



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 Cisco ONS 15454 common control card functions. For installation and turn-up procedures, refer to the *Cisco ONS 15454 Procedure Guide*.

Chapter topics include:

- [2.1 Common Control Card Overview, page 2-1](#)
- [2.2 TCC2 Card, page 2-6](#)
- [2.3 TCC2P Card, page 2-10](#)
- [2.4 XCVT Card, page 2-15](#)
- [2.5 XC10G Card, page 2-19](#)
- [2.6 XC-VXC-10G Card, page 2-23](#)
- [2.7 AIC-I Card, page 2-28](#)

2.1 Common Control Card Overview

The card overview section summarizes card functions and compatibility.

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. See the [“1.17.1 Card Slot Requirements” section on page 1-72](#) for a list of slots and symbols.

2.1.1 Cards Summary

[Table 2-1](#) lists the common control cards for the Cisco ONS 15454 and summarizes card functions.

Table 2-1 Common Control Card Functions

Card	Description	For Additional Information...
TCC2	The Advanced Timing, Communications, and Control (TCC2) card is the main processing center for the ONS 15454 and provides system initialization, provisioning, alarm reporting, maintenance, and diagnostics. It has additional features including supply voltage monitoring, support for up to 84 data communications channel/generic communications channel (DCC/GCC) terminations, and an on-card lamp test.	See the “2.2 TCC2 Card” section on page 2-6.
TCC2P	The Advanced Timing, Communications, and Control Plus (TCC2P) card is the main processing center for the ONS 15454 and provides system initialization, provisioning, alarm reporting, maintenance, and diagnostics. It also provides supply voltage monitoring, support for up to 84 DCC/GCC terminations, and an on-card lamp test. This card also has Ethernet security features and 64K composite clock building integrated timing supply (BITS) timing.	See the “2.3 TCC2P Card” section on page 2-10.
XCVT	The Cross Connect Virtual Tributary (XCVT) card is the central element for switching; it establishes connections and performs time-division switching (TDS). The XCVT can manage STS and Virtual Tributary (VT) circuits up to 48c.	See the “2.4 XCVT Card” section on page 2-15.
XC10G	The 10 Gigabit Cross Connect (XC10G) card is the central element for switching; it establishes connections and performs TDS. The XC10G can manage STS and VT circuits up to 192c. The XC10G allows up to four times the bandwidth of XC and XCVT cards.	See the “2.5 XC10G Card” section on page 2-19.
XC-VXC-10G	The 10 Gigabit Cross Connect Virtual Tributary/Virtual Container (XC-VXC-10G) card serves as the switching matrix for the Cisco 15454 ANSI multiservice platform. The module operates as a superset of the XCVT or XC10G cross-connect module. The XC-VXC-10G card provides a maximum of 1152 STS-1 or 384 VC4 cross-connections and supports cards with speeds up to 10 Gbps.	See the “2.6 XC-VXC-10G Card” section on page 2-23.
AIC-I	The Alarm Interface Card–International (AIC-I) provides customer-defined (environmental) alarms with its additional input/output alarm contact closures. It also provides orderwire, user data channels, and supply voltage monitoring.	See the “2.7 AIC-I Card” section on page 2-28.
AEP	The alarm expansion panel (AEP) board provides 48 dry alarm contacts: 32 inputs and 16 outputs. It can be used with the AIC-I card.	See the “1.12 Alarm Expansion Panel” section on page 1-56

2.1.2 Card Compatibility

Table 2-2 lists the Cisco Transport Controller (CTC) software release compatibility for each common-control card. In the tables below, “Yes” means cards are compatible with the listed software versions. Table cells with dashes mean cards are not compatible with the listed software versions.

Table 2-2 Common-Control Card Software Release Compatibility

Card	R3.3	R3.4	R4.0	R4.1	R4.5	R4.6	R4.7	R5.0	R6.0	R7.0	R7.2	R8.0	R8.5	R9.0
TCC+	Yes	Yes	Yes	Yes	—	—	—	—	—	—	—	—		
TCC2	—	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TCC2P	—	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
XC	Yes	Yes	Yes	Yes	—	Yes	—	Yes ¹	Yes ¹	Yes ¹	Yes ¹	Yes ¹	Yes ¹	Yes ¹
XCVT	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
XC10G	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
XC-VXC-10G	—	—	—	—	—	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes
AIC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC-I	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AEP	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

1. The XC card does not support features new to Release 5.0 and later.

2.1.3 Cross-Connect Card Compatibility

The following tables list the compatible cross-connect cards for each Cisco ONS 15454 common-control card. The tables are organized according to type of common-control card. In the tables below, “Yes” means cards are compatible with the listed cross-connect card. Table cells with dashes mean cards are not compatible with the listed cross-connect card.

Table 2-3 lists the cross-connect card compatibility for each common-control card.

Table 2-3 Common-Control Card Cross-Connect Compatibility

Card	XCVT Card	XC10G Card ¹	XC-VXC-10G Card ¹
TCC+ ²	Yes	Yes	—
TCC2	Yes	Yes	Yes
TCC2P	Yes	Yes	Yes
XC	— ³	— ³	— ³
XCVT	Yes	— ³	— ³
XC10G	— ³	Yes	— ³
XC-VXC-10G	— ³	— ³	Yes
AIC-I	Yes	Yes	Yes

Table 2-3 Common-Control Card Cross-Connect Compatibility (continued)

Card	XCVT Card	XC10G Card ¹	XC-VXC-10G Card ¹
AEP	Yes	Yes	Yes

1. Requires SA-ANSI or SA-HD shelf assembly.
2. The TCC+ is not compatible with Software R4.5 or greater.
3. These cross-connect cards are compatible only during an upgrade.

Table 2-4 lists the cross-connect card compatibility for each electrical card. For electrical card software compatibility, see Table 3-2 on page 3-3.

**Note**

The XC card is compatible with most electrical cards, with the exception of the DS3i-N-12, DS3/EC1-48, DS1/E1-56, and transmux cards, but does not support features new to Release 5.0 and later.

Table 2-4 Electrical Card Cross-Connect Compatibility

Electrical Card	XCVT Card	XC10G Card ¹	XC-VXC-10G Card ¹
EC1-12	Yes	Yes	Yes
DS1-14	Yes	Yes	Yes
DS1N-14	Yes	Yes	Yes
DS3-12	Yes	Yes	Yes
DS3N-12	Yes	Yes	Yes
DS3-12E	Yes	Yes	Yes
DS3N-12E	Yes	Yes	Yes
DS3/EC1-48	—	Yes	Yes
DS3XM-6 (Transmux)	Yes	Yes	Yes
DS3XM-12 (Transmux)	Yes	Yes	Yes
DS3i-N-12	Yes	Yes	Yes
DS1/E1-56	Yes	Yes	Yes

1. Requires a 15454-SA-ANSI or 15454-SA-HD shelf assembly.

Table 2-5 lists the cross-connect card compatibility for each optical card. For optical card software compatibility, see Table 4-2 on page 4-5.

**Note**

The XC card is compatible with most optical cards, with the exception of those cards noted as incompatible with the XCVT card, but does not support features new to Release 5.0 and later.

