Optical Networking Solutions

Cutting edge WDM technology for your needs
Complete Solutions for WDM and Dark Fiber Applications

PacketLight’s carrier class CWDM, DWDM and OTN optical platforms offer the flexibility to build a cost-effective, highly efficient network for enterprises, telcos and managed service providers. PacketLight products are highly integrated 1U solutions that meet the challenges faced by operators with simplified plug-and-play deployment and easy management for transport networks, data centers, storage facilities and enterprise connectivity.

Carrier Grade Reliability
Reliable, carrier grade CWDM, DWDM and OTN solutions that ensure access to business and critical data while protecting investment, with scalable, pay-as-you-grow architecture, network upgrades without service disruption, and carrier class service with guaranteed service level agreement (SLA).

Rich High-end Feature Set
Unique, integrated 1U architecture with a rich feature set that allows scalability, manageability, and ease-of-use and maintenance, to support any WDM infrastructure, from simple point-to-point networks to metro access rings and linear add-and-drop networks.

Flexibility and Scalability
Multi-rate transponders, muxponders, optical amplification, pluggable optics and ROADM provide the flexibility to build a cost-effective, scalable, highly efficient optical network infrastructure for carriers, enterprises, campuses and data centers.

Low Power Consumption Solution in 1U Form Factor
PacketLight solutions are the smallest, most integrated of their kind. They have a high port density, decreasing the cost of space and power consumption, two of the main challenges in data centers, telecom and internet exchange.

Easy Network Operation
PacketLight LightWatch™ NMS/EMS and free web-based management tools enable remote configuration, performance monitoring, fault management, and easy administration capabilities that allow users to quickly adapt to the equipment without lengthy training.

Solid Savings
The modular design of the solutions enables true pay-as-you-grow architecture that significantly reduces CAPEX. Simplified operation and remote management eliminate high maintenance costs, reducing overall solution OPEX.
Wide Range of WDM & OTN Products

- Carrier class feature set
- Layer-1 encryption
- 1U form factor devices
- Integrated OTN layer
- Performance monitoring
- Simple to install and configure
- Multi-rate transponders
- Supports single or dual fiber
- Optional integrated mux/demux, EDFA, optical switch, and DCM modules
- High wavelength utilization
- Supports tunable DWDM optics
- Multi-rate muxponders
- Supports 1.5Mbps up to 100G
- Low latency connectivity
- Scales up to 96 wavelengths
- Hot swappable PSU and fan
- Amplification over long distances
- EMS/NMS management

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Diagram Elements:

- Layer-1 encryption
- Low power consumption
- 1U rack mount
- Multi operation modes
- Low latency connectivity
- High wavelength utilization

High Capacity Integrated Solutions

- Carrier class feature set
- Layer-1 encryption
- 1U form factor devices
- Integrated OTN layer
- Performance monitoring
- Simple to install and configure
- Multi-rate transponders
- Supports single or dual fiber
- Optional integrated mux/demux, EDFA, optical switch, and DCM modules
- High wavelength utilization
- Supports tunable DWDM optics
- Multi-rate muxponders
- Supports 1.5Mbps up to 100G
- Low latency connectivity
- Hot swappable PSU and fan
- Amplification over long distances
- EMS/NMS management
PL-2000AD
200G Optical Transport Solution

200G multi-protocol multi-rate muxponder/transponder/ADM for metro and long haul optical transport solutions, in 1U

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

Features Overview
- Multiple user-configurable operation modes: muxponder, transponder and ADM
- Supported clients: 10G/40G/100G LAN, 8G/16G/32G Fibre Channel, STM-64/OC-192 SDH/SONET, OTU2/OTU2e/OTU3/OTU4 OTN
- Forward error correction (FEC):
  - ITU-T G.709 GFEC or UFEC for metro applications
  - Soft decision (SD) FEC for long haul applications
- Dual pluggable CFP2 coherent tunable DWDM line interfaces
- Layer-1 GCM-AES-256 based encryption
- Comprehensive line and service performance monitoring
- Integrated EDFAs, mux/demux, and optical switch
- Remote management with in-band or out-of-band optical supervisory channel (OSC)
- Supports standard MSA pluggable SFP+ (8G/32G client), QSFP+ (40G client), QSFP28 (100G client) and CFP2 (uplink)
- Dual AC or DC pluggable power supply and pluggable fan unit

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 10G/40G/100G 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.

