



Configuring the MGX RPM

This chapter describes how to complete a basic configuration of the MGX Route Processor Module (RPM). It provides procedures for configuring the ATM port adapter and Ethernet, Fast Ethernet and FDDI (for the RPM/B) back card interfaces and permanent virtual circuits (PVCs). For details on how to make connections between an RPM and a PXM and among either service modules or other RPMs, see [Chapter 6, “Setting Up Connections Between Other Devices and the RPM.”](#) The chapter contains the following sections:

- [Accessing the RPM Command Line Interface](#)
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- [Configuring the RPM](#)
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- [Configuring Permanent Virtual Circuits on the RPM](#)
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This chapter provides information necessary to get the RPM up and running. Detailed software configuration information is available in Cisco IOS configuration and command reference publications, which are available on the Cisco Documentation CD-ROM and online.

Accessing the RPM Command Line Interface

To configure the RPM, you must access the command line interface (CLI) of the RPM.

The RPM CLI can be accessed using any of the following methods:

- Console port on the front of the RPM

The RPM has an RJ-45 connector on the front of the card module. If you configure the RPM on site, connect a console terminal (an ASCII terminal or a PC running terminal emulation software) directly to the console port on your RPM using an RS-232 to RJ-45 cable for CLI access (see [Chapter 3, “Installing the MGX RPM”](#)).



Note The console port is the only way to access the RPM CLI when the card module is first installed into an MGX 8850 chassis.

- **cc** from another MGX 8850 card

After initial configuration, you can also configure the RPM through the PXM. You can access the RPM CLI by entering the **cc** (change card) command from any of the other cards.

- Telnet from a workstation, PC, or another router

After initial configuration, you can also configure the RPM remotely via telnet. After the RPM is installed and has PVCs to other RPMs or routers in the network, you can telnet to the RPM CLI remotely from these other devices.

To connect a modem to the auxiliary port on the RPM see [Chapter 3, “Installing the MGX RPM.”](#)

Booting the RPM

When the RPM is booted, the boot image must be the first file in the bootflash. If the bootflash does not have a valid boot image as a first file, the card may not be able to boot and can result in bootflash corruption. If the bootflash is corrupted, you will have to send the card back for an external burn with a valid boot image.

You can reboot the RPM from the PXM by entering the command **resetcd** *<card_number>* from the switch CLI, where *card_number* is the slot number of the RPM that is being rebooted.



Note Omitting the card number resets the entire system.

Also, you can reboot the RPM from the RPM using the RPM console port and entering the **reload** command.

Each time you turn on power to the RPM by inserting the RPM into the MGX 8850, it goes through the following boot sequence:

1. The RPM runs diagnostics on the CPU, memory, and interfaces.
2. The system bootstrap software, which is the boot image, executes and searches for a valid Cisco IOS image, which is the RPM runtime software.

The source of the Cisco IOS image is determined by the configuration register setting. To verify this setting, you can enter either the **show version** or **show bootvar** command. (See the [“Viewing the Hardware Configuration”](#) section later in this chapter.)

- If the configuration register is set to the factory-default setting of **0x01**, RPM will come up and stay in boot mode.
 - If the configuration register is **0x2**, the RPM will look for the runtime image either in bootflash or on the PXM C:RPM drive.
3. The search for runtime image is determined by which boot system command is entered.
 - Entering the **boot system c:<runtime_image_name>** command will result in a search for a runtime image on the PXM C:RPM drive.
 - Entering the **boot system bootflash:<runtime_image_name>** command will result in a search for a run time image in the bootflash.

4. If the runtime software is not found after three attempts, the RPM reverts to the boot mode.
5. If a valid Cisco IOS image is found, then the RPM searches for a valid configuration, which can reside in NVRAM or as a configuration file either on the PXM hard disk C: drive or in bootflash.

If you want to load from a specific configuration file, you should enter either the **boot config bootflash:<config_file>** command or the **boot config c:<config_file>** command.

6. For normal RPM operation, there must be a valid Cisco IOS image on the PXM C: drive or in bootflash, and a configuration in NVRAM or configuration file in bootflash or on the PXM disk.

The first time you boot the RPM, configure the RPM interfaces and save the configuration to a file in NVRAM. Then follow the procedure described in “[Initializing the RPM Card.](#)” For information on the Cisco IOS instructions, see [Appendix C, “IOS and Configuration Basics.”](#)

RPM Bootflash Precautions

The RPM bootflash is used to store boot image, configuration and “run time” files. The Flash stores and accesses data sequentially, and the RPM boot image must be the first file stored to successfully boot the card. Erasing the boot image or moving it from the first position on the Flash will cause the card to not boot.

The RPM boot image, which comes loaded on the Flash, will work for all RPM IOS images. Therefore, there is no reason to ever delete or move the factory installed boot image.



Note

Erasing or moving the boot image can cause RPM boot failure. When this happens, the RPM must be returned to Cisco and reflashed.

In order to avoid this unnecessary failure, requiring card servicing, you should

- Never erase the boot file from the RPM Flash
- Never change the position of the boot file on the RPM Flash
- Use care when “squeezing” the Flash to clean it up.

As long as the boot file remains intact in the first position on the flash, the RPM will successfully boot.

Verifying the IOS Files on Bootflash

Enter the **show bootflash** command to verify the IOS files on the bootflash. The following screen displays the RPM command sequence.

```
Router#show bootflash:
```

```

-#- ED --type-- --crc--- -seek-- nlen -length- -----date/time----- name
1  .. image   AB6CF374 2BAFB4   11  2600756 Jul 25 2001 02:41:41 rpm-boot-mz
2  .. config  44E48EC2 34712C   18   573685 Aug 07 2001 23:03:42 auto_config_slot16
3  .. config  7B53E8DC 40E368   18   815547 Aug 08 2001 19:28:03 auto_config_slot15

```

```
28777624 bytes available (3990376 bytes used)
```

```
Router#
```

Verifying the IOS Files on the PXM C: Drive

The IOS image can be stored on the PXM hard drive. To confirm this, make sure you are in the C:RPM directory. Enter the **ll** command to list the contents of the directory. You should see a file with a name beginning with **rpm-js-mz**, which is the IOS image.



Tip

Copy the RPM Cisco IOS image into the RPM directory of the PXM hard disk with the filename specified in the RPM boot command.

The following screen displays the PXM C:RPM content listing.

```
8850_NY.7.PXM.a > cd C:RPM

8850_NY.7.PXM.a > ll
  size      date      time      name
  -----
    512     FEB-23-2001  17:59:54  .          <DIR>
    512     FEB-23-2001  17:59:54  ..         <DIR>
 2621276   FEB-23-2001  15:46:36  rpm-boot-mz.122-3.6.T1
8585684   FEB-23-2001  20:32:34  rpm-js-mz.122-3.6.T2
    744     FEB-27-2001  10:24:22  auto_config_slot11

In the file system :
  total space : 102400 K bytes
  free space  : 91984 K bytes

8850_NY.7.PXM.a >
```

Initializing the RPM Card

The first time you boot the RPM card, you must boot it from flash memory as shown in the following procedure, then copy the IOS image on the PXM to the RPM. Refer to the *Cisco MGX 8850 Multiservice Switch Software Configuration Guide*, *Cisco MGX 8250 Edge Concentrator Installation and Configuration*, and *Cisco MGX 8230 Edge Concentrator Installation and Configuration* for instructions on copying files.

