

PLANTRONICS DS150A
ComSet* DATA TERMINAL
MAINTENANCE

1. GENERAL

1.01 This section is a cover sheet for the Plantronics/ComSet Data Terminal DS150A Maintenance Manual 09134-00.

1.02 This system uses a "Touch-Tone®" telephone with the Plantronics ComSet Data Terminal attached to input information and receive a visual response from a remote computer via private line or switched network.

1.03 The Plantronics ComSet DS150A Visual Data Terminal consists of a cathode ray tube (CRT) display unit, a modem, and a control unit. This is a receive only device. Transmission to the computer and connection to the line is via "Touch-Tone" telephone or rotary dial telephone with an associated "Touch-Tone" pad.

2. USOC CODE/CUSTOMER OPTIONS

ComSet Terminal (USOC DMV++)

01	300 Baud
02	150 Baud
03	110 Baud

3. ORDERING - SERVICE/RETURNS

3.01 Factory repair service is provided by Plantronics on a repair and return basis.

3.02 All purchasing and returns is handled by Western Electric (WE).

3.03 Order Wording -

(Qty) Terminal, Data ComSet, Plantronics, DS-150A

Maintenance Spares

(Qty) Subassembly, Display, Plantronics, 09103-01

(Qty) Board, Demodulator, Plantronics, 09110-01

(Qty) Board, Regulator, Plantronics, 09113-01

(Qty) Board, Converter, Data, Plantronics, 09116-01

(Qty) Panel, Front, Plantronics, 09128-01

(Qty) Cord, Power, Plantronics, 07779-01

(Qty) Buss, Interconnect, Plantronics, 09077-01

(Qty) Kit, Fuse, Plantronics, 09172-01

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Attachment:

Plantronics/ComSet Data Terminal DS150A Maintenance Manual 09134-00

PLANTRONICS

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PLANTRONICS/ComSet[®] DATA TERMINAL DS150A

MAINTENANCE MANUAL

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CONTENTSPAGESection

1.	General	1
	Terminal Description	1
	Terminal Controls and Indicators	3
	Specifications	6
2.	Installation and Operation	9
	Unpacking	9
	Installation Procedure	9
	Operation and Test Procedure	18
	Transportation to User Site	19
	User Site Requirements	20
	User Site Installation	20
	On-Site Troubleshooting	20
	Removal/Replacement	23
3.	Functional Description	25
	Terminal Overview	25
	Demodulator Board Circuit Description	27
	Data Converter Board Circuit Description	27
	ComSet CRT Display Description	37
	Regulator Board Circuit Description	37
4.	Maintenance	39
	General Information	39
	Recommended Equipment and Tools for Maintenance	39
	Disassembly/Reassembly Procedure	39
	Fault Isolation Procedure	54
	Cleaning and Touch-up Procedure	60
	Spare Parts List	60
5.	Warranty and Factory Service	62
	Warranty	62
	Factory Service	62

<u>FIGURES</u>		<u>PAGE</u>
Figure 1-1	ComSet Terminal Installation	2
Figure 1-2	ComSet Terminal Display Repertoire	4
Figure 2-1	ComSet Terminal Packing, Exploded View	10
Figure 2-2	Baud Rate Switch Location	12
Figure 2-3	Connecting Interface Cable to Standard Desk Sets	13
Figure 2-4	Connecting Interface Cable to AE890 Desk Set	14
Figure 2-5	Connecting Interface Cable to ComSet Terminal Unit	15
Figure 3-1	Terminal Functional Block Diagram	26
Figure 3-2	Terminal Interconnect Wiring Diagram	28
Figure 3-3	Demodulator Functional Block Diagram	29
Figure 3-4	Data Converter Signal Flow Block Diagram	30
Figure 3-5	Character Generation	34
Figure 3-6	Data Converter Command and Control Diagram	35
Figure 4-1	Terminal Bottom View	41
Figure 4-2	Terminal Rear View	42
Figure 4-3	Removing Chassis from Housing	43
Figure 4-4	Left Side of Chassis	45
Figure 4-5	Rear View of Chassis	46
Figure 4-6	Right Side of Chassis	48
Figure 4-7	Removal of Data Converter Board	49
Figure 4-8	Chassis with Data Converter Board Removed	51
Figure 4-9	Top View of Chassis	53
Figure 4-10	Front Panel Removal	55
Figure 4-11	Disassembled Terminal	61

<u>TABLES</u>		<u>PAGE</u>
Table 2-1	Baud Rate Selection	12
Table 2-2	Interface Cable and Telephone Set Connections	16
Table 2-3	Connections for Western Electric 500D Telephone Set with 1035 Dial and 185A Network	17
Table 2-4	On-Site Troubleshooting Procedures	21

1. GENERAL

1.01 This manual describes the Plantronics ComSet Data Terminal, Model DS150A, and includes installation procedures, on-site troubleshooting, principles of operation and maintenance procedures. For detailed information on the ComSet system operation see ComSet System Description and Interface Specification 09069-00.

Terminal Description

1.02 The ComSet terminal is primarily designed as the display vehicle for a data entry or inquiry/response data system using dial-up or private line networks. A typical installation (figure 1-1) consists of a standard pushbutton (DTMF) telephone and the ComSet terminal. The terminal consists of the ComSet display unit, the ComSet interface cable (mounted on the phone) and power cord.

1.03 In operation of the ComSet terminal, the user originates a normal telephone call to the computer or data terminal. Upon receiving an indication (2225-Hz answerback tone) that the connection to the computer is complete, the user is then ready to enter data. Data is entered via dual-tone multifrequency (DTMF) signals generated by the pushbutton pad. Response data is transmitted from the computer in ASCII format by frequency-shift keying (FSK) and displayed on the CRT of the display unit.

1.04 The ComSet terminal consists of a receive-only modem that accepts 110, 150 or 300 baud, bit-serial FSK ASCII format data from the computer end. This information is formatted into a 64-character presentation and displayed on the CRT in four contiguous text segments (lines) of 16 characters in length. Receipt of a "carriage return" (CR) code erases the display screen, cancels the blinking feature (see below), and initializes the system such that the next incoming character code will be displayed on the upper left-hand position of the screen. The first

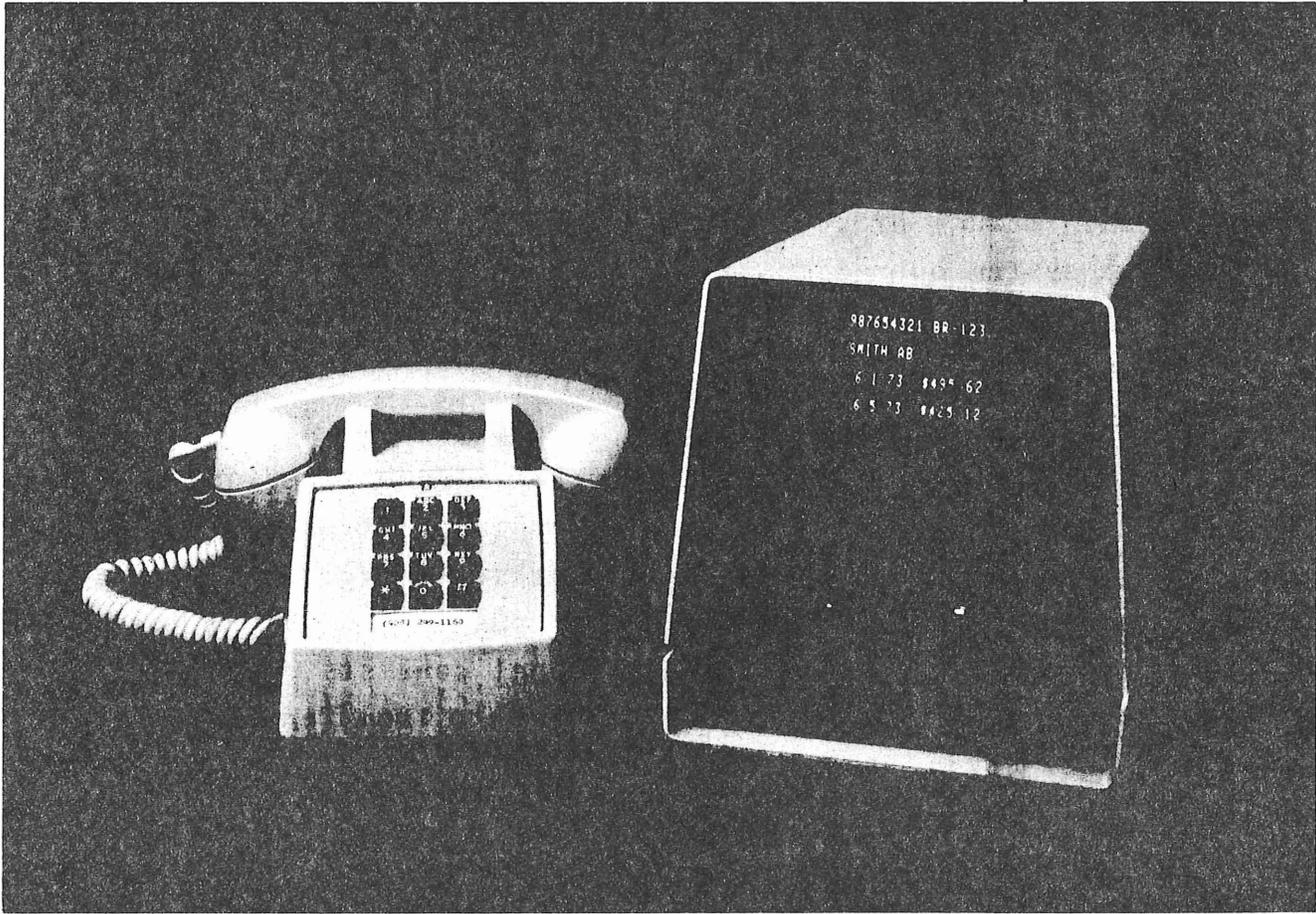


Figure 1-1. ComSet Terminal Installation

16 characters subsequent to the "carriage return" will be presented sequentially on the first text line, characters 17 through 32 on the second text line, 33 through 48 on the third text line, and the final 16 characters on the last text line. (Should the terminal receive more than 64 characters after a CR, the overflow information will over-write, commencing at character position number 1.)

1.05 To provide means for alerting the viewer, a blink feature has been included. On the ASCII command DC-1, all information on the screen will commence blinking at a rate of approximately once per second. Blinking will be terminated upon receipt of the next CR command.

1.06 Figure 1-2 shows the entire display repertoire of 64 ASCII alphanumeric and punctuation characters.

Terminal Controls and Indicators

1.07 The status of the system is indicated by two small indicators. These light emitting diodes (LEDs) are mounted on the front panel below the display screen.

- (a) DATA indicates the status of the modem-telephone line connection. When the DATA indicator is OFF, the ComSet terminal cannot receive data from the remote terminal. When the DATA indicator is ON it indicates that a connection has been established, the remote modem is on-line, the 2225-Hz mark tone from the modem is present and the terminal may print received data. If the DATA lamp flashes at a steady rate it indicates an incomplete connection, i.e., ringing, busy signal, disconnected call, etc.

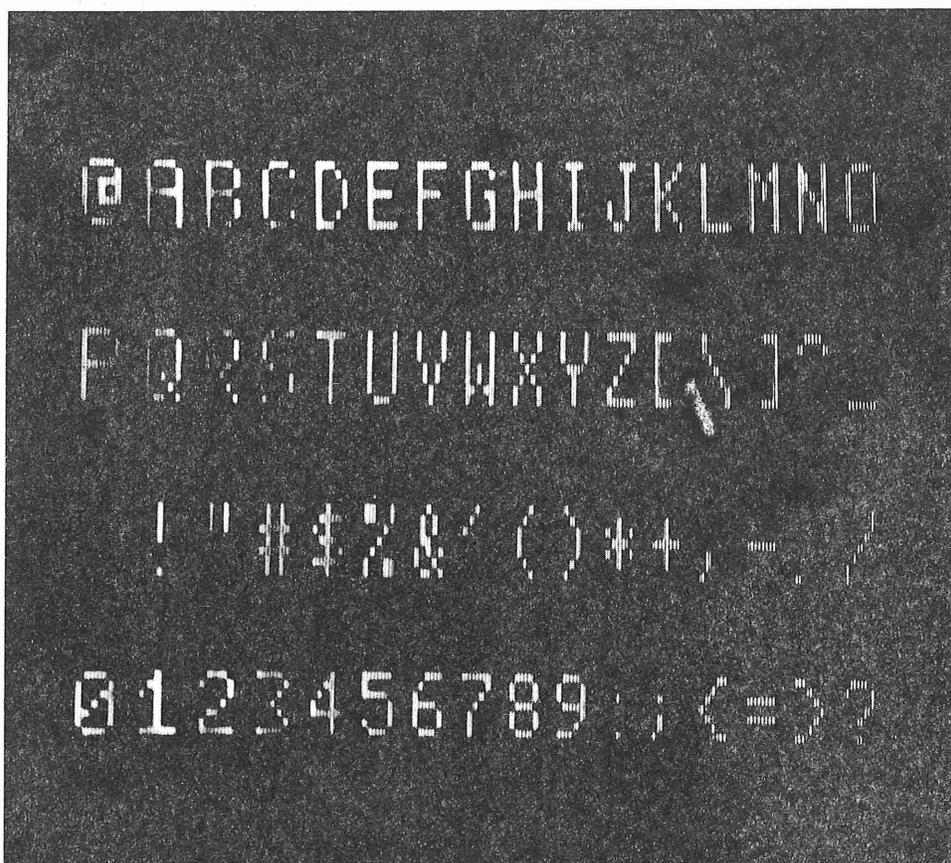


Figure 1-2. ComSet Terminal Display Repertoire

- (b) POWER indicates the status of the power cord, rear panel power switch, fuse, and power supply. It must be illuminated for the terminal to operate properly.
- (c) POWER SWITCH is a rocker switch located at the lower right side of the display terminal on rear. Depressing the side of the power switch closest to the outside of the chassis turns power ON.
- (d) The CLEAR switch is a spring-loaded momentary toggle switch. In its normal (center) or locked (upper) position, the terminal will operate normally. Received data will remain on the display screen indefinitely, provided that the POWER indicator remains on, and the DATA indicator remains off. When the CLEAR switch is activated (downward to its momentary position) and released, the display screen is erased and the system initialized so that subsequent data are received and appear beginning in the upper left-hand character position (position number one).
- (e) The DATA switch is a two-position toggle switch. In its up (DATA) position it connects the terminal to the network of the telephone. Thus, when the telephone handset is lifted from its cradle the ComSet terminal is connected to the line. The telephone receiver may be used to monitor the call, however, the microphone will not function. The telephone may not be used for voice communication with the DATA switch in the DATA position. When the DATA switch is actuated to its down position, the ComSet terminal is disconnected from the telephone network. In this position voice communication is possible and the telephone functions normally. However, incoming data will not be displayed by the terminal.

