Dynamic Optical Transport

WDM Transport & OTN Switching Solutions for Optical Networking Applications from Network Edge to Carrier Core

EKINOPS360 OPTICAL TRANSPORT PORTFOLIO PRODUCT BROCHURE 02 | 2021

EKINOPS360

Dynamic Optical Transport

The Optical Experts EKINOPS

TABLE OF CONTENTS

DESCRIPTION OF EKINOPS GROUP

Ekinops is a leading provider of open and fully interoperable Layer 1, 2 and 3 solutions to service providers around the world. Our programmable and highly scalable solutions enable the fast, flexible and cost-effective deployment of new services for both high-speed, high-capacity optical transport as well as virtualization-enabled managed enterprise services.

Our product portfolio consists of three highly complementary product and service sets: Ekinops360, OneAccess and Compose.

- One, marketed under the Ekinops360 brand name, provides a single, fully integrated platform for metro, regional, long-haul and OTN switching applications.
- OneAccess offers a wide choice of physical and virtualized deployment options for Layer 2 and Layer 3 access network functions. For full product information, refer to the OneAccess portfolio brochure or website at www.ekinops.com .
- Compose supports service providers in making their networks software-defined with a variety of software management tools and services, including the scalable SD-WAN Xpress.

As service providers embrace SDN and NFV deployment models, Ekinops enables future-proofed deployment today, enabling operators to seamlessly migrate to an open, virtualized delivery model at a time of their choosing.

A global organization, with operations in 4 continents; Ekinops (EKI) - a public company traded on the Euronext Paris exchange - is headquartered in Lannion, France, and Ekinops Corp., a wholly-owned subsidiary, is incorporated in the USA.

OVERVIEW

Ekinops360

Ekinops360 consists of two distinct but interoperable product lines, one for high-capacity WDM transport and the other for efficient, flexible OTN switching, both managed through a unified interface. The combination of these two systems provides a highly powerful platform enabling Layer 1 connectivity for any type of optical networking application.

The WDM product line delivers active and passive DWDM and CWDM solutions for all transport applications from short reach enterprise, access and data center interconnection (DCI) to metro, regional long haul, ultra-long haul and even submarine distances with line rates from 1G to 600G and beyond. It can also be used for mobile backhaul and fronthaul applications in 3G, 4G and 5G radio access networks.

Developed by a team of senior telecom engineers with extensive experience in designing optical systems and sub- systems for long haul and submarine applications, it has proven to be the most adaptable Layer 1 optical transport system in the industry.

EKINOPS360 Dynamic Optical Transport

- Line rates from 1G to 600G
- Advanced optics including white box-based open ROADMs up to 20 degrees and low noise amplifiers with both EDFA and Raman technology
- Multi-protocol service aggregation to a single optical carrier with multi-tier aggregation for sub-10G service transport on high speed coherent channels

FLEXRATE™ EKINOPS

- Alien wavelength capabilities allowing customers to add capacity over existing infrastructure without disruption of existing traffic
- System automation capabilities reduce reliance on manual tasks to commission and operate networks while increasing network uptime by minimizing human error
- Flexgrid and ITU-standard 50GHz/75GHz/100GHz channel plans
- Bi-directional transmission capability over single fiber for all line rates from 10G to 600G
- Extended Temperature Range (ETR) operation from -40 °C to +65 °C for deployment in outdoor cabinets and other unconditioned spaces
- Advanced Forward Error Correction for 10G/40G and coherent solutions

TRANSPORT ON-A-CHIP TECHNOLOGY T-CHIP® EKINOPS

- Programmable **T-Chip®** (Transport-on-a-Chip) technology that enables a small footprint, low power consumption, short manufacturing times, and quick introduction of new features via software rather than hardware
- Operationally efficient requiring minimum space & power consumption

White Box Family

RM200FRS02-WB

Client: 2x100G / Line: 100G/200G

RMROADM-H4-WB

4D ROADM + Amplifier + OSC + OCM

RMROADM-H10-WB

10D ROADM + Amplifier + OSC + OCM

RMOAC17-WB

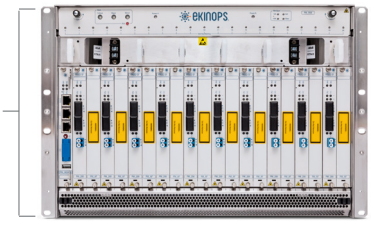
InLine Amplifier + OSC

EKINOPS C200HC

Client: 40x10G/8x40G/12x100G/2x400G
Line: 1G-600G

Mid-Size Applications

EKINOPS C600HC



Client: 120x10G/24x40G/20x100G/6x400G
Line: 1G-600G

Large Applications

EKINOPS*ETS* OTN Switch Platform

The Ekinops360 OTN product line is the Ekinops Transport Switch (ETS). It is a G.709 standards-based OTN switch that integrates Layer 1 and Layer 2 networking capability to provide a highly functional, service-oriented solution for the efficient delivery of any client service. The ETS is designed for all applications from the edge to the core and is available in multiple form factors. The ETS de-couples client and line side interfaces, eliminating the service scalability limitations inherent in pure WDM transport solutions, and virtualizing valuable optical resources to make them more efficient and profitable.