-
- Step 1** From the switch CLI, enter **cc <RPM card slot #>** to access the router card.
The router prompt (>) appears
 - Step 2** Enter **enable** and your password when prompted, so that you can enter privileged commands.
 - Step 3** Enter **dir** to display the flash memory directory as shown here, and note the boot image software version.

```
Router#dir
Directory of bootflash:/

   1  -rw-      2621276   Feb 22 2001 18:28:03  rpm-boot-mz.122-3.6.T1
   2  -rw-         553   Feb 22 2001 16:18:34  auto_config_slot10
```

- Step 4** Enter **dir c:** to display the contents of the C:RPM directory on the PXM hard drive. Note the runtime image filename for Step 7.

```
Router#dir c:
Directory of c:/

65540  -rw-      2621276   Feb 23 2001 19:13:10  rpm-boot-mz.122-3.6.T1
66738  -rw-      8585684   Feb 23 2001 19:15:24  rpm-js-mz.122-3.6.T2
```

- Step 5** Enter **configure terminal** at the prompt to enable the RPM interface.
- ```
Router#configure terminal
```
- Step 6** Enter **no boot system** to clear any existing boot system commands.
- ```
Router(config)#no boot system
```
- Step 7** The RPM can be booted from either the bootflash or PXM hard disk, by entering either,
boot system bootflash:< filename> to load the runtime software from the bootflash
or
boot system c:< filename> to load the runtime software from the PXM hard disk
- Step 8** Enter **end** or press **Ctrl Z** to exit the configuration interface mode.
- ```
Router(config-if)#end
```
- Step 9** Enter **copy run start** to save the configuration.
- ```
Router#copy run start
```
- Step 10** Enter **reload** on the RPM.
- ```
Router#reload
```

---

To verify the version, enter the **show version** or **show diag** commands. See the “[Viewing the Hardware Configuration](#)” section later in this chapter.

## Assigning an IP Address to the Switch Interface

You need to assign an IP address for the RPM on the ATM switch. This procedure tells you how to configure the ATM switch interface with the IP address.



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Obtain the correct IP and ATM network addresses for your RPM on the ATM switch from your system administrator or consult your network plan to determine correct addresses before you continue to configure the RPM.

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- Step 1** Enter **show ip int brief** to display your router IP interfaces.
- ```
Router#show ip int brief
Interface                IP-Address      OK? Method Status          Protocol
Switch1                  unassigned     YES NVRAM  up              up
```
- Note that the switch does not have an assigned IP address.
- Step 2** Enter **conf terminal** to enter global configuration mode.
- ```
Router#conf terminal
Enter configuration commands, one per line. End with CNTL/Z.
```
- Step 3** To enter interface configuration mode for the ATM interface, enter **interface switch1** at the prompt.
- ```
Router(config)#interface switch1
```

Step 4 Enter **ip address** followed by the IP address to be assigned to the ATM switch.

```
Router(config-if)#ip address 1.1.1.1 255.255.255.0
```

Step 5 Enter **end** or press **Ctrl-Z** to exit the configuration interface mode.

```
Router(config-if)#end
```

Step 6 Enter **show ip int brief** to display the IP address assigned to the ATM switch. The following screen is an example.

```
Router#show ip int brief
Interface                IP-Address      OK? Method Status          Protocol
Switch1                  1.1.1.1         YES manual up              up
```

Note that the newly added interface address appears in the display.

Step 7 Enter **show run** to verify the configuration of the RPM, as shown in the following example screen.

```
Router#show run
Building configuration...

Current configuration : 729 bytes
!
version 12.1
no service single-slot-reload-enable
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router
!
boot system c:rpm-js-mz.122-3.6.T2
boot config c:auto_config_slot11
logging rate-limit console 10 except errors
enable password cisco
!
ip subnet-zero
no ip finger
!
no ip dhcp-client network-discovery
!
!
interface Switch1
 ip address 1.1.1.1 255.255.255.0
 no atm ilmi-keepalive
 switch autoSynch off
!
ip kerberos source-interface any
ip classless
no ip http server
!
!
!
line con 0
 transport input none
line aux 0
line vty 0 4
 no login
!
end
```

Step 8 Enter **copy run start** at the prompt to write the configuration to the router NVRAM memory.

```
Router#copy run start
Building configuration...
[OK]
```

The IP address is now active and ready to use.

Booting the RPM From the PXM C: Drive

The IOS image should be stored on the PXM hard drive. To confirm this, make sure you are in the /RPM directory and use the **ls** command to list the contents of the directory. You should see the RPM IOS image as shown in the example below. The following example displays the PXM commands illustrating this command sequence:

```
NODENAME.1.7.PXM.a > cd C:RPM

NODENAME.1.7.PXM.a > ls
.
..
rpm-boot-mz.122-3.6.T1
rpm-js-mz.122-3.6.T2

In the file system :
  total space : 3176712 K bytes
  free  space : 3067819 K bytes

NODENAME.1.7.PXM.a >
```

If the image is not there, you will need to use the TFTP file-transfer application to load the image to the PXM hard drive.

The following example displays a TFTP sequence:

```
marka-u5:4> ls -l rpm-js-mz.122-3.6.T2
-rw-r--r--  1 marka  eng      4560820 Apr  2 12:16 rpm-is-mz.120-4.0.1.T
marka-u5:5> tftp 172.29.37.154
tftp> bin
tftp> put rpm-js-mz.122-3.6.T2 RPM/rpm-js-mz.122-3.6.T2
Sent 4560820 bytes in 41.2 seconds
tftp> q
marka-u5:6>
```

To load the IOS image from the PXM hard drive, the RPM must be configured.



Tip

Put the RPM's Cisco IOS image in the RPM directory of the PXM hard disk with the filename specified in the RPM **boot** command.

To verify the accessibility of the PXM C: drive from the RPM, enter the following privileged-level EXEC command:

```
MGX8850-RPM# dir c:
Directory of c:/

-rw-      5584092  Oct 19 1999 15:39:54  rpm-js-mz.122-3.6.T2
-rw-      1680448  Oct 19 1999 15:39:54  rpm-boot-mz.122-3.6.T1
```

No space information available

Enter the **boot system** command to override the default boot setting and to configure the RPM to boot from the PXM:

```
MGX8850-RPM (config)# boot system c:filename
```

Enter the **write memory** command to save the configuration on the NVRAM:

```
MGX8850-RPM# write memory
```

Reload the RPM and boot the Cisco IOS from the PXM disk.

Configuring the RPM

You can configure the RPM using [Configuration Mode](#). This method is recommended if you are familiar with the Cisco IOS commands.



