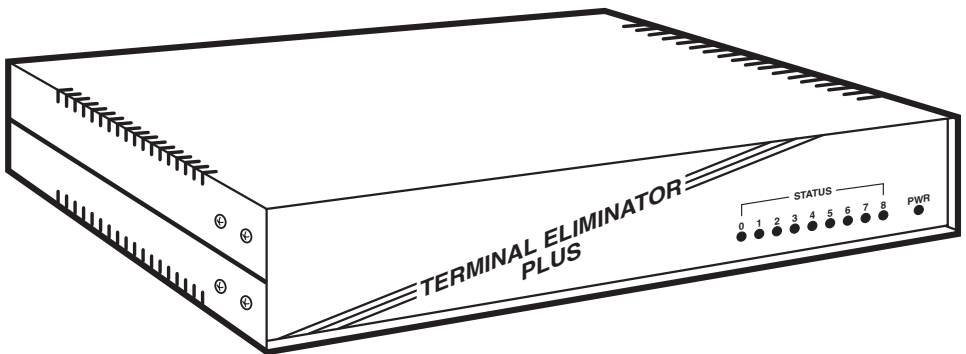




Terminal Eliminator Plus



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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 J 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.

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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 classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.



This product is CE certified. This certificate indicates that the product is suitable for use in commercial and light industrial environments as defined in EN 50081-1:1992.

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 conectado 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 física 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 líneas de energía.
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 objetos líquidos 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: Objetos 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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NOTE

Call Technical Support at 724-746-5500 for guidance in choosing cables.

1. Specifications

Approval — FCC Class A, DOC Class/MDC classe A

Interface — Serial EIA RS-232-C/CCITT V.24, each port individually selectable as DTE or DCE

Protocol — Asynchronous

Data Format — 7 or 8 data bits (each port individually selectable); automatically adjusts to any stop-bit setting; even, odd, or no parity (each port individually selectable)

Flow Control — Hardware (DTR/CTS), software (X-ON/X-OFF), or (master port only) X-ON/poll (each port individually selectable)

Operating Mode — Full duplex

Data Rates — 110, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bps (each port individually selectable)

Internal Memory — 31K buffer, expandable to 59K

User Controls — Keyboard commands from master device; (1) Internal reset pushbutton

Indicators — (10) Front-mounted LEDs: (1) Power, (9) Port Activity

Connectors — Standard 5-port unit (TL482A[E]-R3): (5) DB25 female; Standard unit plus 4-Port Expansion Board (TL483-C): (9) DB25 female

Pins Supported — 1, 2, 3, 4, 5, 6, 7, 8, 20, and 22

Power — *For 120-VAC, 60-Hz operation:* From wallmount power supply: Optimal input: 115 VAC, 60 Hz @ 175 mA; Output: 18 VAC CT @ 2.2 A; *For 240-VAC, 50-Hz operation:* From wallmount power supply: Optimal input: 230 VAC, 50 Hz @ 90 mA; Output: 18 VAC CT @ 2.2 A

Mean Time Between Failures (Ground-Benign Environment) — Standard unit: 20,000 hrs.; Standard unit with expansion board: 16,000 hrs.

Operating Temperature — 32° to 113°F (0° to 45°C)

Storage Temperature — -4° to 158°F (-20° to 70°C)

Humidity — 0 to 95% relative humidity, non-condensing

Enclosure — Steel

Size — 2.5"H x 12.1"W x 11.1"D (6.4 x 30.8 x 28.2 cm)

Weight — Net: 6.6 lb. (3 kg); With expansion board: 7.2 lb. (3.3 kg); With power supply: 8.7 lb. (3.9 kg); With expansion board and power supply: 9.3 lb. (4.3 kg)

2. Introduction

The Terminal Eliminator Plus (TEP) is named for one of its primary uses—to eliminate the need for more than one operator console in a computerized information-gathering system. The TEP allows one asynchronous terminal to serve as the operator's console (the "master") for up to four (eight with the optional 4-Port Expansion Board) serial async input devices ("slaves") such as CPUs, data loggers, data concentrators, data PABXs, network management systems, and intelligent test-data sets/analyzers. For applications requiring more than eight slave ports, multiple TEPs can be connected together in a method called "cascading": cable is run from the slave port of one unit to the master port of another. You can cascade three "layers" of TEPs from a main TEP for a maximum of 4096 possible slave ports.

The Terminal Eliminator Plus is especially suited for applications where most of the operator's console use is devoted to receiving output-log messages and status reports with an occasional need for interactive responses from the keyboard. Two primary types of applications are typical:

(A) Using the TEP to concentrate the console output of many mainframe computers in a large computer center to one operator's console. The operator will then receive all messages (to mount magtapes, etc.) at one convenient location.

(B) Using the TEP to poll or concentrate the output from other devices such as bar-code readers, scales, security systems, etc., to a master PC. This PC will be running a program created or purchased by the customer to extract and interpret the data from the TEP and act on it according to the customer's needs: create files from the data, print scale weights to an attached printer, etc.

The standard Terminal Eliminator Plus supports four input devices and one output device. It has 32K of RAM, of which approximately 31K is devoted to buffering. You can expand your TEP's input-port capacity and/or RAM with the following items:

- The 4-Port Expansion Board (our product code TL483-C) provides four additional input ports. (This manual reports numbers for the standard five-port TEP in the main text, but follows these with numbers for the expanded nine-port TEP in parentheses.)
- The RAM Upgrade (our product code TL484) provides 32K of additional RAM, of which 28K is devoted to buffering.

2.1 The Data-Direction Modes

The Terminal Eliminator Plus operates in five basic data-direction settings (“modes”): Concentrate Only, Concentrate & Broadcast, Conversation, Transparent Conversation, and Broadcast Only. Certain commands are available in each mode; see **Section 5.2**.

In Concentrate Only Mode (slaves → master), the TEP assembles messages received from up to four (or eight) slaves at speeds (independent on each port) of up to 19.2 Kbps. It stores the messages in its internal buffer until the master is available to receive the data. The TEP then outputs the messages to the master at speeds up to 19.2 Kbps. It checks data coming in from the master for commands but doesn’t transmit master-port data to any of the slave ports.

In Concentrate & Broadcast Mode (slaves ↔ master), the TEP concentrates all slave data into one data stream and transmits it to the master. It checks data coming in from the master for commands, and non-command data is broadcast to all slave ports.

When interactive operation is required, you can access Conversation Mode (slave ↔ master) to allow the master device or user to communicate bidirectionally with one selected slave device. The master port’s non-command data is transmitted to the single slave the master selects. This slave’s data is transmitted to the master in the format you established at installation and initialization time (see **Chapters 3 and 4**). Messages from other devices are buffered until you exit Conversation Mode.

In Transparent Conversation Mode (slave ↔ master), the master port’s non-command data is once again transmitted to the single slave the master selects, and data from other slaves is buffered until the conversation is over. But under this setting the slave’s data is transmitted to the master “transparently” (without formatting or any other changes).

Broadcast Only Mode (slaves ← master) allows you to send messages to all input devices simultaneously. The master’s non-command data is broadcast to all slaves; data from the slaves is buffered but is not sent to the master until the operator exits Broadcast Mode.

These and other functions of your TEP are further described in **Chapter 5**.

2.2 The Front-Panel LEDs

There are a total of 10 LEDs located on the unit's right front panel: nine Port-Status LEDs (numbered 0 through 8) and one Power LED. The Power LED will be *lit* when the Terminal Eliminator Plus is getting power and will be *dark* when the TEP is unplugged or is not getting power. Each Port-Status LED will *flash* or *blink* if data is being transmitted or received by the corresponding port, *be steadily lit* if there is a buffer overflow on the corresponding port, or *remain dark* if there is no data activity on the corresponding port. On standard units without the 4-Port Expansion board, LEDs 5 through 8 will always be dark.

2.3 The Internal DIP Switches and Reset Button

All of the hardware controls for your Terminal Eliminator Plus are internal. Of most importance are the DIP switches: two "system switches" SWF and SWG, which determine data formatting and allow you to tailor the unit's major functions to the needs of your application, and five (or nine) "port switches" SWA through SWE (plus SWH through SWK, if you have the 4-Port Expansion Board), which determine data speeds, word structure, etc.

The TEP also has a reset button mounted on its motherboard. This button is used to reinitialize the TEP: Any time you make modifications to the internal switch settings, you can hit the reset button to activate the changes. (No data can be processed while the TEP is reinitializing. Unplugging and replugging the TEP will also reset the unit.)

3. Installation

Installing the Terminal Eliminator Plus (TEP) involves between four and eight steps, depending on your application:

1. Setting the internal DIP switches.
2. Configuring the DTE/DCE shunt jumpers.
3. Tying signal ground to frame ground with jumper W1 (optional).
4. Inserting the RAM upgrade chip (optional).
5. Installing the 4-Port Expansion Board (optional).
6. Rackmounting the TEP (optional).
7. Connecting your devices to the slave ports and master port.
8. Connecting the TEP to electric power.

3.1 Setting the Internal DIP Switches

There are six screws screwed into the enclosure on either side of the TEP: three above a horizontal seam, three below. For each side, unscrew and retain the three screws above the seam. This will allow you to remove the cover of the unit's enclosure and expose the motherboard.

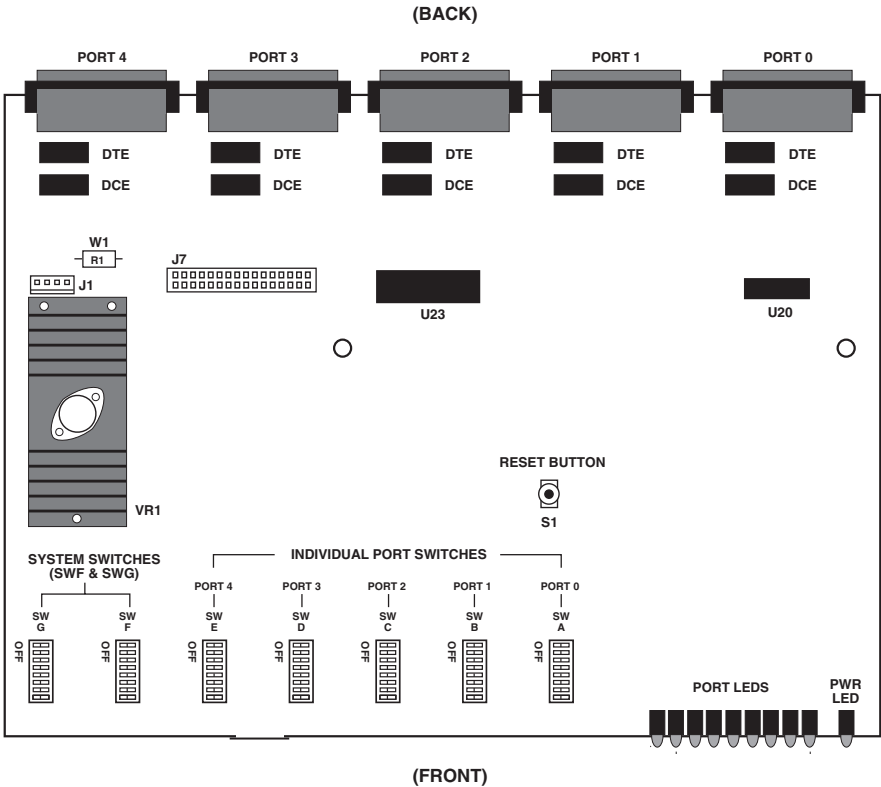
Figures 3-1 and 3-2 on the next two pages show the location of the TEP's internal DIP switches for the standard 5-port unit and for the 4-Port Expansion Board. There are two types of internal DIP switches: option switches for individual ports (SWA-SWE and SWH-SWK) and system-option switches that affect all ports (SWF and SWG). The possible switch settings are discussed in **Sections 3.1.1** and **3.1.2**.

