HCD-E1

HDSL CSU/DSU

Installation and Operation Manual

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Always observe standard safety precautions during installation, operation and maintenance of this product. Only a qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this instrument. No adjustment, maintenance or repairs should be performed by either the operator or the user.

Telecommunication Safety

The safety status of each of the ports on HCD-E1 are declared according to EN41003 and is detailed in the table below. Interconnection of these ports with other apparatus should be made such that the equipment continues to comply with clause 2.3 of EN60950 for SELV circuits after such a connection is made.

Ports	**Safety Status**	
Data channels, unbalanced E1, supervisory port, alarm relay, LAN	SELV	Circuit operating with Safety Extra-Low Voltage
HDSL, balanced E1	TNV-1	Circuit whose normal operating voltage is within the limits of SELV, on which overvoltages from Telecommunications Networks *are* possible.

Regulatory Information

FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning per EN 55022

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Declaration of Conformity

Manufacturer's Name:	RAD Data Communications Ltd.
Manufacturer's Address:	24 Raoul Wallenberg St. Tel Aviv 69719 Israel

declares that the product:

Product Name: **HCD-E1**

Conforms to the following standard(s) or other normative document(s):

EMC:	EN 55022 (1994)	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
	EN 50082-1 (1992)	Electromagnetic compatibility – Generic immunity standards for residential, commercial and light industry.
Safety:	EN 60950 (1992/93)	Safety of information technology equipment, including electrical business equipment.

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC. The product was tested in a typical configuration.

Tel Aviv, August 4th, 1998

Haim Karshen
VP Quality

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Quick Start Guide

Installation of HCD-E1 should be carried out only by an experienced technician. If you are familiar with RAD's HDSL modems, use this guide to prepare HCD-E1 for operation.

1. Installing HCD-E1

Switch and Jumper Settings

HCD-E1 contains two sets of jumpers:

- Main board internal jumpers and DIP switch
- E1 sublink interface board jumpers.

If you are using HCD-E1 as a central unit (LTU), you can use the default settings for the main board R/C jumper and DIP switch.

- If you are using HCD-E1 as a remote unit (NTU), do the following:

  1. Turn the unit off.
  2. Open the HCD-E1 case.
  3. Set the R/C jumper (JP4) to the R (remote) position.
  4. Set section 2 (DB INIT) of the S1 DIP switch to ON.
  5. Turn the unit on for a short time (until self-test is completed).
  6. Turn the unit off.
  7. Set section 2 (DB INIT) of the S1 DIP switch to OFF.
  8. Turn the unit on.

If you are operating HCD-E1 with a balanced E1 interface, you can use the default settings of the sublink interface board jumpers.

- If you are using HCD-E1 with an unbalanced E1 interface, do the following:

  1. Turn the unit off.
  2. Open the HCD-E1 case.
  3. Identify and remove the three nuts that fasten the sublink interface board to the spacers.
  4. Remove the nuts and their washers.
  5. Disconnect the flat cable from the connector J10 on the main board.
  6. Hold the sublink interface board from its sides, and carefully pull it straight up. Once the board is free, turn the board over the rear panel, and let it rest on the work table. Do not strain the wires connecting the board to the BNC connectors.

7. Set the JP12 jumper to UNBAL E1.
8. Set the JP16 and JP17 jumpers to UNBAL.
9. Connect the JP9 jumper.
10. Install the JP8 and JP10 jumpers.
11. Reinstall the sublink interface board by reversing the procedure by which you removed it. Pay special attention to the following:
    - Mate correctly the flat cable connector with the corresponding main board connector.
    - Make sure that the RJ-45 connector has been properly inserted into its place in the rear panel, and none of the BNC connectors wires have been damaged.
    - Make sure to place the original washers under each nut. Fasten the nuts tightly.

Connecting the Interfaces

Connecting the E1 Sublink

- Connect the E1 sublink. For a balanced interface, use an RJ-45 connector and connect it to the HCD-E1 port marked SUB E1. For an unbalanced interface, use two BNC connectors and connect them to the HCD-E1 ports marked RX OUT and TX IN.

Connecting the Data Ports

- Connect the DTEs to the HCD-E1 data channel ports. Use the adapter cables supplied with the unit.

Connecting the Line

- Connect the HDSL line to the HCD-E1 rear panel RJ-45 port designated HDSL.

Connecting the Control Terminal

- If you are using a control terminal, connect a cable between the control terminal and the port designated CONTROL DCE.

Connecting the Power

AC-Powered Unit

- Use the 5 ft (1.5m) standard power cable provided with the unit. Make sure the ON/OFF switch on the rear panel is set to OFF, then connect the cable first to the HCD-E1 rear panel, then to the power source.

DC-Powered Unit

- For the DC version of HCD-E1, refer to *DC Power Supply Connection Supplement*.

2. Configuring HCD-E1

You can configure and operate HCD-E1 from either the front panel or a supervisory terminal.

Note *Some of the HCD-E1 configuration parameters depend on the type of remote unit being used. Therefore, after the HDSL synchronization is reached, wait for about 1 minute before you start configuring the modem. This allows the proper recognition of the remote unit and ensures the correct HCD-E1 configuration.*

Configuring HCD-E1 from Front Panel

To configure HCD-E1 from the front panel:

1. Scroll to the SYSTEM PARAMETER in the top row of the front-panel LCD and set the system parameters (available for the HCD-E1 unit configured as central).
2. Scroll to SL PARAMETERS in the top row of the front panel LCD and configure the time slot allocation.
3. Scroll to CHANNEL PRM in the top row of the front panel LCD and, for each data channel, configure the data rate, and time slot allocation. This command also allows you to set several other data transfer parameters, depending on whether or not the channel has an Ethernet interface.
4. If your application explicitly requires the use of the unframed mode, select it under SL PARAMETERS or CHANNEL PRM. Make sure to assign all 32 times slots to the active port.
5. Scroll to DNLOAD PRM in the top row of the front panel LCD and set the parameters for inband transmission of management data.

Note *The inband transfer of the management traffic is not available in the unframed mode.*

The remote unit automatically downloads the configuration of the central unit, unless the CONFIG REMOTE parameter in the SYSTEM PARAMETER screen of the central unit is set to NO.

Configuring HCD-E1 from Control Terminal

If you want to manage HCD-E1 from a remote supervisory terminal, you must prepare the unit by setting its control port parameters from the front panel:

1. Scroll to SP PARAMETERS in the top row of the front panel LCD.
2. Set the speed, data rate, parity, interface, and management mode parameters for the control port.

To configure HCD-E1 from a control terminal:

1. Configure the terminal as follows:
   - Select full-duplex mode.
   - Turn the terminal echo off.
   - Disable any type of flow control.

2. Connect the terminal to the CONTROL DCE port of HCD-E1.
3. Press **<Enter>** three times.
4. If the terminal displays the password prompt (**PASSWORD>**), enter the password. The default password is **HCD**. If the node number of HCD-E1 is a number other than zero, enter the node number along with the password. Use the following syntax:

   NODE<Space>'node number'<Space>'password'<Enter>

   If there is no password prompt, just enter the node number, followed by the desired command.

   The prompt **HCD>** appears.
5. Select the control terminal type by entering the **DEF TERM** command. The default terminal type is VT-100. The other type options are VT-52, TV-920, FREEDOM-100, and FREEDOM-220. Use the following syntax to set the terminal type:

   DEF TERM<Space>'terminal type'<Enter>

Note *If you enter DEF TERM without the terminal type, HCD-E1 resets all the control terminal codes to 0.*

If your terminal requires control sequences different from those used by the terminals listed above, type the command **F** and enter your terminal control sequences. If the current control codes are not compatible with your terminal and you cannot enter the desired codes, enter the **INIT F** command to reset the codes to 0, then use the **F** command to modify the control codes starting from the known field values.

6. Set the following additional CONTROL DCE port parameters by entering the **DEF SP** command: password protection, idle disconnect time etc.
7. Set the system parameters by entering the **DEF SYS** command.
8. Set the sublink parameters by entering the **DEF SL** command.
9. Configure the data channel parameters by entering the **DEF CH X** command, where **X** is the channel number (1 or 2).
10. If you are using an SNMP management application:
    - Use the **DEF AGENT** command to configure the SNMP agent parameters.
    - Use the **DEF DL** command to configure the in-band management parameters.
11. If you are using the terminal to control a single HCD-E1 unit, do not change the node number 0 assigned to the unit. For multidrop operation, you can assign each HCD-E1 unit a node number between 1 and 255. Use the **DEF NODE** command to assign a node number.

12. You can assign each HCD-E1 unit a logical name of up to eight characters. The logical name helps identify the source of alarm messages that HCD-E1 sends to the supervision terminal. Use the **DEF NAME** command to assign a logical name.
13. To reset HCD-E1, use the **RESET** command.
14. To reset a configuration of HCD-E1 to default values, use the **INIT DB** command.

Note

- *The RESET and the INIT DB commands cause HCD-E1 to reinitialize, disrupting traffic through HCD-E1 until it resumes normal operation.*
- *Change of the framing mode causes double temporary synchronization loss.*

Tips

- *Use the **HELP** command to display the correct syntax of commands.*
- *It is usually sufficient to configure the central unit only, in which case the central unit's configuration parameters are automatically downloaded to the remote unit.*

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Introduction

1.1 Overview

General

HCD-E1 is a standalone HDSL NTU (Network Terminal Unit) / LTU (Line Terminal Unit) that provides the user with one E1 sublink drop & insert port and two n × 64 kbps or n × 56 kbps data channels. Fractional E1 from the E1 sublink, as well as data from the n × 64 kbps / n × 56 kbps channels are multiplexed over E1 frames and transferred by the HDSL modem to the remote location. For direct connection to DACS, RAD's HCD-E1 unit can be used in the central office, eliminating the need to convert back to n × 64 kbps.

HCD-E1 supports the transmission of two synchronous data channels and one E1 sublink, over the HDSL link. The sublink enables the connection of fractional E1 equipment (digital PBXs), thus enabling HCD-E1 to serve as an integrating multiplexer for E1 and fractional E1 services.

The mapping of the user's data to the main link time slots is user-selectable. For the synchronous data ports and E1 sublink, three mapping methods are available: bundling into consecutive or alternate time slots, or placing in individually selected time slots. A sublink time slot is always routed to the main link time slot with the same number.

In addition, HCD-E1 can also be operated in an unframed mode: in this mode HCD-E1 accepts a 2048 kbps data stream through the E1 sublink or data channel and converts it to an unframed G.703 signal for transport over the HDSL link. Thus, HCD-E1 can also serve as an interface converter and high-speed, short-distance modem.

HCD-E1 can work with an HDSL repeater (H-RPT) on the main link. HCD-E1 can check the H-RPT alarm messages and connect/disconnect the local loopback on H-RPT (LOOP L HRPT).

Versions

HCD-E1 can be ordered in several versions, which differ in the number and type of user ports:

- One or two synchronous data channels. The data channels can be ordered with RS-530, V.35, V.36/RS-449, or X.21 interfaces.
- One synchronous data channel (with RS-530, V.35, V.36/RS-449, or X.21 interface) and one Ethernet interface module (IR-ETH, IR-ETH/Q, or IR-IP).

When you order a unit with a V.35, V.36/RS-449, or X.21 interface, you receive a unit with the RS-530 interface provided with a corresponding adapter cable.

HCD-E1 is available in the AC and DC versions.

The AC version is powered by 100 to 240 VAC, 50 or 60 Hz. As an option, HCD-E1 can also be ordered with a -48 VDC power supply.

Note

*In this manual, the generic term **HCD-E1** is used when the information is applicable to all HCD-E1 versions. Information applicable to a specific version is explicitly identified.*

Applications

Figure 1-1 shows a typical application for HCD-E1. In this application, HCD-E1 is used to connect the synchronous data channels over an HDSL line, while the sublink is used to connect to a digital PABX trunk.

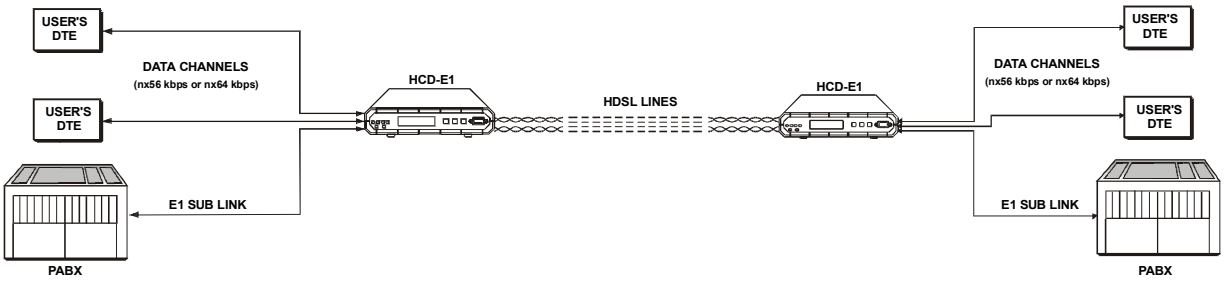


Figure 1-1 Typical HCD-E1 Application

Features

Statistics Collection

HCD-E1 offers extensive performance statistics collection capabilities:

- **E1 performance statistics.** When operating with the CRC-4 option enabled, HCD-E1 stores E1 line statistics in compliance with the requirements of ITU-T Rec. G.706. The user can display the statistics collected for the line connected to the E1 sublink of the local unit, as well as for the link connected to the E1 sublink of the remote unit.
- **HDSL performance statistics.** HCD-E1 stores performance statistics for each of the two HDSL lines in compliance with the requirements of ITU-T Rec. G.826.

Test and Diagnostics Capabilities

HCD-E1 has comprehensive diagnostics capabilities, which include the following loopbacks:

- Local loopbacks on the data channel and E1 sublink of the local HCD-E1
- Local loopback on the HDSL lines

- Remote loopbacks on the data channel and E1 sublink of the local HCD-E1
- Remote loopbacks on the data channel and E1 sublink of the remote unit.
- Inband-activated remote loopback on the data channel of remote HCD-E1
- H-RPT local loop (towards the HCD-E1 configured as central) when working with the HDSL repeater.

In order to enable testing of marginal links, HCD-E1 also offers Bit Error Rate (BER) testing on the synchronous data channels, using locally generated, pseudo-random sequence. To provide compatibility with other BER testing equipment, the user can select the pseudo-random pattern that best matches his need.

Maintenance is further enhanced by advanced power-up self-test capabilities, and by an automatically performed cyclic self-test that provides circuit-level diagnostics data. The user can also read the diagnostic data of the remote unit through the HDSL link.

HCD-E1 can identify the type of the unit at the remote end of the HDSL link and provides the user with a possibility to read the diagnostic data of the remote unit through the HDSL link.

LEDs and Alarms

HCD-E1 responds to any alarm detected during its operation by an alarm message and stores it in a buffer that can hold up to 100 messages. A front panel LED indicator lights when the alarm buffer contains alarm messages. The local operator can then review the contents of the alarm buffer on the front panel display, or from an ASCII terminal connected to the supervisory port.

HCD-E1 can provide an alarm indication by means of an alarm relay (dry contacts), which enables remote signaling of alarm conditions when HCD-E1 is located far from the personnel in charge for its proper operation.

In addition to the alarm buffer, front-panel LED indicators display in real time the status of the E1 sublink and the HDSL lines, and alert when test loops are present in the system. The status of the LAN in the case of the Ethernet version is indicated by the Ethernet module LEDs located on the HCD-E1 rear panel.

Time Slot Handling

When operating in any of the framed modes, HCD-E1 allows the user to configure the routing of the individual time slots for each of the data channels, and for the sublink. The routing can be modified during system operation, without disrupting the service to users of time slots that are not rerouted. HCD-E1 automatically connects the time slots in both the receive and transmit directions.

To expedite the routing, HCD-E1 supports two “bundle” routing modes, called “sequential bundle” and “alternate bundle” modes. In the sequential mode, one “bundle” (group of consecutive time slots, identified by the number of the starting time slot and the total number of time slots) can be routed to the corresponding main link time slots, where they are inserted in the main link frame sequentially, in consecutive time slots (1, 2, 3, 4, 5, etc). In the alternate mode, the time slots are inserted in the following way: 1, 3, 5, 7, etc.

For data channels and the sublink, the user can either individually select the main link time slots in which the user's data is to be inserted, or can use one of the “bundle” routing modes. Time slots assigned to data channels are always defined as data time slots. A sublink time slot is always routed to the main link time slot with the same number.

Priority Bumping

HCD-E1 will continue working (at a half of its baud rate) even if one of its HDSL lines is down. The priority bumping feature allows the user to select the timeslot priority (high or low) in this case. The time slots which have been assigned high priority will continue being sent on the remaining HDSL line.

Unframed Mode

HCD-E1 can also be operated in an unframed mode: in this mode HCD-E1 accepts a 2048 kbps data stream through the E1 sublink or data channel and converts it to an unframed G.703 signal for transport over the HDSL link. Thus, HCD-E1 can also serve as an interface converter and high-speed, short-distance modem.

When the unframed mode is selected in the E1 sublink, HCD-E1 transparently transfers the data stream received from the E1 port to the main link. The E1 sublink or data channel must be configured for operation in unframed mode at a data rate of 2048 kHz, and the other data ports must be disconnected from the main link.

1.2 Physical Description

HCD-E1 is a compact unit, intended for installation on desktops or shelves. The unit height is 1U (1.75").

An optional rack-mount adapter kit enables the installation of one or two HCD-E1 units in a 19" rack.

Figure 1-2 shows the 3D view of HCD-E1.

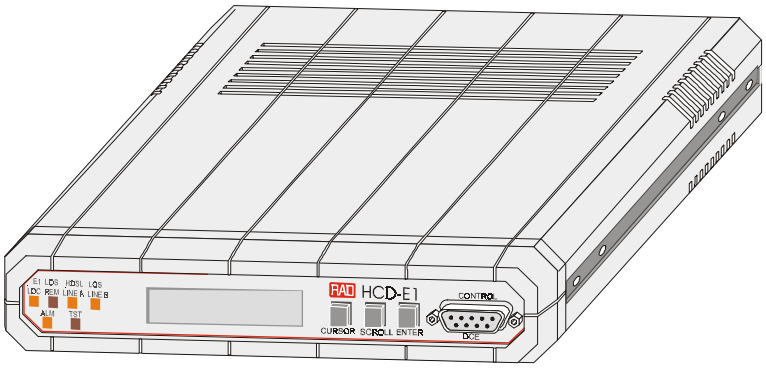


Figure 1-2 HCD-E1 3D View

Front Panel

The front panel provides control over the unit operation. The LEDs provide real-time indications related to the operation and status of the unit.

The LCD together with three push-button switches are used to display status (alarm) messages, diagnostics and performance monitoring data, test status and configuration parameters of HCD-E1. You can also use the LCD and push buttons to configure the unit. For details, see Chapter 3, *Operation* and Chapter 5, *Troubleshooting and Diagnostics*.

Rear Panel

The rear panel of the unit allows access to interface and power connections. For details, see Chapter 2, *Installation*. For versions with the Ethernet data channel, the rear panel contains Ethernet module LEDs providing real-time indications related to the operation and status of the LAN.

1.3 Functional Description

Data Channel Characteristics

HCD-E1 data ports support user-selectable transmission rates. The supported data rates are integer multiples of 56 kbps or 64 kbps (n × 56 kbps or n × 64 kbps, where n is in the range of 1 to 32, corresponding to rates in the range of 56 kbps to 1792 kbps, or 64 kbps to 2048 kbps respectively).

HCD-E1 supports the following types of data port interfaces: RS-530, V.35, X.21, V.36/R-449/422 and IR-ETH (10BaseT or 10Base2), IR-ETH/Q (10BaseT) or IR-IP (10BaseT).

HCD-E1 has two data ports, each terminated in a 25-pin D-type female connector. The units with an Ethernet interface arrive with the Ethernet interface module built in the upper port.

When using the RS-530 interface, equipment with RS-530 interface can be directly connected to the data channel connector using standard cables. Equipment with V.36/RS-422/RS-449, X.21 and V.35 interfaces can be connected by means of adapter cables, supplied with the unit.

Each HCD-E1 data port supports the following control lines:

- **RTS** - input from the locally connected data equipment
- **CTS** - the user can permanently set the CTS line in the active state, or can make the CTS line follow the RTS line.
- **DSR** - the DSR line is always active when the HCD-E1 is powered, except when a remote main link test loopback is activated.
- **DCD** - the DCD line is active when the HCD-E1 main link interface is synchronized.

E1 Link Interface Characteristics

The HCD-E1 sublink (E1) interface meets the requirements of ITU G.703, G.704, G.706, and G.732. HCD-E1 supports framed and unframed E1 data streams. For framed data streams, HCD-E1 also supports the CRC-4 option specified in ITU G.704. CRC-4 use is user-selectable.

The E1 port has two line interfaces: a 120-Ω balanced line interface terminated in an RJ-45 eight-pin female connector, and a 75-Ω unbalanced interface terminated in two BNC female coaxial connectors. Line coding is HDB3. The nominal balanced interface transmit level is ±3V, and the unbalanced interface transmit level is ±2.37V. The maximum allowed line attenuation is up to 10 dB.

To increase the E1 sublink range, it can be ordered with an integral LTU. In this case, the maximum line attenuation is 36 dB, enabling range of up to 2 km, using typical cables.

Jitter performance complies with the requirements of ITU G.823.

HDSL Subsystem Characteristics

The HCD-E1 HDSL subsystem uses dual duplex transmission over two 2-wire lines. The line code on the HDSL lines is 2B1Q at a rate of 584 kbaud (equivalent to a data transfer rate of 1168 kbps).

Using advanced equalization, adaptive filtering, and echo cancellation techniques, HCD-E1 compensates for line impairments, bridged taps, and mixed cables commonly encountered in the local distribution network. Moreover, due to its high immunity to background noise, HCD-E1 enables the transmission of multiple HDSL signals in the same physical cable without requiring pair selection.

HCD-E1 can operate on unloaded AWG-22, AWG-24, and AWG-26 twisted-wire pairs, and other similar pairs. Up to two bridged taps, having a length of up to 500m, are tolerated. HCD-E1 achieves typical ranges of 4.8 km (3.0 miles) on AWG-24 (0.5 mm) pairs, and up to 3.8 km (2.4 miles) on AWG-26 (0.4 mm) pairs. When working with the HDSL repeater (H-RPT), typical ranges are up to 9.2 km (5.7 miles) from central to remote unit on AWG-24 (0.5 mm) pairs, and up to 7.2 km (4.5 miles) from central to remote unit on AWG-26 (0.4 mm) pairs. The HDSL line interfaces are terminated in an RJ-45 eight-pin female connector.

The transmission of data on each twisted-wire pair (HDSL line) is full duplex, and except for the distribution of payload data bits between the two lines, each HDSL line operates independently.

HCD-E1 provides an embedded operations channel (***eoc***) within the HDSL data streams, which enables end-to-end system management and supervision.

The HDSL subsystem operates in a master-slave mode.

The master unit, called *line termination unit* (LTU), determines the distribution of payload data between the HDSL lines, controls the system start-up procedure, provides the timing reference for HDSL line transmission, and manages the communication on the *eoc* channel.

The slave unit, located at the remote end of the link, is called *network termination unit* (NTU).

HCD-E1 supports both the central (LTU) and the remote (NTU) operating modes; the actual operating mode (LTU or NTU) is user-selectable.

Note *If you have a phantom-fed H-RPT on the HDSL link, your HCD-E1 must be used as NTU only.*

Management

Local Control

HCD-E1 is designed for unattended operation. HCD-E1 configuration, that is, the complete collection of its operating parameters, is determined by a database stored in non-volatile memory. The database parameters and the operation of HCD-E1 can be controlled by means of a simple menu, operated by push buttons located on the front panel. During setup, the LCD display guides the operator in the execution of the desired operations. The display provides information concerning the current system configuration and operating mode, and the available values of each programmable parameter. In case of operator errors, HCD-E1 displays the configuration error number, which helps the operator take the correct action.

Remote Management

In addition to front panel control, HCD-E1 supports management from a remote location. The remote management capabilities can be used to configure the HCD-E1 parameters and display status (alarm) messages, diagnostics information, performance monitoring data, and the test status.

These functions are performed through a serial RS-232 port that enables serial communication with a supervision terminal.

Using the supervision terminal functions, the user can also enable remote management using IP communications, i.e., Telnet and SNMP. The IP communication uses the Serial Link Internet Protocol (SLIP).

The remote management capabilities available through the serial RS-232 port are as follows:

- Management by means of a Supervision Terminal
- Management by means of Telnet
- SNMP Management.

If you have an H-RPT on your link, you can use either SP or Telnet management to display the status messages of H-RPT and, if your application allows this, connect/disconnect the H-RPT loop (from the unit configured as central). For the description of the H-RPT loop and how to operate it, refer to Section 5.4, *Diagnostic Tests* in Chapter 5.

Management by means of a Supervision Terminal. Any "dumb" ASCII terminal connected to the CONTROL DCE port of HCD-E1 (or a PC running a terminal emulation program), controlled by the program stored in HCD-E1, can be used as a supervision terminal.

The supervision terminal can communicate with HCD-E1 using either point-to-point or polled (multidrop) communication. For polling purposes, each HCD-E1 can be assigned an eight-bit address, for a maximum of 255 nodes (the zero address is reserved).

As an option, you can connect a dial-up modem to the control port, to provide call-in capabilities.

In addition to the remote management functions listed above, the supervision terminal is also used for the preliminary configuration of HCD-E1, to enable the use of IP communication for Telnet and SNMP management.

Management by means of Telnet. HCD-E1 also supports the Telnet protocol, which enables remote management using the same command line interface available with a supervision terminal. Telnet uses TCP/IP communication through the RS-232 port of HCD-E1.

SNMP Management. The SNMP management capability enables fully graphical, user-friendly management using the RADview network management stations offered by RAD, as well as management by other SNMP-based management systems.

Inband and Out-of-Band Management

HCD-E1 includes a proprietary IP router for in-band management traffic. This function enables HCD-E1 to transfer in-band IP and SNMP management messages generated by or addressed to other HCD-E1 units, and also transfer in-band management traffic addressed to other RAD equipment that operates over E1 links, such as MEGAPLEX-2100, DXC-30/DXC-10A/DXC-8R, etc.

A basic management topology, which is suitable for both SNMP and Telnet management, is shown in *Figure 1-3*. In this example, a network management station is attached to an Ethernet LAN. A remote access LAN extender, MBE/RAS/A, is located near the managed equipment (such as HCD-E1, MEGAPLEX-2100(*), etc.), and its serial ports are connected via cables to the CONTROL connectors of the equipment.

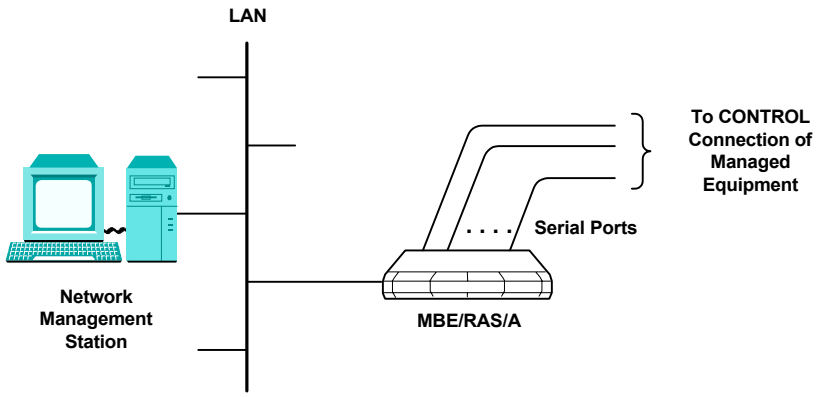


Figure 1-3 Basic Management Topology Using Network Management Station

HCD-E1 also includes an SNMP agent that enables SNMP management of the HCD-E1, using the UDP-over-IP protocol. The SNMP agent can communicate out-of-band and/or in-band, where each communication mode can be separately enabled:

Out-of-band communication is performed via the serial ports of HCD-E1, using the Serial Link Internet Protocol (SLIP). When using out-of-band communication, it is necessary to disable the Autobaud function, and select a specific data rate for the port data rate (9600 bps is recommended).

In-band communication is performed over HDSL lines (i.e., over the main link), and when applicable, over the sublink as well. This communication mode uses a proprietary protocol. The user can configure the system to transfer the in-band management traffic either by means of the E1 time slot 0 (sublink), or in a dedicated user-selected time slot (main link or sublink). Using in-band management, a user of an SNMP management station connected to one HCD-E1 can also control the HCD-E1 unit located to the remote end of the main link, or the sublink.

The in-band management data rate depends on the selected routing method:

- When using the TS 0 of the sublink, the data rate is 4 kbps.
- When using a dedicated main link slot, the data rate is 64 kbps.
- When using a dedicated sublink slot, the data rate is 8 kbps.

The HCD-E1 SNMP agent must be enabled by the user, so that it will accept the management messages transmitted by the network management station.

Each SNMP agent recognizes the messages addressed to its own IP address. In addition, the SNMP agent includes a proprietary built-in IP router, which is able to route management messages in accordance with the network topology determined by the routing algorithm, without requiring the user to provide a priori topology information on the network. The user can read the information collected by the IP router on the additional remote SNMP agents which are served by the router.

The proprietary IP router operates only on the in-band traffic.

The advanced capabilities of the HCD-E1 SNMP agents allow easy integration of the HCD-E1 in wide-area managed communication systems. Its capabilities support any practical communication network topology, as illustrated in the example shown in *Figure 1-4*.

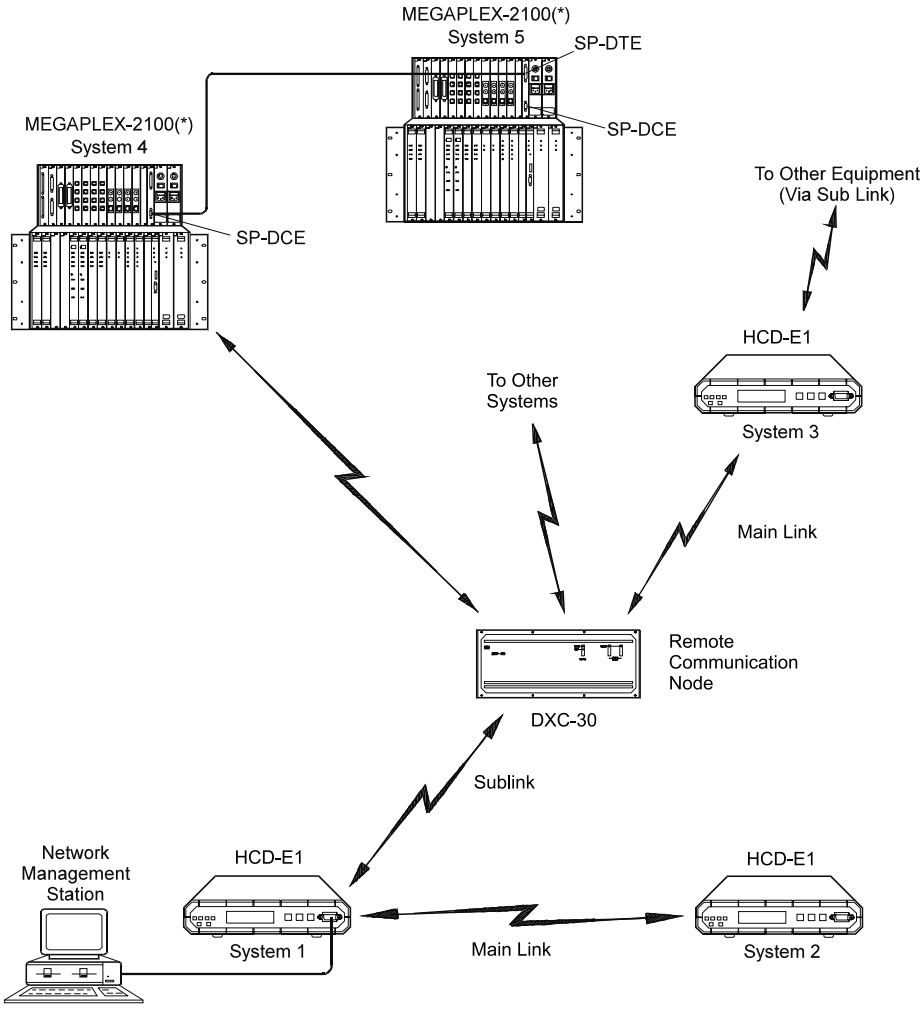


Figure 1-4 Extended Management Topology Using Network Management Station

The network shown in *Figure 1-4* can be managed by a single network management station, because of the flexible routing capabilities of the SNMP agent can carry the management traffic over many different paths.

For example, the following paths can be made available for the management traffic, when the management station is attached to HCD-E1:

- The network is connected to the network management station using a single serial communication link, attached to the CONTROL DCE port of HCD-E1 (system 1).
- In-band communication through the HCD-E1 No. 1 main and sub links is used to manage the remote units connected to the remote ends of the corresponding links:
  - HCD-E1 No. 2 is managed via the main link of HCD-E1 No. 1.
  - The sublink of HCD-E1 No. 1 is connected via the E1 transmission plant to a remote communication node, which is used to perform rerouting. The rerouting is based on a digital cross-connect system and E1/T1 converter, DXC-30, also offered by RAD. The DXC-30 can be configured to support the RAD proprietary in-band management protocol using time slot 0.
  - The DXC-30 transfers the management traffic to several of its ports. These ports are connected to other systems, e.g., HCD-E1 No. 3, MEGAPLEX-2100(*) No. 4, etc. Each remote system can relay the management traffic to other equipment.

Thus an entire wide-area network can be managed by means of a network management station connected to any HCD-E1 unit (or to any of the other RAD equipment which supports SNMP management).

Control of Remote Unit from Central Unit

As described above, the operation of the HCD-E1 system is basically asymmetrical, i.e., the HDSL subsystem inherently operates in a central (master)/remote (slave) mode. HCD-E1 takes advantage of this characteristic to expedite the configuration, management and supervision tasks related to the remote unit.

All the parameters that determine the end-to-end system performance can be configured on the central unit only. They are automatically transferred (**downloaded**) from HCD-E1 configured as central to the unit configured as remote, using the *eoc* channel. The user of the local unit configured as central can also initiate tests on the unit configured as remote.

Using the remote management, the user of the local unit can read and clear through the *eoc* channel the alarm messages and performance parameters of the unit at the remote site.

Thus, HCD-E1 configured as central unit serves as a full-function proxy agent for the remote unit with respect to all the management methods (LCD, supervision terminal, Telnet, and SNMP). When using in-band management, each unit is managed separately and operates as an agent in its own right.

System Timing

HCD-E1 offers selectable timing options, which enable the distribution of timing over the HDSL system, from the central office to the remote end. The use of stuffing on the HDSL subsystem ensures that the E1 signal and the data rate provided to the customer equipment by the remote unit are locked to the timing of the E1 signal and data rate received by the central unit.

HCD-E1 Configured as Central Unit (LTU)

The HCD-E1 unit configured as LTU has two timing modes: external timing and internal timing.

With **external timing**, the HCD-E1 system timing is locked to the clock signals recovered from the incoming clock or to external clock signals (derived from one of the synchronous data channels or from the E1 sublink). *Figure 1-5* shows the flow of timing signals through the HCD-E1 system in the external timing mode.

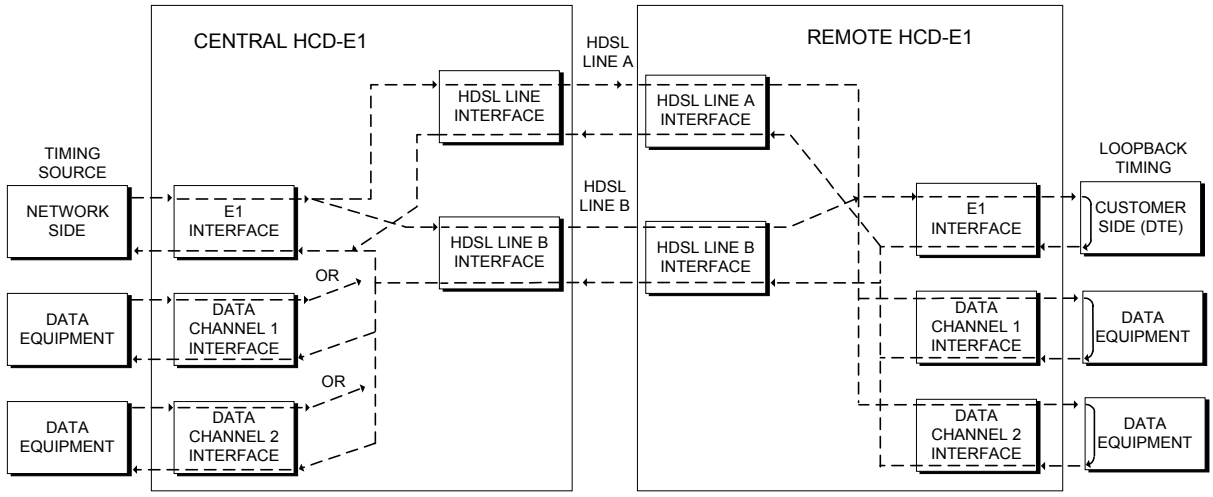


Figure 1-5 Flow of Timing Signals through HCD-E1 System in the External Timing Mode

With **internal timing**, the HCD-E1 system timing is determined by the clock signal generated by an internal crystal oscillator. *Figure 1-6* shows the flow of timing signals through the HCD-E1 system in the internal timing mode.

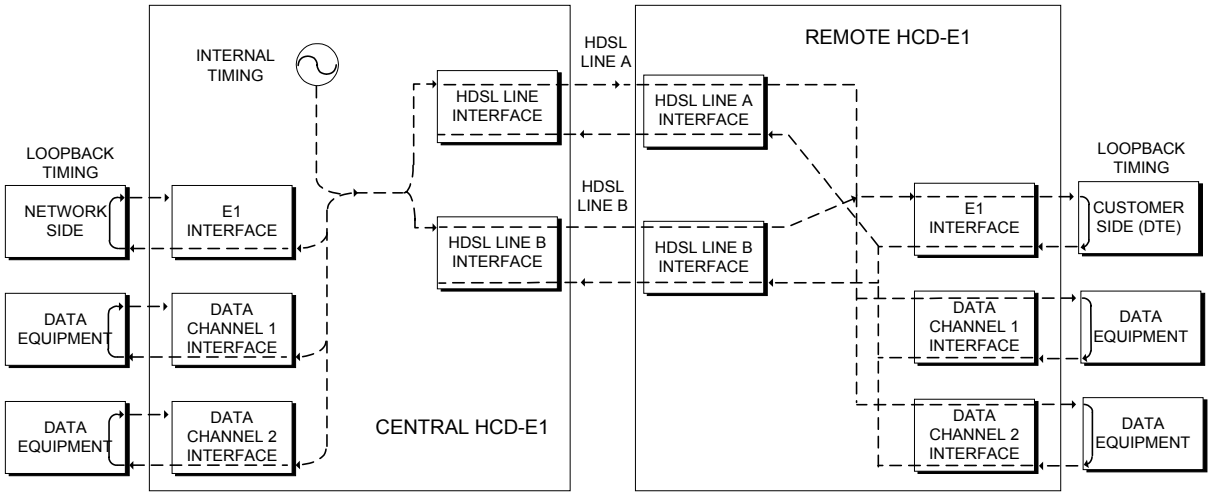


Figure 1-6 Flow of Timing Signals through HCD-E1 System in the Internal Timing Mode

HCD-E1 Configured as Remote Unit (NTU)

The HCD-E1 unit configured as NTU always locks its internal system timing to the incoming HDSL signals, that is, to the timing of the unit configured as central. The timing is derived from the clock signal recovered from line A; if line A fails, HCD-E1 automatically switches to the clock signal recovered from line B.

Data Channel Timing

The HCD-E1 data ports have three timing modes: DCE, DTE1 and DTE2.

- In the **DCE** timing mode, the HCD-E1 data channel provides transmit and receive clocks for the equipment connected to the data port.
- In the **DTE1** timing mode, the HCD-E1 data channel sends the receive data accompanied by the receive clock, derived from the main system clock, to the data equipment connected to the data port, and accepts data according to the data equipment transmit clock.
- In the **DTE2** timing mode, the HCD-E1 data channel transmits and receives data according to the clock signals provided by the equipment connected to the data port. When using this clocking mode, the main link timing must be locked to the clock signal supplied by the data port interface. The DTE2 mode is not available on channels with X.21 interface.

Figure 1-7 shows a typical application which uses one of the data channels, operating in the DTE2 timing mode, as the timing reference source, and illustrates the flow of timing signals within the system.

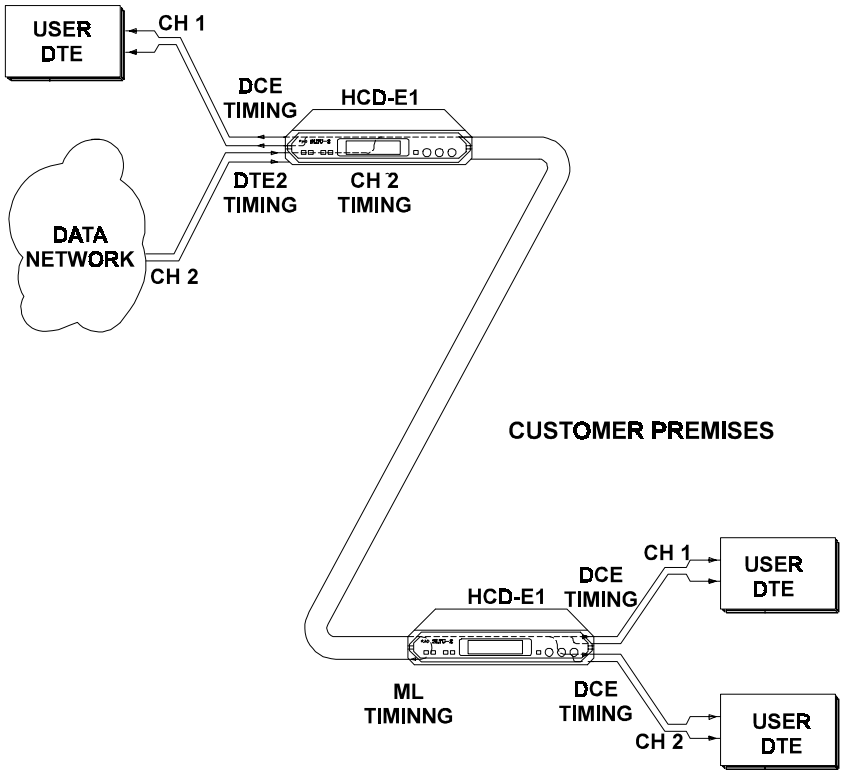


Figure 1-7 Data Channel Timing, Flow of Timing Signals in a Typical Application

In the application shown in *Figure 1-7*, the data equipment located on the customer's premises uses the HCD-E1 link to connect to a data network. Since data networks include accurate timing sources and do not accept data whose timing deviates significantly from the network timing, it is necessary to ensure that the equipment located on the customer's premises uses the data network timing.

For this purpose, the HCD-E1 unit connected to the data network uses channel 2 as its timing source, and therefore its main link timing is locked to the data network timing.

The HCD-E1 unit located on the customer's premises uses main link timing. As a result, its system timing is also locked to the data network timing, and the network timing is transferred to the data equipment located on the customer's premises.

Note that the other data channel of the two HCD-E1 units must use DCE timing (or DTE1 timing, provided the data equipment operates with loopback timing). This enables locking the timing of the other equipment to the accurate timing source serving the data network.

Manual Selection of Data Channel FIFO size (DTE2 Mode)

To optimize jitter performance, the FIFO size of the data channels operating in the DTE2 mode can be selected manually (±16 bits, ±30 bits, ±52 bits, or ±72 bits). The manually-selected value cannot be less than the automatically-selected value. *Table 1-1* lists these values for different data channel rates.

Table 1-1 Automatically-Selected FIFO Size Values

Data Channel Rate	FIFO Size
64 kbps	±16 bits
128 and 192 kbps	±30 bits
256 to 448 kbps	±52 bits
512 to 1536 kbps	±72 bits
1600 to 1792 kbps	±52 bits
1856 and 1920 kbps	±30 bits
1984 and 2048 kbps	±16 bits

Sublink Timing Application

Figure 1-8 shows a typical application which uses the sublink as the timing reference source, and illustrates the flow of timing signals within the system.

In the application shown in *Figure 1-8*, a PABX is connected by a HDSL link to a digital exchange, and must therefore use the exchange timing. For this purpose, the HCD-E1 unit connected to the exchange uses the clock signal recovered from the sublink as the system timing reference, and HCD-E1 located on the customer's premises uses main link timing (LBT).

Therefore, the system timing of HCD-E1 located on the customer's premises is locked to the digital exchange timing. The exchange timing is thus transferred to the PABX located on the customer's premises.

Note that the data channels of the two HCD-E1 units must use DCE timing (or DTE1 timing, provided the data equipment operates with loopback timing). This enables locking the timing of all the other equipment connected to the HCD-E1 units to the accurate timing source serving the digital exchange.

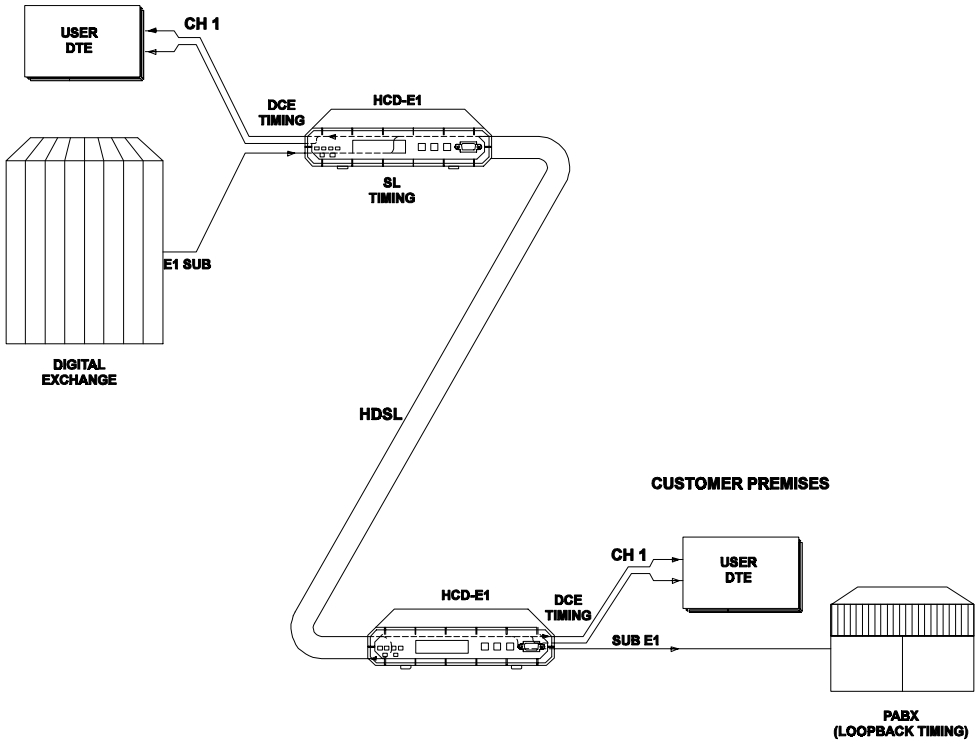


Figure 1-8 Sublink Timing, Flow of Timing Signals in a Typical Application

Main Principles of Operation

This section describes the E1 and the HDSL environments, to provide the background information required for the understanding of the configuration parameters of the HCD-E1 system.

The E1 (CEPT) Environment

The E1 line interfaces of the HCD-E1 comply with the applicable requirements of ITU-T Rec. G.703, G.704, G.706, G.732, and G.823.

E1 Signal Structure

The E1 line operates at a nominal rate of 2.048 Mbps, using a line signal encoded according to the High-Density Bipolar 3 (HDB3) code. The data transferred over the E1 line is organized in frames. Each E1 frame includes 256 bits. The E1 frame format is shown in *Figure 1-9*.