The ETS platform is designed with a pay-as-you-grow architecture that allows for cost-effective solutions for installations of all sizes. Its agnostic cell-based switching fabric delivers the functionality and efficiency service providers need to support any service type. Centralized switch fabrics operate either in an N+1 or 1+1 configuration while the control and timing functions provide 1+1 redundancy for high availability and carrier-grade reliability. Blade-based switching for the edge uses the same switch fabric technology allowing for hardwired connectivity across the backplane and eliminating the need for—as well as the cost of—a central fabric at sites with low capacity. The ETS platform provides ODUk level granularity from ODU0 to ODU4—including ODUFlex with hitless adjustment (HAO)—so it can switch any service regardless of size including using ODUFlex to switch Layer 2 VLANs.

The ETS platform uses a distributed ASON-based software control plane that enables service configuration and performance monitoring. It also provides link verification, network discovery and multilayer resource availability functions providing all nodes full knowledge of the network state in real time. The software abstracts and simplifies the underlying switch complexity using an interface adaptation layer that allows the operator to configure the OTN switch using simple commands from the management system. The control plane supports multiple line protection schemes including 1+1, 1+R and 1+1+R to maximize the availability of high priority traffic.

Celestis *nms*

COMPOSE

Both the WDM and OTN product lines are managed by Celestis NMS, Ekinops advanced network management system, through a common GUI interface. As a web-based network and service layer management application, Celestis NMS requires no client software to download or maintain. Part of Ekinops Compose software suite, it simplifies network monitoring and diagnostics by correlating key network information to services for easier identification of impacted services/customers in the event of a failure and speeds fault isolation. Key features include:

- Integrated element management, network management and service management functions in a single system
- Fully distributed architecture in order to guarantee high performance and high scalability
- Support for thousands of managed devices and up to 150 simultaneous user sessions
- High availability architecture (cluster and load balance)
- Integrated design tool for offline modeling and network optimization with direct import/export of files
- Layered software architecture (J2EE + Web Services)
- State of the art web presentations tools
- Intuitive graphical user interface (GUI)

Celestis NMS provides access to the ETS Management System (NMS), the standards-based TMN management tool for the OTN Switch Equipment, Networks and Services. The NMS has a distributed architecture in order to ensure flexibility for managing a variety of network technologies, high availability, high performance and scalability. NMS applications can be installed in a single standalone server for managing small networks or in multi-server clusters to ensure high availability and scalability when managing large networks. The ETS NMS can also manage multiple chassis as a single network element using a single IP address creating a management cluster.

