

FCD-E1A

E1 or Fractional E1 Access Unit



FEATURES

- E1 or Fractional E1 access unit
- Four ISDN BRI "S" interface user ports
- Supports one or two data ports with selectable sync data rates: $n \times 56$, $n \times 64$ kbps
- Optional sub-E1 drop & insert user port for PBX connectivity
- Failure-immune sub-E1 port ensuring uninterrupted service (G.703 only)
- Data port interfaces: V.35, RS-530, V.36/RS-449 or X.21
- Optional Ethernet or Fast Ethernet bridge, with or without VLAN support or IP router as DTE interface
- Management:
 - Out-of-band via V.24 supervisory port or Ethernet management port
 - Inband via TS0 or dedicated timeslot
- SNMP agent
- Dial-in option for remote out-of-band management
- Dial-out for alarm report
- Optional integrated ISDN backup
- E1 main link can be supplied with a fiber optic interface
- 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-E1A 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-E1A operates opposite RAD's modular DXC (multiservice access node) products or other vendors' E1 equipment, for multilink star applications such as SDH networks access. The DXCs and FCD-E1A can operate together with a centralized SNMP network management (see Figure 3).
- FCD-E1A can be ordered with either a standard electric (G.703) or a fiber optic E1 main link. Both options are also available with an optional sub-E1 drop & insert port. The unit can be ordered with either one or two data ports. Alternatively, an Ethernet bridge/router port is available instead of a second data port.

BASIC UNIT

- The basic unit includes a power supply, one E1 main link and one data port.
- The electrical 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 both 2 and 16 frames per multiframe, with or without CRC-4. Line coding is HDB3. The integral LTU (soft-configurable) ensures a range of up to 2 km.
- FCD-E1A 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.

E1 or Fractional E1 Access Unit

- The following fiber optic interfaces are available:
 - 850 nm with LED transmitter for use over multimode fiber at distances up to 5 km (3 miles)
 - 1310 nm with laser diode transmitter for use over single mode fiber at distances up to 62 km (38 miles)
 - 1550 nm with laser diode transmitter for use over single mode fiber for extended range up to 100 km (62 miles).
- Timeslot assignment is programmable, allowing data from each data or sub-E1 port to be placed automatically into consecutive timeslots. Alternatively, timeslots can be assigned manually at user discretion.
- Multiple clock source selection ensures maximum flexibility for supporting different applications. The E1 main link may derive its timing from the recovered receive clock, from an internal oscillator, from one of the data ports or from the sub-E1 port.
- ISDN dial backup ensures the continuity of data services.

- Bypassing the sub-E1 port to the G.703 main link (non fiber-optic) ensures uninterrupted service to the sub-E1 port and provides immunity to hardware or power failures.
- FCD-E1A 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 (see *Ordering*).

USER INTERFACES

- The following data port interfaces can be ordered: V.35, RS-530, V.36/RS-449 or X.21. A second data port can also be ordered.
- The synchronous data ports can operate in the following clock modes:
 - **DCE:** FCD-E1A provides both transmit and receive clocks to the user equipment, with optional sampling of the incoming data with an inverted clock
 - **DTE1:** FCD-E1A provides transmit clock, attached user equipment provides receive clock (not for X.21)
 - **DTE2:** attached user equipment provides both transmit and receive clocks (not for X.21)
- When equipped with IR-ETH, IR-ETH/Q or IR-ETH/QN interface modules, FCD-E1A transparently connects remote LANs, as well as VLANs, over the E1 links. It filters Ethernet frames, forwarding only frames destined to the WAN.
- The IR-ETH/QN port has the 10/100BaseT interface and supports autonegotiation and VLAN frames.
- FCD-E1A equipped with the IR-IP interface module operates as an IP gateway, forwarding packets destined to the IP network. This prevents broadcast to the WAN and enables the LAN users to register for an IP multicast group.
- FCD-E1A with the IR-IP interface module connects the local IP networks to the public networks at full E1 speed, in contrast to connection over statistical protocols, such as Frame Relay.

