

Cisco Catalyst IR8140 Heavy Duty Router Installation Guide

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Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

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- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
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Preface

This preface describes the objectives, audience, organization, and conventions of this guide and describes related documents that have additional information.

The preface contains these sections:

- Objective, on page ix
- Audience, on page ix
- Conventions, on page ix
- Related Documentation, on page x
- Communications, Services, and Additional Information, on page x

Objective

This guide provides an overview of the Cisco Catalyst IR8140 Heavy Duty Router (hereafter called the router or IR8140H) and explains how to install and make connections to the router.

Audience

This guide is intended for people who have a high level of technical ability, although they may not have experience with Cisco software.

Conventions

This section describes the conventions used in this guide.

Note Means reader take note. Notes contain helpful suggestions or references to additional information and material.

Caution This symbol means reader be careful. In this situation, you might do something that could result in equipment damage or loss of data.

Tip Means *the following information will help you solve a problem* . The tip information might not be troubleshooting or even an action, but could be useful information.

Warning Means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device.

Related Documentation

All of the IR8140H documentation can be found online at:

- Product Page

  https://www.cisco.com/c/en/us/support/routers/catalyst-ir8100-heavy-duty-series-routers/series.html

- Datasheet:

  https://www.cisco.com/c/en/us/products/collateral/routers/catalyst-ir8100-heavy-duty-series-routers/nb-06-cat-ir8140-hd-ser-rout-ds-cte-en.html

- Regulatory Compliance and Safety Information:

  https://www.cisco.com/c/dam/en/us/td/docs/IIOT/compliance/routers/rcsi-0249-book.pdf

- Software Configuration Guide:

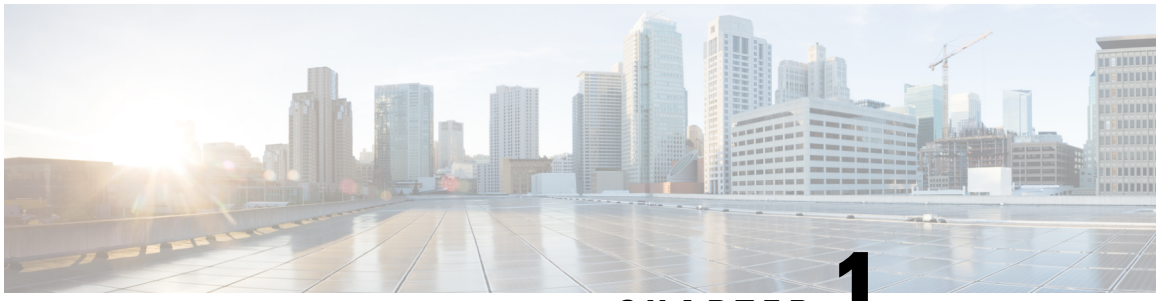
  https://www.cisco.com/c/en/us/td/docs/routers/access/ir8140/b_ir8100-config-guide.html

Communications, Services, and Additional Information

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
- To get the business results you're looking for with the technologies that matter, visit Cisco Services.
- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco DevNet.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.

Cisco Bug Search Tool

Cisco Bug Search Tool (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.



CHAPTER 1

Cisco Catalyst IR8140H Router Hardware Description and Specifications

This chapter describes the major hardware features of the Cisco Catalyst IR8140H Heavy Duty Router (henceforth referred to as router or IR8140H in this document), including the chassis, internal and external connectors and ports, and hardware specifications.

These topics are discussed:

- Cisco Catalyst IR8140H Router Overview, on page 1
- Router Hardware Overview: Exterior, on page 2
- Operating Range, on page 12
- Accessories, on page 12
- Port Pinouts, on page 14

Cisco Catalyst IR8140H Router Overview

The Cisco Catalyst IR8140H router is a ruggedized communication platform designed for use in Field Area Network (FAN) power distribution grids that require outdoor, pole-mounted routers. The FAN is a distribution system in which power generation and transmission are linked to the power consumers.

The router provides an end-to-end communication network that enables increased power grid efficiency and reliability, reduced energy consumption, and reduced greenhouse gas emissions. The router can be leveraged across applications, including:

- Smart transportation and roadways
- Advanced Metering Infrastructure (AMI)
- Distribution Automation (DA)
- Integration of Distributed Energy Resources (DER)
- Remote Workforce Automation
- Smart Lighting

The router provides reliable and secure real-time communication between the FAN systems and the numerous devices that exist in the FAN, including meters, sensors, protection relays, Intelligent Electronic Devices (IEDs), plug-in electric vehicle (PEV) charging stations, and distributed solar farms. Network data is forwarded

and processed over secure communication links between devices within the distribution grid for local decision processing.

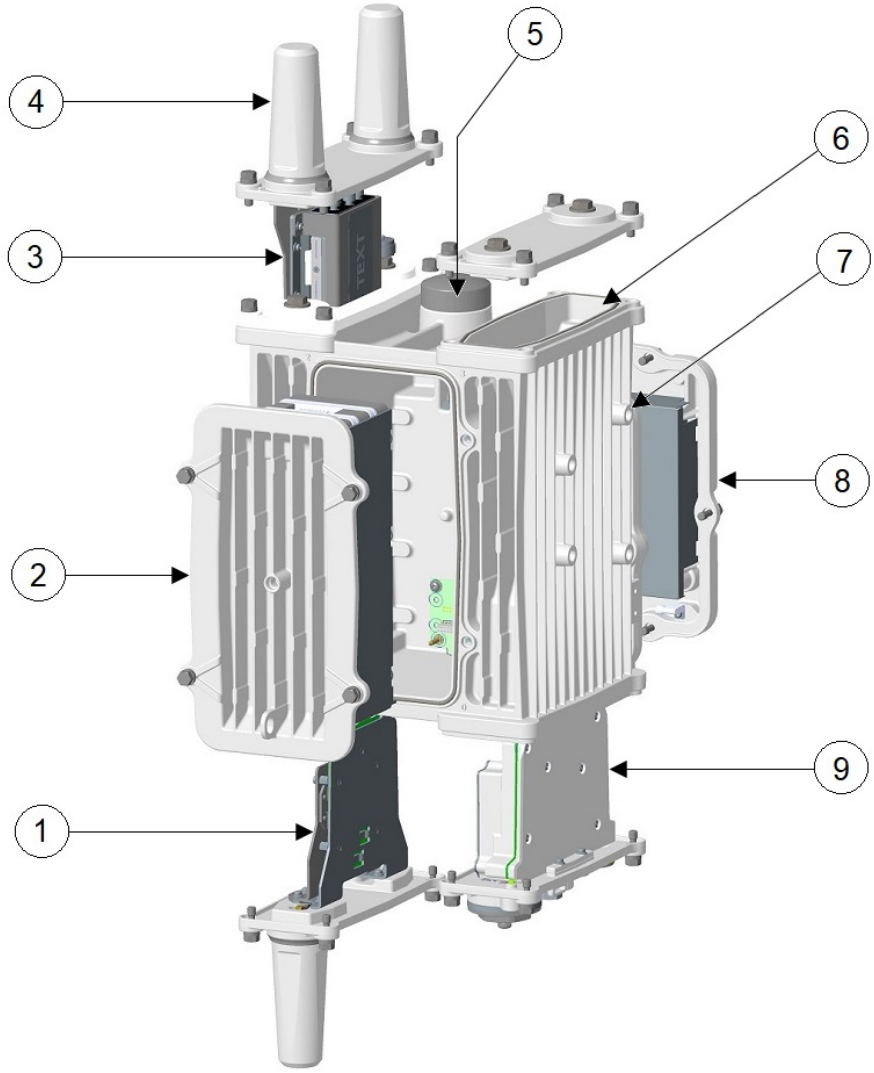
Router Hardware Overview: Exterior

The IR8140H is an IP67 industrial router for outdoor use. It comprises of a base modular platform with four module slots. One of the four IR8140H modules is larger than the other three and is referred to the super slot and is identified as Slot 0. This super slot is reserved for the CPU module. It faces downward in the IR8140H as shown in the following figure. The other three slots support Universal Interface Modules (UIMs).



Note Do not leave module slots unsealed because it can damage the router when exposed to the elements outdoors. We recommend that you use a slot cover when the module is not populated. See Accessories, on page 12.

Figure 1: IR8140H with Component Labeling



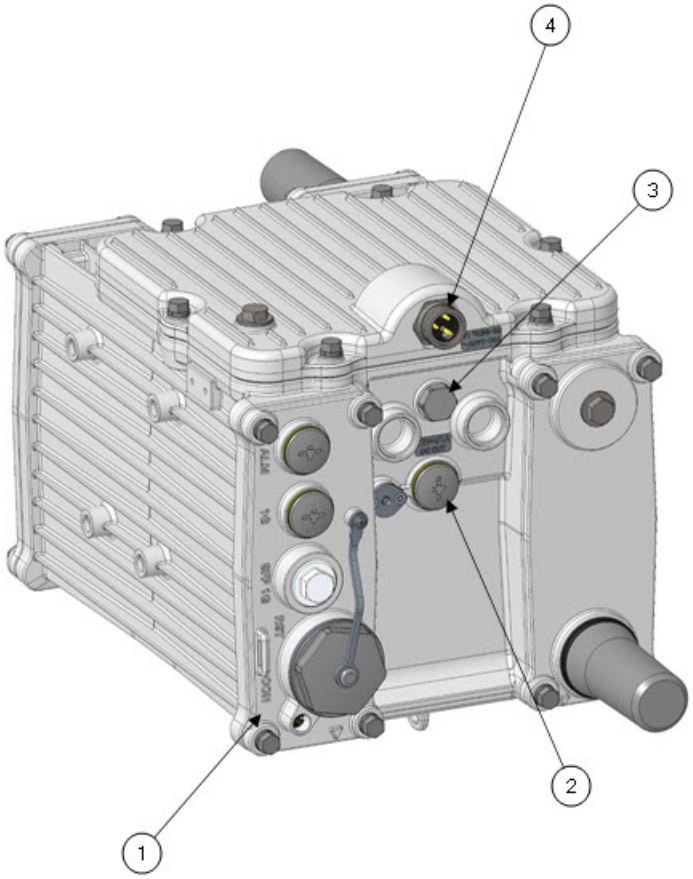
The following table provides a summary of all the modules and power supplies supported on the IR8140H shown in the figure above.

Table 1: Cisco Catalyst IR8140H Components

Item No.	Description
1	Industrial Router Module Heavy Duty with one antenna, for example, a IRMH-WPAN module.
2	Battery Backup Unit (BBU) Module. Up to three BBUs can be stacked in the enclosure.

Item No.	Description
3 and 4	Universal Interface Module (UIM) with two antennas (3). The antenna (4) is part of the module. The UIM slots that are available for industrial router modules that provide connectivity to Neighborhood Area Networks (NAN) endpoints and to the WAN for connectivity to the utility control center. IR8140H supports the following UIMs: • IRMH-WPAN module (WPAN Module. Normally installed in the downward facing slot: slot 1) **Note** From Cisco IOS XE Release 17.7.1, you can install two WPAN modules to the chassis. If you want to install two WPAN modules, install one module in slot 1, and the other in slot 2 or 3. • IRMH-LTE module (LTE Module. Normally installed in one of the upward-facing slots: slot 2 or slot 3) • IRMH-LTEA module (LTE Advanced Module. Normally installed in one of the upward-facing slots: slot 2 or slot 3) • IRMH-5GS6-GL module (4G LTE / 5G FR1 Module. Normally installed in one of the upward-facing slots: slot 2 or slot 3) **Note** The IRMH-5GS6-GL module is supported on IR8140H from Cisco IOS XE Release 17.8.1. You can install only one IRMH-5GS6-GL module in the chassis. • IRMH-LTE7-NA-900 and IRMH-LTE7-EAL (LTE CAT7) modules are supported on Cisco IOS XE Release 17.17.1 and later. • IRMH-5GR16SA (5G FR1) module is supported on Cisco IOS XE Release 17.17.1 and later.
5	GNSS/GPS antenna. Identifies the router location after it is installed and is in use. The GNSS/GPS antenna provides accurate time and location information to the system.
6	Empty Universal Interface Module (UIM) slot with cover elevated. By default, the cover is attached unless a module is installed in the IR8140H chassis.
7	4 x Mounting posts (M8)
8	Power supply
9	CPU module provides processing power for the IR8140H modules and provides two Gigabit Ethernet connections to the backhaul network and other IP network devices. The CPU module is installed in slot 0 and it is the largest module slot. It is found at the bottom of the IR8140H.

Figure 2: Bottom View of the IR8140H with Cable Port Seals



Item No.	Description
1	CPU module. The CPU module provides processing power for the IR8140H modules and provides two Gigabit Ethernet connections to the backhaul network and other IP network devices. The CPU module is installed in slot 0, which is the largest module slot. It is found at the bottom of the IR8140H. The CPU module includes the following items: • Console Port - CON • Reset Button - RST • SSD Module - SSD • Alarm Port - ALM • SFP Gigabit Ethernet- SFP 1G • SYS LED • 10/100/1000 RJ45 Ethernet - 1G You must remove the plugs on the bottom of the CPU module to access the items listed above. • See Figure 1: IR8140H with Component Labeling, on page 3 and Figure 2: Bottom View of the IR8140H with Cable Port Seals, on page 5 to view the location of the CPU module in the IR8140H chassis. • See Checking the System (SYS) LED, on page 78 to view the system LED states.
2	12VDC_OUT/1A port covered by cable port seal to power an external device. Available only when Power-over-Ethernet (PoE) is *not in use*.
3	Pressure vent. The vent relieves the pressure build up inside the router chassis that can be caused by changing temperatures in the router installation environment. The vent also protects the router interior from dust, dirt, water, and other environmental elements.
4	AC power input with a 7/8” 3-pin circular AC power connector.

For an illustration of cable port seals, see Figure 8: PG13 Plug: Cable Port Seal, on page 14.

The following figure shows the CPU module with covers off all components.

Figure 3: CPU Module with Covers Off All Components (Front Faceplate View of CPU Module)

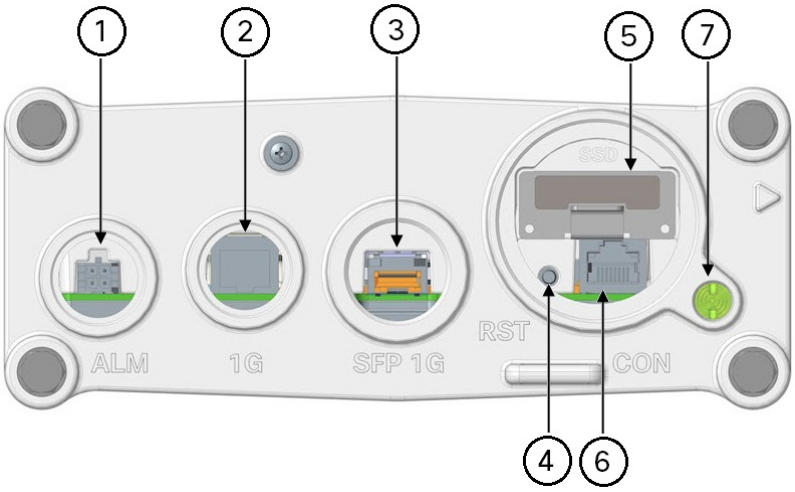
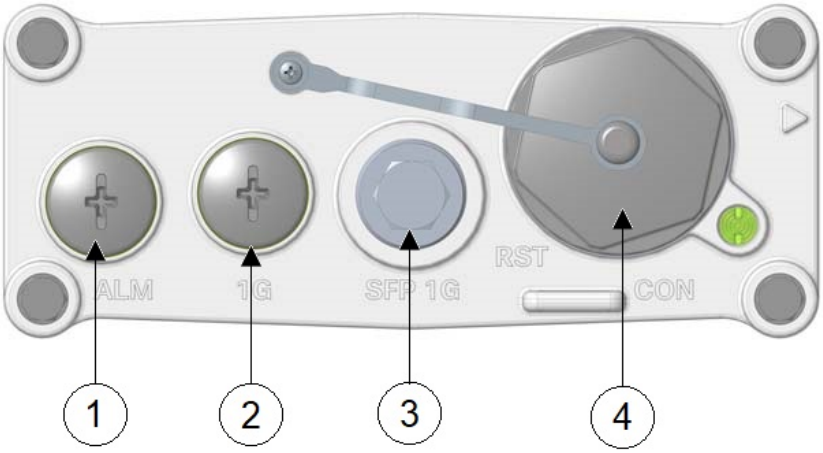


Table 2: Description of CPU Module Components (Left-to-Right)

Item No.	Item	Description
1	ALM	Alarm port with Micro-fit 4P connector
2	1G	10/100/1000 Mbps Ethernet port
3	SFP 1G	SFP One Gigabit Ethernet
4	RST	Reset button
5	SSD	SSD module (optional)
6	CON	Console port (accessible when plug is removed)
7	LED	SYS LED See SYS LED States to view the system LED states.

The following figure shows the CPU module with covers over all components.

Figure 4: CPU Module with Covers Over All Components



Item No.	Item
1	Alarm port covered by PG13 plug **Note** To remove alarm port plug, use #3 Phillips bit.
2	Ethernet port covered by PG13 plug **Note** To remove Ethernet port plug, use #3 Phillips bit.
3	SFP port covered by 3/4 NPT plug **Note** To remove the SFP port plug, use the 5/8" 6 Pt socket driver.
4	Reset button and console port covered by M42 plug **Note** To remove M42 plug, use an adjustable wrench that spans to 1 3/8".

The following figure shows the bottom view of the router.

Figure 5: Bottom View of IR8140H Without Cable Seals

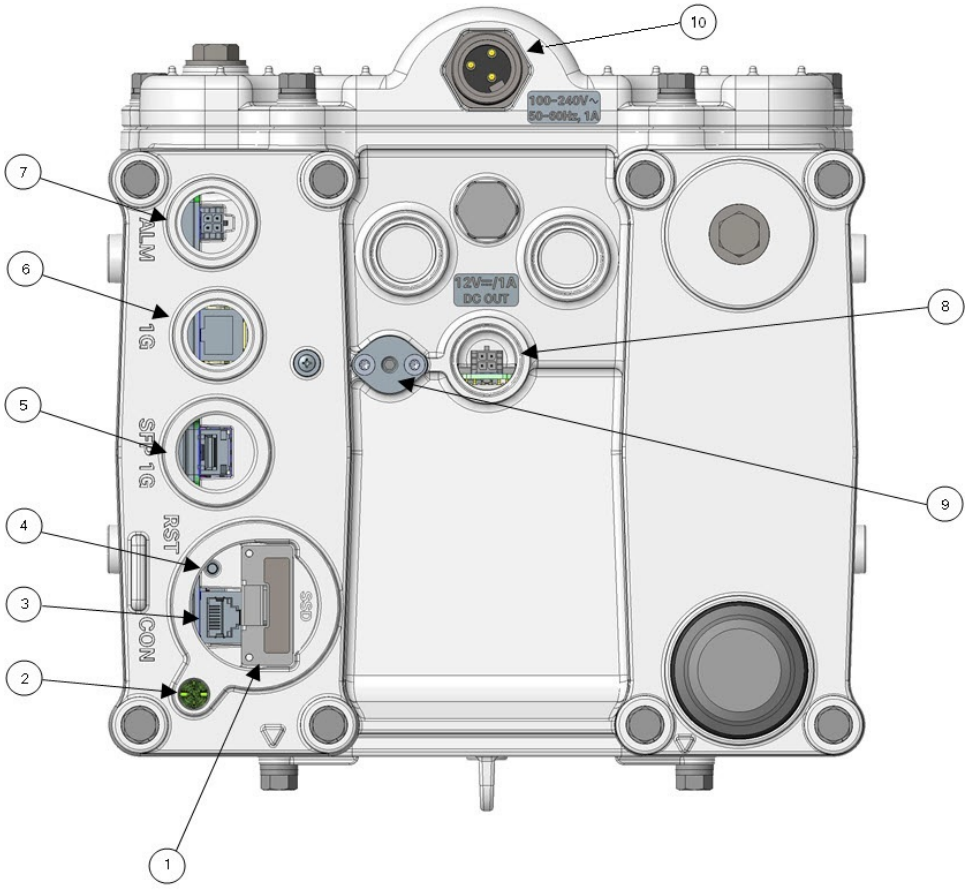


Table 3: Components at the Bottom of IR8140H Without Cable Port Seals

Item No.	Hardware Feature	Item No.	Hardware Feature
1	SSD module	6	One Gigabit Ethernet (1G) with PG13 port
2	LED See SYS LED States to view the system LED states.	7	Alarm port with PG13 port
3	Console port (accessible when plug is removed)	8	12VDC/1A DC output
4	Reset button	9	BBU locking screw

Item No.	Hardware Feature	Item No.	Hardware Feature
5	Small form-Factor Pluggable (SFP) 1G SFP 1G module can be installed or removed while the router is on and operating normally. See Connecting the SFP Port, on page 83 for instructions on how to install and remove an SFP module from the CPU module.	10	AC power input—Hexagonal 7/8" 3-pin circular connector

The following table provides the IR8140H hardware features.

Table 4: IR8140H Hardware Features

Hardware Feature	Description
CPU Module: Quantity of one (1)	The CPU module provides processing power for the IR8140H modules, and two Gigabit Ethernet connections to the backhaul network and other IP network devices. The CPU module is installed in slot 0, which is the largest module slot. It is found at the bottom of the IR8140H. You can access the following ports and connectors when you remove the plugs found at the bottom of the CPU module, as seen in Figure 5: Bottom View of IR8140H Without Cable Seals, on page 9. • ALM: Alarm port for use with PG13 cable gland (Figure 7: Cable Gland, on page 13). • 1G: 10/100/1000 Mbps Ethernet port for use with PG13 cable gland. This port provides up to 15 W of PoE PSE output power (only available with IR8140H-P-K9 SKU). • SFP 1G: One Gigabit Ethernet SFP socket. **Note** Requires an SFP adapter kit, if you want to cable it. • RST: Reset button covered by M42 plug • CON: Console Port (RJ45): Accessible when M42 plug is removed.

Hardware Feature	Description
Universal Interface Module (UIM) slots, Quantity of three (3) slots	The three Universal Interface Module (UIM) slots are available for ruggedized industrial router modules that provide connectivity to Neighborhood Area Networks (NAN) endpoints and to the WAN for connectivity to the utility control center. IR8140H supports the following UIMs: • IRMH-WPAN module • IRMH-LTE module • IRMH-LTEA module • IRMH-5GS6-GL module • IRMH-LTE7 module • IRMH-5GR16SA module
Management interface	An RJ-45 console port on the CPU module provides local access to the router for management and administration tasks. Accessible when the plug is removed.
N-type female connectors	Allows direct connection of an antenna or cable to the IR8140H.
60W Power Supply Unit (PSU) Board	Found at the back of the IR8140H. **Note** The power supply can be replaced in the field. However if the router is installed on a pole, the IR8140H must first be removed from the pole to swap the power supply. Also, BBU must be disabled before swapping the power supply. The Power over Ethernet-enabled (PoE-enabled) PID (IR8140H-P-K9) allows up to 15-W PoE output power.
Battery Backup Unit (BBU)	Up to three BBUs can be installed in an IR8140H. The BBUs are stacked upon one another in the module assembly in which they reside. When you install three BBUs, up to eight hours of battery backup power is available on a fully-loaded system if there is an AC power failure. BBUs can be replaced in the field. BBUs are found in the center-front of the IR8140H.
12VDC_Out	Provides 12 VDC/1A to power an external device. The power option is only available when PoE is not in use.
Small form-Factor Pluggable (SFP)	SFP modules can be installed or removed while the router is on and operating normally. See Connecting the SFP Port, on page 83 for instructions on how to install and remove an SFP module from the CPU module.
GNSS/GPS	An integrated GNSS receiver provides accurate time and location information to the system.
Mounting Bracket Kit	Includes mounting hardware for the IR8140H.

Hardware Feature	Description
Optional Items (To Be Ordered Separately)	
Pole-mount kit	Includes the following equipment to support installation of the IR8140H on a pole: • Mounting plate • Two clamp brackets • Required hardware
Band strap kit	Two steel straps and band strip kit
Strap tool kit	BAND-IT strap tool
Antenna plug	IR-ANT-PLUG
Cable gland	IR-IP67GLAND
Fiber kit	Cable Extender and Cable Gland (AIR-ACC15-SFP-GLD=)
Module slot cover	IRMH-BLANK

Operating Range

IR8140H can operate in a temperature range of -40°C to +70°C.

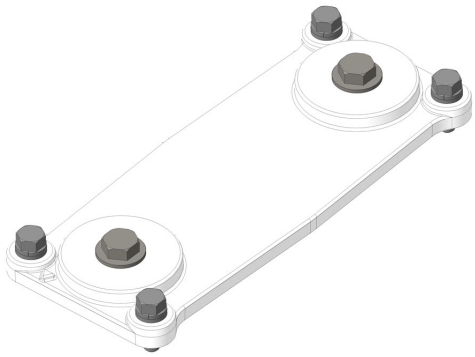
Accessories

Module Slot Cover

The following figure shows an illustration of the slot cover you can use to cover empty IR8140H module slots. You should always cover an empty module slot to prevent damage to a system that is exposed to the elements.

Note Slot covers are ordered separately.

Figure 6: Module Slot Cover



Cisco Product ID
IRMH-BLANK

Cable Glands

A cable gland (also known as a cable connector) is required to install cables in the CPU Alarm and Ethernet ports and the Chassis 12VDC_OUT port. Use a compatible cable gland to attach and secure the end of a cable to the router. The cable gland provides cable strain relief and seals the cable entry into the router chassis to prevent damage to the router interior.

Note Cable glands must be ordered separately. Note that the following figure might not be an exact depiction of the latest version of the cable gland.

