WANG

3401

INTEGRATED TERMINAL

Model: 2236DW

Customer Engineering
Product Maintenance Manual

741-0903

Preface

This document is a reprint of the 2236DW Integrated Workstation Product Maintenance Manual.

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with instructions to operate, troubleshoot and repair the 2236DW Integrated Workstation.

Edition

Third Edition (November, 1984)

This reprint of the 2236DW Integrated Workstation manual (741-0903) obsoletes document(s) no. 729-0903, 729-0903-A, 729-0903-A1, Service Bulletin No. 80, Service Bulletin No. 80A. The material in this document may only be used for the purpose stated in the Preface. Updates and/or changes to this document will be published as Publications Update Bulletins (PUB's) or subsequent editions.

Proprietary Notice

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MODEL 2236DW INTEGRATED TERMINAL

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SECTION 1
INTRODUCTION

1.1 SCOPE

This publication contains information necessary to unpack, install, and maintain the 2236DW Integrated Terminal. Also contained herein is a functional description of the 2236DW. Electrical and physical specifications and an explanation of the various features are included as well.

1.2 TERMINAL FACTORS

The 2236DW Integrated Terminal is a Z80-based CRT/Workstation. It consists of a 12 inch (30.4 cm) diagonal measure CRT, a KEYTRONIC capacitive-type keyboard (#725-2637), a 210-7456 twelve inch monitor sweep PCB, and a 210-7592-1 (initial shipments will use a version of PCB 7592 which is designated 210-7592-1) logic-and-power supply PCB containing a Z80 microprocessor and its supporting components (including PIO, CTC, UART and PROMs). By locating the logic and its power supply on one terminal board, production, installation, and maintenance have been simplified.

The 2236DW is an enhancement of the existing 2236DE. It offers the same features of the DE plus the added capabilities of supporting Wang 2200/WP Word Processing Software. Users may now perform word processing and data processing applications at the same terminal. The new terminal features include:

- Word Processing style cursor control and function keys which support the integrated Word Processing and Data Processing functions.
- Repeating keys and underlined characters
- Character display attributes including bright, blinking, and underlined characters plus reversed video
- Graphics character set
- Box graphics
- Interface to local printer independent of the CPU
- Self Test diagnostics

SECTION 2 GENERAL DESCRIP-TION

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SECTION 2
GENERAL DESCRIPTION

2.1 CRT DISPLAY

The 2236DW Integrated Terminal contains a 12-inch (30.5 centimeter) diagonal measure Cathode Ray Tube (CRT) screen display. The CRT displays a full 128-character set, including uppercase and lowercase keyboard characters, some foreign language characters, special symbols, and underlining. The CRT also displays an alternate character set of graphic characters and box graphics. All characters may be displayed using one or more of several character display attributes.

The CRT has a 24-line, 80 characters-per-line capacity (1,920 character positions) for full-screen operator prompting and verification of keyed characters. Brightness and contrast controls provide a sharp, clear image on the screen. Display speed is approximately 2,000 characters per second at 19,200 baud. A cursor, resembling an underscore, indicates the location on the display where the next character will appear. In addition to controlling cursor movement and positioning from the keyboard, a number of codes can be used to manipulate the cursor under program control for specially formatted displays.

2.2 THE KEYBOARD

The 2236DW Integrated Terminal is equipped with a new combination keyboard (WLI part #725-2637) which features the conventional typewriter format plus a numeric keypad as well as cursor control and editing and special function keys normally associated with Wang Word Processing systems (See Figure 2-1). The following paragraphs describe the actions associated with each group of keys. For convenience of discussion, the keyboard has been divided into four zones as shown in Figure 2-1.

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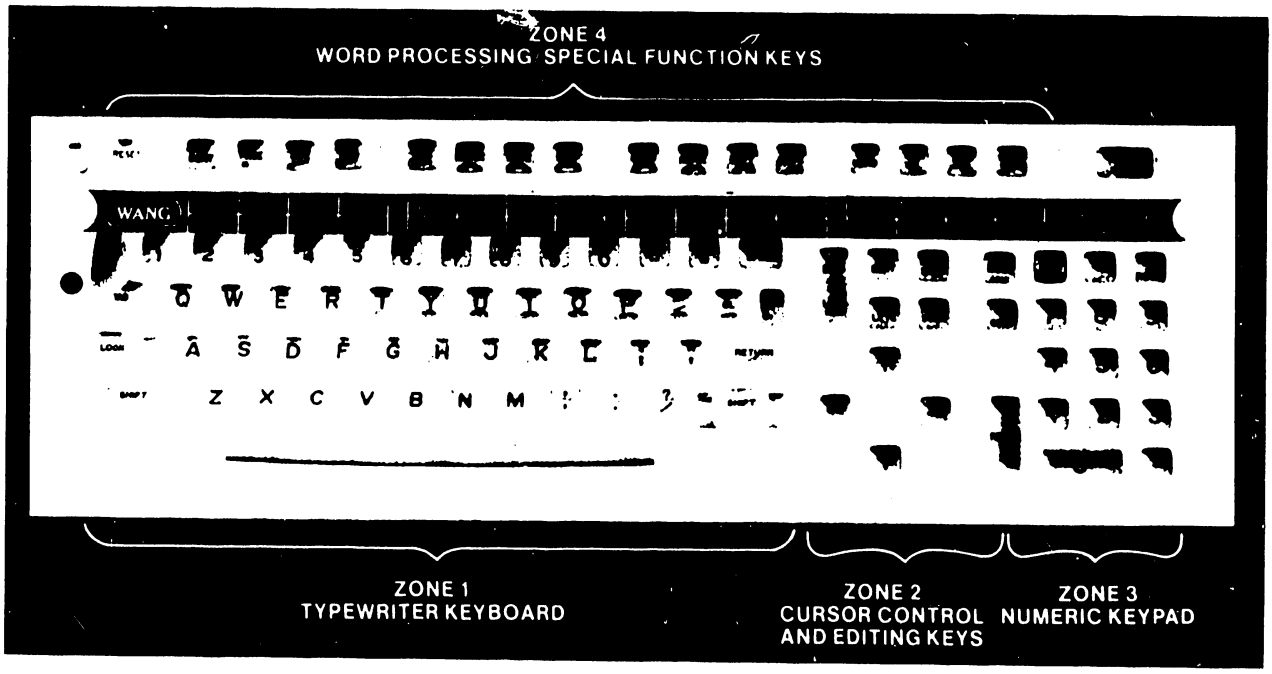

Figure 2-1 The Model 2236DW Keyboard

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Zone 1 - Typewriter Keyboard -- Similar to a standard typewriter, this zone contains the alphanumeric characters, the special purpose characters such as @ # $ ¢ and the arithmatic operators "+ - * / = ", TAB, GL, RETURN and SHIFT keys which perform the following functions:

- TAB sets the format line zone and advances the cursor through successive zones on the screen to facilitate table creation.

- GL (glossary) is a useful function in Word Processing whereby repeatedly used text may be created once, stored on disk and retrieved again with two keystrokes; GL followed by the glossary number.

- RETURN terminates the present text line and repositions the cursor at the beginning of the next line.

Zone 2 - Cursor Control and Editing Keys -- This zone contains Editing keys (INSERT and DELETE), Location keys (NEXT SCRN and PREV SCRN), and Cursor Control keys (control movement of cursor in indicated direction -- up, down, right, and left).

Zone 3 - Numeric Keypad -- The numeric zone is designed like a standard 10-key numeric pad for rapid entry of numeric characters. The numeric keys are grouped here for convenience. Digits may be entered by using the numeric keys in either the numeric or the alphanumeric zone. This zone also includes such keys as ERASE, HALT/CONT, and RETRN.

Zone 4 - Word Processing/Special Function Keys -- Across the top of the keyboard are 16 Word Processing/Special Function keys. When using the word processing software, the Word Processing Function keys simplify document creation and revision. For example, the CENTER key automatically centers a line of text, the MOVE key allows any amount of text to be moved within a document, and the REPLC key allows a character-defined sequence to be replaced with another within a document.

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A summary of special function keys follows:

1. AUTOSCORE MODE

   To underscore (underline) new text and inserted characters as they are entered by the operator.

2. BACKSPACE

   To move the cursor backwards through text. Usually to strike over incorrect text.

3. CANCEL

   To terminate any function or operation before the EXECUTE key has been touched.

4. CENTER

   To center text automatically on a line.

5. COPY

   To highlight consecutive text in one part of a document, and copy it to another location in the same document. Both parts of the document will contain the same exact text.

6. CURSOR CONTROLS

   To position the cursor on the screen, or to move the cursor to the beginning or end of the screen.

7. DECIMAL TAB

   To automatically align columns of numbers on their decimal points, or to right justify any column of text or figures without decimal points.

8. DELETE

   To highlight consecutive text in a document, and to remove it from that document.

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9. EXECUTE

To signal the system that the present course of action is acceptable to the operator.

10. FORMAT

To set or change the right hand margin, tab settings, and/or vertical print spacing between lines.

11. GLOSSARY

To automatically have the system recall and enter into a document some previously-created text or instructions.

12. GO TO PAGE

To replace the current screen with any desired page of a document.

13. INDENT

To indent paragraphs or any section of text automatically.

14. INSERT

To insert any amount of text into an existing document.

15. MERGE

To create letters or documents with provision for the future addition of "variable" information from a second document. To combine two documents into one.

16. MOVE

To highlight consecutive text in one part of a document and then move it to another part of that document.

17. NEXT SCREEN/PREVIOUS SCREEN

To view any screenload of text in a document.

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18. NOTE

To allow non-printing comments (notes) to appear on the screen but not on the printed document.

19. PAGE

To define the end of a page.

20. REPLACE

To highlight consecutive text in a document and then replace it with other text.

21. RETURN

To end a line of type and bring the cursor to the start of the next line.

22. SEARCH

To search through a document and stop at any defined character sequence.

23. STOP

To stop the printer. Usually for changing the print wheel or sometimes, the forms.

24. SUBSCRIPT, SUPERSCRIPT

To allow the printer to move up and/or down one half (1/2) line from the main typing line to create subscripts and/or superscripts.

25. TAB

To indent the beginning of a paragraph or other text not on the left margin.

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The word processing keys also serve as special function keys that can be set up by the programmer to perform program-defined functions. Since each of these keys may be pressed in conjunction with the SHIFT key, a total of 32 special function keys is available. The keys are numbered '0 -- '15 (lowercase) and '16 -- '31 (uppercase). Simultaneously pressing a key numbered '0 -- '15 with SHIFT accesses a key from '16 -- '31. The function key number is labeled on the front surface of each key. Additionally, the TAB key and the GL key in Zone 1 can be used as special function keys.

Special function keys may be used to perform a variety of tasks, e.g., start program execution, access subroutines, or enter a predefined text string. The operator is informed of the meanings of the special function keys either by screen prompts or by means of the label strip located immediately below this row of keys. In order to perform a given task, a special function key must be defined by the user with a DEFFN' statement in the currently loaded program. The special function keys are also used during master initialization to load the BASIC-2 interpreter and operating system.

The keyboard has two modes of operation, selected by a toggle switch labeled A/A and A/a. The dual mode keyboard is designed for both data processing and word processing applications.

In Programmer's mode (A/A), uppercase alphabetic characters are produced, whether the keyboard is shifted or unshifted. Shifted numeric keys produce symbols and special characters. In Operator's mode (A/a), the keyboard functions as a standard typewriter, producing uppercase and special characters when shifted, and producing lowercase and numeric characters in unshifted operation.

The 2236DW also includes a Caps Lock feature. In either A/A or A/a mode: Caps Lock (activated by pressing the lock key) produces uppercase alphabetic characters; all other characters, such as the numeric keys, are lowercase. (Refer to Table 2-1 for a detailed listing of the performance of the keys in each different operating mode.)

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Table 2-1 Operation of Keyboard Modes

	A/A mode	A/a mode
Unshifted Operation	Alpha Keys -- Uppercase Punctuation -- Lowercase Numerics -- Lowercase (numbers) Special Function -- '0 to '15 CONTINUE -- Active HALT -- Inactive RESET -- Inactive ERASE -- From cursor position LOAD RUN key -- RUN	Alpha Keys -- Lowercase Punctuation -- Lowercase Numerics -- Lowercase (numbers) Special Function -- '0 to '15 CONTINUE -- Active HALT -- Inactive RESET -- Inactive ERASE -- From cursor position LOAD RUN key -- RUN
Caps Lock Operation	Alpha Keys -- Uppercase Punctuation -- Lowercase Numerics -- Lowercase (numbers) Special Function -- '0 to '15 CONTINUE -- Active HALT -- Inactive RESET -- Inactive ERASE -- From cursor position LOAD RUN key -- RUN	Alpha Keys -- Uppercase Punctuation -- Lowercase Numerics -- Lowercase (numbers) Special Function -- '0 to '15 CONTINUE -- Active HALT -- Inactive RESET -- Inactive ERASE -- From cursor position LOAD RUN key -- RUN
Shifted Operation	Alpha Keys -- Uppercase Punctuation -- Uppercase Numerics -- Uppercase (symbols) Special Function -- '16 to '31 CONTINUE -- Inactive HALT -- Active RESET -- Active ERASE -- Line Erase LOAD RUN key -- LOAD	Alpha Keys -- Uppercase Punctuation -- Uppercase Numerics -- Uppercase (symbols) Special Function -- '16 to '31 CONTINUE -- Inactive HALT -- Inactive RESET -- Inactive ERASE -- Line Erase LOAD RUN key -- LOAD

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The keyboard allows characters to be underlined. On non-English versions of the keyboard, characters can also be accented. All keys on the keyboard will repeat if held down. The microprocessor in the terminal automatically adjusts the repeat key rate according to the rate at which characters are being echoed to the CRT. The keyboard clicker sounds each time the repeated character is transmitted. Thus, both aural and visual evidence of the repeated character are given to the user. (The repeating key is particularly useful for moving the cursor when editing.)

Special features of the Model 2236DW keyboard include the following:

- Keyboard Clicker -- The clicker provides audio feedback when a key is sufficiently pressed. The volume of the keyboard clicker may be adjusted.

- N-key Rollover -- This feature permits a new key to be pressed and output to the terminal while a previous key is still being held down. This process can continue for any number of keys; each new key pressed takes precedence over any keys already held down. The N-key rollover feature helps eliminate errors during high-speed typing.

- Terminal Alarm -- The alarm provides audio feedback to indicate the occurrence of errors or special conditions, e.g., pressing an undefined special function key, typing beyond a specified field, displaying an error message. The volume of this audio alarm may also be adjusted.

The RESET key, located in the upper-left corner of the keyboard, immediately stops program execution, listing, and I/O operations; clears the CRT; homes the cursor; signals ready; and returns to the console user (Console Input mode). RESET is also used during master initialization and hardware diagnostic operations. The RESET key is an undesirable means of terminating execution and generally should not be used to end program execution; HALT should be used for this purpose. As a protective feature, RESET and HALT are active only in Programmer's mode (A/A), and only if pressed in conjunction with the SHIFT key.

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NOTE

On a 2200MVP or LVP, RESET affects only the partition to which the terminal is currently attached (the terminal's foreground partition). No other partitions are affected by RESET.

The new keyboard requires a new face plate (WLI part #452-2401-XA) to fit the particular distribution of keys and it should be ordered with the new keyboard in the event of upgrading the 2236DE to 2236DW. Otherwise the new keyboard is conventional in geometry and hookup to the terminal.

2.3 TERMINAL/CPU INTERFACE

Each 2236DW Integrated Terminal is connected to either a 2236MXD Terminal Processor or a 22C32 Triple Controller when configured with a 2200MVP, LVP, or VP Central Processing Unit. Existing controllers must be revised to current standards to support the 2236DW terminal as follows:

A) Change the two PROMs on PCB 210-7516-A

FROM	TO
378-4092	378-4092-R1
378-4093	378-4093-R1

B) Change the two PROMs on PCB 210-7789-A

FROM	TO
378-4092	378-4092-R1
378-4093	378-4093-R1

C) Change the four PROMS on PCB 210-7591-A

FROM	TO
378-2140-R06	378-2140-R07
378-2141-R06	378-2141-R07
378-2142-R06	378-2142-R07
378-2143-R06	378-2143-R07

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D) Change the four PROMs on PCB 210-7816-A

FROM	TO
378-2591	378-2591-R1
378-2449	378-2449-R1
378-2450	378-2450-R1
378-2451	378-2451-R1

NOTE: The above changes do not affect other devices operating from the CPU: ie., all previously supported devices remain compatible after the changes.

These devices handle I/O operations between the CPU and the terminals, and buffer data entered from or transferred to the terminals.

The 2236MXD terminal processor is used on the 2200MVP CPU, which can support 12 terminals (4 per terminal processor). The Model 2236MXD is also used on the 2200LVP, which can support 4 terminals. Because 2200/WP Word Processing Software requires 28K of user memory per terminal, the maximum number of terminals that can simultaneously operate WP varies with available user memory. The 22C32 Triple Controller supports a single terminal and can be used on the 2200VP, MVP, and LVP CPU. The 2236DW plugs directly into the terminal connector on back of th SVP CPU; no additional controllers are necessary.

Model 2236DW terminals can be attached locally to the 2200MVP or LVP CPU at distances up to 2000 feet (606.1 meters), or remotely via modems and telephone lines. Terminals connected to a 2200SVP or LVP CPU can be attached locally at a maximum distance of 50 feet (15.2 meters) and 2000 feet (606.1 meters) respectively. Communication between the terminal and the CPU is asynchronous and full-duplex, with selectable line speeds ranging from 300 to 19,200 bits per second (bps). To accelerate communications between the terminals and the CPU, the system performs automatic data compression on information transmitted to each terminal.

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Each 2236DW can support its own terminal printer which can be used for program output. Additionally, hard copy of CRT displays can be created at each terminal site. A dump of the display screen to the terminal printer may be initiated from the keyboard, resulting in the printing of all standard characters present on the screen. The screen dump feature requires no special software and can be performed at any time.

The 2236DW and its controller employ microprocessors to optimize data throughput. For example, strings of four or more identical characters are compressed for transmission into 3-byte blocks. A ready/busy protocol controls information flow between the terminals and the terminal processor. Thus, it is unnecessary for the attached printer to keep up with the serial communication line data rate. These features are automatic and are completely transparent to the software executing in the 2200 CPU.

As an added feature, the 2236DW performs self-testing diagnostics every time it is turned on. These diagnostics ensure optimal terminal condition before use. If the unit fails one of the tests, a continuous alarm sounds, alerting the user to the failure. The tests allow a Wang Customer Service Representative to quickly identify the problem and minimize downtime.

The 2236DW terminal also incorporates a power supply that relies on air convection cooling, rather than a fan. This feature provides quiet terminal operation.

Any standard Wang printer or plotter with a 36-pin cable connection may be plugged into the printer connector on the 2236DW Integrated Terminal. A Wang-supplied direct-connection cable or an optional modem cable plugs into a RS-232-C-compatible connector on the terminal.

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2.4 THE SCREEN DUMP

The screen dump feature allows the user to obtain a hard copy record of the CRT on a printer attached to the terminal. Screen dump is a temporary off-line terminal operation which may be initiated only by the terminal operator. In fact, a BASIC-2 program can neither initiate nor detect the activation of a screen dump. Therefore, the screen dump may be used to preserve hard copy records of the screen even after the program has stopped with an error or after a CPU failure. However, this also means it is the terminal operator's responsibility not to activate screen dump while the terminal printer is in use. If screen dump is activated while a program is using the printer, the screen dump output will be inserted on its own separate page, and printing will then resume without missing any characters. To activate a screen dump, use the following procedure.

1. Press the EDIT key and hold it down for approximately two seconds. An immediate click will be heard. The CRT image will be frozen with the image to be dumped.

2. When a second click is sounded, the screen dump has been activated. (If the EDIT key is released before the second click is heard, the key is treated as the EDIT key and the screen image is unfrozen.)

3. The screen image is transmitted to the printer, preceded by a carriage return and form feed, which neatly formats the output. (If a screen dump is activated while a program is using the printer, the screen dump output will be inserted on its own separate page.)

4. The screen dump ends with another form feed.

5. Normal processing of output from the CPU is resumed. (No data is lost, even if the CPU has attempted output to the CRT or printer while the screen dump was in progress.)

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During a screen dump, the keyboard remains active. Pressing any key will terminate the screen dump and restore normal processing. If the screen dump fails, make sure the printer is selected and try again. If the screen dump still fails, use the CLEAR button found on many printers. Do not use the terminal's RESET, because it will clear the screen.

