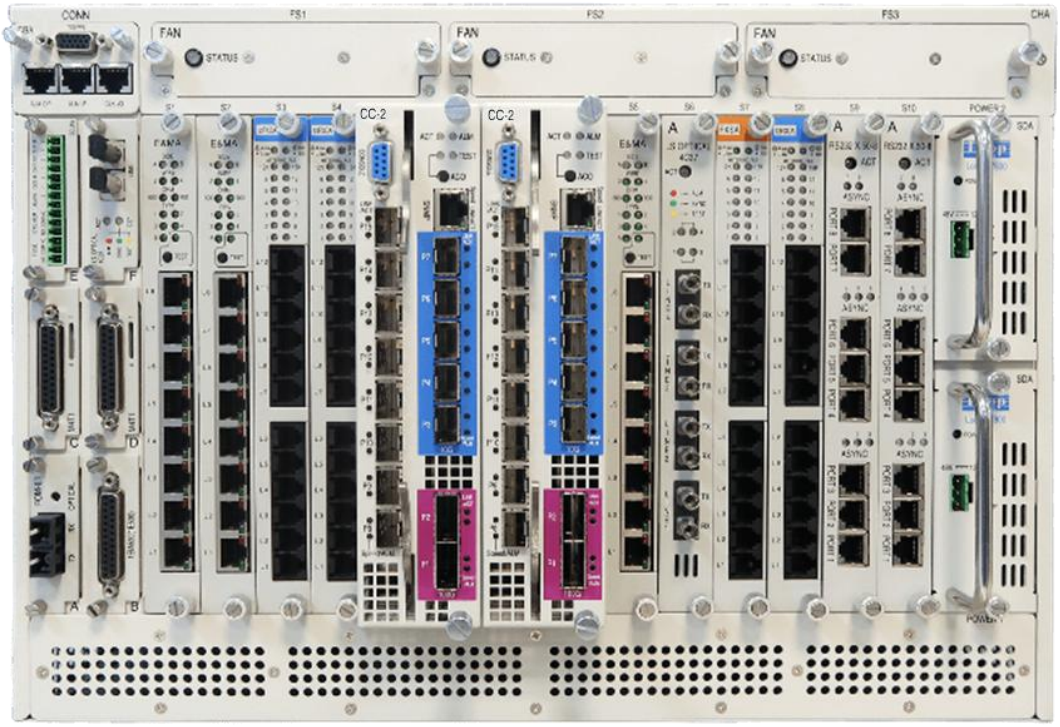
Loop-G7800 PTN
MPLS/CE Packet Transport Network



ETSI Front View of G7800

Description

G7800 supports both MPLS-TP and Carrier Ethernet (EPL, EVPL, EPLAN, EVC defined in MEF) for packet transportation, as well as advanced L3 features for enterprise network services. In addition to native Ethernet transport, G7800 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 G7800 with core switching bandwidth up to 400Gbps supports 100GE, 40GE, 10GE and 1GE along with additional TDM interfaces, including STM-n/OC-n, E1/T1, and a rich variety of low-speed DS0 interfaces. The system is a perfect combination of PTN/CE, SDH, and PDH technologies.

G7800 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 G7800 is 7U in height, and its powerful functions enable customers to provision a service-grooming hub, ring, or mesh 10G packet network with ultimate ease.

G7800 comes with an environmentally friendly design. G7800 devices are products with low pollution. 90% of the metal structure uses low-pollution stainless steel and aluminum plates, which is more environmentally friendly than materials used in previous products. It also comes with detachable design, for easy assembly and disassembly. G7800 also comes with recyclable design; after it reaches end of life, its components can be dismantled for reuse, recycling, energy recovery, or other non-wasteful means.

Features

Mechanical and Electrical

- 7U height, 19" width ETSI unit (front access)
- Power supply: hot swappable DC, dual for redundancy
- Operating Temperature: -20 ºC to 60ºC

System Capacity

- Up to 2 x 100GE/40GE ports
- Up to 34 x 10GE ports
- Up to 76 x 1GE ports
- Up to 64 x FE Base-T ports
- Up to 320 x E1/T1 ports
- Up to 60 x DS3* ports
- Up to 12 x STM-1 ports
- Up to 12 x STM-4 ports
- Up to 12 x STM-16 ports
- Up to 16 x POE/POE+ ports
- Up to 8 x POE++ ports
- Up to 590 Mpps Throughput

MPLS-TP

- Any Ethernet port can be configured as NNI (MPLS port) or UNI (Ethernet service port)
- Bi-directional LSP with 2K maximum instances
- Tunnel instances: 2K
- PWs per system: 5K maximum
- Transit LSPs: 2K
- Terminating (protected) tunnels: 1K
- Fast BFD sessions (≤ 10ms): 2K
- 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 per card:
  - CC-2: 64 PWs
  - TE1-32-LoSW1 card: up to 32 PWs
  - B2G5-2-LoSW410 card: up to 2676 PWs

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): 9000
- Layer 2 Multicast Entries: 2K
- EPL, EVPL, EP-LAN, EPV-LAN, EP-Tree
- E-Access: EPL-Access, EPVL-Access

Network Protection

- MPLS-TP
  - LSP 1+1/1:1
  - LSP E2E protection switching < 50ms

Ethernet Pseudowire Services

- E-Line, E-LAN, E-Tree services as defined by MEF 9 and 14 and using VPWS/VPLS
- VPWS PW instances: 2K
- VLANs: 4094 maximum instances
- Native Ethernet packets supported
- Encapsulation: PW/LSP (MPLS-TP), VLAN tagging (1Q), VLAN double tagging (Q-in-Q)

TDM Pseudowire Services

- Circuit Emulation
  - DS0 (64K timeslots): CES & multiframe PW
  - Unframed E1/T1: SAToP PW
  - VC-11/12/3/4, VT-1.5/2, STS-1/3: CEP PW
- PDH Timing recovery: ACR/DCR/System
- ACR/DCR support
- SDH Circuit Emulation over Packet (CEP)
- Encapsulation
  - PW/LSP (TDM over MPLS-TP),
  - MEF 8 (TDM over Ethernet),
  - TDM over IP
- DS0 cross-connection
  - Two-way FE1(N*DS0) to VTE1 cross-connection
  - Two-way FE1(N*DS0) to FE1(N*DS0) cross-connection

Native TDM Cross-Connection

VPLS

- VPLS bridging
- H-VPLS bridging
- 128K MAC addresses
- 2K VPLS/VFI 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
  - G.8265.1 Profile (Frequency Synchronization)
- SyncE
  - Synchronous Ethernet from all built-in and plug-in GbE, 10GbE ports
  - ITU-T Ethernet Synchronous Message Channel (ESMC)
- 3E timing
- TDM line clock: E1/T1 and STM/OC ports

  - PW Redundancy
  - 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)
- Upload/Download NE configuration through TFTP/SFTP
- Syslog, NTP
- SNMP Port 1:1 Protection
- Console 1+1 Protection

Network Security

- MACSec (Media Access Control Security)
  - IEEE 802.1AE MACsec
  - AES-128-CMAC or AES-256-CMAC*
  - Authentication using Certificate or Pre-Shared Keys (PSK)
  - Switch-to-Switch (static CAK) mode
  - Switch-to-Host (dynamic CAK) mode*
- IPSec (Internet Protocol Security)
  - IPSec/IKE VPN tunnel for Control-plane
  - IKEv1/IKEv2 support
  - Support encryption algorithms: AES128, AES256*
  - Support integrity algorithms – md5, sha1, sha256
  - Password – (PSK) based and certificate-(pubkey) based keys
- Storm Suppression
  - Broadcast, Multicast, Unknown Unicast or Known Unicast packets
- External clock input and output (2 Mbps / 2 MHz)

L3 Routing

- IPv4 Routings
- VRF: up to 200 instances
- ARP, Ping, Trace route
- VRRP: 255 instances
- Static Route
- RIP v2
- OSPF v2
- Routing table size: 14,000~19,000
- Routing among Physical Ethernet ports, VLAN virtual port (VLAN routing), and PW ports.
- 32 Sub interfaces
- IGMP v2/v3
- PIM-SM
- NTP client
- IPv6 Routings*
- BGP*

*Future option

Ordering Information

Note 1: RoHS compliant units are identified by the letter **G** appearing at the end of the ordering code.
Note 2: S3~S8 are 10GE slots, while S1~S2 and S9~S10 are 1GE slots.

Ordering Code	Description	Notes
Main Unit		
Loop-G7800-CHA-**G**	7U height rack chassis for G7800 **without** CPU, power, connector board, fan and plug-in cards. The chassis includes a heat buffer on the bottom.	Please order CPU, power, connector board, fan and tributary cards separately.
Connector Board		
Loop-G7800-CB-**OPT**-**G**	1x DB15 for TOD/PPS 1x RJ45 for CLK I/O (2x IN & 2x OUT for 2M/E1) 1x RJ45 for ALARM I/P (4 alarm Inputs) 1x RJ45 for ALARM O/P (4 alarm outputs)	- The connector board is optional. Please only order one per system if needed. - Comes with one conversion cable: Loop-ACC-CAB-HDB15M-100-2BNCM-3RJ48M-DB9F-**G** - Usable with: Loop-G7800-CHA-**G** and Loop-G7800-CHB-FL-**G**

OPT=		
NO	Alarm output with Normal Open support	Contact circuit stay in open state when alarm free, and in short/closed state when system power off or in alarm state.
NC	Alarm output with Normal Closed support	Contact circuit stay in short/closed state when alarm free, and in open state when system power off or in alarm state.

CPU Module		
Loop-G7800-CC-2-**mgmt**-**G**	CC-2 card is a Controller/CPU module for G7800 chassis with RS232 console port. It supports 400 Gbps core switching bandwidth and up to 396Gbps I/O bandwidth with full-duplex at wire-speed. This module also supports built-in line interfaces including: - 5 x 10GE SFP+ ports - 8 x 1GE SFP ports - 2 x 100GE/40GE ports if activation license purchased (Loop-G7800-CC-2-100GLIC)	- Please order two for redundancy protection. - Please order SFP optical modules separately. See separate SFP module brochure - The 10GE port supports dual-rate 1GE/10GE SFP+ Optical - The 1GE port supports dual-rate FE/1GE SFP Optical. - Please specify the **mgmt** option listed in the table below
Loop-G7800-CC-2-LITE-**mgmt**-**G**	CC-2 card is a Controller/CPU module for G7800 chassis with RS232 console port. It supports 400Gbps core switching bandwidth and up to 396Gbps I/O bandwidth with full-duplex at wire-speed. This module also supports built-in line interfaces including: - 2 x 10GE SFP+ ports - 4 x 1GE SFP ports - 2 x 100GE/40GE ports if activation license purchased (Loop-G7800-CC-2-100GLIC)	- Please order two for redundancy protection. - Please order SFP optical modules separately. See separate SFP module brochure - The 10GE ports support dual-rate 1GE/10GE SFP+ Optical - The 1GE ports support dual-rate FE/1GE SFP Optical. - Please specify the **mgmt** option listed in the table below

- The code **mgmt** must be replaced by the following options. Please replace **mgmt** with your selection.

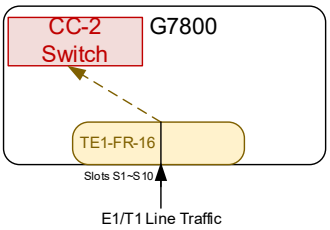
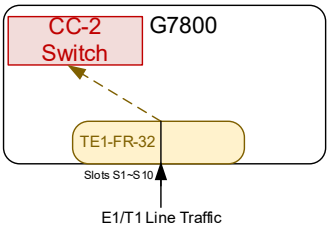
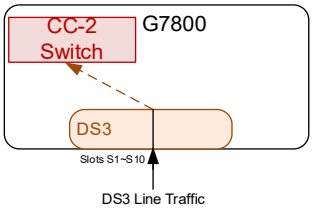
mgmt=	Description	Notes
LCT	LCT activation license included	Used with Loop-LCT Graphical Configuration Software for management
[blank]	Management via LCT disabled	If LCT is required in the future, it can still be activated via a feature activation license.

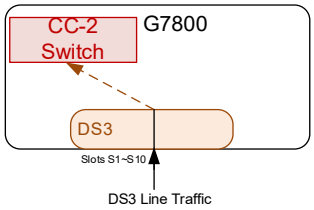
Port Activation License		
Loop-G7800-CC-2-100GLIC	100G/40G port activation license on single G7800 CC-2 or CC-2 LITE controller.	- Used with Loop-G7800-CC-2-**G** and Loop-G7800-CC-2-LITE-**G** controller. - One license will activate **all 100GE/40GE ports** on single CC-2 controller. - For systems with CC-2 controller redundancy, each CC-2 requires its own license activation respectively. - Please also purchase one Loop-ACC-CAB-QSFP100G-100-QSFP100G-AOC-**G** cable for redundancy facilitation
Loop-G7800-CC-2-10GLIC	License to activate ONE 10GE Port on single G7800 CC-2 LITE controller.	- Used with Loop-G7800-CC-2-LITE-**G** controller. - One license will activate **ONE** additional **10GE** port on single CC-2 controller. For systems with CC-2 redundancy, each CC-2 requires its own 10G port license activation respectively. - Order extra license if the required license is more than 1, for a maximum of 3
Loop-G7800-CC-2-1GLIC	License to activate ONE 1GE Port on single G7800 CC-2 LITE controller.	- Used with one Loop-G7800-CC-2-LITE-**G** controller. - One license will activate **ONE** additional **1GE** port on single CC-2 controller. For systems with CC-2 redundancy, each CC-2 requires its own 1GE port license activation respectively. - Order extra license if the required license is more than 1, for a maximum of 4
Feature Activation License for Controller		
Loop-G7800-CC-2-LCTLIC	Feature Activation License for LCT Graphical Configuration Software to support Loop-G7800-CC-2-**G** and Loop-G7800-CC-2-LITE-**G** controller card.	- Loop-LCT Software is purchased separately.
Loop-G7800-L3VRFLIC*	Feature Activation License for G7800 controller card to support L3 routing functions including VRF and VRRP.	
Loop-G7800-SMLIC-	Activation License for G7800 to	- Ordering example: Loop-

term*	provide firmware maintenance services including controller and tributary cards (Term=N x 366 days, where N ranges from 1 to 10)	G7800-SMLIC-1x366, Loop-G7800-SMLIC-2x366 and etc.

