AC System Cabling

HMM-166-0.2
CRAY T3E Air-cooled System
Last Modified: April 1997

Figures

Tables

This document provides detailed information about the cables and connections that are internal to CRAY T3E air-cooled (AC) cabinets. This document also provides an overview of a typical CRAY T3E AC system.

Record of Revision

October 1996

Original printing.

Revision 0.1: December 1996

Converted document to HTML. Removed reference to Master GigaRing clock wire, which does not exist. Modified Table 20 and Table 21, which list the PEM-to-WACS and clock-to-WACS pin assignments, respectively.

Revision 0.2: April 1997

Updated GigaRing cable part numbers in Table 6.

General System Information

A typical CRAY T3E AC system includes three major types of equipment:

- One or more CRAY T3E AC cabinets
- A scalable I/O system
- A system workstation (SWS)

Both the CRAY T3E AC cabinet and the scalable I/O are nodes on the GigaRing channel. The CRAY T3E AC cabinet communicates with the scalable I/O via the GigaRing channel. The scalable I/O communicates with the system workstation over the Cray Research Ethernet channel.

The CRAY T3E cabinet(s) have

- GigaRing channels (for I/O)
- Warning and control system (WACS) connections for maintenance
- One to six processing element modules (PEMs) per cabinet

A minimum scalable I/O system includes:

- A PC-10, with WACS connections for maintenance
- A multipurpose node (MPN-1) with optional SBus-based controllers and with an Ethernet connection from the MPN to the Cray Research Ethernet (for support)

The scalable I/O system may also be configured to include:

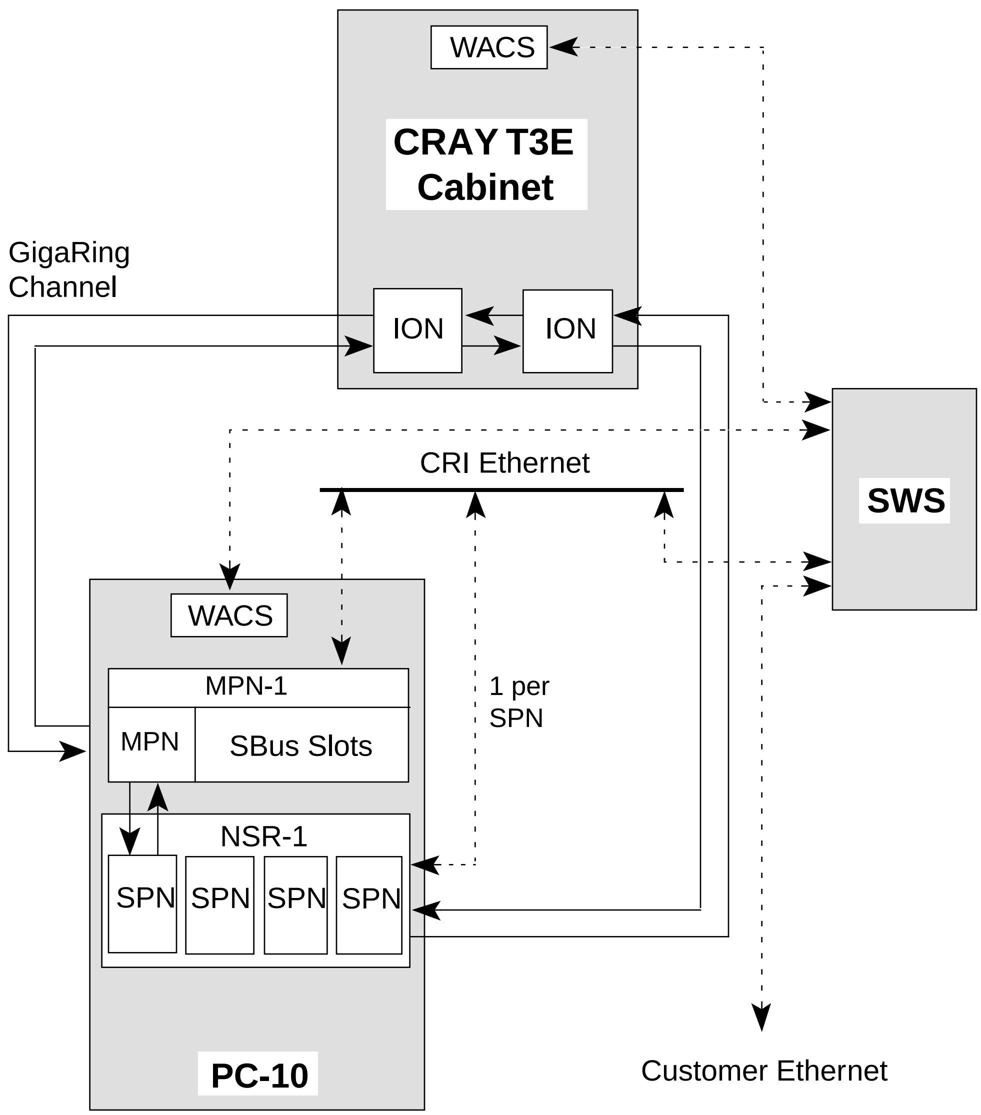
- One or more node subracks (NSR-1) for optional single-purpose nodes (SPNs), with an Ethernet connection from each SPN to the Cray Research Ethernet (for support)
- Disk storage systems; options include SCSI disks and fibre channel disks

In addition, the system may include IPI disks, which are housed in a separate cabinet.

The SPARC based system workstation (SWS) connects to the Cray Research Ethernet and to the CRAY T3E WACS and PC-10 WACS.

Figure 1 is a block diagram of a typical system. In Figure 1, the CRAY T3E system is shown connected to a single GigaRing channel.

Figure 1. Typical System



CRAY T3E AC Cabinet Overview

The CRAY T3E AC system is a self-hosting, massively parallel processing (MPP) computer system. The CRAY T3E AC system uses standard commercial power and does not require additional power equipment.

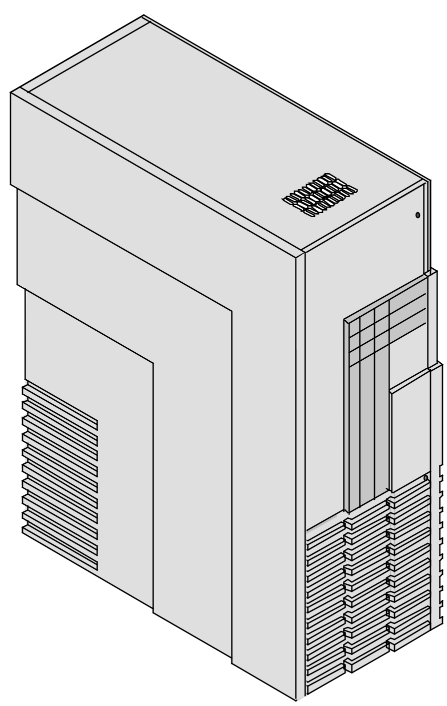
In addition, the CRAY T3E AC system does not require cooling support equipment, such as a heat exchanger unit (HEU). Instead, the system is fan cooled by blowers that draw air through the cabinets. Customer-provided air-handling equipment cools the warm air that is discharged from the system's blowers (fans).

To improve cooling, each module and each power supply is positioned vertically and fitted with a heat sink (radiator). Heat from the module and power supply components transfers to the heat sinks, where it then transfers to air. The module and power supply rails contain air ducts that direct the airflow over the heat sinks.

The AC PEMs are single-board modules, with 4 processing elements (PEs) per module. The system scales up 1 PEM at a time, beginning with cabinet 0, slot 1. Each cabinet can hold 6 modules. The maximum configuration comprises 6 cabinets, which contain a total of 34 PEMs (136 PEs) and 2 clock modules.

Figure 2 shows a single CRAY T3E AC cabinet with trim.

Figure 2. Single Cabinet with Trim (Front Left View)



Cabinet, Slot, PEM, and Rail Numbering

The CRAY T3E AC system contains 1 to 6 CRAY T3E AC cabinets. The cabinets are numbered 0 through 5. Each cabinet contains 6 module slots. Each slot is identified by a 3-number designator that consists of the cabinet number and the slot number. Slot numbering starts at 001 (cabinet 0, slot 1) and goes to 506 (cabinet 5, slot 6).

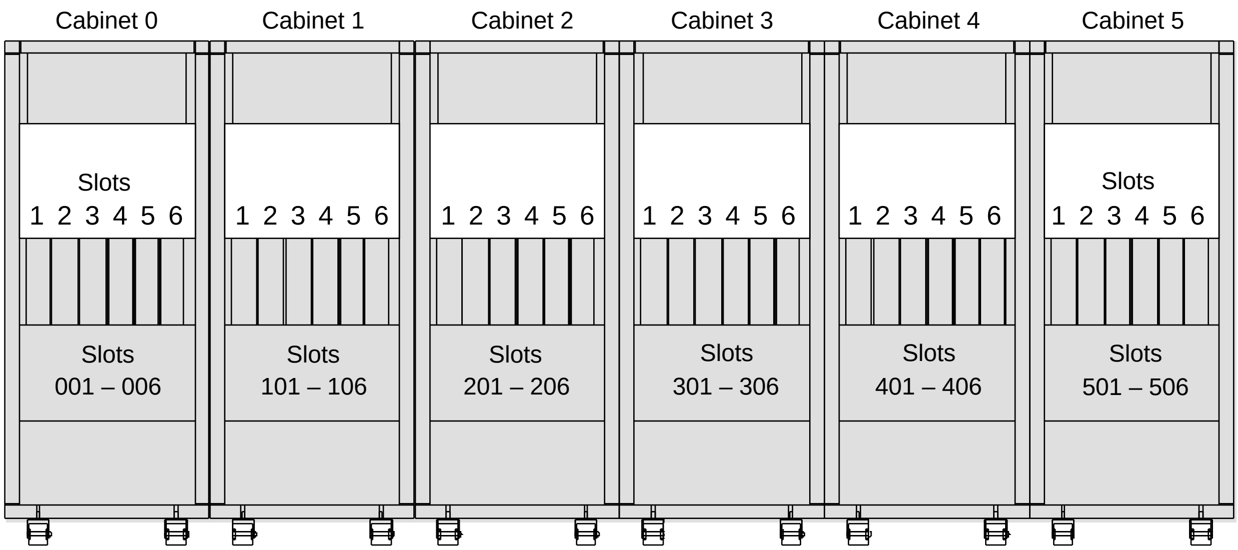
A fully populated 6-cabinet CRAY T3E AC system contains 34 PEMs and 2 clock modules. The first PEM in the system (the PEM in slot 1 of cabinet 0) is designated PEM 0. The last PEM in the system is designated PEM 33 (the clock modules are not counted). The clock module in cabinet 0 is clock module 0; the clock module in cabinet 3 is clock module 1.

Several tables within this document show source and destination connector locations. A source or destination connector of 004-zah03, for example, represents:

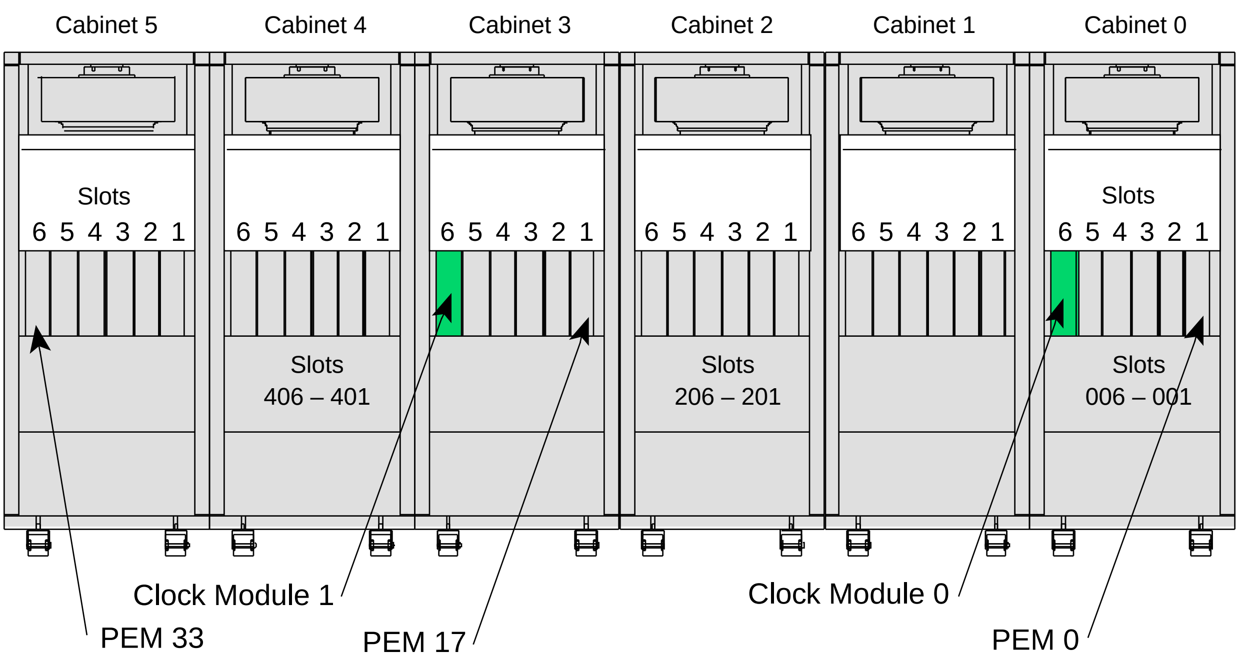
- 004 - cabinet 0, module slot 4
- zah - rail connector zah
- 03 - pin 03 of connector zah (true and complement pins included)

Figure 3 shows the cabinet numbering scheme and slot numbering scheme for the maximum system configuration. (Note that the power supply insertion end of the cabinet is the system *front*.)

Figure 3. CRAY T3E AC Cabinets – Maximum Configuration



System Front, Power Supply Insertion End



System Rear, Module Insertion End

Module Connections

In addition to power connections, each AC PEM contains the following types of major connections:

- Torus (logic)
- GigaRing (I/O)
- Clock
- WACS
- Boundary scan

Each module PCB contains edge connectors for all of these connections. The PCB connectors are shuttle-type connectors, as discussed on the following pages. The PCB connectors join to connectors in the module rails. Figure 4 shows the PCB edge connectors and the associated PEM rail connectors.

The Z-side wiremat is located above the modules, and the Y-side wiremat is located below the modules. The Y side of the board, however, is inserted toward the top of the cabinet. As a result, the Y-side board (edge) connectors mate with the Z-side rail (wiremat) connectors, and the Z-side board (edge) connectors mate with the Y-side rail (wiremat) connectors.

NOTE: Both the Y-side wiremat and the Z-side wiremat contain X, Y, and Z dimension torus connections.

The cabinets ship with the rails and modules installed and with most (or all) connections complete. For single-cabinet systems, all internal connections remain intact during shipment. For multiple-cabinet system, only wires and cables that pass from cabinet to cabinet are disconnected for shipment.

Figure 4. PEM Connectors (Viewed through Heat Sink)

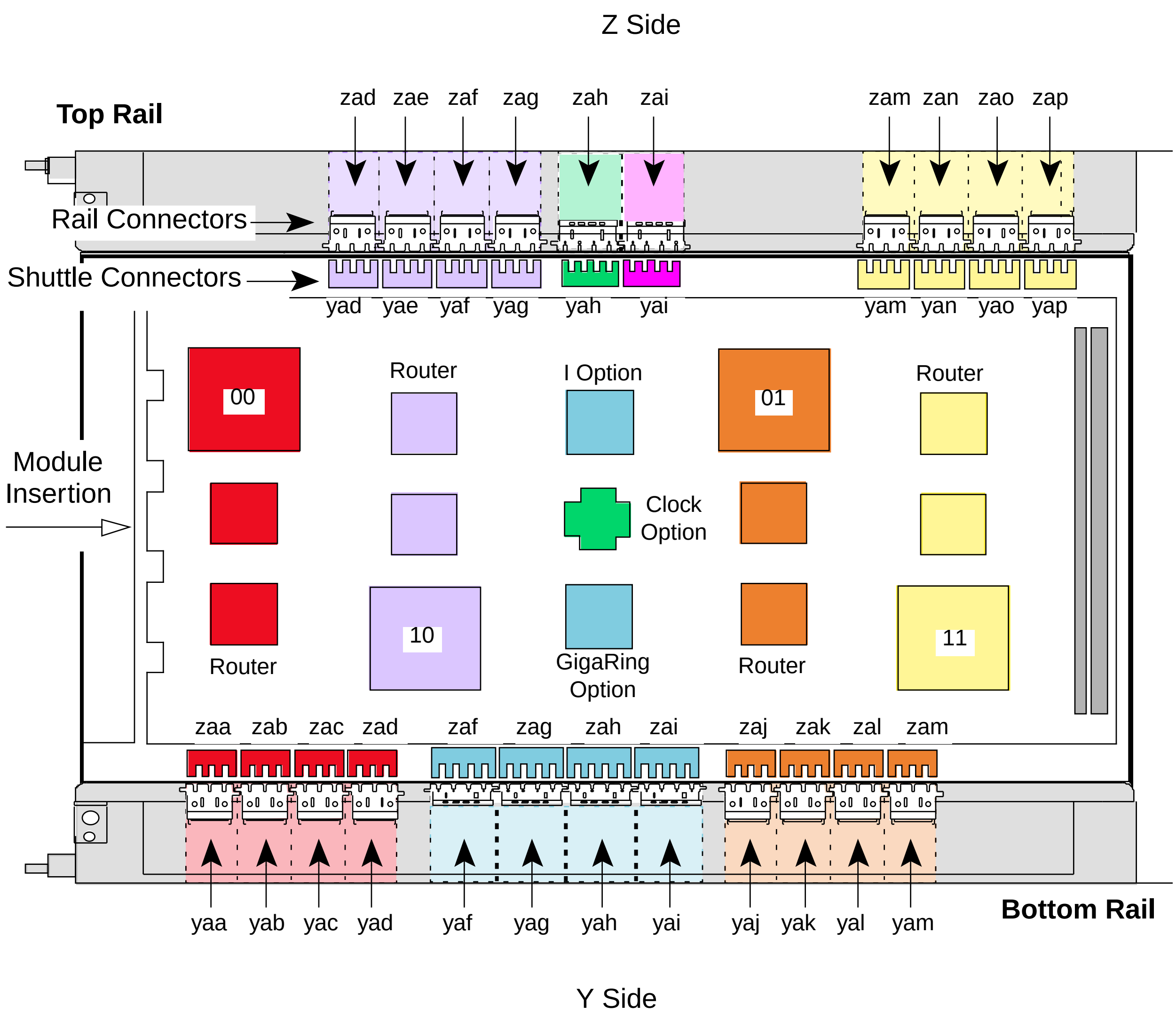


Table 1 provides details on the connectors shown in Figure 4. It shows the names of the PCB edge connectors and rail connectors.

Table 1. Module PCB and Rail Connector Names and Usages

PCB Connector	Rail Connector	Usage
Z-side connectors (above modules)		
YAD	ZAD	Node 10 – Y dimension
YAE	ZAE	Node 10 – Z dimension
YAF	ZAF	Node 10 – Z dimension
YAG	ZAG	Node 10 – X dimension
YAH	ZAH	Clock, WACS, Boundary Scan
YAI	ZAI	Boundary Scan
YAM	ZAM	Node 11 – Y dimension
YAN	ZAN	Node 11 – Z dimension
YAO	ZAO	Node 11 – Z dimension
YAP	ZAP	Node 11 – X dimension
Y-side connectors (below modules)		
ZAA	YAA	Node 00 – X dimension
ZAB	YAB	Node 00 – Z dimension
ZAC	YAC	Node 00 – Z dimension
ZAD	YAD	Node 00 – Y dimension
ZAF	YAF	GigaRing – Negative Ring In (NRI)
ZAG	YAG	GigaRing – Positive Ring Out (PRO)
ZAH	YAH	GigaRing – Negative Ring Out (NRO)
ZAI	YAI	GigaRing – Positive Ring In (PRI)
ZAJ	YAJ	Node 01 – X dimension
ZAK	YAK	Node 01 – Z dimension
ZAL	YAL	Node 01 – Z dimension
ZAM	YAM	Node 01 – Y dimension

Figure 5 shows the clock module connectors, and Table 2 provides details on the connectors.

Figure 5. Clock Module ConnectorsClock

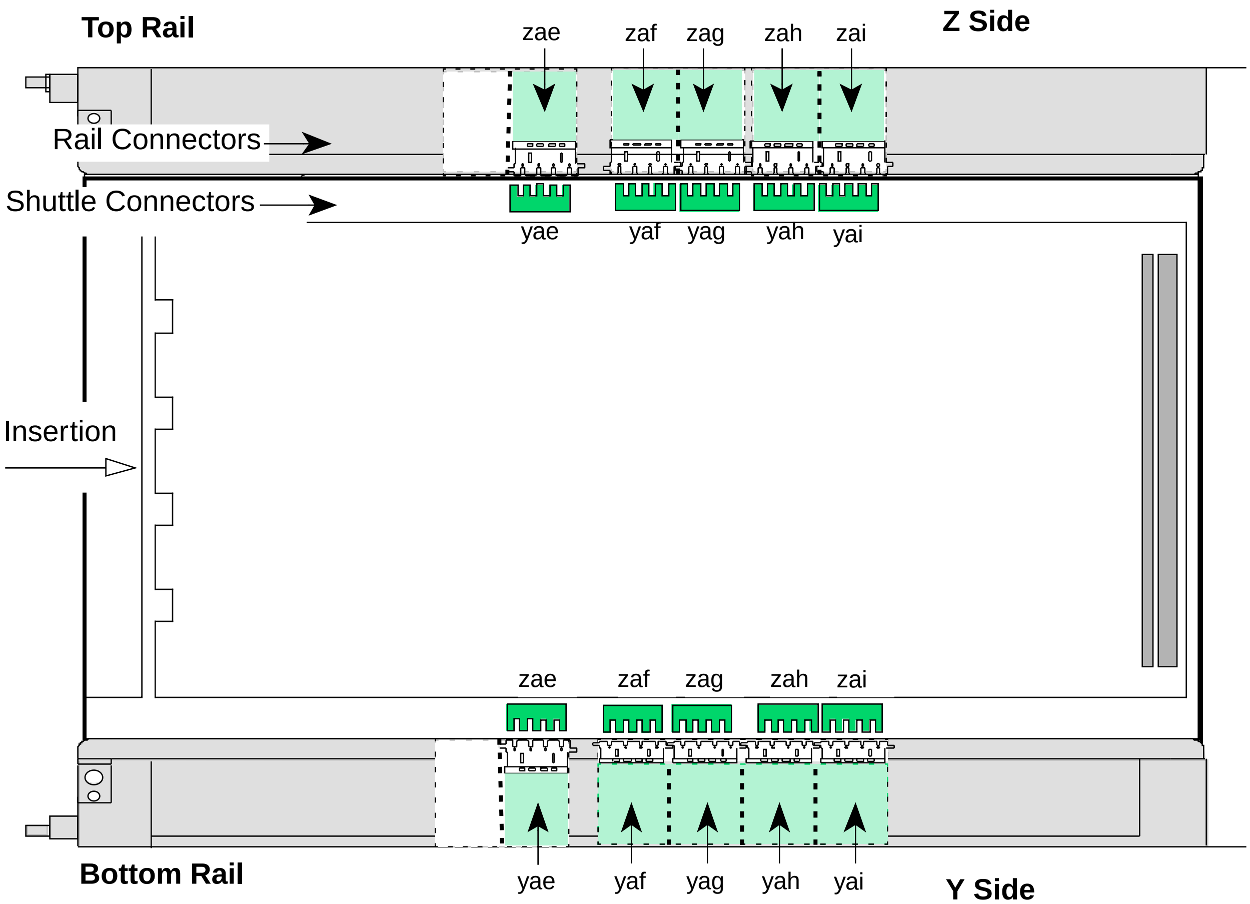


Table 2. Clock PCB and Rail Connector Names and Usages

PCB Connector	Rail Connector	Usage
Z-side connectors (above modules)		
YAE	ZAE	stms0 fanout/stms0,1 i
YAF	ZAF	stclk fanout/stclk in/snclk
YAG	ZAG	snclk
YAH	ZAH	snclk in/mxclk
YAI	ZAI	mnclk/clksel/mtclk in
Y-side connectors (below modules)		
ZAE	YAE	stm1 fanout
ZAF	YAF	snclk/stclk fanout
ZAG	YAG	snclk fanout

Table 2. Clock PCB and Rail Connector Names and Usages

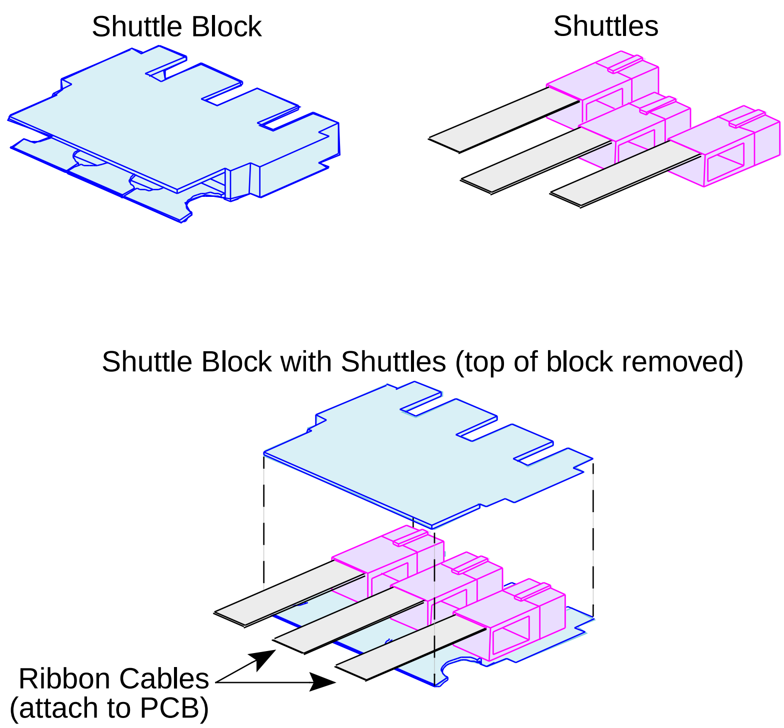
PCB Connector	Rail Connector	Usage
ZAH	YAH	oscscx/mxclk in/mxclk out
ZAI	YAI	-10 & in/sense & interlock/tclk select

Shuttle Connectors

The CRAY T3E system uses *shuttle connectors*. A shuttle connector comprises two main parts: the rail connector and the PCB connector (also known as the edge connector). The rail connector contains pins and has no movable parts. The PCB connector contains sliding shuttles (refer to Figure 6), which contain sockets. The CRAY T3E system uses three styles of shuttle connectors:

- A 3-shuttle connector with 36 pin/socket pairs (torus connections)
- A 4-shuttle connector with 48 pin/socket pairs (GigaRing connections)
- A 4-shuttle connector with 64 pin/socket pairs (clock & scan connections)

Figure 6. PCB Shuttle Connector



After you install a module, you must *cam* it to connect the PCB connectors to the rail connectors. *Camming* is a mechanical process that pushes the shuttles vertically away from the PCB. As a result of this movement, the shuttle sockets slide over the pins in the rail connectors.