Recommended for the following applications:
- Metro and long haul network applications up to 2,500km
- 100G protected ring topology
- High capacity DCI for enterprise, campus, cloud computing networks
- 200G links to bolster existing OTN/DWDM infrastructure
- Last mile access/aggregation for 10G/40G/100G managed services
- Secured and encrypted communication for all protocols
### Technical Specifications

#### Product Configurations

- **Dual 10x10G Muxponder:** Up to 20 multi-service 10G clients aggregated to 2xOTU4 uplinks
- **40G and 16x10G Muxponder:** 40G LAN and up to 16 multi-service 10G clients aggregated to 2xOTU4 uplinks
- **Dual 40G and 12x10G Muxponder:** 2x40G LAN and up to 12 multi-service 10G clients aggregated to 2xOTU4 uplinks
- **Dual 100G Transponder:** 2x100GbE LAN mapped to 2xOTU4 uplinks
- **100G Transponder and 10x10G Muxponder:** 100GbE LAN mapped to one OTU4 uplink and up to 10 multi-service 10G clients aggregated to 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 EDFA

#### Optical Output Power
- 2dBm to -2dBm

#### OSNR
- SFP+: LR (1310nm), SR (850nm), ER (1550nm), ZR (1550nm), C/DWDM
- 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 100/1000Base-X
  - RJ-45 serial port
  - RJ-45 external alarm port
  - OTN in-band GCC channel
- **Protocols:** SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, 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, 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, 350W 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
  - CNSA Top Secret Suite 2015
- **Note:** For specific countries, models that include Layer-1 GCM-AES-256 based encryption will be marked with the suffix C.

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

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PL-2000ADS
200G Short Haul ADM Encryption Solution

200G multi-protocol multi-rate muxponder/transponder/ADM for short haul optical transport solutions and Layer-1 encryption

Features Overview
■ Supports multiple, user-configurable, operation modes: muxponder, transponder, and ADM
■ Supported clients: 10G/40G/100G LAN, 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 client), QSFP+ (40G client), QSFP28 (100G client) and QSFP28 (100G uplink)
■ Dual AC or DC pluggable power supply and pluggable fan unit

For 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

Secured and Encrypted Communication 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 for the following applications
■ Last mile access/aggregation CPE for 10G/40G/100G 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 10G/40G/100G services
■ High bandwidth connectivity for data center and cloud computing
Technical Specifications

Product Configurations

Dual 10x10G Muxponder: Up to 20 multi-service 10G clients aggregated to 2xOTU4 uplinks

Dual 40G and 12x10G Muxponder: 2x40G LAN and up to 12 multi-service 10G clients aggregated to 2xOTU4 uplinks

Dual 100G Transponder: 2x100GbE LAN mapped to 2xOTU4 uplinks

100G Transponder and 10x10G Muxponder: 100GbE LAN mapped to one OTU4 uplink and up to 10 multi-service 10G clients aggregated to 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 LAN, 40GbE LAN, 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

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

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 10/100Base-T
■ 2xSFP MNG ports 100/1000Base-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, SNTP, 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
■ CNSA Top Secret Suite 2015

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

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PL-2000
20G Optical Transport Solution

Advanced 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, and video protocols such as DVB-ASI, SD/HD/3G-SDI
- Dual standard-based optical transport network (OTN) OTU2 uplinks supporting multiple forward error correction (GFEC/I.4/I.7) types
- 1+1 facility protection
- Low latency
- Supports standard MSA SFPs (client), XFPs (uplink), and C-band tunable XFPs
- Supports line and service performance monitoring
- Remote management optical supervisory channel (OSC)
- Optional integrated EDFA, mux/demux, DCM and optical switch
- Dual AC or DC pluggable power supply and pluggable fan unit
- Web-based GUI and SNMP EMS management
- 1U footprint with low power consumption

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

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

A Flexible Platform
The PL-2000 reduces the solution cost and operation complexity by increasing fiber utilization and spectral efficiency. Each of the 10G OTU2 uplinks can simultaneously aggregate SDH/SONET, Ethernet, Fibre Channel and video services, providing a perfect access platform for multiple clients, and enables to merge legacy and new services transparently. Together with PacketLight LightWatch NMS the system provides A-to-Z provisioning. The PL-2000 Incorporates forward error correction suitable for long distance amplified DWDM network.

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

Recommended for the following 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

■ 2xSFP MNG ports 100/1000MBase-X

■ RS-232 serial port

■ DB9 external alarm port

Protocols: SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, SNTP, RSTP, TFTP and 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 , 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-2000M

200G Coherent Optical Transport

High transport capacity 200G muxponder/transponder over a single wavelength

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

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

Modular and Cost-effective 200G Transport Solution
The PL-2000M provides a modular and cost-effective way of rolling out services or uplifting existing network capacity. It is low power consumption, saves rack space and reduces the overall solution CAPEX and OPEX by increasing the capacity of enterprise DCI and metro networks.