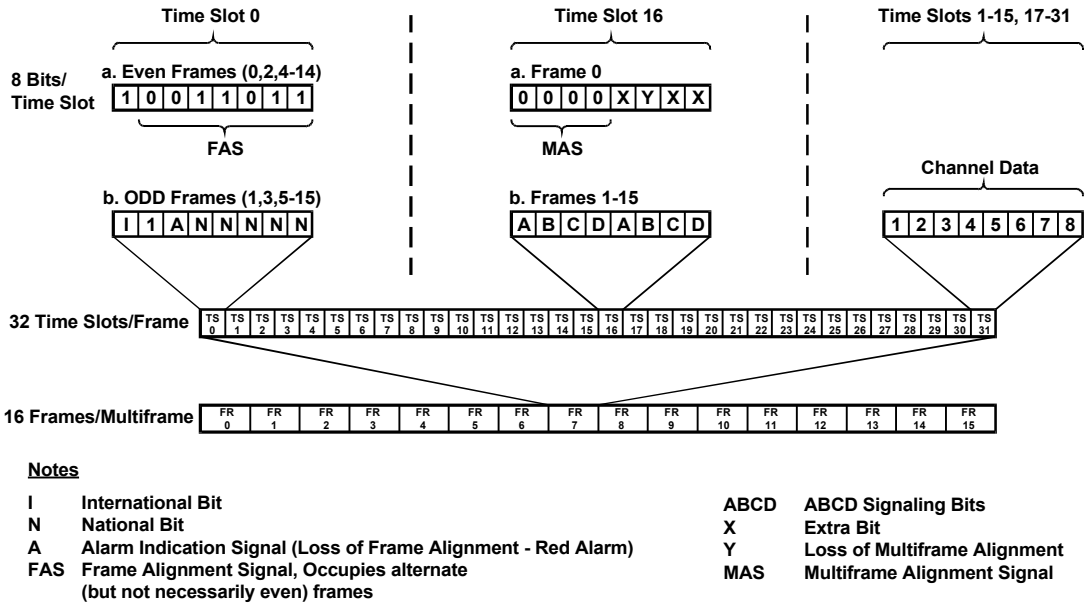


Figure 1-9 E1 (CEPT) Frame Format

The 256 bits consist of 32 time slots of eight bits each, that carry the data payload. The frame repetition rate is 8,000 per second, and therefore the data rate supported by each time slot is 64 kbps. The number of time slots available for user data is maximum 31, because time slot 0 is always used for frame synchronization.

Time Slot 0

Time slot 0 is used for two main purposes:

- Delineation of frame boundaries. For this purpose, in every second frame time slot 0 carries a fixed pattern, called Frame Alignment Signal (FAS). Frames carrying the FAS are defined as even frames, as they are assigned number 0, 2, 4, etc. when larger structures (multiframes) are used.

The receiving equipment searches for this fixed pattern in the data stream using a special algorithm, a process called frame synchronization. Once this process is successfully completed, the equipment can identify each bit in the received frames.

- Transmission of housekeeping information. In every frame without FAS (odd frames), time slot 0 carries housekeeping information. This information includes:
  - Bit 1 - this bit is called the international (I) bit. Its main use is for error detection using the optional CRC-4 function.
  - Bit 2 - this bit is always set to 1, a fact used by the frame alignment algorithm.

– Bit 3 - this bit is used as a Remote Alarm Indication (RAI), to notify the equipment at the other end that the local equipment lost frame alignment, or does not receive an input signal.

– The other bits, identified as S_{a4} through S_{a8}, are designated national bits, and are actually available to the users, provided agreement is reached as to their use. RAD equipment with SNMP agents can use the S_{a4} bit for in-band management traffic. The total data rate of the in-band management traffic when using the S_{a4} bit, is 4 kbps.

Multiframes

To increase the information carrying capacity without wasting bandwidth, the frames are organized in larger patterns, called multiframes. Two types of multiframes are generally used:

- G732N, which consists of 2 frames (one odd frame and one even frame). The G732N multiframe is generally used when time slot 16 is available to the user. In this mode, the maximum number of time slots available for payload is 31 (maximum payload data rate of 1984 Kbps). For systems which use the Common-Channel Signaling (CCS) method, the CCS information is often transmitted in time slot 16.

- G732S, which consists of 16 frames. The G732S multiframe is generally used when time slot 16 serves for the transmission of end-to-end signaling using Channel-Associated Signaling (CAS). CAS is typically used on links that transfer voice channels. In this mode, the maximum number of time slots available for payload is 30 (maximum data rate of 1920 kbps).

E1 Line Statistics Using CRC-4 Error Detection

HCD-E1 supports the CRC-4 function in accordance with ITU G.704, which allows the evaluation of the quality of transmission over E1 links.

When the CRC-4 option is enabled, frames are arbitrarily grouped in groups of 16 (these groups are called CRC-4 multiframes, and do not bear any relationship to the 16-frame multiframe structures used with the G732S super-frame explained above). A CRC-4 multiframe always starts with a frame that carries the frame alignment signal. The CRC-4 multiframe structure is identified by a six-bit ***CRC-4 multiframe alignment signal***, which is multiplexed into bit 1 of time slot 0 of each odd-numbered (1, 3, 5, etc.) frame of the multiframe (up to frame 11 of the CRC-4 multiframe). Each CRC-4 multiframe is divided into two submultiframes of 8 frames (2048 bits) each. The detection of errors is achieved by calculating a four-bit checksum on each 2048-bit block (submultiframe). The four checksum bits calculated on a given submultiframe are multiplexed, bit by bit, in bit 1 of time slot 0 of each even-numbered frame of the next submultiframe.

At the receiving end, the checksum is calculated again on each submultiframe and then compared against the original checksum (sent by the transmitting end in the next submultiframe). The results are reported by two bits multiplexed in bit 1 of time slot 0 in frames 13, 15 of the CRC-4 multiframe, respectively. Errors are counted and used to prepare statistic data on transmission performance.

E1 (CEPT) Line Signal

The basic E1 line signal is coded using the High-Density Bipolar 3 (HDB3) coding rules. The HDB3 coding format is an improvement of the Alternate Mark Inversion (AMI) code.

In the AMI format, “ones” are alternately transmitted as positive and negative pulses, whereas “zeros” are transmitted as a zero voltage level. The AMI format cannot transmit long strings of “zeros”, because such strings do not carry timing information.

The HDB3 coding rules restrict the maximum length of a “zero” string to three pulse intervals. Longer strings are encoded at the transmit end to introduce non-zero pulses. To allow the receiving end to detect these artificially-introduced pulses and to enable their removal to restore the original data string, the encoding introduces intentional bipolar violations in the data sequence. The receiving end detects these violations and when they appear to be part of an encoded “zero” suppression string - it removes them.

Bipolar violations which are not part of the HDB3 zero-suppression string are assumed to be caused by line errors, and are counted separately, to obtain information on the quality of the transmission link when the CRC-4 function is not used.

E1 Line Alarm Conditions

The loss of frame alignment (also called loss of synchronization) condition is declared when too many errors are detected in the frame alignment signal (FAS), e.g., when 3 or 4 FAS errors are detected in the last 5 frames. Loss of frame alignment is cleared after no FAS errors are detected in two consecutive frames. The loss of frame alignment is reported by means of the A bit (see *Figure 1-5*).

The alarm indication signal (AIS) is an unframed “all-ones” signal, and is used to maintain line signal synchronization in case of loss of input signal, e.g., because an alarm condition occurred in the equipment that supplies the line signal. Note that the equipment receiving an AIS signal loses frame synchronization.

The excessive bit error rate is measured on the frame alignment signal. The alarm threshold is an error rate higher than 10^{-3} that persists for 4 to 5 seconds. The alarm condition is canceled when the error rate decreases below 10^{-4} for 4 to 5 consecutive seconds.

HDSL Environment

Transmission Media

HDSL systems are intended to operate on the local subscriber plant, which typically uses a mixture of unshielded twisted-wire pairs. Moreover, it is also necessary to tolerate bridged taps. HDSL systems properly operate on this media. The only requirement is that the lines must not be loaded. In addition, it is assumed that the nominal impedance of the pairs is 135Ω, and that the pairs are balanced with respect to ground.

Because of the variance in the transmission characteristics of the lines, HDSL systems must compensate for the differential transmission delay between the lines being used by a given system.

HDSL Line Signal

The line code on the HDSL line is 2B1Q (2 Binary, 1 Quaternary). This is a four-level pulse-amplitude modulation code without redundancy, under which each pair of information bits is converted to a quaternary symbol, called quat (bits can assume two levels, whereas quats have four levels).

The encoding rule of the 2B1Q code is as follows:

Binary Digits	Quaternary Symbol
00	-3
01	-1
10	+3
11	+1

The levels of the quaternary signal are symmetrically located around the 0V, and the nominal peak symbol level specified by the HDSL standards is 2.64V. *Figure 1-6* illustrates the 2B1Q encoding rule.

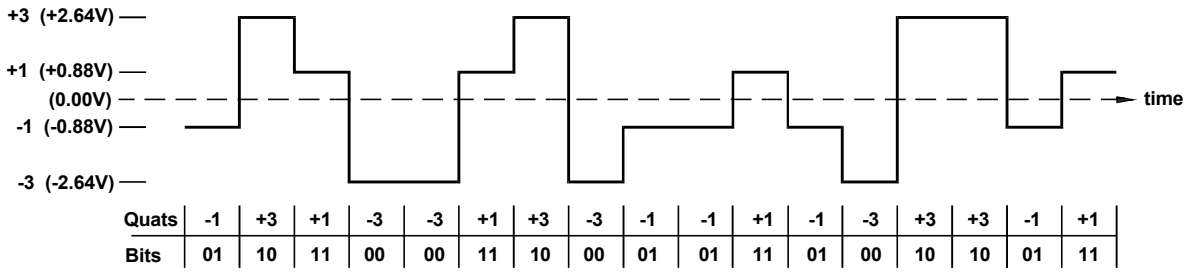


Figure 1-10 2B1Q Encoding Rule

Due to the encoding of two bits into one symbol, the symbol rate on the HDSL line is half the bit rate. Taking into consideration a payload rate of 2048 kbps and framing overhead, for two-loop operation the required per-loop data rate is 1168 kbps (equivalent to a symbol rate of 584 kbaud).

By reducing the line symbol rate, the maximum range that can be reached is increased. Together with the advanced digital signal processing techniques implemented in HDSL systems, this results in a robust data transmission system that can reliably operate over regular unconditioned local loops, while exceeding several times the ranges that can be achieved by direct transmission of an E1 signal.

HDSL Line Signal Structure

The HDSL line signal is organized in frames. Each frame has a nominal duration of 6 msec: this translates to 3504 quats (7008 bits) for two-loop systems. However, due to the use of stuffing, frames without stuffing quats are actually one quat shorter, while frames with stuffing are one quat longer than the nominal.

The HDSL frames carry the following types of data:

- Core frames
- Synchronization words
- HDSL overhead quats

A **core frame** consists of 144 bytes (1152 bits). The structure of the core frames depends on the type of data being carried. The core frames are split, on a per byte basis, for transmission in parallel over the HDSL lines. *Figure 1-11* shows the mapping of the 32 application time slots of the core frame into the two groups of 18 time slots carried by the two HDSL lines:

  – Time slots 0 and 16 are carried in parallel on both HDSL lines.

  – HDSL line 1 carries the odd-numbered application time slots up to time slot 16, and then even-numbered application time slots.

  – HDSL line 2 carries the even-numbered application time slots up to time slot 16, and then odd-numbered application time slots.

  – The last HDSL time slot is filled with ones (AIS signal).

The **synchronization word** consists of 7 quats, and its function is to enable HDSL frame alignment.

16 **HDSL overhead quats** are used to carry the following data:

- Indications such as far-end block error (FEBE), loss of signal and bipolar violations on the E1 interface.
- Embedded operations channel (***eoc***). The *eoc* allows supervision and management of system operation (status, diagnostic loopbacks and tests, repeater support, etc.) or vendor-defined functions (e.g., configuration downloading).
- Identification of the HDSL line number (seven quats). This allows the receiver to detect unintentional interchange of pairs.

2048 kbps Data at the Application Frame Interface		Time Slots Inserted in Core Frame with 2048 kbps Data			HDSL Line 1	HDSL Line 2
		TS0	0			
TS0		TS0	1		**TS0**	**TS0**
TS1		TS1	2			
TS2		TS2	3		TS1	TS2
TS3		TS3	4			
TS4		TS4	5		TS3	TS4
TS5		TS5	6			
TS6		TS6	7		TS5	TS6
TS7		TS7	8			
TS8		TS8	9		TS7	TS8
TS9		TS9	10			
TS10		TS10	11		TS9	TS10
TS11		TS11	12			
TS12		TS12	13		TS11	TS12
TS13		TS13	14			
TS14		TS14	15		TS13	TS14
TS15	⇔	TS15	16	⇔		
TS16	Mapping into	**TS16**	17	Mapping to the	TS15	**TS16**
TS17	Core Frames	**TS16**	18	two HDSL Lines		
TS18		TS17	19		**TS16**	TS17
TS19		TS18	20			
TS20		TS19	21		TS18	TS19
TS21		TS20	22			
TS22		TS21	23		TS20	TS21
TS23		TS22	24			
TS24		TS23	25		TS22	TS23
TS25		TS24	26			
TS26		TS25	27		TS24	TS25
TS27		TS26	28			
TS28		TS27	29		TS26	TS27
TS29		TS28	30			
TS30		TS29	31		TS28	TS29
TS31		TS30	32			
		TS31	33		TS30	TS31
		AIS	34			
		AIS	35		**AIS**	**AIS**

Figure 1-11 Mapping of Core Frame into HDSL Frames

HDSL-Related System Functions

The HDSL subsystem performs the following main functions:

- Mapping of input data bits into HDSL frames, for transmission on the HDSL lines
- Start-up process
- Frame alignment
- Loop identification and correction
- System management by means of the *eoc* channel
- Collection of performance data.

To achieve proper operation, the management of the HDSL subsystem is performed under the control of the central unit (LTU) unit, which provides the timing reference for HDSL line transmission, and manages the communication on the *eoc* channel with the remote unit (the NTU) located on the customer's side.

The transmission of data on each HDSL line is full duplex. To enable duplex transmission over one pair, the HDSL transceivers use an echo canceler, based on advanced digital signal processing (DSP) techniques. When starting system operation, the echo canceler is “trained”, to enable the separation of the received signal from the transmit signal (near-end crosstalk - NEXT). The training is performed by transmitting a special sequence for a predetermined period. This process is called “start-up process”; data transmission can start only after its successful completion.

Interaction between E1 Port and HDSL Lines

In case the E1 sublink interface loses synchronization, a loss of input data indication signal is sent via the HDSL lines.

In case an HDSL line interface loses synchronization, idle code is inserted in the E1 data stream time slots, which have been assigned to this line.

1.4 Technical Specifications

HDSL Interface

Compliance	ETSI TR-152
Signal Format	Dual duplex, 2B1Q line coding
Line Baud Rate	584 kbaud (equivalent to 1168 kbps), for each pair
Line Type	Two unconditioned, unloaded twisted pairs
Impedance	135Ω
Transmit Pulse Shape	As per ETSI TR-152
Transmit Signal Power	+13.5 dBm ± 0.5 dBm
Loop Loss	31 dB max at 150 kHz (584 kbaud)
Range *- Without H-RPT*	Up to 3.8 km (2.4 miles) for 26 AWG (0.4 mm) Up to 4.8 km (3.0 miles) for 24 AWG (0.5 mm)
- With H-RPT	Up to 7.2 km (4.5 miles) for 26 AWG (0.4 mm) from central to remote unit Up to 9.2 km (5.7 miles) for 24 AWG (0.4 mm) from central to remote unit
Return Loss	16 dB minimum, 25 kHz to 317 kHz @ 135Ω
Differential Line Delay	Maximum 50 µs at 150 kHz
Equalizer	Automatic adaptive equalizer
Connector	RJ-45

E1 Sublink Interface

Applicable Standards	ITU-T Rec. G.703, G.704, G.706, G.732, G.823
Framing	- G732N, no multiframe, intended for use with CCS, without CRC-4 - G732N, no multiframe, intended for use with CCS, with CRC-4 - Transparent transfer of frame, for unframed operation or use with proprietary framing
Nominal Line Data Rate	2.048 Mbps
Line Code	HDB3
Line Impedance (user-selectable)	- 120Ω, balanced - 75Ω, unbalanced

	Signal Levels	
	Transmit Levels	- Balanced interface: ±3V ±10% - Unbalanced interface: ±2.37V ±10%
	Receive LEVELS	0 to -10 dB
	Jitter Performance	Per ITU G.823
	Connectors	- Balanced interface: 8-pin RJ-45 female connector - Unbalanced interface: two BNC coaxial connectors
Data Channel Interface	*Data Rate*	Multiples of 56 or 64 kbps, up to 2.048 Mbps
	Interface Connectors	
	RS-530	25-pin D-type female
	V.35	34-pin male (via adapter cable)
	RS-449/V.36	37-pin D-type male (via adapter cable)
	X.21	15-pin D-type male (via adapter cable)
	IR-ETH	RJ-45 (10BaseT) or BNC (10Base2)
	IR-ETH/Q	RJ-45
	IR-IP	RJ-45
Statistics (Performance Monitoring)	*E1 Sublink with CRC-4*	Per ITU G.706
	E1 Sublink without CRC-4	Bipolar violations (BPV)
	HDSL Performance	Per ITU G.826
Front Panel Controls	*LCD*	2 rows × 16 characters
	Push Buttons	CURSOR, SCROLL, ENTER
Indicators	*E1 Sublink*	E1 LOS - LOC E1 LOS - REM
	HDSL Lines	HDSL LOS - LINE A HDSL LOS - LINE B
	Status	TST ALM

Diagnostics	*Loopbacks*	- HDSL main link local loopback, towards the E1 sublink and data channels of the local unit - Channel loopback on the local unit towards the DTE connected to the data channel of the remote unit (per channel) - Channel loopback on the remote unit towards the DTE connected to the data channel of the local unit (per channel) - Channel loopback on the local unit towards the DTE connected to its data channel (per channel) - In-band code-activated loopback on the remote unit towards the DTE connected to the data channel of the local unit - E1 sublink loopback on the local unit towards the equipment connected to the E1 sublink of the local unit - E1 sublink loopback on the local unit towards the equipment connected to the E1 sublink of the remote unit - E1 sublink loopback on the remote unit towards the equipment connected to the E1 sublink of the local unit. - H-RPT local line loopback towards the LTU-configured unit (available from the LTU-configured unit in applications with an H-RPT)
	BERT Functionality	BER measurement through remote HCD-E1 (per data channel)
Timing	*HDSL Link*	
	Receive Timing	Always recovered from the received HDSL signal
	Transmit Timing (user-selectable)	- Internal timing, derived from a local ±50 ppm oscillator - External timing, locked to the transmit clock of a selected synchronous channel or to the E1 sublink clock signal - Loopback timing (remote unit only): locked to the recovered HDSL receive signal of the central unit

	E1 Sublink	
	Receive Timing	Always recovered from the E1 sublink receive data signal
	Transmit Timing (user-selectable)	Follows the transmit timing of the HDSL link.
	Synchronous Data Channels	- **DCE** timing mode: HCD-E1 data channel provides transmit and receive clocks for the DTE connected to the data port. - **DTE1** timing mode: HCD-E1 data channel sends the receive data accompanied by the receive clock, derived from the main system clock, to the DTE connected to the data port, and accepts data from DTE according to the DTE transmit clock. - **DTE2** timing mode: HCD-E1 data channel transmits and receives data according to the clock signals provided by the equipment connected to the data port. (not available on channels with X.21 interface).
Supervisory Port	*Interface*	V.24/ RS-232, asynchronous DCE interface for direct connection of control terminal or dial-up modem
	Data Rate	300, 1200, 2400, 4800, 9600 bps, with Autobaud option
	Word Format	- One start bit - 7 or 8 data bits - Parity: none, odd, or even - One stop bit
	Connector	9-pin D-type, female
Alarm Relay	*Function*	Floating pair of NO and NC contacts
	Contact Ratings	Open-circuit: maximum 60 VDC Short-circuit: maximum 0.25A
Physical	*Depth*	243 mm / 9.5 in
	Width	215 mm / 8.5 in
	Height	43.7 mm / 1.75 in (1 U)
	Weight	1.5 kg / 3.5 lb

Power	*AC Source*	100 ÷240 VAC, 50 or 60 Hz
	DC Source	-48 VDC (-36 VDC to -72 VDC)
Environment	*Operating Temperature*	0 ÷50°C (32 ÷122°F)
	Relative Humidity	Up to 90%, non-condensing

Chapter 2

Installation and Setup

This chapter describes installation procedures for the standalone HCD-E1 device. For instructions on installation of one or two units in a 19-inch rack, refer to the *Rack Mounting Kit for 19-inch Racks* guide that comes with the RM kit.

After installing the unit:

- Refer to Chapter 3 for detailed system configuration information and procedures using the front panel controls.
- Refer to Chapter 4 for detailed system configuration procedures using an ASCII terminal, TELNET host, or SNMP agent connected to the HCD-E1 control port.

In case a problem is encountered, refer to *Chapter 5* for test and diagnostics instructions.

Warning

Internal settings, adjustment, maintenance, and repairs may be performed by only by a skilled technician who is aware of the hazards involved.

Always observe standard safety precautions during installation, operation and maintenance of this product.

2.1 Site Requirements and Prerequisites

An AC-powered HCD-E1 units should be installed within 1.5m (5 ft) of an easily-accessible grounded AC outlet capable of furnishing the required supply voltage, in the range of 100 to 240 VAC.

A DC-powered HCD-E1 units require a -48 VDC power source, which must be adequately isolated from the mains supply. In order to prevent a fire hazard, a suitable fuse must be installed in the -48 VDC line.

Allow at least 90 cm (36 in) of frontal clearance for operator access and at least 10 cm (4 in) clearance at the rear of the unit for interface cable connections.

Caution Do not stack units one on top of another.

The ambient operating temperature of the HCD-E1 should be 0 to 50°C (32 to 122°F), at a relative humidity of up to 90%, non-condensing.

2.2 Package Contents

The HCD-E1 package includes the following items:

- HCD-E1 unit
- HCD-E1 Installation and Operation Manual
- AC power cord or DC power supply connector kit.
- Interface adapter cable/s (interface ordering options, see *Connecting the Interfaces* later in this chapter).

2.3 Installation and Setup

HCD-E1 is a standalone device designed for tabletop or bench installation. It is delivered completely assembled. No provision is made for bolting the unit to the tabletop.

To complete the installation of HCD-E1, you must perform the following (in the given order):

- Determine the required configuration of HCD-E1, according to your application, and set the internal jumpers and switches accordingly.
- Connect the E1 sublink, the HDSL lines, the data channels and the control port, if necessary.
- Connect power to the unit.

These procedures are described on the following pages.

Setting the Internal Jumpers and Switches

This section provides information on the functions of the internal jumpers and switches, to help you in the selection of the correct setting for particular application, and gives step-by-step instructions for performing the internal settings. The default settings are also listed.

All the other configuration actions can be performed from the front panel or from a control terminal, after the installation is completed. Information and detailed instructions for these operations appear in *Chapter 3* and *Chapter 4*, respectively.

HCD-E1 Printed Circuit Boards

HCD-E1 comprises three printed circuit boards (PCBs): the main board and two interface PCBs.

Figure 2-1 shows the location and identification of the boards installed in the HCD-E1 unit.

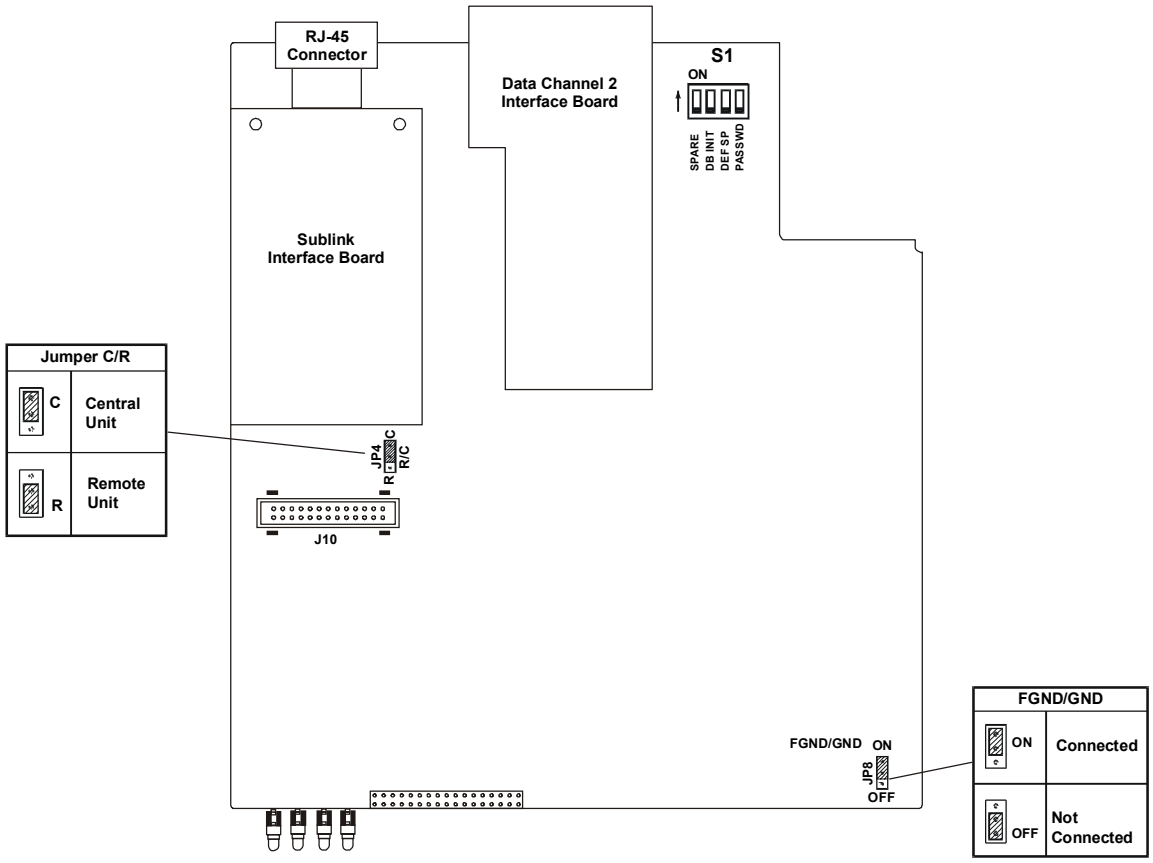


Figure 2-1 HCD-E1 - Identification of Boards, Jumpers and Switches

The **Main Board** contains the common signal processing circuits, the interfaces to the main link (HDSL) and the Data Channel 1 interface. A DIP switch unit (S1) and two jumpers (JP4 and JP8) are provided for user settings. The board contains additional jumpers which are factory-set and should not be changed by the user.

The Data Channel 2 Interface Board provides the connections of data channel 2. The board does not have any user-set jumpers or switches (except for the Ethernet board, see *Appendix C* and *Appendix D*).

The **E1 Sublink Interface Board** provides the E1 connections and contains several user-set jumpers.

To set the internal jumpers and switches, you must do the following in this order:

- Open the HCD-E1 case
- Set the Main Board Jumpers and Switch, referring to *Figure 2-1*.
- Remove the E1 Sublink Internal Board, if it is necessary to modify its settings.
- Identify jumper and switch locations and settings on the Sublink Interface Board (referring to *Figure 2-4*) and change settings as required.
- Reinstall the E1 Sublink Interface Board, if it has been removed.
- Reinstall the HCD-E1 cover.

Warning

Access to the inside of the equipment is permitted only to authorized and qualified service personnel.

To avoid accidental electric shock, always disconnect the interface cables and the power cord before removing the unit from its casing.

Line voltages are present inside HCD-E1 when it is connected to power and/or to the lines. Moreover, under external fault conditions dangerous voltages may appear on the lines connected to the unit.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled technician who is aware of the hazard involved. Capacitors inside the instrument may still be charged even after the instrument has been disconnected from its source of supply.

Caution

HCD-E1 contains components sensitive to electrostatic discharge (ESD). To prevent ESD damage, avoid touching the internal components. Before moving jumpers, touch the HCD-E1 frame.

Opening the HCD-E1 Case

To reach the internal jumpers and switches of HCD-E1, it is necessary to open its case. To do this, proceed as follows:

1. Disconnect all the cables connected to the HCD-E1.
2. Turn the unit over (bottom facing up).
3. Unscrew the four cover screws (see *Figure 2-2*) and keep them in a safe place.
4. Turn the unit over (bottom facing down).
5. After the four screws are released, remove the HCD-E1 top cover by pulling it straight up.

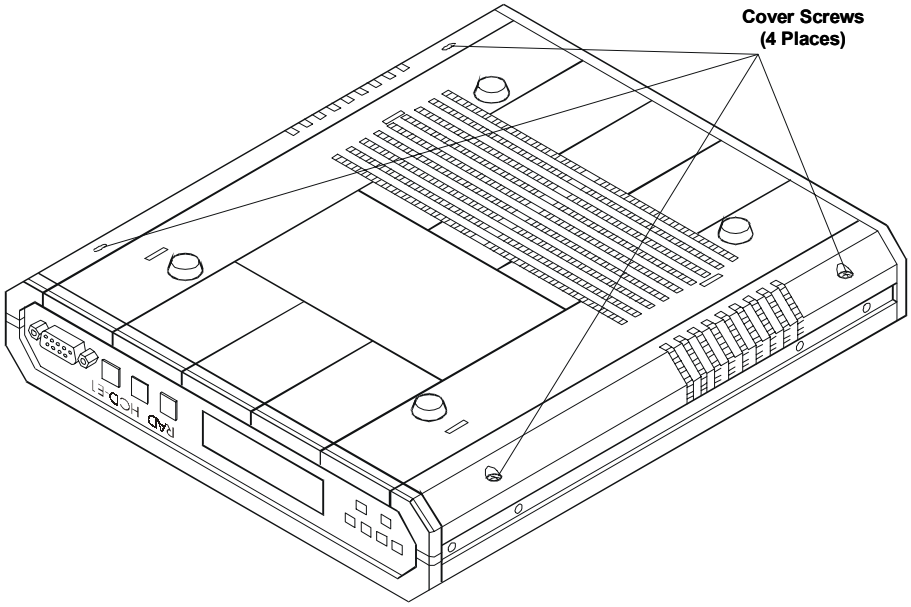


Figure 2-2 Identification of Cover Screws

Setting the Main Board Internal Jumpers and Switches

The internal jumpers and switches located on the HCD-E1 main board are identified in *Figure 2-1*. The functions of jumpers and switches are described below.

Switch S1

DIP switch S1 allows you to enforce the default password and node number (section 4) or reload the desired group of default parameters (sections 2 and 3). Any changes in switch section positions must be performed on a unit not connected to power.

Note *If you want to change the hardware configuration of your HCD-E1 (for example, remove an E1 sublink or one of the data channels from the unit), you will have to reload its database with default parameters (see below and the DB INIT command in Chapter 4).*

- **Switch section 1 –** not used in this unit and is reserved as spare.
- **Switch section 2 – DB INIT**. This section selects the source of the database configuration parameters:

  ON HCD-E1 uses the default parameters stored in its EPROM for reloading of the database.

  OFF HCD-E1 uses the parameters stored in the database.

  HCD-E1 is delivered with the database loaded with the default parameters. If needed, you can move the switch to the ON position again, to reload the database and restart HCD-E1 with the default parameters.

  HCD-E1 is shipped with section 2 set at OFF.

- **Switch section 3 – DEF SP.** This section selects the source of the control port parameters:

  ON HCD-E1 uses the default parameters stored in its program EPROM. For the default values, *see Table 3-4* in Chapter 3.

  OFF HCD-E1 uses the parameters stored in the database.

  HCD-E1 is shipped with section 3 set at OFF.

- **Switch section 4 – PASSWD.** To prevent unauthorized personnel from using the HCD-E1 supervision program, you can use password protection with a password, consisting of up to eight alphanumeric characters. HCD-E1 is delivered with a default password, **HCD**, but normally the password is selected by the user.

  ON HCD-E1 uses the default password.

  OFF HCD-E1 uses the user-selected password.

  HCD-E1 is shipped with section 4 set at OFF.

Note *You can make HCD-E1 temporarily use default values of the password (control port parameters) without erasing the user-selected values from the database. To do this, set the PASSWD (DEF SP) section to ON, leaving DB INIT at OFF and turn the unit on. Then, when you turn HCD-E1 off, reset the appropriate section to OFF and turn the unit on again, HCD-E1 will use the user-selected parameters.*

R/C Function Selection Jumper, JP4

The jumper JP4 (R/C) is used to select the function of the HCD-E1 unit:

C HCD-E1 operates as a central unit (LTU).

R HCD-E1 operates as a remote unit (NTU).

HCD-E1 is shipped with the jumper set at C.

FGND/GND Jumper, JP8

The FGND/GND jumper is used to control the connection between the internal signal ground and the frame ground.

ON Ground is shorted to the frame ground.

OFF Ground is not shorted to the frame ground.

HCD-E1 is shipped with the jumper set at ON.

Warning

Setting the FGND/GND jumper to OFF may make the equipment unsafe for direct connection to unprotected telecommunication networks at locations where constant excessive voltages may be present on the lines.

Removing the E1 Sublink Interface Board

The E1 sublink interface board is located over the main board, and is installed with the component side facing the main board. It is electrically connected to the main board by means of a flat cable via the J10 connector on the main board *(see Figure 2-1*).

The E1 sublink interface board is attached to the main board by means of two metal spacers. The two spacers near the rear panel are also used to provide a low-resistance path to ground.

The board is connected by wires to the E1 sublink BNC connectors, which are fastened to the rear panel. These wires do not have to be disconnected when the sublink interface board is removed.

Figure 2-3 explains how to remove the sublink interface board. Use the following procedure:

1. Identify the two nuts that fasten the sublink interface board to the spacers.
2. Remove the nuts and their washers.
3. Disconnect the flat cable from the connector J10 on the main board (see *Figure 2-1*).
4. Hold the sublink interface board from its sides, and carefully pull it straight up. Once the board is free, turn the board over the rear panel, and let it rest on the work table. Do not strain the wires connecting the board to the BNC connectors.

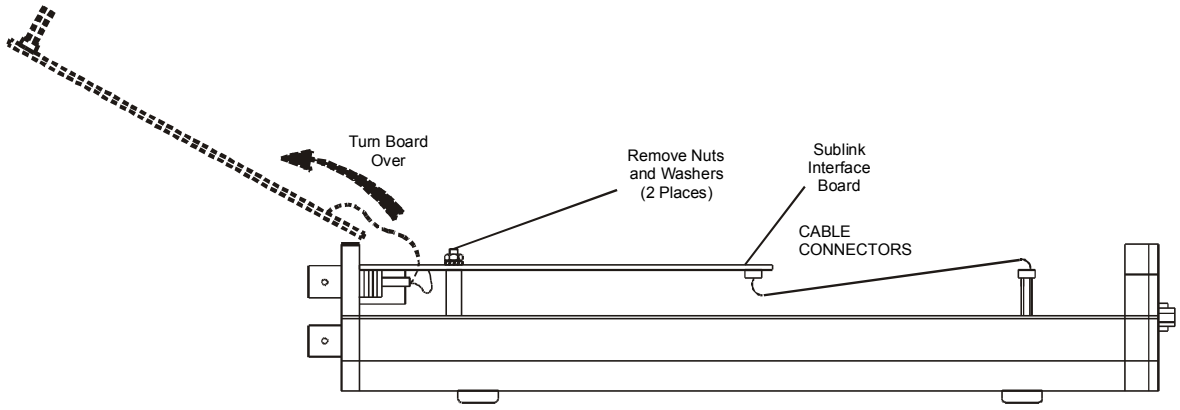


Figure 2-3 Removal of Sublink Interface Board

Setting the Sublink Interface Board Jumpers

Figure 2-4 shows the component side of the E1 sublink interface board, as seen after it is removed from the unit.

Note *The interface board has protection fuses for the surge protection circuits located on the line side of the line isolation transformers. These fuses are also identified in Figure 2-4.*

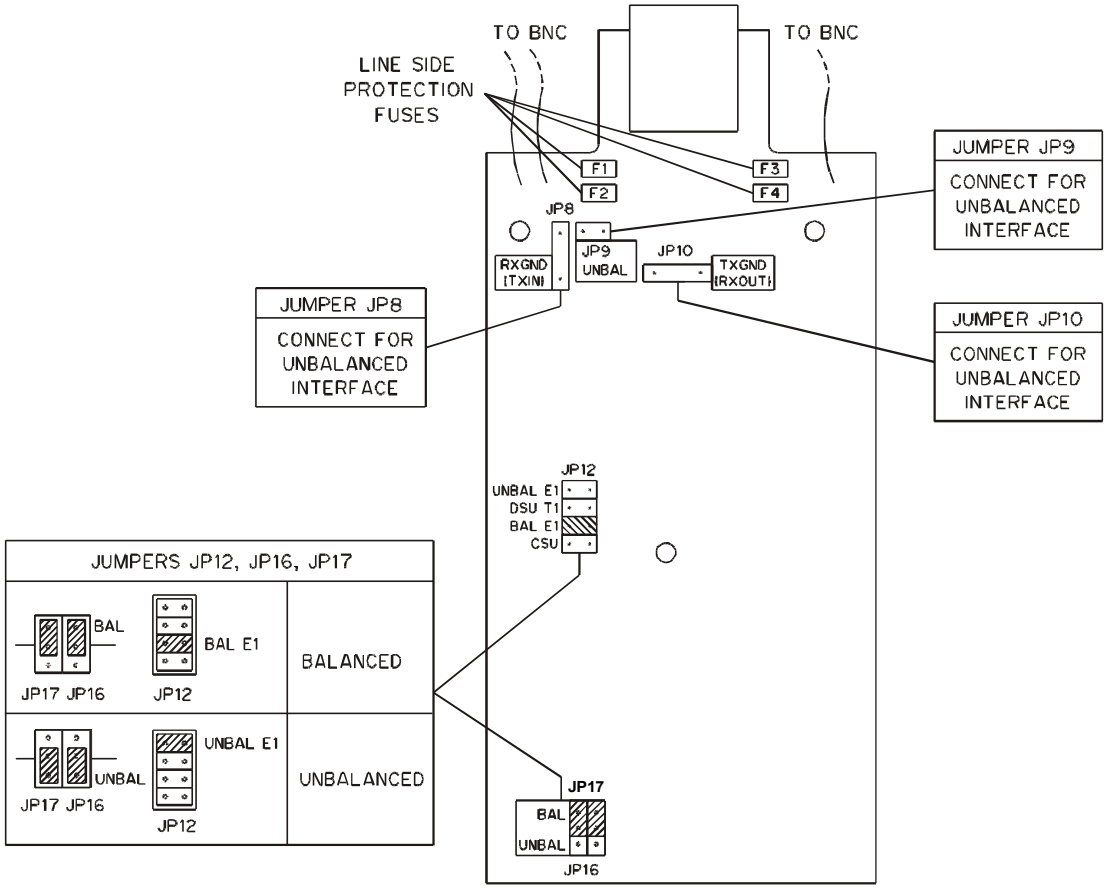


Figure 2-4 E1 Sublink Interface Board, Internal Settings

Set the jumpers as follows:

Interface Selection Jumpers, JP9, JP12, JP16, and JP17

The jumpers JP9 and JP12 and the double jumper JP16-JP17 are used to select the E1 sublink interface. ***All the jumpers must be always set to the same position (either BAL or UNBAL).***

- For operation with the balanced interface:
  - Set the jumper JP12 to BAL E1.
  - Set the jumpers JP16 and JP17 to BAL.
  - Disconnect the jumper JP9.

- For operation with the unbalanced interface:
  - Set the jumper JP12 to UNBAL E1.
  - Set the jumpers JP16 and JP17 to UNBAL.
  - Connect the jumper JP9.

HCD-E1 is shipped with all the jumpers set for balanced interface.

E1 Sublink Transmit Side Ground Reference Jumper, JP8

The jumper JP8 controls the ground reference of the E1 sublink transmit output when working with the unbalanced interface.

In accordance with ITU-T recommendations, this jumper is an option when the unbalanced interface is used (the line is normally grounded at the transmit side).

HCD-E1 is shipped with the jumper not installed (operation with balanced interface).

E1 Sublink Receive Side Ground Reference Jumper, JP10

The jumper JP10 controls the ground reference of the E1 sublink receive output when working with the unbalanced interface.

In accordance with ITU-T recommendations, this jumper is an option when the unbalanced interface is used (the line is normally grounded at the transmit side).

HCD-E1 is shipped with the jumper not installed (operation with balanced interface).

Reinstalling the E1 Sublink Interface Board

If during the procedure the E1 sublink interface board has been removed, reinstall it by reversing the procedure described above. Pay special attention to the following:

- Mate correctly the flat cable connector with the corresponding main board connector.
- Make sure that the RJ-45 connector has been properly inserted into its place in the rear panel, and none of the BNC connectors wires have been damaged.
- Make sure to place the original washers under each nut. Fasten the nuts tightly. Pay particular attention to proper fastening to the two spacers located near the rear panel.

Reinstalling the HCD-E1 Cover

After completing the internal settings, reinstall the top cover as follows:

1. Position the lower half of the HCD-E1 case on a flat, clean surface. Check that the decorative black plastic strips on the sides of the unit are still in place (if not, place the strips in the grooves on the sides of the lower half).
2. Identify the front and the rear of the top cover, and position the cover on the lower half of the HCD-E1, so that the cover guides are located just above the holes in the lower half. Close the cover and ensure that the protruding tips of the cover guides enter the corresponding recesses in the lower half.
3. Hold the cover in place and turn the assembly over, to gain access to the bottom of the unit.
4. Insert the original cover screws in their positions and tighten carefully. Do not use excessive torque.

Connecting the Interfaces

Figure 2-5 shows a typical rear panel of a standard HCD-E1 unit and identifies its connector locations.

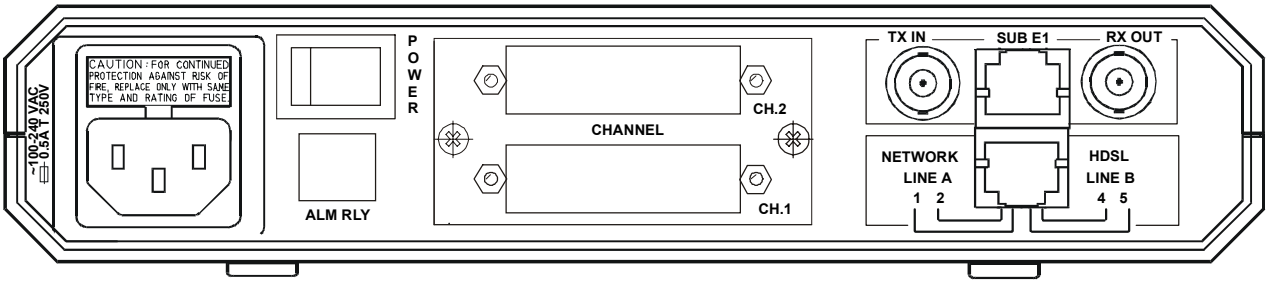


Figure 2-5 HCD-E1 Rear Panel (AC Powered Unit)

Connecting the E1 Sublink

The balanced interface of the E1 sublink is terminated in an RJ-45 connector. *Appendix B* provides the pin allocation for this connector.

The unbalanced interface is terminated in two BNC connectors.

Connect the E1 sublink cable(s) to the connector(s) corresponding to the interface in use. ***Do not connect to both the balanced and unbalanced connectors!***

- When using the DTE with balanced interface, connect the DTE cable to the RJ-45 connector designated SUB E1.
- When using the DTE with unbalanced interface, connect the DTE cable to the two BNC connectors designated RX/OUT and TX/IN. Pay attention to correct connection of the receive and transmit cables to the RX/OUT and TX/IN connectors.

Connecting the Data Channels

HCD-E1 typically has two data ports, each terminated in a 25-pin D-type female connector. The units with an Ethernet interface arrive with the Ethernet interface module built in the upper port. For the description of the Ethernet interface, see *Appendix C* and *Appendix D*.

When using the RS-530 interface, equipment with RS-530 interface can be directly connected to the data channel connector using standard cables.

Equipment with V.36/RS-422/RS-449, X.21 and V.35 interfaces can be connected by means of adapter cables, supplied with the unit. *Table 2-1* lists these cables and describes their applications.

You can also prepare these cables yourself in accordance with the port connector wiring information given in *Appendix B*.

Table 2-1 HCD-E1 Interface Adapter Cables

Interface		Cable	Length
Port	Data Equipment		
V.35 DCE	V.35 DTE	CBL-HS2V1	1.5m (5 ft)
V.35 DTE1	V.35 DCE	CBL-HS2V2	1.5m (5 ft)
V.35 DTE2	V.35 DCE	CBL-HS2V3	1.5m (5 ft)
RS-422 DCE	RS-422 DTE	CBL-HS2R1	1.5m (5 ft)
RS-422 DTE1	RS-422 DCE	CBL-HS2R2	1.5m (5 ft)
RS-422 DTE2	RS-422 DCE	CBL-HS2R3	1.5m (5 ft)
RS-422 DCE	X.21 DTE	CBL-HS2X1	0.36m (1.2 ft)

When using adapter cables, first connect the adapter cable to the channel connector, and then connect the data cable to the adapter connector.

Connecting the HDSL Lines

To connect the remote equipment (HDSL lines) to HCD-E1, connect the cable to the RJ-45 connector designated NETWORK HDSL. *Appendix B* provides the pin allocation for this connector.

Connecting the HCD-E1 Alarm Relay Port

The alarm relay contacts are available in a special RJ-11, 4-pin connector. To connect HCD-E1 to alarm equipment, you will have to prepare a special cable according to the following pinout.

Pin	Function
1	Common
2	NC
3	NO
4	not in use

Connecting the Control Port

If you are using the control terminal, connect a cable prepared in accordance with *Appendix B* between the control port connector, designated CONTROL DCE (see *Figure 3-1* in Chapter 3), and the control terminal. If the control terminal is connected via modems, use a cross-over cable.

Note *The various interface cables should be shielded, in order to comply with FCC rules. HCD-E1 and its data interfaces will work well even if the cables are not shielded, but some radio interference may occur.*

Connecting the Power

To connect the power to HCD-E1, refer to the appropriate section below, depending on your version of the unit (AC or DC).

Warning

Before switching on this instrument and connecting any other cable, the protective earth terminals of this instrument must be connected to the protective ground conductor of the mains power cord. If you are using an extension cord (power cable) make sure it is grounded as well.

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.

For AC version, make sure that only fuses of the required rating, as marked on the rear panel, are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse. Whenever it is likely that the fuse protection has been damaged, make the unit inoperative and secure it against unintended operation.

AC Power Connection

AC power should be supplied to the HCD-E1 through the 5 ft (1.5m) standard power cable terminated by a standard 3-prong plug (see *Figure 2-5*). The cable is provided with the unit.

1. Check that the ON/OFF switch on the HCD-E1 rear panel is set to OFF.
2. First, connect the power cable to the connector on the HCD-E1 rear panel, and then to the mains outlet.

DC Power Connection

To connect DC power to HCD-E1, refer to *DC Power Supply Connection Supplement*.

Chapter 3

Front Panel Operating Instructions

3.1 General

This chapter contains detailed instructions for operating HCD-E1 from the front panel. The information presented in this chapter includes:

- HCD-E1 front panel - *Section 3.2*
- General description of HCD-E1 control, display and push-button functions, and menu organization - *Section 3.3*
- HCD-E1 configuration parameters - *Section 3.4*
- Operating procedures (turn-on, front-panel indications, performance monitoring and turn-off) - *Section 3.5*
- HCD-E1 local configuration setup - *Section 3.6*.

