EXA3000 Installation Troubleshooting

Goal

The goal of this skill set is to be able to troubleshoot possible EXA3000 installation problems.

Objectives

Students should learn the following from this skill set:

- The safeties and interlocks on the EXA3000 and how to use this information for troubleshooting.
- Possible power problems and solutions encountered during an installation.
- Possible heat exchanger problems and solutions encountered during an installation.
- Possible tester problems and solutions encountered during an installation.
- How to swap high speed cables to identify a bad cable.
- Possible acceptance program problems and solutions encountered during an installation.

In This Skill Set

Resources

1. *EXA3000 Test System Installation Guide*

   http://www.san-jose.tt.slb.com/doc_page/soc.htm

   or

   T&T Home Page→San Jose Technical Info→Technical Publications→ SOC Testers→ EXA3000 Installation Guide

2. *EXA3000 Test System Site Preparation Guide*

   http://www.san-jose.tt.slb.com/doc_page/soc.htm

   or

   T&T Home Page→San Jose Technical Info→Technical Publications→ SOC Testers→ EXA3000 Site Preparation Guide

3. *EXA3000 High Speed Cabling Diagram*

   http://zapata.san-jose.tt.slb.com:922/cse_ix_cd/EXa3000_data/OPEN_ME_EXA3000.html

   or

   T&T Home Page→San Jose Technical Info→Technical Support Information→ Test Systems→ CDROM→ Explore the EXA3000 Section→ EXA3000 High Speed Cabling Diagram

4. *EXA3000 Harness/Cabling Block Diagram*

   http://zapata.san-jose.tt.slb.com:922/cse_ix_cd/EXa3000_data/OPEN_ME_EXA3000.html

   or

   T&T Home Page→San Jose Technical Info→Technical Support Information→ Test Systems→ CDROM→ Explore the EXA3000 Section→ EXA3000 Harness/Cabling Block Diagram

5. *ITS 9000 Heat Exchanger Schematic*

   http://zapata.san-jose.tt.slb.com:922/cse_ix_cd/IX_CD_data/OPEN_ME_FRIST_page_IX.html

   or

   T&T Home Page→San Jose Technical Info→Technical Support Information→ Test Systems→ CDROM→ Explore the IX Section→ Heat exchanger schematics

6. *Integrated Heat Exchanger Manual*

http://www.san-jose.tt.slb.com/doc_page/soc.htm

or

T&T Home Page→San Jose Technical Info→Technical Publications→ SOC Testers→ EXA2000/EXA3000 Heat Exchanger Manual

Information 1

System Safeties and Interlocks

The system has a series of safeties and interlocks providing equipment and personal protection. These safeties are both hardware and software.

This section contains explanations and actions that can be used for debugging purposes regarding the safeties and interlocks in the EXA3000 test system. The next section will deal with power up problems, and knowledge of this information will be helpful at that time.

The interaction between the various safeties and interlocks can be seen in the following documentation, and can be accessed in the Resources section.

- *EXA3000 Test System Site Preparation Guide*-EMO Schematic
- *EXA3000 Harness/Cabling Block Diagram*
- *ITS 9000IX/KX Heat Exchanger Schematic*
- *Integrated Heat Exchanger Manual*

Power Conditioner

The power conditioner for the EXA3000 system is a 60 KVA, 90 KVA, or 130 KVA unit with the following safety features:

- The power conditioner has interlock switches to force an Emergency Machine Off (EMO) condition if a service panel is removed.
- Thermal sensors inside the unit force an EMO condition if the temperature of the transformer core exceeds vendor recommendations.
- The input circuit breaker is Under-Voltage (UV) controlled. Removing the 24 volts DC from the UV unit forces the circuit breaker to trip into the off position.
- The input circuit breaker is lockable in the off position.
- The power conditioner generates an EMO voltage of 24 volts DC. Both the AC inputs and the DC outputs are fused.

Heat Exchanger

The heat exchanger provided with the EXA3000 system is a common base unit integrated into the system mainframe. The AC power and control cables are internal to the system. The heat exchanger's safety features are:

Coolant Pump

The overload on the coolant pump motor trips if the motor is in an overloaded condition. Normally this does not occur. The overload condition must exceed the overload adjustment for an extended period of time.

To reset the pump motor in an overload condition, allow the motor to cool down and then press the manual reset button on the overload unit.

Coolant Pressure Switch

The coolant pressure switch protects the liquid-cooled portion of the system in the event of pressure loss by removing the DC ENABLE signal, which trips the power conditioner output breakers CB2 and CB3, removing power to the liquid-cooled portion of the system.

Water Sensor

The water sensor, which is a float switch designated S9, is located in the bottom tray in the heat exchanger. It detects the presence of water in the tray. When S9 opens, it breaks the EMO loop and causes a system EMO.

Coolant Reservoir

The holding tank has two floats inside that monitor the coolant level.

- The first float warns if the coolant level is low. Two amber lights come on. One is located on the face of the heat exchanger control panel and the other is on top of the heat exchanger.
- The second float indicates that the holding tank is empty and stops the coolant pump. The DC ENABLE signal is removed, which trips the power conditioner output breakers CB2 and CB3, removing the power to the liquid-cooled portion of the system.

Heat Exchanger 24 Volts AC

Inside the heat exchanger, the transformer TR-1 supplies a 24-volt AC signal. The primary input voltage for TR-1 is 208 volts AC, with a secondary output voltage of 24 volts AC. The transformer is rated at 100 VA.

Both of the inputs and the output of TR-1 are fused. The input fuses, F1 and F2, are 2 amp, 600 volt AC fuses. The output fuse, F3, is a 5 amp, 32-volt AC fuse.

Room Sensor

A room sensor is located next to the system's main AC panel. This sensor is connected to the heat exchanger controller and provides information about room temperature and humidity. From these two values, a room dew point calculation is made.

- If the dew point exceeds 57 degrees Fahrenheit, or 13.9 degrees Celsius, the coolant operating temperature changes to 65 degrees Fahrenheit, or 18.3 degrees Celsius.
- If the dew point rises above 63 degrees Fahrenheit, or 17.2 degrees Celsius, the liquid-cooled portion of the system is turned off to prevent condensation.

Heat Exchanger Controller

The heat exchanger controller is programmed to maintain proper coolant temperatures. Table 1 shows the temperatures of the different control points and their resulting actions. Figure 1 is a graph of the normal operating set point operational sequence.

