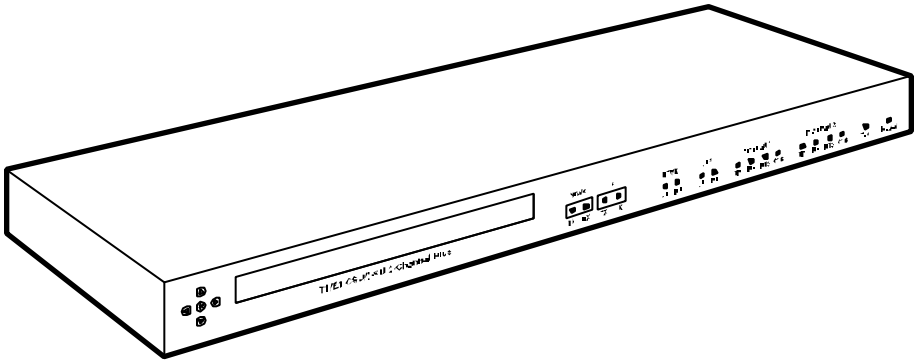
BLACK BOX
NETWORK SERVICES

JANUARY 2002
MT902A

T1/E1 CSU/DSU – 2 Channel Plus



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FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO-FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio-frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

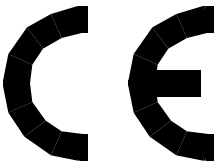
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

EUROPEAN UNION DECLARATION OF CONFORMITY

This equipment complies with the requirements of the European EMC Directive 89/336/EEC.



NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

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Contents

Chapter **Page**

1. Specifications

NOTE: During the course of this product's lifetime, modifications might be made to its hardware or firmware that could cause these specifications to change without notice.

1.1 Characteristics of the Entire CSU/DSU

Compliance:
RFI: CE (EN50082-1, EN55022, EN41003); FCC Part 15 Subpart B Class A, IC Class/classe A;
FCC Part 68;
Electrical safety: UL® 1459

Interfaces:
To line: Balanced T1 or E1 (user-selectable);
To CPE: Balanced T1 or E1 (user-selectable) Drop-and-Insert;
To local data devices: EIA/TIA RS-232, ITU V.35 proprietarily pinned on DB25, or ITU RS-422/449/530 pinned on DB25 according to RS-530 (independently user-selectable);
To terminal or terminal emulator: EIA/TIA RS-232 pinned on RJ-45 according to TIA-561;
To LAN (not currently supported): 10BASE-T Ethernet

Protocol:
Synchronous

User Controls:
(5) Front-mounted pushbuttons for use with the front-panel LCD configuration menu;
Terminal-based menu system;
Designed for SNMP management, but this isn't supported at the time of this writing

Indicators:
Front-panel 2 x 40 LCD for configuration menu;
(14) LEDs for network and CPE alarms, data-port signal activity, test, and power

Connectors: (4) Front-mounted bantam jacks: network TX, network RX, CPE TX, and CPE RX;
Rear-mounted:
(2) RJ-48C female (110 ohms ±10%): (1) to T1/E1 line, (1) to T1/E1 CPE;
(2) DB25 female to local data devices (adapters and adapter cables available to reach non-RS-232 devices);
(2) RJ-45 female: (1) to terminal or terminal emulator, (1) to 10BASE-T LAN (not currently supported);
(1) 3-position terminal block for DC power inlet;
(1) IEC 320 male for AC power inlet

Enclosure: Aluminum

Temperature Tolerance: Operating: 32 to 122˚F (0 to 50˚C);
Storage: 14 to 158˚F (–10 to +70˚C)

Humidity Tolerance: 5 to 95% noncondensing

Power: Either –20 to –72 VDC (–48 VDC nominal) or 90 to 250 VAC, 50 to 60 Hz (autosensing) through detachable input cord and internal transformer

Size: 1.75"H (1U) x 17"W x 12"D (4.4 x 43.2 x 30.5 cm)

Weight: 4.5 lb. (2 kg)

1.2 Characteristics of the Network and CPE T1/E1 Ports

Compatibility: T1: ITU G.704, G.824; ANSI T1.403; TR 54016, 54019A, 62411;
E1: ITU G.703, G.704, G.706, G.732, G.823

Data Rate: T1: 1.544 Mbps;
E1: 2.048 Mbps

Clock Source: Internal, looped (receive recovered) from line or CPE, or external from local DTE on data port 1 or 2 (independently user-selectable)

Coding: T1: B8ZS;
E1: HDB3

Jitter Control: T1: TR 62411, ANSI T1.408, T1.403;
E1: ETSI TBR12/13

Framing: T1: D4(SF) or ESF (independently user-selectable);
E1: ITU G.704

T1 Operation: Long-haul or short-haul (independently user-selectable)

T1 Line Build Out: Long haul: 0, 7.5, 15, or 22.5 dB (independently user-selectable);
Short haul: Keyed to cable-length ranges in multiples of 110 ft. (33.5 m), from 0 to 110 ft. (0 to 33.5 m) up to 550 to 660 ft. (167.6 to 201.2 m), independently user-selectable

Input Signal: T1: DSX-1 to –36 dB;
E1: ITU G.703 to –43 dB

1.3 Characteristics of the Local Data Ports

Data Rate: Any multiple of 56 or 64 kbps from 56 to 1984 kbps (independently user-selectable); rates above 128 kbps shouldn't be selected on any data port configured as RS-232

Clock Source: Internal or external from local DTE (independently user-selectable)

DS0 Mapping: Fully user-configurable

RTS/CTS Response: Either RTS is recognized and CTS follows it, or RTS is ignored and CTS is always ON (independently user-selectable)

RTS/CTS Delay: 20 clock cycles or none (independently user-selectable)

2. Introduction

2.1 Overview

The T1/E1 CSU/DSU – 2 Channel Plus is a feature-rich universal CSU/DSU (Channel Service Unit/Data Service Unit) designed to operate over T1 or E1 facilities. The T1/E1 CSU/DSU – 2 Channel Plus provides three user interfaces: two for local data devices and one for T1/E1 CPE (customer premise equipment). These three inputs are multiplexed onto a signal transmitted and received over a standard T1 (1.544-Mbps) or E1 (2.048-Mbps) interface. Both the network and user T1/E1 ports have a built-in CSU interface to terminate long-haul T1 or E1 lines.

2.2 Features and Benefits

- **User-selectable T1 or E1**
  The hardware of your T1/E1 CSU/DSU – 2 Channel Plus supports both T1 and E1. You can choose which interface it uses from its configuration menus.

- **T1 or E1 Drop-and-Insert port**
  The CSU/DSU has a second T1/E1 digital port for a user connection, to support PBX voice communication. Because the CSU/DSU has this Drop-and-Insert digital port as well as its two local data ports, the need for a channel bank can be eliminated in many applications.

- **T1/E1 conversion**
  The CSU/DSU can provide T1/E1 conversion, and is ideally suited for areas that deploy both T1 and E1 services. The unit can convert m-law-encoded voice to A-law encoding and vice-versa, and convert voice signaling to/from T1 formats from/to E1 format.

- **Two Nx56/64 data ports**
  The CSU/DSU has two universal Nx56/64 data ports to support high-speed data, LAN traffic, or videoconferencing. The data ports can be independently set to communicate using V.35, RS-530, RS-422/449, or RS-232.

- **Full TDM bandwidth management**
  The CSU/DSU has a full TDM timeslot-allocation unit. The three user ports can be configured to use any combination of DS0s (timeslots) from the network T1/E1 port.

- **Two configuration methods**
  The CSU/DSU can be configured with either its front-panel LCD or with a VT100 compatible terminal or terminal emulator.