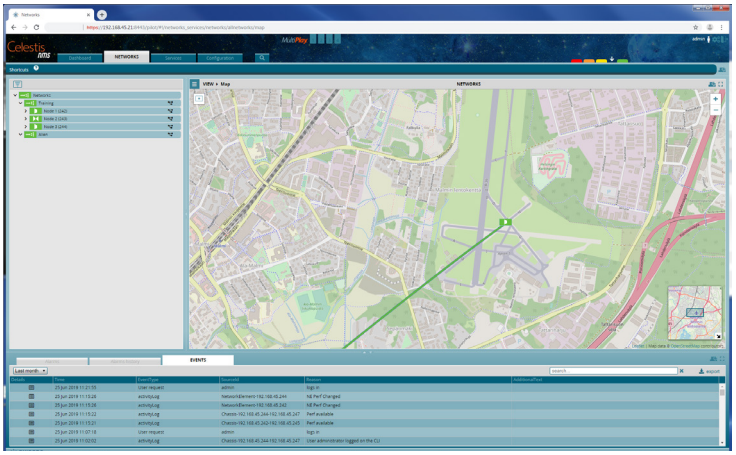


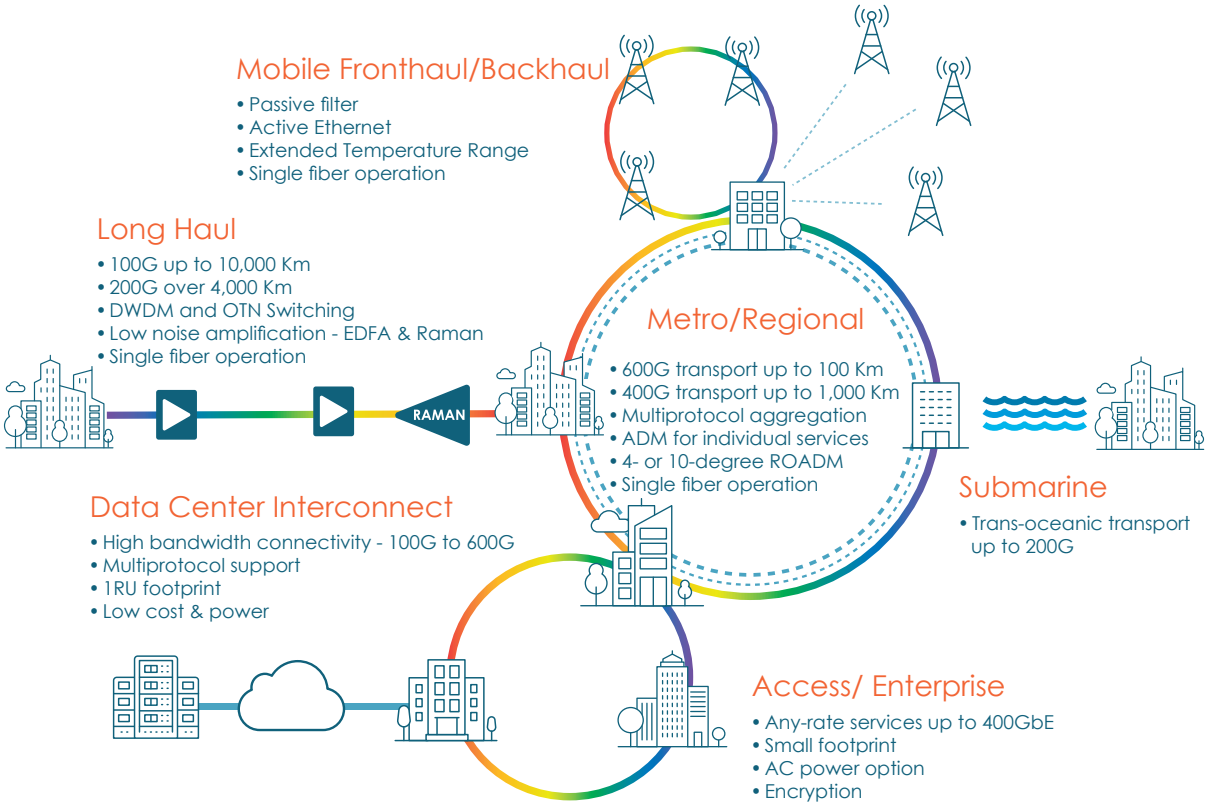
Figure : Ekinops Celestis NMS street-level view

OpenStreetMap® is built by a community of mappers and allows comprehensive net-work views, zooming in easily from a very high-level, entire-network view to a detailed view. Ekinops Celestis® NMS supports maps up to level 14 equivalent to a 1:35000 scale in offline mode. Higher scales such as 1:2000 are supported in online mode, depending on available storage server capacity.

Most Ekinops360 modules include an embedded Data Communications Channel (DCC) for remote monitoring and management. Management information is embedded and transported in the same wavelength but outside of the client traffic, eliminating the need for allocating a special wavelength.

Optical Supervisory Channel (OSC) capability is available for both dual-fiber and single-fiber networks using 1510nm and/or 1590nm channels to maintain management connectivity outside the data plane.

ONE PLATFORM - MULTIPLE SOLUTIONS



APPLICATIONS

Alien Wavelengths
- Easiest, most cost-efficient way to add capacity
- Replace n x 10G with 100G/200G/300G/400G/500G/600G
- Proven operation over any 3rd party line system

Anyhaul Transport
- FlexRate™ technology with tunable performance
- Span any distance from 10m to 10,000 Km on a single line card
- Multi-protocol, multi-rate client service support
- No license fees to upgrade line speed & no keyed optics

OTN Switching
- Highly scalable from 100G to 6 Tbps switch capacity
- Multiple form factors to address any application
- Increased service protection and network reliability

Data Center Interconnection
- Small 2RU form factor with up to 1.2Tbps capacity—2 x 600G or 6 x 200G
- FlexRate™ programmable line interface—selectable from 100G to 600G
- Compatible with existing filters, no line system replacement needed
- Eliminates rip-and-replace with 'evergreen' design that allows technology migration within existing units by simply replacing modules

Encryption
- Bulk Layer 1 encryption of Layer 2/3 services—lower latency and more secure
- Industry standard AES-GCM 256 encryption engine
- FIPS 140-2 compliant solution

Extended Temperature Range
- Operates in any temperature from -40 °C to +65 °C with no impact on system performance
- Ideal for unconditioned spaces and outdoor cabinets
- Active and passive solutions

Fiber Deep
- Efficient aggregation of 10G services at every fiber node
- Programmable capacity up to 600G to meet backhaul requirements
- Enhanced metro core transport

Single Fiber Operation
- Bi-directional transport of up to 32 channels per direction (64 channels on a single fiber)
- Supported for all line rates from 10G to 600G
- Complete line of single fiber capable transponders, muxponders, amplifiers, filters and ROADMs

Submarine Transport
- High speed, low cost 200G capacity upgrade over trans-Atlantic distances and 100G over trans-Pacific distances
- Same system used for both terrestrial and submarine connectivity