Specifications

1.08 Display Format

- (a) 5 x 7 character dot matrix
- (b) 64 character maximum (four lines of 16 characters each)

1.09 Input Signal

- (a) Format: ASCII
- (b) Frequencies: 2025 Hz = Space
2225 Hz = Mark
- (c) Control Codes: CR erases screen and initializes system.
DC-1 starts screen blinking. Reset on CR.
- (d) Data Rate: 110, 150, 300 baud (10, 15, 30 characters per second) selectable at time of installation.
- (e) Levels: -40 dBm (minimum)
0 dBm (maximum)
- (f) Stability: 2125 Hz $\pm 2\%$ center frequency
200 Hz $\pm 5\%$ modulation
- (g) Impedance: 200 ohms (replacing telephone set transmitter)
- (h) Loop Current: 20 mA minimum
50 mA maximum
- (i) Response Time: 2 ms (maximum)
- (j) Error Rate: 1 in 10^5 (maximum)

1.10 Noise performance

- (a) Insensitive to power line noise at 50/60 Hz and related harmonics.
- (b) Insensitive to impulse noise from atmospheric static and switching transients found on unconditioned telephone lines.
- (c) Signal to in-band non-coherent noise immunity: 6 dB (minimum).
- (d) Signal to out-of-band noise immunity: -20 dB (minimum).

1.11 General

- (a) Operating voltage: 117 Vac \pm 10%, 60 Hz
- (b) Weight: 10 pounds
- (c) Shipping weight: 15 pounds
- (d) Dimensions: 9-1/4 in. deep
7-7/8 in. wide
8-1/8 in. high
- (e) Temperature: 0^oC to 50^oC (operating)
-10^oC to 65^oC (non-operating)
- (f) Maximum relative humidity: 90% (no condensation)
- (g) Altitude (operating): 10,000 feet maximum

2. INSTALLATION AND OPERATION

2.01 This section covers unpacking, installation, operation, transportation, on-site testing and on-site troubleshooting.

Unpacking

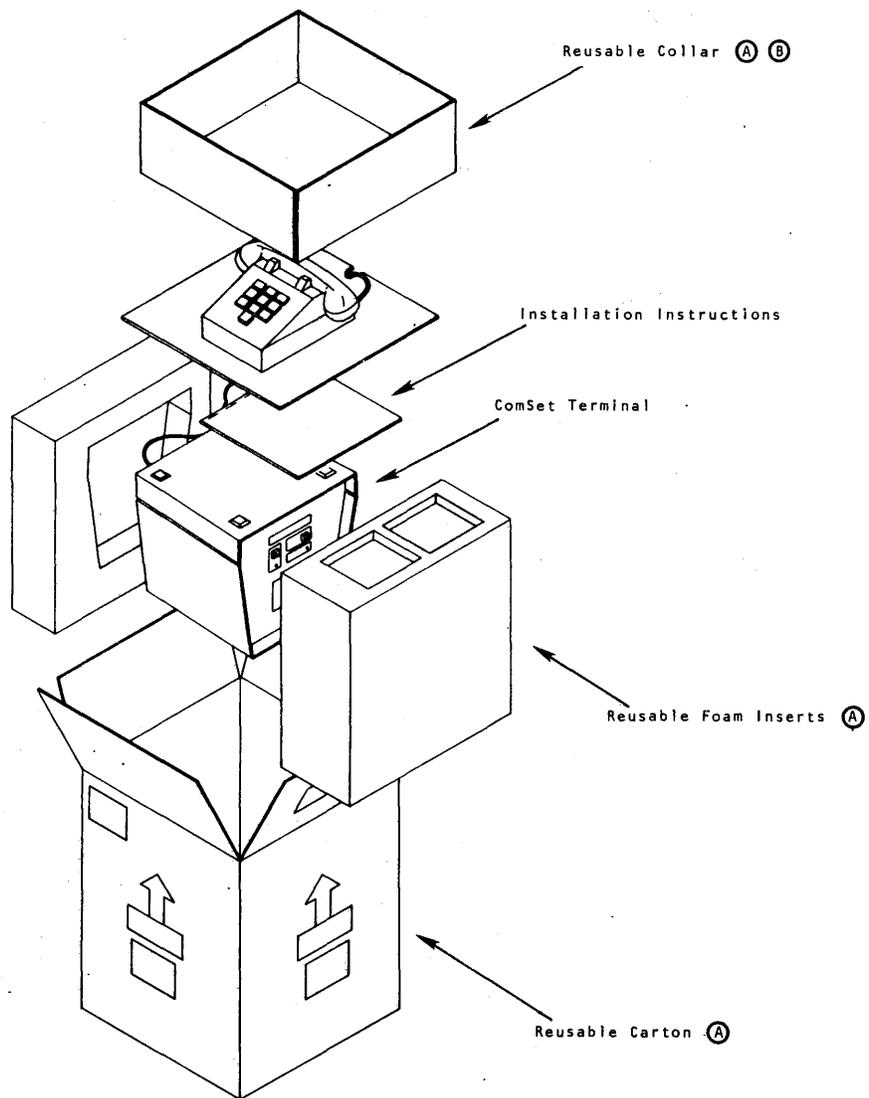
2.02 To unpack the ComSet terminal, refer to figure 2-1 and the following procedure:

- (a) With carton flaps open all the way, remove reusable telephone collar(s) and turn carton upside down on tabletop.
- (b) Lift carton up by flaps, letting ComSet display unit slide out.
- (c) Place ComSet display unit on its base and remove plastic inserts.
- (d) Remove plastic airbags containing ComSet interface cable, power cord, and mounting kit.
- (e) Replace collar and inserts in carton.
- (f) Retain carton for shipping or carrying purposes

Installation Procedure

2.03 The following are the steps for installing a ComSet terminal to a telephone:

- (a) The proper data rate should be selected.
- (b) The ComSet interface cable should be attached and wired to the telephone set and connected to the receptacle at the rear of the display unit.



NOTES:

- (A) Retain for transportation use
- (B) Collar Provides space for packing telephone set (shown)

Figure 2-1. ComSet Terminal Packing, Exploded View (shown with telephone in place)

- (c) The complete terminal should be tested before installation at the user site.

NOTE: DO NOT connect equipment to ac power or telephone line until interface cable wiring has been completed.

2.04 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 screws from the bottom and the three screws from the rear of the terminal.
- (b) Remove the back panel and slide the ComSet forward out of its housing.
- (c) Locate data rate selector switch at bottom left rear of display unit on data converter board (see figure 2-2).
- (d) Set desired data rate placing selector switch segments to the positions indicated in table 2-1.

2.05 To connect the interface cable to the telephone set, proceed as follows:

- (a) Attach interface cable to telephone set per figures 2-3 and 2-4. Figure 2-3 gives instructions for standard telephones. Figure 2-4 is for Automatic Electric type 890 or phones of similar design.
- (b) Connect interface cable spade lugs per table 2-2.
- (c) Connect interface cable to receptacle at rear of terminal, see figure 2-5.

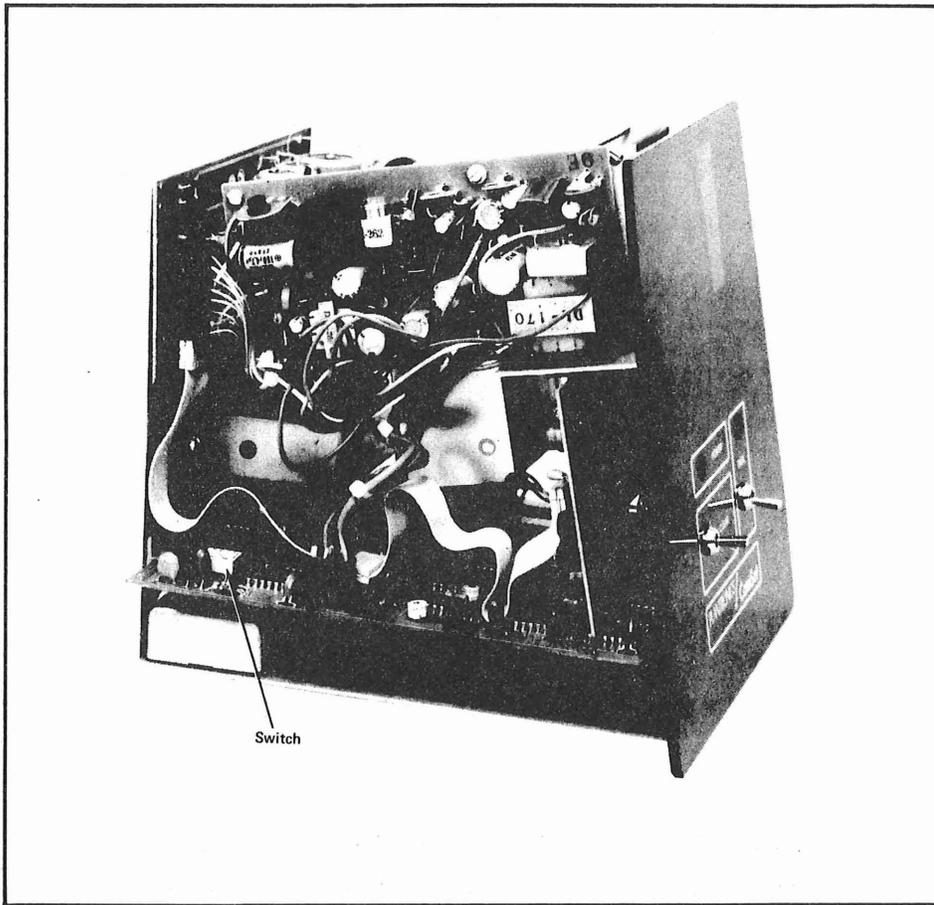


Figure 2-2. Baud Rate Switch Location

Table 2-1. Baud Rate Selection S1-2, S1-3 and S1-4

Set Switch ON	Set Switch OFF	Baud Rate
S1-2, S1-4	S1-3	300
S1-3, S1-4	S1-2	150
S1-3	S1-2, S1-4	110

STEP	PROCEDURE
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 plate, under DTMF pad.
4.	Fasten interface cable to clamp with cable-tie.
5.	Make interface cable connections as stated in tables 2-2 and 2-3, 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.

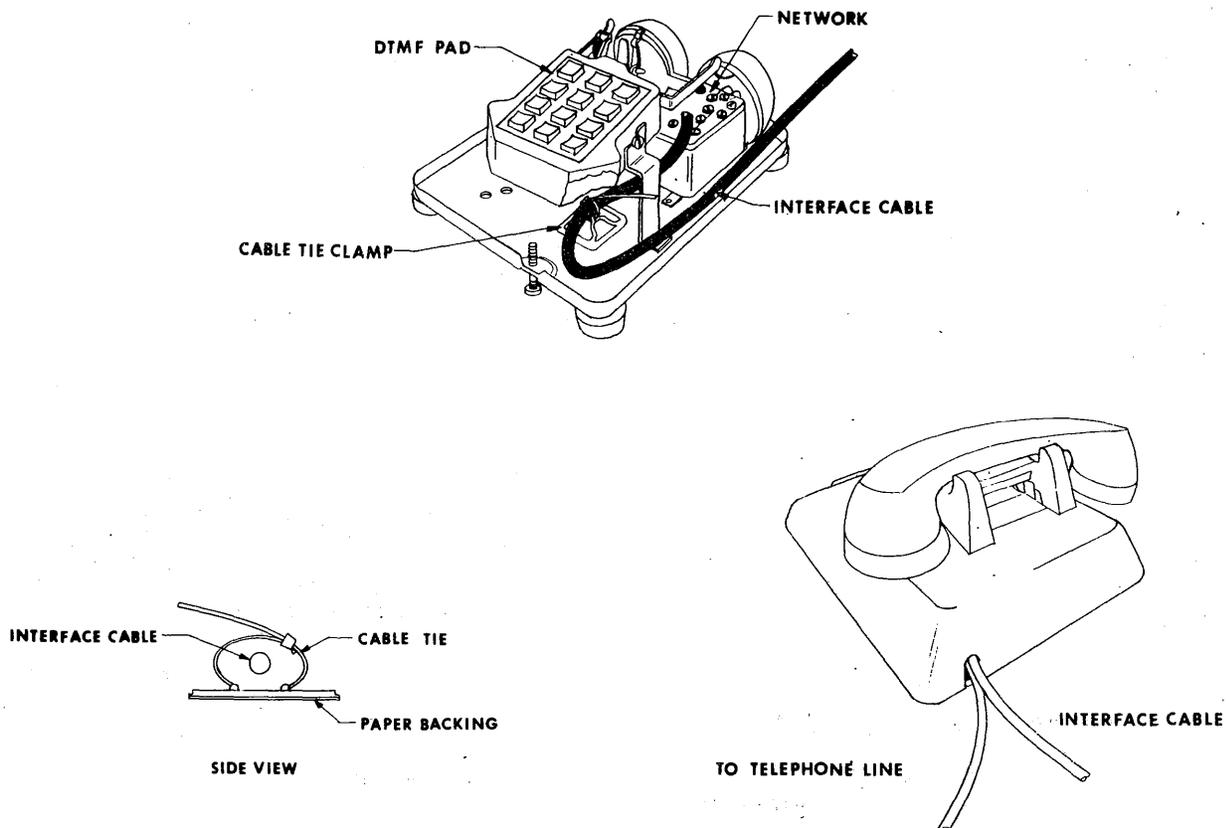


Figure 2-3. Connecting Interface Cable to Standard Desk Sets

STEP	PROCEDURE
1.	Remove telephone housing from base.
2.	Remove paper backing from adhesive side of cable-tie clamp.
3.	Install cable-tie clamp on base.
4.	Fasten interface cable to clamp with cable-tie.
5.	Make all interface cable connections as stated in tables 2-2 and 2-3, as appropriate. Use plastic snap-on insulators provided in mounting kit for wire splice.
6.	Route interface cable through remaining cable exit hole in rear of base.
7.	Replace telephone housing, ensuring interface and telephone line cables are not trapped or stressed by housing or base and that cradle switch operation is free.

