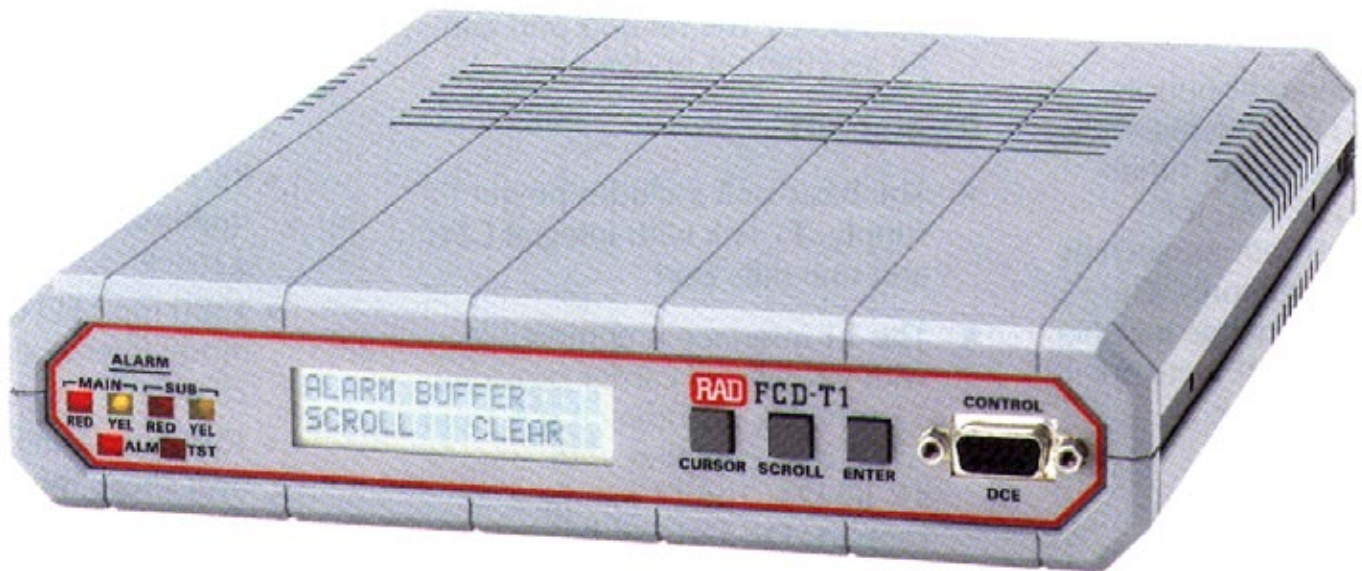


FCD-T1

T1 or Fractional T1 CSU/DSU



FEATURES

- T1 or Fractional T1 CSU/DSU
- Supports one or two data ports with selectable sync data rates: n x 56, n x 64 kbps
- Optional sub-T1 drop & insert port for PABX connectivity
- Failure immune sub-T1 ensuring uninterrupted service (G.703 only)
- Data interfaces: V.35, RS-530, V.36/RS-449 or X.21
- Optional high performance built-in Ethernet bridge
- SNMP agent
- Inband remote management
- Dial-in option for remote out-of-band management
- Dial-out for alarm report
- T1 main link with integral CSU (optional)
- Optional fiber optic main link with the following interfaces:
 - 850 nm LED for multimode
 - 1310 nm LED for single mode
 - 1310 nm laser for single mode
 - 1550 nm laser for extended range up to 100 km/62 miles over single mode
- Framing format: D4, ESF (main link and sub-T1 port) and unframed (main link only)
- Zero suppression (main link and sub-T1 port): B7ZS, B8ZS and transparent
- T1 interface complies with: AT&T TR62411, TR62421, ANSI T1.403 and AT&T 54016 (local support)
- Enhanced diagnostics include:
 - User activated local and remote loopbacks
 - Integrated BER tester
 - Fractional T1 inband loop
- Stores 24 hours of T1 network performance monitoring and last 100 alarms
- Relay activation upon alarm event
- Alarm mask configurable for any alarm

FCD-T1

T1 or Fractional T1 CSU/DSU

DESCRIPTION

- FCD-T1 is a CSU/DSU for T1 or Fractional T1 services. It can be used as a rate and interface converter, or as an integrating multiplexer for T1 and Fractional T1 services (see Figure 2).
- FCD-T1 also operates opposite RAD's modular DXC (DACS) products or other vendors' T1 equipment, for multilink star applications, such as access to SONET networks. The DXCs and FCD-T1 operate together with centralized SNMP network management (see Figure 3).
- FCD-T1 can be ordered with a regular T1 (including an integral CSU), or a fiber optic link. Both configurations are also available with an optional sub-T1 drop & insert port. The unit can also 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, electrical/copper T1 link with integral CSU and one data port.
- 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.
- FCD-T1 ordered with a fiber optic link 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.

