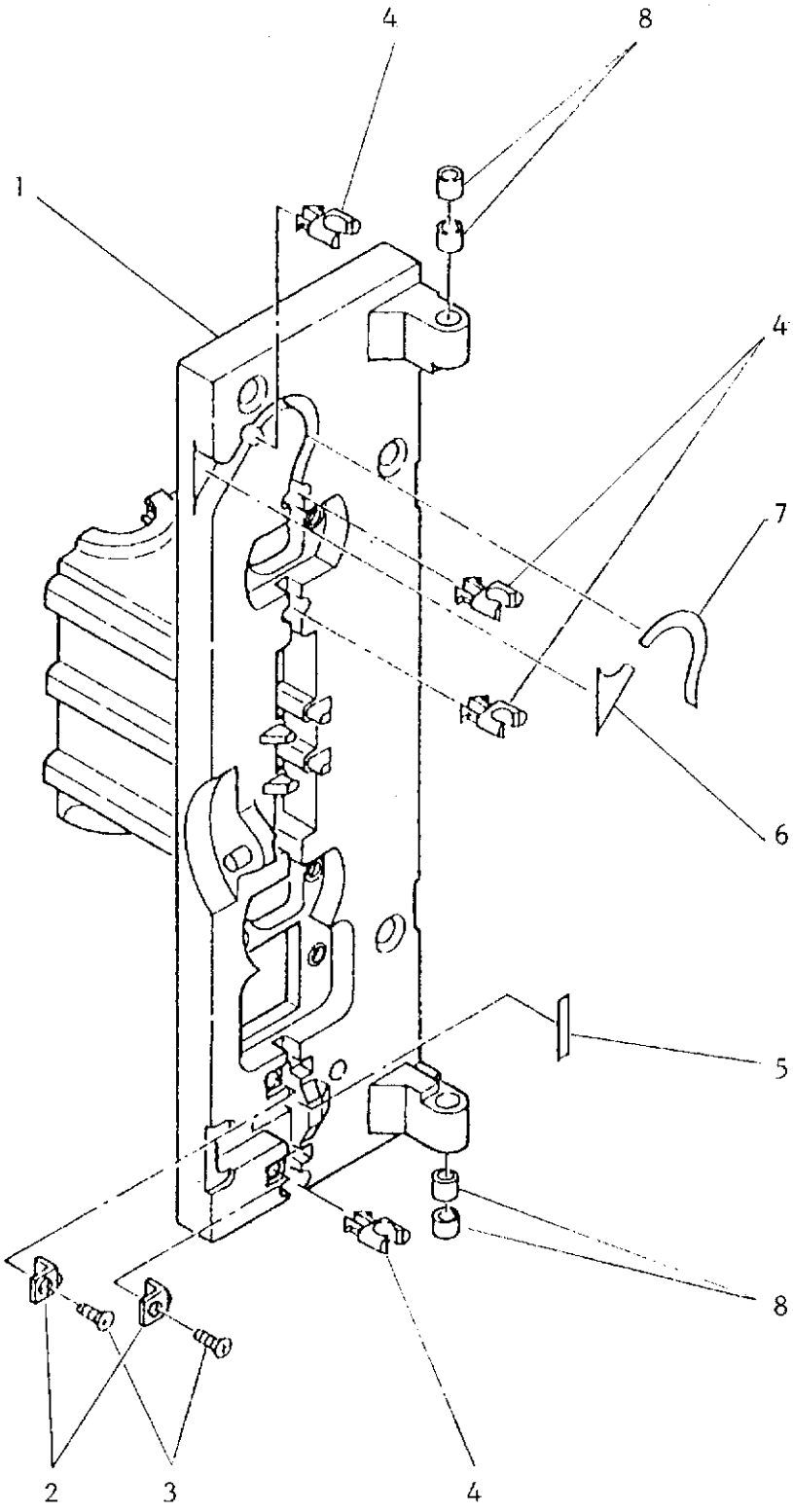


Figure 8-8. Pump 1 Base Plate Assembly

Parts list for Figure 8-9

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8- 9-	DUNT1228.A	S048720	... PUMP HEAD 2 ASSEMBLY	1
-1	GCOVA100.B	S048725	.... PUMP HEAD COVER, Pump 2	1
-2	CDOR1003.A	S047949	.... DOOR ASSEMBLY, Pump 2	1
-3	GDOR1003.A	S047950	..... PUMP HEAD DOOR, Pump 2	1
-4	CHNDP100.E	S047869	..... DOOR LATCH ASSEMBLY, Pump 2	1
-5	LPLTP105.A	S048741	.....PLATE, Label	1
-6	TLABZ104.B	S048764	..... LABEL, PUSH (7-26-6-29)	1
-7	PMAGT100.B	S048498	..... MAGNET	1
-8	LPiN1011.A	S048778	..... PIN	1
-9	TLABZ104.F	S048760	..... LABEL,Tube loading instruction, Pump 2(7-26-6-21)	1
-10	LPLTM105.B	S048796	..... BACK PLATE COVER, Pump 2	1
-11	LANGF102.B	S048703	.... FIXING BRACKET, Finger cover, Pump 2	1
-12	LPLTM105.D	S048706	.... FIXING BRACKET, Finger cover, Pump 2	1
-13	LANGK101.D	S048791	.... HOLDING BRACKET, Motor bottom, Pump 2	1
-14	QCNW1074.A	S048783	.... WIRE HARNESS, Pump 2 ground	1

Note: The rest of the parts on Figure 8-9 are on the list for Figures 8-7 and 8-9.

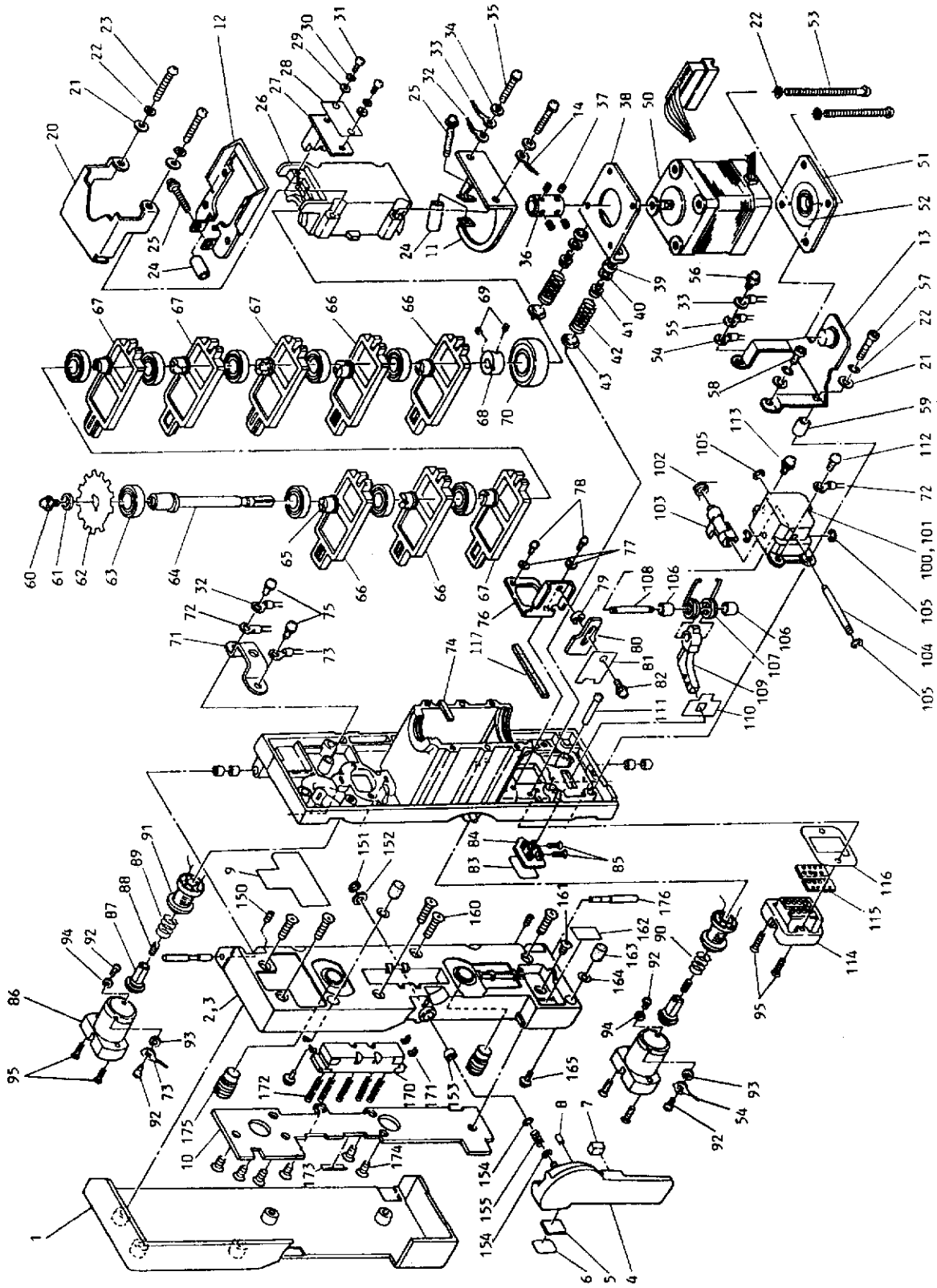


Figure 8-9. Pump Head 2 Assembly

Parts List for Figure 8-10

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
	CDOR1003.A	S047949	.... DOOR ASSEMBLY, Pump 2	1
-1	LPLTP103.F	S048722	.... BASE PLATE, Pump 2	1
-2	PGiDM100.D	S048486	.... TUBING GUIDE, Safety clamp	2
-3	XJSUF20P.A	4009310064	.... SCREW, Tubing guide	2
-4	PGiDM100.E	S048487	.... TUBING GUIDE, Tubing channel	4
-5	TLABZ105.C	S048763	.... DECAL, Tubing channel at outlet	1
-6	TLABZ105.B	S048762	.... DECAL, Tubing channel at inlet, Pump 2	1
-7	TLABZ106.B	S048780	.... DECAL, Upper tubing channel, Pump 2	1
-8	LBSHZ101.B	S048501	.... BUSHING, Door hinge	4

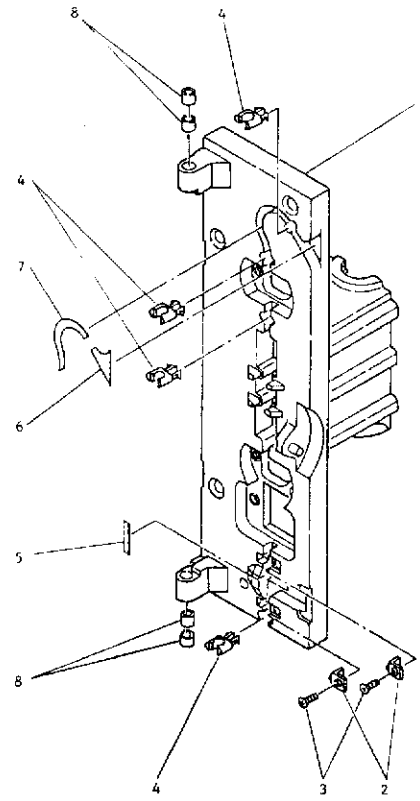
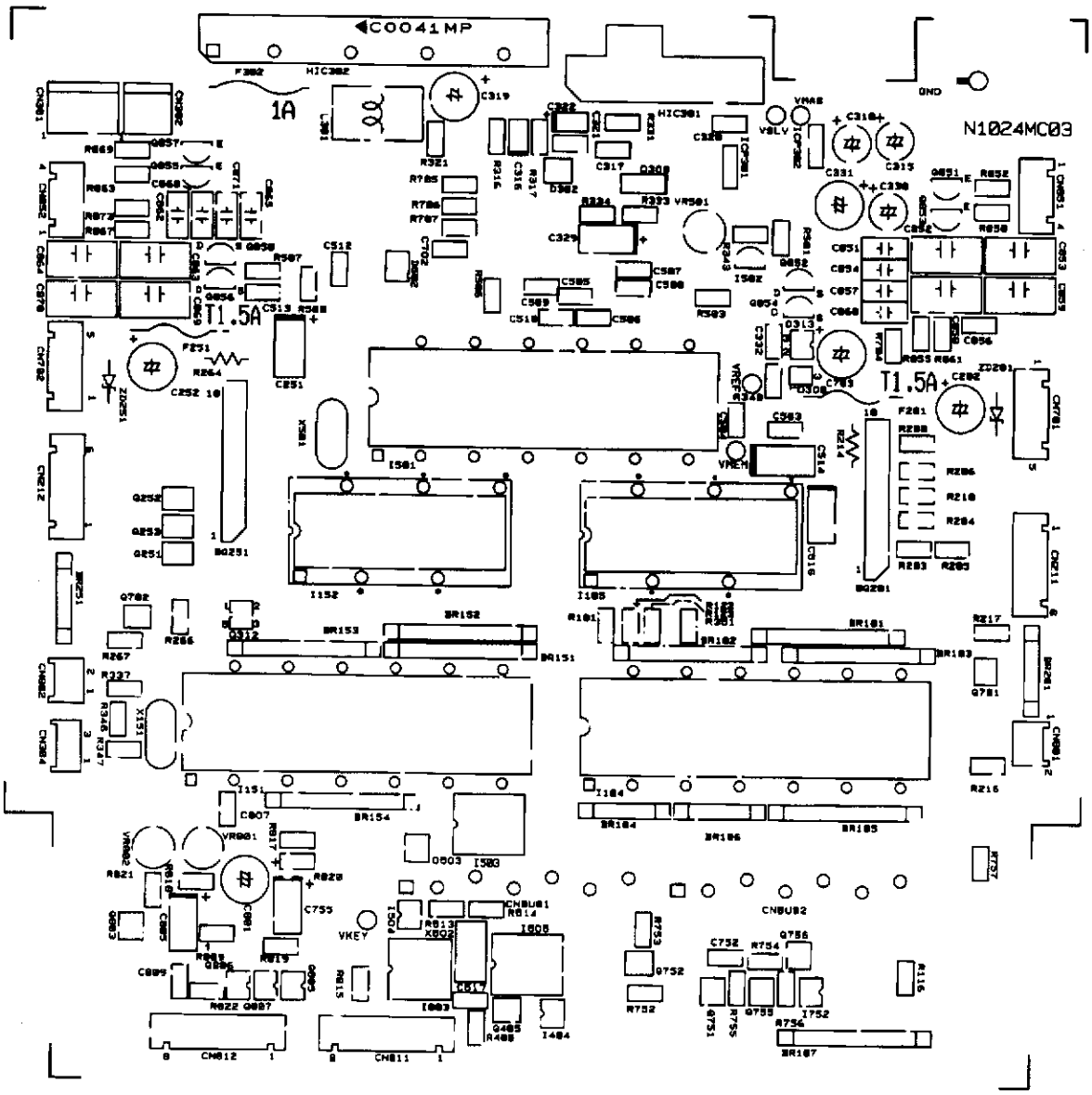


