

VUSET* DS150A DATA TERMINAL DESCRIPTION, INSTALLATION, AND MAINTENANCE

1. GENERAL

1.01 This section covers VUSET DS150A Data Terminal which is manufactured by Plantronics, Incorporated. The data terminal is used in the VUSET Data System which is installed as part of DATAPHONE† data communications service.

*—Registered trademark of Plantronics

†—Registered trademark of AT&T.

1.02 Whenever this section is reissued, the reason(s) for reissue will appear in this paragraph.

1.03 The VUSET Data System is an on-line data entry or inquiry-response communications system for use on the switched telephone network. The system is composed of the VUSET Data Station and the VUSET Data Terminal which has associated with it a telephone which has either TOUCH-TONE † service or a rotary dial type set. If a rotary dial type set is used, it must be modified with an auxiliary TOUCH-TONE pad. Inquiries from the terminal end to the computer, via the data station, are made using the TOUCH-TONE pad. The data station is described in Section 590-004-115.

1.04 The data terminal is a stand-alone device which is installed with standard 12-button TOUCH-TONE service set or with a rotary dial type set which has an auxiliary TOUCH-TONE pad. The data terminal connects to the internal network of the telephone, which connects to the tip and ring pair for transmission over the switched telephone network.

1.05 The telephone set is used to make the initial connection with the computer. The TOUCH-TONE pad is then used to transmit data

to the computer. Data received from the computer, modulated in frequency-shift keying, is demodulated within the terminal and displayed on the cathode ray tube in the terminal.

1.06 Descriptive, operating, and maintenance information on the data terminal is given in the attached reprint of the Installation, Operation, and Maintenance Practice 09731 prepared by Plantronics, Incorporated.

2. UNIVERSAL SERVICE ORDER CODED (USOC) OPTIONS

2.01 Table A lists the USOC options for the data terminal.

TABLE A

DS150A TERMINAL OPTIONS

UNIVERSAL SERVICE ORDER CODE (NOTE)

DMV++

OPTION CODE	FUNCTION
A1	300 baud data speed
A2	Other speed selected as specified in Option B.
B3	150 baud data speed
B4	110 baud data speed

Note: Refer to Section 590-000-100 for determination of the USOC suffix.

VuSet™ DATA TERMINAL DS150A

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VuSet™ DATA TERMINAL DS150A

1. SYSTEM DESCRIPTION AND OPERATION

VuSet General System Description

1.01 The VuSet system is an on-line, data entry or inquiry response system which uses a TOUCH-TONE® telephone as the data entry device. The VuSet system is installed as part of DATA-PHONE® service using the exchange telephone network as its transmission medium.

1.02 The system includes the VuSet Data Terminal Model DS150A, which is the remote data display device, and the VuSet Data Station Model DS151A, which provides the interface between the telephone network and the customers' computer (DTE). See Figure 1.

1.03 Communication from the remote terminal site over the telephone lines to the data station is Dual Tone Multi-Frequency (DTMF) signalling entered through the TOUCH-TONE telephone or accessory pad.

1.04 The data station and the computer communicate in character-serial ASCII code.

1.05 Frequency Shift Keying (FSK) signalling is used from the data station, over the phone lines back to the remote data terminal.

1.06 Call origination occurs at the data terminal end as the data station is not capable of call origination and the terminal cannot automatically answer an incoming call.

1.07 The interface between the data station and the computer conforms to EIA Standard RS-232-C. Control circuits are described in the Interface Connections section.

Data Terminal

1.08 The DS150A Data Terminal (Figure 2) is installed with a standard 12 button TOUCH-TONE telephone used to make the initial connection with the computer and transmit data. An accessory pushbutton pad must be added for data entry with a rotary dial phone.

1.09 Data transmitted through the telephone lines to the data station may be optionally displayed on the terminal CRT as a verification of data entry accuracy and acceptance/transmittal by the data station.

1.10 Computer data transmitted from the data station to the terminal in FSK is demodulated within the terminal and displayed on the CRT.

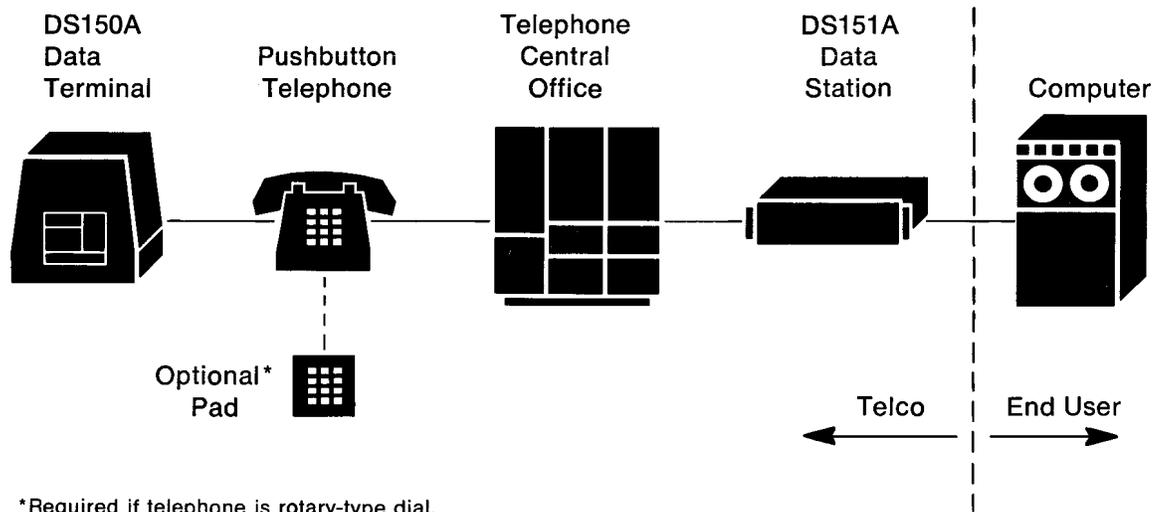


Figure 1, Simplified VuSet System

Data Station

1.11 A single DS151A Data Station (Figure 3) can include up to eight line cards (Data Sets) allowing that many lines to access the computer at one time. For heavier line traffic, additional data stations can be installed.

1.12 Each Data Set provides:

- a) Decoding of incoming TOUCH-TONE DTMF signals.
- b) Handshaking and data interchange with the computer (DTE).
- c) Frequency Shift Keying (FSK) modulation of computer generated data for transmission over the telephone network to the data terminal.

1.13 The data format is a start/stop, 10 unit ASCII code transmitted at 110, 150 or 300 baud. The FSK Mark and Space frequencies are F2 Series 2225 Hz and 2025 Hz, respectively.

1.14 Interface with the telephone line is direct, with the data set handling the line supervision.

System Operation

1.15 The user originates a call to the computer in the normal manner with the terminal TALK/DATA switch in either position. Calls are automatically answered by the data set which returns a 2225 Hz answerback tone to indicate completion of "hand-shaking" with the computer.

1.16 The user places the data terminal on-line by moving the DATA/TALK switch to the DATA position.

1.17 Data is entered from the terminal end via the telephone or accessory pushbutton pad. The data set translates the TOUCH-TONE DTMF signals to ASCII code for the computer.

1.18 Computer generated ASCII data is converted to FSK by the data set and transmitted to the terminal for demodulation and display.

1.19 Disconnection is initiated by one of the following:

- a) The terminal user disconnects or hangs-up in the usual manner. The data set will disconnect after a selected time-out interval (nominally 10 seconds).



Figure 2, VuSet DS150A Data Terminal Installation

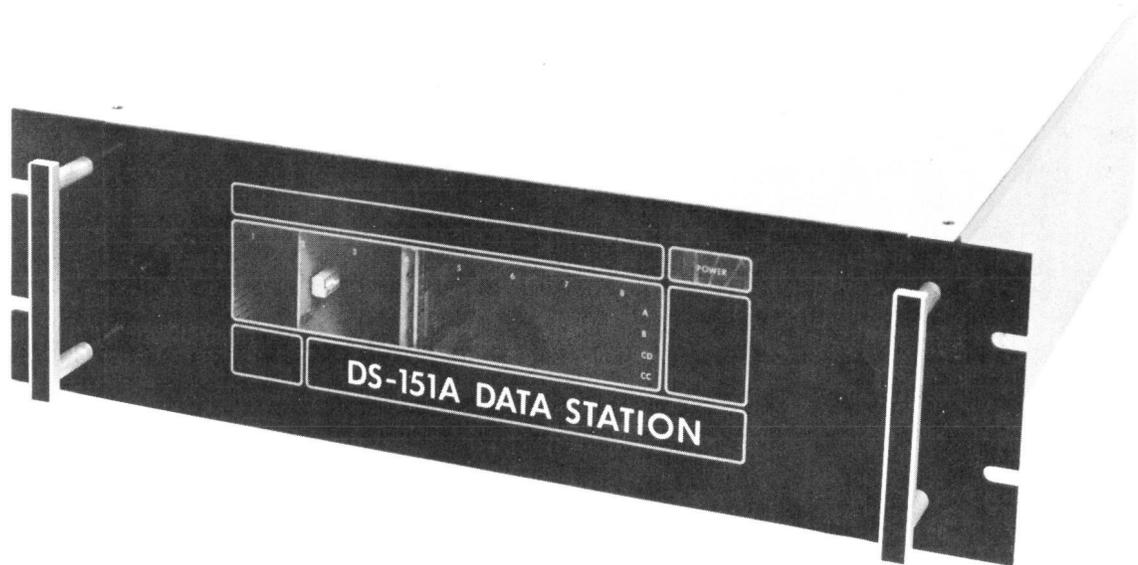


Figure 3, VuSet DS151A Data Station

- b) The data set will time-out after cessation of input from either the data terminal or from the computer.
- c) Disconnect is initiated by the computer by control of the EIA-CD lead.
- d) The data set may be arranged to immediately disconnect on the receipt of the ## characters from the TOUCH-TONE pad associated with the data terminal.

1.20 Control codes are software controlled.

1.21 Table A shows character by character data flow through the system. The terminal and data set operate in a half-duplex communications mode.

System Programming

1.22 Questions concerning programming shall be referred to systems support personnel.

VuSet SYSTEM

2. DATA TERMINAL DESCRIPTION AND OPERATION

VuSet Data Terminal Description

- 2.01** The terminal consists of a receive-only data set, display electronics, small CRT screen, a CLEAR switch, a DATA/TALK switch, and two indicator lights.
- 2.02** The terminal weighs approximately 10 pounds and measures about 8 inches wide by 9 inches deep.
- 2.03** The terminal accepts bit-serial FSK-ASCII data from the computer which is formatted into a 64-character display (maximum) on the CRT in four lines of 16 characters each.

- 2.04** Receipt of a ASCII "carriage return" (CR) code erases the display CRT and initializes the system so that the next incoming character will be displayed on the upper left-hand position of the screen. Should the terminal receive more than 64 characters before a CR, overflow information will over-write, commencing at character position number 1 in the upper left-hand corner.
- 2.05** Figure 4 shows the complete repertoire of ASCII print characters which can be displayed.
- 2.06** A blinking feature is included to alert the viewer. ASCII command DC-1 will cause all information on the screen to blink approximately once per second. This mode of operation will be terminated upon receipt of the next CR command.

**TABLE A
VuSet Data Flow**

TERMINAL TO COMPUTER							
TT PAD		DATA SET		COMPUTER			
0	5	DTMF →	0	5	ASCII →	0	5
1	6		1	6		1	6
2	7		2	7		2	7
3	8		3	8		3	8
4	9		4	9		4	9
*		} Characters converted by Data Set	*		{	CAN (CTL X)	
#			#			CR	
##			##			EOT (1)	
<p>(1) Switchable option at the data set. Data set may be set to immediately disconnect upon receipt of ##. In this mode, EOT is not sent to the computer.</p>							
COMPUTER TO TERMINAL							
VUSET		DATA SET		COMPUTER			
A-Z		← FSK		← ASCII	A-Z		A-Z
0-9			0-9		0-9		
@[] \ \ _ !			@[] \ \ _ !		@[] \ \ _ !		
" # \$ % & ' ()			" # \$ % & ' ()		" # \$ % & ' ()		
* + , - . / :			* + , - . / :		* + , - . / :		
; < > = ?			; < > = ?		; < > = ?		
SPACE			SPACE		SPACE		
NON-PRINT. ERASES SCREEN AND INITIALIZES DISPLAY			CR		CR		
NON-PRINT. CAUSES SCREEN TO BLINK			DC1		DC1		

Indicators

- 2.07** Terminal status is shown by two indicator lights (LED's) below the display screen.
- 2.08** *POWER*. The POWER lamp indicates status of AC power to the terminal and must be illuminated for the terminal to operate.
- 2.09** *DATA*. The DATA lamp indicates the status of the telephone line connection.
- When the DATA indicator is ON steady, it indicates that a connection has been established, the terminal is receiving the 2225 Hz Mark tone from the data set, and the terminal may display received data when sent.
 - The DATA lamp flashing at a steady rate indicates an incomplete connection, i.e., ringing, busy signal, disconnected call, etc.
 - When the DATA lamp is OFF, the terminal will not receive data.

Controls

- 2.10** *POWER*. A two-position ON/OFF rocker switch located in the back of the terminal which controls the power supply. Power must be ON to operate the terminal.
- 2.11** *DATA/TALK* The DATA/TALK switch is a two-position toggle.
- In DATA (up) position, the terminal is connected to the telephone.
 - When the telephone handset is lifted from its cradle, the terminal is connected to the line. The telephone receiver may be used to monitor the call, however, the

transmitter will be disconnected. The telephone cannot be used for voice communication with the switch in DATA position.

- When the switch is moved to its TALK (down) position, the terminal is disconnected and voice communications are possible.

2.12 *CLEAR*. When the CLEAR switch is activated downward to its momentary position and released, the display screen is erased and initialized to receive subsequent data.

2.13 The screen can also be cleared by receipt of the next computer generated carriage return (CR).

Data Terminal Operation

2.14 Figure 5 is a copy of the VuSet Terminal Operators Instructions provided with each terminal for operator use at each terminal location.

- Connection with the computer is established with the telephone by dialing the appropriate access number. Check that POWER is ON, lift the handset, wait for the dial tone and call the computer telephone number.
- Any characters remaining on the terminal CRT screen may be erased with the CLEAR switch.
- When the answerback tone (2225 Hz) is heard, place the DATA/TALK switch in the DATA position. The DATA lamp on the terminal will light, indicating transmission may begin.
- The handset cannot be returned to the cradle without disrupting the connection. Loss of DATA indication at any time during the transaction (except

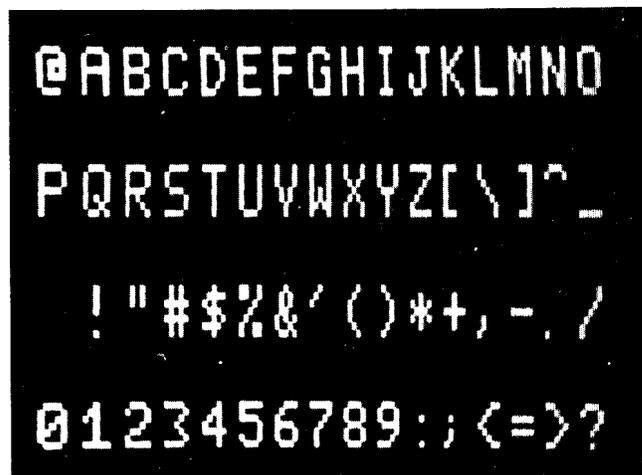


Figure 4, Display Repertoire

VuSet SYSTEM

when a TOUCH-TONE button is depressed) may require a disconnect and re-initiation of the call.

- e) The telephone pushbutton dial or accessory pad is used for data entry. Dial or pad buttons must be pushed slowly and firmly when entering data due to entry speed limitations.
- f) When the "Echoplex" character return option is enabled at the data set, character entry from the TOUCH-TONE pad will be returned for verification to the terminal CRT simultaneous with its transmission to the computer.
- g) The data rate for the system is normally 300 baud. If slower rates are required for particular installations, both terminal and data set channels must be set to the SAME desired rate during installation.
- h) Disengagement from the telephone line is accomplished by placing the handset back on the telephone cradle or by the disconnect options described in paragraph 1.19.
- j) The DATA/TALK switch may then be actuated downward to the TALK position restoring normal telephone operation.