Table 2-5 Optical Card Cross-Connect Compatibility

Optical Card	XCVT Card	XC10G Card ¹	XC-VXC-10G Card ¹
OC3 IR 4 1310	Yes	Yes	Yes
OC3 IR 4/STM1 SH 1310	Yes	Yes	Yes

Table 2-5 Optical Card Cross-Connect Compatibility (continued)

Optical Card	XCVT Card	XC10G Card ¹	XC-VXC-10GCard ¹
OC3 IR /STM1SH 1310-8	—	Yes	Yes
OC12 IR 1310	Yes	Yes	Yes
OC12 LR 1310	Yes	Yes	Yes
OC12 LR 1550	Yes	Yes	Yes
OC12 IR/STM4 SH 1310	Yes	Yes	Yes
OC12 LR/STM4 LH 1310	Yes	Yes	Yes
OC12 LR/STM4 LH 1550	Yes	Yes	Yes
OC12 IR/STM4 SH 1310-4	—	Yes	Yes
OC48 LR 1550	Yes	Yes	Yes
OC48 IR/STM16 SH AS 1310	Yes ²	Yes	Yes
OC48 LR/STM16 LH AS 1550	Yes ²	Yes	Yes
OC48 ELR/STM16 EH 100 GHz	Yes	Yes	Yes
OC48 ELR 200 GHz	Yes	Yes	Yes
OC192 SR/STM64 IO 1310	—	Yes	Yes
OC192 IR/STM64 SH 1550	—	Yes	Yes
OC192 LR/STM64 LH 1550	—	Yes	Yes
OC192 LR/STM64 LH ITU 15xx.xx	—	Yes	Yes
OC192SR1/STM64 IO Short Reach and OC192/STM64 Any Reach (OC192-XFP cards)	—	Yes	Yes
15454_MRC-12	Yes	Yes	Yes
MRC-2.5G-4	Yes	Yes	Yes

1. Requires a 15454-SA-ANSI or 15454-SA-HD shelf assembly.

2. Requires Software Release 3.2 and later in Slots 5, 6, 12, 13.

Table 2-6 lists the cross-connect card compatibility for each Ethernet card. For Ethernet card software compatibility, see Table 5-2 on page 5-3.

**Note**

The XC card is compatible with most Ethernet cards, with the exception of the G1000-4, but does not support features new to Release 5.0 and later.

Table 2-6 Ethernet Card Cross-Connect Compatibility

Ethernet Cards	XCVT Card	XC10G Card ¹	XC-VXC-10G Card ¹
E100T-12	Yes	—	—
E1000-2	Yes	—	—
E100T-G	Yes	Yes	Yes
E1000-2-G	Yes	Yes	Yes

Table 2-6 Ethernet Card Cross-Connect Compatibility (continued)

Ethernet Cards	XCVT Card	XC10G Card ¹	XC-VXC-10G Card ¹
G1K-4	Yes, in Slots 5, 6, 12, 13	Yes	Yes
ML100T-12	Yes, in Slots 5, 6, 12, 13	Yes	Yes
ML1000-2	Yes, in Slots 5, 6, 12, 13	Yes	Yes
ML-MR-10	No	Yes	Yes
ML100X-8	Yes, in Slots 5, 6, 12, 13	Yes	Yes
CE-100T-8	Yes	Yes	Yes
CE-1000-4	Yes	Yes	Yes
CE-MR-10	No	Yes	Yes

1. Requires a 15454-SA-ANSI or 15454-SA-HD shelf assembly.

Table 2-7 lists the cross-connect card compatibility for each storage area network (SAN) card. For SAN card software compatibility, see the “6.1.3 FC_MR-4 Compatibility” section on page 6-4.

Table 2-7 SAN Card Cross-Connect Compatibility

SAN Cards	XCVT Card	XC10G Card ¹	XC-VXC-10G Card ¹
FC_MR-4	Yes	Yes	Yes

1. Requires SA-ANSI or SA-HD shelf assembly

2.2 TCC2 Card



Note

For hardware specifications, see the “A.4.1 TCC2 Card Specifications” section on page A-12.

The TCC2 card performs system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection/resolution, SONET section overhead (SOH) DCC/GCC 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

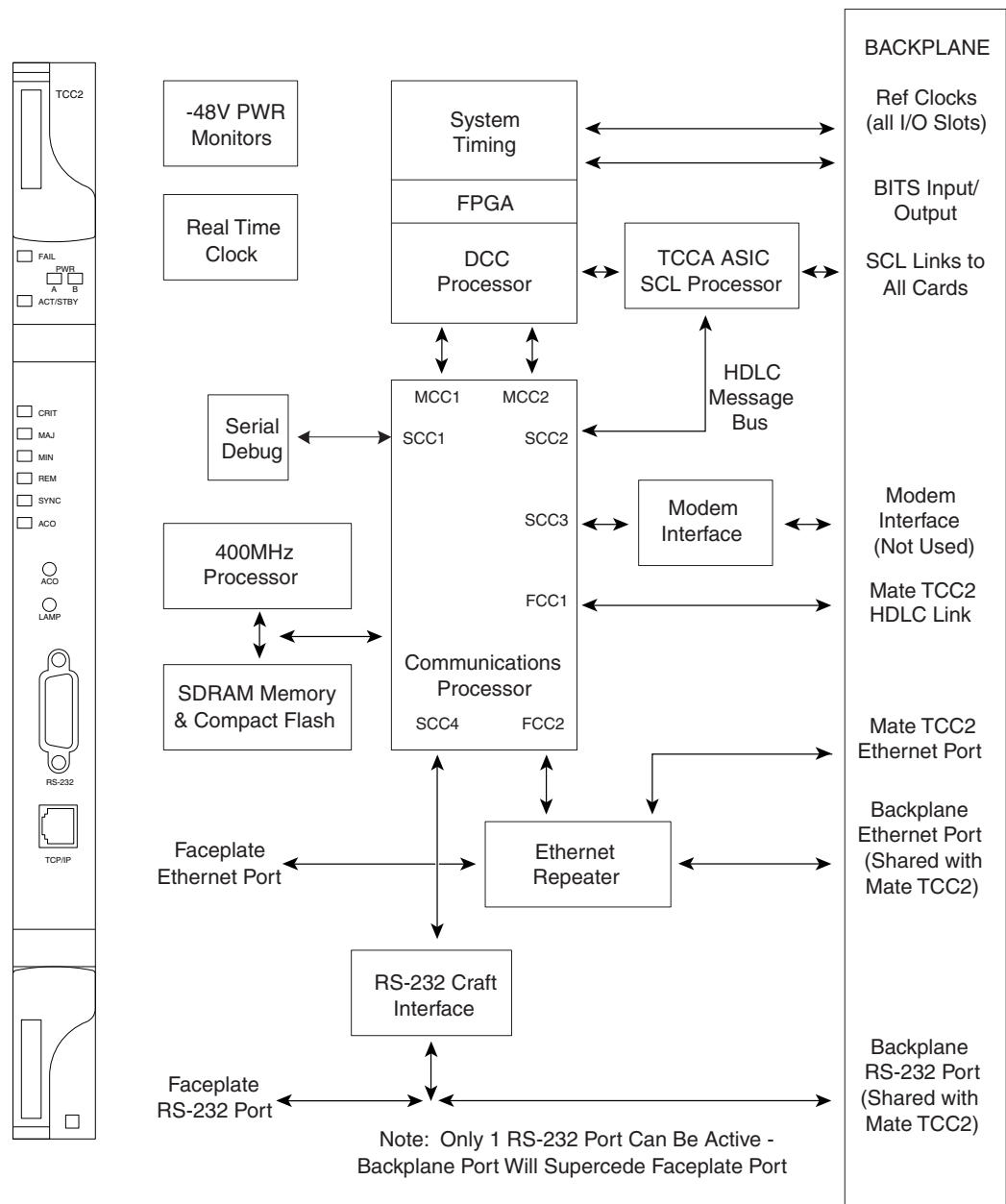
The TCC2 card requires Software Release 4.0.0 or later.