Figure 8-10. Pump 2 Base Plate Assembly

Parts list for Figure 8-11

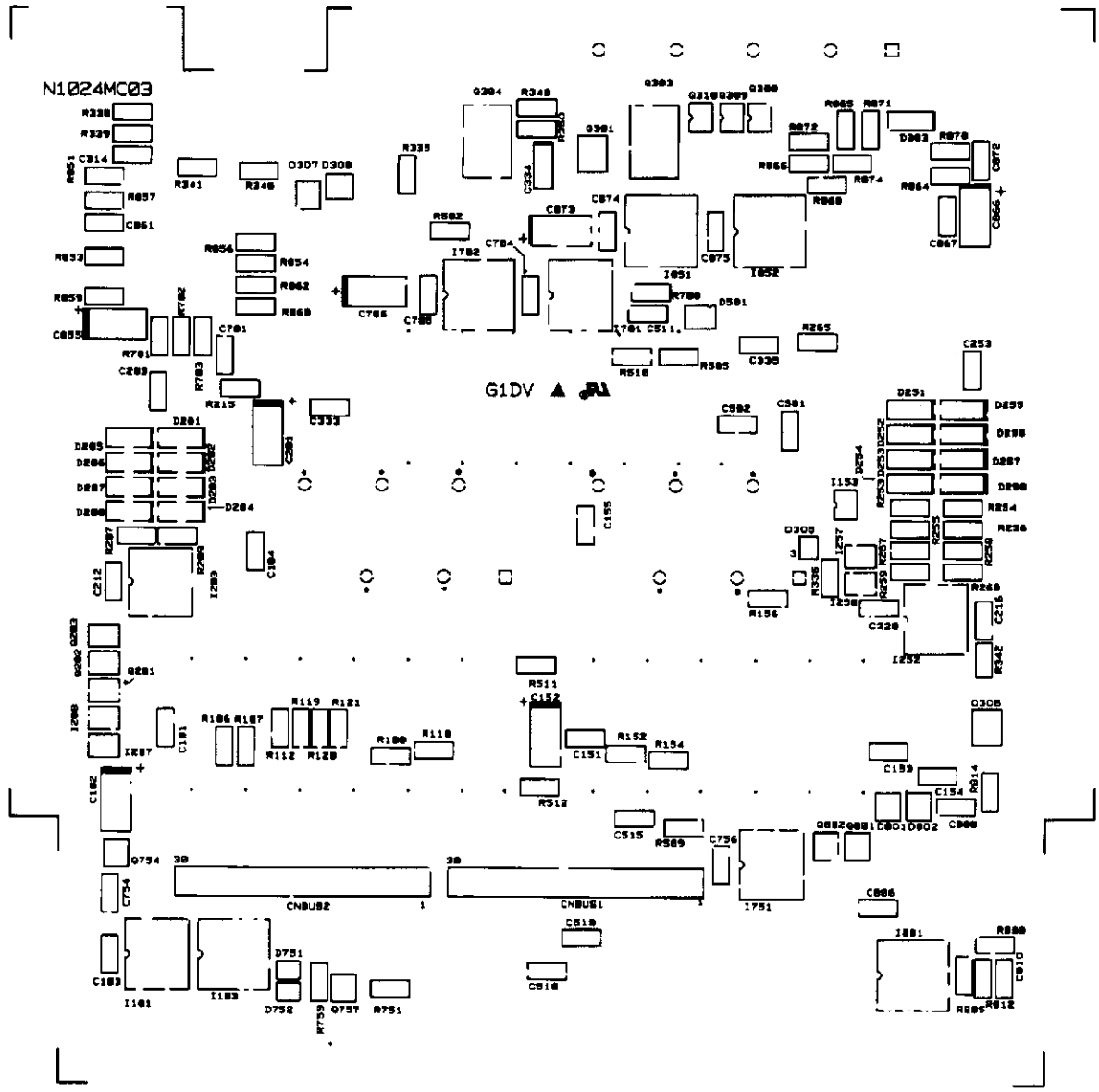
Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-11-	CPWBN102.i	F039130011	CPU&PERIPHERAL CIRCUIT CARD ASSEMBLY*	1
-50	5009420004	5009420004	. TEST PIN, GND	1
-98	5009425004	5009425004	. FUSE, 1.5 A, 125 V, SB (F201, 251)	2
-99	QFSH8300.A	5009425006	. FUSE, 1 A (F302)	1
-100	VHViCPF1.A	6009590001	. IC PROTECTOR, 600 mA (ICP301, 302)	2
-102	5009410003	5009410003	. TEST PIN (TP)	5
-103	QCNCM100.D	5009410007	. CONNECTOR (CN211, 212)	2
-104	QCNCM100.B	5009410005	. CONNECTOR (CN301)	1
-105	QCNCM100.A	5009410004	. CONNECTOR (CN302)	1
-106	QCNCW508.A	5009410046	. CONNECTOR (CN304)	1
-107	QCNCM101.B	5009410029	. CONNECTOR (CN701, 702)	2
-108	QCNCM100.E	5009410008	. CONNECTOR (CN801, 802)	2
-109	QCNCM233.A	5009410015	. CONNECTOR (CN811, 812)	2
-110	QCNCM101.A	5009410028	. CONNECTOR (CN851, 852)	2
-111	5009410043	5009410043	. CONNECTOR (CNBUS1, 2)	2
-112	5009420002	5009420002	. PART POST, Fuses	6

* If the CPU board is being replaced, you may need to replace the software to maintain compatibility. See 6.3.14 or call 1-800-THE-PUMP for details.



Component Side

Figure 8-11. CPU & Peripheral CCA (Sheet 1 of 2)



Solder Side

Figure 8-11. CPU & Peripheral CCA (Sheet 2 of 2)

Parts list for Figure 8-12

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-12-	CPWBN102.D	F033130003	DISPLAY CIRCUIT CARD ASSEMBLY	1
-27	3004090004	3004090004	. DUST SEAL, LCDs	1
-28	F044610001	F044610001	. INSULATION COVER, Message LCD	2
-29	5009420001	5009420001	. TEST PIN, GND	1
-30	XBPSD30P.L	4009310007	. SCREW, Transistors	2
-31	4009320003	4009320003	. NUT, Transistors	2
-32	4009310065	4009310065	. SCREW, Backlight	16
-33	XWSSD300.A	4009330009	. WASHER, Transistors	2

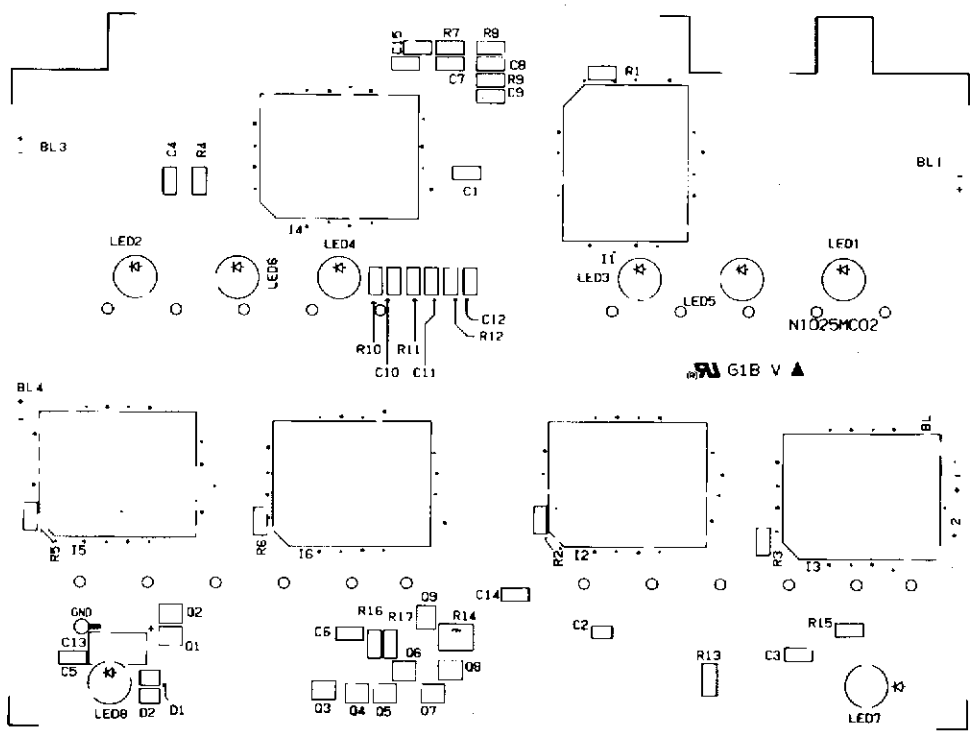


Figure 8-12. Display CCA, Component Side (Sheet 1 of 2)

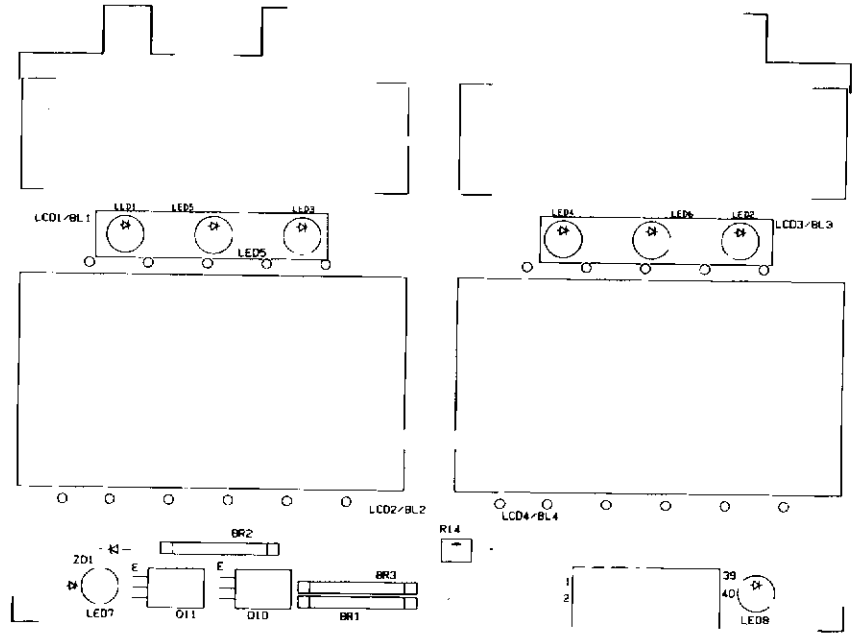


Figure 8-12. Display CCA, Solder Side (Sheet 2 of 2)

Parts list for Figure 8-13

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-13-	CPWBN102.G	F033130005	I/O CIRCUIT CARD ASSEMBLY	1
-20	5009492011	5009492011	. LED, Charging (LED301)	1
-21	5009420001	5009420001	. TEST PIN, GND	1
-22	RRLYD321.A	5009450001	. RELAY, Nurse call (RY401)	1
-23	F054620002	F054620002	. POSITIONING BLOCK, Charging LED	1

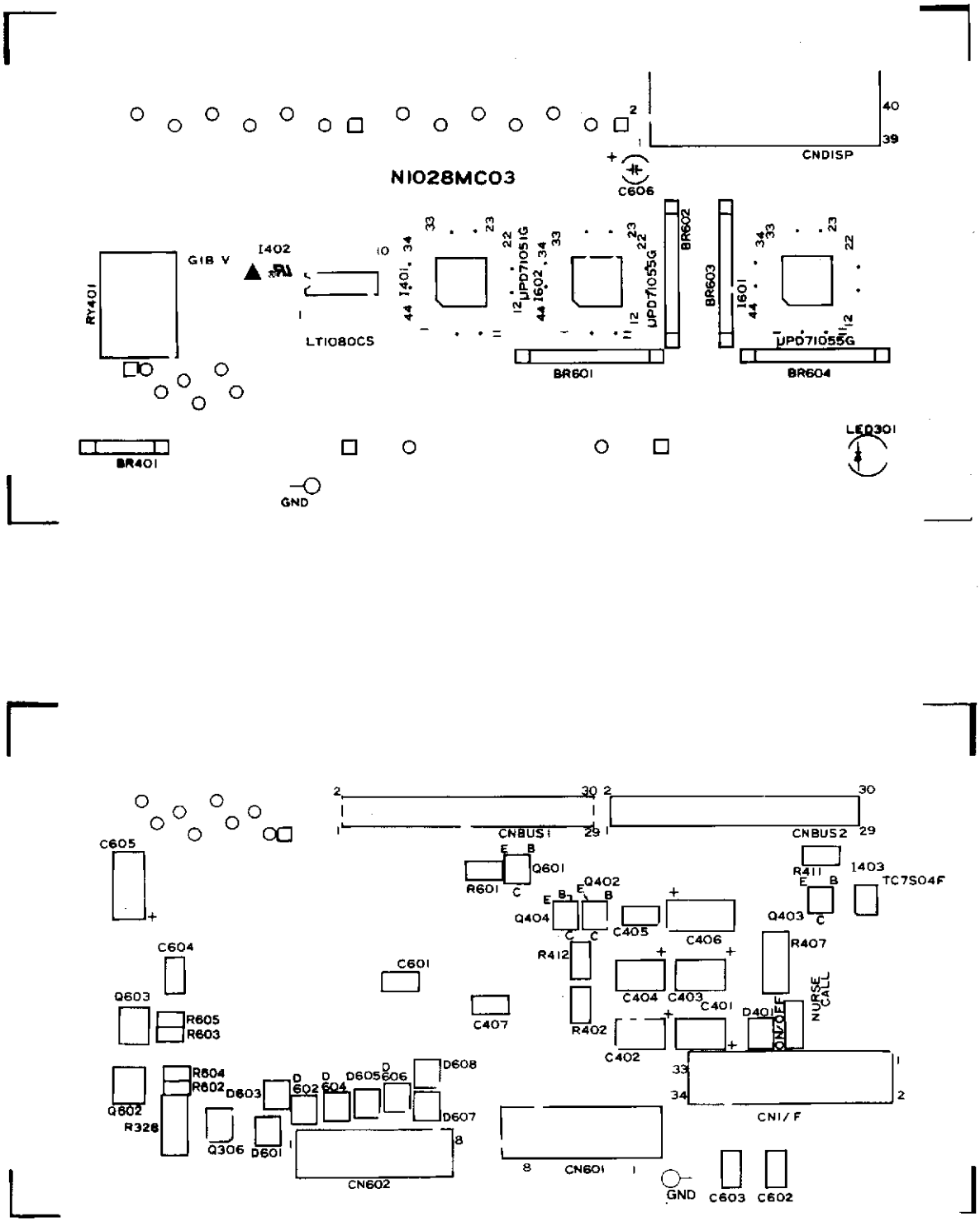


Figure 8-13. I/O CCA

Parts list for Figure 8-14

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-14-	CPWBN102.H	F034130006	AUDIBLE ALARM CIRCUIT CARD ASSEMBLY . .	1
-10	5009410044	5009410044	. CONNECTOR (CN751)	1
-11	QCNCM100.C	5009410006	. CONNECTOR (CN752)	1

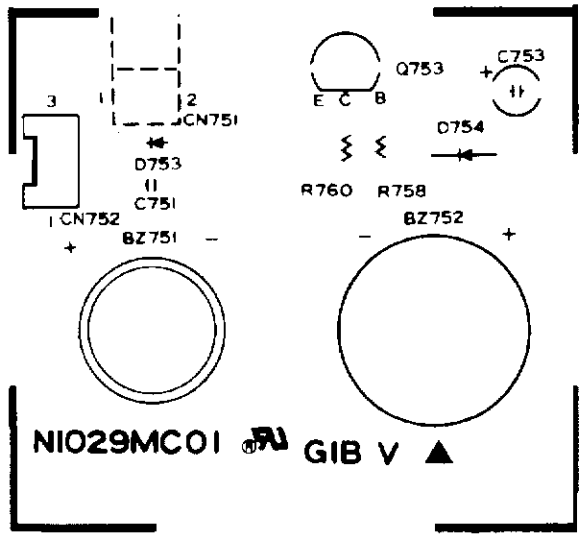


Figure 8-14. Audible Alarm CCA

Parts List for Figure 8-15

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-15-	CPWBF103.A	F034140007	TERMINAL CIRCUIT CARD ASSEMBLY	1
-1	QCNCM100.E	5009410008	. CONNECTOR (CNLOCK)	1
-2	QCNCM101.B	5009410029	. CONNECTOR (CNTEST)	1
-3	5009410045	5009410045	. CONNECTOR (CNDROP)	1
-4	5009410048	5009410048	. CONNECTOR (CNI/F)	1
-5	QCNCM233.A	5009410015	. CONNECTOR (CNTEST)	1
-6	5009410016	5009410016	. CONNECTOR (CNIPM)	1

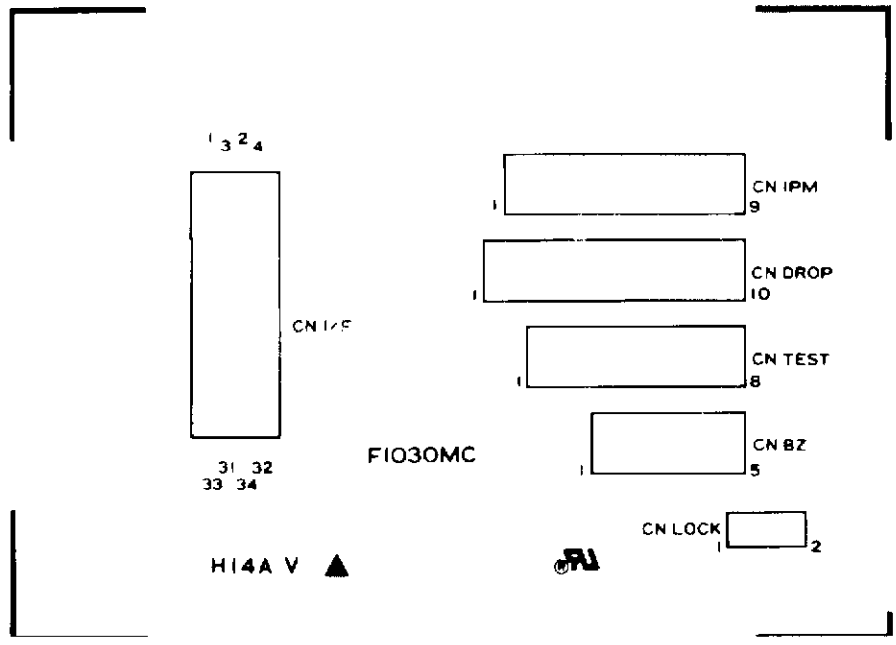


Figure 8-15. Terminal CCA

Parts list for Figure 8-16

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
8-16-	RDENC100.B	F039130008	DC POWER SUPPLY	1
-42	OCBPJCCC.A	5009425013	. FUSE, 3.15 A, 125 V (F1)	1
-43	5009410040	5009410040	. MALE CONNECTOR, 2 Pin	1
-47	OCBLRS00.A	5009420007	. FUSE SUPPORTER	1
-48	OCBPZZ00.A	5009420006	. FUSE CLIP	2