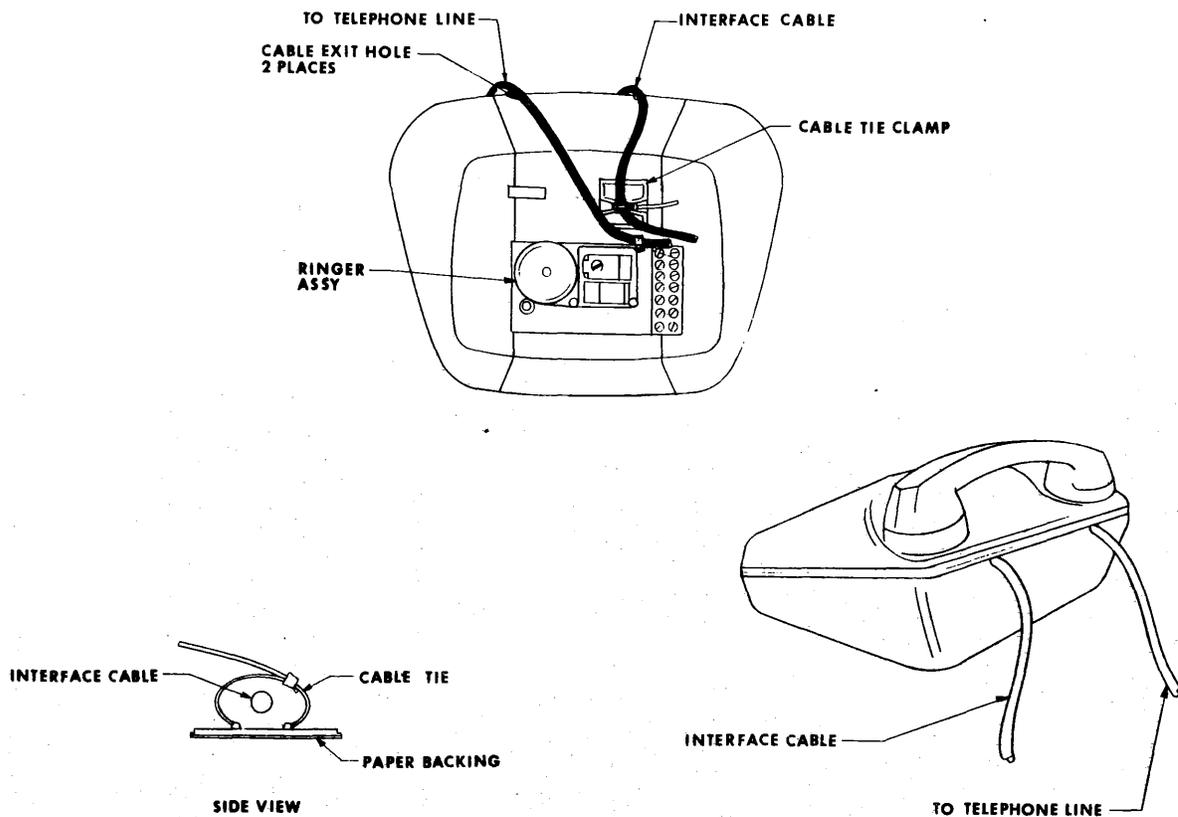


Figure 2-4. Connecting Interface Cable to AE890 Desk Set

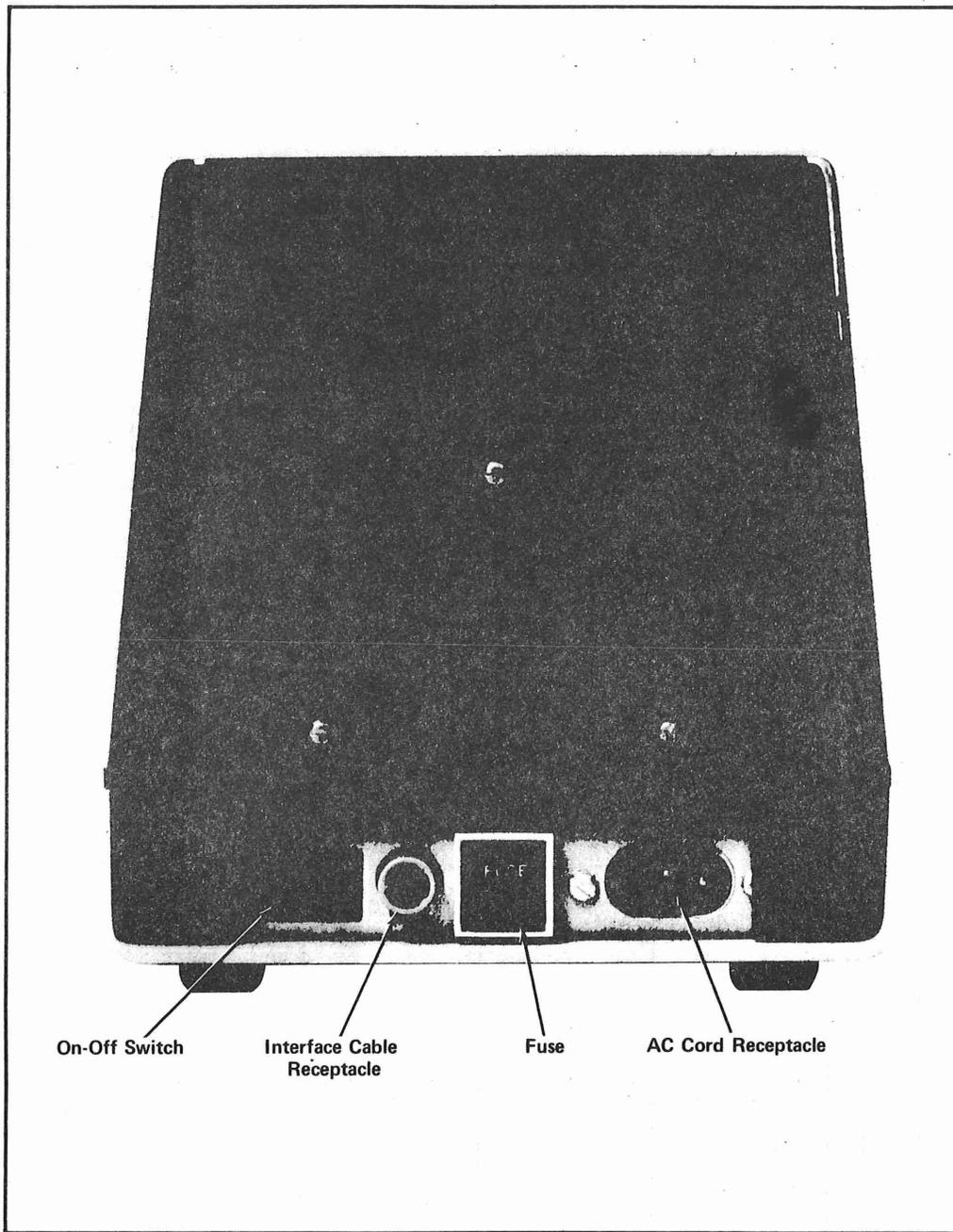
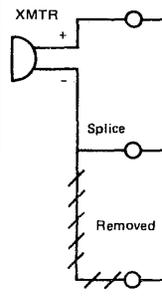


Figure 2-5. Connecting Interface Cable to ComSet Terminal Unit

Table 2-2. Interface Cable and Telephone Set Connections

Telephone Set Circuit	Interface Cable			Telephone Set			
	Lead Color	Switch Circuit	Lead Function	WECO 2500 D	WECO 2554 B	WECO 500/D with 1035C3A Dial	ITT 2500
	Red	→	Add (R) to Positive Transmitter Lead	Network T (or Term Strip 11)	Term Strip 11	Splice to previously spliced (R) Transmitter Lead and (S-W) 4 lead of 1035 dial.	Term Strip 11
	Green	↘	Remove Negative Transmitter lead from Normal termination and splice to (Gn)	Remove (BK) Handset wire from Network B and splice.	Remove (BK) Handset wire from Network B and splice.	Remove (BK) Handset wire from Network B and splice.	Remove (BK) Handset wire from Network B and splice.
	Black	↗	Add (BK) to normal termination for negative transmitter lead.	Network B	Network B	Network B	Network B

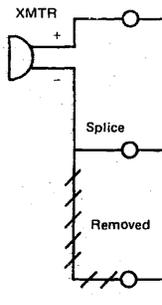
Telephone Set Circuit	Interface Cable			Telephone Set			
	Lead Color	Switch Circuit	Lead Function	SC 2500	SC 500D with 1035 C3A Dial	AE 80 (Touch-Call)	AE 890
	Red	→	Add (R) 2 to Positive Transmitter Lead.	Term Strip 11	Network R	Trans Unit 5	Induction Coil 5
	Green	↘	Remove Negative Transmitter lead from Normal termination and splice to (Gn) 5.	Remove (BK) handset wire from Network B and splice.	Remove (BK) Handset wire from Network B and splice.	Remove (GN) wire from spacer terminal A and splice.	Remove (GN) wire from Terminal Strip 6B and splice.
	Black	↗	Add (BK) 8 to normal termination for negative transmitter lead.	Network B	Network B	Spacer Term A	Term Strip 6B

Table 2-3. Connections for Western Electric 500D Telephone Set with 1035 Dial and 185A Network.

STEP	
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 the 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 2-2.
	NOTE: NO WIRES REMAIN ON TERMINAL "F" OF NETWORK.
	<u>References:</u> Section 502-501-101 (500D) 501-164-1035 (C3A)

- (d) Connect power supply cord to receptacle at rear of terminal, see figure 2-5.

Operation and Test Procedure

2.06 This procedure verifies operation of the ComSet terminal.

- (a) Connect telephone set to telephone line using standard plant practices.
- (b) Plug in 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 switch on display unit is in UP position.
- (f) Pick up telephone handset and ensure dial tone is present.
- (g) Place call to number. (If this is a test, see Plantronics Automatic Test Station Product Information Bulletin 22-001).
- (h) On receipt of answerback tone, you are ready to communicate with the computer. Do not replace handset in cradle.
- (i) Enter data via pushbutton pad according to the appropriate system procedures. Response will appear on CRT display.

- (j) Upon completion of call, replace handset in cradle. DATA indicator should now be extinguished.

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

Transportation to User Site

- 2.07 If above installation has been accomplished at a test or shop location then it is necessary to move both the telephone set and the ComSet terminal to the user location.

- 2.08 Repack ComSet terminal in shipping carton with telephone set. Refer to figure 2-1 and the following procedure:
 - (a) Set POWER switch in OFF position.
 - (b) Disconnect power supply cord from mains supply.
 - (c) Disconnect power supply cord 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.

- (i) Place telephone set with interface cable attached in collar zone of carton.
- (j) Tape carton closed.

User Site Requirements

2.09 The following facilities are required at the user site:

- (a) Telephone line with a dual-tone multifrequency capability; or an auxiliary 12-button DTMF pad must be attached to telephone set before attachment of interface cable. (See Installation Procedure, paragraphs 2.03 through 2.05.)
- (b) Three-wire 117V, 60-Hz power receptacle within reach of 8-foot power cord on display unit.
- (c) Desk, table, or platform capable of supporting ComSet terminal and telephone set. Maximum separation between these units is four feet.

User Site Installation

2.10 Install telephone set with ComSet terminal attached according to standard plant practices. Then test the completed installation per paragraph 2.06.

2.11 It is suggested that the ComSet carton, including collar and inserts, be retained at the user location in case it is necessary to transport a unit to a different location.

On-Site Troubleshooting

2.12 Table 2-4 provides guidelines for the analysis and correction of troubles that may occur in the ComSet terminal. This is intended solely for the purpose of correcting

Table 2-4. On-Site Troubleshooting Procedures

	SYMPTOM	ACTION
1.	POWER lamp OFF	-Test 117-Vac power source -Plug in power cord -Turn POWER switch ON -Replace 1-amphere slow-blow fuse
2.	Scattered characters on screen when power first turned on (acceptable occurrence)	-Set DATA switch to DATA position -Check symptom 1 -Depress CLEAR switch
3.	No dial tone	-Check telephone line -Check interface cable to telephone set connections for wrong punchings, opens or shorts -Replace telephone set
4.	Busy signal	-Line in use -Line not available
5.	DTMF pad does not operate	-Calling party control (CPC) battery reversal; install polarity guard per plant practices -Reverse tip and ring leads at connector block -Check symptom 3
6.	No answerback tone	-Wrong telephone number -Distant dataset problem
7.	No DATA lamp indication upon receipt of carrier	-Check handset receiver, listen for answerback tone to FSK data. If remote station has timed out, recall -Place DATA switch in DATA (up) position -Interface cable connected to rear of display unit -Check interface cable to telephone set connections for wrong punchings, opens or shorts
8.	No response to first # key entry	-Computer system busy -Does this system respond to # key -Recall -Check symptom 7
9.	With echoplex option in use, wrong data returned	-Noisy line -Pressed wrong DTMF -Recall -Check DTMF common switch and tones generator for proper operation
10.	No data on screen	-Check symptom 7 -Remove display unit from housing and adjust brightness control (remembering original position) -Check circuit connectors in display unit

Table 2-4. On-Site Troubleshooting Procedures (Cont.)

	SYMPTOM	ACTION
11.	Wrong message or characters on screen	-Pressed wrong DTMF -Noisy telephone line -Recall -Proper data rate selected
12.	DATA lamp stays on after message received	-Computer modem waiting for DTMF disconnect sequence, if used
13.	Bright background or dull characters	-Remove display unit from housing and adjust brightness
14.	Telephone will not operate for voice communication (microphone inoperable)	-Place DATA switch in down position -Is interface cable connected to rear of display unit -Check interface cable to telephone set connection for wrong punchings, opens or shorts

troubles that do not require field change-out of any parts. If suggested action does not correct the deficiency, remove and return ComSet terminal for servicing. A more detailed troubleshooting and maintenance guide is available in the Maintenance Section 4.

2.13 The key to quick and efficient troubleshooting in the ComSet terminal is the ability to use the video display and indicator lamps to help identify the particular problem. Table 2-4 lists the trouble indications and the suggested action to correct or identify the problem.

Removal/Replacement

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

2.15 Proceed as follows if the entire ComSet 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 paragraphs 2.03 through 2.05.
- (c) Following standard plant practices, re-connect the telephone to the line.

2.16 An alternative to the above procedure might be 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 display unit, see figure 2-5.

2.17 If only the display unit is to be replaced, proceed as follows:

- (a) Disconnect the interface cable from the rear of the display unit being replaced, and set display unit aside.
- (b) Connect interface cable to receptacle at rear of new display unit, see figure 2-5.
- (c) Connect power supply cord to receptacle at rear of new display unit, see figure 2-5.
- (d) Test new display unit using procedure given in paragraph 2.06.

2.18 Pack the equipment for transportation using the procedure given in paragraphs 2.07 and 2.08, but note that the telephone set might not be included. In any case, be sure to place the collar on top of the display unit to provide a tight fit in the packing container.

3. FUNCTIONAL DESCRIPTION

3.01 This section covers an overview of the terminal features and functional description of the various terminal sub-assemblies.

