



## Shelf Configuration Rules

---

The design of the Cisco ONS 15540 ESPx requires that a set of rules be followed during physical configuration of the shelf. These rules, along with examples, are provided in this chapter. This chapter contains the following major sections:

- [Shelf Rules for Mux/Demux Motherboards, page 3-1](#)
- [Shelf Rules for 4-Channel and 8-Channel Add/Drop Mux/Demux Modules, page 3-2](#)
- [Shelf Rules for 32-Channel Terminal Mux/Demux Modules, page 3-5](#)
- [Shelf Rules for Transponder Modules, page 3-5](#)
- [Shelf Rules for Line Card Motherboards, page 3-6](#)
- [Shelf Rules for PSMs, page 3-7](#)
- [Cabling Rules for Cross Connect Drawers, page 3-7](#)
- [General Rules for Ring Topologies, page 3-8](#)



### Note

Applying the shelf configuration rules requires an understanding of the Cisco ONS 15540 ESPx system components and protection schemes. See especially the [“System Components” section on page 1-4](#) and the [“About Protection Against Fiber and System Failures” section on page 2-1](#).

---

## Shelf Rules for Mux/Demux Motherboards

This section describes the shelf rules for mux/demux motherboards.

### OSC Support

In configurations where the OSC is not used, only one mux/demux motherboard is required on the shelf. When the OSC is used, two mux/demux motherboards with OSC support are required on the shelf.

# Shelf Rules for 4-Channel and 8-Channel Add/Drop Mux/Demux Modules

This section describes the shelf rules for 4-channel and 8-channel add/drop mux/demux modules for different types of protection.

## Add/Drop Mux/Demux Modules Without Protection

In an unprotected configuration, a shelf can have only one 4-channel or 8-channel add/drop mux/demux module with a given channel band transmitting and receiving in a given direction (either west or east). [Table 3-1](#) lists the conflicting bands 4-channel and 8-channel add/drop mux/demux modules. If an add/drop mux/demux module that supports a band in a particular row of column 1 in [Table 3-1](#) is installed on a shelf in an unprotected configuration, that shelf cannot also have a module that supports any of the conflicting bands in column 2 transmitting and receiving in the same direction. For example, modules for band A and band AB both cannot transmit to and receive from the west.

**Table 3-1** Conflicting Bands for Add/Drop Mux/Demux Module

Band	Conflicting Bands
A	A with OSC, AB, AB with OSC
B	B with OSC, AB, AB with OSC
C	C with OSC, CD, CD with OSC
D	D with OSC, CD, CD with OSC
E	E with OSC, EF, EF with OSC
F	F with OSC, EF, EF with OSC
G	G with OSC, GH, GH with OSC
H	H with OSC, GH, GH with OSC
A with OSC	A, AB, any band with OSC
B with OSC	B, AB, any band with OSC
C with OSC	C, CD, any band with OSC
D with OSC	D, CD, any band with OSC
E with OSC	E, EF, any band with OSC
F with OSC	F, EF, any band with OSC
G with OSC	G, GH, any band with OSC
H with OSC	H, GH, any band with OSC
AB	A, A with OSC, B, B with OSC, AB, AB with OSC
CD	C, C with OSC, D, D with OSC, CD, CD with OSC
EF	E, E with OSC, F, F with OSC, EF, EF with OSC
GH	G, G with OSC, H, H with OSC, GH, GH with OSC
AB with OSC	A, B, AB, any band with OSC
CD with OSC	C, D, CD, any band with OSC

**Table 3-1** *Conflicting Bands for Add/Drop Mux/Demux Module (continued)*

Band	Conflicting Bands
EF with OSC	E, F, EF, any band with OSC
GH with OSC	G, H, GH, any band with OSC

## Add/Drop Mux/Demux Modules with Protection

When configuring channels to use splitter protection or line card protection, two 4-channel or 8-channel add/drop mux/demux modules with the same channels must be present on the shelf. [Table 3-1](#) lists the conflicting bands when using the 4-channel or 8-channel add/drop mux/demux modules. If two add/drop mux/demux modules that support a band in a particular row of column 1 in [Table 3-1](#) are installed on a shelf in an unprotected configuration, that shelf cannot also have other mux/demux modules that support any of the conflicting bands in column 2. For example, if the two mux/demux modules support band A, then there can be no mux/demux modules supporting band AB on the same shelf.

