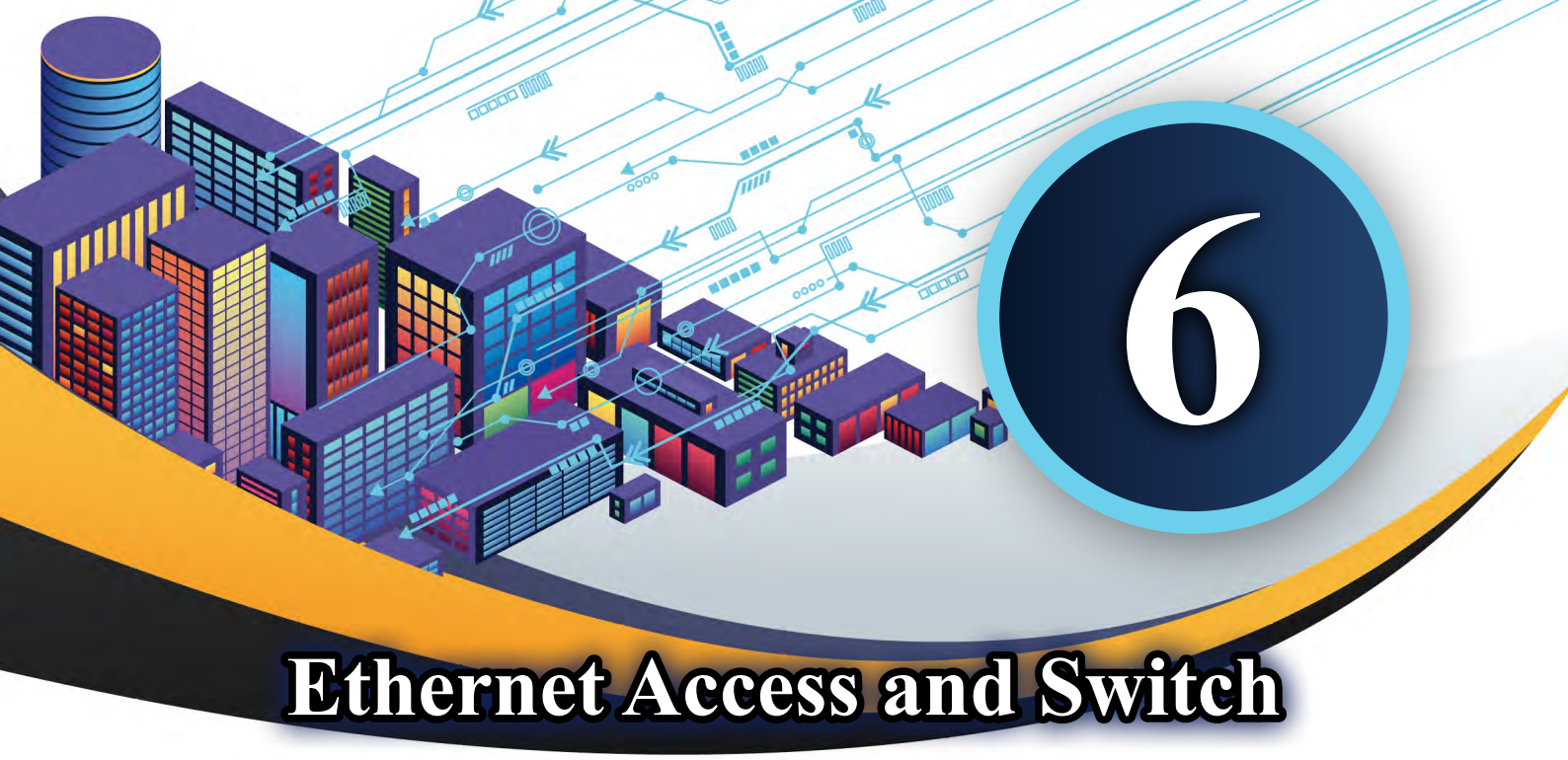


6

Ethernet Access and Switch

Loop-IP6330 L2 GbE Intelligent Switch 194

Loop-IP6340 L2 Smart Management Ethernet Switch 195

Loop IP6510-LN Multiple WAN Router 197

Loop-IP6608 CE2.0 Switch 199

Loop-IP6610 L2/L3 E1/DS1/DTE/DCE/ Router/Bridge Box 201

Loop-IP6618 CE2.0 Switch 202

Loop-IP6808 L2 Unmanaged 8-Port Industrial Secure Gigabit Switch 204

Loop-IP6810 Self-Healing Ring NTU 205

Loop-IP6818 8-port Industrial L2/L3 Managed Gigabit PoE/PoE+ Switch 209

Loop-IP6820 Self-Healing Ring NTU 210

Loop-IP6828 Industrial Rack-Mount L2/L3 Managed Gigabit Ethernet PoE/PoE+ Switch 214

Loop-G7820 L2/L2.5/L3 Intelligent Switch 216

Loop-IP6330 L2 GbE Intelligent Switch

Features

- 1 U height
- 24 GbE ports
  - 24 ports of RJ45 (10/100/1000Mbps-TX) interfaces, Full/Half duplex auto-negotiation
- L2 Switch functions:
  - VLAN
  - Jumbo Frame reach up to 9600 bytes
  - Max. 1024 active VLAN with VID (1 to 4094)
  - Port-based VLAN
  - Rate Control
  - QoS
    - 8 priority queues per port
    - Strictly Priority or Weighted Round-Robin (WRR) scheduling
  - Port Rate limiting for ingress/egress traffic
- Storm control
- MAC table size 8k
- LACP for link aggregation (IEEE 802.3ad)
- IGMP snooping and query
- Software Upgrade
- Event Log
- Management port and interface
  - Embedded SNMP v1, v2c
  - Telnet
  - Web Management (Http)
- IEEE compliance
  - 802.1p
  - 802.3, 802.3u, 802.3ab, 802.3x, 802.3az
- RoHS compliant

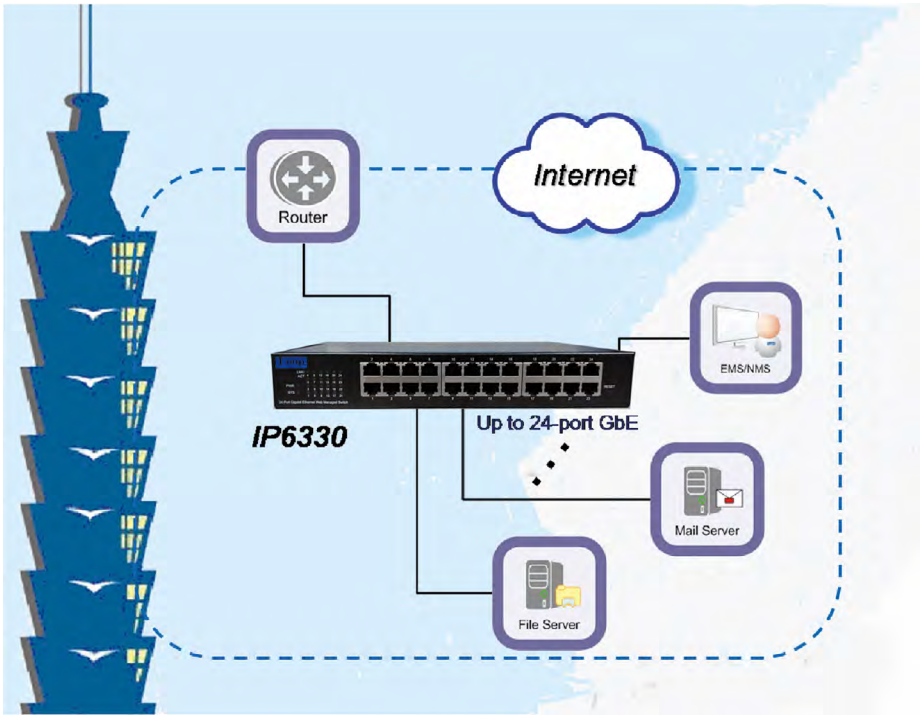
Description

The Loop-IP6330 L2 GbE Intelligent Switch is a cost-effective 24-port GbE L2 Ethernet switch that offers high performance and quality service at a very affordable price.

The IP6330 switch provides total 24 GbE ports with 24 RJ45 ports. The switch capability of IP6330 supports non-blocking for full line speed traffic.

The IP6330 supports lots of L2 switch management functions including. 802.1Q VLAN, Rate Control, Port Configuration, Port Mirroring, Port Statistics, QoS functions, ... etc. The console interfaces of IP6330 supports remote management by SNMP, HTTP, HTTPS, and Telnet interfaces.

Application Illustration



Loop-IP6340 L2 Smart Management Ethernet Switch

Features

- Connector
  - 24 GbE (10/100/1000 Mpbs) RJ45 ports
  - 4 SFP (1000 Mpbs) fiber ports
- Port settings
  - Auto/Full/Half Duplex
  - Auto-negotiation
- L2 Switch functions
  - VLAN
    - Static, port-based, tag-based, Voice OUI
  - Jumbo Frame 64 to 9216 bytes
  - VLAN ID (1 to 4094)
  - Rate Control
  - QoS
    - 8 priority queues per port
    - Strictly Priority (SP) scheduling
    - Weighted Round-Robin (WRR) scheduling
    - Cos, DSCP, IP precedence
    - Port Rate limiting for ingress/egress traffic
- Spanning Tree Protocol (STP) Modes
  - STP
  - Rapid STP (RSTP)
  - Multiple STP (MSTP)
- Device discovery protocol
  - LLDP, LLDP-MED
- IEEE compliance
  - 802.3, 802.3u, 802.3ab, and 802.3x
  - 802.3az EEE enable and disable
  - Flow control
- Management
  - Telnet, HTTP, HTTPS, SNMP
- Security
  - Protected Port
  - Storm Control
  - DoS attack prevention
  - DHCP Snooping
- Diagnostics
  - Port mirroring, Ping test, Copper test
- Firmware configuration upgrade and backup
- Other features
  - MDI/MDI-X auto crossover
  - NWay protocol and auto-detection
  - IGMP Snooping v2/v3
  - LACP port trunking up to 8 static or dynamic groups

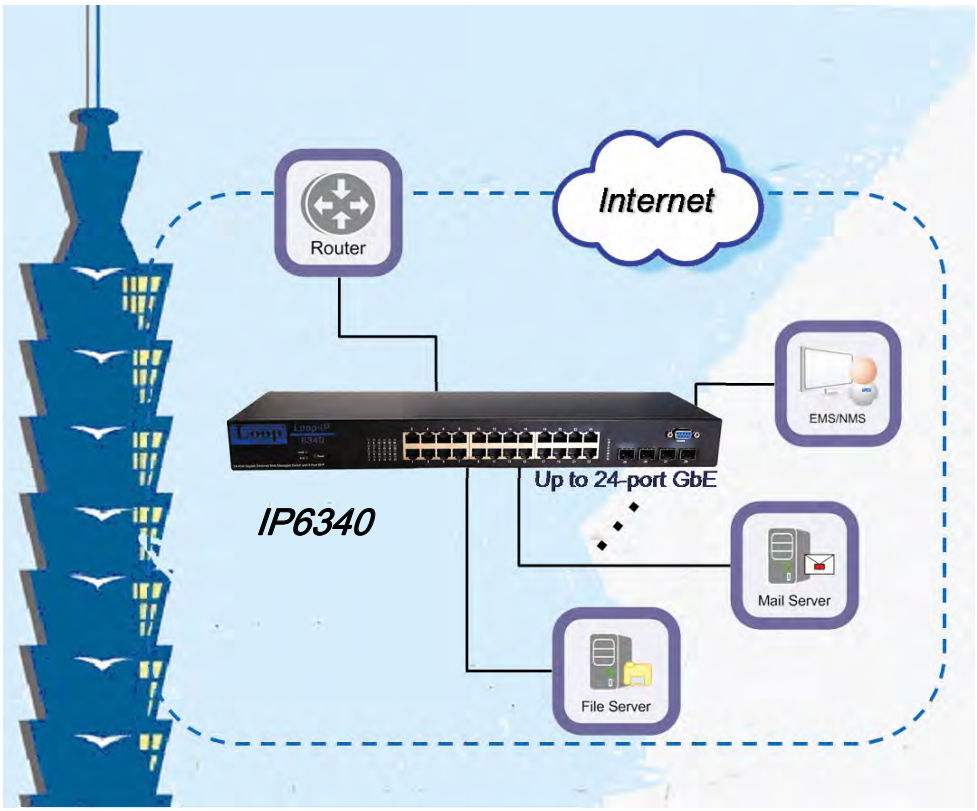
Description

The Loop-IP6340 L2 Smart Management Ethernet Switch is equipped with 24 gigabit RJ45 ports and 4 SFP slots. The switch supports high performance, enterprise-level security control & QoS Layer 2 management features. It is a cost-effective product solution for the small and medium business.

The switch supports the Web GUI to control each port status and bandwidth control by port rate limiting. The Storm Control feature protects against Broadcast, Multicast and Unicast Storm. The rich Quality of Service (QoS) & VLAN provides enhanced traffic management capabilities to move your data smoother and faster. The device supports a complete lineup of layer 2 features, including 802.1Q tag VLAN number up to 4094, Port Isolation, Port Mirroring, Port ACL, STP/RSTP/MSTP, Link Aggregation Group and 802.3x Flow Control function. It also supports SNMP management functions.

The switch complies with IEEE802.3az Energy Efficient Ethernet to save power consumption, Support IGMP Snooping v2/v3 function to improve traffic performance. Moreover, the rich diagnostic LEDs on the front-panel provide the operating status of individual port and whole system.

Application Illustration



Loop IP6510-LN Multiple WAN Router

Description

The IP6510-LN Multiple WAN Edge Router has IPv4/IPv6 dual stack functionality and Level 3 Routing in a single unified device. It is suitable for large deployments that require only moderate bandwidth and a small port density but a very competitive CapEx. The LN stands for Linux, which backs up the Loop-OS architecture inside the IP6510-LN. The new Loop-OS includes many advanced features with more functionality to help you improve your network.

These features inside the Loop-OS include IPv4/IPv6 dual stack routing capability, software bridging*, and network security features. With RIPng, OSPFv3 and BGP-4, the IP6510-LN is able to build a reliable IPv6 routed network.

All WAN ports and LAN ports can be configured into bridge mode*, router mode, or combinations of both. WAN interfaces including Ethernet, and E1/T1 provide flexibility for any access network.

Using VPN connectivity over IPSec included in the Loop-OS software suite allows a highly secure and reliable connection over an IP-based network to any location.

* Future option

Features

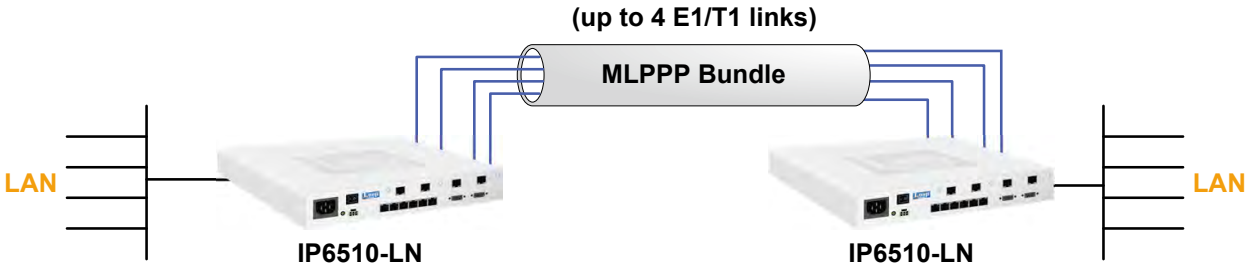
- Mechanical and Electrical
  - 2 Tributary Slots for WAN interfaces
  - Power Module
    - AC and DC coexist
    - AC power: 100 to 240 Vac, 0.8 A
    - DC power: -36 to -72 Vdc, 1.2 A
  - Commercial unit: 0°C to 50°C;
  - Industrial unit: -20°C to 70°C
- WAN Interface
  - Tributary Slots
    - 2 ports
    - Cold-swappable
    - Plug-in card types:
      - E1 card: 2 ports per card, Nx64k
      - T1 card: 2 ports per card, Nx64k
      - Ethernet card: 1 port per card, electrical RJ45
      - Ethernet card: 1 port per card, optical SFP
  - Built-in 2 Ethernet ports
  - Multiple WANs per fractional E1/T1 interface is supported, up to 64 WAN per system (maximum 16 WAN supports PPP encapsulation)
- LAN Interface
  - 4 Ethernet ports
- All Ethernet Interfaces
  - 10/100BaseT
  - Speed and duplex-mode auto-negotiation
  - Auto MDI/MDI-X cross-over
- Layer 2 Encapsulation Protocols
  - PPP, MLPPP, Cisco HDLC, raw HDLC
- Management
  - Telnet and SSHv1/v2 (up to 4 concurrent sessions)
  - SNMPv3
  - Multilevel login privilege control
  - Syslog
  - NTP Client for IPv4, up to 4 NTP server
- QoS
  - Policy based Egress Rate Limiting
  - Traffic Classification based on
    - Outbound direction
    - IPv4 or IPv6
    - Source/Destination IP Address Range
    - TCP/UDP Port Number
    - (DSCP+ENC) 1byte field / ToS 1 byte field
    - Any Protocol Type
- Layer 3
  - IPv4/IPv6 dual stack
  - Routing Protocols: Static Route, RIPv1/v2, RIPng, OSPFv2/v3, BGP4.
  - Multicast protocols: IGMPv1/v2/v3
  - VLAN Routing based on Static Route, RIPv1/v2, RIPng, OSPFv2/v3.
  - Address Translation
    - NAT
    - Port Forwarding Table for NAPT (Virtual Service)
  - IP-VPN connectivity over IPSec
- Security
  - IPSec
    - Encryption: DES, 3-DES, AES-128/AES-256
    - Authentication: MD5, SHA-1
    - Key Management
      - IKEv1/v2 (pre-shared key or RSA certificate)
    - Up to 64 concurrent tunnels per interface
  - IP-VPN connectivity over IPSec
  - Access Control
    - Packet-Filtering based on policy type:
      - Inbound/Outbound direction
      - Source/Destination IP Address Range
      - Any Protocol Types (ICMP, TCP, UDP, etc.)
      - TCP/UDP Port Number Range

  - 1 control list per interface
  - Up to 100 rules per control list
- 802.1x port-based authentication*
- Multilevel login privilege control
- Radius Client is supported, up to 3 Radius servers available for addressing.
- SSHv1/v2
- SNMPv3

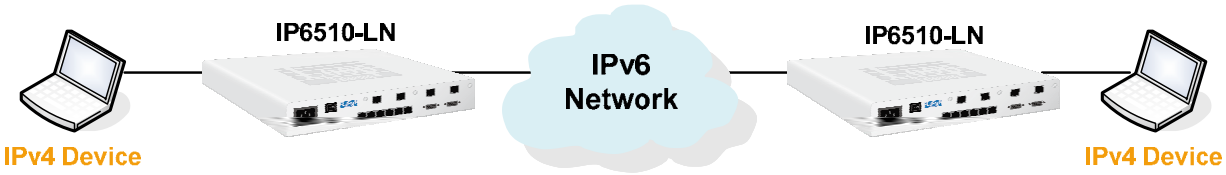
- DHCP
  - DHCP Server/Relay for IPv4/IPv6
  - BOOTP compatible for IPv4
- Software Bridging*
  - Frame size up to 1916 bytes*
- IEEE 802.2x Flow Control*
- STP(802.1d) *, RSTP(802.1w) *, MSTP(802.1s) *
- Up to 16K MAC Table*
- User-configurable MAC aging time*
- Ethernet FCS padding/unpadding*
- 802.1x port-based authentication*
- VLAN*
  - Support up to 4094 VLANs*
  - VLAN ID mapping*
  - Support Q-in-Q *
  - Support VLAN Routing

* Future option

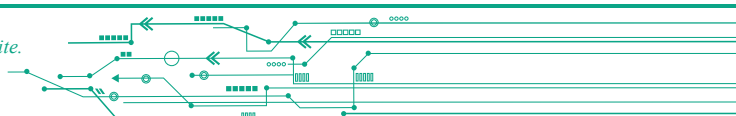
Application Illustrations



Multilink PPP



IPv4 and IPv6 Interworking



Loop-IP6608 CE2.0 Switch

Features

- 4 × 10/100/1000Mbps RJ45 Ports + 6 × 1G SFP Ports
- Carrier Ethernet 2.0 compliant
- 99.999% availability
- ITU-T G.8031/G.8032 protection switching
- ITU-T G.8262 Synchronous Ethernet with SSM
- IEEE 1588v2 Boundary and Transparent Clock with nanosecond accuracy
- ITU-T G.8275.x PTP Telecom Profile supported on Boundary Clock and Transparent Clock
- Comprehensive Ethernet OAM supported: IEEE 802.1ag CFM, 802.3ah EFM, and ITU-T Y.1731
- Service Activation Testers incorporated: RFC2544, Y.1564
- Non-blocking wire-speed switching

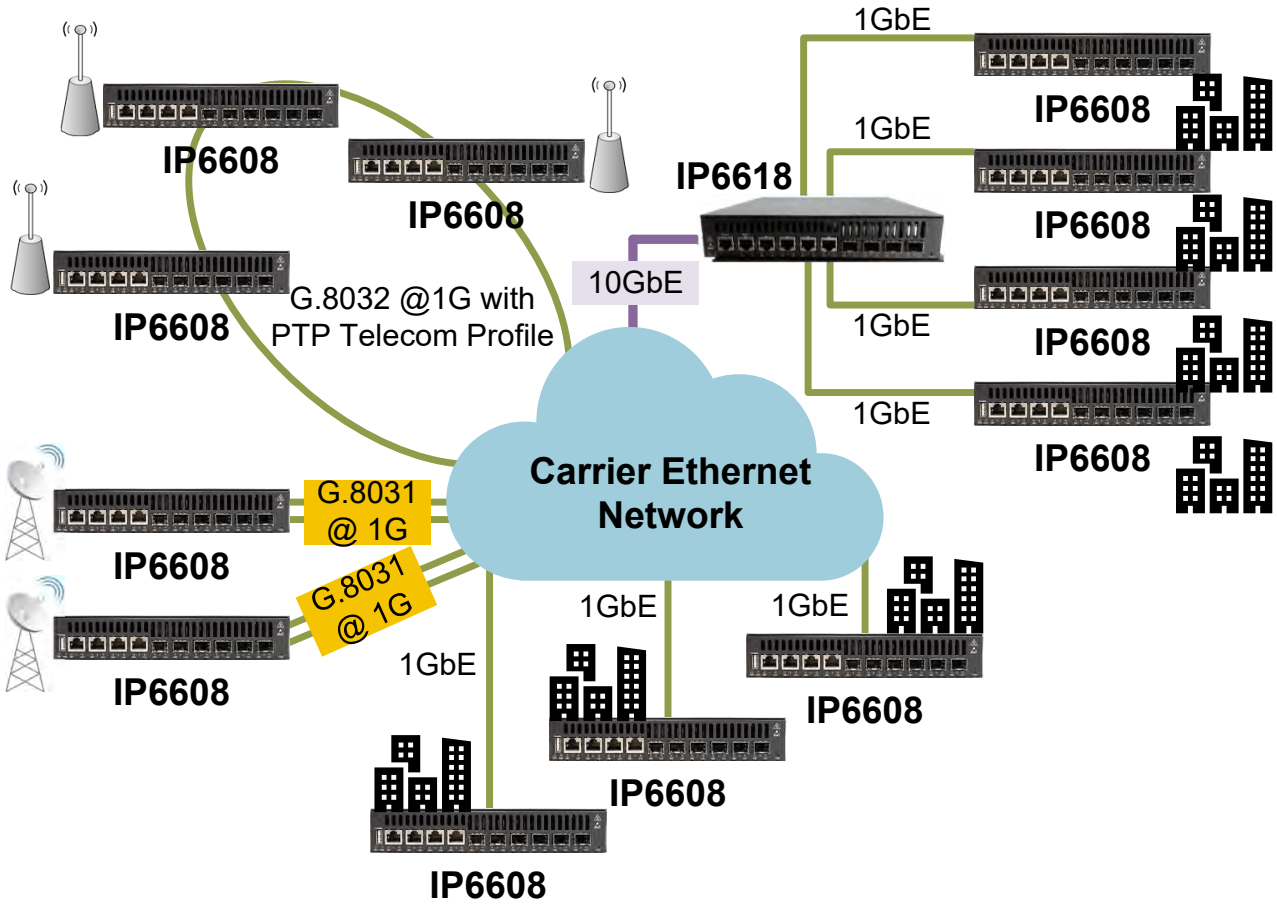
Description

Loop-IP6608 leverages the purpose-built silicon technologies to fulfill the needs that modern Carrier Class Ethernet services require with ultra-low power consumption. The standard compliant features bring hassle free operations with the benefits of unmatched resiliency, superb synchronization accuracy, and comprehensive OAM.

As the SLA (Service Level Agreement) is at the center part of the Carrier Ethernet services and the Ethernet OAM protocol suite is the key to enable the services. The IP6608 NIDs embed the hardware Ethernet OAM engines for ensuring the real time monitoring can be achieved. The protocol suite covers link status, service level, network monitoring, as well as performance metrics. IEEE 802.1ag CFM, 802.3ah EFM, ITU-T Y.1731 Performance Monitoring are all included in the OAM feature suite, furthermore, both IETF RFC 2544 and ITU-T Y.1564 hardware-based tester are also in place which enables the operation center the ability of performing diagnostics and performance testing remotely. This capability effectively reduces service personnel costs and ensures outstanding user experiences.

The PTP (IEEE 1588v2) has become the de facto synchronization solution that has been widely adopted in different application scenarios which requires precision timing mechanism. By incorporating the OCXO better than what Stratum 3 required, the IP6608 NIDs perfectly maintain the 1588v2 accuracy within nano-second scale. The Sync-E (ITU-T G.826x) assisted 1588v2 delivers not only the accuracy, but with outstanding stability persistently. The importance of synchronization grows drastically as the mobile traffic grows with unprecedented speed. The exceptional PTP performance on IP6608 effectively satisfies such synchronization requirements the LTE & LTE-Adv. base-stations needed. The 1588v2 capabilities delivered by IP6608 ensure what LTE & LTE-A requested, and potentially what the 5G technology will need can be perfectly fulfilled.
ERPS, the ITU-T G.8032 Ethernet Ring Protection Switching, is firmly built inside IP6608 NIDs as the foundation that provides sub-50ms switching capabilities. No need to worry about incidentally operation interruptions any longer that drastically reduces the OpEx of the network operators. The ERPS feature is assisted by dedicated hardware engine embedded in the silicon; hence, it ensures the consistent performance on the switching time whenever the interruption happens. In addition to ERPS, other protection related protocols are all supported, such as IEEE 802.1d STP, 802.1w/s RSTP & MSTP, and 802.3ad LACP, etc.

Application Illustration



Loop-IP6610 L2/L3 E1/DS1/DTE/DCE/ Router/Bridge Box

Features

- Supports 1 or 4 Ethernet LAN ports
- Supports 1 WAN port for multiple interfaces: E1, DS1, and DTE (V.35, V.36, EIA530, RS449, RS232, X.21, RS422)
- Supports 1 DCE (V.35) port
- Supports 10/100 BaseT speed auto-sensing and half/ full duplex auto-negotiation
- Supports Router or Bridge mode
- Multicolor LED indicators
- Local control and diagnostic via DB9S console port
- Local/remote management through local console, LAN, or WAN
- Supports CLI (command line interface)
- Supports SNMP management
- Industrial series: -40°C to 70°C; Commercial series: 0°C to 50°C.

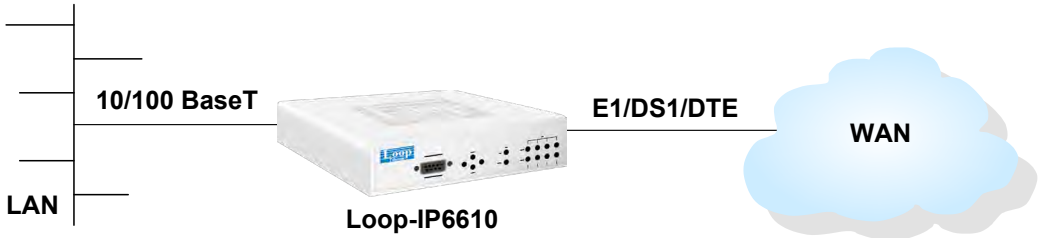
Description

The Loop-IP6610 L2/L3 Router/Bridge provides connectivity from 10/100 BaseT to E1, DS1, DTE or DCE in a small metal box.

The Loop-IP6610 L2/L3 Router/Bridge contains a DB9S console port, which allows users to execute in-service diagnostics and fault isolation from a local or remote terminal. The Loop-IP6610 L2/L3 Router/Bridge also allows remote access to Telnet via Ethernet or WAN port. The IP6610 L2/L3 Router/Bridge series also provides multicolor LED indicators on the front panel and an ACO (Alarm Cut Off) button.

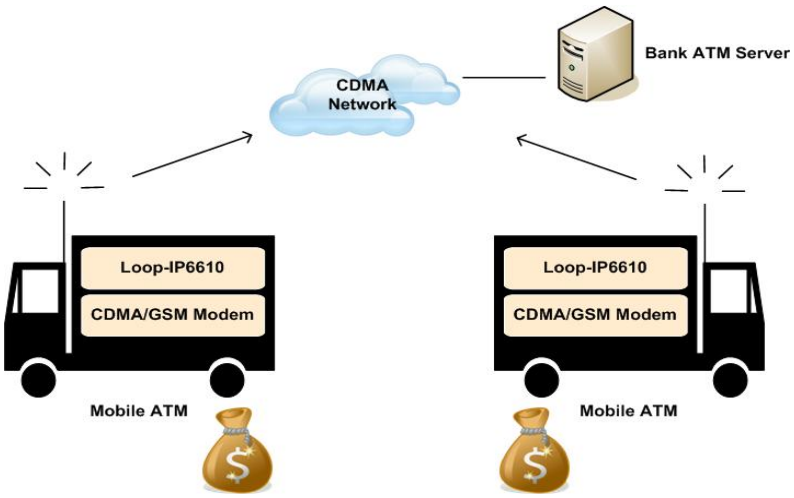
Application Illustrations

Basic Use



Ethernet to Data Transmission Application

Mobile ATM Solution



Loop-IP6618 CE2.0 Switch

Features

- 4 × 1G RJ45 Ports + 2 × 1G/2.5G SFP Ports + 2 × 10G SFP Ports
- Carrier Ethernet 2.0 compliant
- ITU-T G.8031/G.8032 protection switching
- ITU-T G.8262 Synchronous Ethernet with SSM
- IEEE 1588v2 Boundary and Transparent Clock with nanosecond accuracy
- ITU-T G.8275.x PTP Telecom Profile supported on Boundary Clock and Transparent Clock
- Comprehensive Ethernet OAM supported: IEEE 802.1ag CFM, 802.3ah EFM, and ITU-T Y.1731
- Service Activation Testers incorporated: RFC2544, Y.1564
- Non-blocking wire-speed switching

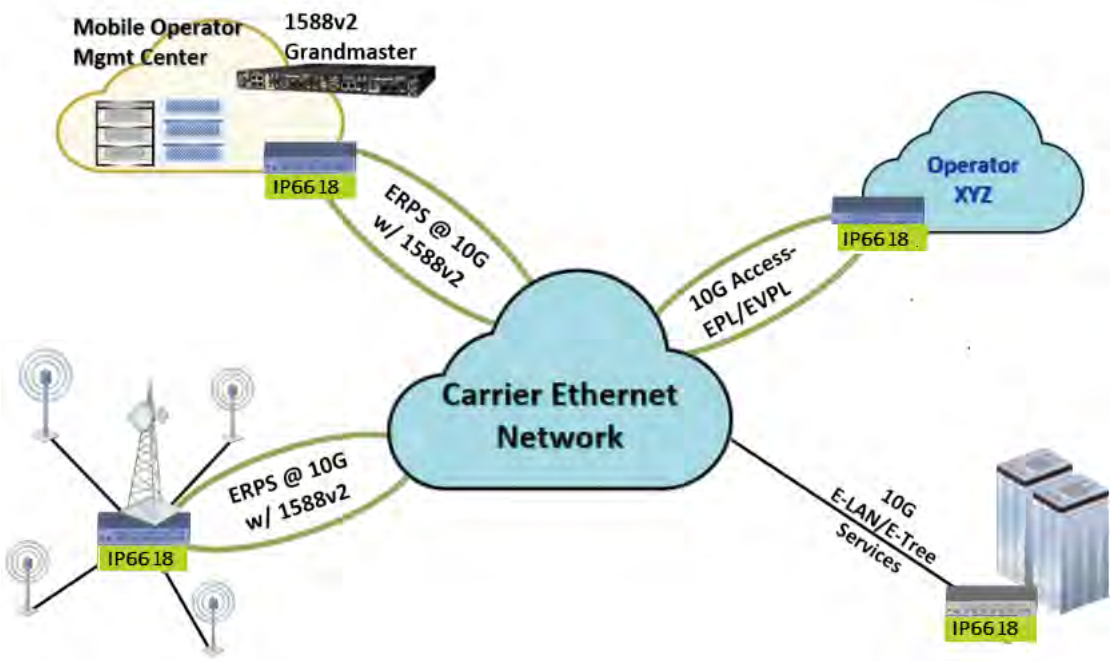
Description

Loop-IP6618 leverages the purpose-built silicon technologies to fulfill the needs that modern Carrier Class Ethernet services require with ultra-low power consumption. The standard compliant features bring hassle free operations with the benefits of unmatched resiliency, superb synchronization accuracy, and comprehensive OAM.

As the SLA (Service Level Agreement) is at the center part of the Carrier Ethernet services and the Ethernet OAM protocol suite is the key to enable the services. The IP6618 NIDs embed the hardware Ethernet OAM engines for ensuring the real time monitoring can be achieved. The protocol suite covers link status, service level, network monitoring, as well as performance metrics. IEEE 802.1ag CFM, 802.3ah EFM, ITU-T Y.1731 Performance Monitoring are all included in the OAM feature suite, furthermore, both IETF RFC 2544 and ITU-T Y.1564 hardware-based tester are also in place which enables the operation center the ability of performing diagnostics and performance testing remotely. This capability effectively reduces service personnel costs and ensures outstanding user experiences.

The PTP (IEEE 1588v2) has become the de facto synchronization solution that has been widely adopted in different application scenarios which requires precision timing mechanism. By incorporating the OCXO better than what Stratum 3 required, the IP6618 NIDs perfectly maintain the 1588v2 accuracy within nano-second scale. The Sync-E (ITU-T G.826x) assisted 1588v2 delivers not only the accuracy, but with outstanding stability persistently. The importance of synchronization grows drastically as the mobile traffic grows with unprecedented speed. The exceptional PTP performance on IP6618 effectively satisfies such synchronization requirements the LTE & LTE-Adv. base-stations needed. The 1588v2 capabilities delivered by IP6618 ensure what LTE & LTE-A requested, and potentially what the 5G technology will need can be perfectly fulfilled.
ERPS, the ITU-T G.8032 Ethernet Ring Protection Switching, is firmly built inside IP6618 NIDs as the foundation that provides sub-50ms switching capabilities. No need to worry about incidentally operation interruptions any longer that drastically reduces the OpEx of the network operators. The ERPS feature is assisted by dedicated hardware engine embedded in the silicon; hence, it ensures the consistent performance on the switching time whenever the interruption happens. In addition to ERPS, other protection related protocols are all supported, such as IEEE 802.1d STP, 802.1w/s RSTP & MSTP, and 802.3ad LACP, etc.

Application Illustration



Loop-IP6808 L2 Unmanaged 8-Port Industrial Secure Gigabit Switch

Features

- 6 x 10/100/1000 BASE-T(X) RJ45 ports
- Additional 2x 10/100/1000M BASE-T(X) RJ45 ports or 2x1000 BASE-X SFP slots supporting MACsec encryption.
- 99% of throughput guaranteed, no additional latency
- Ideal for a plug-and-play local area network protection. Embedded MACsec Key Agreement allows high-protection with no configuration.
- IP30 aluminum housing, DIN-Rail or Wall mount
- Works from -20°C~70°C
- Prioritizes Profinet Packets according to 802.1q

Description

Secure the information flowing through your Local Area Network! IP6808 Smart Secure Gigabit Switch uses MACsec technology to Encrypt all data flowing from the secure ports to any other MACsec-capable device. This will protect your network also from Insider's Threats, such as information gathering through wiretapping, or unintentional commands sent by impersonation.

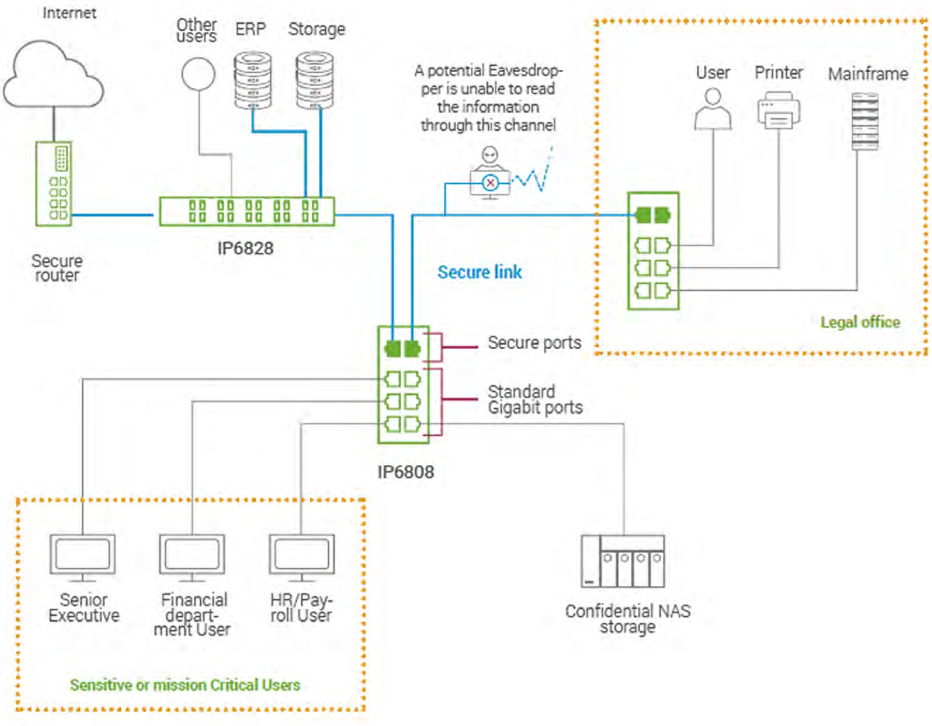
IP6808 provides Standard 6-Gigabit RJ45 ports and additional 2-Secure Gigabit RJ45 ports or 2-Secure Gigabit SFP uplink slots. Being Encryption hardware-based, there is no additional latency and 99% of the Gigabit throughput is guaranteed.

This Smart Secure Switch is the simplest Local Area Network solution and the only "Plug-n-Play" solution available! IP6808 will autonomously negotiate the encryption key with any other MACsec device

Its modern, small and compact design makes the device installation possible on virtually any surface. It provides an Advanced level of EMC protection as well as MIL-STD-810F shock, drop, vibration protection. IP6808 is hence suitable for the majority of the industrial applications. Its operating temperature ranges from -20°C to 70°C.

IP6808 Unmanaged MACSec Gigabit Ethernet Switch is compliant with the essential sections of EN 60950, UL/IEC 60950 , MIL-STD- 810F covering operating temperature, power input voltage and vibration.

Application Illustrations



Loop-IP6810 Self-Healing Ring NTU

Features

- Full frontal access (ETSI) unit complies with IP30 standard
- Desktop, wall, or DIN Rail mounting
- Compact intelligent FX packet optical ring with Layer 2 switching capabilities
- WAN port with OA&M functionality
  - Dual SFP optical housing interfaces
  - Dual RJ45
- Tributary ports
  - 3 ports 10/100 BaseT Ethernet (with PoE option available in DC 48 only)
  - 2 ports RS232/485 interfaces, user selectable via 2-port DIP switch
  - 2 dry contact for input and 2 dry contact for output; support point-to-point and point-to-multi-point
- Power modules
  - On-board fixed single AC supply
  - On-board fixed single/dual DC modules with dual feed
- Auto-discovery topology, auto-diagnostic and remote-configure for easy plug-and-install (up to 64 units)
- Supports SNTP
- Ethernet Functionality
  - Loop Ethernet Automatic Protection Switching (LEAPS)
    - Fault recovery time: less than 50 ms
    - Point-to point: fault recovery time less than 8 ms
    - Up to 15 units: fault recovery time less than 25 ms
  - IEEE 802.1w RSTP
  - IEEE 802.3x Flow Control, 802.1q Port Base VLAN / Port Isolation
- Up to 1024 MAC addresses
- Built-in BERT
- High speed, asynchronous RS232/RS485 for point-to-point, point-to-multi-point, or omnibus-like applications
- Master/Slave units setting by using DIP switch
- Auto-negotiating or forced speed for speed and full/half duplex for Ethernet ports
- Full/half duplex for tributary Ethernet ports
- Alarm relay and ACO (Alarm Cut Off) button
- Remote firmware download via TFTP & Z modem
- Remote configuration upload & download via TFTP
- Management port and interface
  - In-band management
  - RS232 console via DB9 connector
  - SNMP v1, v3
  - SSH v2
  - Telnet
  - LoopView GUI EMS
- IEEE 1613, IEC61850-3 (for DC -48 Vdc only)
- RoHS compliant

Description

The Loop-IP6810 is a self-healing ring network termination unit (NTU) with a built-in L2 switch. It can be desktop, wall or DIN rail mounted. LEAPS, RSTP, Ethernet Ring protection or point-to-point protection is made possible in 100 Base-FX networks with the IP6810.

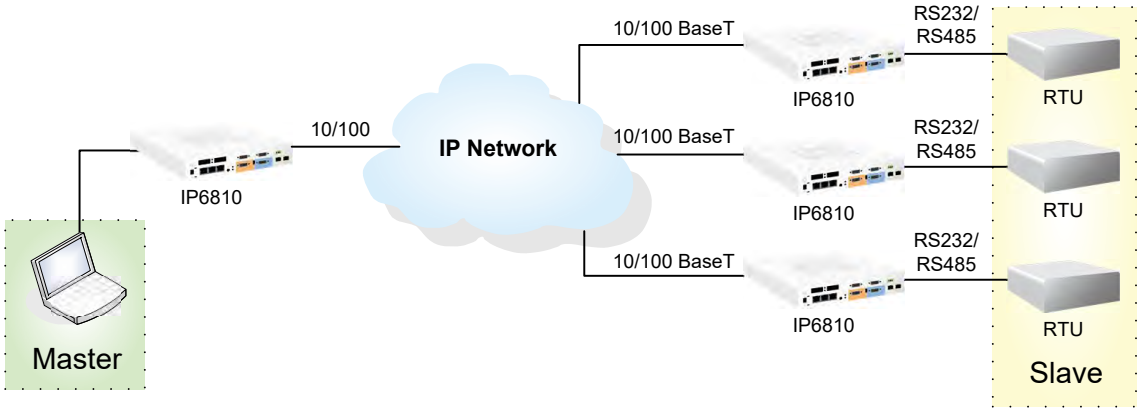
All end equipment can be either in packet format via Ethernet ports or serial data via RS232/485 interfaces which will be converted into packet format within the IP6810. The IP6810 has two WAN optical and electrical interfaces, two RS232/485 DTE interfaces, three Ethernet LAN interfaces, two sets of dry contact IN/OUT interfaces, and one alarm relay connector. The IP6810 comes in an industrial hardening mode to support temperatures from -20°C to 70°C (-4°F to 158°F).

The IP6810 supports auto-discovery to locate all units on the ring, and also supports remote configuration for ease of installation.

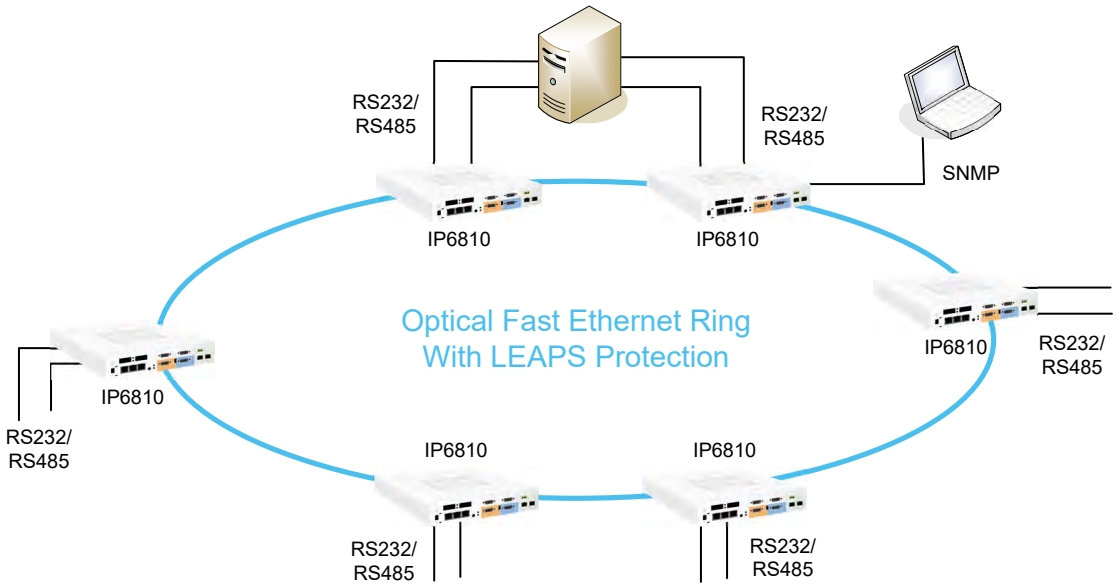
Single AC, single DC or dual DC is supported based on field requirements. Power over Ethernet (PoE) option is also available.

The IP6810 facilitates automation systems, SCADA systems, surveillance systems, traffic control systems, transportation systems and IP networking with robust protection in ring, point-to-point, or omnibus-like topology. Easy installation and configuration make maintenance and further expansion more efficient and cost-effective.