To convert Celsius (°C) to Fahrenheit (°F):

$$T_F = \frac{9}{5} T_C + 32$$

To convert Fahrenheit (°F) to Celsius (°C):

$$T_C = \frac{5}{9} (T_F - 32)$$

Table 1: Controller Temperatures for Heat Exchanger Operations

Temp (°F)	***Temp (°C)***	***Purpose***	***Action***
95	35	Room high temp limit	Cooling unit off
89.6	32	High temp ALARM	Cooling unit off in manual mode
80.6	27	High temp ALARM	Cooling unit off in auto mode
68	20	Power down cooling	DC ENABLE off
66.02	18.9	Chiller temp OK	DC ENABLE on
66.92	19.4	High temp warning in high coolant temp mode	Blink light
64.94	18.3	High coolant temp mode	
62.96	17.2	Low temp warning in high coolant mode	Blink light
62.96	17.2	Humidity-2 sensor	Cooling unit off
61.88	16.6	High temp warning in normal coolant temp mode	Blink light
59.9	15.5	Normal coolant temp mode	
57.92	14.4	Low temp warning in normal coolant temp mode	Blink light
57.2	13.9	Humidity-1 sensor	If dew point is < 57.2 °F, or 13.9 °C, then the set point is the normal coolant temp of 59.9 °F, or 15.5 °C. If dew point is > 57.2 °F, or 13.9 °C, then the set point is the high coolant temp of 64.94 °F, or 18.3 °C.
55.4	13	Low temp ALARM	Cooling unit off

Alarm Conditions - Auto Mode	room temp > 95 °F, or 30.6 °C
	fluid temp > 80 °F, or 26.7 °C
	fluid reservoir empty
	fluid temp < 55 °F, or 19.2 °C
	dew point is > 63 °F, or 17.2 °C
	fluid pressure went low > 8 seconds
Alarm Conditions -Manual Mode	fluid temp > 90 °F, or 32.2 °C
	fluid reservoir empty, with digital input DI7 high
	fluid temp < 55 °F, or 19.2 °C

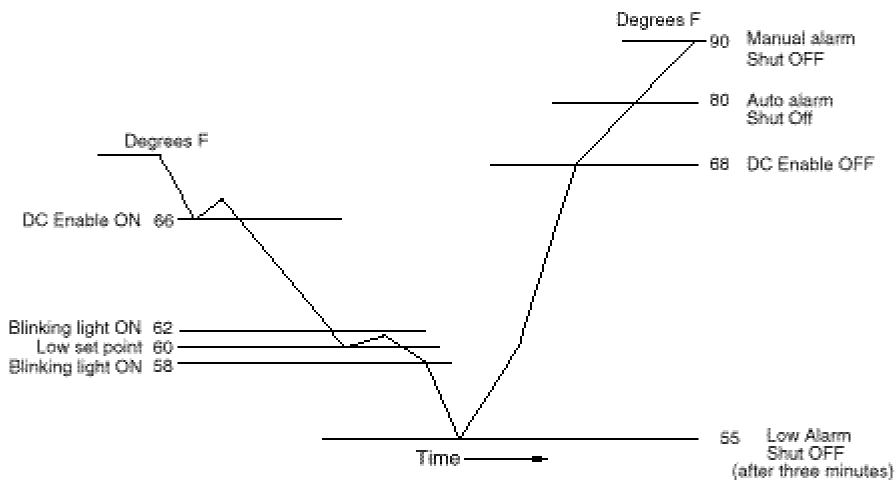

Figure 1: Heat Exchanger Normal Operating Set Point Operational Sequence

The SSC display is located on the heat exchanger's internal service panel. Table 2 shows the heat exchanger's status signals that are sent to the SSC. In addition to providing four inputs to the SSC, the heat exchanger receives a SYSTEM GOOD signal from the SSC. The SYSTEM GOOD signal is provided as a digital input to the controller and is used to turn the green SYSTEM GOOD light on and off on the user interface panel. The amber CHECK SYSTEM light is on when the SYSTEM GOOD light is off.

Table 2: Heat Exchanger Status Signals

Status Signals	***Meaning***
CHILLER_OK signal low	Chiller status is good
60/65 set point signal low	Control coolant at low set point
+/- degree set point signal low	Coolant less than 2 °F from set point
Coolant low signal low	Holding tank level is OK

System Status Controller (SSC)

The SSC is located inside the mainframe and monitors voltages and temperatures internal to the system. All DC voltages are monitored on a per cage basis. The high speed bay boards and the PEC cards have over-temperature monitoring. All boards in the card cage are powered off when a single board in that card cage indicates an over-temperature condition.

- If a monitored voltage goes above or below 10 percent of nominal, all of the DC voltages to that card cage are inhibited, or turned off.
- If a monitored temperature on a pin slice or a pin electronics board is an excessive temperature, all DC power to that card cage is turned off.
- The SSC turns the DC output on or off when requested using a PSU switch. When the PSU switch is turned on, the SSC determines if conditions are proper to allow DC power to be applied to that card cage. The PSU switch may be on but the DC power is off. The SSC sequences the different voltages to the card cages on or off in a pre-determined manner.

NOTE: If the SSC is not powered on, the liquid-cooled portion of the system cannot be turned on.

Power Supplies

The power supplies have internal circuits that provide over current, over voltage, and over-temperature protection. Any of the above excessive conditions will cause the DC voltage to be either removed due to a thermal or over voltage trip, or reduced due to an over current condition.

The power supplies DC outputs are turned on under operator control using the PSU switches. All power supplies have internal fans to cool internal components.

Manipulator

The manipulator movement is controlled by the operator and provides the following safeties:

- If the loadboard is mounted and vacuum is on, all of the manipulator motor movements are inhibited.
- A cable and spring system supports the testhead’s weight so that only a small force is required to move the testhead.
- An overload sensor is a safety mechanism to stop the testhead movement if there is an obstruction to the testhead movement in the vertical direction.

EMO Circuit

The EMO circuit is powered from a 24 volt DC power source. The circuit is activated when the on button on the power conditioner is pressed. As long as the relay is active, the main input rotary circuit breaker on the power conditioner can be turned on.

The EMO circuit is intended to remove AC power under the following circumstances:

- Opening any of the power conditioner panels
- Someone presses an EMO button
- The heat exchanger detects water in the bottom of the bay
- The thermal sensors above the cages open due to excessive heat

Removing the EMO voltage removes the 24 volts DC from the main input rotary circuit breaker and causes it to trip.

When the EMO circuit is on, it allows:

- The power conditioner’s main input rotary circuit breaker to be turned on.
- Output breakers CB2 and CB3 at the power conditioner to be turned on, if the smoke detector does not activate.
- All circuit breakers that control the liquid-cooled portion of the system to be turned on, if the smoke detector does not activate.

Undervoltage (UV) Trip Circuit

The EXA3000 UV trip and EMO circuits are different. While both circuits use under voltage trip modules to turn off circuit breakers, their functions and purpose in the system are different.

The UV trip circuit provides a method to remove AC power from the liquid-cooled portion of the system in the event of:

- Heat exchanger or controller I/O failure
- SSC power supply failure
- Smoke detected in the system

The UV trip circuit voltage is generated when the EMO circuit is active. The 24 volt DC voltage is routed through the heat exchanger and the SSC.

A different 24 volt AC, generated in the system's main AC panel powers the smoke detector units.

The following conditions must be met to activate the UV controlled circuit breakers.

- The heat exchanger must be in a condition for the green lamp on the service panel to be on.
- The SSC must have DC power applied to the SSC alarm board.
- The smoke detectors have not detected smoke.

When the conditions above exist, the 24 volt DC voltage is available and allows the circuit breakers to be turned on. The UV trip voltage controls output circuit breakers in the power conditioner.

Smoke Detection Circuit

The EXA3000 has two smoke detectors. They are located in the top of each system mainframe bay. The EMO voltage provides power to the smoke detectors, which sample the exhaust air and cause an alarm condition if smoke is detected. The smoke detection circuit is designed to prevent a fire from spreading beyond the system cabinet. If the detectors sense smoke, the high powered portion of the system is turned off.

