

# FCD-E1LC, FCD-T1LC

Managed E1/T1 or Fractional E1/T1 Access Units



Managed TDM multiplexers for access to full or fractional E1/T1 services

- Managed access units for E1/T1 or fractional E1/T1 service
- E1/T1 main link and sublink support framed and unframed signals
- One or two data ports with selectable sync data rates:  $n \times 56$  kbps or  $n \times 64$  kbps
- Serial data port interfaces: V.24, V.35, V.36/RS-449, RS-530, or X.21
- Optional sub-E1/T1 drop-and-insert port for PBX connectivity
- Optional Ethernet 10/100BaseT bridge with VLAN support, or V.24 serial interface (second user port)

FCD-E1LC and FCD-T1LC are managed access units that convert rates and interfaces for full or fractional E1/T1 services.

These units support a single or dual serial  $n \times 56$  kbps or  $n \times 64$  kbps data user interface. The second serial data interface port can be replaced by an Ethernet LAN interface to allow LAN-to-LAN connectivity over TDM media.

The FCD-E1LC and FCD-T1LC units interconnect with RAD modular DXC, Megaplex products and E1/T1 equipment from other vendors to support multilink star applications such as access to SDH networks. All these products — DXC, FCD, and Megaplex — operate together under centralized SNMP network management.



## FCD-E1LC, FCD-T1LC

### Managed E1/T1 or Fractional E1/T1 Access 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. It 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. The integral LTU ensures a range of up to 2 km (1.2 miles) and is software-selectable.

The T1 interface is compatible with virtually all carrier-provided T1 services, including ASDS from AT&T. It complies with TR-62411 and TR-62421 and supports D4 and ESF framing formats. Zero suppression over the line is software-selectable for either transparent, B7ZS or B8ZS. The software-selectable integral CSU ensures a range of up to 2.1 km (1.3 miles).

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 an ESF T1 network.

The FCD-E1LC and FCD-T1LC units can be programmed to assign data automatically from each data port into consecutive timeslots. The user can also assign timeslots manually.

Timing for the E1/T1 main link and sublink may come from the recovered receive clock, an internal oscillator, or one of the data ports. This multiple clock source selection ensures maximum flexibility for supporting different applications.

Front panel LEDs indicate alarms, E1/T1 signal loss, and diagnostic loopback operation. Rear panel LEDs on the Ethernet interface modules indicate LAN status and activity.

FCD-E1LC and FCD-T1LC are compact standalone units. A rack mount adapter kit enables installation of one or two (side-by-side) units in a 19-inch rack.

## USER INTERFACES

The FCD-E1LC and FCD-T1LC units feature the following user interfaces:

- Serial data interfaces: V.24, V.35, V.36/RS-449, RS-530, X.21
- Ethernet 10/100BaseT LAN interface module with a built-in bridge (IR-ETH/QN).

The synchronous data ports of FCD-E1LC operate in the following clock modes:

- DCE: The FCD units provide both transmit and receive clocks to the user equipment, with optional sampling of the incoming data with an inverted clock
- DTE1: The FCD units provide the transmit clock, while the transmit clock is provided by the attached user equipment
- DTE2: The attached user equipment provides both transmit and receive clocks.

The IR-ETH/QN interface module has a 10/100BaseT interface that supports VLAN frames, autonegotiation, fault propagation, and automatic learning and aging. The module transparently connects FCD-E1LC and FCD-T1LC to remote LANs over E1/T1 links. It filters Ethernet frames and forwards only frames that are destined for the WAN.

## MANAGEMENT & MAINTENANCE

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

- ASCII terminal connected to the async control port
- SNMP management
- Telnet.

All models support an internal SNMP agent that is managed by any generic SNMP station or by the RADview SNMP-based management application.

FCD-E1LC and FCD-T1LC support both dial-in and dial-out modem connections through the serial RS-232 port, by using SLIP or PPP protocol or a command line interpreter on an ASCII terminal. These out-of-band connections can be used for remote configuration and monitoring, as well as for sending callout alarm messages.

Up to 100 time-stamped alarms are available for retrieval through the supervision terminal, a Telnet host, or a RADview management station.

Inband management can be performed either by dedicated timeslot using standard Frame Relay protocol (RFC 1490), or by using the spare  $S_a$  bits on timeslot 0 for FCD-E1LC or FDL bits for FCD-T1LC. This allows the user to setup, monitor, and run diagnostics on the remote unit. The spare bits on TSO or FDL that are used for inband access must be passed transparently end-to-end.