3.1.1 INDIVIDUAL PORT SWITCHES

Each port can be configured individually for the following options:

- Baud Rate: 110, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bps
- Parity: Even, odd, or none
- Data Bits per Word: 7 or 8
- Flow Control: Hardware (DTR/CTS) or software (X-ON/X-OFF); also (master port only) X-ON/poll
- Buffer Control (slave ports only): Always buffer data or only buffer in Conversation modes
- Trigger Reinitialization and Load Defaults (master port only)

Fig. 3-1. The Terminal Eliminator Plus's motherboard.

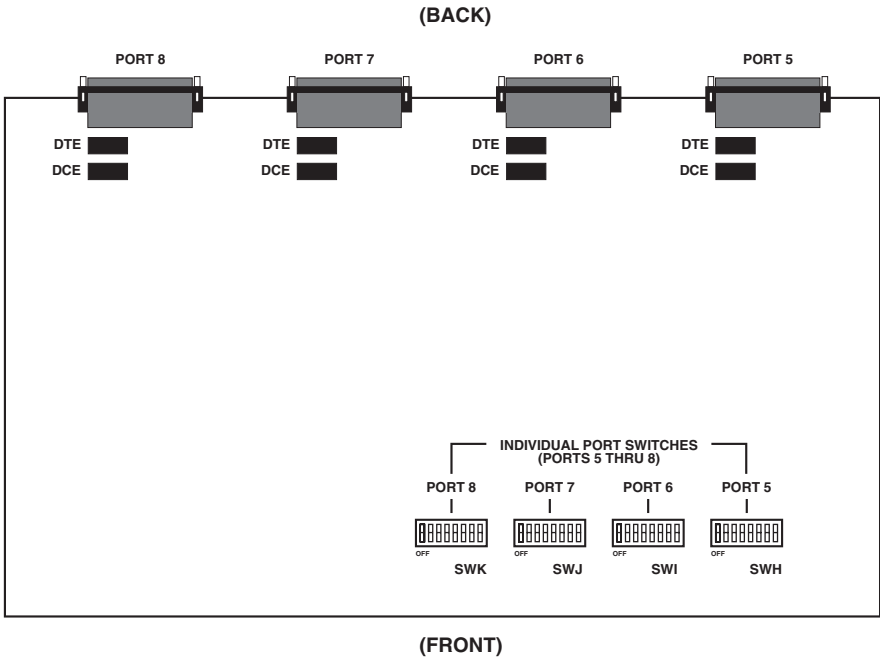


The DIP switches that correspond to each port:

On the standard unit's motherboard (as shown above in Figure 3-1):

- SWA - for the master port [0]
- SWB - for slave port 1
- SWC - for slave port 2
- SWD - for slave port 3
- SWE - for slave port 4

Fig. 3-2. The 4-Port Expansion Board.



On the 4-Port Expansion Board (as shown above in Figure 3-2):

- SWH - for slave port 5
- SWI - for slave port 6
- SWJ - for slave port 7
- SWK - for slave port 8

Table 3-1 on page 9 lists the possible settings for the master port’s switch, SWA. Table 3-2 on page 10 lists the possible settings for each slave port’s switch. You can set the expansion-board switches before you actually insert the board into the TEP; just be careful not to bump the switches when you insert the board.

(text continues on page 16)

TERMINAL ELIMINATOR PLUS

Table 3-1. The Master-Port DIP Switch (SWA)

OPTION	SWITCH-POSITION SETTING							
	1	2	3	4	5	6	7	8
SPEED (in bps)								
110	ON	ON	ON					
300	OFF	ON	ON					
600	ON	OFF	ON					
1200	OFF	OFF	ON					
2400	ON	ON	OFF					
4800	OFF	ON	OFF					
9600	ON	OFF	OFF					
19,200	OFF	OFF	OFF					
PARITY				Invalid Setting*				
None				OFF	ON			
Even				ON	OFF			
Odd				OFF	OFF			
None								
DATA BITS								
Eight						ON		
Seven						OFF		
FLOW CONTROL/ RELOAD (Reload)**							ON	ON
X-ON/Poll†							OFF	ON
DTR/CTS							ON	OFF
X-ON/X-OFF							OFF	OFF

*When both switches are set to ON, the TEP will generate a self-test message.

**When positions 7 and 8 are set to ON, the TEP resets itself and reloads its NVRAM with the factory-default values for all items on its initialization menu. (This will come in handy if a menu option is set wrong in such a way that it prevents you from activating the menu to fix it.) Set one or both of these positions OFF and reset the unit again before using the TEP.

†When the TEP receives an X-ON from the master device, it transmits one complete record (if it has received one), then X-OFFs itself until it receives another X-ON from the master device.

See **Section 5.6**.

Table 3-2. The Slave-Port DIP Switches (SWB-SWE, SWH-SWK)

OPTION	SWITCH-POSITION SETTING							
	1	2	3	4	5	6	7	8
SPEED (in bps)								
110	ON	ON	ON					
300	OFF	ON	ON					
600	ON	OFF	ON					
1200	OFF	OFF	ON					
2400	ON	ON	OFF					
4800	OFF	ON	OFF					
9600	ON	OFF	OFF					
19,200	OFF	OFF	OFF					
PARITY								
None				ON	ON			
Even				OFF	ON			
Odd				ON	OFF			
None				OFF	OFF			
DATA BITS								
Eight						ON		
Seven						OFF		
FLOW CONTROL DTR/CTS							ON	
X-ON/X-OFF							OFF	
BUFFER CONTROL*								
Buffer data in Conversation modes only								ON
Always buffer								OFF

*See Section 5.5.3.

3.1.2. SYSTEM-OPTION SWITCHES

There are two DIP switches on the motherboard, labeled SWF and SWG (see Figure 3-1). The possible settings for these switches are listed in Table 3-3 below and Table 3-4 on page 11. The options corresponding to each setting are described in more detail in the text starting on page 12.

Table 3-3. The System DIP Switch SWF

OPTION	SWITCH-POSITION SETTING							
	1	2	3	4	5	6	7	8
STATUS MESSAGES								
Disabled	ON							
Enabled	OFF							
STANDARD MODE								
Concentrate and Broadcast		ON						
Concentrate Only		OFF						
BROADCAST-MODE FLOW CONTROL								
Acknowledged			ON					
Ignored			OFF					
ECHO MASTER INPUT								
Enabled				ON				
Disabled				OFF				
CARRIAGE RETURN BEFORE DATA FROM DIFF. SLAVE								
Enabled					ON			
Disabled					OFF			
LINE-LABELING STYLE								
Label all lines from same slave						ON		
Label first lines only						OFF		
LABEL ISOLATION								
Place label on line by itself							ON	
Place label on same line as data							OFF	
SLAVE DATA THAT PRECEDES "BEGINNING RECORD" CHAR.								
Pass it								ON
Throw it away								OFF

Table 3-4. The System DIP Switch SWG

OPTION	SWITCH-POSITION SETTING							
	1	2	3	4	5	6	7	8
RECEIVED CARRIAGE-RETURN STRIPPING								
Disabled	ON							
Enabled	OFF							
RCVD. LINE-FEED STRIPPING								
Disabled		ON						
Enabled		OFF						
OTHER NONPRINTABLE-CHARACTER STRIPPING								
Disabled			ON					
Enabled			OFF					
CARRIAGE-RETURN INSERT AT END OF RECORD								
Disabled				ON				
Enabled				OFF				
TRANSMISSION DELAY AFTER CARRIAGE RETURNS								
Enabled (100-ms delay)					ON			
Disabled (no delay)					OFF			
LINE-FEED INSERT AFTER CARRIAGE RETURNS								
Disabled						ON		
Enabled						OFF		
SLAVE-DATA TRANSMISSION								
Transmit one record from current slave, one from next slave, etc.							ON	
Transmit records from current slave until timeout occurs, then switch							OFF	
POSITION 8 RESERVED FOR FUTURE USE								—

NOTE: The SWG options are for data received from slaves and transmitted to the master only.

3.1.2.A Status Messages (SWF Position 1)

If you want the Terminal Eliminator Plus to inform users of its current mode or of mode changes with status messages, set position 1 of DIP switch SWF to OFF: Status messages will be enabled. (For examples of these status messages, see **Section 5.1.2.**)

If status messages would be superfluous or counterproductive, disable them by setting position 1 ON.

3.1.2.B Standard Mode (SWF Position 2)

After the TEP is reset, or after the user exits the Broadcast Only Mode or either Conversation Mode by sending the “Disconnect” or “Abort” command string, the TEP will default to a standard mode in which data from the slave ports is concentrated. If you want this standard mode to be Concentrate and Broadcast, in which non-command data from the master is simultaneously broadcast to the slaves, set position 2 of SWF to ON. If, on the other hand, you want the standard mode to be Concentrate Only, in which non-command data from the master is discarded, set position 2 OFF.

3.1.2.C Broadcast-Mode Flow Control (SWF Position 3)

When the Terminal Eliminator Plus receives data from the master to be broadcast to all slaves, and one or more of the slaves have flow-controlled the TEP OFF, you have two options. You can choose for the TEP to buffer the broadcast data, then transmit it all at once when all the slaves are ready to receive it, by setting position 3 of SWF to ON. Alternatively, you can choose for the TEP to just skip any port that is flow-controlled OFF, and discard the copy of the data it would have sent to that slave, by setting position 3 OFF.