In an alarm condition, the relay that provides power to the under-voltage trip circuit breakers is turned off. With the relay off, all AC power to the liquid-cooled section of the system is also turned off.

To allow the system to power up again, the EMO circuit must be turned off and then back on. After the EMO circuit has been turned back on, follow the normal system power up procedure.

Information 2

Troubleshooting Initial Power Up Problems

This section contains symptoms and recommended actions for some common initial power up problems on the EXA3000 test system. They are not a comprehensive or step-by-step troubleshooting guide, but a database for common initial power up problems.

NOTE: Feedback regarding new power up problems encountered more than once should be forwarded to Technical Support for inclusion in the next skill set revision.

You should have the following three documents available when troubleshooting a power up problem. The documentation can be accessed in the Resources section.

- *EXA3000 Test System Site Preparation Guide*-EMO Schematic
- *EXA3000 Harness/Cabling Block Diagram*
- *ITS 9000IX/KX Heat Exchanger Schematic*

Input Power Problems

Problem	***Possible Solutions***
Input power to the power conditioner incorrect	Contact customer facilities personnel to correct input power from customers power source.
Input power at CB1 of the system is incorrect.	If input power to the power conditioner is correct, contact electrician or vendor to correct output power from power conditioner. Verify taps inside the power conditioner for correct configuration. Verify correct wire connection inside power conditioner.

EMO Problems

Problem	***Possible Solutions***
EMO circuit does not operate correctly	Check for correct EMO voltage potentials at source and all connection points. Check for secure wire connections at all points

Heat Exchanger Monitoring Problems

The controller inside the heat exchanger bay monitors two important specifications:

- Coolant
- Room Air

If the limits are exceeded for coolant or internal system air, the controller turns off AC power to the liquid-cooled section of the system. This keeps the under-voltage trip circuit breakers on, and is not a system EMO.

Coolant Problems

Problem	***Possible Solutions***
With the system on, coolant is constantly being monitored for temperature and flow. The following conditions turn off AC power to the liquid-cooled section of the system.	Coolant temperature is above 68 °F or below 55 °F Coolant pressure is lower than 35 PSI. Coolant supply tank is near empty

Heat exchanger will not turn on at all	The pump has a current sensor. It is located above the AC contactor. The buttons and small dial located on the unit can identify this. If the red button has been tripped, pressing this button in will reset the sensor. The dial is set too low for the pump current. The correct value is 27 amps or the Full Load Amperage (FLA) of the pump.
The heat exchanger turns on for less then 15 seconds and shuts off	Too much flow, input water is too cold, or a combination of both. The heat exchanger core temperature may go below 50 °F so when you turn on the heat exchanger the coolant temperature goes below 50 °F. The heat exchanger turns off to prevent damage caused by the coolant freezing and condensing. Once the heat exchanger is turned off it will not turn on until the temperature of the coolant goes above 51 °F. To determine if you have this problem, monitor the temperature of the coolant when you power up. If the temperature drops below 50 °F then you have this problem. To enable the system to power up you need to do one of two things. Both of these are temporary and need to be set back to the original settings after the system is powered on. ♦ Reduce the flow by partially closing the input chilled water valve, normally located in the customer's chilled water plumping. Do not close it completely. ♦ Increase the input water temperature above 51 °F.
System powers down due to coolant temperature being too hot or cold. A/B modulating valve not operating correctly.	Check the Y1 setting for the A/B modulating valve. For example, if the reading is 50%, that equates to 5.0 volt controller output. The formula is xx percent = x.x volts. Using a DVM, this 5 volt measurement should be seen on analog output AO-1, pin 51, of the controller and on one of the wires at the modulating motor. If reading is not 5.0 volts, the controller could be bad. If reading is 5.0 volts, the modulating motor could be bad. Verify good wire contacts at both ends. See Table 3.

Room Air Problems

Problem	***Possible Solutions***
System powers down due to the room air temperature or humidity	Check the air temperature setting, X3, and the humidity value setting, X2, on the controller to see if the readings exceed room temperature limits, X3 and A, or the calculated dew point limits, Z3 and A. See Table 4 for information on the controller settings.

Table 3: Heat Exchanger Controller Inputs, Outputs, and Troubleshooting Information

Johnson Controller Input and Output Settings and Measurements			
NOTE: On, Off, High or Low in **bold** indicates normal operating condition			
Three Analog Inputs		***Information***	
Coolant temperature sensor	Between AI1, pin 2 and AIC, pin 3		
Humidity sensor	Between AI2, pin 5 and AIC, pin 6		
Room temperature sensor	Between AI3, pin 8 and AIC, pin 9		
Eight Digital Inputs			
Start	DI1, pin 31 is **low**, and DO4 is high		
Reset	DI2, pin 33 is high, turns off outputs		
Auto or manual	DI3, pin 35 is **low** in auto mode		
Low or high	DI4, pin 37 is **low** in low position		
Sys good	DI5, pin 39 is **low**, system good		
Pressure OK	DI6, pin 41 is **low**, pressure ok		
Fluid tank empty	DI7, pin 43 is **low**, tank is ok		
Fluid tank low	DI8, pin 45 is **low**, tank is ok		
One Analog Output			
Modulating motor	AO1, pin 51 varies from 0 to 10 volts		
Five Digital Outputs			
Temp 65	DO3, pin 71 is high, DO2 turns off		
CT-1	DO4, pin 77 is **high**, turns on pump		
High dew	DO5, pin 73 is high, dew point > 63		
Valve position	DO7, pin 75 is high, valve > 95 percent		
Low pressure	DO8, pin 81 is high if DI6 is high		
Eight Expansion Outputs		***LED Status***	***Notes:***
Chiller OK to SSC	DO1, Exp #1 R1 and NO is **low**	on	**Status to SSC**
Set point status to SSC	DO2, Exp #1 R2 and NO is **low,** 60 F	on	**Status to SSC**
< 2 degrees Fahrenheit to SSC	DO3, Exp #1 R3 and NO is **low,** <2 F	on	**Status to SSC**
Coolant low to SSC	DO4, Exp #1 R4 and NO is **low,** fluid ok	on	**Status to SSC**
Check system	DO5, Exp #2 R1 and NC is **low**	on	**Relay open when** on**, sys OK**
Tank low	DO6, Exp #2 R2 and NC is **low**	on	**Relay open when** on**, fluid OK**
DC enable	DO7, Exp #2 R3 and NO is **low**	on	**Relay closed when** on
System good	DO8, Exp #2 R4 and NO is **high**	on	**Relay closed when** on

Table 4: Heat Exchanger Controller Keys, Settings, and Troubleshooting Information

