WY-50 Display Terminal

Maintenance Manual

WYSE

WY-50 DISPLAY TERMINAL
MAINTENANCE MANUAL

PUBLICATION HISTORY

Date	Notes
Ø2-84	Initial publication.

RELATED PUBLICATIONS

Wyse No.	Title
88-Ø11-Ø1	WY-50 Display Terminal Reference Manual
88-Ø21-Ø1	WY-50 Display Terminal Quick-Reference Guide

TRADEMARKS

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DISCLAIMER

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of this manual, and any implied warranties or fitness for any
particular application are disclaimed.

The specification and information are subject to change without
prior notification. The right to revise this manual without
obligation to notify any person or organization is also reserved.

SAFETY WARNING

The terminal power cable is supplied with a safety ground. Do not
use the terminal with an ungrounded outlet. Disconnect the power
cable from the terminal before removing the top cover for any
reason.

Dangerous voltages are present when the terminal is ON and may
remain after the power is OFF. Be extremely cautious. Do not
work alone.

The internal phosphor of the CRT (cathode ray tube) is toxic.
Wear safety goggles and rubber gloves whenever the CRT is handled.
If the tube breaks, exposing skin or eyes to the phosphor, immed-
iately rinse the affected area with cold water and consult a
physician.

FCC WARNING

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

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SPECIFICATIONS

Physical	Display Console	12"H x 12.3"W x 13"D
	Footprint	12.25"W x 10.25"D
	Keyboard	2.25"H x 17.25"W x 7.6"D
	Finish	Two-tone gray
	Shipping Weight	30 lbs. (approx.)
Display	CRT	14" diagonal with non-glare green phosphor. Front mounted power ON/OFF and intensity control. 13 degree tilt and 270 degree swivel.
	Format	24 rows x 80 or 132 columns (user selectable), plus 2 rows for terminal status and function key indentification.
	Characters	80-column: 7 x 13 matrix in 10 x 13 cell. 132-column: 7 x 13 matrix in 9 x 13 cell.
	Character Set	128 ASCII, upper/lower case including 32 control codes and line drawing graphics.
	Language Keyboard Codes	US (American), UK (British), French, German, Danish, Spanish
	Attributes	Normal, dim, blink, blank, reverse, underscore, and combinations.
	Cursor	Block or line; blinking/nonblinking (user selectable.)
Keyboard	Type	Low-profile detached, with 6-foot coiled cable. Two-position tilt with low position to DIN specification.

SPECIFICATIONS (CONT)

Keyboard (Cont)	Layout	101 keys arranged in typewriter, numeric pad, and function key sections. 16 user programmable function keys providing 32 separate codes.
Communications	Type	Two asynchronous EIA RS-232C ports: modem (main) and auxiliary (printer). Baud rate, character size, parity, etc. can be specified independently for each interface.
	Mode	Block or conversational; half or full duplex (user selectable).
	Baud Rates	Can be specified independently for each interface.
	Character Format	7 or 8 data bits; 1 or 2 stop bits; odd, even, mark, or no parity (user selectable).
	Handshake Protocols	XON/XOFF, DTR, both, or none (user selectable).
Functions	Cursor Movement	Left, right, up, down, home, tab, back tab, line feed, direct X-Y addressing.
	Editing Functions	Erase memory, erase to end-of-line/field, erase to end-of-screen, insert and delete line/character.
	Form Data Entry	Protect mode ON/OFF, write protect mode ON/OFF. Protected data can be selected as dim, reverse, or normal.
	Message Fields	Local and host message fields in top row. Host controllable 26th row displays function key labels, shifted and unshifted.

Functions (Cont)	Soft Setup	Nonvolatile memory permits soft setup from keyboard for data communications parameters, operating modes, function key sequences, etc.
Compatibility	Native Mode	WY-100 ADM-31
	Compatible Mode	TeleVideo 910, 920, 925 ADDS Viewpoint Hazeltine 1500
Environment	Operating Temp	32° to 113°F (0° to $+45^{\circ}$C).
	Storage Temp	-40° to $+140^{\circ}$F (-40° to $+60^{\circ}$C).
	Humidity	10% to 90%, non-condensing.
	Altitude	Sea level to 15,000 ft.
Power	Standard	90 to 130 VAC, 60 Hz $\pm 5\%$
	Optional	200 to 240 VAC, 50 Hz $\pm 5\%$
	Wattage	45 watts

1.1 INTRODUCTION

The Wyse WY-50 is a compact, high performance, low cost terminal capable of meeting the needs of a wide variety of applications. The WY-50 consists of a display console and a detached keyboard from which data can be entered for display on the CRT. All of the electronics necessary to support the display and keyboard are contained within the display console itself.

In addition to the CRT and keyboard, the WY-50 contains two independent telecommunication interfaces. Peripherals, such as a hard copy printer, connect to the terminal via interface connectors on the rear panel.

All the component parts are organized around and controlled by the microcomputer. The microcomputer controls all internal data manipulation and processing functions. Figure 1-1 is a simplified block diagram of the WY-50.
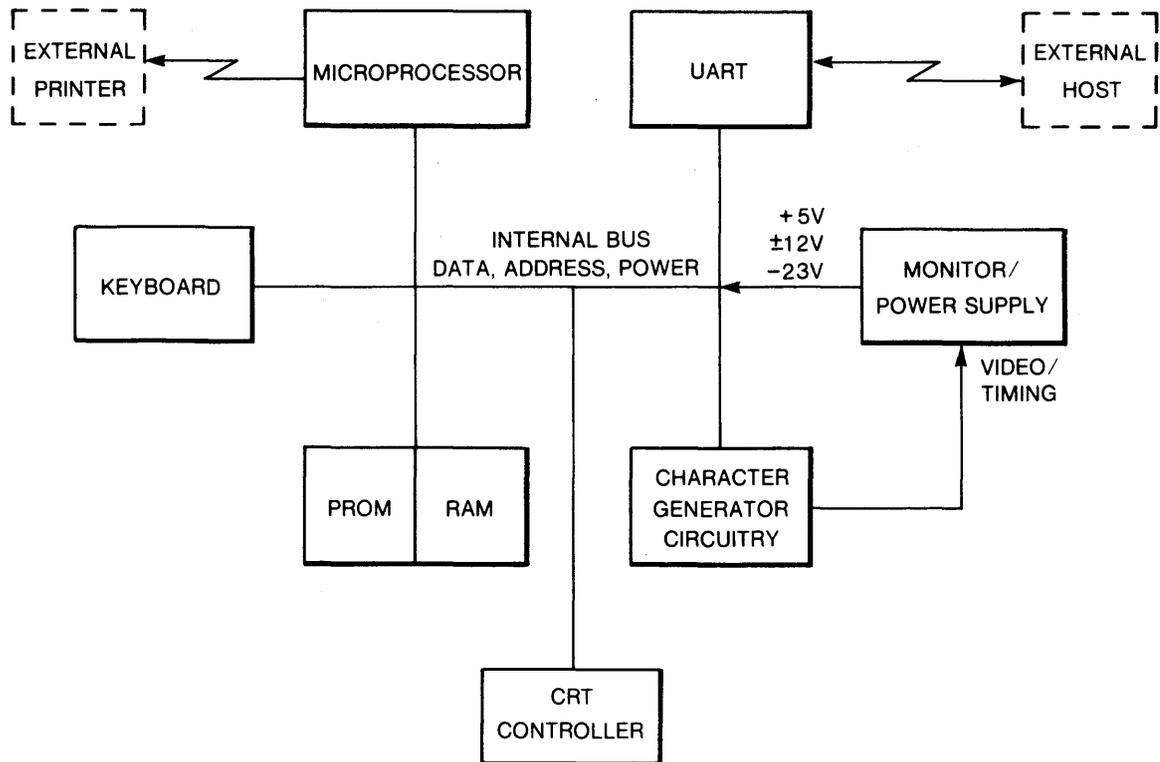
Figure 1-1. SIMPLIFIED BLOCK DIAGRAM

1.2 SYSTEM FUNCTIONAL DESCRIPTION

The WY-50 consists of a microcomputer, a CRT controller, asso-
ciated control logic, and input/output devices. This circuitry is
mounted on a single printed circuit board located in the display
console pedestal. All the basic functions are controlled by the
microcomputer. Timing and control signals for the CRT are gen-
erated on the microcomputer printed circuit board. The deflec-
tion, high voltage, and power supply circuitry is located on a
single printed circuit card which sits just below the neck of the
CRT. The microcomputer card and the CRT power supply card are
interconnected by cabling. Both cards are housed within the
display console.

1.3 MICROCOMPUTER

The heart of the WY-50 is an 8-bit, single component microcomputer
which has 128 bytes of RAM, 32 I/O lines, two 16-bit counter/
timers, a full duplex UART (universal asynchronous receiver/trans-
mitter), and integral interrupt and clock circuitry. The micro-
computer uses an external EPROM for program storage. This EPROM
can be either 4K, 8K, or 16K bytes. In addition to EPROM, a
buffer consisting of up to 4K of RAM is utilized for display
memory. The microcomputer connects to a bidirectional bus to
which the CRT controller and telecommunications interface elec-
tronics are connected. These circuits can perform their functions
independently while interfacing with the microcomputer or the
memory on a DMA (direct-memory access) or interrupt basis.

1.4 MEMORY

The memory consists of RAM, EPROM, and EAROM. EPROM is used for
program storage and contains the power-up and self test routines.
The EAROM (electrically alterable read-only memory) is used to
store the operator's setup parameters (such as baud rate and
parity). RAM is used to store display information which is
repeatedly read out of the memory by the CRT controller to refresh
the CRT screen.

The microcomputer has an address range capability of 64K bytes.
In addition to this addressing range capability, the microcomputer
treats external program storage (EPROM) separately (it has its own
enable line). This means that external EPROM can consume an
additional 64K bytes of memory space without infringing on the
space available for I/O or RAM. Figure 1-2 is a memory map for
the WY-50. Note that EPROM is not shown, as it does not occupy
I/O or memory address space.

HEX ADDRESS

0000H	0FFFH	1st 2K OF RAM	**RAM**
1000H	1FFFH		
2000H	2FFFH	2nd 2K OF RAM	
3000H	3FFFH		
4000H	4FFFH	CRT CONTROLLER	**CRT CONTROLLER**
5000H	5FFFH		
6000H	6FFFH	S.I.O. (UART)	**UART**
7000H	7FFFH		
8000H	8FFFH	ROW BUFFER DIAGNOSTIC REGISTER	**ROW BUFFER DIAGNOSTIC REGISTER**
9000H	9FFFH		
A000H	AFFFH	KEYBOARD LATCH	**KEYBOARD**
B000H	BFFFH		
C000H	CFFFH	EAROM	**EAROM**
D000H	DFFFH		
E000H	EFFFH	UNASSIGNED	
F000H	FFFFH		

Figure 1-2.   MEMORY   MAP

The standard RAM capacity is 4K bytes and consists of two 2K x 8 RAM chips.

Each 2K x 8 bytes RAM is allocated 8K bytes of addressing space. The lower RAM address range is 0000H to 1FFFH. The upper RAM is from 2000H to 3FFFH. Since each RAM uses only 2K bytes of address space, the RAM addressing wraps around at 2K bytes page boundaries. The system firmware addresses the RAM from 1800H to 27FFH in order to access 4K bytes of unique contiguous locations.

1.5   INPUT/OUTPUT DEVICES

The input/output devices consist of a keyboard, a CRT display, and two telecommunication interfaces.

1.5.1   KEYBOARD

The keyboard consists of 101 keys mounted on a single-sided printed circuit board. All keys are momentary action key switches. They are scanned periodically by the micro-computer to determine if a key closure has occurred.

Figure 1-3 illustrates the WY-50 keyboard. A more complete description is found in Section 4.4.

1.5.2   CRT DISPLAY

The WY-50 features a 14-inch CRT. It displays 24 rows of characters (either 80 or 132 column) and 2 control rows (one for terminal status and one for function key identification). The displayed characters are read from RAM by the CRT controller on a direct-memory access basis. The CRT also contains an integral power supply which provides power for the rest of the logic.

1.5.3   TELECOMMUNICATIONS

The WY-50 has two independent asynchronous interfaces which conform with the EIA standard RS-232C. Data rates can be set independently for either interface. These parameters are operator controlled and are defined in the setup procedures in the Installation section of this manual (2.4). The primary (modem) interface can communicate at data rates up to 38.4K bps. The auxiliary (printer) interface can communicate at data rates up to 19.2K bps.
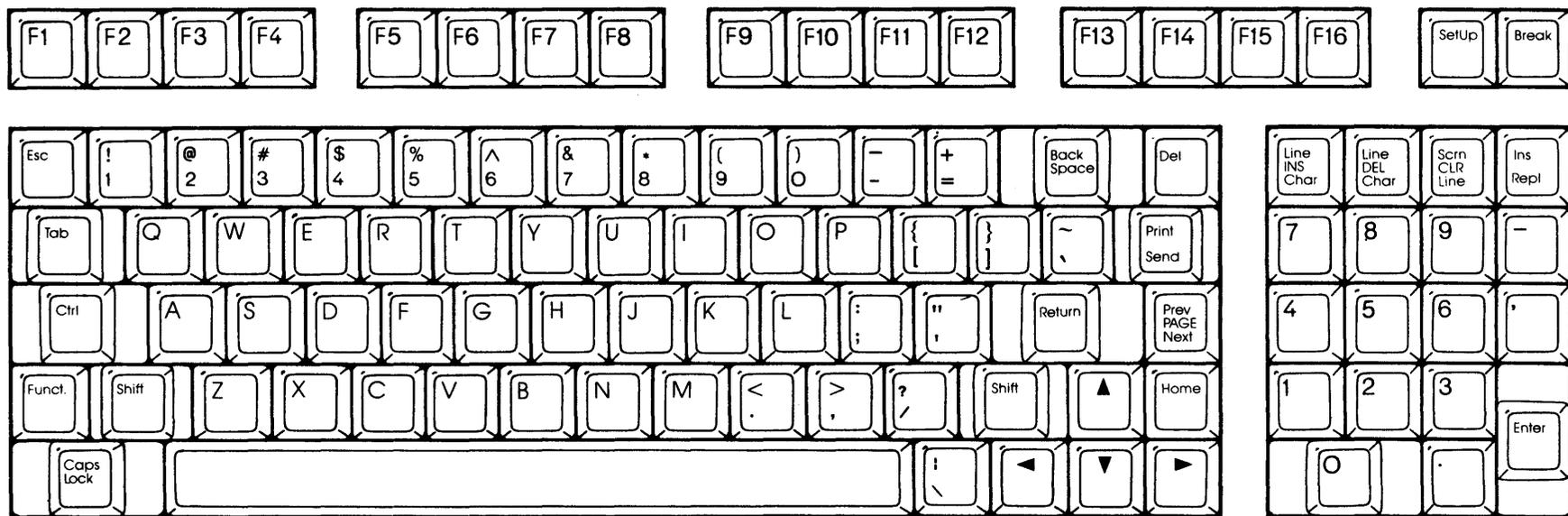
Figure 1-3. KEYBOARD

2.0 INSTALLATION

2.1   UNPACKING THE TERMINAL

The WY-50 is shipped in a special container that protects it from
shipping damage (see Figure 2-1). Instruction documents are
packed in the same container.

