



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 2-8](#)
- [2.4 XCVT Card, page 2-11](#)
- [2.5 XC10G Card, page 2-15](#)
- [2.6 AIC Card, page 2-18](#)
- [2.7 AIC-I Card, page 2-22](#)

2.1 Common Control Card Overview

The card overview section summarizes card functions and compatibility.

**Note**

Each card is marked with a symbol that corresponds to a slot (or slots) on the ONS 15454 shelf assembly. The cards are then installed into slots displaying the same symbols. See the “[1.16.1 Card Slot Requirements](#)” section on [page 1-60](#) 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 2-8
XCVT	The Cross Connect Virtual Tributary (XCVT) card is the central element for switching; it establishes connections and performs TDS. The XCVT can manage STS and Virtual Tributary (VT) circuits up to 48c.	See the “2.4 XCVT Card” section on page 2-11.
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 2-15.
AIC	The Alarm Interface Card (AIC) provides customer-defined (environmental) alarms with its additional input/output alarm contact closures. It also provides orderwire.	See the “2.6 AIC Card” section on page 2-18.
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 2-22.
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 “1.11 Alarm Expansion Panel” section on page 1-46

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	R2.2.1	R2.2.2	R3.0.1	R3.1	R3.2	R3.3	R3.4	R4.0	R4.1	R4.5	R4.6	R4.7	R5.0
TCC+	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—	—	—	—
TCC2	—	—	—	—	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes
TCC2P	—	—	—	—	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes
XC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes ¹
XCVT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—	—	—	Yes
XC10G	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	Yes	Yes
AIC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC-I	—	—	—	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AEP	—	—	—	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

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
TCC+ ¹	Yes	Yes
TCC2	Yes	Yes
TCC2P	Yes	Yes
XC ²	—	—
XCVT	Yes	—
XC10G	—	Yes
AIC	Yes	Yes
AIC-I	Yes	Yes
AEP	Yes	Yes

1. The TCC+ is not compatible with Software R5.0.

2. The XC card does not support features new to Release 5.0.

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, and transmux cards, but does not support features new to Release 5.0 and greater.

Table 2-4 Electrical Card Cross-Connect Compatibility

Electrical Card	XCVT Card	XC10G Card
EC1-12	Yes	Yes
DS1-14	Yes	Yes
DS1N-14	Yes	Yes
DS3-12	Yes	Yes
DS3N-12	Yes	Yes
DS3-12E	Yes	Yes
DS3N-12E	Yes	Yes
DS3/EC1-48	No	Yes
DS3XM-6 (Transmux)	Yes	Yes
DS3XM-12 (Transmux)	Yes	Yes
DS3i-N-12	Yes	Yes

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

**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 greater.

Table 2-5 Optical Card Cross-Connect Compatibility

Optical Card	XCVT Card	XC10G Card
OC3 IR 4 1310	Yes	Yes
OC3 IR 4/STM1 SH 1310	Yes	Yes
OC3 IR /STM1SH 1310-8	—	Yes
OC12 IR 1310	Yes	Yes
OC12 LR 1310	Yes	Yes
OC12 LR 1550	Yes	Yes
OC12 IR/STM4 SH 1310	Yes	Yes
OC12 LR/STM4 LH 1310	Yes	Yes
OC12 LR/STM4 LH 1550	Yes	Yes
OC12 IR/STM4 SH 1310-4	—	Yes

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

Optical Card	XCVT Card	XC10G Card
OC48 IR 1310	Yes	Yes
OC48 LR 1550	Yes	Yes
OC48 IR/STM16 SH AS 1310	Yes ¹	Yes
OC48 LR/STM16 LH AS 1550	Yes ²	Yes
OC48 ELR/STM16 EH 100 GHz	Yes	Yes
OC48 ELR 200 GHz	Yes	Yes
OC192 SR/STM64 IO 1310	—	Yes
OC192 IR/STM64 SH 1550	—	Yes
OC192 LR/STM64 LH 1550	—	Yes
OC192 LR/STM64 LH ITU 15xx.xx	—	Yes

1. Software R3.2 and later in Slots 5, 6, 12, 13.

2. Software R3.2 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 greater.

Table 2-6 *Ethernet Card Cross-Connect Compatibility*

Ethernet Cards	XCVT Card	XC10G Card ¹
E100T-12	Yes	—
E1000-2	Yes	—
E100T-G	Yes	Yes
E1000-2-G	Yes	Yes
G1000-4	—	Yes
G1K-4	Yes, in Slots 5, 6, 12, 13	Yes
ML100T-12	Yes, in Slots 5, 6, 12, 13	Yes
ML1000-2	Yes, in Slots 5, 6, 12, 13	Yes
CE 100T-8	Yes	Yes

1. The XC10G card requires a TCC+/TCC2/TCC2P card, Software R3.1 or later and the 15454-SA-ANSI or 154545-SA-HD shelf assembly to operate.

