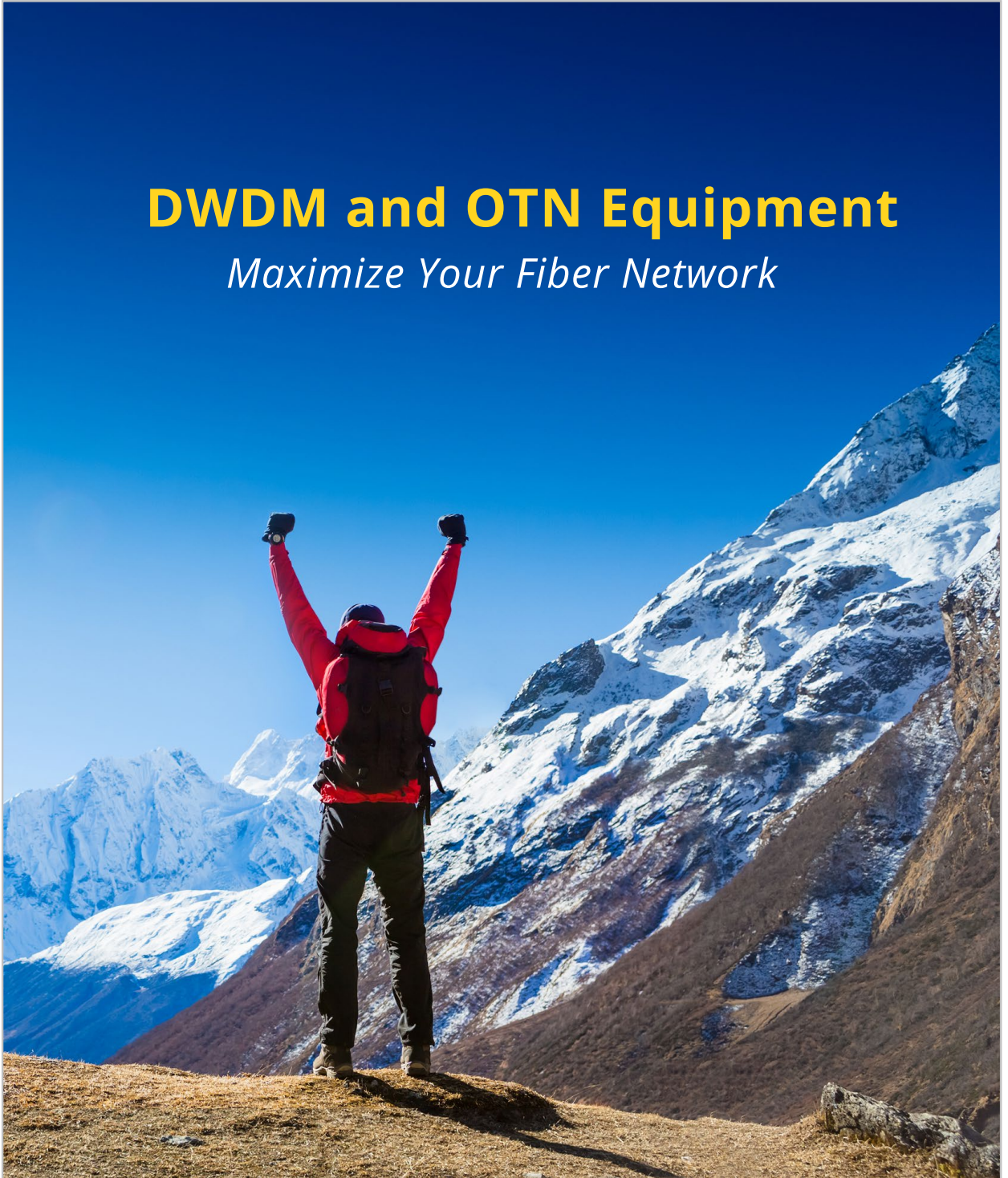


DWDM and OTN Equipment

Maximize Your Fiber Network



Equipment for DWDM and OTN Networks



PacketLight's carrier-grade DWDM and OTN equipment offers the flexibility to build a cost-effective, highly efficient optical transport network for a variety of industries such as carriers, finance, enterprises, broadcast companies, utilities, government organizations, education networks, as well as content service providers.

PacketLight products are tailored to meet your fiber optic network challenges, and are simple to install, deploy and manage, using PacketLight's NMS for the whole deployment lifecycle.

Carrier-class Reliability

Reliable, carrier-grade devices ensure business and critical data links, while protecting your investment, with scalable, pay-as-you-grow architecture, network upgrades without service disruption, and guaranteed service level agreement (SLA).

Rich Feature Set

Integrated 1U architecture with a rich feature set, allowing scalability, manageability, and ease-of-use and maintenance, supporting any network infrastructure, from simple point-to-point, to metro access rings and linear add- and-drop networks.

Flexibility and Scalability

Transponders and muxponders that support a mix of data, storage and video services and standardized pluggable optics, optical amplification, and ROADM, all provide the flexibility to build a cost-effective, scalable, highly efficient optical network infrastructure.

Easy Deployment Life Cycle

PacketLight LightWatch™ NMS and free web-based management tools enable simple installation, remote configuration, performance monitoring, fault management, and administration capabilities that allow users to deploy the devices without lengthy training.

Solid Savings

Integrated 1U with high port density, reducing OPEX by saving space and power consumption. The modular design enables true pay-as-you-grow architecture that significantly reduces CAPEX.

Reasons to Choose PacketLight



Carrier-class



Pay-as-you grow



Layer-1 encryption



Cost-saving small footprint



Easy to manage via NMS



Remote management

Our Range of Products



Layer-1 encryption



Low power consumption



1U rack mount



Multi operation modes



Low latency connectivity



High wavelength utilization

Service	DCI	Metro	Long Haul
400G	PL-4000T T	PL-4000T T	PL-4000T T
	PL-4000G T		
100G	PL-2000T T	PL-2000T T	PL-2000T T
	PL-2000M T	PL-2000M T	PL-2000M T
	PL-4000G T	PL-4000T M	PL-4000T M
	PL-4000T M	PL-4000M M	PL-4000M M
	PL-4000M M		
8/16/32G	PL-1000TE T	PL-2000M M	PL-2000M M
	PL-2000M M	PL-4000M M	PL-4000M M
	PL-4000M M		
	PL-2000ADS A M		
10/25/40G	PL-1000TE T	PL-1000TN T	PL-1000TN T
	PL-2000M M	PL-2000M M	PL-2000M M
	PL-4000M M	PL-4000M M	PL-4000M M
	PL-2000ADS A M		
1-4G	PL-1000TE T	PL-2000 A M	PL-2000 A M

T Transponder M Muxponder A ADM Layer-1 Encryption

Infrastructure					
Diagnostics	ROADM	EDFA	Raman	Mux/Demux	DCM
PL-1000D	PL-1000RO	PL-1000IL	PL-1000R	PL-300	PL-300

NMS	Support
PacketLight LightWatch	PL-Care

Main Benefits

- High wavelength utilization
- Low latency connectivity
- Layer-1 encryption
- Simple to install and configure
- 1U form factor devices
- Network management system
- Integrated mux/demux, EDFA, optical switch, DCM (optional)
- Pay-as-you-grow architecture

Applications

- Data center interconnect
- Alien wavelength
- Fiber monitoring and diagnostics
- Video transport
- Layer-1 encryption
- Single fiber applications
- DWDM over CWDM
- Multimode fiber solutions

Industries

- Carriers & ISPs
- Dark Fiber Providers
- Utilities
- Research & Education
- Enterprises
- Smart City
- Financial Institutions
- Government
- Broadcasters

PL-4000M 600G ADM/Muxponder/Transponder

600G multi-protocol multi-rate optical transport solution for metro and long haul networks

Features Overview

- Flexible high capacity architecture based on 400G pluggable digital coherent optical modules
- Supported clients: 10/25/100Gb Ethernet, 16G Fibre Channel, OTU2/2e/4
- Flexible mix of client services mapped into 100/200/300/400G DWDM wavelengths
- Supports oFEC on the line side
- Uplinks: Dual 400G CFP2-DCO Open ROADM pluggable coherent modules
- Range of modulation modes: 16QAM, 8QAM, QPSK
- Clients:
 - Up to 6 x QSFP28 for 100GbE or OTU4
 - 24 x SFP+ / SFP28 for lower rate services
- Layer-1 GCM-AES-256 encryption
- Elliptic Curve Diffie-Hellman key exchange
- Comprehensive line and service performance monitoring
- Integrated EDFAs pre-amp/booster (optional)
- Facility protection using an integrated optical switch (optional)
- OTN SNCP 1+1 service protection for ring applications
- Remote management using in-band GCC or out-of-band OSC
- Easy maintenance with field-replaceable parts:
 - Dual hot pluggable power supply units (AC/DC)
 - Fan unit

100/200/300/400G Long Haul & Metro Applications

The PL-4000M is a cost-effective solution for rolling out multi-rate 10/25/100GbE, 16G FC, OTU2/2e/4 services, or increasing existing network capacity. The device delivers 600G in a 1U chassis using dual 400G CFP2-DCO Open ROADM standard-based pluggable coherent modules for metro and long haul applications.

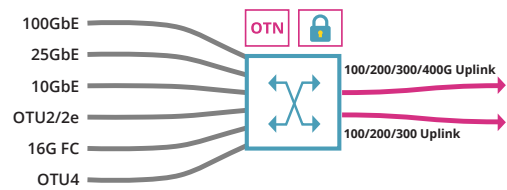


Main Benefits

- **Cost-effective high capacity transport of 400G over single wavelength**
- **Supports flexible mix of client interface protocols**
- **Embedded Layer-1 GCM-AES-256 encryption**
- **Integrated EDFAs and optical switch in 1U chassis**
- **User-configurable operation mode**

Flexible Architecture, Facility Protection

The PL-4000M provides full demarcation point between the service and the OTN/DWDM network, and is interoperable with any third party switch or router. This provides full visibility and performance monitoring of both line optical transport layer (OTN) and 10/25/100GbE, 16G FC, and OTU2/2e/4 service interfaces.



PL-4000M Diagram

Recommended applications:

- 300G/400G metro / long haul applications
- 100G/200G long haul applications
- High capacity DCI for enterprise, campus and cloud computing networks
- 400G links to bolster existing OTN/DWDM infrastructure
- Last mile access/aggregation CPE for 100GbE managed services
- Secured and encrypted communication for 10/25/100GbE, and OTU2/2e/4 services



Layer-1 encryption

1U

1U rack mount



Cost-effective solution

Technical Specifications

Product Configurations

Single 400G Muxponder: mix of client interfaces aggregated into a 400G uplink

Dual 100/200/300G Muxponder: mix of client interfaces aggregated into two 100/200/300G uplinks

Optical Amplifiers: Up to two EDFA modules (optional)

Optical Switch: 1+1 facility protection (optional)

Uplink Characteristics

Bit Rate:

- 400G OTUC4
- 300G OTUC3
- 200G OTUC2
- 100G OTUC1

Optical Interface:

Dual CFP2-DCO 400G uplinks

Tuneability Range:

- DWDM ITU-T G.694.1 grid
- C-band, with flex-grid support

FEC Support:

- oFEC

CFP2-DCO:

- Tx power 400G: -8dBm to +3dBm
- Rx power: 400G -23dBm, 300G -23dBm, 200G -30dBm
- 400G 16QAM OSNR Tolerance at -12dBm Rx Power: typical 21.8dB, min. 22.8dB
- 300G 8QAM OSNR Tolerance at -16dBm Rx Power: typical 18.9dB, min. 19.4dB
- 200G QPSK OSNR Tolerance at -17dBm Rx Power: typical 13.9dB, min. 14.9dB
- Rx Sensitivity at High OSNR: 400G 16QAM -22.5dBm, 300G 8QAM -23dBm, 200G QPSK -30dBm

Chromatic Dispersion Tolerance:

- 400G: 26,000ps/nm
- 300G: 26,000ps/nm
- 200G: 40,000ps/nm

Optical Monitoring:

- Tx and Rx power
- Chromatic dispersion
- OSNR

Client Characteristics

Service Types:

- 10GbE, 25GbE, 100GbE
- 16G Fibre Channel
- OTU2/2e/4

Optical Interface:

- QSFP28: LR4/ER4 (1310nm), SR4 (850nm), CWDM4
- SFP+: LR (1310nm), SR (850nm), ER (1550nm), ZR (1550nm), C/DWDM
- SFP28: LR (1310nm), SR (850nm)

Amplifier

Applications: Booster, pre-amp

Output Power:

- Booster: up to 20dBm
- Pre-amp: up to 5dBm

Input Power:

- Booster: -24dBm to +10dBm
- Pre-amp: -36dBm to -10dBm

Gain:

- Booster: 5dB to 22dB
- Pre-amp: 13dB to 22dB

Operating Modes:

- Automatic gain control (AGC)
- Automatic power control (APC)

Network Management

Management Ports:

- 2xRJ-45 LAN port 100/1000MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RJ-45 serial port
- RJ-45 external alarm port
- OTN in-band GCC channel

Management Protocols:

- HTTP/HTTPS, CLI over RS-232 or CLI over Telnet/SSH, SNMPv2/3, Syslog, RADIUS, TACACS+, SNMP, TFTP & SFTP, REST, NETCONF

NMS:

- PacketLight LightWatch™ NMS, or third party NMS over SNMP

OAM:

- Facility loopback (client and line interfaces), client terminal loopback, PRBS, event log, alarms

Performance Monitoring:

- Optical PM for all optical ports
- OTN PM for uplink and OTU2/2e/4 services
- L1 PM for 10/25/100GbE and 16G FC
- L2 PM for 10/25/100GbE

Visual Indicators: LED status indicators for client and line ports, Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade: Hitless traffic – dual image

Power Supply

AC/DC: 100 to 240 VAC, 50/60 Hz, -44 to -60 VDC, 300W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 45°C (+23°F to +113°F) operational

Humidity: 5% to 85% RH

Storage: 85°C

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 15.75" (D)
- 45mm (H) x 440mm (W) x 400mm (D)

Weight: 8.4kg / 18.5lb (max)

Mounting: 19", ETSI and 23"

Encryption

Functionality: Full speed, transparent Layer-1 optical encryption for selected services or for the OTUC4/OTUC3/OTUC2/OTUC1 uplink/s.