3.1.2.D Echo Master Input (SWF Position 4)

If your master device doesn't automatically display what you type at its keyboard on its monitor (some older terminals, for example), you might want to enable the echoing of master-port data back to the master device so that users can see what they're doing: Set position 4 of SWF to ON. We don't recommend this setting: It creates a lot of work for the TEP's CPU and degrades the TEP's performance. A better solution, if possible, would be to configure the master device to do the echoing (perhaps by setting its internal switches to half-duplex). In most circumstances, you'll probably want to disable the echo by setting position 4 OFF.

3.1.2.E Slave-Data Separation (SWF Position 5)

To improve the readability of the data that comes to the master from the slaves, you might want the Terminal Eliminator Plus to separate data from different slaves with a blank line by inserting a carriage return in front of the first line from a new slave: Set position 5 of SWF to ON. If this would be superfluous or counterproductive, set position 5 OFF.

3.1.2.F Line-Labeling Style (SWF Position 6)

You can assign identifying labels to slaves, so that any given batch of data can be identified as having come from one or another particular device (see **Sections 4.2.3 and 5.5.4.B**). If you want these labels to appear before each line of data, set position 6 of SWF to ON. If you want these labels to appear only before the first line of data from each slave, set position 6 OFF. See **Section 5.5.4.C**.

3.1.2.G Label Isolation (SWF Position 7)

If you want labels to appear on the same lines as the data records, set position 7 of SWF to OFF. If you want labels to appear on lines by themselves, set position 7 ON.

3.1.2.H Slave Data That Precedes “Beginning Record” Char. (SWF Position 8)

You can assign a character that the Terminal Eliminator Plus will recognize as the “beginning record” character: the character that marks where a slave’s data record begins (see **Sections 4.2.1 and 5.5.3**). If you want the TEP to discard any slave data that precedes the “beginning record” character, set position 8 of SWF to OFF. If you want the TEP to hang onto slave data that precedes this character, and transmit it with the rest of the record (assuming the “beginning record” character is eventually received), set position 8 ON. If you are not going to use a “beginning record” character, the setting of this position is irrelevant.

3.1.2.I Received Carriage-Return Stripping

If you want the TEP to strip carriage returns out of data records it receives from slaves before it retransmits them to the master, set position 1 of SWG to OFF. If you want the TEP to leave the carriage returns in, set position 1 ON.

3.1.2.J Received Line-Feed Stripping

If you want the TEP to strip line feeds out of data records it receives from slaves before it retransmits them to the master, set position 2 of SWG to OFF. If you want the TEP to leave the line feeds in, set position 2 ON.

3.1.2.K Other Nonprintable-Character Stripping (SWG Position 3)

To assure that your master device isn't adversely affected by unexpected control codes, you might want the TEP to strip nonprintable characters (not including carriage returns and line feeds) out of the data records it receives from slaves before it retransmits them: Set position 3 of SWG to OFF. If you want the TEP to leave the nonprintable characters in, set position 3 ON.

3.1.2.L Carriage-Return Insert After End of Record (SWG Position 4)

If you want the Terminal Eliminator Plus to insert a carriage return at the end of each valid slave record that doesn't already end with a carriage return, set position 4 of SWG to OFF. If you don't want the TEP to insert any carriage returns, set position 4 ON.

3.1.2.M Transmission Delay After Carriage Returns (SWG Position 5)

If your master device is an older hardcopy-display unit that needs a delay after each carriage return to move its print head, you will want to set position 5 of SWG to ON, which will cause the TEP to wait for 100 ms (one-tenth of a second) after transmitting a carriage return to the master before transmitting more data. If you have no need for this delay, set position 5 OFF.

3.1.2.N Line-Feed Insert After Carriage Returns (SWG Position 6)

If you want the Terminal Eliminator Plus to insert a line feed after every carriage return it transmits to the master, set position 6 of SWG to OFF. If you don't want the TEP to insert line feeds, set position 6 OFF.

3.1.2.O Slave-Data Transmission (SWG Position 7)

If you want the TEP to switch from one slave's data stream to the next on a record-by-record basis, set position 7 of SWG to ON. If you don't want the TEP to switch to another slave until the "no receive" timeout occurs (usually after several records are transmitted from the current slave), set position 7 OFF. See **Section 5.5.4.O**.

3.2 Configuring Shunt Jumpers for DTE or DCE

Each of the 5 (or 9) ports has a bank of shunt jumpers located next to its port connector on the rear of the internal circuit boards (refer to Figures 3-1 and 3-2). These jumpers allow each port to be configured as either Data Terminal Equipment (DTE) or Data Communications Equipment (DCE). This feature eliminates the need for crossover cables to connect your equipment to the Terminal Eliminator Plus. Standard straight-through cabling is all that is required.

Table 3-5, below, shows the RS-232 signals used by the Terminal Eliminator Plus and their directions at a given port when that port is configured as DTE or DCE.

Table 3-5. Input and Output Signals with a Terminal Eliminator Plus's Port as a DTE or DCE

AS A DTE	AS A DCE	SIGNAL DIRECTION
TXD (2)	RXD (3)	Output from TEP
RXD (3)	TXD (2)	Input to TEP
RTS (4)	DCD (8)	Output from TEP
CTS (5)	DTR (20)	Input to TEP
N/A	DSR (6)	Output from TEP
DCD (8)	RTS (4)	Input to TEP
DTR (20)	CTS (5)	Output from TEP
RI (22)	N/A	Input to TEP

3.3 Tying Signal Ground to Frame Ground (Optional)

Figure 3-1 shows the location of jumper position W1 on the Terminal Eliminator Plus's motherboard. This position is left open at the factory; close it if you want to tie signal ground to frame ground. To do this, we recommend that you solder a 100- Ω , 0.5-W resistor in location W1. You can use a wire jumper instead of a resistor, but be careful that ground circulating currents are limited to acceptable levels.

3.4 Inserting the Memory-Expansion Chip (Optional)

Follow the procedure described in this section to insert the 32K Memory Expansion integrated circuit (IC) chip (part number TL484).

CAUTION!

If this procedure is not performed correctly, the TEP might not work right. Please note that the IC is susceptible to static discharge and can be permanently damaged if not handled properly. Do not remove the IC from its packing container until you are ready to use it. Discharge any static electricity from yourself before you begin the upgrade procedure.

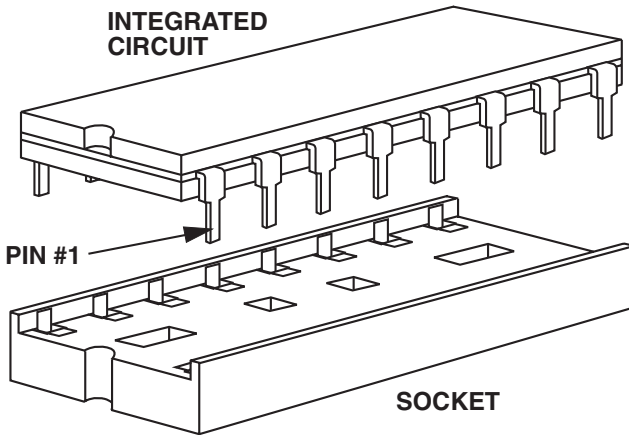
(If you are performing this upgrade on a previously installed and operated Terminal Eliminator Plus, rather than at initial installation time, unplug the TEP and remove its cover as described in **Section 3.1.**)

First, locate the empty chip socket labeled "U6" on the motherboard. This socket is not shown in Figure 3-1, but it is directly behind the front-panel LEDs. Position the IC so that its notch is lined up with the notch in the socket, as shown in Figure 3-3 on the next page. Place the IC on top of the socket, making sure all of the pins are lined up with their respective receptacle holes.

(Occasionally, the distance between one row of pins and the other row on the new IC may be wider than the distance between the rows in the socket. If this is the case, lay the IC on its side, on top of a flat surface, with the pins facing toward you. Gently press down on the IC, bending all of the pins slightly inward. This will decrease the distance between the rows of pins and allow the IC to be inserted in the socket.)

Now gently press the IC into the socket. Continue to press downward on the IC until it is fully seated. The IC is now installed and will provide 28K of additional buffer RAM (32K minus 4K used by the TEP).

Fig. 3-3. The orientation of the RAM-upgrade chip and its socket.



(If you are performing this upgrade on a previously installed and operated TEP, rather than at initial installation time, put the cover back on and plug the TEP back in to resume operation.)

NOTE: If later, after operating the upgraded TEP, you determine that the IC isn't working correctly, unplug the unit, remove its cover, then remove the IC by following this procedure:

1. Insert a small screwdriver between the IC and its socket.
2. Very gently pry one end of the IC partially up from the socket.
3. Insert the screwdriver at the other end of the IC and very gently pry that end of the IC partially up from the socket.
4. Continue to alternately pry up one end, then the other, until the IC is free.

After removing the IC, check it for bent pins or any other physical damage. If a pin is bent, straighten the pin with a small screwdriver or pliers and then reinsert the IC. Replace the cover, plug the TEP back in, and test the unit's buffering capacity. If the problem hasn't been solved, contact Black Box.

3.5 Expansion-Board Installation (Optional)

The 4-Port Expansion Board (part number TL483-C) comes with the following hardware, which you will use to mount the board:

- 2 spacers (standoffs)
- 8 screwlocks
- 1 screw

Proceed as follows and refer to Figure 3-4, on the next page, to install the 4-Port Expansion Board:

(If you have already set the port switches, be careful not to bump them. If you are performing this expansion on a previously installed and operated Terminal Eliminator Plus, rather than at initial installation time, unplug the TEP and remove its cover as described in **Section 3.1.**)

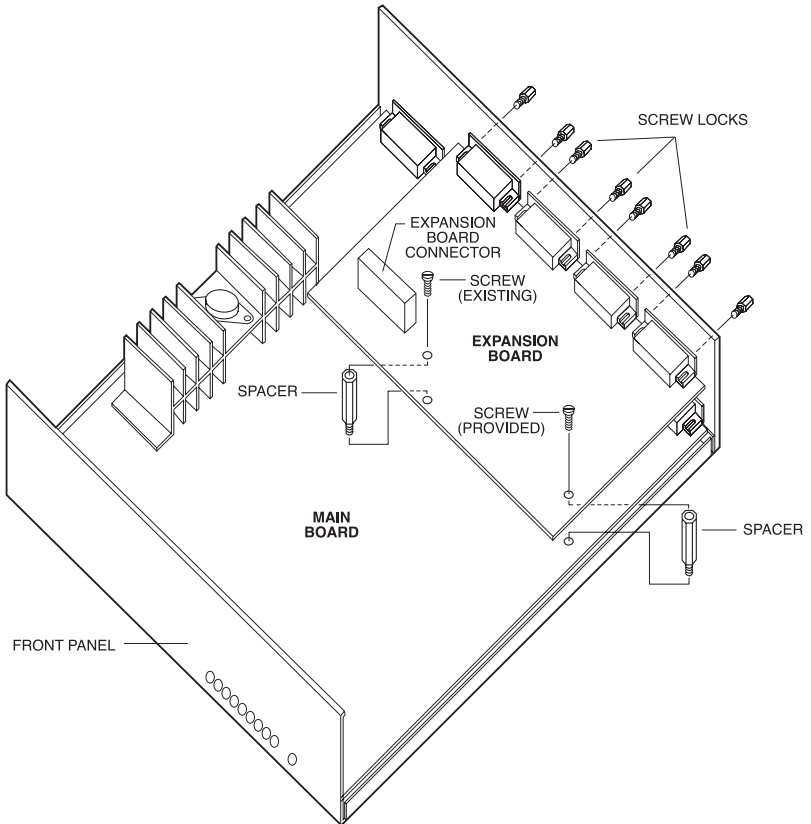
1. Remove the screw located near IC chip U23 on the motherboard. Do not discard this screw.
2. Insert one of the spacers in the hole from which you took the screw.
3. Insert the other spacer in the hole located near IC U20 on the motherboard.
4. Line up the port connectors on the 4-Port Expansion Board with the holes in the back cover. Make sure the pin connector on the bottom of the Expansion Board is aligned properly with the pin socket on the motherboard. Carefully press the pin connector into the pin socket.