2.2 TCC2 Card

The TCC2 card, which requires Software R4.0 or later, 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.

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).

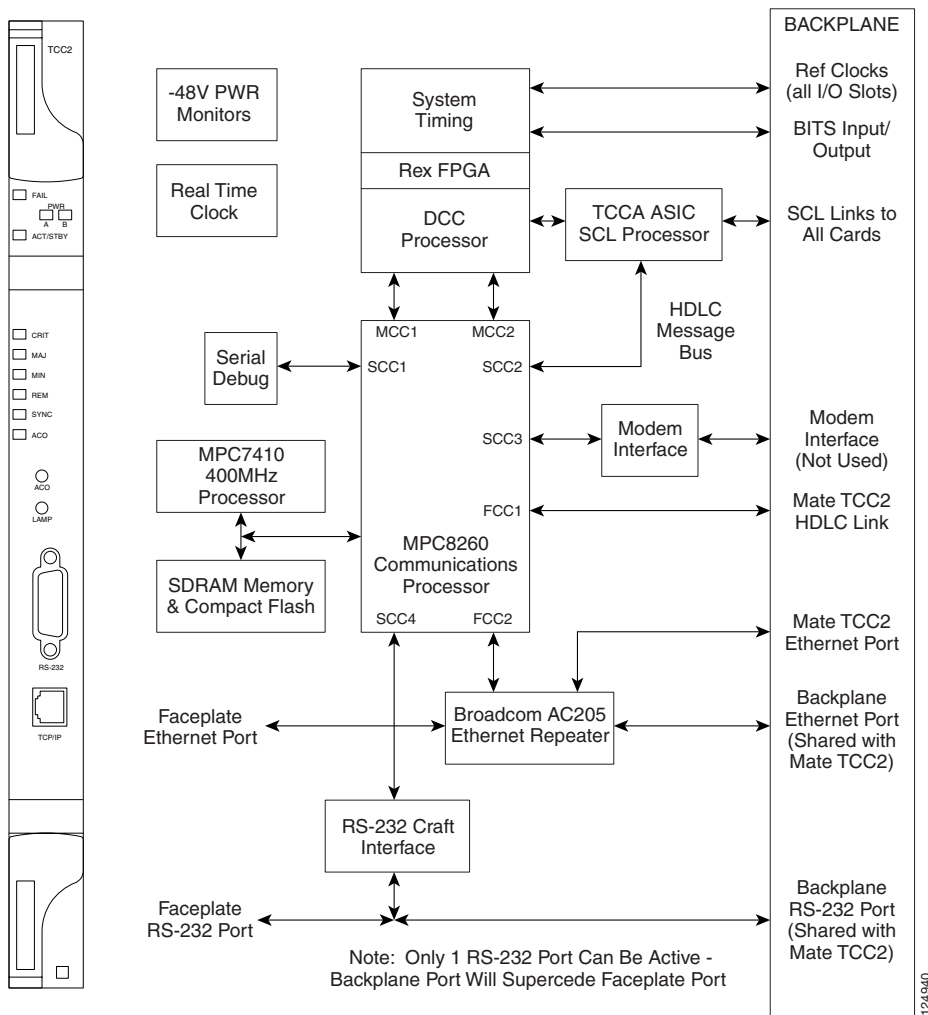


Note

The TCC2 card supports both -48 VDC and -60 VDC input requirements.

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 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 via the backplane.

**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 eight LEDs. [Table 2-7](#) describes the two card-level LEDs on the TCC2 card faceplate.

Table 2-7 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 2-8 describes the six network-level LEDs on the TCC2 faceplate.

Table 2-8 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.

2.3 TCC2P Card

The 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.



Note

The TCC2P card requires Software Release 4.0.0 or later.