The rail connectors are located in slots in the module rails. They screw into place as shown in Figure 7. Figure 8 shows the relation of PCB and rail connectors.

Figure 7. Rail Connectors – Attachment to Rails

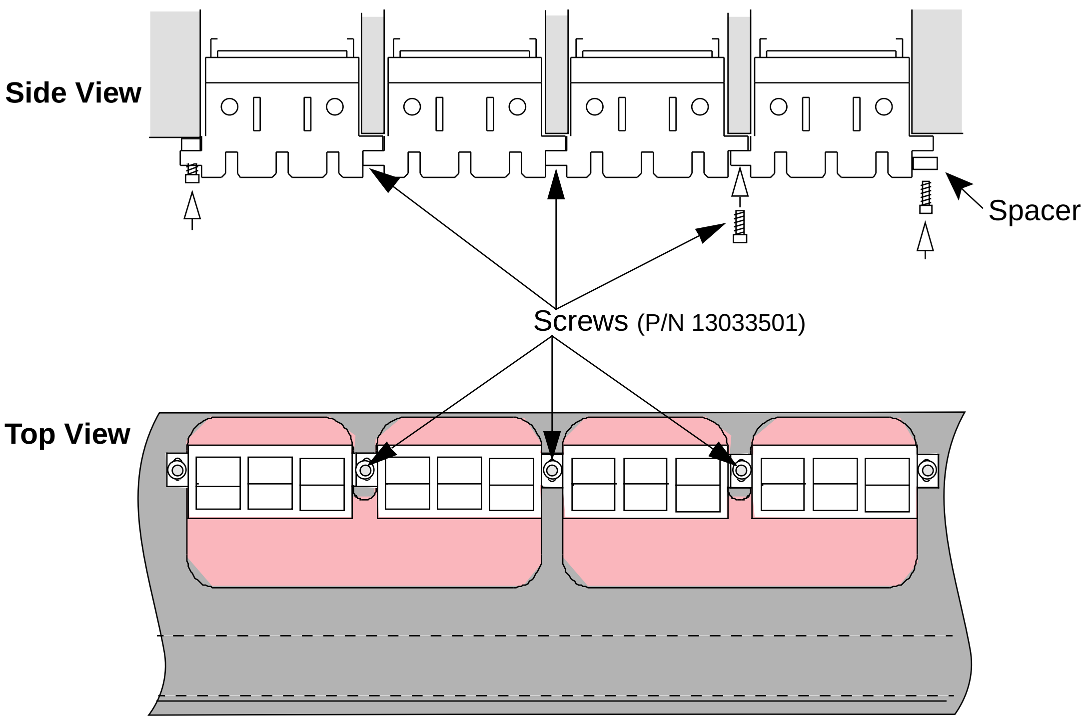
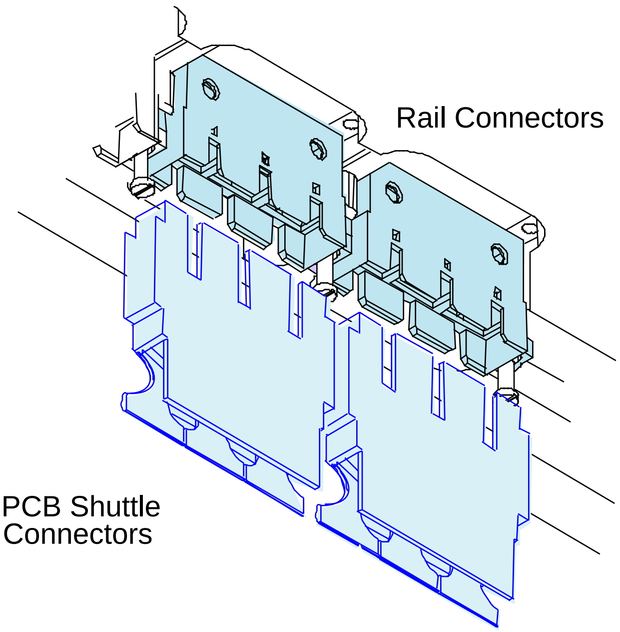


Figure 8. Relation of PCB and Rail Connectors – Simplified

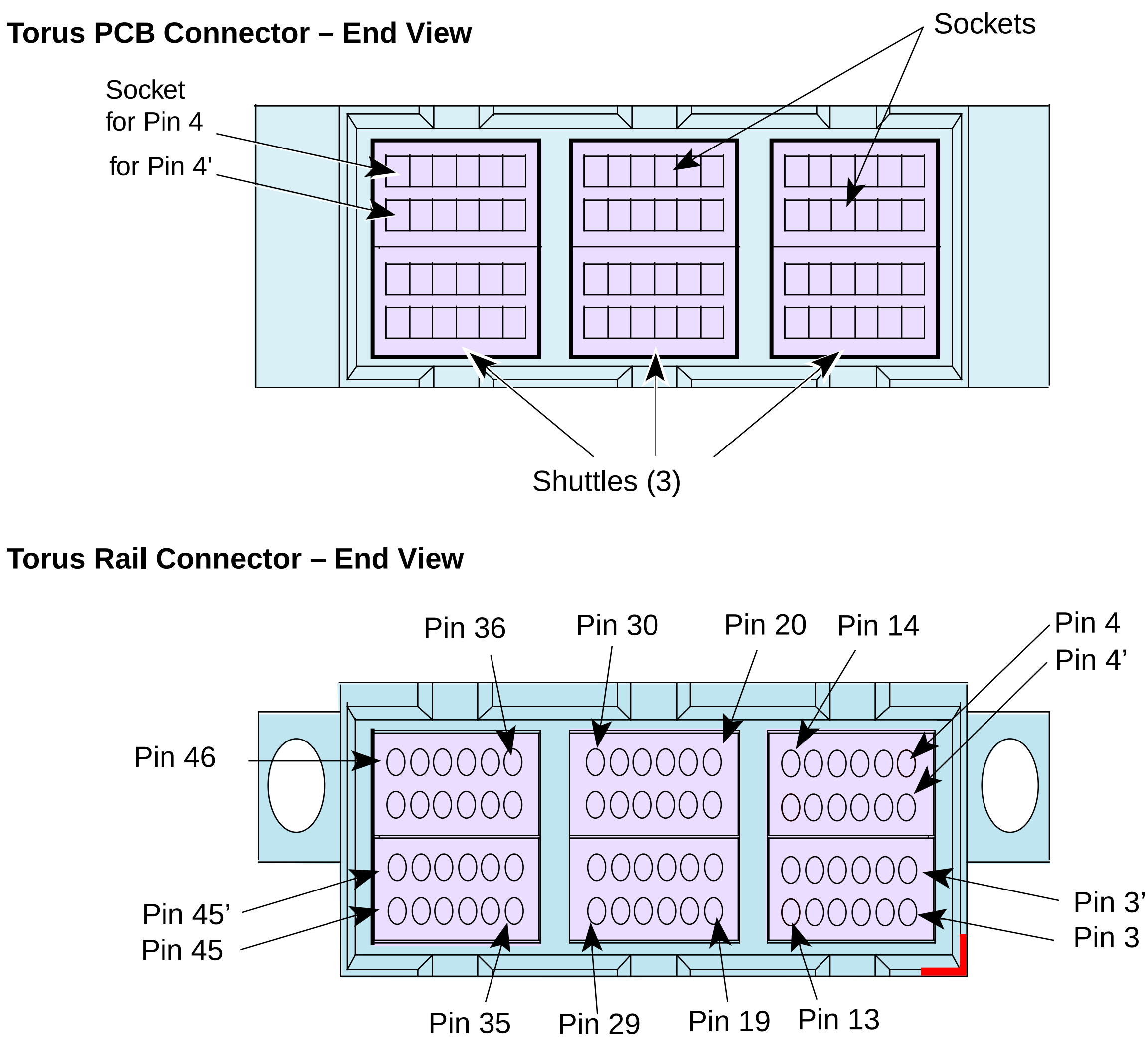


NOTE:

For simplicity, this figure does not show the shuttles or pins, and it shows the PCB connectors further from the rail connectors than in a real system. In a real system, the connector blocks almost touch.

Figure 9 shows an end view of the pins and sockets for a 3-shuttle PCB/rail connector pair. The pins are installed as pin_true/pin_not pairs. Figure 10 shows the pin numbering scheme on the 4-shuttle GigaRing rail connectors. Figure 11 shows the pin numbering scheme on the 4-shuttle clock and scan rail connectors.

Figure 9. Torus PCB and Rail Connectors



NOTE: Each pin pair consists of a true and complement (') pin.

NOTE: Pin numbering for torus connections and GigaRing connections starts at pin 3 rather than pin 1. Pins 1 & 2, 15 & 16, 17 & 18, 31 & 32, 33 & 34, etc. are not present.

Figure 10. GigaRing Rail Connector

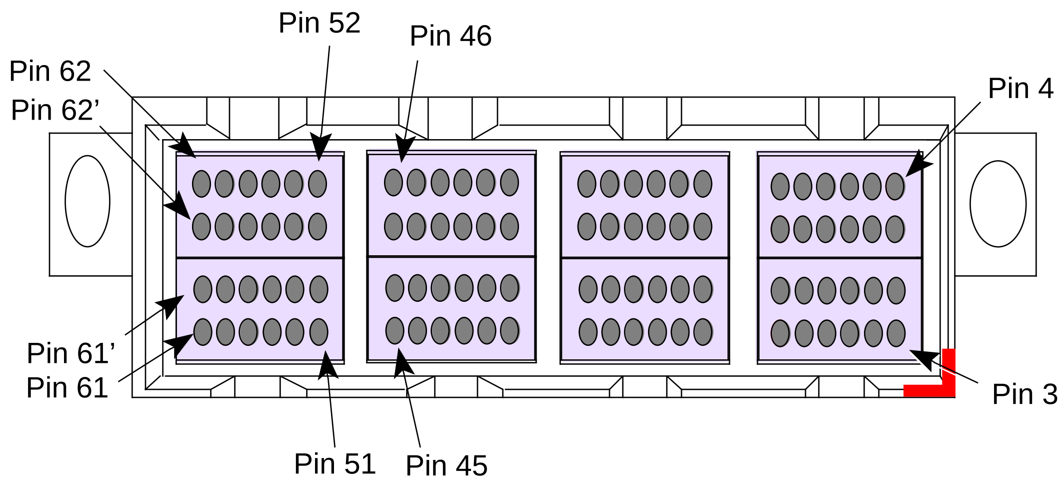
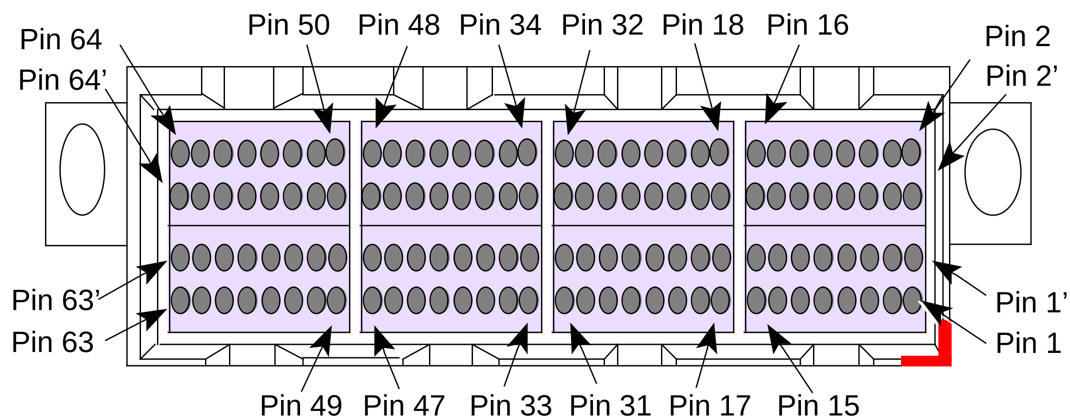


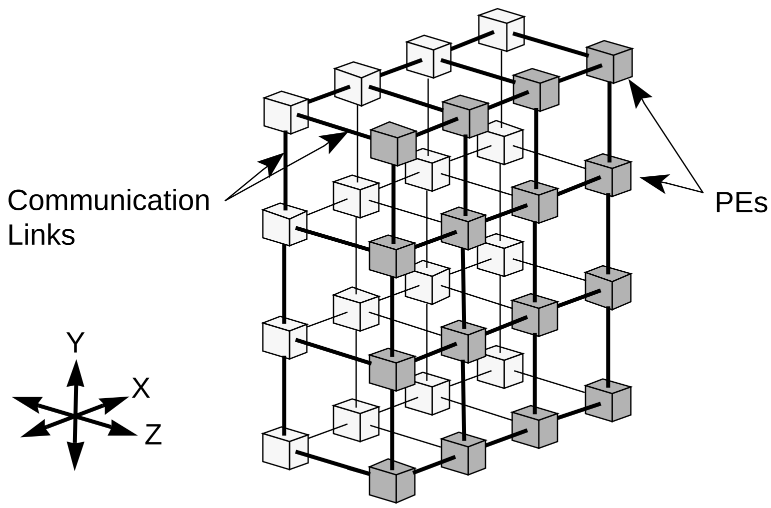
Figure 11. Clock or Scan Rail ConnectorClock



Torus Cabling

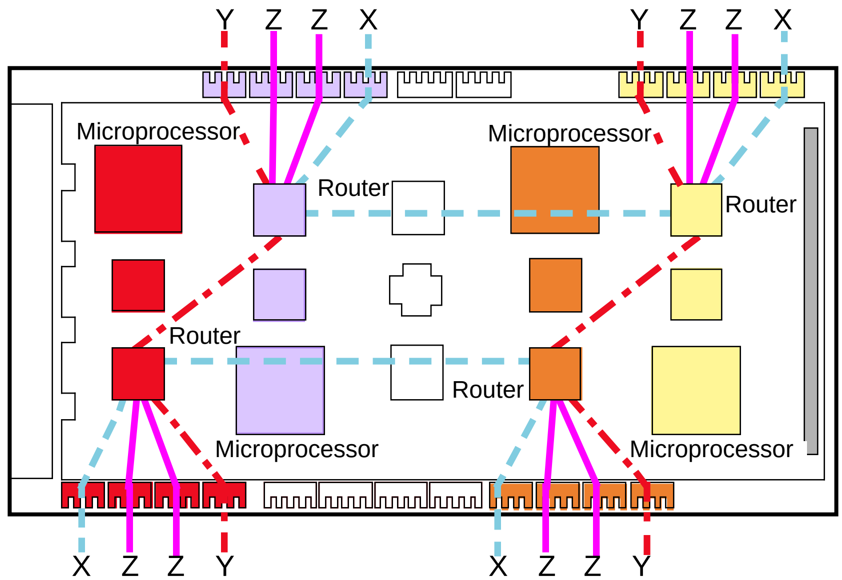
The PEs communicate with one another via a three-dimensional torus interconnect network. Figure 12 shows a simplified, logical representation of a network. For clarity, the figure does not show some communication links.

Figure 12. Torus Interconnect Network – Simplified



Each PE has six torus connections (or communication links): +X, –X, +Y, –Y, +Z, and –Z. On each PE, one X link and one Y link are hardwired on the PCB. The other four links are external, pluggable connections. Refer to Figure 13.

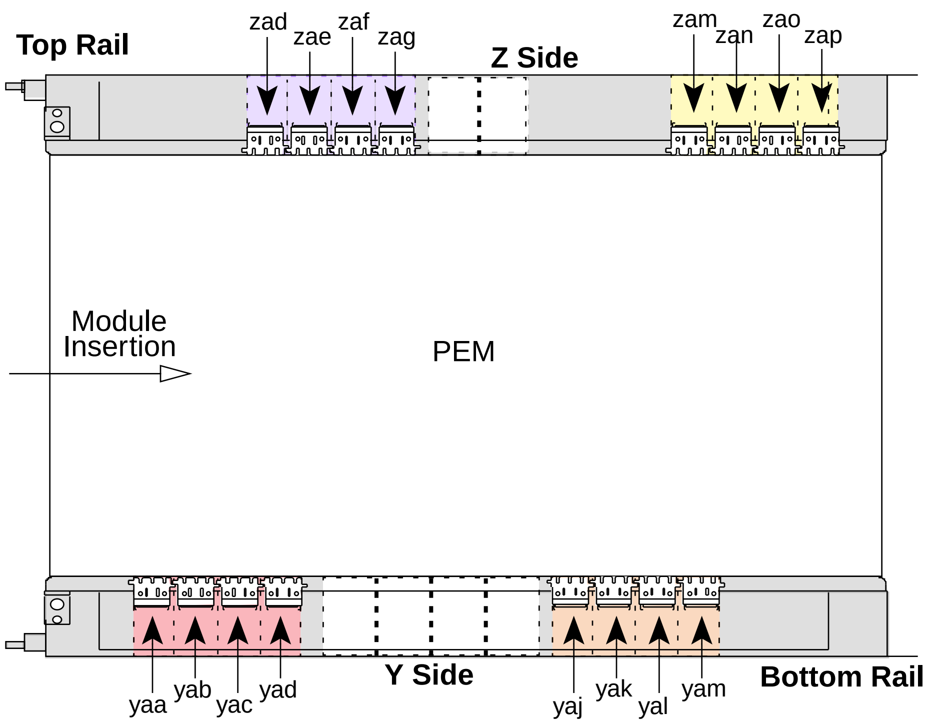
Figure 13. PEM Torus Connectors



Torus Cables

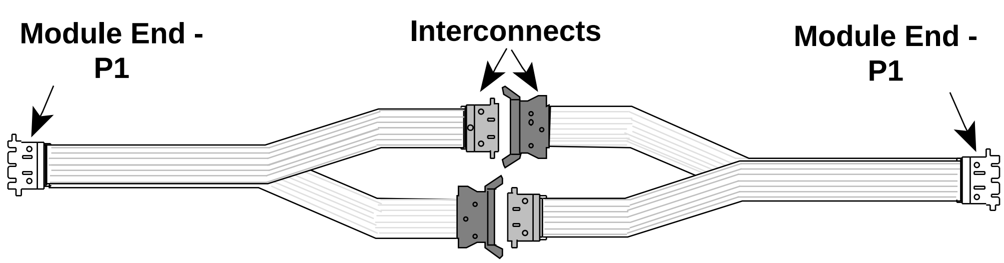
Each PEM rail in the AC cabinet contains eight torus cables that connect to the PCB connectors on the module (four connectors per PE). Figure 14 shows the locations and names of the various torus connectors in the rails.

Figure 14. Torus Rail Connector Locations – Side View



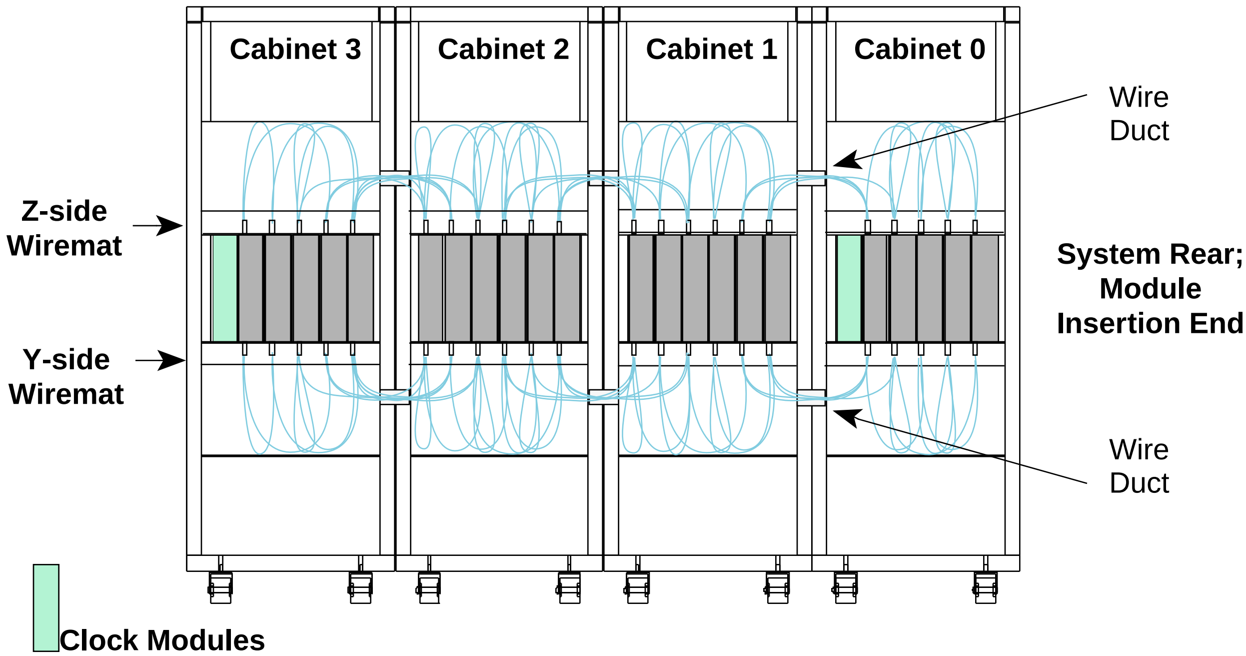
Each torus cable consists of a 3-shuttle rail connector (P1) and a pair of ribbon cables. One ribbon cable has a 40-*socket* connector (P2), and the other has a 40-*pin* connector (P3). These two cables connect to the two cables from the next PE in the torus (same dimension). Figure 15 shows two torus cables; the cables are oriented for connection.

Figure 15. Torus Ribbon Cable Assemblies



The torus connections may be between PEs on the same board or between PEs on different boards. In fact, some connections link PEs in adjacent cabinets, as shown in Figure 16. Note that torus cables never pass from the Z-side wiremat to the Y-side wiremat.

Figure 16. Torus Connections – Four-cabinet System



The CRAY T3E AC system uses a different length torus cable for each dimension in the torus. Table 3 lists the three types.

Table 3. Torus Cables

Description	Part Number	Length	Color Code
X dimension	15112904	13 inches (33 cm)	Grey
Y dimension	15112906	23 inches (58 cm)	Green
Z dimension	15112905	24 inches (61 cm)	Blue

The torus cable configuration of individual PEMs often changes when you add more PEMs to the system. For example, the cabling configuration of the module in slot 2 of cabinet 0 in a system that contains 3 PEMs is different than the cabling configuration of the same module in a system that contains 4 PEMs.

As a result of these cabling changes, the cabling configurations are too complex to explain here. Instead, this document provides an overview of the torus cabling concepts. For example, Figure 17 and Figure 18 illustrate some general principles of torus cabling.