Algorithms:

- Encryption/decryption: GCM-AES-256
- Key exchange: ECC CDH, Curve P-384
- Message digest: SHA-384

Authentication:

- Role-based user/password authentication

Compliance:

- FIPS 140-3 Level 2

Note: For specific countries, models that include Layer-1 GCM-AES-256 based encryption will be marked with the suffix C.

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-2000M 200G Muxponder/Transponder

200G over a single wavelength coherent transport solution

Features Overview

- User-configurable muxponder and transponder operation modes
- Supported clients: 10GbE, 40GbE, 100GbE, 8G/16G/32G Fibre Channel, 12G-SDI, STM-64/OC-192, SONET/SDH, OTU2/OTU2e/OTU3/OTU4 OTN
- 200G uplink aggregation using any mix, for example: up to 20x10GbE (multi-rate) clients, 2x100GbE clients, 1x100GbE + 10x10GbE clients, 4x40GbE + 4x10GbE clients
- Forward error correction (FEC)
- 200G pluggable CFP2 coherent (ACO) tunable DWDM line interface
- Operation modes:
 - 16QAM 200G metro ~650km
 - DP-QPSK 100G long haul ~4000km
- Layer-1 GCM-AES-256 encryption
- Diffie-Hellman key exchange
- Line and service performance monitoring
- Optional integrated EDFA, mux/demux and optical switch
- Facility protection using an optional integrated optical switch
- Remote management with in-band GCC or out-of-band OSC
- Dual AC or DC pluggable power supply and pluggable fan unit
- Supports standard MSA pluggable SFP+, SFP28, QSFP+, QSFP28 and CFP2
- 1U footprint with low power consumption

Data Center Interconnect and Metro Applications

The PL-2000M is an advanced 200G multi-protocol multi-rate solution for building high capacity optical transport networks. This 1U platform with flexible architecture enables the same device to be used in multiple applications and to adapt to network growth and changes.



Main Benefits

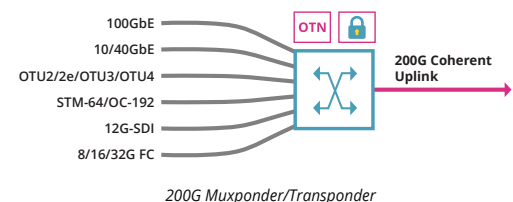
- **Cost-effective 200G capacity over single wavelength**
- **Highly integrated 1U muxponder and transponder**
- **Supports flexible mix of client interface protocols**
- **Embedded GCM-AES-256 encryption for all protocols**
- **User-configurable 100G/200G operation mode**

Modular, Cost-effective 200G Transport Solution

The PL-2000M provides a modular and cost-effective way of rolling out services or uplifting existing network capacity. It is low power consumption, saves rack space and reduces the overall solution CAPEX and OPEX by increasing the capacity of enterprise DCI and metro networks.

The PL-2000M can multiplex 2x100G clients into a single coherent CFP2 uplink, providing low cost high spectral efficiency.

The device seamlessly integrates with PacketLight's products to deliver carrier grade, high-end 200G solutions.



Recommended applications:

- 100G for alien wavelength applications
- Metro network applications ranging up to 1,000km
- High capacity DCI for enterprise, campus and cloud computing networks
- 200G links to bolster existing OTN/DWDM infrastructure
- Last mile access/aggregation CPE for 10G/40G/100G managed services
- Secured, encrypted communication for all protocols



Layer-1 encryption



Low power consumption



1U 1U rack mount



Multi operation modes

Technical Specifications

Product Configurations

Muxponder: Aggregation of up to 20 multi-service, multi-rate, multi-protocol client interfaces: Ethernet, Fibre Channel, SONET/SDH, and OTN into a 200G uplink.

Dual 100G Transponder: 2x100GbE mapped into 1x200G uplink

100G Transponder and 10X10G Muxponder: 100GbE + 10x10GbE mapped into 1x200G uplink

Optical Amplifiers: Optional up to two EDFA modules

Mux/Demux: Optional 2ch mux/demux module

Optical Switch: 1+1 facility protection

Uplink Characteristics

Bit Rate:

- 200G OTUC2V2 - 2x132.2680Gbps
- 100G OTU4V2 - 131.1026Gbps

Optical Interface: CFP2 coherent (ACO)

Tuneability range:

- DWDM ITU-T G.694.1 grid
- C-band, with flex-grid support
- Channels 13-60.5, with 50GHz spacing

FEC Support:

- Standard ITU-T G.709 GFEC
- Enhanced HD-FEC, or SD-FEC

Optical Output Power:

- 100G: -2dBm to +3dBm
- 200G: -5dBm to 0dBm

OSNR:

- 100G: 12dB at 0.1nm
- 200G: 23dB at 0.1nm

Sensitivity:

- 100G: -21dBm
- 200G: -18dBm

Optical Monitoring: Tx and Rx power, dispersion, OSNR

Client Interfaces Characteristics

Service types:

- 10GbE, 40GbE, 100GbE,
- 8G/16G/32G Fibre Channel
- 12G-SDI
- STM-64/OC-192
- OTU2, OTU2e, OTU4

Optical Interface:

- SFP+: LR (1310nm), SR (850nm), ER (1550nm), ZR (1550nm), C/DWDM
- SFP28: LR (1310nm), SR (850nm)
- QSFP+: LR4 (1310nm), ER4 (1310nm), SR4 (850nm), LR PSM
- QSFP28: LR4 (1310nm), ER4 (1310nm), SR4 (850nm), CWDM4 (CWDM)

Amplifier

Applications: Booster, pre-amp

Output Power:

- Booster: +4 to +14dBm
- Pre-amp: +5dBm

Input Power:

- Booster: 0 to +10dBm
- Pre-amp: -25 to -9dBm

Gain:

- Booster: +4 to +14dB
- Pre-amp: +18dB

Operating Modes:

- Automatic gain control (AGC)
- Automatic power control (APC)

Network Management

Management Ports:

- 2xRJ-45 LAN port 10/100MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RJ-45 serial port
- RJ-45 external alarm port
- OTN in-band GCC channel

Management Protocols:

- SNMP, HTTP, HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Syslog, RADIUS, TACACS+, SNMP, TFTP & FTP, REST, NETCONF

NMS:

- PacketLight LightWatch™ NMS/EMS, or third party NMS over SNMP

OAM:

- Facility loopback (client and line interfaces), PRBS, event log, alarms
- Automatic laser shut-down (ALS)

Performance Monitoring:

- Layer-1 PM for all services (except for 32G FC)
- Layer-2 PM for Ethernet
- OTN PM for uplinks
- Optical power Rx levels for all optical ports

Visual Indicators: LED status indicators for client and line ports, Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade: Hitless traffic - dual image

Power Supply

AC/DC: 100 to 240 VAC, 50/60 Hz, -36 to -60 VDC, 250W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational

Humidity: 5% to 85% RH

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 11.22" (D)
- 45mm (H) x 440mm (W) x 285mm (D)

Weight: 8.5kg / 18.75lb (max)

Mounting: 19", ETSI and 23"

Encryption

Functionality: Full speed, transparent Layer-1 encryption for selected clients or for the OTU4 uplinks

Algorithms:

- Encryption/decryption: GCM-AES-256
- Message digest: SHA-384

Authentication:

- Role-based user/password authentication

Compliance:

- FIPS 140-2 certified
- Common Criteria EAL2 certified
- CNSA Top Secret Suite B 2015 compliant

Note: For specific countries, models that include Layer-1 GCM-AES-256 based encryption will be marked with the suffix C.

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-2000ADS 200G ADM/Muxponder/Transponder

Multi-protocol multi-rate 200G transport solution for short haul networks, with Layer-1 encryption



Features Overview

- Supports multiple, user-configurable, operation modes: muxponder, transponder, and ADM
- Supported clients:
 - 10Gb/40Gb/100Gb Ethernet
 - 8G/16G/32G Fibre Channel
 - 12G-SDI
 - STM-64/OC-192
 - OTU2/OTU2e, OTU4
- Standards-based forward error correction (FEC) for short haul applications
- Dual pluggable QSFP28 interfaces for uplink and client
- Layer-1 GCM-AES-256 based encryption
- Low latency muxponder/transponder/ADM
- Comprehensive line and service performance monitoring
- Remote management with in-band or out-of-band optical supervisory channel (OSC)
- Supports standard MSA pluggable:
 - SFP+ (8G/10G/16G/32G FC client)
 - SFP28 (32G FC client)
 - QSFP+ (40GbE client)
 - QSFP28 (100GbE client)
 - QSFP28 (100GbE uplink)
- Dual AC or DC pluggable power supply and pluggable fan unit

Short Haul 200G Applications

The PL-2000ADS provides modular and cost-effective high transport capacity of up to 200G by aggregating multiple services into dual 100G OTU4 uplinks. The solution is low power consumption and saves rack space, reducing overall CAPEX and OPEX, and enabling to easily and cost-effectively increase capacity of short haul networks.

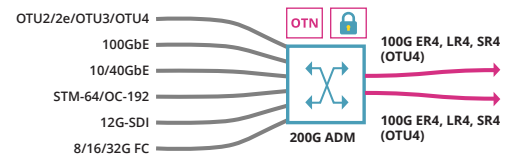
Main Benefits

- **Easy deployment and management of dual 100G short haul / access networks**
- **Versatile 1U chassis platform, with very low power consumption**
- **Embedded GCM-AES-256 encryption for all protocols**
- **Encryption feeder in front of any third party OTU4 interface**

Security and Encryption for all Services

The PL-2000ADS is a cost-effective 200G solution for short haul and access networks, incorporating GCM-AES-256 Layer-1 encryption.

The unit can also function as a standalone 200G encryption machine for any mix of the featured client services.



