



Connecting Cisco Serial Network Modules to the Network

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This guide describes how to connect Cisco serial network modules to your network. It contains the following sections:

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About Serial Connections

Before you connect a device to a serial port, you need to know the following:

- Type of device—data terminal equipment (DTE) or data communications equipment (DCE)—you are connecting to
- Type of connector, male or female, needed to connect to the device
- Signaling standard required by the device

About DTE and DCE Devices

A device that communicates over a synchronous serial interface is either a DTE or a DCE device. A DCE device provides a clock signal between the device and the router. A DTE device does not provide a clock signal. DTE devices usually connect to DCE devices. The documentation that accompanied the device



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should tell you whether it is DTE or DCE. (Some devices have a jumper to select DTE or DCE mode.) If you cannot find this information in your documentation, see [Table 1](#) to help you determine the proper device type.

Table 1 Identifying the Device Type

Device Type	Typical Connector	Typical Devices
DTE	Male ¹	Terminal PC
DCE	Female ²	Modem CSU/DSU Multiplexer

1. If pins protrude from the base of the connector, the connector is male.
2. If the connector has holes to accept pins, the connector is female.



Note

Serial ports configured as synchronous DTE require external clocking from a channel service unit/data service unit (CSU/DSU) WAN interface card or other DCE device.

About Serial Cables Used with Cisco 2600 Series, Cisco 3600 Series, Cisco 3700 Series, and Cisco MWR 1941-DC Routers

Cisco Systems offers ten types of serial cables (also called *serial adapter cables* or *transition cables*) as listed in [Table 2](#).

Table 2 Serial Cables and Cisco Smart Serial Cables

Standard Serial Cables	Cisco Smart Serial Cables
EIA/TIA-232 serial cable	EIA/TIA-232 Smart Serial cable
EIA/TIA-449 serial cable	EIA/TIA-449 Smart Serial cable
V.35 serial cable	V.35 Smart Serial cable
X.21 serial cable	X.21 Smart Serial cable
EIA/TIA-530 serial cable	EIA/TIA-530 Smart Serial cable EIA/TIA-530A Smart Serial cable

The documentation for the device you plan to connect to the serial port should indicate which interface is used. You can then order a serial transition cable of the correct type.



Tip

A cable providing surge protection (CAB-SS-SURGE) is also available from Cisco Systems for use with the NM-16A/S network module. See the [“12-in-1 Smart Serial Cables”](#) section on page 5 for instructions on connecting the surge protector cable.

A standard serial cable uses a universal 60-pin plug at the network module or WAN interface card end. The Smart Serial cable uses a 12-in-1 Smart Serial connector designed by Cisco. The network end of each cable provides the physical connectors most commonly used for the interface. For example, the network end of the EIA/TIA-232 serial cable is a DB-25 connector, the most widely used EIA/TIA-232 connector.

All serial interface types except EIA/TIA-530 and EIA/TIA-530A are available in DTE or DCE format: DTE with a plug connector at the network end, and DCE with a receptacle at the network end. V.35 is available in either mode, with either gender at the network end. EIA/TIA-530 and EIA/TIA-530A are available in DTE only.

Serial cables are not provided with the network module. For ordering information, see the [“Obtaining Documentation, Obtaining Support, and Security Guidelines”](#) section on page 16.

Although manufacturing your own serial cables is not recommended (because of the small size of the pins on the DB-60 serial connector), cable pinouts are provided in the online document *Cisco Modular Access Router Cable Specifications*. For further information, see the [“Obtaining Documentation, Obtaining Support, and Security Guidelines”](#) section on page 16.

About Data Rates and Distance Limitations

All serial signals are subject to distance limits, beyond which the signal degrades significantly or is completely lost. Generally, the slower the data rate, the greater the distance.

[Table 3](#) lists recommended maximum speeds and distances for each serial interface type. If you understand and compensate for potential electrical problems, you may get good results at speeds and distances greater than those listed. For instance, the recommended maximum rate for V.35 is 2 Mbps, but 4 Mbps is commonly used.

Table 3 Serial Interface Recommended Maximum Speeds and Distances

Data Rate, bps	EIA/TIA-232 Distance		EIA/TIA-449, -530, -530A, V.35, and X.21 Distance	
	Feet	Meters	Feet	Meters
2400	200	60	4100	1250
4800	100	30	2050	625
9600	50	15	1025	312
19200	25	8	500	150
38400	12	4	250	75
56000	9	3	100	30
1544000 (T1)	—	—	50	15

Balanced drivers allow EIA/TIA-449 signals to travel greater distances than EIA/TIA-232 signals. The recommended distance limits for EIA/TIA-449 shown in [Table 3](#) are also valid for V.35, X.21, and EIA/TIA-530. Typically, EIA/TIA-449 and EIA/TIA-530 support 2-Mbps rates, and V.35 can support 4-Mbps rates.

