



Ethernet Cards

The Cisco ONS 15454 integrates Ethernet into a SONET platform through the use of Ethernet cards. This chapter describes the E-Series, G-Series, and ML-Series Ethernet cards. For G-Series and E-Series Ethernet application information, see [Chapter 16, “Ethernet Operation.”](#) For installation and card turn-up procedures, refer to the *Cisco ONS 15454 Procedure Guide*. For ML-Series configuration information, see the *Cisco ONS 15454 SONET/SDH ML-Series Multilayer Ethernet Card Software Feature and Configuration Guide*.



Note

The terms "Unidirectional Path Switched Ring" and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as "Path Protected Mesh Network" and "PPMN," refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

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5.1 Ethernet Card Overview

The card overview section summarizes card functions, power consumption, and temperature ranges.

**Note**

Each card is marked with a symbol that corresponds to a slot (or slots) on the ONS 15454 shelf assembly. The cards are then installed into slots displaying the same symbols. Refer to the *Cisco ONS 15454 Procedure Guide* for a list of slots and symbols.

5.1.1 Ethernet Cards

Table 5-1 lists the Cisco ONS 15454 Ethernet cards.

Table 5-1 Ethernet Cards for the ONS 15454

Card	Port Description	For Additional Information...
E100T-12	The E100T-12 card provides 12 switched, autosensing, 10/100BaseT Ethernet ports.	See the “5.2 E100T-12 Card” section on page 5-5.
E100T-G	The E100T-G card provides 12 switched, autosensing, 10/100BaseT Ethernet ports and is compatible with the XC10G card.	See the “5.3 E100T-G Card” section on page 5-7.
E1000-2	The E1000-2 card provides two IEEE-compliant, 1000-Mbps ports. Gigabit Interface Converters (GBICs) are separate.	See the “5.4 E1000-2 Card” section on page 5-10.
E1000-2-G	The E1000-2-G card provides two IEEE-compliant, 1000-Mbps ports. GBICs are separate. The E1000-2-G card is compatible with the XC10G card.	See the “5.5 E1000-2-G Card” section on page 5-13.
G1000-4	The G1000-4 card provides four IEEE-compliant, 1000-Mbps ports. GBICs are separate. The G1000-4 requires the XC10G card.	See the “5.6 G1000-4 Card” section on page 5-16.
G1K-4	The G1K-4 card provides four IEEE-compliant, 1000-Mbps ports. GBICs are separate. The G1K-4 card is functionally identical to the G1000-4 card, but can operate with XC, XCVT, or XC10G cross-connect cards.	See the “5.7 G1K-4 Card” section on page 5-19.
ML100T-12	The ML100T-12 card provides 12 switched, autosensing, 10/100Base-T Ethernet ports.	See the “5.8 ML100T-12 Card” section on page 5-22.
ML1000-2	The ML1000-2 card provides two IEEE-compliant, 1000-Mbps ports. Small form-factor pluggable (SFP) connectors are separate.	See the “5.9 ML1000-2 Card” section on page 5-25.

5.1.2 Card Power Requirements

Table 5-2 lists power requirements for Ethernet cards.

Table 5-2 Ethernet Card Power Requirements

Card Name	Watts	Amps	BTU/hr
E100T-12	65.00	1.35	221.93
E100T-G	65.00	1.35	221.93
E1000-2	53.50	1.11	182.67
E1000-2-G	53.50	1.11	182.67
G1000-4	63.00 incl. GBICs	1.31	215.11

Table 5-2 Ethernet Card Power Requirements (continued)

Card Name	Watts	Amps	BTU/hr
G1K-4	63.00 incl. GBICs	1.31	215.11
ML100T-12	53.00	1.10	181.0
ML1000-2	49.00 incl. SFPs	1.02	167.3

5.1.3 Card Temperature Ranges

Table 5-3 shows C-Temp and I-Temp compliant cards and their product names.



Note

The I-Temp symbol is displayed on the faceplate of an I-Temp compliant card. A card without this symbol is C-Temp compliant.

Table 5-3 Ethernet Card Temperature Ranges and Product Names for the ONS 15454

Card	C-Temp Product Name (0 to +55 degrees Celsius)	I-Temp Product Name (-40 to +65 degrees Celsius)
E100T-12	15454-E100T	—
E1000-2	15454-E1000-2	—
E100T-G	15454-E100T-G	—
E1000-2-G	15454-E1000-2-G	—
G1000-4	15454-G1000-4	—
G1K-4	15454-G1K-4	—
ML100T-12	15454-ML100T-12	—
ML1000-2	15454-ML1000-2	—

5.1.4 Ethernet Clocking Versus SONET/SDH Clocking

Ethernet clocking is asynchronous. IEEE 802.3 clock tolerance allows some links in a network to be as much as 200 ppm (parts or bits per million) slower than other links (0.02%). A traffic stream sourced at line rate on one link may traverse other links which are 0.02% slower. A fast source clock, or slow intermediate clocks, may limit the end-to-end throughput to only 99.98% of the source link rate.

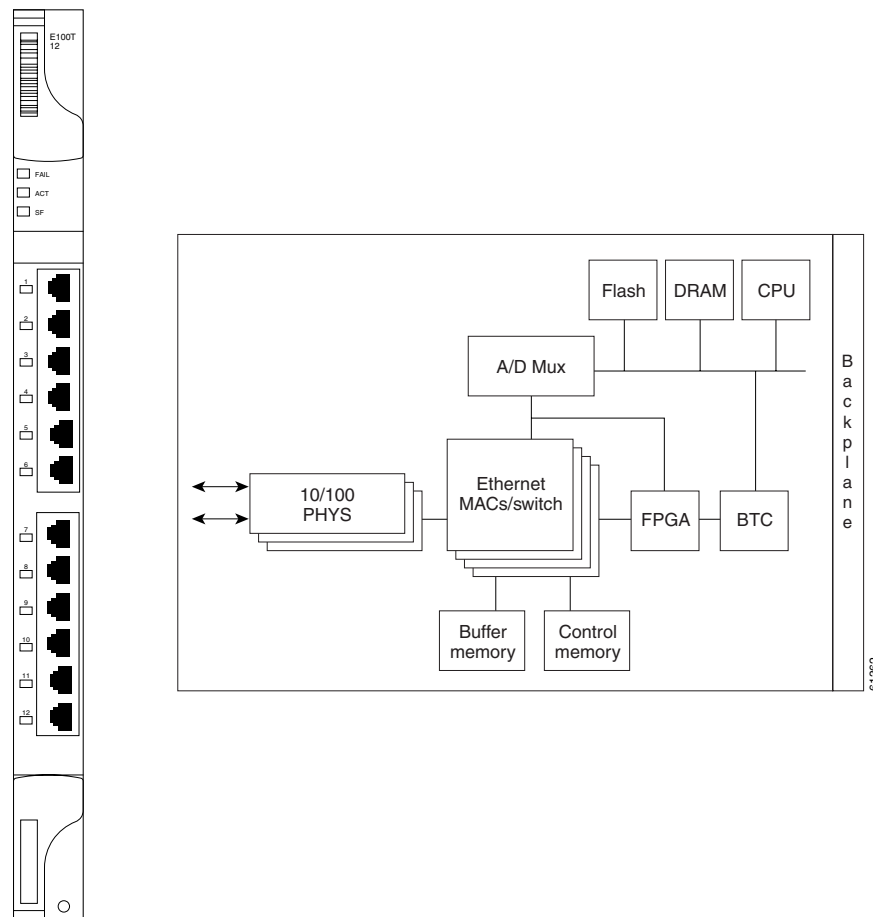
Traditionally, Ethernet is a shared media that is under utilized except for brief bursts which may combine from multiple devices to exceed line-rate at an aggregation point. Due to this utilization model, the asynchronous clocking of Ethernet has been acceptable. Some Service Providers accustomed to loss-less TDM transport may find the 99.98% throughput guarantee of Ethernet surprising.

Clocking enhancements of ML-Series and G-Series cards ensure Ethernet transmit rates that are at worst 50 ppm slower than the fastest compliant source clock, ensuring a worst-case clocking loss of 50 ppm - a 99.995% throughput guarantee. In many cases, the ML-Series or G-Series clock will be faster than the source traffic clock, and line-rate traffic transport will have zero loss. Actual results will depend on clock variation of the traffic source transmitter.

