

E1 or Fractional E1 Access Unit



FEATURES

- E1 or Fractional E1 access unit
- Supports one or two data ports with selectable sync data rates: $n \times 56$ or $n \times 64$ kbps
- Optional sub-E1 drop & insert port for PABX connectivity
- Optional high performance built-in Ethernet bridge
- The E1 main link can be supplied with the following options:
 - Built-in LTU
 - Fiber optic interface
- Failure immune sub-E1 ensuring uninterrupted service (G.703 only)
- Data interfaces: V.35, RS-530, V.36/RS-449 or X.21
- SNMP agent
- Inband remote management
- Dial-in option for remote out-of-band management
- Dial-out for alarm report
- E1 interface complies with: ITU G.703, G.704, G.706, G.732, G.823
- Enhanced diagnostics include:
 - User activated local and remote loopbacks
 - Integrated BER tester
 - Fractional E1 inband loop
- Stores 24 hours of E1 network performance monitoring and last 100 alarms
- Relay activation upon alarm event
- Alarm mask configurable for any alarm

DESCRIPTION

- FCD-E1 is an access unit for E1 or Fractional E1 services. It can be used as a rate and interface converter or as an integrating multiplexer for E1 and Fractional E1 services (see Figure 2).
- FCD-E1 also operates opposite RAD's modular DXC (multiservice access node) products or other vendors' E1 equipment, for multilink star applications, such as access to SDH networks. The DXCs and FCD-E1 operate together with centralized SNMP network management (see Figure 3).
- FCD-E1 can be ordered with a regular E1 (G.703) or a fiber optic link. Both configurations are also available with an optional sub-E1 drop & insert port. The unit can be ordered with either one or two data ports. The second port can be an Ethernet bridge port.

BASIC UNIT

- The basic unit includes power supply, E1 link 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. Zero suppression over the line is HDB3. The integral LTU (optional) ensures a range of up to 2 km.
- FCD-E1 can be ordered with a fiber optic link, which eliminates the need for an external fiber optic modem. The fiber optic link provides a secure link in hazardous or hostile environments. It complies with ITU standards G.921 and G.956.

FCD-E1

E1 or Fractional E1 Access Unit

- Four fiber optic interfaces are available:
 - 850 nm LED for use over multimode fiber at distances up to 5 km (3 miles)
 - 1300 nm LED for use over single mode fiber at distances up to 47 km (29 miles)
 - 1300 nm laser diode for use over single mode fiber at distances up to 62 km (38 miles)
 - 1550 nm laser diode for use over single mode fiber for extended range up to 100 km (62 miles).
- Timeslot assignment is programmable, allowing data from each data port and from the sub-E1 port to be placed into timeslots consecutively. FCD-E1 also provides additional flexibility, by giving full user control over the data ports timeslot allocation without restrictions.
- Multiple clock source selection ensures maximum flexibility for supporting different applications. The E1 main link may be clocked from the recovered receive clock, from an internal oscillator, from one of the data ports or from the sub-E1 port.
- Immunity to hardware and power failure is provided by bypassing the sub-E1 port to the main link (non fiber optic), ensuring uninterrupted service to the sub-E1 port.
- FCD-E1 is available as a standalone unit. A rack mount adapter kit enables installation of one or two standalone units, side by side in a 19" rack.

