



CHAPTER 2

Common Control Cards



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.

This chapter describes the Cisco ONS 15454 common-control cards. For installation and card turn-up procedures, refer to the *Cisco ONS 15454 DWDM Procedure Guide*. For card safety and compliance information, refer to the *Cisco Optical Transport Products Safety and Compliance Information* document.



Note

Unless otherwise specified, "ONS 15454" refers to both ANSI and ETSI shelf assemblies.



Note

The cards described in this chapter are supported on the Cisco ONS 15454, Cisco ONS 15454 M6, Cisco ONS 15454 M2 platforms, unless noted otherwise.

Chapter topics include:

- [2.1 Card Overview, page 2-2](#)
- [2.3 TCC2 Card, page 2-3](#)
- [2.4 TCC2P Card, page 2-8](#)
- [2.5 TCC3 Card, page 2-12](#)
- [2.6 TNC Card, page 2-16](#)
- [2.7 TSC Card, page 2-25](#)
- [2.8 Digital Image Signing, page 2-33](#)
- [2.9 AIC-I Card, page 2-34](#)
- [2.10 MS-ISC-100T Card, page 2-39](#)
- [2.11 Front Mount Electrical Connections, page 2-42](#)

2.1 Card Overview

The card overview section lists the cards described in this chapter.

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. For a list of slots and symbols, see the “Card Slot Requirements” section in the *Cisco ONS 15454 Hardware Installation Guide*.

2.1.1 Common Control Cards

The following common control cards are needed to support the functions of the DWDM, transponder, and muxponder cards on ONS 15454 shelf:

- TCC2 or TCC2P or TCC3
- AIC-I (optional)
- MS-ISC-100T (multishelf configurations only)

The TNC and TSC cards are used to support the functions of DWDM, transponder, and muxponder cards on the Cisco ONS 15454 M2 and Cisco ONS 15454 M6 shelves.

2.1.2 Card Compatibility

Table 2-1 lists the platform and software release compatibility for the control cards.

Table 2-1 Platform and Software Release Compatibility for Control Cards

Card Name	R4.5	R4.6	R4.7	R5.0	R6.0	R7.0	R7.2	R8.0	R8.5	R9.0	R9.1	R9.2
TCC2	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DWDM
TCC2P	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DWDM
AIC-I	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DWDM
MS-ISC-100T	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DW DM	15454-DWDM
TCC3 ¹	No	No	No	No	No	No	No	No	No	No	No	15454-DWDM
TNC	No	No	No	No	No	No	No	No	No	No	No	15454-M2 and 15454-M6
TSC	No	No	No	No	No	No	No	No	No	No	No	15454-M2 and 15454-M6

1. The TCC3 card is backward compatible with software Release 9.1 and earlier releases. In the Release 9.1 and earlier releases, the TCC3 card boots up as the TCC2P card in the Cisco ONS 15454 DWDM systems.

2.1.3 Front Mount Electrical Connections (ETSI only)

The following Front Mount Electrical Connections (FMECs) are needed to support the functions of the DWDM, transponder, and muxponder cards:

- MIC-A/P
- MIC-C/T/P

2.2 Safety Labels

This section explains the significance of the safety labels attached to some of the cards. The faceplates of the cards are clearly labeled with warnings about the laser radiation levels. You must understand all warning labels before working on these cards.

2.2.1 Hazard Level 1 Label

The Hazard Level 1 label is shown in [Figure 2-1](#).

Figure 2-1 Hazard Level Label



The Hazard Level label warns users against exposure to laser radiation of Class 1 limits calculated in accordance with IEC60825-1 Ed.1.2. This label is displayed on the faceplate of the cards.



Warning

Class 1 laser product. Statement 1008

2.3 TCC2 Card

(Cisco ONS 15454 only)



Note

For TCC2 card specifications, see the [“A.3.1 TCC2 Card Specifications”](#) section on page A-4.

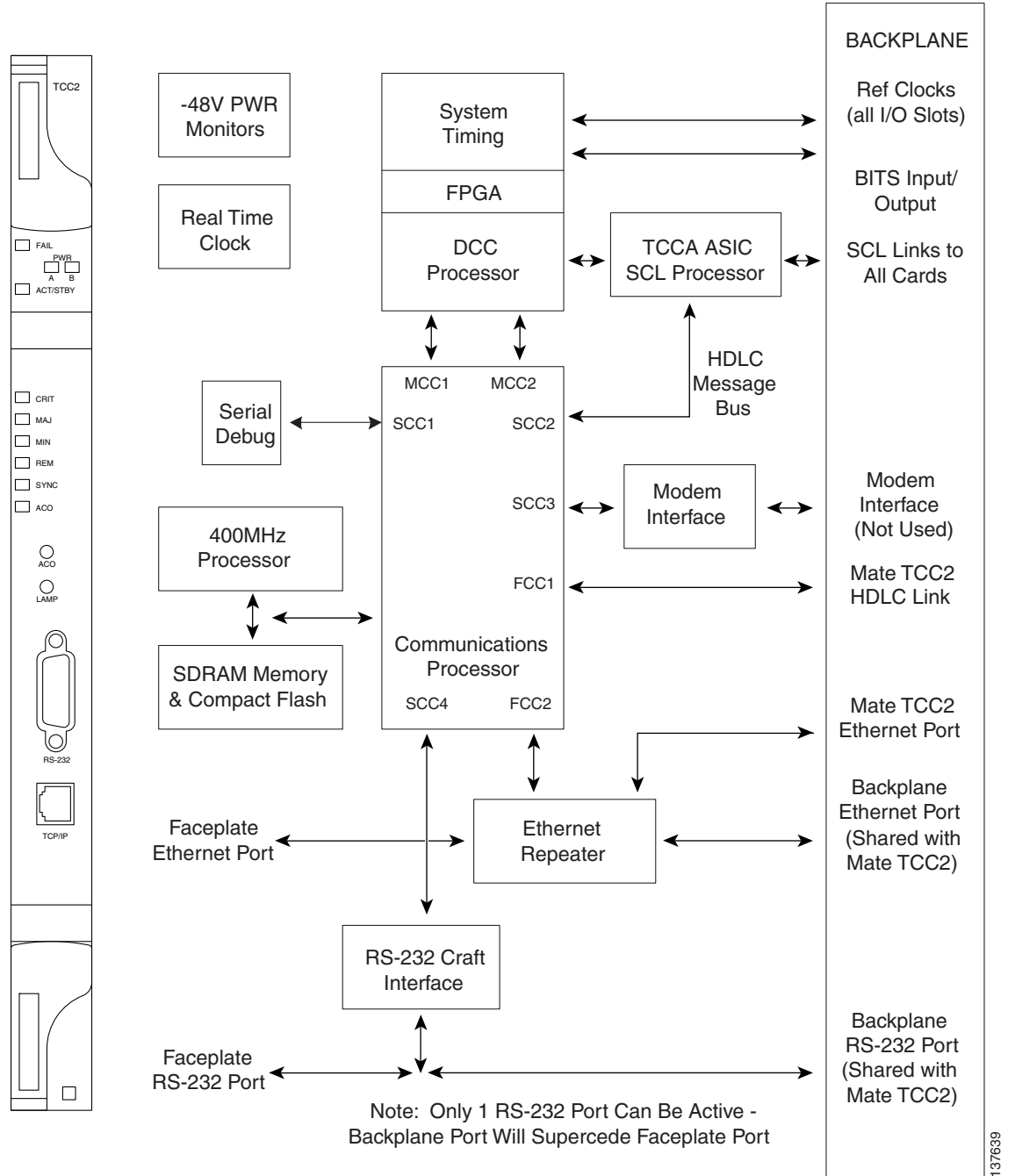
The Advanced Timing, Communications, and Control (TCC2) card performs system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection/resolution, SONET section overhead (SOH) data communications channel/generic communications channel (DCC/GCC)

termination, optical service channel (OSC) DWDM data communications network (DCN) termination, and system fault detection for the ONS 15454. The TCC2 also ensures that the system maintains Stratum 3 (Telcordia GR-253-CORE) timing requirements. It monitors the supply voltage of the system.

**Note**

The LAN interface of the TCC2 card meets the standard Ethernet specifications by supporting a cable length of 328 ft (100 m) at temperatures from 32 to 149 degrees Fahrenheit (0 to 65 degrees Celsius).

[Figure 2-2](#) shows the faceplate and block diagram for the TCC2.

Figure 2-2 TCC2 Faceplate and Block Diagram

137639

2.3.1 TCC2 Functionality

The TCC2 card terminates up to 32 DCCs. The TCC2 hardware is prepared for up to 84 DCCs, which will be available in a future software release.

The node database, IP address, and system software are stored in TCC2 nonvolatile memory, which allows quick recovery in the event of a power or card failure.

The TCC2 performs all system-timing functions for each ONS 15454. The TCC2 monitors the recovered clocks from each traffic card and two building integrated timing supply (BITS) ports for frequency accuracy. The TCC2 selects a recovered clock, a BITS, or an internal Stratum 3 reference as the system-timing reference. You can provision any of the clock inputs as primary or secondary timing sources. A slow-reference tracking loop allows the TCC2 to synchronize with the recovered clock, which provides holdover if the reference is lost.

The TCC2 monitors both supply voltage inputs on the shelf. An alarm is generated if one of the supply voltage inputs has a voltage out of the specified range.

Install TCC2 cards in Slots 7 and 11 for redundancy. If the active TCC2 fails, traffic switches to the protect TCC2.

The TCC2 card has two built-in interface ports for accessing the system: an RJ-45 10BaseT LAN interface and an EIA/TIA-232 ASCII interface for local craft access. It also has a 10BaseT LAN port for user interfaces via the backplane.

2.3.2 Redundant TCC2 Card Installation

Cisco does not support operation of the ONS 15454 with only one TCC2 card. For full functionality and to safeguard your system, always operate with two TCC2 cards.

When a second TCC2 card is inserted into a node, it synchronizes its software, its backup software, and its database with the active TCC2. If the software version of the new TCC2 does not match the version on the active TCC2, the newly inserted TCC2 copies from the active TCC2, taking about 15 to 20 minutes to complete. If the backup software version on the new TCC2 does not match the version on the active TCC2, the newly inserted TCC2 copies the backup software from the active TCC2 again, taking about 15 to 20 minutes. Copying the database from the active TCC2 takes about 3 minutes. Depending on the software version and backup version the new TCC2 started with, the entire process can take between 3 and 40 minutes.

2.3.3 TCC2 Card-Level Indicators

The TCC2 faceplate has ten LEDs. [Table 2-2](#) describes the two card-level LEDs on the TCC2 faceplate.

Table 2-2 TCC2 Card-Level Indicators

Card-Level LEDs	Definition
Red FAIL LED	This LED is on during reset. The FAIL LED flashes during the boot and write process. Replace the card if the FAIL LED persists.
ACT/STBY LED Green (Active) Yellow (Standby)	Indicates the TCC2 is active (green) or in standby (yellow) mode. The ACT/STBY LED also provides the timing reference and shelf control. When the active TCC2 is writing to its database or to the standby TCC2 database, the card LEDs blink. To avoid memory corruption, do not remove the TCC2 when the active or standby LED is blinking.

2.3.4 Network-Level Indicators

Table 2-3 describes the six network-level LEDs on the TCC2 faceplate.

Table 2-3 TCC2 Network-Level Indicators

System-Level LEDs	Definition
Red CRIT LED	Indicates critical alarms in the network at the local terminal.
Red MAJ LED	Indicates major alarms in the network at the local terminal.
Yellow MIN LED	Indicates minor alarms in the network at the local terminal.
Red REM LED	Provides first-level alarm isolation. The remote (REM) LED turns red when an alarm is present in one or more of the remote terminals.
Green SYNC LED	Indicates that node timing is synchronized to an external reference.
Green ACO LED	After pressing the alarm cutoff (ACO) button, the ACO LED turns green. The ACO button opens the audible alarm closure on the backplane. ACO is stopped if a new alarm occurs. After the originating alarm is cleared, the ACO LED and audible alarm control are reset.