Four fiber optic interfaces are available:

- 850 nm LED for use over multimode fiber at distances up to 3 miles/5 km
 - 1310 nm LED for use over single mode fiber at distances up to 29 miles/45 km
 - 1310 nm laser diode for use over single mode fiber at distances up to 34 miles/55 km
 - 1550 nm laser diode for use over single mode fiber for extended range up to 55 miles/88 km.
- Timeslot assignment is programmable, allowing data from each data port and from the sub-T1 port to be placed into timeslots (DS0s), consecutively. FCD-T1 also provides additional flexibility, by giving full user control over the data ports timeslot allocation, without restrictions.

APPLICATION

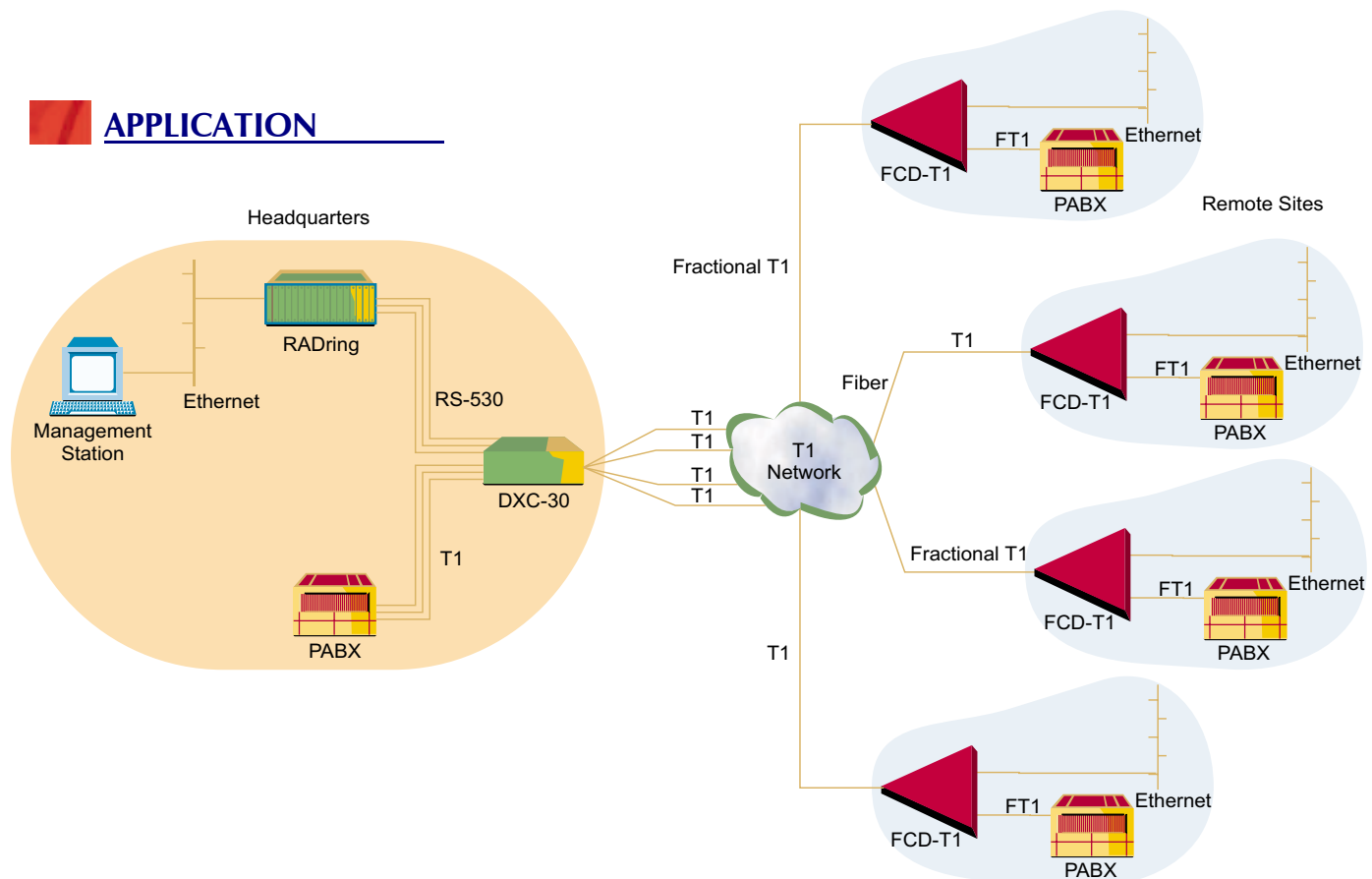


Figure 1. Extended Ethernet Management over T1 Network

- Multiple clock source selection ensures maximum flexibility for supporting different applications. The T1 main link may be clocked from the recovered receive clock, from internal oscillator, from one of the data ports, or from the sub-T1 port.
- Bypassing the sub-T1 port to the main link (not available with the fiber optic link) ensures uninterrupted service to the sub-T1 port, providing full immunity to hardware and power failure.
- The optional sub-T1 port can be configured for D4 or ESF framing, while the T1 main link framing is ESF. This enables, for example, connection of T1 D4 equipment over a T1 ESF network.
- FCD-T1 is available as a standalone unit. A rack mount adapter kit enables installation of one or two (side-by-side) standalone units in a 19" rack.

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 (option to sample the incoming data with an inverted clock)
 - **DTE1:** external transmit clock is input (coming from the user DTE)