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Obtain the correct network addresses from your system administrator or consult your network plan to determine correct addresses before you configure the RPM.

If you would like a quick review of the Cisco IOS software, see the [“Establishing 1:N Redundancy Between Two or More RPM Cards”](#) section later in this chapter.

Configuring Back Card Interfaces

Once back card cable connections are made (see [Chapter 4, “Cabling the MGX RPM Back Cards”](#) for connector descriptions and cable attachment instructions) and basic configuration on the RPM is completed, Ethernet, Fast Ethernet, and FDDI back card interfaces on the RPM must be configured. This is then followed by the configuration of the permanent virtual circuits (PVCs) and the connections between the RPM and the PXM and either service modules or other RPMs.

Preparing to Configure Back Card Interfaces

If you want to configure interfaces in a new RPM or change the configuration of an existing interface, you will need the following information:

- Protocols you plan to route on each new interface.
- Internet protocol (IP) addresses if you plan to configure the interfaces for IP routing.
- Whether the new interfaces will use bridging.
- Whether the new interfaces will use LAN.

The **configure** command requires privileged-level access to the EXEC command interpreter, which usually requires a password. Contact your system administrator to obtain EXEC-level access.

Back Card Bay and Interface Port Numbers

This section describes how to identify the back card bay and interface port numbers on the RPM for all back card interface types.

Physical port addresses specify the physical location of each interface port, regardless of the type, on the RPM. In the RPM, this address is composed of a two-part number in the form *<interface bay number/interface port number>*, as follows:

- *<interface bay number>* identifies the bay in which the back card is installed, either upper (1) or lower (2) bay.
- *<interface port number>* identifies the interface port(s) on the back card. FE cards have one interface number. 4E/B cards have four numbered interfaces.

For example, the following command specifies interface port 1 of the upper Ethernet back card in the RPM. You need to enter this information to select a specific port on a back card or ATM interface.

```
Router(config)#interface fastEthernet 1/1
```

Also, you can identify interface ports by checking the bay/interface port location on the body of the RPM or by using **show** commands to display information about a specific interface or all interfaces in the RPM.

Configuring 4E and 4E/B Interfaces

The Ethernet interfaces are configured to allow a connection to a LAN. To configure the interface parameters, you need to know your Ethernet interface network addresses.

The following procedure displays how to configure an Ethernet interface to allow communication over a LAN.

- Step 1** At the privileged-level prompt, enter configuration mode and specify that the console terminal will be the source of the configuration subcommands, as follows:

```
RPM-3# configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
RPM-3(config)#
```

- Step 2** At the prompt, enter the subcommand **interface** to specify the interface to be configured, followed by **ethernet** to specify back card type, then *bay/port* (for the bay of the MGX 8850 where the RPM resides, upper (1) or lower (2) back card, and for port number on the back card).



Note The 4E and 4E/B interfaces are numbered 1, 2, 3, 4 and not 0, 1, 2, 3 as in other IOS platforms.

In this procedure, the 2 interface of the lower ethernet back card in the RPM in slot 5 of the MGX 8850 are used as an example.

```
RPM-3(config)# interface e 2/2
```

- Step 3** If IP routing is enabled on the system, you can assign an IP address and subnet mask to the interface with the **ip address** configuration subcommand, as in this example:

```
RPM-3(config-int)# ip address 1.1.1.10 255.255.255.0
```

- Step 4** Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.
- Step 5** Change the shutdown state to up and enable the interface as follows:
- ```
RPM-3 (config-int)# no shutdown
```
- Step 6** Configure additional interfaces as required.
- Step 7** When you have included all of the configuration subcommands to complete the configuration, press **Ctrl-Z** to exit configuration mode.
- Step 8** Write the new configuration to nonvolatile memory as follows:
- ```
RPM-3# copy running-config startup-config
[OK]
RPM-3#
```

To check the interface configuration using **show** commands, proceed to the section “Checking the Configuration.”

Configuring FE Interfaces

The following procedure describes a basic fast ethernet configuration.

- Step 1** At the privileged-level prompt, enter configuration mode and specify that the console terminal will be the source of the configuration subcommands, as follows:
- ```
RPM-3# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RPM-3 (config)#
```
- Step 2** At the prompt, enter the subcommand **interface** to specify the interface to be configured, followed by **fastethernet** to specify back card type, then *bay/port* (for the bay of the MGX 8850 where the RPM resides, upper (1) or lower (2) back card, and for port number on the back card).
- In this procedure, the 1 interface of the upper fastethernet back card in the RPM in slot 5 of the MGX 8850 is used as an example.
- ```
RPM-3 (config)# interface fastethernet 1/1
```
- Step 3** If IP routing is enabled on the system, you can assign an IP address and subnet mask to the interface with the **ip address** configuration subcommand, as in the following example:
- ```
RPM-3 (config-if)# ip address 1.1.1.10 255.255.255.0
```
- Step 4** Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.
- Step 5** Change the shutdown state to up and enable the interface as follows:
- ```
RPM-3 (config-if)# no shutdown
```
- Step 6** Configure additional interfaces as required.
- Step 7** When you have included all of the configuration subcommands to complete the configuration, press **Ctrl-Z** to exit configuration mode.

Step 8 Write the new configuration to nonvolatile memory as follows:

```
RPM-3# copy running-config startup-config
[OK]
RPM-3#
```

This completes the procedure for creating a basic configuration.

Half-duplex operation is the default transmission mode for the FE back cards. Enter the **full-duplex** command to configure full-duplex operation for the FE back cards as follows:

```
RPM-3# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RPM-3(config)#
RPM-3(config)# interface fastethernet 2/1
RPM-3(config-if)# full-duplex
Ctrl-z
```

Enter the **show interfaces fastethernet** command to verify that the 2/1 Fast Ethernet interface is now configured for full-duplex operation as follows:

```
RPM-3# sh int fastethernet 2/1
FastEthernet 2/1 is administratively up, line protocol is up
  (display text omitted)
  Encapsulation ARPA, loopback not set, keepalive not set, fdx, 100BaseTX
```

Enter the **no full-duplex** command to return the interface to half-duplex operation as follows:

```
RPM-3# config t
Enter configuration commands, one per line. End with CNTL/Z.
RPM-3(config)# int fastethernet 2/1
RPM-3(config-if)# no full-duplex
Ctrl-z
RPM-3#
```

Enter the **show interfaces fastethernet** command to verify that the 2/1 Fast Ethernet interface is now configured for half-duplex operation as follows:

```
RPM-3# sh int fastethernet 2/1
FastEthernet2/1 is administratively up, line protocol is up
  (display text omitted)
  Encapsulation ARPA, loopback not set, keepalive not set, hdx, 100BaseTX
  (display text omitted)
```

The RJ-45 receptacle is the default media type for FE-TX back card and the SC receptacle (for fiber-optic connections) is the default media type for FE-FX back card. Use the **media-type mii** command to configure the MII receptacle as the media type for the FE back cards as follows:

```
RPM-3# config t
Enter configuration commands, one per line. End with CNTL/Z.
RPM-3(config)# int fa 2/1
RPM-3(config-if)# media-type mii
Ctrl-z
RPM-3# sh int fa 2/1
FastEthernet2/1 is administratively up, line protocol is up
  (display text omitted)
  Encapsulation ARPA, loopback not set, keepalive not set, hdx, MII
  (display text omitted)
```

Enter the **media-type 100** command to return the media type for the FE back cards to the RJ-45 receptacle or SC receptacle.