Figure 7: Cable Gland



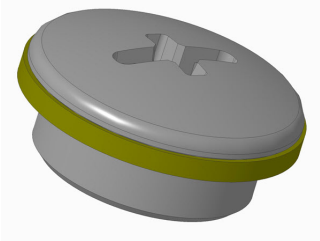
Table 5: Supported Cisco Cable Port Seal

Cisco Product ID
IR-IP67GLAND

Cable Port Seals

Unused CPU (Alarm and Ethernet) and Chassis 12VDC_OUT ports must be sealed with a liquid-tight cover (PG13) cable port seal to protect the router interior from environmental elements.

Figure 8: PG13 Plug: Cable Port Seal



Note The cable port seals come with the chassis, and cannot be orderable separately.

Caution Do not install the router unless all the unused chassis cable ports are sealed. Leaving chassis ports unsealed might damage the router.

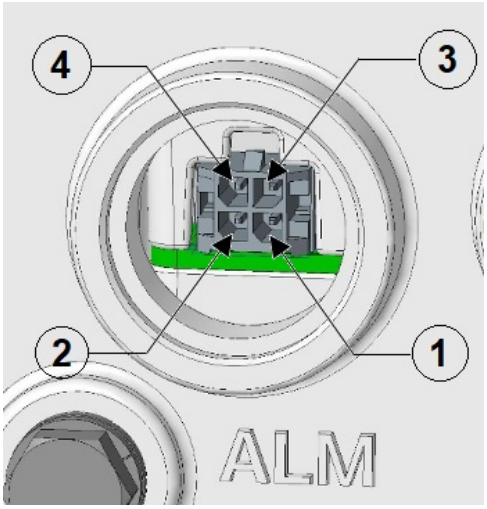
Port Pinouts

The following sections provide information about alarm port and DC Out port pinouts.

Alarm Port

The following figure shows the alarm port and pinouts.

Figure 9: Alarm Port



Pin	Description
Pin 1	Alarm Input/Output #1

Pin	Description
Pin 2	Alarm Input/Output #2
Pin 3	Alarm Common #1
Pin 4	Alarm Common #2

Note Pins 3 and 4 are tied together at the router, but are isolated from ground.

The following figure shows a mating connector: Micro-Fit 3.0™ Receptacle Housing.

Figure 10: Mating Connector

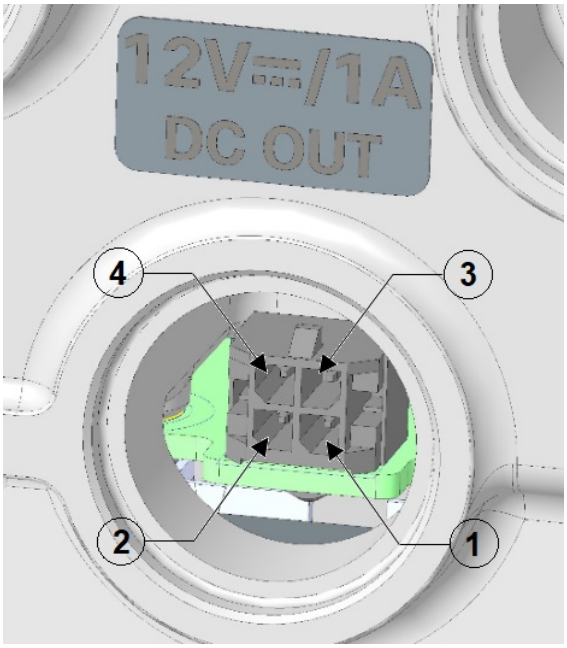


1	Pin 1	3	Pin 3
2	Pin 2	4	Pin 4

12V/1A DC Out Port

The following figure shows the 12V/1A DC Out port and pinouts.

Figure 11: 12V/1A DC Out Port



Pin	Description
Pin 1	+12 V Output pin
Pin 2	Ground pin
Pin 3	Cable_Present_L Input pin) **Note** External 12 V DC Out Cable should ground this pin 3 to pin 4 directly so that the router detects that the cable is inserted (present).
Pin 4	Ground pin

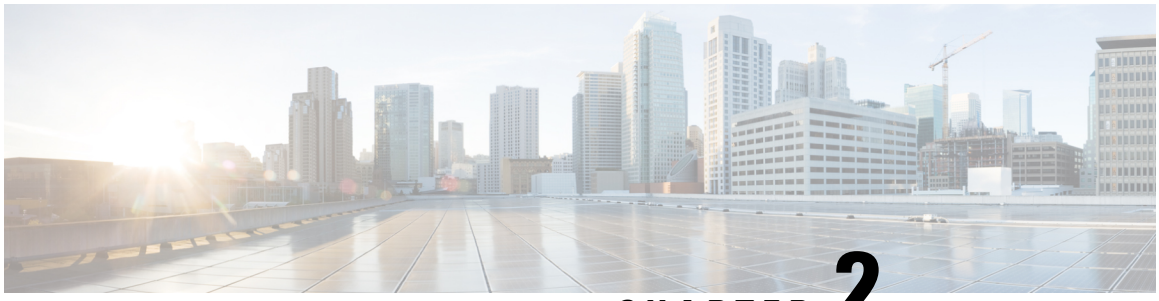
The power connector housing is installed on the router power harness for connection to an external, non-Cisco module. The following figure shows a mating connector: Micro-Fit 3.0™ Receptacle Housing.

Figure 12: Mating Connector



1	Pin 1	3	Pin 3

2	Pin 2	4	Pin 4



CHAPTER 2

Unpacking the Router

This chapter contains these sections:

- Unpacking the Router, on page 19
- Package Contents, on page 19
- Supported Modules and Interfaces, on page 21

Unpacking the Router

This chapter includes instructions about how to unpack the IR8140H and describes the items that ship with the router.

Note When you unpack the router, do not remove the foam blocks attached to the antennas and antenna connectors until you install the router. The foam protects the antennas and connectors during installation.

To unpack the router:

Procedure

Step 1 Open the shipping container and carefully remove the contents.

Step 2 Return all the packing material to the shipping container, and save it.

Step 3 Ensure that all the items listed in Package Contents, on page 19 are included in the shipment. If any item is damaged or missing, notify your authorized Cisco sales representative.

Package Contents

The following table lists the items that are shipped with your router.

Table 6: IR8140H Package Contents

Qty.	Item	Description

1	Cisco IR8140H	Router enclosure with the following components installed:
		• Power supply (100 to 240 VAC, 60 W output) attached to the back of the IR8140H. Power supply converts AC input voltage to 12V DC output voltage for the router (+/- 10 percent) and input frequency 60Hz and 50Hz (+/- 5 percent)
		• Up to three plug-in UIMs installed with the following two supported module types (slots 1, 2, and 3):
		  • IRMH-WPAN module
		  • IRMH-LTE module
		• CPU module (reserved Slot 0, bottom of the unit)
		• On-board GNSS receiver with pre-installed antenna
		• N-type connector for direct mount of outdoor antennas
		• Battery Backup Units (BBUs), 0 to 3 depending on the configuration ordered

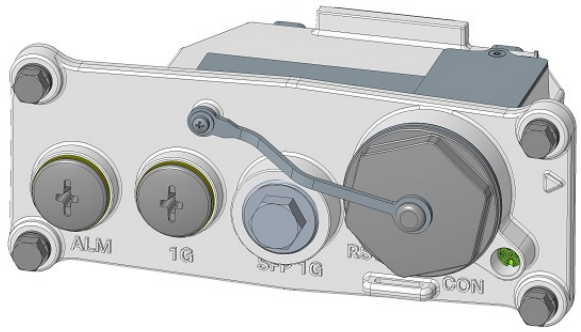
1	Console cable	RJ-45 to DB-9
1	Grounding kit	Grounding lug and two screws
1	Mounting Bracket Kit	Includes: • Mounting bracket • Required hardware
Optional Items (Ordered Separately)		
1	Pole mount kit	Includes: • Mounting plate • Two clamp brackets • Required hardware
1	Band strap kit	Two steel straps
1	Strap tool kit	BAND-IT strap tool
1	Antenna plug	IR-ANT-PLUG

Qty.	Item	Description
1	Cable glands kit	Includes: • One cable gland (more can be ordered) • One tube of antiseize compound
1	Fiber Adapter Kit	Includes: • Cable extender • Cable gland
3	Module slot cover	IRMH-BLANK

Supported Modules and Interfaces

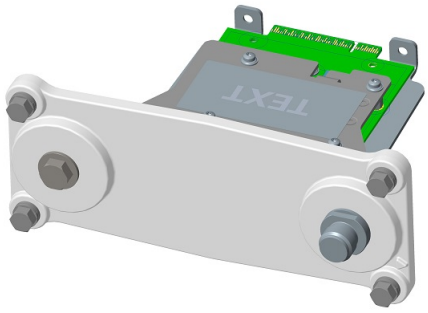
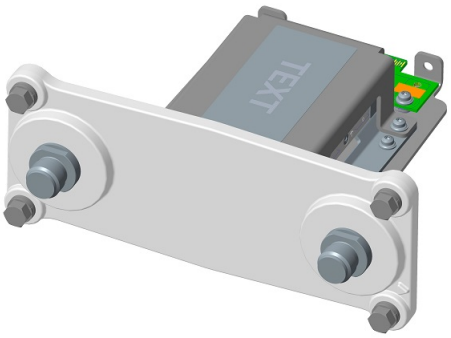
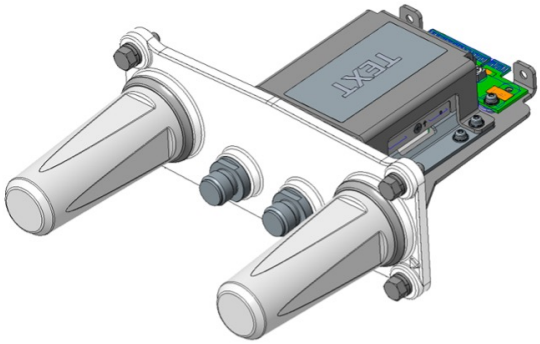
The Supervisor module serves as the CPU for the industrial router and is installed at the bottom of the router in the super slot.

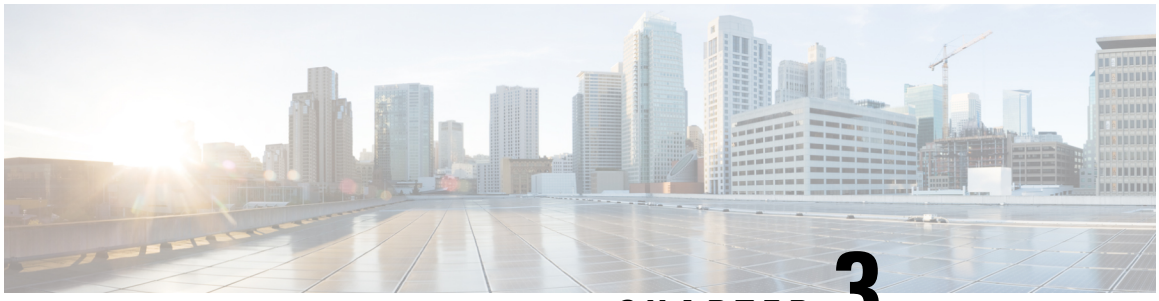
Figure 13: IRMH-SUP-SP Supervisor Module



The following table shows the supported interface modules for IR8140H. For a complete list of all supported modules, see Supported Modules, on page 54.

Table 7: Supported Interface Modules on IR8140H

Type	Module
IRMH-WPAN module	
IRMH-LTE and IRMH-LTE7 modules	
IRMH-5GS6-GL and IRMH-5GR16SA modules	



CHAPTER 3

Installation Safety and Site Preparation

This chapter contains safety and site preparation information.

Note We recommend that you read this entire chapter before installing the IR8140H router.

These topics are discussed:

- Safety Recommendations, on page 23
- Safety with Electricity, on page 23
- Preventing Electrostatic Discharge Damage, on page 24
- Safety Warnings, on page 24
- Site Requirements, on page 27
- Power Guidelines and Requirements, on page 29
- Preparing for Network Connections, on page 29

Safety Recommendations

To ensure general safety, follow these guidelines:

- Keep the chassis area clear and dust free during and after installation.
- Keep tools and chassis components away from walk areas.
- Do not wear loose clothing that could get caught in the chassis. Fasten your tie or scarf and roll up your sleeves.
- Wear safety glasses when working under conditions that might be hazardous to your eyes.
- Do not perform any action that creates a hazard to people or makes the equipment unsafe.

Safety with Electricity

Follow these guidelines when working on equipment powered by electricity:

- Read all warnings in Safety Warnings, on page 24.

- Locate the emergency power-off switch for your installation location. If an electrical accident occurs, you can quickly turn off the power.
- Disconnect all power before doing the following:
  - Installing or removing a chassis
  - Working near power supplies
- Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, frayed power cords, and missing safety grounds.
- Do not work alone if hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.
- Never open the enclosure of the router's internal power supply.
- If an electrical accident occurs, proceed as follows:
  - Use caution; do not become a victim yourself.
  - Turn off power to the device.
  - If possible, send another person to get medical aid. Otherwise, assess the victim’s condition and then call for help.
  - Determine if the person needs rescue breathing or external cardiac compressions; then take appropriate action.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. It can occur if electronic printed circuit cards are improperly handled and can cause complete or intermittent failures. Always follow ESD-prevention procedures when removing and replacing modules:

- Ensure that the router chassis is electrically connected to earth ground.
- Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to an unpainted surface of the chassis frame to channel unwanted ESD voltages safely to ground. To guard against ESD damage and shocks, the wrist strap and cord must operate effectively.
- If no wrist strap is available, ground yourself by touching a metal part of the chassis.

⚠

Caution For the safety of your equipment, periodically check the resistance value of the antistatic strap. It should be between 1 and 10 megohms (Mohm).

Safety Warnings

This section contains important safety warnings for the installation and use of the router.

Translated versions of all safety warnings are available in the safety warnings document that ships with your router, and is available on Cisco.com.

Warning **Statement 1071—**Warning Definition

IMPORTANT SAFETY INSTRUCTIONS

Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Read the installation instructions before using, installing, or connecting the system to the power source. Use the statement number at the beginning of each warning statement to locate its translation in the translated safety warnings for this device.

SAVE THESE INSTRUCTIONS



Warning **Statement 1005—**Circuit Breaker

This product relies on the building's installation for short-circuit (overcurrent) protection. To reduce risk of electric shock or fire, ensure that the protective device is rated not greater than:

Warning **Statement 1008—**Class 1 Laser Product

This product is a Class 1 laser product.

Warning **Statement 1017—**Restricted Area

This unit is intended for installation in restricted access areas. Only skilled, instructed, or qualified personnel can access a restricted access area.

Warning **Statement 1024—**Ground Conductor

This equipment must be grounded. To reduce the risk of electric shock, never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

Warning **Statement 1051—**Laser Radiation

Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.

Warning **Statement 1074—**Comply with Local and National Electrical Codes

To reduce risk of electric shock or fire, installation of the equipment must comply with local and national electrical codes.

Warning **Statement 1255—**Laser Compliance Statement

Pluggable optical modules comply with IEC 60825-1 Ed. 3 and 21 CFR 1040.10 and 1040.11 with or without exception for conformance with IEC 60825-1 Ed. 3 as described in Laser Notice No. 56, dated May 8, 2019.

Warning **Statement 2012—**Voluntary Control Council for Interference (VCCI) Class A Warning for Japan

This is a Class A product based on the standard of the VCCI Council. If this equipment is used in a domestic environment, radio interference may occur, in which case, you may be required to take corrective actions.

Warning **Statement 4011—**National Communications Commission (NCC) Warning

Without permission granted by the NCC, no company, enterprise, or user is allowed to change the frequency, enhance the transmitting power, or alter the original characteristic or performance of an approved low-power radio-frequency device. Low-power radio-frequency devices must not influence aircraft security or interfere with legal communications (conformance to legal communications means that radio communications are operated in compliance with the Telecommunications Management Act). If this happens, the user must cease operation immediately until there is no longer any interference. Low-power radio-frequency devices must *not* be impacted by nearby legal communications or ISM radio wave-radiated devices.

Warning **Statement 9001—**Product Disposal

Ultimate disposal of this product should be handled according to all national laws and regulations.

Brazil Regulatory Information

English Translation

This equipment is not entitled to the protection from harmful interference and may not cause interference with duly authorized systems.

Portuguese Translation

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.

Site Requirements

This section describes the requirements your site must meet for safe installation and operation of your router. Ensure that the site is properly prepared before beginning installation. If you are experiencing shutdowns or unusually high errors with your existing equipment, this section can also help you isolate the cause of failures and prevent future problems.

Pole-Top Installation Requirements

The pole-top installation steps (see Mounting the Router, on page 31) require that the router mounting and installation locations, usually at the top of a power or other utility pole, have the following connections available for basic router installation:

- AC power connection, as described in Power Guidelines and Requirements, on page 29.
- Ethernet connection, as described in Ethernet Connections, on page 29.

Environmental Requirements

The location of your router is an important consideration for proper operation. Equipment placed too close together, inadequate ventilation, and inaccessible panels can cause malfunctions and shutdowns, and can make maintenance difficult. Plan for access to both the power supply-side and cable-side panels of the router.

If you are currently experiencing shutdowns, or an unusually high number of errors with your existing equipment, these precautions and recommendations may help you isolate the cause of failure and prevent future problems:

- Always follow the ESD-prevention procedures described in Preventing Electrostatic Discharge Damage, on page 24 to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.
- Ensure that all the empty module slots have blank panels installed and that all the ports are sealed.
- When other equipment is installed on or connected to the router, try operating the router by itself, if possible. Power off other equipment (such as USB devices and installed third-party modules) to allow the router under test to have a maximum cooling air and clean power.

FCC Safety Compliance Statements

Class A Notice for FCC

Modifying the equipment without Cisco's authorization may result in the equipment no longer complying with FCC requirements for Class A digital devices. In that event, your right to use the equipment may be limited by FCC regulations, and you may be required to correct any interference to radio or television communications at your own expense.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

The FCC, with its action in ET Docket 9608, has adopted a safety standard for human exposure to RF electromagnetic energy emitted by FCC-certified equipment. When used with approved Cisco antennas, Cisco products meet the uncontrolled environmental limits found in OET 65 Subpart C and ANSI C95.1 2019. Proper operation of this radio device according to the instructions in this publication results in user exposure substantially below the FCC recommended limits.

The antenna(s) used for this device may be located with or operating in conjunction with the following devices only:

1. Two or more modular transmitters with FCC ID: N7NEM7455, only one (1) of which may transmit simultaneously with other transmitters types.
2. Two or more modular transmitters with FCC ID: N7NWP7610, only one (1) of which may transmit simultaneously with all other transmitters types.
3. Two or more modular transmitters with FCC ID: RI7LM960, only one (1) of which may transmit simultaneously with other transmitters types.
4. Two or more modular transmitters with FCC ID: LDK-CGMOFDM, only one (1) of which may transmit simultaneously with other transmitters types.

To ensure RF exposure compliance, installers must be provided with antenna installation and transmitter operating conditions described in this document and in the antenna installation documentation.

FCC Class A warnings

The following information is for FCC compliance of Class A devices:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. 1. This device may not cause interference.
2. 2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. 1. L'appareil ne doit pas produire de brouillage;

2. 2. L’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

Important ISED Radiation Exposure Statement:

This equipment complies with ISED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 30cm between the radiator & your body.

Cet équipement est conforme aux limites d’exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 30cm de distance entre la source de rayonnement et votre corps

Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

CAN ICES-3 (A)/NMB-3(A)

The Country Code Selection feature is disabled for products marketed in the US/Canada.

Power Guidelines and Requirements

- Check the power at your site to ensure that you are receiving power that is free of spikes and noise.
- Install a power conditioner, if necessary.
- Confirm that the AC input power supply has a 110 VAC nominal 1.0 A rms or 220 VAC nominal 0.5 A rms output-sourcing capability.

Preparing for Network Connections

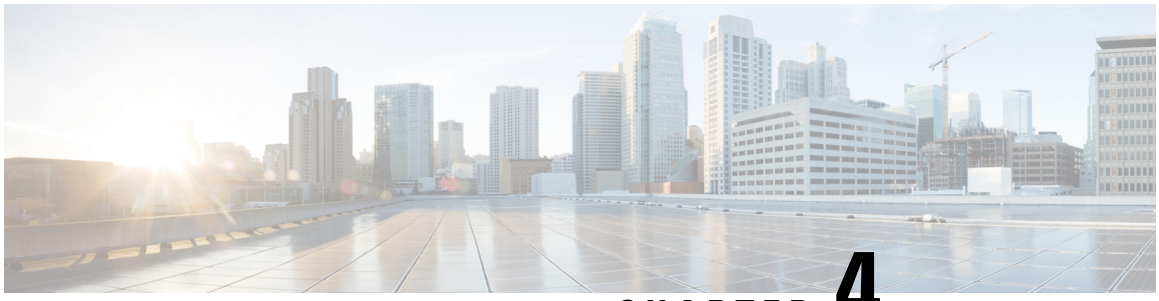
When setting up your router, consider distance limitations and potential electromagnetic interference (EMI) as defined by the applicable local and international regulations.

Network connection considerations are provided for several types of network interfaces and are described in the following sections.

Ethernet Connections

The IEEE has established Ethernet as standard IEEE 802.3. The router supports the following Ethernet implementations:

- 1000BASE-X: 1000 Mb/s full-duplex transmission over a fiber optics cable.
- 100BASE-X: 100 Mb/s full-duplex transmission over a fiber optics cable.
- 10/100/1000Base-T: 10/100/1000 Mb/s Copper Port.



CHAPTER 4

Mounting the Router

This chapter describes the safety information, equipment, and procedures required to mount the IR8140H router on a vertical pole or streetlight.

These topics are discussed:

- Mounting Kits Overview, on page 31
- General Safety Information for Mounting, on page 32
- Contents of the Mounting Kits, on page 32
- Materials and Tools You Must Have, on page 36
- Mounting Instructions, on page 36
- Grounding Instructions, on page 50

Mounting Kits Overview

You will need some or all of the kits described in this section to install the router on a pole. Your installation environment and requirements determine the kits you need.

For a detailed description of each kit, see Contents of the Mounting Kits, on page 32.

Cisco Product ID (PID)	Name	Description
—	Mounting Bracket Kit, on page 34	Use this kit if your installation requires a Cisco mounting bracket to mount the router. This kit is included in the router accessory kit, and is used with the pole kit, and includes the hardware required to attach the mounting bracket to the mounting plate.
IR-PMK1000	Pole Mount Kit, on page 32	This kit is required for all pole or streetlight installations, and includes a mounting plate and the hardware required to attach the mounting plate to a pole. This kit includes the two steel straps of IR-PMK_BAND as well.
IR-PMK-BAND	Band Strap Kit, on page 34	This kit includes two steel straps for mounting the router on poles larger than 4.5 inches (11.4 cm) in diameter. This kit is used together with the pole mount kit (Pole Mount Kit, on page 32). A BAND-IT tool is required to install the steel straps on a pole.

Cisco Product ID (PID)	Name	Description
AIR-BAND-INST-TL=	Strap Tool Kit, on page 35	This kit includes a BAND-IT tool that is required when using steel straps to install the router on poles larger than 4.5 inches (11.4 cm) in diameter.

General Safety Information for Mounting

Read the safety warnings in this section.

One person is required to properly and safely mount the router.

Note All mounting methods at any location are subject to the acceptance of local jurisdiction.

Note The mounting surface, attaching screws, and optional wall anchors must be able to support a 50 pound (22.7 kg) static weight.

Note Personnel mounting the router must understand grounding methods.

Contents of the Mounting Kits

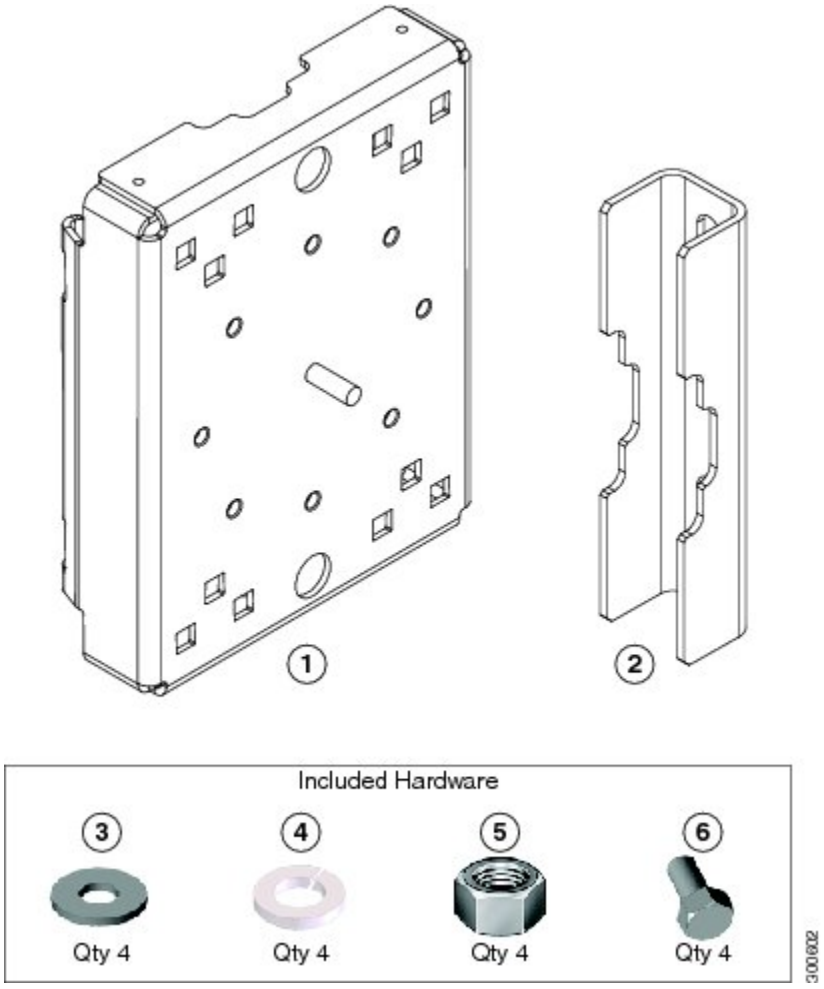
This section describes the contents of the mounting kits available for the router, and when you should use each kit.

