

# FCD-E1, FCD-T1

## E1/T1 or Fractional E1/T1 Access Units



### FEATURES

- E1/T1 or Fractional E1/T1 access units
- Support one or two data ports with selectable sync data rates:  $n \times 56/64$  kbps
- Optional sub-E1/T1 drop & 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)
- The 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 Figure 2).
- FCD-E1 and FCD-T1 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 & 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 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.
- 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

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the line is selectable for either transparent, B7ZS or B8ZS. The user-selectable integral CSU ensures a range of up to 1.3 mile.

- 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 LED for use over multimode fiber at distances up to 5 km (3 miles)
  - 1310 nm laser diode for use over single mode fiber at distances up to 62 km (38 miles)
- 1550 nm laser diode for use over single mode fiber for extended range 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 may be timed from the recovered receive clock signal, from an internal oscillator, from one of the data ports, or from 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 enables connection

of E1 equipment not supporting CRC-4, over an E1 network that is working with 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 (side by side) units in a 19" rack.

## APPLICATIONS

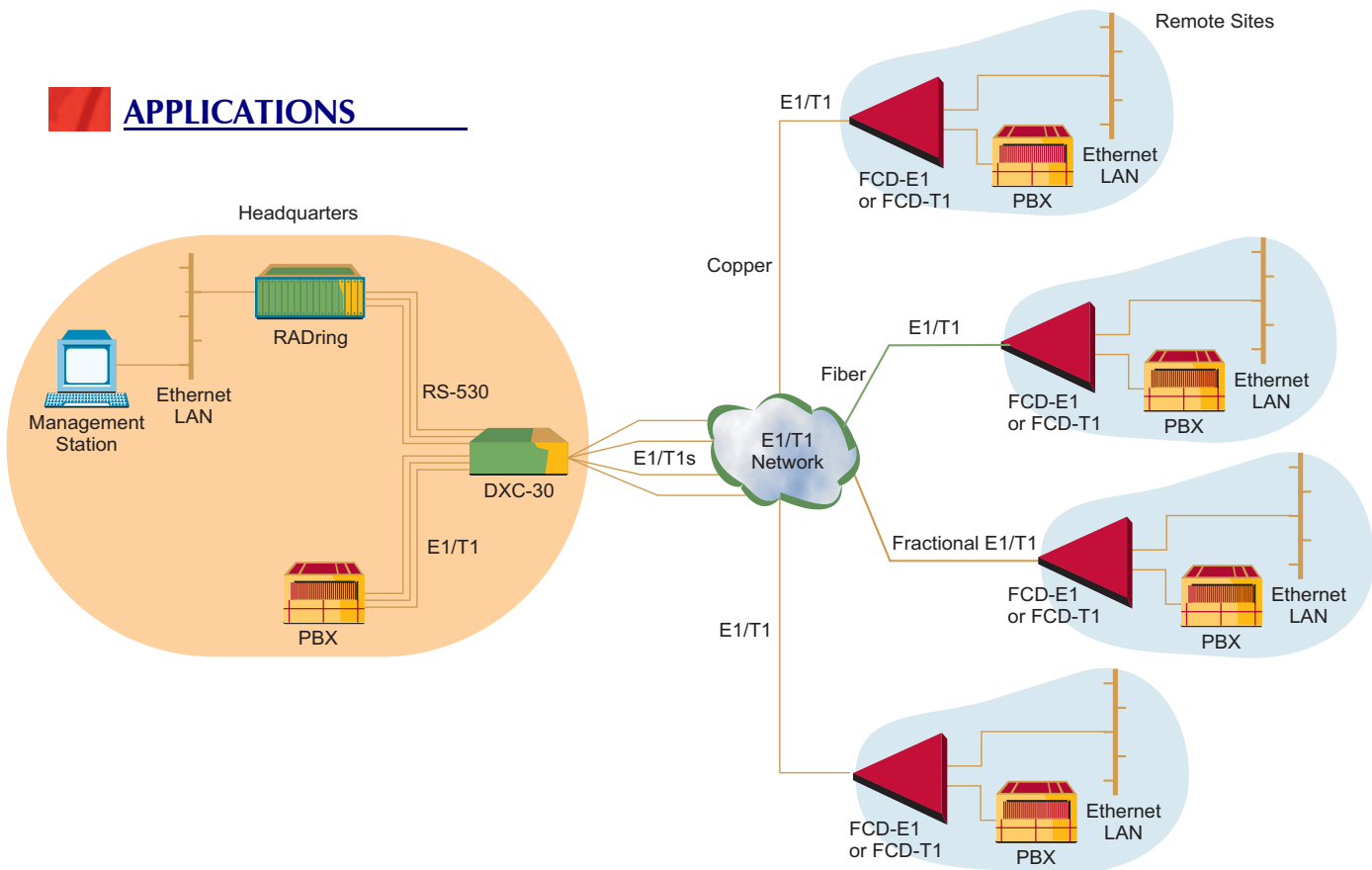


Figure 1. Extended Ethernet Management over E1/T1 Network

## USER INTERFACE

- The following user data port interfaces can be ordered: V.35, RS-530, V.36/RS-449 or X.21. 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.
- When equipped with optional IR-ETH or IR-ETH/Q Ethernet bridge modules, FCD-E1 and FCD-T1 can transparently connect remote LANs, as well as VLANs, over unframed E1/T1 links, utilizing the full E1/T1 bandwidth. It filters Ethernet frames, forwarding only the frames destined to the WAN.