APPLICATIONS

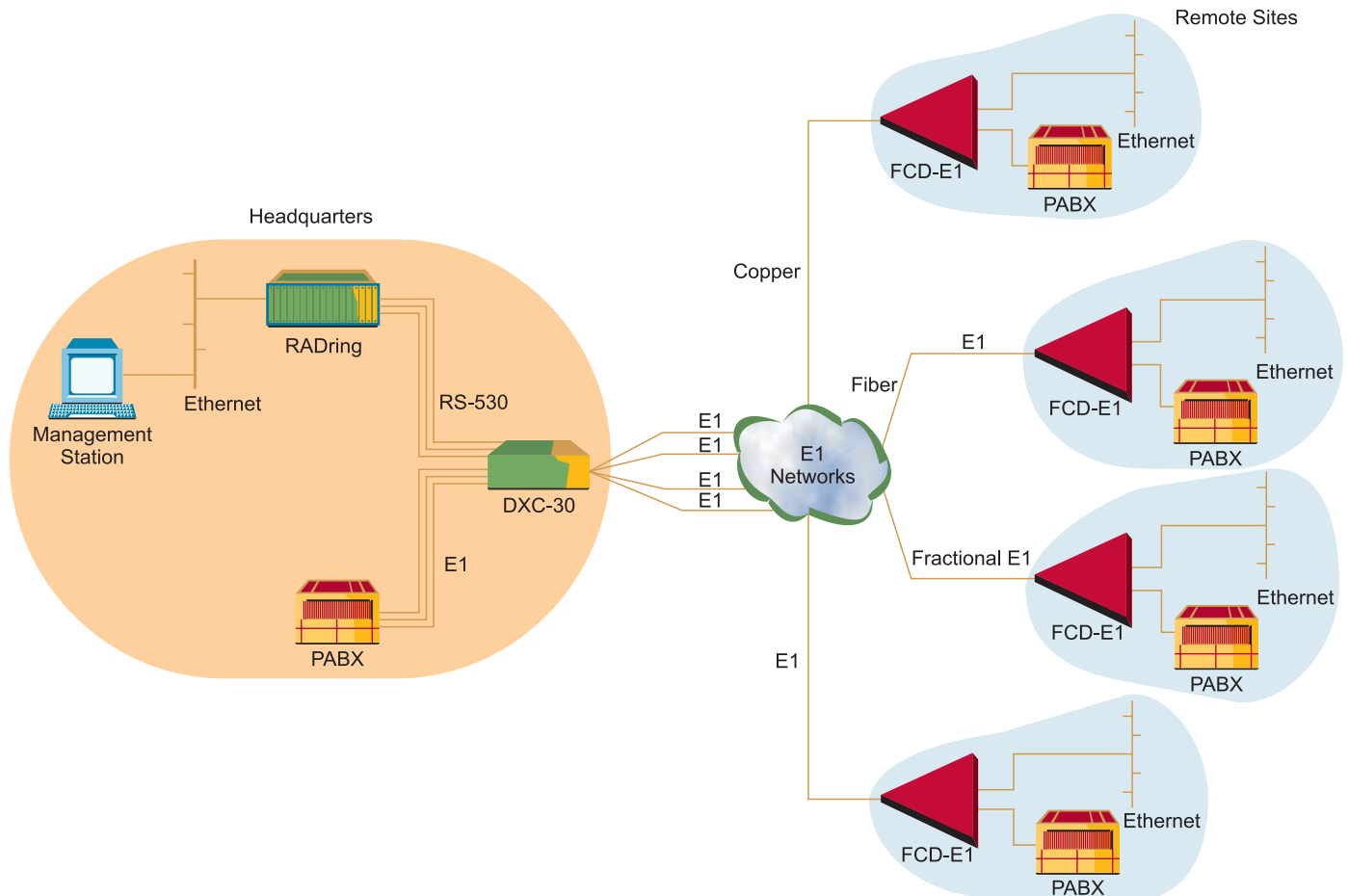


Figure 1. Extended Ethernet Management over E1 Network

USER INTERFACE

- The following data port interfaces can be ordered: V.35, RS-530, V.36/RS-449 or X.21. The ports can operate in the following clock modes:
 - DCE transmit and receive clocks are output
 - DTE1 external transmit clock is input (coming from the user DTE)
 - DTE2 both the transmit and receive clocks are externally input
 - Invert data sampling is done using an invert clock
- The optional built-in Ethernet bridge is a high performance remote, self-learning bridge. It is ideal as a LAN extender or segmenter over E1 link applications. The LAN table stores up to 10,000 addresses and is automatically updated. Filtering and forwarding is performed at the maximum theoretical rate of 15,000 pps (wire speed) and the buffer can hold 256 frames with a throughput latency of 1 frame. Filtering can be disabled for extender or segmenter applications. The Ethernet port is available with either 10BaseT (UTP) or 10Base2 (BNC) interface. The Ethernet port with 10BaseT operates in full duplex mode, while the one with 10Base2 operates in half duplex.

