DWDM and OTN Equipment

Maximize Your Fiber Network
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.
### Our Range of Products

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**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 & Defense
- Broadcasters

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**Infrastructures**

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**Support**

- PacketLight LightWatch
- PL-Care
PL-4000M 400G Muxponder

Aggregation of flexible mix of services into a 400G DWDM uplink

Features Overview
- Flexible high capacity architecture based on 400G pluggable digital coherent optical modules
- Supported clients: 10/25/100Gb Ethernet, 16/32G Fibre Channel, OTU2/2e/4
- Flexible mix of client services mapped into a single 400G DWDM wavelength
- Supports O-FEC on the line side
- Uplinks: Dual 400G CFP2-DCO Open ROADM pluggable coherent modules
- Clients:
  - 4 x QSFP28 for 100GbE or OTU4
  - 24 x SFP+ / SFP28 for all others
- 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)
- 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

400G Metro and 200G Long Haul Applications
The PL-4000M is a modular and cost-effective solution for rolling out multi-rate 10/25/100GbE, 16/32G FC, OTU2/2e/4 services, or increasing existing network capacity. The device delivers 400G 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 200G/400G operation mode

Flexible Architecture, Facility Protection
The PL-4000M provides full demarcation point between the service and the OTN/DWDM uplink, 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, 16/32G FC, and OTU2/2e/4 service interfaces.

Recommended applications:
- 400G metro / long haul applications, up to 1,200 km
- 200G long hall applications ranging up to 2,500 km
- 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
**Technical Specifications**

**Product Configurations**

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

**Optical Amplifiers**: Up to two EDFA modules (optional)

**Optical Switch**: 1+1 facility protection (optional)

**Uplink Characteristics**

**Bit Rate**:
- 400G OTUC4
- 200G OTUC2

**Optical Interface**: Dual CFP2-DCO 400G uplinks

**Tunability Range**:
- DWDM ITU-T G.694.1 Grid
- C-band, with flex-grid support

**FEC Support**: O-FEC

**CFP2-DCO**:
- Tx power 400G: -10dBm to 0dBm
- Rx power 400G: -23dBm
- 400G 16QAM OSNR Tolerance at -12dBm Rx Power: typical 21.8dB, min. 22.8dB
- 200G QPSK OSNR Tolerance at -17dBm Rx Power: typical 13.9dB, min. 14.9dB
- Tx and Rx power
- Chromatic dispersion
- OSNR

**Client Characteristics**

**Service Types**:
- 10GbE, 25GbE, 100GbE
- 16G/32G 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

**Protocols**: SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP & SFTP

**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), terminal loopback, PRBS, event log, alarms

**Performance Monitoring**:
- Layer-1/2 PM for 10/25/100GbE services
- OTN PM for uplink and OTU2/2e/4 services
- Optical PM 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, -44 to -60 VDC, 300W max
- PSU Redundancy: Single/dual feeding, hot swappable

**Cooling Unit**: Hot swappable fan unit

**Environmental**

**Operating Temperature**: -5ºC to 45ºC (+23ºF to +113ºF) operational

**Humidity**: 5% to 85% RH

**Storage**: 85ºC

**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 encryption for selected services or for the 400G OTUC4 uplink

**Compliance**:
- FIPS 140-2 Level 2
- CNSA Top Secret Suite 2015

**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

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For more information please contact us at www.packetlight.com

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### 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, 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

### 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-200M 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-200M 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.

### Data Center Interconnect and Metro Applications

The PL-200M 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.