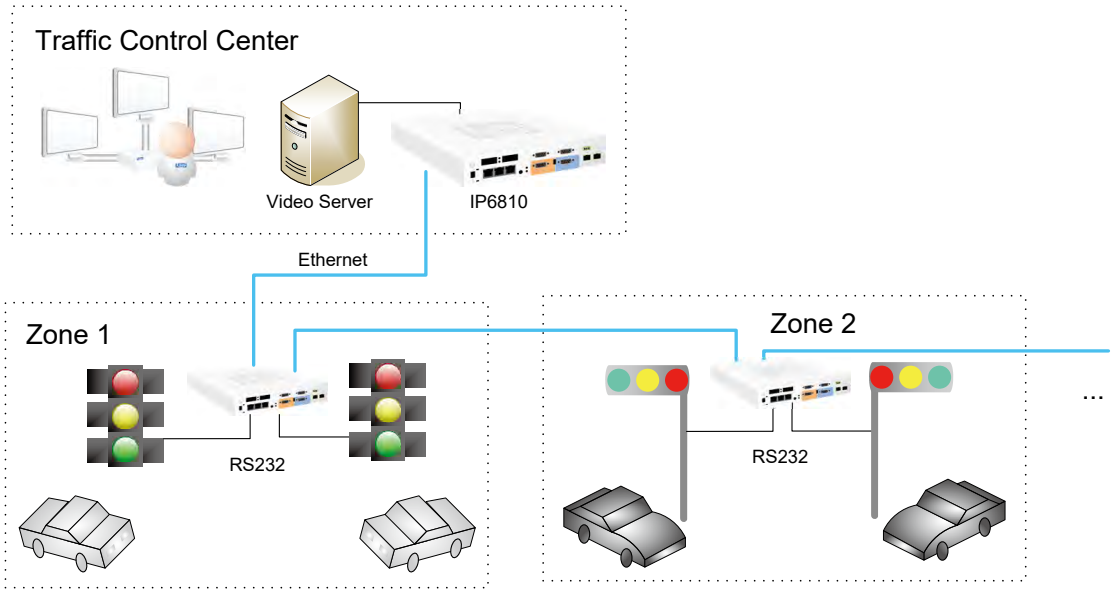
Application Illustrations



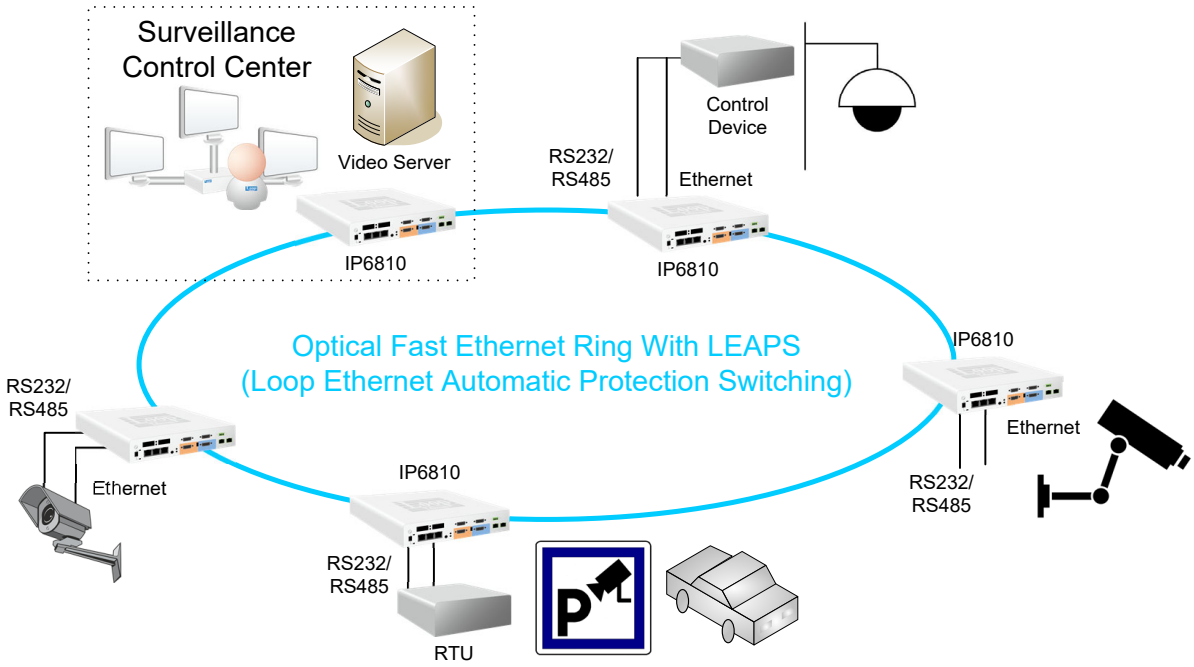
Point-to-Multi-Point Application



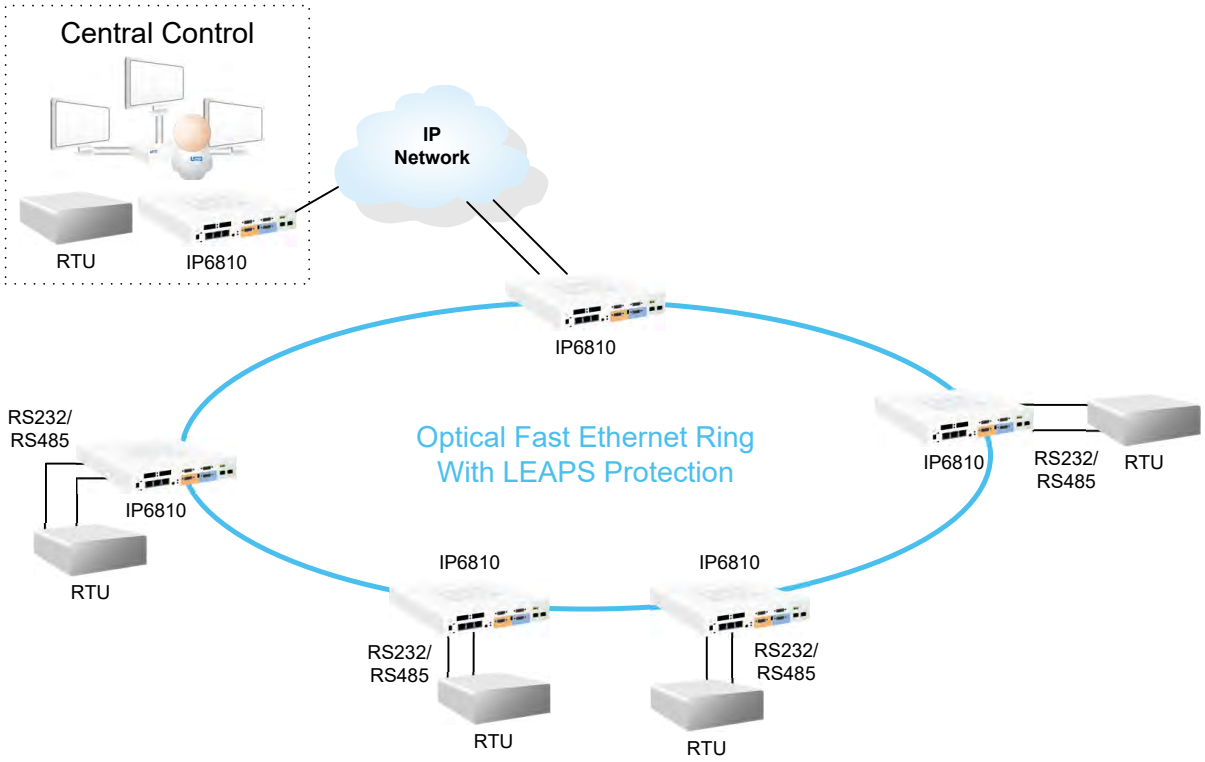
Local SCADA



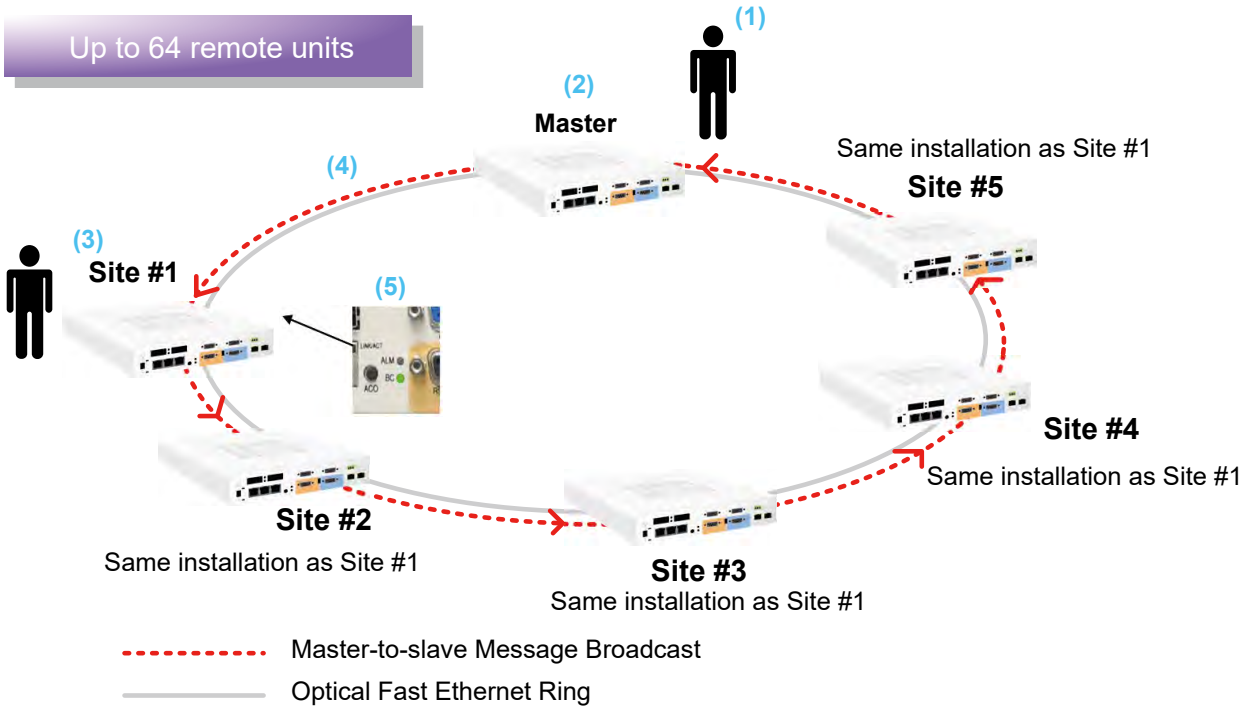
Traffic Light Management



Video Surveillance



Remote SCADA



No Configuration Necessary in Advance for Installation

Setup Procedure:

(1) Set DIP switch to Master, connect both WAN ports and power up the unit
(2) On VT100, set the master unit's Auto-Discovery function to ENABLE
(3) On remote site, set the unit's DIP switch to Slave, connect both WAN ports and power up the unit
(4) The master unit will automatically detect the slave unit and show the information on VT100 screen
(5) BC LED will turn GREEN, which indicates the Link between Master and Site 1 is ON

Auto-Configure (Plug-and-Play)

Loop-IP6818 8-port Industrial L2/L3 Managed Gigabit PoE/PoE+ Switch

4 RJ45 & 4 SFP port

Features

- 4 10/100/1000 BASE-T(X) RJ45 ports and 4 1000 BASE-X SFP slots.
- Up to 4 802.3af/ 802.3at Power over Ethernet ports, with maximum 30W
- PoE/PoE+ power per port and maximum 120 W device power budget.
- Powerful Layer-3 Switching, supporting IPv4 Static, RIPv1/v2 and OSPFv2
- Layer-2 Redundancy, with ERPS, RSTP, MSTP.
- EN50121-4 Certified for Railway applications
- Operational between -20°C~70°C

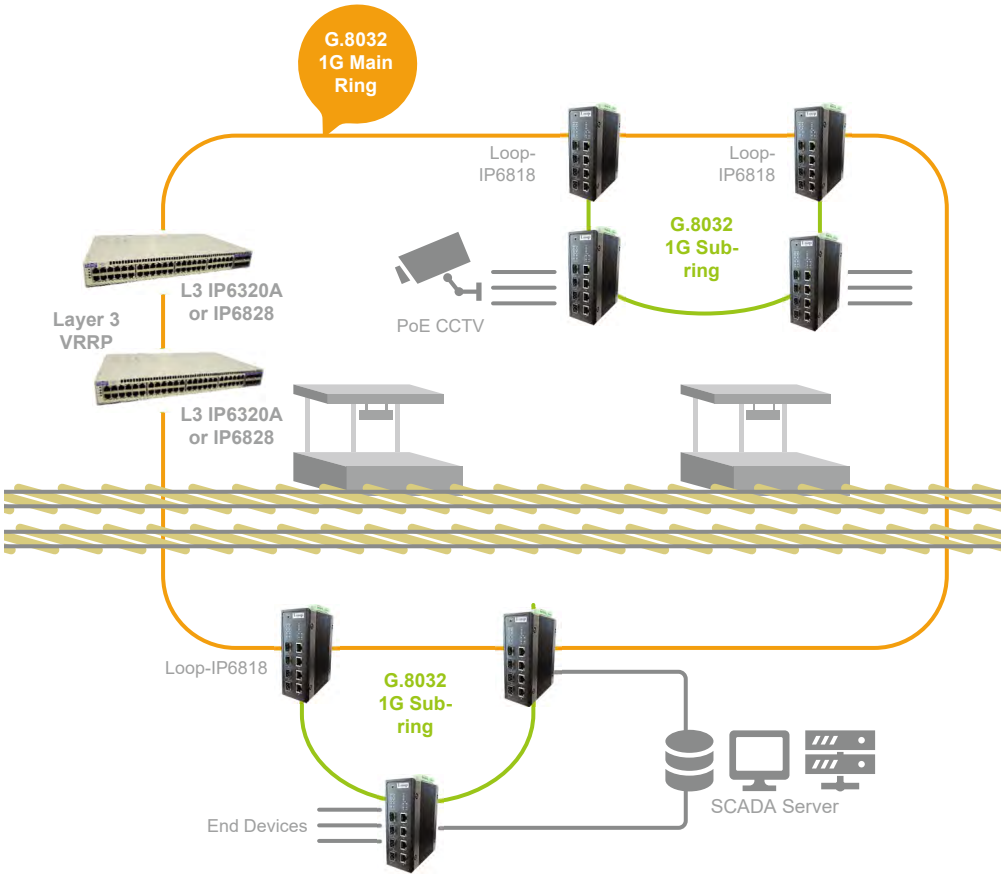
Description

Loop-IP6818 is an Industrial Grade L2/L3 Managed Gigabit Ethernet PoE/PoE+ Switch, specifically designed to provide a highly reliable, fault-tolerant, extremely fast network connection in harsh environments.

Within its compact DIN-Rail housing design, the Loop-IP6808A allows you to choose between different port combinations: 10/100/1000 BASE-T(X) RJ45 port, 1000 BASE-X SFP port and IEEE 802.3af/at complaint PoE/ PoE+ RJ45. Layer-3 routing version supports IPv4 static routing, RIP v1/v2 and OSPFv2.

This is the right choice if you want to set up a Reliable network environment with its intelligent features and keep equipment connected all the time, even in case of temporary network breakdowns through RSTP, ERPS Rings redundancy. MAC-based Black List/White List, IEEE 802.1x, RADIUS, TACACS+, etc., and keep your network safe.

Application Illustration



Loop-IP6820 Self-Healing Ring NTU

Description

The Loop-IP6820 is a gigabit Ethernet self-healing ring network termination unit (NTU). The layer 2 switch supports the very efficient ERPS G.8032 Ethernet Ring Protection. For ring topologies the IP6820 supports auto-discovery to discover up to 128 units on the ring as well as remote configuration for easy installation.

All end devices can be in packet format via Ethernet ports or serial data via RS232/422/485 interfaces, which are converted into packets within the IP6820. The device has two WAN optical interfaces, two LAN optical interfaces, four electrical LAN interfaces, and one alarm relay interface. Manufacturing options include four additional electrical LAN interfaces, four or eight RS232/422/485 interfaces, and two sets of Dry Contact in/out interfaces.

With an embedded GbE L2 switch chip, the IP6820 also supports RSTP and MSTP for all Ethernet ports. It can be powered by a single or dual DC power supply, depending on field requirements. PoE (Power over Ethernet) and PoE+ are available as manufacturing options. Physical DIN rail mounting is also supported.

The IP6820 can be used in automation, SCADA, surveillance, traffic control, transportation, and IP networking. Network topologies include ring protection, point-to-point, and point-to-multipoint. Easy installation and configuration simplifies the IP6820's maintenance and expansion.

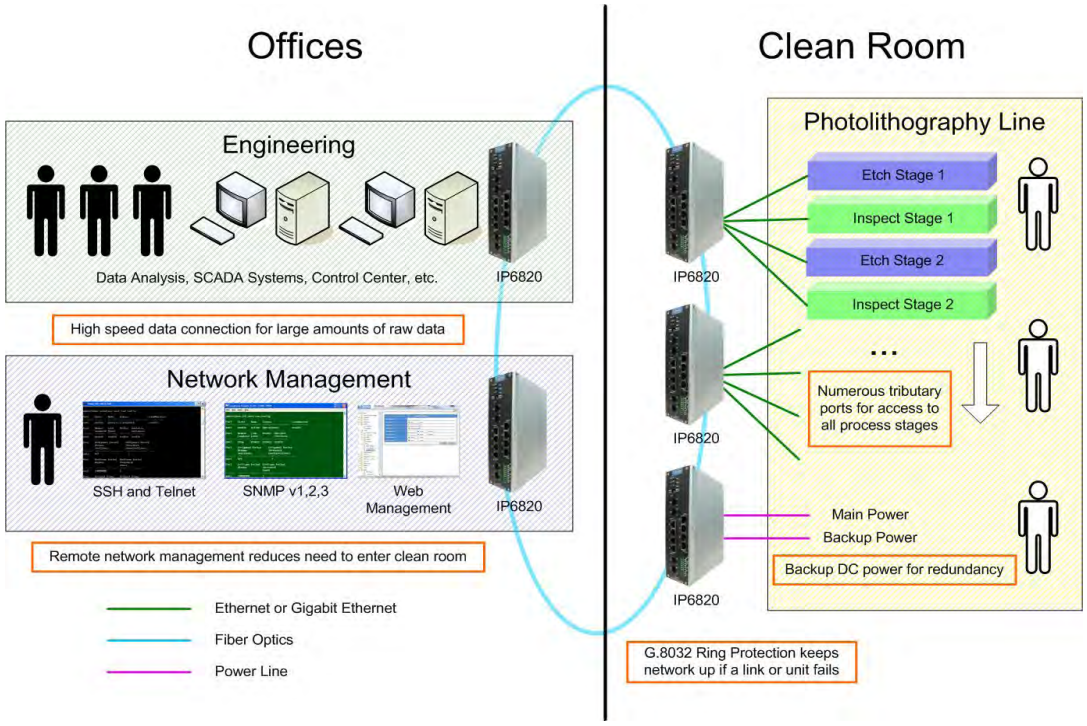
Features

- Mechanical, Electrical, Environmental
  - Full frontal access (ETSI) unit complies with IP30 standard
  - DIN Rail mounting
  - Alarm relay and ACO (alarm cutoff) button
  - Power: Single/dual DC modules with dual feed
  - Input voltage monitoring, instant voltage monitoring, and temperature monitoring
  - RoHS Compliant
  - IEEE 1613, IEC61850-3 (for DC -48 Vdc only)
- Interface Ports
  - WAN port with OA&M functionality
    - Dual SFP optical housing interfaces
  - Tributary ports
    - Up to eight ports 10/100/1000 BaseT Ethernet
    - Two SFP housing ports
    - PoE and PoE+ options available in DC48 only for LAN ports 3-10 (RJ45)
    - Up to 8 RS232/RS422/RS485 interface ports supporting full or half duplex mode
    - Auto-negotiating or forced speed for speed and full/half duplex for tributary Ethernet ports
- Other Features
  - Jumbo frame: Up to 9600 bytes
  - Synchronization
    - NTP V4 client
    - Synchronous Ethernet
  - Dry contact interface
    - Two alarm inputs and two relay outputs
    - Supports point-to-point and point-to-multipoint applications
- Ethernet Functionality
  - G.8032 Ethernet Ring for WAN ports
  - IEEE 802.1d STP, 802.1w RSTP, 802.1s MSTP
  - IEEE 802.3x Flow Control, 802.1q port based VLAN and port isolation, 802.1p QoS
  - IEEE 802.3ad Link Aggregation Control Protocol (LACP)*, port trunking
  - IEEE 802.1X Radius Client
  - Auto-discovery, auto-diagnostic, and remote configuration for easy installation (up to 128 units)
  - Master/Slave units setting via DIP switch
  - IEEE 802.1ad VLAN Stacking (Q-in-Q)
  - IGMP snooping v1 and v2
- OAM Protocols
  - IEEE 802.3ah OAM Ethernet in First Mile (EFM)
    - Supports dying gasp functionality
  - IEEE 802.1ag OAM
    - Connectivity Fault Management (CFM)
  - Y.1731 OAM (available on WAN ports only)
- Management
  - SSH v2, Telnet
  - SNMP v1/v2/v3
  - HTTP management
  - Web-based management via Loop-iNET
  - Remote configuration upload/download via TFTP
  - Download firmware upgrades via TFTP

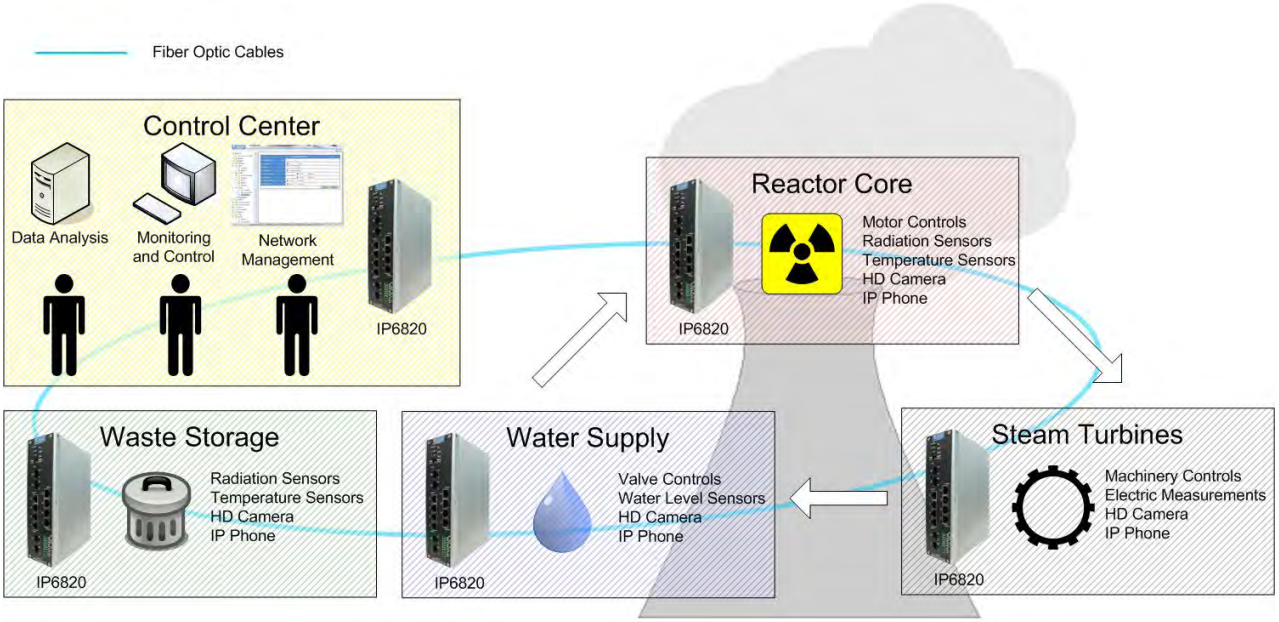
* Future option

Application Illustrations

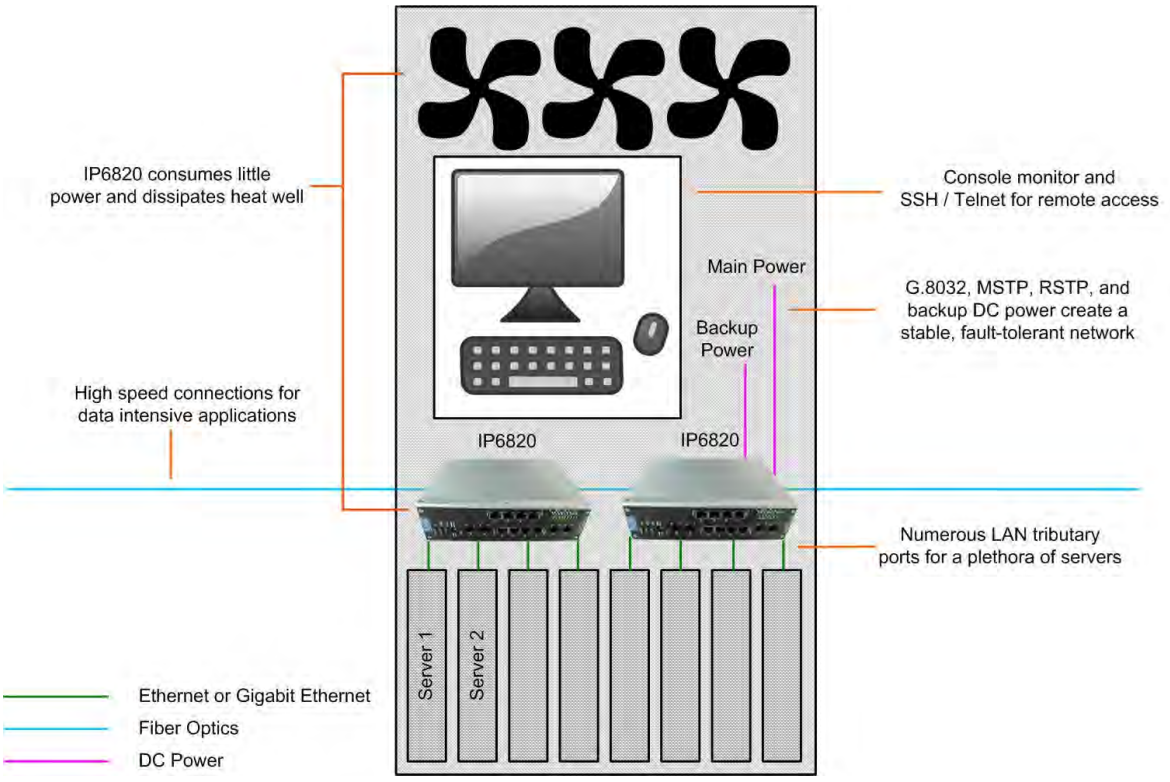
Industrial Automation at Semiconductor Factory



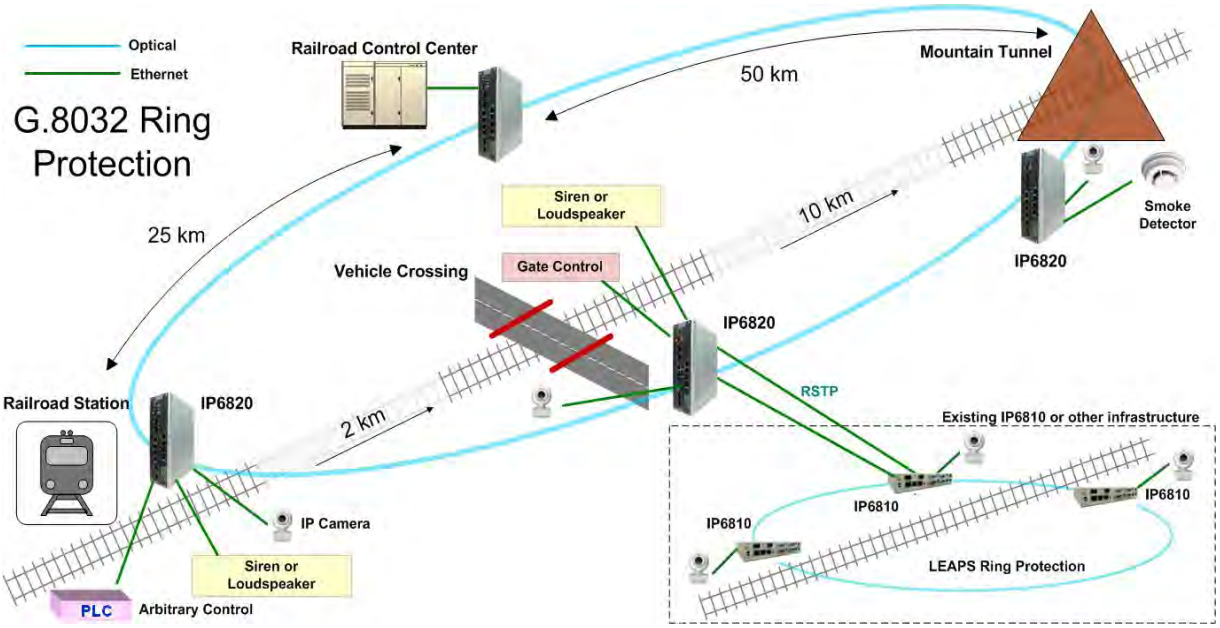
SCADA in Nuclear Power Plant



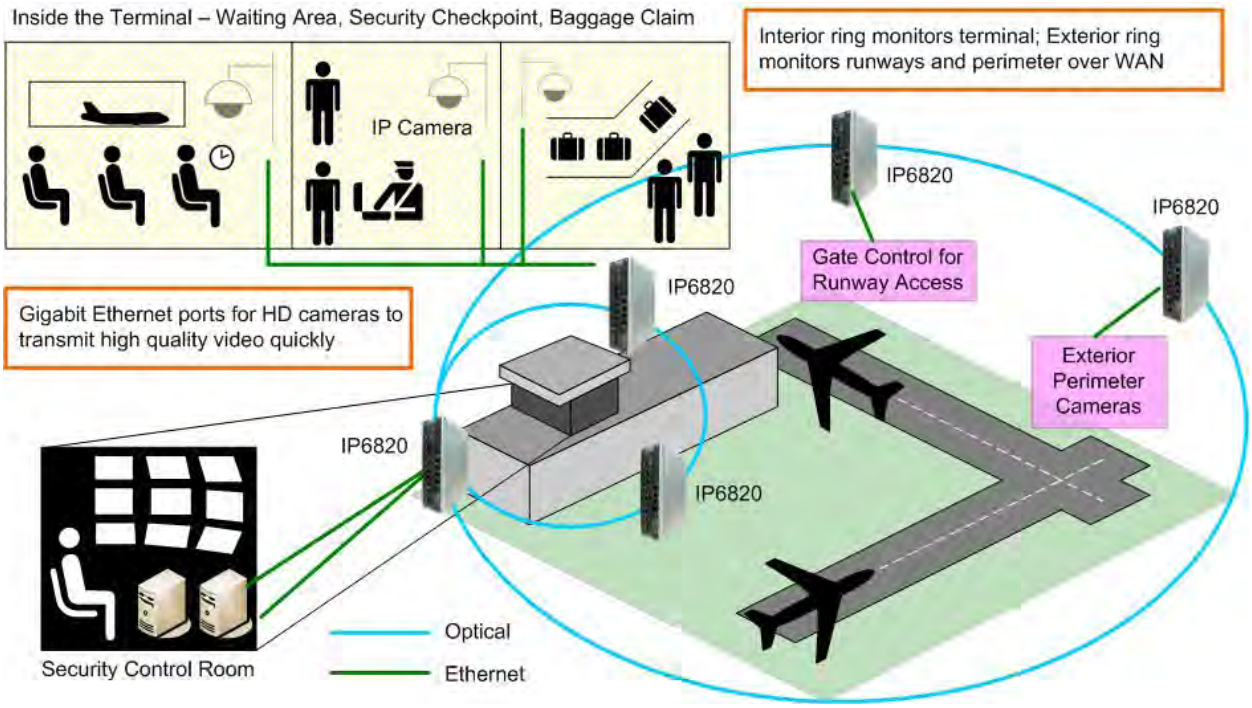
Server Rack in a Cluster



Railroad Automation and Monitoring



Security Monitoring at an Airport



Loop-IP6828 Industrial Rack-Mount L2/L3 Managed Gigabit Ethernet PoE/PoE+ Switch

Description

This high-density IP6828 Managed Rack-mount switch will provide you the flexibility your application needs. You will be able to choose among 6 different Layer-3 Routing Core versions (based on power supply and uplink port configurations) and five different 4/8-Port modules and customize your device in a very simple way.

IP6828 supports up to 24 Gigabit ports in any 8 or 4-port multiple configurations. Specifically designed for bringing power through Ethernet cable virtually anywhere, a maximum output Power over Ethernet of 720W over the 24 ports is allowed (PoE/PoE+ configuration - 802.3af/at). Available in 3 power input variants, it is EN 60950-1:2006 certified and designed to handle the harshest environments. Its fanless design and EMC Level 3 protection guarantee operations within -40 and +75°C, with 24 PoE/PoE+ ports running full power and makes it suitable to be used for almost every application.

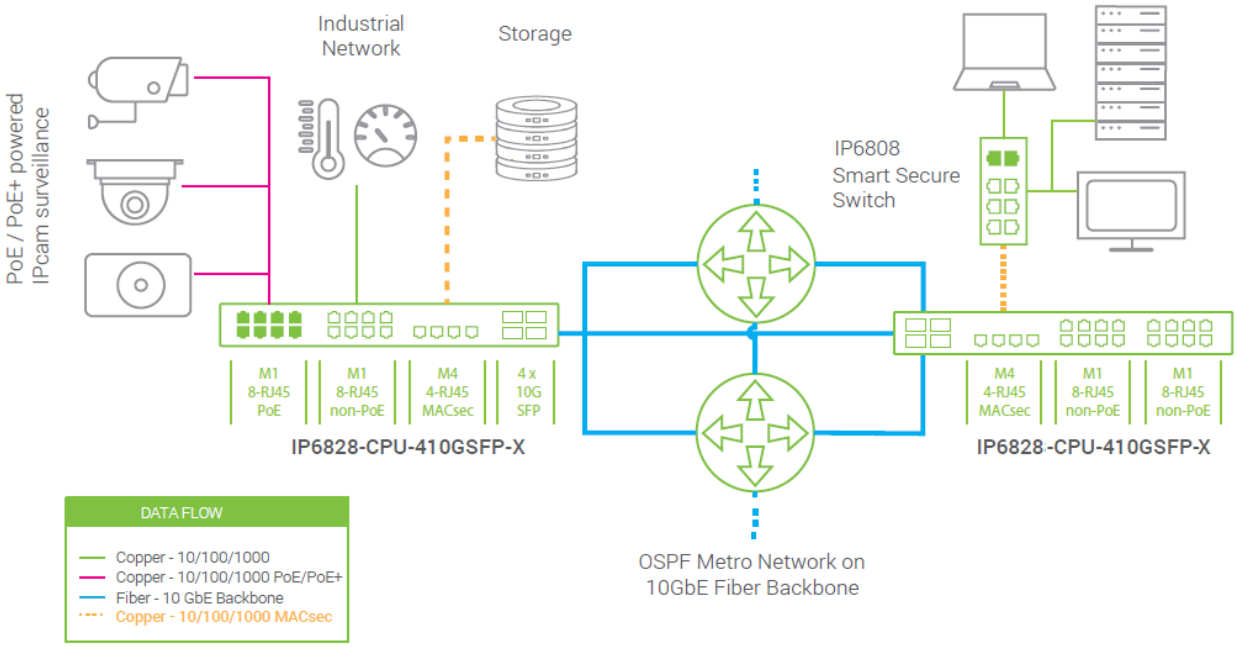
IP6828 supports IPv4 Static Routing, RIPv1/v2, OSPFv2, IGMP, IGMP Snooping, PIM Dense Mode and Sparse Mode and VRRP for Routing Redundancy. Then, it is allowing (through ERPS) network self-recovery down to 50ms on full load. Almost any redundant ring topology is supported, such as ITU-T G.8032 ERPS Ring, IEEE802.1D-2004 RSTP, STP, MSTP and many compatible rings. Endless additional features are provided.

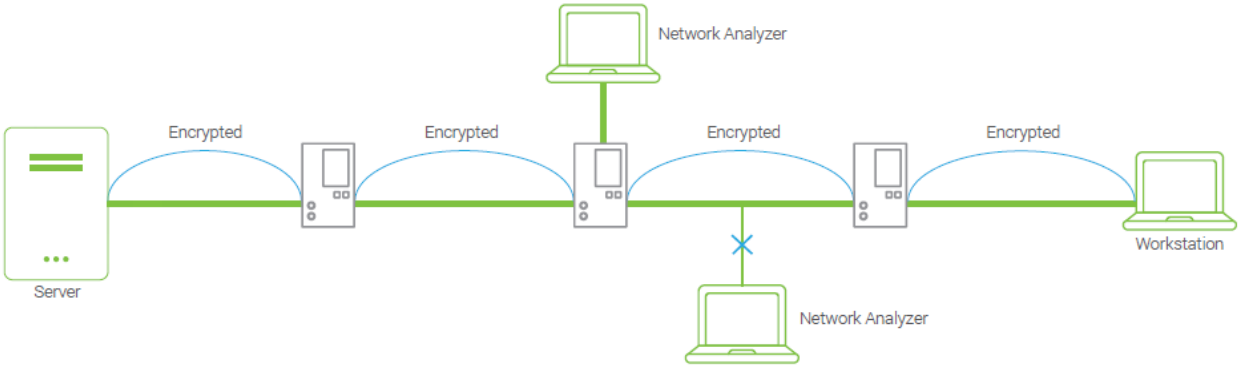
The first Industrial Managed Secure Switch ! Protect your LAN from Eavesdropping and impesronation through 802.1AE MACsec. With no additional latency and 100% Gigabit Throughput guarantee, dedicated modules can provide you the internal ultimate security solution.

Features

- Maximum 64Gbps switching capacity, 95.24Mpps throughput
- Rugged industrial design for -40~75°C harsh environment operation
- Flexible modular configuration, 3 Module-dedicated slots
- Up to 24 PoE/PoE+ ports, with maximum 720W of PoE/PoE+ power budget
- 4 x 1 Gigabit or 4 x 10 Gigabit SFP Uplink slots
- ITU-T G.8032 ERPS Ring, RSTP redundancy
- RIP, OSPF, Static Routing, PIM supported Layer-3 switching

Application Illustration





Loop-G7820 L2/L2.5/L3 Intelligent Switch

Description

The Loop-G7820 is a high performance Ethernet switch to meet next generation Metro, Data Center and Enterprise Ethernet network requirements designed based on high-end scalable chipset with integration of Layer 2 to Layer 3 packet processing engine, traffic management and fabric interface.

The G7820 switch provides a total of 48 GbE RJ45 ports. The switch capability of G7820 supports 120Gbps non-blocking switching for full line speed traffic.

The G7820 provides advanced L2 and L3 features to meet the requirements in Carrier Ethernet and Enterprise network application. G7820 main features including full IPv4/IPv6* stack, On-chip OAM (802.1ag/CFM/EFM), and Protocol Independent APS (<50ms protect switching).

Features

- Capacity
  - 8 x 10GbE ports
  - 48 GbE ports
  - 120 Gbps Wire-Speed Bi-dir Switching Capacity
- MPLS-TP
  - Any Ethernet port can be configured as NNI (MPLS port) or UNI (Ethernet service port)
  - Bi-directional LSP
  - Static LSP/PW provisioning via NMS
  - MPLS-TP OAM per ITU G.8113.2
- Carrier Ethernet
  - Ethernet OAM – 802.3ah, 802.1ag/Y.1731
  - IEEE 802.1d STP, 802.1w RSTP, 802.1s MSTP
  - IEEE 802.3x Flow Control, 802.1q port based VLAN and port isolation, 802.1p QoS
  - IEEE 802.3ad Link Aggregation Control Protocol (LACP)
  - IEEE 802.1ad VLAN Stacking (Q-in-Q)
  - Number of VLANs: 4094
- Layer 3
  - VRF (Lite) *
  - ARP, Ping, Trace route
  - VRRP
  - Static Route
  - RIP v1/v2
  - OSPF
  - NTP server/client
  - IGMP v2/v3
  - PIM-SM
  - Number of SubInterfaces: 32
- Network Protection
  - LSP 1+1 protection (send two, pick one) per RFC6378, based on TP OAM as fault detection
  - LSP 1:1 protection (RFC6378)
  - ERPS (G.8032) Ring Protection based on Ethernet OAM as fault detection
  - ERPS Sub-Ring
  - End to end protection switching within sub 50ms
- Management
  - Fully manageable via SNMP (v1, v2, v3)
  - Fully manageable via CLI
    - Serial port
    - SSH, Telnet via Ethernet
  - Account Security
    - Two types of privileges: Operator (read only) and Administrator (read and write)
    - Radius Client Authentication
  - Upload/Download NE configuration
  - Syslog, NTP
- Ethernet Services
  - E-Line, E-LAN, E-Tree services as defined by MEF 9 and 14 and using VPWS/VPLS
  - Native Ethernet packets supported
  - Encapsulation: PW/LSP (MPLS-TP), VLAN tagging (1Q), VLAN double tagging (Q-in-Q)
- VPLS
  - VPLS bridging
  - H-VPLS bridging
  - 32K MAC addresses
  - 2K VPLS instances per device
  - Split horizon to prevent forwarding loops
- CoS/QoS
  - 8 Priority Queues
  - Scheduling: Strict Priority:, WRR with Hierarchy
  - Ingress Policing & Egress Shaping per service
  - CIR / PIR (EIR) 2-rate-3-color
  - MPLS: TC/EXP-Inferred-PSC (Per Hop Behavior Scheduling Class) LSP
- Timing
  - IEEE 1588 v2*
    - PTP Clocks: Ordinary/Boundary/Transparent
    - ToD (Time of day)
    - PPS (Pulse per second) output interface
  - SyncE
    - Synchronous Ethernet from all GbE ports (not on FET ports)
    - ESMC per ITU-T (Ethernet Synchronous Message Channel)

* Future option

Application Illustrations

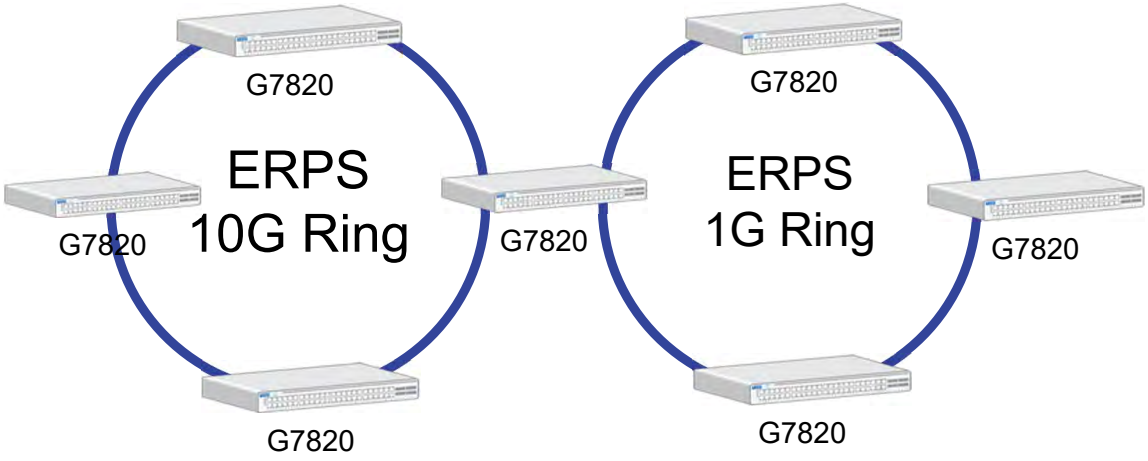


Figure 1 Ethernet Ring Protection Switching (ERPS) network

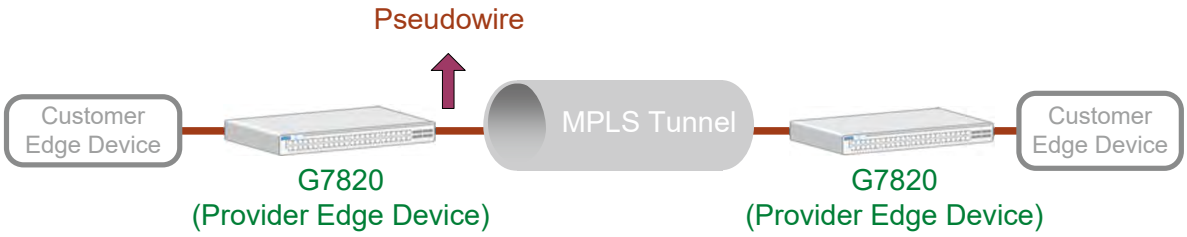


Figure 2 Virtual private wire service (VPWS) network

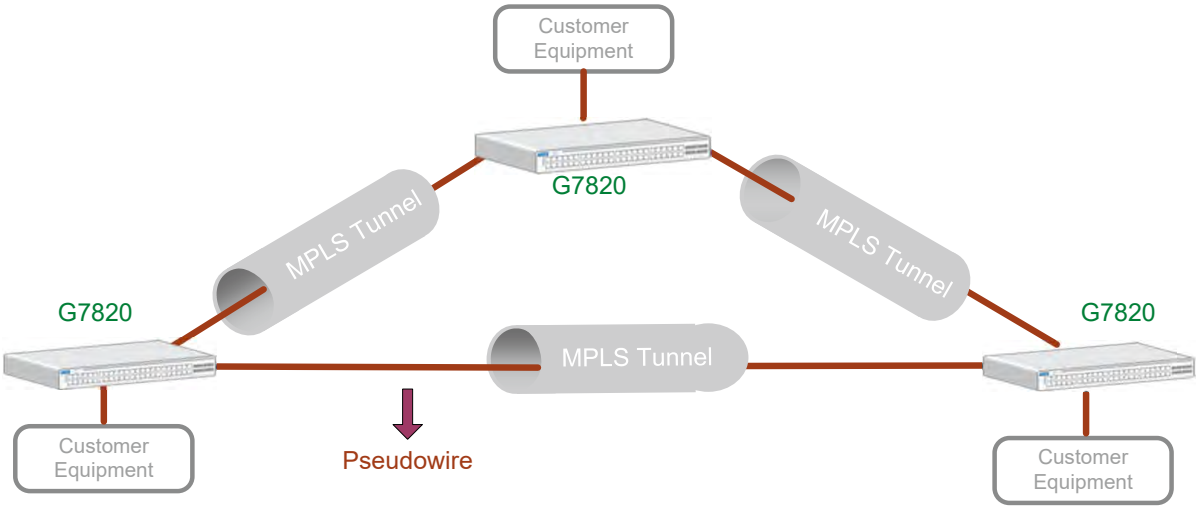
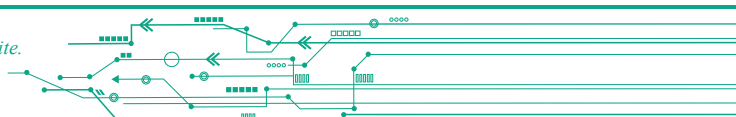


Figure 3 Virtual private LAN service (VPLS) network



7

TDM over Ethernet

Loop-IP6702A TDMoEthernet 220

Loop-IP6704A TDMoEthernet 222

Loop-IP6750 Service Aggregation & Access Device 224

Loop-IP6702A TDMoEthernet

Description

The Loop-IP6702A device allows operators to transport Unframed/Framed 1 E1/FE1 (1 Unframed/Framed T1/FE1) data stream with timing information over PSN (Packet Switched Network) via Pseudowire Protocol – SAToP or CESoPSN . Another IP6702A converts the received packet stream back to original E1/FE1 or T1/FE1 data stream with original timing information. This allows cost-effective migration from existing legacy TDM networks to Packet Switched Network.

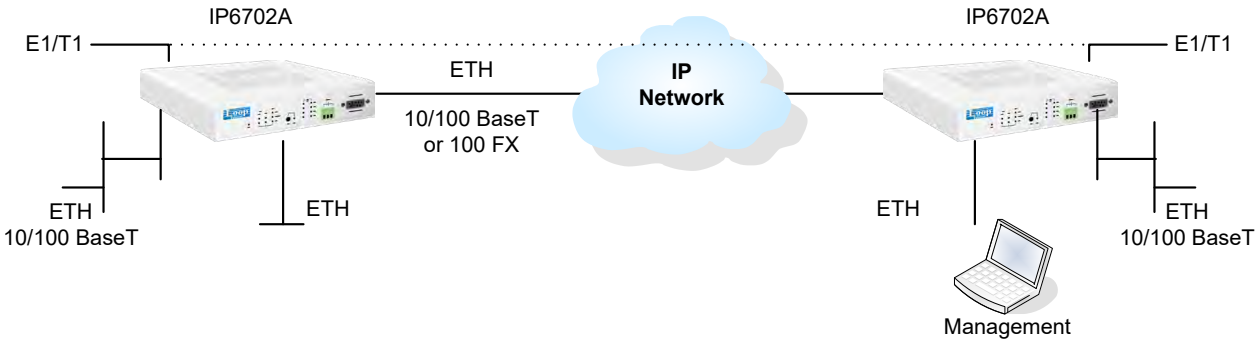
Features

- Mechanics and Electrics
  - ANSI shelf
  - Power:
    - Fixed AC
    - Fixed DC
    - Combined AC and DC (AoD)
- Ethernet Interface
  - Four Ethernet ports for WAN or LAN port assignment
    - One Fast Ethernet with 1 SFP housing
    - Three 10/100 BaseT Ethernet
- User Tributary Interface
  - TDM Tributary interfaces: up to 1 E1 or 1 T1 Unframed mode/Framed mode
  - DTE interface: 1 RS422/V.11
- L2 Switching
  - Jumbo frame size up to 2048 bytes
  - VLAN:
    - Maximum 4K VLAN ID
    - Maximum 16 con-current VLAN Groups
    - Support C-VLAN/S-VLAN tag adding and removing on Pseudowire
    - Support 802.1q Port-Based VLAN on Ethernet/ SNMP Port
  - Support 802.1d MAC Learning
  - Support 803.3x Flow control on input ports
  - Packet Transparency
- Pseudowire Capability
  - Support SAToP and CESoPSN
  - Support E1/T1 traffic emulation over UDP/IP Network
  - Maximum 16 Pseudowires
  - 1 E1/T1 can support up to 16 pseudowires
  - PDV Compensation Depth: up to 256 ms
  - Jitter Buffer Size: up to 256 frames
- Pseudowire Diagnostic Function
  - Built-in BERT for E1/T1 to Line or WAN direction
  - IP – MAC Table Display
- Jitter & Wander
  - PPM version: conforms to G.823 Traffic Interface (+/- 1ppm)
- Timing Reference
  - Internal (4.6 ppm)
  - Line (E1/T1)
  - Adaptive Clock Recovery: 4 ACR clock servos can recovery clock from any 4 Pseudowires
- OAM Capability
  - Support 1 SNTP timing reference
  - LOS, LOF, LCV*, RAI, AIS, FEBE*, BES, DM*, ES, SES, UAS and LOMF*
  - Multi-color LED indicators
  - Alarm relay
  - ACO (Alarm Cutoff) button
- Management Interfaces
  - 1 user-selectable Ethernet/SNMP port
  - SNMP v1/v3 with 5 SNMP trap IP
  - DB-9 Console port with VT-100 menu
  - Telnet and SSH v2
  - C-VLAN tag on management traffic
- Standards Compliance
  - SAToP and CESoPSN
  - MEF8*

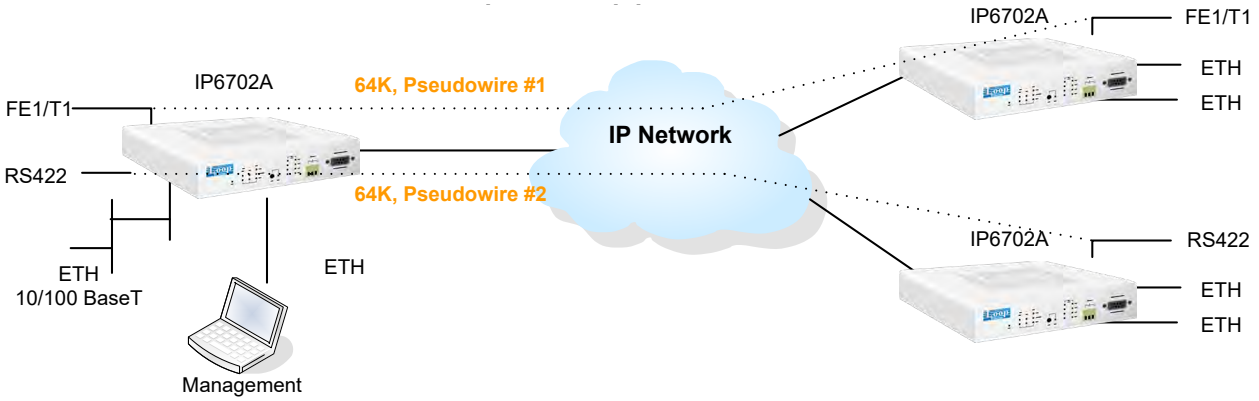
* Future Option

Application Illustrations

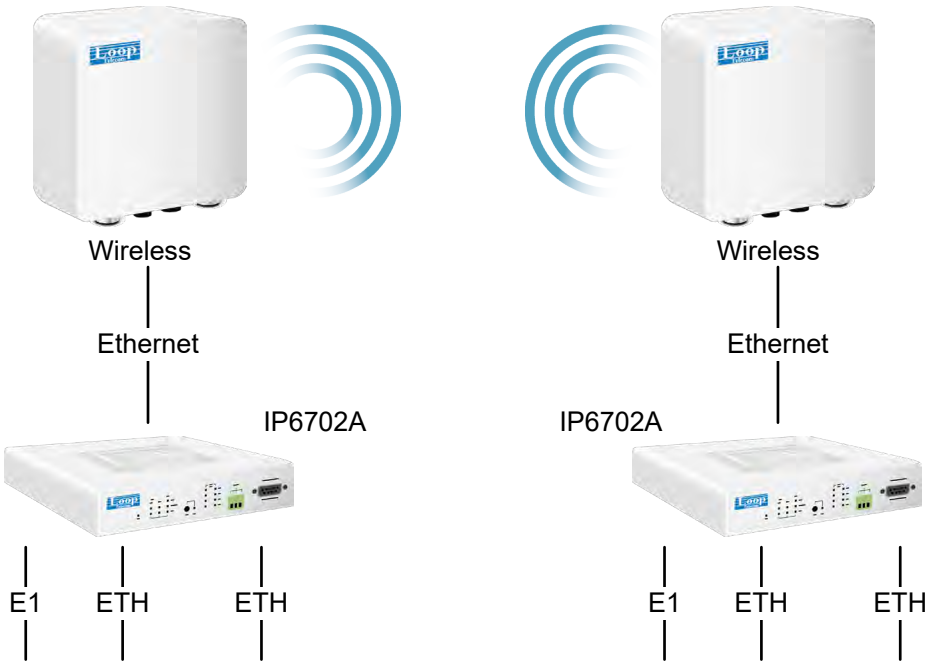
Point to Point Application



Fractional E1 Point to Multipoint Application



E1/LAN Ethernet Radio Application



Loop-IP6704A TDMoEthernet

Description

The **Loop-IP6704A TDMoEthernet** is an ideal solution for service providers to build their network and achieve a fast return on investment. Currently providers need to transport both TDM and Packet traffic. These can be achieved using the E1/FE1,T1/FT1 and Gigabit Ethernet tributary ports of the IP6704A.

