

## XTM SERIES

# FIBER PROTECTION UNIT

## Providing sub-50 ms Resilience in Optical Networks

The **Fiber Protection Unit (FPU/1)** is part of the Infinera XTM Series and is a one-slot unit used to provide protection against fiber cuts. The FPU/1 has optical split-and-select functionality.

### How it Works

The aggregated dense wavelength-division multiplexing (DWDM) signal is duplicated in the transmit direction via the optical split function. The optical select function in the receive direction then selects which path should be forwarded to the connected traffic units. If the active path loses optical power, for example in a fiber cut scenario, a photo detector detects loss of light and the switch function performs an automatic switch to the other path. The switch is performed in about 10 milliseconds (ms), enabling the traffic to be restored well within the standard requirement of 50 ms.

Both receive ports have a photo detector, which means that both paths are monitored and an alarm is raised if the protection path is shut down.

### Shared Protection for Lowest Cost

In general, using a fiber protection unit as shown in Figure 1 provides the lowest cost for resilience against fiber cuts since the cost of the fiber protection unit is shared by all traffic units in the network element. This configuration is well suited when all connections are carried between the same end points.

In a mesh network, however, this will typically not be the case. Protection of mesh connections typically requires protection on a per wavelength basis. For XTM Series traffic units operating at a line rate of 10 gigabits per second (Gb/s), two line ports are typically provided for built-in 1+1 line protection, or two units are deployed in a full client/equipment protection configuration, as shown in Figure 2.



### Key benefits:

- Provides lowest cost for network protection in point-to-point networks
- This plug-in unit can be used in any XTM Series chassis option, enabling a highly flexible resilience deployment
- Low power design ensures low total cost of ownership

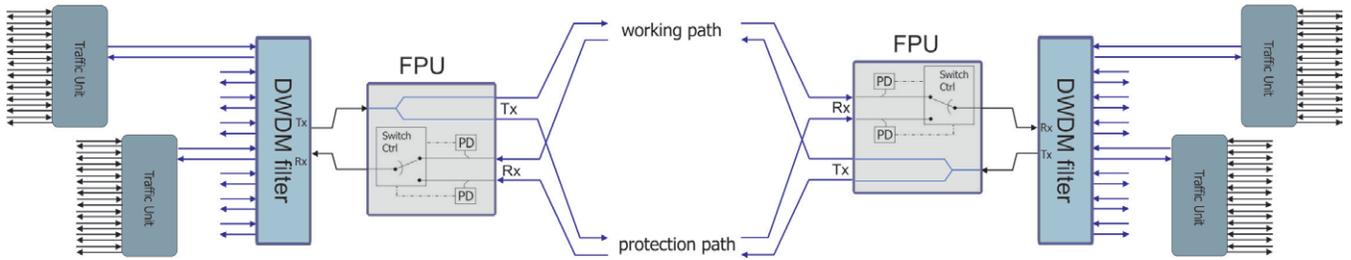


Fig 1. The FPU/1 in a Network Scenario with Traffic Units and DWDM Filters.

### Dedicated 100 Gb/s Protection

For traffic units operating at a line rate of 100 Gb/s or higher, the option of using an FPU/1 per wavelength can be a highly economical alternative since the 100 Gb/s interface is comparatively expensive and using the FPU/1 avoids the need for a second standby 100 Gb/s interface.

### Simple but Feature-rich

The FPU/1 has a light emitting diode (LED) to indicate that a port has ingress or egress optical input power. LED indicators are also used to show which ingress port is selected by the internal switch function within the FPU/1. Both these port status attributes are visible via the Digital Network Administrator for XTM Series (DNA-M) system.

The optical power threshold for generating a protection switch can be changed to suit amplified as well as unamplified DWDM/coarse wavelength-division multiplexing (CWDM) configurations or low channel as well as high channel count configurations.

The FPU/1 maintains the switch position if the electrical power is lost and when the power is restored.

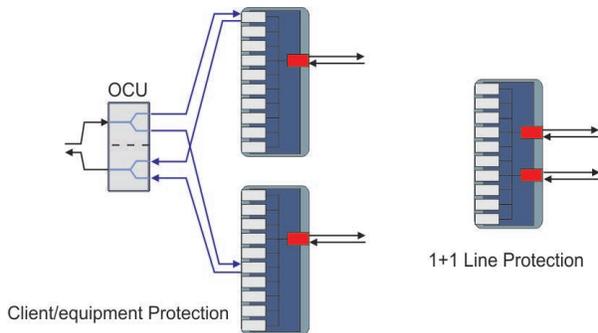


Fig 2. 1+1 Line Protection and Client/Equipment Protection, Which are Typical Protection Options for Services up to 10 Gb/s.

### Mounting Options

The FPU/1 is a one-slot plug-in unit that can be mounted in the TM-102/II chassis to form a self-managed, rack-mounted fiber protection network element, which can be employed in optical systems requiring fiber protection function.



Fig 3. FPU/1 Mounted in a TM-102/II Chassis.

For point-to-point configurations where a fiber protection unit is used to provide protection of the aggregated wavelength, the FPU/1 may be placed together with the other units in a TM-3000/II or TM-301 chassis.

In a network element having a fiber protection unit for each 100 Gb/s connection, the FPU/1 units can be placed together with the traffic units or separately, for example, in a TM-301 chassis. The three rack unit TM-301 chassis can house up to four FPU/1 units and can act as a separate fiber protection chassis, which constitutes part of the same network element as other units from a management perspective.

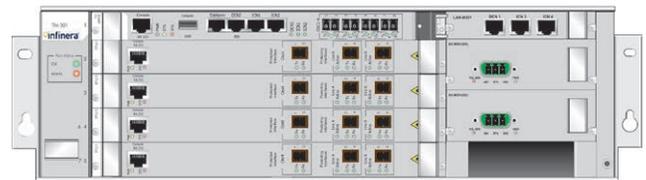


Fig 4. FPU/1 Mounted in a TM-301 Chassis.

## Extended Switch Criteria

Fiber protection units are activated in response to a loss of light or when the optical power level falls below a pre-set threshold. The fiber protection units may not perform a protection switch operation in the event of a high bit error rate if the optical power level remains above the threshold level.

The FPU/1 can, however, also perform a protection switch operation based on alarms generated by the traffic unit that it is connected to. However, this feature can only be used when one FPU/1 is used per traffic unit and when the two units are placed in the same card cage.

Alarms such as "loss of sync" and "forward error correction (FEC) failure" can, therefore, also improve the resilience level compared to "loss of light" protection only.

## Low Power Design

The FPU/1 only consumes a maximum of 9 watts (W). Low power consumption in combination with small footprint reduces operational costs and enables greater capacity at sites with restrictions on power consumption, cooling and space.

### Specifications

Input Power Range	Client interface: -15 to + 21 dBm Line interface: -30 to + 21 dBm
Switch Threshold Range	-35 to 0 dBm
Switch Time	~10 ms at passage of loss of signal (LOS) threshold
Indicators	LED for ingress and egress optical power on all ports LED for position of switch Power and system LEDs
Power Consumption	Max 9 W
Insertion Loss	Ingress client to egress line: max 4.2 dB (1270-1350 nm, 1510-1610 nm) Ingress line to egress client: max 1.7 dB (1270-1350 nm, 1510-1610 nm)
Commands	Auto Force left Force right Toggle
Misc. Features	Switch stays in position upon electrical power loss Switch criteria can be extended to include alarms from traffic unit (future release)

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