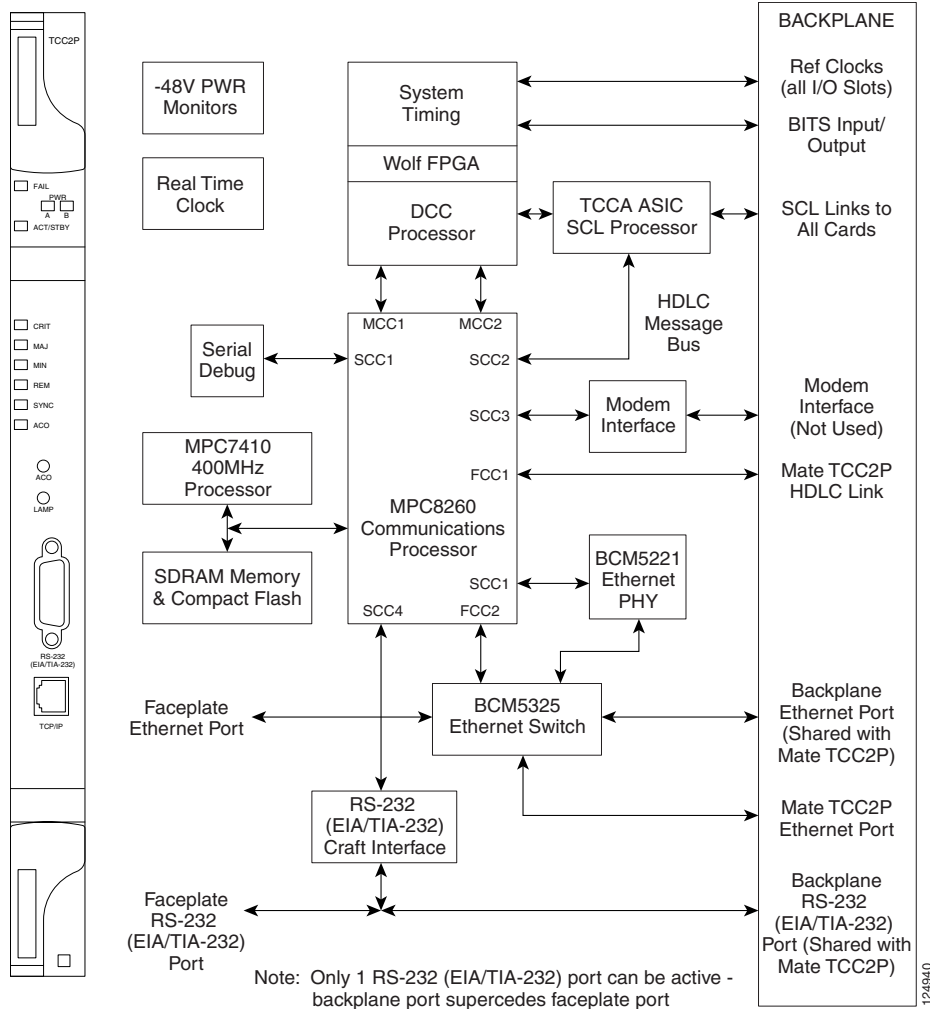


Note

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.

Figure 2-2 TCC2P Faceplate and Block Diagram



2.3.1 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.

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.

2.3.2 TCC2P Card-Level Indicators

The TCC2P faceplate has eight LEDs. [Table 2-9](#) describes the two card-level LEDs on the TCC2P faceplate.

Table 2-9 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 2-10](#) describes the six network-level LEDs on the TCC2P faceplate.