5.2 E100T-12 Card

The ONS 15454 uses E100T-12 cards for Ethernet (10 Mbps) and Fast Ethernet (100 Mbps). Each card provides 12 switched, IEEE 802.3-compliant, 10/100BaseT Ethernet ports that can independently detect the speed of an attached device (autosense) and automatically connect at the appropriate speed. The ports autoconfigure to operate at either half or full duplex and determine whether to enable or disable flow control. You can also configure Ethernet ports manually. [Figure 5-1](#) shows the faceplate and a block diagram of the card.

Figure 5-1 E100T-12 Faceplate and Block Diagram



The E100T-12 Ethernet card provides high-throughput, low-latency packet switching of Ethernet traffic across a SONET network while providing a greater degree of reliability through SONET self-healing protection services. This Ethernet capability enables network operators to provide multiple 10/100-Mbps access drops for high-capacity customer LAN interconnects, Internet traffic, and cable modem traffic aggregation. It enables the efficient transport and co-existence of traditional time-division multiplexing (TDM) traffic with packet-switched data traffic.

Each E100T-12 card supports standards-based, wire-speed, Layer 2 Ethernet switching between its Ethernet interfaces. The IEEE 802.1Q tag logically isolates traffic (typically subscribers). IEEE 802.1Q also supports multiple classes of service.

5.2.1 Slot Compatibility

You can install the E100T-12 card in Slots 1 to 6 and 12 to 17. Multiple E-Series Ethernet cards installed in an ONS 15454 can act independently or as a single Ethernet switch. You can create logical SONET ports by provisioning STS channels to the packet switch entity within the ONS 15454. Logical ports can be created with a bandwidth granularity of STS-1. The E100T-12 supports STS-1, STS-3c, STS-6c, and STS-12c circuit sizes.


Note

When making an STS-12c Ethernet circuit, the E-Series cards must be configured as single-card EtherSwitch.

5.2.2 E100T-12 Card-Level Indicators

The E100T-12 card faceplate has two card-level LED indicators, described in [Table 5-4](#).

Table 5-4 E100T-12 Card-Level Indicators

Card-Level Indicators	Description
Red Fail LED	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the E100T-12 card. As part of the boot sequence, the FAIL LED is on until the software deems the card operational.
Green ACT LED	A green ACT LED provides the operational status of the E100T-12. If the ACT LED is green, it indicates that the E100T-12 card is active and the software is operational.
SF LED	Not used.

5.2.3 E100T-12 Port-Level Indicators

The E100T-12 card has 12 pairs of LEDs (one pair for each port) to indicate port conditions. [Table 5-5](#) lists the port-level indicators. You can find the status of the E100T-12 card port using the LCD on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot.

Table 5-5 E100T-12 Port-Level Indicators

LED State	Description
Amber	The port is active (transmitting and receiving data).
Solid green	The link is established.
Green light off	The connection is inactive, or traffic is unidirectional.

5.2.4 E100T-12 Compatibility

Do not use the E100T-12 card with the XC10G card. The E100T-G is compatible with the XC10G.

5.2.5 E100T-12 Card Specifications

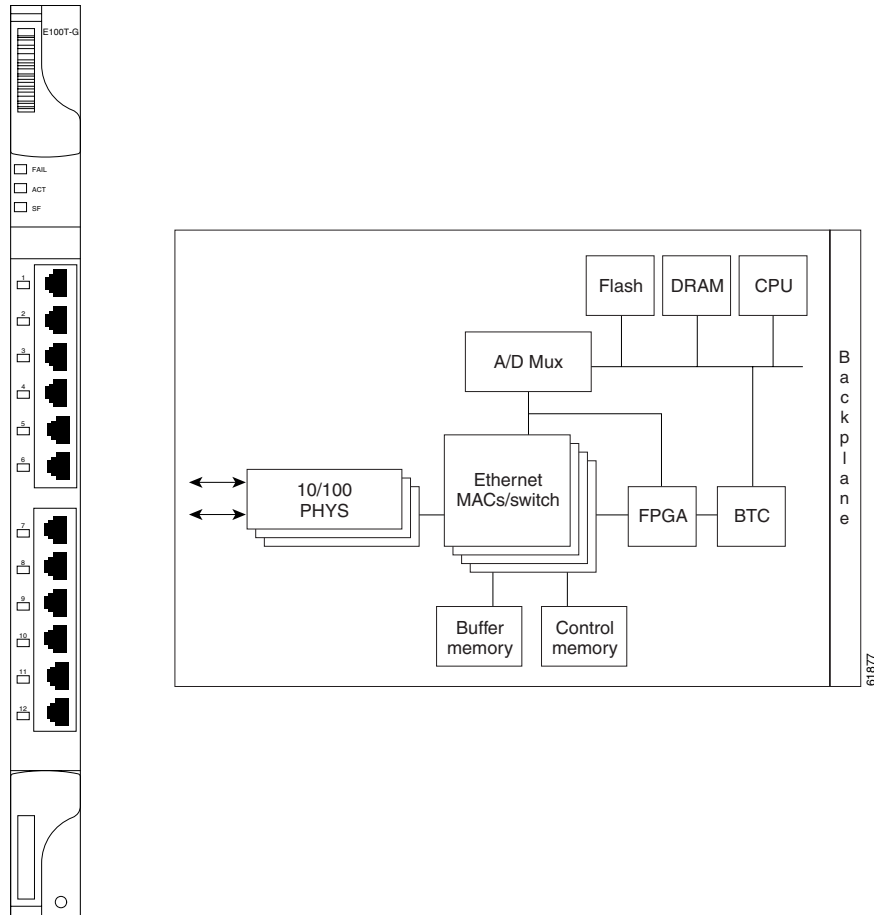
The E100T-12 card has the following specifications:

- Environmental
 - Operating temperature
 - C-Temp (15454-E100T): 0 to +55 degrees Celsius (32 to 131 degrees Fahrenheit)
 - Operating humidity: 5 to 95%, noncondensing
 - Power consumption: 65 W, 1.35 A, 221.93 BTU/hr
- Dimensions
 - Height: 321.3 mm (12.650 in.)
 - Width: 18.2 mm (0.716 in.)
 - Depth: 228.6 mm (9.000 in.)
 - Card weight: 1.0 kg (2.3 lb)
- Compliance
 - ONS 15454 cards, when installed in a system, comply with these safety standards: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

5.3 E100T-G Card

Use the E100T-G card when the XC10G card is in use. The ONS 15454 uses E100T-G cards for Ethernet (10 Mbps) and Fast Ethernet (100 Mbps). Each card provides 12 switched, IEEE 802.3-compliant, 10/100BaseT Ethernet ports that can independently detect the speed of an attached device (autosense) and automatically connect at the appropriate speed. The ports autoconfigure to operate at either half or full duplex and determine whether to enable or disable flow control. You can also configure Ethernet ports manually. [Figure 5-2 on page 5-8](#) shows the faceplate and a block diagram of the card.

Figure 5-2 E100T-G Faceplate and Block Diagram



The E100T-G Ethernet card provides high-throughput, low-latency packet switching of Ethernet traffic across a SONET network while providing a greater degree of reliability through SONET self-healing protection services. This Ethernet capability enables network operators to provide multiple 10/100 Mbps access drops for high-capacity customer LAN interconnects, Internet traffic, and cable modem traffic aggregation. It enables the efficient transport and co-existence of traditional TDM traffic with packet-switched data traffic.

Each E100T-G card supports standards-based, wire-speed, Layer 2 Ethernet switching between its Ethernet interfaces. The IEEE 802.1Q tag logically isolates traffic (typically subscribers). IEEE 802.1Q also supports multiple classes of service.

**Note**

When making an STS-12c Ethernet circuit, the E-Series cards must be configured as single-card EtherSwitch.

5.3.1 Slot Compatibility

You can install the E100T-G card in Slots 1 to 6 and 12 to 17. Multiple E-Series Ethernet cards installed in an ONS 15454 can act independently or as a single Ethernet switch. You can create logical SONET ports by provisioning a number of STS channels to the packet switch entity within the ONS 15454. Logical ports can be created with a bandwidth granularity of STS-1. The ONS 15454 supports STS-1, STS-3c, STS-6c, or STS-12c circuit sizes.

5.3.2 E100T-G Card-Level Indicators

The E100T-G card faceplate has two card-level LED indicators, described in [Table 5-6](#).

Table 5-6 E100T-G Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the E100T-G card. As part of the boot sequence, the FAIL LED is turned on until the software deems the card operational.
Green ACT LED	A green ACT LED provides the operational status of the E100T-G. If the ACT LED is green it indicates that the E100T-G card is active and the software is operational.
SF LED	Not used.