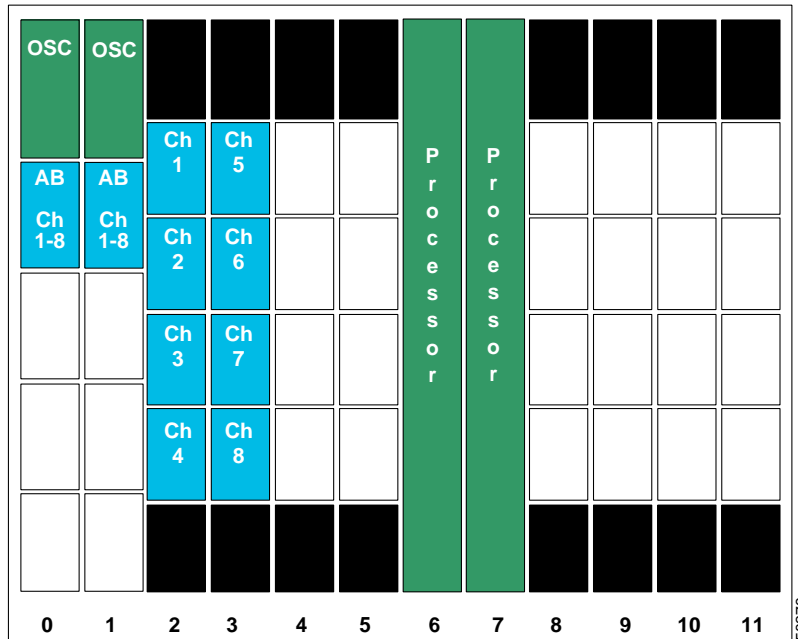


**Note**

During migration, one of the modules might not be present, or one of the modules might contain only a subset of the channels present on the other module.

[Figure 3-1](#) shows an example shelf configuration for splitter protection with add/drop mux/demux modules for band AB in positions 0/0 and 1/0.

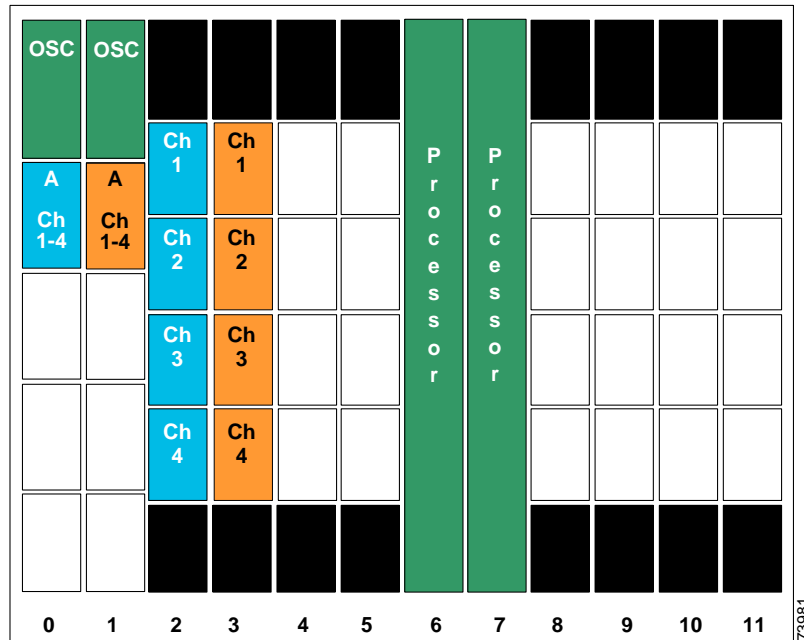
**Figure 3-1** *Example Installation of Add/Drop Mux/Demux Modules with Splitter Protection*



56279

Figure 3-2 shows an example shelf configuration for line card protection with add/drop mux/demux modules for band A in positions 0/0 and 1/0.