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

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

Recommended for the following applications:
- High conformance 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 and encrypted communication for all protocols

Features Overview
- User-configurable muxponder and transponder operation modes
- Supported clients: 10G/40G/100G LAN, 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 20x10G (multi-rate) clients, 2x100G clients, 1x100G + 10x10G clients, 4x40G + 4x10G 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+, QSFP+, QSFP28 and CFP2
- 1U footprint with low power consumption
### Technical Specifications

#### Product Configurations

**Single 20x10G Muxponder:** Up to 20 multi-service 10G clients aggregated to 1x200G uplink

**40G and 16x10G Muxponder:** 40G LAN + up to 16 multi-service 10G clients aggregated to 1x200G uplink

**Dual 40G and 12x10G Muxponder:** 2x40G LAN + up to 12 multi-service, 10G clients aggregated to 1x200G uplink

**Dual 100G Transponder:** 2x100GbE LAN mapped to 1x200G uplink

**100G Transponder and 10x10G Muxponder:** 100GbE LAN + 10x10G mapped to 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 OTU2 C2V2: 2x132.2680Gbps
- 100G OTU4 C2V2: 131.1026Gbps

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

**Tune-ability 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

**Optical Output Power:**
- 100G: -2dBm to -3dBm
- 200G: -5dBm to 0dBm

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

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

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

#### Client Interfaces Characteristics

**Service type:**
- 10GbE LAN, 40GbE LAN, 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
- QSFP+: LR4 (1310nm), ER4 (1310nm), SR4 (850nm), L R5M
- QSFP28: LR4 (1310nm), ER4 (1310nm), SR4 (850nm), CWDM4 (CWDM)

**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)

**Protocols:**
- SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, 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 (except for 32G FC)
- Layer-2 PM for Ethernet
- OTN PM for uplinks
- Optical power Rx levels for all optical ports

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

**Software Upgrade:** Hitless traffic – dual image

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

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

**Cooling Unit:** Hot swappable fan unit

**Environmental**
- Operating Temperature: -5°C to 50°C (+23°F to +122°F) operational
- Humidity: 5% to 85% RH

**Physical Dimensions**
- 1U: 1.77” (H) x 17.32” (W) x 11.22” (D)
- 45mm (H) x 440mm (W) x 285mm (D)
- Weight: 8.5kg / 18.75lb (max)
- Mounting: 19", ETSI and 23"

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

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

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

**Approvals & Standards**
- CE, FCC, RoHS, REACH
- NEBS ready

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PacketLight LightWatch™

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

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PL-1000GM

Multi-rate 10G/40G/100G Optical Transport Solution

100G multi-protocol multi-rate muxponder/transponder for metro and data center high capacity solutions

100G High Capacity Optical Transport Solution

The PL-1000GM is a highly integrated platform which provides a unified 100G optical transport layer, capable of serving multiple applications and protocols in enterprise, data center and metro networks for data, storage and TDM connectivity applications.

Main Benefits

■ 100G solution expandable up to 96 channels
■ Supports any mix of 10G, 40G muxponder or 100G transponder in the same platform
■ Highly integrated solution including EDFAs, mux/demux and DCMs
■ Optical interface flexibility using pluggable optics in both client and line sides
■ Low power consumption

Modular and Cost-effective 100G Transport Solution

The PL-1000GM modularity meets market demands for low power consumption, rack space savings and reduction in the overall solution CAPEX and OPEX by cost-effectively increasing network capacity. The platform allows migration from current to future service requirements (protocols and rates) without the need to replace the unit.

Features Overview

■ Highly integrated 1U architecture
■ 100G muxponder and transponder in one box
■ Aggregates various mix of services into 100G OTU4 DWDM uplink: 10x10G, 2x40G Eth + 2x8/10G, 1x40G Eth + 6x8/10G
■ Low cost SR10 100G transponder mode
■ 10 times better spectral efficiency than 10x10G links
■ Supported clients: 10G/40G/100G LAN, 8G Fibre Channel, STM-64/OC-192 and OTU2/OTU2e
■ Uplink based on coherent 50GHz tunable DWDM CFP for up to 1,200km
■ Standard MSA pluggable optics for 100G line and 8G/10G/40G/100G client interfaces
■ Performance monitoring on all interfaces
■ Integrated optical amplifiers and DCM for extended reach
■ Out-of-band OSC or in-band GCC remote management
■ Dual AC/DC pluggable power supply and fan unit

Recommended for the following applications:

■ Expanding 10G infrastructure capacity to 100G
■ Building 100G metro networks up to 1,200km
■ Providing 100G links over existing DWDM infrastructure
■ Data center connectivity and cloud applications
■ Last mile access/aggregation CPE for managed services providers
Technical Specifications

Product Configurations

10x10G Muxponder: Up to 10 multi-service & rate 10G clients mapped each to ODU2 & aggregated to OTU4 100G uplink

1x40G and 6x10G Muxponder: Up to 6 multi-service & rate 10G clients mapped each to ODU2 & 40G LAN mapped to ODU3 aggregated to OTU4 100G uplink

2x40G and 2x10G Muxponder: Up to 2 multi-service & rate 10G clients mapped each to ODU2 & 2x40G LAN mapped to ODU3 aggregated to OTU4 100G uplink