Terminal Overview

3.02 The ComSet 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 used for data entry to the DTE.

3.03 Figure 3-1 is a functional block diagram of the ComSet terminal. The terminal is a receive-only device which displays received ASCII-FSK data.

3.04 The basic operation is as follows: The DTMF signals pass through the telephone set to the demodulator card. This unit has two main functions. It acts as the interface between the telephone plant and the display unit by providing dc isolation to protect the network. With the data switch in the data position, the transmitter in the handset is electrically replaced with the ComSet terminal. The other function is filtering and demodulation of the data to integrated circuitry levels.

3.05 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.

3.06 This video signal is passed on to the video 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 by a 5 x 7 dot matrix.

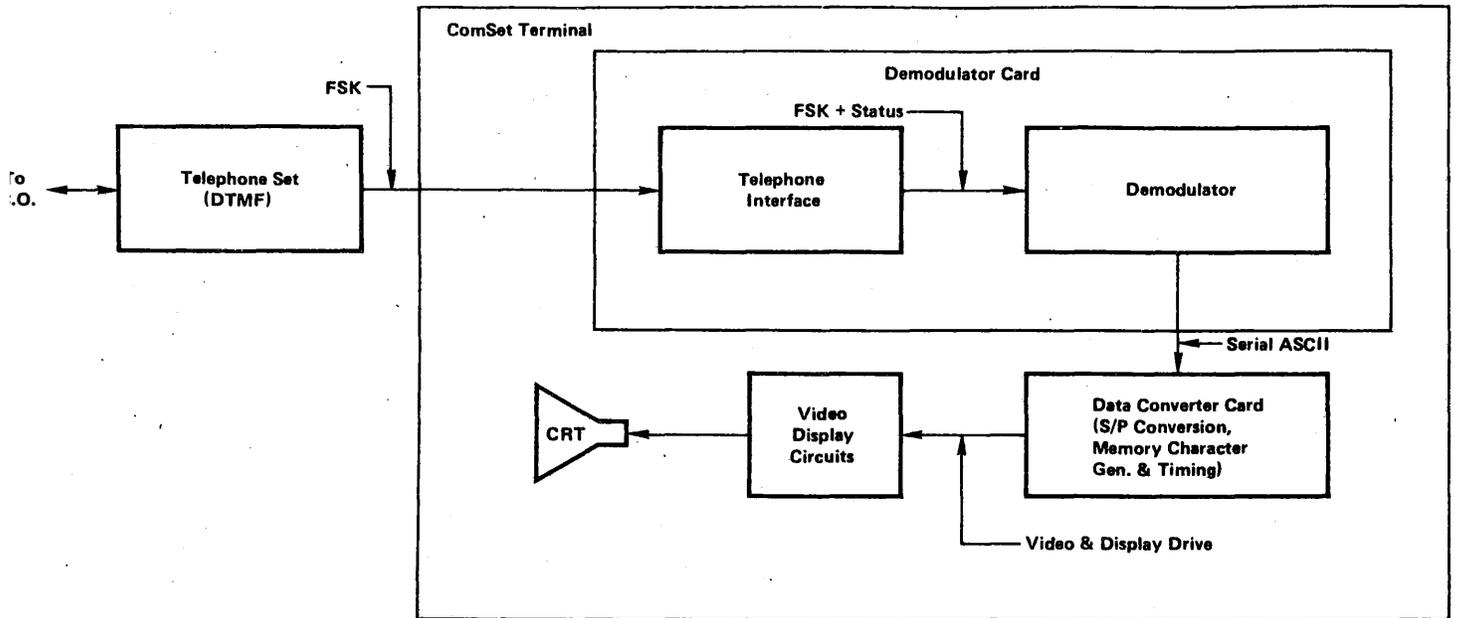


Figure 3-1. Terminal Functional Block Diagram

3.07 Figure 3-2 is an interconnect diagram for all of the terminal subassemblies discussed.

Demodulator Board Circuit Description

3.08 The demodulator, functioning similarly to a receive-only type 103 data set, is illustrated in figure 3-3. FSK data enters the photo coupler isolating circuit from the telephone line. The FSK signal is then fed to the AGC network. The network accepts signal levels between -40 dBm and 0 dBm, amplifying the signal for presentation to the bandpass filter amplifiers. The preselector 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.

3.09 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.

3.10 The phase-locked loop demodulator accepts FSK Mark and Space signals, corrects small frequency phase errors, converts to EIA RS-232-C voltage levels, compensates for temperature changes and presents the data simultaneously to the level converter and mark detector.

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

Data Converter Board Circuit Description

3.12 Terminal logic serial to parallel conversion, figure 3-4, depicts the flow of data through the logical portion of the terminal. When the mark detector senses a Mark, the serial-to-parallel converter is enabled to accept data from the level

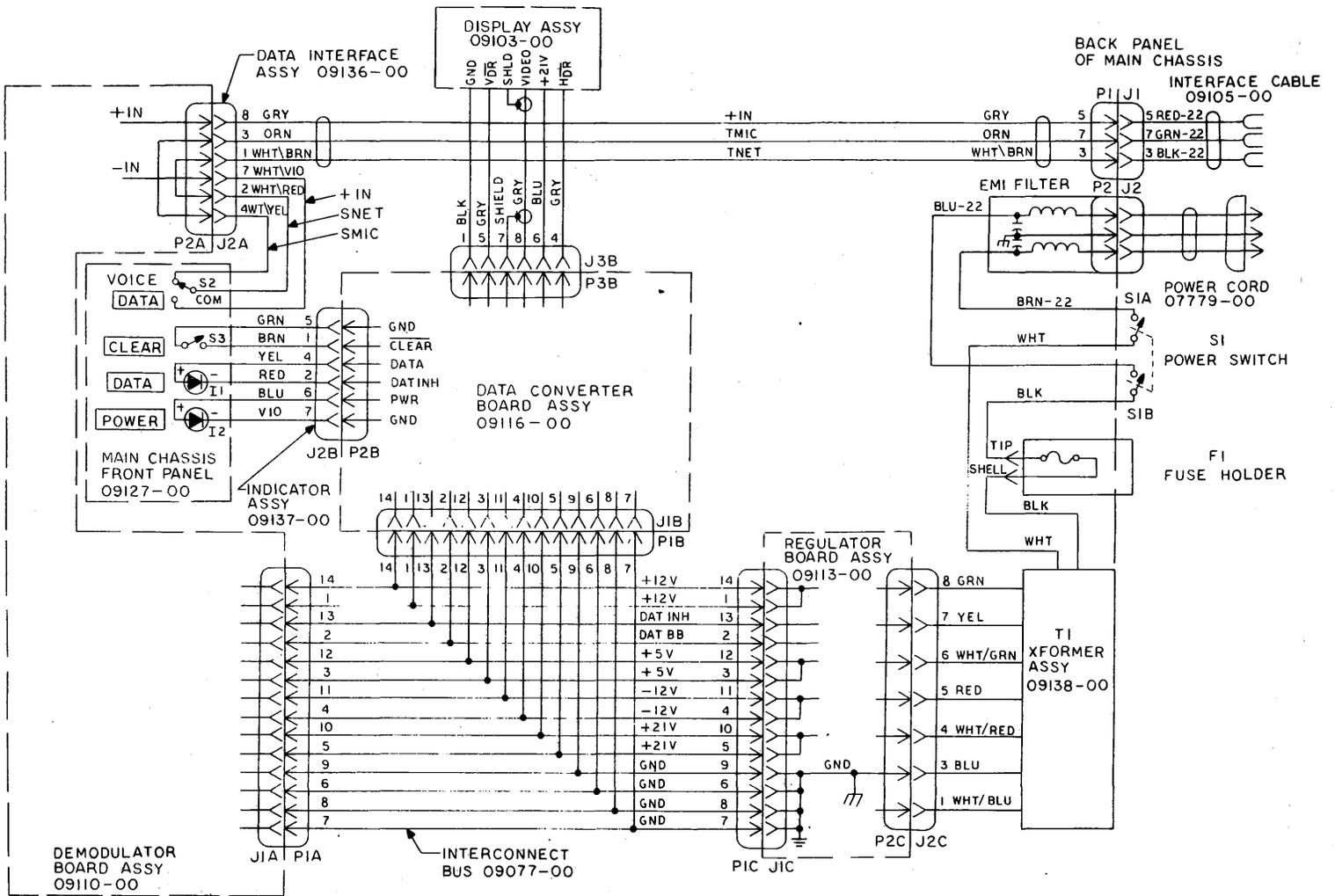


Figure 3-2. Terminal Interconnect Wiring Diagram

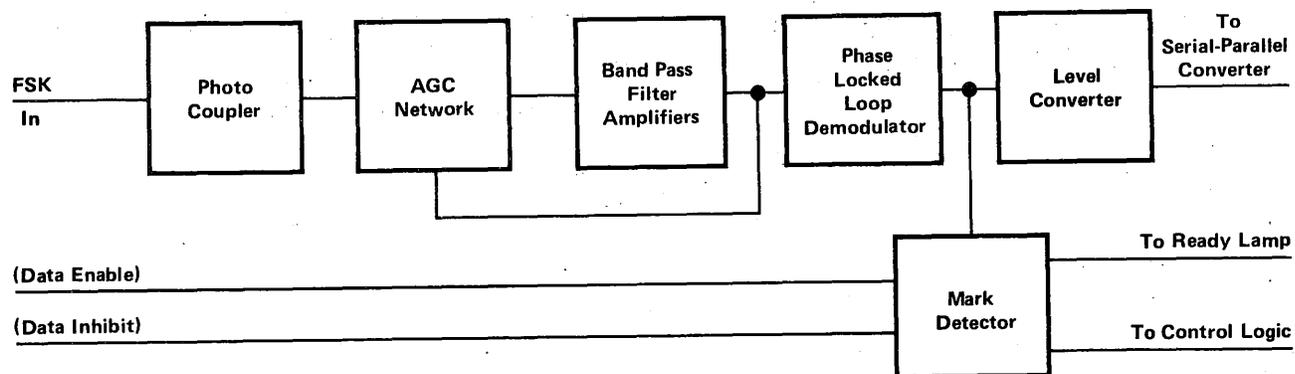


Figure 3-3. Demodulator Functional Block Diagram

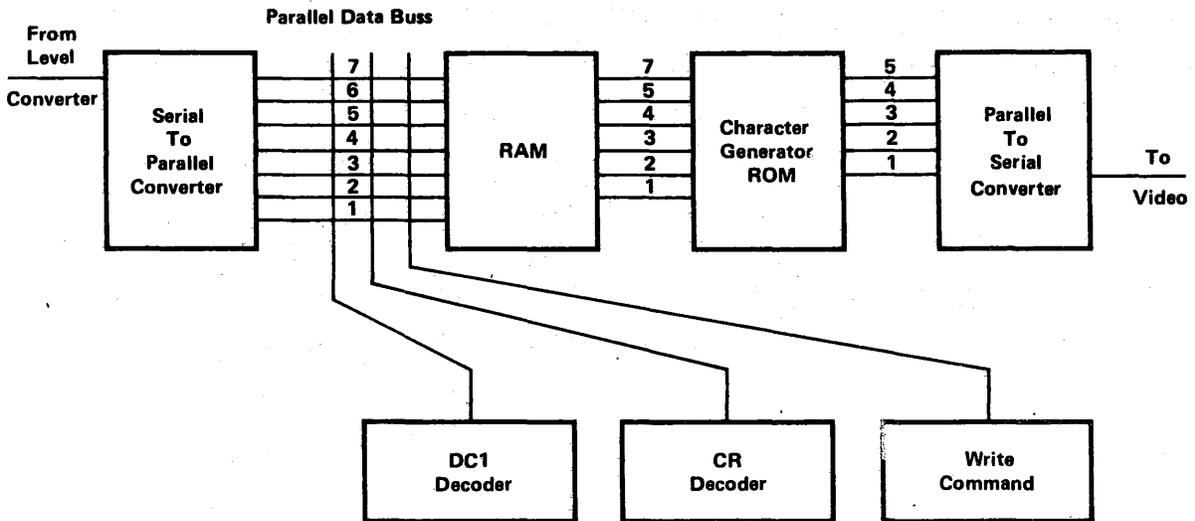


Figure 3-4. Data Converter Signal Flow Block Diagram

converter. 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 into control logic just as the last information bit steps in. Control logic now stops further bits from entering the converter, freezes 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.

3.13 DC-1 (Blink) Decoder. This decoder tests for the control character, DC-1. It is used to create a CRT screen blinking condition. Its presence will cause the entire screen to appear to blink at a 1-Hz rate until cancelled by CR. Its object is to alert the person operating the terminal.

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

3.15 Write Command Decoder. This is the final decoder. It operates only upon receipt of the strobe signal and samples for legal characters. This is a test of bits 6 and 7. 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, bit 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).

3.16 Random Access Memory (RAM). 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 or holds 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.

3.17 A line and address counter determines the specific storage location for each character. When CR is received or the manual CLEAR switch is depressed, this 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. Hence, 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.

3.18 To this point the entire operation is known as the WRITE operation. The information has been written to the terminal. Now, it is up to the terminal to do another operation called a READ operation. The ComSet terminal has to have the capability of printing on the CRT screen without destroying the information stored in the memory. This is because the phosphor coating on the CRT screen can only glow for very short periods of time before fading. That time is known as persistency. In order to keep information on the screen, the terminal must periodically repeat a read operation to refresh the screen or keep it glowing.

3.19 Character Generation by the Read Only Memory (ROM). The ComSet ROM is characterized as a 64 x 7 x 5 dot generator. That is, 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.

3.20 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. This 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.

3.21 The ROM is set up and then, as shown in figure 3-5, 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., until all sixteen character positions of the first text line are out. A counter advances by one and the same row repeats itself. This counter advances so that the row of dots is repeated on four horizontal traces. Then another counter advances permitting the second row to be output four times.

3.22 This procedure continues until the first line of text is complete, or after thirty-two sweeps (horizontal traces). Separation between text lines equals the text lines. It follows the ROM pauses while 32 blank horizontal lines are swept. Then, the second text line commences just like the first. Eventually, after 256 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 is a continuous process that stops only when the ComSet is turned off.

