



CHAPTER 7

Protection Switching Module

This chapter describes the Protection Switching Module (PSM) card used in Cisco ONS 15454 dense wavelength division multiplexing (DWDM) networks. For installation and card turn-up procedures, refer to the *Cisco ONS 15454 DWDM Procedure Guide*. For card safety and compliance information, refer to the *Cisco Optical Transport Products Safety and Compliance Information* document.



Note

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

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7.1 PSM Card Overview

The PSM card performs splitter protection functions. In the transmit (TX) section of the PSM card (see [Figure 7-1](#)), the signal received on the common receive port is duplicated by a hardware splitter to both the working and protect transmit ports. In the receive (RX) section of the PSM card ([Figure 7-1](#)), a switch is provided to select one of the two input signals (on working and protect receive ports) to be transmitted through the common transmit port.

The PSM card supports multiple protection configurations:

- Channel protection—The PSM COM ports are connected to the TXP/MXP trunk ports.
- Line (or path) protection—The PSM working (W) and protect (P) ports are connected directly to the external line.
- Multiplex section protection—The PSM is equipped between the MUX/DMX stage and the amplification stage.
- Standalone—The PSM can be equipped in any slot and supports all node configurations.

The PSM card is a single-slot card that can be installed in any node from Slot 1 to 6 and 12 to 17. The PSM card includes six LC-PC-II optical connectors on the front panel. In channel protection configuration, the PSM card can be installed in a different shelf from its peer TXP/MXP card.



Note It is strongly recommended that you use the default layouts designed by Cisco Transport Planner, which place the PSM card and its peer TXP/MXP card as close as possible to simplify cable management.

For more information on the node configurations supported for the PSM card, see the [“11.3 Supported Node Configurations for PSM Card” section on page 11-43](#).

For more information on the network topologies supported for the PSM card, see the [“12.6 Network Topologies for the PSM Card” section on page 12-19](#).

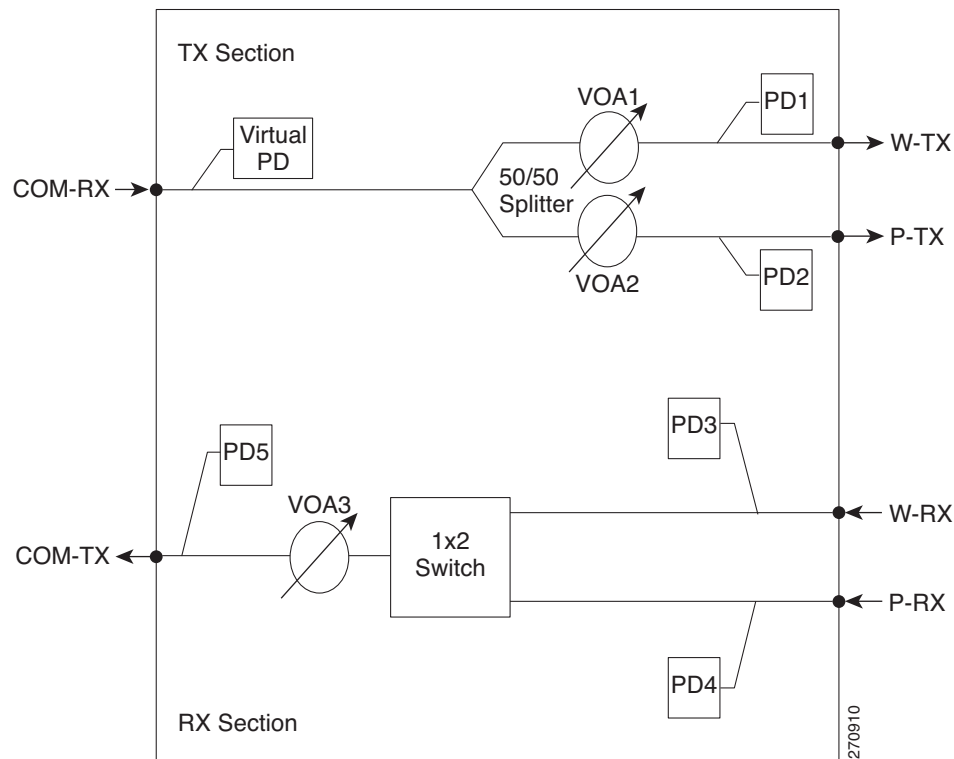
7.2 Key Features

The PSM card provides the following features:

- Operates over the C-band (wavelengths from 1529 nm to 1562.5 nm) and L-band (wavelengths from 1570.5 nm to 1604 nm) of the optical spectrum.
- Implements bidirectional nonrevertive protection scheme. For more details on bidirectional switching, see the [“7.6 PSM Bidirectional Switching” section on page 7-5](#).
- Supports automatic creation of splitter protection group when the PSM card is provisioned.
- Supports switching priorities based on ITU-T G.873.1.
- Supports performance monitoring and alarm handling with settable thresholds.
- Supports automatic laser shutdown (ALS), a safety mechanism used in the event of a fiber cut. ALS is applicable only in line protection configuration. For details on ALS provisioning for the card, refer to the *Cisco ONS 15454 DWDM Procedure Guide*. For information about using the card to implement ALS in a network, see the [“12.11 Network Optical Safety” section on page 12-30](#).

7.3 PSM Block Diagram

[Figure 7-1](#) shows a simplified block diagram of the PSM card.

Figure 7-1 PSM Block Diagram

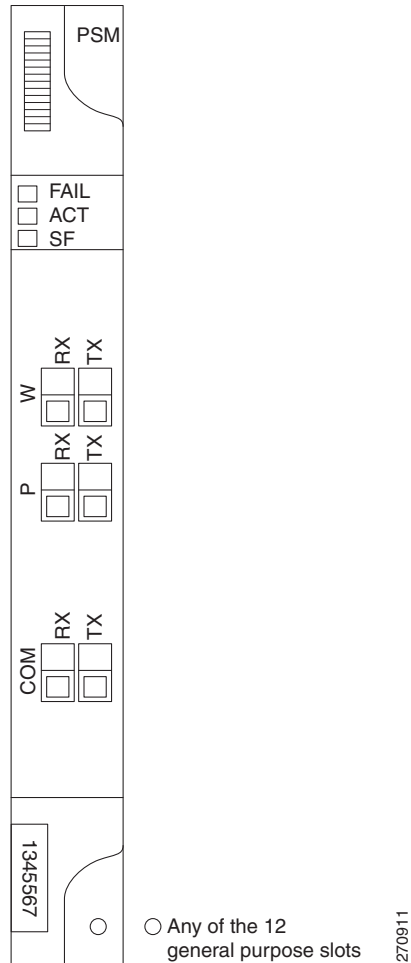
7.4 PSM Faceplate Ports

The PSM card has six optical ports located on the faceplate:

- COM-RX (receive) is the input signal port.
- COM-TX (transmit) is the output signal port.
- W-RX is the working input signal port (receive section).
- W-TX is the working output signal port (transmit section).
- P-RX is the protect input signal port (receive section).
- P-TX is the protect output signal port (transmit section).

All ports are equipped with photodiodes to monitor optical power and other related thresholds. The COM-RX port is equipped with a virtual photodiode (firmware calculations of port optical power) to monitor optical power. The W-RX, P-RX, W-TX, and P-TX ports have optical power regulation, which are provided by variable optical attenuators (VOA). All VOAs equipped within the PSM card work in control attenuation mode.

Figure 7-2 shows the PSM card faceplate.

Figure 7-2 PSM Card Faceplate

7.5 PSM Card-Level Indicators

Table 7-1 shows the three card-level indicators on the PSM card.