Table 2-10 TCC2P Network-Level Indicators

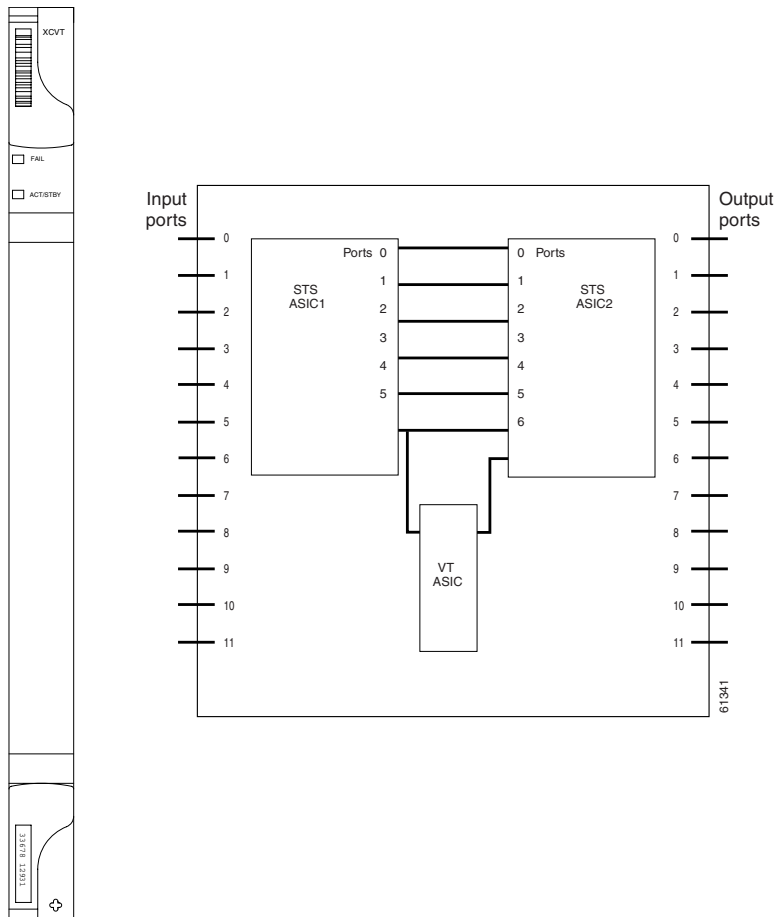
System-Level LEDs	Definition
Red CRIT LED	Indicates critical alarms in the network at the local terminal.
Red MAJ LED	Indicates major alarms in the network at the local terminal.
Amber MIN LED	Indicates minor alarms in the network at the local terminal.
Red REM LED	Provides first-level alarm isolation. 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 XCVT Card

The Cross Connect Virtual Tributary (XCVT) card establishes connections at the STS-1 and VT levels. The XCVT provides nonblocking STS-48 capacity to Slots 5, 6, 12, and 13, and nonbidirectional blocking STS-12 capacity to Slots 1 to 5 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

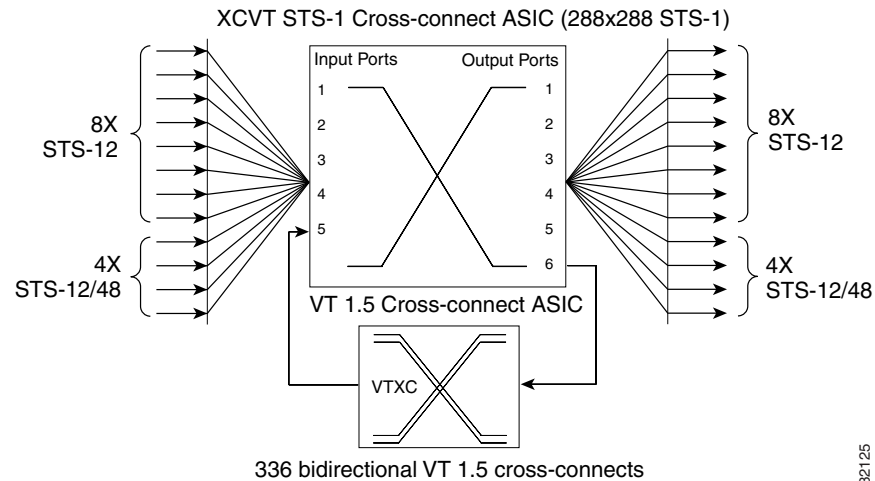
The XCVT card works with the TCC2/TCC2P card to maintain connections and set up cross-connects within the node. The XCVT or XC10G is required to operate the ONS 15454. You can establish cross-connect (circuit) information through CTC. The TCC2/TCC2P card establishes the proper internal cross-connect information and relays the setup information to the XCVT card.


Caution

Do not operate the ONS 15454 with only one XCVT or XC10G 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 2-11 shows the VT numbering scheme for the ONS 15454 as it relates to the Telcordia standard.

Table 2-11 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

Table 2-11 VT Mapping (continued)

ONS 15454 VT Number	Telcordia Group/VT Number
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

A single DS3XM-6 can demultiplex (map down to a lower rate) six DS-3 signals into 168 VT1.5s that the XCVT card manages and cross connects. XCVT cards host a maximum of 336 bidirectional VT1.5s. In most network configurations, two DS3XM-6 cards are paired as working and protect cards.