- **Various power options**
  The CSU/DSU may be powered from a DC or AC supply. DC input can be from –20 to –72 VDC. AC input from 90 to 250 VAC, 50 to 60 Hz, is autosensed. This allows the CSU/DSU to be used virtually anywhere in the world without needing special power adapters or power supplies.

- **Upgradeable firmware**
  If new firmware is released for the CSU/DSU, you can easily download it into your unit by attaching a PC running a terminal emulator.

2.3 The Complete Package

At the time of this writing, the T1/E1 CSU/DSU – 2 Channel Plus ships from the factory with its power cord, an RJ-48C T1/E1 cable, a DB9 to RJ-45 terminal adapter, rackmount brackets and screws, and this manual. However, the package components are subject to change without notice.

3. Installation

Installing the T1/E1 CSU/DSU – 2 Channel Plus requires no special tools, adjustments, or measurements. First, decide whether you'll be placing the CSU/DSU on a flat surface or in a 19" equipment rack.

If you'll be rackmounting it, use a screwdriver to screw the included rackmount brackets onto the sides of the CSU/DSU with the included screws. There are two screws for each bracket; they pass through two screwholes in the bracket's side flange and into matching holes on the side of the CSU/DSU. You can orient the "ears" of the brackets in either of two ways: flush with the front panel of the CSU/DSU, so that the front panel is even with the front of the rack, or reversed toward the rear of the CSU/DSU, so that the front of the unit protrudes from the front of the rack. Once the brackets are fastened to the CSU/DSU, secure the bracket ears to the rack's side rails with your own screws, bolts, cage nuts, etc.

Once you've placed the CSU/DSU where you want it to be, connect the T1/E1 lines, your CPE, your data equipment, and (if desired) a terminal or terminal-emulating PC to the connectors on the CSU/DSU's rear panel:

- The CSU/DSU's network T1/E1 port (labeled "NTWK") is an RJ-48C socket. Use a standard T1/E1 cable with RJ-48C plugs to connect it to your T1 or E1 line.
- The CSU/DSU's CPE T1/E1 port (labeled "CPE") is also an RJ-48C socket. Use a standard T1/E1 cable with RJ-48C plugs to connect it to your premise T1/E1 equipment.
- The CSU/DSU's data ports (labeled "DATA PORT 1" and "DATA PORT 2") are DB25 female connectors. To connect either of them to an RS-232 DTE, use a standard straight-through-pinned RS-232 cable or PC/AT (DB25 to DB9) cable with a DB25 male connector at the CSU/DSU end. To connect either of them to a V.35, RS-530, or RS-422/449 device, you'll need to use special cables or adapters.
- If you want to monitor or manage the CSU/DSU with a terminal or a PC running a terminal emulator, you can attach the terminal or PC to the CSU/DSU's terminal port, which is an RJ-45 socket labeled "TERMINAL." Use a straight-through-pinned twisted-pair cable with RJ-45 plugs plus a modular DB25 or DB9 adapter to make this connection.

See the **Appendix** for the pinouts of these cables and adapters.

NOTE

There is also an RJ-45 connector labeled "10BASE-T" on the rear panel, designed for future support of a 10BASE-T LAN connection for SNMP management. At the time of this writing, however, this connector doesn't work and shouldn't be used.

Now connect the CSU/DSU to its power source. If you're powering it with DC, run DC-power wiring from a working DC source (20 to 72 VDC, 48 VDC optimum) to the DC-inlet terminal block on the CSU/DSU's rear panel. (Connect the positive lead to the "+" terminal, the negative lead to the "–" terminal, and the ground lead to the "FRAME" terminal.) If you're powering it with AC, run the included power cord from a working AC outlet to the IEC 320 male AC inlet labeled "100-240 VAC" on its rear panel. The CSU/DSU should begin operating immediately; it has no ON/OFF switch.

4. Configuration and Operation

4.1 The LCD's Status Screen

When the T1/E1 CSU/DSU – 2 Channel Plus powers up, its front-panel LCD will display the version number of the CSU/DSU's firmware and the date. After about five seconds, it will switch to the Status Screen. The Status Screen displays any alarms present on the network or CPE T1/E1 ports. If no alarms are present, it will display "Normal." Pressing the [*] (Enter) button at the Status Screen will switch to the LCD Configuration Menus (see **Section 4.2**) if they're enabled (see **Section 4.3.1**). When you exit the Configuration Menus, you'll return to the Status screen.

4.2 The LCD's Configuration Menus

You can bring up the Configuration Menus on the front-panel LCD of the T1/E1 CSU/DSU – 2 Channel Plus by pressing the [*] (Enter) button while the Status Screen is displayed (see **Section 4.1**). These menus present you with a series of configuration choices. For each configuration parameter, choose the setting you want by moving the highlight to it with the [←] (Left), [→] (Right), [↑] (Up), and/or [↓] (Down) buttons, then press [*] (Enter) to confirm your selection. (If you press Enter and then discover that you've made a mistake, there's no way to go back to an earlier screen; you'll have to go forward through the menus to the end, then restart them from the beginning.) Here are the menus you'll see, listed in the order in which you'll see them (the numbers they're assigned in this listing won't actually appear on screen):

[1] Network T1/E1 Port Framing
Choose T1 D4 framing, T1 ESF framing, or E1 mode for the network T1/E1 port.

[2] Network T1/E1 Short/Long-Haul Selection
Choose short-haul or long haul operation for the network T1/E1 port.

[3] Network T1/E1 Line Build Out

- If in the previous two menus you selected a T1 framing plus short-haul operation, this menu will be a list of distance ranges: "0-110" (0 to 110 ft., 0 to 33.5 m), "110-220" (110 to 220 ft., 33.5 to 67 m), etc., up to "550-660" (550 to 660 ft., 167.6 to 201.2 m). Choose the distance range that your short-haul run falls into.
- If in the previous two menus you selected a T1 framing plus long-haul operation, this menu will be a list of actual "line build out" decibel values (0, 7.5, 15, or 22.5 dB) that you can choose from.
- If in the first menu you selected E1 mode, this menu won't appear at all.

[4] CPE T1/E1 Port Activation
Choose "Yes" to activate the CPE T1/E1 port or "No" to deactivate it. If the CPE T1/E1 port is activated, any timeslots not used by the data ports will be mapped to it.

[5] CPE T1/E1 Port Framing
[6] CPE T1/E1 Short/Long Haul Selection
[7] CPE T1/E1 Line Build Out
These menus are the same as menus 1 through 3, but apply to the CPE T1/E1 port rather than the network T1/E1 port.

[8] Data Port 1 Activation
Choose "Yes" to activate data port 1, or "No" to deactivate local data port 1. If data port 1 is deactivated, the remainder of the data port 1 menus will be skipped.

[9] Data Port 1 Data Rate
To set this port for a specific data rate, first determine whether the data rate of the attached device is a multiple of 56 kbps or 64 kbps. (If the rate is evenly divisible by both 56 and 64 kbps, use 64 kbps.) Based on this, choose either "56" or "64" here, then move on to the next menu. (For example, 768 kbps is divisible by 64 kbps, not 56 kbps, so you'd choose "64.")

[10] Data Port 1 Data Rate (N)
Divide the desired data rate by 56 or 64 kbps—whichever you chose in the previous menu—to get the multiplier (N) that you need to select here. For example, if your desired speed is 768 kbps, 768 divided by 64 is 12, so you'd select "12." The multiplier N is equivalent to the number of DS0 timeslots that will be assigned to this data port; from 1 to 24 will be available for T1, 1 to 31 for E1. Bear in mind that if data port 1 will be an RS-232 port (see menu 12 below), you shouldn't choose a multiplier that would yield a data rate above 128 kbps.

[11] Data Port 1 Starting Timeslot
Choose the number of the *first* DS0 timeslot (of the available 24 for T1 or 31 for E1) to be assigned to data port 1. The remainder of the timeslots for this port are assigned contiguously following the first. (To assign non-contiguous timeslots to a port, you'll need to use the terminal-based menus; see **Section 4.3.3**.)

