MIO Port Cabling

This chapter describes how to cable the interface ports on Management I/O (MIO) or Management I/O Universal (UMIO) cards.

It includes the following sections:

Interface Ports

The interface ports are selectively enabled based on their functions in the system – management versus non-management.

Front Panel Ports

MIO/UMIO cards in slot 5 and slot 6 of the ASR 5500 chassis support the following twisted-pair copper management interface ports:

- one serial Console port (RJ45)

- two 1 Gigabit Ethernet ports (RJ45)

Daughter Card Ports

MIO/UMIO daughter cards support ten 10 Gigabit Ethernet ports each. The 10 GbE ports connect to other network devices via fiber optic cables that terminate on SFP+ transceivers. These ports support service traffic (non-management).

Figure 1: MIO/UMIO Ports
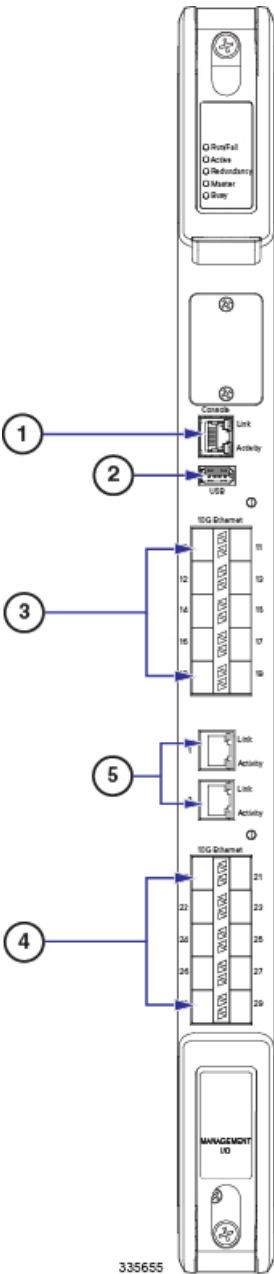
1	Console port [Port 3]	2	USB port
3	10 GbE ports, DC-1 [Ports 10 – 19]	4	10 GbE ports, DC-2 [Ports 20 – 29]
5	1 GbE ports (1000Base-T) [Ports 1 and 2]		

Port Status LEDs

Each of the MIO port interfaces is equipped with two status LEDs:

- **Link**: This green LED shows whether or not the line card is connected to the network. The LED is illuminated when the card is connected.

- **Activity**: This green LED shows when data is transmitted or received. The LED is illuminated or blinks when data is passing through the interface.

Figure 2: Link/Activity LEDs
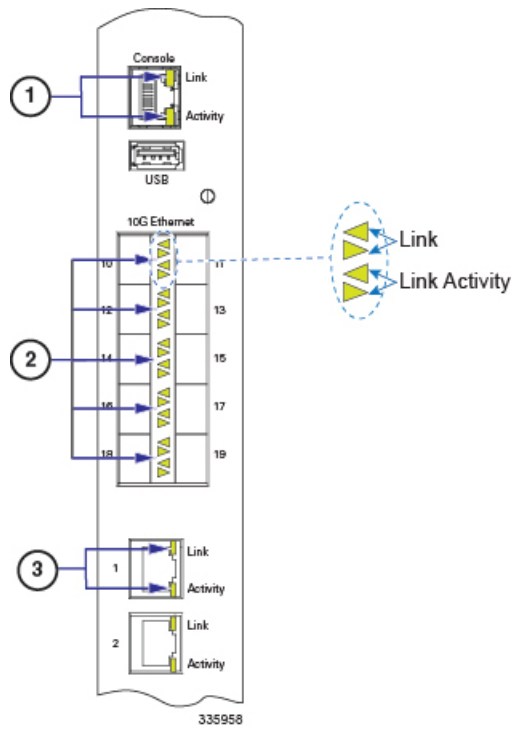
1	Link/Act. LEDs - Console port	2	Link/Act. LEDs - 10 GbE ports
3	Link/Act. LEDs - 1 GbE MGMT ports		

For the 10 GbE ports on each daughter card, the top two LEDs indicate Link status; the left/right arrows indicate for which port. The bottom two LEDs indicate Activity.