High Speed or High Density Tributary Modules (Select 1 to 10 cards from High Speed Tributary Modules list below)

Ordering Code	Description	Notes
Loop-G7800-XGE-9XG-a-G*	9 x 10G Ethernet Port SFP Optical Interface	- Please order SFP optical modules separately. See separate SFP module brochure. - Order 2 x AOC cables for each XGE-9XG card: Loop-ACC-CAB-QSFP100G-100-QSFP100G-AOC-G.
Loop-G7800-GFE-8T-a-G	8-port 10/100/1000Mbps BaseT Ethernet card	Works in 10GE slots **(S3~S8)** only
Loop-G7800-GFE-8POE1-a-G	8-port 10/100/1000Mbps BaseT Ethernet card with POE+ capability on **every port.** The POE+ is powered from the **system backplane** with power limit of: - 150W (Total Per Card) - 30W (per Port)	- The PoE+ per IEEE 802.3at-2009 can fallback to support PoE per IEEE802.3af-2003 - Works in 10GE slots **(S3~S8)** only - For Loop-G7800-GFE-8POE1-a-G and Loop-G7800-GFE-4POEP1-a-G cards, only two of either may be registered on a single G7800 simultaneously.
Loop-G7800-GFE-8POE2-a-G	8-port 10/100/1000Mbps BaseT Ethernet card with POE+ capability on **every port**. The POE+ is powered externally from the **card front panel** with power limit of: - 240W (Total Per Card) - 30W (per Port)	- The PoE+ per IEEE 802.3at-2009 can fallback to support PoE per IEEE802.3af-2003. - Works in 10GE slots **(S3~S8)** only
Loop-G7800-GFE-4POEP1-a-G	8-port 10/100/1000Mbps BaseT Ethernet card with POE++ capability on **ports 2/4/6/8**. The POE++ is powered from **system backplane** with power limit of: - 150W (Total Per Card) - 90W (per Port)	- The PoE++, per IEEE 802.3bt-2018, can fallback to support PoE+ per IEEE 802.3at-2009 or PoE per IEEE802.3af-2003. - Works in 10GE slots **(S3~S8)** only - For Loop-G7800-GFE-8POE1-a-G and Loop-G7800-GFE-4POEP1-a-G cards, only two of either may be registered on a single G7800 simultaneously.
Loop-G7800-GFE-4POEP2-a-G	8-port 10/100/1000Mbps BaseT Ethernet card with POE++ capability on **ports 2/4/6/8**. The POE++ is powered externally from **card front panel** with power limit of: - 360W (Total Per Card) - 90W (per Port)	- The PoE++, per IEEE 802.3bt-2018, can fallback to support PoE+ per IEEE 802.3at-2009 or PoE per IEEE802.3af-2003. - Works in 10GE slots **(S3~S8)** only
Loop-G7800-GFE-10S-a-G	10-port 1GE or 1-port 10GE SFP Optical Interface Card	Please order SFP optical modules separately. See separate SFP module brochure
Loop-G7800-GFE-1XG-a-G	1-port 10GE SFP+ Optical Interface Card	
Loop-G7800-XCU-a-G	SDH/SONET cross-connect card on a TDM-dedicated bus.	- Use two cards for redundancy exclusively in Slot 7 and Slot 8.

Ordering Code	Description	Notes
	Supports 816 VC3 x 816 VC3 and 4032 VC12 x 4032 VC12 external interface, 1 x STM-64 or 2 x STM-16 or 8 x STM-4/1.	
Loop-G7800-TE1-16-LoSW1-a-**G**	16-port T1 or 16-port E1(120 ohm) software programmable plug-in module with 1 x SCSI connector, supporting Unframed T1/E1 Circuit Emulation over PSN (SAToP) for Line to Switch.	- Please order separately for conversion panels and cables listed in below tables.
Loop-G7800-TE1-32-LoSW1-a-**G**	32-port T1 or 32-port E1(120 ohm) software programmable plug-in module with 2 x SCSI connectors, supporting Unframed T1/E1 Circuit Emulation over PSN (SAToP) for Line to Switch.	- Please order separately for conversion panels and cables listed in below tables.
Loop-G7800-TE1-16-75-LoSW1-a-**G**	16-port T1 or 16-port E1(75 ohm) software programmable plug-in module with 1 x SCSI connector, supporting Unframed T1/E1 Circuit Emulation over PSN (SAToP) for Line to Switch.	- Please order separately for conversion panels and cables listed in below tables.
Loop-G7800-TE1-32-75-LoSW1-a-**G**	32-port T1 or 32-port E1(75 ohm) software programmable plug-in module with 2 x SCSI connectors, supporting Unframed T1/E1 Circuit Emulation over PSN (SAToP) for Line to Switch.	- Please order separately for conversion panels and cables listed in below tables.
Loop-G7800-TE1-FR-16-LoSW10-a-**G***	16-port T1 or 16-port E1(120 ohm) software programmable plug-in module with 1 x SCSI connector, supporting both **Framed** & **Unframed*** T1/E1 Circuit Emulation over PSN (CES & SAToP) for **L**ine to **Sw**itch.	- Order two for redundancy. - Please order separately for conversion panels and cables listed in below tables.  -
Loop-G7800-TE1-FR-32-LoSW10-a-**G**	32-port T1 or E1(120 ohm) software programmable plug-in module with 2 x SCSI connectors, supporting both **Framed** & **Unframed*** T1/E1 Circuit Emulation over PSN (CES & SAToP) for **L**ine to **Sw**itch.	- Order two for redundancy. - Please order separately for conversion panels and cables listed in below tables.  -
Loop-G7800-DS3-6-LoSW3-a-**G***	6-port DS3 plug-in module with DIN 1.0/2.3 connectors, supporting DS3 CEP Circuit Emulation from **L**ine to **Sw**itch.	- Order two for redundancy.  -
Loop-G7800-DS3-6-LoSW31-a-**G***	6-port DS3 plug-in module with DIN 1.0/2.3 connectors, supporting DS3 CEP Circuit Emulation from **L**ine to **Sw**itch.	- Order two for redundancy.

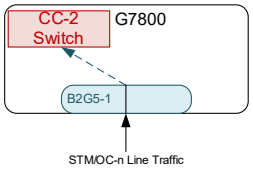
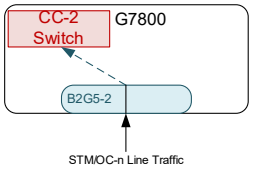
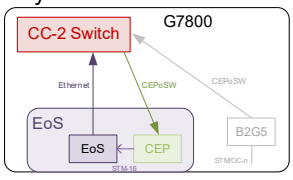
Ordering Code	Description	Notes
	In addition, M13 T1 SAToP can be optionally enabled per port.	

■ If extra features are required on the same DS3 card in the future, please purchase an additional feature activation license for it.

Feature Activation License		
Loop-G7800-DS3-6-LoSW31LIC*	Feature activation license for G7800 DS3 module to support DS3 CEP Circuit Emulation from **L**ine to **Sw**itch with M13 T1 SAToP option.	Use with **Loop-G7800-DS3-6-LoSW3*** card.

Note: The DS3 card supports multiple features, but some features cannot be activated simultaneously. During registration, please select one mode. Once chosen, re-registration is required to switch to another mode.

*Future Option

Ordering Code	Description	Notes
Loop-G7800-B2G5-1-LoSW410-a-**G**	Circuit Emulation for 1 x STM-16 or 1 x STM-4 or 1 x STM-1 Channelized Line Interface card, supporting Circuit Emulation for STM-n/OC-n traffic from physical **L**ine to **Sw**itch Used in CC-2/CHA **10GE slots (S3~S8)**, it supports One STM-16 or One STM-4 or One STM-1 interfaces without SFP (mini-GBIC) optical module. The STM-n can be software configure as OC-3n for SONET application.	- Please order SFP optical modules separately. See separate SFP module brochure - STM-n where n can be 1/4/16 - OC-n where n can be 3/12/48 
Loop-G7800-B2G5-2-LoSW410-a-**G**	Circuit Emulation for 2 x STM-16 or 2 x STM-4 or 2 x STM-1 Channelized Line Interface card, supporting Circuit Emulation for STM-n/OC-n traffic from physical **L**ine to **Sw**itch Used in CC-2/CHA **10GE slots (S3~S8)**, it supports Two STM-16 or Two STM-4 or Two STM-1 interfaces without SFP (mini-GBIC) optical module. The STM-n can be software configure as OC-3n for SONET application.	- Please order SFP optical modules separately. See separate SFP module brochure - STM-n where n can be 1/4/16 - OC-n where n can be 3/12/48 
Loop-G7800-EoS-CEPoSW41-a-**G**	EoS (Ethernet Over SDH/SONET) processing card for up to one STM-16/OC-48 worth traffic over CEP. The EoS over CEP traffic is groomed from either local or remote B2G5 card with CEP enabled. The Ethernet traffic can be tapped from any Ethernet UNI physical ports in the system or VPWS PW.	- Work in **10GE slots (S3~S8)** only 

*Future Option

Low Speed Tributary Modules (Select 1 to 10 cards from Low Speed Tributary Modules list below)

Ordering Code	Description	Note
Loop-G7800-8RS232-RJ-**G**	8-port RS232 plug-in card with X.50 subrate multiplexing scheme and X.54 encoding, with 8 RJ48 connectors for 8 RS232 Async ports	
Loop-G7800-8RS232-DB-**G**	8-port RS232 plug-in card with X.50 subrate multiplexing scheme and X.54 encoding, with 2 RJ48 connectors and 2 DB44 connectors for Async and Sync ports	Two conversion cables are included (DB44 connector to two DB25 and one DB9 connector; (Loop-ACC-CAB-DB44M-100- 2DB25F-1DB09F-DB).
Loop-G7800-8DBRA-RJ-**G***	8-channel data bridge plug-in card, with 8 RJ48 connectors for 8 data bridge Async ports	
Loop-G7800-8DBRA-DB-**G***	8-channel data bridge plug-in card, with 2 RJ48 connectors and 2DB44 connectors for 8 data bridge Async ports	Two conversion cables are included (DB44 connector to two DB25 and one DB9 connector; (Loop-ACC-CAB-DB44M-100- 2DB25F-1DB09F-DB).
Loop-G7800-8DCB-**G**	8-channel dry contact type B plug-in card with maximum voltage 220 Vdc or 250 Vac	
Loop-G7800-8DCC-**G***	8-channel dry contact type C plug-in card with maximum voltage 100 Vdc or 250 Vac	
Loop-G7800-RTB-**G**	8-LAN port/64 WAN ports router/bridge plug-in card	
Loop-G7800-8SRU-DB-**G**	8-port SRU plug-in card with DS0B-5 subrate multiplexing scheme and DS0A encoding, with 2 RJ48 connectors and 2 DB44 connectors for Async and Sync ports	To use with this card (DB version), it is recommended to purchase two conversion cables (Loop-ACC-CAB-DB44M-100-2DB25F-1DB09F-DB-G x 2)
Loop-G7800-8SRU-RJ-**G**	8-port SRU plug-in card with DS0B-5 subrate multiplexing scheme and DS0A encoding, with 8 RJ48 connectors for Async ports	
Loop-G7800-6UDTEA-**G**	Universal data interface card with software configurable modes for - Up to 6-port sub 64K RS232 with V.110, or - Up to 4-port Nx64K X.21/RS232/RS422/V.35/V.36/ EIA530/RS449 Port 1 to 4: two DB44 connectors Port 5 to 6: two RJ48 connectors	Conversion cables are NOT included. Please order conversion cable separately for different DTE interfaces from below. - Loop-ACC-CAB-DB44M-100-2DB25F-VB-**G** - Loop-ACC-CAB-DB44M-100-2DB15F-VB-**G** - Loop-ACC-CAB-DB44M-100-1DB15F-1DB25F-VB-**G** - Loop-ACC-CAB-DB44M-100-2M34F-VB-**G** - Loop-ACC-CAB-DB44M-100-2DB37F-VB-**G** - Loop-ACC-CAB-DB44M-100-1DB37F-1M34F-VB-**G**
Loop-G7800-2GH-**G***	2-channel G.SHDSL plug-in card (2 pair)	
Loop-G7800-4GH-**G***	4-channel G.SHDSL plug-in card (1 pair)	
Loop-G7800-12FXOA-**typ**-**G**	12-channel FXOA plug-in card with 600/900 Impedance, Battery Reverse and Loop Start. Without Ground Start and Metering Pulse. Used with 12 RJ11.	For **typ** option, please refer to the table below for detail information.
Loop-G7800-12FXOA-GS-**typ**-**G**	12-channel FXOA plug-in card with 600/900 Impedance, Battery Reverse, Loop Start and [Ground Start]. Used with 12 RJ11.	

For 12FXOA card

■ Where **typ** is used to select the connector type:

typ=	Description	Note
RJ	12 x RJ11	

Ordering Code	Description	Note
Loop-G7800-12FXSA-02-**sn-pta-typ-G**	12-channel FXSA plug-in card with 600/900 Impedance, Battery Reverse, Loop Start and PLAR. Without Ground Start and Metering Pulse. Used with 12 RJ11 connectors or 1 Telco 64* connector.	12FXSA-02-GMP includes all FXS card functions For **sn** option, please refer to the table below for detail information **pta**= power type. For **pta** option, please refer to the table below for detail information Please use with 100-240Vac or ±48Vdc powered main units.
Loop-G7800-12FXSA-02-P-**sn-pta-typ-G**	12-channel FXSA plug-in card with 600/900 Impedance, Battery Reverse, Loop Start, PLAR and [PLAR bit programmable]. Without Ground Start and Metering Pulse. Used with 12 RJ11 connectors or 1 Telco 64* connector.	
Loop-G7800-12FXSA-02-M-**sn- pta-typ-G**	12-channel FXSA plug-in card with 600/900 Impedance, Battery Reverse, Loop Start, PLAR and [Metering Pulse]. Used with 12 RJ11 connectors or 1 Telco 64* connector.	
Loop-G7800-12FXSA-02-MPP-**sn-pta-typ-G**	12-channel FXSA plug-in card with 600/900 Impedance, Battery Reverse, Loop Start, PLAR, [PLAR bit programmable] and [Metering Pulse]. Used with 12 RJ11 connectors or 1 Telco 64* connector.	
Loop-G7800-12FXSA-02-GS-**sn-pta-typ-G**	12-channel FXSA plug-in card with 600/900 Impedance, Battery Reverse, Loop Start, PLAR and [Ground Start]. Used with 12 RJ11 connectors or 1 Telco 64* connector.	12FXSA-02-GMP includes all FXS card functions **pta**= power type. For **sn, pt, and typ** options, please refer to the table below for detail information. Please use with 100-240Vac or ±48Vdc powered main units.
Loop-G7800-12FXSA-02-GM-**sn-pta-typ-G**	12-channel FXSA plug-in card with 600/900 Impedance, Battery Reverse, Loop Start, PLAR, [Ground Start] and [Metering Pulse]. Used with 12 RJ11 connectors or 1 Telco 64* connector.	
Loop-G7800-12FXSA-02-GMP-**sn-pta-typ-G**	12-channel FXSA plug-in card with 600/900 Impedance, Battery Reverse, Loop Start, PLAR, [PLAR bit programmable], [Ground Start] and [Metering Pulse]. Used with 12 RJ11 connectors or 1 Telco 64* connector.	