3.23 Control Logic. As indicated by figure 3-6, the process of 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

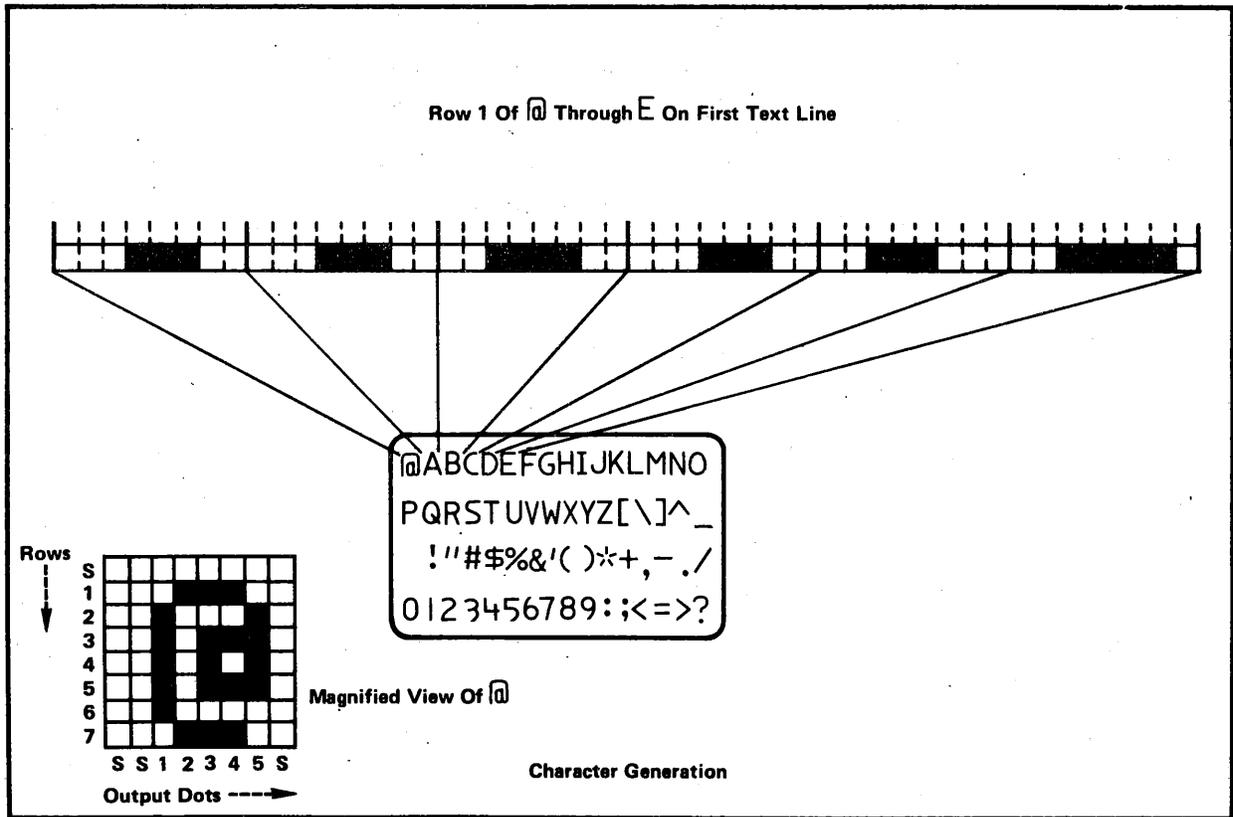


Figure 3-5. Character Generation

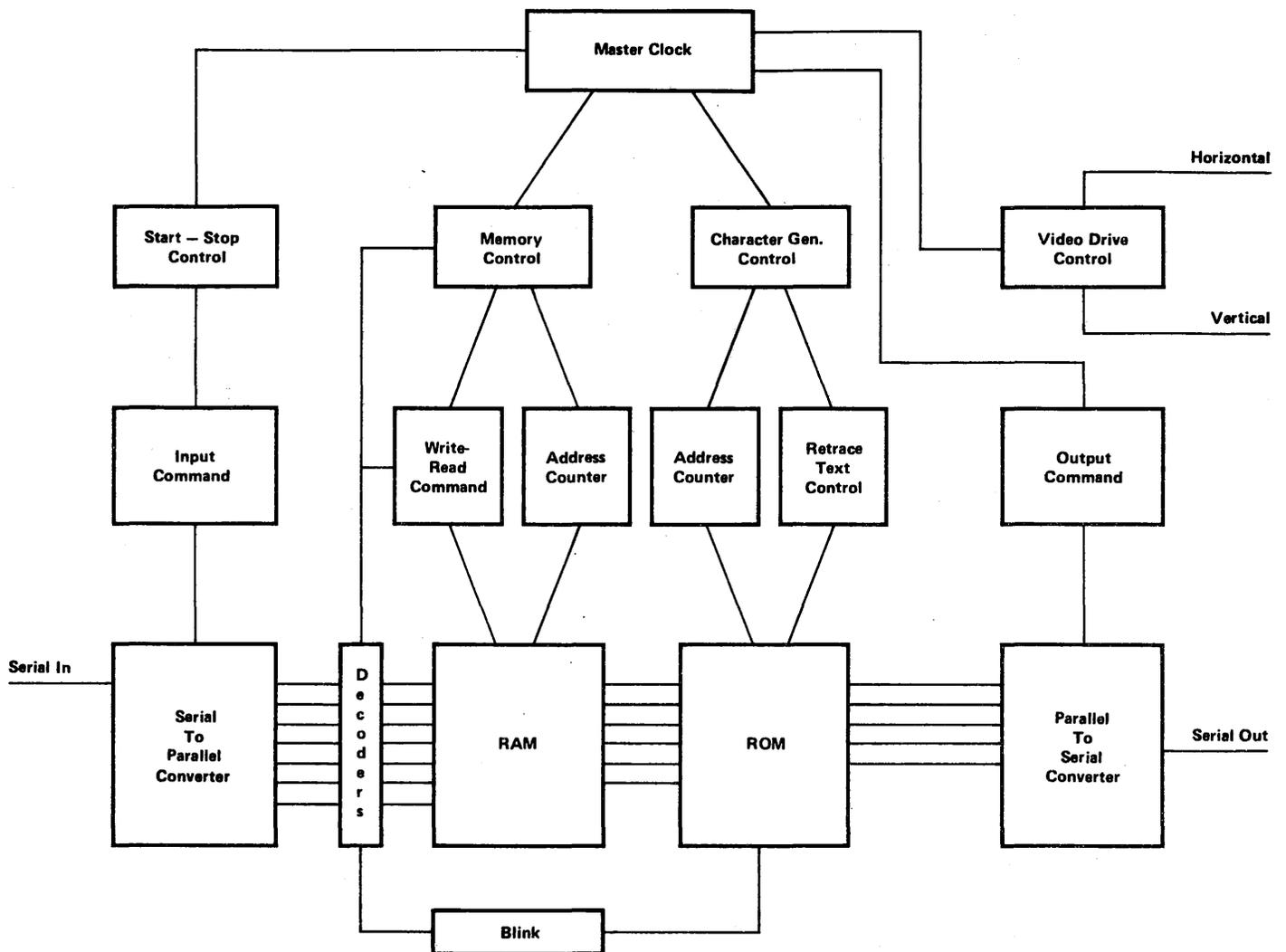


Figure 3-6. Data Converter Command and Control Diagram

dividers that become counters or steppers. The end counters or steppers run continuously or on command only, depending upon their function. Some of these are explained below, more or less in the order presented in this section.

- (a) Start-Stop Control. When the start bit is sensed, a stepper begins to increment at the selected bit rate (300, 150 or 110 b/s). 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 3.12) indicates a character is on the parallel data buss and is part of the last two cycles.
- (b) Memory Control. This control has several functions:
 - (1) 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.
 - (2) The read address counter runs whenever write is not operating.
 - (3) Write command is issued on receipt of a legal character.
 - (4) Read for each character in the memory, even when write is operating.
- (c) Character Generator Control. Essentially, this is the blink control, text separation, CRT horizontal retrace time and address counter.

- (d) 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.

- (e) Horizontal and Vertical Drive Clocks. The horizontal drive provides the horizontal sweep frequency and the vertical drive provides the vertical sweep frequency.

ComSet_CRT_Display_Description

3.24 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.

3.25 The ComSet 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. Each, therefore, tracks from the master clock eliminating the necessity of external controls as horizontal and vertical hold. The brightness control remains, but as an internal adjustment. Actual operation of the display, excepting the preceding comments, is similar to television video and not included as part of this manual.

Regulator_Board_Circuit_Description

3.26 The regulator board receives the 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 +5V, +12V, -12V. The regulator board also supplies unregulated +21V to power the display assembly.

4. MAINTENANCE

General Information

4.01 The information required for maintenance and repair of the ComSet to the subassembly level is provided in this section. Included sections are Recommended Tools, Disassembly/Reassembly, Fault Isolation, Cleaning, Spare Parts List, Warranty, and Service information. The Fault Isolation Procedure, paragraph 4.17, is intended to aid authorized personnel of a repair center in isolating damage and/or malfunction to a particular subassembly and determination of disposition.

Recommended Equipment and Tools for Maintenance

4.02 The Fault Isolation Procedure is designed to isolate the failure to one out of five replaceable subassemblies with the aid of minimum of external test equipment. However, a WECO type 2500 telephone or equivalent and a source of FSK signal along with standard hand tools will be needed.

Disassembly/Reassembly Procedure

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

CAUTION: Hazardous voltages may be present at or near the second anode of the cathode ray tube. (See figure 4-9.)

4.04 Remove the terminal chassis from the outer housing:

- (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 4-1.)
- (e) Remove the three #4-40 screws from the back of the terminal. (See figure 4-2.)
- (f) Slide the terminal chassis out the front of the housing. (See figure 4-3.)

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

4.05 Replacing the terminal chassis in the outer housing:

- (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) Attach the back panel to the chassis with three #4-40 screws. (See figure 4-2.)

