FCD-155

STM-1/OC-3 Terminal Multiplexer

DESCRIPTION

- FCD-155 is an STM-1/OC-3 add/drop multiplexer that transports LAN and traditional (TDM) traffic over SDH/SONET networks. When bandwidth granularity of the Ethernet channel is configured to 2 Mbps (VC-12) or 1.5 Mbps (VT-1.5), FCD-155 utilizes the SDH/SONET infrastructure for cost-effective connectivity.

- Optional PDH interfaces include:
  - 4- or 8-port E1 or T1 interfaces
  - Single-port E3/T3 interface

- Optional Ethernet configurations include:
  - 2-port bridging 10/100BaseT interface
  - 6-port 10/100BaseT interface (two bridging and four transparent ports)
  - Single-port Ethernet interface with 2-port bridging 10/100BaseT and 10/100/1000BaseT (RJ-45) or 1000BaseSX (SFP interface).

FEATURES

- STM-1/OC-3 PDH/Ethernet terminal multiplexer for grooming LAN and legacy (TDM) traffic over SDH/SONET networks

- Ethernet traffic maps to:
  - One VC-3/VC-4/STS-1
  - Up to 3 VC-3/STS-1
  - Up to 63 VC-12 or 84 VT-1.5

- PDH interface supporting 4 or 8 × E1/T1 (G.703) or a single E3/T3 link

- 10/100BaseT and GbE (Gigabit) Ethernet interfaces offer VLAN support and point-to-multipoint switching capability

- QoS via priority queues per virtual group

- Multiple nodes are managed over a single shared VC-12/VT-1.5 channel, or multiplexed into virtual group traffic

- Management via ASCII terminal, Telnet host, Web terminal, SNMP-based network management station, or over DCC

- Multiple system clock synchronization options

- Demarcation point between the carrier and the customer networks

- Channelized STM-1/OC-3 standard main link with fiber interface

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NETWORK INTERFACE

- The STM-1/OC-3 interfaces are user-configurable and provide a high-quality and high-availability link, as well as performance monitoring of the traffic path.

- The STM-1/OC-3 link is supplied with an SFP socket (see *Ordering*).

- The user can define the following SDH/SONET clock sources:
  - Internal
  - Recovered from the STM-1/OC-3 interface, including automatic selection based on SSM (Synchronization Status Messaging)
  - External E1

- FCD-155 supports an optional 1+1 link protection mechanism (unidirectional MSP/APS) and SNCP path protection.

- Maintenance capabilities include user-activated local loopbacks and remote loopbacks on the STM-1/OC-3 main link and PDH tributaries.

LAN INTERFACE

- The 2-port 10/100BaseT or single-port Gigabit Ethernet interfaces include a built-in Ethernet bridge that supports VLAN according to IEEE 802.1Q and 802.1p.

- The 4-port transparent LAN extension, without bridge functionality, creates total separation between customers for security. The maximum frame length is 2 kb.

- The 10/100BaseT LAN interface supports autonegotiation for plug-and-play Ethernet connectivity and complies to IEEE 802.3/Ethernet V.2 standards.

- An optional Gigabit Ethernet port enables connection of one LAN port to eight virtual groups. This option provides LAN extension over SDH/SONET networks with bridge functionality. The maximum frame length is 2 kb.

- Ethernet traffic is mapped into SDH/SONET containers using the following link layer protocols:
  - Generic Framing Procedure (G.7041, FP-T1X1.5/2001-186, GFP-F), framed mode
  - Link Access Procedure for SDH/SONET (LAPS) protocols following draft recommendation ITU-T X.85/X.86.

- Each user's Ethernet traffic can be mapped into SDH/SONET virtual containers in any of the following ways:
  - Up to 63 × VC-12, or 84 × VT-1.5
  - 3 × VC-3/STS-1
  - 1 × VC-4.

- Ethernet traffic can be switched to different bundles of virtually concatenated VCs (up to 8 bundles) according to a predefined group.