[12] Data Port 1 Interface
Choose RS-232, V.35, or RS-530/449 as the data-communication interface for data port 1.

[13] Data Port 1 Transmit Clock
Choose data port 1's clock source: "Internal" if the transmit clock will be provided by the T1/E1 CSU/DSU – 2 Channel Plus or "External" if the transmit clock will be provided by the attached DTE.

[14] Data Port 1 Permanent RTS
Choose "Yes" to enable "permanent RTS" for data port 1 or "No" to disable it. When permanent RTS is enabled, the port will ignore RTS from the DTE, and CTS is always on. When permanent RTS is disabled, CTS will follow RTS from the DTE.

[15] Data Port 1 RTS/CTS Delay
- If you disabled permanent RTS in the previous menu, choose "Yes" here to enable RTS/CTS delay for data port 1, or "No" to disable it. If RTS/CTS delay is enabled, CTS will turn on approximately 20 clock cycles after RTS. Otherwise, CTS will follow RTS immediately.
- If you enabled permanent RTS in the previous menu, this menu won't appear at all.

[16] Data Port 2 Activation
[17] Data Port 2 Data Rate
[18] Data Port 2 Data Rate (N)
[19] Data Port 2 Starting Timeslot
[20] Data Port 2 Interface
[21] Data Port 2 Transmit Clock
[22] Data Port 2 Permanent RTS
[23] Data Port 2 RTS/CTS Delay
These menus are the same as menus 8 through 15, but apply to data port 2 rather than data port 1.

[24] Timing Source
Choose the CSU/DSU's overall clock source. The available options are "Looped" (receive-recovered from the network T1/E1 port), "Internal," "CPE T1/E1" (receive-recovered from the CPE T1/E1 port), "Data Port 1" (external from the DTE attached to data port 1), and "Data Port 2" (external from the DTE attached to data port 2). This menu is split into two screens. The arrows at the left or right of the screen show which button to press to see the other options.

[25] Save Changes or Abort
After you make your Timing Source selection at the previous menu, you will be asked whether you want to save and activate the configuration changes you have made. Choose "Yes" to save and activate your changes—note that this overwrites the previous configuration, even if it came from the terminal port (see **Section 4.3.3**)—or choose "No" to abort the changes. When you press Enter to make your selection, the LCD will exit the Configuration Menus and resume displaying the Status Screen (see **Section 4.1**).

4.3 Terminal-Based Management

You can manage and configure the T1/E1 CSU/DSU – 2 Channel Plus through a terminal or terminal-emulating PC attached to the CSU/DSU through the RJ-45 terminal port labeled "Terminal" on its rear panel. This is an RS-232 port pinned according to TIA-561, and you'll connect a terminal or PC to it using the included adapter (plus additional cable if necessary); see the **Appendix** for pinouts.

The port runs at 9600 baud, with 8 data bits, no parity, and one stop bit. When the terminal is connected, you'll see a login screen like the one shown in Figure 4-1.

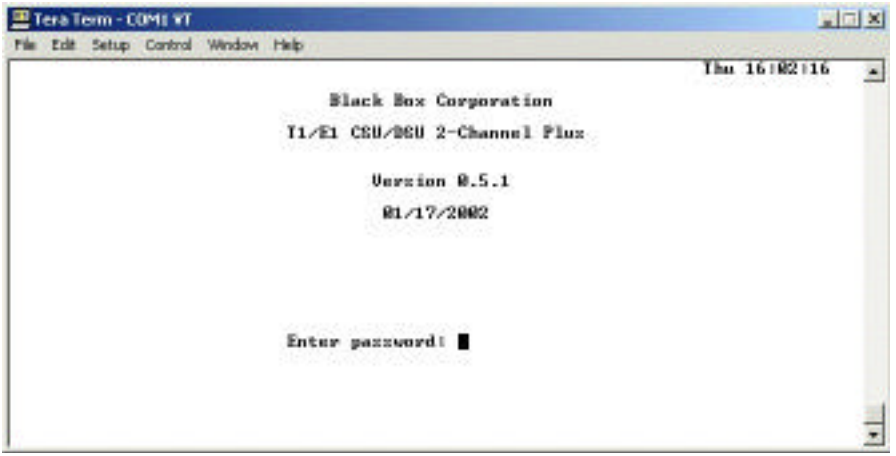

Figure 4-1. The login screen.

The CSU/DSU has four "access levels" (see **Section 4.3.4**). To log in at one of these levels, type the password for that level and press [Enter]. Logging in at level 4 will bring up the Password Edit Menu (see **Section 4.3.4**). Logging in at level 1, 2, or 3 will bring up the Main Menu shown in Figure 4-2 on the next page. You can choose one of three options at this menu: "System Functions," "Monitor/Test," or "Configure." Type the option number and press [Enter] to make a selection. At each submenu of this menu, press [Escape] to to return to the previous menu; press [Escape] here to log out of the terminal-based menus entirely.

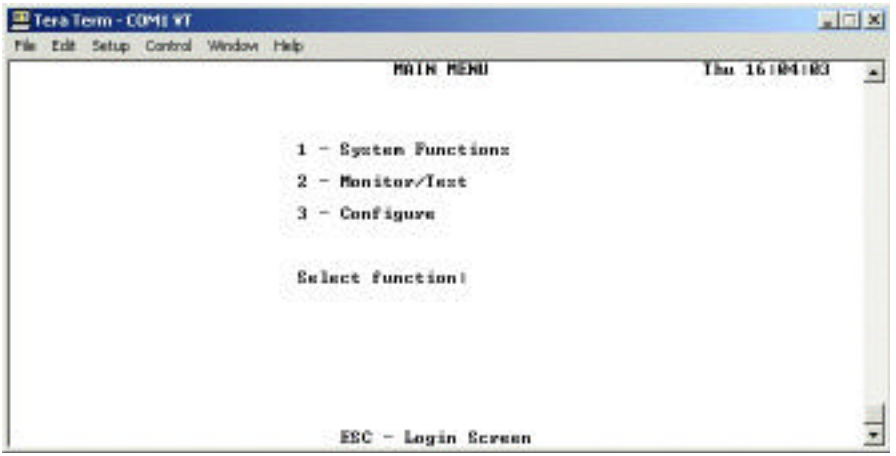

Figure 4-2. The Main Menu.

4.3.1 The System Functions Menu

Press [1] followed by [Enter] at the Main Menu to bring up the System Functions Menu, shown in Figure 4-3. There are seven options available at this menu. Type the option number and press [Enter] to make a selection.

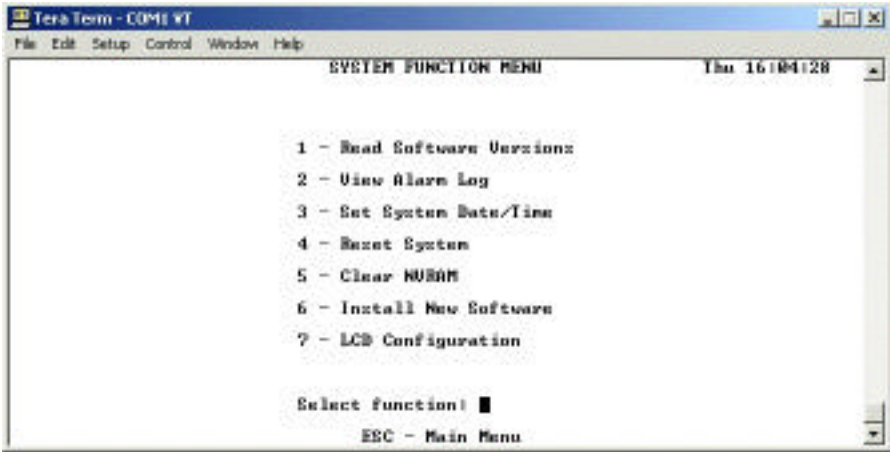

Figure 4-3. The System Functions Menu.