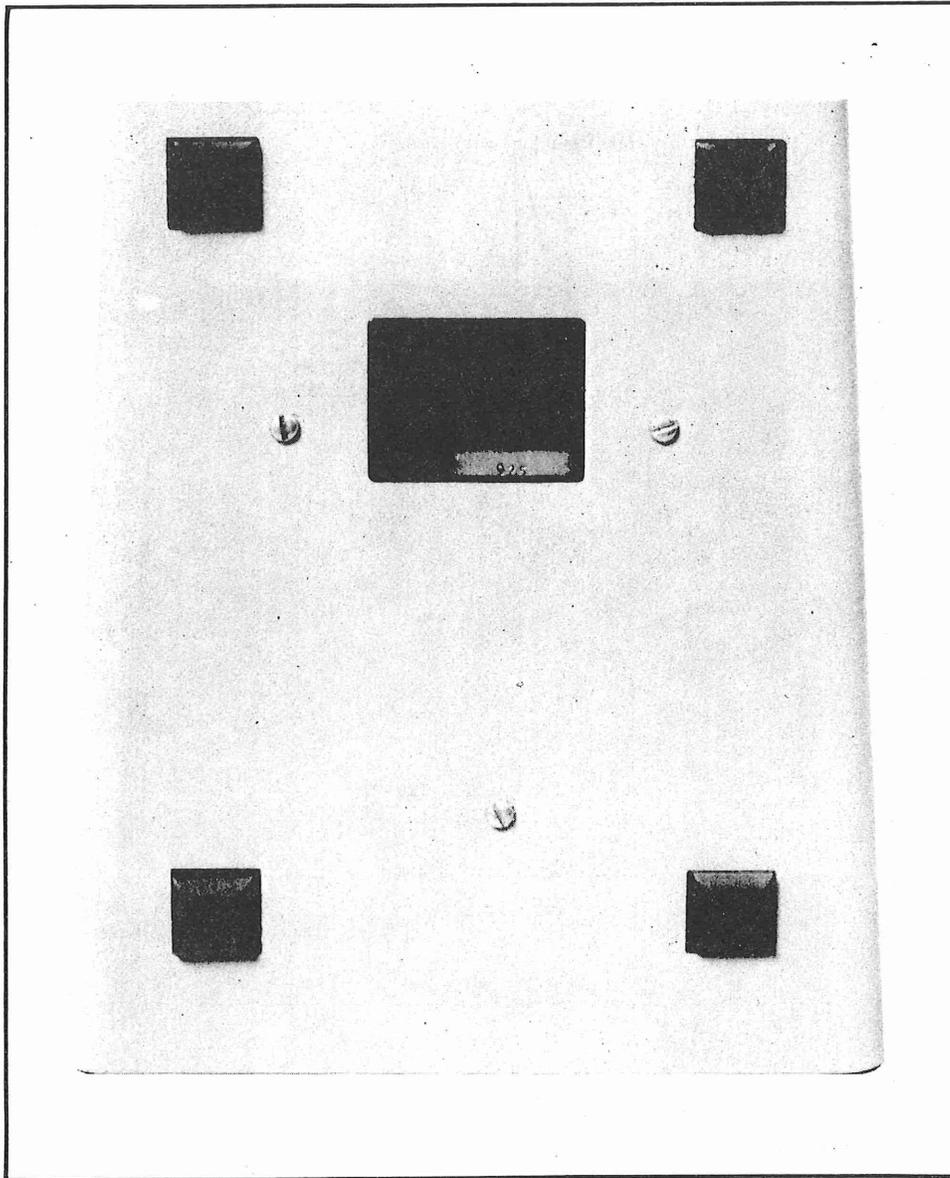


Figure 4-1. Terminal Bottom View

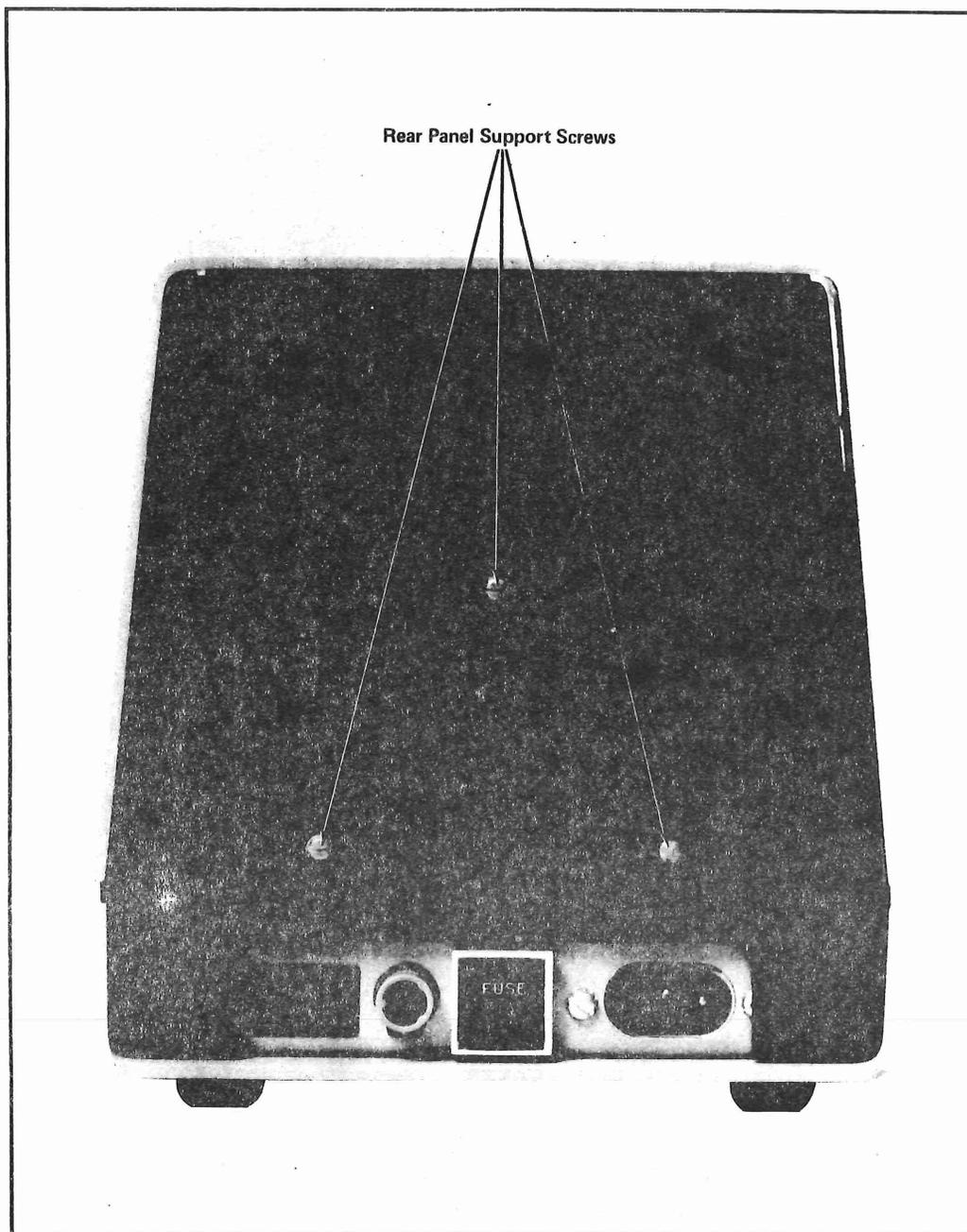


Figure 4-2. Terminal Rear View

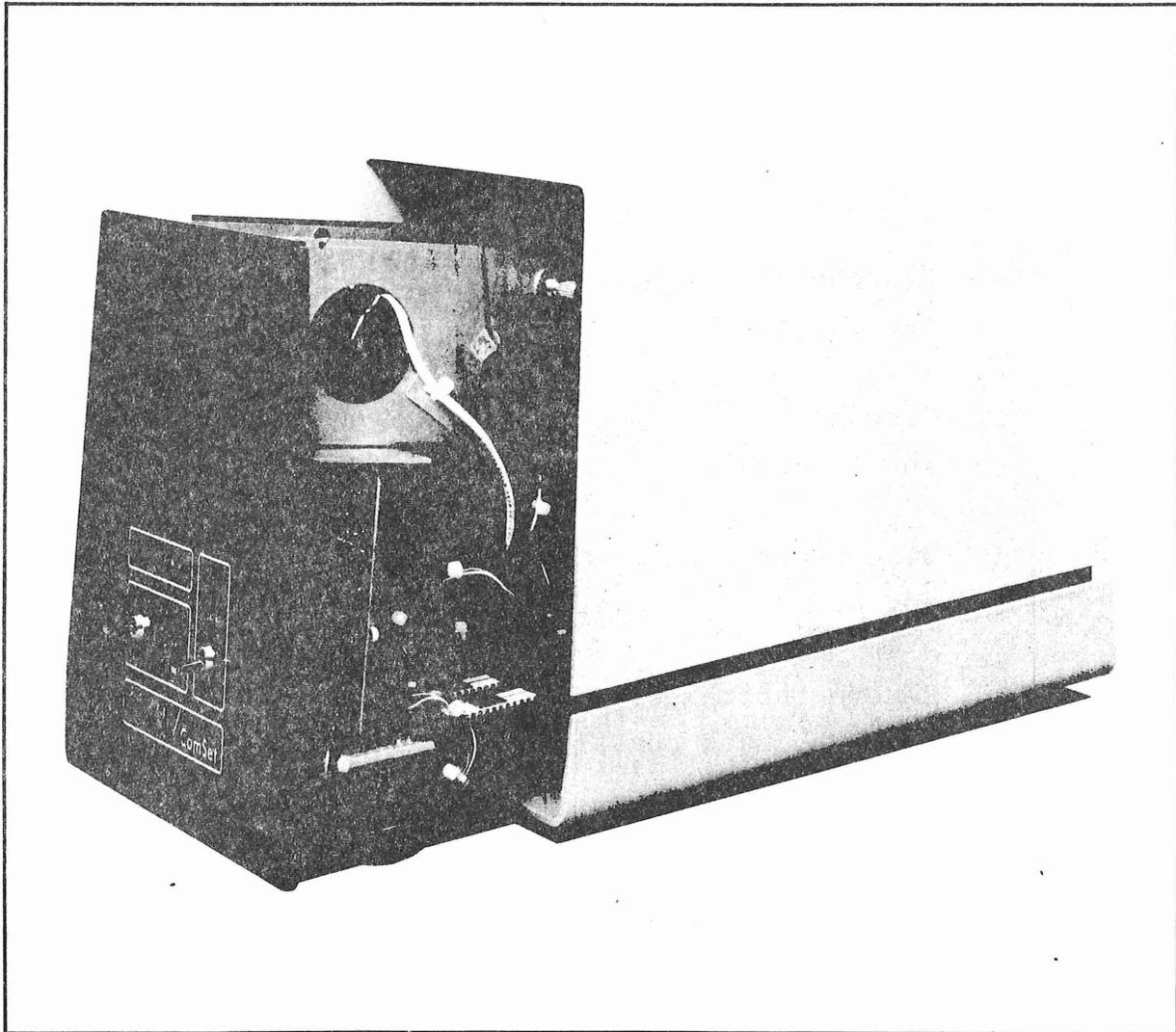


Figure 4-3. Removing Chassis From Housing

- (f) Install the three #6-32 screws on the bottom of the terminal. (See figure 4-1.)

4.06 Remove the regulator board assembly from the main chassis:

- (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 4-4.)
- (e) Remove the three regulator support screws (#4-40) from the back chassis. (See figure 4-5.)
- (f) Remove the board by pulling it up from the chassis.

4.07 Replacement of regulator board assembly:

- (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 4-5.)
- (c) Insert the mica washer 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. (See figure 4-5.)
- (e) Connect J2C and P1C to the regulator board. (See figure 4-4.)

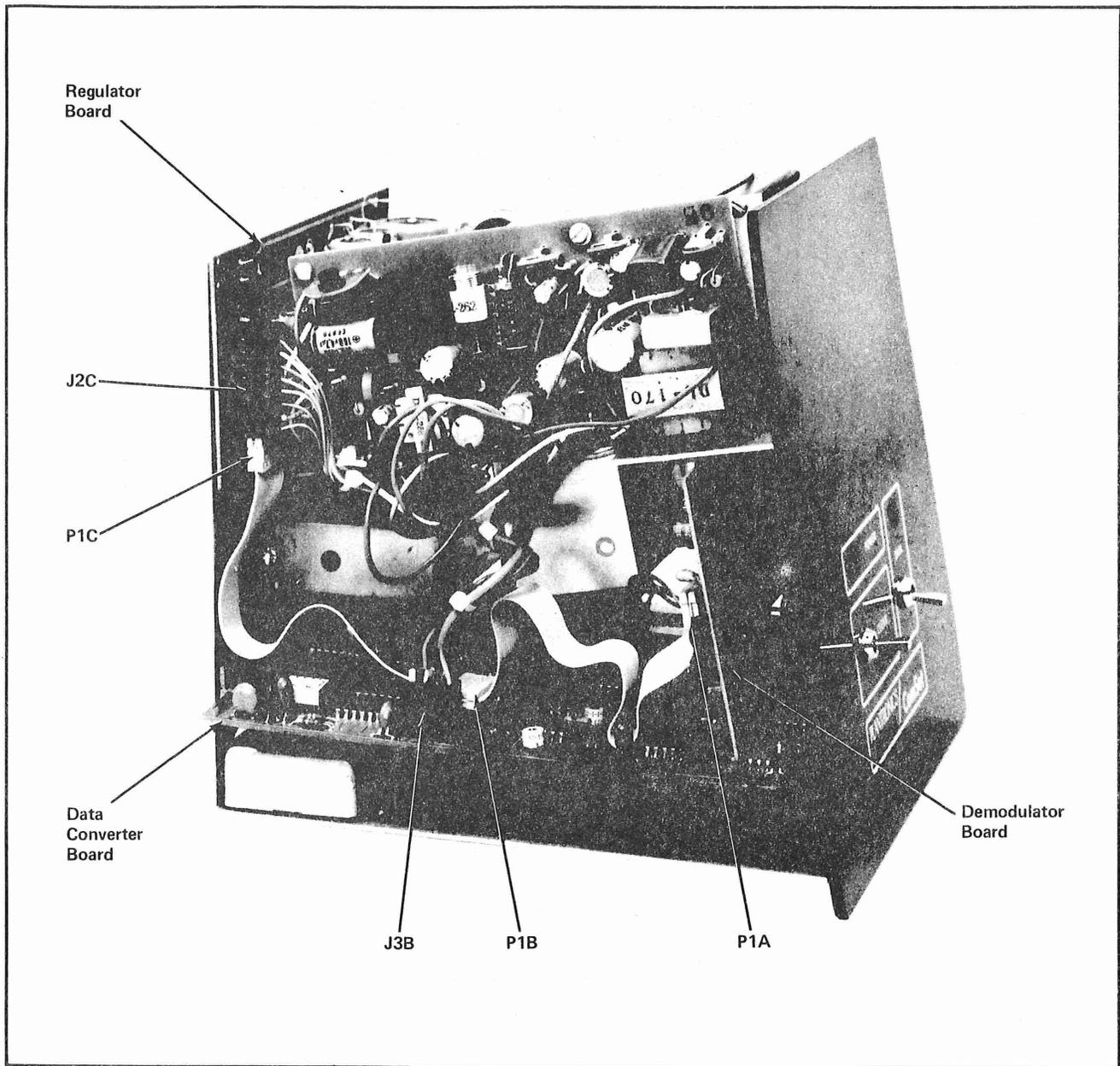


Figure 4-4. Left Side of Chassis

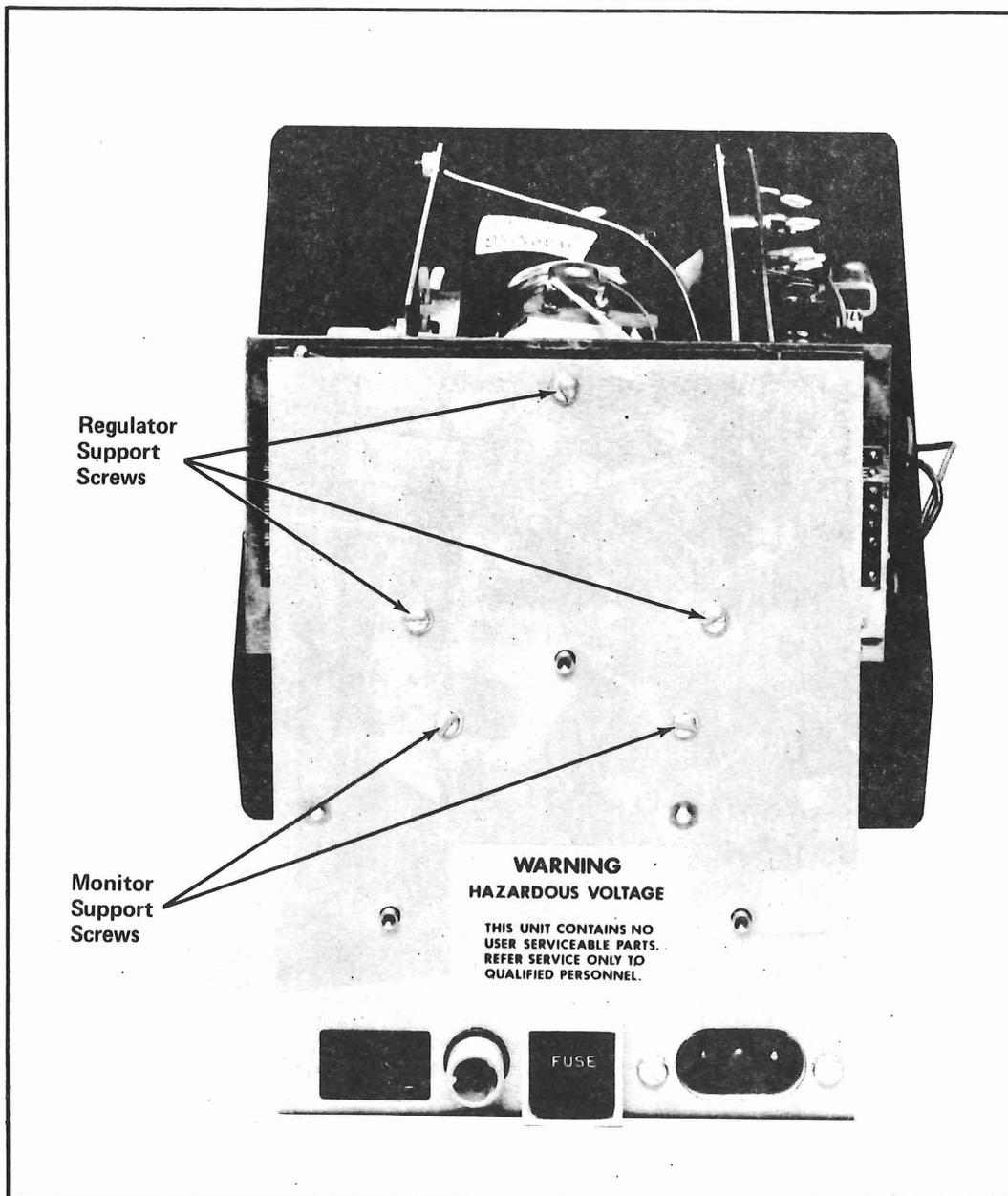


Figure 4-5. Rear View of Chassis

4.08 Remove the data converter board:

- (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 4-4 and 4-6.)
- (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 4-7.)

4.09 Replacement of the data converter board:

- (a) Slide the data converter board into the card guides from the left side of the terminal. (See figure 4-7.)
- (b) Connect P1B, J2B and J3B to the data converter card. (See figures 4-4 and 4-6.)

4.10 Remove the demodulator board assembly:

- (a) The data converter board must be removed before removing the demodulator board. (See paragraph 4.08.)
- (b) Disconnect the power supply cord from the power main.
- (c) Disconnect the power supply cord from the back of the terminal.