Pole Mount Kit

Use the Cisco pole mount kit to install the mounting plate on any pole or streetlight. The kit supports poles that meet the following criteria:

- **Size:** 2 to 16-inch diameter poles
- **Material:** Metal, wood, or fiberglass poles

Figure 14: Pole Mount Kit Contents



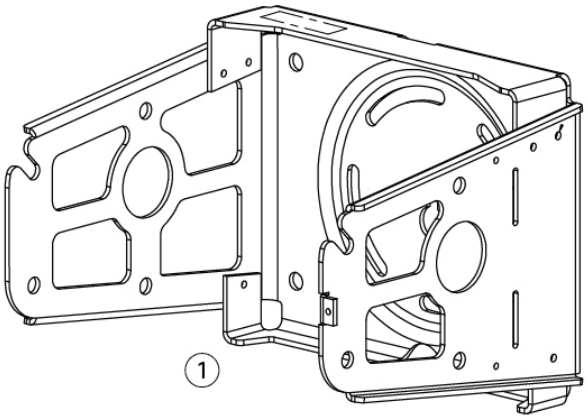
Item	Name	Qty.	Description
1	Mounting plate	1	Install mounting plate on pole. Mounting bracket attaches to the mounting plate.
2	Clamp brackets	2	Use the clamp brackets to install the mounting plate on a pole of up to 4.5 inches in diameter.
Included Hardware			
3	Washer (3/8 inch)	4	Use the included hardware to attach the mounting plate to the pole, as described in Installing the Mounting Plate On To a Pole, on page 36.
4	Split lock washer (3/8 inch)	4	
5	Nut (3/8-16)	4	
6	Carriage bolt (3/8-16 x 7 inches)	4	

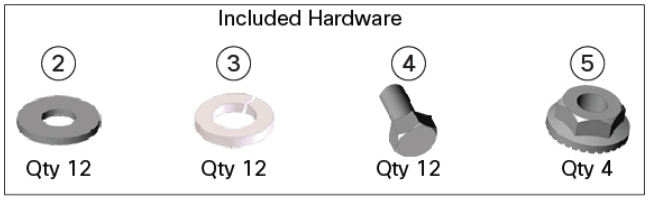
Mounting Bracket Kit

Use the mounting bracket kit if you require a Cisco mounting bracket. The mounting bracket attaches to the mounting plate, and then the router is installed on the mounting bracket.

You can also use any compatible mounting bracket with the Cisco pole mount kit. Check with your authorized Cisco reseller for compatible mounting brackets. See Pole Mount Kit, on page 32.

Figure 15: Mounting Bracket Kit Contents—Required Parts





Item	Name	Qty.	Description
1	Mounting bracket	1	Mounts router to the mounting plate or wall.
Included Hardware			
2	Washer (M8)	12	Use the hardware specified in the figure above (items 2 through 5) to attach the mounting bracket to the mounting plate, and the router to the mounting bracket. Assemble the washer, split-lock washer, and bolt as described in Assemble Bracket Hardware, on page 42.
3	Split lock washer (M8)	12	
4	Bolt (M8 x 1.25)	12	
5	Serrated nut (M8 x 1.25)	1	Use the nut to align the mounting bracket to the pole bracket when pole bracket is being used.

Band Strap Kit

Use the straps in the band strap kit when you mount the router on a pole larger than 4.5 inches (11.4 cm) in diameter. This installation also requires the pole mount kit and strap tool kit. See Pole Mount Kit, on page 32 and Strap Tool Kit, on page 35.

Figure 16: Band Strap Kit Contents



Item	Description
1	Steel straps (2)

Strap Tool Kit

Use the tool in the strap tool kit to attach the steel straps that are included in the band strap kit. Steel straps are required to install the mounting plate on poles larger than 4.5 inches (11.4 cm) in diameter. See Band Strap Kit, on page 34.

Note The tool in the strap tool kit is manufactured and supported by BAND-IT.

Figure 17: Strap Tool Kit Contents



Item	Description
1	Strap tool
2	Strap tool documentation (not shown)

Materials and Tools You Must Have

- 1/2-inch (13-mm) socket wrench
- #2 Phillips head screwdriver

Mounting Instructions

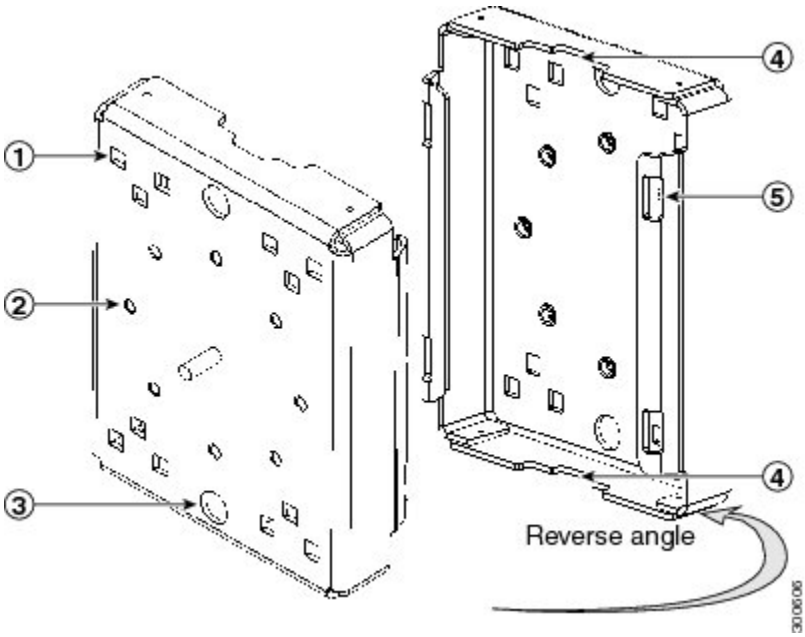
This section includes all the procedures required to mount the router on any supported pole type.

Installing the Mounting Plate On To a Pole

This section describes three different procedures for installing the mounting plate on a pole. Follow the instructions provided for the pole type used in your installation.

The instructions in these sections refer to the mounting plate features shown in the following table.

Figure 18: Mounting Plate Details



Item	Description	Qty.
1	Carriage bolt holes	4
2	Bracket mount holes	8
3	Clearance holes, 3/4 in.	2
4	Pole clamp notches	2
5	Steel band strap slots	4

Install the Mounting Plate—Poles Up To 4.5 Inches in Diameter

Required Materials

- Mounting plate, carriage bolts, and clamp brackets as described in Pole Mount Kit, on page 32.
- 13-mm box-end socket wrench

To install the mounting plate on a vertical pole up to 4.5 inches (11.4 cm) in diameter, perform this procedure.

Procedure

Step 1 Select a mounting location on the pole and place the top and bottom pole clamp bracket (1) notches against the pole.

Step 2 Place one of the clamp brackets on the opposite side of the pole, aligning the clamp bracket holes with the top two carriage bolt holes on the mounting plate.

Step 3 Insert a carriage bolt (5) through each of the top two carriage bolt holes on the mounting plate and through the holes in the clamp brackets.

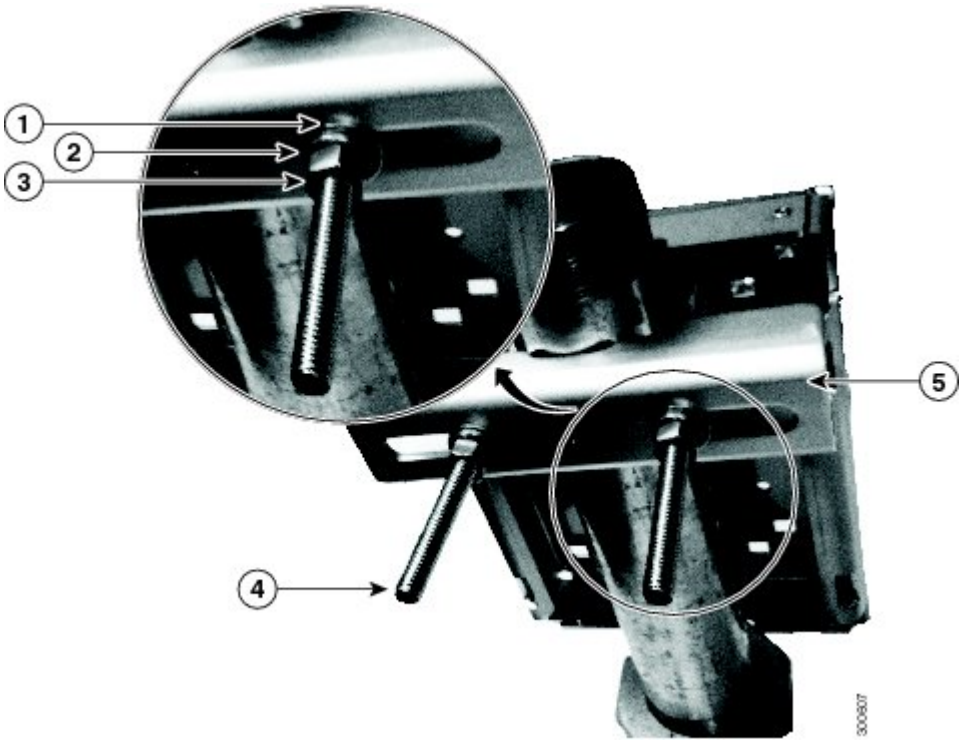
Step 4 Position each bolt in the clamp so that the bolt is next to the pole, as shown in the following figure.

Step 5 To place the bracket hardware on each carriage bolt (see the following figure):

a) Place the washer (2) and then the split lock washer (3) on the back of each carriage bolt (5).

b) Thread the hex nut (4) on each carriage bolt. Ensure that the split-lock washer is between the washer and the nut.

Figure 19: Carriage Bolt Hardware Assembly Details



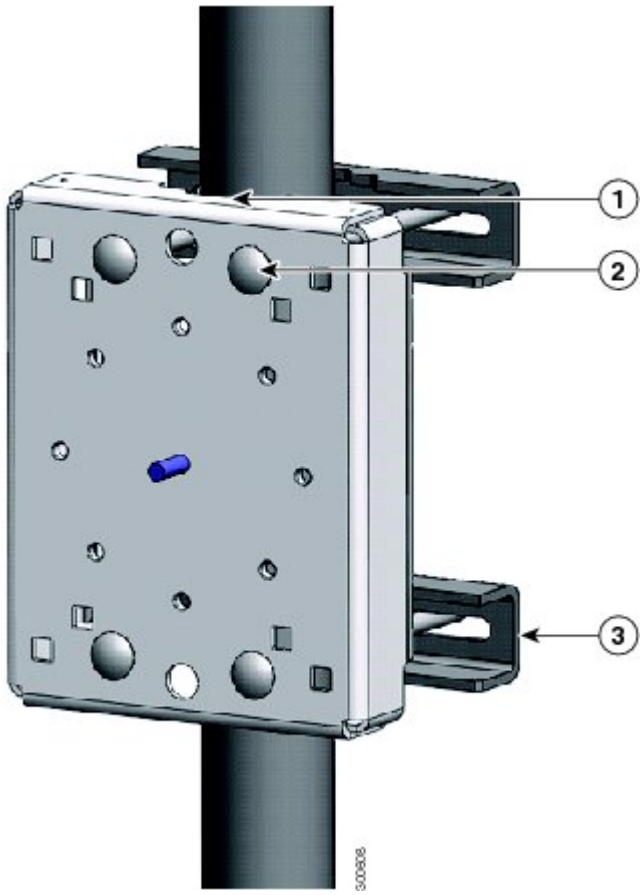
Step 6 Hand tighten the hex nuts (do not over tighten).

Step 7 Repeat Step 3 through Step 6, installing the two bottom carriage bolts and the second clamp bracket at the bottom of the mounting plate.

Step 8 Position the mounting plate and clamp brackets on the pole, as needed, before tightening the carriage bolts further.

Step 9 Use a socket wrench to evenly tighten all four carriage bolts to finish installing the mounting plate on the pole.

Figure 20: Mounting Plate Installed on Pole with Clamp Brackets



Item	Description
1	Pole clamp notch
2	Carriage bolts (4)
3	Pole clamps (2)

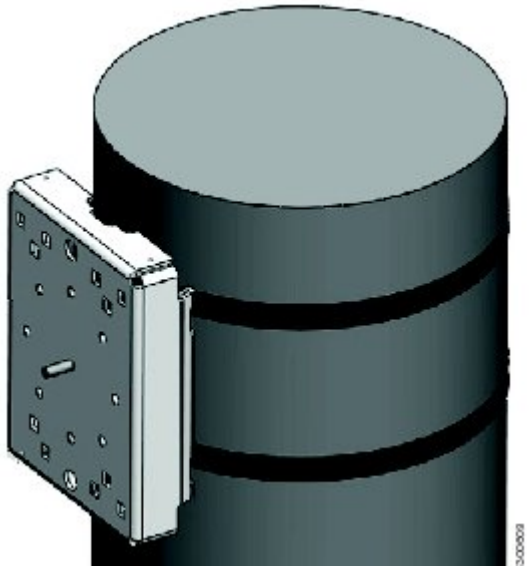
Install the Mounting Plate—Poles Larger than 4.5 Inches in Diameter

Required Materials

- Mounting plate and steel straps as described in Pole Mount Kit, on page 32
- BAND-IT tool as described in Strap Tool Kit, on page 35
- Torque wrench

To install the mounting plate on a vertical pole that is larger than 4.5 inches (11.4 cm) in diameter, perform the following procedure.

Figure 21: Mounting Plate Installed on Pole with Steel Straps for a Pole Greater than 4.5 Inch In Diameter



Procedure

Step 1 Assemble the straps and the mounting plate by threading the two steel straps through the band strap slots on the mounting plate.

Step 2 Select a mounting location on the pole.

Step 3 Position the mounting plate on the pole, as needed, and tighten the straps around the pole.

Step 4 Use the BAND-IT strap tool to tighten the metal bands around the pole, following the instructions in the box that is provided with the tool. Ensure that the metal bands are as tight as possible (approximately 7 ft lbs).

Note
When the metal bands are tightened to the full tension, the mounting plate cannot be adjusted unless the metal bands are disassembled or cut.

Install the Mounting Plate—Mounting on Wood Pole (Optional)

If the pole used in your installation is made of wood, you can optionally install the mounting plate using the procedure described in this section. This is an alternate mounting method to the following two mounting methods, which can also be used when mounting the router on a wood pole:

- Install the Mounting Plate—Poles Up To 4.5 Inches in Diameter, on page 37
- Install the Mounting Plate—Poles Larger than 4.5 Inches in Diameter, on page 39

Required Materials

- Mounting plate as described in Pole Mount Kit, on page 32.

- Hardware that you supply: 5/8-in. carriage bolt (length depends on the pole size in your installation), standard washer, fender washer, and nut (2 sets)
- Tools that you supply: Drill, drill bit (for 5/8-in. through bolts), and 13-mm box-end socket wrench

To mount the router on a wood pole:

Procedure

Step 1 Place the mounting plate on the selected mounting location on the pole.

Step 2 Mark the drilling locations on the pole through the clearance holes and remove the mounting plate.

Step 3 Drill holes completely through the pole at the points you marked in Step 2.

Step 4 Position the mounting plate over the drilled holes. Align the clearance holes on the mounting plate with the drilled holes.

Step 5 Place a standard washer against one of the clearance holes on the mounting plate and then feed the bolt through the washer, clearance hole, and drilled hole. Push the bolt all the way through the pole. See Figure 18: Mounting Plate Details, on page 37.

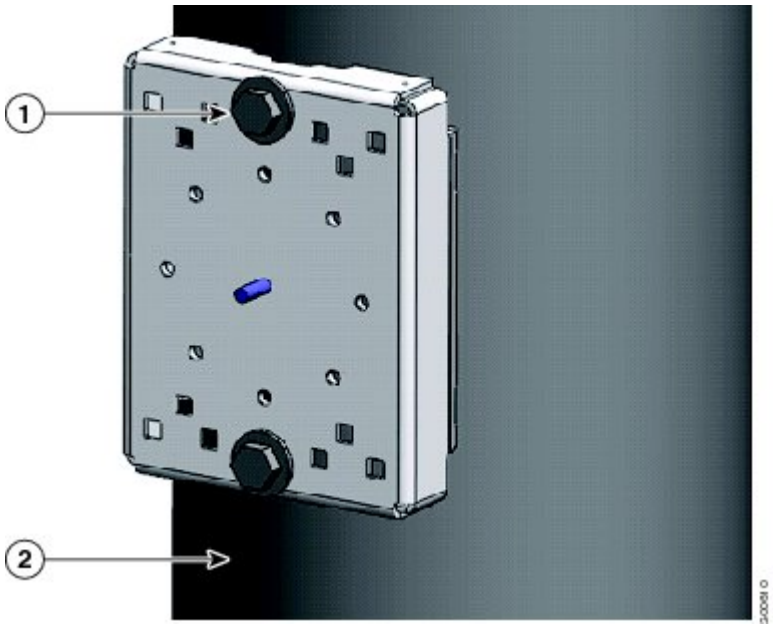
Step 6 Follow these steps on the opposite side of the pole:

a) Place a fender washer at the end of the bolt, and then a nut.
b) Hand tighten the nut.

Step 7 Repeat Step 5 and Step 6 for the second bolt.

Step 8 Use a socket wrench to evenly tighten both bolts to finish installing the mounting plate on the wooden pole (see the following figure).

Figure 22: Mounting Plate Installed on Wooden Pole with Through Bolts



Item	Description
1	5/8-in. through bolts (2)

Item	Description
2	Wood pole

Attach the Mounting Bracket to the Mounting Plate

This section describes how to attach the mounting bracket to the mounting plate.

Assemble Bracket Hardware

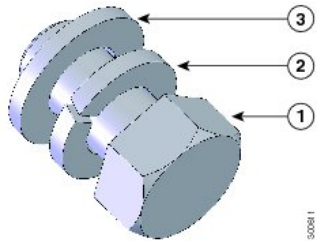
Several of the procedures in this section require you to assemble the bracket hardware before installing the bracket. A bracket hardware set consists of one bolt, one washer, one split-lock washer, and one nut.

To assemble the bracket hardware set, perform the following procedure.

Procedure

Step 1 Slide the split-lock washer (2) on the bolt (1), as shown in the following figure.

Figure 23: Assemble Bracket Hardware Set

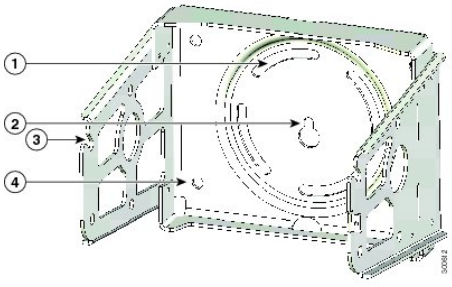


Step 2 Slide the regular washer (3) on the bolt (1).

Ensure that the split-lock washer is between the regular washer and the bolt, as shown in the above figure.

The instructions for the procedures in this section make a reference to the mounting plate shown in the following figure.

Figure 24: Mounting Bracket Details



1	Pivot grooves (4)	2	Quick-hang notch

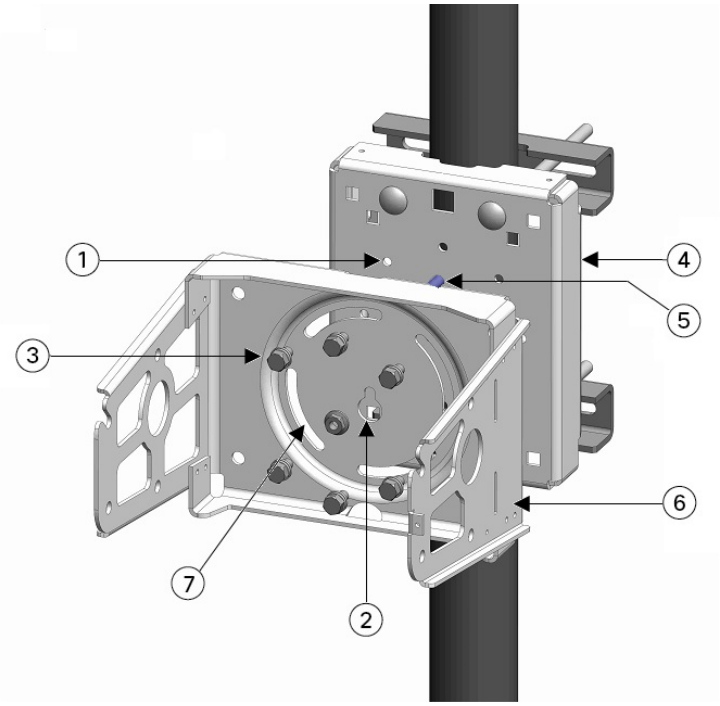
3	Quick-hang slots (2)	4	Optional wall-mount holes (4)

Note
The mounting plate must be installed as described in the section Installing the Mounting Plate On To a Pole, on page 36.

Attach the Mounting Bracket

To attach the mounting bracket to the mounting plate, perform this procedure.

Figure 25: Mounting Bracket Attached to Mounting Plate



Required Materials

- Mounting bracket and hardware as described in the Mounting Bracket Kit, on page 34
- 13-mm box-end socket wrench

Procedure

Step 1 Assemble six sets of bracket hardware (washer, split-lock washer, and bolt), as detailed in Assemble Bracket Hardware, on page 42.

Step 2 Place the mounting bracket (6) against the mounting plate by inserting the bracket quick-hang notch (2) over the mounting plate quick-hang stud (5).

Step 3 Thread the serrated nut onto the quick-mount stud (4) and hand tighten (do not over tighten).

Step 4 Align the pivot grooves (7) on the bracket with four of the bracket-mount holes (1) on the mounting plate. Follow these guidelines:

- Each of the four pivot grooves on the bracket must be attached to at least one bracket-mount hole on the mounting plate.
- The final orientation of the mounting plate and router determine which bracket-mount holes are used.
- Mount the router, as described in Installing the Mounting Plate On To a Pole, on page 36.

Step 5 Insert one bolt assembly (3) through one of the pivot grooves (7) on the bracket and then through the corresponding bracket mount hole on the mounting plate.

Step 6 Repeat Step 5 for the remaining bolt assemblies.

Step 7 Position the mounting-bracket onto the mounting plate, as needed, before further tightening the bolts.

Step 8 Use a socket wrench to evenly tighten all four bolts and the serrated nut to finish installing the bracket on the plate. Use a torque of 6 to 7 foot-pounds when tightening the bolts and nut.

Attach the Router Onto the Mounting Bracket

This section describes how to attach the IR8140H to the mounting bracket.

Required materials:

- 13-mm box-end socket wrench
- Two sets of bracket hardware (split-lock washer, regular washer, and bolt). Attach each of the bracket sets to opposite sides of the IR8140H to provide support and enable it to rest on the bracket to each side of the router (see Figure 23: Assemble Bracket Hardware Set, on page 42).

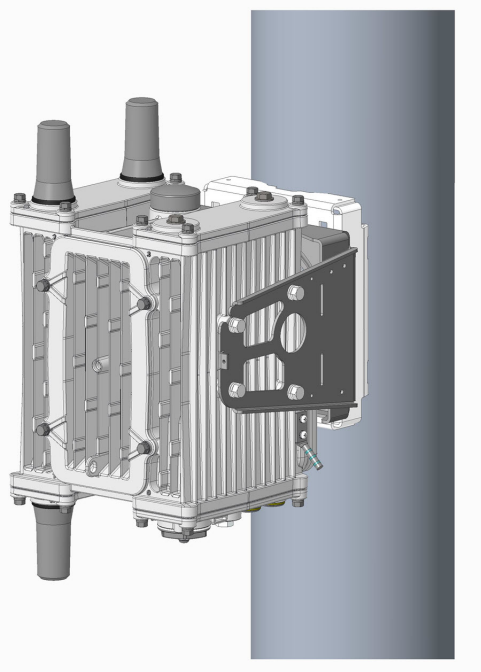
Procedure

Step 1 Attach two sets of bracket hardware, one on either side of the IR8140H router.

Step 2 Slide the router onto the bracket and rest it on the two quick-hang slots (see Figure 24: Mounting Bracket Details, on page 42).

Step 3 Use a socket wrench to evenly tighten the two sets of bracket hardware to secure the router to the mounting bracket.

Figure 26: IR8140H Attached to the Mounting Bracket



Step 4 You are now ready to ground the router. See Grounding the Router, on page 50.

Installing the Security Bracket on the Router

The security bracket is used to secure the CPU, UIMs, and BBU on the router with a padlock. (The padlock is not provided by Cisco.)

