Safety Information and Pre-installation Tasks

This chapter describes safety information and procedures that should be performed prior to installation of hardware.

This chapter contains the following major sections:

Note Before you install, operate, or service the system, read the *Regulatory Compliance and Safety Information for the Cisco ONS 15500 Series* for important safety information you should know before working with the system.

For more information on hardware, refer to the *Cisco ONS 15540 ESP Hardware Installation Guide.*

For more information on software, refer to the *Cisco ONS 15540 ESP Configuration Guide and Command Reference.*

Safety Information

This section describes safety considerations for operating the Cisco ONS 15540 ESP. This section includes critical safety warnings, precautions, and ESD guidelines.

Critical Safety Warnings

This section includes warnings that may appear in the Cisco ONS 15540 ESP product documents.

Wrist Strap Warning

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.**

Restricted Area Warning

Warning **This unit is intended for installation in restricted access areas. A restricted access area is where access can only be gained by service personnel through the use of a special tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.**

Qualified Personnel Warning

Warning **Only trained and qualified personnel should be allowed to install or replace this equipment.**

Card Handling Warning

Warning **High-performance devices on this card can get hot during operation. To remove the card, hold it by the faceplate and bottom edge. Allow the card to cool before touching any other part of it or before placing it in an antistatic bag.**

Warning Definition

Warning **This warning symbol 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. To see translations of the warnings that appear in this publication, refer to the Regulatory Compliance and Safety Information document that accompanied this device.**

Disconnect Device Warning

Warning **A readily accessible disconnect device must be incorporated in the building's installation wiring.**

DC Protection

Warning **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a Listed and Certified fuse or circuit breaker 25A, minimum 60VDC, is used on all current-carrying conductors.**

Laser Radiation Warning

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

General Safety Precautions

General safety precautions are not related to any specific procedures and do not appear elsewhere in this publication. Personnel must understand and apply the following precautions during installation and testing of the Cisco ONS 15540 ESP.

- Know standard electrical safety and electrical wiring and connection practices.
- Be familiar with cardio-pulmonary resuscitation (CPR). Obtain this information through the appropriate national authority (such as the Red Cross or the local equivalent). This knowledge is imperative for personnel working with or near voltages with levels capable of causing injury or death.

Recommended Safety Precautions

The following precautions are recommended when working on the Cisco ONS 15540 ESP:

- Do not lift an object alone that could be too heavy for one individual.
- Keep your work area tidy and free of obstructing objects at all times.
- Do not wear loose clothing, jewelry, or other items that could be caught in the components during installation or use.
- Use the equipment only in accordance with the electrical power rating.
- Do not work alone if hazardous conditions may exist in your workplace.
- Install the Cisco ONS 15540 components in compliance with the following local and national electrical codes:
  - In the United States: National Fire Protection Association (NFPA) 70; US National Electrical Code
  - In Canada: Canadian Electrical Code, part I, CSA C22.1
  - Elsewhere: International Electrotechnical Commission (IEC) 364, part 1-7
- Properly ground the equipment.
- Connect only a DC power source that complies with the safety extra-low voltage (SELV) requirements in UL1950, CSA 950, EN 60950, and IEC950 to Cisco ONS 15540 DC power supply input.
- Terminate all laser outputs properly before connecting laser inputs.
- Disconnect the input end of an optical fiber jumper cable before disconnecting the output end.
- Handle glass fiber with care. Glass fiber can be broken if mishandled. Using broken fiber can result in permanent equipment damage.
- Protect skin from exposed glass fiber. It can penetrate the skin.
- Limit the number of personnel that have access to lightwave transmission systems. Personnel should be authorized and properly trained if access to laser emissions is required.
- Limit the use of laser test equipment to authorized, trained personnel during installation and service. This precaution includes using optical loss test (OLT) set, optical spectrum analyzer, and optical time domain reflectometer (OTDR) equipment.