Data Terminal Operation With TOUCH-A-MATIC Telephone

2.15 The remote VuSet Data Set should be set for ECHOPLEX "OFF".

2.16 The VuSet Data Terminal/TOUCH-A-MATIC combination should be properly installed, per section 4.

- a) The VuSet Terminal shall be in the Data Mode and Powered "ON".
- b) The TOUCH-A-MATIC telephone is to be used for automatic data entry. The data is placed in the telephone set's memory in the same manner as a telephone number is entered. The appropriate BSPs on the TOUCH-A-MATIC telephone operation shall be adhered to.
- c) The TOUCH-A-MATIC telephone has the capability to intermix manual and automatic dialing as follows:
 - d) If at any time information is keyed in manually, the RECORD OFF button must be depressed before additional data can be entered from memory. (The RECORD lamp will not light at any time, but depressing the RECORD OFF button will remove the set from the "Last Number Dialed Mode" and allow additional automatic dialing.)
 - e) If the set is equipped with the "One-Touch Calling"¹ option, the initial number must be dialed automatically (even if the one-touch calling switch is in the OFF position). This allows the dial tone detector to complete its function and then additional data may

be entered automatically or manually if desired. The rule given in b (1) above would apply after the first number was automatically dialed.

NOTE: 1 One-Touch calling permits the automatic turn on of a speakerphone connected to the TOUCH-A-MATIC telephone and the automatic dialing of the number desired by depressing one memory button.

Data Terminal Model DS150A Specifications

2.29 Data Specifications.

Display Format: 5 x 7 Character dot matrix
64 characters maximum (4 lines of
16 characters each)

Input Signal/Format: FSK-ASCII Format
Space = 2025 Hz
Mark = 2225 Hz

ASCII Codes

CR erases screen, resets to home position.

DC-1 starts screen blinking, reset by CR.

64 alphanumeric codes, upper case only.

Input Data Rate: 110, 150 or 300 baud
(10, 15, 30 characters/second)
selectable at installation.
Asynchronous operation.

Receive Level Sensitivity: 0 to -40 dBm
(referenced to telephone line)

2.30 Power Requirements

Operating Voltage: Single phase, grounded,
117 Vac \pm 10%, 60 Hz,
8 foot power cord provided

2.31 Physical Characteristics.

Weight: 10 pounds (approximately) (4.54 kg)

Dimensions: 9-1/4 inches deep (23.50 cm)
7-7/8 inches wide (20.00 cm)
8-1/8 inches high (20.64 cm)

2.32 Operating Environment.

Temperature: 0° to 50° C (operating)
-10° to 65° C (non-operating)

Moisture: 0 to 90% relative humidity
(no condensation)

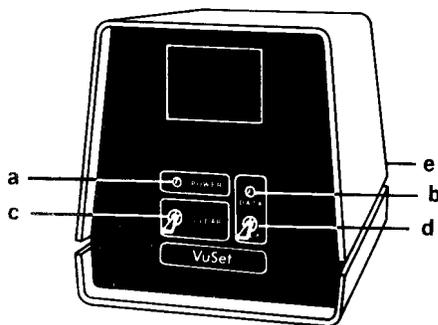
Altitude: 10,000 feet maximum (operating)
(3048m)

VuSet Visual Data Terminal

The combination of the VuSet terminal and a TOUCH-TONE® telephone using the exchange telephone network provides the user with an on-line inquiry/response system. The system affords instant yet economical retrieval of data by using the telephone to communicate with a data source such as a computer.

The telephone is a standard TOUCH-TONE telephone set or it may be a rotary telephone with an auxiliary TOUCH-TONE pad. Using the TOUCH-TONE telephone set all dialings of telephone numbers and data input is entered via the TOUCH-TONE buttons. Using a rotary set, the telephone number is dialed on the telephone set but data is entered via the pad.

The VuSet data display terminal is used as a receive-only display vehicle for data entry or inquiry/response system. The terminal has a three-inch Cathode Ray screen which can display 64 alphanumeric characters on 4 lines, 16 characters per line. There are two red indicator lamps marked POWER and DATA and three control switches marked CLEAR, DATA/TALK and POWER.



EQUIPMENT DESCRIPTION

INDICATORS:

The status of the system is indicated by two red lamps on the front panel below the display screen indicated as POWER and DATA.

a) **POWER Lamp** indicates the status of the power supply. It must be lit for the terminal to operate properly. If the lamp is dark, check the POWER switch on the back of the terminal (e). If it is in the ON position and the light is still dark, check the POWER connection on the back of the terminal and the AC wall outlet. Also check to make sure there is power into the building.

b) **DATA Lamp** indicates the status of the connection. When the lamp is off the VuSet is not receiving data. When the lamp is on it indicates that a connection from the data source to the VuSet terminal is established and received data will be displayed. The data lamp will flash when there is an incomplete connection (busy or ringing). If the line is busy, hang up and re-dial.

CONTROLS:

Two switches on the front panel of the VuSet terminal are shown as CLEAR and DATA/TALK. A POWER switch is located on the back panel.

c) **CLEAR Switch** is a two-position toggle switch. In the center position the terminal operates normally. Received data will remain on the screen indefinitely, provided that the POWER lamp remains on and the DATA lamp remains off. When this switch is operated downward and released (the switch returns to the NORMAL position), all data on the screen is erased.

d) **DATA/TALK Switch** is a two-position toggle switch that controls the use of the associated telephone set.

In the DATA (up) position, the telephone set is used in conjunction with the VuSet terminal. The telephone can not be used for voice communication with the switch in the DATA position.

In the TALK (down) position, the telephone functions normally and voice communication is possible.

e) **POWER Switch** is a two-position ON/OFF rocker switch located in the back of the terminal which controls the power supply. Power must be on to operate the set. However, at the end of the business day power may be turned off.

TO PLACE A CALL TO THE DATA SOURCE:

- Verify that the POWER lamp is on.
 - If the lamp is off, make certain the POWER switch is on, the plug is in the power outlet and power is available at the outlet.
 - If the lamp remains off report the trouble to the Telephone Company.
 - If characters appear on the screen use the CLEAR switch to erase.
- Operate the DATA switch to the DATA (up) position.
- Select an idle line on the telephone where required.
- Lift the handset.
- Listen for dial tone.
- Dial _____
- The DATA lamp flashes during dialing.
- Listen for the ringing signal. (If you hear a busy signal, hang up and try again.)
- Wait for high pitched answerback tone which indicates the called station is ready to receive data. The DATA lamp lights steadily. CLEAR screen as necessary.
- **LEAVE THE HANDSET OFF-HOOK.** A high pitched tone continues to signal during the transaction.
- Use the TOUCH-TONE dial/pad to enter data as locally directed. Push dial or pad buttons slowly and firmly.

TO DISCONNECT A CALL:

- Replace the handset onto the switchhook—hang up—DATA lamp will go off.
- Depress the CLEAR switch (down) and release to clear display screen, if desired.
- To restore the telephone for normal voice communication, push the DATA/TALK switch (down) to the TALK position.

TO REPORT TROUBLE:

Trouble that is encountered on Telephone Company provided equipment should be reported by calling _____ . In the report, indicate that the trouble is "DATAPHONE® Service Trouble."

09862-02

® Registered Servicemark of AT&T Co.

REV. A

How to operate the
VuSet Visual Data Terminal



Figure 5, VuSet Terminal Operators Instruction Card

3. PRINCIPLES OF OPERATION

Functional Overview

3.01 The VuSet terminal attaches to a standard DTMF telephone set for interface to the telephone network. The telephone's pushbuttons are used to establish the communication path to the data terminal equipment (DTE, computer). The DTMF pad is then used for data entry to the DTE.

3.02 Figure 6 is a functional block diagram of the VuSet terminal. The terminal is a receive-only device which displays received ASCII-FSK data. Figure 7 is the interconnect diagram for the terminal subassemblies.

3.03 The FSK signals pass through the telephone set to the demodulator board. With the data/talk switch in the data position, the transmitter in the handset is electrically replaced with the VuSet terminal. The function is filtering and demodulation of the data from FSK to ASCII.

3.04 The bit-serial, character-serial data is then passed onto the data converter card where it is converted to a 7-bit parallel character-serial form. The data is decoded for various operations, typically; write, blink and erase. Data is stored in a refresh-type memory and is used to address a character generator. Output of the character generator is a video pulse train.

3.05 The video pulse signal is passed on to the display circuits and modulates the CRT scanning beam on and off in proper synchronization such that the beam dots form characters on the screen. Each character is made up of a 5 x 7 dot matrix.

Demodulator Board Circuit Description

3.06 Demodulator functions are shown in Figure 8. FSK data enters the photo coupler isolating circuit from the telephone line. The FSK signal is then fed to the AGC network. The network amplifies the signal for presentation to the bandpass filter amplifiers. The pre-selector filter is tuned to the band center frequency, 2125 Hz. Space and Mark filters, providing final shaping of the bandpass curve of the receiver, are tuned to 1950 and 2300 Hz, respectively.

3.07 A feedback loop provides control voltage for the AGC. Simultaneously, the filter outputs are taken through a limiting amplifier designed to limit signal level 12 dB below the established gain-controlled signal level. The output of the limiting amplifier feeds a phase-locked loop demodulator.

3.08 The phase-locked loop demodulator accepts FSK Mark and Space signals, corrects small frequency phase errors, compensates for temperature changes and presents the data to the level converter.

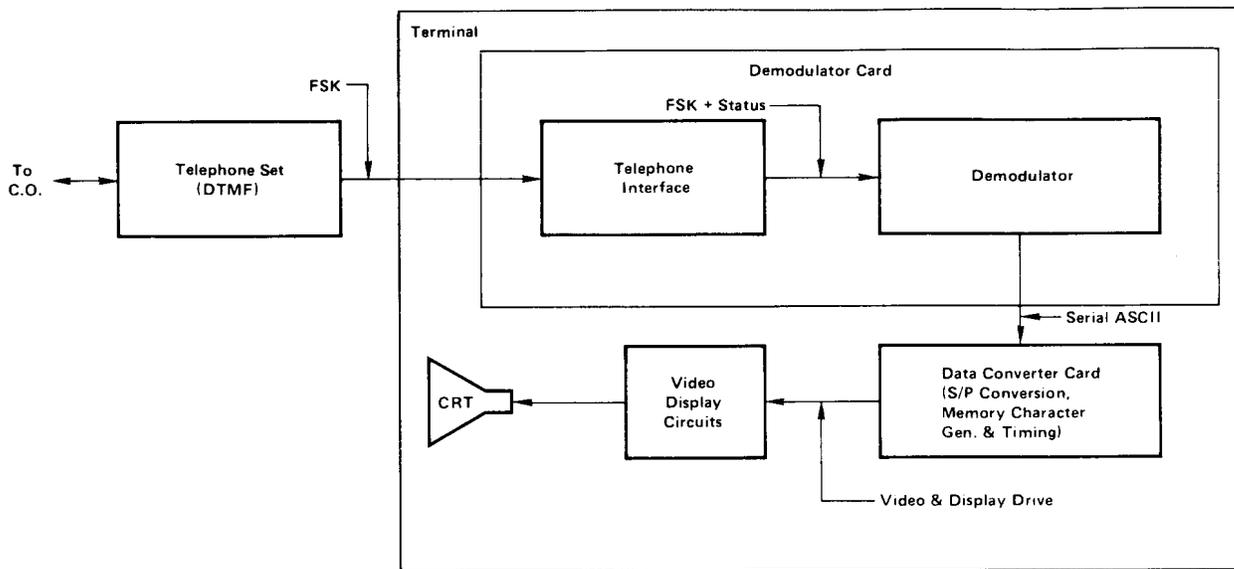


Figure 6, Terminal Function Block Diagram

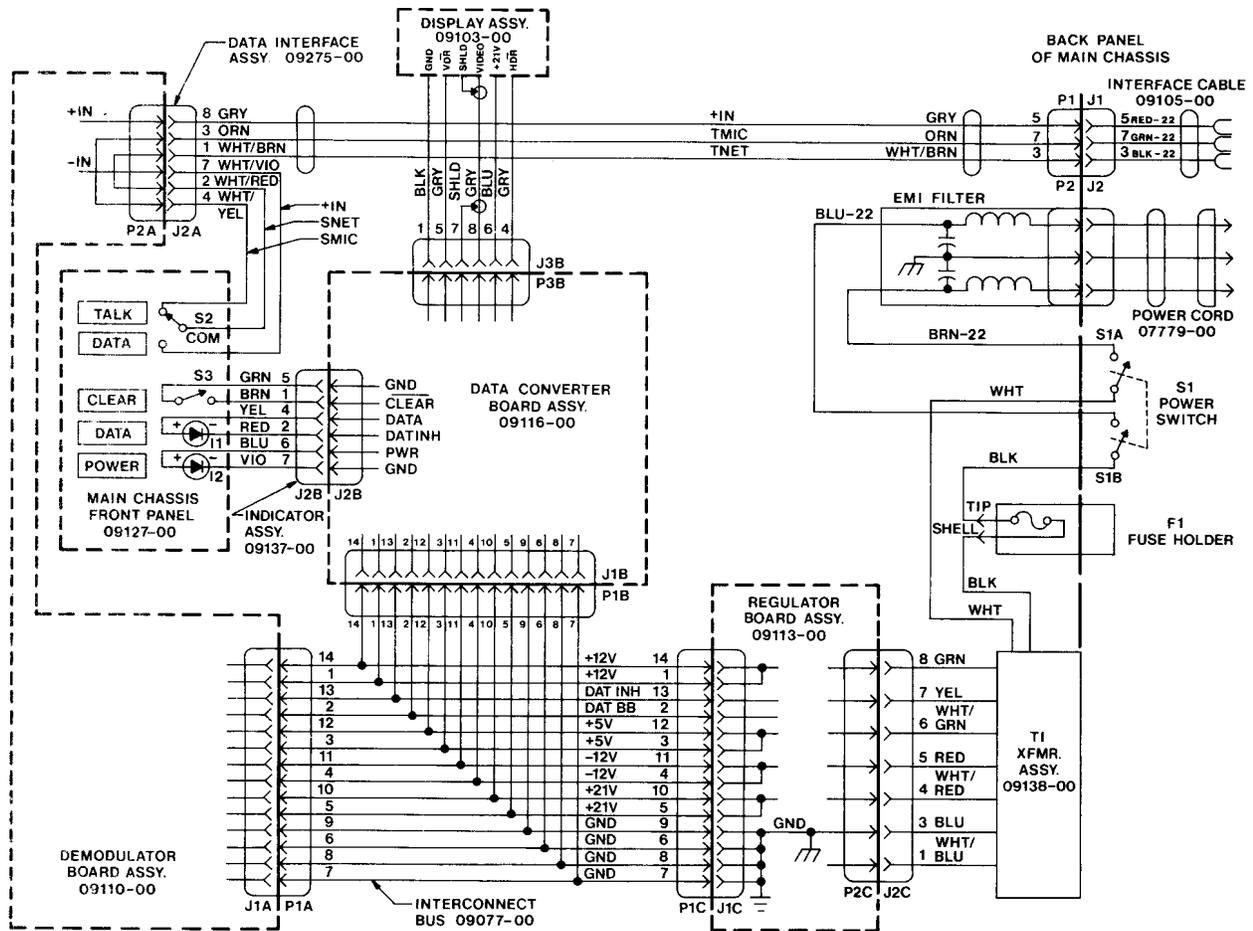


Figure 7, Terminal Interconnect Wiring Diagram

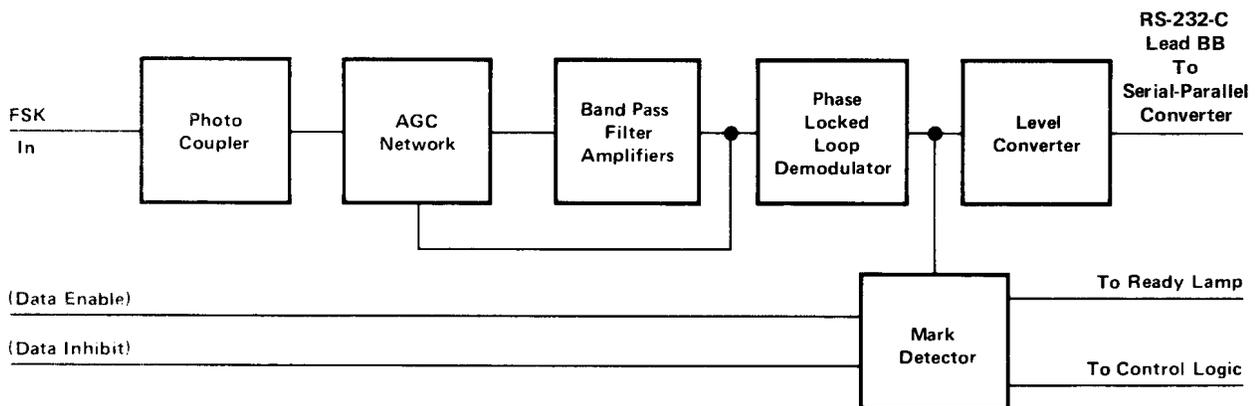


Figure 8, Demodulator Functional Block Diagram

3.09 The level converter changes the demodulator output from EIA voltage levels of more negative than -3V (Mark) and more positive than +3V (Space) to corresponding logic level states of one (1) and zero (0), respectively, for processing in the data terminal.