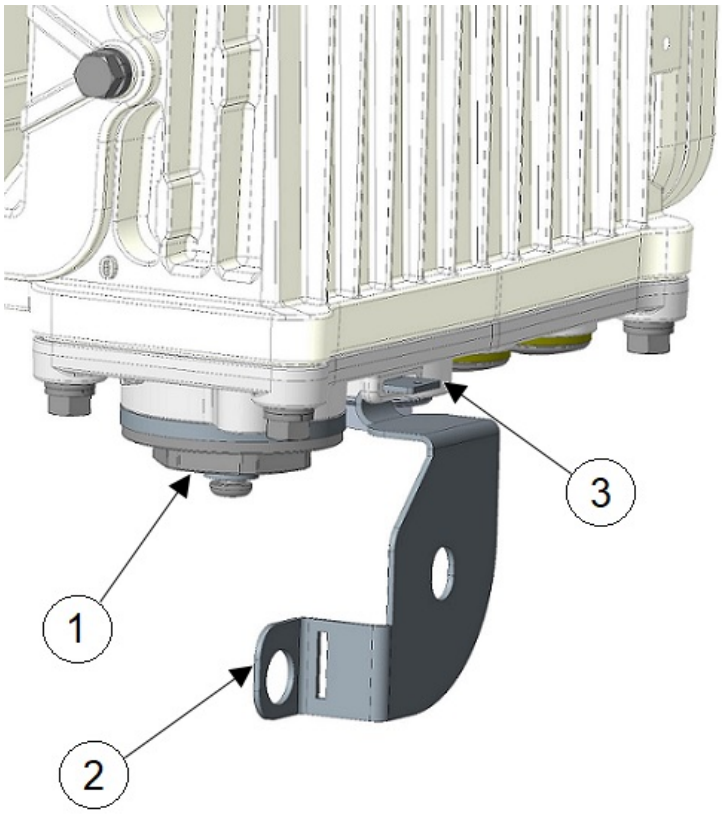
Follow these steps to install the security bracket.

Before you begin

Ensure all bolts and screws on the unit are tightened. Every module slot should have a module or a cover installed. Ensure the plastic CPU console port plug is installed and tight. This plug should be found on the bottom right side of the unit and should be screwed into the front-most hole on the bottom module.

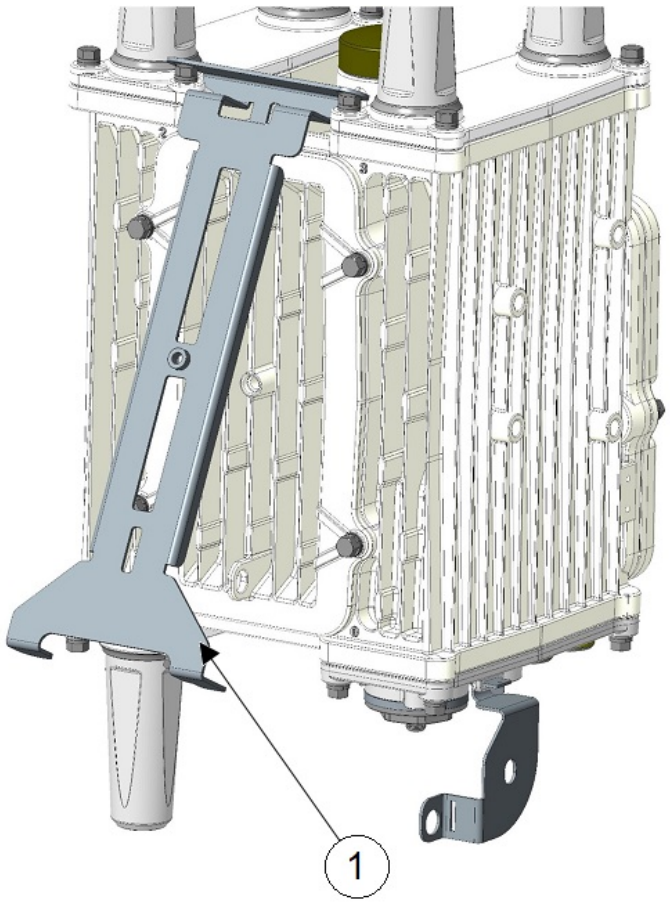
Procedure

Step 1 Hang the CPU security bracket (**2**) onto the slot (**3**) on the bottom of the chassis. When looking at the front of the chassis, the slot will be found at the bottom right of the chassis towards the front. Insert the U-shaped flange of the CPU security bracket into the slot from the inner side of the chassis, so that the opening of the U-shape comes out of the outside of the chassis. The CPU security bracket should be able to hang freely on the slot. See the following figure.

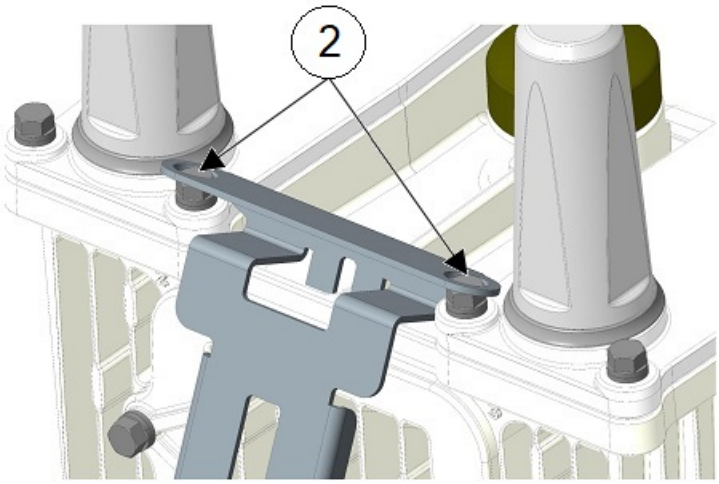


1	CPU console port plug
2	CPU security bracket
3	Slot on the bottom of the chassis to install the CPU security bracket

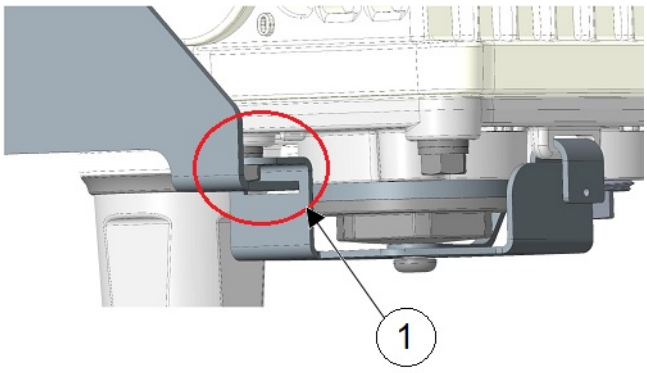
Step 2 Hold the long front BBU security bracket (**1**) and attach it from the top of the chassis. It should be done at an angle in order to correctly mount the top two holes on the top screws. It should fit over the top two inner screws on each top module. Notice that the security bracket only fits in one direction. It is not symmetrical. There is a top and a bottom of the bracket.



The following figure shows the top two screws (**2**) to align the security bracket over and fit onto.

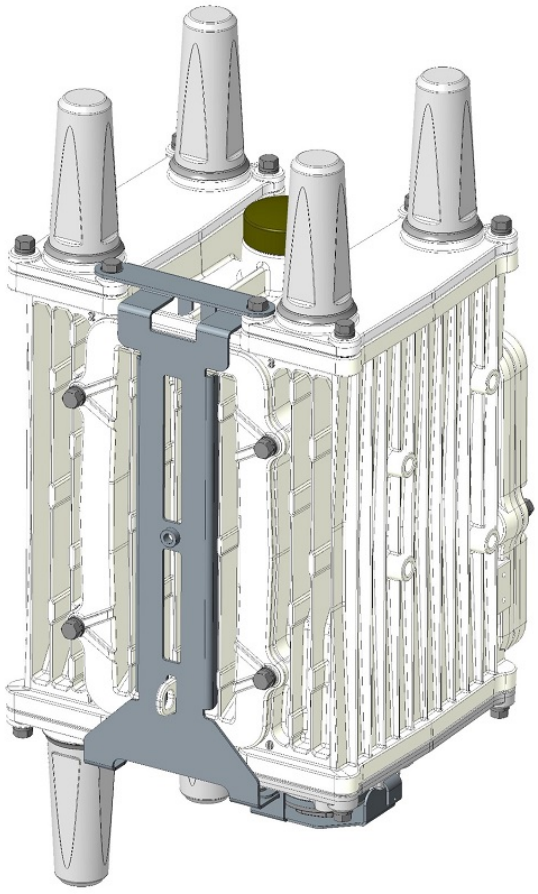


Step 3 Once the bracket is seated over the top screws, slowly rotate the bracket closer to the front of the chassis. At the same time, one hand should be used to lift the bottom, circular, CPU bracket so that the slot in the CPU bracket lines up with the bottom right flange of the BBU bracket so that they click into place. This will ensure a safe mount of the CPU bracket. The flange on the CPU bracket should be seated above the flange of the front BBU security bracket.

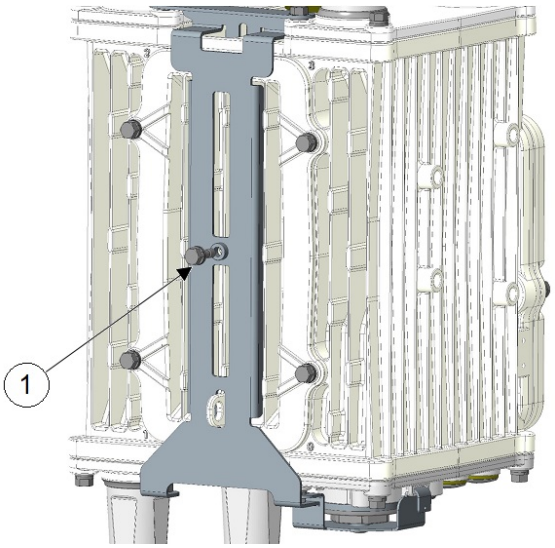


1	BBU security bracket and CPU security bracket connecting together.

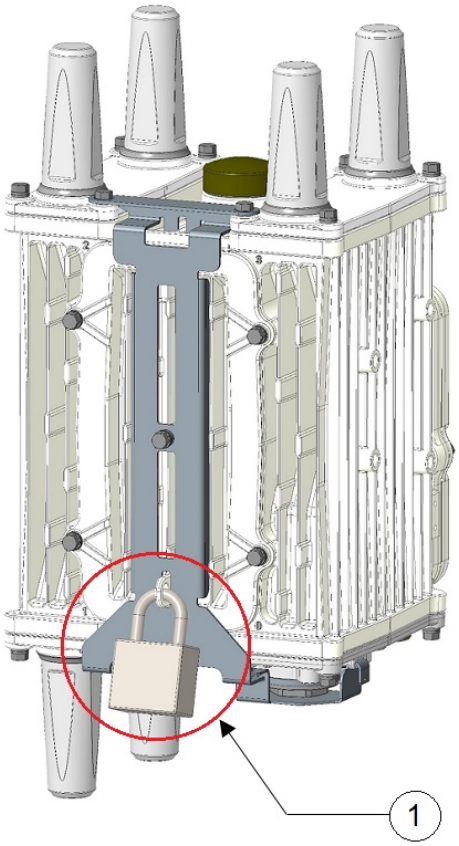
The following figure shows the mounted BBU security bracket and CPU security bracket.



Step 4 Use the M6 size bolt (**1**) included with the bracket to secure the bracket into place on the front of the chassis through the hole in the middle of the chassis front BBU cover. Torque to 15 to 20 in-lbs.



Step 5 Secure the BBU bracket and the unit with a padlock to the padlock tab on the front slot (**1**).



Grounding Instructions

In all installations, after the router is mounted, you must properly ground the unit according to the instructions in this section before connecting the router to the network and power.

Warning **Statement 1024**—Ground Conductor

This equipment must be grounded. To reduce the risk of electric shock, never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

Warning **Statement 1074**—Comply with Local and National Electrical Codes

To reduce risk of electric shock or fire, installation of the equipment must comply with local and national electrical codes.

Grounding Hardware

The router is shipped with a grounding kit, as shown in the following figure.

Figure 27: Router Grounding Kit Contents



Item	Description	Qty.
1	Grounding lug	1
2	Screws	2

Materials You Supply

You must provide the tools listed in Materials and Tools You Must Have, on page 36.

Grounding the Router

You can perform these steps when the IR8140H is attached onto the mounting bracket, as seen in Figure 26: IR8140H Attached to the Mounting Bracket, on page 45.

To ground the router:

Procedure

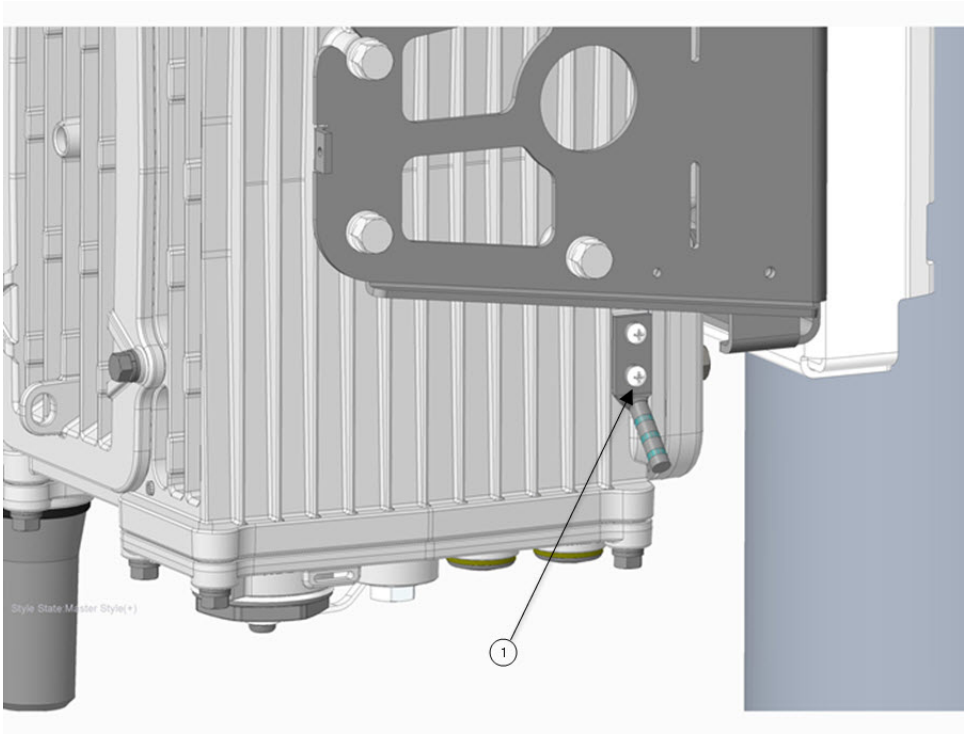
Step 1 Use the appropriate crimping tool or pliers to crimp the 6-gauge ground wire (included in the grounding kit) to the grounding lug.

Step 2 Connect the grounding lug to the router chassis ground connection point shown in Figure 28: Grounding Lug Connectors (Chassis Ground Connection Point) , on page 51, using the supplied grounding screws.

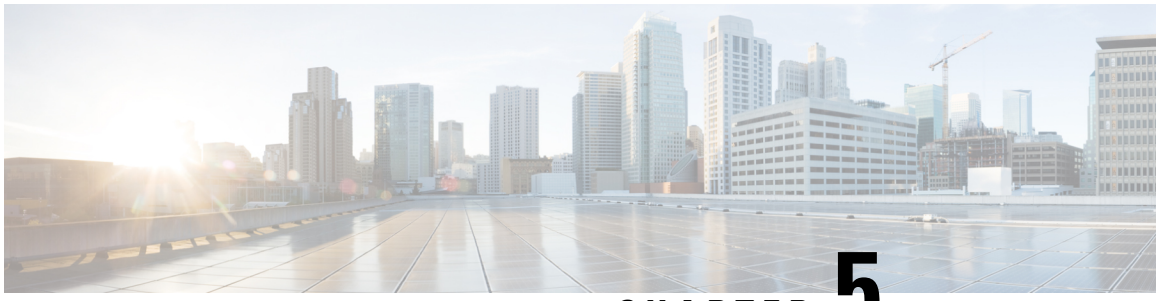
Note
Tighten the grounding screws to 20-24 in-lbs of torque. Do not overtighten!

Step 3 If necessary, strip the other end of the ground wire and connect it to a reliable earth ground, such as a grounding rod or an appropriate grounding point on a pole that is grounded.

Figure 28: Grounding Lug Connectors (Chassis Ground Connection Point)



Item Number	Description
1	Ground lug and screws (qty. of 2) and 6-gauge ground wire



CHAPTER 5

Installing Universal Interface Modules

This chapter discusses how the Cisco Catalyst IR8140 Heavy Duty Router supports up to three Universal Interface Modules (UIMs) that enable Neighborhood Area Network (NAN) connections from the router to field devices such as meters and Intelligent Electronic Devices (IEDs), and from the router to the central utility station or data management center.

These topics are discussed:

- Installing or Replacing Modules, on page 53
- Installing Modules in the Router, on page 53

Installing or Replacing Modules

The router supports up to three UIMs. Depending on the configuration, your router could arrive in a shipping container with all required modules already installed. However, you need to install a module when you:

- Add modules to your current installation.
- Replace a faulty module.

Installing Modules in the Router

This section provides general instructions for installing modules in the router.

Preparing to Install Modules

Before installing modules in the router, ensure that the following guidelines have been met:

- Verify that there is adequate airflow around the router. See Installation Safety and Site Preparation, on page 23.
- Make sure the router is powered off.
- When modules are installed in a closed assembly (such as inside the router), the temperature around it might be higher than normal room temperature.
- The installation environment humidity must not exceed 95 percent (noncondensing).

- The installation site altitude must be no higher than 10,000 feet.

Installation Warning Statements

This section includes the installation warning statements. Translations of these warning statements appear in the Regulatory Compliance and Safety Information for Cisco Catalyst Industrial Router 8140 Heavy Duty Series Router documents on Cisco.com, at:

- Regulatory Compliance and Safety Information:

  https://www.cisco.com/c/dam/en/us/td/docs/IIOT/compliance/routers/rcsi-0249-book.pdf

Warning To prevent airflow restriction, allow clearance around the router of 6" on vertical sides and 12" above and below.

Installing and Removing Modules

This section provides general module installation steps (for offline cases), and includes informatioin about additional documentation.

Tools and Materials You Supply

You must provide the following tool to install and remove modules:

- 10-mm socket driver

Supported Modules

The following table shows the UIMs supported on IR8140H. For information about supported antennas in each module, see Selecting and Installing Antennas, on page 65.

Table 8: Supported UIMs

Module Type	Module PID	Description	
Cellular modules (LTE/5G)	IRMH-LTE-MNA	Multicarrier band-14 CAT4 LTE module for North America	
	IRMH-LTE-MNA-900	Multicarrier band-14 CAT4 LTE module for North America with 900-MHz WPAN coexistence filter	
	IRMH-LTEA-EA	CAT6 LTE advanced module for Europe and North America	
	IRMH-LTEA-EA-900	CAT6 LTE advanced module for Europe and North America with 900-MHz WPAN coexistence filter	
	IRMH-LTEA-LA	CAT6 LTE advanced module for APAC, LATAM, and ANZ	
	IRMH-LTEAP18-GL	CAT18 LTE advanced PRO module for ALL Global Regions	
	IRMH-5GS6-GL	5G Sub-6 GHz universal interface module for ALL Global Regions IRMH-5GS6-GL supports the same bands and frequencies as P-5GS6-GL PIM. For more information, see the following docuemntation: • Cisco Wireless WAN Routers and Modules Data Sheet • 5G Sub-6 GHz Pluggable Interface Module	
	IRMH-LTE7-NA-900	CAT 7 LTE module for North America	
	IRMH-5GR16SA	United States, Europe, Canada, Japan, Australia and New Zealand	
	WPAN modules	IRMH-WPAN-NA	IEEE 802.15.4e/g 900-MHz WPAN module for North America
IRMH-WPAN-BRZ		IEEE 802.15.4e/g 900-MHz WPAN module for Brazil	

Table 9: Thermal Mitigation for IRMH-LTE7-NA-900, IRMH-LTE7-EAL, IRMH-5GR16SA

	MaximumAmbient Temperature (C/F)	AirFlow (LFM)	ThroughputPerformance
IRMH-LTE7-NA-900 IRMH-LTE7-EAL IRMH-5GR16SA	25°C/77°F	0	Passed
	63°C/145.4°F	0	Passed
	70°C/158°F	0	Throttled
	85°C/185°F	200	Passed
	-40°C/-40°F	200	Passed

Module Installation Locations

To ensure support for all module types and allow convenient cabling, we recommend the following installation location guidelines:

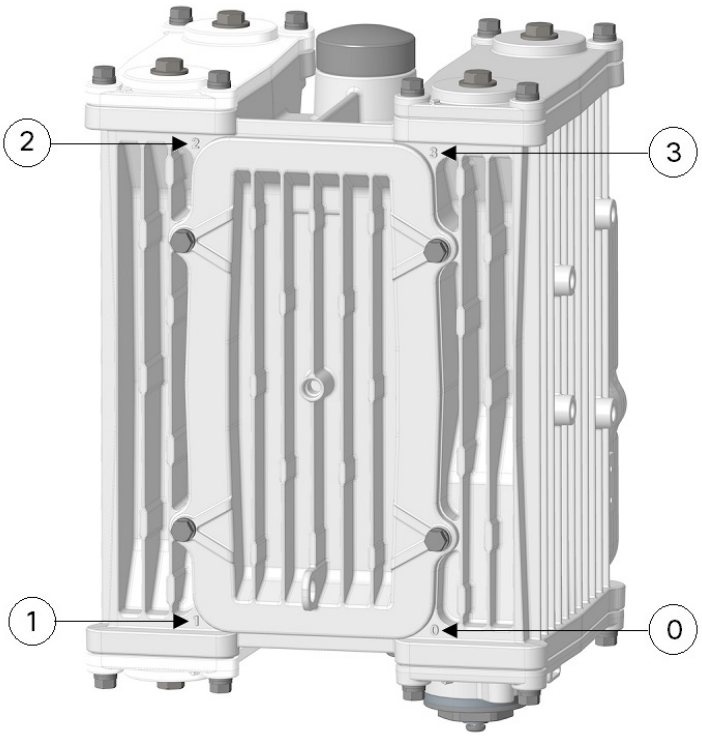
- UIMs and module slot compatibility are listed in Table 10: UIM Locations in the IR8140H Router, on page 56 and illustrated in Figure 29: Module Slot Identifiers, on page 57.
- Module antenna installation procedures are illustrated in Attaching an Antenna to IR8140H, on page 67.
- Antenna port locations are illustrated in Figure 30: Antenna Ports on Slot 1, on page 58 and Figure 31: Antenna Ports on Slot 2 and Slot 3, on page 58.

Table 10: UIM Locations in the IR8140H Router

Installation Slot	UIM Type
Slot 1	WPAN module
Slot 2 or 3 **Note** Installing WPAN module in slot 2 or 3 is supported from Cisco IOS XE Release 17.7.1.	WPAN module or Cellular module (4G/5G) **Note** For restrictions and guidance on installing a WPAN module in slots 2 or 3, see Recommended Module Installation Scenario and Antenna Selection, on page 59.

The following figure shows the slot identifier on the router chassis.

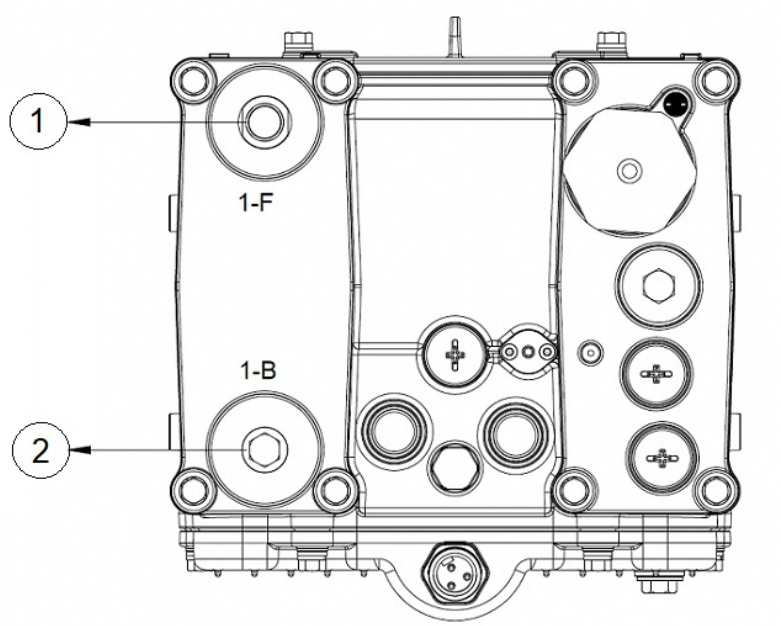
Figure 29: Module Slot Identifiers



0	Slot identifier 0 (CPU/Supervisor module slot)	2	Slot identifier 2 (UIM slot)
1	Slot identifier 1 (UIM slot)	3	Slot identifier 3 (UIM slot)

The following figure shows the antenna ports on slot 1.

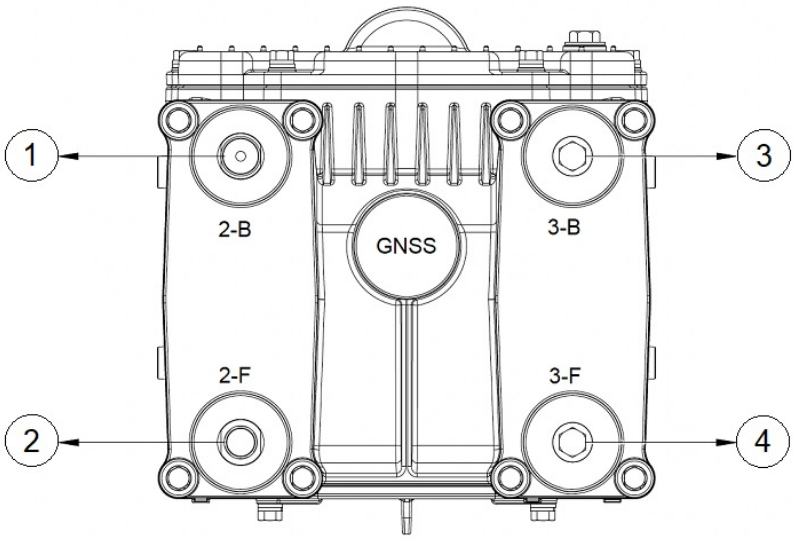
Figure 30: Antenna Ports on Slot 1



1	Antenna Port 1-F	2	Antenna Port 1-B

The following figure shows the antenna ports on slot s and slot 3.