To check the interface configuration using **show** commands, see the section “[Configuring 4E and 4E/B Interfaces](#).”

Configuring FDDI Interfaces on the RPM/B

This section provides the procedures for performing a basic configuration of the interfaces on full-duplex FDDI back cards installed in an RPM/B.

- Step 1** At the privileged-level prompt, enter configuration mode. Specify that the console terminal will be the source of the configuration subcommands, as follows:

```
RPM-3# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RPM-3 (config)#
```

- Step 2** At the prompt, enter the subcommand **interface** to specify the interface to be configured, followed by **fddi** to specify back card type, then *bay/port* (for the bay of the MGX 8850 where the RPM/B resides, upper (1) or lower (2) back card, and for port number on the back card).

In this procedure, the 1 interface of the lower FDDI back card in the RPM in slot 5 of the MGX 8850 is used as an example.

```
RPM-3 (config)# interface fddi 2/1
```

- Step 3** If IP routing is enabled on the system, you can assign an IP address and subnet mask to the interface with the **ip address** configuration subcommand, as in the following example:

```
RPM-3 (config-if)# ip address 1.1.1.10 255.255.255.0
```

- Step 4** Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.

- Step 5** Change the shutdown state to up and enable the interface as follows:

```
RPM-3 (config-if)# no shutdown
```

- Step 6** Configure additional interfaces as required.

- Step 7** When you have included all of the configuration subcommands to complete the configuration, press **Ctrl-Z** to exit configuration mode.

- Step 8** Write the new configuration to nonvolatile memory as follows:

```
RPM-3# copy running-config startup-config
[OK]
RPM-3#
```

To check the interface configuration using **show** commands, see the section “[Configuring FDDI Interfaces on the RPM/B](#)”.



Note

If you require full-duplex operation, verify that you are using PA-F/FD-SM or PA-F/FD-MM back cards.

Configuring FDDI Full-Duplex Operation

Full-duplex operation requires FDDI back cards PA-F/FD-SM or PA-F/FD-MM.

Full-duplex operation is *not* the default configuration and must be turned on using the **full-duplex** command. To turn off full-duplex operation (and enable half-duplex operation) and reset the interface, use the **no full-duplex** (or **half-duplex**) command.

Following is an example of configuring an FDDI interface for full-duplex operation using the **full-duplex** command:

```
RPM-3# conf t
Enter configuration commands, one per line. End with CNTL/Z.
RPM-3(config)# int fddi 2/1
RPM-3(config-if)# full-duplex
Ctrl-z
RPM-3#
```



Note

If the back card does not support full-duplex operation, the following error message will appear: “%FDDI2/1 interface does not support full-duplex.” If the back card *does* support full-duplex operation, the interface will reset as it changes to full-duplex operation.

The output of the **show interfaces fddi bay/port** command displays the state of the FDDI back card interface and the state of full-duplex operation. Following is a partial sample output of this command from an FDDI interface with full-duplex operation enabled:

```
RPM-3# show int fddi 2/1
Fddi 2/1 is up, line protocol is up
Hardware is MIF68840_MM, address is 0060.7054.8808 (bia 0060.7054.8808)
Internet address is 2.1.1.3/24
MTU 4470 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 9/255
Encapsulation SNAP, loopback not set, keepalive not set
ARP type: SNAP, ARP Timeout 04:00:00
FDX supported, FDX enabled, FDX state is *
```

where *, in the last line, could be *idle*, *request*, *confirm*, or *operation*, depending on the state the FDDI interface was in when the show interfaces command is entered.

When full-duplex operation is turned off using the **no full-duplex** (or **half-duplex**) command, the last line of the preceding display includes the following information: FDX supported, FDX disabled. If the back card does *not* support full-duplex, the message FDX NOT supported is displayed.

Checking the Configuration

After configuring the new interface, use the **show** commands to display the status of the new interface or all interfaces and the **ping** command to check connectivity.

Using Show Commands to Verify the New Interface Status

The following steps use **show** commands to verify that the new interfaces are configured and operating correctly.

-
- Step 1** Enter the **show version** command to display the system hardware configuration. Ensure that the list includes the new interfaces.

- Step 2** Display all the current back cards and their interfaces with the **show controllers** command.
- Step 3** Specify one of the new interfaces with the **show interfaces** [*type card/interface*] command. Verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state, up or down.
- Step 4** Display the protocols configured for the entire system and specific interfaces with the **show protocols** command. If necessary, return to configuration mode to add or remove protocol routing on the system or specific interfaces.
- Step 5** Display the running configuration file with the **show running-config** command.
- Step 6** Display the configuration stored in NVRAM using the **show startup-config** command. Verify that the configuration is accurate for the system and each interface.

If the interface is down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the network interface is properly connected and terminated. If you have problems bringing the interface up, contact TAC for assistance. For detailed software configuration information, refer to the Cisco IOS configuration and command reference publications. These publications are available on the Documentation CD-ROM that came with your RPM, or you can order printed copies.

Using Show Commands to Display Interface Information

To display information about a specific interface, enter the **show interfaces** command with the interface type and port address in the format **show interfaces** [*type bay/port*] for the MGX 8850 RPM.



Note

For complete command descriptions and examples for all of the supported platforms, refer to the publications listed in the Preface.

RPM Show Interfaces Command

Following is an example of how the **show interfaces** [*type bay/port*] command displays status information (including the chassis physical slot, card number,