For instructions on the use of a control terminal to control and monitor HCD-E1 operation remotely, refer to *Chapter 4*.

3.2 Front Panel Controls, Connectors, and Indicators

Figure 3-1 shows the front panel of HCD-E1. *Table 3-1* lists the functions of the HCD-E1 controls, connectors and indicators, located on the HCD-E1 front panel.

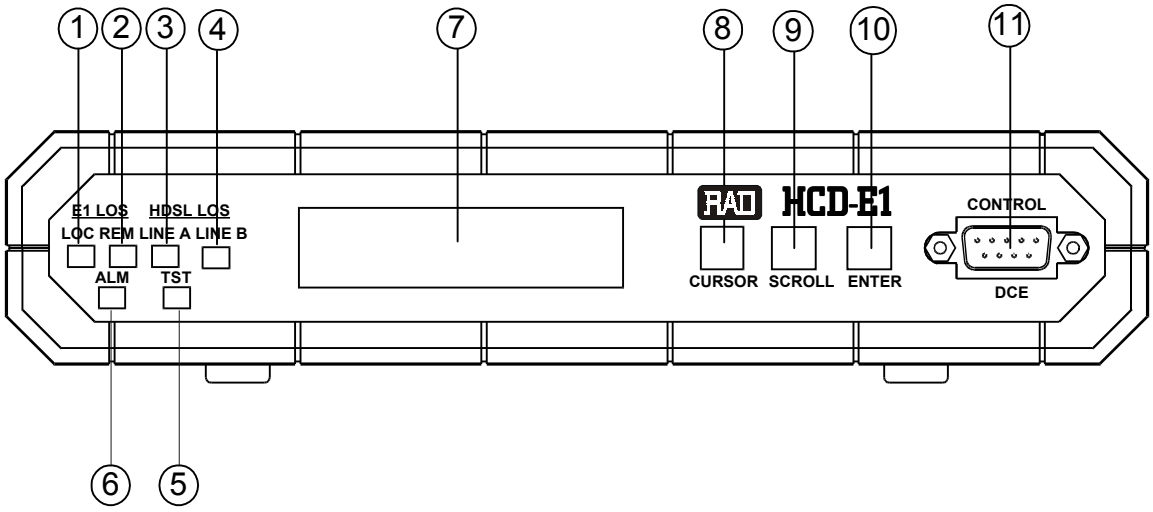


Figure 3-1 HCD-E1 Front Panel

Table 3-1 HCD-E1 Controls, Connectors and Indicators

No	Name	Type	Function
1	E1 LOS LOC	LED indicator	Lights when the local E1 port loses frame synchronization to the incoming signal (in the UNFRAMED mode, the indicator lights when the incoming signal is corrupted or missing)
2	E1 LOS REM	LED indicator	Lights when the equipment connected to the E1 port reports loss of synchronization. This indication is not available when the UNFRAMED mode is selected.
3	HDSL LOS LINE A	LED indicator	Lights when the HDSL line A (line 1) circuits lose synchronization to the incoming signal
4	HDSL LOS LINE B	LED indicator	Lights when the HDSL line B (line 2) circuits lose synchronization to the incoming signal
5	TST	LED indicator	Lights when a test is active
6	ALM	LED indicator	Lights when ON-state alarms (for explanation of the term see Section 5.2, *Status Indications and Alarms,* in Chapter 5) are stored in the HCD-E1 alarm buffer
7		Alphanumeric display	Liquid crystal display (LCD) used to display messages and status information. The display contains 2 rows of 16 characters each.
8	CURSOR	Push button	Used to move among the information fields on the LCD
9	SCROLL	Push button	Used to scroll among the available options displayed on the LCD
10	ENTER	Push button	Used to confirm the changes made in HCD-E1 operation
11	CONTROL DCE	Connector	Connection to control terminal

3.3 Control of HCD-E1 Operation

General

The HCD-E1 operating mode is determined by a set of parameters stored in an internal non-volatile memory. To select these parameters, you can use the HCD-E1 front panel push buttons or a control terminal.

After the operating parameters have been loaded (this process is called *configuration setup)*, HCD-E1 no longer requires operator attendance.

The configuration selected by the user and stored in the HCD-E1 memory is not affected when power is turned off. Upon turn-on, HCD-E1 checks the validity of the stored configuration data, and after the self-test takes the last selected configuration (unless you have changed the default setting of DIP switch S1, Section 2, from OFF to ON, as described in Chapter 2, *Installation*). If the configuration does not require modification, HCD-E1 is ready for operation immediately after power is applied. However, if the configuration data is corrupted, HCD-E1 loads a default configuration instead. The default configuration, prepared by the manufacturer, is stored in the EPROM.

All operations are performed using an interactive, menu-driven interface, controlled by the LCD and three push buttons. HCD-E1 guides you in the execution of the required task by means of messages and checks your inputs. Moreover, HCD-E1 will suggest you only those parameter values which are available on your HCD-E1 model in the selected operating mode.

If you make a configuration error (for example, you select a parameter value that conflicts with the current operating mode), HCD-E1 rejects the erroneous selection and displays an error message that identifies the error.

For detailed operating instructions, see *Section 3.5* and *Section 3.6*.

Organization of the LCD

The HCD-E1 display has two rows:

- **The upper row** shows the *header*, which can be one of the following:
  - ALARM BUFFER
  - PORT DIAG
  - HDSL DIAG
  - TEST OPTION
  - Name of one of seven configuration parameter groups (see *Section 3.4*)
- **The lower row** displays the following information:
  - Parameter name and value
  - Status messages
  - Test or loopback name and status
  - Error messages
  - Diagnostics messages

Figure 3-2 shows the basic LCD menu structure.

FIRST ROW	***SECOND ROW***	
ALARM BUFFER	SCROLL CLEAR	
	EMPTY	
SYSTEM PARAMETER	CLK MASTER	(only for the unit configured as central)
	CLK_FBACK	(only for the unit configured as central)
	HCD TYPE	
	CONFIG REM	(only for the unit configured as central)
	HRPT	
TEST OPTION: SL	LOCAL PORT	
	REM PORT	
	REM REM PORT	
TEST OPTION: ML	LOCAL LINE	
TEST OPTION: CHX*	LOCAL CH	
	REM CH	
	REM REM CH	
	BERT	
	INBAND LOOP	
TEST OPTION: HRPT	LOCAL HRPT	(only for the unit configured as central)
SL PARAMETERS	FRAME	
	SYNC	
	CRC-4	
	MAP MODE	
	NUM OF TS	
	START TS	(only when MAP is selected as SEQ or ALT)
	TS_0 to TS_31	
	IDLE CODE	
PORT DIAG: SL	ERROR CRC...	(or BPV COUNT)
	LST DEG MIN	(see *Table 5-3*)
HDSL DIAG: LINEX*	CURR ES ...	
	L. TERM INT	(see *Table 5-4*)
SP PARAMETERS	SPEED	
	DATA	
	PARITY	
	INTERFACE	
	AUX DEV	(only for HCD-E1 configured as central)
	FRAME	
CHANNEL PRM: CHX*	MULT	
	MAP	
	SPEED	
	START TS	
	CTS	
	ETHER	(only when data channel has Ethernet interface)
	BRIDGING	(only when data channel has Ethernet interface)
	FIFO SIZE	
	CLK MODE	
	TS_0 to TS_31	
BERT PRM	PATTERN	
	ERR RATE	
DNLOAD PRM	SL MODE	
	ML MODE	
	SL TS NUM	only if SL MODE is selected as DEDIC
	ML TS NUM	only if ML MODE is selected as DEDIC
PB PARAMETERS	TS_1 to TS_31	

* X denotes the number of an HDSL line or data channel. It can be 1 or 2.

Figure 3-2 HCD-E1 LCD Basic Menu Structure

Information Displayed on the LCD

The LCD displays four types of information messages:

- Status messages (alarms)
- Diagnostics and performance monitoring data
- Test status
- Configuration parameters.

Status Messages (Alarms)

When HCD-E1 is not being configured and neither PORT DIAG nor HDSL DIAG is displayed, it displays one of the two screens that appear under the header ALARM BUFFER. If the alarm buffer contains status messages (ON-state alarms), the LCD second row shows “SCROLL CLEAR” and the ALM indicator is lit. Otherwise, the ALM LED is off, and the second row of the LCD shows “EMPTY”.

For the definition of ON-state alarms, list of alarm messages and instructions how to work with them, refer to Section 5.2, *Status Indications and Alarms,* in Chapter 5.

Diagnostics and Performance Monitoring Data

HCD-E1 can display the E1 port traffic performance parameters gathered when operating with the CRC-4 function enabled. When the CRC-4 function is disabled, the HCD-E1 can still display BPV statistics.

In addition, HCD-E1 can display the HDSL line performance parameters.

The diagnostics data appear under the headers PORT DIAG: SL and HDSL DIAG. For explanation of the diagnostics data parameters and their monitoring, refer to Section 5.3, *Performance Diagnostics Data,* in Chapter 5.

Test Functions

The test functions of HCD-E1 include:

- Local and remote loopbacks on the E1 port, data channels, and local loopback on the HDSL lines.
- Remote loopbacks on the E1 port and data channels of the remote unit.
- Bit error rate testing on each data channel.
- In-band activated remote loopback on each data channel
- Local loopback on the H-RPT (when working with the latter and your HCD-E1 is configured as central)

The test options appear under the header TEST OPTION. For description of the test functions and instructions how to operate them, refer to Section 5.4, *Diagnostic Tests,* in Chapter 5.

Configuration Parameters

HCD-E1 configuration parameters are divided into the following seven groups: system parameters (SYSTEM PARAMETER), sublink parameters (SL PARAMETERS), channel parameters (CHANNEL PRM), control port parameters (SP PARAMETERS), priority bumping parameters (PB PARAMETERS), BERT parameters (BERT PRM), and download parameters (DNLOAD PRM).

Section 3.4 describes each group of parameters and provides practical configuration guidelines, where necessary.

In addition to the parameters configured from the front panel, there are parameters that can be controlled only from the control terminal. These are described in *Chapter 4*.

Using Front-Panel Push Buttons

HCD-E1 operation is controlled by means of the LCD and the three push buttons designated CURSOR, SCROLL and ENTER. The same control actions are consistently used for all the activities:

Cursor Use this push-button to indicate what you want to change. Pressing the CURSOR push button moves the cursor (a bar that indicates the selected field) among the fields in the current display.

Scroll Some fields list several different items. You can change ("scroll") the item indicated by the cursor by pressing SCROLL.
Press this push button repeatedly to display the alternatives for the current field indicated by the cursor. Holding this button pressed causes automatic scrolling of the available alternatives.

Enter Press this button once to select the value displayed in the field indicated by the cursor.

- If the selected value is valid, it replaces the old value and the change takes effect immediately.
- If your selection is incorrect, it is not accepted. In this case, HCD-E1 displays a CONFIG ERROR message with a two-digit code in the second display row. The code indicates what is wrong. After a short time, the error message disappears and HCD-E1 returns to the original display. Now you can correct the error. Refer to *Section 5.5* for the list of the error codes and description of what to do to correct the error.

Additional Functions of ENTER

The ENTER key has two additional functions:

1. When the LCD displays the ALARM BUFFER screen, the ENTER key can be used to delete all the alarm messages in the buffer.
2. When the LCD displays the PORT DIAG or HDSL DIAG screens, the ENTER key can be used to reset the performance monitoring counter being displayed (see *Displaying Performance Data on the Front-Panel LCD* in Chapter 5).

3.4 Configuration Parameters

This section lists the HCD-E1 configuration parameters and their functions. The information is organized in tables for each group of parameters:

Group	Display	See...
System parameters	SYSTEM PARAMETER	*Table 3-2*
Sublink parameters	SL PARAMETERS	*Table 3-3*
Control port parameters	SP PARAMETERS	*Table 3-4*
Channel parameters	CHANNEL PRM	*Table 3-5*
BERT parameters	BERT PRM	*Table 3-6*
Download parameters	DNLOAD PRM	*Table 3-7*
Priority bumping parameters	PB PARAMETERS	*Table 3-8*

The tables also list the parameter values included in the HCD-E1 default configuration and important practical guidelines for configuring some of them.

Note *In addition to the parameters listed in the tables, HCD-E1 supports other parameters, which can be modified only via the control port. These parameters are explained in Chapter 4.*

System parameters can be set only on a unit configured as central.

Table 3-2 System Parameters

Designation	Function	Values		Configuration Guidelines
CLK MASTER*	Selects the master timing reference.	INT	Internal oscillator is selected	Select SL for connection to carrier lines. For a point-to-point application with standalone equipment at both link ends, you can also select INT. Prior to setting CLK MASTER to CH1 or CH2, you must set the timing mode of the corresponding channel to DTE2 and assign at least one time slot (see *Table 3-5*, Channel Parameters, or the DEF CH command in Chapter 4).
		SL	Locked to the recovered receive clock of the E1 sublink.	
		CH1 or CH2	Locked to the external clock supplied to the corresponding data channel, provided the channel timing mode is DTE2.	
		Default: INT		
	Note: *When HCD-E1 is configured as a remote unit, the CLK MASTER parameter doesn't appear at all. The clock is always locked to the recovered receive clock of the HDSL line. This locks the outgoing timings of the E1 port and data channels to the timing of the HDSL signal. If both lines operate normally, HCD-E1 uses the recovered clock of line A (line 1); if line 1 fails, HCD-E1 automatically switches to the recovered clock of line 2.*			
CLK_FBACK*	Selects the alternate (fallback) system timing reference, for use in case the master reference fails.	NONE	No fallback source is used. In this case, the internal oscillator is automatically selected when the master reference fails.	Select a source different from that selected as master. To disable switching to the fallback source, select NONE. In this case, the default fallback clock source is the HCD-E1 internal clock oscillator. Prior to setting CLK_FBACK to CH1 or CH2, you must set the timing mode of the corresponding channel to DTE2 and assign at least one time slot.
		SL	Locked to the recovered E1 sublink receive clock.	
		CH1 or CH2	Locked to the external clock supplied to the corresponding user data channel, provided the channel timing mode is DTE2	
		Default: NONE		
HCD TYPE	Displays HCD-E1 configuration mode	CENTRAL	HCD-E1 configured as central unit	
		REMOTE	HCD-E1 configured as remote unit	

Table 3-2 System Parameters (Cont.)

Designation	Function	Values		Configuration Guidelines
CONFIG REM*	Selects the ability to configure a remote unit	YES	Enables the downloading function. The configuration values selected for HCD-E1 configured as central unit are downloaded to the unit configured as remote, and determine the remote unit operating mode.	
		NO	Disables the downloading function.	
		Default: YES		
HRPT	Shows whether your HDSL link contains an H-RPT repeater	YES	The HDSL link contains H-RPT.	
		NO	There is no HDSL repeater on the HDSL link.	

* Parameters marked with an asterisk are displayed only when your HCD-E1 is configured as central unit.

Note

1. If in your application the downloading function is disabled (CONFIG REM at the central unit set to NO), and the unit configured as central is reset or restarted (for example, after power-up), its parameters may be automatically downloaded to the unit configured as remote, and replace the locally-modified parameters. In order for this not to happen, make sure that Section 2 (DB INIT) of the DIP Switch S1 of the unit configured as central is set to OFF (see "Setting the Internal Jumpers and Switches" in Chapter 2).

2. A data channel or a sublink can serve as a timing reference only if at least one time slot is assigned to it. For details refer to Working with Time Slots section below.

Table 3-3 Sublink Configuration Parameters

Designation	Function	Values		Configuration Guidelines
FRAME	Selects the framing mode for the sublink	UNFRAMED	The E1 sublink transparently transfers the incoming data stream on a bit-by-bit basis. This allows transfer of unframed 2048 kbps data streams, or of data streams using any framing method (standard or proprietary).	Select the framing mode specified for use in your network. When transferring unstructured data streams, or data streams with proprietary framing, select UNFRAMED. To select UNFRAMED, you have to assign all the 32 time slots.
		G732N	Two frames per multiframe. Time slot 16 is passed transparently.	
		Default: G732N		
SYNC (does not appear in UNFRAMED mode)	Permits to reduce the time required for the E1 sublink to return to normal operation after local loss of synchronization	CCITT	Complies with ITU-T Rec. G. 732	Select CCITT, unless your application has special requirements
		FAST	After 1 second	
		62411	Similar to the requirements of AT&T TR-62411 (after 10 seconds)	
		Default: CCITT		
CRC-4 (does not appear in UNFRAMED mode)	Enables the generation of check bits (in accordance with the CRC-4 polynomial specified by ITU G.704) for the frames transmitted on the E1 sublink, and the checking of check bits carried by the frames	NO	CRC-4 option disabled	Select YES, unless HCD-E1 is connected to equipment that does not support this capability.
		YES	CRC-4 option enabled	
		Default: NO		

Table 3-3 Sublink Configuration Parameters (Cont.)

Designation	Function	Values	Configuration Guidelines
MAP MODE	Determines the selection method for the E1 sublink time slots transferred to the HDSL link. ***Note***: *The selected sublink time slots are allocated the same time slots in the HDSL link frame.*	USER Free user selection of time slots SEQ Sequential allocation of time slots, starting from a user-specified time slot (defined under START TS). ALT Alternate allocation of time slots. This selection means that starting from a specified slot, defined under START TS, the time slot allocation looks like this: DATA NC DATA NC DATA, etc. **Default: USER**	To assign individual time slots, select USER. To let HCD-E1 assign the time slots automatically in accordance with the NUM OF TS parameter, select SEQ (sequential allocation) or ALT (alternate allocation). If you have selected SEQ or ALT, you must also set the starting time slot under START TS.
NUM OF TS	Selects the total number of time slots being assigned.	NC, 0, 1, ..., 32 for UNFRAMED 1 to 32 for G732N **Default: NC**	When working in UNFRAMED mode, this parameter must be set to 32. In ALT mode, the number of time slots assigned depends on the value of START TS and is 16 at maximum.
START TS	Selects the starting time slot for SEQ or ALT time slot allocation	Any number in the range of 01 to 31, consistent with the desired number of user time slots. **Default: 0**	When working in UNFRAMED mode, this parameter must be set to 0. If you selected SEQ mode for G732N, make sure that the sum of the START time slot number and of the NUM OF TS parameter does not exceed 31.
IDLE_CODE	Selects the code transmitted to fill idle (unused) time slots in the E1 frames	The available selections are 00 to FF (hexadecimal) **Default: FF**	

Table 3-3 Sublink Configuration Parameters (Cont.)

Designation	Function	Values		Configuration Guidelines
TS_0 to TS_31 (for UNFRAMED) TS_1 to TS_31 (for G732N)	If you have selected USER under MAP, selects, for each HDSL time slot, whether to use it for carrying the user's payload or not. If you have selected SEQ or ALT, displays the time slot allocation.	NC DATA **Default:**	Time slot not used (not connected) Time slot used to carry payload data **NC**	For each time slot to be used, select DATA to assign the time slot to carry user's payload, or NC to skip it. Make sure you assign the exact number of time slots needed to support the data rate selected by means of the NUM OF TS parameter. Avoid selecting time slots, which have already been assigned to data channels or in-band management

Table 3-4 Control Port Parameters

Designation	Function	Values	Configuration Guidelines
SPEED	Selects control port data rate	300, 1200 ,2400, 4800, 9600 (bps), AUTO AUTO Autobaud operation. HCD-E1 automatically identifies the control port data rate. **Default: AUTO**	To enable the supervisory port to use the SLIP protocol (for example, for SNMP or Telnet management), select the specific data rate being used. In all the other cases, select AUTO. In this case HCD-E1 performs the automatic baud rate recognition procedure. To ensure positive identification of terminal data rate, start the communication with three consecutive carriage returns (<CR>).
DATA	Selects the number of data bits in the word format	7 or 8 data bits. **Default: 8**	Make sure that the number of data bits is the same as on the terminal.

Table 3-4 Control Port Parameters (Cont.)

Designation	Function	Values	Configuration Guidelines
PARITY	Selects the method of parity checking	ODD Odd parity EVEN Even parity NONE Parity check disabled (available only with 8 data bits) **Default: NONE**	Make sure that the parity is the same as on the terminal.
INTERFACE	Selects control port interface	DCE HCD-E1 operates as a DCE for the control terminal. DTE HCD-E1 operates as a DTE, for connection via modem to the control terminal. **Default: DCE**	Select DCE when directly connected to the control terminal. Select DTE when connected to a modem.
	Note: *The INTERFACE parameter changes only the direction of the interface control (handshaking) signals, but not the functions of the interface pins. Therefore, when connecting to a modem, it is necessary to use a cross cable.*		
AUX DEV (does not appear with HCD-E1 configured as remote)	Selects the management mode supported by the HCD-E1 control port	TERMINAL Management by means of a supervision terminal. NMS-SLIP Management by means of Telnet host or an SNMP network management station. NONE Not in use **Default: TERMINAL**	

Table 3-5 Channel Parameters

Designation	Function	Values		Configuration Guidelines
FRAME	Selects a framed or unframed mode of HDSL framer	FRAMED	HDSL framer is in the framed mode	Select UNFRAMED if your remote unit is HTU-E1 and desired payload data rate is 2048 kbps.
		UNFRAMED	Allows transfer of unframed 2048 kbps data streams	***Note***: *Any change in the operating mode from FRAMED to UNFRAMED and vice versa will cause double temporary HDSL synchronization loss*.
		Default:	**FRAMED**	
	Important: *If you select UNFRAMED, the payload data rate* ***must be*** *1792 kbps or 2048 kbps. Priority bumping is not applicable in this mode*.			
MULT	Selects the basic data rate per HDSL timeslot	64K	Basic data rate is 64 kbps	Select the basic rate of the user's payload, 56 kbps or 64 kbps, in accordance with the desired user's channel data rate.
		56K	Basic data rate is 56 kbps	The recommended selection is 64 kbps. When you select 56 kbps, HCD-E1 packs the user's data in bytes by adding an "1" bit for each seven user bits, therefore actually the line data rate is always a multiple of 64 kbps.
		Default: 64		
MAP	Selects the time slot allocation method used for mapping user's data into the time slots of the HDSL link	USER	Free user selection of time slots.	To assign individual time slots, select USER.
		SEQ	Sequential allocation of time slots, starting from a user-specified slot, defined under START TS.	To let HCD-E1 assign the time slots automatically in accordance with the SPEED parameter, select SEQ (sequential allocation) or ALT (alternate allocation).
		ALT	Alternate allocation of time slots, starting from a user-specified time slot, defined under START TS.	ALT means that starting from a specified slot, defined under START TS, the slot allocation looks like this: DATA NC DATA NC DATA etc.
		Default: USER		
SPEED	Selects the channel payload data rate. For a channel with Ethernet interface, selects the transfer rate through the HDSL link	Available data rates are multiples of the basic rate (56 kbps or 64 kbps). The multiples are in the range of 1 to 32, resulting in rates of 56, 112, 168, ..., 1792 kbps or 64, 128, 192, ..., 2048 kbps, respectively.		The maximum possible speed selected for the ALT mode depends on the START parameter and cannot exceed the multiple of MULT and 16.
		Default: NC		

Table 3-5 Channel Parameters (Cont.)

Designation	Function	Values	Configuration Guidelines
START TS	Selects the starting time slot for SEQ or ALT time slot allocation (not displayed for USER allocation)	Any number in the range of 0 to 31, consistent with the desired number of user time slots. **Default: 0**	If you have selected SEQ, make sure that the sum of START time slot number and of SPEED divided by MULT does not exceed 31.
CTS	Selects the state of the CTS line in the data channel interface (not relevant for the Ethernet interface)	ON CTS continuously on =RTS CTS line follows the RTS line **Default: ON**	For polled applications, select =RTS.
ETHER (appears only when data channel has Ethernet interface)	Selects the Ethernet LAN traffic transfer mode	HALF_DUP Half duplex operation FULL_DUP Full duplex operation **Default: HALF_DUP**	
BRIDGING (appears only when data channel has Ethernet interface)	Reserved for future use.	Always displays FILTER, independently of the selected Ethernet traffic control function.	To select the Ethernet traffic control function, use Ethernet bridge DIP switch SW-1, Section 3 (see *Appendix C*). Set the DIP switch, Section 3 to ON (FILTER) if you want to filter the traffic sent to the remote end (recommended).
FIFO SIZE	Selects the size of the FIFO buffer for the data channel. This parameter is used in the DTE2 mode. In the other modes, HCD-E1 sets the buffer size automatically.	AUTO Automatic size selection. 32, 60, 104,144 Buffer size in bits corresponds to FIFO lengths of ±16, ±30, ±52, and ±72 bits). **Default: AUTO**	Select AUTO (automatic FIFO buffer size selection), which means that the FIFO buffer size is automatically selected, in accordance with the jitter that must be tolerated at each data rate. When using the DCE and DTE1 clock modes, it is not necessary to increase the FIFO buffer size. If the DTE2 mode is used, and the jitter expected in a specific application is higher than what can be tolerated when using the automatically selected size, you can manually select a FIFO buffer size greater than the AUTO size. The AUTO values are listed in *Table 1-1*.

Table 3-5 Channel Parameters (Cont.)

Designation	Function	Values		Configuration Guidelines
CLK MODE	Selects the clocking mode of the given data channel.	DCE	The data channel provides both transmit and receive clocks to the user DTE.	Select in accordance with the type of equipment connected to the user data channel (see Chapter 1 for more information): • **DCE -** For direct connection to a synchronous DTE • **DTE1 -** For connection via a modem with external clock, or another equipment that accepts a receive clock and outputs a transmit clock. • **DTE2 -** For connection via a modem or other type of equipment (such as a multiplexer), that provides both receive and transmit clocks. You must select this mode when the HCD-E1 timing is to be locked to an external clock (see *CLK MASTER*), or the external clock is intended for use as a fallback reference (see *CLK_FBACK*).
		DTE1	The data channel provides the receive clock to the user while receiving the transmit clock from the DTE.	
		DTE2	The data channel receives both the transmit and receive clocks from the user DCE.	
		Default: DCE		
TS_0 to TS_31	If you have selected USER under MAP, selects, for each HDSL time slot, whether to use it for carrying the user's payload or not. If you have selected SEQ or ALT, displays the time slot allocation.	NC	Time slot not used (not connected)	For each time slot to be used, select DATA to assign the time slot to carry user's payload, or NC to skip it. Make sure you assign the exact number of time slots needed to support the data rate selected by means of the SPEED parameter. Avoid selecting time slots, which have already been assigned to another channel, sublink, or in-band management.
		DATA	Time slot used to carry payload data	
		Default: NC		

Table 3-6 BERT Parameters

Designation	Function	Values	Configuration Guidelines
PATTERN	Selects the test pattern.	2E3-1, 2E4-1, 2E5-1, 2E6-1, 2E7-1, 511, 2E10-1, 2047, 2E15-1, 2E17-1, 2E18-1, 2E20-1, QRSS, 2E21-1, 2E22-1, 2E23-1, 2E25-1, 2E28-1, 2E29-1, 2E31-1, 2E32-1. **Default: 2E3-1**	
ERR RATE	Enables the injection of a calibrated rate of errors in the transmitted test pattern.	SINGLE 10E-1, 10E-2, 10E-3, 10E-4, 10E-5, 10E-6, or 10E-7 NO ERR **Default: NO ERR**	Select NO ERR to disable the injection of errors Select SINGLE to enable the injection of single errors Select 10E-1 to enable the injection of errors at a rate of 10E-1 (one error in every 10 test pattern bits), and same with 10E-2, 10E-3, 10E-4, 10E-5, 10E-6, up to 10E-7 (one error in every 10 million test pattern bits). See *Operating BERT from the Front Panel* in Section 5.4 for the error injection procedure.

Table 3-7 Download Parameters

Designation	Function	Values	Configuration Guidelines
SL MODE	Selects the in-band transmission mode for the sublink	NONE In-band SNMP and Telnet traffic is ignored TS0/F In-band SNMP and Telnet traffic is received and transmitted in time slot 0. DEDIC In-band SNMP and Telnet traffic is received and transmitted in a dedicated user-selected time slot. **Default: NONE**	Select NONE also when using UNFRAMED mode. To use the S_{a4} bit in time slot 0, select TS0/F If you selected DEDIC, you must also select a free time slot using the SL TS NUM parameter.
ML MODE	Selects the in-band transmission mode for the selected main link.	NONE In-band SNMP and Telnet traffic is ignored DEDIC In-band SNMP and Telnet traffic is received and transmitted in a dedicated user-selected time slot. **Default: NONE**	Select NONE also when using UNFRAMED mode. If you selected DEDIC, you must also select a free time slot using the ML TS NUM parameter.
SL TS NUM	Selects the free time slot when SL MODE is selected as DEDIC.	1 to 31 **Default: 31**	If you have selected DEDIC both for SL and ML modes, make sure that the assigned time slot is the same for both links.
ML TS NUM	Selects the free time slot when ML MODE is selected as DEDIC.	0 to 31 **Default: 31**	If you have selected DEDIC both for SL and ML modes, make sure that the assigned time slot is the same for both links.

Table 3-8 Priority Bumping Configuration Parameters

Designation	Function	Values
TS_1 to TS_31	Selects the time slot priority in the case one of the HDSL lines is down. The time slots which have been assigned high priority will continue being sent on the remaining HDSL line.	LOW Low priority HIGH High priority **Default: LOW**

Note *1. The priority bumping will work in the framed mode only.*

2. TS-0 has always HIGH priority. The maximum number of other time slots that can be configured to high priority is 16.

3.5 Operating Instructions

This section covers the following activities:

- Turning HCD-E1 on
- Checking the HCD-E1 configuration
- Normal HCD-E1 operating indications
- Monitoring the HCD-E1 performance
- Turning HCD-E1 off

Refer to *Section 3.6* for local configuration setup instructions.

Turning HCD-E1 On

To turn HCD-E1 on, set the rear POWER switch to ON (AC version) or connect it to the power supply (DC version). Upon turn-on, HCD-E1 performs a self-test: observe the front-panel indications.

During the self-test, HCD-E1 displays its current software revision:

```
HCD REV 2.1
SELF TEST
```

After successfully completing the self-test procedure, HCD-E1 switches to the default ALARM BUFFER screen.

If HCD-E1 fails the self-test, its LCD will display a description of the fault. In this case, HCD-E1 must be repaired before it can be used again.

Warning

Access to the inside of the unit is permitted only to qualified and authorized personnel

If the self-test reveals that configuration data selected by the user and stored in the HCD-E1 database is corrupted, HCD-E1 generates the DB CHKSUM ERR alarm message. In this case, it is necessary to initialize the database. To do this, use the INIT DB command, if you have access to a control terminal. Otherwise, do the following:

1. Set Section DB INIT of the internal switch S1 to ON.
2. Turn HCD-E1 on for a short time (until the power-up self-test is performed) .
3. Return the DB INIT switch section to OFF. Now HCD-E1 is operating with the default parameters. The parameter values included in the default configuration are listed in *Section 3-4*.
4. Configure the unit, if necessary.

Refer to *Chapter 2* for more detailed procedures.

You can verify the HCD-E1 configuration as explained in the following section. If the configuration does not require modification, HCD-E1 is ready for operation immediately after the self-test is completed. For information how to change the configuration, refer to *Section 3.6*.

Checking the Current Operating Configuration

Before performing the procedure below, review *Section 3-4*, which explains the HCD-E1 configuration parameters.

To check the current operation configuration, proceed as follows:

Note *During the following procedure, do not press the ENTER push button, to prevent accidental change of parameters.*

Step	Action	Key	Result
1	Bring the cursor to the top row (if it is not already there).	CURSOR	
2	Scroll to display SYSTEM PARAMETER in the top row.	SCROLL	The second row shows the first system parameter (CLK MASTER if your HCD-E1 is configured as central) and its current selection.
3	Bring the cursor to the left-hand field in the second row.	CURSOR	
4	Scroll to see the other system parameters.	SCROLL	After each pressing of the SCROLL button, the second row displays the name and current value of the next system parameter. Continue until the first parameter appears again.
5	Bring the cursor to the left-hand field in the top row.	CURSOR	
6	Bring to display the next group of configuration parameters (the sublink parameters).	SCROLL	The first row displays SL PARAMETERS. The second row shows the first parameter of the port parameters, FRAME, and its current value.
7	Bring the cursor to the left-hand field in the second row.	CURSOR	
8	Scroll to see the other parameters of this group.	SCROLL	After each pressing of the SCROLL button, the second display row shows the current value of the next parameter. Continue until FRAME appears again.
9	Repeat steps 5 to 8 to display the control port parameters, SP PARAMETERS and CHANNEL PRM CH1	CURSOR SCROLL	
10	Bring the cursor to the right-hand field in the top row.	CURSOR SCROLL	The first row displays CHANNEL PRM CH1.

Step	Action	Key	Result
11	Bring the cursor to the right-hand field in the top row	CURSOR	
12	Scroll to display CH2	SCROLL	The first row displays CHANNEL PRM CH2.
13	Repeat steps 7, 8 to see other Channel 2 parameters.	CURSOR, SCROLL	
14	Repeat steps 5 to 8 to display the rest of the parameters: BERT PRM, DNLOAD PRM, PB PARAMETERS		

Normal Indications LCD

If no ON-state alarm* is stored in the alarm buffer (ALM indicator off), HCD-E1 continues to display the last user-selected display. If there are ON-state alarm messages stored in the alarm buffer (ALM indicator lights) and neither PORT DIAG nor HDSL DIAG screen is displayed, the top row displays the message ALARM BUFFER.

In addition, HCD-E1 will automatically abort the current activity (except PORT DIAG and HDSL DIAG) and will redisplay the ALARM BUFFER message if no front-panel button is pressed for one minute.

When the top row shows ALARM BUFFER, the second row displays the following information:

- If there are no ON-state alarm messages stored in the alarm buffer, the second row shows EMPTY.
- If the alarm buffer contains ON-state alarms, HCD-E1 displays SCROLL in the left-hand field of the second row, and CLEAR in the right-hand field.

* For explanation of the term, instructions on displaying and clearing the alarms, refer to Section 5.2, *Status Indications and Alarms,* in Chapter 5.

LEDs

During normal operation, all the HCD-E1 front-panel indicators are off.

- The TST indicator lights when a test is active. The test type can be displayed by entering the TEST OPTIONS (*Chapter 5*).
- The E1 LOS LOC indicator lights when the E1 port loses frame synchronization to the incoming signal (in the UNFRAMED mode, the indicator lights when the incoming signal is corrupted or missing).
- The E1 LOS REM indicator of a link lights when the equipment connected to the E1 port reports loss of synchronization. This indication is not available when the UNFRAMED mode is selected.
- The HDSL LOS indicator lights when the circuits of the corresponding HDSL line lose synchronization to the incoming signal.
- The ALM indicator lights when ON-state alarms are stored in the HCD-E1 alarm buffer.

Monitoring the HCD-E1 Performance

HCD-E1 continuously measures diagnostics performance data. The diagnostics data is available under PORT DIAG or HDSL DIAG.

For the explanation of the measured parameters, refer to Section 5.3, *Performance Diagnostics Data,* in Chapter 5.

Turning HCD-E1 Off

To turn HCD-E1 off, do the following:

- If you have an AC version, set the HCD-E1 rear power switch to OFF
- If you have a DC version, disconnect the power cord from the unit.

3.6 Local Configuration Setup Procedure

General

Before starting any configuration action:

- Review the relevant configuration parameters given in *Section 3-4*.
- Consult a list of the required parameters from the network subscription data, and/or from your system administrator.

To set up the HCD-E1 configuration, act in the following order:

1. Select the system parameters (only if your unit is configured as central).
2. Select the E1 sublink parameters.
3. Select the channel parameters.
4. Select the parameters of the control port, if needed.
5. Select the priority bumping parameters, if needed and possible.
6. Select the download parameters (if you want to enable in-band management).
7. Select the BERT parameters, if necessary.

If your HCD-E1 is configured as remote, you will have to configure it only when the CONFIG REM parameter (see *Table 3-2, System Parameters*) of your unit configured as central is set to NO.

The general configuration procedure is explained on the following page. Tables in *Section 3.4* list special considerations and guidelines for each group of parameters.

Password Protection

HCD-E1 has password protection designed to avoid undesirable modification of its parameters. You will be able to configure HCD-E1 from the front panel only if its password protection is disabled. Otherwise, you can use the HCD-E1 front panel to display the current parameter values, but cannot modify them. If you try to modify a parameter or perform a test function from the front panel while the password protection is enabled, HCD-E1 will display CONFIG ERROR 04 (for the list of configuration error messages see *Table 5-5* in Chapter 5).

If you have access to an ASCII control terminal, you can use the DEF SP command to enable or disable the password protection (see *Chapter 4* for detailed instructions).

If the terminal is not available, you must set for a short time the DB INIT section of the internal switch S1 to ON for disabling password protection, as explained in *Section 2-4*.

Note *This action will delete all the current parameters on your HCD-E1 and make it use the default parameter values. If your unit is configured as central, these parameters will be also automatically downloaded to the remote unit. That is to say, now you will need to reconfigure both the central and the remote unit. The only case you would not have to do it is when your unit is configured as remote and you want its parameters to be automatically downloaded from the unit configured as central (its CONFIG REM parameter from SYSTEM PARAMETER menu set at YES).*

General Configuration Procedure

Before starting the configuration procedure, make sure that all the user-initiated loopbacks are disconnected. To disconnect the loopbacks, select OFF under the TEST OPTION field (see Section 5.4*, Diagnostic Tests,* in Chapter 5*)*.

If your configuration attempt is invalid, HCD-E1 shortly displays a CONFIG ERROR XY message (the code XY identifying the error) and then returns to its normal display. For explanation of the configuration error messages refer to Section 5.5, *Configuration Error Messages,* in Chapter 5.

To configure the unit, follow the steps below:

Step	Action	Key	Result
1	Bring the cursor to the top row (if not already there).	CURSOR	
2	Scroll to display the desired group of parameters in the top row.	SCROLL	The second row shows the first parameter in the selected group and its current value.
	Note: *When the desired group of parameters must be separately selected for each data channel, the top row includes an additional field (at the rightmost side of the top row): this field is used to select the desired channel number.*		
3	Bring the cursor to the left-hand field (parameter name) in the second row, and then scroll to display the desired parameter in the selected group.	CURSOR SCROLL	
4	Bring the cursor to the right-hand field (the parameter value) in the second row.	CURSOR	
5	Scroll to set the required value for the displayed parameter.	SCROLL	The second row shows the available values.
6	When the desired parameter value is displayed, confirm the new parameter value. ***Note***: *For the CHANNEL PRM, SL PARAMETERS and DNLOAD PRM groups, you must press ENTER only after you have changed all the parameters (that required changes), otherwise HCD-E1 displays the CONFIG ERROR message. For more information,* see *Table 3-3 and Table 3-5*.	ENTER	The second row displays shortly CONFIG ENTER, then returns to the normal display.
7	Repeat steps 3 to 6 until values are assigned to all the parameters in the group.	SCROLL	The second row displays the current selection.
	Note: *You do not have to press ENTER each time you change a parameter within a group. However, once you have finished to modify parameters of a certain group (such as system, sublink, etc.), you must press ENTER to confirm the selection. If you change parameter values, but return the cursor to the top row and scroll to another group without pressing ENTER, the changes are discarded and HCD-E1 shortly displays the message CONFIG LOSS.*		
8	Repeat steps 1 to 7 until values are assigned to all the parameters in the desired groups.	CURSOR SCROLL ENTER	
9	After completing the configuration actions, you can use steps 1, 2 to return to the ALARM BUFFER screen. If ON-state alarm messages are stored in the alarm buffer and the current screen is not PORT DIAG or HDSL DIAG, the ALARM BUFFER screen will be automatically displayed if no push button is pressed for one minute.	CURSOR SCROLL	The top row displays: ALARM BUFFER.

Note *Pressing ENTER accepts your choice only if the cursor is in the right-hand field of the second row.*

Working with Time Slots

This section provides instructions for performing time slot configuration from the front panel.

Reassigning All Time Slots between Data Channels/Sublink

If you want to reassign all timeslots from one data channel/sublink to another data channel/sublink, you must close the data channel/sublink (free all timeslots assigned to it), and then assign the timeslots to another data channel/sublink.

1. If the data channel/sublink, which you want to close serves as master or fallback clock source, you must select a different timing reference first. Perform the selection by scrolling to SYSTEM PARAMETERS in the top row and setting temporarily CLK MASTER to INT and CLK FBACK to NONE.
2. Deactivate all loopback tests. For instructions on deactivating loopback tests from the front panel, refer to *Diagnostic Tests* in Chapter 5.
3. To close a data channel, scroll to CHANNEL PRM CHX in the top row. Set the SPEED parameter to NC and press the ENTER button.
4. To close the sublink, scroll to SL PARAMTERS in the top row. Set the NUM OF TS parameter to NC and press the ENTER button.
5. To reassign the closed time slots to the sublink, scroll to SL PARAMTERS in the top row and assign the time slots to the sublink. Refer to *Table 3-3* for instructions on assigning time slots to the sublink.
6. To reassign the closed time slots to a data channel, scroll to CHANNEL PRM CHX in the top row and assign the time slots to the channel. Refer to *Table 3-4* for instructions on assigning time slots to data channels.
7. Select the new sources for the CLK MASTER and CLK FBACK parameters.

Note *You must assign at least one timeslot to the data channel or sublink, which you select as master or fallback clock source.*

Reconfiguring Individual Time Slots

To reconfigure individual time slots, follow the steps below:

1. Deactivate all loopback tests. For instructions on deactivating loopback tests from the front panel, refer to *Diagnostic Tests* in Chapter 5.
2. To reassign time slots currently assigned to a data channel, scroll to CHANNEL PRM CHX in the top row. Set the SPEED parameter to the corresponding (lower) value. To reassign time slots currently assigned to the sublink, scroll to SL PARAMETERS in the top row. Set the NUM OF TS parameter to the corresponding (lower) value. Select USER under MAP MODE. For each time slot you want to reassign, scroll to the time slot in the bottom row and set it to NC. When the closing of the desired time slots is completed, press ENTER.

3. To reassign closed time slots to a data channel, scroll to CHANNEL PRM CHX in the top row. Set the SPEED parameter to the corresponding (higher) value. For each time slot you want to reassign, scroll to the time slot in the bottom row and set it to DATA. When the reassignment of the desired time slots is completed, press ENTER.
4. To reassign closed time slots to the sublink, scroll to SL PARAMTERS in the top row. Set the NUM OF TS parameter to the corresponding (higher) value. For each time slot you want to reassign, scroll to the time slot in the bottom row and set it as desired. When the reassignment of the desired time slots is completed, press ENTER.

Replacing a Time Slot Used for the In-band Management

Before selecting a new time slot for the main link in-band management, you must close the current dedicated time slot.

1. Scroll to DNLOAD PRM in the top row, scroll to ML TS NUM in the bottom row.
2. Scroll to the current dedicated timeslot and close it by setting it to NC.

   Wait 20 seconds (40 seconds if H-RPT is installed in the HDSL link).

Note *Make sure that the time slot, which you intend to use for the in-band management is not assigned to a data channel or sublink.*

3. Assign the desired timeslot to the in-band management from the DNLOAD PRM menu.

Chapter 4

Control from the Supervisory Port

4.1 General

This chapter provides detailed instructions for the management of HCD-E1 by means of ASCII terminals and IP hosts using the Telnet protocol.

The initial configuring of HCD-E1 is to be performed using a standard ASCII terminal connected to the HCD-E1 control port, CONTROL DCE. However, after performing the initial configuration, you can manage HCD-E1 using any of the following three options:

- Use the terminal as a supervision terminal, for performing all the management activities supported by the HCD-E1.
- Manage HCD-E1 from any IP host using the Telnet protocol. After establishing a Telnet session with HCD-E1, the Telnet protocol offers the same functionality as the supervision terminal, and in addition enables remote access over IP networks.
- Manage HCD-E1 by means of SNMP-based network management stations, e.g., the RADview network management station offered by RAD, using the SLIP protocol for communication.

This chapter includes the following information:

- Description of supervision terminal hardware requirements, communication and handshaking - *Section 4-2*.
- Starting a management session by means of the supervision terminal - *Section 4-3*.
- Description of the set of commands and command syntax available for the supervision terminal - *Section 4-4* and *Section 4-5*. The same command set is available to Telnet users.
- General operating instructions, including start-up, routine operations, and stopping of remote control - *Section 4-6*.

The instructions appearing in this chapter assume that the supervision terminal operator is familiar with the HCD-E1 system and with its configuration parameters.

For instructions regarding the use of the RADview network management station, refer to the *RADview User's Reference Manual*.

4.2 Hardware Requirements

Terminal Characteristics

Any standard ASCII terminal ("dumb" terminal or personal computer emulating an ASCII terminal) equipped with a V.24/RS-232 communication interface can be used to control HCD-E1 operation. Make sure to initialize HCD-E1 for correct terminal operation as explained in Section 4-3, otherwise some of the commands may not work properly.

The software necessary to run the HCD-E1 control program is contained in the HCD-E1 system.

Telnet (IP) Host Characteristics

Typically, the Telnet host is a PC with the appropriate suite of TCP/IP protocols, or a UNIX station.

The Telnet host can be directly connected to the managed HCD-E1 unit, or located at any site from which IP communication be established to the managed HCD-E1.

Control Port Interface Characteristics

HCD-E1 has a V.24/RS-232 asynchronous DCE port, designated CONTROL DCE and terminated in a 9-pin D-type female connector. The control port continuously monitors the incoming data stream and will immediately respond to any input string received through this port; moreover, when configured to support SLIP, messages in each of the supported protocols are automatically identified and processed.

The supervision terminal can be connected either directly to the HCD-E1 control port (the CONTROL DCE connector), or through a modem or any other type of full-duplex data link. The HCD-E1 control port interface type must be set in accordance with the connection method (see *Section 3-6*):

DCE Intended for direct connection to terminals. Since terminals usually have DTE interfaces, in this case the connection to the port is made by means of a straight-through cable.

DTE Intended for connection through a modem or data link. In this case, you need a cross cable (also called null modem cable) to connect to the CONTROL DCE connector.

The HCD-E1 control port can be configured to communicate at rates of 300, 1200, 2400, 4800, or 9600 bps. The word format consists of one stop bit and 7 or 8 data bits. Parity can be odd, even or disabled.

HCD-E1 supports two types of modems:

- Dial-up Hayes™ compatible modems. HCD-E1 has call-in capability, that is, it can accept external calls.
- Multidrop modems, such as the RAD SRM-8 miniature multidrop modem.

For multidrop operation, each HCD-E1 can be assigned a node number in the range of 1 through 255. Assigning node number 0 to the HCD-E1 means that it will accept and answer any message: this is not permitted in multidrop operation. Node number 0 is however recommended for use with both point-to-point and dial-up modes.

Each HCD-E1 can be assigned a logical name of up to eight characters. The logical name is sent in each transmission of alarm messages. The name helps the operator to identify the source of messages that are received by the supervision terminal.

The relevant HCD-E1 configuration parameters are described in *Section 3-5* and *Section 4-5*. Instructions for configuring the HCD-E1 control port appear in *Section 3-8*.

Control Port Handshaking Protocol

The control lines being used in each DCE and DTE modes and the direction of the control signals are detailed in the following chart.

Control Line	Interface Type	
	DCE	DTE
CTS	Out	Not Used
DCD	Out	Out
DSR	Out	Out
DTR	In	In
RI	Not Used	In
RTS	In	In

Data Terminal Ready (DTR)

The terminal sets the DTR line ON (active) to gain control over HCD-E1 and start a configuration/monitoring session.

When the DTR is ON, the front panel controls are disabled, and the LCD displays a message that notifies the operator that HCD-E1 is under remote management:

- When the management mode defined by means of the DEF SP command (or SP PARAMETERS on the front panel) is the supervision terminal (AUXILIARY DEVICE = TERMINAL), the LCD shows **`TERMINAL ON LINE`**.
- When the management mode is the Telnet or SNMP (AUXILIARY DEVICE = NMS-SLIP), the LCD shows **`NETWORK ON LINE`** and displays the IP address.