Multiple Client Services Aggregate into Dual 100G OTU4 Uplinks

Recommended applications:

- Last mile access/aggregation CPE for 10/40/100GbE managed service
- High capacity, short haul enterprise and campus networks
- Dynamic add/drop of services in ring and linear add/drop topologies
- Feeder solution for third party OTU4 transponder card
- Up to 200G Layer-1 encryption solution for 10/40/100GbE services
- High bandwidth connectivity for data center and cloud computing



Layer-1 encryption



Low power consumption

1U

1U rack mount



Multi operation modes

Technical Specifications

Product Configurations

Muxponder: Aggregation of up to 20 multi-service, multi-rate, multi-protocol client interfaces: Ethernet, Fibre Channel, SONET/SDH, and OTN into 2xOTU4 uplinks

Dual 100G Transponder: 2x100GbE mapped into 2xOTU4 uplinks

100G Transponder and 10x10G

Muxponder: 100GbE mapped into one OTU4 uplink and up to 10 multi-service 10GbE clients aggregated into a second OTU4 uplink

Uplink Characteristics

Bit Rate: 112Gbps (OTU4)

Optical Interface: 2xQSFP28

FEC Support: Standard ITU-T G.709 GFEC

Optical Reach: Up to 40km with ER4

Optical Output Power: 2dBm to -2dBm

Optical Monitoring: Tx and Rx power

Client Interfaces

Service type: 10GbE, 40GbE, 100GbE, 8G/16G/32G FC, 12G-SDI, STM-64/OC-192, OTU2, OTU2e, OTU3, OTU4

Optical Interface:

- SFP+: LR (1310nm), SR (850nm), ER (1550nm), ZR (1550nm), C/DWDM
- SFP28: LR (1310nm), SR (850nm)
- QSFP+: LR4 (1310nm), ER4 (1310nm), SR4 (850nm), LR PSM
- QSFP28: LR4 (1310nm), ER4 (1310nm), SR4 (850nm), CWDM4 (CWDM)

Management:

- Web browser over HTTP/HTTPS,
- PacketLight LightWatch™ NMS/EMS, or third party NMS over SNMP
- REST, NETCONF
- CLI over RS-232 or CLI over Telnet/SSH

OAM:

- Facility loopback (client and line interfaces), PRBS, event log, external alarms (input and output)
- Automatic laser shut-down (ALS)

Network Management

Management Ports:

- 2xRJ-45 LAN port 10/100MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RJ-45 serial port
- RJ-45 external alarm port
- OTN in-band GCC channel

Management Protocols: SNMP, v1/v2/v3 HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNMP, TFTP & FTP

Performance Monitoring:

- Layer-1 PM for all services
- Layer-2 PM for Ethernet
- OTN PM for uplinks
- Optical power Rx levels for all optical ports
- Egress PM for all services

Visual Indicators: LED status indicators for: client and line ports, Management and LAN ports, system Critical/Major/Minor and Power Supply

Software Upgrade: Hitless traffic – dual image

Power Supply

AC/DC: 100 to 240 VAC, 50/60 Hz, -36 to -60 VDC, 170W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational

Humidity: 5% to 85% RH

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 11.22" (D)
- 45mm (H) x 440mm (W) x 285mm (D)

Weight: 8.5kg / 18.75lb (max)

Mounting: 19", ETSI, 23"

Encryption

Functionality: Full speed, transparent Layer-1 encryption for selected clients or for the OTU4 uplinks

Algorithms:

- Encryption/decryption: GCM-AES-256
- Key exchange: ECC Cofactor Diffie-Hellman with P-384 curve
- Message digest: SHA-384

Authentication:

- Role-based user/password

Compliance:

- FIPS 140-2 certified
- Common Criteria EAL2 certified
- CNSA Top Secret Suite B 2015 compliant

Note: For specific countries, models that include Layer-1 GCM-AES-256 based encryption will be marked with the suffix C.

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-2000 20G ADM/Muxponder

Multi-protocol multi-rate muxponder with flexible uplink aggregation, capacity of up to 20G



Features Overview

- Single or dual configurable 10G muxponders
- Up to 16 multi-protocol and multi-rate services aggregation over single or dual OTU2 uplinks
- Service types supported:
 - Fast Ethernet
 - GbE
 - 1/2/4G FC/FICON
 - STM-1/OC-3, STM-4/OC-12, STM-16/OC-48
 - Video protocols such as DVB-ASI, SD-SDI, HD-SDI, 3G-SDI
- Dual standard-based optical transport network (OTN) OTU2 uplinks supporting multiple forward error correction (GFEC/I.4/I.7) types
- 1+1 facility protection
- Low latency
- Supports standard MSA SFPs (client), XFPs (uplink), and C-band tunable XFPs
- Supports line and service performance monitoring
- Remote management optical supervisory channel (OSC)
- Optional integrated EDFA, mux/demux, DCM and optical switch
- Dual AC or DC pluggable power supply and pluggable fan unit
- Web-based GUI and SNMP EMS management
- 1U footprint with low power consumption

Sub-10G Multi-protocol Multi-rate ADM/Muxponder

The PL-2000 provides an efficient and flexible aggregation layer of multi-protocol multi-rate sub-10G services into a 10G OTU2 uplink trunk, reducing the number of wavelengths needed for a sub-10G solution by a factor of 8 on average. The PL-2000 increases the spectral efficiency of WDM networks.

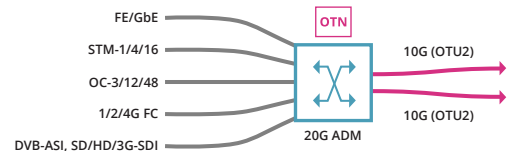
Main Benefits

- Provides a sub-10G gateway for 10/100G OTN networks supporting LR and tunable DWDM uplink modules
- Transparently multiplexes up to 16 client services into single or dual independent 10G OTU2 wavelengths
- Simultaneously aggregates SDH/SONET, Ethernet, Fibre Channel and video services

A Flexible Platform

The PL-2000 reduces the solution cost and operation complexity by increasing fiber utilization and spectral efficiency. Each of the 10G OTU2 uplinks can simultaneously aggregate SDH/SONET, Ethernet, Fibre Channel and video services, providing a perfect access platform for multiple clients, and enables to merge legacy and new services transparently.

Together with PacketLight LightWatch NMS the system provides A-to-Z provisioning. The PL-2000 incorporates forward error correction suitable for long distance amplified DWDM network.



Multiple Client Services ADM/Muxponder into 2 x 10G OTU2 Uplinks

Recommended applications:

- 10G ring applications
- Sub-10G gateway for 10G/100G OTN networks
- Multi-service access platform for service providers
- Transporting multi-services over long distance optical network
- Upgrading legacy infrastructure with new services
- Efficient aggregation of multiple native video streams over DWDM and OTN infrastructure



Low power consumption

1U

1U rack mount



Multi operation modes

Technical Specifications

System

Topology: Point-to-point, ring or linear add/drop

Transport Network Medium: Access/metro CWDM/DWDM or dark fiber

Protection: 1+1 facility per service

Product Configurations

Dual 10G OTU2 Muxponder: Up to 16 multi-service & rate clients mapped over two independent OTU2 uplinks

Single protected 10G OTU2 uplink: Up to 16 multi-service & rate clients mapped over protected OTU2 uplink

EDFA: Optional EDFA module

Mux/Demux: Optional mux/demux module

Amplifier

Output Power: 14, 17, 20 or 23dBm

Input Power: -36dBm up to 16dBm

Gain: 8dB to 22dB

Operating Modes:

- Automatic gain control (AGC)
- Automatic power control (APC)

Eye Safety: Automatic laser power reduction upon fiber cut or disconnection

Mux/Demux

Channels: 2/4/8 CWDM or DWDM

Spacing: 50/100GHz (for DWDM)

Muxponder Uplink

Bit Rate: 10.7092G (OTU2)

Optical Interface: Pluggable XFP transceiver

OTN support:

- ODU1 VCAT mapping to OTU2
- Supported FEC types:
 - G.709 GFEC (RS)
 - G.975.1 I.4
 - G.975.1 I.7

Muxponder Service

Service Type:

- Optical or copper GbE
- FC/FICON 1G, 2G or 4G
- Optical or copper Fast Ethernet
- STM-1, STM-4, STM-16
- OC-3, OC-12, OC-48

Bit Rate: 100Mbps to 4.25Gbps

Optical/copper Interface: Pluggable SFP transceiver

Network Management

Management Ports:

- RJ-45 LAN port 10/100MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RS-232 serial port
- DB9 external alarm port

Management Protocols:

- SNMP, HTTP, HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Telnet, SSH, Syslog, RADIUS, TACACS+, SNMP, RSTP, TFTP & FTP

NMS:

- PacketLight LightWatch™ NMS/EMS, or third party NMS/EMS over SNMP

OAM: Facility loopback (client & line interfaces), PRBS, event logger, alarms, ALS

Performance Monitoring: Layer-1 PM for all services, optical power Tx, Rx levels for all optical ports, Layer-2 PM for the data services 1G & 10G LAN

Visual Indicators: LED: client and line ports, Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade: Hitless traffic – dual image

Power Supply

AC/DC: 100 to 240 VAC, 50/60 Hz, -36 to -60 VDC, 68W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational

Humidity: 5% to 85% RH

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 9.05" (D)
- 45mm (H) x 440mm (W) x 230mm (D)

Weight: 5.5kg / 12.1lb (max)

Mounting: 19", ETSI and 23"

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-4000T 1.6T Muxponder / Transponder

Transport of 4 x 200G/300G/400G wavelengths, for high capacity metro and long haul applications



Features Overview

- Pay-as-you-grow architecture based on standard pluggable coherent optical modules
- Up to 4 slices of 200G/300G/400G
- Supported services: 100GbE, 400GbE, OTU4
- Supported line FEC:
 - C-FEC (OIF-ZR)
 - oFEC (Open ROADM and Open ZR+)
- Range of modulation modes: 16QAM, 8QAM, QPSK
- Client options per slice:
 - 400GbE QSFPDD
 - 4 x 100GbE QSFP28
 - 4 x OTU4 QSFP28
- Supported 400G QSFPDD client optics: LR8/SR8/FR4/DR4/DR+/LR4
- Uplink options per slice:
 - 400G CFP2-DCO
 - 400G QSFPDD-DCO
- Layer-1 GCM-AES-256 encryption
- Elliptic Curve Diffie-Hellman key exchange
- Comprehensive line and service performance monitoring
- Integrated EDFA, mux/demux and up to 4 optical switches (optional)
- Facility protection using integrated optical switches (optional)
- Remote management with in-band GCC, or out-of-band OSC
- Easy maintenance with field-replacable and hot-swappable parts:
 - Dual hot pluggable power supply units (AC/DC)
 - Fan unit

400G Muxponder/Transponder

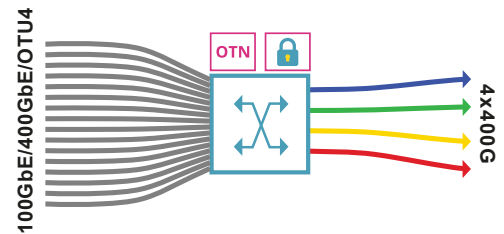
The PL-4000T is a modular and cost-effective high capacity solution for rolling out 400GbE and 100GbE services, or increasing existing network capacity. The device has four 400G pluggable uplink optical modules, delivering up to 1.6T in a 1U chassis. The PL-4000T integrates mux/demux, EDFA and OSW and delivers the entire optical layer. This flexible solution enables pay-as-you-grow architecture.

Main Benefits

- **Cost-effective high capacity transport of 200G/300G/400G over single wavelength**
- **Up to 4x400G transponders/muxponders in a 1U chassis**
- **Embedded Layer-1 GCM-AES-256 encryption**
- **Integrated EDFA, mux/demux and optical switch in 1U**
- **Modular and cost-effective for future growth and maintenance**

Flexible Pay-as-you-grow Architecture, with Redundancy

The solution provides full demarcation point between the service and the DWDM network, and is interoperable with any third party switch or router. This provides full visibility and performance monitoring of both the optical transport layer (OTN) and 100GbE/400GbE/OTU4 service interfaces.



PL-4000T Transponder/Muxponder Diagram

Recommended applications:

- Metro and long haul network applications
- High capacity DCI for enterprise, campus and cloud computing networks
- 400G wavelengths to bolster existing OTN/DWDM infrastructure
- Last mile access/aggregation CPE for 100/400GbE managed services
- Secured and encrypted communication for 100/400GbE services



Layer-1 encryption



1U 1U rack mount



Cost-effective solution

Technical Specifications

Product Configurations

Muxponder: 4x100G clients per 200G/300G/400G slice

Transponder: 1x400G per 400G

Optical Amplifiers: Up to two EDFA modules (optional)

Mux/Demux: 4ch mux/demux module (optional)

Optical Switch:

- 1+1 optical switch
- 4 x 1+1 optical switches

Uplink Characteristics

Bit Rate:

- 200G/300G/400G OpenROADM
- 200G/300G/400G OpenZR+

Optical Interface: CFP2-DCO or QSFPDD-DCO 400G uplink

Tunability range:

- DWDM ITU-T G.694.1 grid
- C-band, with flex-grid support

FEC Support:

- oFEC
- C-FEC

CFP2-DCO:

- Tx power 400G: -8dBm to +3dBm
- Rx power 400G: -23dBm
- Rx power 300G: -23dBm
- Rx power 200G: -30dBm
- 400G 16QAM OSNR Tolerance at -12dBm Rx Power: typical 21.8dB, min. 22.8dB
- 300G 8QAM OSNR Tolerance at -16dBm Rx Power: typical 18.9dB, min. 19.4dB
- 200G QPSK OSNR Tolerance at -17dBm Rx Power: typical 13.9dB, min. 14.9dB
- Rx Sensitivity at High OSNR: 400G 16QAM -22.5dBm, 300G 8QAM -23dBm, 200G QPSK -30dBm

Chromatic Dispersion Tolerance:

- 400G: 26,000ps/nm
- 300G: 26,000ps/nm
- 200G: 40,000ps/nm

QSFPDD-DCO:

- Tx power 400G: -6 to -10dBm
- 400G 16QAM C-FEC OSNR Tolerance at -12dBm Rx power: typical 24dB, min. 26dB
- Rx sensitivity at high OSNR: 400G 16QAM/ C-FEC -20dBm