System Automation
- Automatic topology discovery with hands-free commissioning
- Point-and-click service provisioning remotely from the NOC
- Automatic power balancing for optimal performance

WDM Systems

PHYSICAL SPECIFICATIONS

CHASSIS	CAPACITY	HEIGHT	WIDTH*	DEPTH	AC POWER	DC POWER
C200HC	6 modules	2 RU	442 mm | 17.4"	269 mm | 10.7" *(DC version)* 442 mm | 17.7" *(AC version)*	Internal Option *— AC/DC versions available —*	Standard
C200HC ETR	6 modules	2 RU	442 mm | 17.4"	269 mm | 10.7"	N/A	Standard
C600HC	20 modules	7 RU	442 mm | 17.4"	269 mm | 10.7"	External Option	Standard
RM_200FRS02-WB RM_10010-WB	2x100G clients 10x10G clients	1 RU	446 mm | 17.8"	238 mm | 9.5"	External Option	Standard

**Note: standard 19" ETSI - ETSI 21" and 23" mounting options also available.*

OPERATING TEMPERATURE

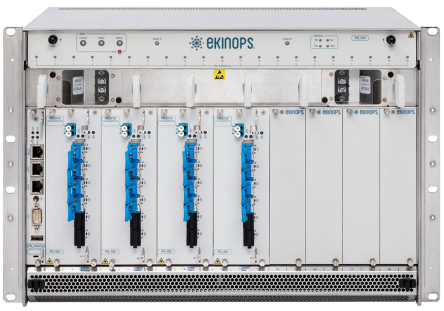
-5°C to +50°C | +23°F to +122°F
-40°C to +65°C | -40°F to +149°F *(C200HC-ETR)*

STORAGE TEMPERATURE

-20°C to +70°C | -4°F to +150°F
-40°C to +70°C | -40°F to +158°F *(C200HC-ETR)*

POWER CONSUMPTION

C200HC	Maximum fully loaded 500W
C200HC-ETR	Maximum fully loaded 150W
C600HC	Maximum fully loaded 1000W
RM_200FRS02-WB	75W (incl. optics)
RM-10010-WB	135W (incl. optics)



C600HC

C200HC

RM 200FRS02-WB

OTN Systems

PHYSICAL SPECIFICATIONS

CHASSIS	CAPACITY	HEIGHT	WIDTH*	DEPTH	POWER
ETS12	12 modules	21 RU	475 mm | 19"	240 mm | 9.6"	40.8 to -57.6 VDC
ETSc6	6 modules	6 RU	475 mm | 19"	240 mm | 9.6"	40.8 to -57.6 VDC
ETSc2	2 modules	2 RU	475 mm | 19"	240 mm | 9.6"	40.8 to -57.6 VDC
ETSc1	2 half-modules	1 RU	475 mm | 19"	240 mm | 9.6"	40.8 to -57.6 VDC

**Note: standard 19" ETSI - ETSI 21" and 23" mounting options also available.*

OPERATING TEMPERATURE 0°C to +40°C | +32°F to +104°F

STORAGE TEMPERATURE -40°C to +70°C | -40°F to +158°F

POWER CONSUMPTION

ETS12	Maximum fully loaded 3250W
ETSc6	Maximum fully loaded 1640W
ETSc2	Maximum fully loaded 580W
ETSc1	Maximum fully loaded 150W

ETS12 ETSc6 ETSc2 ETSc1

OPTICAL LINE INTERFACES

EKINOPS uses a variety of both pluggable and integrated optics on its equipment. Pluggable options include SFP, SFP+, SFP28, XFP, QSFP+, QSFP28 CFP and CFP2 and will vary depending on the individual line card. Ekinops proprietary integrated OTX optics are used on our coherent line cards. The OTX is a special optical module designed by Ekinops to achieve exceptional span distances without in- line amplification.

EKINOPS360

Dynamic Optical Transport

WDM PRODUCTS

High Bitrate Modules: 600G | 200G | 100G
→ FlexRate™ Transponders/Muxponders

PM_600FRS06-SF

3 slots **Pluggable 600G FlexRate™ Transponder/Muxponder**

Pluggable 100G to 600G multi-reach muxponder with six multiprotocol QSFP28 client ports. Single integrated tunable 100G/200G/300G/400G/500G/600G coherent FlexRate line port with FEC. Used for transmission from 10Km to 10,000Km. Compatible with 400GbE client interface. Compatible with single fiber bi-directional operation.

PM_400FRS04-SF

3 slots **Pluggable 400G FlexRate™ Transponder/Muxponder**

Pluggable 100G to 400G multi-reach muxponder with four multiprotocol QSFP28 client ports. Single integrated tunable 100G/200G/300G/400G coherent FlexRate line port with FEC. Used for transmission from 10Km to 10,000Km. Compatible with single fiber bi-directional operation.