CAUTION!

DO NOT FORCE THE CONNECTOR AND SOCKET TOGETHER. Excessive force may damage the pins. If the connector and socket don't fit together easily, realign them and try again.

5. The four RS-232 connectors on the Expansion Board line up with four cutouts in the back panel of the TEP. Each cutout has a bulge on either side to allow access to the corresponding connector's screwlock holes. Screw the eight screwlocks into these holes.

Fig. 3-4. Installing the 4-Port Expansion Board.



6. Screw the screw you removed in Step 1 through either spacer hole in the Expansion Board, into the corresponding spacer.
7. Screw the screw provided with the Expansion Board through the other spacer hole, into the other spacer.

The 4-Port Expansion Board is now installed. (If you haven't set the Expansion Board's switches yet, see **Section 3.1**. If you are performing this upgrade on a previously installed and operated TEP, rather than at initial installation time, put the cover back on and plug the TEP back in to resume operation.)

3.6 Rackmounting the TEP (Optional)

Follow the procedure described in this section to install the Terminal Eliminator Plus in a rack by using the Rackmount Kit (our product code TL486).

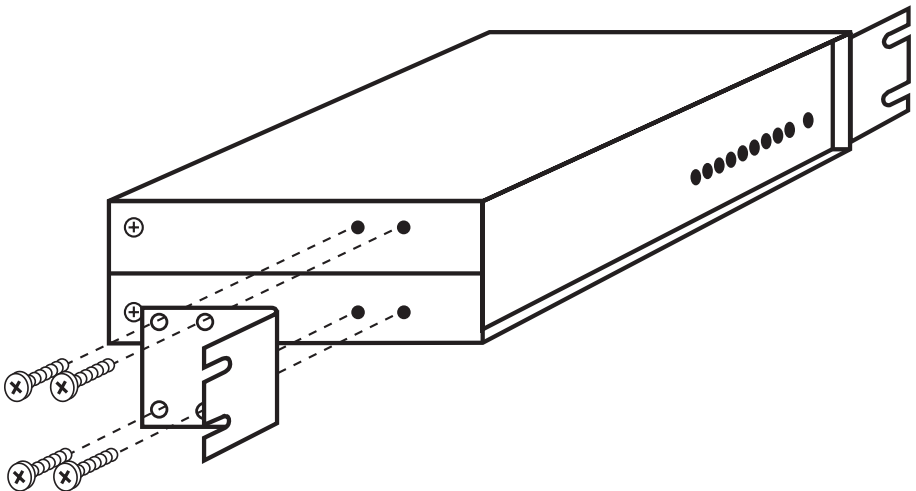
NOTE

The Rackmount Kit consists only of two rackmount brackets. It does not contain the necessary hardware (screws, clips, bolts, etc.) to mount the brackets to the rack. Before installing the Terminal Eliminator Plus in a rack, make sure that all the switches and jumpers have been set to the desired settings, as described in Sections 3.1 through 3.3. If this is part of your initial TEP installation rather than a later alteration, make sure that the internal power-supply connector is properly attached to the 4-pin male connector on the motherboard, then replace the unit's cover.

1. Remove (but don't discard) the front four screws from each side of the Terminal Eliminator.
2. Position the rackmount brackets as shown in Figure 3-5, below.
3. Screw each set of four screws that you removed in Step 1 through the holes in the corresponding rackmount bracket and back into the holes in the Terminal Eliminator. (Make sure these screws are tight.)

NOTE

Fig. 3-5. Attaching the rackmount brackets.

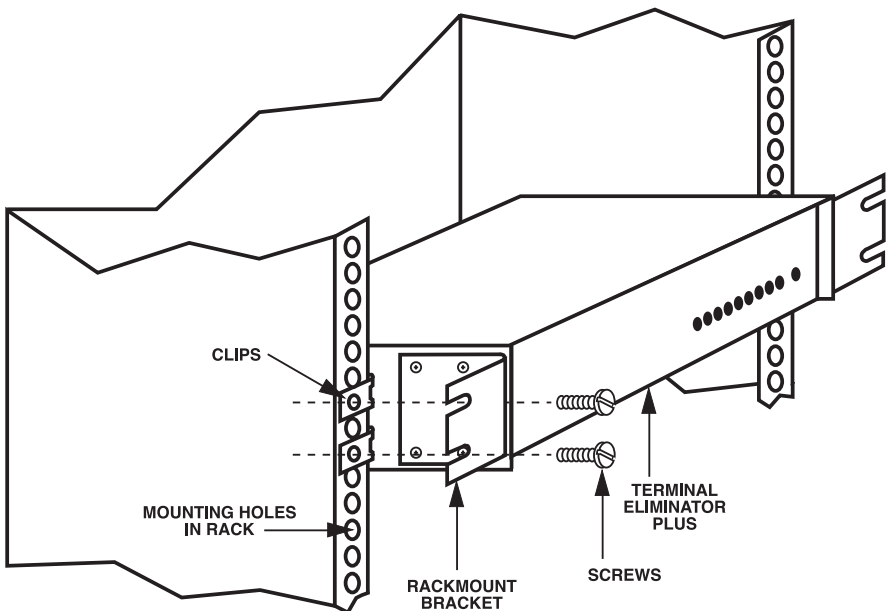


Steps 4 through 6 are given as a general guide. The actual procedure may vary slightly depending upon what sort of mounting hardware you have.

4. Position rackmount clips over the mounting holes on the rack (see Figure 3-6).
5. Align the grooves in the TEP's rackmount brackets with the clips you just attached to the rack.
6. Screw four mounting screws (not supplied) through the grooves in the brackets and into the clips on the rack. (As before, make sure these screws are tight.)

The Terminal Eliminator Plus is now installed in your equipment rack.

Fig. 3-6. Mounting the TEP in a rack.



3.7 Connecting Devices to the Master and Slave Ports

Once you have configured the Terminal Eliminator Plus's internal switches and jumpers, (optionally) installed either of the internal upgrades, and (also optionally) mounted the TEP on a rack, you are ready to connect the Terminal Eliminator Plus to the input (slave) devices and master console:

1. If you haven't rackmounted the TEP, and so already taken these steps, verify that the power-supply connector is properly inserted into the 4-pin male connector on the Terminal Eliminator Plus's motherboard, then replace the unit's cover.
2. Connect the input-device cables to slave ports 1 through 4 (or 1 through 8).
3. Connect the master-console cable to the master port (port 0).

Lastly, plug the wallmount power supply into a suitable outlet.

This completes the installation of your Terminal Eliminator Plus. It is now ready to be configured for continuous operation.

4. Configuration

4.1 The Initialization Menu

When you first plug in the Terminal Eliminator Plus, the TEP will immediately begin operating in either Concentrate Only or Concentrate and Broadcast Mode, depending on how you have set the system-option switch SWF, position 2 (refer to **Section 2.1.2.B**). If status messages are enabled (SWF position 1—refer to **Section 2.1.2.A**), the message “** BEGIN LOG **” will appear. Before you let the TEP run continuously, you should configure it for your application with its initialization menu.

Your configuration session will be easier if your (at least temporary) master device is a PC or terminal that advances one line for each carriage-return/line-feed pair, moves the cursor back one position with the Backspace code, and sends the Escape code out of its serial port when you press the Escape key. This is because (a) the initialization menu and associated messages are transmitted with a carriage-return/line-feed pair at the end of each line, and (b) the Backspace code and Escape code are used to edit input and abort/exit functions (see below).

You can bring up the initialization menu on the master device’s screen from either of the Concentrate modes by entering from the master device the four characters “INIT” followed by a carriage return:

INITIALIZATION MENU:

- (1) See/Set beginning record character
- (2) See/Set ending record character
- (3) See/Set labels inserted at beginning of records
- (4) See/Set record length that terminates records
- (5) See/Set No-Receive delay that terminates records
- (6) See/Set maximum output line length
- (7) See/Set character to use for disconnect & abort commands
- (8) See/Set Back to Concentrate Mode timeout
- (9) Exit Initialization Menu

Select option # (1-9) and depress <Enter>:

Press any key from 1 to 9 and hit the carriage-return key to bring up option-specific text followed by a data-entry field or fields. Usually you will first be asked to provide the number of a slave port, because, for most of the options, the settings are individually selectable for each slave port. If in such a case you want your response to apply to all slave ports anyway, type “0” (zero) followed by a carriage return—this will have no effect on the master port.

(In addition to the carriage-return or enter key, which tells the TEP to accept the data as it currently appears in the entry field as correct, two other special keys are useful when you are in the middle of setting an option. You can use the backspace key to retrace your steps, so you can correct data-entry errors. You can also hit the escape key to abort the selection in progress and return to the initialization menu.)

When you respond with a port number, unless you type “0” to set an option for all slave ports, the current default setting for that option for that port will be displayed in the next entry field. If you decide that you don’t really want to change any port’s setting of this option, just hit [ESCAPE] to go back to the menu. If you decide that you don’t want to change this setting for this port, but you might want to for another port, hit [RETURN] or [ENTER] to leave the displayed value unchanged, and the TEP will prompt you for another port number.