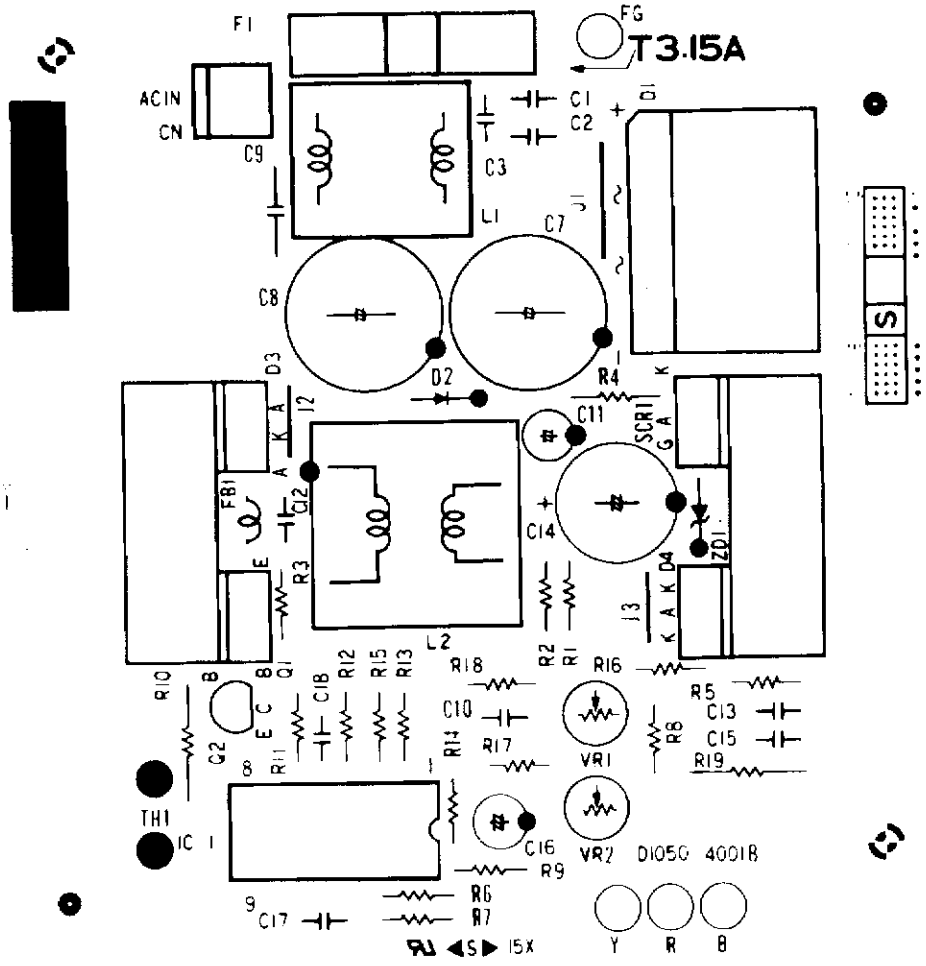


Figure 8-16. DC Power Supply

Parts List for Packaging Materials

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
XX			PACKAGING MATERIALS	
XX-1	SPAKC124.A	07-05-06-086	. INDIVIDUAL CARTON (7-5-6-86)	1
XX-2	SPAKA124.C*	F033720001	. LEFT FOAM CUSHION	1
XX-3	SPAKA124.C*	F033720002	. RIGHT FOAM CUSHION	1
XX-4	SPAKA124.B	F033720003	. BOTTOM FOAM CUSHION	1
XX-5	3004035009	3004035009	. POLYETHYLENE POUCH, 240 x 360, 30 µm	1
XX-6	SSAKH654.A	3009035010	. POLYETHYLENE POUCH, Device	1

*SPAKA124.C is the Prod. Svc. part number for both the left and right foam cushions.

Parts List for Accessories and Options

Fig.& Index No.	Prod. Svc. #	Mfg. Part #	Description	Qty.
YY-1	TiNSE109.A	7-19-1-248	. OPERATOR'S MANUAL	1
YY-2	072601098	07-26-01-098	. SERIAL NUMBER LABEL	1
YY-3	072606030	7-26-6-30	. BATTERY RECHARGE TAG	1
YY-4	MP32T3	MP32T3	. PCS Kit (3.5" floppy diskette)	Optional
YY-5	MP32T4	MP32T4	. PCS Kit (5.25" floppy diskette)	Optional
YY-6	F039140016	F039140016	..PCS Cable (9-pin to 25-pin)	Optional
YY-7	F039140017	F039140017	..PCS Cable (9-pin to 9-pin)	Optional
YY-8	QCNW1060.A	F039140015	. WIRE HARNESS, Service Port	Optional
YY-9	UKOG1013.B	F049230002	. THICKNESS GAUGE, Occlusion Sensor Calibration	1
YY-10	072501552	7-25-1-552	. CLEANING LABEL	Optional
YY-11	072501553	7-25-1-553	. CLEANING INSTRUCTION LABEL	Optional

Section 9

Warranty and Service Information

9.1 Warranty Information

Baxter Healthcare Corporation warrants that the equipment shall be free from defects in material and workmanship when delivered to the original purchaser. Baxter Healthcare Corporation's sole obligation shall be limited to repair or replacement, at Baxter's option and expense, of the defective part or unit for a period of one year following the date of initial delivery. Warranty for the replaceable battery pack is limited to a period of six months under normal use and service.

The warranty extends only to the original purchaser and is not assignable or transferable, and shall not apply to auxiliary equipment, disposable accessories, or light sources.

BAXTER HEALTHCARE CORPORATION WARRANTS THAT THE EQUIPMENT IS FIT FOR THE PURPOSES AND INDICATIONS DESCRIBED IN THE LABELING WHEN USED IN ACCORDANCE WITH THE DIRECTIONS FOR USE. UNLESS THE EQUIPMENT IS USED IN ACCORDANCE WITH SUCH INSTRUCTIONS, THIS WARRANTY IS VOID AND OF NO EFFECT. NO OTHER EXPRESSED OR IMPLIED WARRANTY EXISTS, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. BAXTER'S SOLE OBLIGATION AND PURCHASER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT AT BAXTER'S OPTION. BAXTER SHALL NOT BE LIABLE FOR PROXIMATE, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. Modifications, alterations, recalibrations or abuse, and service by other than a Baxter authorized representative may void the warranty.

9.2 Service Information

While under Baxter Healthcare Corporation Warranty, Service Agreement (optional), or lease agreement, the instrument must not be opened by unauthorized personnel.

To contact Product Service for service and repair information for all instruments, call 1-(800) THE-PUMP.

Shipping costs for all units returned to Baxter shall be paid by the customer. The unit must be packed in its original container or in another Baxter approved container that will provide adequate protection during shipment. To ensure prompt return, a Product Service representative must be notified before shipping any unit for repair. When calling Product Service, please be prepared to provide code number and serial number of the unit. A service request number will be issued and should accompany all communications. A brief written description of the problem should be attached to the instrument when it is returned for service.

Baxter Healthcare Corporation will not be responsible for unauthorized returns or for units damaged in shipment due to improper packing.

9.3 General Information

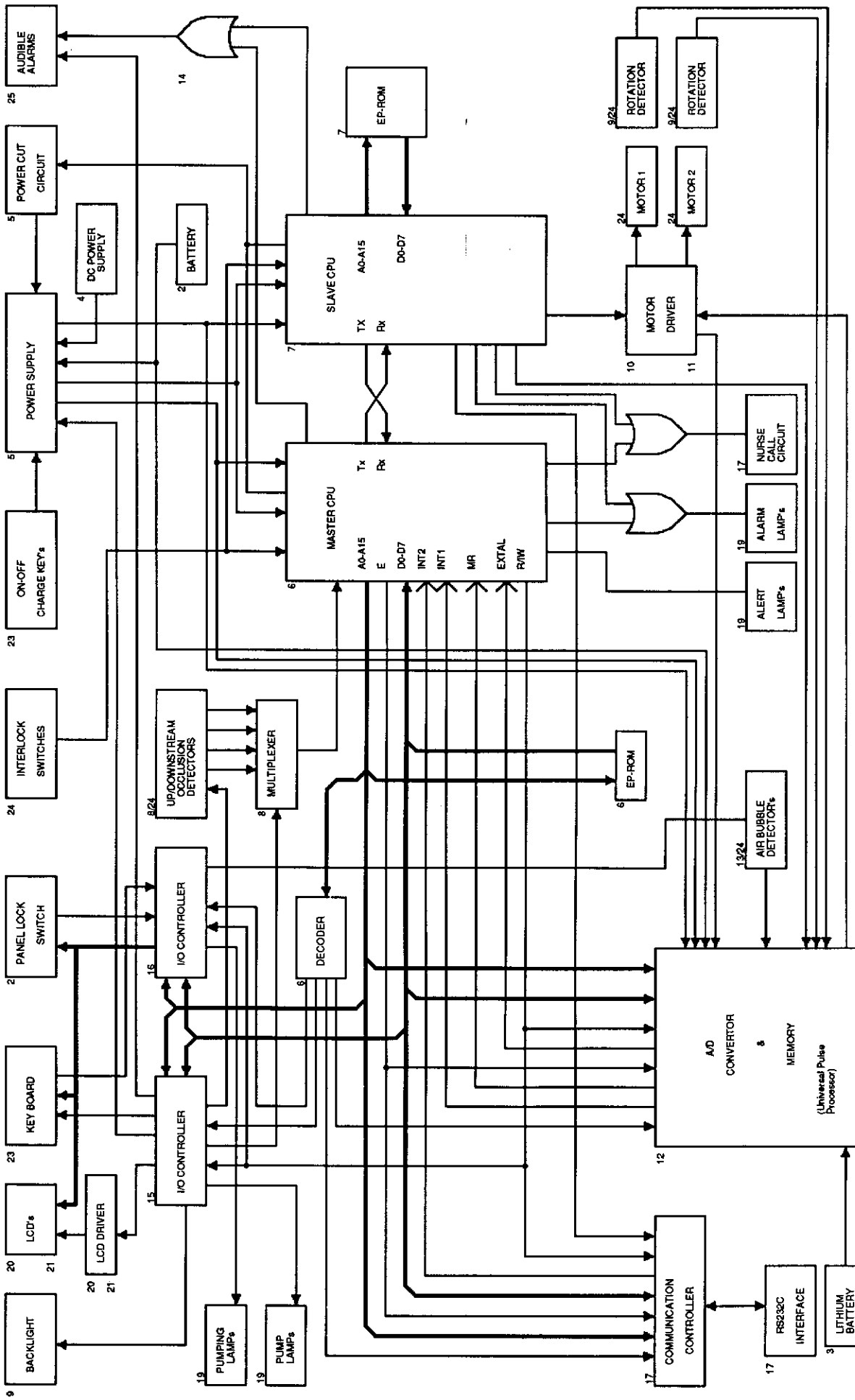
Baxter Healthcare Corporation reserves the right to change the design without notice.

Section 10

Diagrams

This section contains all of the schematic and wiring diagrams for the Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump. These diagrams are intended only to assist the reader in understanding the theory of operation.

The CPU board circuitry is shown in Figures 5 through 14. The I/O board is shown in Figures 15 through 18, and the Display board is shown in Figures 19 through 21. All other circuit boards are one-sheet figures. The diagrams are listed below.



Note: The number at upper left of each block refers to Figure number.

