Symptom	Possible Cause	Action
Humidifier reservoir has scaling.	Use of tap water	Replace humidifier reservoir.

4.6 Additional Troubleshooting Tips

Following are tips on taking many of the measurements and diagnosing the failures that are referred to in the troubleshooting charts. For some tips, it may be necessary to determine the revision level of the relay board. The revision code is located in a triangle printed on the component side of the PCB. Refer to Figure 6-34 and Figure 6-35.

4.6.1 Raising and Lowering the Elevating Base

In the event of a system failure, it may be possible to raise or lower the elevating base in the service mode. Hold down the override button (>37) to bring up the service screen. The pedals are now activated and may assist in troubleshooting or transport.

If the switches still do not operate it may be possible to raise or lower the elevating base using the pedal function on page 2 of the service screen.

4.6.2 Incubator Heaters and Bed Safety Thermostat

There are two 115 volt incubator heaters rated at 225 watts at 104 volts and mounted at opposite ends of the incubator heat sink. They are always connected in parallel and are powered by isolated 115 volts from the heater isolation transformer. This voltage is switched by the incubator SSR.

The resistance of each heater is about 48 ohms and they are in parallel so you should measure about 24 ohms. Note that the bed safety thermostat is in series with the heaters so if the reading is open circuit you must take readings at the connectors under the bed to determine which is defective.

To measure the incubator heater resistance on units with revision 9 or lower relay boards, disconnect the black wire on the incubator SSR and the white wire on the output of the isolation transformer and measure between these 2 wires.

To measure the incubator heater resistance on units with revision 10 or higher relay boards, disconnect the black wire on the incubator SSR and the connector from J54 on the relay board. Measure between harness connector pin 4 and the black wire.

The incubator heater and bed safety thermostat resistance can also be measured by the removing the bottom cover and measuring directly at the components.

4.6.3 Power Supplies

The 5V and 12V supplies are generated on the power supply. +5STBY is generated on the relay board. These voltages are distributed to the control board, display driver board, servo oxygen board, and expansion slots through a harness with a series of 4 pin connectors. The easiest place to measure the power supplies is at one of the spare 4 pin connectors on this power bus.

Signal	Location	Wire Color	Value
+5V	J42 pins 1-2	Orange and blue	4.75 to 5.25
+5VSTBY	J42 pins 1-4	Orange and green	4.75 to 5.25
+12V	J42 pins 1-3	Orange and red	10.8 to 13.2

The 5VSTBY should also be present during power fail.

+5VAN and -5VAN are generated on the control board and are only used on the control board. They can be measured on the test points on the control board.

Signal	Location	Value
+5V	TP2 pins 1-4	4.75 to 5.25
+5VSTBY	TP2 pins 3-4	4.75 to 5.25
+5AN	TP1 pins 5-6	4.75 to 5.25
-5AN	TP1 pins 4-6	-4.0 to -5.5

4.6.4 Switches/Thermostat

Use switch status diagram on the second service screen to assist in troubleshooting the switches.

Humidity reservoir	Relay bd J32 pins 2-3	Closed when reservoir is closed
Add water thermostat	Relay bd J32 pins 1-3	Opens when reservoir needs water

Elevating base		
Left or right up	Relay bd J40 pins 2-4	Closed when either switch is pressed
Left or right down	Relay bd J40 pins 1-4	Closed when either switch is pressed

The following switches are membrane switches. When closed the resistance should be less than 200 ohms.

Display Touch Panel Switches		
Alarm Silence	Display Driver bd J21 pins1-2	Closed when switch is pressed
>37 degrees	Display Driver bd J21 pins1-3	Closed when switch is pressed
Servo Control	Display Driver bd J21 pins1-4	Closed when switch is pressed
Up	Display Driver bd J21 pins1-5	Closed when switch is pressed
Down	Display Driver bd J21 pins1-6	Closed when switch is pressed
Intervention	Display Driver bd J21 pins1-8	Closed when switch is pressed
Manual Mode Inc.	Display Driver bd J21 pins1-9	Closed when switch is pressed

4.6.5 Humidifier Heater/Safety Thermostat

The humidifier has two separate heater elements rated at 225 watts at 104 volts. They are connected in parallel for 115 volt operation and in series for 230 volt operation. The humidifier safety thermostat is in series with the heater. It opens at 130 +/-5 C and closes at 90 +/-8 C. Measure the resistance at J53.1 to J53.3.

The resistance of each heater is about 144 ohms so it should measure about 72 ohms for 115 units, 288 ohms for 230 units.

4.6.6 Compartment Air Probe and Patient Probes

Use the service screen to read the temperature of the compartment and patient probes. There are two thermistors in each probe. During stable temperature conditions the thermistors should read the same resistance within a few ohms.

Patient probe #1	Control bd J4 pins 1-3, 2-3
Patient probe #2	Control bd J2 pins 1-3, 2-3
Compartment probe	Control bd J1 pins 1-2, 3-4

Temperature (C)	Resistance (Ohms)
20	12527
25	10000
30	8037
35	6500

4.6.7 Incubator Heat Sink Sensor Thermistor

Use the service screen to read the resistance of the heat sink sensor.

Thermistor	Control bd J3 pins 1-2

Temperature (C)	Resistance (Ohms)
20	25000
25	20000
30	16102
35	13048
40	10636
80	2506
90	1827
100	1353
110	1017
120	775

4.6.8 Elevating Base Motor

If you must replace a footswitch when the bed is all the way down, use pedal screen on service screen to raise or lower the bed.

The e-base is driven at 24 volts DC (acceptable range 24-32). The following chart shows the control signal values and the output voltages for each of the motor conditions.

Switch	Control Signals, Relay Board				E-base	
	J37 pin 23	J37 pin 26	J37 pin 24	J37 pin 27		
	24V SELECT	E/H ACTIVATE	NVERTPOLARITY	E/H SELECT	J45-1	J45-2
Raise E-base	0	0	1	0	+24V	Gnd
Lower E-base	0	0	0	0	Gnd	+24V
None	NA	1	NA	NA	NA	NA

4.6.9 Troubleshooting the 50 Pin Ribbon Cable

All of the communication between the control and relay boards passes through the 50 pin ribbon cable. Many of the troubleshooting procedures in this manual recommend that you verify continuity for specific pins in the cable. Because it is difficult to remove and measure the cable without possibly changing the resistance, it is suggested that you keep a spare 50 pin ribbon cable to use as a troubleshooting tool.