Johnson Controller Keys and Settings	
NOTE: On, Off, High or Low in bold indicates normal operating condition	
X Key-Analog Inputs	
1 = Coolant temperature	Fluid temp > 80 °F, or 27 °C, in auto or > 90 °F, or 32 °C, in manual, unit will shut off
2 = Humidity value in percent RH	Dew point is > 63 °F, or 17.2 °C, unit will shut off
3 = Room air temperature	Room temp > 95 °F, or 35 °C, in auto, unit will shut off
Y Key-Digital Outputs	
1 = Motor actuator position in percent	Displays % of valve stroke
2 = N/A	
3 = On, set point 65 °F, or 18.3 °C, selected	**Off**, set point 60 °F, or 15.5 °C, selected
4 = **On**, pump contactor is on	Off, pump contactor is off
5 = On, dew point is > 63 °F, or 17.2 °C	**Off**, dew point is < 63 °F, or 17.2 °C
6 = N/A	
7 = On, valve position is > 95 percent	**Off**, valve position is < 95 percent
8 = On, pressure fault detected	**Off**, pressure fault not detected
D Key-Digital Inputs (Input State)	
1 = **On**, start relay is closed (low)	Off, start relay is open (high)
2 = **On**, reset button is closed (low)	Off, reset button is open (high)
3 = **On**, S2 in auto position (low)	Off, S2 in manual operation (high)
4 = On, 65 °F operation (high)	**Off**, S3 in 60 °F operation (low)
5 = **On**, SSC sys good/true (low)	Off, SSC sys good/false (high)
6 = **On**, fluid pressure is ok (low)	Off, fluid pressure is low (high)
7 = **On**, tank is full (low)	Off, tank is low (high)
8 = **On**, tank is not empty (low)	Off, tank is empty (high)
XT Key-Extension Outputs	***Example: To view XT11, press Y, then XT***
11 = **On**, chiller ok, low signal to SSC	Off, chiller is not ready, high signal to SSC
12 = **On**, 60 °F set point, low signal to SSC	Off, 65 °F set point, high signal to SSC
13 = **On**, < 2 °F from set point, low signal to SSC	Off, > 2 °F from set point, high signal to SSC
14 = **On**, tank is full, low signal to SSC	Off, tank is low, high signal to SSC
15 = **On**, system status is good	Off, check system light is on
16 = **On**, tank is full	Off, tank low light is on
17 = **On**, DC enable is on	Off, DC enable is off
18 = **On**, System good is on	Off, System good is off

Table 4: Heat Exchanger Controller Keys, Settings, and Troubleshooting Information (Continued)

X,Y, and Z Keys-Expansion Decode	
Fluid Sensor Resistor Limits	**NOTE:** Spec is from 45 °F to 95 °F, LED on if > spec
Press X1, which is the coolant temperature, then press the A button	Low limit of sensor resistor
Press the A button again	High limit of sensor resistor
Room Relative Humidity (RH) Limits	
Press X2, which is the room RH, then press the A button	Zero percent RH
Press the A button again	100 percent RH
Room Temperature Resistor Limits	**NOTE:** Spec is from 45 °F to 95 °F, LED on if > spec
Press X3, which is the room temperature, then press the A button	Low is 45 °F
Press the A button again	High is 95 °F
Calculated Dew Point to Switch to 65 °F	***57 percent RH mode***
Press Z3, then press the A button	Calculated dew point
Press the A button five more times to exit	
Calculated Dew Point for Shutdown	***63 percent RH mode***
Press Z4, then press the A button	Calculated dew point
Press the A button five more times to exit	

AC Power Up Problems

Problem	*Possible Solutions*
With PSU switch off and the power supply AC breaker on, voltage is present at output of power supply.	There should be no voltage on output of power supply. If voltage is present, check the inhibit lines from the PSU board to the power supply. The inhibit wire could be loose or disconnected. PSU board could be bad.

DC Power Up Problems

Problem	*Possible Solutions*
Short is measured at the testhead motherboard between two power supplies.	This is normally an installation wiring error at one of the test head power supplies.
SSC will not operate correctly, incorrect SSC messages, or LEDs on alarm board flicker.	Verify that the SSC power supply, CP1, has correct input and output voltages. See Table 5 for SSC power supply information.
No output voltage present at power supply or the cage/testhead powers down when the power supply AC breaker and PSU switch are on.	Verify power supply has all correct input voltages. Verify power supply inhibit signal is correct. Verify that the alarm board and PSU cables have not fallen off and verify that they are in the correct locations. See Table 6, Table 7, and Table 8 for details and Figure 2 and Figure 3 for cable locations.
All liquid-cooled cages and testhead will not remain powered up.	Verify that the DC enable light is on, and the power conditioner output breakers CB2 and CB3 are on.
Cannot power up the C and H cages due to the tester's green DC enable light is off and the CB2 and CB3 power conditioner output breakers cannot be set.	Cycle the power on the heat exchanger and the SSC alarm board. Verify the coolant temperature is within specification, which is between 58 °F, or 14.4 °C, and 62 °F, or 16.6 °C. The customer's chilled water temperature may be out of spec due to various facility reasons.
Cannot power cage/testhead up after boards are installed. Cage/testhead power stayed on before boards were installed.	Remove boards from the cage to see if cage stays powered on. If it does, one or more boards could be bad. If cage still powers down, verify no backplane pins are bent. Power supply could have gone bad.

Table 5: SSC Power Supply Information

Circuit Breaker	***Power Supply and Module***	***PSU Switch***	***Output Voltage (volts)***	***Spec (mV)***	***Ripple and Noise (mV, p-p)***	***Output Voltage For:***
CB7	CPU (6)	CPU	5.2	+/- 104	50	Alarm board
CB7	CPU (7a)	CPU	15	+/- 300	50	Alarm board
CB7	CPU (7b)	CPU	-15	+/- 300	50	Alarm board

Table 6: Alarm Board Signals, Cable, and Connector Information (IX/KX)

Alarm Board Signals	***Alarm Board Connector***	***Signal To/From***
+15 volt input power supply	J800	SSC PS41-1A (SSCP) (pins1,4,2,5)
-15 volt input power supply	J800	SSC PS41-1B (SSCP) (pins1,4,2,5)
+5.25 volt input power supply	J801	SSC PS41-1C (SSCP) (pins1,4,2,5)
AFFICHEUR	J811	SSC display
RS232 TXD, RXD	J818	Force board and workstation
Control signals, bus 1	J830	J900 PSU-C board
Control signals, bus 2	J831	J900 PSU-H board
TH1 monitoring, voltage and temperature, TH and USER power supplies	J840	P77 on top ARM motherboard, to P75 and P76 on testhead motherboard
TH1REF, DEW_TH1, C0-15, L0-39	J841	
TH2REF, DEW_TH2, C0-15, L0-39	J846	
TH2 monitoring, voltage and temperature	J845	
H1 cage monitoring of voltage, temp, DC-OK, C0-15, and L0-39	J850	J24 H1 cage backplane monitor
H2 cage monitoring of voltage, temp, DC-OK, C0-15, and L0-39	J855	J24 H2 cage backplane monitor
H3 cage monitoring of voltage, temp, DC-OK, C0-15, and L0-39	J860	J24 H3 cage backplane monitor
H4 cage monitoring of voltage, temp, DC-OK, C0-15, and L0-39	J865	J24 H4 cage backplane monitor
C cage monitoring of voltage, temp, DC-OK, C0-15, and L0-39	J870	J24 C cage backplane monitor
SS monitoring of voltage, temp, DC-OK, C0-15, and L0-39	J875	J24 aux (kx) analog (ix) backplane monitor
DCSS cage monitoring	J880	J524 DCSS1 L/H/V/UCDPS backplane monitor
DCSS2 monitoring (not used on IX/KX systems)	J885	J524 DCSS2 backplane monitor
Status monitoring	J900	Cooling bay monitoring
Vacuum_Fail_TH1	J905	Vacuum control
Vacuum_Fail_TH2 (Not Used)	J910	Vacuum control
Warning	J915	
H cages HIGHVOL_INH/, which is the 320 volt DC enable/disable signal	J920	J1 on all 320 volt DC power supplies

