FCD-E1E

Managed E1 and Fractional E1 Access Device

TDM multiplexer enables Ethernet, Sub-E1 and Serial Services over E1

- E1 main link and sublink supporting both framed and unframed signals
- One data port with selectable sync data rates of n × 64 kbps
- Optional sub-E1 drop-and-insert port
- Optional Ethernet 10/100BaseT bridge (with or without VLAN support)
- Inband management with SNMP agent

FCD-E1E is a managed access unit that converts rates and interfaces for E1 and fractional E1 services.

FCD-E1E features a serial n × 64 kbps data user interface, and/or an Ethernet LAN interface to allow LAN-to-LAN connectivity over TDM media.

The unit interconnects with RAD's modular DXC (DACS) products and E1 equipment from other vendors, to support multilink star applications such as access to SDH networks, FCD, and Megaplex units.

The E1 interface is compatible with virtually all carrier-provided E1 services and meets ITU recommendations G.703, G.704, G.706, G.732, G.823, and G.826.

RAD
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FCD-E1E supports both 2 and 16 frames per multiframe, with or without CRC-4. The E1 interface also accepts a 2048-kbps data stream and converts it to an ITU-T Rec. G.703 unframed signal for transport over the E1 main link and sublink. Line code is HDB3/AMI. The integral LTU ensures a range of up to 2 km (1.2 miles) and is software selectable.

The optional sub-E1 port can be configured to work without CRC-4, while the E1 main link is working with CRC-4. E1 equipment not supporting CRC-4 can thus connect to an E1 network that does work with CRC-4.

Bypassing the sub-E1 port to the main link ensures uninterrupted service to the sub-E1 port and full immunity to hardware and power failure.

The unit can be configured to assign data from the data port into consecutive timeslots or the user can assign timeslots manually.

Multiple clock source selection ensures maximum flexibility. Timing for the E1 main link and sublink may come from the recovered receive clock, an internal oscillator, or the data port.

An optional 10/100BaseT Ethernet port can be ordered for management, with or without bridge functionality.

Note: *The devices originally ordered with management only functionality (/UTPM) can be upgraded to the /UTP (bridge and management) functionality by ordering a special software license key (see Ordering).*

Front-panel LEDs indicate power, alarms, and diagnostic loopback operation. Rear panel LEDs on the E1 interfaces indicate local and remote sync loss. Rear-panel LEDs on the optional Ethernet port indicate link integrity and activity.

FCD-E1E is available in two models:

- Plastic enclosure (FCD-E1E)
- Metal enclosure with LCD and push-buttons on the front panel (FCD-E1E/L).

Both enclosures can be mounted alone or in pairs in a 19-inch rack using RAD's optional rack mount kits (see *Ordering*).
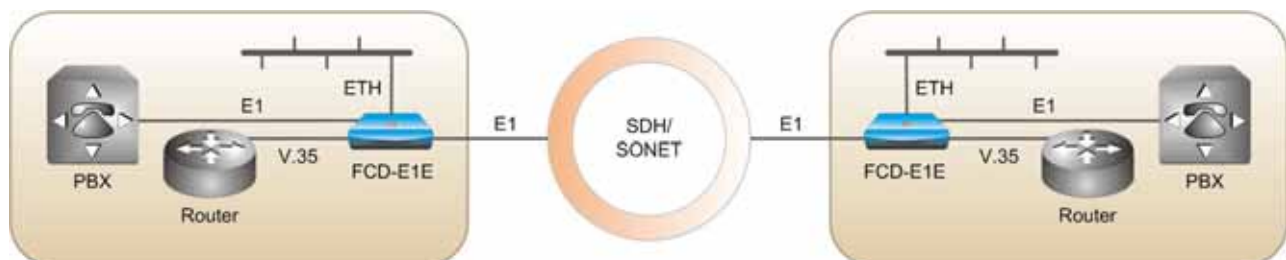

Figure 1. Point to Point Ethernet, Data and Fractional E1 over E1

USER INTERFACES

The FCD-E1E unit features the following user interfaces:

- Serial data interfaces: V.24/RS-232, V.35, V.36/RS-449, RS-530, X.21
- Ethernet 10/100BaseT LAN interface.

The synchronous data ports of FCD-E1E operate in the following clock modes:

- DCE: FCD-E1E provides both transmit and receive clocks to the user equipment, with optional sampling of the incoming data with an inverted clock
- DTE1: FCD-E1E provides the receive clock, while the transmit clock is provided by the attached user equipment (not for X.21 and V.24)
- DTE2: The remote user equipment provides both transmit and receive clocks (not for X.21 and V.24).

The optional bridge port is a standard 10/100BaseT half/full-duplex port featuring autonegotiation and automatic crossover support. Its interface supports VLAN frames, automatic learning and aging. The bridge port transparently connects FCD-E1E to remote LANs over E1 links. It filters Ethernet frames and forwards only frames that are destined for the WAN.