APPLICATIONS

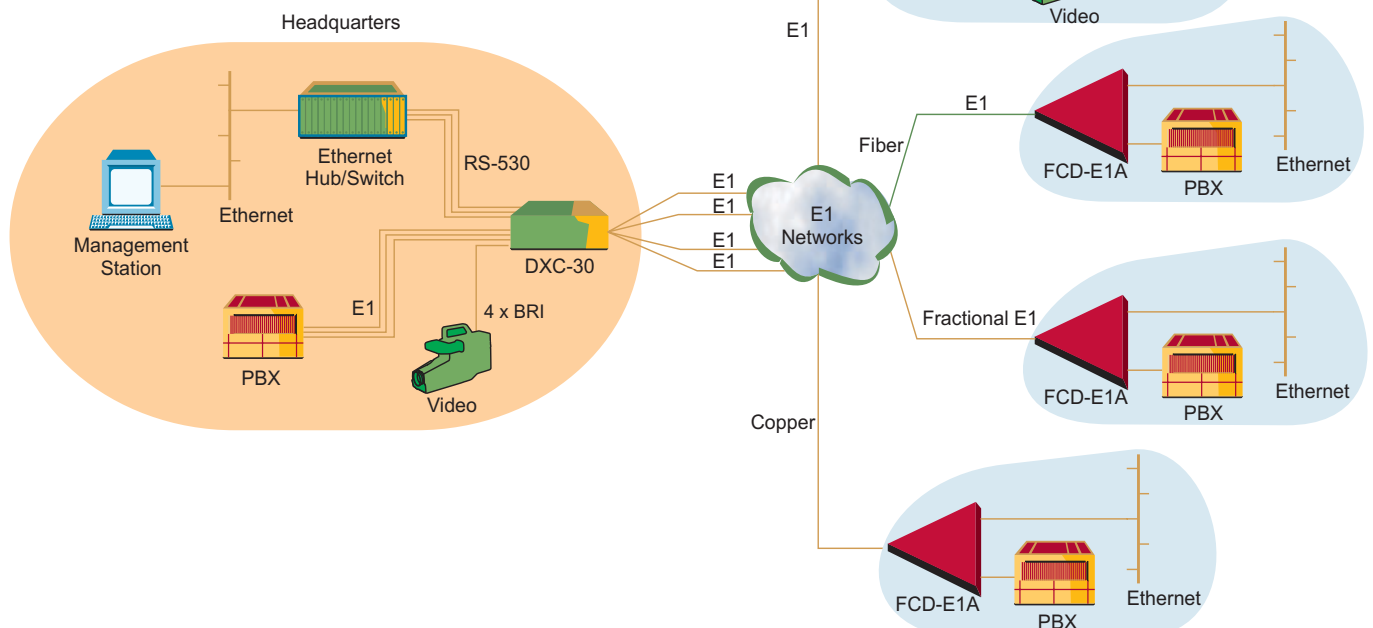


Figure 1. Extended Ethernet Management over E1 Network

- The IR-ETH/QN port is available with 10/100BaseT interface. Other Ethernet ports are available with 10BaseT (UTP) or 10Base2 (BNC) interfaces.
- The optional four ISDN "S" interfaces can be used for extending ISDN services to locations that do not support ISDN. Each "S" interface port operates in full duplex over 4-wire twisted-pair for a range of up to 1000m (3300 ft).
- The optional IBE backup interface enables FCD-E1A to provide automatic backup of its data port over switched ISDN networks.
- 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:
 - ASCII terminal connected to the SLIP control port
 - SNMP management connected through either SLIP control port or inband management.
 - Telnet session performed through either SLIP control port or inband management.
 - Menu-driven management using front panel LCD with three push-buttons.
- FCD-E1A has an internal SNMP agent and can be controlled by any generic SNMP station or by the RADview SNMP network management application.
- FCD-E1A supports both dial-in and dial-out modem connections. These connections can be used for remote out-of-band configuration and monitoring, as well as for sending callout alarm messages. Connection can be done via the serial V.24 SLIP, PPP or Ethernet ports.
- Inband management can be performed by using the spare bits (Sa bits) on Timeslot 0 (TS0) or by using a dedicated timeslot using standard protocols, Frame Relay (RFC 1490), PPP and standard RIP2 routing. 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.
- Maintenance capabilities include user activated local and remote loopbacks on the E1 main link, sub-E1 and data ports. The user can activate a BER test for each data port individually. Additionally, each data port responds to an ANSI FT1 inband loop code (RDL), generated from the remote FCD-E1A 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.