It is not possible for a screen dump to produce an exact image of the screen because the terminal microprocessor cannot tell what sort of printer is attached to the terminal. A conservative subset of the CRT character set is therefore employed during a screen dump. The USA version of the Model 2236DW can screen dump all characters between HEX(20) and HEX(7E), including all uppercase and lowercase characters on the keyboard. Underlined characters are translated to their nonunderlined equivalents. The actual character set used for screen dump varies among the international versions of the terminal. However, the following general rules do apply.

1. Any character not in the screen dump character set is translated to the number symbol (#).
2. Display attributes are ignored. All characters are printed in the same font and pitch.
3. Character set graphics are also translated to the number symbol (#).
4. Box graphics are ignored.

CAUTION

Since normal printing is interrupted when a screen dump is requested, the screen dump will be inserted into a report already printing. Although screen dumps eject a page before and after a dump, the user's report may be temporarily halted in the middle of the page. For some reports, this may be acceptable, but for preprinted forms such as invoices or customer statements, a screen dump which interrupts current printing could present problems.

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2.5 MODEL 2236DW TERMINAL SPECIFICATIONS

Size

Height	13.5 in. (34.3 cm)
Depth	20.5 in. (52.1 cm)
Width	19.8 in. (50.3 cm)

Weight

41.0 lb (18.6 kg)

CRT

Display Size	12 in. diagonal (30.5 cm)
Capacity	24 lines, 80 characters/line
Character Height	0.16 in. (0.41 cm)
Character Width	0.09 in. (0.23 cm)

Character Set

128 characters, including uppercase and lowercase letters; each character is assigned one or more attributes for high- or low-intensity display, reverse video, blinking, or underlining. Additional alternate character set consisting of 64 graphic characters and other special symbols is supplied. Also capable of displaying line-segment (box) graphics, separate from either character set.

Keyboard

Typewriter keyboard which can generate 88 different ASCII characters, including uppercase and lowercase letters, numbers, and symbols. Also included are a numeric keypad, several program control keys, and 18 program-definable special function keys: 16 numbered keys along the top of the keyboard, and the TAB and GL keys located in the alphanumeric keyboard zone. Each special function key can be used with the SHIFT key for a total of 36 Special Function keys. The keyboard also contains editing keys (INSERT and DELETE), location keys (NEXT SCRN and PREV SCRN), and cursor control keys (controls movement of cursor in indicated direction -- up, down, right, and left).

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Operating Environment

Temperature

50 F to 80 F (10 C to 30 C)

Relative Humidity

35% to 65% noncondensing (recommended)

20% to 80% noncondensing (allowable)

Power Requirements

115 or 230 VAC ± 10%

50 or 60 Hz ± 1.0 Hz

50 Watts

Fuses

2 amp (SB) @ 115 V/60 Hz

1 amp (SB) @ 230 V/50 Hz

Communication Mode

Asynchronous, full-duplex

Transmission Rates

Manually selectable for each terminal at 300, 600, 1200, 2400, 9600, or 19.2K baud

Character Format

When communicating with a 2200MVP, LVP, SVP, or VP system:

1 start bit, 1 stop bit

8 data bits, plus odd parity (11 bits/character)

Other selectable character formats:

8 data bits, no parity

7 data bits, odd parity

7 data bits, even parity (10 bits/character)

PROM Complement

L16	378-3067
L17	378-4095 R2
L18	378-4094 R2
L55	378-2447
L56	EA-ROM

SECTION 3

FUNCTIONAL DESCRIPTION

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SECTION 3
FUNCTIONAL DESCRIPTION

The 2236DW Integrated Terminal is a software-intensive workstation which is controlled by the master CPU. The hardware contained on the logic board, PCB 210-7592-1 is concerned mainly with the management of the display on the screen and the transfer of data and commands between the terminal and the CPU.

The following brief discussion describes the functions performed by the major components indicated in the block diagram shown in Fig 3-1.

UART Handles the communication of data and commands between the terminal and the CPU through the RS 232 connector . The UART is software controlled and transmits data according to a preselected baud rate determined by manually resettable bank of switches . The CPU reads the switches and loads appropriate data pattern into "Baud Rate Decode" which will set the clock period for the UART.

CTC The Counting and Timing Circuit provides the workstation with a general purpose interval timer, mainly used to generate in- terrupts for the Z80 microprocessor in order to intiate actions which require the use of the Z80 buses such as during transmit or receive.

PIO The paralled Input /Output chip acts as interface between the Z80 and other components such as the keyboard and the UART

VTAC The Video Timer And Controller chip is concerned with the management of the display of characters and attributes on the screen. This includes the generation of dot-matrix outlines of characters,the horizontal and vertical sweep signals and the placement of characters in a given row and column . In conjunction with "Character Memory", the VTAC maintains the display on the screen through the block labled "CRT Control Logic" which provides the drive for the CRT.

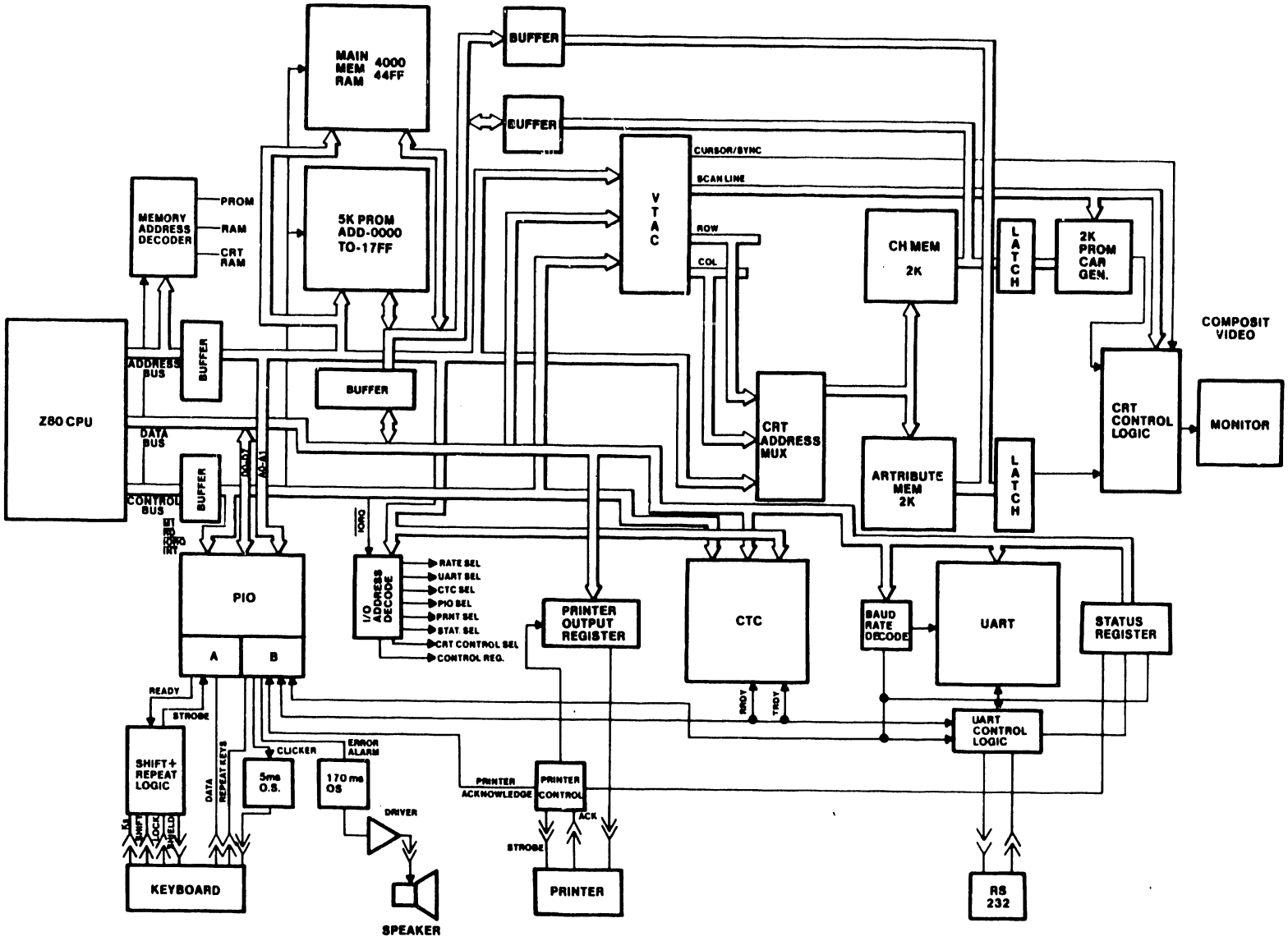

Figure 3-1 Mode 2236DW Block Diagram

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III.D.1M-2A

KEYBOARD This external device interfaces with the PIO when dealing with the terminal's logic . When a key is struck a code is generated and an interrupt is issued to the Z80 which accepts it based on a priority scheme. Repeated interrupts will be generated when a key is depressed for more than 300 ms, and will continue for as long as the key is held down. The clicker will sound when the key code is accepted.

Z80 MICROPROCESSOR This chip supervises the operation of the above cited components,provides control signals and services for their functions and programs them during initializtion and performs limited local processing. The Z80 is provided with operating program in two 2k Bytes of PROMs, L17 and L18 including a power-up diagnostic routine.

The major components of the board are tied together by four main buses:

1. Buffered Address Bus which leads to PIO,"IO Address Decode", CTC and memory
2. Data Bus which connects to PIO, CTC, and UART.
3. Buffered Data Bus which leads to memory and VTAC.
4. Buffered Control Bus which connects to PIO and CTC.

When power is applied to the terminal, the microprocessor is reset and begins executing its program at location 0000 of PROMs L17,18. The program contains the code necessary to initialize the programmable components, VTAC, CTC, UART and PIO for their default functions. The processor also administers a series of tests to verify that vital functions of the board are operational. Should any function fail the test, the microprocessor terminates the test, activates the speaker continuously and flags the error code on an LED; if one is mounted on L10 socket.

When all functions have passed the power-up diagnostics, the microprocessor reads and displays a message which identifies the terminal, its baud rate, parity and the keyboard translation table (USA, international).

3.1 2200 WORD PROCESSING SOFTWARE

Wang's 2200 Word Processing Software is NOT an Operating System package; rather it is an Application package which the customer purchases through normal marketing channels and installs on his own 2200 system. Customer Engineering personel are not required to support the WP software and should refer customer's enquiries to the local Wang software analyst.

The following brief information about the 2200 Word Processing software is included here for your information. This software package functions similiar to the Wang's Office Information System (OIS) software and has the same menus as the OIS WP. The package is released on flexible diskettes in either single-sided single-density diskette type (three diskettes) or double-side double-density diskettes type (one diskette). This package requires a minimum of 28 (twenty-eight) kBytes of user's memory.

The software is installed on the 2200 disk system by selecting the drive where the software diskette resides, then loading "WPINSTLL". A menu will be displayed which requires response to questions such as date, time, destination disk, address, etc. In the event the destination disk does not have sufficient space to accommodate the software (approximately 3000 sectors), the installation procedure will fail. Once the blanks in the menus are filled-in, executing the menu will initiate the transfer of software to the destination disk and the operator will be prompted to remove/load other diskettes as the case may be.

Following the installation on the system disk, the program "WPSUPER" must be loaded and run whereby the Supervisory menu is displayed for the selection of WP defaults. Here the operator creates Volumes which will contain Libraries in which WP Documents will reside.

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The Disk Assignment option must be selected first to designate the WP address on the disk system. The next option selected should be the Volume Maintenance menu where a volume name, address and size are specified; pass word is optional. Finally the Library Maintenance option will be selected to designate libraries, from A through Z and a through z, on the volumes created already. Other selections enable the assignment of certain terminals as WP only on certain libraries and designate certain printers as WP printers.

SECTION 4 SITE PREPAR-ATION

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SECTION 4
SITE PREPARATION

The 2236DW is designed to operate in a normal office environment; radical changes in temperature or humidity can adversely affect the terminal. The 2236DW should be located in an environment similar to that of the central processor and a separate grounded outlet should be provided for it. Refer to the Model 2200MVP Maintenance Manual (03-0071-1), Section 2 for more details.

SECTION 5

UNPACKING AND INSTALLATION

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SECTION 5
UNPACKING AND INSTALLATION

The 2236DW is shipped completely assembled. An 8 foot (2.4 m) AC power cord and one 25 foot (7.6 m) direct-connection (signal) cable is supplied with each terminal. Longer direct-connection cables can be ordered if desired. Refer to Section 10 for cable part numbers.

Before unpacking the terminal, check the packing slip to ensure that the proper equipment has been delivered. After checking the packing slip, inspect the shipping carton for damage (crushed corners, punctures, etc.). If the carton appears undamaged, carefully remove the terminal and inspect it for damage. If damage is discovered, file an appropriate claim promptly with the carrier involved and notify the WLI Ditribution Center (Dept. #90), Quality Assurance Dept., Tewksbury, MA 01876. Inform them of the extent of damage and arrange for equipment replacement if necessary.

After inspecting the terminal exterior, trace the outline of the exposed portion of the CRT screen with a grease pencil. This outline is used in Section 4.3 for video display adjustments. (See Figure 5-1.)

Remove the terminal cover as follows: (See Figure 5-2.)

a. Remove the three Phillips screws located under the plastic strip on the keyboard and remove the keyboard plate.
b. Remove the Phillips screw on the left and right side of the terminal cover.
c. Lift the cover up and away from the terminal; take care not to hit or nick the CRT, or strain the Brightness/Contrast wires.
d. Remove the Brightness and Contrast control wires from the clamp on the side of the cover. Lay the cover on its side next to the terminal. Do not unplug the Brightness and Contrast Molex connector from the cross-brace at the top of the CRT.
e. Remove foam packing material from front of 210-7456 PCB.

III.D.1M-2A

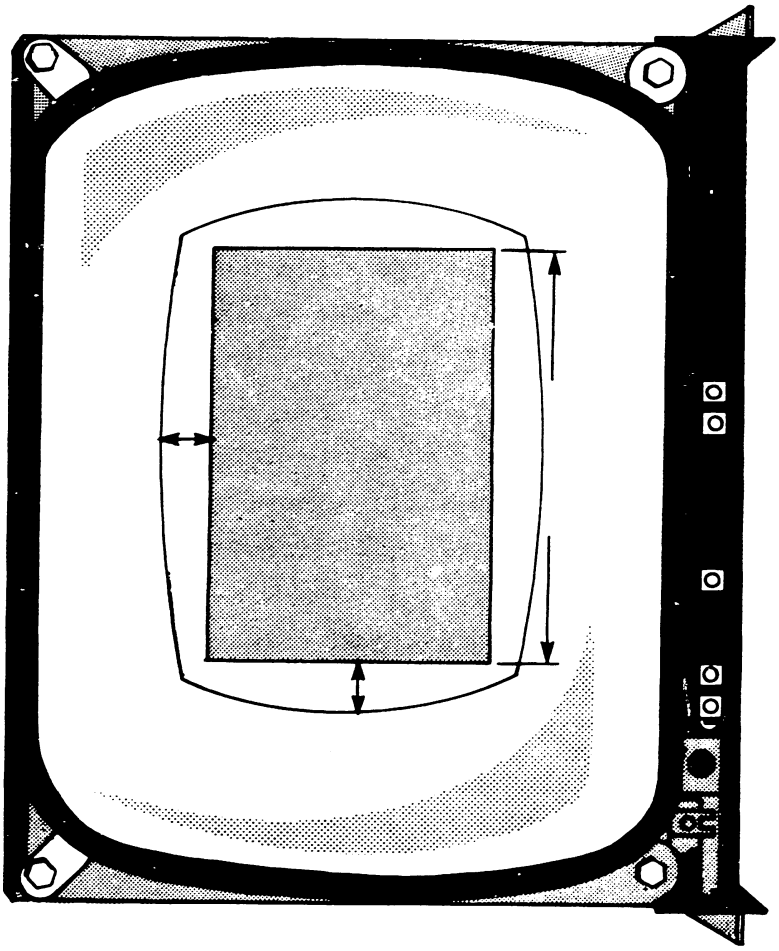

Figure 5-1 CRT Outline

III.D.1M-2A

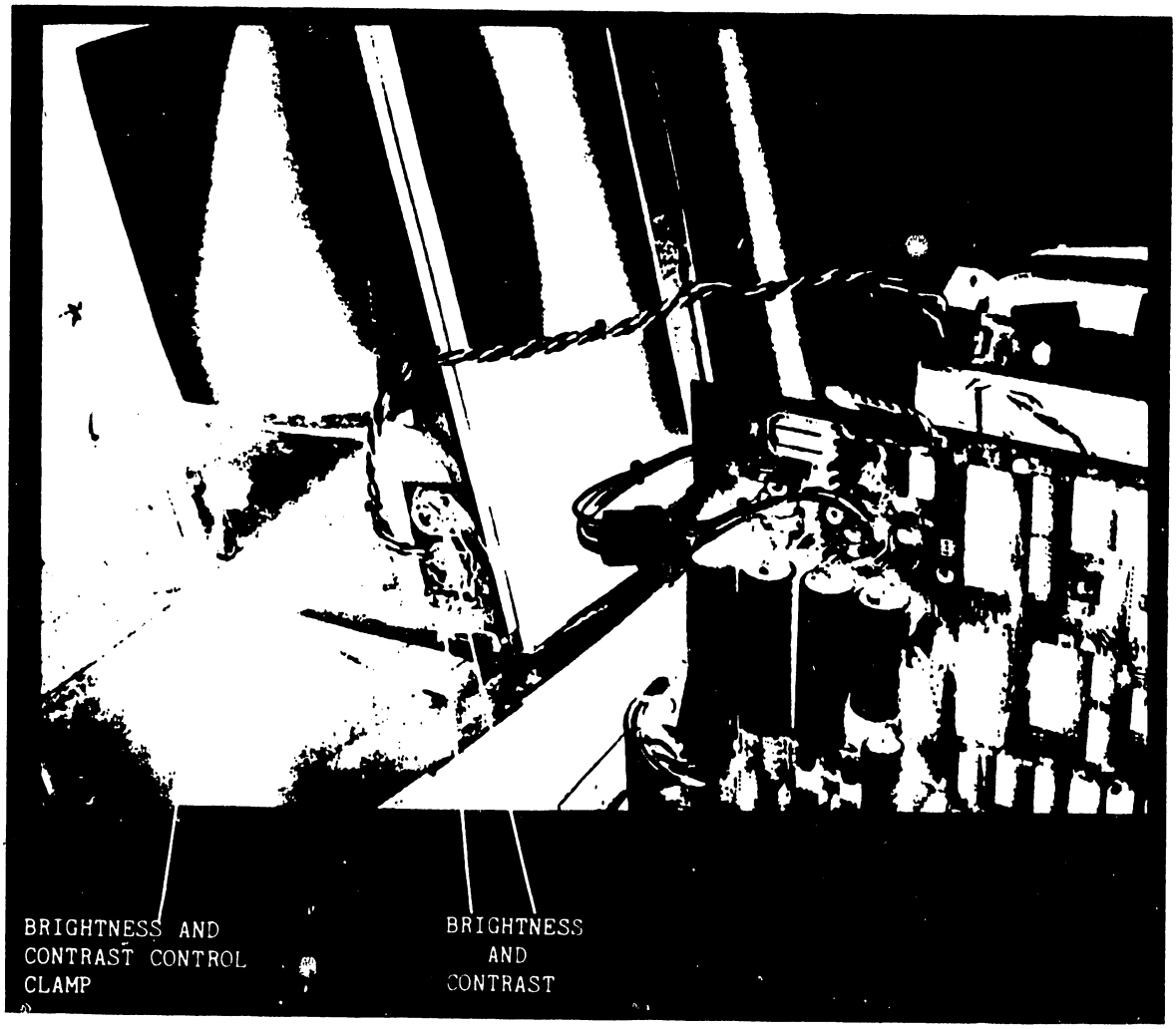

Figure 5-2 CRT and Cover

III.D.1M-2A

Visually inspect the inside of the terminal for metal shavings, solder splashes, loose connections, and improperly seated PCBs. Do not replace the cover at this time.