To remove the terminal, set the container on a convenient flat
surface; cut the tape holding the top of the box closed and fold
back the lid. Place your hand across the exposed styrofoam
supports for the terminal and simultaneously turn the box upside
down. The box can now be lifted off the terminal. Next, rotate
the terminal so it is laying on its side. This allows one of the
styrofoam inserts to be removed. Then the keyboard can be
removed. Rotate the terminal again so it is setting on its
pedestal. The other styrofoam insert can now be removed. The
power cord is packed in one of the external cavities of the
styrofoam inserts.
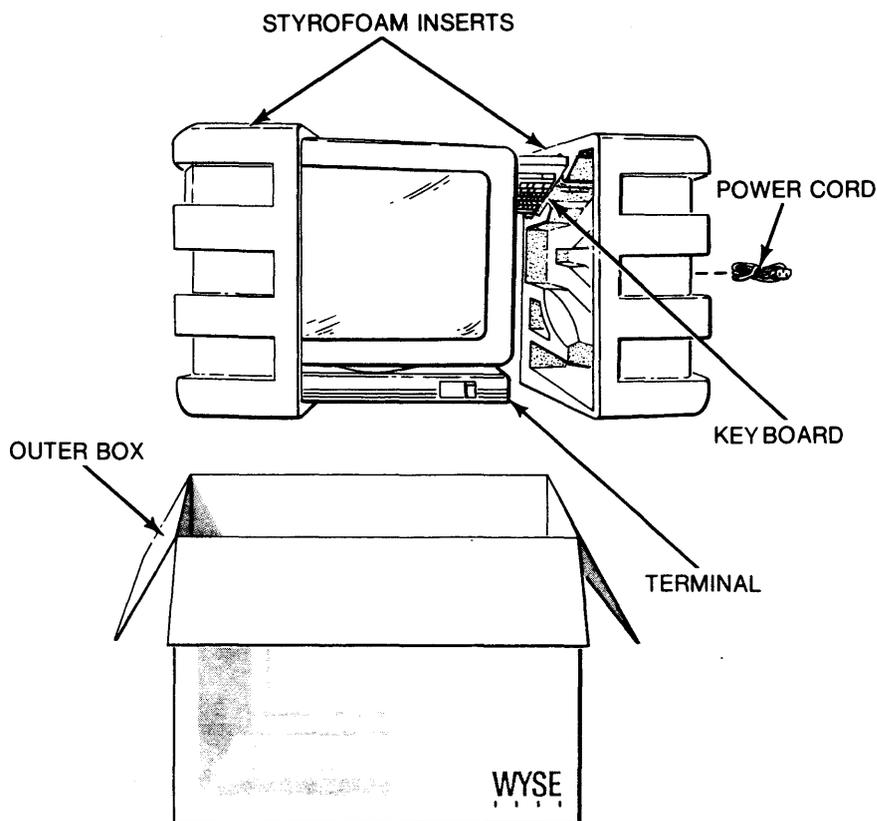
Figure 2-1.   SHIPPING CONTAINER

When unpacking the equipment, check each item in the container against the packing slip. If any breakage or physical damage is apparent, file a claim with the carrier immediately. Be sure to save the damaged shipping container, as most carriers require an examination prior to settling any claims.

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CAUTION
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Use extreme care to prevent damage to
the unit during unpacking and removal
from the shipping container.

2.2   ENVIRONMENTAL CONSIDERATIONS

The terminal may be mounted on a table, desktop or any other vibration-free horizontal surface reasonably free from lint and dust. Abnormally bright room light or direct sunlight from a window can interfere with viewing the display.

The display enclosure requires a 13"H x 13"W x 13"D space envelope. The detachable keyboard requires a 18"W x 8"D space envelope (see Figure 2-2).
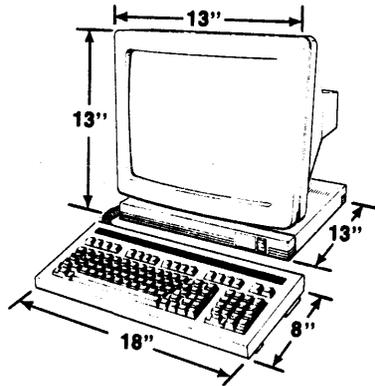
Figure 2-2.   SPACE REQUIREMENTS

The WY-50 may be installed adjacent to most other types of electrical or electronic equipment without serious interference. Situate the terminal as far as possible from noisy electro-mechanical devices like card punches. Avoid locations that are characterized by strong magnetic fields, which can distort and interfere with the operation of the video display.

Ambient temperatures should never exceed 45° Celcius (113° Fahenheit) when the terminal is in operation. No special cooling provisions are needed. Ensure a free flow of air at the rear of the display console. Do not set the terminal system on sound deadening devices that can impede the intake of cooling air at the bottom of the unit.

2.3 OPERATOR CONTROLS

The operator has access to two controls and two telecommunication connectors. Figure 2-3 depicts the WY-50 rear panel.
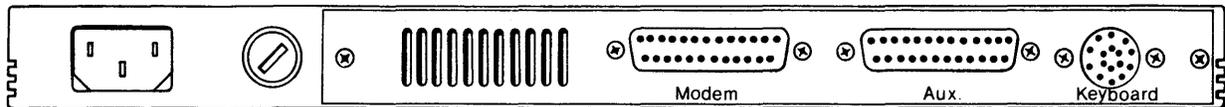
Figure 2-3. REAR PANEL

2.3.1 POWER CORD

The power cord should be inserted into the connector on the rear panel and then plugged into the AC power source. The AC plug is keyed and cannot be inserted improperly.

CAUTION

Compare the voltage specified on the configuration label (on back of CRT enclosure) to the AC power source to prevent damaging the terminal.

2.3.2 KEYBOARD

The keyboard should be plugged into the keyboard connector on the rear panel. This plug is also keyed and fits only one way. Avoid plugging the keyboard in or out with the power ON.

2.3.3 COMMUNICATIONS CABLING

Connect the communications cable from the host computer or modem to the communications connector labeled MODEM. This port is setup to communicate at 9600 baud, no parity, with one stop bit and eight data bits. The operator can change these parameters by going into the setup (see 2.4).

Connect the printer (if applicable) to the connector on the rear panel labeled AUX. This port is configured to operate at 9600 baud, no parity, with one stop bit and eight data bits. The operator can change these parameters by going into the setup (see 2.4).

2.3.4 POWER SWITCH

The power switch is located on the display console pedestal's lower right-hand corner. Pressing the top of the switch turns the AC power ON. Pressing the bottom of the switch turns the power OFF.

2.3.5 BRIGHTNESS CONTROL

The brightness control is a thumbwheel located on the lower right-hand corner of the CRT bezel. Rotating the wheel DOWN increases the display brightness. Rotating it UP decreases the brightness.

2.4 SETUP PARAMETERS

Upon application of power, the WY-50 beeps and executes an internal self test. Upon completion of the self test and when the CRT has warmed up (approximately 30 seconds), the cursor appears in the upper left-hand corner of the display. The unit is now ready for operation based upon the default setup parameters.

The default parameters can be inspected by pressing SHIFT while simultaneously pressing SET UP. The first level of default parameters displays across the bottom of the screen. To examine the other four levels of default parameters press ▼ (cursor DOWN). Each depression of this key allows the operator to examine another default level. Default parameters can be changed by following the procedure outlined below.

1. Enter the setup by pressing SHIFT and SET UP simultaneously.

2. Press ▼ (cursor DOWN) until the default parameter to be changed is displayed on the bottom row of the screen.

3. Press ► (cursor RIGHT) until the specific parameter to be changed is highlighted.

4. Press the SPACE BAR to advance the parameter to the specific setting desired.

5. Press the cursor keys as required to advance to the next parameter to be changed.

6. To exit the setup, press **SHIFT** and **SET UP** simultaneously.

    The CRT display should now ask if the parameters which have been changed should be saved for a power-on. Changes not saved will be implemented immediately but revert back to the default parameters the next time the power is turned on.

    A. Pressing **Y** saves the parameters keyed in but does not alter any of the function key definitions.

    B. Pressing **A** saves all changes made.

7. To return to a normal operating mode, press any key.

    The terminal is now operational using the parameters defined in the setup.

    Should the operator desire to get back to the power-on default parameters without cycling the power, all that is required is to press **ESC** while in the setup.

Refer to the WY-50 Reference Manual for more comprehensive instructions on the setup.

2.5   DIAGNOSTICS

The WY-50 contains a complete set of diagnostic utilities which can be invoked from the keyboard. Refer to Section 7.0 for further details.

installation

3.0 GENERAL MAINTENANCE INFORMATION

3.1 MODULES

The WY-50 utilizes modular construction techniques. This allows
the service technician to replace the failing module with a
minimum amount of down time.

The terminal consists of three major modules (see Figure 3-1),
these modules are described below:

MODULE NAME   **FUNCTION**

1. **Monitor/Power Supply**   The monitor/power supply
                                      performs two major functions;
                                      it converts AC input voltage
                                      to the required DC voltages
                                      (+5V, $\pm$12V and -23V) and
                                      contains the necessary logic
                                      for the horizontal, vertical,
                                      and video signals for display
                                      on the CRT screen.

2. **Keyboard**   The keyboard is a scanned
                                      matrix which, when a key is
                                      pressed, flags the CPU so that
                                      the appropriate key code can
                                      be generated. Key debouncing
                                      is done by the CPU.

3. **Microcomputer PCB**   The microcomputer PCB contains
                                      all of the electronics neces-
                                      sary to generate the video
                                      signals as well as all I/O
                                      signals. All of the control
                                      logic resides on this printed
                                      circuit board.

MONITOR/POWER SUPPLY

BEZEL

KEYBOARD

PEDESTAL

MICROPROCESSOR PCB
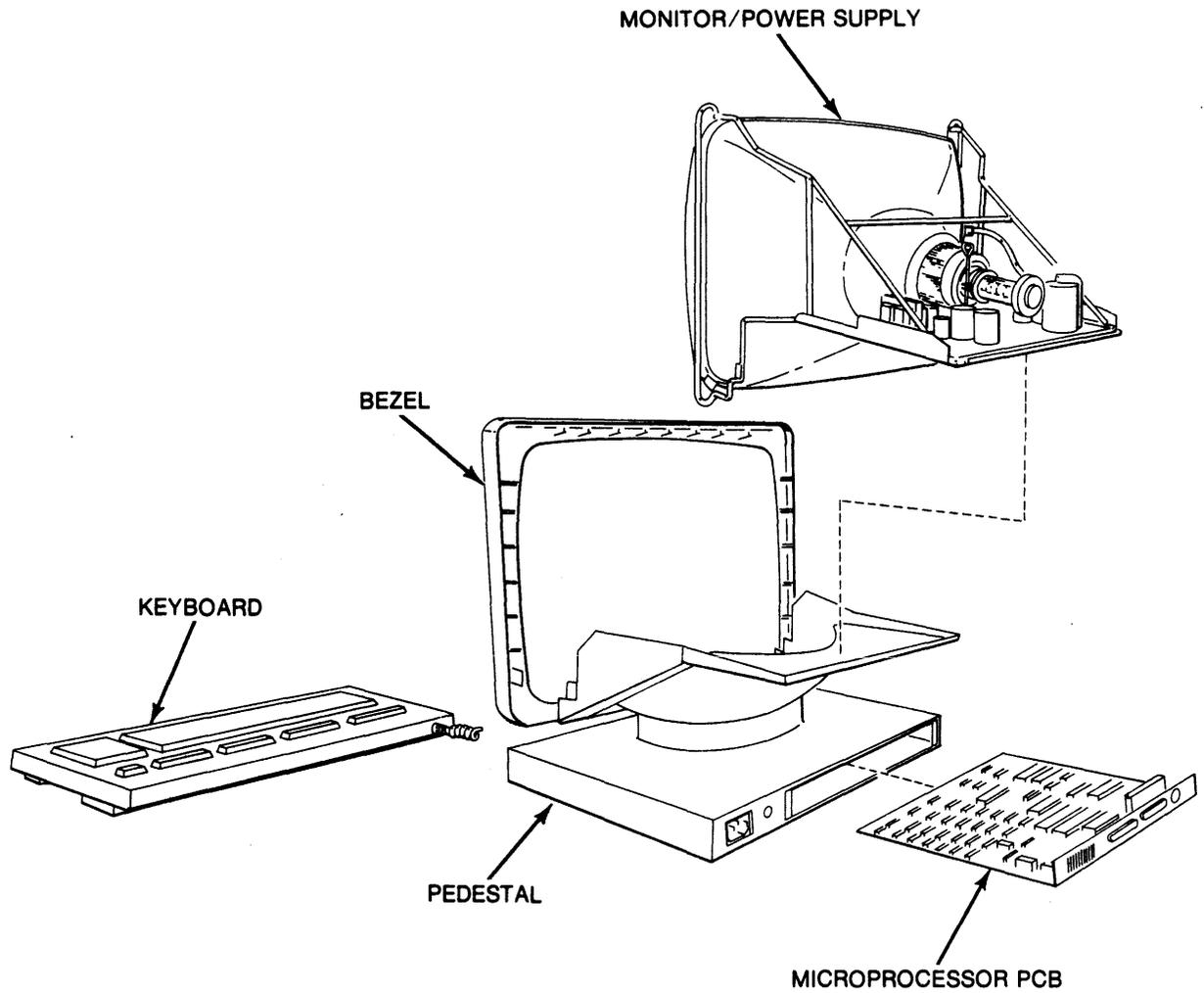
Figure 3-1. MAJOR MODULES (EXPLODED VIEW)

3.2   PRINTED CIRCUIT BOARD LAYOUT AND COMPONENT IDENTIFICATION

Wyse utilizes an X-Y coordinate system on all printed circuit boards. This aids the technician in locating integrated circuits on the PCB which were referenced on the schematics. A brief explanation of the coordinate system follows.