Figure 10-1. System Block Diagram

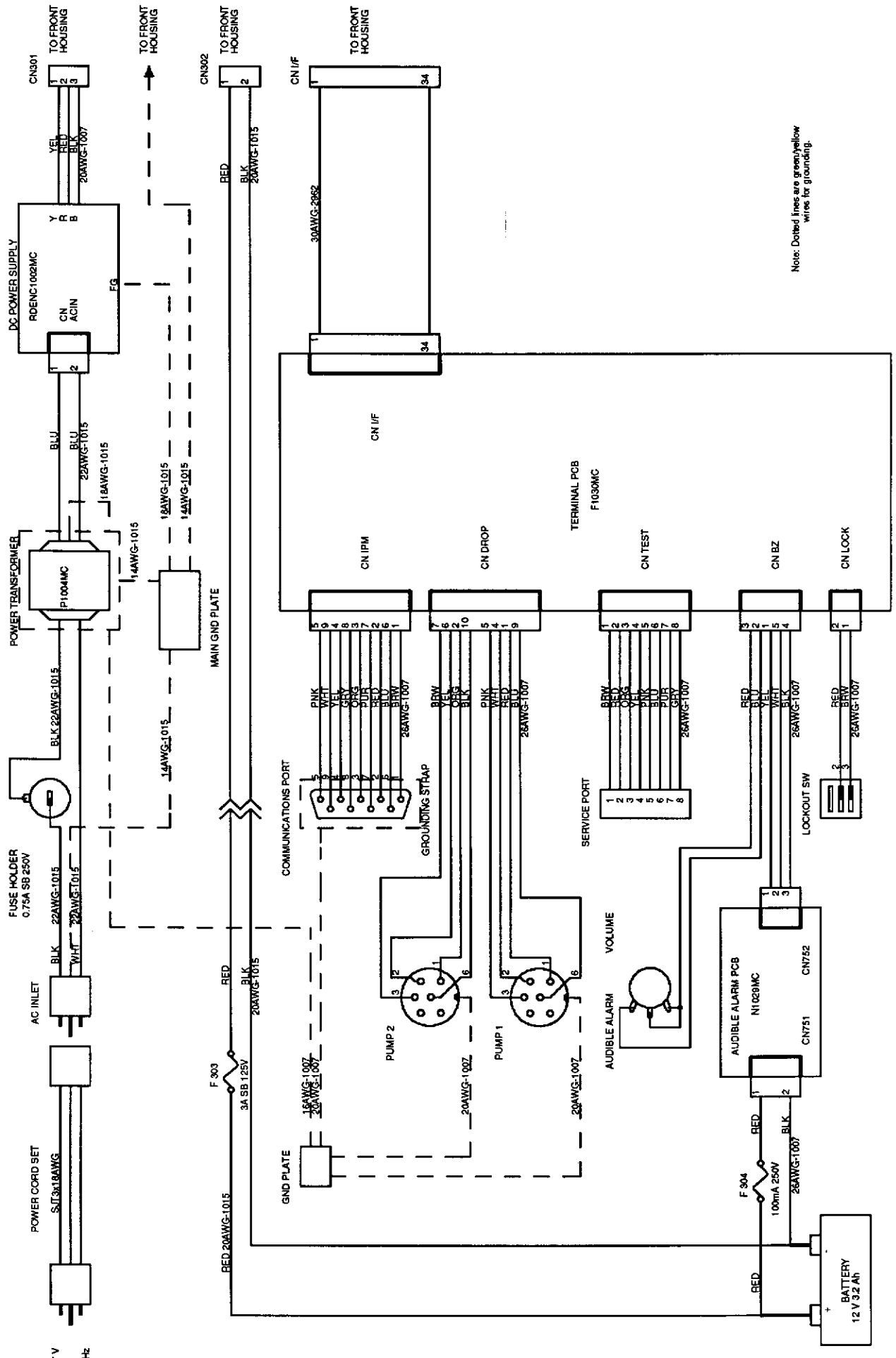


Figure 10-2. Rear Housing Wiring Diagram

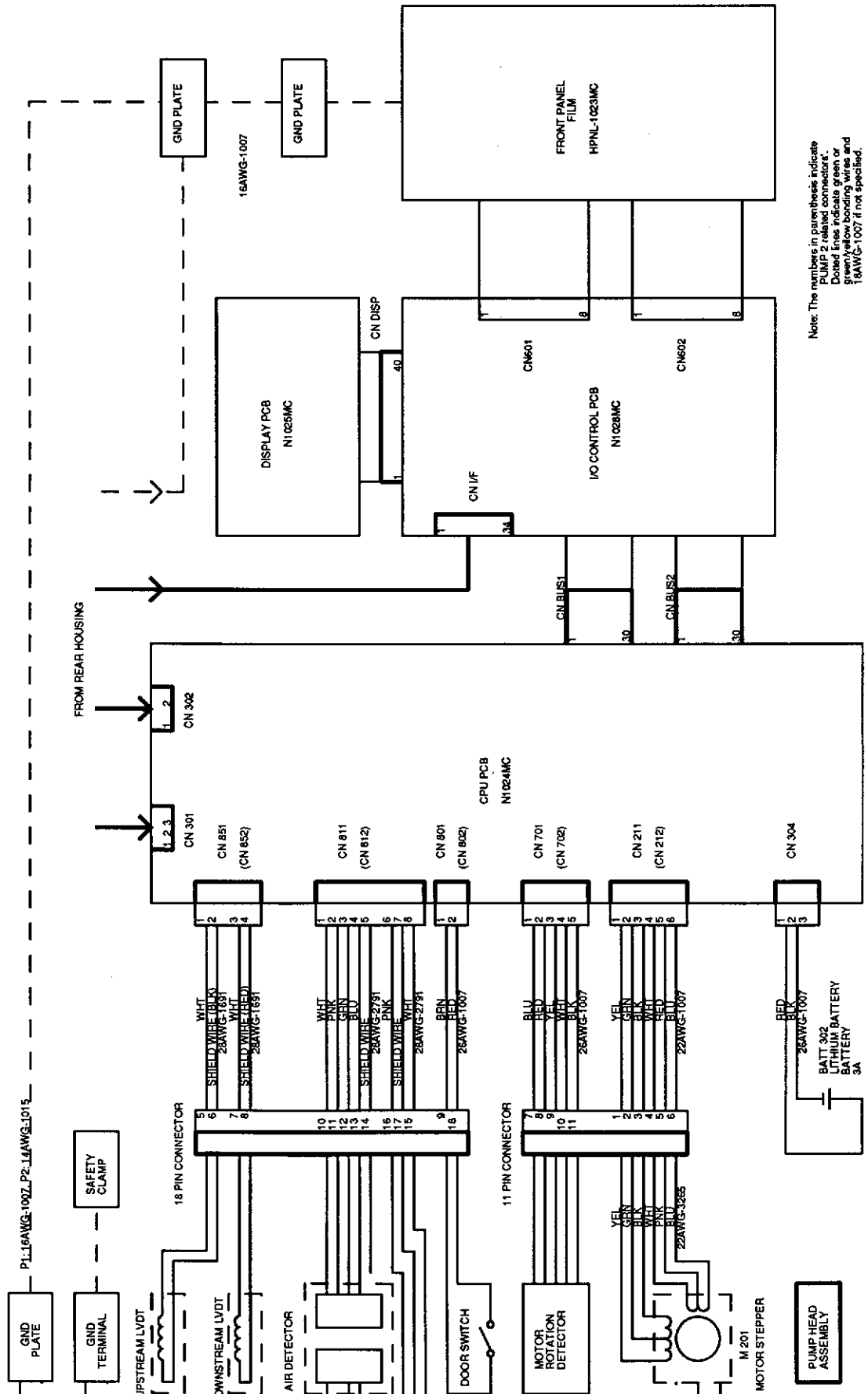


Figure 10-3. Front Housing Wiring Diagram

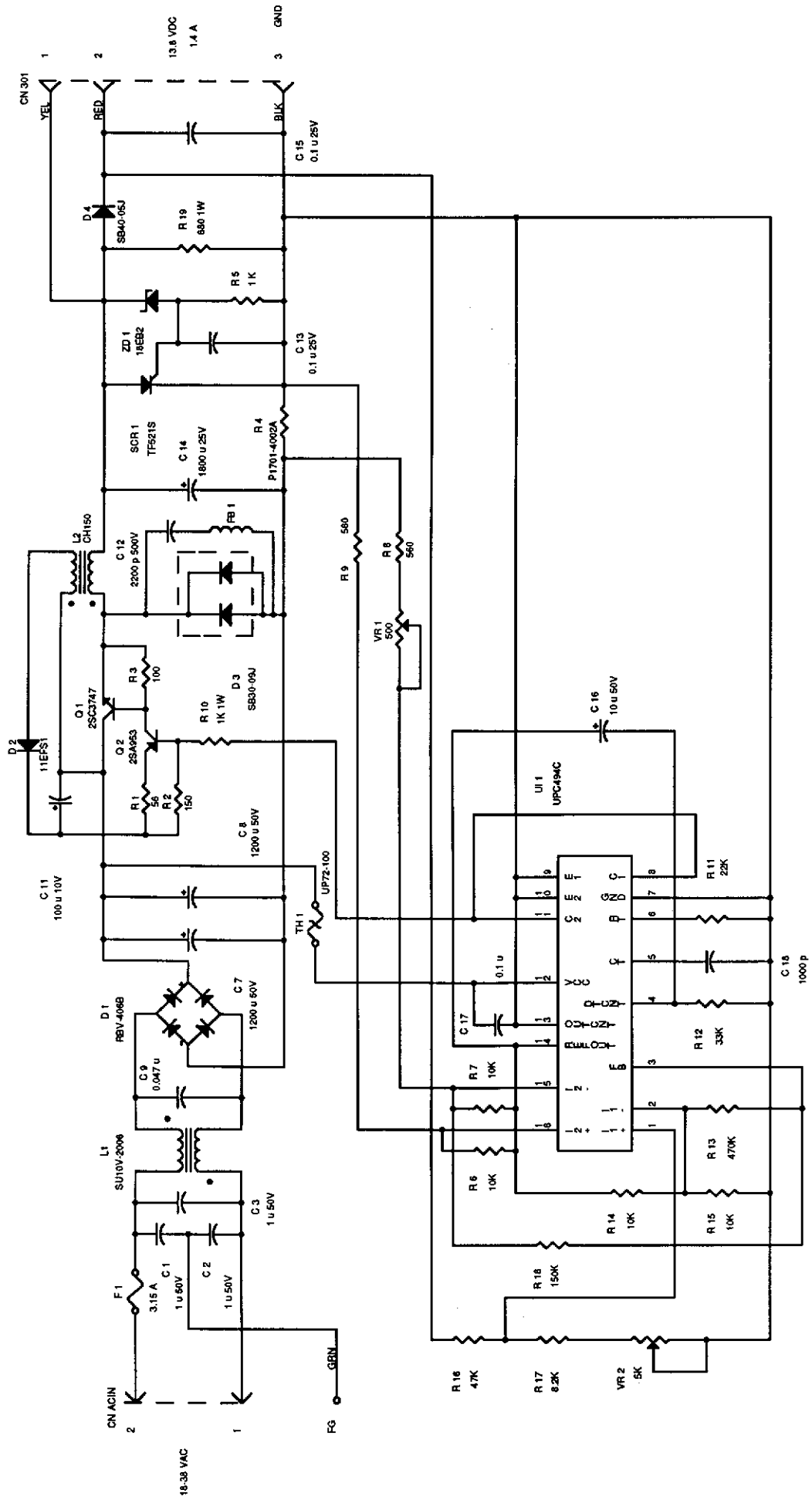


Figure 10-4. DC Power Supply Circuit

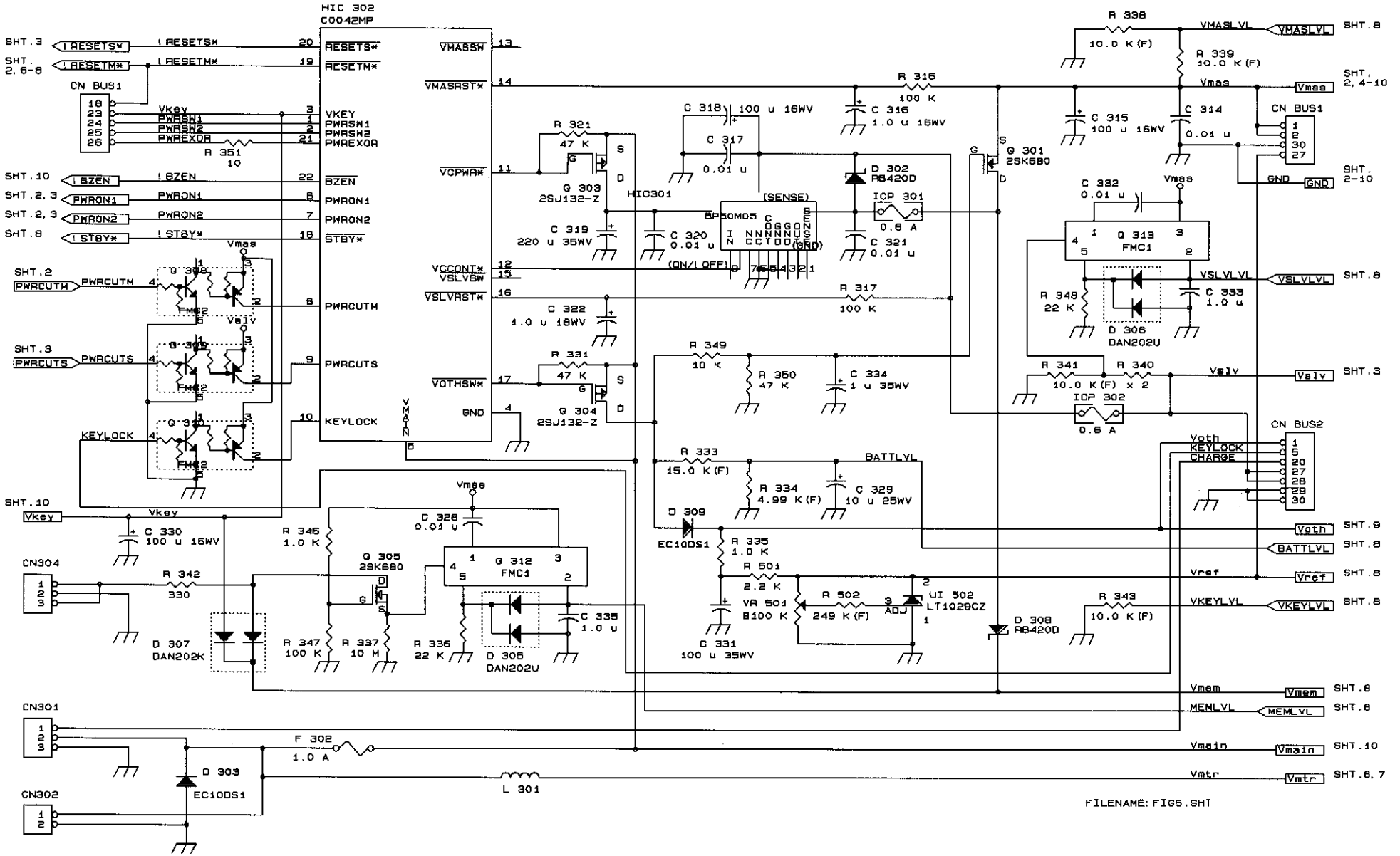


Figure 10-5.
CPU Board (Sheet 1 of 10), Power Supply Schematic Diagram

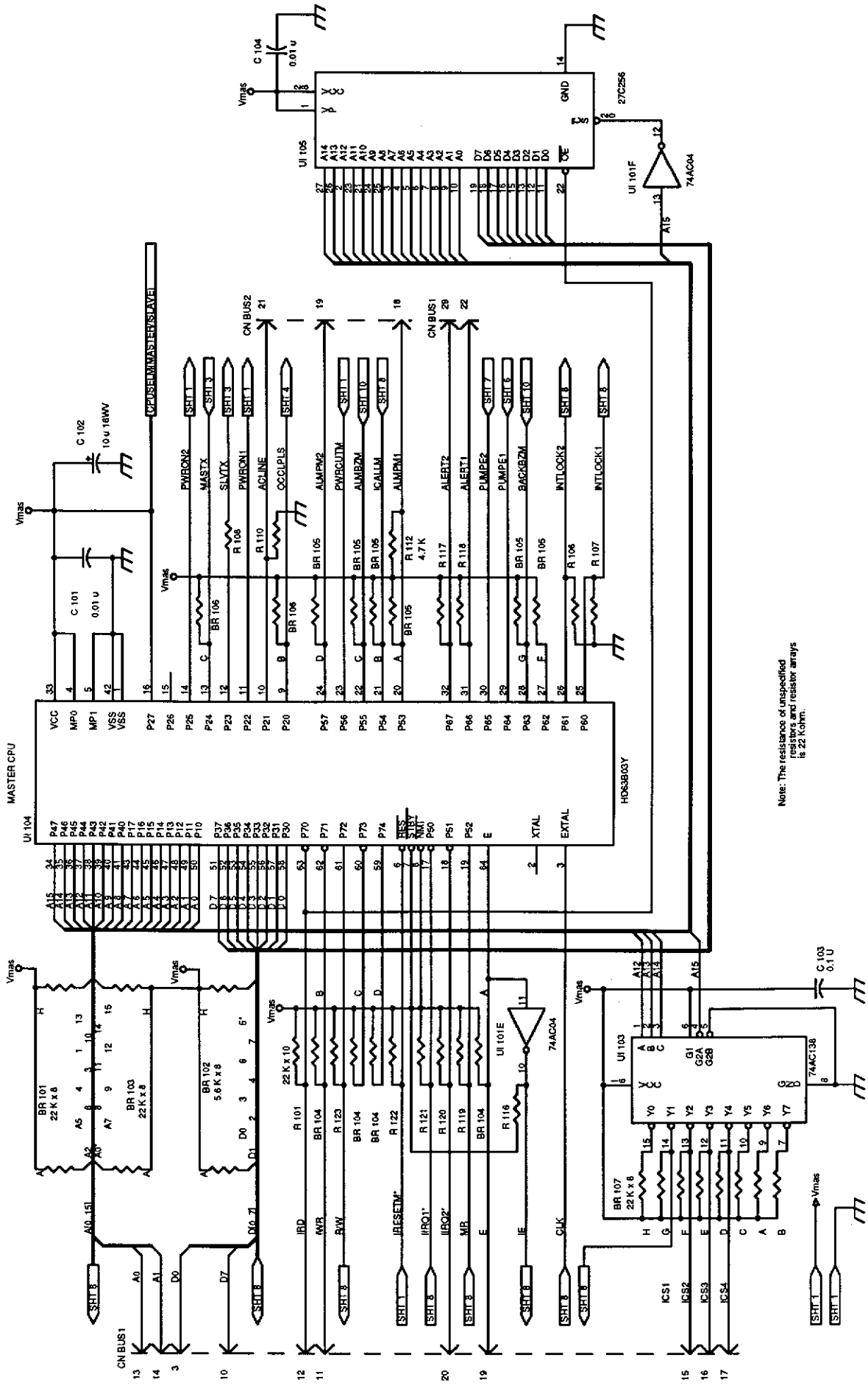
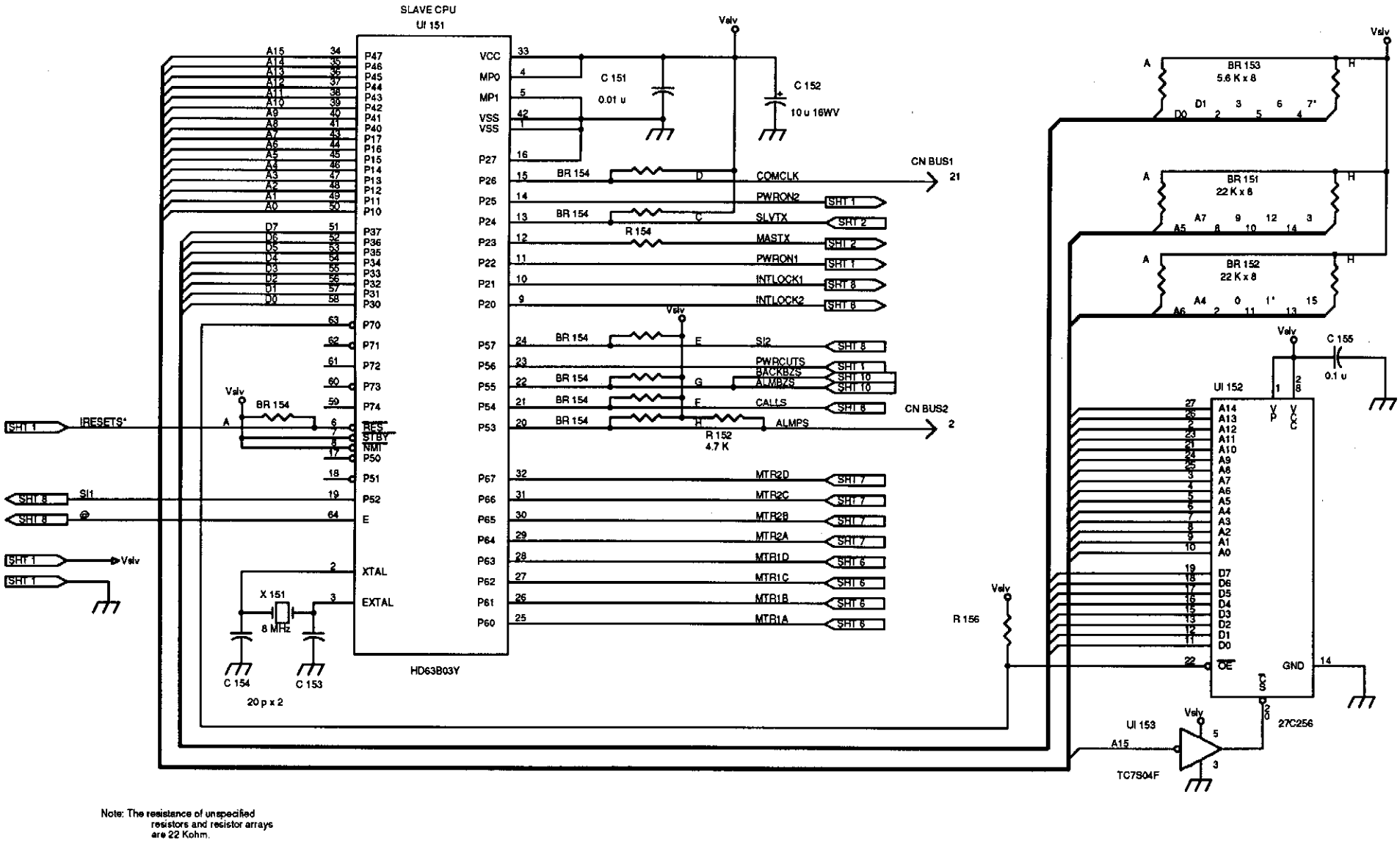


Figure 10-6.
CPU Board (Sheet 2 of 10), Master CPU Schematic Diagram



Note: The resistance of unspecified resistors and resistor arrays are 22 Kohm.

