# **Mainframe Cabinet Field Replacement Procedures**

HMM-308-0 CRAY J90se Series Systems Last Modified: November 1996

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# Introduction

This document guides you in removing and replacing the field replaceable parts inside the CRAY J90se series mainframe cabinets. This document includes cleaning and maintenance procedures for parts that need periodic cleaning.

This document organizes the procedures according to:

- Common replacement procedures that apply to both the CRAY J98se, CRAY J916se, and CRAY J932se mainframes.
- CRAY J98se and CRAY J916se mainframe replacement procedures
- CRAY J932se mainframe replacement procedures

# **ESD Precautions**

Observe ESD precautions during the entire removal and replacement process. Required apparel includes an ESD smock, ESD wrist strap, and ESD shoes or shoe straps.

For further information on safety and ESD, read the *Safety and ESD Guidelines*, Cray Research publication number HGM-016-A.

# FRP 1: Power-down/Power-up Procedures

Several situations occur that require you to remove power from the system. When you perform a field replacement procedure (FRP), it may be necessary for you to remove power from an individual cabinet or from the entire system. This FRP provides procedures for both of these situations. You should read *Safety and ESD Guidelines*, Cray Research publication number HGM-016-A, before you perform any replacement procedures.

#### **Tools Required**

None.

#### Individual Cabinet Power-down Procedure

- 1. Ensure that the operating system is not running before you proceed.
- 2. Move the circuit breaker at the rear of the appropriate cabinet to the 0 (OFF) position. Refer to Figure 1.
- 3. Press the ALARM ACKNOWLEDGE button on the central control unit (CCU) to disable the alarm. Refer to Figure 2.

#### Individual Cabinet Power-up Procedure

At the rear of the appropriate cabinet, move the circuit breaker to the 1 (ON) position. Refer to Figure 1.



#### Figure 1. Circuit Breaker Locations

#### System Power-up Procedure

- 1. Place each I/O cabinet circuit breaker in the 1 (ON) position. Refer to Figure 1. Then place the mainframe cabinet circuit breaker in the 1 (ON) position.
- 2. Ensure that the SYSTEM READY LED on the central control unit (CCU) is illuminated (refer to Figure 2). The system is now ready for the boot sequence.

#### System Power-down Procedure

- 1. Ensure that the operating system is not running before you proceed.
- 2. Open the front door of the mainframe cabinet. Refer to FRP 2.
- 3. Push the SYSTEM OFF button in the lower-right corner on the CCU and release it. Refer to Figure 2.
  - **NOTE:** Pushing the SYSTEM OFF button removes power from all of the cabinets in the system. Verify that each cabinet circuit breaker trips to the 0 (OFF) position.

Figure 2. Central Control Unit



# FRP 2: Opening the Front Cabinet Door

The CRAY J90se series systems use two distinct styles of front door: one style for the mainframe cabinet and a second style for the I/O cabinet; both doors open the same way.

#### **Tools Required**

None.

#### **Opening Procedure**

- 1. Locate the latch on the upper-right corner of the door. Refer to Figure 3.
- 2. Push down on the latch and swing the door open.

Figure 3. Front Door Latch



# FRP 3: Open, Close/Remove, Replace Rear Door

Most field replacement procedures (FRPs) involve the rear door of the cabinet. In most cases, you need to only open the door. There are some FRPs, however, that require removal of the door. This FRP describes both procedures.

#### **Tools Required**

- To open the rear door, you will need a 5/32-in. hex driver.
- To remove the rear door, you will need a #2 Phillips screwdriver.

#### **Door Opening Procedure**

- 1. At the rear of the cabinet, locate the two latches at the left top and left bottom of the door. Turn these latches counterclockwise. Refer to Figure 4.
- 2. Grasp the door handle and swing the door open to the right.



Figure 4. Rear Door Latches

#### **Door Removal Procedure**

- 1. With the door open, locate the ground wire that connects the door to the chassis. Refer to Figure 5.
- 2. With a screwdriver, remove the screw that connects the ground wire to the chassis.
- 3. Lift the door up about 1 in. (2.5 cm) and remove the door from the cabinet.



#### Figure 5. Rear Door Ground Wire

#### **Door Replacement Procedure**

- 1. Place the door onto the two hinge pins. Refer to Figure 6.
- 2. Replace the screw to reconnect the ground wire.
- 3. To close the door, swing the door shut and turn the two latches clockwise.

Figure 6. Rear Door Hinge Detail



# FRP 4: Remove/Replace Cabinet Side Panel

If you need to upgrade a CRAY J90se series system by connecting additional I/O cabinets, you will need to remove the side panel from the existing cabinet and place it on the side of the new cabinet.

## **Tools Required**

- Thin knife blade to use as a pry
- #2 Phillips screwdriver

#### Side Panel Removal Procedure

1. **CAREFULLY** pry the eight screw covers from the front side panel. The back side panel has six screws. Use a very thin, strong pry to remove these. It may be necessary to start with a knife blade. Refer to Figure 7 to locate these covers.



- 2. Loosen the eight captive screws that were revealed in Step 1.
- 3. Lift off the panel and set it aside.

Figure 7. Cabinet Side Panel



# Side Panel Replacement Procedure

- 1. Place the side panel into the recess on the side of the cabinet.
- 2. Tighten the eight captive screws.
- 3. Replace the eight screw covers.

# FRP 5: Incoming AC Power Assembly

The mainframe incoming AC power assembly contains a line filter, a circuit breaker, and an AC power distribution network.

#### **Tools Required**

#2 Phillips screwdriver

#### **Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Remove the mainframe AC plug from the AC outlet. This outlet will probably be under the floor if the system is installed on a raised floor.



- 4. Open the rear door of the mainframe cabinet using FRP 3.
- 5. Remove the four screws that secure the incoming AC power assembly to the mainframe cabinet. Refer to Figure 8.
- 6. Grasp the AC power cord at the incoming AC power assembly and pull it out slightly until the sides of the AC power assembly clear the chassis. Refer to Figure 8.