Figure 31: Antenna Ports on Slot 2 and Slot 3



1	Antenna Port 2-B	3	Antenna Port 3-B
2	Antenna Port 2-F	4	Antenna Port 3-F

Recommended Module Installation Scenario and Antenna Selection

The following sections provide instructions on recommended module installation scenarios of WPAN and LTE modules, and guidance on antenna selection.

Single WPAN and Single LTE

For a deployment with one WPAN module and one LTE module, the following deployment scenarios are supported:

- Anterix + WPAN—The IR8140 with a WPAN module and an IRMH-LTEA-EA-900 module supports Anterix Band 8c plus public LTE bands.
- CBRS + WPAN—The IR8140 with a WPAN module and an IRMH-LTEA18-GL or IRMH-5GS6-GL module supports CBRS Band 48 plus public LTE bands.

Recommended installation and antenna selection:

- Anterix + WPAN—Install WPAN module in slot 1 and IRMH-LTEA-EA-900 module in slot 3. Attach the ANT-5G-MP-OUT-N antennas directly to both modules.
- CBRS + WPAN—Install WPAN module in slot 1 and IRMH-LTEA18-GL or IRMH-5GS6-GL module in slot 3. Attach ANT-5G-MP-OUT-N antenna directly on WPAN. Since there is no 900 MHz coexistence filter on these modules, use a 5 - 10 foot cable to provide RF isolation, to attach the ANT-5G-OMNI-OUT-N antenna on the LTE module.



Note The antennas should maximize their relative vertical separation.

We recommend the following installation locations and antenna ports:

- WPAN module—Slot 1, antenna port 1-F
- LTE module—Slot 3, antenna port 3-F: Main LTE, antenna port 3-B: Div LTE



Note For single WPAN deployment, we do not recommend the multi-element deployment, which may create an adverse position where the antennas are actually closer than intended.

Single WPAN and Dual LTE

For a deployment with one WPAN module and two LTE modules, choose IRMH-LTEA-EA-900 or IRMH-LTE-MNA-900 (with 900-MHz WPAN coexistence filter) as the LTE modules. Install the WPAN module in slot 1, and install the LTE modules in slot 2 and slot 3.

We recommend the following installation locations and antenna ports:

- WPAN module—Slot 1, antenna port 1-F
- LTE module 1—Slot 2, antenna port 2-F: Main LTE, antenna port 2-B: Div LTE

Note For increased isolation and better WPAN and LTE performance, we recommend that you use ANT-5G-OMNI-OUT-N antennas with 10-ft cables for the LTE module in slot 2.

- LTE module 2—Slot 3, antenna port 3-F: Main LTE, antenna port 3-B: Div LTE

Dual WPAN and Single LTE

For a deployment with two WPAN modules and one LTE module, choose IRMH-LTEA-EA-900 or IRMH-LTE-MNA-900 (with 900-MHz WPAN coexistence filter) as the LTE module.

We recommend the following installation locations and antenna ports:

- WPAN module 1—Slot 1, antenna port 1-F
- WPAN module 2—Slot 2, antenna port 2-F, using extension cable with ANT-5G-OMNI-OUT-N antenna
- LTE module—Slot 3, antenna port 3-F: Main LTE, antenna port 3-B: Div LTE

Dual WPAN Only (no LTE Module)

For a deployment with two WPAN modules, we recommend that you install one WPAN module in slot 1 using antenna port 1-F. Install the second WPAN module in either slot 2 (using antenna port 2-F) or slot 3 (using antenna port 3-F), with 10-ft cables and ANT-5G-OMNI-OUT-N antennas.

Note The antennas should maximize their relative vertical separation.

Installing a Module in the Router

Note This is a general installation procedure for installing modules in the chassis of the router. For hardware installation and software configuration steps that are specific to your module, see the installation and configuration guide for the corresponding module.

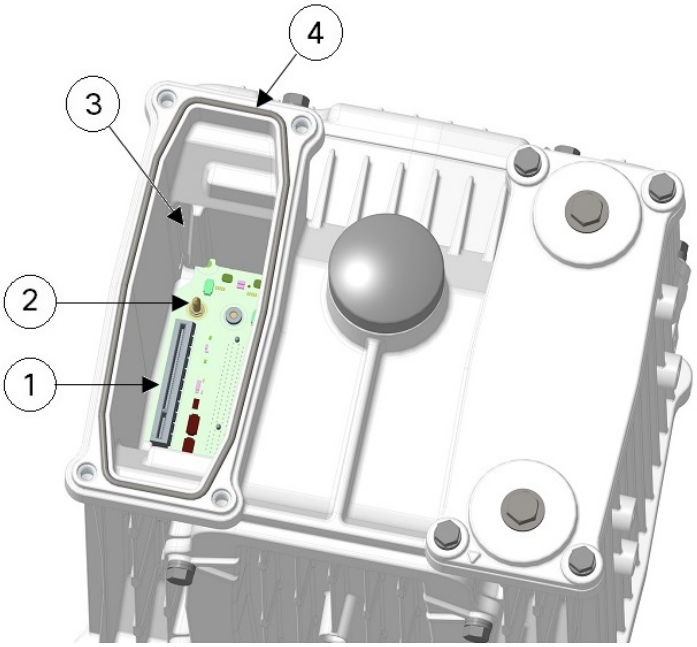
To install a module in an available slot of the router:

Procedure

Step 1 Disable any installed battery backup units, and disconnect the router from AC power.

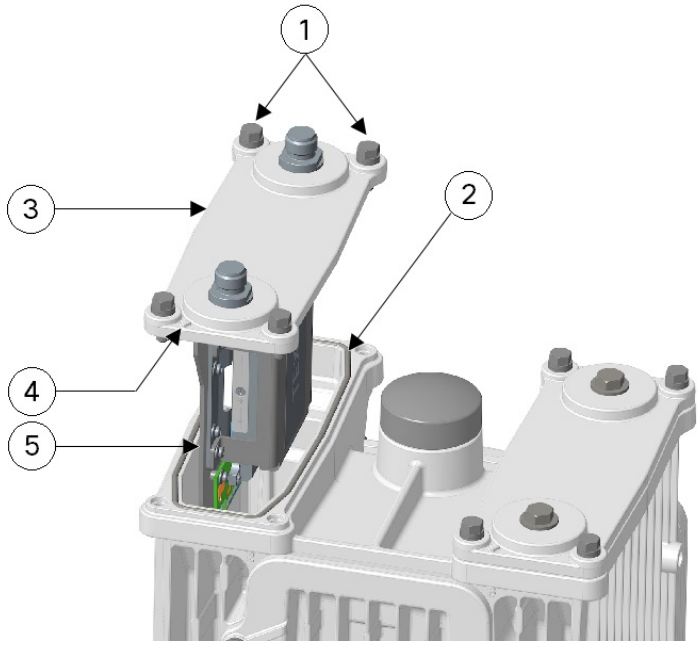
Step 2 If there is a blank or module in the applicable slot, follow the instructions provided in Removing a Module or a Blank from the Router, on page 62.

Step 3 Ensure that gasket is fully contained in the groove and all the debris is removed from the gasket surface.



1	UIM interface connector	3	Chassis guide slot
2	Guide pin	4	Gasket

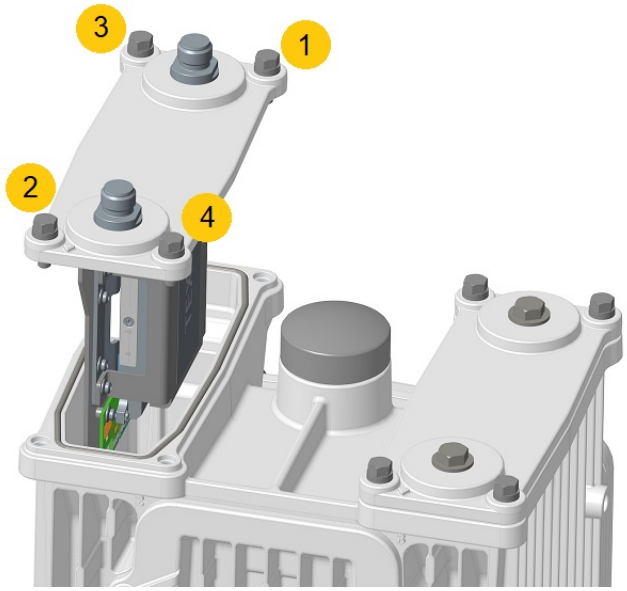
Step 4 Align the module orientation indicator with the front of chassis. Align the carrier edge with the chassis guides and fully insert the module into the slot.



1	M6 bolts	2	Gasket

3	Module	4	Module orientation indicator
5	Align carrier edge with chassis guides		

Step 5 Use a 10-mm socket driver and tighten four bolts to 15 to 20 in-lbs in a sequence, as shown in the following figure. Then repeat torque sequence to 30 to 35 in-lbs for final torque.



Step 6 Attach the RF cables or antennas to the N-connectors on the UIMs if applicable.

Step 7 Connect the router to the AC power and to the network.

Step 8 Re-enable the Battery Backup Unit (BBU) using the command, as described in the Cisco Catalyst IR8140 Heavy Duty Series Router Software Configuration Guide.

Removing a Module or a Blank from the Router

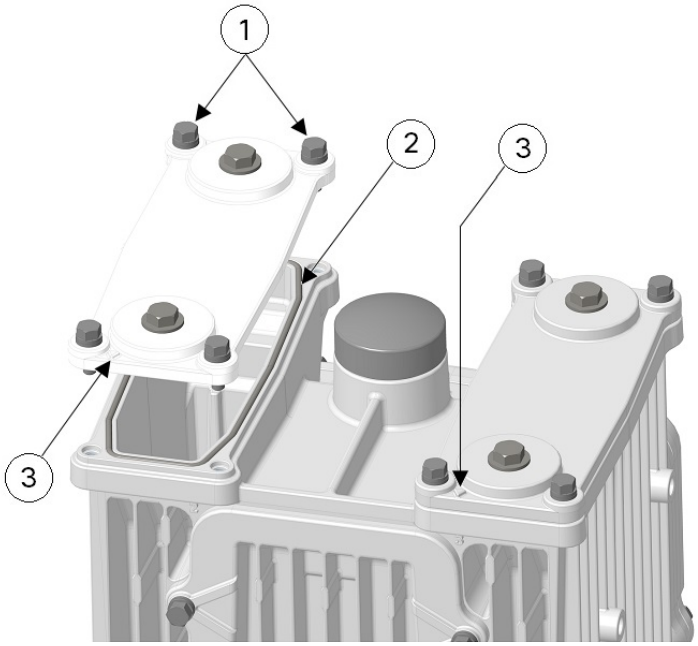
To remove a module or a blank from the router:

Procedure

Step 1 Disable the installed battery backup units, and disconnect the router from AC power.

Step 2 Remove the cables attached to the UIM.

Step 3 Fully loosen the four M6 bolts on the UIM or the UIM blank using the 10-mm socket driver. (Do not remove bolts from the faceplate.)



1	M6 bolts	2	Gasket
3	Module orientation indicator		

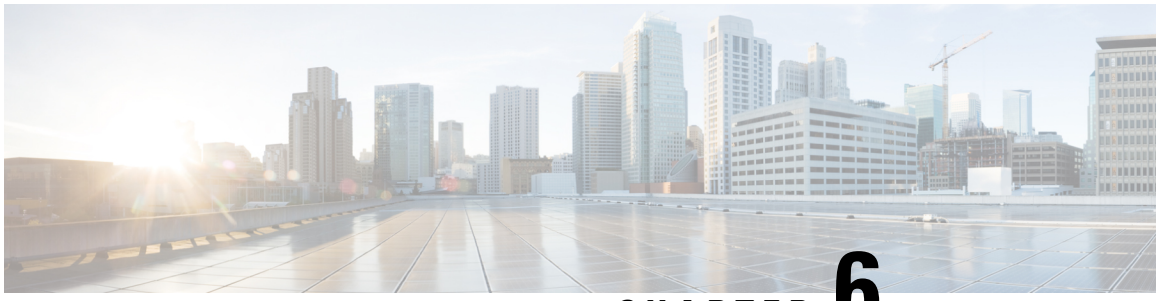
Step 4 Use your hands to gently pull the module or the blank from the router.

Step 5 Ensure that the gasket is fully contained in groove and all debris is removed from gasket surface.

Step 6 Do not leave the slot open and unattended. Install a new module or a blank, as described in Installing a Module in the Router, on page 60.

Step 7 Connect the router to AC power and to the network.

Step 8 Re-enable the BBU using the commands, as described in the Cisco Catalyst IR8140 Heavy Duty Series Router Software Configuration Guide.



CHAPTER 6

Selecting and Installing Antennas

These topics are discussed:

- Overview of the Antennas, on page 65
- Antenna Installation Best Practices, on page 65
- Attaching an Antenna to IR8140H, on page 67
- Supported Antennas for IR8140H, on page 68
- Supported Antenna Cables and Lightning Arrestors for IR8140H, on page 71

Overview of the Antennas

Note Before you install the Cisco Catalyst IR8140 Heavy Duty Router on a vertical pole or streetlight, install the antennas on the UIMs. It is difficult to install the antennas after the router is installed.

The following section contains information about selecting antennas on the IR8140H router.

The IRMH-LTE or IRMH-LTEA cellular modules have two RF N-type (f) connectors on each UIM, Main and Div (Diversity), which are used to connect to the LTE modem. The Diversity port is also referred to as an Aux connector.

The IRMH-LTEAP18-GL module has four RF N-type (f) connectors. There are two pairs of Main and Diversity connectors, which are used to connect to such modems.

The IRMH-5GS6-GL module has four RF N-type (f) connectors. All four ports support 3G/4G LTE and 5G FR1.

Antenna Installation Best Practices

The optimal site location for antennas in 4G and 5G routers and cellular modules plays a significant role in determining overall cellular link performance. Routers located at the farthest coverage points might have 10 to 50 percent of the bandwidth available compared to routers located closer to the cellular base station tower, away from obstructions, and with an unobstructed view of the cellular tower.

Because antennas transmit and receive radio signals over the air, the signal propagation and antenna performance may be adversely affected by the surrounding environment, including physical obstructions. Radio frequency

(RF) interference may also occur between wireless systems located close to each other, especially if the antennas of these systems are also in close proximity. Interference may also occur when an antenna is in close proximity to cable clutter or other sources of radio interference.

Follow these guidelines to ensure the best possible performance:

- Keep antennas away from electrical and signal cable clutter. Metal conductors inside cables may block the antenna view of the base station. Additionally, unshielded (and even shielded cables in some cases) may radiate signals that interfere with RF signal reception.
- We recommend that all the cellular antennas for the IR8140H are oriented vertically to ensure polarization match. While polarization of the signal may change because it is reflected from obstructions when the view is unobstructed, vertical polarization is optimal.
- For a deployment with both a WPAN module and an LTE module, choose IRMH-LTEA-EA-900 or IRMH-LTE-MNA-900 (with 900-MHz WPAN coexistence filter) as the LTE module, and use recommended antennas and cables. For more information, see Module Installation Locations, on page 56.

  For increased isolation and better WPAN and LTE performance, you can choose 10-ft cables and either ANT-5G-OMNI-OUT-N or any of the available multielement antenna solutions, for example, ANT-4-5G4-O.

Note The antennas should maximize their relative vertical separation.

- For optimal MIMO performance, set the cellular Main and Aux antennas apart by at least 17 inches (43 cm). At the lowest LTE frequency of 700 MHz, 17 inches represents 1 wavelength. Spacing of half (or 0.5) wavelength or 8.5 inch (22.5 cm) results in good MIMO performance.
- Spacing the Main and Aux LTE antennas by less than 8.5 inches may result in significantly reduced MIMO performance.
- Spacing the antennas too close to each other, for example, 3 inches, results in the antennas significantly detuning from their original designed performance because of increased antenna coupling.
- Wherever possible, mount the IR8140H router with the UIM and antenna where the cellular base station or tower are within sight and without physical obstructions. Barriers along the line of sight between the router and the local base station degrade the wireless radio signals. Install the IR8140H, UIMs and antennas above floor level in office environments or near the ceiling for better performance because most obstructions tend to be near the floor level.
- The density of the materials used in a building's construction determines the number of walls the signal must pass through while still maintaining adequate coverage. Consider the following before choosing the location for installing the antenna:
  - Paper and vinyl walls have very little effect on signal penetration.
  - Solid and precast concrete walls limit signal penetration to one or two walls without degradation of coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.

- A thick metal wall or wire-mesh stucco wall causes signals to reflect back and causes poor penetration.

- Avoid mounting the antenna next to a column or vertical support that could create a shadow zone and reduce the coverage area.
- Keep the antenna away from reflective metal objects such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.

Important Notes:

This radio transmitter [IC : 2461N-CGMOFDM] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio [IC: 2461N-CGMOFDM] a été approuvé par Innovation, Sciences et Développemen économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Attaching an Antenna to IR8140H

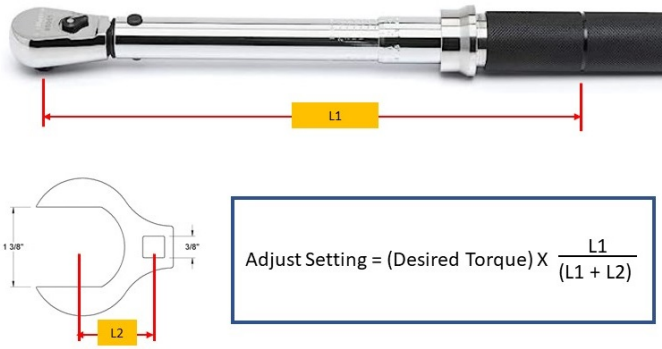
This section illustrates how to attach the antenna ANT-5G-MP-OUT-N to IR8140H router.

Recommended tools that you need to install the antenna:

- Torque wrench with the range that can be set to 4 to 4.5 ft-lbs.

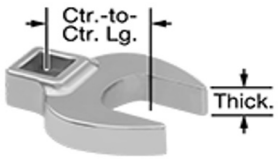
  Torque wrench setting must be adjusted when using offset socket or strap wrench since the lever arm has increased. Torque wrench setting will be less than the desired setting.

  Figure 32: Torque Wrench



- Tight-clearance offset socket, which is often used with an extension. These sockets turn fasteners and fittings in obstructed areas that a regular socket can't reach.

Figure 33: Tight-Clearance Offset Socket



- 3/8" square drive strap wrench, which can be used on the antenna or an offset socket on a torque wrench.

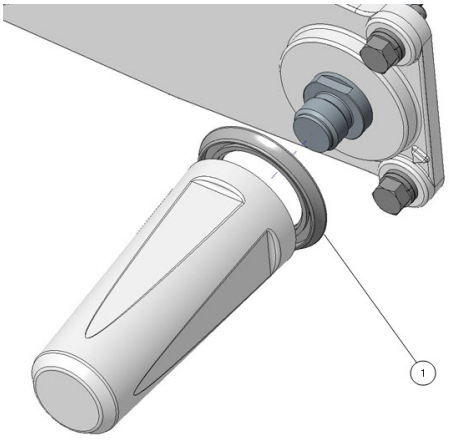
  The size required is 1 3/8”, which should be added to the torque wrench. Pair these wrenches with your square-drive ratchet wrench to create more leverage and torque than you can achieve with standard strap wrenches of the same size. The following figure shows the 3/8" square drive strap wrench.

  Figure 34: 3/8" Square Drive Strap Wrench



Be sure to attach the black gasket labeled (1) in the following figure to the antenna before attaching the antenna to the router. Use a torque of 4 to 4.5 ft-lbs to attach the antenna to IR8140H.

Figure 35: Attaching the Gasket to Antenna



1	Gasket

Supported Antennas for IR8140H

See the following tables for information about the supported antennas.

Supported Antennas for Universal Interface Modules

The following table shows the supported antennas for each UIM.

Table 11: Supported Antennas for Universal Interface Modules

UIM	Module PID	Antenna Selection Single Port PID
LTE Advanced (3GPP Category 4)	IRMH-LTE-MNA IRMH-LTE-MNA-900[1]	2 x LTE (4G/5G) antennas: • ANT-5G-OMNI-OUT-N[2] • ANT-4G-OMNI-OUT-N • ANT-5G-MP-OUT-N
LTE Advanced (3GPP Category 6)	IRMH-LTEA-EA IRMH-LTEA-EA-900[1] IRMH-LTEA-LA	2 x LTE (4G/5G) antennas: • ANT-5G-OMNI-OUT-N[2] • ANT-4G-OMNI-OUT-N • ANT-5G-MP-OUT-N
LTE CAT18	IRMH-LTEAP18-GL	4 x LTE (4G/5G) antennas: [3] • ANT-5G-OMNI-OUT-N • ANT-5G-MP-OUT-N Or 1x 4-in-1 multielement antenna: ANT-4-5G4-O
4G LTE/5G FR1	IRMH-5GS6-GL	4 x LTE (4G/5G) antennas[3]: • ANT-5G-OMNI-OUT-N • ANT-5G-MP-OUT-N Or 1x 4-in-1 multielement antenna: ANT-4-5G4-O

1 IRMH-LTE-MNA-900 and IRMH-LTEA-EA-900 modules are deployed only when using WPAN and LTE.
2 ANT-5G-OMNI-OUT-N needs an extension cable.
3 Use two of each antenna type to maintain proper spatial separation and proper MIMO operation.

Supported Antennas for WPAN Modules

Table 12: Supported Antennas for WPAN Modules

WPAN Module	Module PID	Antenna Selection Single Port PID
IEEE 802.15.4g WPAN (OFDM/FSK)	IRMH-WPAN-NA IRMH-WPAN-BRZ	ANT-5G-OMNI-OUT-N[4] ANT-WPAN-OD-OUT-N[5] ANT-5G-MP-OUT-N ANT-LPWA-DB-O-N-5[6]

[4] ANT-5G-OMNI-OUT-N needs an extension cable.
[5] For use with WPAN Australia and New Zealand
[6] ANT-LPWA-DB-O-N-5 needs an extension cable.

Outdoor Antennas

Antenna	PID	Antenna Specifications
Mast-Mounted/Outdoor 4G/5G-FR1	ANT-5G-OMNI-OUT-N	Antenna Type: Dipole Frequency Band: 617-960 MHz 1448-1511 MHz 1695-2690 MHz 3300-4200 MHz 5150-7125 MHz Connector: N-type (f)
Multipurpose/Outdoor 4G/5G-FR1	ANT-5G-MP-OUT-N	Antenna Type: Monopole Frequency Band: 617-960 MHz 1710-5925 MHz Connector: N-type (m)
Mast-Mounted/Outdoor	ANT-WPAN-OD-OUT-N	Antenna Type: Dipole Frequency Band: 863-928 MHz Connector: N-type (m)

Antenna	PID	Antenna Specifications
Outdoor/Vertical	ANT-LPWA-DB-O-N-5	Antenna Type: Dipole Frequency Band: 863-928 MHz Connector: N-type (f)
4-in-1 (LTE) Outdoor/Vertical	ANT-4-5G4-O	Antenna Type: Multi-Element Frequency Band: 617-960 MHz 1710-5925 MHz Connector: 4xN-type (m) with 10ft low-loss cables

Supported Antenna Cables and Lightning Arrestors for IR8140H

You can choose the N(m) to N(m) RF cables from the following table to use with the antennas that require extension cables. For more information on supported cables, see the Cisco Industrial Routers and Industrial Wireless Access Points Antenna Guide.

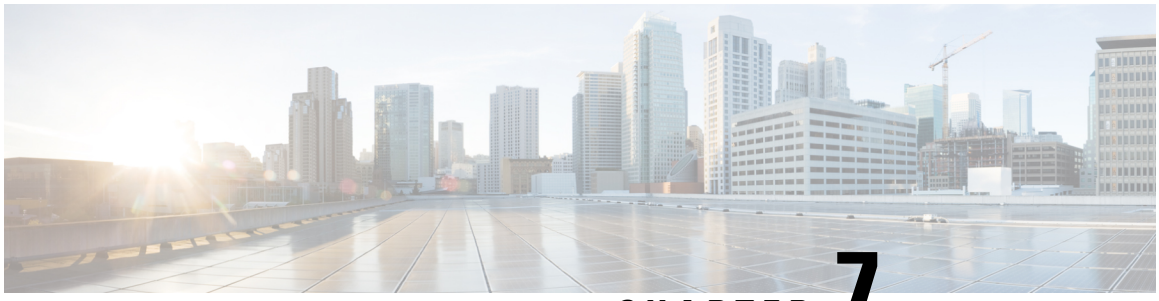
Table 13: Supported Antenna Cables for IR8140H

Antenna PID	Extension Cable PID	Cable Description	RF Loss
ANT-5G-OMNI-OUT-N ANT-LPWA-DB-O-N-5	CAB-L400-5-N-NS	N(m)-STR to N(m)-STR LMR-400, 5 foot RF cable Type: outdoor DB (direct burial)	0.2dB @ 0.7 GHz 0.3dB @ 1.0 GHz 0.4dB @ 1.7 GHz 0.5dB @ 2.4 GHz 0.8dB @ 5.8 GHz
	AIR-CAB010LL-N	N(m)-STR to N(m)-RA LMR-400, 10 foot RF cable Type: outdoor DB (direct burial)	0.4dB @ 0.7 GHz 0.5dB @ 1.0 GHz 0.7dB @ 1.7 GHz 0.9dB @ 2.4 GHz 1.5dB @ 5.8 GHz
	CAB-L400-20-N-N	N(m)-STR to N(m)-RA LMR-400, 20 foot RF cable Type: outdoor DB (direct burial)	0.8dB @ 0.7 GHz 1.0dB @ 1.0 GHz 1.3dB @ 1.7 GHz 1.6dB @ 2.4 GHz 2.5dB @ 5.8 GHz

The following table shows the supported lightning arrestor for IR8140H.