2.3.5 Power-Level Indicators

Table 2-4 describes the two power-level LEDs on the TCC2 faceplate.

Table 2-4 TCC2 Power-Level Indicators

Power-Level LEDs	Definition
Green/Amber/Red PWR A LED	The PWR A LED is green when the voltage on supply input A is between the low battery voltage (LWBATVG) and high battery voltage (HIBATVG) thresholds. The LED is amber when the voltage on supply input A is between the high battery voltage and extremely high battery voltage (EHIBATVG) thresholds or between the low battery voltage and extremely low battery voltage (ELWBATVG) thresholds. The LED is red when the voltage on supply input A is above extremely high battery voltage or below extremely low battery voltage thresholds.
Green/Amber/Red PWR B LED	The PWR B LED is green when the voltage on supply input B is between the low battery voltage and high battery voltage thresholds. The LED is amber when the voltage on supply input B is between the high battery voltage and extremely high battery voltage thresholds or between the low battery voltage and extremely low battery voltage thresholds. The LED is red when the voltage on supply input B is above extremely high battery voltage or below extremely low battery voltage thresholds.



Note

For ONS 15454 ETSI shelf, the power-level LEDs are either green or red. The LED is green when the voltage on supply inputs is between the extremely low battery voltage and extremely high battery voltage thresholds. The LED is red when the voltage on supply inputs is above extremely high battery voltage or below extremely low battery voltage thresholds.

2.4 TCC2P Card

(Cisco ONS 15454 only)

**Note**

For TCC2P card specifications, see the [“A.3.2 TCC2P Card Specifications” section on page A-5](#).

The Advanced Timing, Communications, and Control Plus (TCC2P) card is an enhanced version of the TCC2 card. The primary enhancements are Ethernet security features and 64K composite clock BITS timing.

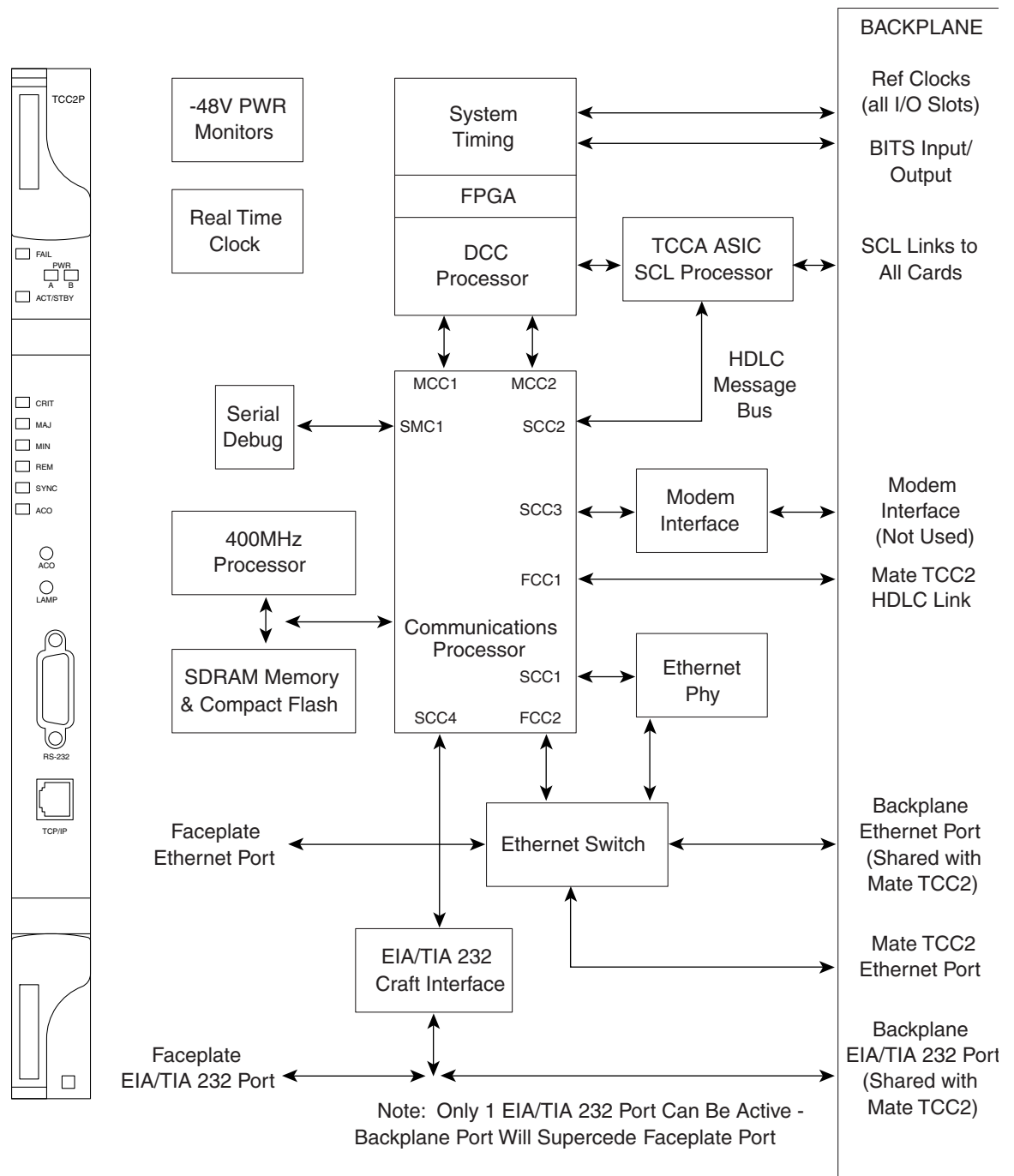
The TCC2P card performs system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection/resolution, SONET SOH DCC/GCC termination, and system fault detection for the ONS 15454. The TCC2P also ensures that the system maintains Stratum 3 (Telcordia GR-253-CORE) timing requirements. It monitors the supply voltage of the system.

The TCC2P card supports multi-shelf management. The TCC2P card acts as a shelf controller and node controller for the ONS 15454. The TCC2P card supports up to 12 subtended shelves through the MS-ISC card or external switch. In a multi-shelf configuration, the TCC2P card allows the ONS 15454 node to be a node controller.

The TCC2P card is compliant to the following standards:

- The LAN interface of the TCC2P card meets the standard Ethernet specifications by supporting a cable length of 328 ft (100 m) at temperatures from 32 to 149 degrees Fahrenheit (0 to 65 degrees Celsius). The interfaces can operate with a cable length of 32.8 ft (10 m) maximum at temperatures from –40 to 32 degrees Fahrenheit (–40 to 0 degrees Celsius).
- The TCC2P card is Restriction of Use of Hazardous Substances (RoHS) complaint. The RoHS regulations limit or ban the specific substances such as lead, cadmium, polybrominated biphenyl (PBB), mercury, hexavalent chromium, and polybrominated diphenyl ether (PBDE) flame retardants in a new electronic and electric equipment.

[Figure 2-3](#) shows the faceplate and block diagram for the TCC2P card.

Figure 2-3 TCC2P Faceplate and Block Diagram

2.4.1 TCC2P Functionality

The TCC2P card supports multichannel, high-level data link control (HDLC) processing for the DCC. Up to 84 DCCs can be routed over the TCC2P card and up to 84 section DCCs can be terminated at the TCC2P card (subject to the available optical digital communication channels). The TCC2P selects and processes 84 DCCs to facilitate remote system management interfaces.

The TCC2P card also originates and terminates a cell bus carried over the module. The cell bus supports links between any two cards in the node, which is essential for peer-to-peer communication. Peer-to-peer communication accelerates protection switching for redundant cards.

The node database, IP address, and system software are stored in TCC2P card nonvolatile memory, which allows quick recovery in the event of a power or card failure.

The TCC2P card performs all system-timing functions for each ONS 15454. The TCC2P card monitors the recovered clocks from each traffic card and two BITS ports for frequency accuracy. The TCC2P card selects a recovered clock, a BITS, or an internal Stratum 3 reference as the system-timing reference. You can provision any of the clock inputs as primary or secondary timing sources. A slow-reference tracking loop allows the TCC2P card to synchronize with the recovered clock, which provides holdover if the reference is lost.

The TCC2P card supports 64/8K composite clock and 6.312 MHz timing output.

The TCC2P card monitors both supply voltage inputs on the shelf. An alarm is generated if one of the supply voltage inputs has a voltage out of the specified range.

Install TCC2P cards in Slots 7 and 11 for redundancy. If the active TCC2P card fails, traffic switches to the protect TCC2P card. All TCC2P card protection switches conform to protection switching standards when the bit error rate (BER) counts are not in excess of $1 * 10^{\text{exp} - 3}$ and completion time is less than 50 ms.

The TCC2P card has two built-in Ethernet interface ports for accessing the system: one built-in RJ-45 port on the front faceplate for on-site craft access and a second port on the backplane. The rear Ethernet interface is for permanent LAN access and all remote access via TCP/IP as well as for Operations Support System (OSS) access. The front and rear Ethernet interfaces can be provisioned with different IP addresses using CTC.

Two EIA/TIA-232 serial ports, one on the faceplate and a second on the backplane, allow for craft interface in TL1 mode.



Note

To use the serial port craft interface wire-wrap pins on the backplane, the DTR signal line on the backplane port wire-wrap pin must be connected and active.

2.4.2 Redundant TCC2P Card Installation

Cisco does not support operation of the ONS 15454 with only one TCC2P card. For full functionality and to safeguard your system, always operate with two TCC2P cards.

When a second TCC2P card is inserted into a node, it synchronizes its software, its backup software, and its database with the active TCC2P card. If the software version of the new TCC2P card does not match the version on the active TCC2P card, the newly inserted TCC2P card copies from the active TCC2P card, taking about 15 to 20 minutes to complete. If the backup software version on the new TCC2P card does not match the version on the active TCC2P card, the newly inserted TCC2P card copies the backup

software from the active TCC2P card again, taking about 15 to 20 minutes. Copying the database from the active TCC2P card takes about 3 minutes. Depending on the software version and backup version the new TCC2P card started with, the entire process can take between 3 and 40 minutes.

2.4.3 TCC2P Card-Level Indicators

The TCC2P faceplate has ten LEDs. [Table 2-5](#) describes the two card-level LEDs on the TCC2P faceplate.

Table 2-5 TCC2P Card-Level Indicators

Card-Level LEDs	Definition
Red FAIL LED	This LED is on during reset. The FAIL LED flashes during the boot and write process. Replace the card if the FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Indicates the TCC2P is active (green) or in standby (amber) mode. The ACT/STBY LED also provides the timing reference and shelf control. When the active TCC2P is writing to its database or to the standby TCC2P database, the card LEDs blink. To avoid memory corruption, do not remove the TCC2P when the active or standby LED is blinking.

2.4.4 Network-Level Indicators

[Table 2-6](#) describes the six network-level LEDs on the TCC2P faceplate.

Table 2-6 TCC2P Network-Level Indicators

System-Level LEDs	Definition
Red CRIT LED	Indicates critical alarms in the network at the local terminal.
Red MAJ LED	Indicates major alarms in the network at the local terminal.
Amber MIN LED	Indicates minor alarms in the network at the local terminal.
Red REM LED	Provides first-level alarm isolation. The remote (REM) LED turns red when an alarm is present in one or more of the remote terminals.
Green SYNC LED	Indicates that node timing is synchronized to an external reference.
Green ACO LED	After pressing the ACO button, the ACO LED turns green. The ACO button opens the audible alarm closure on the backplane. ACO is stopped if a new alarm occurs. After the originating alarm is cleared, the ACO LED and audible alarm control are reset.

2.4.5 Power-Level Indicators

Table 2-7 describes the two power-level LEDs on the TCC2P faceplate.

