

# FCD-155

## STM-1/OC-3 Terminal Multiplexer



- Groomed LAN and legacy (TDM) traffic over SDH/SONET networks
- VLAN and point-to-multipoint switching
- Ethernet traffic mapped 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
- 4 or 8 × E1/T1 (G.703) or a single E3/T3 link on the PDH interface
- Channelized STM-1/OC-3 main link with fiber interface

FCD-155 is an STM-1/OC-3 SDH terminal 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 interface 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).

### SDH/SONET

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*). It is strongly recommended to order this device with **original RAD SFPs installed**. This ensures that prior to shipping, RAD has performed comprehensive functional quality tests on the entire assembled unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs.

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 features 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

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#### ETHERNET

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 a total separation between customers, for security. The maximum frame length is 2 kb.

The 10/100BaseT LAN interface features autonegotiation for plug-and-play Ethernet connectivity and complies with IEEE 802.3/Ethernet V.2 standards. The interface also performs VLAN stacking.

An optional Gigabit Ethernet interface connects one LAN port to eight virtual groups. This option extends LAN over SDH/SONET networks with bridge functionality. The maximum frame length is 2 kb.

Ethernet traffic is mapped into SDH/SONET containers using VCAT and encapsulated with:

- Generic Framing Procedure (ITU-T G.7041, ANSI T1-105.02), 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 x VC-12, or 84 x VT-1.5
- 3 x VC-3/STS-1
- 1 x 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 implemented in compliance with the G.7042 standard, which allocates bandwidth according to Ethernet traffic.

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

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

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

## TDM

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 transports 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 AND SECURITY

Remote units can be managed in any of the following ways:

- DCC using IP tunneling over OSI DCN based on ITU-T G.7712
- IP/PPP over DCC protocol
- 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.

The 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-EMS, RAD's SNMP network management application
- TFTP applications to update software and upload/download remote configurations
- ConfiguRAD via Web browser.

## MONITORING AND 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 an optional rack-mount adaptor kit. A single unit can be mounted on the wall using an optional wall-mount adapter kit (see *Ordering*).

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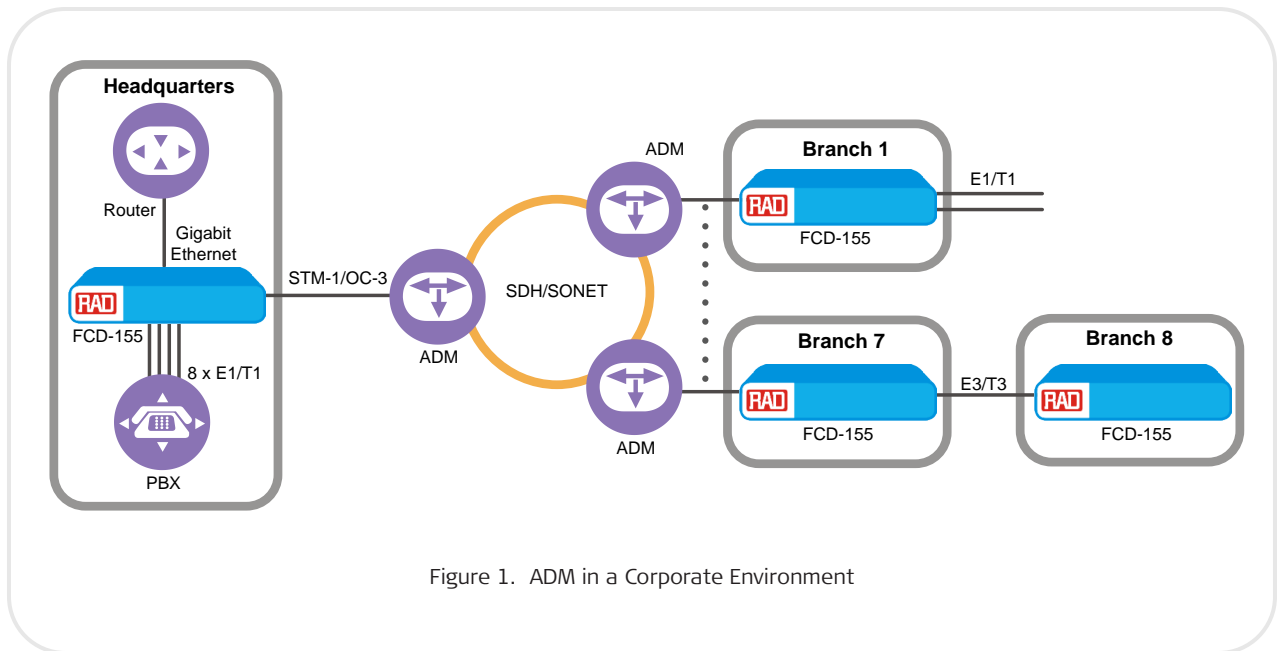


Figure 1. ADM in a Corporate Environment

## Specifications

### SDH/SONET NETWORK INTERFACES

#### Number of Ports

1 (second link available for redundancy)

