

## VCO/4K Power Subsystem

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The power subsystem in the VCO/4K Open Programmable Switch consists of the following main components:

- Power entry module
- Power backplane
- Power supply module (two modules in redundant systems)

This subsystem is in the lower portion of the VCO/4K system. Figure 3-1 shows the front of a redundant system with the door removed and two power supply modules visible. Figure 3-2 shows the power entry module in the rear of the system. The power backplane is located internally, between the power supply modules and the power entry module.

The power subsystem powers the following:

- Programmable switch logic
- Disk storage units
- Analog functions
- Ring voltage (if optional ring generator is installed)
- Cooling fans

Figure 3-1 VCO/4K Redundant System (Front View)

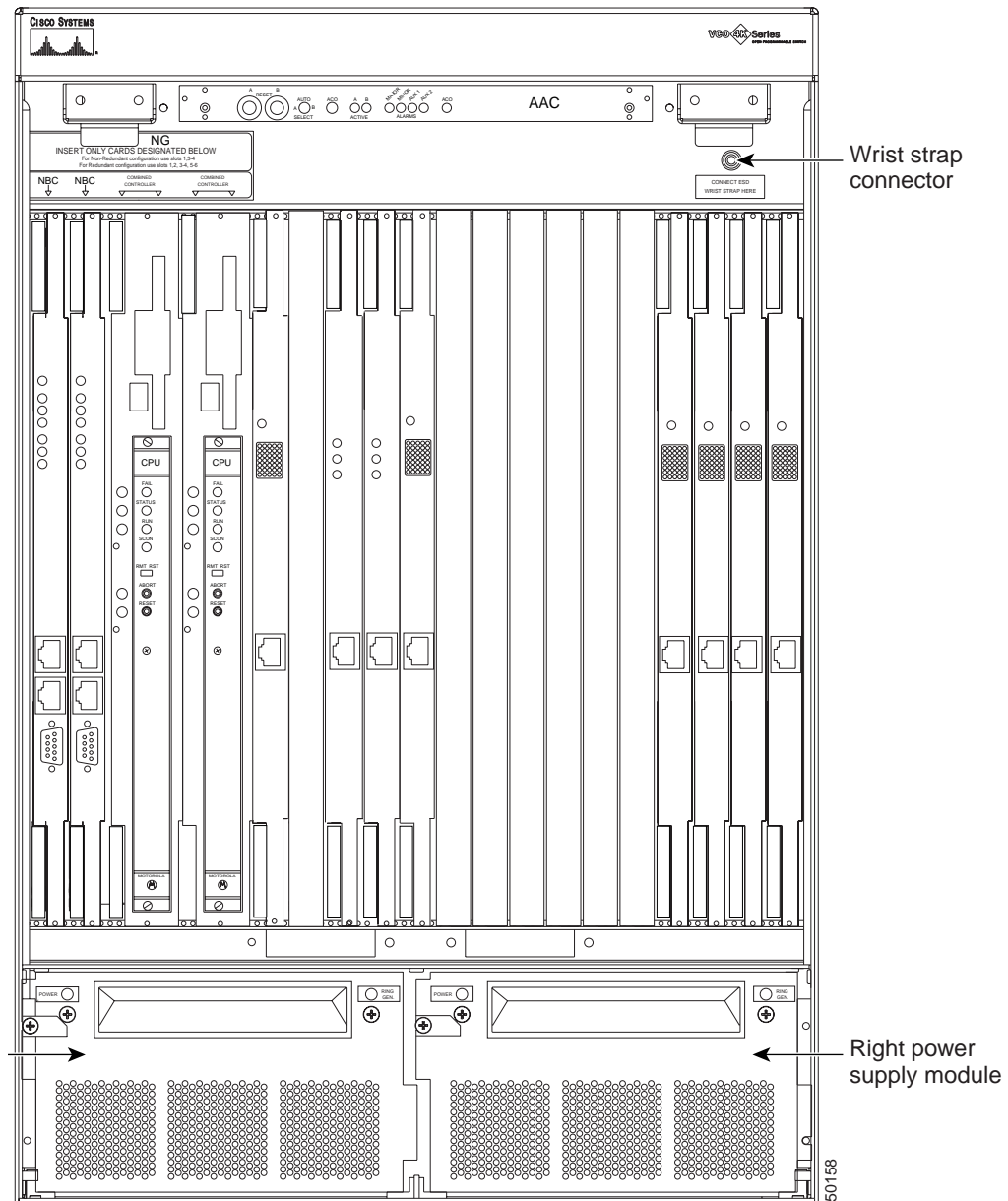
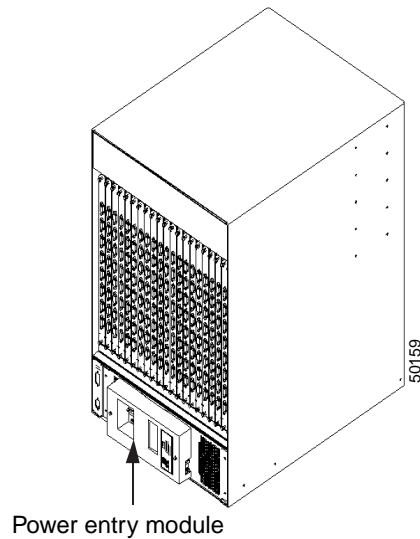