The Loop-IP6704A device allows operators to transport and **Time Slot Cross Connect** E1/FE1, T1/FT1, E&M, X.21, RS232, V.35, EIA530, QFXSA or QFXO, G.703, C37.94 data stream with timing information over PSN (Packet Switched Network) via Pseudowire Protocol – SAToP/CESoPSN/MEF8. Another IP6704A converts the received packet stream back to original E1/FE1, T1/FT1, E&M, X.21, RS232, V.35, EIA530, QFXSA or QFXO , G.703, C37.94 data stream with original timing information. This allows cost-effective migration from existing legacy TDM networks to existing PSN**.**

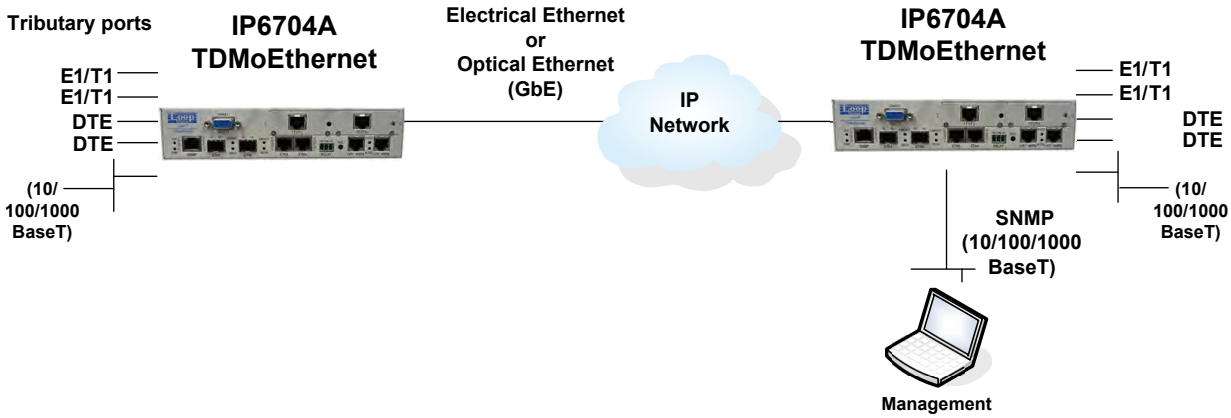
For transport of TDM signals, the Jitter and Wander adheres to G.823/G.824 Traffic Interface.

Features

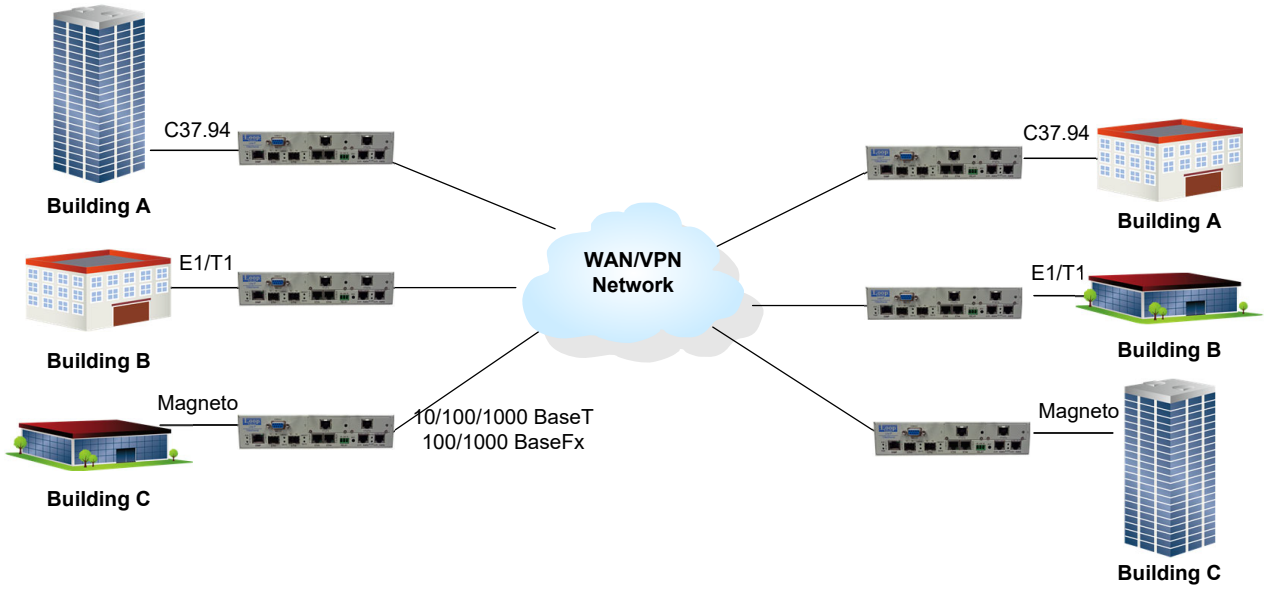
- Mechanical and Electrical
  - 1U height, 1/2 19” rack width. ANSI shelf.
  - Power module
    - Up to two DC plug-in modules or Hybrid 100 to 240 Vac and -48 Vdc (-36 to -72 Vdc) coexist fixed power supply
  - Temperature range from 0° to 75°C
- Ethernet Interface
  - Four Ethernet ports for WAN or LAN port by software configuration
    - Two Gigabit Ethernet (GbE) with 2 SFP housing
    - Two 10/100/1000 BaseT Ethernet
  - IEEE 802.3ad Ethernet Link Aggregation*
- Timing
  - Internal/Line
  - Adaptive Clock Recovery for TDM Pseudowires
    - Jitter and Wander conforms to G.823/824 for Traffic Interface
  - SyncE
- Management
  - SNMPv1/v3
  - DB-9 Console port with VT-100 menu
  - Telnet and SSH v2
  - iNET GUI
- L2 Switching
  - VLAN
    - Maximum 4094 concurrent VLAN Groups
    - Support C-VLAN/S-VLAN tag adding and removing on Pseudowire
    - Support 802.1q Port-Based VLAN on Ethernet/ SNMP Port
    - Support Q-in-Q
  - Support 802.1d MAC Learning
  - Support 803.3x Flow control* on input ports
  - Support 802.1D STP, 802.1w RSTP, 802.1s MSTP*
  - Support IGMP Snoopingv2 (RFC 2236)*
  - Jumbo frame up to 10k bytes
  - IS-IS Packet transparency*
- Tributary Interface
  - Up to four T1/E1 ports per module with a max of 2 modules plus 2 T1/E1 on main board giving a maximum capacity of 10 T1/E1.
  - Up to two single port DTE modules:
    - X.21 or RS232/V.24 or V.35 or EIA530
  - Up to 2 voice modules:
    - Four ports E&M
    - Four ports FXS
    - Four ports FXO
    - Four ports Magneto
    - Supports Echo Cancellation
- OAM
  - E1/T1 OAM
    - RFC-2495: LOS, LOF, LCV*, RAI, AIS, FEBE*, BES, DM*, ES, SES, UAS and LOMF*
- QoS
  - Ingress Rate Limiting* per Ethernet port with 64kbps/1Mbps/10Mbps granularity
  - Ethernet Network Level:
    - 3-bit Priority Code Point – PCP field within 802.1P/802.1Q Ethernet frame – CoS
    - 4 priority queues per port
  - IP Network Level:
    - 6-bit DiffServ Code Point -DSCP field – ToS
  - Scheduling Algorithm
    - Strict Priority (SP)
    - Weighted Round Robin (WRR)
- Pseudowires
  - TDM Pseudowires
    - Up to 16 concurrent pseudowires
    - 1 E1/T1 can support up to 16 pseudowires.
    - Pseudowire protocols
      - SAToP
      - CESoPSN
      - MEF-8 (CESoETH)
    - Packet Delay Variation Compensation Depth up to 256 ms
- Diagnostics
  - E1/T1 BERT & Loopback

* Future option

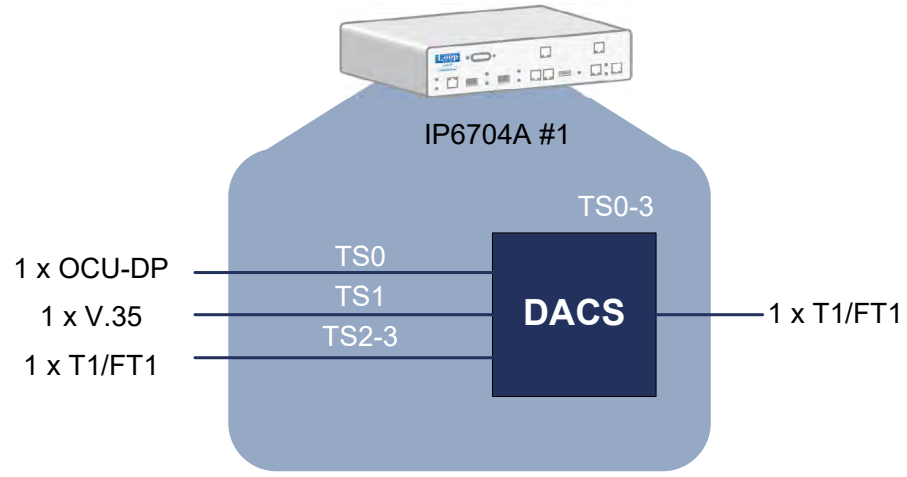
Application Illustrations



IP6704A Point-to-Point Application



IP6704A on VPN Network



IP6704A on Digital Access Cross-Connect System (DACS)

Loop-IP6750 Service Aggregation & Access Device

ANSI Front View

ETSI Front View

Description

The **Loop-IP6750 Service Aggregation & Access Device** is an effective way for service providers to build their network and achieve a fast return on investment. Currently providers need to transport both TDM and Packet traffic. These can be achieved using the E1/T1 and Gigabit Ethernet tributary ports of the IP6750.

In addition to working now, service providers also have to build the network to meet *future requirements*.

The IP6750 can handle temperature ranges of 0° to 65°C. It supports many protocols such as MEF-8 CESoETH, SyncE and IEEE1588v2 Precision Timing, G.8031 Ethernet Linear Protection Switching, and a RFC2544 built-in traffic generator.

The IP6750's durability and capabilities make it an important device for your network to meet the requirements of a carrier-grade Service Level Agreement (SLA).

Product Features

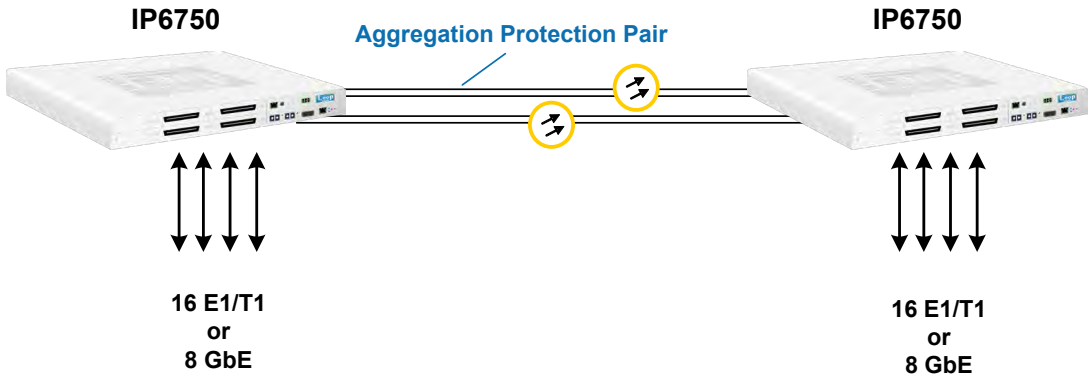
- Mechanical and Electrical
  - 1U height, 19" width ANSI/ETSI
  - Power module
    - AC/DC dual feed slots
    - Hot swappable
  - Industrial series with temperature range from 0° to 60°C
- WAN Aggregate Interface
  - 2 GbE ports with SFP housing
  - IEEE 802.3ad Ethernet Link Aggregation
  - G.8032 v1/v2 – Ethernet Ring Protection Switching (ERPS)
  - G.8031 Ethernet Linear Protection Switching (ELPS)*
  - Compliant with MEF 9, 10.2, 14, 18, and 19*
- Timing
  - Internal/Line
  - External BITS I/O with RJ connector: 2 Mbps, 2 MHz composite clock
  - Adaptive Clock Recovery for TDM Pseudowires
    - Jitter and Wander conforms to MEF 18, ITU-T G.8261, and G.823/824 for Traffic Interface
  - SNTPv4
  - SyncE (ITUT-G.8261) GE interfaces
  - IEEE 1588v2 slave/boundary/transparent clock
  - Internal stratum 3 clock (hold-over state)
  - TOD interface
  - 1PPS interface
- L2 Switching
  - 5G non-blocking switching capacity
  - Jumbo frame size up to 10K bytes
  - Maximum 4K VLANs
  - 802.1d MAC Table Learning (maximum 32K)*
  - 802.1d STP, 802.1w RSTP, 802.1s MSTP*
  - IGMP Snooping v2 RFC 2236 and v3 RFC4604*
- L3 Routing for Management
  - OSPFv2/OSPFv3*
  - Static Routing
- Management
  - SNMPv1/v2c/v3
  - CLI command line interface
  - Telnet and SSHv1/v2
  - 802.1x (port access protocol) *
  - RADIUS Client (User Authentication)
- Tributary Interface
  - 4 hot-swappable slots for the following cards:
    - CGbE: Combo Gigabit Ethernet card
      - 2 port groups per card, (1 SFP optical, 1 electric) up to 8 port groups per system
    - E1 / T1 card
      - 4 ports per card, up to 16 ports per system
      - E1/T1 software configurable per card
- OAM
  - Ethernet OAM
    - 802.1ag / Y.1731
    - 802.3ah
  - Syslog and Dying Gasp alarm
- QoS
  - Ingress Rate Limiting per port
  - Ethernet Network Level
    - 3-bit Priority Code Point – PCP field within 802.1p / 802.1q Ethernet frames – CoS
    - 8 priority queues per port
  - IP Network Level
    - 6-bit DiffServ Code Point – DSCP field – ToS
  - Scheduling Algorithms
    - Strict Priority (SP)
    - Weighted Round Robin (WRR)

- Congestion Avoidance
  - Weighted Random Early Detection (WRED) *
- Policing algorithm
  - Two-Rate Three-Color
  - Token Bucket

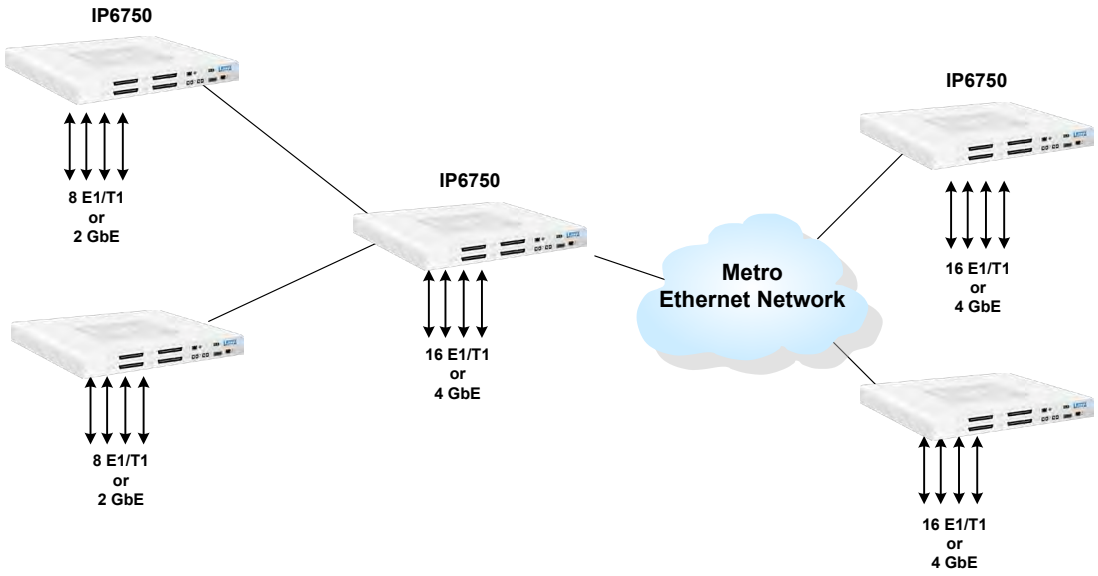
- Pseudowires
  - TDM Pseudowires
    - Up to 64 concurrent pseudowires (256 concurrent pseudowires*)
  - Pseudowire protocols
    - SAToP
    - CESoPSN
    - MEF-8 (CESoETH)
    - Packet Delay Variation Compensation Depth up to 256 ms
  - Ethernet Pseudowires (MPLS-TP)
    - Port-based and VLAN based*
    - Supports Q-in-Q*
    - Native Ethernet packets supported*
- Diagnostics
  - Built-in traffic generator to support RFC2544/ Y.1564 and Y.1731 testing
  - E1/T1 BERT & Loopback
  - Ethernet loopback

* Future option

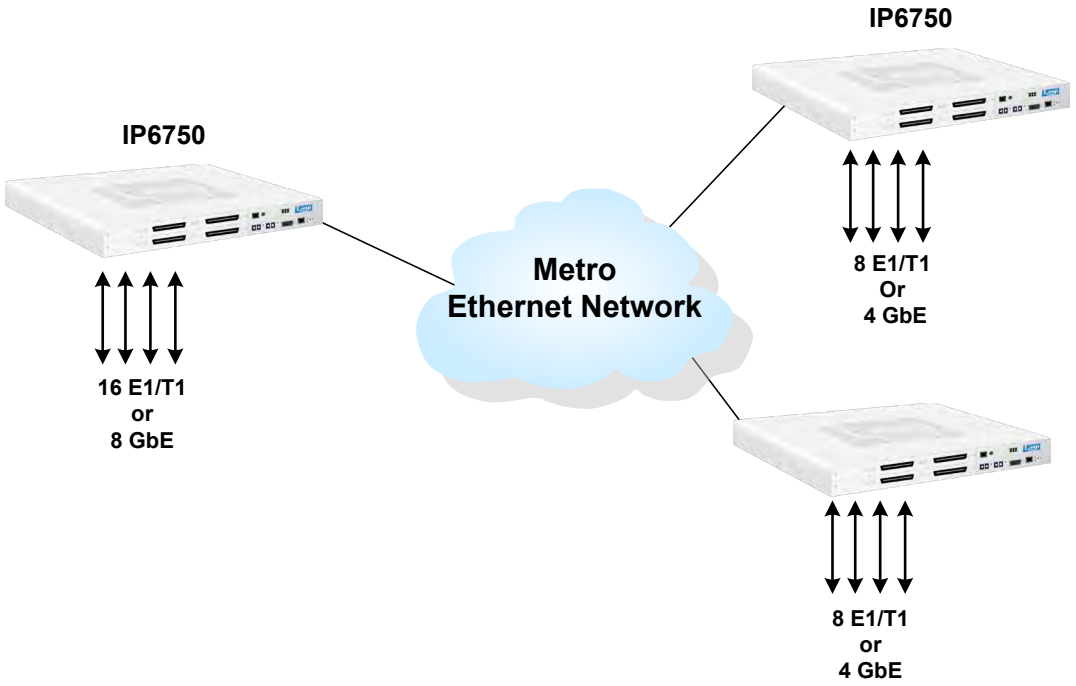
Application Illustrations



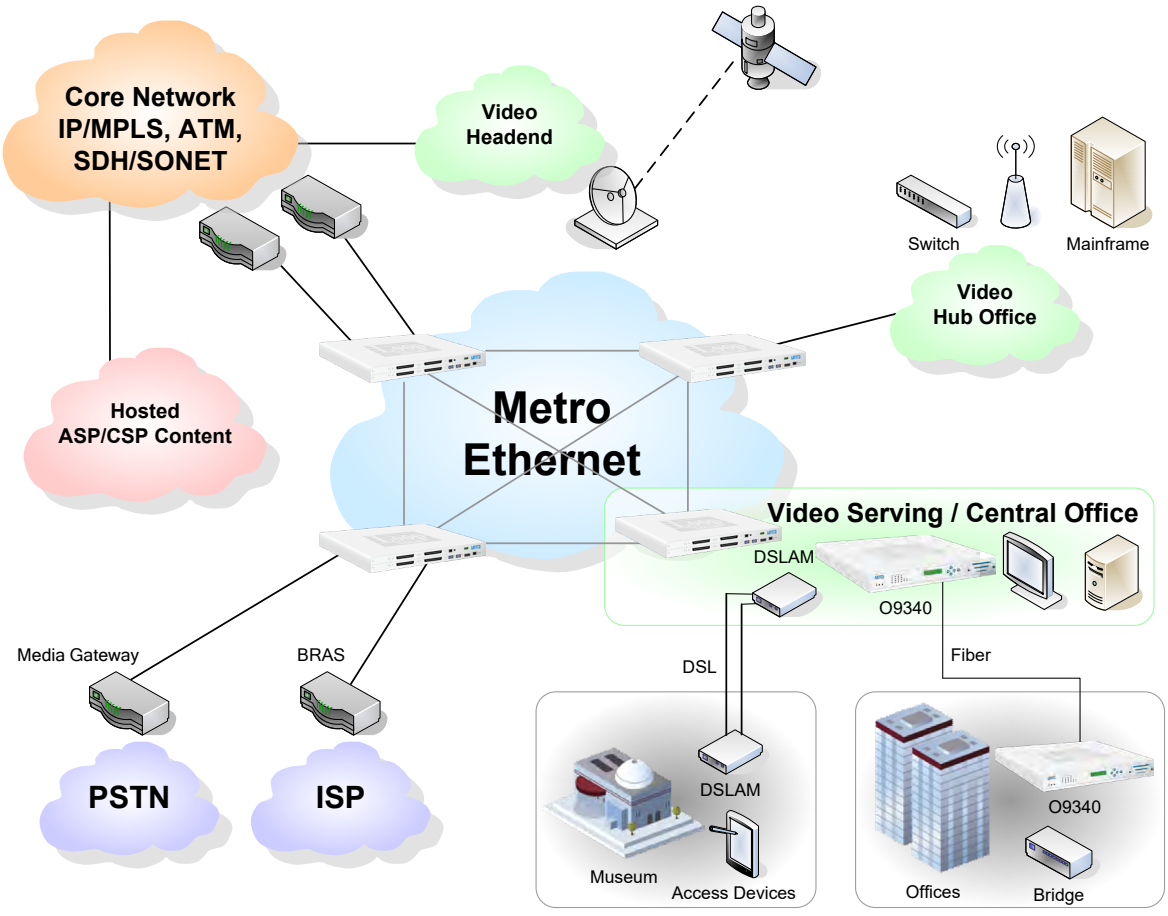
Point to Point Application



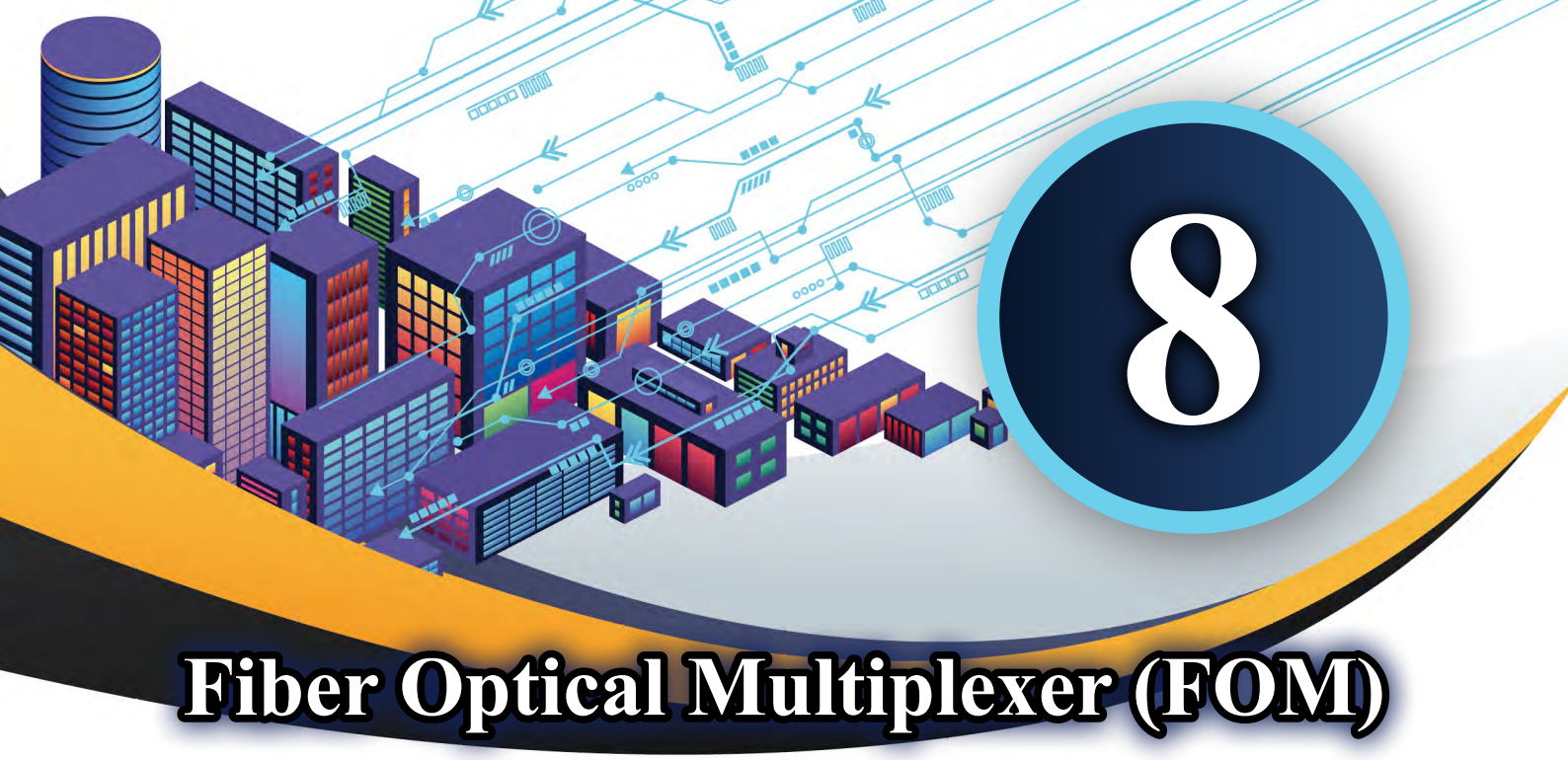
Multistage Multiplexer Application



Single Stage Multiplexer Application



Metro Ethernet Application



8

Fiber Optical Multiplexer (FOM)

Loop-O9210S PDH Fiber Optical Mux 228

Loop-O9310 4E1 Fiber Optical Mux 229

Loop-O9340S Multi-Services Gigabit FOM 230

Loop-O9210S PDH Fiber Optical Mux

Features

- 19“ unit (1U), standalone, wall mount, and rack mount
- Aggregate port
  - One optical interface
- Tributary ports:
  - Fixed on main board
    - One 4E1 or
    - One 4E1 with 100M bps Ethernet
  - Optional daughter card fixed on panel
    - One 4E1
- Supports multiple optical fiber transmission distances
- Single/dual pair optical fiber modules selectable
- Optical line rate: 150Mbps
- BNC/RJ48C connectors for E1s
- LED indicators for alarms and loopbacks
- RS-232 (DB9) Console port
- Local and remote loopbacks
- Power
  - AC or DC (not available at the same time)

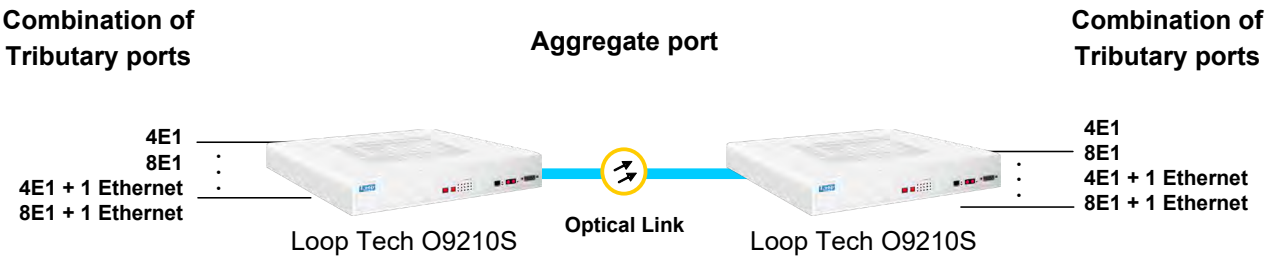
Note: Only non-RoHS compliant and non-CE certified model available.

Description

Loop-O9210S is a point-to-point optical transmission device developed from VLSI that provides not only a choice of fixed 4E1 or 4E1 plus 100M Ethernet bridge, but also the expansion of another 4 E1 links for multiplex transmission over an optical fiber. It provides longer reach without repeaters and superior performance compared to copper media.

Loop-O9210S has a strong alarm monitoring system, and also local/remote loopbacks controlled by the console or DIP switch. With its high integration, low power consumption, stability, and desktop-mount design, installation and operation is easy and convenient.

Application Illustration



Loop-O9310 4E1 Fiber Optical Mux

CPU Version

Features

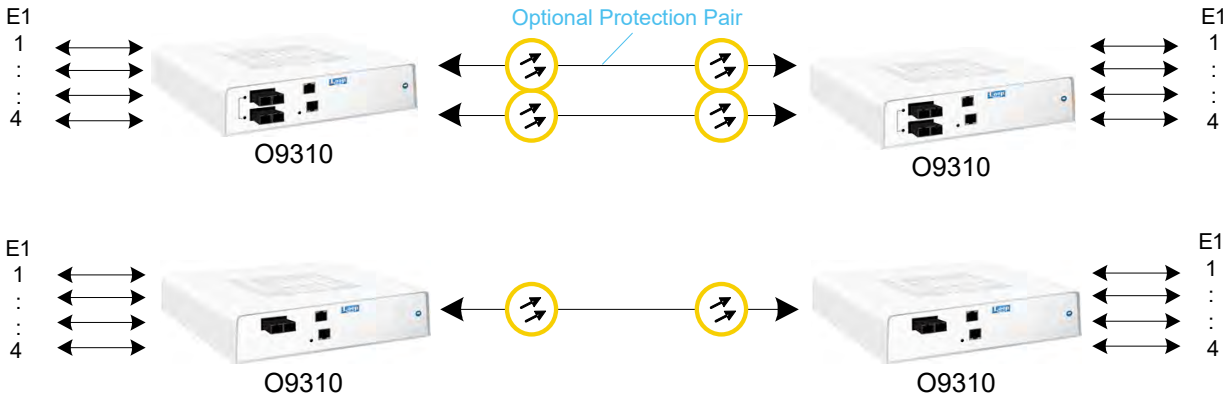
- Up to 4 E1 links on one fiber
- Optical 1+1 protection
- Console and Ethernet port for SNMP management
- Management via SNMP
- Remote slave unit can be managed through Embedded Operation Channel (EOC)
- LED indicators
- Alarm relay and alarm cut off
- BNC or RJ45 connectors for 4 E1s (manufacturing option)
- Multiple optical fiber transmission distances
- Single mode and multi-mode fiber modules

Description

Loop Telecom's Loop-O Fiber Optical Mux product family provides ideal solutions for building fiber-based E1 networks. The Loop-O9310 can multiplex up to 4 E1 signals for transmission over an optical fiber, resulting in longer reach without repeaters and superior performance compared to copper media.

The E1 model supports an optional 1+1 protection. It is available in SNMP manageable version. The SNMP manageable model has a master unit with CPU for managing a slave unit, and a slave unit without CPU that is managed by the master unit through EOC. Applications include interconnections for LAN, WAN, SONET/SDH, ATM, and DLC.

Application Illustration



Loop-O9340S Multi-Services Gigabit FOM

Features

- 1U height, ETSI shelf (full frontal access) or ANSI shelf (front and rear access)
- Rack mount, wall mount, and standalone
- Aggregate ports
  - 2 Gigabit Optical Interface with SFP housing
  - (1+1) protection
  - Protection Switching time within 50 ms
  - Manual or automatic protection switch
- Proprietary Optical Aggregate throughput: at least 860 Mbps
- Tributary ports:
  - Hot-swappable
  - 4 slots
  - E1/T1 card
    - 4 or 8 E1/T1 ports
    - Up to 16 E1/T1 ports per system
    - E1/T1 per card software configurable
  - GbE card
    - 2 Combo Gigabit Ethernet (GbE) port groups (RJ45 or SFP housing)
    - Up to 8 Combo Gigabit Ethernet (GbE) ports per system
    - Diagnostics (Loopback and BERT)
    - L2 Functions:
      - Packet Transparency: BPDU packet transparency; IEEE 802.1q VLAN, 802.1ad (Q-in-Q)
      - QoS: 4 priority queues for packet classification; 256K bytes of packet buffer per priority queue, IEEE 802.1p CoS
      - Traffic Rate Control: Rate limited with 256K bps granularity; pause frame according to IEEE 802.3X standard.
- Power modules (hot swappable)
  - DC -48V (-36 to -75 Vdc), dual for redundancy
  - AC 100 to 240 Vac, dual for redundancy
- Alarm relay
- Firmware download to the local and remote unit
- Configuration upload and download
- Management port and interface
  - LCD with keypad on ANSI-shelf
  - Console port (RS232, DB9), VT100 menu-driven
  - SNMP Ethernet port
  - SNMP v1, v2c
  - Telnet via SNMP port
  - In-band management in traffic bandwidth
- RoHS compliant

Description

The Loop-O9340S Multi-Services Gigabit FOM is a flexible, cost-effective fiber optical modulator (standalone) which provides an ideal solution for 2G/3G BTS and buildings with fiber-based E1/T1 and Ethernet networks. With a hot-pluggable platform, it allows service providers to carry up to 16 E1/T1, 32 E1, 8 Combo Gigabit Ethernet (GbE) or a mix with both interface signals over a proprietary Gigabit optical pipe.

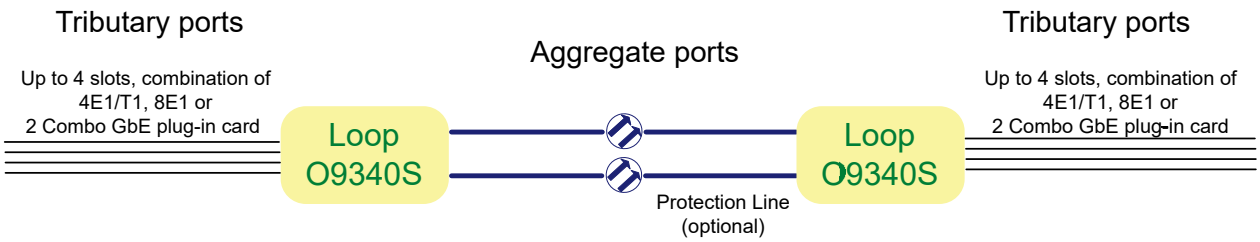
To select the protection level, users can choose dual pair fiber for the line (1+1) in the point-to-point application and dual power supplies for power protection.

The Loop-O9340S can be managed through a console port, Ethernet port, Telnet, and SNMP agents. It supports local control and diagnostics using console port. The unit also supports local and remote monitoring and diagnostics. Contacts for office alarms are available.

Applications for Loop-O9340S include interconnections for LAN, WAN, SONET/SDH, ATM and DLC.

Application Illustration

Point-to-point application



9

mPTN MPLS/Carrier Ethernet

Loop-G7860 mPTN MPLS/CE Packet Transport Network 232

Loop-IP6750 Service Aggregation & Access Device 235

Loop-O9400R PTN/SDH/SONET ADM/TM 238

Loop-O9500R PTN/SDH/SONET/PDH IMAP(CHPA chassis & CCPA Controller) 243

Loop-G7860 mPTN MPLS/CE Packet Transport Network

Description

ETSI Front View of G7860A

G7860A supports both MPLS-TP and Carrier Ethernet (EPL, EVPL, EPLAN, EVC defined in MEF) for packet transportation. In addition to native Ethernet transport, G7860A can be used as the gateway for PDH and SDH/SONET networks to enter PSNs using Circuit Emulation and Encapsulation technologies. Encapsulation technologies include TDMoE, TDMoIP, and TDMoMPLS. Circuit Emulation include CESoPSN (NxDS0/64K), SAToP (Unframed E1/T1), and CEP (SDH/SONET paths). Pseudowires make grooming and multiplexing DS0, E1/T1, and SDH/SONET paths easier, and service integrity can also be monitored and protected via packet network protection schemes.

One G7860A with up to 85G packet switching capacity supports six 10GbE SFP+ and four 1GbE SFP built-in interfaces along with 16 E1/T1 built-in ports. With the two hot-swappable plug-in slots, the system capacity can be scaled up with additional E1/T1 ports, STM-n/OC-n, or GbE electrical/optical interfaces.

G7860A provides high availability and reliability required by Carrier, Power Utility, Military, Government and Transportation applications by supporting MPLS-TP LSP 1:1/1+1 protection and ERPS, with protection switching time <50ms. Ethernet and MPLS section and end-to-end OAM are also provided for monitoring service integrity and performance. The compact G7860A is only 1U height, but its powerful functions enable customers to provision a service-grooming hub, ring, or mesh 10G packet network with ultimate ease.

Features

- Mechanical and Electrical
  - 1U height, 19” width ETSI unit (front access)
  - Power supply: hot swappable DC/AC, dual for redundancy
  - Operating Temperature: -20 ºC to 65 ºC
- System Capacity
  - Up to 6 x 10GbE SFP+ ports
  - Up to 16 x 1GbE Base-T
  - Up to 20 x 1GbE SFP
  - Up to 80 x E1/T1 ports
  - Up to 8 x STM-1/OC-3 ports or 2 x STM-4/OC-12 ports
  - Up to 4 x STM-1/OC-3 MSP pairs or 2 x STM-4/OC-12 pairs
  - 16 x E1/T1 ports with SCSI interface
- MPLS-TP
  - Any Ethernet port can be configured as NNI (MPLS port) or UNI (Ethernet service port)
  - Bi-directional LSP
  - Static LSP/PW provisioning via NMS
  - Ethernet (VPWS, VPLS, H-VPLS) and TDM (CESoPSN, CEP, and SAToP) services
  - MPLS-TP OAM and QoS
  - TDM PW Support:
    - 32 TE1 card: up to 256 pseudowires
    - MB E1/T1: up to 256 pseudowires
    - B16 card: up to 512 pseudowires
- Carrier Ethernet
  - L2 Switching/Bridging
  - STP, RSTP, MSTP
  - Port based VLAN and port isolation
  - VLAN Stacking (Q-in-Q)
  - CE OAM
    - CFM: Ethernet Service OAM (802.1ag/Y1731)
    - EFM: Ethernet Link OAM (802.3ah)
  - Flow Control
  - Link Aggregation Control Protocol (LACP)
  - Jumbo Frame (MTU) = 9600
- Network Protection
  - MPLS-TP
    - LSP 1+1/1:1
    - LSP E2E protection switching < 50ms
    - Based on TP OAM for fault detection
  - CE
    - ERPS Ring (G.8032) Protection
    - ELPS (G.8031) Linear Protection
  - SDH/SONET
    - STM-n/OC-n MSP 1+1 Protection
- Management
  - Fully manageable via SNMP (v1, v2, v3)
  - Fully manageable via CLI
    - Serial port
    - SSH, Telnet via Ethernet
  - GbE Interface in-bands
  - Account Security
    - Two types of privileges: Operator (read only) and Administrator (read and write)
    - Radius Client and 802.1x Authentication
  - Upload/Download NE configuration
  - Syslog, NTP
- TDM Pseudowire Services
  - Circuit Emulation
    - DS0 (64K timeslots): CES & multiframe PW
    - Unframed E1/T1: SAToP PW

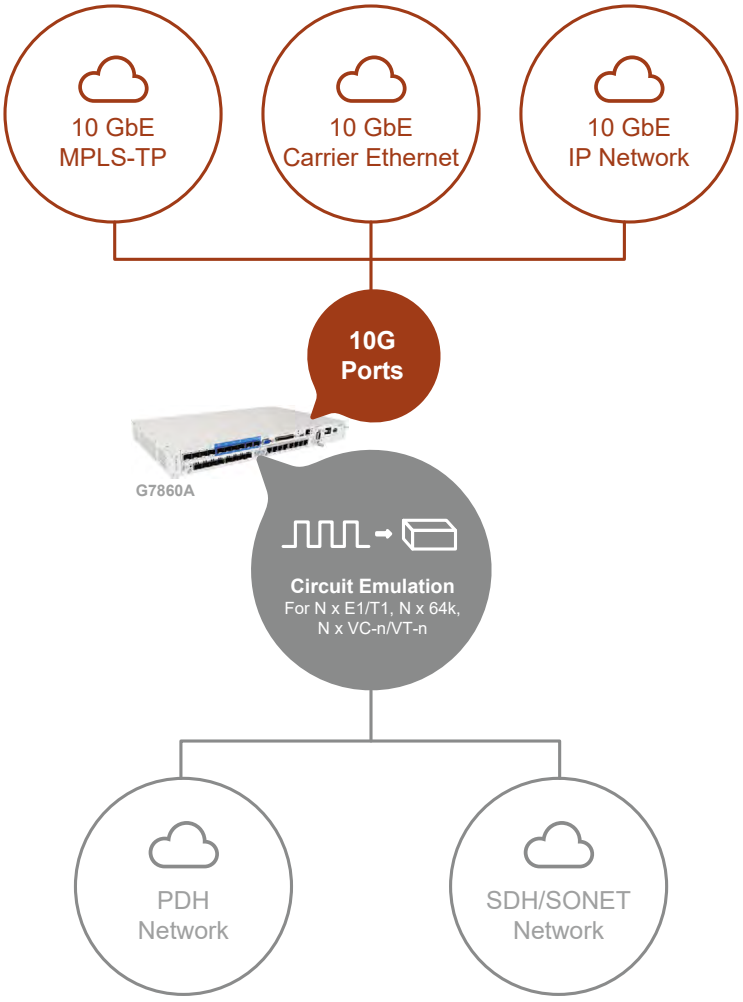
  - VC-3/4/11/12, VT-1.5/2, STS-1/3: CEP PW
- PDH Timing recovery: ACR/DCR/System
- ACR/DCR support
  - 32TE1 card: up to 32 instances
  - MB E1/T1: up to 16 instances
  - B16 card: up to 256 instances
- SDH Circuit Emulation over Packet (CEP)
- Encapsulation
  - PW/LSP (TDM over MPLS-TP),
  - "Dry martini", MEF 8 (TDM over Ethernet),
  - TDM over IP
- PDH cross-connection to SDH/SONET*

- Ethernet Pseudowire Services
  - E-Line, E-LAN, E-Tree services as defined by MEF 9 and 14 and using VPWS/VPLS
  - Native Ethernet packets supported
  - Encapsulation: PW/LSP (MPLS-TP), VLAN tagging (1Q), VLAN double tagging (Q-in-Q)
- VPLS
  - VPLS bridging
  - H-VPLS bridging
  - 32K MAC addresses
  - 2K VPLS instances per device
  - Split horizon to prevent forwarding loops

- CoS/QoS
  - 8 Priority Queues
  - Scheduling: Strict Priority, WRR with Hierarchy
  - Ingress Policing & Egress Shaping per service
  - CIR / PIR (EIR) 2-rate-3-color
  - MPLS: TC/EXP-Inferred-PSC (Per Hop Behavior Scheduling Class) LSP
- Timing
  - SSM quality level compatible
  - IEEE 1588 v2 (via SyncE only)
    - PTP Clocks: Ordinary/Boundary/Transparent
    - ToD (Time of day)
    - 1-PPS (One Pulse per second) output interface
  - SyncE
    - Synchronous Ethernet from all built-in and plug-in GbE, 10GbE ports
    - ITU-T Ethernet Synchronous Message Channel (ESMC)
  - Stratum 3 timing
  - TDM line clock: E1/T1 and STM/OC ports
  - External clock input and output (2 Mbps / 2 MHz)

* Future option

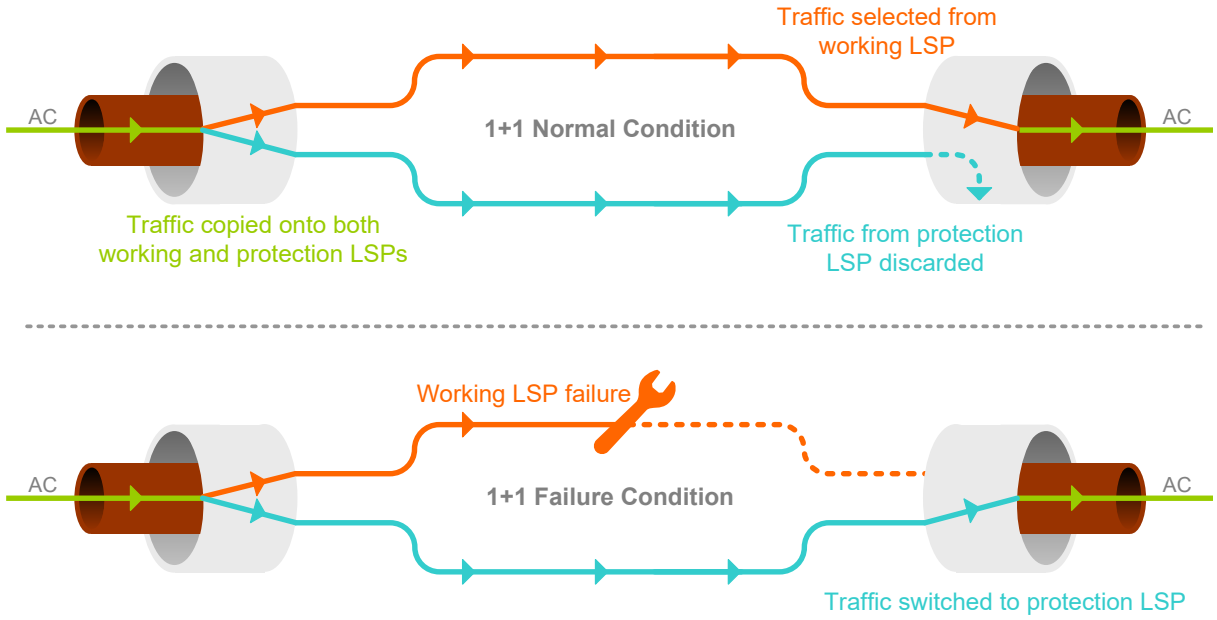
Application Illustration



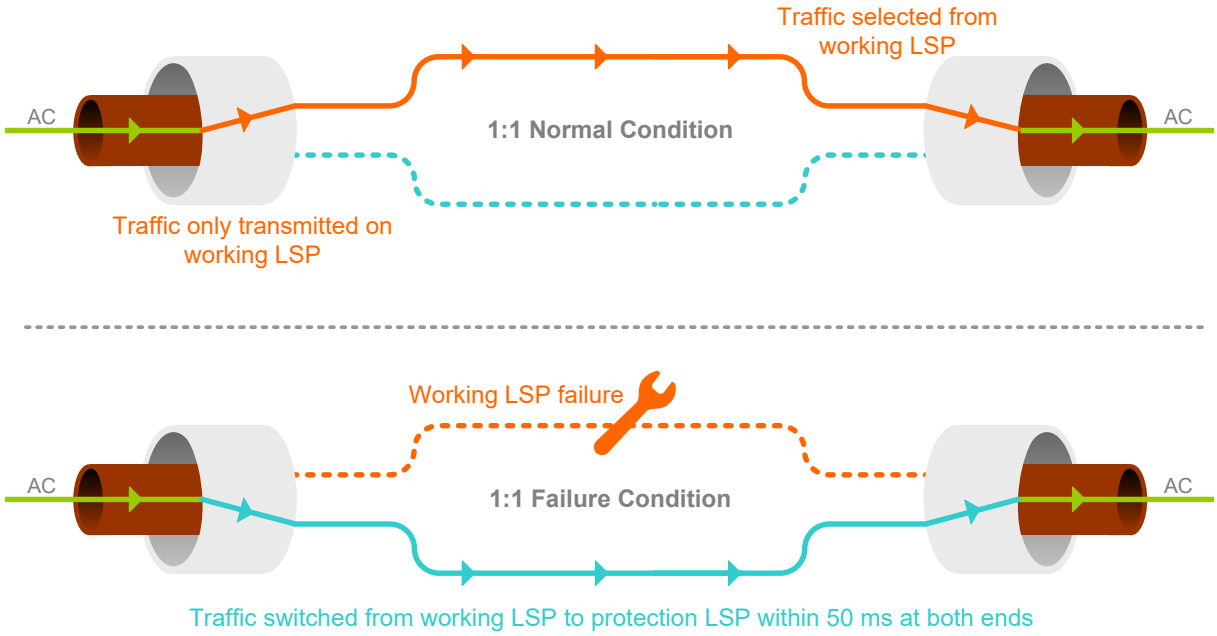
MPLS-TP LSP protection

MPLS-TP network protects traffic by creating a tunnel between remote ends with two label switching paths (LSPs) to achieve **1:1** or **1+1** protection. Remote nodes communicate with each other to ensure **automatic protection switching (APS)** takes place when the working path fails.