Asynchronous and Synchronous Serial Module Data Rates

The following data-rate limitations apply to the slow-speed serial interfaces found on asynchronous and synchronous serial modules:

- The maximum data rate on the slow-speed asynchronous interface is 115.2 kbps. The traffic throughput rate allowed is the full 115.2 kbps, with 10 percent of traffic in the opposite direction.
- The maximum data rate for the slow-speed synchronous interface is 128 kbps full duplex.

Connecting Asynchronous Network Modules to Asynchronous Devices

An asynchronous network module provides two or four 68-pin receptacles. Each receptacle connects to asynchronous devices by means of an octal cable that has a 68-pin plug at the module end and eight connectors at the network end, one for each of the eight EIA/TIA-232 serial ports. Depending on the type of cable, the network end consists of either RJ-45 connectors or male DB-25 connectors. RJ-45-to-DB-25 adapters are also available.

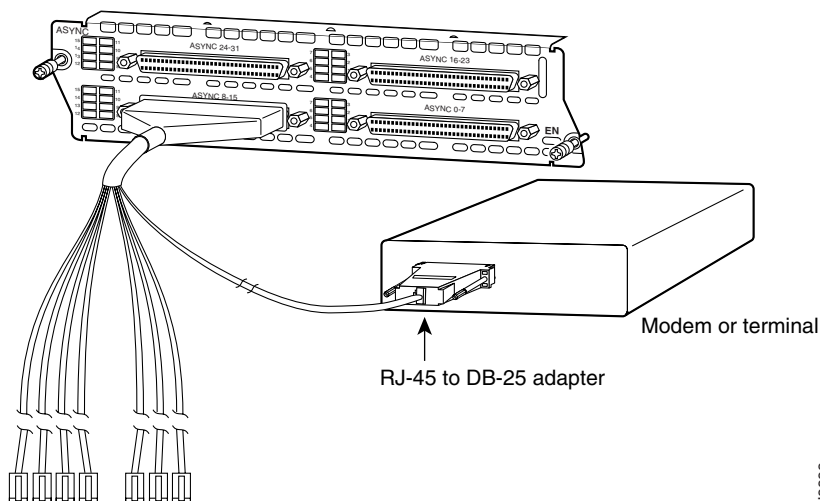
Ports are numbered from right to left and from bottom to top, as labeled on the module rear panel. (See the [“Asynchronous Network Module Interface Numbering”](#) section on page 7.)

Octal Cables

Octal cables are not provided with the network module. For ordering information, see the [“Obtaining Documentation, Obtaining Support, and Security Guidelines”](#) section on page 16.

Use an octal cable, and adapters if necessary, to connect each of the module’s 68-pin receptacles to one or more asynchronous modems, terminals, or other devices. (See [Figure 1](#).)

Figure 1 Connecting an Asynchronous Network Module to an Asynchronous Device

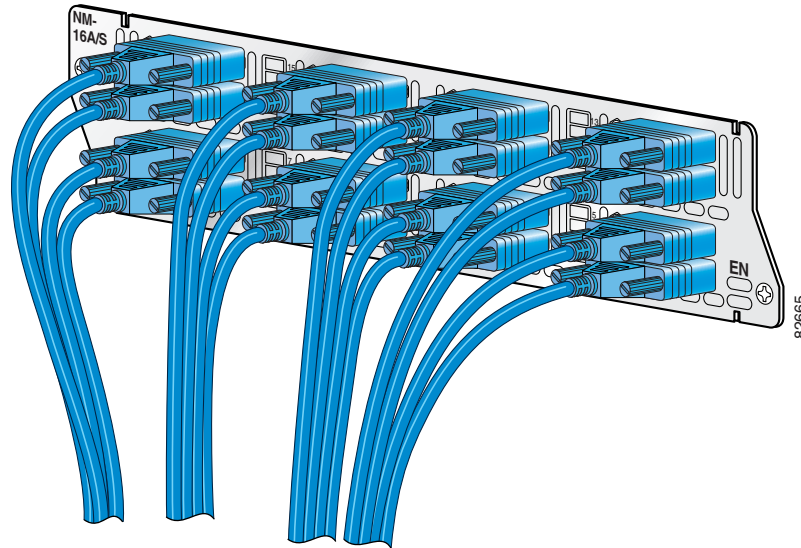


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12-in-1 Smart Serial Cables

The Cisco NM-16A/S network module uses sixteen 12-in-1 Smart Serial cables. The cables connect the network module to a patch panel or one or more asynchronous modems, terminals, or other devices. (See [Figure 2](#).)

Figure 2 Connecting the NM-16A/S Network Module



To patch panel or other network device

The surge protection cable (CAB-SS-SURGE) is installed between the network module and the 12-in-1 Smart Serial cable. (See [Figure 3](#).)