Table 7-1 PSM Card-Level Indicators

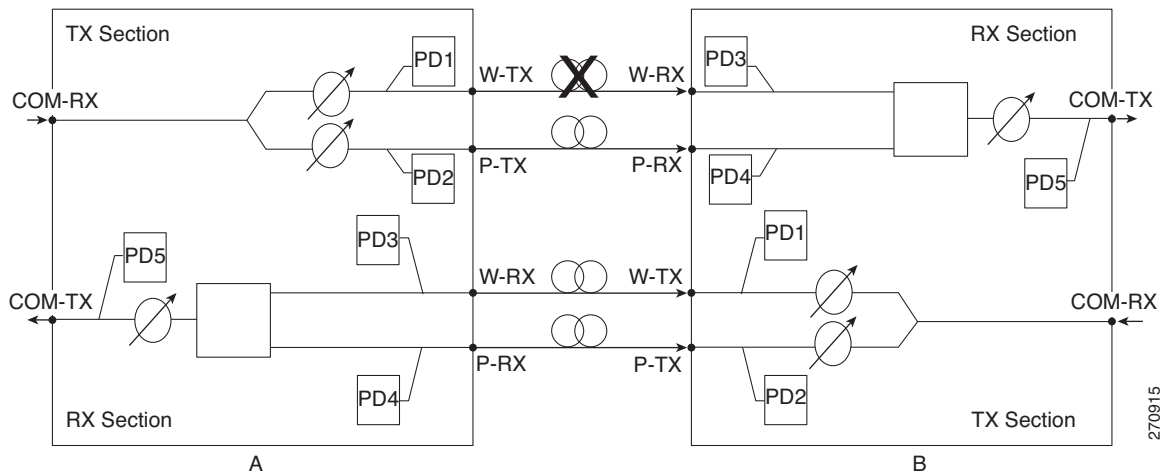
Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that an internal hardware failure occurred. Replace the card if the red FAIL LED persists.

Table 7-1 PSM Card-Level Indicators (continued)

Card-Level Indicators	Description
Green ACT LED	The green ACT LED indicates that the PSM is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.6 PSM Bidirectional Switching

A VOA is equipped after the hardware splitter within the PSM card. The VOA implements bidirectional switching when there is a single fiber cut in a protection configuration involving two peer PSM cards. [Figure 7-3](#) shows a sample configuration that explains the bidirectional switching capability of the PSM card.

Figure 7-3 PSM Bidirectional Switching

In this example, there is a fiber cut in the working path from Station A to Station B as shown in [Figure 7-3](#). As a result of the fiber cut, an LOS alarm is raised on the W-RX port of Station B and it immediately switches traffic on to its P-RX port. Station B simultaneously also stops transmission (for approximately 25 milliseconds) on its W-TX port, which raises an LOS alarm on the W-RX port of Station A. This causes Station A to also switch traffic to its P-RX port. In this way, PSM implements bidirectional switching without any data exchange between the two stations.

Since the two stations do not communicate using signaling protocols (overhead bytes), a Manual or Force protection switch on the PSM card is implemented by creating a traffic hit. For example, consider that you perform a Manual or Force protection switch on Station A. The TX VOA on the active path is set to automatic VOA shutdown (AVS) state for 25 milliseconds. This causes Station B to switch traffic to the other path because it cannot differentiate between a maintenance operation and a real fail. After 25 milliseconds, the VOA in Station A is automatically reset. However, Station B will not revert back by itself because of nonrevertive switching protection scheme used in the PSM card.

To effectively implement switching, the Lockout and Force commands must be performed on both the stations. If these commands are not performed on both the stations, the far-end and near-end PSMs can be misaligned. In case of misalignment, when a path recovers, traffic might not recover automatically. You might have to perform a Force protection switch to recover traffic.

**Note**

The order in which you repair the paths is important in the event of a double failure (both the working and protect paths are down due to a fiber cut) on the PSM card in line protection configuration when the active path is the working path. If you repair the working path first, traffic is automatically restored. However, if you repair the protect path first, traffic is not automatically restored. You must perform a Force protection switch to restore traffic on the protect path.