

FCD-E1, FCD-T1

E1/T1 or Fractional E1/T1 Access Units



FEATURES

- Access units for E1/T1 or fractional E1/T1 services
- One or two data ports with selectable sync data rates: $n \times 56/64$ kbps
- Optional sub-E1/T1 drop-and-insert port for PBX connectivity
- Fail-safe sub-E1/T1 link ensuring uninterrupted service (G.703 only)
- Serial data interfaces: V.35, RS-530, V.36/RS-449, or X.21
- Optional high-performance built-in Ethernet bridge, with or without VLAN support
- SNMP internal agent
- Management:
 - Out-of-band via V.24 supervisory port
 - Inband via TS0 or dedicated timeslot
- Dial-in option for remote out-of-band management
- Dial-out for alarm report
- E1 interface complies with: ITU G.703, G.704, G.706, G.732, G.823
- T1 interface complies with: AT&T TR62411, TR62421, ANSI T1.403, and AT&T 54016 (local support)
- E1/T1 main link can be supplied with the following options:
 - Copper interface with built-in software-selectable LTU for E1 and CSU for T1
 - Fiber optic interface
- Enhanced diagnostics include:
 - User-activated local and remote loopbacks
 - Integrated BER tester
 - Fractional E1/T1 inband loop
- Store 24 hours of E1/T1 network performance monitoring and last 100 alarms
- Relay activation upon alarm event
- Alarm mask configurable for any alarm

DESCRIPTION

- FCD-E1 and FCD-T1 are access units for E1/T1 or fractional E1/T1 services. They can be used as rate and interface converters or as integrating multiplexers for E1/T1 and fractional E1/T1 services (see Figures 1 and 2).
- The units also operate opposite RAD's modular DXC (DACS) products or other vendors' E1/T1 equipment, to support multilink star applications, such as access to SDH networks. The DXC and the FCD units are managed by a centralized SNMP network management system (see Figure 3).
- FCD-E1 and FCD-T1 can be ordered with either a copper E1/T1 or a fiber optic link. Both configurations are available with an optional sub-E1/T1 drop-and-insert port. The units can be ordered with either one or two user data ports. The second port can be an Ethernet bridge port, with or without VLAN support.

BASIC UNIT

- The basic unit includes a power supply, electrical/copper E1/T1 link with integral LTU/CSU, and one data port.
- The E1 interface is compatible with virtually all carrier-provided E1 services and meets ITU recommendations G.703, G.704, G.706, and G.732. It supports either 2 or 16 frames per multiframe, with or without CRC-4. Line coding is HDB3. The user-selectable integral LTU ensures a range of up to 2 km (1.2 miles).

FCD-E1, FCD-T1

E1/T1 or Fractional E1/T1 Access Units

- The T1 interface is compatible with virtually all carrier provided T1 services, including ASDS from AT&T and complies with TR-62421. The T1 interface supports D4 and ESF framing formats. Zero suppression over the line is selectable for either transparent, B7ZS, or B8ZS. The user-selectable integral CSU ensures a range of up to 2.1 km (1.3 miles).
- FCD-E1 and FCD-T1 can be ordered with a fiber optic link, eliminating the need for an external fiber optic modem. The fiber optic link provides a secure link in hazardous or hostile environments. It complies with ITU standards G.921 and G.956.
- Three fiber optic interfaces are available:
 - 850 nm laser for use over multimode fiber at distances of up to 5 km (3 miles)
 - 1310 nm laser diode for use over single-mode fiber at distances of up to 62 km (38 miles)
 - 1550 nm laser diode for use over single-mode fiber at extended range of up to 100 km (62 miles).
- Timeslot assignment is programmable, allowing data from each data port and from the sub-E1/T1 port to be placed automatically into consecutive timeslots. Alternatively, timeslots can be allocated manually, at user discretion.
- Multiple clock source selection ensures maximum flexibility for supporting different applications. The E1/T1 main link timing can be taken from the recovered receive clock signal, an internal oscillator, one of the data ports, or the sub-E1/T1 port.
- The optional sub-E1 port can be configured to work without CRC-4, while the E1 main link is working with CRC-4. This allows non-CRC-4 E1 equipment to connect to an E1 network that uses CRC-4.
- The optional sub-T1 port can be configured with D4 or ESF framing, while the T1 main link framing is ESF. This enables connection of T1 D4 equipment over a T1 network.
- Bypassing the sub-E1/T1 port to the main link (not applicable with the fiber optic link) ensures uninterrupted service to the sub-E1/T1 port, providing full immunity to hardware and power failure.
- FCD-E1 and FCD-T1 are compact standalone units. A rack mount adapter kit enables installation of one or two units side-by-side in a 19-inch rack.