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). 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).

Figure 2-1 shows the faceplate and block diagram for the TCC2 card.

Figure 2-1 TCC2 Card Faceplate and Block Diagram

2.2.1 TCC2 Card Functionality

The TCC2 card supports multichannel, high-level data link control (HDLC) processing for the DCC. Up to 84 DCCs can be routed over the TCC2 card and up to 84 section DCCs can be terminated at the TCC2 card (subject to the available optical digital communication channels). The TCC2 card selects and processes 84 DCCs to facilitate remote system management interfaces.

The TCC2 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 TCC2 card nonvolatile memory, which allows quick recovery in the event of a power or card failure.

The TCC2 card performs all system-timing functions for each ONS 15454. The TCC2 monitors the recovered clocks from each traffic card and two BITS ports (DS1, 1.544 MHz) 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. All TCC2 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 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 over the backplane.

**Note**

When using the LAN RJ-45 craft interface or back panel wirewrap LAN connection, the connection must be 10BASE T, half duplex. Full duplex and autonegotiate settings should not be used because they might result in a loss of visibility to the node.

**Note**

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.

**Note**

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.

2.2.2 TCC2 Card-Level Indicators

The TCC2 faceplate has ten LEDs. [Table 2-8](#) describes the two card-level LEDs on the TCC2 card faceplate.

Table 2-8 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) Amber (Standby)	Indicates the TCC2 is active (green) or in standby (amber) 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.

2.2.3 Network-Level Indicators

Table 2-9 describes the six network-level LEDs on the TCC2 faceplate.

Table 2-9 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.
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 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.

2.2.4 Power-Level Indicators

Table 2-10 describes the two power-level LEDs on the TCC2 faceplate.

Table 2-10 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.

2.3 TCC2P Card



Note

For hardware specifications, see the [“A.4.2 TCC2P Card Specifications”](#) section on page A-13.

The TCC2P card is an enhanced version of the TCC2 card. For Software Release 5.0 and later, the primary enhancements are Ethernet security features and 64K composite clock BITS timing. It also supports E1 SDH external timing sources so that a SONET shelf can be deployed in a network using SDH timing. SDH timing is typically used when the SONET platform is deployed for Au3 SDH applications.

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 card 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 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).

Figure 2-2 shows the faceplate and block diagram for the TCC2P card.

The diagram illustrates the internal architecture of the TCC2P system, showing the following components and their interconnections:

- Power and Timing:** -48V PWR Monitors, Real Time Clock, System Timing, and FPGA are interconnected.
- Processing:** The DCC Processor is connected to the TCCA ASIC SCL Processor and the Communications Processor.
- Communication:** The Communications Processor is the central hub, connected to MCC1, MCC2, SMC1, SCC2, SCC3, FCC1, SCC1, SCC4, and FCC2. It also interfaces with a Serial Debug port, a 400MHz Processor, and SDRAM Memory & Compact Flash.
- External Interfaces:**
 - Modem Interface:** Connected to SCC3 and SCC2 via an HDLC Message Bus.
 - Ethernet:** An Ethernet Phy is connected to SCC1 and FCC2, which then connects to an Ethernet Switch.
 - RS-232:** An RS-232 Craft Interface is connected to SCC4 and FCC2, which then connects to an Ethernet Switch.
- Backplane:** The system connects to the BACKPLANE through:
 - Ref Clocks (all I/O Slots)
 - BITS Input/Output
 - SCL Links to All Cards
 - Modem Interface (Not Used)
 - Mate TCC2 HDLC Link
 - Backplane Ethernet Port (Shared with Mate TCC2)
 - Mate TCC2 Ethernet Port
 - Backplane RS-232 Port (Shared with Mate TCC2)

Note: Only 1 RS-232 Port Can Be Active - Backplane Port Will Supercede Faceplate Port

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 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 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.

**Note**

When using the LAN RJ-45 craft interface or back panel wirewrap LAN connection, the connection must be 10BASE T, half duplex. Full duplex and autonegotiate settings should not be used because they might result in a loss of visibility to the node.

**Note**

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.

**Note**

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.

2.3.1.1 System Timing Functions

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 (BITS_IN_A and BITS_IN-B) for frequency accuracy. The TCC2P card selects a recovered clock, a BITS clock, 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 minimum free-run accuracy, holdover stability, pull-in, and hold-in characteristics are as defined in ITU-T G.813 option I in Section 5, 6, and 10, ITU-T G.811 Section 5, and ITU-T G.812 Sections 6 and 7, as well as in ANSI EN 300 462-5-1.

**Note**

If SDH timing is selected (see the [“2.3.1.1.2 SDH Timing Operation”](#) section on page 2-13), it is not possible to select an E1 or DS1 port from the DS1/E1-56 high-density card as a timing reference.

2.3.1.1.1 SONET Timing Operation

The TCC2P card supports a 64 kHz + 8 kHz composite clock BITS input (BITS IN) as well as a 6.312-MHz BITS OUT clock. The BITS clock on the system is configurable as DS1 (default), 1.544 MHz, or 64 kHz. The BITS OUT clock runs at a rate determined by the BITS IN clock, as follows:

If BITS IN = DS1, then BITS OUT = DS1 (default)

A BITS output interface configured as 6.312 MHz complies with ITU-T G.703, Appendix II, Table II.4, with a monitor level of -40 dBm +/- 4 dBm.

2.3.1.1.2 SDH Timing Operation

The TCC2P card supports typical external E1 SDH timing sources so that the card can be provisioned to accept either an SDH or SONET timing standard. The initial default is for the card to use SONET timing; the default can be changed to SDH timing after the TCC2P card boots up. The BITS OUT clock runs at a rate determined by the BITS IN clock, as follows:

- If BITS IN = E1, then BITS OUT = E1
- If BITS IN = 2.048 MHz (square wave clock), then BITS OUT = 2.048 MHz (square wave clock)
- If BITS IN = 64 kHz, then BITS OUT = 6.312 MHz

The TCC2P card supports the E1 BITS OUT signal as defined in ITU-T G.703 Section 9, and the BITS OUT 2.048 MHz signal as defined in ITU-T G.703 Section 13. All of the BITS OUT signals meet the output signal criteria (including jitter and wander) as defined in ITU-T G.813 Sections 5 and 6, ITU-T G.811 Section 5, and ITU-T G.812, Section 6.

When SDH timing is selected, SDH Sync Status Messaging (SSM) is transmitted on the output ports and received on the input ports. SSM can be enabled or disabled.

The following framing options are allowed when E1 2.048 MHz timing is selected:

- Frame Alignment Signal (FAS)
- Frame Alignment Signal plus Channel Associated Signal (FAS + CAS)
- Frame Alignment Signal plus Cyclic Redundancy Check (FAS + CRC)
- Frame Alignment Signal plus Channel Associated Signal plus Cyclic Redundancy Check (FAS + CAS + CRC)

2.3.2 TCC2P Card-Level Indicators

The TCC2P faceplate has ten LEDs. [Table 2-11](#) describes the two card-level LEDs on the TCC2P faceplate.

Table 2-11 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.

2.3.3 Network-Level Indicators

Table 2-12 describes the six network-level LEDs on the TCC2P faceplate.

Table 2-12 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 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.