- Link Capacity Adjustment Scheme (LCAS) is supported in compliance with the G.7042 standard, which allocates bandwidth according to Ethernet traffic.
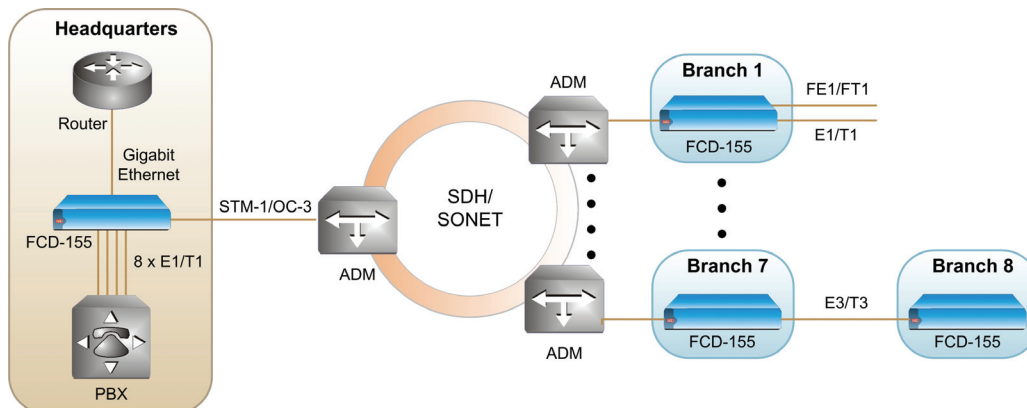
APPLICATION

Figure 1. ADM Application in a Corporate Environment

- SDH/SONET media can transport basic Ethernet packets of up to 1536 bytes enabling connection to MPLS networks.

- The Ethernet interfaces allow interconnection of SAN (Storage Area Networks) devices with Ethernet packets up to 2 kb.

- Spanning Tree Protocol (STP) and Rapid Spanning Tree Protocol (RSTP) support Layer 2 ring applications.

TDM INTERFACE

- FCD-155 has an optional interface module containing 4 or 8 E1/T1 balanced interface ports that transfer data transparently in compliance with the G.703 standard. The unbalanced E1 interface is software selectable on the 8-port version. The 4-port version is jumper selectable and requires an adapter cable (see Ordering).

- An optional E3/T3 port supports unframed E3/T3 links over SDH/SONET.

- TDM traffic is mapped into SDH/SONET VC-12/VC-11/VC-3 or SONET VT1.5/STS-1 containers that can be placed anywhere within the STM-1/OC-3 bandwidth.

MANAGEMENT

- Remote units can be managed in any of the following ways:
  - IP/PPP over DCC protocol
  - Via a dedicated virtual group containing at least one VC-12/VT-1.5 channel
  - Inside user traffic in a virtual group separated by the GFP Channel ID or VLAN tag
  - Out-of-band, via direct connection to one of the LAN ports.

- Status and diagnostic information is defined, configured, and monitored using one of the following methods:
  - ASCII terminal connected to the V.24/RS-232 control port
  - Telnet host via management platform or LAN port
  - Network management station running RADview, the SNMP network management application
  - TFTP applications to update software and upload/download remote configurations
  - ConfiguRAD via a Web browser.

DIAGNOSTICS

- FCD-155 has comprehensive diagnostic capabilities, including:
  - Ethernet and SDH/SONET link monitoring
  - Real-time alarms that alert the user of fault conditions. Alarms are reported to the management station and simultaneously relayed through a dry contact port.

GENERAL

- An AC or DC power supply is provided with an alarm-activated fan for forced-air cooling.

- FCD-155 is a compact standalone unit. One or two units can be installed side-by-side in a 19-inch rack using the optional rack-mount adaptor kit. One FCD-155 can be mounted on the wall using the optional wall-mount adapter kit (see Ordering).

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SPECIFICATIONS

STM-1/OC-3 MAIN LINK (NETWORK)

- **Number of Ports**
  1 (second link available for redundancy)

- **Bit Rate**
  155.52 Mbps ±20 ppm

- **SFP Socket**
  Characteristics: See *Table 1*
  SPF options: See *Ordering*

- **Timing**
  - Internal clock
  - Recovered from the STM-1/OC-3 interface
  - External clock from PDH tributary

- **Compliance**
  SDH: ITU-T G.957
  SONET: GR-253-core

- **Framing**
  SDH: ITU-T G.707, G.708, G.709
  SONET: ANSI T1.105-1995, GR-253-core