- 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.

MANAGEMENT & MAINTENANCE

- Setup, control and monitoring of status and diagnostics information can be activated via:
 - Front panel LCD with three push-buttons
 - Menu-driven management
 - ASCII terminal connected to the async control port command line interpreter
 - SNMP management connected to the async control port.
- FCD-E1 has an internal SNMP agent and can be controlled by any generic SNMP station or by the RADview SNMP network management application.
- FCD-E1 supports dial-in, dial-out modem connections. These connections can be used for remote out-of-band configuration, monitoring and for sending callout alarm messages using the ASCII (terminal) or SLIP protocols.
- Inband management can be performed by using the spare bits (Sa bits) on timeslot 0 or through a dedicated timeslot that supports proprietary protocol and Frame Relay RFC 1490. This allows setup, monitoring and diagnostics of the remote unit. Inband access by using spare bits on timeslot 0 is possible only if those bits are passed transparently end-to-end.
- Maintenance capabilities include user activated local and remote loopbacks at the E1 main link, sub-E1 and data ports. The user can activate a BER test for each data or sub-E1 port individually. Each data or sub-E1 port responds to an ANSI FT1 RDL (T1E1.2/93-003) inband loop code, generated from the remote FCD-E1 or DXC in a specific bundle of timeslots allocated only to that port.
- When operating with CRC-4, E1 network statistics are stored in memory according to RFC-1406. The statistic information may be retrieved locally through the control port.

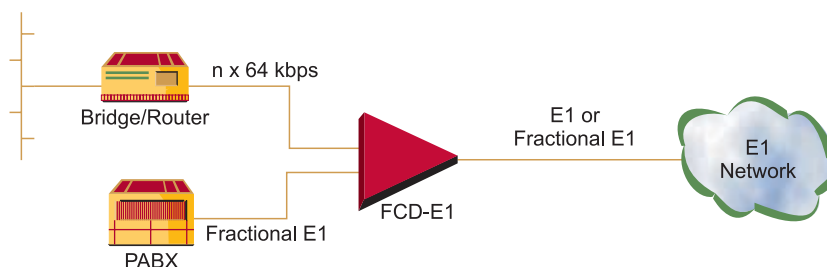


Figure 2. Connection of LAN Traffic together with PABX Traffic to E1 Network

SPECIFICATIONS

E1 MAIN LINK (NETWORK) AND SUB-E1 PORT

- Framing**
 256N (no MF, CCS)
 256N (no MF, CCS) with CRC-4
 256S (TS16 MF, CAS)
 256S (TS16 MF CAS) with CRC-4
- Bit Rate**
 2.048 Mbps
- Line Code**
 AMI
- Zero Suppression**
 HDB3
- Impedance**
 120Ω, balanced
 75Ω, unbalanced
- Signal Level**
 Main link receive:
 0 to -36 dB / with LTU
 0 to -10 dB / without LTU
 Main link transmit:
 ±3V (±10%), balanced
 ±2.37V (±10%), unbalanced
 Sub-E1 port receive:
 0 to -10 dB
 Sub-E1 port transmit:
 ±3V (±10%), balanced
 ±2.37V (±10%), unbalanced
- Jitter Performance**
 - As per ITU G.823
 - ETSI TBR-12 and TBR-13
- Connectors**
 RJ-48c 8-pin, balanced
 Two BNC coaxial, unbalanced
- Transmit Timing**
 Internal accuracy:
 ±30 ppm
 Loopback timing:
 ±130 ppm
 Sub-E1:
 2.048 Mbps ±130 ppm (locked on E1 main link)
 External timing from data port:
 n x 56, n x 64 ±130 ppm
- Compliance**
 ITU G.703, G.704, G.706, G.732

