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PRELIMINARY

FCD-E1L, FCD-T1L

RAD

Managed E1/T1 or Fractional E1/T1 Access Units



FEATURES

- Managed E1/T1 or Fractional E1/T1 access units
- E1 and T1 main link interfaces support both framed and unframed signals
- Support one or two data ports with selectable sync data rates of $n \times 64$ kbps
- Serial data 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 as DTE interface
- Autoconfiguration function for plug-and-play operability
- SNMP 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
- 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 user interface that can be either $n \times 64$ kbps serial data interface or Ethernet LAN interface allowing LAN-to-LAN connectivity over TDM media.
- FCD-E1L and FCD-T1L 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 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

FCD-E1L, FCD-T1L

Managed E1/T1 or Fractional E1/T1 Access Units

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 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

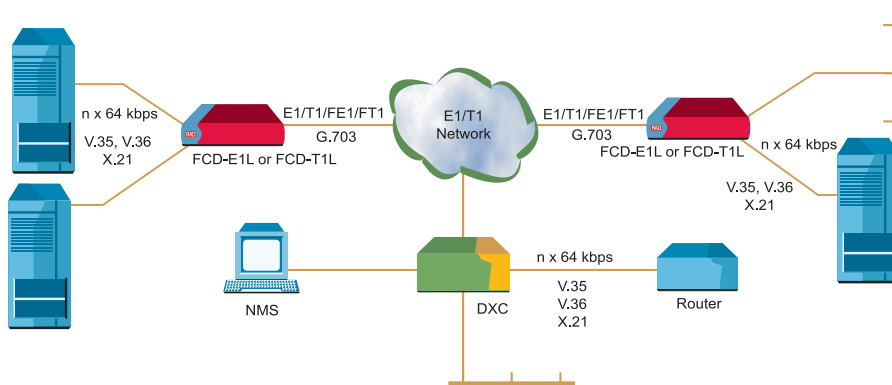
- FCD-E1L and FCD-T1L support the following types of user interfaces:
 - Serial data interfaces: RS-530, V.35, X.21, V.24, V.36/RS-449
 - Ethernet LAN interface modules with a built-in bridge (IR-ETH, IR-ETH/Q, IR-ETH/QN) or an IP router (IR-IP).
- The synchronous data ports can operate in the following 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 transmit clock, attached user equipment provides receive clock
 - **DTE2:** 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 LAN/VLANs, over the E1/T1 links. They filter Ethernet frames, forwarding only frames destined to the WAN.
- The IR-ETH/QN port has a 10/100BaseT interface and supports autonegotiation and VLAN frames.

- FCD-E1L and FCD-T1L equipped with the IR-IP interface module operate as IP gateways, forwarding IP packets 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 the local IP networks to the 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 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 by using the spare bits (Sa bits) on Timeslot 0 (TS0) or by using a dedicated timeslot with the standard Frame Relay (RFC 1490) or RAD proprietary protocol. This allows setup, monitoring and diagnostics of the remote unit. Inband access by using spare bits on TS0 is possible only if these bits are passed transparently end-to-end.

APPLICATION



FCD-E1L, FCD-T1L

Managed E1/T1 or Fractional E1/T1 Access Units

- Maintenance capabilities include user activated local and remote loopbacks at the E1/T1 main link and data ports. 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/T1 MAIN LINK

- **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
- **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
- **Line Impedance**
 - E1: 120Ω, balanced or 75Ω, unbalanced
 - T1: 100Ω, balanced
- **Transmit Timing**
 - Locked to the system clock

- **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 Jitter Performance**
 - As per ITU G.823, ETSI TBR-12 and TBR-13
- **T1 Jitter Performance**
 - As per AT&T TR-62411
- **Connectors**
 - E1: RJ-45, 8-pin, balanced or two BNC coaxial, unbalanced
 - T1: RJ-45, 8-pin, balanced
- **Compliance**
 - E1: ITU G.703, G.704, G.706, G.732, G.823, G.826
 - T1: AT&T TR-62411, AT&T 54016, AT&T TR-62421, ANSI T1.403
- **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
- **Performance Monitoring**
 - Local support of CRC-4
 - Statistics according to RFC 1406 and G.826

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 x 64 kbps (n=1,2...,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.

- **Connectors**
 - 10BaseT (UTP): Shielded RJ-45
 - 10/100BaseT (UTP): Shielded RJ-45
 - 10Base2 (BNC): Two BNC coaxial (not for IR-ETH/QN)

GENERAL

- **System Clock**
 - Internal clock:
 - ±50 ppm
 - Loopback timing:
 - ±130 ppm
 - External timing from data port:
 - ±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)
- **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

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- **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**

AUTO CONFIGURATION push-button

- **Alarms**

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

- **Physical**

Height: 44 mm / 1.75 in
Width: 215 mm / 8.5 in
Depth: 243 mm / 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 the 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]	Delay [frames]	Line Code	WAN Protocol
IR-ETH	10,000	15,000	256	1	Manchester	HDLC
IR-ETH/Q	2,000	2,000	256	1	Manchester	HDLC
IR-ETH/QN	1,024	150,000	85	1	<ul style="list-style-type: none"> ▪ 10BaseT: Manchester ▪ 100BaseT: MLT3 	HDLC
IR-IP	-	-	256	1	Manchester	<ul style="list-style-type: none"> ▪ PPP (PAP/CHAP) ▪ Frame Relay (RFC 1490) ▪ HDLC

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.



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