2.4.4 XCVT Card-Level Indicators

Table 2-12 shows the two card-level LEDs on the XCVT card faceplate.

Table 2-12 XCVT Card-Level Indicators

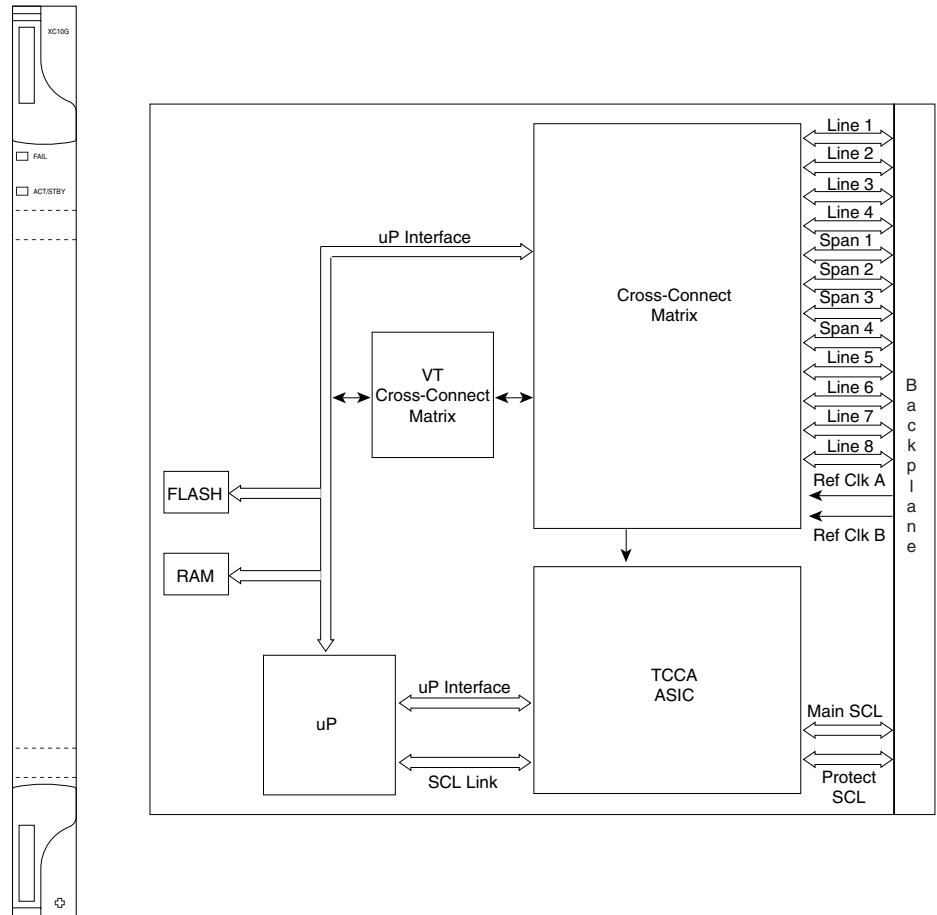
Card-Level Indicators	Definition
Red FAIL LED	Indicates that the cards processor is not ready. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Indicates whether the XCVT card is active and carrying traffic (green) or in standby mode to the active XCVT card (amber).

2.5 XC10G Card

The 10 Gigabit Cross Connect (XC10G) card cross connects STS-12, STS-48, and STS-192 signal rates. The XC10G allows up to four times the bandwidth of the XC and 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 card assigns bandwidth to each slot on a per STS-1 or per VT1.5 basis.

The XC10G or XCVT card is required to operate the ONS 15454. You can establish cross-connect (circuit) information through the CTC. The TCC2/TCC2P 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