Figure 17. Example of Z-side Torus Connections – 4-PEM System

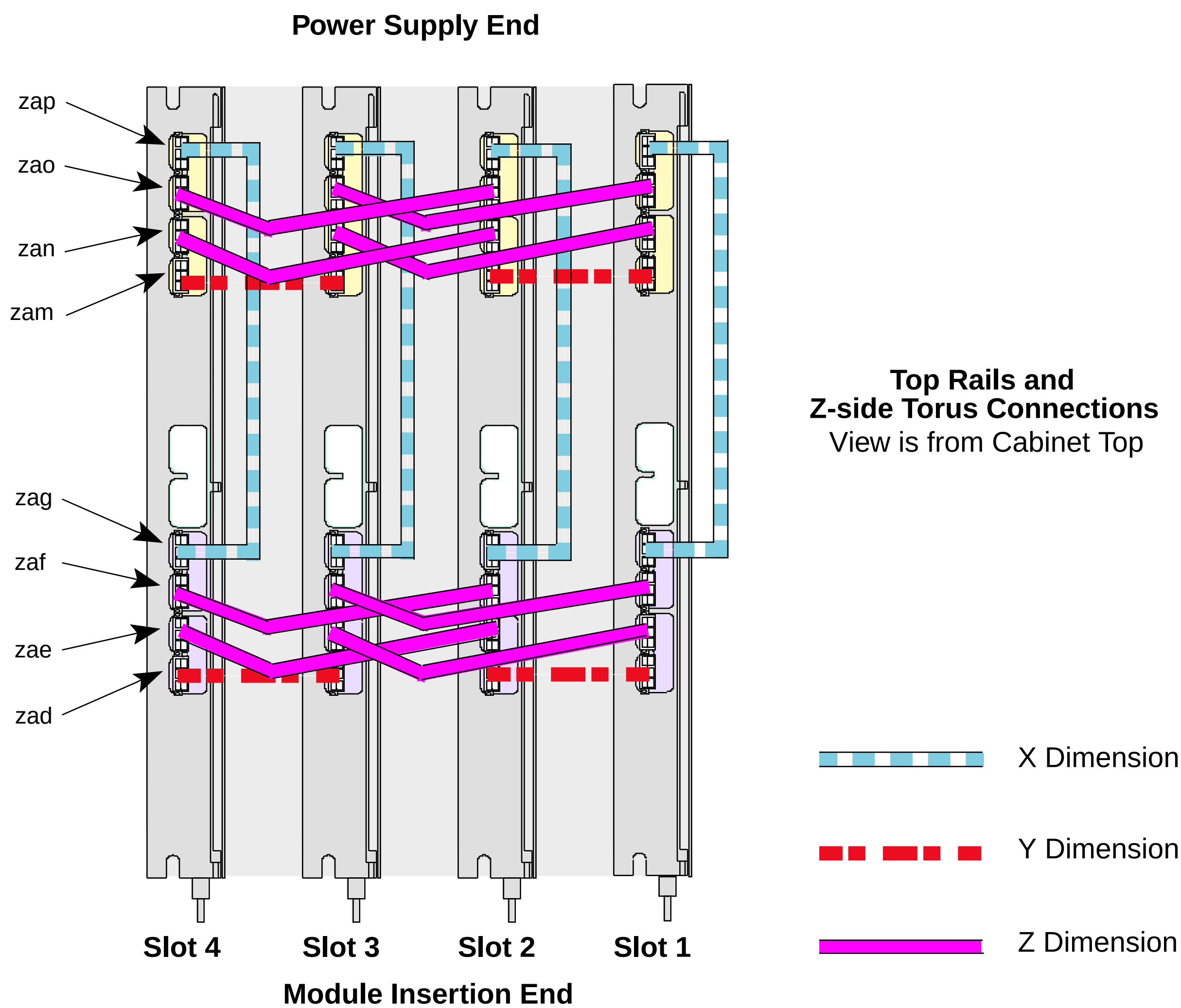


Figure 18. Example of Y-side Torus Connections – 4-PEM System

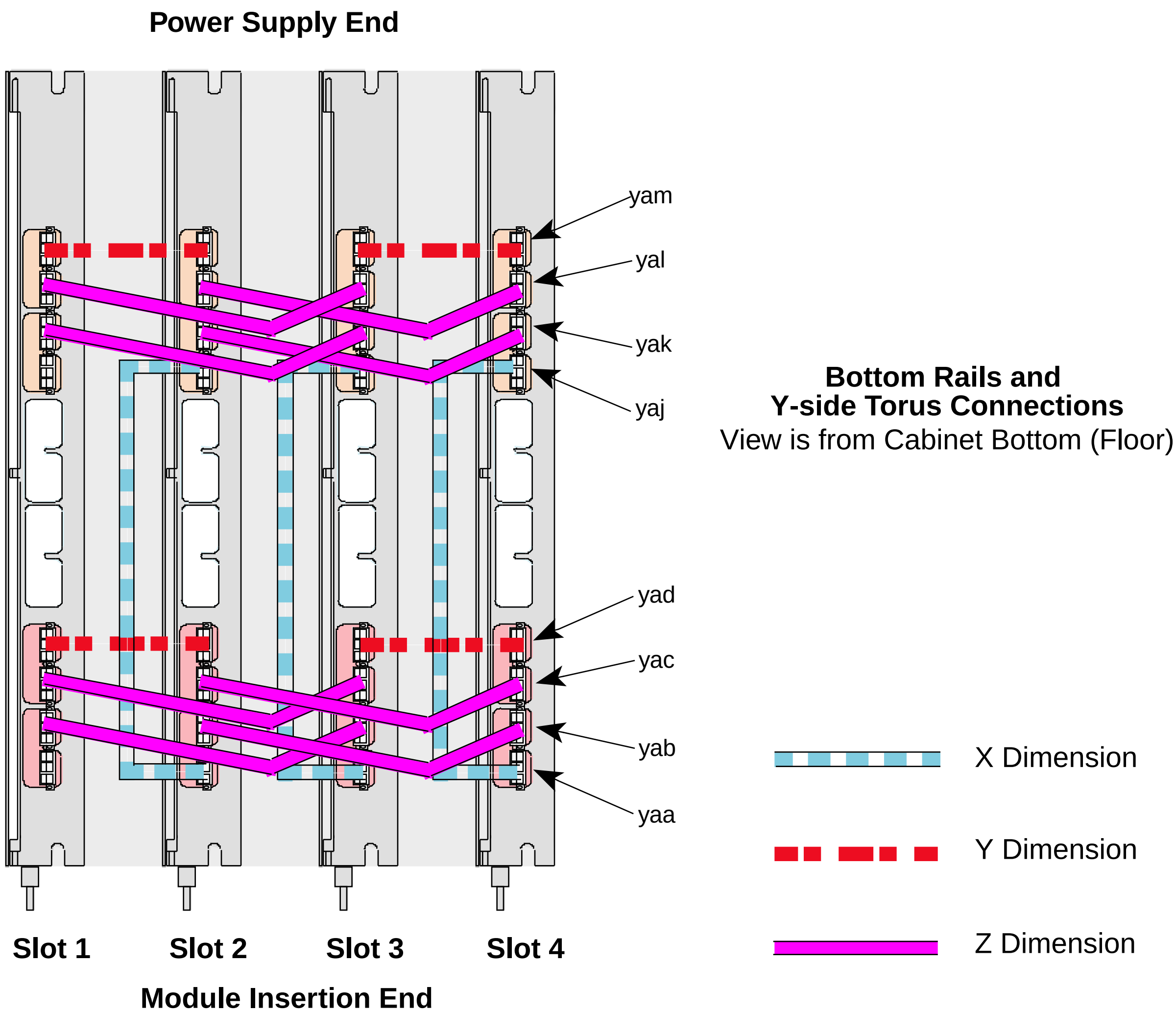
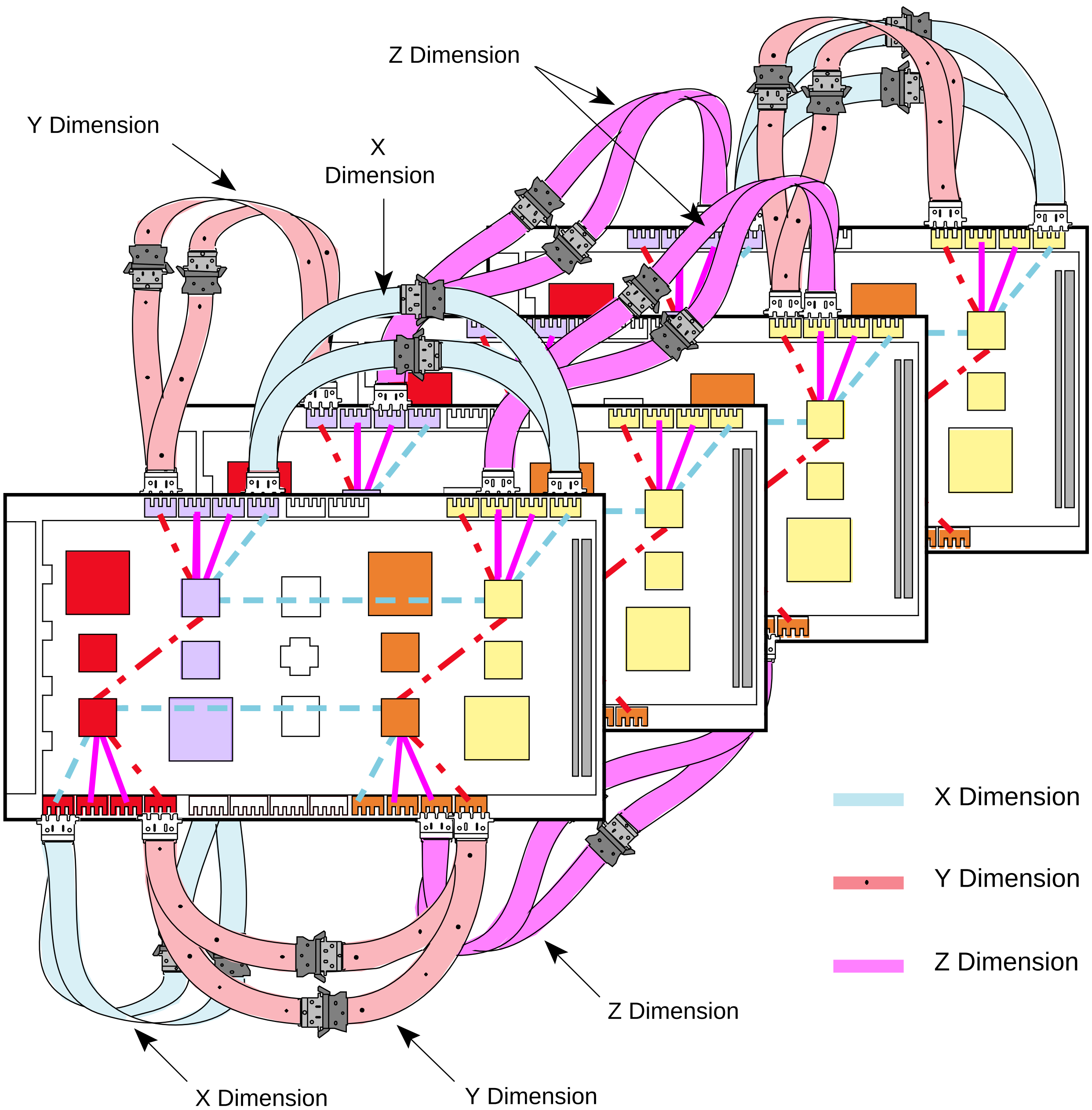


Figure 19 provides a more detailed view of torus connections on four PEMs. For clarity, the figure shows only a few torus connections and does not show the rails.

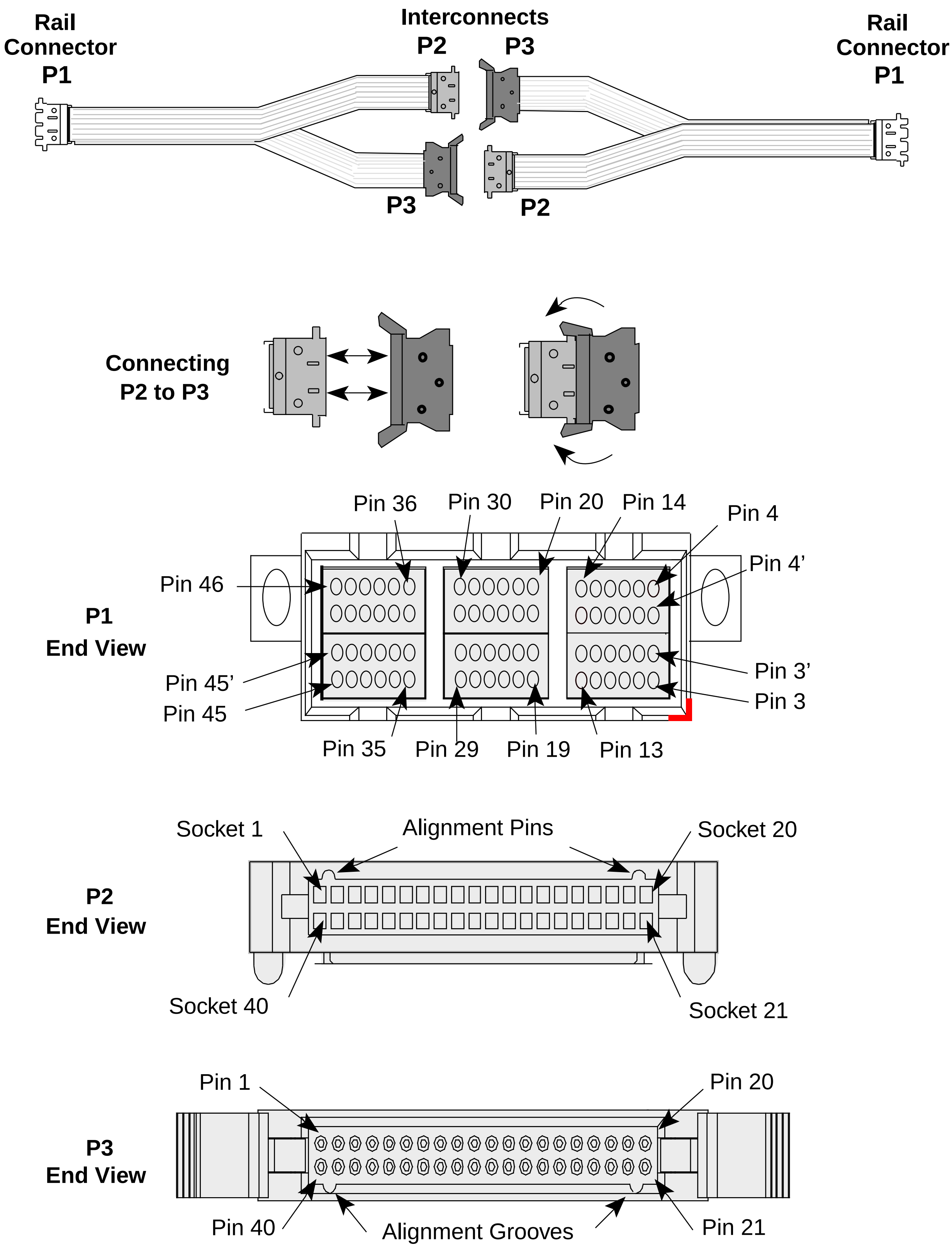
Figure 19. Example of Torus Connections



NOTE: For clarity, this figure shows fewer than half of the total torus connections and does not show rails.

Figure 20 shows the pin numbering scheme for the connectors on a torus cable assembly. (All three types of torus cables use the same pin numbering scheme.)

Figure 20. Connectors P2 and P3 – Torus Cable Assembly



Pin Assignments

Table 4 provides the pin signal assignments for the torus cables. (The X-dimension, Y-dimension, and Z-dimension torus cables all have the same pin assignments.)

Table 4. Torus Cable Pin Assignments

Output Channel			Input Channel		
P1 Pins	Signal	P3 Pins	P1 Pins	Signal	P2 Pins
3, 3’	Clock (out14)	39, 2	4, 4’	Clock (in14)	2, 39
5, 5’	Vdd (ground)	38, 3	6, 6’	Vdd (ground)	3, 38
7, 7’	Bit 00	37, 4	8, 8’	Bit 00	4, 37
9, 9’	Bit 01	36, 5	10, 10’	Bit 01	5, 36
11, 11’	Bit 02	35, 6	12, 12’	Bit 02	6, 35
13, 13’	Bit 03	34, 7	14, 14’	Bit 03	7, 34
19, 19’	Bit 04	33, 8	20, 20’	Bit 04	8, 33
21, 21’	Bit 05	32, 9	22, 21’	Bit 05	9, 32
23, 23’	Bit 06	31, 10	24, 24’	Bit 06	10, 31
25, 25’	Bit 07	30, 11	26, 26’	Bit 07	11, 30
27, 27’	Bit 08	29, 12	28, 28’	Bit 08	12, 29
29, 29’	Bit 09	28, 13	30, 30’	Bit 09	13, 28
35, 35’	Bit 10	27, 14	36, 36’	Bit 10	14, 27
37, 37’	Bit 11	26, 15	38, 38’	Bit 11	15, 26
39. 39’	Bit 12	25, 16	40, 40’	Bit 12	16, 25
41, 41’	Bit 13	24, 17	42, 42’	Bit 13	17, 24
43, 43’	Vdd (ground)	23, 18	44, 44’	Vdd (ground)	18, 23
45, 45’	Spare (ospare)	22, 19	46, 46’	Spare (ispare)	19, 22

NOTE: In columns that contain pin numbers, the first number is the true pin and the second number is the false/complement pin.

GigaRing Cabling

In the CRAY T3E AC system, data input and output takes place via GigaRing channels. In general, a CRAY T3E AC system has at least two GigaRing channels: one for maintenance and support, and one or more for customer I/O. Systems can effectively support a GigaRing channel for every two PEMs in the system.

In most configurations, each GigaRing channel connects two PEMs. Each PEM in the CRAY T3E AC system contains one I/O controller (composed of a GigaRing option and an I option) that supports GigaRing channel communication.

Each PEM also contains a GigaRing connection to the I/O bulkhead; therefore, every PEM in the system can potentially connect to a GigaRing channel. This PEM GigaRing connection comprises four 4-shuttle connectors, as shown in Figure 21. Each shuttle connector connects to a PEM-to-bulkhead cable: 2 cables for input and 2 for output. Each PEM-to-bulkhead cable contains a rail connector, 2 ribbon cables, and an 80-pin bulkhead connector. This 80-pin connector attaches to the external GigaRing cables at the I/O bulkhead.

Figure 21. PEM GigaRing Option and Connectors

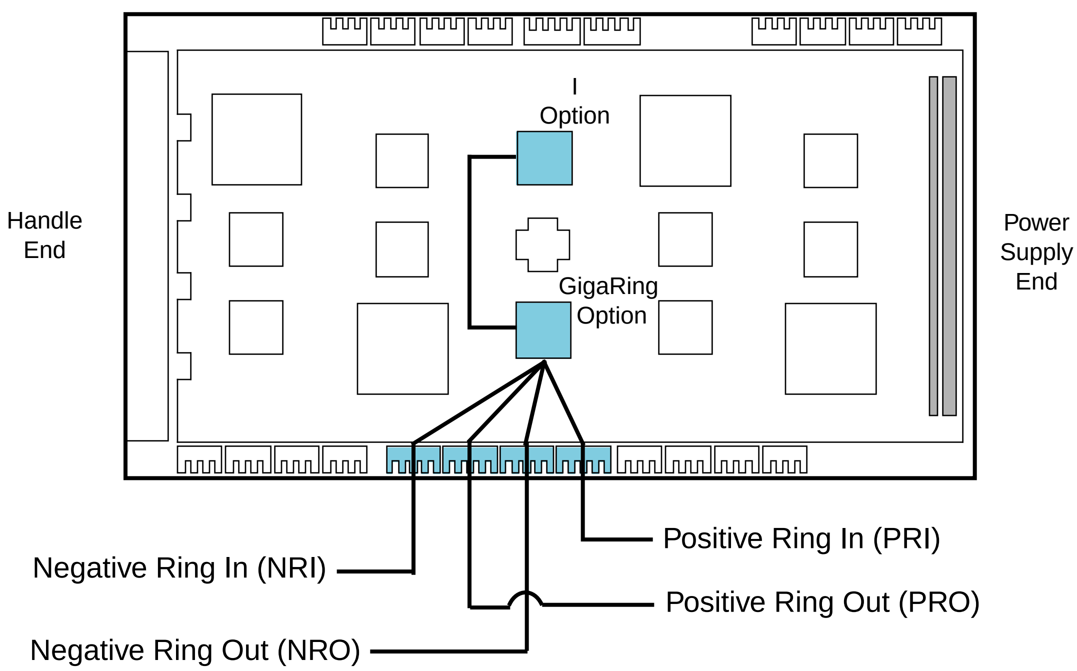


Table 5 describes the PEM-to-bulkhead connections. Figure 22 shows a PEM-to-bulkhead GigaRing cable.

Table 5. PEM-to-Bulkhead GigaRing Connections

Description	Rail Connector	Cable Part Number	Length	Jackpost Screw Reference (on bulkhead)
Negative Ring In – NRI	yaf	15200500	36 in.	Female
Positive Ring Out – PRO	yag		(91.4 cm)	Male
Negative Ring Out – NRO	yah			Male
Positive Ring In – PRI	yai			Female

Figure 22. PEM-to-bulkhead GigaRing Cable

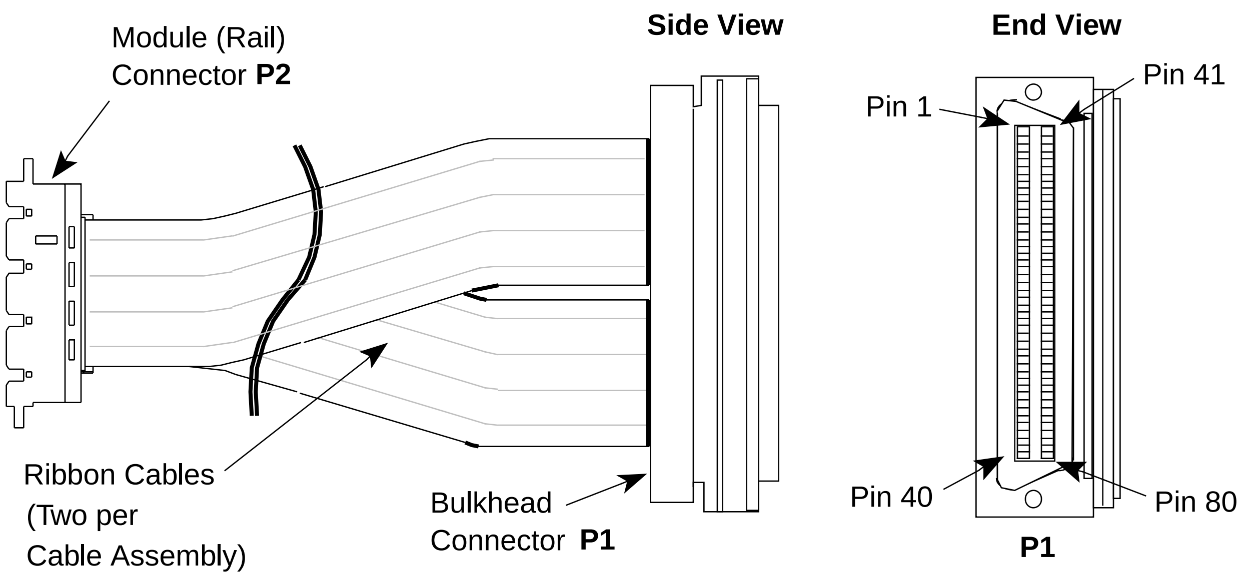
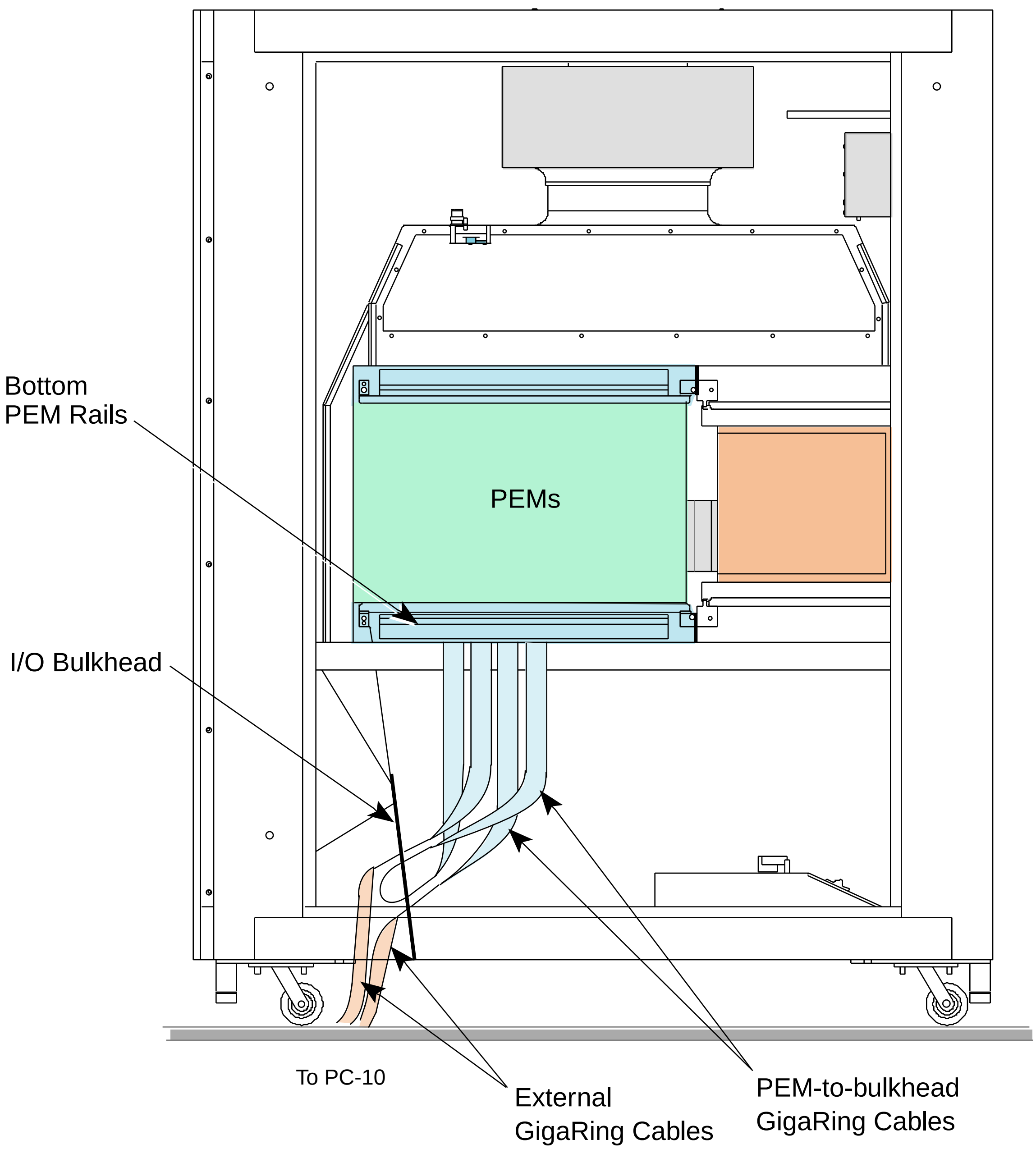


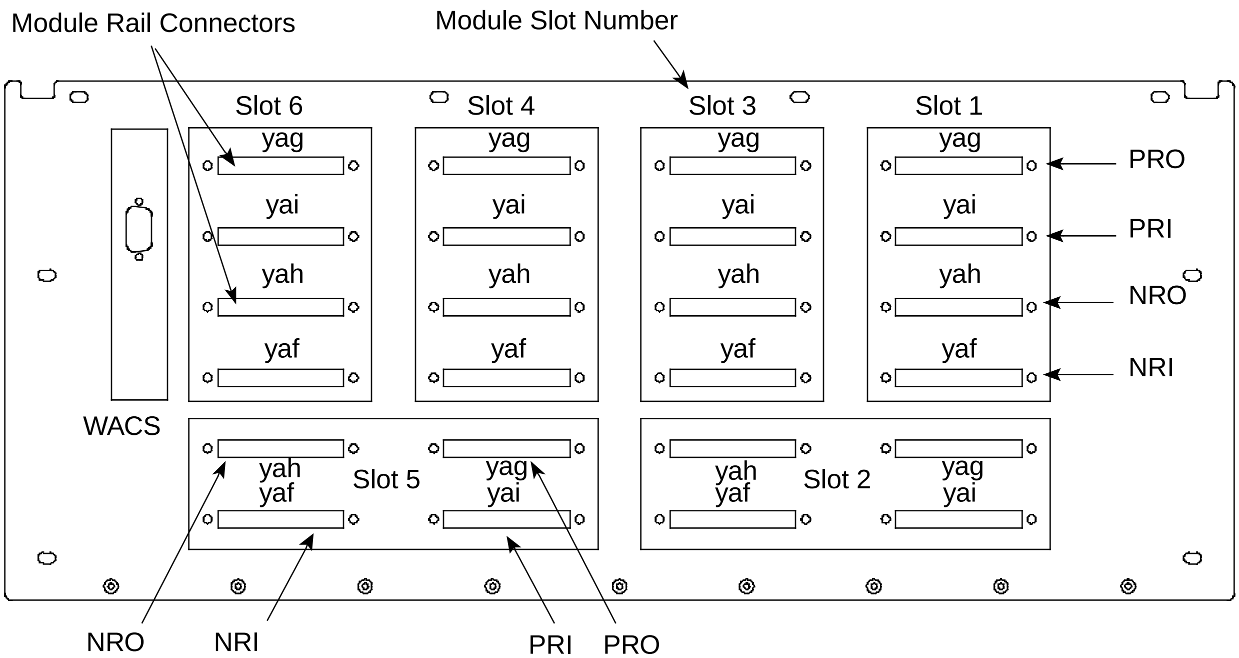
Figure 23 is a side view of a cabinet that shows the relative locations of the PEM-to-bulkhead GigaRing cables. In a real system, the cables pass through the space between the I/O bulkhead and the rear wall of the intake plenum.