For 12-channel FXSA card:

■ Where **sn** is used to select special function. If this option is not required, omit the **sn** field in the ordering code.

sn =	Description	Note
sn = omit	FXS Loop Feed = -48 Vdc with 25 mA current limit; alarm tone enable; normal ring	
S1	FXS Loop Feed = -48 Vdc with 35 mA current limit	
S4	Remove alarm tone	
S5	Double ring tone transmit	

Note: For sn (special function), please contact your nearest Loop sales representative.

■ Where **pta** is used to select the following functions.

pta=	Description	Note
PWR	For G7800 CHA chassis using SDA power module with ±48Vdc input power	

■ Where **typ** is used to select the connector type:

typ=	Description	Note
RJ	12 x RJ11	
TELCO*	1 x Telco 64 Connector	

*Future Option

Ordering Code	Description	Note
Loop-G7800-12MAGA-**typ-G***	12-channel Magneto plug-in module with ring across L1&GND and L1&L2. Software programmable. Used with 12 RJ11 connectors	For **typ** option, please refer to the table below for detail information

For 12MAGA card*

■ Where **typ** is used to select the connector type:

typ=	Description	Note
RJ	12 x RJ11	

Ordering Code	Description	Note
Loop-G7800-8EMA-**x-pt-typ-G**	8-channel 2W/4W E&MA plug-in card. Used with 8 RJ45 connectors or 1 Telco 64 connector.	**pt** = power type For **x, pt** and **typ** options, please refer to the table below for detail information

For 8EMA:

■ Where **x** is used to select signaling bits type and special functions:

x =	Description	Notes
E	Follows ETSI signaling bits	Signaling bits setting is software configurable.
A	Follows ANSI signaling bits	
R	Reverse for ON-HOOK and OFF-HOOK signaling bits exchange	
AR	Follows ANSI signaling bits and reverse bit	

■ Where **pt** is used to select the following functions:

pt=	Description	Notes
PWR	For G7800 with CHA chassis using SDA power module with ±48Vdc input power	

■ Where **typ** is used to select the connector type:

typ=	Description	Notes
RJ	8 x RJ45	
TELCO	1 x Telco 64 Connector	

Ordering Code	Description	Note
Loop-G7800-4E1-**cc**-**G**	4-channel E1 plug-in card	For **cc** option, please refer to the table below for detail information
Loop-G7800-4T1-**G**	4-channel T1 plug-in card	

For 4E1 cards

■ Where **cc** is used to select connector:

cc =	Description	Note
RJ	RJ48C connector	
BNC	BNC connector	

Ordering Code	Description	Note
Loop-G7800-8UDTEA-**opm**-**G**	8-port universal data interface card that supports RS232/RS422/RS485 full-duplex DCE interface which is software configurable Available option mode: Terminal Server, Omnibus, and Clock Pass Through	For **opm** option, please refer to the table below for detail information.

For 8UDTEA card

■ Where **opm** is used to select 8UDTEA functions

opm	Description
DCE	Support RS232/RS422/RS485 DCE interface which is software configurable
TS	Support Terminal Server Function and DCE
OMNI	Support Omnibus Function and DCE
CPT	Support Clock Pass Through function and DCE
TSOMNI	Support Terminal Server, Omnibus Function and DCE
HD	Support RS232/RS422/RS485 DCE interface with Full- and Half-Duplex modes
TSHD	Support Terminal Server Function and DCE with Full- and Half-Duplex modes
OMNIHD	Support Omnibus Function and DCE with Full- and Half-Duplex modes
TSOMNIHD	Support Terminal Server, Omnibus Function and DCE with Full- and Half-Duplex modes
FULL	Terminal Server, Omnibus Function, Clock Pass Through and DCE with Full- and Half-Duplex modes
Feature Activation License	**Description**

opm	Description
Loop-G7800-8UDTEA-TSLIC	Feature Activation License for Loop-G7800-8UDTEA card to support Terminal Server function
Loop-G7800-8UDTEA-OMNILIC	Feature Activation License for Loop-G7800-8UDTEA card to support Omnibus function
Loop-G7800-8UDTEA-CPTLIC	Feature Activation License for Loop-G7800-8UDTEA card to support Clock Pass Through function
Loop-G7800-8UDTEA-TSOMNILIC	Feature Activation License for Loop-G7800-8UDTEA card to support Terminal Server function and Omnibus function
Loop-G7800-8UDTEA-HDLIC	Feature Activation License for Loop-G7800-8UDTEA card to support Full- and Half-Duplex modes
Loop-G7800-8UDTEA-TSHDLIC	Feature Activation License for Loop-G7800-8UDTEA card to support Terminal Server function with Full- and Half-Duplex modes
Loop-G7800-8UDTEA-OMNIHDLIC	Feature Activation License for Loop-G7800-8UDTEA card to support Omnibus function with Full- and Half-Duplex modes
Loop-G7800-8UDTEA-TSOMNIHDLIC	Feature Activation License for Loop-G7800-8UDTEA card to support Terminal Server and Omnibus function with Full- and Half-Duplex modes
Loop-G7800-8UDTEA-FULLLIC	Terminal Server, Omnibus, Clock Pass Through, and Full- and Half-Duplex modes

Ordering Code	Description	Note
Loop-G7800-6CDA-**cdm**-**G**	6-channel G.703 Interface at 64 Kbps data rate. Per port configurable for Co-directional or Contra-directional interfaces.	For **cdm** option, please refer to the table below for detail information.

For 6CDA card

- Where **cdm** is used for co-directional/contra-directional mode selection. Must select one from table below.

cdm	Description
cc	Supports G.703 Contra-directional controlling (DCE) and Co-directional interface configuration
cs	Supports G.703 Contra-directional subordinate / Centralized (DTE) and Co-directional interface configuration
mixed	Supports G.703 Contra-directional controlling (DCE), Contra-directional subordinate / Centralized (DTE) and Co-directional interface configuration

Ordering Code	Description	Note
Loop-G7800-4C37SFPA-**G**	4- channel C37.94 plug-in card (SFP port)	

- SFP module for Loop-G7800-4C37SFPA-**G**

Code	Description										Notes
	Mode		Data Rate		Wave Length		Distance		Connector		
	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	
MRPTD	M	Multi-Mode	R	2 M	P	850nm	T	2km	D	LC connector with DDM	SFP Module
PRB2D	P	Single-Mode	R	2 M	B	1310nm	2	20km	D	LC connector with DDM	SFP Module

Ordering Code	Description	Note
Loop-G7800-ODP-**typ***	8-channel OCU-DP plug-in module. Used with 8 RJ48S connectors.	Only **non-RoHS** compliant model available **Limited Quantity**

For ODP card*

- Where **typ** is used to select the connector type:

typ=	Description	Note
RJ	8 x RJ48S	

Ordering Code	Description	Note
Loop-G7800-1FOMA-**opt**-**G**	1FOMA Fiber Optical Interface with 1x9 optical port	For **opt** option, please refer to the table below for detail information.

For FOM and 1FOMA card

■ Where **opt** is used to select optical module type (All optical modules are RoHS compliant):

opt =	Description	Note
NHB3S (was SAA)	Single optical module with dual uni-directional fiber, 1310 nm, SC optical connector, 30 km ***- S1.1***	- Use dual fiber - Units delivered ITU-T G.957 application code
NHB5S (was SBB)	Single optical module with dual uni-directional fiber, 1310 nm, SC optical connector, 50 km ***– L1.1***	- Use dual fiber - Units delivered ITU-T G.957 application code
NHB3F (was SCC)	Single optical module with dual uni-directional fiber, 1310 nm, FC optical connector, 30 km ***– S1.1***	- Use dual fiber - Units delivered ITU-T G.957 application code
***NHC2S (was SDD)**	Single optical module with dual uni-directional fiber, 1550 nm, SC optical connector, 20 km ***– S1.2***	- Use dual fiber - Units delivered ITU-T G.957 application code * For the orders of the listed optical modules, please contact your Loop sales representative.
NHCUS (was SEE)	Single optical module with dual uni-directional fiber, 1550 nm, SC optical connector, 100 km ***– L1.2***	- Use dual fiber - Units delivered ITU-T G.957 application code
WHD2S (was SSM)	Single optical module with single bi-directional fiber (master), 1310 nm transmit and 1550 receive, SC optical connector, 30 km ***– S1.1/ S1.2***	- 1310 nm from master to slave - Order **SSM** to use with **SSS** - Use 1 fiber - ITU-T G.957 application code
WHE2S (was SSS)	Single optical module with single bi-directional fiber (slave), 1310 nm receive and 1550 transmit, SC optical connector, 30 km ***- S1.1/ S1.2***	- 1550 nm from slave to master - Order **SSS** to use with **SSM** - Use 1 fiber - ITU-T G.957 application code

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

*Future Option

Mini Plug-in Modules (Select 1 to 6 cards from list below)

Ordering Code	Description	Notes
Transportation		
Loop-G7800-S1T1-**G**	1-channel T1 interface card	
Loop-G7800-S1E75-**G**	1-channel of E1plug-in card w/ 75 ohm	
Loop-G7800-S1E120-**G**	1-channel of E1 plug-in card w/ 120 ohm	
Loop-G7800-SM4T1-**G**	Mini Quad T1 plug-in card	Includes a three meter conversion cable (Loop-ACC-CAB-DB25M-300-4RJ48M)
Loop-G7800-SM4E75-**G**	Mini Quad E1 plug-in card with 75 ohm	Includes a three meter conversion cable (Loop-ACC-CAB-DB25M-300-8BNCM)
Loop-G7800-SM4E120-**G**	Mini Quad E1 plug-in card with 120 ohm	Includes a three meter conversion cable (Loop-ACC-CAB-DB25M-300-4RJ48M)
Loop-G7800-SFOM-**opt**-**G**	Fiber Optical plug-in card	For **opt** option, please refer to the table below for detail information

For FOM and 1FOMA card

■ Where **opt** is used to select optical module type (All optical modules are RoHS compliant):

opt =	Description	Note
NHB3S (was SAA)	Single optical module with dual uni-directional fiber, 1310 nm, SC optical connector, 30 km ***- S1.1***	- Use dual fiber - Units delivered ITU-T G.957 application code
NHB5S (was SBB)	Single optical module with dual uni-directional fiber, 1310 nm, SC optical connector, 50 km **– *L1.1***	- Use dual fiber - Units delivered ITU-T G.957 application code
NHB3F (was SCC)	Single optical module with dual uni-directional fiber, 1310 nm, FC optical connector, 30 km **– *S1.1***	- Use dual fiber - Units delivered ITU-T G.957 application code
***NHC2S (was SDD)**	Single optical module with dual uni-directional fiber, 1550 nm, SC optical connector, 20 km **– *S1.2***	- Use dual fiber - Units delivered ITU-T G.957 application code * For the orders of the listed optical modules, please contact your Loop sales representative.
NHCUS (was SEE)	Single optical module with dual uni-directional fiber, 1550 nm, SC optical connector, 100 km **– *L1.2***	- Use dual fiber - Units delivered ITU-T G.957 application code
WHD2S (was SSM)	Single optical module with single bi-directional fiber (master), 1310 nm transmit and 1550 receive, SC optical connector, 30 km **– *S1.1/ S1.2***	- 1310 nm from master to slave - Order **SSM** to use with **SSS** - Use 1 fiber - ITU-T G.957 application code
WHE2S (was SSS)	Single optical module with single bi-directional fiber (slave), 1310 nm receive and 1550 transmit, SC optical connector, 30 km ***- S1.1/ S1.2***	- 1550 nm from slave to master - Order **SSS** to use with **SSM** - Use 1 fiber - ITU-T G.957 application code

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

*Future Option

Ordering Code	Description	Notes
Serial and Digital Access		
Loop-G7800-S1V35-**G***	1-channel V.35 plug-in card	
Loop-G7800-S1X21-**G***	1-channel X.21 plug-in card	
Loop-G7800-S1RS232-**G***	1-channel RS232 plug-in card	
Loop-G7800-S3RS232a-**G***	3-channel RS232 async/Sync, DCE/DTE plug-in card	To use with 3RS232a interface card, it is recommended to purchase a conversion cable (Loop-ACC-CAB-DB44M-150-2DB25F-DB9F-DCE-G, or Loop-ACC-CAB-DB44M-150-2DB25F-DB9F-DTE-G)
Loop-G7800-S1ODP	1 port OCU DP Interface card	Limited Quantity Only non-RoHS compliant model available
Voice and Analog Access		
Loop-G7800-SQEMA-**wr-m-**T**n-x-G**	Jumper selectable: 2/4 WIRE; A/B side Quad E&M voice card.	- For -48Vdc power supply only. - For **wr**, **m**, **n**, **x** option, please refer to the tables below for detail information. - Includes a 0.6 meter conversion cable (Loop-ACC-CAB-DB44M-60-4RJ45M-**G**)

For QEMA card (Quad E&MA card):

■ where **wr** is used to select wire type:

wr =	Description	Notes
2w	2 wire	
4w	4 wire	

■ Where **m** is used to select QEM card signaling side (must select one):

m =	Description	Notes
B	B (carrier side) connects to A side.	
A	A (exchange side) connects to B side. A side M lead to B side M lead, A side E lead to B side E lead.	

■ Where **n** is used to select QEM card signaling type (must select one):

n =	Description	Notes
O	For voice transmission only.	Circuit Type doesn't matter.
1	Type I (Original) E&M Signaling Circuit	M lead provides discharge for the A side.
2	Type II Circuit. This design attempts to reduce ground noise by adding two leads: SB (Signal to Battery) and SG (Signal to Ground)	Reduced ground noise. Ground current is eliminated at the cost of two more wires per circuit.
3	Type III Circuit. The SG lead serves as a discharge for the M lead. Reduces delay caused by combination of (a) low current electronic detectors, and (b) long runs of the E and M leads.	Type III is rare because ground currents on the E return would cause noise
4	Type IV Circuit. Based on the Type 2 circuit. This E&M circuit provides symmetry.	
5	Type V Circuit. For applications where ground noise is not an issue. Based on the Type 2 circuit.	