100G Transponder: 100GbE or OTU4 services to OTU4 100G uplink

Optical Amplifiers: Optional up to two EDFA modules

DCM: Optional tunable or fixed DCM

Mux/Demux: Optional 4ch mux/demux module

Uplink Characteristics

Bite Rate: 120Gb/s

Optical Interface: DWDM CFP

Tune-ability range: DWDM ITU-T G.694.1 channels 15-60, with 50GHz spacing

OTN Support: Standard ITU-T G.709 GFEC or enhanced HG-FEC

Optical Reach: 1,200km, 20,000ps/nm

Optical Output Power: 0dBm

RX sensitivity: -18dBm, OSNR with SD-FEC 15dB

OTN Overhead: OTU4/ODU4 OH monitoring

Client Interfaces Characteristics

Service type: 10GbE LAN, 40GbE LAN, 100GbE, 8G FC, STM-64/OC-192

OTU2, OTU2e

Optical Interface:

- SFP+: LR (1310nm), SR (850nm), ER (1550nm), ZR (1550nm) & C/DWDM
- QSFP+: LR4 (1310nm), SR4 (850nm)
- CXF: SR10 (850nm)

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: +10 to +22dB
- Pre-amp: +18dB

Operating Modes:

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

Mux/Demux

Channels: 4 DWDM channels

Spacing: 100GHz

Insertion loss: <4dB end-to-end

Network Management

Management Ports:

- RJ-45 LAN port 10/100MBase-T
- 2xSFP MNG ports 100/100MBase-X
- RS-232 serial port
- DB9 external alarm port
- OTN in-band GCC channel

Protocols: SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, SNTP, TFTP & 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 & line interfaces), PRBS, event logger, alarms, ALS

Performance Monitoring:

- Layer-1 PM for all services
- Layer-2 PM for Ethernet
- OTN PM for uplink

Optical power Rx levels for all optical ports

Visual Indicators: LED status indicators for: client & 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, 180W 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: 7.5kg / 17.64lb (max)

Mounting: 19", ETSI & 23"

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

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PL-1000GT
Coherent 100G Long Haul Muxponder/Transponder

100G OTU4 OTN coherent muxponder/transponder supporting 8G/10G/40G/100G services

Long Haul Transport Solution
The PL-1000GT is a 100G modular transport solution for building long distance networks. The device is a 1U platform with low power consumption, ideal for long haul 100G applications up to 2,000km.

Main Benefits
- Easy and flexible transmission of mix of services over a single wavelength in long haul applications
- Ability to transport 10G/40G and 100G services in one box
- High spectral efficiency for long haul solutions
- Tunable DWDM 100G uplink which can be used as an alien wavelength over any existing DWDM network
- 1U with integrated EDFA for high attenuation links

Modular and Cost-effective 100G Transport Solution
The PL-1000GT resolves the challenge of having to choose between 40G and 100G solutions by mapping two 40G clients into a 100G uplink. The device integrates with PacketLight's product line, for serving multiple applications of data, storage and TDM networks.

The platform allows migration from current to future service requirements (protocols and rates) seamlessly, without infrastructure replacement.

Features Overview
- 100G coherent muxponder and transponder in one box
- Muxponder configurations for aggregating services into a single coherent OIF standards-based 100G OTU4 uplink:
  - 10x10G
  - 1x40G + 6x10G
  - 2x40G + 2x10G
- Supported clients: 10G/40G/100G LAN, 8G Fibre Channel, STM-64/OC-192, OTU2/OTU2e/OTU4, 100GBase-SR10, SR4, LR4, ER4
- Coherent OIF standards-based tunable uplink
- Forward error correction (FEC), GFEC, or HG-FEC
- Supports standard MSA pluggable client optics: SFP+ (8G/10G), QSFP+ (40G) and CFP (100G)
- Performance monitoring on all interfaces
- Out-of-band OSC or in-band GCC remote management
- Highly integrated 1U architecture
- Dual DC power feeding and pluggable fan unit
- Operates on dual or single fiber

Recommended for the following applications:
- Alien wavelength over existing third party WDM infrastructure
- Building efficient DWDM long haul networks up to 2,500km
- Increasing the capacity and spectral efficiency of existing 10G/40G long haul networks
- Building high capacity long haul backbone for utility, oil, gas and mining industries
- High bandwidth connectivity for data center and cloud computing
Technical Specifications

**Product Configurations**

**10x10G Muxponder:** Up to 10 multi-service & rate 10G clients mapped each to ODU2 and aggregated to OTU4 100G uplink

**1x40G and 6x10G Muxponder:** Up to 6 multi-service & rate 10G clients mapped each to ODU2 and 40G LAN mapped to ODU3 aggregated to OTU4 100G uplink

**2x40G and 2x10G Muxponder:** Up to 2 multi-service & rate 10G clients mapped each to ODU2 and 2x40G LAN mapped to ODU3 aggregated to OTU4 100G uplink