When you end the terminal control connection, returning the control to the HCD-E1 front panel, the DTR line goes OFF (becomes inactive).

Request to Send (RTS)

The RTS line is normally ON (active) when the supervision terminal is in session.

When the RTS line is OFF (inactive), HCD-E1 interprets any data received from the terminal on the TD line as MARK.

Clear to Send (CTS)

The state of the CTS line is determined by the CTS parameter:

ON	The CTS line is always ON (active).
=RTS	The CTS line follows the RTS line.

Data Carrier Detect (DCD)

The state of the DCD line depends on the communication address (node number):

- When the node number is 0, the DCD line is always ON (active).
- When a non-zero node number is used, the DCD becomes ON (active) when data is detected on the RD line, provided HCD-E1 recognizes its own address in the data stream.

To simulate DTE operation, the delay between these events can be set by the user (by means of the DCD_DEL parameter).

Ring Indication (RI)

The RI line is used only with dial-up modems (INT=DTE).

The RI line is normally OFF (inactive), and switches to the ON (active) state when the modem attached to the HCD-E1 front-panel CONTROL DCE connector detects an incoming call (see also the *DSR Line* section).

Data Set Ready (DSR)

- Usually, the DSR line is configured to track the DTR line. In this case, if the control port interface is DTE, the DSR line will be set to ON for five seconds when the RI line is ON while the DTR line is OFF.
- If the control port interface is DCE, the DSR line can also be configured to be continuously ON. However, if the DTR line switches to OFF, the DSR line will also switch to OFF for 5 seconds.

In addition, HCD-E1 always sets DSR OFF (inactive) for 5 seconds when the EXIT command is executed, or the disconnect time-out expires.

AUTOBAUD Function

When the AUTOBAUD function is enabled, HCD-E1 can identify the operating data rate of the terminal by analyzing the timing of three consecutive Carriage Return + Line Feed characters (generated by pressing three times the carriage return key). The detected data rate is then used for the current communication session.

The automatic baud rate identification procedure is performed (or repeated) whenever three consecutive carriage returns are received after one of the following events occurs:

- The DTR line has been switched OFF.
- The EXIT command has been executed.
- The idle disconnect time-out expired because no data has been exchanged with the supervision terminal.

In case one of these events occurred, HCD-E1 assumes that the current communication session has been terminated.

Note that when SLIP communication is required, the AUTOBAUD function must be disabled.

4.3 Starting a Supervision Terminal Management Session

Control Terminal Configuration

Configure the terminal for the communication parameters used by the HCD-E1 CONTROL DCE port, select the full-duplex mode, turn the terminal echo off, and disable any type of flow control. For the initial configuration session, it is recommended to use the default communication parameters: 9600 bps, one start bit, eight data bits, no parity, one stop bit. Connect the terminal cable to the CONTROL DCE connector of the HCD-E1. Turn the control terminal on. You are now ready to start a management session.

Preliminary Settings for Initial Configuration Session

If HCD-E1 does not respond (there is no echo or response to any command entered at the terminal), this may be caused by one of the following:

- CONTROL DCE communication parameters are not identical to those of the terminal
- HCD-E1 is configured to use a non-zero node number

You can cover both possibilities by setting the DB INIT switch to ON. This will enforce the default communication parameters and the default (0) node number, and disable the password protection in one action, and you will then be able to start the communication session. However, HCD-E1 allows a finer procedure, which lets you preserve your preset configuration. To do so, follow the procedure below. Remember that all the changes will take place only after you turn the HCD-E1 off for a short time, and then turn it back on.

1. If you don't know the node number, go to step 2. If you know the node number, enter it followed by the command (see *General Guidelines and Principles* below). If there is still no response, go to step 3. If you see asterisks instead of the command you typed, this means that HCD-E1 requires you to enter a password. Press <CR> and type in the node number followed by the password. If you don't know the password, set the PASSWD section of switch S1 to ON, to enforce the default password 'HCD'. This action enforces the default (0) node number, and you can enter the 'HCD' password without any node number prefix. Now, you will receive the HCD-E1 working prompt and be able to start the session.
2. Set the PASSWD section of S1 to ON, to enforce the default (0) node number. Enter <CR>. If there is still no response, go to step 3. If the prompt you see is 'PASSWORD', enter 'HCD' to see the working prompt.
3. Set the DEF SP section of S1 to ON. If there is still no response, return to step 1 or 2, depending on whether you know the node number. Note that this time password protection is disabled.

Initial Configuration

After successfully starting the management session, use the command **`DEF TERM 'terminal_type'`** to select the terminal type, if needed. **`'terminal_type'`** stands for one of the following types: VT-52, VT-100, TV-920, FREEDOM-100, or FREEDOM-220. If your terminal requires control sequences differing from those used by the terminals listed above, type the command **`F`** and enter your terminal control sequences.

If the current control codes are not compatible with your terminal and you cannot enter the desired codes, enter the **`INIT F`** command to reset the codes to 0, and then use the **`F`** command to modify the control codes starting from the known field values.

Working with Time Slots

This section provides instructions for performing time slot configuration from the supervisory terminal.

Reassigning All Time Slots between Data Channels/Sublink

If you want to reassign all timeslots from one data channel/sublink to another data channel/sublink, you must close the data channel/sublink (free all timeslots assigned to it), and then assign the time slots to another data channel/sublink.

1. Check the current time slot allocation by entering the DSP TS command.
2. If the data channel/sublink, which you want to close serves as master or fallback clock source, you must select a different timing reference first. Use the DEF SYS command to set temporarily the CLK MASTER to INT and CLK FBACK to NONE.
3. Deactivate all loopback tests. To do this, use the CLR TST command.

4. To close a data channel, use the DEF CH X command and set the SPEED parameter to NC.
5. To close the sublink, use the DEF SL command and set the NUM_OF_TS parameter to NC.
6. To reassign the closed time slots to the sublink, use the DEF SL command and assign the time slots to the sublink.
7. To reassign the closed time slots to a channel, use the DEF CH X command and assign the time slots to the channel.

Note *You must assign at least one timeslot to the data channel or sublink, which you select as master or fallback clock source.*

Reconfiguring Individual Time Slots

To reconfigure individual time slots, follow the steps below:

1. Deactivate all loopback tests. To do this, use the CLR TST command.
2. To reassign time slots currently assigned to a data channel, use the DEF CH X command. To reassign time slots currently assigned to the sublink, use the DEF SL command. Set each time slot you want to reassign to NC.
3. To assign closed time slots to a data channel, use the DEF CH X command. Set each time slot you want to assign to DATA.
4. To assign closed time slots to the sublink, use the DEF SL command. Set each time slot you want to assign as desired.

Replacing a Time Slot Used for In-band Management

Before selecting a new time slot for the main link in-band management, you must close the current dedicated time slot.

1. Close the time slot used for the in-band management with the DEF DL command.

   Wait 20 seconds (40 seconds if H-RPT is installed in the HDSL link).

Note *Make sure that the time slot, which you intend to use for the in-band management is not assigned to a data channel or sublink.*

2. Assign the desired time slot to the in-band management, using the DEF DL command.

4.4 HCD-E1 Control Language

This section presents the HCD-E1 control language syntax, its usage, and set of commands.

General Guidelines and Principles

Following are general guidelines you have to be familiar with when working with HCD-E1 commands:

- Commands can be entered only when the HCD-E1 control port working prompt is displayed. The prompt is **HCD>**, and it always appears at the beginning of a new line. The cursor appears to the right of the prompt.
- Commands are case-insensitive, that is, you can type commands in either lowercase or uppercase letters.
- To correct typing errors, press the BACKSPACE key until the error is cleared, and then type the correct command.
- Use space as a separator between command fields and/or parameters.
- Commands must end with a carriage return <CR>.
- To cancel the current command, press CTRL-C. You will obtain the HCD-E1 prompt again.
- If AUTOBAUD is on, start any session by pressing the <CR> key three times in sequence. This will ensure identification of terminal data rate.
- At the start of a session, when password protection is on, the prompt HCD-E1 displays is PASSWORD. This means that HCD-E1 is waiting for the password before continuing. When you start entering the password, HCD-E1 responds to your input with asterisks. After the correct password is received, HCD-E1 sends the working prompt.
- After the working prompt is displayed, the user can enter the desired command. Full duplex communication with the terminal is necessary.
- When HCD-E1 uses a non-zero node number, prefix any command with: **NODE<SP>'node number'<SP>,** where 'node number' is the three-digit node number. No response will occur until the node number is received and acknowledged by the addressed HCD-E1. Acknowledgment is indicated by the echoing of the node number part, i.e. Node<SP>nnn<SP>, where <SP> stands for space.
  - At the start of a session, when password protection is on, you must enter the password after the node number. After the correct password is received, HCD-E1 sends the working prompt.
  - If password protection is off, this step is omitted and the working prompt appears after the node number conditions are fulfilled.
- The node number is in the range of 1 through 255 (0 indicates that the selective addressing function is disabled). To set or change the node number, use the DEF NODE command.
- Command evaluation starts only when you press the <CR> key after the last page of the data form.

- In case a command is invalid, HCD-E1 does not execute it and displays the following:
  - `'Bad command or parameter. Type 'h' for help'` if the command syntax is wrong
  - An appropriate error message (see *Section 5.5* in Chapter 5) if the command is not valid in the current system configuration or values you are trying to set are wrong.

  The correct command must then be sent again.
- You can avoid the command execution by pressing CTRL-C. This will result in the display of the HCD-E1 prompt, and a new command can be entered. You can also use CTRL-C to stop the automatic repetition of commands (/R option).
- Use CTRL-A to browse among the last ten commands.
- Use CTRL-D to repeat the last command.
- If an idle disconnect time-out is specified, HCD-E1 automatically disconnects the ongoing session if no command is received from the terminal for the specified time-out interval.

Command Options

The following general types of options are available with some commands (see details in the command set index, *Table 4-1*).

Option	Meaning	Example of Usage
/A	All	CLR ALM /A Clears all the alarms stored in the alarm buffer
/C	Clear	DSP ALM /C Displays all the alarms stored in the alarm buffer, and then clears all the ON-type alarms* stored in the alarm buffer
/CA	Clear all	DSP ALM /CA Displays all the alarms stored in the alarm buffer, and then clears all the alarms stored in the alarm buffer
/R	Repeat automatically command execution (available only when node number is 0)	DSP ST LINE /R Enables you to monitor the status of line 1

* For explanation of the term see Section 5.2, *Status Indications and Alarms,* in Chapter 5.

Index of Commands

Table 4-1 lists the HCD-E1 commands in alphabetical order.

Table 4-1 HCD-E1 Command Set Index

Command	Purpose	Options
CLR ALM	Clear the alarms stored in the HCD-E1 alarm buffer	/A
CLR ALM REM	Clear the alarms stored in the remote unit alarm buffer	/A

Table 4-1 HCD-E1 Command Set Index (Cont.)

Command	Purpose	Options
CLR ALM HRPT	Clear the ON-type alarms stored in the H-RPT alarm buffer	/A
CLR LOOP BERT CH X, or CLR LP BERT CH X*	Deactivate the BERT test on data channel X of the remote unit	
CLR LOOP INBAND CH X, or CLR LP INBAND CH X*	Deactivate the in-band loopback on data channel X of HCD-E1	
CLR LOOP L HRPT, or CLR LP L HRPT	Deactivate a local loop on H-RPT (only for HCD-E1 configured as central)	
CLR LOOP L LINE, or CLR LP L LINE	Deactivate a local (L) loopback on the HDSL lines	
CLR LOOP L CH X, or CLR LP L CH X*	Deactivate the local (L) loopback on data channel X of local HCD-E1	
CLR LOOP R CH X, or CLR LP R CH X*	Deactivate the remote (R) loopback on data channel X of local HCD-E1	
CLR LOOP R R CH X, or CLR LP R R CH X*	Deactivate the remote (R) loopback on data channel X of the remote unit	
CLR LOOP L SL, or CLR LP L SL	Deactivate a local (L) loopback on the E1 sublink of the local HCD-E1	
CLR LOOP R SL, or CLR LP R SL	Deactivate the remote (R) loopback on the E1 sublink of the local HCD-E1	
CLR LOOP R R SL, or CLR LP R R SL	Deactivate a remote (R) loopback on the E1 sublink of the remote unit	
CLR TST	Clear all the user-initiated tests and loopbacks	
DATE	Set the internal date for HCD-E1	
DEF AGENT	Define the parameters of the internal SNMP agent of HCD-E1	
DEF BERT CH 1 DEF BERT CH 2	Define the type of test sequence, set the error injection rate to be used for BER testing on the corresponding channel, and control the receipt of the activation pattern for the in-band loopback initiation.	
DEF CH 1 DEF CH 2	Configure the parameters of the corresponding channel	
DEF DL	Define the E1 sublink and main link in-band management parameters	
DEF NAME	Define the logical name of HCD-E1	
DEF NODE	Define the node number of HCD-E1	
DEF PB	Define the time slot mapping of priority bumping	
DEF PWD	Define a password	
DEF SL	Define E1 sublink parameters	
DEF SP	Define control port parameters	
DEF SYS	Define system parameters	
DEF TERM	Reset the terminal control codes to 0	

Table 4-1 HCD-E1 Command Set Index (Cont.)

Command	Purpose	Options
DEF PWD	Define a password	
DEF SL	Define E1 sublink parameters	
DEF SP	Define control port parameters	
DEF SYS	Define system parameters	
DEF TERM	Reset the terminal control codes to 0	
DEF TERM VT100 DEF TERM TV920 DEF TERM VT52 DEF TERM FREEDOM100 DEF TERM FREEDOM220	Select the control codes for one of the standard terminal types	
DSP ALM	Display the contents of the local unit alarm buffer, and optionally clear the buffer	/C /CA
DSP ALM HRPT	Display the contents of the H-RPT alarm buffer, and optionally clear the buffer	/C /CA
DSP ALM REM	Display the contents of the remote unit alarm buffer, and optionally clear the buffer	/C /CA
DSP BERT CH1 DSP BERT CH2	Display the results of the last BER measurement made on the corresponding channel	/R /C /I /S
DSP HDR TST	Display hardware faults detected during the power-on self-test and during normal operation	
DSP HDSL PM LPX	Display the contents of the performance monitoring registers of a selected HDSL line (X stands for the line number, 1 or 2) of the local HCD-E1, and optionally clear these registers	/CA
DSP PB	Display time slot mapping of priority bumping	
DSP REM AGENT	Display information on the remote SNMP agents handled by the HCD-E1 IP router	
DSP R HDR TST	Display hardware faults detected at the remote unit (during the power-on self-test and during normal operation)	
DSP R HDSL PM LPX	Display the contents of the performance monitoring registers of the remote unit for a selected HDSL line (X stands for the HDSL line number, 1 or 2), and optionally clear these registers	/CA
DSP R SL PM	Display the contents of the sublink performance monitoring registers of the remote unit and optionally clear the registers	/C /CA
DSP SL PM	Display the contents of the sublink performance monitoring registers of the local unit, and optionally clear these registers	/C /CA
DSP ST CH1 DSP ST CH2	Display status information on the corresponding channel	
DSP ST LINE X	Display status information on the HDSL lines (X stands for the HDSL line number, 1 or 2), optionally repeat automatically	/R

Table 4-1 HCD-E1 Command Set Index (Cont.)

Command	Purpose	Options
DSP ST SL	Display status information on the E1 sublink, and the contents of the sublink BPV counters (when CRC-4 function is off), and optionally clear these counters or repeat automatically	/R /C
DSP ST SYS	Display system status information (node name and number, software and hardware versions, clock source, central/remote mode, type of remote unit, types of data channel interfaces). Also displays the presence of H-RPT on the HDSL link and its software and hardware versions.	
DSP TS	Display the allocation of the time slots of the HDSL signal	
EXIT	End the current control session	
F	Select the codes for the “clear the screen”, “cursor right”, and “cursor home” commands sent to the supervision terminal	
H	Display a concise index of commands and option switches	
INIT DB	Reload the database with the default parameters instead of the user-configured parameters. *Table 4-2* lists default parameter values	
INIT F	Reset the codes for “clear the screen”, “cursor right”, and “cursor home” to 0	
LOOP BERT CH X, or LP BERT CH X*	Activate the BER test on data channel X of the remote unit	
LOOP INBAND CH X, or LP INBAND CH X*	Activate the in-band loopback on data channel X of the remote unit	
LOOP L HRPT, or LP L HRPT	Activate a local loop on H-RPT (only for HCD-E1 configured as central)	
LOOP L LINE, or LP L LINE	Activate a local (L) loopback on the HDSL line	
LOOP L CH X, or LP L CH X*	Activate the local (L) loopback on data channel X of local HCD-E1	
LOOP R CH X, or LP R CH X*	Activate the remote (R) loopback on data channel X of local HCD-E1	
LOOP R R CH X, or LP R R CH X*	Activate the remote (R) loopback on data channel X of remote HCD-E1	
LOOP L SL, or LP L SL	Activate a local (L) loopback on the E1 sublink of the local HCD-E1	
LOOP R SL, or LP R SL	Activate the remote (R) loopback on the E1 sublink of the local HCD-E1	
LOOP R R SL, or LP R R SL	Activate a remote (R) loopback on the E1 sublink of the remote HCD-E1	
RESET	Reset the HCD-E1 system	
TIME	Set the internal time of HCD-E1	

*CH X stands for CH 1 (data channel 1) or CH 2 (data channel 2); X stands for 1 or 2.

4.5 HCD-E1 Command Set Description

This section describes the HCD-E1 commands. The commands are listed in alphabetical order. The description includes command format, use, and options.

The following notational conventions are used below:

[ ]	Square brackets indicate optional entry/parameter
' '	Single quotes delimit user entry
<CR>	Indicates the pressing of the carriage return (Enter) key
LPX	Identifies the HDSL line (LP1 for line 1, LP2 for line 2)
X	Identifies the HDSL line (1 for line 1, 2 for line 2) or the channel (1 for channel 1, 2 for channel 2)

CLR ALM

Purpose

Clear the alarm buffer.

Syntax

CLR ALM [/A]

Use

- To clear only alarms of the ON type stored in the alarm buffer (see *Table 5-1*), type:

```
CLR ALM<CR>
```

Note *CLR ALM command does not remove ON-type alarms from the alarm buffer, it just turns them off. The ALM LED on the front panel still remains lit, and you are able to see these alarms on the LCD and on the terminal.*

- To clear all the alarm messages stored in the alarm buffer (including the history of ON/OFF-type alarms) and remove them from the alarm buffer, type:

```
CLR ALM/A<CR>
```

HCD-E1 performs the command and displays the date and time, followed by the HCD-E1 prompt. If the /A option was used and no alarm condition is present at the moment, the ALM LED goes off.

CLR ALM REM

Purpose

Clear the remote unit alarm buffer.

Syntax

CLR ALM REM [/A]

Use

- To clear only alarms of the ON type stored in the alarm buffer of the remote unit (see *Table 5-1*), type:

```
CLR ALM REM<CR>
```

Note *CLR ALM command does not remove ON-type alarms from the alarm buffer, it just turns them off. The ALM LED on the front panel still remains lit, and you are able to see these alarms on the LCD and on the terminal.*

- To clear all the alarms stored in the alarm buffer of the remote unit (including the history of ON/OFF-type alarms) and remove them from the alarm buffer, type:

```
CLR ALM REM/A<CR>
```

HCD-E1 performs the command and displays the date and time , followed by the HCD-E1 prompt. If the /A option was used and no alarm condition is present at the moment, the ALM LED goes off.

CLR ALM HRPT

Purpose

Clear the H-RPT alarm buffer.

Syntax

CLR ALM HRPT [/A]

Use

- To clear only alarms of the ON type (see *Table 5-2*) stored in the alarm buffer of the H-RPT repeater, type:

```
CLR ALM HRPT<CR>
```

Note *CLR ALM command does not remove ON-type alarms from the alarm buffer, it just turns them off. The ALM LED on the front panel still remains lit, and you are able to see these alarms on the LCD and on the terminal.*

- To clear all the alarms stored in the alarm buffer of the H-RPT repeater (including the history of ON/OFF-type alarms) and remove them from the alarm buffer, type:

```
CLR ALM HRPT/A<CR>
```

HCD-E1 performs the command and displays the date and time , followed by the HCD-E1 prompt.

CLR LOOP

Purpose

Deactivate the specified user-initiated loopback or test.

Syntax

CLR LOOP [loop type], or CLR LP [loop type]

Use

- To deactivate a local (L) loopback on the HDSL lines, type:

  CLR LOOP L LINE<CR> or CLR LP L LINE<CR>*

- To deactivate a local (L) loopback on the E1 sublink of the local HCD-E1, type:

  CLR LOOP L SL<CR> or CLR LP L SL<CR>

- To deactivate the remote (R) loopback on the E1 sublink of the local HCD-E1, type:

  CLR LOOP R SL<CR> or CLR LP R SL<CR>

- To deactivate a remote (R) loopback on the E1 sublink of the remote unit, type:

  CLR LOOP R R SL<CR> or CLR LP R R SL<CR>

- To deactivate the local (L) loopback on data channel X of local HCD-E1, type:

  CLR LOOP L CH X<CR> or CLR LP L CH X<CR>

- To deactivate the remote (R) loopback on data channel X of local HCD-E1, type:

  CLR LOOP R CH X<CR> or CLR LP R CH X<CR>

- To deactivate the remote (R) loopback on data channel X of remote HCD-E1, type:

  CLR LOOP R R CH X<CR> or CLR LP R R CH X<CR>

- To deactivate the BERT test on data channel X of HCD-E1, type:

  CLR LOOP BERT CH X<CR> or CLR LP BERT CH X<CR>

- To deactivate the in-band loopback on data channel X of the remote unit, type:

  CLR LOOP INBAND CH X<CR> or CLR LP INBAND CH X<CR>

- To deactivate a local loopback on the H-RPT, type:

  CLR LOOP L HRPT<CR> or CLR LP L HRPT<CR>*

* These commands are available only from the unit configured as central.

HCD-E1 performs the command and displays the date and time, followed by the HCD-E1 prompt. The TST LED goes off, if there are no more tests activated.

CLR TST

Purpose

Deactivate all the user-initiated tests and loopbacks being activated from this unit.

Syntax

CLR TST

Use

To deactivate all the user-initiated tests and loopbacks, type:

```
CLR TST<CR>
```

HCD-E1 performs the command and displays the date and time , followed by the HCD-E1 prompt. The TST LED goes off.

Note *If no test or loopback is currently activated, HCD-E1 displays ERROR 02 on the terminal.*

DATE

Purpose

Set the date for the HCD-E1 internal real-time clock.

Syntax

DATE

Use

1. Type:

```
DATE<CR>
```

HCD-E1 sends the entry line for the first parameter:

```
DAY   = 01
```

2. If you do not want to change the current value of the parameter, press <CR> to confirm it and continue to the next line, otherwise press F to increase or B to decrease the displayed values, and then press <CR> to confirm the selected value. HCD-E1 displays the entry line for the next parameter.
3. Repeat the procedure in step 2 to set the month. HCD-E1 displays the entry line for the year.
4. Type the four digits of the current year. HCD-E1 displays the entry line for the week day.
5. Repeat the procedure in step 2 to set the week day, and then press <CR> to end.

A typical display, as seen after all the parameters are selected, is shown below:

```
DAY                 = 01
MONTH               = 03
YEAR [4 CHARS]      = 1996
WEEK DAY            =FRI
```

Below HCD-E1 displays the date and time (note that the date has changed), followed by the HCD-E1 prompt.

DEF AGENT

Purpose

Display and modify the current SNMP agent parameters. Refer to *Appendix A* for additional explanations.

To enable SNMP and Telnet management, it is necessary to define all the parameters.

Syntax

DEF AGENT

Use

1. To define the SNMP agent parameters, type:

   ```
   DEF AGENT<CR>
   ```

   You will see the entry line for the first parameter,

   ```
   TELNET_APATHY_TIME
   10 MIN
   ```

2. If you do not want to change the current value of the parameter, press <CR> to confirm it and continue to the next line, otherwise type in the new value and then press <CR>. HCD-E1 displays the entry line for the next parameter.
3. Repeat the procedure until all the parameters are defined, and then press <CR> to end.

A typical display, as seen after all the parameters are selected, is shown below:

```
IP ADDRESS IS:          =   192.114.029.233
READ COMMUNITY IS:      =   public
WRITE COMMUNITY IS:     =   private
TRAP COMMUNITY IS:      =   public
```

After performing the command, HCD-E1 displays the date and time, followed by the HCD-E1 prompt.

Display Fields

The agent parameters displayed on the data form, their range of values and description of how to change them are as follows:

TELNET_APATHY_TIME	Press the F or B keys to select the time, in minutes, after which a Telnet connection will be automatically terminated if no incoming activity is detected. The available values are 10MIN, 15MIN, and 20MIN. **Default is 10MIN.**
IP ADDRESS	Type in the IP address assigned to the HCD-E1 SNMP agent in the dotted-quad format (four three-digit numbers in the range of 000 through 255, separated by periods).
READ COMMUNITY	Type in the name of the SNMP community that has read-only authorization (the HCD-E1 SNMP agent will accept getRequest and getNextRequest commands only from management stations using that community). You may enter up to 32 alphanumeric characters.
WRITE COMMUNITY	Type in the name of the SNMP community that has read-write authorization (the HCD-E1 SNMP agent will also accept setRequest commands from management stations using that community). You may enter up to 32 alphanumeric characters.
TRAP COMMUNITY	Type in the name of the SNMP community to which the HCD-E1 SNMP agent will send traps. You may enter up to 32 alphanumeric characters.

Note *For explanation of the terms see Appendix A.*

DEF BERT

Purpose

Define the BERT test conditions.

Syntax

DEF BERT CH X

Use

1. Type the following:

- To define the BER test parameters for channel 1:

```
DEF BERT CH 1<CR>
```

- To define the BER test parameters for channel 2:

```
DEF BERT CH 2<CR>
```

HCD-E1 displays the BERT parameters data form:

```
PATTERN    ERROR_INJECTION_RATE   RX_INBAND
2E3-1      NO ERR                 DISABLE
```

The functions of the fields are as follows:

PATTERN — Selects the test pattern. The available selections are the QRSS test pattern, and the following pseudo-random sequences: 2E3-1, 2E4-1, 2E5-1, 2E6-1, 2E7-1, 511, 2E10-1, 2047, 2E15-1, 2E17-1, 2E18-1, 2E20-1, 2E21-1, 2E22-1, 2E23-1, 2E25-1, 2E28-1, 2E29-1, 2E31-1, 2E32-1.

ERROR_INJECTION_RATE — Enables the injection of a calibrated rate of errors in the transmitted test pattern.

The available selections are: 10E-1, 10E-2, 10E-3, 10E-4, 10E-5, 10E-6, 10E-7, NO ERR, or SINGLE.

- Select NO ERR to disable the injection of errors
- Select SINGLE to enable the injection of single errors
- Select 10E-1 to enable the injection of errors at a rate of 10E-1 (one error in every 10 test pattern bits), and same with 10E-2, 10E-3, 10E-4, 10E-5, 10E-6, up to 10E-7 (one error in every 10 million test pattern bits).

See ***DSP BERT CH*** command below for the error injection procedure.

RX_INBAND — Controls the receipt of the in-band loopback activation pattern. The available selections are ENABLE and DISABLE.

- Select ENABLE to enable initiation of the in-band loopback upon receipt of the activation pattern.
- Select DISABLE to disable the in-band loopback activation pattern receipt.

2. Move the cursor to the desired field using the spacebar, and change, if necessary, using the F or B keys. After making the desired selections, press <CR> to end. HCD-E1 displays the date and time, followed by the HCD-E1 prompt.

DEF CH

Purpose

Define the data channel parameters of HCD-E1.

Syntax

DEF CH X

Use

1. Define the channel parameters as follows:

- To define channel 1 parameters, type:

```
DEF CH 1<CR>
```

- To define channel 2 parameters, type:

```
DEF CH 2<CR>
```

HCD-E1 displays the first line of the channel parameters data form. A typical form is shown below:

```
FRAME_MODE  MULTIPLIER  MAP_TYPE   SPEED     START_TS  CTS     FIFO_SIZE
FRAMED      64          USER       NC        N/A       ON      AUTO
```

2. Change the desired parameters (using spacebar to move between them and pressing F or B to increase or decrease their value) and press<CR> to move to the next line. HCD-E1 displays the second line of the channel parameters data form. A typical form is shown below:

```
CLOCK_MODE     ETHERNET_MODE   BRIDGING
DCE                N/A         N/A
```

Note *If the FRAME_MODE field shows N/A, it means that the sublink or the other channel is in UNFRAMED mode and all the 32 HDSL timeslots are assigned to it.*

The following table lists the available user port configuration parameters and their functions. The table also lists the parameter values included in the default configuration of the channel. For configuration guidelines, refer to *Table 3-5* in Chapter 3.

Designation	Function	Values	
FRAME_MODE	Selects a framed or unframed mode of HDSL framer	FRAMED	HDSL framer is in the framed mode
		UNFRAMED	Allows transfer of unframed 2048 kbps data streams, if you have an E1 port at the far end of the HDSL link
		Default:	**FRAMED**
***Note**: It is recommended to select FRAMED unless your application does not explicitly need the unframed mode.*			
MULTIPLIER	Selects the basic data rate per HDSL timeslot	64K	Basic data rate is 64 kbps
		56K	Basic data rate is 56 kbps
		Default: 64	
MAP_TYPE	Selects the time slot allocation method used for mapping user's data into the time slots of the HDSL signal	USER	Free user selection of time slots
		SEQ	Sequential allocation of time slots, starting from a user-specified slot (defined under START_TS).
		ALT	Alternate allocation of time slots. This selection means that starting from a specified slot, the slot allocation, defined under START_TS, looks like this: DATA NC DATA NC DATA, etc.
		Default: USER	
SPEED	Selects the channel payload data rate.	Available data rates are multiples of the basic rate (56 or 64 kbps). The multiples are in the range of 1 to 32, resulting in rates of 56, 112, ..., 1736 kbps or 64, 128, 192, ..., 1984 kbps, respectively. When working in UNFRAMED mode, the data rate must be 1792 or 2048 kbps for basic rates 56 kbps or 64 kbps, respectively. **Default: NC**	

Designation	Function	Values
START_TS	Selects the starting time slot for SEQ or ALT time slot allocation	Any number in the range of 0 to 31, consistent with the desired number of user time slots. The sum of the START_TS and of the SPEED divided by MULTIPLIER must not exceed 32. **Default: N/A**
CTS	Selects the state of the CTS line in the data channel. For a channel with Ethernet interface, this field always shows N/A, and cannot be changed	ON CTS continuously on =RTS CTS line follows the RTS line N/A Not applicable **Default: ON**
FIFO_SIZE	Selects the FIFO buffer size of the data channel. This parameter is used in the DTE2 mode. In the other modes, HCD-E1 sets the buffer size automatically. The AUTO values are listed in *Table 1-1*.	AUTO Automatic size selection. 32, 60, 104,144 Buffer size in bits (corresponds to FIFO lengths of ±16, ±30, ±52, and ±72 bits). **Default: AUTO**
CLOCK_ MODE	Selects the clocking mode of the given data channel.	DCE The data channel provides both transmit and receive clocks to the DTE connected to it. DTE1 The data channel provides the receive clock to the DTE connected to it while receiving the transmit clock from it. DTE2 The data channel receives both the transmit and receive clocks from the DCE connected to it. **Default: DCE**
ETHERNET_ MODE	Selects the Ethernet LAN traffic transfer mode. For a channel with serial data interface, this field always shows N/A, and cannot be changed	HALF_DUP Half duplex operation FULL_DUP Full duplex operation N/A Not applicable **Default: HALF_DUP**
BRIDGING	Reserved for future use. To select the Ethernet traffic control function, use Ethernet bridge DIP switch SW-1, section 3 (see *Appendix C*).	For a channel with serial data interface, this field always shows N/A. For a channel with Ethernet interface, this field must be always set to FILTER, independently of the selected Ethernet traffic control function.

3. Change the desired parameters (if needed) and press<CR>. HCD-E1 displays the first line of the time slot map of the channel currently being configured. A typical display is shown below:

```
TS_0        TS_1        TS_2        ...        TS_9
NC          DATA        NC          ...        NC
```

If you have selected USER under MAP_TYPE, you will have to select the time slot manually. To do this, proceed as follows:

4. Use the spacebar to move between time slots. For each time slot, select between DATA (time slot allocated to the channel) and NC (not connected) by pressing F or B.

5. After completing the first line, press <CR> to move to the next line. Repeat the procedure until all the time slots are defined. When done, press <CR> to finish. HCD-E1 displays the date and time, followed by the HCD-E1 prompt.

Note *Make sure that the basic rate (56 kbps or 64 kbps) multiplied by the number of time slots you selected is equal to your SPEED selection.*

DEF DL

Purpose

Define the in-band management communication parameters of HCD-E1.

Syntax

DEF DL

Use

1. Type:

   DEF DL<CR>

   HCD-E1 displays the first line of the channel parameters data form. A typical line is shown below:

   ```
   ML_DL_MODE  ML_TS_NUM   ML_DL_SPEED
   NONE        N/A         N/A
   ```

   The available selections are as follows:

   NONE HCD-E1 does not use the main link to carry in-band management traffic

   DEDIC HCD-E1 uses a user-selected time slot for in-band management traffic over the main link.

2. Select the desired mode (and time slots under the ML_TS_NUM field in the case you selected the DEDIC mode) and press<CR>. HCD-E1 displays the second line of the data form:

   ```
   SL_DL_MODE    SL_TS_NUM  SL_DL_SPEED
   NONE          N/A        N/A
   ```

   The available selections are as follows:

   NONE HCD-E1 does not use the sublink to carry in-band management traffic

   TS0/F HCD-E1 uses the S_{a4} bit in time slot 0 for in-band management traffic over the sublink

   DEDIC HCD-E1 uses a user-selected time slot for in-band management traffic over the sublink.

3. Select the desired mode and the time slot. HCD-E1 performs the command and displays the date and the time followed by the HCD-E1 prompt.

Note

1. If you selected DEDIC in both ML_DL_MODE and SL_DL_MODE, make sure that the slots you've selected in the ML_TS_NUM and SL_TS_NUM fields are the same.

2. Parameters ML_DL_SPEED and SL_DL_SPEED are always N/A.

DEF NAME

Purpose

Define the logical name (up to eight alphanumeric characters).

Syntax

DEF NAME

Use

1. To define the HCD-E1 logical name, type:

   DEF NAME<CR>

   HCD-E1 displays the logical name entry form:

   ENTER NODE NAME (MAX 8 CHARACTERS) =

2. Type the desired name, and then press <CR>. HCD-E1 displays the following line:

   CURRENT NAME = 'name'

   (where 'name' is the logical name HCD-E1 is currently assigned), and then the date and time, followed by the HCD-E1 prompt.

Note *If you want to store a logical name in the database, make sure that the DB INIT section of the HCD-E1 internal switch S1 is set to OFF. Otherwise, the default name (blank) is enforced.*

DEF NODE

Purpose

Define the node number, or address, of HCD-E1. The allowed range is 0 to 255.

Syntax

DEF NODE

Use

1. Type:

   DEF NODE<CR>

HCD-E1 displays the node entry form:

NODE (0 to 255) = 0

2. Type the desired number in the range of 0 to 255, and then press <CR>. HCD-E1 performs the command and displays the date and time, followed by the HCD-E1 prompt.

Note *If you want to store the user-selected node number, make sure that the DB INIT section of the HCD-E1 internal switch S1 is set to OFF. To use the user-selected node number, set the PASSWD section of S1 to OFF. Otherwise, the default number (0) is enforced.*

DEF PB

Purpose

Define each time slot priority (high or low). In case one of the HDSL lines is down, time slots with high priority will still continue to be sent on the remaining line.

Syntax

DEF PB

Use

1. Type:

   DEF PB<CR>

2. HCD-E1 displays the first line of the time slot map of the priority bumping. A typical display is shown below:

```
TS_1        TS_2        ...             ...        TS_31
LOW         HIGH        ...             ...        LOW
```

3. If you want to change the priorities, use the spacebar to move between time slots. For each desired time slot, select between HIGH and LOW by pressing F or B.

4. After completing the first line, press <CR> to move to the next line. Repeat the procedure until all the desired time slots are defined. When done, press <CR> to finish. HCD-E1 displays the date and time followed by the HCD-E1 prompt.

Note

1. The priority bumping will work in the framed mode only.

2. TS-0 has always HIGH priority. The maximum number of other time slots that can be configured to high priority is 16.

DEF PWD

Purpose

Define a new user password for the HCD-E1 system. The password must have 4 to 8 characters.

Syntax

DEF PWD

Use

1. Type:

   DEF PWD<CR>

   The following password entry screen appears:

   NEW PASSWORD (4 to 8 CHARS) =

2. Type the required password. Carefully check that the specified password has been indeed typed in, and then press <CR>. HCD-E1 displays the next line:

   ```
   CURRENT PASSWORD = 'password'
   ```

   where 'password' is the current password, and then the date and time, followed by the HCD-E1 prompt.

Note *If you want to store the user-selected password, make sure that the DB INIT section of the HCD-E1 internal switch S1 is set to OFF. To use the user-selected password, set the PASSWD section of S1 to OFF. Otherwise, the default password (HCD) is enforced.*

DEF SL

Purpose

Select the sublink parameters of the HCD-E1

Syntax

DEF SL

Use

1. To define the sublink parameters, type:

   ```
   DEF SL<CR>
   ```

   HCD-E1 displays the first line of the sublink parameters data form. For explanation of parameters and configuration guidelines, refer to *Table 3-3* in *Chapter 3*. A typical display is shown below:

FRAME	CRC-4	SYNC	MAP_TYPE	START_TS	NUM_OF_TS	IDLE_TS_CODE
G732N	NO	CCITT	USER	N/A	NC	FF

Note *If the FRAME field shows N/A, it means that one of the channels is in UNFRAMED mode and all the 32 HDSL timeslots are assigned to it.*

2. Change the parameter values using the spacebar to move between the fields and pressing F or B to scroll among the available selections.
3. After the desired parameter values are selected, press <CR>. HCD-E1 displays the second line of the data form:

TS_0	TS_1	TS_2	...	TS_9
NC	NC	DATA	...	NC

4. Use the spacebar to move between time slots. For each time slot, select between DATA (time slot allocated to the current channel) and NC (not connected) by pressing F or B.
5. After completing the first line of time slots, press <CR> to move to the next line. Repeat the procedure until all the time slots are defined.

6. When done, press <CR> to finish. HCD-E1 displays the date and time followed by the HCD-E1 prompt.

Note

1. *You will have to perform steps 3 and 4 only in the case you have selected USER in the MAP_TYPE field. Otherwise HCD-E1 selects the time slots automatically.*
2. *If you have selected SEQ, make sure that the sum of START_TS and NUM_OF_TS does not exceed 32.*
3. *If you have selected ALT, make sure that NUM_OF_TS*2 + START_TS ≤ 31.*

DEF SP

Purpose

Define the control port parameters. See *Section 3-4* for parameters description and practical guidelines on their selection.

Syntax

DEF SP

Use

1. Type:

   DEF SP<CR>

2. The first page of the control port parameters data form is displayed. A typical form is shown below. The form presents the current parameter values as defaults.

SPEED	DATA	PARITY	INTERFACE	CTS	DCD_DEL	DSR
AUTO	8	NO	DCE	=RTS	0 MS	ON

3. Change the parameter values, using the spacebar to move between the fields and pressing F or B to scroll among the available selections.
4. When done, press <CR> to display the next page of control port parameters. A typical form is shown below.

POP_ALM	PWD	LOG_OFF	AUXILIARY DEVICE
NO	NO	NO	TERMINAL

5. Repeat the procedure given in step 3 above to select new parameter values.

After the desired parameter values are selected, press <CR> to end. HCD-E1 displays the date and time, followed by the HCD-E1 prompt.

Parameters Programmable from the Terminal

In addition to the parameters listed in *Section 3-4*, the following parameters can be programmed from the terminal only.

PWD Password protection:

YES Password protection is enabled.

NO Password protection is disabled.

LOG_OFF Idle disconnect time:

NO Automatic session disconnection disabled.

10_MIN Automatic disconnection after ten minutes if HCD-E1 receives no input.

CTS Determines CTS state:

ON The CTS line is always ON (active).

=RTS The CTS line follows the RTS line.

DCD_DEL With the HCD-E1 control port defined as DTE, indicates the delay (in msec) between DCD=ON and the sending of data.
Values: 0, 10, 50, 100, 200, 300 msec.

POP_ALM Controls the automatic display of alarms on the terminal:

YES The terminal automatically displays the alarm status whenever an ON-type alarm appears or an ON/OFF-type alarm changes its state to ON (for the term definition, see *Section 5.2* in *Chapter 5*). If no such event occurs, HCD-E1 displays the alarm status every 10 minutes.

NO The automatic display feature is disabled.

DSR Determines the DSR state:

ON The DSR line is continuously ON. It will switch to OFF for five seconds after the DTR line is switched OFF.

DTR The DSR line tracks the DTR line. When INTERFACE=DTE, the DSR line will switch to ON for five seconds when the RI line is ON while the DTR line is OFF.

AUXILIARY DEVICE Selects the management mode supported by the HCD-E1 control port:

TERMINAL Management by means of a supervision terminal.

NMS-SLIP Management by means of Telnet host or an SNMP network management station.

NONE Not in use

Note *In order for HCD-E1 to use the selected parameters, verify that Section 3 - DEF SP and Section 2 - DB INIT of Switch S1 (see "Setting the Internal Jumpers and Switches" in Chapter 2) is in the OFF state (factory setting). Otherwise, HCD-E1 will use the default parameters.*

DEF SYS

Purpose

Assign values to system parameters.

Syntax

DEF SYS

Use

1. Type:

   DEF SYS<CR>

   HCD-E1 displays the system parameters data form, which presents the current parameter values as defaults. A typical form is shown below.

CLK_MASTER	CLK_FBACK	CONFIG_REM
INT	NONE	YES

   For description of the CLK_MASTER, CLK_FBACK and CONFIG_REM parameters, see *Table 3-2* in *Section 3-4*.

Note *This command makes sense only for HCD-E1 configured as a central unit (LTU). HCD-E1 configured as remote will display N/A instead of parameter values.*

2. Bring the cursor to the first field and, if desired, change the parameter value by pressing F or B to scroll among the available selections.
3. Using spacebar, move to the second parameter and perform the above procedure.
4. After the desired value is selected, press <CR> to end. HCD-E1 displays the date and time, followed by the HCD-E1 prompt.

DEF TERM

Purpose

Define the control sequences to be sent to the supervision terminal to perform the following terminal control functions:

- Clear the screen.
- Move the cursor to the screen home position.
- Move the cursor to the right by one position.

This command is similar to the F command (see below), except that it also enables you to specify a terminal type so that HCD-E1 will automatically configure itself for using the corresponding control sequences. The terminal types supported by this command are: VT-52, VT-100, TV-920, FREEDOM-100, FREEDOM-220, and terminals compatible with one of them.

The codes used by the supported terminals are listed in the following table:

Function	Terminal Type				
	TV920	**VT52**	**VT100**	**Freedom100**	**Freedom220**
Clear Screen	1B2A0000	N/A	1B5B324A	1B2A0000	1B5B324A
Cursor Home	1E000000	1B480000	1B5B4800	1E000000	1B5B4800
Cursor Right	0C000000	1B430000	1B5B3143	0C000000	1B5B0143

Syntax

DEF TERM ‘terminal’

Use

To configure HCD-E1 for using the control sequences corresponding to a supported terminal, type:

```
DEF TERM 'terminal'<CR>
```

where 'terminal' stands for one of the types listed in the table above.

HCD-E1 performs the command and displays the date and the time followed by the HCD-E1 prompt.

Note *If you enter DEF TERM (without the terminal type), HCD-E1 will reset to 0 all the three codes.*

DSP ALM

Purpose

Display the contents of the local unit alarm buffer. This buffer can contain up to 100 alarms.

Syntax

DSP ALM[Option]

Use

- To display the complete contents of the buffer, type:

  ```
  DSP ALM<CR>
  ```

- *To display the complete buffer contents and then clear the ON-type alarms, type:

  ```
  DSP ALM/C<CR>
  ```

- *To display the complete buffer and then clear all the stored alarms, type:

  ```
  DSP ALM/CA<CR>
  ```

* See the description of CLR ALM command earlier in this chapter for explanation of what the “clear” action means.

Display Format

The contents of the alarm buffer are displayed as a table with four columns: alarm number, alarm syntax (description), alarm state, and date & time of alarm occurrence. Each block of alarms received from HCD-E1 is preceded by a header. The header lists the assigned logical name and the node number of the HCD-E1 unit which sent the alarm block, and thus it serves as an easily-identified separator between alarms transmitted by different HCD-E1 units.

In the end, HCD-E1 displays the date and time, followed by the HCD-E1 prompt.

Table 5-1 in Chapter 5 lists all the HCD-E1 alarm messages in alphabetical order and corrective actions that you can undertake to fix the problem.

DSP ALM HRPT

Purpose

Display the contents of the alarm buffer of the H-RPT repeater located on the HDSL link. This buffer can contain up to 100 alarms.

Syntax

DSP ALM HRPT

Use

- To display the complete contents of the H-RPT buffer, type:

  DSP ALM HRPT<CR>

- *To display the complete H-RPT buffer contents and then clear the ON-type alarms, type:

  DSP ALM HRPT/C<CR>

- *To display the complete H-RPT buffer contents and then clear all the stored alarms, type:

  DSP ALM HRPT/CA<CR>

*See the description of CLR ALM command earlier in this chapter for explanation of what the “clear” action means.

The format of the H-RPT alarm buffer display is similar to the format for the local alarm buffer, described in the ***DSP ALM*** section above.

DSP ALM REM

Purpose

Display the contents of the alarm buffer of the appliance located at the remote end of the HDSL link. This buffer can contain up to 100 alarms.

Syntax

DSP ALM REM[Option]

Use

- To display the complete contents of the remote buffer, type:

  DSP ALM REM<CR>

- *To display the complete buffer contents and then clear the ON-type alarms, type:

  DSP ALM REM/C<CR>

- *To display the complete buffer and then clear all the stored alarms, type:

  DSP ALM REM/CA<CR>

*See the description of CLR ALM command earlier in this chapter for explanation of what the “clear” action means.

The format of the remote alarm buffer display is similar to the format for the local alarm buffer, described in the ***DSP ALM*** section above.

DSP BERT CH

Purpose

Display the results of an on-going bit error ratio measurement on the desired channel.

When monitoring the BER results, you may also start and stop error injection, and restart the error count by clearing the accumulated error results. Note that monitoring is not possible when using Telnet.

The error injection rate is defined by means of the DEF BERT command (see earlier in this chapter).

Syntax

DSP BERT CH X

Use

- To display the current results of a BER test on channel 1, type:

  DSP BERT CH 1<CR>

- To display the current results of a BER test on channel 2, type:

  DSP BERT CH 2<CR>

Note *These commands are valid only when the BERT test (LOOP BERT) is active on the specified channel, otherwise HCD-E1 displays ERROR 26.*

- To display the current results of a BER test and then reset the error count, type:

```
DSP BERT CH 1 /C<CR>
   or
DSP BERT CH 2 /C<CR>
```

- To monitor the results of a BERT test, type:

```
DSP BERT CH 1 /R<CR>
   or
DSP BERT CH 2 /R<CR>
```

In this case, you will see the commands you can use while monitoring the BER test results, and the line of the BER results themselves.

```
PRESS I FOR ERROR INJECT
PRESS S FOR STOP ERROR INJECT
PRESS C TO CLEAR ERROR BITS
```

To inject errors, act as follows:

1. To inject errors at the rate you have selected with the ***DEF BERT*** command, type I.

2. To resume error injection, type S and then I. To clear error bits, type C.

To stop the monitoring and obtain again the command prompt, press CTRL+C.