Chromatic Dispersion Tolerance:

- 400G: 2,400ps/nm

Client Characteristics

Service Types:

- 100Gb Ethernet
- 400Gb Ethernet
- OTU4

Optical Interface:

- 100GbE QSFP28 LR4/ER4/SR4/ZR/CWDM4/FR1/DR1
- 400GbE QSFPDD LR8/SR8/FR4/DR4/DR+/LR4

FEC Support:

- 100GbE: RS-FEC or no-FEC
- 400GbE: KP4-FEC
- OTU4: ITU-T G.709 G-FEC

Amplifier

Applications: Booster, pre-amp

Output Power:

- Booster: up to 20dBm
- Pre-amp: up to 5dBm

Input Power:

- Booster: -24dBm to +10dBm
- Pre-amp: -36dBm to -10dBm

Gain:

- Booster: 5dB to 22dB
- Pre-amp: 13dB to 22dB

Operating Modes:

- Automatic gain control (AGC)
- Automatic power control (APC)

Network Management

Management Ports:

- 2xRJ-45 LAN port 100/1000MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RJ-45 serial port
- RJ-45 external alarm port
- OTN in-band GCC channel

Management Protocols:

- HTTP/HTTPS, CLI over RS-232 or CLI over Telnet/SSH, SNMPv2/3, Syslog, RADIUS, TACACS+, SNMP, TFTP & SFTP, REST, NETCONF

NMS:

- PacketLight LightWatch™ NMS, or third party NMS over SNMP

OAM:

- Facility loopback (client and line interfaces), terminal loopback, PRBS, event log, alarms

Performance Monitoring:

- Layer-1/2 PM for 100/400GbE services
- FlexO PM
- OTN PM for uplink and OTU4 services
- Optical PM for optical ports

Visual Indicators: Status indicators for client and line ports, Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade:

Hitless traffic – dual image

Power Supply

AC/DC: 100 to 240 VAC, 50/60 Hz, -44 to -60 VDC, 300W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 45°C (+23°F to +113°F) operational

Humidity: 5% to 85% RH

Storage: 85°C

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 15.75" (D)
- 45mm (H) x 440mm (W) x 400mm (D)

Weight: 8.4kg / 18.5lb (max)

Mounting: 19", ETSI, 21", 23"

Encryption

Functionality: Full speed transparent Layer-1 encryption for selected 100GbE/400GbE/OTU4 services / 400G uplinks

Compliance:

- FIPS 140-3 Level 2

Algorithms:

- Encryption/decryption: GCM-AES-256
- Key exchange: ECC CDH, Curve P-384
- Message digest: SHA-384

Authentication: Role-based user/password authentication

Note: For specific countries, models that include Layer-1 GCM-AES-256 based encryption will be marked with the suffix C.

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-4000G 4.8T Transponder

Mix of 400GbE and 100GbE over 400G wavelengths for high capacity DCI applications, in integrated 1U

Features Overview

- Pay-as-you-grow architecture based on standard pluggable coherent optical modules
- Operation modes:
 - 12 x 400GbE transponder
 - 48 x 100GbE transponder
- Supported services: 100GbE, 400GbE
- Supports oFEC (OpenROADM standard) and CFEC (OIF-ZR standard) on the line side
- Standard MSA pluggable modules:
 - 12 x 400GbE QSFP-DD-DR4/DR4+/FR4/LR8/FR8 clients
 - 48 x 100GbE QSFP-DD-DR4/DR4+/FR4 clients
- Comprehensive line and service performance monitoring
- Integrated EDFA, mux/demux and optical switch (optional)
- Facility protection using an integrated optical switch (optional)
- Remote management with out-of-band OSC
- Easy maintenance with field-replaceable parts:
 - Dual hot pluggable power supply units (AC/DC)
 - Fan unit

100GbE/400GbE Transponder

The PL-4000G is a modular and cost-effective high capacity solution for rolling out 400GbE and 100GbE services, or increasing existing network capacity. The device has twelve 400G pluggable uplink optical modules, delivering up to 4.8T in a 1U chassis. The PL-4000G integrates mux/demux, EDFA and OSW and delivers the entire optical layer. This flexible solution enables pay-as-you-grow architecture.

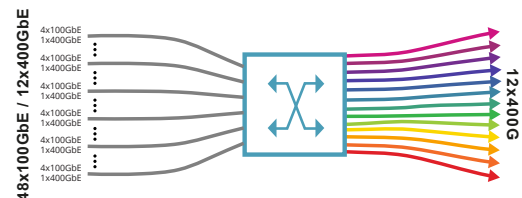


Main Benefits

- **Cost-effective high capacity transport mix of 100GbE and 400GbE client services**
- **Up to 12 x 400GbE transponders**
- **Up to 48 x 100GbE transponders**
- **Integrates EDFA, mux/demux and optical switch in 1U**
- **Modular and cost-effective for future growth and maintenance**
- **Low power consumption, high density device ports**

Full Demarcation

The device provides full demarcation point between the service and the DWDM network, and is interoperable with any third party switch or router. This provides full visibility and performance monitoring of both the optical transport layer and 100GbE/400GbE service interfaces.



PL-4000G Transponder Diagram

Recommended applications:

- High capacity DCI for Internet exchange and research and education networks
- 400G links to bolster existing DWDM infrastructure
- Last mile access/aggregation CPE for 100/400GbE managed services



Pay as you grow

1U

1U rack mount



Cost-effective solution

Technical Specifications

Product Configurations

Transponder:

- Up to 12 x 400GbE
- Up to 48 x 100GbE

Optical Amplifiers: Up to two EDFA modules (optional)

Mux/Demux: 12ch mux/demux module (optional)

Optical Switch: 1+1 facility protection (optional)

Uplink Characteristics

Bit Rate:

- 400G OpenROADM/OIF ZR

Optical Interface:

- QSFP-DD-DCO

Tunability range:

- DWDM ITU-T G.694.1 grid
- C-band, with flex-grid support

QSFP-DD-DCO OpenROADM:

FEC Support: oFEC

Tx Power:

- 400G 16QAM 1dBm to -9dBm
- 300G 8QAM 1dBm to -9dBm
- 200G 8QAM 1dBm to -9dBm
- 200G QPSK 1dBm to -9dBm
- 100G QPSK 1dBm to -9dBm

Rx Sensitivity at High OSNR (>36dB):

- 400G 16QAM -20dB (FlexO - oFEC)
- 300G 8QAM -23dBm
- 200G 8QAM -28dBm
- 200G QPSK -28dBm
- 100G QPSK -32dBm

OSNR Sensitivity:

- 400G 16QAM 23.5dB @-14dBm
- 300G 8QAM 18dB @-16dBm
- 200G 8QAM 17.5dB @-16dBm
- 200G QPSK 15.7dB @-18dBm
- 100G QPSK 12dB @-20dBm

Chromatic Dispersion Tolerance:

- 400G 16QAM 12,000ps/nm
- 300G 8QAM 48,000ps/nm
- 200G 8QAM 48,000ps/nm
- 200G QPSK 48,000ps/nm
- 100G QPSK 80,000ps/nm

QSFP-DD-DCO ZR:

- **FEC Support:** CFEC
- **Tx power:** -8dBm
- **Rx power:** 13dBm to -23dBm
- **400G 16QAM CFEC OSNR Tolerance at -12dBm Rx Power:** typical 26dB
- **Rx sensitivity at high OSNR (>36dB):** 400G 16QAM/CFEC -20dBm
- **Chromatic Dispersion Tolerance:** 400G OIF ZR: 2,400ps/nm

Client Characteristics

Service Types:

- 400Gb Ethernet
- 100Gb Ethernet

Optical Interface:

- 400GbE QSFP-DD-DR4/FR4/LR8/FR8
- 100GbE QSFP-DD-DR4/DR4+/FR4

FEC Support:

- 400GbE: KP4-FEC RS(544,514)
- 100GbE: KR4-FEC RS(528,514) or no-FEC

Amplifier

Applications: Booster, pre-amp

Output Power:

- Booster: up to 20dBm
- Pre-amp: up to 5dBm

Input Power:

- Booster: -24dB to +10dBm
- Pre-amp: -36dB to -10dBm

Gain:

- Booster: 5dB to 22dB
- Pre-amp: 13dB to 22dB

Operating Modes:

- Automatic gain control (AGC)
- Automatic power control (APC)

Network Management

Management Ports:

- 2xRJ-45 LAN port 100/1000MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RJ-45 serial port
- RJ-45 external alarm port

Management Protocols:

- SNMP v1/v2/v3, HTTP/HTTPS, CLI over RS-232 or over Telnet/SSH, Syslog, RADIUS, TACACS+, SNMP, TFTP & SFTP, REST, NETCONF

NMS:

- PacketLight LightWatch™ NMS/EMS, or third party NMS over SNMP

OAM:

- Facility loopback (client and line interfaces), terminal loopback, PRBS, event log, alarms

Performance Monitoring:

- Layer-1/2 PM for 100/400GbE services
- FlexO
- FEC Corrected/Uncorrected errors
- Optical PM for optical ports

Visual Indicators:

Status indicators for client and line ports, Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade:

Hitless traffic – dual image

Power Supply

AC/DC:
100 to 240 VAC, 50/60 Hz,
-44 to -60 VDC, 250W max

PSU Redundancy:

Single/dual feeding, hot swappable

Cooling Unit:

Hot swappable fan unit

Environmental

Operating Temperature:

-5°C to 45°C (+23°F to +113°F) operational

Humidity: 5% to 85% RH

Storage: 85°C

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 15.75" (D)
- 45mm (H) x 440mm (W) x 400mm (D)

Weight: 8.3kg / 18.3lb (max)

Mounting: 19", ETSI, 21", 23"

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-2000T 800G Transponder

800G Transport Platform for high capacity applications



Features Overview

- Pay-as-you-grow architecture based on pluggable 200G digital coherent optical modules
- Operation modes: QPSK 100G long haul and 8/16 QAM 200G metro
- Supported clients: 100Gb Ethernet, OTU4
- Supported FEC modes:
 - Line: SD-FEC for metro and long haul applications
 - OTU4 service: ITU G.709 GFEC
 - 100GbE service: IEEE Clause BJ-FEC
- Standard MSA pluggable:
 - CFP2 DCO tunable DWDM for 100G/200G line interface
 - QSFP28 SR4/LR4/ER4/CWDM4 for 100G client interface
- Layer-1 GCM-AES-256 encryption
- Elliptic Curve Diffie-Hellman key exchange
- Comprehensive line and service performance monitoring
- Optional integrated EDFA, mux/demux and optical switch
- Facility protection using an optional integrated optical switch
- Remote management with in-band GCC, or out-of-band OSC
- Easy maintenance with field-replaceable parts:
 - Dual hot pluggable power supply units AC/DC
 - Fan unit

200G Metro and 100G Long Haul Applications

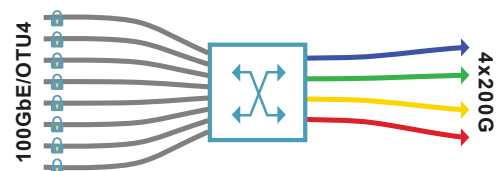
The PL-2000T is a modular and cost-effective solution for rolling out 100G services or increasing existing network capacity. The device has four 200G pluggable optical modules, delivering up to 800G in a 1U chassis, and enabling pay-as-you-grow architecture.

Main Benefits

- **Integrated EDFA, mux/demux and optical switch in 1U**
- **High transport capacity of 800G with configurable modulation scheme**
- **Embedded Layer-1 optical encryption**
- **Managed service platform**
- **Modular and cost-effective for future growth and maintenance**

Flexible Pay-as-you-grow Architecture, with Redundancy

The solution provides full demarcation point between the service and the uplink DWDM side and is interoperable with any third party switch or router. This provides full visibility and performance monitoring of both line optical transport layer (OTN) and 100G LAN/OTU4 service interfaces.