Figure 8. Incoming AC Power Assembly Securing Screws

- 7. Pull the tray out of the mainframe cabinet until the Hubbell Twist-Lock connector, which is located on the rear of the incoming AC power assembly, is accessible. Refer to Figure 9.
- 8. Remove the Twist-Lock connector from the incoming AC power assembly.
- 9. Pull the tray out of the mainframe cabinet until the cables that are connected to the front of the incoming AC power assembly are accessible.

Figure 9. Incoming AC Power Assembly Twist-Lock Connector



- 10. Label and remove the cables.
  - **NOTE:** The connectors on the front of the incoming AC power assembly are daisy chained together. These connectors are the sense and control connectors.
- 11. Remove the entire tray from the mainframe cabinet and set it on a cleared area of the floor.

#### **Replacement Procedure**

- 1. Unpack the new incoming AC power assembly. Save the packing material for reuse when you return the defective power assembly to Logistics.
- 2. Place the front of the incoming AC power assembly on the bottom of the mainframe cabinet.
- 3. Push the tray into the mainframe cabinet until it is possible to reconnect the cables that you removed from the front of the incoming AC power assembly. Reconnect the cables.
- 4. Push the tray further into the mainframe cabinet until it is possible to reconnect the Twist-Lock connector.
- 5. Carefully push the tray the rest of the way into the mainframe cabinet. Ensure that no cables are pinched.
- 6. Insert and tighten the four screws that secure the incoming AC power assembly to the mainframe cabinet.
- 7. Ensure that the circuit breaker is in the 0 (OFF) position.
- 8. Insert the mainframe AC plug into the AC outlet.
- 9. Power up the mainframe cabinet using FRP 1.
- 10. Close the rear door of the mainframe cabinet using FRP 3. The system is now ready for the boot sequence.

# FRP 6: 48 Vdc Power Supply

The 48 Vdc power supply is a self-contained unit. The front-end power supply assembly includes two or three 48 Vdc power supplies. (Two power supplies are included with CRAY J98se mainframes.) These power supplies are connected in an n+1 configuration to provide DC power to the processor and memory modules. The 48 Vdc power supplies are capable of being removed and replaced while the mainframe is in operation.

#### **Tools Required**

#2 Phillips screwdriver

#### **Removal Procedure**

- 1. Open the front door of the mainframe cabinet using FRP 1.
- 2. Locate the defective 48 Vdc power supply by noting the indicator LEDs on the front-end status panel. Refer to Figure 10.

Figure 10. Front-end Power Supply Status Panel



- 3. Loosen the two knurled screws that secure the front-end air filter housing. Refer to Figure 10.
- 4. Lift and remove the air filter housing from the front of the front-end power-supply assembly.

5. Loosen the captive screw on the front of the defective 48 Vdc power supply. Refer to Figure 11.





- 6. Grasp the handle and pull the 48 Vdc power supply out of the front-end power-supply assembly.
  - **NOTE:** The 48 Vdc power supply is not restrained. Do not let it fall off the chassis during removal.

#### **Replacement Procedure**

- 1. Unpack the new 48 Vdc power supply. Save the packing material for reuse when you return the defective 48 Vdc power supply to Logistics in Chippewa Falls.
- 2. Place the rear of the new 48 Vdc power supply onto the lip of the chassis; then push the power supply into its slot in the chassis. Be sure to seat the power supply firmly in place.
- 3. Tighten the captive screw to secure the 48 Vdc power supply.
- 4. Vacuum or clean the air filter before you replace it.
- 5. Place the bottom of the air filter housing into the U-channel on the front of the front-end power-supply assembly. Tighten the two captive screws to secure the air filter housing.
- 6. Close the front door of the mainframe cabinet.

# **FRP 7: Front-end Power Supply Chassis**

The front-end power supply chassis contains the monitoring and control circuits and the switching circuits for the three 48 Vdc power supplies.

#### **Tools Required**

#2 Phillips screwdriver

#### **Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the front door of the mainframe cabinet using FRP 2.
- 4. Remove the 48 Vdc power supplies using FRP 6.
- 5. Remove the four screws that secure the blank panel that is located directly above the front-end power supply chassis. Refer to Figure 12.



Figure 12. Front-end Power Supply Securing Screws

6. Label and disconnect the cables that are located on the top of the 48 Vdc power supply chassis. Refer to Figure 13.





- 7. Remove the four front-end assembly screws that secure the front-end power supply chassis to the mainframe cabinet. Refer to Figure 12.
- 8. Pull the chassis out of the mainframe cabinet slowly until the AC power cord is visible. Refer to Figure 14.



Figure 14. Front-end Power Supply Power Cord

- 9. Disconnect the AC power cord from the rear of the incoming AC power assembly. This power cord uses a Twist-Lock connector.
- 10. Completely remove the front-end power supply chassis from the mainframe cabinet.

#### **Replacement Procedure**

- 1. Unpack the new front-end power supply chassis. Set the packing material aside to reuse when you return the defective front-end power supply chassis to Logistics.
- 2. Slide the new front-end power supply chassis partially into the mainframe cabinet; leave room at the rear to connect the AC power cord.
- 3. Connect the AC power cord at the rear of the front-end power supply chassis to the rear of the incoming AC power assembly.



### WARNING

Be sure that all cables are clear of the 48 Vdc power supply chassis before you proceed or cable damage or electrical shock could occur.

4. Slide the front-end power supply chassis the rest of the way into the mainframe cabinet.

- 5. Insert and tighten the four screws that secure the front-end power supply chassis to the mainframe cabinet. Refer to Figure 12.
- 6. Connect the cables to the top of the front-end power supply chassis.
- 7. Replace the blank panel and insert and tighten the four screws to secure the panel to the mainframe chassis.
- 8. Replace the 48 Vdc power supplies using FRP 6.
- 9. Power up the mainframe cabinet using FRP 1.
- 10. Check the 48 Vdc status LEDs to confirm the correct operation of the 48 Vdc power supply chassis. Refer to Figure 13.
- 11. Close the front door of the mainframe cabinet. The system is now ready for the boot sequence.