5.1 VOLTAGE AND FREQUENCY SELECTION

The 2236DW operates on either 115 or 230 VAC and at either 50 or 60 Hz. Before connecting the terminal to a power source, check the serial tag attached to the terminal. Set the voltage-select switch on the lower right side of the CRT monitor to the appropriate position (115 or 230) and ensure that jumper J11 on the 210-7592-1 PCB is in position, if required. Install J11 if the terminal is to operate at 60 Hz, remove J11 if the terminal is to operates at 50 Hz. (See Figure 5-3.)

5.2 VOLTAGE CHECKS AND ADJUSTMENTS

The power supply is located on the 210-7592-1 PCB. Five jumpers, labeled J14, J15, J16, J17 and J18, connect the power supply voltage to the logic circuits. Remove these five jumpers before performing the initial voltage check and adjustments, which are performed as follows: (See Figures 5-4 and 5-5.)

Three of the jumpers are located above the large filter capacitors. The jumper on the left is +20 volts DC. The jumper in the middle is +5 volts DC, and the jumper on the right is +12 volts DC.

****NOTE****

Use only one hand when working inside an electronic chassis that is powered-up. This avoids the risk of grounding oneself to the chassis with one hand while touching an electrical connection with the other, causing severe shock.

a. Place the terminal in its permanent location.
b. Ensure that the terminal ON/OFF switch on the rear of the chassis is in the OFF position. Plug in the AC power cord.

III.D.1M-2A

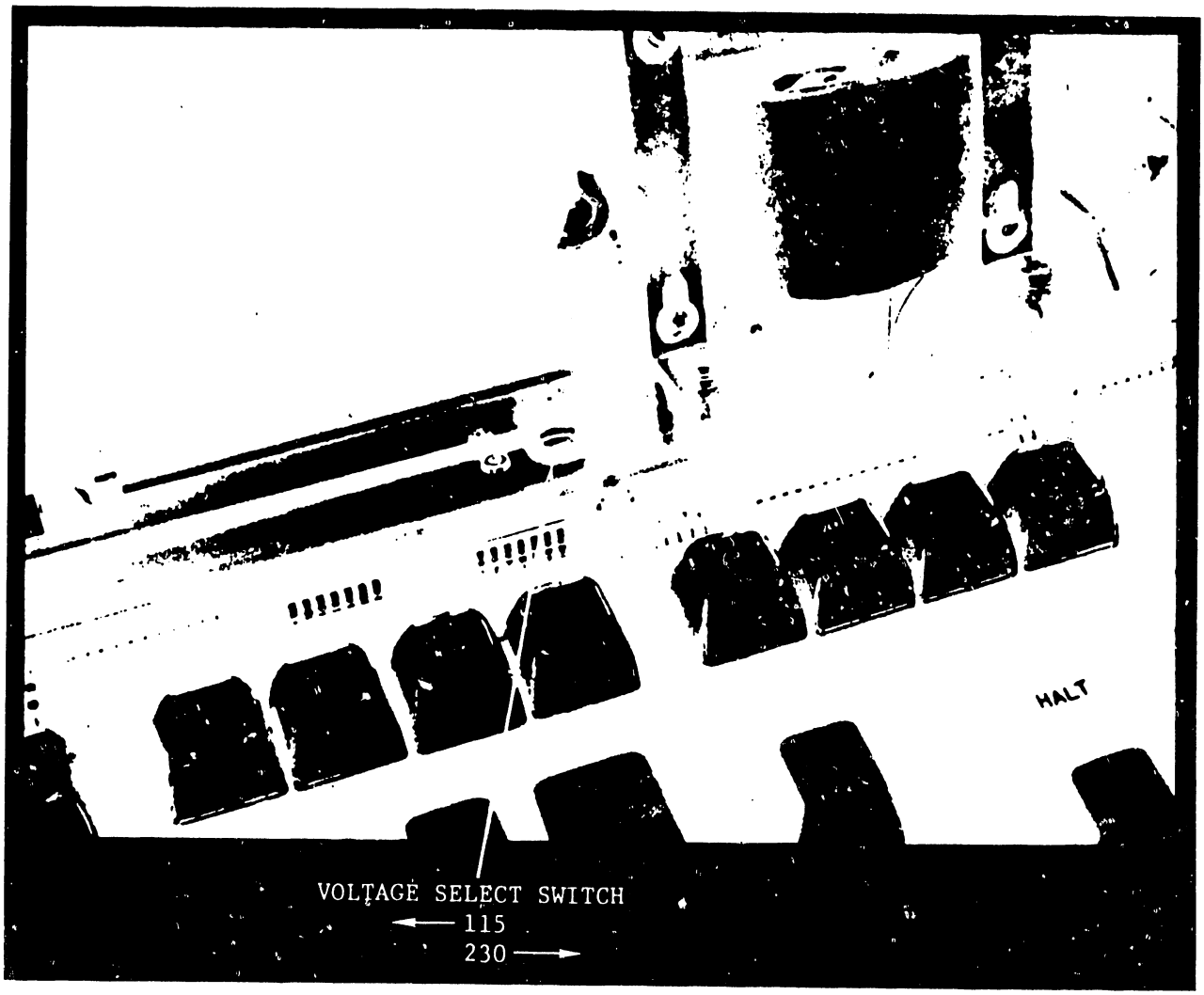

Figure 5-3 Voltage Select Switch

III.D.1M-2A

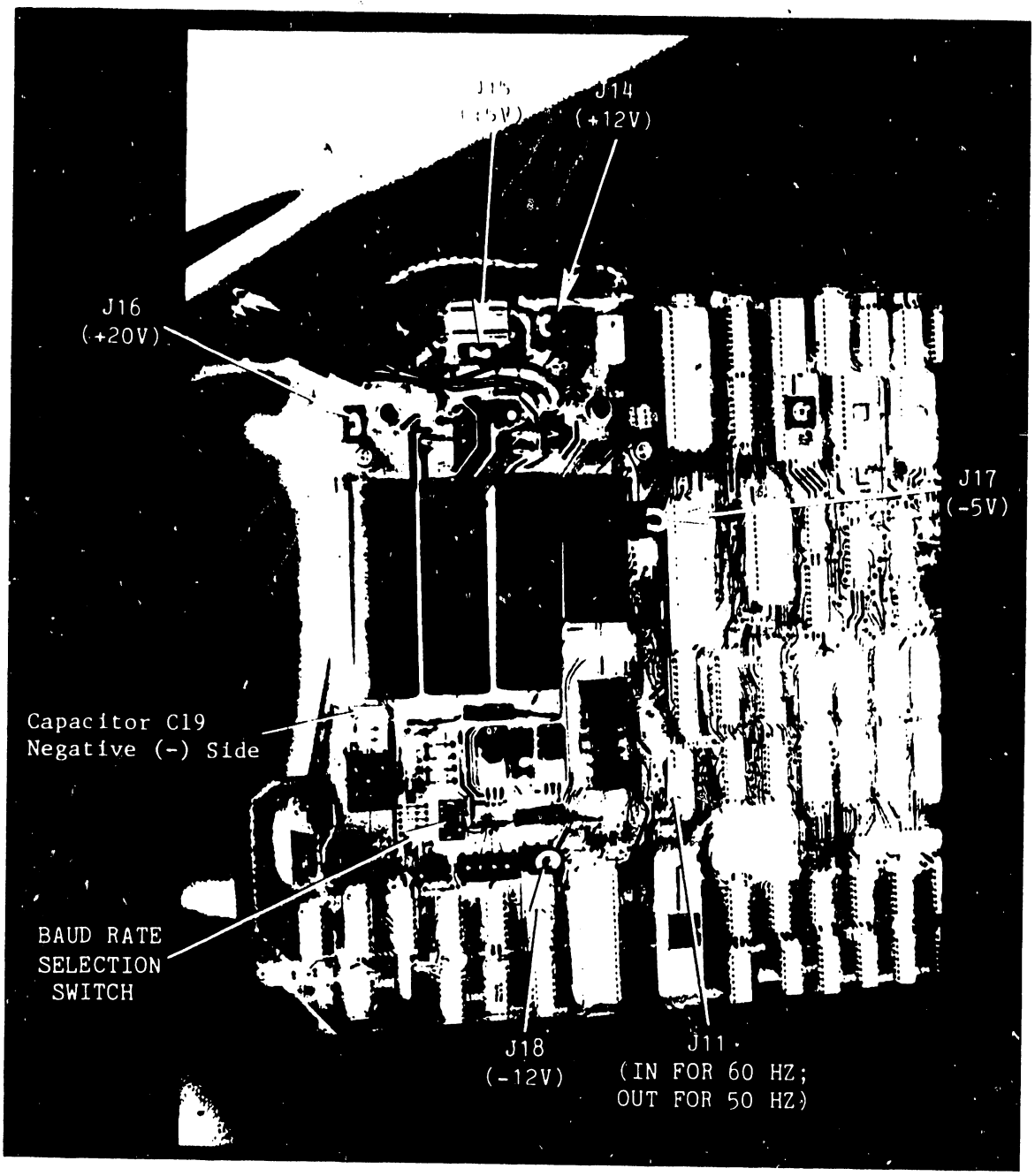

Figure 5-4 Jumper Locations (210-7592 PCB)
and Baud Rate Selection Switch

III.D.1M-2A

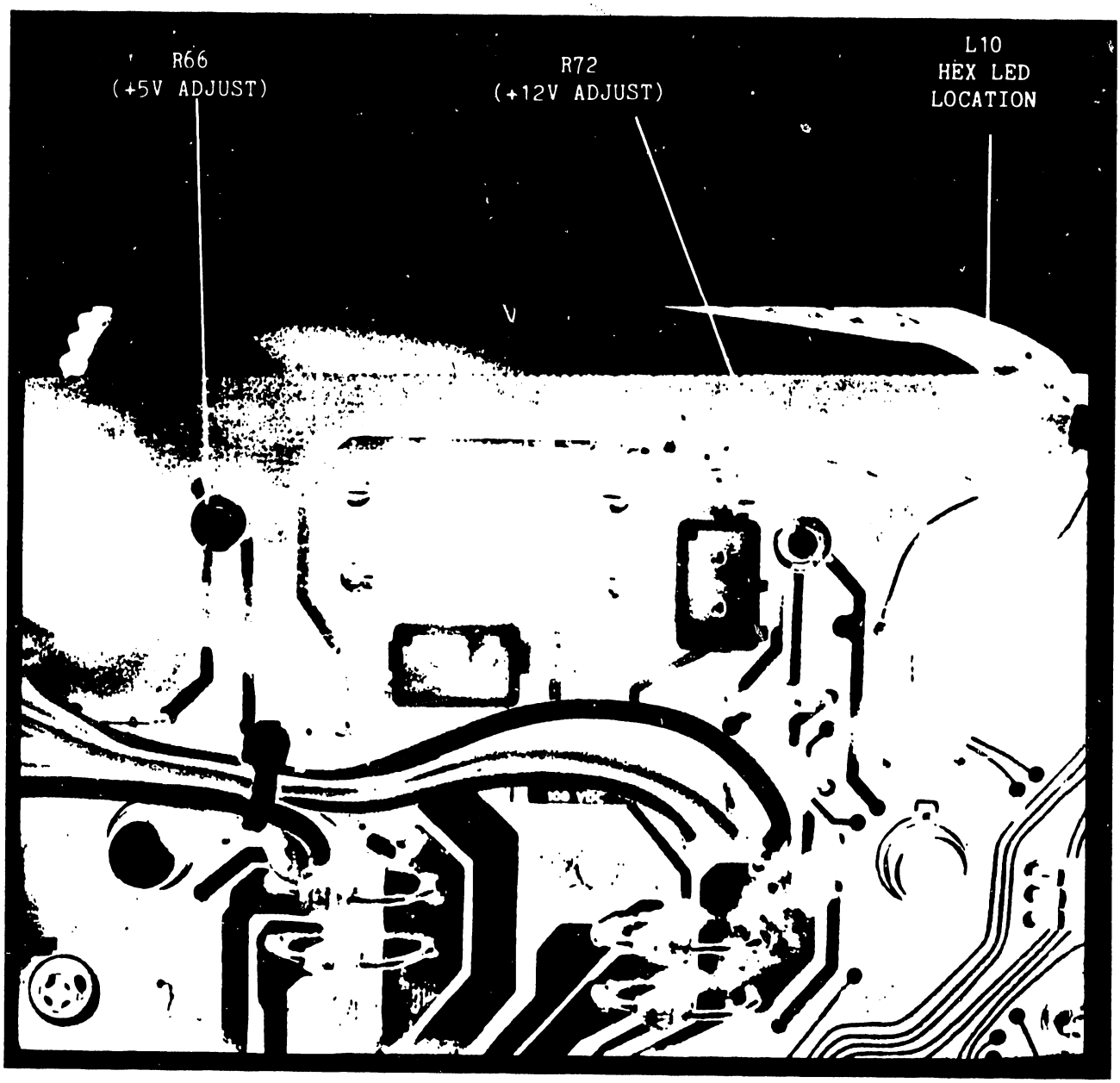

Figure 5-5 Close-Up of R66 and R72

III.D.1M-2A

c. Power-up the terminal.

d. Connect the common lead of a DVM to a ±0V location on the 210-7592-1 PCB. (Negative side of capacitor C19, for example.)

e. Place the DVM probe against pin 1 of the J14 connector; a reading of a +12 VDC ±0.12 should be obtained. Adjust R72 to obtain the proper reading if voltage is out of limits.

f. Place the DVM probe against pin 1 of the J15 connector; a reading of ± 05 VDC ±0.05 should be obtained. Adjust R66 to obtain the proper reading if voltage is out of limits.

g. Place the DVM probe against pin 2 of the J16 connector; a reading of ± 20 VDC ± 3.0 should be obtained. This voltage is non-adjustable, replace PCB if voltage is out of limits.

h. Place the DVM probe against pin 2 of the J17 connector; a reading of - 5 VDC ±0.25 should be obtained. This voltage is non-adjustable, replace PCB if voltage is out of limits.

i. Place the DVM probe against pin 1 of the J18 connector; a reading of - 12 VDC ±0.60 should be obtained. This voltage is non-adjustable, replace PCB if voltage is out of limits.

j. If voltages are within limits, power-down the terminal and reinstall the five jumpers.

k. To check voltage under load conditions, power-up the terminal and recheck voltage readings according to the previous steps. Adjust voltages as necessary.

5.3 VIDEO DISPLAY ADJUSTMENT

The following adjustments should not be attempted by anyone not familiar with CRT servicing procedures and precautions. Avoid prolonged close-range exposure to unshielded portions of the CRT to prevent injury from unnecessary exposure to X-ray radiation. Refer to Figures 5-1 and 5-6 when performing the following procedures.

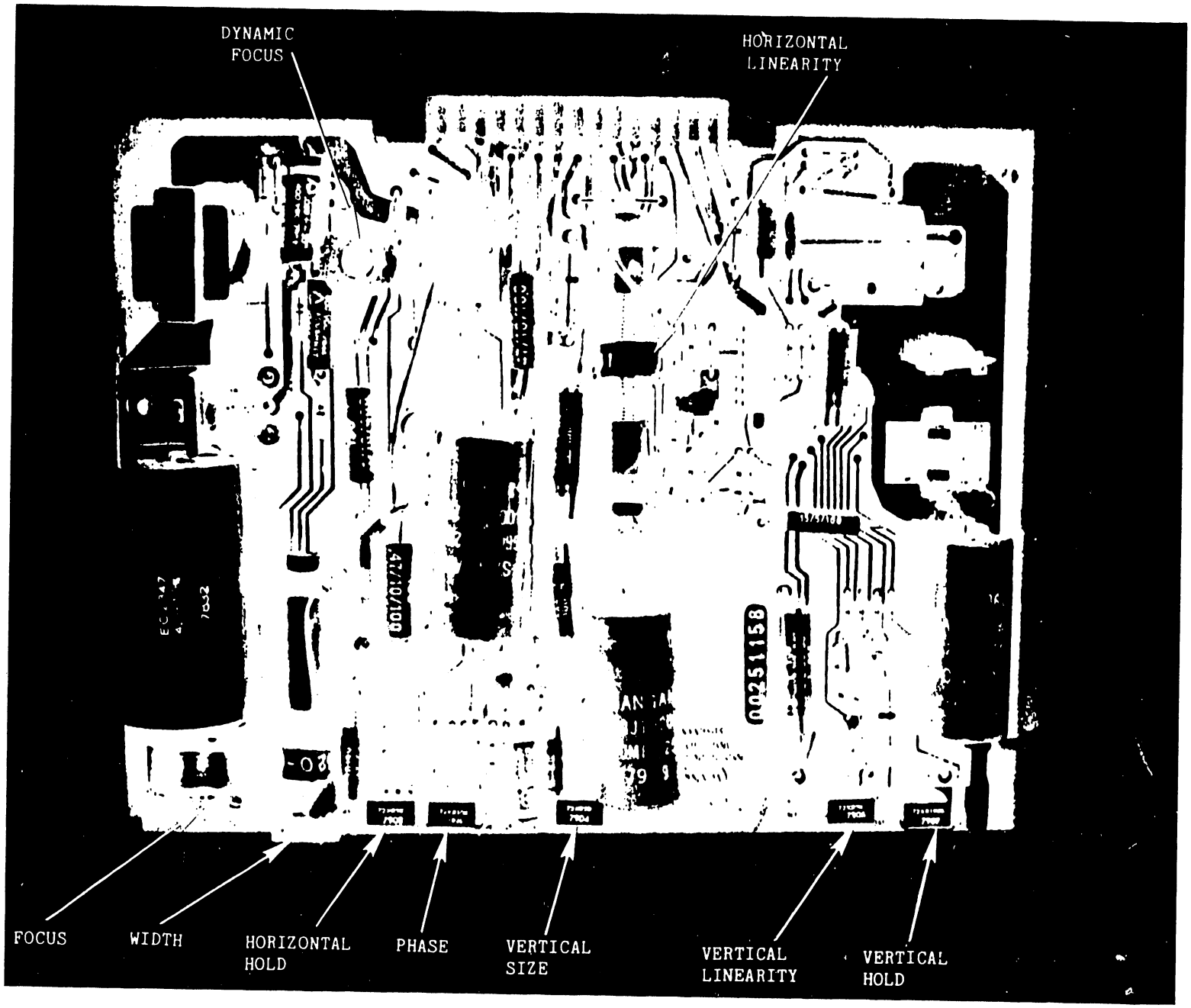

Figure 5-6 210-7456 PCB

III.D.1M-2A

III.D.1M-2A

Access to most display adjustment controls on the 7456 PCB is through the front of the terminal using a non-conductive adjustment tool. Enter the following program on the 2236DW to dispaly the letters HO over the entire CRT screen before adjusting the display controls:

```
1 FOR A = 1 TO 960
2 PRINT "HO";
3 NEXT A
```

a. Adjust the brightness potentiometer (POT) located on the terminal cover until the video raster appears on the screen.
b. If the character rows on the CRT are of unequal height, adjust the Vertical Linearity POT (R18) on the 210-7456 PCB.
c. Adjust the Vertical Size POT (R24) on the 7456 PCB if a gap greater or less than 3/4" $\pm$ 1/4" exists between the top edge of the raster and the pencil line (from Section 4) on the CRT face.
d. Adjust the Width Coil (Z2) on the 7456 PCB if the horizontal size of the raster is not 7-3/4" $\pm$ 1/4".
e. If the random character pattern is not horizontally aligned within the CRT display raster, adjust the Phase POT (R35) on the 7456 PCB to center the character set.
f. Adjust the Focus POT, R28, on the 7456 PCB for best focus.

Once these adjustments have been made, power-down the terminal. Wash the grease pencil markings off the CRT face with a cloth dampened in a mild detergent solution. Perform Power-Up Diagnostics, as described in Section 6. If the diagnostics are successful, reassemble terminal and proceed as follows.

5.4 TERMINAL INTERCONNECTION

An RS-232-C and an AMP connector are located on the back of the terminal chassis. (See Figure 5-7.) As viewed from the rear of the terminal, the RS-232-C connector is on the right side, and connects the terminal to a CPU I/O controller (or a modem, for remote applications). The AMP connector is located beside the RS-232-C and connects the terminal directly to a printer. (Refer to Paragraph 2.4, Screen Dump.)