PL-2000T Transponder Diagram

Recommended applications:

- Metro network applications ranging up to 1,000km
- High capacity DCI for enterprise, campus and cloud computing networks
- 200G links to bolster existing OTN/DWDM infrastructure
- Last mile access/aggregation CPE for 100G managed services
- Secured and encrypted communication for 100G protocols



Layer-1 encryption

1U

1U rack mount



Cost-effective solution

Technical Specifications

Product Configurations

Transponder: 4x200G metro or 4x100G long haul

Optical Amplifiers: Optional up to two EDFA modules

Mux/Demux: Optional 4ch mux/demux module

Optical Switch: Optional 1+1 facility protection

Uplink Characteristics

Bit Rate:

- 200G OTUC2'
- 100G OTUC1'

Optical Interface: CFP2 coherent (DCO)

Tunability range:

- DWDM ITU-T G.694.1 grid
- C-band, with flex-grid support
- C-band, with 100GHz/50GHz spacing

FEC Support:

- Standard ITU-T G.709 GFEC
- SD-FEC

Tx Power:

- 8/16 QAM (200G): -0.5 to -10dBm
- DP-QPSK (100G): -0.5 to -5dBm

Rx Power:

- 16 QAM (200G): -22dBm
- 8 QAM (200G): -24dBm
- DP-QPSK (100G): -29dBm

OSNR Sensitivity (at -18dBm Rx Power):

- 16 QAM (200G): 19.8dB
- 8 QAM (200G): 18.1dB
- DP-QPSK (100G): 11.4dB

Chromatic Dispersion

- 16 QAM (200G): 16,000ps/nm
- 8 QAM (200G): 20,000ps/nm
- DP-QPSK (100G): 40,000ps/nm

Client Characteristics

Service types:

- 100G LAN
- OTU4

Optical Interface:

- SM QSFP28 - LR4/ER4 (1310nm)
- MM QSFP28 - SR4 (850nm)

FEC Support:

- OTU4: Standard ITU-T G.709 GFEC or Zero FEC
- 100G LAN: BJ-FEC or no-FEC

Amplifier

Applications: Booster, pre-amp

Output Power:

- Booster: up to +20dBm
- Pre-amp: +5dBm

Input Power:

- Booster: -24 to +10dBm
- Pre-amp: -36 to -9dBm

Gain:

- Booster: 5 to 22dB
- Pre-amp: 13 to 22dB

Operating Modes:

- Automatic gain control (AGC)
- Automatic power control (APC)

Network Management

Management Ports:

- 2xRJ-45 LAN port 10/100MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RJ-45 serial port
- RJ-45 external alarm port
- OTN in-band GCC channel

Management Protocols:

- SNMPv1/v2/v3, HTTP/HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Syslog, RADIUS, TACACS+, SNMP, TFTP & FTP/SFTP, REST, NETCONF

NMS:

- PacketLight LightWatch™ NMS/EMS, or third party NMS over SNMP

OAM:

- Facility loopback (client and line interfaces), PRBS, event log, alarms

Performance Monitoring:

- Layer-1/2 PM for 100G LAN services
- OTN PM for uplink and OTU4 services
- Optical PM for optical ports

Visual Indicators: Status indicators for client and line ports, Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade: Dual image, hitless swap

Power Supply

AC/DC: 100 to 240 VAC, 50/60 Hz, -36 to -60 VDC, 250W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational

Humidity: 5% to 85% RH

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 11.22" (D)
- 45mm (H) x 440mm (W) x 285mm (D)

Weight: 8.5kg / 18.75lb (max)

Mounting: 19", ETSI, 21" and 23"

Encryption

Functionality:

Full speed transparent Layer-1 encryption for OTU4 uplinks

Algorithms:

- Encryption/decryption: GCM-AES-256
- Key exchange: ECC CDH, Curve P-384
- Message digest: SHA-384

Authentication:

Role-based user/password authentication

Compliance:

- FIPS 140-2
- CNSA Top Secret Suite B 2015

Note: For specific countries, models that include Layer-1 GCM-AES-256 based encryption will be marked with the suffix C.

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-1000TN 10G OTN Transponder

6x10G OTN multi-protocol multi-rate OTN transponders, with total capacity of 60G

Features Overview

- 6 independent ITU G.Sup43 standard-based multi-rate 8/10G OTN transponders
- Supported clients:
 - 10Gb/40Gb Ethernet
 - 8G/10G Fibre Channel (FC)
 - STM-64/OC-192
 - OTU2/2e
- Three FEC types: ITU G.709 GFEC, G.975.1 EFEC I.4 and UFEC I.7 for enhanced performance
- Supports full C-band tunable DWDM on line side optics
- Supports multi-rate client interfaces over a common OTN infrastructure
- 1+1 facility and optical switch line protection
- Comprehensive performance monitoring and full OTN managed layer
- Optional integrated EDFAs, DCM, mux/demux and optical switch modules
- Remote management with in-band GCC or out-of-band optical supervisory channel (OSC)
- Cost-effective 1U platform with low power consumption, ideal for customer located equipment (CLE)
- Supports standard MSA pluggable modules:
 - SFP+ (client)
 - XFP (uplink)
- Dual AC or DC pluggable power supply and pluggable fan unit
- Operates on single or dual fiber networks

Multi-protocol 10G OTN Transponders

The PL-1000TN holds up to 6 multi-protocol transponders for mapping 8G/10G services over OTU2/2e/2f OTN. It is a highly integrated solution for unified transport of different protocols over a common optical transport layer.



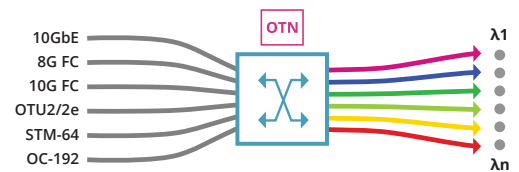
Main Benefits

- Long haul connectivity for up to 52dB using a single 1U device
- Smallest integrated transport solution of its kind, saving rack space
- Enhanced forward error correction
- Reduces backbone cost by cutting the number of regenerators

Integrated 1U OTU2 Transponder

The PL-1000TN meets market demands for low power consumption and rack space savings, reducing the overall solution CAPEX and OPEX.

The device provides the entire optical solution in a 1U, integrating EDFAs, mux/demux and DCM with the OTN transponders.



PL-1000TN Multi-rate Transponder Diagram

Recommended applications:

- Building efficient DWDM OTN transport solutions for enterprises over common OTN long distance optical network
- Building a robust packet optical network infrastructure
- Multi-rate OTN transponder for ROADM-based applications
- CPE device for end-to-end managed services over carrier backbone
- Upgrading SONET/SDH backbones to OTN backbones
- OTU2e OTN regenerator



Low power consumption

1U

1U rack mount



Multi operation modes

Technical Specifications

System

Transport Network Medium: Access/metro CWDM, DWDM or dark fiber / long distance optical fiber networks / OTN backbone networks

Protection: 1+1 facility

Product Configurations

Transparent OTU2 Transponder:

- **Non-protected:** Up to 6 independent client signals mapped into corresponding OTU2 line protocols
- **1+1 protected:** Up to 3 dual independent client signals mapped into corresponding 10G OTU2/2e/2f line protocols

EDFA: Up to two EDFA modules

Mux/Demux: Up to two mux/demux modules

Optical Switch: 1+1 facility protection <50ms switch time optical module

Optical Amplifier

Output Power: 14, 17, 20 or 23dBm

Input Power: -36dBm up to 16dBm

Gain: 8dB to 22dB

Operating Modes:

- Automatic Gain Control (AGC)
- Automatic Power Control (APC)

Eye Safety: Automatic laser power reduction upon fiber cut or disconnection

Mux/Demux

Channels: 4/8 CWDM or DWDM channels

Spacing: 50/100GHz (for DWDM)

Line (Uplink)

Protocols:

- OTU2 (10.709)
- OTU2e (11.095) as per G.Sup43
- OTU2f (11.317)

FEC Types: G.709 GFEC (RS) , G.975.1 EFEC I.4 , G.975.1 UFEC I.7

Optical Interface:

- Up to 6 pluggable XFP transceivers
- DWDM, tunable DWDM
- CWDM

Client Service

Client Protocols:

- 10G/40G LAN (10.3125G/4x10.3125G)
- 8G/10G FC (8.5G/10.518)
- STM-64/OC-192 (9.953)
- OTU2

Optical Interface:

- Up to 6 pluggable SFP+ transceivers
- 850nm multimode
- 1310nm single mode

Network Management

Management Ports:

- RJ-45 LAN port 10/100MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RJ-45 serial port
- RJ-45 external alarm port
- OTN in-band GCC channel

Management Protocols:

- SNMP, HTTP, HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Syslog, RADIUS, TACACS+, SNMP, TFTP & FTP

NMS:

- PacketLight LightWatch™ NMS/EMS, or third party NMS over SNMP

OAM:

- Facility loopback (client and line interfaces), PRBS, event log, alarms
- Automatic laser shut-down (ALS)

Performance Monitoring:

- Layer-1 PM for all services
- Layer-2 PM for Ethernet
- OTN PM for uplinks
- Optical power Rx levels for all optical ports

Visual Indicators: LED status indicators for: client and line ports, Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade: Hitless traffic – dual image

Power Supply

AC/DC: 90 to 246 VAC, 50/60 Hz, -36 to -60 VDC, 70W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F)

Operational Humidity: 5% to 85% RH

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 9.05" (D)
- 45mm (H) x 440mm (W) x 230mm (D)

Weight: 5.5kg / 12.1lb (max)

Mounting: 19", ETSI and 23"

Configuration

License-based: 4, 6 transponders

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-1000TE 1G-16G Transponder

8 multi-rate multi-protocol transponders, supporting Layer-1 encryption, for high capacity DCI



Features Overview

- Multi-rate and multi-protocol mix of 8 transponders, configurable from 622M up to 40G
- Service types: Data - GbE/10G and 40G LAN, Storage - 1G/2G/4G/8G/10G/16G FC, SONET/SDH - STM-4/OC-12, STM-16/OC-48, STM-64/OC-192, Video - HD-SDI/3G-SDI (PAL and NTSC), Wireless - CPRI 1-7 (614M to 9.8G rates)
- Low latency connectivity, ideal for data center interconnect applications
- Encryption algorithm: GCM- AES-256 Layer-1 data encryption. Periodical Diffie Hellman key exchange. Complies with NIST FIPS-140-2 and CNSA Top Secret Suite B 2015 requirements
- Supported Layer-1 Encryption services: Data - GbE/10Gb/40Gb Ethernet Storage - 4G/8G/10G/16G FC
- Remote management and topology discovery for the optical network
- Pluggable SFP/SFP+ interfaces for both service and WDM channels
- Supports full C-band tunable DWDM on the line side (SFP+)
- Optional integrated EDFAs, mux/demux, DCM and optical switch
- Supports 1+1 facility protection
- Bi-directional performance monitoring
- Dual AC or DC pluggable power supply and pluggable fan unit
- Supports single and dual fiber networks

Low Latency 1G-16G WDM Transponder

The PL-1000TE/PL-1000TE Crypto is a CWDM/DWDM solution for connecting two data centers or back up sites. The device is an advanced, all-in-one optical transport solution, supporting up to 8 transponders with a flexible mix of industry-standard-protocols. The product integrates a rich and cost-effective feature set in a 1U chassis with low power consumption.

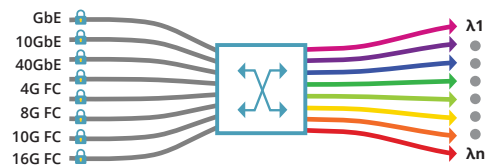
The PL-1000TE Crypto supports innovative Layer-1 optical encryption capability for 1G/10G/40G Ethernet LAN and 4G/8G/16G FC storage services.

Main Benefits

- Flexible mix of services provides transparent migration capability from up to 10G to 10G services with no downtime
- Layer-1 encryption prevents disclosure of information to unauthorized parties with 100% throughput
- Maximum flexibility and scalability

Standards-based Layer-1 Encryption

The PL-1000TE/PL-1000TE Crypto allows easy upgrade or expansion of the required services by simply adding pluggable optic modules (SFP/SFP+) into the available slots or by implementing PacketLight's multi-chassis stackable solution. This architecture provides true scalability at a minimum cost.



PL-1000TE Diagram - Multi-rate Transponder Layer-1 Encryption

Recommended applications:

- High capacity, low latency, secure data center interconnect (DCI)
- Efficient connectivity for campus, ISP and enterprise networks
- Upgrade of existing WDM networks to support 10/40Gb Ethernet and 16G FC services
- Trading applications and synchronous data center replication requiring low latency
- Distance extension for 40G data networks up to 120km



Layer-1 encryption



Low power consumption



1U 1U rack mount



Multi operation modes

Technical Specifications

System

Topology: Point-to-point, ring, linear ADM, dual or single fiber

Transport Network Medium: Metro CWDM, DWDM and dark fiber

Cryptography

Crypto Algorithm: GCM-AES-256

Key Management: ECC Cofactor Diffie-Hellman with P-384 curve

Message Authentication: SHA-384

Crypto Services:

- Data: GbE/10G/40G Ethernet
- Storage: 4G/8G/10G/16G FC

Note: For specific countries, models that include Layer-1 GCM-AES-256 based encryption will be marked with the suffix C.

