FCD-155

STM-1/OC-3 Terminal Multiplexer

RAD

- Built-in switching mechanism serves up to four remote sites in point-to-multipoint topology

- QoS via four priority queues per virtual group supporting 802.1p, IPv4 TOS/DiffServ and port ID

- Management of multiple nodes 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

- STM-1/OC-3 system clock synchronization to the network port, one of the PDH ports, or internal oscillator

FEATURES

- SDH/SONET terminal multiplexer for grooming LAN and legacy traffic (TDM) over SDH/SONET networks

- Demarcation point between the carrier and the customer networks

- GFP (G.7041), LAPS (X.85/86) encapsulation of Ethernet over SDH/SONET

- High order payload virtual concatenation – mapping the Ethernet traffic over up to 3 × VC-3/STS-1 links

- High order payload without virtual concatenation – mapping the Ethernet traffic over a single VC-3/VC-4/STS-1 link

- Low order payload with virtual concatenation – mapping the Ethernet traffic over up to 63 × VC-12 or 84 × VT1.5 channels

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

- Optional 1+1 redundant network interface (single-ended MSP/APS)

- 4 × E1/T1 (G.703), or single E3/T3 optional module for supporting traditional services

- Up to six 10/100BaseT interfaces conforming to IEEE 802.3u and 802.3x standards, two basic interfaces also supporting VLAN according to IEEE 802.1Q and 802.1p

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DESCRIPTION

- FCD-155 is an SDH/SONET terminal multiplexer that enables transport of LAN and traditional (TDM) traffic over SDH/SONET networks. With bandwidth of the Ethernet channel configured in 2 Mbps (VC-12) or 1.5 Mbps (VT-1.5) increments, FCD-155 utilizes the SDH/SONET infrastructure for cost-effective Internet access and LAN connectivity. Additionally, FCD-155 supports legacy TDM-based services in the SDH/SONET environment.

- The basic unit includes two LAN interfaces, a single STM-1/OC-3 interface, and an AC or DC power supply.

- The following optional interfaces can be added to the basic unit:
  - Four E1 or T1 interfaces
  - Single E3 or T3 interface
  - Second STM-1/OC-3 uplink for 1+1 link redundancy of the main link (single-ended MSP/APS).

WAN INTERFACE

- For direct connection to the SDH/SONET network, FCD-155 has one standard network port with a software-configurable STM-1/OC-3 interface. It provides the customer with a high quality and high availability link, and performance monitoring of the traffic path.

- The STM-1/OC-3 link is available with a variety of fiber optic and copper coaxial connector options (see *Table 1*).

- The user can define the following SDH/SONET clock sources:
  - Internal
  - Recovered from the STM-1/OC-3 interface
  - External E1.

- FCD-155 supports optional single-ended 1+1 redundancy mechanism (MSP/APS).

- Maintenance capabilities include user-activated local and remote loopbacks on the tributary E1 links.

LAN INTERFACE

- The 10/100BaseT LAN interface supports autonegotiation for plug-and-play Ethernet connectivity. Ethernet interfaces comply with the IEEE 802.3/Ethernet V.2 standards.

- The two basic interfaces also include a built-in Ethernet bridge supporting VLAN according to IEEE 802.1Q and 802.1p.

- The 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 (LAPS) protocols – as per the ITU-T X.85/X.86 draft recommendations.