3.2.1   PRINTED CIRCUIT BOARD X-Y COORDINATE SYSTEM

Along the length of the WY-50 microcomputer board runs a set of alphabetic coordinates (A, B, C etc.), and along the width runs a set of numeric coordinates (1, 2, 3 etc.). These coordinates form an X-Y grid so that ICs can be located rapidly. In addition, next to each IC, its X-Y coordinate is printed on the silkscreen. This allows rapid, error-free identification of components. Refer to Figure 3-2 for an example of coordinate identification.
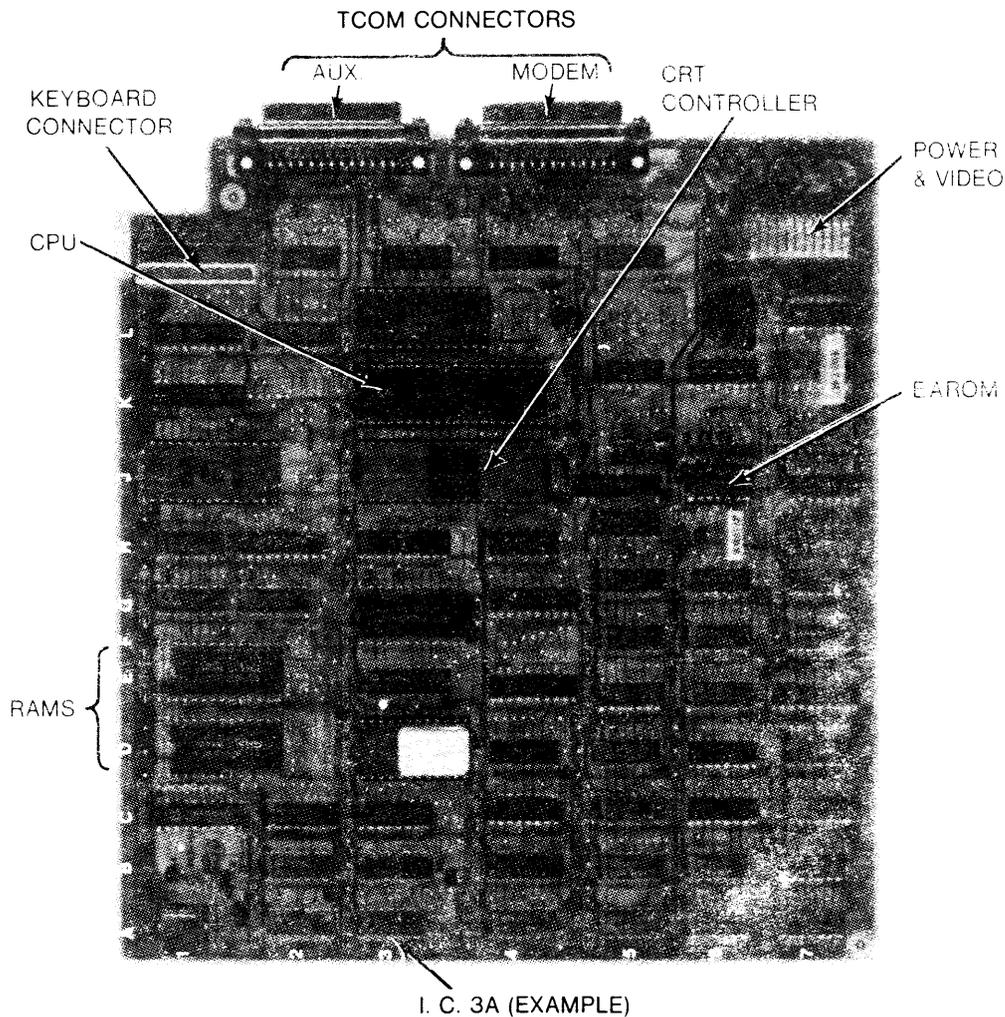
Figure 3-2.   MICROCOMPUTER PCB

3.3   AC INPUT STRAPPING

The terminal can operate on a 120 VAC, 60 Hz or optionally at 230 VAC, 50 Hz. The operating voltage is selected by a jumper located on the monitor/power supply logic card. Refer to Figure 3-3 for jumper location. When strapped for 230 VAC operation, the primary AC fuse should be changed to a 1/2 amp fuse.

CRT TOP VIEW

TO JUMPER FOR 230 VAC. REMOVE THE SLIP ON
CONNECTOR FROM THE 230V CONNECTOR PIN.
REMOVE THE WIRE CONNECTED TO THE 115V PIN
AND PLACE IT ON THE 230V PIN. PLACE THE SLIP ON
CONNECTOR REMOVED FROM THE 230V CONNECTOR
PIN ON THE 115V CONNECTOR.

N   230V   115V
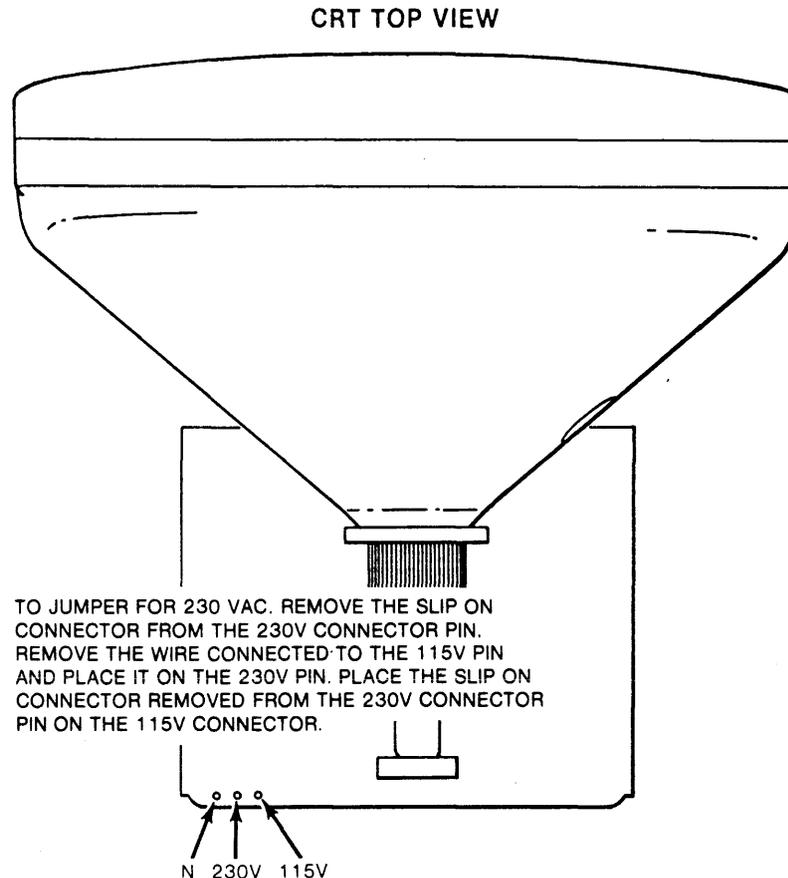
**Figure 3-3.   AC INPUT STRAP LOCATIONS
(MONITOR/POWER SUPPLY)**

3.4   PREVENTATIVE MAINTENANCE

The WY-50 requires no preventative maintenance other than occasional cleaning of the CRT screen. The screen should be cleaned with a soft, lint-free cloth. Under no circumstances should chemical substances or abrasives be used to clean the screen. The face of the CRT may also be cleaned with a soft cloth and isopropyl alcohol or a commercial glass cleaner such as Windex. (Apply the cleaner to the cloth, not directly to the screen.)

3.5 CONNECTOR INFORMATION

The following tables define the connector pin-outs for the communication, keyboard, and monitor/power supply connectors.

CONNECTOR J1 (Modem Port)

Pin #	Signal Name
1	Shield Ground (AA)
2	Transmit Data (TXD)
3	Receive Data (RXD)
4	Request To Send (RTS)
5	Clear To Send (CTS)
7	Signal Ground (AB)
8	Data Carrier Detect (DCD)
9	Dot Clock Out
14	HSync. Out
18	External Video Input
20	Data Terminal Ready (DTR)
24	Vertical Sync. Out
25	External Dim Input

Pins 6, 10, 11, 12 13, 15, 16, 17, 19, 21, 22, & 23 have no connection.

CONNECTOR J3 (Keyboard Interface)

Pin #	Signal Name
1	Chassis Ground
2	Logic Ground
3	+5V
4	Address bit 2
5	Address bit 1
6	Address bit 0
7	Address bit 3
8	Address bit 5
9	Address bit 6
10	Address bit 4
11	Key Return
12	N/C

CONNECTOR J2 (Printer Port)

Pin #	Signal Name
1	Shield Ground
2	Receive Data
3	Transmit Data
4	Request To Send
6	Data Set Ready
7	Signal Ground
8	Data Carrier Detect
20	Data Terminal Ready

Pins 5, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23 24, & 25 have no connection.

CONNECTOR J4 (Monitor/Power Supply)

Pin #	Signal Name
1	Video
2	Video Ground
3	Dim
4	Horizontal Drive
5	Vertical Drive
6	+12V
7	-12V
8	+5V
9	Ground (Power)
10	Ground (Power)
11	-23V
12	+5V

3-5

4.0 THEORY OF OPERATION

4.1   INTRODUCTION

The purpose of this section is two-fold; to aquaint the service technician with the WY-50's basic logic functions and then to describe each of these functions. For technicians unfamiliar with raster scan techniques, a brief explanation of terms is given in Section 4.6.

An overall detailed block diagram and description of the WY-50 is given to aquaint the reader with the basic operation of the terminal. This is followed by an overall description of how the blocks work together.

4.2   MICROCOMPUTER BOARD BLOCK DIAGRAM

Figure 4-1 is a block diagram of the microcomputer PCB. All of the logic (except the display and power supply) is located on the microcomputer printed circuit board. Note that each block of the block diagram is numbered. This number corresponds to the item numbers given in the following descriptions.

1.   SINGLE COMPONENT MICROCOMPUTER

The WY-50 utilizes a single component microcomputer which contains 128 bytes of RAM, 32 I/O lines, two 16-bit counter/timers, and a UART. It has integral interrupt and clock circuitry. The microcomputer IC uses eight data lines which are multiplexed with the lower eight address lines. Address information appears on these lines only when the ALE (address latch enable) signal is present. The upper address lines (A8-A15) are non-multiplexed single direction lines. The UART on the microcomputer chip is used for driving an RS-232C compatible printer.

2.   CRT CONTROLLER

The programmable video timing controller IC is initialized by the microcomputer chip upon application of power. The CRT controller interfaces to the video display buffer (RAM) on a direct-memory access basis. Display data is then sent to the character generation circuitry for processing. The CRT controller chip generates the cursor and also provides the necessary timing and control information for the display logic (scan line count, horizontal sync, vertical sync, and blank).

3. **UART**

    The UART's function is to take parallel data from the
    microcomputer and convert it to a bit-serial format for
    use by external communications equipment. In addition,
    the UART converts bit-serial information received from
    an external source to parallel information usable by
    the microcomputer. The UART flags the microcomputer
    that it needs servicing with an interrupt.

4. **DISPLAY RAM**

    The display RAM consists of two 2K by 8 bytes static
    RAM chips. RAM is used as a volatile storage medium
    for display information and TCOM buffers. The RAM can
    be accessed by either the microcomputer or the CRT
    controller.

5. **PROM**

    The PROM is used for nonvolatile program storage.
    Every routine is resident in the PROM. The WY-50 PROM
    can be either 4K, 8K, or 16K bytes. The PROM does not
    reside within the normal memory map because it has its
    own unique enable line (PSEN).

6. **RAM ADDRESS MULTIPLEXER**

    The RAM address multiplexer allows either address
    information from the microcomputer or from the CRT
    controller to access the RAM. The multiplexer is
    selected by the MBC (memory bus control) signal which
    is generated by the CRT controller.

7. **COMMAND DECODE LOGIC**

    The command decode logic decodes the high order address
    bits ($A13$, $A14$, $A15$) and the Read and Write control
    lines ($\overline{RD}$ and $\overline{WR}$) from the microcomputer. From these
    signals the decoder generates enable signals for the
    RAMs, UART, CRT controller, electrically alterable ROM
    (EAROM) keyboard, and the diagnostic row buffer
    register.