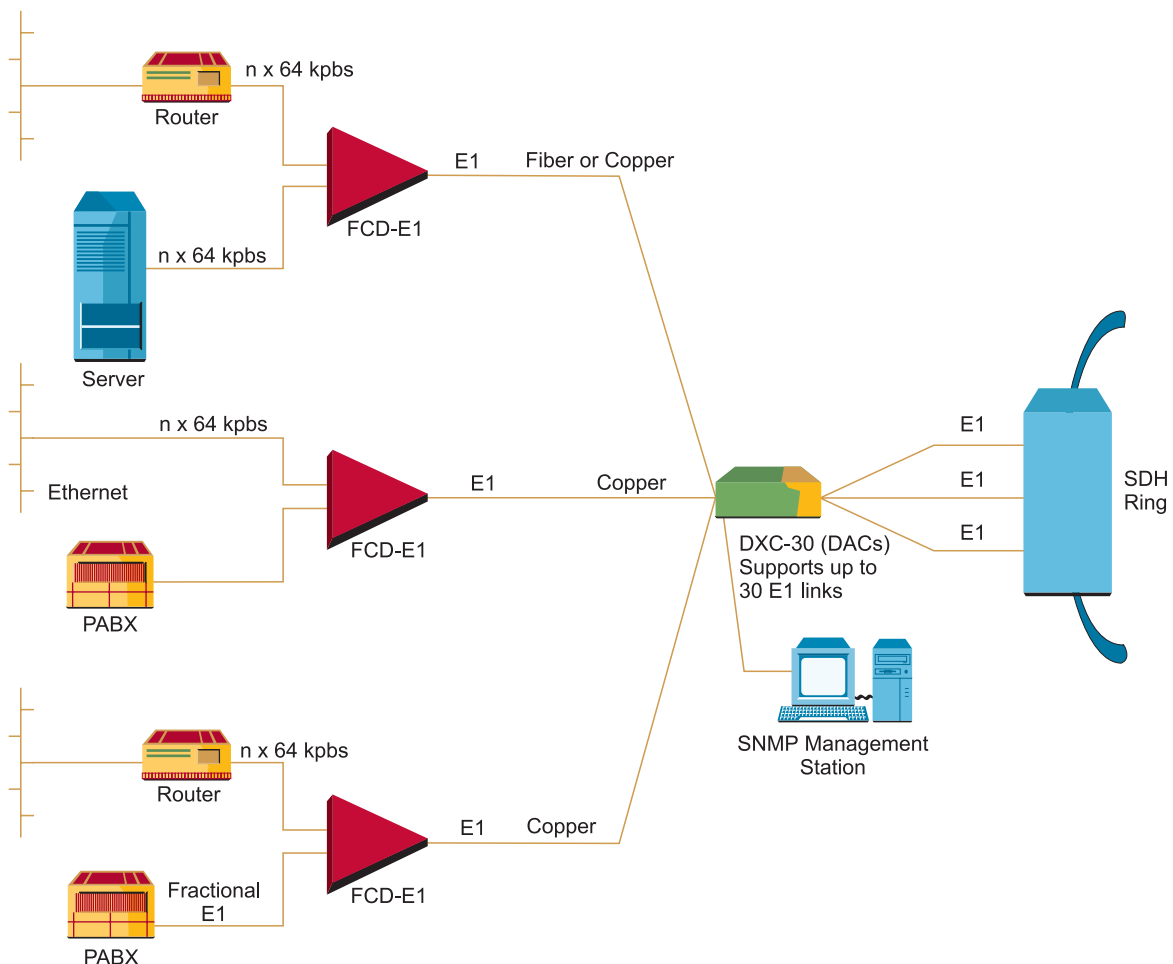


Figure 3. SDH Access Solution for Multiple Remote Sites

E1 or Fractional E1 Access Unit

FIBER OPTIC LINK

- **Operating Wavelength**
850, 1300 or 1550 nm (see *Ordering*)
- **Receiver Sensitivity**
(For BER = 1×10^{-9})
-38 dBm at 850 nm
-40 dBm at 1300, 1550 nm
- **Connectors**
ST, FC/PC or SC (see *Ordering*)
- **Output Power**
-18 dBm for 850 nm into 62.5/125
-18 dBm for 1300 nm into 9/125
-12 dBm for 1300 and 1550 nm laser into 9/125
- **Dynamic Range**
28 dB for all types of optical interfaces
- **Budget (Max)**
20 dB for 850 nm over 62.5/125
22 dB for 1300 nm over 9/125
28 dB for 1300 and 1550 nm laser over 9/125