MANAGEMENT AND MAINTENANCE

Status and diagnostic information is defined, configured, and monitored using any of the following methods:

- Menu-driven management using the front panel LCD with three pushbuttons (metal enclosure only)
- ASCII terminal connected to the async control port
- Telnet (only with optional Ethernet port)
- RADView element manager (only with optional Ethernet port).

Up to 2048 time-stamped alarms can be retrieved through the supervision terminal.

Maintenance capabilities include user-activated local and remote loopbacks on the E1 main link, sublink, and data port. The user can activate a BER test on the main link or sublink.

E1 network statistics are stored in memory, according to IETF RFC4805. Statistical information can be retrieved locally through the control port.

FCD-E1E performs VLAN tagging and priority labeling according to IEEE 802.1p&Q (enhanced QoS, supporting strict/weighted fair queue mechanism, with 802.1p/DSCP/IP Precedence priority). The unit performs rate limiting (egress and ingress).

Specifications

E1 MAIN LINK AND SUBLINK

Framing
256N (no MF, CCS)
256N (no MF, CCS) with CRC-4
256S (TS16 MF, CAS)
256S (TS16 MF, CAS) with CRC-4
Unframed

Bit Rate
2.048 Mbps

Line Code
AMI/HDB3

Zero Suppression
HDB3

Line Impedance

120Ω, balanced
75Ω, unbalanced

Transmit Timing
Locked to the system clock

Signal Level
Receive:
    0 to –10 dB short haul
    0 to –36 dB long haul

Transmit:
    ±3V (±10%), balanced

    ±2.37V (±10%), unbalanced

Jitter Performance: as per ITU G.823,
    ETSI TBR-12 and TBR-13

Connectors
RJ-45, 8-pin, balanced
Two BNC coaxial, unbalanced

Compliance
ITU G.703, G.704, G.706, G.732, G.823,
G.826

Performance Monitoring
Local support of CRC-4
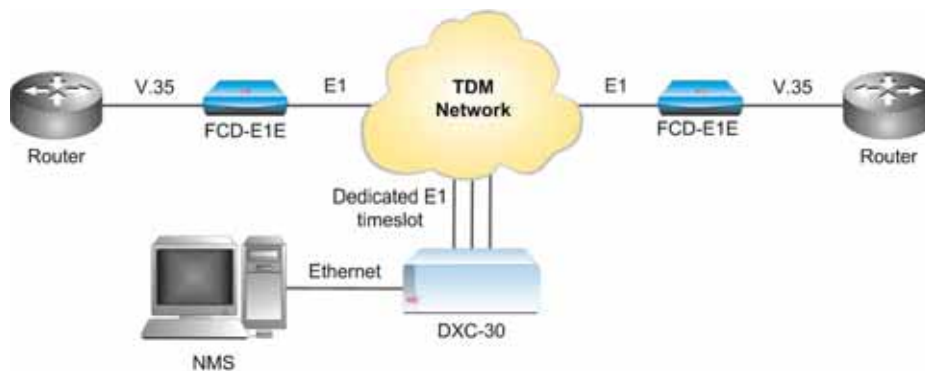Full statistical diagnostics according to
    RFC-2495

Figure 2. Managed V.35 to E1 Converter

DATA PORTS

Connectors
D-type, 25-pin, RS-530, female
(converted via adapter cables to V.35,
X.21, V.36/RS-449 or V.24/RS-232)

Data Rate
n × 64 kbps (n=1 to 2) for V.24 port
n × 64 kbps (n=1 to 32) for other ports

Clock Modes
DCE: Rx and Tx clock to user device
DTE1: Tx clock to user device;
    Rx clock from user device (not for X.21
    and V.24)
DTE2: Rx and Tx clock from user device
    (not for X.21 and V.24)

Control Signals
CTS follows RTS or constantly ON,
    soft-selectable
DSR constantly ON (except during the
    remote main link loopback)
DCD constantly ON (except during the
    loss of sync on main link)

ETHERNET BRIDGE PORT

Compliance
IEEE 802.3, 802.3u, 802.1p&Q

Interface and Connector
10/100BaseT (UTP) with shielded RJ-45

Data Rate
10 Mbps or 100 Mbps, full or half-duplex

Maximum Frame Length
1800 bytes

LAN Table
2048 MAC addresses

Throughput
4,207 pps

Latency*
0.51 ms (64-byte frame size)

FCD-E1E to FCD-E1E, 1.6M LAN rate

Delay
4.437 ms for 1 Mbps (bidirectional,
1518 byte frame size)

Buffer
320 frames

Line Code
10BaseT: Manchester
100BaseT: MLT3

WAN Protocol
HDLC

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MANAGEMENT PORTS

CONTROL DCE Port
Interface: RS-232
Connector: 9-pin D-type, female
Format: asynchronous
Baud rate: 9.6–115.2 kbps,
Character: 8-bit no parity