*Future Option

Ordering Code	Description	Notes
Loop-G7800-SQFXOA-**x**-**G**	Quad FXO voice plug-in card used with 4 RJ11	- GS = Ground Start - For -48 Vdc and AC (100 to 240 Vac) power supply only. - For **x** option, please refer to the table below for detail information.
Loop-G7800-SQFXOA-GS-**x**-**G**	Quad FXO with GS plug-in card used with 4 RJ11	
Loop-G7800-SQFXSA-**x-pt**-**G**	Quad FXSA voice plug-in card	Jumper setting options: Loop Stsrt, Ground Start (GS), Metering Pulse Transmit 12/16 KHz (MP). For **x** & **pt** option, please refer to the table below for detail information.
Loop-G7800-SQFXSA-M-**x-pt**-**G**	Quad FXSA with MP 16 KHz voice plug-in card	
Loop-G7800-SQFXSA-M12-**x-pt**-**G**	Quad FXSA with MP 12 KHz voice plug-in card used	
Loop-G7800-SQFXSA-GS-**x-pt**-**G**	Quad FXSA with GS plug-in card	
Loop-G7800-SQFXSA-GM-**x-pt**-**G**	Quad FXSA with GS and MP 16 KHz voice plug-in card	
Loop-G7800-SQMAGA-**G**	Quad channel magneto plug-in card	

For voice card (QEMA/QFXOA*/QFXSA):

■ Where **x** is used to select all of voice card signaling bits. If this is not required, omit the **x** field in the ordering code.

QEMA	**E**	Follows ETSI signaling bits	
	A	Follows ANSI signaling bits	
	S	Follows customer's special bits assignment	
QFXOA*	**A**	Follows ANSI signaling bits	
	S	Follows customer's special bits assignment	
	E	Follows ETSI signaling bits	
	T	Trunk condition OFF-HOOK	
	AT	Follows ANSI signaling bits w/ trunk condition OFF-HOOK	
	ST	Follows customer's special bits assignment w/ trunk condition OFF-HOOK	
QFXSA	**A**	Follows ANSI signaling bits	
	E	Follows ETSI signaling bits	
	S	Follows customer's special bits assignment	
***Note 1:** For S (customer's special bit), please contact your Loop sales representative.*			
***Note 2**: If **x** is not selected from the table above, the default setting for signaling bits is ETSI and for trunk condition is ON-HOOK.*			

For QFXSA:

■ Where **pt** is used to select the power:

pt=	Description	Notes
PWR	For G7800 with CHA chassis using SDA power module with ±48Vdc input power	

*Future Option

Ordering Code	Description	Notes
Data Processing		
Loop-G7800-SECA-**G***	Echo canceller card	
Loop-G7800-SABRA-**G**	Analog Bridge Card for G7800	
Packet Access		
Loop-G7800-SRTA-**G**	2-LAN ports/64 WAN port router/bridge plug-in card	
Teleprotection Access		
Loop-G7800-SM1C37-**LSFOM-G**	1- channel C37.94 plug-in mini card	For **LSFOM** option, please refer to the table below for detail information

For mini LS Optical module (mini C37.94):

■ Where **LSFOM** is to select **LS-F**iber **O**ptical **M**odule option, each module has 5 letters.

LSFOM Code	Description										Notes
	Mode		Data Rate		Wavelength		Distance		Connector/ Interface		
	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	
ZRATT	Z	Multi-mode	R	2 M	A	820nm	T	2km	T	ST/UPC	
QRATT	Q	Multi-mode	R	2 M	A	850nm	T	2km	T	ST/UPC	
NRB2T	N	Single mode	R	2 M	B	1310nm	2	20km	T	ST/UPC	

*Future Option

Accessories

Power Module		
Loop-G7800-SD-G*	Single -48 Vdc (-36 to -75 Vdc), 1000W, 21A power module	Order two for redundancy protection.
Loop-G7800-SDA-G	Single -48 Vdc (-36 to -75 Vdc), 500W, 12A power module	Order two for redundancy protection.
Power Cord		
Loop-ACC-PC-USA-G	AC power cord for Taiwan/America	
Loop-ACC-PC-EU-G	AC power cord for Europe	
Loop-ACC-PC-UK-G	AC power cord for UK	
Loop-ACC-PC-AUS-G	AC power cord for Australia	
Loop-ACC-PC-CH-G	AC power cord for China	
Power Adaptor and Converter		
Loop-ACC-AC**x**-DC55-500W-G	500 Watts, AC (85 ~ 264Vac) to DC (+55Vdc, 10A) adaptor Working temperature: -30 to 70°C	Where **x** is used for selecting AC power plug type
Loop-ACC-AC**x**-DC55-1000W-G*	1000 Watts, AC (90 ~ 264Vac) to DC (+55Vdc, 21A) adaptor Working temperature: -20 to 60°C	Where **x** is used for selecting AC power plug type
Loop-ACC-PWRBOX-MAIN-G	1U External Power Box with two slots apply to 2 x AC power adaptor, or 2 x DC power converter or 1 x AC power adaptor and 1 x DC power converter.	- For G7800-A and G7800-B - Comes with 19"/23" ear mount
Loop-ACC-PWRBOX-DC-130-55-500W-G	500Watt, DC (67.2~154Vdc) to DC (55Vdc, 9A) power converter fitting into Loop-ACC-PWRBOX-MAIN-G Working temperature: -20 to +60°C	
Loop-ACC-PWRBOX-AC**x**-55-500W-G	500 Watts, AC (90 ~ 260Vac) to DC (+55Vdc, 18.5A) adaptor fitting into Loop-ACC-PWRBOX-MAIN-G Working temperature: -30 to 70°C	Where **x** is used for selecting AC power plug type
Loop-ACC-PWRBOX-AC**x**-55-1000W-G*	1000 Watts, AC (90 ~ 260Vac) to DC (+55Vdc, 18.5A) adaptor fitting into Loop-ACC-PWRBOX-MAIN-G Working temperature: -30 to 70°C	Where **x** is used for selecting AC power plug type

- Where **x** is used for selecting AC power plug type:

x =	Description	Note
A	adaptor power plug type for USA and Taiwan	
E*	adaptor power plug type for Europe	
U*	adaptor power plug type for UK	

*Future Option

Fan Module		
Loop-G7800-FAN-G	FAN module for chassis cooling	Please order 3 FAN modules per system
User's Manual		
Loop-G7800-UM	Optional paper copy of User's Manual for Loop-G7800-CHA controller. A CD version of the manual is already included as standard package.	
Optical Transceivers		
Please place your order using the 5-digit alphanumeric codes listed in the separate SFP Optical Module Brochure. **Note**: The 10G and 100G optical transceiver modules are brand-specific. Only Loop-branded optical transceiver modules will work with the G7800.		
Loop-ACC-CAB-SFP10G-100-SFP10G-AOC-G	Stacking cable using SFP+ 10Gbps AOC (Active Optical Cable) Length: 100 cm	
Loop-ACC-CAB-QSFP40G-100-QSFP40G-AOC-G	40G QSFP+ AOC (Active Optical Cable) using multi-mode fiber with 850nm 4-channel bi-directional AOC supports 40Gbps aggregate data rate Maximum link length up to 1m by using OM3 MMF	

	Length: 100 cm Operating Temperature: 0 ~ +70˚C	
Loop-ACC-CAB-QSFP100G-100-QSFP100G-AOC-**G**	100G QSFP28 AOC (Active Optical Cable) using multi-mode fiber with 850nm 4-channel bi-directional AOC supports 100Gbps aggregate data rate Maximum link length up to 1m by using OM3 MMF Length: 100 cm Operating Temperature: 0 ~ +70˚C	
Blank Panels		
30.002958.A00LF	Blank Panel for Controller slot	
30.002744.A00LF	Blank Panel for Power Supply slot	
30.001027.A00LF	Blank Panel for Single slot 1~10	
30.002988.A00LF	Blank Panel for Mini slot A~F	

Mounting Ear		
19”/23” ear mounts	A pair of 19”/23” ear mounts is supplied as part of standard package.	For other sizes, please contact your nearest Loop sales representative.
Conversion Panels		
Loop-ACC-P-1SCSI-16RJ-**G** 	16-port 1u panel for one SCSI to 16 RJ connectors without cable 432x44x23mm (WxHxD)	**Order One** for Loop-G7800-TE1-16-LoSW1-**G** **Order Two** for Loop-G7800-TE1-32-LoSW1-**G** Please order Conversion Cable separately for connection between card and Conversion Panel.
Loop-ACC-P-1SCSI-16WW-**G** 	16-port 1u panel for one SCSI to 16 Wire Wrap connectors without cable 432x44x40mm (WxHxD)	
Loop-ACC-P-1SCSI-16BNC-**G** 	16-port 1.5u panel for one SCSI to BNC connectors without cable 432x66x53mm (WxHxD)	**Order One** for Loop-G7800-TE1-16-75-LoSW1-**G** **Order Two** for Loop-G7800-TE1-32-75-LoSW1-**G** Please order Conversion Cable separately for connection between card and Conversion Panel.
Conversion Cable		
Loop-ACC-CAB-SCSI68M-200-1SCSI68M 	SCSI68/ Male to one SCSI68/Male; Length 200 cm cable for connection between card and Conversion Panel.	Used for all Conversion Panels
Loop-ACC-CAB-HDB15M-100-2BNCM-3RJ48M-DB9F-**G**	One HD-sub 15 pin/ Male connector to two BNC/ Male, three RJ48/ Male, and one DB9/ Female connector; Length: 100 cm	- Used for Clock interfaces, including external, PPS, and ToD clocks
Loop-ACC-CAB-DB44M-100-2DB25F-VB	DSUB-44 pin/Male to two DSUB-25 pin/Female plug, Length:100cm	Used in V.35, V.36 and RS232 interfaces.
Loop-ACC-CAB-DB44M-100-2DB15F-VB	DSUB-44 pin/Male to two DSUB-15 pin/Female plug, Length:100cm	Used in X.21 interface.
Loop-ACC-CAB-DB44M-100-2M34F-VB	DSUB-44 pin/Male to two M34 pin/Female plug, Length:100cm	Used in V.35 interface.
Loop-ACC-CAB-DB44M-100-2DB37F-VB	DSUB-44 pin/Male to two DSUB-37 pin/Female plug, Length:100cm	Used in EIA530/RS449 and RS422 interfaces.
Loop-ACC-CAB-DB44M-100-2DB25F-1DB09F-DB-**G**	DSUB-44 pin/Male to two DSUB-25 pin/Female-one DSBU-9 pin/Female plug, Length:100cm	Use with Loop-G7800-8SRU-DB-**G** plug-in card.
Y-Box		
Loop-VV-B-**G**	1 for 1 protection Y-Box with BNC connectors (4-E1)	For Loop-G7800-4E1-**BNC**-**G**
Loop-VV-R-**G**	1 for 1 protection Y-Box with RJ48C connectors (16-E1)	For Loop-G7800-4E1-**RJ**-**G**
Loop-VV-T-**G**	1 for 1 protection Y-Box with RJ48C connectors (16-T1)	For Loop-G7800-4T1-**G**

Loop-ACC-CAB-DB44M-150-2DB25F-DB9F-DCE-**G**	DSUB-44 pin/Male to two DSUB-25 pin/Female and one DSUB-9 pin/Female plug. Length:150cm	Used with Loop-G7800-S3RS232a-**G** plug-in card for DCE mode
Loop-ACC-CAB-DB44M-150-2DB25F-DB9F-DTE-**G**	DSUB-44 pin/Male to two DSUB-25 pin/Female and one DSUB-9 pin/Female plug. Length:150cm	Used with Loop-G7800-S3RS232a-**G** plug-in card for DTE mode
Loop-ACC-CAB-DB25M-300-8BNCM	DB25/Male to eight BNC/Male cable; Length: 300 cm	Use with Loop-G7800-SM4E75-**G**
Loop-ACC-CAB-DB25M-300-8BNCF	DB25/Male to eight BNC/Female cable; Length: 300 cm	Use with Loop-G7800-SM4E75-**G**
Loop-ACC-CAB-DB25M-300-4RJ48M	DB25/Male to four RJ48C/Male cable; Length: 300 cm	Use with Loop-G7800-SM4E120-**G**
Telco Cables		
Ordering Code	**Description**	**Note**
Loop-ACC-CAB-TELCO64-500-OE-**x**-**y**	Telco64/Male to Open-End cable; Length: 500 cm	• Custom cable lengths shorter than 1000cm available upon request • **x** = pair count; **y** = connector exit angle • Non-RoHS compliant For **x**, **y** options, please refer to the table below for detail information.
■ Where **x** is used to select the wire pairs option:		
x =	**Description**	**Note**
15P*	Number of contacts: 30 pins	Use for 12FXSA-02 series cards with Telco 64 connector.
32P	Number of contacts: 64 pins	Use for 8EMA series cards with Telco 64 connector
■ Where **y** is used to select the Telco 64 connector exit angle:		
y =	**Description**	**Note**
90	90 degree	
180	180 degree	

*Future Option

Order Example:

Main unit:

Loop-G7800-CHA-G x 1

CPU Main Switch

Loop-G7800-CC-2-G x 2

Plug-in modules:

Loop-G7800-GFE-8T-a-G x 2

Power modules:

Loop-G7800-SDA-G x 2

Feature Activation License:

Loop-G7800-CC-2-100GLIC x 2

Description:

1 7U height rack chassis for G7800 without CPU, power, connector board, fan and plug-in cards;

2 Redundant CPU and 400Gbps L2/L2.5/L3 Switch card with 2 x 100/40GE[NOTE], 5 x GE/10GE and 8 GE

2 8 x 1000/100/10Mbps Ethernet Twist-Pair modules using RJ45 connector

2 -48 Vdc (-36 to -75 Vdc), 12A power module

2 100G/40G port activation license on single G7800 controller.

NOTE: To support 2 x 100/40GE, it is also **required** to purchase a Feature Activation License (in this case Loop-G7800-CC-2-100GLIC) for activation. Two licenses are needed in case of redundancy.

