Card Protection

This chapter explains the Cisco ONS 15454 card protection configurations. To provision card protection, refer to the *Cisco ONS 15454 Procedure Guide*.

Chapter topics include:

7.1 Electrical Card Protection

The ONS 15454 provides a variety of electrical card protection methods. This section describes the protection options. Figure 7-1 shows a 1:1 protection configuration and Figure 7-2 on page 7-3 shows a 1:N protection configuration.

This section covers the general concept of electrical card protection. Specific electrical card protection schemes depend on the Electrical Interface Assembly (EIA) type used on the ONS 15454 backplane. Table 7-1 on page 7-4 details the specific electrical card protection schemes.

Note   An ONS 15454 configuration needs at least two slots reserved for OC-N cards.
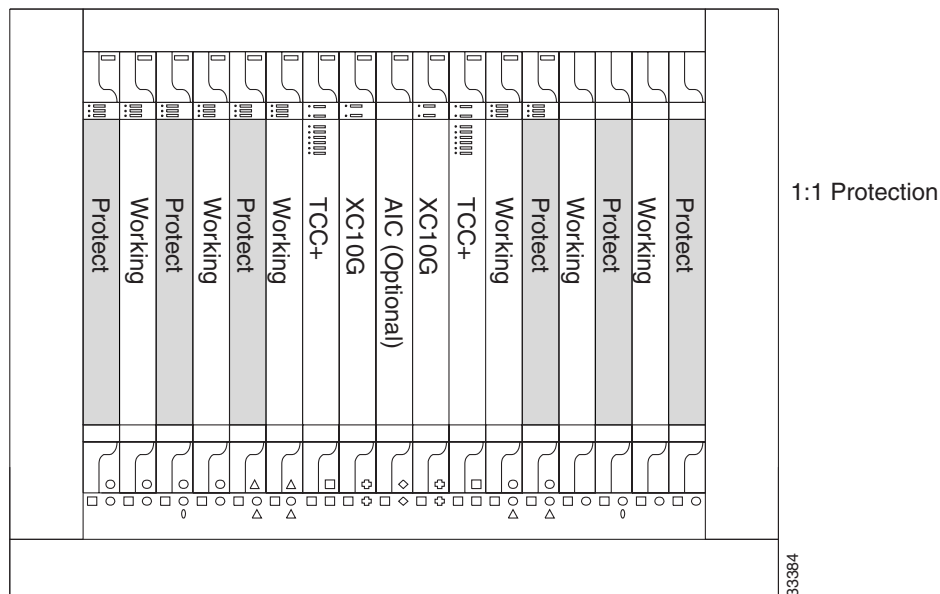
Caution   When a protection switch moves traffic from the DS3-12 working/active card to the DS3-12 protect/standby card, ports on the new active/standby card cannot be placed out of service as long as traffic is switched. Lost traffic can result when a port is taken out of service, even if the DS3-12 standby card no longer carries traffic.

7.1.1 1:1 Protection

In 1:1 protection, a working card is paired with a protect card of the same type. If the working card fails, the traffic from the working card switches to the protect card. You can provision 1:1 to be revertive or nonrevertive. If revertive, traffic automatically reverts to the working card after the failure on the working card is resolved. Figure 7-1 shows the ONS 15454 in a 1:1 protection configuration. Each working card in an even-numbered slot is paired with a protect card in an odd-numbered slot: Slot 1 is protecting Slot 2, Slot 3 is protecting Slot 4, Slot 5 is protecting Slot 6, Slot 17 is protecting Slot 16, Slot 15 is protecting Slot 14, and Slot 13 is protecting Slot 12.