When the entry field appears in which you can change an option’s setting, you will receive detailed instructions on the valid range of data that can be entered. For example, if you select option 6, to see and set the maximum output-line length, then after you give it a particular port number you will be prompted:

```
Enter the maximum size of any output line (1-255 or 0 infinite): 72_
```

The “72” from the line above is the current default setting. If you hit [ESCAPE] or [ENTER] it will remain unchanged, but if you hit a number key from 0 to 9, the “72” will be erased and the number you typed will be displayed (there is no need to backspace to clear the “72” before entering your new setting).

When you hit [ENTER] to tell the TEP to accept the data as it appears, the new setting is immediately saved to NVRAM (nonvolatile RAM) and becomes the new default setting for that option for that port. (This default setting will be preserved even if the TEP loses power; it will remain in effect until you change it again.) You will be prompted for another port number; enter 0 to 8 or hit [ESCAPE] to return to the menu.

When you are finished with your configuration, leave the initialization menu by entering “9” followed by a carriage return. The Terminal Eliminator Plus will reset itself, then resume operating in the standard Concentrate mode that it started out in.

4.2 Menu Options

Descriptions of the initialization-menu options:

4.2.1 BEGINNING-OF-RECORD CHARACTER

If you allow this option to have a character value (the range is 0 to 255 decimal, 00 to FF hex, or 256 = disabled), the TEP will not recognize a record as having begun, nor will it recognize an “end-of-record” character (see below) or “no-receive delay,” until it senses the character you select. The TEP will begin counting record length after sensing this character. You can set the TEP’s system switch SWF to either pass or discard data received before the beginning-of-record character (see **Section 3.1.2.H**). The factory default for this selectable-by-port option is “disabled.”

This character can be used even if the end-of-record character is disabled. Records can be terminated by the “no-receive delay” timeout or by the maximum-record-length restriction.

4.2.2 END-OF-RECORD CHARACTER

If you allow this option to have a character value (the range is 0 to 255 decimal, 00 to FF hex, or 256 = disabled), then, when the TEP is receiving a slave’s record and senses the character you select, it will treat the record as having ended at that point. The factory default for this selectable-by-port option is 13 decimal, 0D hex (the ASCII carriage return).

If you disable this character for a given port, do not also disable both the “no-receive delay” timeout and the maximum record length for that port. When it’s in either Concentrate mode, the TEP will not transmit slave data to the master unless the data is in the form of a complete, valid record, which can never happen if all of these delimiters are disabled.

4.2.3 LABELS INSERTED AT THE BEGINNING OF RECORDS

If you allow this option to have a value other than [NULL] (the range is 0 to 16 printable characters), the TEP will precede records from the selected slave port with the label you enter. Refer to **Section 5.5.4.B**. The factory defaults for this selectable-by-port option are “P1 ” for port 1, “P2 ” for port 2, etc., up to “P4 ” for port 4 (or “P8 ” for port 8 if you’ve installed the 4-Port Expansion Board).

4.2.4 RECORD LENGTH THAT TERMINATES RECORDS

If you allow this option to have a value other than zero (the range is 1 to 999 characters, or 0 = disabled), the TEP will regard slave records as ending when they reach this length. Refer to **Section 5.5.3**. The factory default for this selectable-by-port option is 72 characters.

4.2.5 “NO RECEIVE” DELAY THAT TERMINATES RECORDS

If you allow this option to have a value other than zero (the range is 1 to 65535 “ticks,” or 0 = disabled), the TEP will regard a slave’s record as ending when this amount of time elapses without further receipt of data from the slave device. Refer to **Section 5.5.3**. The factory default for this selectable-by-port option is “disabled.”

Here time is measured in “ticks” of the TEP’s internal clock; each tick is equivalent to 10.4167 milliseconds. The maximum delay is 65535 ticks, equivalent to 11 minutes and 22.66 seconds. Table 4-1, below, shows equivalences for some rounder, more useful figures.

Table 4-1. Equivalences for Setting the “No Receive” Timeout

TIME INTERVAL	NUMBER OF TICKS
250 ms	24
500 ms	48
750 ms	72
1 s	96
2 s	192
5 s	480
10 s	960
30 s	2880
1 min.	5760
2 min.	11520
5 min.	28800

4.2.6 MAXIMUM OUTPUT LINE LENGTH (LINE WRAP)

If you allow this option to have a value other than zero (the range is 1 to 255 characters, or 0 = disabled [infinite length]), the TEP will cause an automatic line wrap (insert a carriage return) if any slave is sending a record longer than your screen. Refer to **Sections 5.5.4.F and 5.5.4.J**. The factory default for this global (same for all ports) option is 72 characters.

4.2.7 DISCONNECT/ABORT CHARACTER

Strings of your disconnect/abort character (which you can choose to be “N,” “O,” “P,” or “Q”) form your disconnect and abort commands, which are necessary for exiting either Conversation mode or Broadcast Only Mode and returning to the standard Concentrate mode. If you have only one Terminal Eliminator Plus, this isn’t very important, but if you’re cascading TEPs to two, three, or four total layers, the only way such an arrangement functions properly when you use a Conversation mode is if you assign a different character to each layer (see **Sections 5.2.1 and 5.2.2**). The factory default for this global (same for all ports) option is “N.”

4.2.8 THE “BACK TO CONCENTRATE MODE” TIMEOUT

If you allow this option to have a value other than zero (the range is 1 to 65535 times 50 ms, or 0 = disabled), the TEP will automatically exit either Conversation mode and return to its standard Concentrate mode when this amount of time elapses without receipt of data from the master device. Refer to **Section 5.3.2**. The factory default for this selectable-by-port option is “disabled.”

Here time is measured in increments of 50 milliseconds. The maximum delay is 65535 times 50 ms, equivalent to 54 minutes and 36.75 seconds. To set the delay for a certain number of seconds, enter that number multiplied by 20 (“100” for 5 seconds, “200” for 10 seconds, etc.). To set the delay for a certain number of minutes, enter that number multiplied by 1200 (“6000” for 5 minutes, “12000” for 10 minutes, etc.).

5. Operation

Once the Terminal Eliminator Plus has been installed and configured, it begins to operate continuously. This chapter details how the TEP works and how you can control it with a combination of keyboard commands, the initialization menu, and DIP switch settings.

5.1 The Master Device

The main function of the TEP is to gather data from various input (slave) devices for display on a master device. The first thing you must see to is that the TEP, your master device, and your slave devices are working together to give you understandable output.

5.1.1 MASTER-DEVICE TYPES

A fairly simple terminal and keyboard can be used to configure the TEP. Collecting, displaying, and recording your data might or might not require more sophisticated equipment.

If your master-port device must be a display device like a terminal or printer (and not a PC with a program collecting the data), then examine your data. If the data contains no non-printable cursor-positioning control codes other than carriage returns and line feeds, you can get a readable display by using a “dumb” terminal or a “dumb” printer mode.

If your data contains cursor-positioning codes, however, you have two choices. You can use a “dumb” master and set the TEP to strip the codes out (refer to **Section 5.5.4.M**), if this produces readable results. But chances are that the output will look much better if you can hook up a “smarter” master device that can respond properly to these codes.

Things to remember if you’re using a “smarter” master device: To make sure the TEP doesn’t alter the slaves’ data, you’ll have to disable all the TEP’s formatting options, even the format-related DIP-switch options, when using either of the Concentrate modes; also, you should use the Transparent Conversation Mode when making a one-to-one link. Your slave devices must also be able to respond to a command from the master to refresh the current screen. This refresh will need to be done when the TEP’s master port’s output changes to another slave port’s data.

5.1.2 MASTER-PORT STATUS MESSAGES

If the user sets position 1 of system switch SWF to OFF, the Terminal Eliminator Plus will send status messages to the master device. The user can get an idea of what mode the TEP is in from some of these messages: They show (a) that the unit has been reset or (b) a command to switch modes has been processed. Here are all of the status messages:

“** BEGIN LOG **”—The TEP has been reset and is now in the standard Concentrate mode.

“Px CONNECTED”—The TEP has switched from its standard Concentrate mode to one of the Conversation modes. “Px,” where x=a number from 1 to 4 (or 8), is the selected slave port.

“BROADCAST ONLY”—The TEP has switched from its standard Concentrate mode to Broadcast Only Mode.

“DISCONNECT”—The TEP has switched back to the standard Concentrate mode.

“**KEYBOARD INPUT TIMED OUT**”—Master-input echoing is enabled (see **Section 3.1.2.D**), the TEP is not in a Conversation mode, and the 3-second “no-data-to-echo timeout” has occurred. This message, followed by its two carriage returns, allows the TEP to resume sending slave data on a new line after the user stops typing in data to echo. (When the TEP is in a Conversation mode, no message is sent other than a carriage return allowing slave data to resume on the next line.) NOTE: Neither the “KEYBOARD” message nor the solitary carriage return can be disabled by setting position 1 of SWF to ON.

NOTE: All these status messages are preceded and followed by a carriage return; all but “** BEGIN LOG **” are followed by two carriage returns. After each carriage return, the TEP delays 100 ms if position 5 of SWG is set to ON, then inserts a line feed if position 6 of SWG is set to OFF.

5.2 Valid Command Strings

5.2.1 “DISCONNECT”

To exit Broadcast Only Mode or either Conversation mode after all master-port data buffered in the TEP has been transmitted to the slave device(s), the user sends four consecutive command characters from the master device. The command character can be one of four different characters (“N,” “O,” “P,” or “Q”) selected from the initialization menu that is sent to the master device when the “Initialization” command is entered (see below). Thus, a valid “Disconnect” command string would be “NNNN,” “OOOO,” “PPPP,” or “QQQQ.”

When cascading multiple TEPs, each “layer” of units should be assigned a different command character. See **Sections 5.3.3 and 5.3.5**.

5.2.2 “ABORT”

To exit Broadcast Only Mode or either Conversation mode immediately, throwing away any buffered master-port data destined for the slave port(s) if necessary, the user sends eight consecutive command characters from the master device. The command character can be one of four different characters (“N,” “O,” “P,” or “Q”) selected from the initialization menu that is sent to the master device when the “Initialization” command is entered (see below). Thus, a valid “Abort” command string would be “NNNNNNNN,” “OOOOOOOO,” “PPPPPPPP,” or “QQQQQQQQ.”

When cascading multiple TEPs, each “layer” of units should be assigned a different command character. See **Sections 5.3.3 and 5.3.5**.

5.2.3 “CONVERSATION”

To enter Conversation Mode from either of the Concentrate modes, the user sends from the master device an ASCII “C,” then an ASCII port number from “1” to “8,” followed by a carriage-return character (ASCII [CR]). For example, “C3[CR]” puts the user in Conversation Mode with the slave on port 3.