Figure 3-2 VCO/4K System (Rear View)



## Specifications

The following specifications apply for the three power subsystem components, and the ring generator:

Operating Temperature	10 to 40°C (50 to 104°F)
Relative Humidity	20 to 80% (noncondensing); temperature rise or fall should not exceed 10°C (18°F) per hour

## Specifications for Power Entry Module

Part Number	DC:	Contact your Cisco Systems sales representative
	AC:	Contact your Cisco Systems sales representative
	Dual DC Kit:	Contact your Cisco Systems sales representative
Physical Dimensions	Height:	5 in. (12.5 cm)
	Width:	16 in. (40 cm)
	Depth:	3 in. (7.5 cm)
Nominal Input Voltages	DC:	-48 VDC
	AC:	120 VAC or 240 VAC

# Specifications for Power Supply Module

Part Number	AC	Contact your Cisco Systems sales representative
	DC	Contact your Cisco Systems sales representative
Physical Dimensions	Height:	5 in. (12.5 cm)
	Width:	8 in. (20 cm)
	Depth:	7 in. (42.5 cm)
Output Voltages	All VDC:	+5, +15, -15, +12, +24, -48

# Specifications for Ring Generator (optional)

Part Number	Contact your Cisco Systems sales representative	
Physical Dimensions	Height:	4 in. (10 cm)
	Width:	4 in. (10 cm)
	Depth:	1 in. (2.5 cm)
Output Voltage:	77 VAC	

# Power Entry Module

The power entry module (PEM) serves as a mechanical connection point for site power. It includes the following (refer to Figure 3-4):

- Power connector
- Power switch
- Power line filter

The PEM accepts AC or DC source voltages listed in Table 3-1.



**Note**

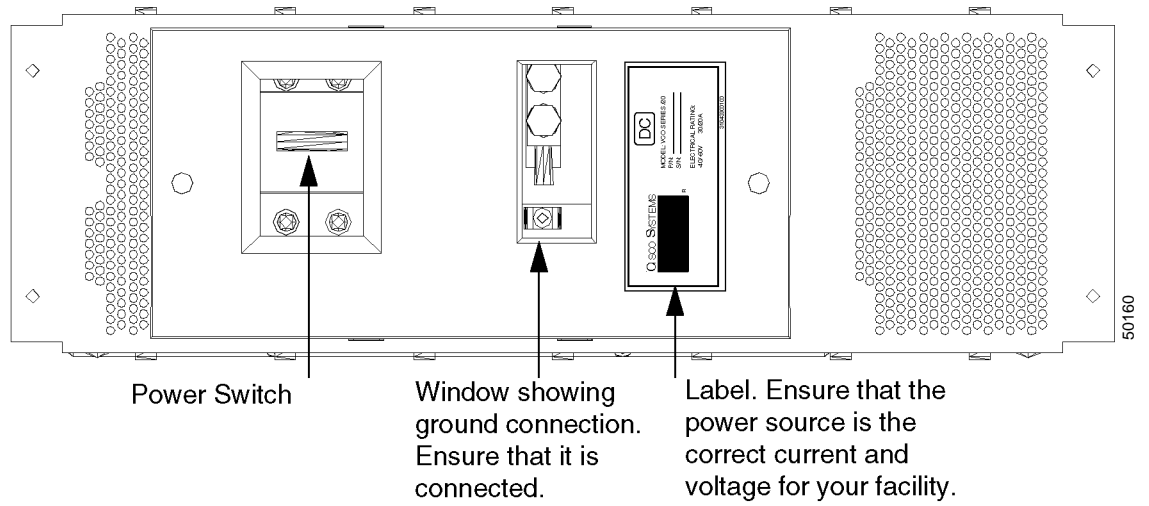
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The power entry module accepts either a single-line AC feed, a dual-line DC feed, or a single-line DC feed. The factory-installed power supply modules are compatible with the power entry module configuration. The label on the power entry module will either specify your system’s type of input power (see Figure 3-4) or list both possibilities (see Figure 3-5). Always verify the input power type by looking at the front of each power supply module. Ensure that the power source is the correct current and voltage for your facility before cabling the power source.