Product Options

Transponder: 850/1310nm to C/DWDM, 3R

Mux/Demux: 2x4 / 1x8 wavelengths

Amplifier: 1/2 EDFA (booster/pre-amp)

DCM: Up to 200km

Optical Switch: 1+1 facility protection

CWDM Link

Wavelength: ITU-T G.694.2 1270-1610nm, 20nm spacing

DWDM Link

Wavelength: ITU-T G.694.1 channels 15-60, 100GHz spacing, optional tunable SFP+ with 50GHz spacing

OSC: 1490nm, 1510nm

Optical Reach: 400km for 1.25Gbps, 200km for 2.66Gbps, 80km for 4.25/8.5/10Gbps, 40km for 16G FC

Optical Output Power:

- Sub-10G: 0dBm (min) to +4dBm (max)
- 8G/10G: -1dBm (min) to +2dBm (max)

Sensitivity:

- Up to 2.66Gbps: -28dBm APD
- 4G/8G/10G: -24dBm APD, -14dBm PIN

Optical Monitoring: Tx & Rx power

Link Attenuation: <4dB (mux + demux)

Service Side

Interface Rates: 1.25G to 10.51875G

Optical Interface: 850nm, 1310nm, 1550nm

Non Crypto Services:

1G/2G/4G/8G/10G/16G FC, 1G/10G LAN, STM-4/OC-12, STM-16 /OC-48, STM-64/OC-192, CPRI 1-7, Video HD-SDI, 3G-SDI

Copper Services: 1000MBase-T

Amplifier

Applications: Booster, pre-amp

Output Power: Booster: +17dBm, +20dBm, 23dBm, pre-amp: +14dBm

Input Power: Booster: -24 to +16dBm, pre-amp: -36dBm up to 0dBm

Gain: Booster: +8dB to +22dB, pre-amp: +20dB

Operating Modes: Automatic gain control (AGC), automatic power control (APC)

Eye Safety: Automatic laser power reduction upon fiber cut or disconnection

Network Management

Management Ports:

- RJ-45 LAN port 10/100MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- RS-232 serial port
- DB9 external alarm port

Management Protocols:

- SNMP, HTTP, HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Syslog, RADIUS, TACACS+, SNMP, RSTP, TFTP and FTP

NMS:

- PacketLight LightWatch™ NMS/EMS, or third party EMS NMS over SNMP

OAM: Facility loopback (client and line interfaces), PRBS, event logger, alarms, ALS

Performance Monitoring: Layer-1 PM for all services, Layer-2 PM for Ethernet, optical power Tx, Rx levels for all optical ports, 1G & 10G

Visual Indicators: LED: client and line ports, Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade: Hitless traffic – dual image

Optical Switch

Topology: Protected point-to-point

Switching time: Less than 50ms

Signal WL: C-band and L-band

Max input power: 27dBm

Insertion loss: Transmit side 3.8dB, Receive side 1.2dB

Power Supply and Fans

AC/DC:

100 to 240 VAC, 50/60Hz, -38 to -60 VDC, 120W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational

Humidity: 5% to 85% RH

Size:

1U:

- 1.77" (H) x 17.32" (W) x 9.05" (D)
- 45mm (H) x 440mm (W) x 230mm (D)

Weight: 7kg / 15.4lb (max)

Mounting: 19", 23" and ETSI

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready
- FIPS-140-2 compliant
- CNSA Top Secret Suite B 2015 compliant

PL-1000D Diagnostic and Monitoring Solution

Diagnostic device using OTDR to detect fiber quality and cut, and OSA for spectrum and OSNR analysis

Features Overview

- Monitoring up to 16 fibers simultaneously, 8 by the OTDR and 8 by the OSA
- Controlled with PacketLight web application or PacketLight's Lightwatch™ NMS
- Main Metro OTDR features:
 - Integrates 1:8 optical switch, OTDR, OADMs
 - 24dB fiber loss
 - Integrated with third party GIS tools
- Main Regional OTDR features:
 - Integrates 1:8 optical switch, OTDR, OADMs
 - 32dB fiber loss
 - Integrated with third party GIS tools
- Main OSA features:
 - Integrates 1:8 optical switch, OSA, splitters
 - Supports full C-band 50GHz/100GHz ITG grid
 - Measures the power, frequency and OSNR of the optical channels in the fiber
- 1U footprint 19"
- Dual redundant AC/DC power suppliers
- Hot swappable fan unit
- Low power consumption

How the PL-1000D Works

The PL-1000D consists of two technologies for non-intrusive monitoring live fiber optic networks. The OTDR locates fiber cut by sending high-powered diagnostic optical pulses into the fiber and creating Rayleigh back-reflections. The returning signals are measured and calculated, indicating the accurate location and intensity of the fault. The OSA presents for each fiber the optical spectrum and the OSNR of each wavelength, providing the operator with a full, accurate and detailed picture of the fiber.



Main Benefits

- Simultaneous OTDR diagnostics of up to 8 fibers
- OSA monitoring of up to 8 fibers
- In-service fiber monitoring
- Can operate over dark fiber or over third party network
- Detection of fiber tapping attempts
- Provide alarm when the trace events are changed
- Graphical display of the OTDR and OSA in any browser

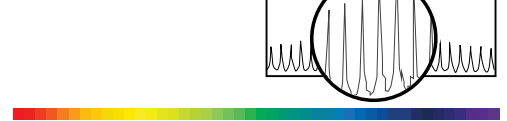
Full Fiber Diagnostic Device

The PL-1000D conducts full non-disruptive monitoring and analysis of the network's fiber. The OTDR monitors up to 8 fibers simultaneously, identifying a break or degradation in each fiber and where the break is. The embedded OSA provides the full optical DWDM spectrum and OSNR of up to 8 fibers simultaneously. The solution provides high-level visibility of the fiber characterization and operating wavelengths and saves network managers time and OPEX expenses associated with identifying and repairing faults.

OTDR



OSA



PL-1000D OTDR and OSA Solution

Recommended applications:

- Monitoring dark fibers service/infrastructure
- Monitoring lighted DWDM fibers
- In service OTDR measurements for DWDM networks
- In service OSA measurements for DWDM networks
- Detection of fiber tapping



Technical Specifications

Product Configurations

- Metro or Regional OTDR
- OSA

Metro OTDR

- Wavelength: 1610nm
- Distance Range: 120 km
- Dynamic Range: 24dB
- Loss Measurement Accuracy: ± 0.1 dB
- Max Optical Output Power: 17dBm

Regional OTDR

- Wavelength: 1610nm
- Distance Range: 140 km
- Dynamic Range: 32dB
- Loss Measurement Accuracy: ± 0.1 dB
- Max Optical Output Power: 20dBm

OSA

- Channel Spacing: 50GHz or 100GHz ITG grid
- Frequency Window: C-band
- Frequency Accuracy: ± 0.1 GHz
- Slice Width: 0.3125GHz
- Min Channel Width: 312.5MHz
- Max Channel Width: 4.875THz
- Input Channel Power (Pch): -35dBm - 0dBm
- Channel Power Accuracy: ± 0.5 dBm

Network Management

Management Protocols:

- SNMP, HTTP, HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP & FTP, SNMPv2/ SNMPv3

NMS:

- PacketLight LightWatch™ NMS/EMS, or third party EMS/NMS over SNMP

Visual Indicators:

LED status indicators for Management and LAN ports, system Critical/Major/Minor indicators, and Power Supply alarms

Software Upgrade:

Hitless traffic - dual image

Power Supply

AC/DC:

90 to 246 VAC, 50/60 Hz, -36 to -60 VDC, 60W max

PSU Redundancy:

Single/dual feeding, hot swappable

Cooling Unit:

Hot swappable fan unit

Environmental

Operating Temperature:

-5°C to 50°C (+23°F to +122°F) operational

Humidity:

5% to 85% RH

Physical Dimensions

1U:

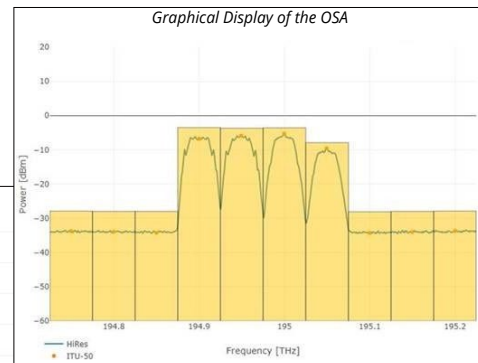
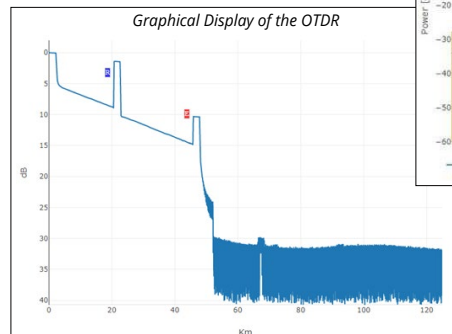
- 1.77" (H) x 17.32" (W) x 9.05" (D)
- 45mm (H) x 440mm (W) x 230mm (D)

Weight: 5.5kg / 12.1lb (max)

Mounting: 19", ETSI and 23"

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready



PL-1000RO WSS ROADM

Highly flexible wavelength routing

Features Overview

- Flexible add/drop of wavelengths
- Up to 8-degree ROADM
- Flex-grid ready
- Supports 10G/100G/200G and 400G wavelengths
- Up to 96 C-band add/drop wavelengths (configurable)
- WDM spacing - 50GHz or 100GHz
- Supports automatic channel restoration
- Power monitoring on all channels
- Optical power equalization between all channels
- A-to-Z provisioning of wavelengths and protection through NMS system
- Supports up to 96 C-band channels
- Supports optional embedded EDFA booster/pre-amp
- Dual AC or DC pluggable power supply and pluggable fan unit

Colorless, Directionless ROADM for 50GHz and 100GHz Grid

The PL-1000RO offers ROADM functionality based on advanced next generation wavelength-selective switch (WSS) technology.

The solution offers highly flexible wavelength routing capabilities suitable for mesh, ring, linear add/drop, core and edge DWDM network topologies. The PL-1000RO supports colorless, directionless, flex-grid, 50GHz grid and 100GHz grid (configurable).



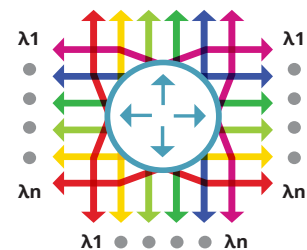
Main Benefits

- **Power monitoring for all channels and automatic power balancing**
- **Supports optional embedded EDFA booster/preamp**
- **Optional DCM and band splitters**
- **Embedded optical supervisory channel (OSC) for remote management**
- **User-friendly NMS to deploy new services, control and monitor the optical network**

Full Fiber Diagnostic Device

The user configures the PL-1000RO dynamically to add/drop selected wavelengths at any node in the network and can seamlessly change the network node capacity as needed. The device automatically equalizes and balances the power of the added and bypassed wavelengths.

The PL-1000RO simplifies network management and reduces operation costs (OPEX) by allowing fast deployment of new wavelengths remotely. The ROADM fully integrates with PacketLight's WDM product line.



PL-1000RO Integrated ROADM Platform

Recommended applications:

- Configuration and management of mesh and ring-based DWDM network architecture
- Wavelength routing for mesh, ring, linear add/drop, core and edge DWDM network topologies
- Wavelength power balancer in amplified links
- Network management by remotely deploying new wavelengths



Technical Specifications

	4 degree		8 degree		Unit	Notes
	Min	Max	Min	Max		
Insertion Loss	13	14	8	10	dB	All ports
Loss Uniformity		1.5		1	dB	All ports
Channel Range	191.3	196.0	191.3	196.0	THz	Full C-band, 1529.55 to 1567.13nm
Channel Count		48/96		48/96	Channels	50/100 GHz spacing ITU grid (CH13-CH60)
PMD	-0.2	0.2		1.2	ps/nm	In passband
Switch Speed		800	1000	3000	ms	
VOA Range	0	15	0	15	dB	

Full C-band Amplifier

Output Power: 14dBm to 23dBm
Input Power: -36dBm up to +16dBm
Gain: 8dB to 38dB
Operating Modes

- Automatic gain control (AGC)
- Automatic power control (APC)

Eye Safety: Automatic laser power reduction upon fiber cut or disconnection

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 9.05" (D)
- 45mm (H) x 440mm (W) x 230mm (D)

Weight: 8kg / 17.64lb (max)
Mounting: 19", ETSI and 23"

Network Management

Management Ports

- 2xRJ-45 LAN port 10/100MBase-T
- 2xSFP MNG ports 100/1000MBase-X
- 8xSFP MNG ports 100MBase-X
- RS-232 serial port
- DB9 external alarm port

Management Protocols: SNMP, HTTP, HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Syslog, RADIUS, TACACS+, Sntp, TFTP and FTP

NMS:

- PacketLight LightWatch™ NMS/EMS, or third party EMS/NMS over SNMP

Performance Monitoring:

- Layer-1 PM for all wavelengths
- OCM for input and output directions

Visual Indicators: LED status indicators for: Management and LAN ports, amplifier/s, system Critical/Major/Minor and Power Supply

Software Upgrade: Hitless traffic – dual image

Power Supply

AC/DC: 90 to 246 VAC, 50/60 Hz, -36 to -60 VDC, 60W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational

Humidity: 5% to 85% RH

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-1000IL DWDM EDFA Amplification Solutions

Versatile, cost-effective platform with single, dual or quad DWDM amplifiers

Features Overview

- Up to 4 amplifier modules in a 1U chassis
- Supports up to 96 wavelengths
- Supports AGC and APC operation modes
- Embedded OSC for remote management and topology detection
- Optional optical switch for facility protection
- Integrated single/dual DCM for long distance 10G amplified links
- Supports single and dual fiber operation
- Supports optional up to 16 channel mux/demu
- Offers several EDFA types:
 - Booster
 - Inline
 - Pre-amplifiers
 - Midstage
- Low power consumption
- Built-in eye safety mechanism
- Monitoring on the input and output power and user configurable gain
- Dual AC or DC pluggable power supply and fan unit

Long Distance and Attenuation in the Network

The PL-1000IL is designed to cost-effectively extend the optical link power budget for building long distance DWDM solutions. It provides amplification for a range of optical solutions, from single wavelength, up to the full C-band, and incorporates several types of low-noise Erbium-doped fiber amplifiers (EDFAs): booster, inline, and pre-amplifier.