APPLICATIONS

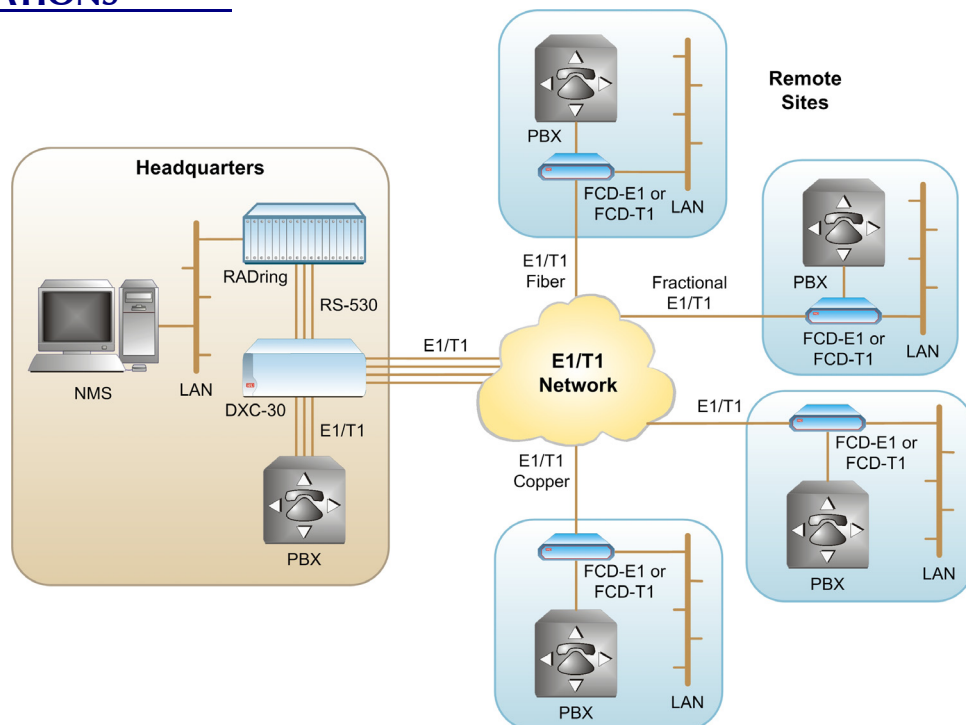


Figure 1. Extended Ethernet Management over E1/T1 Network

USER INTERFACE

- V.35, RS-530, V.36/RS-449, or X.21 user data port interfaces are available. The ports can operate in the following clock modes:
 - **DCE:** transmit and receive clocks are output (option to sample the incoming data with an inverted clock)
 - **DTE1:** external transmit clock is input (coming from the user DTE)
 - **DTE2:** both transmit and receive clocks are externally input.
- Optional IR-ETH or IR-ETH/Q Ethernet bridge modules allow FCD-E1 and FCD-T1 to connect transparently to remote LANs and VLANs, to use full E1/T1 bandwidth over unframed links. The bridge filters Ethernet frames and forwards only the frames sent to the WAN. Ethernet ports are 10BaseT (UTP) that operate in half- or full-duplex mode.