In 1+1 mode, traffic is copied onto both working and protection LSPs. When receiving traffic, the remote LER only selects traffic from one of the two LSPs to decapsulate.



In 1:1 mode, traffic flows only on the working LSP. When a failure occurs on the working LSP, traffic is then switched to the protection LSP within 50 ms.



Loop-IP6750 Service Aggregation & Access Device

ANSI Front View

ETSI Front View

Description

The **Loop-IP6750 Service Aggregation & Access Device** is an effective way for service providers to build their network and achieve a fast return on investment. Currently providers need to transport both TDM and Packet traffic. These can be achieved using the E1/T1 and Gigabit Ethernet tributary ports of the IP6750.

In addition to working now, service providers also have to build the network to meet *future requirements*.

The IP6750 can handle temperature ranges of 0° to 65°C. It supports many protocols such as MEF-8 CESoETH, SyncE and IEEE1588v2 Precision Timing, G.8031 Ethernet Linear Protection Switching, and a RFC2544 built-in traffic generator.

The IP6750's durability and capabilities make it an important device for your network to meet the requirements of a carrier-grade Service Level Agreement (SLA).

Features

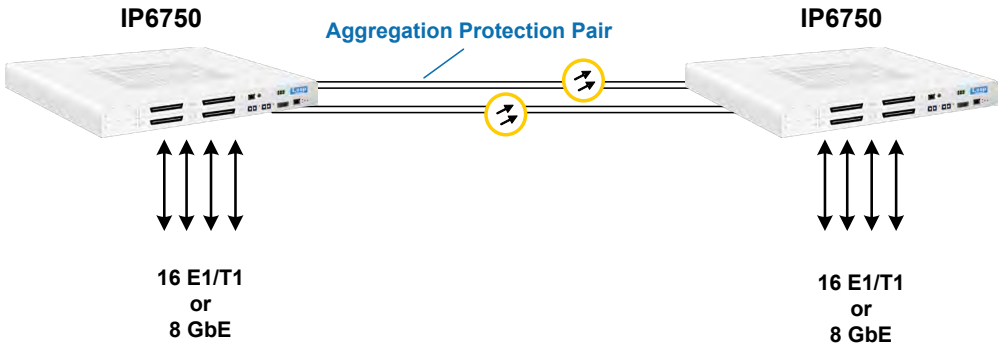
- Mechanical and Electrical
  - 1U height, 19" width ANSI/ETSI
  - Power module
    - AC/DC dual feed slots
    - Hot swappable
  - Industrial series with temperature range from 0° to 60°C
- WAN Aggregate Interface
  - 2 GbE ports with SFP housing
  - IEEE 802.3ad Ethernet Link Aggregation
  - G.8032 v1/v2 – Ethernet Ring Protection Switching (ERPS)
  - G.8031 Ethernet Linear Protection Switching (ELPS)*
  - Compliant with MEF 9, 10.2, 14, 18, and 19*
- Timing
  - Internal/Line
  - External BITS I/O with RJ connector: 2 Mbps, 2 MHz composite clock
  - Adaptive Clock Recovery for TDM Pseudowires
    - Jitter and Wander conforms to MEF 18, ITU-T G.8261, and G.823/824 for Traffic Interface
  - SNTPv4
  - SyncE (ITUT-G.8261) GE interfaces
  - IEEE 1588v2 slave/boundary/transparent clock
  - Internal stratum 3 clock (hold-over state)
  - TOD interface
  - 1PPS interface
- L2 Switching
  - 5G non-blocking switching capacity
  - Jumbo frame size up to 10K bytes
  - Maximum 4K VLANs
  - 802.1d MAC Table Learning (maximum 32K)*
  - 802.1d STP, 802.1w RSTP, 802.1s MSTP*
  - IGMP Snooping v2 RFC 2236 and v3 RFC4604*
- L3 Routing for Management
  - OSPFv2/OSPFv3*
  - Static Routing
- Management
  - SNMPv1/v2c/v3
  - CLI command line interface
  - Telnet and SSHv1/v2
  - 802.1x (port access protocol) *
  - RADIUS Client (User Authentication)
- Tributary Interface
  - 4 hot-swappable slots for the following cards:
    - CGbE: Combo Gigabit Ethernet card
      - 2 port groups per card, (1 SFP optical, 1 electric) up to 8 port groups per system
    - E1 / T1 card
      - 4 ports per card, up to 16 ports per system
      - E1/T1 software configurable per card
- OAM
  - Ethernet OAM
    - 802.1ag / Y.1731
    - 802.3ah
  - Syslog and Dying Gasp alarm
- QoS
  - Ingress Rate Limiting per port
  - Ethernet Network Level
    - 3-bit Priority Code Point – PCP field within 802.1p / 802.1q Ethernet frames – CoS
    - 8 priority queues per port
  - IP Network Level

- 6-bit DiffServ Code Point – DSCP field – ToS
- Scheduling Algorithms
  - Strict Priority (SP)
  - Weighted Round Robin (WRR)
- Congestion Avoidance
  - Weighted Random Early Detection (WRED)*
- Policing algorithm
  - Two-Rate Three-Color
  - Token Bucket

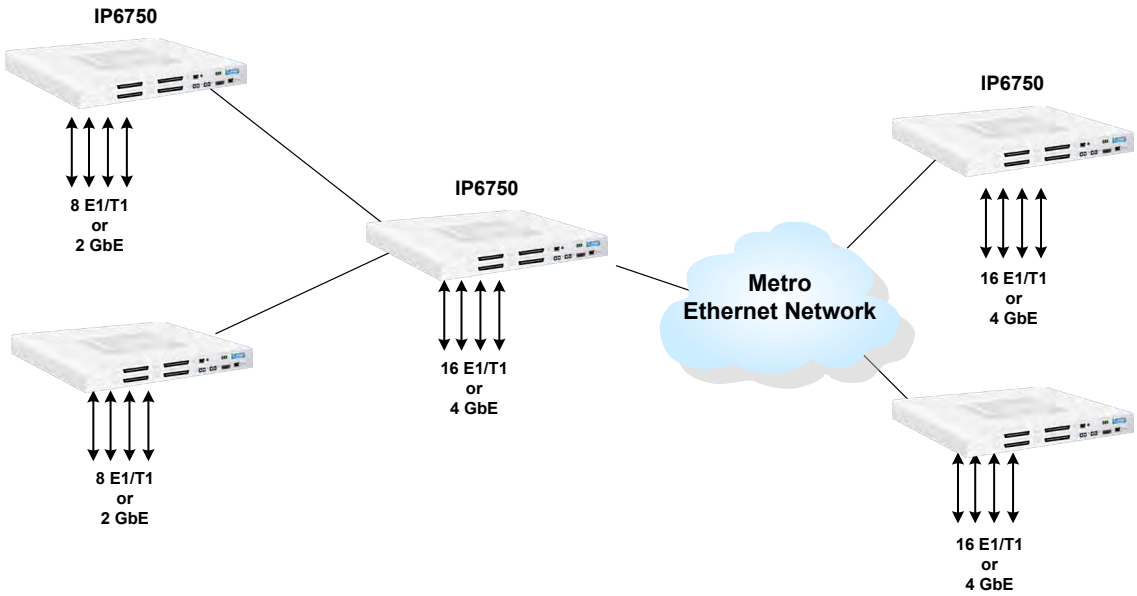
- Pseudowires
  - TDM Pseudowires
    - Up to 64 concurrent pseudowires (256 concurrent pseudowires*)
    - Pseudowire protocols
      - SAToP
      - CESoPSN
      - MEF-8 (CESoETH)
    - Packet Delay Variation Compensation Depth up to 256 ms
  - Ethernet Pseudowires (MPLS-TP)
    - Port-based and VLAN based*
    - Supports Q-in-Q*
    - Native Ethernet packets supported*
- Diagnostics
  - Built-in traffic generator to support RFC2544/ Y.1564 and Y.1731 testing
  - E1/T1 BERT & Loopback
  - Ethernet loopback

* Future option

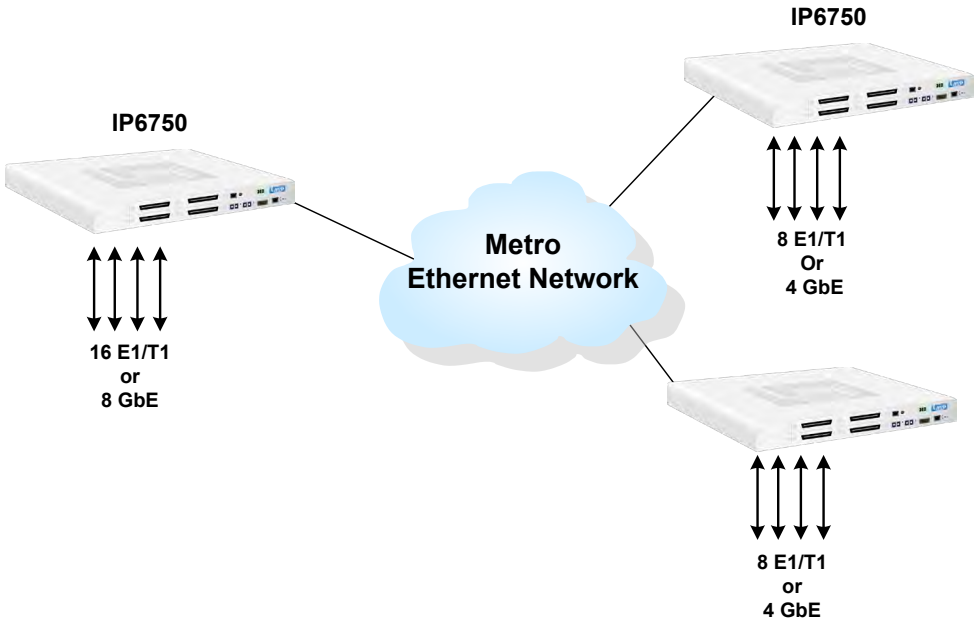
Application Illustrations



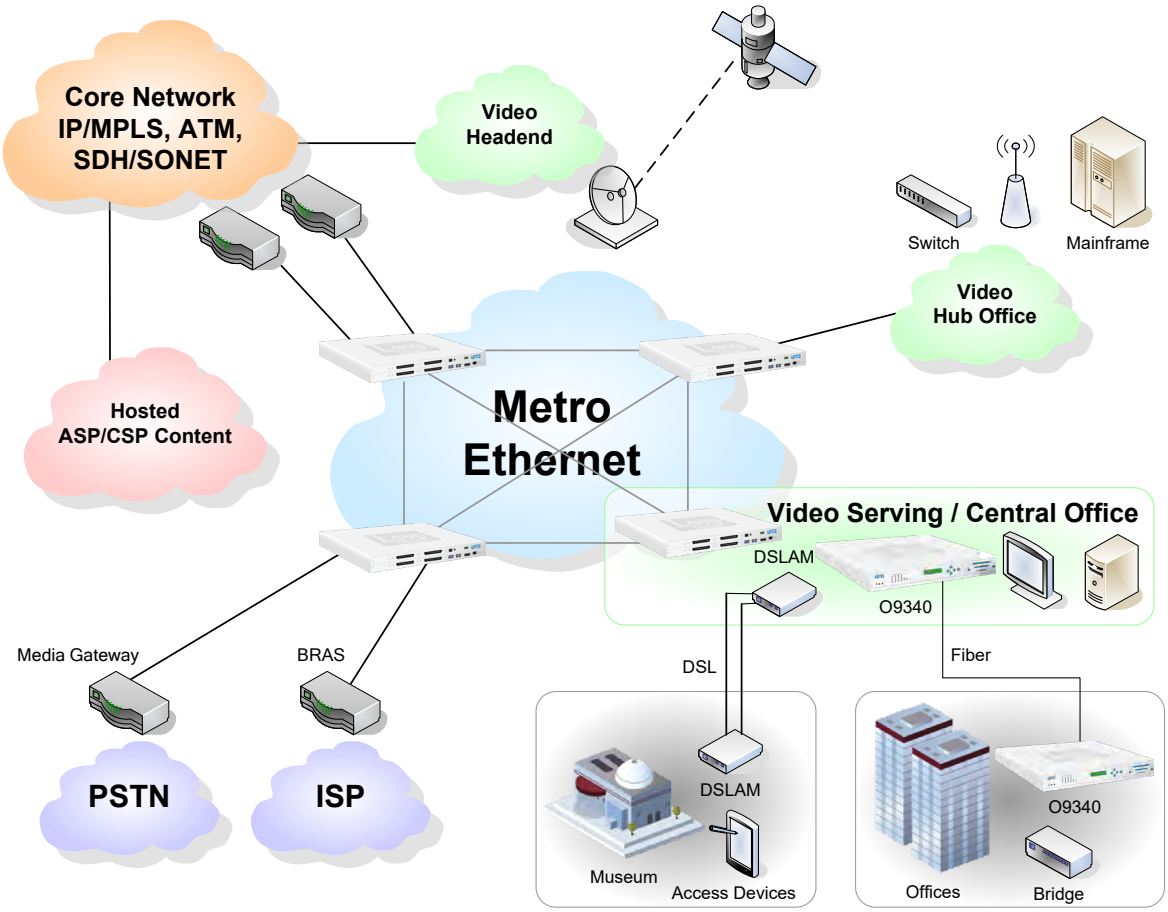
Point to Point Application



Multistage Multiplexer Application



Single Stage Multiplexer Application



Metro Ethernet Application

Loop-O9400R PTN/SDH/SONET ADM/TM

Supporting PTN, SDH & PDH

Features

- 6U height, full front access (ETSI) shelf support up to 2.5G Mbps backplane
- SDH/SONET VCn/VTn Cross-Connect Capacity: 15Gbps bidirectional non-blocking
- PTN (CE and MPLS-TP) Switching Capacity: 100Gbps bidirectional non-blocking
- Modular design, Hot-swappable cross-connect modules, tributary modules, SFP and SFP+ optical
- Hot-swappable cross-connect modules, tributary modules and power modules
- Temperature-controlled fan tray
- Aggregate cross-connect modules (controller modules)
  - Up to STM-1/4/16 (OC-3/12/48) aggregate lines with software configuration (CCPA)
- Tributary modules: 8 tributary slots
  - Two ports STM-1 (OC-3) or One port STM-4 (OC-12) module
  - Three ports E3/T3 module
  - 16/32/63 ports E1/T1 tributary module
  - One port STM-16 (OC-48)
  - 8GE tributary module with L2 switch
  - PTN10G module (Three 10G or Eight 1G ports)
  - PTNext (One 10G or Ten 1G ports)
- DC Power Module (-40 to -72 Vdc), 500W
  - Dual power (1+ 1) protection
- Protection
  - Controller cross-connect unit (CCPA) protection, MSP (1+1), SNCP/UPSR Ring
  - Tributary protection
    - E1/T1: Card/Port (1:1) using Y-box, Line (1+1)
    - E3/T3: Line (1+1)
    - B155/622: MSP, SNCP/UPSR
    - Ethernet: Card protection
    - PTN Switch Fabric 1:1
- Network Protection
  - MSP 1+1
  - SNCP/UPSR
  - Ethernet Ring Protection (ERPS G.8032)
  - Link Aggregation (Inter and Intra board)
  - LSP Linear Protection (1+1/1:1) sub 50ms
- External/Internal/Line timing source with SSM
  - SyncE
  - IEEE 1588
  - TDM clocks
- TM, ADM, and cross-connect
- Full cross-connect at VC11/VC12/VC3/VC4 levels
- Support framed and unframed VC4-4 and VC4-4c
- External/Internal/Line timing source with SSM
- Ethernet supports GFP, LAPS, VCAT, BCP, LCAS and non-LCAS
- Management
  - Console port, VT100 menu-driven
  - SNMP port: Both v1 and v3 supported
  - Telnet, SSH, and Radius
  - Centralized management with Loop's EMS/iNMS over DCC channel
  - Loop-iNET GUI Element Management System
  - TMN management (Loop-iNMS) with full FCAPS and end-to-end circuit management
- RoHS compliant

Description

The Loop-O9400R is a standards-compliant high density SDH/SONET/ADM/TM with a full T1/E1 cross-connect rack system.

The O9400R has full add-and-drop capability according to the figures below:

- 1 STM-16 tributaries
- 4 STM-4 tributaries or 8 STM-4 tributaries*
- 16 STM-1 tributaries
- 24 E3/T3 tributaries
- 504 E1/T1 tributaries
- 64 10/100M Ethernet EoS tributaries
- 8 GbE EoS tributaries
- 6 10GbE and 16 1GbE tributaries
  - Up to 36 1GbE/FE tributaries

*Future Option

With up to 4 STM-1/4/16 (OC-3/12/48) aggregate interfaces on cross-connect modules and 16 STM-1 (OC-3) interfaces on tributaries, the Loop-O9400R offers the service provider a versatile protection scheme including SNCP (UPSR), and MSP (1+1) protection for network topology. Path protection switching can be automatically or manually activated through a management system.

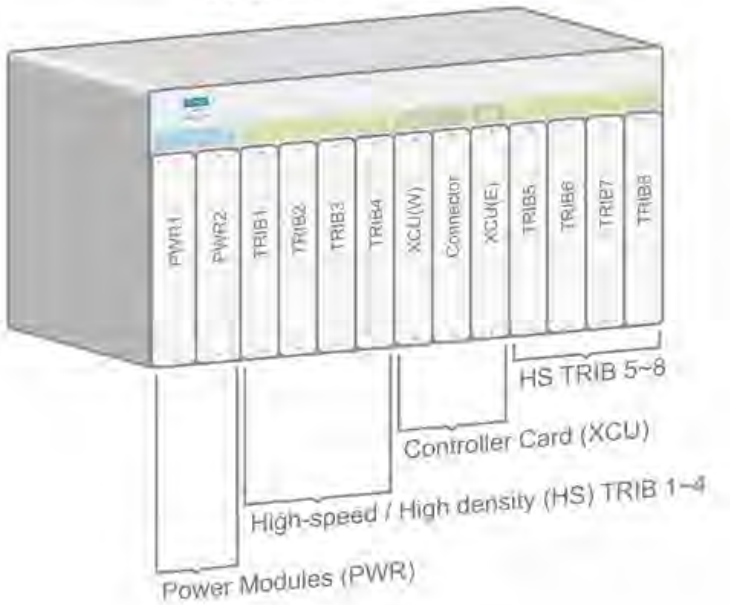
With the PTN10G interface card, the O9400R can transport SDH/SONET over PSN network. With O9400R as a gateway between SDH/SONET and PTN, existing SDH/SONET network users will be able to migrate from SDH/SONET/PDH to PTN network smoothly and seamlessly.

All interfaces are fully compliant with the relevant ETSI standards and ITU recommendations. The Loop-O9400R provides powerful Operation, Administration, Maintenance and Provisioning (OAM&P) functionality, including fault management, performance monitoring, configuration management, and network security management. Through a console port, OAM&P can be achieved both locally and remotely via SNMP or menu-driven interfaces.

The Loop-O9400R provides a complete set of operation interfaces that are consistent with the Telecommunication Management Network (TMN) concept (ITU Recommendation M.30, G.784) for SDH/SONET Network Element/Operations System (NE/OS), NE/NE, and NE/Craft communications. Users can easily operate the Loop-O9400R locally or remotely for centralized management.

Loop-O9400R Front Panel

Module Schematics



Loop-O9400R Card Type and Capacity Reference Table

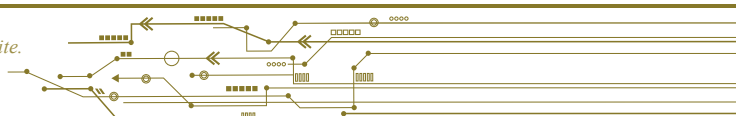
Table STM-1/4/16 (OC3/12/48) Aggregate Line

In this table, STM-16 can be OC-48, STM-4 can also be OC-12; STM-1 can also be OC-3; E1 can also be T1; and E3 can also be T3.

Mode 1 Bandwidth Allocation

SLOTS	TRIB 1	TRIB 2	TRIB 3	TRIB 4	XCU1(W)	CONNECTOR	XCU2(E)	TRIB 5	TRIB 6	TRIB7	TRIB 8
GLOBAL PAYLOAD SDH	4 X 155M	N/A	4 X 155M	N/A	2 x 2.5G		2 x 2.5G	4 X 155M	N/A	4 X 155M	N/A
	2 x 155M	2 x 155M	2 x 155M	2 x 155M				2 x 155M	2 x 155M	2 x 155M	2 x 155M
	4 X 155M	N/A	16 x 155M	N/A				4 X 155M	N/A	4 X 155M	N/A
	2 x 155M	2 x 155M	16 x 155M	N/A				2 x 155M	2 x 155M	2 x 155M	2 x 155M
Tributary (Plug-in Modules)											
Link without MSP	STM-1 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)	STM-1/4/16 (2 ports)		STM-1/4/16 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)
	STM-4	N/A	STM-4	N/A	STM-1/4/16 (2 ports)		STM-1/4/16 (2 ports)	STM-4	N/A	STM-4	N/A
Link with MSP (1+1) See Note 1	STM-1 (2 ports)	(B)	STM-1 (2 ports)	(B)	STM-1/4/16 (2 ports)		STM-1/4/16 (2 ports)	STM-1 (2 ports)	(B)	STM-1 (2 ports)	(B)
	STM-4	(B)	STM-4	(B)	STM-1/4/16 (2 ports)		STM-1/4/16 (2 ports)	STM-4	STM-4 (B)	STM-4	(B)
Max 504 E1 (Single)	63 E1	63 E1	63 E1	63 E1				63 E1	63 E1	63 E1	63 E1
Max 252 E1 (Protection)	63 E1	(B)	63 E1	(B)				63 E1	(B)	63 E1	(B)
Max. 24 E3 (Single)	3 E3	3 E3	3 E3	3 E3				3 E3	3 E3	3 E3	3 E3
Max 12 E3 (Protection)	3 E3	(B)	3 E3	(B)				3 E3	(B)	3 E3	(B)
8GES16SW (Single)	N/A	N/A	8GES16SW Note1	N/A Note1				N/A	N/A	N/A	N/A
8GES16SW (Protection)	N/A	N/A	8GES16SW	(B)				N/A	N/A	N/A	N/A
8GES4SWA (Single)	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps				8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps
8GES4SWA (Protection)	8 x 10/100/1000 Mbps	(B)	8 x 10/100/1000 Mbps	(B)				8 x 10/100/1000 Mbps	(B)	8 x 10/100/1000 Mbps	(B)
B2G5 (Single)	N/A	N/A	B2G5 Note1	N/A Note1				N/A	N/A	N/A	N/A
B2G5 (Protection)	N/A	N/A	B2G5	(B)				N/A	N/A	N/A	N/A
PTN10G (Single)	N/A	N/A	3 x 10G or 8 x 1G	N/A				N/A	N/A	N/A	N/A
PTN10G (Protection)	N/A	N/A	3 x 10G or 8 x 1G	(B)				N/A	N/A	N/A	N/A
PTNext	10 x 1G	10 x 1G									

Note 1: The B2G5 module only applicable to O9400R's tributary slot 3 and 4. The CHPA backplane support up to 2.5G Mbps mapping bandwidth.

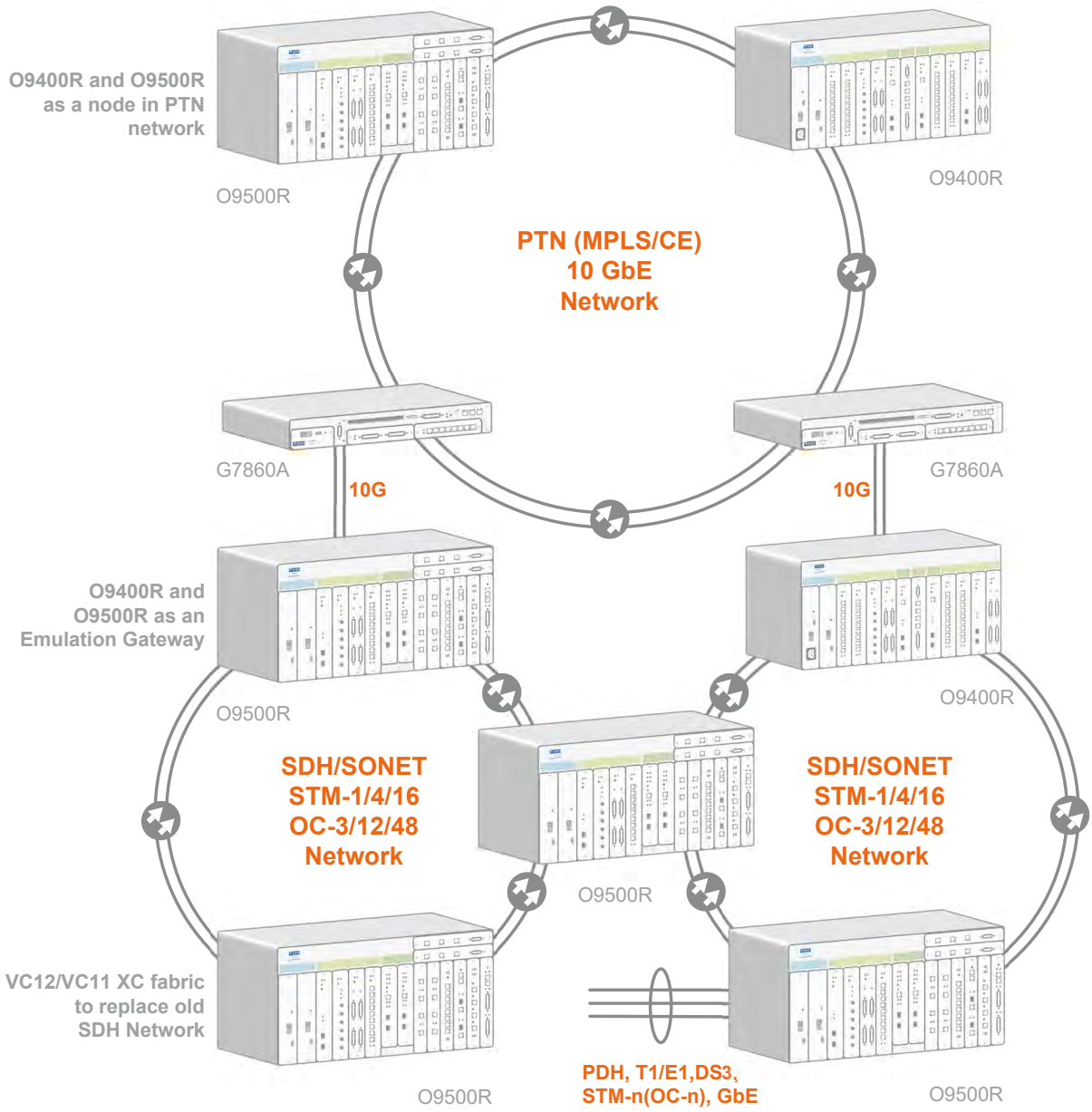


Mode 2 Bandwidth Allocation*

SLOTS	TRIB 1	TRIB 2	TRIB 3	TRIB 4	XCU1(W)	CONNECTOR	XCU2(E)	TRIB 5	TRIB 6	TRIB7	TRIB 8
GLOBAL PAYLOAD SDH	4 X 155M	4 X 155M	4 X 155M	4 X 155M	2 x 2.5G		2 x 2.5G	4 X 155M	4 X 155M	4 X 155M	4 X 155M
Tributary (Plug-in Modules)											
Link without MSP	STM-1 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)	STM-1/4/16 (2 ports)		STM-1/4/16 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)	STM-1 (2 ports)
	STM-4	STM-4	STM-4	STM-4	STM-1/4/16 (2 ports)		STM-1/4/16 (2 ports)	STM-4	STM-4	STM-4	STM-4
Link with MSP (1+1) See Note 1	STM-1 (2 ports)	(B)	STM-1 (2 ports)	(B)	STM-1/4/16 (2 ports)		STM-1/4/16 (2 ports)	STM-1 (2 ports)	(B)	STM-1 (2 ports)	(B)
	STM-4	(B)	STM-4	(B)	STM-1/4/16 (2 ports)		STM-1/4/16 (2 ports)	STM-4	STM-4 (B)	STM-4	(B)
Max 504 E1 (Single)	63 E1	63 E1	63 E1	63 E1				63 E1	63 E1	63 E1	63 E1
Max 252 E1 (Protection)	63 E1	(B)	63 E1	(B)				63 E1	(B)	63 E1	(B)
Max. 24 E3 (Single)	3 E3	3 E3	3 E3	3 E3				3 E3	3 E3	3 E3	3 E3
Max 12 E3 (Protection)	3 E3	(B)	3 E3	(B)				3 E3	(B)	3 E3	(B)
8GES4SWA (Single)	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps				8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps	8 x 10/100/1000 Mbps
8GES4SWA (Protection)	8 x 10/100/1000 Mbps	(B)	8 x 10/100/1000 Mbps	(B)				8 x 10/100/1000 Mbps	(B)	8 x 10/100/1000 Mbps	(B)

*Future Option

Applications



PTN10G Ring and SDH/SONET Ring Application

Loop-O9500R PTN/SDH/SONET/PDH IMAP (CHPA chassis & CCPA Controller)

Features

- 6U height, full front access (ETSI) shelf
- SDH/SONET VCn/VTn Cross-Connect Capacity: 14Gbps bidirectional non-blocking
- PTN (CE and MPLS-TP) Switching Capacity: 100Gbps bidirectional non-blocking
- Hot-swappable modular design
  - Cross-connect unit (controller modules, XCU)
    - STM-1/4/16 (OC-3/12/48) aggregate lines
    - Software configurable
  - Tributary Modules
    - High-Speed/High Density (HS) modules (VC/VT XC)
    - Low-Speed (LS) modules (DS0 XC)
  - Power Modules (DC)
    - 48 Vdc, 500W
    - Dual Power (1+1) Protection
- Cross-connect Unit Protection Scheme
  - Dual controller for redundancy
  - MSP (1+1)
  - SNCP/UPSR Ring
- Protection Schemes
  - E1/T1: Card(1:1), Port (1:1), Line (1+1), DS0 SNCP (3E1/T1 card only)
  - E3/T3: Line (1+1)
  - XCU, B155/622, B2G5: MSP 1+1, SNCP/UPSR
  - Ethernet Card Protection
  - PTN10G Switch Fabric 1:1
  - MPLS tunnel LSP (1+1/1:1), switch time <50ms
- Ethernet Functions
  - Link Aggregation (Inter and Intra board)
  - External/Internal/Line timing source with SSM via SyncE, IEEE 1588, and TDM clocks
  - Ethernet over SDH/SONET supports GFP, LAPS, VCAT, LCAS and non-LCAS
  - Alarm suppression, masking and reports
- Circuit Emulation and Encapsulation for TDM data over Packet Switched Network (SAToP, CESoPSN, CEP)
- Management
  - Console port, VT100 menu-driven
  - SNMP, Telnet and SSH for remote management
  - In-band management channels
    - SDH/SONET DCC (XCU, B16, B2G5)
    - MPLS pseudowire (PTN10G)
    - DS0 timeslots (LS cards)
  - Centralized management with Loop's EMS/NMS
    - Loop-iNET GUI (EMS)
    - Loop-iNMS (NMS) with full FCAPS and end-to-end circuit management and diagnosis
  - Bridge mode or OSPF routing
- RoHS compliant

Description

The Loop-O9500R PTN/SDH/SONET/PDH IMAP (Integrated Multi-Services Access Platform) is an economical, all-in-one solution for integrating various types of signals and transportation over various types of networks within one enclosure. Its universal roles and modular design make it effortless to perform traffic grooming for both peripheral and core networks by providing access interfaces, multiplexing, cross-connection, gateways, and transportation channels.

For **access interfaces**, 10+ low-speed modules are designed to encapsulate industry specific signals into DS0 timeslots. These interfaces include Voice (e.g. FXS, FXO, E&M, and etc.), Digital (e.g. RS232, RS449, X.21, and etc.), Teleprotection (e.g. G.703, C37.94) and so on.

For **multiplexing and cross-connection**, O9500R provides non-blocking cross-connection of up to 672 DS0 timeslots, which equal to 21 E1 channels, to serve as a **MUX/DACS**, and VC-n/VT-n fabric for SDH/SONET non-blocking cross-connection to serve as an **ADM**.

For **transportation**, high-speed modules provide transportation channels such as 10Gb MPLS/Carrier Ethernet/IP switching and routing from PTN10G card, STM-1/4/16(OC-3/12/48) channels from Controller, B155/622, and B2G5 cards, Optical channels from 7-port FOM cards, E1/T1 channels from 63-port E1/T1 cards, and E3/T3 channels from 3-port E3/T3 cards.

For **gateways**, the signals from different interfaces can be freely encapsulated, cross-connected, and transported over a variety of transportation networks. For instance, E1/T1 and E3/T3 channels can be encapsulated into VT/VC paths and

transported over SDH/SONET. Modules such as TDMoE and 8GESW make it possible for TDM traffic to be transported over Ethernet (DS0 over Ethernet) and the other way around (Ethernet over SDH/SONET) via circuit emulation and virtual concatenation technologies. Using the PTN10G card, SDH/SONET and DS0 circuits can also be encapsulated for packet network transportation.

Multiple **protection schemes** are designed at different levels, including path-level SNCP/UPSR and section-level MSP (1+1) for SDH/SONET, circuit and line protection for access interfaces, DS0 SNCP/UPSR and ULSR for low-speed modules, MPLS-TP with two LSPs per tunnel, ELPS and ERPS, and 1+1 module redundancy for power, controller, and plug-in cards.

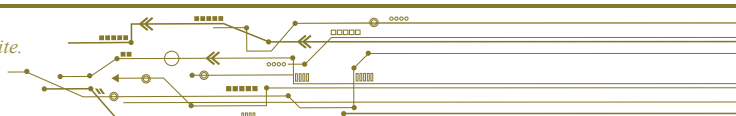
Performance and fault are also monitored to ensure service integrity. Operation, Administration, Maintenance and Provisioning (OAM&P). These functionalities are fully incorporated into the operation system. O9500R is fully compatible with Loop-iNET (EMS) and Loop-iNMS (Integrated NMS) to achieve centralized management for large scale networks.

O9500R (CCPA) Compatible Tributary Modules

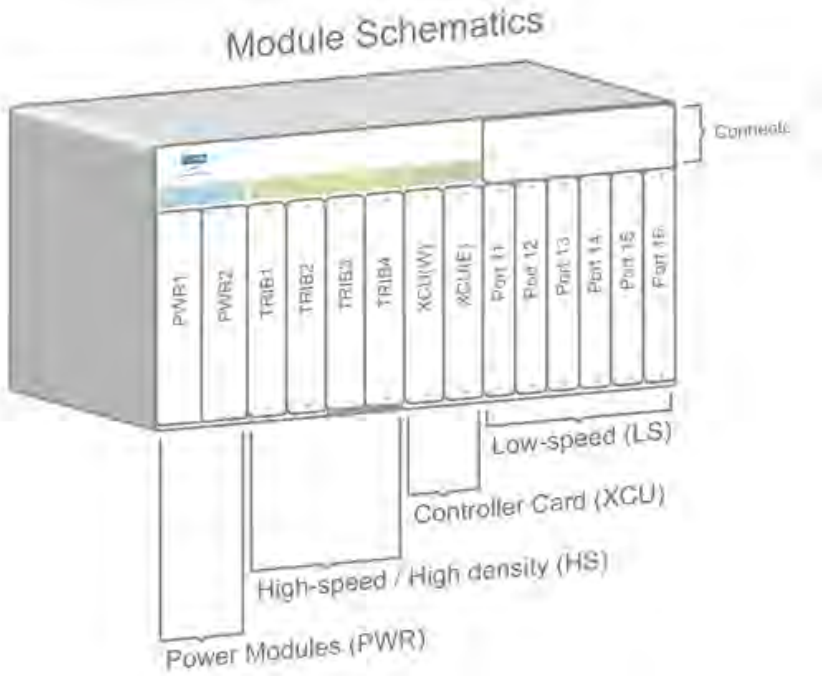
Plug-in cards with yellow background are high-speed cards using 622M backplane, and those with magenta background are high-speed cards using 2.5G backplane. Plug-in cards without background color are low-speed cards.

Type	Module	Description
High-speed/ High Density (HS)	PTN10G	3 x 10GbE + 8 x 1GbE PTN plug-in module
	PTNext	10 x 1GbE PTN plug-in module
	B155/622	2-channel STM-1 (OC-3) tributaries with or without MSP 1+1
		1-channel STM-4 (OC-12) tributaries with or without MSP 1+1
	B2G5	1-channel STM-16 (OC-48) tributaries with or without MSP 1+1
	E1/T1	63 port E1/T1 tributaries
		32 port E1/T1 tributaries
		16 port E1/T1 tributaries
	E1(75 ohm)	63 E1(75 ohm) plug-in card
		32 E1(75 ohm) plug-in card
		16 E1(75 ohm) plug-in card
	E3/T3	3 T3 or 3 E3 software programmable interface with M13/Mx3 function for T3 interface only
	8GESW	8 GbE Ethernet over SDH card with L2 switch (8GES4SWA/8GES16SWA)
Low-speed (LS) Single slot	RTB	8-port Bridge/Router
	4E1/4T1	4-channel E1/T1
	3E1/3T1*	3-channel E1/T1
	2GH	2-channel G.SHDSL (2 pairs) without line power
	4GH	4-channel G.SHDSL (1 pairs) without line power
	8CD	8-channel G.703 card at 64 Kbps data rate
	4C37	4 channel C37.94 (low-speed optical)
	8RS232	8-channel RS232/V.24
	8DC	8-channel Dry Contact I/O
	8DCB	8-channel Dry Contact I/O type B
	8E&MA	8-channel 2W/4W E&M
	12FXSA	12-channel FXS
	12FXOA	12-channel FXO
	12MAGA*	12-channel Magneto
	TDMoEA	4 GbE for TDM signal over Ethernet
	8DBRA	8-channel Data Bridge
	8UDTEA	8-channel DTE
	1FOMB	1 port FOM (1FOMB)
	OCUDPA	8-channel OCU/DP
	6UDTEA	6-channel DTE
Low-speed (LS) Dual slot	TTA	Four ports for DTT input and output.

*Future Option



Front Panel View of O9500R (CHPA with CCPA)



Tributary Module: Maximum Capacity without Protection

High-speed Module	Channel	TRIB 1	TRIB 2	TRIB 3	TRIB 4	System Max. channels
E1/T1	E1/T1	63	63	63	63	252
E3/T3	E3/T3	3	3	3	3	12
8GES4SWA	GbE	8	8	8	8	32
B155/622	STM-1	2	2	2	2	8
	STM-4	1	1	1	1	4
B2G5	STM-16	N/A	N/A	1	N/A	1
PTN10G	10GE	N/A	N/A	3	3	6
	1GE	N/A	N/A	8	8	16

Low-speed Module	Channel	Maximum Channels	
		TRIB 11~16 each	System
1FOMB	FOM	1	6
RTB	FE bridge and router	8	48
2/4 channel G.SHDSL	G.SHDSL	2/4	12/24
4E1/T1	E1/T1	4E1/4T1	21E1/28T1
3E1/T1*	E1/T1	3	18
8CD	G.703	8	48
4C37	C37.94	4	24
8DC	Dry Contact	8	48
8DCB	Dry Contact	8	48
8RS232	RS232	8	48
12FXSA	FXS	12	72
12FXOA	FXO	12	72
12MAGA*	Magneto	12	72
8E&MA	E&M	8	48
TDMoEA	TDMoE	4	24
8DBRA	RS232	8	48
8UDTEA	RS232/RS422/RS449	8	48
OCUDPA	OCU/DP	8	48
6UDTEA	RS232/X.21/V.35/V.36/EIA530	6	36

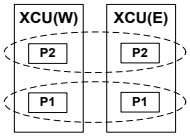
Tributary Module: SDH/SONET Channel and Protection

HS Module	Channel	TRIB 1	TRIB 2	TRIB 3	TRIB 4
B155/622	STM-1	2	2	2	2
	STM-1 MSP (1+1)	2		2	
	STM-4	1	1	1	1
	STM-4 MSP (1+1)	1		1	
B2G5	STM-16	N/A	N/A	1	N/A
	STM-16 MSP (1+1)	N/A	N/A	1	N/A
		N/A	N/A	1	

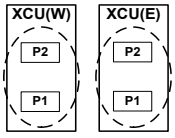
Controller Card: SDH/SONET Channel and Protection

Channel	XCU 1	XCU 2	System
STM-1/4/16	2	2	4
	1 MSP (1+1)	1 MSP (1+1)	2
	2 MSP (1+1)		2

Note 1 STM-16 (OC-48) is not available on O9500-R-CCPA-S4 unless activated by a premium license.
Note 2 MSP (1+1) chains on XCU (W) and XCU (E) can be paired as follows:



Card-level protection (horizontal):
XCU(W) port 1 and XCU(E) port 1
XCU(W) port 2 and XCU(E) port 2



Port-level protection (vertical):
XCU(W) port 1 and XCU(W) port 2
XCU(E) port 1 and XCU(E) port 2

Tributary Module: Non-SDH/SONET High-speed Channel and Protection

HS Module	Channel	Protection	Number of channels			
			TRIB 1	TRIB 2	TRIB 3	TRIB 4
16/32/63TE	E1/T1	X	16/32/63	16/32/63	16/32/63	16/32/63
		O	16/32/63	**(B)**	16/32/63	**(B)**
3TE	E3/T3	X	3 E3	3 E3	3 E3	3 E3
		O	3 E3	**(B)**	3 E3	**(B)**
8GES4SWA	Ethernet 10/100/1000BT	X	8 ports	8 ports	8 ports	8 ports
		O	8 ports	**(B)**	8 ports	**(B)**
PTN10G	switch	O	N/A	N/A	1	**(B)**
	10GbE	X	N/A	N/A	3	3
	1GbE	X	N/A	N/A	8	8
PTNext Note 2	1GbE	X	10	10	N/A	N/A
	10GbE	X	1	1	N/A	N/A
		O	7 optical ports	**(B)**	7 optical ports	(B)

(B) signifies backup/protection

Note 1: Protection Group on O9500R shall always be neighboring Tributary cards. Two cards of the identical model shall be mounted on TRIB 1 & 2 or TRIB 3 & 4 to form a protection group. TRIB 1 and TRIB 3 serve as the primary cards while TRIB 2 and TRIB 4 serve for protection.

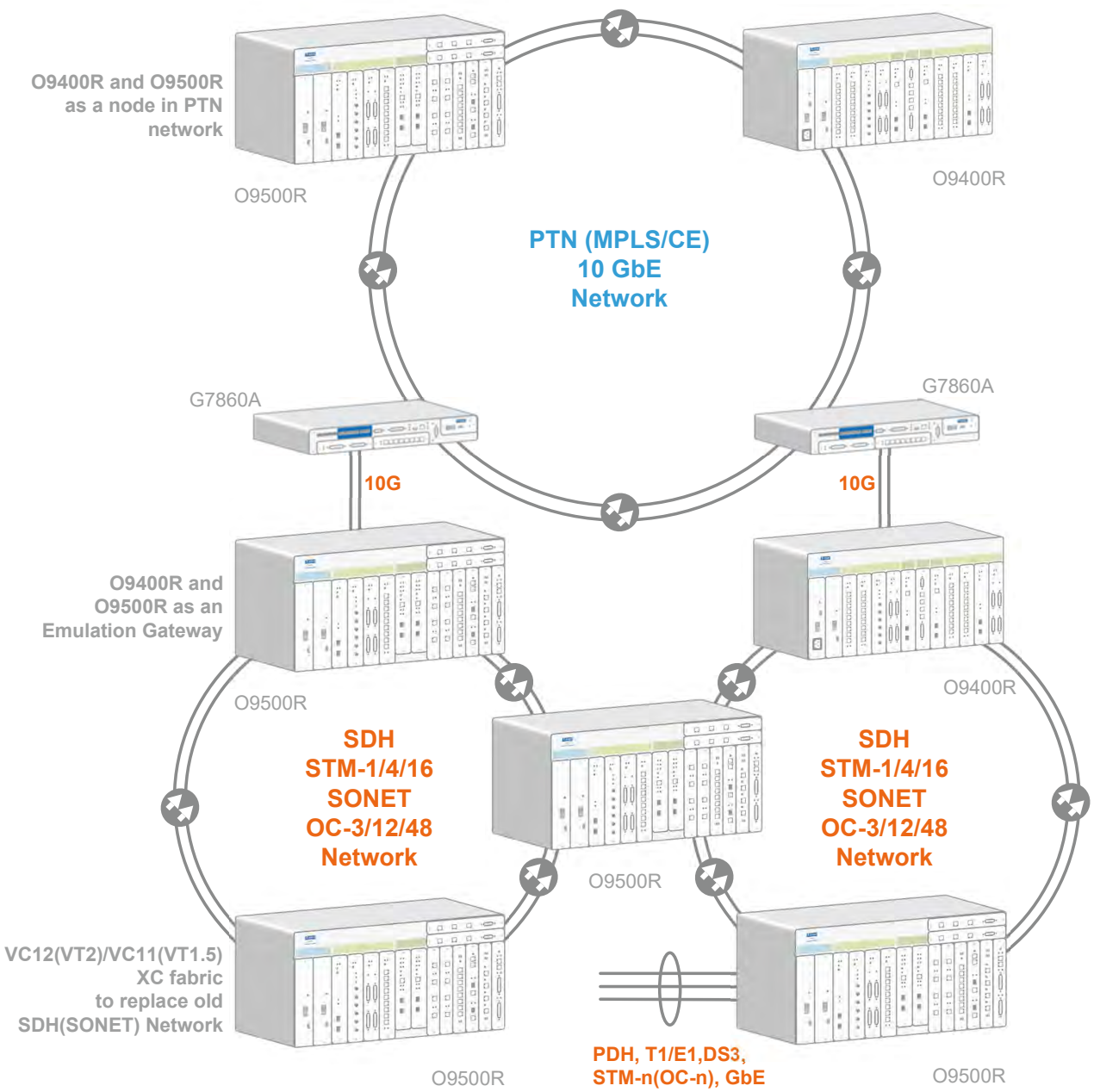
Note 2: The 1GbE ports and the 10GbE port are mutually exclusive.