Maintenance capabilities include user-activated local and remote loopbacks on the E1/T1 main link, sublink, and data ports. The user can activate a BER test on the main link. Also, the main link responds to an ANSI FT1 RDL (T1.403) inband loop code, or a user-configured pattern generated by a remote FCD-E1LC, FCD-T1LC, or DXC in a specific bundle of timeslots allocated only to that port. The user can also define BER or inband tests to run on any timeslot of the main link.

E1 network statistics are stored in memory, according to RFC 1406. Statistical information can be retrieved locally through the control port.

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.

# FCD-E1LC, FCD-T1LC

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

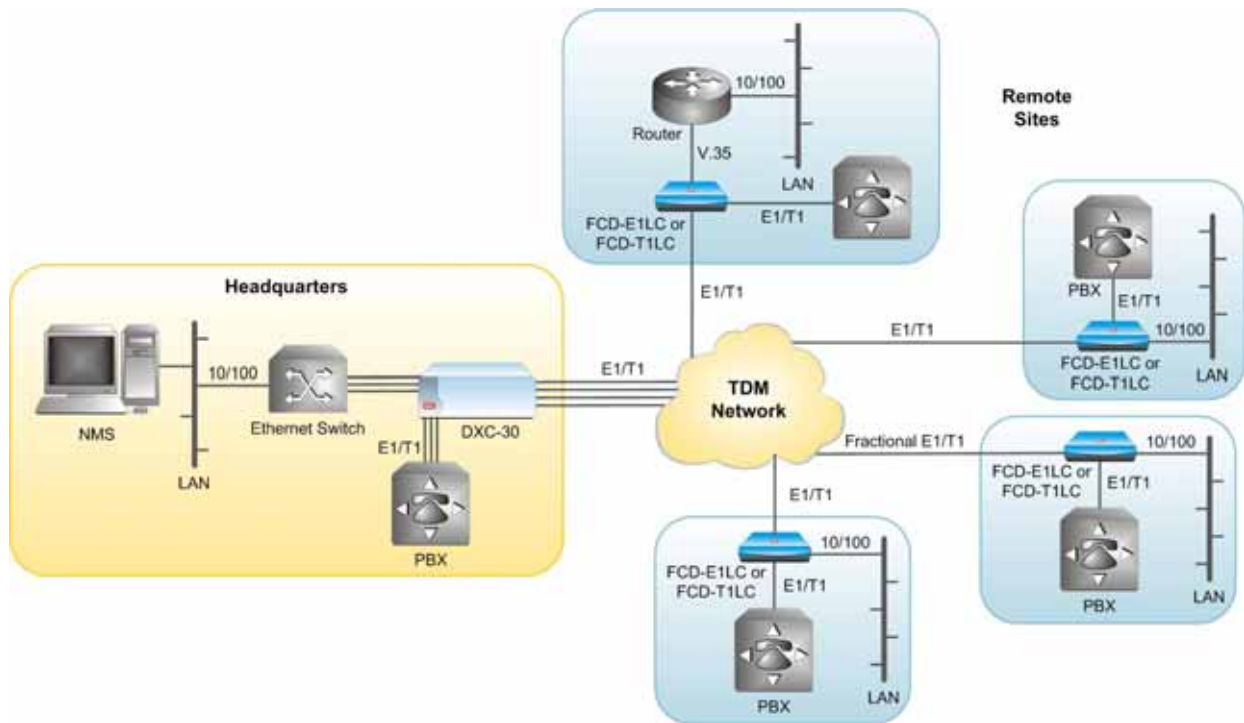


Figure 1. Extended Ethernet Management over E1/T1 Network

# 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

### Zero Suppression

HDB3

### Line Impedance

120 $\Omega$ , balanced  
75 $\Omega$ , unbalanced

### Transmit Timing

Locked to the system clock

### Signal Level

Receive:

0 to -10 dB without LTU  
0 to -36 dB with LTU

Transmit:

$\pm 3V$  ( $\pm 10\%$ ), balanced  
 $\pm 2.37V$  ( $\pm 10\%$ ), unbalanced

### Jitter Performance

As per ITU G.823, ETSI TBR-12 and TBR-13

### Connectors

RJ-45, 8-pin, balanced  
Two BNC coaxial, unbalanced, using  
adapter cable

### 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-1406

## T1 MAIN LINK AND SUBLINK

### Framing

D4  
ESF  
Unframed (main link only)

### Bit Rate

1.544 Mbps

### Line Code

AMI

### Zero Suppression

Transparent, B7ZS, B8ZS

### Line Impedance

100 $\Omega$ , balanced

### Transmit Timing

Locked to the system clock

### Signal Level

Receive:

0 to -10 dB without CSU  
0 to -36 dB with CSU

Transmit:

-7.5, -15, -22.5 dB with CSU  
 $\pm 3V$ ,  $\pm 10\%$  soft adjustable at 0 to 655  
ft without CSU

### T1 Jitter Performance

As per AT&T TR-62411

### Connector

RJ-45, 8-pin, balanced

### Compliance

AT&T TR-62411, AT&T 54016, AT&T  
TR-62421, ANSI T1.403

### Performance Monitoring

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

## DATA PORTS

### Connectors

D-type, 25-pin, RS-530, female  
(converted via adapter cables to V.35,  
X.21, V.36/RS-449)  
Additional connectors for second user  
port: D-type, 25-pin, female for V.24,  
RJ-45 for ETH

### Data Rate

$n \times 56/64$  kbps ( $n=1$  to 24) for T1  
 $n \times 64$  kbps ( $n=1$  to 31) for E1  
 $n \times 64$  kbps ( $n=1$  to 2) for V.24 port

### Clock Modes

DCE: Rx and Tx clock to user device  
DTE1: Rx clock to user device;  
Tx 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, unless in test mode  
DCD constantly ON, unless in sync loss

**ETHERNET BRIDGE PORT****Interface and Connector**

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

**Maximum Frame Length**

1536 bytes

**LAN Table**

2048 MAC addresses

**Throughput**

4,000 pps

**Latency**

300 µsec (64-byte frame size, 2M LAN rate)

**Buffer**

120 frames

**Line Code**

10BaseT: Manchester

100BaseT: MLT3

**WAN Protocol**

HDLC

**DIAGNOSTICS****Main E1/T1 link**

Local loopback

Remote loopback

BER test

Code-activated inband loopback per data port

Code-activated T1 network loopback (FCD-T1LC only)

**Sublink**

Local loopback

Remote loopback

Code-activated T1 network loopback (FCD-T1LC only)

**Data Port**

Local loopback

Remote loopback

**GENERAL****System Clock**

Internal clock: ±50 ppm

Loopback timing: ±130 ppm

External timing from data port: ±130 ppm

**Management Port**

Interface: RS-232, 9-pin D-type, female

Format: asynchronous

Baud rate: 1.2–115.2 kbps, autobaud

Character: 8-bit no parity, 7-bit odd or even parity

**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)

Main/sub-T1: RED ALARM (red), YEL ALARM (yellow)

**Physical**

Height: 4.4 cm (1.7 in)

Width: 21.7 cm (8.5 in)

Depth: 17.0 cm (6.7 in)

Weight: 0.8 kg (1.8 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

# FCD-E1LC, FCD-T1LC

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

Table 1. FCD Comparison Table

Features					
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

## FCD-E1LC, FCD-T1LC

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

## Ordering

## STANDARD CONFIGURATIONS

FCD-E1LC/X21/ETQN  
 FCD-E1LC/X21/S/ETQN  
 FCD-E1LC/V35/S/ETQN  
 FCD-E1LC/X21  
 FCD-E1LC/V35  
 FCD-T1LC/X21/S  
 FCD-T1LC/530/530  
 FCD-T1LC/V35/ETQN  
 FCD-T1LC/530  
 FCD-T1LC/V35

## SPECIAL CONFIGURATIONS

FCD-E1LC/ε/\*/%  
 E1 or fractional E1 access unit  
 FCD-T1LC/ε/\*/%  
 T1 or fractional T1 access unit

*Legend*

- ε Data port interface:  
 530 RS-530  
 V35 V.35  
 X21 X.21  
 V36 V.36/RS-449
- \* S Optional drop-and-insert E1/T1 sublink
- % Optional second data port interface:  
 530 RS-530  
 V35 V.35  
 X21 X.21  
 V36 V.36/RS-449  
 V24 for V.24  
 ETQN 10/100BaseT Ethernet bridge with VLAN support

## SUPPLIED ACCESSORIES

Power cord and AC/DC adaptor plug

The following cables are supplied for each data port interface specified for operating in DCE clock mode:

**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

**RM-33-2**

Hardware for mounting one or two units in a 19-inch rack

**CBL-DB9F-DB9M-STR**

Control port cable

**CBL-RJ45/2BNC/E1/X**

RJ-45 to BNC adaptor cable  
 (for unbalanced main link interface)

**CBL-RJ45/2BNC/E1**

RJ-45 to BNC adaptor cable  
 (for unbalanced sublink interface)

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

Adaptor cables for DB-25 channel connectors, for operation in the DTE1 and DTE2 clock modes

*Legend*

- \* 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

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