Table 2-7 TCC2P Power-Level Indicators

Power-Level LEDs	Definition
Green/Amber/Red PWR A LED	The PWR A LED is green when the voltage on supply input A is between the low battery voltage (LWBATVG) and high battery voltage (HIBATVG) thresholds. The LED is amber when the voltage on supply input A is between the high battery voltage and extremely high battery voltage (EHIBATVG) thresholds or between the low battery voltage and extremely low battery voltage (ELWBATVG) thresholds. The LED is red when the voltage on supply input A is above extremely high battery voltage or below extremely low battery voltage thresholds.
Green/Amber/Red PWR B LED	The PWR B LED is green when the voltage on supply input B is between the low battery voltage and high battery voltage thresholds. The LED is amber when the voltage on supply input B is between the high battery voltage and extremely high battery voltage thresholds or between the low battery voltage and extremely low battery voltage thresholds. The LED is red when the voltage on supply input B is above extremely high battery voltage or below extremely low battery voltage thresholds.



Note

For ONS 15454 ETSI shelf, the power-level LEDs are either green or red. The LED is green when the voltage on supply inputs is between the extremely low battery voltage and extremely high battery voltage thresholds. The LED is red when the voltage on supply inputs is above extremely high battery voltage or below extremely low battery voltage thresholds.

2.5 TCC3 Card

(Cisco ONS 15454 only)



Note

For TCC3 card specifications, see the [“A.3.3 TCC3 Card Specifications”](#) section on page A-6.

The Timing Communications Control Three (TCC3) card is an enhanced version of the TCC2P card. The primary enhancements include the increase in memory size and compact flash space. The TCC3 card boots up as TCC2P card in older releases and as TCC3 card from Release 9.2 onwards.

The TCC3 card performs system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection/resolution, SONET SOH DCC/GCC termination, and system fault detection for the ONS 15454. The TCC3 also ensures that the system maintains Stratum 3 (Telcordia GR-253-CORE) timing requirements. It monitors the supply voltage of the system.

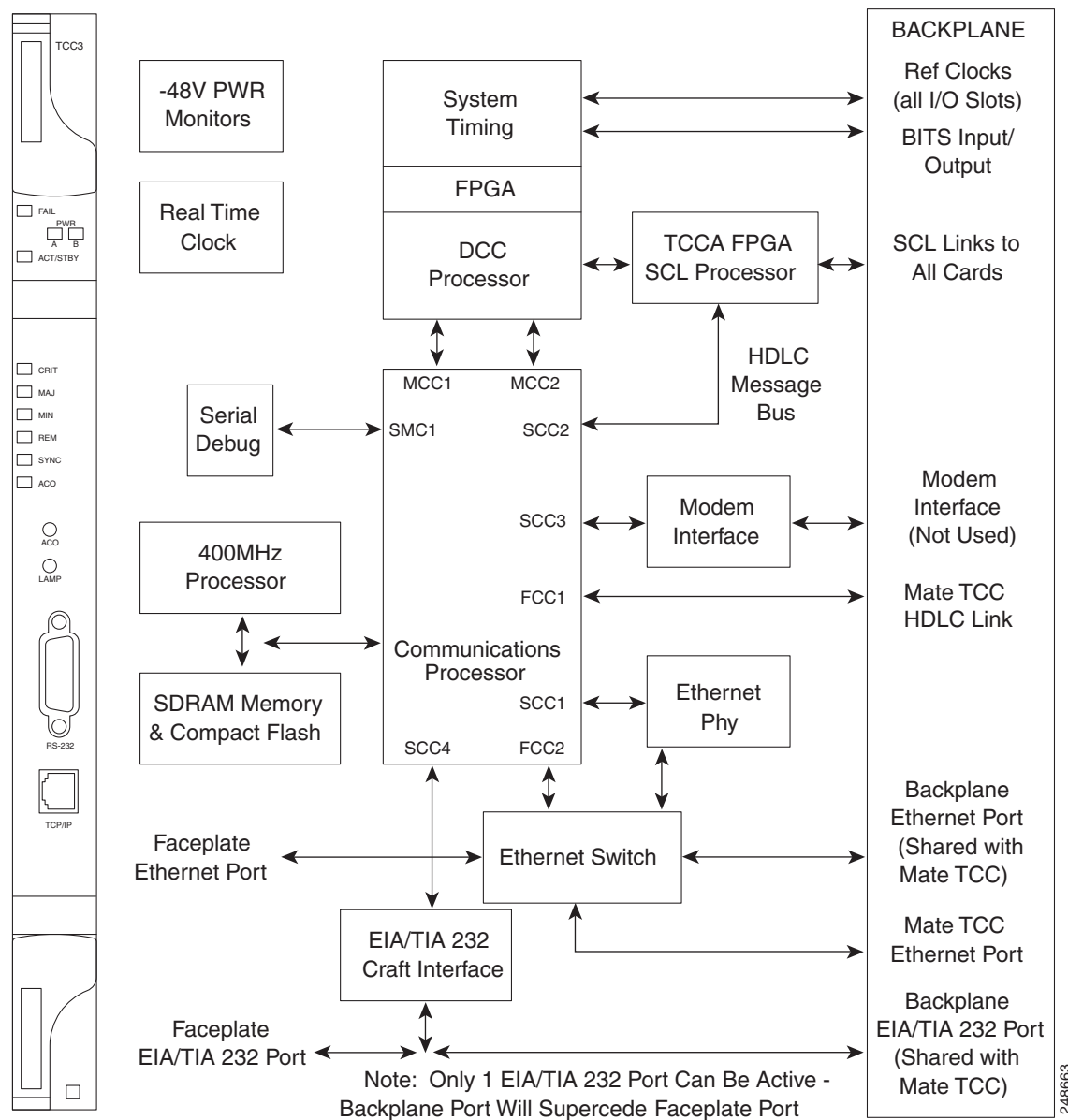
The TCC3 card supports multi-shelf management. The TCC3 card acts as a shelf controller and node controller for the ONS 15454. The TCC3 card supports up to 30 subtended shelves through the MSM-ISC card or external switch. In a multi-shelf configuration, the TCC3 card allows the ONS 15454 node to be a node controller if an M6 shelf is subtended to it. We recommend the use the TCC3 card as a node controller when the number of subtended shelves exceeds four.

The TCC3 card is compliant with the following standards:

- The LAN interface of the TCC3 card meets the standard Ethernet specifications by supporting a cable length of 328 ft (100 m) at temperatures ranging from 32 to 149 degrees Fahrenheit (0 to 65 degrees Celsius). The interfaces can operate with a cable length of 32.8 ft (10 m) maximum at temperatures from -40 to 32 degrees Fahrenheit (-40 to 0 degrees Celsius).
- The TCC3 card is Restriction of Use of Hazardous Substances (RoHS) compliant. The RoHS regulations limit or ban the specific substances such as lead, cadmium, polybrominated biphenyl (PBB), mercury, hexavalent chromium, and polybrominated diphenyl ether (PBDE) flame retardants in a new electronic and electric equipment.

Figure 2-3 shows the faceplate and block diagram for the TCC3 card.

Figure 2-4 TCC3 Faceplate and Block Diagram



2.5.1 TCC3 Functionality

The TCC3 card supports multichannel, high-level data link control (HDLC) processing for the DCC. Up to 84 DCCs can be routed over the TCC3 card and up to 84 section DCCs can be terminated at the TCC3 card (subject to the available optical digital communication channels). The TCC3 selects and processes 84 DCCs to facilitate remote system management interfaces.

The TCC3 card also originates and terminates a cell bus carried over the module. The cell bus supports links between any two cards in the node, which is essential for peer-to-peer communication. Peer-to-peer communication accelerates protection switching for redundant cards.

The node database, IP address, and system software are stored in the TCC3 card's nonvolatile memory, which allows quick recovery of data in the event of a power or card failure.

The TCC3 card performs all system-timing functions for the ONS 15454. The TCC3 card monitors the recovered clocks from each traffic card and two BITS ports for frequency accuracy. The TCC3 card selects a recovered clock, a BITS, or an internal Stratum 3 reference as the system-timing reference. You can provision any of the clock inputs as primary or secondary timing sources. A slow-reference tracking loop allows the TCC3 card to synchronize with the recovered clock, which provides holdover if the reference is lost.

The TCC3 card supports 64/8K composite clock and 6.312 MHz timing output.

The TCC3 card monitors both the supply voltage inputs on the shelf. An alarm is generated if one of the supply voltage inputs has a voltage level above the specified range.

The TCC3 card has two built-in Ethernet interface ports for accessing the system: one built-in RJ-45 port on the front faceplate for on-site craft access and a second port on the backplane. The rear Ethernet interface is for permanent LAN access and all remote access via TCP/IP as well as for Operations Support System (OSS) access. The front and rear Ethernet interfaces can be provisioned with different IP addresses using CTC.

Two EIA/TIA-232 serial ports, one on the faceplate and a second on the backplane, allow for craft interface in TL1 mode.



Note

To use the serial port craft interface wire-wrap pins on the backplane, the DTR signal line on the backplane port wire-wrap pin must be connected and active.

2.5.2 Redundant TCC3 Card Installation

We do not recommend the operation of the ONS 15454 with only one TCC3 card. For full functionality and to safeguard your system, always operate with two TCC3 cards.

Install TCC3 cards in Slots 7 and 11 for redundancy. If the active TCC3 card fails, traffic switches to the protect TCC3 card. All TCC3 card protection switches conform to protection switching standards when the bit error rate (BER) counts are not in excess of $1 * 10 \exp - 3$ and completion time is less than 50 ms.

When a second TCC3 card is inserted into a node, it synchronizes its software, backup software, and database with those of the active TCC3 card. If the software version of the new TCC3 card does not match the version on the active TCC3 card, the newly inserted TCC3 card copies from the active TCC3 card, taking about 15 to 20 minutes to complete. Copying the database from the active TCC3 card takes about 3 minutes. Depending on the software version and backup version the new TCC3 card started with, the entire process can take between 3 and 40 minutes.

2.5.3 TCC3 Card-Level Indicators

The TCC3 faceplate has ten LEDs. [Table 2-5](#) describes the two card-level LEDs on the TCC3 faceplate.

Table 2-8 TCC3 Card-Level Indicators

Card-Level LEDs	Definition
Red FAIL LED	Indicates the TCC3 card is being reset. The FAIL LED flashes during the boot and write process. Replace the card if the FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Indicates the TCC3 is active (green) or in standby (amber) mode. The ACT/STBY LED also provides the timing reference and shelf control. When the active TCC3 is writing to its database or to the standby TCC3 database, the card LEDs blink. To avoid memory corruption, do not remove the TCC3 when the active or standby LED is blinking.

2.5.4 Network-Level Indicators

[Table 2-6](#) describes the six network-level LEDs on the TCC3 faceplate.

Table 2-9 TCC3 Network-Level Indicators

System-Level LEDs	Definition
Red CRIT LED	Indicates critical alarms in the network at the local terminal.
Red MAJ LED	Indicates major alarms in the network at the local terminal.
Amber MIN LED	Indicates minor alarms in the network at the local terminal.
Red REM LED	Indicates first-level alarm isolation. The remote (REM) LED turns red when an alarm is present in one or more of the remote terminals.
Green SYNC LED	Indicates that node timing is synchronized to an external reference.
Green ACO LED	Indicates the audible alarms. After pressing the ACO button, the ACO LED turns green. The ACO button opens the audible alarm closure on the backplane. ACO is stopped if a new alarm occurs. After the originating alarm is cleared, the ACO LED and audible alarm control are reset.

2.5.5 Power-Level Indicators

Table 2-7 describes the two power-level LEDs on the TCC3 faceplate.

