**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
STM-1/OC-3 Terminal Multiplexer

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 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](image-url)
• 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 adaptor kit (see Ordering).
STM-1/OC-3 Terminal Multiplexer

**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, 8 E1, 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

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**Table 1. Interface Characteristics**

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

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