 - **DTE2:** both the transmit and receive clocks are externally input.

- The optional built-in Ethernet bridge is a high performance remote, self-learning bridge. It is ideal as a LAN extender or segmenter over T1 links. The LAN table stores up to 10,000 addresses and is updated automatically. Filtering and forwarding is performed at the maximum theoretical rate of 15,000 pps (wire speed). 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 or half duplex mode, while the one with 10Base2 operates in half duplex only.

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 control port
 - SNMP management connected to the control port.
- FCD-T1 has an internal SNMP agent and can be controlled by any generic SNMP station or by the user-friendly, GUI-based RADview SNMP network management application.

- FCD-T1 supports 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 using the Facility Data Link (FDL) in the ESF framing format, or by using a dedicated timeslot. This allows setup, monitoring and diagnostics of the remote unit. Inband access by using the FDL is possible only if the FDL is passed transparently end-to-end.
- When operating in the ESF format, T1 network statistics are stored in memory in compliance with both ANSI and AT&T standards. The statistical information may be retrieved by the service supplier (ANSI only), or locally through the control port.
- Maintenance capabilities include user activated local and remote loopbacks on the T1 main link, sub-T1 and data ports. FCD-T1 with a CSU option responds to network activated loops (PLB, LLB). The user can activate a BER test for each data port individually. Each data port responds to an ANSI FT1 inband loop code, generated from the remote FCD-T1 or DXC in a specific bundle of timeslots allocated only to that port.

