



Card Protection



Note

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

This chapter describes the card and port protection configurations for the Cisco ONS 15310-CL and Cisco ONS 15310-MA. To provision protection, refer to the "Turn Up a Node" chapter in the *Cisco ONS 15310-CL and Cisco ONS 15310-MA Procedure Guide*. Chapter topics include:

- [4.1 Overview, page 4-1](#)
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4.1 Overview

The Cisco ONS 15310-CL has a single common control card (15310-CTX-CL), so no redundant common-control protection is available. The only card protection available is 1+1 optical protection through the two optical ports. The ONS 15310-CL does not provide electrical interface protection (1:1 and 1:N).

The optical ports on the 15310-CTX-CL card are provided through Small Form-factor Pluggables (SFPs), which are referred to as pluggable port modules (PPMs) in Cisco Transport Controller (CTC), the ONS 15310-CL software interface. See the "[3.2.4 15310-CL-CTX Optical Interfaces](#)" section on [page 3-7](#) for more information.

The Cisco ONS 15310-MA has a pair of common control cards (CTX2500), each with two optical ports, and up to four electrical cards (DS1-28/DS3-EC1-3 or DS1-84/DS3-EC1-3). 1:1 protection groups are supported for like pairs of electrical cards, and 1+1 protection groups can be set up between two optical ports on the same CTX2500 card or between the optical ports on two separate CTX2500 cards. Optimized 1+1 protection can be set up by provisioning optical ports as Synchronous Digital Hierarchy (SDH) ports.

When two CTX2500 cards are installed, the CTX2500 card is 1:1 protected. The 15310-MA can function in a single CTX2500 configuration mode.

4.2 ONS 15310-CL Port Protection

This section describes the port protection methods for the ONS 15310-CL.

4.2.1 1+1 Optical Port Protection

When you set up 1+1 optical protection for the ONS 15310-CL, the working optical port on one ONS 15310-CL node is paired with a working optical port on other ONS 15310-CL nodes in a 1+1 protection group. Similarly, the protect optical port on one ONS 15310-CL node is paired with protect optical ports on other ONS 15310-CL nodes in a 1+1 protection group. The data rate and port type of the protect port must match that of the working port. Because the ONS 15310-CL has only two optical ports, they must always be in the same protection group. The rates of the two ports must be the same, either OC-3 or OC-12.

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 port to the protect port, the signal stays switched until it is manually switched back. Revertive 1+1 protection automatically switches the signal back to the working port when the working port comes back online after the wait-to-restore (WTR) time has elapsed.

To provision 1+1 protection, refer to the “Turn Up a Node” chapter in the *Cisco ONS 15310-CL and Cisco ONS 15310-MA Procedure Guide*.

4.2.2 Unprotected Ports

An unprotected port is not included in a protection scheme; therefore, a port failure or a signal error results in lost data. Because no bandwidth lies in reserve for protection, unprotected schemes maximize the available ONS 15310-CL bandwidth. Unprotected is the default protection type.

4.3 ONS 15310-MA Card and Port Protection

This section describes the card and port protection methods for the ONS 15310-MA.

4.3.1 1:1 Electrical Card Protection

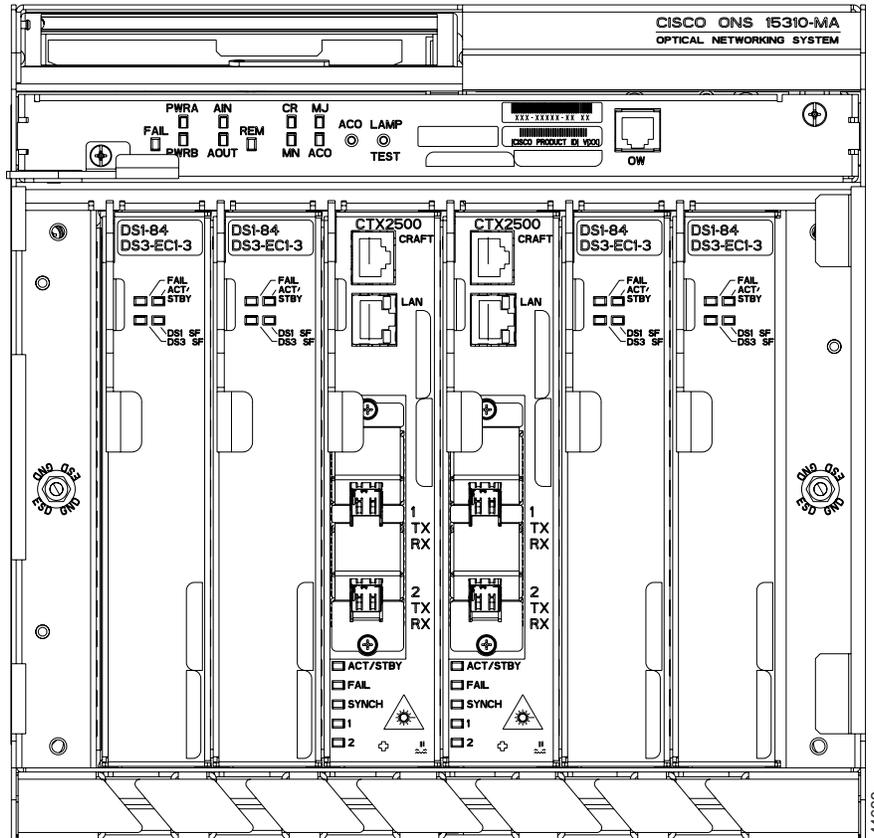
The ONS 15310-MA chassis accommodates two types of electrical cards, the DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3, and one type of common-control card, the CTX2500. [Figure 4-1](#) illustrates one possible chassis configuration, with two CTX2500 cards and two pairs of DS1-84/DS3-EC1-3 cards.