III.D.1M-2A

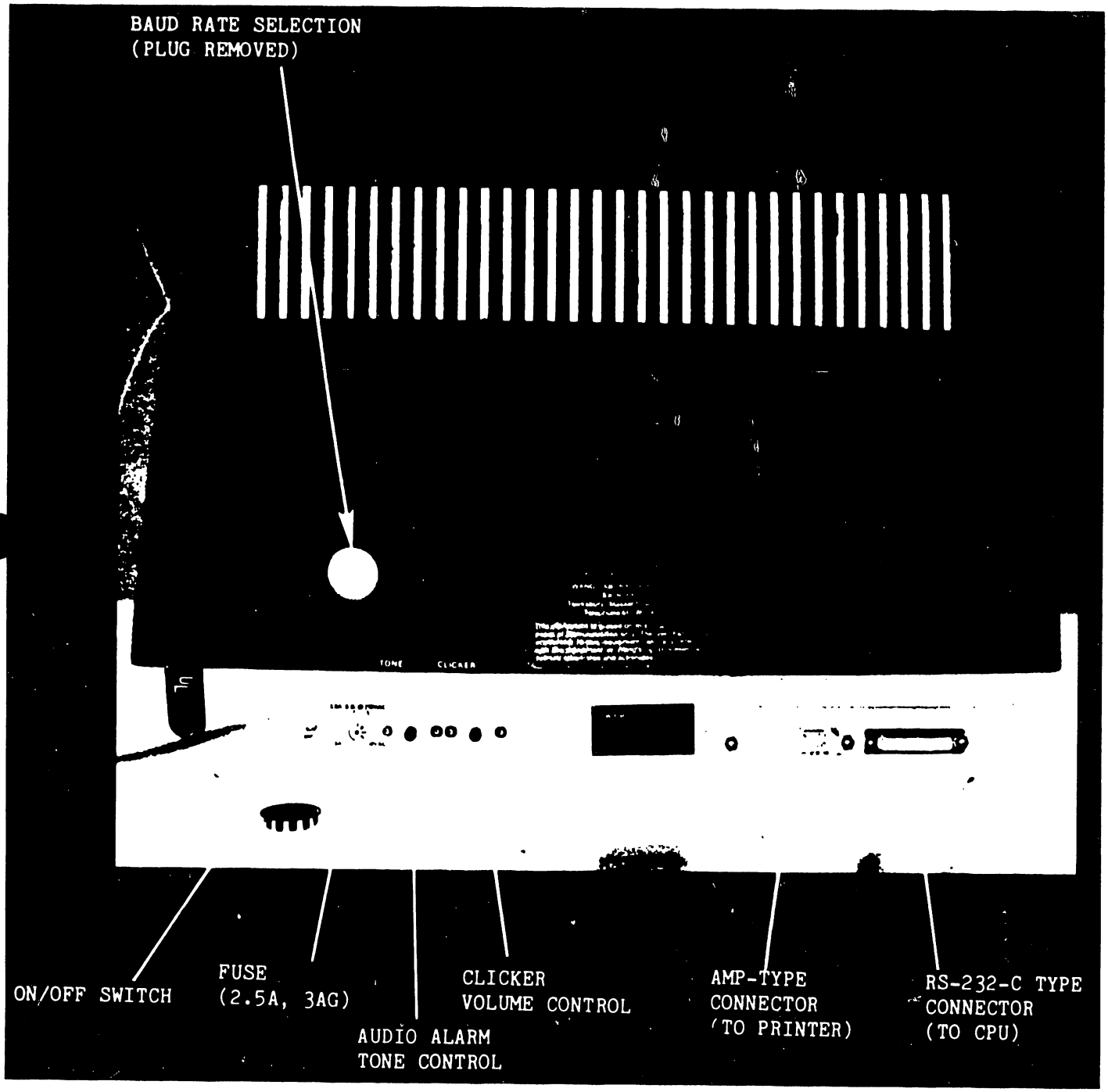

Figure 5-7 Rear of Terminal

III.D.1M-2A

When used with a direct-connection cable, the 2236DW can be located up to 2,000 feet from a CPU. (Refer to Section 10, Terminal/CPU Cable.) This cable must be connected properly between the terminal and the controller. One end of the cable is labeled TER, the other is labeled MUX. Connect the end labeled TER to the RS-232-C connector. Do not connect the cable in reverse. The 2236DW can also be connected remotely to a CPU, via modems and telephone lines.

5.5 TERMINAL CONTROLLERS

The 2236DW is attached locally to a CPU by means of either of two devices: a 22C32 Triple Controller that connects the 2236DW to either a 2200VP or a 2200MVP system, or a 2236MXD Terminal Processor that connects the 2236DW to a 2200MVP system. By using a combination of two 2236MXDs and one 22C32, a total of nine terminals can be connected to an MVP System; only one 2236DW terminal can be connected to a VP system.

The 22C32 and 2236MXD handle I/O operations between the terminal and CPU and act as buffers for data transmitted to/from the terminal. Communications between the terminal and the CPU by means of either a 2236MXD or 22C32 is asynchronous, full-duplex. The 2236MXD offers selectable line speeds ranging from 300 to 19.2K Baud; the 22C32 Triple Controller has a fixed communication rate of 19.2K Baud.

There are no modems capable of handling a 19.2K transmission rate, at this time. Because of this, the 22C32 Triple Controller, with its fixed 19.2K Baud rate, cannot support remote workstation applications. A 2236MXD controller must be used because of its selectable line speeds.

NOTE

Installation of modifications for utilizing the cursor control pad on the 2236DW terminal in the program development mode will be on a next call basis. When a 2236 MXD Terminal Controller or a 22C32 Triple Controller is repaired, the ECNs (No. 18474 for the Triple and No. 18475 for the MXD) should be installed on the board before it is returned to stock.

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5.6 CONTROLLER SWITCH SETTINGS

Refer to Paragraphs 3.3.2 through 3.4.2 of the 2200MVP Maintenance Manual (03-0071-1) for information concerning device address and baud rate settings for the 2236MXD. PROMs used on the 2236MXD must be R5 or above, the 210-7290-1 PCB must be at Rev. 1 or greater, and the 210-7291-1 PCB must be at Rev. 2 or greater in order to use a 2236DW terminal with a 2236MXD controller.

Because the 22C32 Triple Controller has a fixed baud rate of 19.2K, only device address switches, located on the lower right side of the 210-7515 PCB, are set in the controller. There are three switch banks on the 7515 PCB, the bottom right-most bank is used to set the terminal device address. Set these switches as follows:

Number of Terminals	Switch Settings* Sw1	Sw2	Sw3	Sw4	Sw5	Device Address
One	1	0	0	0	0	00_{16}
Five**	1	0	0	1	0	40_{16}
Nine***	1	0	0	0	1	80_{16}

* 0 = OFF; 1 = ON. Sw1 is the Terminal Enable, it is always set to 1; Sw2 - Sw5 are the Terminal Device Address Switches.
** One 2236MXD; One 22C32 (MVP System only)
*** Two 2236MXDs; One 22C32 (MVP System only)

5.7 BAUD RATE SELECTION

The baud rate selection switches for the 2236DW are located on the 210-7592-1 PCB. Access these switches by removing the large plug on the back of the terminal. (See Figures 5-4 and 5-7.) Switch One must be ON and Switch Two must be OFF; these two switches determine the number of data bits and type of parity used. Ensure that the baud rate switch settings at the terminal are the same as those at the controller or modem. Set the baud rate switches according to Table 5-1.

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Table 5-1 Baud Rate Settings

Baud Rate	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5
300	ON	OFF	ON	ON	ON
600	ON	OFF	OFF	ON	ON
1200	ON	OFF	ON	OFF	ON
2400	ON	OFF	OFF	OFF	ON
4800	ON	OFF	ON	ON	OFF
9600	ON	OFF	OFF	ON	OFF
19,200	ON	OFF	ON	OFF	OFF

SECTION 6 POWER-UP DIAG-NOSTICS

III.D.1M-2A

SECTION 6
POWER-UP DIAGNOSTICS

Whenever the 2236DW terminal is powered-up, diagnostic routines resident in the Z80 microcode are performed. If the diagnostics pass, the power-up message is displayed and control passes to the main microcode. The power-up message is displayed for three seconds and is cleared when the first character is received from the CPU. However, if the CPU is powered-up before the terminal CRT is sufficiently warmed-up, the terminal power-up message may not appear. If this occurs, power-down then immediately power-up the terminal.

If a failure is detected by the diagnostics, an audio alarm is activated and control is not passed to the main microcode. A HEX LED (WLI #340-0015) installed at location L10 on the 7592-1 PCB (see Figure 5-5) will display the failing diagnostic phase. Table 6-1 lists the diagnostic displays and possible causes of failure.

If the # symbol is displayed, either the baud rate switches are incorrect or a problem exists in the terminal. If "????OBPS" is displayed, the baud rate switches are in an illegal setting. In this state the baud rate is undefined.

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Table 6-1 Power-Up Diagnostic Definitions

HEX LED DISPLAY	DISPLAY MEANING	TROUBLE LOCATIONS
0000	Z80 or PROM malfunction, or address decoding logic malfunction.	L2, L8, L9, L16, L17, L18, L19
0001	Z80 Reset and Conditional Jump Test	L2, L8, L9, L16, L17, L18, L19, L44
0010	Z80 Register and Processor Test	L9, L2, L44
0011	Memory Select Test	L8, L9, L19
0100	Data Bus Test	L9, L44, L51
0101	Address Bus Test	L8, L9, L19
0110	RAM Test	L4, L5
0111	RAM Test	L4, L5
1000	Not Used	
1001	PROM Test	L16, L17, L18, L56
1010	Keyboard Table PROMs Test	L16, L17, L18, L56
1011	Vertical Retrace Interrupt Test	L52, L79, L96

At power-up, the hardware blanks the Hex display. If either the Z80 (L9) and PROMs (L16, 17, 18), or the address decoding (L8, 19) logic are malfunctioning, the display could stay blanked. If any test fails in a predicted manner, the Hex display remains at the value of the failed test. After all tests are completed, the diagnostic loads a "0" into the display and passes control to the main microcode.

CHAPTER 7

PREVENTIVE MAINTENANCE AND DIAGNOSTIC

III.D.1M-2A

SECTION 7

PREVENTIVE MAINTENANCE

Preventive maintenance on the 2236DW is scheduled for every six months. It consists of inspecting the terminal for worn parts, adjusting the terminal controls as needed, general cleaning of the terminal, and updating the terminal with the appropriate ECNs.

Routine maintenance consists of cleaning the terminal cover, keyboard, and CRT face with a mild detergent solution when necessary.

SECTION 8

MAJOR ASSEMBLY REMOVAL & REPLACEMENT

III.D.1M-2A

SECTION 8
MAJOR ASSEMBLY REMOVAL AND REPLACEMENT

This section discusses removal and replacement procedures for several major workstation assemblies. (See Figures 8-1, 8-2 and 8-3.) Before removing the following assemblies, ensure that the power switch is OFF and the AC power cord is unplugged. Remove the terminal cover as described in Section 5.

8.1 CRT ANODE DISCHARGE PROCEDURE

Even with power removed, the terminal cathode ray tube can hold a charge of several thousand volts. To eliminate the risk of accidental CRT discharge, which can result in serious injury, discharge the CRT anode as follows: (See Figure 8-3)

a) Attach* one end of a length of insulated wire to the metal shaft of a plastic-handled, heavy-duty screwdriver.
b) Attach* the other end of the wire to CHASSIS GROUND.
c) Using a non-conductive tool such as a plastic alignment tool, carefully raise the edge of the rubber anode cap high enough to insert the screwdriver.
d) Taking care not to touch the metal shaft of the screwdriver or any metal part of the terminal, discharge the CRT anode by touching the anode clip with the grounded screwdriver.
e) After discharging the CRT, remove the grounding wire and reseat the rubber anode cap.

* Attach wire by means of alligator clips. If no clips are available, strip 3/4" of insulation from each end of the wire. Tightly wrap one end around the screwdriver shaft, secure the other end to CHASSIS GROUND, NOT LOGIC GROUND.

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8.2 TERMINAL ELECTRONICS PCB REMOVAL

Remove the terminal electronics PCB (210-7592-1) as follows: (See Figures 8-1, 8-2 and 8-3.)

a) Unplug all Molex connectors on the PCB.
b) Unplug the keyboard, printer, and CPU ribbon cables.
c) Remove the four Phillips-head screws holding the PCB to the CRT chassis support rods.
d) Lift the board up and out of the terminal.

To replace or reinstall the terminal electronics PCB, reverse the above procedure.

8.3 CRT CHASSIS ASSEMBLY REMOVAL

Remove the CRT chassis assembly (270-0372) as follows: (See Figure 8-3)

****NOTE****

In a 2236DW terminal, replace a defective CRT chassis with a Wang CRT chassis assembly only.

a) Unplug all Molex connectors on the 210-7592 PCB.

b) Unplug the keyboard, printer, and CPU ribbon cables from the 210-7592-1 PCB.

c) Unplug the brightness/contrast Molex connector from the cross-brace at the top of the CRT chassis.

d) Remove the four Phillips-head screws holding the 7592-1 PCB support rods to the CRT chassis.

e) Lift the 7592-1 PCB, still attached to the support rods, up and out of the terminal.

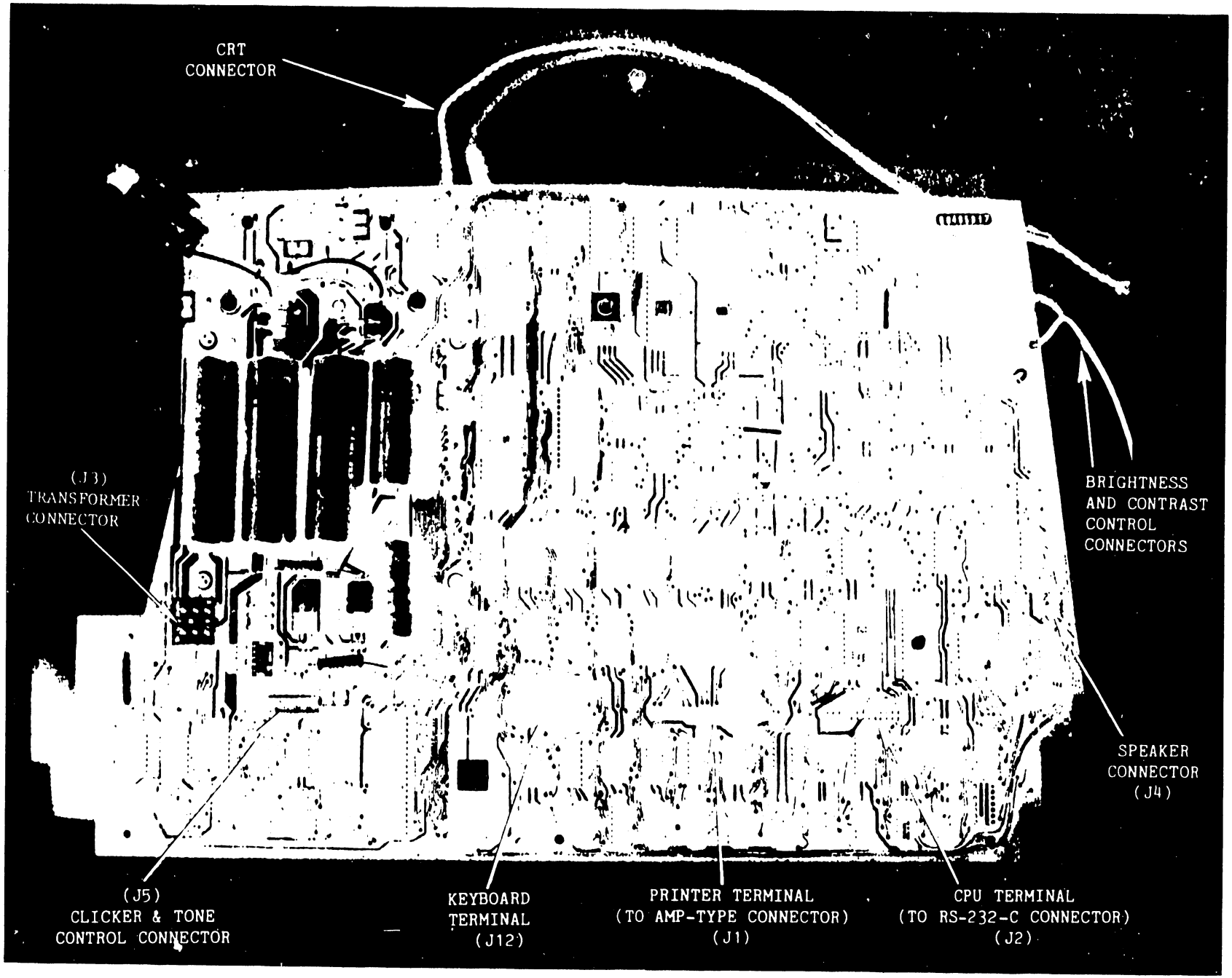

Figure 8-1 210-7592-1 PCB

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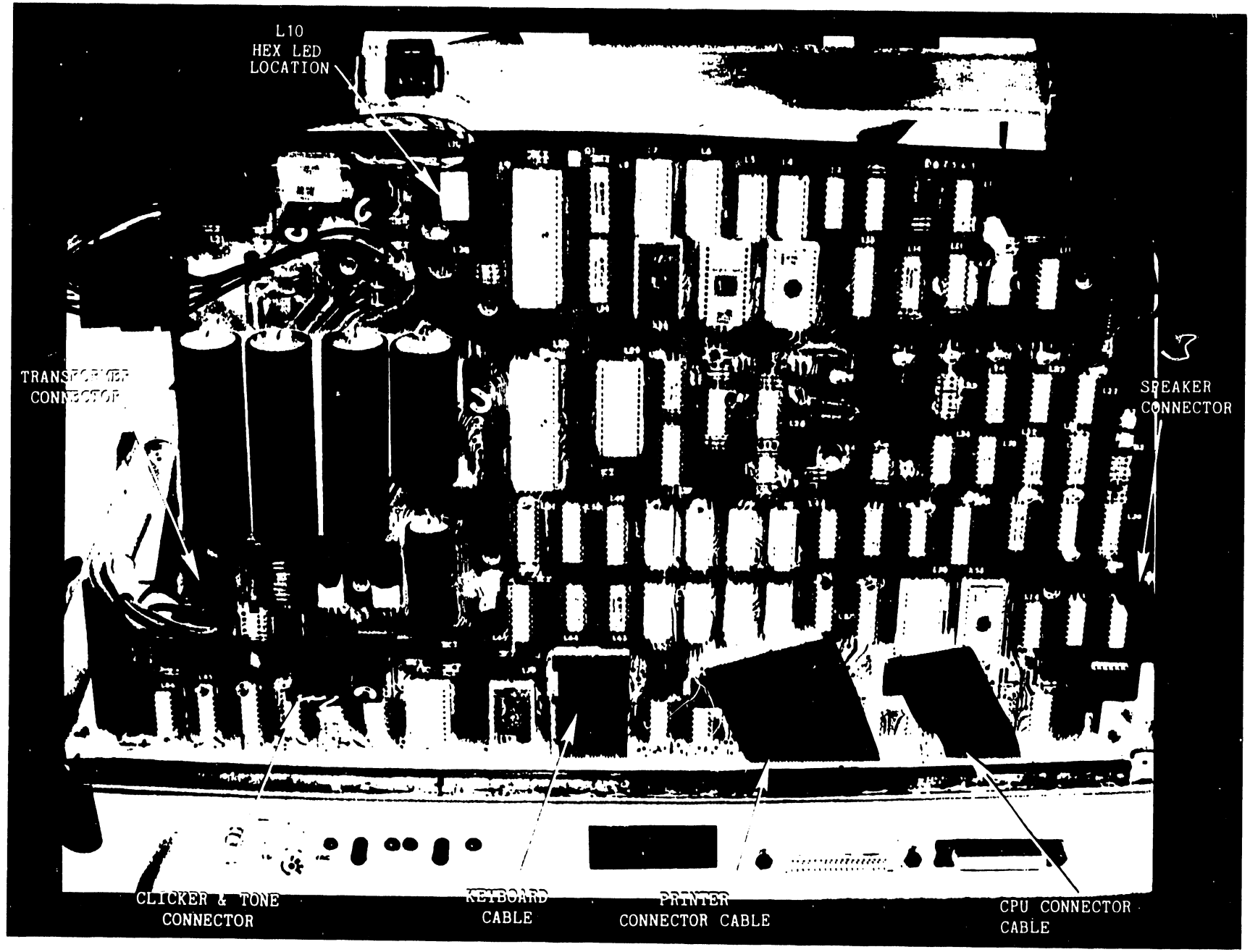