### 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
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 OTUC2’V2 - 2x132.2680Gbps
  - 100G OTU4V2 - 131.1026Gbps
- **Optical Interface:** CFP2 coherent (ACO)
- **Tuneability range:**
  - DWDM ITU-T G.694.1 GRID
  - Channels 13-60.5, with 50GHz spacing
- **FEC Support:**
  - Standard ITU-T G.709 GFEC
  - Enhanced HD-FEC, or SD-FEC

**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 type:**

- 10Gbe, 40Gbe, 100Gbe, 8G/16G/32G FC, 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), 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

**Protocols:** SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP & FTP

**Management:**

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

**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:** -5ºC to 50ºC (+23ºF to +122ºF) 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

**Compliance:**

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

**Algorithms:**

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

**Approvals & Standards**

- CE, FCC, RoHS, REACH
- NEBS ready
Main Benefits

- Flexible OTN cross connect
- Dynamic mix of services
- Embedded encryption for all protocols
- Highly integrated 1U solution

Secured and Encrypted Communication for all Services

The flexible architecture of the PL-2000AD enables the same device to be used in multiple applications and adapt to network growth and changes.

It supports and aggregates a flexible mix of 10GbE, 40GbE, 100GbE client interface protocols into 2x100G OTU4 uplinks.

The platform supports various client services, allowing easy migration from current to future services without replacing the unit. The product supports standards-based Layer-1 encryption, configurable per service or per uplink.

For Metro and Long Haul 200G Applications

The PL-2000AD is the smallest and most integrated transport solution of its kind, reaching up to 200km/42dB without intermediate sites and 2500km with inline sites. A powerful 200G multi-protocol multi-rate muxponder/transponder/ADM solution for building high capacity optical transport networks.
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

**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:** 127.157GHz (OTU4v with 20% SD-FEC)

**Optical Interface:** CFP2 coherent (ACO)

**Tunability Range:** DWDM ITU-T G.694.1 GRID channels 17-60.5, with 50GHz spacing

**FEC Support:** Standard ITU-T G.709 GFEC, enhanced HD-FEC, or SD-FEC

**Optical Reach:** Up to 2,500km with standard inline EDFAs

**Optical Output Power:** 2dBm to -2dBm

**OSNR:**
- Long haul: 14dB, 2,500km
- Metro: 17dB, 1,200km

**Sensitivity:** -25dBm

**Optical Monitoring:** Tx and Rx power, dispersion, OSNR

Client Interfaces

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

**Optical Interface:**
- SFP+: LR (1310nm), SR (850nm), ER (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

**Protocols:** SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP & FTP

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

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

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, power, 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, 350W max

**PSU Redundancy:** Single/dual feeding, hot swappable

Environment

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

**Humidity:** 5% to 85% RH

Physical Dimensions

**1U:**
- 19" (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

**Compliance:**
- FIPS 140-2 Level 2 compliant
- 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
  - 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.

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 to 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
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, 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

**Protocols**: SNMP, v1/v2/v3 HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SFTP, 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

**Compliance**:
- FIPS 140-2 Level 2 compliant
- Common Criteria EAL2 certified
- CNSA Top Secret Suite B 2015 compliant

**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

**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.

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
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
  - 2x SFP MNG ports 100/1000MBase-X
  - RS-232 serial port
  - DB9 external alarm port
- **Protocols:** SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, STMP, FTP
- **Management:** Web browser over HTTP/HTTPS, PacketLight LightWatch™ NMS/EMS, or third party NMS/EMS over SNMP, CLI over RS-232 or CLI over Telnet/SSH
- **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 and 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:** -5ºC to 50ºC (+23ºF to +122ºF) 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**

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PL-4000T 4x400G Transponder/Muxponder

1.6T integrated device transporting 4 x 400G wavelengths, for high capacity metro and long haul applications

Features Overview

- Pay-as-you-grow architecture based on standard pluggable coherent optical modules
- Operation modes per slice:
  - 4 x 100G muxponder
  - 1 x 400G transponder
- Supported services: 100GbE, 400GbE, OTU4
- Supported line FEC:
  - C-FEC (for OIF-ZR standard)
  - O-FEC (for Open ROADM and Open ZR+)
- Client options:
  - Up to 16 x 100GbE/OTU4 QSFP28
  - Up to 4 x 400GbE QSFP28
- Supported 400G QSFP28 client optics: LR8, FR8, SR8
- Uplink options:
  - Up to 4 x 400G CPF2-DCO
  - Up to 4 x 400G QSFP28-DCO
- Layer-1 GCM-AES-256 encryption
- Elliptic Curve Diffie-Hellman key exchange
- 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 in-band GCC, or out-of-band OSC
- Easy maintenance with field-replaceable parts:
  - Dual hot pluggable power supply units (AC/DC)
  - Fan unit

Main Benefits

- Cost-effective high capacity transport of 400G over single wavelength
- Up to 4 x 400G transponders/muxponders in a 1U chassis
- Embedded Layer-1 GCM-AES-256 optical 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 uplink, 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.