# **FRP 8: Blower Assembly**

The mainframe blower assembly is an assembly that should have a very low failure rate. However, in the event that a failure does occur, the entire system will be down. The blower assembly is large and bulky, but it can usually be replaced by one person.

#### **Tools Required**

- #2 Phillips screwdriver
- Channel-lock type pliers

#### **Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the rear door of the mainframe cabinet using FRP 3.
- 4. Remove the four screws that secure the exhaust plenum to the cabinet. Refer to Figure 15 to locate the exhaust plenum.
- 5. Remove the five screws that secure the rear of the blower assembly to the bottom of the mainframe card cage. Refer to Figure 15.
- 6. Open the front door of the mainframe cabinet using FRP 2.
- 7. Remove the blank panel above the 48 Vdc power supply status assembly by removing the four screws. Refer to Figure 12.
- 8. Remove the control cable and the power input cable from the blower chassis. Refer to Figure 16.
- 9. Remove the backplane cover by removing the two screws that secure the cover to the mainframe chassis. Refer to Figure 12.









Figure 16. Blower Assembly Cables

- 10. Use channel-lock pliers to remove the locking rings from the clock/scan module cooling ducts. Refer to Figure 17.
- 11. Remove the cooling ducts from the holes in the chassis. Pull gently down until the ducts clear the chassis; then bend the ducts slightly.
- 12. From the front of the mainframe cabinet, gently push the blower assembly to start removing it from the cabinet. Push the blower assembly approximately 3 in. (7.5 cm).

#### Figure 17. Clock/Scan Module Cooling Ducts



The blower assembly weighs approximately 25 lbs and is awkward to handle. Use proper lifting techniques. Failure to do so may result in injury.

13. From the rear of the cabinet, firmly grasp and pull the blower assembly from the mainframe chassis.

#### **Replacement Procedure**

- 1. Carefully unpack the new blower assembly. Set the packing material aside for reuse when you return the defective blower assembly to Logistics.
- 2. Grasp the new blower assembly and set the rear of the assembly onto the rail shelf in the rear of the mainframe chassis. Push the blower assembly into the mainframe cabinet.
- 3. At the front of the mainframe cabinet, insert the clock/scan module cooling ducts into the holes in the chassis. Refer to Figure 17.
- 4. Replace the cooling duct locking rings.
- 5. At the rear of the mainframe cabinet, insert the five screws that secure the blower assembly to the bottom of the mainframe card cage. Refer to Figure 15.
- 6. At the rear of the mainframe cabinet, insert the four screws that secure the exhaust plenum to the mainframe chassis. Refer to Figure 15.
- 7. At the front of the mainframe cabinet, connect the control cables and the power input cable to the blower assembly. Refer to Figure 16.
- 8. Apply power to the mainframe cabinet using FRP 1 and ensure that the replacement blower is operational. The blower is operational if you can detect airflow through the exhaust plenum at the rear of the mainframe cabinet.
- 9. Replace the blank panel at the front of the mainframe cabinet. Refer to Figure 12.
- 10. Close the front and rear doors of the mainframe cabinet. The system is now ready for the boot sequence.

# **FRP 9: Processor or Memory Module**

The mainframe contains two types of modules: the processor module and the memory module. Both types of module are removed and replaced in the same manner.

#### **Tools Required**

An optional torquing tool (P/N 90472600) is available from Customer Service Logistics in Chippewa Falls. The torquing tool can be used to seat or unseat the CPU and memory modules. The torquing tool applies 28 in-lbs of torque (hand tight). The cost is \$150.00.

#### Module Removal Procedure

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the rear door of the mainframe cabinet using FRP 3.
- 4. Refer to either Figure 18 or Figure 19 to help determine the location of the failing module.
- 5. If you are removing a memory module, skip this step. If you are removing a processor module, remove the channel cables that are connected to the front of the module.
- 6. Turn the jack screws located at the top and bottom of the module counterclockwise until the module is loose in the chassis. Refer to Figure 20.

M e m 0	M e m 2	Processor O	Produle sor	Produle 2	Produle 3 r	M e m 1	M e m 3
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Figure 18. Module Locations, 4 X 4 Chassis

Processor module 0 contains CPUs 0, 1, 2, and 3. Processor module 1 contains CPUs 4, 5, 6, and 7. Processor module 2 contains CPUs 8, 9, 10, and 11. Processor module 3 contains CPUs 12, 13, 14, and 15.

Figure 19. Module Locations, 2 X 2 Chassis

M e m 0	M e m 1	Produle sor	Produles or 1				
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Processor module 0 contains CPUs 0, 1, 2, and 3. Processor module 1 contains CPUs 4, 5, 6, and 7.





## CAUTION

The modules are heavy. Use proper lifting techniques to avoid back injury and module damage.

- 7. Grasp the module securely and remove it from the chassis.
- 8. Place the module on a static-dissipative surface.

#### **Module Replacement Procedure**

- 1. Carefully unpack the replacement module. Be sure to save the packing material for reuse when you return the defective module to Logistics in Chippewa Falls.
- 2. Place the module into the module guides in the mainframe chassis and push the module into the chassis until it contacts the damper handles.
- 3. Turn the damper handle counterclockwise 1/4 turn, and push the module the rest of the way into the chassis (until it contacts the backplane).
  - **NOTE:** Turn each jack screw simultaneously in Step 4 to avoid binding the module on the module rails.
- 4. Turn each jack screw clockwise and hand tighten to fully seat the module.
- 5. If applicable, reconnect the appropriate channel cables to the processor module.
- 6. Close the rear door of the cabinet using FRP 3.
- 7. Power up the cabinet using FRP 1. The system is now ready for the boot sequence.