Figure 10-7.
CPU Board (Sheet 3 of 10), Slave CPU Schematic Diagram

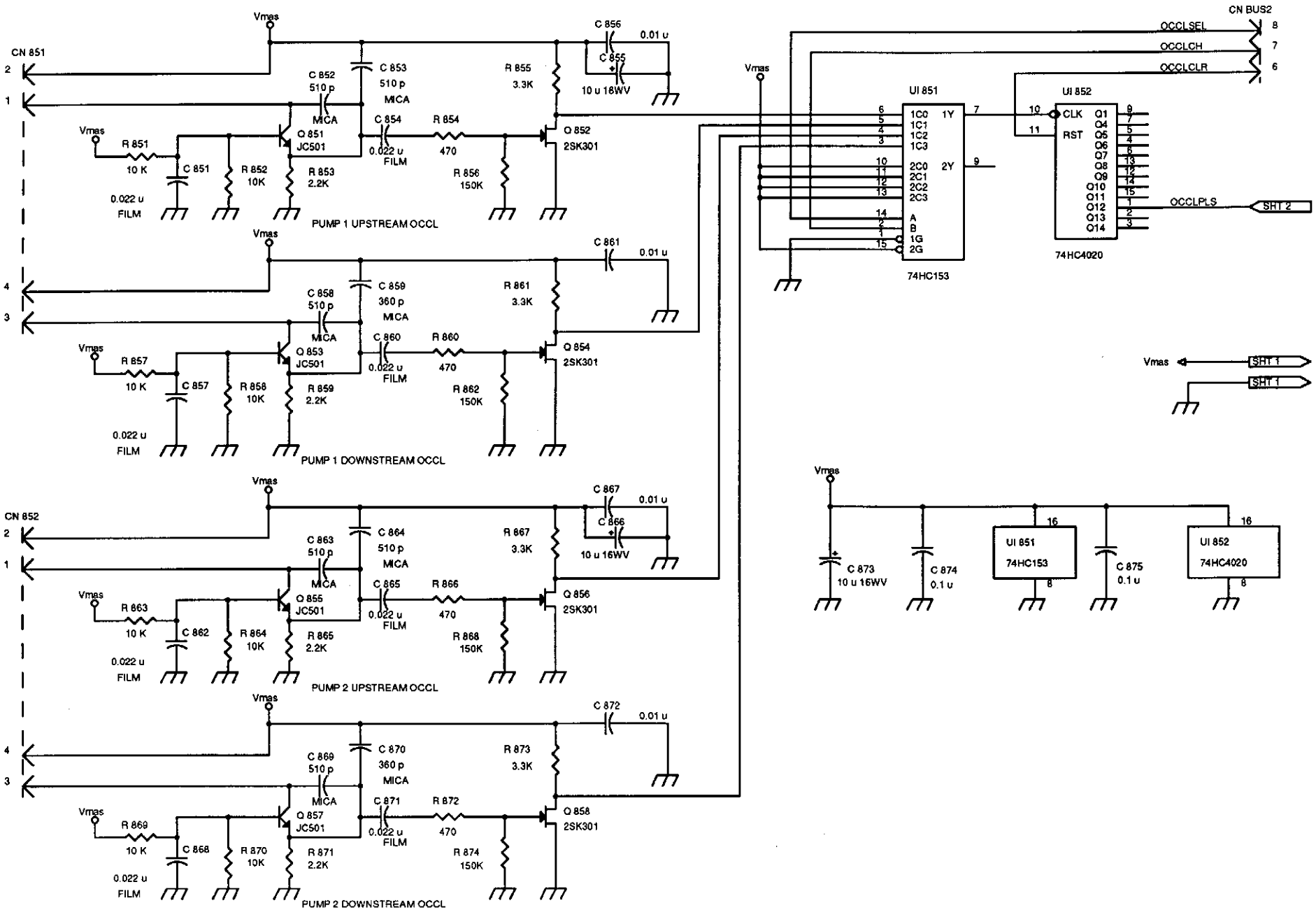


Figure 10-8.
CPU Boatrd (Sheet 4 of 10), Occlusion Detection Circuit

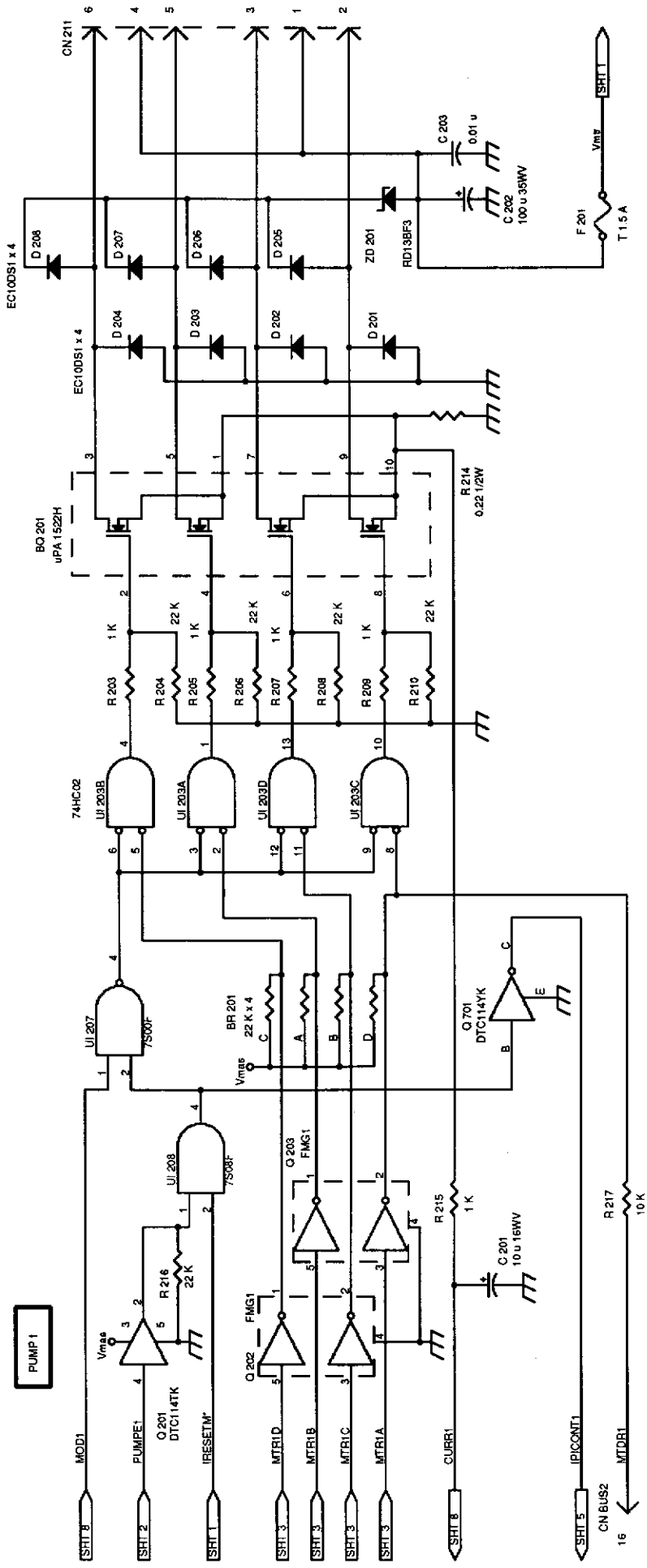


Figure 10-10.
CPU Board (Sheet 6 of 10), Pump 1 Motor Control Circuit

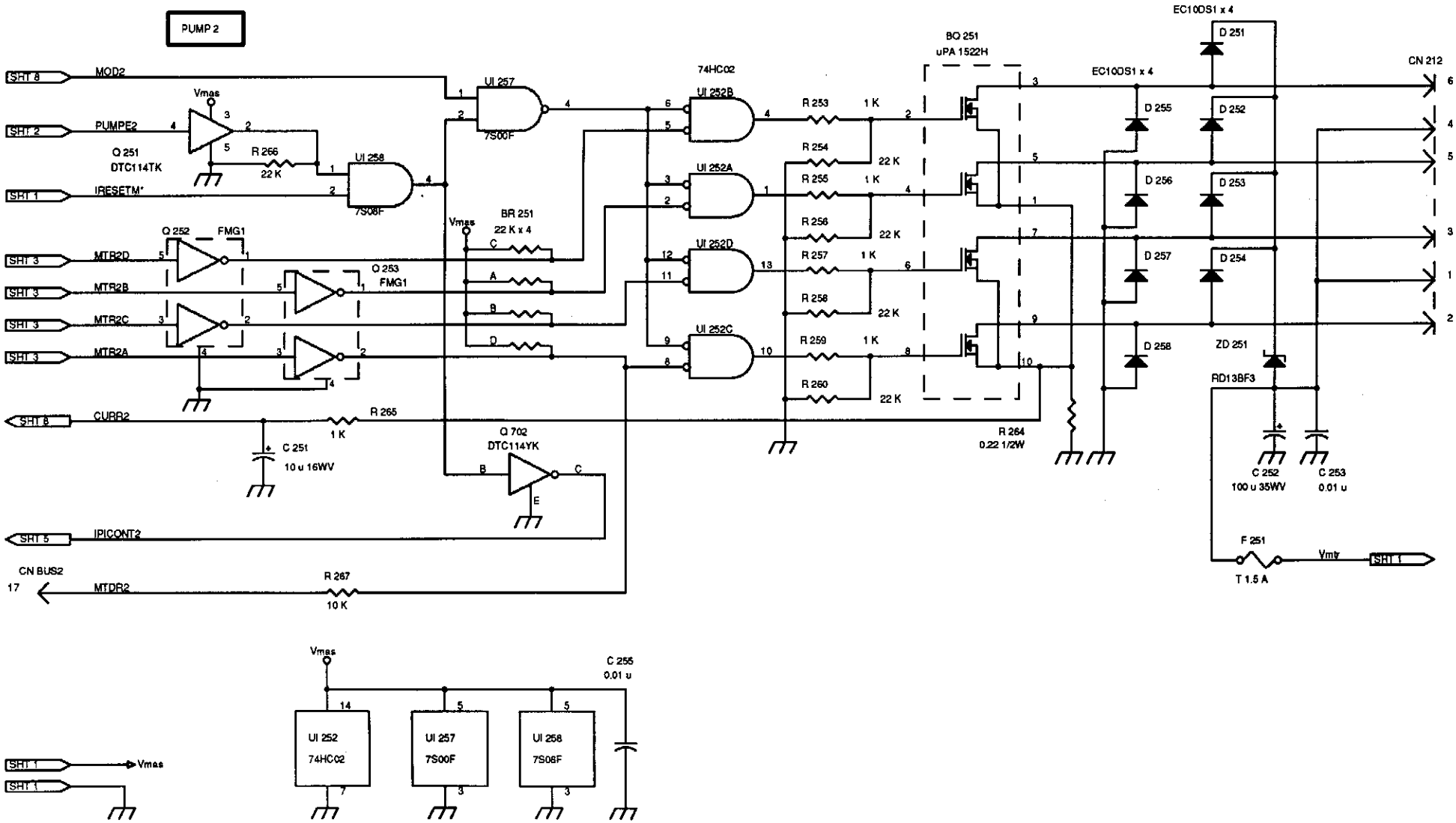


Figure 10-11.
CPU Board (Sheet 7 of 10), Pump 2 Motor Control Circuit

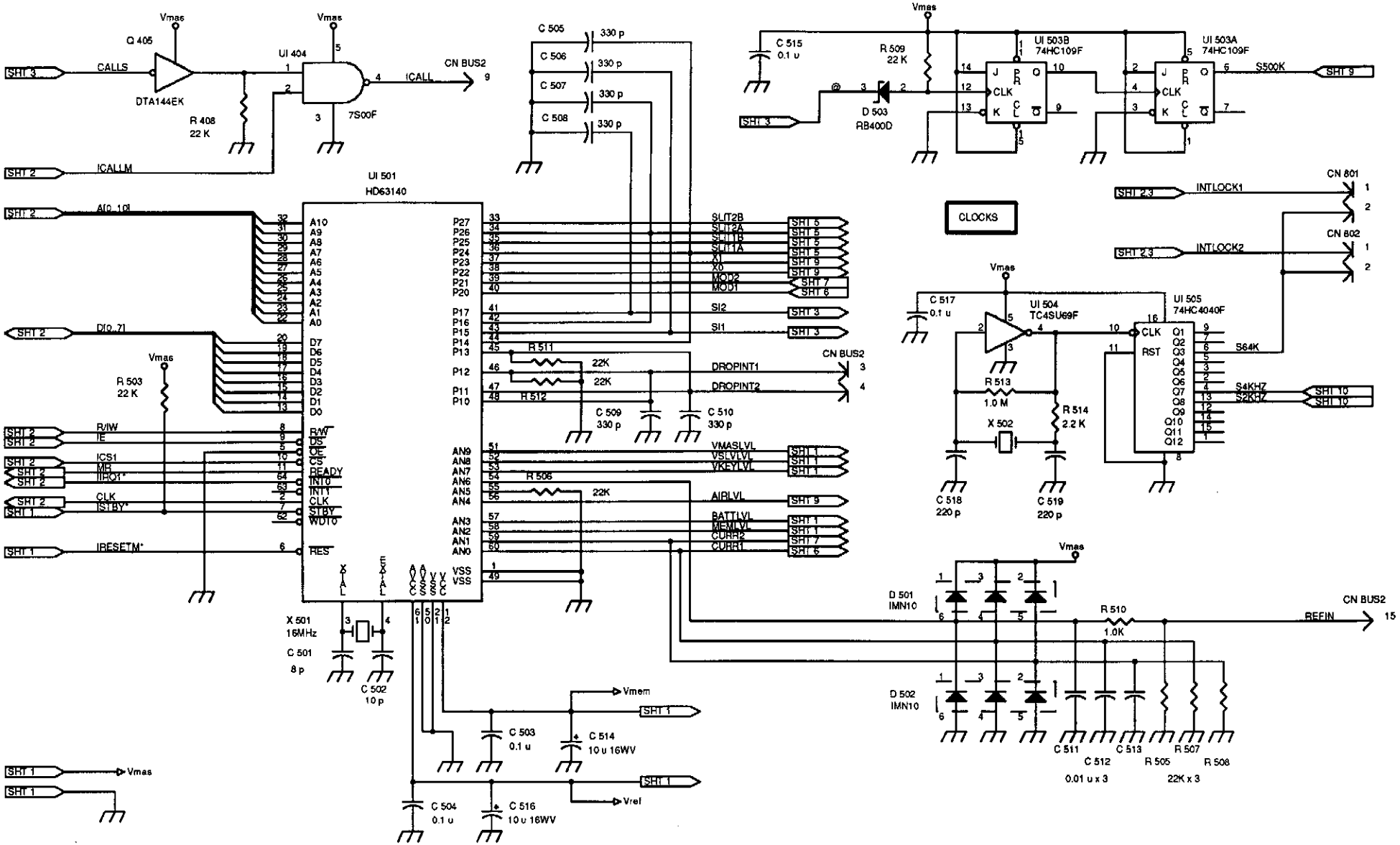


Figure 10-12.
CPU Board (Sheet 8 of 10), A/D Convertor and Clock Circuit

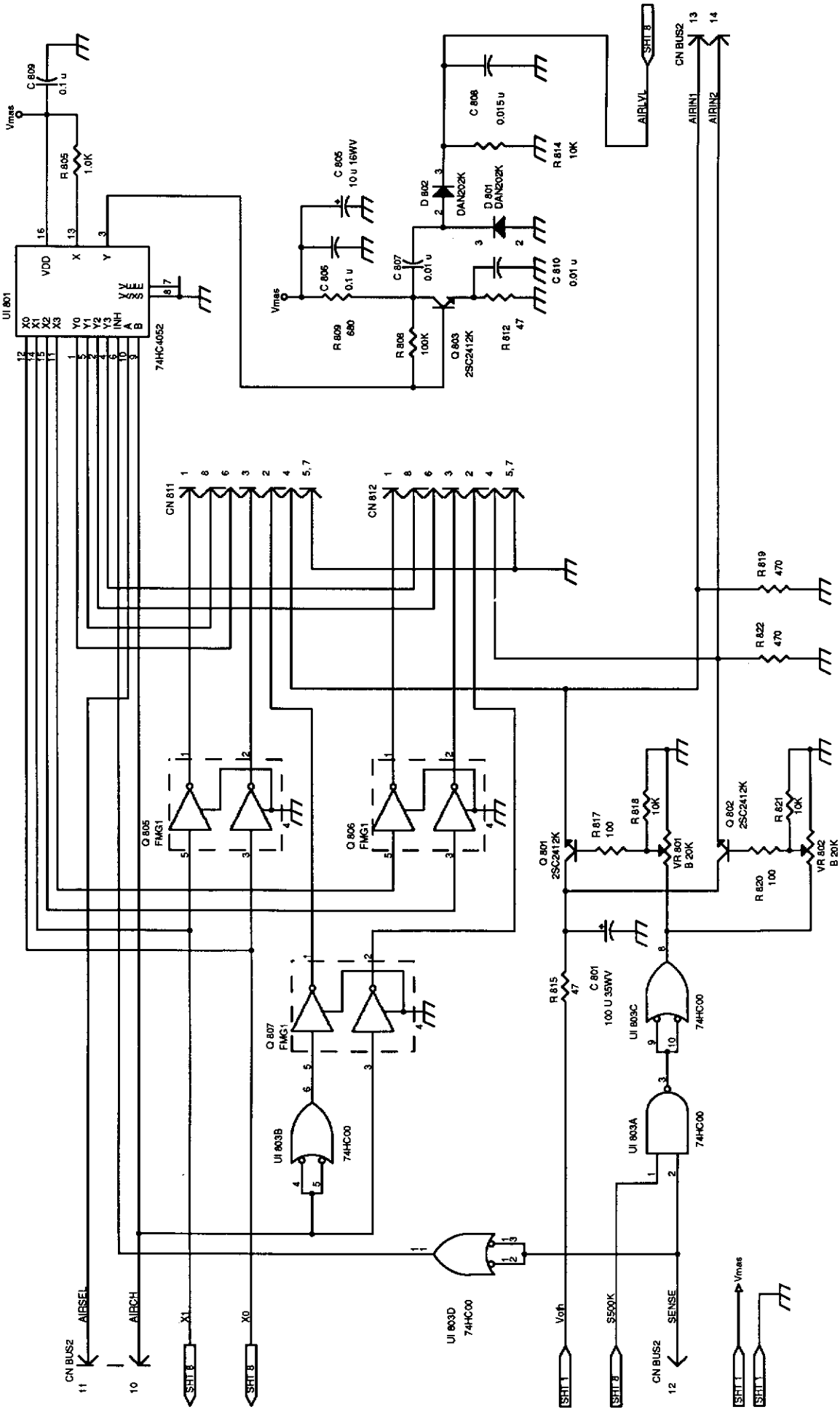


Figure 10-13.
CPU Board (Sheet 9 of 10), Air Detection Circuit

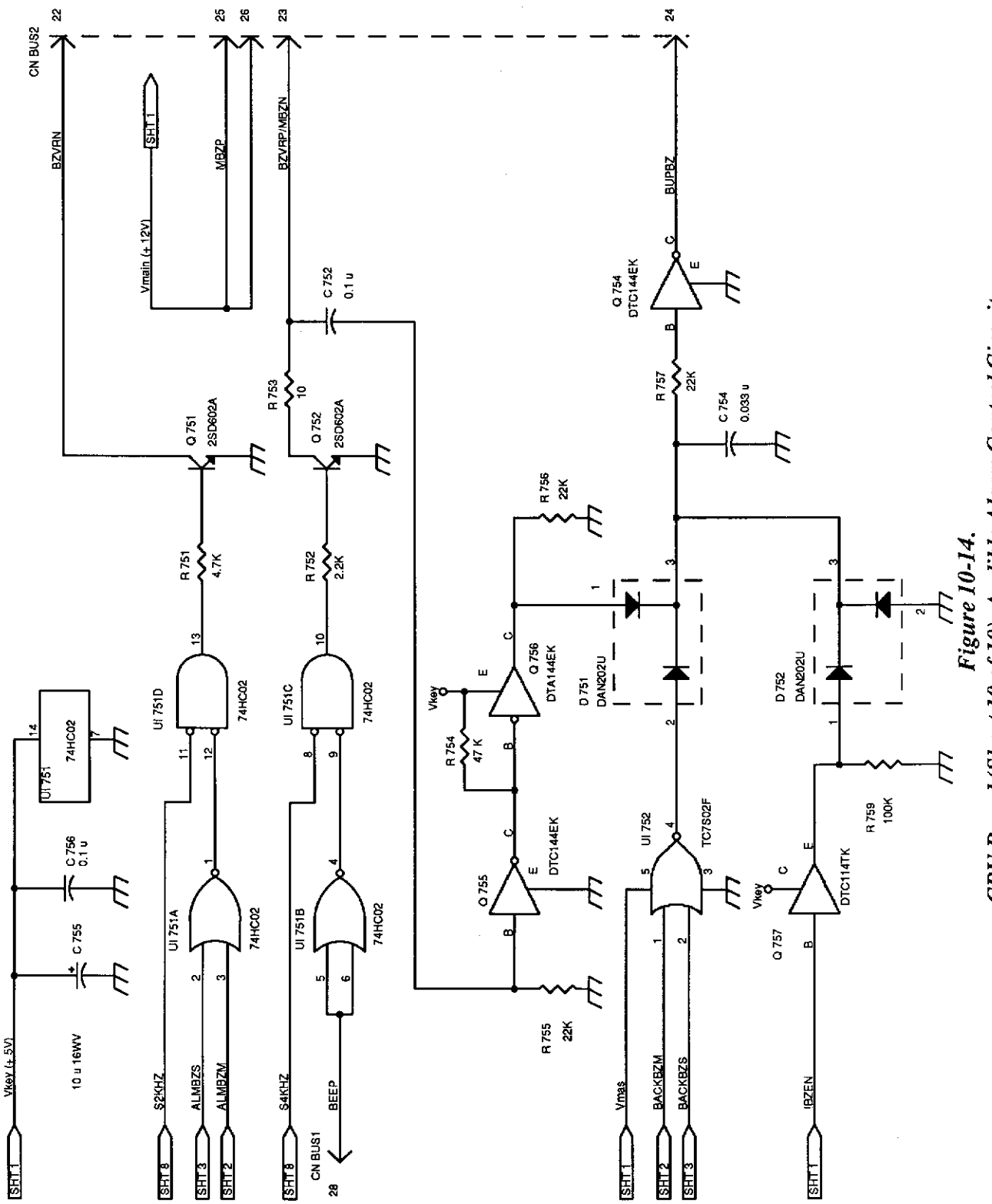


Figure 10-14.
CPU Board (Sheet 10 of 10), Audible Alarm Control Circuit

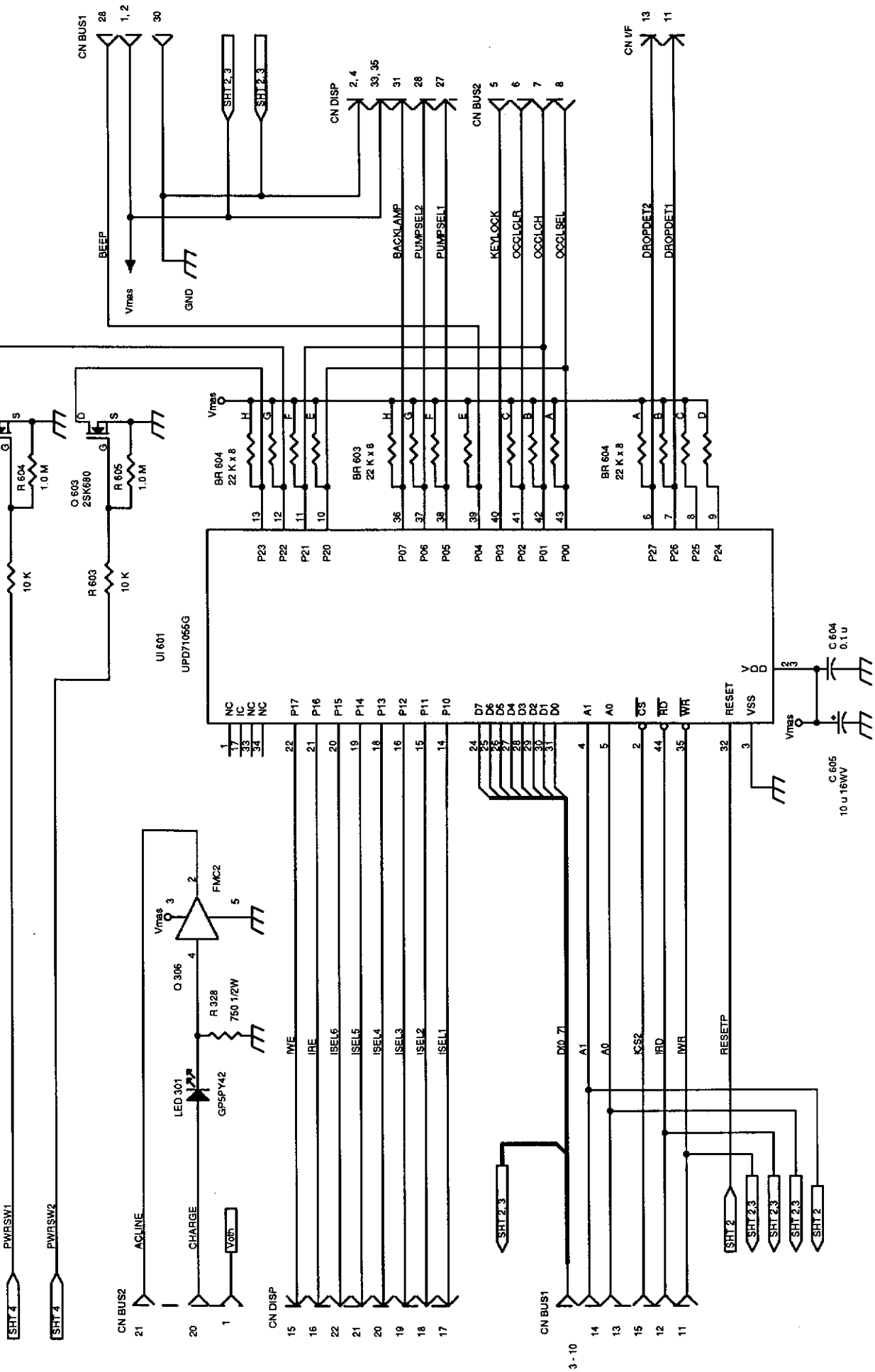


Figure 10-15.
I/O Board (Sheet 1 of 4), PPI and AC Detection Circuit

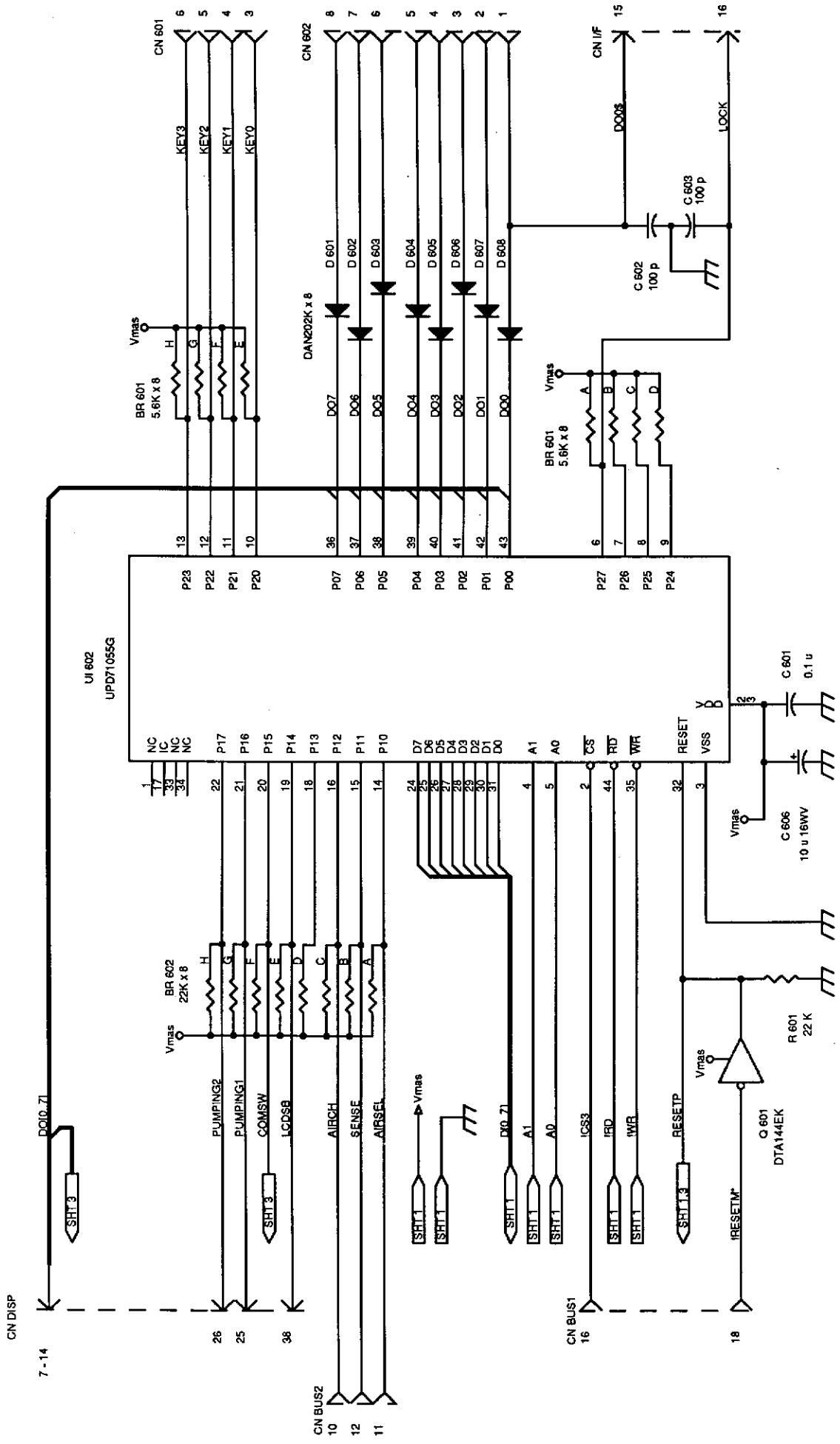


Figure 10-16.
I/O Board (Sheet 2 of 4), Key Interface Circuit

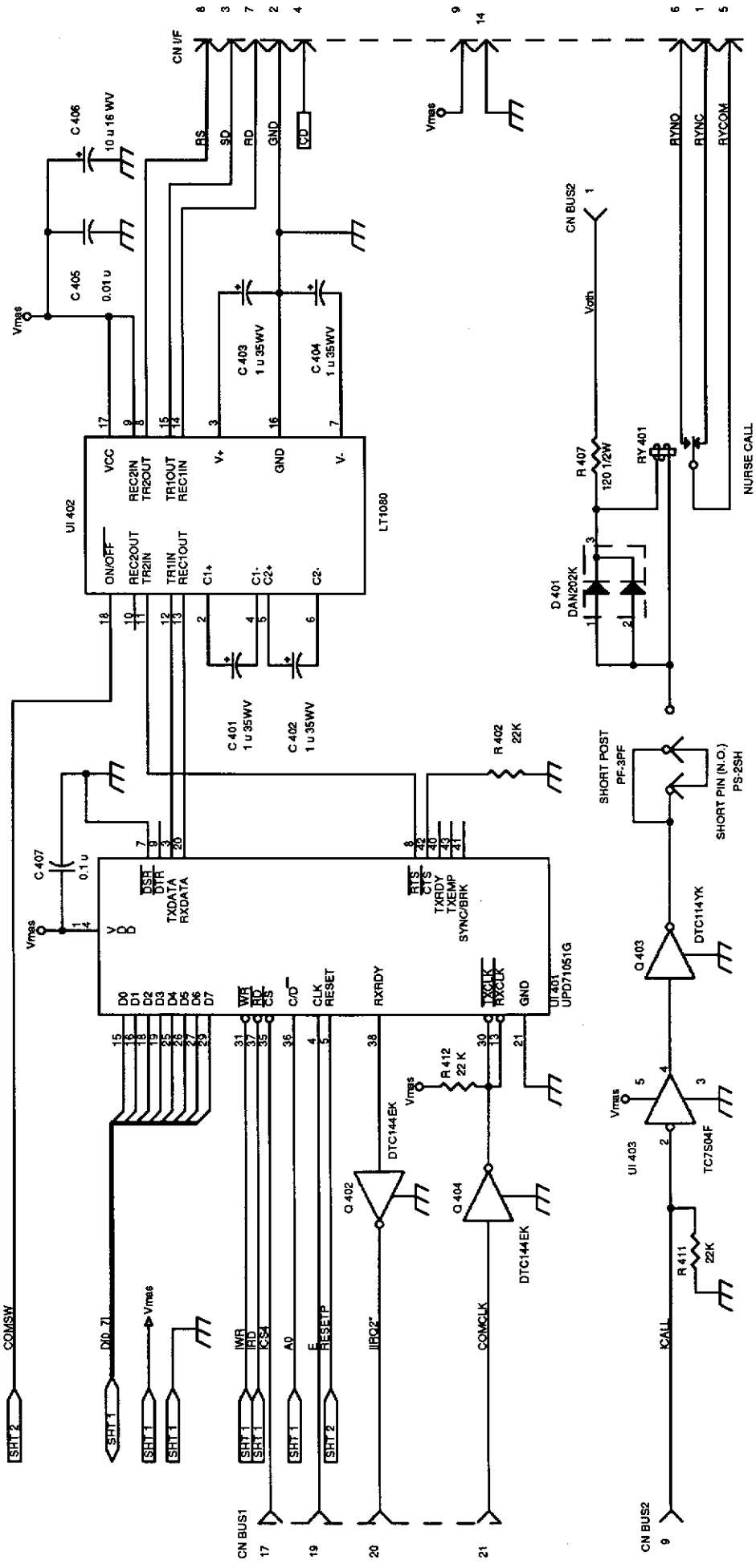


Figure 10-17.
I/O Board (Sheet 3 of 4), I/O Interface Circuit

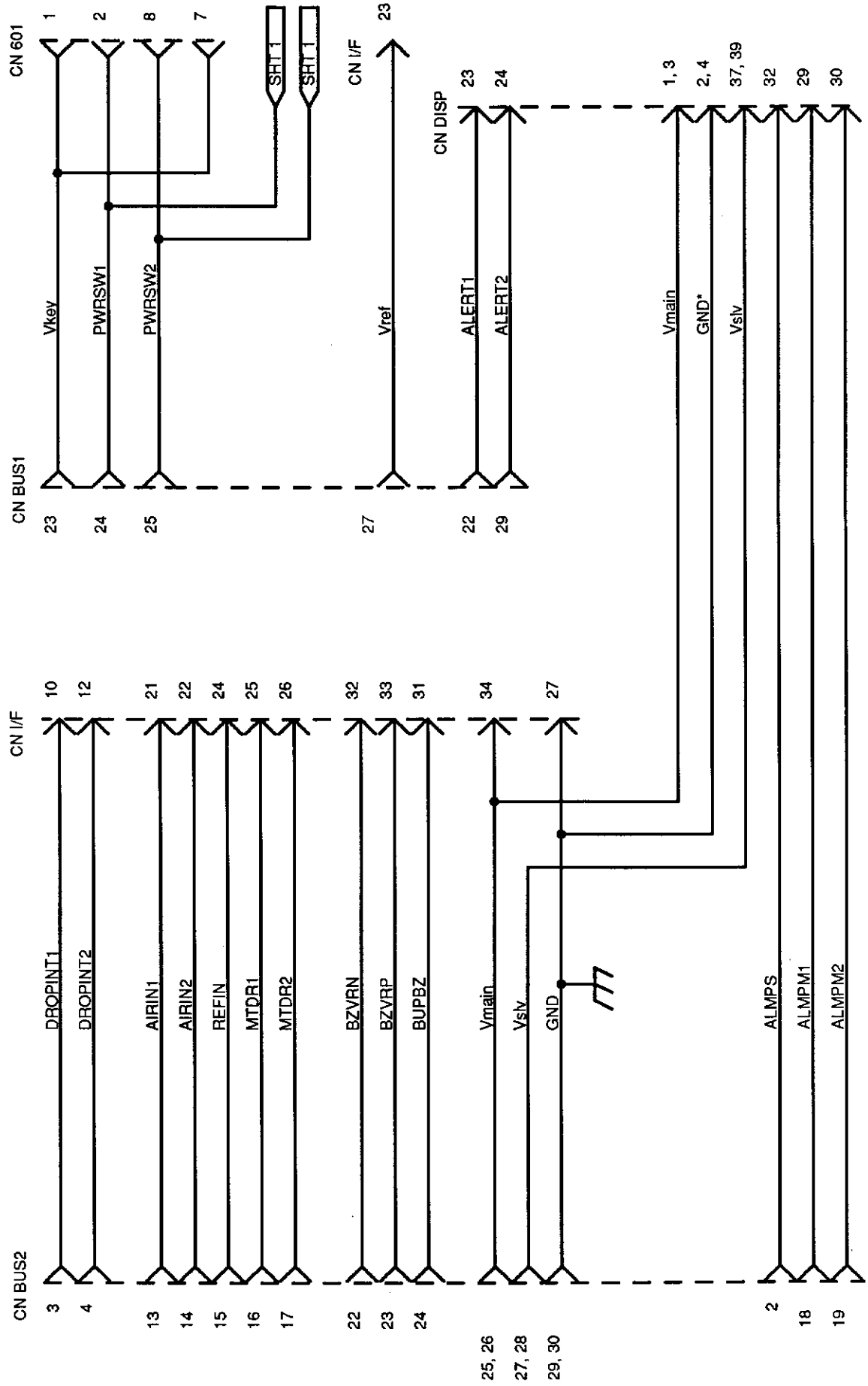


Figure 10-18.
I/O Board (Sheet 4 of 4), Signals Passing Through the I/O Board

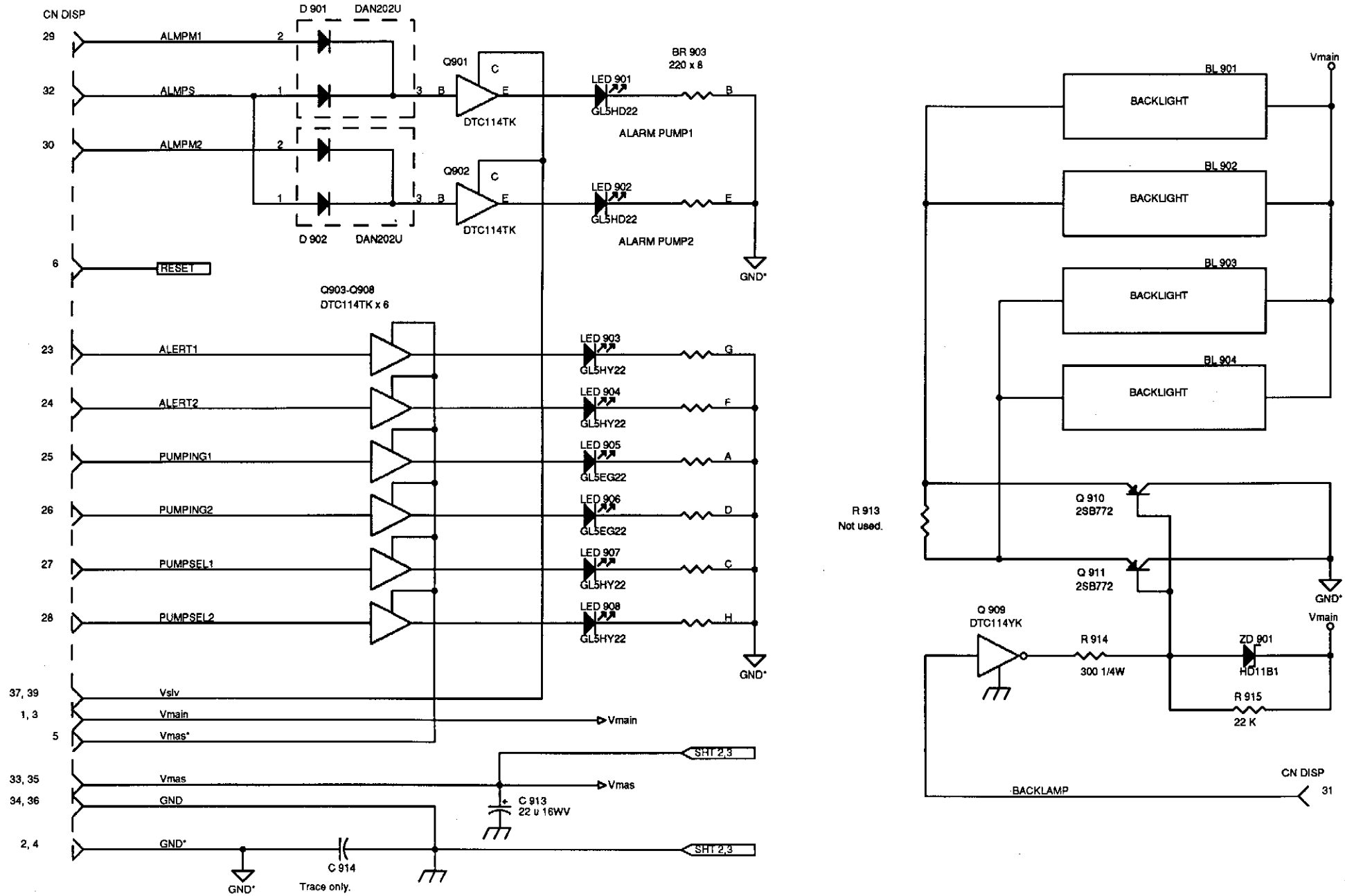


Figure 10-19.
Display Board (Sheet 1 of 3), LED Driver Circuit

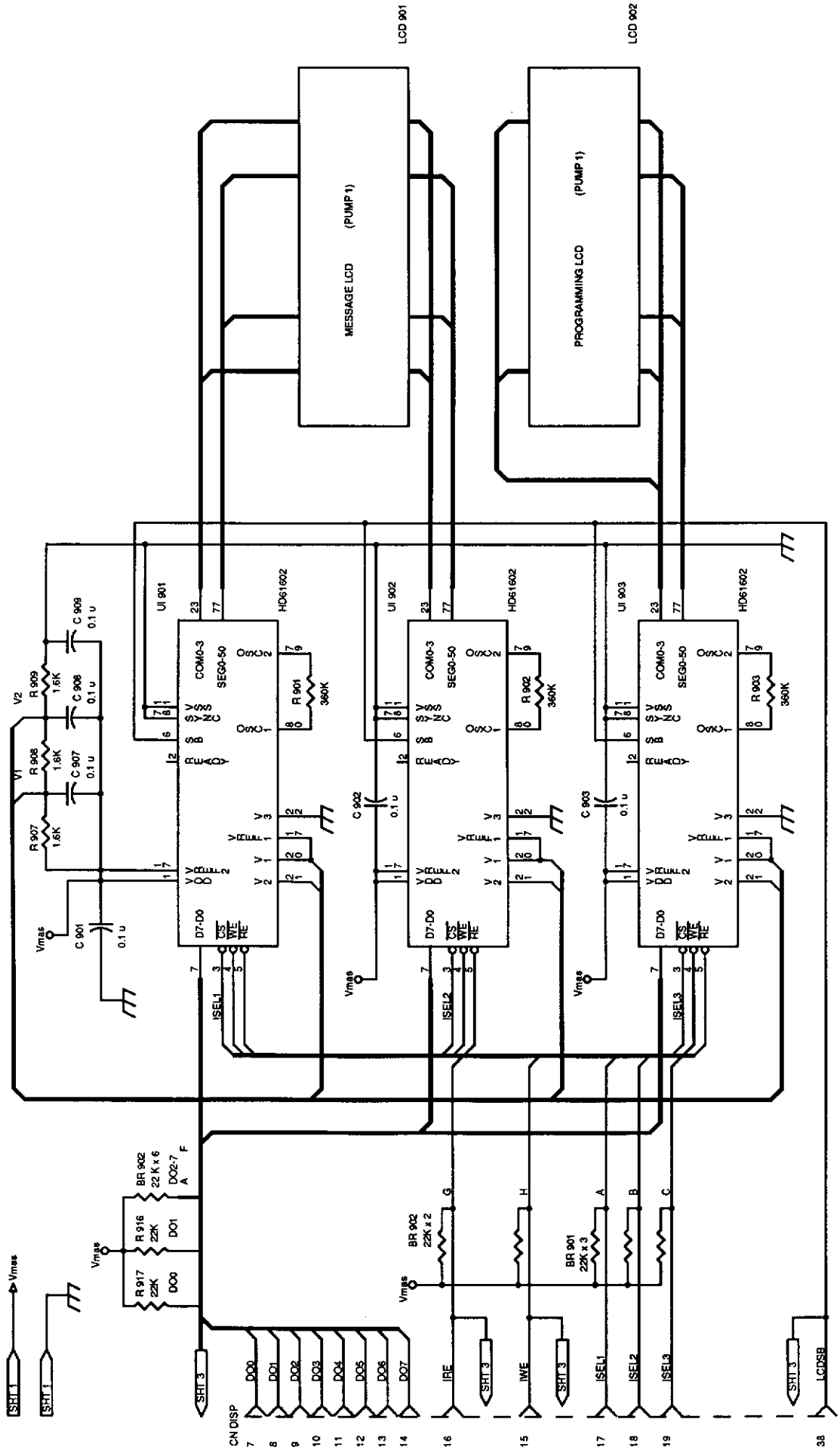


Figure 10-20.
Display Board (Sheet 2 of 3), Pump 1 LCD Control Circuit

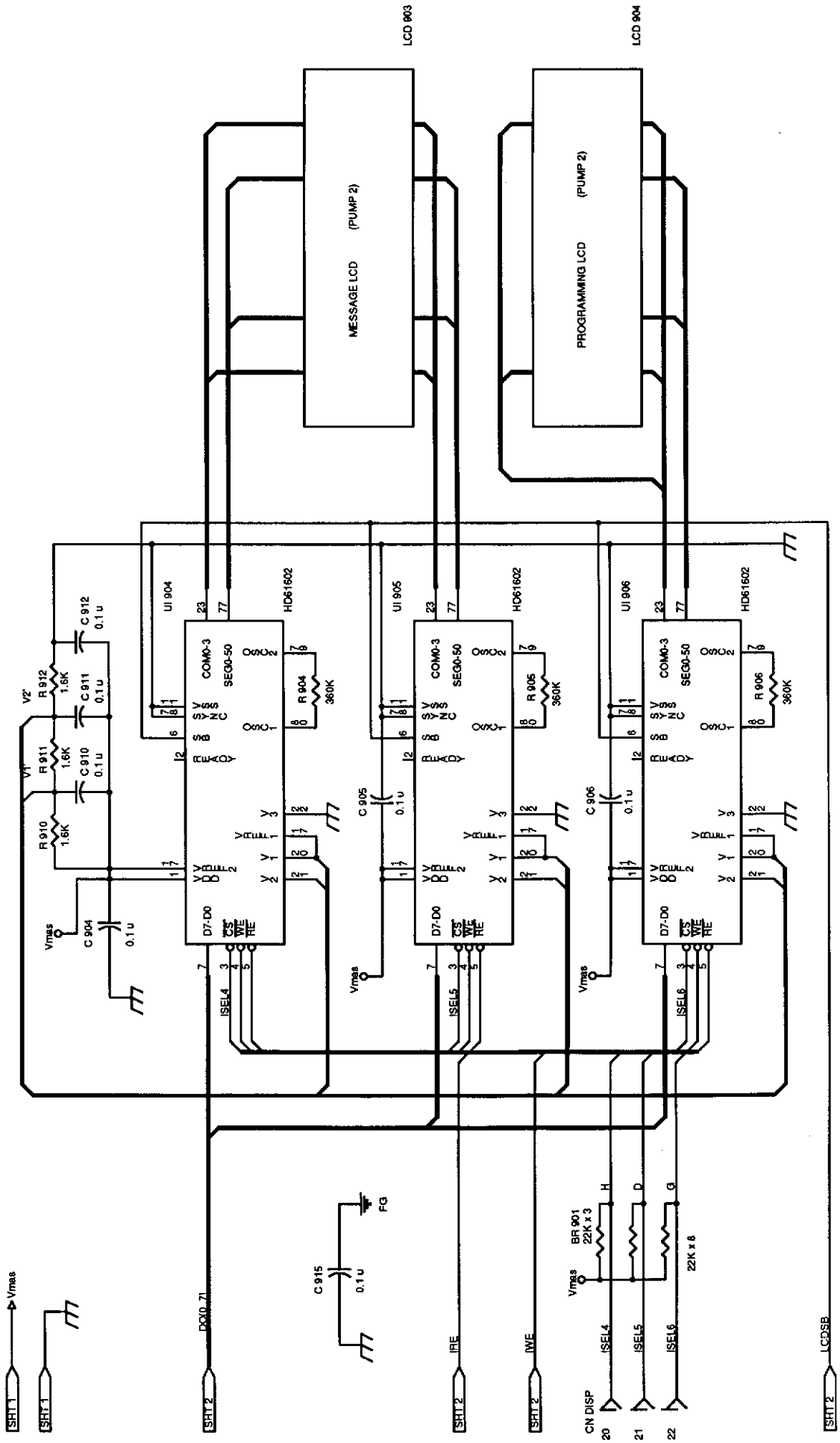


Figure 10-21.
Display Board (Sheet 3 of 3), Pump 2 LCD Control Circuit

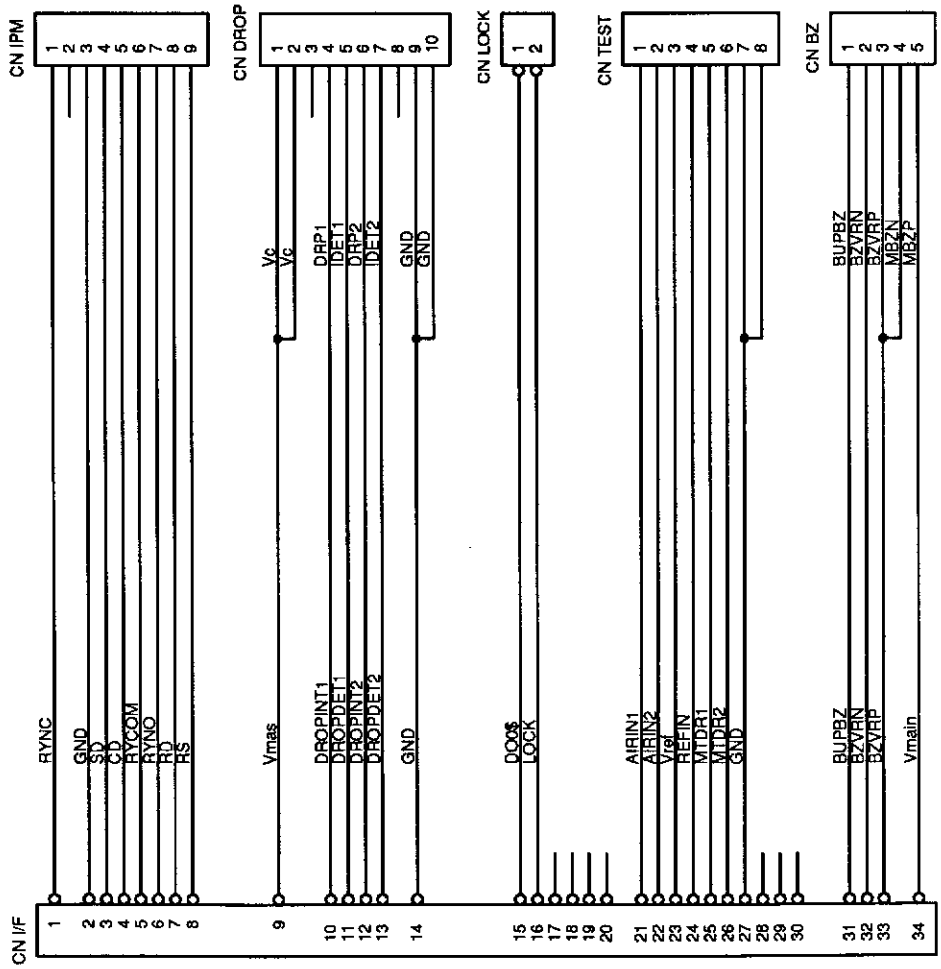


Figure 10-22. Terminal Board

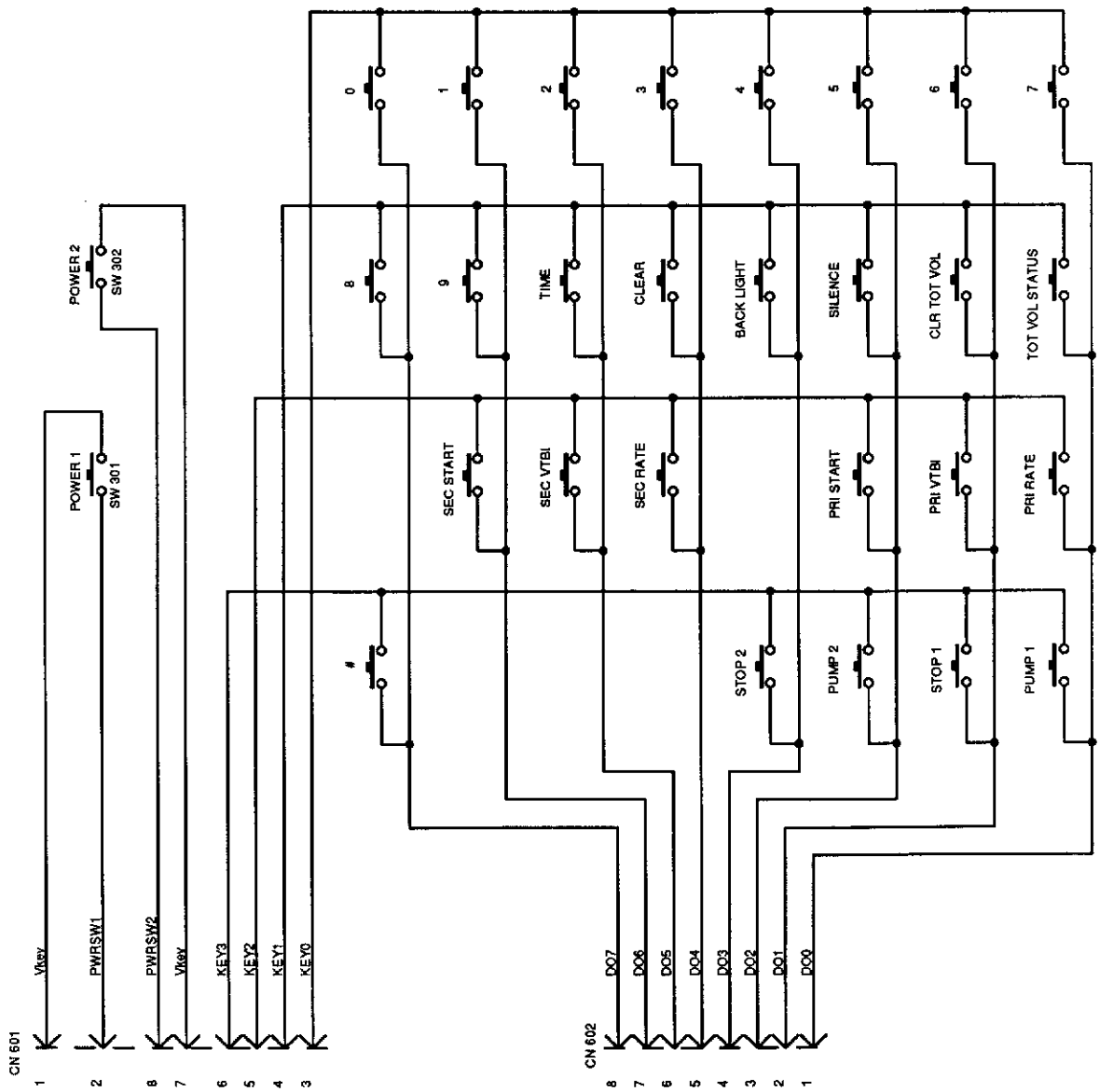


Figure 10-23. Front Panel Switches

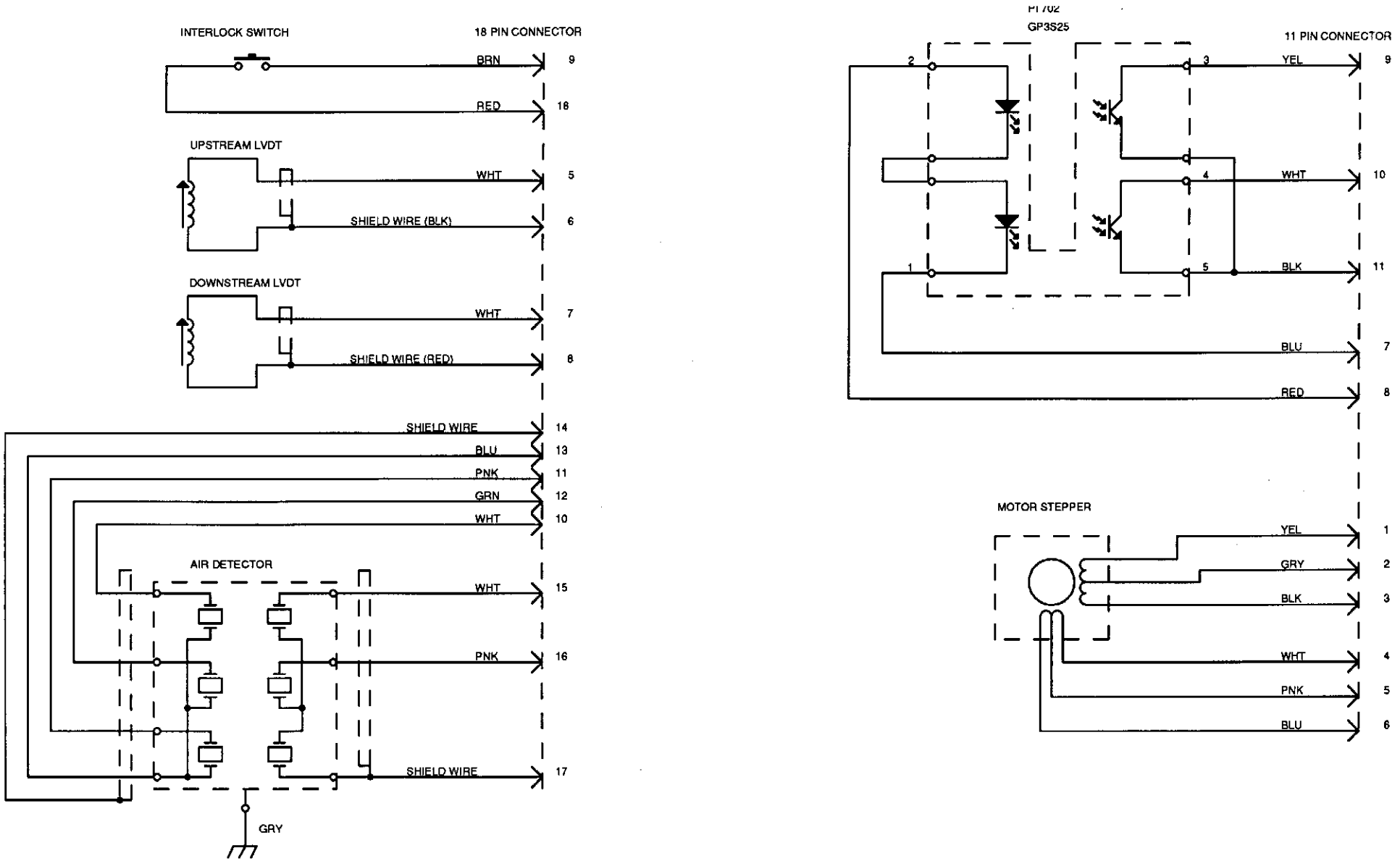


Figure 10-24. Pump Head Assembly Wiring Diagram

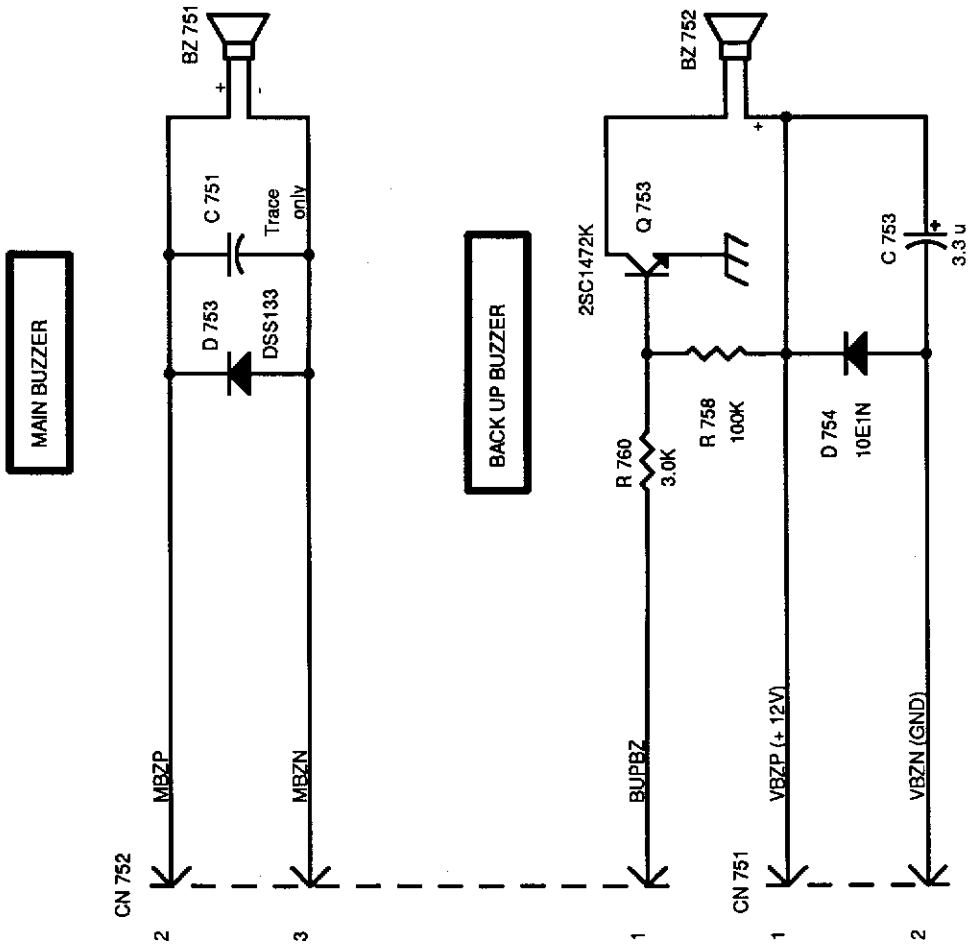


Figure 10-25. Audible Alarm Board Schematic Diagram

Appendix A

Key Sequences

This appendix contains a summary of all special key sequences applicable to the device.

A.0.1 User Key Sequences

ALARM RECALL