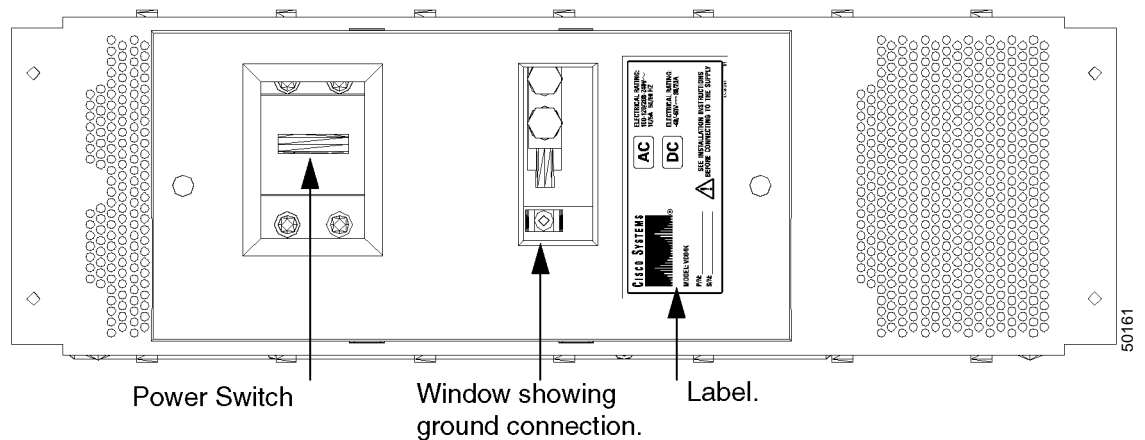
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The line filter ensures that electromagnetic interference (EMI) neither enters nor exits the system.

**Figure 3-3** Power Entry Module With Input Power Type Specified



**Figure 3-4** Power Entry Module With Both Input Power Types Specified



## Input Power

The VCO/4K can be purchased for AC or DC operation. Your system will come with either AC or DC power supplies, accordingly. Table 3-1 lists the power input ratings for AC or DC sources.

**Table 3-1 VCO/4K Power Input Ratings**

Nominal	Range	Current	Frequency
-48 VDC (per feed)	-40 to -60 VDC	20 amps	DC
120 VAC, single phase	100 to 120 VAC	10 amps	50/60 Hz
240 VAC, single phase	208 to 240 VAC	5 amps	50/60 Hz

Refer to the *Cisco VCO/4K Hardware Installation Guide* for information on proper wiring of input power. The VCO/4K system is shipped with a kit containing lugs for the input power cabling.



**Warning**

**Do not open the power entry module (PEM) or you will void your Cisco Systems warranty.**

Table 3-2 indicates the required terminal (labeled TB1 through TB5) for each conductor, for the four possible input power sources. Refer to the *Cisco VCO/4K Hardware Installation Guide* for illustrations.