5.2.4 “TRANSPARENT”

To enter Transparent Conversation Mode from either of the Concentrate modes, the user sends from the master device an ASCII “T,” then an ASCII port number from “1” to “8,” followed by a carriage-return character (ASCII [CR]). For example, “T5[CR]” puts the user in Transparent Conversation Mode with the slave on port 5.

5.2.5 “BROADCAST”

To enter Broadcast Mode from either of the Concentrate modes, the user sends from the master device the two ASCII characters “BC” followed by a carriage-return character (ASCII [CR]).

5.2.6 “INITIALIZATION”

To access the initialization menu (from which you can change some of the TEP’s settings) from either of the Concentrate modes, the user sends from the master device the four ASCII characters “INIT” followed by a carriage-return character (ASCII [CR]).

5.2.7 “RESET”

To reset the TEP and clear all its buffers from either of the Concentrate modes, the user sends from the master device the five ASCII characters “RESET” followed by a carriage-return character (ASCII [CR]).

5.2.8 “BREAK”

To send a 250-ms break sequence to a slave device when the TEP is in one of the Conversation modes, the user sends from the master device the four ASCII characters “BBBB” followed by a carriage-return character (ASCII [CR]). If the current mode is one of the Concentrate modes, include an ASCII port number after the four “B”s to indicate which slave device should receive the break sequence (for example, “BBBB1[CR]” to send a break to the slave device on port 1).

5.2.9 CHAINED COMMANDS

It is possible to go from either (a) a Conversation mode with one slave device to a Conversation mode with another slave device or (b) a Conversation mode to Broadcast Only Mode, or vice versa, without an interlude of the standard Concentrate mode. (See **Section 5.3** for more information about these modes.) This can be done by chaining multiple commands together while output flow control is disabled at the master port.

For example, if you are using X-ON/X-OFF flow control on the master port and you want to switch from Conversation mode with slave port 1 to Conversation mode with slave port 2, enter the following chained command string with imbedded software flow-control codes: [X-OFF] NNNNC2 [X-ON]. The X-OFF will prevent concentrated slave data from being sent

when the TEP recognizes the “NNNN” command to return to Concentrate mode. The “C2” will change the mode from Concentrate to Conversation with slave port 2. Then the X-ON will allow the TEP to transmit slave 2’s data to the master device. If you’re using the X-ON/poll flow-control method (see **Section 5.6**), you can omit the [X-OFF] code from the chained-command string if you are starting from Conversation Mode (*not* Transparent Conversation Mode) and you wait until you receive the end of a valid record before sending the chained command string.

5.3 The Data-Direction Modes in Detail

The Terminal Eliminator Plus’s five data-direction modes are described in **Section 2.1**. Here are more details.

5.3.1 ACCESSING THE MODES

- To get to Concentrate Only Mode, position 2 of system switch SWF must be OFF. If it is, the TEP will go to this mode when a user (a) first plugs in the unit, (b) resets the unit, or (c) exits Broadcast Only Mode or either Conversation mode by issuing the “Disconnect” or “Abort” command string (see **Sections 5.2.1 and 5.2.2**) from the master device.
- To get to Concentrate and Broadcast Mode, position 2 of system switch SWF must be ON. If it is, the TEP will go to this mode when a user (a) first plugs in the unit, (b) resets the unit, or (c) exits Broadcast Only Mode or either Conversation mode by issuing the “Disconnect” or “Abort” command string (see **Sections 5.2.1 and 5.2.2**) from the master device.
- To get to Conversation Mode, a user must enter the “Conversation” command string (see **Section 5.2.3**) from the master device when the TEP is in either Concentrate mode.
- To get to Transparent Conversation Mode, a user must enter the “Transparent” command string (see **Section 5.2.4**) from the master device when the TEP is in either Concentrate mode.
- To get to Broadcast Only Mode, a user must enter the “Broadcast” command string (see **Section 5.2.5**) from the master device when the TEP is in either Concentrate mode.

5.3.2 THE CONVERSATION MODES

Communication in the Concentrate modes is many-to-one, all slaves interacting with the master simultaneously. But there are times when the operator of the master console might need to actively interface with one selected device. For example, the operator may have reason to closely observe the data of one particular slave port, and perhaps respond with data from the console. Or there may be a need for the console operator and a particular slave device to transfer data bidirectionally.

In the Conversation modes, the Terminal Eliminator basically acts as a one-to-one switch, with the master port linked to any one of the slaves for full-duplex bidirectional communication. The console and selected device can transfer information back and forth without being interrupted by the other slaves. Any data received on any slave port is buffered by the Terminal Eliminator Plus until the one-to-one link (Conversation Mode) is terminated by the console operator.

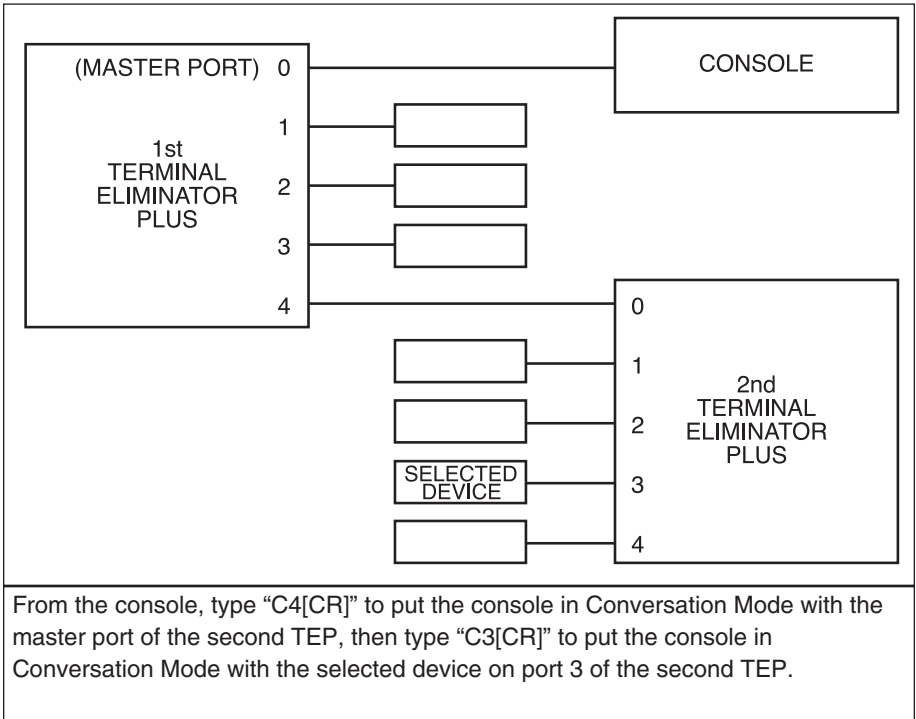
If you want to change the slave that is in a Conversation mode with the console, or if you want to switch to Broadcast Only Mode, you can either return to Normal Mode and enter the appropriate one of the “*Cn*[CR],” “*Tn*[CR],” or “*BC*[CR]” commands, as described in **Sections 5.2.4 through 5.2.5**, or you can enter a chained command as described in **Section 5.2.9**.

The only difference between regular Conversation Mode and Transparent Conversation Mode is that the Transparent version allows data to flow through the TEP to the master device unchanged by the formatting conventions you establish with the TEP’s internal DIP switches and initialization menu. This is especially useful when a particular slave’s data is more legible or easier to diagnose for problems in its raw state.

The “Disconnect” and “Abort” commands (see **Sections 5.2.1 and 5.2.2**) are the only commands the TEP will execute in either of the Conversation modes. Return to your TEP’s standard Concentrate mode to enter any other command.

To prevent conversations from monopolizing the TEP, you can enable a “Back to Concentrate Mode” timeout in the initialization menu. This timeout counts down when no data is received from the master device; if it expires, the TEP goes back to its standard Concentrate mode. See **Section 4.2.8**.

Fig. 5-1. Accessing Conversation Mode with Cascaded TEPs.



5.3.3 ACCESSING CONVERSATION MODE IN CASCADE APPLICATIONS

Two or more Terminal Eliminator Plus units can be linked together to increase the number of slave ports above 4 (or 8). This is referred to as "cascading." Run cable from slave port(s) of the "first-layer" TEP directly to the master port(s) of one or more subsidiary TEPs. You can then run cable from slave port(s) of these "second-layer" unit(s) to the master port(s) of one or more "third-layer" units, and so on, to a maximum of four layers with 4096 available slave ports.

If you are cascading TEPs, putting the master in Conversation Mode with a device directly connected to this TEP involves the same one-step process described in the previous section. But activating a conversation with a device on one of the *subsidiary* units requires additional steps. First, make sure that the disconnect/abort command character for each layer of TEPs is different (see **Section 4.2.7**). Then change the mode of each TEP between the master device and the selected slave device one at a time, starting at the first-layer TEP (the one to which the master device is attached) and working your way upward to higher-numbered layers. Assuming that you're starting from a Concentrate-mode connection to the first-layer Terminal Eliminator Plus, to

enter a Conversation mode with a device connected to a second-layer TEP, send “C*n*[CR]C*m*[CR]” from the master device, where *n*=the slave port of the first-layer TEP that the second-layer TEP is attached to, and *m*=the slave port of the second-layer TEP that the desired device is attached to. Figure 5-1 on the next page shows an illustration of this.

To properly exit Conversation mode when you’re finished, the disconnect or abort command must be issued to the highest-layer TEP first, then the next-highest, and so on downward to the first layer again. For example, assuming

- the first-layer command character is “N” and the second-layer character is “O,”
- you want to exit the conversation smoothly and allow data in the buffers to be transmitted, and
- you want to end up talking to the first-layer unit in its standard Concentrate mode,

then send the “disconnect” command string “OOOONNNN”.

5.3.4 BROADCAST ONLY MODE

When you want to transmit data to ALL slave devices simultaneously while the Terminal Eliminator Plus buffers their input data, enter Broadcast Only Mode. You can enter Broadcast Only Mode with a single command from a Concentrate mode (see **Section 5.2.5**) or a chained command from a Conversation Mode (see **Section 5.2.9**).

The “Disconnect” and “Abort” commands (see **Sections 5.2.1 and 5.2.2**) are the only commands the TEP will execute in the Broadcast Only Mode. Return to your TEP’s standard Concentrate mode to enter any other command.

5.3.5 ACCESSING BROADCAST ONLY MODE IN CASCADE APPLICATIONS

Two or more Terminal Eliminator Plus units can be linked together to share the same operator’s console. This is referred to as “cascading.” (Refer to **Section 5.3.3** for the rest of the general principles.)