- The Ethernet ports are available with Ethernet 10BaseT (UTP) or 10Base2 (BNC) interfaces. The Ethernet port with 10BaseT operates in full duplex mode, while the one with 10Base2 operates in half duplex.

## MANAGEMENT & MAINTENANCE

- Setup, control and monitoring of status and diagnostics information can be activated via:
  - 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 and 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 via 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 by using the spare bits (Sa 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 by 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. The statistic information may be retrieved locally through the control port.
- When operating in the ESF format, T1 network statistics are stored in memory, according to ANSI and AT&T standards. The 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 in a specific bundle of timeslots allocated only to that port.

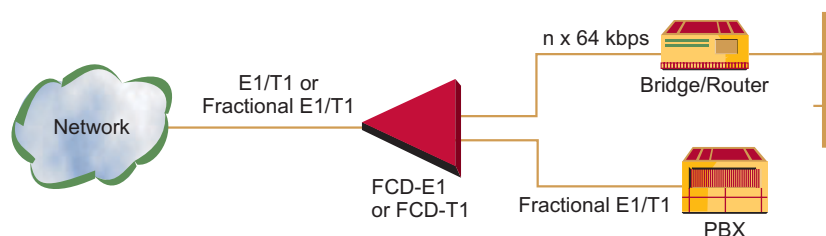


Figure 2. Connection of LAN Traffic together with PBX Traffic to E1/T1 Network

# 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 (no MF, CCS) with CRC-4
  - 256S (TS16 MF, CAS)
  - 256S (TS16 MF CAS) with CRC-4
  - 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 x 56, n x 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/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 x 56 or n x 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

Wave-length [nm]	Fiber Type [μm]	Transmitter Type	Typical Power Coupled into Fiber [dBm]	Receiver Sensitivity [dBm]	Typical Optical Budget [dB]	Typical Maximum Range	
						[km]	[mi]
850	62.5/125 multimode	LED	-18	-38	18	5	3
1310	9/125 single mode	Laser	-12	-39	25	62	38
1550	9/125 single mode	Laser	-12	-39	25	100	62