**100G Transponder:** 100Gbe LAN or OTU4 services to OTU4 100G uplink

**EDFA:** Optional EDFA module

**Uplink Interface**

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

**Optical Interface:** DWDM OIF standard based coherent

**Tunable Range:** ITU-T G.694.1 channels 15-60, with 50GHz spacing

**FEC Type Support:** Standard ITU-T G.709 GFEC or enhanced HG-FEC

**Optical Reach:** 2000km, 40,000ps/nm

**Optical Output Power:** 0dBm

**Sensitivity:** -18dBm, OSNR with SD-FEC

**OTN Overhead:** OTU4/ODU4 OH monitoring

**Client Interfaces**

**Service type:** 10Gbe LAN, 40Gbe LAN, 100Gbe LAN, 8G FC, STM-64/OC-192, OTU2, OTU2e

**Optical Interface:**
- SFP+: LR (1310nm), SR (850nm), ER (1550nm), ZR (1550nm) CWDM/DWDM
- QSFP+: LR4 (1310nm), SR4 (850nm)
- CFP: LR4 (1310nm), SR10 (850nm), ER4 (1310nm)

**Amplifier**

**Applications:** Booster, pre-amp

**Output Power:**
- Booster: +14dBm, +17dBm, +20dBm
- Pre-amp: +5dBm

**Input Power:**
- Booster: -24 to +16dBm
- Pre-amp: -36 to -15dBm

**Gain:**
- Booster: +10 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
- OTN in-band GCC channel

**Protocols:** SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, SNTP, 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, ALS
- Event logger alarms

**Performance Monitoring:**
- Layer-1 PM for all services
- OTN PM for uplink
- Optical power Rx levels for all optical ports

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

**Software Upgrade:** Hitless traffic – dual image

**Power Supply**

**DC:** -36 to 60 VDC, 260W max

**PSU Redundancy:** Dual feeding

**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:** 8kg / 17.64lb (max)

**Mounting:** 19”, ETSI and 23”

**Approvals & Standards**

- CE, FCC, RoHS, REACH
- NEBS ready

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**PL-2000DC**

1.6T DCI Optical Transport Platform

1.6T high capacity platform in 1U, for data center interconnect, 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 for the following 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, 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, -36 to -60 VDC, 540W max (>100W per drawer)

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 20.87” (D)

45mm (H) x 440mm (W) x 530mm (D)

Weight: 26kg / 57.32lb (max)

Mounting: 19”

Approvals & Standards

- CE, FCC
- RoHS, REACH

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PL-2000T

800G Optical Transport Platform

800G transponder in 1U, 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 QAM 8/16 200G metro
- Supported clients: 100G LAN, OTU4
- Supported FEC modes:
  - Line: HDFEC/SD-FEC for metro and long haul applications
  - OTU4 service: ITU G.709 GFEC
  - 100GbE service: IEEE Clause BJ-FEC
- Standard MSA pluggable:
  - CFP2 DCO tunable DWDM for 100G/200G line interface
  - QSFP28 SR4/LR4/ER4/CWDM4 for 100G client interface
- Layer-1 GCM-AES-256 encryption
- Elliptic Curve Diffie-Hellman key exchange
- Comprehensive line and service performance monitoring
- Optional integrated EDFA, mux/demux and optical switch
- Facility protection using an optional integrated optical switch
- Remote management with in-band GCC, or out-of-band OSC
- Easy maintenance with field-replaceable parts:
  - Dual hot pluggable power supply units AC/DC
  - Fan unit

200G Metro and 100G Long Haul Applications

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

Main Benefits

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

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

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

Recommended for the following 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
- HD-FEC or SD-FEC
Tx Power:
- QAM8/16 (200G): -10dBm
- DP-QPSK (100G): -5dBm
Rx Power:
- QAM16 (200G): -22dBm
- QAM8 (200G): -24dBm
- DP-QPSK (100G): -29dBm

OSNR Sensitivity (at -18dBm Rx Power):
- QAM16 (200G): 19.8dB
- QAM8 (200G): 18.1dB
- DP-QPSK (100G): 11.4dB

Chromatic Dispersion
- QAM16 (200G): 16,000ps/nm
- QAM8 (200G): 20,000ps/nm
- DP-QPSK (100G): 40,000ps/nm

Client Characteristics
Service types:
- 100G LAN
- OTU4
Optical Interface:
- SM QSFP28 - LR4/ER4 (1310nm)
- MM QSFP28 SR10 (850nm)
FEC Support:
- OTU4: Standard ITU-T G.709 GFEC or Zero FEC
- 100G LAN: BJ-FEC or no-FEC

Amplifier
Applications: Booster, pre-amp
Output Power:
- Booster: up to +20dBm
- Pre-amp: +5dBm
Input Power:
- Booster: -24 to +10dBm
- Pre-amp: -36 to -9dBm
Gain:
- Booster: 5 to 22dB
- Pre-amp: 13 to 22dB

Operating Modes:
- Automatic gain control (AGC)
- Automatic power control (APC)

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

Protocols: SNMPv1/v2/v3, HTTP/HTTPS, Telnet/SSH, Syslog, RADIUS, SNTP, TFTP & FTP/SFTP
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-1/2 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

Layer-1 Encryption
1U rack mount
Cost effective solution

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, 21” and 23”