If you are using Telnet, it is impossible to monitor the results. In this case, use the following commands (available from the supervisory port as well).

- To display the results and start the injection of errors, type:

```
DSP BERT CH 1 /I<CR>
   or
DSP BERT CH 2 /I<CR>
```

- To display the results and then stop the injection of errors, type:

```
DSP BERT CH 1 /S<CR>
     or
DSP BERT CH 2 /S<CR>
```

- To display the results and clear error bits, type:

```
DSP BERT CH 1 /C<CR>
     or
DSP BERT CH 2 /C<CR>
```

Display Format

The BER test results displayed on the screen are valid for the instant when the display command has been issued (or for the last time the counters have been cleared, whichever occurred last). When the /R option is used, the results are periodically updated.

The results are presented in the following format:

ERROR_BITS	RUN_ TIME (SEC)	ERRORS (SEC)	SYNC_ LOSS (SEC)	ERROR_INJECT
0	100	0	0	OFF

The display fields are as follows:

ERROR_BITS	Total number of bit errors detected.
RUN_TIME (SEC)	Total time the test is running.
ERRORS (SEC)	Total number of seconds in which errors have been detected.
SYNC_LOSS (SEC)	Total number of seconds in which loss of pattern occurred.
ERROR_INJECT	Indicates whether errors are injected (ON) or not (OFF).

Note *All the counters have a range of 0 through 65535. When the maximum value is reached, the counter freezes, therefore in general the value of 65535 indicates that the counter has overflown.*

DSP HDR TST

Purpose

Display the results of the last hardware test of the local HCD-E1. The results show the status detected during the power-on self-test, and any faults detected during regular operation.

Syntax

DSP HDR TST

Use

To display the local unit hardware test report, type

```
DSP HDR TST<CR>
```

Display Format

The display shows NO HARDWARE FAILURE if everything checks good, or displays the appropriate message from the following list:

- EPROM FAILURE
- I/O EXP. FAILURE
- HDSL FRAMER FAILURE
- TRANSCEIVER FAILURE

After the message HCD-E1 displays the date and time, followed by the HCD-E1 prompt.

DSP HDSL PM

Purpose

Display the contents of performance monitoring registers of a selected HDSL line of the local HCD-E1. For an explanation of the HDSL performance monitoring registers, refer to *Section 5-3*.

Syntax

DSP HDSL PM [LPX] [Option]

Use

1. To display the performance monitoring registers of the local unit, act as follows:

- To display the performance monitoring registers of HDSL line 1, type:

  DSP HDSL PM LP1<CR> or **DSP HDSL PM<CR>**

- To display the performance monitoring registers of HDSL line 2, type:

  DSP HDSL PM LP2<CR>

- To display current values of the performance monitoring registers of the HDSL line 1, and then clear all these registers and restart the count intervals, type:

  DSP HDSL PM LP1/CA<CR> or **DSP HDSL PM<CR>/CA**

- To display current values of the local performance monitoring registers of the HDSL line 2, and then clear all these registers and restart the count intervals, type:

  DSP HDSL PM LP2/CA<CR>

A typical display is shown below:

```
PM HDSL LINE    -   1


CURRENT ES        = 0
CURRENT UAS       = 0
CURRENT SES       = 0
CURRENT BBE       = 0
CURRENT TIMER     = 388
```

For the description and allowed range of the parameters, see *HDSL Performance Monitoring* in Section 5.3.

2. Press any key to see the next screen:

Note *HCD-E1 displays this screen only if HCD-E1 has been working over 15 minutes after power-up.*

```
INTERVAL 01  ES = 000 UAS = 000 SES = 000 BBE = 000
             ESR = 00.00% SESR = 00.00% BBER = 00.00%
INTERVAL 02  ES = 000 UAS = 000 SES = 000 BBE = 000
             ESR = 00.00% SESR = 00.00% BBER = 00.00%
INTERVAL 03  ES = 000 UAS = 000 SES = 000 BBE = 000
             ESR = 00.00% SESR = 00.00% BBER = 00.00%
INTERVAL 04  ES = 000 UAS = 025 SES = 026 BBE = 001
             ESR = 00.00% SESR = 02.88% BBER = 00.11%


24 HOUR ES      =  0
24 HOUR UAS     =  25
24 HOUR SES     =  26
24 HOUR BBE     =  1
24 INTERVAL     =  04
```

DSP PB

Purpose

Display the priority bumping of time slots selected by the user.

Syntax

DSP PB <CR>

Use

To display the priority bumping of time slots, type:

```
DSP PB<CR>
```

A typical display is shown below:

```
TIME SLOT MAPPING OF PRIORITY BUMPING
=====================================

TS:         0      1      2      3      4      5      6      7      8      9
PRIORITY:   HIGH   LOW    LOW    LOW    LOW    LOW    LOW    LOW    LOW    LOW

TS:         10     11     12     13     14     15     16     17     18     19
PRIORITY:   LOW    LOW    LOW    LOW    LOW    LOW    LOW    LOW    LOW    LOW

TS:         20     21     22     23     24     25     26     27     28     29
PRIORITY:   LOW    LOW    LOW    LOW    LOW    LOW    LOW    LOW    LOW    LOW

TS:         30     31
TYPE:       LOW    LOW
```

Note *This command would show correct information only when one of the lines is down*

DSP R HDR TST

Purpose

Display the results of the last hardware test performed by the unit located at the remote end of the HDSL link (during power-on self-test or regular operation).

Syntax

DSP R HDR TST

Use

- To display the hardware test report, type

  DSP R HDR TST<CR>

Display Format

The display shows NO HARDWARE FAILURE if everything checks good, or displays the appropriate message from the following list:

- EPROM FAILURE
- I/O EXP. FAILURE
- HDSL FRAMER FAILURE
- TRANSCEIVER FAILURE

After the message, HCD-E1 displays the date and time, followed by the HCD-E1 prompt.

DSP R HDSL PM

Purpose

Display the contents of the performance monitoring registers of the appliance located at the remote end of the HDSL link.

For an explanation of the HDSL performance monitoring registers, refer to *Section 5-3*.

Syntax

DSP R HDSL PM [LPX] [Option]

Use

- To display the performance monitoring registers of HDSL line 1 of the remote unit, type:

  DSP R HDSL PM LP1<CR> or **DSP R HDSL PM<CR>**

- To display the performance monitoring registers of HDSL line 2 of the remote unit, type:

  DSP R HDSL PM LP2<CR>

- To display current values of the performance monitoring registers of the HDSL line 1, and then clear all these registers and restart the count intervals, type:

  DSP R HDSL PM LP1/CA<CR> or **DSP R HDSL PM/CA <CR>**

- To display current values of the performance monitoring registers of the HDSL line 2, and then clear all these registers and restart the count intervals, type:

  DSP R HDSL PM LP2/CA<CR>

The format of the display is similar to the format for the performance monitoring registers of the local unit, described in the ***DSP HDSL PM*** section above.

DSP R SL PM

Purpose

Display the contents of the sublink performance monitoring registers of the unit located at the remote end of the HDSL link. This option is available only when the CRC-4 function is enabled on both sublinks: at the local and the remote ends of the HDSL link (see ***DEF SL*** command).

For an explanation of the sublink performance monitoring registers, refer to *Section 5-3*.

Syntax

DSP R SL PM [Option]

Use

- To display the performance monitoring registers of the sublink of the remote unit, type:

  DSP R SL PM<CR>

- To display current values of the performance monitoring registers of the sublink of the remote unit, and then clear only the event register, type:

  DSP R SL PM /C<CR>

- To display current values of the performance monitoring registers of the sublink of the remote unit, and then clear all these registers and restart the count intervals, type:

  DSP R SL PM /CA<CR>

HCD-E1 performs the command and displays the date and the time followed by the HCD-E1 prompt.

The format of the display is similar to the format for the local unit performance monitoring registers, described in the ***DSP SL PM*** section below.

Note *In case the CRC-4 function is disabled, HCD-E1 displays an error message: ILLEGAL COMMAND FOR CURRENT MODE. If the CRC-4 function is enabled on the sublink of the local unit, but disabled at the remote end, HCD-E1 will display meaningless information.*

DSP REM AGENT

Purpose

Display information on the SNMP agents that are known to the IP router of the HCD-E1 when SNMP management is enabled.

Note *For SNMP management to be enabled, the following conditions must be satisfied:*

1. *The units must have different IP addresses and different MUX_NAME's.*
2. *A dedicated slot must be assigned in both units.*

Syntax

DSP REM AGENT

Use

- To display the remote agent information, type:

```
DSP REM AGENT
```

If not all conditions listed above are fulfilled, HCD-E1 displays the following message:

```
CAN NOT FIND REMOTE AGENT
```

Otherwise, HCD-E1 displays a table listing the remote agents. A typical display is shown below:

```
IP ADDRESS      MUX NAME     DISTANCE
-------------------------------------

192.114.50.2    RAD1         006
192.114.50.3    RAD2         012
```

The fields displayed for each agent are as follows:

IP ADDRESS The IP address of the remote agent (see the *DEF AGENT* command above).

MUX NAME The logical name of the remote agent (see the *DEF NAME* command above).

DISTANCE The distance is a metric that indicates the logical distance (through the management network) to the remote agent, and is used, among other factors, in the selection of the optimal route to be used by the management traffic.

The distance is assigned as follows:

- Each segment between two IP routers is assigned a weight of 6. For example, when the path to an agent passes two HCD-E1 with their SNMP management enabled, the distance is 12.

When the management network includes one or more additional distinct (***alternate***) paths between two IP routers that connect to the same remote agent, each such path is assigned a weight of 7 (6 + 1), 8 (6 + 2), etc. per segment. For example, if the route in the above example has an additional path in parallel with one segment, the additional route to RAD2 has a distance of 13; when additional paths are found in parallel with each segment, the distances will be 13, 14, 15.

DSP SL PM

Purpose

Display the contents of the E1 sublink performance monitoring registers of the local HCD-E1. This option is available only when the CRC-4 function is enabled (see ***DEF SL*** command).

For an explanation of the user's port performance monitoring registers, refer to *Section 5-3*.

Syntax

DSP SL PM [Option]

Use

1. To display the local performance monitoring registers, act as follows:

- To display the performance monitoring registers of the local unit sublink, type:

```
DSP SL PM<CR>
```

- To display current values of the performance monitoring registers of the local unit sublink, and then clear only the event register, type:

```
DSP SL PM /C<CR>
```

- To display current values of the performance monitoring registers of the local unit sublink, and then clear all these registers and restart the count intervals, type:

```
DSP SL PM /CA<CR>
```

A typical display is shown below:

```
PM OF PORT        -  A

CRC ERROR EVENTS  = 0
CRC AVG ERR EVENTS  = 0
CURRENT ES        = 0
CURRENT UAS       = 0
CURRENT SES       = 0
CURRENT BES       = 0
CURRENT LOFC      = 0
CURRENT CSS       = 0
CURRENT TIMER     = 176
```

For the description and allowed range of the parameters, see *E1 Performance Monitoring* in Section 5.3.

2. Press any key to see the next screen:

Note *HCD-E1 displays this screen only if it has been working over 15 minutes after power-up.*

```
INTERVAL 01 ES = 000 UAS = 000 BES = 000 SES = 000 LOFC = 000 CSS = 000
INTERVAL 02 ES = 000 UAS = 000 BES = 000 SES = 000 LOFC = 000 CSS = 000
INTERVAL 03 ES = 001 UAS = 034 BES = 000 SES = 044 LOFC = 001 CSS = 001

24 HOUR ES      = 1
24 HOUR UAS     = 34
24 HOUR SES     = 44
24 HOUR BES     = 0
24 HOUR LOFC    = 1
24 HOUR CSS     = 1
24 DEGRADE MIN  = 0
LAST 24 DEGRADE MIN = 0
24 INTERVAL     = 03
```

Note *If the CRC-4 function is disabled, HCD-E1 displays an error message: ILLEGAL COMMAND FOR CURRENT PORT MODE.*

DSP ST CH

Purpose

Display status information for a specified channel.

Syntax

DSP ST CH X

Use

- To display the status information for a selected channel, type:

```
DSP ST CH 1<CR>  or DSP ST CH 2<CR>
```

A typical channel status display is shown below:

```
STATUS OF CH  -1
INTERFACE  =  RS530

LOOPS    REMOTE    REM     LOCAL   BERT    T_        R_
TYPE =             REM                     INBAND    INBAND
         NO        NO      NO      NO      NO        NO
PORT STATE = CONNECTED
RTS STATE  = OFF
```

Display Format

The fields included in the status information display are listed below:

LOCAL Indicates the state of the local loopback:

- NO - local loopback is deactivated.
- YES - local loopback is activated.

REMOTE Indicates the state of the remote loopback:

- NO - remote loopback is deactivated.
- YES - remote loopback is activated.

REM REM Indicates the state of the remote remote loopback:

- NO - remote remote loopback is deactivated.
- YES - remote remote loopback is activated.

BERT Indicates the state of the BER test:

- NO - BER test is deactivated.
- YES - BER test is activated.

T_INBAND Displays **YES** to indicate that the user requested the sending of the in-band remote loopback activation sequence.

R_INBAND Displays **YES** when a loopback has been connected as a result of the reception of the in-band remote loopback activation sequence.

PORT STATE Displays whether the selected channel is connected to another port:

- CONNECTED - the channel is connected.
- NOT CONNECTED - the channel is not connected.

RTS Displays the state of the RTS line in the channel connector:

- OFF - the RTS line is not active.
- ON - the RTS line is active.

DSP ST LINE

Purpose

Display status information on the HDSL lines.

Syntax

DSP ST LINE [Option]

Use

- To display the current status information for HDSL line 1, type:

  DSP ST LINE 1<CR> or **DSP ST LINE<CR>**

  HCD-E1 performs the command and displays the date and time followed by the HCD-E1 prompt.

- To monitor continuously line 1 status information, type:

  DSP ST LINE 1/R<CR> or **DSP ST LINE /R<CR>**

  The display will be automatically updated. To stop the monitoring, press CTRL+C.

- To display the current status information for HDSL line 2, type:

  DSP ST LINE 2<CR>

  HCD-E1 performs the command and displays the date and time followed by the HCD-E1 prompt.

- To monitor continuously line 2 status information, type:

  DSP ST LINE 2/R<CR>

  The display will be automatically updated. To stop the monitoring, press CTRL+C.

Display Format

A typical HDSL line status display is shown below.

```
STATUS OF LINE          -  1

LINE LOOP           =   LOCAL
                        =====
                        NO

LINE ALARMS         =   SYNC LOSS      SIGNAL LOSS
                        =========      ===========
                        OFF            OFF

HRPT LOOP           =   NO
```

The fields included in the status information display are listed below:

LINE LOOP Displays the state of the local line loop on the corresponding HDSL line.

NO Local line loop is not activated
YES Local line loop is activated

LINE ALARMS Displays the state of the line alarms on the corresponding HDSL line:

SYNC LOSS ON indicates loss of synchronization on the corresponding HDSL line.

OFF indicates normal operation.

SIGNAL LOSS ON indicates loss of input signal on the corresponding HDSL line.

OFF indicates normal operation.

HRPT LOOP Displays the state of the H-RPT loop towards the unit configured as central (appears only if H-RPT is present on the HDSL line).

NO H-RPT loop is not activated
YES H-RPT loop is activated

DSP ST SL

Purpose

Display status information on the local E1 sublink, and optionally clear the BPV counters (applicable only when the CRC-4 function is disabled).

Syntax

DSP ST SL [Option]

Use

- To display the current status information for the E1 sublink, type:

```
DSP ST SL
```

- To display the status information, and then clear the BPV counters, type:

```
DSP ST SL /C<CR>
```

HCD-E1 performs the command and displays the date and time followed by the HCD-E1 prompt.

- To monitor continuously the status information, type:

```
DSP ST SL /R<CR>
```

The display will be automatically updated. To stop the monitoring, press CTRL+C.

Display Format

A typical sublink status display is shown below.

```
STATUS OF PORT

TYPE               =  E1
FUNCTION           =  DSU

ALARMS             =  L. SYNC LOSS  R. SYNC LOSS
                      ============  ============
                      OFF           OFF

LOOPS              =  REM PORT      REM REM PORT   LOCAL PORT
                      ========      ============   ==========
                      NO            NO             NO

BPV LAST MINUTE    =  0
BPV WORST MINUTE   =  1
```

The fields included in the status information display are listed below:

TYPE Displays the type of the sublink interface: E1

FUNCTION Displays the type of interface hardware installed on the user's port: LTU or DSU

ALARMS Indicates the status of the sublink alarms. The displayed alarms depend on the framing mode:

- For G732N, this field shows the local and remote 'loss of frame alignment' alarms.
- For the unframed mode, L. SYNC LOSS shows the 'loss of signal' alarm. R. SYNC LOSS is meaningless.

LOOPS Displays the state of each type of loopback that can be activated on the user's port.

BPV LAST MINUTE Displays the number of BPV events detected in the last minute. This counter is displayed only when the CRC-4 function is disabled.

BPV WORST MINUTE Displays the number of BPV events detected in the worst minute. This counter is displayed only with CRC-4 disabled.

DSP ST SYS

Purpose

Display system status information.

Syntax

DSP ST SYS

Use

- To view the current system status, type:

```
DSP ST SYS<CR>
```

HCD-E1 performs the command and displays the date and the time followed by the HCD-E1 prompt.

Display Format

A typical status information display is shown below.

```
NODE                    =  0
NAME                    =  'HCD-E1 name'
NODAL CLOCK             =  INT
HTU TYPE                =  CENTRAL
REMOTE HTU TYPE         =  HCD-E1
SOFTWARE VER            =  2.0
HARDWARE VER            =  0.0
DTE INT. TYPE CH 1      =  V35
DTE INT. TYPE CH 2      =  RS530
HRPT:                   =  NTU_SIDE
HRPT SOFTWARE VER       =  1.0
HRPT HARDWARE VER       =  1.0
```

The system status fields are described below (from top to bottom):

NODE	The node number of the HCD-E1
NAME	The node name of the HCD-E1 (if you have defined it with the DEF NAME command)
NODAL CLOCK	For a unit configured as central, indicates the current source for the HCD-E1 system clock: INT, SL, CH1 or CH2. For a unit configured as remote, always shows LBT.
HCD TYPE	Indicates the function of the HCD-E1: CENTRAL or REMOTE
REMOTE HCD TYPE	Indicates type of the unit at the remote end of the HDSL link
SOFTWARE VER	HCD-E1 software version
HARDWARE VER	HCD-E1 hardware version
DTE INT. TYPE CH 1	Type of interface of data channel 1
DTE INT. TYPE CH 2	Type of interface of data channel 2

HRPT	Indicates whether there is an H-RPT repeater on the HDSL link, and the side of H-RPT to which your HCD-E1 is connected.
DOESN'T EXIST	There is no H-RPT on the HDSL link.
NTU_SIDE	Your HCD-E1 is configured as central
LTU_SIDE	Your HCD-E1 is configured as remote
HRPT SOFTWARE VER	H-RPT software version (this field is displayed only if there is H-RPT on the HDSL link)
HRPT HARDWARE VER	H-RPT hardware version (this field is displayed only if there is H-RPT on the HDSL link)

DSP TS

Purpose

Display the allocation of the time slots of the HDSL signal.

Syntax

DSP TS

Use

To display the time slot information, type:

```
DSP TS<CR>
```

A typical display is shown below:

```
TIME SLOT MAPPING OF MAIN LINES
===============================

TS:         0      1      2      3      4      5      6      7      8      9
TYPE:       NC     NC     NC     NC     NC     NC     NC     CH2    NC     NC

TS:         10     11     12     13     14     15     16     17     18     19
TYPE:       NC     NC     CH1    NC     NC     NC     NC     NC     NC     NC

TS:         20     21     22     23     24     25     26     27     28     29
TYPE:       NC     NC     SL     NC     NC     NC     DEDIC  NC     NC     NC

TS:         30     31
TYPE:       NC     NC
```

Following is a list of fields appearing in the time slot display:

TS Indicates the main link time slot number 0 through 31

TYPE Indicates the type of time slot assignment:

NC	time slot not assigned
CH1	time slot is assigned to data channel 1
CH2	time slot is assigned to data channel 2
SL	time slot is assigned to E1 sublink
DEDIC	time slot is assigned for in-band management

After performing the command, HCD-E1 displays the date and the time followed by the HCD-E1 prompt.

EXIT

Purpose

End the current session and return control to the HCD-E1 front panel.

Syntax

EXIT

Use

- Type:

```
EXIT<CR>
```

HCD-E1 performs the command and displays the date and the time followed by the HCD-E1 prompt.

F

Purpose

Define the codes used to be sent to the supervision terminal to perform the following terminal control functions:

- Clear the screen
- Move the cursor to the screen home position.
- Move the cursor to the right by one position.

The codes used by typical terminals are listed in the following table:

Function	Terminal Type				
	TV920	**VT52**	**VT100**	**Freedom100**	**Freedom220**
Clear Screen	1B2A0000	N/A	1B5B324A	1B2A0000	1B5B324A
Cursor Home	1E000000	1B480000	1B5B4800	1E000000	1B5B4800
Cursor Right	0C000000	1B430000	1B5B3143	0C000000	1B5B0143

Syntax

F

Use

1. To display the current codes, type:

   F<CR>

   The terminal function entry screen is displayed. The screen includes three separate lines, displayed one after the other. A typical screen, showing all the three lines, is shown below:

   ```
   CLEAR SCREEN     =   hhhhhhhh
   CURSOR HOME      =   hhhhhhhh
   CURSOR RIGHT     =   hhhhhhhh
   ```

   where h indicates hexadecimal digits.

2. To change a code, bring the cursor under the first digit of the code to be changed, by pressing <CR>, then enter the appropriate hexadecimal digits of the code.
3. Repeat the procedure until all the necessary codes are changed.

HCD-E1 performs the command and displays the date and the time followed by the HCD-E1 prompt.

H or HELP

Purpose

Display an index of the control port commands and the options available for each command.

Syntax

H or HELP

Use

Type:

H or HELP<CR>

HCD-E1 displays the first HELP page. Press any key to see the next page.

Note *If H-RPT is connected on the HDSL link, you will also get commands for its support.*

When finished, HCD-E1 displays the date and the time followed by the HCD-E1 prompt.

INIT DB

Purpose

Erase the user-defined configuration from the database and load the database with a specified set of default parameters values *(see Table 4-2)*.

Syntax

INIT DB

Use

Type:

```
INIT DB<CR>
```

This command loads the default parameters and resets the HCD-E1.

Note *Traffic through HCD-E1 may be interrupted until you configure it anew.*

Table 4-2 HCD-E1 Default Configuration

Parameter Type	Parameter Designation	Default Value
General	PASSWORD	HCD
	NODE (node number)	0
	CLEAR SCREEN	1B5B324A
	CURSOR HOME	1B5B4800
	CURSOR RIGHT	1B5B3143
SYSTEM	CLK_MASTER	INT
	CLK_FBACK	NONE
	CONFIG REM	YES
SL (sublink)	FRAME	G732N
	CRC-4	NO
	SYNC	CCITT
	IDLE_TS_CODE	FF
	MAP_TYPE	USER
	NUM_OF_TS	NC
	Time Slots	NC
SP (control port)	SPEED	AUTO
	DATA	8
	PARITY	NONE
	INTERFACE	DCE
	CTS	=RTS
	DCD_DEL	0_MS
	DSR	ON
	POP_ALM	NO
	PWD	NO
	LOG_OFF	NO
	AUXILIARY DEVICE	TERMINAL
CH1/CH2	FRAME	FRAMED
	MULTIPLIER	64
	MAP_TYPE	USER
	SPEED	NC
	CTS	ON
	FIFO_SIZE	AUTO
	CLOCK_MODE	DCE
	Time Slots	NC

Table 4-2 HCD-E1 Default Configuration (Cont.)

Parameter Type	Parameter Designation	Default Value
BERT	PATTERN ERROR_INJECTION_RATE RX_INBAND	2E3-1 NO ERR DISABLE
DOWNLOAD	ML_DL_MODE SL_DL_MODE	NONE NONE

INIT F

Purpose

Resets the terminal control codes used to clear the terminal screen, to move the cursor to the right, and to return the cursor to the home position to 0.

Syntax

INIT F

Use

Type:

```
INIT F<CR>
```

HCD-E1 performs the command and displays the date and the time followed by the HCD-E1 prompt.

LOOP

Purpose

Activate a user-controlled loopback on HCD-E1 (see *Section 5-4* for the loopback descriptions).

Syntax

LOOP [loop type]

Use

To activate a loopback, type the appropriate command. The commands depend on the loopback type, on the channel or link for the loop to be performed on, and on the type of unit working opposite HCD-E1. The following table lists all the commands available:

To activate	Type
BERT test on data channel X of HCD-E1	LOOP BERT CH X, or LP BERT CH X*
In-band loopback on data channel X of the remote unit	LOOP INBAND CH X, or LP INBAND CH X*
Local (L) loopback on the HDSL lines (only from the unit configured as central)	LOOP L LINE, or LP L LINE
Local (L) loopback on data channel X of local HCD-E1	LOOP L CH X, or LP L CH X*
Remote (R) loopback on data channel X of local HCD-E1	LOOP R CH X, or LP R CH X*
Remote (R) loopback on data channel X of remote unit	LOOP R R CH X, or LP R R CH X*
Local (L) loopback on the E1 sublink of the local HCD-E1	LOOP L SL, or LP L SL
Remote (R) loopback on the E1 sublink of the local HCD-E1	LOOP R SL, or LP R SL
Remote (R) loopback on the E1 sublink of the remote unit	LOOP R R SL, or LP R R SL
Local loopback on H-RPT (only from the unit configured as central)	LOOP L HRPT, or LP L HRPT

HCD-E1 performs the requested command and displays the date and time, followed by the HCD-E1 prompt.

RESET

Purpose

Reset HCD-E1. This command causes HCD-E1 to initialize, therefore the traffic through HCD-E1 will be disrupted until HCD-E1 returns to normal operation.

Syntax

RESET

Use

- To reset HCD-E1, type:

```
RESET<CR>
```

TIME

Purpose

Set the time for the HCD-E1 internal real-time clock.

Syntax

TIME

Use

1. Type:

   TIME<CR>

HCD-E1 sends the entry line for the first parameter:

```
HOUR              = 12
```

2. If you do not want to change the current value of the parameter, press <CR> to confirm it and continue to the next line, otherwise press F to increase or B to decrease the displayed values, and then press <CR> to confirm the selected value. HCD-E1 displays the entry line for the next parameter.
3. Repeat the procedure until all the parameters are defined, and then press <CR> to end.

Tip *Set the time about one minute beyond the current time and then press <CR> at the correct instant.*

A typical display, as seen after all the parameters are selected, is shown below:

```
HOUR      =  12
MINUTE    =  25
SECOND    =  16
```

Below HCD-E1 displays the date and time (note that the time has changed), followed by the HCD-E1 prompt.

4.6 Supervision Terminal Operating Instructions

Before using the supervision terminal make sure the preparations listed in Section 4-3 have been completed and all the relevant equipment have been turned on.

Starting a Session - Single HCD-E1

When the terminal is used to control a single HCD-E1, always assign node number 0 to the HCD-E1. Use the following startup sequence to connect to a HCD-E1 that has been assigned node number 0. We assume that you are using the AUTO (Autobaud) mode, which is the default one when you switch on the equipment.

1. Press the <CR> key three times. When HCD-E1 has successfully identified the data rate of the supervision terminal, it notifies you of the results of its power-up self-test:

   `HCD Self Test in Progress...OK,` or

   `HCD Self Test in Progress...Failed`

   - If the HCD-E1 self test failed, you must repair HCD-E1 before you can continue using it.
   - If HCD-E1 successfully passed the power-up self-test, it sends the following message:

   `HCD Supervisory Port On Line. Type 'H' For Help`

Note *Pressing <CR> activates the HCD-E1 self-test only if it is the first session after HCD-E1 has been turned on.*

   If the optional password protection has been activated, HCD-E1 displays the following prompt:

   `PASSWORD>`

2. Type the password (four to eight characters) and then press <CR>.

   For each password character typed by you the terminal displays an asterisk *. The default password is **HCD**.

3. If the password is accepted, HCD-E1 enters the session, and the terminal displays:

   `HCD>`

   The HCD-E1 front panel display shows:

   `TERMINAL ON LINE`

   The front panel controls are disabled as long as HCD-E1 is under remote control.

Note *To regain the front-panel control at the local site, use the options described in the section "Ending a Control Session" below.*

Starting a Session - Multiple HCD-E1

When one terminal is used to control several HCD-E1 connected via modems, non-zero node numbers are assigned to each HCD-E1. The node numbers, in the range of 1 to 255, are assigned during the first session (see the previous section), by means of the command DEF NODE.

Important *If you are using a multidrop configuration, do not assign address 0 to any of the HCD-E1 connected to a given terminal. Make sure the interface type is set as DTE, and select the appropriate DCD_DEL parameter.*

To establish a session with a specific HCD-E1, use the following procedure:

1. Press the <CR> key three times.
2. Type NODE, space, the desired HCD-E1 node number, another space, and then type the desired command and press <CR>. For example, with node number 234, type:

   NODE<SP>234<SP> 'command' <CR>

   - If the addressed HCD-E1 does not use password protection, it immediately executes the command.
   - If the addressed HCD-E1 is password-protected, it displays a row of asterisks instead of the command you have typed. After you press <CR>, it displays the following prompt:

     PASSWORD>

3. Type again the node number part and then the password. For example, for node number 234, type:

   NODE<SP>234<SP>'password'<CR>

4. If the password is correct, HCD-E1 displays the working prompt: HCD>. Otherwise, it displays the password prompt once more:

   PASSWORD>

5. Enter your command following the HCD working prompt.

Control Session

During the control session, you type the desired commands at the terminal keyboard. You must see the HCD-E1 echo character by character.

For a multidrop configuration, always prefix your command with a node number part, as described above.

If a wrong character appears, backspace to clear the error, and then type again the correct character.

When you see the correct and complete command in the echo line, press <CR> to execute the command. HCD-E1 processes the command and displays the appropriate response.

At the end of the command execution, HCD-E1 displays the current date and time, and then provides a new prompt for the next command line.

If you changed your mind, and want to abort the command, press CTRL+C. You will again receive the prompt, so you can enter another command.

Note

Use CTRL+C to stop automatic repetition of commands sent with the /R option.

If your command is not correct, HCD-E1 does not execute it and displays the following:

- **'Bad command or parameter. Type 'H' for help'** if the command syntax is wrong
- An appropriate error message (see *Section 5.5* in Chapter 5) if the command is not valid in the current system configuration or values you are trying to set are wrong.

The correct command must then be sent again.

If the terminal screen fills up during the exchange with HCD-E1, HCD-E1 displays the message:

```
HIT ANY KEY TO CONTINUE...
```

After pressing any key, the terminal scrolls to the next page.

Ending a Control Session

You can end the control session in one of the following three ways:

- Disconnect the cable from the HCD-E1 front-panel CONTROL DCE connector.
- Send the EXIT command from the supervision terminal.
- HCD-E1 automatically returns to front panel control if no commands are received for a certain period of time (controlled by the LOG_OFF parameter). You can, however, disable this time-out and thus also this way of ending the session.

Chapter 5

Troubleshooting and Diagnostics

5.1 General

This chapter describes the HCD-E1 diagnostics functions, which include:

- Status indications and alarms - *Section 5.2*
- Performance diagnostics - *Section 5.3*
- Diagnostic loopbacks - *Section 5.4*
- Configuration error messages - *Section 5.5*
- Power-up self-test - *Section 5.6*
- Troubleshooting instructions - *Section 5.7*.

5.2 Status Indications and Alarms

Front-Panel LEDs

The status of HCD-E1 is indicated by the ALM, TST, E1 LOS and HDSL LOS LED indicators located on the front panel. For description of LED indicators and their functions, refer to *Table 3-1* and Section 3.5, *Operating Instructions,* in Chapter 3.

Alarms

HCD-E1 maintains an alarm buffer, which can store a maximum of 100 alarms. Alarms can be of two types, designated as ON/OFF and ON:

- A message indicating an **ON/OFF-type** alarm is displayed on the LCD only when the alarm condition is present, and is automatically stopped from being displayed when the alarm condition is cleared (if the alarm is being displayed, it will disappear only when the display is refreshed by scrolling).
- A message indicating an **ON-type** alarm still can be displayed on the LCD even after the event that caused the alarm condition is cleared.

In this manual, we often use the term *ON-state alarm*. An **ON-state alarm** is either an ON-type alarm or an ON/OFF-type alarm when its alarm condition is still present.

When an ON/OFF-type alarm changes its state from ON to OFF, it is not removed from the alarm buffer. Moreover, a new entry of this alarm is added to the alarm buffer. This feature enables you to see the alarm history on the terminal using the DSP ALM command. A typical display looks like this:

ALARM 01	SIGNAL LOSS: SL	OFF	1998-01-01	00:04.46
ALARM 01	SIGNAL LOSS: SL	ON	1998-01-01	00:00.01

Messages displayed on the LCD and on the control terminal have a similar syntax. *Table 5-1* presents in alphabetical order the alarm messages displayed on the HCD-E1 LCD and control terminal, and lists the actions required to correct the alarm condition.

H-RPT Alarms

If you have an H-RPT repeater on the HDSL link, HCD-E1 allows you to monitor and work with the H-RPT alarms via its supervision terminal. The H-PRT buffer stores a maximum of 100 alarms. The types and states of the H-RPT alarms and the rules of working with the H-RPT alarm buffer are exactly the same as for the HCD-E1 alarm buffer. *Table 5-2* presents the H-RPT alarm messages displayed on the HCD-E1 control terminal in order of their numbers, and lists the actions required to correct the alarm condition. The H-RPT alarms are not available from the LCD.

Alarm Relay

HCD-E1 has an alarm relay, which enables you to automatically turn on alarm indication by properly connecting the relay alarm contacts to your alarm equipment *(see "Connecting the HCD-E1 Alarm Relay Port" in Chapter 2*).

The Alarm Relay has a pair of change-over dry contacts: the Normally-Open (NO) contacts close in case of an alarm, and the Normally-Close (NC) contacts open in case of an alarm. The alarm contacts are floating with respect to the signal and chassis grounds of HCD-E1.

The following events will activate the alarm relay:

- Loss of power (indicated by the NO contacts)
- Detection of a hardware failure, or any other failure, during the power-up self-test
- Detection of real-time clock battery failure during the power-up self-test
- Detection of a disruption in the database during the power-up self-test
- Loss of HDSL lines (1 or 2) synchronization
- Signal loss, excessive bit error rate, excessive rate of bipolar violations, loss of local or remote frame synchronization or reception of AIS on the E1 sublink.

The corresponding alarms in *Table 5-1* are marked with an asterisk (*). The relay returns automatically to the no-alarm state when none of the alarm conditions listed above is present.

Table 5-1 HCD-E1 Alarm Buffer Messages

LCD Message	Terminal Message	Alarm Number	Probable Cause	Corrective Actions	Alarm Type
AIS OCCURR: SL*	AIS OCCURRED: SL*	12	AIS is being detected on the E1 sublink.	Check the equipment connected to the E1 sublink.	ON/OFF
AIS SYN LOS: SL*	AIS SYNC LOSS: SL*	13	AIS and loss of frame alignment on the E1 sublink.	Check the equipment connected to the E1 sublink.	ON/OFF
_	ALARM BUFFER OVERFLOW	16	More than 100 alarms entries have been written in the alarm buffer since the last clear command. New alarms are overwriting the older alarms.	Read the messages and then clear the buffer by sending the CLR ALM/A command from the control terminal.	ON/OFF
BPV ERROR: SL	BPV ERROR: SL	02	A bipolar violation error has been detected on the local unit's E1 sublink.	Check the connection between the E1 sublink and its DTE.	ON
CRC-4 ERROR: SL	CRC-4 ERROR: SL	10	Bit errors have been detected by CRC-4 checking on the data received by the local unit's sublink.	Check the connection between the E1 sublink and its DTE.	ON
DB CHKSUM ERR*	DB CHECKSUM ERROR*	15	The database currently stored in the non-volatile memory of HCD-E1 is corrupted.	1. Enter the INIT DB command from the control terminal or set the DB INIT section of switch S2 to ON, to load the default configuration in the place of the current database, then reconfigure HCD-E1 with the desired parameters. 2. Perform the power-up self-test and replace HCD-E1 if it fails the test.	ON/OFF

Table 5-1 HCD-E1 Alarm Buffer Messages (Cont.)

LCD Message	Terminal Message	Alarm Number	Probable Cause	Corrective Actions	Alarm Type
DB-INIT DW IS ON	DB-INIT SWITCH IS ON	21	Section DB INIT is set to ON. This message appears only upon power-up.	If it is no longer necessary to enforce the default database parameter values, change setting to OFF.	ON
DIAL CYCLE FAIL*	DP DIAL CYCLE FAILED*	44	The current cycle of call attempts (both to the primary and alternate numbers) failed.	Check the modem connected to the CONTROL DCE connector. If the called numbers are often busy, you may also increase the number of call retries	ON
DIFF DEDIC TS	DIFFERENT DTS CENTRAL & REMOTE	39	The time slot assigned for management in the central unit and in the remote unit are not the same time slot	Select the time slots assigned for management correctly.	ON/OFF
DP ALT CALL FAIL*	DP ALTERNATE CALL FAILED*	46	The call attempts to the alternate dial-out number failed	If the number is not busy, check the modem connected to the CONTROL DCE connector. If the called numbers (primary as well as alternate) are often busy, you may also increase the number of call retries	ON
DP PRM CALL FAIL*	DP PRIMARY CALL FAILED*	45	The call attempts to the primary dial-out number failed	If the number is not busy, check the modem connected to the CONTROL DCE connector. If the called number is often busy, you may also increase the number of call retries	ON

Note *Alarms 44, 45 and 46 appear only when you perform a DSP ALM REM command and you have HTU-E1 or HTU-2 at the remote site.*

Table 5-1 HCD-E1 Alarm Buffer Messages (Cont.)

LCD Message	Terminal Message	Alarm Number	Probable Cause	Corrective Actions	Alarm Type
DTE NOT CON CH:1	DTE NOT CONNECTED TO CH:1	38	The Ethernet interface is not connected to an operating LAN	Check the cable connecting the LAN, the LAN media, and check that at least one station is active on the LAN	ON/OFF
DTE NOT CON CH:2	DTE NOT CONNECTED TO CH:2	41	The Ethernet interface is not connected to an operating LAN	Check the cable connecting the LAN, the LAN media, and check that at least one station is active on the LAN	ON/OFF
ELASTIC BUF OVF	ELASTIC BUFFER OVERFLOW	34	The HDSL elastic buffer is overflown.	1. Check the timing of clocks selected in the system, and make sure that they are derived from the same source. 2. Perform the power-up self-test and replace HCD-E1 if it fails the test.	ON
ELS BUF ERR: LP1 ELS BUF ERR: LP2	ELASTIC BUFFER ERROR: LP1 ELASTIC BUFFER ERROR: LP2	33	The corresponding HDSL line is not supplying data.	1. Check HDSL line connections. 2. Check the operation of the local and remote units and replace if necessary.	ON
EXC ERR RAT: SL*	EXCESSIVE ERROR RATIO: SL*	11	Excessive bit error rate (higher than 10^{-3}) is detected in the data received by the local unit's sublink.	Check the connection between the E1 sublink and its DTE.	ON/OFF
EXCESS BPV: SL*	EXCESSIVE BPV: SL*	07	Excessive BPV are detected on the E1 sublink.	1. Check if there is a problem in the network facilities used by the E1 sublink. 2. Perform the power-up self-test and replace HCD-E1 if it fails the test.	ON/OFF

Note *Alarm 38 appears only when you perform DSP ALM REM command and you have an HTU-2 at the remote site.*

Table 5-1 HCD-E1 Alarm Buffer Messages (Cont.)

LCD Message	Terminal Message	Alarm Number	Cause	Corrective Actions	Alarm Type
FALLBACK CLK USE*	CLOCK WAS CHANGED TO FALLBACK*	47	HCD-E1 switched to the fallback clock source, because the master clock source failed.	Check the master clock source. A clock source (recovered from CH1, or CH2, or SL) is replaced as a result of failure under the following conditions: • CH1, CH2 - fails when data channel equipment is disconnected or inoperative (DTR line not asserted) • SL - fails when the E1 sublink loses frame synchronization	ON
FRAME SLIP: SL	FRAME SLIP: SL	04	A frame slip occurred on the E1 sublink.	1. Check the clock source selection. 2. Check the clock source stability at far end of the E1 link. 3. Perform the power-up self-test and replace HCD-E1 if it fails the test.	ON
HARDWARE FAILURE*	HARDWARE FAILURE*	18	HCD-E1 technical failure (failure of one of the internal programmable components). This message can appear only upon power-up.	Replace HCD-E1.	ON
INTERNAL CLK USE	CLOCK WAS CHANGED TO INTERNAL	24	HCD-E1 configured as central switched to the internal clock source, because both the master and the fallback clock sources failed.	1. Check the two clock sources. 2. Perform the power-up self-test and replace HCD-E1 if it fails the test.	ON/OFF

Table 5-1 HCD-E1 Alarm Buffer Messages (Cont.)

LCD Message	Terminal Message	Alarm Number	Cause	Corrective Actions	Alarm Type
L. SYNC LOSS: SL*	LOCAL SYNC LOSS: SL*	14	Local loss of frame synchronization alarm on the sublink	1. Check cable connections between the E1 sublink and its DTE. 2. Check the line and/or other communication equipment connected to the E1 sublink. 3. Perform the power-up self-test and replace the HCD-E1 if it fails the test.	ON/OFF
LOC CRC ALM: LP1 LOC CRC ALM: LP2	LOCAL CRC ALM: LP1 LOCAL CRC ALM: LP2	30	A CRC-6 error has been detected in the input signal of the specified HDSL line.	If the number of CRC-6 errors is significant (more than a few errors per hour), perform the following: 1. Check the HDSL lines to the remote unit. 2. Perform self-test on the two units and replace the unit that fails the self-test.	ON
LOOP INBAND ON: CHX	LOOP INBAND ON: CHX	42	In-band loopback is connected on the appropriate channel.	Set the inband loop to OFF, if you don't need it any more.	ON/OFF
LOOPS INVERTED	LOOPS ARE INVERTED	32	The unit (configured as remote) detected incorrect HDSL line connections (interchange between the two HDSL lines).	Internally, the remote unit automatically corrects the connections to enable regular operation.	ON/OFF
MASTER CLK USE*	CLOCK WAS CHANGED TO MASTER*	48	HCD-E1, configured as central, switched back to the clock source selected as the master source.	Normal state - no action required	ON
PHASOR OVF:CH1	PHASOR OVERFLOW:CH1	37	A problem of receive or transmit clock between the data channels	Check the remote equipment.	ON
PHASOR OVF:CH2	PHASOR OVERFLOW:CH2	40	A problem of receive or transmit clock between the data channels	Check the remote equipment.	ON

Table 5-1 HCD-E1 Alarm Buffer Messages (Cont.)

LCD Message	Terminal Message	Alarm Number	Cause	Corrective Actions	Alarm Type
PSWRD DW IS ON	PSWRD SWITCH IS ON	19	Section PASSWD is set to ON. This message appears only upon power-up.	If it is no longer necessary to enforce the default password and node number, change setting to OFF.	ON
REM BPV ERROR	REMOTE BPV ERROR	28	A report of bipolar violation error at the sublink of the remote appliance has been received via the *eoc*.	Have the link between the E1 sublink of the remote unit and its DTE checked.	ON
REM CRC ALM: LP1 REM CRC ALM: LP2	REMOTE CRC ALM: LP1 REMOTE CRC ALM: LP2	31	The remote unit reports that a CRC-6 error has been detected in the input signal of the specified HDSL line.	If the number of CRC-6 errors is significant (more than a few errors per hour), perform the following: 1. Check the HDSL lines to the remote unit. 2. Perform self-test on the two units and replace the one that fails the self-test.	ON
REM IND ALARM*	REMOTE INDICATION ALARM*	29	The remote unit reports a remote sync loss alarm occurred at its E1 sublink.	1. Check cable connections between the E1 sublink of the remote unit and its DTE. 2. Check the line and/or other communication equipment connected to the E1 sublink. 3. Replace the remote equipment.	ON/OFF
REM SIGNAL LOSS*	REMOTE SIGNAL LOSS*	27	A report of loss of input signal at the E1 sublink of the remote equipment has been received.	1. Check cable connections between the E1 sublink of the remote unit and its DTE. 2. Check the line and/or other communication equipment connected to the E1 sublink of the remote unit. 3. Replace the remote equipment.	ON/OFF

Table 5-1 HCD-E1 Alarm Buffer Messages (Cont.)

LCD Message	Terminal Message	Alarm Number	Cause	Corrective Actions	Alarm Type
R. SYNC LOSS: SL	REMOTE SYNC LOSS: SL	23	The equipment connected to the E1 sublink reports loss of frame alignment.	Check the equipment connected to the E1 sublink of your HCD-E1	ON/OFF
RTC BATTERY FAIL*	REAL TIME CLOCK BATTERY FAILURE*	22	The battery that powers the HCD-E1 internal real-time clock when HCD-E1 is not powered, has failed. This message appears only upon power-up.	Have the HCD-E1 repaired.	ON
SELF TEST ERROR*	SELF TEST ERROR*	17	A problem has been detected during HCD-E1 self-test.	Repeat the self-test, and replace the HCD-E1 if it fails the self-test.	ON
SIGNAL LOSS:LP1* SIGNAL LOSS:LP2*	SIGNAL LOSS:LP1* SIGNAL LOSS:LP2*	25	Loss of HDSL line input signal.	1. Check the corresponding HDSL line. 2. Perform self-test on the two units and replace the one that fails the self-test.	ON/OFF
SIGNAL LOSS: SL*	SIGNAL LOSS: SL*	01	Loss of input signal on the E1 sublink.	1. Check cable connections to the E1 sublink connector. 2. Check the line and/or other communication equipment connected to the E1 sublink.	ON/OFF
SP-PAR DW IS ON	SP-PAR SWITCH IS ON	20	Section DEF SP is set to ON. This message appears only upon power-up.	If it is no longer necessary to enforce the default control port parameters, change setting to OFF	ON
STUFF OVERFLOW	STUFFING OVERFLOW	35	The stuffing mechanism cannot compensate for the frequency difference between the DTE clock and the HDSL clock.	1. Check the clock source selection. 2. Check the equipment providing the DTE signal (unstable clock source). 3. Perform the power-up self-test and replace the HCD-E1 if it fails the test.	ON

Table 5-1 HCD-E1 Alarm Buffer Messages (Cont.)

LCD Message	Terminal Message	Alarm Number	Cause	Corrective Actions	Alarm Type
SYNC LOSS:LP1* SYNC LOSS:LP2*	SYNC LOSS:LP1* SYNC LOSS:LP2*	26	Loss of synchronization on the specified HDSL line.	1. Check the corresponding HDSL line. 2. Perform self-test on the two units and replace the one that fails the self-test.	ON/OFF
TIMING OVERFLOW	TIMING OVERFLOW	36	The data line recovery circuits cannot recover the data line clock, because its frequency is not within the supported range.	1. Check the equipment providing the data signal, and make sure its clock source is stable. 2. Perform the power-up self-test and replace HCD-E1 if it fails the test.	ON

Table 5-2 H-RPT Alarm Buffer Messages

Alarm Message	Alarm Number	Cause	Corrective Actions	Alarm Type
HRPT_LTU SIGNAL LOSS:LP1 HRPT_LTU SIGNAL LOSS:LP2	01	Loss of input signal on the specified HDSL line at the LTU side of H-RPT.	1. Check the corresponding HDSL line. 2. Perform a self-test on the unit configured as remote and replace the unit if it fails the self-test. 3. Replace H-RPT.	ON/OFF
HRPT_NTU SIGNAL LOSS:LP1 HRPT_NTU SIGNAL LOSS:LP2	02	Loss of input signal on the specified HDSL line at the NTU side of H-RPT.	1. Check the corresponding HDSL line. 2. Perform a self-test on the unit configured as central and replace the unit if it fails the self-test. 3. Replace H-RPT.	ON/OFF
HRPT_LTU SYNC LOSS:LP1 HRPT_LTU SYNC LOSS:LP2	03	Loss of synchronization on the specified HDSL line at the LTU side of H-RPT.	1. Check the corresponding HDSL line. 2. Perform a self-test on the unit configured as remote and replace the unit if it fails the self-test. 3. Replace H-RPT.	ON/OFF

Table 5-2 HCD-E1 Alarm Buffer Messages (Cont.)

