

# FCD-E1L, FCD-T1L



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



### FEATURES

- Managed access units for E1/T1 or Fractional E1/T1
- E1/T1 main link interfaces support both framed and unframed signals
- Provide one or two data ports with selectable sync data rates of  $n \times 64$  kbps
- Serial data port interfaces: V.35, RS-530, V.36/RS-449, V.24 or X.21
- Optional Ethernet or Fast Ethernet bridge (with or without VLAN support) or IP router
- Autoconfiguration function for plug-and-play operability
- SNMP agent
- Management:
  - Out-of-band via V.24 supervisory port
  - Inband via TS0 or dedicated timeslot over Frame Relay
- Dial-in option for remote out-of-band management

- Dial-out for alarm report
- Enhanced diagnostics include:
  - User activated local and remote loopbacks
  - Integrated BER tester
  - Fractional E1/T1 inband loop
- Stores 24 hours of E1 network performance monitoring and last 100 alarms
- Alarm mask configurable for any alarm

### DESCRIPTION

- FCD-E1L and FCD-T1L are managed access units, which can be used as rate and interface converters for E1/T1 and Fractional E1/T1 services.
- FCD-E1L and FCD-T1L support a single or dual serial  $n \times 64$  kbps data user interface. Instead of serial data interface port, an Ethernet LAN interface can be ordered, allowing LAN-to-LAN connectivity over TDM media.

- FCD-E1L and FCD-T1L also operate opposite RAD's modular DXC (DACS) products, as well as other vendors' E1/T1 equipment, to support multilink star applications, such as access to SDH networks. The DXC and the FCD units operate together with a centralized SNMP network management.
- 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. It can also accept a 2048 kbps data stream and convert it to an ITU-T Rec. G.703 unframed signal for transport over the E1 main link. Line code is HDB3. The integral LTU ensures a range of up to 2 km/1.2 miles and is soft-selectable.
- 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 1.3 mile.
- Timeslot assignment is programmable, allowing data from each data port to be placed automatically into consecutive timeslots. Alternatively, timeslots can be assigned manually at user discretion.
- FCD-E1L and FCD-T1L feature autoconfiguration for plug-and-play connectivity. Upon connection to the E1/T1 link, the units detect the E1/T1 parameters and perform autoconfiguration accordingly. This E1/T1 learning process can be activated via either a push-button on the FCD-E1L/FCD-T1L front panel or a terminal command. The state of the learning process is

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monitored by a dedicated LED indicator and/or supervision terminal messages.

- Multiple clock source selection ensures maximum flexibility for supporting different applications. The E1/T1 main link may be timed from the recovered receive clock, from an internal oscillator, or from one of the data ports.
- FCD-E1L and FCD-T1L feature front panel LEDs to indicate alarms, E1/T1 signal loss condition and diagnostic loopback operation. The rear panel LEDs of the Ethernet interface modules indicate the LAN status and activity.
- FCD-E1L and FCD-T1L are available as standalone units. A rack mount adapter kit enables installation of one or two (side by side) standalone units in a 19" rack (see *Ordering*).

### USER INTERFACES

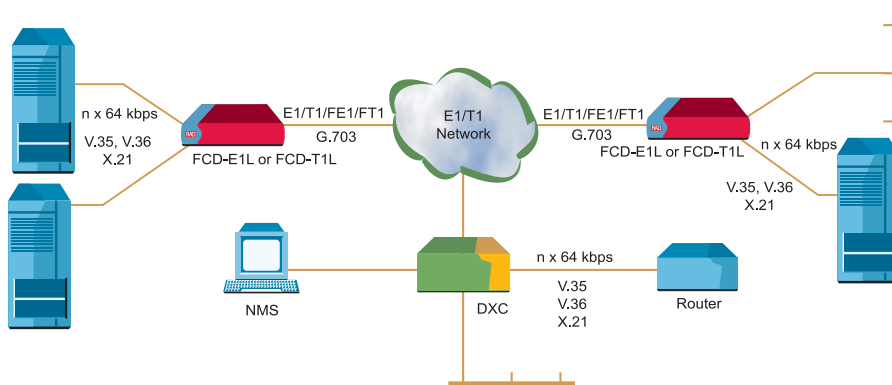
- FCD-E1L and FCD-T1L support the following types of user interfaces:
  - Serial data interfaces: RS-530, V.35, X.21, V.24, V.36/RS-449
  - Ethernet LAN interface modules with a built-in bridge (IR-ETH, IR-ETH/Q, IR-ETH/QN) or an IP router (IR-IP).