The following examples show a few of the several possible ONS 15310-MA chassis configurations:

- No electrical cards at all. This is the case if you choose to install Ethernet cards, such as the CE-100T-8 or ML-100T-8, instead of electrical cards. The Ethernet cards cannot be used to form a protection group.
- Unprotected electrical cards. This is the case if, instead of a pair of electrical cards in Slots 1 and 2 or 5 and 6, you install only a single electrical card in Slots 1, 2, 5, or 6. A filler card or Ethernet card must be installed in a slot where an input/output (I/O) card is missing.

- A single CTX2500 card. In this case, a filler card must be installed in a slot where a CTX2500 card is missing.
- A mix of electrical cards. A DS1-28/DS3-EC1-3 card can protect an adjacent DS1-28/DS3-EC1-3 card, a DS1-84/DS3-EC1-3 card can protect an adjacent DS1-84/DS3-EC1-3 card, and a DS1-84/DS3-EC1-3 card can protect an adjacent DS1-28/DS3-EC1-3 card. However, a DS1-28/DS3-EC1-3 card cannot protect an adjacent DS1-84/DS3-EC1-3 card.

Figure 4-1 ONS 15310-MA Chassis Card Layout



The configuration of the backplane connectors creates two sets of paired (adjacent) expansion slots for electrical cards. Slots 1 and 2 are a pair and Slots 5 and 6 are a pair. When two electrical cards are plugged into either of the card-slot pairs, the ONS 15310-MA automatically creates a 1:1 protection group for the two cards, if possible. If a protection group cannot be created (see the rules for protection group creation later in this section), one of the cards will be marked as UNKNOWN with the state as MISMATCH in CTC, because the ONS 15310-MA cannot support two unprotected electrical cards in the 1–2 or 5–6 card slot pairs. The 1:1 automatic protection group is created when the second electrical card in a pair is either plugged in or is preprovisioned.

Unprotected is the default state for the first electrical card plugged into (or preprovisioned) in either the Slot 1-to-2 or Slot 5-to-6 card slot pairs. When the second card is plugged in or preprovisioned, the protection group is created, if possible.

When protection groups are created, the following rules must be noted:

1. The protection group will be automatically created if possible. If the node cannot create the protection group automatically, then the second card to be plugged in or preprovisioned will be shown as UNKNOWN with the state as MISMATCH in CTC.
2. If possible, the ONS 15310-MA designates the cards in Slots 1 and 5 as working. If Slot 1 or 5 cannot be working (due to violation of one of the other rules), then Slot 2 or 6 will be the working slot.
3. Cards can protect like cards. In addition, a DS1-84/DS3-EC1-3 card can protect a DS1-28/DS3-EC1-3 card. However, a DS1-28/DS3-EC1-3 card cannot protect a DS1-84/DS3-EC1-3 card.
4. If the first card to be provisioned has existing circuits or is in use as a timing source when the second card is provisioned, then the first card must become the working card and cannot become the protect card.
5. The timing source will not switch to a protect card, when a soft reset is executed on the card that is used as a timing source.
6. Automatic protection groups default to nonrevertive. The protection group can be edited to turn on reversion and set a revert time. The protection group can also be edited to change the protection group name.

The following scenario does not result in the creation of a protection group because rules are violated:

1. Plug a DS1-84/DS3-EC1-3 card into Slot 1 and provision a circuit on it.
2. Plug a DS1-28/DS3-EC1-3 card into Slot 2.

The DS1-84/DS3-EC1-3 card needs to be the working card, because it has a circuit on it (see Rule 4). However, the DS1-28/DS3-EC1-3 card cannot protect the DS1-84/DS3-EC1-3 card (see Rule 3), so no protection group is formed.