One or both pumps should be in the STOPPED mode. Codes will be recalled only for the pump that is ON and in the STOPPED mode. Press SILENCE and TOT VOL STATUS. Then within 1 second, press CLEAR TOT VOL. The display scrolls backward through the alarm codes and automatically exits at the end.

SOFTWARE VERSION NUMBER

Press SILENCE and either ON-OFF/CHARGE key to display the software version number. To exit, release these keys. The PRCS configuration number is also displayed in the upper line of the Pump 2 Message Display and the PRCS version number is displayed in the lower line of the Pump 2 Message Display.

FLOW CHECK

Press CLR and TOT VOL STATUS. When these keys are released, the display will disappear 10 seconds later. This display can be accessed whether the pumps are running or stopped.

INSPECT CONFIGURATION

Both pumps must be powered ON and in the STOPPED mode. Press TIME and TOT VOL STATUS and hold for 1 second. To exit, press this same combination, or either STOP key.

A.0.2 Service-Only Key Sequences

MODIFY CONFIGURATION

Press both STOP keys and one ON-OFF/CHARGE key. Scroll through the options with the SEC START key and lock them in with the PRI START key. See Table 1-1 for values. When finished, press the same ON-OFF CHARGE key that was initially pressed.

For example, in the CLR ALARM option:

To erase alarm log on Pump 1, press "1" and PRI START.
To erase alarm log on Pump 2, press "2" and PRI START.

The configuration settings should be inspected after exiting the Modify Configuration mode in order to verify that the settings were made correctly. See Inspect Configuration under User Key Sequences.

AUTOMATIC TEST MODES

Press CLEAR TOT VOL and one of the numbers between 1 and 5 (for Automatic Test Modes 1 through 5) and either ON-OFF/CHARGE key. To exit, press the same ON-OFF/CHARGE key that was used to get into the mode.

Mode 1 Displays occlusion sensor calibration values and A/D converter reference voltage.

Mode 2 Displays air sensor outputs, supply voltage to the master and slave CPU, main and memory battery voltages.

Mode 3 This is the flow volume mode used in production only. The PRI RATE key can be used to scroll through the preset rates of 10, 125, 250, 499, 999, and 1999 mL/hr. The sensors are all disabled. **This mode is not to be used on human patients, because the occlusion and air sensors are disabled.**