Figure 3 *Connecting the Cisco Surge Protector Cable (CAB-SS-SURGE) to the NM-16A/S Network Module*

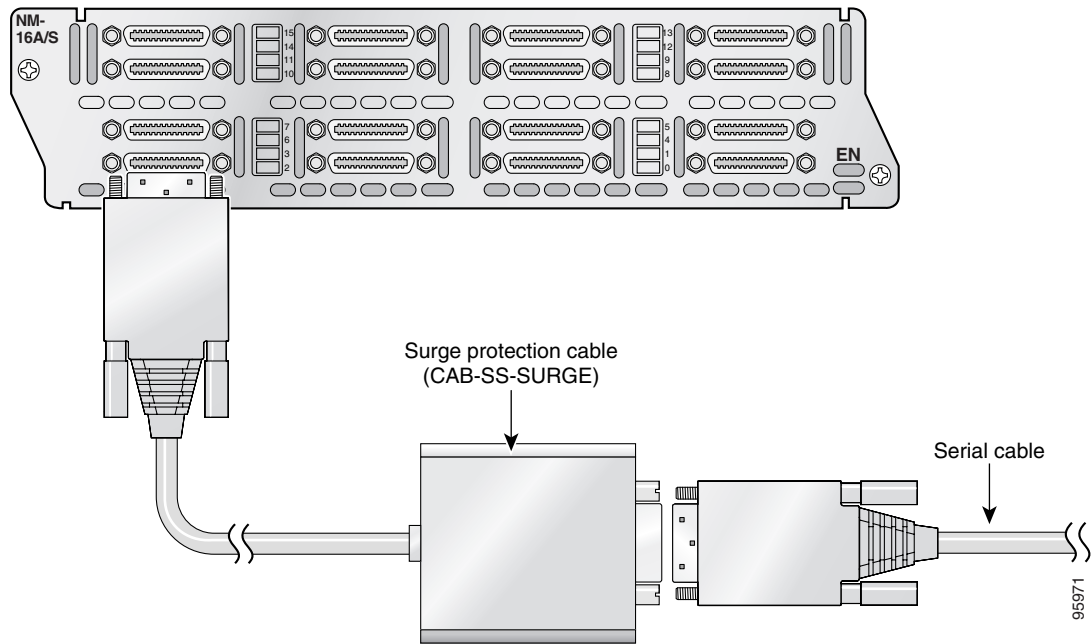
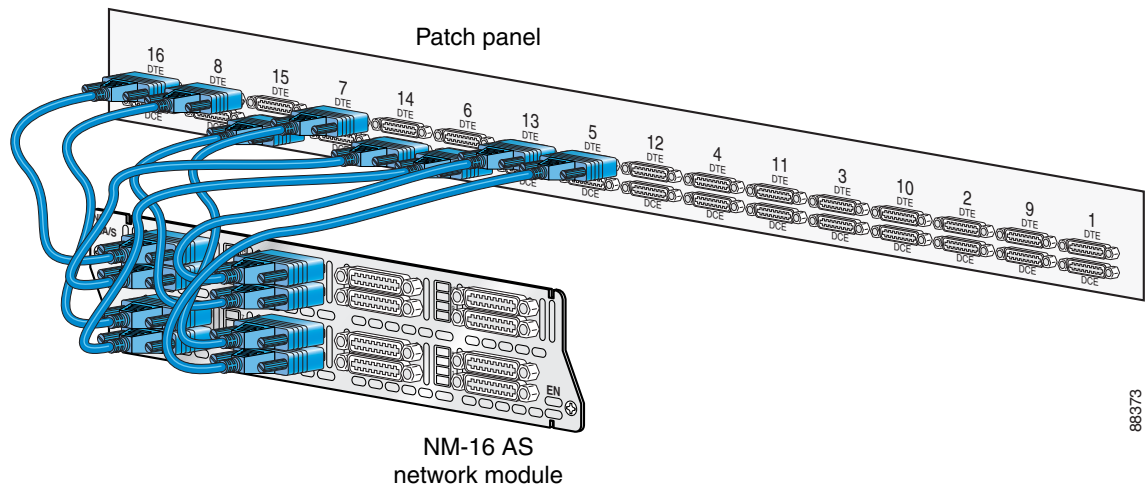


Figure 4 shows the 12-in-1 Smart Serial cables going from the Cisco NM-16A/S network module to a patch panel installed above the network module in a standard telco rack. The numbers next to the connectors on the patch panel correspond to the port number (or connector) on the other side of the patch panel.

Figure 4 *Cabling the Cisco NM-16AS Network Module to a Patch Panel*



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Asynchronous Network Module Interface Numbering

Certain Cisco IOS configuration commands identify asynchronous ports by an interface number (or a line number, which is the same as the interface number). The interface number of a port on an asynchronous network module is related to the slot number where the module is installed and the unit number of the port in the module.