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

Compliance: CNSA Top Secret Suite 2015

Algorithms:
- Key exchange: ECC CDH, Curve P-384
- Message digest: SHA-384

Approval & Standards
- CE, FCC, RoHS, REACH
- NEBS ready

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PL-1000T
100G OTN Transponder Solution

100G transponder platform for metro and data center interconnect applications

Features Overview
- 1U demarcation platform
- Low power consumption customer premises equipment (CPE)
- 100G OTU4 transponder mode supporting 100GBase-SR10/LR4/ER4 client Interface
- Standards based ITU-T G.709 100G OTU4 uplink
- Forward error correction (FEC), GFEC, or HG-FEC
- Supports pluggable line side, CFP: Coherent, 4x28Gbps DWDM, SR4, LR4, ER4
- Supports 100G media converter mode
- Supports 1+1 facility protection
- Comprehensive line and service performance monitoring
- Integrated EDFAs, mux/demux, DCM
- Remote management with in-band or out-of-band OSC
- Supports full C-band tunable coherent DWDM on line side
- Supports standard MSA CFP (uplink), and CFP/CFP2 (client) 100G pluggable optics
- Dual AC or DC pluggable power supply and pluggable fan unit
- Operates on both dual or single fiber

Affordable 100G Connectivity over Dark Fibre or OTN
The PL-1000T is an advanced demarcation transponder solution which provides high capacity optical transport solutions. It is a highly integrated platform for providing a unified 100G optical transport layer, supporting various 100G client interfaces including LR4/ER4 and SR10.

Main Benefits
- OTN-based 1+1 facility protection
- Single device 100G media converter
- Supports up to two integrated optical amplifiers, mux/demux & DCM
- Integrates with any standards-based LR4 interface third party network equipment

Modular and Cost-effective 100G Transport Solution
The PL-1000T is a modular and cost-effective transport solution for rolling out 100G services, and seamlessly interfaces with any third party equipment. It is low power consumption and saves rack space, reducing the overall solution CAPEX and OPEX, while increasing the capacity of enterprise and metro networks.

The PL-1000T is the smallest, most integrated transport solution of its kind, reaching up to 200km/42dB without intermediate sites and 1200km with inline sites.

Recommended for the following applications:
- 100G transport solution for DCI and metro
- CPE for 100G managed services
- Providing 100G links over existing infrastructure (alien wavelength)
- Supporting SR4, SR10, LR4, ER4 in compact device
- Operating as media converter between the different 100G optical interfaces
Technical Specifications

Product Configurations

**100G Transponder:** 100GbE LAN or OTU4 to 100G OTU4 uplink

**100G Media Converter:** Converting 100GE LAN optical modules

**Optical Amplifiers:** Optional up to two EDFA modules

**DCM:** Optional tunable or fixed DCM

**Mux/Demux:** Optional 4ch mux/demux module

Uplink Characteristics

**Bite Rate:** 120Gbps

**Optical Interface:** DWDM CFP

**Tunability range:** DWDM ITU-T G.694.1 Channels 15-60, with 50GHz spacing

**OTN Support:** Standard ITU-T G.709 GFEC or enhanced HG-FEC

**Optical Reach:** 1,200km, 20,000ps/nm

**Optical Output Power:** 0dBm

**RX sensitivity:** -18dBm, OSNR with SD-FEC 15dB

**OTN Overhead:** OTU4/ODU4 overhead

Client Interfaces Characteristics

**CFP:** LR4 (1310nm), SR10 (850nm), ER4 (1310nm), SR4 (850nm)

**CFP2:** LR4 (1310nm)

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: +10 to +22dB
- Pre-amp: +18dB

Operating Modes:
- Automatic gain control (AGC)
- Automatic power control (APC)

Mux/Demux

**Channels:** 4 DWDM channels

**Spacing:** 100GHz

**Insertion loss:** <4dB end-to-end

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
- OTN in-band GCC channel

Protocols: SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, SNTP, TFTP and FTP

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
- OTN PM for uplink
- 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, 160W 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:** 7.5kg / 17.64lb (max)

Mounting: 19”, ETSI and 23”

Approvals & Standards

- CE, FCC, RoHS, REACH
- NEBS ready

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PL-1000TN

6x10G OTN Multi-protocol Multi-rate Transponders

Highly integrated OTN solution with 8G/10G transponders, and total capacity of 60G in 1U

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

Recommended for the following 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

Features Overview
- 6 independent ITU G.Sup43 standard-based multi-rate 8/10G OTN transponders
- Supported clients: 10G/40G LAN, 8G/10G Fibre Channel (FC), STM-64/OC-192, and 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 SFP+ (client) and XFP (uplink)
- Dual AC or DC pluggable power supply and pluggable fan unit
- Operates on single or dual fiber networks