# FRP 10: Clock/Scan Module

The clock/scan module is located in the mainframe cabinet. It provides system clocks and multiplexes the scan functions of the system. The clock/scan module also provides 3.3 Vdc to the CPU enable connector on the backplane to enable or disable CPUs.

#### **Tools Required**

#2 Phillips screwdriver

#### **Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the front door of the mainframe cabinet using FRP 2.
- 4. Release the two retaining screws that secure the backplane cover. Refer to Figure 21.
- 5. Remove the CPU enable cable connector from the clock/scan module.



Figure 21. Mainframe Cabinet (Front View)

6. Grasp the ejector handles on the clock/scan module and press upward on the top handle and downward on the bottom handle to release the module from the backplane. Refer to Figure 22.





7. Pull the clock/scan module out of the guide slots and remove it from the cabinet.

# CAUTION

Place the defective clock/scan module on an ESD-safe surface to prevent further damage to the module.

#### **Replacement Procedure**

- 1. Unpack the new clock/scan module. Retain the packing material for reuse when you return the defective module to Logistics in Chippewa Falls.
- 2. Set the clock/scan module in the guide slots.
- 3. Push the clock/scan module into the chassis until it contacts the backplane connectors.
- 4. Using the ejector handles as push-pads, seat the clock/scan module firmly in the backplane connector.
- 5. Connect the CPU enable cable to the clock/scan module.
- 6. Replace the backplane cover; then tighten the two retaining screws.
- 7. Close the front door of the mainframe cabinet.
- 8. Power up the mainframe cabinet using FRP 1. The system is now ready for the boot sequence.
# FRP 11: Backplane

It may be necessary to replace the backplane to correct communication problems between CPUs or between a CPU and memory. It is necessary to replace the backplane if a system is being upgraded from a 2 X 2 configuration to a 4 X 4 configuration. The backplane removal/replacement process has been defined as a Cray Technical Support level procedure. Please contact the local Cray Research office or the Cray Customer Service Call Center to arrange for this procedure.

### **Tools Required**

- #2 Phillips screwdriver
- 5/32-in. ball-head hex driver
- 7/64-in. ball-head hex driver
- 3/8-in. nut driver

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the front door of the mainframe cabinet using FRP 2.
- 4. Remove the backplane cover by loosening the two retaining screws. Refer to Figure 21.
- 5. Remove the clock/scan module using FRP 10.
- 6. Go to the rear of the cabinet and open the rear door using FRP 3.
- 7. At the rear of the cabinet, loosen and partially extract all of the mainframe modules. It is not necessary to completely remove these modules, but they must be released from the backplane and moved forward approximately 2 in. (5 cm). Refer to FRP 9.
- **NOTE:** Cover the holes of the clock module cooling ducts and the holes that the 48 Vdc power cables route through to prevent screws or nuts from dropping into other assemblies.

- 8. Remove the four nuts that secure the 48 Vdc power cables to the 48 Vdc power bus and remove the power cables from the studs. Refer to Figure 23.
  - **NOTE:** The two outside 48 Vdc wires are black wires, and the two inside 48 Vdc wires are white wires.
- 9. Remove the sense cable from the upper-left corner of the backplane. Refer to Figure 24.
- 10. Remove the CPU enable connector from the lower connector in the upper-left corner of the backplane. Refer to Figure 24.

Figure 23. Backplane Power Bus Connections







### CAUTION

The backplane is heavy. Remove the side screws first, then the bottom screws, and finally the top screws. Failure to do so may result in damage to the backplane.

- 11. Remove the perimeter screws that secure the backplane to the chassis.
- 12. After you have removed all of the screws, tip the top of the backplane forward and bring the right side forward. Remove the backplane from the chassis and set it aside for later return to Logistics in Chippewa Falls.

#### **Replacement Procedure**

1. Unpack the new backplane. Save the packing material for reuse when you return the old backplane to Logistics in Chippewa Falls.

### CAUTION

Remove the protective covers from the backplane connectors very carefully to avoid bending pins

- 2. Place the new backplane into the front of the mainframe cabinet.
- 3. Replace all of the perimeter screws to secure the backplane to the chassis.
- 4. Replace the sense cable on the upper connector in the upper-left corner of the backplane. Refer to Figure 24.
- 5. Replace the CPU enable connector on the lower connector in the upper-left corner of the backplane. Refer to Figure 24.
- 6. Replace the 48 Vdc cables on the studs of the 48 Vdc power bus and secure them with the four nuts you removed earlier. These connections must be tight to prevent power loss.

- 7. At the rear of the cabinet, secure all of the mainframe modules using FRP 9. Close the rear door using FRP 3.
- 8. At the front of the cabinet, replace the clock/scan module using FRP 10.
- 9. Replace the backplane cover and tighten the two retaining screws to secure the cover to the chassis. Refer to Figure 21.
- 10. Close the front door of the mainframe cabinet.
- 11. Reconnect the AC power connector under the floor.
- 12. Power up the system using FRP 1. The system is now ready for the boot sequence.

# **FRP 12: Central Control Unit**

The central control unit (CCU) is located at the top of the mainframe cabinet and is connected to the emergency power-off button on the front door. The CCU contains the SYSTEM OFF button and provides both audible and LED alarms. The CCU contains a battery backup system that maintains the condition of the LEDs for up to 72 hours.

### **Tools Required**

- #2 Phillips screwdriver
- Small flat-bladed screwdriver

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the rear door of the mainframe cabinet using FRP 3.
- 4. Label and disconnect the cables located at the bottom of the CCU. Refer to Figure 25.
- 5. Set the BATTERY switch to the 0 position to disconnect the battery. Refer to Figure 25.





- 6. Open the front door of the mainframe cabinet using FRP 2.
- 7. At the front of the CCU, remove the cable that connects the front door to the CCU.



Figure 26. CCU Securing Screws

## CAUTION

The CCU is not held in the cabinet by any locking mechanism. Do not push the CCU more than 3 in. (8 cm). Failure to do so may damage the CCU.