and port address) for the interfaces you specify. In these examples, the four Ethernet 10BASE-T interfaces (1–4) are in the lower back card in the RPM in slot 4 of the MGX 8850 (interfaces are administratively shut down until you enable them).

```
rpm_slot4#sh int e 2/1
Ethernet2/1 is administratively down, line protocol is down
  Hardware is AmdP2, address is 00c0.0023.84d0 (bia 00c0.0023.84d0)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy:fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
```

```
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
0 input packets with dribble condition detected
35 packets output, 5510 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
```

```
rpm_slot4#sh int e 2/2
```

```
Ethernet2/2 is up, line protocol is up
Hardware is AmdP2, address is 00c0.0023.84d1 (bia 00c0.0023.84d1)
Internet address is 172.29.37.141/24
MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set, keepalive set (10 sec)
ARP type:ARPA, ARP Timeout 04:00:00
Last input 00:00:01, output 00:00:00, output hang never
Last clearing of "show interface" counters never
Queueing strategy:fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 1 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
    5753 packets input, 399324 bytes, 0 no buffer
    Received 5711 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 input packets with dribble condition detected
    249 packets output, 26248 bytes, 0 underruns
    0 output errors, 1 collisions, 1 interface resets
    0 babbles, 0 late collision, 7 deferred
    0 lost carrier, 0 no carrier
    0 output buffer failures, 0 output buffers swapped out
```

```
rpm_slot4#sh int e 2/3
```

```
Ethernet2/3 is administratively down, line protocol is down
Hardware is AmdP2, address is 00c0.0023.84d2 (bia 00c0.0023.84d2)
MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set, keepalive set (10 sec)
ARP type:ARPA, ARP Timeout 04:00:00
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Queueing strategy:fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 input packets with dribble condition detected
    35 packets output, 5510 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier
    0 output buffer failures, 0 output buffers swapped out
```

```
rpm_slot4#sh int e 2/4
```

```
Ethernet2/4 is administratively down, line protocol is down
Hardware is AmdP2, address is 00c0.0023.84d3 (bia 00c0.0023.84d3)
MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set, keepalive set (10 sec)
ARP type:ARPA, ARP Timeout 04:00:00
Last input never, output never, output hang never
Last clearing of "show interface" counters never
```

```

Queueing strategy:fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 input packets with dribble condition detected
  35 packets output, 5510 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets
  0 babbles, 0 late collision, 0 deferred
  0 lost carrier, 0 no carrier
  0 output buffer failures, 0 output buffers swapped out
Switch4/1 is up, line protocol is up
Hardware is ENHANCED ATM PA
MTU 4470 bytes, sub MTU 4470, BW 149760 Kbit, DLY 80 usec,
  reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ATM, loopback not set, keepalive not supported
Encapsulation(s):AAL5
4096 maximum active VCs, 0 current VCCs
VC idle disconnect time:300 seconds
0 carrier transitions
Last input never, output 00:00:00, output hang never
Last clearing of "show interface" counters never
Queueing strategy:fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  883 packets input, 42644 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  918 packets output, 44307 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets
  0 output buffer failures, 0 output buffers swapped out

```

With the **show interfaces** [*type bay/port*] command, use arguments such as the interface type (ethernet, and so forth), bay and port number (bay/port) to display information about a specific Ethernet 10Base-T interface only.

Viewing the Hardware Configuration

The **show version** (or **show hardware**) command displays the configuration of the system hardware (the number of each back card type installed), the software version, the names and sources of configuration files, and the boot images. Following is an example of the **show version** command:

```
RPM-3# show version
```

```

Cisco Internetwork Operating System Software
IOS (tm) RPM Software (RPM-JS-M), Version 12.1(5)T, RELEASE SOFTWARE (fc1)
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Wed 26-Mar-99 17:14 by marka
Image text-base:0x600088E0, data-base:0x60D74000

ROM:System Bootstrap, Version 11.3(19980311:221233) [phsu-120 237], DEVELOPMENT SOFTWARE
BOOTFLASH:RPM Software (RPM-BOOT-M), Version 12.0(2)T, RELEASE SOFTWARE (fc1)

rpm_slot4 uptime is 28 minutes
System restarted by reload
Running default software

cisco RPM (NPE150) processor with 57344K/8192K bytes of memory.

```



```

R4700 processor, Implementation 33, Revision 1.0 (512KB Level 2 Cache)
Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
4 Ethernet/IEEE 802.3 interface(s)
1 ATM network interface(s)
125K bytes of non-volatile configuration memory.
4096K bytes of packet SRAM memory.

8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2102

```

To determine which type of back card is installed in your system, enter the **show diag [slot]** command. Specific back card information is displayed, as shown in the following example of an 4E back card in back card slot 1:

```

RPM-3# show diag 1

Slot 1:
Ethernet port adapter, 4 ports
port adapter is analyzed
port adapter insertion time 2d09h ago
Hardware revision 1.1          Board revision A0
Serial number 4294967295      Part number 73-1556-04
Test history 0x0              RMA number 00-00-00
EEPROM format version 1
EEPROM contents (hex):
0x20: 01 02 01 01 FF FF FF FF 49 06 14 04 00 00 00 00
0x30: 50 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF

```

See the next section, “Using the ping Command” to verify that each interface port is functioning properly.

Using the ping Command

The *packet internet groper* (**ping**) command allows you to verify that an interface port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. This section provides brief descriptions of the **ping** command. After you verify that the system has booted successfully and is operational, you can use this command to verify the status of interface ports.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified time-out is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the address 1.1.1.10:

```

RPM-3# ping 1.1.1.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 1.1.1.10, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
RPM-3#

```

If the connection fails, verify that you have the correct IP address for the server and that the server is active (powered on). Repeat the **ping** command.

Configuration Mode

You can configure the RPM manually if you prefer not to use AutoInstall or the prompt-driven System Configuration Dialog.



Note

Seen [Appendix C, “Cisco IOS Modes of Operation”](#) for basic information about Cisco IOS software, getting context-sensitive help, and saving configuration changes.

Perform the following steps to configure the RPM manually:

Step 1 Connect a console terminal to the RPM.

Follow the instructions described in [Chapter 3, “Installing the MGX RPM,”](#) in the section “[Connecting a Console Terminal or PC to the RPM Console Port,](#)” and then power on the RPM.

Step 2 When you are prompted to enter the initial dialog, enter **no** to go into the normal operating mode of the RPM:

```
Would you like to enter the initial dialog? [yes]: no
```

Step 3 After a few seconds you will see the user EXEC prompt (Router>).

By default, the host name is Router, but the prompt will match the current host name. In the following examples, the host name is MGX8850-RPM. Enter the **enable** command to enter enable mode. You can only make configuration changes in enable mode:

```
MGX8850-RPM> enable
```

The prompt will change to the privileged EXEC (enable) prompt, MGX8850-RPM#.

Step 4 Enter the **configure terminal** command at the enable prompt to enter configuration mode:

```
MGX8850-RPM# config terminal
```

You can now enter any changes you want to the configuration. You will probably want to perform the following tasks:

- a. Assign a host name for the RPM using the **hostname** command.
- b. Enter an enable secret using the **enable secret** command.
- c. Enter an enable password using the **enable password** command.
- d. Assign addresses to the interfaces using the *protocol* **address** command.
- e. Specify which protocols to support on the interfaces.

Refer to the Cisco IOS configuration and command reference publications for more information about the commands you can use to configure the RPM. You can also refer to the *Cisco MGX 8850 Multiservice Switch Installation and Configuration* and *Cisco MGX 8800 Series Switch Command Reference* guides for information about the commands you can use to configure the RPM.

Step 5 When you finish configuring the RPM, enter the **exit** command until you return to the privileged EXEC prompt (MGX8850-RPM#).

- Step 6** To save the configuration changes to NVRAM, enter the **copy running-config startup-config** command at the privileged EXEC prompt:

```
MGX8850-RPM# copy running-config startup-config
*****
```

The RPM is now configured and will boot with the configuration you entered.

This concludes the initial RPM configuration.