Cisco 3600 Series and Cisco MWR 1941-DC Router 16- and 32-Port Interface Numbering

Cisco 3600 series and Cisco MWR 1941-DC router slot numbering is explained in the [“Network Module Slot Locations and Numbering on Cisco Access Routers”](#) section on page 3.

Ports on the 16- and 32-port asynchronous network modules correspond to the outputs of the octal cables that connect the module to the network. These ports are numbered in the same pattern as slot numbers, beginning at 0 at the lower right and continuing from right to left and (in the 32-port module) from bottom to top. In the 16-port module, the right connector provides ports 0 to 7, and the left connector provides ports 8 to 15, as labeled on the module rear panel. In the 32-port module, the connectors in the bottom row provide ports 0 to 7 and 8 to 15, and the connectors in the top row provide ports 16 to 23 and 24 to 31.

The interface number of a port is determined using the following formula:

$$\text{interface-number} = (32 \times \text{slot-number}) + \text{unit-number} + 1$$

For example, asynchronous port 12 in slot 1 corresponds to interface number $(32 \times 1) + 12 + 1 = 45$. This is also the line number for the port. Port 12 in slot 1 is always assigned interface number 45, regardless of whether the module in slot 0 is a 16-port asynchronous module, a 32-port asynchronous module, or some other type of module—or even whether there is a network module in slot 0 at all. If you move the module in slot 1 to a different slot, however, its interface numbers change.



Note

The Cisco MWR 1941-DC router has one network module slot (slot 1).

[Table 4](#) shows the range of interface numbers available for each type of asynchronous network module in each Cisco 3600 series router slot. (Interface 0 is automatically assigned to the console.)

Table 4 *Cisco 3600 Series 16- and 32-Port Asynchronous Network Module Interface Numbering*

Slot Number	Interface Numbers (16-Port Module)	Interface Numbers (32-Port Module)
0	1–16	1–32
1	33–48	33–64
2	65–80	65–96
3	97–112	97–128
4	129–144	129–160
5	161–176	161–192
6	193–208	193–224

Cisco 2600 Series and Cisco MWR 1941-DC Router Serial Interface Numbering

Interface numbering for Cisco 2600 series and Cisco MWR 1941-DC routers differ from Cisco 3600 series interface numbering in the following ways:

- WAN interface card slot numbers always appear as slot 0, even if the interface card is installed in the slot labeled W1.
- WAN interface cards are numbered dynamically, starting with the first card installed. For example:
 - If slot W0 is empty and slot W1 contains a 1-port serial WAN interface card, the interface number is serial 0/0.
 - If slot W0 contains a 2-port serial WAN interface card and slot W1 contains a 1-port serial interface card, serial 0/0 and 0/1 reside in slot W0 and serial 0/2 resides in slot W1.

Port Interface Numbering



Note

The Cisco MWR 1941-DC router requires Cisco IOS Release 12.2(15)MC1a and later for 4- and 8-port asynchronous/synchronous and 16- and 32-port asynchronous modules network module support.

4- and 8-Port

The 4-port and 8-port asynchronous/synchronous network modules, when configured for asynchronous operation under releases earlier than Cisco IOS Release 11.2(7)P, use a different interface numbering algorithm:

$$\text{interface-number} = (16 \times \text{slot-number}) + \text{unit-number} + 1$$

16- and 32-Port

Table 5 shows the numbers available under this numbering scheme. These interface numbers create potential conflicts with the numbers assigned to 16- and 32-port asynchronous modules; that is, it would be possible for a 16- or 32-port asynchronous module in one slot to overlap the interface numbers of a 4- or 8-port asynchronous and synchronous module in another slot.

Table 5 4-, 8-, and 16-Port Serial Network Module Interface Numbering

Slot Number	Interface Numbers (4-Port Module)	Interface Numbers (8-Port Module)	Interface Numbers (16-Port Module)
0	1–4	1–8	1–16
1	17–20	17–24	17–24
2 ¹	33–36	33–40	33–40
3 ¹	49–52	49–56	49–64
4	N/A	N/A	65–80
5	N/A	N/A	81–96

1. Cisco 3640 and Cisco 3660 routers only.

To prevent this conflict, Cisco IOS Release 11.2(7)P, which is required to operate 16- and 32-port asynchronous network modules, checks when the router boots for the presence of 4- and 8-port asynchronous/synchronous network modules configured as asynchronous. If the software finds any of these network modules, it rewrites the starting configuration in nonvolatile random access memory (NVRAM), if necessary, to adopt the new line numbering scheme for these modules, as shown in [Table 6](#).