Loop-G7800 PTN MPLS/CE Packet Transport Network Specifications

Physical/Electrical

Model		G7800-CHA
Dimensions		7U, 442 x 308 x 223.5 mm (W x H x D)
Power		Single -48 Vdc (-36 to -75 Vdc), 12A power module
Temperature	Operating	-20 to 60°C
	Storage	-30 to 70°C
Weight	Net Weight (Chassis only)	6kg (13.2lbs)
	Max. Weight	18kg (39.7 lbs)
Humidity		0-90%RH (non-condensing)
Mounting		Desk-top stackable, 19/23 inch rack mountable

Power Consumption

Module Type	Module	Power Consumption per Card (Watt)
Controller	CC-2 (light loading)	40
	CC-2 (full loading)	70
Connecter Board	Connector (CB)	1
High-speed Plug-in Modules	GFE-8T	22
	GFE-8POE1	187
	GFE-8POE2	22
	GFE-4POEP1	187
	GFE-4POEP2	22
	B2G5-2	45
	TE1-FR-32-LoSW10	22
	TE1-32-LoSW1	16
	TE1-16-LoSW1	16
Low-Speed Plug-in Modules	6CDA	2
	4E120*	3
	8EMA	8
	12FXOA	5
	12FXSA	27
	12MAGA*	8
	6UDTEA	2
	8UDTEA	4
	8RS232	3
	8DCB/8DCC*	4
	LSFOM/4C37.94	3
	RTB	7
	ODP*	4
	1FOMA	2
	QT1/QE1	3
Mini Plug-in Modules	1-channel T1 interface card	2
	1-channel of E1 plug-in card w/ 75 or 120 ohm	2
	Mini Quad T1 plug-in card	2
	Mini Quad E1 plug-in card with 75 or 120 ohm	2
	Fiber Optical plug-in card	2
	1-channel V.35 plug-in card*	1
	1-channel X.21 plug-in card*	2
	1-channel RS232 plug-in card*	1
	3-channel RS232 async/Sync, DCE/DTE plug-in card*	7
	1 port OCU DP Interface card	2
	QEMA	2
	QFXSA	1
	QFXO	1
	QMAGA	6
	Echo Canceller Card*	2

Module Type	Module	Power Consumption per Card (Watt)
	Analog Bridge Card	2
	1-channel C37.94 plug-in mini card	2
Fan	FANA	3

Standard Compliance

RFC (IETF)		RFC (IETF)	
826	Address Resolution Protocol (ARP)	4842	Considerations for a Transport Profile
854	MIL STD 1782 Telnet Protocol Specification	5085	Pseudowire Virtual Circuit Connectivity Verification (VCCV)
1042	Standard for the Transmission of IP Datagrams over IEEE 802 Networks	5086	CESoPSN
1112	IGMP V1	5254	Requirements for Multi-Segment PWE3
1305	Network Time Protocol (NTP) Version 3	5317	Multiprotocol Label Switching (MPLS)
2236	Internet Group Management Protocol, Version 2		MPLS Generic Associated Channel
2273	SNMPv3 Applications	5462	MPLS Label Stack Entry
2328	OSPF Version 2	5586	MPLS Generic Associated Channel
2453	RIP Version 2	5601	Pseudowire (PW) Management Information Base (MIB)
2571	An Architecture for Describing SNMP Management Frameworks	5602	PW over MPLS PSN MIB
		5603	Ethernet PW MIB
2572	Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)	5654	Requirements OAM for MPLS-TP
		5659	An Architecture for Multi-Segment PWE3
		5710	Path Error Message Triggered MPLS and GMPLS LSP Reroutes
2573	SNMP Applications		
2737	Entity MIB (Management Information Base) (Version 2)	5718	An In-band Data Communication Network for MPLS-TP
2865	Remote Authentication Dial-In User Service (RADIUS)	5798	Virtual Router Redundancy Protocol VRRP Version 3 for IPv4 & IPv6
3031	Multiprotocol Label Switching Architecture	5860	Requirements for OAM in MPLS-TP
3032	MPLS Label Stack Encoding	5880	Bidirectional Forwarding Detection (BFD)
3270	MPLS Support of differentiated Services	5882	Generic Application of Bidirectional Forwarding Detection
3376	Internet Group Management Protocol, Version 3		
		5884	BFD for MPLS Label Switched Paths
3410	Introduction and Applicability Statements for Internet Standard Management Framework	5885	BFD for the Pseudowire VCCV
		5920	Security Framework for MPLS and GMPLS Networks
3411	An Architecture for Describing SNMP Management Frameworks	5921	A Framework of MPLS in Transport Network
3412	Message Processing and Dispatching	5950	MPLS-TP Network Management Framework
3413	SNMP Applications	5951	Network Management Requirements for MPLS-TP
3414	User-based Security Model		
3415	View-based Access Control Model	5960	MPLS-TP Data Plane Architecture
3417	Transport Mappings for the SNMP	6215	MPLS-TP User-to-Network and Network-to-Network Interfaces
3418	Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)	6291	Guidelines for the Use of the “OAM” Acronym in the IETF
3569	PIM-SSM PIM Source Specific Multicast	6370	MPLS Transport Profile(MPLS-TP) Identifier
3768	Virtual Router Redundancy Protocol VRRPv2	6371	OAM Framework for MPLS-Based Transport Networks
3811	Definitions of Textual Conventions (TCs) for MPLS Management	6372	MPLS-TP Survivability Framework
		6373	MPLS-TP Control Plane Framework
3812	MPLS Traffic Engineering (TE) Management Information Base (MIB)	6374	Packet Loss and Delay Measurement for MPLS Networks
3813	MPLS Label Switching Router (LSR) Management Information Base (MIB)	6375	A Packet Loss and Delay Measurement Profile for MPLS-Based Transport Networks
3826	The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model	6378	MPLS-TP Linear Protection
		6426	On demand connectivity verification
3985	Pseudo Wire Emulation Edge-to-Edge Architecture	6427	MPLS Fault Management OAM
		6428	Proactive connectivity verification
4115	A Differentiated Service Two-Rate, Three-Color Marker with Efficient Handling of in-Profile Traffic	6478	Pseudowire Status for Static Pseudowire
		6639	MPLS-TP MIB-Based Management Overview
4379	Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures	6669	Overview of the OAM toolset for MPLS-Based Transport Networks
4385	Pseudowire Emulation Edge to Edge (PWE3)	6941	MPLS Transport Profile (MPLS-TP) Security Framework

4448	Encapsulation Methods for Transport of Ethernet over MPLS Use over an MPLS PSN
4553	SAToP (Structured Agnostic TDM over Packet Switched Networks) Networks
4664	Framework for L2VPNs (VPLS/VPWS)
4665	Service Requirements for Layer 2 Provider-Provisioned Virtual Private Networks (QoS)
7213	MPLS Transport Profile (MPLS-TP) Next-Hop Ethernet Addressing
7276	An Overview of OAM
7331	Bidirectional Forwarding Detection (BFD) Management Information Base (MIB)

ITU-T

G.8031	ELPS
G.8032	ERPS
G.8101	Terms and Definitions for MPLS Transport Profile
G.811	Timing characteristics of primary reference clocks
G.8110	MPLS layer network architecture
G.8110.1	Architecture of MPLS-TP Layer Network
G.8112	Interfaces for the MPLS-TP Transport Profile layer Network
G.8113.2	MPLS-TP OAM
G.8121	Characteristics of MPLS-TP Network Equipment Functional Blocks
G.8121.2	Characteristics of MPLS-TP equipment functional blocks supporting ITU-T G.8113.2/Y.1372.2
G.8131	MPLS-TP Linear Protection
G.8151	Management aspects of the MPLS-TP network element
G.8271	Time and phase synchronization aspects of packet networks
G.8262	Timing characteristics of a synchronous Ethernet equipment slave clock
	Timing and synchronization aspects in packet networks
G.8261	Ethernet OAM
Y.1731	Operations, administration and maintenance (OAM) functions and mechanisms for Ethernet-based networks

IEEE

802.1d	STP
802.1p	Traffic Prioritization
802.1w	RSTP
802.1s	MSTP
802.1q	VLAN
802.1ab	Local and metropolitan area networks - Station and Media Access Control Connectivity Discovery
802.1ad	VLAN Tag Stacking (Q-in-Q)
802.1ag	Ethernet OAM (CFM)
802.3	Carrier Sense Multiple Access with Collision Detection
802.3ab	Gigabit Ethernet over copper
802.3ad	Link Aggregation Control Protocol
802.3ae	10 Gigabit Ethernet
802.3ah	Ethernet in the First Mile (EFM)
802.3u	Type 100BASE-T MAC parameters, Physical Layer, MAUs, and Repeater for 100 Mb/s Operation
802.3x	Flow Control
802.3z	Gigabit Ethernet Standard over fiber (1000Base-SX/LX)
1588 v2	Precision Time Protocol (PTP)

EMC/EMI

FCC15 Class A
EN 55032 Class A/EN 55035
EN 50121-4
IEC 61850-3
ANSI C63.4a-2017
ETSI ES 201468
IEC 60068-2-1
IEC 60068-2-3
IEC 60068-2-52
IEC 60068-2-64
IEC 61000-4-2
IEC 61000-4-3
IEC 61000-4-4
IEC 61000-4-5
IEC 61000-4-6
IEC 61000-4-8
IEC 61000-4-16
IEC 61000-4-18
IEEEC37.90.2

Surge

IEEEC37.90.1

Safety

EN62368-1

MEF

8
9
14
MEF Carrier Ethernet (CE) 2.0 compliant for EPL (Ethernet Private Line), EVPL (Ethernet Virtual Private Line), EP-LAN (Ethernet Private LAN) , EVP-LAN (Ethernet Virtual Private LAN), EP-Tree (Ethernet Private Tree) and EVP-Tree (Ethernet Virtual Private Tree)

Environmental Protection Standards

2011/65/EU & (EU)2015/863
2012/19/EU (WEEE)

Computer Security

FIPS 140-3

CC-2 Controller Card

Controller card with up 400Gbps core switching capability.

100/40 Gigabit Ethernet (100GE/40GE) Interface NOTE	
QSFP28/QSFP+ Ports	2 x 100GE/40GE Selection of Rate: 100GE or 40GE and Selection of Module: QSFP28 for 100GE interfaces, and QSFP+ for 40GE Auto laser shutdown (ALS)
Direction	Duplex(half/full), auto-negotiation
10 Gigabit Ethernet (10GE) Interface	
SFP Ports	5 x 10GE Auto laser shutdown (ALS)
Speed	10Gbps/1Gbps
Direction	Duplex(half/full), auto-negotiation
Gigabit Ethernet (GE) Interface	
SFP Ports	8 x 1GE Auto laser shutdown (ALS)
Speed	1000Mbps/100Mbps
Direction	Duplex(half/full), auto-negotiation

WAN Transmission	All Ethernet interfaces on the CC-2/CC-2-Lite controller can be used as NNI and UNI (WAN and LAN)
Redundancy	To provide the redundancy of the 100GE/40GE interfaces, it is mandatory to interconnect the two CC-2 by an 100GE/40GE connection. Then the two CC-2 redundant controllers have only two ports of 100GE/40GE available to connect to external nodes
Dimensions	50 x 211.5 x 247.4 mm(W x H x D)

NOTE: Since there is NO backplane interconnection between the two Controllers (CC-2) for 100GE/40GE interfaces, it is mandatory to interconnect the two CC-2 via 100/40GE connection at the front panel to enable the 100GE/40GE interfaces in Controller Redundancy scenario. In such scenario, the two redundant controllers will have only two ports of 100GE/40GE available to connect to external nodes.

Ethernet Interfaces

GFE-10S Card

Plug-in module with 10 x 1GE SFP ports or 1 x 10GE SFP+ port for port extension of CC-2.

LAN Gigabit Ethernet (GbE) Interface

SFP Ports	10 x 1GE SFP ports Auto laser shutdown (ALS)
Speed	1 or 10Gbps per port
Direction	duplex(full), auto-negotiation (Ports 4-11 only)

Ethernet Function

GFE-10S is a port extension card for CC-2 and its functions are the same as CC-2.

GFE-1XG Card

Plug-in module with 1 x 10GE SFP+ port for port extension of CC-2.

LAN Gigabit Ethernet (GbE) Interface

SFP Ports	1 x 10GE SFP+ ports Auto laser shutdown (ALS)
Speed	10Gbps per port
Direction	duplex(full)

Ethernet Function

GFE-1XG is a port extension card for CC-2 and its functions are the same as CC-2.

GFE (-8POE1, -8POE2, -4POEP1, 4POEP2 and -8T) Cards

Plug-in module with 8 x RJ45 ports Ethernet Twist-Pair with PoE/PoE+/PoE++ capability.

LAN Gigabit Ethernet (GbE) Interface

Number of Ports	8
Connector Type	RJ45 (Gigabit Ethernet)
Speed	**8T:** 10/100/1000Mbps Ethernet Twist-Pair (in 10GE slots)

PoE Output	**8POE1 and 8POE2**: 10/100/1000Mbps Ethernet Twist-Pair w/ PoE+ (in 10GE slots) **4POEP1 and 4POEP2**: 10/100/1000Mbps Ethernet Twist-Pair (in 10GE slots) **8T:** none **8POE1:** 30W (per port), 150W (per card) **8POE2:** 30W (per port), 240W (per card) **4POEP1:** 90W(on port 2/4/6/8), 150W (per card) **4POEP2:** 90W(on port 2/4/6/8), 360W (per card)

XGE-9XG Card*

Plug-in module with 9 x 10GE SFP ports for port extension of CC-2.

LAN Gigabit Ethernet (GbE) Interface	
SFP Ports	9 x 10GE SFP ports Auto laser shutdown (ALS)
Speed	10Gbps
Direction	duplex(half/full), auto-negotiation
WAN Transmission	
QSFP28 Ports	2 x 100GE Auto laser shutdown (ALS)
Speed	100Gbps
Direction	duplex(half/full), auto-negotiation
Ethernet Function	
XGE-9XG is the port extension card for CC-2 and its functions are the same as CC-2.	