MANAGEMENT & MAINTENANCE

- Status and diagnostic information is defined, configured, and monitored using one of the following methods:
 - ASCII terminal connected to the SLIP control port
 - SNMP management connected through either SLIP control port or inband management
 - Telnet session performed through either SLIP control port or inband management
 - Menu-driven management using front panel LCD with three push-buttons.
- FCD-E1 and FCD-T1 have an internal SNMP agent that can be controlled by any generic SNMP station or by the RADview SNMP network management application.
- FCD-E1 and FCD-T1 support both dial-in and dial-out modem connections over the serial V.24/RS-232 port by using SLIP protocol or ASCII terminal command line interpreter. These connections can be used for remote out-of-band configuration and monitoring, as well as for sending callout alarm messages.
- Inband management can be performed using the spare bits (S_a bits) on timeslot 0 or through a dedicated timeslot that supports proprietary protocol and Frame Relay RFC 1490. This allows setup, monitoring, and diagnostics of the remote unit. Inband access using spare bits on Timeslot 0 is possible only if those bits are passed transparently end-to-end.
- When operating with CRC-4, E1 network statistics are stored in memory, according to RFC-1406. Statistical information may be retrieved locally through the control port.
- In ESF format operation, T1 network statistics are stored in memory, according to ANSI and AT&T standards. Statistical information may be retrieved by the service provider (ANSI only) or locally through the control port.
- Maintenance capabilities include user-activated local and remote loopbacks at the E1/T1 main link, sub-E1/T1, and data ports. The user can activate a BER test for each data or sub-E1/T1 port individually. Each data or sub-E1/T1 port responds to an ANSI FT1 RDL (T1E1.2/93-003) inband loop code, generated by the remote FCD-E1, FCD-T1, or DXC unit in a specific bundle of timeslots allocated only to that port.

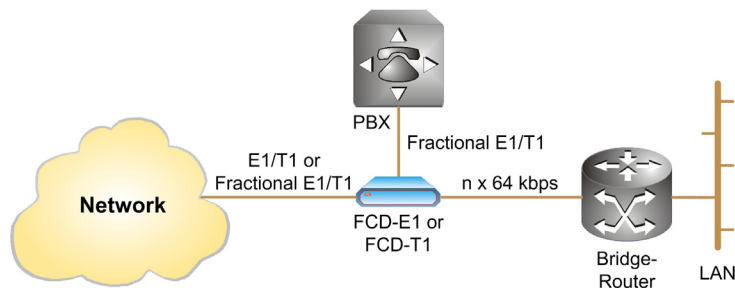


Figure 2. LAN Traffic and PBX Traffic on E1/T1 Network

FCD-E1, FCD-T1

E1/T1 or Fractional E1/T1 Access Units

SPECIFICATIONS

E1/T1 MAIN LINK AND SUBLINK

- **E1 Framing**
 - 256N (no MF, CCS)
 - 256N with CRC-4 (no MF, CCS)
 - 256S (TS16 MF, CAS)
 - 256S with CRC-4 (TS16 MF CAS)
 - Unframed (main link only)
- **T1 Framing**
 - D4
 - ESF
 - Unframed (main link only)
- **Bit Rate**
 - E1: 2.048 Mbps
 - T1: 1.544 Mbps
- **Line Code**
 - E1: HDB3
 - T1: AMI
- **T1 Zero Suppression**
 - Transparent, B7ZS, B8ZS
- **E1 Signal Level**
 - Receive:
 - 0 to -10 dB without LTU
 - 0 to -36 dB with LTU (main link only)
 - Transmit:
 - ±3V (±10%), balanced
 - ±2.37V (±10%), unbalanced
- **T1 Signal Level**
 - Receive:
 - 0 to -10 dB without CSU
 - 0 to -36 dB with CSU (main link only)
 - Transmit:
 - 0, -7.5, -15, -22.5 dB with CSU
 - ±3V, ±10% soft adjustable at 0 to 655 ft without CSU

- **Line Impedance**
 - E1: 120Ω, balanced or 75Ω, unbalanced
 - T1: 100Ω, balanced
- **Connectors**
 - E1: RJ-45, 8-pin, balanced or two BNC coaxial, unbalanced
 - T1: RJ-45, 8-pin, balanced
- **Main Link Timing**
 - Internal accuracy: ±30 ppm
 - Loopback timing: ±130 ppm
 - Sub-E1: 2.048 Mbps ±130 ppm
 - Sub-T1: 1.544 Mbps ±130 ppm
 - External timing from data port:
 - n × 56, n × 64 ±130 ppm
- **Sublink Timing**
 - Locked on the main link
- **Compliance**
 - E1: ITU G.703, G.704, G.706, G.732
 - T1: AT&T TR-62411, ANSI T1.403
- **E1 Jitter Performance**
 - As per ITU G.823, ETSI TBR-12 and TBR-13
- **T1 Jitter Performance**
 - As per AT&T TR-62411