Table 2-10 TCC3 Power-Level Indicators

Power-Level LEDs	Definition
Green/Amber/Red PWR A LED	Indicates the voltage on supply input A. The PWR A LED is green when the voltage on supply input A is between the low battery voltage (LWBATVG) and high battery voltage (HIBATVG) thresholds. The LED is amber when the voltage on supply input A is between the high battery voltage and extremely high battery voltage (EHIBATVG) thresholds or between the low battery voltage and extremely low battery voltage (ELWBATVG) thresholds. The LED is red when the voltage on supply input A is above extremely high battery voltage or below extremely low battery voltage thresholds.
Green/Amber/Red PWR B LED	Indicates the voltage on supply input B. The PWR B LED is green when the voltage on supply input B is between the low battery voltage and high battery voltage thresholds. The LED is amber when the voltage on supply input B is between the high battery voltage and extremely high battery voltage thresholds or between the low battery voltage and extremely low battery voltage thresholds. The LED is red when the voltage on supply input B is above extremely high battery voltage or below extremely low battery voltage thresholds.


Note

For the ONS 15454 ETSI shelf, the power-level LEDs are either green or red. The LED is green when the voltage on supply inputs is between the extremely low battery voltage and extremely high battery voltage thresholds. The LED is red when the voltage on supply inputs is above extremely high battery voltage or below extremely low battery voltage thresholds.

2.6 TNC Card

(Cisco ONS 15454 M2 and ONS 15454 M6 only)

The TNC card combines the functions of multiple cards such as TCC2P, OSCM, ISC, and AIC-I cards. The card has a similar look and feel to TCC2/TCC2P/TCC3 cards.


Note

For TNC card specifications, see the [A.3.4 TNC Card Specifications \(Cisco ONS 15454 M2 and Cisco ONS 15454 M6\)](#), page A-6 section.

The TNC card is provisioned as master and slave in the 15454-M6 shelf, and as a stand-alone card in the 15454-M2 shelf. The TNC card serves as the processor card for the node.

On the 15454-M6 shelf, install redundant TNC cards in slots 1 and 8. If the active TNC card fails, system traffic switches to the redundant TNC card. The card supports line cards from slots 2 to 7.

On the 15454-M2 shelf, install the stand-alone TNC card in slot 1. The TNC card supports line cards in slots 2 and 3.

The TNC card monitors both the supply voltage inputs on the 15454-M6 shelf. The TNC card raises an alarm if one of the supply voltage inputs has a voltage out of the specified range. The 15454-M2 shelf has dual power supply.

You can insert and remove the TNC card even when the system is online, without impacting the system traffic.

You can upgrade the TSC card to a TNC card. During the upgrade, the TNC card does not support OSC functions such as UDC, VoIP, DCC, and timing function. However, you can still provision the SFP ports on the TNC card during the upgrade. The TNC and TSC cards cannot be inserted in the same shelf.

**Note**

Downgrade procedures from TNC cards to TSC cards are not supported. For information on upgrading TSC card to a TNC card, refer chapter, "Upgrade, Add, and Remove Cards and Nodes" in the *Cisco ONS 15454 DWDM Procedure Guide*.

The TNC card supports all the alarms supported by the TCC2P and AIC-I cards. The card adjusts the fan speed according to the temperature and reports a fan failure alarm.

**Note**

The LAN interface of the TNC card meets the standard Ethernet specifications by supporting a cable length of 328 ft (100 m) at temperatures from 32 to 149 degrees Fahrenheit (0 to 65 degrees Celsius). The interfaces can operate with a cable length of 32.8 ft (10 m) maximum at temperatures from -40 to 32 degrees Fahrenheit (-40 to 0 degrees Celsius).

2.6.1 Functions of TNC

The functions of the TNC card are explained in the following sections:

2.6.1.1 Communication and Control

The TNC card acts as node controller and shelf controller. The control tasks include system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection, and resolution. The control tasks also include SONET and SDH data communications channel (DCC) termination, 84 section SDCC and multiplex section MSDCC terminations, 28 SDCC tunnels or SDCC-to-line LDCC terminations, and system fault detection for the 15454-M2 and 15454-M6 shelves.

The system initialization tasks include assigning the network parameters to the system and loading the system with the provisioning data stored in the database. The line cards in the system do not boot without the TNC card.

The TNC card supports and provides the following:

- OSC communication to implement the Optical DCN, User Data Channels and Voice over IP interface.
- Supervisory data channel (SDC) for communication between the nodes.
- Two point-to-point Ethernet channels at 10 Mbps to carry Voice over IP traffic.
- Two point-to-point Ethernet channels at 10/100 Mbps to carry UDC traffic.
- Passive inventory of external devices on the 15454-M2 and 15454-M6 shelves.
- Supports OSC, UDC, and VoIP traffic. Two UDC/VoIP ports are present on the external connection unit that can be configured to carry UDC/VoIP traffic.

**Note**

The TNC card supports UDC and VoIP configuration only when OSC is configured on the ports. To delete the OSC channel on a port, delete the UDC and VoIP configuration on that port. For more information, refer chapter, "Install the Cisco ONS 15454 Shelf Assembly" in the *Cisco ONS 15454 DWDM Procedure Guide*.

On the 15454-M2 and 15454-M6 shelves, the TNC card must adhere to the following rules for SDCC/LDCC allocation:

- SDCC + SDCC Tunnels ≤ 68
- LDCC ≤ 28
- IP Tunnels ≤ 10
- SDCC + SDCC tunnels + (LDCC * 3) ≤ 84

2.6.1.2 Optical Service Channel

The TNC card supports two optical service channels (OSC) through two small-form factor pluggable (SFP) ports. The two SFP ports are named SFP1 and SFP2. The supported SFPs on TNC ports are ONS-SC-OSC-ULH, ONS-SE-155-1510, and ONS-SC-Z3-1510.

**Note**

When you replace SFPs on the TNC card, provisioning for the current SFP has to be deleted before the new SFP is plugged in.

SFP1 supports the following payloads:

- OC-3/STM-1
- Fast Ethernet (FE)
- Gigabit Ethernet (GE)

SFP2 supports the following payloads:

- Fast Ethernet (FE)
- Gigabit Ethernet (GE)

2.6.1.3 Timing and Synchronization

The TNC card performs all the system-timing functions for the 15454-M2 and 15454-M6 shelves. This includes short-term clock recovery, reducing the need to reset the calendar and time-of-day settings after a power failure.

The TNC card ensures that the system maintains Stratum 3 (Telcordia GR-253-CORE) timing and synchronization requirements. The TNC card supports external, line, and internal timing inputs.

The TNC card supports 64KHz+8KHz composite clock and 6.312 MHz timing output.

**Note**

The TNC card supports the BITS-1 and BITS-2 external timing interfaces on the ONS 15454 M6 shelf. The card supports the BITS-1 interface on the ONS 15454 M2 shelf.

The TNC card monitors the recovered clocks from each traffic card and two building integrated timing supply (BITS-1 and BITS-2) ports for accurate frequencies. The card selects a recovered clock, a BITS, OC-N/STM-N, or an internal Stratum 3 reference as the system-timing reference. You can provision any of the clock inputs as primary or secondary timing sources. A slow-reference tracking loop allows the TNC card to synchronize with the recovered clock, which provides holdover if the reference is lost.

The card supports SNTP operation that allows the nodes to synchronize the system clock automatically with a reference SNTP server following system reboots, card resets, and software upgrades.

For more information on the timing function, see the [Timing Reference](#) chapter.

2.6.1.4 MultiShelf Management

The TNC card supports multishelf management of up to 30 shelves including the node controller. The card supports up to 29 subtending shelves. The subtending shelves can be the ONS 15454 M6 or ONS 15454 shelves. This allows network administrators to isolate faults and provision new services across the DWDM network.

In the ONS 15454 M6 shelf, there are six FE RJ45 ports on the ECU and each TNC card supports three FE RJ45 connections to connect subtending shelves.

2.6.1.5 Database Storage

The TNC card provides 4 GB of non-volatile database storage (IDE Compact Flash Module) for communication, provisioning, and system control. This allows full database recovery during power failure.

The TNC card supports writing and reading to and from an external non-volatile memory device. The card also communicates with the non-volatile memory device through a USB 2.0 standard interface.

The USB-WRITE-FAIL alarm may be raised on the TNC card when synchronization occurs between Compact Flash and USB Flash. If this alarm does not clear even after 20 minutes duration, it is recommended to contact TAC.

For information on USB-WRITE-FAIL alarm, see the *Cisco ONS 15454 DWDM Troubleshooting Guide*.

**Note**

The configuration details are stored in the database of the TNC card. The database restore from a TNC card to a TSC card or vice versa is not supported.

2.6.1.6 Interface Ports

The TNC card has three built-in interface ports:

- RJ-45 LAN port
- RJ-45 console port
- RS-232 port (serial port)

The RJ-45 LAN port and RS-232 port are located on the faceplate of the TNC card. The RJ-45 console port is behind the faceplate of the TNC card.

The front access RJ-45 LAN port provides 10/100 BASE-T Ethernet connectivity to the system. The RJ-45 LAN port has LEDs to provide link and activity status. The RJ-45 LAN port provides local and remote access to the Cisco Transport Controller through a common Web interface.

The RJ-45 console port is used to launch a debug session on the TNC card.

The RS-232 port is used to connect to the Transaction Language 1 (TL1) management interface. In TL1 mode, the RS-232 port runs at 9.6 Kbps without any flow control.

The front access LAN port and RJ-45 EMS LAN port can be provisioned with different IP addresses by configuring the TNC card in secure mode using CTC. On 15454 M2, the EMS port is on the power module. On 15454 M6, the EMS port is on the ECU.

The two SFP ports (SFP1 and SFP2) are used for primary OSC and secondary OSC connections. SFP1 supports OC-3/STM-1, FE, or GE payloads; SFP2 supports FE or GE payloads.

The two SFP ports on the TNC card are in IS,AINS administrative state during payload creation. In this state, only the following alarms are raised:

- AS-MT alarm on PPM
- AS-CMD alarm on PPM and facility
- Prov-Mismatch alarm on PPM

The TX power is -40 and RX power is -50 for Ultra long-haul SFPs. The TX power is -40 and RX power is -40 for other SFPs. When the OSC is created, the two SFP ports move to IS state. In this state, all the supported alarms are raised.

**Note**

VLAN tagged traffic is not supported on UDC or VoIP ports that are present on the external connection unit.

2.6.1.7 External Alarms and Controls

The TNC card provides customer-defined (environmental) alarms and external controls on the ONS 15454 M6 shelf. The card provides input/output alarm contact closures. The TNC card operates in two modes:

- External alarms mode - This is the default mode and up to 14 alarm input ports can be configured. External alarms (input contacts) are typically used for external sensors such as open doors, temperature sensors, flood sensors, and other environmental conditions.
- External control mode - Up to 10 alarm input ports and four alarm output ports can be configured. External controls (output contacts) are typically used to drive visual or audible devices such as bells and lights, but they can control other devices such as generators, heaters, and fans.

To configure the external alarms and external controls, go to Provisioning -> Alarm Extenders tab in the CTC node view. To view the external alarms and external controls, go to Maintenance -> Alarm Extenders tab in the CTC node view. For information on how to configure and view the external alarms and external controls, refer chapter “*Manage Alarms*” in the *Cisco ONS 15454 DWDM Procedure Guide*.

**Note**

The LCD module must be present in the ONS 15454 M6 shelf assembly to provision alarms from the ECU, fan-tray assembly, or power modules.

For information on pinouts of external alarms and external controls, see the “ONS 15454 ANSI Alarm, Timing, LAN, and Craft Pin Connections” section in the *Cisco ONS 15454 Hardware Installation Guide*.

2.6.3 Lamp Test

The TNC card supports a lamp test function that is activated by pressing the Lamp Test button on the faceplate or from CTC. The lamp test function allows the user to test the working state of LEDs and ensures that all LEDs are functional. When you activate the lamp test function, all the port LEDs illuminate simultaneously for several seconds.

2.6.4 TNC Card Installation (ONS 15454 M6)

On the ONS 15454 M6 shelf, the TNC card operates in either simplex or duplex (redundant) control mode. In redundant control mode, high availability is achieved.

When a redundant TNC card is inserted into a node, it synchronizes its software, backup software, and database with the active TNC card. If the software versions do not match, the redundant TNC card copies from the active TNC card, taking about 15 to 20 minutes to complete. If the software versions match, the redundant TNC card copies the backup software from the active TNC card, taking about 15 to 20 minutes. Copying the database from the active TNC card takes about 3 minutes. Depending on the software version and backup version the redundant TNC card started with, the entire process can take between 3 and 40 minutes.