*Future Option

SDH Interfaces

B2G5-2-LoSW410	Plug in module with Two STM-16 (OC-48) with/without MSP (1+1) protection on Ports 1 & 5, without SFP (mini-GBIC) Optical modules The STM-n can be software configured as OC-3n for SONET application.
EoS-CEPoSW41	Supporting the transport of Ethernet, from PWS or local UNI, over SDH/SONET from any B2G5-x cards and vice versa. In CC-2/CHA 10GE slots, it supports up to one STM-16 worth of bandwidth with EoS. Up to 48 VCG supported for EoS services.
TE1-16/32-LoSW1	16 or 32 port unframed E1(120 ohm)/T1 card, support the conversion TDM to emulation PW over Ethernet or MPLS-TP with 1 or 2 SCSI interfaces
TE1-16/32-75-LoSW1	16 or 32 port unframed E1(75 ohm)/T1 card, support the conversion TDM to emulation PW over Ethernet or MPLS-TP with 1 or 2 SCSI interfaces

XCU Card

Number of ports	Up to 8 x STM-n/OC-n ports per XCU card
Physical Interface	2.5G/622M/155M SFP interfaces
Connector	SFP

Diagnostics

Loopback Test	Local loopback, payload loopback, line loopback	
BERT Test	Optical interface	Direction: to optical lines

Performance Monitor

Performance Reports	Performance Parameters: Error Block (EB), Background Block Error (BBE), Error Second(ES), Burst Error Second (BES), Severe Error Second (SES), Unavailable Second(UAS)			
Alarm History				
	SDH/SONET Line Alarm	SDH	Line	PI-LOS RS-LOF RS-TIM MS-SD MS-SF MS-AIS MS-RDI MS-REI B1-BIP B2-BIP

		Ho-Path	AU-LOP AU-AIS HP-SD HP-SF HP-UNEQ HP-PLM HP-TIM HP-RED-P HP-RDI-S HP-RDI-C HP-LOM HP-REI
		Lo-Path	TU-LOP TU-AIS LP-SD LP-SF LP-UNEQ LP-PLM LP-TIM LP-RDI-P LP-RDI-S LP-RDI-C LP-REI LP-BIP
	SONET	Line	LOS-PI, LOF-S, TIM-S, SD-L , SF-L , AIS-L , RDI-L , REI-L UAS, B1-BIP, B2-BIP
		STS-Path	LOP-P, AIS-P, SD-P, SF-P, UNEQ-P, PLM-P, TIM-P, RDI-P-P, RDI-S-P, RDI-C-P, RDI-P-P, LOM-P, REI-P, B3-BIP-P
		VT-Path	LOP-V, AIS-V, SD-V, SF-V, UNEQ-V, PLM-V, TIM-V, RDI-P-V, RDI-S-V, RDI-C-V, REI-V, BIP-V

Alarm Queue Contains up to 10000 alarm records of latest alarm types, alarm severity, date, and time.

Voice Cards

12FXSA/12FXOA Cards

Connector	Twelve RJ11	
Alarm Conditioning	CGA busy after 2.5 seconds of LOS, LOF	
Encoding	A-law or μ-law, user selectable together for all	
AC Impedance	Balanced 600 or 900 ohms (selectable together for all)	
Longitudinal Conversion Loss	> 46dB	
Cross talk measure	Max -70dBm0	
Gain Adjustment	FXSA: -21 to +3 dB / 0.1dB step transmit & receive FXOA: -21 to +10 dB / 0.1dB step transmit & receive	
Signal/ Distortion	> 25dB with 1004 Hz, 0dBm input	
Frequency Response	± 0.5 dB from 300 to 3400 Hz, coincide with ITU-T G.712	
Idle Channel Noise	Max. –65 dBm0p	
Variation of Gain	±0.5dB	
12FXOA	Ringing REN	0.5B (AC)
	Detectable Ringing	25 Vrms
	Loop Resistance	≤ 1800 Ω
	DC Impedance (ON-HOOK)	> 1M Ω
	DC Impedance (OFF-HOOK)	235 Ω @ 25mA feed ; 90 Ω @ 100mA feed
12FXSA Loop Feed	-48Vdc with 25mA current limit per port Jumper Selectable: 25mA(default=25mA), 30mA, or 35mA(sn=S1)	
12FXSA Signalling	Normal / PLAR: Private Line Auto Ring down	
12FXSA Ringing	1 REN at 5K meters per port 16.7Hz, 20Hz, 25Hz, 50Hz, user selectable for all ports Jumper selectable: 64, 76, and 85 Vrms (triangle wave), (default= 76 Vrms for Ring Voltage) 2 sec on 4 sec off, or 1 sec on 2 sec off optional for PLAR ON	
12FXSA Tone	Alarm Tone: 480Hz/620Hz/-24dBm Ring Back Tone: 440Hz/480Hz/-19dBm	
12FXSA functions	Basic functions: Bettary Reverse, Loop Star, PLAR Optional functions: PLAR ON/PLAR bit programmable, Ground Start, and/or Metering Pulse.	
Signaling Bit A,B,C,D	Programable bit	

- All in-band signaling tones are carried transparently by the digitizing process.
- Customer is responsible for in-band signaling compatibility between a telephone and a switch, or between a PBX and a switch.
- FXSA specification shown above support FXSA hardware version N and up.

*Magneto Voice Card (12MAGA)**

Connector	Twelve RJ11
Alarm Conditioning	CGA busy after 2.5 seconds of LOS, LOF

Encoding	A-law or μ-law, user selectable per card configurable
Impedance	Balanced 600 or 900 ohms (for magneto telephone impedance)
Longitudinal Conversion Loss	> 46dB
Gain Adjustment	-21 to +7 dB / 0.1dB step transmit gain (D-A) -21 to +13 dB/0.1dB step receive gain (A-D)
Signal/ Distortion	> 25dB with 1004 Hz, 0dBm input
Frequency Response	± 0.5 dB from 300 to 3400 Hz, coincide with ITU-T G.712
Idle Channel Noise	Max. –65 dBm0p

Signaling

Minimum Detectable Ringing Voltage	16 Vrms
Crank Detectable Across	L1 & L2 Mode (Tip and Ring), L1 & GND Mode(Tip and GND) per port software programmable
Crank Detected time	Valid carnk: more than 250 ms Invalid crank: less than 160 ms
Ringing Generation	Voltage: 76 Vrms (sine wave) Frequency: 25Hz
Ring duration	Software configurable options: 1. PLAR OFF (Continuous Mode) Ring duration depends on cranking time 2. PLAR OFF (One-time) Mode Crank the phone for one time, and the ring duration of the far-end phone could be 0.7, 1.0, 1.5 or 2.0 sec 3. PLAR ON When FXS phone off-hooked, the ring duration of the far-end magneto phone could be 0.7, 1.0, 1.5 or 2.0 sec
Ringing Send Across	L1 & L2 Mode (Tip and Ring), L1 & GND Mode(Tip and GND)
Signaling	Turn Magneto Phone crank (Ringing across Tip and Ring or Tip and Ground)
Signaling Bit A,B,C,D	Per-port configurable

- Signaling is carried transparently by the digitizing process.
- Use Magneto card default setting for communications between magneto telephones
- Use Magneto card PLAR mode setting for communications between a magneto telephone and a regular telephone

QEMA Card

Connector	One 44-pin connector, adapter cable included for 4 RJ45 connectors.
Power	110-220Vac, ±48Vdc
Alarm Conditioning	CGA busy after 2.5 seconds of LOS, LOF
Encoding	A-law or μ-law, user selectable as a group
Impedance	Balanced 600Ω or 900Ω
Gain Adjustment (Per-port setting)	-10 to +7 dB / 0.1dB step for transmit (D/A) gain -10 to +14 dB / 0.1dB step for receive (A/D) gain
Gain Variation	± 0.5 dB at 0 dBm0 input
Frequency Response	± 0.5 dB from 300 to 3400 Hz, coincide with ITU-T G.712
I/O Power Range	A/D Analog input level: -66 dBm (0.00039 Vrms) ~ + 3 dBm (1.09 Vrms) D/A Analog output level: -66 dBm (0.00039 Vrms) ~ + 4 dBm (1.22 Vrms)
Longitudinal Balance	> 63dB
Longitudinal Conversion Loss	＞ 46dB
Total Distortion	＞ 35 dB at 0 dBm0 input
Idle Channel Noise	＜ -65 dBm0p
Wire Mode	2 wire and 4 wire
Signaling	Type I, Type II, Type III, Type IV, Type V, and also TO (Transmit Only)
M Lead Output Current	18 mA (maximum)
E Lead Sensor Current	0.3 mA (minimum)
EM Type Setting	Jump Selectable
Operational Temp.	0°C to +50°C
Relative Humidity	0% to 95%
Carrier Connection	Side A and side B setup by Jump

All in-band signaling tones are carried transparently by the digitizing process.
Customer is responsible for in-band signaling compatibility between a telephone and a switch, or between a PBX and a switch.

QFXOA Card

Quad FXO voice card (4 FXO per plug-in)

Connector	QFXOA: 1, 2, 3, or 4 FXO per RJ11 connector	
Power for QFXOA	110-220Vac and –48Vdc	
Alarm Conditioning	CGA busy after 2.5 seconds of LOS, LOF	
Encoding	A-law or μ-law, user selectable together for all	
AC impedance	Balanced 600 or 900 ohms (selectable together for all)	
Longitudinal Rejection	55 dB	
Loss Adjustment	0, 3, 6, or 9 dB transmit & receive	
Signal/ Distortion	> 46dB with 1004 Hz, 0dBm input	
Frequency Response	± 0.5 dB from 300 to 3400 Hz, coincide with ITU-T G.712	
FXS Loop Feed	Supports line power with 25mA (default) current limit (30mA and 35mA, Jump selectable)	
FXO	Ringing REN	0.5B (AC)
	Detectable Ringing	25 Vrms
	Loop Resistance	≤ 1800 Ω
	DC impedance (ON-HOOK)	> 1M Ω
	DC impedance(OFF-HOOK)	235 Ω @ 25mA feed
		90 Ω @ 100mA feed
FXS Ringing	Supports 2 REN per port (1 REN = 6930Ω + 8 μF) 20 Hz, other frequencies: 16.7Hz, 25 Hz, 50Hz (Jump selectable) 78 Vrms (sine wave) (45 Vrms to 86 Vrms wide range by Resistor selectable) 2 sec on 4 sec off, or 1 sec on 2 sec off optional for PLAR	
Metering Pulse	12KHz/ 16KHz • Power: 10dBm • Sensitivity: -27dBm (-21dBm to -45dBm by Resistor selectable)	
Signaling	Loop Start, GND-Start, Metering Pulse (12KHz, 16KHz), DTMF, Dialing Pulse, PLAR, Battery Reverse (supports Line Reverse Signaling for Billing)	

All in-band signaling tones are carried transparently by the digitizing process.
Customer is responsible for in-band signaling compatibility between a telephone and a switch, or between a PBX and a switch.

QFXSA Card

Quad FXSA voice card (4 FXS per plug-in)

Connector	1, 2, 3, or 4 FXS per RJ11 connector
Power for QFXS	±48Vdc
Alarm Conditioning	CGA busy after 2.5 seconds of LOS, LOF
Encoding	A-law or μ-law (user selectable)
AC impedance	Balanced 600 or 900 ohms (user selectable)
Longitudinal Rejection	55 dB
Gain Adjustment	-21 to +3 dB / 0.1 dB step for transmit (D/A) & receive (A/D) gain
Signal/ Distortion	> 46dB with 1004 Hz, 0dBm input
Frequency Response	± 0.5 dB from 300 to 3400 Hz, coincide with ITU-T G.712
Loop Feed	±48Vdc with 25mA current limit per port Jumper selectable: 25mA, 30mA, 35mA
Ringing	Support 2 REN per port (1 REN = 6930Ω + 8 μF) 16.7Hz, 20Hz, 25Hz, 50Hz (user programmable) Default 78 Vrms (sine wave) (64 Vrms by jumper setting) 2 sec on 4 sec off, or 1 sec on 2 sec off optional for PLAR (user programmable)
Metering Pulse	12KHz/ 16KHz (2.4Vrm/1Vrm user programmable)
Signaling	Loop Start (Metering Pulse, DTMF, Dialing Pulse, PLAR), GND-Start (Tip Open, Ring GND), OOS Alarm, Battery Reverse

All in-band signaling tones are carried transparently by the digitizing process.
Customer is responsible for in-band signaling compatibility between a telephone and a switch, or between a PBX and a switch.

QMAGA Card

Connector	RJ11 x 4
Power	110-220 Vac or ±48 Vdc
Alarm Conditioning	CGA busy after 2.5 seconds of LOS, LOF
Encoding	A-law or μ-law, user selectable per card configurable
Impedance	Balanced 600 or 900 ohms (for magneto telephone impedance)

Longitudinal Conversion Loss	> 46dB
Gain Adjustment	-16 to +7 dB / 0.1dB step transmit gain (D-A) -16 to +13 dB/0.1dB step receive gain (A-D)
Signal/ Distortion	> 25dB with 1004 Hz, 0dBm input
Frequency Response	± 0.5 dB from 300 to 3400 Hz, coincide with ITU-T G.712
Idle Channel Noise	Max. –65 dBm0p

Signaling

Minimum Detectable Ringing Voltage	16 Vrms
Crank Detectable Across	L1 & L2 Mode (Tip and Ring), L1 & GND Mode(Tip and GND) per port software programmable
Crank Detected time	Valid crank: more than 250 ms Invalid crank: less than 160 ms
Ringing Generation	Voltage: 76 Vrms (sine wave) Frequency: 25Hz
Ring duration	Software configurable options: 4. PLAR OFF (Continuous Mode) Ring duration depends on cranking time 5. PLAR OFF (One-time) Mode Crank the phone for one time, and the ring duration of the far-end phone could be 0.7, 1.0, 1.5 or 2.0 sec 6. PLAR ON When FXS phone off-hooked, the ring duration of the far-end magneto phone could be 0.7, 1.0, 1.5 or 2.0 sec
Ringing Send Across	L1 & L2 Mode (Tip and Ring), L1 & GND Mode(Tip and GND)
Signaling	Turn Magneto Phone crank (Ringing across Tip and Ring or Tip and Ground)
Signaling Bit A,B,C,D	Programmable

- Signaling is carried transparently by the digitizing process.
- Use Magneto card default setting for communications between magneto telephones
- Use Magneto card PLAR mode setting for communications between a magneto telephone and a regular telephone

Serial and Digital Access Interfaces

6UDTEA Card

Mode 1: Sub-Rate mode

DTE Interface (RS232)

Data Port	Up to 2		
MUX	Maximum 6 subrate port / 64Kbps		
Data Rate	Asynchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K
	Synchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K,
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 48K, 64K
Connector	RJ48-ASYNC (Port5, Port6)		
Alarm	Remote Alarm		
	RTS Loss		
Loopback	To-DTE		
	To-DS1 (To Line)		
Electrical	DCE		
Protocol	V.110		

DTE Interface (X.21/RS232/RS422)

Data Port	Up to 4		
MUX	Maximum 4 subrate port / 64Kbps		
Data Rate	Asynchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K
	Synchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K,
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 48K, 64K

Connector	DB44 (Port1, Port2), DB44 (Port3, Port4)
Alarm	Remote Alarm
	RTS Loss
Loopback	To-DTE
	To-DS1 (To Line)
Electrical	DCE
Protocol	V.110

Mode 2: N*64K Mode

DTE Interface (X.21/RS232/V.35/V.36/EIA530/RS449)

Data Port	Up to 4 (Port 1 to 4)
Data Rate	Synchronous N*64kbps, N = 1 to 32
	Asynchronous mode is not supported.
Connector	DB44 (Port 1, Port 2), DB44 (Port 3, Port 4)
Alarm	RTS Loss
Loopback	To-DTE
	To-DS1 (To Line)
Electrical	DCE

Note: When oversampling is enabled in MODE2, port 5 ~ 6 will be disabled.