**Table 3-2 Input Wiring Connections for AC and DC VCO/4K Systems**

Conductor	Terminal
Single Feed -48 VDC (nominal)	
Jumper 1	TB1 to TB4
Jumper 2	TB2 to TB5
Battery return (+)	TB4
Battery (-)	TB5
Ground	TB3
Dual Feed -48 VDC (nominal)	
Battery Return A(+)	TB1
Battery A(-)	TB2
Battery Return B (+)	TB4
Battery B (-)	TB5
Ground	TB3
Single Feed 120 VAC (nominal)	
Neutral	TB5
Line	TB2
Ground	TB3
Single Feed 240 VAC (nominal)	
Line 1	TB2
Line 2	TB5
Ground	TB3

## Indicator LEDs

There are two LEDs on the front of the power supply module: the power LED on the left side, and the Ring Generator LED on the right side. See Figure 3-5.

### Power LED

The power LED is on the upper left side of the power supply module. When illuminated, it is either green or red.

- Green indicates that the power is on and operation is normal.
- Red indicates a voltage failure although the interlock switch is closed and the power is on.  
Replace either the fuse or the power supply module. Refer to the “Spare Fuse Kit” section on page 3-14 for information on the fuse, and the “Removal and Replacement Procedures” section on page 3-11.
- Red could also indicate that you failed to install the external jumper needed for single-line feed DC operation (refer to Table 3-2).
- When the LED is off, or if it glows a faint red (reduced illumination), the interlock switch is open (power to the module is turned off).

### Ring Generator LED

The Ring Generator LED is on the upper right side of the power supply module. When illuminated, it is either green or red.

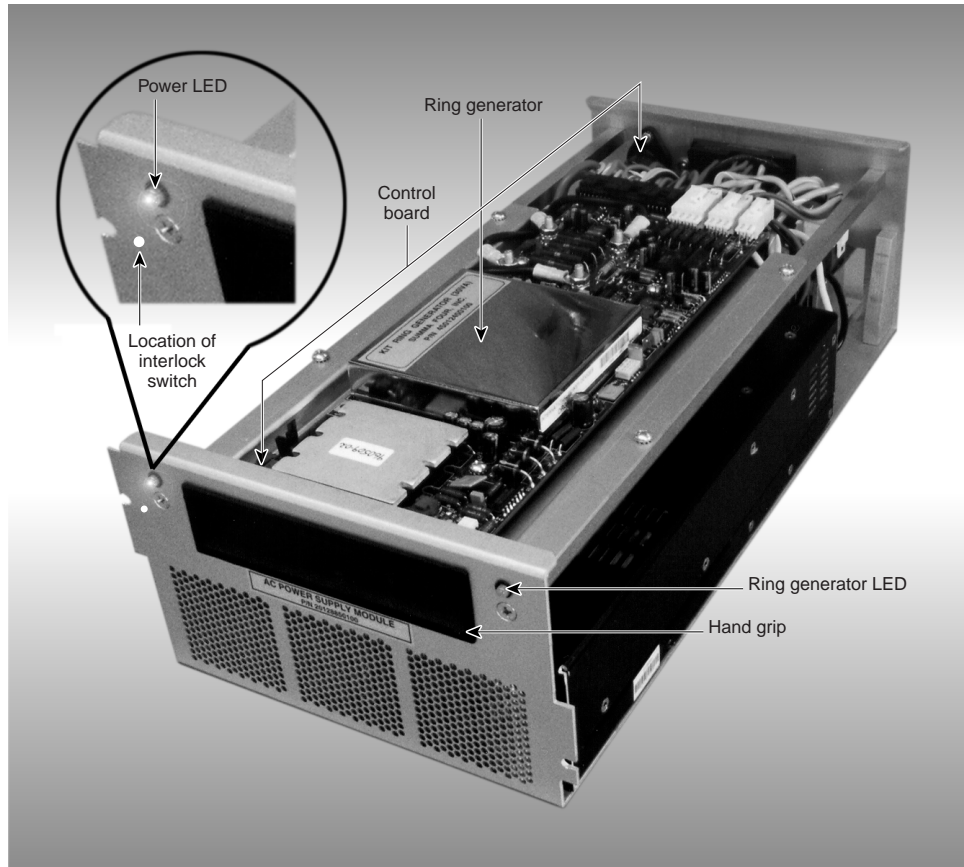
- Green indicates that a ring generator is installed and working correctly.
- Red indicates a ring generator failure.
- When the LED is off, there is no ring generator present in that power supply module.