Choose "Read Software Versions" by pressing [1] followed by [Enter] at the System Functions Menu. This causes the CSU / DSU display the version numbers and dates of its active software (firmware) and any backup firmware loaded during a previous upgrade, as shown in Figure 4-4 on the next page.

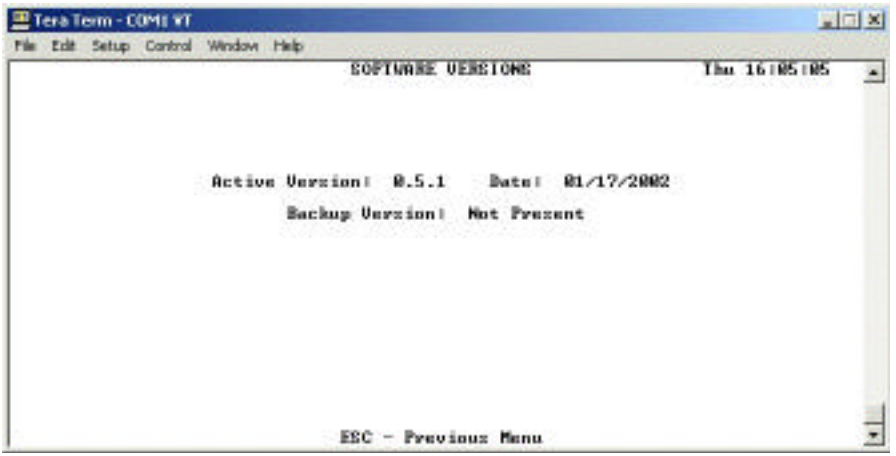

Figure 4-4. The Read Software Versions screen.

Choose "View Alarm Log" by pressing [2] followed by [Enter] at the System Functions Menu. This causes the CSU/DSU to list the fifteen most recent alarm conditions, or to display "Alarm log not available yet" if there are no errors to report, as shown in Figure 4-5. If any errors are listed, you can press "c" at this screen to clear them from the log.

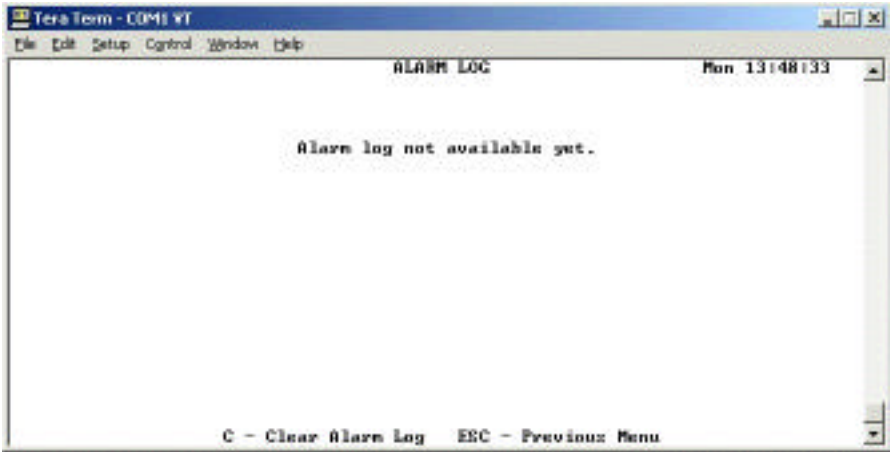

Figure 4-5. The View Alarm Log screen under normal conditions.

Choose "Set System Date/Time" by pressing [3] followed by [Enter] at the System Functions Menu if you want to view and set the CSU/DSU's internal date and time. The CSU/DSU will display the current date in mm/dd/yy format, the time in 24-hour (military) hh:mm:ss format, and then the day of the week, as shown in Figure 4-6. To set a new system time or date, use the arrow keys to move the cursor to either the "New time" field or "New date" field. Enter any new time in 24-hour (military) hh:mm:ss format. Enter any new date in mm/dd/yy format (you must type the colons and slashes—they aren't automatically generated). Press [Enter] to submit either new setting.

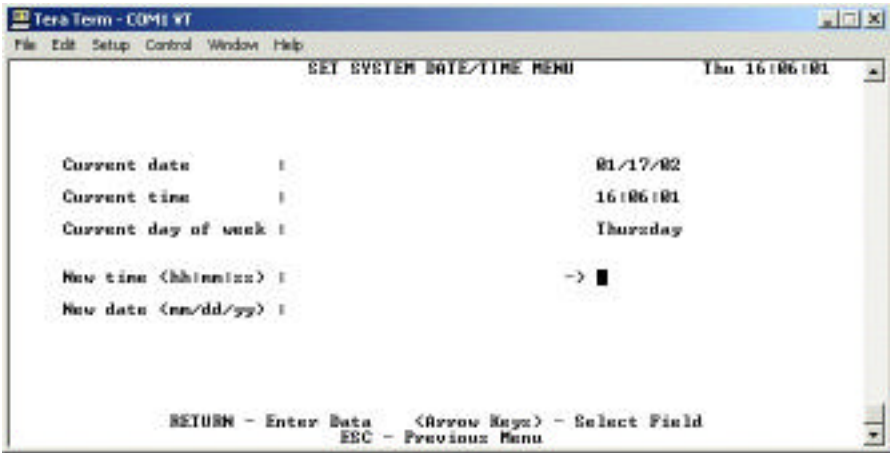

Figure 4-6. The Set System Date/Time Menu.

If you want to reboot the CSU/DSU (if, for example, it or one of its attached communication links has begun behaving oddly), choose "Reset System" by pressing [4] followed by [Enter] at the System Functions Menu. You'll then see the prompt "Reset system (Y/N)?". Press "Y" to confirm your choice. If you do, the CSU/DSU will reboot, but will continue using the existing values for all of its configuration parameters.

If you want to clear the CSU/DSU's NVRAM (nonvolatile memory) and *then* reboot the unit, choose "Clear NVRAM" by pressing [5] followed by [Enter] at the System Functions Menu. You'll then see the prompt "Clear NVRAM and reboot (Y/N)?". Press "Y" to confirm your choice. If you do, the CSU/DSU's current configuration will be entirely cleared (except for its passwords), and the unit will reboot with the factory-default values for all of its configuration parameters.

Occasionally we might release upgraded firmware for the CSU/DSU, and Black Box Tech Support might direct you to download it and install it in your unit. To install such a firmware file, make sure that it is stored on a PC with terminal-emulator software that's attached to the CSU/DSU's "TERMINAL" port (see **Chapter 3**). Then choose "Install New Software" by pressing [6] followed by [Enter] at the System Functions Menu. This triggers the following sequence of activity:

1. If this is the first time you've done this and the backup flash memory is empty, it will be erased automatically; otherwise, you will be prompted, "Erase flash (Y/N)?". Press "Y" to erase the flash and continue, or "N" to abort.

2. You will prompted to choose the transmission protocol for the file transfer: either regular "XMODEM" or "XMODEM/CRC—XMODEM1K (recommended)."

3. Once you make your protocol selection, you will be prompted to "Begin sending the file now." If you haven't already done so, run the terminal emulator on the PC, set it for the protocol you've selected, and instruct it to transmit the firmware file.

4. If the file is transferred successfully, you will see the message "Download complete, writing flash" followed by "Download successful, version *x.yz* written to flash." (If something goes wrong with the download, you'll see an error message and be returned to the System Functions Menu, where you'll have to start over. This won't have any adverse affect on the CSU/DSU, which will continue running on the current firmware stored in the other flash memory.)