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.

Recommended applications:

- Metro and long haul network applications ranging up to 1,000km
- High capacity DCI for enterprise, campus and cloud computing networks
- 400G links to bolster existing OTN/DWDM infrastructure
- Last mile access/aggregation CPE for 100/400GbE managed services
- Secured and encrypted communication for 100/400GbE services
Technical Specifications

Product Configurations

**Muxponder**: 4x100G per 400G

**Transponder**: 1x400G per 400G

**Optical Amplifiers**: Up to two EDFA modules (optional)

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

**Optical Switch**: 1+1 facility protection (optional)

Uplink Characteristics

**Bit Rate**:
- 400G FlexO
- 200G FlexO

**Optical Interface**: CFP2-DCO or QSFP-DD-DCO 400G uplink

**Tunability range**:
- DWDM ITU-T G.694.1 Grid
- C-band, with flex-grid support

**FEC Support**:
- C-FEC
- O-FEC

**QSFP-DD-DCO**:
- Tx power 400G: -10dBm to 0dBm
- Rx power 400G: -20dBm
- 400G 16QAM OSNR Tolerance at -12dBm Rx Power: typical 21.3dB, min. 22.3dB
- 200G QPSK OSNR Tolerance at -17dBm Rx Power: typical 13.7dB, min. 14.7dB
- Rx Sensitivity at high OSNR: 400G 16QAM/O-FEC -23dBm, 400G 16QAM/C-FEC -20dBm, 200G QPSK -30dBm

**Chromatic Dispersion Tolerance**:
- 400G: 26,000ps/nm
- 200G: 50,000ps/nm

Client Characteristics

**Service Types**:
- 100Gb Ethernet
- 400Gb Ethernet
- OTU4

**Optical Interface**:
- 100Gbe QSFP28 LR4/ER4/SR4
- 400Gbe QSFP-DD LR8/SR8/FR4/DR4

**FEC Support**:
- 100Gbe: RS-FEC or no-FEC
- 400Gbe: KP4-FEC
- OTU4: Standard 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: -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
- OTN in-band GCC channel

**Protocols**:
- SNMP v1/v2/v3, HTTP/HTTPS, Telnet/SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP & SFTP

**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), 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 140-2 Level 2
- CNSA Top Secret Suite B 2015

**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 C-FEC on the line side (OIF-ZR standard)
- Standard MSA pluggable modules:
  - 12 x 400GbE QSFP-DD-DR4/FR4/LR8/FR8 clients
  - 48 x 100GbE QSFP-DD-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

Main Benefits
- Cost-effective high capacity transport mix of 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.

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.

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
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 ZR-OIF

Optical Interface:
- QSFP-DD-DCO ZR

Tunability range:
- DWDM ITU-T G.694.1 Grid
- C-band, with flex-grid support

FEC Support:
- C-FEC

QSFP-DD-DCO ZR:
- Tx power: -6dBm to -10dBm
- Rx power: -20dBm

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:
- 400Gb Ethernet
- 100Gb Ethernet

Optical Interface:
- 400GbE QSFP-DD-DR4/FR4/LR8/FR8
- 100GbE QSFP-DD-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

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

Protocols:
- SNMP v1/v2/v3, HTTP/HTTPS, Telnet/SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP & SFTP

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

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)

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready
PL-2000DC 1.6T Transponder

High capacity platform, for DCI, cloud and colocation providers, and high capacity applications