- Ethernet traffic of each user can be mapped into SDH/SONET virtual containers in any of the following ways:
  - Up to 63 × VC-12, or 64 × VT-1.5
  - 3 × VC-3/STS-1
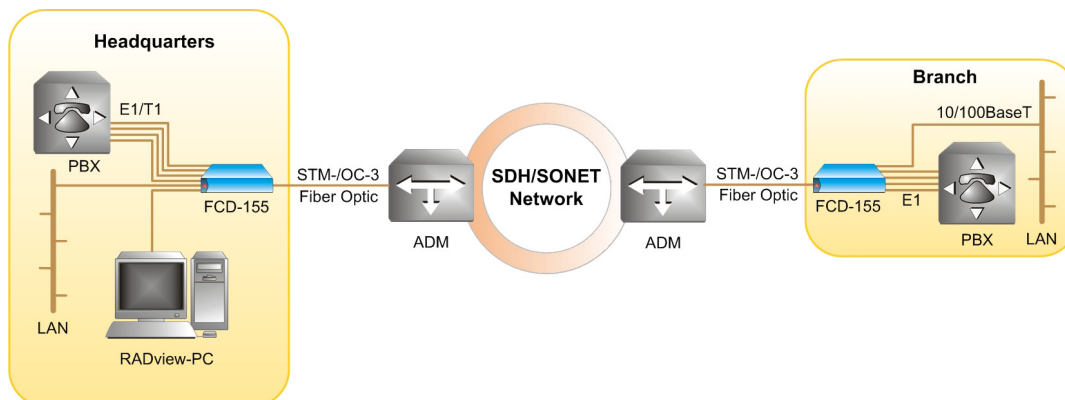 - 1 × VC-4.

APPLICATIONS

Figure 1. Point-to-Point Transparent LAN and TDM Interconnection

- 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 G.7042 standard, allowing adjustment of bandwidth allocated for Ethernet traffic.

- Ethernet packets of up to 1536 bytes can be transported over SDH media to enable connection to MPLS networks.

- A transparent LAN option adds four additional LAN ports directly connected to four additional virtual groups in the Ethernet mapper. This option provides totally transparent LAN extension over SDH, without bridge functionality, to create total separation between customers, for security. The maximum frame length is 2 kB.

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

TDM MODULES

- FCD-155 has an optional four balanced E1/T1 interface ports that support transparent data transfer in compliance with G.703. A jumper-selectable unbalanced E1 interface is also available, which requires an adapter cable (see *Ordering*).

- An optional E3/T3 interface port adds support of unframed E3/T3 links over SDH/SONET.

- The TDM traffic is mapped into SDH 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 the following ways:
  - IP over DCC protocol
  - Via dedicated virtual group containing at least one VC-12/VT-1.5 channel
  - Inside the user traffic in a virtual group, separated from the user traffic by the GFP Channel ID or VLAN tag
  - Out-of-band, via direct connection to one of the LAN management 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, RAD's SNMP network management application
  - TFTP applications for software update and remote configuration download and upload
  - ConfiguRAD via a Web browser.

DIAGNOSTICS

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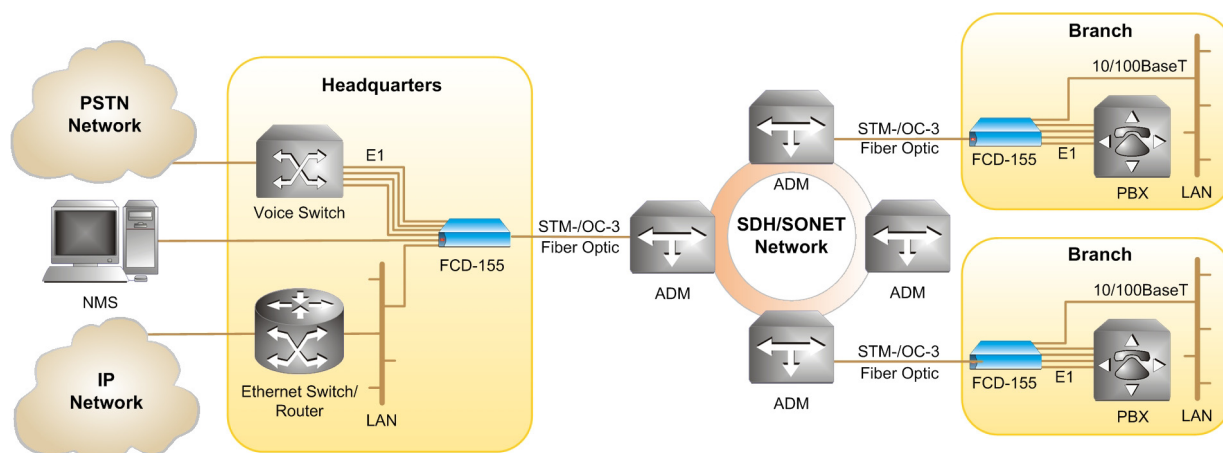 - Ethernet and SDH/SONET link monitoring.