Table 6 *New 4- and 8-Port Serial Network Module Interface Numbering*

Slot Number	Interface Numbers (4-Port Module)	Interface Numbers (8-Port Module)
0	1–4	1–8
1	33–36	33–40
2 ¹	65–68	65–72
3 ¹	97–100	97–104

1. Cisco 3640 and Cisco 3660 routers only.

When an automatic configuration update is performed, the following message appears:

```
Line number convention changed from 16 lines/slot to 32 lines/slot.
```

4-Port Serial Network Module

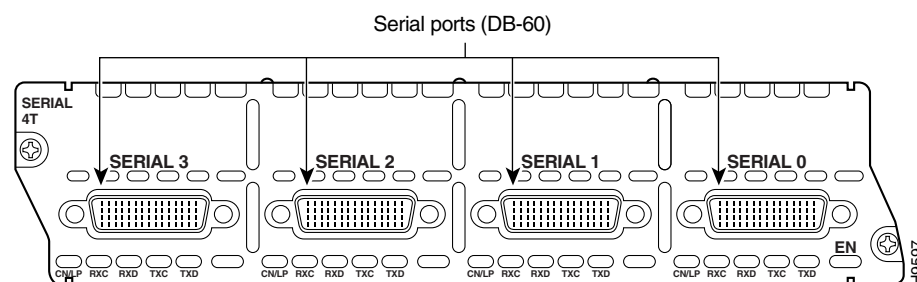
This section provides information about the 4-port serial network module (Cisco product number NM-4T). (See [Figure 5](#).) With the appropriate serial transition cable, each port on this module can provide an EIA/TIA-232, EIA/TIA-449, V.35, X.21, EIA/TIA-530 DTE, or nonreturn to zero/nonreturn to zero inverted (NRZ/NRZI) serial interface. The module provides a synchronous data rate of 8 MB per second on port 0, 4 MB per second each on port 0 and port 2, or 2 MB on all four ports simultaneously.



Note

Half-duplex and binary-synchronous communications are not supported on the 4-port serial network module.

Figure 5 *4-Port Serial Network Module*

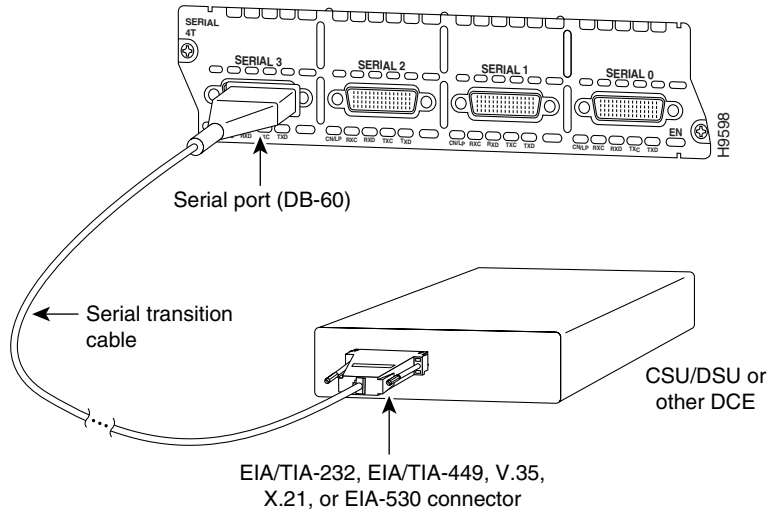


Connecting the 4-Port Serial Module to a Network

The 4-port serial network module provides four universal, high-density, 60-pin receptacles. The serial cable attached to each receptacle determines the port's electrical interface type and mode, DTE or DCE.

After you install a 4-port serial module, use the appropriate serial cable to connect each of the DB-60 serial ports to a synchronous modem, channel service unit/data service unit (CSU/DSU), or other DCE equipment. (See [Figure 6](#).)

Figure 6 Connecting a 4-Port Serial Module to a CSU/DSU



4-Port Serial Network Module LEDs

All network modules have an enable (EN) LED. This LED indicates that the module has passed its self-tests and is available to the router.

Each port on the 4-port serial network module also has the additional LEDs shown in [Figure 7](#) and described in [Table 7](#).

Figure 7 4-Port Serial Network Module LEDs

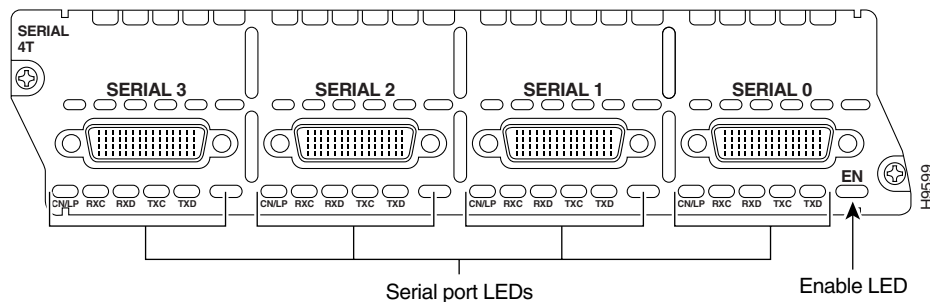


Table 7 4-Port Serial Network Module LEDs

LED	Meaning
CN/LP	In connect mode when green, in loopback mode when yellow
RXC	Receive clock
RXD	Receive activity
TXC	Transmit clock
TXD	Transmit activity

16- and 32-Port Asynchronous Serial Network Modules

This section provides information about the following network modules:

- 16-port asynchronous network module (NM-16A) (see [Figure 8](#))
- 32-port asynchronous network module (NM-32A) (see [Figure 9](#))

When used with corresponding octal cables, these modules provide 16 or 32 EIA/TIA-232 data terminal equipment (DTE) serial interfaces. Speeds up to 134.4 kbps are supported.