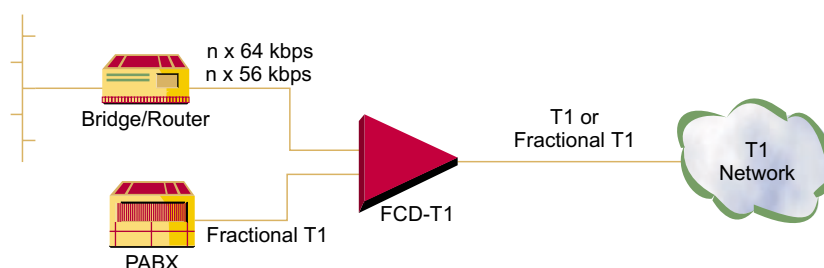


Figure 2. Connection of LAN Traffic together with PABX Traffic to T1 Network

T1 or Fractional T1 CSU/DSU

SPECIFICATIONS

T1 MAIN LINK

- **Framing**
D4, ESF, unframed
- **Bit Rate**
1.544 Mbps
- **Line Code**
AMI
- **Zero Suppression**
Transparent, B7ZS, B8ZS
- **Impedance**
100Ω, balanced
- **Signal Level**
Receive:
With CSU: 0 to -36 dB
Without CSU: 0 to -10 dB
Transmit:
With CSU: 0, -7.5, -15, -22.5 dB; ±3V (±10%)
Without CSU: Soft-adjustable at 0 to 655 ft
- **Jitter Performance**
 - As per AT&T TR-62411
 - ETSI TBR-12
- **Connectors**
RJ-45 8-pin
- **Transmit Timing**
 - Internal accuracy: ±30 ppm
 - Loopback timing: ±130 ppm
 - Sub-T1: 1.544 Mbps ±130 ppm
 - External timing from data port: n x 56, n x 64 ±130 ppm

FIBER OPTIC LINK

- **Compliance**
G.921, G.956
- **Operating Characteristics**
See Table 1.
- **Connectors**
ST, FC/PC or SC (see Ordering)

SUB-T1 PORT

- **Framing**
D4, ESF
- **Bit Rate**
1.544 Mbps
- **Line Code**
AMI
- **Zero Suppression**
Transparent, B7ZS, B8ZS
- **Impedance**
100Ω, balanced
- **Signal Level**
Receive:
0 to -10 dB
Transmit:
±3V (±10%), soft-adjustable at 0 to 655 ft
- **Jitter Performance**
 - As per AT&T TR-62411
 - ETSI TBR-12
- **Connectors**
RJ-45 8-pin
- **Transmit Timing**
Locked on T1 main link
- **Compliance**
AT&T TR-62411, ANSI T1.403

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 x 56 or n x 64 kbps,
(n=1,2...,24)
- **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 RED ALARM

Table 1. Fiber Optic Interface Characteristics

Wave-length (nm)	Fiber Type (μm)	Transmitter Type	Power Coupled into Fiber (dBm)	Receiver Sensitivity (dBm)	Optical Budget (dB)	Maximum Receiver Input Power (dBm)	Receiver Dynamic Range (dB)	Typical Maximum Range (km / mi)
850	62.5/125 multimode	LED	-18	-38	20	-10	28	5 / 3
1310	9/125 single mode	LED	-18	-40	22	-12	28	45 / 29
		Laser	-12	-34	22	-12	28	55 / 34
1550	9/125 single mode	Laser	-12	-34	22	-12	28	88 / 55

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

- **Timeslot Allocation**
 - Consecutive (bundled)
 - Alternate
 - User defined

Diagnostics

- Main T1 link:
local and remote loopback
- Sub-T1 port:
local and remote loopback
- Data port:
Local data port loopback
Remote data port loopback
Data port BER test
T1 network loopback, code activated
Inband code activated loopback per data port

Performance Monitoring (on T1 Main Link)

- Full statistical diagnostics according to ANSI T1.403-1989
Local support of ESF diagnostics according to AT&T PUB 54016

Management Ports

- **DCE**
Interface and Connector:
V.24/RS-232, 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
- **DTE**
Interface and Connector:
V.24/RS-232, 9-pin D-type, female
Format: Asynchronous
Baud rate: 0.3 to 57.6 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