PM_200FRS02 (-SF)

1 slot **Pluggable 200G FlexRate™ Transponder/Muxponder**

Pluggable 100G/200G multi-reach transponder/muxponder with two multiprotocol QSFP28 client ports. Single integrated coherent FlexRate 100G/200G line port with FEC. Used for transmission from 10Km to 10,000Km. -SF version compatible with single fiber bi-directional operation.

RM_200FRS02-WB

1 RU **1RU FlexRate™ Transponder/Muxponder**

Rackable 100G/200G multi-reach transponder/muxponder shelf with two multiprotocol QSFP28 client ports. Single integrated coherent FlexRate 100G/200G line port with FEC. Used for transmission from 10Km to 10,000Km.

PM_100G-AGG

2 slots **100G Aggregation Module**

Pluggable 100G muxponder with 10 multiprotocol SFP+ client ports. Single pluggable QSFP28 G.709 OTU4 line side port. Used for efficient aggregation of 10 x 10G services or 2 x 40GbE + 2 x 10GbE onto high speed coherent line or to interface with any OTN network.

PM_100G-EMUX

1 slot **100 Gigabit Ethernet Aggregation Module**

10GbE/40GbE to 100G aggregator module. Multiple configuration options (10 x 10G; 1 x 40GbE + 4 x 10GbE; 2 x 40GbE). 3 client ports, 1 line port, QSFP+ clients and QSFP28 line interface.

PM_100G-EMUX-SFP

2 slots **10x10 Gigabit Ethernet Aggregation Module**

10GbE to 100G aggregator module, 10 clients ports, 1 line port, SFP+ clients and QSFP28 line interface.

PM_CRYPTO

2 slots **Hardware based Data Security Engine**

Pluggable 100G muxponder with 10 multiprotocol SFP+ client ports and 1 QSFP28 client port. Multiple configuration options (10 x 10G; 2 x 40GbE + 2 x 10GbE; 1 x 100GbE). Single pluggable QSFP28 G.709 OTU4 encrypted line side port. AES-GCM 256 encryption module used for bulk Layer 1 in-flight data protection. GDPR compliant. FIPS 140-2 compliant.

High Bitrate Modules: 600G | 200G | 100G
→ 100Gbps Longhaul Transponders and Muxponders

RM_10010-WB

1 RU **100G Ultra-long haul Muxponder**

Rackable 100G White Box long haul muxponder with ten multiprotocol SFP+ client ports. Single integrated coherent 100G tunable line port with FEC. Used for transmission up to 6,000Km.

8Gbps | 10Gbps | 16Gbps Modules
→ 8Gbps, 10Gbps and 16 Gbps Transponder Modules

PM_1001RR

1 slot **10G Metro, Regional and Long Haul Transponder & Regenerator**

Pluggable 10G 3R regenerator with dual XFP line ports. Used for mid-span regeneration.

PM_C1001HC

1 slot **10G Metro, Regional and Long Haul Transponder & Regenerator**

Pluggable 10G transponder with a single multiprotocol SFP+ client port. Single pluggable XFP line side port with DynaFEC. Used for long haul transport of 10G services.

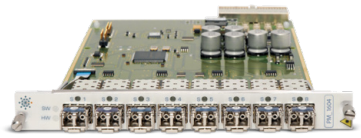
PM_C1001PC

2 slots **Protocol Converter**

Pluggable 10G protocol converter with a single XFP client port. Single pluggable XFP line side port. Used for converting 10GbE LAN client to 10GbE WAN line interface for transporting 10GbE services over SONET/SDH networks.

PM_1604

1 slot **Quad 8G/10G/16G Fibre Channel & 10GbE Transponder**



Pluggable quad 16G multiprotocol transponder with four SFP+ client ports. Four pluggable SFP+ line side ports with 3R Regen. Used for efficient transport of 8G/10G/16G Fibre Channel and 10GbE services.

8Gbps | 10Gbps | 16Gbps Modules
→ 10Gbps Aggregation Modules

PM_C1008MPLH

2 slots **Multi-Protocol, Multi-Rate, 10G Multiplexer/ADM with FEC**

Pluggable 10G muxponder with eight multiprotocol SFP client ports. Dual pluggable line side ports with FEC. Used for timeslot-based service aggregation with add/drop capability.

PM_E1008

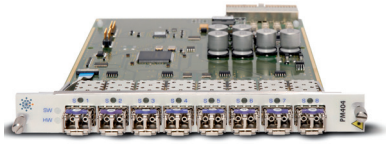
2 slots **Pluggable 10G Ethernet Muxponder**

Pluggable 10G muxponder with eight Gigabit Ethernet SFP client ports. Single pluggable 10 Gigabit Ethernet SFP+ line side port. Used for cost-efficient aggregation of GbE services as well as direct connectivity to FlexRate and 100G muxponder modules for aggregation to a high-speed coherent line.

Low Speed Aggregation and Media Converter Modules

PM_404

1 slot **Multiport Transponder**



Pluggable quad multi-rate transponder with a four SFP client ports. Four pluggable SFP line side ports with 3R regen. Used for efficient transport of any service from 100Mbps to 4Gbps.