- **Line Code**
  NRZ

LAN INTERFACE

- **Number of Ports**
  - 2 or 6 10/100BaseT ports
  - Optional 1 GbE

- **Compatibility**
  Relevant sections of IEEE 802.3u, 802.3x, 802.1D and 802.1Q

- **LAN Table**
  1,024 MAC addresses with selectable automatic aging time

- **Data Rate**
  - 10BaseT: 10 Mbps
  - 100BaseT: 100 Mbps
  - 1000BaseT: 1000Mbps (Gigabit Ethernet)
  - Autonegotiation

- **Connectors (per port)**
  - RJ-45, shielded
  - SFP socket (for transceivers, see Ordering)

E1/T1 PDH INTERFACE (OPTION)

- **Number of Ports**
  4 E1, 4 T1, 8E1, or 8 T1

- **Compatibility**
  ITU-T Rec. G.703, unframed

- **Nominal Data Rate**
  E1: 2.048 Mbps
  T1: 1.554 Mbps

- **Line Code**
  E1: HDB3
  T1: B8ZS

- **Impedance**
  E1: 120Ω balanced or 75Ω unbalanced
  T1: 100Ω balanced

- **Maximum Line Attenuation**
  36 dB (LTU mode)
  12 dB (DSU mode)

- **Timing**
  - Source clock is recovered from the receive signal coming from the remote E1/T1 side
  - Locked to the SDH/SONET interface clock

- **Connectors**
  4-ports: RJ-45, shielded
  8-ports: 44-pin, D-type, female

Table 1. Interface Characteristics

	Transceiver	Wavelength [nm]	Fiber Type [μm]	Transmitter Type	Connector Type	Input Power [dBm] (min)	(max)	Output Power [dBm] (min)	(max)	Typical Max. Range [km]	[miles]
STM-1/OC-3 Uplink	SFP-1	1310	62.5/125 multimode	VCSEL	LC	-30	-14	-20	-14	2	1.2
	SFP-2	1310	9/125 single mode	Laser	LC	-28	-8	-15	-8	15	9.3
	SFP-3	1310	9/125 single mode	Laser	LC	-34	-10	-5	0	40	24.8
	SFP-4	1550	9/125 single mode	Laser	LC	-34	-10	-5	0	80	49.7
	SFP-11	Copper Uplink	Coaxial cable 75Ω impedance	–	Mini-BNC	–	–	–	–	0.135*	0.08*
GbE User Port	SFP-5	850	50/125 multimode	VCSEL	LC	-17	0	-9.5	0	0.55	0.3
	SFP-6	1310	9/125 single mode	Laser	LC	-20	-3	-9.5	-3	10	6.2
	SFP-7	1550	9/125 single mode	Laser	LC	-22	-3	0	+5	80	49.7
	SFP-8D	1310	9/125 single mode	Laser	LC	-21	-3	0	-4	40	24.8

Using RG59 B/U.

E3/T3 PDH INTERFACE (OPTION)

- **Number of Ports**
  1

- **Compatibility**
  ITU-T Rec. G.703, unframed

- **Data Rate**
  E3: 34.368 Mbps
  T3: 44.736 Mbps

- **Framing**
  Unframed

- **Line Code**
  E3: HDB3
  T3: B3ZS

- **Line Impedance**
  75Ω

- **Connector**
  Two BNC female

- **Timing**
  - Source clock is recovered from the receive signal from the remote E3/T3 side
  - Locked to the SDH/SONET interface clock

MANAGEMENT PORTS

- **CONTROL Port**
  Interface: V.24/RS-232
  Connector: 9-pin D-type, female
  Format: Asynchronous
  Baud rate: 0.3–115.2 kbps
  Selectable word format:
    7 or 8 bits, no parity, 7 bit odd or even parity

- **Out-of-Band Access**
  - Single Ethernet port FCD-155 version: MNG ETH port
  - Other FCD-155 versions: ETH 1 and ETH 2 ports (through internal Ethernet switch)

INDICATORS

- **General**
  PWR (green) – Power
  TST (yellow) – Test
  MAJ ALM (red) – Major alarm
  MIN ALM (red) – Minor alarm
  LOC SYNC LOSS (red) – Local loss of synchronization on the STM-1/OC-3 links
  REM SYNC LOSS (red) – Remote loss of synchronization on the STM-1/OC-3 links