FIBER OPTIC LINK

- **Compliance**
 - G.921, G.956
- **Operating Characteristics**
 - See Table 1.
- **Connectors**
 - ST, FC (FC/PC), or SC (see Ordering)

DATA PORTS

- **Number of Data Ports**
 - One or two (see Ordering)
- **Interface**
 - RS-530, V.35, X.21, V.36/RS-449
- **Connectors**
 - D-type 25-pin, female RS-530 pinout
- **Data Rate**
 - n × 56 or n × 64 kbps, (n=1,2,...,31)
- **Clock Modes**
 - DCE: Rx and Tx clock to DTE
 - DTE1: Rx clock to user device; Tx clock from user device
 - DTE2: Rx and Tx from DCE
- **Control Signals**
 - CTS follows RTS or constantly On, soft-selectable
 - DSR constantly On, unless in test mode
 - DCD constantly On, unless in LOC SYNC LOSS

ETHERNET BRIDGE PORTS

- **LAN Table**
 - IR/ETH: 10,000 addresses
 - IR/ETH/Q: 2,000 addresses
- **Filtering and Forwarding**
 - IR/ETH: 15,000 pps
 - IR/ETH/Q: 2,000 pps
- **Buffer**
 - 256 frames
- **Delay (IR/ETH only)**
 - 1 frame
- **Line Code**
 - Manchester

Table 1. Fiber Optic Interface Characteristics

Operating Wavelength	Connector	Fiber Type	Transmitter Type	Typical Output Power	Receiver Sensitivity*	Typical Optical Budget	Typical Maximum Range	
							[nm]	[μm]
850	ST, SC, FC	62.5/125 multimode	Laser	-16	-38	20	5	3
1310	ST, SC, FC	9/125 single mode	Laser	-12	-40	28	62	38
1550	ST, SC, FC	9/125 single mode	Laser	-12	-40	28	100	60

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- **WAN Protocol**
HDLC

- **Connectors**
10BaseT (UTP): Shielded RJ-45

Note: IR-ETH and IR-ETH/Q interface modules conform to the IEEE 802.3/Ethernet V2 standard. Additionally, IR-ETH/Q supports the IEEE 802.1/Q frames.

GENERAL

- **Performance Monitoring**
E1 Main Link

- Local support of CRC-4
- Full statistical diagnostics according to RFC-1406

T1 Main Link

- Local support of ESF diagnostics according to AT&T PUB 54016
- Full statistical diagnostics according to ANSI T1.403-198

- **Timeslot Allocation**

- Consecutive (bundled)
- Alternate
- User defined

- **Diagnostics**

Main E1/T1 link:

Local and remote loopback

Sub-E1/T1 port:

- Local and remote loopback
- Sub-E1/T1 port BER test

Data ports:

- Local loopback
- Remote loopback
- BER test
- Inband code activated loopback
- T1 network loopback, code-activated (FCD-T1 only)

- **Management Ports**

Interface and connector:

V.24/RS-232, 9-pin D-type, female

Format: asynchronous

Baud rate:

- DCE: 0.3 to 19.2 kbps, autobaud
 - DTE: 0.3 to 9.6 kbps
- Character: 8 bit no parity, 7 bit odd or even parity

- **Front Panel Control**

LCD:

2 rows of 16 characters

Push-buttons:

Cursor, Scroll, Enter

- **Indicators**

- General:
 - PWR (green) – Power
 - TST (yellow) – Test
 - ALM (red) – Alarm

- Main E1 and Sub-E1:
 - LOC SYNC LOSS (red) – Local sync loss
 - REM SYNC LOSS (red) – Remote sync loss
- Main T1 and Sub-T1:
 - RED ALARM (red) – Red alarm on main link and sublink
 - YEL ALARM (yellow) – Yellow alarm on main link and sublink

- **Alarms**

The last 100 alarms are time-stamped, stored, and available for retrieval.

- **Alarm Relay**

Three relay contacts are available on the CONTROL DTE connector. The alarm relay is activated by each alarm in the alarm buffer (user-defined).