5. If the download was successful, you'll be prompted, "Would you like to make this the active software (Y/N)?" Press "Y" to switch the startup pointer to the backup flash so that it becomes the active flash and runs the new firmware when the CSU/DSU is next rebooted. Press "N" to leave the new firmware inactive in the backup flash memory and return to the System Functions Menu. (At the time of this writing, there isn't any way to make the backup firmware active without going through the download procedure again, but this will probably be changed in a future firmware revision.)

6. You will be prompted, "Reboot to activate software (Y/N)?" Press "Y" to reboot the CSU/DSU immediately or "N" to return to the System Functions Menu and continue running the old firmware until the next reboot.

If you want to disable the CSU/DSU's LCD-based Configuration Menus (see **Section 4.2**) so that changes to the CSU/DSU's configuration can be made only through the terminal-based configuration menus (see **Section 4.3.3**), choose "LCD Configuration" by pressing [7] followed by [Enter] at the System Functions Menu. You'll see the screen and prompt shown in Figure 4-7; use the space bar to toggle between "Y" (LCD Configuration Menus enabled) and "N" (LCD Configuration Menus disabled).

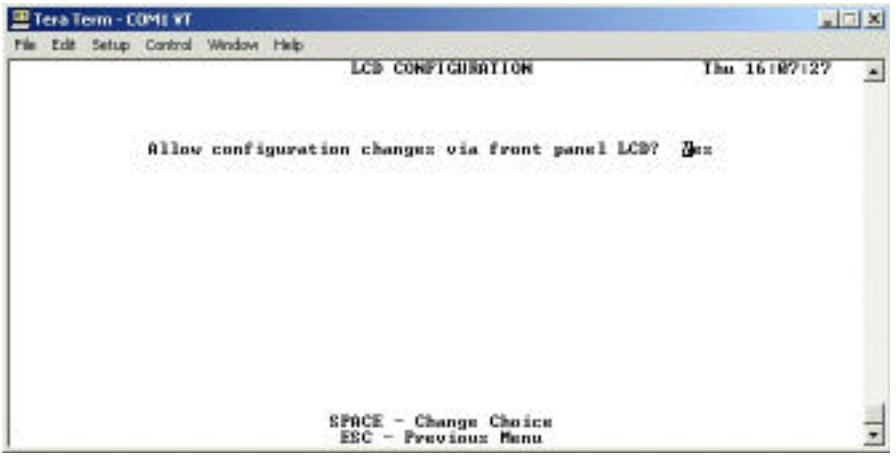

Figure 4-7. The LCD Configuration screen.

4.3.2 The Monitor/Test Menu

Press [2] followed by [Enter] at the Main Menu to bring up the Monitor/Test Menu, shown in Figure 4-8. It can provide alarm status and performance statistics for the T1/E1 ports, control-lead status for both data ports, and a variety of loopback tests.

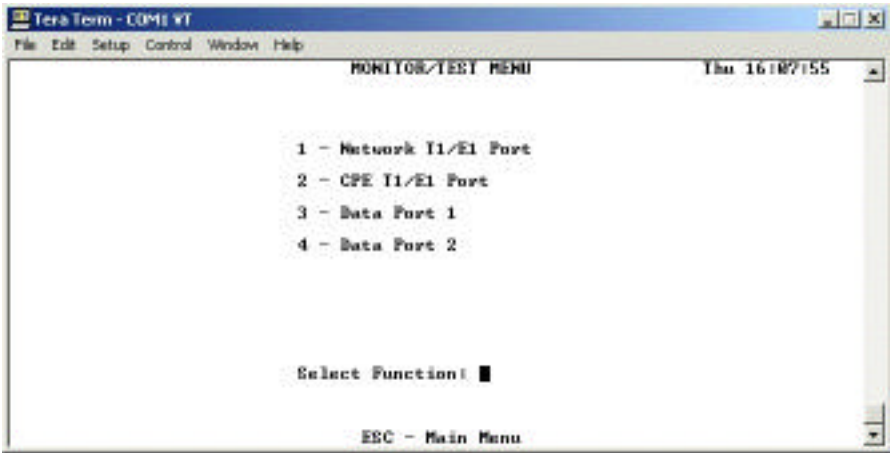

Figure 4-8. The Monitor/Test Menu.

At this menu, select the port that you want to monitor or test by pressing the corresponding number followed by [Enter]. If you select the Network T1/E1 or CPE T1/E1 port and that port is enabled, a screen like that shown in Figure 4-9 will appear. (If the CPE port is disabled, the text "CPE T1/E1 IS INACTIVE" appears instead.)

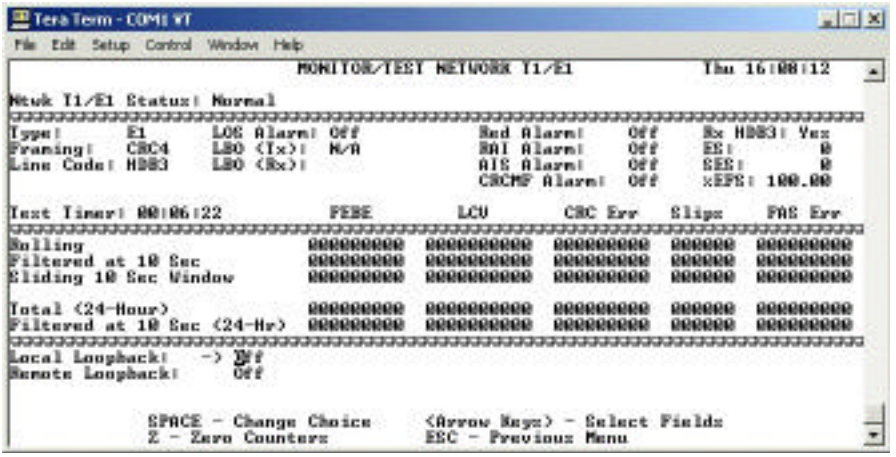

Figure 4-9. An active T1/E1 Monitor/Test screen (Network port shown).

There are three main fields on this screen, which you can use the arrow keys to select between:

- "Ntwk T1/E1 Status" or "CPE T1/E1 Status" shows the status of the port:
  - "Normal" for regular operation,
  - "Loss of Signal Alarm" if receive signal has been lost,
  - "Red Alarm" if the receive signal is out of frame,
  - "AIS Alarm" if the far end is sending an all-ones signal to indicate that they've lost receive signal,
  - "Yellow Alarm" (T1) or "RAI Alarm" (E1) if the far end is signaling that their receive data is out of frame,
  - "CRC Multiframe Alarm" if a large number of frames are being hit with cyclic redundancy check errors.
- You can press the spacebar to toggle "Local Loopback" or "Remote Loopback" on or off for the chosen port (Network or CPE). When a loopback test is turned on, normal data transmission is interrupted and data is looped back toward its source, where the received data can be error-checked against what was originally transmitted. "Local Loopback" means that data received at the local data ports that is destined for the chosen port and has passed through the framer is looped back toward the data ports, while for "Remote Loopback," data received at the chosen port is looped back toward where it came from (the network or CPE).

Below the "Status" report is a section of the screen in which various characteristics and status variables of this port are reported:

- **Type:** Whether the port is configured as "T1" or "E1."
- **Framing:** The port's data-framing format; either "D4" or "ESF" for T1, always "CRC4" (G.703) for E1.
- **Line Code:** The port's line coding; always "B8ZS" for T1 or "HDB3" for E1.
- **LOS Alarm:** "Off" unless the CSU/DSU is currently detecting a loss of signal on this port.
- **LBO (Tx)**: For T1, the Line Build Out for the data currently being transmitted from the port. Will say "N/A" for E1.
- **LBO (Rx)**: (At the time of this writing, this function is not supported.)