Data Converter Board Circuit Description

3.10 Terminal logic serial to parallel conversion, Figure 9, depicts the flow of data through the logical portion of the terminal. When the carrier detector senses a carrier, the serial-to-parallel converter is enabled to accept data. As a start pulse Mark-to-Space transition is detected, control signals step the data into the serial-to-parallel converter bit by bit. The start bit is stepped out of the converter by control logic just as the last information bit steps in. Control logic now stops further bits from entering the converter, holds the seven information bits on the parallel data buss momentarily, alerts other control logic and the decoders ahead with a control signal called OPERAND (or OPD) and prepares to accept a new character in the converter.

DC-1 (Blink) Decoder

3.11 This decoder tests for the control character, DC-1, used to create a CRT screen blinking condition. Its presence will cause the entire screen to blink at a 1-Hz rate until cancelled by CR.

Carriage Return Decoder

3.12 This decoder tests for the function character, CR. When this decoded, the screen is cleared or erased, the blink is stopped, position counters are returned to zero and the next character to be displayed on the screen will appear in the first print position in the upper left hand corner.

Write Command Decoder

3.13 The final decoder, operates only upon receipt of the strobe signal and samples for legal characters. This is a test of bits 6 and 7.

3.14 If bits 6 and 7 are both zeros, the character is a control or function character and ignored. If either bit 6 or 7 is a one, or both are a one, the character is legal and a write command is issued to permit this character to enter the memory (RAM). Only six of the 7 bits are stored in the memory. Bit 6 is eliminated since bit 7 actually performs the same function, but in the opposite logical state. (If bit 6 is a one, but 7 is a zero and vice versa.) This allows a clear memory to display all space characters (there is never a time when the memory does not contain data) and converts the lower case letters to upper case (a limit of the character generator).

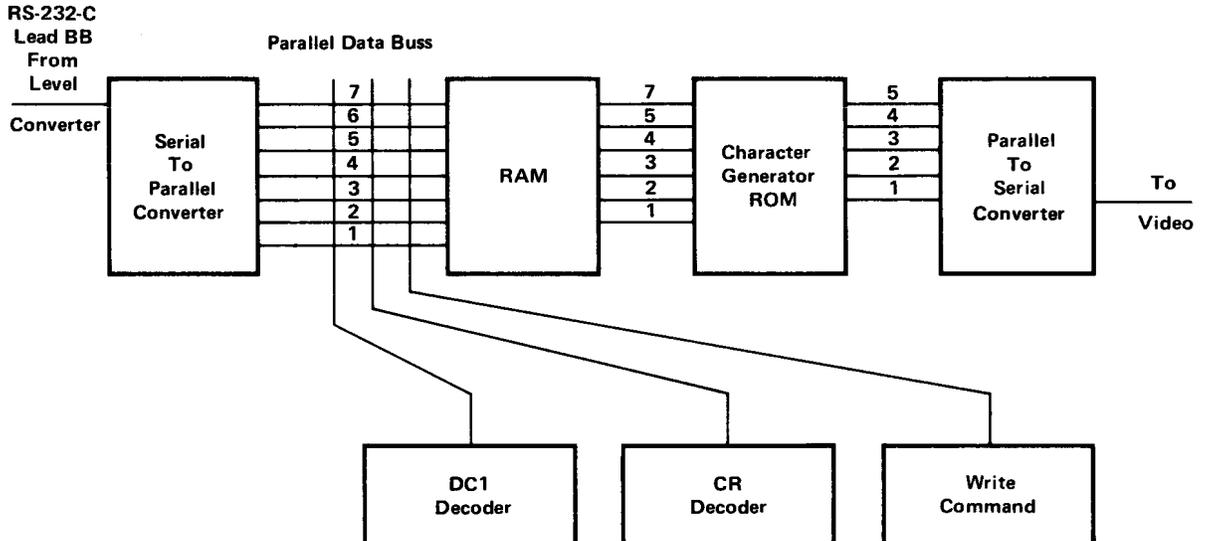


Figure 9, Data Converter Signal Flow Block Diagram

Random Access Memory (RAM)

3.15 When a WRITE command signal is issued, the character on the parallel data buss will be stored in a specific location in the memory. This RAM stores 64 characters. A carriage return function character or CLEAR switch clears the memory. If more than 64 characters are received in one message, the 65th character will replace character one and so forth.

3.16 A line and address counter determines the specific storage location for each character. When CR is received or the manual CLEAR switch is depressed, the counter is reset to zero. Each time a legal character is accepted the counter advances and a character is placed in a new location. When the last character of a message is received, the counter stops at that number (or address) and waits for the next character. It is possible to have a short message stay on the CRT screen and accept a new short message on the screen following the original message.

3.17 The VuSet terminal has the capability of printing on the CRT screen without destroying the information stored in the memory. To keep information on the screen, the terminal will periodically repeat a read operation to refresh the screen or keep it glowing.

Character Generation by the Read Only Memory (ROM)

3.18 The VuSet ROM is a 64 x 7 x 5 dot generator. It will accept 64 different character codes and reform them into 7 rows of 5 dot positions for each character. When a READ command is issued by control logic, information is transferred out of the Memory (RAM) and passed through the character generator (ROM) in the same precise order in which it was stored.

3.19 The purpose of ROM is to transform the ASCII coded characters into rows of dots that are swept onto the CRT screen row by row. The ROM is manufactured to accept ASCII format data and output dots for printable characters on the screen. The codes and dots cannot be changed. Each dot position is logically a one or zero. A one becomes the lighted portion of a character on the screen; the zero allows the screen to remain dark at its specific location.

3.20 The ROM is set up and then, as shown in Figure 10, sends out five dots (or lack of dots) representing the top row of the first character in a continuous stream that is stepped out of the ROM and through the parallel to serial converter. Then the top row of the second character, third, fourth, etc., are sent until all sixteen character posi-

tions of the first text line are out. A text retrace counter advances by one and the same row repeats itself slightly lower vertically than the first sweep. This counter again advances so that the row of dots is repeated on four horizontal traces which make up the first or top row. An address counter then advances permitting the second row to be output four times.

3.21 The procedure continues until the first line of text is complete, or after thirty-two sweeps (horizontal traces). Separation between text lines equals or is less than the text lines. The ROM output is blanked by the converter while the blank horizontal lines are swept. Then, the second text line commences just like the first. After the required number of sweeps, the entire message is on the screen. The refresh program is simply a repetition of the original message at a 60-Hz rate. This continuous process stops only when the VuSet is turned off.

Control Logic (Figure 11)

3.22 Accepting serial data and converting to printed words on the CRT screen is a complex operation. The master clock, always running, drives the control operation through a series of dividers that become counters or steppers. The end counters or steppers run continuously or on command only, depending upon their function.

3.23 *Start-Stop Control.* When the start bit is sensed, a stepper begins to increment at the selected bit rate (300, 150 or 110 bps). This allows each bit to be stepped through the serial-to-parallel converter. When the start bit is stepped out, the stepper continues for two more cycles and stops, waiting for the next character. OPERAND (see paragraph 3.10) indicates a character is on the parallel data buss and is part of the last two cycles.

3.24 *Memory Control.* This control has several functions:

- a) The write address counter increments for each legal character as it is received and is only reset to zero by a manual clear or receipt of control character CR.
- b) The read address counter runs whenever write is not operating.
- c) Write command is issued on receipt of a printable character.
- d) Read for each character in the memory, even when write is operating.

3.25 *Character Generator Control.* Essentially, this is the blink control, text separation, CRT horizontal retrace time and address counter.

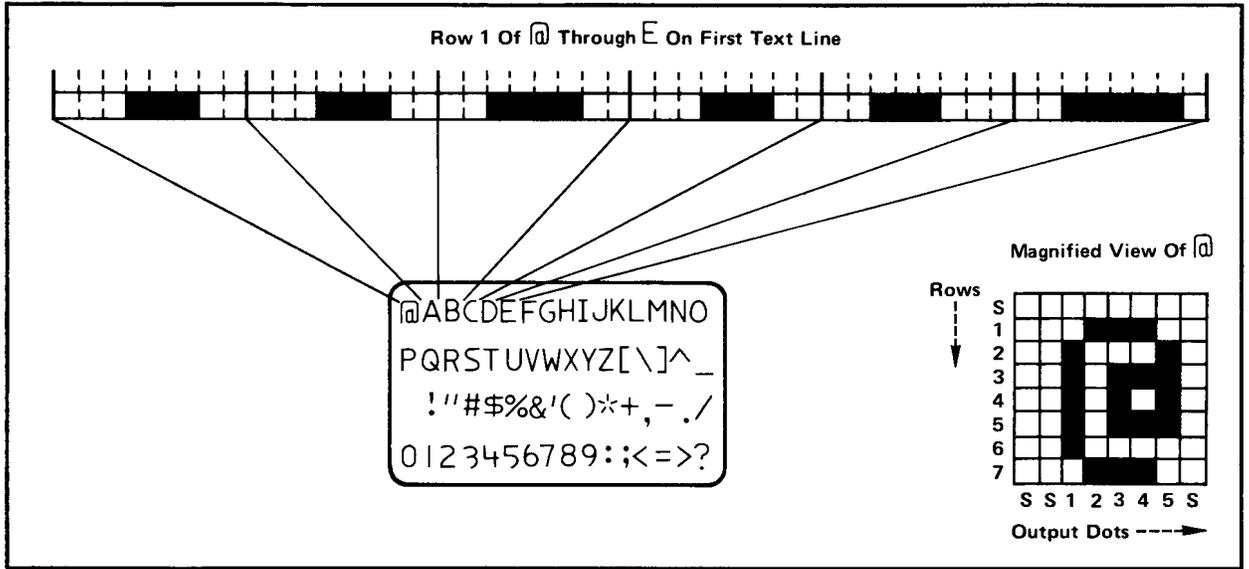


Figure 10, Character Generation

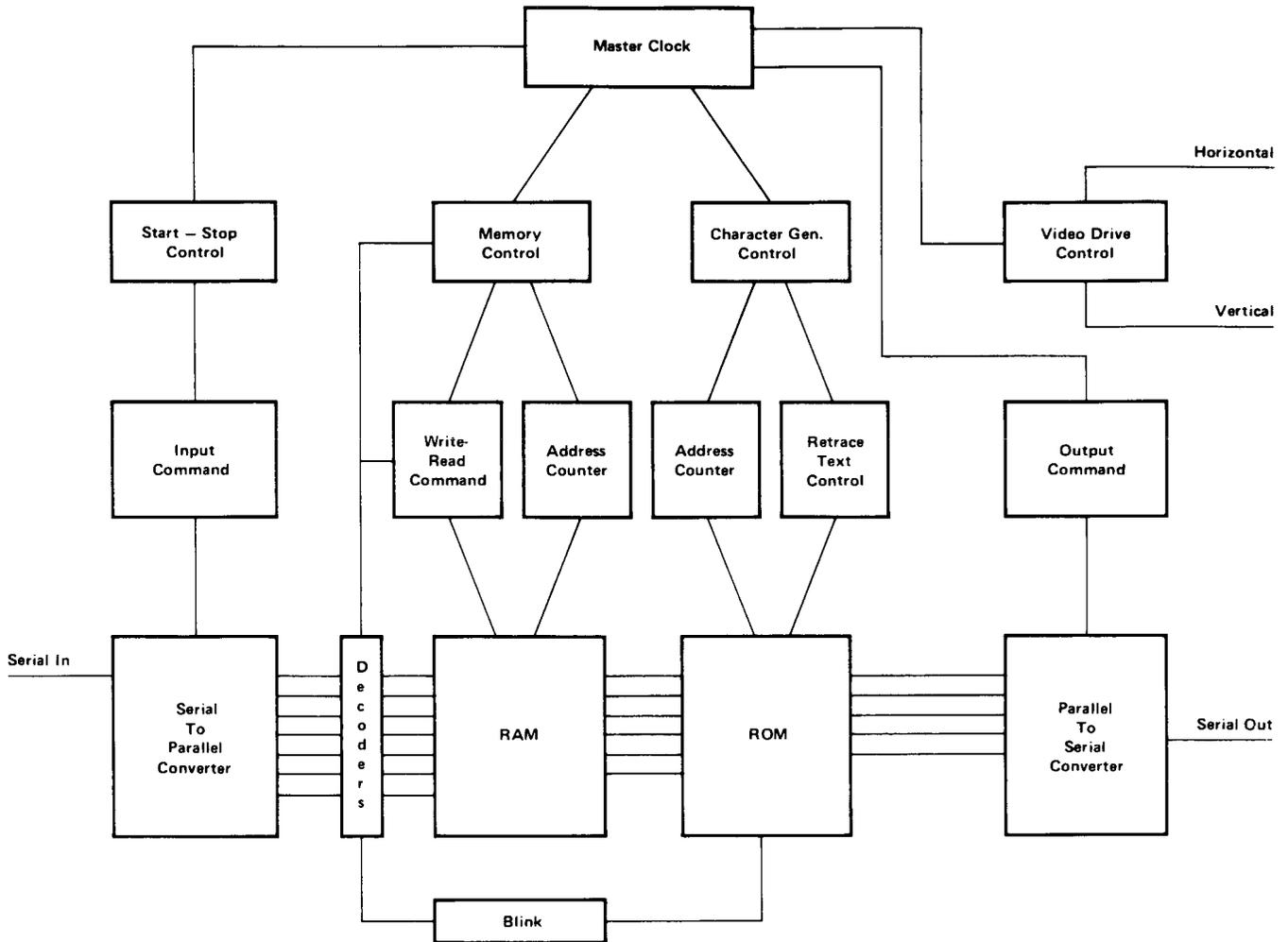


Figure 11, Data Converter Command and Control Diagram

3.26 *Parallel-to-Serial Converter.* The dots are output from the ROM in parallel to the parallel-to-serial converter. Then under control of the clock, the parallel-to-serial converter outputs a stream of dots to the video line.

3.27 *Horizontal and Vertical Drive Clocks.* The horizontal drive provides the horizontal sweep frequency and the vertical drive provides the vertical sweep frequency.

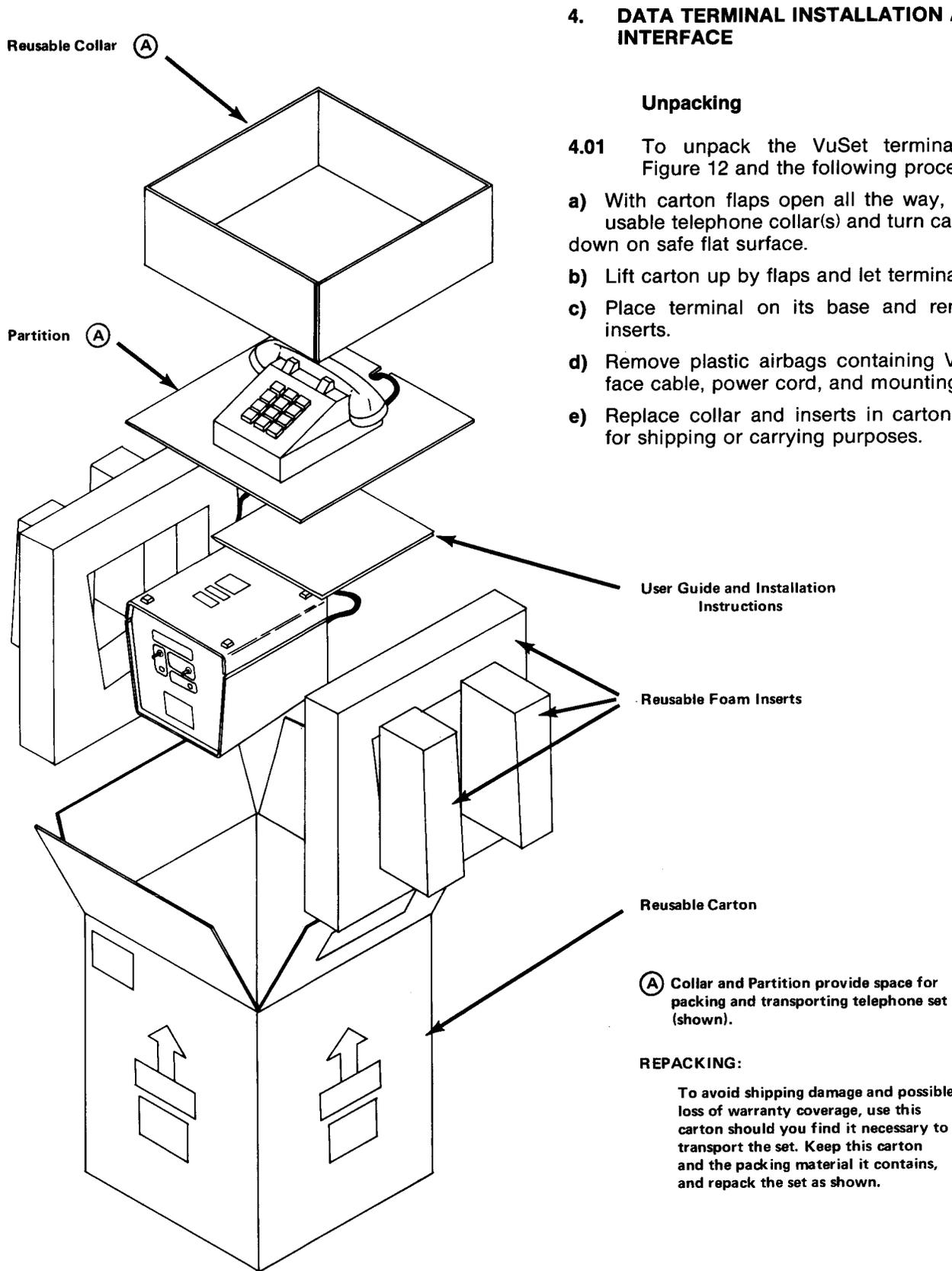
CRT Display

3.28 The CRT display assembly consists of the deflection circuits PC board, the flyback transformer, the high voltage rectifier, the yoke, the CRT and its pin socket.