- **Physical**

Height: 4.3 cm (1.7 in)
Width: 21.5 cm (8.5 in)
Depth: 24.3 cm (9.5 in)
Weight 1.3 kg (2.9 lb)

- **Power**

100–240 VAC; 47–63 Hz
–48 VDC, nominal (40–57 VDC)
Power consumption: 6W

- **Environment**

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

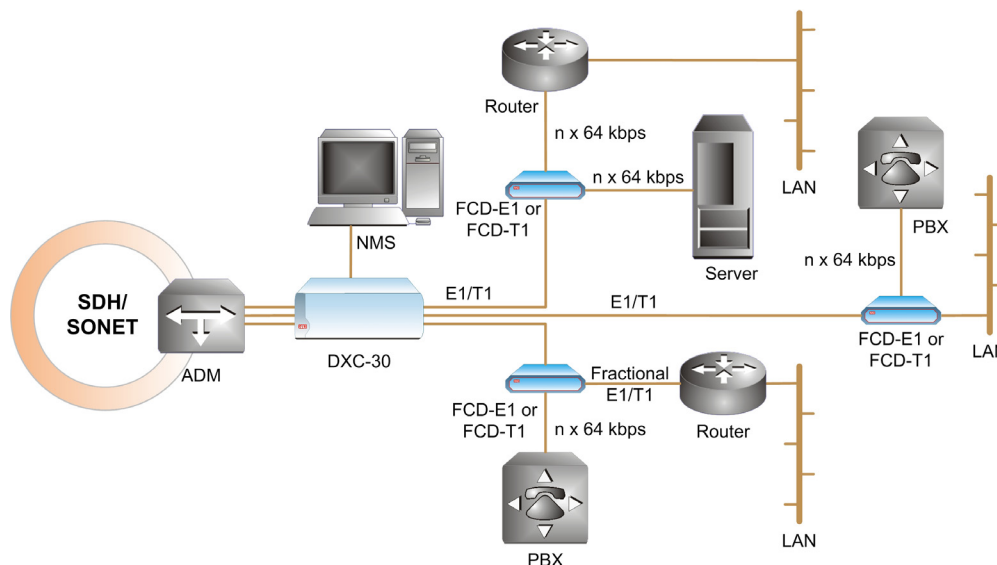


Figure 3. SDH/SONET Access Solution for Multiple Remote Sites

FCD-E1, FCD-T1

E1/T1 or Fractional E1/T1 Access Units

ORDERING

FCD-E1/*/~/&/%/#+

E1 or Fractional E1 Access Unit

FCD-T1/*/~/&/%/#+

T1 or Fractional T1 Access Unit

* Specify **S1** for optional drop&insert copper E1/T1 sublink

~ Specify power supply voltage:
AC for 100 to 240 VAC
48 for -48 VDC

& Specify data port interface:

530 for RS-530

V35 for V.35

X21 for X.21

V36 for V.36/RS-449

% Specify optional second data port interface:

530 for RS-530

V35 for V.35

X21 for X.21

V36 for V.36/RS-449

ETUB for UTP (10BaseT) Ethernet bridge

ETUQ for UTP (10BaseT) Ethernet bridge with VLAN support

Specify link connector type:

ST for ST type fiber connectors

FC for FC/PC type fiber connectors

SC for SC type fiber connectors

(Default is G.703 electrical/copper interface)

+ Specify optical interface wavelength and transmitter type (not relevant with copper interface):

85 for 850 nm, multimode, laser

13L for 1310 nm, single mode, laser

15L for 1550 nm, single mode, laser

SUPPLIED ACCESSORIES

AC power cord (when AC power supply is ordered)

DC adapter plug (when DC power supply is ordered)

The following cables (suitable for use in DCE clock mode only) are supplied for each data port interface specified.

Cable length is 2m (6 ft):

CBL-HS2/V/1 for 34-pin V.35

CBL-HS2/R/1 for 37-pin V.36/RS-449

CBL-HS2/X/1 for 15-pin X.21

OPTIONAL ACCESSORIES

The following cables convert 25-pin data port connectors into the respective interface. Cable length is 2m (6 ft).

CBL-HS2/*/#

* Specify interface, clock mode:

V/2 for 34-pin V.35, DTE1

V/3 for 34-pin V.35, DTE2

R/2 for 37-pin V.36/RS-449, DTE1

R/3 for 37-pin V.36/RS-449, DTE2

Specify cable connector type:

F for female

M for male

CBL-DB9F-DB9M-STR

Control port cable

RM-17

Kit for mounting one or two FCD-E1 or FCD-T1 units into a 19-inch rack



data communications

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