# FCD-E1, FCD-T1

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- **WAN Protocol**  
HDLC

*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.*

- **Connectors**  
10BaseT (UTP): Shielded RJ-45  
10Base2 (Coax): BNC

### 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 port:

Local loopback

Remote loopback

Data port BER test

Inband code activated loopback per data port

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

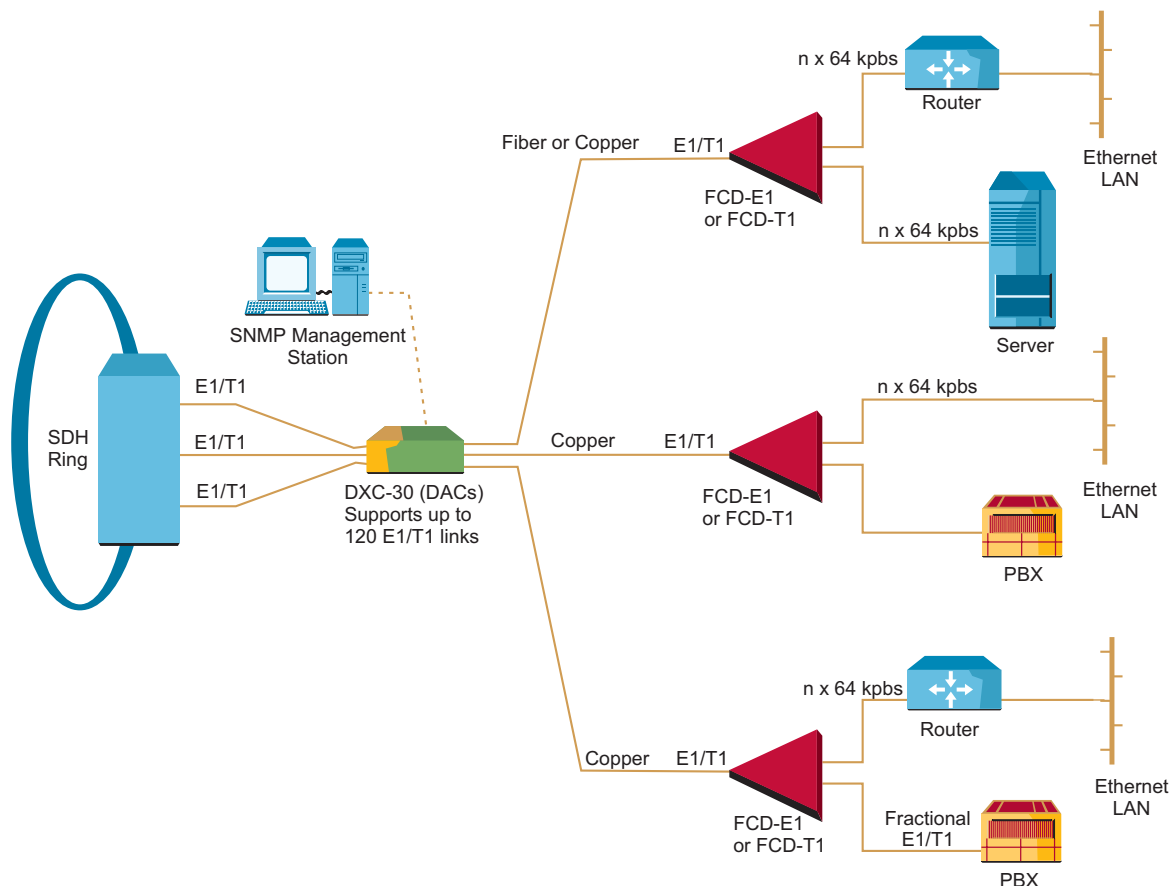


Figure 3. SDH/SONET Access Solution for Multiple Remote Sites



# FCD-E1, FCD-T1

## E1/T1 or Fractional E1/T1 Access Units

### • Indicators

General: PWR (green), TST (yellow), ALM (red)  
Main E1 and Sub-E1: LOC SYNC LOSS (red), REM SYNC LOSS (red)  
Main T1 and Sub-T1: RED ALARM (red), YEL ALARM (yellow)

### • Alarms

Last 100 alarms are stored and available for retrieval. Each alarm is time stamped.

### • Alarm Relay

3 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

## 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

**ETBB** for BNC (10Base2) Ethernet bridge

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

**ETBQ** for BNC (10Base2) 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

**13L** for 1310 nm, single mode, laser

**15L** for 1550 nm, single mode, laser

### CABLES

The following cables convert the FCD-E1's or FCD-T1's 25-pin data port connector into the respective interface. Cable length is 2m (6 ft), unless otherwise indicated.

#### **CBL-HS2\*/#/**

Adapter cables for DB-25 channel connectors

\* Specify interface, clock mode:

**V/1** for 34-pin V.35, DCE

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

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

**R/1** for 37-pin V.36/RS-449, DCE

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

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

**X/1** for 15-pin X.21, DCE

# Specify cable connector type:

**F** for female

**M** for male

**Note:** By default, cables for DCE clock mode operation are supplied for each data port according to interface option specified. Cables for DTE1 and DTE2 mode operation must be ordered separately.

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