2.6.5 Card-Level Indicators

The TNC faceplate has twelve LEDs. [Table 2-11](#) describes the two card-level LEDs on the TNC faceplate.

Table 2-11 TNC Card-Level Indicators

Card-Level LEDs	Definition
Red FAIL LED	Indicates the TNC card is in fail mode. This LED is on during reset. This LED flashes during the boot and write process. Replace the card if the FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Indicates the TNC card is active (green) or in standby (amber) mode. The ACT/STBY LED also provides the timing reference and shelf control. When the active TNC is writing to its database or to the standby TNC database, the card LEDs blink. To avoid memory corruption, do not remove the TNC card when the active or standby LED is blinking.

2.6.6 Network-Level Indicators

[Table 2-12](#) describes the six network-level LEDs on the TNC faceplate.

Table 2-12 *TNC Network-Level Indicators*

System-Level LEDs	Definition
Red CRIT LED	Indicates critical alarms in the network at the local terminal.
Red MAJ LED	Indicates major alarms in the network at the local terminal.
Yellow MIN LED	Indicates minor alarms in the network at the local terminal.
Red REM LED	Provides first-level alarm isolation. The remote (REM) LED turns red when a critical, major, or minor alarm is present in one or more of the remote terminals.
Green SYNC LED	Indicates the synchronization status; Indicates that node timing is synchronized to an external reference.
Green ACO LED	Indicates the Alarm Cut-Off status. After pressing the ACO button, the ACO LED turns green. The ACO button opens the audible alarm closure on the backplane. ACO is stopped if a new alarm occurs. After the originating alarm is cleared, the ACO LED and audible alarm control are reset.

2.6.7 Power-Level Indicators

Table 2-13 describes the two power-level LEDs on the TNC faceplate.

Table 2-13 TNC Power-Level Indicators

Power-Level LEDs	Definition
Green/Red PWR A LED	Indicates the status of power to the card. The PWR A LED is green when the voltage on supply input A is between the low battery voltage (LWBATVG) and high battery voltage (HIBATVG) thresholds. The LED is red when the voltage on supply input A is above high battery voltage/extremely high battery voltage (EHIBATVG) or below low battery voltage/extremely low battery voltage (ELWBATVG) thresholds. The LED is red when the voltage on supply input A is 0.
Green/Red PWR B LED	Indicates the status of power to the card. The PWR B LED is green when the voltage on supply input B is between the low battery voltage and high battery voltage thresholds. The LED is red when the voltage on supply input B is above high battery voltage/extremely high battery (EHIBATVG) voltage or below low battery voltage/extremely low battery voltage (ELWBATVG) thresholds. The LED is red when the voltage on supply input B is 0.

2.6.8 Ethernet Port Indicators

Table 2-14 describes the two port-level LEDs on the TNC faceplate.

Table 2-14 TNC Port-Level Indicators

Port-Level LEDs	Definition
Green LINK LED	Indicates the connectivity status.
Amber ACT LED	Indicates data reception.

2.6.9 SFP Indicators

Table 2-15 describes the SFP LED indicators.

Table 2-15 TNC SFP Indicators

Port Type	Link LED	Activity LED
OC3	<ul style="list-style-type: none"> • RED - No link • GREEN - Link 	—
FE	<ul style="list-style-type: none"> • RED - No link • GREEN - Link 	Blinks on packet flow
GE	<ul style="list-style-type: none"> • RED - No link • GREEN - Link 	Blinks on packet flow

2.6.10 Protection Schemes

The TNC card supports active and redundant architecture. The ONS 15454 M6 shelf supports 1:1 equipment protection with one TNC card acting as active and the other TNC card as redundant.

The ONS 15454 M2 shelf supports simplex control mode. In this mode, the active TNC card operates without a redundant TNC card.

The ONS 15454 M6 shelf supports both simplex and redundant control mode. In redundant control mode, the active TNC card operates with a redundant TNC card as the backup. If the active TNC card is removed, system traffic switches to the redundant TNC card. If the redundant TNC card is not present or not in the standby state, removing the active TNC card results in loss of system traffic and management connectivity.

In redundant control mode, a TNC card can protect another TNC card. However, a TNC card cannot protect a TSC card or vice versa.

2.6.11 Cards Supported by TNC

The TNC card supports 15454 MSTP line cards except the following cards:

- OSCM
- ISC
- AIC
- AIC-I

The TNC card is not interoperable with TCC2 /TCC2P/TCC3 cards. The TNC and TCC cards cannot be inserted in the same shelf.

The line cards such as Transponder and Muxponder cards can be inserted in the ONS 15454 M2 and ONS 15454 M6 shelves along with the TNC card.

2.7 TSC Card

(Cisco ONS 15454 M2 and ONS 15454 M6 only)

The TSC card combines the functions of multiple cards such as TCC2P, ISC, and AIC-I cards. The card has a similar look and feel to TCC2/TCC2P/TCC3 cards.

**Note**

For TSC card specifications, see the [A.3.5 TSC Card Specifications \(ONS 15454 M2 and ONS 15454 M6\)](#), page A-7 section.

The TSC card is provisioned as master and slave in the ONS 15454 M6 shelf, and as a stand-alone card in the ONS 15454 M2 shelf. The TSC card serves as the processor card for the node.

On the ONS 15454 M6 shelf, install redundant TSC cards in slots 1 and 8. If the active TSC card fails, system traffic switches to the redundant TSC card. The TSC card supports line cards from slots 2 to 7.

On the ONS 15454 M2 shelf, install the stand-alone TSC card in slot 1. The TSC card supports line cards in slots 2 and 3.

The TSC card monitors both the supply voltage inputs on the 15454-M6 shelf. The TSC card raises an alarm if one of the supply voltage inputs has a voltage out of the specified range. The 15454-M2 shelf has dual power supply.

You can insert and remove the TSC card even when the system is online, without impacting the system traffic.

The TSC card does not support optical service channel (OSC) and SFP ports.

You can upgrade the TSC card to a TNC card. During the upgrade, the TNC card does not support OSC functions such as UDC, VoIP, DCC, and timing function. However, you can still provision SFP ports on the TNC card during the upgrade. The TNC and TSC cards cannot be inserted in the same shelf.

The TSC card supports all the alarms supported by the TCC2P and AIC-I cards. The card adjusts the fan speed according to the temperature and reports a fan failure alarm.

**Note**

The LAN interface of the TSC card meets the standard Ethernet specifications by supporting a cable length of 328 ft (100 m) at temperatures from 32 to 149 degrees Fahrenheit (0 to 65 degrees Celsius). The interfaces can operate with a cable length of 32.8 ft (10 m) maximum at temperatures from -40 to 32 degrees Fahrenheit (-40 to 0 degrees Celsius).

2.7.1 Functions of TSC

The functions of the TSC card are explained in the following sections:

2.7.1.1 Communication and Control

The TSC card acts as a shelf controller. The control tasks include system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection, and resolution. The control tasks also include SONET and SDH data communications channel (DCC) termination, 84 section SDCC and multiplex section MSDCC terminations, 28 SDCC tunnels or SDCC-to-line LDCC terminations, and system fault detection for the ONS 15454 M2 and ONS 15454 M6 shelves.

The system initialization tasks include assigning the network parameters to the system and loading the system with the provisioning data stored in the database. The line cards in the system do not boot without the TSC card.

The TSC card supports and provides the following:

- Passive inventory of external devices on the 15454-M2 and 15454-M6 shelves.
- 100 Mbps UDC on the 15454-M6 shelf.

On the 15454-M2 and 15454-M6 shelves, the TSC card must adhere to the following rules for SDCC/LDCC allocation.

- $\text{SDCC} + \text{SDCC Tunnels} \leq 68$
- $\text{LDCC} \leq 28$
- $\text{IP Tunnels} \leq 10$
- $\text{SDCC} + \text{SDCC tunnels} + (\text{LDCC} * 3) \leq 84$

2.7.1.2 Timing and Synchronization

The TSC card performs all the system-timing functions for the 15454-M2 and 15454-M6 shelves. This includes short-term clock recovery, reducing the need to reset the calendar and time-of-day settings after a power failure.

The TSC card ensures that the system maintains Stratum 3 (Telcordia GR-253-CORE) timing and synchronization requirements. The TSC card supports external, line, and internal timing inputs.

The TSC card supports 64KHz+8KHz composite clock and 6.312 MHz timing output.



Note

The TSC card supports the BITS-1 and BITS-2 external timing interfaces on the 15454-M6 shelf. The card supports the BITS-1 interface on the 15454-M2 shelf.

The TSC card monitors the recovered clocks from each traffic card and two building integrated timing supply (BITS-1 and BITS-2) ports for accurate frequencies. The card selects a recovered clock, a BITS, OC-N/STM-N, or an internal Stratum 3 reference as the system-timing reference. You can provision any of the clock inputs as primary or secondary timing sources. A slow-reference tracking loop allows the TSC card to synchronize with the recovered clock, which provides holdover if the reference is lost.

The card supports SNTP operation that allows the nodes to synchronize the system clock automatically with a reference SNTP server following system reboots, card resets, and software upgrades.

For more information on the timing function, see the [Timing Reference](#) chapter.

2.7.1.3 MultiShelf Management

The TSC card supports multishelf management with support for up to 30 shelves including the node controller. The card supports up to 29 subtending shelves. The subtending shelves can be the 15454-M6 or 15454-DWDM shelves. This allows network administrators to isolate faults and provision new services across the DWDM network.

In the 15454-M6 shelf, there are six FE RJ45 ports on the ECU. Each TSC card supports three FE RJ45 connections to connect subtending shelves.

2.7.1.4 Database Storage

The TSC card provides 4 GB of non-volatile database storage (IDE Compact Flash Module) for communication, provisioning, and system control. This allows full database recovery during power failure.

The TSC card supports writing and reading to and from an external non-volatile memory device. The card also communicates with the non-volatile memory device through a USB 2.0 standard interface.

**Note**

The configuration details are stored in the database of the TSC card. The database restore from a TSC card to a TNC card or vice versa is not supported.

2.7.1.5 Interface Ports

The TSC card has three built-in interface ports:

- RJ-45 LAN port
- RJ-45 console port
- RS-232 port (serial port)

The RJ-45 LAN port and RS-232 port are located on the faceplate of the TSC card. The RJ-45 console port is behind the faceplate of the TSC card.

The front access RJ-45 LAN port provides 10/100 BASE-T Ethernet connectivity to the system. The RJ-45 LAN port has LEDs to provide link and activity status. The RJ-45 LAN port provides local and remote access to the Cisco Transport Controller through a common Web interface.

The RJ-45 console port is used to launch a debug session on the TSC card.

The RS-232 port is used to connect to the TL1 management interface. In TL1 mode, the RS-232 port runs at 9.6 Kbps without any flow control.

The front access LAN port and RJ-45 EMS LAN port can be provisioned with different IP addresses by configuring the TSC card in secure mode using CTC. On 15454 M2, the EMS port is on the power module. On 15454 M6, the EMS port is on the ECU.

2.7.1.6 External Alarms and Controls

The TSC card provides customer-defined (environmental) alarms and external controls on the ONS 15454 M6 shelf. The card provides input/output alarm contact closures. The TSC card operates in two modes:

- External alarms mode - This is the default mode and up to 14 alarm input ports can be configured. External alarms (input contacts) are typically used for external sensors such as open doors, temperature sensors, flood sensors, and other environmental conditions.
- External control mode - Up to 10 alarm input ports and four alarm output ports can be configured. External controls (output contacts) are typically used to drive visual or audible devices such as bells and lights, but they can control other devices such as generators, heaters, and fans.