Mode 3: Hybrid Mode

DTE Interface (X.21/RS232/V.35/V.36/EIA530/RS449)

Data Port	Up to 4 (Port 1 to 4)
Data Rate	Synchronous N*64kbps, N = 1 to 32 for port 1 ~ 3 ; N = 1 to 20 for port 4
	Asynchronous mode is not supported.
Connector	DB44 (Port 1, Port 2), DB44 (Port 3, Port 4)
Alarm	RTS Loss
Loopback	To-DTE
	To-DS1 (To Line)
Electrical	DCE

DTE Interface (RS232)

Data Port	Up to 2 (Port 5 and Port 6)
MUX	Maximum 2 oversampling port
Data Rate	No Synchronous mode supported
	Asynchronous 200, 300, 0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 57.6K, 115.2K, 128K
Connector	RJ48 (Port 5, Port 6)
Alarm	Remote Alarm
	RTS Loss
Loopback	To-DTE
	To-DS1 (To Line)
Electrical	DCE

Mode 4: Clock Pass Through

DTE Interface (X.21/RS449/RS422/RS232/V.35/V.36/EIA530)

Data Port	Up to 4 (Port 1 to 4)
Data Rate	Synchronous 0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K
	Tx and Rx byte count
Connector	DB44
Alarm	LOLC, LOCH, CRE
Loopback	To-DTE, To-DS1 (To Line)
Electrical	DCE

Note: Port 5~6 are disabled in Mode 4.

Mode 5: N x 64K with Local and Remote Loopback

DTE Interface (X.21/RS449/RS422/RS232/V.35/V.36/EIA530)

Data Port	Up to 4 (Port 1 to 4)
Data Rate	Synchronous N*64kbps, N = 1~32
Connector	DB44
Protection	DTE signal duplicated via Y-box and transported by working and protection cards
Alarm	RTS Loss, FPGA fail
Diagnostics	DTE Loopback: To-DTE, To-DS1 (To Line)
	Local and Remote Loopback (except for X.21 interface)
	V.54 standard
	BERT

Electrical	DCE

Note: Port 5~6 are disabled in Mode 5.

8UDTEA Interface Card

RS232/RS422/RS485 Data Interface Function

Data Port	8 port Universal DTE card
ASYNC Data Rate	200,300, 600, 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K, 115.2K, 128K bps by oversampling
Data Interface	RS232, RS485, RS422
Connector	RJ48C
Interface	DCE only

Terminal Server Function

Data Port	8 port Terminal Server
ASYNC Data Rate	600, 1200, 2400, 4800, 9600, 19.2K, 38.4K bps
Data Interface	RS232, RS485, RS422
WAN	64 WANs per card Bandwidth for each WAN is N x 64Kbps; N=1 to 32
IP Address	Up to 8 remote IP Address per port, when role is client
Router Function	RIP-I, RIP-II, Static Route
Stop bit	1 bit, 1.5 bit and 2 bit software configurable
Parity bit	None, Odd, Even
data bit	5, 6, 7 and 8 bit.
Role	Server, Client
Data Buffer Size	1 to 2048 Byte
Data Buffer Time out	1 to 255 ms

Omnibus Function

Data Port	Eight ports per card
Asynchronous Data Rate	600, 1200, 2400, 4800, 9600, 19.2K, 38.4K bps
Data Interface	RS232, RS485, RS422
Synchronous	Not supported
Connector	RJ45C
Data Length	5, 6, 7, 8
Parity	None, Odd, Even
Stop Bit	1, 1.5, 2
Role	Master, Slave
Data Buffer Size	1~2048 Byte
Data Buffer Timeout	1~255 ms
Application	Daisy Chain, Star, Point to Multipoint

Clock Pass Through Function

Data Port	Eight ports per card
Synchronous Data Rate	600, 1200, 2400, 4800, 9600, 19.2K, 38.4K bps
Data Interface	RS232
Connector	RJ45C
Application	Pass through RS232 clock transparently for RADAR application

Flow Control

Hardware (RS232 only)	Oversampling: RTS and DTR Active and Permanent Omnibus: RTS Active and Permanent
Software	Terminal Server: Enable and Disable

Loopback

Loopback function	To DTE loopback To Local loopback

LED Indicator

Multi LED indicators	ACT: green-power on; red-alarm exist TS: green-mode is terminal server

X.50 (Omni): green-mode is omnibus
Over Sampling: green-mode is over sampling

DTE Interface (RS232-X.50 mux. 8-port)

Data Port	Up to twelve 8-port RS232 cards							
MUX	Maximum 5 subrate port per 64K bps							
Data Rate	Asynchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K					
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K					
	Synchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K					
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 48K, 64K					
Card Type	Port Number							
	1	2	3	4	5	6	7	8
Eight RJ48	Async/ Sync Note 1	Async/ Sync Note 1	Async	Async/ Sync Note 1	Async/ Sync Note 1	Async	Async	Async
Two DB44 + Two RJ48	Async/Sync	Async/Sync	Async	Async/Sync	Async/Sync	Async	Async	Async
Connector	Eight RJ48 (port 1 to port 8) DB44 (port1,port2,port3), DB44 (port4,port5,port6), RJ48 (port7) and RJ48(port8)							
Conversion Cable	A three-into-one conversion cable adapts the DB44 connector to 3 connecters (one DB9S and two DB25S)							
Electrical	RS232 Interface, DCE							

Note 1: Sync- with rate up to 19.2 Kbps achieved by oversampling at 64 Kbps

DTE Interface (RS232 with V.110 encoding, 6-port)

Data Port	Up to 6 port						
MUX	Maximum 6 subrate port / 64Kbps						
Protocol	Supports V.110						
Data Rate	Asynchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K				
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K				
	Synchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K,				
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 48K, 64K				
Card Type	Port Number						
	1	2	3	4	5	6	
RJ48	Async	Async	Async	Async	Async	Async	
DB44	Sync/Async	Sync/Async	Async	Sync/Async	Sync/Async	Async	
Connector	DB44 (port1,port2,port3) DB44 (port4,port5,port6) or RJ48 (port 1 to Port 6 are 6RJ48)						
Alarm	Remote Alarm RTS Loss						
Loopback	To-DTE To-DS1 (To Line)						
Electrical	RS232 Interface, DCE						

DTE Interface (RS232 with V.110 encoding, 3-port)*

Data Port	Up to 3 ports				
MUX	Maximum 3 subrate port / 64Kbps				
Data Rate	Asynchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 7.2K**, 9.6K, 14.4K**, 19.2K		
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 7.2K**, 9.6K, 14.4K**, 19.2K, 38.4K		
	Synchronous	Mux mode	0.6K, 1.2K, 2.4K, 4.8K, 7.2K**, 9.6K, 14.4K**, 19.2K		
		Independent mode	0.6K, 1.2K, 2.4K, 4.8K, 7.2K**, 9.6K, 14.4K**, 19.2K, 38.4K, 48K, 64K		
Connector	DB44				
DB44	Port Number				
	1		2	3	
	Sync/Async		Sync/Async	Async	
Alarm	Remote Alarm RTS Loss				
Loopback	To-DTE (To Line)				

	To-DS1
Electrical	RS232 Interface, DCE or DTE

**proprietary transport mode for 7.2K and 14.4K data rate

6CDA Interface

Data Port	6-port
Interface	cc mode : ITU G.703 64 Kbps co-directional and Contra-directional controlling (DCE) interface cs mode : ITU G.703 64 Kbps co-directional and Contra-directional subordinate / Centralized (DTE) interface mixed mode : ITU G.703 64 Kbps co-directional, Contra-directional controlling (DCE) and Contra-directional subordinate / Centralized (DTE) interface
Connector	120ohm, RJ48
Line Distance	Up to 500 meters
Alarm	Co-directional : LOS and insert AIS(All 1) Contra-directional : LOO (Loss Of Octet)
Loopack	DTE Payload Loopback, Local Loopback

DTE Interface (Data Bridge Card)

Data Port	Up to twelve 8-port data bridge card (each card supports up to 120 DS0 for data bridge)	
Feature	20 end points per multi-drop circuit to into a logical ended 56K or 64K channel Per port supports bridge function to N remote Trib. Site (N=1~20)	
Data Rate	Asynchronous	Support to receive 1200 to 19200 bps asynchronous data via oversampling channel
Bridge function	one port with one DS-0 to many (Maximum is 20 for remote Tributary data box)	

20 drops for each DS0 to remote Tributary data box and 8 ports RS232 shared the 128 channels.

8SRU Interface

Data Port		Up to 8 ports							
Data Rate		Asynchronous		Mux mode	0.3K, 1.2K, 2.4K, 4.8K, 9.6K, 14.4K, 19.2K, 28.8K, 38.4K				
				Independent mode	0.3K, 1.2K, 2.4K, 4.8K, 9.6K, 14.4K, 19.2K, 28.8K, 38.4K				
		Synchronous		Mux mode	2.4K, 4.8K, 9.6K, 19.2K, 28.8K, 38.4K, 48K, 64K				
				Independent mode	2.4K, 4.8K, 9.6K, 19.2K, 28.8K, 38.4K, 48K, 64K				
	Port Number	1	2	3	4	5	6	7	8
Card Type	Eight RJ48	Async	Async	Async	Async	Async	Async	Async	Async
	Two DB44 + Two RJ48	Async/ Sync	Async/ Sync	Async	Async/ Sync	Async/ Sync	Async	Async	Async
Connector		DB44 (port1, port2, port3), DB44 (port4, port5, port6), RJ48 (port7), RJ48 (port8) Eight RJ48 (port 1 to port 8)							
Conversion Cable		A three-into-one conversion cable adapts the DB44 connector to 3 connecters (one DB9S and two DB25S)							
Electrical		RS232 Interface, DCE							

Data-Processing Interfaces*

Dry Contact Type B Interface

Inputs -		**Outputs -**	
8-channel	2-port per card, 4-pair per port	8-channel	8-pair per card
Connector	RJ45	Connector	Screw type
Internal Resistance	100 K	Initial Insulation Resistance	Min. 1000M ohm (at 500 Vdc)
Activation Current	3 ma	Max. Current	2A
Deactivation Current	1.5 ma	Max. Voltage	220 Vdc, 250 Vac
Allowable Current	4 ma		

Analog Bridge Card (ABRA)

Group	Up to 8 groups per card, 16 members per group
Analog Bridge Mode	Master/Slave Architecture

	Downstream : 2 to many Upstream : many to 2
Voice Conference Mode with CAS Signalling	Any-to-any conference bridge Up to 16 members in one conference group Silence detection/suppression
RS232 Data Bridge Mode	Master/Slave Architecture Downstream : 2 to many (up to 14 Slave units) Upstream : many to 2
Voice Protection Mode	One Master to two Slaves for 1+1 protection Analog signals only 42 protection groups
OCU-DP Data Bridge Mode (MJU Mode)	Master/Slave Architecture Downstream: 1 to many (up to 14 Slave units) Upstream: many to 1
PCM encoder/decoder	Compatible with ITU-T G.711 A-law/Mu-law coding.
LED Indicator	Multi-color indication

Echo Canceller Card

Echo Cancellation	64ms uni-directional, 64ms bi-directional and 128ms uni-directional
Channel	Up to 64 channels
Functions	- one way or bi-direction cancellation from PCM bus to ECA card - E1/T1 multichannel echo cancellation
PCM encoder/decoder	Compatible with ITU-T G.711 A-law/Mu-law coding.
LED Indicator	Multi-color indication
Compliant	ITU-T G.165 and ITU-T G.168-2000 and 2002

Transportation Interfaces

Network Line Interface - T1

Line Rate	1.544 Mbps ± 50 bps	Output Signal	DSX1
Line Code	AMI or B8ZS	Framing	D4/ESF (selectable)
Input Signal	ABAM cable length up to 655 feet	Connector	RJ48C

Network Line Interface - E1

Line Rate	2.048 Mbps ± 50 ppm	Framing	ITU G.704
Line Code	AMI or HDB3	Connector	BNC/RJ48C
Input Signal	ITU G.703	Electrical	75 ohm Coax/120 ohm twisted pair
Output Signal	ITU G.703	Jitter	ITU G.823

Network Line Interface - Mini 4E1

Line Rate	2.048 Mbps ± 50 ppm	Framing	ITU G.704
Line Code	AMI or HDB3	Connector	DB25S
Input Signal	ITU G.703	Electrical	75 ohm Coax/120 ohm twisted pair
Output Signal	ITU G.703	Jitter	ITU G.823

Network Line Interface - Mini 4T1

Line Rate	1.544 Mbps ± 32 ppm	Framing	D4/ESF
Line Code	AMI/B8ZS	Connector	DB25S
Input Signal	ITU G.703 DSX-1 0dB to -30dB w/ALBO	Output Signal	ITU G.703 DSX-1 w/o, -7.5, -15dB LBO ITU G.703 DSX-1 w/short (0-110, 110-220, 220-330, 330-440, 440-550, 550~660 feet)
Jitter	AT&T TR 62411	Pulse Template	AT&T TR 62411
Data Rate	n * (64) Kbps (n=1-24)		

G.shdsl Line Interface (2GH/4GH)*

Number of ports	2 or 4
Line Rate for 4-channel G.shdsl	n x 64Kbps (n= 3 to 31)
Line Rate for 2-channel G.shdsl	n x 64Kbps (n= 3 to 15)
Line Code	16-TCPAM, full duplex with adaptive echo cancellation
Connector	RJ45
Electrical	Unconditioned 19-26 AWG twisted pair

Sealing current	Max. 20 MA source current
Clock Source	From System, Line
Diagnostic Test	G.SHDSL Loopback: To-LINE, To-bus BERT: QRSS

DTE Interface (X.21)*

Data Port	Up to nine 1-port DTE X.21 card
Data Rate	56 or 64 Kbps, n = 1 to 32
Connector	DB15

DTE Interface (V.35)*

Data Port	Up to nine 1-port DTE V.35 card
Data Rate	56 or 64 Kbps, n = 1 to 32
Connector	DB25S (optional conversion cable DB25S to M34 connector)

DTE Interface (RS232)*

Data Port	1-port RE232 card
Data Rate	56 or 64 Kbps *n, n=1 - 2
Mapping	Any sequential time slots