5.3.3 E100T-G Port-Level Indicators

The E100T-G card has 12 pairs of LEDs (one pair for each port) to indicate port conditions ([Table 5-7](#)). You can find the status of the E100T-G card port using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot.

Table 5-7 E100T-G Port-Level Indicators

LED State	Description
Yellow (A)	Port is active (transmitting and/or receiving data). By default, indicates the transmitter is active but can be software controlled to indicate link status, duplex status, or receiver active.
Solid Green (L)	Link is established. By default, indicates the link for this port is up, but can be software controlled to indicate duplex status, operating speed, or collision.

5.3.4 E100T-G Card Specifications

The E100T-G card has the following specifications:

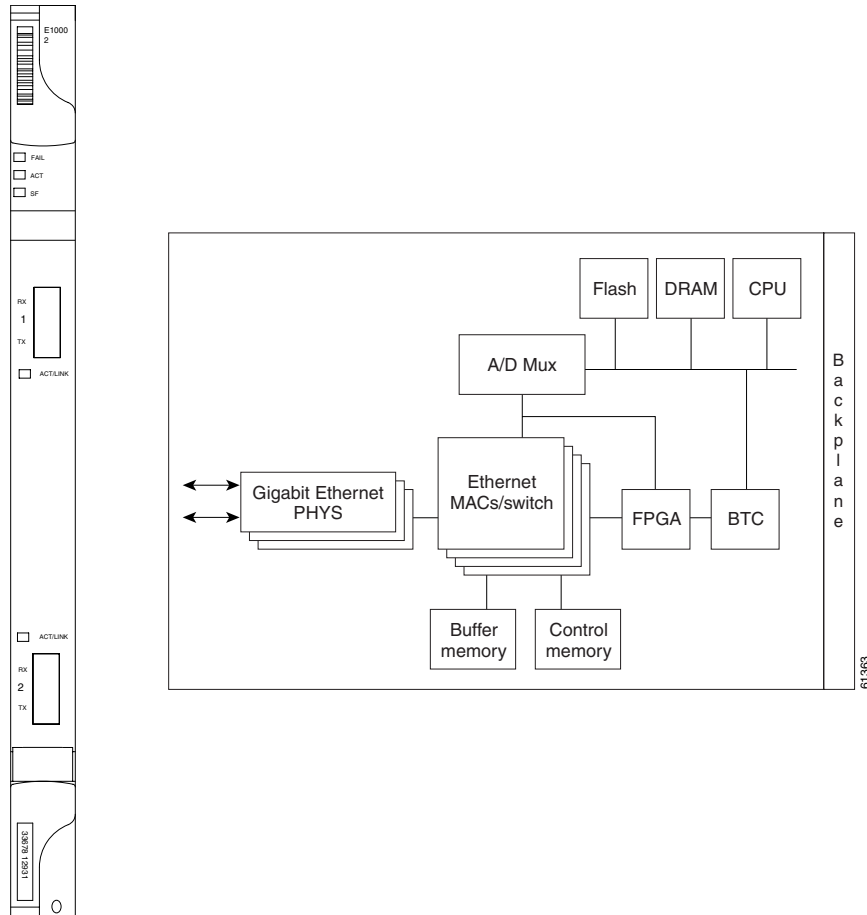
- Environmental
 - Operating temperature:
C-Temp (15454-E100T-G): 0 to +55 degrees Celsius (32 to 131 degrees Fahrenheit)
 - Operating humidity: 5 to 95%, noncondensing
 - Power consumption: 65 W, 1.35 A, 221.93 BTU/hr
- Dimensions
 - Height: 321.3 mm (12.650 in.)
 - Width: 18.2 mm (0.716 in.)
 - Depth: 228.6 mm (9.000 in.)
 - Card weight: 1.0 kg (2.3 lb)
- Compliance
 - ONS 15454 cards, when installed in a system, comply with these safety standards: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

5.4 E1000-2 Card

The ONS 15454 uses E1000-2 cards for Gigabit Ethernet (1000 Mbps). The E1000-2 card provides two IEEE-compliant, 1000-Mbps ports for high-capacity customer LAN interconnections. Each port supports full-duplex operation.

The E1000-2 card uses GBIC modular receptacles for the optical interfaces. For details, see the [“5.10 GBICs and SFPs” section on page 5-28](#).

[Figure 5-3 on page 5-11](#) shows the card faceplate and a block diagram of the card.

Figure 5-3 E1000-2 Faceplate and Block Diagram

The E1000-2 Gigabit Ethernet card provides high-throughput, low-latency packet switching of Ethernet traffic across a SONET network while providing a greater degree of reliability through SONET self-healing protection services. This enables network operators to provide multiple 1000-Mbps access drops for high-capacity customer LAN interconnects. It enables efficient transport and co-existence of traditional TDM traffic with packet-switched data traffic.

Each E1000-2 card supports standards-based, Layer 2 Ethernet switching between its Ethernet interfaces and SONET interfaces on the ONS 15454. The IEEE 802.1Q VLAN tag logically isolates traffic (typically subscribers).

Multiple E-Series Ethernet cards installed in an ONS 15454 can act together as a single switching entity or as independent single switches supporting a variety of SONET port configurations.

You can create logical SONET ports by provisioning STS channels to the packet switch entity within the ONS 15454. Logical ports can be created with a bandwidth granularity of STS-1. The ONS 15454 supports STS-1, STS-3c, STS-6c, or STS-12c circuit sizes.

**Note**

When making an STS-12c circuit, the E-Series cards must be configured as single-card EtherSwitch.

5.4.1 Slot Compatibility

You can install the E1000-2 card in Slots 1 to 6 and 12 to 17. The E1000-2 is compatible with the XC or XCVT cross-connect cards, but not the XC10G. The E1000-2-G is compatible with the XC10G.

5.4.2 E1000-2 Card-Level Indicators

The E1000-2 card faceplate has two card-level LED indicators, described in [Table 5-8](#).

Table 5-8 E1000-2 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the E1000-2 card. As part of the boot sequence, the FAIL LED is turned on until the software deems the card operational.
Green ACT LED	A green ACT LED provides the operational status of the E1000-2. When the ACT LED is green it indicates that the E1000-2 card is active and the software is operational.
SF LED	Not used.

5.4.3 E1000-2 Port-Level Indicators

The E1000-2 card has one bicolor LED per port ([Table 5-9](#)). When the green LINK LED is on, carrier is detected, meaning an active network cable is installed. When the green LINK LED is off, an active network cable is not plugged into the port, or the card is carrying unidirectional traffic. The amber port ACT LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.

Table 5-9 E1000-2 Port-Level Indicators

LED State	Description
Amber	The port is active (transmitting and receiving data).
Solid green	The link is established.
Green light off	The connection is inactive, or traffic is unidirectional.

5.4.4 E1000-2 Compatibility

The E1000-2 is compatible with XC or XCVT cross-connect cards. The XC10G requires the E1000-2-G.

5.4.5 E1000-2 Card Specifications

The E1000-2 card has the following specifications:

- Environmental
 - Operating temperature:
C-Temp (15454-E1000-2): 0 to +55 degrees Celsius (32 to 131 degrees Fahrenheit)
 - Operating humidity: 5 to 95%, noncondensing
 - Power consumption: 53.50 W, 1.11 A, 182.67 BTU/hr
- Dimensions
 - Height: 321.3 mm (12.650 in.)
 - Width: 18.2 mm (0.716 in.)
 - Depth: 228.6 mm (9.000 in.)
 - Card weight: 0.9 kg (2.1 lb)
- Compliance
 - ONS 15454 cards, when installed in a system, comply with these safety standards: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950
 - Eye safety compliance: Class I (21 CFR 1040.10 and 1040.11) and Class 1M (IEC 60825-1 2001-01) laser products