Figure 8 16-Port Asynchronous Network Module

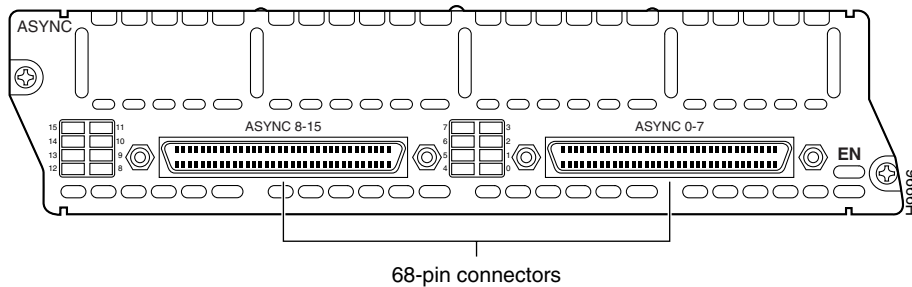
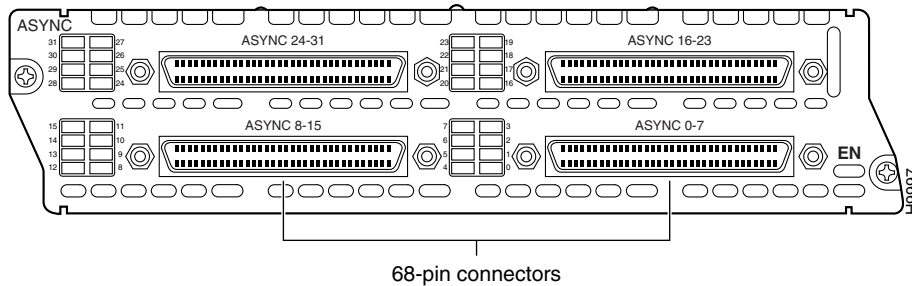


Figure 9 32-Port Asynchronous Network Module



Asynchronous Network Module LEDs

All network modules have an enable (EN) LED. This LED indicates that the module has passed its self-tests and is available to the router.

Each port on an asynchronous network module also has a green status LED to indicate that the port is connected to the network. These LEDs are grouped in blocks of eight to the left of each module and are labeled with the port numbers. (See [Figure 10](#) and [Figure 11](#).)

Figure 10 16-Port Asynchronous Network Module LEDs

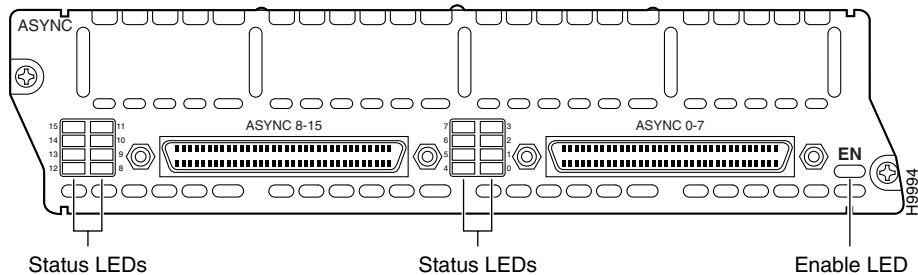
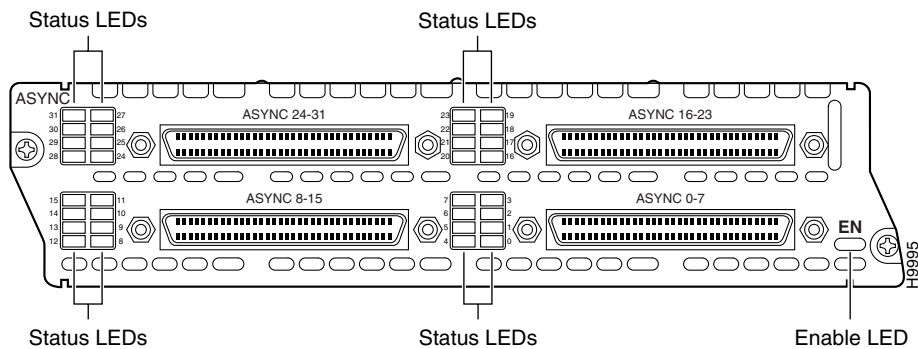


Figure 11 32-Port Asynchronous Network Module LEDs



4-, 8-, and 16-Port Asynchronous/Synchronous Serial Network Modules

This section provides information about the following network modules for Cisco modular routers:

- 4-port asynchronous/synchronous serial network module (NM-4A/S) (see [Figure 12](#)).
- 8-port asynchronous/synchronous serial network module (NM-8A/S) (see [Figure 13](#)).
- 16-port asynchronous/synchronous serial network module (NM-16A/S) (see [Figure 14](#)).