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

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.
Technical Specifications

System

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

Protection: 1+1 facility

Product Configurations

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

EDFA: Up to two EDFA modules

Mux/Demux: Up to two mux/demux modules

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

Optical Amplifier

Output Power: 14, 17, 20 or 23dBm

Input Power: -36dBm up to 16dBm

Gain: 8dB to 22dB

Operating Modes:
- Automatic Gain Control (AGC)
- Automatic Power Control (APC)

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

Mux/Demux

Channels: 4/8 CWDM or DWDM channels

Spacing: 50/100GHz (for DWDM)

Line (Uplink)

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

FEC Types: G.709 GFEC (RS), G.975.1 EFEC 1.4, G.975.1 UFEC 1.7

Optical Interface:
- Up to 6 pluggable XFP transceivers
- DWDM, tunable DWDM
- CWDM

Client Service

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

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

Network Management

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

Protocols: SNMP, HTTP, HTTPS, Telnet, SSH, Syslog, RADIUS, 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

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PL-1000TE

8 Multi-rate Transponders, Supporting Layer-1 Optical Encryption

Low latency multi-rate multi-protocol transponders providing high DCI capacity

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 DWDM and CWDM 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 in the same product provides transparent migration capability from sub-10G to 10G services with zero downtime
■ Optical Layer-1 encryption prevents disclosure of information to unauthorized parties with 100% throughput
■ Maximum flexibility and scalability

Layer-1 Encryption with the Latest Security Standards

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 for the following 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 120 km
Technical Specifications

**System**

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

**Transport Network Medium:** Metro CWDM, DWDM and dark fiber

**Cryptography**

**Crypto Algorithm:** GCM-AES-256

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

**Message Authentication:** SHA-384

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

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

**Product Options**

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

**Mux/Demux:** 2x4 / 1x8 wavelengths

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

**DCM:** Up to 200km

**Optical Switch:** 1+1 facility protection

**CWDM Link**

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

**DWDM Link**

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

**OSC:** 1490nm, 1510nm

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

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

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

**Layer-1**

**Layer-1 encryption**

**Low power consumption**

**1U rack mount**

**Multi operation modes**

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

**Copper Services:**
- 1G/2G/4G/8G/10G/16G Ethernet
- 1G/10G LAN, STM-4/OC-12, STM-16 /OC-48, STM-64/OC-192, CPRI 1-7, Video HD-SDI, 3G-SDI

**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 2015**

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PL-1000D
Diagnostic and Monitoring Solution

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

Features Overview

- Operates as an optical time domain reflectometer (OTDR), optical spectrum analyzer (OSA), or both
- Monitoring up to 16 fibers simultaneously, 8 by the OTDR and 8 by the OSA
- Controlled with PacketLight web application or PacketLight’s Lightwatch™ NMS
- Main OTDR features:
  - Integrates 1:8 optical switch and OTDR
  - 30dB fiber loss
  - Embedded 1610nm OADMs
  - Accuracy 15m
  - Dead zone of 5m from transmitter
- Main OSA features:
  - Integrates 1:8 optical switch and OSA
  - Embedded splitters
  - Supports full C-band
  - Supports 50GHz or 100GHz ITG grid
  - Measures the power, frequency and OSNR of the optical channels in the fiber
- 1U footprint 19"
- Dual redundant AC/DC power suppliers
- Hot swappable fan unit
- Low power consumption

How the PL-1000D Works

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

Main Benefits

- Simultaneous OTDR diagnostics of up to 8 fibers
- OSA monitoring of up to 8 fibers
- In-service fiber monitoring
- Can operate over dark fiber or over third party network
- Integrates with other PacketLight solutions
- Detection of fiber tapping attempts

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.

Recommended for the following 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**
OTDR, OSA, or both

**OTDR**
- **Wavelength:** 1610nm
- **Distance Range:** 125Km
- **Dynamic Range:** 30dB
- **Event Dead Zone:** 5m
- **Loss Measurement Accuracy:** ±0.1dB
- **Max Optical Output Power:** 17dBm

**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 Management:** Web browser over HTTP/HTTPS, PacketLight LightWatch™ NMS/EMS, 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 8.66" (D)
- **Weight:** 5.5kg / 12.1lb (max)

**Approvals & Standards**
- CE, FCC, RoHS, REACH
- NEBS ready
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 and both 50GHz and 100GHz grids.

Main Benefits

- Power monitoring for all channels and automatic power balancing
- Supports optional embedded EDFA booster/preamp
- Optional internal 4/8 mux/demux, 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

Flexibility in Services over the Same Fiber

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 for the following 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>2 degree</th>
<th>4 degree</th>
<th>Unit</th>
<th>Notes</th>
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<tr>
<td><strong>Insertion Loss</strong></td>
<td>Min 10</td>
<td>Max 11</td>
<td>Min 13</td>
<td>Max 14</td>
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<td><strong>Loss Uniformity</strong></td>
<td>Min 1.5</td>
<td>Max 1.5</td>
<td>dB</td>
<td>All ports</td>
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<td><strong>Channel Range</strong></td>
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<td>Max 196.0</td>
<td>Min 191.3</td>
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<td><strong>Channel Count</strong></td>
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<td>Max 48/96</td>
<td>Channels</td>
<td>50/100 GHz spacing ITU grid (CH13-CH60)</td>
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<td><strong>PMD</strong></td>
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<td>Max 0.2</td>
<td>ps/nm</td>
<td>In passband</td>
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<td><strong>Switch Speed</strong></td>
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<td>Max 100</td>
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<tr>
<td><strong>VOA Range</strong></td>
<td>Min 0</td>
<td>Max 15</td>
<td>dB</td>
<td></td>
</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, 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