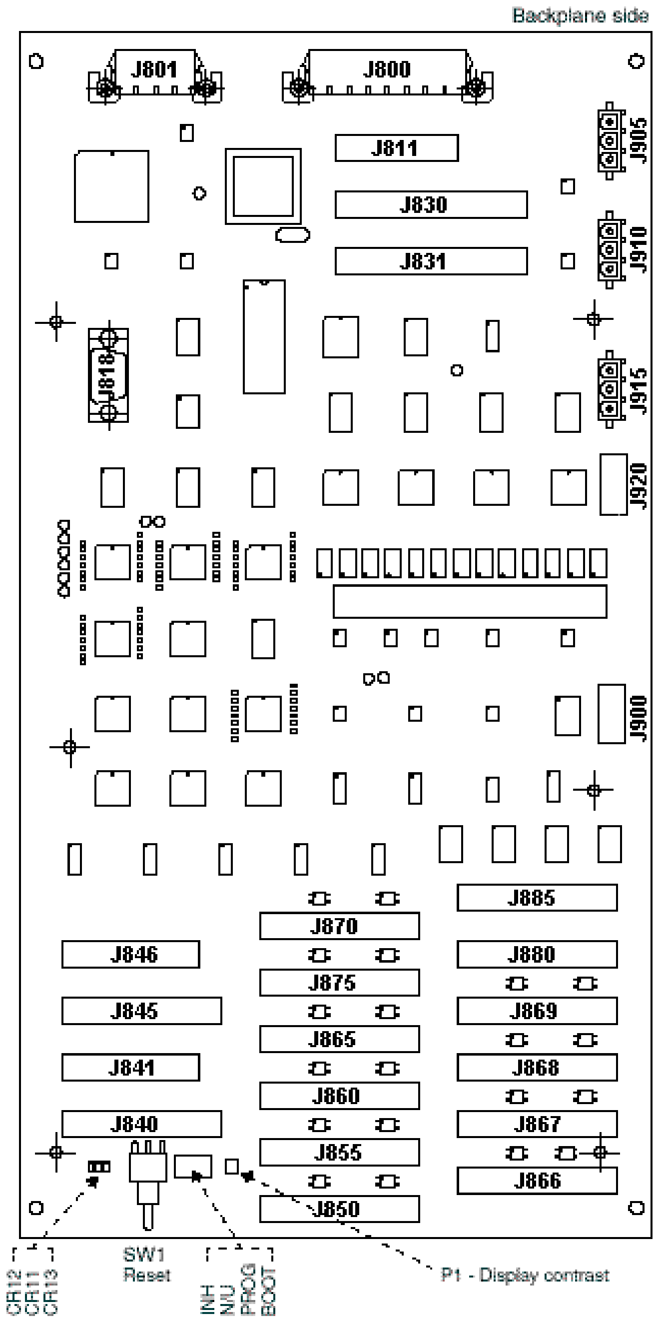

Figure 2: Alarm Board Layout, Part Number 794000701

Table 7: Controller Bay PSU Board Signals, Cable, and Connector Information (IX/KX)

C Bay PSU Board Signals	***PSU Board Connector***	***Signal To/From***
External address, data, and control signals	J900	Alarm board J830
+5.25 volt input power supply	J901	SSC power supply
PSU_0_INHIBIT, DC_OK 0 to DC_OK 11	J910	Analog cage IX (not used)
PSU_1_INHIBIT, DC_OK 12 to DC_OK 23	J915	J10 on analog cage KX (not used)
PSU_2_INHIBIT	J920	J10 Cp3a, Cp4, Cp5 for KX or Cp3c, 3b3, 3a1 for IX
PSU_3_INHIBIT	J925	
PSU_4_INHIBIT	J930	
PSU_5_INHIBIT, DC_OK 24 to DC_OK 35	J935	Analog cage IX (not used)
PSU_6_INHIBIT, DC_OK 36 to DC_OK 47	J940	J10 UP1 power supply
PSU_7_INHIBIT, DC_OK 48 to DC_OK 59	J945	J10 CP1 power supply and CPU backplane
PSU_8_INHIBIT	J950	AUX cage inhibit KX
PSU_9_INHIBIT	J955	
PSU_10_INHIBIT	J960	J10 DCSS power supply inhibit
PSU_11_INHIBIT	J965	
NOTE: At this time, DC_OK is only used for CPU power supplies		

Table 8: H Bay PSU Board Signals, Cable, and Connector Information (IX/KX)

H Bay PSU Board Signals	***PSU Board Connector***	***Signal To/From***
External address, data, and control signals	J900	Alarm board J831
+5.25 volt input power supply	J901	SSC power supply
PSU_0_INHIBIT, DC_OK 0 to DC_OK 11	J910	H2 cage power supply inhibit
PSU_1_INHIBIT, DC_OK 12 to DC_OK 23	J915	
PSU_2_INHIBIT	J920	H1 cage power supply inhibit
PSU_3_INHIBIT	J925	
PSU_4_INHIBIT	J930	H4 cage power supply inhibit
PSU_5_INHIBIT, DC_OK 24 to DC_OK 35	J935	
PSU_6_INHIBIT, DC_OK 36 to DC_OK 47	J940	
PSU_7_INHIBIT, DC_OK 48 to DC_OK 59	J945	Testhead 2
PSU_8_INHIBIT	J950	
PSU_9_INHIBIT	J955	
PSU_10_INHIBIT	J960	Testhead 1 power supply inhibit
PSU_11_INHIBIT	J965	H3 cage power supply inhibit
NOTE: At this time, DC_OK is only used for CPU power supplies		