OTN Product Line

PM_100G-XPONDER

2 slots **10x10G Add/Drop Crossponder**

Pluggable 100G crossponder provides efficient aggregation of up to ten 10GbE services into a single 100G OTN uplink with the ability to add or drop any individual 10GbE service or combination of services up to five at any node on the network. 10 multiprotocol SFP+ client ports and two pluggable QSFP28 G.709 OTU4 line side ports.

PM_O6006MP

2 slots **HEX 10G Multi-protocol OTN Transponder**

Pluggable 6x10G OTN-based multiprotocol transponder with six SFP+ client ports. Six pluggable SFP+ OTU2/OTU2e line side ports with G.709 FEC. Used for efficient transport of 10G services over standard OTN network.

Extended Temperature Range Products

C200HC-ETR

2 RU **Ekinops360 Dynamic, Multi-Reach Transport Platform**

Extended Temperature Range version of 2RU modular shelf with temperature-hardened fans and management card. Operating temperature range from -40 °C to +65 °C.

Extended Temperature Range *(ETR)*

PM_06006-ETR

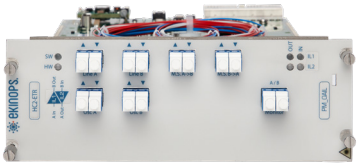
2 slots **10G Multi-protocol OTN Transponder**

Pluggable 3x10G OTN-based multiprotocol transponder with three SFP+ client ports. Three pluggable SFP+ OTU2/OTU2e line side ports with G.709 FEC. Used for efficient transport of 10G services over standard OTN network. Operates in any environment from -40 °C to +65 °C. ETR version is fully compatible and interoperable with non-ETR version.

Extended Temperature Range *(ETR)*

PM_OAIL-HC2-ETR

3 slots **High Capacity Optical Amplifier**



Extended Temperature Range pluggable amplifier. +17dBm output power. Variable gain range +18 dB to +32 dB. 1510nm OSC Add & Drop. Operating temperature range from -40 °C to +65 °C.

Extended Temperature Range *(ETR)*

CM_OM8-ETR

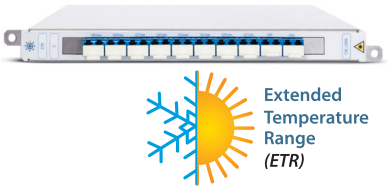
1 slot **DWDM Optical Multiplexer**

Case mounted 8-channel passive optical multiplexer units with Extended Temperature Range capability. For DWDM applications. BR/RB versions compatible with single fiber bi-directional operation. Operating temperature range from -40 °C to +65.

Extended Temperature Range *(ETR)*

CM_OM-ETR-CWDM

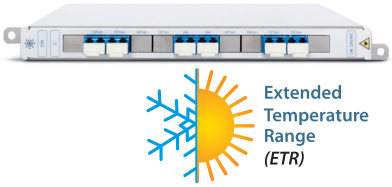
1 slot **CWDM Optical Multiplexer Family**



Case mounted 8- and 10-channel passive optical multiplexer units with Extended Temperature Range capability. For CWDM applications. CSF versions compatible with single fiber bi-directional operation. Operating temperature range from -40 °C to +65 °C.

CM_OADM-ETR-DWDM

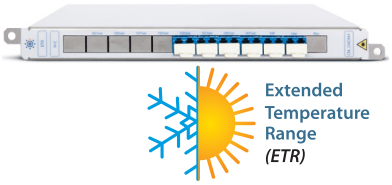
1 slot **DWDM Optical Add & Drop Multiplexer Family**



Case mounted 1-, 2- and 4-channel passive optical multiplexer units with Extended Temperature Range capability. For DWDM applications. SF versions compatible with single fiber bi-directional operation. Operating temperature range from -40 °C to +65 °C.

CM_OADM-ETR-CWDM

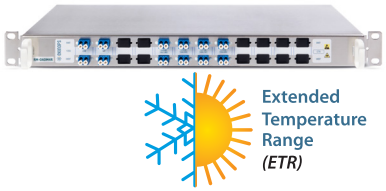
1 slot **CWDM Optical Add & Drop Multiplexer Family**



Case mounted 1-, 2- and 4-channel passive optical multiplexer units with Extended Temperature Range capability. For CWDM applications. CSF versions compatible with single fiber bi-directional operation. Operating temperature range from -40 °C to +65 °C.

RM_OADM4R-ETR

1 RU **Optical Add-Drop Multiplexer, 4 Wavelengths (Bi-directional)**



Rackable 1RU 4-channel, dual sided bi-directional optical add/drop multiplexer shelf with mid-access point and Exteneded Temperature Range capability from -40 °C to +65 °C.

Infrastructure Elements
→ Optical Amplifier Modules

PM_OABP-HCS (-BR/-RB)

2 slots **High Capacity Next Generation Booster/Pre-Amplifier**

Pluggable high capacity booster/pre-amplifier module. +17 dBm or +20 dBm output power. Variable gain range from +10 dB to +18dB (booster) or +18 dB to +32 dB (pre-amp). Integrated OSC channel for remote management. BR/RB version compatible with single fiber bi-directional operation.