Note

The Cisco NM-16A/S network module uses a Cisco patented 12-in-1 Smart Serial cable.

With the appropriate serial transition cable, the ports on these modules can provide an EIA/TIA-232, EIA/TIA-449, V.35, X.21, EIA/TIA-530 DTE, or NRZ/NRZI serial interface. The NM-16 A/S network module can provide an EIA/TIA-530A DTE interface.



Caution

To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, connect the 8-port A/S serial network modules (NM-8A/S) and 16-port A/S serial network modules (NM-16A/S) only to intrabuilding or nonexposed wiring or cabling. The intrabuilding cable must be shielded and the shield must be grounded at both ends.

Figure 12 4-Port Asynchronous/Synchronous Serial Network Module

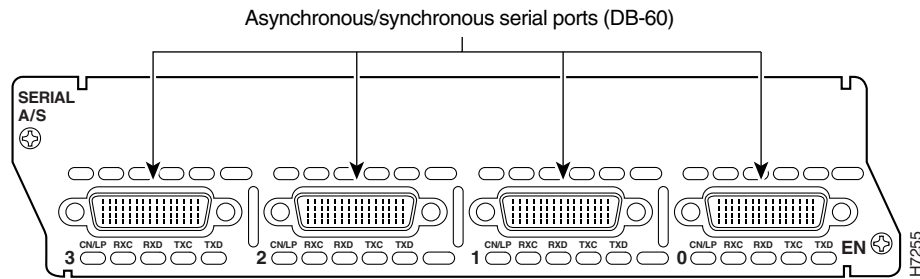


Figure 13 8-Port Asynchronous/Synchronous Serial Network Module

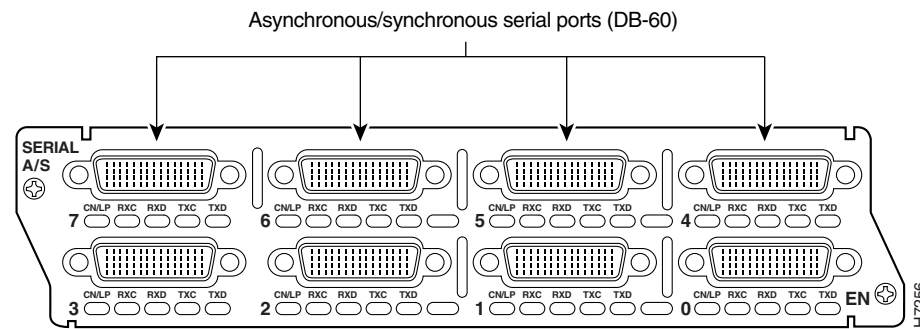
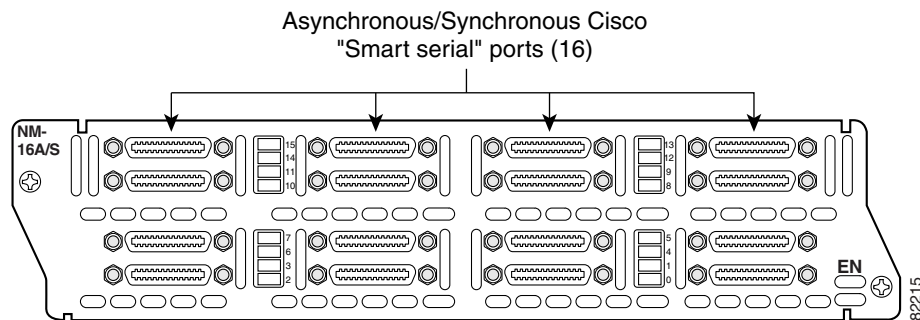


Figure 14 16-Port Asynchronous/Synchronous Serial Network Module



Asynchronous/Synchronous Serial Module LEDs

Figure 15 shows LEDs for the 4-port asynchronous/synchronous serial network module. Figure 16 shows LEDs for the 8-port asynchronous/synchronous serial network module. Figure 17 shows the LEDs for the 16-port asynchronous/synchronous serial network module.