Ethernet Port (optional)
Interface: 10/100BaseT
Connector: RJ-45

DIAGNOSTICS

Main E1 link
Local loopback
Remote loopback
BER test

Sublink
Local loopback
Remote loopback
BER test

Data Port
Local loopback
Remote loopback

GENERAL

System Clock
Internal clock: ±32 ppm
Loopback timing: ±100 ppm
External timing from data port: ±100 ppm

Timeslot Allocation
Consecutive (bundled)
User-defined

Indicators
General:
    PWR (green)
    TST (yellow)
    ALM (red)

Main/sub-E1:
    LOC SYNC LOSS (red)
    REM SYNC LOSS (red)

Ethernet:
    LINK (green) – Ethernet link status
    ACT (yellow) – Ethernet activity status

Physical
Plastic enclosure:
Height: 43.7 mm (1.7 in)
Width: 217 mm (8.5 in)
Depth: 170 mm (6.7 in)
Weight: 0.5 kg (1.1 lb)

Metal enclosure:
Height: 43.7 mm (1.7 in)
Width: 215.5 mm (8.48 in)
Depth: 152.7 mm (6.0 in)
Weight: 0.7 kg (1.5 lb)

Power
AC/DC: 100 to 240 VAC, -48 to -60 VDC,
    nominal power consumption: 5W max.

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

Table 1. FCD Comparison Table

Features	FCD-E1	FCD-E1L	FCD-E1LC/T1LC	FCD-E1E	FCD-E1A
Total user ports	3	2	3	2	3
Interface types	RS-530, V.35, V.36, X.21, Sub-E1	RS-530, V.35, V.36, X.21, Ethernet bridge (10/100BaseT with VLAN support)	RS-530, V.24, V.35, V.36, X.21, Ethernet Bridge (10/100BaseT with VLAN support), Sub-E1/T1	RS-530, V.35, V.36/RS-449, X.21, V.24/RS-232, Ethernet Bridge (10/100BaseT with VLAN support), Sub-E1	RS-530, V.35, V.36/RS-449, X.21, Sub-E1
E1/T1 line type	Copper	Copper	Copper	Copper	Copper
LCD panel	✓	–	–	✓	✓
Auto-configuration	–	✓	–	–	–
SNMP management	✓	✓	✓	✓	✓
Interoperability	Megaplex, DXC	Megaplex, DXC	Megaplex, DXC	Megaplex, DXC	Megaplex, DXC
ETH out-of-band for management	✓	✓	✓	✓	✓
E1 bypass	✓	–	–	✓	✓
ETH performance	–	VLAN transparent	VLAN transparent	VLAN priority tagging (802.1p/Q)	VLAN transparent

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Ordering

STANDARD CONFIGURATIONS

FCD-E1E/2E1/UTP/V35/L
FCD-E1E/2E1/UTPM/V35/L

SPECIAL CONFIGURATIONS

FCD-E1E/@/+/&/*

Legend

@   TDM interface:
   1E1   1 balanced E1 as uplink
   1E1CX 1 unbalanced E1 as uplink
   2E1   Balanced E1 and sub E1
   2E1CX Unbalanced E1 and sub E1

+   Ethernet interface (Default=no Ethernet):
   UTP   10/100BaseT Ethernet port (bridge and management)
   UTPM   10/100BaseT Ethernet port (management only)

&   Data port interface:
   V35   V.35
   V36   V.36/RS-449
   530   RS-530
   X21   X.21
   V24   V.24/RS-232 (asynchronous)

*   Enclosure (Default=plastic):
   L   Metal, with LCD

FCD-E1E/SW/$

Software upgrade pack for enabling bridge and management services on the Ethernet port.

Note: *When this option is ordered, RAD sends a code for activating the required feature.*

SUPPLIED ACCESSORIES

Power cord
AC/DC adapter plug

CBL-HS2/*/#
Adaptor cables for DB-25 channel connectors, for operation in the DCE, DTE1, and DTE2 clock modes. Cable length is 2m (6 ft).

Legend

*   Interface, clock mode:
   V/1   34-pin V.35, DCE
   V/2   34-pin V.35, DTE1
   V/3   34-pin V.35, DTE2
   R/1   37-pin V.36/RS-449, DCE
   R/2   37-pin V.36/RS-449, DTE1
   R/3   37-pin V.36/RS-449, DTE2
   X/1   15-pin X.21, DCE

Connector:
   F   female
   M   male

OPTIONAL ACCESSORIES

CBL-DB9F-DB9M-STR
Control port cable

CBL-RJ45/2BNC/E1
RJ-45 to BNC adaptor cable

RM-33-2
Hardware kit for mounting one or two FCD-E1E units into a 19-inch rack

RM-35/@
Kit for mounting 1 or 2 FCD-E1E/L units (metal enclosure) in a 19-inch rack

Legend

@   Rack mount kit:
   P1   Mounting one unit
   P2   Mounting two units

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