- The synchronous data ports can operate in the following clock modes:
  - DCE: FCD-E1L/FCD-T1L provides both transmit and receive clocks to the user equipment, with optional sampling of the incoming data with an inverted clock
  - DTE1: FCD-E1L/FCD-T1L provides the transmit clock, the attached user equipment provides the receive clock
  - DTE2: the attached user equipment provides both transmit and receive clocks.
- When equipped with IR-ETH, IR-ETH/Q or IR-ETH/QN interface modules, FCD-E1L and FCD-T1L transparently connect remote LANs over E1/T1 links. They filter Ethernet frames, forwarding only frames that are destined to the WAN. The IR-ETH/QN port supports autonegotiation and VLAN frames.
- FCD-E1L and FCD-T1L equipped with the IR-IP interface module operate as IP gateways, forwarding IP packets that are destined to the IP network. This prevents broadcast to the WAN and enables LAN users to register for IP multicast groups.
- FCD-E1L and FCD-T1L with the IR-IP interface module also connect local IP networks to public networks at full E1/T1 speed, in contrast with connection over statistical protocols, such as Frame Relay.
- The IR-ETH/QN port is available with a 10/100BaseT interface. Other Ethernet ports are available with 10BaseT (UTP) or 10Base2 (BNC) interfaces.

### MANAGEMENT & MAINTENANCE

- Setup, control and monitoring of status and diagnostics information can be activated via:
  - ASCII terminal connected to the async control port
  - SNMP management connected to the async control port.
- FCD-E1L and FCD-T1L have an internal SNMP agent and can be managed by any generic SNMP station or by the user-friendly, GUI-based RADview SNMP network management application.
- FCD-E1L and FCD-T1L 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 either via a dedicated timeslot with the standard Frame Relay (RFC 1490), or by using the spare bits (Sa bits) on Timeslot 0 (FCD-E1L) or FDL bits (FCD-T1L). This allows setup, monitoring and diagnostics of the remote unit. Inband access by using spare bits on TSO or FDL bits is possible only if these bits are passed transparently end-to-end.

## APPLICATION



# FCD-E1L, FCD-T1L

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- Maintenance capabilities include user activated local and remote loopbacks at the E1/T1 main link and data ports. Local loopbacks can be activated either from the terminal or via the DIP switch. The user can activate a BER test on the data port. Additionally, the data port responds to an ANSI FT1 RDL (T1E1.2/93-003) inband loop code, generated by the remote FCD-E1L, FCD-T1L or DXC in a specific bundle of timeslots allocated only to that port.
- E1 network statistics are stored in memory, according to RFC 1406. The statistic information may 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.

## SPECIFICATIONS

### E1 MAIN LINK

- **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 (main link only)
  - 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
- **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

- **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 (main link only)
  - Transmit:
    - 0, -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 to V.35, X.21, or V.36/RS-449 via adapter cables
  - D-type 25-pin V.24, female
- **Data Rate**  
 $n \times 64$  kbps ( $n=1,2,\dots,31$ )
- **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, V.24)
  - DTE2: RX and TX clock from user device (not for X.21, 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/ROUTER PORT

Refer to *Table 1* below.