To configure the external alarms and external controls, go to Provisioning -> Alarm Extenders tab in the CTC node view. To view the external alarms and external controls, go to Maintenance -> Alarm Extenders tab in the CTC node view. For information on how to configure and view the external alarms and external controls, refer chapter “*Manage Alarms*” in the *Cisco ONS 15454 DWDM Procedure Guide*.

**Note**

The LCD module must be present in the ONS 15454 M6 shelf assembly to provision alarms from the ECU, fan-tray assembly, or power modules.

For information on pinouts of external alarms and external controls, see the “ONS 15454 ANSI Alarm, Timing, LAN, and Craft Pin Connections” section in the *Cisco ONS 15454 Hardware Installation Guide*.

2.7.1.7 Digital Image Signing (DIS)

The TSC card provides services that authenticate the origin of the software running on the Cisco ONS 15454 M2 and Cisco ONS 15454 M6 platforms. For more information, see the [2.8 Digital Image Signing, page 2-33](#) section.

2.7.2 Faceplate and Block Diagram

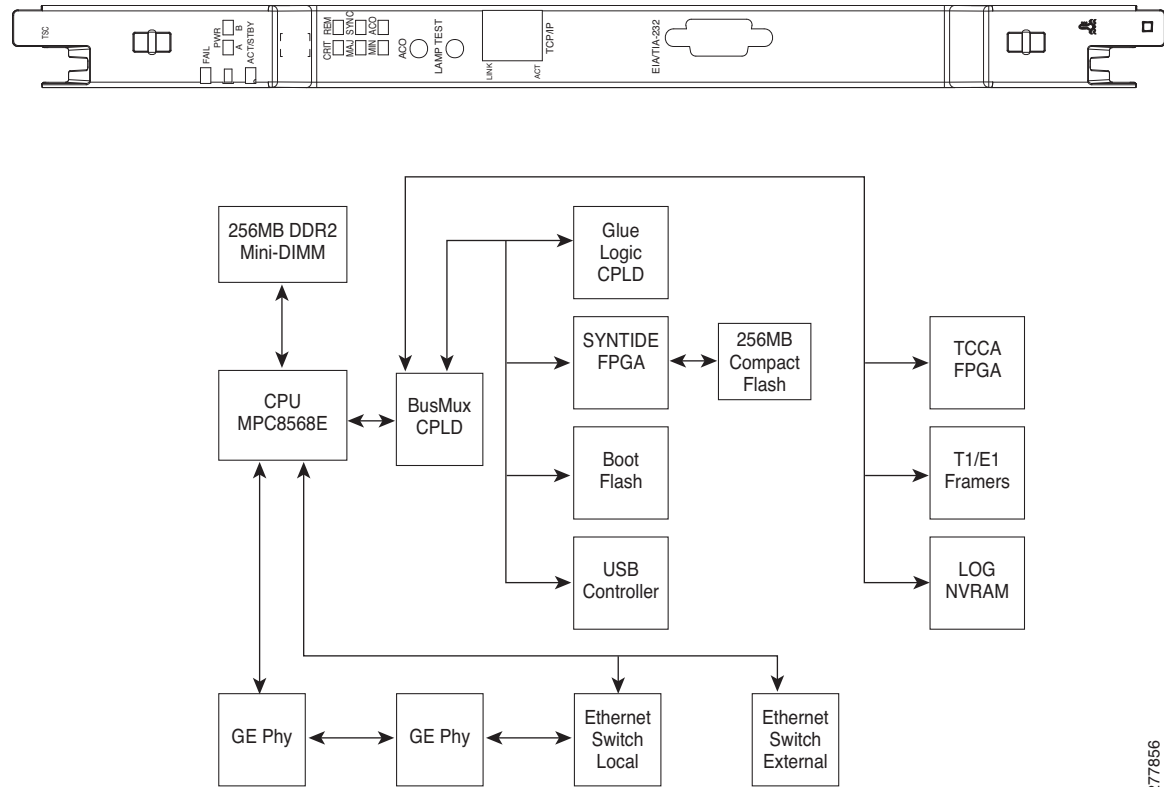
The faceplate design of the TSC card allows sufficient space to insert or remove cables while accessing the Ethernet ports.

The TSC card can be installed only in slots 1 or 8 of the 15454-M6 shelf and in slot 1 of the 15454-M2 shelf. The TSC card has an identifier on the faceplate that matches with an identifier in the shelf. A key is also provided on the backplane interface connectors as identifier in the shelf.

The TSC card supports field-programmable gate array (FPGA) for the backplane interface. The TSC card has two FPGA: TCCA and SYNTIDE.

[Figure 2-6](#) illustrates the faceplate and block diagram for the TSC card.

Figure 2-6 TSC Faceplate and Block Diagram



277856

2.7.3 Lamp Test

The TSC card supports a lamp test function that is activated by pressing the Lamp Test button on the faceplate or from CTC. The lamp test function allows the user to test the working state of LEDs and ensures that all LEDs are functional. When you activate the lamp test function, all the port LEDs illuminate simultaneously for several seconds.

2.7.4 TSC Card Installation (ONS 15454 M6)

On the ONS 15454 M6 shelf, the TSC card operates in either simplex or duplex (redundant) control mode. In redundant control mode, high availability is achieved.

When a redundant TSC card is inserted into a node, it synchronizes its software, backup software, and database with the active TSC card. If the software versions do not match, the redundant TSC card copies from the active TSC card, taking about 15 to 20 minutes to complete. If the software versions match, the redundant TSC card copies the backup software from the active TSC card, taking about 15 to 20 minutes. Copying the database from the active TSC card takes about 3 minutes. Depending on the software version and backup version the redundant TSC card started with, the entire process can take between 3 and 40 minutes.

2.7.5 Card-Level Indicators

The TSC faceplate has twelve LEDs. [Table 2-11](#) describes the two card-level LEDs on the TSC faceplate.

Table 2-16 TSC Card-Level Indicators

Card-Level LEDs	Definition
Red FAIL LED	Indicates the TSC card is in fail mode. The FAIL LED flashes during the boot and write process. Replace the card if the FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Indicates the TSC card is active (green) or in standby (amber) mode. The ACT/STBY LED also provides the timing reference and shelf control. When the active TSC is writing to its database or to the standby TSC database, the card LEDs blink. To avoid memory corruption, do not remove the TSC card when the active or standby LED is blinking.

2.7.6 Network-Level Indicators

[Table 2-12](#) describes the six network-level LEDs on the TSC faceplate.

Table 2-17 *TSC Network-Level Indicators*

System-Level LEDs	Definition
Red CRIT LED	Indicates critical alarms in the network at the local terminal.
Red MAJ LED	Indicates major alarms in the network at the local terminal.
Yellow MIN LED	Indicates minor alarms in the network at the local terminal.
Red REM LED	Provides first-level alarm isolation. The remote (REM) LED turns red when a critical, major, or minor alarm is present in one or more of the remote terminals.
Green SYNC LED	Indicates the synchronization status; Indicates that node timing is synchronized to an external reference.
Green ACO LED	Indicates the Alarm Cut-Off status. After pressing the ACO button, the ACO LED turns green. The ACO button opens the audible alarm closure on the backplane. ACO is stopped if a new alarm occurs. After the originating alarm is cleared, the ACO LED and audible alarm control are reset.

2.7.7 Power-Level Indicators

Table 2-13 describes the two power-level LEDs on the TSC faceplate.

Table 2-18 TSC Power-Level Indicators

Power-Level LEDs	Definition
Green/Red PWR A LED	Indicates the status of power to the card. The PWR A LED is green when the voltage on supply input A is between the low battery voltage (LWBATVG) and high battery voltage (HIBATVG) thresholds. The LED is red when the voltage on supply input A is above high battery voltage/extremely high battery voltage (EHIBATVG) or below low battery voltage/extremely low battery voltage (ELWBATVG) thresholds. The LED is red when the voltage on supply input A is 0.
Green/Red PWR B LED	Indicates the status of power to the card. The PWR B LED is green when the voltage on supply input B is between the low battery voltage and high battery voltage thresholds. The LED is red when the voltage on supply input B is above high battery voltage/extremely high battery (EHIBATVG) voltage or below low battery voltage/extremely low battery voltage (ELWBATVG) thresholds. The LED is red when the voltage on supply input B is 0.

2.7.8 Ethernet Port Indicators

[Table 2-14](#) describes the two port-level LEDs on the TSC faceplate.

Table 2-19 TSC Port-Level Indicators

Port-Level LEDs	Definition
Green LINK LED	Indicates the connectivity status.
Amber ACT LED	Indicates the data reception.

2.7.9 Protection Schemes

The TSC card supports active and redundant architecture. The ONS 15454 M6 shelf supports 1:1 equipment protection with one TSC card acting as active and the other TSC card as redundant.

The 15454-M2 shelf supports simplex control mode. In this mode, the active TSC card operates without a redundant TSC card.

The 15454-M6 shelf supports both simplex and redundant control mode. In redundant control mode, the active TSC card operates with a redundant TSC card as the backup. If the active TSC card is removed, system traffic switches to the redundant TSC card. If the redundant TSC card is not present or not in the standby state, removing the active TSC card results in loss of system traffic and management connectivity.

In redundant control mode, a TSC card can protect another TSC card. However, a TSC card cannot protect a TNC card or vice versa.

2.7.10 Cards Supported by TSC

The TSC card supports 15454 MSTP line cards except the following cards:

- OSCM
- ISC
- AIC
- AIC-I

The TSC card is not interoperable with TCC2 /TCC2P/TCC3 cards. The TSC and TCC cards cannot be inserted in the same shelf.

The line cards such as Transponder and Muxponder cards can be inserted in the 15454-M2 and 15454-M6 shelves along with the TSC card.

2.8 Digital Image Signing

(Cisco ONS 15454 M2 and ONS 15454 M6 only)

The DIS feature complies with the new U.S. Government Federal Information

Processing Standard (FIPS) 140-3 to provide security for all software provided on the Cisco ONS 15454 M6 and ONS 15454 M2 platforms. This standard requires software to be digitally signed and verified for authenticity and integrity prior to load and execution.

DIS feature automatically provides increased protection. DIS focuses on software security and provides increased protection from attacks and threats to Cisco ONS 15454 M2 and ONS 15454 M6 products. DIS verifies software integrity and provides assurance that the software has not been tampered with or modified. Digitally signed Cisco software provides counterfeit protection.

New controller cards, such as TNC/TSC, provide services that authenticate the origin of the software running on the Cisco ONS 15454 M2 and Cisco ONS 15454 M6 platforms. The signage and verification process is transparent until verification fails.

2.8.1 DIS Identification

Digitally signed software can be identified by the last three characters appended to the working version and protected version field in CTC. The DIS conventions can be viewed under the working version displayed in the **Maintenance > Software** tab in CTC. For example, 9.2.0 (09.20-X10C-29.09-SDA) and 9.2.0 (09.20-010C-18.18-SPA).

The significance of the three characters appended to the software version is explained in Table:

Table 2-20 *DIS Conventions in the Software Version*

Character	Meaning
S (first character)	Indicates that the package is signed.
P or D (second character)	Production (P) or Development (D) image. Production image—Software approved for general release. Development image—development software provided under special conditions for limited use.
A (third character)	This third character indicates the version of the key used for signature generation. The version changes when a key is revoked and a new key is used. The values of the version key varies from A to Z.

For information on how to retrieve and view DIS information in CTC please refer to the “Turn Up a Node” Chapter in the *Cisco ONS 15454 DWDM Procedure Guide*, 9.2.