2.3.4 Power-Level Indicators

Table 2-13 describes the two power-level LEDs on the TCC2P faceplate.

Table 2-13 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.

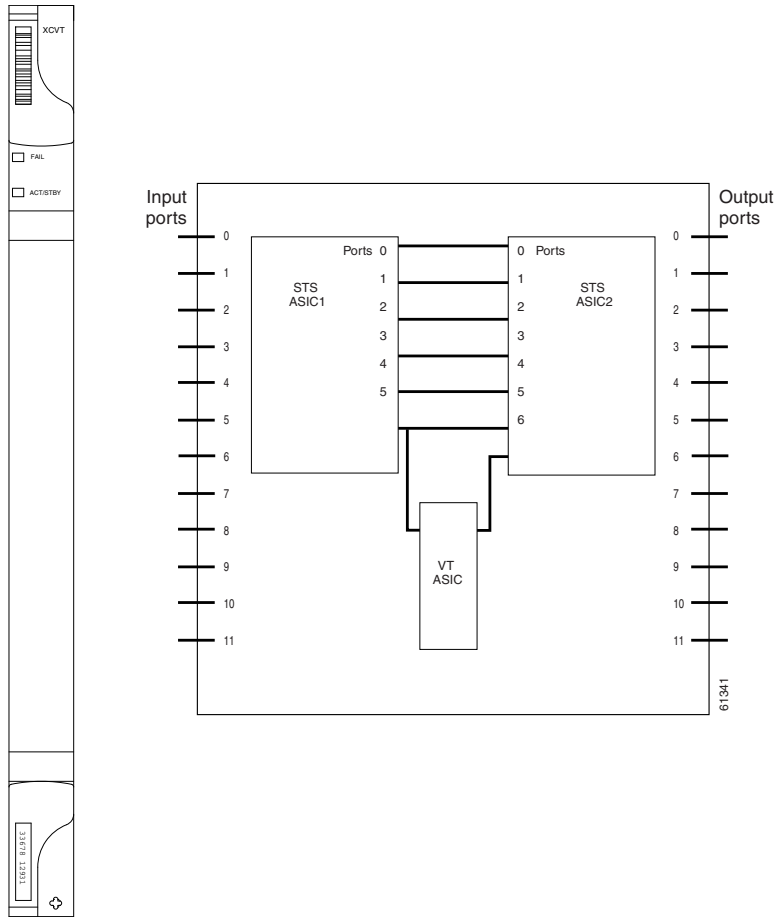
2.4 XCVT Card

**Note**

For hardware specifications, see the [“A.4.3 XCVT Card Specifications”](#) section on page A-14.

The Cross Connect Virtual Tributary (XCVT) card establishes connections at the STS-1 and VT levels. The XCVT provides STS-48 capacity to Slots 5, 6, 12, and 13, and STS-12 capacity to Slots 1 to 4 and 14 to 17. Any STS-1 on any port can be connected to any other port, meaning that the STS cross-connections are nonblocking.

Figure 2-3 shows the XCVT faceplate and block diagram.

Figure 2-3 XCVT Faceplate and Block Diagram

2.4.1 XCVT Functionality

The STS-1 switch matrix on the XCVT card consists of 288 bidirectional ports and adds a VT matrix that can manage up to 336 bidirectional VT1.5 ports or the equivalent of a bidirectional STS-12. The VT1.5-level signals can be cross connected, dropped, or rearranged. The TCC2/TCC2P card assigns bandwidth to each slot on a per STS-1 or per VT1.5 basis. The switch matrices are fully crosspoint and broadcast supporting.

The XCVT card provides:

- 288 STS bidirectional ports
- 144 STS bidirectional cross-connects
- 672 VT1.5 ports via 24 logical STS ports
- 336 VT1.5 bidirectional cross-connects
- Nonblocking at the STS level
- STS-1/3c/6c/12c/48c cross-connects

The XCVT card works with the TCC2/TCC2P cards to maintain connections and set up cross-connects within the node. The cross-connect cards (such as the XCVT and XC10G), installed in Slots 8 and 10, are required to operate the ONS 15454. You can establish cross-connect (circuit) information through CTC. The TCC2/TCC2P cards establish the proper internal cross-connect information and relay the setup information to the XCVT card.

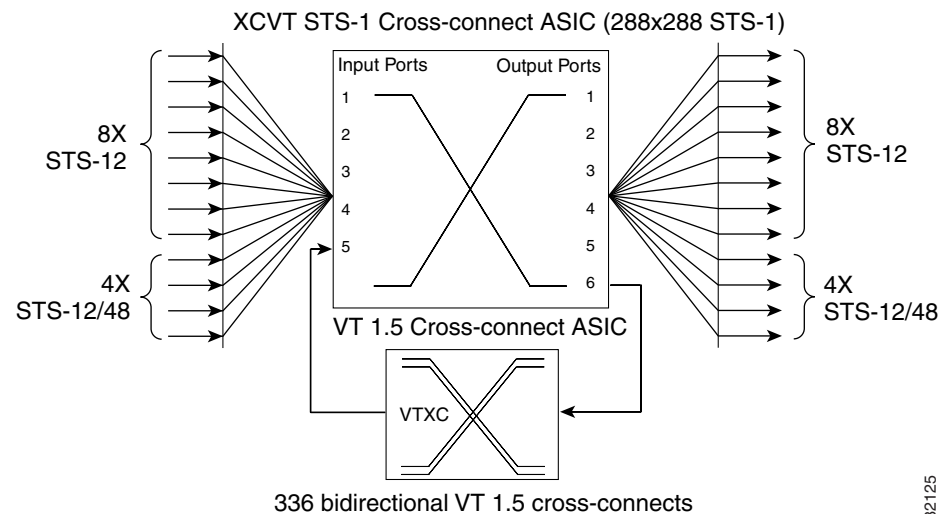


Caution

Do not operate the ONS 15454 with only one cross-connect card. Two cross-connect cards of the same type (two XCVT or two XC10G cards) must always be installed.

Figure 2-4 shows the cross-connect matrix.

Figure 2-4 XCVT Cross-Connect Matrix



2.4.2 VT Mapping

The VT structure is designed to transport and switch payloads below the DS-3 rate. The ONS 15454 performs VT mapping according to Telcordia GR-253-CORE standards. Table 2-14 shows the VT numbering scheme for the ONS 15454 as it relates to the Telcordia standard.

Table 2-14 VT Mapping

ONS 15454 VT Number	Telcordia Group/VT Number
VT1	Group1/VT1
VT2	Group2/VT1
VT3	Group3/VT1
VT4	Group4/VT1
VT5	Group5/VT1
VT6	Group6/VT1
VT7	Group7/VT1
VT8	Group1/VT2

Table 2-14 VT Mapping (continued)

ONS 15454 VT Number	Telcordia Group/VT Number
VT9	Group2/VT2
VT10	Group3/VT2
VT11	Group4/VT2
VT12	Group5/VT2
VT13	Group6/VT2
VT14	Group7/VT2
VT15	Group1/VT3
VT16	Group2/VT3
VT17	Group3/VT3
VT18	Group4/VT3
VT19	Group5/VT3
VT20	Group6/VT3
VT21	Group7/VT3
VT22	Group1/VT4
VT23	Group2/VT4
VT24	Group3/VT4
VT25	Group4/VT4
VT26	Group5/VT4
VT27	Group6/VT4
VT28	Group7/VT4

2.4.3 XCVT Hosting DS3XM-6 or DS3XM-12

A DS3XM card can demultiplex (map down to a lower rate) M13-mapped DS-3 signals into 28 DS-1s that are then mapped to VT1.5 payloads. The VT1.5s can then be cross-connected by the XCVT card. The XCVT card can host a maximum of 336 bidirectional VT1.5s.