PM_OAIL-HCS (-SF)

2 slots **High Capacity Next Generation Inline Amplifier**

Pluggable high capacity in-line amplifier module. +17 dBm or +20 dBm output power. Variable gain range from +18 dB to +32 dB. Integrated OSC channel for remote management. SF version compatible with single fiber bi-directional operation.

PM_OAC20

2 slots **Pluggable C-band Erbium Doped Fiber Amplifier**

Pluggable high capacity booster/pre-amplifier module. +20 dBm output power. Variable gain range from +15 dB to +25dB. Integrated OSC channel for remote management.

RM_OAC17-WB

1 RU **Open White Box Optical Line Amplifier for C-band**

1RU Variable Gain Optical Line Amplifier, 15dB to 25db gain, +17dBm output power, for WDM application over the C band. Includes 1510 nm Optical Supervisory Channel.

PM_ORA14

1 slot **Pluggable Raman Amplification Module**

Pluggable Raman amplifier with up to +14 dB gain. Can be used in counter-propagating or co-propagating configurations.

Infrastructure Elements
→ Optical Add & Drop Modules

RM_ROADM-H4-WB

1 RU **Four-Degree Open Architecture ROADM Shelf**

Rackable 4 degree reconfigurable optical add/drop multiplexer White Box. Includes ROADM, optical amplifier with 1510 nm optical supervisory channel (OSC) and optical channel monitoring (OCM). Scalable from two to four degrees using one RM ROADM White Box per ROADM degree. Supports more than 96 channels.

RM_ROADM-H10-WB

1 RU **Ten-Degree Open Architecture ROADM Shelf**

Rackable 10 degree reconfigurable optical add/drop multiplexer White Box. Includes ROADM, optical amplifier with 1510 nm optical supervisory channel (OSC) and optical channel monitoring (OCM). Scalable from two to ten degrees using one RM ROADM White Box per ROADM degree. Supports more than 96 channels.

PM_ROADM-FLEX-H4M

1 slot **Flexgrid Four-Degree Pluggable ROADM**

Pluggable single-slot 4-degree reconfigurable optical add/drop multiplexer with optical channel monitoring (OCM). Scalable from two to four degrees using one module per degree. Supports more than 96 channels.

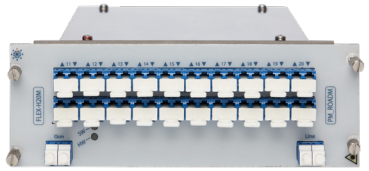
PM_ROADM-FLEX-H10M

2 slots **Flexgrid Ten-Degree Pluggable ROADM**

Pluggable dual-slot 10-degree reconfigurable optical add/drop multiplexer with optical channel monitoring (OCM). Scalable from two to ten degrees using one module per degree. Supports more than 96 channels.

PM_ROADM-FLEX-H20M

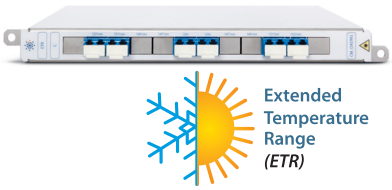
3 slots **Flexgrid Twenty-Degree Pluggable ROADM**



Pluggable three-slot 20-degree reconfigurable optical add/drop multiplexer with optical channel monitoring (OCM). Scalable from two to twenty degrees using one module per degree. Designed for directionless configurations. Supports more than 96 channels.

CM_OADM-ETR-DWDM

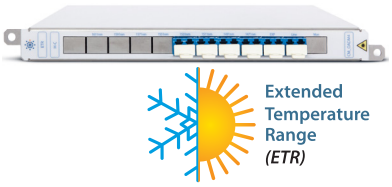
1 slot **DWDM Optical Add & Drop Multiplexer Family**



Case mounted 1-, 2- and 4-channel passive optical multiplexer units with Extended Temperature Range capability. For DWDM applications. SF versions compatible with single fiber bi-directional operation. Operating temperature range from -40 °C to +65 °C.

CM_OADM-ETR-CWDM

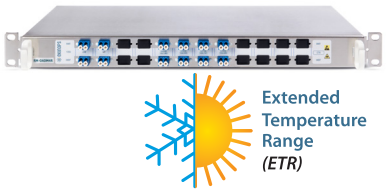
1 slot **CWDM Optical Add & Drop Multiplexer Family**



Case mounted 1-, 2- and 4-channel passive optical multiplexer units with Extended Temperature Range capability. For CWDM applications. CSF versions compatible with single fiber bi-directional operation. Operating temperature range from -40 °C to +65 °C.

RM_OADM4R-ETR

1 RU **Optical Add-Drop Multiplexer, 4 Wavelengths (Bi-directional)**



Rackable 1RU 4-channel, dual sided bi-directional optical add/drop multiplexer shelf with mid-access point and Exteneded Temperature Range capability from -40 °C to +65 °C.