Verifying Network Connectivity

When you have installed and configured the RPM, enter the following commands in user EXEC mode to verify network connectivity.

- **ping**—Sends a special datagram to the destination device, then waits for a reply datagram from that device.
- **telnet**—Logs in to a remote node
- **trace**—Discovers the routes that packets take when traveling from one RPM to another.

If there is a problem with network connectivity, see [Appendix A, “Maintaining the MGX RPM”](#) the “[Reading Front Panel LEDs](#)” section, and check the cable connections. If there is still a problem, check the RPM configuration. Contact customer service for further assistance.

Specifying the Boot Method

You can enter multiple boot commands in the configuration in NVRAM to provide a backup method for loading the Cisco IOS image onto the RPM. The RPM boots using the first **boot** command that succeeds. If you enter multiple boot commands, the RPM executes them in the order they are entered. There are two ways to load the Cisco IOS image: from the PXM hard drive or from a TFTP server on the network.

1. PXM Hard Drive

The RPM has access to the file system on the PXM C: drive, in the C:RPM directory. Use the console port on the RPM to boot the RPM from Flash so that you configure its ATM switch interface as **no shutdown**, which lets you access the C: drive on the PXM and copy files to the startup config or to the bootflash.



Note **no shutdown** is the default.

2. TFTP server

If the PXM hard drive does not contain a valid Cisco IOS image, you can specify that system software be loaded from a TFTP server on your network as a backup boot method for the RPM. In the following example, replace *filename* with the filename of the Cisco IOS image, and replace *ipaddress* with the IP address of the TFTP server:

```
MGX8850-RPM> enable
Password: enablepassword
MGX8850-RPM# configure terminal
MGX8850-RPM (config)# boot system tftp filename ipaddress
MGX8850-RPM (config)# Ctrl-Z
```

```
MGX8850-RPM# copy running-config startup-config
Building configuration ...
[OK]
MGX8850-RPM# exit
MGX8850-RPM>
```

In the following example, replace filename with the filename of the Cisco IOS image. Type the following commands to boot the RPM from the PXM and copy files:

```
MGX8850-RPM> enable
Password:enablepassword
MGX8850-RPM# configure terminal
MGX8850-RPM (config)# boot system c:filename
MGX8850-RPM (config)# Ctrl-Z
MGX8850-RPM# copy running-config startup-config
Building configuration ...
[OK]
MGX8850-RPM#
```

Then reload the RPM to get back to rommon and then boot full IOS from the PXM disk.



Note

Put the RPM IOS image in the RPM directory of the PXM hard disk with the filename specified in the RPM boot command.

Configuring Permanent Virtual Circuits on the RPM

A PVC is a point-to-point connection between two or more devices. This section describes how to configure a PVC originating on the RPM ATM interface and terminating on a service module within a single MGX 8850 or on another RPM.

A PVC is established for each ATM end node with which the RPM communicates. The characteristics of the PVC are established when the PVC is created and include the following:

- Quality of service (QoS)
- ATM Adaptation Layer 5 mode (AAL5)
- Encapsulation type (LLC/SNAP, MUX, and QSAAL)

Each RPM PVC supports routing protocols including the following:

- Multiprotocol IP: static route, IGRP, RIPv1 & v2, OSPF, IS-IS, EIGRP, BGP with multiprotocol extensions.

In most service provider network cores, the recommended routing protocols are OSPF or IS-IS, with additional use of BGP where appropriate.

- Multiprotocol Label Switching (MPLS)



Note

MPLS encapsulation within a PVC is only one of two MPLS modes supported by the RPM. The other is full ATM MPLS which uses MPLS Label VCs (LVCs) and not PVCS.

- Fast switching of IP packets
- Pseudobroadcast support for multicast packets

Resource Partitioning

Like the other card modules in the MGX 8850 switch, resource partitions must be defined on the RPM. The **rpmrsctrtn** command defines the bandwidth and addressing resources assigned to each controller (PAR, Tag (MPLS), or PNNI).

The **rpmrsctrtn** command is used to modify the resource partitioning on the RPM. It is necessary to use the **rpmrsctrtn** command before you add any PVCs or connections to the RPM because by default all partitions are disabled. Enter the **rpmrsctrtn** command to set up resource partitioning, as shown in the following example:

```
RPM-3(config)# rpmrsctrtn PAR 100 100 1 255 0 3840 4047
Partition type [par|tag|pnni] Percent ingress [<0-100>] Percent egress [<0-100>] Minimum
VPI [<0-255>] Maximum VPI [<0-255>] Minimum VCI [<0-3840>] Maximum VCI [<0-3840>] Number of
LCNs [<0-4047>]
```



Note

The MGX 8850 CLI has partitioning capability to support MPLS or “Tag” control of the MGX resources. The “Tag” partition will be required once the MGX 8850 has support for an RPM acting as a Label Switch Controller (LSC). LSC support is not yet available, so the “Tag” partition is not used. Despite the lack of a “Tag” partition, the MGX 8850 supports MPLS edge function, by use of either PVCs or PVPs. For more information, see [Chapter 7, “Configuring MPLS and VPN.”](#)

[Table 5-1](#) describes the **rpmrsctrtn** command parameters.

Table 5-1 rpmrsctrtn Parameter Description

Parameter	Description
par tag pnni	The controller type that you want to define.
ingress-percent	The percentage of the ingress bandwidth on the ATM switch interface that can be allocated by the controller type. The aggregate of the ingress bandwidth across all three controllers can exceed 100 percent.
egress-percent	The percentage of the egress bandwidth on the ATM switch interface that can be allocated by the controller type. The aggregate of the egress bandwidth across all three controllers can exceed 100 percent.
min-vpi	The minimum VPI value that can be assigned on PVCs on this controller. The VPI range on the three controllers can overlap.
max-vpi	The maximum VPI value that can be assigned on PVCs on this controller. The VPI range on the three controllers can overlap.
min-vci	The minimum VCI value that can be assigned on PVCs on this controller. Unlike the VPI range, the VCI range cannot overlap the VCI range of another controller.
max-vci	The maximum VCI value that can be assigned on PVCs on this controller. Unlike the VPI range, the VCI range cannot overlap the VCI range of another controller.
lcns	The total number of logical connections that can use this controller.

Configuring Permanent Virtual Circuits

All permanent virtual circuits (PVCs) configured into the RPM remain active until the circuit is removed from the configuration. The PVCs also require a permanent connection to the ATM switch. All virtual circuit characteristics apply to PVCs. When a PVC is configured, all the configuration options are passed on to the ATM port adapter. These PVCs are writable into nonvolatile RAM (NVRAM) as part of the RPM configuration and are used when the RPM image is reloaded.

Each PVC on the RPM is associated with a subinterface. Some subinterfaces support multiple PVCs (multipoint) that do the equivalent of broadcasting. Others only support one PVC (point-to-point). If a point-to-multipoint PVC exists, then that PVC can be used as the sole broadcast PVC for all multicast requests.