Figure 23. PEM-to-bulkhead GigaRing Cables – Side View



The I/O bulkhead is located below the modules. It contains slots for 24 GigaRing connectors (enough for 6 GigaRing nodes) as shown in Figure 24. The base of the bulkhead is hinged; the bulkhead swings outward to provide service access.

Figure 24. I/O Bulkhead – Connector LocationsGigaRing



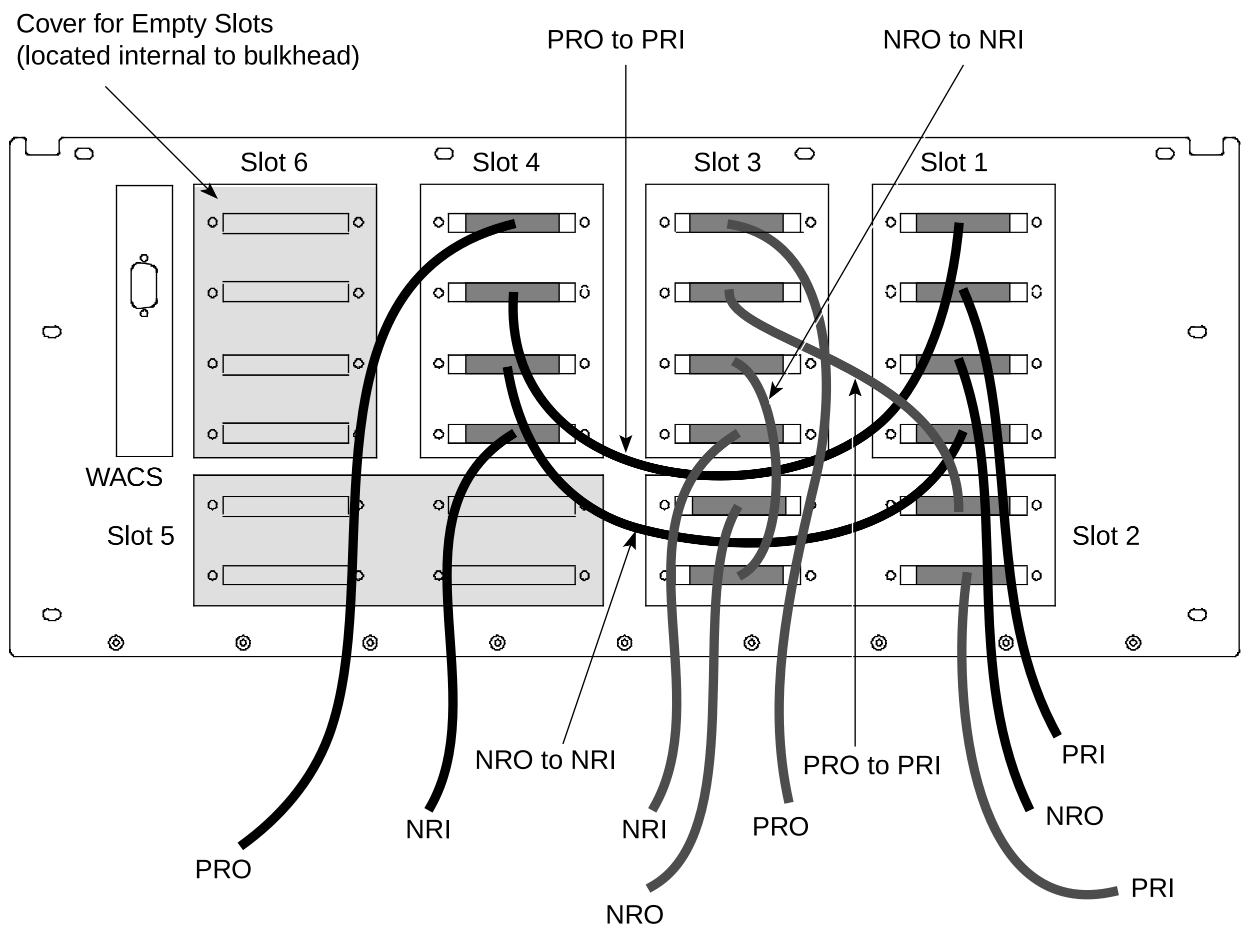
The cable-to-bulkhead slot connections are defined by module slot numbers and edge connector names as shown in Figure 24. The connections are the same in each chassis of the system. However, when a slot is empty or when a slot contains a clock module, the bulkhead does not contain connections from that slot. A cover plate attaches to the each empty slot on the bulkhead.

Although all PEMs are cabled to the I/O bulkhead, some PEMs are not configured on a GigaRing channel. In other words, the *external* connections to the I/O bulkhead determine the GigaRing cabling configuration, and these external configurations are variable.

Standard configurations contain two or three GigaRing channels per cabinet, usually with adjacent PEMs on a channel. The boundary scan master (slot 1 of cabinet 0) and a support module (which is often the last PEM in the system) are configured on the same channel, which is referred to as the support channel. Personnel use the support channel to run boundary scan and offline diagnostics and to support the operating system.

GigaRing cable assemblies of various lengths complete the external connections that pass from the bulkhead to other nodes in the CRAY T3E system or to external devices (nodes) on the GigaRing channel. These cables connect one node's positive or negative ring out to the next node's positive or negative ring in, as shown in Figure 25.

Figure 25. GigaRing Configuration Example – 4-PEM System



NOTE: In this example, slots 1 and 4 are on the maintenance/support GigaRing channel. Slots 2 and 3 are on the customer I/O GigaRing channel.

Table 6 lists the external GigaRing cables that are available at the time of publication.

Table 6. External GigaRing CablesGigaRing

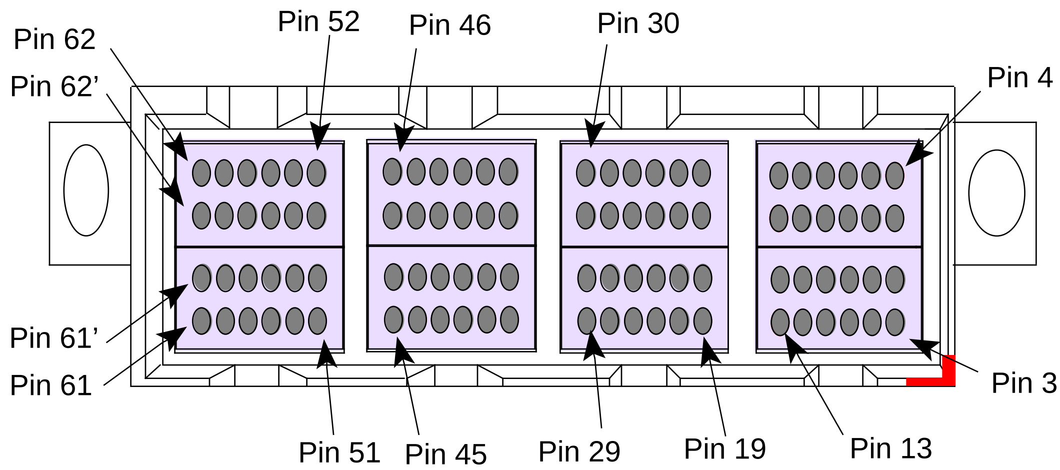
Description	Cable Part Number	Length
Cable assembly, GigaRing flat 0.5 m	13296700	0.5 m
Cable assembly, GigaRing flat 0.8 m	13296701	0.8 m
Cable assembly, GigaRing flat 11 m	13296800	11 m

Pin Assignments

Figure 26 shows the pin numbering scheme for the connectors on the PEM-to-bulkhead GigaRing cable.

Figure 26. PEM-to-bulkhead GigaRing Connectors

GigaRing Rail Connector (P2)



GigaRing Bulkhead Connector (P1)

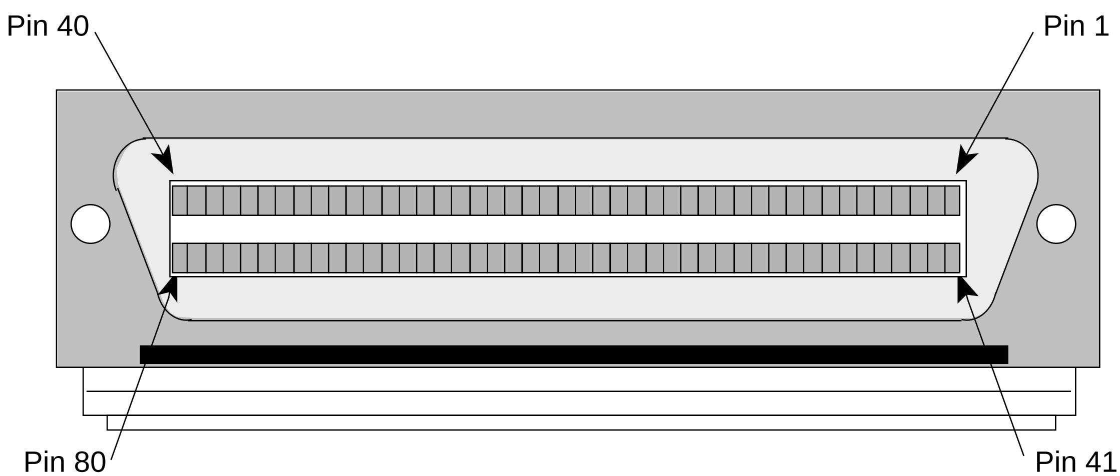


Table 7 lists the pin assignments and signal names for the GigaRing rail connector. The negative ring and the positive ring (both in and out) use the same PEM-to-bulkhead GigaRing cable.

Table 7. GigaRing Rail Connector (P2) – Pin Assignments

P2 Pin	Signal	P1 Pin	P2 Pin	Signal	P1 Pin	P2 Pin	Signal	P1 Pin
3	Vdd		23	Bit 04	35	43	Bit 12	26
3'			23'		36	43'		27
4	Vdd		24	Bit 19	54	44	Bit 27	5
4'			24'		55	44'		6
5	Vdd		25	Bit 06	33	45	Bit 15	63
5'			25'		34	45'		64
6	Vdd		26	Bit 20	12	46	Bit 28	42
6'			26'		13	46'		43
7	Vdd		27	Bit 07	72	51	Bit 14	24
7'			27'		73	51'		25
8	Clock	20	28	Bit 21	52	52	Bit 29	3
8'		21	28'		53	52'		4
9	Bit 01	78	29	Bit 09	70	53	Flag	61
9'		79	29'		71	53'		62
10	Vdd		30	Bit 22	10	54	Bit 30	42
10'			30'		11	54'		43
11	Bit 00	39	35	Bit 08	20	55	Parity	22
11'		40	35'		31	55'		23
12	frm (frame)	18	36	Bit 23	50	56	Bit 31	1
12'		19	36'		51	56'		2
13	Bit 03	76	37	Bit 11	68	57	spr (spare)†	59
13'		77	37'		69	57'		60
14	Bit 16	57	38	Bit 24	48	58	Vdd	
14'		58	38'		49	58'		
19	Bit 02	37	39	Bit 10	28	59	Vdd	
19'		38	39'		29	59'		
20	Bit 17	16	40	Bit 25	7	60	Vdd	
20'		17	40'		8	60'		
21	Bit 05	74	41	Bit 13	66	61	Vdd	
21'		75	41'		67	61'		
22	Bit 18	14	42	Bit 26	46	62	Vdd	
22'		15	42'		47	62'		

† The spr pin carries the Cable Detect Clock signal, which has a frequency of 9.375 MHz. It detects whether the cable is connected.

Table 8 lists the pin assignments for the bulkhead connector P1. Use Table 8 in conjunction with Table 7 to determine the signal assignments.

Table 8. Bulkhead Connector to Rail Connector – Pin Cross-reference

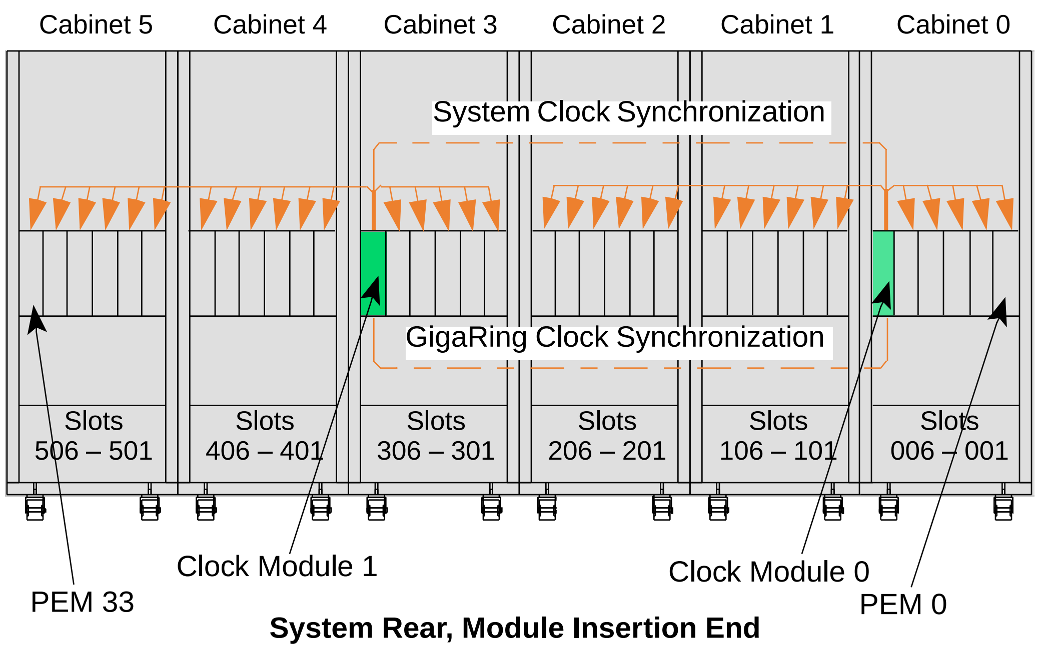
P1 Pin	P2 Pin	P1 Pin	P2 Pin	P1 Pin	P2	P1 Pin	P2 Pin
1	56	21	8’	41	Ground	61	53
2	56’	22	55	42	54	62	53’
3	52	23	55’	43	54’	63	45
4	52’	24	51	44	46	64	45’
5	44	25	51’	45	46’	65	Ground
6	44’	26	43	46	42	66	41
7	40	27	43’	47	42’	67	41’
8	40’	28	39	48	38	68	37
9	Ground	29	39’	49	38’	69	37’
10	30	30	35	50	36	70	29
11	30’	31	35’	51	36’	71	29’
12	26	32	Ground	52	28	72	27
13	26’	33	25	53	28’	73	27’
14	22	34	25’	54	24	74	21
15	22’	35	23	55	24’	75	21’
16	20	36	23’	56	Ground	76	13
17	20’	37	19	57	14	77	13’
18	12	38	19’	58	14’	78	9
19	12’	39	11	59	57	79	9’
20	8	40	11’	60	57’	80	Ground

Clock Cabling

Each PEM receives one System Clock signal and one GigaRing Clock signal from a clock module. The clock in slot 6 of chassis 0 (clock module 0) fans out clock signals to chassis 0, 1, and 2. The clock in chassis 3 (clock module 1) fans out clock signals to chassis 3, 4, and 5. Refer to Figure 27.

NOTE: Clock modules also fan out boundary scan signals. Refer to the "Boundary Scan Cabling" section for more information.

Figure 27. Clock Signal Fanout



Two wires synchronize clock module 1 with clock module 0: a master system clock wire in the Z-side wire mat, and a master GigaRing clock wire in the Y-side wire mat. In addition, a master system clock wire and a master GigaRing clock wire loop back to clock module 0 from itself.

The clocks fan out the clock signals to the PEMs via cables in the top (Z-side) wire mat. Each PEM has a separate system clock wire and a separate GigaRing clock wire. Both wires are 34-AWG, 100-ohm, 120-in. wire assemblies with a 2-pin connector on each end. The Master system clock wire assembly is a 24-ft. (732-cm) shielded assembly with a pair of 2-pin connectors at each end. Figure 28 shows the clock wire assemblies.

Figure 28. Clock Wire Assemblies

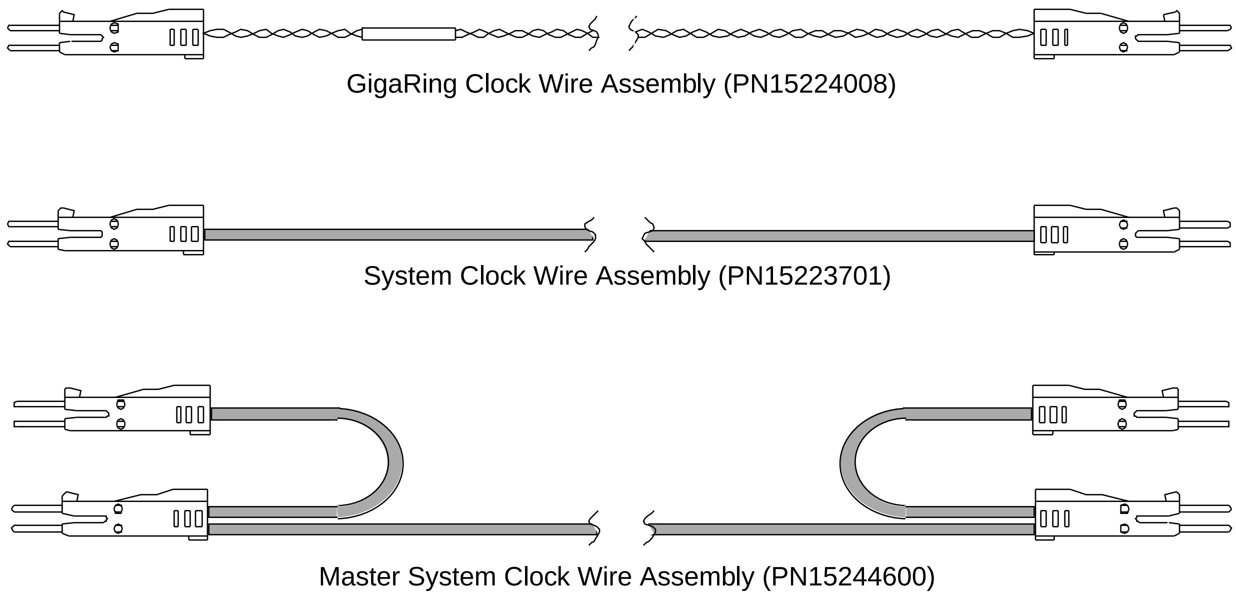


Table 9 lists the part numbers and lengths for the three types of clock wires.

Table 9. Clock Wires

Description	Part Number	Length
GigaRing clock fan-out (and master)	15224008	120 in. (305 cm)
System clock fan-out	15223701	120 in. (305 cm)
Master system clock	15244600	288 in. (732 cm)

The connector-ends of the wire assemblies plug into the PEM and clock module rail connectors as shown in Figure 29. When a system ships, one end of any clock wire that runs between cabinets is disconnected. During multiple-cabinet installations and during upgrades, personnel must connect any unconnected clock wires.

Figure 29. Wire Insertion

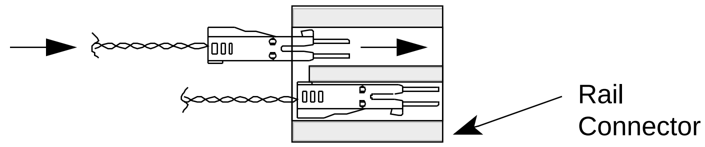
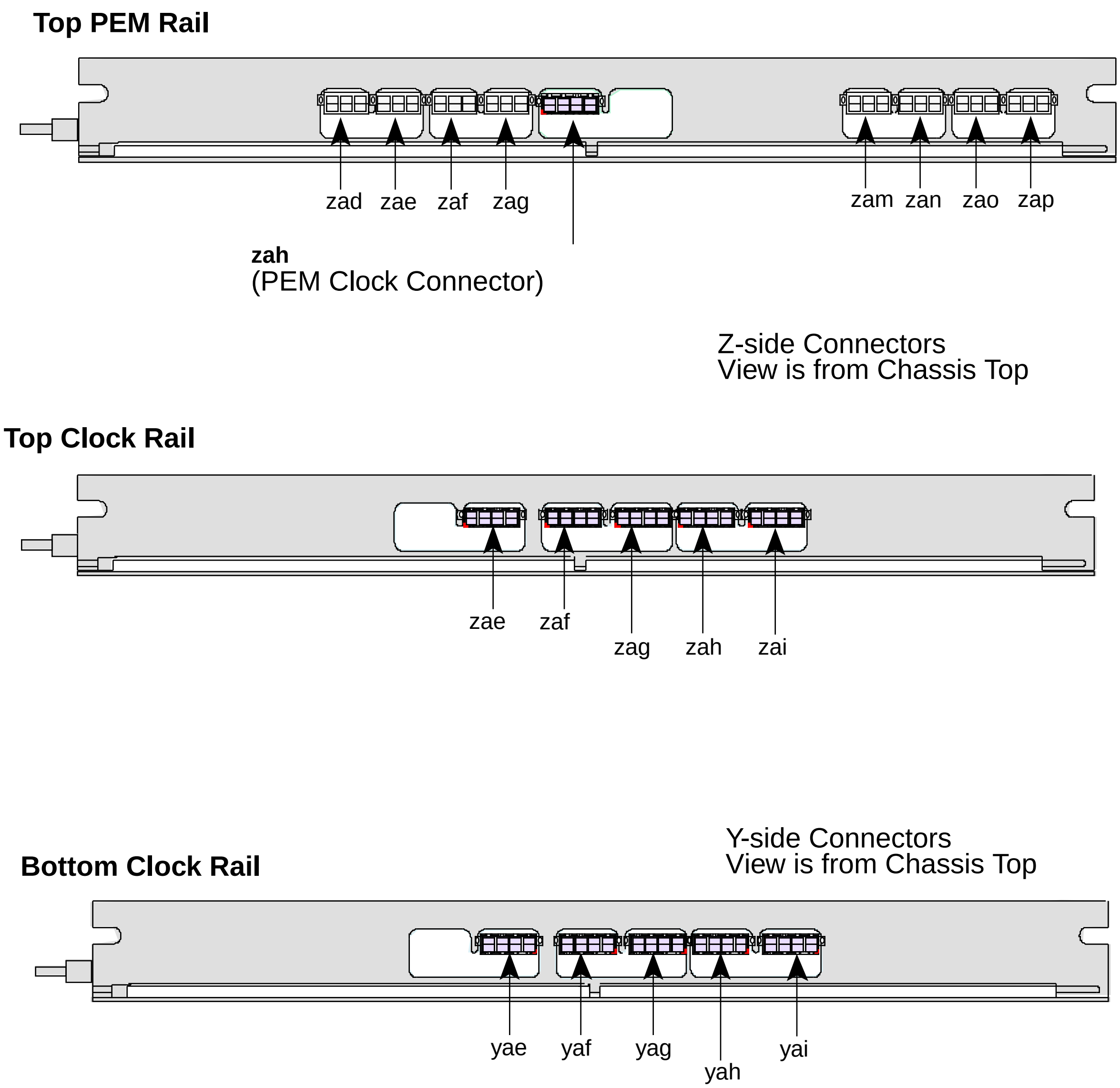


Figure 30 shows the locations of the “clock” connectors on the PEM rail and clock rails.