Figure 7-1   ONS 15454 Cards in a 1:1 Protection Configuration (SMB EIA Only)
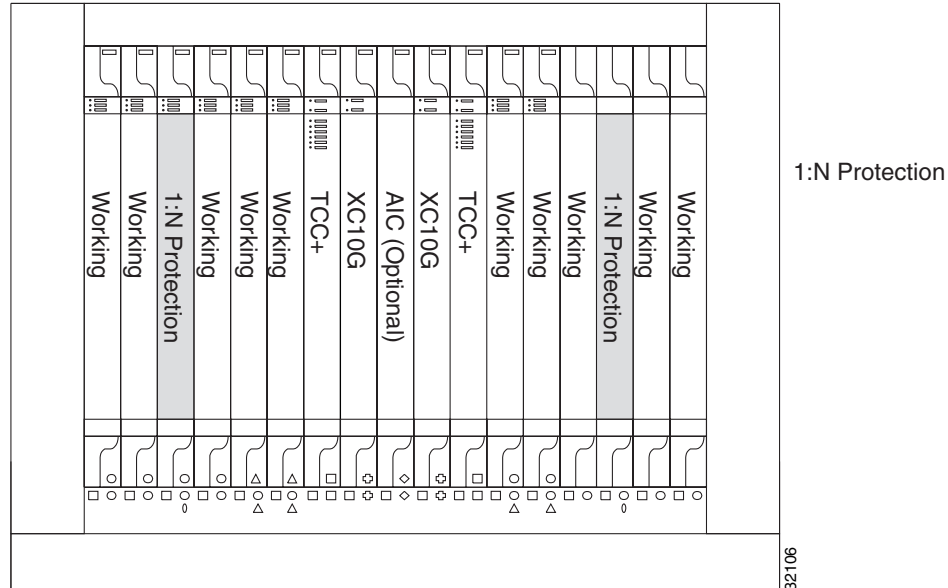

7.1.2 1:N Protection

1:N protection allows a single card to protect up to five working cards of the same speed, DS-1 or DS-3. A DS1N-14 card protects DS1-14 cards, a DS3N-12 card protects DS3-12 cards, and DS3N-12E cards protect DS3-12E cards. DS3i-N-12 cards can only protect other like DS3i-N-12 cards. The standard DS1-14, DS3-12, and DS3-12E cards provide 1:1 protection only. 1:N protection operates only at the DS-1 and DS-3 levels. 1:N cards have added circuitry to act as the protect card in a 1:N protection group. Otherwise, the card is identical to the standard card and can serve as a normal working card.

The physical DS-1 or DS-3 interfaces on the ONS 15454 backplane use the working card until the working card fails. When the node detects this failure, the protect card takes over the physical DS-1 or DS-3 electrical interfaces through the relays and signal bridging on the backplane. Figure 7-2 shows the ONS 15454 in a 1:N protection configuration. Each side of the shelf assembly has only one card protecting all of the cards on that side.

Figure 7-2   ONS 15454 Cards in a 1:N Protection Configuration (SMB EIA Only)

7.1.2.1 Revertive Switching

1:N protection supports revertive switching. Revertive switching sends the electrical interfaces (traffic) back to the original working card after the card comes back online. Detecting an active working card triggers the reversion process. There is a variable time period for the lag between detection and reversion, called the revertive delay, which you can set using the ONS 15454 software, Cisco Transport Controller (CTC). To set the revertive delay, refer to the *Cisco ONS 15454 Procedure Guide*. All cards in a protection group share the same reversion settings. 1:N protection groups default to automatic reversion.

7.1.2.2 1:N Protection Guidelines

Several rules apply to 1:N protection groups in the ONS 15454:

- Working and protect card groups must reside in the same card bank (A or B).
- The 1:N protect card must reside in Slot 3 for side A and Slot 15 for side B.
- Working cards may sit on either or both sides of the protect card.

The ONS 15454 supports 1:N equipment protection for all add-drop multiplexer (ADM) configurations (ring, linear, and terminal), as specified by Telcordia GR-253-CORE.

The ONS 15454 automatically detects and identifies a 1:N protect card when the card is installed in Slot 3 or Slot 15. However, the slot containing the 1:N card in a protection group must be manually provisioned as a protect slot because by default all cards are working cards.

For detailed procedures on setting up DS-1 and DS-3 protection groups, refer to the *Cisco ONS 15454 Procedure Guide*.

7.2 Electrical Card Protection and the Backplane

Protection schemes for electrical cards depend on the Electrical Interface Assembly (EIA) type used on the ONS 15454 backplane. The difference is due to the varying connector size. For example, because BNC connectors are larger, fewer DS3-12 cards can be supported when using a BNC connector. Table 7-1 shows the electrical card protection for each EIA type.