8. **LOW ORDER ADDRESS LATCH**

    This IC latches the lower order address information
    presented to it by the microcomputer at address latch
    enable time. This is necessary because the lower
    address lines also serve as the bidirectional data bus.

9. **BIDIRECTIONAL BUS DRIVER**

This driver gates data from the microcomputer to RAM or data from RAM to the microcomputer.

10. **KEYBOARD LATCH**

The microcomputer tests to see if a key has been pressed on the keyboard by addressing each key and then examining the keyboard return line (Pl.4 on the CPU). The keyboard latch is used to latch this address information so it can be utilized by the keyboard logic.

11. **ROW BUFFER RAM**

The row buffer RAM is loaded with display information from the display RAM. This display data is read out of the RAM 13 times (once for each scan line) and pre-sented to the character generation circuit for decoding.

12. **ROW BUFFER LATCH**

The row buffer latch holds the display data from the video buffer (part of the display RAM) until it can be loaded into the row buffer RAM.

13. **ROW BUFFER DIAGNOSTIC LATCH**

This latch is used for diagnostics only. It latches data during DMA transfers from the row buffer RAM to the row buffer data latch. At the end of each DMA transfer it retains the last byte transferred. This byte can be read by the CPU (prior to the next DMA transfer) and is useful in diagnosing failures in the data path between the video buffer and the character generation circuitry.

14. **MEMORY BUS CONTROL LATCH**

The memory bus control latch, latches the CNTRL 3 signal from the CRT controller. The resultant output is known as memory bus control. This signal is used to select the RAM address multiplexer and enables the row buffer latch. It is used when the CRT controller uses DMA to read in a row of characters.

15. **ROW ADDRESS LATCHES**

When the CRT controller initiates a DMA transfer, it outputs the address of the data in the video buffer it wishes to display. This address information (RA0-RA13) is latched into the row address latches for use by the RAM address multiplexer.

16. **ROW BUFFER DATA LATCH**

The row buffer data latch stores each character to be displayed (one at a time) for use by the attribute decoding and character generation circuitry.

17. **ATTRIBUTE DECODING LOGIC**

Each character read out of the row buffer RAM is examined to see if it is an attribute (blink, dim, reverse video, etc.). Attribute characters are distinguishable by the fact that bit 7 must be high and bits 5 and 6 must be low. If an attribute code is detected, the display blanks at the attribute's location and all subsequent characters exhibit the attribute which was enabled.

18. **ATTRIBUTE LATCHES**

The attribute latches are comprised of a current attribute and a row attribute latch. These latches ensure that each character displayed has the correct attribute and that each scan line within a row starts with the correct attribute.

19. **CHARACTER GENERATOR**

The character generator is a PROM which has been programmed to provide a unique bit pattern output for each displayable character.

20. **CHARACTER GENERATOR ADDRESS LATCH**

The CRT controller chip's outputs are multiplexed. One of the outputs which occurs is scan line information. This scan line information is presented to the address latch where it will (in conjunction with data from the row buffer RAM) serve as address information to the character generator.

21. **PARALLEL TO SERIAL CONVERTER**

The output of the character generator PROM is an 8-bit parallel code. The raster scanned CRT is a serial device. The parallel to serial converter converts the parallel output of the character generator to serial format which the CRT can utilize.

22. **VIDEO DRIVERS AND DOT STRETCHER**

This circuitry provides the needed power to the output of the parallel to serial converter to enable it to interface with the CRT. In addition, a dot stretching circuit extends the ON time of video dots so that

single vertical rows of dots appear to have the same intensity as strings of horizontal dots. The BLANKING signal is used to disable the driver so that the video output is inhibited during Vertical and Horizontal Blanking.

23. **VIDEO CLOCK GENERATOR**

The clock generator consists of a crystal oscillator and the necessary logic required to provide the clocks to the video circuitry. One clock is generated at the video dot rate, and another clock is generated at the video character rate.

24. **COMMAND LATCH**

The command latch is attached directly to the micro-computer's data bus. When enabled, the command latch latches data bits 0-5 and uses these to provide control/data to the electrically alterable ROM.

25. **NONVOLATILE MEMORY**

The nonvolatile memory consists of an electrically alterable read-only memory which is programmed by the operator in the setup. This memory is used to store setup parameters such as baud rate and parity. The EAROM retains its data until reprogrammed by the operator.

26&27. **LEVEL CONVERTERS (EAROM)**

The EAROM requires logic levels of +12V and -23V to operate. The level conversion logic provides these logic levels to the input circuitry and converts the EAROM's output to TTL levels.

28&33. **LEVEL CONVERTERS (EIA TO TTL)**

These level converters change the EIA RS-232C logic levels to TTL levels for use by the UARTs.

29&32. **LEVEL CONVERTERS (TTL TO EIA)**

These level converters change the TTL logic levels from the UARTs to RS-232C levels for use with external equipment.

30. **TCOM CLOCK GENERATOR**

The telecommunications (TCOM) clock generator circuit consists of a crystal oscillator which provides the basic clock for the UART. The UART is then programmed (by the user in the setup) for the appropriate baud rate.

31. **PASS-THRU MULTIPLEXER**

   The pass-thru multiplexer can be enabled so that data
   received by the main UART can be passed-thru to the
   output of the secondary UART (inside the microcomputer
   IC). This allows data being received to be sent
   directly to a printer without CPU intervention.

32. **SEE ITEM 29**

33. **SEE ITEM 28**

34. **CPU CLOCK GENERATOR**

   The CPU clock generator consists of a 11.000 MHz
   crystal connected to the XTAL inputs of the CPU. The
   CPU has its own internal clock generation circuitry
   which divides the basic crystal frequency into
   components usable by the CPU.

4.3 CRT AND POWER SUPPLY BLOCK DIAGRAM

The WY-50 utilizes a combination monitor/power supply assembly.
The power supply provides all of the necessary voltages for all
the logic. These voltages are: +12V, -12V, +5V, and -23V. The
-23V is used exclusively by the EAROM. Figure 4-2 is a block
diagram of the combination monitor/power supply. Note that each
block is numbered. This number corresponds with the item number
in the following description.

1. **VOLTAGE DOUBLER**

   The terminal operates with either a 115 VAC or 230 VAC
   input. The voltage doubler circuit provides 350 VDC to
   the oscillator circuit when 115 VAC is applied and is
   passive when the 230 VAC input strap is installed.
   This assures that the oscillator (DC to AC inverter)
   always has a 350 VDC input regardless of the AC input
   voltage.

2. **DC TO AC INVERTER**

   The inverter consists of a pair of switching tran-
   sistors. The purpose of this circuit is to provide AC
   input voltage to the main power transformer. The DC to
   AC inverter is synchronized with the horizontal oscil-
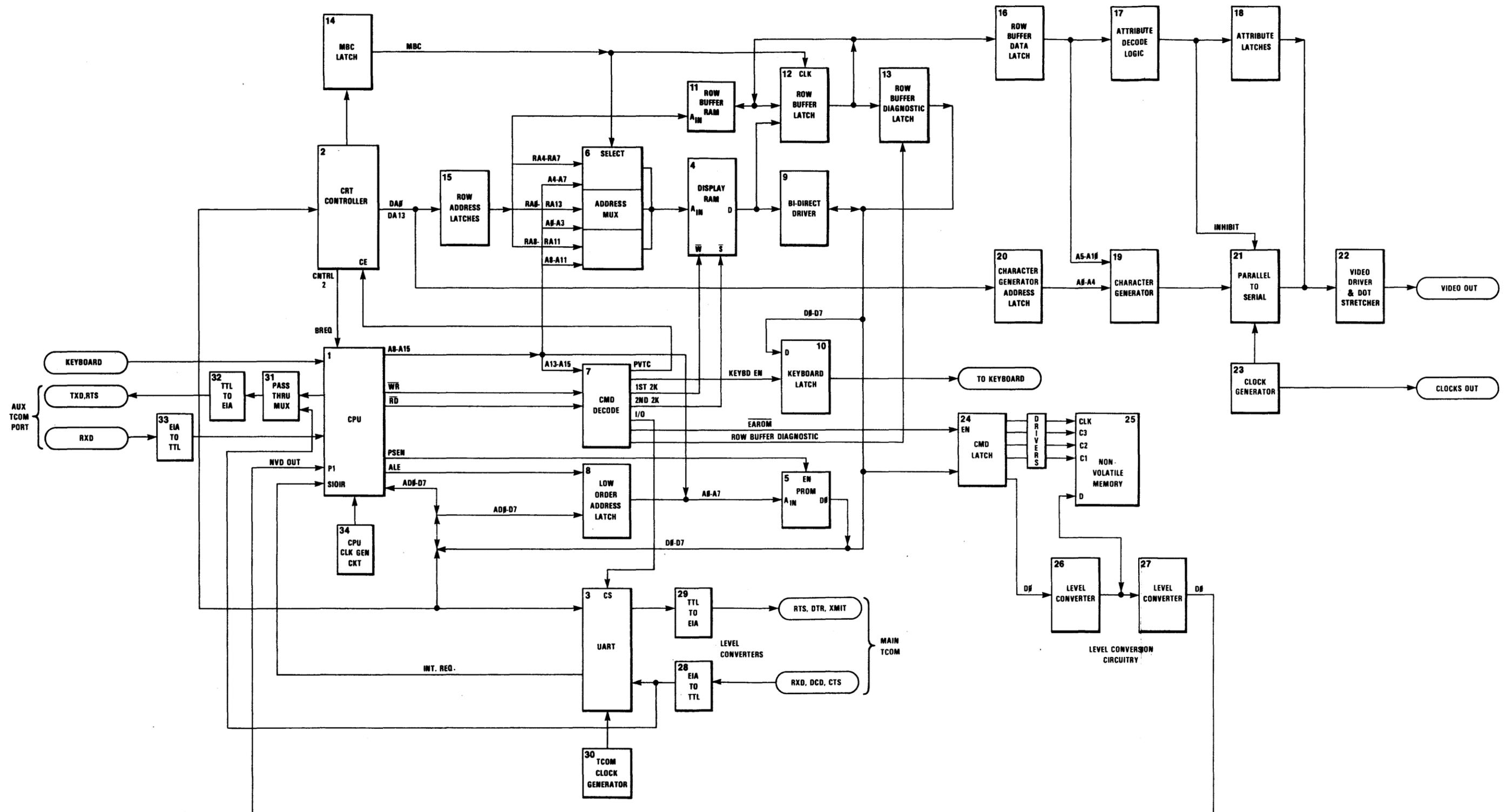   lator to eliminate beat frequencies.

4-6

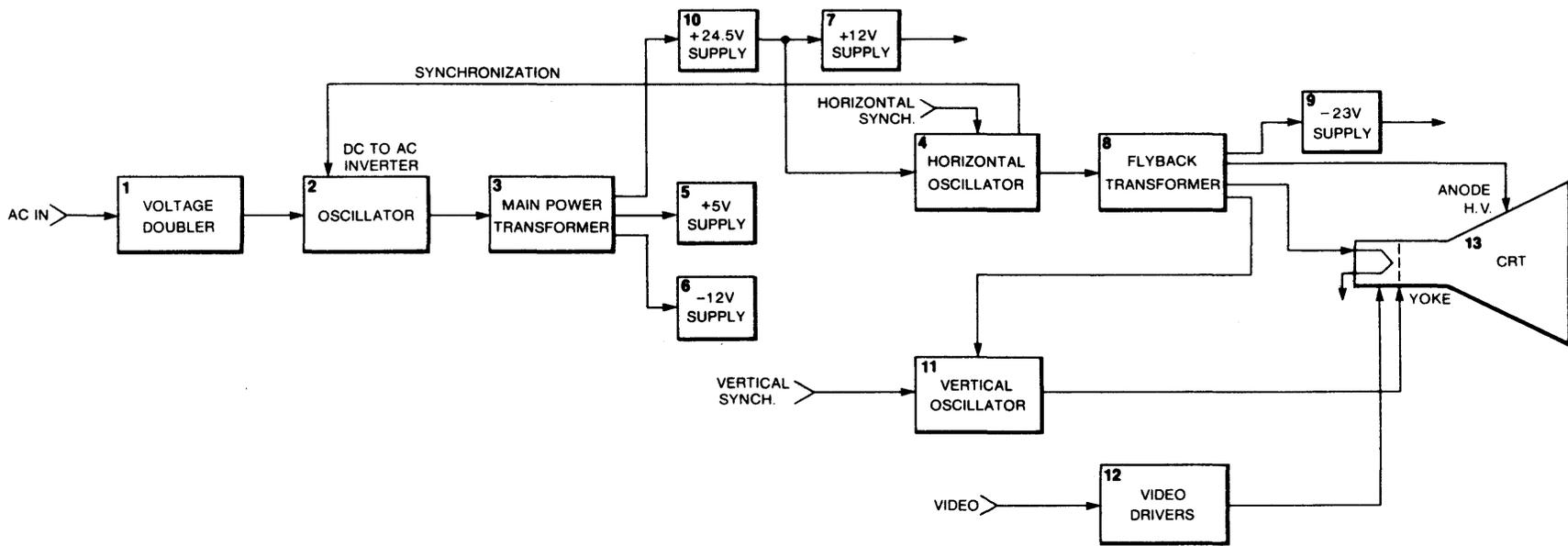**Figure 4-1. MICROCOMPUTER PCB BLOCK DIAGRAM**

Figure 4-2. MONITOR/POWER SUPPLY BLOCK DIAGRAM

3. **MAIN SWITCHING POWER TRANSFORMER**

   The main power transformer provides taps for the power
   supply regulator circuitry and the horizontal
   oscillator.

4. **HORIZONTAL OSCILLATOR**

   The horizontal oscillator provides the necessary signal
   to drive the flyback transformer at the correct
   frequency. It also ensures that the yoke is driven at
   the correct frequency so that the electron beam sweeps
   from left to right at the correct rate. Refer to
   Figure 4-3 for the horizontal oscillator timing
   information.