Figure 30. Clock Connector Locations

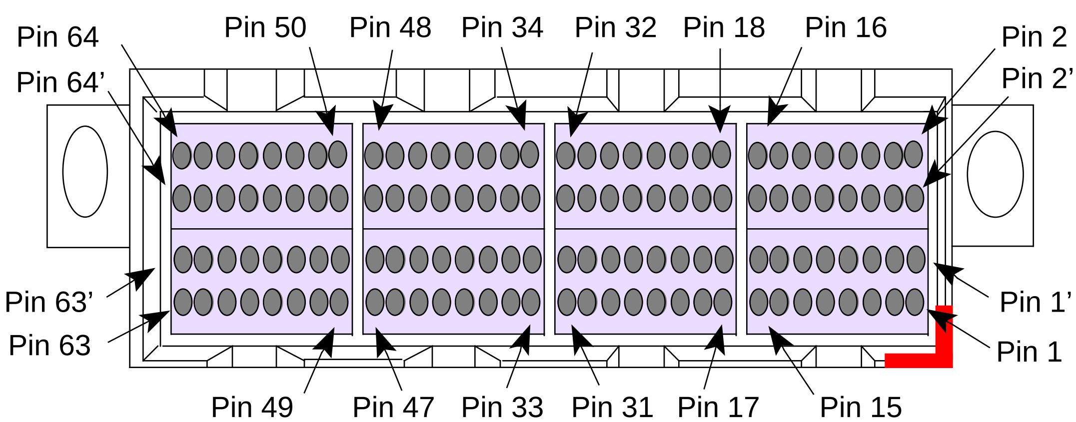


Pin Assignments

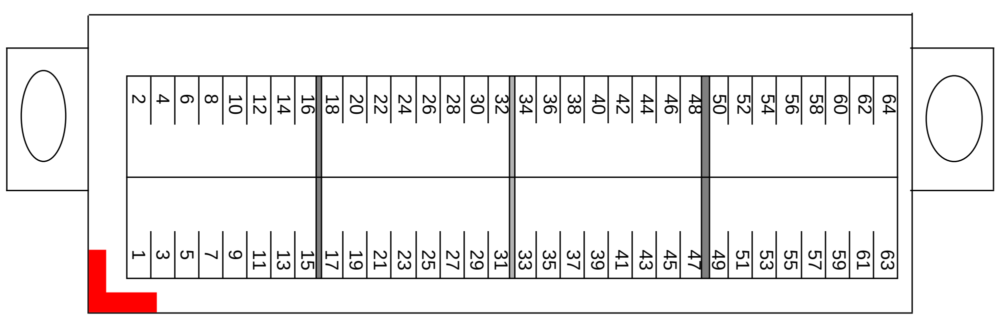
The 2-pin connectors on the clock wires plug into the rail connectors. Figure 31 shows the pin numbering scheme as viewed from the module and from the wire-insertion end. The view from the wire-insertion end of the connector is important because it shows the locations where you must insert the clock wires during installation or upgrade procedures.

Figure 31. PEM Rail Clock Connector Pin Numbering

PEM Rail Clock Connector - View from Module



PEM Rail Clock Connector - View from Wire-insertion End



Refer to Table 10 through Table 14 for the pin signal assignments for the various clock wires and signals.

Table 10. System Clock Connections – Chassis 0, 1, and 2Clock

Source			Destination			
Slot	Connector	Pin	Slot	Connector	Pin	Signal
006	zai	04	006	zah	03	Master System Clock to CKM0
006	zai	51	006	zah	07	Ground Drain
006	zag	04	001	zah	03	System Clock Fanout to PEM 0
006	zag	06	002	zah	03	System Clock Fanout to PEM 1
006	zag	08	003	zah	03	System Clock Fanout to PEM 2
006	zag	10	004	zah	03	System Clock Fanout to PEM 3
006	zag	11	005	zah	03	System Clock Fanout to PEM 4
006	zag	13	101	zah	03	System Clock Fanout to PEM 5
006	zag	14	102	zah	03	System Clock Fanout to PEM 6
006	zag	19	103	zah	03	System Clock Fanout to PEM 7
006	zag	20	104	zah	03	System Clock Fanout to PEM 8
006	zag	22	105	zah	03	System Clock Fanout to PEM 9
006	zag	24	106	zah	03	System Clock Fanout to PEM 10
006	zag	26	201	zah	03	System Clock Fanout to PEM 11
006	zag	28	202	zah	03	System Clock Fanout to PEM 12
006	zag	29	203	zah	03	System Clock Fanout to PEM 13
006	zag	30	204	zah	03	System Clock Fanout to PEM 14
006	zag	35	205	zah	03	System Clock Fanout to PEM 15
006	zag	37	206	zah	03	System Clock Fanout to PEM 16

Table 11. System Clock Connections – Chassis 3, 4, and 5

Source			Destination			
Slot	Connector	Pin	Slot	Connector	Pin	Signal
006	zai	07	306	zah	03	Master System Clock to CKM 1
006	zai	52	306	zah	07	Ground Drain
306	zag	04	301	zah	03	System Clock Fanout to PEM 17
306	zag	06	302	zah	03	System Clock Fanout to PEM 18
306	zag	08	303	zah	03	System Clock Fanout to PEM 19
306	zag	10	304	zah	03	System Clock Fanout to PEM 20
306	zag	11	305	zah	03	System Clock Fanout to PEM 21
306	zag	13	401	zah	03	System Clock Fanout to PEM 22
306	zag	14	402	zah	03	System Clock Fanout to PEM 23
306	zag	19	403	zah	03	System Clock Fanout to PEM 24
306	zag	20	404	zah	03	System Clock Fanout to PEM 25
306	zag	22	405	zah	03	System Clock Fanout to PEM 26
306	zag	24	406	zah	03	System Clock Fanout to PEM 27
306	zag	26	501	zah	03	System Clock Fanout to PEM 28
306	zag	28	502	zah	03	System Clock Fanout to PEM 29
306	zag	29	503	zah	03	System Clock Fanout to PEM 30
306	zag	30	504	zah	03	System Clock Fanout to PEM 31
306	zag	35	505	zah	03	System Clock Fanout to PEM 32
306	zag	37	506	zah	03	System Clock Fanout to PEM 33

Table 12. GigaRing Clock Connections – Chassis 0, 1, and 2

Source			Destination			
Slot	Connector	Pin	Slot	Connector	Pin	Signal
006	**y**ah	51	006	**y**ah	52	Master GigaRing Clock to CKM0 Fanout
006	zah	19	001	zah	07	GigaRing Clock Fanout to PEM 0
006	zah	20	002	zah	07	GigaRing Clock Fanout to PEM 1
006	zah	21	003	zah	07	GigaRing Clock Fanout to PEM 2
006	zah	22	004	zah	07	GigaRing Clock Fanout to PEM 3
006	zah	23	005	zah	07	GigaRing Clock Fanout to PEM 4
006	zah	24	101	zah	07	GigaRing Clock Fanout to PEM 5
006	zah	25	102	zah	07	GigaRing Clock Fanout to PEM 6
006	zah	26	103	zah	07	GigaRing Clock Fanout to PEM 7
006	zah	27	104	zah	07	GigaRing Clock Fanout to PEM 8
006	zah	28	105	zah	07	GigaRing Clock Fanout to PEM 9
006	zah	29	106	zah	07	GigaRing Clock Fanout to PEM 10
006	zah	30	201	zah	07	GigaRing Clock Fanout to PEM 11
006	zah	35	202	zah	07	GigaRing Clock Fanout to PEM 12
006	zah	36	203	zah	07	GigaRing Clock Fanout to PEM 13
006	zah	37	204	zah	07	GigaRing Clock Fanout to PEM 14
006	zah	38	205	zah	07	GigaRing Clock Fanout to PEM 15
006	zah	39	206	zah	07	GigaRing Clock Fanout to PEM 16

Table 13. GigaRing Clock Connections – Chassis 3, 4, and 5

Source			Destination			
Slot	Connector	Pin	Slot	Connector	Pin	Signal
306	**y**ah	51	306	**y**ah	52	Master GigaRing Clock to CKM 1 Fanout
306	zah	19	306	zah	07	GigaRing Clock Fanout to PEM 17
306	zah	20	301	zah	07	GigaRing Clock Fanout to PEM 18
306	zah	21	302	zah	07	GigaRing Clock Fanout to PEM 19
306	zah	22	303	zah	07	GigaRing Clock Fanout to PEM 20
306	zah	23	304	zah	07	GigaRing Clock Fanout to PEM 21
306	zah	24	305	zah	07	GigaRing Clock Fanout to PEM 22
306	zah	25	401	zah	07	GigaRing Clock Fanout to PEM 23
306	zah	26	402	zah	07	GigaRing Clock Fanout to PEM 24
306	zah	27	403	zah	07	GigaRing Clock Fanout to PEM 25
306	zah	28	404	zah	07	GigaRing Clock Fanout to PEM 26
306	zah	29	405	zah	07	GigaRing Clock Fanout to PEM 27
306	zah	30	406	zah	07	GigaRing Clock Fanout to PEM 28
306	zah	35	501	zah	07	GigaRing Clock Fanout to PEM 29
306	zah	36	502	zah	07	GigaRing Clock Fanout to PEM 30
306	zah	37	503	zah	07	GigaRing Clock Fanout to PEM 31
306	zah	38	504	zah	07	GigaRing Clock Fanout to PEM 32
306	zag	39	505	zah	07	GigaRing Clock Fanout to PEM 33
306	zag	37	506	zah	07	GigaRing Clock Fanout to PEM 33

Table 14 lists the pin assignments for the PEM clock connector (rail connector zah). Note that the PEM clock connector contains PEM-to-WACS connections (including auxiliary voltage connections) and boundary scan connections, as well as clock signals.

Table 14. PEM Clock Connector (Rail Connector ZAH)

Pin	Signal (Complement)	Signal (True)	Description
03	sysclkinc	sysclkint	12ns Sysclk In (shielded)
04	vdd	vdd	vdd for test vehicle
05	Unused	Unused	
06	vdd	landmk [0]	Landmark Bit 0
07	scxclkinc	scxclkint	6.67ns GigaRing clk in (shielded)
08	vdd	landmk [1]	Landmark Bit 1
09	Unused	Unused	
10	vdd	landmk [2]	Landmark Bit 2
11	Unused	Unused	
12	auxpos	auxpos	Reserved for +10V (EV5.6)
13	auxpos	auxpos	Reserved for +10V (EV5.6)
14	auxpos	auxpos	Reserved for +10V (EV5.6)
19	sensevss	sensevdd	Sense VSS
20	intlok1	intlok1	Interlock 1
21	therm1p1	therm1p2	Thermistor 1
22	therm2p1	therm2p2	Thermistor 2
23	sensevss	sensevdd	Meter VSS
24	intlok2	intlok2	Interlock 2
25	p00tdioden	p00tdiodep	Node 00 EV5 Tdiode
26	c00tdioden	c00tdiodep	Node 00 C Tdiode
27	r00tdioden	r00tdiodep	Node 00 R Tdiode
28	p01tdioden	p01tdiodep	Node 01 EV5 Tdiode
29	c01tdioden	c01tdiodep	Node 01 C Tdiode
30	r01tdioden	r01tdiodep	Node 01 R Tdiode
35	p10tdioden	p10tdiodep	Node 10 EV5 Tdiode
36	c10tdioden	c10tdiodep	Node 10 C Tdiode
37	r10tdioden	r10tdiodep	Node 10 R Tdiode
38	p11tdioden	p11diodep	Node 11 EV5 Tdiode
39	c11tdioden	p11diodep	Node 11 C Tdiode
40	r11tdioden	r11diodep	Node 11 R Tdiode
41	itdioden	itdiodep	I Option Tdiode
42	thtdioden	thtdiodep	TH Option Tdiode
43	scxtdioden	scxtdiodep	GigaRing Option Tdiode
44	vss	vss	Reserved for VSS EV5.6
45	vss	vss	Reserved for VSS EV5.6
46	vss	vss	Reserved for VSS EV5.6

Table 14. PEM Clock Connector (Rail Connector ZAH) (continued)

Pin	Signal (Complement)	Signal (True)	Description
51	tmsmbc	tmsmbt	SCAN TMSMb (bar)
52	tckmc	tckmt	SCAN TCKM
53	tdimc	tdimt	SCAN TDIM
54	tdomc	tdomt	SCAM TDOM
55	tcksc	tckst	SCAN TCKS
56	repeatic	repeatit	Repeat IN
57	repeatoc	repeatot	Repeat OUT
58	vdd	sme	SCAN Scan_master_enable Module slot 1
59	Unused	Unused	
60	Unused	Unused	
61	vdd	vdd	VDD for test vehicle
62	vdd	vdd	VDD for test vehicle

Boundary Scan Cabling

The CRAY T3E system uses boundary scan to test the continuity of logical interconnects.

All boundary scan signals originate from the *scan master* PEM. The PEM in slot 1 of cabinet 0 serves as the scan master (SM). This PEM is identical to other PEMs; it is designated as the scan master by jumper wiring in the upper rail's clock connector.

The scan master sends signals to the modules in two ways: from PEM to PEM via daisy chains, and through clock module fanouts. As shown in Figure 32 and Figure 33, the signals pass through two *scan chains*: 0 and 1. Scan chain 0 passes signals from the scan master to the PEMs in cabinets 0, 1, and 2. Scan chain 1 passes signals to the PEMs in cabinets 3, 4, and 5.

Boundary scan uses the following signals:

- Vdd / SME – Scan Master Enable. This jumper signal designates the PEM in slot 1 of cabinet 0 as the scan master.
- TCK – Test Clock. The scan master sends this signal to the clock module(s) for fan out to all PEMs in the system.
- TMS - Test Mode Select. This signal supports test logic reset and scan operation modes.
- TDO - Test data out.
- TDI - Test data in.
- REPEATI and REPEATO - Repeat In and Repeat Out. These are input and output signals of a logic gate that boosts the logic signal level as the test data travels from point to point over a long distance. The REPEAT connections are used in configurations with four or more cabinets.

The scan master sends the TCK signal to clock module 0. Clock module 0 then fans out the TCK signal to itself and to clock module 1, if present. Clock module 0 then fans out the TCK signal to the PEMs in cabinets 0, 1, and 2. Clock module 1 fans out the TCK signal to the PEMs in cabinets 3, 4, and 5.

The scan master generates a TMS signal for each chain and sends these signals to the system clock modules. The clock modules fan out TMS0 and TMS1 to the PEMs.

Test Data signals are daisy-chained through the cabinets. In systems with four or more cabinets, the Test Data signals return to the scan master via *repeaters*. In other words, the signals must travel so far that they require boosting. To accomplish this, the TDO signal from the last PEM in the system is wired to the RepeatI connector on the PEM in slot 301 (via a jumper / intermediate connection). The RepeatO connector on the PEM in slot 301 is then connected to the TDI connector on the scan master (again via a jumper / intermediate wire).

Figure 32. PEM-to-PEM Signal Distribution

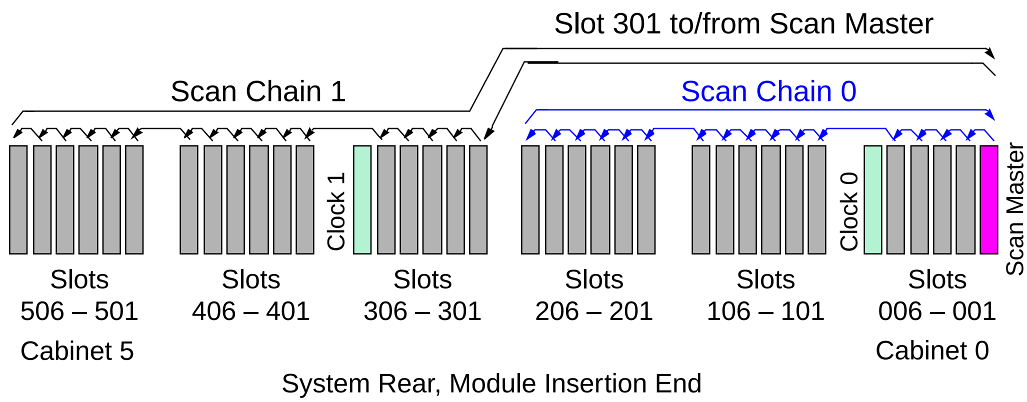


Figure 33. Clock Fanout

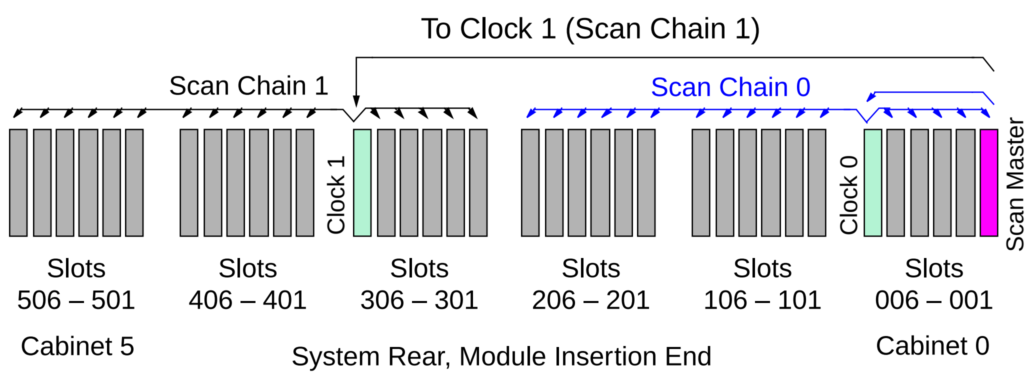
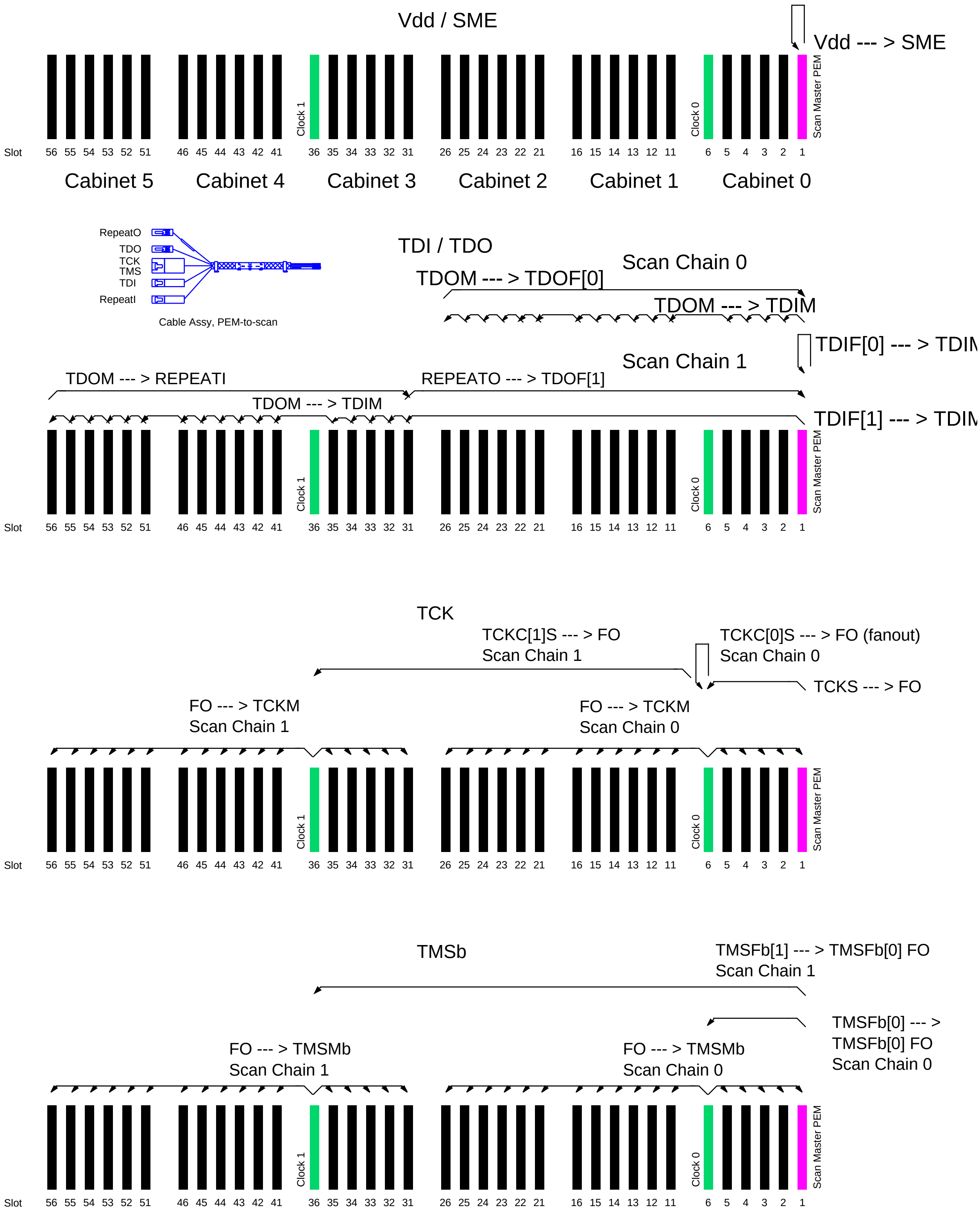


Figure 34 provides a more detailed illustration of the boundary scan signal distribution shown in Figure 32 and Figure 33.

Figure 34. Boundary Scan Signal Distribution – DetailBoundary scan



The boundary scan signals pass through cables and wires in the Z-side wiremat (above the modules). Table 15 lists tBoundary scanhe boundary scan cables and wires.

Table 15. Boundary Scan Cables and Wires

Description	Number	Length	Assembly/Kit
PEM-to-scan pigtail cable assembly	15214300	12 in. (31 cm)	1/PEM top rail assy
Clock internal (100 Ohm) wire assembly	15223701	120 in. (305 cm)	1/clock top rail assy 1/AC6 base kit
Scan jumper cable assembly	15223802	120 in. (305 cm)	2/slot clock mech kit 1/cab. 6 upgrade kit
Termination (VDD / SME) wire assembly	15223900	2 in. (5 cm)	1/AC6 base kit
Edge-to-edge wire assembly	15224009	144 in. (366 cm)	1/clock top rail assy
Edge-to-pigtail cable assembly, 2-position socket	15237601	120 in. (305 cm)	1/slot clock mech kit
Edge-to-pigtail cable assembly, 4-position pin	15237701	120 in. (305 cm)	1/PEM top rail assy
Edge-to-pigtail cable assembly, 2-position pin	15237801	120 in. (305 cm)	1/slot clock mech kit

Each top PEM rail contains a PEM-to-scan cable assembly (or pigtail). Figure 35 shows the cable assembly, and Table 16 describes the 5 plug-in connectors on the cable assembly.

Figure 35. PEM-to-scan Pigtail Cable Assembly (P/N 15214300)

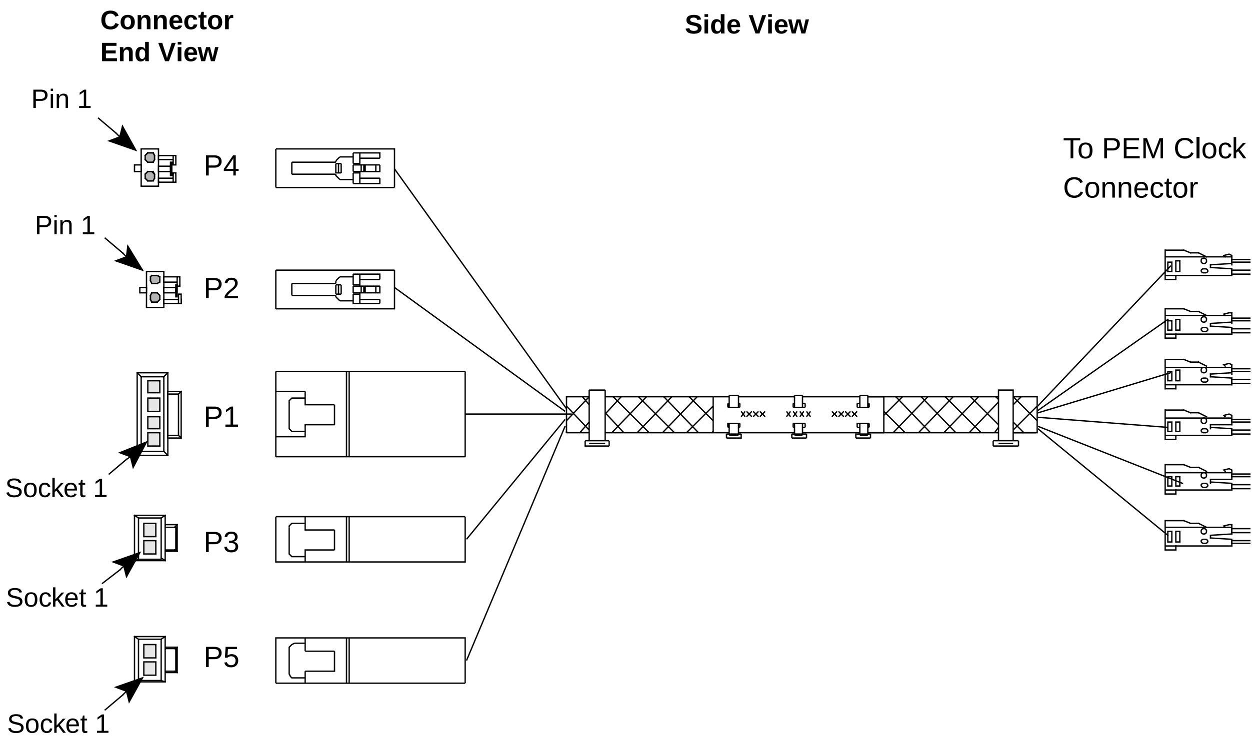


Table 16. PEM-to-scan Pigtail Cable Connectors

Connector	Wire Color	Signal	Notes
P1	Red	TCK	Connector P1 supports clock fanout. P1 connects to a 4-wire bundle (P/N 15237701) from the clock.
	Blue	TMS	
P2	Black	TDO	Connectors P2 and P3 support daisy chained scan data signals.
P3	White	TDI	
P4	Green	RepeatO	These connectors support feedback of TDOM in larger systems. Therefore, for most slots, these connectors are not used.
P5	Yellow	RepeatI	

Figure 36 shows the other boundary scan wires and cables.