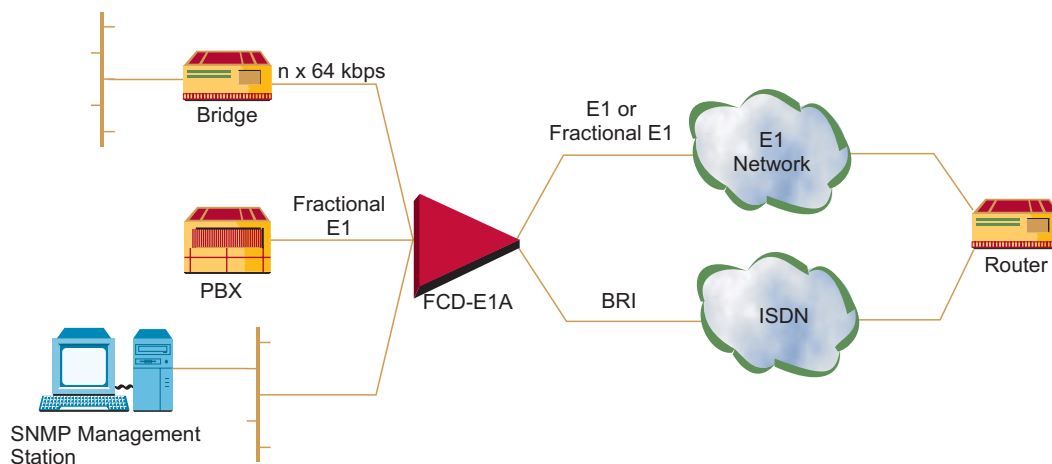


Figure 2. Connection of LAN Traffic together with PBX Traffic to E1 Network

FCD-E1A

E1 or Fractional E1 Access Unit

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
Unframed (main link only)
- **Bit Rate**
2.048 Mbps
- **Line Code**
HDB3
- **Impedance**
120Ω, balanced
75Ω, unbalanced
- **Signal Level**
Receive:
0 to -36 dB with LTU
0 to -10 dB without LTU
Transmit:
±3V (±10%), balanced
±2.37V (±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
- **Transmit Timing**
Locked to the system clock
- **Compliance**
ITU G.703, G.704, G.706, G.732
- **Performance Monitoring (on E1 Main Link)**
Local support of CRC-4
Statistics according to RFC-1406

FIBER OPTIC MAIN LINK

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

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 RS-530, female
- **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 clock from DCE
- **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 2* below.