Table 14: Supported Lightning Arrestor for IR8140H

Lightning Arrestor PID	Connector Type	Arrestor Type and Frequency Range (MHz)
IOT-LA-NM-NF	N(m)-STR to N(f)-STR	DC to 6000 MHz GDT type



CHAPTER 7

Connecting the Router

This chapter provides installation instructions for the Cisco Catalyst Industrial Router 8140 Heavy Duty Router. The procedures you must follow depend on your network environment and specific requirements.

These topics are discussed:

- Before Installing, on page 73
- Connecting to AC Power, on page 74
- Reset Button, on page 76
- Checking the System (SYS) LED, on page 78
- Additional Router Connections, on page 78
- Connecting the Console Port, on page 82
- Connecting the SFP Port, on page 83
- Connecting the Ethernet Port, on page 87
- Connecting the Alarm Port, on page 89
- Installing Modules and Antennas, on page 90

Before Installing

Read the safety warnings in this section and the Installation Safety and Site Preparation, on page 23 before beginning the installation procedures.

Prepare the Installation Site

These procedures assume that the installation site is prepared according to the information in Installation Safety and Site Preparation, on page 23.

Preventing Electrostatic Discharge Damage

Many of these components are sensitive to electrostatic discharge (ESD) damage, which can occur when electronic cards or components are handled improperly, resulting in complete or intermittent failures.

Caution To prevent ESD damage, follow these guidelines:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- Place any removed memory card on an antistatic surface or in a static shielding bag. If the card is going to be returned to the factory, immediately place it in a static shielding bag.
- Avoid contact between the card and clothing. The wrist strap protects the card from ESD voltages on the body only; ESD voltages on clothing can still cause damage.
- Do not remove the wrist strap until the installation is complete.

Cabling Guidelines

Follow these guidelines for using cables with the router:

- Position cables so that they do not place strain on the router connectors.
- Organize cables into bundles when necessary to avoid intertwining.
- Inspect cables to ensure adequate routing and bend radius.
- Install cable ties that comply with your site requirements.

Connecting to AC Power

When connecting the router to AC power, you must ensure that the following conditions are met:

- AC power can be readily and conveniently removed from the router. The power should not be removed by disconnecting the AC power connector on the unit. It should be removed by disabling AC power at the power circuit.

Caution Before connecting or disconnecting the power cord, remove AC power from the power cord using a suitable service disconnect.

- Protect AC power plugs and AC receptacles from water and other outdoor elements. You can use a UL-listed waterproofing enclosure that is suitable for covering the AC receptacle and AC power plug that supplies power to the unit, as described in Article 406 of the National Electric Code (NEC).
- When you install the unit outdoors, or in a wet or damp location, the AC branch circuit that powers the unit should have ground fault protection (GFCI), as required by Article 210 of the NEC.
- If the power cord goes through a metal cover, a bushing should be installed to prevent fraying of the cord. When using a strain relief bushing, you should follow these recommendations:
  - Use properly sized parts
  - Use bushings that are safety certified

- Use parts that are suitable for outdoor installation

- Ensure that the user-supplied AC power plug is certified for outdoor use and has a minimum IP67 rating.

The following sections describe the AC power cable and the procedure to connect to AC power.

AC Power Cable

The router supports the Cisco AC power cable that is shipped with the unit. One end of the cable has the router AC power connector, the other end is unfinished and you must attach an AC power plug, or terminate the cable at your installation site. The AC power plug or termination method you use depends on the power source, such as a junction box, at your site.

If you attach an AC power plug:

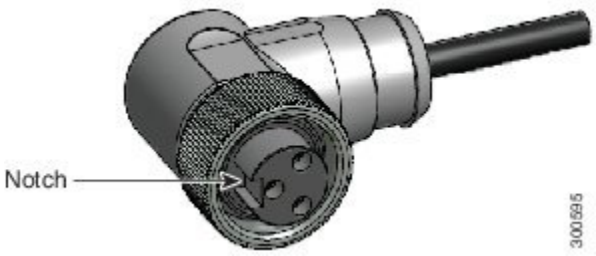
- Use a plug that complies with local and national electrical codes.
- Verify that the connection between the cable and plug is weatherproof.

Note You might have to cut the cable if a specific cable length is needed for your installation.

Caution Ensure that the power source is OFF before connecting or disconnecting the power cord wires from the power source.

Caution To attach the appropriate connector to the AC power cable, follow the manual or other instructions provided by the electrical equipment vendor, ensuring that you comply with the electrical codes for your installation location.

Figure 36: Router AC Power Cable (Router Connector End)



Connecting to AC Power

To connect the router's AC connector to an AC power source, perform this procedure. When connecting the router AC power connector, always connect the router end of the cable first. When removing the AC power connector, always disconnect the router end of the cable last.

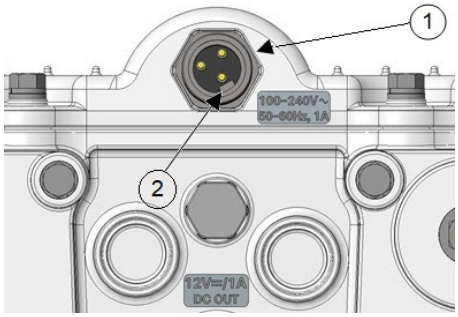
Procedure

Step 1 Verify that the unit is grounded, as described in Grounding the Router, on page 50.

Step 2 Turn off the power to the AC power source at the designated circuits.

Step 3 Align the notch in the AC power cable connector with the key in the router AC power connector, and then push the cable connector into the router connector. When the cable connector is fully seated, rotate the cable connector ring clockwise until it is tight.

Figure 37: Router AC Connector and AC Connector Key



1	AC power connector	2	AC connector key

Step 4 Confirm that the router antennas are connected to the router before you apply power to the router.

Step 5 Connect the other end of the AC power cable to the power source, using the instructions that came with the connecting device.

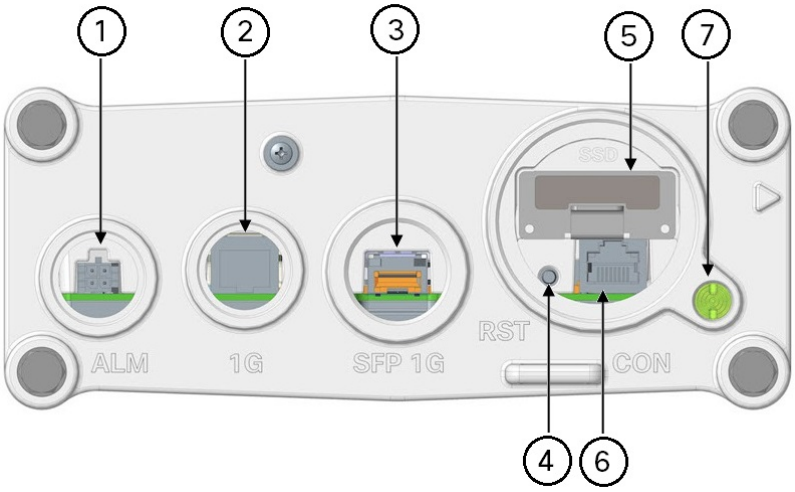
Step 6 Turn on the AC power at the designated circuits.

The router powers on and boots the software image.

Reset Button

The following figure shows the reset button on the CPU module.

Figure 38: CPU Module Components



1	Alarm port with Micro-fit 4P connector with cable port seal.	2	10/100/1000 Mbps Ethernet port
3	SFP One Gigabit Ethernet	4	Reset button
5	SSD module	6	Console port (accessible when plug is removed)
7	SYS LED		

Caution When you use the Reset button to restore the router to the factory default software configuration, the current software configuration is permanently deleted from the router.

Do not use the Reset button to power the router on and off; the router powers on immediately after it is connected to an AC power source.

The Reset button must be pressed and held for at least 5 seconds to return the router to factory default. If the router is equipped with BBU, you must either disable BBU charge-discharge or enable BBU transportation mode prior to removing the AC power in order to fully power down the router. After that, simultaneously press the Reset button while applying power to the router.

Accessing the Reset Button

You must use a nonmetallic pin or any other thin metal tool that is no larger than 3/16 inches in diameter to access and press the Reset button.

Checking the System (SYS) LED

To verify that the router has been successfully installed, check the System (SYS) LED on the router base. When the router starts, the SYS LED displays any of these states.

Table 15: SYS LED States

State	Description
Off	System is not powered on.
Blinking green	System is in boot-up phase or in ROMMON.
Solid green	System is operating normally.
Solid yellow	System is receiving power, but there is an internal error. For example, interface is administratively unshut but is down because of cable disconnection.
Blinking amber	Registered interface is down. **Note** The registered interface must not be administratively shut down.

Additional Router Connections

This section provides information about making other, additional router cable connections. Follow the procedures in this section based on your network configuration and requirements.

External Connections and Chassis Cable Ports

When connecting the router's internal ports to external cables or exterior devices, you must thread the router cables through the chassis cable ports designated for this purpose. Some chassis ports are reserved for specific cables and the remaining ports can be used based on your network configuration and cabling requirements.

Caution When you make router cable connections through the ports, you must use cable glands, as described in Using Cable Glands, on page 79, to protect the router's interior from environmental elements, including moisture, heat, cold, and dust. Failure to use cable glands with the chassis cable ports can result in damage to the router.

Note We recommend that you cover the ports mentioned in this section with a PG 13.5 plug when they are not in use. Ensure that you torque the PG 13.5 plug to 10-12 in-lbs.

Using Cable Glands

This section describes how to use cable glands with the router cables that are threaded through the chassis cable ports, as described in External Connections and Chassis Cable Ports, on page 78.

Caution The cable glands must be used for all the cables that are threaded through the router chassis cable ports to prevent exposing the router's interior to environmental elements.

Ordering Cisco Cable Glands

You can order a cable gland kit from Cisco using the model number IR-IP67GLAND. Each kit contains one cable gland.

Tools You Must Have

You must have these tools to connect cable glands:

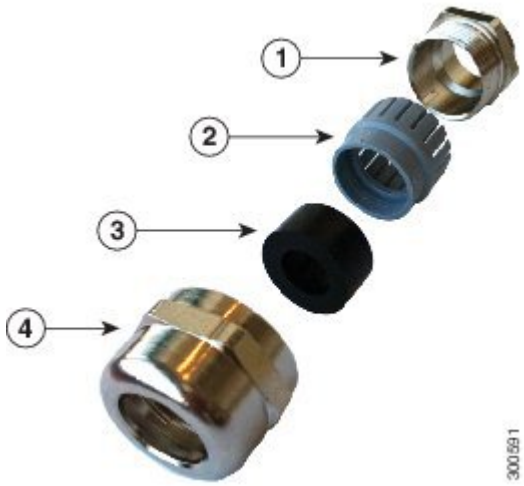
- #3 Phillips screwdriver to remove port seals from the router
- Adjustable wrench that spans to 1 3/8" (for SFP Extender and M42 Plug)
- 5/8" 6 Pt socket driver (for SFP Plug)
- 15/16-inch (24-mm) open-end wrench

Cable Glands

Figure 39: Cable Glands, Assembled



Figure 40: Cable Gland Components



Item	Name	Description
1	Adapter	Connects directly to the chassis cable port on the router.
2	Grommet	Secures the split gasket over the cable.
3	Split gasket	Fits over the cable and creates a liquid-tight seal inside the glands.
4	Cap	Fits over the gasket-and-cable assembly and connects it to the chassis cable port.

Cable Requirements

Cables used with the cable glands should meet the following criteria:

- Outdoor-rated
- UV-stabilized
- Diameter of 0.20-0.35 inches (5.08-8.89 mm)

Caution Cables must be a minimum of 0.20 in. in diameter to create an adequate seal within the cable glands. Using smaller cables could result in an inadequate seal, and expose the router's interior to environmental elements.

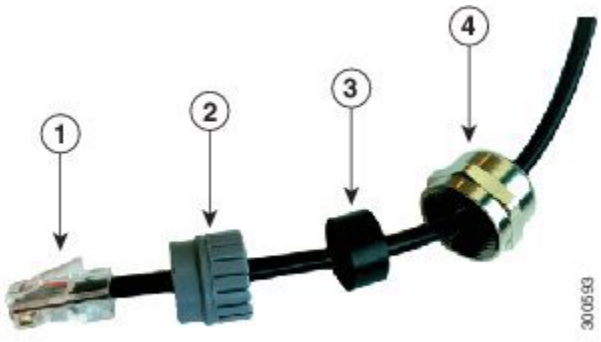
Cable Glands Installation

Follow the steps provided in this section for every cable that you will connect through the chassis cable ports on the router. Step 4 and Step 5 can be done ahead of time and the prepared cable gland assembly can be transported to the router installation site.

The cable glands components referred to in this section are shown in Figure 40: Cable Gland Components, on page 80.

The following figure shows an Ethernet cable, but the steps are the same for all cable types.

Figure 41: Cable Gland Components Threaded on a Cable



1	Cable connector (to router)	3	Split gasket
2	Grommet	4	Cap

Procedure

Step 1 Verify that the cable you are using meets the requirements described in Cable Requirements, on page 80.

Step 2 Remove the port plug from the port on the router. Use the #3 Phillips screwdriver, if needed.

The router is shipped with port plugs in unused ports.

Step 3 Use your hands to attach the cable glands adapter (item 1 in Figure 40: Cable Gland Components, on page 80) into the chassis cable port on the router.

Step 4 Thread the following cable gland components over the cable in this order (Figure 41: Cable Gland Components Threaded on a Cable, on page 81):

a. Cap

b. Split gasket

c. Grommet

Step 5 Slide the split gasket along the cable and into the grommet, pressing firmly to ensure that the gasket is completely seated in the grommet.

Step 6 Thread the connector-end of the cable through the router port and insert it into the corresponding router connector.

Step 7 Align and press the grommet-gasket assembly into the adapter.

Step 8 Slide the cap along the cable, over the grommet, and then onto the adapter.

Step 9 Hand-tighten the cap, and then use the open-end wrench to tighten it until the split gasket seals around the cable (6 to 7 foot-pounds of torque). There should be 5-10 pounds of cable-pull support.

Connecting the Console Port

See Figure 38: CPU Module Components, on page 77 for the console port location.

To configure the router through the Cisco IOS CLI, you must establish a connection between the router console port and either a terminal or a PC with a terminal emulation program, such as PuTTY or TeraTerm. The console port is located on the router's exterior and is labeled CON.

Use this port to connect a PC terminal, enabling you to log directly into the router's system software to perform a configuration or execute other commands.

Caution The console port does not support cable glands. When a cable is connected to this port, the router's interior is exposed to environmental elements, which can damage the port and the router's interior. This port should be exposed only during terminal sessions, when a cable is connected to the port. This port should never be left unattended when in use. When not in use, cover the console port with an M42 plug that is attached to the CPU module. Ensure that you torque the M42 plug to 13 to 15 in-lbs.

Connecting

This section describes how to connect a PC terminal to the console port.

Your router kit includes a console cable with an RJ-45 connector on one end, and a DB-9 connector on the other end.

- When a terminal is connected to the console port, you can connect directly to the router and configure it. You can connect a PC terminal to this port while the router is operating normally.
- To connect a PC terminal to the router, you must provide one of the following adapters, depending on the device port—RJ-45-to-DB-25 female DTE adapter, RJ-45-to-DB-9 female DTE adapter (labeled TERMINAL), or USB-to-DB-9 adapter.
- To remove the RJ-45 cable from the console port, compress the retention latch on the RJ-45 connector while removing the cable from the port. Use any small, flat, nonmetallic tool to press the latch while pulling the cable from the port.

To connect a PC or PC terminal to the console port:

Procedure

Step 1 Connect the RJ-45 connector on the console cable to the console port on the router.

Step 2 If your device requires a DB-9 adapter, connect the adapter you provide to the DB-9 connector on the cable.

Step 3 Connect the adapter-end or DB-9 connector-end of the console cable to your terminal or PC.

Note

A typical connection to a PC is through the PC's USB port. A DB-9 to USB adapter is required for that case if you use the included Cisco console cable. Alternately, you can use the RJ45-to-USB Cisco Router Console cables, that do not require an additional adapter.

Connecting the SFP Port

See Figure 38: CPU Module Components, on page 77 for the SFP port locations.

Small Form-Factor Pluggable (SFP) modules are transceiver devices that plug into the router's SFP port. The transceiver connects the electrical circuitry of the module with the optical network.

The SFP module used on each port must match the wavelength specifications at the other end of the cable. The cable must not exceed the stipulated cable length for reliable communications.

Use only Cisco SFP transceiver modules with the router. Each SFP transceiver module supports the Cisco Quality Identification (ID) feature that allows a Cisco switch or router to identify and validate that the transceiver module is certified and tested by Cisco.

Warning

Statement 1008—Class 1 Laser Product

This product is a Class 1 laser product.

Caution

Do not remove the dust plugs from the fiber-optic SFP module port, or the rubber caps from the fiber-optic cable until you are ready to connect the cable. The plugs and caps protect the SFP module ports and cables from contamination and ambient light.

Caution

We recommend that you not install or remove the SFP module while the fiber-optic cable is attached to it because of the potential damage to the cables, to the cable connector, or to the optical interfaces in the SFP module. Disconnect the cable before you remove or install an SFP module.

Materials and Tools You Must Have

You must have these tools and materials to install the SFP transceiver module:

- Tools listed in Tools You Must Have, on page 79.
- Wrist strap or other personal grounding device to prevent ESD occurrences.
- Antistatic mat or antistatic foam to set the transceiver on.
- Fiber-optic end-face cleaning tools and inspection equipment. For complete information on inspecting and cleaning fiber-optic connections, see the white paper at:

  http://www.cisco.com/en/US/tech/tk482/tk876/technologies_white_paper09186a0080254eba.shtml

Connecting a Fiber-Optic Cable to the Router

The Cisco Fiber Kit is required to support fiber-optic network connections.

Your require the following materials for connecting the fiber-optic cable to the router:

- Small form-factor pluggable (SFP) transceiver module
- SFP module adapter
- Duplex LC fiber-optic cables. The outer diameter of the fiber optic cable should be 0.24 to 0.47 inches (6 to12 mm).
- Adjustable wrench that adjusts to 1 1/8" minimum

You can connect the fiber-optic networking cable to the SFP port. The SFP transceiver module is used to connect the cable to the SFP port. To install the SFP transceiver module and the cable, follow this procedure:

Procedure

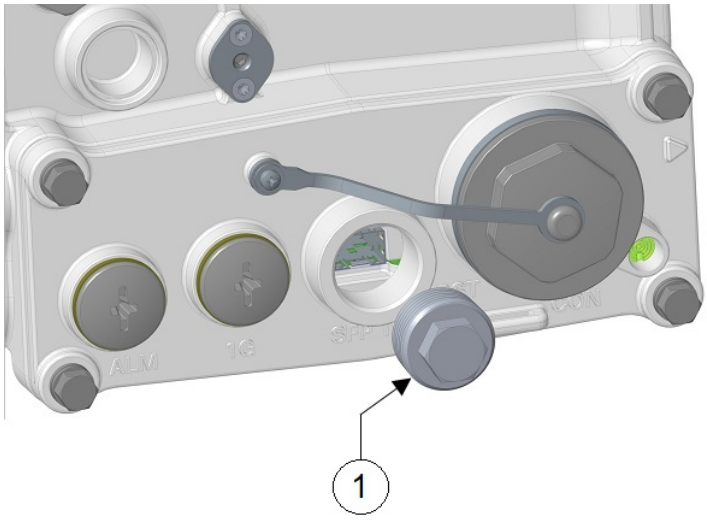
Step 1 Ensure that all the power sources have been disconnected from the router.

Step 2 Remove the ¾ NPT covering plug (see **1** of the following figure) from the SFP port by following the guidelines given in this step.

The SFP port covering plug is designed to be removed only once, and then be replaced with the SFP adapter. The plug does not have a rubber O-ring, but is fixed in place using a thread seal tape on the threads during manufacturing. While removing the plug, you need to ensure that its hex bolt-head does not get stripped.

Use a 5/8” (16-mm) 6-point socket wrench to loosen the hex bolt-head SFP port plug. Firmly and carefully, turn the socket wrench counter-clockwise to loosen the plug. This requires a torque of 1–2 ft-lb (0.73–1.4 Nm).

Though not ideal, a 5/8” (16-mm) 12-point socket wrench can be used too. A crescent wrench is to be used only if the socket wrenches are not available. Do not use a pipe or monkey wrench for this task, because this will strip the hex bolt-head.



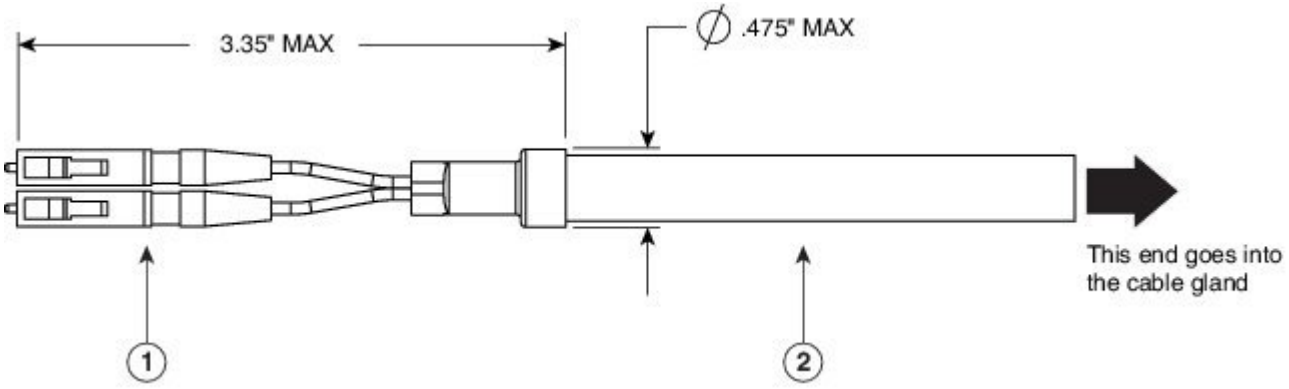
Step 3 Insert the SFP module into the SFP port, and ensure that it latches properly. See #unique_106 unique_106_Connect_42_fig_qh4_t5y_ypb for assembly detail.

Step 4 Loosen the cable gland's nut (round end of the cable gland) by turning counterclockwise, but do not remove it.

Step 5 Feed the terminated fiber cable through the gland and adapter, as shown in the following figure.

Note
The optic fiber connectors are too big to pass through the cable gland. That is the reason why you need to thread the cable through the gland from the unterminated end (even if the cable is quite long).

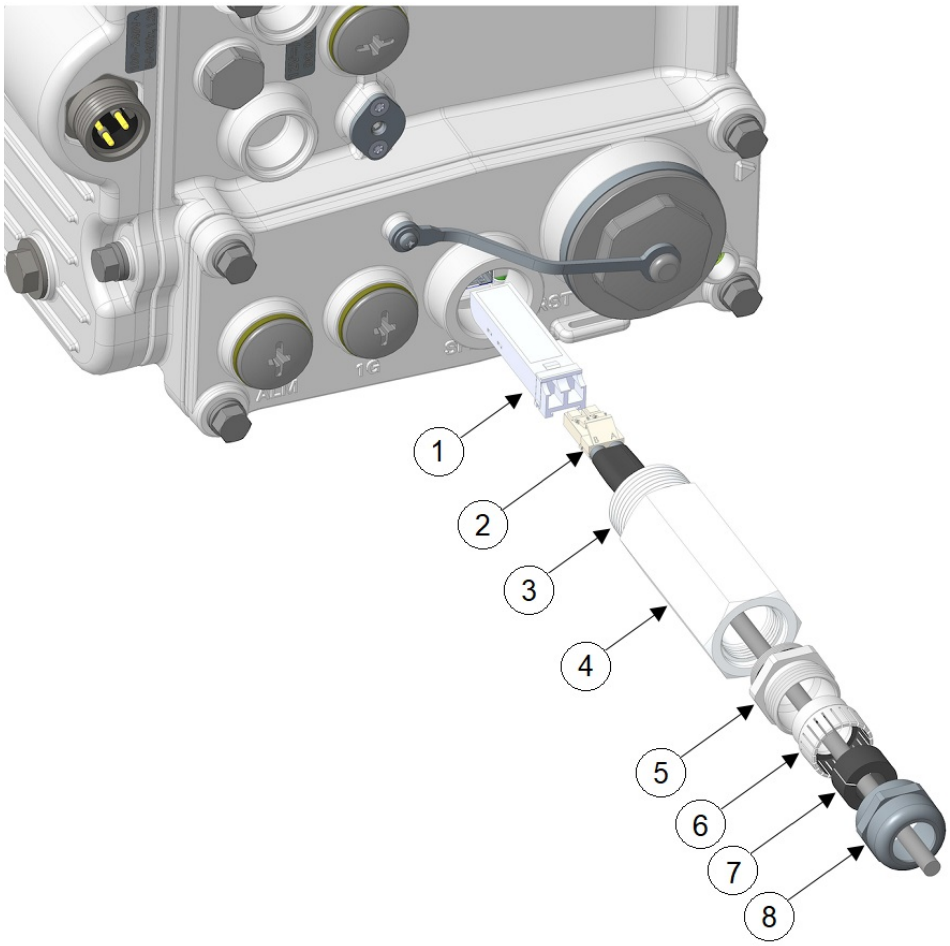
Figure 42: Duplex LC Fiber Optic Cable



1	Duplex LC optic fiber connector	2	Optic fiber cable

Step 6 Insert the LC optic fiber connector-end of the cable into the SFP module adapter. Do not attach the cable gland to the adapter yet. See the following figure.