Alarm Message	Alarm Number	Cause	Corrective Actions	Alarm Type
HRPT_NTU SYNC LOSS:LP1 HRPT_NTU SYNC LOSS:LP2	04	Loss of synchronization on the specified HDSL line at the NTU side of H-RPT.	1. Check the corresponding HDSL line. 2. Perform a self-test on the unit configured as central and replace the unit if it fails the self-test. 3. Replace H-RPT.	ON/OFF
HRPT_SELF TEST ERROR	05	A problem has been detected during the cyclic H-RPT self-test.	Replace H-RPT.	ON
HRPT_LTU CRC ALM: LP1 HRPT_LTU CRC ALM: LP2	06	A CRC-6 error has been detected in the input signal of the specified HDSL line.	If the number of CRC-6 errors is significant (more than a few errors per hour), perform the following: 1. Check the appropriate HDSL line from the H-RPT to the unit configured as remote. 2. Perform a self-test on the unit configured as remote and replace the unit if it fails the self-test. 3. Replace H-RPT.	ON
HRPT_NTU CRC ALM: LP1 HRPT_NTU CRC ALM: LP2	07	A CRC-6 error has been detected in the input signal of the specified HDSL line.	If the number of CRC-6 errors is significant (more than a few errors per hour), perform the following: 1. Check the HDSL lines to the remote unit. 2. Perform a self-test on the unit configured as central and replace the unit if it fails the self-test. 3. Replace H-RPT.	ON
HRPT ALARM BUFFER OVERFLOW	08	More than 100 alarms entries have been written in the H-RPT alarm buffer since the last clear command. New alarms are overwriting the older alarms.	Read the messages and then clear the buffer by sending the CLR ALM HRPT/A command from the control terminal.	ON/OFF

Working with Alarm Buffer

You can manage the alarm buffer either from the control terminal, or from the LCD.

From the Control Terminal

To display the active alarms from the control terminal, type DSP ALM. The terminal displays up to 100 alarms stored in the buffer, for each alarm listing its number, its state (ON or OFF), the date and the time when the last change in its state occurred. To clear the alarms, use the commands CLR ALM and CLR ALM REM. For more details, see description of the corresponding command in Section 4.5, *HCD-E1 Command Set Description*.

From the LCD

You can view the ON-state alarms stored in the alarm buffer, on the front panel LCD display, and delete the alarm messages from the buffer when no longer needed. This procedure is explained below.

When the top row shows ALARM BUFFER, the second row displays the following information:

- During normal operation, the second row shows EMPTY (no alarm messages).
- If the alarm buffer contains ON-state alarms, the LCD shows SCROLL in the left-hand field of the second row, and CLEAR in the right-hand field.

To display the alarms, bring the cursor to SCROLL, and then press ENTER: you can now scroll between the ON-state alarms stored in the alarm buffer. To interpret the alarm messages displayed in the second row, *refer to Table 5-1*.

To correct the reported problem, perform the corrective actions in the given order, until the problem is resolved.

To clear alarm messages from the HCD-E1 alarm buffer, act as follows:

Step	Action	Key	Display
1	Display ALARM BUFFER in the first row.	CURSOR	ALARM BUFFER
2	Bring the cursor in the second row, to CLEAR.	CURSOR	
3	Press ENTER to clear the ON-type alarms and the alarm history in the alarm buffer.	ENTER	If no ON-state alarms are present, the second row should show EMPTY.

This action is equivalent to the CLR ALM/A command (see Section 4.5, *HCD-E1 Command Set Description,* in Chapter 4).

5.3 Performance Diagnostics Data

General

HCD-E1 has two capabilities for collection of performance statistics: E1 and HDSL performance monitoring capability.

This section first describes the principles and parameters of the E1 and HDSL performance monitoring and then explains how to display performance data from the HCD-E1 front panel. For information on displaying the performance data from the control terminal, see *Chapter 4*.

E1 Sublink Performance Monitoring

This section describes the performance evaluation and monitoring functions provided by HCD-E1 with respect to the user's traffic (on the E1 link between the DTE and the user's port). The functions actually available depend on the use of the CRC-4 function: whether it is enabled or disabled.

Below are listed performance monitoring parameters with the CRC-4 function enabled and disabled, followed by a summary table (*Table 5-2*) listing the displays of all these parameters on the HCD-E1 front panel in the order of their appearance, accompanied by a short description and ranges available.

E1 Performance Monitoring with CRC-4 Function Enabled

When the CRC-4 function is enabled, you are able to monitor the end-to-end data transmission performance. HCD-E1 derives information about errors from the E1 data payload by performing a cyclic redundancy check (CRC), and transmits the resulting CRC checksum in addition to the raw data bits.

The receiving end recalculates the checksum and compares the results with the received checksum: any difference between the two checksums indicates that the current data block being evaluated contains bit errors.

When the CRC-4 function is enabled, HCD-E1 stores E1 line statistics for the E1 port. This permits real-time monitoring of E1 data transmission performance.

The performance monitoring parameters are listed below:

- **Current CRC-4 error events (ERROR CRC)**

  A CRC-4 error event is any multiframe containing a CRC error and/or OOF event. The number of CRC events in the current second is collected in a current CRC error events register.

- **Current average CRC-4 errors (AV ERR CRC)**

  The average number of CRC events per second. The average is updated every second.

Note *You can display the register contents at any time. When the CRC error events are displayed on the front-panel LCD, you can reset the register by pressing ENTER.*

- **Current errored seconds (CURR ES)**

  An errored second is any second containing one or more CRC error events, or one or more OOF events, or one or more controlled slip events. The data is collected for the current 15-minute interval.

- **Current unavailable seconds (CURR UAS)**

  An unavailable second is any second in which a failed signal state exists. A failed signal state is declared when 10 consecutive severely errored seconds (SES) occur, and is cleared after 10 consecutive seconds of data are processed without a SES.

- **Current severely errored seconds (CURR SES)**

  A SES is a second with 832 or more CRC error events, or one or more OOF events. The data is collected for the current 15-minute interval.

- **Current bursty errored seconds (CURR BES)**

  A BES is a second with 2 to 831 CRC error events. The data is collected for the current 15-minute interval.

- **Current loss of frame counter (CURR LOFC)**

  The loss of frame (LOF) counter counts the loss of frame alignment events. The data is collected for the current 15-minute interval.

- **Current slip second counter (CURR CSS)**

  A CSS is a second with one or more controlled slip events. The data is collected for the current 15-minute interval.

- **Current seconds (CURR SECS)**

  The number of seconds in the current measurement interval. A measurement interval has 900 seconds (15 minutes).

Note *This register is called "CURRENT TIMER" on the control terminal.*

HCD-E1 also provides support for long-term statistics gathered over the long-term interval (96 15-minute intervals, i.e., a total of 24 hours) for the E1 port. The additional parameters included in this class are:

- **Long-term errored seconds (L.TERM ES)**

  The total number of ES in the current 24-hour interval.

- **Long-term fail seconds (L.TERM UAS)**

  The total number of UAS in the current 24-hour interval.

- **Long-term severely errored seconds (L.TERM SES)**

  The total number of SES in the current 24-hour interval.

- **Long-term bursty errored seconds (L.TERM BES)**

  The total number of BES in the current 24-hour interval.

- **Long-term loss of frame counter (L.TERM LOFC)**

  The total number of LOF events in the current 24-hour interval.

- **Long-term slip second counter (L.TERM CSS)**

  The total number of CSS in the current 24-hour interval.

- **Long-term interval (L.TERM INT)**

  The number of valid 15-minute intervals in the previous 24 hour period.

- **Current degraded minutes (CUR DEG MIN)**

  The total number of degraded minutes in the current 24-hour interval. A degraded minute is a minute in which the bit error rate (BER) exceeded 1×10^{-6}. This number is updated every minute.

- **Last degraded minutes (LST DEG MIN)**

  The total number of degraded minutes in the last 24-hour interval. This number is updated every 24 hours.

E1 Performance Monitoring with CRC-4 Disabled

In this case HCD-E1 does not support the capabilities listed above, but is capable of gathering the number of bipolar violations measured during the last minute.

The performance evaluation and monitoring parameters collected by the HCD-E1 when the CRC-4 function is disabled are listed below:

- **Bipolar violations last minute count (BPV COUNT)**

  The total number of bipolar violations counted in the last minute. This number is updated every minute.

- **Bipolar violations worst count (BPV WORST)**

  The number of bipolar violations counted in the worst minute since the last resetting of the BPV count. This number is updated every minute.

Summary of E1 Performance Monitoring

Table 5-3 gives a summary of the performance diagnostics data displayed under the header PORT DIAGNOSTICS on the HCD-E1 front panel.

Table 5-3 Summary of E1 Performance Monitoring

Display	Description	Range
ERROR CRC	The number of CRC error events recorded since the last time the register was cleared. The display is updated every second.	0 - 1000
AV ERR CRC	The average number of CRC error events recorded since the last time the register was cleared. The display is updated every second.	0 - 1000
CURR ES	Number of ES measured during the current 15-minute interval. The display is updated every second.	0 - 900
CURR UAS	Number of UAS measured during the current 15-minute interval. The display is updated every second.	0 - 900
CURR SES	Number of SES measured during the current 15-minute interval. The display is updated every second.	0 - 900
CURR BES	Number of BES measured during the current 15-minute interval. The display is updated every second.	0 - 900
CURR LOFC	Number of loss of frame synchronization events measured during the current 15-minute interval. The display is updated every second.	0 - 255
CURR CSS	Number of CSS measured during the current 15-minute interval. The display is updated every second.	0 - 255
CURR SECS (CURRENT TIMER on the terminal)	The time in seconds that expired from the start of the current 15-minute interval. The display is updated every second.	0 - 900
L.TERM ES	Number of ES measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 65535
L.TERM UAS	Number of UAS measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 65535
L.TERM SES	Number of SES measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 65535
L.TERM BES	Number of BES measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 65535
L.TRM LOFC	Number of loss of frame synchronization events measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 255
L.TERM CSS	Number of CSS measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 255
L.TERM INT	The number of 15-minute intervals that expired from the start of the current 24-hour interval. The display is updated every 15 minutes.	0 - 96
CUR DEG MIN	Number of degraded minutes measured during the last 24 hours. The display is updated every minute.	0 - 1440

Table 5-3 Summary of E1 Performance Monitoring (Cont.)

Display	Description	Range
LST DEG MIN	Last 24-hour count of degraded minutes. The display is updated every 24 hours.	0 - 1440
BPV COUNT	The total number of BPV errors during the last minute The display is updated every minute.	0 - 9999
BPV WORST	The number of BPV errors measured during the worst minute. The display is updated every minute.	0 - 9999

HDSL Performance Monitoring

This section describes the performance evaluation and monitoring functions provided by HCD-E1 with respect to the HDSL transmission performance on each line.

The HDSL performance monitoring parameters are listed below:

- **Current errored seconds (ES)**

  An errored second is any second containing one or more errored blocks, or the occurrence of a severely disturbed period (SDP). The data is collected for the current 15-minute interval.

- **Current unavailable seconds (UAS)**

  An unavailable second is any second in which a failed signal state exists. A failed signal state is declared when 10 consecutive severely errored seconds (SES) occur, and is cleared after 10 consecutive seconds of data are processed without a SES. The data is collected for the current 15 minute interval.

- **Current severely errored seconds (SES)**

  A SES is a second with more than 30% errored blocks or one or more SDP's. The data is collected for the current 15-minute interval.

- **Current background block error (BBE)**

  A BBE is an errored block not occurring during an SES. The data is collected for the current 15-minute interval.

- **Errored Seconds Ratio (ESR)**

  The ratio of ES to the total seconds in the current 15-minute interval (not displayed on the LCD).

- **Severely errored seconds ratio (SESR)**

  The ratio of SES to the total seconds in the current 15-minute interval (not displayed on the LCD).

- **Background block error ratio (BBER)**

  The ratio of BBE to the total seconds in the current 15-minute interval (not displayed on the LCD).

- **Current seconds (SECS)**

  The number of seconds in the current measurement interval. A measurement interval has 900 seconds (15 minutes).

Note *This register is called "CURRENT TIMER" on the control terminal.*

The same parameters are also available over 24-hour intervals (***long-term statistics***).

Summary of HDSL Performance Monitoring

Table 5-4 gives a summary of the performance diagnostics data displayed under HDSL DIAG: LINE1 or HDSL DIAG: LINE2 on the HCD-E1 front panel.

Table 5-4 Summary of HDSL Performance Monitoring from the Front Panel

Display	Description	Range
CURR ES	Number of ES measured during the current 15-minute interval. The display is updated every second.	0 - 900
CURR UAS	Number of UAS measured during the current 15-minute interval. The display is updated every second.	0 - 900
CURR SES	Number of SES measured during the current 15-minute interval. The display is updated every second.	0 - 900
CURR BBE	Number of BBE measured during the current 15-minute interval. The display is updated every second.	0 - 900
CURR SECS (CURRENT TIMER on the terminal)	The time in seconds that expired from the start of the current 15-minute interval. The display is updated every second.	0 - 900
L.TERM ES	Number of ES measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 65535
L.TERM UAS	Number of UAS measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 65535
L.TERM SES	Number of SES measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 65535
L.TERM BBE	Number of BBE measured during the current 24-hour interval. The display is updated every 15 minutes.	0 - 65535
L.TERM INT	The number of 15-minute intervals that expired from the start of the current 24-hour interval. The display is updated every 15 minutes.	0 - 96

Displaying the Performance Data on the Front-Panel LCD

To display the E1 and HDSL performance diagnostics data on the HCD-E1 front-panel LCD, use the following procedure:

Step	Action	Key	Result
1	Bring the cursor to the left-hand field of the top row (if it is not already there).	CURSOR	
2	Scroll to display PORT DIAG: SL in the top row.	SCROLL	
3	Bring the cursor to the left-hand field in the second row	CURSOR	The second row shows the first E1 performance item and its current value.
4	Scroll to see the other E1 performance statistics	SCROLL	After each pressing of SCROLL, the second row shows the current value of the next item. Continue until the first item appears again.
5	Bring the cursor to the left-hand field of the top row (if not already there).	CURSOR	
6	Scroll to display HDSL DIAG in the top row.	SCROLL	The right-hand field of the top row indicates LINE1, meaning that the displayed diagnostics data pertains to line 1. Second row shows the first performance item for line 1 and its current value.
7	Bring the cursor to the left-hand field in the second row.	CURSOR	
8	Scroll to see the other statistics.	SCROLL	After each SCROLL pressing, the second row shows the current value of the next item. Continue until the first item appears again.
9	Bring the cursor to the right-hand field of the top row (if it is not already there).	CURSOR	
10	Scroll to display LINE2.	SCROLL	Second row shows the first performance item for line 2 and its current value.
11	Repeat steps 7 and 8 above to see the other statistics of line 2.	SCROLL	After each pressing of SCROLL, the second row shows the current value of the next item. Continue until the first item appears again.

Resetting the Performance Data Registers

The registers storing diagnostics data can be reset. To reset a register, bring the register to display and press ENTER. To ensure that the collected data remains meaningful and correlated after a specific register is reset, HCD-E1 will automatically perform the following actions.

For E1 Registers:

- When the CRC-4 function is enabled:
  - Since the data collected for the current interval and for the current 24-hour interval is correlated, pressing ENTER while any of the following CURR or L.TERM data items (ES, UAS, SES, BES, LOFC, CSS, CURR SECS, CUR DEG MIN, LST DEG MIN, and L.TERM INT) is displayed, clears all the performance diagnostics registers, not only the one appearing on the display.
  - Resetting the ERROR CRC register automatically resets the AV ERR CRC register, and *vice versa*: resetting the AV ERR CRC register automatically resets the ERROR CRC register.
- When the CRC-4 function is disabled, resetting the BPV COUNT register automatically resets the BPV WORST register, and *vice versa*: resetting the BPV WORST register automatically resets the BPV COUNT register.

For HDSL Registers:

When you press ENTER, *all* the HDSL performance registers that pertain to the line whose number is displayed in the right-hand field of the top row are simultaneously reset.

Displaying the Performance Data on a Control Terminal

You can display the performance data on the control terminal by means of the DSP SL PM, DSP R SL PM, DSP HDSL PM, and DSP R HDSL PM commands, as explained in *Chapter 4*. By adding the /C switch to the DSP SL PM and DSP R SL PM commands, you can reset the CRC ERROR EVENTS and CRC AVG ERR EVENTS registers for the E1 sublink of the appropriate (local or remote) unit. By adding the /CA switch to the command, you can reset *all* the performance diagnostics registers.

5.4 Diagnostic Tests

Diagnostic Loopbacks

The user-controlled test functions of HCD-E1 consist of the following diagnostic loopback tests:

Loopback Description	Terminal Command	Designation on the LCD	
		Second Row	Top Row (Right)
Loopback (local) on the two HDSL lines towards the DTEs connected to your HCD-E1	LOOP L LINE	LOCAL LINE	ML
Local loopback on the H-RPT repeater towards the HCD-E1 unit configured as central	LOOP L HRPT	LOCAL HRPT	HRPT
Loopback (local) on the E1 sublink of the local towards the DTE connected to it	LOOP L SL	LOCAL PORT	SL
Loopback (remote) on the E1 sublink of the local HCD-E1 towards the DTE connected to the E1 sublink of the remote HCD-E1	LOOP R SL	REM PORT	SL
Loopback (remote remote) on the E1 sublink of the remote unit, towards the DTE connected to the E1 sublink of the local HCD-E1	LOOP R R SL	REM REM PORT	SL
Loopback (local) on the data channel X of the local HCD-E1 towards the DTE connected to it	LOOP L CH X	LOCAL CH	CHX
Loopback (remote) on the data channel X of the local HCD-E1 towards the DTE connected to this channel of the remote HCD-E1	LOOP R CH X	REM CH	CHX
Loopback (remote remote) on the data channel X of the remote HCD-E1 towards the DTE connected to this channel of the local HCD-E1	LOOP R R CH X	REM REM CH	CHX
In-band activated loopback on data channel X of the remote unit towards the DTE connected to this channel of the local HCD-E1	LOOP INBAND CH X	INBAND LOOP	CHX
BER testing on the data channel	LOOP BERT CH X	BERT	CHX

You can access these loopbacks from the TEST OPTION menu.

The following paragraphs describe the loopbacks identified by the supervision terminal command.

LP L LINE

These local loopbacks on the HDSL lines are performed in the HDSL framer, as shown in *Figure 5-1*. Test signal is provided either by the equipment connected to one of the inputs, which must receive its own transmissions without errors, or by applying the BERT test.

This test fully checks the connections to the equipment connected to the local E1 sublink and/or data channels, as well as the circuits of the local unit.

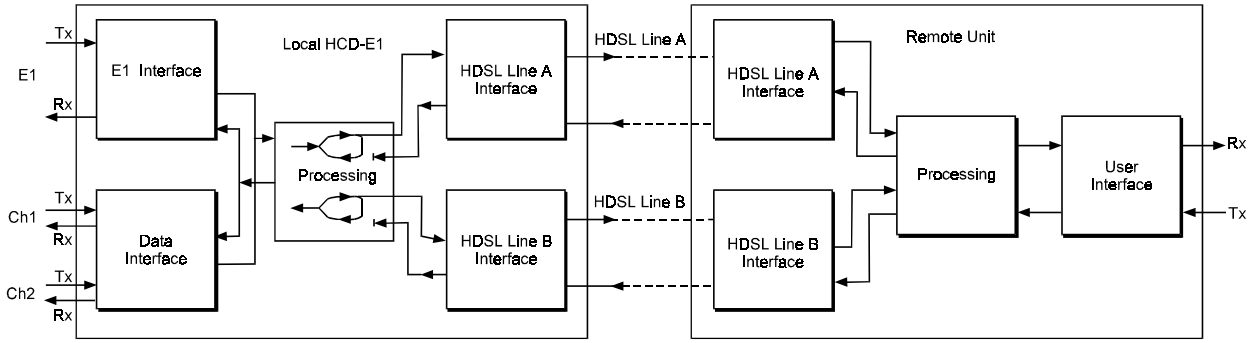


Figure 5-1 LP LINE Loopback

Notes

1. This loopback can be activated only from the unit configured as central.

2. While this loop is active, HCD-E1 loses HDSL synchronization.

LP L HRPT

This local loopback on the HDSL repeater is performed as shown in *Figure 5-2*. The loopback can be performed only from the HCD-E1 unit configured as central.

This test fully checks the connections to the equipment connected to the local E1 sublink and/or data channels of the HCD-E1 unit configured as central, all the circuits of both HCD-E1 and H-RPT, and the transmission path connecting the two units.

During the loopback, the remote unit continues to receive data sent from the central unit.

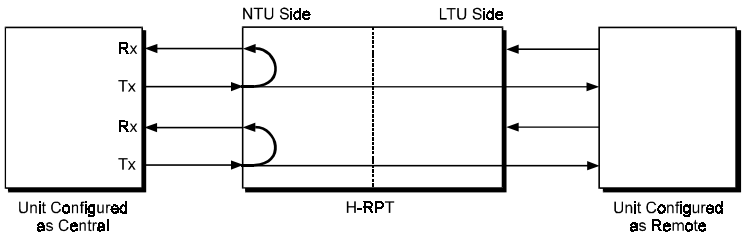


Figure 5-2 H-RPT Local Loopback

LP L SL

This local loopback towards the E1 sublink of the local HCD-E1 is performed by connecting the E1 sublink input signal (input to HCD-E1) to the output of the sublink from HCD-E1, as shown in *Figure 5-3*. The test signal is provided by the equipment connected to the E1 sublink of the local HCD-E1, which must receive its own transmission without errors while the loopback is activated.

This test fully checks the connections to the equipment connected to the E1 sublink of the local HCD-E1. During the loopback, the local HCD-E1 continues sending data from the DTE connected to its E1 sublink, over the HDSL link.

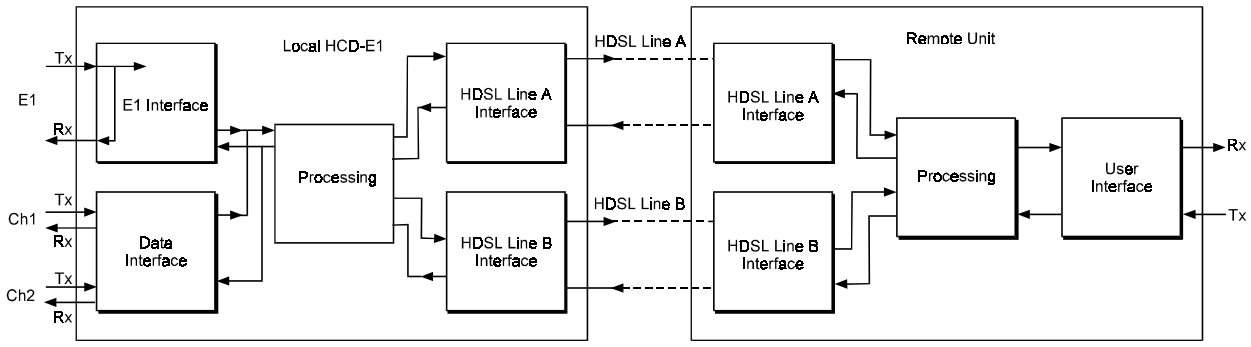


Figure 5-3 LP L SL Loopback

LP R SL

This remote loopback towards the DTE connected to the E1 sublink of the remote HCD-E1 is performed by connecting the sublink transmit signal (output from HCD-E1) to the sublink receive path (input from HCD-E1) within the sublink line interface circuits, as shown in *Figure 5-4*. The test signal is provided by the equipment connected to the E1 sublink of the remote HCD-E1, which must receive its own transmission without errors while the loopback is activated.

This test checks the connections to the equipment connected to the E1 sublink of the remote HCD-E1, all the circuits of the local and remote HCD-E1, and the transmission path connecting the two units.

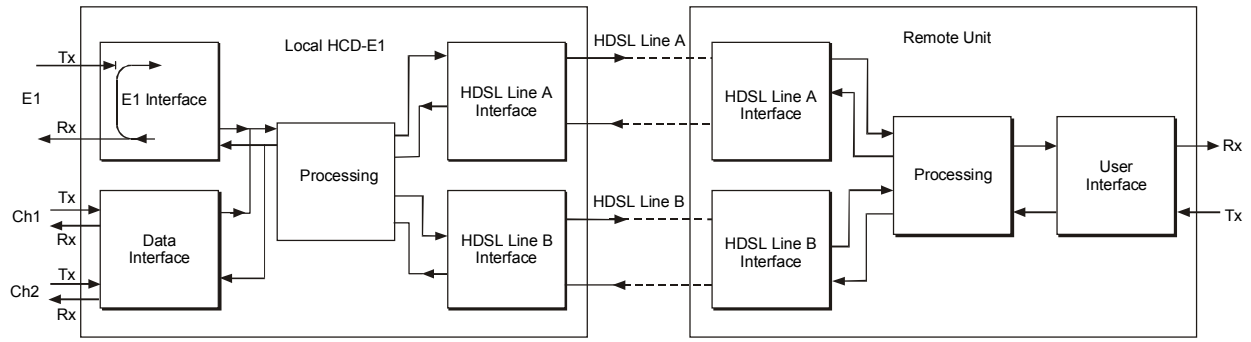


Figure 5-4 LP R SL Loopback

During the loopback, the DTE connected to the E1 sublink of the local HCD-E1, continues to receive data.

LP R R SL

This remote remote loopback towards the DTE connected to the E1 sublink of the local HCD-E1 is performed by connecting the transmit signal of the E1 sublink of the remote unit (output from the remote HCD-E1) to the input of its receive path (input from the remote HCD-E1) within the sublink line interface circuits, as shown in *Figure 5-5*. The test signal is provided by the equipment connected to the E1 sublink of the local HCD-E1, that must receive its own transmission without errors while the loopback is activated.

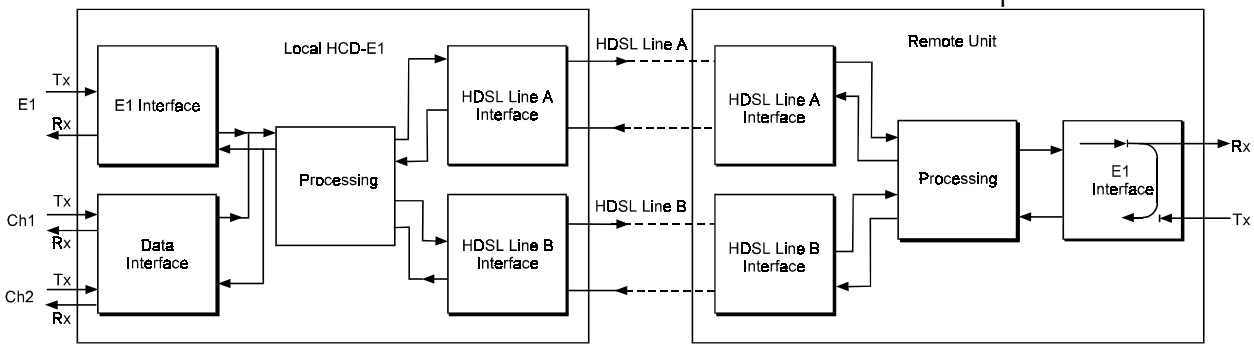


Figure 5-5 LOOP R R SL Loopback

This test checks the connections to the equipment connected to the E1 sublink of the local HCD-E1, all the circuits of the remote unit, the functions of the remote and local units, and the transmission path between them. During this loopback, the DTE connected to the E1 sublink of the remote HCD-E1 continues to receive data.

Note *The following loopbacks (LP L CH, LP R CH, LP R R CH and LP INBAND CH) are not recommended for HCD-E1 channel with Ethernet interface. Although a channel loopback is not forbidden in principle, it may cause a state of permanent collision on the LAN (this would prevent other users from using the LAN as long as the loopback is connected).*

LP L CH X

This local loopback on the data channel X of the local HCD-E1 (X can be 1 or 2) is performed by connecting the data channel transmit signal to the input of the receive path, as shown in *Figure 5-6*. The test signal is provided by the DTE connected to this channel of the local HCD-E1, which must receive its own transmission without errors while the loopback is activated. During the loopback, this channel of the local HCD-E1 continues sending the user's data to the link.

This test mainly checks the connections to the local data channel interface.

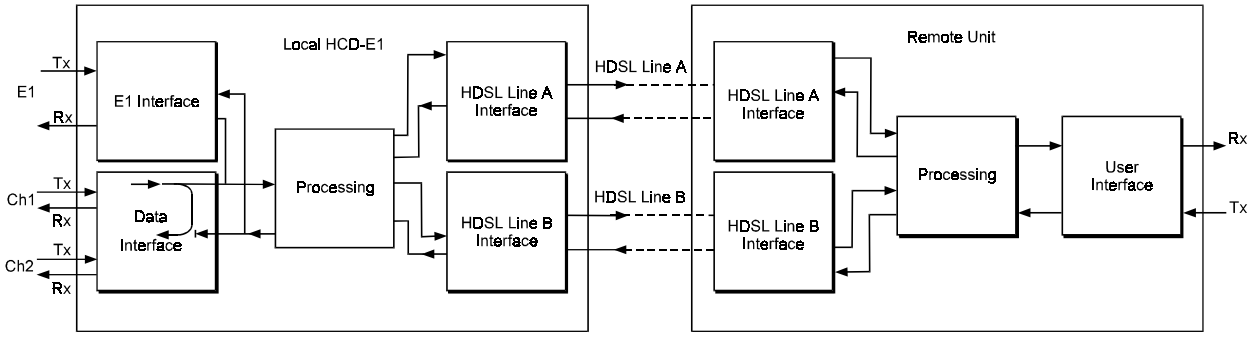


Figure 5-6 LP L CH 1 Loopback

LP R CH X

This remote loopback towards the DTE connected to data channel X of the remote HCD-E1 (X can be one or two) is performed by connecting the local data channel receive signal to its transmit input, as shown in *Figure 5-7* for the loop on channel 1. The test signal is provided by the DTE connected to the data channel of the remote HCD-E1, which must receive its own transmission without errors while the loopback is activated.

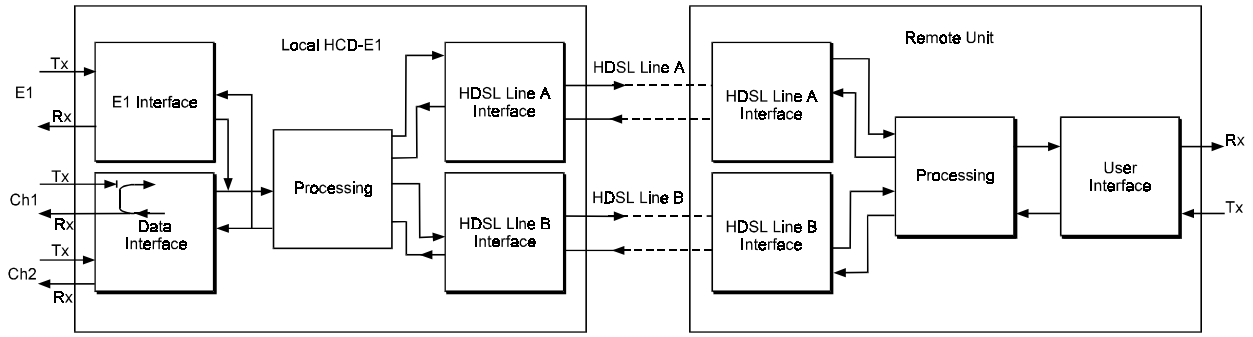


Figure 5-7 LP R CH 1 Loopback

This test fully checks the user data link, including the cables connecting the DTE to the remote unit, the transmission path connecting the two units and the circuits of the local HCD-E1. During the loopback, the DTE connected to the tested data channel of the local HCD-E1 continues to receive data.

LP R R CH

This remote remote loopback towards the DTE connected to the data channel of the local HCD-E1, is performed by connecting the transmit signal of this data channel of the remote HCD-E1 to the input of its receive path within the data channel interface circuits, as shown in *Figure 5-8* for the loop on channel 1. The test signal is provided by the DTE connected to the data channel of the local HCD-E1, which must receive its own transmission without errors while the loopback is activated.

This test checks the connections to the DTE connected to the data channel of the local HCD-E1, all the circuits of the remote unit, the functions of the remote unit and local HCD-E1, and the transmission path connecting the two units. During the loopback, the DTE connected to the tested channel of the remote unit continues to receive data.

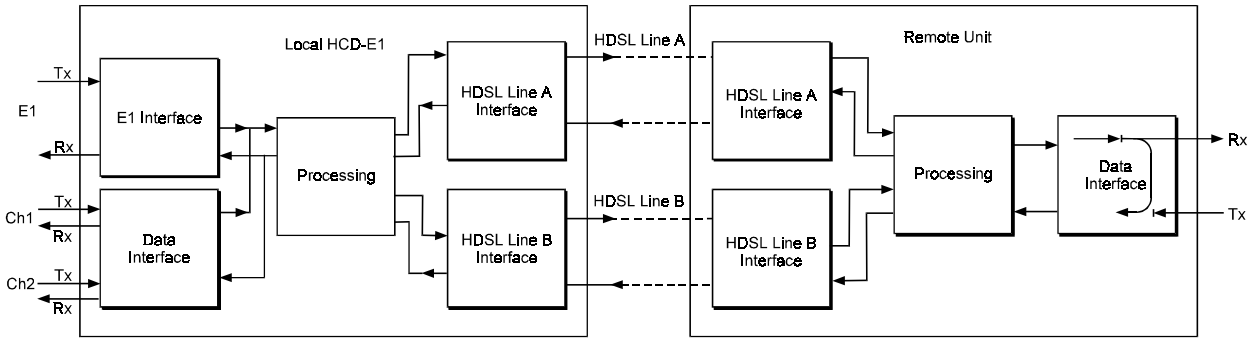


Figure 5-8 LP R R CH 1 Loopback

LP INBAND CH X

The in-band activated channel loopback (see *Figure 5-9*) is similar to the channel data remote remote loopback, except for the way it is connected.

This loopback is activated and deactivated by transmitting special sequences for approximately two seconds, in contrast to the LP R R CH loopback, where the command arrives with *e.o.c.*

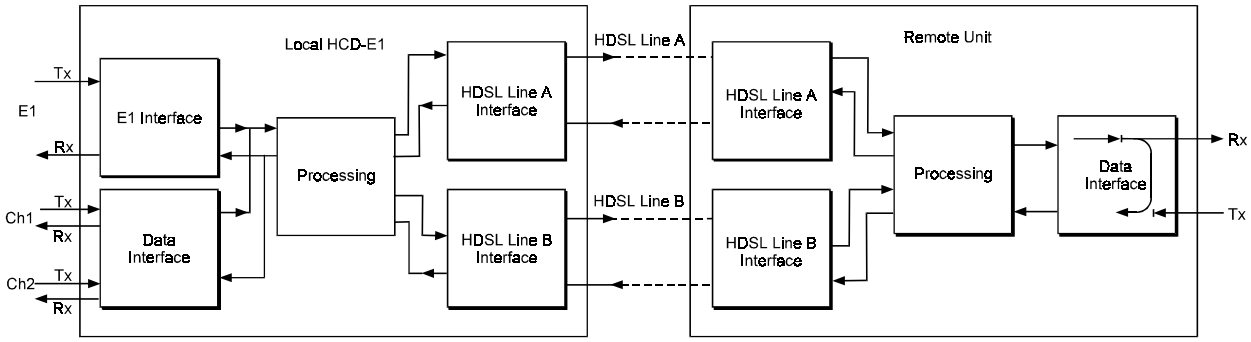


Figure 5-9 LP INBAND CH 1 Loopback

LP BERT CH X

BER testing (see *Figure 5-10*) does not represent a loopback in itself; to be performed, it requires one of the channel or line loopbacks to be already activated, towards your BERT.

BER testing can be performed on one channel at a time. To perform the test over the whole link, end-to-end, you may use the LP R R CH loopback on the same channel; for a local test, use the LP L LINE loopback.

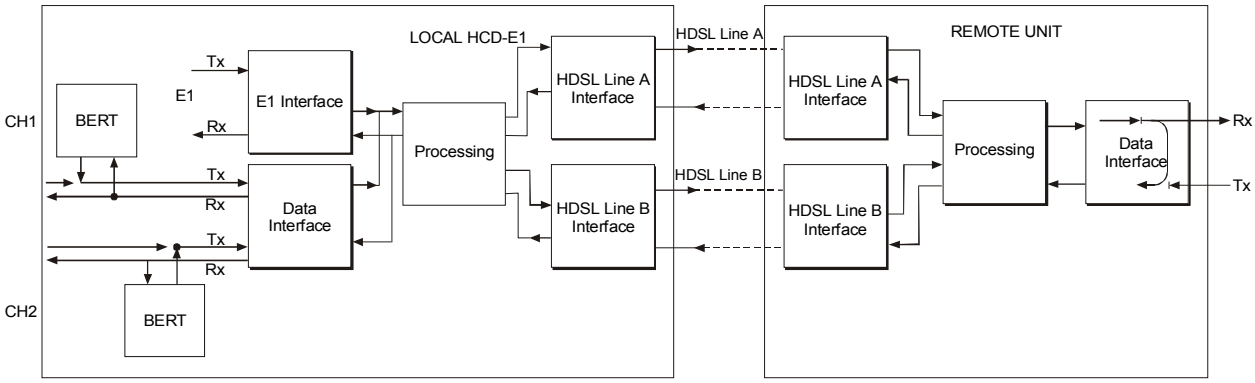


Figure 5-10 LP R R CH 1 Loopback + LP BERT CH 1

During the test, the local data channel is disconnected, the DSR line is off; an internal pattern generator connects a user-selected test sequence to the transmit input of the local data channel interface. To calibrate the system, you can inject errors at a selectable rate.

The receive output is connected to a pattern evaluator. The evaluator compares the received and transmitted patterns and detects errors. The test results are presented as follows:

- On the supervision terminal, detailed full data is displayed, including information on factors such as the number of seconds during which HCD-E1 lost frame synchronization (*see the **DSP BERT** command in Chapter 4*).
- On the LCD, the result appears as GOOD (no errors) or BAD (at least one error has been detected during the BER measurement interval). For more details, *see "Operating BERT from the Front Panel"* below.

Operating Loopbacks from the Front Panel

Before starting the execution of a test, pay attention to the following points:

- At any time, you can connect only one loopback on the E1 sublink, and one on each channel.
- If a loopback is already connected, the TST indicator lights. If you try to connect a loopback while another loopback of the same type is already connected, HCD-E1 displays an error message.

To activate or deactivate a specific test, use the following procedure:

Step	Action	Key	Result
1	Bring the cursor to the left-hand field in the top row (if it is not already there).	CURSOR	
2	Scroll to display TEST OPTION in the top row.	SCROLL	The right-hand field of the top row may show OFF (in this case the second row is empty), SL, ML, CH1, CH2, or HRPT. OFF indicates that either no test is currently active or a test is active but can be deactivated. CH1, CH2, SL, ML, or HRPT indicates that a test is currently active (in this case the TST LED lights), or enabled.
3	To enable the activation of the E1 sublink test, bring the cursor to the right-hand field in the top row, and scroll to display SL.	CURSOR, SCROLL	The second row displays the first test option: LOCAL PORT.
4	Bring the cursor to the left-hand field in the second row, and scroll to display the desired type of loopback: LOCAL PORT (E1 sublink local loopback) REM PORT (E1 sublink remote loopback) REM REM PORT (E1 sublink remote remote loopback)	CURSOR, SCROLL	The second row shows the current state of the selected test, OFF or ON.
5	To enable the activation of the main link test, bring the cursor to the right-hand field in the top row, and scroll to display ML.	CURSOR, SCROLL	The second row displays LOCAL LINE.
6	To enable the activation of CH X loopbacks, bring the cursor to the right-hand field in the top row and scroll to display the desired number of channel CH1 or CH2.	CURSOR SCROLL	The second row displays the first test option: LOCAL CH

Step	Action	Key	Result
7	Bring the cursor to the left-hand field in the second row, and scroll to display the desired type of loopback: LOCAL CH (data channel local loopback) REM CH (data channel remote loopback) REM REM CH (data channel remote remote loopback) BERT (BERT test) INBAND LOOP (in-band loopback)	CURSOR, SCROLL	The second row shows the current state of the selected test, OFF or ON.
8	To enable the activation of the H-RPT loop (available only for HCD-E1 configured as central), bring the cursor to the right-hand field in the top row, and scroll to display HRPT.	CURSOR, SCROLL	The second row displays LOCAL HRPT.
9	To change the test state, bring the cursor to the right-hand field in the second row, and scroll to display the desired state (ON or OFF).	CURSOR, SCROLL	The second row shows the new state of the selected test (for instance, ON).
10	Press ENTER to activate or deactivate the displayed test.		The TST indicator lights if the test is activated, or goes off if no more tests are active.

To deactivate all the tests activated from this unit, simultaneously, perform steps 1, 2, 3 above: in step 3 select OFF, and then press ENTER. The TST LED should turn off.

Operating BERT from the Front Panel

To activate the BERT test, you must first select the BERT parameters for the appropriate channel (see *Table 3-6* in Chapter 3 for the LCD menu description and the ***DEF BERT** command* in Chapter 4 for additional information). You must also remember that you can perform this test only on a connected channel (at least one HDSL time slot must be assigned to this channel).

To display the current parameter values, and change them as necessary, use the following procedure:

Step	Action	Key	Result
1	Check/configure your channel according to Chapter 3 (see *Checking the Current Operating Configuration* in Section 3.5 or *General Configuration Procedure* in Section 3.6).		
2	Bring the cursor to the left-hand field in the top row (if it is not already there).	CURSOR	
3	Scroll to display BERT PRM in the top row.	SCROLL	
4	Move the cursor to the right-hand field and scroll to display the desired channel.	CURSOR, SCROLL	The right-hand field of the top row shows CH1 or CH2
5	Bring the cursor to the left-hand field in the second row, and scroll to display PATTERN.	CURSOR, SCROLL	The right-hand field in the second row displays the current value.
6	Move the cursor to the right-hand field and scroll to display the desired pattern.	CURSOR, SCROLL	
7	Bring the cursor to the left-hand field in the second row, and scroll to display ERR RATE.	CURSOR, SCROLL	The right-hand field in the second row displays the current value.
8	Move the cursor to the right-hand field and scroll to display the desired error rate. For selection, consult *Table 3-6* in Chapter 3 and *DEF BERT command* in Chapter 4. When done, press ENTER.	CURSOR, SCROLL ENTER	
9	Prior to activating the BERT test on the data channel, activate one of the following loopbacks: LP R R CH on the selected channel, LP LOCAL LINE, or LP L HRPT (if your HCD-E1 is configured as central), as described in the above section (*Operating Loopbacks from the Front Panel*).		The TST indicator lights up.
10	Bring the cursor to the left field of the top row and scroll to display TEST OPTION.	CURSOR, SCROLL	
11	Bring the cursor to the right field in the top row, and scroll to display your channel number (CH1 or CH2).	CURSOR, SCROLL	
12	Bring the cursor to the left field of the second row and scroll to display BERT.	CURSOR, SCROLL	
13	Bring the cursor to the rightmost field of in the second row , select ON and press ENTER to perform the BERT test.	CURSOR, SCROLL, ENTER	In the middle field of the second row, HCD-E1 displays the test result: BAD or GOOD.
14	To inject errors, press ENTER (to make sure that error injection is enabled, see step 8).	ENTER	GOOD turns to BAD and the letter I appears next to it.
15	If you want to repeat error injections, perform step 14.	ENTER	BAD turns to GOOD, and the letter I next to it disappears.

Step	Action	Key	Result
16	To deactivate the BERT test, scroll to OFF and press ENTER.	ENTER	
17	Deactivate the loopback on the appropriate channel as described in the previous section.		

Operating Loopbacks from a Control Terminal

The diagnostic loopbacks can be operated by means of a control terminal, using the LOOP and CLR LOOP commands. For more detail, see description of the corresponding command in Section 4.5, *HCD-E1 Command Set Description*.

5.5 Configuration Error Messages

If HCD-E1 detects a configuration mismatch, it displays an appropriate configuration error message. These messages appear both on the LCD and on the supervision terminal. Some of the messages are not available on the LCD. There is also one unavailable on the supervision terminal.

On the control terminal, configuration error messages have the format ERROR, followed by a two-digit code and a short description of the error message after the error code. The LCD displays CONFIG ERROR followed by the error two-digit code, without description. *Table 5-5* lists the configuration error messages in order of their codes and explains each of them. Messages not available on the LCD are marked with an asterisk (*).

Table 5-5 Configuration Error Messages

Error Code	Terminal Message and Description
ERROR 01	ILLEGAL LOOP COMBINATION You are trying to activate illegal combination of loopbacks.
ERROR 02*	LOOP IS NOT ACTIVE You are trying to disconnect a loopback that is not active.
ERROR 03	ILLEGAL COMMAND FOR CURRENT PORT MODE You are trying to perform a command, which is illegal for the current configuration. For example, you are trying to display the E1 sublink performance diagnostics while the CRC-4 function is disabled, or you are attempting to configure remote HCD-E1, when it is under control of central unit (CONFIG_REM parameter of the central unit is set to YES) and the HDSL line is synchronized.
ERROR 04	On LCD only: You are trying to change a parameter from the front panel when the password protection is enabled

Table 5-5 Configuration Error Messages (Cont.)

Error Code	Terminal Message and Description
ERROR 05	MASTER AND FALLBACK CLOCK ARE THE SAME You are trying to select the same source as both master and fallback clock source. Check and change as required.
ERROR 06	ILLEGAL NUMBER OF TIME SLOTS SELECTED The total number of high priority time slots selected exceeds the maximum (16 time slots) allowed
ERROR 07*	ILLEGAL NODE NUMBER You are trying to select a node with number greater than 255.
ERROR 08	ILLEGAL SPEED FOR CURRENT AUXILIARY DEVICE The AUTO (Autobaud) mode cannot be selected when the supervisory port is to support the SLIP protocol (AUX DEV parameter is set to NMS-SLIP).
ERROR 09	DIFFERENT DEDICATED TS ALLOCATION You are trying to select different time slots of main link and sublink for dedicated time slot, and dedicated timeslot of sublink is not TS-0.
ERROR 10	CONFLICT IN SPEED PARAMETER The number of time slots currently allocated to a data channel or sublink is not equal to the number of time slots required to support the nominal data rate configured for this channel/sublink under SPEED or NUM OF TS parameter. Check and change as required.
ERROR 11	ILLEGAL TIME SLOT ALLOCATION At least one main link time slot is being assigned to more than one user (for example to the sublink and one of the channels). Check the dedicated time slot assignment, as well as time slot assignment for each channel and for the E1 sublink, with particular attention to automatic assignments (SEQ and ALT modes).
ERROR 12	TIME SLOT OUT OF RANGE When using the SEQ or ALT mapping mode, the sum of the number of time slots requested for a data channel (or sublink) and the starting time slot for that channel (or sublink) exceeds 31. Check and change as required.
ERROR 13	CONFLICT BETWEEN CLOCK MODE AND FIFO SIZE FIFO size can be other than AUTO only if the clock mode of the data channel is DTE2.
ERROR 14	ILLEGAL UNFRAMED CONFIGURATION For working in unframed mode, all the 32 time slots must be assigned.
ERROR 15	INVALID MASTER CLOCK SOURCE The channel you are trying to select as the fallback clock source is either not connected, or its clock mode is not DTE2. Check and change as required.
ERROR 16	INVALID FALLBACK CLOCK SOURCE The channel you are trying to select as the master clock source is either not connected, or its clock mode is not DTE2. Check and change as required.