2.4.4 XCVT Card-Level Indicators

Table 2-15 shows the two card-level LEDs on the XCVT card faceplate.

Table 2-15 **XCVT Card-Level Indicators**

Card-Level Indicators	Definition
Red FAIL LED	Indicates that the cards processor is not ready. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Indicates whether the XCVT card is active and carrying traffic (green) or in standby mode to the active XCVT card (amber).

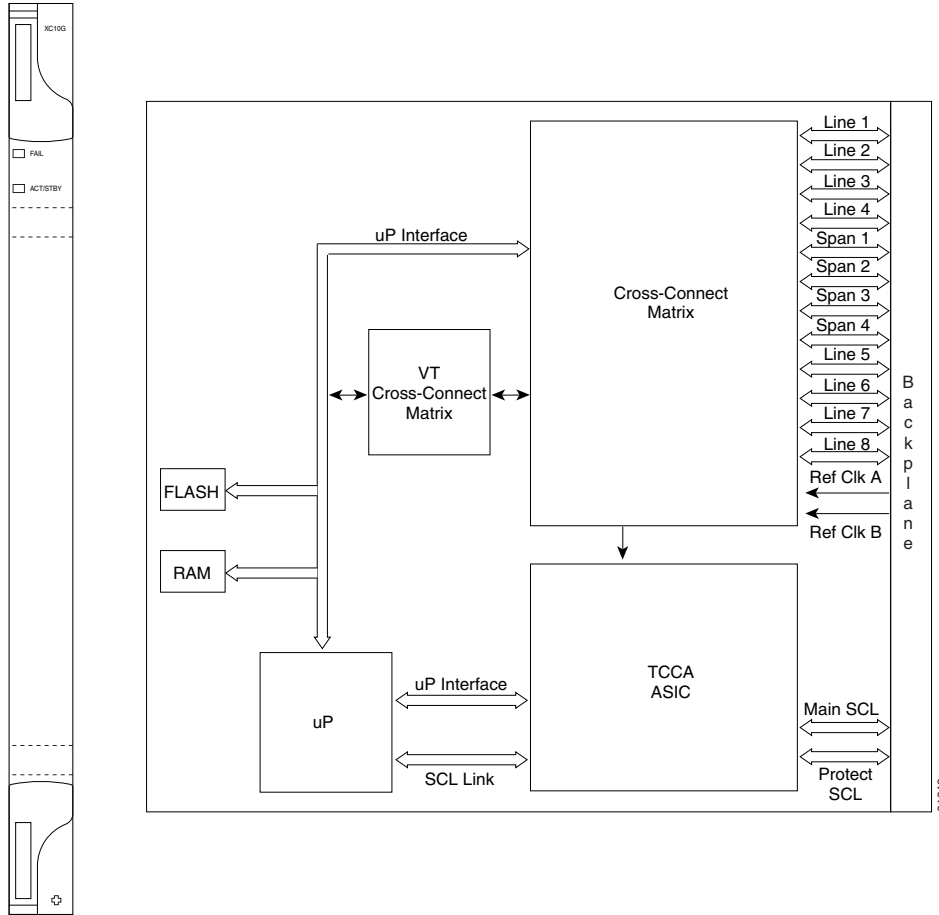
2.5 XC10G Card

**Note**

For hardware specifications, see the [“A.4.4 XC10G Card Specifications” section on page A-14](#).

The 10 Gigabit Cross Connect (XC10G) card establishes connections at the STS-1 and VT levels. The XC10G provides STS-192 capacity to Slots 5, 6, 12, and 13, and STS-48 capacity to Slots 1 to 4 and 14 to 17. The XC10G allows up to four times the bandwidth of the XCVT cards. The XC10G provides a maximum of 576 STS-1 cross-connections through 1152 STS-1 ports. Any STS-1 on any port can be connected to any other port, meaning that the STS cross-connections are nonblocking.

[Figure 2-5](#) shows the XC10G faceplate and block diagram.

Figure 2-5 XC10G Faceplate and Block Diagram

2.5.1 XC10G Functionality

The XC10G card manages up to 672 bidirectional VT1.5 ports and 1152 bidirectional STS-1 ports. The TCC2/TCC2P cards assign bandwidth to each slot on a per STS-1 or per VT1.5 basis.

Two cross-connect cards, installed in Slots 8 and 10, are required to operate the ONS 15454. You can establish cross-connect (circuit) information through the CTC. The cross-connect card establishes the proper internal cross-connect information and sends the setup information to the cross-connect card.

The XC10G card provides:

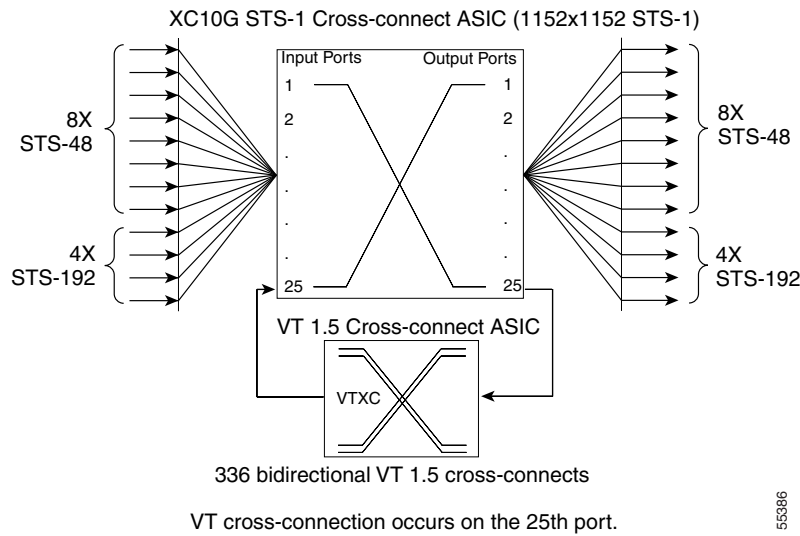
- 1152 STS bidirectional ports
- 576 STS bidirectional cross-connects
- 672 VT1.5 ports via 24 logical STS ports
- 336 VT1.5 bidirectional cross-connects
- Nonblocking at STS level
- STS-1/3c/6c/12c/48c/192c cross-connects

**Caution**

Do not operate the ONS 15454 with only one XCVT or XC10G card. Two cross-connect cards of the same type (either two XCVT or two XC10G cards) must always be installed.

Figure 2-6 shows the cross-connect matrix.

Figure 2-6 XC10G Cross-Connect Matrix



2.5.2 VT Mapping

The VT structure is designed to transport and switch payloads below the DS-3 rate. The ONS 15454 performs VT mapping according to Telcordia GR-253-CORE standards. Table 2-16 shows the VT numbering scheme for the ONS 15454 as it relates to the Telcordia standard.