- **ETH, MNG, GbE (per port)**
  LINK (green) – LAN link integrity
  ACT (yellow) – LAN data activity

- **E1/T1 PDH Interface (per port)**
  SIG LOSS (red) – E1 link signal loss
  AIS (red) – AIS on E1 link

- **E3/T3 PDH Interface**
  SIG LOSS (red) – E3/T3 link signal loss

- **STM-1/OC-3 Main Links**
  SIG LOSS (red) – STM-1/OC-3 link signal loss
  ON LINE (green) – STM-1/OC-3 link is active (indicator is on) or on standby (indicator is blinking)

GENERAL

- **Power**
  AC: 100 to 240 VAC ±10%, 50 to 60 Hz
  DC: –48 VDC (–40 to –72 VDC)

- **Power Consumption**
  30W

- **Alarms**
  Last 100 alarms are time stamped, stored, and available for retrieval

- **Alarm Relay Port**
  Operation: normally open, normally closed, using different pins
  Connector: 9-pin, D-type, female

- **Physical**
  Height: 4.4 cm (1.7 in)
  Width: 21.5 cm (8.5 in)
  Depth: 30.0 cm (11.8 in)
  Weight: 2.4 kg (5.3 lb)

- **Environment**
  Temperature: 0°–50°C (32°–122°F)
  Humidity: Up to 90%, non-condensing

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▮▮ <u>ORDERING</u>

FCD-155/*/&/$
STM-1/OC-3 Terminal Multiplexer

Note: SFP transceivers are not included in the chassis for the uplink and/or the fiber GbE interfaces (see *SFP Transceivers*).

* Specify power supply:
    AC for 100 to 240 VAC
    48 for –48 VDC

& Specify the LAN interface:
    2U for 2 bridging 10/100BaseT
        ports
    6U for 2 bridging and
        4 transparent 10/100BaseT
        ports
    GE for 1 10/100/1000BaseT (GbE)
        port, copper interface and SFP
        socket

$ Specify PDH interface:
    4E1 for 4 × E1 G.703 ports
    4T1 for 4 × T1 G.703 ports
    8E1 for 8 × E1 G.703 ports
    8T1 for 8 × T1 G.703 ports
    E3 for 1 × E3 G.703 ports
    T3 for 1 × T3 G.703 ports

    Notes:
    The 4 x E1 port option is delivered with a balanced E1 interface. To convert the interface from balanced to unbalanced, use converter cable CBL-RJ45/2BNC/E1/X.

SFP TRANSCEIVERS

(For redundancy, order two SFP transceivers)

STM-1/OC-3 UPLINK

SFP-1 for STM-1/OC-3, 1310 nm multimode VCSEL, LC connector
SFP-2 for STM-1/OC-3, 1310 nm single mode laser (S1.1), LC connector
SFP-3 for STM-1/OC-3, 1310 nm, single mode laser, long haul (L1.1), LC connector
SFP-4 for STM-1/OC-3, 1550 nm single mode laser, long haul (L1.2), LC connector
SFP-11 for for STM-1/OC-3, electrical interface, mini-BNC coaxial connector

GbE

SFP-5 for GbE, 850 nm multimode VCSEL
SFP-6 for GbE, 1310 nm single mode laser (LX-SM)
SFP-7 for GbE, 1550 nm single mode laser, long haul LX-H (ZX)
SFP-8D for GbE, 1310 nm single mode laser, long haul (LX-H)

SUPPLIED ACCESSORIES

AC power cord (when AC power supply is ordered)

DC adapter plug (when DC power supply is ordered)

CBL-DB9F-DB9M-STR
Control port cable

OPTIONAL ACCESSORIES

CBL-RJ45/2BNC/E1/X
Cable for converting a balanced E1 interface to an unbalanced E1 interface. Contains one RJ-45 balanced connector and two unbalanced BNC coaxial connectors.

CBL-MINIBNC-BNC
Cable for adapting two mini-BNC connectors to two full-sized BNC connectors (for SFP-11)

RM-35/@
Hardware kit for mounting one or two units in a 19-inch rack

@ Specify rack mount kit type:
    P1 for mounting one unit
    P2 for mounting two units

WM-35
Hardware for mounting one unit on the wall

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