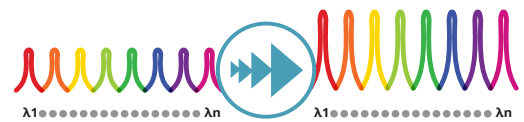
Main Benefits

- Fully managed via dedicated integrated OSC
- Full remote monitoring on the input and output power, and user-configurable gain
- Eye safety feature - automatically shuts down the EDFA in case of fiber interruption
- Fully integrated solution including mux/demux, amplifier, and DCM
- Integrates with PacketLight management platforms and transponder/muxponder products

Flexibility in Services over the Same Fiber

The PL-1000IL is fully managed, configured and monitored remotely as part of the network, via optical supervisory channel (OSC). The device supports AGC and APC operation modes. The EDFA gain is controlled, adjusted and monitored by the user, and APC operating mode allows to maintain constant output power.

The EDFA has high optical signal to noise ratio (OSNR), enabling to cascade several EDFAs to form an amplified OTN link over long distances, without the need for regenerators.



PL-1000IL Integrated Amplification Solution

Recommended applications:

- Extending the optical link power budget to meet distance and attenuation requirements of DWDM networks
- Upgrading the optical link budget to support 10G/40G/100G services
- Reducing the number of regenerators and sites along the fiber
- Overcoming high loss in old fiber infrastructure
- Facility protection for fiber redundancy solutions
- Inline, edge and unidirectional mid-stage applications



Low power consumption

1U

1U rack mount



Multi operation modes

Technical Specifications

System

Topology: Point-to-point, ring, linear ADM, inline, edge or midstage

Transport Network Medium: Metro DWDM / dark fiber

Software Upgrade: Dual image, hitless swap

Booster

Output Power: Up to 23dBm

Input Power: -24dBm up to 16dBm

Gain: 8dB to 22dB

Inline

Output Power: Up to 23dBm

Input Power: -24dBm up to 13dBm

Gain: 5dB to 22dB

Pre-amplifier

Output Power: Up to 14dBm

Input Power: -36dBm up to 15dBm

Gain: 20dB

Midstage

Output Power: 8dBm per channel

Input Power: -36dBm up to 15dBm

Total Output Power: up to 23dBm

Gain: up to 40dB

General

Gain Flatness: +/-1dB

Noise Figure: 4-6dB

PMD: 0.3ps

PDL: 0.3 dB

Operating Modes:

- Automatic gain control (AGC)
- Automatic power control (APC)

Eye Safety: Automatic laser power reduction upon fibre cut or disconnection

Optional Optical Switch

Switching Time: <50ms

Max Input Power: 27dBm

Insertion Loss Transmit Side: 3.8dB

Receive side: 1.2dB

Network Management

Management Ports:

- RJ45 10/100MBase-T
- 2xSFP 100Base-X
- RS-232 serial port
- DB9 alarm port
- 8xSFP 100Base-X MC ports

Management Protocols:

- SNMP, HTTP, HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Syslog, RADIUS, TACACS+, SNMP

NMS:

- PacketLight LightWatch™ EMS or third party EMS over SNMP

OAM: Input/output power monitoring event logger and alarms

Management Channel: 2 x optical supervisory channel (OSC)

Visual Indicators: LED status indicators for EDFA ports, power and system

Software Upgrade: Hitless traffic - dual image

DCM

DCM Type : Tunable DCM or fixed DCM

Fibre Type: G.652

Fibre Span: 20-200km

Max insertion loss: <3dB

Standard: ITU G.671

Power Supply

AC/DC: 90 to 246 VAC, 50/60 Hz, -36 to -60 VDC, 60W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 9.05" (D)
- 45mm (H) x 440mm (W) x 230mm (D)

Weight: 5.5kg / 12.1lb (max)

Mounting: 19", ETSI and 23"

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational

Humidity: 5% to 85% RH

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-1000R DWDM Raman Amplification Solutions

Counter-propagating Raman amplifier and hybrid Raman-EDFA



Features Overview

- Counter-propagating Raman amplifier with optionally embedded booster and preamp EDFAs in 1RU
- Detection of open connectors and/or broken fiber up to few tens of kilometers from the pump module
- High power connector safety switch cover
- Supports the following Raman configurations:
 - Counter-propagating Raman
 - Hybrid Raman-EDFA
- Up to 12dB average gain for G.652 fiber (2-pump)
- Gain flattening optimization based on fiber type and pump power
- Effective noise figure (NF) of -1dB
- 1U footprint with low power consumption
- Dual AC or DC pluggable power supply and pluggable fan unit
- Web-based GUI and SNMP EMS management

Distributed Raman Amplification

The PL-1000R is designed for distributed Raman amplification applications, cost-effectively extending the optical link power budget and significantly improving OSNR for building long distance DWDM solutions. It provides amplification for a range of optical solutions and incorporates several configurations of Raman amplifier, including counter-propagating and hybrid Raman-EDFA.

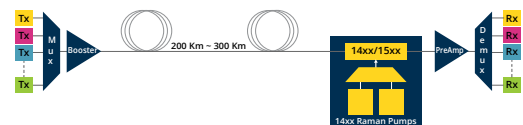
Main Benefits

- Acts as terminal Raman amplifier and as inline hybrid Raman-EDFA
- Full remote monitoring
- Eye safety feature - automatically shuts down the Raman in case of fiber interruption
- Detects fiber disruption or cut tens of kilometers from the pump
- Integrates with PacketLight management platforms and transponder/muxponder products

Laser Safety

The PL-1000R is fully managed, configured and monitored remotely as part of the network via optical supervisory channel (OSC). The Raman is controlled, adjusted and monitored by the user.

The Raman includes three eye safety mechanisms that shut down the unit in case of fiber link disruption, such as open connectors or broken fiber, even at a distance of a few tens of kilometers from the unit.



PL-1000R Raman Amplification Solution

Recommended applications:

- Long repeaterless links
- Low latency links (less FEC and O-E-O conversion)
- Storage area networks (SANs), remote locations, disaster recovery
- Security-sensitive applications
- Improving OSNR in long-haul and ultra-long haul links
- 400G, 200G and 100G transmission and/or increasing channel count to 96 WDM channels



Low power consumption

1U

1U rack mount



Multi operation modes

Technical Specifications

Optical Specifications - Raman

Wavelength Range: 1529-1565nm

Wavelength Range, OSC: 1500-1520nm

Input Power Range: -47dBm to -5dBm

Gain: 12dB

Maximum Pump Power: 550mW
(2 pumps)

Average Gain (G.652 fiber): 12dB
(typical for 2 pumps)

Operating Mode: Automatic power control (APC)

Gain Flatness: +/-0.6dB

Signal Insertion Loss: 2.9dB

Noise Figure: -1dB

PDG: 0.3dB

PMD: 0.6pssec

Eye Safety: Automatic laser power reduction upon fibre cut or disconnection

Monitored Parameters

- Pump power
- Signal power
- Back-reflected power
- Operating temperature

Optical Specifications - Booster EDFA

Output Power: Up to 23dBm

Input Power: -24dBm up to 14.5dBm

Gain: 8dB to 22dB

Optical Specifications - PreAmp EDFA

Output Power: Up to 20dBm

Input Power: -36dBm up to -7dBm

Gain: 20dB

Network Management

Management Ports:

- RJ45 10/100MBase-T
- 2xSFP 100Base-X
- RS-232 serial port
- DB9 alarm port
- 8xSFP 100Base-X MC ports

Management Protocols:

- SNMP, HTTP, HTTPS, CLI over RS-232 or CLI over Telnet/SSH, Syslog, RADIUS, TACACS+, SNMP

NMS:

- PacketLight LightWatch™ EMS or third party EMS over SNMP

OAM: Input/output power monitoring event logger and alarms

Management Channel: Optical supervisory channel (OSC)

Visual Indicators: LED status indicators for ports, eye safety, power and system

Software Upgrade: Dual image, hitless swap

Power Supply

AC/DC: 90 to 246 VAC, 50/60 Hz, -36 to -60 VDC, 60W max

PSU Redundancy: Single/dual feeding, hot swappable

Cooling Unit: Hot swappable fan unit

Physical Dimensions

1U:

- 1.77" (H) x 17.32" (W) x 9.05" (D)
- 45mm (H) x 440mm (W) x 230mm (D)

Weight: 5.5kg / 12.1lb (max)

Mounting: 19", ETSI and 23"

Environmental

Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational

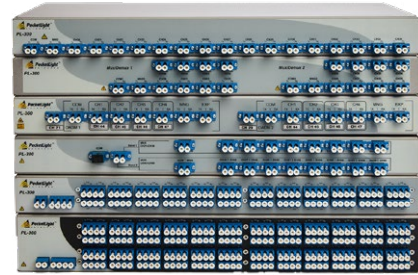
Humidity: 5% to 85% RH

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

PL-300 Passive Family

Up to 96ch Mux/Demux, DCM, OADM in 1U



Features Overview

- Passive transparent any rate, any service multiplexing
- Compliant with all optical networking products (ITU grid)
- DWDM passive optical mux/demux supported configuration: 4/8/16/48/96 channels
- CWDM passive optical mux/demux supported configuration: 4/8/16 channels
- Integrates up to four DCMs
- OADM for 1-4 wavelengths
- Supports single and dual fiber operation
- Integrates with all PacketLight products
- Stackable solution for multiplexing optical services up to 200G each
- Supports full C-band and L-band
- Supports 100GHz and 50GHz
- 1U, 19" rack mount chassis
- Simple installation and modularity
- Optional TAP Monitoring Port

Maximize Fiber Utilization & Capacity

The PL-300 provides passive optical layer functions for 4-96 DWDM wavelengths mux/demux, 4-16 CWDM wavelengths mux/demux, optical dispersion compensation module (DCM), optical add and drop (OADM), splitters and combiners.

The passive optical network products interconnect seamlessly with PacketLight's transponder, muxponder, amplifier and ROADM product lines, and third party WDM products, to form cost-effective high capacity DWDM and CWDM solutions.

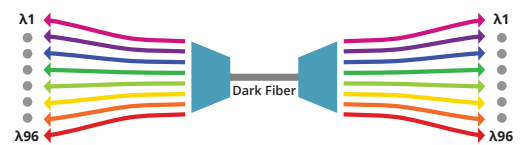
Main Benefits

- Customized per customer application requirements
- Standards-based and can integrate with third party solutions
- Scalable solution, allowing customers to expand as needed, saving operating costs and resources

Flexibility in Services over the Same Fiber

The PL-300 provides high granularity wavelength add and drop capabilities and offers a large set of passive optical modules that are tailored to the customers' network requirements.

The device supports a wide range of CWDM and DWDM mux/demux, OADM and DCMs in various configurations, suitable for any type of CWDM, DWDM, OTN and ROADM network building block.