*Future Option

Application Illustration

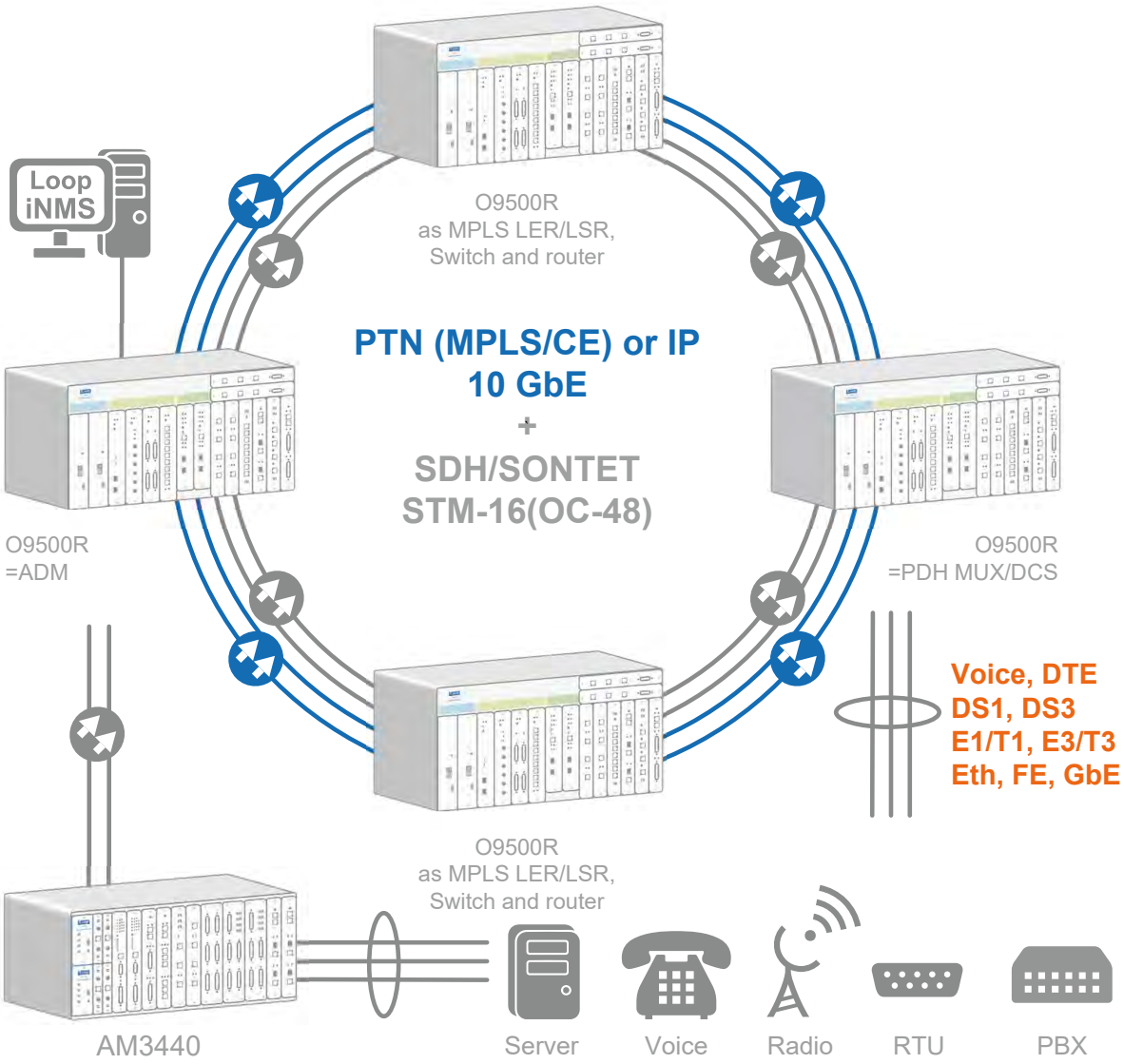
PTN and SDH/SONET Ring Application

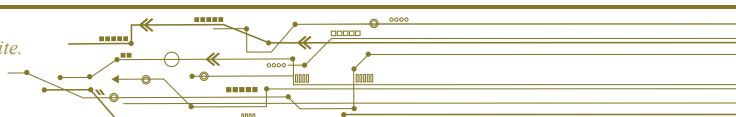
O9500R acts as a node in a PTN 10G Network ring or as an Emulation Gateway to merge SDH/SONET traffic onto PTN (MPLS/CE) stream. Distinct from O9400R, O9500R is also capable of cross-connecting PDH and SDH/SONET traffic within the same enclosure, acting as both a Terminal Multiplexer (TM) and a Cross-connect system (DACS).



Dual Ring and Triple Role

One O9500R can be simultaneously connected to PTN and SDH/SONET backbone rings. PTN10G module and STM-16(OC-48) interface can be simultaneously mounted in O9500R and form a dual ring (PTN and SDH/SONET rings). The roles of an O9500R can be a deluxe combination of an SDH/SONET ADM, a PTN MPLS Label Edge Router (LER), and a PDH Multiplexer.





10 Wavelength Division Multiplexer

WDM1800 Wavelength Division Multiplexing Multi-Service Platform 252

WDM1800

Wavelength Division Multiplexing Multi-Service Platform

Features

- Full frontal access (ETSI) Shelf
- Two rack-mountable chassis types:
  - CHAa (5U): *
    - 2 x Controller Slots
    - 2 x Power Module Slots
    - 1 x FAN Module Slot
    - 15 x Tributary Module Slots
  - CHBa (2U):
    - 2 x Controller Slots
    - 2 x Power Module Slots
    - 1 x FAN Module Slot
    - 6 x Tributary Module Slots
- Dual controller modules, dual power modules for redundancy
- Support console (RS232/USB) and Ethernet (RJ45/SFP) for local and remote management
- Support Web, Telnet, SSH, and SNMP v1/v3 management
- Compatible with SNMP-based GUI network management systems and supported by LoopiNET and Loop iNMS
- Plug-in Module Types (all are hot-pluggable)
  - Transponder Modules
  - Muxponder Modules*
  - Wavelength Division Multiplexing (Mux/Demux) Modules
  - Optical Link Protection Modules
  - Amplifier Modules
  - Dispersion Compensation Modules (DCM)*
- Hardened - Extended temperature range: -5 ~ + 65°C

WDM1800-CHAa (5U)

WDM1800-CHBa (2U)

* Future option

Description

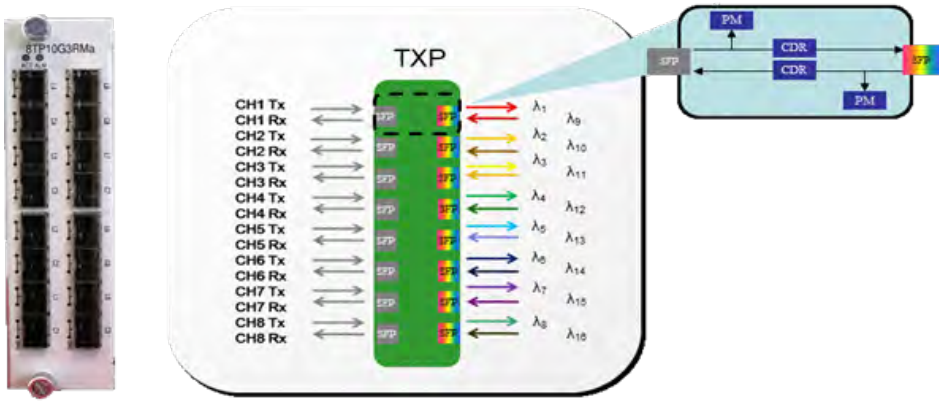
The Loop-WDM1800 Wavelength Division Multiplexing Multi-Service Platform is designed to deliver a number of client data services by multiplexing/demultiplexing several different wavelengths into/from an optical fiber. The WDM1800 platform provides up to 15 universal plug-in slots for mounting different modules, including Transponder, Muxponder, WDM Mux/Demux filters, Optical Link Protection (OLP) modules and amplifier modules. Compact, modular and cost – effective design of the WDM1800 platform makes it easier to select suitable modules for current needs and upgradable for future requirements. With two shelf sizes and universal pluggable slots, an initial network can be deployed with low first-in cost. Future in-service network expansion is as simple as adding and configuring new modules to realize cost-effective and pay-as-you-grow advantages.

In-service passive performance monitoring on each client data and modular redundancy, enabled when dual controller modules and dual power modules are installed in the chassis, make the WDM1800 an excellent fit for mission critical applications.

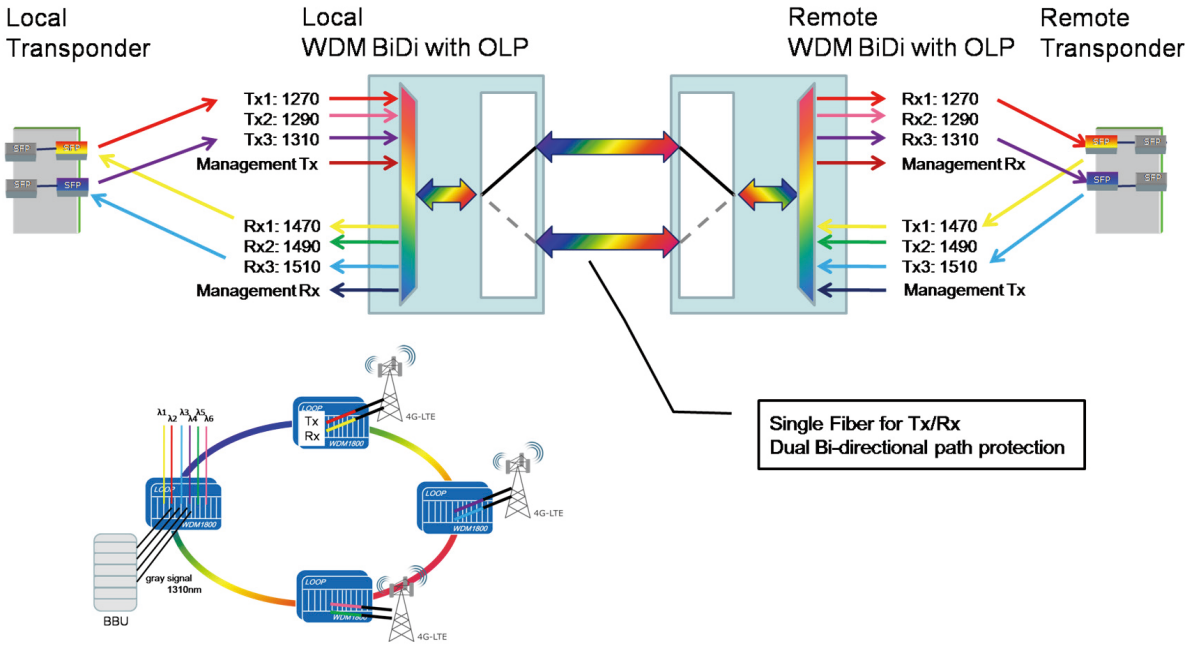
The WDM1800 supports local control and diagnostics by using a VT-100 terminal connected to the console port, and Ethernet and SFP ports for Web, Telnet, SSH, and SNMP v1/v3 management as well. Furthermore, optional Optical Supervisory Channel (OSC) can be accessed via Transponder and/or Muxponder moduleconnection for remote management.

Application Illustration

Transponder

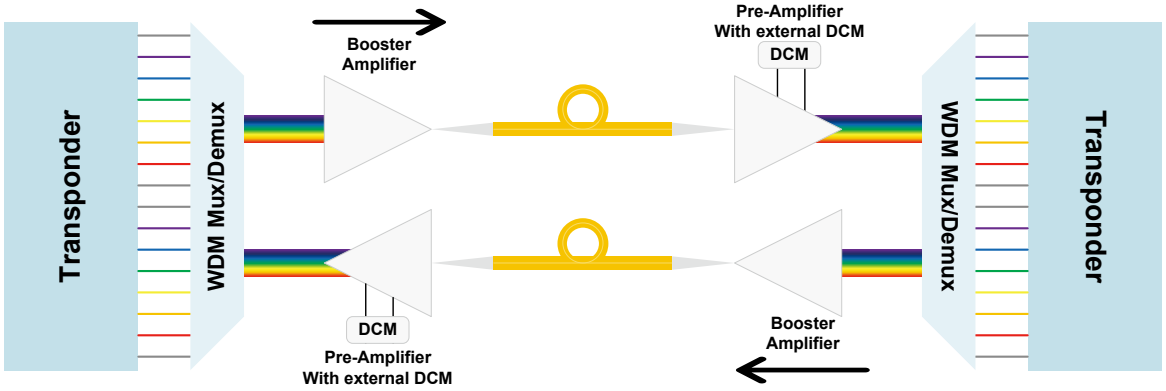


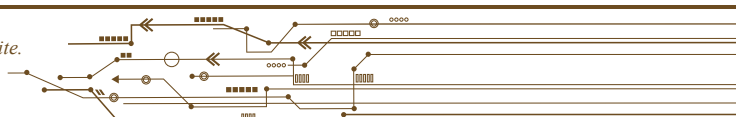
WDM modules with OLP

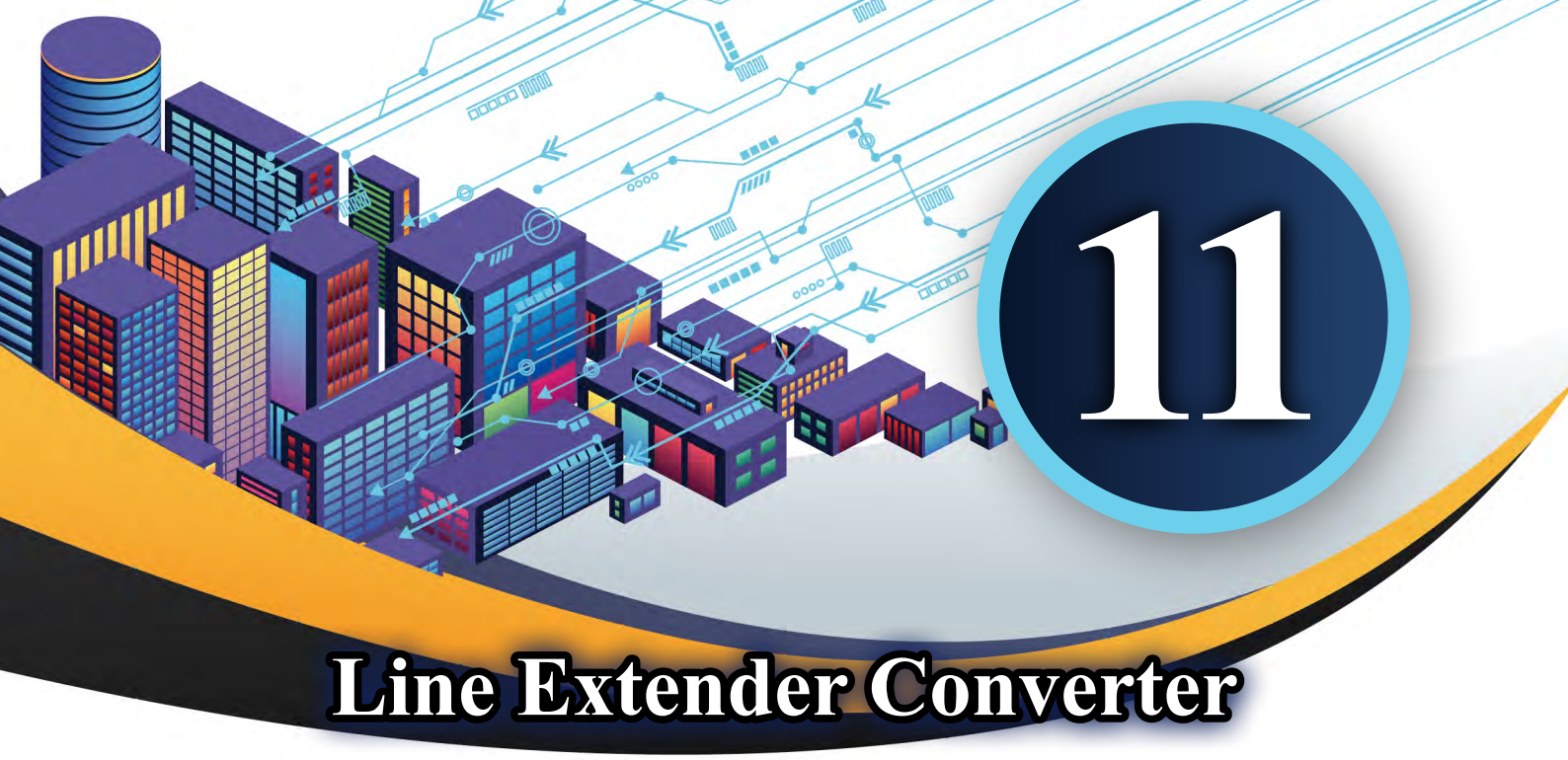


Booster Amplifer and Pre-Amplifer EDFA

Booster Amplifier and Pre-Amplifier EDFA: Depending on the link budge (i.e. optical transceiver type, fiber type, reach distance and etc), none, one or both of these amplifiers may be required. External Dispersion Compensation Module (DCM) may or may not be required as well.







11

Line Extender Converter

G.SHDSL

Loop-H3300-3S Series G.SHDSL Standalone 256

Loop-H3304RA High Density G.SHDSL.bis Rack Card 257

Loop-H3310-S G.SHDSL Standalone 259

E1 CSU DSU

Loop-E1500-2S CSU/DSU Series Standalone 262

T1 CSU DSU

Loop-T2500 FT1 CSU/DSU Series Standalone 265

Integral Access Shelf

Loop-C5600 Multi-Services Shelf 267

Loop-H3300-3S Series G.SHDSL Standalone

Features

- 1-pair/2-pair/1+1 G.SHDSL mode selectable
- 1 pair G.SHDSL.bis
- Dying Gasp report function on 2-pair G.SHDSL Mode (manufacturing option)
- STU-C(master) or STU-R(slave) mode selectable
- E1 (120 ohm) /T1 software configurable
- Supports router or bridge mode
- Built in self-test, loopback and QRSS functions interface hybrid co-existence in one chassis
- Local/remote management through console port, LAN, or WAN
- Log-in and password security protection
- VT100 firmware download
- Supports configuration upload/download
- SNMP and Telnet are supported
- Multi-color LED indicators
- Optional front panel keys and 2-line by 16-character LCD display
- Standard compliance:
  - G.SHDSL: ITU-T G.991.2 Annex A,B
  - G.SHDSL.bis: ITU-T G.991.2 Annex F

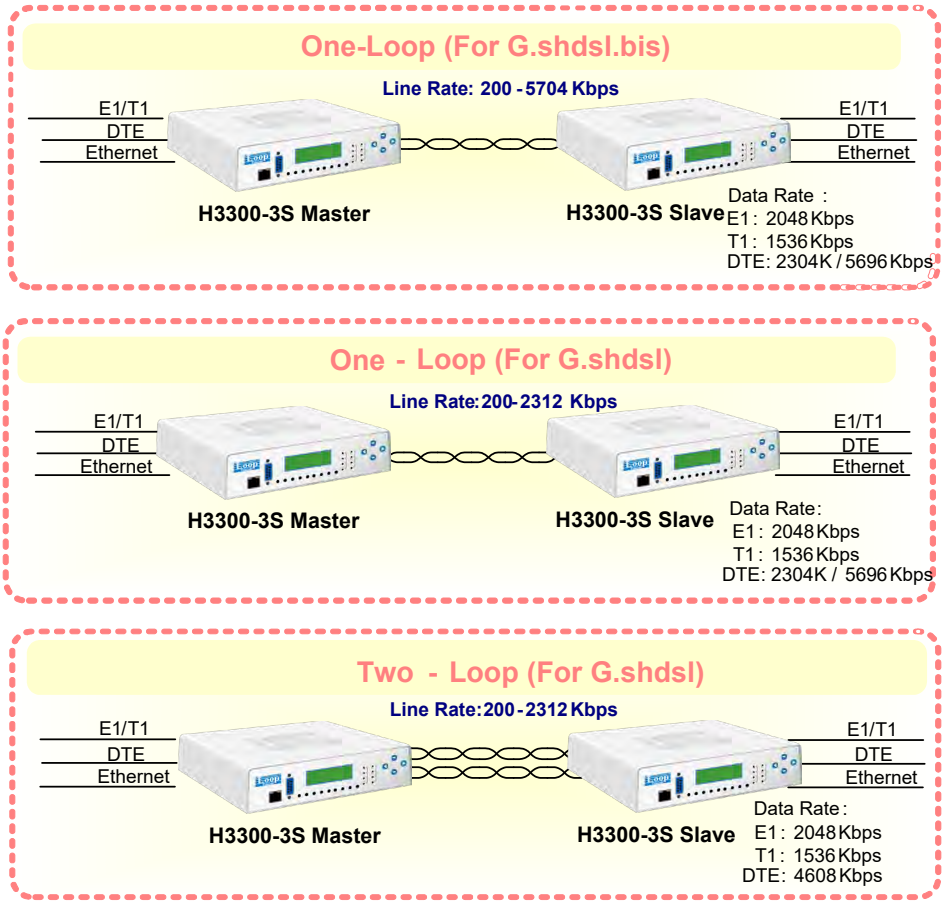
Description

The Loop-H3300-3S is part of the H3300 family of CPE products based on the G.SHDSL transmission standard. It uses the standard 16/32-TCPAM line format over twisted copper pairs to provide digital transport for a variety of data formats and data rates.

The distances that this technology can span without repeaters are dependent on the data rate. The Loop-H3300-3S provides high speed transport for a T1/E1 link plus an additional Ethernet bridge, V.35 data transport over one (1) or two (2) twisted copper pairs.

The H3300-3S works as a pair (master and slave unit) or as a slave unit to the one of the three master units: AM3440's G.SHDSL card, H3300 rack and H3300-3S standalone. The master unit is usually a rack-mounted model located in the central office. The slave unit is usually a standalone model located at the customer's premises.

Application Illustrations



Loop-H3304RA High Density G.SHDSL.bis Rack Card

Features

- Hot pluggable interface card for C5600 shelf
- Ethernet and E1 over SHDSL application
- WAN port
  - 4-port G.SHDSL/G.SHDSL.bis
    - Up to four 1-pair G.SHDSL or G.SHDSL.bis
    - Up to two 2-pair G.SHDSL or G.SHDSL.bis
    - Up to two G.SHDSL/G.SHDSL.bis 1+1 protection
  - Line rate
    - For 1-pair and 2-pair G.SHDSL, the maximum line rate per pair is 2.312M bps
    - For 1-pair and 2-pair G.SHDSL.bis, the maximum line rate is 5.704M bps
  - Sealing current (optional)
  - Using 16/32-TCPAM
  - STU-C (master) mode
  - Supports auto-adaptive rate
- Tributary port
  - Two 10/100M fast Ethernet
    - VLAN (IEEE 802.1Q, 802.1p, 802.1ad (Q-in-Q))
    - QoS
    - RSTP (IEEE 802.1d/802.1w)
    - Supports E-Line dedicated connection between LAN1-WAN1 and LAN2-WAN2
  - 4 E1 ports (optional)
- For C5600 shelf with one controller card:
  - Up to 14 (2Ethernet + 4E1) and 1 (2Ethernet only) H3304RA cards
- Diagnostics: Loopback and BERT test pattern
- Firmware download
- Configuration upload and download
- Standards compliance:
  - ITU-T G.991.2 (G.SHDSL Annex A and B for 1-pair/2-pair), (G.SHDSL.bis Annex F for 1-pair/2-pair)
- ITU-T G.994.1

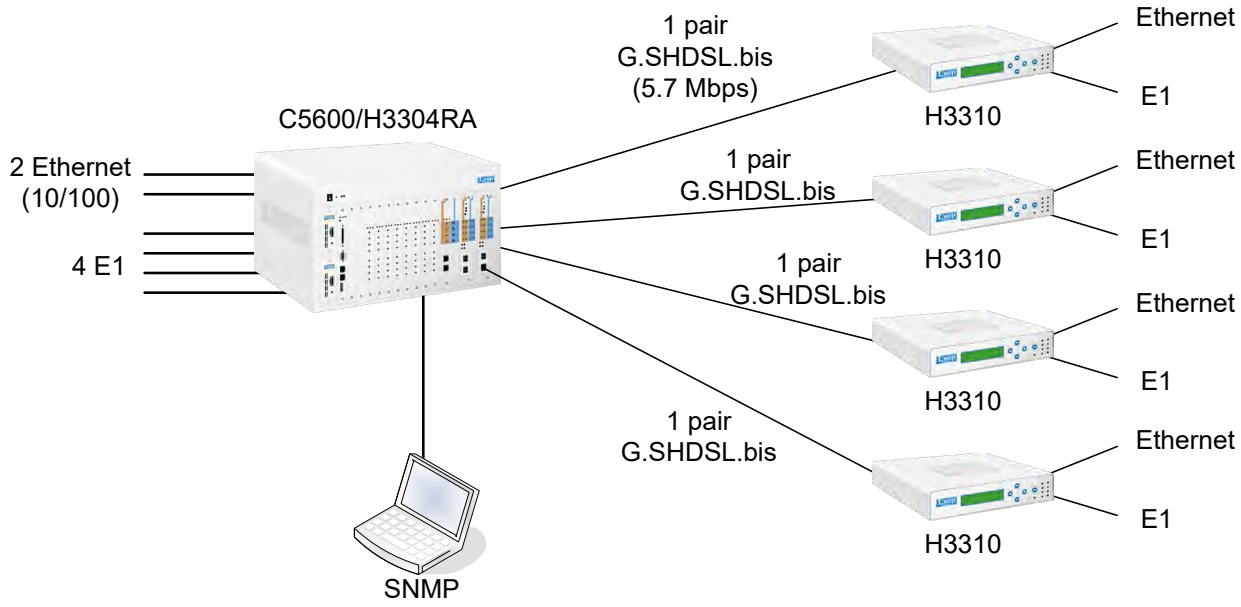
Description

The Loop-H3304RA G.SHDSL.bis plug-in card provides high-speed digital transport over wire pairs by using 16-TCPAM, 32-TCPAM technology for Ethernet and E1 point to point and point to multipoint applications. H3304RA supports 2 fast Ethernet ports on the main card and optional 4 E1 ports over 1-pair/2-pair DSL. A choice of line rates is available with the lower line rates applicable to the longer reaches. The distance that this technology can span without repeaters is dependent on the data rate. The H3304RA plug-in card can work with the H3310 remote unit.

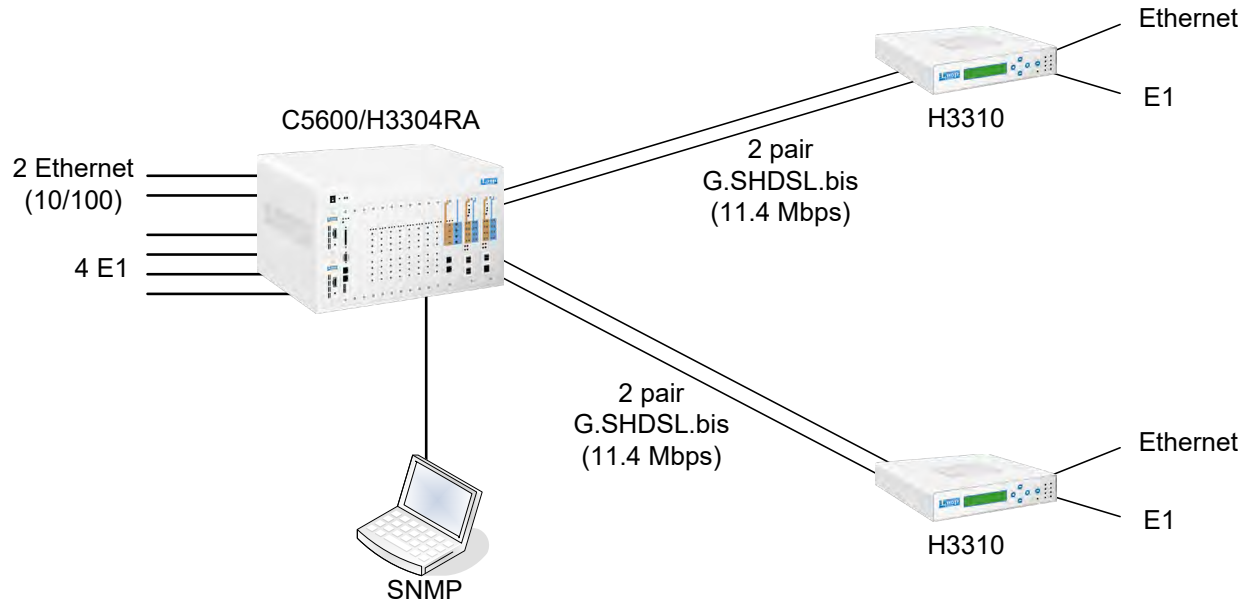
For WAN ports, the H3304RA has four G.SHDSL/G.SHDSL.bis lines which can be grouped into different combinations. For example, combinations can be 4 ports of 1-pair line, or 2 ports of the 2-pair line, or 1+1 protection. For tributary ports, the H3340RA provides 2 fast Ethernet ports and optional 4-port E1 tributary cards.

The rack card is intended to be plugged into the Loop-C5600 multi-services shelf for use in central offices. The H3304RA supports configuration, diagnostics, and fault isolation by using a local terminal, remote Telnet or SNMP management via the controller of the C5600 shelf.

Application Illustration



Ethernet and E1 Share 1-pair G.SHDSL.bis (5.7 Mbps)



Ethernet and E1 Share 2-pair G.SHDSL.bis (11.4 Mbps)

Loop-H3310-S G.SHDSL Standalone

Features

- Point to point application
- WAN port
  - 1-pair/2-pair/1+1 G.SHDSL mode selectable
  - 1 pair G.SHDSL.bis
  - 1-pair/2-pair G.SHDSL.bis with hardware bridge option only
  - STU-C (master) or STU-R (slave) mode selectable
- Tributary port
  - Supports up to 2-pair G.SHDSL
    - One E1 port
    - One V.35 DTE port
    - One X.21 DTE port
    - One E1 and two Ethernet ports (Router/SNMP Mode)
    - One E1 and two Ethernet ports (Bridge/SNMP Mode)
    - Two Ethernet ports (Bridge/SNMP Mode)
    - Two Ethernet ports (Router/SNMP Mode)
  - Supports up to 1-pair G.SHDSL.bis
    - One E1 port
    - One V.35 DTE port
    - One X.21 DTE port
    - One E1 and two Ethernet ports (Router/SNMP Mode)
    - One E1 and two Ethernet ports (Bridge/SNMP Mode)
    - Two Ethernet ports (Bridge/SNMP Mode)
    - Two Ethernet ports (Router/SNMP Mode)
  - Supports up to 2-pair G.SHDSL.bis
    - One E1 and two Ethernet ports (hardware Bridge/SNMP Mode) with QoS function
    - Two Ethernet ports (hardware Bridge/SNMP Mode) with QoS function
- Power:
  - Fixed AC (100 to 240 Vac)
  - Fixed DC (-48 Vdc, -42 to -72 Vdc)
  - Fixed AC (100 to 240 Vac) and DC (-48 Vdc, -42 to -72 Vdc)
- Local and remote firmware download
- Local configuration upload/download
- Multi-color LED indicators
- Local/remote management through console port, LAN, or WAN
- Management port and interface
  - LCD and keypad (optional)
  - Console port with VT-100 menu
  - SNMP
    - Embedded SNMP
    - Telnet
- Standards compliance
  - ITU-T G.991.2 (G.SHDSL Annex A, B) and G.994.1
  - ITU-T G.991.2 (G.SHDSL.bis Annex F) and G.994.1

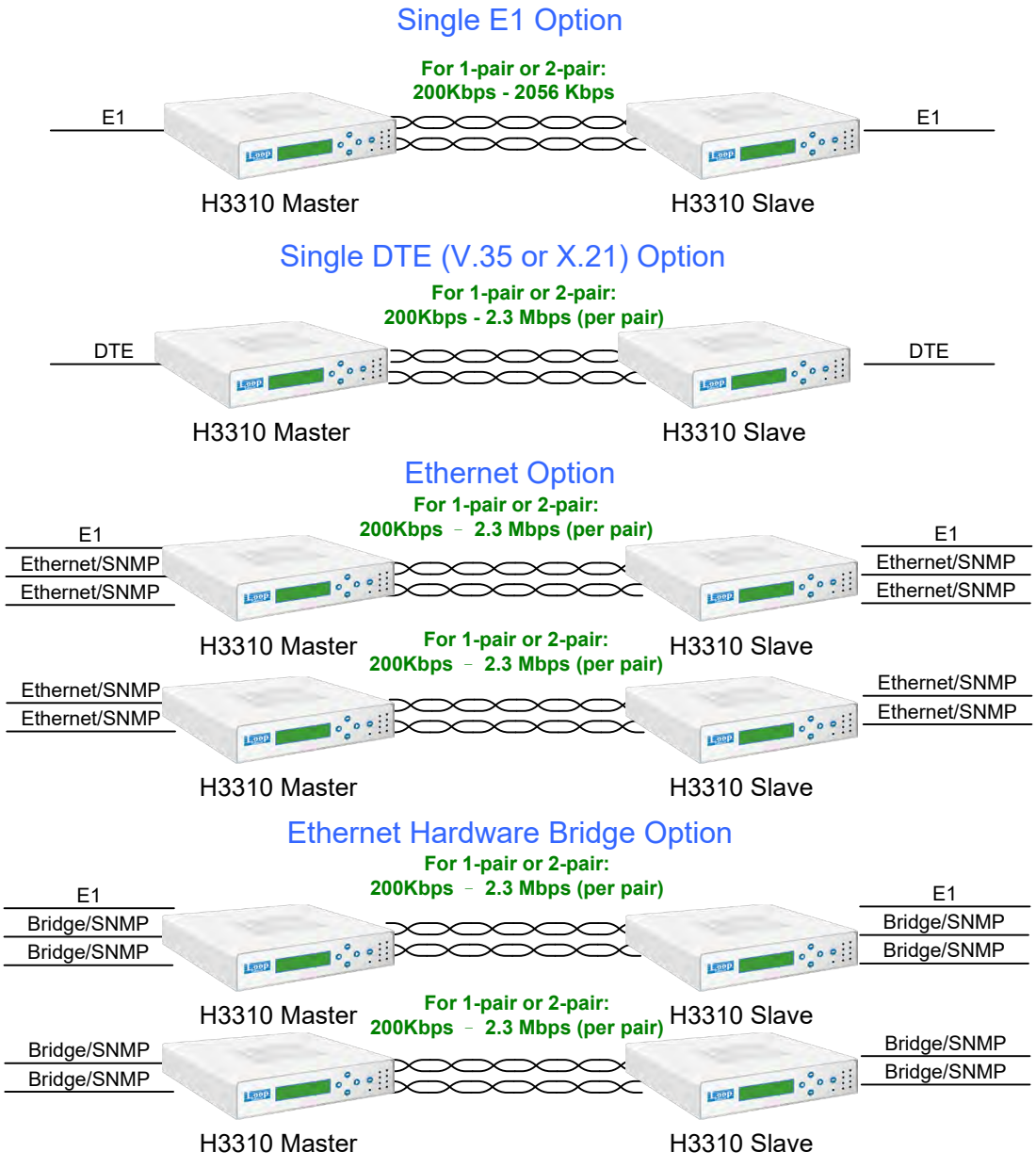
Description

The Loop-H3310-S provides high-speed digital transport over a single copper pair using standard 16 TCPAM/32 TCPAM technology. Versatility of this series comes from a choice of digital interfaces and a choice of line rates, with the lower line rates applicable to longer reaches.

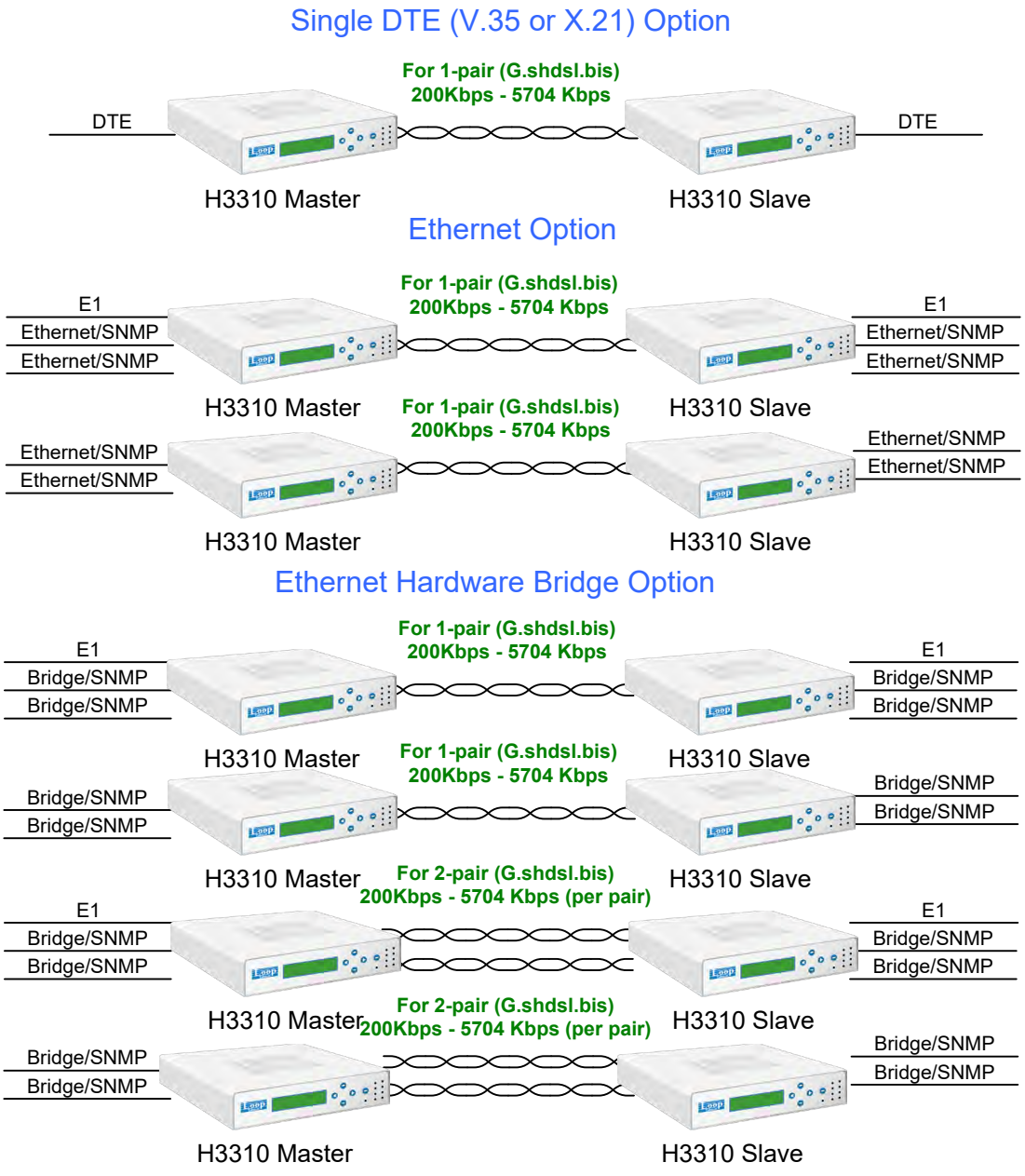
This standalone version is intended for customer premises installation only. The H3310-S provides a high-speed data link with DTE interfaces: E1, V.35, E1 plus 2 Ethernets (Bridge or Router mode), 2 Ethernets (Bridge or Router mode). With the hardware bridge option, the H3310 supports up to 2-pair G.SHDSL.bis with QoS. The H3310-S supports configuration and diagnostics from a local or remote terminal. This allows execution of in-service diagnostics and fault isolation.

Application Illustrations

G.SHDSL Solution



G.SHDSL.bis Solution



Loop-E1500-2S CSU/DSU Series Standalone

Features

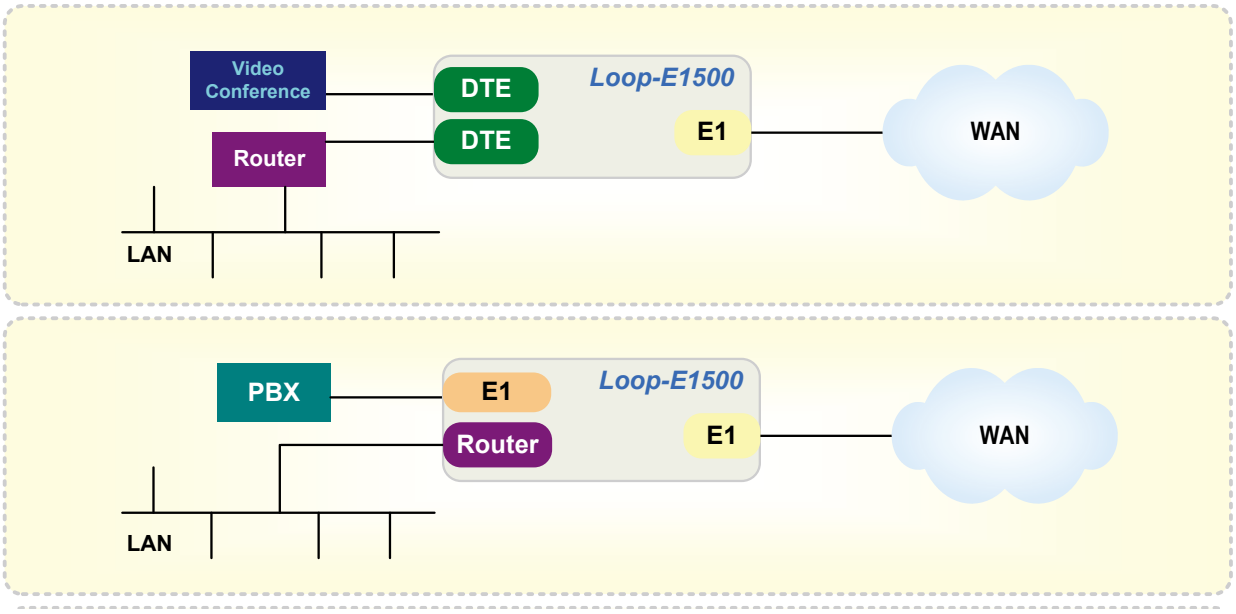
- DSU functionality integrated with an intelligent CSU in a compact package
- Supports up to 2 customer equipment interfaces including E1 ICSU, serial DTE, router, and Alarm Input
- Up to 31 WAN ports with aggregate data rate of 2.048 Mbps
- Supports SNMP Network Management Systems
- Supports In-band Management
- Connects to LAN/WAN, CAD/CAM, or Hosts to E1 Network Services
- Local control and diagnostic via RS232 port or 2-line by 16-character LCD & keypad
- Router - 10/100 BaseT auto selection
- Multicolor LED indicators

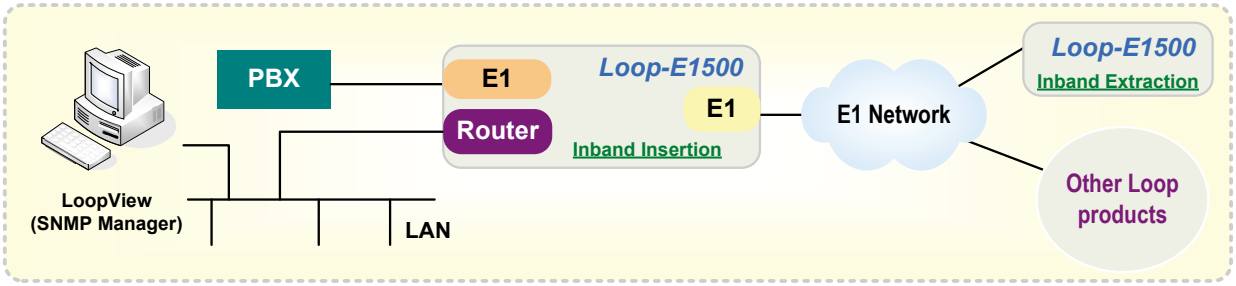
Description

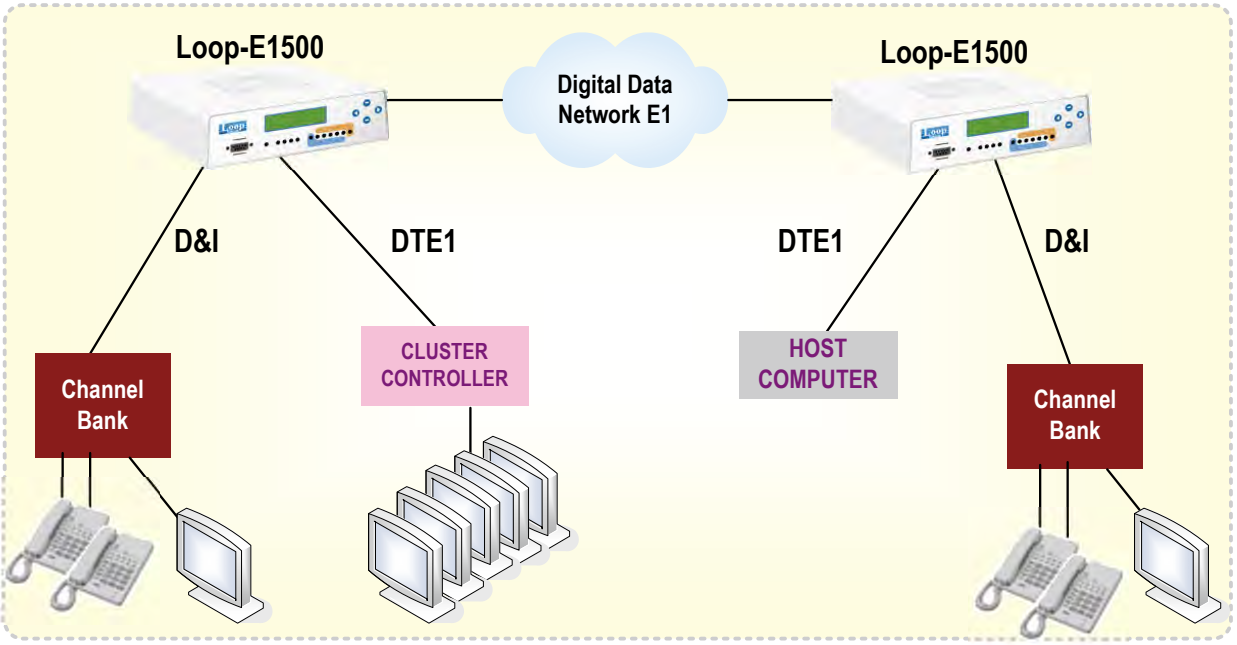
Loop Telecom's Loop-E1500 CSU/DSU product series provide an economic solution to E1 network access when not all 31 DS0 channels are needed. Clear channel (32 DS0 channels) is also available. This product series support High Density Bipolar 3 (HDB3) coding and provide continuous error checking, performance polling, and in-service diagnostics. Customer equipment interfaces include E1 ICSU, serial DTE, Alarm Input, and routers. With a DTE port operating from 56 Kbps to 2048 Kbps, Loop-E1500 CSU/DSU allows users to interconnect LANs and WANs, CAD and CAM, video conference, mainframe hosts, and more. With a router interface, users can connect LAN to WAN directly without an additional bridge/router.

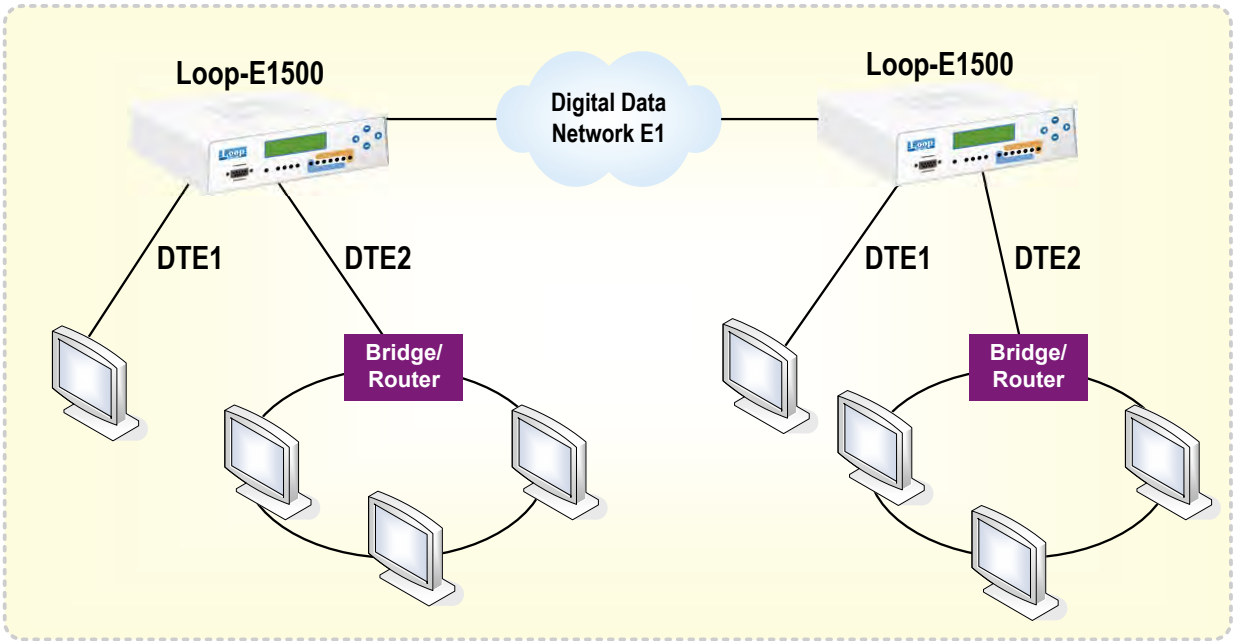
The Loop-E1500 CSU/DSU series supports local control and diagnostics using a 2-line by 16-character LCD display / keypads or through a RS232 console port. This allows users to execute in-service diagnostics and fault isolation. An in-band management channel with GUI is available. The Loop-E1500 CSU/ DSU also provides multicolor LED indicators on the front panel. Using SNMP network management and a Telnet connection, users can remotely control and diagnose Loop-E products from anywhere.