## Interlock Switch

The interlock switch is under the power LED. Use this switch to remove and replace power supply modules while the system is running. To safely remove the power supply module, turn off the output power (switch in the open position). Remove the upper left screw to open the interlock switch. Refer to Figure 3-5. Refer to the “Removal and Replacement Procedures” section on page 3-11 for instructions on removing a redundant power supply module.

When you close the interlock switch, the output power is turned on, and the power supply module is operational.

Figure 3-5 Power Supply Module



## Power Backplane

Input power from the power entry module travels through the power backplane to the power supply module where it is converted to usable voltages. The power supply module distributes the voltages to the power backplane, which distributes it to the rest of the system.

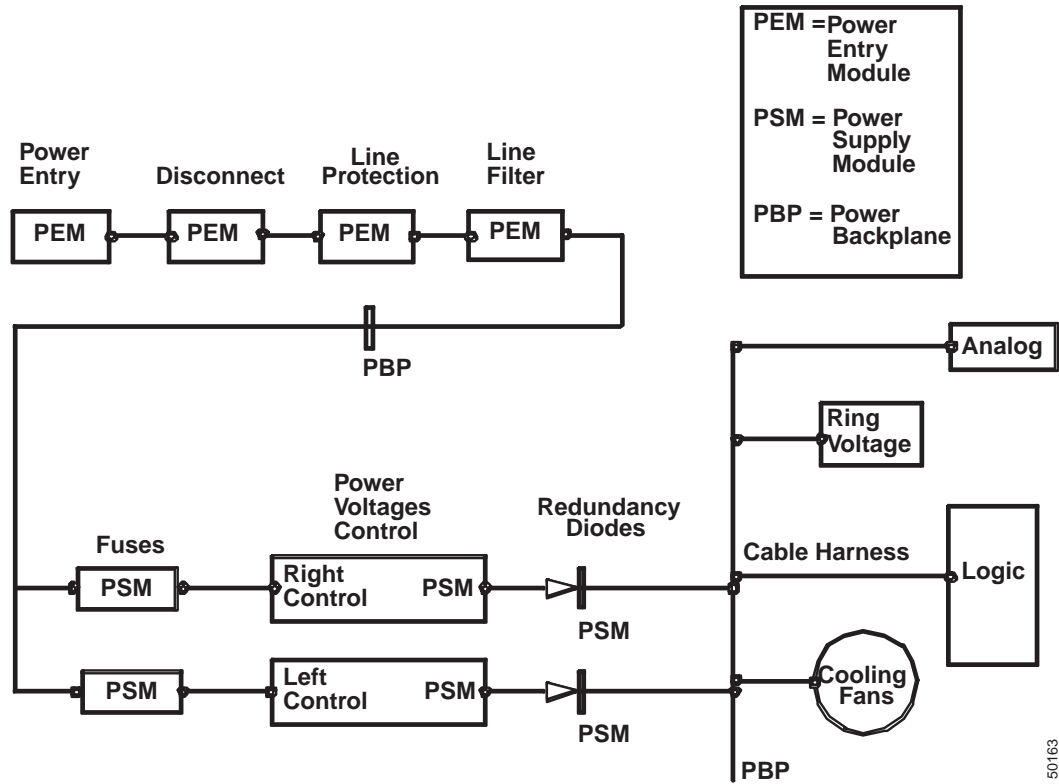
The power backplane contains:

- Four fuses (can be automatically reset)
- Connections for alarm signals
- Internal equipment safety connection

Figure 3-6 is a system-level functional diagram of the power subsystem for single-feed AC/DC operation. Figure 3-7 is the diagram for dual-feed DC operation.