Figure 36. Boundary Scan Wires and Cables

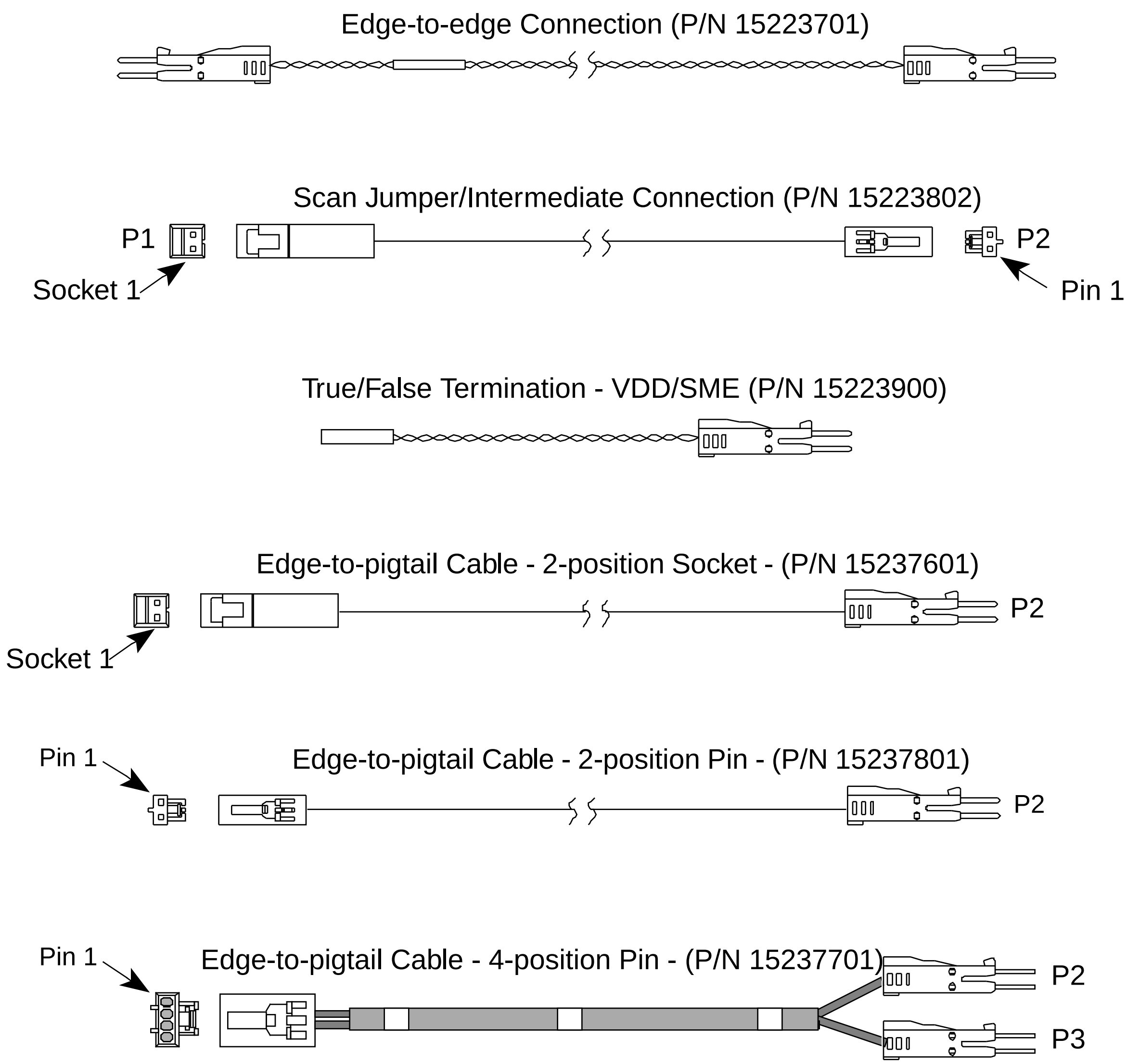
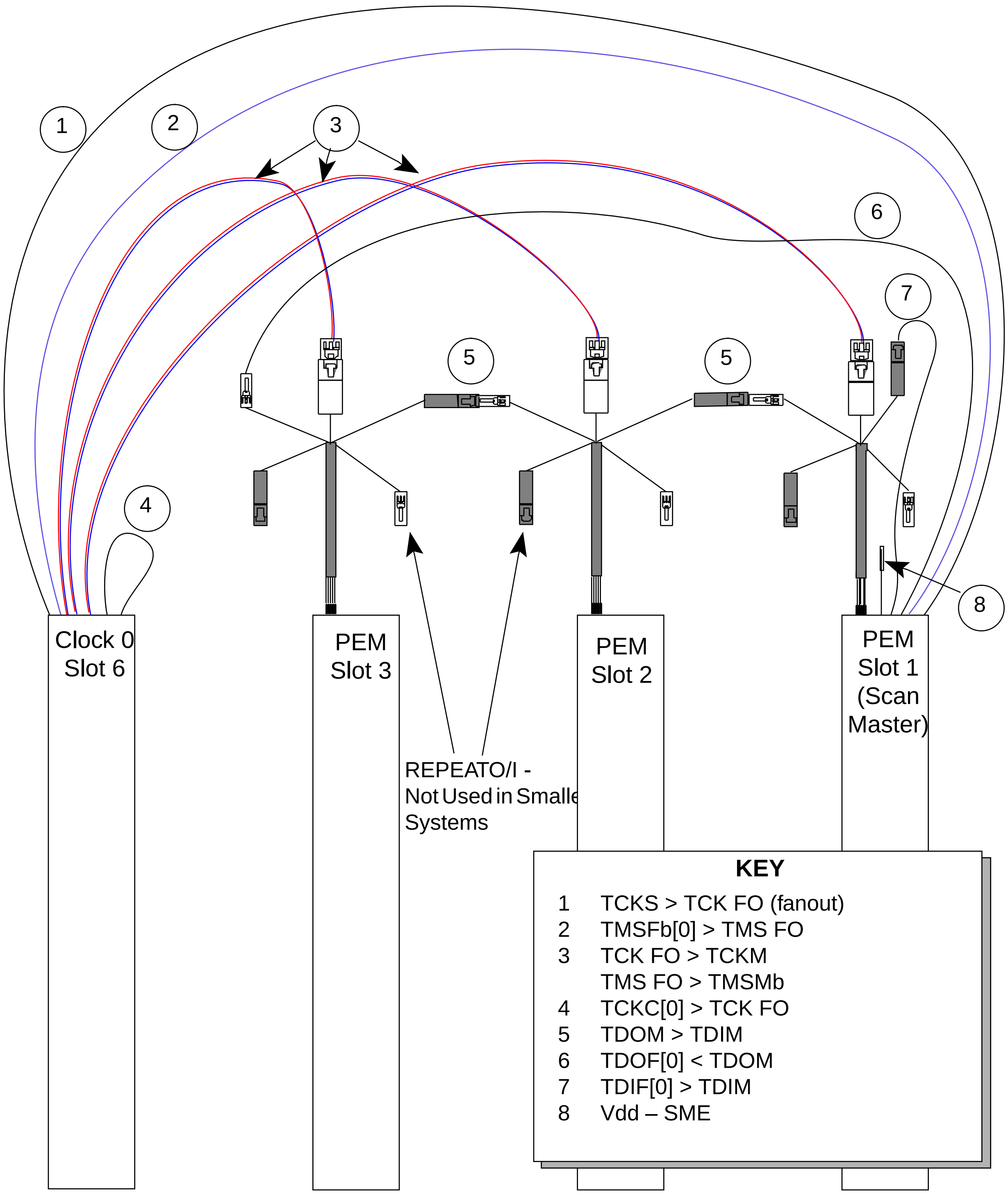


Figure 37 is a simplified illustration of the boundary scan wiring for a CRAY T3E AC system with three PEMs.

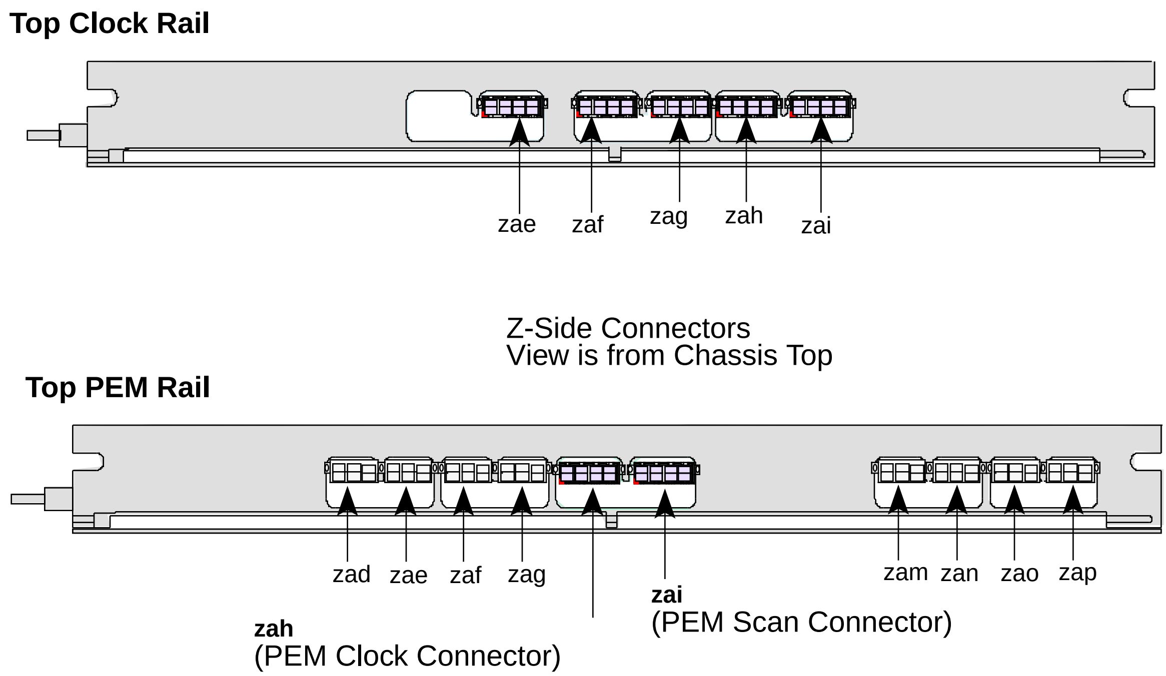
Figure 37. Example of Boundary Scan Wiring (Simplified)



Each PEM has a 4-shuttle scan connector (rail connector zai); however, it is not wired on any PEM other than the scan master PEM. Instead, most boundary scan wires plug into the PEM's *clock* connector. In addition, one end of many of the boundary scan cables connects to the clock module.

Figure 38 shows the locations of the scan and clock connectors on the top PEM rail and top clock rail.

Figure 38. Scan Connector Locations

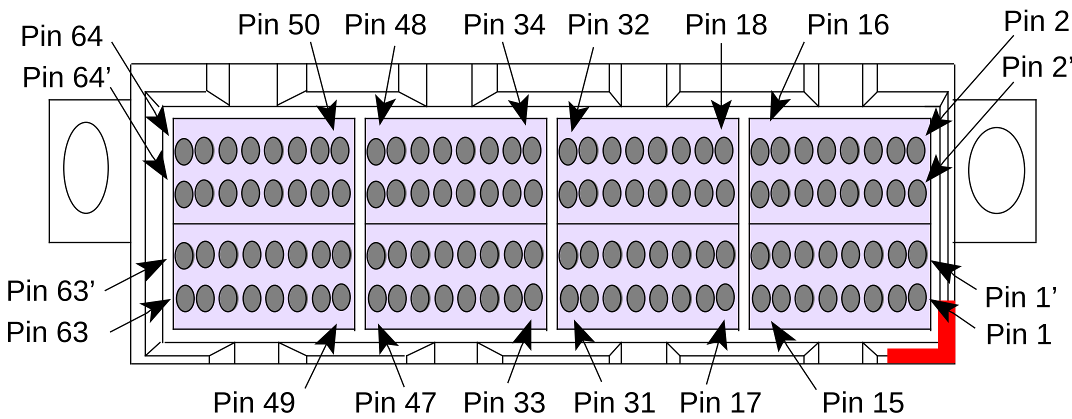


Pin Assignments

Figure 39 shows the pin numbering scheme for any of the rail connectors used with boundary scan: PEM clock, PEM scan, and clock module connectors. The view from the wire-insertion side of the connector is important because it shows the locations where you must insert boundary scan wires if necessary.

Figure 39. Clock or Scan Rail Connector – Pin Numbering

Clock or Scan Rail Connector - View from Module



Clock or Scan Rail Connector - View from Wire-insertion End

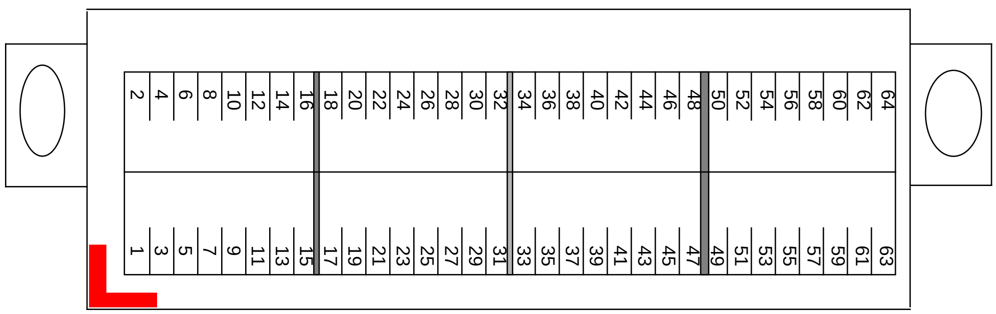


Table 17 lists the pin signal assignments for the scan connector (zai) on the PEM rail. As mentioned, every PEM contains a scan connector; however, it contains only a few connections. Most scan connections take place via the PEM clock connectors.

Table 17. Boundary Scan Rail Connector (zai)

Pin	Complement Signal	True Signal	Pin	Complement Signal	True Signal
03	tdifc [00]	tdift [00]	35	tmsfbc [08]	tmsfbt [08]
04	tdifc [01]	tdift [01]	36	tmsfbc [09]	tmsfbt [09]
05	tdifc [02]	tdift [02]	37	tmsfbc [10]	tmsfbt [10]
06	tdifc [03]	tdift [03]	38	tmsfbc [11]	tmsfbt [11]
07	tdifc [04]	tdift [04]	39	tmsfbc [12]	tmsfbt [12]
08	tdifc [05]	tdift [05]	40	tmsfbc [13]	tmsfbt [13]
09	tdifc [06]	tdift [06]	41	tmsfbc [14]	tmsfbt [14]
10	tdifc [07]	tdift [07]	42	tmsfbc [15]	tmsfbt [15]
11	tdifc [08]	tdift [08]	43	tdofc [00]	tdoft [00]
12	tdifc [09]	tdift [09]	44	tdofc [01]	tdoft [01]
13	tdifc [10]	tdift [10]	45	tdofc [02]	tdoft [02]
14	tdifc [11]	tdift [11]	46	tdofc [03]	tdoft [03]
19	tdifc [12]	tdift [12]	51	tdofc [04]	tdoft [04]
20	tdifc [13]	tdift [13]	52	tdofc [05]	tdoft [05]
21	tdifc [14]	tdift [14]	53	tdofc [06]	tdoft [06]
22	tdifc [15]	tdift [15]	54	tdofc [07]	tdoft [07]
23	tmsfbc [00]	tmsfbt [00]	55	tdofc [08]	tdoft [08]
24	tmsfbc [01]	tmsfbt [01]	56	tdofc [09]	tdoft [09]
25	tmsfbc [02]	tmsfbt [02]	57	tdofc [10]	tdoft [10]
26	tmsfbc [03]	tmsfbt [03]	58	tdofc [11]	tdoft [11]
27	tmsfbc [04]	tmsfbt [04]	59	tdofc [12]	tdoft [12]
28	tmsfbc [05]	tmsfbt [05]	60	tdofc [13]	tdoft [13]
29	tmsfbc [06]	tmsfbt [06]	61	tdofc [14]	tdoft [14]
30	tmsfbc [07]	tmsfbt [07]	62	tdofc [15]	tdoft [15]

Using the Engineering Wire List

The tables on this page contain excerpts from the Engineering wire list specification for boundary scan (specification 800513 - A5). The first table below contains information about wires that are specific to Scan Master functions. The other tables contain wire lists for the populated slots in the system.

For example, the “PE4” table contains a list of wires that connect to the rail (PEM) in slot 1 of cabinet 0, and the “PE8” table contains a list of wires that connect to the rail in slot 2 of cabinet 0.

Scan Master

Source		Intermediate	Destination		Signal Description
Slot / Conn / Pin	Wire P/N and Color	Wire P/N and Color	Slot / Conn / Pin	Wire P/N and Color	
001-zah58	15223900				Vdd - Scan Master Enable
001-zah55	15223701		006-zai46		TCKS > 1-8 TCK FO
006-zai42	15223701		006-zaf46		TCKC[0] > 1-68 TCK FO
001-zai23	15224009		006-zae61		TMSFb[0] > 1-34 TMS FO

PE4

Source		Intermediate	Destination		Signal Description
Slot / Conn / Pin	Wire P/N and Color	Wire P/N and Color	Slot / Conn / Pin	Wire P/N and Color	
006-zaf44	15237701 P2		001-zah52	15214300, red	1-68 TCK FO > TCKM
006-zae55	P3		001-zah51	blue	1-34 TMS FO > TMSMb
001-zai43	15237601		001-zah54	black	TDOF[0] < TDOM
001-zai03	15237801		001-zah53	white	TDIF[0] > TDIM

PE8

Source		Intermediate	Destination		Signal Description
Slot / Conn / Pin	Wire P/N and Color	Wire P/N and Color	Slot / Conn / Pin	Wire P/N and Color	
006-zaf43	15237701 P2		002-zah52	15214300, red	1-68 TCK FO > TCKM
006-zae54	P3		002-zah51	blue	1-34 TMS FO > TMSMb
001-zai43	15237601		002-zah54	black	TDOF[0] < TDOM
001-zah54	15214300, blk		002-zah53	white	TDOM > TDIM

The following pages provide explanations of information contained in the tables.

Figure 40. Explanation of the Boundary Scan Engineering Wire List – Part 1

Source		Intermediate	Destination		Signal Description
Slot / Conn / Pin	Wire P/N and Color	Wire P/N and Color	Slot / Conn / Pin	Wire P/N and Color	
001-zah58	15223900				Vdd - Scan Master Enable
001-zah55	15223701		006-zai46		TCKS > 1-8 TCK FO
006-zai42	15223701		006-zaf46		TCKC[0] > 1-68 TCK FO
001-zai23	15224009		006-zae61		TMSFb[0] > 1-34 TMS FO

This column lists the part numbers of the wires and cables.

This column lists the destination cables and connectors (if any). In this case, there are none because both ends of the cables listed in the “source” columns plug directly into the rail connectors. In other cases, this column contains the PEM-to-scan pigtail, P/N 15214300.

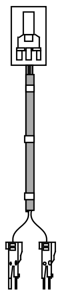
This column lists the “source” pin locations. One end of each cable plugs into a connector at a location listed above.

This column lists the “destination” pin locations. The pins from one end of the cables plug into the connector(s) at the locations listed above.

This column contains the part numbers for any required intermediate cables. (None are required for smaller systems.)

This column contains descriptions of the signals that transfer over the connections.

Figure 41. Explanation of the Boundary Scan Engineering Wire List – Part 2



Edge-to-Pigtail
Cable Assembly
(4-position Pin)
P/N 15237701

Edge-to-Pigtail Cable
Assembly (2-position
Socket) P/N
15237601

Connector P2 on the
PEM-to-Scan Cable
Assembly (Pigtail),
P/N 15214300, in slot 001

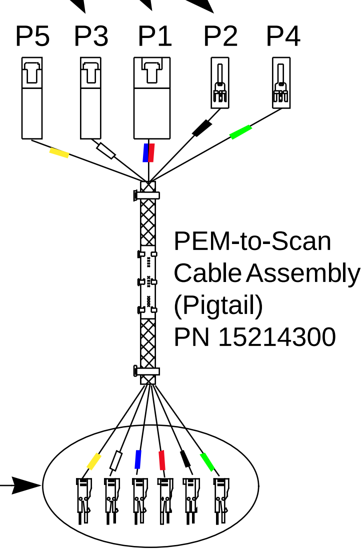
PE8

Source		Intermediate	Destination		Signal Description
Slot / Conn / Pin	Wire P/N and Color	Wire P/N and Color	Slot / Conn / Pin	Wire P/N and Color	
006-zaf43	15237701 P2		002-zah52	15214300, red	1-68 TCK FO > TCKM
006-zae54	P3		002-zah51	blue	1-34 TMS FO > TMSMb
001-zai43	15237601		002-zah54	black	TDOF[0] < TDOM
001-zah54	15214300, blk		002-zah53	white	TDOM > TDIM

NOTES

The TDOF[0] < TDOM and TDOM > TDIM connections disconnect to make larger or smaller systems. In general, these connections are made to the PEM with the highest slot number in the system.

REPEATO and REPEATI connections are not required for smaller systems; therefore, connectors P4 and P5 on the pigtail (PN 15214300) are not used in this case.



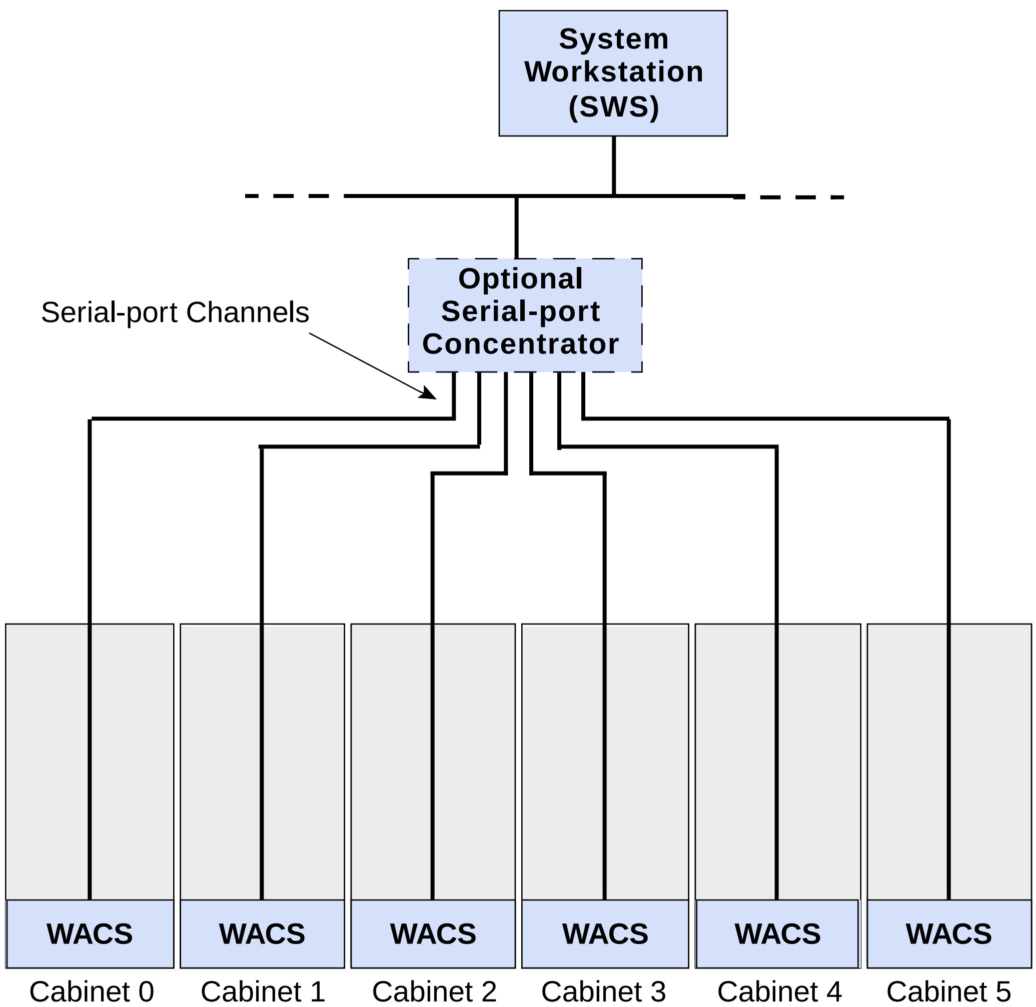
The pins shown at right plug into the rail at the locations listed above.

WACS Cabling

Each CRAY T3E AC cabinet has a self-contained WACS. The WACS in each cabinet may connect to the system workstation (SWS) in one of two ways: through direct RS-232 serial-port connection or through a serial-port-to-Ethernet concentrator. Scanner A in each WACS controls the communications between the cabinet and the SWS.

Figure 42 provides an overview of the system WACS cabling for a CRAY T3E AC system with the maximum configuration.

Figure 42. WACS System Cabling – Block Diagram



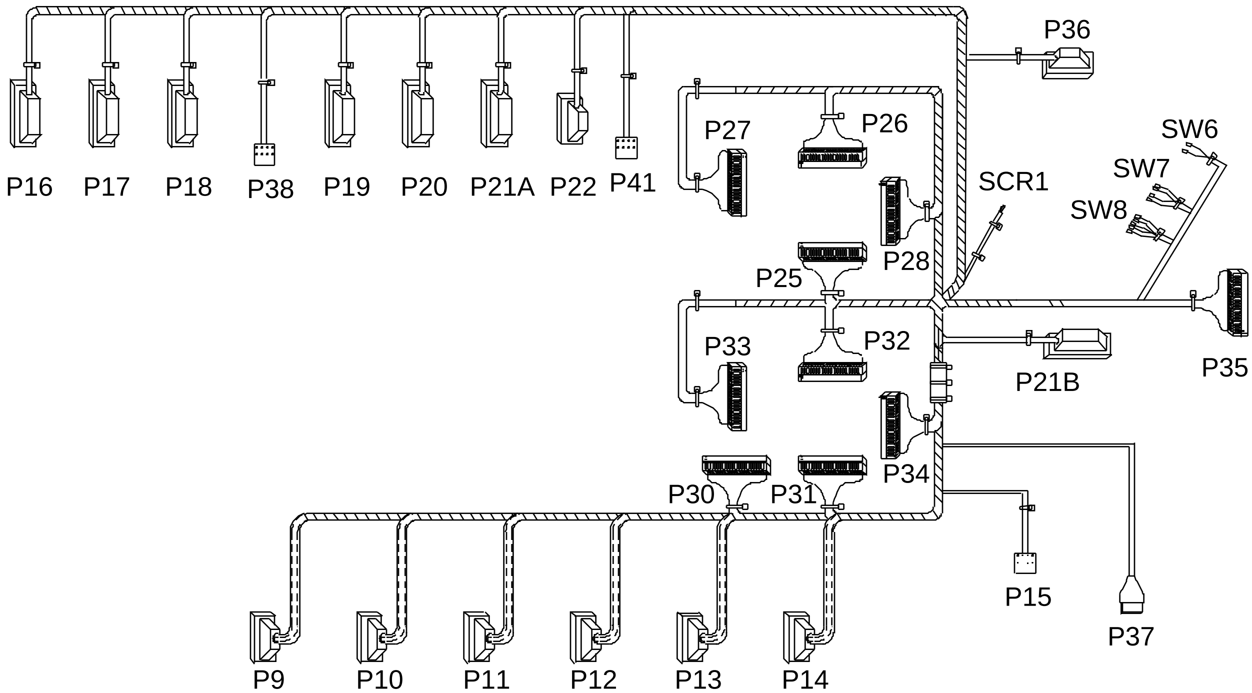
Cabinet WACS Cabling

In each cabinet, a single control harness contains most of the WACS wiring. Table 18 describes the harness connectors. Figure 43 shows the harness.