Figure 8-2 210-7592-1 PCB in Chassis

III.D.1M-2A

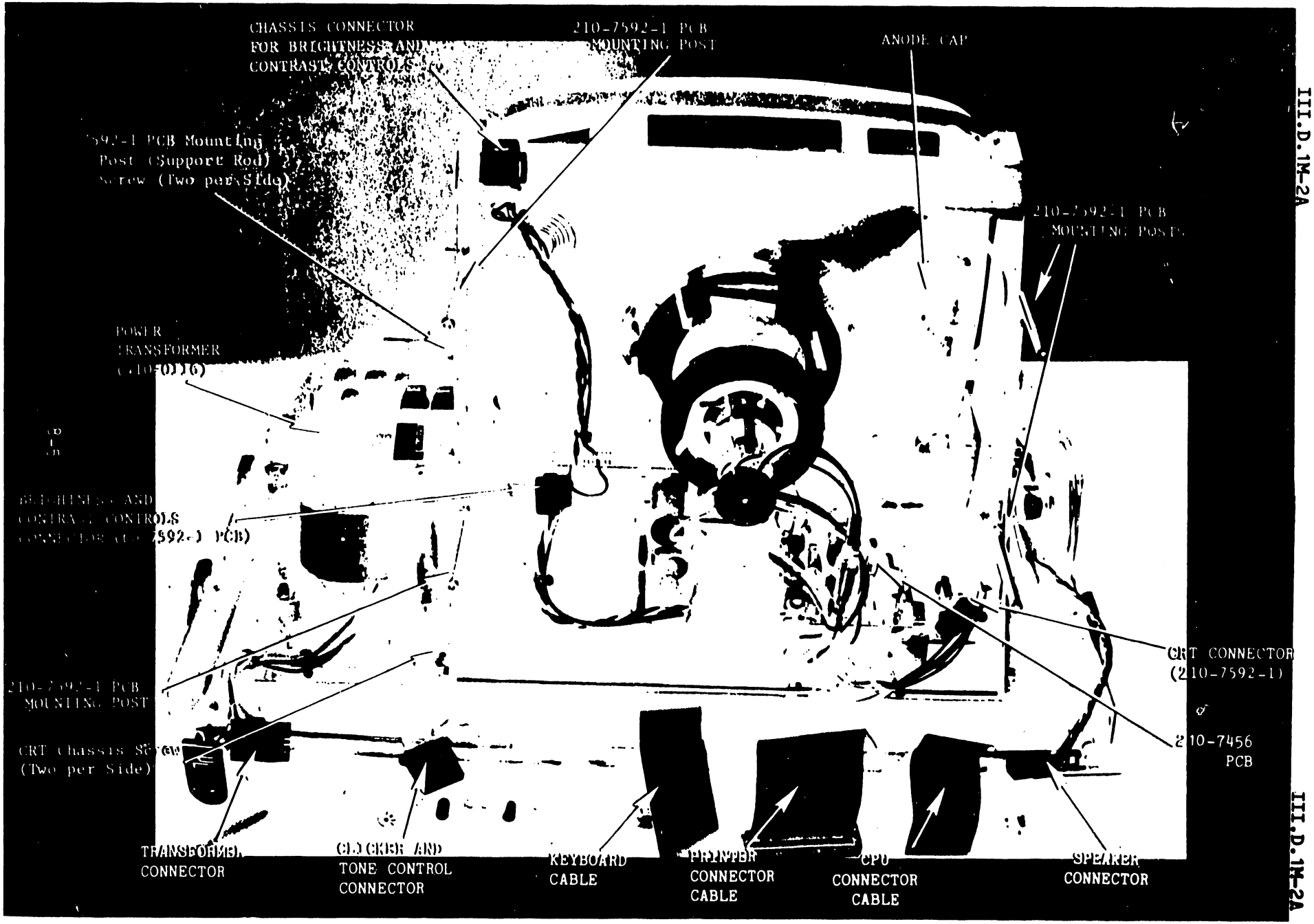

Figure 8-3 Rear View of Chassis with 210-7592-1 PCB Removed

III.D.1M-2A

f) Remove the four screws and star washers securing the CRT chassis to the terminal. The monitor electronics PCB (7456) is part of this chassis.

g) Carefully lift the CRT chassis assembly up and out of the terminal.

h) Reverse the above procedure to install a new assembly.

i) Adjust Z1 on the 7456 PCB to acheive an 80X24 character display on the CRT.

j) Perform the video diplay adjustments found in Section 5.3.

8.4 MONITOR ELECTRONICS PCB REMOVAL

Remove the monitor electronics PCB (7456) by grasping the front of the PCB and pulling with a slow steady pressure, moving the PCB gently from side-to-side. Insert the monitor PCB by reversing this procedure.

8.5 KEYBOARD ASSEMBLY REMOVAL

Remove the Keyboard Assembly (725-2637) as follows:

a) Remove the four Phillips-head screws securing the keyboard to the chassis. Check that all four washers located between the keyboard and the chassis are accounted for.

b) Unplug the keyboard ribbon cable from the keyboard PCB.

c) Remove screw connecting keyboard ground strap to terminal chassis.

d) Lift the keyboard up and away from the chassis.

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e) Before installing a keyboard, check the bottom for a shorting tape to protect MOS chips from static charges. Remove the tape before installation.

To replace or reinstall the keyboard, reverse the above procedure.

8.6 POWER TRANSFORMER REMOVAL

Remove the Power Transformer (410-0116) from the chassis as follows:

a) Unplug the Molex connector joining the transformer to the 7592-1 PCB.

b) Remove the four Phillips-head screws and washers securing the transformer to the chassis.

c) Lift the transformer up and out of the chassis.

To replace or reinstall the transformer, reverse the above procedure.

SECTION 9 STANDARD FEATURES

III.D.1M-2A

SECTION 9
STANDARD FEATURES

This section explains four standard features found on the 2236DW Terminal.[1] These features are: Character Display Attributes, Alternate Graphics Set Selection, and Box Graphics.

9.1 CHARACTER DISPLAY ATTRIBUTES

In order to highlight information on the screen, the Model 2236DW provides several display attributes that can be selected for any character displayed on the screen. The available display attributes are the following.

- Bright -- Characters are displayed in high intensity.
- Blink -- Characters blink.
- Reverse Video -- The character itself is dark while the character background display is light (dark on light).
- Underline -- Characters are displayed with an underscore.

HEX Codes Used to Invoke Display Attributes

Immediately after power is turned on, the Model 2236DW displays characters in normal intensity, non-blinking, normal video (light on dark), and non-underlined (this attribute shall henceforth be referred to as simply "normal intensity"). The power-on default meaning of HEX(0E) is bright, non-blinking, normal video, and non-underlined.

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The display attribute to be used is selected by sending a command of the following form to the CRT.

HEX(02 04 xx yy 0E)

or

HEX(02 04 xx yy 0F)

where:

02 04 = The control code sequence which indicates to the terminal that special character display attributes are to be selected.

xx yy = The HEX codes specifying the display attributes to be selected, where:

xx = 00 for normal intensity, no blink
02 for bright, no blink
04 for normal intensity, blinking
0B for bright, blinking

yy = 00 for normal video, no underline
02 for reverse video
04 for underline
0B for reverse video, underline

0E or 0F = A terminator character which causes the display attributes selected by xx yy to be turned on or off; HEX(0E) turns the selected attributes on, HEX(0F) turns them off.

Note that there are two ways to code the attribute "blinking". However, on the Model 2236DW, blinking normal intensity and blinking high intensity characters both appear as blinking, high intensity.

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Special Uses of Alternate Display Attributes

1. LIST D

   The CPU sends out a HEX(0E) at the beginning of each REM% statement in the program. Thus, comment statements appear in the most recently selected alternate display attribute.

2. 100 PRINT "PROMPT";: LINPUT HEX(0E), A$: PRINT A$

   The field to be entered appears in the most recently selected alternate display attribute. When entry is terminated with a carriage return, the alternate attribute is cancelled, so the PRINT statement prints A$ in normal intensity.

3. 150 PRINT HEX(0E); "PROMPT"; HEX(0F);

   160 LINPUT A$

   This time, only the prompt appears in the most recently selected alternate attribute.

Summary of Display Attribute Rules

The following list contains the general rules for governing the use of display attributes.

1. HEX(02 04 xx yy 0E) selects and activates a display attribute. Attributes activated in this manner are turned off only by HEX(0F) or by another HEX(0204... sequence. The attribute is <u>not</u> turned off by carriage return, HEX(0D). Thus, it is possible to highlight a portion of either one or several lines.

2. HEX(02 04 xx yy 0F) selects, but does <u>not</u> activate, a display attribute. Normal intensity is activated instead.

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3. An isolated HEX(0E) activates the attribute selected by the last HEX(0204... sequence for a maximum of one text line. The attribute remains in effect until the occurrence of either an automatic carriage return, a programmed HEX(0D), or a HEX(0F).
4. Rule 1 takes precedence over Rule 3. If an attribute is selected and activated by Rule 1, a subsequent HEX(0E) will not cause the attribute to be turned off by the next carriage return.
5. An isolated HEX(0F) always turns off the alternate attribute and restores normal intensity.
6. Screen clear, HEX(03), clears the screen to black, but otherwise has no effect on the meaning of HEX(0E) or the attribute currently in effect. Likewise, scrolling the screen scrolls in a black line, but otherwise has no effect on attributes.
7. Programmers are reminded that reverse video spaces are white, not black. Zoned format PRINT statements, i.e., PRINT, PRINT TAB, and the third parameter of PRINT AT, use spaces to clear the screen. These statements will leave white areas on the screen when reverse video is activated.
8. Terminal power on and the RESET key cause normal intensity characters to be selected and the meaning of HEX(0E) to be defined as high intensity.
9. The system considers all codes HEX(00) to HEX(0F) to occupy no space on the output medium. Thus, attribute selection sequences do not cause the system to issue automatic carriage returns or throw off the column count used by TAB and zoned format PRINT statements.
10. Control codes HEX(00) to HEX(0F) do not have attributes. It is not possible to change the attribute of a character by passing the cursor through it with a PRINT AT statement.
11. The meaning of isolated HEX(0E) is maintained by the terminal, not the partition. If a program gives up control of the CRT with $RELEASE TERMINAL, there is a good chance that a program in another partition will change the meaning of HEX(0E) in the course of using attributes.

III.D.1M-2A

9.2 SELECTION OF CHARACTER SETS

The Model 2236DW actually offers two character sets: the normal character set (refer to Figure 9-1) and the alternate character set (refer to Figure 9-2). The following sequence is used for selecting either character set.

HEX (02 02 xx 0F)

where:

02 02 = The control code sequence which indicates to the terminal that a character set will be selected.

xx = A HEX code specifying the character set to be selected.

If xx = 00 The normal character set is selected. The codes HEX(90) to HEX(FF) are underline versions of characters from HEX(10) to HEX(7F).

If xx = 02 The alternate character set is selected. The codes HEX(80) to HEX(FF) represent the graphic characters and symbols.

0F = A terminator character that signals the end of the character selection sequence.

Any character of either character set can be underlined by using the underline character attribute. Either character set may differ on foreign language versions of the terminal. All versions of the terminal are capable of producing uppercase alphabet, numbers, and most of the special characters used in BASIC programming.

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In the character set selection, the following items should be noted.

1. In the alternate character set, the codes HEX(9C) to HEX(BF) are presently undefined and reserved for future expansion. Any use of these codes involves the risk of being incompatible with future use of the terminal.

2. With the exception of the following HEX codes, the character sets of both the 2236DE and the 2236DW terminals are identical. The following HEX code values have been redefined for the normal character set of the 2236DW terminal.

HEX	2236DW Normal Character Set	2236DE Normal Character Set
5F	down arrow	left arrow
7F	up/down arrow	section symbol
80	dotted space	blank
8D	left arrow	up/down arrow
8F	page character	paragraph symbol
DF	underlined down arrow	underlined left arrow
FF	underlined up/down arrow	underlined section symbol

3. The following Hex code values have been redefined for the alternate character set of the 2236DW terminal.

HEX	2236DW Alternate Character Set	2236DE Alternate Character Set
5F	down arrow	left arrow
7B	up/down arrow	section symbol

NOTE

1. Character set is identical for DE and DW units when terminal is turned on.

2. Print Hex (0202040F) will "turn on" a translation table which is describe above.

3. Print Hex (0202000F), Reset or Clear will "turn off" translation table.

III.D.1M-2A

High-order HEX Digit

Low-order HEX Digit	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	å	Space	0	@	P	°	p	.	â	_	0	@	P	°	p
1	ê	!	1	A	Q	a	q	♦	ê	!	1	A	Q	a	q
2	ì	"	2	B	R	b	r	▶	ì	"	2	B	R	b	r
3	ô	#	3	C	S	c	s	◀	ô	#	3	C	S	c	s
4	û	$	4	D	T	d	t	→	û	$	4	D	T	d	t
5	ä	%	5	E	U	e	u	⌙	ä	%	5	E	U	e	u
6	ë	&	6	F	V	f	v	|	ë	&	6	F	V	f	v
7	ï	'	7	G	W	g	w	..	ï	'	7	G	W	g	w
8	ö	(	8	H	X	h	x	'	ö	(	8	H	X	h	x
9	ü	)	9	I	Y	i	y	`	ü	)	9	I	Y	i	y
A	à	*	:	J	Z	j	z	^	à	*	:	J	Z	j	z
B	è	+	;	K	[	k	↓	■	è	+	;	K	[	k	↓
C	ù	,	<	L	\	l	£	‖	ù	,	<	L	\	l	£
D	Ä	-	=	M	]	m	é	←	Ä	-	=	M	]	m	é
E	Ö	.	>	N	↑	n	ç	ß	Ö	.	>	N	↑	n	ç
F	Ü	/	?	O	↓	o	¢	⊥	Ü	/	?	O	↓	o	¢

Figure 9-1 The Normal Character Set of the 2236DW Terminal

III.D.1M-2A

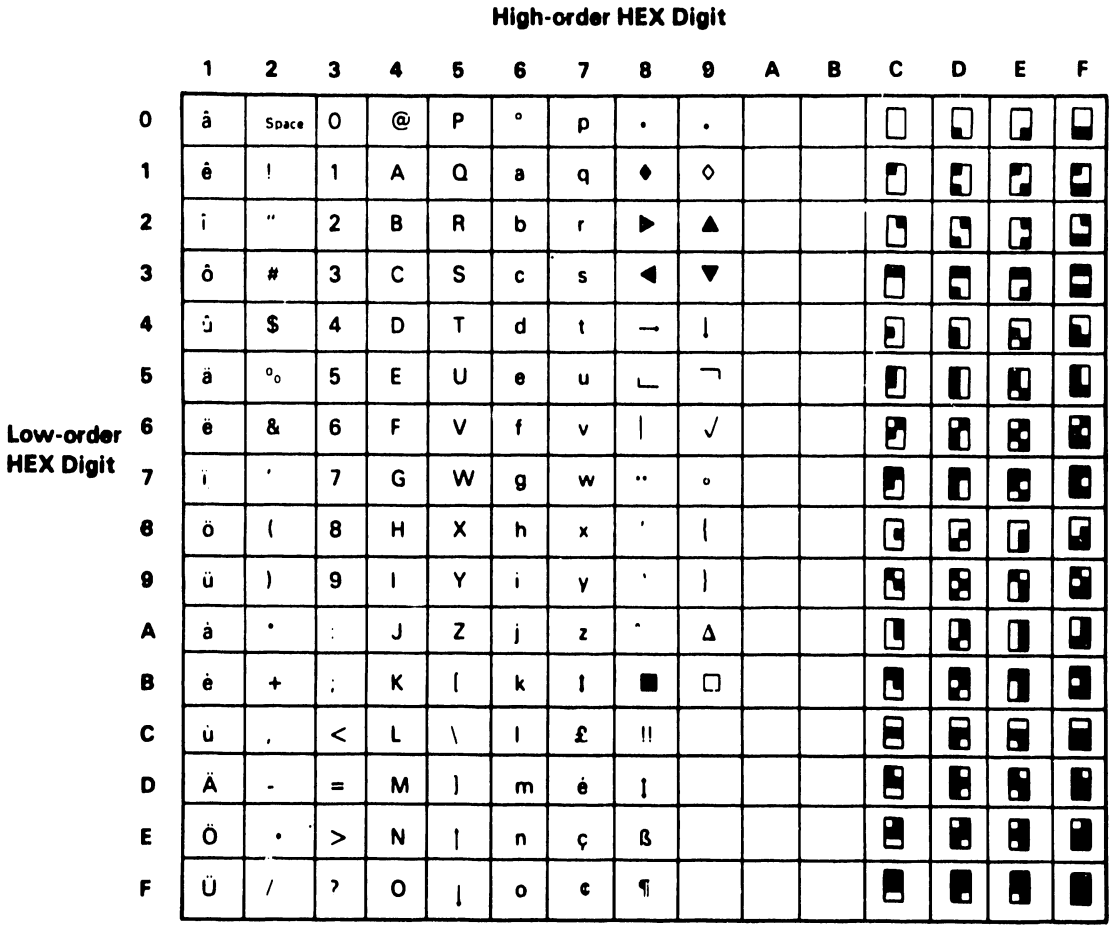

Figure 9-2 The Alternate Character Set of the 2236DW Terminal

III.D.1M-2A

The 64 graphic characters, HEX(C0) to HEX(FF), are represented by all the combinations of sixths of a character space, where the character space is divided as shown in Figure 9-3. When displayed, graphic characters are extrapolated to fill the entire character position. For this reason, adjacent areas of two graphic characters will touch; thus, continuous lines (bars) of light or dark areas can be displayed on the screen. When combined with display attributes, character graphics are useful for the construction of bar graphs, histograms, and other special displays.

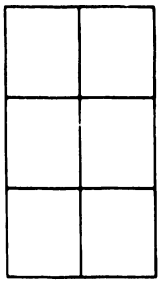

Figure 9-3 Division of a Character Space

The HEX codes for each specific graphic design are determined in the following manner. Use HEX(C0) as the base, with each different segment (each sixth of a character space) equal to the following HEX values.

01	02
04	08
10	20

III.D.1M-2A

Suppose the design  was desired. To obtain the appropriate HEX value add desired segments to the base. For example:

```
    C0      Base
    01
    02      Desired segments
  + 04
    ---
    C7      Resulting HEX code for desired design
```

Therefore, the design  would be coded as HEX(C7). For a quick and easy reference, programmers should also refer to Figure 9-2, The Alternate Character Set of the 2236DW Terminal.

Examples of the Character Sets

```
PRINT HEX(02 02 00 0F); HEX(C6 C5 C2 D2 D5 C1 D2 D9)
```

This statement selects codes HEX(90) to HEX(FF) to represent normal characters HEX(10) to HEX(7F) with underline. Thus, the screen would display the word FEBRUARY with an underline.

```
PRINT HEX(02 02 02 0F); HEX(FF FC F0);
```

This statement selects the alternate character set and displays three character boxes of decreasing heights (). These are the characters most useful for constructing vertical bar graphs.

III.D.1M-2A

Summary of Character Set Selection

The rules concerning the use of character set selection can be summarized as follows.

1. HEX(02 02 00 0F) selects the normal character set. The meaning of codes HEX(90) to HEX(FF) are defined to be the normal characters HEX(10) to HEX(7F) with underline.

2. HEX(02 02 02 0F) selects the alternate character set. The codes HEX(80) to HEX(FF) represent the graphic characters and other special symbols.

3. Power on and RESET select the default character set (the normal character set for the standard USA Model 2236DW).

4. Carriage return does not affect character set selection. The sequences given in Rules 1 to 3 are the only methods for changing character sets.

5. As with attributes, the character set selection sequences affect the interpretation of characters at the time they are received by the terminal. Therefore, underlined and graphic characters may be used in different areas of the same display. Once on the screen, a character is modified only by explicitly striking over it with another character or by screen clear.

6. All display attributes can be used with both the normal and the alternate character set.

III.D.1M-2A

9.3 PRINT BOX FUNCTION

General Form:

BOX (height, width)

where:

height = Expression specifying the height of the box; each unit is the height of a character space.

width = Expression specifying the width of the box; each unit is the width of a character space.