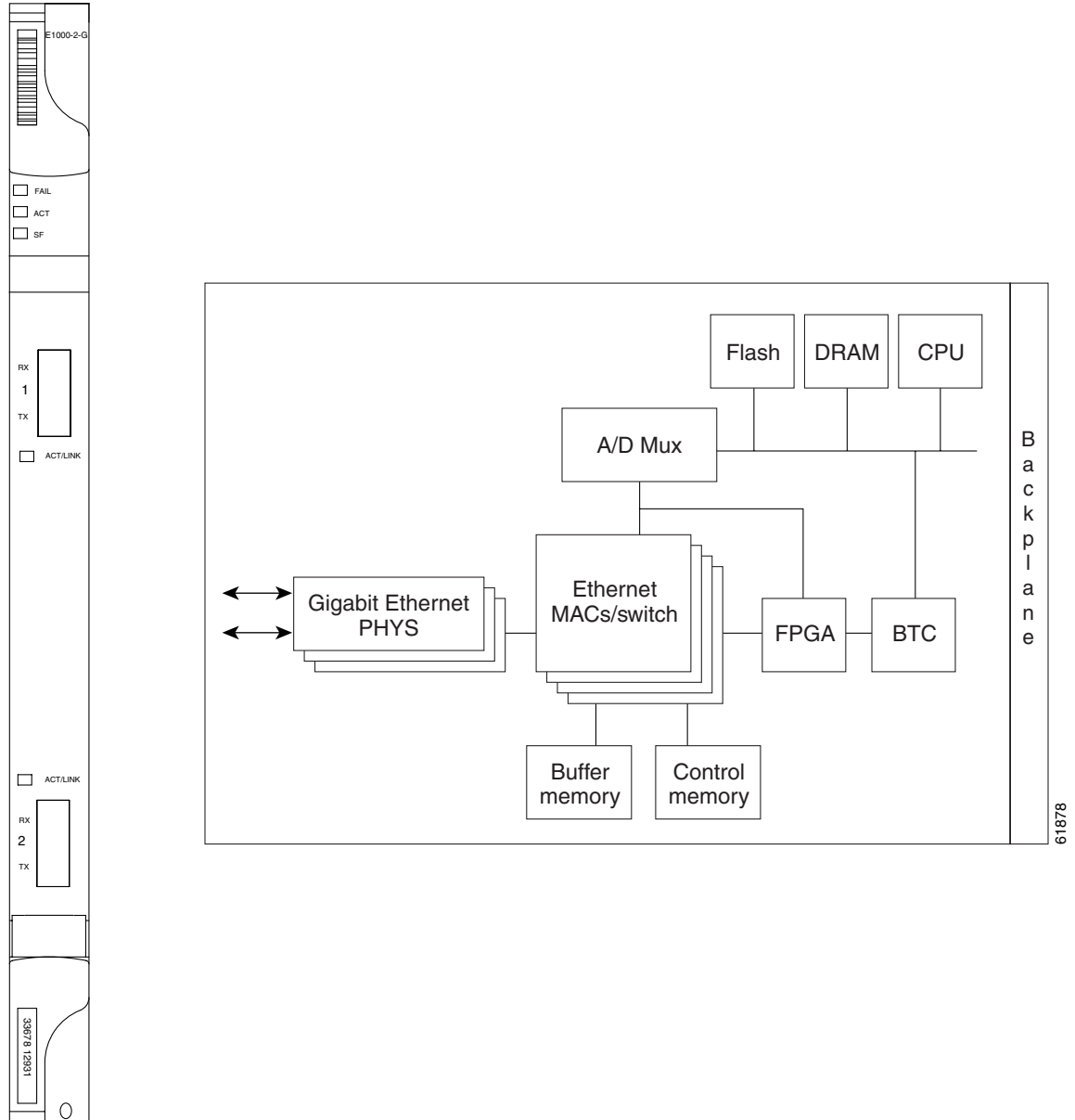
5.5 E1000-2-G Card

Use the E1000-2-G with the XC10G card. The ONS 15454 uses E1000-2-G cards for Gigabit Ethernet (1000 Mbps). The E1000-2-G card provides two IEEE-compliant, 1000-Mbps ports for high-capacity customer LAN interconnections. Each port supports full-duplex operation.

The E1000-2-G card uses GBIC modular receptacles for the optical interfaces. For details, see the [“5.10 GBICs and SFPs” section on page 5-28](#).

[Figure 5-4 on page 5-14](#) shows the card faceplate and a block diagram of the card.

Figure 5-4 E1000-2-G Faceplate and Block Diagram



The E1000-2-G Gigabit Ethernet card provides high-throughput, low-latency packet switching of Ethernet traffic across a SONET network while providing a greater degree of reliability through SONET self-healing protection services. This enables network operators to provide multiple 1000-Mbps access drops for high-capacity customer LAN interconnects. It enables efficient transport and co-existence of traditional TDM traffic with packet-switched data traffic.

Each E1000-2-G card supports standards-based, Layer 2 Ethernet switching between its Ethernet interfaces and SONET interfaces on the ONS 15454. The IEEE 802.1Q VLAN tag logically isolates traffic (typically subscribers).

Multiple E-Series Ethernet cards installed in an ONS 15454 can act together as a single switching entity or as independent single switches supporting a variety of SONET port configurations.

You can create logical SONET ports by provisioning STS channels to the packet switch entity within the ONS 15454. Logical ports can be created with a bandwidth granularity of STS-1. The ONS 15454 supports STS-1, STS-3c, STS-6c, or STS-12c circuit sizes.

**Note**

When making an STS-12c Ethernet circuit, the E-Series cards must be configured as a single-card EtherSwitch.

5.5.1 E1000-2-G Compatibility

The E1000-2-G is compatible with XC10G, XC, or XCVT cross-connect cards. You can install the card in Slots 1 to 6 and 12 to 17.

5.5.2 E1000-2-G Card-Level Indicators

The E1000-2-G card faceplate has two card-level LED indicators, described in [Table 5-10](#).

Table 5-10 E1000-2-G Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the E1000-2-G card. As part of the boot sequence, the FAIL LED is turned on until the software deems the card operational.
Green ACT LED	A green ACT LED provides the operational status of the E1000-2-G. If the ACT LED is green it indicates that the E1000-2-G card is active and the software is operational.
SF LED	The SF LED is not used in the current release.

5.5.3 E1000-2-G Port-Level Indicators

The E1000-2-G card has one bicolor LED per port ([Table 5-11](#)). When the green LINK LED is on, carrier is detected, meaning an active network cable is installed. When the green LINK LED is off, an active network cable is not plugged into the port, or the card is carrying unidirectional traffic. The amber port ACT LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.

Table 5-11 E1000-2-G Port-Level Indicators

LED State	Description
Amber	The port is active (transmitting and receiving data).
Solid green	The link is established.
Green light off	The connection is inactive, or traffic is unidirectional.

5.5.4 E1000-2-G Card Specifications

The E1000-2-G card has the following specifications:

- Environmental
 - Operating temperature:
C-Temp (15454-E1000-2-G): 0 to +55 degrees Celsius (32 to 131 degrees Fahrenheit)
 - Operating humidity: 5 to 95%, noncondensing
 - Power consumption: 53.50 W, 1.11 A, 182.67 BTU/hr
- Dimensions
 - Height: 321.3 mm (12.650 in.)
 - Width: 18.2 mm (0.716 in.)
 - Depth: 228.6 mm (9.000 in.)
 - Card weight: 0.9 kg (2.1 lb)
- Compliance
 - ONS 15454 cards, when installed in a system, comply with these safety standards: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950
 - Eye Safety Compliance: Class I (21 CFR 1040.10 and 1040.11) and Class 1M (IEC 60825-1 2001-01) laser products