Application Illustrations

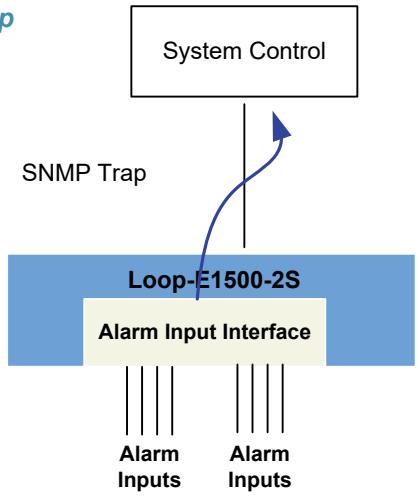



PBX
E1
Router
Loop-E1500
E1
Inband Insertion
E1 Network
Loop-E1500
Inband Extraction
Other Loop products
LoopView
(SNMP Manager)
LAN

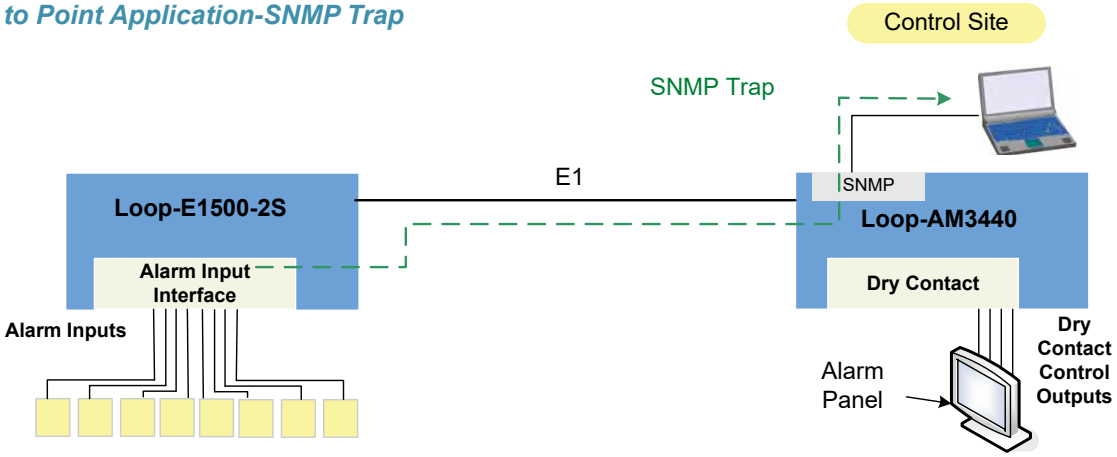

Loop-E1500
Digital Data
Network E1
Loop-E1500
D&I
DTE1
DTE1
D&I
Channel
Bank
CLUSTER
CONTROLLER
HOST
COMPUTER
Channel
Bank


Loop-E1500
Digital Data
Network E1
Loop-E1500
DTE1
DTE2
DTE1
DTE2
Bridge/
Router
Bridge/
Router

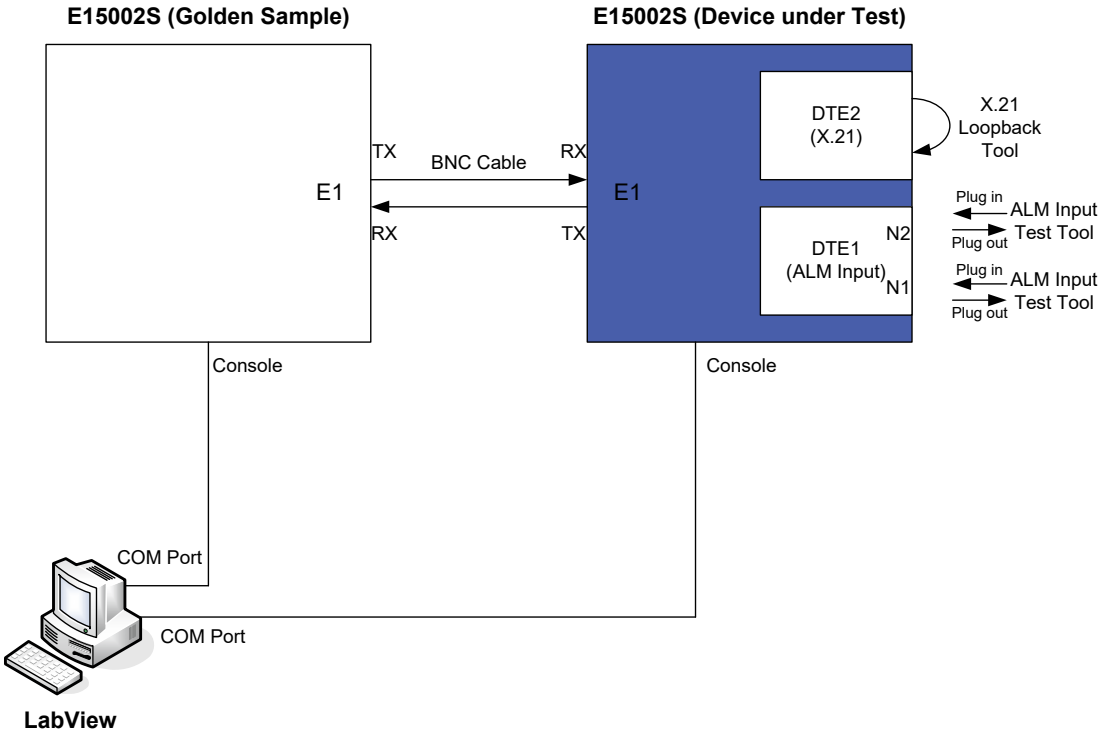
Alarm Input Application-SNMP Trap



Point to Point Application-SNMP Trap



Test Station Application Illustrations



Loop-T2500 FT1 CSU/DSU Series Standalone

Features

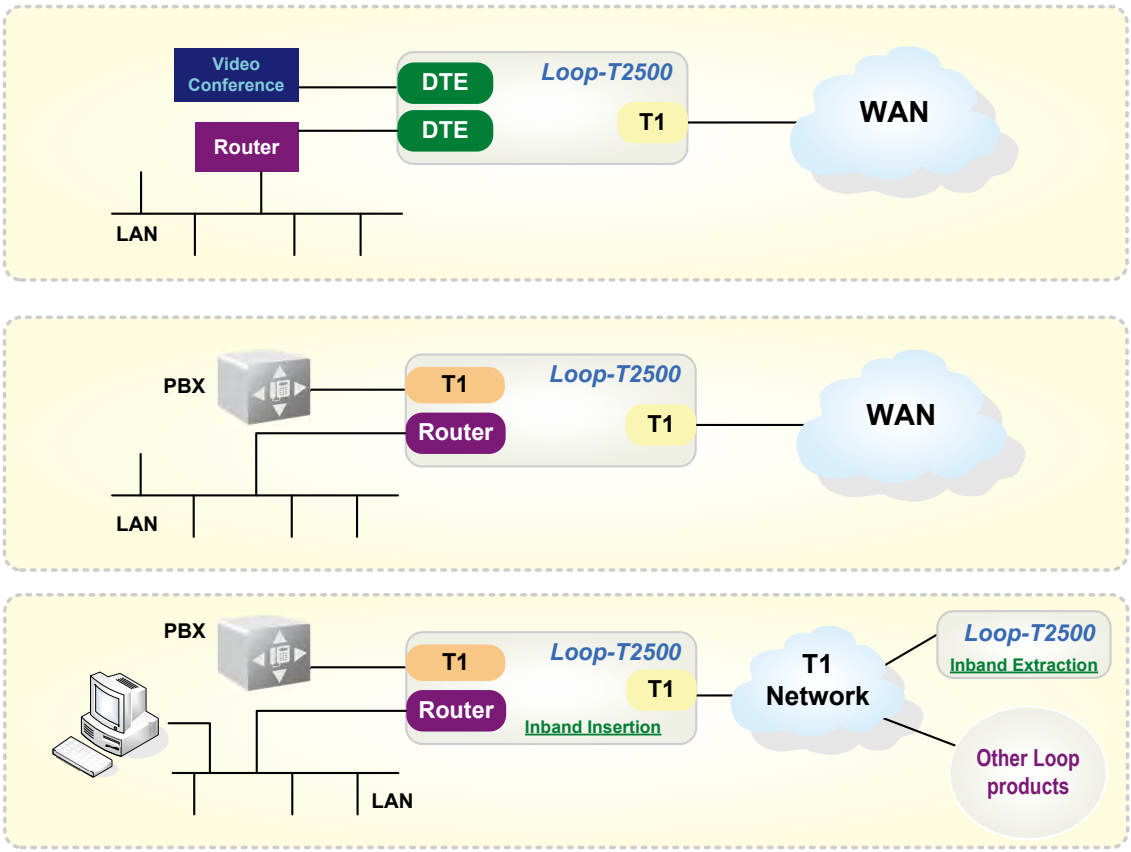
- DSU functionality integrated with an intelligent CSU in a compact package
- Customer equipment interfaces include T1, DTE, and Router
- SNMP network management or terminal console port
- Supports In-band Management
- A GUI management system with Windows based available
- Connection to LAN/WAN, CAD/CAM, or Hosts to T1 Network Services
- Optional advanced jitter performance
- One 2-line by 16-character LCD display

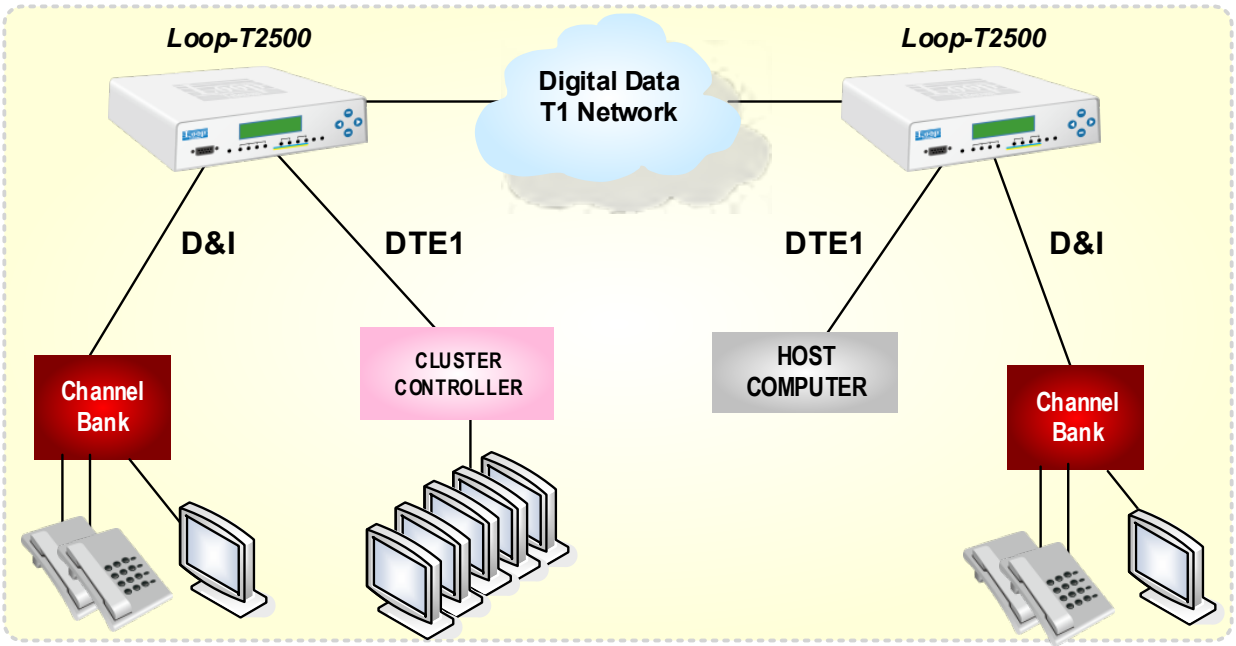
Description

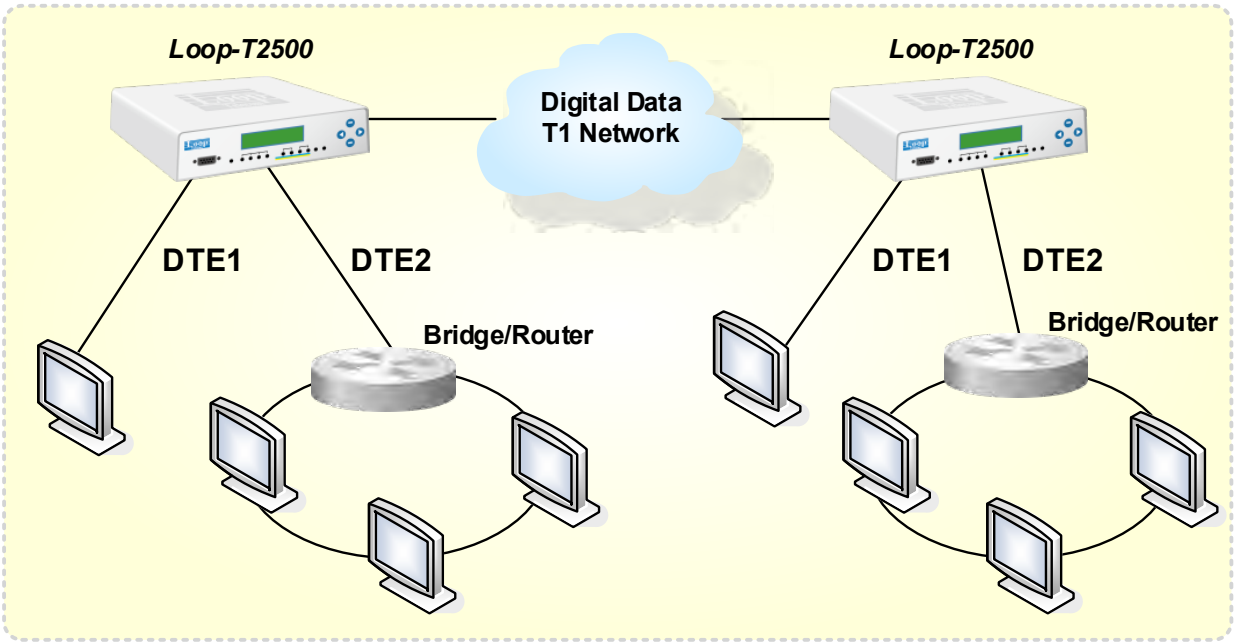
Loop Telecom's Loop-T2500 FT1 CSU/DSU series provides an economic solution to T1 network access cost when only a partial of 24 DS0 channels is needed. This product series support Extended Super frame Format (ESF) which makes possible continuous error checking, performance polling, and in-service diagnostics. Customer equipment interfaces include T1, series DTE, and Router. With a DTE port operating from 56 to 1536 Kbps, Loop-T2500 FT1 CSU/DSU allows users to interconnect LANs and WANs, CAD and CAM, video conference, mainframe hosts, and others.

Loop-T2500 FT1 CSU/DSU series supports local control and diagnostics using 2-line by 16-character LCD display and keypads or RS232 console port. This allows users to execute in-service diagnostics and fault isolation. The multicolor LEDs on the front panel provide both line side and DTE side with status indicators. An in-band management channel with GUI is available. Using SNMP Network Management Systems or Telnet connection, users can remotely control and diagnose Loop-T products from anywhere. A GUI Windows based SNMP manager, LoopView, is available.

Application Illustrations




Loop-T2500
Digital Data
T1 Network
Loop-T2500
D&I
DTE1
DTE1
D&I
Channel
Bank
CLUSTER
CONTROLLER
HOST
COMPUTER
Channel
Bank


Loop-T2500
Digital Data
T1 Network
Loop-T2500
DTE1
DTE2
DTE1
DTE2
Bridge/Router
Bridge/Router

Loop-C5600 Multi-Services Shelf

C5600 5U chassis

C5600 6U chassis

Features

- Front and back access (ANSI) unit with optional fan tray and LCD
- Supports dual controller cards*
- Number of plug-in line cards
  - Single controller with 15 slots for plug-in line cards
  - Each line card is fully independent
- Accepts rack card of type:
  - Loop-H3308R Ethernet over Bonded G.SHDSL.bis
  - Loop-H3304R High Density G.SHDSL
  - Loop-H3304RA High Density G.SHDSL.bis
- Power modules
  - Hot-swappable DC plug-in modules (-48 Vdc: -36 to -75 Vdc), dual for redundancy
- Alarm relay
- Log in and password security protection
- Firmware download
- Configuration upload/download
- Management port and interface
  - RS232 console port with VT-100 menu
  - Two 10/100M fast Ethernet SNMP ports
  - SNMP v1 with 5 trap IP
  - Telnet with Secure Shell (SSH) protocol
  - Access Control List (ACL)
- RoHS compliant

Description

The Loop-C5600 is a high density multi-services shelf designed to accept a mix of Loop series rack cards. These include the Loop-H3308R, Loop-H3304R, and Loop-H3304RA. The C5600 provides one common controller to manage up to 15 plug-in cards and a dual controller* to manage up to 14 plug-in cards.

- For 1 controller card C5600 chassis
  - 15 single slot H3308R (2/4-pair G.SHDSL.bis)
  - 7 dual slot H3308R (8-pair G.SHDSL.bis)
  - 14 single slot H3304R
  - 14 (2Ethernet + 4E1) and 1 (2Ethernet only) H3304RA
  - 7 dual slot O9340R

- For dual controller card C5600 chassis*
  - 14 single slot H3308R (2/4-pair G.SHDSL.bis)
  - 7 dual slot H3308R (8-pair G.SHDSL.bis)
  - 14 single slot H3304R
  - 14 (2Ethernet + 4E1) H3304RA

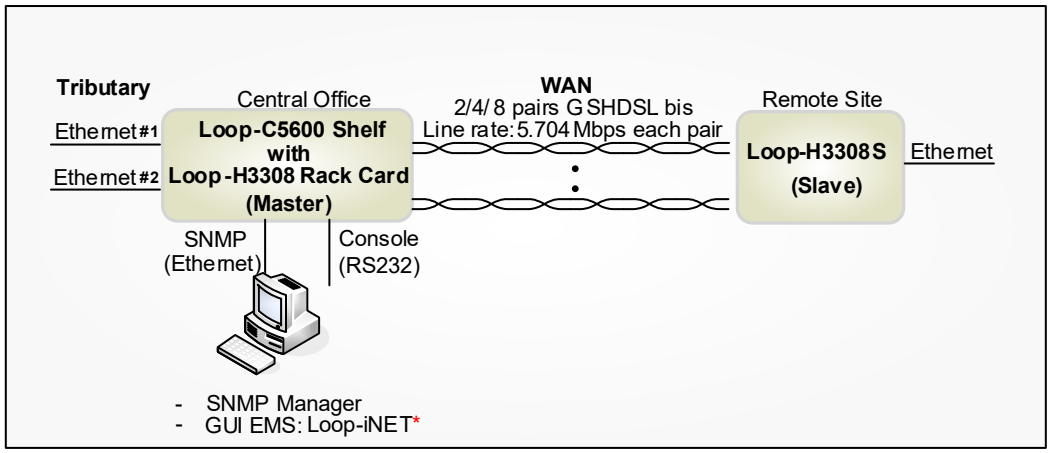
Loop-C5600 Integral Access Shelf supports local configuration and diagnostics by using a local or remote terminal. Users are able to address and identify each rack card's position and its card type. This enables users to execute in-service diagnostics and fault isolation.

By using SNMP or Telnet connection on the shared controller card of the rack unit, users can remotely control and diagnose Loop rack cards from a centralized location.

* Future option

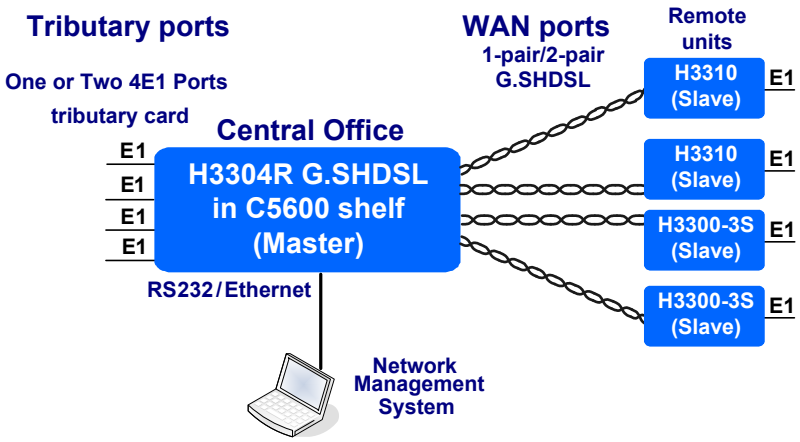
Application Illustrations

H3308R Application

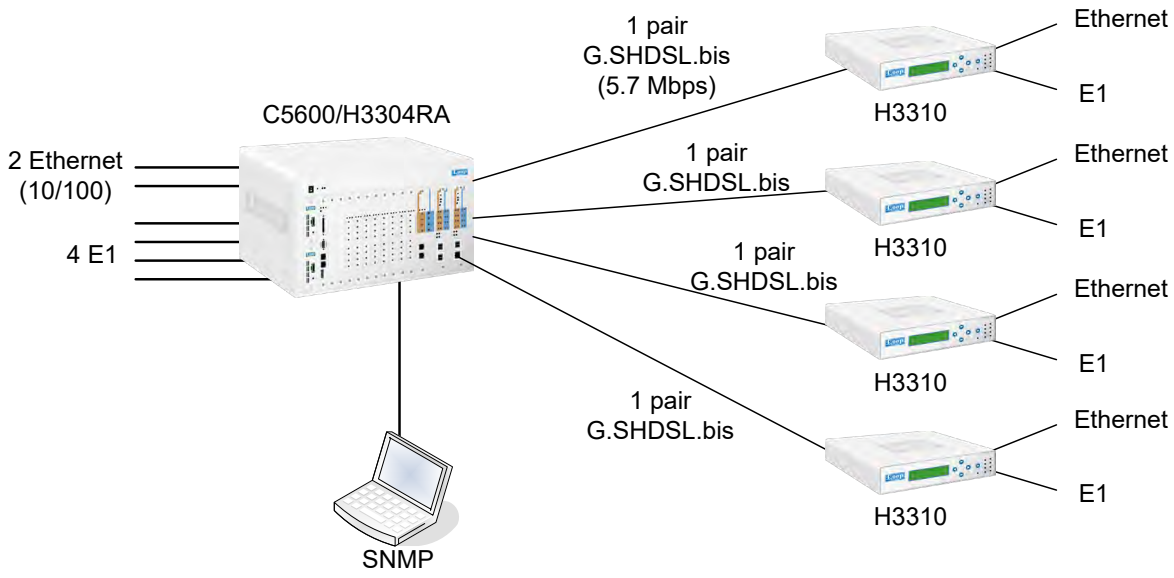


* Future option

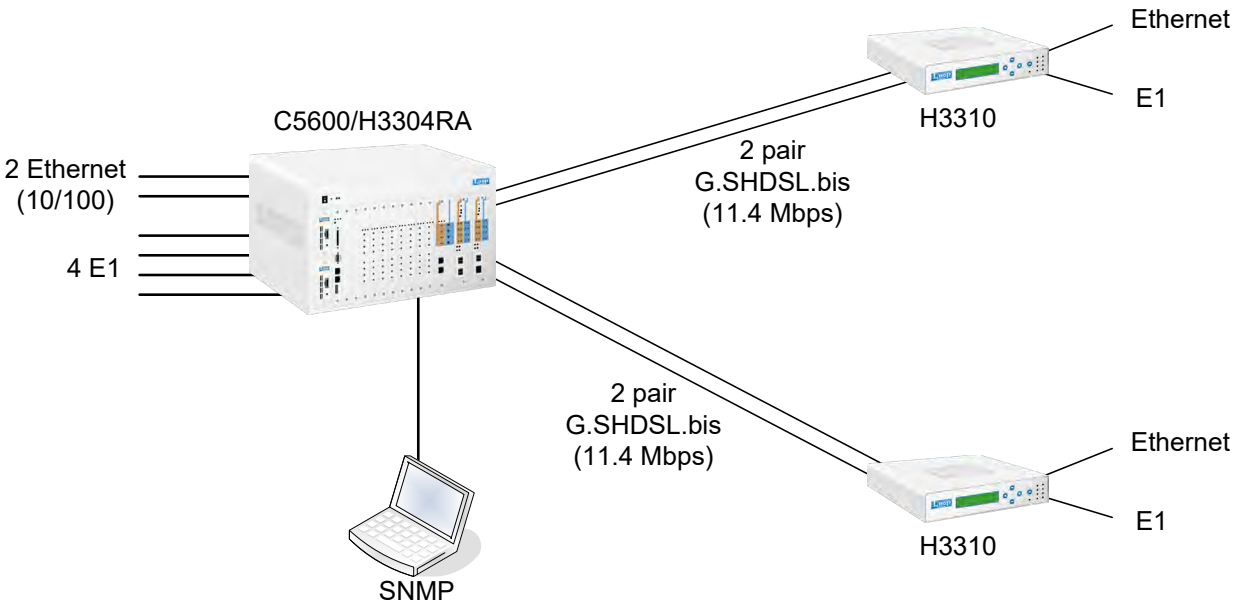
H3304R Application



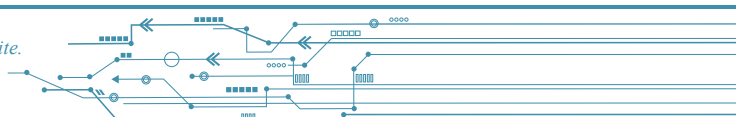
H3304RA Applications



Ethernet and E1 Share 1-pair G.SHDSL.bis (5.7 Mbps)



Ethernet and E1 Share 2-pair G.SHDSL.bis (11.4 Mbps)



12

IIOT

Environmental Security Monitoring Loop-IOT0510 272

Video Surveillance Solution for Substation or Campus Loop-CCTV0710 281

Environmental Security Monitoring Loop-IOT0510

Description and Concept

The IOT0510 Environmental Security Monitoring System was **originally designed and privately labeled for LOOP for Data Centers, IT Rooms and Confidential Lab operators** but later enhanced for more unattended locations such as:

- Data centers/IT rooms/Network infrastructure
- Industrial centers and manufacturing facility
- Military camps
- Agriculture and storage
- Public buildings and facilities like government buildings, transportation stations, vehicle parking and etc.

To help operators meet the demands for environmental and physical security, energy conservation, and remote management for the next decade via cloud.

Note 1: 3G/4G-LTE to Ethernet/Wi-Fi router for connecting to cloud server (country and carrier specific).

Some fields of applications

- Data Centers and Edge Security
- Per-user, per-rack and security protected environmental (Temperature, Humidity, AMP, Airflow, Air Quality etc.…), IT assets and access monitoring.
- With option, monitors the CRAC[Note2] information and manages cooling system
- Reduces the number of on-site visits for both manned and unmanned.
- Secures and provides detailed health information about the edge data center's environment and physical security (Bay Door's Open or Close status). Operating conditions under 24 x 365 surveillance.
- Integrated IP security cameras.

Industrial Control and Automation

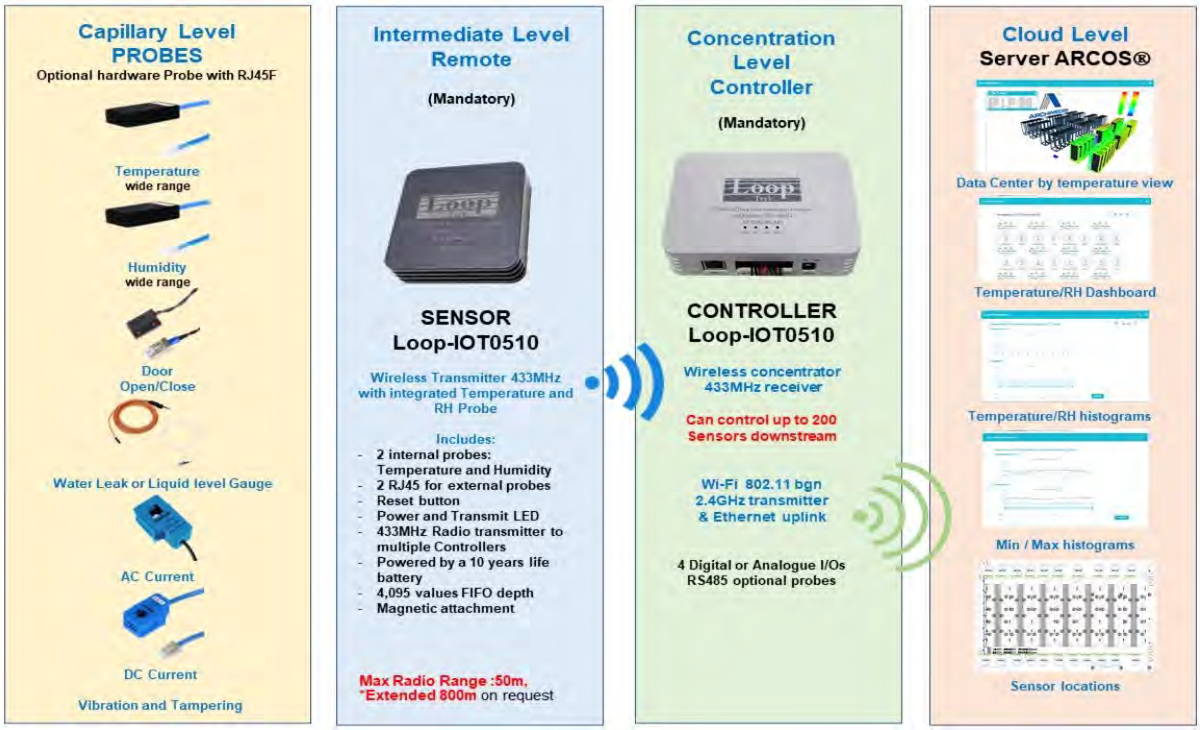
- Temperature and humidity monitoring and controls.
- Water leak detection monitoring.
- Real time power consumption monitoring (AC and DC).
- Metal detection or separation for structural monitoring.
- Vibration, tamper, shake, move, tilt detection for physical security.
- Pre-set warning triggers and notification.
- Integrated Analytics and all tools for data analysis, reports, audits and prediction.
- IP security cameras.
- 3rd party devices support.

Agriculture and Food Safety

- Mission critical temperature and humidity monitoring.
- Airborne particle counts and air quality PM0.3, PM0.5, PM1.0, PM2.5 and PM10 for nearby wildfire monitoring
- Smoke detection
- Explosive gas detection.
- Water leak detection.
- Tamper detection and prevention
- 4G/5G cloud-based remote real time monitoring and access anywhere.

Buildings, Transportation and Parkings

- Temperature and humidity monitoring for comfort level and energy savings.
- Airborne particle counts and air quality PM1.0, PM2.5 and PM10.
- Smoke detection.
- HVAC performance monitoring.
- Traffic flow analysis with IP cameras.



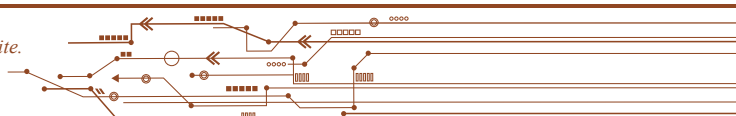
Hierarchy from capillary level up to Server

Features

The IOT0510 System has the following functions and features:

(1) Simple and easy-to-use user interface. With a simple training session, users can operate the entire system through its cloud-based GUI either locally or remotely, with a secured communication link or via Internet.
(2) 3D virtual graphical heat map, dashboards and histograms showing temperature and humidity heat map of every rack.
(3) Dashboards and histograms showing airflow speed, power consumption, rack access, IT assets and other mission critical profile.
(4) Computer room air conditioning **(CRAC[Note2])**, analysis, data center's Power Utilization Efficiency (PUE), AC load percentage, rack load percentage, airflow index and cooling index (overheat or overcool).
(5) Air quality (i.e., PM1.0, PM2.5, PM10, etc.) and airborne particles from 0.3um to 10um provides indication of the clean-ness or dust-ness of cooling air and when air system clean might be needed.
(6) Monitored data and alarms in real time in table and graphic formats.
(7) Historic data and alarms in table and graphic formats.
(8) Multiple levels of user privileges (configuration, set points, search, warning trigger points, data export, user notification, etc.).
(9) Historic data and alarm search, export and print in table or Excel format.
(10) Data export to back up storage devices for compliance audits, integrated AI performance analytics and improvement, customized dashboards, network uptime and reports.
(11) User-defined warning threshold for every monitoring parameter.
(12) Warning signals can be set to trigger any of the IO ports to control audible alarms, auto dialers and any 3rd party devices via dry relays. Warning notifications can be sent to mobile devices via email and/or text messages from unmanned data centers.
(13) Automatic and semi-automatic CRAC[NOTE2] group control for energy savings.
(14) Web-based system for multi-user and multi-location access via public or private cloud service.
(15) Per rack-based assets management for assets tracking, search and inventory.
(16) Cloud configurable IO ports can be configured as input or output, analog or digital for 3rd party device interface and integration.
(17) User accounts and privileges.

NOTE 2: On demand option to collect and show the CRAC information from cooling system over RS485 or ModBus or TCP/IP



Sensors & Probes

Wireless Sensor Specifications

Parameter	Nominal Range
Wireless Sensor and its probes	Autonomous box with battery, wireless 433MHz transmitter, two built-in temperature and humidity probes and two RJ45s for optional external probes. Internal 433MHz radio, and long life batterie.
2 Internal probes	Temperature and Humidity
2 optional external probes 2 x RJ45 connectors	With 2 optional external probes on probe 2-3: temperature -40°C - +100 °C and humidity 0 - 100% measurements (THa), water leak (W10a, W100a), door open/close status (DSa), AC current (AC60a, AC200a), tamper detection (TamperDetec) and etc.
External probes cable	Standard 0.5 meter or custom cable length
Sensor data transmission	Ultra-low power proprietary wireless system for meshed network redundancy at 433MHz, no license required, distance 50m indoor, or 800m outdoor with high radio power option
Battery type	Two AA Lithium batteries, included
Battery operational life	About 10 years
Sensor size	75 x 75 x 19.5 (mm) – with magnetic fix for free metal mounting
Weight	120 g
User interface	Cloud or private server-based GUI with 3D visualization
Data storage	Cloud based service or private server
Gateway	The controller centralizes up to 200 sensors and forward over Wi-Fi/ Ethernet the data to the cloud server and repeat if transmission is blocked.

External Probes

Temperature Measurement Probe Specifications

Parameter	Test condition	Min.	Typ.	Max.	Unit
Internal probe temperature range	Internal	-20	–	+50	°C
External probe temperature range	External	-40	–	+100	°C
Temperature resolution		–	0.1	–	°C
Data refresh rate	Change > 0.5°C	–	30	–	Sec
Temperature accuracy	15 to 40 °C	–	±0.5	–	°C
	0 to 15°C and 40 to 60°C	–	±1	–	
Temperature response time		–	30	–	Sec
Temperature long term drift	0 to 50 °C	–		0.05	°C/yr

Humidity Measurement Probe Specifications

Parameter	Test condition	Min.	Typ.	Max.	Unit
Operating humidity range		0	–	100	% rH
Humidity resolution		–	1	–	% rH
Humidity accuracy	20 to 80 % rH	–	±4.5	–	% rH
	Otherwise	–	±6	–	
Humidity hysteresis		–	±1	–	% rH
Data refresh rate	Change > 5%	–	30	–	Sec

DSa: Door Open/Close Probe (used on wireless Sensor or Controller)

Parameter	Type	Min.	Max.	Accuracy	Unit
Open/close Door detection	Door status	Closed	Open	N/A	Open/Close

W10a/W100a: Water leak probe (used on Sensor or Controller)

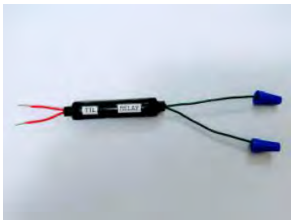
Parameter	Type	Min.	Max.	Accuracy	Unit
Water leak detection	Cable laid down on floor or wrap around water pipe for water detection.	10	100	15 mm DIA x 2.5 mm water puddle	Ft

AC60a/AC200a: AC power current probe, calculated consumption (used on wireless sensor and controller)

Parameter	Type	Min.	Max.	Accuracy	Unit
AC Current consumption	Measured	0	60/200	+5% / +10%	A A/KW
Consumption calculated by ARCOS software for selected voltage 110, 220V or other					
Consumption	Calculated	0	>10	+5% / +10%	KW

DC200a: DC Power Current Probe, calculated Consumption (use on Controller port IO5)

Parameter	Type	Min.	Max.	Accuracy	Unit
DC Power	DC current	0	200	+5%	A A/KW
Consumption calculated by ARCOS software with selected voltage					KW



RYa: Dry Relay for controlling auto dialer, facility alarm, flashlight, 3rd party devices, etc. (Used on Controller only)

Parameter	Type	V On	V Off	Switching Voltage/ Current	Operating Temperature
Dry Relay	TTL driven reed relay	>2.25V	<0.5V	200V AC or DC	-40°C to +85°C
	SPST	Normal open		250mA	Non-polarized on both TTL and relay sides

Wireless AC Power Current Probe

Wireless AC Power Current Probe, calculated power consumption (use 433MHz radio to connect only to Controller without transmitter sensor)

Parameter	Type	Min.	Max.	Accuracy/Resolution	Unit
AC Current consumption	Measured	2.5	60	< +/-3% / 0.1A	A A/KW
Working voltage: 1 to 380 Va, operating in -20 to 60°C, sampling every 30s. Consumption calculated by ARCOS software with selected voltage					
Wire temperature measurement -20 to 70°C, accuracy: <+/- 1C					

Controller

Controller Specifications:

Parameter	Description
Independent Controller	- Concentration up to 200 wireless sensors - 1 RS485, 2 wires Bi-directional up to 38,4Kbps - IO1, IO2 and IO3 for external probe or digital input/output or analog input (0.0 to 3.3Vdc) - IO4 for analogue input (0.0 to 10.0Vdc) - Radio receiver 433MHz - Uplink Ethernet 10/100BaseT or Wi-Fi selectable
Sensor Concentrator	- Supports the concentration up to 200 wireless 433MHz Sensors data and/or AC wireless power probes - 433MHz receiver transmissions. - Many Controllers can work together in Mesh redundant form
Local Capture	Internal probes: Air quality and atmosphere air pressure. With optional external probes on IO1-IO3: relay (RYa), water leak (W10a, W100a), AC current (AC60a, AC200a), door open/close status (DSa), tamper detection (TamperDetec) and etc.
Wi-Fi	Communication to main web access router. 802.11 b/g/n 2.4GHz client. Bi-directional communication for Controller/Cloud setup synch.
Power Supply	DC 12Vdc, delivered with AC/DC 12v adapter
Controller Size	145 x 90 x 35 mm
Data Storage	Cloud based service or private server
Software Server	Cloud server for single enterprise or for Telco and multiple clients

General Purpose IO Ports Specifications:

Parameter	Nominal Range
Number of GPIOs	Three digital GPIOs and one analog input
Configuration	Cloud configurable
Types of GPIO	IO1 to IO3: - Digital input active low (DIAL): - Digital input active high (DIAH); - Digital output active low (DOAL); - Digital output active high (DOAH); IO4: - Analog input: (0.0V to 10.0VDC) IO5: RJ45 connector for combo port for IO1, IO2 and special probes Third parties' probes support
Analog measurement	± 0.05V accuracy
Analog measurement	0.01V resolution
Measurement sampling	Every 30 sec
Input impedance	>3.9K
Output sink or source current	>10 mA

Air quality Sensor (Controller's built-in function)

Parameter	Nominal Range	Unit
Measured Air Particle Size	0.3, 0.5, 1.0, 2.5, 5.0, 10 / PM1.0, PM2.5, PM10	um / PM
Response Time	2	min
Operating Temperature	0 to 50	°C
Flammable Gas Options	H2, LPG, CH4, CO, propane Detection range: 200 – 10,000 Resolution:10- Accuracy: +/-10%	ppm
Operating Humidity	0 to 99	%

AF10a: Airflow Speed (use for Controller IO4)

Parameter	Nominal Range
Measurement range	0 to 10m/s
Accuracy (at 25°C)	±5% of full scale
Response time	Reach 90% of ultimate value within 1 sec.
Media	Air
Recommended operating temperature	15 to 35°C
Working environment, relative humidity	10 to 90%
Storage temperature	-10 to 60°C

Air Pressure (build-in Controller)

Parameter	Nominal Range
Measurement range	30,000 Pa - 126,000 Pa (absolute)
Accuracy	±200 Pa
Response time	Reach 90% of ultimate value within 1 sec.
Recommended operating temperature	0 to 50°C
Working environment, relative humidity	10 to 90%
Storage temperature	-10 to 60°C

Cloud Server

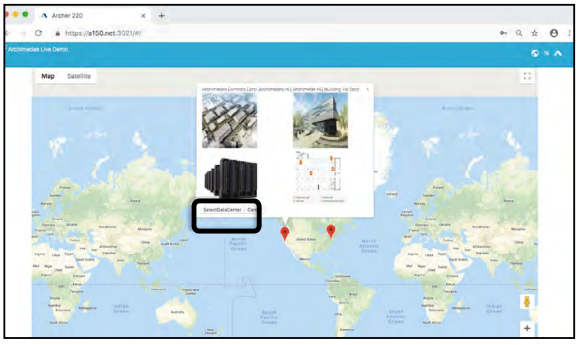
This Cloud Server manages all system data, records and analytics in local as well as cloud-based storage for user sharing, remote monitoring, and management. Its WEB based architecture allows multi-user and multi-location access, both locally and remotely. The data center operator can log in through a secured VPN to view, control, and manage every aspect of the data center's environmental conditions.

Arcos® Cloud Server

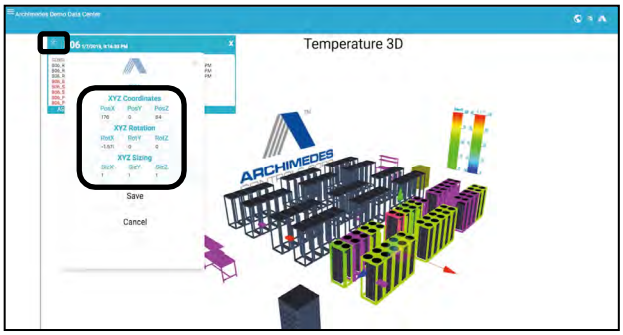
The Arcos® Cloud services can run as a
- **Private Cloud Management Software** or
- **Public Cloud Management Software** provided by vendor or operator.

Users from their PC, tablet or mobile will have the access to information of their sites over secure web access to ARCOS® server which gives:

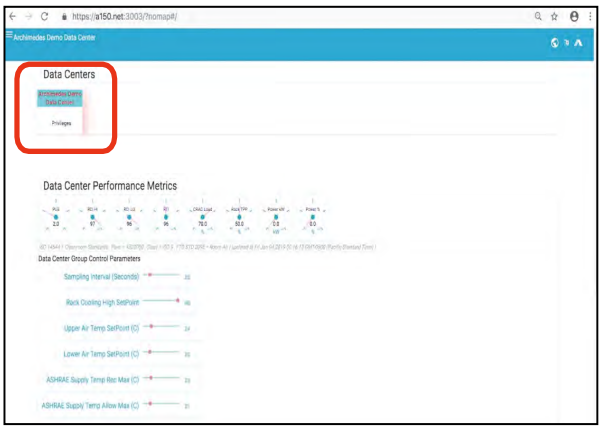
- The location of sites, Controller and Sensors



- A 3D rack heat map in the site

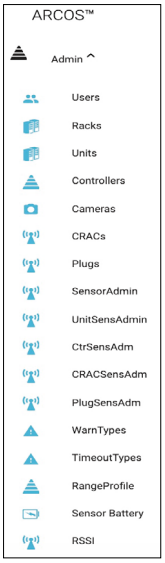


- The virtual access to the site

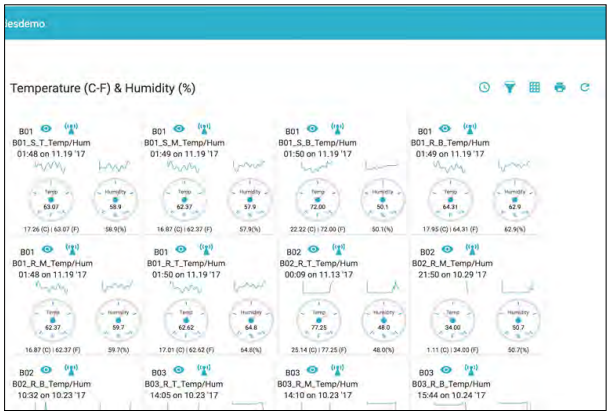


With an access to all elements:
Users, Racks, Units, Controllers, CRACs, Sensors, Admin and Sensors.
And the functionalities to Add, Delete, Filter, Edit, Display and Print/Save the current viewing items in CSV format.

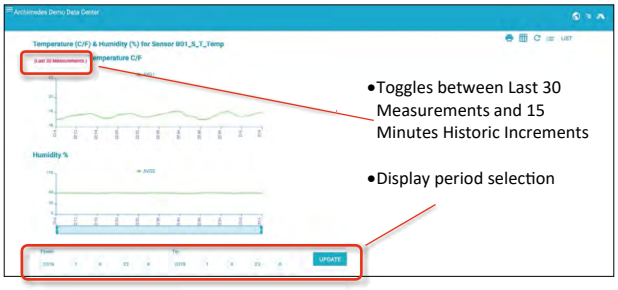
As an example of Controller selection:



Dashboard Temperature and Humidity view



Temperature and Humidity histogram



CRAC[NOTE2] **(Computer Room Air Conditioning)** Information of room cooling systems is recorded and visible in ARCOS software together with all parameters as temperature, air distribution, humidity and power consumption per rack or even large sever of rack in the Data Center.