- **Alarms:**
  - If "Red Alarm" is not "Off," the data being received at this port is out of frame;
  - If "Yellow Alarm" (T1) or "RAI Alarm" (E1) is not "Off," the data being received at the other end of the link is out of frame;
  - If "AIS Alarm" is not "Off," the other end of the link has lost the receive signal; and
  - If "CRCMF Alarm" is not "Off," the data being received contains abnormally high numbers of cyclic redundancy check errors.

- **Rx B8ZS** (T1) or **Rx HDB3** (E1): Indicates whether the data currently being received at this port is encoded.

- **ES**: The number of errored seconds (seconds during which errors have occurred) that the CSU/DSU has detected since it was most recently initialized.

- **SES**: The number of severely errored seconds (seconds during which the bit-error rate has risen to 1×10^{3} or higher) that the CSU/DSU has detected since it was most recently initialized.

- **%EFS**: The percentage of seconds that the data received at this port has been free of errors since the CSU/DSU was most recently initialized.

While the CSU/DSU is operating, it is continually testing the received data. The "Test Timer" field shows how long this automatic testing has been in progress since the CSU/DSU was most recently initialized. The CSU/DSU automatically reinitializes itself at 12:00 midnight each day, and of course if there is an error or problem you can reset or reboot the CSU/DSU manually (see **Section 4.3.1**) or press "Z" at this menu to restart the tests from zero (see below). The Test Timer has nothing to do with the loopback tests that can be triggered at this screen.

Below the Test Timer field is a section of the screen in which various errors are counted. The counters can be zeroed out (and the Test Timer set back to zero as well) by pressing "Z". Each column in this section tracks a different type of error:

- For T1, the first column is **OOF** (out of frame), an indication that frame was lost. For E1, the first column is **FEBE** (far-end block errors), an indication from the far end that it received a framing or CRC error.

- The second column is **LCV** (line-code violations).

- For T1 with D4 framing, the third column is **F-Bit** (framing-bit errors). For T1 with ESF framing or E1, the third column is **CRC Err** (cyclic redundancy check errors), an indication that data has failed error-checking.
- The fifth column is **Slips** (timing slips).
- For T1 with D4 framing, the sixth column is blank. For T1 with ESF framing, the sixth column is **Fe Err** (Fe-bit errors). For E1, the sixth column is **FAS Err** (frame-alignment-signal errors).

Each row keeps a different type of error total:

- **Rolling**: Continuous total of occurrences for each error since the CSU / DSU was most recently initialized.
- **Filtered at 10 Sec**: Number of ten-second intervals during which each error has occurred since the CSU / DSU was most recently initialized.
- **Sliding 10 Sec window**: Total for each error during the previous ten seconds.
- **Total (24-Hour)**: The total number of occurrences of each error in the 24 hours before the CSU / DSU was most recently initialized.
- **Filtered at 10 Sec (24-Hr)**: The total number of ten-second intervals during which each error occurred in the 24 hours before the CSU / DSU was most recently initialized.

If you select Data Port 1 or 2 from the Monitor / Test Menu, a screen like the one shown in Figure 4-10 on the next page will appear if the port is enabled. It displays some of the port's main configuration parameters, as well as the state of the port's control-signal leads. (If the chosen Data Port is disabled, the text "DATA PORT *N* IS INACTIVE" appears instead.)

Figure 4-10. A Data-Port Monitor/Test screen (Data Port 1 shown).

4.3.3 The Configuration Menu

Press [3] followed by [Enter] at the Main Menu to reach the Configuration Menu, shown in Figure 4-11. From here you can reconfigure the T1/E1 ports, the data ports, and the system-timing (clock) source at dedicated screens. (At these screens, use the arrow keys to move among the various parameters and fields, press the space bar to toggle their values, and press [Escape] to return to the Configuration Menu when you're finished.) When configuration is complete, press [Escape] at this menu; you will be prompted to save the new settings (refer to the end of this section), then returned to the Main Menu.

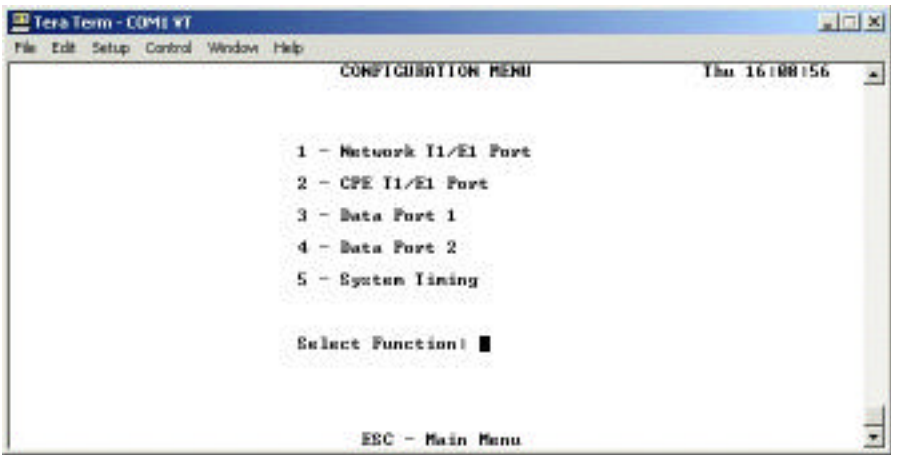

Figure 4-11. The Configuration Menu.

Choose "Network T1/E1 Port Configuration" by pressing [1] followed by [Enter] at the Configuration Menu. A screen will be displayed, as shown in Figure 4-12, where you can choose the framing and Line Build Out settings for this port.

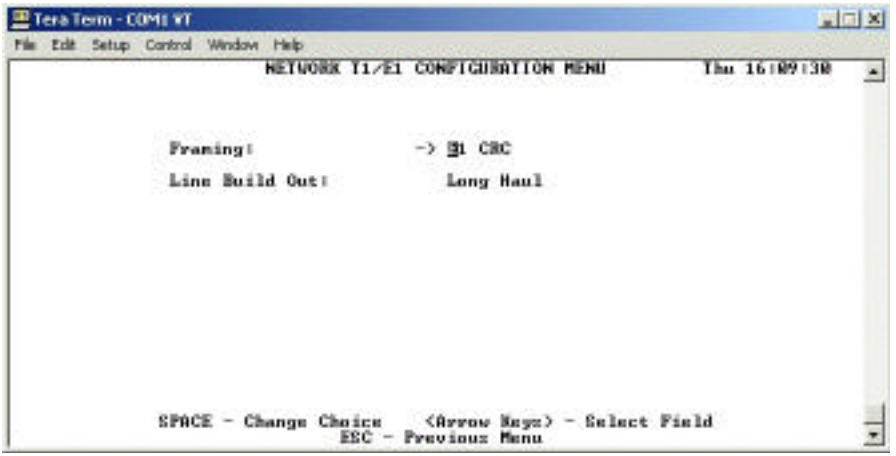

Figure 4-12. The Network T1/E1 Configuration screen.

Choose "CPE T1/E1 Port Configuration" by pressing [2] followed by [Enter] at the Configuration Menu. A screen will be displayed, as shown in Figure 4-13, where you can choose whether to activate the Drop-and-Insert port and, if you do, what framing and Line Build Out it should use.