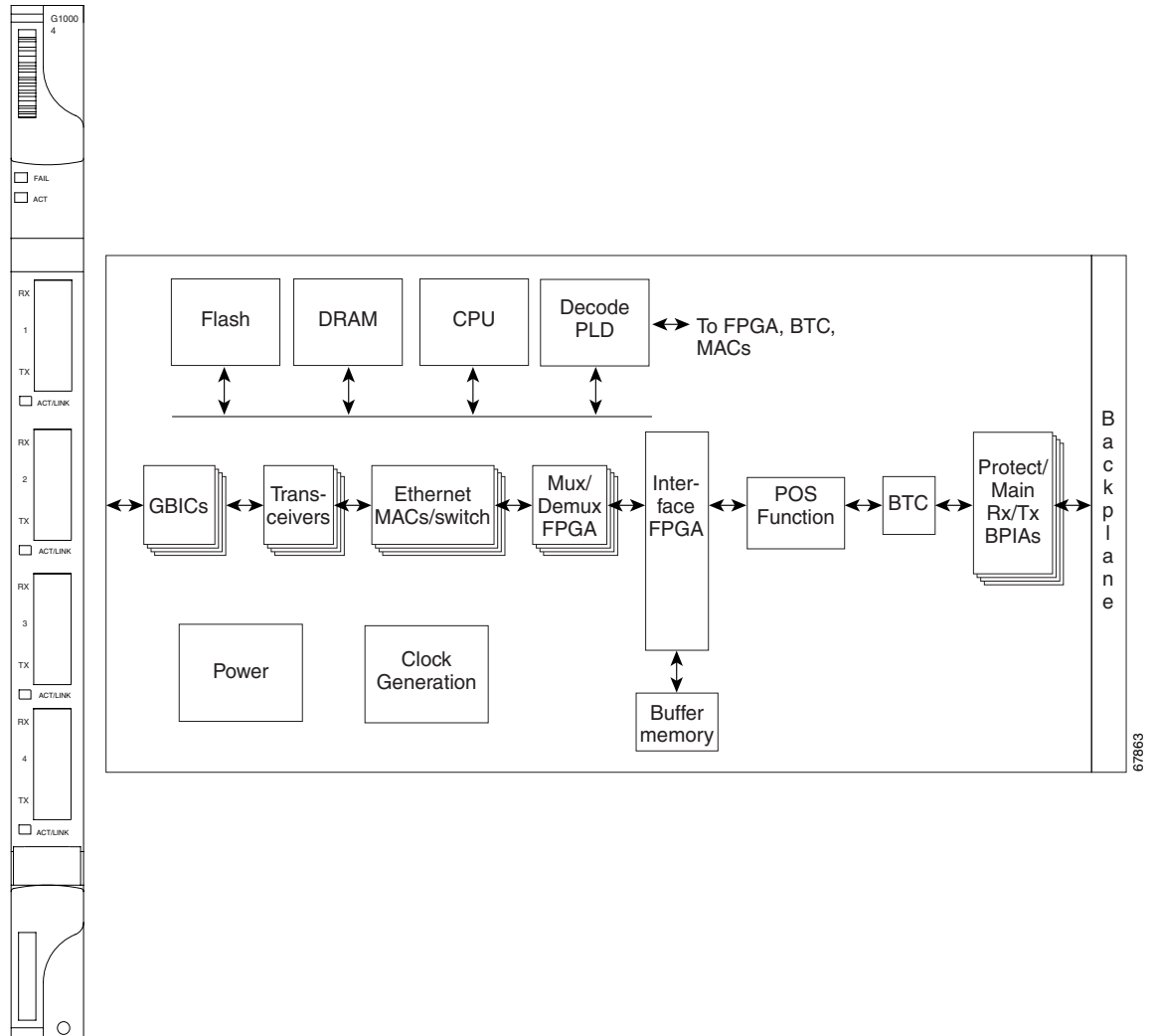
5.6 G1000-4 Card

The G1000-4 card requires the XC10G card. The ONS 15454 uses G1000-4 cards for Gigabit Ethernet (1000 Mbps). The G1000-4 card provides four ports of IEEE-compliant, 1000-Mbps interfaces. Each port supports full-duplex operation for a maximum bandwidth of OC-48 on each card.

The G1000-4 card uses GBIC modular receptacles for the optical interfaces. For details, see the [“5.10 GBICs and SFPs” section on page 5-28](#).

[Figure 5-5 on page 5-17](#) shows the card faceplate and the block diagram of the card.

Figure 5-5 G1000-4 Faceplate and Block Diagram



The G1000-4 Gigabit Ethernet card provides high-throughput, low latency transport of Ethernet encapsulated traffic (IP and other Layer 2 or Layer 3 protocols) across a SONET network. Carrier-class Ethernet transport is achieved by hitless (< 50 ms) performance in the event of any failures or protection switches (such as 1+1 automatic protection switching [APS], path protection, or bidirectional line switch ring [BLSR]). Full provisioning support is possible via Cisco Transport Controller (CTC), Transaction Language One (TL1), or Cisco Transport Manager (CTM).

The circuit sizes supported are STS-1, STS-3c, STS-6c, STS-9c, STS-12c, STS-24c, and STS-48c.

5.6.1 STS-24c Restriction

Due to hardware constraints, the card imposes an additional restriction on the combinations of circuits that can be dropped onto a G-Series card. These restrictions are transparently enforced by the ONS 15454, and you do not need to keep track of restricted circuit combinations.

When a single STS-24c terminates on a card, the remaining circuits on that card can be another single STS-24c or any combination of circuits of STS-12c size or less that add up to no more than 12 STSs (that is a total of 36 STSs on the card).

If STS-24c circuits are not being dropped on the card, the full 48 STSs bandwidth can be used with no restrictions (for example, using either a single STS-48c or 4 STS-12c circuits).

**Note**

The STS-24c restriction only applies when a single STS-24c circuit is dropped; therefore, you can easily minimize the impact of this restriction. Group the STS-24c circuits together on a card separate from circuits of other sizes. The grouped circuits can be dropped on other G-Series cards on the ONS 15454.

5.6.2 G1000-4 Card-Level Indicators

The G1000-4 card faceplate has two card-level LED indicators, described in [Table 5-12](#).

Table 5-12 G1000-4 Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (red)	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the G1000-4 card. As part of the boot sequence, the FAIL LED is turned on, and it turns off if the software is deemed operational. The red FAIL LED blinks when the card is loading software.
ACT LED (green)	A green ACT LED provides the operational status of the G1000-4. If the ACT LED is green, it indicates that the G1000-4 card is active and the software is operational.

5.6.3 G1000-4 Port-Level Indicators

The G1000-4 card has one bicolor LED per port. [Table 5-13](#) describes the status that each color represents.

Table 5-13 G1000-4 Port-Level Indicators

Port-Level LED Status	Description
Off	No link exists to the Ethernet port.
Steady amber	A link exists to the Ethernet port, but traffic flow is inhibited. For example, an unconfigured circuit, an error on line, or a nonenabled port might inhibit traffic flow.
Solid green	A link exists to the Ethernet port, but no traffic is carried on the port.
Flashing green	A link exists to the Ethernet port, and traffic is carried on the port. The LED flash rate reflects the traffic rate for the port.

5.6.4 G1000-4 Compatibility

The G1000-4 card requires Cisco ONS 15454 Release 3.2 or later system software and the XC10G cross-connect card. You can install the card in Slots 1 to 6 and 12 to 17, for a total shelf capacity of 48 Gigabit Ethernet ports. The practical G1000-4 port per shelf limit is 40, because at least two slots are typically filled by OC-N trunk cards such as the OC-192.

5.6.5 G1000-4 Card Specifications

The G1000-4 card has the following specifications:

- Environmental
 - Operating temperature:
C-Temp (15454-G1000-4): 0 to +55 degrees Celsius (32 to 131 degrees Fahrenheit)
 - Operating humidity: 5 to 95%, noncondensing
 - Power consumption: 63.00 W, 1.31 A, 215.11 BTU/hr
- Dimensions
 - Height: 321.3 mm (12.650 in.)
 - Width: 18.2 mm (0.716 in.)
 - Depth: 228.6 mm (9.000 in.)
 - Card weight: 0.9 kg (2.1 lb)

5.7 G1K-4 Card

The G1K-4 card is the functional equivalent of the G1000-4 card and provides four ports of IEEE-compliant, 1000-Mbps interfaces. Each interface supports full-duplex operation for a maximum bandwidth of 1 Gbps or 2 Gbps bidirectional per port, and 2.5 Gbps or 5 Gbps bidirectional per card. Each port autonegotiates for full duplex and IEEE 802.3x flow control. The G1K-4 card uses GBIC modular receptacles for the optical interfaces. For details, see the [“5.10 GBICs and SFPs” section on page 5-28](#).