- 8. Remove the four screws that secure the CCU to the chassis. Refer to Figure 26.
- 9. At the rear of the mainframe cabinet, gently push on the CCU to begin moving it out of the cabinet.
- 10. At the front of the mainframe cabinet, grasp the CCU and pull it out of the cabinet. The CCU is approximately 17 in. (43 cm) long, but it is not heavy.

### **Replacement Procedure**

- 1. Unpack the new CCU. Set the packing material aside for reuse when you return the defective CCU to Logistics.
- 2. Slide the new CCU into the front of the mainframe cabinet.
- 3. Insert and tighten the four screws that secure the CCU to the chassis. Refer to Figure 26.
- 4. At the rear of the mainframe cabinet, reconnect the CCU cables. Refer to Figure 25.
- 5. Using a small flat-bladed screwdriver, move the BATTERY switch from the 0 to the 1 position. Refer to Figure 25.
- 6. Close the rear door using FRP 3.
- 7. At the front of the cabinet, reconnect the cable between the front door and the CCU.
- 8. Close the front door.
- 9. Power up the mainframe cabinet first and then power up the I/O cabinet (refer to FRP 1). The system is now ready for the boot sequence.

# FRP 13: Incoming AC Power Assembly

The mainframe incoming AC power assembly contains a line filter, a circuit breaker, and an AC power distribution network.

### **Tools Required**

#2 Phillips screwdriver

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Remove the mainframe AC plugs from the AC outlets. These outlets will probably be under the floor if the system is installed on a raised floor.



- 4. Remove the right side panel from the back of the mainframe cabinet using FRP 4.
- 5. Remove the four screws that secure the incoming AC power assembly to the mainframe cabinet. Refer to Figure 27.
- 6. Grasp the AC power cords at the incoming AC power assembly and pull out slightly until the sides of the AC power assembly clear the chassis. Refer to Figure 27.
- 7. Pull the tray out of the mainframe cabinet until the Twist-Lock connectors, located on the front of the incoming AC power assembly, become accessible through the lower-right side of the mainframe cabinet.



Figure 27. Mainframe Incoming AC Power Assembly Screws

- 8. Label and remove the Twist-Lock connectors and sense cables from the front of the incoming AC power assembly.
  - **NOTE:** The connectors on the front of the incoming AC power assembly are daisy chained together. These connectors are the sense and control connectors.
- 9. Remove the entire tray from the mainframe cabinet and set it on a cleared area of the floor.

- 1. Unpack the new incoming AC power assembly. Save the packing material for reuse when you return the defective power assembly to Logistics.
- 2. Place the front of the incoming AC power assembly on the bottom of the mainframe cabinet.
- 3. Push the tray into the mainframe cabinet until it is possible to reconnect the cables that you removed from the front of the incoming AC power assembly. Reconnect these cables.
- 4. Push the tray in completely. Be careful not to pinch or cut the cables.
- 5. Insert and tighten the four screws that secure the incoming AC power assembly to the mainframe cabinet. Refer to Figure 27.
- 6. Ensure that the circuit breaker is in the 0 (OFF) position.
- 7. Insert the mainframe AC power plugs into the AC outlets.
- 8. Power up the mainframe cabinet using FRP 1. The system is now ready for the boot sequence.

## FRP 14: 48 Vdc Power Supply

There are five 48 Vdc power supplies in the front-end power supply chassis. These five power supplies are connected in an n+1 configuration to provide DC power to the processor and memory modules. The 48 Vdc power supplies are capable of being removed and replaced while the mainframe is in operation.

#### **Tools Required**

#2 Phillips screwdriver

- 1. Open the front door of the mainframe cabinet using FRP 2.
- 2. Locate the defective 48 Vdc power supply by noting the indicator LEDs on the front-end status panel. Refer to Figure 28.
- 3. Loosen the two knurled screws that secure the front-end air filter housing. Refer to Figure 28.
- 4. Lift and remove the air filter housing from the front of the front-end power-supply assembly.
- 5. Loosen the captive screw on the front of the defective 48 Vdc power supply. Refer to Figure 29.
- 6. Grasp the handle and pull the 48 Vdc power supply out of the front-end power-supply assembly.
  - **NOTE:** The 48 Vdc power supply is not restrained. Do not let it fall off the chassis during removal.



Figure 28. Front-end Power Assembly Status Panel

Figure 29. 48 Vdc Power Supplies



- 1. Unpack the new 48 Vdc power supply. Save the packing material for reuse when you return the defective 48 Vdc power supply to Logistics in Chippewa Falls.
- 2. Place the rear of the new 48 Vdc power supply onto the lip of the chassis; then insert the power supply slowly into its slot in the chassis. Carefully engage the power supply with the connectors, and then firmly seat the power supply with the connectors.
- 3. Tighten the captive screw to secure the 48 Vdc power supply.
- 4. Clean the air filter by vacuuming it before you replace it.
- 5. Place the bottom of the air filter housing into the U-channel on the front of the front-end power assembly. Tighten the two captive screws to secure the air filter housing.
- 6. Close the front door of the mainframe cabinet.

# **FRP 15: Front-end Power Assembly**

The front-end power assembly contains the monitoring and control circuits and the switching circuits for the five 48 Vdc power supplies. It weighs approximately 50 lbs. Two people are required to remove the front-end power assembly from the mainframe.

### **Tools Required**

#2 Phillips screwdriver

#### **Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the front door of the mainframe cabinet using FRP 2.
- 4. Remove the five 48 Vdc power supplies using FRP 14.
- 5. Label and disconnect the cables that are located on the top of the front-end power assembly. Refer to Figure 31.
- 6. Remove the four screws that secure the front-end power assembly to the mainframe cabinet (two screws are covered by the air filter).
- 7. Pull the assembly out of the mainframe cabinet slowly until the AC power cords are visible. Refer to Figure 32.

Disconnect the AC power cords from the front of the incoming AC power assembly. These power cords use a Twist-Lock connector.