Infrastructure Elements
→ Optical Multiplexer Modules

RM_OM40FT

1 RU **WDM Multiplexer / Demultiplexer**

Rackable 40-channel 1RU passive optical flat top multiplexer with 100GHz spacing. RM OM40 can be upgraded to 80 DWDM channels with 50GHz spacing.

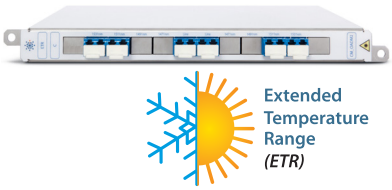
RM_OM64FT

1 RU **WDM Coherent Multiplexer / Demultiplexer**

Rackable 64-channel 1RU passive optical flat top multiplexer with 75GHz spacing. Uses wideband AWG filter design for high baud rate coherent channels up to 600G.

CM_OM8-ETR

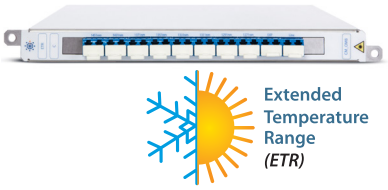
1 slot **DWDM Optical Multiplexer**



Case mounted 8-channel passive optical multiplexer units with Extended Temperature Range capability. For DWDM applications. BR/RB versions compatible with single fiber bi-directional operation. Operating temperature range from -40 °C to +65.

CM_OM-ETR-CWDM

1 slot **CWDM Optical Multiplexer Family**



Case mounted 8- and 10-channel passive optical multiplexer units with Extended Temperature Range capability. For CWDM applications. CSF versions compatible with single fiber bi-directional operation. Operating temperature range from -40 °C to +65 °C.

Infrastructure Elements
→ Optical Protection Modules

PM_OPS2

1 slot **Optical Protection Switch**

Pluggable dual window, single channel optical protection switch module. Supports both 1310nm and 1550nm optical windows.

PM_OPS2D

1 slot **Dual Optical Protection Switch**

Pluggable dual window, dual channel optical protection switch module. Supports both 1310nm and 1550nm optical windows on both channels.

Infrastructure Elements
→ System Automation Modules

PM_OPM8

1 slot **Optical Power Measurement Module**

Pluggable remote optical performance monitoring module. Used for automated power balancing in locations where feature is not available.

PM_OTDR

1 slot **Optical Time Domain Reflectometer**

Pluggable optical time domain reflectometer module. Supports one or two fibers independently. Used to detect fiber failures up to 80 Km from the node. Operates at 1610nm.

PM_VOA

1 slot **8-port Pluggable Variable Optical Attenuator**

Pluggable variable optical attenuator module. Up to eight pluggable SFP VOAs per module. Used for cost efficient power management.

EKINOPS360

Dynamic Optical Transport

OTN PRODUCTS

Pluggable Modules *(PM)*
pages 24-25

ETS12 Module

PM_ETS10014-L2XC-A

1 slot **Dual Rate 10G + 100G Line Module for ETS12**

Pluggable 240G multiprotocol service aggregation module with SFP+ and CFP pluggable interfaces. 1x100G + 14X10G in a single slot with B&W or tunable WDM optics.

ETSc6 /ETSc2 Modules

PM_LC2-MP2-B

1 slot **200G Multirate Multiprotocol Aggregation Module**

Pluggable 200G multi-rate, multi-protocol service aggregation module with SFP (low bitrate interface), SFP28, QSFP28 and CFP2 pluggable interfaces. 1x200G/2x100G + 12x8G/10G + 10x100Mbps-4Gbps in a single slot with B&W or tunable WDM optics. Integrated management & timing features.

PM_LC4-MP2-A

1 slot **400G Multirate Multiprotocol Aggregation Module**

Pluggable 400G multi-rate, multi-protocol service aggregation module with SFP28, QSFP28 and CFP2 pluggable interfaces. 2x200G/4x100G + 20x10G/25G in a single slot with B&W or tunable WDM optics. Integrated management & timing features.

PM_LC5-MP4-A

1 slot **500G Multirate Multiprotocol Aggregation Module**

Pluggable 500G multi-rate, multi-protocol service aggregation module with SFP28, QSFP28, QSFP28-DD and CFP2 pluggable interfaces. 1x400G + 2x200G + 4x100G + 16x8G/10G/25G in a single slot with B&W or tunable WDM optics. Integrated management & timing features.

ETSc1 Module

PM_LC1-MP1-C

1 slot **100G Aggregation Module**

Pluggable 100G Ethernet aggregation module for network edge applications. Efficiently maps up to eight Gigabit Ethernet interfaces into ODU0 payloads or eight 10GbE interfaces into ODU2e for further aggregation to an OTU4 uplink. B&W or tunable DWDM optics.

Dynamic Optical Transport
WDM Transport & OTN Switching Solutions for Optical Networking Applications from Network Edge to Carrier Core

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