Features Overview

- Pay-as-you-grow architecture based on pluggable 400G transponder drawers and optical modules
- Supported clients: 100G LAN, OTU4
- Supported FEC modes:
  - Line: GFEC/UFEC + SD-FEC for metro and long haul applications
  - OTU4 service: ITU G.709 GFEC
  - 100GbE service: IEEE Clause 91 RS-FEC
- Standard MSA pluggable:
  - CFP2 ACO tunable DWDM for 100G/200G line interface
  - QSFP28 SR4/ER4/LR4/CWDM4 for 100G client interface
- Comprehensive line and service performance monitoring
- Remote management with in-band GCC, or out-of-band OSC
- Easy maintenance with field-replaceable parts:
  - Dual pluggable power supply units AC/DC
  - Fan unit
  - Equipment controller card

For 200G Short Haul and Metro Applications

The PL-2000DC is a modular and cost-effective solution for rolling out 100G services or increasing existing network capacity. The device has four 400G pluggable drawers and pluggable optical modules, delivering up to 1.6T in a 1U chassis, and enabling pay-as-you-grow architecture.

Main Benefits

- High transport capacity of 1.6T in 1U
- 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 service interfaces 100G LAN/OTU4.

Recommended applications:

- 1.6T connectivity for DCI and colocation providers
- 1.6T connectivity for cloud and internet exchange
- High capacity, 16 x 100G managed service platform
- 8 x 100G transponders for carriers’ long haul links
### Technical Specifications

#### Product Configuration
- **4 x Drawers:** Pluggable, 400G each

#### Uplink Characteristics
- **Bit Rate:** 2 x 200G (OTUC2)
- **Optical Interface:** 2 x CFP2 ACO
- **FEC Support:** Standard ITU-T G.709 GFEC/UFEC, SD-FEC
- **Optical Reach:** Up to 600 km for 200G, and 4,000 km for 100G
- **Optical Monitoring:** Tx and Rx power
- **Sensitivity:** 100G: -21dBm, 200G: -18dBm

#### Service Characteristics
- **Service Types:** 4 x 100GbE / OTU4, per single 400G drawer
- **Optical Interfaces:** QSFP28: LR4 (1310nm) / ER4 (1310nm) / SR4 (850nm) / CWDM4
- **FEC Support:** OTU4: ITU-T G.709 GFEC
- **100GbE:** RS-FEC

#### Network Management
- **Management Ports:**
  - 3xRJ-45 LAN port 10/100MBase-T
  - 2xSFP MNG ports 100/1000MBase-X
  - RJ-45 serial port
  - OTN in-band GCC channel
- **Protocols:** SNMP v1/v2/v3, HTTP/HTTPS, Telnet/SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP and FTP
- **Management:**
  - Web browser over HTTP/HTTPS
  - PacketLight LightWatch™ NMS/EMS
  - Third party NMS over SNMP
  - CLI over RS-232
  - CLI over Telnet/SSH
- **OAM:** Facility loopback and PRBS (client and line interfaces), event log, automatic laser shut-down (ALS)
- **Performance Monitoring:**
  - Layer-1 PM for all services
  - Layer-2 PM for Ethernet
  - OTN PM for uplinks
  - Optical power Tx and Rx levels for all optical ports
- **Visual Indicators:** LED indicators for:
  - Client and line ports
  - Management and LAN ports
  - System critical/major/minor
  - Power supply alarms
- **Software Upgrade:** Hitless traffic – dual image

#### Power Supply
- **AC/DC:** 100 to 240 VAC, 50/60 Hz, -44 to -72 VDC, 540W max (+100W per drawer)
- **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 20.87” (D)
  - 45mm (H) x 440mm (W) x 530mm (D)
- **Weight:** 13.66kg / 30.11lb (max)
- **Mounting:** 19”

#### Approvals & Standards
- CE, FCC
- RoHS, REACH

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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

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.

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.