Assuming that you’re starting from a Concentrate mode on the first-layer Terminal Eliminator Plus, to broadcast to the slave devices attached to only *one* third-layer TEP, send “C*n*[CR]C*m*[CR] BC[CR]” from the master device, where *n*=the slave port of the first-layer TEP that is connected to the master port of the second-layer TEP, and *m*=the slave port of the second-layer TEP that is connected to the master port of the third-layer TEP. These commands put the TEPs in the first two layers in Conversation (one-to-one) Mode, so the master device can broadcast to the slave ports of just the third-layer TEP.

To broadcast to the slave devices attached to *all* TEPs on a given layer is easier, but only if no slave ports lower than that layer are occupied by slave devices. For example, again assuming that you're starting from a Concentrate-mode connection to the first-layer Terminal Eliminator Plus, to broadcast to the slave devices attached to all third-layer TEPs, send "BC[CR]BC[CR]BC[CR]". However, if there are slave devices attached to second-layer or first-layer TEPs, the first broadcast data they will receive will be "BC[CR]" or "BC[CR]BC[CR]" respectively. Don't use this "global broadcast" command string if not all of your slaves are on the same layer.

To properly exit Broadcast Only Mode when you're finished with a cascaded connection, the disconnect/abort-command character of the second-layer units must have been changed previously to something other than the command character used by the first-layer unit (see **Section 4.2.7**), and the command character of the third-layer units must have changed to something other than those used by either of the higher two layers. For example, assuming

- the first-layer command character is "N," the second-layer character is "O," and the third-layer character is "P,"
- you want to exit the conversation immediately, throwing away any master-port data that might remain in the TEP's buffers, and
- you want to end up talking to the first-layer unit in its standard Concentrate mode,

then send the "abort" command string "PPPPPPPOOOOOOOO
NNNNNNNN".

Since the TEP doesn't support anything like a selective Broadcast mode or a one-to-many selective Conversation mode, there is no straightforward way to simultaneously establish a broadcast to the slave devices attached to some but *not* all of the subsidiary TEPs on a given layer. To broadcast through only some of the TEPs on a given layer—and this might occur frequently if some of the TEPs on a given layer are occupied only by slaves and others are occupied only by subsidiary TEPs—you must command the desired TEPs into Broadcast Only Mode, broadcast to their slaves, then exit Broadcast Only Mode, one TEP at a time.

5.3.6 THE BROADCAST-MODE FLOW-CONTROL OPTION

When the master device is transmitting to all slave ports during Concentrate and Broadcast Mode or Broadcast Only Mode, the Terminal Eliminator Plus sends data to the slaves one byte at a time in “round robin” fashion [consecutively from Port 1 to Port 4 (or 8)]. Each port receiving this broadcast data can exercise independent flow control. The TEP provides the option of either acknowledging or ignoring incoming flow control during broadcasting. Position 3 of system switch SWF controls this option:

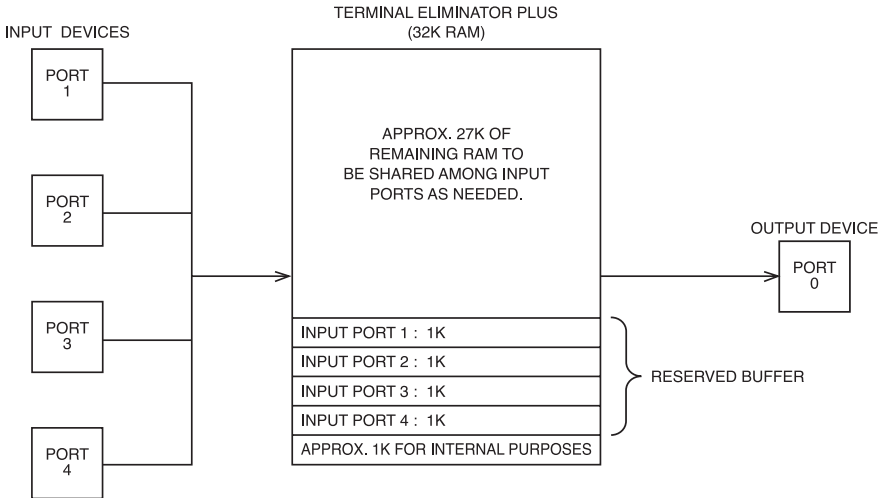
ON: With position 3 ON, the Terminal Eliminator Plus will acknowledge a port’s flow control signal. The TEP transmits the data from the master console to each input port one byte at a time. If it encounters a port that is configured for hardware flow control, and DTR/CTS is inactive, the TEP will wait for the port to raise DTR/CTS before transmitting further data to *any* port. The console data received will be buffered. The same principle applies if the TEP encounters a port that is configured for X-ON/X-OFF flow control. If that port receives an X-OFF, the TEP will wait for the port to receive an X-ON character before transmitting further data to *any* port.

OFF: With position 3 OFF, the Terminal Eliminator Plus will bypass any port that is exercising flow control. When the TEP encounters a port that is configured for hardware (or software) flow control, and has dropped DTR/CTS (or sent an X-OFF character), it will not transmit that byte to the port. Instead, the TEP continues transmitting to the other ports in consecutive order. When the buffered port raises DTR (or sends an X-ON character), the TEP will resume data transmission to that port. Any bytes that were *not* transmitted to the port are lost.

The setting of SWF position 3 only affects flow control during broadcasting. It has no effect during Concentrate Only Mode or either Conversation mode.

5.3.7 THE “BACK TO CONCENTRATE MODE” TIMEOUT

From the initialization menu, you can set and enable, or disable, a timeout to exit from either of the Conversation modes or Broadcast Only Mode back to the standard Concentrate mode. This timeout is useful when the TEP is normally used in a Concentrate mode, and is only occasionally used in a Conversation mode to send some data to a slave device. If you forget to exit the conversation by sending the “Disconnect” or “Abort” commands (refer to **Sections 5.2.1 and 5.2.2**), this timeout will occur and take the TEP back to its standard Concentrate mode so other slaves’ data can be transmitted to the master device (possibly preventing the TEP’s internal buffer from overflowing when attached slave devices don’t respond to flow-control requests).

Fig. 5-2. Dynamic allocation of 32K of buffer space.

5.4 Buffer Allocation

A standard Terminal Eliminator Plus has 32K of RAM, with approximately 1K dedicated to program “self-storage” and 31K of RAM available for buffer space.

A TEP with the 32K Memory Expansion chip installed has 64K of RAM, with approximately 5K dedicated to program “self-storage” and 59K of RAM available for buffer space.

The TEP uses a dynamic buffer. Each input device is given a minimum of 1K of RAM reserved exclusively for that port. In this way, a single port cannot monopolize all the Terminal Eliminator’s buffer space. The remaining memory is distributed among all active ports according to the current demand. If each port were given an equal amount of the total buffer space and some of the ports were inactive, there would be a great deal of wasted buffer not available for use. Dynamic allocation provides far more efficient use of buffer space. Figure 5-2 on the next page illustrates the principle of dynamic allocation, using the standard unit with 32K of RAM as an example.

5.5 Data Processing

5.5.1 PROCESSING OF RECEIVED MASTER-PORT DATA

The data received from the master port is always checked for commands valid in the current data-direction mode of the unit. Valid command strings are acted upon after all previous data received from the master port has been processed, with the exception of the “Abort” command. If the TEP is in a mode where the “Abort” command is valid, the TEP will act on the command immediately (before any previously received and currently buffered data).

If the data received is not a valid command string, the data will be either thrown away or transmitted to one or more slave ports depending on the current data-direction mode. For example, if the TEP is in Broadcast Only or Concentrate & Broadcast Mode, the master port’s data will be broadcast to some or all slaves depending on the setting of the Broadcast-Mode flow-control option (system switch SWF position 3). If the TEP is in either of the Conversation modes, the master port’s data will be transmitted to the selected slave device.

Optionally, data received from the master port can be echoed back to the master device (system switch SWF position 4 on). This may be required by old hardcopy terminals.

5.5.2 SCANNING FOR SLAVE RECORDS

Records from different slaves are transmitted in “round-robin” fashion. That is, each port is checked in ascending order from Port 1 through Port 4 (or 8). You can select when the TEP will switch from the current port to the next sequential port by setting position 7 of system switch SWG. Refer to **Section 5.5.4.O**.

5.5.3 PROCESSING RECEIVED SLAVE-PORT DATA

Firstly, slave data is never checked for valid command strings. The TEP only recognizes commands received through its master port.

Secondly, slave data doesn’t even have to be displayed or buffered. If you set position 8 of a slave port’s DIP switch ON, the TEP will throw away that slave’s data until you enter either Conversation mode with that slave port; only during Conversation-mode sessions will the TEP buffer that slave’s data. This feature is useful when the attached devices are, for example, scales that are constantly transmitting the current weight being measured: Discarding data outside of conversation situations assures that (a) the repeated data will not overflow the TEP’s internal buffer and (b) you won’t have to process scale data until you are ready to receive it.

If the option described above is not enabled for a given port, data received from that port will be buffered in the TEP’s internal buffer at all times. Once

any slave data is in the TEP's internal buffer, the TEP will transmit the data to the master device in one of two different ways depending on whether the current mode is of the Concentrate or Conversation type.

In either of the Conversation modes, the slave's data will be taken from the TEP's internal buffer and retransmitted out the master port (using the word structure, baud rate, and flow control you've set for of the master port with port switch SWA) on a character-by-character basis. If the TEP is *not* in Transparent Conversation Mode, then—depending on how you've set the TEP's options—the slave data may be formatted (data inserted or stripped) for a more readable output (see the next section).

In either of the Concentration modes, a particular slave's data will only be transmitted to the master device when:

1. It's that slave's turn in the round-robin scan.
2. The TEP has buffered enough data from that slave device to define at least one valid record. Valid record requirements are defined by the user at initialization time.
3. The master port is not flow-controlled OFF (DTR input low, for example).

Valid records can be defined as any combination of the following:

1. Received data (1 or more bytes) terminated by a user-selected end-of-record character (for example, [ETX] code, carriage return, or form-feed character). Refer to **Section 4.2.2**.
2. Received data matching the user-defined terminating record length (1 to 255 bytes). Refer to **Section 4.2.4**.
3. Received data that is followed by an inter-record gap (a period of time between records in which no characters are received). Throughout this manual, the inter-record gap is called the "no-receive delay." You can set this time period to between 1 and 65535 times 10.4 ms. Refer to **Section 4.2.5**.

Any of the above can be disabled, but don't disable all three for the same port at the same time, or no valid records will ever occur and none of that port's data will be sent to the master. An additional qualifier can be used to further define a record:

4. A record can optionally contain a user-selectable beginning-of-record character that the TEP must sense before it will recognize any of the above as valid. Any data received prior to the beginning-of-record character will be passed or discarded depending on the setting of position 8 of system switch SWF. For example, the TEP won't recognize an end-of-record character until it receives a beginning-of-record character; it won't start counting the record's size until it receives the beginning-of-record character; and it will ignore any inter-record gap until it receives a beginning-of-record character. Refer to **Section 4.2.1**.