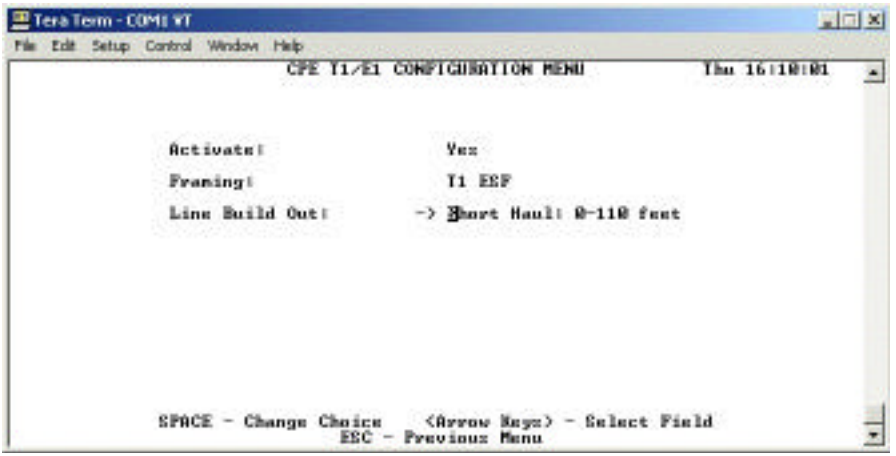

Figure 4-13. The CPE T1/E1 Configuration screen.

Choose “Data Port 1 Configuration” or “Data Port 2 Configuration” by pressing [3] or [4] respectively followed by [Enter] at the Configuration Menu. A screen will be displayed, as shown in Figure 4-14, where you can choose whether to activate that data port and, if you do, what data rate, interface, transmit clock, and RTS/CTS options it should use.

You can also select the port’s DS0 timeslot assignments by moving the cursor to a timeslot with the arrow keys, and then pressing the space bar to toggle the timeslot as assigned or unassigned. Timeslots assigned to this port are denoted by an “X,” unused timeslots by a period, and timeslots assigned to the other port by a “U.” You can’t assign timeslots that have already been assigned to the other data channel. The total bandwidth assigned to this port is shown below the timeslot map.

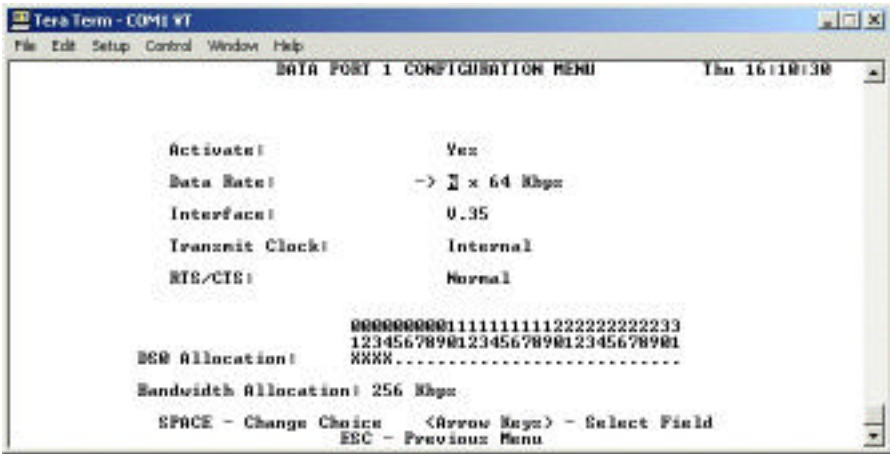

Figure 4-14. The Data Port Configuration screen (Data Port 1 shown).

Choose “System Timing Configuration” by pressing [5] followed by [Enter] at the Configuration Menu. A screen will be displayed, as shown in Figure 4-15, where you can use the space bar to choose the system-timing source as looped (receive-recovered from the network T1/E1 port), internal, receive-recovered from the CPE T1/E1 port, external from data port 1, or external from data port 2.

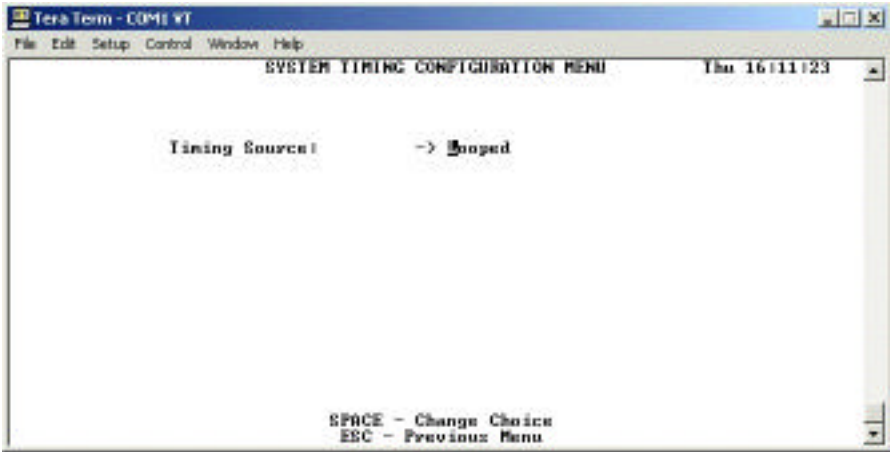

Figure 4-15. The System Timing Configuration screen.

When you finish making your configuration changes, press [Escape] at the Configuration Menu. You will be prompted to save and activate the new settings as shown in Figure 4-16. If you do, note that this saved configuration will overwrite the previous configuration, even if it came from the LCD—see **Section 4.2**. If you don't, any changes you made will be aborted. Either way, you will be returned to the Main Menu.

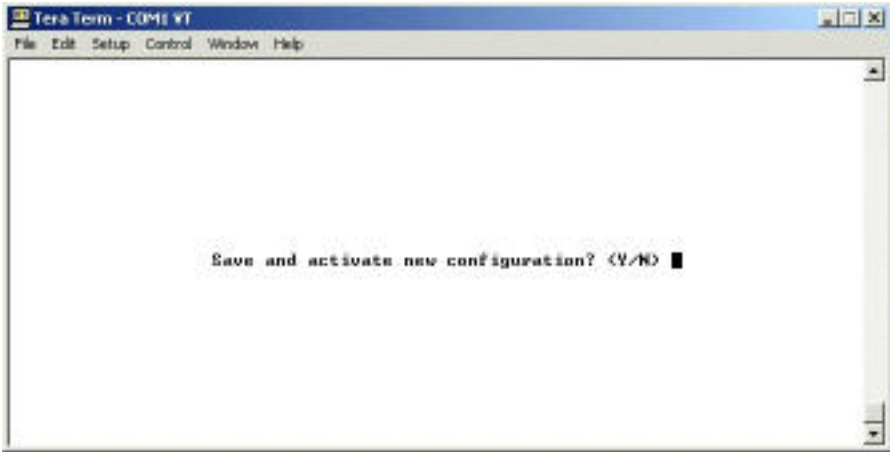

Figure 4-16. The Save New Configuration screen.

4.3.4 Access Levels and the Password Edit Menu

The T1/E1 CSU/DSU – 2 Channel Plus has four access levels, each with its own password. This allows you to give different users different types of access to the CSU/DSU's terminal-based menus. Users who log in at Access Level 1 can only select the "Read Software Versions" and "View Alarm Log" options from the System Functions Menu. Users who log in at Access Level 2 can select any of the options from the System Functions Menu except for "Clear NVRAM," "Install New Software," and "LCD Configuration." Level 2 also allows access to all functions of the Monitor/Test Menu. Users who log in at Access Level 3 can access all of the options in the System Functions, Monitor/Test, and Configuration Menus. Users who log in at Access Level 4 can use the Password Edit Menu (and this is the only accessible menu at this level—log in at Level 3 for other purposes).

At the Password Edit Menu (shown in Figure 4-17), which can only be reached by logging in at Level 4, you can edit the passwords for Levels 1 through 4. Use the arrow keys to select the password to edit, type the new password, and then press [Enter]. (Do *not* forget your passwords! If you do, you'll have to call Black Box Technical Support for help.) When you're finished, press [Escape] to return to the login screen. The default passwords are "one" for Level 1, "two" for Level 2, "three" for Level 3, and "THE MASTER" (with the embedded space) for Level 4. Note that all passwords are case-sensitive.