- **Interface Connectors**
  - IR-ETH, IR-ETH/Q, IR-IP: 10BaseT (UTP) with shielded RJ-45 or 10Base2 (BNC) with two BNC coaxial
  - IR-ETH/QN: 10/100BaseT (UTP) with shielded RJ-45

### GENERAL

- **System Clock**
  - Internal clock:
    - $\pm 50$  ppm
  - Loopback timing:
    - $\pm 130$  ppm
  - External timing from data port:
    - $\pm 130$  ppm
- **Diagnostics**
  - Main E1/T1 link:
    - Local and remote loopback
  - Data port:
    - Local loopback
    - Remote loopback
    - Data port BER test
    - Inband code activated loopback per data port
    - T1 network loopback, code-activated (FCD-T1L only)

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- **Timeslot Allocation**  
Consecutive (bundled)  
User-defined
- **Management Port**
  - Interface and connector:  
V.24/RS-232, 9-pin D-type, female
  - Format: Asynchronous
  - Baud rate: 1.2-19.2 kbps, autobaud
  - Character: 8 bit no parity, 7 bit odd or even parity
- **Indicators**  
General: PWR (green), TST (yellow), ALM MAJ, ALM MIN (red), AUTO CONFIGURATION  
Main E1: LOC SYNC LOSS (red), REM SYNC LOSS (red)  
Main T1: RED ALARM (red), YEL ALARM (yellow)
- **Front Panel Controls**  
Single push-button for auto configuration
- **Alarms**  
Last 100 alarms are stored and available for retrieval. Each alarm is time stamped.
- **Physical**  
Height: 4.4 cm / 1.75 in  
Width: 21.5 cm / 8.5 in  
Depth: 24.3 cm / 9.6 in  
Weight 0.9 kg / 2.0 lb
- **Power**  
AC: 100 to 240 VAC; 47 to 63 Hz  
DC: -48 VDC (-40 to -57 VDC)  
Power consumption: 5W max.
- **Environment**  
Temperature: 0-50°C / 32-122°F  
Humidity: up to 90%, non condensing

## ORDERING

**FCD-E1L\*/~/&/%**  
E1/Fractional E1 Access Unit

**FCD-T1L\*/~/&/%**  
T1/Fractional T1 Access Unit

- \* Specify E1 main link interface type:  
**B** for balanced with RJ-45 connector  
**U** for unbalanced with BNC connector
  - ~ Specify power supply voltage:  
**AC** for 110 VAC to 240 VAC  
**48** for -48 VDC
  - & Specify data port interface:  
**530** for RS-530  
**V35** for V.35  
**X21** for X.21  
**449** for V.36/RS-449
  - % Specify optional second data port interface:  
**530** for RS-530 interface  
**V35** for V.35 interface  
**X21** for X.21 interface  
**V24** for V.24 interface  
**449** for RS-449 interface
- ETQN** for UTP Ethernet bridge VLAN (10/100BaseT)  
**ETUB** for UTP Ethernet bridge (10BaseT)  
**ETBB** for BNC Ethernet bridge (10Base2)  
**ETUQ** for UTP Ethernet bridge VLAN (10BaseT)

**ETBQ** for BNC Ethernet bridge VLAN (10Base2)

**ETUR** for UTP Ethernet router (10BaseT)

**ETBR** for BNC Ethernet router (10Base2)

## CABLES

The following cables convert FCD-E1L's or FCD-T1's 25-pin data port connectors into the respective interface. Cable length is 2m (6 ft).

### 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:** 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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Hardware for mounting one or two units in a 19" rack

Table 1. Ethernet Interface Modules Characteristics

Interface Module	LAN Table [addresses]	Filtering & Forwarding [frames per second]	Buffer [frames]	Line Code	WAN Protocol
IR-ETH	10,000	15,000	256	Manchester	HDLC
IR-ETH/Q	2,000	2,000	256	Manchester	HDLC
IR-ETH/QN	1,024	150,000	85	<ul style="list-style-type: none"> <li>▪ 10BaseT: Manchester</li> <li>▪ 100BaseT: MLT3</li> </ul>	HDLC
IR-IP	-	-	256	Manchester	<ul style="list-style-type: none"> <li>▪ PPP (PAP/CHAP)</li> <li>▪ Frame Relay (RFC 1490)</li> <li>▪ HDLC</li> </ul>

**Note:** All the Ethernet interface modules conform to the IEEE 802.3/Ethernet V2 standard. Additionally, IR-ETH/Q supports IEEE 802.1q frames, and IR-ETH/QN conforms to IEEE 802.1q (relevant parts), 802.1p and 802.3x.