NOTE: Any or all of the above "record defining" rules can be individually set for each slave port by using the initialization menu. For example, you can define for slave port 1 that records must end with a carriage return and/or a maximum size of 40 bytes, for slave port 2 that records must end with an [ETX], for slave port 3 that records must be 80 bytes long, for slave port 4 that records must be 132 characters or terminated by an inter-record gap of 250 ms, and so on.

5.5.4 FORMATTING OF SLAVE DATA IN CONCENTRATE MODES AND CONVERSATION MODE

The slave data that is sent to the master device can optionally be formatted to match your display needs in either of the Concentrate modes or Conversation Mode (not Transparent Conversation mode). This formatting of data may be useful when a slave's data is being viewed by a user at a display device such as a printer or terminal/console. The formatting is also useful when a slave's data is being received and processed or recorded by a PC program. Both the program and those who retrieve data from it may find it easier to handle the data if it is formatted differently.

The formatting can generally be described as adding or stripping data from the original data stream of the slave. For example, the slave data can be preceded by a user-assigned label that can uniquely identify which slave port the data was received from (for example, "scale #1"). All of the formatting options are optional and can be enabled by either setting DIP switches or by accessing the initialization menu.

The rest of this section is an itemized list and description of all possible format options.

5.5.4.A *Separate Different Slaves' Data with a Blank Line*

Because data from all the slaves is combined into the master port's output-data stream during Concentrate modes, this option will help in visually separating the different ports' data.

System switch SWF position 5 ON to enable

enabled: Slave 1's data	disabled: Slave 1's data
Slave 2's data	Slave 2's data

NOTE: The example above assumes a carriage return follows the data to perform a line wrap.

5.5.4.B *Insert a User-Assigned Label at the Beginning of Each Slave's Data*

Assign this label through the initialization menu. It can be any printable ASCII string up to 16 characters long; it can also be a NULL string (equivalent to no label at all). This label is inserted at the beginning of data, as well as when data is interrupted by a line wrap caused by the record reaching the maximum line length.

substantial labels: Slave #1 xyz	null labels: xyz
Slave #2 xyz	xyz

NOTE: The example above assumes a carriage return follows the data to perform a line wrap.

5.5.4.C *Label All Consecutive Lines from Same Slave or First Line Only*

If you select "label first line only," the TEP won't place labels on consecutive lines, but rather will transmit space characters equal to the size of the label so the data output on each line starts in the same column. (This assumes that switch SWF position 7 is OFF; see the next format option.)

System switch SWF position 6 OFF to label first line only

label first: Slave #1 abc	label all: Slave #1 abc
def	Slave #1 def

NOTE: The example above assumes a carriage return follows the data to perform a line wrap.

5.5.4.D Place User-Assigned Slave Label on a Line By Itself

System switch SWF position 7 ON to enable

enabled: Slave #1	disabled: Slave #1 abc
abc	

System switch SWF position 6 & 7 ON to label first line & put label on a line by itself; SWF position 6 OFF & position 7 ON to label all lines & put label on a line by itself

both enabled: Slave #1	6 disabled, 7 enabled: Slave #1
abc	abc
def	Slave #1
	def

NOTE: The example above assumes a carriage return follows the data to perform a line wrap.

5.5.4.E Transmit (or Don't Transmit) Slave Data That Precedes User-Selected Beginning-of-Record Character

System switch SWF position 8 ON to pass data before the beginning-of-record character

user-selected beginning-of-record character = [FS] (ASCII "field separator" control code)

user-selected end-of-record character = [ETX] (ASCII "end-of-text" control code)

slave data received: [STX]12345[FS]67890[ETX] (where [STX] = ASCII "start-of-text" control code)

data output if stripping data before the beginning-of-record character (that is, throwing away the first field of the record): [FS]67890[ETX]

data output if passing data before the beginning-of-record character: [STX]12345[FS]67890[ETX]

5.5.4.F A Note Before You Read Further

The next few options may make more sense if you first understand how data is displayed on “dumb” terminals or printers.

A carriage return ([CR]) moves the cursor or the print head to the first column of the display. On some display devices the [CR] will also advance the cursor or print head to the next row. A [CR] typically terminates a line of data, and prevents data from running beyond the displayable area of the display device (that is, it causes a line wrap).

A line feed ([LF]) moves the cursor or print head down to the next row but in the same column. On devices where [CR] doesn't advance to the next row, you will usually find a [CR][LF] pair following all data. Some devices will, in fact, display multiple [CR]s, [LF]s, or [CR][LF] pairs to double- or triple-space the output.

Display devices can have different line lengths. For example, some printers print 80 characters per line and some print 132 characters per line. Typically data sent to a display device would contain a [CR] (or [CR][LF] pair) before, or at, the maximum line length. If you sent 132 bytes of data (followed by a [CR][LF] pair) to a printer that has only 80 characters per line, then usually the 81st to 132nd characters of the data will not be printed, or they will wrap to the next line, causing lines to be lost at the bottom of the page.

Because the Terminal Eliminator Plus may be concentrating data from a variety of different types of devices, it may be very hard to get a consistent output to a display device unless you use the following options—for example, strip all received [CR]s and [LF]s and just add one [CR] (plus, possibly, one [LF]) to the end of each line. If you are losing data at the ends of lines or pages, you may want to program a maximum output-line length using the initialization menu.

5.5.4.G Don't Transmit Received Carriage-Return Characters

System switch SWG position 1 OFF

5.5.4.H Don't Transmit Any Received Line-Feed Characters

System switch SWG position 2 OFF

5.5.4.I Insert One Carriage-Return Character at the End of the Record Unless the Record Ends with [CR] or a [CR][LF] Pair

System switch SWG position 5 OFF

5.5.4.J Insert One Carriage-Return Character at the Maximum User-Assigned Line Length, and Reset the Line Count for Every Slave [CR] Transmitted

“See/Set maximum output line length” option in the initialization menu (see **Section 4.2.6**)

5.5.4.K. Insert One Carriage-Return Character at the End of Every Valid Record Unless the Record Already Ends With a [CR]

System switch SWG position 4 OFF

5.5.4.L Insert One Line-Feed Character After Every Carriage Return Transmitted to the Master Device

System switch SWG position 7 OFF

5.5.4.M Don't Transmit Nonprintable Characters Other Than [CR] and [LF]

Certain nonprintable control codes, often received in groups, may have special meaning to your particular display device. These can include codes that cause the device to:

- 1) clear the screen
- 2) switch to reverse-video
- 3) position the cursor at a certain row and column
- 4) ring its internal bell

Because different slave devices may have been designed to interface with different types of display device than the one you're using, you may experience weird problems when receiving these nonprintable control codes. It may be easier to get a consistent output by stripping these nonprintable codes and only passing printable characters.

System switch SWG position 3 OFF

5.5.4.N Delay 100 ms After Transmitting Carriage Returns to Master Device

Certain old hardcopy-display devices require a delay in their received data stream after they receive a carriage-return character. This delay allows them to move their mechanical print heads to the beginning of the line.

System switch SWG position 6 ON

5.5.4.O Protocol for Transmitting Slave Records

During either of the Concentrate modes, the master port's output data stream is a concentration of data from slave ports. When do we switch from one slave port's data to the next? On a character-by-character basis, a line-by-line basis, a record-by-record basis, or on an inter-record gap (a user-assigned "no-receive delay" timeout)? The Terminal Eliminator Plus gives you two options. You can set a DIP-switch position to have the master port switch to another slave's data either (a) at the end of a record or (b) on an inter-record gap.

Using the first setting (switch after a record), when the TEP transmits the end of one slave port's record, it will search through its internal receive buffers for data from the other slave ports (in sequential order), looking for a complete record to transmit. When it finds one, it will then switch to the slave port that sent that record. Note that if only one slave port is sending data, its records will be transmitted one after the other until another slave port has a complete record to transmit.

Using the second option (switching on an inter-record gap), when the TEP transmits the end of a slave port's record, it will continue to transmit any additional records from this same slave port that are buffered or are being received, until it finds an inter-record gap—inter-record gaps that occurred between existing buffered records are remembered and treated as such—that meets or exceeds the user-assigned time limit for this particular slave port. After this timeout it will search through its internal receive buffers for data from the other slave ports (in sequential order), looking for a complete record to transmit. When it finds one, it will then switch to the slave port that sent that record.

If the user has disabled a slave port's "no receive" timeout, then the Terminal Eliminator Plus, after transmitting the end of one of that slave port's records, will immediately begin looking to transmit a valid record from another slave port.

Switching which slave is transmitting to the master device on an inter-record gap is useful in applications where viewing multiple consecutive records is more "user-friendly" than viewing single-record slices. This is the case in applications concentrating console outputs from one or more mainframes. The mainframe may send a paragraph of information instructing the operator to mount a certain magtape so it can run the payroll program. This paragraph of instructions is much easier to read if it isn't interrupted by records from other mainframes until the paragraph is completely displayed. System switch SWG position 7:

ON: Transmit one record from a slave port, then look for records from subsequent ports to transmit

OFF: Transmit records from one slave until the inter-record gap ("no receive" timeout) occurs

5.6 Master-Port Flow Control

You can prevent the Terminal Eliminator Plus from transmitting slaves' data records to the master device by activating the flow-control method you select for the master port (DTR/CTS, X-ON/X-OFF or X-ON/poll).

X-ON/poll is a special type of flow control; here's how it works. If you select X-ON/poll, the TEP will not transmit any record until the device attached to the master port (typically a PC running a communication program controlled by a user) sends it an ASCII code defined as the "X-ON" character. After receiving an "X-ON," when the TEP has a complete record for any port, it will send this single record, but it will not send any more until it receives another "X-ON" character (in other words, it will "X-OFF" itself). If the TEP does not have a complete, valid record when it receives an "X-ON," the master device can timeout and then transmit an "X-OFF" to the TEP to assure that it will not send the next record until the master device is ready.

6. Troubleshooting

6.1 Calling Black Box

If you determine that your Terminal Eliminator Plus is malfunctioning, *do not attempt to alter or repair it*. Contact Black Box. The problem might be solvable over the phone.

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.
- Any particular application that, when used, appears to create the problem or make it worse.

6.2 Shipping and Packaging

If you need to transport or ship your Terminal Eliminator Plus:

- Package it carefully. We recommend that you use the original container.
- Before you ship a unit for repair or return, contact Black Box to get a Return Materials Authorization (RMA) number, and make sure you include everything you received with the unit when you ship it.



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