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PL-1000IL
DWDM EDFA Amplification Solutions

Versatile, cost-effective, 1U 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/demux
- 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

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

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

Flexibility in Services over the Same Fibre
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 for the following 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
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, 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°C to 50°C (+23°F to +122°F) operational

Humidity: 5% to 85% RH

Approvals & Standards
- CE, FCC, RoHS, REACH
- NEBS ready

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PL-1000R

DWDM Raman Amplification Solutions

Counter-propagating Raman amplifier and hybrid Raman-EDFA in 1U platform

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 for the following 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

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, 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
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 for the following 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

### Description

<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>
</tr>
</thead>
<tbody>
<tr>
<td>Dual Fiber 4ch Mux/Demux</td>
<td>4</td>
<td>1471-1531</td>
<td>&lt;4dB</td>
<td></td>
</tr>
<tr>
<td>Dual Fiber 8ch Mux/Demux</td>
<td>8</td>
<td>1471-1611</td>
<td>&lt;4dB</td>
<td></td>
</tr>
<tr>
<td>Dual Fiber 16ch Mux/Demux</td>
<td>16</td>
<td>1311-1611</td>
<td>&lt;6dB</td>
<td></td>
</tr>
<tr>
<td>2 x Dual Fiber 4ch Mux/Demux</td>
<td>4</td>
<td>1471-1531, 1471-1531</td>
<td>&lt;4dB</td>
<td></td>
</tr>
<tr>
<td>2 x Dual Fiber 8ch Mux/Demux</td>
<td>8</td>
<td>1471-1611, 1471-1611</td>
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</tr>
<tr>
<td>2 x Dual Fiber 16ch Mux/Demux</td>
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<td>1311-1611, 1311-1611</td>
<td>&lt;6dB</td>
<td></td>
</tr>
<tr>
<td>Single Fiber 8ch Mux</td>
<td>8</td>
<td>1471-1611</td>
<td>&lt;4dB</td>
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<td></td>
</tr>
</tbody>
</table>

### DWDM Add/Drop Insertion Loss

- **Single ch.:** Express 0.8dB, add/drop 1.5dB
- **Dual ch.:** Express 1.3dB, add/drop 1.5 dB
- **Quad ch.:** Express 2.5dB, add/drop 2.7dB

### CWDM Splitters/Combiners Insertion Loss
- DWDM: 1.5dB
- CWDM: 0.8dB
- 1310nm: <1.5dB

### DCM

- **Fibre Type:** G.652
- **PMD:** <1.2ps
- **Fibre Span:** 20km-200km
- **Wavelength Range:** 1527nm-1567nm
- **Residual Dispersion:** <±2%
- **Max Insertion Loss:** 3dB

### Environmental

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

### Physical Dimensions 1U:

- **1U**
  - 1.77” (H) x 17.32” (W) x 9.05” (D)
  - 45mm (H) x 440mm (W) x 220mm (D)
- **1.5U**
  - 2.65” (H) x 17.32” (W) x 9.05” (D)
  - 66mm (H) x 440mm (W) x 220mm (D)

### Weight

- 3.5kg / 7.7lb (max)

### Approvals & Standards

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

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PacketLight LightWatch

NMS

A multi-platform Java-based network management system (NMS)

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.

**Fault Management**
- Displays history of network events
- Shows current alarms
- Supports filtering events and alarms
- Supports archiving and browsing old events
- Event forwarding to email
- Supports audible alarms

**NMS Highlights**
- Hierarchical topology of the devices in the network
- User account management
- Network fault management
- Network inventory management
- Task scheduling (SW downloads, configuration files upload/download)
- Collects and stores PM counters from all network elements
- Multi-chassis management and service management module
User Management

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

Task Scheduling

Scheduling of:
- 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

Inventory

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

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)

Technical Specifications

Hardware Requirements

Server:
- CPU - Intel® Core i7 3.0GHz or higher
- 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 2008/2012 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 to/from NEs: TFTP/SFTP
Web Browser to NE: HTTP/HTTPS
CLI to NE: Telnet/SSH
Syslog Messages from NE to the Server: Syslog
**PL-Care**

Global Professional Services

PacketLight’s optical network solutions are designed and engineered for smooth installation and uninterrupted service

**Your Partners**
- PacketLight's 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.

**PacketLight Care Center (PLCC)**

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.

**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).

**PL-Care Offers**
- 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).