Figure 43: Exploded View of Connecting Fiber-Optic Cable to the Router



1	SFP module	5	Adapter base
2	SFP cable	6	Grommet
3	Extender threads	7	Gasket
4	Extender	8	Compression cap

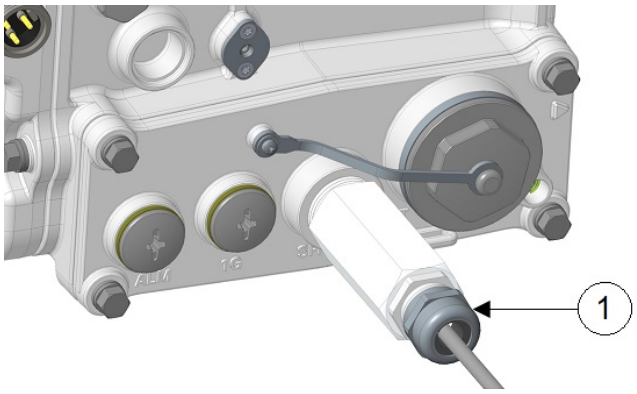
Step 7 Insert the LC optic fiber connector into the SFP module and ensure that it latches into place.

Step 8 Apply sealing tape or sealant to the threads of the extender, and then thread the extender into the SFP port of the router chassis. Use an adjustable wrench to tighten the threaded end of the cable gland to 6 to 7 lb-ft (8.1 to 9.5 Nm).

Step 9 Thread the adapter base into the extender with 3 to 4 ft-lbs of torque.

Step 10 Insert *keyed* grommet into the adapter base, and insert the gasket into the grommet.

Step 11 Tighten the compression cap (**1**) until the grommet and gasket compress on to the cable and provides seal and cable stress relief. Use an adjustable or open-end wrench to tighten to 2.7 to 3.2 lb.ft (3.66 to 4.34 Nm).



Caution
When removing this SFP assembly, it is absolutely imperative that you proceed in the reverse order of this installation. Start by loosening the cable gland's nut.

Connecting the Ethernet Port

See Figure 38: CPU Module Components, on page 77 for the Ethernet port location.

The router features a Gigabit Ethernet port for connecting the router to an Ethernet network through a hub or switch.

- One or two Ethernet cables are typically provided with the router. Additional cables and transceivers can be ordered from Cisco. For ordering information, contact customer service.
- When connecting a cable to the Ethernet port, you must use a cable gland and thread the cable through the chassis cable port on the router. See External Connections and Chassis Cable Ports, on page 78.

Connecting an Ethernet Cable to the Router

The following tools and materials are required:

- Shielded outdoor-rated Ethernet (CAT5e or better) cable
- RJ-45 connector and installation tool
- #3 Phillips screwdriver

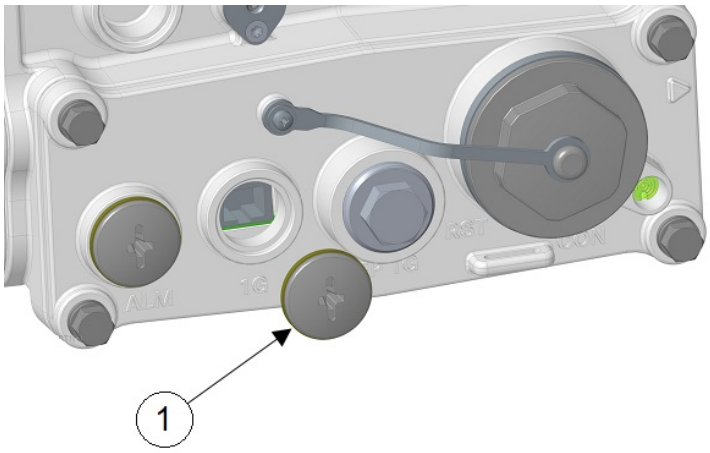
To connect the shielded Ethernet cable to the router, follow these steps:

Procedure

Step 1 Ensure that all the power sources to the router are turned off.

Step 2 Verify that the router is grounded, as described in Grounding Instructions, on page 50.

Step 3 Remove the PG13.5 plug-and-seal ring (**1**) from the router chassis with the #3 Phillips screwdriver.

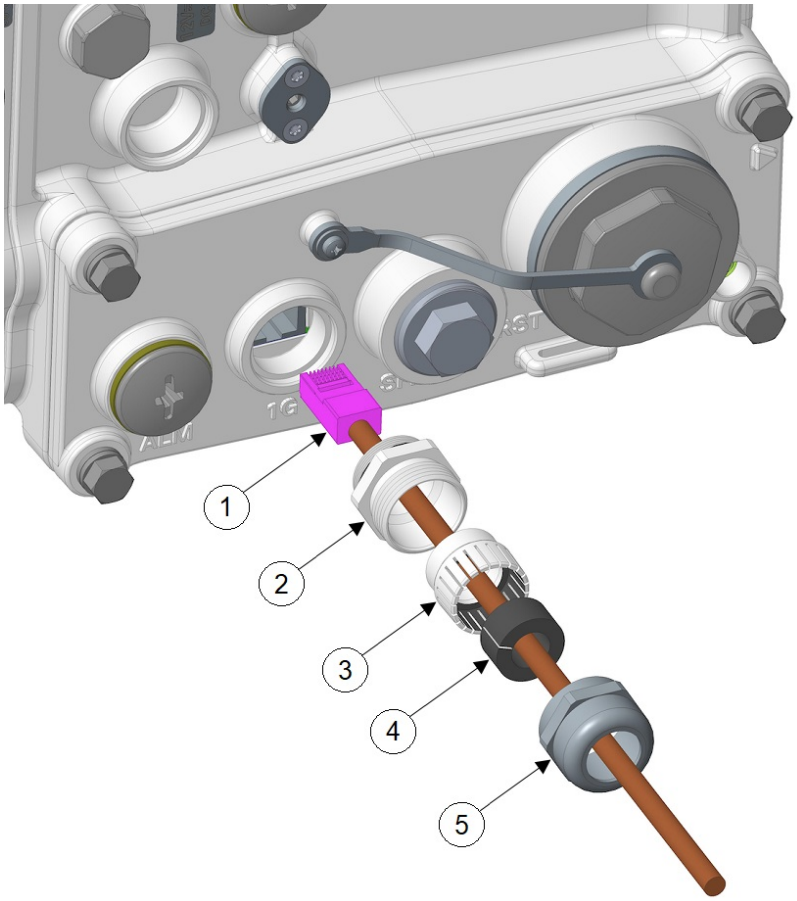


Step 4 Loosen the cable gland's nut (round end of the cable gland) by turning it counter-clockwise, but do not remove.

Step 5 Insert the unterminated end of the Ethernet cable through the sealing nut end of the cable gland, and pull several inches of the cable through the adapter.

Step 6 Install an RJ-45 connector on the unterminated end of the Ethernet cable using your Ethernet cable installation tool.

Step 7 Carefully insert the RJ-45 cable connector into the Ethernet port opening on the router chassis, and connect to the internal Ethernet connector, as shown in the following figure.



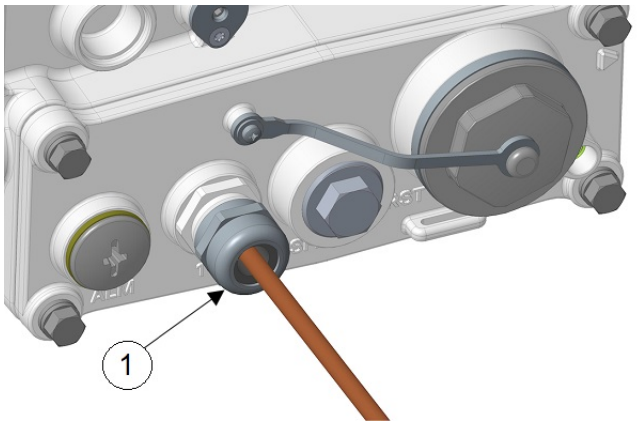
1	RJ-45 cable connector	4	Split gasket
2	Adapter base	5	Compression cap
3	Grommet		

Step 8 Thread the adapter base into the Ethernet port and tighten with 3 to 4 ft-lbs of torque.

Step 9 Insert *keyed* grommet into the adapter base.

Step 10 Install the split gasket around the cable, and then insert the gasket into the compression ring.

Step 11 Tighten the compression cap (**1** in the following figure) until the grommet and gasket compress on to the cable and provide seal and cable stress relief. Use an adjustable or open-end wrench to tighten to 2.7 to 3.2 lb.ft (3.66 to 4.34 Nm).



Step 12 Route your Ethernet cable.

Connecting the Alarm Port

See Figure 38: CPU Module Components, on page 77 for the alarm port location.

Attach the alarm port to an alarm system to monitor software events and errors. The alarm port supports two bidirectional channels that can be configured as inputs or outputs independently.

The alarm-trigger setting determines when an alarm is sent to the attached alarm system.

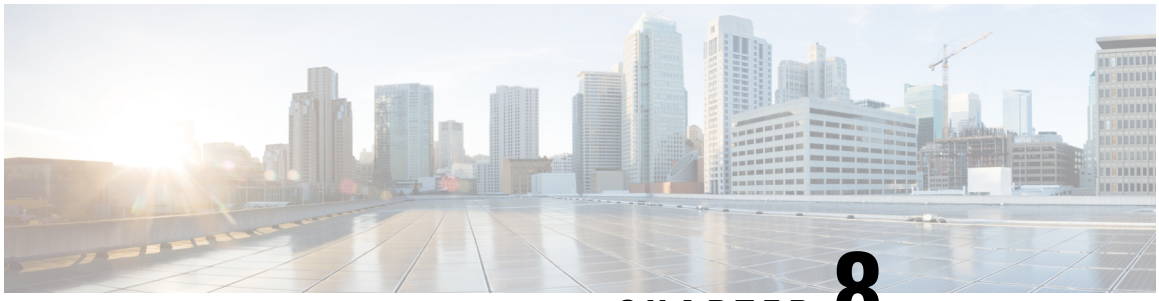
- You can connect this port while the router is operating normally.
- If you use an alarm system on your network, connect the alarm port to an alarm system, using an alarm cable that you provide.
- When connecting this port to an external alarm system, you must use cable glands and thread cables through the chassis cable ports on the router. See External Connections and Chassis Cable Ports, on page 78.
- When configuring the alarm channel as an input, the alarm input will detect an open or closed external circuit, such as a relay.

- When configuring the alarm as an output, the alarm output requires users to provide their own external relay and external pull-up resistor in the range of 3 to 60 V. The resistor value needs to be strong enough to energize the relay, but weak enough to stay under 100 mA when the pullup is forced to 0 V.

The procedure to connect to the alarm port is identical to the one described in Connecting an Ethernet Cable to the Router, on page 87, with the exception that the connector is not RJ45, but a 4-pin Micro-Fit. See Alarm Port, on page 14 for details.

Installing Modules and Antennas

The router supports up to three UIMs. Each module requires one or two antennas, which are installed on or near the router. See Installing Universal Interface Modules, on page 53 and Attaching an Antenna to IR8140H, on page 67.



CHAPTER 8

Installing Battery Backup Units

Cisco Catalyst IR8140 Heavy Duty Router supports up to three battery backup units (BBUs) that provide power to the router if the router's AC power supply fails or is not available. This section describes the BBU features and installation procedures.

These topics are discussed:

- Battery Backup Operations, on page 91
- BBU Status, on page 92
- Battery Backup Mode, on page 93
- BBU Lifecycle Handling and Storage Guidelines, on page 93
- Preparing to Install a BBU, on page 96
- BBU Components, on page 97
- Online Insertion and Removal, on page 98
- Installing BBUs in the Router, on page 98
- BBU Technical Specifications, on page 106

Battery Backup Operations

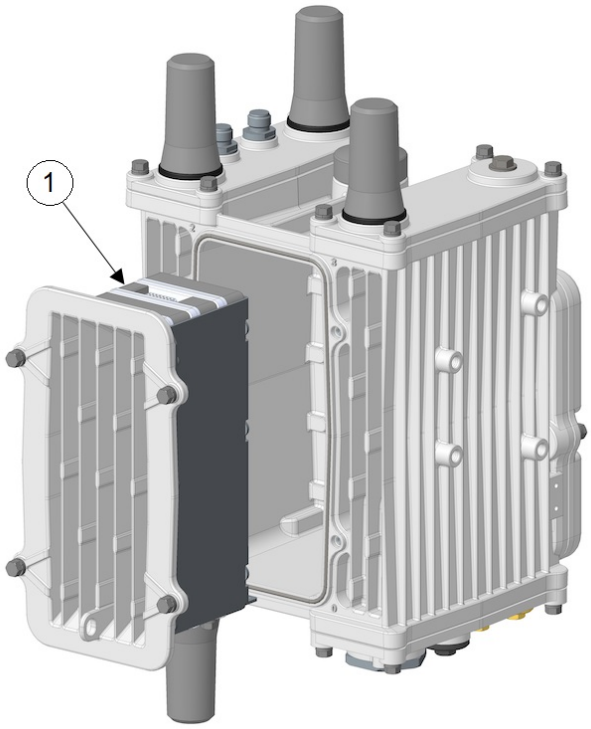
BBUs provide the router with an emergency power source if the AC power source is unavailable.

The router supports up to three BBUs. The units are mounted in the center-front of the IR8140H. When you install three BBUs, up to 8 hours of battery backup power is available on a fully-loaded system in the event of an AC power failure. BBUs can be replaced in the field.

BBUs can be installed in the router when the router is powered on and operating normally.

The BBU's internal components include battery cells, a primary protection circuit, a fuel gauge, and a charger. For detailed, illustrated descriptions of a BBU, see BBU Components, on page 97.

Figure 44: Battery Backup Units Mounted on Router



Item	Cisco Product ID (PID)	Description
1	IRMH-BATT-4AH	Battery backup units. The router supports up to three BBUs.

BBU Status

A BBU must first be enabled before it can begin supplying power to the router. The BBU continues to supply power to the router until at least one of the following conditions is met:

- All BBUs are completely discharged.
- AC power to the router is restored.
- The BBU is disabled with software commands (see Cisco Catalyst IR8140 Heavy Duty Series Router Software Configuration).

Note For information on technical details about the router power path selection and the conditions that trigger a BBU to begin operating, see BBU Technical Specifications, on page 106.

Battery Backup Mode

This section describes the impact on the router configuration and operating capabilities when the router switches from AC power to BBU power.

BBU Capacity

The router supports up to three BBUs at one time. You should install as many BBUs, as needed, up to three, to meet your emergency power requirements.

If all the installed batteries fully discharge while providing backup power to the router, the router will send a dying gasp message and then shut down.

Router Configuration

The router's software configuration is not impacted when the router switches from AC power to BBU power.

Universal Interface Module Operation

By default, the UIMs installed in the slots continue to operate normally when the router switches from AC power to BBU power.

You can configure the router to automatically power off specific modules when the router switches to BBU power.

BBU Lifecycle Handling and Storage Guidelines

This section contains information about the BBU status and condition during the BBU lifecycle and how to approach and manage it.

BBU Storage-Related Definitions

- Shelf life: Shelf life is the length of time before a BBU needs to be recharged in order to avoid BBU over-discharge.
- State of charge: State of charge (SoC) is the amount of charge on a battery and it is expressed as a percentage value. For example, an SoC of 100 percent represents a battery that is fully charged, and an SoC of 0 percent represents a battery that is fully discharged.

BBU Shipping and Receiving Guidelines

The BBU shipping and receiving guidelines define the BBU SoC status and how it can be managed at this stage of the BBU life cycle:

- Cisco ships BBUs with a minimum of 60 percent SoC from the Cisco contract manufacturer.

- Each BBU should have a minimum SoC of 50 percent on being received from the Cisco contract manufacturer.
  - A minimum SoC of 50 percent allows for approximately 10 weeks between shipment from Cisco's contract manufacturer and a customer checking the SoC.
  - SoC decreases by approximately 1 percent per week (because of self-discharge).
  - The BBU SoC status can be checked using the CLI.
  - BBUs with less than 50 percent SoC should be recharged by the system integrator or customer to >50 percent SoC.

BBU Storage and Handling Guidelines

The BBU storage and handling guidelines define the BBU shelf life status and how it can be managed at this stage of the BBU lifecycle:

- The shelf life of a BBU installed in a router with discharge disabled and BBU disabled, or for a spare BBU, is typically 6 to 12 months.
- Prior to its connection to an AC source, a BBU's shelf life is a minimum of 21 days.
- When long-term storage at a customer site is anticipated, Cisco requires that a BBU be recharged prior to the expiration of shelf life.
- When AC power is disconnected and the Cisco IR8140H router is removed from service:
  - The router switches to DC power supplied by the BBUs and remains powered for approximately 8 hours.
  - After 8 hours the BBUs reach low-voltage disconnect, and the remaining shelf life is a minimum of 21 days.
  - The BBUs should be placed in BBU disable mode when the router is removed from service in order to extend BBU shelf life up to 365 + 21 days
  - The remaining shelf life depends on the SoC prior to the removal of AC power and the BBU being placed in the BBU disable mode.
  - Disabling a BBU at 0 percent SoC means a minimum remaining shelf life of 21 days, and disabling a BBU 100 percent SoC means a maximum remaining shelf life of 386 days.

Recharging a BBU

To recharge a BBU:

Procedure

Step 1 Connect the router to an AC power source.

Step 2 Enable the BBU.

Step 3 Allow at least 8 hours of charge time per BBU, that is, for routers with three BBUs each, allow 24 hours charge time per router.

Step 4 When the charge time is completed, disable a BBU if it will not be used as backup power for this router.

Replacing a BBU

When you replace a BBU in the router, we highly recommend that you do the following:

- Replace all the BBUs.
- Verify that all the replacement BBUs are the same version.

When a router operates with different BBU versions, it may result in misbehavior in the BBU functionality.

To replace a BBU:

Procedure

Step 1 Disconnect the BBU module from the router according to the instructions provided in Removing the BBU Cage from the Faceplate, on page 103 and Removing BBU Modules from the BBU Cage, on page 100.

Step 2 Replace all the BBUs of the router at the same time.

Note
Do not mix used BBUs with new BBUs.

BBU Disposal Guidelines

Instructions for disposal of BBUs:

- For routers under warranty, follow the standard Cisco Return Material Authorization (RMA) procedures.
- If Cisco identifies a BBU or set of BBUs as a nonfunctional item that can be discarded without being returned for failure analysis, BBUs removed for replacement must be disposed of in accordance with local guidelines.
- U.S. and Canadian customers should utilize www.call2recycle.org to properly recycle the lithium ion BBUs.
- For local recycling outside of the U.S. and Canada, customers should contact the following Cisco email for guidance specific to the customer's country or region—environment@cisco.com
- For further local take-back and recycling information, customers can find the relevant information at: www.cisco-returns.com.

Preparing to Install a BBU

Before installing BBUs in the router, ensure that the following guidelines have been met.

Tools You Must Have

You must use a #1 Phillips screwdriver to install or remove the BBUs inside the BBU cage. You also need these tools:

- T15 Torx Driver
- 10-mm Socket Driver

Safety Warnings

We recommend that you also read the safety warnings in Installation Safety and Site Preparation, on page 23.

Warning **Statement 1015—**Battery Handling

To reduce risk of fire, explosion, or leakage of flammable liquid or gas:

- Replace the battery only with the same or equivalent type recommended by the manufacturer.
- Do not dismantle, crush, puncture, use a sharp tool to remove, short the external contacts, or dispose of the battery in fire.
- Do not use if battery is warped or swollen.
- Do not store or use battery in a temperature > .
- Do not store or use battery in low air pressure environment < .

When a router operates with different BBU versions, it may result in misbehavior in the BBU functionality.

Preventing Electrostatic Discharge Damage

BBUs are sensitive to electrostatic discharge (ESD) damage that can occur when electronic cards or components are handled improperly, and result in complete or intermittent failures.

To prevent ESD damage, follow these guidelines:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- Place the BBUs on an antistatic surface or in a static shielding bag. If a BBU will be returned to the factory, immediately place it in a static shielding bag.
- Avoid contact between the battery and clothing. The wrist strap protects the battery from ESD voltages on the body only; ESD voltages on clothing can still cause damage.

- Do not remove the wrist strap until the installation is complete.

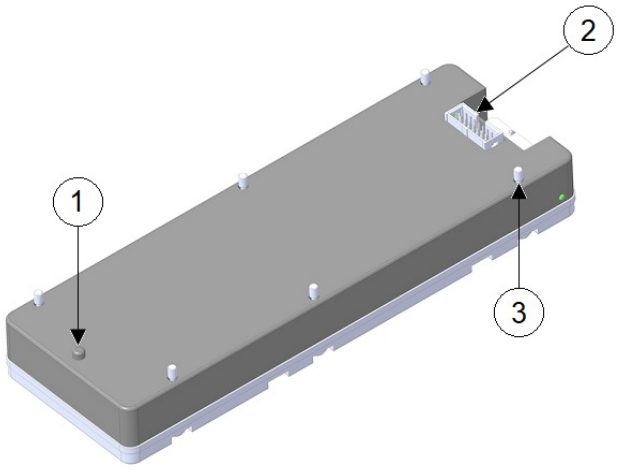
BBU Components

This section illustrates and describes the BBU components that you should be familiar with when installing the BBUs.

Note For technical specifications of the components described in this section, see BBU Technical Specifications, on page 106.

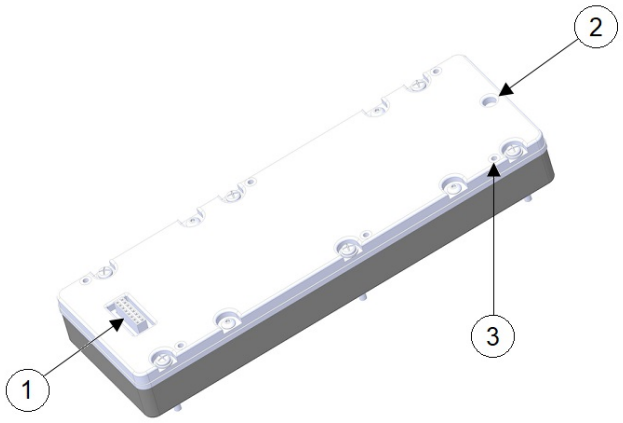
There is a plug connector at the back and a socket connector at the front of each BBU. Also, there is a BBU alignment pin at the back and an alignment hole at the front. When BBUs are plugged into each other, they mate front to back. The plug connector engages with the socket connector, and the alignment pin with the alignment hole. When you connect a second or third battery to a battery that is already installed, use the alignment pin and hole to ensure correct battery position and align the battery connectors.

Figure 45: Rear of Battery Backup Unit



Item	Description
1	BBU Alignment Pin
2	BBU Interface Plug
3	Captive screws (6) for installing the BBU for stacking or installing BBUs inside the BBU bracket of the BBU module

Figure 46: Front of Battery Backup Unit



Item	Description
1	BBU Interface Socket
2	BBU Alignment Hole
3	Captive Nut (6) for installing the BBU for stacking or installing BBUs inside the BBU bracket of the BBU module

Online Insertion and Removal

Online Insertion and Removal (OIR) of BBU is supported for IR8140H from Cisco IOS XE Release 17.7.1.

Installing BBUs in the Router

This section describes how to install a BBU in the router. A new BBU will be about 50 percent charged when you receive it.

Caution When you install a BBU in the router, if no AC power is being supplied to the router, the BBU (if it is not in a disabled state) will immediately begin to power the router when it is connected.

To prevent the BBU from powering the router prior to installation in the field, the BBU is disabled during shipment. To ensure that the BBU can be charged and power the router when required, enable the BBU right after installation.

Follow these steps to install BBUs in the router:

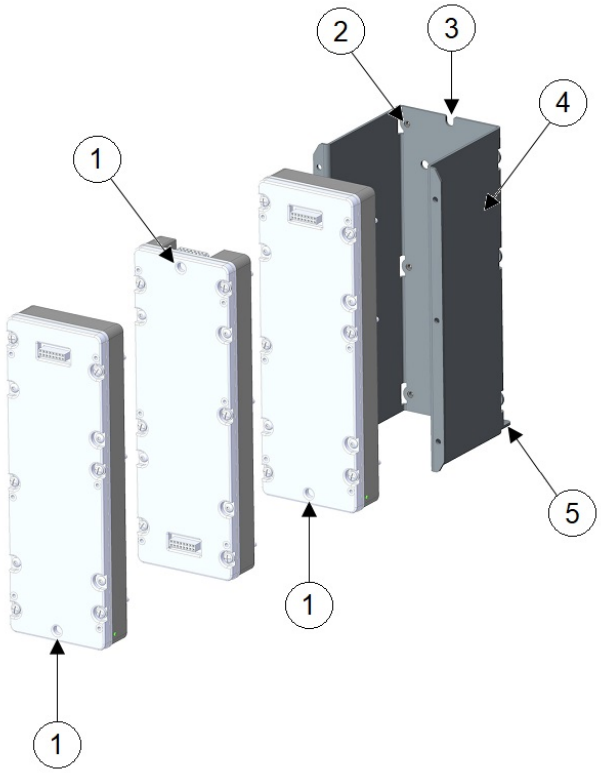
1. Install BBU Modules to the BBU Cage, on page 99
2. Attaching the BBU Cage to the Faceplate, on page 100
3. Installing BBU Assembly or Blank to the Router, on page 103

Follow these steps to remove BBUs from the router:

1. Removing the BBU Assembly or Blank from the Router, on page 106
2. Removing the BBU Cage from the Faceplate, on page 103
3. Removing BBU Modules from the BBU Cage, on page 100

Install BBU Modules to the BBU Cage

Follow these steps to install BBU modules to the BBU cage:



1	Alignment hole	4	BBU cage
2	Captive nuts (6)	5	BBU security tab
3	BBU cage pin notch		

Procedure

Step 1 To install the first BBU module, line up the BBU pin with the BBU cage pin notch, and then torque the six captive screws to 7 to 9 in-lbs with a #1 Phillips screwdriver in sequence, as shown in the following figure.