Table 2-16 VT Mapping

ONS 15454 VT Number	Telcordia Group/VT Number
VT1	Group1/VT1
VT2	Group2/VT1
VT3	Group3/VT1
VT4	Group4/VT1
VT5	Group5/VT1
VT6	Group6/VT1
VT7	Group7/VT1
VT8	Group1/VT2
VT9	Group2/VT2
VT10	Group3/VT2
VT11	Group4/VT2

Table 2-16 VT Mapping (continued)

ONS 15454 VT Number	Telcordia Group/VT Number
VT12	Group5/VT2
VT13	Group6/VT2
VT14	Group7/VT2
VT15	Group1/VT3
VT16	Group2/VT3
VT17	Group3/VT3
VT18	Group4/VT3
VT19	Group5/VT3
VT20	Group6/VT3
VT21	Group7/VT3
VT22	Group1/VT4
VT23	Group2/VT4
VT24	Group3/VT4
VT25	Group4/VT4
VT26	Group5/VT4
VT27	Group6/VT4
VT28	Group7/VT4

2.5.3 XC10G Hosting DS3XM-6 or DS3XM-12

A DS3XM card can demultiplex (map down to a lower rate) M13-mapped DS-3 signals into 28 DS-1s that are then mapped to VT1.5 payloads. The VT1.5s can then be cross-connected by the XC10G card. The XC10G card can host a maximum of 336 bidirectional VT1.5s.

2.5.4 XC10G Card-Level Indicators

[Table 2-17](#) describes the two card-level LEDs on the XC10G faceplate.

Table 2-17 XC10G Card-Level Indicators

Card-Level Indicators	Definition
Red FAIL LED	Indicates that the cards processor is not ready. This LED illuminates during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Indicates whether the XC10G is active and carrying traffic (green), or in standby mode to the active XC10G card (amber).

2.5.5 XCVT/XC10G/XC-VXC-10G Compatibility

The XC10G and XC-VXC-10G cards support the same features as the XCVT card. The XC10G or XC-VXC-10G cards are required for OC-192, OC-48 any-slot (AS), OC3-8, and OC12-4 operation. Do not use the XCVT card if you are using an OC-192, OC3-8, or OC12-4 card or if you install an OC-48 AS card in Slots 1 to 4 or 14 to 17.

**Note**

A configuration mismatch alarm occurs when an XCVT cross-connect card co-exists with an OC-192, OC3-8, or OC12-4 card placed in Slots 5, 6, 12, or 13 or with an OC-48 card placed in Slots 1 to 4 or 14 to 17.

If you are using Ethernet cards, the E1000-2-G or the E100T-G must be used when the XC10G or XC-VXC-10G cross-connect card is in use. Do not pair an XCVT card with an XC10G or XC-VXC-10G card. When upgrading from an XCVT to the XC10G or XC-VXC-10G card, refer to the “Upgrade Cards and Spans” chapter in the *Cisco ONS 15454 Procedure Guide* for more information.

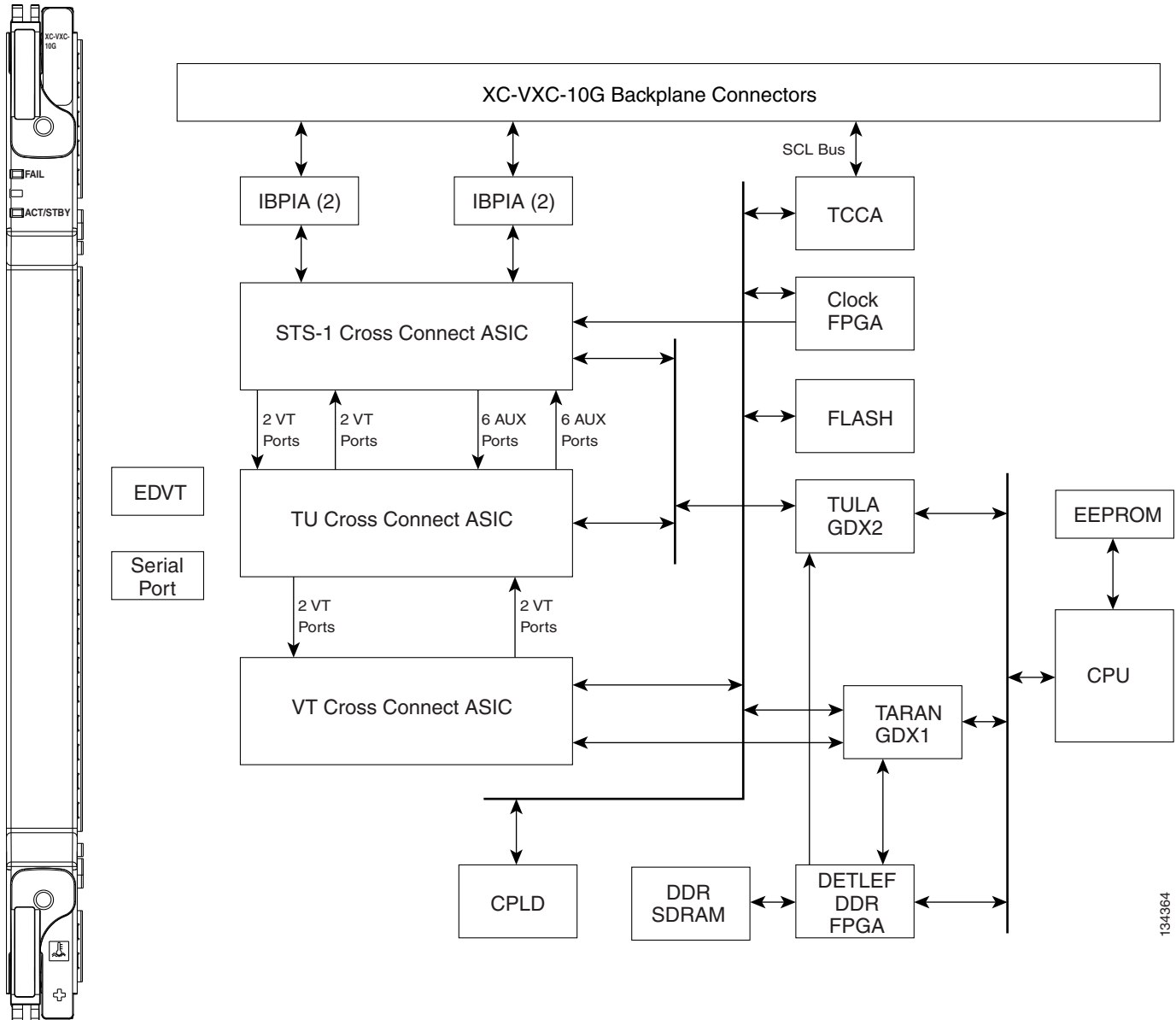
2.6 XC-VXC-10G Card

**Note**

For hardware specifications, see the [“A.4.5 XC-VXC-10G Card Specifications”](#) section on page A-15.

The XC-VXC-10G card establishes connections at the STS and VT levels. The XC-VXC-10G provides STS-192 capacity to Slots 5, 6, 12, and 13, and STS-48 capacity to Slots 1 to 4 and 14 to 17. Any STS-1 on any port can be connected to any other port, meaning that the STS cross-connections are nonblocking.

[Figure 2-7](#) shows the XC-VXC-10G faceplate and block diagram.

Figure 2-7 XC-VXC-10G Faceplate and Block Diagram

2.6.1 XC-VXC-10G Functionality

The XC-VXC-10G card manages up to 1152 bidirectional high-order STS-1 ports. In addition, it is able to simultaneously manage one of the following low-order VT cross-connect arrangements:

- 2688 bidirectional VT1.5 low-order ports, or
- 2016 VT2 low-order ports, or
- 1344 bidirectional VT1.5 ports and 1008 bidirectional VT2 ports (mixed grooming)

The TCC2/TCC2P card assigns bandwidth to each slot on a per STS-1, per VT1.5, or per VT2 basis. The switch matrices are fully crosspoint and broadcast supporting.