Note   For EIA installation, refer to the *Cisco ONS 15454 Procedure Guide*.
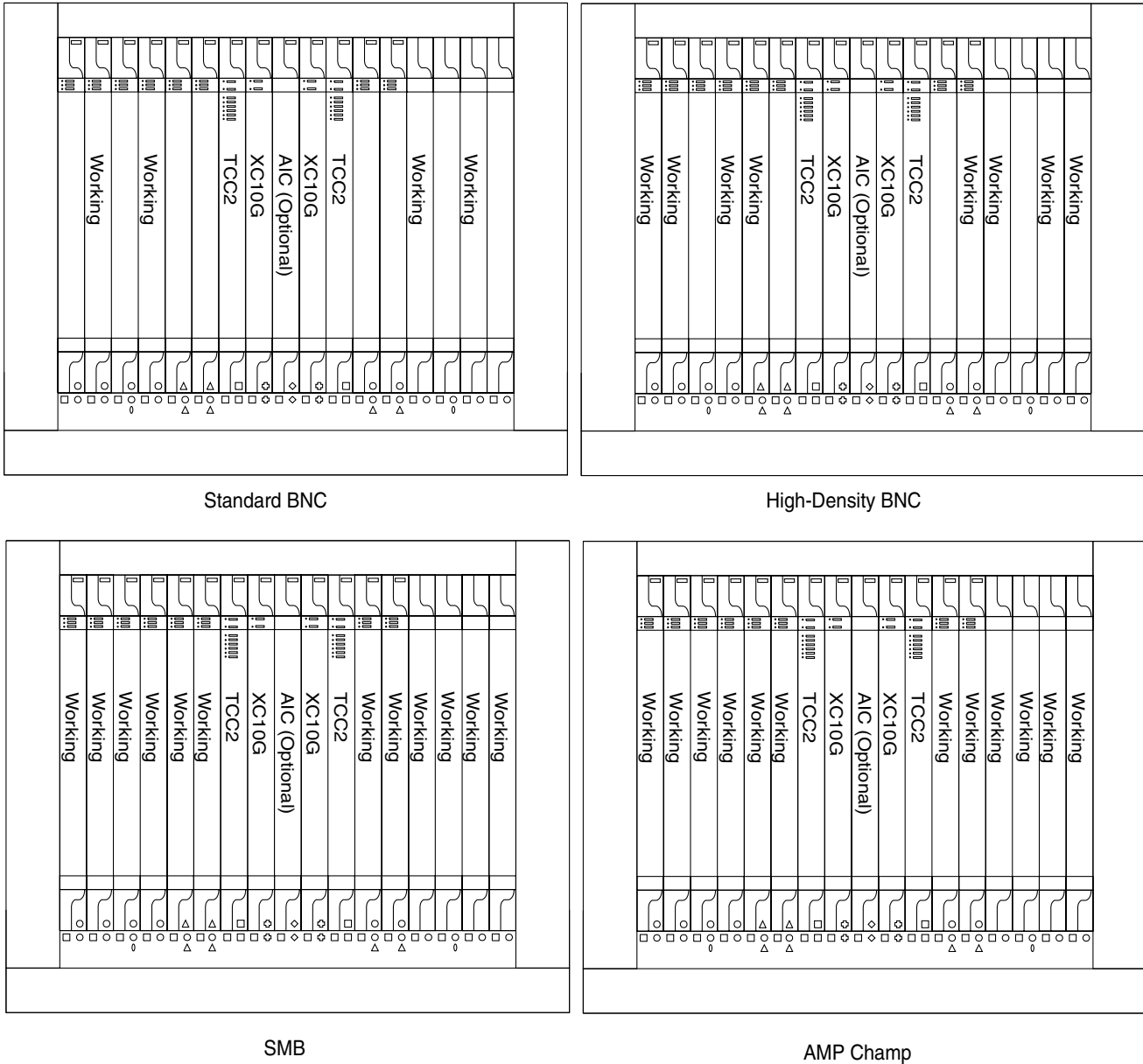
Caution   When a protection switch moves traffic from the DS3-12 working/active card to the DS3-12 protect/standby card, ports on the new active/standby card cannot be taken out of service as long as traffic is switched. Lost traffic can result when a port is taken out of service even if the DS3-12 standby card no longer carries traffic.