- Exclude any unauthorized personnel from the immediate laser radiation area during service and installation when there is a possibility that the system may become energized. Consider the immediate service area to be a temporary laser-controlled area.
- The Cisco ONS 15540 ESP function in the 1310 to 1550 nm range, which is considered invisible radiation. You cannot see the laser light being emitted by a fiber, a pigtail, or a bulkhead connector. Use appropriate eye protection during fiber-optic system installation or maintenance whenever there is potential for laser radiation exposure, as recommended by the company's health and safety procedures. Observe this precaution whether or not warning labels have been posted.

Preventing ESD Damage

Electrostatic discharge (ESD) damage occurs when electronic cards or components are mishandled and can result in complete or intermittent failures. Note the following guidelines before you install or service the system:

- Always wear an ESD-preventive wrist or ankle strap when handling electronic components. Connect one end of the strap to an ESD jack or an unpainted metal component on the system (such as a captive installation screw).
- Handle cards by the faceplates and edges only; avoid touching the printed circuit board and connector pins.
- Place any removed component on an antistatic surface or in a static shielding bag.
- Avoid contact between the cards and clothing. The wrist strap only protects the card from ESD voltages on the body; ESD voltages on clothing can still cause damage.

Note For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megaohms (Mohms).

Required Equipment

This section lists the required system equipment, cable, and test equipment.

System Requirements

The following equipment is assumed to be present and installed:

- Cisco ONS 15540 chassis and external AC power supply if needed
- Processor cards (1 or 2)
- Air Inlet
- Fan Tray

Cable Requirements

This section lists the cable requirements for the Cisco ONS 15540 ESP.

Cisco ONS 15540 ESP cabling

The Cisco ONS 15540 ESP chassis requires the following cables and drawers:

- Mux/demux cabling:
  - Add/drop mux/demux cabling: short cables with MU-MU connectors
  - Terminal mux/demux cabling: short cables with MU-MU connectors
- Transponder module to client cables: medium size cable with SC connectors
  - SM transponder modules: SC to SC SM cable or SC to ST SM cable, 1.0 m or 3.0 m
  - MM transponder modules: SC to SC MM cable or SC to ST MM cable, 1.0 m or 3.0 m
  - Extended range transponder modules: cable depends on SFP optics type. See Table 1-1 and Table 1-2.
  - Y-cables: Multimode or single mode Y-cable
- Trunk cables: MU to SC patch cable or MU to ST patch cable, 1.0 m or 3.0 m

Table 1-1 Fixed Rate SFP Optics Features

Part Number	Supported Protocols	Fiber Type	Wavelength	Connector Type
15500-XVRA-01A2	ESCON, SONET OC-3 SR, SDH STM-1	MM 62.5/125 m	1310 nm	MT-RJ
15500-XVRA-02C1	Gigabit Ethernet[1], Fibre Channel (1 Gbps)[2]	MM 50/125 m MM 62.5/125 m	850 nm	Duplex LC
15500-XVRA-02C2	Fibre Channel (2 Gbps)[3]	MM 50/125 m MM 62.5/125 m	850 nm	Duplex LC
15500-XVRA-03B1	Gigabit Ethernet[4], Fibre Channel (1 Gbps)[5]	SM 9/125 m	1310 nm	Duplex LC
15500-XVRA-03B2	Fibre Channel (1 Gbps[6] and 2 Gbps[7])	SM 9/125 m	1310 nm	Duplex LC
15500-XVRA-06B1	SONET OC-12 SR[8], SDH STM-4	SM 9/125 m	1310 nm	Duplex LC
15500-XVRA-07B1	SONET OC-48 SR, SDH STM-16	SM 9/125 m	1310 nm	Duplex LC

1. 1000BASE-SX
2. FC-0-100-M5-SN-S and FC-0-100-M6-SN-S standards
3. FC-0-200-M5-SN-S and FC-0-200-M6-SN-S standards
4. 1000BASE-LX
5. FC-0-100-SM-LC-S standard
6. FC-0-100-SM-LC-S standard
7. FC-0-200-SM-LC-S standard
8. SR = short range