Application Diagram

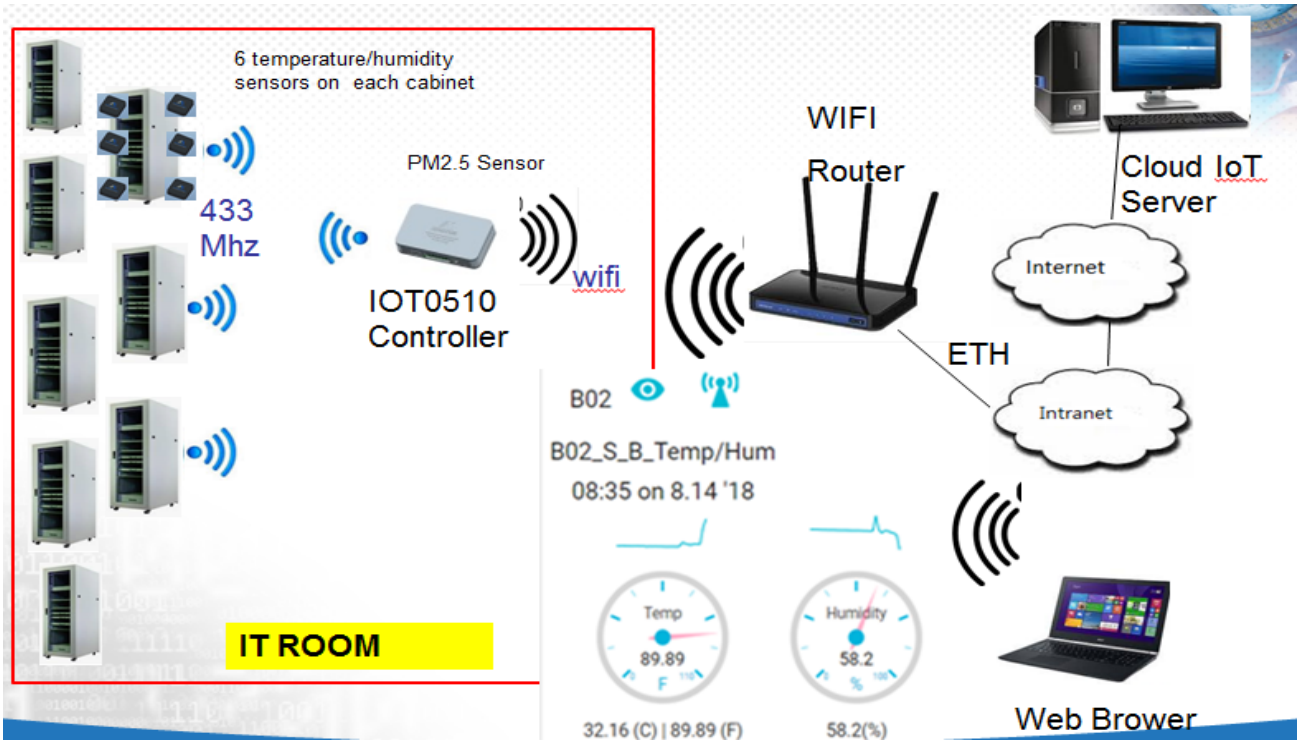
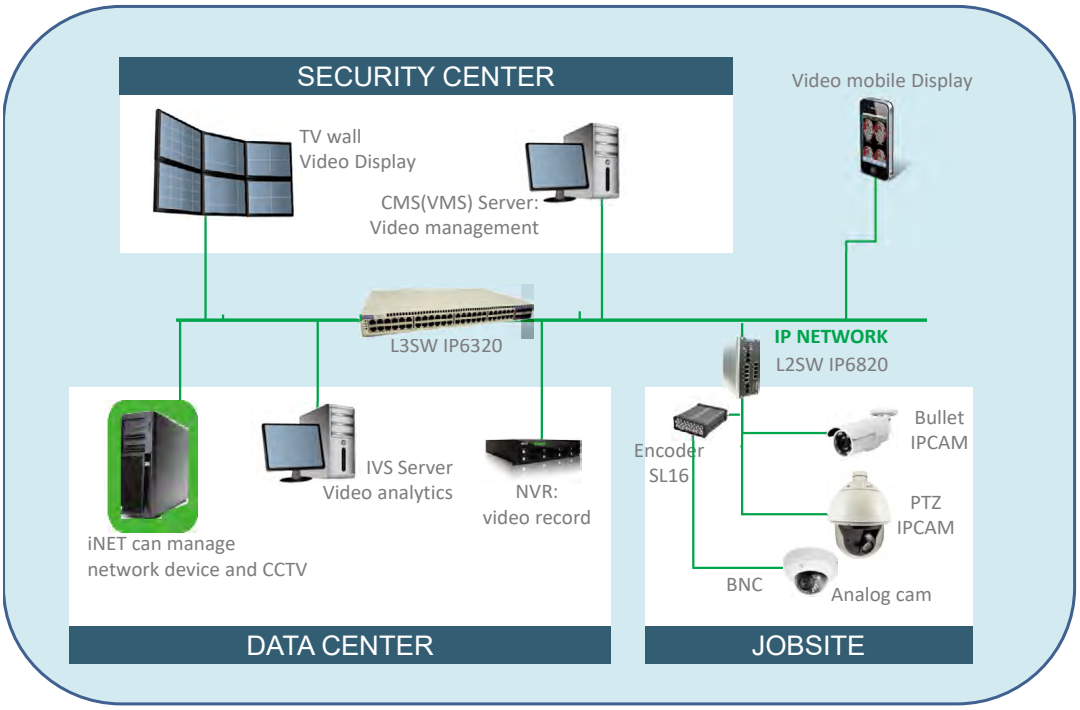


Figure 1 IOT0510 Application Diagram at IT Room

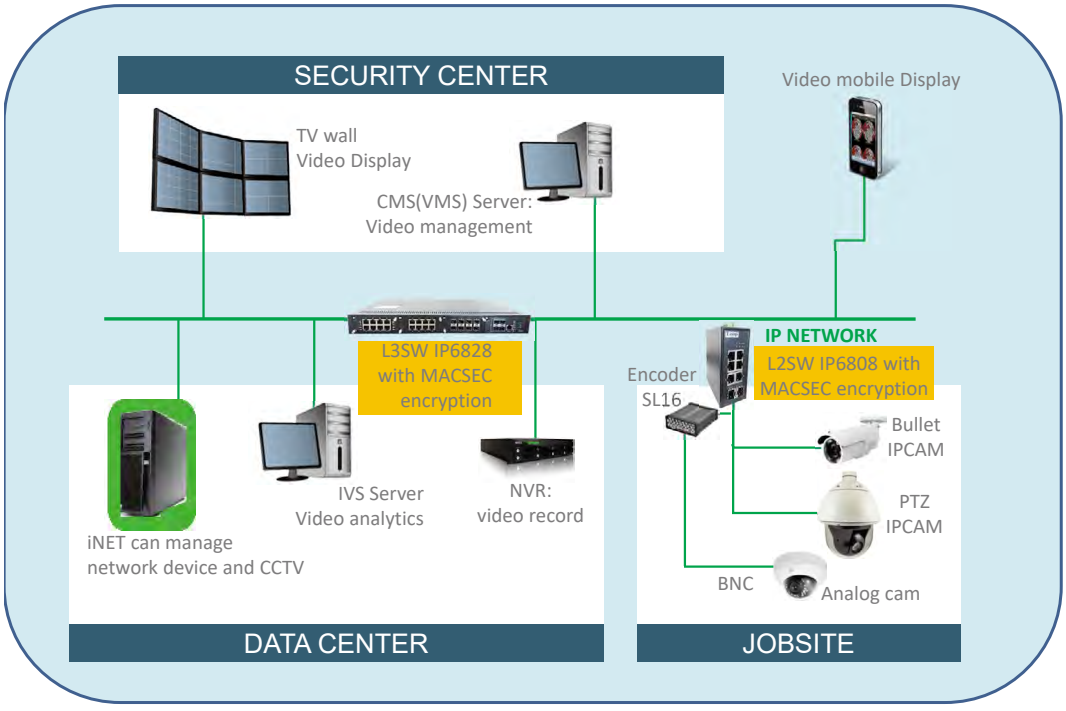
Video Surveillance Solution for Substation or Campus Loop-CCTV0710

Description

Nowadays, the frequency of global terrorism and crime is increasing rapidly. To meet your security requirements for substations or campuses, Loop Telecom provides a total security solution and video surveillance system. Loop Telecom's video surveillance system includes easy-to-install IP cameras, bullet ones and dome ones, as well as sufficient management tools: NVR, CMS, TV Wall, IVS and EMS.



Architecture of CCTV, Network and iNET



Architecture of CCTV, Network w/ Encryption and iNET

- The Core Network can deploy L3SW IP6320. Access Switch can deploy L2SW IP6820/IP6810.
- The Core Network w/ Encryption can deploy L3SW IP6828. Access Switch can deploy L2SW IP6808.
- At Job Site, there are IP cameras connect to IP6820 via POE. Analog camera can connect to Encoder SL16 which converts analog video signal to be IP packets.
- At Data Center, there are NVRs which are to do video record. There are IVSs which are to do video analytics.
- EMS iNET can manage network device and CCTV simultaneously.
- At Security Center, there is CMS server which is to do video management. There is TV Wall which is to do video display

IPCAMs

IPCAM Q2V6-E. The application is for Parking Lot and Main exit.

- Fixed Bullet IPCAM
- 3 Megapixel with 1080p
- Day & Night
- PoE
- 30 fps at 1920 x 1080p
- Waterproof IP66

IPCAM Z4SF-F . The application is for Dangerous Zone.

- 8 Megapixel with 4k2k(3840x2160)
- Day & Night
- PoE
- 30 fps at 4k2k
- Waterproof IP66 and Vandal Proof(IK10)

IPCAM Z4SA-D. The application is for Conference Room.

- Mini Fish-Eye IPCAM
- 6 Megapixel with 1080p
- Day & Night
- PoE
- 30 fps at 1920 x 1080p
- Waterproof IP66

IPCAM 820Z2-G4. The application is capable of remote directional and zoom in/out control.

- PTZ (Pan/Tilt/Zoom) Speed Dome IPCAM
- 2 Megapixel with 1080p
- Day & Night
- 30x Optical Zoom Lens WDR, PoE
- 30 fps at 1920 x 1080
- Pan & Tilt
- Waterproof (IP66)

Analog Encoder L8. The application is to convert analog camera signal to be IP packets.

- Video input :8 BNC
- Video Standard : NTSC/PAL
- Video Compression: Dual H.264+MJPEG
- RS485 for PELCO D,PELCO P

Management

NVR 5464(Network Video Recorder)

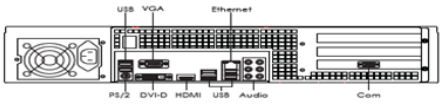
- Manage up to 64 cameras or video encoders
- Recording up to 64 channels
- Live view local up to 64 channels, remote up to 64 channels
- Synchronized playback local up to 64 channels
- Export video with RAW & AVI formats
- Event trigger, response, and notification
- Mobile Client, Web Client, Workstation
- Location-based management with eMap

CMS CC5404 (Central Management System) CMS CC5404 (Central Management System)

- Live view local up to 64 channels
- Synchronized playback local up to 64 channels
- Export video with RAW & AVI formats
- Event trigger, response, and notification
- TV wall support

TV-Wall NC5406

- 76 video streams up to D1@30fps
- Layout: 1x1,2x2,3x3,4x4,3x2,4x3,5x3,5x5,6x6,8x6,8x8 and custom layout
- Flexible TV wall server layout management, adjustable size and position.



IVS 5400(Intelligent Video Surveillance Server)

- Operating System: Win7 Pro 64bit
- Supported Channels/Rules: 16/1
- Resolution: CIF
- Frame Rate:10
- Streaming Protocol: RTSP/ONVIF
- Video Input: Camera

IVS Function

INTRUSION (Virtual Fence)

Detection and signaling of the intrusion within virtual areas of the crossing of virtual lines in a certain direction (tripwire) by subjects of interest.

GATE FLOW (People Counting)

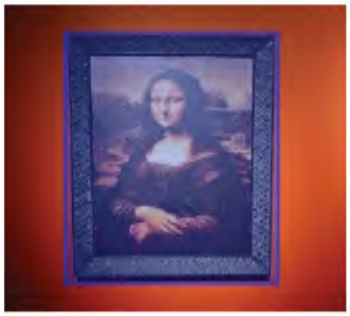
Counting and collection of the number of persons crossing virtual gates in a certain direction

OCCUPANCY RATE

Estimation and collection of the percentage of occupancy of virtual areas by subjects of interest, and for each area signaling of an occupancy percentage higher than a defined threshold

LEFT OBJECT

Detection and signaling of objects left unattended within virtual areas for longer than a defined time



STOLEN OBJECT

Detection and signaling of objects removed from virtual areas

LOITERING

Detection and signaling of subjects of interest that remain within virtual areas for longer than a defined time

SLIP FALL

Detection and notification a person falling and remaining on the ground for longer than a defined time

LPR

Detection and reading of vehicles license plates for access control management

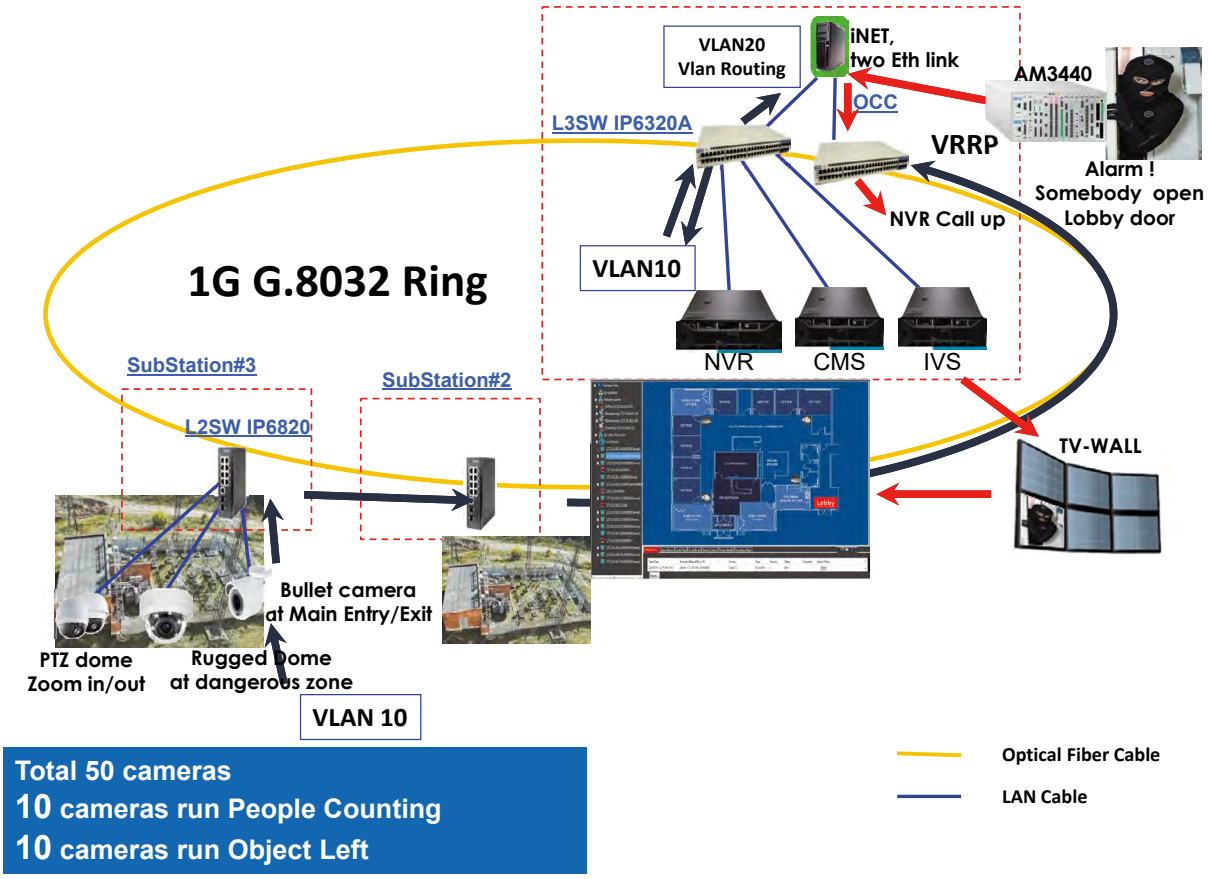
Parking LOT

Detection and notification of the status (free/occupied) of configured parking areas

iNET EMS

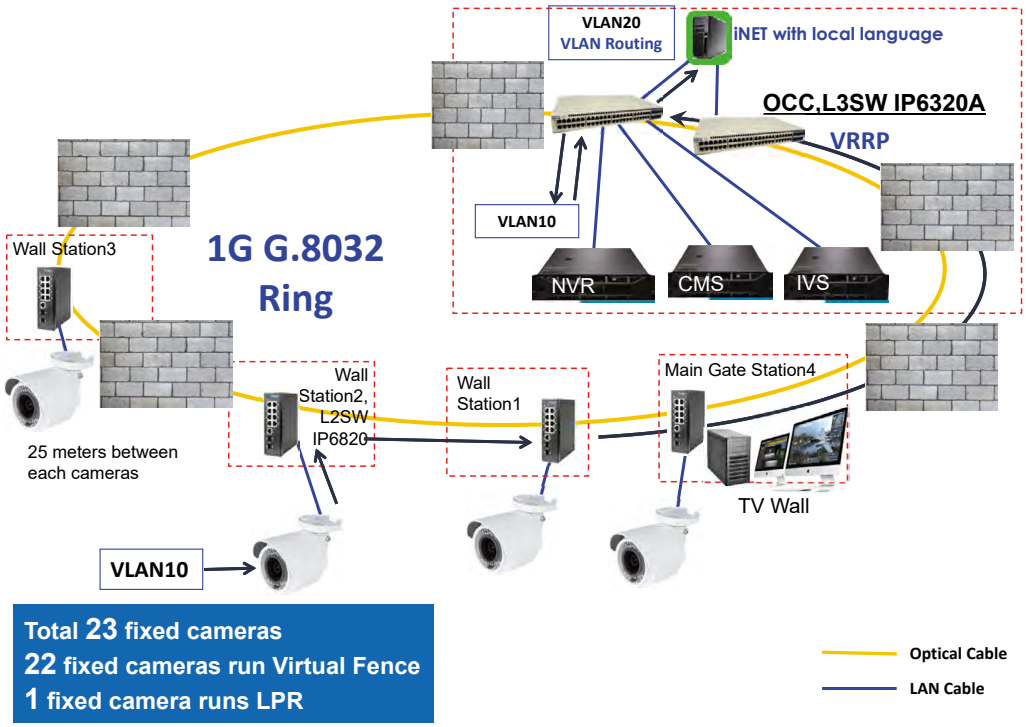
- Integrated networking system with complete solution for CCTV Video Surveillance application
- Centralized or distributed system architecture includes CMS, NVR, TV Wall, and NMS
- Event-driven video playback & snapshot, remote I/O control and PTZ control for selected IP CAM model.
- Please refer to iNET brochure and manual for details.

Applications



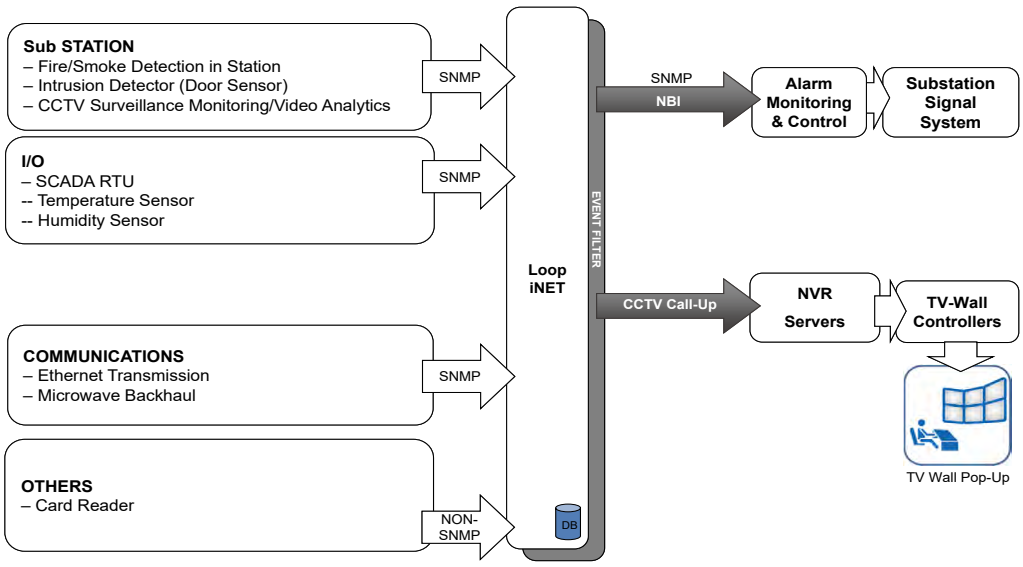
Application Diagram for Substation

Step1. Create G.8032 ring by IP6320A and IP6820
Step2. IP6820 connects to IPCAM.
Bullet Cameras are deployed at Main Entry/Exit.
Rugged Dome cameras are deployed at dangerous zone.
PTZ Dome cameras are deployed for Zoom in/out.
Step3. L3SW IP6320A connects to NVR, CMS/IVS
Step4. L3SW IP6320A connects to iNET
Step5. IPCAM Vlan10 to NVR Vlan10
Step6. INET VLan20 to NVR Vlan10
Step7. When INET receives alarm, it will call up NVR
Step8. NVR triggers TV-WALL for Lobby video
Step9. NVR will show eMAP on lobby location



Application Diagram for Campus

- The total length of Campus wall is 535 meters.
- Each bullet camera is allocated with Virtual Fence every 25 meters. So there are 535/25=22 cameras.
- Then there's a bullet camera with LPR allocated at Main gate.
- Totally 22+1=23 bullet cameras.



Application Diagram of iNET at Substation

Step1. Substation got intrusion detection, it will send SNMP trap to LOOP iNET.
Step2. Card reader maybe be power failure, LOOP iNET can PING(NON-SNMP) this card reader.
Step3. iNET send SNMP trap to Alarm Monitoring &Control via NBI(North Bound Interface)
Step4. iNET will call up NVR server.
Step5. NVR will trigger TV WALL.

13 Accessories

Loop Airflow Guide Rack Applicable to O9400R/V4150 288

Cable Management with Air Filter Applicable to O9400R/V4150 289

Conversion Panels, Y-Boxes, Y-Box Panels 290

SFP/SFP+ Optical Modules 299

Loop Airflow Guide Rack
Applicable to O9400R/V4150

Description

The Loop Air Flow Guide is an easy to use supporting module for the V4150/O9400R units. You can install it on the top or bottom of the V4150/O9400R depending on your heating requirements.

Installing the Airflow Guide both at the top and bottom of the unit creates perfect air circulation, which guides the relatively cold air into the rack and hot air out of the rack, thus keeping the temperature down and preventing damage due to overheating.

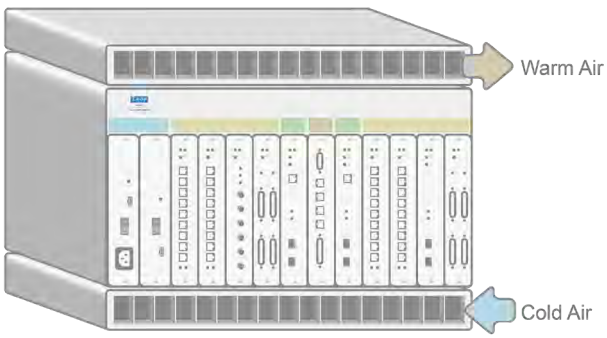
To see how the Airflow Guide functions to guide the cold air in and hot air out, refer to the application illustration section on the following page.

Application Illustration

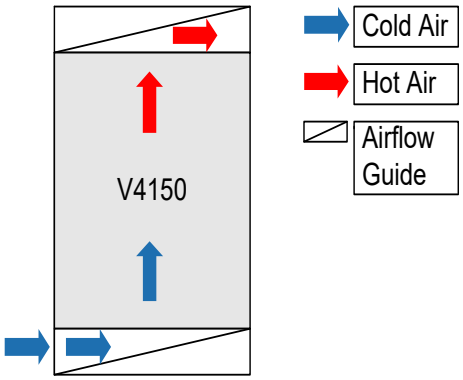
The following drawing shows the front and side view of two units that are equipped with two Airflow Guides at the top and bottom.

Note that the Airflow Guide can also be flipped and installed in reverse so that cold air can enter from the back and hot air can exit from the front of the rack. Proper installation depends on the site's air conditioning requirements.

Front View



Side View



Cable Management with Air Filter

Applicable to O9400R/V4150

Side View

Front View

Description

The Loop Cable Management with Air Filter accessory is an easy to use supporting module for the V4150/O9400R unit. It is the best solution for mounting an Air Filter without interference from the cables.

With the help of Cable Management, engineers no longer need to trace through messy cables, better heat dispersion can be expected, and simplified troubleshooting and rack card expansion are assured.

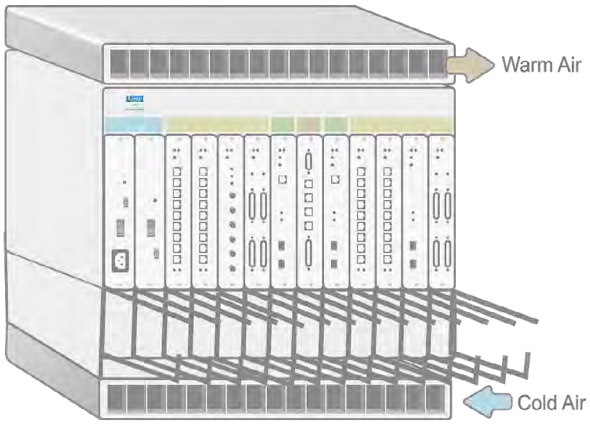
Accumulated dust on the surface of the unit will keep heat inside the operating unit, which could damage the internal circuitry. The Air Filter on the bottom of the Cable Management can help to keep the dust away from the machine, providing a clean and safe operating environment.

The Cable Management can be installed together with Loop Telecom's Airflow Guide. To understand what the Cable Management can do with the Airflow Guide Rack, refer to the Application Illustration section on the following page.

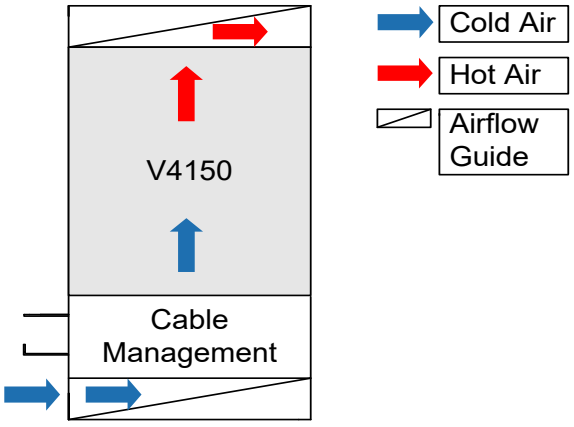
Application Illustration

Installing Cable Management together with the Airflow Guide

Front View



Side View



Conversion Panels, Y-Boxes, Y-Box Panels

Description

Loop Telecom offers conversion panels, Y-boxes, and Y-box panels available to E1/T1 cards in AM3440, O9400R, and O9500R products.

The conversion panel is one SCSI to 16 BNC, 16 RJ, or 16 Wire-Wrap connectors which available for O9400R, and O9500R. The Conversion Panels is for high density E1/T1 cards in O9400R and O9500R.

The Y-Box is used for protection switching of terminal equipment, but not the transmission line connecting the terminal equipment. There are two types of Y-Boxes: the Y-Box for Quad E1/T1 cards in O9500R and Quad E1/T1 and Mini Quad E1/T1 AM3440 series; the Y-Box Panels for high density E1/T1 cards in O9400R and O9500R.

Ordering Information

Conversion Panels: Applicable to O9500R and O9400R

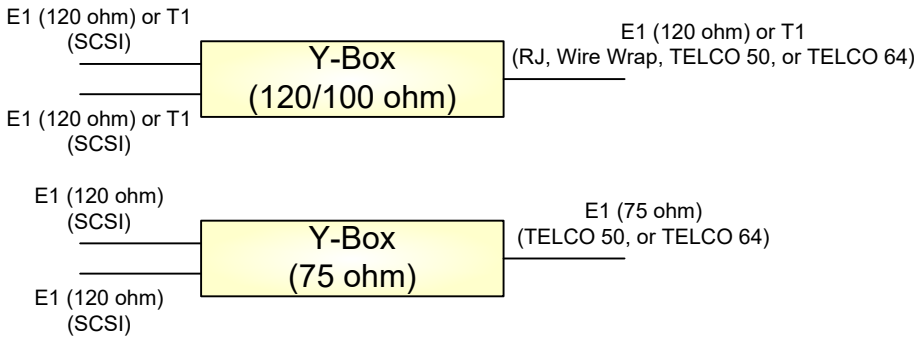
Unit	Model	Description
	Loop-ACC-P-1SCSI-16RJ-**G**	One SCSI to sixteen RJ (1u height) without cable; 432x44x23mm (WxHxD)
	Loop-ACC-P-1SCSI-16BNC-**G**	One SCSI to sixteen BNC (1.5u height) without cable; 432x66x53mm (WxHxD)
	Loop-ACC-P-1SCSI-16WW-**G**	One SCSI to sixteen Wire Wrap (1u height) without cable; 432x44x40mm (WxHxD)

Y-Box: Applicable to O9500R, AM3440

Unit	Model	Description
	Loop-VV-B-**G**	1 for 1 protection Y-Box with BNC connectors (4-E1)
	Loop-VV-R-**G**	1 for 1 protection Y-Box with RJ48C connectors (16-E1)
	Loop-VV-T-**G**	1 for 1 protection Y-Box with RJ48C connectors (16-T1)

Y-Box Panels : Applicable to O9500R, O9400R

1u height: 432x44x100mm (WxHxD)



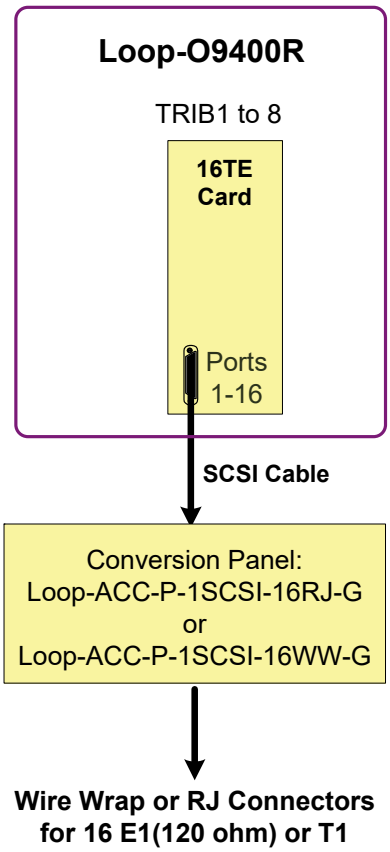
Unit	Model	Description
	Loop-ACC-Y-2SCSI-16RJ-**G**	1u Y-box 16-port panel for two SCSI (E1(120 ohm) or T1) to 16 RJ (E1(120 ohm) or T1) connectors without cable
	Loop-ACC-Y-2SCSI– 16WW-**G**	1u Y-box 16-port panel for two SCSI (E1(120 ohm) or T1) to 16 Wire Wrap (E1(120 ohm) or T1) without cable
	Loop-ACC-Y-2SCSI- 1T64P16-16TE-**G**	1u 16-port Y-box panel in (E1(120 ohm) or T1) for two SCSI to one TELCO 64 (E1(120 ohm) or T1) connectors (16 ports per TELCO connector) without cable
	Loop-ACC-Y-2SCSI- 1T64P16-16E75-**G**	1u 16-port Y-box panel for two SCSI (E1(120 ohm)) to one TELCO 64 (E1(75 ohm)) connectors (16 ports per TELCO connector) straight without cable
	Loop-ACC-Y-2SCSI- 2T50P8-16TE-**G**	1u 16-port Y-box panel in (E1(120 ohm) or T1) for two SCSI to two TELCO 50 (E1(120 ohm) or T1) connectors (8 ports per TELCO connector) without cable
	Loop-ACC-Y-2SCSI- 2T50P8-16E75-**G**	1u 16-port Y-box panel for two SCSI (E1(120 ohm)) to two TELCO 50 (E1(75 ohm)) connectors (8 ports per TELCO connector) without cable
	Loop-ACC-Y-4SCSI- 2T64P16-32TE-**G**	1u 32-port Y-box panel in E1 120 ohm or T1 for four SCSI to two TELCO 64 (E1(120 ohm) or T1) connectors (16 ports per TELCO connector) without cable
	Loop-ACC-Y-4SCSI- 2T64P16-32E75-**G**	1u 32-port Y-box panel for four SCSI(E1(120 ohm)) to two TELCO 64 (E1(75 ohm)) connectors (16 ports per TELCO connector) without cable
	Loop-ACC-Y-4SCSI- 3T50P12-32TE-**G**	1u 32-port Y-box panel in (E1(120 ohm) or T1) for four SCSI to three TELCO 50 (E1(120 ohm) or T1) connectors (12 ports to the first TELCO connector, 12 ports to the second TELCO connector and 8 ports to the third TELCO connector) without cable
	Loop-ACC-Y-4SCSI- 3T50P12-32E75-**G**	1u 32-port Y-box panel for four SCSI (E1(120 ohm)) to three TELCO 50 (E1(75 ohm)) connectors (12 ports to the first TELCO connector, 12 ports to the second TELCO connector and 8 ports to the third TELCO connector) without cable
	Loop-ACC-Y-4SCSI- 4T50P8-32TE-**G**	1u 32-port Y-box panel in (E1(120 ohm) or T1) for four SCSI to four TELCO 50 (E1(120 ohm) or T1) connectors (8 ports per TELCO connector) without cable
	Loop-ACC-Y-4SCSI- 4T50P8-32E75-**G**	1u 32-port Y-box panel for four SCSI (E1(120 ohm)) to four TELCO 50 (E1(75 ohm)) connectors (8 ports per TELCO connector) without cable

Conversion Panel Applications

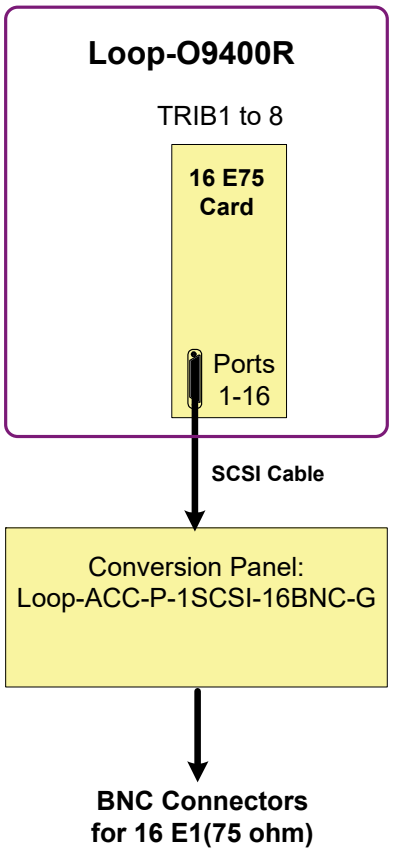
E1/T1 Connector Conversion Panel Illustration

One conversion panel supports up to sixteen ports. For 16E1/T1 cards, one conversion panel is required; for 32E1/T1 cards, two conversion panels are required; for 63E1/T1 cards, four conversion panels are required.

(A) 16TE Converted to WireWrap/RJ Connectors

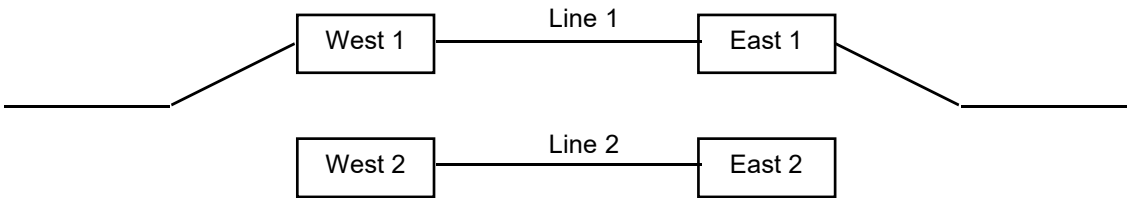


(B) 16E75 Converted to BNC Connectors

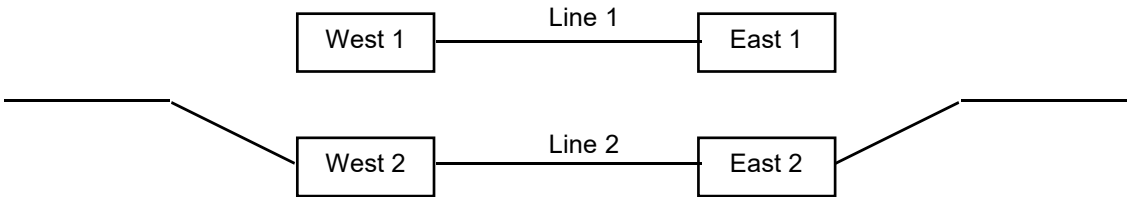


Y-Box Applications

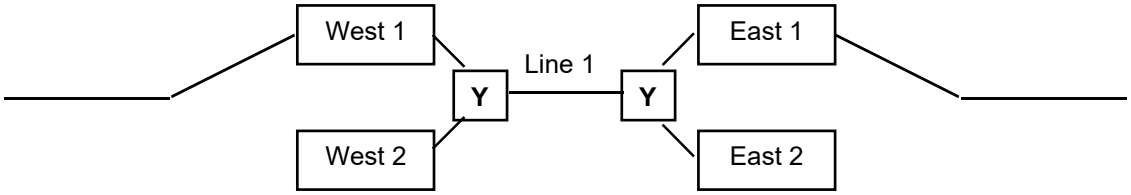
A Y-Box is used for protection switching of terminal equipment, but not the transmission line connecting the terminal equipment. In a conventional protection-switching scheme, both the terminal equipment and the line connecting the terminals are protected.



In the above example, the signal normally traverses from Terminal West 1 — Line1 — Terminal East 1. The protection path is West 2 — Line 2 — East 2. In case of a fault either in West 1 or East 1, or Line 1, protection switching takes place and the path will become as follows.



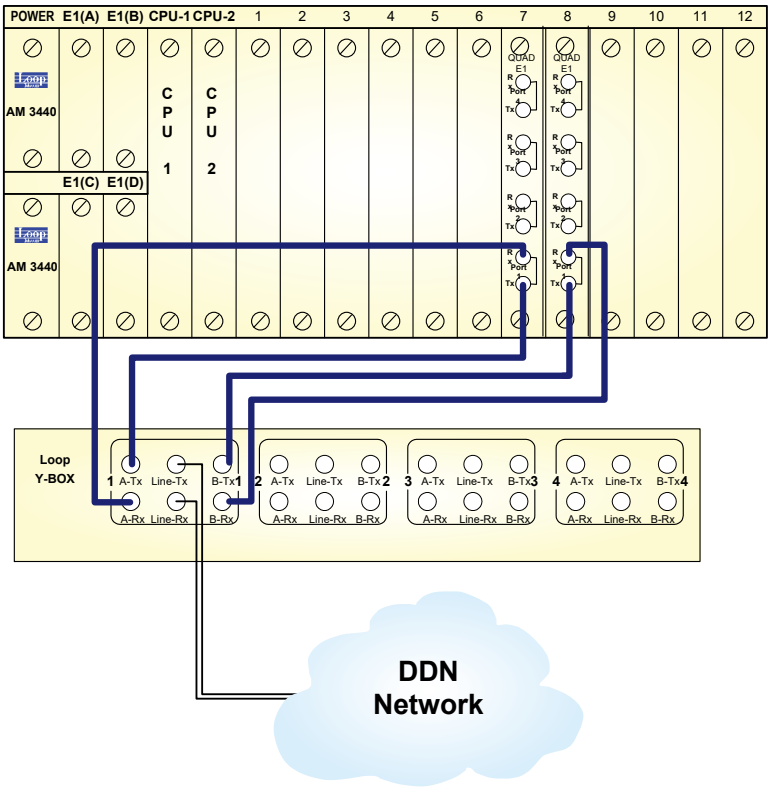
There will be situations where, due to cost, the line is not protected, only the terminal equipment is protected. In such cases, the Y-box is used.



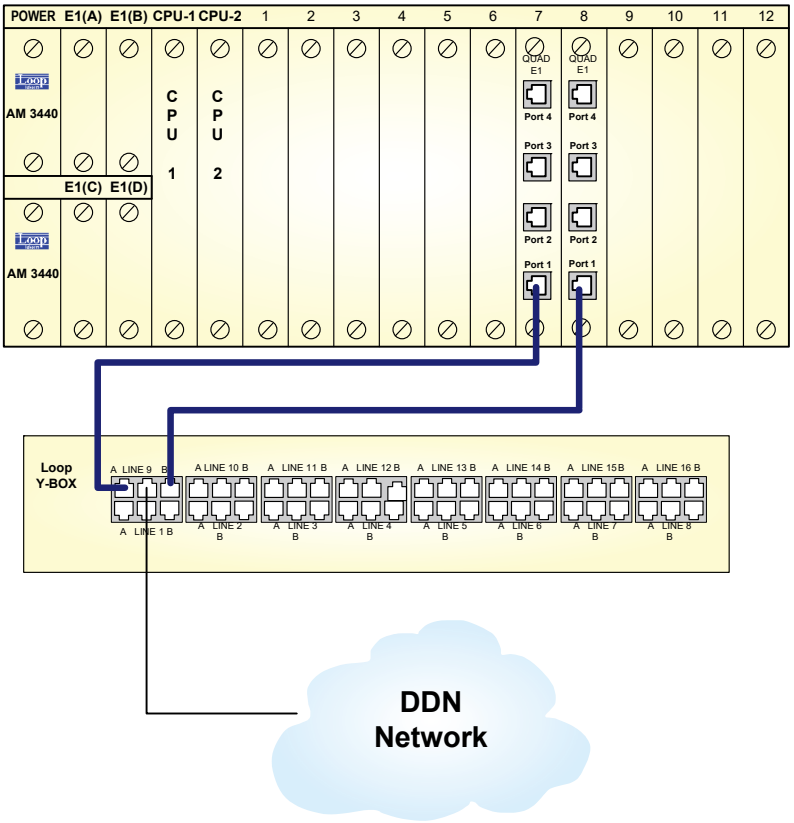
In the above example, the line is not protected, but the terminal equipments are.
In summary, the Y-box is used when terminal equipment needs to be protected but the transmission line is not.

Y-Box for QE1/T1 cards of AM3440 or O9500R illustration

If you are using the BNC type Y BOX, use BNC cables to connect it to the AM3440 or O9500R. Using AM3440 as an example shown in the figure below. For illustration purposes, only Port 1 is protected in this sample diagram. To protect other ports you must connect them in a similar manner.



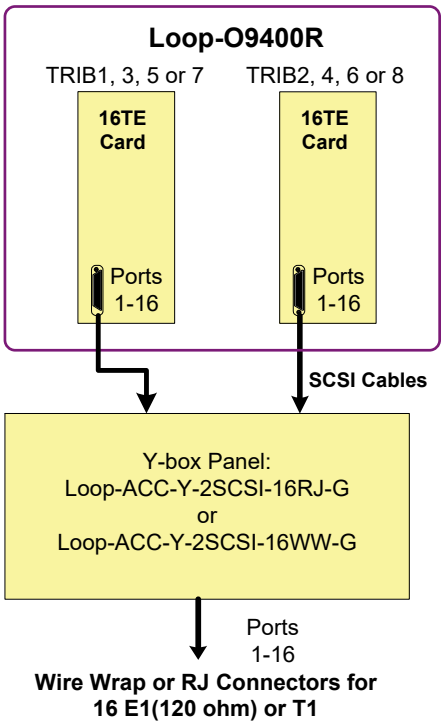
If you are using the RJ48C type Y BOX, connect it to the AM3440 or O9500R. Using AM3440 as an example shown in the figure below. For illustration purposes, only Port 9 is protected in this sample diagram. To protect other ports you must connect them in a similar manner.



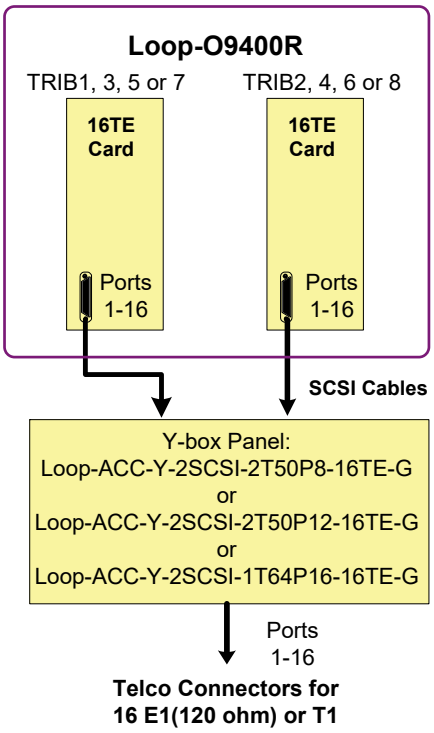
Y-Box for E1/T1 cards of O9400R, or O9500R illustration

Using O9400R as an example shown in the figure below.

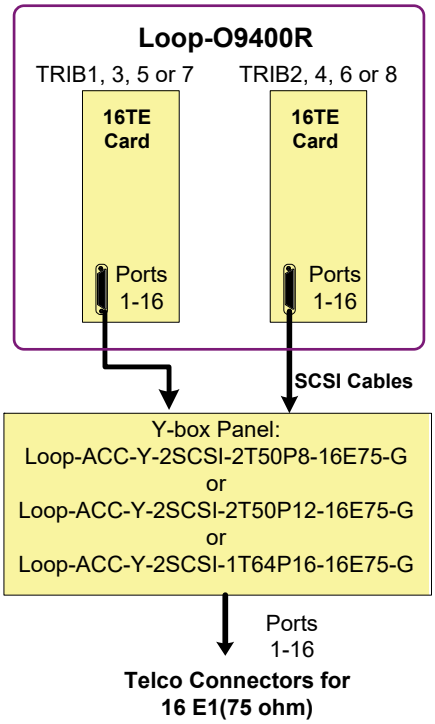
Ⓐ **16TE Card/Port Protection via Y- box Panel to 16 E1(120 ohm) or T1 WireWrap/RJ Connectors**



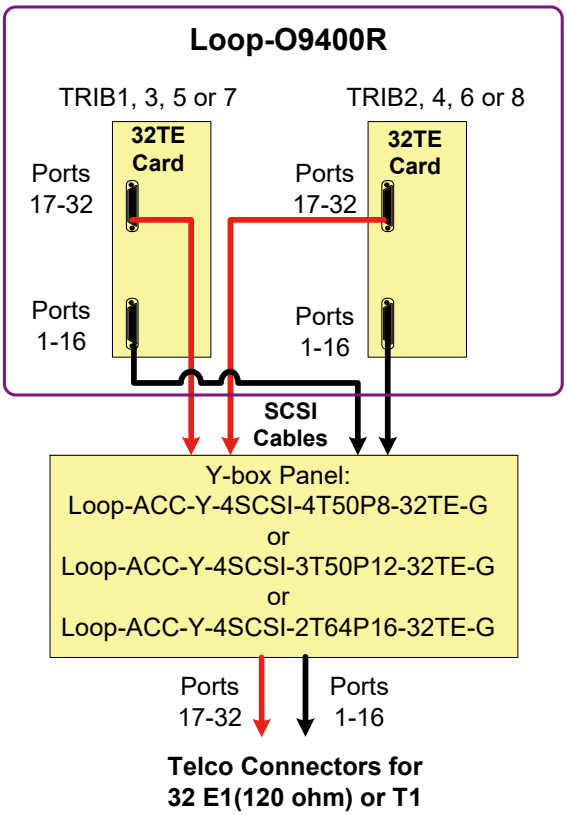
Ⓑ **16TE Card/Port Protection via Y- box Panel to Telco 16 E1(120 ohm) or T1 Connectors**



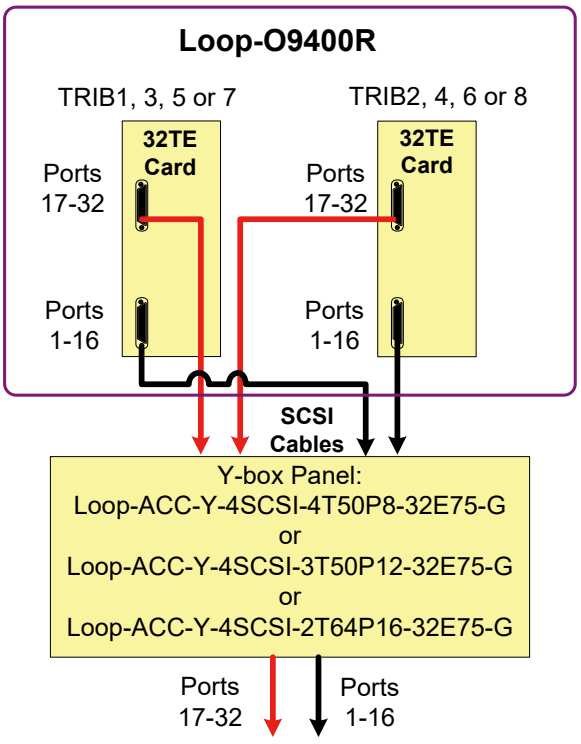
Ⓒ **16TE Card/Port Protection via Y- box Panel to Telco 16 E1(75ohm) Connectors**



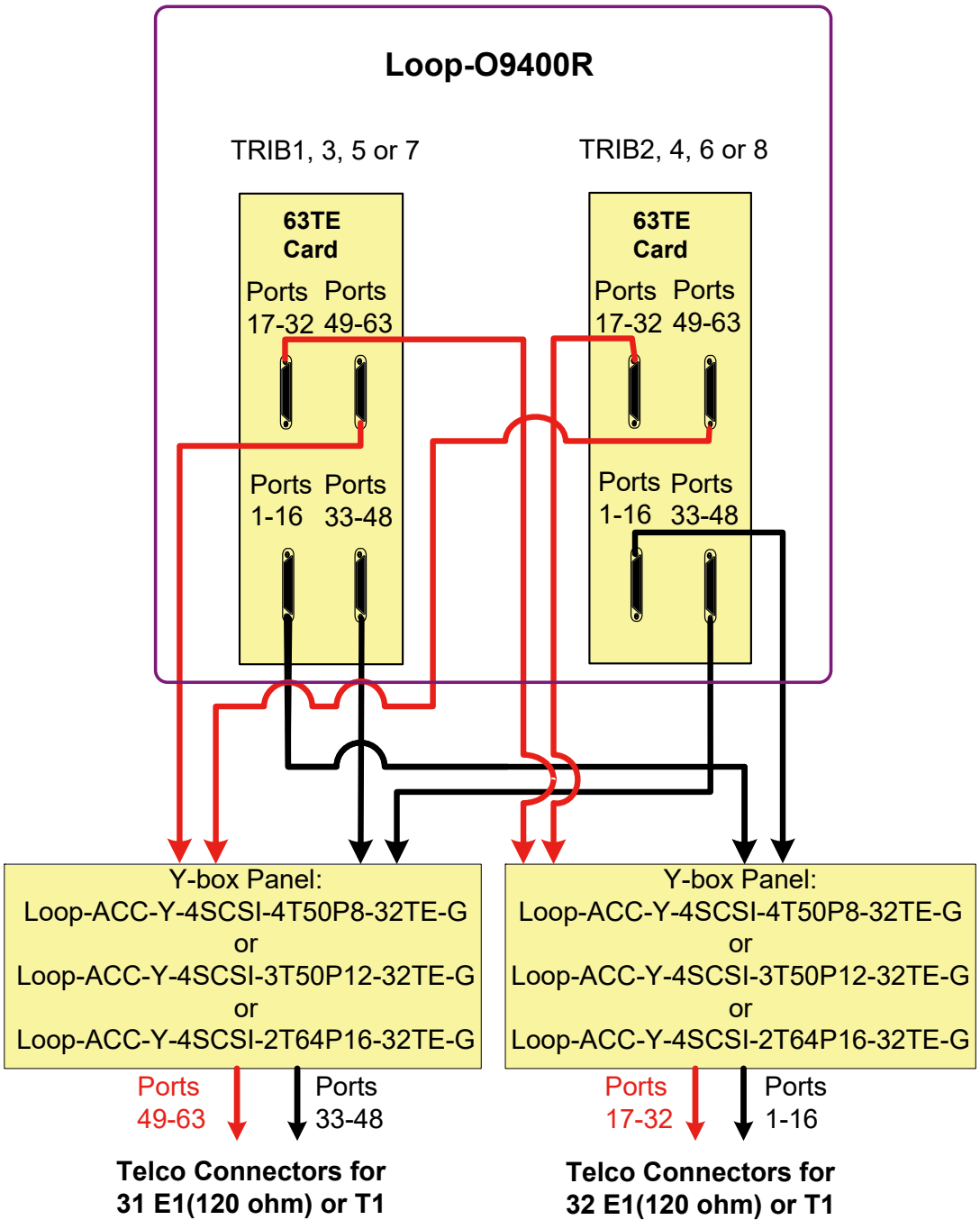
Ⓓ 32TE Card/Port Protection via Y- box Panel to Telco 32 E1(120 ohm) or T1 Connectors



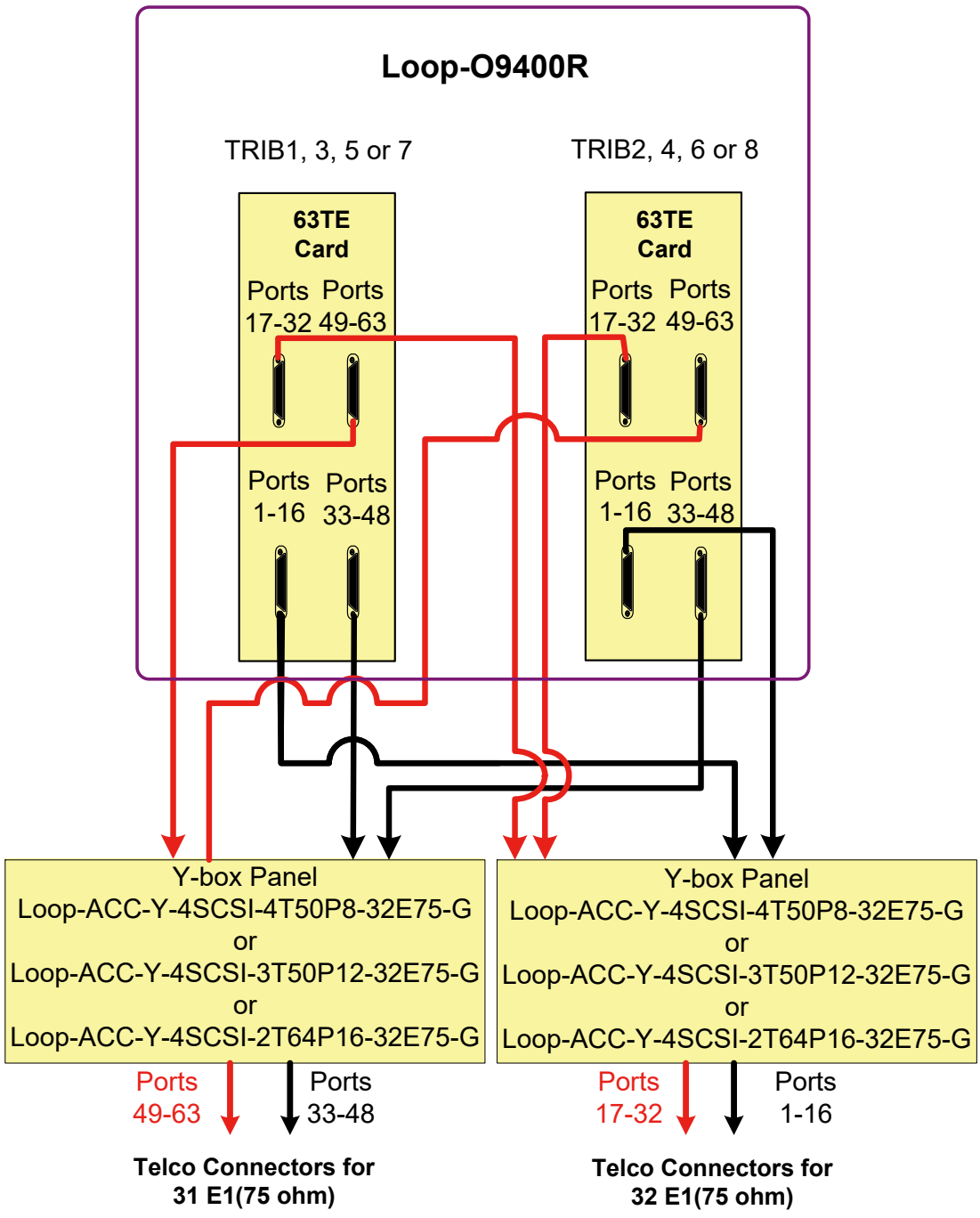
Ⓔ 32TE Card/Port Protection via Y- box Panel to Telco 32 E1(75 ohm) Connectors



(F) 63TE Card/Port Protection via Y- box Panel to Telco Connectors for 32 E1(120 ohm) or T1 and Telco Connectors for 31 E1(120 ohm) or T1



Ⓖ 63TE Card/Port Protection via Y- box Panel to Telco Connectors for 32 E1(75 ohm) and Telco Connectors for 31 E1(75 ohm)



SFP/SFP+ Optical Modules

SFP / SFP+ modules:

1. 10G SFP+ Ordering Info
   The maximum distance up to 100KM
2. 2.5G SFP Ordering Info
   The maximum distance up to 160KM
3. 1.25G SFP Ordering Info
   The maximum distance up to 200KM
4. 622~155M SFP Ordering Info
   The maximum distance up to 140KM
5. 4622M SFP Ordering Info
   The maximum distance up to 200KM
6. 125M/155M SFP Ordering Info
   The maximum distance up to 240KM
7. 1x9 155M/125M/1~100M Ordering Info
   The maximum distance up to 200KM
8. 1x9 2M Ordering Info
9. 1x8 2M Ordering Info
10. 2M SFP Ordering Info
11. 155M / 1.25G SFP EE Transceiver Module for SDH only
12. SFP Electrical Transceiver Copper 10/100/1000

Description

For all Loop products, a SFP port requires an additional SFP optical module for wire connection. Loop products compatible with each SFP model are listed under section titles. For optical modules that are not listed in this chapter, please contact your nearest Loop sales representative.