Each subinterface is identified as *slot/interface.subinterface*. The *slot* is the card slot number of the RPM, the *interface* is always 1, and the *subinterface* is a number that identifies the subinterface PVCs on the RPM.

A subinterface is created while in the configuration mode by typing the **interface switch** command. The **IP address** is set using the IP address command.

To configure a PVC, you must perform the following tasks:

-
- Step 1** Create a point-to-point or multipoint subinterface.
 - Step 2** Assign an IP address to the subinterface.
 - Step 3** Create an ATM PVC.
 - Step 4** Define a map list (for multipoint only).
 - Step 5** Add a connection between the RPM and the PXM.
 - Step 6** Add the remaining connection segments as needed.
-

Refer to the *MGX 8850 Wide Area Switch Installation and Configuration*, for more information on creating PVCs on the RPM and the rest of the Cisco 7000 family of routers. See [Chapter 6, “Setting Up Connections Between Other Devices and the RPM.”](#)

Creating a PVC

When you create a PVC, you create a virtual circuit descriptor (VCD) and attach it to the virtual path identifier (VPI) and virtual channel identifier (VCI). A VCD is an ATM port adapter-specific mechanism that identifies to the ATM port adapter which VPI/VCI to use for a particular packet. The ATM port adapter requires this feature to manage packets for transmission. The number chosen for the VCD is independent of the VPI/VCI used. When you create a PVC, you also specify the AAL and encapsulation. A rate queue is used that matches the default peak and average rate, which are equal, and are specified in kilobits per second. To create a PVC on the ATM port adapter interface, use the **atm pvc** command. To remove a PVC, enter the **no** form of this command.

```
atm pvc vcd vpi vci aal-encap
no atm pvc vcd
```

RPM:

```
RPM-3 (config)# interface switch chassis-slot/1.subinterface interface-type
```

where the interface-type is either point-to-point, multipoint, or tag.

```
RPM-3 (config-if)# atm pvc 2048 255 128 aal5snap
```

**Note**

You can also use the **pvc vpi/vci** command, which is described in the Cisco IOS documentation.

**Note**

Because the ATM port adapter is internal to the RPM and the interface is logical not physical, you can not remove it. It is always referred to as *slot/1*.

- **vcd**—A unique index value describing this VC in the range of 1 to MAXVC (defined when setting up resource partitioning). Do not use VCD 1, as this is reserved to the system.
- **vpi**—The ATM network VPI to use for this VC in the range of 0 through 255. A VPI of 0 indicates that this PVC is a VCC. A non-0 value indicates that the PVC is a VPC.
- **vci**—The ATM network VCI to use for this VC in the range of 0 through 3,824.
- **aal-encap**—The encapsulation type to use on this VC from the following:
 - **aal5mux**—Specifies the MUX-type for this VC. A protocol type must be specified.
 - **aal5snap**—LLC/SNAP precedes the protocol datagram.
 - **aal5nlpid**—NLPID precedes the protocol datagram.
 - **qsaal**—A signaling type VC.
 - **aal5ciscopp**—Used for PPP applications.

The **atm pvc** command creates *PVC n* and attaches the PVC to *VPI* and *VCI*. The AAL used is specified by *aal* and encapsulation by *encap*.

The default for peak rate and average rate is that peak = average, and the PVC is automatically connected to the highest bandwidth rate queue available. For detailed software configuration information, refer to the Cisco IOS configuration and command reference publications. These publications are available on the Documentation CD-ROM that came with your RPM, or you can order printed copies.

Mapping a Protocol Address to a PVC

Cisco IOS software supports a mapping scheme that identifies the ATM address of remote hosts/RPMs. This address can be specified either as a VCD for a PVC or a network service access point (NSAP) address for SVC operation.

Enter mapping commands as groups; multiple map entries can exist in one map list. First create a map list, then associate the list with an interface.

Enter the **map-list** command and then enter the protocol, protocol address, and other variables, as follows:

```
map-list name
protocol-type protocol-address [atm-vc vcd] | atm-nsap nsap-address] [broadcast]
```

The **broadcast** keyword specifies that this map entry receives the corresponding protocol broadcast requests to the interface (for example, any network routing protocol updates). If you do not specify **broadcast**, the ATM software is prevented from sending routing protocol updates to the remote hosts.

After you create the map list, specify the ATM interface to which it applies with the interface command, as follows:

RPM usage:

```
RPM-3# interface switch 5/1
```

Associate the map list to an interface with the following command:

```
map-group name
```

You can create multiple map lists, but only one map list can be associated with an interface. Different map lists can be associated with different interfaces. The following is an example of the commands to map a list to an interface on an RPM:

```
RPM-3# interface switch 5/1
ip address 1.1.1.2 255.255.255.0
 map-group atm1
  atm pvc 2 0 1 aa15snap
!
no ip classless
!
map-list atm1
 ip 1.1.1.1 atm-vc 2 broadcast
```



Note

The RPM can not use VCD=1, because it already uses VCD=1 for the IP connection to the PXM.

Establishing 1:N Redundancy Between Two or More RPM Cards

RPM cards support 1:N redundancy, whereby one RPM card can be configured as a redundant or secondary (backup) card for one or multiple primary RPM cards, forming a redundant group. There can be multiple redundant groups in one shelf. RPM 1:N redundancy is a cold redundancy, in which the configuration of a failed primary card is copied to the standby secondary card. All traffic to and from the primary RPM card is switched to the secondary card after it becomes active. Because this is a cold redundancy solution, service interruption is expected. As with other service modules, the layer 2 state is restored when the secondary card becomes active. However, RPM also performs layer 3 functionality, such as maintaining routing tables. The routing tables are created manually or by routing protocols, such as IGRP, BGP, or OSPF. Because routing protocols are used, the layer 3 state is restored within three to five minutes, depending on the protocol used.

RPM 1:N redundancy supports the following features:

- Increases availability by decreasing the DPM of the network by reducing boot-up, switchover, and upgraded times.
- Supports L2 redundancy and restores L3 state via reconvergence.
- Supports RPM 1:1 warm redundancy when N=1.
- Support for up to 11 active (primary) RPM cards per single redundant (standby or secondary) RPM for the MGX 8850 and MGX 8250.
Support for up to 3 active (primary) RPM cards per single redundant (standby or secondary) RPM for the MGX 8230.
- Support for a maximum of 6 redundant groups per MGX 8850 or MGX 8250.
Support for a maximum of 2 redundant groups per MGX 8230..
- Does not utilize either the MGX 8850 distribution or redundancy bus.

The redundant card must be present and active and must not have any connections configured. Any connection configuration will cause the **addred** command to be rejected.

**Note**

Secondary or redundant cards can only backup like RPM cards. Therefore, secondary or standby RPM/B cards can only backup primary RPM/B cards, and secondary RPM-PR cards can only backup primary RPM-PR cards.

To establish a backup card for an RPM card, use the following procedure.