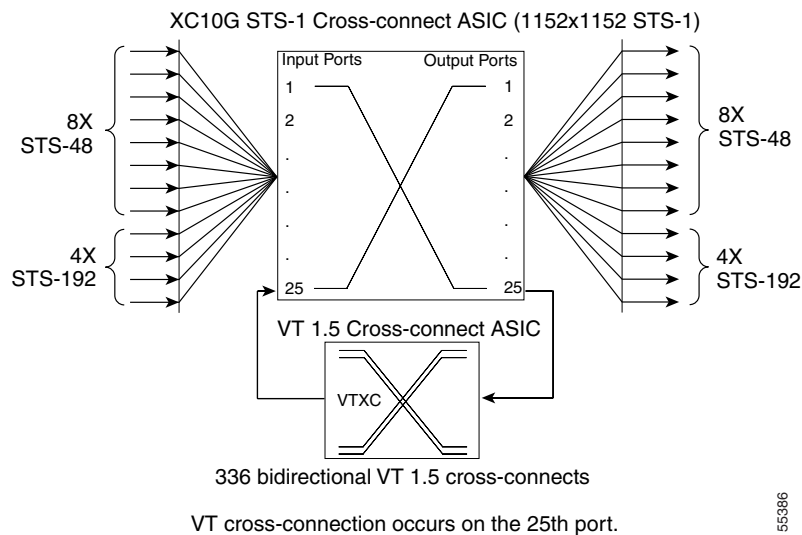
- 576 STS bidirectional cross-connects
- 672 VT1.5 ports via 24 logical STS ports
- 336 VT1.5 bidirectional cross-connects
- Nonblocking at STS level
- STS-1/3c/6c/12c/48c/192c cross-connects

**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 2-13 shows the VT numbering scheme for the ONS 15454 as it relates to the Telcordia standard.

Table 2-13 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

Table 2-13 VT Mapping (continued)

ONS 15454 VT Number	Telcordia Group/VT Number
VT7	Group7/VT1
VT8	Group1/VT2
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

2.5.3 XC10G Hosting DS3XM-6

A single DS3XM-6 can demultiplex (map down to a lower rate) six DS-3 signals into 168 VT1.5s that the XC10G card manages and cross connects. XC10G cards host a maximum of 336 bidirectional VT1.5 ports. In most network configurations two DS3XM-6 cards are paired as working and protect cards.

2.5.4 XC10G Hosting DS3XM-12

A single DS3XM-12 can demultiplex (map down to a lower rate) twelve DS-3 signals into 336 VT1.5s that the XC10G card manages and cross connects. XC10G cards host a maximum of 336 bidirectional VT1.5 ports. The DS3XM-12 cards supports 1:1 protection (cards are paired as working and protect). The DS3XM-12 also supports 1:N protection where one DS3XM-12 card can protect up to five DS3XM-12 cards or DS3XM-6 cards for ported protection, or up to seven DS3XM-12 cards for portless protection.

2.5.5 XC10G Card-Level Indicators

Table 2-14 describes the two card-level LEDs on the XC10G faceplate.

Table 2-14 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).

2.5.6 XCVT/XC10G Compatibility

The XC10G supports the same features as the XCVT card. The XC10G card is required for OC-192 operation and OC-48 any-slot (AS) operation. Do not use the XCVT card if you are using the OC-192 card or if you install an OC-48 AS card in Slots 1 to 4 or 14 to 17.



Note

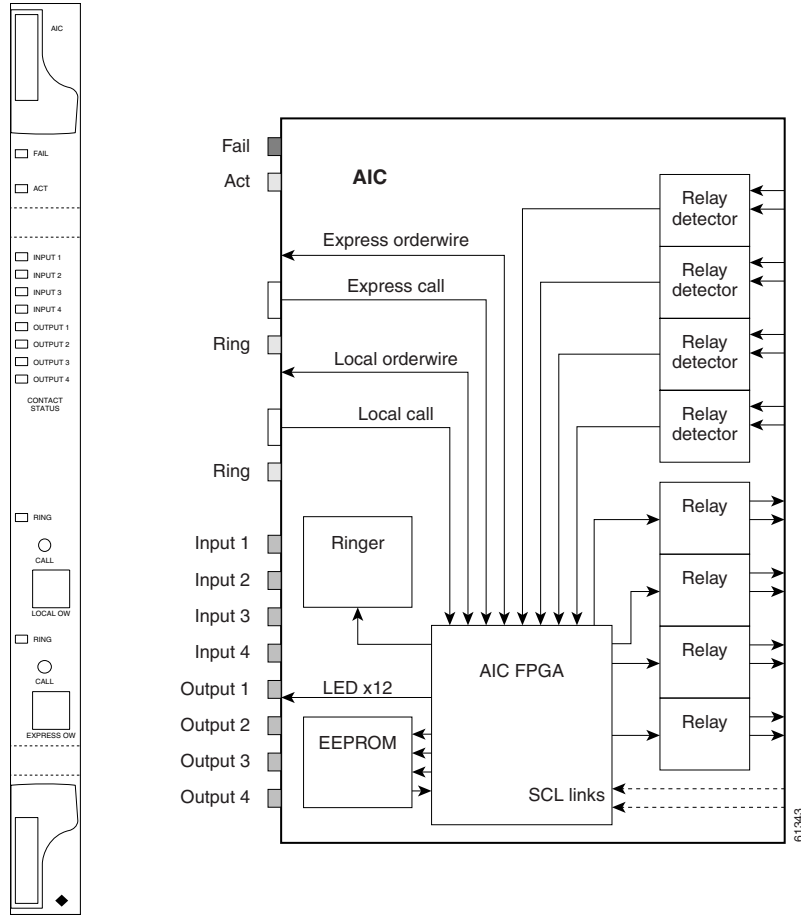
A configuration mismatch alarm occurs when an XCVT cross-connect card co-exists with an OC-192 card placed in Slots 5, 6, 12, or 13 or with an OC-48 card placed in Slots 1 to 4 or 14 to 17.