Figure 3-6 Power Subsystem Functional Diagram for Single-Feed AC/DC Operation

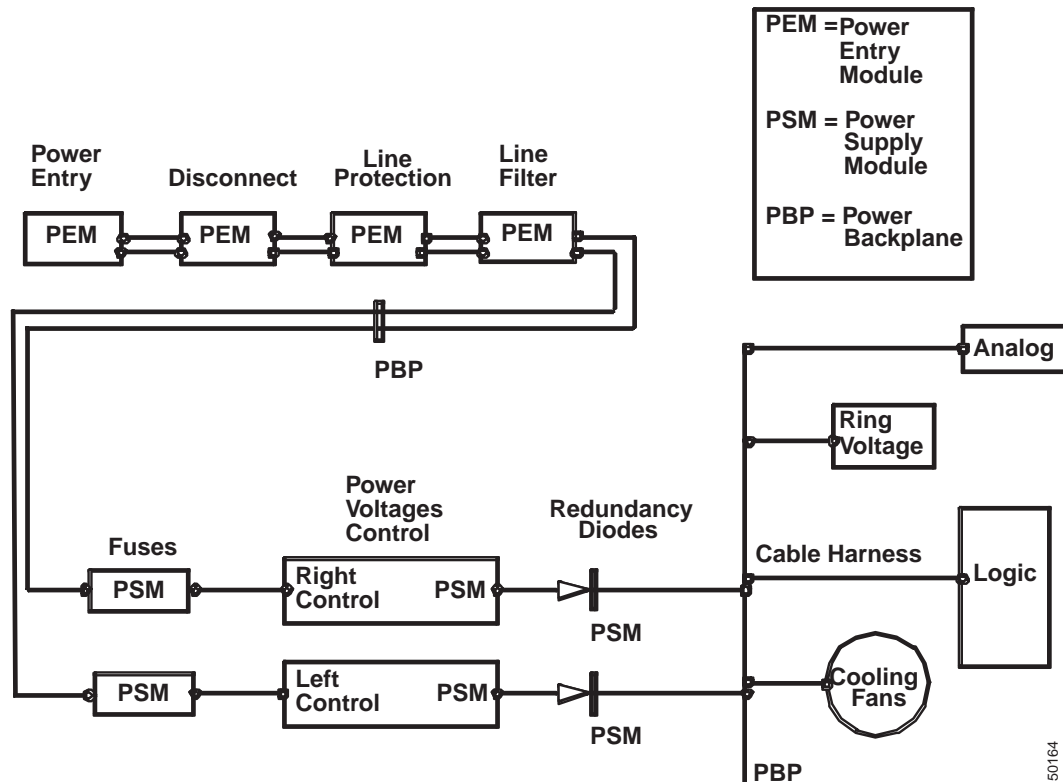


Note

If you want single DC input power, you must install two external jumpers: a/rtn to b/rtn and a/bat to b/bat. This way, both power supply modules are powered from a common feed.

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Figure 3-7 Power Subsystem Functional Diagram for Dual-Feed DC Operation



## Output Power Redundancy and Load Sharing

The main power supply module is on the left of all VCO/4K systems. In nonredundant systems, ensure that the power supply module is on the left.

The following describes the power supply load-sharing and redundancy in VCO/4K systems:

- The modules share the total load on each voltage in redundant systems.
- The system automatically remains in operation without interruption, during and after a power supply module failure. The system disconnects the failed module and switches all power to the redundant module.
- The power supply modules provide individual load-sharing for each voltage. If a voltage failure occurs, it continues to load-share the remaining voltages.

For example, if the +5 VDC voltage fails in a power supply module, the remaining voltages are not affected, and continue to load-share with the other module.

- Each module is equipped with a 25-amp fuse, ensuring that redundancy is maintained in the event of an overcurrent fault. If a fuse blows in one power supply module, the system does not shut down.

The power supply module provides six regulated DC voltages for system operation, as shown in Table 3-3.

*Table 3-3 DC Voltages for System Operation*

Voltage	Tolerance	Current
+5 VDC	±0.25V	84 amps
+15 VDC	±0.5V	4 amps
-15 VDC	±0.5V	4 amps
+12 VDC	+3V, -0V	1 amp
+24 VDC	±1.0V	1 amp
-48 VDC	±4.0V	3 amps

## Ring Generator

The ring generator is active only when it is installed in the left power supply module. Ring generators can be installed in both power supply modules in a redundant system. However, the ring generator in the right power supply module is not connected to the system and is considered a spare. Power loss to the left power supply module results in loss of the ring generator (if installed).

The two circuit configuration jumpers, JP6 and JP7, on the power supply module, are configured as shown in Table 3-4 when the VCO is shipped with a ring generator installed. This configuration is required for proper operation of the ring generator alarm and its LED. Refer to the “Indicator LEDs” section on page 3-7 for information about the LED.