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

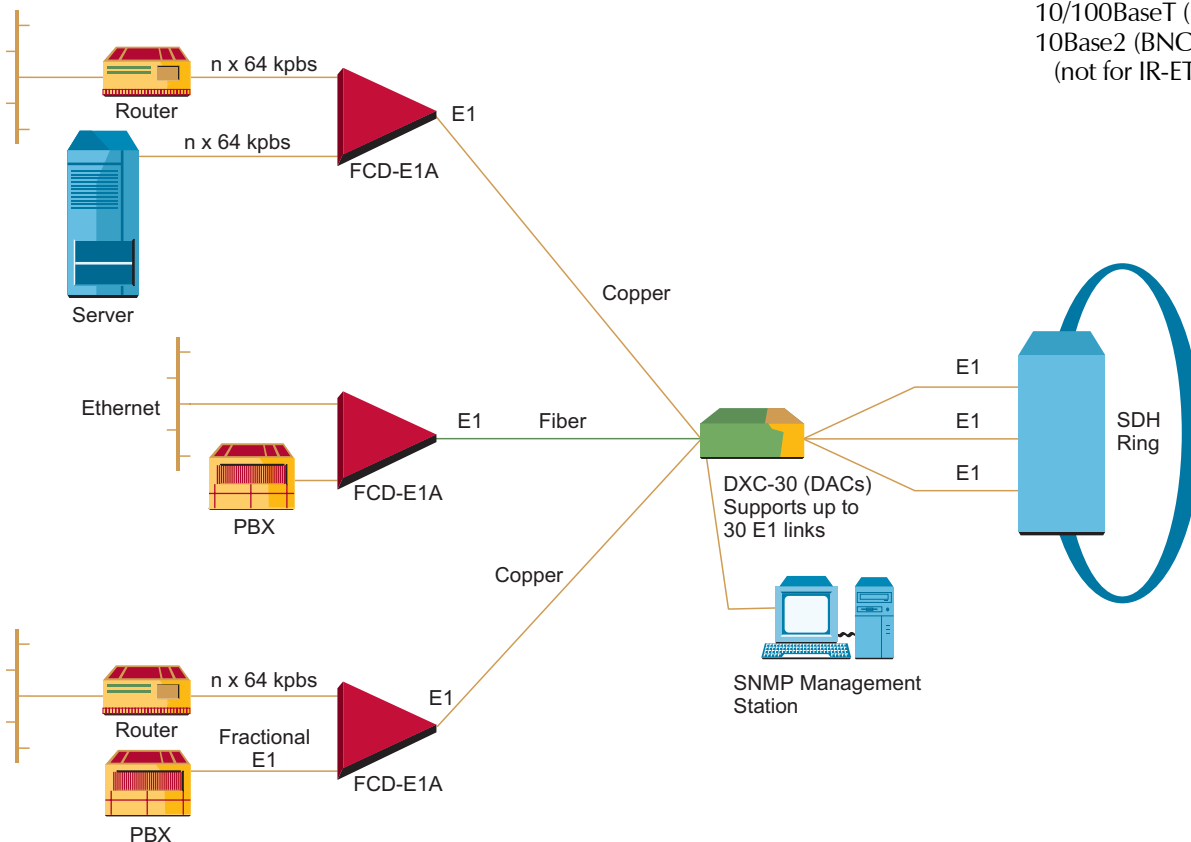


Figure 3. SDH Access Solution for Multiple Remote Sites

E1 or Fractional E1 Access Unit

"S" INTERFACE PORTS

- **Number of Ports**
Four "S" 2B+D interface channels
- **Compliance**
ETS 300012
- **Interface**
4-wire, full-duplex
- **Bit Rate**
192 kbps \pm 100 ppm
- **Line Code**
Pseudo-ternary
- **Line Termination**
100 Ω , \pm 5%
- **Range**
1000m (3300 ft)
Signal Levels
Receive:
+1.5 to -7.5 dB relative to the nominal amplitude
Transmit:
 \pm 750 mV
- **Timing Modes**
NT: Transmit timing is locked to system timing clock
TE: Looped back towards the "S" interface (timing is derived from RX signal from the ISDN switch NT)
- **Connector**
RJ-45 (8-pin) per channel
- **Power Feeding Voltage**
38V (\pm 4V), as per TR5805-3074
1W per channel

IBE BACKUP INTERFACE

- **Number of Channels**
One BRI "S" channel
- **Standards**
ITU I.430, Q.921, Q.931
ETSI NET 3, i-CTR3

- **Signal Format**
Pseudoternary line coding
- **Line Type**
Two unloaded twisted pair cables
- **Impedance**
100 Ω , balanced
- **Range**
Up to 1000m (3300 ft)
- **Connector**
RJ-45 (8-pin)

MANAGEMENT PORTS

- **CONTROL DCE 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
- **CONTROL Port (Serial)**
 - Connector
V.24/RS-232, 9-pin D-type female
 - Format
Asynchronous
 - Baud rate
0.3-57.6 kbps, autobaud
 - Character
8 bit no parity, 7 bit odd or even parity
- **CONTROL Port (Ethernet)**
 - Ethernet 10BaseT, RJ-45
 - Ethernet 10Base2, BNC