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
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 100GHz/50GHz spacing

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

Rx Power:
- 8/16 QAM (200G): -0.5 to -10dBm
- DP-QPSK (100G): -5.0 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 QSF28 - LR4/ER4 (1310nm)
- MM QSF28 - 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:
- 2x RJ-45 LAN port 10/100MBase-T
- 2x SFP MNG ports 100/1000MBase-X
- RJ-45 serial port
- RJ-45 external alarm port
- OTN in-band GCC channel

Protocols:
- SNMPv1/v2/v3, HTTP/HTTPS, Telnet/SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP & FTP/SFTP

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, 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

Compliance:
- FIPS 140-2 Level 2
- CNSA Top Secret Suite B 2015

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

Layer-1 encryption
1U 1U rack mount
Cost-effective solution
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

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.

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.

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
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)
Protocol:
- 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

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

Protocols: SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP & FTP
Management:
- Web browser over HTTP/HTTPS,
- PacketLight LightWatch™ NMS/EMS, or third party NMS over SNMP,
- CLI over RS-232 or CLI over Telnet/SSH
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: -5ºC to 50ºC (+23ºF to +122ºF)
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
- 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.

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
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 2.5Gbps, 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/OE-12, STM-16/OE-48, STM-64/OE-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

**Protocols:** SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP, RSTP, TFTP and FTP

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

**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:** -5ºC to 50ºC (+23ºF to +122ºF) 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 Level 2 compliant
- CNSA Top Secret Suite B 2015 compliant

For more information please contact us at www.packetlight.com
Diagnostic device using OTDR to detect fiber quality and cut, and OSA for spectrum and OSNR analysis

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.

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.

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:** ±0.1dB
- **Max Optical Output Power:** 17dBm

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

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

**Network Management**

**Management Protocols:**
- SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP and FTP

**Management**
- Web browser over HTTP/HTTPS
- SNMPv2/SNMPv3
- TFTP/SFTP
- PacketLight LightWatch™ NMS/EMS
- Third party EMS NMS over SNMP
- CLI over RS-232 or CLI over Telnet/SSH

**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

---

**Graphical Display of the OTDR**

**Graphical Display of the OSA**
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.

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

<table>
<thead>
<tr>
<th></th>
<th>4 degree</th>
<th>8 degree</th>
<th>Unit</th>
<th>Notes</th>
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<td>Min: 13</td>
<td>Min: 8</td>
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<td>All ports</td>
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<td></td>
<td>Max: 14</td>
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<td>THz</td>
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<td><strong>Channel Count</strong></td>
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<td>Channels</td>
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</tr>
</tbody>
</table>

### 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, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP, TFTP and FTP

- **Management**
  - Web browser over HTTP/HTTPS
  - PacketLight LightWatch™ NMS/EMS
  - Third party EMS NMS over SNMP
  - CLI over RS-232 or CLI over Telnet/SSH

### 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**: -5ºC to 50ºC (+23ºF to +122ºF) 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

**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.

**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

---

**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.
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

Protocols: SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP
Management: Web browser over HTTP/HTTPS, PacketLight LightWatch™ EMS or third party EMS over SNMP, CLI over RS-232 or CLI over Telnet/SSH
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 ºC to 50 ºC (+23ºF to +122ºF) 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) or Inband (GCC). 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.

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
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: 0.6psec
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
Gain Flatness: +/-0.6dB

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

Protocols: SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, TACACS+, SNTP
Management: Web browser over HTTP/HTTPS, PacketLight LightWatch™ EMS or third party EMS over SNMP, CLI over RS-232 or CLI over Telnet/SSH
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 (OADMs), 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, OADMs and DCMs in various configurations, suitable for any type of CWDM, DWDM, OTN and ROADM network building block.