3.29 The VuSet terminal does not use composite video signals as does a standard television receiver. Each of the three signals, video, horizontal and vertical are independent, controlled by the master clock eliminating the necessity of external controls as horizontal and vertical hold. The brightness control remains, but as an internal adjustment.

Regulator Board Circuit Description

3.30 The regulator board receives ac voltages from three separate secondary windings on the power transformer. The ac voltages are rectified and fed to three separate voltage regulators which provide regulated voltages of +5 Vdc, +12 Vdc, -12 Vdc. The regulator board also supplies unregulated +21V to power the display assembly.



4. DATA TERMINAL INSTALLATION AND INTERFACE

Unpacking

4.01 To unpack the VuSet terminal, refer to Figure 12 and the following procedure:

- a) With carton flaps open all the way, remove reusable telephone collar(s) and turn carton upside down on safe flat surface.
- b) Lift carton up by flaps and let terminal slide out.
- c) Place terminal on its base and remove foam inserts.
- d) Remove plastic airbags containing VuSet interface cable, power cord, and mounting kit.
- e) Replace collar and inserts in carton and retain for shipping or carrying purposes.

User Guide and Installation Instructions

Reusable Foam Inserts

Reusable Carton

(A) Collar and Partition provide space for packing and transporting telephone set (shown).

REPACKING:

To avoid shipping damage and possible loss of warranty coverage, use this carton should you find it necessary to transport the set. Keep this carton and the packing material it contains, and repack the set as shown.

Figure 12, Data Terminal Packing

Data Rate Setting

4.02 The terminal is factory set at 300 baud. If a data rate other than 300 baud is to be used, proceed as follows:

- a) Remove display unit from housing by removing the three #6-32 screws from the bottom.
- b) Metal cased terminals also require removal of three #4-40 screws from the rear of the terminal. Remove the back panel and slide the terminal forward out of its housing.
- c) The #4-40 screws are **not** present on the back of plastic cased terminals. Simply slide the chassis forward after removing the bottom screws.
- d) Visually inspect all subassemblies for damage and ensure solid connections.
- e) Locate data rate selector switch on the data converter board (see Figure 13,) and set desired data rate placing selector switch segments to the positions indicated in Table B. Switch S1 is a four seg-

ment switch on 09116-00 data converter boards and a five segment switch on 09219-00 data converters. The segments used for baud rate selection, however, are S1-2, S1-3 and S1-4 in both configurations.

CAUTION: *Data rates must be set the same for terminal and data set.*

TABLE B
Baud Rate Selection

Set Switch ON	Set Switch OFF	Baud Rate
S1-2, S1-4	S1-3	300 (factory set)
S1-3, S1-4	S1-2	150
S1-3	S1-2, S1-4	110

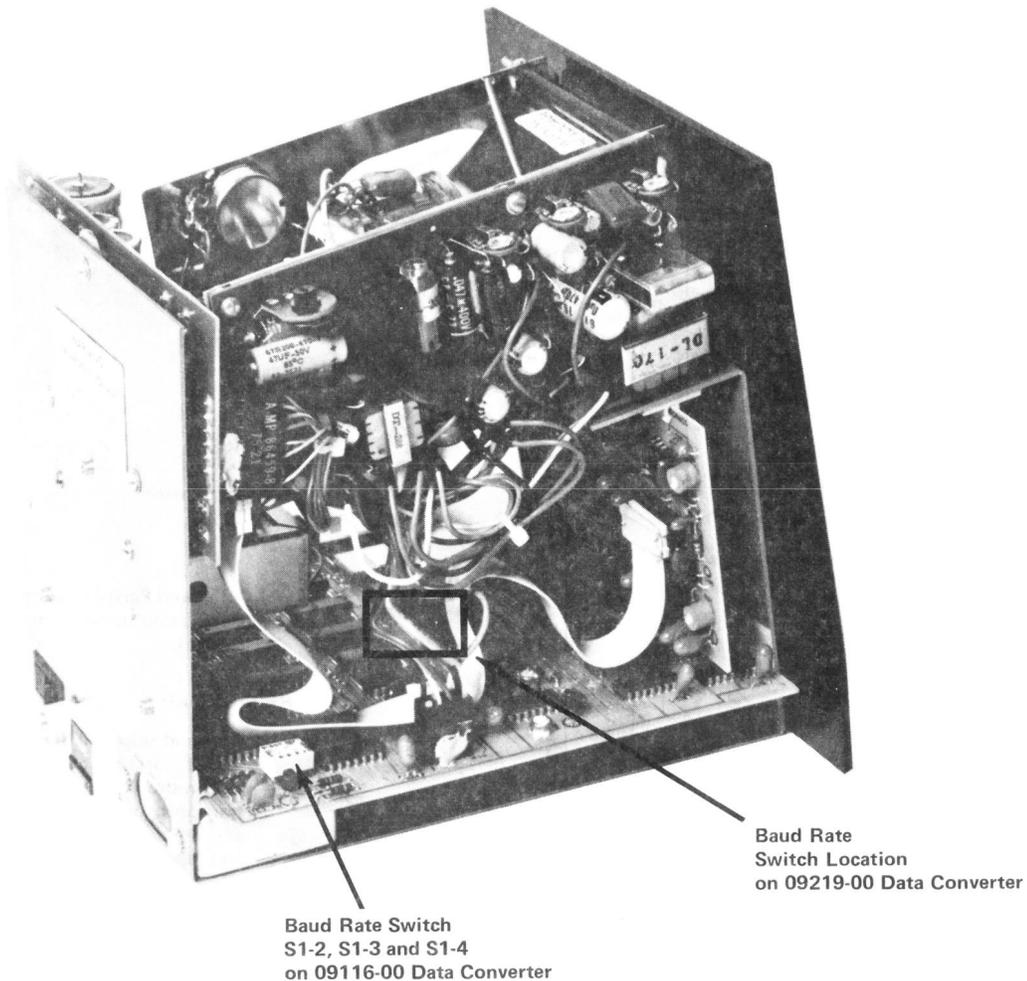


Figure 13, Baud Rate Switch Location

Interface Cable Connection

CAUTION: Do not apply power to terminal or connect telephone to line before making connections per this section.

4.03 Connect the interface cable to the telephone set as follows:

- a) Route interface cable to standard telephone sets per Figure 15 and Table D as necessary.
- b) Route interface cable to TOUCH-A-MATIC® telephones per Figure 16 and Table E.
- c) Connect interface cable spade lugs per Table C.
- d) Connect interface cable to receptacle at rear of terminal, see Figure 14. Note that the cable connector is of the push-on, pull-off type and should **not** be turned or twisted to attach or remove.
- e) Connect power supply cord to receptacle at rear of terminal.

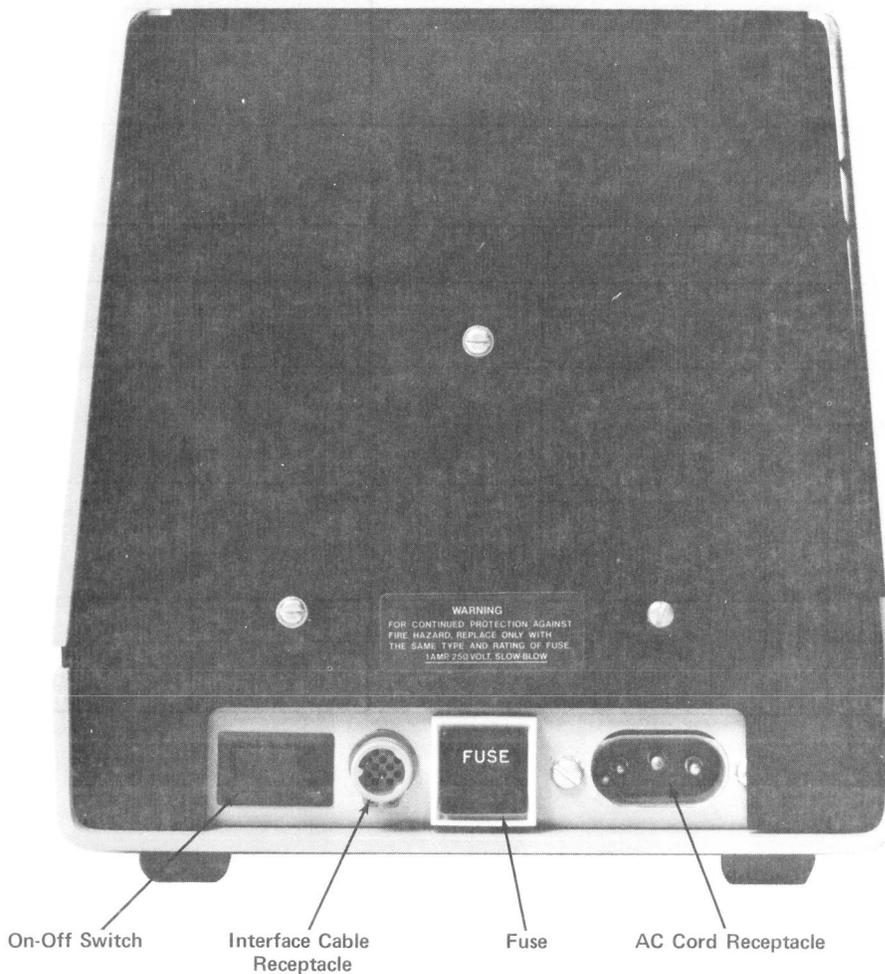


Figure 14, Interface Connections to VuSet Terminal

TABLE C
Telephone Set Interface Connections

TELEPHONE SET CIRCUIT	INTERFACE CABLE			TELEPHONE SET			
	LEAD COLOR	SWITCH CIRCUIT	LEAD FUNCTION	WECO 2500 D, 2564, 2565,	WECO 500D, 564, 565, WITH 1035C3A DIAL		
<p>The diagram shows a telephone set circuit with three terminals: XMTR (positive transmitter), SPLICE, and REMOVED (negative transmitter). Arrows indicate the connection of interface cable leads: Red to XMTR, Green to SPLICE, and Black to REMOVED.</p>	Red	→	Add (Red) to positive transmitter lead on telephone network.	Network T	Splice to previously spliced (Red) transmitter lead and (S-W) 4 lead of 1035 dial.		
	Green	↘	Remove negative transmitter lead from normal network termination and splice to (Grn).	Remove (Blk) handset wire from Network B and splice.	Remove (Blk) handset wire from Network B and splice.		
	Black	↗	Add (Blk) to normal network termination for negative transmitter lead.	Network B	Network B		

TELEPHONE SET CIRCUIT	INTERFACE CABLE			TOUCH-A-MATIC TELEPHONE SETS			
	LEAD COLOR	SWITCH CIRCUIT	LEAD FUNCTION	WECO 2960	WECO 2872	WECO 2870	
<p>The diagram shows a telephone set circuit with three terminals: XMTR (positive transmitter), SPLICE, and REMOVED (negative transmitter). Arrows indicate the connection of interface cable leads: Red to XMTR, Green to SPLICE, and Black to REMOVED.</p>	Red	→	Add (Red) to Positive Transmitter Lead on telephone network.	PSB-20	TB2-12	TB-15	
	Green	↘	Remove Negative transmitter lead from normal network termination and splice to (Grn).	Remove (Blk) handset wire from PSB-21 and splice	Remove (Blk) handset wire from TB2-8 and splice	Remove (Blk) handset wire from TB-13 and splice	
	Black	↗	Add (Blk) to normal network termination for negative transmitter lead.	PSB-21	TB2-8	TB-13	

VuSet SYSTEM

PROCEDURE (SEE NOTE 1)	
1.	Remove telephone housing from base plate.
2.	Remove paper backing from adhesive side of cable-tie clamp.
3.	Install cable-tie clamp to base place, under DTMF pad. See Note 2.
4.	Fasten interface cable to clamp with cable-tie.
5.	Make interface cable connections as stated in Tables C and D as appropriate. Use plastic snap-on insulator provided in mounting kit for wire splice.
6.	Replace telephone housing, ensuring interface cable is not trapped or stressed by housing or base and that cradle switch operation is free.

- NOTES:**
- 1 Disconnect telephone from line using standard plant practices before performing this procedure.
 - 2 For other type telephones, cable-tie clamp may be cut to shape and/or clamped on any reasonable interior surface.

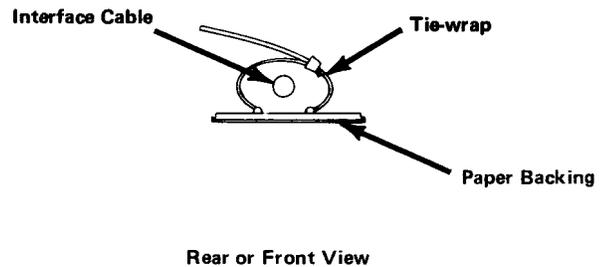
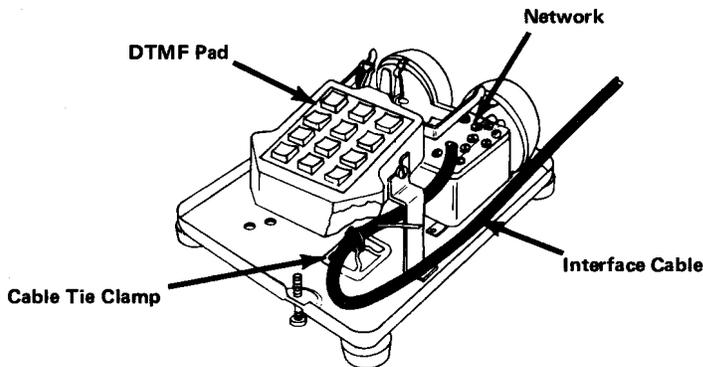
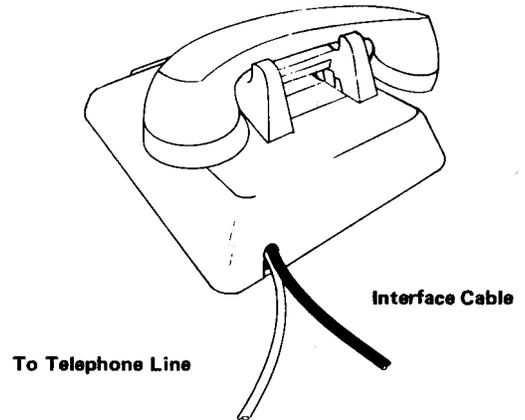
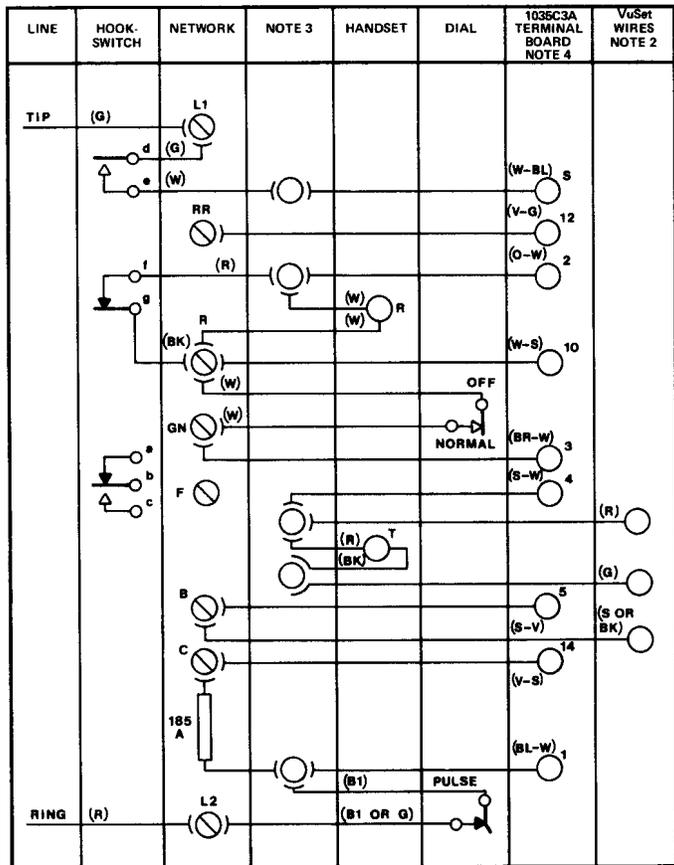


Figure 15, Interface Connections to Standard Desk Set Telephones

TABLE D
Connections for Western Electric 500D & 565HK
Telephone Sets with 1035 Dial and 185A Network
BSP 502-501-101 (500D), 501-164-1035 (C3A)



PROCEDURE (SEE NOTE 1)	
1.	Insulate separately and store 1035 dial leads as follows: 6, 7, 9, and 11. Modify 500D, add 185A network and add 1035 C3 dial, as follows:
2.	Remove (W) line switch lead from F of network and splice to (W-BL) S lead of 1035 dial.
3.	Remove (Y) and (S) line switch leads from L2 of network and store.
4.	Remove (BL) dial pulse lead from F of network and connect to L2 of network. Connect one wire of 185A network to C of network.
5.	Remove (BL or G) dial pulse lead from RR of network and connect to (BL-W) 1 lead of 1035 dial and one wire of 185A network.
6.	Connect (V-G) 12 lead of 1035 dial to RR of network.
7.	Remove (W) handset lead and (R) line switch lead from GN of network and splice to (O-W) 2 of 1035 dial.
8.	Connect (BR-W) 3 of 1035 dial to GN of network.
9.	Remove (R) handset lead from R of network and splice to (S-W) 4 lead of 1035 dial.
10.	Connect (W-S) 10 lead of 1035 dial to R of network.
11.	Connect (S-V) 5 lead of 1035 dial to B of network.
12.	Connect (V-S) 14 lead of 1035 dial to C of network.
13.	Remove (BR) line switch lead from C of network and store.
14.	Add connections as shown in Table C.