## CAUTION

The 48 Vdc power supply weighs approximately 50 lbs. Two people are required to remove the front-end power supply from the mainframe. Failure to use two people may result in personal injury or damage to the power supply. 8. Completely remove the front-end power assembly from the mainframe cabinet.



#### Figure 30. Front-end Power Assembly Screws



Figure 31. Front-end Power Assembly Cables

Figure 32. Front-end Power Assembly Power Cords



- 1. Unpack the new front-end power assembly. Set the packing material aside to reuse when you return the defective front-end power assembly to Logistics.
- 2. Slide the new front-end power assembly partially into the mainframe cabinet; leave room at the rear to connect the AC power cords.
- 3. Connect the AC power cords at the rear of the front-end power assembly to the front of the incoming AC power assembly.



- 4. Slide the front-end power assembly the rest of the way into the mainframe cabinet.
- 5. Insert and tighten the four screws that secure the front-end power assembly to the mainframe cabinet. Refer to Figure 30.
- 6. Connect the cables to the top of the front-end power assembly.
- 7. Replace the blank panel and insert and tighten the four screws to secure the cover to the mainframe chassis.
- 8. Replace the five 48 Vdc power supplies using FRP 14.
- 9. Power up the mainframe cabinet using FRP 1.
- 10. Check the 48 Vdc status LEDs to confirm the correct operation of the front-end power assembly. Refer to Figure 31.
- 11. Close the front door of the mainframe cabinet. The system is now ready for the boot sequence.

# **FRP 16: Blower Assembly**

The mainframe blower assembly should have a very low failure rate. However, in the event that a failure does occur, the entire system will be down. The blower assembly is large and bulky; two people are required to remove it from the mainframe.

## **Tools Required**

- #2 Phillips screwdriver
- Channel-lock type pliers

### **Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the rear door of the mainframe cabinet using FRP 3.
- 4. Remove the four screws that secure the exhaust plenum to the cabinet. Refer to Figure 33 to locate the exhaust plenum.
- 5. Remove the seven screws that secure the rear of the blower assembly to the bottom of the mainframe card cage. Refer to Figure 34.
- 6. Open the front door of the mainframe cabinet using FRP 2.
- 7. Loosen the two captive screws and open card cage A door. Refer to Figure 35.
- 8. Look down over the top of the front-end power assembly and remove the control system cable and the power input cable from the blower chassis. Refer to Figure 36.

# CAUTION

The blower assembly weighs approximately 80 lbs and is awkward to handle. Two people are required to remove the blower from the system. Failure to use two people may result in personal injury or damage to the blower assembly. 9. From the rear of the cabinet, firmly grasp and pull the blower assembly from the mainframe chassis. Note how the blower assembly engages with the mainframe chassis slide rails. Refer to Figure 34.







Figure 34. Blower Assembly Rear Screws



Figure 35. Blower Assembly Access Panels



Figure 36. Blower Assembly Cables

1. Carefully unpack the new blower assembly. Set the packing material aside for reuse when you return the defective blower assembly to Logistics.

## CAUTION

The blower assembly weighs approximately 80 lbs and is awkward to handle. Two people are required to remove the blower from the system. Failure to use two people may result in personal injury or damage to the blower assembly.

- 2. Grasp the new blower assembly and set the rear of the assembly onto the rail shelf in the rear of the mainframe chassis. Push the blower assembly into the mainframe cabinet. The blower assembly should slide onto the rail shelf and form an airtight closure.
- 3. At the rear of the mainframe cabinet, insert the seven screws that secure the blower assembly to the bottom of the mainframe card cage. Refer to Figure 34.
- 4. At the rear of the mainframe cabinet, position the exhaust plenum on the chassis and insert the four screws that secure the exhaust plenum to the mainframe chassis. Refer to Figure 33.
- 5. At the front of the mainframe cabinet, connect the control system cable and the power input cable to the blower assembly. Refer to Figure 36.
- 6. Apply power to the mainframe cabinet using FRP 1 and ensure that the replacement blower is operational. The blower is operational if you can detect airflow through the exhaust plenum at the rear of the mainframe cabinet.
- 7. Close the front and rear doors of the mainframe cabinet. The system is now ready for the boot sequence.

# **FRP 17: Processor or Memory Module**

The mainframe contains two types of modules: the processor module and the memory module. Both types of modules are removed and replaced in the same manner.

### **Tools Required**

An optional torquing tool (P/N 90472600) is available from Customer Service Logistics in Chippewa Falls. The torquing tool can be used to seat or unseat the CPU and memory modules. The torquing tool applies 28 in-lbs of torque (hand tight). The cost is \$150.00.

#### **Module Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the front door of the mainframe using FRP 2 or the rear door of the mainframe cabinet using FRP 3. If need to remove a module from the front of the mainframe, open the card cage door by loosening the two captive screws. Refer to Figure 37. If necessary, use the diagram shown in Figure 38 to determine the location of the module to be removed.
- 4. If you need to remove a processor module, remove the channel cables that are connected to the front of the module.
- 5. Turn the jack screws located at the top and bottom of the module counterclockwise until the module is loose in the chassis. Refer to Figure 39.

### CAUTION

The modules are heavy. Use proper lifting techniques to avoid back injury and module damage.

- 6. Grasp the module securely and remove it from the chassis.
- 7. Place the module on a static-dissipative surface.

Figure 37. Card Cage A Door



## Figure 38. Module Locations

#### Front

8 X 8 System

	Mem 4	Mem 6	Proc 4	Proc 5	Proc 6	Proc 7	Mem 5	Mem 7
Card Cage A	Mem Sec 4	Mem Sec 6	CPUs	CPUs	CPUs	CPUs	Mem Sec 5	Mem Sec 7
			16	20	24	28		
			17	21	25	29		
			18	22	26	30		
			19	23	27	31		
	Midplane							
Card Cage B	Mem Sec 0	Mem Sec 2	CPUs	CPUs	CPUs	CPUs	Mem Sec 1	Mem Sec 3
			0	4	8	12		
			1	5	9	13		
			2	6	10	14		
			3	7	11	15		
	Mem 0	Mem 2	Proc 0	Proc 1	Proc 2	Proc 3	Mem 1	Mem 3
	Back							

**NOTES**: Proc 4, Proc 5, Proc 6, and Proc 7 slots may be vacant in an 8 x 8 configuration. All memory module slots will always be filled.