Purpose:

The BOX function is used within a PRINT statement to draw or erase a box or line on a CRT which has box graphics capability. The first expression specifies the height of the box; the second is the width of the box. The sign of the arguments determines whether lines are drawn or erased. If the signs are nonnegative, lines are drawn; negative signs cause lines to be erased. If the box height is zero, a horizontal line is drawn or erased. A width of zero causes a vertical line to be drawn or erased. The BOX function positions the box so that the upper-left corner is at the current cursor position. Drawing a box does not move the CRT cursor.

Examples:

```
PRINT BOX (3, 4);                      -- Draws a 3 x 4 box

PRINT BOX (-3, -4);                    -- Erases a 3 x 4 box

PRINT BOX (0, X);                      -- Draws a horizontal line X
                                          units long

PRINT BOX (-7, 0);                     -- Erases a vertical line 7
                                          units long

PRINT AT (5, 10); BOX (1, 6); "TITLE"  -- Displays TITLE enclosed in
                                          a box
```

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Note that in order to include the field TITLE in the last example, the box had to be one character wider than the length of the field, and the left edge of the box had to be one character position to the left of the field to be enclosed. Therefore, to box a field in general, use the statement:

```
PRINT BOX (1, LEN(A$)+1); "␣"; A$
```

where A$ is the given field, LEN(A$) is the length of the field A$, and the symbol ␣ represents one space.

Box graphics can also be used for highlighting entry fields as shown in the following example.

```
CLEAR
10 PRINT "PROMPT"; BOX(1, 17);:LINPUT A$
RUN
```

Box Graphics

The 2236DW Integrated Terminal can display continuous horizontal or vertical lines, enabling forms to be drawn or information to be separated by lines or boxes. The horizontal line unit is a line segment the width of a character space, but positioned from the middle of one character space to the middle of the next character space. Horizontal lines are displayed between rows of characters.

The vertical line unit has the height of a character space. Vertical lines are drawn through the middle of a character space; the line coexists with the character at that location. (Note that since the height and width of a character space are not the same unit measurement, boxes are not drawn proportionally. However, because of these measurements, a programmer can easily box fields of characters.)

III.D.1M-2A

Figures 9-4 and 9-5 illustrate the placement of box graphic lines. Figure 9-4, which shows the smallest possible box, was produced by the statement PRINT BOX(1,1); "AB". It illustrates the placement of horizontal and vertical box graphic lines relative to the character position. Figure 9-5, which was produced by the statement PRINT BOX(1,1); HEX(0202020F); HEX(E1CC), demonstrates where box graphic lines appear relative to character set graphic blobs.

The terminal allows the programmer to consider the CRT as both a box graphics display and a character display that just happen to be displayed on the same screen. While in Character mode, only the characters and their attributes are modified while box graphics remain intact. For example, within a boxed area used to highlight a prompt, the prompt may be rewritten a number of times without altering or erasing the box itself. The one exception to this rule is screen clear, HEX(03) which clears both characters and box graphics. During a box graphics sequence, characters and their attributes are undisturbed.

Because the Character and Box Graphic modes are independent, it is easy to update portions of either display. The third argument of PRINT AT is useful for clearing portions of the display. Though slower than screen clear, the statement PRINT AT (0,0,) is useful for clearing the characters from the screen without disturbing the box graphics.

Figure 9-4 Box Graphic Line Placement Relative to Character Position

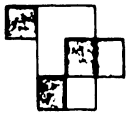


Figure 9-5 Box Graphic Line Placement Relative to Graphic Character Set

SECTION 10 TERMINAL/CPU CABLE

III.D.1M-2A

SECTION 10
TERMINAL/CPU CABLE

One 8-ft (2.4-m) cable to power source. One 25-ft (7.6-m) direct connection cable is provided with each Model 2236DW, unless an optional direct connection cable is ordered for a terminal. Nonextendable cables are available optionally for direct connection up to 2000 ft (606.1 m). Refer to Table 10-1.

Table 10-1 Direct Connection Cables

Length in Feet	Length in Meters	Part Number
25	7.6	120-2236-25
50	15.2	120-2236-50
100	30.3	120-2236-1
200	60.6	120-2236-2
300	90.9	120-2236-3
400	121.5	120-2236-4
500	151.5	120-2236-5
600	181.8	120-2236-6
700	212.1	120-2236-7
800	242.4	120-2236-8
900	272.7	120-2236-9
1000	303.0	120-2236-10
1250	378.8	120-2236-11
1500	454.5	120-2236-12
1750	530.3	120-2236-13
2000	606.1	120-2236-14

Modem cables are available optionally in lengths of 12 ft (3.7 m), with extensions of 25 ft (7.6 m) and 50 ft (15.2 m). (Refer to Table 10-2) Combined cable distance however, from Wang equipment to a modem is 50 ft (15.2 m) maximum according to Electronics Industries Association (EIA) standards.

Table 10-2 Modem Cables

Length in Feet	Length in Meters	Part Number
12	3.7	120-2227-12
25	7.6	220-0219
50	15.2	220-0220

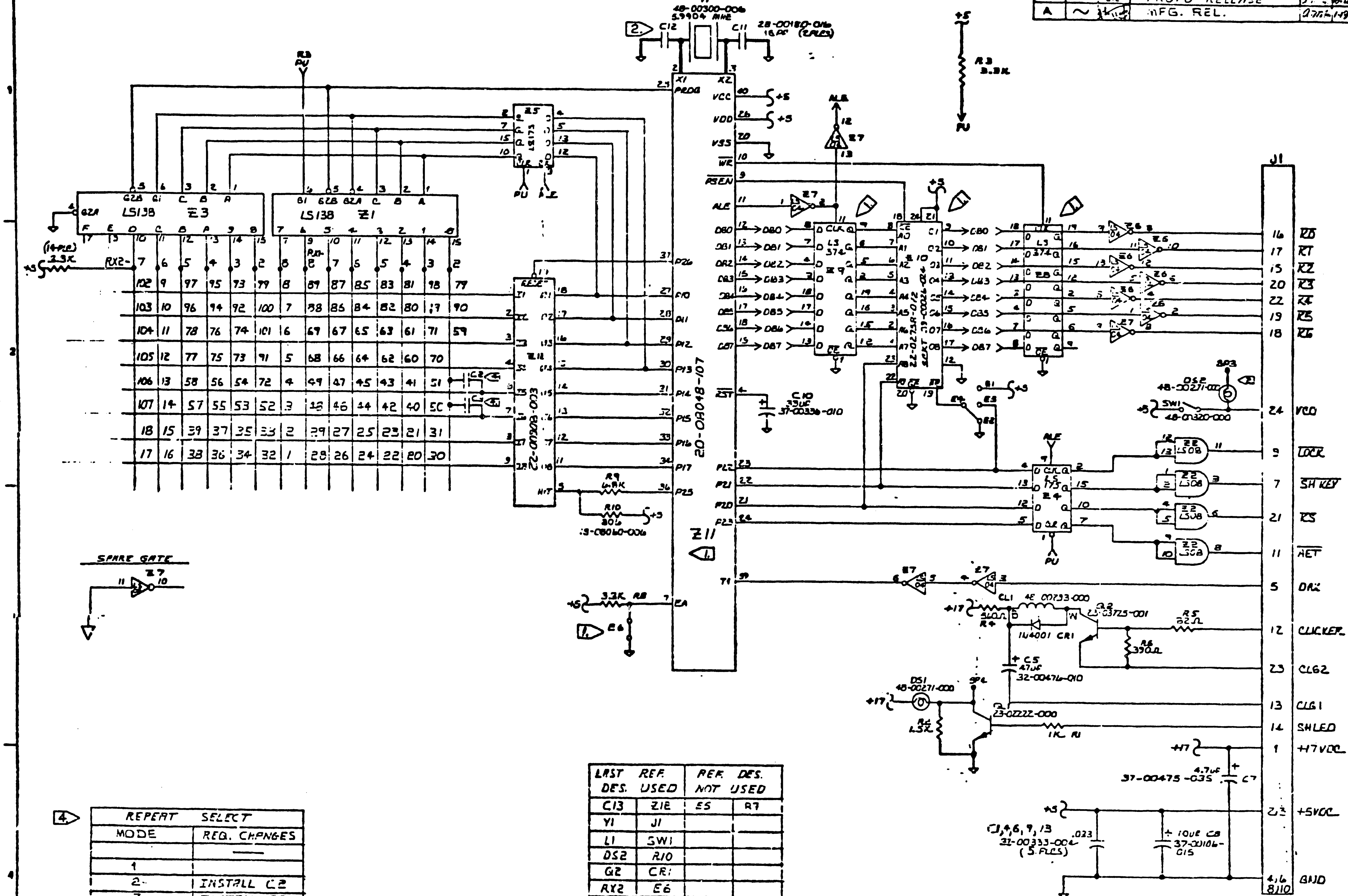
SECTION 11 DRAW-INGS

III.D.1M-2A

SECTION 11
DRAWINGS

The attached schematics for PCB 7592 constitute the diagrams for PCB 210-7592-1 when modified by ECO No. 18485D attached.

REV.	ECO	BY	DESCRIPTION	APP.	DATE
~	~	JP	PROTO RELEASE	[illegible]	[illegible]
A	~	[illegible]	MFG. REL.	[illegible]	1-19-81



LAST DES.	REF. USED	REF. DES. NOT USED	
C13	Z12	E5	R7
Y1	J1		
L1	SW1		
DS2	R10		
Q2	CR1		
RX2	E6		

4.

REPEAT SELECT	
MODE	REQ. CHANGES
	—
1	
2	INSTALL C2
3	INSTALL C3

3. -001 ASSY SHOWN

2. NOT NORMALLY INSTALLED.

1. ON -050 SERIES ASSY'S ONLY, INSTALL 20-08035-000 AT Z11, INSTALL Z8 Z9 AND Z10, DELETE CONNECTIONS AT E6 AND Z8.

MANUFACTURE PARTS AND/OR ASSY'S PER K.T.C. DOCUMENT: FTP 36-233 37-00727-107

UNLESS OTHERWISE NOTED ALL DIMENSIONS ARE IN INCHES

XXX DIMENSION NOT TO SCALE

USED ON: WANG

RELEASED

APP. [illegible]

CH. [illegible]

DR. [illegible] 9-[illegible]-80

TOL. EXCEPT AS NOTED: HOLE DIA. FRACT. ± 1/64" XX ± .03" XXX ± .010" ANG. ± 1°

QTY.	PART NO.	DESCRIPTION	ITEM

SCALE: NONE

TITLE: SCHEMATIC

key tronic corporation, SPOKANE, WASH. U.S.A.

DWG NO: 55-02251

SHEET 1 OF

C

MILLIMETERS IN PARENTHESIS
TOLERANCES TO BE EQUIVALENT TO INCH DIMENSIONS

DO NOT SCALE

EXTERNAL CONTRAST

NOT LOADED FOR 7456-2

VARIATION CHART			
COMP	7456	7456-1	7456-2
R19	330-3068	330-4027	330-3063
C30	300-2412	300-2417	300-2412
C31	300-2413	300-2418	300-2413
Z2	320-0053	320-0054	320-0053
Z3	320-0051	320-0052	320-0051
HOR. YOKE	320-0052	320-0057	320-0052
FLY-BACK	410-1007	410-1008	410-1007
R5	330-2068	330-2068	330-3068
* V YOKE L	YEL	BLU	YEL
* V YOKE K	BLU	RED	BLU
* V YOKE H	RED	YEL	RED

COMPONENTS NOT LOADED FOR 7456-2	
R9,10,40	330-2047
R11	331-2010
R11	330-1022
R12	337-3012
R44	330-1047
C3	300-1820
C15	300-4022
Q5	375-1014
Q2	375-1056
D4,10	380-1001
C32	300-1047
Q1	375-1012

7456 P7

SEPARATE IMPEDANCE ENGINEERING 376-4381

IC LOCATION	W. L. PART NO	30V
L1	376-0260	1
L2	376-0239	5
L3	376-0261	13

NOTES:
1. CONNECT G2 LEAD TO PIN B UNLESS UNABLE TO ACHIEVE RASTER CUT OFF

COMP.	W. L. PART No.
R2	330-3022
R 3,37	330-3097
R4	330-3012
R16	330-3010
R9	330-2068
R4,39,44	330-1047
R6	330-2015
R10,40	330-2047
R12	337-3012
R13	337-1056
R15	336-1019
R16,27,38	330-5010
R17,21	330-2022
R1	331-2010
R 30	330-3068
R20	330-5022
R11	330-1022
R22	330-4047
R23	330-4015
R24	336-1021
R28	331-0022
R26	330-6012
R18	336-0031
R29	330-5027
R31	330-6047
R32	330-2010
R18, 33	336-1020
R34	333-0067
R35	336-1015
R36	330-1068
R1	332-1033
R41	330-4027
R43	330-4068
R7	320-2286
D2	380-4000
D3	380-2001
D5,7	380-3009
D6,9	380-3010
D8	380-3012
D4,10	380-1001
E1	320-0054
R43	330-4068

COMP.	W. L. PART NO.
C1, 24	300-3006
C2,10,27	300-3019
C3	300-1820
C9	300-1470
C12	300-2415
C26,29	300-2247
C14	300-3310
C16,18	300-1915
C19	300-3010
C21,23	300-1918
C22	300-4000
C25	300-2416
C28	300-2418
C4,8,17	300-1912
C5	300-2215
C6,11,20	300-3062
C7	300-3035
C13	300-1914
C32	300-1047
Q1	375-1012
Q2	375-1056
Q3	375-1027
Q4	375-1027
Q5	375-1014
C15	300-4022
T1	410-1006
C33	300-1921

E-REV 7456	E-REV 7456-1	E-REV 7456-2
4	4	1

REV	DESCRIPTION
9	DWR # 5396
6	REVISED PER ECN # 1724 APP'D
2	REVISED PER ECN # 1084 APP'D
1	REVISED PER ECN # 1084 APP'D
4	REVISED PER ECN # 1084 APP'D
7	REVISED PER ECN # 1084 APP'D
3	REVISED PER ECN # 1303 APP'D
3	REVISED PER ECN # 1347 APP'D
3	REVISED PER ECN # 1311 APP'D
4	REVISED PER ECN # 1311 APP'D
4	REVISED PER ECN # 17052 APP'D

WANG LABORATORIES, INC.

BY	DATE	APPROVED BY	DATE
DWN	5-31-77	E ENGR	
CHK	6-30-77	M ENGR	
		MFG ENGR	

MODEL NO. 9" & 12" WANG MONITOR
SEE ENGR SPECIFICATIONS

TITLE: ELECTRONICS PCA 9" AND 12" MONITOR

SIZE D | 7456 - | REV

SCALE | SHT | OF

DO NOT SCALE

17.4 MHz (2J) 17.4 MHz (1J) 17.4 MHz (3CC)(3F2) 17.4 MHz (3F9)(3B11)(3C4)(4E11) 17.4000 MHz XTAL C1 .01uF R1 270Ω R2 270Ω L13 SO4 L12 74161 L42 04 L43 32 L27 LS257 Q1 SPSG551 R4 1K R5 330Ω R6 10Ω R7 4.7K +5VR +10V TP15 TP14 C2 47uF 15V (T) D1 1N4148 R8 330Ω POR (4C8) POR (4D5,1B5) RESET WAIT (2A6) WAIT

BAB0, BAB1 (4FG) BAB2 - BAB12 (2G11) BAB0 - BAB3 (3G11) MREQ (1B8) RAM SEL (1D7) BAB8 BAB9 BAB10 L14 LS138 L19 L8 LS244 L20 L21 L22 L23 L24 L25 L26 L27 BAB0 BAB1 BAB2 BAB3 BAB4 BAB5 BAB6 BAB7 BAB8 BAB9 BAB10 BAB11 BAB12 BAB13 BAB14 BAB15

RATE SEL (4C11) CTC SEL (4D6) PIO SEL (4F5) CRT CONTROL SEL (3E11) PRINTER REG SEL (4D3) STATUS REG SEL (4F2) UART SEL (4C11)

PROM SEL RAM SEL (1G7) CRT RAM SEL (2A10)(3A8) L3 LS139 L15 LS240 SEE NOTE 1 SHT 8 DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 +5VR R82 4.7K SEE NOTE 1 SHT 8 SDTR (4B5) PR WST (4E3) BLINK (3B9) NO BLINK (3A9) BLK CR (3B3) S DYCR (3B3) BEEP (4A10) R75 4.7K +5VR

TPI +5VR 4.7K BUSRQ L9 Z-80 CPU D0 D1 D2 D3 D4 D5 D6 D7 L51 LS245 DIR G DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 BDB0 BDB1 BDB2 BDB3 BDB4 BDB5 BDB6 BDB7 +10V 4.7K NMI BUSAK HALT INT M1 MREQ IORQ RD WR RFSH Vcc GND +5V 20V L44 367 L42 04 +10V INT (4D4) R11 4.7K .5...K

M1 (4EG) MREQ (1G7) IORQ (4EG) RD (2B10)(4EG)(4C11) WR (2B10)(4E3)(4C11)(1EG)

BDB0 - BDB7 (2C3) WR (1B8) L5 2114 L4 2114 BAB0 BAB1 BAB2 BAB3 BAB4 BAB5 BAB6 BAB7 BAB8 BAB9 I/O1 I/O2 I/O3 I/O4 CS WE BDB0 BDB1 BDB2 BDB3 BDB4 BDB5 BDB6 BDB7

L18 2716 L17 2716 L16 2732 SEE NOTE 2 SHT 8 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 BDB0 BDB1 BDB2 BDB3 BDB4 BDB5 BDB6 BDB7 CS (PROG) CS (PROG) CS (PE) Vss Vpp Vbb Vcc 12 19 21 24 ±0V +12V -5V +5VR C3 C4 1uF C5 C6 C7 15uF 20V (T) ±0V -2V -5V +5VR +10V PROG

SEE NOTE 1 SHT 8 POR (1E10) SDTR (1D8) L73 00 L72 75150 STB GND V- V+ +12VR R63 1.5K DTR ±0V -12V +12V

R12 4.7K R13 47K L35 RESET TRIG DIS THR CNT OUT GND Vcc CB .05uF CY .01uF ±0V

TEST DB0 DB1 DB2 DB3 CLICKER CLG2 CLG1 100Ω CCW MTD EXTERNAL

ECN NO. PENDING 18485

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY	DATE
MATERIAL	DWN	6/14/77	E ENGR	
	CHK		M ENGR	
MODEL NO. 2236E SEE ENGRG SPECIFICATIONS			MFG ENGR	
FINISH	TITLE SINGLE BOARD TERMINAL ELECTRONICS			
TOL EX AS NOTED .XX ± .XXX ± FRAC ± ANG ± FINISH √	SCALE SEE CHART	SHT / OF 8	D 7592	REV
	WANG PART NUMBER		SIZE DRAWING NUMBER	

REVISION — SEE SHT 8

D 7592

DO NOT SCALE

11 10 9 8 7 5 4 3 2 1

G F E D C B A

$CC_0 - CC_7$ (1E7)

$BAB_0 - BAB_{12}$ (1E1)

$DC_0 - DC_7$ (3C10)

$\overline{RD}$ (1B8)

$\overline{GATE}$ (3A6)

$\overline{NR}$ (1B8)

CRT RAM SELECT (1D7)

SW MUX (3B7)

BAB7

L63 157 L64 L78 L77 L58 L76 L75 L73 L74 L46 L48 L45 L47 L60 L62 L59 L61 L50 L74

2114

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
MATERIAL	MODEL NO. 2236E	DWN		EE ENGR	
	SEE ENGR SPECIFICATIONS	CHK		ME ENGR	
	No.			MFG ENGR	
FINISH	TOL EE AS NOTED .XX ± .FRAC ± .XXX ± .ANG ± FINISH	TITLE SINGLE BOARD TERMINAL ELECTRONICS			
	SCALE NONE SHT 2 OF 8	SEE CHART	D	7592	ET
		MACH PART NUMBER	SIZE	DRAWING NUMBER	REV.