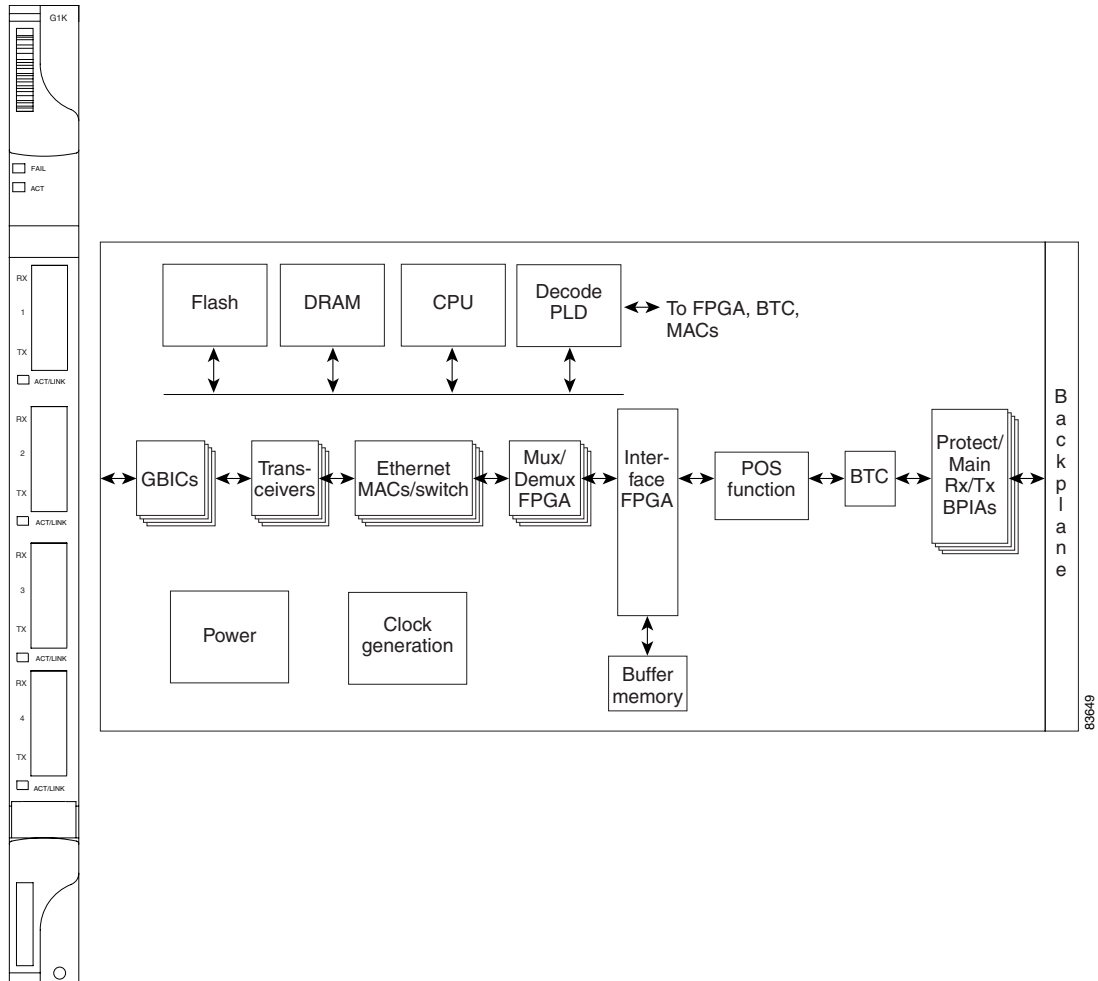
[Figure 5-6 on page 5-20](#) shows the card faceplate and the block diagram of the card.



Warning

Class 1 laser product.

Figure 5-6 G1K-4 Faceplate and Block Diagram

**Warning**

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

The G1K-4 Gigabit Ethernet card provides high-throughput, low-latency transport of Ethernet encapsulated traffic (IP and other Layer 2 or Layer 3 protocols) across a SONET network while providing a greater degree of reliability through SONET self-healing protection services. Carrier-class Ethernet transport is achieved by hitless (< 50 ms) performance in the event of any failures or protection switches (such as 1+1 APS, path protection, BLSR, or optical equipment protection) and by full provisioning and manageability, as in SONET service. Full provisioning support is possible via CTC or CTM. Each G1K-4 card performs independently of the other cards in the same shelf.

5.7.1 STS-24c Restriction

Due to hardware constraints, the card imposes an additional restriction on the combinations of circuits that can be dropped onto a G-Series card. These restrictions are transparently enforced by the ONS 15454, and you do not need to keep track of restricted circuit combinations.

When a single STS-24c terminates on a card, the remaining circuits on that card can be another single STS-24c or any combination of circuits of STS-12c size or less that add up to no more than 12 STSs (that is a total of 36 STSs on the card).

If STS-24c circuits are not being dropped on the card, the full 48 STSs bandwidth can be used with no restrictions (for example, using either a single STS-48c or 4 STS-12c circuits).



Note

The STS-24c restriction only applies when a single STS-24c circuit is dropped; therefore, you can easily minimize the impact of this restriction. Group the STS-24c circuits together on a card separate from circuits of other sizes. The grouped circuits can be dropped on other G-Series cards on the ONS 15454.

5.7.2 G1K-4 Compatibility

When installed in ONS 15454s running software prior to Software Release 4.0, the G1K-4 cards require the XC10G card to operate. Software R4.0 and later identifies G1K-4 cards as G1K-4s upon physical installation. Software prior to R4.0 identifies both G1000-4 and G1K-4 cards as G1000-4s upon physical installation.

You can install the G1K-4 card in Slots 1 to 6 and 12 to 17, for a total shelf capacity of 48 Gigabit Ethernet ports. (The practical limit is 40 ports because at least two slots are typically populated by optical cards such as OC-192).

However, when installed on an ONS 15454 running Software R4.0 and later, the G1K-4 card is not limited to installation in ONS 15454s with XC10G cards but can also be installed in ONS 15454s with XC and XCVT cards. When used with XC and XCVT cards on an ONS 15454 running Release 4.0 and later, the G1K-4 is limited to the high-speed slots (Slots 5, 6, 12, and 13).

5.7.3 G1K-4 Card-Level Indicators

The G1K-4 card faceplate has two card-level LED indicators, described in [Table 5-14](#).

Table 5-14 G1K-4 Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (red)	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the G1K-4 card. As part of the boot sequence, the FAIL LED is turned on, and it goes off when the software is deemed operational. The red FAIL LED blinks when the card is loading software.
ACT LED (green)	A green ACT LED provides the operational status of the G1K-4. If the ACT LED is green, it indicates that the G1K-4 card is active and the software is operational.

5.7.4 G1K-4 Port-Level Indicators

The G1K-4 card has four bicolor LEDs (one LED per port). [Table 5-15](#) describes the status that each color represents.

Table 5-15 G1K-4 Port-Level Indicators

Port-Level LED Status	Description
Off	No link exists to the Ethernet port.
Steady amber	A link exists to the Ethernet port, but traffic flow is inhibited. For example, a lack of circuit setup, an error on the line, or a nonenabled port might inhibit traffic flow.
Solid green	A link exists to the Ethernet port, but no traffic is carried on the port.
Flashing green	A link exists to the Ethernet port, and traffic is carried on the port. The LED flash rate reflects the traffic rate for the port.

5.7.5 G1K-4 Card Specifications

The G1K-4 card has the following specifications:

- Environmental
 - Operating temperature: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)
 - Operating humidity: 5 to 95%, noncondensing
 - Power consumption: 63.00 W, 1.31 A at –48 V, 215.1 BTU/hr
- Dimensions
 - Height: 321.3 mm (12.650 in.)
 - Width: 18.2 mm (0.716 in.)
 - Depth: 228.6 mm (9.000 in.)
 - Depth with backplane connector: 235 mm (9.250 in.)
 - Weight not including clam shell: 0.9 kg (2.1 lb)
- Compliance

ONS 15454 optical cards, when installed in a system, comply with these standards:

 - Safety: IEC 60950, EN 60950, UL 60950, CSA C22.2 No. 60950, TS 001, AS/NZS 3260, IEC 60825-1, IEC 60825-2, 21 CFR 1040-10, and 21 CFR 1040.11
 - Class 1 laser product

5.8 ML100T-12 Card

The ML100T-12 card provides 12 ports of IEEE 802.3-compliant, 10/100 interfaces. Each interface supports full-duplex operation for a maximum bandwidth of 200 Mbps per port and 2.488 Gbps per card. Each port independently detects the speed of an attached device (autosenses) and automatically connects at the appropriate speed. The ports autoconfigure to operate at either half or full duplex and can

determine whether to enable or disable flow control. For ML-Series configuration information, see the *Cisco ONS 15454 SONET/SDH ML-Series Multilayer Ethernet Card Software Feature and Configuration Guide*.

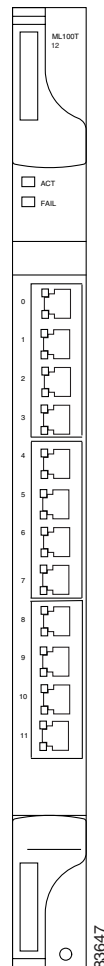
Figure 5-7 shows the card faceplate.



Caution

Shielded twisted-pair cabling should be used for inter-building applications.