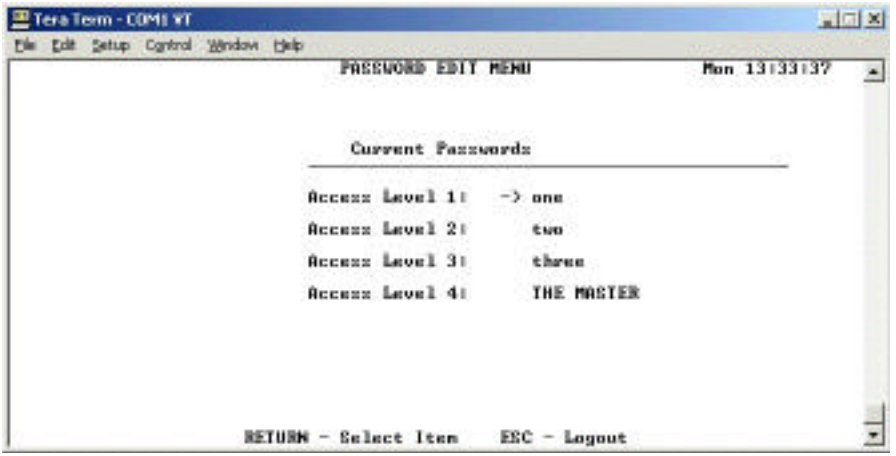

Figure 4-17. The Password Edit Menu.

5. Troubleshooting

5.1 Calling Black Box

If you determine that your T1/E1 CSU/DSU – 2 Channel Plus is malfunctioning, *do not attempt to alter or repair it*. It contains no user-serviceable parts. Contact Black Box Technical Support at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem;
- when the problem occurs;
- the components involved in the problem—cables, devices, etc.;
- any particular application that, when used, appears to create the problem or make it worse; and
- the results of any testing you've already done.

5.2 Shipping and Packaging

If you need to transport or ship your T1/E1 CSU/DSU – 2 Channel Plus:

- Package it carefully. We recommend that you use the original container.
- Before you ship the CU/DSU back to Black Box for repair or return, contact us to get a Return Authorization (RA) number.

Appendix: Pinouts

A.1 Network T1/E1 Port ("NTWK")

This RJ-48C socket is designed to be connected to a balanced T1 or E1 network.

Pin	Signal	Direction
1	Rx Tip	In
2	Rx Ring	In
4	Tx Tip	Out
5	Tx Ring	Out

All other pins N/C.

A.2 CPE T1/E1 Port ("CPE")

This RJ-48C socket is a Drop-and-Insert interface designed to be connected to balanced T1 or E1 customer premise equipment.

Pin	Signal	Direction
1	Tx Tip	In
2	Tx Ring	In
4	Rx Tip	Out
5	Rx Ring	Out

All other pins N/C.

A.3 Data Ports ("DATA PORT 1" and "DATA PORT 2")

These DB25 female connectors are designed to be connected to local data devices. They can be configured to function as RS-232, RS-422/449/530, or V.35 interfaces (see **Sections 4.2** and **4.3.3**). (Adapters or adapter cables will be required to attach RS-449 devices with DB37 connectors or V.35 devices with M/34 connectors.)

Pinout when configured as **RS-232**:

Signal	DB25 Pin	Direction
Protective Ground (PGND)	1	Common
Transmit Data (TD)	2	In
Receive Data (RD)	3	Out
Request to Send (RTS)	4	In
Clear to Send (CTS)	5	Out
Data Set Ready (DSR)	6	Out
Signal Ground (SGND)	7	Common
Received Line Signal Detector (RLSD), a.k.a. Carrier Detect (CD)	8	Out
Transmitter Signal Element Timing – DCE (TSETC), a.k.a. Transmit Clock (TC)	15	Out
Receiver Signal Element Timing – DCE (RSETC), a.k.a. Receive Clock (RC)	17	Out
Data Terminal Ready (DTR)	20	In
Transmitter Signal Element Timing – DTE (TSETT), a.k.a. External Clock (EXTC)	24	In

Pinout when configured as **RS-530** (DB25) or **RS-422/449** (patched to DB37):

Signal	Pair ID	DB25 Pin	DB37 Pin	Direction
Shield (n.a./SHD)	n.a.	1	1	Common
RS-449: Send Data (SD)/	A	2	4	In
RS-530: Transmitted Data (TD)	B	14	22	In
RS-449: Receive Data (RD)/	A	3	6	Out
RS-530: Received Data (RD)	B	16	24	Out
Request to Send (RS/RTS)	A	4	7	In
	B	19	25	In
Clear to Send (CS/CTS)	A	5	9	Out
	B	13	27	Out
RS-449: Data Mode (DM)/	A	6	11	Out
RS-530: DCE Ready (DCR), a.k.a. Data Set Ready (DSR)	B	22	29	Out
Signal Ground (SG/SGND)	n.a.	7	7	Common
RS-449: Receiver Ready (RR)/	A	8	13	Out
RS-530: Received Line Signal Detector (RLSD), a.k.a. Carrier Detect (CD)	B	10	31	Out
RS-449: Terminal Timing (TT)/	A	11	17	In
RS-530: Transmitter Signal Element Timing – DTE (TSETT), a.k.a. External Clock (EXTC)	B	24	35	In
RS-449: Send Timing (ST)/	A	15	5	Out
RS-530: Transmitter Signal Element Timing – DCE (TSETC), a.k.a. Transmit Clock (TC)	B	12	23	Out
RS-449: Receive Timing (RT)/	A	17	8	Out
RS-530: Receiver Signal Element Timing – DCE (RSETC), a.k.a. Receive Clock (RC)	B	9	26	Out
RS-449: Terminal Ready (TR)/	A	20	12	In
RS-530: Data Terminal Ready (DTR)	B	23	30	In

Pinout when configured as **V.35** (patched to M/34):

Signal	Pair ID	DB25 Pin	M/34 Pin	Direction
Shield (SHD)	n.a.	1	A	Common
Send Data (SD)	A	2	P	In
	B	14	S	In
Receive Data (RD)	A	3	R	Out
	B	16	T	Out
Request to Send (RTS)	n.a.	4	C	In
Clear to Send (CTS)	n.a.	5	D	Out
Data Set Ready (DSR)	n.a.	6	E	Out
Signal Ground (SGND)	n.a.	7	B	Common
Received Line Signal Detector (RLSD), a.k.a. Carrier Detect (CD)	n.a.	8	F	Out
Serial Clock Transmit External (SCTE),	A	11	U	In
a.k.a. External Clock (EXTC)	B	24	W	In
Serial Clock Transmit (SCT), a.k.a.	A	15	Y	Out
Transmit Clock (TC)	B	12	AA	Out
Serial Clock Receive (SCR), a.k.a.	A	17	V	Out
Receive Clock (RC)	B	9	X	Out
Data Terminal Ready (DTR)	n.a.	20	H	In

A.4 Terminal Port ("TERMINAL")

This RJ-45 socket is designed to be connected to a terminal or terminal-emulating PC. An adapter or adapter cable will be required to attach a PC or terminal with DB9 or DB25 connectors.

Signal	RJ-45 Pin	DB9 Pin	DB25 Pin	Direction
Received Line Signal Detector (RLSD), a.k.a. Carrier Detect (CD)	2	1	8	Out
Data Terminal Ready (DTR)	3	4	20	In
Signal Ground (SGND)	4	5	7	Common
Receive Data (RD)	5	2	3	Out
Transmit Data (TD)	6	3	2	In
Clear to Send (CTS)	7	8	5	Out
Request to Send (RTS)	8	7	4	In

All other pins/signals N/C.

DISCLAIMER

The manufacturer and its authorized agents shall in no event be liable for any general, indirect, or consequential damages arising out of or caused by the use of or the inability to use the T1/E1 CSU/DSU – 2 Channel Plus.

NOTES

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