Mode 4 This is the aging mode used in production only. Both pumps are set to 500 mL/hr. **This mode is not to be used on human patients, because the occlusion sensors are disabled.**

Mode 5 This is the LCD test mode.

Appendix B

Data Sheet, Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump (2M8048)

This data sheet should be used to record the results obtained when performing the Operational Checkout of the device. The calibration values of the air sensors and occlusion sensors and the configuration option settings can also be recorded.

Flo-Gard® 6300 Dual Channel Volumetric Infusion Pump (2M8048)
Device Serial Number_____
Software Version Number_____

CONFIGURATION OPTION SETTINGS (See Section 1.5 to view or modify settings)

Initial Configuration (Factory-set values are shown in parentheses)		Modified Configuration to:	
OCCLUSION (LEVEL 1)	1( ) 2( ) 3( )	OCCLUSION	1( ) 2( ) 3( )
AUDIB SWI (OFF)	ON ( ) OFF( )	AUDIB SWI	ON ( ) OFF( )
AUTO RES (3)		AUTO RES	
DOOR OPEN (OFF)	ON ( ) OFF( )	DOOR OPEN	ON ( ) OFF( )
AIR SIZE (NORM)	NORM ( ) MIN( )	AIR SIZE	NORM ( ) MIN( )
ALARM INT (1)		ALARM INT	
ALERT INT (7)		ALERT INT	
MAX RATE (1999)		MAX RATE	
MAX VTBI (9999)		MAX VTBI	
FLOW CHECK (OFF)	ON ( ) OFF ( )	FLOW CHECK	
CLOSE CLAMP (ON)	ON ( ) OFF ( )	CLOSE CLAMP	

Comments:

DC VOLTAGE CALIBRATION VALUES (Test Mode 2)

DESCRIPTOR	WINDOW DISPLAYED	ACCEPTABLE VALUE		ACTUAL VALUE
		S/N 59000016 - 5902693Y	All Others	
V_{mas} = MAST	Pump 1 SEC RATE	472 - 552 (a)	472 - 579 (a)	
V_{slv} = SLAV	Pump 1 SEC VTBI	472 - 552 (a)	472 - 579 (a)	
V_{main} = MB	Pump 2 SEC RATE	688 - 735 (b)	688 - 735 (b)	
V_{mem} = BB	Pump 2 SEC VTBI	297 - 419 (c)	565 - 746 (d)	

(a) Actual voltage = Displayed data x 0.00976
(b) Actual voltage = Displayed data x 0.01952. Device must be plugged in when reading is taken.
(c) Actual voltage = Displayed data x 0.00488 + 1.6
(d) Actual voltage = Displayed data x 0.00488

AIR SENSOR CALIBRATION VALUES (Test Mode 2)

DESCRIPTOR	WINDOW DISPLAYED	ACCEPTABLE VALUE	ACTUAL VALUE	
			PUMP 1	PUMP 2
NORM	PRI RATE	350 - 650 (a)		
