

FCD-E1, FCD-T1

E1/T1 or Fractional E1/T1 Access Units



Access units for E1/T1 or fractional E1/T1 services

- Several 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)
- Optional high-performance built-in Ethernet bridge
- SNMP internal agent
- Enhanced diagnostics functionality using user-activated local and remote loopbacks, Integrated BER tester and Fractional E1/T1 inband loop

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 1* and *Figure 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 SNMP, a centralized network management system (see *Figure 3*).

FCD-E1/T1 is supplied with a copper E1/T1 main link; an optional sub-E1/T1 drop-and-insert port is also available. The units can be ordered with either one or two user data ports. The second port can be an Ethernet bridge port, compliant with the IEEE 802.3/Ethernet V2 standard.



FCD-E1, FCD-T1

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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).

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).

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 ultimate flexibility for 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 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.

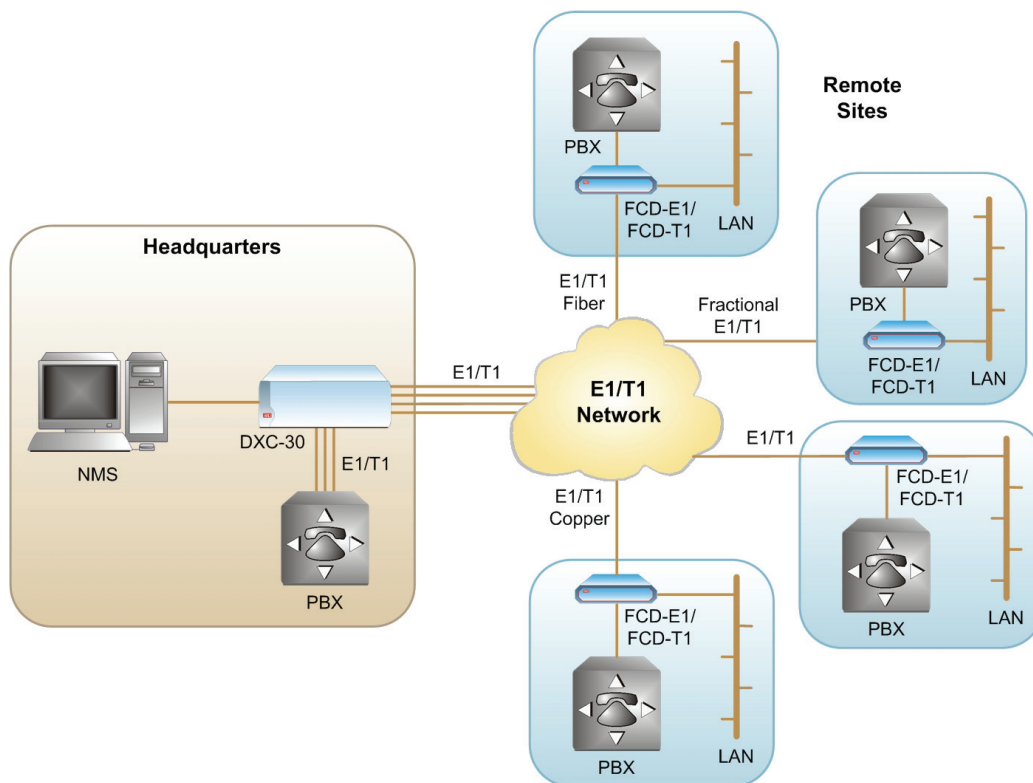


Figure 1. Extended Ethernet Management over E1/T1 Network

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 Ethernet bridge modules allow FCD-E1 and FCD-T1 to connect transparently to remote LANs, 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

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 through the SLIP control port or inband

- Telnet session through the SLIP control port or inband
- 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 the RADview SNMP network management application or any generic SNMP station. FCD-E1 and FCD-T1 support both dial-in and dial-out modem connections over the serial V.24/RS-232 port, using SLIP 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. Both methods allow 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.

MONITORING

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.

DIAGNOSTICS

Diagnostic 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.

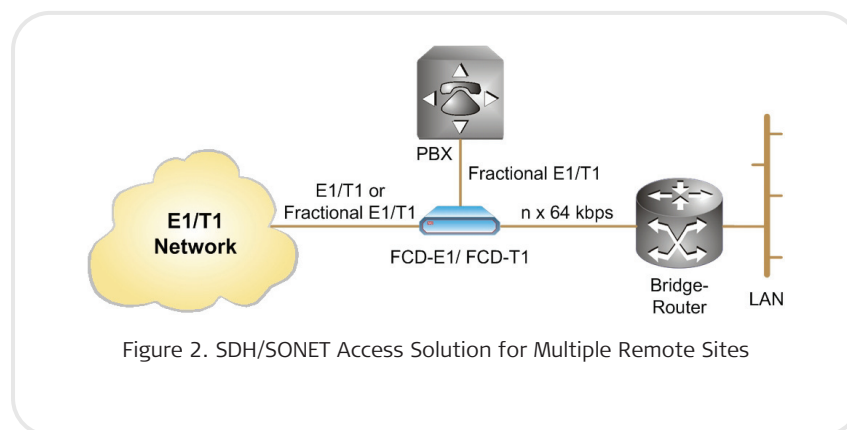


Figure 2. SDH/SONET Access Solution for Multiple Remote Sites

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

E1 Main Link Performance Monitoring

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

T1 Main Link Performance Monitoring

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

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

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

$n \times 56$ or $n \times 64$ kbps, ($n=1,2,\dots,31$)