Figure 39. Module Jack Screws

### **Module Replacement Procedure**

- 1. Carefully unpack the replacement module. Be sure to save the packing material for reuse when you return the defective module to Logistics in Chippewa Falls.
- 2. Place the module into the module guides in the mainframe chassis and push the module into the chassis until it contacts the damper handles.
- 3. Turn the damper handle counterclockwise 1/4 turn, and push the module the rest of the way into the chassis (until it contacts the midplane).
  - **NOTE:** Turn each jack screw simultaneously in Step 4 to avoid binding the module on the module rails.
- 4. Turn each jack screw clockwise and hand tighten to fully seat the module.
- 5. If necessary, reconnect the appropriate channel cables to the front of the processor module.
- 6. Close the rear door of the cabinet using FRP 3.
- 7. Power up the cabinet using FRP 1. The system is now ready for the boot sequence.

# FRP 18: Clock/Scan Module

The clock/scan module is located in the rear of the mainframe cabinet. It provides system clocks and multiplexes the scan functions of the CRAY J932se system. The clock module incorporates the same clock board assembly as the CRAY J916se system but uses an extended mechanical frame. This frame serves two functions:

- To extend the card latching points to a point where they are accessible to enhance removal and insertion
- To minimize air leakage and electromagnetic interference (EMI)

#### **Tools Required**

#2 Phillips screwdriver

#### **Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the rear door of the mainframe cabinet using FRP 3.
- 4. Release the two retaining screws that secure the cover. Refer to Figure 40.
- 5. Remove the CPU enable cable connector from the clock/scan module.
- 6. Grasp the ejector handles on the clock/scan module and press upward on the top handle and downward on the bottom handle to release the module from the midplane. Refer to Figure 41.

## CAUTION

Place the defective clock/scan module on an ESD-safe surface to prevent further damage to the module.

- 7. Pull the clock/scan module out of the guide slots and remove it from the cabinet.
- 8. Remove the clock module cover by removing the four cover screws. Refer to Figure 41.
- 9. Remove the clock module by removing the four screws and four flat washers that secure the clock module to the clock unit frame. Refer to Figure 41.

1. Unpack the new clock/scan module. Retain the packing material for reuse when you return the defective module to Logistics in Chippewa Falls.

Install the new clock module on the clock unit frame. The clock module fits into the recessed edge of the top and bottom guide rails.

# CAUTION

Damage to the equipment may result if you overtighten the screws into the plastic rails.

- 2. Install the four screws and four flat washers to secure the clock module to the clock unit frame.
- 3. Install the four cover screws to secure the clock module cover to the clock unit frame.
- 4. Push the clock/scan module into the chassis until it contacts the midplane connectors.
- 5. Using the ejector handles as push-pads, seat the clock/scan module firmly in the midplane connector.
- 6. Connect the CPU enable cable connector to the clock/scan module.
- 7. Replace the cover; then tighten the two retaining screws.
- 8. Close the rear door of the mainframe cabinet.

9. Power up the mainframe cabinet using FRP 1. The system is now ready for the boot sequence.









# **FRP 19: Midplane**

It may be necessary to replace the midplane to correct communication problems between CPUs or between a CPU and memory. The midplane is removed by working from the front and back of the mainframe. The IOS cabinets do not need to be disconnected in order to remove the midplane. Removal of the midplane has been defined as a Cray Technical Support level procedure. Please contact the local Cray Research office or the Cray Customer Service Call Center to arrange for this procedure. Two people are required to remove the midplane.

### **Tools Required**

- #2 Phillips screwdriver
- 5/32-in. ball-head hex driver
- 7/64-in. ball-head hex driver
- 3/8-in. nut driver

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Disconnect the AC power connector from the mainframe.
- 4. Remove all of the mainframe modules using FRP 9.
- 5. Remove the clock/scan module using FRP 10.
  - **NOTE:** Cover the cooling ducts on the bottom of the card cage to prevent screws or nuts from falling into the blower assembly.
- 6. Remove the mainframe blower assembly using FRP 16.
- 7. From the front of the cabinet, remove the eight screws that secure the inlet duct to the chassis. Refer to Figure 42.
- 8. Remove the six screws (three on each side) that are located behind the sense cable connector supports. These screws secure card cage A to the chassis. Refer to Figure 42.
- 9. Remove the two sense cables. Refer to Figure 42.

- 10. Remove the power-bus cables from the front-end power assembly. Refer to Figure 42.
- 11. From the back of the cabinet, remove the four screws (two on each side) that secure card cage B to the chassis. Refer to Figure 43.
  - **NOTE:** Cover the cooling ducts on the bottom of the card cage to prevent screws or nuts from falling into other assemblies.
- 12. Remove the six screws (three on each side on the back of card cage B) that secure card cage B to the midplane stiffeners. Refer to Figure 44.

### CAUTION

Two people are required to remove card cage B from the chassis. Failure to use two people may result in personal injury or damage to the card cage.

- 13. Using two people, remove card cage B by siding it out of the back of the chassis.
- 14. From the front of the chassis, push card cage A and the air inlet duct toward the back of the chassis. Continue sliding card cage A and the air inlet duct until card cage A is approximately 3 in. (7.5 cm) from the end of the slide rail.
- 15. From the back of the mainframe, push the air inlet duct towards the front of the mainframe until the rear edge of the inlet duct is about 4 in. (10 cm) beyond the midplane, exposing the sense cable connectors that lead to the CCU. Refer to Figure 45.
- 16. Remove the sense cable connector from each side of card cage A. Refer to Figure 44.
- 17. Remove the 32 screws that secure the power bus to the midplane. Refer to Figure 45.