Figure 15 4-Port Asynchronous/Synchronous Serial Network Module LEDs

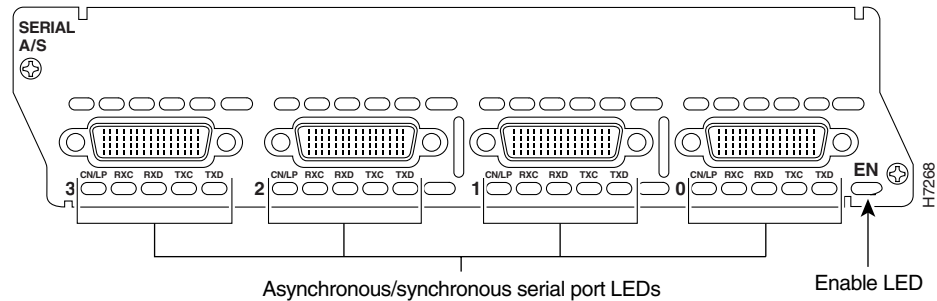
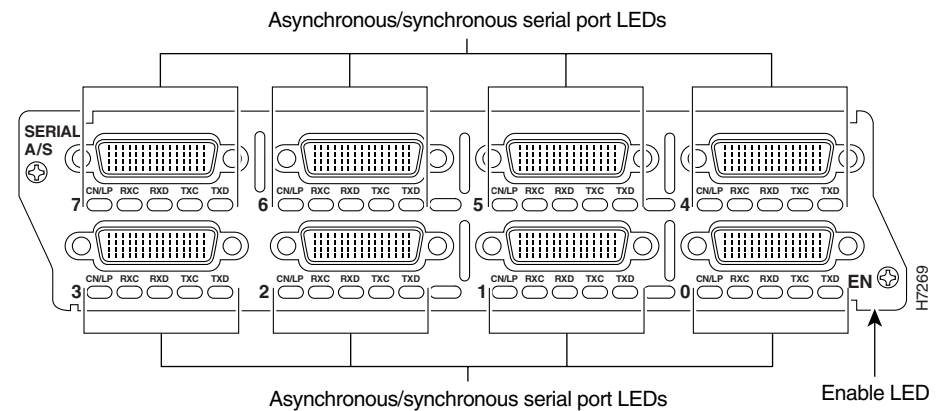


Figure 16 8-Port Asynchronous/Synchronous Serial Network Module LEDs

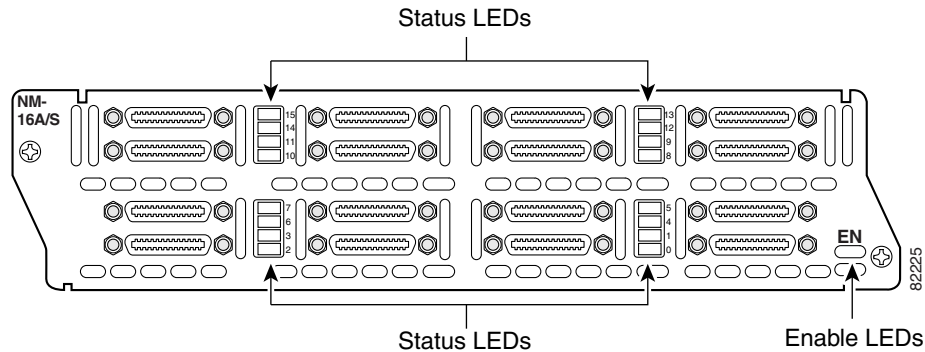


All network modules have an enable (EN) LED. This LED indicates that the module has passed its self-tests and is available to the router.

Each port on an asynchronous/synchronous serial network module also has the additional LEDs shown in Table 8.

Table 8 4- and 8-Port Asynchronous/Synchronous Serial Network Module LEDs

LED	Meaning
CN/LP	In connect mode when green, in loopback mode when yellow
RXC	Receive clock
RXD	Receive activity
TXC	Transmit clock
TXD	Transmit activity

Figure 17 16-Port Asynchronous/Synchronous Serial Network Module LEDs

The NM-16 A/S network module has LEDs that indicate the status of the port. When the LED is green, the physical port is in the up state. When the LED is yellow, the port is in loopback mode. (See [Table 9](#).)

Table 9 16-port Asynchronous Status LEDs and Enabled LEDs

Mode	LED Color	Meaning
DCE	Green	Data terminal ready (DTR) and request to send (RTS) are present.
DTE	Green	Data set ready (DSR), data carrier detect (DCD), and clear to send (CTS) are present.
Loopback	Yellow	The port is in loopback mode

Related Documents

For additional information, see the following documents and resources.

Related Topic	Document Title
Regulatory compliance and safety information	<i>Cisco Network Modules and Interface Cards Regulatory Compliance and Safety Information</i> http://www.cisco.com/en/US/docs/routers/access/interfaces/rcsi/IOHrcsi.html
Cisco IOS software website and reference documentation	<i>Cisco IOS Software</i> http://www.cisco.com/web/psa/products/index.html?c=268438303

Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and also recommended aliases and general Cisco documents, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>

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