2.9 AIC-I Card

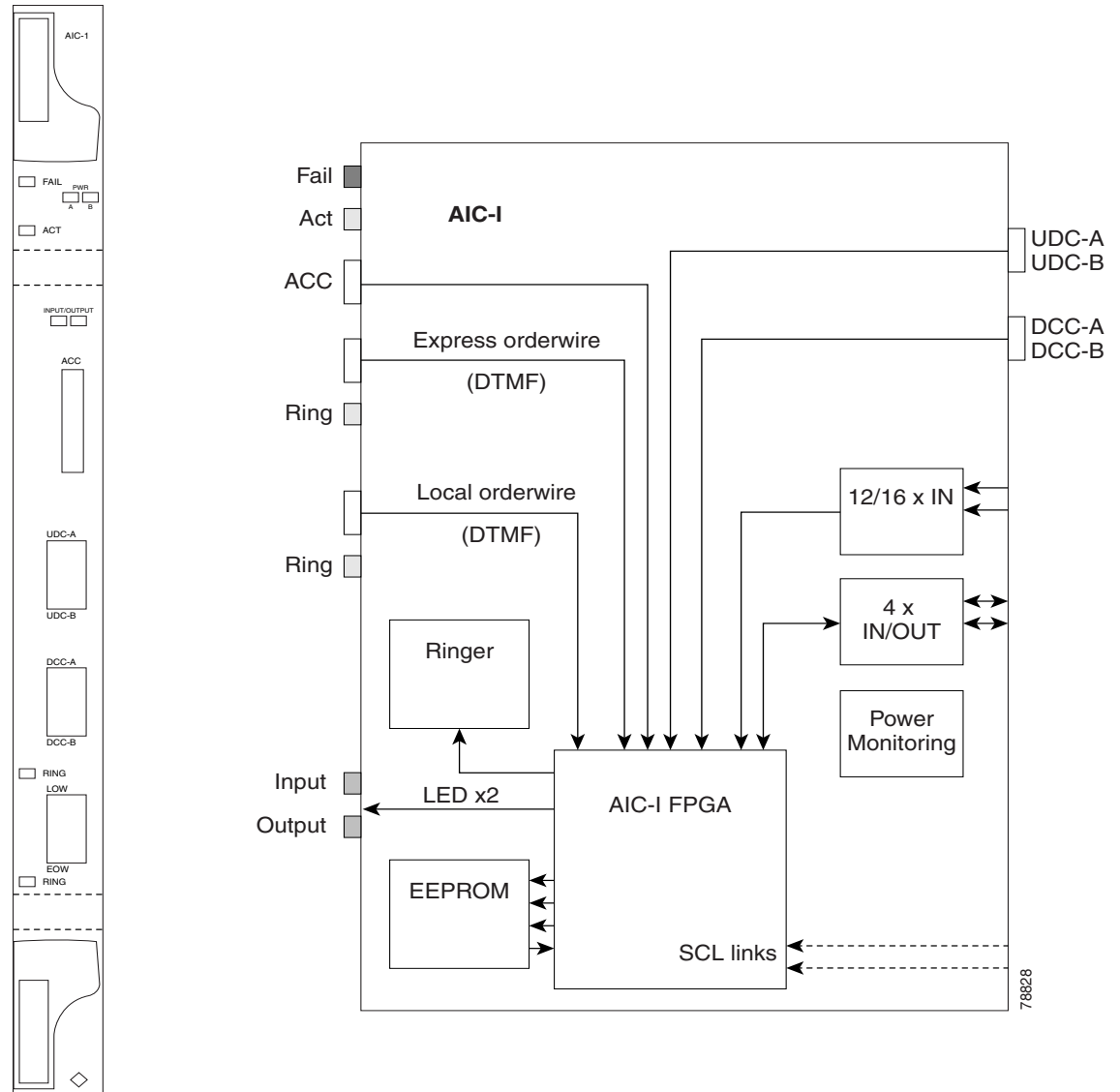
(Cisco ONS 15454 only)



Note

For hardware specifications, see the [“A.3.6 AIC-I Card Specifications” section on page A-8](#).

The optional Alarm Interface Controller–International (AIC-I) card provides customer-defined (environmental) alarms and controls and supports local and express orderwire. It provides 12 customer-defined input and 4 customer-defined input/output contacts. The physical connections are via the backplane wire-wrap pin terminals. If you use the additional alarm expansion panel (AEP), the AIC-I card can support up to 32 inputs and 16 outputs, which are connected on the AEP connectors. The AEP is compatible with ANSI shelves only. A power monitoring function monitors the supply voltage (–48 VDC). [Figure 2-7](#) shows the AIC-I faceplate and a block diagram of the card.

Figure 2-7 AIC-I Faceplate and Block Diagram

2.9.1 AIC-I Card-Level Indicators

Table 2-21 describes the eight card-level LEDs on the AIC-I card faceplate.

Table 2-21 AIC-I Card-Level Indicators

Card-Level LEDs	Description
Red FAIL LED	Indicates that the card's processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green ACT LED	Indicates the AIC-I card is provisioned for operation.

Table 2-21 AIC-I Card-Level Indicators (continued)

Card-Level LEDs	Description
Green/Red PWR A LED	The PWR A LED is green when a supply voltage within a specified range has been sensed on supply input A. It is red when the input voltage on supply input A is out of range.
Green/Red PWR B LED	The PWR B LED is green when a supply voltage within a specified range has been sensed on supply input B. It is red when the input voltage on supply input B is out of range.
Yellow INPUT LED	The INPUT LED is yellow when there is an alarm condition on at least one of the alarm inputs.
Yellow OUTPUT LED	The OUTPUT LED is yellow when there is an alarm condition on at least one of the alarm outputs.
Green RING LED	The RING LED on the local orderwire (LOW) side is flashing green when a call is received on the LOW.
Green RING LED	The RING LED on the express orderwire (EOW) side is flashing green when a call is received on the EOW.

2.9.2 External Alarms and Controls

The AIC-I card provides input/output alarm contact closures. You can define up to 12 external alarm inputs and 4 external alarm inputs/outputs (user configurable). The physical connections are made using the backplane wire-wrap pins or FMEC connections. For information about increasing the number of input/output contacts, see the “ONS 15454 ANSI Alarm Expansion Panel” section in the *Cisco ONS 15454 Hardware Installation Guide*.

LEDs on the front panel of the AIC-I indicate the status of the alarm lines, one LED representing all of the inputs and one LED representing all of the outputs. External alarms (input contacts) are typically used for external sensors such as open doors, temperature sensors, flood sensors, and other environmental conditions. External controls (output contacts) are typically used to drive visual or audible devices such as bells and lights, but they can control other devices such as generators, heaters, and fans.

You can program each of the twelve input alarm contacts separately. You can program each of the sixteen input alarm contacts separately. Choices include:

- Alarm on Closure or Alarm on Open
- Alarm severity of any level (Critical, Major, Minor, Not Alarmed, Not Reported)
- Service Affecting or Non-Service Affecting alarm-service level
- 63-character alarm description for CTC display in the alarm log

You cannot assign the fan-tray abbreviation for the alarm; the abbreviation reflects the generic name of the input contacts. The alarm condition remains raised until the external input stops driving the contact or you provision the alarm input.

The output contacts can be provisioned to close on a trigger or to close manually. The trigger can be a local alarm severity threshold, a remote alarm severity, or a virtual wire:

- Local NE alarm severity: A hierarchy of Not Reported, Not Alarmed, Minor, Major, or Critical alarm severities that you set to cause output closure. For example, if the trigger is set to Minor, a Minor alarm or above is the trigger.

- Remote NE alarm severity: Same as the local NE alarm severity but applies to remote alarms only.
- Virtual wire entities: You can provision any environmental alarm input to raise a signal on any virtual wire on external outputs 1 through 4 when the alarm input is an event. You can provision a signal on any virtual wire as a trigger for an external control output.

You can also program the output alarm contacts (external controls) separately. In addition to provisionable triggers, you can manually force each external output contact to open or close. Manual operation takes precedence over any provisioned triggers that might be present.

**Note**

For ANSI shelves, the number of inputs and outputs can be increased using the AEP. The AEP is connected to the shelf backplane and requires an external wire-wrap panel.

2.9.3 Orderwire

Orderwire allows a craftsperson to plug a phoneset into an ONS 15454 and communicate with craftspeople working at other ONS 15454s or other facility equipment. The orderwire is a pulse code modulation (PCM) encoded voice channel that uses E1 or E2 bytes in section/line overhead.

The AIC-I allows simultaneous use of both local (section overhead signal) and express (line overhead channel) orderwire channels on a SONET/SDH ring or particular optics facility. Express orderwire also allows communication via regeneration sites when the regenerator is not a Cisco device.

You can provision orderwire functions with CTC similar to the current provisioning model for DCC/GCC channels. In CTC, you provision the orderwire communications network during ring turn-up so that all NEs on the ring can reach one another. Orderwire terminations (that is, the optics facilities that receive and process the orderwire channels) are provisionable. Both express and local orderwire can be configured as on or off on a particular SONET/SDH facility. The ONS 15454 supports up to four orderwire channel terminations per shelf. This allows linear, single ring, dual ring, and small hub-and-spoke configurations. Orderwire is not protected in ring topologies such as bidirectional line switched ring (BLSR), multiplex section-shared protection ring (MS-SPRing), path protection, or subnetwork connection protection (SNCP) ring.

**Caution**

Do not configure orderwire loops. Orderwire loops cause feedback that disables the orderwire channel.

The ONS 15454 implementation of both local and express orderwire is broadcast in nature. The line acts as a party line. Anyone who picks up the orderwire channel can communicate with all other participants on the connected orderwire subnetwork. The local orderwire party line is separate from the express orderwire party line. Up to four OC-N/STM-N facilities for each local and express orderwire are provisionable as orderwire paths.

The AIC-I supports selective dual tone multifrequency (DTMF) dialing for telephony connectivity, which causes one AIC-I card or all ONS 15454 AIC-I cards on the orderwire subnetwork to “ring.” The ringer/buzzer resides on the AIC-I. There is also a “ring” LED that mimics the AIC-I ringer. It flashes when a call is received on the orderwire subnetwork. A party line call is initiated by pressing *0000 on the DTMF pad. Individual dialing is initiated by pressing * and the individual four-digit number on the DTMF pad.

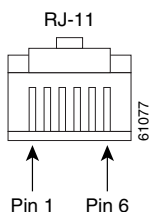
Table 2-22 shows the pins on the orderwire connector that correspond to the tip and ring orderwire assignments.

Table 2-22 Orderwire Pin Assignments

RJ-11 Pin Number	Description
1	Four-wire receive ring
2	Four-wire transmit tip
3	Two-wire ring
4	Two-wire tip
5	Four-wire transmit ring
6	Four-wire receive tip

When provisioning the orderwire subnetwork, make sure that an orderwire loop does not exist. Loops cause oscillation and an unusable orderwire channel.

Figure 2-8 shows the standard RJ-11 connectors used for orderwire ports.

Figure 2-8 RJ-11 Connector

2.9.4 Power Monitoring

The AIC-I card provides a power monitoring circuit that monitors the supply voltage of –48 VDC for presence, undervoltage, and overvoltage.

2.9.5 User Data Channel

The user data channel (UDC) features a dedicated data channel of 64 kbps (F1 byte) between two nodes in an ONS 15454 network. Each AIC-I card provides two user data channels, UDC-A and UDC-B, through separate RJ-11 connectors on the front of the AIC-I card. Each UDC can be routed to an individual optical interface in the ONS 15454. For instructions, see the *Cisco ONS 15454 DWDM Procedure Guide*.

The UDC ports are standard RJ-11 receptacles. Table 2-23 lists the UDC pin assignments.

Table 2-23 UDC Pin Assignments

RJ-11 Pin Number	Description
1	For future use
2	TXN
3	RXN

Table 2-23 UDC Pin Assignments (continued)

RJ-11 Pin Number	Description
4	RXP
5	TXP
6	For future use

2.9.6 Data Communications Channel

The DCC features a dedicated data channel of 576 kbps (D4 to D12 bytes) between two nodes in an ONS 15454 network. Each AIC-I card provides two data communications channels, DCC-A and DCC-B, through separate RJ-45 connectors on the front of the AIC-I card. Each DCC can be routed to an individual optical interface in the ONS 15454. For instructions, see the *Cisco ONS 15454 DWDM Procedure Guide*.

The DCC ports are synchronous serial interfaces. The DCC ports are standard RJ-45 receptacles. [Table 2-24](#) lists the DCC pin assignments.