Figure 5-7 ML100T-12 Faceplate



The card features two virtual packet over SONET (POS) ports with a maximum combined bandwidth of STS-48. The ports function in a manner similar to OC-N card ports, and each port carries an STS circuit with a size of STS-1, STS-3c, STS-6c, STS-9c, STS-12c, or STS-24c. For step-by-step instructions on configuring an ML-Series card SONET STS circuit, refer to the “Create Circuits and VT Tunnels” chapter of the *Cisco ONS 15454 Procedure Guide*.

The ML-Series POS ports supports virtual concatenation (VCAT) of SONET circuits and a software link capacity adjustment scheme (SW-LCAS). The ML-Series card supports a maximum of two VCAT groups with each group corresponding to one of the POS ports. Each VCAT group can contain two circuit

members. An ML-Series card supports STS-1c-2v, STS-3c-2v and STS-12c-2v. For step-by-step instructions on configuring an ML-Series card SONET VCAT circuit, refer to the “Create Circuits and VT Tunnels” chapter of the *Cisco ONS 15454 Procedure Guide*.

5.8.1 ML100T-12 Card-Level Indicators

The ML00T-12 card supports two card-level LED indicators. The card-level indicators are described in [Table 5-16](#).

Table 5-16 ML100T-12 Card-Level Indicators

Card-Level LEDs	Description
Red FAIL LED	The red FAIL LED indicates that the card’s processor is not ready or that a catastrophic software failure occurred on the ML100T-12 card. As part of the boot sequence, the FAIL LED is turned on until the software deems the card operational.
Green ACT LED	A green ACT LED provides the operational status of the ML100T-12. If the ACT LED is green, it indicates that the ML100T-12 card is active and the software is operational.

5.8.2 ML100T-12 Port-Level Indicators

The ML100T-12 card provides a pair of LEDs for each Fast Ethernet port: an amber LED for activity (ACT) and a green LED for LINK. The port-level indicators are described in [Table 5-17](#).

Table 5-17 ML100T-12 Port-Level Indicators

Port-Level Indicators	Description
ACT LED (Amber)	A steady amber LED indicates a link is detected, but there is an issue inhibiting traffic. A blinking amber LED means traffic is flowing.
LINK LED (Green)	A steady green LED indicates that a link is detected, but there is no traffic. A blinking green LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.
Both ACT and LINK LED	Unlit green and amber LEDs indicate no traffic.

5.8.3 ML100T-12 Slot Compatibility

The ML100T-12 card works in Slots 1 to 6 or 12 to 17 with the XC10G cross-connect card. It works only in high-speed slots (Slots 5, 6, 12, or 13) with the XC or XCVT cross-connect card.

5.8.4 ML100T-12 Card Specifications

The ML100T-12 card has the following specifications:

- Environmental
 - Operating temperature: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

- Operating humidity: 5 to 95%, noncondensing
- Power consumption: 53.00 W, 1.10 A at –48 V, 181.0 BTU/hr
- Dimensions
 - Height: 321.3 mm (12.650 in.)
 - Width: 18.2 mm (0.716 in.)
 - Depth: 228.6 mm (9.000 in.)
 - Depth with backplane connector: 235 mm (9.250 in.)
 - Weight not including clam shell: 1.0 kg (2.3 lb)
- Compliance

ONS 15454 cards, when installed in a system, comply with these safety standards: IEC 60950, EN 60950, UL 60950, CSA C22.2 No. 60950, TS 001, and AS/NZS 3260

5.9 ML1000-2 Card

The ML1000-2 card provides two ports of IEEE-compliant, 1000-Mbps interfaces. Each interface supports full-duplex operation for a maximum bandwidth of 2 Gbps per port and 4 Gbps per card. Each port autoconfigures for full duplex and IEEE 802.3x flow control.

SFP modules are offered as separate orderable products for maximum customer flexibility. For details, see the “5.10 GBICs and SFPs” section on page 5-28.

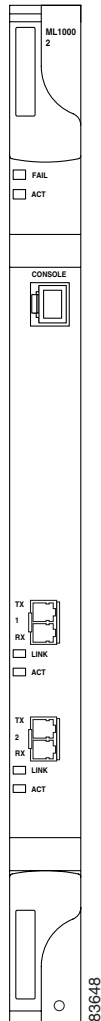
Figure 5-8 on page 5-26 shows the ML1000-2 card faceplate.



Warning

Class 1 laser product.

Figure 5-8 ML1000-2 Faceplate

**Warning**

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

The card features two virtual packet over SONET (POS) ports with a maximum combined bandwidth of STS-48. The ports function in a manner similar to OC-N card ports, and each port carries an STS circuit with a size of STS-1, STS-3c, STS-6c, STS-9c, STS-12c, or STS-24c. For step-by-step instructions on configuring an ML-Series card SONET STS circuit, refer to the “Create Circuits and VT Tunnels” chapter of the *Cisco ONS 15454 Procedure Guide*.

The ML-Series POS ports supports VCAT of SONET circuits and a software link capacity adjustment scheme (SW-LCAS). The ML-Series card supports a maximum of two VCAT groups with each group corresponding to one of the POS ports. Each VCAT group can contain two circuit members. An ML-Series card supports STS-1c-2v, STS-3c-2v and STS-12c-2v. For step-by-step instructions on configuring an ML-Series card SONET VCAT circuit, refer to the “Create Circuits and VT Tunnels” chapter of the *Cisco ONS 15454 Procedure Guide*.

5.9.1 ML1000-2 Card-Level Indicators

The ML1000-2 card faceplate has two card-level LED indicators, described in [Table 5-18](#).

Table 5-18 ML1000-2 Card-Level Indicators

Card-Level LEDs	Description
SF LED (Red)	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the ML1000-2 card. As part of the boot sequence, the FAIL LED is turned on until the software deems the card operational.
ACT LED (Green)	A green ACT LED provides the operational status of the ML1000-2. When the ACT LED is green, it indicates that the ML1000-2 card is active and the software is operational.

5.9.2 ML1000-2 Port-Level Indicators

The ML1000-2 card has three LEDs for each of the two Gigabit Ethernet ports, described in [Table 5-18](#).

Port-Level Indicators	Description
ACT LED (Amber)	A steady amber LED indicates a link is detected, but there is an issue inhibiting traffic. A blinking amber LED means traffic flowing.
LINK LED (Green)	A steady green LED indicates that a link is detected, but there is no traffic. A blinking green LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.
Both ACT and LINK LED	Unlit green and amber LEDs indicate no traffic.

5.9.3 Slot Compatibility

The ML1000-2 card works in Slots 1 to 6 or 12 to 17 with the XC10G cross-connect card. It works only in high-speed slots (Slots 5, 6, 12, or 13) with the XC or XCVT cross-connect card.

5.9.4 ML1000-2 Card Specifications

The ML1000-2 card has the following specifications:

- Environmental
 - Operating temperature: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)
 - Operating humidity: 5 to 95%, noncondensing
 - Power consumption: 49.00 W, 1.02 A at –48 V, 167.3 BTU/hr
- Dimensions
 - Height: 321.3 mm (12.650 in.)
 - Width: 18.2 mm (0.716 in.)
 - Depth: 228.6 mm (9.000 in.)

- Depth with backplane connector: 235 mm (9.250 in.)
- Weight not including clam shell: 2.1 lb (0.9 kg)
- Compliance
 - ONS 15454 optical cards, when installed in a system, comply with these standards:
 - Safety: IEC 60950, EN 60950, UL 60950, CSA C22.2 No. 60950, TS 001, AS/NZS 3260, IEC 60825-1, IEC 60825-2, 21 CFR 1040-10, and 21 CFR 1040.11
 - Class 1 laser product

5.10 GBICs and SFPs

The ONS 15454 Ethernet cards use industry standard small form-factor pluggable connectors (SFPs) and Gigabit Interface Converter (GBIC) modular receptacles. The ML-Series Gigabit Ethernet cards use standard Cisco SFPs. The Gigabit E-Series card and the G-Series card use standard Cisco GBICs. With Software Release 4.1 and later, G-Series cards can also be equipped with dense wavelength division multiplexing (DWDM) and coarse wavelength division multiplexing (CWDM) GBICs to function as Gigabit Ethernet transponders.

For all Ethernet cards, the type of GBIC or SFP plugged into the card is displayed in CTC and TL1. Cisco offers SFPs and GBICs as separate orderable products.

Table 5-19 lists specifications for the non-WDM GBICs and SFPs.