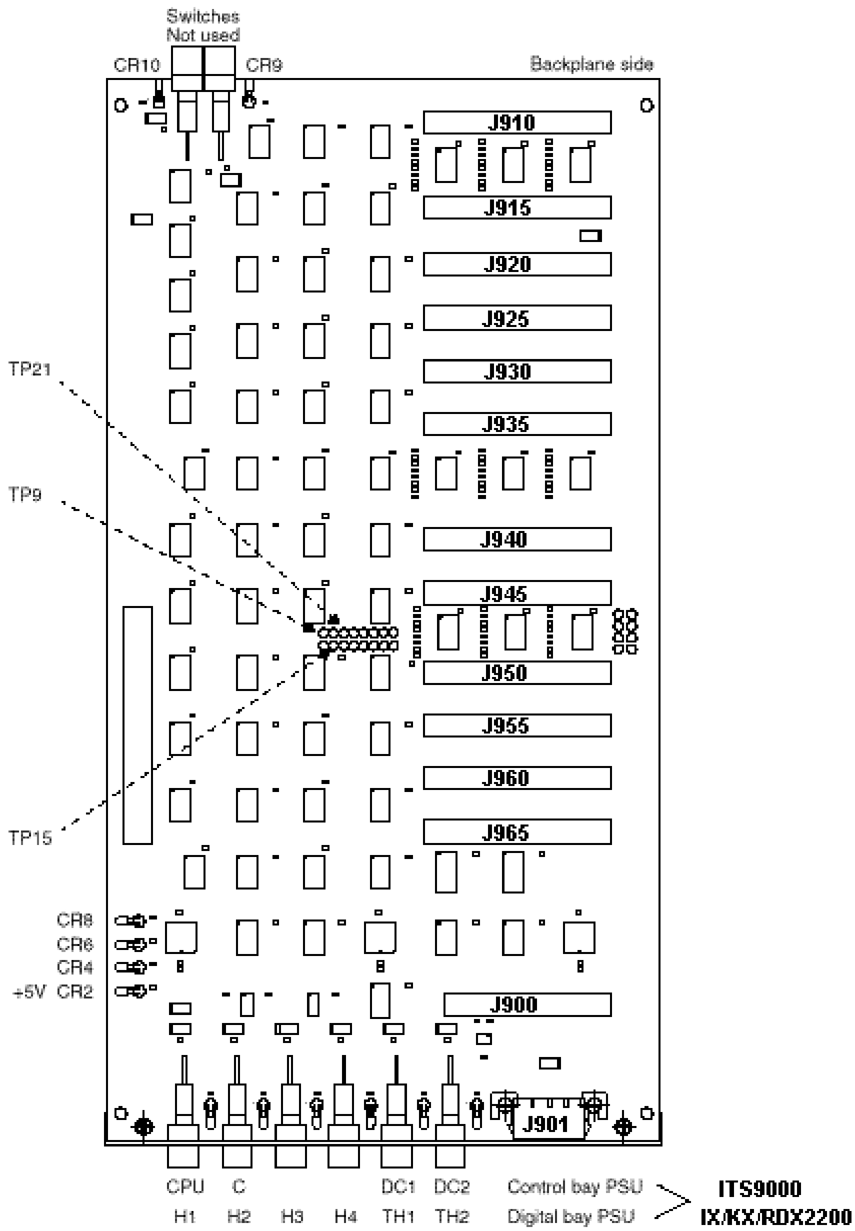

Figure 3: PSU Board Layout, Part Number 794000702

Information 3

Troubleshooting Tester Problems

This section contains symptoms and recommended actions for some common initial tester problems on the EXA3000 test system. They are not a comprehensive or step-by-step troubleshooting guide, but a database for common tester problems.

NOTE: Feedback regarding new tester problems encountered more than once should be forwarded to Technical Support for inclusion in the next skill set revision.

Bus Problems

Problem	*Possible Solutions*
Intermittent bus problems	Check temperature on bus terminator board. If it's cold, there is a problem. It should be warm. Check the crimp on the -5V wires to the terminator boards at cages. They could be loose due to shipment, de-cabling or cabling process. Also measure resistors, from signal to ground, on backplane terminator board. Should be 26 ohms, if measuring 50 ohms or higher, terminator board is bad.
Bus errors	If bus in inoperable, check for missing major bus signals by doing the following: In reg_talk, type the following: **lp {ws 9920 4000}** Using a scope, check the resource test point on all HSI boards. The first cage in the HS bus path that does not have a signal on this test point is where the signal is getting lost. Either the cable connection at the exit of the previous cage or the connection at the input to the cage under question. Look carefully for bent pins! Move the HS VVI cables to take a cage out of the loop to see if it is causing bus problems. Execute the failing bus event to see if it still exists. If the problem has been resolved, the cause of the failure is located in the eliminated H cage. If problem still exists, you need to repeat this procedure for the remaining cages. Figure 4 shows the VVI bus cable interconnection between the VVI board, C cage, and H cages. **NOTE:** VVI bus cable inputs/outputs on HSI boards in the C and H cages: Input is E-A1 to E-A11 Output is E-A128 to E-A138 **NOTE:** Bus cable part numbers, good to have as spares: VVI to HSI cable part number is 50903190 HSI long cable part number is 50903191 HSI short cable part number is 50903192 It may be necessary to scope signals to see the problem. Figure 5 shows the pin-out of the signals on the bus terminator board. The boards are located on each side of the C and H cages. This is a good place to probe. An extender tool for scope probes, part number 09907846, can be used.

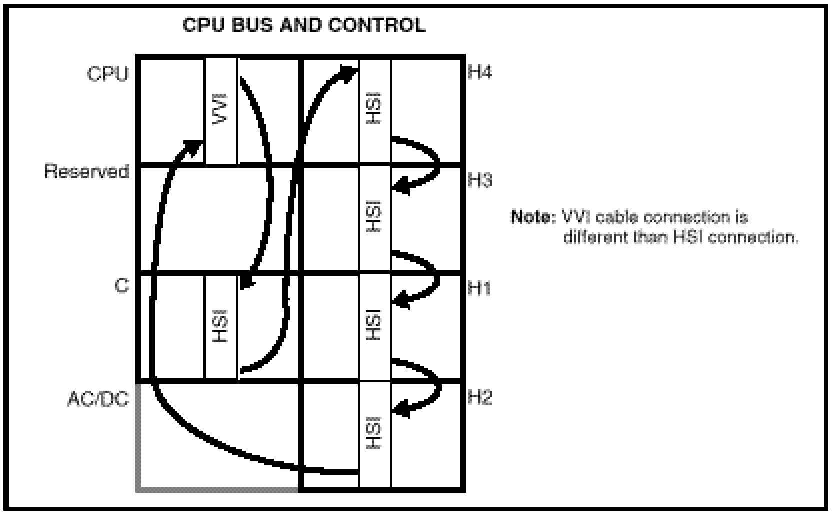

Figure 4: EXA3000 VVI to HSI Bus Interface

Pin	E	D	C	B	A
92	GRD.	GRD.			
93	GRD.	GRD.			
94	GRD.	GRD.			
95	GRD.	GRD.			
96	DB0	GRD.			
97	DB1	GRD.			
98	DB2	GRD.			
99	DB3	GRD.			
100	DB4	GRD.			
101	DB5	GRD.			
102	DB6	GRD.			
103	DB7	GRD.			
104	DB8	GRD.			
105	DB9	GRD.			
106	DB10	GRD.			
107	DB11	GRD.			
108	DB12	GRD.			
109	DB13	GRD.			
110	DB14	GRD.			
111	DB15	GRD.			
112	SO	GRD.			
113	S1	GRD.			
114	UWORD	GRD.			
115	TH2SEL	GRD.			
116	TXC	GRD.			

Figure 5: Bus Terminator Board Signal Location

Cabling Checks

Before beginning any lengthy runs of diagnostics, run main_mem and ps_mem to check the run-time cabling. Run th_diag, option 5, to check the testhead high speed cabling. Mount a loadboard to test the vacuum. Run dc_diag to check the DC cabling.

When problems exist that could be cabling errors, review the pre-install checklist located in the shipping documentation envelope. Check if the factory in removed any cables. This has been added by the factory to inform the installation owner of any handling or removing of cables due to re-dressing, replacements or modifications after power-down.

Th_diag Failures

Problem	***Possible Solutions***
Th_diag fails one pin	High speed cable installed incorrectly on H cage Bent H cage backplane pin Bad high speed cable from testhead to failing pin slice slot Pin slice board bad Digital pin electronics board bad
Th_diag fails in groups of eight pins or more	Bent pin caltree board at ARM Pin pushed out on caltree slot at ARM High speed cables from testhead to failing pin slice slots reversed Pin slice board bad Digital pin electronics board(s) bad Caltree board bad
To verify if a high speed cable from the testhead to H cage is defective	Swap cables to see if problem moves. The cables are interchangeable. See Table 9 for high speed cable signal names, signal location and cable numbers.