Table 18. WACS Harness Connectors

Connectors	Connect(s) to	# of Pins
P9 – P14	Power supplies 1 – 6	9
P15	Inlet thermistors	4
P16 – P20	PEMs slots 1 – 5	25
P21A	PEM - slot 6	25
P21B	Clock module - slot 6	25
P22	Clock module select on interconnect board	15
P25	Scanner B; connector J5	40
P26	Scanner B; connector J6	40
P27	Scanner B; connector J7	40
P28	Scanner B; connector J8	40
P30	Scanner A; connector J4	40
P31	Scanner A; connector J5	40
P32	Scanner A; connector J6	40
P33	Scanner A; connector J7	40
P34	Scanner A; connector J8	40
P35	Display module	40
P36	Switch module: clock select and Bscan	15
P37	SWS serial-port connection	9
P38	Exhaust thermistors	4
P41	Digital ground bus	2
2 wires	Blower controller (SCR1)	N/A
2 wires	Restart switch (SW6)	N/A
6 wires	Remote Restart Enable switch (SW7)	N/A
10 wires	Power Supply Margin switch (SW7)	N/A

Figure 43. WACS Harness



The cabinet also contains two other types of WACS cables: PEM-to-WACS and clock-to-WACS cable assemblies. Table 19 lists the part numbers for the various WACS cables.

Table 19. Cabinet WACS Cables

Description	Part Number
Control harness	57252700
PEM-to-WACS cable assembly	15214200
Clock-to-WACS cable assembly	57263800

Figure 44 shows the approximate physical locations of the cabinet WACS harness and connectors and of the other WACS cables. For simplicity, the illustration does not reflect the exact locations of the connectors or the exact routing of the harness. Refer to the following table while you study Figure 44.

Number	Description
1	PEM-to-WACS cables (P/N 15214200) – these cables are not part of the WACS harness
2	Module control connectors (P16 – P21A) and clock select connection (P22)
3	Exhaust air thermistor connector (P38)
4	Blower speed control connection
5	Scanner B connectors (P25 – P28)
6	Wire duct – wires pass through this duct and run to the modules, SCR1, and thermistors
7	Scanner A connectors (P30– P34)
8	Power supply connectors (P9 – P14)
9	Inlet air thermistor connector (P15) – these wires run through the vertical wire duct
10	Clock control connection (P21B)
11	Serial-port connection (P37)
12	Clock-to-WACS cable (P/N 15241200)

Figure 44. WACS Harness – Cabinet Side View

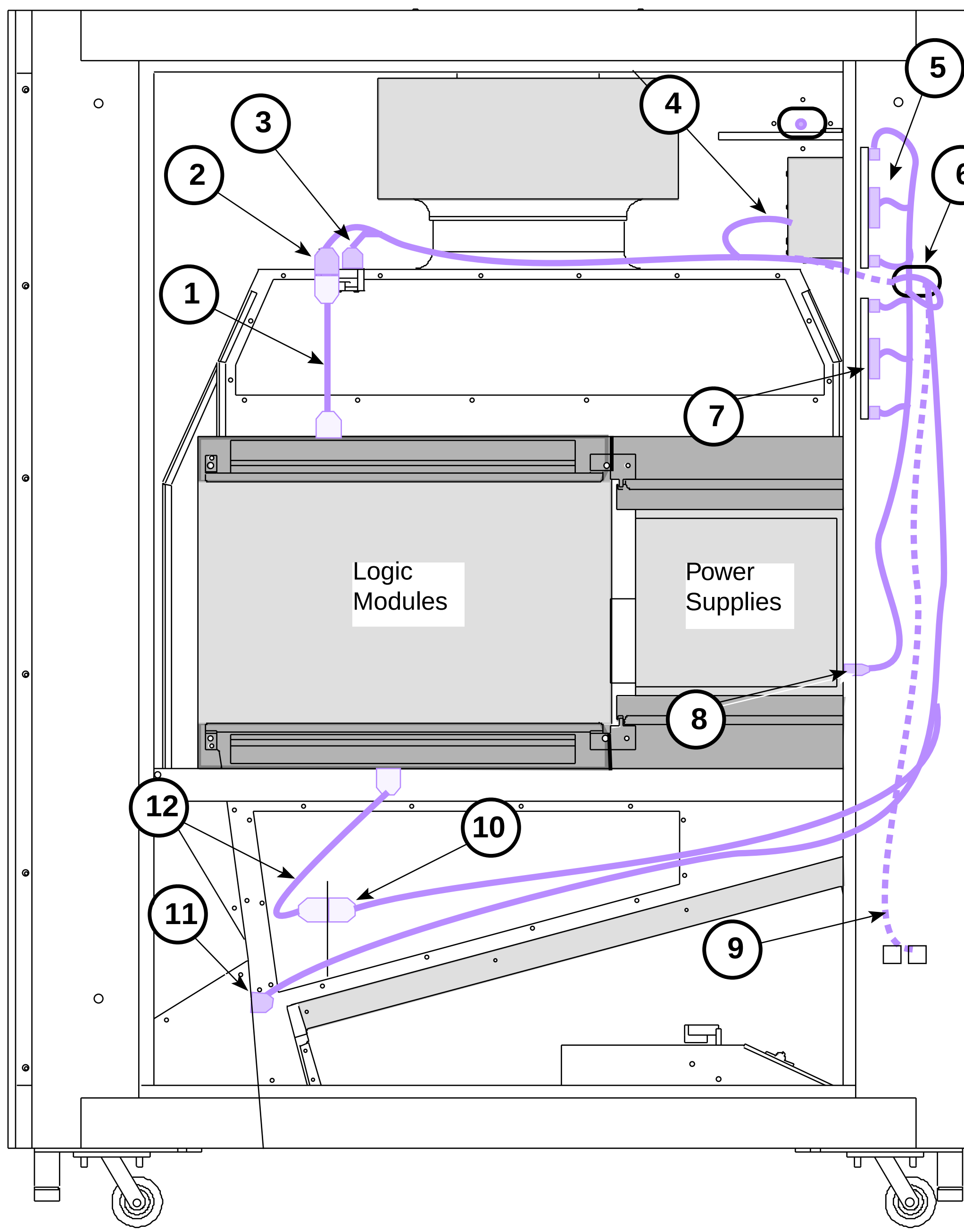
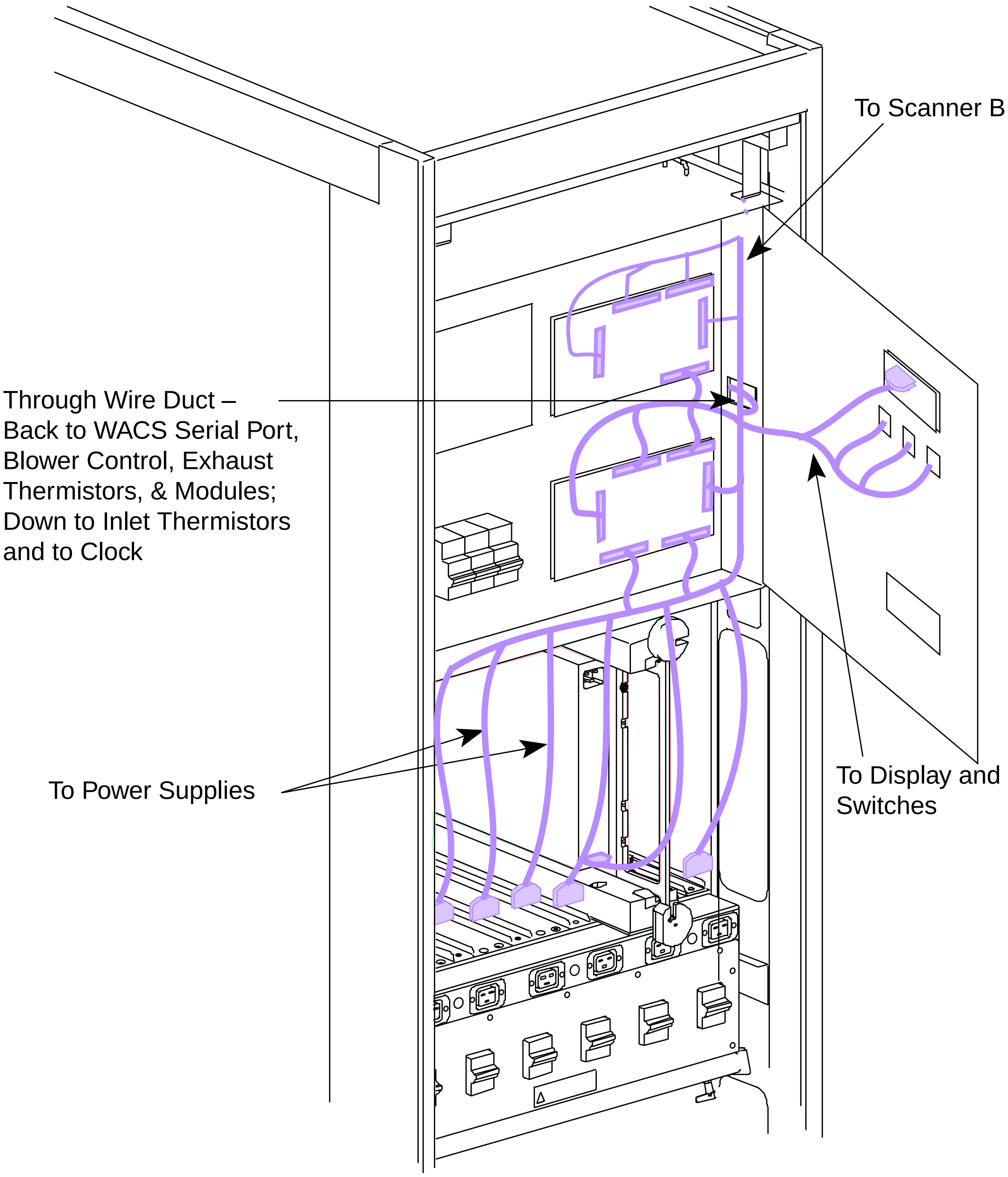


Figure 45 shows the WACS harness wires that are visible from the front of the cabinet. Note again that the illustration does not reflect the exact locations of the connectors or the exact routing of the harness. In addition, note that Figure 45 shows only one power supply, with connection. The other power supply control connectors are shown unconnected.

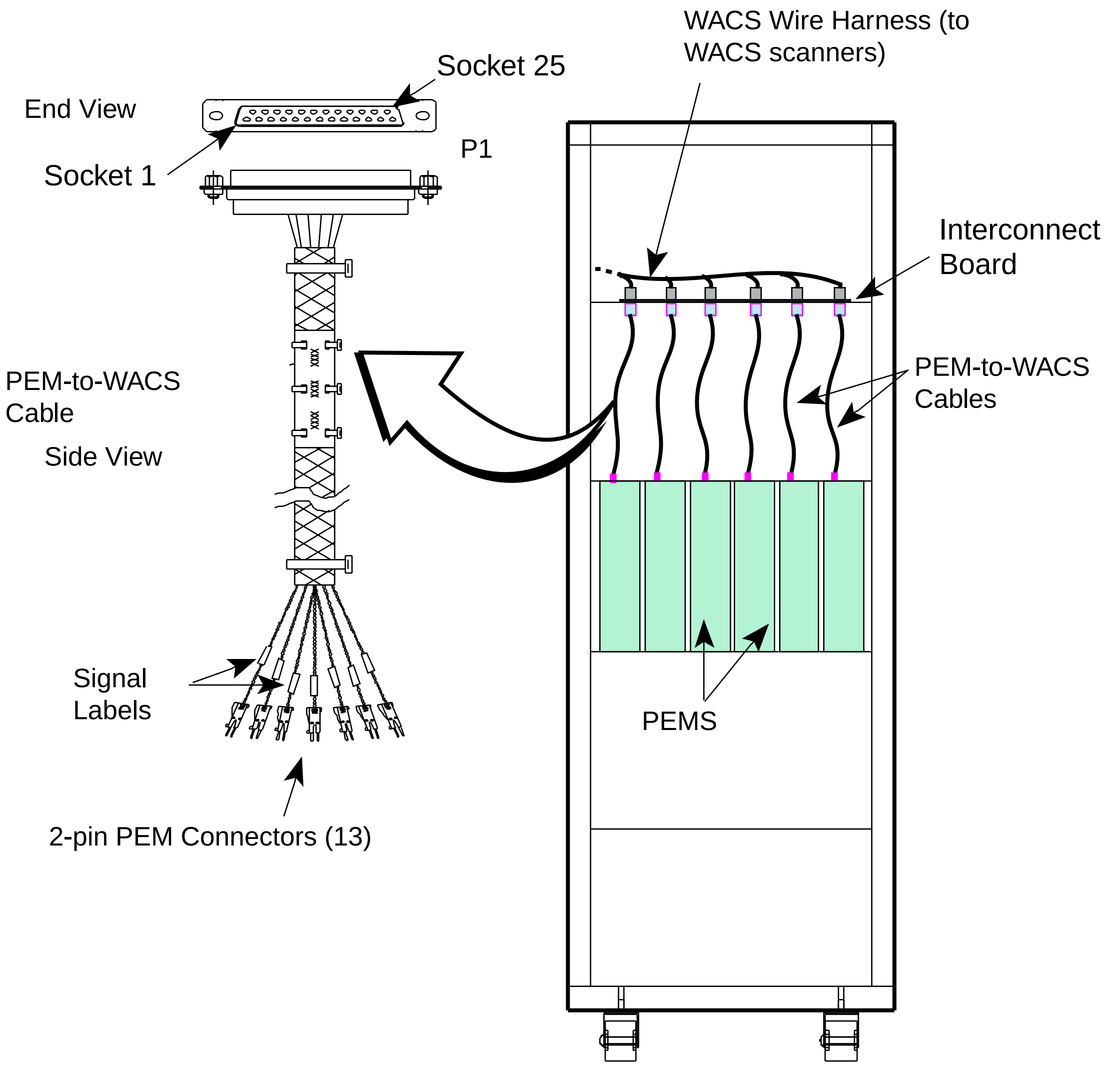
Figure 45. WACS Harness – Cabinet Front View



Module Connections

Information passes between the WACS and the PEM via the PEM's *clock* connector (rail connector zah). A PEM-to-WACS cable, shown in Figure 46, connects the PEM to the WACS wire harness. At one end of the cable, thirteen 2-pin connectors plug into the PEM via rail connector zah. At the other end, a 25-socket connector (P1) plugs into the wire harness at the interconnect bulkhead, which is directly above the modules.

Figure 46. PEM-to-WACS Cable Assembly



The clock module's WACS connector is similar to the PEM-to-WACS cable. It plugs into connector yai on the bottom (Y side) of the clock PCB. It connects to the WACS harness via a connection on the rear panel of the intake plenum.

Pin Assignments

The tables in this section contain pin assignments for the various connectors associated with the cabinet WACS.

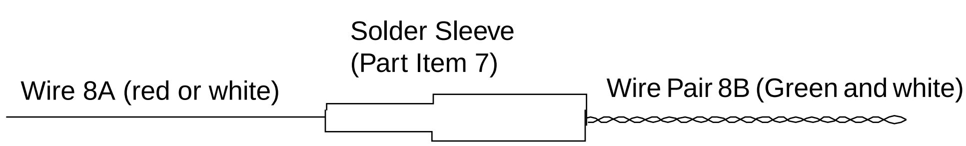
PEM-to-WACS Cable

Table 20 lists the pin assignments for the PEM-to-WACS cable (part number 15214200). The “From” columns list the sockets (on connector P1) where the wires connect. The “To” columns list the wire labels, which include the destinations in the rail connectors; for example, the wire labeled _H_19 plugs into position 19 on the PEM rail’s clock connector (zah).

Table 20. PEM-to-WACS Cable Pin Assignments

2-Pin Pair	Wire Color	From	To	2-Pin Pair	Wire Color	From	To
1	Green	P1-1	_H_19	8	Red	P1-15	+10_H_12
	White	P1-2			Green/wht		
2	Green	P1-3	_H_20	9	Red	P1-17	+10_H_13
	White	P1-4			Green/wht		
3	Green	P1-5	_H_21	10	Red	P1-19	+10_H_14
	White	P1-6			Green/wht		
4	Green	P1-7	_H_22	11	White	P1-16	VDD_H_44
	White	P1-8			Green/wht		
5	Green	P1-9	_H_23	12	White	P1-18	VDD_H_45
	White	P1-10			Green/wht		
6	Green	P1-11	Unused	13	White	P1-20	VDD_H_46
	White	P1-12			Green/wht		
7	Green	P1-13	_H_24				
	White	P1-14					

NOTE: 2-pin pairs 8 through 13 include a solder connection in the cable as shown in the following figure.



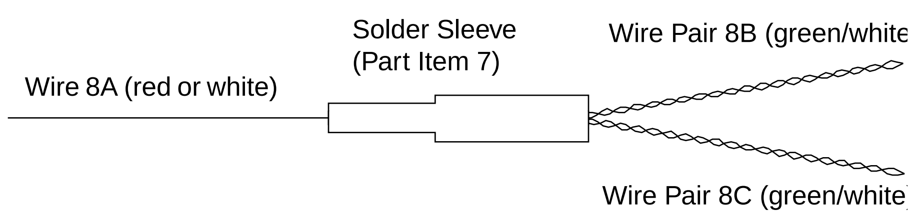
Clock-to-WACS Cable

Table 21 lists the pin assignments for the clock-to-WACS cable (part number 57263800). The "From" columns list the sockets (on connector P1) where the wires connect. The "To" columns list the destinations in the rail connectors and in internal solder sleeves.

Table 21. Clock-to-WACS Cable Pin Assignments

2-Pin Pair	Wire Color	From	To	2-Pin Pair	Wire Color	From	To
1	Green	P1-1	YAI 35	8	Rd/grn/wt	P1-16	YAI 3
	White	P1-2			Rd/grn/wt		YAI 4
2	Green	P1-3	YAI 36	9	Rd/grn/wt	P1-18	YAI 5
	White	P1-4			Rd/grn/wt		YAI 6
3	Green	P1-5	YAI 37	10	Rd/grn/wt	P1-20	YAI 7
	White	P1-6			Rd/grn/wt		YAI 8
4	Green	P1-7	YAI 38	11	Green/wht	P1-15	YAI 19
	White	P1-8			Green/wht		YAI 20
5	Green	P1-9	YAI 39	12	Green/wht	P1-17	YAI 21
	White	P1-10			Green/wht		YAI 22
6	Green	P1-11	YAI 40	13	Green/wht	P1-19	YAI 23
	White	P1-12			Green/wht		YAI 24
7	Green	P1-13	YAI 41	14	Green	P1-21	YAI 42
	White	P1-14			White	P1-22	

NOTE: 2-pin pairs 8 through 13 include a solder sleeve in the cable. The 2-pin connector connects to wires B and C. Wires B and C are soldered (at part item 7) to wire A as shown in the following figure.



WACS Harness Connectors

Table 22 lists the pin assignments for the module WACS connectors (P16 to P21) on the WACS harness. These 25-pin connectors plug into the PEM-to-WACS cables at the interconnect bulkhead.

Table 22. Module WACS Connectors (P16 to P21A/B) – Pin and Signal Allocations

Pin	Signal	Description
1	Sense +	The power supply monitors the module voltage via this connection (then regulates the voltage).
2	Sense –	
3	B ACoIl (jump 1A)	Interlock - power supply enable
4	S Enable+ (jump 1B)	Interlock - power supply enable
5	B M TEMP	Module temperature – backup thermistor
6	B M TEMP RTN	Module temperature return – backup thermistor
7	P M TEMP	Module temperature – primary thermistor
8	P M TEMP RTN	Module temperature return – primary thermistor
9	Meter 3.3Gnd	Meter - primary ground
10	Meter –3.3V	Meter - primary voltage
11	Meter 4.5Gnd	Meter - auxiliary ground
12	Meter –4.5V	Meter - auxiliary voltage
13	M CONT (jump 2a)	Interlock - module install
14	M CONT RTN (jump 2b)	Interlock - module install return
15	Auxiliary +	Auxiliary voltage inputs (daisy chained to provide sufficient current on 34-AWG wire)
16	Auxiliary –	
17	Auxiliary +	
18	Auxiliary –	
19	Auxiliary +	
20	Auxiliary –	
21	PEM: Not Used Clock module: B +ECL4	Reset after boundary scan (signal sent to clock module only)
22	PEM: Not Used Clock module: B -ECL4	Reset after boundary scan (signal sent to clock module only)
23	Not Used	
24	Not Used	
25	Not Used	

Table 23 provides source and destination information for the module WACS connectors (P16 to P21). The source pins are on connectors P16 to P21, and the destination pins are on other WACS harness connectors.

Table 23. Module Connector (Bulkhead) Pins - Destinations

Source	Destination					
Pin (on P16 to P21)	P16 (Slot 1) Connects to:	P17 (Slot 2) Connects to:	P18 (Slot 3) Connects to:	P19 (Slot 4) Connects to:	P20 (Slot 5) Connects to:	P21A / P21B (Slot 6) Connects to:
1	P9 - pin 5	P10 - pin 5	P11 - pin 5	P12 - pin 5	P13 - pin 5	P14 - pin 5
2	P9 - pin 9	P10 - pin 9	P11 - pin 9	P12 - pin 9	P13 - pin 9	P14 - pin 9
3	P25 - pin 5	P25 - pin 7	P25 - pin 9	P25 - pin 11	P25 - pin 13	P25 - pin 15
4	P9 - pin 1	P10 - pin 1	P11 - pin 1	P12 - pin 1	P13 - pin 1	P14 - pin 1
5	P27 - pin 1	P27 - pin 4	P27 - pin 7	P27 - pin 10	P27 - pin 13	P27 - pin 16
6	P27 - pin 3	P27 - pin 6	P27 - pin 9	P27 - pin 12	P27 - pin 15	P27 - pin 18
7	P33 - pin 1	P33 - pin 4	P33 - pin 7	P33 - pin 10	P33 - pin 13	P33 - pin 16
8	P33 - pin 3	P33 - pin 6	P33 - pin 9	P33 - pin 12	P33 - pin 15	P33 - pin 18
9	P26 - pin 2 P32 - pin 2	P26 - pin 4 P32 - pin 4	P26 - pin 6 P32 - pin 6	P26 - pin 8 P32 - pin 8	P26 - pin 10 P32 - pin 10	P26 - pin 12 P32 - pin 12
10	P26 - pin 1 P32 - pin 1	P26 - pin 3 P32 - pin 3	P26 - pin 5 P32 - pin 5	P26 - pin 7 P32 - pin 7	P26 - pin 9 P32 - pin 9	P26 - pin11 P32 - pin 11
11	P26 - pin 14 P32 - pin 14	P26 - pin 16 P32 - pin 16	P26 - pin 18 P32 - pin 18	P26 - pin 20 P32 - pin 20	P26 - pin 22 P32 - pin 22	P26 - pin 24 P32 - pin 24
12	P26 - pin 13 P32 - pin 13	P26 - pin 15 P32 - pin 15	P26 - pin 17 P32 - pin 17	P26 - pin 19 P32 - pin 19	P26 - pin 21 P32 - pin 21	P26 - pin 23 P32 - pin 23
13	P28 - pin 1 P34 - pin 1	P28 - pin 3 P34 - pin 3	P28 - pin 5 P34 - pin 5	P28 - pin 7 P34 - pin 7	P28 - pin 9 P34 - pin 9	P28 - pin 11 P34 - pin 11

Table 23. Module Connector (Bulkhead) Pins - Destinations (continued)

Source	Destination					
Pin (on P16 to P21)	P16 (Slot 1) Connects to:	P17 (Slot 2) Connects to:	P18 (Slot 3) Connects to:	P19 (Slot 4) Connects to:	P20 (Slot 5) Connects to:	P21A / P21B (Slot 6) Connects to:
14	P28 - pin 2 P34 - pin 2	P28 - pin 4 P34 - pin 4	P28 - pin 6 P34 - pin 6	P28 - pin 8 P34 - pin 8	P28 - pin 10 P34 - pin 10	P28 - pin 12 P34 - pin 12
15	P9 - pin 6 P16 - pin 17 P16 - pin 19	P10 - pin 6 P17 - pin 17 P17 - pin 19	P11 - pin 6 P18 - pin 17 P18 - pin 19	P12 - pin 6 P19 - pin 17 P19 - pin 19	P13 - pin 6 P20 - pin 17 P20 - pin 19	P14 - pin 6 P21 - pin 17 P21 - pin 19
16	P9 - pin 7 P16 - pin 18 P16 - pin 20	P10 - pin 7 P17 - pin 18 P17 - pin 20	P11 - pin 7 P18 - pin 18 P18 - pin 20	P12 - pin 7 P19 - pin 18 P19 - pin 20	P13 - pin 7 P20 - pin 18 P20 - pin 20	P14 - pin 7 P21 - pin 18 P21 - pin 20
17	P9 - pin 6 P16 - pin 15 P16 - pin 19	P10 - pin 6 P17 - pin 15 P17 - pin 19	P11 - pin 6 P18 - pin 15 P18 - pin 19	P12 - pin 6 P19 - pin 15 P19 - pin 19	P13 - pin 6 P20 - pin 15 P20 - pin 19	P14 - pin 6 P21 - pin 15 P21 - pin 19
18	P9 - pin 7 P16 - pin 16 P16 - pin 20	P10 - pin 7 P17 - pin 16 P17 - pin 20	P11 - pin 7 P18 - pin 16 P18 - pin 20	P12 - pin 7 P19 - pin 16 P19 - pin 20	P13 - pin 7 P20 - pin 16 P20 - pin 20	P14 - pin 7 P21 - pin 16 P21 - pin 20
19	P9 - pin 6 P16 - pin 15 P16 - pin 17	P10 - pin 6 P17 - pin 15 P17 - pin 17	P11 - pin 6 P18 - pin 15 P18 - pin 17	P12 - pin 6 P19 - pin 15 P19 - pin 17	P13 - pin 6 P20 - pin 15 P20 - pin 17	P14 - pin 6 P21 - pin 15 P21 - pin 17
20	P9 - pin 7 P16 - pin 16 P16 - pin 18	P10 - pin 7 P17 - pin 16 P17 - pin 18	P11 - pin 7 P18 - pin 16 P18 - pin 18	P12 - pin 7 P19 - pin 16 P19 - pin 18	P13 - pin 7 P20 - pin 16 P20 - pin 18	P14 - pin 7 P21 - pin 16 P21 - pin 18
21	Not Used	Not Used	Not Used	Not Used	Not Used	P28 - pin 21
22	Not Used	Not Used	Not Used	Not Used	Not Used	P28 - pin 22

The following tables contain pin assignments for the various connectors on the WACS harness.