The following scenario also does not result in the creation of a protection group because rules are violated:

1. Plug a DS1-28/DS3-EC1-3 card into Slot 1 and enable the retiming option on it.
2. Plug a DS1-84/DS3-EC1-3 card into Slot 2.

Because the DS1-84/DS3-EC1-3 card does not support retiming, it cannot become a protection card for the DS1-28/DS3-EC1-3 card, so no protection group is formed.

The following scenario results in the creation of a protection group because no rules are violated:

1. Plug a DS1-28/DS3-EC1-3 card into Slot 1 and provision a circuit on it.
2. Plug a DS1-84/DS3-EC1-3 card into Slot 2.

A protection group is automatically formed, with the DS1-28/DS3-EC1-3 card operating as the working card, and the DS1-84/DS3-EC1-3 card operating as the protection card.

Automatic protection groups cannot be created or deleted by users. A protection group is automatically deleted when the protect card is deleted.

4.3.2 1+1 Optical Port Protection

With two CTX2500 cards installed, four optical ports are available (two on each card). A 1+1 protection group can be created between any two pairs of optical ports with matched port rates.

A protection group can be created using two ports on the same CTX2500 card or between ports on adjacent CTX2500 cards. You can also create a 1+1 protection group on each card for a total of two protection groups. In this case, working and protection ports are provisioned on Slot 3 and working and protection ports are provisioned on Slot 4 (the same card can have both working and protect ports on it).

The CTX2500 card supports optimized 1+1 protection groups. Optimized 1+1 protection is mainly used in networks that have linear 1+1 bidirectional protection schemes and it requires that optical ports are provisioned to SDH. Optimized 1+1 is a line-level protection scheme that includes two lines: working and protect. One of the two lines assumes the role of the primary channel, from which traffic is selected, and the other port assumes the role of the secondary channel, which protects the primary channel. Traffic switches from the primary to the secondary channel based on either an external switching command or line conditions. After the line condition or the external switching command that was responsible for a switch clears, the roles of the two sides are reversed.

4.3.3 .CTX2500 Card Equipment Protection

The ONS15310MA supports a single and dual CTX2500 card configurations. In the dual configuration, with a CTX2500 card inserted in Slot 3 and Slot 4, the CTX2500 card is also protected. One of the cards becomes the active card and the other becomes the standby card. Soft resets executed in the dual CTX2500 card configuration as well as in the single CTX2500 card configuration are errorless. Software upgrades in the single and dual configurations are also errorless.

In the dual configuration, there is a switchover from the active CTX2500 card to standby CTX2500 card during the soft reset of the active CTX2500 card. After the soft reset or software upgrade, the old standby CTX2500 card becomes the new active CTX2500 card. The old active CTX2500 card becomes the standby CTX2500 card.

The CTX2500 card is equipment protected in a dual CTX2500 card configuration. Any reset occurring on the active CTX2500 card that is triggered due to failure causes a switchover of the CTX2500 card, causing the old standby card to become the active card.

If there are any path protection or 1+1 protected ports configured across the two CTX2500 cards, a protection switch will cause the port on the active CTX2500 card to become the active port for 1+1 or the path protection selector.

**Note**

- Any unprotected port on the CTX2500 card being reset may undergo a traffic loss when the CTX2500 is reinitialized.
- If protection exists between two optical ports on the same CTX2500 card and if that CTX2500 card is reset, the traffic may be affected when the CTX2500 card is reinitialized.

The two items above do not apply for a user-initiated soft reset or software upgrade. These resets are errorless

4.4 Automatic Protection Switching

Unidirectional switching allows traffic on the transmit and receive optical fibers to switch independently.

With nonrevertive 1+1 protection, automatic protection switching (APS) switches a signal after a failure from the working port to the protect port and the signal stays switched to the protect port until it is manually switched back. Revertive switching automatically switches the signal back to the working port when the working port comes back online. 1+1 protection is unidirectional and nonrevertive by default; revertive switching is easily provisioned using CTC.

Traffic over a 1+1 APS link is errorless during a soft reboot or a software upgrade for ONS 15310-CL nodes regardless of whether the 1+1 APS protection is active.

4.5 External Switching Commands

The external switching commands on the ONS 15310-CL and ONS 15310-MA are Manual, Force, and Lock Out. A Manual switch will switch traffic if the path has an error rate less than the signal degrade (SD). A Force switch will switch traffic even if the path has SD or signal fail (SF) conditions. A Force switch has a higher priority than a Manual switch. In 1+1 mode, however, if there is an SF condition on the protect line, the SF condition has a higher priority than Force, and Force cannot override the SF condition to make a switch to the protect line. Lockouts can only be applied to a protect port (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).