- NOTES:**
1. Disconnect telephone from line using standard plant practices before performing this procedure.
 2. If the 500D telephone is a model which does **not** have color coded wires and has soldered lugs on the network, replace the telephone with a later model having spade lugs on the network.
 3. Connect After 1035C3A Connections.
 4. Splice or Spare Unused Terminals As Appropriate.
 5. Wires 6, 7, 8, 9, 11, 13 and T Not Used.
 6. **NO WIRES REMAIN ON TERMINAL "F" OF NETWORK.**

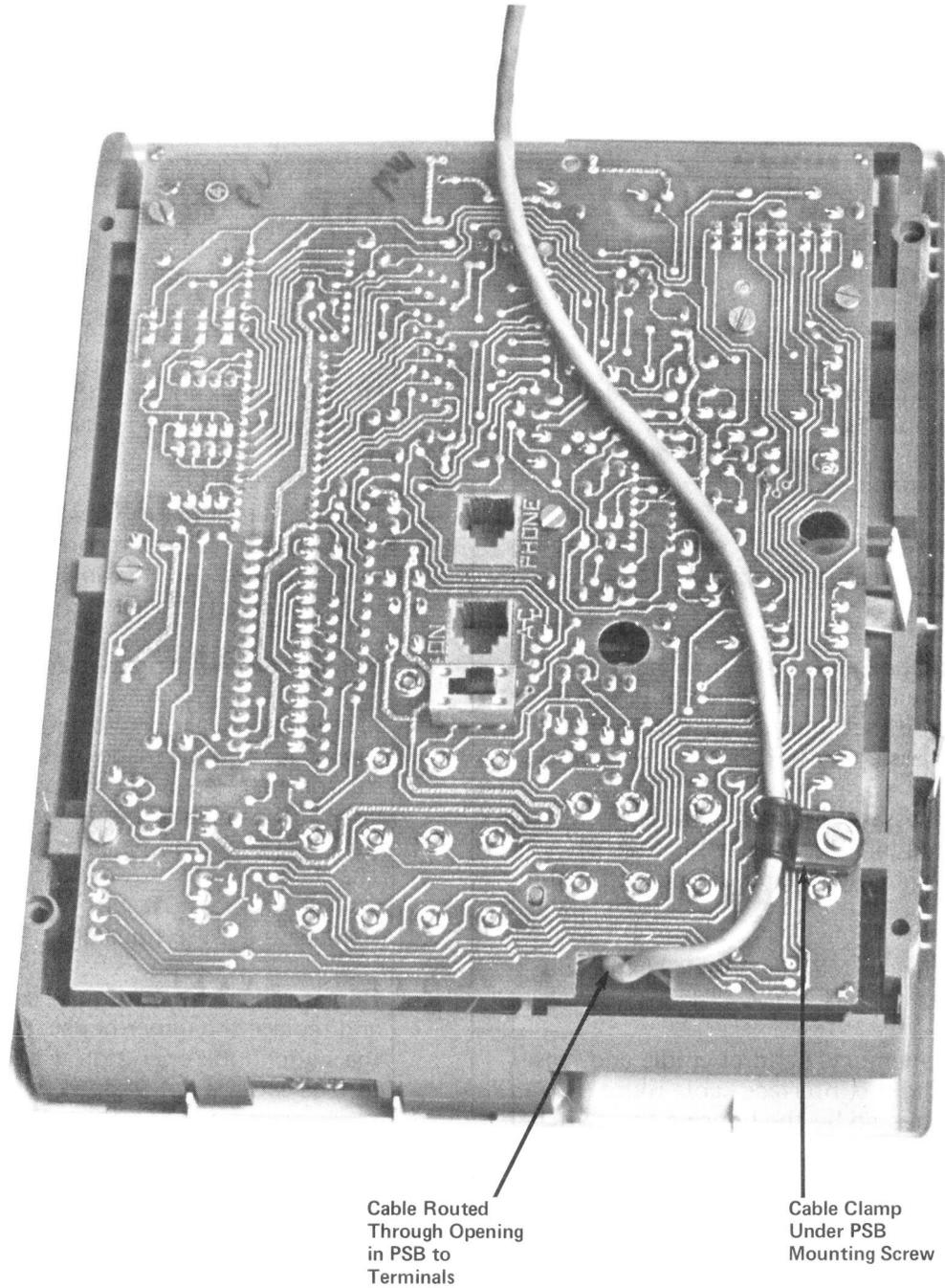


Figure 16, TOUCH-A-MATIC Telephone Interface Cable Routing

TABLE E
Connections for Western Electric TOUCH-A-MATIC®
Telephones, Models 2870, 2872 and 2960

Model 2870 **BSP 503-300-101**
Model 2872 **503-603-101**

Model 2960 **BSP 503-301-101**

PROCEDURE	
1.	Disconnect power cord and tip and ring mounting cord from phone.
2.	Remove faceplate and handset cradle.
3.	Remove backing paper from adhesive side of cable tie clamp. Install clamp to rear surface of housing 1/2" from the bottom and 1/2" from the left-hand edge.
4.	Remove the captive memory screws (4), lift memory to the right and rest it on the DTMF pad.
5.	Route the spaded end of the interface cable through the rear cable mounting hole and to the left around the terminal board and the switchboard assembly.
6.	Make the necessary interface cable connections as stated in Table C. Use the snap-on insulator provided in the mounting kit for the wire splice.
7.	Secure interface cable to cable-tie clamp with the cable tie.
8.	Replace the memory, handset cradle and faceplate, ensuring the interface cable is not trapped or stressed by the housing and switchhook operation is free.

PROCEDURE	
1.	Disconnect power cord and tip and ring mounting cord from phone.
2.	Remove lower housing (4 screws).
3.	Remove upper housing. (3 screws under faceplate on the right and 1 screw under number plate.)
4.	Route interface cable (spade lug end in first) through rear mounting cord knockout in lower housing. Route cable through opening in power supply board as shown in Figure 16.
5.	Remove battery from battery compartment.
6.	Make the connections as defined in Table C. The splice is to be made using the snap-on insulator provided under the power supply board. The cable is then to be secured using the cable clamp provided as shown in Figure 16.
7.	Replace the lower housing.
8.	Replace the battery into the compartment and replace the upper housing. Verify that the switchhook operation is free and the interface cable is not trapped or stressed.
9.	Replace the power cord and the tip and ring mounting cord.

VuSet SYSTEM

Operation and Test Procedure

4.04 This procedure verifies operation of the VuSet terminal.

- a) Connect telephone set to telephone line using standard plant practices.
 - b) Plug in VuSet power cord.
 - c) Set POWER switch in ON position.
 - d) Scattered characters may appear on the screen after 30 seconds; this is normal. Clear screen by depressing CLEAR switch and release.
 - e) Ensure that the DATA/TALK switch on display unit is in UP position.
 - f) Pick up telephone handset and ensure dial tone is present.
 - g) Place call to VuSet test station number
-
- h) On receipt of answerback tone, you are ready to communicate with the computer. Leave handset off-hook.
 - j) Enter data via pushbutton pad according to the appropriate system procedures. Response will appear on CRT display.

k) Upon completion of call, replace handset onto the switch-hook. DATA indicator should now be extinguished.

NOTE: The DATA/TALK switch must be in the DATA position for communications with the computer. In the event you wish to use the telephone for voice communications, place the DATA/TALK switch in the TALK position.

VuSet Automatic Test Station (ATS)

4.05 A dial-up automatic test station for VuSet customers is available. It permits installers or repairmen to exercise a VuSet Terminal from a customer site or test bench. The automatic test station consists of a DS151A Data Station, a data set with echoplex character recognition system and a DTE simulator board.

4.06 The ATS data set is equipped with an echoplex feature which will permit a character recognition and return of all other TOUCH-TONE entries, which do not interact with the DTE simulator as the control characters # and * do. This permits selected manual testing of TOUCH-TONE inputs of characters 0 through 9 and their returned ASCII equivalents.

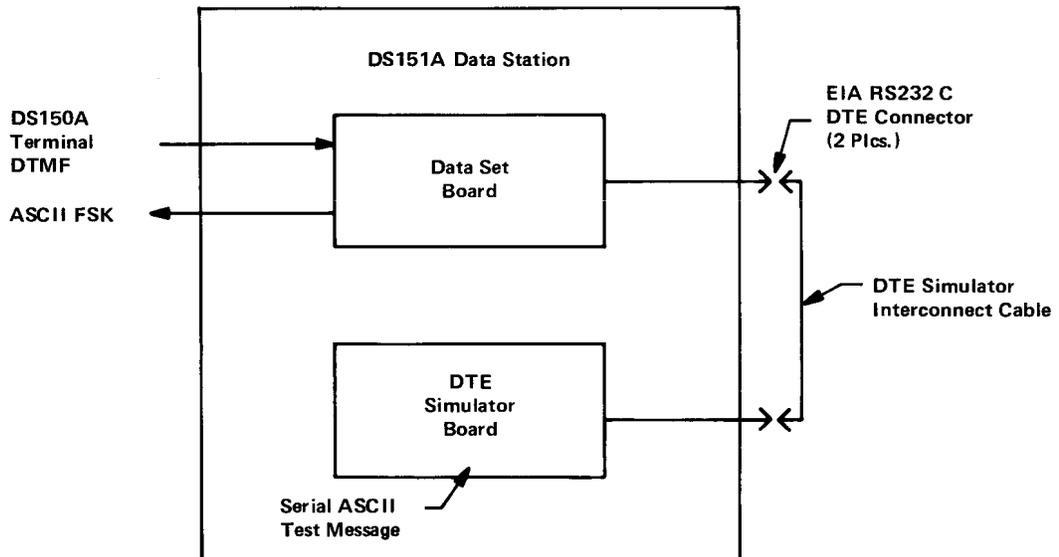


Figure 17, DTE Simulator Test Block Diagram

VuSet SYSTEM

Other Tests

4.11 Additional testing of terminal, touch-tone pad and data set functions may be tested by setting the data set switch (S2) into DLB (digital loop back) mode. This disables the data set interface with the DTE or DTE Simulator.

Site Requirements, Customer Responsibilities

4.12 The following facilities are required at the user site:

- a) Telephone line with a dual-tone multifrequency capability; or an auxiliary 12-button TOUCH-TONE pad must be attached to telephone set before attachment of interface cable. (See paragraphs 4.03)
- b) Three-wire, single phase, grounded, 117V, 60-Hz power receptacle within reach of 8-foot power cord on display unit. Reference: National Electrical Code 1971, Chapter 8, Article 800—Communications Circuits.
- c) Desk, table, or platform capable of supporting VuSet terminal and telephone set. Maximum separation between these units is four feet.

Site Requirements, TELCO Responsibilities

4.13 The DS150A and the DS151A are designed to operate on telecommunication lines as described in BSP Section 314-205-501. These lines shall be checked as required by Section 314-205-501 for Type 1 data sets prior to installation of the VuSet equipment.

TABLE F
Troubleshooting Guide

Initial Installation

Symptom	Cause	Action
1. Power Lamp off	1. Unit unplugged 2. Power Switch off 3. Loose Fuse 4. Open Fuse 5. Defective VuSet	1. Plug A.C. Power Cord into rear of VuSet and into 115AC receptacle. 2. Turn Power Switch on. 3. Reseat Fuse Holder. 4. Replace Fuse 5. Replace VuSet.
2. Alpha-numeric characters scattered across screen	1. Normal	1. Press Clear Switch.
3. Clear Switch will not clear Screen	1. Defective VuSet	1. Replace VuSet.

Operational

1. Tone heard in Handset Receiver but no Data Light	1. Data/Talk Switch in Talk Position 2. Interface Cable unplugged 3. Interface Cable wired improperly 4. Defective VuSet	1. Put Switch in Data Position. 2. Push (do not twist) Interface Cable into receptacle in rear of VuSet. 3. Verify connection per Installation Instruction para. 4.03. 4. Replace VuSet.
2. No tone heard in Receiver	1. Incorrect phone number dialed 2. System at other end down 3. Defective Network	1. Verify phone number. 2. Verify system operation. 3. Replace Telephone.
3. DTMF pad does not operate after connection to Data Set has been established	1. Polarity reversal 2. Defective Touch-Tone Pad	1. Install Polarity Guard per plant practices. 2. Replace Telephone.
4. No data on Screen while data is being transmitted from the DTE (Listen to the Handset Receiver)	1. Loose Circuit Connectors in VuSet 2. Brightness Adjustment or Contrast Adjustment turned down 3. VuSet data rate setting different from Data Set and/or DTE 4. Interface Cable problem 5. Defective VuSet	1. Remove Housing, check Connections. 2. Adjust Brightness Control (see para. 6.18) or Contrast Control (see Fig. 25). 3. Set VuSet to correct data rate (see para. 4.02). 4. Check Interface Cable and telephone set connections for opens, shorts and proper terminals (see Table C). 5. Replace VuSet.
5. Wrong message or characters on the Screen	1. Noisy telephone line 2. Intermittent Interface Cable 3. VuSet data rate setting different from Data Set and/or DTE 4. VuSet improperly grounded 5. Defective VuSet	1. Hang up and redial the DTE or test facility. 2. Inspect and replace Interface Cable as necessary. 3. Set VuSet to correct data rate (see para. 4.02). 4. Ground the AC Power Connection (see para. 4.12). 5. Replace VuSet.
6. Telephone will not operate for voice communications (Transmitter inoperative)	1. Data/Talk Switch in Data Position. 2. Interface Cable not connected to the rear of the VuSet 3. Defective Interface Cable	1. Place Data/Talk Switch in Talk Position. 2. Connect Interface Cable to rear of VuSet (see para. 4.03). 3. Replace Interface Cable.

5. ON-SITE TROUBLESHOOTING

General

5.01 Table F provides guidelines for analysis and correction of troubles that may occur in the VuSet terminal. This is intended solely for the purpose of correcting troubles that do not require field change-out of any parts. If suggested action does not correct the deficiency, remove and return the VuSet terminal for servicing. Additional trouble-shooting and maintenance instructions are available in the Maintenance Section 6.

5.02 The video display and indicator lamps are the key to quick and efficient trouble-shooting in the VuSet terminal to help identify a particular problem. Table F lists the trouble indications and the suggested action to correct or identify the problem.