Figure 3-2 Example Installation of Add/Drop Mux/Demux Modules with Line Card Protection



## Cabling Add/Drop Mux/Demux Modules

The following rules apply when cabling the trunk and thru interfaces on the 4-channel and 8-channel add/drop mux/demux modules:

- Use optical fiber cables with MU connectors for cabling the mux/demux modules to each other and to the OSC.
- Cable the OSC from the mux/demux motherboard only to the add/drop mux/demux module that connects to the trunk (east and west sides). Connect the OSC IN on the mux/demux module to OSC OUT on the mux/demux motherboard; connect the OSC OUT on the mux/demux module to OSC IN on the mux/demux motherboard.
- Connect west to east, never west to west or east to east, between nodes in a ring.
- Connect the trunk receive direction to TI (trunk interface) IN, and trunk transmit direction to TI OUT (east and west sides).
- Connect Thru OUT to TI IN, and OUT to TI IN between add/drop mux/demux modules on the same side.
- Connect Thru OUT to Thru IN between add/drop mux/demux modules on west and east sides.

For examples of cabling add/drop mux/demux module in a protected ring configuration, see [Figure 1-7 on page 1-17](#) and [Figure 1-8 on page 1-18](#).

## Shelf Rules for 32-Channel Terminal Mux/Demux Modules

The following rules apply when cabling the 32-channel terminal mux/demux modules:

- No cabling is necessary between 32-channel terminal mux/demux modules.
- Cable the OSC from the mux/demux motherboard to the OA and OD connectors on the terminal mux/demux module. Connect OSC OUT to OA and OSC IN to OD.

## Shelf Rules for Transponder Modules

The following rules apply to transponder modules:

- When using y-cable protection, ensure that both transponder modules are the same type (single-mode, multimode, extended range, or 10-GE) for a given client signal. For example, if client signal A connects by a y-cable to transponders in positions 2/0 and 8/0, then both of those transponder modules must either be single-mode, multimode, or extended range. Also, if using extended range transponder modules, the transceivers must be the same type.
- It is possible for some transponder modules to be missing. This might happen in cases where channels are not needed, or during migration.
- When the line card motherboard directly is directly cabled to the mux/demux module or mux/demux motherboard, the transponder modules in the line card motherboard must support channels in the same 4-channel band. [Table 3-2](#) shows the required positions for the transponder modules in the line card motherboard.

**Table 3-2** *Transponder Module Placement When Using Direct Cross Connects*

Channel <sup>1</sup>	Transponder Slot/Subslot <sup>2</sup>
w+0	y/0
w+1	y/1
w+2	y/2
w+3	y/3

1. w = first channel number in a 4-channel band
2. y = transponder slot number in the shelf

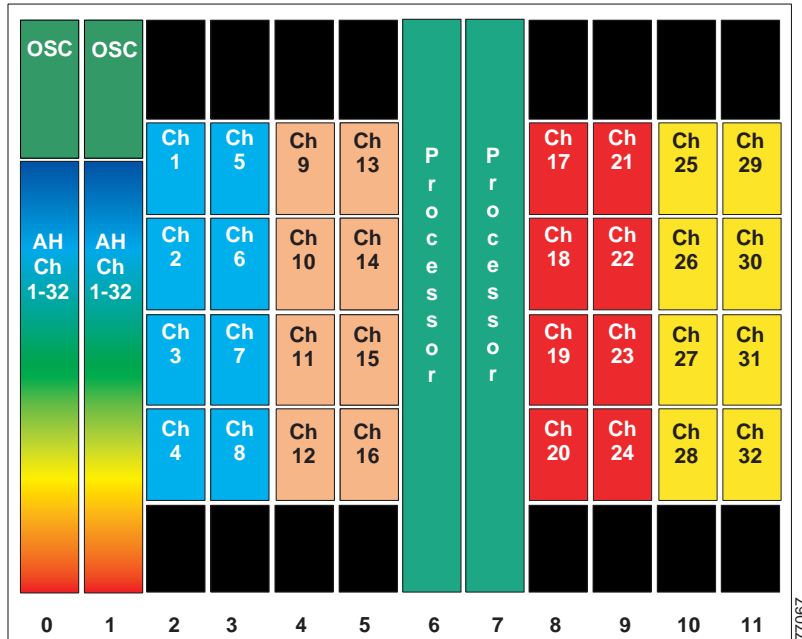
See [Figure 3-3](#) for an example configuration.