Table 2-24 DCC Pin Assignments

RJ-45 Pin Number	Description
1	TCLKP
2	TCLKN
3	TXP
4	TXN
5	RCLKP
6	RCLKN
7	RXP
8	RXN

2.10 MS-ISC-100T Card

(Cisco ONS 15454 only)



Note

For hardware specifications, see the [“A.3.10 MS-ISC-100T Card Specifications”](#) section on page A-11.

The Multishelf Internal Switch Card (MS-ISC-100T) is an Ethernet switch used to implement the multishelf LAN. It connects the node controller shelf to the network and to subtending shelves. The MS-ISC-100T must always be equipped on the node controller shelf; it cannot be provisioned on a subtending controller shelf.

The recommended configuration is to implement LAN redundancy using two MS-ISC-100T cards: one switch is connected to the Ethernet front panel port of the TCC2/TCC2P card in Slot 7, and the other switch is connected to the Ethernet front panel port of the TCC2/TCC2P card in Slot 11. The Ethernet

configuration of the MS-ISC-100T card is part of the software package and is automatically loaded. The MS-ISC-100T card operates in Slots 1 to 6 and 12 to 17 on the node controller shelf; the recommended slots are Slot 6 and Slot 12.

Table 2-25 lists the MS-ISC-100T port assignments.

Table 2-25 MS-ISC-100T Card Port Assignments

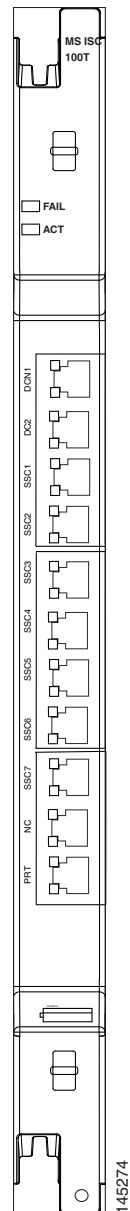
Port	Description
DCN 1 and DCN 2	Connection to the network
SSC1 to SSC7	Connection to subtending shelves
NC	Connection to TCC2/TCC2P using a cross-over cable
PRT	Connection to the PRT port of the redundant MS-ISC-100T

Figure 2-9 shows the card faceplate.



Caution

Shielded twisted-pair cabling should be used for interbuilding applications.

Figure 2-9 MS-ISC-100T Faceplate

2.10.1 MS-ISC-100T Card-Level Indicators

The MS-ISC-100T card supports two card-level LED indicators. The card-level indicators are described in [Table 2-26](#).

Table 2-26 MS-ISC-100T Card-Level Indicators

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

2.11 Front Mount Electrical Connections

This section describes the MIC-A/P and MIC-C/T/P FMECs, which provide power, external alarm, and timing connections for the ONS 15454 ETSI shelf.

2.11.1 MIC-A/P FMEC


Note

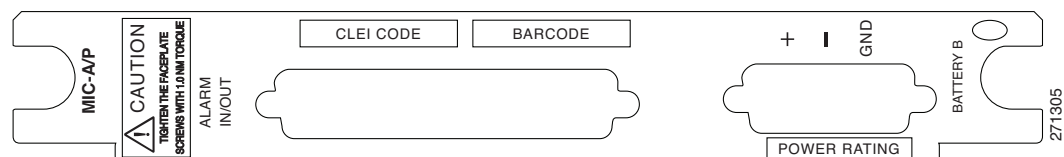
For hardware specifications, see the [“A.3.8 MIC-A/P FMEC Specifications \(ETSI only\)”](#) section on page A-10.

The MIC-A/P FMEC provides connection for the BATTERY B input, one of the two possible redundant power supply inputs. It also provides connection for eight alarm outputs (coming from the TCC2/TCC2P card), sixteen alarm inputs, and four configurable alarm inputs/outputs. Its position is in Slot 23 in the center of the subrack Electrical Facility Connection Assembly (EFCA) area.

The MIC-A/P FMEC has the following features:

- Connection for one of the two possible redundant power supply inputs
- Connection for eight alarm outputs (coming from the TCC2/TCC2P card)
- Connection for four configurable alarm inputs/outputs
- Connection for sixteen alarm inputs
- Storage of manufacturing and inventory data

For proper system operation, both the MIC-A/P and MIC-C/T/P FMECs must be installed in the ONS 15454 ETSI shelf. [Figure 2-10](#) shows the MIC-A/P faceplate.

Figure 2-10 MIC-A/P Faceplate

[Figure 2-11](#) shows a block diagram of the MIC-A/P.

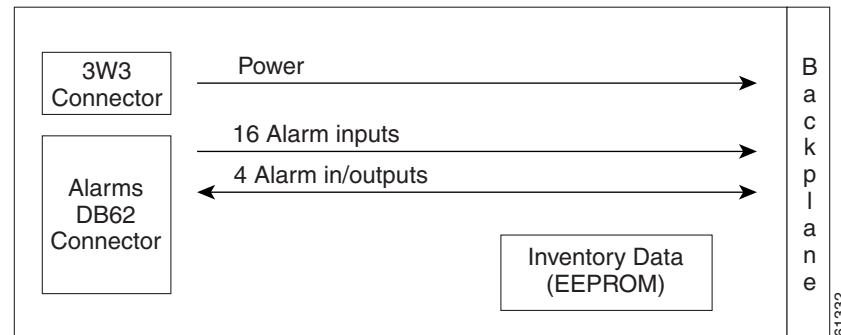
Figure 2-11 MIC-A/P Block Diagram

Table 2-27 shows the alarm interface pinouts on the MIC-A/P DB-62 connector.

Table 2-27 Alarm Interface Pinouts on the MIC-A/P DB-62 Connector

Pin No.	Signal Name	Signal Description
1	ALMCUTOFF N	Alarm cutoff, normally open ACO pair
2	ALMCUTOFF P	Alarm cutoff, normally open ACO pair
3	ALMINP0 N	Alarm input pair 1, reports closure on connected wires
4	ALMINP0 P	Alarm input pair 1, reports closure on connected wires
5	ALMINP1 N	Alarm input pair 2, reports closure on connected wires
6	ALMINP1 P	Alarm input pair 2, reports closure on connected wires
7	ALMINP2 N	Alarm input pair 3, reports closure on connected wires
8	ALMINP2 P	Alarm input pair 3, reports closure on connected wires
9	ALMINP3 N	Alarm input pair 4, reports closure on connected wires
10	ALMINP3 P	Alarm input pair 4, reports closure on connected wires
11	EXALM0 N	External customer alarm 1
12	EXALM0 P	External customer alarm 1
13	GND	Ground
14	EXALM1 N	External customer alarm 2
15	EXALM1 P	External customer alarm 2
16	EXALM2 N	External customer alarm 3
17	EXALM2 P	External customer alarm 3
18	EXALM3 N	External customer alarm 4
19	EXALM3 P	External customer alarm 4
20	EXALM4 N	External customer alarm 5
21	EXALM4 P	External customer alarm 5
22	EXALM5 N	External customer alarm 6
23	EXALM5 P	External customer alarm 6
24	EXALM6 N	External customer alarm 7
25	EXALM6 P	External customer alarm 7

Table 2-27 Alarm Interface Pinouts on the MIC-A/P DB-62 Connector (continued)

Pin No.	Signal Name	Signal Description
26	GND	Ground
27	EXALM7 N	External customer alarm 8
28	EXALM7 P	External customer alarm 8
29	EXALM8 N	External customer alarm 9
30	EXALM8 P	External customer alarm 9
31	EXALM9 N	External customer alarm 10
32	EXALM9 P	External customer alarm 10
33	EXALM10 N	External customer alarm 11
34	EXALM10 P	External customer alarm 11
35	EXALM11 N	External customer alarm 12
36	EXALM11 P	External customer alarm 12
37	ALMOUP0 N	Normally open output pair 1
38	ALMOUP0 P	Normally open output pair 1
39	GND	Ground
40	ALMOUP1 N	Normally open output pair 2
41	ALMOUP1 P	Normally open output pair 2
42	ALMOUP2 N	Normally open output pair 3
43	ALMOUP2 P	Normally open output pair 3
44	ALMOUP3 N	Normally open output pair 4
45	ALMOUP3 P	Normally open output pair 4
46	AUDALM0 N	Normally open Minor audible alarm
47	AUDALM0 P	Normally open Minor audible alarm
48	AUDALM1 N	Normally open Major audible alarm
49	AUDALM1 P	Normally open Major audible alarm
50	AUDALM2 N	Normally open Critical audible alarm
51	AUDALM2 P	Normally open Critical audible alarm
52	GND	Ground
53	AUDALM3 N	Normally open Remote audible alarm
54	AUDALM3 P	Normally open Remote audible alarm
55	VISALM0 N	Normally open Minor visual alarm
56	VISALM0 P	Normally open Minor visual alarm
57	VISALM1 N	Normally open Major visual alarm
58	VISALM1 P	Normally open Major visual alarm
59	VISALM2 N	Normally open Critical visual alarm
60	VISALM2 P	Normally open Critical visual alarm

Table 2-27 Alarm Interface Pinouts on the MIC-A/P DB-62 Connector (continued)

Pin No.	Signal Name	Signal Description
61	VISALM3 N	Normally open Remote visual alarm
62	VISALM3 P	Normally open Remote visual alarm

2.11.2 MIC-C/T/P FMEC


Note

For hardware specifications, see the “[A.3.9 MIC-C/T/P FMEC Specifications \(ETSI only\)](#)” section on [page A-10](#).

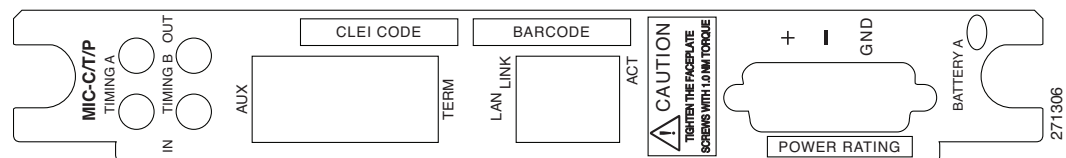
The MIC-C/T/P FMEC provides connection for the BATTERY A input, one of the two possible redundant power supply inputs. It also provides connection for system management serial port, system management LAN port, modem port (for future use), and system timing inputs and outputs. Install the MIC-C/T/P in Slot 24.

The MIC-C/T/P FMEC has the following features:

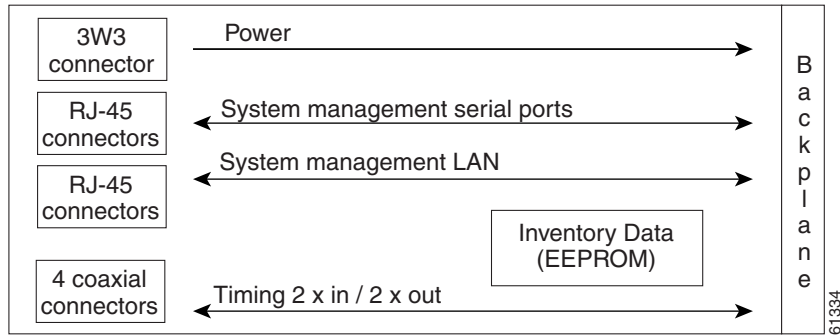
- Connection for one of the two possible redundant power supply inputs
- Connection for two serial ports for local craft/modem (for future use)
- Connection for one LAN port
- Connection for two system timing inputs
- Connection for two system timing outputs
- Storage of manufacturing and inventory data

For proper system operation, both the MIC-A/P and MIC-C/T/P FMECs must be installed in the shelf.

[Figure 2-12](#) shows the MIC-C/T/P FMEC faceplate.

Figure 2-12 MIC-C/T/P Faceplate

[Figure 2-13](#) shows a block diagram of the MIC-C/T/P.

Figure 2-13 MIC-C/T/P Block Diagram

The MIC-C/T/P FMEC has one pair of LEDs located on the RJ45 LAN connector. The green LED is on when a link is present, and the amber LED is on when data is being transferred.