Step 2 To install a second BBU module, line up the BBU alignment pin with the BBU alignment hole, and press the plug and socket connectors together. Torque the six captive screws to 7 to 9 in-lbs with a #1 Phillips screwdriver in sequence, as shown in the following figure.

Step 3 To install a third BBU module, line up the BBU alignment pin with the BBU alignment hole and press the plug and socket connectors together. Torque the six captive screws to 7 to 9 in-lbs with a #1 Phillips screwdriver in sequence, as shown in the following figure.



Removing BBU Modules from the BBU Cage

To remove BBU modules from the BBU cage, you must start with the last BBU module and work inward towards the back of the BBU cage.

Procedure

Step 1 Loosen the six captive screws using a #1 Phillips screwdriver and pull off the BBU module.

Step 2 Proceed to the next BBU module until all the modules are removed.

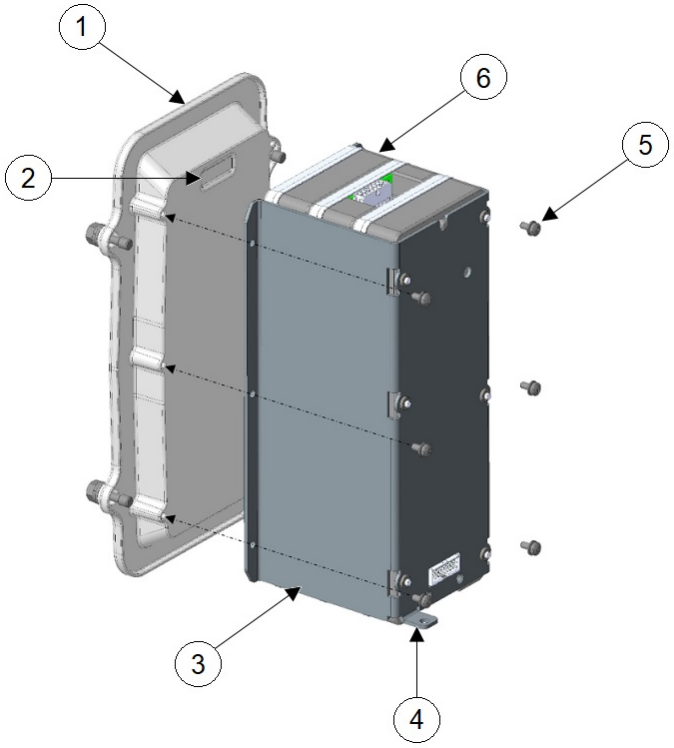
Attaching the BBU Cage to the Faceplate

Follow these steps to attach the BBU cage to the faceplate:

Procedure

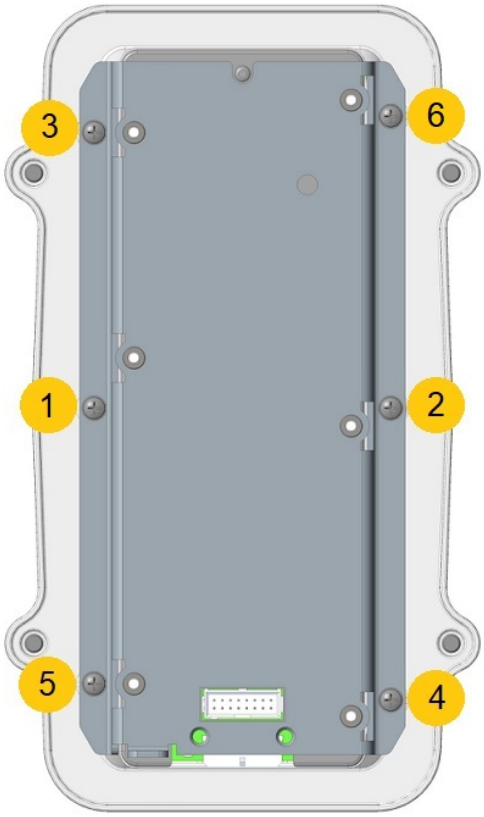
Step 1 Align the BBU cage or assembly to the faceplate, as shown in the following figure. Note the location of the BBU security tab in relation to the faceplate connector relief.

Figure 47: Attaching BBU Cage to Faceplate

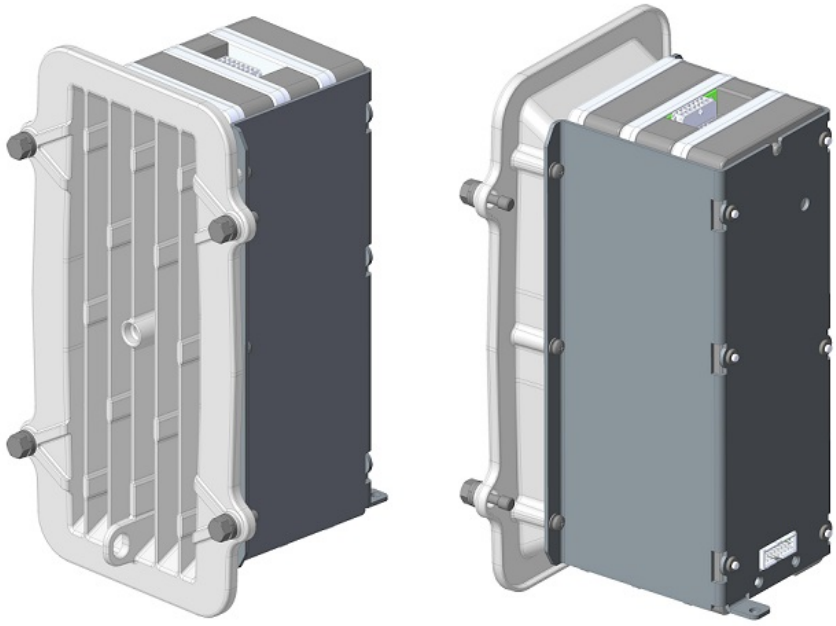


1	Faceplate	4	BBU security tab
2	Connector relief	5	M3.5 screws (6)
3	BBU cage	6	BBU module

Step 2 Insert six M3.5 screws in the locations as shown in the following figure. Torque screws to 10 to 12 in-lbs in sequence, as shown in the following figure.



The BBU assembly is now ready to be mounted to the router.



Removing the BBU Cage from the Faceplate

Follow these steps to remove the BBU cage from the faceplate:

Procedure

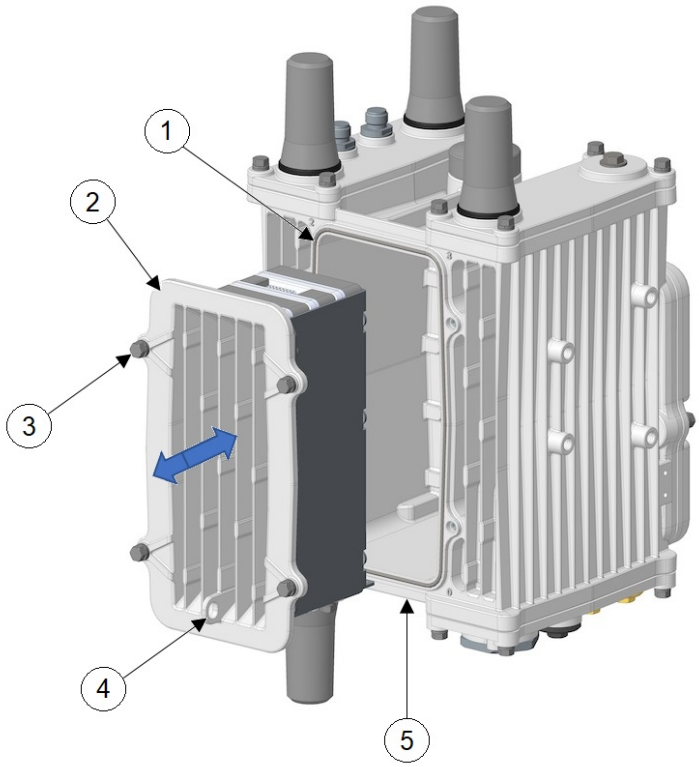
Step 1 Use a T15 Torx driver to remove the six M3.5 screws that attach the BBU cage to the faceplate. Do not discard the screws.

Step 2 Remove the BBU cage or assembly from the faceplate.

Installing BBU Assembly or Blank to the Router

Follow these steps to install the BBU assembly or blank to the router:

Figure 48: BBU Assembly or Blank Mounted on the Router



1	BBU gasket	4	Padlock tab
2	BBU assembly or blank	5	BBU security screw at the bottom of the router
3	M6 bolts (4)		

Procedure

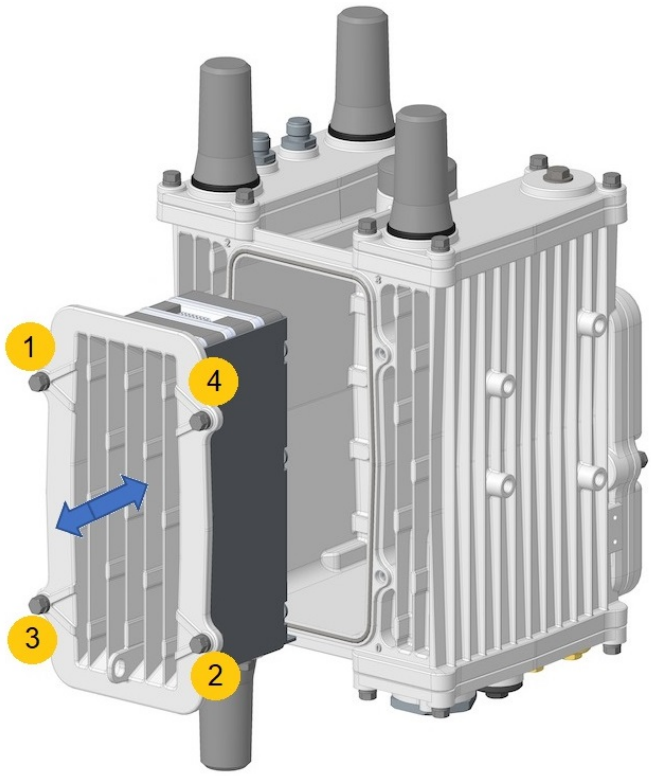
Step 1 Ensure that the BBU gasket is fully installed in the gasket groove and that the sealing surface is clean.

Step 2 Ensure that the BBU security screw is fully backed out (see Install the BBU Security Screw, on page 105).

Step 3 Align the BBU assembly or blank with the router chassis, and note the location of the padlock tab.

Step 4 Carefully push the BBU assembly fully into the cavity. BBU is self aligning with internal guide pins. Do not leave the BBU assembly unattended until the M6 bolts have been tightened.

Step 5 Torque the M6 bolts with a 10-mm socket driver. Torque to 15 to 20 in-lbs in the sequence shown below. Then repeat torque sequence to 30 to 35 in-lbs for final torque.



Install the BBU Security Screw

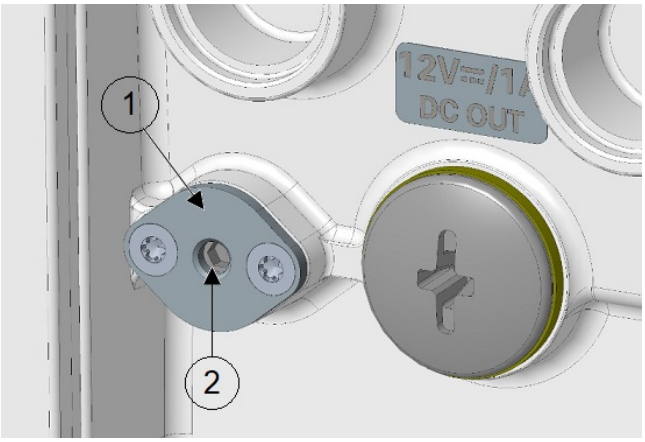
The BBU security screw is located at the bottom of the router.

Follow these steps to install the BBU security screw:

Procedure

Step 1 Ensure that the BBU security screw is backed out until it hits the retention plate.

Figure 49: BBU Security Screw



1	Retention plate (do not remove)	2	BBU security screw (require 3-mm Hex head)

Step 2 Install the BBU assembly and torque bolts according to the detailed instructions in Installing BBU Assembly or Blank to the Router, on page 103.

Step 3 Tighten and torque the BBU security screw to 10 to 12 in-lbs.

Removing the BBU Assembly or Blank from the Router

Follow these steps to remove the BBU assembly or blank from the router:

Procedure

Step 1 Back out the BBU security screw until it hits the retention plate. See Figure 49: BBU Security Screw, on page 106.

Step 2 Loosen four M6 bolts with a 10-mm socket on the BBU faceplate (do not remove the bolts from the faceplate).

Step 3 Pull the BBU assembly or blank out straight.

Caution
The BBU assembly is heavy.

Step 4 Ensure that the BBU gasket stays in place and the sealing surface is clean.

BBU Technical Specifications

This section describes the specifications and standards supported by the BBUs.

Router Power Path Selection

During normal operation, the router is powered by the integrated AC power supply. The BBU enters the discharge mode and begins providing power to the router when the AC power is interrupted outside the range of 85 to 250 V for more than 20 ms. The BBUs can either charge or discharge; they cannot support both simultaneously.

Discharge Conditions

Table 16: Battery Backup Unit—Discharging Specifications

Discharge Conditions	Description
Duration	4 hours minimum with a 10 W power load
Entry to discharge[7]	• AC power (range of 85 to 250 V) not detected for more than 20 ms • Remaining BBU capacity >5 percent • External ambient temperature is within -40 to 122°F (-40 to 50°C)
Exit discharge[8]	• AC power restored in the range of 85 to 250V for more than 20 ms. • Remaining BBU capacity <5 percent • External ambient temperature is outside the range of -40 to 122°F (-40 to 50°C)

[7] All conditions are met.
[8] Any condition is met and system is detected.

Low Battery Status

The device triggers a syslog message and an SNMP trap when the battery average levels falls below 20%. Use the command **show platform hardware battery details** to view the current average BBU power levels. When multiple battery units are used in the device (upto maximum 3 units), the battery unit discharges in a sequential order.

When three BBUs are used, and the device shows the current average battery power level as 20%, the third BBU power level will be about 60%.

Charge Conditions

Table 17: Battery Backup Unit—Charging Specifications

Charge Conditions	Description
Power draw	No more than 20 W when charging

Charge Conditions	Description
Entry to charging limit[9]	• State of Charge (SOC) <85 percent • AC power detected in the range of 85 to 250V for more than 20 ms. • External ambient temperature is within -4 to 104°F (-20 to 40°C)
Exit charging[10]	• AC power (range of 85 to 250 V) not detected for more than 20 ms. • External ambient temperature is outside the range of -4 to 104°F (-20 to 40°C)

[9] All conditions are met.
[10] Any condition is met and system is detected.

Operating and Storage Temperatures

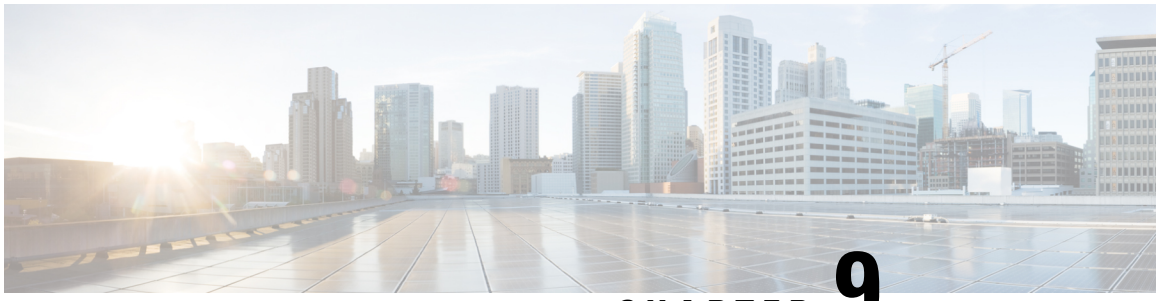
Table 18: Battery Backup Unit—Operating and Storage Temperatures

BBU State	Local BBU Internal Temperature	External Ambient Temperature
Charging	+32 to 122°F (0 to 50°C)	-4 to 104°F (-20 to 40°C)
Discharging	-4 to 140°F (-20 to 60°C)	-40 to 122°F (-40 to 50°C)
Operation (Idle)	-4 to 185°F (-20 to 85°C)	-40 to 158°F (-40 to 70°C)
Storage and shipping	+14 to 113°F (-10 to 45°C) for 3 months maximum	• Short term: +14 to 113°F (-10 to 45°C) for 3 months maximum • Long term: +27 to 77°F (-3 to 25°C) - 65% Relative Humidity - 40 to 90% SoC

Battery Life

Table 19: Battery Backup Unit — Battery Life

Product ID	Battery Life	Charge-Discharge Cycle
IRMH-BATT-4AH	5 years	500



CHAPTER 9

Starting a Router Terminal Session

This chapter describes how to start a terminal session with the IR8140H using the console port. The console port is found in the CPU module.

Start a terminal session with the router when you are at the router installation location and want to administer the router with a direct connection using the CLI software.

These topics are discussed:

- Before You Begin, on page 109
- About the Console Port, on page 109
- Connecting to the Console Port with Microsoft Windows, on page 111
- Connecting to the Console Port with Mac OS X, on page 111
- Connecting to the Console Port with Linux, on page 112

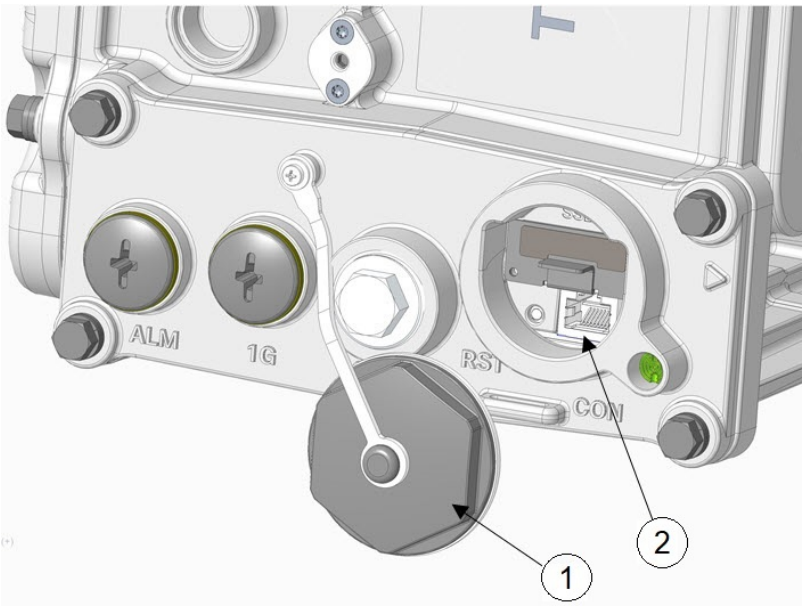
Before You Begin

Before you start a terminal session with the router, you must connect a PC or PC terminal to the router console port.

About the Console Port

The console port is found in the CPU module, as shown in the following figure.

Figure 50: CPU Module with Console Port



1	M42 plug	2	Console port

To access the console port, open the M42 plug.

The console port is an asynchronous serial port that allows you to connect to the device for initial configuration through a standard RS-232 port with an RJ-45 connector. Any device connected to this port must be capable of asynchronous transmission.

Caution The console port does not support cable glands. When a cable is connected to this port, the router's interior is exposed to environmental elements, which can damage the port and the router's interior. This port should be exposed only during terminal sessions, when a cable is connected to the port. This port should never be left unattended when in use.

The console port is an asynchronous serial port that allows you to connect to the device for initial configuration through a standard RS-232 port with an RJ-45 connector. Any device connected to this port must be capable of asynchronous transmission.

Console Port Settings

Configure the following parameters for the console port:

Parameter	Console Port Setting	Description
Baud	9600	Specifies the transmission speed for the connection.
Data bits	8	Specifies the number of bits in an 8-bit byte that is used for data.
Parity	None	Specifies the odd or even parity for error detection.

Parameter	Console Port Setting	Description
Stop bits	1	Specifies the number of stop bits for an asynchronous line.

Using the Ctrl-C Command

The router console port is located in the router's exterior and can be accessed by removing the seal over the console port (see Figure 50: CPU Module with Console Port, on page 110).

On many Cisco routers, you can enter **Ctrl-C** to interrupt the router startup process and then delete or change the admin password, or view or delete the router configuration.

To prevent unauthorized access to the router configurations and passwords, the **Ctrl-C** command is disabled on the router while it is booting up and loading the system software.

Connecting to the Console Port with Microsoft Windows

To connect to the router console port using Microsoft Windows:

Procedure

Step 1 Start a terminal emulator application, such as Windows HyperTerminal (included with some versions of the Windows operating system) or PuTTY.

Step 2 Configure the terminal emulation software with the parameters described in About the Console Port, on page 109.

Step 3 Connect to the router.

Connecting to the Console Port with Mac OS X

To connect a Mac OS X system USB port to the console using the built-in OS X Terminal utility:

Procedure

Step 1 Use the Finder application, and go to **Applications > Utilities > Terminal**.

Step 2 Connect the OS X USB port to the router.

Step 3 Enter the following commands to find the OS X USB port number:

```
macbook:user$ cd /dev
macbook:user$ ls -ltr /dev/*usb*
crw-rw-rw-  1 root    wheel       9,  66 Apr  1 16:46 tty.usbmodem1a21 DT-macbook:dev user$
```

Step 4 Connect to the USB port with the following command, followed by the router USB port speed:

```
macbook:user$ screen /dev/tty.usbmodem1a21 9600
```

To disconnect the OS X USB console from the Terminal window, press **Ctrl+A** followed by **Ctrl+**\.

Connecting to the Console Port with Linux

To connect a Linux system USB port to the console using the built-in Linux Terminal utility:

Procedure

Step 1 Open the Linux Terminal window.

Step 2 Connect the Linux USB port to the router.

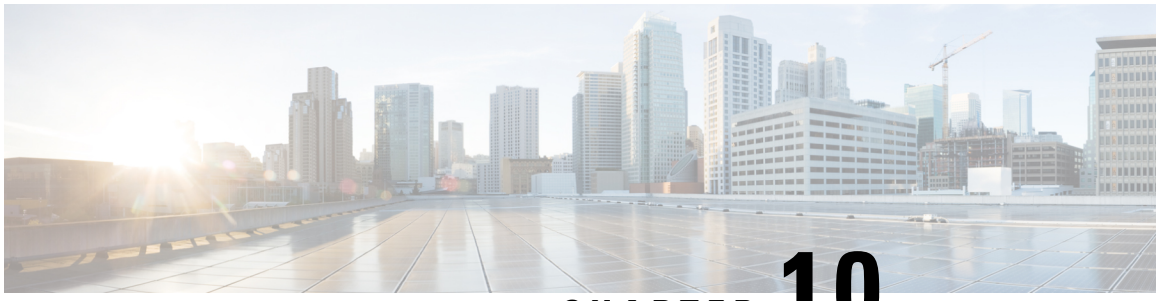
Step 3 Enter the following commands to find the Linux USB port number:

```
root@usb-suse# cd /dev
root@usb-suse /dev# ls -ltr *ACM*
crw-r--r--    1 root     root     188,   0 Jan 14 18:02 ttyACM0
root@usb-suse /dev#
```

Step 4 Connect to the USB port with the following command followed by the router USB port speed:

```
root@usb-suse /dev# screen /dev/ttyACM0 9600
```

To disconnect the Linux USB console from the Terminal window, press **Ctrl+A** followed by **:**, and then enter **quit**.



CHAPTER 10

Unmounting the Router

This chapter describes the safety information, equipment, and procedures involved in removing the Cisco Catalyst IR8140 Heavy Duty Router from a vertical pole.

These topics are discussed:

- Materials and Tools You Must Have, on page 113
- Unmounting the Router From a Pole, on page 113
- Transporting the Router, on page 114

Materials and Tools You Must Have

- 1/2-inch (13-mm) socket wrench
- #2 Phillips head screwdriver

Unmounting the Router From a Pole

To unmount the router from any supported pole type:

Procedure

Step 1 Disable installed battery backup units, if any, and disconnect the router from the AC power.

Step 2 Remove or disconnect any external cables, if any, for example, the external Ethernet connector at the base of unit.

Step 3 Disconnect the internal cables, taking care to remove the cable from the cable glands.

Step 4 Remove the ground wire located at the side of the router.

Step 5 Remove three of the four bolts that attach the mounting bracket to the router. Do not remove the hinge bolt, which is the fourth bolt. Remove the equivalent bolts on the opposite side of the router.

Step 6 Loosen the hinge bolts by two complete turns (do not loosen completely such that the bolts are removed from the chassis).

Step 7 Remove the router from the bracket.

Transporting the Router

To transport the router:

Procedure

Step 1 Disconnect the lightning arrestors that might be installed on the router.

Step 2 (Optional) Configure the BBU to transport mode if the BBU is installed.

Step 3 Verify that all the open chassis ports are sealed with the cable port seal plugs shipped with the router.