- Step 1** Establish a configuration session using a user name with SUPER_GP privileges or higher.
- Step 2** If you have not done so already, initialize both cards as described earlier in this chapter.
- Step 3** Enter the **dspecds** command to verify that the primary and secondary RPM card are in the “Active” state.
- Step 4** Enter the **addred** command.

```
pop20one.7.PXM.a > addred <redPrimarySlotNum> <redSecondarySlotNum> <redType>
```

where *<redPrimarySlotNum>* is the slot number of the primary RPM card, *<redSecondarySlotNum>* is the slot number of the secondary RPM card, and *<redType>* is the number 2 for 1:n redundancy.

After you enter the **addred** command, the switch resets the secondary card; therefore, the secondary card will be unavailable for a few minutes. When the reset is complete, enter the **dspecds** command to show the primary and secondary cards in the active and standby states, respectively.

The redundant RPM cards are shown in slots 2 and 9 with the standby card in slot 9.

```
Unknown.7.PXM.a > dspecds
Unknown                               System Rev: 02.01   Mar. 19, 2001 23:14:58 GMT
Chassis Serial No: SAA03230404 Chassis Rev: B0           GMT Offset: 0
                                                Node Alarm: MAJOR

Card  Front/Back      Card      Alarm      Redundant  Redundancy
Slot  Card State       Type      Status     Slot       Type
---  -
01   Empty              ---      ---        ---        ---
02   Active/Empty      RPM      NONE      09         PRIMARY SLOT
03   Empty              ---      ---        ---        ---
04   Empty              ---      ---        ---        ---
05   Empty              ---      ---        ---        ---
06   Active/Empty      AXSM_10C48  NONE      NA         NO REDUNDANCY
07   Active/Active     PXM      NONE      08         PRIMARY SLOT
08   Empty Resvd/Empty ---      MAJOR     07         SECONDARY SLOT
09   Standby/Empty     RPM      NONE      09         SECONDARY SLOT
10   Empty              ---      ---        ---        ---
11   Empty              ---      ---        ---        ---
12   Empty              ---      ---        ---        ---
13   Empty              ---      ---        ---        ---
14   Empty              ---      ---        ---        ---
```

- Step 5** To display the redundancy relationship between all cards in the switch, enter the **dspreed** command.

Redundant cards are displayed as shown below, indicating primary and secondary slot numbers, card types, card states, and redundancy type.

```
Unknown.7.PXM.a > dspreed
Unknown                               System Rev: 02.01   Mar. 19, 2001 23:15:37 GMT
MGX8850                               Node Alarm: MAJOR

Primary  Primary  Primary  Secondary  Secondary  Secondary  Redundancy
SlotNum  Type    State   SlotNum    Type    State    Type
-----
2        RPM     Active  9          RPM     Standby  1-n
7        PXM     Active  8          PXM     Empty Resvd  1-1
```

Step 6 Return to the primary RPM by entering the **cc** command, **cc <redPrimarySlotNum>**.

```
Unknown.7.PXM.a > cc 2
```

Step 7 Enter **Copy Run Start** or **Write Mem** to save the configuration to the PXM-1 hard disk C:\RPM directory.

This file will be used as the configuration file. The name of the file is **auto_config_slot#** where # is the primary slot number.

Using Softswitch to Change the Active Card

Enter the **softswitch** command to manually change the active card to the standby card. You may want to do this if you need to remove the original active card from the MGX8850 shelf. Before you begin this procedure, make sure that the destination card is in Standby mode. To change the active cards, follow the steps below.

Step 1 Enter the **softswitch** command.

```
Unknown.7.PXM.a > softswitch 2 9
softswitch: Do you want to proceed (Yes/No)? y
```

where 2 is the active card and 9 is the destination card.

The card in slot 9 is now the active RPM card, and the RPM card in slot 2 is reset. It comes up in standby mode after a couple of minutes.

The new active card will not revert to standby mode automatically. Enter **softswitch** to manually switch over the active card back to standby mode. This is the only way the active card will switch over to standby, unless the active card fails.

Step 2 Enter the **softswitch** command to switch the active card back to the original RPM.

```
Unknown.7.PXM.a > softswitch 9 2
softswitch: Do you want to proceed (Yes/No)? y
where 9 is the active card and 2 is the destination card.
```

Deleting Redundancy

To delete card redundancy, the primary card must be active, otherwise this command will be rejected. Enter **delred** followed by the primary card's slot number, as shown here:

```
Unknown.7.PXM.a > delred 2
Redundancy link is deleted
```

The secondary card is reset and comes back up as an active normal RPM card (if it is the last primary card) that can be used for any other purpose. In the following example, the card in slot 9 is now active.

```
Unknown.7.PXM.a > dspcds
Unknown                               System Rev: 02.01   Mar. 20, 2001 00:00:01 GMT
Chassis Serial No: SAA03230404 Chassis Rev: B0   GMT Offset: 0
                                           Node Alarm: MAJOR

Card  Front/Back      Card      Alarm      Redundant  Redundancy
Slot Card State        Type      Status     Slot       Type
---  -

```

01	Empty	---	---	---	---
02	Active/Empty	RPM	NONE	NA	NO REDUNDANCY
03	Empty	---	---	---	---
04	Empty	---	---	---	---
05	Empty	---	---	---	---
06	Active/Empty	AXSM_10C48	NONE	NA	NO REDUNDANCY
07	Active/Active	PXM1	NONE	08	PRIMARY SLOT
08	Empty Resvd/Empty	---	MAJOR	07	SECONDARY SLOT
09	Active/Empty	RPM	NONE	NA	NO REDUNDANCY
10	Empty	---	---	---	---
11	Empty	---	---	---	---
12	Empty	---	---	---	---
13	Empty	---	---	---	---
14	Empty	---	---	---	---

Unknown.7.PXM.a >

Adding Additional Primary Cards

You can add one or more additional RPM cards as primary cards backed up by the secondary card. To do this, enter the **addred** command with the additional card slot numbers.

```
switch.7.PXM.a > addred <redPrimarySlotNum> <redSecondarySlotNum> <redType>
```

Repeat this step for each additional card you want to add to the secondary card backup protection.

Upgrading with 1:N Redundancy

The following procedure describes how to upgrade redundant RPM cards.



Note Redundancy must be established before you use this procedure.

Step 1 On the primary RPM card, upgrade the software. Refer to the *1.1.40 Version Software Release Notes Cisco WAN MGX 8850, MGX 8230, and MGX 8250 Switches*.



Tips Enter the **copy run start** command to save the configuration change.

Step 2 Switch to the secondary card using the **softswitch** command.

```
mgx8850a.7.PXM.a > softswitch <fromSlot> <toSlot>
```

This step makes the secondary card active and resets the primary RPM card. When the primary card resets, it loads the upgraded software defined in Step 1.

Step 3 After the secondary card is active, configure it to upgrade the software. (See Step 1.)

Step 4 Switch back to the primary card using the **softswitch** command.

This step makes the upgraded primary card active and resets the secondary card. When the reset is complete, the secondary card runs the upgraded software.

Step 5 If there are other primary cards with redundant (secondary) cards, repeat this procedure for each primary card.