Cable Management System

If you have equipped your ASR 5500 chassis and MIO/UMIO cards with the Cable Management System, refer to the *Routing and Securing Network Cables* section of the *Cable Management System Installation* appendix for additional information.

Console Port

The Console port (logical Port 3) is an RJ45 RS-232 interface on an MIO or UMIO card that provides access to the command line interface (CLI). The interface communicates at 9600 to 115200 bps; the default is 115,200 bps.

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Important   A connection to the Console port is required if you wish to view boot messages whenever the ASR 5500 chassis is powered up or rebooted. Only the Console port on the Master MIO or UMIO supports logs and CLI sessions. The Console port on the Standby MIO or UMIO is inactive.

RJ45 Port Pinouts

Table 1: Console Port RJ45 Serial Pinout

Pin	Signal Description	Signal Type	Pinout
1	Not connected	—	
2	Not connected	—	
3	Receive Data (RX)	Input	
4	Signal Ground (SGND)	Not applicable	
5	Not connected	—	
6	Transmit Data (TX)	Output	
7	Not connected	—	
8	Not connected	—	

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Important   Hardware flow control is not supported and must be disabled on the connected equipment.

RJ45 to DB9 Adapter

An RJ45-to-RJ45 serial cable and an RJ45-to-DB9 adapter are supplied with each MIO/UMIO. The DB9 adapter is female. If you use the cable and adapter together, refer to the following figure and table for the cable pinout.
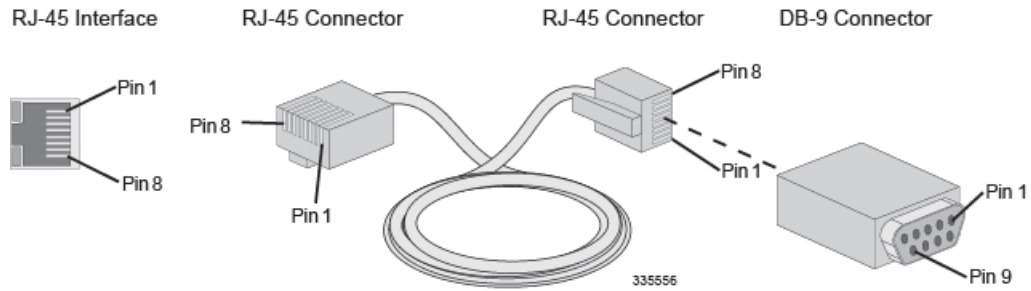
Figure 3: Console RJ45 Cable and DB9 Adapter

Table 2: Console RJ45 Cable to DB9Adapter Pinouts

Signal Description	Signal type	RJ45 Pin	DB9 Pin
Not connected	—	1	7
Not connected	—	2	4
Receive Data (RX)	Input	3	3
Signal Ground (SGND)	Ground	4	5
Not connected	—	5	8
Transmit Data (TX)	Output	6	2
Not connected	—	7	1
Not connected	—	8	6

USB to DB9 Adapter

A USB to Serial DB9 adapter is supplied with each MIO/UMIO. The DB9 connector on the adapter is male and can be used in conjunction with the Console RJ45 Cable and DB9 Adapter to connect a laptop or workstation to the RJ45 port on the MIO/UMIO.

Figure 4: USB to Serial DB9 Adapter

1	USB 1.1 Type B connector	2	DB9 connector (male)

Table 3: USB to DB9 Adapter - DB9 Pinouts

DB9 Pin	Signal Description	Signal type	Console Port
1	Data Carrier Detect (DCD)	Input	Unused
2	Receive Data (RX)	Input	TX
3	Transmit Data (TX)	Output	RX
4	Data Terminal Ready (DTR)	Output	Unused
5	Signal Ground (SGND)	Ground	Ground
6	Data Set Ready (DSR)	Input	Unused
7	Request To Send (RTS)	Output	Unused
8	Clear To Send (CTS)	Input	Unused
9	Ring Indicator (RI)	Input	Unused

This adapter provides a serial port on a laptop or workstation that does not have one. It draws power from the USB port.