Table 1-2 Variable Rate SFP Optics Features

Part Number	Clock Rate Range	Protocol Encapsulations Supported	Fiber Type	Wavelength	Connector Type
15500-XVRA-10A1	Low-band 8 Mbps to 200 Mbps	Sysplex (CLO and ETR)[1] (8 Mbps), Fast Ethernet[2] (125 Mbps), SONET OC-3[3] (155.52 Mbps), SDH STM-1 (622 Mbps), ESCON[4] (200 Mbps)	MM 50/125 m 62.5/125 m	1310 nm	LC
15500-XVRA-10B1	Low-band 8 Mbps to 200 Mbps	Sysplex (CLO and ETR)[1] (8 Mbps), Fast Ethernet[2] (125 Mbps), SONET OC-3[3] (155.52 Mbps), SDH STM-1 (155.52 Mbps), ESCON[4] (200 Mbps)	SM 9/125 m	1310 nm	LC
15500-XVRA-11A1	Mid-band 200 Mbps to 622 Mbps	ESCON[4] (200 Mbps), SONET OC-12[3] (622 Mbps), SDH STM-4 (622 Mbps)	MM 50/125 m 62.5/125 m	1310 nm	LC
15500-XVRA-11B1	Mid-band 200 Mbps to 1.25 Gbps	ESCON[4] (200 Mbps), SONET OC-12[3] (622 Mbps), SDH STM-4 (622 Mbps), FC[4] (1.062 Gbps), GE[4] (LX) (1.25 Gbps)	SM 9/125 m	1310 nm	LC
15500-XVRA-12B1	High-band 1.062 Gbps to 2.488 Gbps	FC[4] (1.062 Gbps and 2.125 Gbps), GE[4] (LX) (1.250 Mbps), SONET OC-48 (2.488 Gbps), SDH STM-16 (2.488 Gbps), ISC peer mode (2.125 Gbps)	SM 9/125 m	1310 nm	LC

1. Manchester coded
2. 4B/5B coded
3. Scrambler 2^{23-1}
4. 8B/10B coded

Test Equipment Requirements

The following test equipment is required:

- Optical Spectrum Analyzer (OSA) capable of reading wavelengths between 1530 nm and 1563 nm
- Optical Time Domain Reflectometer (OTDR)
- Hand-held optical power meter
- Data test set (Ethernet packet generator or analyzer, BERT)
- Fiber cleaning kit
- Optical fiber scope
- Cable installation tool

Before Installing

Before you install the shelf, you must complete the following tasks:

- Unpack and inspect the shelf.
- Maintain a network record.

Caution Use extreme care when removing or installing connectors so you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.**

Unpacking and Inspecting the Shelf

The Cisco ONS 15540 shelf comes with the standard mounting set. The shelf is thoroughly inspected before shipment. If any damage has occurred during transportation or if any item is missing, notify your Cisco customer service representative immediately. Upon receipt, inspect the equipment as follows:

Step 1 Take inventory. Compare the equipment inside with the packing slip and the equipment list provided by customer service. If there are any discrepancies, notify the Customer Service Center.

Step 2 Check for external damage. Visually check all components and immediately report any shipping damage to your customer service representative. Have the following information ready:

- Invoice number of shipper (see packing slip)
- Model and serial number of the damaged unit
- Description of damage
- Effect of damage on the installation

Performing Fiber Plant Characterization

In order to verify fiber characteristics to qualify the fiber in the network, proper testing is required.

The test measurement results must be documented and will be referred to during acceptance testing of a network, as described in this guide.

This test measurement data can also be used to determine whether your network can support higher bandwidth services such as OC-192, and can help determine network requirements for dispersion compensator modules or amplifiers.

Fiber-optic testing procedures must be performed to measure the following parameters:

- link loss (attenuation)
- optical return loss (ORL)

- polarization mode dispersion (PMD)
- chromatic dispersion
- fiber length

For more information on fiber plant characterization, refer to the *Cisco ONS 15540 ESP Planning Design Guide*.