## CAUTION

The midplane is removed from the chassis in Step 18 and Step 19. Two people are required to remove the midplane. One person must remove the screws while the other person prevents the midplane from falling off the back of the mainframe. The midplane weighs approximately 60 lbs. Both people are required to lift the midplane away from the mainframe. Failure to use two people may result in personal injury or damage to the midplane.

- 18. Have a second person support the midplane from the back of the mainframe. Then, from the front of the mainframe, remove the six screws that secure card cage A. Refer to Figure 44.
- 19. Move to the rear of the mainframe and assist the other person. Carefully tilt the midplane away from card cage A and remove it from the rear of mainframe cabinet.


Figure 42. Midplane Removal (Card Cage A)



Figure 43. Midplane Removal (Card Cage B)





## **Replacement Procedure**

1. Unpack the new midplane. Save the packing material for reuse when you return the old midplane to Logistics in Chippewa Falls.

# CAUTION

The midplane weighs approximately 60 lbs. Two people are required to remove the midplane from the shipping container. Failure to use two people may result in personal injury or damage to the midplane.

Place the new midplane onto card cage A guide pins.

## CAUTION

Two people are required to perform Step 2. One person must install the screws while the other person supports the midplane from the back of the mainframe. Failure to do so may result in personal injury or damage to the midplane.

- 2. From the front of the mainframe, install and tighten the six screws (three on each side) to secure the midplane to card cage A. Refer to Figure 44.
- 3. Replace the sense cables on the connectors in the upper-right and upper-left corners of the midplane. Refer to Figure 44.
- 4. Install and tighten the 32 screws that secure the power bus to the midplane. Refer to Figure 45.
- 5. Slide the air inlet duct and card cage A to the front of the cabinet and align the air inlet duct so that it is flush with the front of the cabinet. Refer to Figure 45.
- 6. Position card cage B in the mainframe. Ensure that card cage B and the air inlet duct are interlocked to form an airtight seal.

# CAUTION

Use caution when installing the six screws in Step 7. Ensure that the screws are not cross-threaded. The midplane stiffeners are made of aluminum and can be stripped easily. Install the middle screws first (one on each side) and then hand tighten them. Then install and hand tighten the other screws.

- 7. From the back of the mainframe, install and hand tighten the six screws (three on each side) that secure card cage B to the midplane stiffeners. Refer to Figure 43.
- 8. From the front of the mainframe, install and tighten the six screws that secure card cage A to the midplane.
- 9. Tighten the six screws that you installed in Step 7 to secure card cage B to the midplane.
- 10. From the back of the cabinet, install the four screws (two on each side) that secure card cage B to the chassis. Refer to Figure 43.
- 11. From the front of the mainframe, install the six screws (three on each side) to secure card cage A to the chassis. Refer to Figure 42.
- 12. Ensure that the air inlet duct is flush with the front of the chassis.
- 13. Install the eight screws to secure the air inlet duct to the chassis. Refer to Figure 42.
- 14. Connect the two sense cables to card cage A. Refer to Figure 42.
- 15. Connect the power-bus cables to the front-end power assembly.
- 16. Install the mainframe blower assembly using FRP 16.

#### CAUTION

Remove the protective covers from the backplane connectors very carefully to avoid bending pins.

- 17. Install all of the mainframe modules using FRP 9.
- 18. Install the clock/scan module using FRP 10.
- 19. Close the mainframe cabinet doors.
- 20. Reconnect the AC power connector.
- 21. Power up the system using FRP 1. The system is now ready for the boot sequence.

# FRP 20: Central Control Unit

The central control unit (CCU) is located at the top of the mainframe cabinet. The CCU provides manual and remote control of the system and also provides both audible, LED, and remote alarm and fault indications. The CCU contains a battery backup system that maintains the condition of the LEDs for up to 72 hours.

## **Tools Required**

- #2 Phillips screwdriver
- Small flat-bladed screwdriver

## **Removal Procedure**

- 1. Ensure that the operating system is not running before you proceed.
- 2. Power down the mainframe cabinet using FRP 1.
- 3. Open the rear door of the mainframe cabinet using FRP 3.
- 4. Label and disconnect the CCU cables from the connectors located at the bottom of the CCU. Refer to Figure 46.

Figure 46. CCU Cable Connections (Rear View)



**Rear View** 

- 5. Open the front door of the mainframe cabinet using FRP 2.
- 6. At the front of the CCU, remove the cable that connects the front door to the CCU. Refer to Figure 47.
- 7. Remove the four screws that secure the CCU to the chassis. Refer to Figure 47.

Figure 47. CCU Screws



- 8. At the rear of the mainframe cabinet, gently push on the CCU to begin moving it out of the cabinet.
- 9. Push the two release buttons on the slide rail to release the CCU from the slide rail.
- 10. Remove the screws that secure the slide rail to the CCU and retain the slide rail for installation.
- 11. At the front of the mainframe cabinet, grasp the CCU and pull it out of the cabinet.

# **Replacement Procedure**

- 1. Unpack the new CCU. Set the packing material aside for reuse when you return the defective CCU to Logistics.
- 2. Install the two slide rails on the CCU and secure the slide rails to the CCU by tightening the screws.
- 3. Slide the new CCU into the front of the mainframe cabinet.
- 4. Insert and tighten the four screws that secure the CCU to the chassis. Refer to Figure 47.
- 5. At the rear of the mainframe cabinet, reconnect the CCU cables. Refer to Figure 47.
- 6. Using a small flat-bladed screwdriver, move the BATTERY switch from the 0 to the 1 position. Refer to Figure 46.
- 7. Close the rear door using FRP 3.
- 8. At the front of the cabinet, reconnect the cable between the front door and the CCU. Refer to Figure 47.
- 9. Close the mainframe cabinet front door.
- 10. Power up the mainframe cabinet first and then power up the I/O cabinet. Refer to FRP 1. The system is now ready for the boot sequence.