Figure 5: USB to Console Port Interconnection
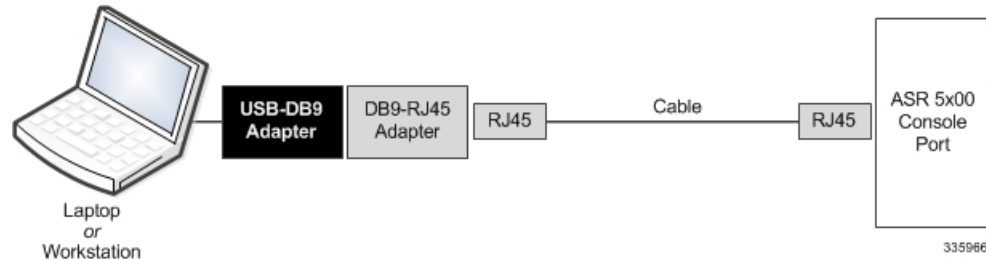
Connect Console Port to Workstation

You can connect the Console port to a workstation or a laptop with a serial port running a communications application, such as Minicom for Linux® or HyperTerminal® for Windows.

To connect a workstation to the Console port, do the following:

Step 1   Plug one end of an RJ45 cable to the port labeled Console on the MIO or UMIO.

Step 2   Plug the other end of the RJ45 cable into the DB9 adapter.

Step 3   Connect the DB9 end of the adapter into the serial port on the workstation.

Step 4   Configure the communications application on the workstation to support the following:

- Baud Rate = 115200 bps
- Data Bits = 8
- Parity = None
- Stop Bits = 1
- Flow Control = None

Connect Console Port to Terminal Server

You can connect the terminal server to a serial port on a terminal server.

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Important   The Console port does not support flow control signaling required by some types of terminal servers. Flow control must be disabled on the connected equipment.

To connect a terminal server to the Console port, do the following:

Step 1   Plug one end of an RJ45 cable to the port labeled Console on the MIO or UMIO.

Step 2   Plug the other end of the RJ45 cable into a port on the terminal server.

Step 3   Configure the communications protocol on the terminal server port to support the following:

- Baud Rate = 115200 bps
- Data Bits = 8
- Parity = None
- Stop Bits = 1
- Flow Control = None

Important   For additional information on connecting the Console port to Cisco servers equipped with asynchronous interface modules, refer to the *Console Port to Cisco Server Cabling* appendix.

Ethernet Management STP Ports

MIOs/UMIOs support two autosensing RJ45 10/100/1000Base-T (IEEE 802.3ab) Ethernet, shielded twisted-pair (STP) copper interfaces (logical Ports 1 and 2) for out-of-band system management access to the CLI.

Important   To comply with GR-1089 intra-building, lightning-immunity requirements and FCC Radiated Emissions Criteria, you must use STP cable and ensure that it is properly terminated at both ends.
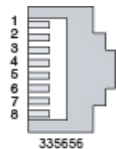
Caution   The 1000Base-T management ports are suitable for connection to intra-building or unexposed wiring or cabling only. These intra-building ports MUST NOT be metallically connected to interfaces that connect to the outside plant (OSP) or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 5) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

The ports support MDI and MDI-X connectors. Ethernet ports normally use MDI connectors and Ethernet ports on a hub normally use MDI-X connectors.

An Ethernet straight-through cable is used to connect an MDI to an MDI-X port. A cross-over cable is used to connect an MDI to an MDI port, or an MDI-X to an MDI-X port.

RJ45 Port Pinouts

Table 4: 1000Base-T RJ45 Ethernet Pinouts

Pin	100Base-T 100Mbps Cat5	1000Base-T 1Gbps Cat5+	Pinout
1	TX+	BI DA+	
2	TX-	BI DA-	
3	RX+	BI DB+	
4	—	BI DC+	
5	—	BI DC-	
6	RX-	BI DB-	
7	—	BI DD+	
8	—	BI DD-	

Connect 1000Base-T Interface to Network Device

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Important   To facilitate maintenance of the network cabling, the Cat-5 cables should be labeled with terminating destinations.

Step 1   Insert one end of the Cat-5 cable into the top MGMT connector (Port 1).

Step 2   Attach the other end of the Cat-5 cable to the appropriate network interface.