D 7592

SIZE A4

DO NOT SCALE

CRT 5037

L79 L96 L53 L78 L56 2708 L55 2708 L53 L73 L54 166 L70 166 L71 8251 L67 97 L57 L75 L69 L68 L98 L38 L74 04 L33 74 L31 74 L32 74 L89 74 L22 04 L42 04 L91 11 L92 02 L00 00 L27 00 L85 04 L53 00 L23 27 L23 32 L39 02 L32 02 L29 02 L20 00 L84 00 L24 00 L74 04 L62 04 L22 04 L67 97

TP28 TP29 TP0 TP6 TP18 TP19 TP22 TP25

$C_0 - C_6$ (2G11) $R_0 - R_6$ (2D11) $BAB_0 - BAB_7$ (1G7) $DB_0 - DB_7$ (1C6) $DC_0 - DC_7$ (2B1) $CCC_0 - CCC_7$ (2E1)

CRT CONTROL (1E7) CRT RAM SEL (1D7) BLINK (1C6) NO BLINK (1C6) BLANK (3F4) SW MUX (2B10) GATE (2B10) WAIT (1E10) CURSOR (3B2) CURSOR (3F7)

BK_0 (3B9) BK_1 (3E4) BK_2 (3G2) BK_3 (3D2) BK_4 (3D2) BK_5 (3C4) BK_6 (3F9) BK_7 (3F9) BK_8 (3E7) BK_9 (3B9) BK_{10} (3D2) BK_{11} (3C2) BK_{12} (3E3) BK_{13} (3E3) BK_{14} (3E4) BK_{15} (3F7) BK_{16} (3D8) BK_{11} (3B7) BK_2 (3F4) BK_{13} (3D5) BK_{14} (3F2) BK_1 (3F8) BK_5 (3C8) BK_{15} (3G7) BK_{16} (3G6) BK_1 (3F1) BK_{1C} (3G6)

HK_{15} (3B2) HK_{12} (3E5) HK_{13} (3D5) HK_{14} (3F2)

V SYN (3A5)(4D6) H SYN (3A8) H SYN (3E10) V SYN (3E9) 17.41 MHz (1G9) 17.4 MHz (1G9) 17.4 MHz (1S1) BLINK (3C9) $\overline{SOYCK}$ (1D6) $\overline{BLK\ CR}$ (1D6)

+12V +5VR +5V -5VR +5VR +12V -5V +5VR +12V

R22 4.7K R23 4.7K R24 4.7K R25 4.7K R26 4.7K R27 4.7K R28 4.7K R29 4.7K R30 220Ω R31 4.7K R32 4.7K R33 4.7K R77 4.7K R78 4.7K R79 4.7K R80 4.7K

		BY	DATE	APPROVED BY	DATE
MATERIAL	MODEL NO 2236E SEE ENGRG SPECIFICATIONS No.	DWN		E ENGR	
		CHK		M ENGR	
FINISH	TOL ±.XX AS NOTED .XXX ± FRAC ± .XXX ± ANG ± FINISH			MFG ENGR	
	SCALE NONE SHT 3 OF 3	TITLE SINGLE CRT TERM. CONT. ELECTRONICS			
		WANG PART NUMBER SEE CHART	SIZE D	DRAWING NUMBER 7542	REV

REVISION

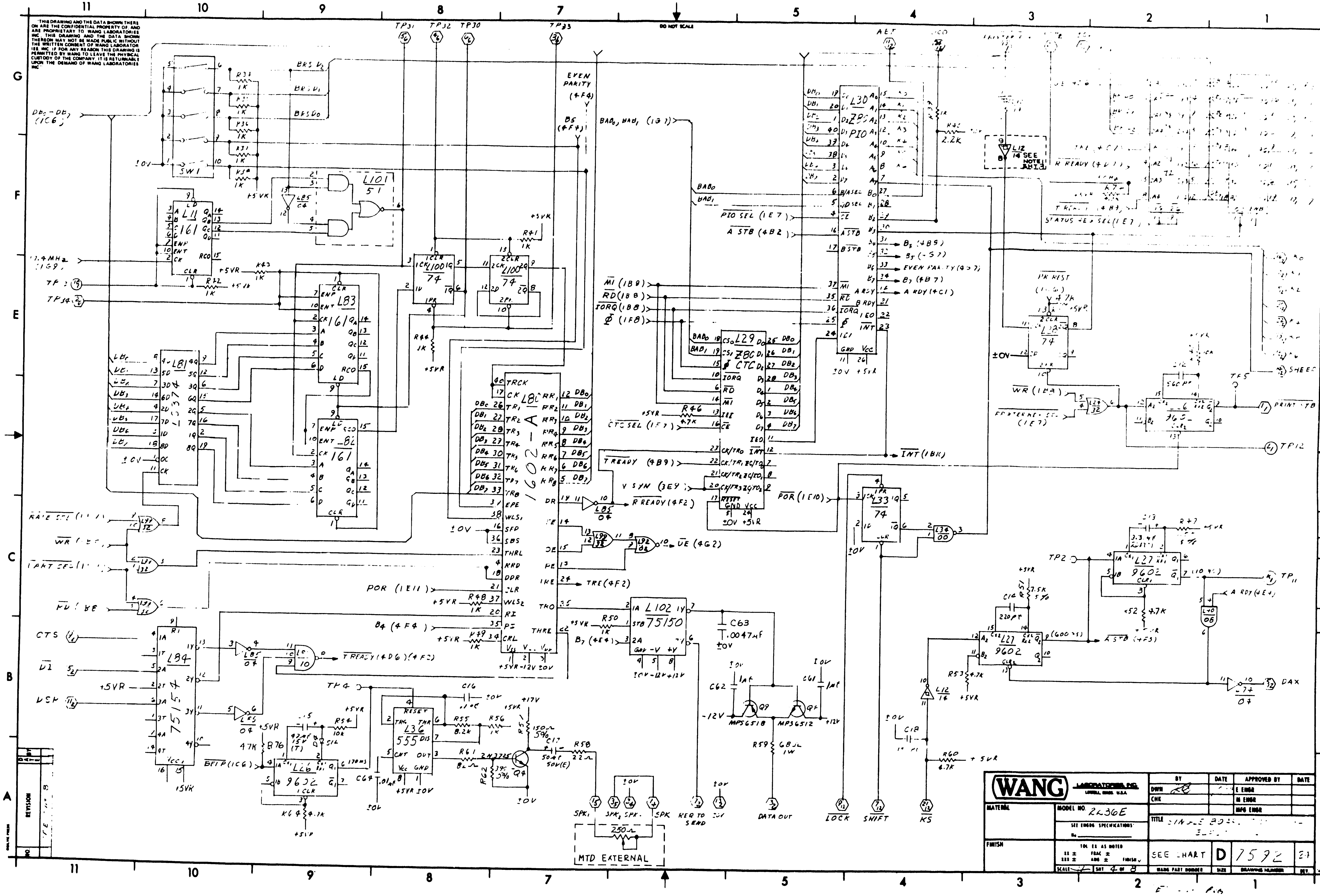
NO

DATE

BY

SEE SHT 1 FOR REVISION HISTORY

E SCHEM PKG


THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF AND ARE PROPRIETARY TO WANG LABORATORIES INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES INC.
DO NOT SCALE
SW1
L11 161
L101 51
L100 74
L83 161
L81 LS374
L82 161
L60 1602-A
L29 Z80 CTC
L30 Z80 PIO
L33 74
L34 00
L84 75154
L102 75150
L36 555
L26 9602
L27 9602
L85 04
L92 02
L97 32
TP31
TP32
TP30
TP33
TP34
TP2
TP4
TP12
EVEN PARITY (4F4)
B5 (4F4)
BABo, BAB1 (1G7)
PIO SEL (1E7)
A STB (4B2)
MI (1B8)
RD (1B8)
IORQ (1B8)
CTC SEL (1F7)
TREADY (4B9)
V SYN (3E4)
POR (1E10)
INT (1B11)
R READY (4F2)
UE (4G2)
TRE (4F2)
POR (1E11)
B4 (4F4)
B7 (4E4)
TREADY (4D6) (4F2)
BEEP (1C6)
A RDY (4C1)
EVEN PARITY (4D7)
WR (1B9)
PRINT STB
DAX
CTS
DI
DSR
SPK
REQ TO SEND
DATA OUT
LOCK
SHIFT
KS
MTD EXTERNAL
MPS6518
MPS6512
2N3725
WANG LABORATORIES INC.
MODEL NO 2236E
SEE CHART
D 7592

DO NOT SCALE

7 VAC - T1 (13)
7VAC - T2 (23)
17 VAC - T1 (53)
17VAC - T2 (33)
±10V - T1 (43)
±10V - T2 (63)
±10V

D5 SR5605 D6 EM403
D7 SR5605 D8 EM403
D9 A15A D10 EM403
D11 A15A D12 EM403

C19 9.5K MF 15V
C20 9.5K MF 15V
C21 1K MF 25V
C25 6K MF 30V
C26 1.15K MF 50V

U21 723
R65 6.8C Ω
R66 1K
R67 2.2K
C22 .1MF
C23 100PF
C24 ±10V .015 MF MYLAR 400V
R68 1.5K
R69 .15Ω 5W 5%
+5VR

U20 723
C27 .01MF
R70 680Ω
R71 .15Ω 5W 5%
C28 .047 (IN) 150 MF
C29 .47MF 50V MYLAR
R72 1K
R73 680Ω
+17V

Q6 MA7905
C29 .47MF 50V MYLAR
C30 1MF

Q7 MA7912
C31 .47MF 50 V MYLAR
C32 1MF

MTD EXT 2N6282 Q1A
2N6282 MTD EXT Q1A

+5VR
+17V
+12V
-5V
-12V

REVISION	BY	DATE
NO.		

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

	BY	DATE	APPROVED BY	DATE
DWN	[illegible]	3/9	E ENGR	
CHK			M ENGR	
			MFG ENGR	

MATERIAL — MODEL NO. [illegible] — SEE ENGRG SPECIFICATIONS No. ____

TITLE SINGLE BOARD [illegible] ELECTRONICS

FINISH — TOL EX AS NOTED: XX ± FRAC ±; XXX ± ANG ± FINISH √

SCALE [illegible] SHT 5 OF 5

SEE CHART — WANG PART NUMBER — D — SIZE — [illegible] — DRAWING NUMBER — 23 — REV

SIZE D

DO NOT SCALE

220-1136

220-1163

7592
R6

J19 J15 J13 J17 J3 J5 J18 J4 J11 J10 J7 J8 J9 J12 J1 J2

C19 C20 C25 C26 C31 C21 C29

KEYBOARD

PRINTER

RS-232C

SEE NOTE 1 SHT 8

SPARE

	BY	DATE	APPROVED BY	DATE
DRWN			E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

FINISH

MODEL NO. 2236E
SEE ENGRG SPECIFICATIONS

TOL. EX. AS NOTED
XX ± FRAC ±
XXX ± ANG ±
FINISH √

TITLE SINGLE BOARD TERMINAL ELECTRO...

SEE CHART | D | 7592 | 21

SCALE | SHT 6 OF 8 | WANG PART NUMBER | SIZE | DRAWING NUMBER | REV.

REVISION

"E" SIZE ANSI

DO NOT SCALE

210 = 209 + 378 OR 377

210	209	L45	L9	L16	L17	L18	L29	L30	L55	L56	L79	L80
7592-A	7592	377-0341-L	377-0344	378-2496-R1	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	377-0323	377-0372	377-0071
AZERTY 7592-B	7592	377-0341-L	377-0344	378-2620	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2415	377-0372	377-0071
SWEDISH 7592-C	7592	377-0341-L	377-0344	378-2624	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2416	377-0372	377-0071
J.K. 7592-D	7592	377-0341-L	377-0344	378-2627	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2418	377-0372	377-0071
GERMAN 7592-E	7592	377-0341-L	377-0344	378-2629	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2420	377-0372	377-0071
SWISS/GER. 7592-F	7592	377-0341-L	377-0344	378-2626	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2414	377-0372	377-0071
SWISS/FR. 7592-G	7592	377-0341-L	377-0344	378-2625	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2414	377-0372	377-0071
NL 7592-H	7592	377-0341-L	377-0344	378-2630	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2419	377-0372	377-0071
NO 7592-J	7592	377-0341-L	377-0344	378-2622	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2417	377-0372	377-0071
CYRILLIC 7592-K	7592	377-0341-L	377-0344	378-2628	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2413	377-0372	377-0071
DANISH 7592-L	7592	377-0341-L	377-0344	378-2623	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2417	377-0372	377-0071
GR/LT 7592-M	7592	377-0341-L	377-0344	378-2621-R1	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2421	377-0372	377-0071
AL 7592-N	7592	377-0341-L	377-0344	378-2697	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2648	377-0372	377-0071
DIAG. 7592-P	7592	377-0341-L	377-0344	378-2519	378-4194-R1	378-4193-R1	377-0343	377-0342			377-0372	377-0071
KATAKANA 7592-Q	7592	377-0341-L	377-0344	378-2500	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2044-R3	377-0372	377-0071
EURO-SPAN. 7592-R	7592	377-0341-L	377-0344	378-2673	378-4095-R1	378-4094-R1	377-0343	377-0342	378-2447-R1	378-2672	377-0372	377-0071
REPAIR KIT 7592-S	7592	377-0341-L	377-0344	378-2673	378-4227	378-4226	377-0343	377-0342	378-2447-R1	378-2672	377-0372	377-0071
ICELANDIC 7592-T	7592	377-0341-L	377-0344	378-2706			377-0343	377-0342	378-2447-R1	378-2705	377-0372	377-0071
CANADIAN 7592-U	7592	377-0341-L	377-0344	378-2716			377-0343	377-0342	378-2447-R1	378-2715	377-0372	377-0071

NO	REVISION	BY
	SEE SHEET 3	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

	BY	DATE	APPROVED BY	DATE
DWN	[illegible]	11/78	E ENGR	
CHK			M ENGR	
			MFG ENGR	

MATERIAL

MODEL NO 2236E

SEE ENGRG SPECIFICATIONS

No.

TITLE SINGLE BOARD TERMINAL ELECTRONICS

FINISH

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH √

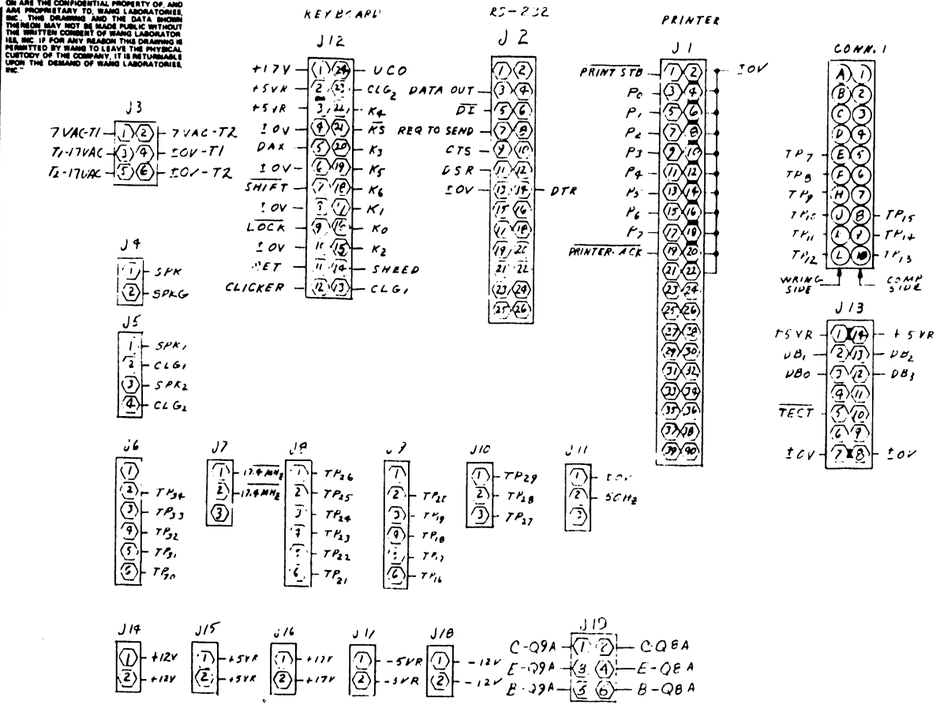
SCALE SHT 2 OF 3

WANG PART NUMBER [illegible] SIZE D DRAWING NUMBER 7592 REV

FOR USE PER

D 7592

DO NOT SCALE



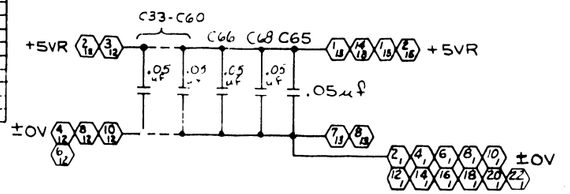
COMPONENT	W.L. PART NO	TYPE
J1	350-0801	40 PCS CONN.
J2	350-0100	26 PCS CONN
J3,19	659-1186	6 PCS CONN.
J4,14-18	659-1198	2 PCS HEADER
J5	658-1194	4 POS HEADER
J6,8,9	658-0106	6 PCS HEADER
J7,10,11	659-0104	3 POS HEADER
J12	326-9118	36 POS CONN.
J13	326-9001	18 POS CONN.
L9,30,39,80	376-9017	SOCKET 40 PIN
L4,5,35-38,59-62	376-9014	SOCKET 18 PIN
L27	376-9013	SOCKET 22 PIN
L10-17,18,55,56	376-9003	SOCKET 24 PIN
L29	376-9015	SOCKET 28 PIN

LOCATION	W.L. PART N.	I.C. TYPE
L1	376-0312	74LS75
L2,11,82,83	376-0099	7416I
L3	376-0226	74LS139
L4,5,35-38,59-62	SEE CHART	
L6,7	SPARE	
L8,19,65	376-0288	74LS244
L9	SEE-CHART	
L10,66		NOT USED
L12	376-0139	7414
L13	376-0187	74S04
L14,98	376-0298	74LS138
L15	376-0297	74LS240
L16,17,18	SEE CHART	
L20,21	376-0066	723
L22,92,94,85	376-0010	7404
L23	376-0125	7427
L24,93,03,99	376-0093	7432
L25,87		SPARE
L26,27	376-0104	9602
L28,31,32,33,89,100	376-0006	7474
L29	SEE-CHART	
L30	SEE-CHART	
L34,39,53,90,97	376-0002	7400
L35,36	376-0126	555
L37,41,57	376-0310	74LS373
L38	376-0085	7409
L39,92	376-0016	7402
L40	376-0081	7408
L44	376-0176	74367
L49,50,51	376-0285	74LS245
L52	376-0270	74S175
L54,70	376-0109	7416
L55,56	SEE CHART	
L58	376-0049	7455
L63,64,78	376-0082	7417
L67	376-0186	7417
L68	376-0191	74160
L69	376-0119	74175
L71	376-0232	74LS298
L75	376-0209	741510
L76,88	376-0193	74502
L77	376-0301	74S158
L78	SEE-CHART	
L80	SEE-CHART	
L81	376-0286	74LS374
L84	376-0077	75154
L86	376-0003	7410
L91	376-0194	7411
L94	376-0206	74S260
L95	376-0271	74386
L96	376-0209	74LS378
L101	376-0012	7451
L102,72	376-0076	75150

I.C. TYPE	LOCATION	SPARE
1100	L37	2
7402	L39	1
74S02	L88	2
7404	L22	6
	L42	1
	L85	1
7408	L40	1
7410	L86	2
741510	L75	2
7411	L91	2
7432	L24	1
	L93	2
74S5.	L101	1
1412	L28	1
7413	L12	2
7432	L93	1
74S86	L99	1