DATA PORTS

- **Number of Data Ports**
One or two (see *Ordering*)
- **Interface**
V.35, RS-530, V.36/RS-449, X.21
- **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 LOC SYNC LOSS

ETHERNET BRIDGE PORT

- **LAN Table**
10,000 addresses
- **Filtering and Forwarding**
15,000 pps
- **Buffer**
256 frames
- **Delay**
1 frame
- **Standard**
Conforms to IEEE 802.3/Ethernet
- **Connectors**
10BaseT (UTP): Shielded RJ-45
10Base2 (Coax): BNC

GENERAL

- **Diagnostics**
Main E1 link:
local and remote loopback
Sub-E1 port:
local and remote loopback
Sub-E1 port BER test
Data port:
Local data port loopback
Remote data port loopback
Data port BER test
Inband code activated loopback per data port
- **Timeslot Allocation**
Consecutive (bundled)
User defined
- **Performance Monitoring (On E1 Main Link)**
Local support of CRC-4
Statistics according to RFC-1406
- **Control Port (DCE)**
Interface: V.24/RS-232
Connector: 9-pin D-type, female
Format: Asynchronous
Baud rate: 1.2 to 19.2 kbps, autobaud
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: Test, Alarm
Main E1: Local sync loss, Remote sync loss
Sub-E1: Local sync loss, Remote sync loss
All indicators are red.
- **Alarms**
Last 100 alarms are stored and available for retrieval. Each alarm is time stamped.
- **Alarm Relay**
3 relay contacts are available on the control DTE port. The alarm relay is activated by certain alarms in the alarm buffer.
- **Physical**
Height: 43.0 mm / 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 (36–72V)
Power consumption: 6W
- **Environment**
Temperature: 0–50°C / 32–122°F
Humidity: up to 90%, non condensing



FCD-E1

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ORDERING

FCD-E1/*/~/&/%/@/#+
E1 or Fractional E1 Access Unit

- * Specify optional drop & insert sub-link:
S1 for E1 sub-link
- ~ Specify power supply voltage:
AC for 115 VAC and 230 VAC
48 for -48 VDC
- & Specify data port interface:
530 for RS-530 interface
V35 for V.35 interface
X21 for X.21 interface
449 for RS-449 interface
- % Specify optional 2-nd data port interface:
530 for RS-530 interface
V35 for V.35 interface
X21 for X.21 interface
449 for RS-449 interface
232 for RS-232 interface
ETU for UTP Ethernet bridge (10BaseT)
ETB for BNC Ethernet bridge (10Base2)
- @ Specify optional line interface:
LTU for integral Line Termination Unit
- #+Specify optional optical interface:
ST for ST connector
SC for SC connector
FC for FC/PC connector
- + **85** for 850 nm, multimode
13 for 1300 nm, single mode
13L for 1300 nm, single mode, laser diode
15L for 1550 nm, single mode, laser diode
(Default is G.703 electrical interface)

CABLES

The following cables convert the 25-pin channel connector into the respective interface. Cable length is 2m (6 ft), unless otherwise indicated.

- CBL-HS2V1** to connect a V.35 DTE using DCE clock mode*
- CBL-HS2V2** to connect a V.35 DCE using DTE1 clock mode*
- CBL-HS2V3** to connect a V.35 DCE using DTE2 clock mode*
- CBL-HS2R1** to connect an RS-449 (V.36) DTE using DCE clock mode*
- CBL-HS2R2** to connect an RS-449 (V.36) DCE using DTE1 clock mode*
- CBL-HS2R3** to connect an RS-449 (V.36) DCE using DTE2 clock mode*
- CBL-HS2X1** to connect an X.21 DTE using DCE clock mode*

* **DCE clock mode:** FCD-E1 provides both transmit and receive clocks

DTE1 clock mode: FCD-E1 provides transmit clock, attached DCE provides receive clock

DTE2 clock mode: attached DCE provides both transmit and receive clocks

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