1 Port OCU-DP Interface Card

Ports	1 Ports card
Operating Modes	4-wire DDS or switched 56
Dedicated Rates	SYNC: 2.4, 4.8, 9.6, 19.2, 56 and 64k clear channel Conforms with AT&T Pub 41458
OCU DP Operation	Conforms with AT&T 62310 and ANSI T1.410
Local Loop Signal	Bipolar return to zero, 50% duty cycle
Transmit Amplitude	+/- 1.5 V (+/- 10%) peak, all rates except 9.6k +/- 0.75 V (+/- 10%) peak at 9.6k
Transmit Source Impedance	135 Ohms +/- 20%
Receive Input Impedance	135 Ohms +/- 20%
Receiver Sensitivity/ Dynamic Range	0 to 43 dB loop loss at 72K & 56K 0 to 34 all other rates
Physical Interface	4-wire loop interface RJ45 modular connector
Network to Loop Test Codes	Zero code suppression, Idle
Loop to Network Test Codes	Zero code suppression, Idle, latch/non-latch, DSU loop-back

OCU/DP Interface Card*

Ports	8 Ports for each card
Line Status Indicator	Per Port 1 dual color LED; Red for LOS, Green for SYNC
Network Connector	RJ48S
Electrical network connection	Tip/Ring and Tip1/Ring1
Transmit Source Impedance	135 Ohms +/- 20%
Receive Input Impedance	135 Ohms +/- 20%
Receiver Sensitivity/ Dynamic Range	0 to 43 dB loop loss at 72K & 56K 0 to 34 all other rates Automatic line equalization
Pulse Amplitude	+/- 1.5 V (+/- 10%) peak, all rates except 9.6k +/- 0.75 V (+/- 10%) peak at 9.6k Bipolar Return to zero, 50% duty cycle
Sealing Current	Typically 16 mA DC
Operating Modes	4-wire DDS Switched 56 support is optional.
Circuit Rates	SYNC: 2.4, 4.8, 9.6, 19.2, 56, 72kbps (64k) clear channel Conforms with AT&T Pub 41458
Encoding and decoding rules	Use bipolar violation to indicate control information: Idle, out of service, Zero substitution using unframed loops
Maintenance control	DSU Non-latching loop-back code (for 2.4, 4.8, 9.6, 19.2, 56k circuit rate) DSU Latching loop-back (TIP, LSC, LBE, FEV) code (for 72k circuit rate)

	Machine maintenance OCU/DP card operation: Payload loopback OCU loopback Local loopback Bi-directional loopback
	V.54 remote loopback code
	Custom defined remote loopback code
Fault and Performance	BERT test supports all ones, all zeros, 2047,511,63 pattern.
	LOS, OOS, ES, SES and UAS alarm.
	Current, last 96 registry and 7 days performance storage.
Environment	Operating Temperature: -20 - 65°C
	Storage Temperature: -30 - 70°C
	Humidity: Up to 90% RH non-condensing
Specification Standard	ANSI T1.410; AT&T Pub 62319, AT&T Pub 62310, ITU-T V.54

Fiber Optical Interface (SFOM)

Source	MLM Laser	Line Code	Scrambled NRZ
Wavelength	1310 ± 50 nm, 1550 ± 40 nm	Detector Type	PIN-FET
50 Km reach		Protection	Optional 1+1 APS

NOTE: Longer or shorter, 15 to 120Km, on special order.

Optical Module	Fiber Direction	Wavelength (nm)	Connector	Distance (km)
NHB3S (was SAA)	Dual uni-directional	1310	SC (Subscriber Connector)	30
NHB5S (was SBB)	Dual uni-directional	1310	SC (Subscriber Connector)	50
NHB3F (was SCC)	Dual uni-directional	1310	FC (Fiber Connector)	30
*NHC2S (was SDD)	Dual uni-directional	1550	SC (Subscriber Connector)	20
SEE	Dual uni-directional	1550	SC (Subscriber Connector)	100
WHD2S (was SSM)	Single bi-directional (master)	1310/1550	SC (Subscriber Connector)	30
WHE2S (was SSS)	Single bi-directional (slave)	1550/1310	SC (Subscriber Connector)	30

NOTE: Other fiber optical options available on special order

* For the orders of the listed optical module, please contact your Loop sales representative.

Packet Access Interfaces

Router-A Interface*

Number of Ports	2 LAN ports, Max. 64 WAN ports, Each WAN port has data rate n x 64K bps, 1≤ n ≤32 (≤ 4Mbps for total of all 64 WAN ports
Physical Interface	10/100 BaseT x 2
Connector	RJ45
Routing Protocol	RIP-I, RIP-II, OSPF, Static
Supporting Protocols	PPP (IPCP/BCP), MLPPP, HDLC, Frame Relay, and Cisco compatible HDLC, NAT/NAPT, DHCP
Diagnostic	Ping, Trace route
QoS	Rate limit

*Fiber Optical Interface (1FOMA)**

Source	MLM Laser	Line Code	Scrambled NRZ
Wavelength	1310 ± 50 nm, 1550 ± 40 nm	Detector Type	PIN-FET
50 Km reach		Protection	1 for 1 protection 1+1 protection

NOTE: Longer or shorter, 15 to 120Km, on special order.

Fiber Optical Interface Characteristics

Optical Module	Fiber Direction	Wavelength (nm)	Connector/Interface	Distance (km)	Power (dB)
NHB3S (was SAA)	Dual uni-directional	1310	SC/UPC	30	19

NHB5S (was SBB)	Dual uni-directional	1310	SC/UPC	50	30
NHB3F (was SCC)	Dual uni-directional	1310	FC/UPC	30	20
*NHC2S (was SDD)	Dual uni-directional	1550	SC/UPC	20	12
SEE	Dual uni-directional	1550	SC/UPC	100	30
WHD2S (was SSM)	Single bi-directional (master)	1310/1550	SC/UPC	30	20
WHE2S (was SSS)	Single bi-directional (slave)	1550/1310	SC/UPC	30	20

NOTE: Other fiber optical options available on special order

* For the orders of the listed optical module, please contact your Loop sales representative.

Teleprotection Access Interfaces

C37.94 & Mini C37.94 Card

ZRATT

Multi-Mode, 2Mbps, 820nm, 2KM, ST/UPC connector

Tx						Rx						Note
Power (dBm)			Wavelength (nm)			Power (dBm)			Wavelength (nm)			
Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
-19.8	--	-12.8	792	820	865	-25.4	--	-9.2	792	820	865	50/125μm Fiber Cable
-16	--	-9				-25.4	--	-9.2				62.5/125μm Fiber Cable

QRATT

Multi-Mode, 2Mbps, 850nm, 2KM, ST/UPC connector

Tx						Rx						Note
Power (dBm)			Wavelength (nm)			Power (dBm)			Wavelength (nm)			
Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
-23	--	-11	790	--	870	-32	--	-11	790	--	870	50/125μm Fiber Cable
-19	--	-11				-32	--	-11				62.5/125μm Fiber Cable

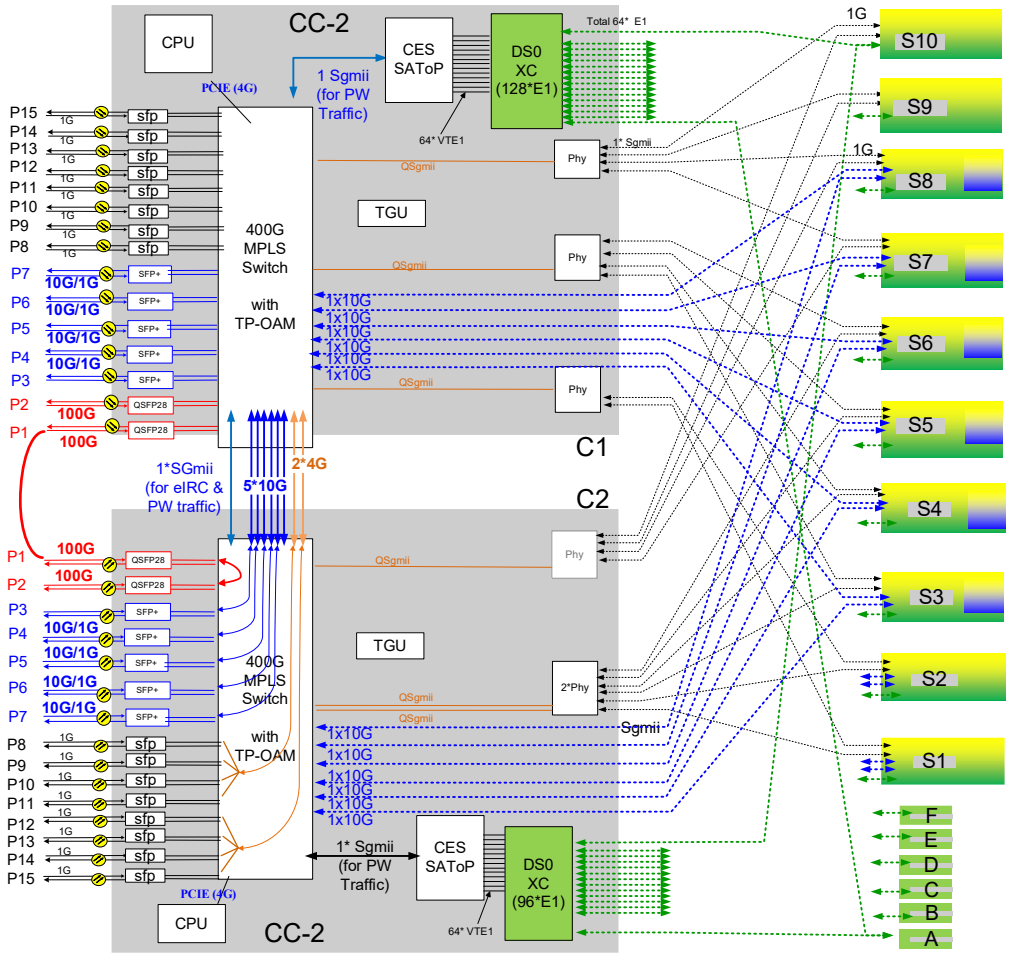
NRB2T

Single-Mode, 2Mbps, 1310nm, 20KM, ST/UPC connector

Tx						Rx						Note
Power (dBm)			Wavelength (nm)			Power (dBm)			Wavelength (nm)			
Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
-20	--	0	1261	1310	1360	-32	--	0	1260	--	1610	

Capacity

G7800 with CC-2 Backplane on CHA Chassis



3440 LS Line Cards (Full&Mini):
E&M
FXS
FXO
RS232
RTB
:::::

PTN Yellow Cards (1G BP) :
TE1-32-LoSW1
DS3-6-x*
B2G5-2-LoSW1
GFE-x

PTN Blue Cards (10G BP) :
B2G5-2-x
GFE-x

New PTN Red Cards (0G BP) :
XGE-9XG*

Slot Organization

The central slots C1 and C2 support the CC-2 MPLS-TP/CE switches.

The mini-slots (Slots A ~ F) support the PDH interface cards and clock card only.

All 10 slots from S1 to S10 support:

- PDH interfaces cards, n x 64Kbps of 4 E1 backplane
- 32 E1/T1 or 16 DS3 cards
- 8 x FE RJ45
- 4 STM-1 or1 STM-4

The next table shows the G7800 slots with supported cards.

Slot Layout

<table>
<tr><td colspan="2">Connector Board</td><td colspan="4">Fan Slot (FS1)</td><td colspan="4">Fan Slot (FS2)</td><td colspan="4">Fan Slot (FS3)</td></tr>
<tr><td>Slot E</td><td>Slot F</td><td rowspan="3">S1</td><td rowspan="3">S2</td><td rowspan="3">S3</td><td rowspan="3">S4</td><td rowspan="3">C1</td><td rowspan="3">C2</td><td rowspan="3">S6</td><td rowspan="3">S7</td><td rowspan="3">S8</td><td rowspan="3">S9</td><td rowspan="3">S10</td><td>Power 2</td></tr>
<tr><td>Slot C</td><td>Slot D</td><td>Power 1</td></tr>
<tr><td>Slot A</td><td>Slot B</td><td></td></tr>
<tr><td colspan="14">Heat Buffer</td></tr>
</table>

Slot & Card Compatibility (G7800 with CC-2/CHA Chassis)

Slot / Card / Backplane Bus	C1/C2	Mini A~D	S1/S2 Slot	S9/S10 Slot	S3~S8 Slot	G7800-A System Total Capacity
		DS0 Bus	DS0 Full Slot / 0G / 1G Bus	DS0 Full Slot / 1G Bus	DS0 Full Slot / 0G / 1G Bus / 10GBus	
CC-2 (2*100G)	**V**	Na	Na	Na	Na	**2 x 100G + 10 x 10GE +16 x GE**
All Mini-Slot DS0	Na	**V**	Na	Na	Na	-
All Single-Slot DS0	Na	Na	**V**	**V**	**V**	-
B2G5-x	Na	Na	Na	Na	**V@10GE**	**12 x STM-16/ 12 x STM-4/ 12 x STM-1**
EoS	Na	Na	Na	Na	**V@10GE**	
TE1-x-LoSW1 TE1-FR-16/32	Na	Na	**V@1GE**	**V@1GE**	**V@1GE**	**320 x E1/T1**
DS3*	Na	Na	**V@1GE**	**V@1GE**	**V@1GE**	**60 x T3**
XCU	Na	Na	Na	Na	**V@10GE**Note 3	**2 x STM-16 or 8 x STM-4/1 or 1 x STM-16 + 4 x STM-4/1**
GFE-10S	Na	Na	Na	Na	**V@10GE**	**6 x 10GE or 60 x GE or 80 x FE Optical**
GFE-8T	Na	Na	Na	Na	**V@10GE**	**48 x GE/FE BaseT (RJ45) 64 x FE BaseT (RJ45)**
GFE-8POE1 GFE-4POEP1	Na	Na	Na	Na	**V@10GE**	**16 x GE/FE POE(+)**
GFE-8POE2 GFE-4POEP2	Na	Na	Na	Na	**V@10GE**	**48 x GE/FE POE(+)**
XGE-9XG*	Na	Na	**V**	Na	**V**	**18 x 10GE**

Note 1:	Due to the number limitation of MAC addresses, S9 & S10 cannot support Ethernet Cards.
Note 2:	V means supported via 8M PCM backplane V@1G means supported via 1GE backplane; V@10GE means supported via 10GE backplane. V means supported via Front Panel 100G connection.
Note 3:	XCU cards can only be supported in **Slot 7** and **Slot 8**.

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