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 local sync loss state

ETHERNET BRIDGE PORTS

LAN Table

10,000 addresses

Filtering and Forwarding

15,000 pps

Delay

1 frame

Line Code

Manchester

Buffer

256 frames

WAN Protocol

HDLC

Connectors

Shielded RJ-45, 10BaseT (UTP)

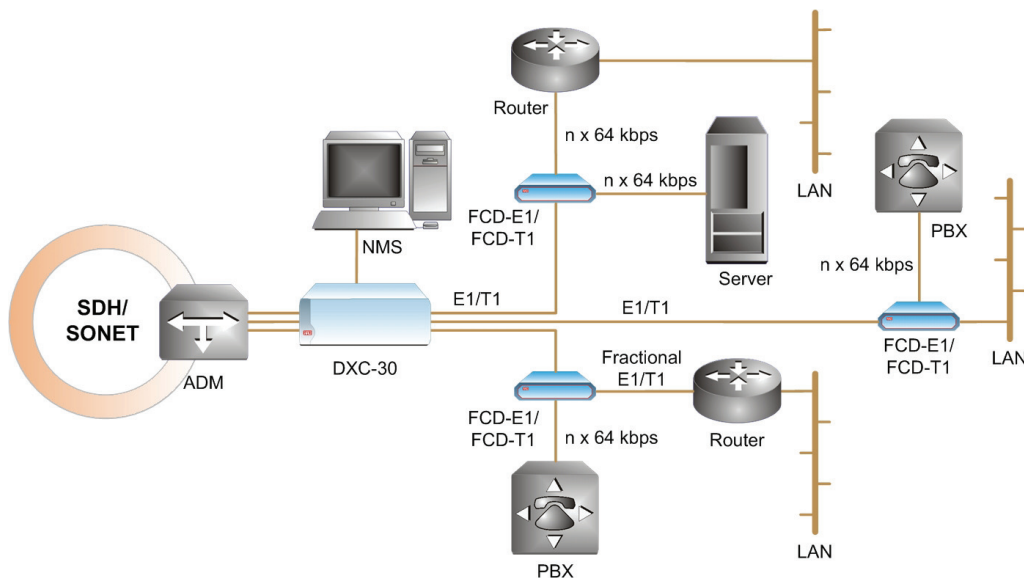


Figure 3. SDH/SONET Access Solution for Multiple Remote Sites

FCD-E1, FCD-T1

E1/T1 or Fractional E1/T1 Access Units

MANAGEMENT

Management Ports

Number: 2 (CONTROL DCE and CONTROL DTE)

Interface: V.24/RS-232

Connector: 9-pin D-type, female

Format: asynchronous

DCE baud rate: 0.3 to 19.2 kbps, autobaud

DTE baud rate: 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

DIAGNOSTICS

Main E1/T1 link

Local and remote loopback

Sub-E1/T1 port

Local and remote loopback

BER test

Data ports

Local loopback

Remote loopback

BER test

Inband code activated loopback

T1 network loopback, code-activated
(FCD-T1 only)

GENERAL**Timeslot Allocation**

Consecutive (bundled)
Alternate
User defined

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: 10W

Environment

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

Table 1. FCD Comparison Table

Features	FCD-E1/T1	FCD-E1L/T1L	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, Ethernet bridge (10BaseT), 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 transparent	VLAN priority tagging (802.1p/Q)	VLAN transparent

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Ordering

FCD-E1, FCD-T1/*/~/&/%

E1/T1 or Fractional E1/T1 Access Unit

Legend

- * Drop&insert copper E1/T1 sublink
(Default=no sublink):
S1
- ~ Power supply:
AC Single 100 to 240 VAC
48 -48 VDC
- & Data port interface:
530 RS-530
V35 V.35
X21 X.21
V36 V.36/RS-449
- % Optional second data port interface:
530 RS-530
V35 V.35
X21 X.21
V36 V.36/RS-449
ETU UTP (10BaseT) Ethernet bridge

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 converting into 34-pin V.35 connector

CBL-HS2/R/1

for converting into 37-pin V.36/RS-449 connector

CBL-HS2/X/1

for converting into 15-pin X.21 connector

OPTIONAL ACCESSORIES

CBL-HS2/*/#

Cables for converting 25-pin data port connectors into the respective interface. Cable length is 2m (6 ft).

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

Cable connector type:

- F** Female
- M** 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

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