MIN	PRI VTBI	350 - 650 (a)		
NORM and MIN	PRI RATE, PRI VTBI	70 or less (b)		

(a) With tubing loaded and pump door closed
(b) With no tubing loaded

OCCLUSION SENSOR CALIBRATION VALUES (Test Mode 1)

DESCRIPTOR	WINDOW DISPLAYED	ACCEPTABLE VALUE	ACTUAL VALUE	
			PUMP 1	PUMP 2
Downstream Occlusion Sensor	PRI VTBI	3127 - 3199 (a)		
Upstream Occlusion Sensor	PRI RATE	3327 - 3399 (a)		
Upstream Occlusion Sensor	PRI RATE	3180 or less (b)		

(a) With thickness gauge (part no. UKOG1013.B) in place.
(b) Without thickness gauge in place.

OPERATIONAL CHECKOUT PROCEDURE

TEST	PUMP 1		PUMP 2	
7.3.2 Fluid Delivery Testing				
Self-Test (All LCD segments illuminate momentarily)	PASS	FAIL	PASS	FAIL
Primary Infusion	PASS	FAIL	PASS	FAIL
7.3.3 Door Open Alarm and/or Close Clamp Message Test				
DOOR OPEN and ***CLOSE CLAMP*** (if configured on) message(s) and audible alarm occur when door is opened during infusion	PASS	FAIL	PASS	FAIL
DOOR OPEN and ***CLOSE CLAMP*** (if configured on) message(s) without audible alarm occurs when door is opened & pump is stopped	PASS	FAIL	PASS	FAIL
7.3.4 Air Alarm Testing				
Pump detects air in tubing ( )110 µL ( )85 µL	PASS	FAIL	PASS	FAIL
7.3.5 Downstream Occlusion Testing				
Occlusion detected	PASS	FAIL	PASS	FAIL
7.3.6 Upstream Occlusion Testing				
Upstream occlusion detected	PASS	FAIL	PASS	FAIL
7.3.7 Battery Testing				
BATTERY appears when device is unplugged during operation	PASS		FAIL	
Device continues to operate while unplugged	PASS		FAIL	
BATTERY message disappears when device is plugged back in	PASS		FAIL	
7.3.8 Panel Lock Test				
Loc message appears when PANEL LOCK switch is pressed	PASS		FAIL	
Front panel keys are not accepted except TOT VOL/STATUS and BACKLIGHT	PASS		FAIL	
Loc message disappears when PANEL LOCK switch is pressed again	PASS		FAIL	
7.3.9 Safety clamp test				
Safety clamp prevents free flow	PASS	FAIL	PASS	FAIL
7.3.11 Alarm Volume				
Alarm volume	PASS		FAIL	
7.3.12 Electrical Safety Tests				
Leakage Current is 50 µA or less	PASS		FAIL	
Ground Impedance is 0.1 Ω or less	PASS		FAIL	
Power cord inspection	PASS		FAIL	

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