Removal/Replacement

5.03 Before disassembly of equipment, set POWER switch on rear of the terminal to OFF position and disconnect power supply cord from 117-Vac main.

5.04 Proceed as follows if the entire VuSet terminal, including the interface cable is to be removed:

- a) Following standard plant practices, disconnect the telephone from the line.
- b) Follow, in reverse, the installation procedure given in paragraph 4.03.
- c) Following standard plant practices, re-connect the telephone to the line.

5.05 An alternative to the above procedure is to remove and replace entire units, including the telephone, by proceeding as follows:

- a) Turn off power switch at rear of display unit.
- b) Disconnect power supply cord from 117-Vac main.
- c) Using standard plant practices, disconnect telephone being replaced from line and connect replacement telephone to the line.
- d) Disconnect interface cable and power supply cord from rear of the terminal. See Figure 14.

5.06 If only the data terminal is to be replaced, proceed as follows:

- a) Disconnect power supply cord from 117-Vac main.
- b) Disconnect the interface cable from the rear of the terminal being replaced and set aside.

- c) Connect interface cable to receptacle at rear of new terminal.
- d) Connect power supply cord to receptacle at rear of new terminal.
- e) Test new terminal per paragraph 4.04.

Transportation to Factory from User Site

5.07 Pack the equipment for transportation as follows noting that the telephone set might not be included. In any case, but sure to place the collar on top of the display unit to provide a tight fit in the packing container. (See Figure 12)

- a) Set POWER switch in OFF position.
- b) Disconnect power supply cord from main supply.
- c) Disconnect power supply from display unit.
- d) Using standard plant practices, disconnect telephone instrument from test line.
- e) Disconnect interface cable from rear of display unit.
- f) Place display unit between foam inserts in carton.
- g) Place power supply cord in space provided alongside display unit.
- h) Replace collar on top of display unit in carton.
- j) Place telephone set with interface cable attached in collar zone of carton.
- k) Tape carton closed.

6. MAINTENANCE

General Information

6.01 Maintenance and repair instructions for the VuSet Data Terminal, to the subassembly level are provided in this section. Included are Recommended Tools, Disassembly/Reassembly, Fault Isolation, Cleaning, Spare Parts List, Warranty, and Service information. The Fault Isolation Procedure is intended to aid TelCo personnel in isolating damage and/or malfunction to a particular subassembly and determination of disposition with a minimum of external test equipment.

Recommended Tools and Equipment

6.02 A WECO type 2500 telephone or equivalent and access to a VuSet Data Set and DTE Simulator will be needed, along with standard hand tools.

Disassembly/Reassembly Procedures

6.03 Each subassembly is removable independently of the others, with the exception of the demodulator board assembly. Removal procedure for each subassembly is followed immediately by its replacement procedure. When removing any part, ensure that the power cord and interface cable are disconnected from the terminal chasses.

CAUTION: Hazardous voltages may be present at or near the second anode of the cathode ray tube. (See Figure 27). Voltage dissipates within 10 seconds after power OFF. Other hazardous voltages exist in portions of the Display Monitor Assembly.

6.04 Chassis Removal:

- a) Disconnect the power supply cord from the power main.
- b) Disconnect the power supply cord from the back of the terminal.
- c) Disconnect the interface cable from the back of the terminal.
- d) Remove the three #6-32 screws from the bottom of the terminal. (See Figure 19)
- e) If the terminal has a metal case, remove the three #4-40 screws from the back. (See Figure 20)
- f) Slide the terminal chassis out the front of the housing. (See Figure 21)

NOTE: For troubleshooting purposes, the terminal may be operated with the outer housing removed by reconnecting the power cord and interface cable.

6.05 Chassis Replacement:

- a) Disconnect the power supply cord from the power main.
- b) Disconnect the power supply cord from the back of the terminal.
- c) Disconnect the interface cable from the back of the terminal.
- d) Slide the terminal chassis into the housing from the front.
- e) If the terminal has a metal case, attach the back panel to the chassis with three #4-40 screws. (See Figure 20)
- f) Install the three #6-32 screws on the bottom of the terminal. (See Figure 19)

6.06 Regulator Board Removal:

- a) Disconnect the power supply cord from the power main.
- b) Disconnect the power supply cord from the back of the terminal.
- c) Disconnect the interface cable from the back of the terminal.
- d) Disconnect connectors J2C and P1C from the regulator board. (See Figure 22)

CAUTION: P1C, J2C, J3B, P1A, and P1C are dual in-line ribbon type cable connectors and should be removed carefully with a thin screwdriver, being careful not to bend the pins. Other terminal connectors are retained by spring type metal clips or RTV on some models.

- e) Remove the three regulator support screws (#4-40) from the back chassis. (See Figure 23)
- f) Remove the board by pulling it up from the chassis being careful not to lose the mica washer insulating the transistor from the chassis.

6.07 Regulator Board Replacement:

- a) Slide the board into place from the top of the terminal.
- b) Install the two bottom #4-40 screws into the back panel. Do not tighten. (See Figure 23)
- c) Insert the mica washer, coated with heat conductive silicone, between the back panel and the top transistor on the regulator board.
- d) Install the top #4-40 screw into the back panel and tighten all three screws.
- e) Connect J2C and P1C to the regulator board. (See Figure 22)