Table 7-1   Electrical Card Protection With EIA Types

Protection Rules	Standard BNC (24 per Side)	High-Density BNC (48 per Side)	SMB (84 per Side)	AMP Champ (84 per Side)
Working card slots (unprotected)	2, 4, 14 and 16	1, 2, 4, 5, 13, 14, 16 and 17	1, 2, 3, 4, 5, 6, 12, 13, 14, 15, 16 and 17	1, 2, 3, 4, 5, 6, 12, 13, 14, 15, 16 and 17
Working card slots (1:1 protection)	2, 4, 14 and 16	2, 4, 14 and 16	2, 4, 6, 12,14,16	2, 4, 6, 12, 14, 16
Protection card slots (1:1 protection)	1, 3, 15 and 17	1, 3, 15, 17	1, 3, 5, 13, 15, 17	1, 3, 5, 13, 15, 17
Working card slots (1:N protection)	2, 4, 14 and 16	1, 2, 4, 5, 13, 14, 16 and 17	1, 2, 4, 5, 6, 12, 13, 14, 16 and 17	1, 2, 4, 5, 6, 12, 13, 14, 16 and 17
Protection card slots (1:N protection)	3 and 15	3 and 15	3 and 15	3 and 15
Unsupported electrical card slots	5, 6, 12 and 13	6 and 12	None	None

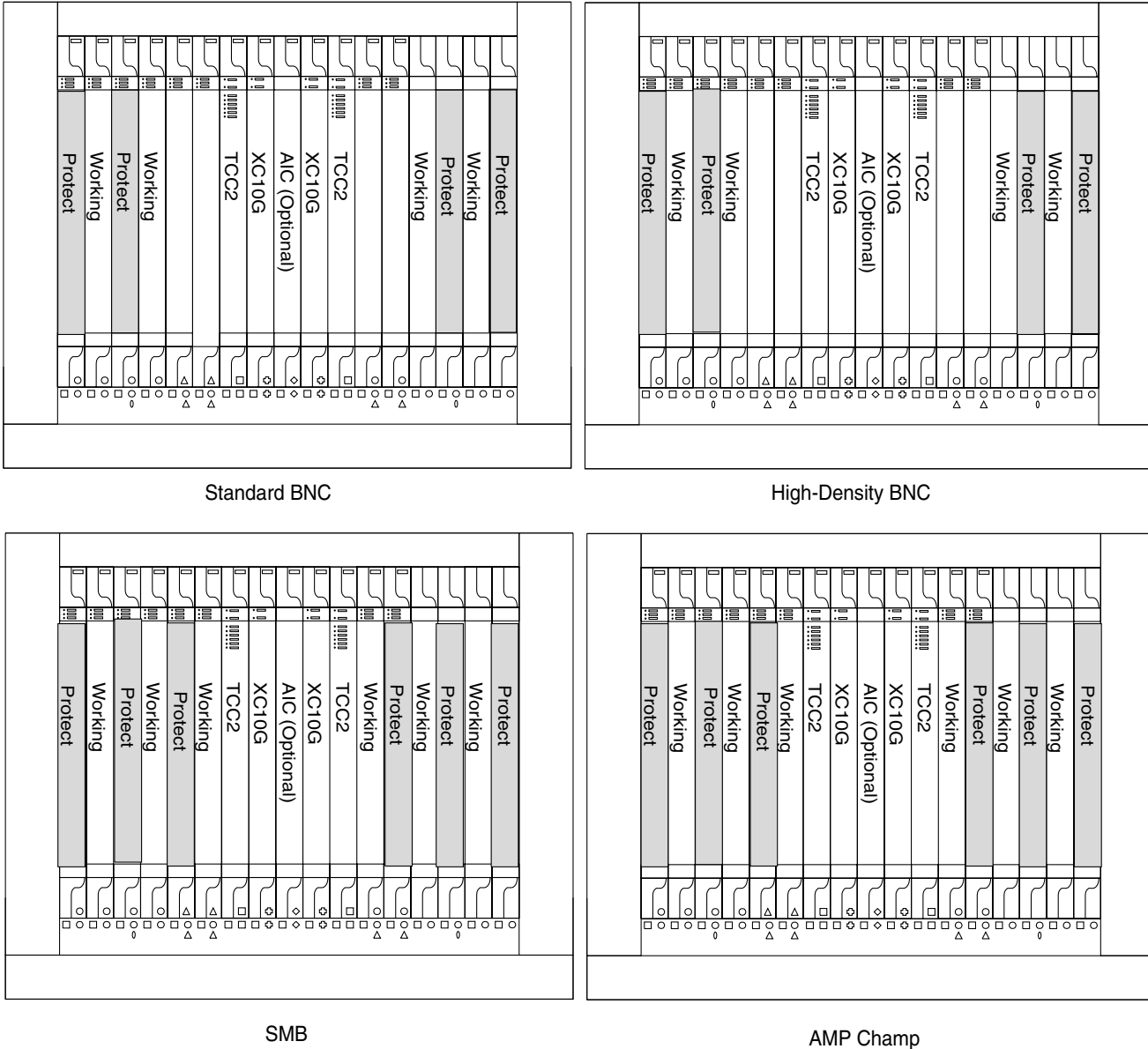Figure 7-3 shows unprotected electrical card schemes by EIA type.