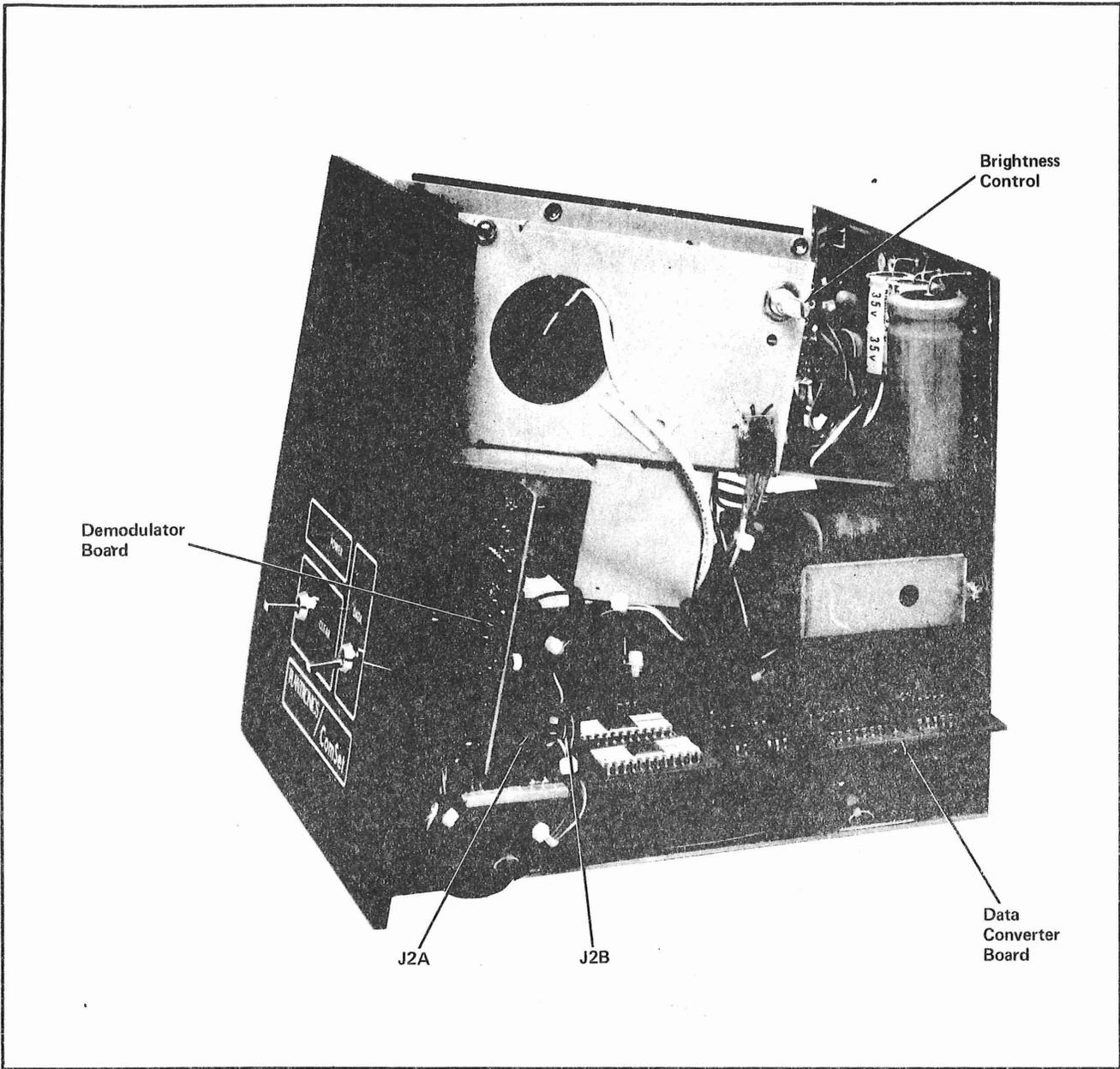


Figure 4-6. Right Side of Chassis

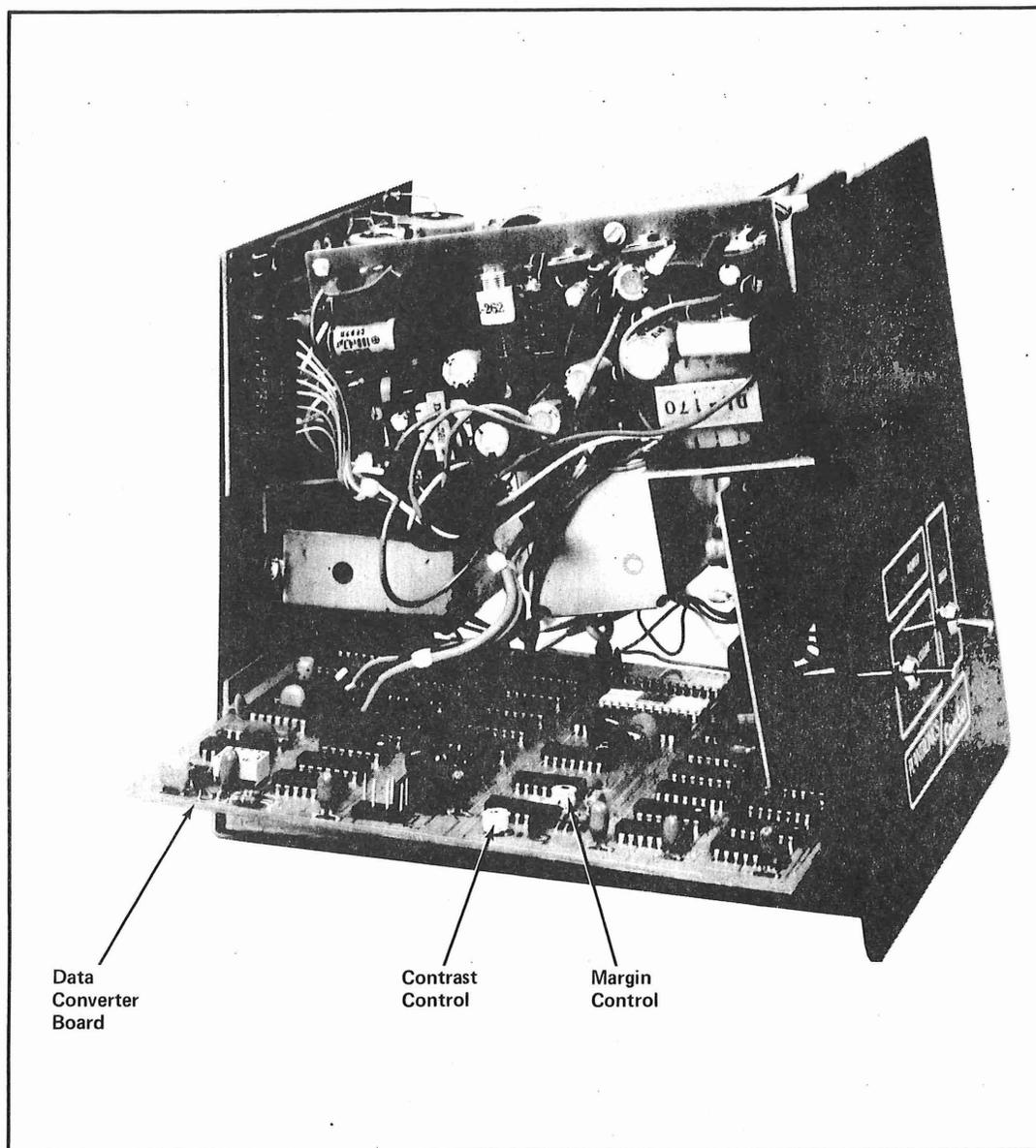


Figure 4-7. Removal of Data Converter Board

- (d) Disconnect the interface cable from the back of the terminal.
- (e) Disconnect P1A and J2A from the demodulator board. (See figures 4-4 and 4-6.)
- (f) Remove the demodulator board by pressing in the keeper on the standoff (figure 4-8). 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.

4.11 Replacement of demodulator board:

NOTE: Caution should be used 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 the components facing rearward, and traces facing the front panel; push upward to seat in guide. (See figure 4-8.)
- (c) Press the demodulator board onto the snap-on standoff. (See figure 4-8.)

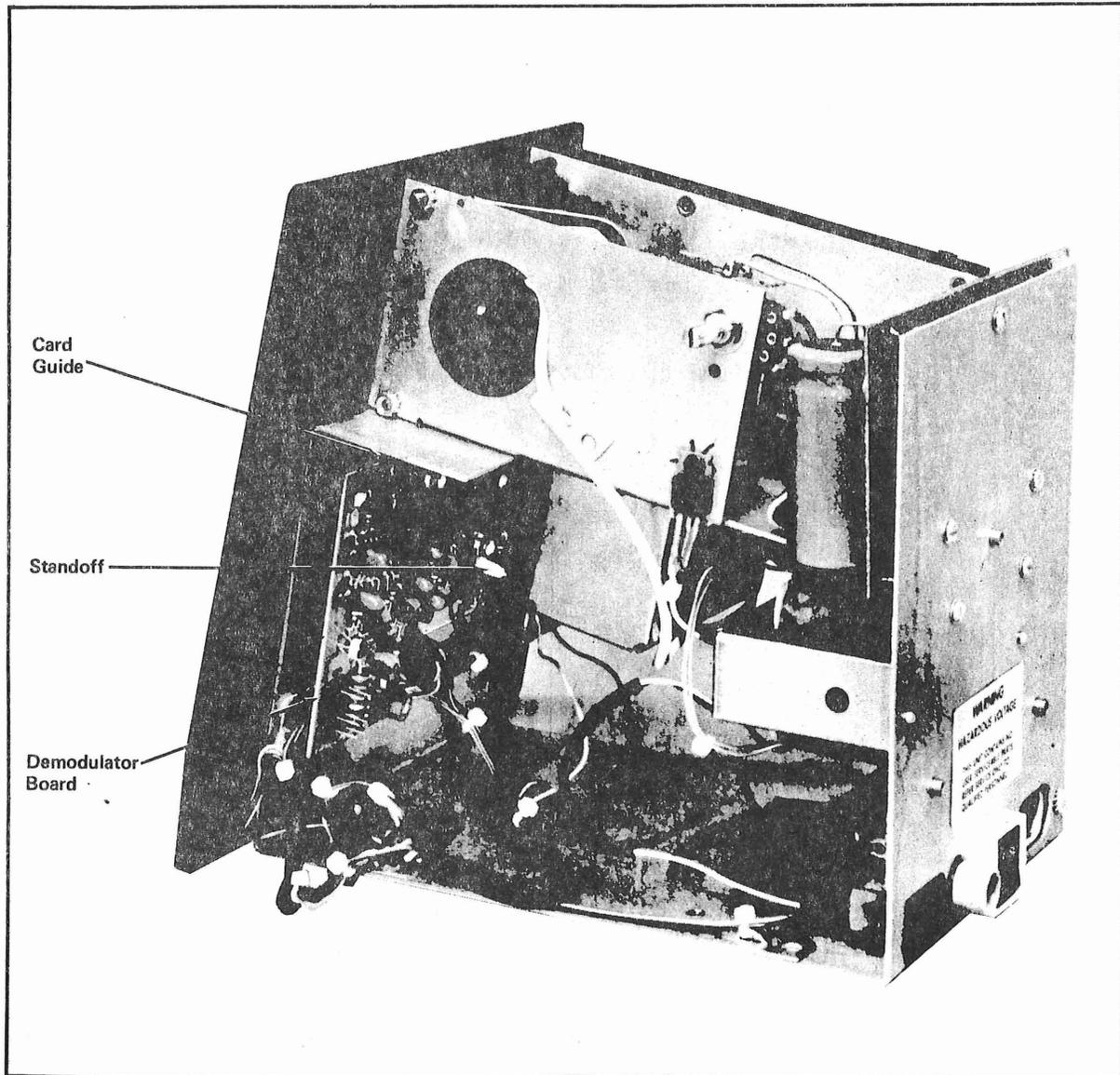


Figure 4-8. Chassis with Data Converter Board Removed

- (d) Connect P1A and J2A to the demodulator board.
(See figures 4-4 and 4-6.)

4.12 Remove the monitor assembly:

CAUTION: Hazardous voltages may be present at or near the second anode of the cathode ray tube.
(See figure 4-9.)

- (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 4-4.)
- (e) Remove the two monitor support screws (#4-40) from the back of the chassis. (See figure 4-5.)
- (f) Loosen the two monitor hold-down screws (#4-40) on each side of the CRT. (See figure 4-9.)
- (g) Slide the monitor forward; it can now be cleared straight up from the main chassis.

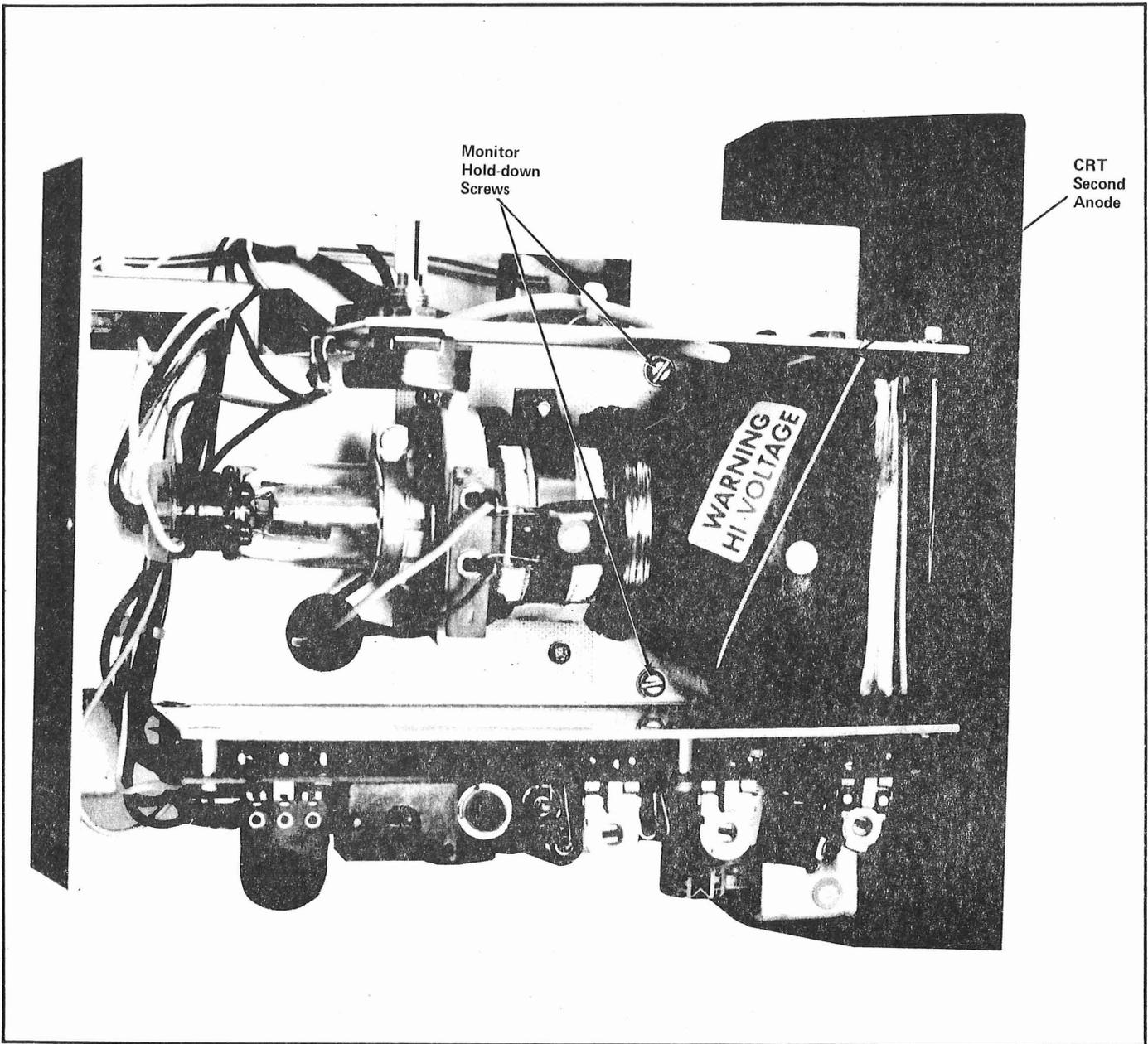


Figure 4-9. Top View of Chassis

4.13 Replacement of the monitor assembly:

CAUTION: Hazardous voltages may be present at or near the second anode of the cathode ray tube.
(See figure 4-9.)