NOTE: It is strongly recommended against purchasing non-Loop branded SFP modules in use with Loop products as compatibility is not proven.

Ordering Info Guideline of SFP/SFP+ modules for SFP/SFP+ housing

The code for each module contains 5 characters for specification as listed below, specifying the options for *Mode, Data Rate, Wave Length, Distance*, and *Connector* in the exact order. An example for the code **GQB2D** would have the specifications of *SFP+ Single-mode, 10.3G ~1.25 Gbps, 1310 nm Commercial, 20 KM*, and *LC connector with DDM*. See the next sections for available combinations.

Mode		Data Rate		Wave Length		Distance		Connector	
E	SFP Electrical Transceiver (EE)	R	2M	A	850 nm Commercial (0 ~ +70°C)	A	100 m	D	LC connector with DDM
M	SFP Multi-Mode	E	10/100M	B	1270~1310nm~1430 nm Commercial (0 ~ +70°C)	B	300 m	W	LC connector without DDM
P	SFP Single-Mode &CWDM&DWDM&BiDi	F	125M	C	1450nm~1550(nm) ~1610nm Commercial (0 ~ +70°C) including 1550 EML(nm)	F	500 m	S	SC connector
N	1*9 Single-Mode(SM) & CWDM Single-Mode& BiDi	H	155 / 125M	D	TX1310nm / RX1490~1550nm Commercial (0 ~ +70°C)	T	2 KM	F	FC connector
Q	1*9 Multi-Mode	J	622 to 155M	E	TX1490~1550nm / RX1310nm Commercial (0 ~ +70°C)	D	5 KM	C	1.0/2.3 Coaxial connector
W	1*9 WDM mode Single Fiber & BiDi	C	622M only	F	TX1310nm / RX1550nm Industrial (-40C ~ +85°C)	1	10 KM	T	ST connector
T	SFP+ Multi-Mode	K	1.25G~622M	G	TX1550nm / RX1310nm Industrial (-40C ~ +85°C)	2	20 KM	R	RJ45 connector
G	SFP+ Single-mode&CWDM&DWDM&BiDi	G	1.25G to 125M	K	1490nm Commercial (0 ~ +70°C)	3	30 KM		
X	XFP Single Mode(SM) Dual fiber & Single Fiber & BiDi	T	1.25G	T	1270~1310~1430nm Industrial(-40 ~ +85°C)	4	40 KM		

Mode		Data Rate		Wave Length		Distance		Connector
Z	1*8 Multi-Mode	M	1.25G multi rate 10/100/1000	L	1450~1550~1610nm Industrial(-40 ~ +85°C)	5	50 KM	
S	TSOP (Transparent SONET/ SDH over Packet) Smart SFP	S	2.5G single rate	P	850nm Industrial (-40 ~ +85°C)	6	60 KM	
U	SFP 28 25G Multi-Mode(MM)	L	2.5G multi rate	Q	TX1510~1490nm / RX1570~1590nm Commercial (0 ~ +70°C)	7	70 KM	
V	SFP 28 25G_Single-Mode(SM)	Q	10G &1.25G multi-data rate	R	TX1570~1590nm / RX1490~1510nm Commercial (0 ~ +70C)	8	80 KM	
K	QSFP 28 100G Multi-Mode(MM)	N	10G BASE (9.95 - 10.5 Gbps)	H	10G TX to RX (0 ~ +70°C)	9	90 KM	
L	QSFP 28 100G Single-Mode(SM)	X	25G	J	10G RX to TX (0 ~ +70°C)	U	100 KM	
		W	100G	S	1550nm (0 ~ +70°C) SONET link	V	110 KM	
				U	100G Commercial (0 ~ +70°C) L0->1294.53/1295.56/1296.59nm L1->1299.02/1300.05/1301.09nm L2->1303.54/1304.58/1305.63nm L3->1308.09/1309.14/1310.19nm	X	120 KM	
				V	100G Industrial (-40 ~ +85°C) L0->1294.53/1295.56/1296.59nm L1->1299.02/1300.05/1301.09nm L2->1303.54/1304.58/1305.63nm L3->1308.09/1309.14/1310.19nm	W	140 KM	
						R	160 KM	
						S	180 KM	
						Y	200 KM	
						Z	240 KM	

Note 1: DDM: digital diagnostic monitoring

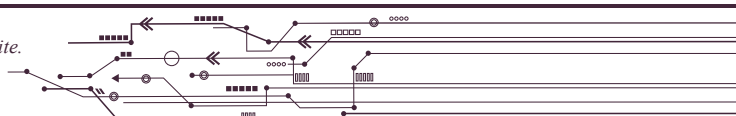
Note 2: Commercial (0 to 70°C); Industrial (-40 to 85°C) unless otherwise noted.

Note 3: BiDi: Bi-directional

For DWDM SFP+ Optical Modules

■ A special defined **-Dxx** ordering code is used to select **frequency** and **wavelength**:

Code	Channel	Frequency(THz)	Center Wavelength(nm)
-D17	17	191.7	1563.86
-D18	18	191.8	1563.05
-D19	19	191.9	1562.23
-D20	20	192.0	1561.42
-D21	21	192.1	1560.61
-D22	22	192.2	1559.79
-D23	23	192.3	1558.98
-D24	24	192.4	1558.17
-D25	25	192.5	1557.36
-D26	26	192.6	1556.55
-D27	27	192.7	1555.75
-D28	28	192.8	1554.94
-D29	29	192.9	1554.13
-D30	30	193.0	1553.33



Code	Channel	Frequency(THz)	Center Wavelength(nm)
-D31	31	193.1	1552.52
-D32	32	193.2	1551.72
-D33	33	193.3	1550.92
-D34	34	193.4	1550.12
-D35	35	193.5	1549.32
-D36	36	193.6	1548.51
-D37	37	193.7	1547.72
-D38	38	193.8	1546.92
-D39	39	193.9	1546.12
-D40	40	194.0	1545.32
-D41	41	194.1	1544.53
-D42	42	194.2	1543.73
-D43	43	194.3	1542.94
-D44	44	194.4	1542.14
-D45	45	194.5	1541.35
-D46	46	194.6	1540.56
-D47	47	194.7	1539.77
-D48	48	194.8	1538.98
-D49	49	194.9	1538.19
-D50	50	195.0	1537.40
-D51	51	195.1	1536.61
-D52	52	195.2	1535.82
-D53	53	195.3	1535.04
-D54	54	195.4	1534.25
-D55	55	195.5	1533.47
-D56	56	195.6	1532.68
-D57	57	195.7	1531.90
-D58	58	195.8	1531.12
-D59	59	195.9	1530.33
-D60	60	196.0	*1529.55*
-D61	61	196.1	1528.77

For CWDM SFP Optical Modules

■ A special defined **-Cxx** ordering code is used to select **wavelength**:

Code	Center Wavelength(nm)	Wavelength(nm)
-C27	1270nm	1264.5 --- 1277.5 nm
-C29	1290nm	1284.5 --- 1297.5 nm
-C31	1310nm	1304.5 --- 1317.5 nm
-C33	1330nm	1324.5 --- 1337.5 nm
-C35	1350nm	1344.5 --- 1357.5 nm
-C37	1370nm	1364.5 --- 1377.5 nm
-C39	1590nm	1384.5 --- 1397.5 nm
-C41	1410nm	1404.5 --- 1417.5 nm
-C43	1430nm	1424.5 --- 1437.5 nm
-C45	1450nm	1444.5 --- 1457.5 nm

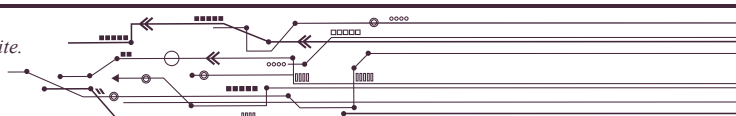
Code	Center Wavelength(nm)	Wavelength(nm)
-C47	1470nm	1464.5 --- 1477.5 nm
-C49	1490nm	1484.5 --- 1497.5 nm
-C51	1510nm	1504.5 --- 1517.5 nm
-C53	1530nm	1524.5 --- 1537.5 nm
-C55	1550nm	1544.5 --- 1557.5 nm
-C57	1570nm	1564.5 --- 1577.5 nm
-C59	1590nm	1584.5 --- 1597.5 nm
-C61	1610nm	1604.5 --- 1617.5 nm

1. 10G SFP+ Ordering Info

1.1 Commercial Range (0 to 70°C)

Compatible with G7860A, IP6320A, PTN10G card, G7820 and WDM1800

Type	Code	Description	Note
10G (mini GBIC) Dual Fiber Commercial (0 to +70°C)	**TNABD**	SFP+ multi-mode optical module with dual uni-directional fiber, 10.3G, 850nm, 33M, 82M, 300M, LC connector with DDM, 10G Ethernet Links SR/SW	
	GNB1D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G, 1310nm, 10KM, LC connector with DDM, 10G Ethernet Links LR/LW	
	GNB2D	SFP+ single -mode optical module with dual uni-directional fiber, 10.3G, 1310nm, 20KM, LC connector with DDM, 10G Ethernet Links LR/LW, 10G SONET OC-192 / STM-64	
	GNB4D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G, 1310nm, 40KM, LC connector with DDM, 10G Ethernet Links ER/EW	
	GNC2D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G, 1550nm,20KM, LC connector with DDM, 10G Ethernet Links ER/EW	
	GNC4D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G, 1550nm, 40KM, LC connector with DDM, 10G Ethernet Links ER/EW	
	GNC8D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G, 1550nm, 80KM, LC connector with DDM, 10G Ethernet Links ZR/ZW	
	GNCUD	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G, 1550nm, 100KM, LC connector with DDM, 10G Ethernet Links ZR/ZW	
10G (mini GBIC) Single Fiber Commercial (0 to +70°C)	**GNH4D**	SFP+ single-mode optical module with single bi-directional fiber, 10.3G, TX1270 / RX1330nm, 40KM, LC connector with DDM, 10G Ethernet Links ZR/ZW	
	GNJ4D	SFP+ single-mode optical module with single bi-directional fiber, 10.3G, TX1330 / RX1270nm, 40KM, LC connector with DDM, 10G Ethernet Links ZR/ZW	
10G (mini GBIC) DWDM Dual Fiber Commercial (0 to +70°C)	**GNC4D-Dxx**	SFP+ DWDM single-mode optical module with dual uni-directional fiber, 10.3G, 1563.8~1528.77nm, 40KM, LC connector with DDM, 10G Ethernet Links ER/EW Frequency(THz) 192.90, Channel 29	
	GNC8D-Dxx	SFP+ DWDM single-mode optical module with dual uni-directional fiber, 10.3G, 1563.8~1528.77nm, 80KM, LC connector with DDM, 10G Ethernet Links ER/EW	



Type	Code	Description	Note
10G (mini GBIC) CWDM Dual Fiber Commercial (0 to +70°C)	**GNC1D-Cxx**	SFP+ CWDM single-mode optical module with dual uni-directional fiber, 10.3G, 1270~1610nm, 10KM, LC connector with DDM, 10G Ethernet Links LR/LW	• For Cxx, please choose code from –C27 to -C61 in the **For CWDM SFP+ Optical Modules** table. • 18 wavelengths from 1270nm to 1610nm, each step 20nm.
	GNC4D-Cxx	SFP+ CWDM single-mode optical module with dual uni-directional fiber, 10.3G, 1470~1610nm, 40KM, LC connector with DDM, 10G BASE-ER/EW	• 40 km 10G Fiber Channel • For Cxx, please choose code from –C47 to -C61 in the **For CWDM SFP+ Optical Modules** table. • 8 wavelengths from 1470nm to 1610nm, each step 20nm.
	GNC7D-Cxx	SFP+ CWDM single-mode optical module with dual uni-directional fiber, 10.3G, 1470~1610nm, 70KM, LC connector with DDM, 10G Ethernet Links ZR/ZW	• For Cxx, please choose code from –C47 to -C61 in the **For CWDM SFP+ Optical Modules** table. • 8 wavelengths from 1470nm to 1610nm, each step 20nm.
10G (mini GBIC) Dual Fiber Commercial (0 to +70°C)	**GQB2D**	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1310nm, 20KM, LC connector with DDM, 10G Ethernet Links LR/LW, 10G SONET OC-192 / STM-64	• All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable
	GQC4D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1550nm, 40KM, LC connector with DDM, 10G SONET Links ER/EW	
	GQC8D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1550nm, 80KM, LC connector with DDM, 10G SONET Links ZR/ZW	
10G (mini GBIC) DWDM Dual Fiber Commercial (0 to +70°C)	**GQC4D-Dxx**	SFP+ DWDM single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1563.8~1528.77nm, 40KM, LC connector with DDM, 10G Ethernet Links ER/EW, 10G SONET OC-192 / STM-64	• For Dxx, please choose code from -D17 to -D61 in the **For DWDM SFP+ Optical Modules** table. • All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable
	GQC8D-Dxx	SFP+ DWDM single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1563.8~1528.77nm, 80KM, LC connector with DDM, 10G Ethernet Links ZR/ZW, 10G SONET OC-192 / STM-64	• For Dxx, please choose code from -D17 to -D61 in the **For DWDM SFP+ Optical Modules** table. • All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable
10G (mini GBIC) CWDM Dual Fiber Commercial (0 to +70°C)	**GQB4D-Cxx**	SFP+ CWDM single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1270~1430nm, 40KM, LC connector with DDM, 10G Ethernet Links ER/EW, 10G SONET OC-192 / STM-64	• For Cxx, please choose code from –C27 to –C43 with each step 20nm in the **For CWDM SFP Optical Modules** table. • 9 wavelengths from 1270nm to 1430nm, each step 20nm. • All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable

Type	Code	Description	Note
10G (mini GBIC) CWDM Dual Fiber Commercial (0 to +70°C)	**GQC4D-Cxx**	SFP+ CWDM single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1450~1610nm, 40KM, LC connector with DDM, 10G Ethernet Links ER/EW, 10G SONET OC-192 / STM-64	• For Cxx, please choose code from –C45 to –C61 with each step 20nm in the **For CWDM SFP Optical Modules** table. • 9 wavelengths from 1450nm to 1610nm, each step 20nm. • All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable
	GQC7D-Cxx	SFP+ CWDM single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1470~1610nm, 70-80KM, LC connector with DDM, 10GBase-ZR/ZW, 10G SONET OC-192 / STM-64	• For Cxx, please choose code from –C47 to –C61 with each step 20nm in the **For CWDM SFP Optical Modules** table. • 8 wavelengths from 1470nm to 1610nm, each step 20nm. • All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable

1.2 Industrial Range (-40 to 85°C)

Compatible with G7860A, IP6320A, PTN10G card, G7820 and WDM1800

Type	Code	Description	Note
10G (mini GBIC) Dual Fiber Industrial (-40°C to 85 °C)	**TNPBD**	SFP+ multi-mode optical module with dual uni-directional fiber, 10.3G, 850nm, 33M, 82M, 300M, 400M, LC connector with DDM, 10G Ethernet Links SR/SW	• Operating Temperature: -10~+85°C Transmit distance: 33m (OM1 Fiber, 62.5/125μm), 82m (OM2 Fiber, 50/125μm), 300m (OM3 Fiber, 50/125μm), 400m (OM4 Fiber, 50/125μm)
	TQPBD	SFP+ multi-mode optical module with dual uni-directional fiber, 10.3G, 850nm, 33M, 82M, 300M, 400M, LC connector with DDM, 10G Ethernet Links SR/SW	
	GNT1D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3Gbps, 1310nm, 10KM, LC connector with DDM, 10G Ethernet Links LR/LW	
	GNT2D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3Gbps, 1310nm, 20KM, LC connector with DDM, 10G Ethernet Links LR/LW	• Operating Temperature: -25~+85°C
	GNL4D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3Gbps, 1550nm, 40KM, LC connector with DDM, 10G Ethernet Links ER/EW	
	GNL8D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3Gbps, 1550nm, 80KM, LC connector with DDM, 10G Ethernet Links ZR/ZW	• Operating Temperature: -25~+85°C
	GNLUD	SFP+ single-mode optical module with dual uni-directional fiber, 10.3Gbps, 1550nm, 100KM, LC connector with DDM, 10G Ethernet Links ZR/ZW	• Operating Temperature: -5~+85°C

Type	Code	Description	Note
	GQT1D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1310nm, 10KM, LC connector with DDM, 10G Ethernet Links LR/LW	• Operating Temperature: -25~+85°C • All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable
	GQT2D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1310nm, 20KM, LC connector with DDM, 10G Ethernet Links LR/LW	
	GQL4D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1550nm, 40KM, LC connector with DDM, 10G SONET Links ER/EW	
	GQL8D	SFP+ single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1550nm, 80KM, LC connector with DDM, 10G SONET Links ZR/ZW	
10G (mini GBIC) DWDM Dual Fiber Industrial (-40°C to 85 °C)	**GQL8D-Dxx**	SFP+ DWDM single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1563.8~1528.77nm, 80KM, LC connector with DDM, 10G Ethernet Links ZR/ZW, 10G SONET OC-192 / STM-64	• For Dxx, please choose code from -D25 to -D28 in the **For DWDM SFP+ Optical Modules** table. • All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable
10G (mini GBIC) CWDM Dual Fiber Industrial (-40°C to 85 °C)	**GQL8D-Cxx**	SFP+ DWDM single-mode optical module with dual uni-directional fiber, 10.3G ~1.25 Gbps, 1290~1610nm, 80KM, LC connector with DDM, 10G Ethernet Links ZR/ZW, 10G SONET OC-192 / STM-64	• For Cxx, please choose code from -C29 to -C61 in the **For DWDM SFP+ Optical Modules** table. • 17 wavelengths from 1290nm to 1610nm, each step 20nm. • All 10.3G ~1.25 Gbps optical module downgrading to 1.25GMbps data rate will be workable

2 2.5G SFP Ordering Info

2.1 Commercial Range (0 to 70°C)

Compatible with O9400R-CC16/CCPA/B2G5 and O9500R-CC16/CCPA/B2G5 cards

Type	Code	Description	Note
2.5G (mini GBIC) Dual Fiber Commercial (0 to +70°C)	**PLB2D**	SFP single-mode optical module with dual uni-directional fiber, 2.5G, 1310nm, 15KM, LC connector with DDM	
	PLB4D	SFP single-mode optical module with dual uni-directional fiber, 2.5G, 1310nm, 40KM, LC connector with DDM	
	PLC8D	SFP single-mode optical module with dual uni-directional fiber, 2.5G, 1550nm, 80KM, LC connector with DDM	
2.5G (mini GBIC) Single Fiber Commercial (0 to +70°C)	**PLD2D**	SFP single-mode optical module with single bi-directional fiber, 2.5G, TX1310 /RX1550, 15~20KM, LC connector with DDM, compatible with IEEE 802.3ah, 1000Base-BX10	
	PLE2D	SFP single-mode optical module with single bi-directional fiber, 2.5G, TX1550 /RX1310, 15~20KM, LC connector with DDM, compatible with IEEE 802.3ah, 1000Base-BX10	
	PLD4D	SFP single-mode optical module with single bi-directional fiber, 2.5G, TX1310/RX1550, 40KM, LC connector with DDM, OC48/STM-16 application	
	PLE4D	SFP single-mode optical module with single bi-directional fiber, 2.5G, TX1550 /RX1310, 40KM, LC connector with DDM, OC48/STM-16 application	

Type	Code	Description	Note
2.5G (mini GBIC) CWDM Dual Fiber Commercial (0 to +70°C)	**PLD4D-Cxx**	SFP CWDM single-mode optical module with dual uni-directional fiber, 2.5G, 1470 ~1610nm, 40KM, LC connector with DDM	• For Cxx, please choose code from -C47 to -C61 with each step 20nm in the **For CWDM SFP Optical Modules** table. • 8 wavelengths from 1470nm to 1610nm, each step 20nm.
2.5G (mini GBIC) DWDM Dual Fiber Commercial (0 to +70°C)	**PLC8D-Dxx**	SFP DWDM single-mode optical module with dual uni-directional fiber, 2.5G, 1563.8~1528.77nm, 80KM, LC connector with DDM, SONET OC-48	• For Dxx, please choose code from -D17 to -D61 in the **For DWDM SFP+ Optical Modules** table.

2.2 Industrial Range (-40 to 85°C)

Compatible with O9400R-CC16/CCPA/B2G5 and O9500R-CC16/CCPA/B2G5 cards

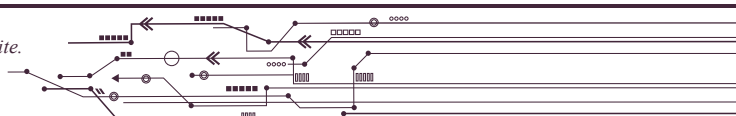
Type	Code	Description	Note
2.5G (mini GBIC) Dual Fiber Industrial (-40 to +85°C)	**PLT2D**	SFP single-mode optical module with dual bi-directional fiber, 2.5G, 1310nm, 20KM, LC connector with DDM	
	PLT4D	SFP single-mode optical module with dual bi-directional fiber, 2.5G, 1310nm, 40KM, LC connector with DDM	
	PLT8D	SFP single-mode optical module with dual bi-directional fiber, 2.5G, 1310nm, 80KM, LC connector with DDM	
	PLL8D	SFP single-mode optical module with dual bi-directional fiber, 2.5G, 1550nm, 80KM, LC connector with DDM	
2.5G (mini GBIC) Single Fiber Industrial (-40 to +85°C)	**PSQ8D**	SFP+ single-mode optical module with single bi-directional fiber, 2.5G, TX1510 / RX1590nm, 80KM, LC connector with DDM, SONET OC-48	
	PSR8D	SFP+ single-mode optical module with single bi-directional fiber, 2.5G, TX1590 / RX1510nm, 80KM, LC connector with DDM, SONET OC-48	

3. 1.25G SFP Ordering Info

3.1 Commercial Range (0 to 70°C)

Compatible with IP6704A, IP6750, IP6820, O9340S, TDMoEA card, PTNext card, 8GES4SWA card, 8GES16SWA card and AM3440-CCPA card

Type	Code	Description	Note
1.25G (mini GBIC) Dual Fiber Commercial (0 to 70°C)	**MTAFD**	SFP multi-mode optical module with dual uni-directional fiber, 1.25G~ 622M, 850nm, 500m, LC connector with DDM, 1000Base-SX	
	MTBTD	SFP multi-mode optical module with dual uni-directional fiber, 1.25G, 1310nm, 2KM, LC connector with DDM, 1000Base-SX+	
	PTB2D	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1310nm, 20KM, LC connector with DDM, 1000Base-LX	
	PTB2W	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1310nm, 20KM, LC connector, 1000Base-LX	
	PTB4D	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1310nm, 40KM, LC connector with DDM, 1000Base-LHX	
	PTB4W	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1310nm, 40KM, LC connector, 1000Base-LHX	



Type	Code	Description	Note
	PTC6D	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1550nm, 60KM, LC connector with DDM, 1000Base-XD	
	PTC6W	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1550nm, 60~80KM, LC connector, 1000Base-XD	
1.25G (mini GBIC) Single Fiber Commercial (0 to 70°C)	**MTDFD**	SFP multi-mode optical module with single bi-directional fiber, 1.25G, TX1310/RX1550, 500~550M, LC connector with DDM, GbE/1X fiber Channel	
	MTEFD	SFP multi-mode optical module with single bi-directional fiber, 1.25G, TX1550/RX1310, 500~550M, LC connector with DDM, GbE/1X fiber Channel	
	PTD2D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1310 /RX1550, 20KM, LC connector with DDM, GbE/1X fiber Channel	
	PTE2D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1550 /RX1310, 20KM, LC connector with DDM, GbE/1X fiber Channel	
	PTD4W	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1310 /RX1550, 40KM, LC connector, GbE/1X fiber Channel	
	PTE4W	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1550 /RX1310, 40KM, LC connector, GbE/1X fiber Channel	
1.25G (mini GBIC) Single Fiber Commercial (0 to 70°C)	**PTD4D**	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1310 /RX1550, 40KM, LC connector with DDM, GbE/1X fiber Channel	
	PTE4D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1550 /RX1310, 40KM, LC connector with DDM, GbE/1X fiber Channel	
	PTD6D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1310 /RX1550, 60KM, LC connector with DDM, GbE/1X fiber Channel	
	PTE6D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1550 /RX1310, 60KM, LC connector with DDM, GbE/1X fiber Channel	
1.25G (mini GBIC) CWDM Dual Fiber Commercial (0 to +70°C)	**PTC4D-Cxx**	SFP CWDM single-mode optical module with dual uni-directional fiber, 1.25G, 1470~1610nm, 20~40KM, LC connector with DDM, GbE/1X fiber Channel	• For Cxx, please choose code from –C47 to -C61 in the **For CWDM SFP+ Optical Modules** table. • 8 wavelengths from 1470nm to 1610nm, each step 20nm. • 8 wavelengths from 1470nm to 1610nm, each step 20nm.
	PTC8D-Cxx	SFP CWDM single-mode optical module with dual uni-directional fiber, 1.25G~622M, 1470~1610nm, 80KM, LC connector with DDM, GbE/1X fiber Channel	• For Cxx, please choose code from –C47 to -C61 in the **For CWDM SFP+ Optical Modules** table. • 8 wavelengths from 1470nm to 1610nm, each step 20nm. • 8 wavelengths from 1470nm to 1610nm, each step 20nm.

3.2 Industrial Range (-40 to +85°C)

Compatible with IP6704A, IP6750, IP6820, O9340S, TDMoEA card, PTNext card, 8GES4SWA card, 8GES16SWA card and AM3440-CCPA card

Type	Code	Description	Note
1.25G (mini GBIC) Dual Fiber Industrial (-40 to 85°C)	**MTPFD**	SFP multi-mode optical module with dual uni-directional fiber, 1.25G, 850nm, 500M, LC connector with DDM, 1000Base-SX	
	MTTTD	SFP multi-mode optical module with dual uni-directional fiber, 1.25G, 1310nm, 2KM, LC connector with DDM, 1000Base-SX+	
	PTT2D	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1310nm, 15-20KM, LC connector with DDM, 1000base-LHX	
	PTT4D	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1310nm, 40KM, LC connector with DDM, 1000base-LHX	
	PTL6D	SFP single-mode optical module with dual uni-directional fiber, 1.25G, 1550nm, 60KM, LC connector with DDM, 1000base-ZX	
1.25G (mini GBIC) Single Fiber Industrial (-40 to 85°C)	**PTF2D**	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1310/ RX1550, 20KM, LC connector with DDM, Gbe/1X fiber Channel	
	PTG2D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1550/ RX1310, 20KM, LC connector with DDM, Gbe/1X fiber Channel	
	PTF4D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1310/ RX1550, 40KM, LC connector with DDM, Gbe/1X fiber Channel	
	PTG4D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1550/ RX1310, 40KM, LC connector with DDM, Gbe/1X fiber Channel	
	PTF6D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1310/ RX1550, 60KM, LC connector with DDM, Gbe/1X fiber Channel	
	PTG6D	SFP single-mode optical module with single bi-directional fiber, 1.25G, TX1550/ RX1310, 60KM, LC connector with DDM, Gbe/1X fiber Channel	

NOTE: For other special optical modules, please contact your nearest Loop sales representative

4. 622~155M SFP Ordering Info

4.1 Commercial Range (0 to 70°C)

Compatible with O9400R, O9500R, O9550, V4150-R-B155 card, O9400-R-B16 card and O9500-R-B16 card

Type	Code	Description	Note
622~155Mbps (mini GBIC) Dual Fiber Commercial (0 to 70°C)	**MJBTD**	SFP multi-mode optical module with dual uni-directional fiber, 622~155M, 1310nm, 2KM, LC connector with DDM	
	PJB2W	SFP single-mode optical module with dual uni-directional fiber, 622~155M, 1310nm, 20KM, LC connector, S4.1/IR1	
	PJB2D	SFP single-mode optical module with dual uni-directional fiber, 622~155M, 1310nm, 20KM, LC connector with DDM, S4.1/IR1	
	PJCXD	SFP single-mode optical module with dual uni-directional fiber, 622~155M, 1550nm, 120KM, LC connector with DDM, Extend distance L4.2	

4.2 Industrial Range (-40 to +85°C)

Compatible with O9400R, O9500R, O9550, V4150-R-B155 card, O9400-R-B16 card and O9500-R-B16 card

Type	Code	Description	Note
622~155Mbps (mini GBIC) Dual Fiber Industrial (-40 to 85°C)	**PJT2D**	SFP single-mode optical module with dual uni-directional fiber, 622~155M, 1310nm, 20KM, LC connector with DDM, S4.1 / IR1	

NOTE: For other special/industrial optical modules, please contact your nearest Loop sales representative.

5 622M SFP Ordering Info

5.1 Commercial Range (0 to 70°C)

Compatible with O9400R, O9500R, O9550, V4150-R-B155 card, O9400-R-B16 card and O9500-R-B16 card

Type	Code	Description	Note
622Mbps (mini GBIC) Dual Fiber Commercial (0 to 70°C)	**MCABD**	SFP multi-mode optical module with dual uni-directional fiber, 622M, 850nm, 300~500M, LC connector with DDM	
	PCB4W	SFP single-mode optical module with dual uni-directional fiber, 622M, 1310nm, 40KM, LC connector, L4.1/LR1	
	PCB4D	SFP single-mode optical module with dual uni-directional fiber, 622M, 1310nm, 40KM, LC connector with DDM, L4.1/LR1	
	PCC8W	SFP single-mode optical module with dual uni-directional fiber, 622M, 1550nm, 80KM, LC connector, L4.2/LR2	
	PCC2D	SFP single-mode optical module with dual uni-directional fiber, 622M, 1550nm, 20KM, LC connector, L4.2/LR2	
	PCC8D	SFP single-mode optical module with dual uni-directional fiber, 622M, 1550nm, 80KM, LC connector with DDM, L4.2/LR2	
622Mbps (mini GBIC) Single Fiber Commercial (0 to 70°C)	**PCD2D**	SFP single-mode optical module with single bi-directional fiber, 622M, TX1310/RX1550, 20KM, LC connector with DDM, S4.1/IR1	
	PCE2D	SFP single-mode optical module with single bi-directional fiber, 622M, TX1550/RX1310, 20KM, LC connector with DDM, S4.2/IR2	
	PCD4D	SFP single-mode optical module with single bi-directional fiber, 622M, TX1310/RX1550, 40KM, LC connector with DDM, L4.1/LR1	
	PCE4D	SFP single-mode optical module with single bi-directional fiber, 622M, TX1550/RX1310, 40KM, LC connector with DDM, L4.2/LR2	
	PCD6D	SFP single-mode optical module with single bi-directional fiber, 622M, TX1310/RX1550, 60KM, LC connector with DDM, L4.1/LR1	
	PCE6D	SFP single-mode optical module with single bi-directional fiber, 622M, TX1550/RX1310, 60KM, LC connector with DDM, L4.2/LR2	
622M (mini GBIC) DWDM Dual Fiber Commercial (0 to +70°C)	**PCC8D-Dxx**	SFP CWDM single-mode optical module with dual uni-directional fiber, 622M, 1563.8~1528.77nm, 80KM, LC connector with DDM	• For Dxx, please choose code from -D47 to -D61 with each step 20nm in the **For CWDM SFP Optical Modules** table.
622M (mini GBIC) CWDM Dual Fiber Commercial (0 to +70°C)	**PCC8D-Cxx**	SFP CWDM single-mode optical module with dual uni-directional fiber, 622M, 1470 ~1610nm, 80KM, LC connector with DDM	• For Cxx, please choose code from -C47 to -C61 with each step 20nm in the **For CWDM SFP Optical Modules** table. • 8 wavelengths from 1470nm to 1610nm, each step 20nm. • 8 wavelengths from 1470nm to 1610nm, each step 20nm.

NOTE: For other special/industrial optical modules, please contact your nearest Loop sales representatives.

5.2 Industrial Range (-40 to +85°C)

Compatible with O9400R, O9500R, O9550, V4150-R-B155 card, O9400-R-B16 card and O9500-R-B16 card

Type	Code	Description	Note
622Mbps (mini GBIC) Dual Fiber Industrial (-40 to 85°C)	**PCT5D**	SFP single-mode optical module with dual uni-directional fiber, 622M, 1310nm, 30~50KM, LC connector with DDM, L4.1 / LR1	

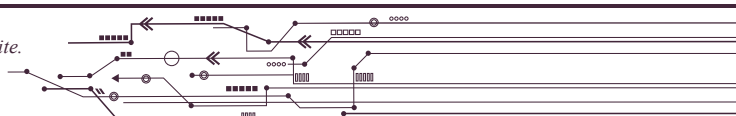
6. 125M/155M SFP Ordering Info

6.1 Commercial Range (0 to 70°C)

Compatible with IP6702A, IP6704A, IP6810, O9150SA, O9400R, O9550, O9500-R-B16 card, V4150-R-B155 card, IP6510-LN, IP6510 and AM3430

Type	Code	Description	Note
155Mbps (mini GBIC) Dual Fiber Commercial (0 to 70°C)	**MHBTD**	SFP multi-mode optical module with dual uni-directional fiber, 155M, 1310nm, 2KM, LC connector with DDM, Fast Ethernet and compliant with ITU recommendation G.957	
	PHB2D	SFP single-mode optical module with dual uni-directional fiber, 155M, 1310nm, 20KM, LC connector with DDM, S1.1/IR1	
	PHC2W	SFP single-mode optical module with dual uni-directional fiber, 155M, 1550nm, 20KM, LC connector, L1.2/LR2	
	PHC2D	SFP single-mode optical module with dual uni-directional fiber, 155M, 1550nm, 15KM, LC connector with DDM, S1.1/IR1	
	PHB5W	SFP single-mode optical module with dual uni-directional fiber, 155M, 1310nm, 60KM, LC connector, L1.1 / LR1	
	PHB5D	SFP single-mode optical module with dual uni-directional fiber, 155M, 1310nm, 60KM, LC connector with DDM, L1.1/LR1	
	PHC8D	SFP single-mode optical module with dual uni-directional fiber, 155M, 1550nm, 80KM, LC connector with DDM, L1.2/LR2	
155Mbps (mini GBIC) Single Fiber Commercial (0 to 70°C)	**MHDTD**	SFP multi-mode optical module with single bi-directional fiber, 155M, TX1310/RX1550, 2KM, LC connector with DDM, Fast Ethernet and compliant with ITU recommendation G.957	
	MHETD	SFP multi-mode optical module with single bi-directional fiber, 155M, TX1550/RX1310, 2KM, LC connector with DDM, Fast Ethernet and compliant with ITU recommendation G.957	
	PHD2D	SFP single-mode optical module with single bi-directional fiber, 155M, TX1310/RX1550, 10~20KM, LC connector with DDM, Fast Ethernet and compliant with ITU-T recommendation G.957	
	PHE2D	SFP single-mode optical module with single bi-directional fiber, 155M, TX1550/RX1310, 10~20KM, LC connector with DDM, Fast Ethernet and compliant with ITU-T recommendation G.957	
	PHD4D	SFP single-mode optical module with single bi-directional fiber, 155M, TX1310/RX1440, 40~50KM, LC connector with DDM, Fast Ethernet and compliant with ITU-T recommendation G.957	
	PHE4D	SFP single-mode optical module with single bi-directional fiber, 155M, TX1550/RX1310, 40~50KM, LC connector with DDM, Fast Ethernet and compliant with ITU-T recommendation G.957	
155M (mini GBIC) DWDM Dual fiber Commercial (0 to +70°C)	**PHC8D-Dxx**	SFP DWDM single-mode optical module with dual uni-directional fiber, 155M, 1563.8~1528.77nm, 80KM, LC connector with DDM, IEEE C37.94 Optical-Electrical Interface Conversion	• For Dxx, please choose code from –D47 to -D61 in the **For DWDM SFP+ Optical Modules** table.
155M (mini GBIC) CWDM Dual fiber Commercial (0 to +70°C)	**PHC4D-Cxx**	SFP CWDM single-mode optical module with dual uni-directional fiber, 155M, 1470~1610nm, 30~40KM (30dB margin), LC connector with DDM, 155 Mbps SONET OC-3/ SDH STM-1/125 Mbps Fast Ethernet	• For Cxx, please choose code from –C47 to -C61 in the **For CWDM SFP+ Optical Modules** table. • 8 wavelengths from 1470nm to 1610nm, each step 20nm.

NOTE: For other special optical modules, please contact your nearest Loop sales representative.



6.2 Industrial Range (-40 to +85°C)

Compatible with IP6702A, IP6704A, IP6810, O9150SA, O9400R, O9550, O9500-R-B16 card, V4150-R-B155 card, IP6510-LN, IP6510 and AM3430

Type	Code	Description	Note
155Mbps (mini GBIC) Dual Fiber Industrial (-40 to +85°C)	**MHPTD**	SFP multi-mode optical module with dual uni-directional fiber, 155M, 850nm, 500M~2KM, LC connector with DDM, Fast Ethernet and compliant with ITU recommendation G.957	
	PHT3D	SFP multi-mode optical module with dual uni-directional fiber, 155M, 1310nm, 30~40KM, LC connector with DDM, S1.1/IR1	
	PHT6D	SFP multi-mode optical module with dual uni-directional fiber, 155M, 1310nm, 50~60KM, LC connector with DDM, L1.1/LR1	
	MRPTD	SFP multi-mode optical module with dual uni-directional fiber, 2KM, 850nm, 2KM, LC connector with DDM, IEEE C37.94 Optical-Electrical Interface Conversion	
125Mbps (mini GBIC) Dual Fiber Industrial (-40 to +85°C)	**MFPTW**	SFP multi-mode optical module with dual uni-directional fiber, 125M, 850nm, 2KM, LC connector, Fast Ethernet and compliant with ITU recommendation G.957	

7. 1x9 155M/125M/1~100M Ordering Info

7.1 Commercial Range (0 to 70°C)

Compatible with AM3430, FOM card for V4200-9/AM3440/O9550, 1FOMA card for AM3440/O9550, 1FOMB card for O9500R, C37.94 card (4C37) for AM3440/O9550/O9500R, mini C37.94 card (M1C37) for AM3440

Type	Code	Description	Note
1x9 155Mbps Dual Fiber Commercial (0 to 70°C)	**NHB3S (was SAA)**	1x9, single-mode optical module with dual uni-directional fiber, 155M, 1310nm, 30KM, SC connector, S1.1/IR1	
	NHB5S (was SBB)	1x9, single-mode optical module with dual uni-directional fiber, 155M, 1310nm, 50-60KM, SC connector, L1.1/IR1	
	NHB3F (was SCC)	1x9, single-mode optical module with dual uni-directional fiber, 155M, 1310nm, 30KM, FC connector, S1.1/IR1	
	***NFB3T**	1x9, single-mode optical module with dual uni-directional fiber, 125M, 1310nm, 30KM, ST connector	* For the orders of the listed optical modules, please contact your Loop sales representative.
	***NHC2S (was SDD)**	1x9, single-mode optical module with dual uni-directional fiber, 155M, 1550nm, 20KM, SC connector, S1.2/IR2	* For the orders of the listed optical modules, please contact your Loop sales representative.
	NHCUS (was SEE)	1x9, single-mode optical module with dual uni-directional fiber, 155M, 1550nm, 100KM, SC connector, L1.2/ LR2	
	NHCXS	1x9, single-mode optical module with dual uni-directional fiber, 155M, 1550nm, 120KM(35db), SC connector	
	NHCYS	1x9, single-mode optical module with dual uni-directional fiber, 155M, 1550nm, 200KM(35db), SC connector, Extended L1.2	• The maximum distance 1x9 optical module current available
1x9 155Mbps Single Fiber Commercial (0 to 70°C)	**WHD2S (was SSM)**	1x9, single-mode optical module with single bi-directional fiber, 155M, TX1310/RX1550, 20~30KM(19db), SC connector, Fast Ethernet	
	WHE2S (was SSS)	1x9, single-mode optical module with single bi-directional fiber, 155M, TX1530/RX1310, 20~30KM(19db), SC connector, Fast Ethernet	
1x9 125Mbps Dual Fiber Commercial (0 to 70°C)	***QFBTT**	1x9, multi-mode optical module with dual uni-directional fiber, 125M, 1310nm, 2KM, ST connector	* For the orders of the listed optical modules, please contact your Loop sales representative.

7.2 Industrial Range (-40 to +85°C)

Compatible with AM3430, FOM card for V4200-9/AM3440/O9550, 1FOMA card for AM3440/O9550, 1FOMB card for O9500R, C37.94 card (4C37) for AM3440/O9550/O9500R, mini C37.94 card (M1C37) for AM3440

Type	Code	Description	Note
1x9 155Mbps Dual Fiber Industrial (-40 to +85°C)	**NHT3S**	1x9, single-mode optical module with dual uni-directional fiber, 155M, 1310nm, 30KM, SC connector, S1.1/IR1	

8. 1x9 2M Ordering Info

8.1 Commercial Range (0 to 70°C)

Compatible with C37.94 card (4C37) for AM3440/O9550/O9500R

Type	Code	Description	Note
1x9 2Mbps Commercial (0 to 70°C)	**QRATT**	1x9, multi-mode optical module, 2M, 850nm, 2KM, ST connector	

9. 1x8 2M Ordering Info

9.1 Commercial Range (0 to 70°C)

Compatible with C37.94 card (4C37) for AM3440/O9550/O9500R

Type	Code	Description	Note
1x8 2Mbps Commercial (0 to 70°C)	**ZRATT**	1x8, multi-mode optical module with separate TX and RX, 2M, 820nm, 2KM, ST connector	• Separate transceiver and receiver

10. 2M SFP Ordering Info

10.1 Commercial Range (0 to 70°C)

Compatible with C37.94(4C37SFPA) card for O9500R

Type	Code	Description	Note
2Mbps Dual Fiber Commercial (0 to 70°C)	**MRATD**	SFP multi-mode optical module with dual uni-directional fiber, 2Mbps, 850nm, 2KM, LC connector with DDM, IEEE C37.94 Optical-Electrical Interface Conversion	• Use 2 fibers for all SFP/SFP+ optical modules

NOTE: For other special optical modules, please contact your nearest Loop sales representative.

11. 10/100/1000M SFP EE Transceiver Module

11.1 Commercial Range (0 to 70°C)

Compatible with G7860A, IP6820, PTNext/8GES4SWA/8GES16SWA cards for O9400R and O9500R

Type	Code	Description	Note
10/100/1000M Copper SFP Transceiver	**EMOAR**	Copper SFP Transceiver, 10/100/1000M, RJ45 with four pair, CAT 5 UTP cabling Interface: SGMII	• Typical cable length=100M
10/100M Copper SFP Transceiver	**EENAR**	Copper SFP Transceiver, 10/100M, RJ45 with four pair, CAT 5 UTP cabling Interface: Serdes	• Typical cable length=100M
1G Copper SFP Transceiver	**ETOAR**	Copper SFP Transceiver, 1G, RJ45 with four pair, CAT 5 UTP cabling Interface: Serdes	• Typical cable length=100M • For IP6820

11.2 Industrial Range (-40 to +85°C)

Compatible with G7860A, IP6820, PTNext/8GES4SWA/8GES16SWA cards for O9400R and O9500R

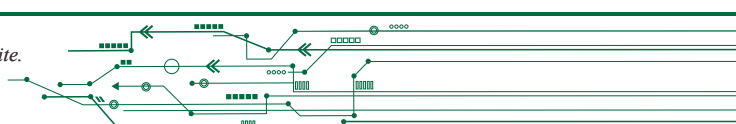
Type	Code	Description	Note
155M Copper SFP Transceiver	**EHNAC**	Copper SFP Transceiver, 155M, Coaxial Connector (Din 1.0/2.3 75Ohm / Din 47279)	• Typical cable length=100M
10/100/1000M Copper SFP Transceiver	**EMNAR**	Copper SFP Transceiver, 10/100/1000M, RJ45 with four pair, CAT 5 UTP cabling Interface: SGMII	• Typical cable length=100M
1G Copper SFP Transceiver	**ETNAR**	Copper SFP Transceiver, 1G, RJ45 with four pair, CAT 5 UTP cabling Interface: Serdes	• Typical cable length=100M • For IP6820

12. 155M SFP EE Transceiver Module for SDH only

12.1 Industrial Range (-40 to +85°C)

Compatible with B16 card for G7860A/O9400R/O9500R

Type	Code	Description	Note
155M Copper SFP Transceiver	**EHNAC**	Copper SFP Transceiver, 155M, Coaxial Connector (Din 1.0/2.3 75Ohm coaxial connector on 8mm pitch/ Din 47279)	Typical cable length=100M



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