Table 5-5 Configuration Error Messages (Cont.)

Error Code	Terminal Message and Description
ERROR 17	TS 0 IS MAPPED TO G732N FRAME TYPE You are trying to assign TS 0 for the G732N frame type
ERROR 18	Reserved for future use.
ERROR 19	ILLEGAL PARAMETER FOR CURRENT CONFIGURATION You are using a parameter which is not supported by this HCD-E1 version or configuration.
ERROR 20	LOOP IS ACTIVE, CAN'T UPDATE HARDWARE When a test or loopback is active, it is not possible to change the HCD-E1 operating mode in accordance with the updated configuration parameters. You may see this message either after pressing ENTER, or after an update data base command has been received through the supervisory port (or in-band management). You must first deactivate the test or loopback.
ERROR 21	CAN'T PERFORM LOOP - CHANNEL NOT CONNECTED The channel on which you are trying to perform a loop has no time slots assigned to it.
ERROR 22	CAN'T PERFORM LOOP - PORT NOT CONNECTED You are trying to activate a loopback on an E1 sublink which is not connected (no E1 time slots are mapped to HDSL frame).
ERROR 23	CAN'T DISCONNECT - LOOP IS ACTIVE You are trying to disconnect a channel while a loop on this channel is currently active.
ERROR 24	CURRENT LOOP IS ALREADY BEING PERFORMED You are trying to perform a loop which is currently active.
ERROR 25	ILLEGAL COMMAND, LINK IN UNFRAMED MODE You are trying to set time slot priority bumping while the link is in unframed mode.
ERROR 26*	CHANNEL BERT LOOP IS NOT ACTIVE You are trying to activate the DSP BERT CH command, while the channel BERT test is not active.
ERROR 27*	YEAR SHOULD BE IN THE RANGE 1996-2095 You are trying to select an invalid number for the year.
ERROR 28*	ILLEGAL DCD_DEL AND INTERFACE COMBINATION You are trying to select a non-zero DCD DELAY, while the HCD-E1 supervisory port interface has been set as DCE.
ERROR 29*	CONFLICT IN INTERFACE AND DSR PARAMETERS You selected DSR=ON, while the supervisory port interface has been set to DTE. The DSR=ON selection is valid only for DCE interface.

5.6 Power-Up Self-Test

HCD-E1 performs a power-up self-test upon turn-on. The self-test sequence, described in *Section 3-5*, tests the critical circuit functions and the display.

In case of failure, HCD-E1 displays an appropriate message in the second row.

5.7 Troubleshooting

In case a problem occurs, check the displayed alarm messages and refer to *Table 5-1* and the entire *Section 5-2* for their interpretation. If the trouble cannot be corrected by performing the actions listed in *Table 5-1*, use *Table 5-6* to identify the trouble symptoms. Perform the actions listed under "Corrective Measures" in the order given in the table, until the problem is corrected.

Table 5-6 Troubleshooting Chart

No.	Trouble Symptoms	Probable Cause	Corrective Measures
1	HCD-E1 is "dead".	No power	Check that both ends of the power cable are properly connected, and that the POWER switch is ON. If HCD-E1 is powered from DC, check the polarity of the power connections.
		Blown fuse (AC version only)	Disconnect power cable from both ends and replace the fuse with another fuse of proper rating.
		Defective HCD-E1	Replace HCD-E1.
2	One or both HDSL LOS LINE indicators light	External problem	Check that the remote unit and H-RPT (if there is one) are operating. Check for proper connection of the pairs connecting between the local and the remote units. Check the loop resistance of the pairs and make sure the resistance does not exceed the design values. You may also use a transmission measurement set to check that loop attenuation is within the allowed limits.
		Defective HCD-E1	Perform a power-up self-test and replace HCD-E1 if it fails the test.

Table 5-6 Troubleshooting Chart (Cont.)

No.	Trouble Symptoms	Probable Cause	Corrective Measures
3	E1 LOS LOC indicator lights (sublink loses frame synchronization).	External problem	Check the cable connected to the E1 equipment. Perform the physical loop on the sublink while the E1 equipment connected to the sublink of the remote HDSL unit continues to send data towards the local unit. If the E1 LOS LOC indicator turns off, check the equipment connected to the sublink of the local unit.
		Defective HCD-E1	Perform a power-up self-test and replace HCD-E1 if it fails the test.
4	E1 LOS REM indicator lights (the equipment connected to the E1 sublink reports loss of synchronization).	Problem at remote end of the E1 sublink	Perform the LOOP L SL test. If the E1 LOS REM indicator turns off, check the cable connected to the E1 equipment and the equipment itself.
		Defective HCD-E1	Perform power-up self-test and replace HCD-E1 if it fails the test.
5	The DTE connected to the local unit's sublink or data channel does not receive data	Cable problem	Activate the local sublink or local channel loopback. If the DTE does not receive its own transmission, check the cable connecting it to the HCD-E1 sublink or data channel connector.
		Defective DTE	Check the DTE.
		Defective HCD-E1	Perform a power-up self-test and replace HCD-E1 if it fails the test.

Appendix A
SNMP Management

A.1 Scope

This appendix provides the specific information required for the management of HCD-E1 by means of the Simple Network Management Protocol (SNMP).

An HCD-E1 configured as a central unit serves as a proxy agent for the remote unit to which it is connected. Therefore, an SNMP-based network management station connected to a central HCD-E1 unit can perform all the management functions available on the remote unit.

A.2 SNMP Environment

General

The SNMP management functions of HCD-E1 are provided by an internal SNMP agent, which communicates through the HCD-E1 control port using the Serial Link Internet Protocol (SLIP).

The SNMP management communication uses the User Datagram Protocol (UDP). UDP is a connectionless-mode transport protocol, part of the suite of protocols of the Internet Protocol (IP).

Note *Telnet management uses the TCP protocol over IP for management communication. After a Telnet session is started, the management interface is similar to that used for the supervision terminal (see Chapter 3).*

This section covers the information related to the SNMP environment. For a description of the IP environment, refer to *Section A-3*.

SNMP Principles

The SNMP management protocol is an asynchronous command/response polling protocol: all the management traffic, except for trap messages, is initiated by the SNMP-based network management station, which addresses the managed entities in its management domain. Only the addressed managed entity answers the polling of the management station.

The managed entities include a function called an “SNMP agent”, which is responsible for interpretation and handling of the management station requests to the managed entity, and the generation of properly-formatted responses to the management station.

SNMP Operations

The SNMP protocol includes four types of operations:

getRequest Command for retrieving specific management information from the managed entity. The managed entity responds with a **getResponse** message.

getNextRequest Command for retrieving sequentially specific management information from the managed entity. The managed entity responds with a **getResponse** message.

setRequest Command for manipulating specific management information within the managed entity. The managed entity responds with a **setResponse** message.

trap Management message carrying unsolicited information on extraordinary events (that is, events which occurred not in response to a management operation) reported by the managed entity.

The Management Information Base

The management information base (MIB) includes a collection of **managed objects**. A managed object is defined as a parameter that can be managed, such as a performance statistics value.

The MIB includes the definitions of relevant managed objects. Various MIB's can be defined for various management purposes, types of equipment, etc.

An object's definition includes the range of values (also called “instances”) and the “access” rights:

Read-only Object value can be read, but cannot be set.

Read-write Object value can be read or set.

Not accessible Object value can neither be read nor set.

MIB Structure

The MIB has an inverted tree-like structure, with each definition of a managed object forming one leaf, located at the end of a branch of that tree. Each “leaf” in the MIB is reached by a unique path, therefore by numbering the branching points, starting with the top, each leaf can be uniquely defined by a sequence of numbers. The formal description of the managed objects and the MIB structure is provided in a special standardized format, called Abstract Syntax Notation 1 (ASN.1).

Since the general collection of MIB's can also be organized in a similar structure, under the supervision of the Internet Activities Board (IAB), any parameter included in a MIB that is recognized by the IAB is uniquely defined.

To provide the flexibility necessary in a global structure, MIB's are classified in various classes (branches), one of them being the experimental branch, and another the group of private (enterprise-specific) branches. Under the

private enterprise-specific branch of MIB's, each enterprise (manufacturer) can be assigned a number, which is its enterprise number. The assigned number designates the top of an enterprise-specific sub-tree of non-standard MIB's. Within this context, RAD has been assigned the enterprise number **164**. Therefore, enterprise MIB's published by RAD can be found under **1.3.6.1.4.1.164**.

MIB's of general interest are published by the IAB in the form of a Request for Comment (RFC) document. In addition, MIB's are also often assigned informal names that reflect their primary purpose. Enterprise-specific MIB's are published and distributed by their originator, which is responsible for their contents.

MIB's Supported by the HCD-E1 SNMP Agent

The interpretation of the relevant MIB's is a function of the SNMP agent of each managed entity. The general MIB's supported by the HCD-E1 SNMP agent are as follows:

- RFC 1158 (standard MIB-II).
- RFC 1406 (standard E1/T1 MIB).

In addition, the HCD-E1 SNMP agent supports the RAD-private (enterprise-specific) MIB identified as (read the following as a continuous string):

```
iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).
rad(164).radGen(6).systems(1).radSysWAN(3).radHcdE1Sa(51).
```

Enterprise-specific MIB's supported by RAD equipment, including those for the HCD-E1, are available in ASN.1 format from the RAD Technical Support Department.

Management Domains Under SNMP

SNMP enables, in principle, each management station that knows the MIB's supported by a device to perform all the management operations available on that device. However, this is not desirable in practical situations, so it is necessary to provide a means to delimit management domains.

SNMP Communities

To enable the delimitation of management domains, SNMP uses “communities”. Each community is identified by a name, which is an alphanumeric string of up to 32 characters defined by the user.

Any SNMP entity (this term includes both managed entities and management stations) is assigned by its user a community name.

Access Restriction Using SNMP Communities

In general, SNMP agents support two types of access rights:

- **Read-only**: the SNMP agent accepts and processes SNMP **getRequest** and **getNextRequest** commands only from management stations which have the same read-only community name.
- **Read-write**: the SNMP agent accepts and processes all the SNMP commands received from a management station with the same read-write community name.

For each SNMP entity, it is possible to define a list of the communities which are authorized to communicate with it, and the access rights associated with each community (this is the SNMP community names table of the entity). For example, the SNMP community names table of the HCD-E1 can include three community names.

In accordance with the SNMP protocol, the SNMP community of the originating entity is sent in each message.

When an SNMP message is received by the addressed entity, first it checks the originator's community: if the community name of the message originator differs from the community name specified for that type of message in the agent, the message it discarded (SNMP agents of managed entities report this event by means of an authentication failure trap).

HCD-E1 Communities

The SNMP agent of the HCD-E1 can use the following community types:

Read — SNMP community that has read-only authorization, i.e., the SNMP agent will accept **getRequest** and **getNextRequest** commands only from management stations using that community.

The default read-only community for RAD network management stations is **public**.

Write — SNMP community that has read-write authorization, i.e., the SNMP agent will also accept **setRequest** commands from management stations using that community.

The default read-write community for RAD network management stations is **private**.

Trap — SNMP community which the SNMP agent will send within trap messages.

The default trap community for RAD network management stations is **public**.

A.3 IP Environment

General

The SNMP agent of HCD-E1 can communicate either out-of-band or in-band:

- Out-of-band communication is performed via the CONTROL DCE port. The communication uses the Serial Link Internet Protocol (SLIP).
- In-band communication is performed via a dedicated time slot (DTS) on one of the links (main or sub-) or both of them and uses a proprietary protocol. The user can select the way of how in-band management traffic is carried on the sublink: by the S_{a4} bit of TS0 (supports a data rate of 4 kbps), or by a dedicated time slot (supports a data rate of 8 kbps). The data rate supported by a dedicated time slot on the main link is 64 kbps.

Notes

1. The number of time slots defined as dedicated must be the same on the main link and the sublink.

2. The data rate of in-band communication via both links depends on the data rate through the sublink: 4 or 8 kbps.

3. A time slot of the main link used for in-band management cannot be used to carry user's data.

The user can separately enable the use of out-of-band communication, and of in-band communication on each link (main and/or sub).

General

The SNMP agent of the HCD-E1 can communicate out-of-band using the Serial Link Internet Protocol (SLIP).

IP Environment

The SNMP agent of the HCD-E1 uses either the UDP or the TCP transport protocol, part of the suite of IP protocols.

IP Address Structure

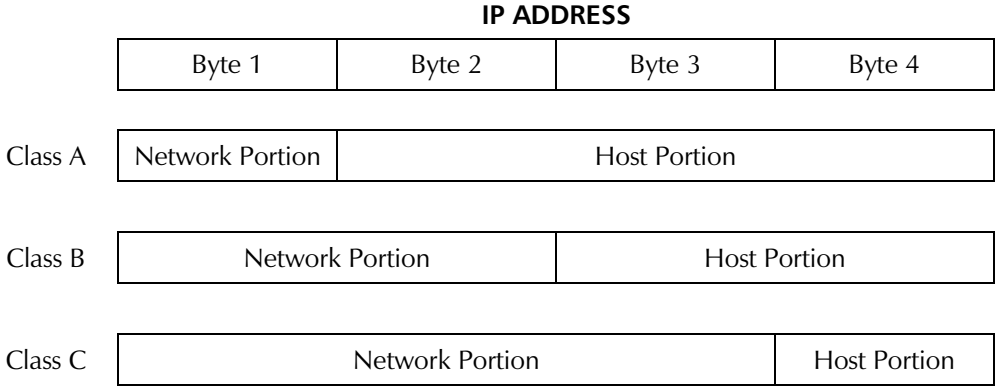
Under the IP protocol, each IP network element (SNMP agents, network management stations, etc.) is called an IP host and must be assigned an IP address. An IP address is a 32-bit number, usually represented as four 8-bit bytes. Each byte represents a decimal number in the range of 0 through 255.

The address is given in decimal format, with the bytes separated by decimal points, e.g., 164.90.70.47. This format is called ***dotted quad notation***.

An IP address is logically divided into two main portions:

Network Portion. The network portion is assigned by the Internet Assigned Numbers Authority (IANA). There are five IP address classes: A, B, C, D, and E. However, only the classes A, B and C are used for IP addressing. Consult your network manager with respect to the class of IP addresses used on your network.

The network portion of an IP address can be one, two or three bytes long, in accordance with the IP address class. This arrangement is illustrated below:



The class of each IP address can be determined from its leftmost byte, in accordance with the following chart:

Address Class	First Byte	Address Range
Class A	0 to 127	0.H.H.H to 127.H.H.H
Class B	128 to 191	128.N.H.H to 191.N.H.H
Class C	192 to 223	192.N.N.H to 223.N.N.H

N - indicates bytes that are part of the network portion

H - indicates bytes that are part of the host portion

Host Portion. The host portion is used to identify an individual host connected to the network. The host identifier is assigned by the using organization, in accordance with its specific needs.

Note *The all-zero host identifier is always interpreted as a network identifier, and must not be assigned to an actual host*.

Often, the host portion is further subdivided into two portions:

- **Subnet number** - For example, subnet numbers can be used to identify departmental subnetworks. The subnet number follows the network identifier.
- **Host number** - the last bits of the IP address.

Automatic Routing of IP Traffic

The SNMP agent of the HCD-E1 units includes a proprietary IP router function, that is used to route management messages automatically.

The proprietary IP router operates both on the in-band, as well as on the out-of-band traffic, depending on the communication methods that have been enabled.

The router of each SNMP agent collects information on the other SNMP agents whose messages pass through by monitoring the IP source and destination addresses of the IP messages, and combining this information with the information on the direction to the management station. This automatic learning capability enables using any network topology, including topologies with closed loops.

A.4 SNMP Traps

The SNMP agent of HCD-E1 supports the standard MIB-II traps. In addition, HCD-E1 reports alarm conditions to the management station by mean of specific traps:

When an alarm condition occurs, HCD-E1 sends a **modmSaAlarmTrap** which carries all the alarms active at the time the trap is sent.

Whenever LEDs on its front panel change state, HCD-E1 sends a **modmSaLedTrap** which reports the state of the LEDs on both the local (central) and remote HCD-E1 units.

Appendix B
Connector Wiring

B.1 E1 Sublink Connectors

The E1 sublink unbalanced interface is terminated in two BNC connectors, designated TX/IN and RX/OUT.

The E1 sublink balanced interface is terminated in an eight-pin RJ-45 connector, designated DTE, and wired in accordance with *Table B-1*.

Table B-1 DTE Connector, Pin Allocation

Pin	Function
1	Transmit Data Output (tip)
2	Transmit Data Output (ring)
3	Frame Ground
4	Receive Data Input (tip)
5	Receive Data Input (ring)
6	Frame Ground
7, 8	Not Connected

B.2 HDSL Lines Connector

The HDSL lines are terminated in an eight-pin RJ-45 connector, designated NETWORK HDSL, and wired in accordance with *Table B-2*.

Table B-2 NETWORK HDSL Connector, Pin Allocation

Pin	Function
1	Line A
2	Line A
3	Not Connected
4	Line B
5	Line B
6, 7, 8	Not Connected

B.3 DCE Interface Connectors and Adapter Cables

HCD-E1 has two data ports, each terminated in a 25-pin D-type female connector. The units with an Ethernet interface arrive with the Ethernet interface module built in the upper port. For the description of the Ethernet interface, see *Appendix C*.

This section describes the wiring of HCD-E1 connectors and adaptor cables for different versions and operating modes of the unit. Names of ready-made cables available from RAD are listed in *Table 2-1* in Chapter 2.

RS-530 Interface

When HCD-E1 is ordered with an RS-530 interface, the physical interface is a 25-pin female connector wired in accordance with *Table B-3*. This interface is ready for working in the DCE timing mode. To have HCD-E1 working in a DTE1 or DTE2 mode, you must prepare a cross-cable in accordance with the two last columns of the table.

Table B-3 RS-530 DCE Connector

Pin	Desig-nation	Direction	Function	DTE1	DTE2
1	FG	↔	Frame Ground	1	1
2	SDA	To HCD-E1	Send Data - wire A	3	3
3	RDA	From HCD-E1	Receive Data - wire A	2	2
4	RTSA	To HCD-E1	Request to Send (RTS) - wire A	8	8
5	CTSA	From HCD-E1	Clear to Send (CTS) - wire A	-	-
6	DSRA	From HCD-E1	Data Set Ready (DSR) - wire A	20	20
7	SG	↔	Signal Ground	7	7
8	DCDA	From HCD-E1	Carrier Detect (DCD) - wire A	4	4
9	RCB	From HCD-E1	Receive Clock - wire B	11	-
10	DCDB	From HCD-E1	Carrier Detect (DCD) - wire B	19	19
11	SCEB	To HCD-E1	Send External Clock - wire B	9	9
12	SCB	From HCD-E1	Send Clock - wire B	-	-
13	CTSB	From HCD-E1	Clear to Send (CTS) - wire B	-	-
14	SDB	To HCD-E1	Send Data - wire B	16	16
15	SCA	From HCD-E1	Send Clock - wire A	-	-
16	RDB	From HCD-E1	Receive Data - wire B	14	14
17	RCA	From HCD-E1	Receive Clock - wire A	24	-
18	LL	To HCD-E1	Local Loopback (V.54 Loop 3)	-	-
19	RTSB	To HCD-E1	Request to Send (RTS) - wire B	10	10
20	DTRA/RCEA	To HCD-E1	Data Terminal Ready(DTR) - wire A/Receive External Clock - wire A	-	15
21	RL	To HCD-E1	Remote Loopback (V.54 Loop 2)	-	-
22	DSRB	From HCD-E1	Data Set Ready (DSR) - wire B	23	23
23	DTRB/RCEB	To HCD-E1	Data Terminal Ready (DTR) - wire B/Receive External Clock - wire B	-	12
24	SCEA	To HCD-E1	Send External Clock - wire A	17	17
25	TM	From HCD-E1	Test Indicator	-	-

V.36/RS-449/422 Interface

When you order an HCD-E1 with the V.36/RS-449/422 interface, it arrives with a RAD adaptor cable CBL-HS2R1 enabling it to work in the DCE mode. Cables CBL-HS2R2 and CBL-HS2R3, enabling HCD-E1 to work in the DTE1 and DTE2 modes, respectively, must be ordered separately. *Table B-4* lists the pinout of the V.36/RS-449/422 adaptor cables for all the three timing modes: DCE, DTE1 and DTE2.

Table B-4 V.36/RS-449/422 Adaptor Cables

Pin	Desig-nation	Direction	Function	DCE	DTE1	DTE2
1	FG	↔	Frame Ground	1	1	1
2	SDA	To HCD-E1	Send Data - wire A	4	6	6
3	RDA	From HCD-E1	Receive Data - wire A	6	4	4
4	RTSA	To HCD-E1	Request to Send (RTS) - wire A	7	13	13
5	CTSA	From HCD-E1	Clear to Send (CTS) - wire A	9	-	-
6	DSRA	From HCD-E1	Data Set Ready (DSR) - wire A	11	12	12
7	SG	↔	Signal Ground	19	19	19
8	DCDA	From HCD-E1	Carrier Detect (DCD) - wire A	13	7	7
9	RCB	From HCD-E1	Receive Clock - wire B	26	35	–
10	DCDB	From HCD-E1	Carrier Detect (DCD) - wire B	31	25	25
11	SCEB	To HCD-E1	Send External Clock - wire B	35	26	26
12	SCB	From HCD-E1	Send Clock - wire B	23	-	-
13	CTSB	From HCD-E1	Clear to Send (CTS) - wire B	27	-	-
14	SDB	To HCD-E1	Send Data - wire B	22	24	24
15	SCA	From HCD-E1	Send Clock - wire A	5	-	-
16	RDB	From HCD-E1	Receive Data - wire B	24	22	22
17	RCA	From HCD-E1	Receive Clock - wire A	8	17	–
18	–	N/A	Not Connected	–	–	–
19	RTSB	To HCD-E1	Request to Send (RTS) - wire B	25	31	31
20	RCEA	To HCD-E1	Receive External Clock - wire A	–	–	5
21	–	N/A	Not Connected	–	–	–
22	DSRB	From HCD-E1	Data Set Ready (DSR) - wire B	29	30	30
23	RCEB	To HCD-E1	Receive External Clock - wire B	–	–	23
24	SCEA	To HCD-E1	Send External Clock - wire A	17	8	8
25	–	N/A	Not Connected	–	–	–

V.35 Interface

When you order an HCD-E1 with the V.35 interface, it arrives with a RAD adaptor cable CBL-HS2V1 enabling it to work in the DCE mode. Cables CBL-HS2V2 and CBL-HS2V3, enabling HCD-E1 to work in the DTE1 and DTE2 modes, respectively, must be ordered separately. *Table B-5* lists the pinout of the V.35 adaptor cables for all the three timing modes: DCE, DTE1 and DTE2.

Table B-5 V.35 Adapter Cables

Pin	Desig-nation	Direction	Function	DCE	DTE1	DTE2
1	FG	↔	Frame Ground	A	A	A
2	SDA	To HCD-E1	Send Data - wire A	P	R	R
3	RDA	From HCD-E1	Receive Data - wire A	R	P	P
4	RTSA	To HCD-E1	Request to Send (RTS) - wire A	C	F	F
5	CTSA	From HCD-E1	Clear to Send (CTS) - wire A	D	–	–
6	DSRA	From HCD-E1	Data Set Ready (DSR) - wire A	E	H	H
7	SG	↔	Signal Ground	B	B	B
8	DCDA	From HCD-E1	Carrier Detect (DCD) - wire A	F	C	C
9	RCB	From HCD-E1	Receive Clock - wire B	X	W	–
10	DCDB	From HCD-E1	Carrier Detect (DCD) - wire B	–	–	–
11	SCEB	To HCD-E1	Send External Clock - wire B	W	X	X
12	SCB	From HCD-E1	Send Clock - wire B	AA	–	–
13	CTSB	From HCD-E1	Clear to Send (CTS) - wire B	–	–	–
14	SDB	To HCD-E1	Send Data - wire B	S	T	T
15	SCA	From HCD-E1	Send Clock - wire A	Y	–	–
16	RDB	From HCD-E1	Receive Data - wire B	T	S	S
17	RCA	From HCD-E1	Receive Clock - wire A	V	U	–
18	–	N/A	Not Connected	–	–	–
19	RTSB	To HCD-E1	Request to Send (RTS) - wire B	–	–	–
20	RCEA	To HCD-E1	Receive External Clock - wire A	–	–	Y
21	–	N/A	Not Connected	–	–	–
22	DSRB	From HCD-E1	Data Set Ready (DSR) - wire B	–	–	–
23	RCEB	To HCD-E1	Receive External Clock - wire B	–	–	AA
24	SCEA	To HCD-E1	Send External Clock - wire A	U	V	V
25	–	N/A	Not Connected	–	–	–

X.21 Interface

When you order an X.21 interface, it arrives with the DCE timing mode cable CBL-HS2X1. *Table B-6* lists its pinout.

Table B-6 X.21 Adaptor Cable

Pin	Direction	Designation	Function	DCE
1	↔	FG	Frame Ground	1
2	Input	SDA	Send Data (wire A)	2
3	Output	RDA	Receive Data (wire A)	4
4	Input	RTSA	RTS (wire A)	3
5	Output	CTSA	CTS (wire A)	–
6	Output	DSRA	DSR (wire A)	–
7	↔	SG	Signal Ground	8
8	Output	DCDA	DCD (wire A)	5
9	Output	RCB	Receive Clock (wire B)	–
10	Output	DCDB	DCD (wire B)	12
11	Input	SCEB	External Send Clock (wire B)	–
12	Output	SCB	Send Clock (wire B)	13
13	Output	CTSB	CTS (wire B)	–
14	Input	SDB	Send Data (wire B)	9
15	Output	SCA	Send Clock (wire A)	6
16	Output	RDB	Receive Data (wire B)	11
17	Output	RCA	Receive Clock (wire A)	–
18	N/A	–	Not connected	–
19	Input	RTSB	RTS (wire B)	10
20	Input	RCEA	External Receive Clock (wire A)	–
21	N/A	–	Not connected	–
22	Output	DSRB	DSR (wire B)	–
23	Input	RCEB	External Receive Clock (wire B)	–
24	Input	SCEA	External Send Clock (wire A)	–
25	N/A	–	Not connected	–

B.4 Control Port Connector

The HCD-E1 control port has a standard RS-232 (V.24) interface. The physical interface is a 9-pin female connector, designated CONTROL DCE and wired in accordance with *Table B-7*.

Table B-7 also describes the connection to the RS-232 interface of a control terminal, and the connection to a dial-out modem. The terminal and the modem are assumed to have D-type 25-pin connectors.

Table B-7 Control Port Interface Signals

Pin of the HCD-E1 Connector	Line	Note	Pin of Control Terminal Connector	Pin of Dial-Out Modem Connector
1	Data Carrier Detect (DCD)	From HCD-E1	8	4
2	Receive Data (RD)	From HCD-E1	3	2
3	Transmit Data (TD)	To HCD-E1	2	3
4	Data Terminal Ready (DTR)	To HCD-E1	20	6
5	Signal Ground (SIG)	Common reference and DC power supply ground	7	7
6	Data Set Ready (DSR)	From HCD-E1	6	20
7	Request to Send (RTS)	To HCD-E1	4	8
8	Clear to Send (CTS)	From HCD-E1	5	-

Appendix C
IR-ETH Interface Module

C.1 General Description

IR-ETH is an interface module for RAD modems, used for converting the Ethernet (10BaseT or 10Base2) electrical levels to the modem TTL levels. It also converts the Ethernet protocol to HDLC to enable long-distance transmission and avoid the Ethernet collision limitation.

IR-ETH includes an internal, self-learning Ethernet bridge, which enables a high performance link between two Ethernet segments at a low transmission rate. The low-speed HDLC transmission is sent over the link using the modem modulation technique, and then converted back to an Ethernet signal at the remote modem.

Figure C-1 shows a typical application using an Ethernet interface bridge. Each modem is connected to an Ethernet network via the Ethernet Interface bridge.

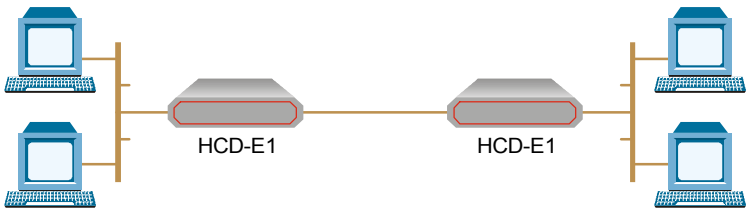


Figure C-1 Typical Application of HCD-E1 with IR-ETH Module

C.2 IR-ETH Connector Options

Figure C-2 and *Figure C-3* show the rear panel of HCD-E1 with the IR-ETH connector options.

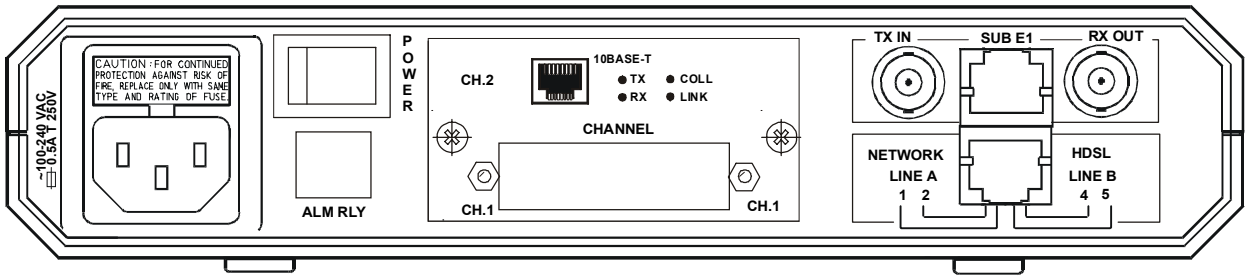


Figure C-2 HCD-E1 Rear Panel for the 10BaseT Option

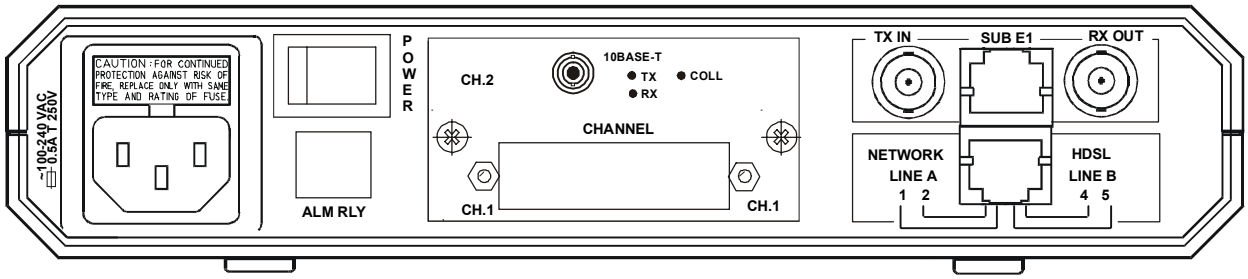


Figure C-3 HCD-E1 Rear Panel for the 10Base2 Option

To connect the external equipment to the Ethernet interface, use standard Ethernet cables with RJ-45 or BNC connector, respectively.

C.3 Technical Specifications

General	*LAN Table*	10,000 addresses
	Filtering and Forwarding	15,000 pps
	Buffer	256 frames
	Delay	1 frame
LAN	*Standard*	Conforms to IEEE 802.3/Ethernet
	Data Rate	10 Mbps (20 Mbps 10BaseT FDX)
	Connectors	10BaseT (UTP): Shielded RJ-45 10Base2: BNC connector
WAN	*Protocol (internal)*	HDLC
	Data Rate	According to the modem transmission rate

C.4 Installation and Operation

Figure C-4 and *Figure C-5* show the Ethernet bridge rear panel components for the 10BaseT and the 10Base2 versions, respectively. *Figure C-6* shows the location of the LED and the DIP switch.

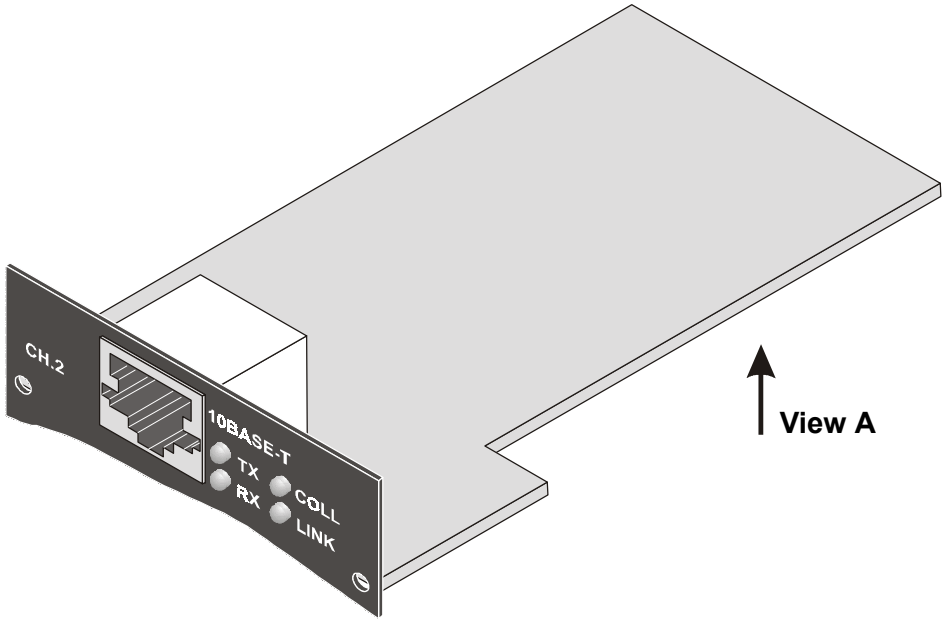


Figure C-4 IR-ETH Module Layout (10BaseT Option)

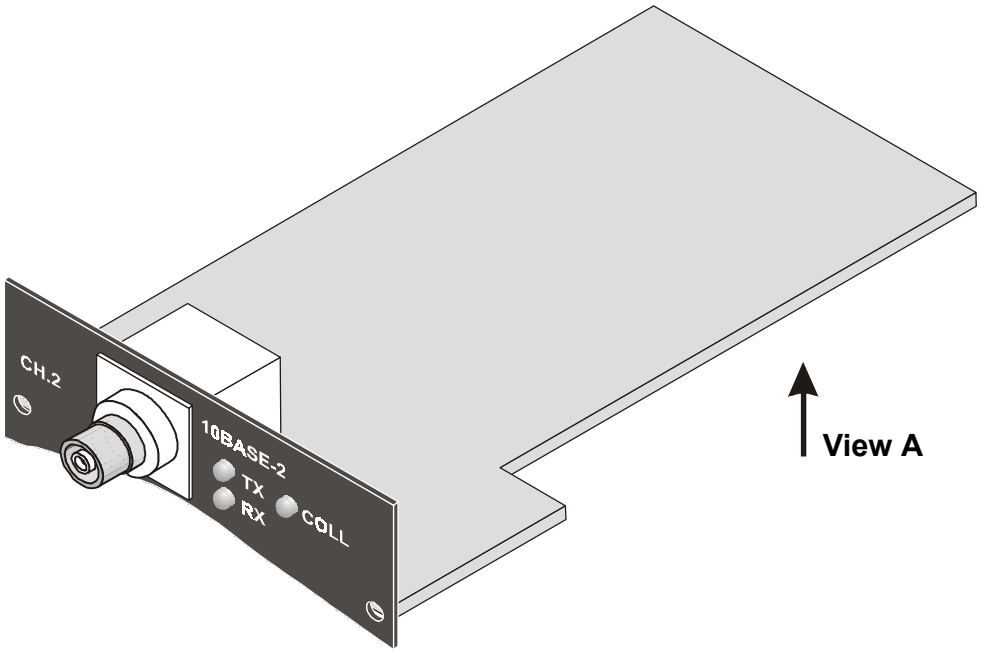


Figure C-5 IR-ETH Module Layout (10Base2 Option)

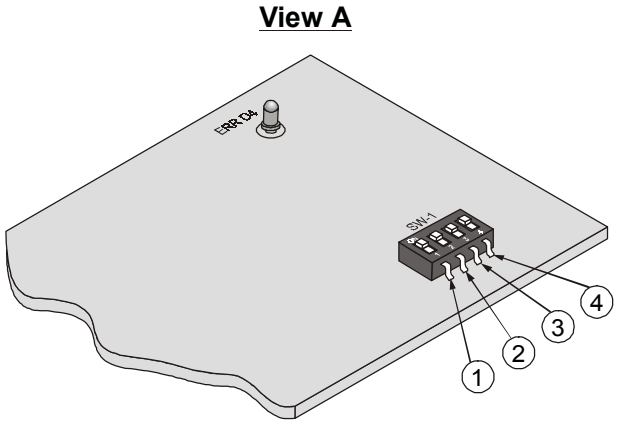


Figure C-6 IR-ETH Module (View A)

LAN Installation

The Ethernet with UTP (10BaseT) connectors is designated as a Station. For 10BaseT installation, either a straight cable or a cross-cable may be required. Use a cross-cable when connecting to a port that does not implement the crossover function internally. Otherwise, use a straight cable. (Hubs usually do implement the crossover function internally while network interface cards and other devices do not).

Table C-1 lists pinout of the IR-Ethernet RJ-45 connector.

Table C-1 RJ-45 Pinout

Pin	Name	Function
1	TD (+)	Transmit data positive
2	TD (-)	Transmit data negative
3	RD (+)	Receive data positive
6	RD (-)	Receive data negative

Switch Settings

Table C-2 describes functions and default settings of the DIP switch SW-1 sections. Function of section 1 is software-controlled, either from the supervision terminal (DEF CH command), or from the front panel (CHANNEL PRM). Its hardware switch is permanently set to OFF and is not allowed for manual setting. Sections 2 and 3 are set in accordance with *Table C-2*.

The DIP switch is on the reverse side of the Ethernet bridge. To change the switch settings, you must undo three screws on the board and detach it from the main unit.

Table C-2 DIP Switch Settings

Section Number	Name	Description	Default Setting
1	SQ/FD	Controls Ethernet mode: full-duplex or half-duplex.	Permanently OFF
2	CMP	ON: Strips padding bits inserted in 64-byte frame OFF: Transmits frames over WAN as is	OFF
3	FIL	ON: Passes only frames destined for another LAN OFF: Disables LAN filter; passes all frames transparently	OFF
4	(nc)		

Note *Set the DIP switch, section 3 to ON if you want to filter the traffic sent to the remote end (recommended).*

If you want to disable the LAN filter, remove resistor R 45 from the Ethernet bridge and set section 3 to OFF.

To control Ethernet mode (full-duplex or half-duplex), use DEF CH command on the terminal or CHANNEL PRM menu on the LCD.

LED Indicators

Table C-3 lists the IR-ETH LED indicators and describes their functions.

Table C-3 IR-ETH Bridge LED Indicators

LED Name	Description	Location	Color
LINK	ON indicates good link integrity (available only in the 10BaseT version)	Rear panel	Green
COLL	ON indicates collision on the attached Ethernet segment	Rear panel	Yellow
RX	ON when data is received from the Ethernet attached segment	Front and rear panels	Yellow
TX	ON when data is transmitted from the modem to the Ethernet segment	Front and rear panels	Yellow
ERR D4	Bridge buffer overrun	On the IR-ETH board	Red

Appendix D
IR-ETH/Q Interface Module

D.1 General

IR-ETH/Q is an interface module for RAD modems, used for converting the Ethernet 10BaseT electrical levels to the modem TTL levels. It converts the Ethernet protocol to HDLC to enable long distance transmission and avoid the Ethernet collision limitation. The IR-ETH/Q module also supports IEEE 802.1/Q frames.

IR-ETH/Q includes an internal, self-learning Ethernet bridge, which enables a high performance link between two Ethernet segments at a low transmission rate. The module also supports VLAN applications. The low-speed HDLC transmission is sent over the link using the modem modulation technique. It is converted back to an Ethernet signal at the remote modem.

Figure D-1 shows a typical application of HCD-E1 with the IR-ETH/Q module. Each modem is connected to an Ethernet network via the Ethernet bridge.

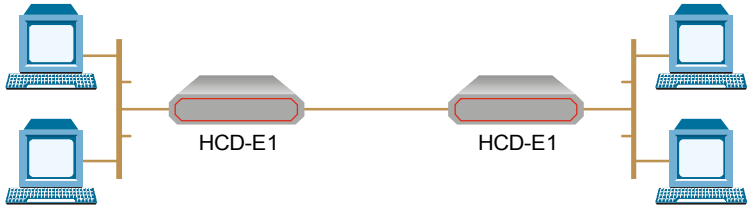


Figure D-1 Typical Application of HCD-E1 with IR-ETH/Q Module

D.2 IR-ETH/Q Connector

Figure D-2 shows the rear panel of HCD-E1, equipped with IR-ETH/Q module. *Table D-1* lists the module RJ-45 connector pinout.

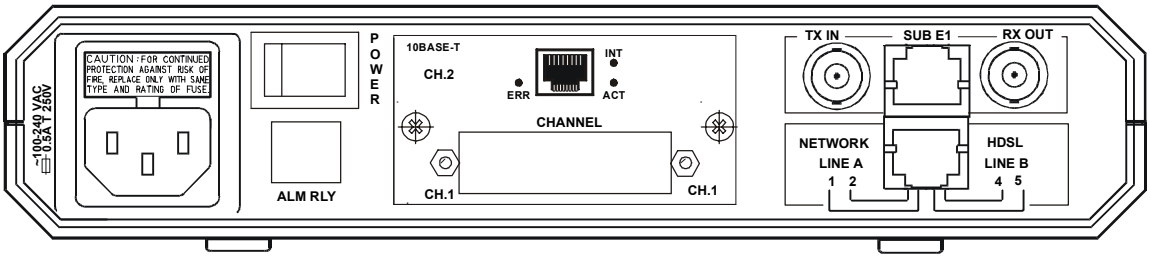


Figure D-2 Rear Panel of HCD-E1 with IR-ETH/Q Module

Table D-1 IR-ETH/Q Connector Pinout

Pin	Signal
3	RCV (+)
6	RCV (-)
1	XMT (+)
2	XMT (-)
–	GND

D.3 Technical Specifications

General	*LAN Table*	5,000 addresses
	Buffer	200 kbytes
LAN	*Standard*	Conforms to IEEE 802.3/Ethernet and supports IEEE 802.1/Q frames
	Data Rate	10 Mbps (20 Mbps 10BaseT FDX)
	Connectors	10BaseT (UTP): Shielded RJ-45
WAN	*Protocol*	HDLC
	Data Rate	According to the modem transmission rate

D.4 Installation and Operation

Figure D-3 shows the IR-ETH/Q rear panel. *Figure D-4* shows the DIP switch, which is located on the reverse side of the board.

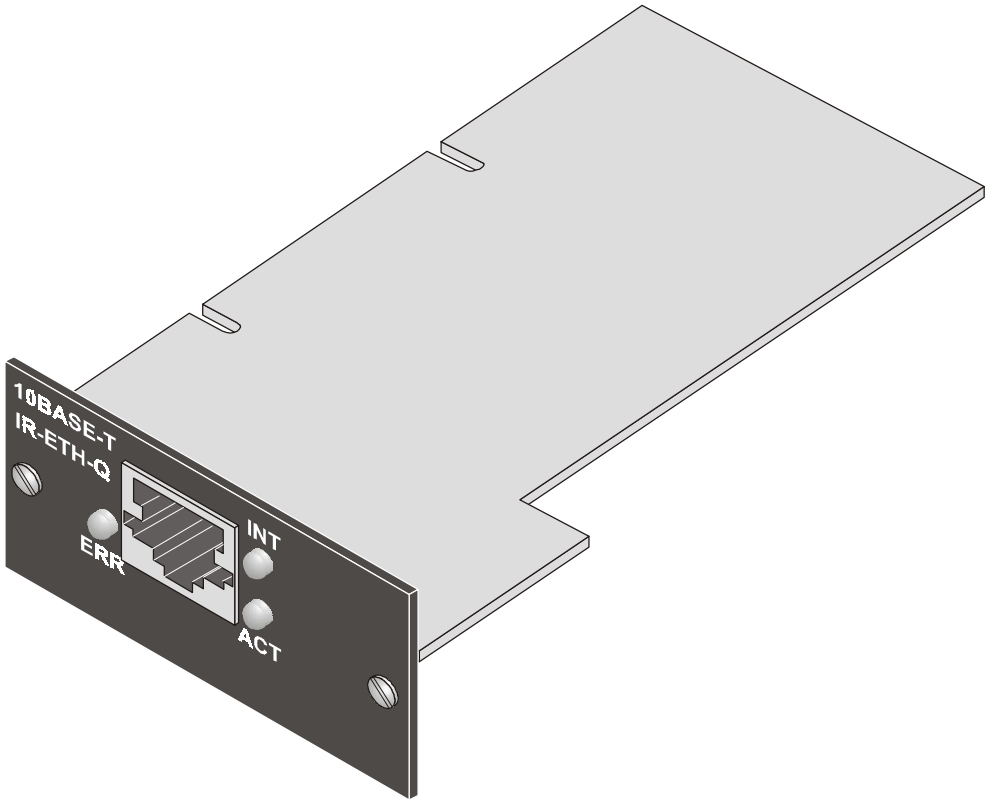


Figure D-3 IR-ETH/Q Module Layout

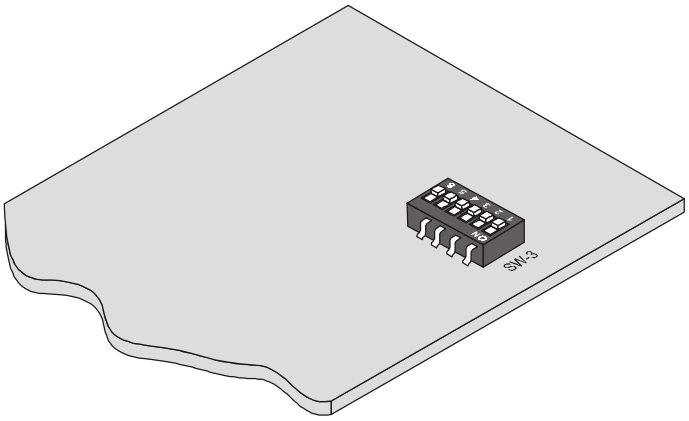


Figure D-4 DIP Switch Location

Setting the DIP Switch

Configure the IR-ETH/Q module by setting the DIP switch in accordance with *Table D-2*. The DIP switch is located on the reverse side of the IR-ETH/Q module. To change the switch settings, you must undo three screws on the board and detach it from the main unit.

Table D-2 DIP Switch Settings

Switch Number	Name	Description		Default Setting
5	FD/HD	ON: OFF:	Full-duplex mode Half-duplex mode	 OFF
***Note**: IR-ETH/Q does not support auto detection. Therefore, the equipment connected to IR-ETH/Q should **not** be set to auto detection mode and the half/full duplex setting should be set manually.*				
6	TRANS/FIL	OFF: ON:	Passes only frames destined for another LAN Disables LAN filter; passes all frames transparently	OFF

Note *For proper operation switch 4 must always be set to OFF (factory setting).*

LED Indicators

Table D-3 lists the IR-ETH/Q rear-panel LED indicators and describes their functions.

Table D-3 DIP Switch Settings

LED Name	Description	Color
INT	ON indicates good link integrity	Green
ERR	ON indicates LAN/WAN buffer overflow	Red
ACT	ON when data is received from the Ethernet attached segment or when data is transmitted from the modem to the Ethernet segment	Yellow
***Note**: In filtered mode, IR-ETH/Q passes frames destined only for another LAN*		

Connecting the LAN

Use either a straight cable or a cross-cable for the LAN connection. Use a cross-cable when connecting to a port that does not implement the crossover function internally. Otherwise, use a straight cable.