Clock Select Connector

Table 24. Clock Select Connector (P22)

Pin	Signal	Destination
1	B +ECL0 (Soft BS)	P28 - pin 24
2	B –ECL0 (Soft BS)	P28 - pin 23
3	S +ECL1 (Hard BS)	P36 - pin 10
4	S -ECL1 (Hard BS)	P36 - pin 3
5	S +ECL2 (Clk Sel 2’1)	P36 - pin 11
6	S -ECL2 (Clk Sel 2’1)	P36 - pin 4
7	S +ECL3 (Clk Sel 2’0)	P36 - pin 12
8	S -ECL3 (Clk Sel 2’0)	P36 - pin 5
9	Not Used	
10	Not Used	
11	Not Used	
12	Not Used	
13	Not Used	
14	Not Used	
15	Not Used	

Power Supply Connectors

Table 25. Power Supply Control Connectors (P9 through P14)

Pin	Signal
1	Power Supply Enable+
2	Power Supply Enable –
3	Margin High
4	Margin Low
5	Sense+ (module voltage)
6	Auxiliary voltage output +
7	Auxiliary voltage output –
8	Margin Common
9	Sense – (module voltage)

Table 26. Power Supply Connector Pins - Destinations

Pin	P9 (PS1) Connects to:	P10 (PS2) Connects to:	P11 (PS3) Connects to:	P12 (PS4) Connects to:	P13 (PS5) Connects to:	P14 (PS6) Connects to:
1	P16 - pin 4	P17 - pin 4	P18 - pin 4	P19 - pin 4	P20 - pin 4	P21A/B - pin 4
2	P25 - pin 33	P25 - pin 34	P25 - pin 35	P25 - pin 36	P25 - pin 37	P25 - pin 38
3	SW8-3 and pin 3 of all other power supplies	SW8-3 and pin 3 of all other power supplies	SW8-3 and pin 3 of all other power supplies	SW8-3 and pin 3 of all other power supplies	SW8-3 and pin 3 of all other power supplies	SW8-3 and pin 3 of all other power supplies
4	SW8-4 and pin 4 of all other power supplies	SW8-4 and pin 4 of all other power supplies	SW8-4 and pin 4 of all other power supplies	SW8-4 and pin 4 of all other power supplies	SW8-4 and pin 4 of all other power supplies	SW8-4 and pin 4 of all other power supplies
5	P16 - pin 1	P17 - pin 1	P18 - pin 1	P19 - pin 1	P20 - pin 1	P21A/B - pin 1
6	P16 - pin 15 P16 - pin 17 P16 - pin 19	P17 - pin 15 P17 - pin 17 P17 - pin 19	P18 - pin 15 P18 - pin 17 P18 - pin 19	P19 - pin 15 P19 - pin 17 P19 - pin 19	P16 - pin 15 P16 - pin 17 P16 - pin 19	P21A/B - pin 15 P21A/B - pin 17 P21A/B - pin 19
7	P16 - pin 16 P16 - pin 18 P16 - pin 20	P17 - pin 16 P17 - pin 18 P17 - pin 20	P18 - pin 16 P18 - pin 18 P18 - pin 20	P19 - pin 16 P19 - pin 18 P19 - pin 20	P16 - pin 16 P16 - pin 18 P16 - pin 20	P21A/B - pin 16 P21A/B - pin 18 P21A/B - pin 20
8	P34 - pin 40 and pin 8 of all other power supplies	P34 - pin 40 and pin 8 of all other power supplies	P34 - pin 40 and pin 8 of all other power supplies	P34 - pin 40 and pin 8 of all other power supplies	P34 - pin 40 and pin 8 of all other power supplies	P34 - pin 40 and pin 8 of all other power supplies
9	P16 - pin 2	P17 - pin 2	P18 - pin 2	P19 - pin 2	P20 - pin 2	P21A - pin 2 P21B - pin 2

Air Thermistor Connectors

Table 27. Inlet Thermistors Connector (P15)

Pin	Signals	Destination
1	B M Temp 7	P27 - pin 19
2	B M Temp RTN7	P27 - pin 21
3	P M Temp 7	P33 - pin 19
4	P M Temp RTN7	P33 - pin 21

Table 28. Exhaust Thermistors Connector (P38)

Pin	Signals	Destination
1	B M Temp 8	P27 - pin 22
2	B M Temp RTN8	P27 - pin 24
3	P M Temp 8	P33 - pin 22
4	P M Temp RTN8	P33 - pin 24

Scanner B ConnectorsPin assignment

Table 29. Scanner B Connector P25

Pin	Signal	Destination	Pin	Signal	Destination
1	BCoil1EN	P25 - pin 2	21	N/C	
2	BCoil1EN	P25 - pin 1	22	N/C	
3	BCoil2EN	P25 - pin 3	23	N/C	
4	BCoil2EN	P25 - pin 4	24	N/C	
5	B AColl3	P16 - pin 3	25	B BRX	P37 - pin 2
6	P AColl3	P31 - pin 5	26	B BTX	P37 - pin 3
7	B AColl4	P17 - pin 3	27	N/C	
8	P AColl4	P31 - pin 7	28	N/C	
9	B AColl5	P18 - pin 3	29	N/C	
10	P AColl5	P31 - pin 9	30	N/C	
11	B AColl6	P19 - pin 3	31	N/C	
12	P AColl6	P31 - pin 11	32	N/C	
13	B AColl7	P20 - pin 3	33	S1 Enable–	P9 - pin 2
14	P AColl7	P31 - pin 13	34	S2 Enable–	P10 - pin 2
15	B AColl8	P21A/B - pin 3	35	S3 Enable–	P11 - pin 2
16	P AColl8	P31 - pin 15	36	S4 Enable–	P12 - pin 2
17	N/C		37	S5 Enable–	P13 - pin 2
18	B ARX	P31 - pin 19	38	S6 Enable–	P14 - pin 2
19	B ATX	P31 - pin 18	39	B J5GND39	P37 - pin 5
20	N/C		40	B J5GND40	P31 - pin 40

Table 30. Scanner B Connector P26

Pin	Signal	Destination	Pin	Signal	Destination
1	M1 Mtr –3.3V	P16 - pin 10 P32 - pin 1	21	M5 Mtr –4.5V	P20 - pin 12 P32 - pin 21
2	M1 Mtr 3.3Gnd	P16 - pin 9 P32 - pin 2	22	M5 Mtr 4.5Gnd	P20 - pin 11 P32 - pin 22
3	M2 Mtr –3.3V	P17 - pin 10 P32 - pin 3	23	M6 Mtr –4.5V	P21A/B - pin 12 P32 - pin 23
4	M2 Mtr 3.3Gnd	P17 - pin 9 P32 - pin 4	24	M6 Mtr 4.5Gnd	P21A/B - pin 11 P32 - pin 24
5	M3 Mtr –3.3V	P18 - pin 10 P32 - pin 5	25	N/C	
6	M3 Mtr 3.3Gnd	p18 - pin 9 P32 - pin 6	26	N/C	
7	M4 Mtr –3.3V	P19 - pin 10 P32 - pin 7	27	N/C	
8	M4Mtr 3.3Gnd	P19 - pin 9 P32 - pin 8	28	N/C	
9	M5 Mtr –3.3V	P20 - pin 10 P32 - pin 9	29	N/C	
10	M5 Mtr 3.3Gnd	P20 - pin 9 P32 - pin 10	30	N/C	
11	M6 Mtr –3.3V	P21A/B - pin 10 P32 - pin 11	31	N/C	
12	M6 Mtr 3.3Gnd	P21A/B - pin 9 P32 - pin 12	32	N/C	
13	M1 Mtr –4.5V	P16 - pin 12 P32 - pin 13	33	N/C	
14	M1 Mtr 4.5Gnd	P16 - pin 11 P32 - pin 14	34	N/C	
15	M2 Mtr –4.5V	P17 - pin 12 P32 - pin 15	35	N/C	
16	M2 Mtr 4.5Gnd	P17 - pin 11 P32 - pin 16	36	N/C	
17	M3 Mtr –4.5V	P18 - pin 12 P32 - pin 17	37	N/C	
18	M3 Mtr 4.5Gnd	P18 - pin 11 P32 - pin 18	38	N/C	
19	M4 Mtr –4.5V	P19 - pin 12 P32 - pin 19	39	N/C	
20	M4 Mtr 4.5Gnd	P19 - pin 11 P32 - pin 20	40	N/C	

Table 31. Scanner B Connector P27

Pin	Signal	Destination	Pin	Signal	Destination
1	B M TEMP 1	P16 - pin 5	21	B M TEMP RTN7	P15 - pin 2
2	B TEMP COPY 1	P33 - pin 25	22	B M TEMP 8	P38 - pin 1
3	B M TEMP RTN1	P16 - pin 6	23	B TEMP COPY 8	P33 - pin 39
4	B M TEMP 2	P17 - pin 5	24	B M TEMP RTN8	P38 - pin 2
5	B TEMP COPY 2	P33 - pin 27	25	P TEMP COPY1	P33 - pin 2
6	B M TEMP RTN2	P17 - pin 6	26	N/C	
7	B M TEMP 3	P18 - pin 5	27	P TEMP COPY2	P33 - pin 5
8	B TEMP COPY 3	P33 - pin 29	28	N/C	
9	B M TEMP RTN3	P18 - pin 6	29	P TEMP COPY3	P33 - pin 8
10	B M TEMP 4	P19 - pin 5	30	N/C	
11	B TEMP COPY 4	P33 - pin 31	31	P TEMP COPY4	P33 - pin 11
12	B M TEMP RTN4	P19 - pin 6	32	N/C	
13	B M TEMP 5	P20 - pin 5	33	P TEMP COPY5	P33 - pin 14
14	B TEMP COPY 5	P33 - pin 33	34	N/C	
15	B M TEMP RTN5	P20 - pin 6	35	P TEMP COPY6	P33 - pin 17
16	B M TEMP 6	P21A/B - pin 5	36	N/C	
17	B TEMP COPY 6	P33 - pin 35	37	P TEMP COPY7	P33 - pin 20
18	B M TEMP RTN6	P21A/B - pin 6	38	N/C	
19	B M TEMP 7	P15 - pin 1	39	P TEMP COPY8	P33 - pin 23
20	B TEMP COPY 7	P33 - pin 37	40	N/C	

Table 32. Scanner B Connector P28

Pin	Signal	Destination	Pin	Signal	Destination
1	M CONT 1	P16 - pin 13 P34 - pin 1	21	B +ECL4 (Reset after B/S)	P21B - pin 21
2	M CONT RTN1	P16 - pin 14 P34 - pin 2	22	B -ECL4 (Reset after B/S)	P21B - pin 22
3	M CONT 2	P17 - pin 13 P34 - pin 3	23	B +ECL0 (Soft B/S)	P22 - pin 1
4	M CONT RTN2	P17 - pin 14 P34 - pin 4	24	B –ECL0 (Soft B/S)	P22 - pin 2
5	M CONT 3	P18 - pin 13 P34 - pin 5	25	N/C	
6	M CONT RTN3	P18 - pin 14 P34 - pin 6	26	N/C	
7	M CONT 4	P19 - pin 13 P34 - pin 7	27	N/C	
8	M CONT RTN4	P19 - pin 14 P34 - pin 8	28	N/C	
9	M CONT 5	P20 - pin 13 P34 - pin 9	29	N/C	
10	M CONT RTN5	P20 - pin 14 P34 - pin 10	30	N/C	
11	M CONT 6	P21A/B - pin 13 P34 - pin 11	31	N/C	
12	M CONT RTN6	P21A/B - pin 14 P34 - pin 12	32	N/C	
13	N/C		33	N/C	
14	N/C		34	B J8+5V34	SW7-5 SW8-2/5
15	B_Sel (Backup Select)	P28 - pin 16	35	N/C	
16	B_Sel (Backup Select)	P28 - pin 15	36	N/C	
17	N/C		37	B SWIT1	SW6-C P34 - pin 37
18	N/C		38	B J8GND38	SW6-NO SW7-1 SW8-A-/B P34 - pin 38
19	N/C		39	B SWIT2	SW7-2 P34 - pin 39
20	N/C		40	N/C	

Scanner A Connectors

Table 33. Scanner A Connector P30

Pin	Signal	Destination	Pin	Signal	Destination
1	N/C		21	P DSP D4	P35 - pin 27
2	N/C		22	P DSP D5	P35 - pin 28
3	N/C		23	P DSP D6	P35 - pin 29
4	N/C		24	P DSP D7	P35 - pin 30
5	SCAN UP	P35 - pin 11	25	N/C	
6	N/C		26	N/C	
7	SCAN DOWN	P35 - pin 12	27	P DSP C7	P35 - pin 20
8	N/C		28	N/C	
9	N/C		29	P DSP C10	P35 - pin 19
10	N/C		30	P DSP C20	P35 - pin 21
11	N/C		31	N/C	
12	N/C		32	P J4+5V32	P35 - pin 33
13	N/C		33	N/C	
14	N/C		34	N/C	
15	N/C		35	N/C	
16	N/C		36	P J4+5V36	P35 - pin 34
17	P DSP D0	P35 - pin 23	37	P J4+12V37	P35 - pin 35
18	P DSP D1	P35 - pin 24	38	P J4+12V38	P35 - pin 36
19	P DSP D2	P35 - pin 25	39	PJ4GND39	P35 - pin 37
20	P DSP D3	P35 - pin 26	40	PJ4GND40	P35 - pin 38

Table 34. Scanner A Connector P31

Pin	Signal	Destination	Pin	Signal	Destination
1	PCoil1EN	P31 - pin 2	21	N/C	
2	PCoil1EN	P31 - pin 1	22	N/C	
3	PCoil2EN	P31 - pin 4	23	N/C	
4	PCoil2EN	P31 - pin 3	24	N/C	
5	P AColl3	P25 - pin 6	25	N/C	
6	N/C		26	N/C	
7	P AColl4	P25 - pin 8	27	N/C	
8	N/C		28	N/C	
9	P AColl5	P25 - pin 10	29	N/C	
10	N/C		30	N/C	
11	P AColl6	P25 - pin 12	31	N/C	
12	N/C		32	N/C	
13	P AColl7	P25 - pin 14	33	N/C	
14	N/C		34	N/C	
15	P AColl8	P25 - pin 16	35	N/C	
16	N/C		36	N/C	
17	N/C		37	N/C	
18	B ATX	P25 - pin 19	38	N/C	
19	B ARX	P25 - pin 18	39	N/C	
20	N/C		40	P J5GND40	P25 - pin 40

Table 35. Scanner A Connector P32

Pin	Signal	Destination	Pin	Signal	Destination
1	M1 Mtr –3.3V	P16 - pin 10 P26 - pin 1	21	M5 Mtr –4.5V	P20 - pin 12 P26 - pin 21
2	M1 Mtr 3.3Gnd	P16 - pin 9 P26 - pin 2	22	M5 Mtr 4.5Gnd	P20 - pin 11 P26 - pin 22
3	M2 Mtr –3.3V	P17 - pin 10 P26 - pin 3	23	M6 Mtr –4.5V	P21A/B - pin 12 P26 - pin 23
4	M2 Mtr 3.3Gnd	P17 - pin 9 P26 - pin 4	24	M6 Mtr 4.5Gnd	P21A/B - pin 11 P26 - pin 24
5	M3 Mtr –3.3V	P18 - pin 10 P26 - pin 5	25	N/C	
6	M3 Mtr 3.3Gnd	P18 - pin 9 P26 - pin 6	26	N/C	
7	M4 Mtr –3.3V	P19 - pin 10 P26 - pin 7	27	N/C	
8	M4 Mtr 3.3Gnd	P19 - pin 9 P26 - pin 8	28	N/C	
9	M5 Mtr –3.3V	P20 - pin 10 P26 - pin 9	29	N/C	
10	M5 Mtr 3.3Gnd	P20 - pin 9 P26 - pin 10	30	N/C	
11	M6 Mtr –3.3V	P21A/B - pin 10 P26 - pin11	31	N/C	
12	M6 Mtr 3.3Gnd	P21A/B - pin 9 P26 - pin 12	32	N/C	
13	M1 Mtr –4.5V	P16 - pin 12 P26 - pin 13	33	N/C	
14	M1 Mtr 4.5Gnd	P16 - pin 11 P26 - pin 14	34	N/C	
15	M2 Mtr –4.5V	P17 - pin 12 P26 - pin 15	35	N/C	
16	M2 Mtr 4.5Gnd	P17 - pin 11 P26 - pin 16	36	N/C	
17	M3 Mtr –4.5V	P18 - pin 12 P26 - pin 17	37	N/C	
18	M3 Mtr 4.5Gnd	P18 - pin 11 P26 - pin 18	38	N/C	
19	M4 Mtr –4.5V	P19 - pin 12 P26 - pin 19	39	N/C	
20	M4 Mtr 4.5Gnd	P19 - pin 11 P26 - pin 20	40	N/C	

Table 36. Scanner A Connector P33

Pin	Signal	Destination	Pin	Signal	Destination
1	P M TEMP 1	P16 - pin 7	21	P M TEMP RTN7	P15 - pin 4
2	P TEMP COPY 1	P27 - pin 25	22	P M TEMP 8	P38 - pin 3
3	P M TEMP RTN1	P16 - pin 8	23	P TEMP COPY 8	P27 - pin 39
4	P M TEMP 2	P17 - pin 7	24	P M TEMP RTN8	P38 - pin 4
5	P TEMP COPY 2	P27 - pin 27	25	B TEMB COPY1	P27 - pin 2
6	P M TEMP RTN2	P17 - pin 8	26	N/C	
7	P M TEMP 3	P18 - pin 7	27	B TEMP COPY2	P27 - pin 5
8	P TEMP COPY 3	P27 - pin 29	28	N/C	
9	P M TEMP RTN3	P18 - pin 8	29	B TEMP COPY3	P27 - pin 8
10	P M TEMP 4	P19 - pin 7	30	N/C	
11	P TEMP COPY 4	P27 - pin 31	31	B TEMP COPY4	P27 - pin 11
12	P M TEMP RTN4	P19 - pin 8	32	N/C	
13	P M TEMP 5	P20 - pin 7	33	B TEMP COPY5	P27 - pin 14
14	P TEMP COPY 5	P27 - pin 33	34	N/C	
15	P M TEMP RTN5	P20 - pin 8	35	B TEMP COPY6	P27 - pin 17
16	P M TEMP 6	P21A/B - pin 7	36	N/C	
17	P TEMP COPY 6	P27 - pin 35	37	B TEMP COPY7	P27 - pin 20
18	P M TEMP RTN6	P21A/B - pin 8	38	N/C	
19	P M TEMP 7	P15 - pin 3	39	B TEMP COPY8	P27 - pin 23
20	P TEMP COPY 7	P27 - pin 37	40	N/C	

Table 37. Scanner A Connector P34

Pin	Signal	Destination	Pin	Signal	Destination
1	M CONT 1	P16 - pin 13 P28 - pin 1	21	N/C	
2	M CONT RTN1	P16 - pin 14 P28 - pin 2	22	N/C	
3	M CONT 2	P17 - pin 13 P28 - pin 3	23	N/C	
4	M CONT RTN2	P17 - pin 14 P28 - pin 4	24	N/C	
5	M CONT 3	P18 - pin 13 P28 - pin 5	25	N/C	
6	M CONT RTN3	P18 - pin 14 P28 - pin 6	26	SPD	SCR1.5
7	M CONT 4	P19 - pin 13 P28 - pin 7	27	GND	SCR1.ccw
8	M CONT RTN4	P19 - pin 14 P28 - pin 8	28	P J8GND28	P35 - pin 39
9	M CONT 5	P20 - pin 13 P28 - pin 9	29	P J8GND29	P35 - pin 40
10	M CONT RTN5	P20 - pin 14 P28 - pin 10	30	N/C	
11	M CONT 6	P21A/B - pin 13 P28 - pin 11	31	N/C	
12	M CONT RTN6	P21A/B - pin 14 P28 - pin 12	32	N/C	
13	N/C		33	N/C	
14	N/C		34	N/C	
15	BACKUP SELECT		35	N/C	
16	BACKUP SELECT		36	N/C	
17	N/C		37	P SWIT1	SW6-C P28 - pin 37
18	N/C		38	P J8GND38	SW6-NO SW7-1/(-) SW8-A-/B P28 - pin 38
19	N/C		39	P SWIT2	SW7-2 P28 - pin 39
20	N/C		40	Margin Common	Pin 8 of all power supplies

Display Module Connector

Table 38. Display Module Connector (P35)

Pin	Signal	Destination	Pin	Signal	Destination
1	N/C		21	P DSP C20	P30 - pin 30
2	N/C		22	N/C	
3	N/C		23	P DSP D0	P30 - pin 17
4	N/C		24	P DSP D1	P30 - pin 18
5	N/C		25	P DSP D2	P30 - pin 19
6	N/C		26	P DSP D3	P30 - pin 20
7	N/C		27	P DSP D4	P30 - pin 21
8	N/C		28	P DSP D5	P30 - pin 22
9	N/C		29	P DSP D6	P30 - pin 23
10	N/C		30	P DSP D7	P30 - pin 24
11	SCAN UP	P30 - pin 5	31	N/C	
12	SCAN DOWN	P30 - pin 7	32	N/C	
13	N/C		33	P J4+5V32	P30 - pin 32
14	N/C		34	P J4+5V36	P30 - pin 36
15	N/C		35	P J4+12V37	P30 - pin 37
16	N/C		36	P J4+12V38	P30 - pin 38
17	N/C		37	P J4GND39	P30 - pin 39
18	N/C		38	P J4GND40	P30 - pin 40
19	P DSP C10	P30 - pin 29	39	P J8GND28	P34 - pin 28
20	P DSP C7	P30 - pin 27	40	P J8GND29	P34 - pin 29

Switch, Serial-port, and Blower Controller Connectors

The following tables list the pin assignments for the switch connectors, the serial-port connector, and the blower controller (SCR1).

Table 39. Clock Select and Boundary Scan Enable Switches (P36)

P36 Pin	Signal	Destination
1	N/C	
2	N/C	
3	S -ECL1 (Hard B/S)	P22 - pin 4
4	S -ECL2 (Clk Sel 2’1)	P22 - pin 6
5	S -ECL3 (Clk Sel 2’0)	P22 - pin 8
6	N/C	
7	N/C	
8	Switch Power	P41 - pin 2
9	N/C	
10	S +ECL1 (Hard B/S)	P22 - pin 3
11	S +ECL2 (Clk Sel 2’1)	P22 - pin 5
12	S +ECL3 (Clk Sel 2’0)	P22 - pin 7
13	N/C	
14	N/C	
15	Digital Ground	P41 - pin 1

Table 40. Serial-port Connection (P37)

Pin	Signal	Destination
1	N/C	
2	B_BRX	P25 - pin 25
3	B_BTX	P25 - pin 26
4	N/C	
5	B_J5GND39	P25 - pin 39
6	N/C	
7	N/C	
8	N/C	
9	N/C	

Table 41. Digital Ground Bus Power (P41)

P41 Wire	Signal	Destination
1	Digital Ground	P36 - pin 15
2	Switch Power	P36 - pin 8

Table 42. Restart Switch (SW6) Pin Assignment

Switch Location	Signal	Destination
SW6-NO	071 Ground Jumper (B_J8GND38 and P_J8GND38)	P28/P34 - pin 38 SW7-1/(-) SW8-A-/B
SW6-C	070 P_SWIT1	P34 - pin 37
	070 B_SWIT1	P28 - pin 37

Table 43. Remote Restart Enable Switch (SW7

Switch Location	Signal	Destination
SW7-(-)	071 Ground Jumper (B_J8GND38 and P_J8GND38)	P28/P34 - pin 38 SW6-NO SW7-1 SW8-A-/B
SW7-A+	077 Jumper	SW7-4
SW7-1	071 Ground Jumper (B_J8GND38 and P_J8GND38)	P28/P34 - pin 38 SW6-NO SW7-(-) SW8-A-/B
SW7-2	072 P_SWIT2	P34 - pin 39
	072 B_SWIT2	P28 - pin 39
SW7-4	077 Jumper	SW7-A+
SW7-5	073 +5 V Jumper (B_J8+5V34)	P28 - pin 34
		SW8-2/5

Table 44. Power Supply Margin Switch (SW8)

Switch Location	Signal	Destination
SW8-A+	078 Jumper	SW8-1
SW8-A-	071 Ground Jumper (B_J8GND38 and P_J8GND38)	P28/P34 - pin 38 SW6-NO SW7-1/(-) SW8-B
SW8-B+	079 Jumper 79	SW8-6
SW8-B-	071 Ground Jumper (B_J8GND38 and P_J8GND38)	P28/P34 - pin 38 SW6-NO SW7-1/(-) SW8-A-
SW8-1	078 Jumper	SW8-A+

Table 44. Power Supply Margin Switch (SW8)

Switch Location	Signal	Destination
SW8-2	073 +5 V Jumper (B_J8+5V34)	P28 - pin 34 SW7-5 SW8-5
SW8-3	075 Margin High	P14 - pin 3
SW8-4	075 Margin Low	P14 - pin 4
SW8-5	073 +5 V Jumper (B_J8+5V34)	P28 - pin 34 SW7-5 SW8-2
SW8-6	079 Jumper	SW8-B+

Table 45. Blower Controller (SCR1) Wiring

Location	Signal	Destination
SCR1.5	SPD	P34 - pin 26
SCR1.ccw	GND	P34 - pin 27