5. **5 VOLT SUPPLY**

   The +5V is derived directly from one of the main
   transformer taps which provides low voltage AC. The
   output of this tap is rectified and regulated.
   Regulation is accomplished by optically coupling a
   signal back to the DC to AC inverter which controls its
   duty cycle, and hence the output voltage of the main
   switching power transformer.

6. **-12V SUPPLY**

   The -12V supply is derived from one of the main trans-
   former taps. The low voltage AC input is rectified and
   regulated.

7. **+12V SUPPLY**

   The +12V supply is derived from the +24.5 VDC. It uses
   a linear regulator.

8. **FLYBACK TRANSFORMER**

   The flyback transformer steps up the output of the
   horizontal oscillator to provide the high voltage
   necessary for the CRT itself. In addition, the flyback
   transformer has taps which provide filament power and
   low voltage AC input to the -23V supply.

9. **-23V SUPPLY**

   The -23V supply receives its low voltage AC input from
   the flyback transformer. This voltage is then
   rectified and filtered to provide the -23V necessary
   for the EAROM.

HORIZONTAL TIMING

DATA CENTER LINE

SYNC WIDTH ≈15μs ←—26.667μs

HORIZONTAL DRIVE

←—0μs
FRONT PORCH

HORIZONTAL BLANKING

←—9.586μs
RETRACE INTERVAL

LINE RATE 44.44μs

VIDEO DATA

50Hz/60Hz 80 CHARACTER PER ROW

SYNC WIDTH ≈15μs ←—26.667μs

HORIZONTAL DRIVE

HORIZONTAL BLANKING

←—9.935μs
RETRACE INTERVAL

←—0μs
FRONT PORCH

VIDEO DATA

50Hz/60Hz 132 CHARACTER PER ROW
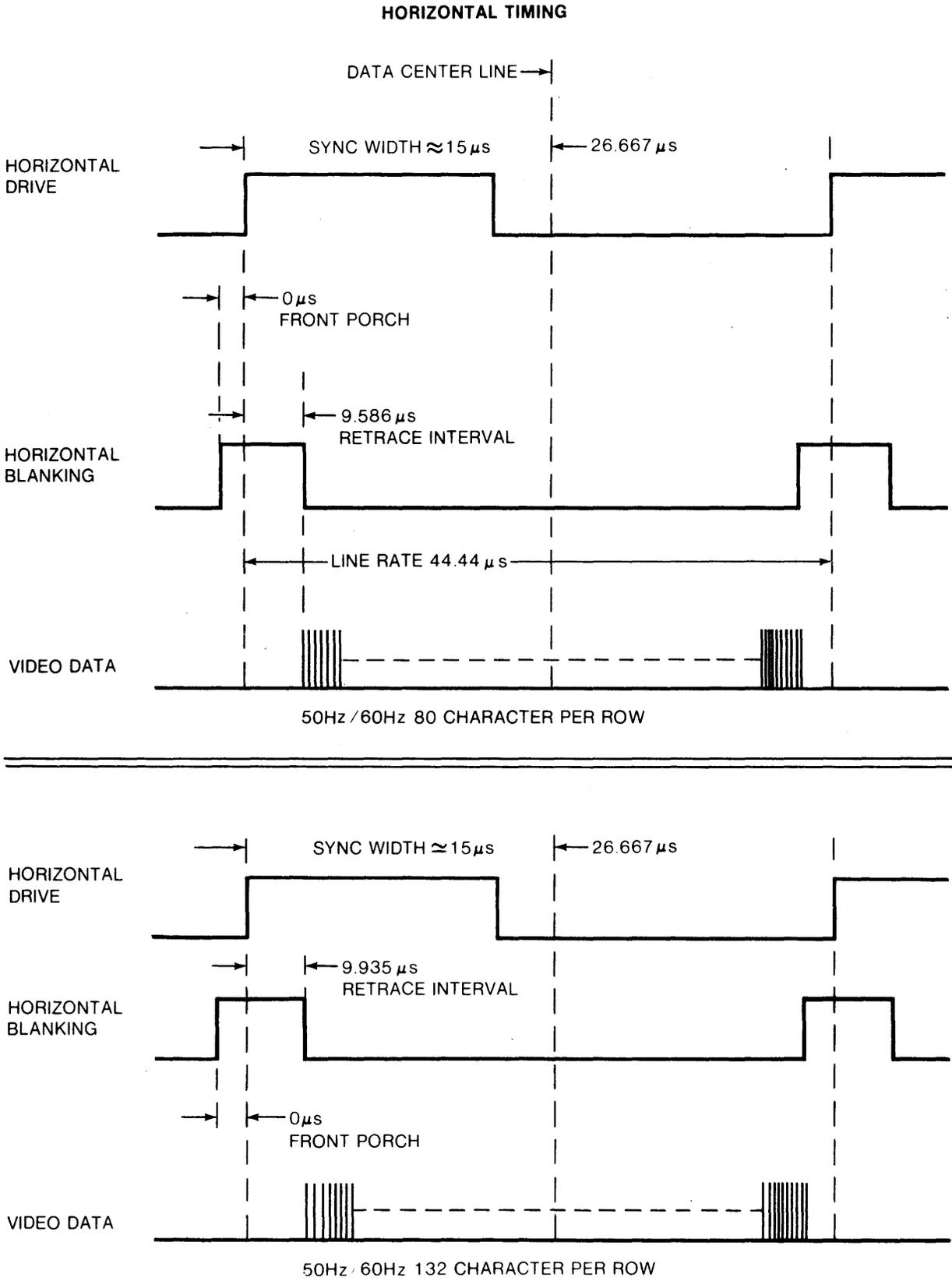
Figure 4-3. HORIZONTAL OSCILLATOR TIMING

10. **+24.5V SUPPLY**

The +24.5V supply is derived from one of the main transformer taps. The low voltage AC input is rectified and then regulated by a linear regulator.

11. **VERTICAL OSCILLATOR**

The vertical oscillator provides the yoke with the correct vertical drive frequency to ensure that the electron beam scans the face of the CRT at the correct vertical repetition rate. Refer to Figure 4-4 for vertical timing information.

VERTICAL TIMING

50Hz/60Hz 80/132 COLUMN

Figure 4-4. VERTICAL TIMING

12. **VIDEO DRIVERS**

The video drivers provide the video input to the CRT with the correct voltage to bias the CRT grid.

13. **CRT**

The cathode ray tube (CRT) is where data is displayed. This is accomplished by modulating the electron beam with the video signal while the beam is being moved across the face of the screen at the rate determined by the horizontal and vertical drive signals.

4.4   KEYBOARD BLOCK DIAGRAM
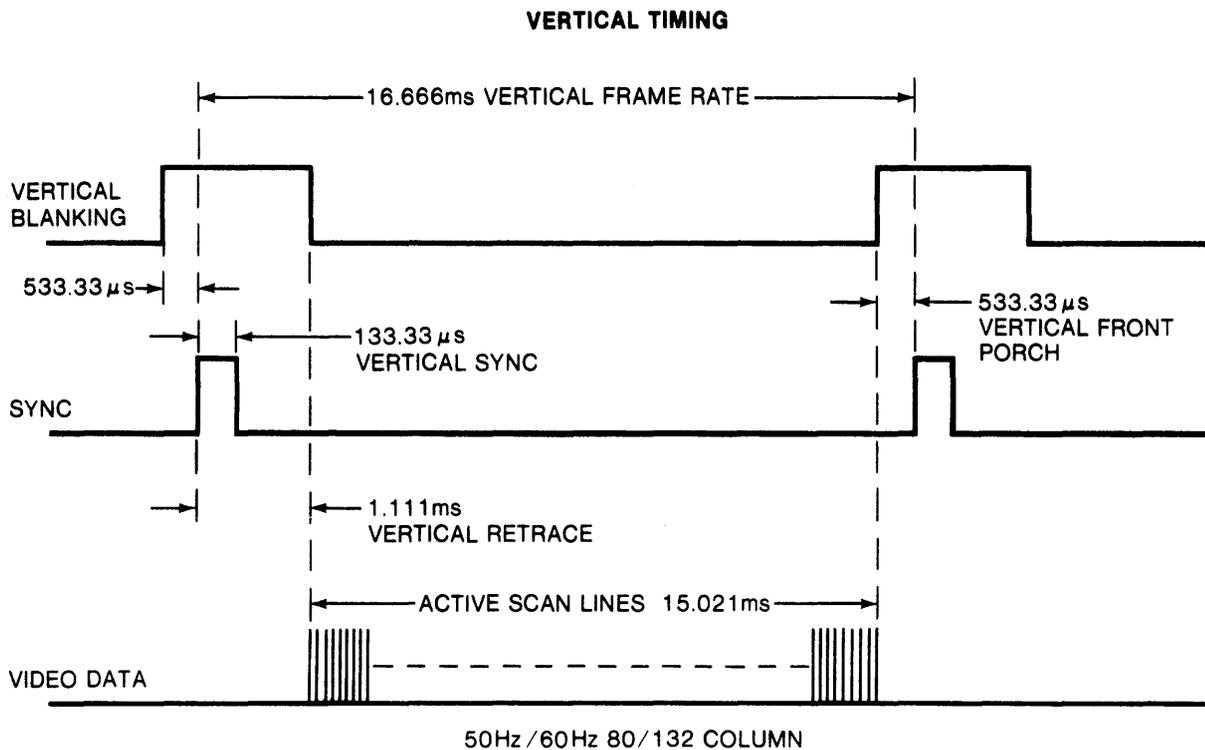
Figure 4-5 is a block diagram of the WY-50 keyboard. The logic to interface with the keyboard is resident on the microcomputer PCB. Note that each block on the block diagram is numbered. This number corresponds to the item numbers given in the following descriptions.
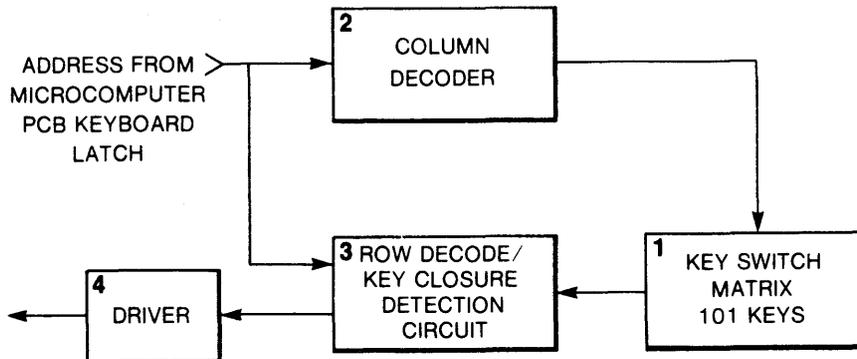
Figure 4-5.   KEYBOARD BLOCK DIAGRAM

1. **KEY SWITCH MATRIX**

    The key switch matrix is divided into sixteen columns and eight rows. Each row is pulled up to +5V with a pull-up resistor. At each intersection of a row and a column a KEY switch is located. Pressing a KEY switch results in a unique column and row juncture.

2. **COLUMN DECODER**

    The column decoder is driven by the keyboard address latch on the microcomputer PCB. Each column is selected by the microcomputer card. When this occurs, the column decoder drives the selected column line low. Because the row lines are all pulled high, a key closure results in the column line pulling the row line low (logic 0).

3. **ROW DECODER/KEY CLOSURE DETECTION CIRCUIT**

    The microcomputer PCB addresses the row decoder which in turn examines each row in the keyboard switch matrix. If a key has been pressed, the row decoder encounters a logic low on its input line (because the column line pulled the row line low). When this occurs, the key closure detection circuit informs the CPU that a key closure has occurred.

4. LINE DRIVERS

The keyboard line drivers provide adequate output so that signal decrease is minimized between the keyboard and the microcomputer PCB.

4.5 FUNCTIONAL DESCRIPTION

The logic board consists of six sections: microprocessor, communications interface, display memory, nonvolatile memory, keyboard interface and video control.

4.5.1 MICROPROCESSOR

The 8031 microprocessor contains 128 bytes of RAM, two counter/timers, a full duplex serial port, and two parallel ports. The processor operates at 11 MHz which results in 1.1 μ sec execution time for most instructions.

The 8031 has a separate address space for program storage and I/O. Program storage is selected with signal $\overline{\text{PSEN}}$. The WY-50 normally uses 8K x 8 bytes of program storage, but may be expanded to 16K x 8 bytes with no jumpers or to 32K x 8 bytes with 1 jumper. The I/O address space is selected by $\overline{\text{RD}}$ (Read) or $\overline{\text{WR}}$ (Write).

There is an 8-bit data bus which has the eight lower order address bits multiplexed during bus cycles. The lower address bits are latched into an 8-bit latch by the ALE signal (address latch enable). The upper eight address bits have a dedicated output port on the 8031.

Port Assignments

PØ.Ø - PØ7	Data bus and lower byte of address bus.
P1.Ø	$\overline{\text{AUX READY}}$. Input from auxiliary serial port. Indicates DTR line is asserted.
P1.1	NVDOUT. Input from nonvolatile memory. Data is shifted in serially from memory.
P1.2	Pass-thru. Output from 8031 causes data received from the modem port to be sent additionally out through the AUX port.
P1.3	$\overline{\text{AUXRTS}}$. Input to 8031 from AUX port. Indicates RTS is being asserted by AUX device.

Port Assignments (Cont.)