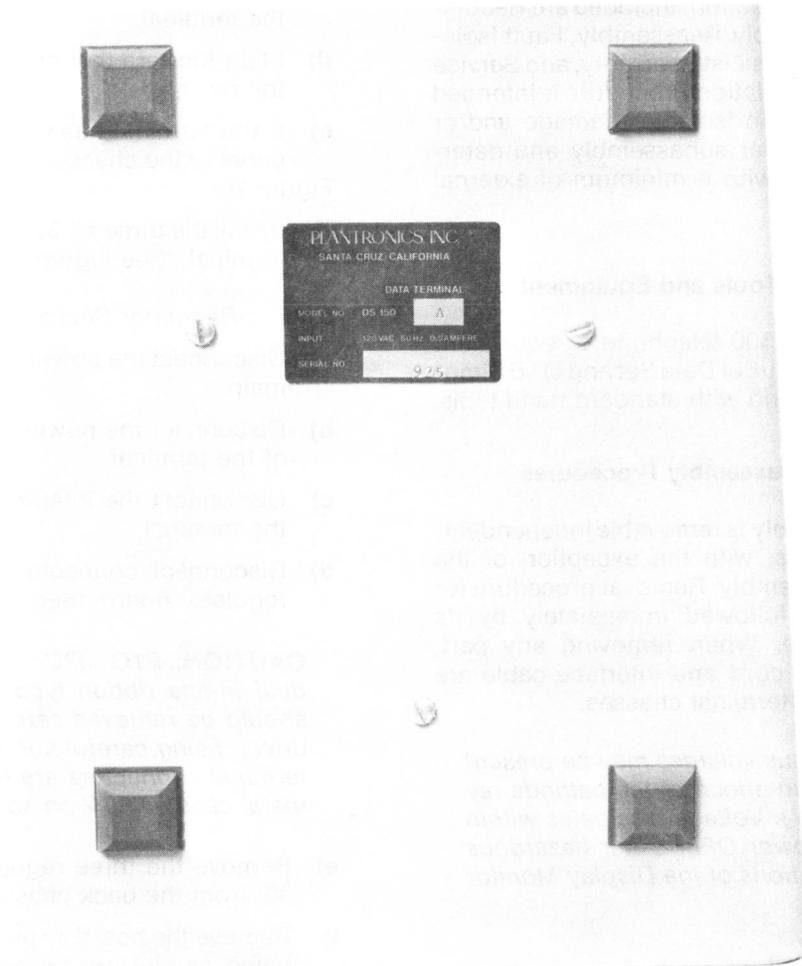


Figure 19, Terminal Bottom View

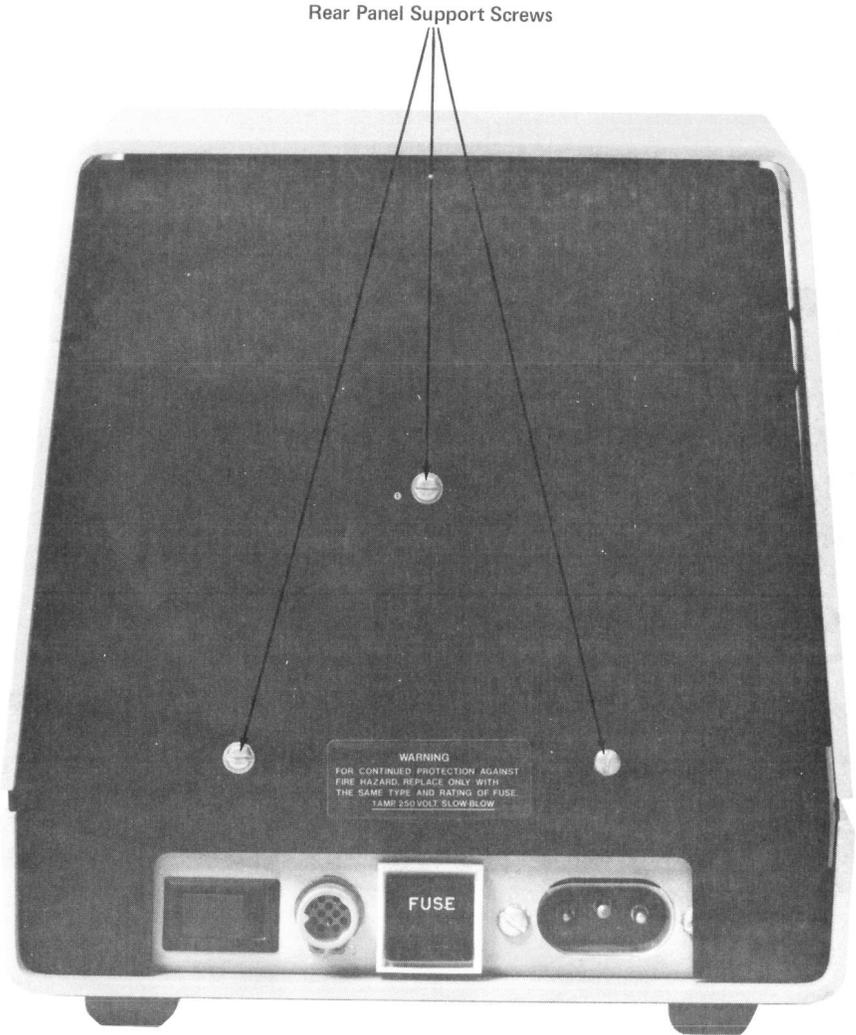


Figure 20, Terminal Rear View

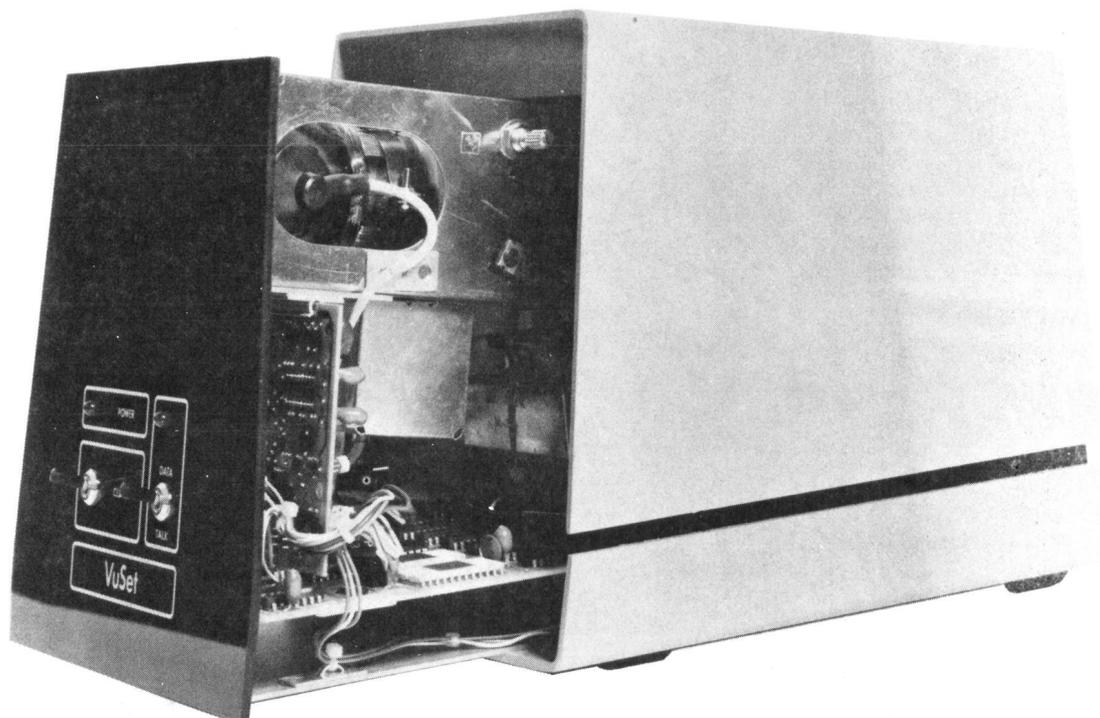


Figure 21, Removing Chassis From Housing

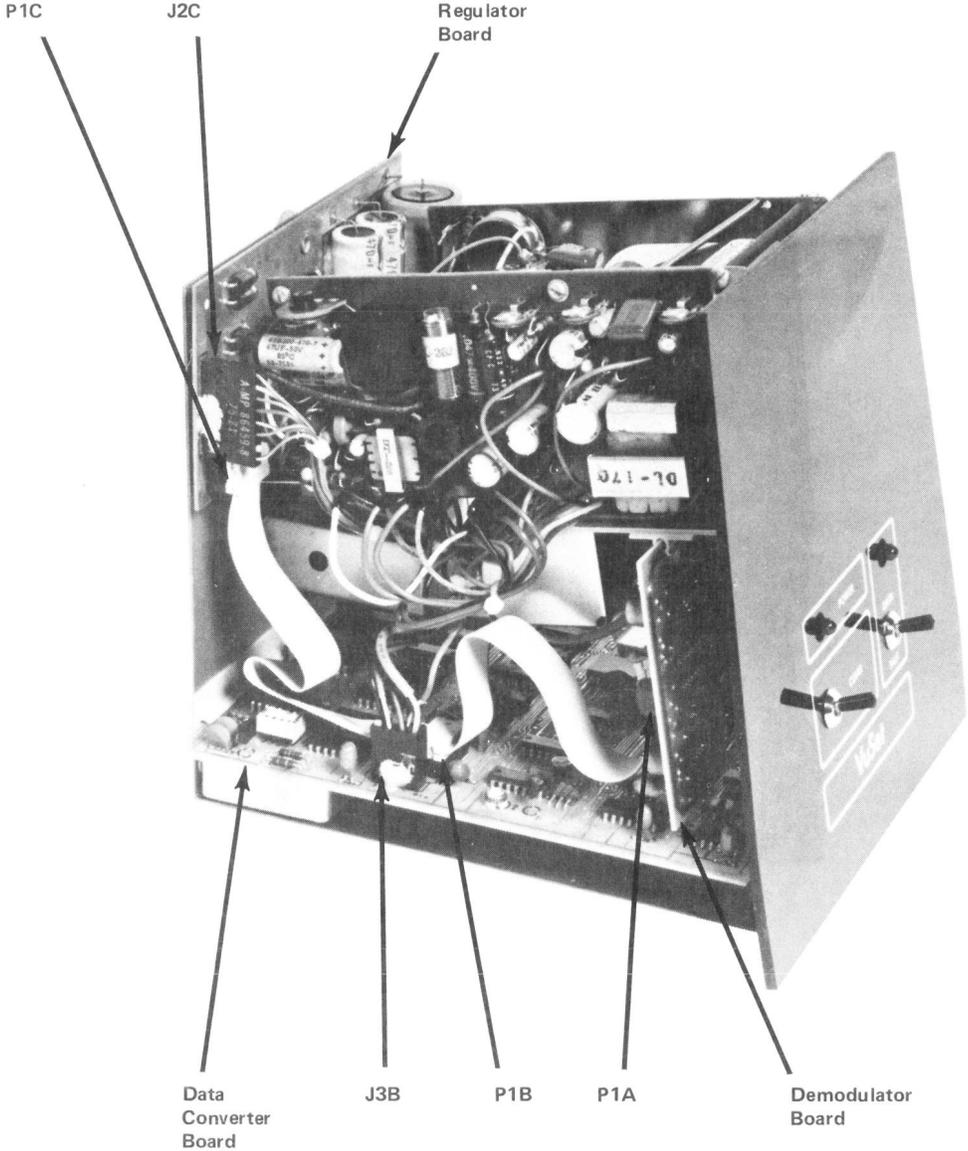


Figure 22, Left Side of Chassis

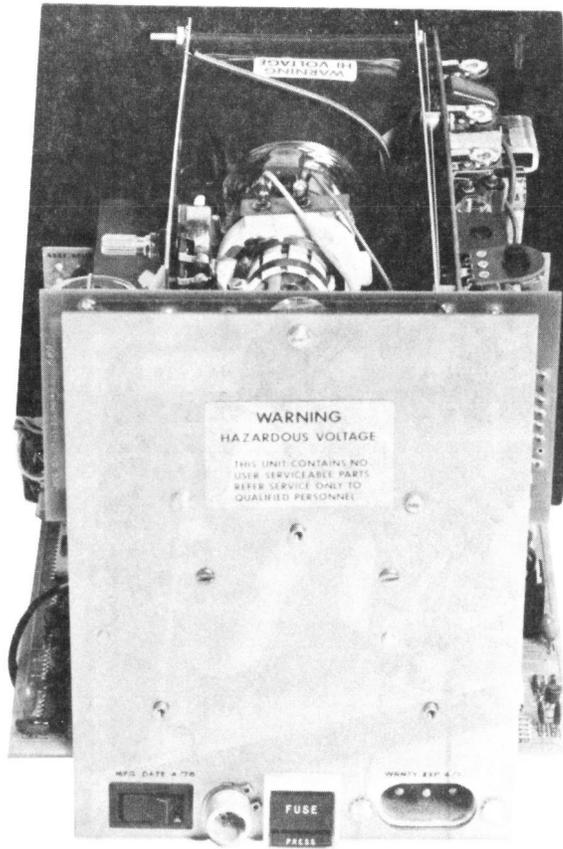


Figure 23, Rear View of Chassis

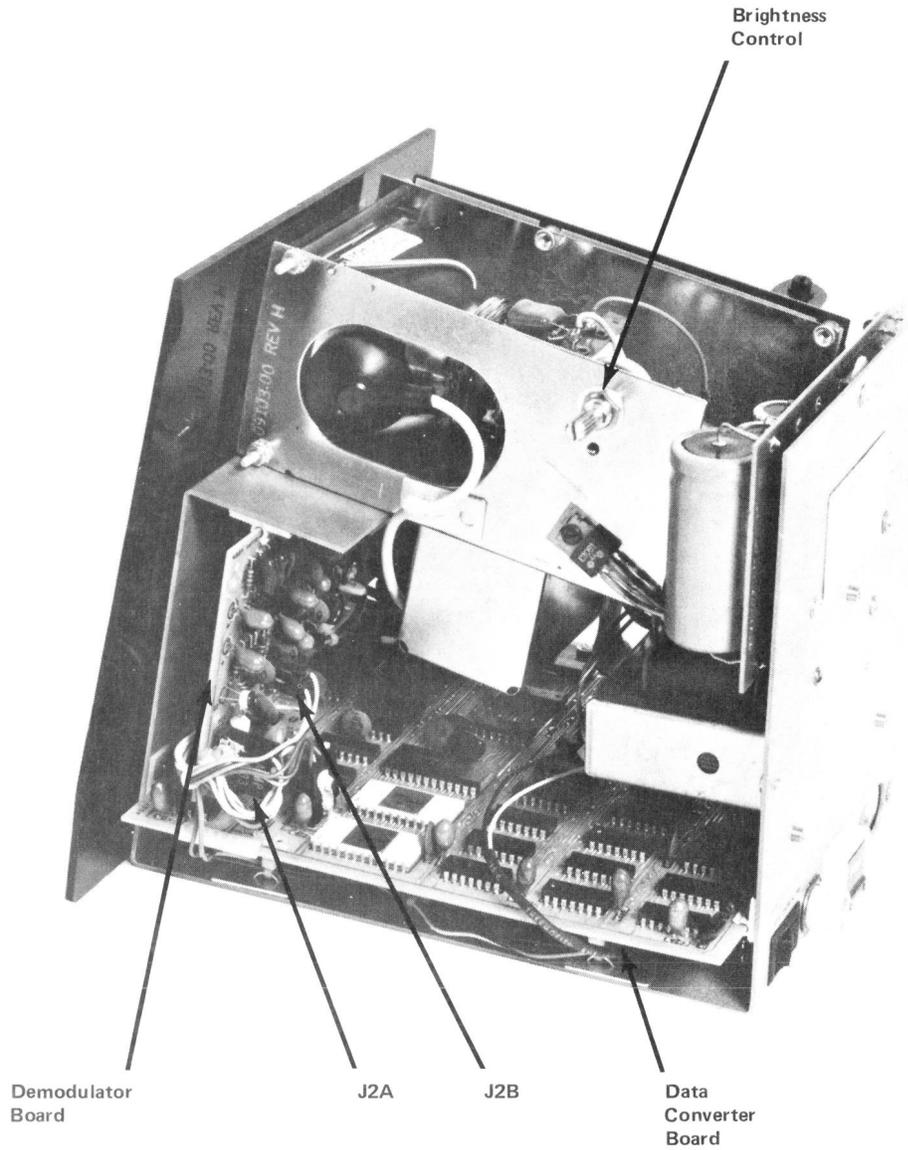


Figure 24, Right Side of Chassis

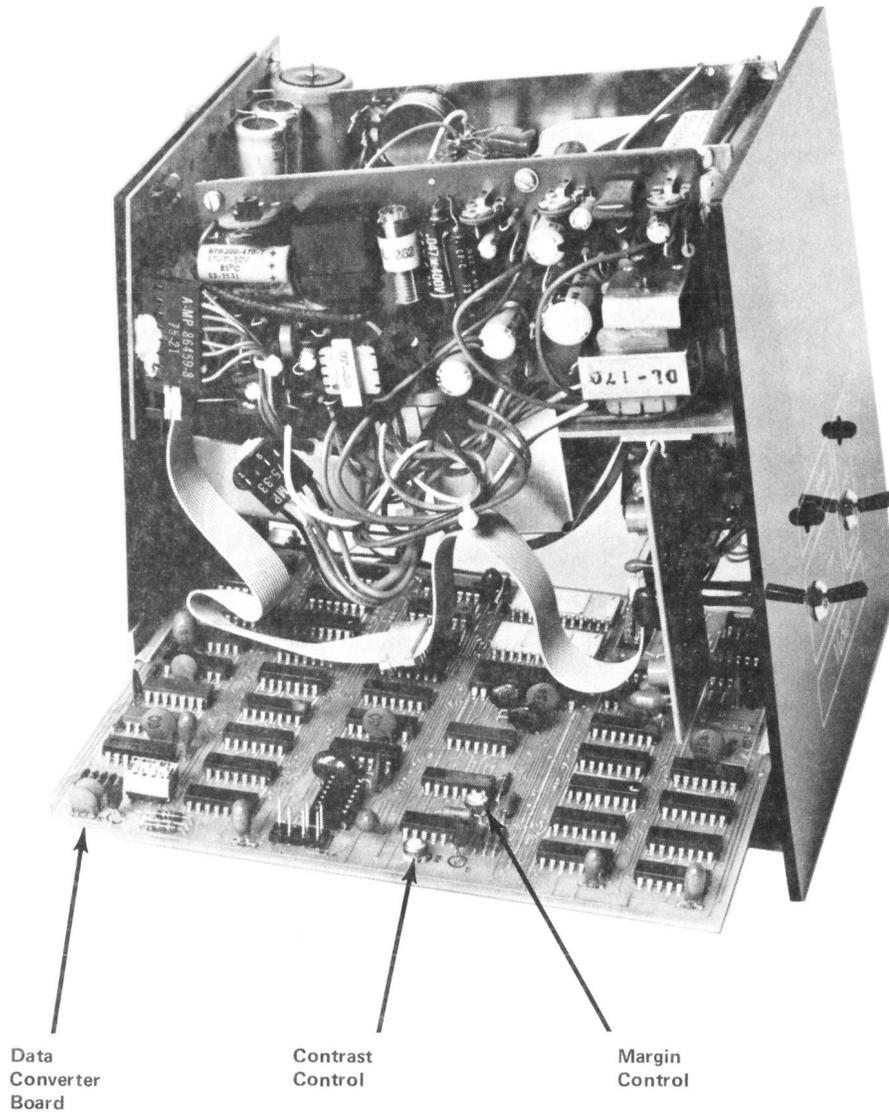


Figure 25, Removal of Data Converter Board

VuSet SYSTEM

6.08 Data Converter Removal:

- a) Disconnect the power supply cord from the power main.
- b) Disconnect the power supply cord from the back of the terminal.
- c) Disconnect interface cable from the back of the terminal.
- d) Disconnect P1B, J2B and J3B from the data converter board. (See Figures 22 and 24)
- e) The data converter board can be removed by sliding it out of the card guide from the left side of the terminal (See Figure 25). The opposite side is restricted for data converter removal because of the wiring between subassemblies.

6.09 Data Converter Replacement

- a) Slide the data converter board into the card guides from the left side of the terminal. (See Figure 25)
- b) Connect P1B, J2B and J3B to the data converter board. (See Figures 22 and 24)

6.10 Demodulator Board Removal:

- a) The data converter board must be removed before removing the demodulator board. (See paragraph 6.08)
- b) Disconnect the power supply cord from the power main.
- c) Disconnect the power supply cord from the back of the terminal.
- d) Disconnect the interface cable from the back of the terminal.
- e) Disconnect P1A and J2A from the demodulator board. (See Figures 22 and 24)
- f) Remove the demodulator board by pressing in the keeper on the standoff. (See Figure 26). The demodulator board may now be pulled loose from the standoff by swinging the bottom of the board rearward, away from the front panel. Pull downward gently to release the upper edge from its guide.

NOTE: Care should be taken when removing the board that it does not catch on the wiring harness for the lamps.

- g) The board may now be cleared from either side of the chassis.

6.11 Demodulator Board Replacement:

CAUTION: Care should be taken when replacing the demodulator board, that it does not catch on or pinch the front panel wiring harness.

- a) The data converter board must **not** be in place before installing the demodulator board.

- b) Place the upper (Straight) edge of the demodulator board in the chassis and guide with components facing rearward, and traces facing the front panel; push upward to seat in guide. (See Figure 26)
- c) Press the demodulator board onto the snap-on standoff.
- d) Connect P1A and J2A to the demodulator board. (See Figures 22 and 24) Reconnect spring retainers whenever completing an electrical reconnection.

6.12 Display Assembly Removal:

CAUTION: Hazardous voltages may be present at or near the second anode of the cathode ray tube. (See Figure 27)

- a) Disconnect the power supply cord from the power main.
- b) Disconnect the power supply cord from the back of the terminal.
- c) Disconnect the interface cable from the back of the terminal.
- d) Disconnect J3B from the data converter board. (See Figure 22)
- e) Remove the regulator board per 6.06.
- f) Remove the two display support screws (#4-40) from the back of the chassis. (See Figure 23)
- g) Loosen the two display assembly hold-down screws (#4-40) on each side of the CRT. (See Figure 27)
- h) Slide the display assembly forward to clear the hold-down screws; it can now be cleared straight up from the main chassis being careful not to scratch the front panel.

6.13 Display Assembly Replacement:

CAUTION: Hazardous voltages may be present at or near the second anode of the cathode ray tube. (See Figure 27)

- a) Place the display assembly over the two hold-down screws (#4-40) and slide back and tighten the screws.
- b) Install the two support screws (#4-40) in the back of the chassis. (See Figure 23)
- c) Connect J3B to the data converter board. (See Figure 25)

6.14 Front Panel Removal:

- a) Remove the nuts on the DATA/TALK and CLEAR switches with a 7/16" open end wrench, being careful not to mar the plastic front panel. The front panel should now be free from the toggle switches. (See Figure 28)

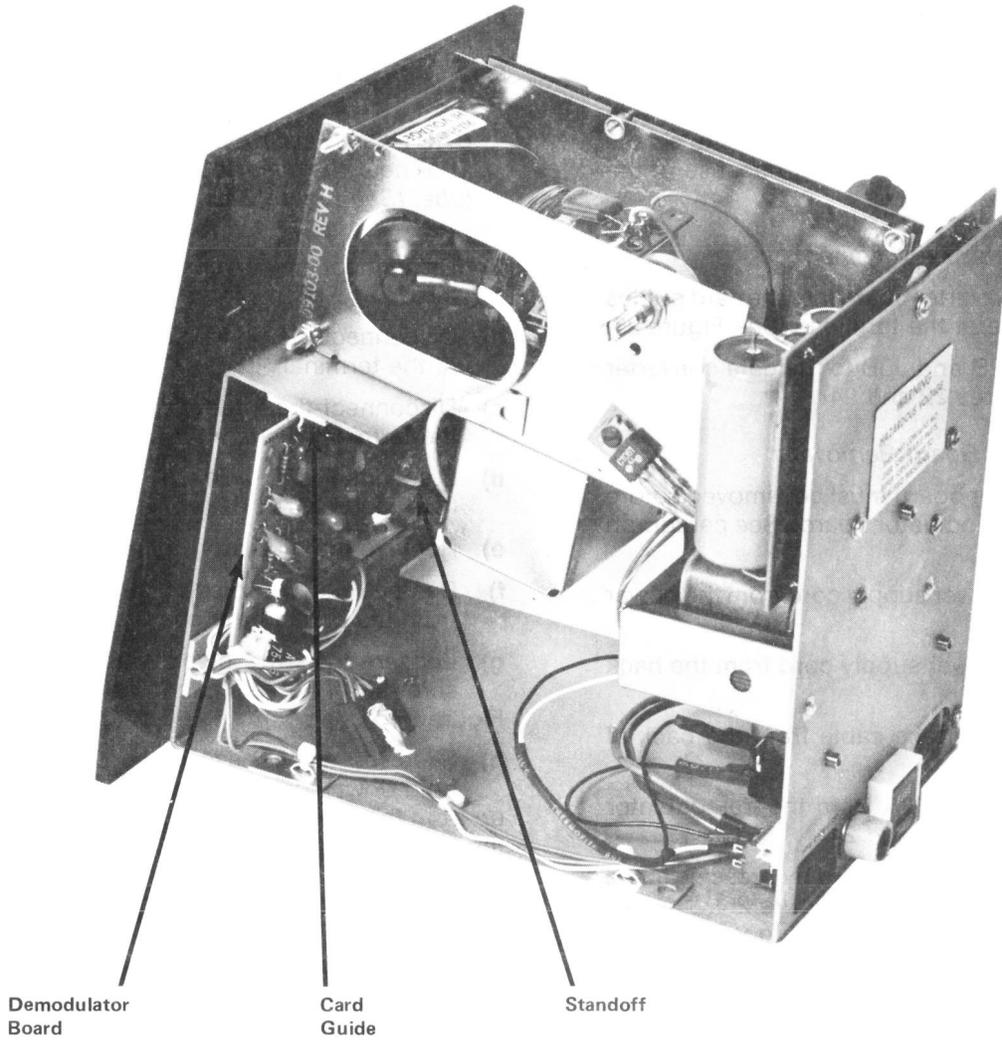


Figure 26, Chassis With Data Converter Board Removed

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6.15 *Front Panel Replacement:*

- a) Place the front cover in place over the DATA/TALK and CLEAR switches.
- b) Install the nuts on the DATA/TALK and CLEAR switches and tighten.

Fault Isolation Procedure

6.16 Connect VuSet terminal to an appropriate FSK signal and apply ac power.

6.17 Perform a preliminary check-out and determine that data modulated FSK signals can be heard in the handset receiver. Do not place handset in telephone cradle. Depress CLEAR switch.

- a) Observe Display Screen:
 1. If there are any light areas or a grey background in the display, go to paragraph 6.19(f).
 2. If display remains dark, go to next paragraph.
- b) Observe the front panel indicators:
 1. If power is the only indicator that is ON go to paragraph 6.12.
 2. If both indicator lights are ON go to paragraph 6.19.
 3. If both indicator lights are OFF go to the next step.
- c) Substitute the regulator board.
- d) If power indicator remains OFF the substitute regulator board may be recovered, but the terminal with the original regulator board should be returned to the factory for repair.
- e) If power indicator now comes ON, the original regulator board has malfunctioned. Restart procedure.
- f) Recheck the interface connections.
- g) If OK substitute interface cable.
- h) If data lamp now comes ON original interface cable has malfunctioned. Restart procedure.
- j) If data lamp remains OFF go to the next step.
- k) Substitute the demodulator board.
- l) If the data lamp indicator now comes ON, the original demodulator card has malfunctioned. Restart procedure.
- m) If the data lamp indicator does not come ON, the terminal has malfunctioned. Substitute part(s) may be recovered and the terminal should be returned to the factory for repair.