- (a) Place the monitor assembly over the two hold-down screws (#4-40) and slide back and tighten the screws. (See figure 4-9.)
- (b) Install the two support screws (#4-40) in the back of the chassis. (See figure 4-5.)
- (c) Connect J3B to the data converter board. (See figure 4-4.)

4.14 Removal of front panel:

- (a) Remove the nuts on the DATA and CLEAR switches being careful not to mar the plastic front panel. The front panel should now be free from the toggle switches. (See figure 4-10.)

4.15 Replacement of the front panel:

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

Fault Isolation Procedure

- 4.16 Connect ComSet terminal to an appropriate FSK signal (see Plantronics Product Information Bulletin 22-001 for information on Plantronics Automatic Test Station) and apply ac power. Follow the steps given in the following paragraphs

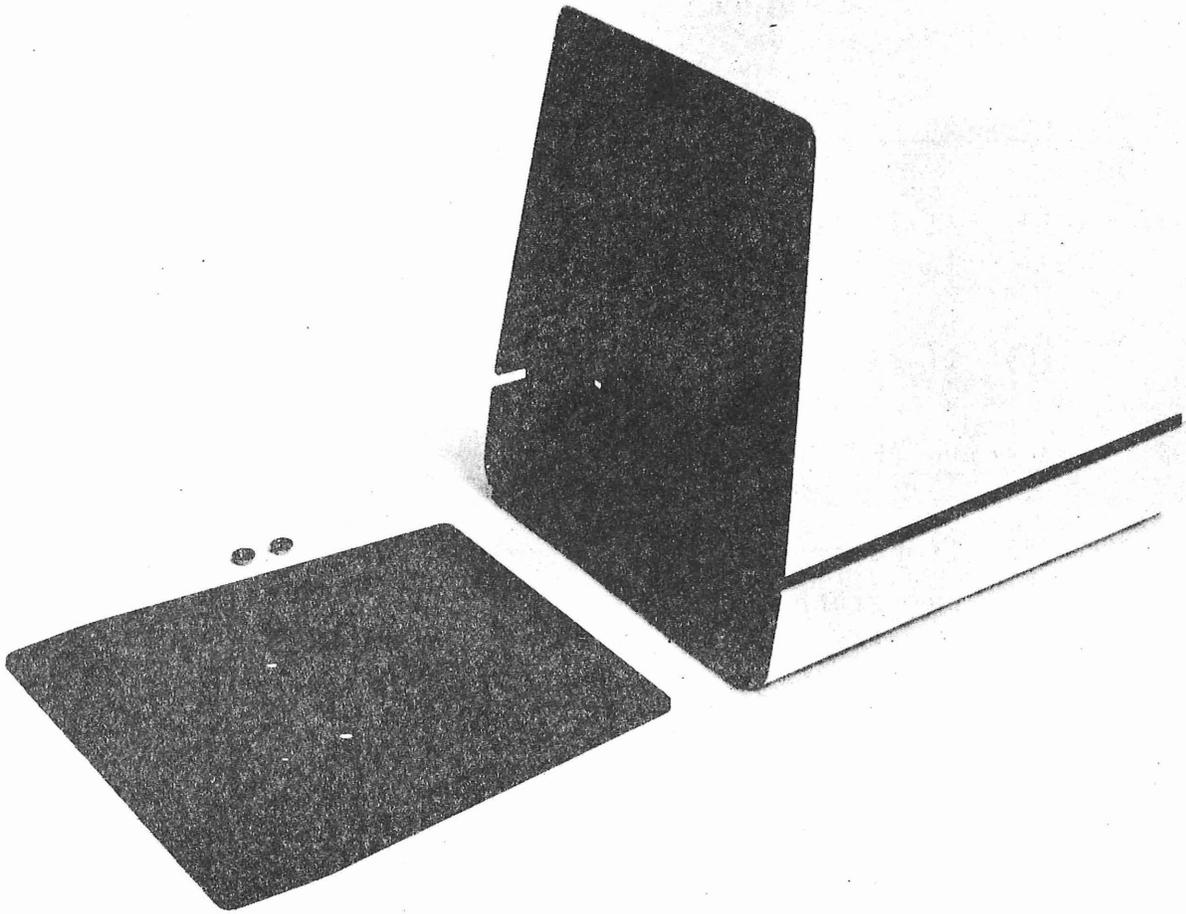


Figure 4-10. Front Panel Removal

until the malfunctioning subassembly has been located.

4.17 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 the CLEAR switch.

4.18 Observe display screen:

- (a) If there are any light areas or a grey background in the display, go to paragraph 4.25.
- (b) If display remains dark, go to next paragraph.

4.19 Observe the front panel indicators:

- (a) If power is the only indicator that is on go to paragraph 4.12.
- (b) If both indicator lights are ON go to paragraph 4.14.
- (c) If both indicator lights are OFF go to next paragraph.

4.20 Substitute regulator board assembly:

- (a) 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.
- (b) If power indicator now comes ON, the original regulator board has malfunctioned. Restart procedure.

4.21 Recheck interface cable connection:

- (a) If OK substitute interface cable.
- (b) If data lamp now comes ON original interface cable has malfunctioned. Restart procedure.
- (c) If data lamp remains OFF go to next paragraph.

4.22 Substitute the demodulator board assembly:

- (a) If the data lamp indicator now comes ON, the original demodulator card has malfunctioned. Restart procedure.
- (b) If the data lamp indicator does not come ON, the terminal is malfunctioned. Substitute part(s) may be recovered and the terminal should be returned to the factory for repair.

4.23 Note setting of video display brightness control, figure 4-6.

- (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 4.30.
- (c) If a white (grey) raster background, or white pattern appears, set brightness for ease of viewing and go on to the next paragraph.

4.24 Observe the pattern on the display screen:

- (a) If a single line or a solid horizontal line appears on the screen just above center, go to paragraph 4.30.
- (b) If the display is not dark but there are not well formed recognizable alphanumeric characters, go to paragraph 4.26.
- (c) If the patterns are alphanumeric characters but the text lines are tilted or ragged, go to paragraph 4.30.
- (d) If the characters appear to be correct but the text lines are formed off screen to the left or right, go to paragraph 4.29.
- (e) Characters are well formed but data (text) on display screen does not correspond with data being transmitted, or display format is not correct. If transmitted data rate is known to be correct, go to next paragraph.

4.25 Substitute the demodulator board assembly:

- (a) If data is now correct, the original demodulator card has malfunctioned. Retest terminal.
- (b) If data is not correct, go to next paragraph.

4.26 Substitute data converter board assembly:

- (a) If the data is now correct, the original data converter board has malfunctioned. Retest terminal.

(b) If the data is incorrect, go to next paragraph.

4.27 Substitute the regulator board assembly:

(a) If data is now correct, the original regulator board is malfunctioning. Replace regulator board. Adjust brightness and contrast control if necessary. (See figures 4-6 and 4-7.) Retest terminal.

(b) If symptom has remained, the terminal is malfunctioning and should be returned to the factory for repair.

4.28 Adjust the margin control (see figure 4-7) while observing display screen:

(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.

4.29 Substitute the data converter board assembly:

(a) If data is correct and can be centered using the margin control (figure 4-7) or if the symptoms are now different, the original data converter board has malfunctioned. Retest terminal.

(b) If symptom has remained, go to next paragraph.

4.30 Substitute the display assembly module:

(a) If data is correct and can be centered using the margin control (figure 4-7) or if the symptoms are now different, the original display assembly module

has malfunctioned. Retest the terminal.

(b) If symptom has remained, go to paragraph 4.28.

Cleaning and Touch-up Procedure

4.31 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.

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 used in cleaning the plastic screen as it is easily scratched. Use only non-abrasive cleaning cloths for this purpose.

Spare Parts List

4.32 Figure 4-11 is a pictorial description of the replaceable subassemblies. The following table indicates the Plantronics part number, description and reference number on figure 4-11 for these subassemblies.

<u>Part Number</u>	<u>Description</u>	<u>Reference Number</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

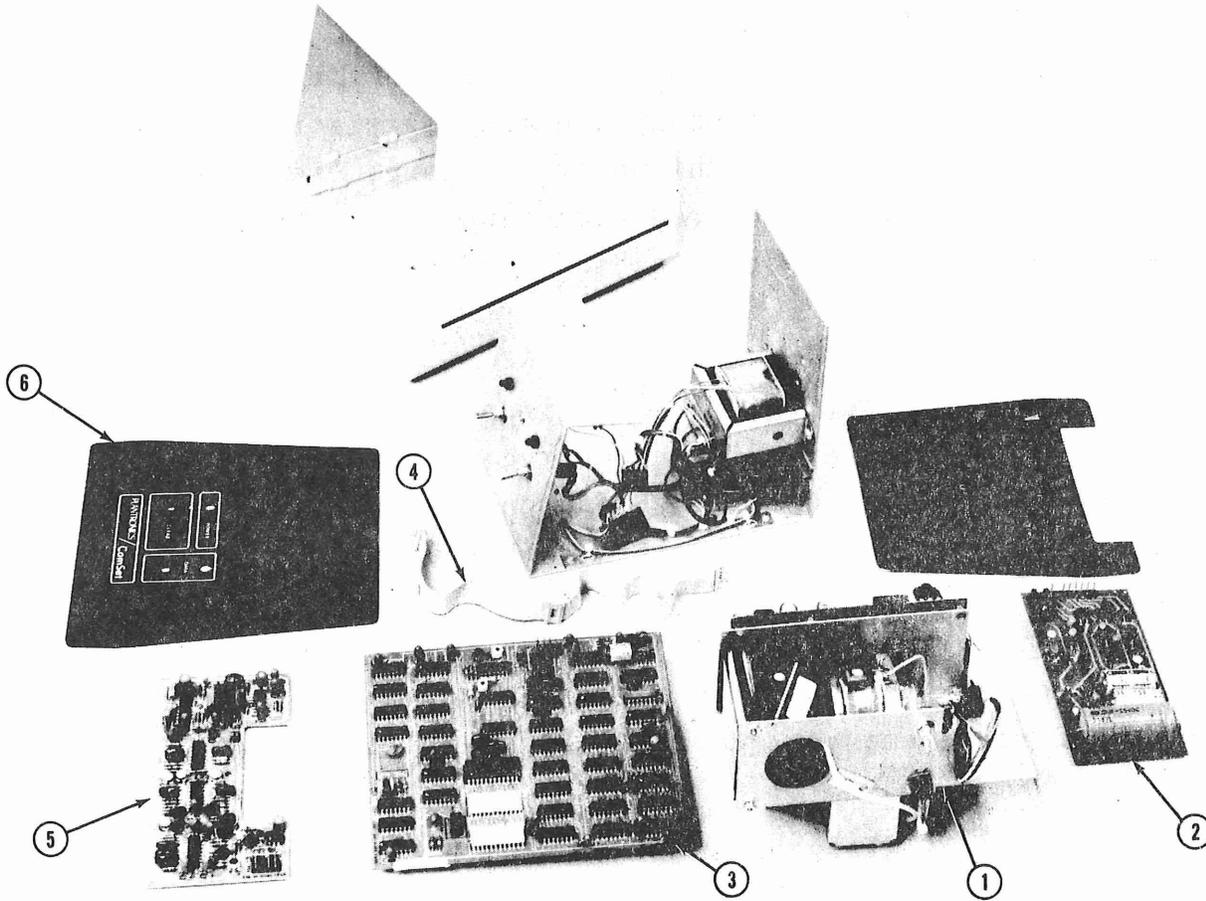


Figure 4-11. Disassembled Terminal

5. WARRANTY AND FACTORY SERVICE

Warranty

5.01 Plantronics ComSet products are guaranteed free from defects in workmanship and materials for a period of one (1) year 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 all external decorative finishes.

5.02 Products returned for repair during the warranty period will be repaired at no charge, provided that the products have not, in the judgement of Plantronics, Inc., been subjected to improper installation, breakage, abuse, neglect or unauthorized repair attempt or alteration. Plantronics will prepay the return transportation by the most appropriate means of delivery. Products returned during the warranty period shall be subject to a handling charge if replacement of damaged items is necessary.

Factory Service

5.03 Factory repair service is provided by Plantronics for products that are out of warranty. This service is operated on a repair and return basis. Charges are based upon labor, material and transportation costs. Equipment returned for repair will be inspected to determine the extent of damage and the cause of failure. This information will be compared with that provided by the customer for each returned item. Unless otherwise directed by the customer, Plantronics will then complete the repair and reconcile all discrepancies to the actual quantity and condition of the equipment received. Shipments to Plantronics shall be pre-paid. Cost of return transportation will be included with the repair billing. Plantronics will select the most appropriate means of return shipment unless otherwise designated by the customer.

5.04 Plantronics will accept returned products, transportation prepaid to:

Plantronics, Inc.
Customer Service Department
345 Encinal Street
Santa Cruz, California 95060

5.05 The following information should be included with the returned units:

1. Bill to Address
2. Ship to Address
3. Purchase Order/Control Number
4. Reason for Return and Serial Number