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: \( n \times 56/64 \text{ kbps} \)
- 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
E1/T1 or Fractional E1/T1 Access Units

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.

![Diagram](image_url)

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
- Menu-driven management using front panel LCD with three push-buttons.
- Telnet session through the SLIP control port or inband

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.

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.
**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
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, ($n=1,2,...,31$)

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)
**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

<table>
<thead>
<tr>
<th>Features</th>
<th>FCD-E1/T1</th>
<th>FCD-E1L/T1L</th>
<th>FCD-E1LC/T1LC</th>
<th>FCD-E1E</th>
<th>FCD-E1A</th>
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</thead>
<tbody>
<tr>
<td>Total user ports</td>
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<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Interface types</td>
<td>RS-530, V.35, V.36, X.21, Ethernet bridge (10BaseT), Sub-E1</td>
<td>RS-530, V.35, V.36, X.21, Ethernet bridge (10/100BaseT with VLAN support), Sub-E1/T1</td>
<td>RS-530, V.24, V.35, V.36, X.21, Ethernet Bridge (10/100BaseT with VLAN support), Sub-E1/T1</td>
<td>RS-530, V.35, V.36, X.21, Ethernet Bridge (10/100BaseT with VLAN support), Sub-E1/T1</td>
<td>RS-530, V.35, V.36, X.21, Ethernet Bridge (10/100BaseT with VLAN support), Sub-E1</td>
</tr>
<tr>
<td>E1/T1 line type</td>
<td>Copper</td>
<td>Copper</td>
<td>Copper</td>
<td>Copper</td>
<td>Copper</td>
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<tr>
<td>LCD panel</td>
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<td>–</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Auto-configuration</td>
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<td>✓</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<td>SNMP management</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>Interoperability</td>
<td>Megaplex, DXC</td>
<td>Megaplex, DXC</td>
<td>Megaplex, DXC</td>
<td>Megaplex, DXC</td>
<td>Megaplex, DXC</td>
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<tr>
<td>ETH out-of-band for management</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>E1 bypass</td>
<td>✓</td>
<td>–</td>
<td>–</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ETH performance</td>
<td>VLAN transparent</td>
<td>VLAN transparent</td>
<td>VLAN transparent</td>
<td>VLAN priority taggingVLAN transparent (802.1p/Q)</td>
<td>VLAN priority taggingVLAN transparent (802.1p/Q)</td>
</tr>
</tbody>
</table>
FCD-E1, FCD-T1
E1/T1 or Fractional E1/T1 Access Units

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