GENERAL

- **System Clock**
Internal clock: \pm 30 ppm
Loopback timing (sub, main E1):
 \pm 130 ppm
External timing from data port
n x 56, n x 64: \pm 130 ppm

- **Diagnostics**
Main E1 link:
Local and remote loopback
Sub-E1 port:
Local and remote loopback
BER test
Data port:
Local data port loopback
Remote data port loopback
BER test
Inband code activated loopback per data port
- **Timeslot Allocation**
Consecutive (bundled)
User-defined
- **Front Panel Control**
LCD:
2 rows of 16 characters
Push-buttons:
Cursor, Scroll, Enter
- **Indicators**
General: TST (yellow), ALM
Main E1: LOC SYNC LOSS, REM SYNC LOSS
Sub-E1: LOC SYNC LOSS, REM SYNC LOSS
Indicators are red except TST
- **Alarms**
Last 100 alarms are stored and available for retrieval. Each alarm is time stamped.
- **Alarm Relay**
3 relay contacts are available on the Alarm Relay port. The alarm relay is activated by alarms in the alarm buffer (user-defined).

Table 1. Fiber Optic Interface Characteristics

| Wave-length [nm] | Fiber Type [μ m] | Transmitter Type | Typical Power Coupled into Fiber [dBm] | Receiver Sensitivity [dBm] | Typical Optical Budget [dB] | Typical Maximum Range [km] | [mi] |
|------------------|-----------------------|------------------|--|----------------------------|-----------------------------|----------------------------|------|
| 850 | 62.5/125 multimode | LED | -18 | -38 | 18 | 5 | 3 |
| 1310 | 9/125 single mode | Laser | -12 | -39 | 25 | 62 | 38 |
| 1550 | 9/125 single mode | Laser | -12 | -39 | 25 | 100 | 62 |

FCD-E1A

E1 or Fractional E1 Access Unit

- **Physical**
Height: 4.3 cm / 1.7 in (1U)
Width: 21.5 cm / 8.5 in
Depth: 24.3 cm / 9.5 in
Weight: 1.3 kg / 2.9 lb
- **Power**
AC: 100 to 240 VAC; 47 to 63 Hz
DC: -48 VDC (40 to 57 VDC)
Power consumption: 10W max
- **Environment**
Temperature: 0-50°C / 32-122°F
Humidity: up to 90%,
non condensing

ORDERING

FCD-E1A*/~/~/\$/&%/#/+

E1 or Fractional E1 Access Unit

* Specify **S1** for optional drop & insert sub-E1 port. (Default is without sub-E1 port)

~ Specify power supply voltage:
AC for 110 VAC to 240 VAC
48 for -48 VDC

\$ Specify management port interface:
V24 for V.24/RS232 (DB-9)
UTP for Ethernet 10BaseT (UTP)
BNC for Ethernet 10Base2 (BNC)

& Specify data port interface:
530 for RS-530 interface
V35 for V.35 interface
X21 for X.21 interface
449 for V.36/RS-449 interface

% Specify optional second data port interface:

530 for RS-530 interface
V35 for V.35 interface
X21 for X.21 interface

449 for V.36/RS-449 interface
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)

ETQN for UTP Ethernet bridge VLAN (10/100BaseT)

ETUR for UTP Ethernet router (10BaseT)

ETBR for BNC Ethernet router (10Base2)

S0 for 4xS0 ISDN

IBE for ISDN backup "S" interface

Specify link connector type:

ST for ST type fiber connectors
FC for FC/PC type fiber connectors
SC for SC type fiber connectors (Default is G.703 electrical/copper interface)

+ Specify optical interface wavelength and transmitter type (not relevant with copper interface):

85 for 850 nm, multimode
13L for 1310 nm, single mode, laser
15L for 1550 nm, single mode, laser

CABLES

The following cables convert the FCD-E1A'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.

Table 2. 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 802.1/q frames, and IR-ETH/QN conforms to IEEE 802.1q (relevant parts), 802.1p and 802.3x.



data communications

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