Table 9: High Speed Cable Information from Testhead to H Cage Backplanes

High Speed Cable Backplane Connection Points from Pin Slice to PECs											
Pin Slice				**Pin Slice Backplane**						**Testhead**	
CABLE TYPE	**CABLE #**	**PIN SLICE**	**CABLE #**	**B.P. PIN #**	**BACKPLANE PIN E**	**BACKPLANE PIN D**	**BACKPLANE PIN C**	**BACKPLANE PIN B**	**BACKPLANE PIN A**	**TESTHEAD CONN #**	**BP PINS E-A**
A	CABLE 4	PIN 7	J8	2	GND	GND	GND_DHI	DHI_Hx_P7	DHI_Hx_P7/	J12	19
				3	DINH_Hx_P7	DINH_Hx_P7/	GND_DINH	GND	GND		20
				4	GND	GND	GND_BCLO	BCLO_Hx_P7	BCLO_Hx_P7/		21
				5	ACHI_Hx_P7	ACHI_Hx_P7/	GND_ACHI	GND	GND		22
		PIN 6	J7	21	GND	GND	GND_BCLO	BCLO_Hx_P6	BCLO_Hx_P6/		25
				22	ACHI_Hx_P6	ACHI_Hx_P6/	GND_ACHI	GND	GND		26
				23	GND	GND	GND_DHI	DHI_Hx_P6	DHI_Hx_P6/		23
				24	DINH_Hx_P6	DINH_Hx_P6/	GND_DINH	GND	GND		24
B	CABLE 3	PIN 5	J6	38	GND	GND	GND_BCLO	BCLO_Hx_P5/	BCLO_Hx_P5	J11	29
				39	ACHI_Hx_P5/	ACHI_Hx_P5	GND_ACHI	GND	GND		30
				40	GND	GND	GND_DHI	DHI_Hx_P5/	DHI_Hx_P5		27
				41	DINH_Hx_P5/	DINH_Hx_P5	GND_DINH	GND	GND		28
		PIN 4	J5	42	GND	GND	GND_DHI	DHI_Hx_P4/	DHI_Hx_P4		31
				43	DINH_Hx_P4/	DINH_Hx_P4	GND_DINH	GND	GND		32
				44	GND	GND	GND_BCLO	BCLO_Hx_P4/	BCLO_Hx_P4		33
				45	ACHI_Hx_P4/	ACHI_Hx_P4	GND_ACHI	GND	GND		34
A	CABLE 2	PIN 3	J4	54	GND	GND	GND_DHI	DHI_Hx_P3	DHI_Hx_P3/	J10	35
				55	DINH_Hx_P3	DINH_Hx_P3/	GND_DINH	GND	GND		36
				56	GND	GND	GND_BCLO	BCLO_Hx_P3	BCLO_Hx_P3/		37
				57	ACHI_Hx_P3	ACHI_Hx_P3/	GND_ACHI	GND	GND		38
		PIN 2	J3	75	GND	GND	GND_BCLO	BCLO_Hx_P2	BCLO_Hx_P2/		41
				76	ACHI_Hx_P2	ACHI_Hx_P2/	GND_ACHI	GND	GND		42
				77	GND	GND	GND_DHI	DHI_Hx_P2	DHI_Hx_P2/		39
				78	DINH_Hx_P2	DINH_Hx_P2/	GND_DINH	GND	GND		40
B	CABLE 1	PIN 1	J2	79	GND	GND	GND_BCLO	BCLO_Hx_P1/	BCLO_Hx_P1	J9	45
				80	ACHI_Hx_P1/	ACHI_Hx_P1	GND_ACHI	GND	GND		46
				81	GND	GND	GND_DHI	DHI_Hx_P1/	DHI_Hx_P1		43
				82	DINH_Hx_P1/	DINH_Hx_P1	GND_DINH	GND	GND		44
		PIN 0	J1	91	GND	GND	GND_DHI	DHI_Hx_P0/	DHI_Hx_P0		47
				92	DINH_Hx_P0/	DINH_Hx_P0	GND_DINH	GND	GND		48
				93	GND	GND	GND_BCLO	BCLO_Hx_P0/	BCLO_Hx_P0		49
				94	ACHI_Hx_P0/	ACHI_Hx_P0	GND_ACHI	GND	GND		50

Vacuum Problems

Problem	Possible Solutions
Cannot achieve vacuum when loadboard is on testhead and the vacuum enable button is pressed.	Verify vacuum is greater than 20 PSI. If not, check the customer's vacuum source. Check for a pinched or twisted vacuum line Check for leaks at seals on contactor board. Seals might be damaged or have loose particles on them.

Loadboard EPROM Problems

Problem	Possible Solutions
Cannot read EEPROM on loadboard when it is on the testhead and the vacuum enable button is pressed.	The serial I/O connections are connected to the calibration EEPROM device. Figure 6 shows the schematic of the device. If you have problems reading the loadboard EEPROM, check for SCLK, SDATA, and VCC at the EEPROM. Normal values are: SDATA on pin 5 is +5 volts SCLK on pin 6 is 148 millivolts GRD on pin 7 is 0 volts VCC on pin 8 is +5 volts Check the purple cable under the contactor board carrying the SCLK and SDATA signals. The loadboard is marked SCLK and SDATA. These signals are used to read and write information to the loadboard EEPROM. They connect to the loadboard through the large pogo pins in the outer ring of the contactor board. See Figure 7. These signals come from the DCCAL board. VCC is generated from the user power supply. It is wired directly from the power supply to the contactor board.