If your system has a ring generator, you must install JP7, in the left module only.

*Table 3-4 JP6 and JP7 Configuration*

Configuration	JP6	JP7
Right Power Supply Module	Install when ring generator is present	Remove
Left Power Supply Module without a ring generator	Remove	Remove
Left Power Supply Module with a ring generator	Install	Install



**Note**

If you install a ring generator, configure the JP6 and JP7 jumpers. The ring generator kit includes installation instructions.

## Removal and Replacement Procedures

Follow ESD rules when removing or replacing a system component. Use a wrist strap connected to the system for grounding. See Figure 3-1.

**Warning**


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**Voltages present on the power backplane and at other test points produce severe, perhaps fatal electrical shock. Observe all precautions normally associated with the testing of electrical equipment.**

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**Turn off power at the source before performing any service.**

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## Removal Procedures

**Caution**


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Follow ESD rules when removing a system component. Use a wrist strap for grounding.

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To remove a nonredundant power supply module:

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- Step 1** Turn the switch off on the power entry module if the system does not contain redundant power supply modules, or if both power supply modules are to be removed simultaneously. The power disconnect switch is located in the rear of the system on the power entry module (see Figure 3-4).
- Step 2** Remove the front door of the VCO/4K system to access the power supply module.
- Step 3** Connect your wrist strap to the system (upper right corner). See Figure 3-1.
- Step 4** Remove the two mounting screws on the front panel of the power supply module.
- When the upper left screw is removed, the power is cut off from the module (the power LED is off).




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**Note** If the LED is faintly illuminated red, and the interlock switch screw is removed, it is safe to remove the power module.

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- Step 5** Grasp the black hand grip on the front of the module with one hand and pull the module out. Use your other hand to provide support underneath the module as you remove it from the system.
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To remove a redundant power supply module:

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- Step 1** Remove the front door of the VCO/4K system to access the power supply module.
- Step 2** Connect your wrist strap to the system (upper right corner). See Figure 3-1.
- Step 3** Remove the two mounting screws on the front panel of the power supply module.
- When the upper left screw is removed, the power is cut off from the module (the power LED is off).




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**Note** If the LED is faintly illuminated red, and the interlock switch screw is removed, it is safe to remove the power module.

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- Step 4** Grasp the black hand grip on the front of the module with one hand and pull the module out. Use your other hand to provide support underneath the module as you remove it from the system.
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## Replacement Procedures



**Caution**

Follow ESD rules when removing a system component. Use a wrist strap for grounding.

To replace a power supply module:

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- Step 1** If the power supply module is nonredundant, ensure that the power is off.
  - Step 2** Remove the front door of the VCO/4K system to access the power supply module.
  - Step 3** Connect your wrist strap to the system (upper right corner). See Figure 3-1.
  - Step 4** Grasp the black hand grip on the front of the module with one hand and use your other hand to provide support underneath the module as you push it into its compartment.
  - Step 5** Fasten the two mounting screws on the front panel of the power supply module.



**Note**

Ensure that you rotate the plate into position to align the left mounting screw before fastening the screw into place.

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- Step 6** If necessary, turn the VCO/4K system on.
  - Step 7** Remove your wrist strap.
  - Step 8** Check the power LED and ensure that the power supply module is operating. Refer to the “Indicator LEDs” section on page 3-7 for information on the LED.
  - Step 9** Replace the front door.



**Caution**

The front door must remain on during system operation for EMI compliance.

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## Troubleshooting



**Note**

More extensive troubleshooting information is contained in the *Cisco VCO/4K Troubleshooting Guide*.

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## Alarms

The following two events occur simultaneously when voltage monitoring on the control board of the power supply module detects either an over- or undervoltage condition:

- An alarm is sent to the Alarm Arbiter Card (AAC) and is displayed on the AAC. The red MAJOR LED turns on; the yellow AUX1 LED turns on.
- The power LED on the power supply module turns red.

When these two events occur, you must replace the power supply module. Refer to the “Removal and Replacement Procedures” section on page 3-11.

## Spare Fuse Kit

One spare fuse kit containing two 25-amp fuses comes with the VCO/4K. A fuse is on the back of each power supply module.