Figure 7-3   Unprotected Electrical Card Schemes for EIA Types

Standard BNC

High-Density BNC

SMB

AMP Champ

110407

Figure 7-4 shows 1:1 protection by EIA type.

Figure 7-4   1:1 Protection Schemes for Electrical Cards with EIA Types

Standard BNC

High-Density BNC

SMB

AMP Champ

Figure 7-5 shows 1:N protection for DS-1 and DS-3 cards.

Figure 7-5   1:N Protection Schemes for DS-1 and DS-3 Cards with EIA Types

Standard BNC

High-Density BNC

SMB

AMP Champ

Note   EC-1 cards do not support 1:N protection.

7.2.1 Standard BNC Protection

When you use BNC connectors, the ONS 15454 supports 1:1 protection or 1:N protection for a total of four working DS-3 electrical cards per shelf or 48 BNCs per shelf. If you are using EC-1 electrical cards with the BNC EIA, the ONS 15454 supports 1:1 protection and a total of four working cards. Slots 2, 4, 14, and 16 are designated working slots. These slots are mapped to a set of 12 BNC connectors on the EIA. These slots can be used without protection for unprotected DS-3 access.

With 1:N or 1:1 protection, Slots 1, 3, 15, and 17 are designated for protection when BNC connectors are used. With 1:N protection, Slots 3 and 15 are also designated for protection when BNC connectors are used. Slots 5, 6, 12, and 13 do not support DS3-12 cards when you use the regular BNC EIA.

7.2.2 High-Density BNC Protection

When you use the high-density BNC EIA, the ONS 15454 supports 1:1 protection or 1:N protection for eight total working DS-3 electrical cards per shelf or 96 BNCs. If you are using EC-1 electrical cards with the high-density BNC EIA, the ONS 15454 supports 1:1 protection and a total of eight working cards. Slots 1, 2, 4, 5, 13, 14, 16, and 17 are designated working slots.

These slots are mapped to a set of 12 BNC type connectors on the EIA. You can use these slots without protection for unprotected DS-3 or EC-1 access. Slots 3 and 15 are designated for 1:N protection slots when you use BNC connectors with the high-density BNC EIA. Slots 6 and 12 do not support DS-3 or EC-1 cards when you use the high-density BNC EIA.

7.2.3 SMB Protection

When you use SMB connectors, the ONS 15454 supports 1:1 or 1:N protection for the DS-1 and the DS-3 electrical cards. If you are using EC-1 cards with the SMB EIA, the ONS 15454 supports 1:1 protection. Working and protection electrical cards are defined by card slot pairs (the same card type is used for working and protect modules; the protection of the card is defined by the slot where it is housed). Each slot maps to a set of 12 or 14 SMB connectors on the EIA depending on the number of ports on the corresponding card. Any slot can be used without protection for unprotected DS-1, DS-3, or EC-1 access.

The DS1N-14 card can be a working or protect card in 1:1 or 1:N protection schemes. When used with 1:N protection, the DS1N-14 card can protect up to five DS1-14 plug-ins using the SMB connectors with the DS-1 electrical interface adapters (baluns).

7.2.4 AMP Champ Protection

When you use AMP Champ connectors, the ONS 15454 supports 1:1 or 1:N protection for the DS-1 cards. The DS1N-14 card can be a working or protect card in 1:1 or 1:N protection schemes. When used with 1:N protection, the DS1N-14 card can protect up to five DS1-14 plug-ins using the AMP Champ EIA.

7.3 OC-N Card Protection

With 1+1 port-to-port protection, any number of ports on the protect card can be assigned to protect the corresponding ports on the working card. The working and protect cards do not have to be placed side by side in the node. A working card must be paired with a protect card of the same type and number of ports. For example, a single-port OC-12 must be paired with another single-port OC-12, and a four-port OC-12 must be paired with another four-port OC-12. You cannot create a 1+1 protection group if one card is single-port and the other is multiport, even if the OC-N rates are the same. The protection takes place on the port level, and any number of ports on the protect card can be assigned to protect the corresponding ports on the working card.