Figure 2. Point-to-Multipoint Corporate Application

GENERAL

- An AC or DC power supply is available 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 adapter kit (see *Ordering*.)

SPECIFICATIONS

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

- **Number of Ports**
  1 (second link available for 1+1 MSP/APS protection)

- **Bit Rate**
  155.52 Mbit/s ±20 ppm

- **Electrical Interface**
  Line attenuation: less than 12.7 dB at 78 MHz
  Impedance: 100Ω
  Connectors: BNC coax

- **Fiber Optic Interface**
  Characteristics: See *Table 1*
  Connectors: Two ST, SC, or FC/PC connectors (see *Ordering*)

- **Timing**
  - Internal clock
  - Recovered from the STM-1/OC-3 interface
  - External E1 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 and GR-253-core

- **Line Code**
  NRZ

LAN INTERFACE

- **Number of Ports**
  2 standard, with VLAN support
  4 optional, without VLAN support

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

- **Type**
  - 10BaseT: 10 Mbps
  - 100BaseT: 100 Mbps
  - Autonegotiation

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

- **Connectors (per Port)**
  RJ-45, shielded

E1/T1 PDH INTERFACE (OPTION)

- **Number of Ports**
  4

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

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

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

- **Interface Type**
  Jumper selectable:
  E1: 120Ω balanced or 75Ω unbalanced (via adapter cable)
  T1: 100Ω balanced

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

- **Connectors**
  RJ-45, shielded

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

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 Option**
  Unframed

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

- **Line Impedance**
  75Ω

- **Connector**
  Two BNC, female

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

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

- **LAN (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 link signal
    loss
  ON LINE (green) – STM-1 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 stored and
  available for retrieval. Each alarm
  is time stamped.

- **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

Table 1. FCD-155 Fiber Optic Interface Characteristics

Wavelength	Fiber Type	Transmitter Type	Power Coupled into Fiber	Receiver Sensitivity	Maximum Range	
[nm]	[µm]		[dBm]	[dBm]	[km]	[miles]
1310	62.5/125 multimode	LED	-20 to -18	-30	2	1.25
1310	9/125 single mode	Laser	-15 to -8	-34	20	12.5
1310	9/125 single mode	Laser (long haul)	-5 to 0	-35	40	25.0
1550	9/125 single mode	Laser	-15 to -8	-32	20	12.5
1550	9/125 single mode	Laser (long haul)	-5 to 0	-36	80	50.0

FCD-155

STM-1/OC-3 Terminal Multiplexer

▮ ORDERING

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STM-1 Terminal Multiplexer

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

& Specify the LAN module:
2U for 2 × 10/100BaseT ports
6U for 6 × 10/100BaseT ports

$ Specify PDH module (not available with CX main link):
4E1 for 4 × E1 G.703 ports
4T1 for 4 × T1 G.703 ports
E3 for 1 × E3 G.703 port
T3 for 1 × T3 G.703 port

Note: FCD-155 with 4 × E1 ports option is delivered with balanced E1 interface. To convert a balanced interface to unbalanced, adapter cable **CBL-RJ45/2BNC/E1** is available from RAD.

Specify main link connector type:
CX for electrical interface with coaxial BNC connectors
ST for ST type fiber connectors
FC for FC/PC type fiber connectors
SC for SC type fiber connectors

+ Specify main link optical interface wavelength and transmitter type (not relevant with CX option):
13M for 1310 nm, multimode, LED
13L for 1310 nm, single mode, laser
15L for 1550 nm, single mode, laser
13LH for 1310 nm, long haul, single mode, laser
15LH for 1550 nm, long haul, single mode, laser

% Specify **D** for optional redundant main link (not available with CX main link)

RM-35

Hardware for mounting one or two units in a 19-inch rack