**Note**

When using a cross connect panel rather than direct cross connections, the transponder modules can be installed in any order in a line card motherboard. However, for easier shelf management, we recommend using the same ordering as described in [Table 3-2](#).

Figure 3-3 Example Shelf Configuration Using 32-Channel Terminal Mux/Demux Modules



## Shelf Rules for Line Card Motherboards

The line card motherboards have MTP connectors located on their front panels: one connector on unprotected motherboards and two connectors for splitter protected motherboards.

In 2.5-Gbps line card motherboards, each MTP connector supports one 4-channel band. In 10-Gbps line card motherboards, each MTP connector supports one 1-channel band.

Line card motherboards can only install into slots 2 through 5 and slots 8 through 11.

## Rules for Configurations with 10-Gbps Line Card Motherboards

An unprotected configuration of 10-Gbps line card motherboards with 10-GE transponder modules supports 16 channels. A protected configuration supports 8 channels.

## Rules for Protected Configurations

The rules for line card motherboards in protected configurations are as follows:

- If splitter protection is used, the transponder slots must use the splitter protected line card motherboards.
- If line card protection is used, the transponder slots should use the unprotected line card motherboards, which do not have the 2x2 optical splitter.
- You can use splitter protected line card motherboards for line card protected configurations. When using splitter protected line card motherboards for line card protections, configure all wavepatch  $y/z/1$  interfaces in the slot as “shutdown.” The upper MTP connector on the line card motherboard is wavepatch  $x/y/0$ ; the lower MTP connector on the line card motherboard is wavepatch  $x/y/1$

**Note**

When configuring a system for line card protection, the unprotected line card motherboards offer the additional advantage of having lower optical power loss.

## Cabling Line Card Motherboards to the Mux/Demux Modules

The Cisco ONS 15540 ESPx supports mux/demux modules with front panel optical filter connectors. If all channels in the line card motherboard are added and dropped at the node, cross connect the line card motherboard MTP connector directly to the mux/demux module. Each mux/demux module supports a specific band of channels. Every 4-channel band on the mux/demux module has its own MTP connector. A 4-channel mux/demux module has one MTP connector, an 8-channels has two, and a 32-channel mux/demux module has eight. Always connect the line card motherboard to the MTP connector for the channels supported by the transponders in the line card motherboard.

## Shelf Rules for PSMs

For trunk fiber protection to function when the PSM (protection switch module) connects to a mux/demux module, the OSC or the in-band message channel (or both) must be available on the shelf. If the OSC is present, the PSM must connect to the mux/demux module that supports the OSC. If the PSM connects to a 10-GE transponder module, use the in-band message channel as the APS message channel to support trunk fiber protection. If the PSM connects to a 2.5-Gbps transponder module, use IP for the APS message channel.

## Cabling Rules for Cross Connect Drawers

The optical cross connect drawer provides a much greater degree of flexibility for provisioning channels on the Cisco ONS 15540 ESPx. It allows you access to individual channels within a band. You can, for example, pass through some channels within a band while adding and dropping others. The cross connect drawer also allows the Cisco ONS 15540 ESPx to accept ITU grid signals from other platforms, such as the Cisco ONS 15530.

For protected configurations, a cross connect drawer supports up to 16 channels. To support more than 8 protected channels, use two cross connect drawers.

**Note**

We recommend using direct cross connections between the line card motherboard and mux/demux module in configurations where no individual channels in the band are passed through and none come from other platforms. Using a cross connect drawer increases the optical power loss.

## General Rules for Ring Topologies

The following network rules apply to ring topologies:

- A channel must be present on only two nodes in the ring when using splitter protection.
- All channels added by a node on an east add/drop mux/demux modules must be dropped on a west add/drop mux/demux module of one or more other nodes on the ring. All channels added by a node on a west add/drop mux/demux module must be dropped by an east add/drop mux/demux module of one or more other nodes on the ring. This rule may be violated during migration.
- A node cannot add a channel that is already present in the same direction until it has dropped that channel.