For example, on a four-port card, you can assign one port as a protection port on the protect card (protecting the corresponding port on the working card) and leave three ports unprotected. Conversely, you can assign three ports as protection ports and leave one port unprotected. With 1:1 or 1:N protection (electrical cards), the protect card must protect an entire slot. In other words, all the ports on the protect card are used in the protection scheme.

1+1 span protection can be either revertive or nonrevertive. With nonrevertive 1+1 protection, when a failure occurs and the signal switches from the working card to the protect card, the signal stays switched to the protect card until it is manually switched back. Revertive 1+1 protection automatically switches the signal back to the working card when the working card comes back online. 1+1 protection is unidirectional and nonrevertive by default; revertive switching is easily provisioned using CTC.

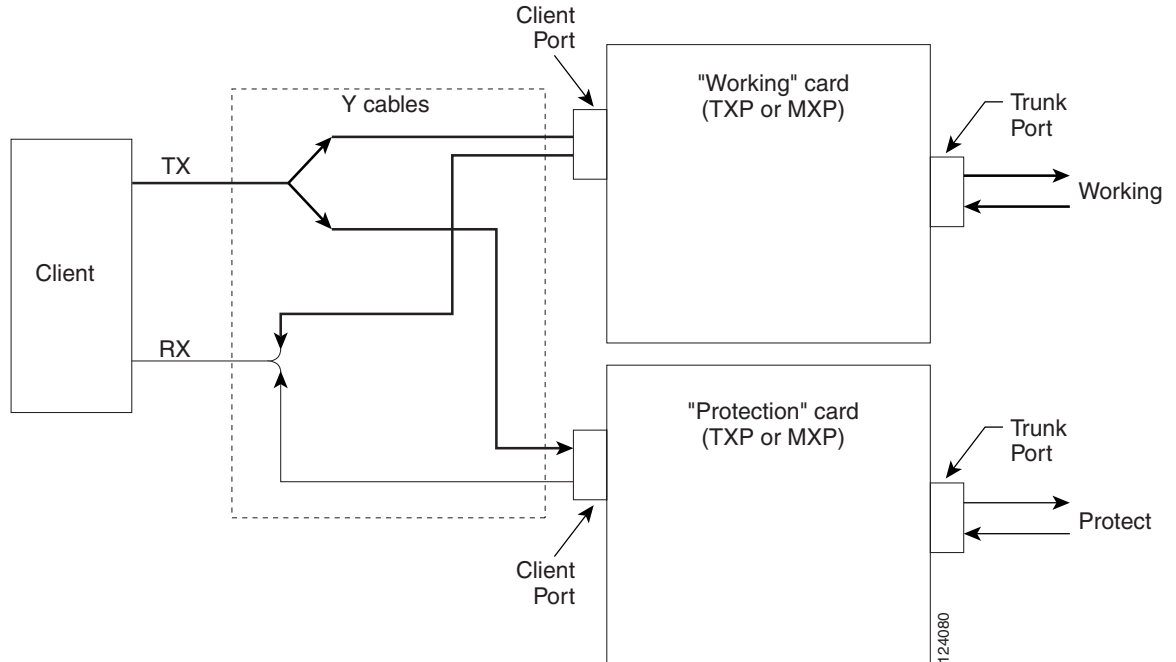# 7.4 Transponder and Muxponder Protection

To create Y-cable protection, you create a Y-cable protection group for two TXP or MXP cards using the CTC software, then connect the client ports of the two cards physically with a Y-cable. The single client signal is sent into the Rx Y-cable and is split between the two TXP or MXP cards. The two Tx signals from the trunk side of the TXP or MXP cards are combined in the TX Y-cable into a single client signal. Only the active card signal passes through as the single TX client signal. The other card must have its laser turned off to avoid signal degradation where the Y-cable joins. Figure 7-6 shows the Y-cable signal flow. The Y-cable protection scheme always switches on the trunk side of the TXP or MXP cards. The client side does not switch.