Step 3   Repeat Steps 1 and 2 to connect the bottom MGMT connector (Port 2).

10 GbE Optical Daughter Card Ports

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Caution   The 10 Gigabit Ethernet ports on the daughter cards are only certified to work with SFP+ transceivers tested and approved by Cisco. MIO and UMIO cards ship with SFP+ transceivers installed.

The 10 Gigabit Ethernet ports accept the following fiber optic to electrical signal Small Form-Factor Pluggable (SFP+) transceiver types:

  • 10GBase-SR – connects the port to a multi-mode fiber optic cable over relatively short distances (30.80 meters).

  • 10GBase-LR – connects the port to a single-mode fiber optic cable over a maximum distance of 10km.

The table below lists the signaling parameters supported for the above transceiver types.

Table 5: SFP+ Transceiver Parameters

SFP+ Transceiver Type	Parameter	Value
10GBase-SR	Maximum transmit level	-1.0dBm
	Minimum transmit level	-7.3dBm
	Maximum receive level	-1.0 dBm (saturation average power)
	Minimum receive level	-11.1 (sensitivity average power)
10GBase-LR	Maximum transmit level	0.5 dBm
	Minimum transmit level	-8.2 dBm
	Maximum receive level	0.5 dBm (saturation average power)
	Minimum receive level	-12.6 (sensitivity average power)

Fiber Optic Bend Radius Guidelines

When a fiber cable is bent excessively, the optical signal within the cable may refract and escape through the fiber cladding. Bending can also permanently damage the fiber by causing micro cracks, especially during cable installation due to pulling forces. The result is known as bend loss: a loss of signal strength that may compromise the integrity of the data transmission.

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Caution   To avoid damaging the fiber optic cable, the cable connector, or the optical interface, do not install or remove fiber optic transceivers with fiber-optic cables attached. Disconnect all cables before removing or installing a transceiver.

Recommended Bend Radius

ANSI/TIA/EIA-568B.3, "Optical Fiber Cabling Components Standard," specifies minimum bend radius standards and maximum pulling tensions for 50/125-micron and 62.5/125-micron fiber-optic cables. Those recommendations include:

  • 1 inch (2.54cm) under no pull load.

  • 2 inches (5.08cm) when subject to tensile loading up to the rated limit.

For inside plant cable other than two- and four-fiber, the standard specifies:

- 10 times the cable's outside diameter under no pull load

- 15 times the cable's outside diameter when subject to tensile load.

There are two types of bend radii:

- The dynamic bend radius is the tightest recommended bend while installing cable at the maximum rated tension. It is the larger of the two specified bend radii (see figure below). Throughout the pull, the minimum bend radius must be strictly followed. If a location exists in the middle of a run where a relatively tight bend is unavoidable, the cable should be hand-fed around the bend or a pulley can be used.

- The static bend radius is the tightest recommended bend while the cable is under a minimum tension. It is the smaller of the two specified bend radii. After the pull is complete, the cable can be bent more tightly to fit into existing space, but not to exceed the long term minimum bend radius.

Always follow the manufacturer's guidelines for minimum bend radius and tension. Failure to do so may result in high attenuation (macrobends) and possible damage to the cable and fiber. Guidelines are normally supplied with the cable manufacturer specification sheets. If the bend radius specifications are unknown, the recommendation is to maintain a minimum radius of 20 times the diameter of the cable.

Figure 6: Recommended Fiber Optic Bend Radii
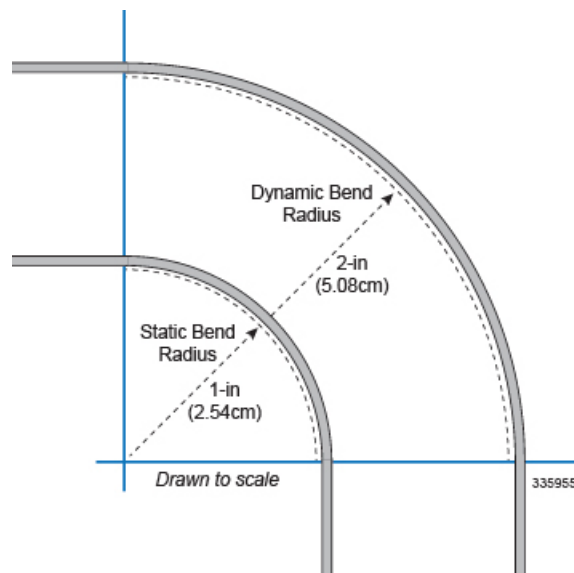
Bend-Insensitive Multimode Fiber

An alternative for maintaining tighter than recommended bend radii is use of Bend-Insensitive Multimode Fiber (BIMMF). BIMMF is more impervious to bend loss than standard 50-micron multimode fiber (MMF) cable.