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
## Technical Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th># MUX WLs</th>
<th>MUX 1 [nm]</th>
<th>MUX 2 [nm]</th>
<th>Insertion Loss (Mux + Demux)</th>
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</thead>
<tbody>
<tr>
<td>Dual Fiber 4ch Mux/Demux</td>
<td>4</td>
<td>1471-1531</td>
<td></td>
<td>&lt;4dB</td>
</tr>
<tr>
<td>Dual Fiber 8ch Mux/Demux</td>
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<td>1471-1611</td>
<td></td>
<td>&lt;4dB</td>
</tr>
<tr>
<td>Dual Fiber 16ch Mux/Demux</td>
<td>16</td>
<td>1311-1611</td>
<td></td>
<td>&lt;6.5dB</td>
</tr>
<tr>
<td>2 x Dual Fiber 4ch Mux/Demux</td>
<td>4</td>
<td>1471-1531</td>
<td>1471-1531</td>
<td>&lt;4dB</td>
</tr>
<tr>
<td>2 x Dual Fiber 8ch Mux/Demux</td>
<td>8</td>
<td>1471-1611</td>
<td>1471-1611</td>
<td>&lt;4dB</td>
</tr>
<tr>
<td>2 x Dual Fiber 16ch Mux/Demux</td>
<td>16</td>
<td>1311-1611</td>
<td>1311-1611</td>
<td>&lt;6.5dB</td>
</tr>
<tr>
<td>Single Fiber 8ch Mux</td>
<td>8</td>
<td>1471-1611</td>
<td></td>
<td>&lt;4dB</td>
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<tr>
<td>Single Fiber 16ch Mux</td>
<td>16</td>
<td>1311-1611</td>
<td></td>
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<tr>
<td>2 x Single Fiber 16ch Mux</td>
<td>16</td>
<td>1311-1611</td>
<td>1311-1611</td>
<td>&lt;6.5dB</td>
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<tr>
<td>CWDM</td>
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<tr>
<td>DWDM</td>
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<tr>
<td>Single ch.: Express 0.8dB</td>
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<tr>
<td>Dual ch.: Express 1.3dB</td>
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<tr>
<td>Quad ch.: Express 2.5dB</td>
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<tr>
<td>Splitters/Combiners Insertion Loss</td>
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<tr>
<td>DWDM: 1.5dB</td>
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<tr>
<td>CWDM: 0.8dB</td>
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<tr>
<td>1310nm: &lt;1.5dB</td>
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<tr>
<td>DCM</td>
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<tr>
<td>Fibre Type: G.652 PMD: &lt;1.2ps</td>
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<tr>
<td>Fibre Span: 20km-200km</td>
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<td>Wavelength Range: 1527nm-1567nm</td>
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<td>Residual Dispersion: +/-2%</td>
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<tr>
<td>Max Insertion Loss: 3dB</td>
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<tr>
<td>Environmental</td>
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<tr>
<td>Operating Temperature: -5°C to +50°C (+23°F to +122°F) operational</td>
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<tr>
<td>Physical Dimensions 1U:</td>
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<tr>
<td>1U</td>
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<tr>
<td>1.77&quot; (H) x 17.32&quot; (W) x 9.05&quot; (D)</td>
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<tr>
<td>45mm (H) x 440mm (W) x 220mm (D)</td>
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<tr>
<td>1.5U</td>
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<tr>
<td>2.65&quot; (H) x 17.32&quot; (W) x 9.05&quot; (D)</td>
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<tr>
<td>66mm (H) x 440mm (W) x 220mm (D)</td>
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<tr>
<td>Weight: 3.5kg / 7.7lb (max)</td>
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<tr>
<td>Approvals &amp; Standards</td>
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<tr>
<td>RoHS, REACH, ETSI, Telcordia GR-12, NEBS ready</td>
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<tr>
<td>Standards: ITU G.671</td>
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</tbody>
</table>
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
Topologies
- 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)
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).

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.

Global Professional Services

Highlights:
- Pre-sales consulting
- 24x7 technical support
- Worldwide training
- Turnkey projects
- Onsite installation
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
- Defense and other 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).

<table>
<thead>
<tr>
<th></th>
<th>Software Upgrades</th>
<th>Extended Warranty</th>
<th>8x5 Phone Support</th>
<th>24X7 Phone support</th>
<th>Spares - NBD Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL-CARE 1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
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<tr>
<td>PL-CARE 2</td>
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</tr>
<tr>
<td>PL-CARE 3</td>
<td>●</td>
<td>●</td>
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