Video Brightness Control (Figure 24)

CAUTION: *Too much brightness on the CRT display can cause an image to be permanently burned into the face of the screen.*

6.18 *Adjust video brightness as follows:*

- a) Rotate first counter-clockwise to stop, then clockwise to stop, while observing the display screen. Return to original setting.
- b) If the display screen remains dark, go to paragraph 6.19.
- c) If a white (grey) raster background, or white pattern appears, set brightness for ease of viewing and go on to the next paragraph.

Video Patterns

6.19 *Adjust Video Patterns as Follows:*

- a) If a single line or a solid horizontal line appears on the screen just above center, go to paragraph 6.20
- b) If a display is not dark and there are not well formed recognizable alphanumeric characters, go to paragraph 6.20(e).
- c) If the patterns are alphanumeric characters but the text lines are tilted or ragged, go to paragraph 6.20(f).
- d) If the characters appear to be correct but the text lines are formed off screen to the left or right, go to paragraph 6.20(e).
- e) Characters are well formed but data (text) on display screen does not correspond with data being transmitted, or display format not correct. If transmitted data rate is known to be correct, go to next paragraph.
- f) Substitute the demodulator board assembly.
- g) If data is now correct, the original demodulator board has malfunctioned. Retest terminal per section 4.04.
- h) If data is not correct, re-install the original demodulator board and go to next paragraph.
- j) Substitute the data converter.
- k) If the data is now correct, the original data converter board has malfunctioned. Retest terminal per section 4.04.
- l) If the data is incorrect, re-install the original data converter board and go to next paragraph.
- m) Substitute the regulator board assembly.
- n) If data is now correct, the original regulator board has malfunctioned. Replace regulator board. Adjust brightness and contrast control if necessary. (See Figures 24 and 25). Retest terminal per section 4.04.
- o) If symptom has remained, re-install the original regulator board and return the terminal for repair.

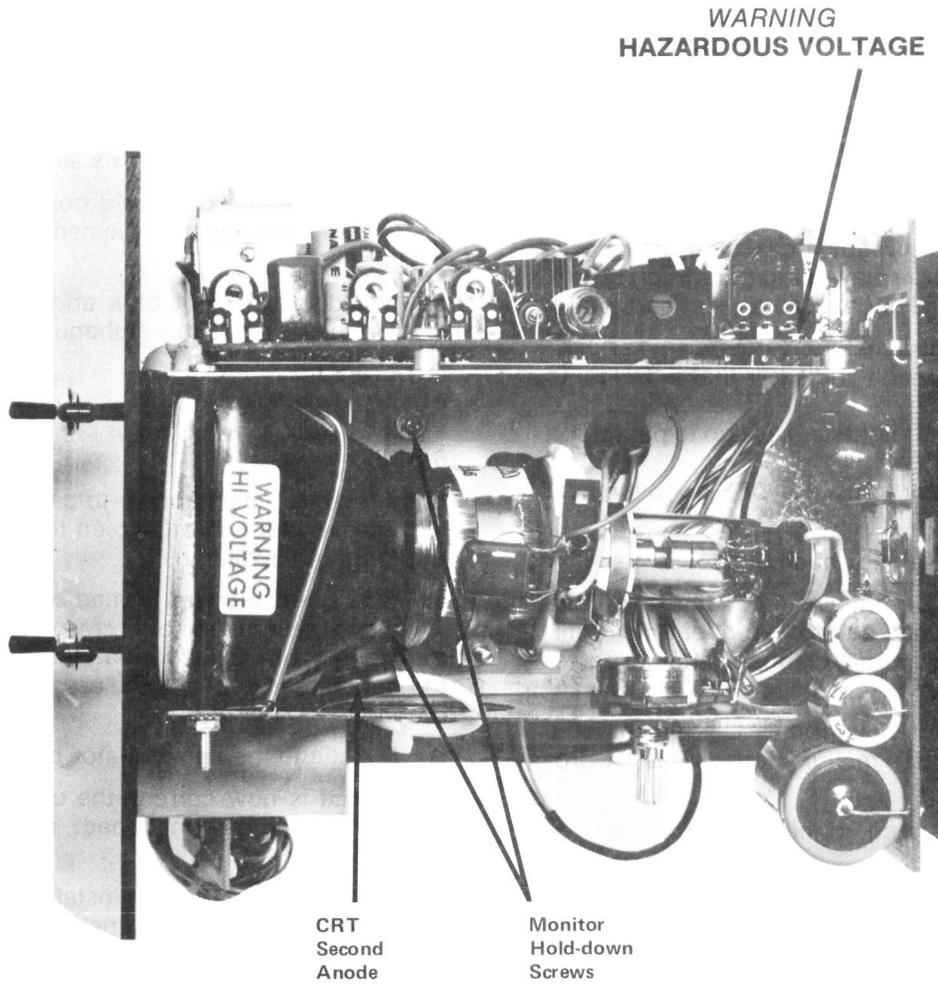


Figure 27, Top View of Chassis

Margin Control Adjustment (Figure 25)

6.20 *Adjust Video Margin as Follows:*

- a) If the data can be centered using the margin control, set the control for the best display and retest the terminal.
- b) If data cannot be centered using the margin control, go to the next paragraph.
- c) Substitute the data converter board assembly.
- d) If data is correct and can be centered by using the margin control (See Figure 25) or if the symptoms are now different, the original data converter board has malfunctioned. Retest terminal per section 4.04.
- e) If symptom has remained, re-install the original data converter board and go to next paragraph.
- f) Substitute the display assembly module.
- g) If data is correct and can be centered using the margin control or if the symptoms are now different, the original display assembly module has malfunctioned. Retest the terminal per section 4.04.
- h) If the symptom has remained, re-install the original display module and return the terminal to the factory for repair.

Cleaning and Touch-up Procedure

6.21 Soap and warm water applied with a damp towel to all external surfaces will give the best results. For stubborn scuff marks, most commercial cleansers can be used as directed without harm. Care should be taken to avoid scratching the surface. Scratches may be covered with the beige semi-gloss enamel paint (Fed-Std-595, Color No., 20450) or black flat enamel.

6.22 The acrylic plexiglass front panel may be washed with plain water or window cleaner. Use a lintless cloth or tissue to polish. Caution should be taken in cleaning the plastic screen as it is easily scratched. Use only non-abrasive cleaning cloths for this purpose.

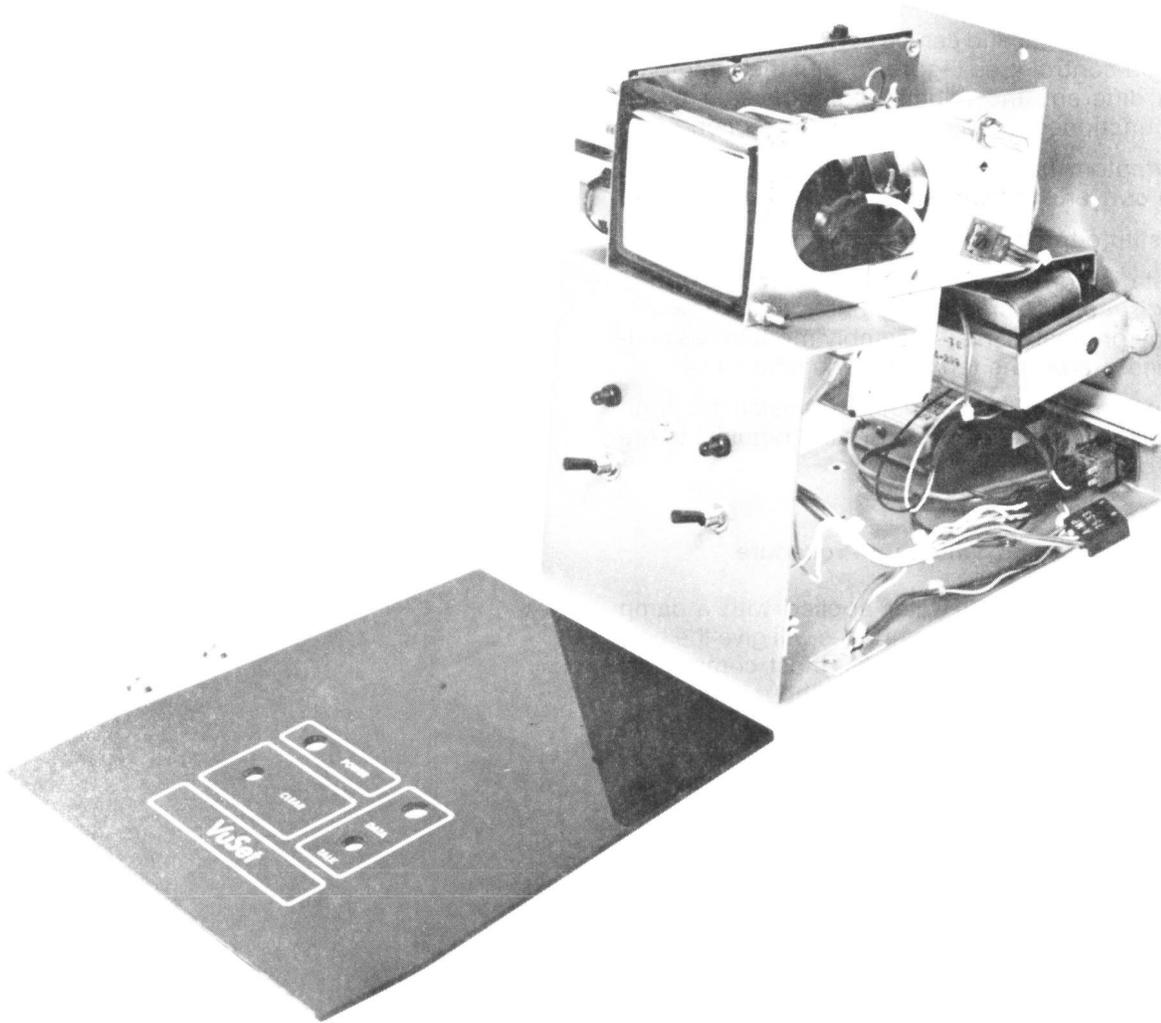


Figure 28, Front Panel Removal

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7. SPARE PARTS LIST

7.01 Figure 29 is a pictorial description of the replaceable subassemblies. The following table indicates the Plantronics part number, description and reference number of Figure 29 for these subassemblies:

<u>Part #</u>	<u>Description</u>	<u>Reference #</u>
09103-01	Display Subassembly	1
09105-01	Interface Cable	—
07779-01	Power Cord	—
09172-00	Fuse Kit	—
09113-01	Regulator Board	2
09116-01	Data Converter Board	3
09077-01	Interconnect Buss	4
09110-01	Demodulator Board	5
09128-01	Front Panel	6
09803-00	Terminal Packing Kit (Set of 5)	—

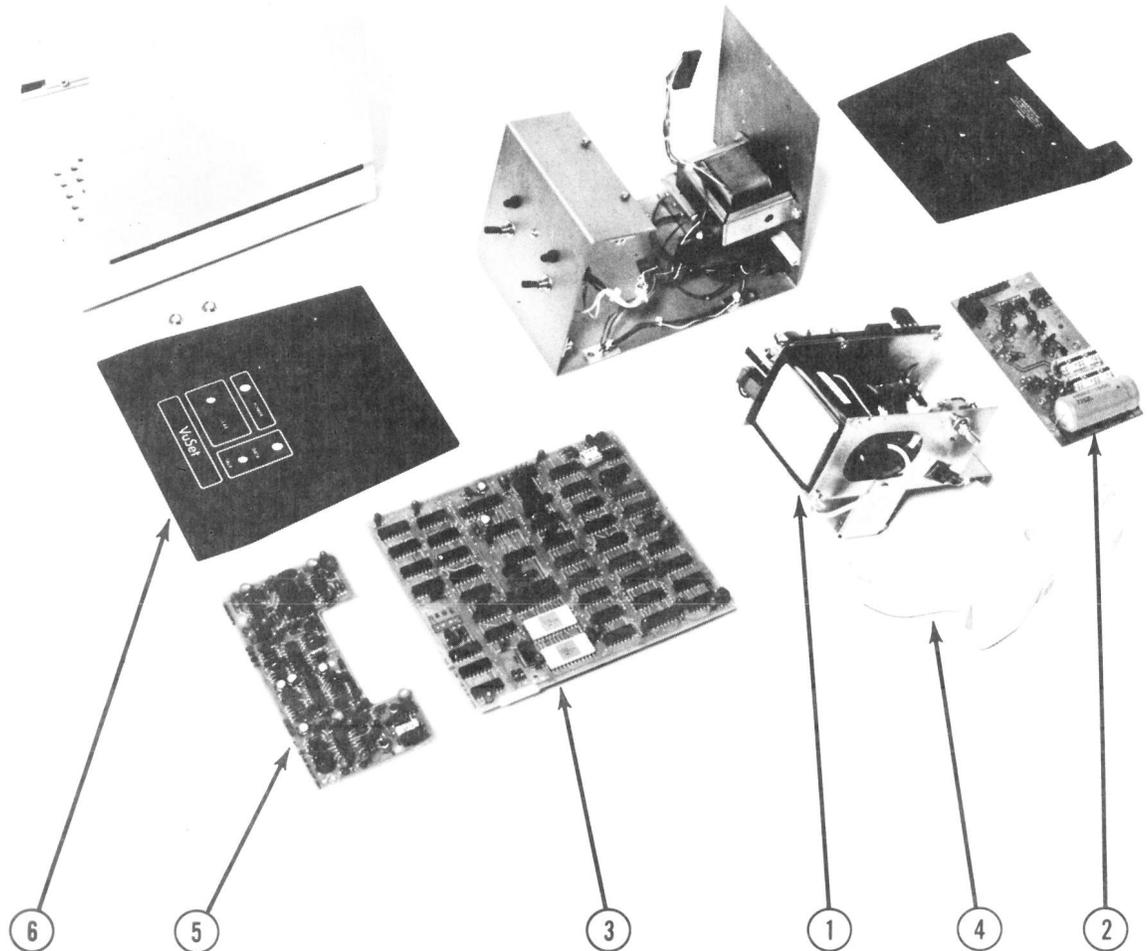


Figure 29, Disassembled Terminal

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8. VuSet WARRANTY & SERVICE POLICY

Warranty

8.01 The Plantronics VuSet Data Terminal and Data Station are warranted free from defects in workmanship and materials for a period of eighteen (18) months from date of shipment. Excluded from this warranty are parts which are considered to be subject to wear and tear in normal usage, such as cords, cables and external controls and decorative finishes.

8.02 Material found defective will, at Plantronics option, be either repaired or replaced on site or returned to Plantronics by prepaid freight for repair or replacement. Material repaired or replaced shall be re-warranted for a period of ninety (90) days from date of repair or replacement or the unexpired portion of the original warranty. Plantronics shall not be liable under this warranty unless:

- a) Plantronics is notified in writing by the customer of the failure.
- b) Such defect or failure has not been caused by misuse, neglect, improper installation, unauthorized repair, alteration or accident.

8.03 Repaired material in warranty shall be refurbished to a like new condition with refurbishment costs borne by the customer. Inspection and repair testing costs shall be borne by Plantronics.

8.04 Extra inspection and testing costs incurred by Plantronics in evaluating material under warranty which is found not defective shall be borne by the customer.

8.05 Material returned for refurbishment only during the warranty period shall be returned to a like new condition with inspection, test and refurbishment costs borne by the customer.

8.06 Missing parts will be replaced and charged at spare parts prices.

Subassembly Warranty

8.07 The warranty period for VuSet subassemblies is the same as that for end item Data Terminals and Data Stations. Subassemblies are date coded at the time of subassembly acceptance but are warranted from the time of end item shipment. The customer must, therefore, provide Plantronics with the date code of items from which failed subassemblies have been removed to establish repair charges for warranted or non-warranted failures.

8.08 If a failed subassembly is returned to Plantronics without such end item date code information, the manufacturing date on the subassembly will be used to establish warranty status.

Factory Service

8.09 Factory repair service is provided by Plantronics for products that are out of warranty, for the normal lifetime of the product. The warranty period for such repaired units will be thirty (30) days from the date of customer installation. Information regarding date of installation and failure data will be furnished to Plantronics by the customer.

8.10 If material is returned for repair and is determined to be beyond repair, Plantronics will notify the customer and, if agreed, will ship a replacement unit at the contract price in effect for new material within five (5) working days.

8.11 Transportation costs of units returned for repair will be borne by the customer and units will be adequately packed to prevent shipping and transportation damage. Return transportation costs for repaired or replacement units will be borne by Plantronics.

Refurbishment Out of Warranty

8.12 VuSet materials may be returned to Plantronics for refurbishment to a like new condition at the contract refurbishment rate. Transportation costs of material returned to Plantronics will be borne by the customer and return transportation costs of refurbished material by Plantronics.

8.13 Out of Warranty material returned for refurbishment shall be tested by Plantronics. Material requiring repair prior to refurbishment will be billed at the contract repair and refurbish rate in effect.