At the STS level (high-order cross-connect), the XC-VXC-10G is always non-blocking (any STS-1 from the system can be cross-connected to any other STS-1 without limitation up to 1152 bidirectional STS-1 ports (576 STS-1 cross-connects)).

In addition, for “mixed” VT1.5 and VT2 grooming, 50% of the available VT resources (ports) are allocated to each VT circuit type. The following three modes are supported (only one mode is available at a time):

- Mode 1: full VT1.5 cross-connect, which is 2688 bidirectional VT1.5 ports (1344 bidirectional VT1.5 cross-connects)
- Mode 2: full VT2 cross-connect, which is 2016 bidirectional VT2 ports (1008 bidirectional VT2 cross-connects)
- Mode 3 (mixed grooming): 50% VT1.5 and 50% VT2 XC, which is 1344 bidirectional VT1.5 ports and 1008 bidirectional VT2 ports (672 bidirectional VT1.5 and 504 VT2 bidirectional cross-connects)

The XC-VXC-10G card provides:

- 1152 STS bidirectional ports
- 576 STS bidirectional cross-connects
- 2688 VT1.5 ports via 96 logical STS ports
- 1344 VT1.5 bidirectional cross-connects
- 2016 VT2 ports via 96 logical STS ports
- 1008 VT2 bidirectional cross-connects
- Mixed grooming (50% VT1.5 and 50% VT2)
- Nonblocking at the STS level
- VT1.5, VT2, and STS-1/3c/6c/12c/48c/192c cross-connects



Note

VT 2 circuit provisioning works between optical cards and the DS3/EC1-48 card (EC1 ports, not the ports provisioned for DS3)

The XC-VXC-10G supports errorless side switches (switching from one XC-VXC-10G on one side of the shelf to the other XC-VXC-10G on the other side of the shelf) when the switch is initiated through software and the shelf is equipped with TCC2/TCC2P cards. The XCVT and XC10G cards do not support errorless switching.

Cross-connect and provisioning information is established through the user interface on the TCC2/TCC2P card. In turn, the TCC2/TCC2P card establishes the proper internal cross-connect information and relays the setup information to the XC-VXC-10G card so that the proper cross-connection is established within the system.

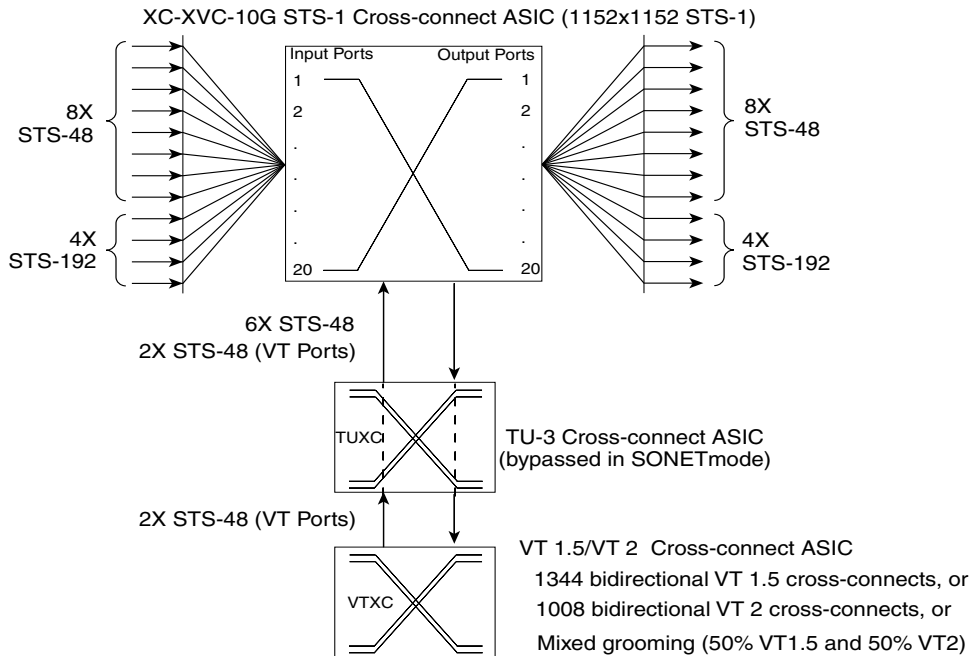
The XC-VXC-10G card is deployed in Slots 8 or 10. Upgrading a system to an XC-VXC-10G from an earlier cross-connect module type is performed in-service, with hitless operation (less than 50-ms impact to any traffic). The XC-VXC-10G can be used with either the standard ANSI shelf assembly (15454-SA-ANSI) or high-density shelf assembly (15454-SA-HD).



Caution

Do not operate the ONS 15454 with only one XC-VXC-10G cross-connect card. Two cross-connect cards must always be installed.

Figure 2-8 shows the XC-VXC-10G cross-connect matrix.

Figure 2-8 XC-VXC-10G Cross-Connect Matrix

2.6.2 VT Mapping

The VT structure is designed to transport and switch payloads below the DS-3 rate. The ONS 15454 performs VT mapping according to Telcordia GR-253-CORE standards. [Table 2-16](#) shows the VT numbering scheme for the ONS 15454 as it relates to the Telcordia standard.

Table 2-18 VT Mapping

ONS 15454 VT Number	Telcordia Group/VT Number
VT1	Group1/VT1
VT2	Group2/VT1
VT3	Group3/VT1
VT4	Group4/VT1
VT5	Group5/VT1
VT6	Group6/VT1
VT7	Group7/VT1
VT8	Group1/VT2
VT9	Group2/VT2
VT10	Group3/VT2
VT11	Group4/VT2
VT12	Group5/VT2
VT13	Group6/VT2

Table 2-18 VT Mapping (continued)

ONS 15454 VT Number	Telcordia Group/VT Number
VT14	Group7/VT2
VT15	Group1/VT3
VT16	Group2/VT3
VT17	Group3/VT3
VT18	Group4/VT3
VT19	Group5/VT3
VT20	Group6/VT3
VT21	Group7/VT3
VT22	Group1/VT4
VT23	Group2/VT4
VT24	Group3/VT4
VT25	Group4/VT4
VT26	Group5/VT4
VT27	Group6/VT4
VT28	Group7/VT4

2.6.3 XC-VXC-10G Hosting DS3XM-6 or DS3XM-12

A DS3XM card can demultiplex (map down to a lower rate) M13-mapped DS-3 signals into 28 DS-1s that are then mapped to VT1.5 payloads. The VT1.5s can then be cross-connected by the XC-VXC-10G card. The XC-VXC-10G card can host a maximum of 1344 bidirectional VT1.5s.

2.6.4 XC-VXC-10G Card-Level Indicators

[Table 2-19](#) describes the two card-level LEDs on the XC-VXC-10G faceplate.

Table 2-19 XC-VXC-10G Card-Level Indicators

Card-Level Indicators	Definition
Red FAIL LED	Indicates that the cards processor is not ready. This LED illuminates during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Indicates whether the XC10G is active and carrying traffic (green), or in standby mode to the active XC10G card (amber).

2.6.5 XC-VXC-10G Compatibility

The XC-VXC-10G card supports the same features as the XC10G card. Either the XC10G or XC-VXC-10G card is required for OC-192, OC3-8, and OC12-4 operation and OC-48 AS operation.