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Important   BIMMF cables are only optimized for 850nm wavelengths and <u>not</u> for 1300nm wavelengths.

BIMMF is structurally the same as standard MMF cable but there is an added layer of glass between the core and the cladding. This layer of glass has a much lower refractive index than the cladding.

Bend-insensitive 50-micron MMF cable is full backwards compatible with existing 50-micron MMF and fully compliant with OM2, OM3 and OM4 standards.

Fiber Optical Connections

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Caution The SFP+ transceiver modules are static sensitive devices. Always use an ESD wrist strap or similar individual grounding device when coming into contact with SFP+ modules.

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Caution Before connecting fiber optic cables, press each module into the slot firmly with your thumb to reseat them.

Removing Dust Plugs

Before removing the dust plugs and making any optical connections, observe the following guidelines:

- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.

- Always inspect and clean the LC connector end-faces just before making any connections. See Cleaning Fiber Optic Connectors, on page 13.

- Always grasp the LC connector housing to plug or unplug a fiber-optic cable.

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Important To facilitate maintenance of the network cabling, all fiber optic cables should be labeled with terminating destinations.

Connecting Fiber Optic Cables

Step 1 Remove the dust plug from the network interface LC connector of the SFP+ module. Save the dust plug for future use.

Step 2 Inspect and clean the LC connector's fiber-optic end-faces.

Step 3 Insert the duplex LC/PC connector on the network cable into the duplex port on the module.

Step 4 Attach the other end of the network fiber-optic cable to the network device that you want to connect.

Step 5 Repeat Step 1 through Step 4 for the remaining ports on the daughter card.

Step 6 Repeat Step 1 through Step 4 for ports on the second DC.

Cleaning Fiber Optic Connectors

Fiber optic connectors join optical fibers together. They can be damaged by improper cleaning and connection procedures. Dirty or damaged fiber optic connectors can degrade communication.

In a fiber optic system, light is transmitted through extremely small fiber cores. Because fiber cores are often 62.5 microns or less in diameter, and dust particles range from a tenth of a micron to several microns in diameter, dust and any other contamination at the end of the fiber core can degrade the performance of the connector interface where the cores meet. Therefore, the connector must be precisely aligned and the connector interface must be absolutely free of foreign material.

Connector loss, or insertion loss, is a critical performance characteristic of a fiber optic connector. Return loss is also an important factor. Return loss specifies the amount of reflected light: the lower the reflection, the better the connection. The best physical contact connectors have return losses of better than −40 dB, but −20 to −30 dB is more common.

The connection quality depends on two factors: the type of connector and the proper cleaning and connection techniques. Dirty fiber connectors are a common source of light loss. Keep the connectors clean at all times, and keep the dust plugs or covers installed when the connectors are not in use.

As a general rule, any time you detect a significant, unexplained loss of light, clean the connectors. To clean the optical connectors, obtain and use a fiber optic cleaning kit and follow the manufacturer's usage instructions. Clean the ferrule, the protective tube or cone that surrounds the fiber core, and the end-face surface of the fiber core.

If a cleaning kit is not available, follow these steps:

1 Use a lint-free tissue soaked in 99 percent pure isopropyl alcohol and gently wipe the end-face of the fiber core. Wait for five seconds for the surfaces to dry and wipe the surfaces a second time.
2 Use clean, dry, oil-free compressed air to remove any residual dust from the connector.
3 Use a magnifying glass or inspection microscope to inspect the ferrule at angle. Do not look directly into the aperture. If you detect any contamination, repeat Steps 1 and 2.

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Caution   Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.