Note *Hubs usually implement the crossover function internally while NICs and other devices do not.*

Appendix E
IR-IP Interface Module

E.1 Introduction

Introduction

IR-IP is a high-performance, miniature IP router based on RAD's unique IP router chip, the ChipRouter.

IR-IP works by taking each Ethernet frame from the LAN and determining whether the IP packet is destined for the IP net on the Ethernet LAN. If not, IR-IP forwards the packet to the WAN link. IP packets received from the WAN link are automatically forwarded to the LAN if the IP net matches.

IR-IP includes hardware filters which handle all filtering operations at wire speed from both LAN-to-WAN and WAN-to-LAN, without dropping a single packet. Filtering and forwarding are performed at the maximum rate of 35,000 and 30,000 frames per second (wire speed), respectively. The buffer can hold 256 frames of maximum size of 1534 bytes and a throughput latency of one frame.

IR-IP is available with 10BaseT (UTP) interface and is fully IEEE 802.3/Ethernet v2 compliant. The IR-IP interface can also operate in full duplex Ethernet applications.

HCD-E1 equipped with IR-IP interface module can be used as a Frame Relay Access Device (FRAD) with an integral IP router. RFC 1490 is supported for a single DLCI on the WAN link. Detection of the DLCI and the maintenance protocol is performed automatically. This allows the IR-IP to be used as the termination unit of IP services over Frame Relay at the customer premises, opposite a Frame Relay switch in the backbone.

Alternatively, Point-to-Point Protocol (PPP) can be run on the WAN link with automatic negotiation on power-up, as well as support for PAP and CHAP authentication. With this feature, IR-IP can operate opposite any PPP compliant access server or backbone router.

IR-IP supports HDLC, which is especially important for broadcast and multicast applications where bandwidth overhead is critical.

IR-IP supports IP multicast at wire speed, making it suitable for any multicast environment including high speed downstream environments, such as satellite and xDSL. Users on the LAN who register with IR-IP for an IP multicast group using the IGMP protocol filter IP multicast packets at wire speed.

Management and advanced configuration are performed via Telnet.

Application

Figure E-1 shows a typical application of HCD-E1 with the IR-IP module.

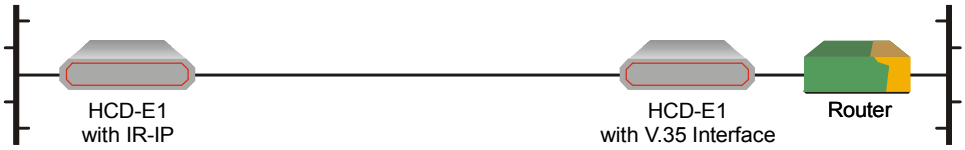


Figure E-1 Typical Application of HCD-E1 with IR-IP Module

E.2 Technical Specifications

Router	*LAN IP Net*	Up to 256 hosts on LAN IP net
	Filtering and Forwarding	30 kbps / 35 kbps
	Buffer	256 frames (maximum size – 1534 bytes)
	Delay	1 frame
LAN	*Standard*	Conforms to IEEE 802.3/Ethernet v2
	Data Rate	10 Mbps (20 Mbps 10BaseT in full duplex topology)
	Connector	10BaseT (UTP): Shielded RJ-45
WAN	*Protocols*	• PPP (PAP/CHAP) • Frame Relay (RFC 1490) • HDLC

E.3 Physical Descriptionr

Figure E-2 shows the rear panel of HCD-E1, equipped with IR-IP module.

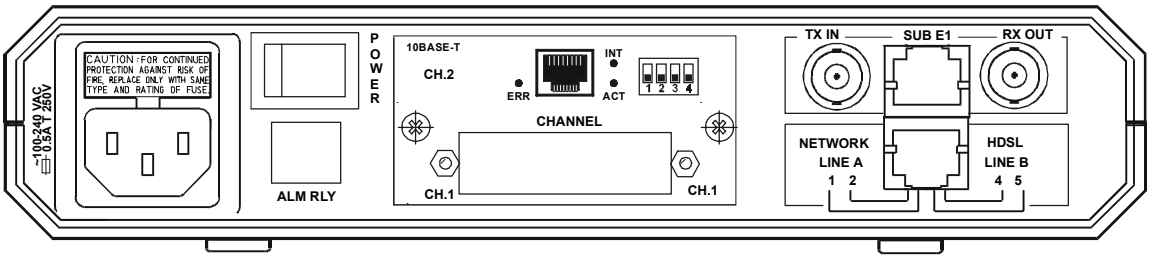


Figure E-2 Rear Panel of HCD-E1 with IR-IP Module

IR-IP LEDs

IR-IP contains three LEDs, which indicate the module activity. *Table E-1* lists the LEDs functions.

Table E-1 IR-IP LEDs Functions

Name	Type	Function
INT	Green LED	ON when IR-IP is powered up.
ACT	Yellow LED	Blinks when there is transmit/receive activity on the Ethernet link.
ERR	Red LED	During regular operation, turns on when a buffer overflow occurs. During power-up, provides additional indications, described below.

IR-IP DIP Switch

IR-IP interface module contains a four-section DIP switch, as seen in *Figure E-3*. *Table E-2* lists the DIP switch functions.

Figure E-3 IR-IP DIP Switch

Table E-2 IR-IP DIP Switch Functions

No	Function	Values
1	Enables IR-IP to learn its IP	**ON** – IP address learning is enabled **OFF** – IP address learning is disabled **Default – OFF**
2	Selects the WAN protocol	**ON** – PPP protocol **OFF** – Frame Relay protocol **Default – OFF**
3	Selects the LAN mode	**ON** – Full duplex operation **OFF** – Half duplex operation **Default – OFF**
4	Controls the remote WAN test loopback, which returns packets received from the WAN back toward the WAN	**ON** – The test loop is activated **OFF** – The test loop is disabled **Default – OFF**

Table E-3 lists the module RJ-45 connector pinout.

Table E-3 IR-IP Connector Pinout

Pin	Name	Function
1	TD (+)	Transmit data positive
2	TD (-)	Transmit data negative
3	RD (+)	Receive data positive
6	RD (-)	Receive data negative

E.4 IR-IP Management Subsystem, General

Introduction

The IR-IP interface module management subsystem supports the following functions:

- Preliminary configuration
- Configuration of management access parameters
- Advanced configuration of IR-IP parameters
- Collection and display of statistical performance data
- Maintenance functions, which include:
  - Software downloading
  - Resetting of various subsystems
  - Display of error log
  - Ping utility, for checking IP connectivity.

The management subsystem of the IR-IP interface module is a separate, independent entity, and therefore it cannot be managed through the HCD-E1 management subsystem.

The communication with the IR-IP management subsystem is made through the local LAN interface connector of the IR-IP module, designated 10BASE-T, using the Telnet protocol. Passwords can be used to prevent unauthorized access.

Accessing the IR-IP Management Subsystem

The IR-IP interface module must be configured in accordance with the specific requirements of the user's application before it can be used in the user's network. As a result, it is not possible to supply default parameters to enable IR-IP to start service without any preliminary configuration.

Therefore, to enable the user to establish Telnet communication and configure IR-IP, IR-IP is delivered with a factory-default set of parameters. The factory-default parameters are automatically used:

- Before the IP router is configured by the user, e.g., when a new HCD-E1 with IR-IP interface module is put into operation
- After the user's configuration parameters have been erased.

When the factory-default parameters are used, the ERR indicator located on the HCD-E1 rear panel, near the IR-IP Ethernet interface connector flashes rapidly (about three times per second). The flashing of the ERR indicator also serves as a warning to the user that the IR-IP WAN interface does not send, nor does it receive packets, and therefore IR-IP can be accessed only from the LAN.

After configuring IR-IP, it starts normal operation and routes the traffic in accordance with the user-selected configuration parameters.

To change the parameters of an already-configured IR-IP, establish communication from a Telnet host using the assigned IP address.

Default IP Communication Parameters

The factory-default IP communication parameters of the interface module are:

- The default IP address of the IR-IP Ethernet port is 192.168.205.1, and the default IP subnet mask is 255.255.255.252.
- The port will accept IP communication only from the IP address 192.168.205.2. Therefore, as long as the factory defaults are in effect, you must assign this address to the Telnet host used to configure IR-IP.

Using the IP learning mechanism, as explained below can change the default parameters.

E.5 Performing Preliminary Configuration

General

The software necessary for performing all the management and configuration functions is stored in the IR-IP interface module, and therefore you only need a regular Telnet host to perform all the activities described in this appendix.

A Telnet host is any computer, e.g., an IBM PC or compatible that fulfills the following minimum requirements:

- A standard 10BaseT Ethernet interface
- A TCP/IP protocol stack, and therefore is capable of supporting IP communication through the Ethernet interface
- Telnet client software
- A ping utility.

Outline of Preliminary Configuration

To perform the preliminary configuration procedure:

1. Connect the Telnet host to the IR-IP interface module.
2. Configure the Telnet host to enable communication with the IR-IP interface module using the default IP parameters.

3. Establish communication with IR-IP and assign the prescribed IP address to its LAN interface.
4. Establish again communication with IR-IP and continue the preliminary configuration in accordance with the *Quick Setup Menu* section below.

Connecting the Telnet Host

Before starting the management and configuration activities, it is necessary to establish IP communication between your Telnet host and the IR-IP interface module. For this purpose, it is necessary to provide a communication path.

Because of the method used to assign an IP address to IR-IP Ethernet port, it is recommended to connect the Telnet host directly to the IP router 10BASE-T connector. This is made by connecting an Ethernet cross cable between the Ethernet connector of the Telnet host and the IP router connector.

However, you may also connect through a common LAN: in this case, connect your Telnet host and IR-IP to Ethernet hub ports using straight cables.

Preliminary Telnet Host Configuration

You can use the IP learning mechanism to configure the IP communication parameters of the IR-IP LAN interface. In this case, skip to the *Assigning the Router LAN Interface Address* section below.

If you prefer to use the factory-default parameters to establish IP communication between your Telnet host and IR-IP, configure the Telnet host as follows:

1. Temporarily configure the host IP address as 192.168.205.2.
2. The initial destination IP address to be used by the host is 192.168.205.1.

Note

The first step in the preliminary configuration process is to assign the desired IP address to the LAN interface of the IR-IP interface module.

After an IP address is assigned and saved, you must change the destination IP address of the Telnet host to the new address, otherwise it is not possible to continue the configuration process. At the same time, you can also change the temporary IP address assigned to the host (192.168.205.2) back to its permanent address.

Assigning the Router LAN Interface Address

The IP address of the IR-IP LAN interface must be configured as part of the preliminary configuration process. To simplify this process, IR-IP includes a simple and convenient IP address learning mechanism.

The IP address can be configured and changed at any time, even after the complete IR-IP configuration process has been performed, because it does not affect other configuration parameters. Moreover, the IP subnet mask is automatically adapted to the new IP address.

IP Learning Mechanism

To simplify the configuration process, IR-IP has a special mechanism for configuring the IP address of its LAN interface. Setting section 1, called IP address learning, of the IR-IP DIP switch (*Figure E-3*) to ON enables this mechanism.

The IP learning mechanism enables IR-IP to learn its LAN interface IP address by receiving frames sent by a ***ping*** utility to the prescribed LAN IP address.

Note *To use the IP learning mechanism, you do not need to know the current address of IR-IP LAN interface, but only the prescribed IP address.*

The IP address is actually retrieved from the ARP frames sent during pinging to locate the ***ping*** destination, not from the ***ping*** frames.

To ensure that the process is correctly performed, it is recommended to check the contents of the ARP table before starting the ***ping*** utility, to make sure that it does not contain the address to be assigned to the IP router LAN interface.

To view and edit the ARP table contents:

If the Telnet host you are using runs under Microsoft Inc. Windows™ 95, 98 or NT, use the following procedure to view and edit the ARP table contents:

1. Display the table using the **`arp -a`** command.
2. If the table includes the intended IP address, remove it from the table using the **`arp -d`** command.

If for some reason the IP learning process does not succeed, before repeating it make sure to remove the IP address from the table.

Assigning a LAN IP Address to a New IR-IP

The following procedure enables you to configure the LAN IP address of a new IR-IP router, i.e., a router using the default parameters (see the *Accessing the IR-IP Management Subsystem* section above).

If HCD-E1 is already operating, skip Step 2 in the following procedure.

To configure the IP router LAN address:

1. Make sure the preparations described above have been completed, including the configuration of the ***ping*** utility.
2. Turn HCD-E1 on and monitor the IP router indicators:
   - The INT indicator turns on
   - The ERR indicator lights steadily for approx. 15 seconds, and then starts flashing at a rapid rate (about three times per second).

   If the ERR indicator turns off, skip to the *What to Do If ...* section below.
3. Set section 1 of IR-IP DIP switch to ON.

   The ERR indicator starts flashing faster (approximately four times a second).

4. Send a ***ping*** to the new address to be used by IR-IP. A confirmation should be received after the third ***ping***: after the confirmation, the flashing will slow down to approximately twice a second.

   If your host does not begin to receive ***ping*** replies after three unsuccessful attempts, skip to the *What to Do If ...* section below.

5. Return section 1 of the IR-IP DIP switch to the OFF position.

   The ERR indicator must turn off.

At this stage, the communication with IR-IP router is lost, because its IP address has been changed. Therefore, you must reconfigure the destination IP address of the Telnet host. If you wish, you may also change the temporary IP address assigned to the host (192.168.205.2) back to its permanent address.

After changing the destination IP address of the Telnet host, it is recommended to turn HCD-E1 off for a few seconds and then back on, before continuing the configuration of the IP router in accordance with the *Quick Setup Menu* section below. At this time, in Step 2 the ERR indicator turns off after the 15-second interval.

Changing the LAN IP Address of a Configured IR-IP

The LAN IP address of an already-configured IR-IP can be changed while it operates, this means it is not necessary to turn HCD-E1 off before starting the configuration procedure. Note however that the IP traffic flow through IR-IP will be disrupted until the other stations in the IP network learn the new address.

To change the LAN IP address of an already-configured IR-IP, use the procedure described above for a new IR-IP with the following differences:

1. Configure the destination address of the ***ping*** utility to the new LAN interface IP address. It is not necessary to change the Telnet host source address.
2. When ready, set section 1 of the IR-IP DIP switch to ON.

   The ERR indicator starts flashing faster (approximately four times a second).
3. Perform Steps 4, 5 of the procedure used for a new IR-IP.

What to Do If ...

After HCD-E1 is turned on, the INT indicator does not light

The IR-IP interface module does not receive power from the HCD-E1 power supply. Service is required.

After HCD-E1 is turned on, the ERR indicator does not light

IR-IP is faulty and must be replaced.

After turn-on, the ERR indicator lights for 15 seconds and then turns off. ACT does not light, and there is no response from IR-IP

No software loaded into IR-IP. Download software using the procedure described in the *New Software Download Menu* section below.

After turn-on, the ERR indicator lights for 15 seconds, and then turns off. ACT lights from time to time, but there is no response from IR-IP

IR-IP has been configured. If you do not know the current IP address of the LAN interface, erase IR-IP router configuration using the procedure given in the *Erasing User's Configuration* section below.

No ping replies from IR-IP

If your host does not begin to receive ***ping*** replies after three unsuccessful attempts, check the physical connection path between the Telnet host Ethernet interface and the IR-IP 10BASE-T connector.

The IP learning process is not successful

Check that the prescribed IP address does not appear in the ARP table.

E.6 IR-IP Management Utility

General Operating Procedures

The IR-IP interface module is managed via a simple, menu-driven utility that uses a basic terminal user interface. A typical screen is shown in *Figure E-4*.

As seen in *Figure E-4*, each screen has a header that identifies the device being configured and its logical name, assigned by the user, followed by the running software revision and date. The bottom line of the screen displays prompts that guide you in the execution of the various activities.

Use the following general procedures to perform the desired activity:

- To change a parameter or to select a menu item, type the corresponding line number.
- For a parameter, which has a discrete set of values, the parameter values are enclosed in brackets [ ]. To select a new value, press the spacebar to scroll among the available values until the desired value is displayed, and then press <Enter> to select the displayed value.
- To enter a value which requires free text entry, type in the desired string and then press <Enter>. Use backspace to erase the current string.
- After all the parameters have been selected, a prompt appears, requesting that you confirm the changes.

Note

For proper display of the screens, you must:

- *Select a fixed-pitch system font for the display. Use your operating system documentation to find how to select a proper font.*
- *Configure the Telnet utility to use VT-100 terminal emulation.*

Starting a Management Utility

The management utility is started automatically when Telnet communication is established. If password protection is enabled (see the *Management Access Menu* section below), you will be prompted to enter the Telnet password. The opening screen, which appears after the Telnet session activation, is the IR-IP Main menu (see *Figure E-4*).

```
IR_IP                    <IR-IP>            S/W Ver.1.00 31/IR (date)

1. Quick Setup
2. Management Access
3. Advanced Setup
4. Device Control
5. View
6. Diagnostic Tool (PING terminal)

Press one of the numbers to select or ESC:
```

Figure E-4 IR-IP Main Menu

To end the utility, press <Esc> when the Main menu is displayed. This will also end the Telnet session.

Menu Structure of Management Utility

Figure E-5 shows the menu structure of the IR-IP management utility.

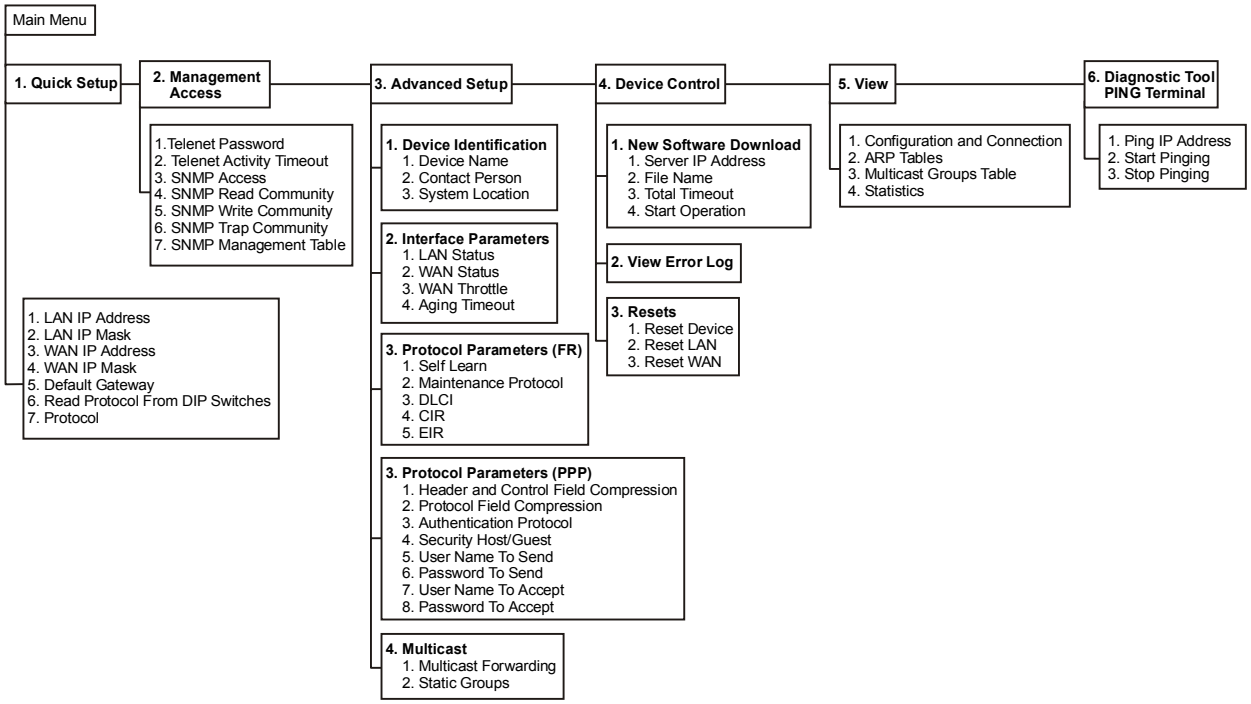


Figure E-5 Management Utility, Menu Structure

E.7 Quick Setup Menu

The Quick Setup menu is used to select the main parameters' values that must be defined before you start using IR-IP.

Use the Advanced Setup menu (see the *Advanced Setup Menu* section below) to specify values for other IR-IP configuration parameters not included in this menu.

To access the Quick Setup menu:

- From the Main menu, type **1**.

The Quick Setup menu appears (*Figure E-6*).

```
IR_IP                    <IR-IP>            S/W Ver.1.00 31/IR (date)
Quick Setup
=======================================================================
1. LAN IP Address                                  :192.168.100.001
2. LAN IP Mask                                     :255.255.255.000
3. WAN IP Address (empty for unnumbered)           :...............
4. WAN IP Mask (empty for unnumbered)              :...............
5. Default Gateway (empty - WAN interface)         :...............
6. Read Protocol From DIP Switches                 :[ Yes ]
7. Protocol                                        :[ Frame Relay ]

Press one of the numbers to select or ESC:
```

Figure E-6 Quick Setup Menu

LAN IP Address Used to enter the IP address for the IP router LAN interface. This is the address to which nodes connected to the local LAN send packets addressed to the WAN.

LAN IP Mask Used to enter the IP subnet mask. The IP router supports a maximum of 254 hosts on the LAN, therefore you must use Class C subnet masks. The basic subnet IP mask for Class C addresses, which supports the maximum possible number of hosts, 254, is 225.225.225.0. To help you understand the selection of IP subnet masks, *Figure E-7* provides a configuration example for a LAN with 6 nodes: the IP subnet mask for a 6-node IP network is 225.225.225.248.

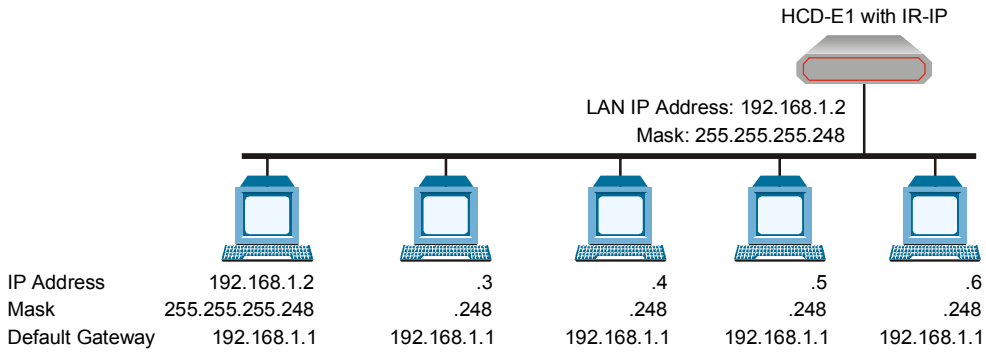


Figure E-7 Selecting the IP Subnet Mask

WAN IP Address

Used to enter the IP address for the IR-IP WAN interface, i.e., the IP address to be used by IP hosts on the WAN to reach this IR-IP interface module.

If the WAN IP Address field remain blank, IR-IP operates in the Unnumbered Router Mode.

WAN IP Mask

Used to enter the IP subnet mask for the WAN interface.

Default Gateway

Operation without Default Gateway

The IP interface module is intended to enable the extension of LANs through the HCD-E1 link. Therefore, its default routing operation is different from the default routing operation of standard IP routers:

- IR-IP forwards packets with destinations not located on the local LAN through the WAN interface
- Packets received from the WAN interface and destined to hosts located on the local LAN are forwarded to the LAN; other packets are discarded.

The default operation is used when the Default Gateway field is blank.

Operation with Default Gateway

You can instruct IR-IP to send packets with destinations not located on the local LAN to a specific router, which is called the ***default gateway***. The default gateway must be connected to the local LAN.

To use this option, enter the IP address of another router attached to the local LAN in the Default Gateway field.

Note *It is very important to obtain the correct parameters from the system administrator or ISP. The most common problem when establishing an IP connection is incorrect configuration of IP parameters and default gateway. Do not try to guess these parameters.*

Read Protocol from DIP Switches

Selecting YES for this parameter forces IR-IP router card to use the WAN protocol selected by section 2 of its DIP switch: PPP or Frame Relay.

Protocol

Used to select the WAN protocol to be used by the IP router card: PPP, HDLC or Frame Relay.

This parameter is available only if the Read Protocol from DIP Switches parameter is set to NO.

E.8 Management Access Menu

The Management Access menu is used to enable the use of passwords to protect the access to IR-IP management utility, and control the inactivity time-out interval.

When password protection is enabled, a Telnet management session can start only after the correct password is entered.

To access the Management Access menu:

- From the Main menu, type **2**.

The Management Access menu appears (*Figure E-8*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
=============================================================================
    1. Telnet Password                              :..........
    2. Telnet Inactivity Timeout (min)              :300..
    3. SNMP Access                                  :Disabled
    4. SNMP Read Community                          :public....
    5. SNMP Write Community                         :public....
    6. SNMP Trap Community                          :public....
    7. SNMP Management Table                        :>>>

Press one of the numbers to select or ESC:
```

Figure E-8 Management Access Menu

Note *Since the IP router card does not support SNMP management, the SNMP Read Community, SNMP Write Community, SNMP Trap Community, and SNMP Management Table parameters are not used.*

Telnet Password

By default, management access to IR-IP via Telnet is unrestricted. To restrict access, enter a Telnet password by selecting **1** in the Management Access menu. The password can include up to 10 characters, and is case-sensitive. The next time a Telnet session is opened, a password must be entered to enable you to access the IR-IP menus.

At any time, only one Telnet connection to IR-IP is permitted. Any attempt to open an additional connection while the current session is open is rejected.

Telnet Inactivity Timeout

This parameter specifies the time a Telnet session is kept open when there is no keyboard activity. When the specified time-out expires, the Telnet session is closed and another user can access IR-IP.

E.9 Advanced Setup Menu

The Advanced Setup menu is used to select the desired group of IR-IP configuration parameters.

The parameters accessed through Advanced Setup menu supplement the parameters available on the Quick Setup screen, by providing control over all the other IR-IP parameters.

To access the Advanced Setup menu:

- From the Main menu, press **3**.

  The Advanced Setup menu appears (*Figure E-9*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
=========================================================================
    1. Device identification
    2. Interface Parameters
    3. Protocol Parameters
    4. Multicast IP

Press one of the numbers to select or ESC:
```

Figure E-9 Advanced Setup Menu

Device Identification Menu

The Device Identification menu is used to define and store in the IR-IP logistic information: the logical name of IR-IP, information on the contact person and device location.

To access the Device Identification menu:

- From the Advanced Setup menu, type **1**.

  The Device Identification menu appears (*Figure E-10*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
.........................................................................
    Device identification
=========================================================================
    1. Device Name                      :IR-IP..
    2. Contact Person                   :Name of contact Person
    3. System Location                  :The location of this device

Press one of the numbers to select or ESC:
```

Figure E-10 Device Identification Menu

Device Name

Select this parameter to assign an arbitrary name to IR-IP for identification by the system manager (up to eight characters). The assigned name is displayed in the screen header.

Contact Person

Select this parameter to enter the name of the person to be contacted with matters pertaining to this equipment unit.

System Location

Select this parameter to enter the physical location of the device.

Interface Parameters Menu

The Interface Parameters menu is used to control the operation of IR-IP interfaces.

To access the Interface Parameters menu:

- From the Advanced Setup menu, type **2**.

The Interface Parameters menu appears (*Figure E-11*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
.............................................................
    Device identification
    Interface Parameters
=============================================================
    1. LAN Status                                  :[ Open  ]
    2. WAN Status                                  :[ Open  ]
    3. WAN Throttle                                :[ Full  ]
    4. Aging Timeout (min)                         :5

Press one of the numbers to select or ESC:
```

Figure E-11 Interface Parameters Menu

LAN Status

Used to enable/disable the flow of packets through LAN interface:

- **Open** – the flow of packets is enabled.
- **Closed** – the flow of packets is disabled. As a result, IR-IP does not accept, nor sends packets to the LAN, but its WAN interface may still be active, and can interact with other IP hosts on the WAN.

WAN Status

Used to enable/disable the flow of packets through the WAN interface:

- **Open** – the flow of packets is enabled.
- **Closed** – the flow of packets through the WAN interface is disabled. As a result, IR-IP does not accept from, nor sends packets to the WAN. However, the LAN interface of the IP router is still active.

WAN Throttle

This parameter specifies the maximum data rate at which frames are sent to the WAN (i.e., to the HCD-E1 HDSL link).

The available selections are:

- 64 kbps
- 128 kbps
- 128 kbps
- 512 kbps
- 1024 kbps
- Full (no restriction on the rate).

Since the IP router buffers have a limited capacity (256 frames), it is recommended to select the WAN Throttle parameter in accordance with the line rate.

Aging Timeout

Used to specify the time after which inactive LAN stations are removed from the IR-IP ARP table.

A station is defined as inactive when no IP traffic is received from it by the IR-IP LAN interface.

WAN Protocol Parameters – Frame Relay Protocol Menu

The Frame Relay Protocol Parameters menu is used to configure the parameters Frame Relay WAN for protocol (the WAN protocol is selected by means of the *Quick Setup Menu*) in *Figure E-6*.

To access the Protocol Parameters menu:

- From the Advanced Setup menu, type **3**.

Self Learn

Used to specify whether the Frame Relay DLCI and maintenance protocol is learned automatically (ENABLED), or is manually entered (DISABLED).

Maintenance Protocol

When the Self Learn parameter is DISABLED, use this parameter to specify the desired maintenance protocol.

DLCI

When the Self Learn parameter is DISABLED, use this parameter to specify the DLCI used for exchanging maintenance protocol messages.

CIR

Used to specify the maximum amount of data, in bits, which the Frame Relay network guarantees to transfer during the measurement interval (the measurement interval is usually one second).

The value of this parameter is obtained from your Frame Relay service provider.

EIR

Used to specify the maximum amount of data, in bits, that the Frame Relay network will attempt to deliver during the measurement interval. The value of this parameter is obtained from the Frame Relay service provider.

A typical Frame Relay Protocol Parameters menu is shown in *Figure D-12*.

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
.....................................................................
    Device identification
    Interface Parameters
    Protocol Parameters
=====================================================================
    1. Self Learn                          :[ Enabled  ]
    2. Maintenance Protocol                :[ ANSI T1.617 ANNEX D ]
    3. DLCI (0-None)                       :0..
    4. CIR                                 :0.......
    5. EIR                                 :64000...

Press one of the numbers to select or ESC:
```

Figure E-12 Frame Relay Protocol Parameters Menu

WAN Protocol Parameters – PPP Protocol

The PPP Protocol Parameters menu is used to configure the parameters PPP WAN for protocol (the WAN protocol is selected by means of the (the WAN protocol is selected by means of the *Quick Setup Menu*) in *Figure E-6*.

To access the Protocol Parameters menu:

- From the Advanced Setup menu, type **3**.

Header and Control Field Compression

Used to control the use of header and control field compression type according to RFC 1661. It is strongly recommended that this compression be used for troubleshooting only.

Protocol Field Compression

Used to control the use of protocol field compression type according to RFC 1661. It is strongly recommended that this compression be used for troubleshooting only.

Authentication Protocol

Used to select the authentication protocol used by an IP router configured as host to validate incoming connections.

Security Host/Guest

This option can be used to configure the IP router either as a guest unit, to be authenticated by another router, or as a host unit, that authenticates other routers.

User Name To Send

The name by which an IP router card configured as guest identifies itself.

Password To Send

The password by which an IP router card configured as guest identifies itself.

User Name To Accept

The user name to be accepted by an IP router configured as host, when an incoming connection request is received.

Password To Accept

The user password to be accepted by an IP router configured as host, when an incoming connection request is received.

A typical PPP Protocol Parameters menu is shown in *Figure E-13*.

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)
Quick Setup
Management Access
Advanced Setup
.....................................................................
    Device identification
    Interface Parameters
    Protocol Parameters
=====================================================================
    1. Header and Control Field Compression     :[ No  ]
    2. Protocol Field Compression:              :[ No  ]
    3. Authentication Protocol                  :[ NONE/NONE  ]
    4. Security Host / Guest                    :[ Guest  ]
    5. User Name To Send                        :.................
    6. Password To Send                         :.................
    7. User Name To Accept                      :.................
    8. Password To Accept                       :.................

Press one of the numbers to select or ESC:
```

Figure E-13 PPP Protocol Parameters Menu

Multicast IP Menu

The Multicast IP menu is used to specify the IP multicast frame forwarding parameters, and to access the static multicast groups' table.

To access the Multicast IP menu:

- From the Advanced Setup menu, press **4**.

The Multicast IP menu appears (*Figure E-14*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
.....................................................................
    Device identification
    Interface Parameters
    Protocol Parameters
    Multicast IP
=====================================================================
    1. Multicast forwarding                      :[ Disable ]
    2. Static groups                             :>>>

Press one of the numbers to select or ESC:
```

Figure E-14 Multicast IP Menu

Multicast Forwarding

Used to control the forwarding of IP multicast frames. The following selections are available:

- **DISABLED** – Disables multicast forwarding in both directions.
- **LAN to WAN** – Enables forwarding of IP multicast frames addressed to groups appearing in the Static Multicast Groups table, from the LAN to the WAN.
- **WAN to LAN** – Enables forwarding of IP multicast frames addressed to groups appearing in the Static Multicast Groups table, from the WAN to the LAN.
- **BIDIRECTIONAL** – Enables forwarding of IP multicast frames addressed to groups appearing in the Static Multicast Groups table, in both directions.
- **WAN to LAN + IGMP** – Enables forwarding of IP multicast frames addressed to groups appearing in the Static Multicast Groups table, from the WAN to the LAN. In addition, more groups can be added dynamically (the additional can be viewed using the View menu – *Figure E-19*).
- **TRANSPARENT** – All the IP multicast frames are forwarded, irrespective of the Static Multicast Groups table.

Static Groups

Select this parameter to access the static multicast groups table. The table is used to specify the IP addresses for up to 10 IP multicast groups. You can add, change, or delete each entry in the table (see the prompt line).

To access the Static Groups menu:

- From the Multicast IP menu, type **2**.

The following screen appears:

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)
                     Static Multicast Groups Table
                     -----------------------------
   Group IP Address
1.  ...............
2.  ...............
3.  ...............
4.  ...............
5.  ...............
6.  ...............
7.  ...............
8.  ...............
9.  ...............
10. ...............
Press 'A'-add, 'E'-edit, 'D'-delete, 'C'-clear all, 'ESC'-exit:
```

Figure E-15 Static Multicast Groups Table

E.10 Device Control Menu

The Device Control menu is used to download software from TFTP servers and perform interface and device resets.

To access the Device Control menu:

- From the Main menu, type **4**.

The Device Control menu appears (*Figure E-16*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)
Quick Setup
Management Access
Advanced Setup
Device Control
-------------------------------------------------------------
    1. New Software Download
    2. View error LOG
    3. Resets
Press one of the numbers to select or ESC:
```

Figure E-16 Device Control Menu

New Software Download Menu

IR-IP operates as a TFTP client, and therefore it is possible to update its software by downloading new software from another computer that operates as a TFTP server.

The New Software Download menu is used to specify the software downloading parameters.

To access the New Software Download menu:

- From the Device Control submenu, type **1**.

  New Software Download menu appears (*Figure E-17*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
Device Control
.....................................................................
    New Software Download
=====================================================================
    1. Server IP Address                          :.............
    2. File Name                                  :.................
    3. Total Timeout (sec)                        :..
    4. Start operation                            :>>>
Press one of the numbers to select or ESC:
```

Figure E-17 New Software Download Menu

Server IP Address

Used to enter the IP address of the TFTP server.

File Name

Used to enter the name and path of the file to be transferred from the TFTP server.

Total Timeout

Used to enter the time IP router should wait for an acknowledgment from the TFTP server, for example 60 seconds.

Start Operation

After selecting all the necessary parameters, type **4** on the New Software Download screen and then press <Enter> to start the downloading.

You can follow the progress of the downloading process (indicated by arrows).

Upon completion of the download process, the unit performs a reset. The Telnet connection is lost and must be restarted if required.

View Error Log Screen

This item of the Device Control submenu is used to view the error log file. This file logs errors detected in IR-IP for debug and technical support purposes.

Resets Menu

The Resets menu allows you to perform reset of IR-IP, or its interfaces. This operation can be used to restore normal operation after service is disrupted by an abnormal condition. Any data stored in the IR-IP buffers is discarded, and the flow of traffic is temporarily interrupted.

To access the Resets menu:

- From the Device Control menu, type **3**.

  The following screen appears:

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
Device Control
.....................................................................
    New Software Download
    View error LOG
    Resets
=====================================================================
    1. Reset Device
    2. Reset LAN
    3. Reset WAN
Press one of the numbers to select or ESC:
```

Figure E-18 Resets Menu

Reset Device

To restart IR-IP:

- From the Resets menu, type **1**.

  You will be prompted to confirm the reset operation.

Note *Resetting the device will restart the IR-IP interface module, and therefore traffic flow is temporarily interrupted, and the Telnet connection is lost.*

Reset LAN

To reset the LAN interface:

- From the Resets menu, type **2**.

  You will be prompted to confirm the reset operation.

Note *This operation restarts the IR-IP LAN controller.*

To continue your Telnet session, press any key within 15 seconds following the confirmation of the reset operation.

Reset WAN

To reset the WAN interface:

- From the Resets menu, type **3**.

  You will be prompted to confirm the reset operation.

Note *Resetting the WAN interface causes the WAN controller to be restarted. This results in renegotiation of the WAN protocol parameters.*

To continue your Telnet session, press any key within 15 seconds following the confirmation of the reset operation.

E.11 View Menu

The View menu is used to view the IR-IP configuration data, and display information on its ARP tables, multicast Groups tables and statistics.

To access the View menu:

- From the Main menu, type **5**.

  The View menu appears (*Figure E-19*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
Device Control
View
------------------------------------------------------------
    1. Configuration and Connection
    2. ARP Tables
    3. Multicast Groups Table
    4. Statistics

Press one of the numbers to select or ESC:
```

Figure E-19 View Menu

Configuration and Connection This screen is used to view the configuration parameters of IR-IP. In addition, you can also view the current status of the LAN and WAN interface.

To access the Configuration and Connection screen:

- From the View menu, type **1**.

The View Configuration screen appears (*Figure E-20*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

                          VIEW CONFIGURATION
                          ------------------
BOOT Version    :1.06  18.03.1999
Device Name     :IP router card
System Location :The location of this device
Contact Person  :Name of contact person

MAC Address     : 00-20-D2-16-3F-9B
Default Gateway : WAN

Intrf Type Baud(Kbps) Prot   IP Address      IP Mask         Status
.....................................................................
LAN   UTP  -------    Ethr   192.168.205.005 255.255.255.000 Connected
WAN   V.110           FR                                     Not Conn.

Press any key to continue:
```

Figure E-20 View Configuratiopn Screen

ARP Tables

This screen is used to display the IR-IP ARP table. This table shows the IP address assigned to each station on the LAN (the stations are identified by their MAC addresses).

To access the ARP Tables screen:

- From the View menu, type **2**.

The ARP Tables screen appears (*Figure E-21*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)


                              ARP Table
                              ---------
    IP Address         MAC Address         IP Address   MAC Address
    192.168.205.003    00-40-33-20-C8-3C

Press any key for exit
```

Figure E-21 ARP Table Screen

Multicast Groups Table Screen

This screen is used to display information about the multicast group IP addresses and their status.

To access the Multicast Groups Table screen:

- In the View menu, type **3**.

  The Multicast Groups Table screen appears (*Figure E-22*).

```
IR_IP                    <IR-IP>            S/W Ver.1.00 31/IR (date)

Multicast Groups Table
----------------------
    Group IP Address Status        Group IP Address Status

Press any key for exit
```

Figure E-22 Multicast Groups Table Screen

Statistics Screen

The Statistics screen is used to display statistical information on the traffic between the networks connected by IR-IP. The data displayed on this screen enables you to evaluate the IR-IP performance. Two different Statistics screens are used, one for the LAN side and the other for the WAN side.

To access the Statistics menu:

- In the View menu, type **4**.

  The LAN and WAN Statistics screens appear (*Figure E-23* and *Figure E-24*).

```
IR_IP                    <IR-IP>            S/W Ver.1.00 31/IR (date)

                          SYSTEM STATISTICS
                          -----------------
Counter Name                  Val     Counter Name                Val
LAN in Octets                 83504   LAN IP Header Errors         0
LAN Unicast Frames In             1   LAN IP Address Errors        0
LAN Non-Unicast Frames In         9   LAN Alignment Errors         0
LAN Out Octets                83504   LAN CRC Errors               0
LAN Unicast Frames Out         3560   LAN Single Collisions        0
LAN Non-Unicast Frames Out        0   LAN Multiple Collisions      0
LAN to WAN Frames Passed       1698   LAN Late Collisions          0
LAN IP Datagram Received       2638   LAN Excessive Collisions     0
LAN to CPU Frames Discarded       0   LAN Frames Too Long Errors   0
LAN to WAN Frames Discarded       0   LAN RX FIFO Overrun Error    0
LAN Out Errors                    0   LAN SQE Transmitted          0
LAN RX Frames Errors              0   LAN Deferred Frames          1
LAN MAC Receive Errors            0   LAN Carrier Sense Lost       0
LAN MAC TX Errors                 0   LAN FIFO Underrun            0

    N - Next Screen. ESC - Back To Previous Menu.
    R - Refresh Page. C - Clear The Counters Of This Page.
```

Figure E-23 LAN Statistics Screen

```
IR_IP                    <IR-IP>            S/W Ver.1.00 31/IR (date)

                          SYSTEM STATISTICS
                          -----------------
Counter Name                    Val    Counter Name                Val
WAN in Octets                 83504    WAN Alignment Errors         0
WAN Out Octets                 1950    WAN Aborted Frames           0
WAN Out Frames                 1723    WAN Short Frames             0
WAN to LAN Frames Transfer     1698    WAN RX FIFO Overrun Error    0
WAN IP Datagram Received       1723    WAN to CPU Frames Errors     0
WAN to CPU Discarded              0    WAN Frame Too Long Errors    0
WAN to LAN Discarded              0    WAN IP Header Errors         0
WAN Out Errors                    0    WAN IP Addres Errors         0
WAN CRC Errors                    0

PPP Address Error                 0
PPP Control Error                 0
DLCI Unrecognized Error           0
Frame Relay Forward Conge         0
Frame Relay Backward Conge        0

    P - Previous Screen. ESC - Back To Previous Menu.
    R - Refresh Page. C - Clear The Counters Of This Page.
```

Figure E-24 WAN Statistics Screen

E.12 Diagnostic Tool (PING Terminal) Menu

This section provides information on the diagnostic tool provided with IR-IP (the ***ping*** utility).

To access the Diagnostic Tools menu:

- In the Main menu, type **6**.

  The Diagnostic Tools menu appears (*Figure E-25*).

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)
Quick Setup
Management Access
Advanced Setup
Device Control
View
Diagnostic Tools (PING terminal)
=================================================================
    1. Ping IP Address                        :192.168.100.011
    2. Start Pinging                          :>>>
    3. Stop Pinging                           :>>>

Press one of the numbers to select or ESC:
```

Figure E-25 Diagnostics Tools Menu

Using the Ping Function

The Ping option is used to confirm IP connectivity by ***pinging*** other IP hosts. Connectivity is confirmed by receiving a reply from the remote (pinged) IP host.

To ping a host:

1. From the Diagnostic Tools menu, type **1** and enter the desired host IP address.
2. Press <Enter> to confirm the destination IP address.
3. To start pinging, type **2** on the Diagnostic Tools screen.

   After pinging starts, you can monitor the ***ping*** status. A typical screen is shown in *Figure E-26*.

Note *After pinging is started, it continues in the background even if you exit the Diagnostics Tools screen. In this case, a Ping Running message appears in the top upper left-hand corner of the screen.*

4. To stop pinging, type **3** from the Diagnostic Tools menu.

   A **Ping Stopped** message is displayed.
   To clear the message and return to the Diagnostic Tools screen, press any key.

```
IR_IP                    <IR-IP>           S/W Ver. 1.00 31/IR (date)

Quick Setup
Management Access
Advanced Setup
Device Control
View
Diagnostic Tools (PING terminal)
=====================================================================
    1. Ping IP Address                          :192.168.100.011
    2. Start Pinging                            :>>>
    3. Stop Pinging                             :>>>

Pinging 192.168.212.001 Sent 27 Recvd 25  Lost 2  Resp.Time 60 ms


Press one of the numbers to select or ESC:
```

Figure E-26 Diagnostic Tools Menu after Receiving Pinging Response

E.13 Erasing User's Configuration

The user-defined configuration parameters are stored in the IP router card flash memory. After the user-defined configuration parameters are erased, the IP router card automatically loads the factory-default parameters .

You may want to erase the current configuration parameters:

1. Before IR-IP is prepared for operation in a new application.
2. When you cannot configure IR-IP because its current LAN-interface IP address and/or the Telnet password, are not known.

To erase the user's configuration:

1. Turn HCD-E1 off.
2. Set all the four sections of the IR-IP DIP switch to ON.
3. Turn HCD-E1 on and monitor the ERR indicator: it must turn on and light steadily.
4. While the ERR indicator is lit (within 15 seconds), set sections 1 and 2 of the DIP switch to OFF.

   The IP router configuration is erased.

Note *If you do not set sections 1 and 2 to OFF within 15 seconds of power-up, the IP router card ignores the setting of all the four sections to ON and starts normal operation. In this case, it is recommended to turn HCD-E1 off and then back on.*

To abort the whole operation, turn HCD-E1 off, return all the four-switch section to the desired positions, and then turn HCD-E1 on again.

5. Turn HCD-E1 off, and the return all the four sections of the DIP switch to the desired positions.

E.14 Erasing IR-IP Software

You may erase the IR-IP application software, without erasing the user-defined parameters.

After the application software is erased, IR-IP starts its TFTP server application, and waits for the downloading of software by a TFTP client connected to its LAN interface. The procedure to be used to download the application software in this case is also described below.

You may want to erase the application software if the downloading of new software using the Device Control menu (see *Figure E-16*) fails, and the IP router card does not function properly.

Erasing Application Software

To erase the application software:

1. Turn HCD-E1 off.
2. Set all the four sections of IR-IP DIP switch to ON.
3. Turn HCD-E1 on and monitor the IR-IP ERR indicator: it must turn on and light steadily.
4. While the ERR indicator is lit (within 15 seconds), set sections 3 and 4 of the IR-IP DIP switch to OFF.

   The IP router application software is erased.

Note

If you do not set sections 3 and 4 to OFF within 15 sec of power-up, IR-IP ignores the setting of all the four sections to ON and starts normal operation. In this case, it is recommended to turn HCD-E1 off and then back on.

Alternately, to abort the whole operation, turn HCD-E1 off, return all the four switches to the desired positions, and then turn HCD-E1 on again.

5. Turn HCD-E1 off, and the return all the four sections of the DIP switch to the desired positions.

Downloading New Software

After erasing the application software, you can download new software from any computer that can serve as a TFTP client.

To enable the downloading, IR-IP automatically activates its TFTP server application with the following factory-default IP parameters:

- IP address:192.168.205.1
- Subnet mask: 255.255.255.252.

Connect the computer serving as a TFTP client to the IR-IP 10BASE-T connector in the way as a Telnet host used for preliminary configuration (see the *Performing Preliminary Configuration* section). The computer IP parameters must be configured as follows:

- IP address 192.168.205.2
- Subnet mask255.255.255.252
- Default gateway 192.168.205.1

To download new software:

1. If necessary, turn HCD-E1 off.
2. Set all the four sections of the IR-IP DIP switch to OFF.
3. Turn HCD-E1 on and monitor the ERR indicator: it must start flashing.
4. Connect the computer to the IP router LAN interface and configure its IP parameters as explained above.
5. Run a standard TFTP client application on the Telnet host, and download the appropriate software file.

   If the download is successful, IR-IP starts using the new software.

   If the downloading fails, repeat the download process.