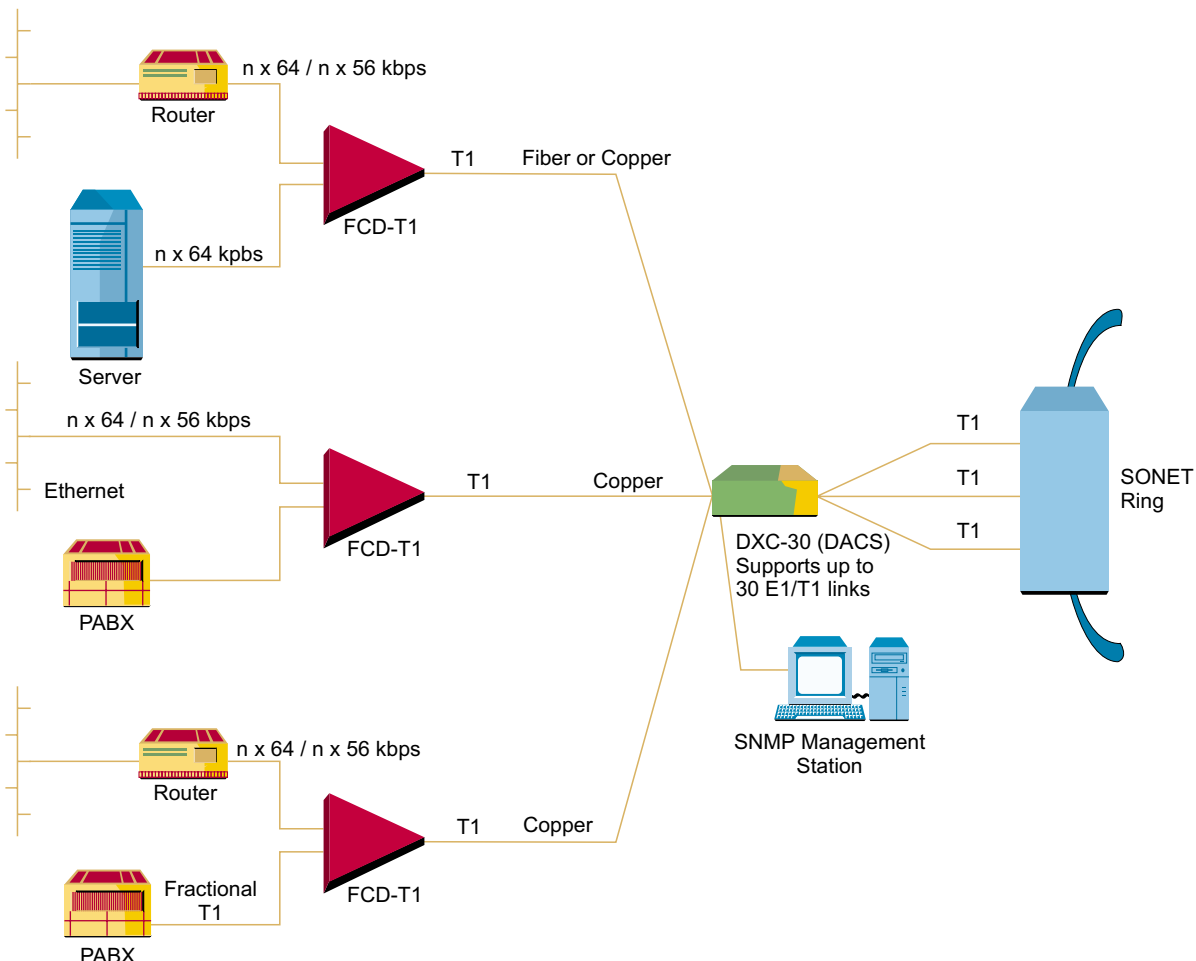


Figure 3. SONET Access Solution for Multiple Remote Sites

FCD-T1

T1 or Fractional T1 CSU/DSU

- **Indicators**

General: Test, Alarm (red)
Main T1: Red alarm (red)
Yellow alarm (yellow)
Sub-T1: Red alarm (red)
Yellow alarm (yellow)

- **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 can be 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 (36-72V)
Power consumption: 6W

- **Environment**

Temperature: 0-50°C / 32-122°F
Humidity: up to 90%,
non-condensing

ORDERING

FCD-T1/*/~/&/%/@/#+
T1 or Fractional T1 CSU/DSU

* Specify **S1** for optional drop & insert T1 sublink

~ Specify power supply voltage:
AC for 100 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 RS-449

% Specify optional second data port interface:
530 for RS-530
V35 for V.35
X21 for X.21
449 for RS-449

ETU for UTP (10BaseT) Ethernet bridge
ETB for BNC (10Base2) Ethernet bridge

Specify link connector type:
CX for electrical interface with coaxial BNC connectors
ST for ST type fiber connectors
FC for FC/PC type fiber connectors
SC for SC type fiber connectors

+ Specify optical interface wavelength and transmitter type (not relevant with CX option):
85 for 850 nm, multimode
13 for 1310 nm, single mode, LED
13L for 1310 nm, single mode, laser
15L for 1550 nm, single mode, laser

@ Specify optional line interface:
CSU for integral CSU

CABLES

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

The cables are not provided with the unit and must be ordered separately.

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-T1 provides both transmit and receive clocks

DTE1 clock mode: FCD-T1 provides transmit clock, attached DCE provides receive clock

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

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data communications

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