Table 5-19 GBIC and SFP Specifications (non-WDM)

Parameter	1000BaseSX GBIC	1000BaseLX GBIC	1000BaseZX GBIC	1000BaseSX SFP	1000BaseLX SFP
Product Name	15454-GBIC-SX	15454-GBIC-LX	15454-GBIC-ZX	15454-SFP-LC-SX	15454-SFP-LC-LX
E1000-2-G/E1000-2	Compatible	Compatible	Not Compatible	Not Compatible	Not Compatible
G1K-4/G1000-4	Compatible	Compatible	Compatible	Not Compatible	Not Compatible
ML1000-2	Not Compatible	Not Compatible	Not Compatible	Compatible	Compatible
IEEE Compliant	Yes	Yes	Yes	Yes	Yes
Center Wavelength (Nominal)	850 nm	1310 nm	1550 nm	850 nm	1310 nm
Central Wavelength (Spectral Range)	770 to 860 nm	1270 to 1355 nm	1540 to 1570 nm	770 to 860 nm	1270 to 1355 nm
Temperature Range (Ambient)	-5 to +55 Celsius	-5 to +55 Celsius	-5 to +50 Celsius	-5 to +55 Celsius	-5 to +55 Celsius
Transmitter Output Power (minimum)	-9.5 dBm	-11 dBm	0 dBm	9.5 dBm	11 dBm
Optical Input Power (Rx)-Minimum	-17 dBm	-19 dBm	-24 dBm	-17 dBm	-19 dBm
Optical Input Power (Rx)-Maximum	0 dBm	-3 dBm	-1 dBm	0 dBm	-3 dBm

Table 5-19 GBIC and SFP Specifications (non-WDM) (continued)

Parameter	1000BaseSX GBIC	1000BaseLX GBIC	1000BaseZX GBIC	1000BaseSX SFP	1000BaseLX SFP
Operating Range for 62.5-micron multimode fiber	220 meters	550 meters ¹	Not Compatible	220 meters	550 meters ¹
Operating Range for 50-micron multimode fiber	550 meters	550 meters ¹	Not Compatible	550 meters	550 meters ¹
Operating Range for 10-micron singlemode fiber	Not Compatible	10 Kilometers	70 Kilometers	Not Compatible	10 Kilometers

1. When using an LX SFP or LX GBIC with multimode fiber, you must install a mode-conditioning patch cord between the SFP/GBIC and the multimode fiber cable on both the transmit and receive ends of the link. The mode-conditioning patch cord is required for link distances less than 100 m (328 feet) or greater than 300 m (984 feet). The mode-conditioning patch cord prevents overdriving the receiver for short lengths of multimode fiber and reduces differential mode delay for long lengths of multimode fiber.

5.10.1 DWDM and CWDM Gigabit Interface Converters

DWDM and CWDM GBICs operate in the ONS 15454 G-Series card when the card is configured in Gigabit Ethernet Transponding mode or in Ethernet over SONET mode. DWDM and CWDM GBICs are both wavelength division multiplexing (WDM) technologies and operate over single-mode fibers with SC connectors. Cisco CWDM GBIC technology uses a 20-nm wavelength grid and Cisco ONS 15454 DWDM GBIC technology uses a 1-nm wavelength grid. CTC displays the specific wavelengths of the installed CWDM or DWDM GBICs. DWDM wavelengths are spaced closer together and require more precise lasers than CWDM. The DWDM spectrum allows for optical signal amplification. For more information on G-Series card transponding mode, see the “5.10 GBICs and SFPs” section on page 5-28.

The DWDM and CWDM GBICs receive across the full 1300-nm and 1500-nm bands, which includes all CWDM, DWDM, LX, ZX wavelengths, but transmit on one specified wavelength. This capability can be exploited in some of the G-Series transponding modes by receiving wavelengths that do not match the specific transmission wavelength.



Note

G1000-4 cards support CWDM and DWDM GBICs. G1K-4 cards with the Common Language Equipment Identification (CLEI) code of WM51RWPCAA (manufactured after August 2003) support CWDM and DWDM GBICs. G1K-4 cards manufactured prior to August 2003 do not support CWDM or DWDM GBICs.



Caution

Operating temperature of the DWDM GBICs is –5 degrees C to 40 degrees C (23 degrees F to 104 degrees F).

The ONS 15454 supported CWDM GBICs reach up to 100 to 120 km over single mode fiber and support eight wavelengths:

- 1470 nm
- 1490 nm
- 1510 nm
- 1530 nm
- 1550 nm

- 1570 nm
- 1590 nm
- 1610 nm

The ONS 15454 supported DWDM GBICs support 32 different wavelengths in the red and blue bands. Paired with optical amplifiers, such as the Cisco ONS 15216, the DWDM GBICs allow maximum unregenerated spans of approximately 300 km (Table 5-20).

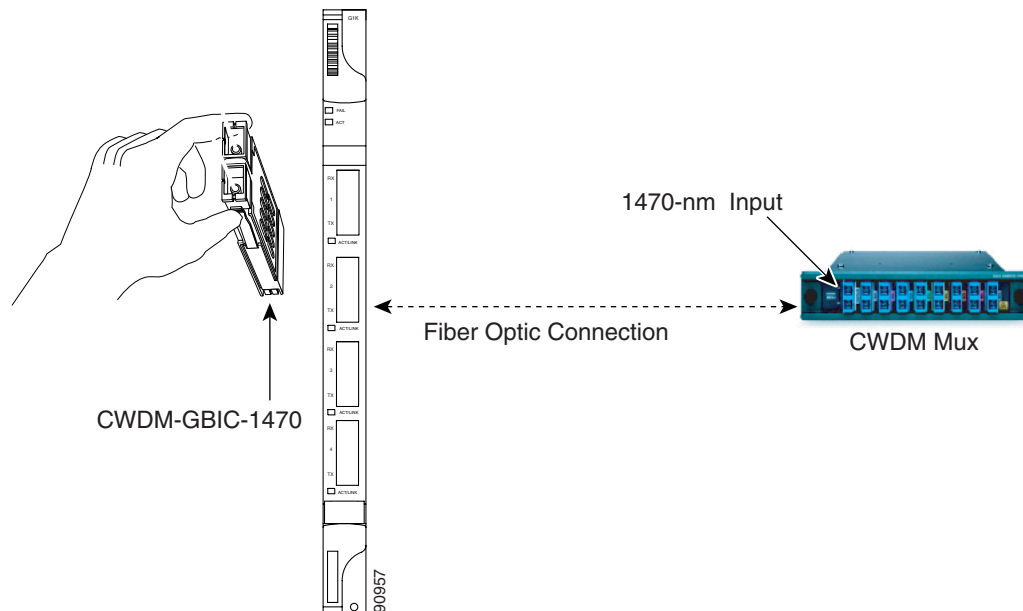
Table 5-20 32 ITU-100 GHz Wavelengths Supported by DWDM GBICs

Blue Band	1530.33 nm	1531.12 nm	1531.90 nm	1532.68 nm	1534.25 nm	1535.04 nm	1535.82 nm	1536.61 nm
	1538.19 nm	1538.98 nm	1539.77 nm	1540.56 nm	1542.14 nm	1542.94 nm	1543.73 nm	1544.53 nm
Red Band	1546.12 nm	1546.92 nm	1547.72 nm	1548.51 nm	1550.12 nm	1550.92 nm	1551.72 nm	1552.52 nm
	1554.13 nm	1554.94 nm	1555.75 nm	1556.55 nm	1558.17 nm	1558.98 nm	1559.79 nm	1560.61 nm

5.10.1.1 Placement of CWDM or DWDM GBICs

CWDM or DWDM GBICs for the G-Series card come in set wavelengths and are not provisionable. The wavelengths are printed on each GBIC, for example, CWDM-GBIC-1490. The user must insert the specific GBIC transmitting the wavelength required to match the input of the CWDM/DWDM device for successful operation (Figure 5-9 on page 5-30). Follow your site plan or network diagram for the required wavelengths.

Figure 5-9 CWDM GBIC with Wavelength Appropriate for Fiber-Connected Device



The *Cisco ONS 15454 Procedure Guide* contains specific procedures for attaching optical fiber to GBICs and inserting GBICs into the G-Series card.

5.10.1.2 Example of CWDM or DWDM GBIC Application

A G-Series card equipped with CWDM or DWDM GBICs supports the delivery of unprotected Gigabit Ethernet service over Metro DWDM and video-on-demand (VoD) transport networks (Figure 5-10). It can be used in short-haul and long-haul applications.

Figure 5-10 G-Series with CWDM/DWDM GBICs in Cable Network