P1.4.	Key Return. Input from the keyboard to the CPU. Signal is high if currently addressed key is depressed.
P1.5	BELL. Output by 8031 to sound tone generator.
P1.6	$\overline{\text{DIM}}$/REV. Output by 8031 to define presentation of protected characters on CRT. Low is dim. High is reverse video.
P1.7	$\overline{8\emptyset}$/132. Output by 8031. Selects 80-column or 132-column display.
P2.0-P2.7	Address bits 8:15 output by 8031 during bus cycles.
P3.0	RXD. Received data from AUX serial port.
P3.1	TXD. Transmitted data from 8031 to AUX port.
P3.2	$\overline{\text{INT}\emptyset}$. ($\overline{\text{BRE}\emptyset}$). Interrupt input from CRT controller during DMA transfers.
P3.3	$\overline{\text{INT1}}$. ($\overline{\text{SI}\emptyset\text{IR}}$). Interrupt input from modem port UART. Indicates data in the receive buffer.
P3.4	T$\emptyset$. ($\overline{\text{VTIR}}$). Timer 0 input. Used to generate interrupts by CRT controller.
P3.5	T1. ($\overline{\text{GRAPHICS}}$). Output by 8031 to turn on graphics interface signals.
P3.6	$\overline{\text{WR}}$. I/O Write signal output by 8031.
P3.7	$\overline{\text{RD}}$. I/O Read signal output by 8031.
RST	Reset. High input resets 8031.
$\overline{\text{EA}}$	$\overline{\text{External Access}}$. Low signal forces 8031 to make program fetches from external ROM.
ALE	Address Latch Enable. Latches multiplexed lower order address bits from data bus into address latch.
$\overline{\text{PSEN}}$	$\overline{\text{Program Store Enable}}$. Enables external ROM during program fetch.

4.5.2 COMMUNICATIONS INTERFACE

The WY-50 has two independent full duplex serial ports, the modem port and the auxiliary (AUX) port. Both are asynchronous.

The modem port is normally connected to a host computer or a modem. The AUX port is normally connected to a peripheral device such as a printer.

The modem port is implemented with a 2661-B UART. This UART derives its baud rate clock from a 4.9152 MHz crystal. The 1488 and 1489 buffers provide the necessary voltage level conversion for interfacing RS-232 lines. Noise filtering is provided by the 220 pF capacitors.

The AUX port uses the UART internal to the 8031. The 11 MHz processor clock is divided down internally by timer 1 in order to provide the necessary baud rates.

In addition to operating independent of the modem port, the AUX port may operate in a pass-thru mode. In the pass-thru mode, the data being received by the modem port is retransmitted out the AUX port. The DTR signal being received by the AUX port is passed through to the modem port. The 8031 UART does not transmit when in this mode. The modem UART can monitor the data stream passing through as well as transmit back to the host or other device on the modem port.

4.5.3 DISPLAY MEMORY

The display memory in the WY-50 is dual-ported between the CRT controller and the 8031 processor. Normally, there are two 2K x 8 bytes RAM chips installed for single page operation.

The printed circuit board (PCB) has provisions for future expansion to one or two 8K x 8 bytes RAMS, but this expansion is not currently supported by the firmware.

During the first scan line of each character row, the 2672 CRT controller asserts an interrupt on $\overline{INT\emptyset}$ of the 8031 about 9 μ sec prior to commencing a DMA transfer from the display RAM. The 8031 may not access the display RAM while this signal is asserted. The 8031 is not halted during the DMA transfer and may service any other devices at this time.

4.5.4 NONVOLATILE MEMORY

The WY-50 stores all configuration parameters in the 100 x 14-bit nonvolatile memory. The memory operates from +12 volt and -23 volts. The proper generation of these voltages requires that the proper horizontal frequency be applied to

the monitor/power supply for at least 250 milliseconds
before trying to read or write the nonvolatile RAM.

The EAROM requires a command code on the C1, C2, C3 inputs
in order to erase, read, or write. Address and data infor-
mation are clocked into the EAROM through the bidirectional
D pin.

The 8031 controls the EAROM through a control latch (4H).
The control latch signal levels are translated by 7406 open
collector inverters to the 12 volt levels required by the
ER1400 EAROM. Data read out of EAROM is translated to TTL
levels by a comparator (7J) before being read by the 8031 on
P1.1.

4.5.5   KEYBOARD INTERFACE

Each key in the keyboard is tested for a key depression by
presenting its address to a latch (1L), then testing the
return line at P1.4 on the 8031. A period of at least 6 μ
sec is allowed to elapse between outputting an address and
testing the key return.

Debouncing and multiple key depressions are handled by the
8031.

4.5.6   VIDEO CONTROL

The video controller consists of the dot and character clock
section, the 2672 programmable CRT controller, attribute
control, character font, and video shift register.

4.5.7   VIDEO CLOCK CIRCUITRY

A 68.85 MHz oscillator provides the basic timing reference
from which the dot clock and character clock are derived. A
68.85 MHz crystal provides the positive feedback around a
74F04 inverter (2B). The crystal is used in a series
resonant overtone mode. A T-network consisting of resistors
R3 and R44 and capacitor C9 provide DC feedback around the
inverter for proper biasing while blocking AC. L1 and C72
form a parallel resonant circuit to reduce the oscillator's
feedback if it attempts to oscillate at the wrong overtone
frequency. C8 provides an AC path to ground for the
resonant circuit.

The output from the oscillator is buffered by another 74F04
and then applied to a divider (2A). The divider circuit
divides by 2 for 132-column operation or by 3 for 80-column
operation. The dot clock from the divider goes to the video
shift register and the character clock generator.

The character clock generator consists of a Johnson counter (3B, 4B, 3A) which divides the dot clock by 10 in 80-column mode and by 9 in 132-column mode. The character clock generator also provides a properly phased load enable signal for the video shift register.

4.5.8   PROGRAMMABLE VIDEO CONTROLLER

The 2672 programmable video timing controller (PVTC) provides all the timing and control signals for displaying characters on the CRT (3J). The 2672 is initialized by the 8031 after power-on with the necessary display parameters. Prior to each displayable character row, the 8031 gives the 2672 the beginning character address for that row. The 2672 fetches characters from the display RAM during the first scan line of each displayable character row. During the following 12 scan lines the characters are retrieved from the row buffer.

The 2672 warns the 8031 of an impending DMA transfer by asserting $\overline{BREQ}$ about $9\,\mu$sec before the DMA transfer begins. After $9\,\mu$sec, the 2672 asserts memory bus control (MBC) which ports the display RAM into the row buffer RAM and disconnects the display RAM from the 8031 bus. Since the 8031 is not halted by the DMA transfers, there is an additional 1.17 milliseconds of program execution time available during each video frame (26 row x $45\,\mu$sec horizontal period).

In addition to providing the character addressing, the 2672 also generates the scan line count and attribute control signals. The scan line count, blink rate, and underscore signals are multiplexed on the 2672's character address lines. At the beginning of each scan line these multiplexed signals are clocked by the falling edge of the blank signal into a latch (4D).

4.5.9   ATTRIBUTE CONTROL

The attribute control section controls the manner in which the characters are presented to the CRT. There are five basic attributes: blink, blank, underscore, reverse, and dim. The attributes may be used individually or in combination. The attributes are nonhidden which means that they are embedded within the display data and occupy a character location on the CRT screen.

As data is presented to the character generator (3D), it is simultaneously decoded by the attribute controller to determine if it is display data or an attribute. If bit 7 is high and bits 6 and 5 are low, then the data byte is interpreted as an attribute byte.

The attribute bit assignments are:

Bit	Value			
7	1			
6	Ø	Indicates byte is an attribute.		
5	Ø			
4	A	Reverse Video	1-ON,	Ø-OFF
3	B	Underscore	1-ON,	Ø-OFF
2	C	Blank	1-ON,	Ø-OFF
1	D	Blink	1-ON,	Ø-OFF
Ø	E	Dim	1-ON,	Ø-OFF

If a data byte is an attribute, it is routed through multi-plexer 5D, 5A, 6A, 7A into the current attribute latch (6C). A new attribute always replaces the previous one and affects all the following displayed data until the next attribute is encountered. Whenever a new attribute is latched, the shift register (2C, 3C, 4C) is inhibited from loading the contents of the character font (3D); therefore, the screen location of an attribute is always blank (video OFF).

The outputs of the attribute latch (6C) are decoded to create the different attributes. Blank and blink are created by inhibiting the shift register from loading. Underscore is exclusive OR'd with the reverse and cursor functions, and the shift register load is inhibited.

The reverse video functions (cursor, underscore, reverse, character) are exclusive OR'd with the serial video bit stream.

At the beginning of the first scan line of each character row, the row attribute latch (6D) is loaded from the current attribute latch (6C). This allows the last active attribute of each character row to propagate to subsequent character rows until a new attribute is encountered. Memory bus control (MBC) from the 2672 PVTC causes this transfer. At the beginning of every scan line (including the first scan line), the current attribute latch (6C) is loaded from the row attribute latch (6D). This action restores the current attribute latch to the initial value for this character row.

The attribute controller also detects protected characters and displays them as dim, reverse, or normal. A protected character is detected when b7 is one and either b6 or b5 (or both) is also one.

4.5.10   CHARACTER GENERATOR

Each character cell is 10 dots (80-column) or 9 dots (132-column) wide by 13 scan lines high.

A 200 ns 2732A EPROM is used to store the font. Address bits (A0-A3) select the appropriate pattern for the current scan line. Address bits (A4-A10) select the 128 ASCII and line drawing characters when A11 is low. A11 controls the lower or upper 128 character select. Both lower and upper have the same characters. The firmware can select A11 for the protect attribute, and the effect of this is to have a protect which is normal video as one of the protect options.

4.5.11   ROW BUFFER DIAGNOSTIC REGISTER

The row buffer diagnostic register (4E) latches data during DMA transfers. At the end of the DMA transfer this register contains the last byte of the transfer. This byte may be read by the CPU prior to the next transfer.

The diagnostic register is useful for testing the data path from display RAM to the row buffer.

4.5.12   VIDEO SHIFT REGISTER

The video shift register (2C, 3C, 4C) provides the serial bit stream to the video input of the monitor, power/supply. The shift register is controlled by the attribute control section by a single signal. The shift register can parallel load from the character font or it can shift right. Whenever the register shifts data out to the right, it also shifts in zeros from the left. In this way the shift register is automatically cleared to all zeros at the end of each character boundary. To create a blank character cell on the CRT it is only necessary to inhibit the register from loading during that character cell boundary.

The output from the shift register goes to a dot stretcher composed of NPN transistor Q2 and capacitor C30. The dot stretcher extends the on-time of the video dots so that vertical columns of single dots appear in equal intensity to horizontal strings of dots.

After the dot stretcher the video goes to exclusive OR gate (7D) which creates reverse video for the cursor and reverse attributes. The video is next OR'd with any external video input (5E). Finally, the video is gated with the blanking signal (7G) from the CRT controller.

4.6   RASTER SCAN TERMINOLOGY

The WY-50 is a computer whose I/O devices make it look like a terminal. Because of this, a number of design features are incorporated to specifically handle these I/O devices. An explanation of these devices and their impact on the design of the WY-50 follows.

The terminal utilizes a 14" CRT display. Because the WY-50 has a video output, a large percentage of its circuitry is devoted to providing the appropriate inputs to the CRT display (i.e., clocks and video information).

The face of the CRT is swept with an electron beam. By controlling this beam intelligent data can be displayed on the face of the CRT. By definition, the electron beam begins in the upper left-hand corner of the display and sweeps from left to right. One sweep of the beam is known as a SCAN LINE. When the beam returns from the right side of the screen back to the left side to begin the next scan line, it must be DISABLED (turned OFF) so that a streak doesn't appear on the face of the CRT. This disablement is known as HORIZONTAL BLANKING. At the end of 338 scan lines, the electron beam is at the lower right-hand corner of the display. In order to return it to the upper left-hand corner, the beam must be DISABLED so that a vertical streak doesn't appear on the face of the CRT. This disablement is known as VERTICAL BLANKING. The period which encompasses the time the beam moves from the upper left-hand corner of the display and returns is known as a FIELD. By convention, field time normally equals the period of the AC power source (i.e., in the United States field time is 1/60 of a second (60 Hz) and in Europe it is 1/50 of a second (50 Hz). The WY-50 uses a 60 Hz field rate in either 60 Hz or 50 Hz AC input.

In the WY-50, characters are constructed within a 10 x 13 matrix. This means the field must be broken into vertical and horizontal axes. The vertical axes consists of scan lines. The horizontal axes consists of bit times. Thirteen scan lines and 10 bit times are used to define the character matrix (10 x 13).

5.0 MAINTENANCE INSTRUCTIONS

5.1 MODULE REPLACEMENT

All modules within the WY-50 can be removed for repair or replacement by the service technician without any special tools.

The following paragraphs describe in detail, how to remove and install each of the modules. For purposes of orientation, FRONT is always the same side as the monitor face. BACK is where the rear panel and power cord are located (see Figure 5-1).
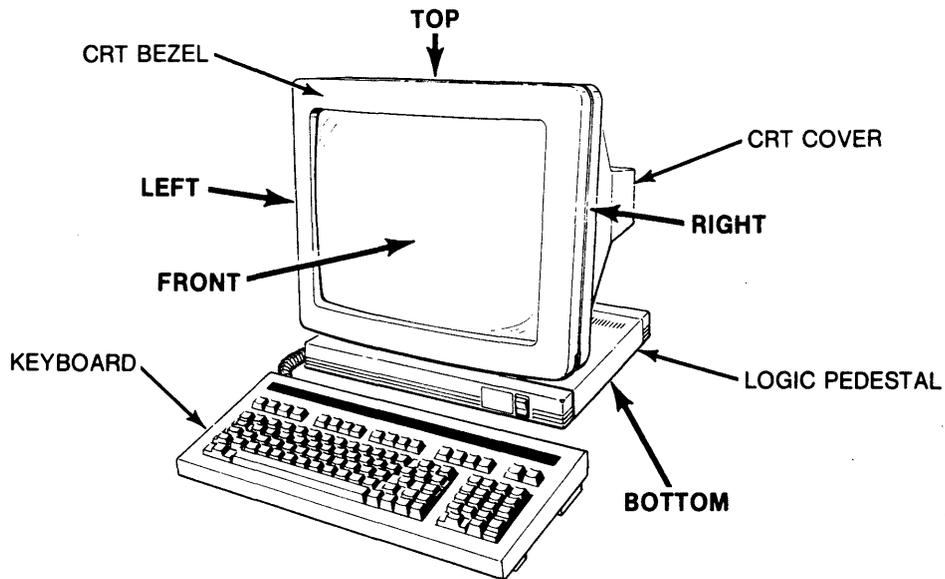

Figure 5-1. ORIENTATION VIEW OF TERMINAL AND COMPONENT NAME

5.2 KEYBOARD REPLACEMENT

Tools Required: None

Procedure:

1. Disconnect the WY-50 from its AC power source.

2. Unplug the keyboard from the keyboard connector at the rear panel.

3. Install the new keyboard.

5.3 MONITOR/POWER SUPPLY REPLACEMENT

Tools Required: #1 Phillips screwdriver (12" long)
                 #2 Phillips screwdriver (Std. length)

Procedure: (See Figure 5-2)

1. Disconnect the WY-50 from its AC power source.

2. Remove the four #1 Phillips screws which hold the CRT cover in place (one screw in each corner near the face of the CRT).