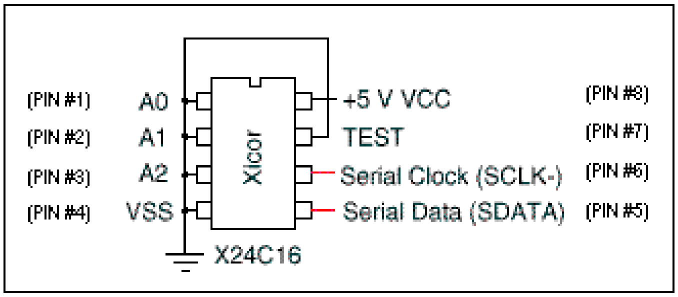

Figure 6: Schematic of Loadboard EEPROM Device

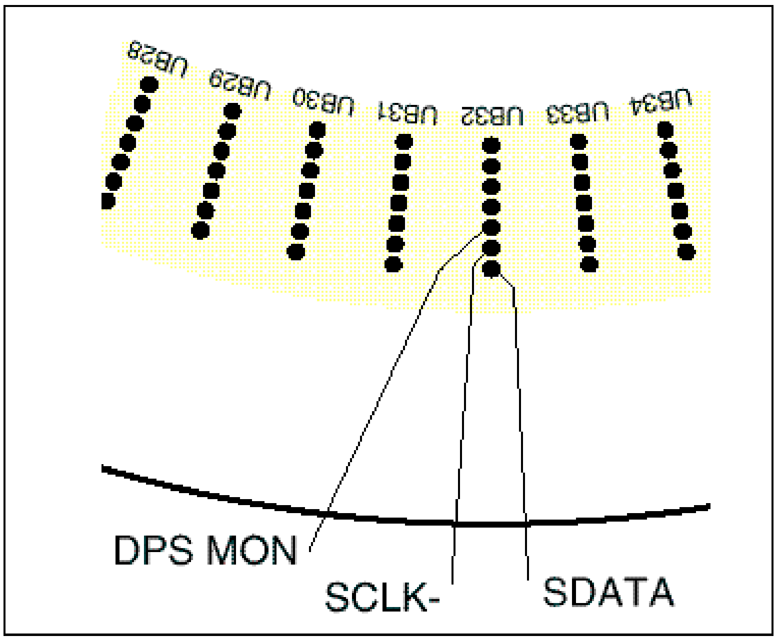

Figure 7: EEPROM Pogo Pin Location

DC Subsystem Problems

Problem	*Possible Solutions*
Caltree_diag fails force & sense resistance test.	If dc_diag and th_diag for DCCAL board passes, PMU cable can be reversed at DCSS backplane even though connector is keyed on the top and bottom. The wires should be on the right side of the connector.
Dc_diag fails PMU and/or DPSs	If the associated boards have been replaced and the failure still exists, the problem could be loadboard related. Check the External Interface Register (EIR) bits at the loadboard for a relay not being selected or selected when it's not supposed to. The EIR bits come from the top and bottom ARM motherboard and the caltrees, and go to the contactor board. Check for loose or disconnected cabling. A total of 64 EIR bits are used to control all possible relays. Figure 8 shows the pogo pin locations where the EIR bits enter the loadboard.

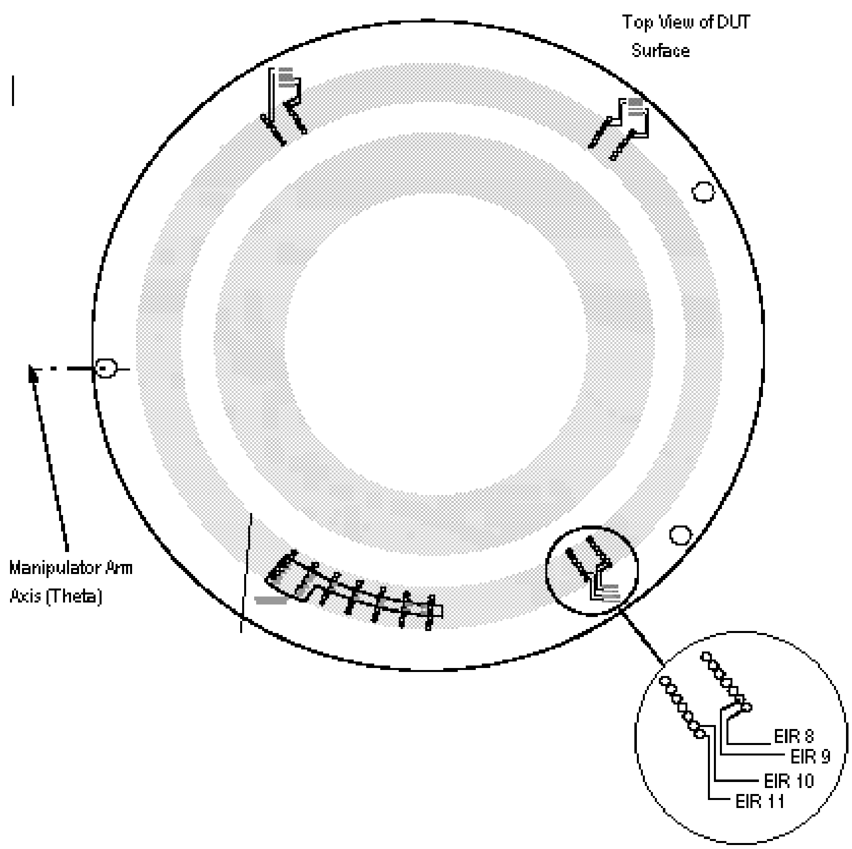

Figure 8: EIR Bit Pogo Pin Location

Other Cabling Problems

Problem	***Possible Solutions***
Fails any alternate data source or cable tests initially after power up. For example, ps_mem, ads_mem, subr_mem, subr_diag, apg*x*_ad_gen, timing_diag cable tests, and so on.	Verify that there are no cables disconnected or loose. Check on the backplanes of the SMAB boards. Ensure that there are no bent pins on backplanes. The factory sometimes removes cables to re-dress them when decabling.
Problem	***Possible Solutions***
No signal at the scope sync jack	Check the scope sync cable connections made during installation at the C cage

Information 4

Troubleshooting Acceptance Problems

This section contains symptoms and recommended actions for some common acceptance failures on the test system. They are not a comprehensive or step-by-step troubleshooting guide, but a database for common acceptance problems.

NOTE: Feedback regarding new acceptance problems encountered more than once should be forwarded to Technical Support for inclusion in the next skill set revision.

Loading and executing the acceptance programs is discussed in the *EXA3000 Installation Acceptance* skill set.

Spechk_IXKX Problems

Problem	***Possible Solutions***
Single pin FAF or LAP failures	Rerun test to verify that the failure repeats. If it does, the most common failures are pin slice or PEC boards.
Multiple pins fail due to graph shifted to one side	Reduce pins to test and rerun spechk. For example, on a 352-pin system, run pins 0-127. This will verify the H1 cage. Then add H2 cage, running pins 0-255. If failure occurs, the problem is in H2 cage. Verify crossover calibration per Tech Bulletin 098
If STM_spechk fails.	STM spechk loadboard could have incorrect path length values stored in the loadboard EEPROM. Calibrate the path lengths of the loadboard by running the following calibration in a Force board xterm. Type: general_docal Select option 15, Pin Pair Calibration. Enter filename > /pathname/stm_lbrd_352.txt

Pechk Problems

Problem	*Possible Solutions*
Single pin failure associated with the PEC references.	The most common failure for a single pin is the digital PEC. Bad loadboard connection is also possible. Reseat loadboard and verify or replace pogo pin.
Multiple pin failure associated with the PEC references.	Verify th_accuracy and caltree_diag pass. If so, the most common failure is the force or sense caltree board or connection. If intermittent failures occur on various pins in the lower current range, cycle th_accuracy using lowest current option. If intermittent failures are seen, monitor the testhead power supplies for noise with a scope while cycling the test. If noise or ripple on testhead supplies exceed 50 millivolts, replace the supply. Also check for good ground connection on supply.

PIO_validate Problems

Problem	*Possible Solutions*
This program checks out the system's parallel port. If it fails:	Verify the correct PH_TASK **Pio_phi -D -h 1a** is running. Confirm that the cables are correct and secure at the tester and test box.

Customer's Acceptance Device Problems

Problem	*Possible Solutions*
Customer's Acceptance Device fails	Clean the loadboard and check the associated pogo pin. If lbrd_dochar values are greater than 40ps, the loadboard is most likely not making good contact with the pogo pin. Reseat the loadboard and repeat test Install another acceptance device and rerun test. Replace the loadboard and rerun. If failure still exists, run spechk or all_cal_diags. For analog failures, pause or loop and use sysma to try the other output relays on the APE. At this time, diagnostics do not check all of them.