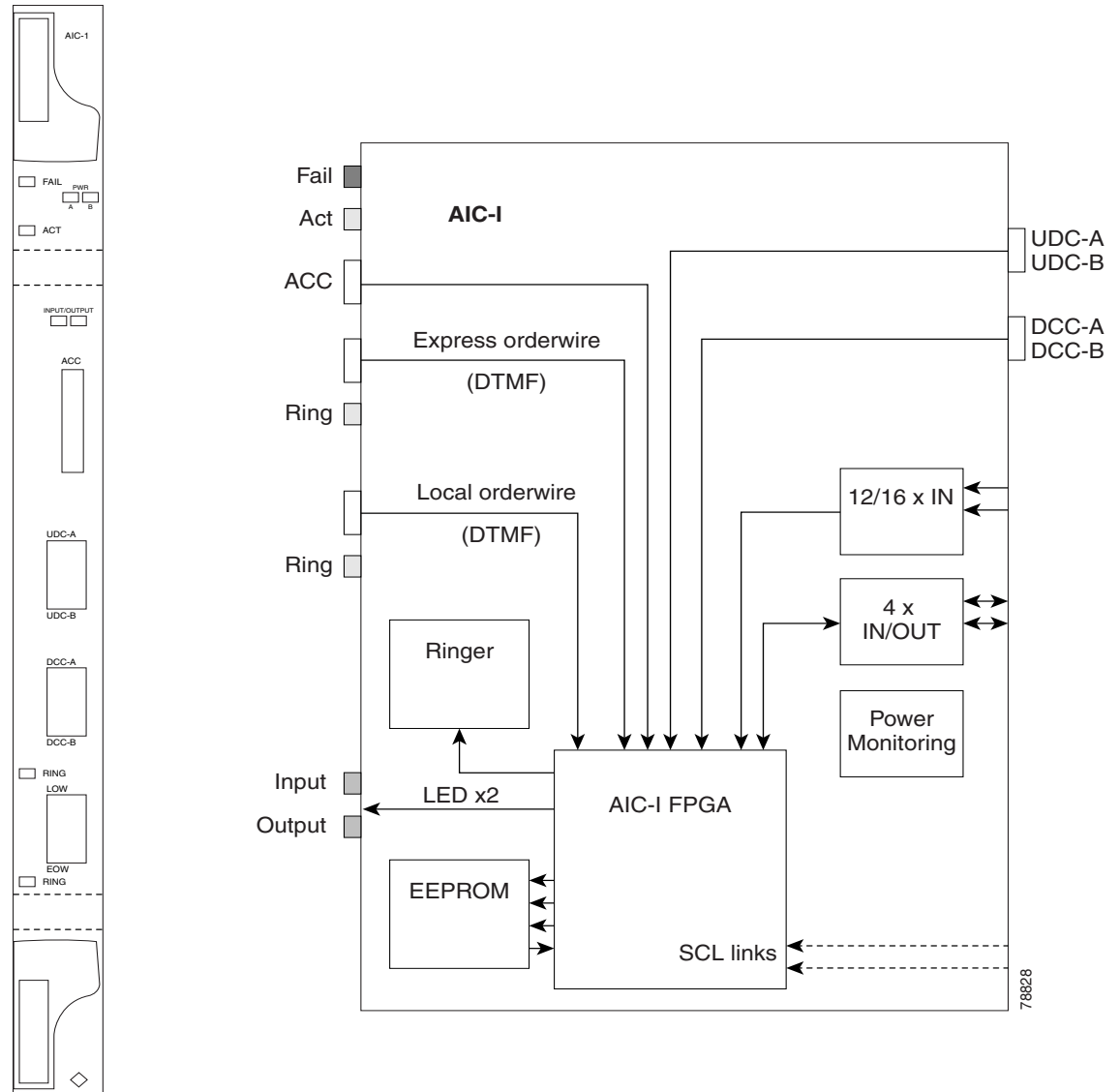
If you are using Ethernet cards, the E1000-2-G or the E100T-G must be used when the XC-VXC-10G cross-connect card is in use. When upgrading from an XC10G card to an XC-VXC-10G card, refer to the “Upgrade Cards and Spans” chapter in the *Cisco ONS 15454 Procedure Guide* for more information. Also refer to the [“2.1.2 Card Compatibility” section on page 2-3](#).

2.7 AIC-I Card

**Note**

For hardware specifications, see the [“A.4.6 AIC-I Card Specifications” section on page A-15](#).

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 through the backplane wire-wrap pin terminals. If you use the additional AEP, the AIC-I card can support up to 32 inputs and 16 outputs, which are connected on the AEP connectors. A power monitoring function monitors the supply voltage (–48 VDC). [Figure 2-9](#) shows the AIC-I faceplate and a block diagram of the card.

Figure 2-9 AIC-I Faceplate and Block Diagram

2.7.1 AIC-I Card-Level Indicators

Table 2-20 describes the eight card-level LEDs on the AIC-I card faceplate.

Table 2-20 AIC-I Card-Level Indicators

Card-Level LEDs	Description
Red FAIL LED	Indicates that the cards 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 2-20 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.
Amber INPUT LED	The INPUT LED is amber when there is an alarm condition on at least one of the alarm inputs.
Amber OUTPUT LED	The OUTPUT LED is amber 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.

2.7.2 External Alarms and Controls

The AIC-I card provides input/output alarm contact closures. You can define up to twelve external alarm inputs and 4 external alarm inputs/outputs (user configurable). The physical connections are made using the backplane wire-wrap pins. See the [“1.12 Alarm Expansion Panel” section on page 1-56](#) for information about increasing the number of input/output contacts.

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 unprovision the alarm input.

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 network element (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**

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.

2.7.3 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 signal) orderwire channels on an 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 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. Keep in mind that orderwire is not protected in ring topologies such as bidirectional line switched rings (BLSRs) and path protection configurations.

**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 facilities for each local and express orderwire are provisionable as orderwire paths.

**Note**

The OC3 IR 4/STM1 SH 1310 card does not support the express orderwire channel.

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 2-21 shows the pins on the orderwire connector that correspond to the tip and ring orderwire assignments.

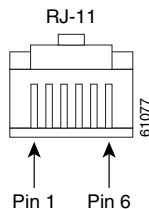
Table 2-21 Orderwire Pin Assignments

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 2-10 shows the standard RJ-11 connectors used for orderwire ports. Use a shielded RJ-11 cable.

Figure 2-10 RJ-11 Connector



2.7.4 Power Monitoring

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

2.7.5 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. Use an unshielded RJ-11 cable. Each UDC can be routed to an individual optical interface in the ONS 15454. For UDC circuit provisioning, refer to the “Create Circuits and VT Tunnels” chapter in the *Cisco ONS 15454 Procedure Guide*.

The UDC ports are standard RJ-11 receptacles. Table 2-22 lists the UDC pin assignments.

Table 2-22 UDC Pin Assignments

RJ-11 Pin Number	Description
1	For future use
2	TXN
3	RXN
4	RXP
5	TXP
6	For future use

2.7.6 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 DCCs, DCC-A and DCC-B, through separate RJ-45 connectors on the front of the AIC-I card. Use a shielded RJ-45 cable. Each DCC can be routed to an individual optical interface in the ONS 15454.

The DCC ports are synchronous serial interfaces. The DCC ports are standard RJ-45 receptacles. [Table 2-23](#) lists the DCC pin assignments.

Table 2-23 DCC Pin Assignments

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