3. Grasp the CRT cover by the sides and slide it off towards the back of the unit.

4. Disconnect the brightness pot wiring harness.

5. Disconnect the AC power harness.

6. Cut the ty-wraps holding the AC harness to the CRT frame (two each).

7. Disconnect the power/data harnesses which goes to the microcomputer PCB.

8. Remove the four screws (#2 Phillips) which hold the monitor/power supply to the logic pedestal.

9. Lift the monitor/power supply free from the logic pedestal.

10. Remove the four #2 Phillips screws which hold the bezel to the CRT.

11. Remove the bezel.

12. Assembly is in the reverse order of disassembly.

13. Refer to Section 6.0 for alignment information.
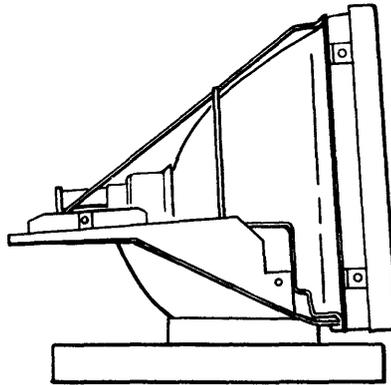
5.4 MONITOR/POWER SUPPLY PC CARD REPLACEMENT

Tools Required: #1 Phillips screwdriver (12" long)

Procedure: (See Figure 5-2)

1. Disconnect the WY-50 from its AC power source.

2. Remove the four #1 Phillips screws which hold the CRT cover in place (one screw in each corner).

SIDE VIEW

CRT TOP VIEW
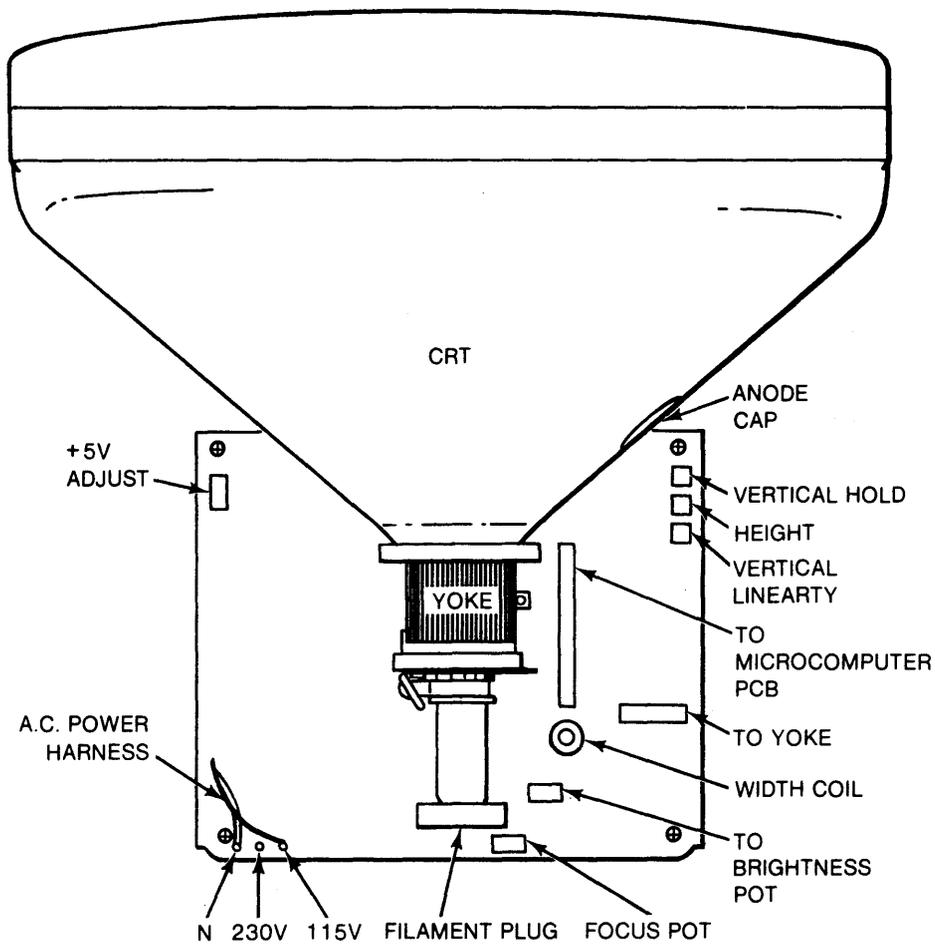
CRT

ANODE CAP

+5V ADJUST

VERTICAL HOLD

HEIGHT

VERTICAL LINEARTY

YOKE

TO MICROCOMPUTER PCB

TO YOKE

A.C. POWER HARNESS

WIDTH COIL

TO BRIGHTNESS POT

N 230V 115V FILAMENT PLUG FOCUS POT

Figure 5-2.   MONITOR/POWER SUPPLY

```
┌─────────────┐
│  CAUTION    │
└─────────────┘
```

High voltage is present. Only trained service personnel should attempt servicing this device.

3. Grasp the CRT cover by the sides and slide it off (towards the back of the unit).

4. Disconnect the brightness pot wiring harness.

5. Disconnect the AC power harness.

6. Disconnect the filament plug from the neck of the CRT.

7. Disconnect the yoke wiring harness plug.

8. Disconnect the power/signal harness to the micro-computer PCB.

9. Ground the CRT anode by inserting a long screwdriver between the wire framework of the CRT monitor and the anode plug itself.

10. Disconnect the anode cap from the CRT.

11. Remove the four #1 Phillips screws which hold the logic card to the CRT frame (one in each corner).

12. Slide the PC board out the rear of the CRT frame.

13. Assembly is in the reverse order of disassembly.

14. Refer to Section 6.0 for alignment information.

5.5   BRIGHTNESS POTENTIOMETER REPLACEMENT

Tools Required: #1 Phillips screwdriver (12" long)
                   #2 Phillips screwdriver (Std. length)

Procedure:

1. Disconnect the WY-50 from its AC power source.

2. Remove the four #1 Phillips screws holding the CRT cover in place.

3. Grasp the CRT cover by the sides and slide it off (towards the back of the unit).

4. Disconnect the brightness pot wiring harness from the monitor PCB.

5. Clip the ty-wraps holding brightness pot harness from the metal CRT framework.

6. Remove the four #2 Phillips screws which hold the CRT bezel in place.

7. Remove the bezel.

8. Remove the two #1 Phillips screws which hold the brightness pot to the bezel.

9. Install the new potentiometer.

10. Assembly is in the reverse order of disassembly.

5.6 AC POWER SWITCH REPLACEMENT

Tools Required: #1 Phillips screwdriver

Procedure:

1. Disconnect the WY-50 from its AC power source.

2. Lay the WY-50 on its side (either side is OK).

3. Remove the six #1 Phillips screws which hold the metal base plate to the display pedestal.

4. Lift the metal base plate free.

CAUTION

The metal base plate tabs can break the display console plastic if not handled carefully.

5. Disconnect the wiring going to the power switch by pulling the slip-on connectors off the switch.

6. Push the power switch out the front of the display pedestal (push the switch towards the front of unit). This is a snap-in switch; you may have to squeeze the snaps to remove it.

7. Install the new switch.

8. Assembly is in the reverse order of disassembly.

5.7 MICROCOMPUTER PCB REPLACEMENT

Tools Required: #1 Phillips screwdriver

Procedure:

1. Disconnect the WY-50 from its AC power source.

2. Disconnect the keyboard from the rear panel.

3. Disconnect the printer and modem communication cables.

4. Remove the two #1 Phillips screws holding the rear panel in place (the rear panel is an integral part of the microcomputer PCB).

5. Pull the rear panel towards the back of the unit (approx. 2").

6. Disconnect the cable from the monitor/power supply.

7. Pull the microcomputer PCB the rest of the way out of the display console pedestal.

8. Install the new microcomputer PCB.

9. Assembly is in the reverse order of disassembly.

6.0 ALIGNMENTS

This section of the manual describes the mechanical and electrical alignments applicable to the Wyse WY-50. Mechanical alignments are defined as those which do not require power to be supplied to the system.

6.1 MECHANICAL ALIGNMENTS

6.1.1 POWER SUPPLY

Non-applicable

6.1.2 MICROCOMPUTER PCB

Non-applicable

6.1.3 KEYBOARD

Non-applicable

6.1.4 MONITOR

Non-applicable

6.2 ELECTRICAL ALIGNMENTS

6.2.1 POWER SUPPLY

The monitor/power supply combination provides all of the voltages necessary for the logic (+5V, +12V, and -23V). The monitor/power supply also supplies +24.5V for internal use of the CRT monitor. This voltage supplies the input to the +12V regulator also. The +24.5V supply and the +5V supply are the only adjustable supplies. The -12V and the input to the +24.5V regulator both track the +5V. The -23V is generated by the flyback transformer, which means horizontal sync must be present before -23V will be generated. All power supply voltages except the +24.5V should be measured at the microcomputer card to eliminate any problems caused by voltage drop in the wiring.

Tools Required: #1 Phillips screwdriver
                 Sensitive voltmeter

Procedure:

1. Disconnect the WY-50 from its AC power source.

2. Remove the four #1 Phillips screws which hold the CRT cover in place (one in each corner).

3. Grasp the CRT cover by the sides and slide it off (toward the back of the unit).

4. Remove the two #1 Phillips screws which hold the rear panel (microcomputer PCB) in place.

5. Slide the microcomputer PCB out, approximately 2" until the connector from the monitor/power supply can be easily reached with the voltmeter probes.

6. Connect the WY-50 to an AC power source.

7. Turn the WY-50 ON.

8. Place the voltmeter on pins 10 and 12 of connector J4. Pin 10 is ground, pin 12 is +5V.

CAUTION

Do not allow the voltmeter leads to short out the connector pins. To do so will damage the terminal.

9. Adjust the +5V potentiometer on the monitor/power supply (located on the right front side of the monitor/power supply PCB when viewed from the front) until the voltage reads +5V ±2%.

10. Check the +12V on pin 6 of J4. It should be +12V ±5%. If the +12V is not within specification, the monitor/power supply card will have to be replaced.

11. Check the -12V on pin 7 of J4. It should be -12V ±5%. If the -12V is not within specification, the monitor/power supply card will have to be replaced.

12. Check the -23V on pin 11 of J4. It should be -23V
    +5%. If the -23V is not within specification and
    the logic PCB is generating a 22 kHz signal on pin 4
    of J4, the monitor/power supply card will have to be
    replaced. If the logic PCB is not generating a 22
    kHz signal, then the logic PCB should be replaced.

13. Place one voltmeter probe on the +24.5V test pin at
    the rear of the monitor/power supply and the other
    probe to the metal frame.

14. Adjust the +24.5V potentiometer on the monitor/power
    supply located on the right rear side of the monitor
    power supply PCB until the voltage reads +24.5V +2%.

15. Turn the WY-50 OFF.

16. Disconnect the WY-50 from its AC power source.

17. Reassemble the unit.

6.2.2   MICROCOMPUTER PCB

Non-applicable

6.2.3   KEYBOARD

Non-applicable

6.2.4   MONITOR

The monitor has a number of electrical alignment adjust-
ments. The majority of these adjustments will never need to
be performed unless the CRT itself or the entire monitor/-
power supply assembly is replaced.

```
{ CAUTION }
```

High voltage is present in the CRT
assembly. Only qualified service
personnel should perform these
alignments.

In order to perform any of the monitor electrical alignments
it is necessary to remove the CRT top cover; this is
accomplished by removing the four #1 Phillips screws which
hold the CRT cover in place and sliding the cover off.
Refer to Figure 5-2 for adjustment locations.

6.2.4.1   Vertical Hold

Tools Required: Slotted plastic screwdriver

Procedure:

1. After removing the CRT top cover, turn the WY-50 ON.

2. Display a full screen of characters (preferably uppercase H).

3. Adjust the vertical hold pot until the display rolls in one direction.

4. Adjust the vertical hold pot until the display rolls in the opposite direction.

5. Center the pot between these two extremes.

6. The picture should be steady.

6.2.4.2   Height

Tools Required: Slotted plastic screwdriver

Procedures:

1. After removing the CRT top cover, turn the WY-50 ON.

2. Display a full screen of characters.

3. Adjust the height pot until the desired display size is obtained.

6.2.4.3   Vertical Linearity

Tools Required: Slotted plastic screwdriver

Procedures:

1. After removing the CRT top cover, turn the WY-50 ON.

2. Display a full screen of characters (preferably uppercase H).

3. Adjust the vertical linearity pot until the characters on the bottom display row are the same height as those on the top display row.