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

2.6 AIC Card

The optional Alarm Interface Controller (AIC) card provides customer-defined alarm input/output (I/O) and supports local and express orderwire. Figure 2-7 shows the AIC faceplate and a block diagram of the card.

Figure 2-7 AIC Faceplate and Block Diagram



2.6.1 AIC Card-Level Indicators

Table 2-15 describes the eight card-level LEDs on the AIC card faceplate.

Table 2-15 AIC 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 card is provisioned for operation.
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.

Table 2-15 AIC Card-Level Indicators (continued)

Card-Level LEDs	Description
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.

2.6.2 External Alarms and Controls

The AIC card provides provisionable input/output alarm contact closures for up to four external alarms and four external controls. The physical connections are made using the backplane wire-wrap pins. The alarms are defined using CTC and TL1. For instructions, refer to the *Cisco ONS 15454 Procedure Guide*.

Each alarm contact has a corresponding LED on the front panel of the AIC that indicates the status of the alarm. 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 four 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.

2.6.3 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 allows simultaneous use of both local (section overhead signal) and express (line overhead channel) orderwire channels on a SONET ring or particular optics facility. Local orderwire also allows communication at 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, which allow linear, single ring, dual ring, and small hub-and-spoke configurations. Orderwire is not protected in ring topologies such as BLSR and path protection.



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. There is no signaling for private point-to-point connections. 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.

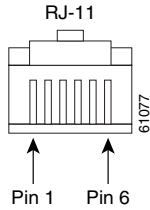
The AIC supports a “call” button on the module front panel which, when pressed, causes all ONS 15454 AICs on the orderwire subnetwork to “ring.” The ringer/buzzer resides on the AIC. There is also a “ring” LED that mimics the AIC ringer. It flashes when any “call” button is pressed on the orderwire subnetwork. The “call” button and ringer LED allow a remote craftsperson to get the attention of craftspeople across the network.

Table 2-16 shows the pins on the orderwire ports that correspond to the tip and ring orderwire assignments.

Table 2-16 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 orderwire pins.