The alarm severity of the client-side Loss of Signal (LOS) alarm is based on the protection status of the card; a critical (CR) alarm is raised for a working card and a minor (MN) alarm is raised for a standby card. If a working card has an active LOS alarm, the alarm severity is CR even though the circuit is protected.
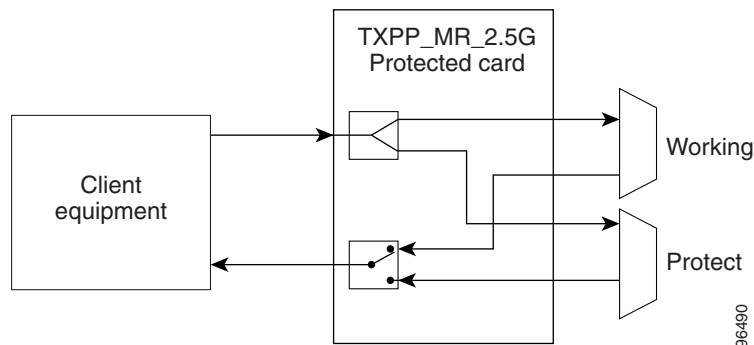
Note   Loss of Signal–Payload (LOS-P), also called Incoming Payload Signal Absent, alarms can occur on a split signal if the ports are not in a Y-cable protection group.

Figure 7-6   Y-Cable Protection

Splitter protection, shown in Figure 7-7, is provided with the TXPP_MR_2.5G card. With splitter protection, the single client signal is split on the trunk side on two different paths. The TXPP card on the RX end chooses one of the two signals and switches to the other in case of failure. The trigger mechanisms for the protection switch are loss of signal (LOS), signal degrade (SD), signal failure (SF), and ITU-T G.709 loss of frame (LOF), LOM, and ODU-AIS.
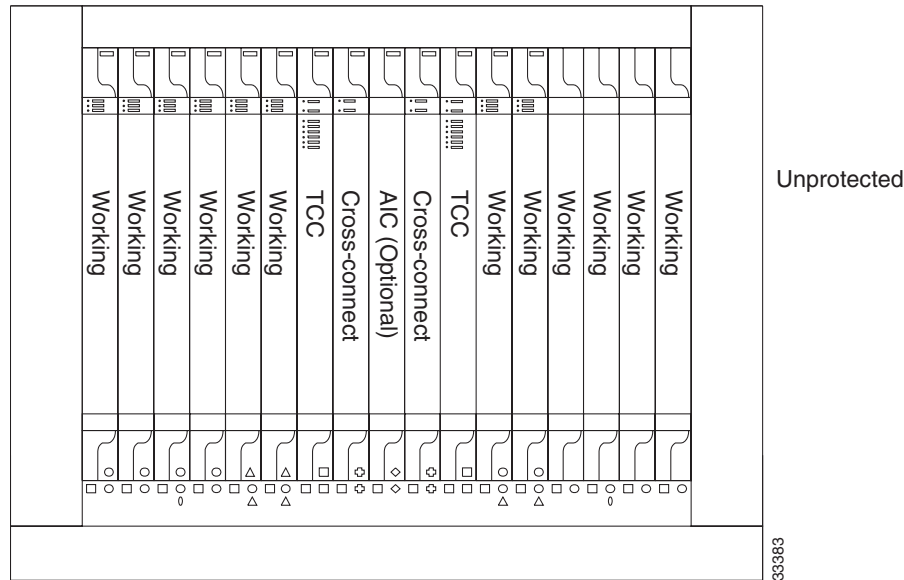
Figure 7-7   Splitter Protection

You create and modify protection schemes using CTC software. For more information, refer to the *Cisco ONS 15454 Procedure Guide*.

7.5 Unprotected Cards

Unprotected cards are not included in a protection scheme; therefore, a card failure or a signal error results in lost data. Because no bandwidth lies in reserve for protection, unprotected schemes maximize the available ONS 15454 bandwidth. Figure 7-8 shows the ONS 15454 in an unprotected configuration. All cards are in a working state.

Figure 7-8   ONS 15454 in an Unprotected Configuration

7.6 External Switching Commands

The external switching commands on the ONS 15454 are Manual, Force, and Lockout. If you choose a Manual switch, the command will switch traffic only if the path has an error rate less than the signal degrade bit error rate threshold. A Force switch will switch traffic even if the path has SD or SF conditions. A Force switch has a higher priority than a Manual switch. Lockouts can only be applied to protect cards (in 1+1 configurations) and prevent traffic from switching to the protect port under any circumstance. Lockouts have the highest priority. In a 1+1 configuration you can also apply a lock on to the working port. A working port with a lock on applied cannot switch traffic to the protect port in the protection group (pair). In 1:1 protection groups, working or protect ports can have a lock on.

Note   Force and Manual switches do not apply to 1:1 protection groups; these ports have a single switch command.