6.2.4.4   Focus

Tools Required: Slotted plastic screwdriver

Procedures:

1. After removing the CRT top cover, turn the WY-50 ON.

2. Display a full screen of characters.

3. Adjust the focus pot until the characters midway between the center of the display and the bezel are distinct and clear. Do not use the focus control to adjust the outer extremities of the screen as some non-linearity exists in all CRTs.

6.2.4.5   Width

Tools Required: Plastic hex tuning coil tool

Procedures:

1. After removing the CRT top cover, turn the WY-50 ON.

2. Display a full screen of characters.

3. Adjust the width coil until the display is the desired width.

CAUTION

Do not use a metal tool to adjust the width coil, as the magnetic properties of a metal tool will affect the adjustment.

6.2.4.6   Display Centering

Tools Required: None

Procedures:

1. After removing the CRT top cover, turn the WY-50 ON.

2. Display a full screen of characters.

3. Adjust the ring magnets (see Figure 6-1) so the display is centered. Both magnets must be used in conjunction with each other.

6.2.4.7 Display Leveling

Tools Required: None

Procedures:

1. After removing the CRT top cover, turn the WY-50 ON.

2. Display a full screen of characters.

3. Loosen the yoke lock.

4. Rotate the yoke until the display is parallel with the top of the bezel.

5. Tighten the yoke lock.

```
{ CAUTION }
```

Do not over-tighten the yoke lock or the neck of the CRT will break. Finger tight is sufficent.

6.3   KEYBOARD CABLE REPLACEMENT

Tools Required: #2 Phillips screwdriver
                   #1 Phillips screwdriver

Procedures:

1. Disconnect the WY-50 from its AC power source.

2. Unplug the keyboard cable from the rear panel.

3. Turn the keyboard upside down and remove the four #2 Phillips head screws holding the keyboard bottom cover (one screw in each corner).

4. Remove the two #2 Phillips head screws holding the keyboard top cover to the metal frame.

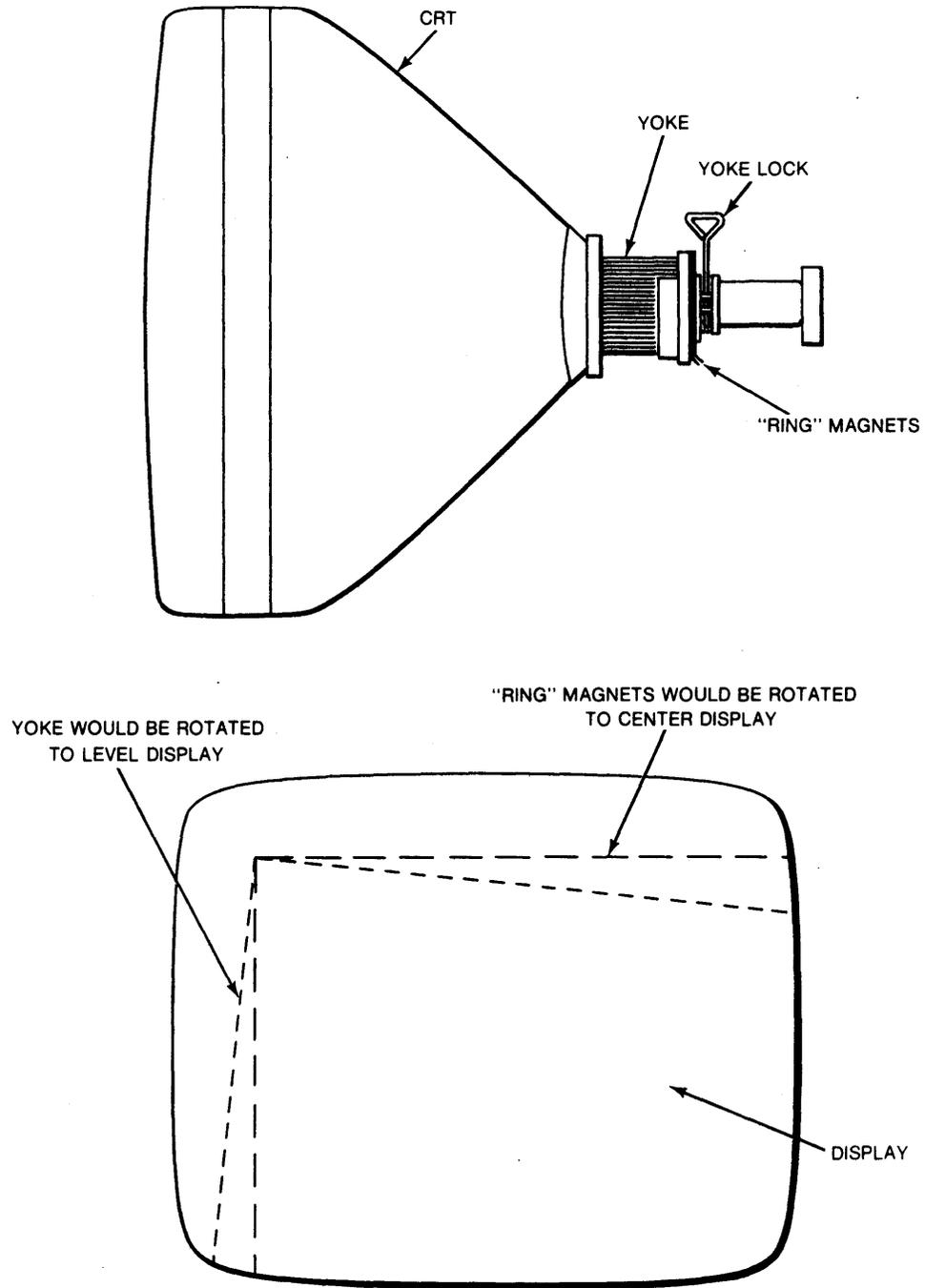5. Lift the keyboard bottom cover up and free, and then turn the keyboard right side up.

CRT

YOKE

YOKE LOCK

"RING" MAGNETS

"RING" MAGNETS WOULD BE ROTATED
TO CENTER DISPLAY

YOKE WOULD BE ROTATED
TO LEVEL DISPLAY

DISPLAY

Figure 6-1. DISPLAY CENTERING

6. Unscrew the #1 Phillips screw holding the keyboard
    cables shielded ground strap to the keyboard.

7. Unplug the keyboard cable from the keyboard.

8. Install the new cable. The plug is keyed and will
    only fit one-way.

9. Replace the keyboard top cover and then the two #2
    Phillips head screws.

10. Replace the plastic keyboard bottom cover and
    install the four #2 Phillips head screws, **DO NOT
    TIGHTEN THE SCREWS**.

11. Turn the keyboard over and ensure that the keys do
    not bind on the keyboard bezel. If the keys do not
    bind, then the four screws can be tightened. If the
    keys do bind, jockey the plastic bezel until the
    keys no longer bind. Then tighten the screws.

7.0 PERFORMANCE TESTS AND TROUBLESHOOTING FLOW CHART

The WY-50 is capable of testing its internal RAM, PROM, EAROM, CPU, and telecommunications logic by running a self-contained self test routine. The WY-50 has two levels of self testing. The first level of testing occurs automatically each time the WY-50 is powered-on. The second level of testing must be invoked by the operator from the keyboard.

7.1 POWER-ON SELF TEST

The power-on self test, tests the WY-50's RAM, CPU and EAROM. The RAM test is a Write/Read test which tests all 4K of RAM. The CPU test, tests the 128 bytes of RAM internal to the CPU as well as the data and address lines. The EAROM test consists of calcu-lating the EAROM's checksum and then comparing it to the checksum bit stored in the ROM.

The power-on self test executes each time power is applied. Should an error be detected during the test an error message will be displayed in the lower right-hand corner of the display. These error messages are defined in Table 7-1.

Table 7-1. Error Message Definition

Error Message	IC Location	Definition
Ø	IE	RAM failure 1st 2K byte block
1	1D	RAM failure 2nd 2K byte block
P	1J	Control PROM error
R	3F or 1C	Display row buffer error
9	6J	EAROM checksum error
X	NA	Modem port error
Y	NA	AUX TCOM port error
Z	3K	CPU failure

7.2   DIAGNOSTIC SELF TEST

The diagnostic self test routine is entered via the setup. This test includes the same memory tests as the power-on self test and additionally tests the telecommunications circuitry. Two special jumpers are required to allow the communications test to function. (See Figure 7-1 for jumper definitions.) The diagnostic test will (after being invoked) continue to run until halted. Should an error be detected during this testing, an error message will be displayed in the lower right-hand corner of the CRT. (See Table 7-1 for error message definition.)

To enter the diagnostic test, follow the steps outlined below:

1. Install a TCOM test plug on both the AUX and modem ports.

2. Enter the setup by pressing **SHIFT** and **SET UP** simultaneously.

3. Press ▼ (cursor **DOWN**) until the TEST parameter appears on the display in the bottom row of the screen.

4. Press ► (cursor **RIGHT**) until the TEST parameter field is highlighted by the cursor.

5. Change the TEST parameter field to ON.

6. Press the **SPACE BAR** to enable the self test. The self test begins execution and continues until halted.

    Press **FUNCT** at this point to switch between 80 and 132 columns.

7. To halt the diagnostic self test, press and hold down **SHIFT** with **SET UP** once more.
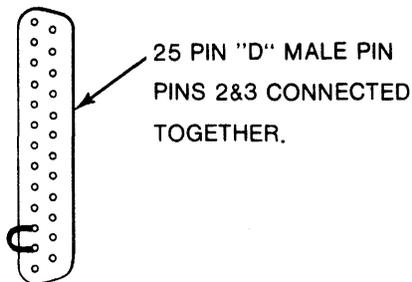
25 PIN "D" MALE PIN
PINS 2&3 CONNECTED
TOGETHER.

Figure 7-1.   TCOM TEST PLUG

7.3   TROUBLESHOOTING FLOW CHART

The troubleshooting flow chart is designed to aid in the location of a faulty module. It is not possible to list all of the possible faults and causes in a product as complex as the WY-50. It is recommended that the technician be familiar with the contents of this manual.
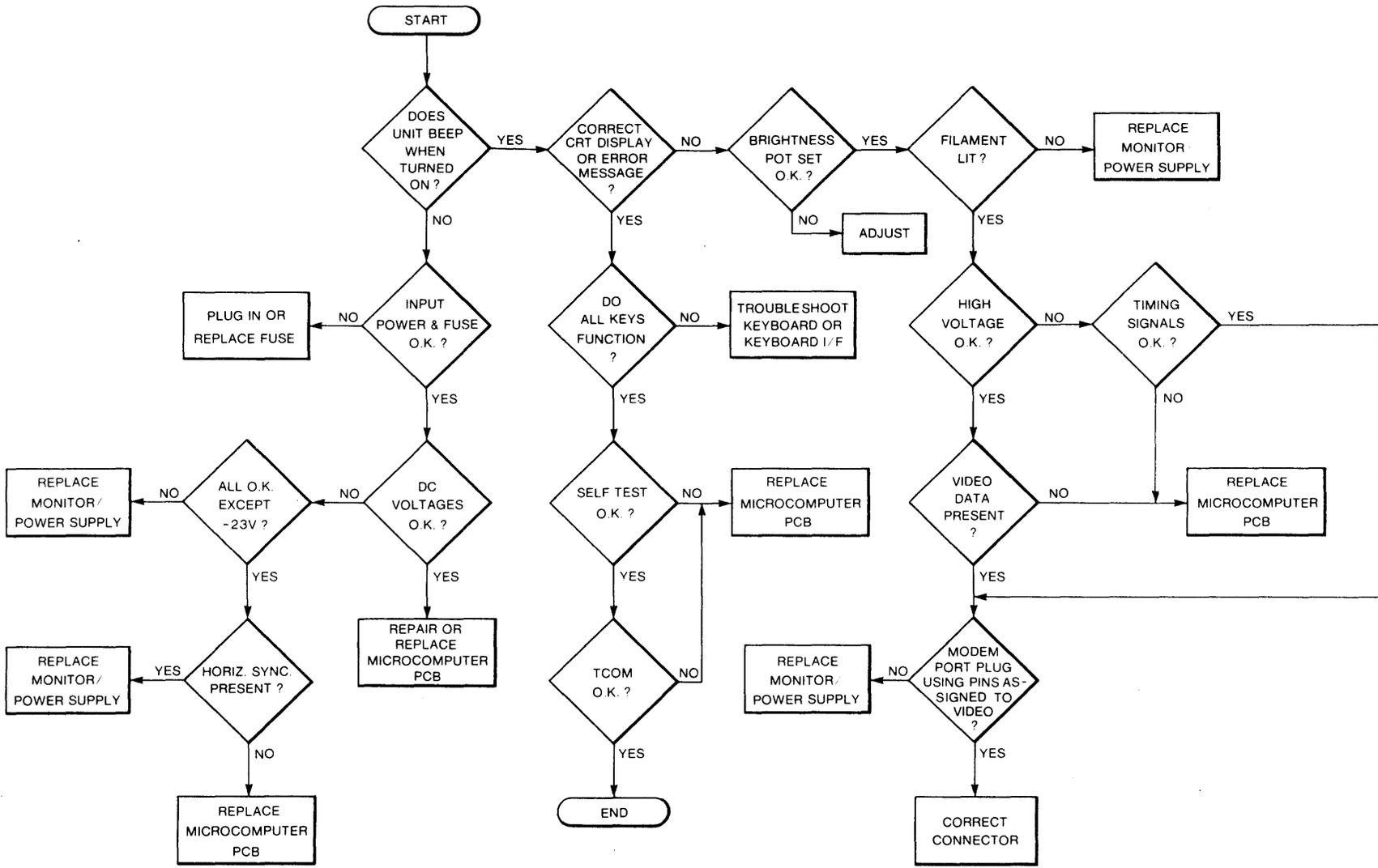
Figure 7-2.   TROUBLESHOOTING FLOW CHART

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