PL-300 Passive Product Family

Recommended applications:

- Expansion of existing fiber capacity regardless of service type
- Building scalable high capacity pay-as-you-grow optical networks
- Low cost fully passive optical layer solution, transparent to service rate and type
- Extending the fiber optical solution reach for 10G services with DCMs
- Building cost-effective add and drop networks
- Enables stackable solution of 100G/sub-100G products

1U 1U rack mount

Technical Specifications

	Description	# MUX WLS	MUX 1 [nm]	MUX 2 [nm]	Insertion Loss (Mux + Demux)
CWDM	Dual Fiber 4ch Mux/Demux	4	1471-1531		<4dB
	Dual Fiber 8ch Mux/Demux	8	1471-1611		<4dB
	Dual Fiber 16ch Mux/Demux	16	1311-1611		<6dB
	2 x Dual Fiber 4ch Mux/Demux	4	1471-1531	1471-1531	<4dB
	2 x Dual Fiber 8ch Mux/Demux	8	1471-1611	1471-1611	<4dB
	2 x Dual Fiber 16ch Mux/Demux	16	1311-1611	1311-1611	<6dB
	Single Fiber 8ch Mux	8	1471-1611		<4dB
	Single Fiber 16ch Mux	16	1311-1611		<6dB
	2 x Single Fiber 8ch Mux	8	1471-1611	1471-1611	<4dB
	2 x Single Fiber 16ch Mux	16	1311-1611	1311-1611	<6dB
DWDM	Dual Fiber 4ch Mux/Demux	4	CH28-CH31		<4dB
	Dual Fiber 8ch Mux/Demux	8	CH28-CH35		<4dB
	Dual Fiber 16ch Mux/Demux	16	CH20-CH35		<11dB
	Dual Fiber 48ch Mux/Demux	48	CH13-CH60		<11dB
	Dual Fiber 96ch Mux/Demux	96	CH13-CH60.5		<12dB
	2 x Dual Fiber 4ch Mux/Demux	4	CH28-CH31	CH28-CH31	<4dB
	2 x Dual Fiber 8ch Mux/Demux	8	CH28-CH35	CH28-CH35	<4dB
	2 x Dual Fiber 16ch Mux/Demux	16	CH20-CH35	CH20-CH35	<11dB
	Single Fiber 8ch Mux	8	CH28-CH35		<2.5dB
	Single Fiber 16ch Mux	16	CH20-CH35		<6dB
	Single Fiber 96ch Mux	96	CH13-CH60.5		<6.5dB
	2 x Single Fiber 8ch Mux	8	CH28-CH35	CH28-CH35	<3dB
	2 x Single Fiber 16ch Mux	16	CH20-CH35	CH20-CH35	<6dB
	2 x Single Fiber 8ch Mux Red/Blue	16	CH21-CH36	CH45-CH60	<12dB

DWDM Add/Drop Insertion Loss

Single ch.: Express 0.8dB, add/drop 1.5dB

Dual ch.: Express 1.3dB, add/drop 1.5 dB

Quad ch.: Express 2.5dB, add/drop 2.7dB

Splitters/Combiners Insertion Loss

DWDM: 1.5dB

CWDM: 0.8dB

1310nm: <1.5dB

DCM

Fibre Type: G.652 PMD: <1.2ps

Fibre Span: 20km-200km

Wavelength Range: 1527nm-1567nm

Residual Dispersion: <+/-2%

Max Insertion Loss: 3dB

Environmental

Operating Temperature: -5°C to +50°C
(+23°F to +122°F) operational

Physical Dimensions 1U:

1U

- 1.77" (H) x 17.32" (W) x 9.05" (D)
- 45mm (H) x 440mm (W) x 220mm (D)

1.5U

- 2.65" (H) x 17.32" (W) x 9.05" (D)
- 66mm (H) x 440mm (W) x 220mm (D)

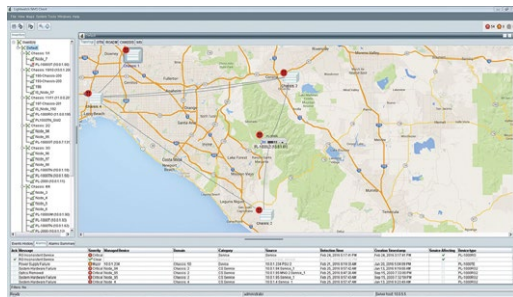
Weight: 3.5kg / 7.7lb (max)

Approvals & Standards

- RoHS, REACH, ETSI, Telcordia GR-12, NEBS ready
- Standards: ITU G.671

PacketLight LightWatch NMS

Multi-platform Java-based network management system (NMS)

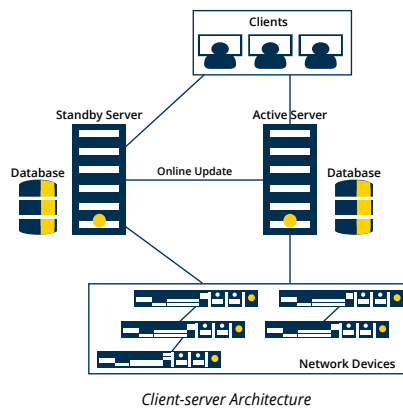


Overview

PacketLight LightWatch™ provides full fault management, configuration, accounting, performance, security (FCAPS) functionality and is compliant with telecommunications management network (TMN) standards.

LightWatch is built with a client-server architecture. It uses the MySQL™ database, and is built with modular client pay-as-you-grow offerings, scalable to 500 network elements and 20 clients.

For fast and complete recovery, LightWatch supports server redundancy and daily database backup.



Technical Specifications

Hardware Requirements

Server:

- CPU - Xeon L3 or L5
- Minimum 8GB RAM
- Minimum 20GB free disk space

Client:

- CPU - Intel™ Core I5 2.5GHz or higher
- Minimum 8GB RAM
- 2GB free disk space for installation

Color monitor: 1024x768 resolution or higher

Software Requirements

Server: Windows Server 2016/2019 64-bits, or Linux Ubuntu 16.04.3 LTS

MySQL 5.6.22 database included with LightWatch installation

Client: Windows 2007/2010 64-bits

Scalability

Network Elements: Up to 500

Clients: Up to 20

Management Protocols

Between Server to NE: SNMPv2c/v3

File Transfer Between Server to/from NE: TFTP/SFTP

Web Browser to NE: HTTP/HTTPS

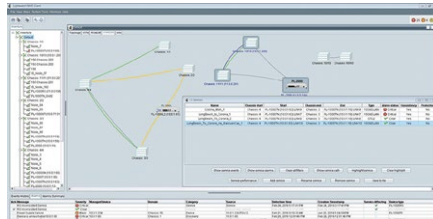
CLI to NE: Telnet/SSH

Syslog Messages from NE to the Server: Syslog

Highlights:

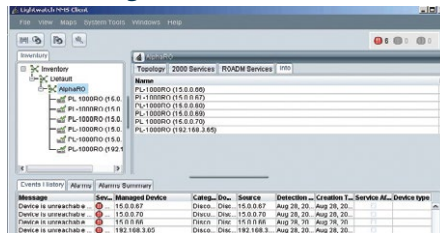
- Hierarchical topology of the devices in the network
- NMS server resiliency
- Network fault management
- Network inventory management
- Task scheduling (upload/download)
- Collects and stores PM counters from all network elements
- Advanced A-Z service management

Topology



- Allows hierarchical domains in the network
- Automatic network topology discovery
- Manual drawing of the connections between nodes
- Multi-chassis management
- Allow definition of background map

Fault Management



- Displays history of network events
- Shows current alarms
- Supports filtering events and alarms
- Keeps up to 30 days of event history
- Event forwarding to email
- Supports audible alarms

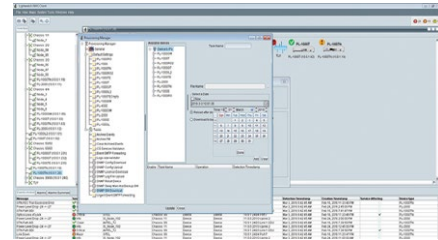
User Management

Provides centralized management of user accounts and several types of users with configurable access privileges: Administrators, NetAdmins, Technicians, Users.

Inventory

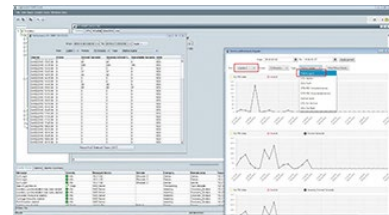
- Displays inventory of group of network elements
- Filters network elements according to field values
- Supports export of inventory into an external file

Task Scheduling



- Download of new SW version into groups of device elements
- Upload of configuration files from group of device elements
- Download of configuration files into group of devices
- Downloading license files into group of devices
- Uploading log files from group of devices

Performance Management



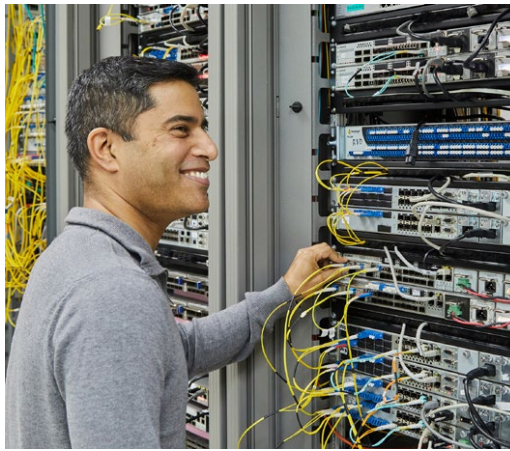
- Collects PM from all devices in the network
- Displays 30 days of history of 15-minute and Day PM data
- Supports configurable graphical view of PM data
- Supports export of PM information into an external file

SMM - Service Management Module

- A-to-Z service provisioning wizard
- Automatic detection of provisioned services
- Displays and highlights the path of a selected service
- Supports display of service path, status and faults
- Supports full service awareness with advanced chassis service management module (CSMM)

PL-Care Support

Global Professional Services



PacketLight Care Center (PLCC)

PacketLight's optical network solutions are designed and engineered for smooth installation and uninterrupted service. PacketLight Care Center (PLCC) goals are to deliver exceptional support and consulting services to our customers, with the aim of ensuring successful operation and no disruptions to mission-critical operations.

Your Partners

- Our fiber optic professional team is your partner in design, planning, implementation and maintenance of your optical network.
- We are your consultants in optimizing optical networks in order to meet your business objectives and budgets.
- We are here to assist you every step of the way in building a reliable, scalable and cost-effective optical network.
- Our highly trained technical team is here to provide 24/7 support, and ensure your network is always up and running.

Expert Assistance

The PLCC team consists of highly trained support and engineering teams, and certified personnel that serve as the backbone for providing professional and quick resolution where required. We provide our customers with expert consulting and troubleshooting assistance, online tools, and a variety of training programs.

In addition, customers can take advantage of PLCC's tools that monitor and simulate their networks. The service team provides 24x7 support to customers worldwide, with mission critical services when needed.

PLCC Support Packages

PL-CARE1

PL-CARE1 covers initial hardware and software warranty for a period of one year after shipment.

The initial hardware warranty includes repair of faulty PacketLight equipment in accordance with the warranty agreement and PLCC's RMA guidelines.

The initial software warranty includes new software versions and access to the most updated maintenance versions for all PacketLight equipment.

PL-CARE2

PL-CARE2 package includes PL-CARE1 features, as well as a dedicated 24x7 call center for nonfunctioning or faulty PacketLight products, and any other issue that may arise.

PL-CARE3

PL-CARE3 package includes all PL-CARE1 and PL-CARE2 features, as well as spare parts dispatched from local offices or PacketLight headquarters, within the next business day (NBD).

Highlights:

- Pre-sales consulting
- 24x7 technical support
- Worldwide training
- Turnkey projects
- Onsite installation



	Software Upgrades	Extended Warranty	8x5 Phone Support	24X7 Phone support	Spares - NBD Delivery
PL-CARE 1	●	●	●		
PL-CARE 2	●	●	●	●	
PL-CARE 3	●	●	●	●	●

Industry Leading Optical Networks Manufacturer

Established in 2000, PacketLight Networks offers a suite of leading CWDM and DWDM solutions for transport of data, storage, voice and video applications over dark fiber and WDM networks.

PacketLight provides the entire optical layer transport solution within a highly integrated compact platform of 1U devices, designed for maximum flexibility, easy maintenance and operation, with real pay-as-you-grow architecture, while maintaining a high level of reliability and low cost.

Our products are easy to install, enable fast network deployment, take up minimal rack space and have low power consumption, all of which significantly reduce OPEX and CAPEX.

Applications

- Carriers, service providers, and dark fiber providers
- Insurance and financial institutions
- Strategic government organizations
- Research and education
- Enterprises and manufacturers
- IT integrators and data center providers
- Utility companies such as railway and power companies

Packetlight Partners

PacketLight works with a worldwide network of resellers and partners to provide you with a complete set of network services.

Consultancy and network design

PacketLight's partners offer our clients the benefit of their optical networking expertise by providing consultancy services that enable enterprises to understand how to implement a fiber optic network that best fits their organization.

Installation and deployment services

Our partners bring a wealth of experience from the optical networking market and have successfully deployed hundreds of PacketLight solutions worldwide.

Many partners hold close relationships with local fiber providers and are able to source out dark fiber for our clients, providing a full end-to-end optical solution.

Managed services

PacketLight partners offer deployment services as well as network monitoring services, fully managed from their network operation center (NOC).



© 2023 PacketLight Networks, Ltd.