#### Data Rate

155.52 Mbps  $\pm$ 20 ppm

#### SFP Transceivers

Characteristics: See the *SFP Data Sheet*

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 Coding

NRZ

### ETHERNET USER INTERFACES

#### Type

2 or 6 10/100BaseT ports

1 GbE port

#### Compliance

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

#### MAC Address Table

2,048 MAC addresses (2U) and 8,182 (GbE) with selectable automatic aging time

#### Data Rate

10BaseT: 10 Mbps

100BaseT: 100 Mbps

1000BaseT: 1000Mbps (Gigabit Ethernet)

Autonegotiation

#### Connectors

RJ-45, shielded

SFP socket (for transceivers, see *Ordering*)

### E1/T1 USER INTERFACES

#### Number of Ports

4 E1, 4 T1, 8E1, or 8 T1

#### Compliance

ITU-T Rec. G.703, unframed

#### Data Rate

E1: 2.048 Mbps

T1: 1.554 Mbps

#### Line Coding

E1: HDB3

T1: B8ZS

#### Impedance

E1: 120 $\Omega$  balanced or 75 $\Omega$  unbalanced

T1: 100 $\Omega$  balanced

#### 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

## FCD-155

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#### E3/T3 INTERFACES

##### Number of Ports

1

##### Compliance

ITU-T Rec. G.703, unframed

##### Data Rate

E3: 34.368 Mbps

T3: 44.736 Mbps

##### Framing

Unframed

##### Line Coding

E3: HDB3

T3: B3ZS

##### Impedance

75Ω

##### Connectors

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

##### Ethernet Management Port

Single Ethernet port FCD-155 version:

MNG ETH port

Other FCD-155 versions:

ETH 1 and ETH 2 ports (through the internal Ethernet switch)

#### DIAGNOSTICS

##### Alarms

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

##### Alarm Relay

Operation: normally open,

normally closed, using different pins

Connector: 9-pin, D-type, female

#### GENERAL

##### Indicators

###### *System Status*

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 and GbE Interface (per port)*

LINK (green) – LAN link integrity

ACT (yellow) – LAN data activity

###### *STM-1/OC-3 Main Links*

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 flashing)

###### *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

##### Power

AC: 100 to 240 VAC ±10%,

50 to 60 Hz

DC: -48 VDC (-40 to -72 VDC)

Power Consumption:

30W

##### 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° to 70°C (32° to 158°F)

Humidity: Up to 90%, non-condensing

## Ordering

### RECOMMENDED CONFIGURATIONS

FCD-155/AC/6U/4E1  
FCD-155/AC/6U/8E1  
FCD-155/AC/2U  
FCD-155/AC/2U/4E1  
FCD-155/48/6U/4E1  
FCD-155/AC/6U  
FCD-155/AC/2U/8E1  
FCD-155-PACK1

### SPECIAL CONFIGURATIONS

Please contact your local RAD partner for additional configuration options

### SOFTWARE KEY

**FCD-155-PACK1**  
Software key for activating the IP tunneling management option

### SFP TRANSCEIVERS

(For redundancy, order two SFP transceivers)

#### STM-1/OC-3 Uplink/\*

- \* **SFP-1** STM-1/OC-3, 1310 nm multimode VCSEL, LC connector
- SFP-2** STM-1/OC-3, 1310 nm single mode laser (S1.1), LC connector
- SFP-3** STM-1/OC-3, 1310 nm, single mode laser, long haul (L1.1), LC connector
- SFP-4** STM-1/OC-3, 1550 nm single mode laser, long haul (L1.2), LC connector
- SFP-11** STM-1/OC-3, electrical interface, mini-BNC coaxial connector
- SFP-18a** STM-1/OC-3, Tx - 1310, Rx - 1550, 9/125 single mode (single fiber), laser (WDM), LC connector
- SFP-18b** STM-1/OC-3, Tx - 1550, Rx - 1310, 9/125 single mode (single fiber), laser (WDM), LC connector
- SFP-19a** STM-1/OC-3, Tx - 1490, Rx - 1570, 9/125 single mode (single fiber), laser (WDM), LC connector
- SFP-19b** STM-1/OC-3, Tx - 1570, Rx - 1490, 9/125 single mode (single fiber), laser (WDM), LC connector

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### GbE User/#

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

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### 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)

#### CBL-G703-8/^

8E1/8T1 interface cables for the DB-44 port connector (one cable required per interface):

#### Legend

^ Connector:

- RJ45** splits into 8 E1/T1 balanced RJ-45 connectors
- RJ45/X** splits into 8 E1/T1 balanced RJ-45 connectors (cross-cable)
- COAX** splits into 8 pairs of E1 unbalanced BNC male connectors
- OPEN** 8 x 4 unterminated free leads 2m (6.6 ft)

#### RM-35/@

Hardware kit for mounting one or two metal FCD-155 units in a 19-inch rack

#### Legend

- @ Rack mount kit (Default=both kits):
  - P1** For mounting one unit
  - P2** For mounting two units

#### WM-35

Hardware kit for mounting one unit on the wall

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