Figure 2-8 RJ-11 Connector

2.7 AIC-I Card

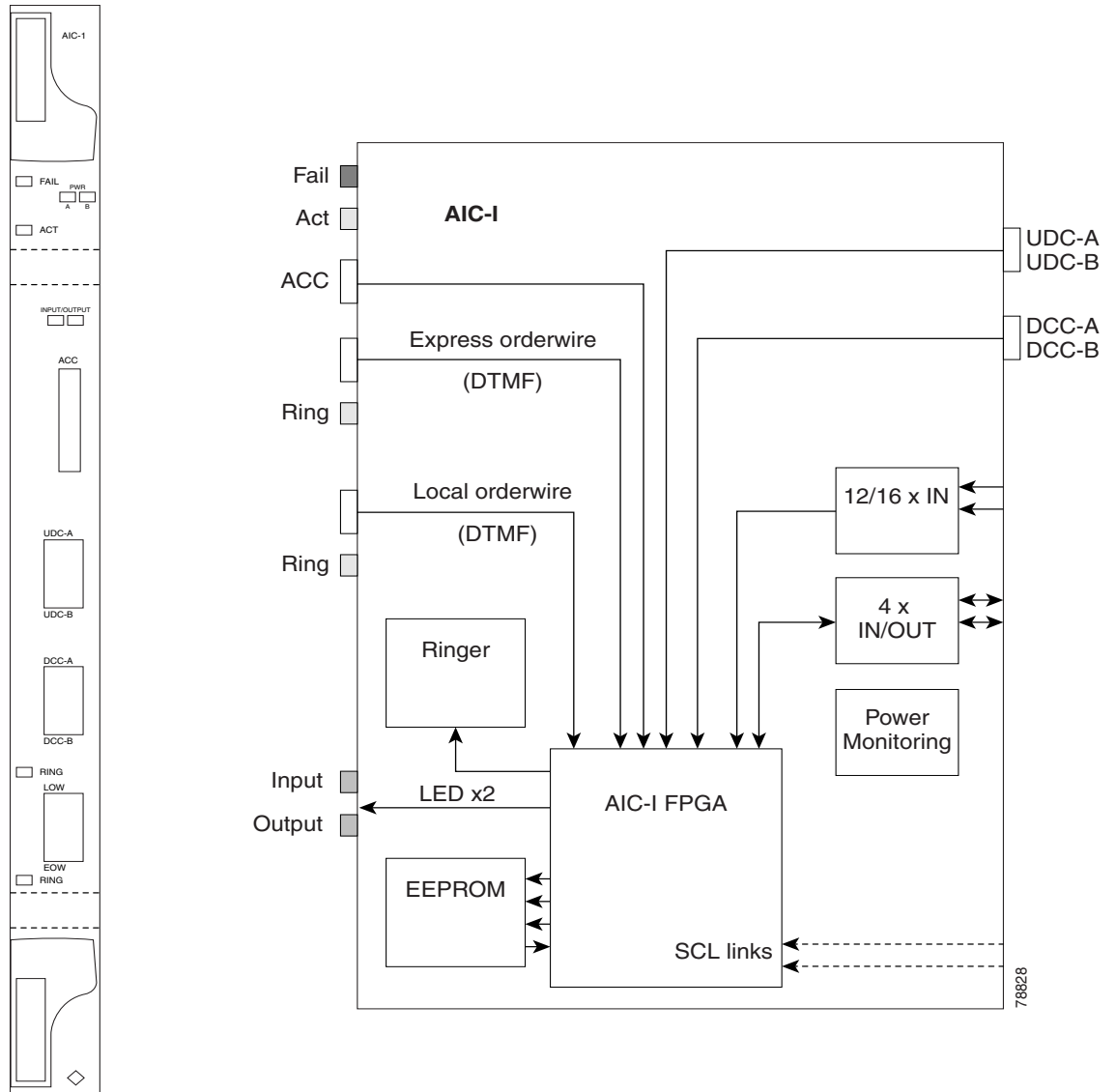
The optional Alarm Interface Controller-International (AIC-I) card provides customer-defined (environmental) alarms and controls and supports local and express orderwire. It provides 12 customer-defined input and 4 customer-defined input/output contacts. The physical connections are via the backplane wire-wrap pin terminals. If you use the additional 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.



Note

After you have upgraded a shelf to the AIC-I card and set new attributes, you cannot downgrade the shelf back to the AIC card.

Figure 2-9 AIC-I Faceplate and Block Diagram



2.7.1 AIC-I Card-Level Indicators

Table 2-17 describes the eight card-level LEDs on the AIC-I card faceplate.

Table 2-17 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 2-17 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 12 external alarm inputs and 4 external alarm inputs/outputs (user configurable). The physical connections are made using the backplane wire-wrap pins. See the “[1.11 Alarm Expansion Panel](#)” section on page 1-46 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 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 channel) orderwire channels on a SONET 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 BLSR and path protection.



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 2-18 shows the pins on the orderwire connector that correspond to the tip and ring orderwire assignments.

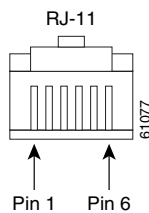
Table 2-18 Orderwire Pin Assignments

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” in the *Cisco ONS 15454 Procedure Guide*.

The UDC ports are standard RJ-11 receptacles. Table 2-19 lists the UDC pin assignments.

Table 2-19 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 data communications channels, 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 standard RJ-45 receptacles. [Table 2-20](#) lists the DCC pin assignments.

Table 2-20 DCC Pin Assignments

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