COMPONENT	W.L PART NO	TYPE
R1,2	330-2027	270-Ω ¼W 10%
R3 9-12 22-27 31 32 33 46-52 53 60 64-74 75-82	330-3047	6.2K ¼W 10%
R4,34-39,41-49,40 49,50,56,88	330-3013	1K ¼W 10%
R5,8	330-3033	330Ω ¼W 10%
R6	330-1015	10Ω ¼W 10%
R7,90,67	330-3022	2.2K ¼W 10%
R13	330-4047	4.7K ¼W 10%
R14	330-2049	499Ω 1/4W 1%
R15	330-1057	562Ω ¼W 5%
R16	330-3013	1K ¼W 5%
R17	330-2011	150Ω ¼W 5%
R18,19	330-3052	5.1K ¼W 5%
R20,21,58	330-1022	220Ω ¼W 10%
R30	330-2022	220Ω ½W 10%
R45,54	330-4010	10A ¼W 10%
R47,51	330-3076	7.5K ¼W 5%
R55	330-3082	8.2K ¼W 10%
R57	330-2216	150Ω ¼W 5%
R59	332-1068	6.8Ω 1W 10%
R61	330-1083	8Ω ¼W 10%
R62	330-6249	390Ω ½W 5%
R65,70,73	330-2068	680Ω ¼W 5%
R66,72	330-2027	1K POT
R68,63	330-3215	1.5K ¼W 10%
R69,71	330-0015	15Ω ¼W 5%
C1,2,64,27	300-1703	.01MF 50V CER
C2,15	300-4020	47MF 15V TI
C3-6,34,32 61,62	300-1931	1MF 50V CER
C7	300-4022	15MF 20V TI
C67	300-2147	.047MF 100V (A)
C12	300-1960	560PF 500V CER
C13	300-4032	33MF 20V TI
C16,22	300-1130	.1MF 50V CER
C17	300-3010	50MF 50V ELEC
C18	300-1150	150PF 500V CER
C19,20	300-3081	2.5MF 15V ELEC
C21	300-3062	1MF 25V ELEC
C23,28	300-1100	100PF 50V CER
C24	300-2417	.015MF 100V MYLAR
C25	300-3080	4.7MF 10V ELEC
C26	300-3255	1.5MF 50V ELEC
C29,31	300-2368	.47MF 50V MYLAR
C8,33-60,65,66,68	300-1700	.05MF 12V CER
C69	300-1920	.004.7MF 100V CER
C14	300-1210	220PF 500V CER
Q1	375-1054	MPS6551
Q2,9	375-1014	MPS6518
Q3	375-1252	MPS6514
Q4	375-0227	2N3725
Q6	374-0302	MA7705
Q7	374-0003	MA7712
Q8	375-1512	MPS6512
D1,2,3,4	380-1101	1N4148 75V 25MA
D5,11	380-3008	ALSA 81T
D6,8,10,12	381-1300	1N4003/A3003+
D7	380-3015	SR5605
XTAL	321-0329	12.4333 MHz
SW1	325-501	SPST SLIDE

VECTOR	CONNECTOR
ABT	4G6
CLG1	1A9
CLG2	1A5
SHEED	A5
CTS	4B1
DATA OUT	4A5
DAX	4B1
DB0-DB7	1A7
DI	4B7
DSR	4B
DTR	1B1
K0-K6	4E1
K5	4A5
LOCK	4A5
P0-P7	4G1
PRINTER ACK	4A3
PRINT STB	4D1
REQ TO SEND	4A6
SHEED	4E1
SHIFT	4A6
TEST	1A7
TP7	3D1
TP8	3C1
TP9	3C1
TP10	3E1
TP11	4C1
TP12	4D1
TP13	4E1
TP14	4F1
TP15	1E11
TP16	3E1
TP17	3B
TP18	3B
TP19	5A6
TP20	3F1
TP21	3D1
TP22	3A10
TP23	3E1
TP24	3C
TP25	3A5
TP26	3E1
TP27	3C
TP28	3C7
TP29	3C7
TP30	4B8
TP31	4B8
TP32	4B7
TP33	4G7
TP34	4E1
11.9 MHZ	G10
50 HZ	4J3
SPK1	1A7
SPK2	4A6
SPKG	4A6
+5V	4A6



E-REV

D

REVISION	BY	DATE	NO
ADD U34 & U35		11-19-79	8
REV PER ECN		12-7-79	9
REV PER ECN #13947 ADD U36 & U37		12-11-79	10
REV PER ECN #12945 & U2954 ADD U38 & U39		12-11-79	11
REV PER ECN #13376 ADD U40		12-11-79	12
REVISED PER ECN #13399 ADD: U41 thru U44		12-7-79	13
REVISED PER ECN #13495 ADD: U45 & U46		12-11-79	14
REVISED PER ECN #13532 ADD: U47 & U48		12-11-79	15
REVISED PER ECN #13533 ADD: U49 & U50		12-11-79	16
REVISED PER ECN #13538 ADD: U51 thru U54		12-11-79	17
REVISED PER ECN #13539 ADD: U55 thru U58		12-11-79	18
REVISED PER ECN #13699 ADD: U59 & U60		4-1-80	19
REVISED PER ECN #13578 ADD: U61 & U62		6-18-80	20
REVISED PER ECN #13572 ADD: U63 & U64		9-9-80	21
REVISED PER ECN #14635 ADD: U65 & U66		10-30-80	22
REVISED PER ECO #13717 ADD: U67 & U68		12-31-80	23
REVISED PER ECO #13773 ADD U69		2-13-81	24

E-REV

WANG LABORATORIES INC. LOWELL, MASS. U.S.A.

	BY	DATE	APPROVED BY	DATE
DWN			EE ENGR	
CHK			MECH ENGR	
			MFG ENGR	

MATERIAL — MODEL NO 2236E — SEE ENGRG SPECIFICATIONS No.

FINISH — TOL EE AS NOTED .XX ± .XXX ± FRAC ± ANG ± FINISH

TITLE: SINGLE BOARD TERMINAL FLEXIKON CL

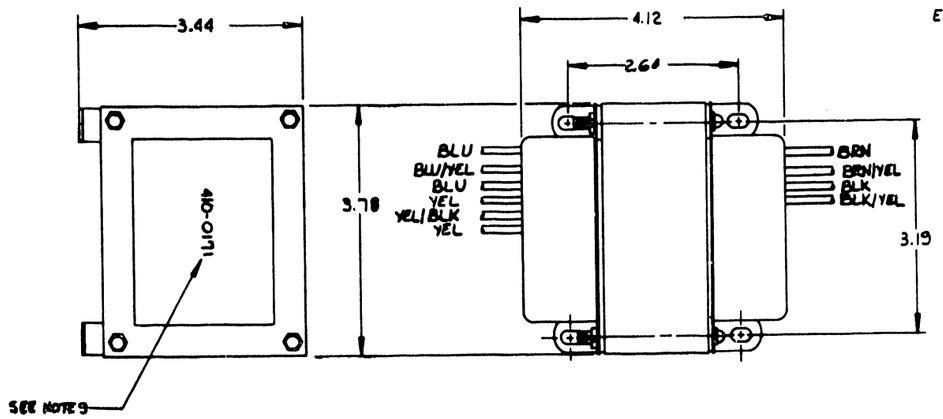
SCALE — SHT 8 OF 8 — EE CHART — SIZE D — DRAWING NUMBER 7592 — REV 24

WANG PART NUMBER

E SIZE DWG.

DIMENSIONS IN PARENTHESIS, TOLERANCES TO BE ESTIMATED TO SUCH DIMENSIONS.

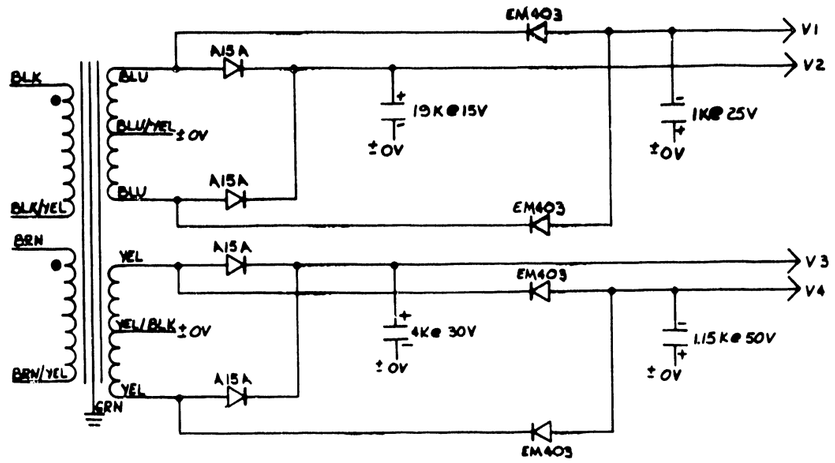
DO NOT SCALE



ELEC. NOTES.

1.) OPERATING FREQUENCY: 50/60 HZ ±5 HZ.
2.) INPUT VOLTAGE RANGE: ±10% 115/230 VAC.
3.) DIELECTRIC TEST VOLTAGE: 1500 VRMS PRI., 1000 VRMS SEC. FOR 1 MIN.
4.) CENTER TAPS BALANCED: ±1%
5.) AC INPUT TAPS ± 1%.
6.) LEAD LENGTH: 18" MIN., UL. & CSA APPROVED PVC WIRE STANDARD WALL.
7.) ALLOWABLE HEAT RISE: UL SPEC. 506 FOR CLASS B UNIT.
8.) LOAD INRUSH AT 115 VAC INPUT, SHALL NOT BLOW A 2 AMP SLOW BLOW FUSE.
9.) WANG LAB. N# & MANUFACTURERS N# SHALL BE MARKED USING .12 HIGH CHARACTERS WITH CONTRASTING INK.
#10.) END CAPS & COPPER STRAP REQUIRED

NOTE: THIS TRANSFORMER WILL BE USED NEAR A CRT. REQUIREMENT #10 MAY NOT BE REQUIRED IF THE TRANSFORMER CAN BE DESIGNED WITH A LOW FLUX LEAKAGE



	MIN. INST. VOLT	LOAD IN AMPS	AC INPUT	MAX INST. VOLT @ NO LOAD & 127 VAC INPUT	NOTES
V1	-6.5 VDC	.20	103 VAC	- 13 VDC	ALL OUTPUTS MUST BE LOADED WITH 560Ω MIN LOAD. MMC 8059 IS UNSHIELDED PART. MMC 8059-S IS SHIELDED PART.
V2	6.5 VDC	3.0	103 VAC	+ 13 VDC	
V3	+17 VDC	2.0	103 VAC	Δ + 30 VDC	
V4	-17 VDC	.20	103 VAC	Δ - 30 VDC	

QTY.	ITEM	WANG PART NO.	DRAWING NO.	DESCRIPTION
NEXT ASSY.				

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

FINISH

MODEL NO. 2236 DE
SEE DRAWING SPECIFICATIONS No. ES1001

TOL. ON AS NOTED: XX ± .010 FRAC ± 1/64; XXX ± .005 ANG ± 1°30' POINTS ±

	BY	DATE	APPROVED BY	DATE
DWN	MFB	11/80	C. EMBR	W.C.D. 11/11/80
CHK		11/80	M. EMBR	
QTY/ 1		11/80	MFG EMBR	

TITLE: TRANSFORMER, 2236 DE

410-0171 | D | 05068-0171 | 1

SCALE: NONE | WT / | SHT / OF /

IL10-990B0 | a

REVISION	BY	DATE
ENGR'G RELEASE		5-8-80

APPENDIX

A

ILLUSTRATED PARTS BREAKDOWN

APPENDIX A

ILLUSTRATED PARTS BREAKDOWN

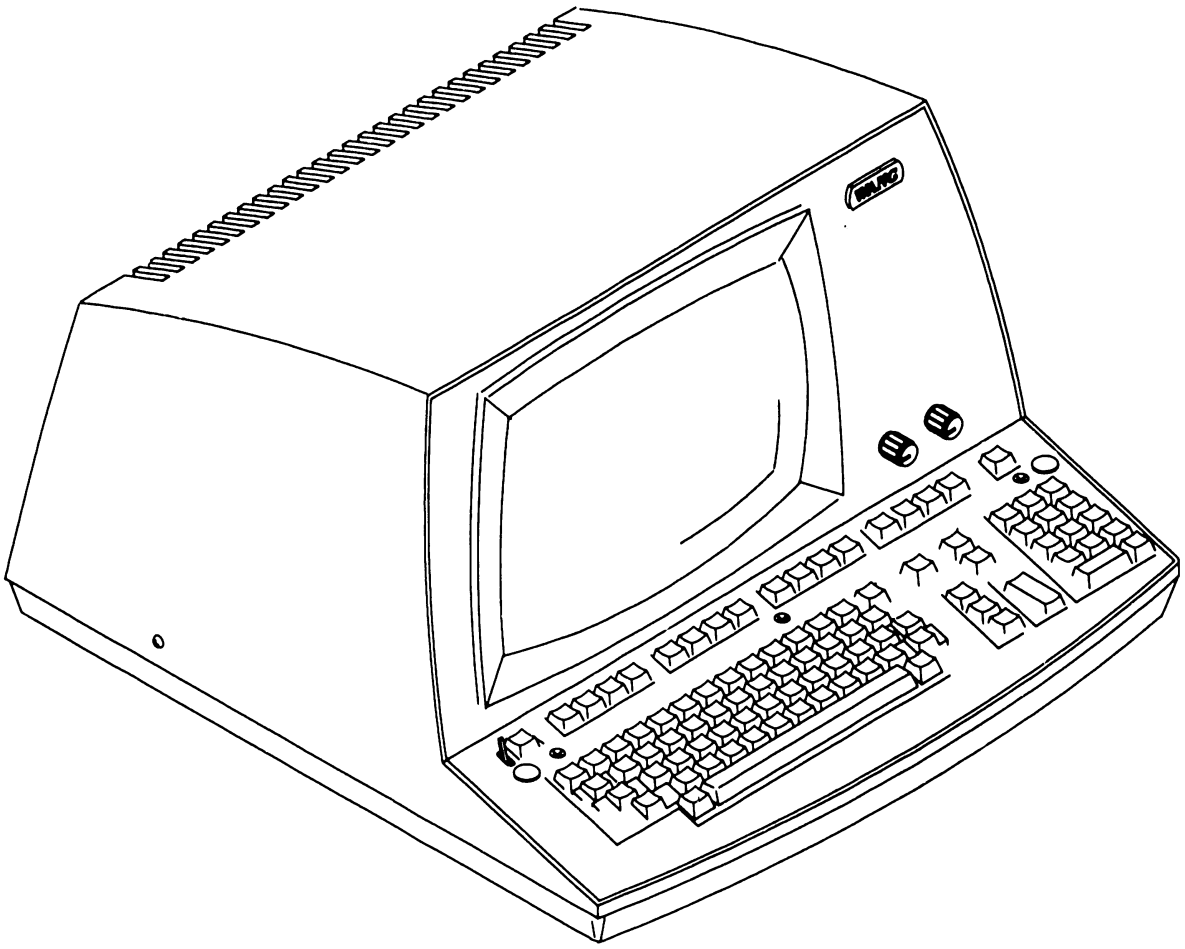


FIGURE 1 FRONTISPIECE (ASSEMBLY PART NO. 177-3249)

EXTERNAL COVERS ASSEMBLY

ITEM NO.	PART NO.	DESCRIPTION
1	449-0289	COVER, MACH (OPEN VENTS)
2	615-0398	PROGRAM STRIP
3	452-2401	PLATE FINISHING WLDMENT
4	449-0459	BEZEL, 12" CRT
5	449-0548	PLATE LOGO, WORKSTATION
6	655-0157	KNOB, ALCO
7	652-0036	3/8"-32, NUT
8	653-0022	LOCK WASHER
9	220-0160	CABLE ASSEMBLY, BRIGHTNESS POT
10	725-2637	KEYBD DW STANDARD
11	279-1026	BASE ASSEMBLY
12	650-4105	10-32x11/8 TRUSS HD PHL

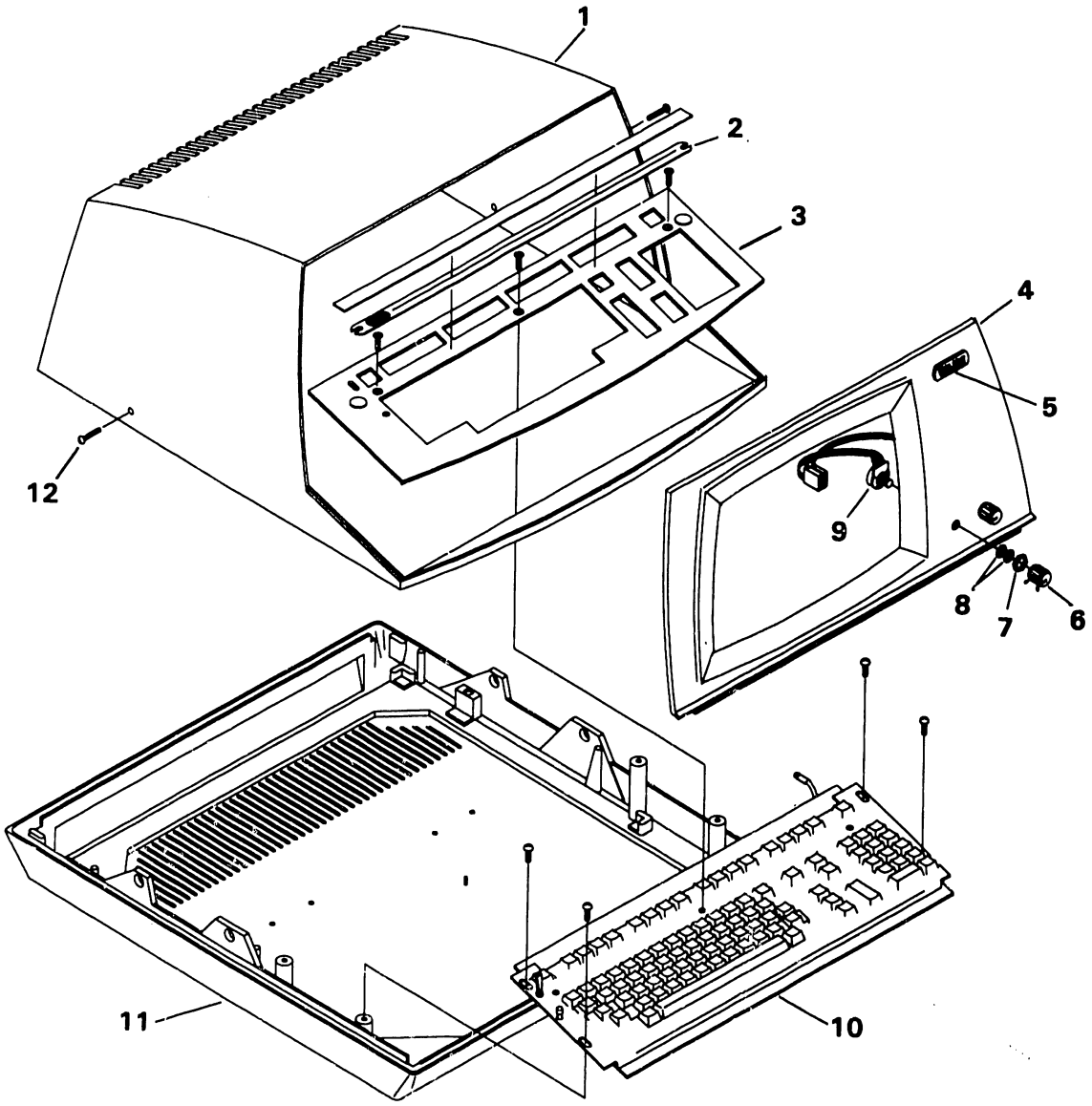


FIGURE 2 EXTERNAL COVERS ASSEMBLY

12" MONITOR & REAR PANEL ASSEMBLY

ITEM NO.	PART NO.	DESCRIPTION
1	210-7592-1A	PCA 2236DW SINGLE BD THERM ELEC
2	270-0579	HEATSINK ASSEMBLY
3	651-0037	#8x3/8" SLTD HEX S.T.SCREW
4	451-3857	SIDE PANEL (R.H.)
5	340-0108	CRT
6	270-0372	12" MONITOR ASSEMBLY
7	651-0053	#10x3/8"HEX HD S.T. SCREW
8	PART OF 6	
9	PART OF 6	
10	350-2073	ANODE CONNECTOR
11	462-0413	SPACER
12	270-3104	FLYBACK TRANSFORMER ASSEMBLY
13	650-2087	4-40x1/4" SCREW
14	210-7456	PCA 12" MONITOR ELEC
15	451-1121	CHASSIS, 12"
16	451-4492	NECKSAVER BRACKET
17	478-0448	NECKSAVER BRACKET INSULATOR
18	651-0037	#8x3/8" SLTD HEX S.T. SCREW
19	651-0037	#8x3/8" SLTD HEX S.T. SCREW
20	452-4042	CARD GUIDE
21	465-1643	GROUNDING SPRING
22	651-0037	#8x3/8" SLTD HEX S.T. SCREW
23	451-4473	SUPPORT BRACKET
24	PART OF 54	
25	PART OF 54	
26	325-2117	SWITCH SLIDE DPDT 115-220
27	654-1288	SNAP BUSHING
28	451-3856	SIDE PANEL (L.H.)
29	652-0012	8-32 LOCKNUT KEPS
30	410-2005	LINE FILTER
31	652-2004	HEX NUT
32	220-1740	A.C. CABLE
33	451-1100	CRT CHASSIS
34	650-3120	6-32x3/8" SCREW
35	220-3086	FLAT CABLE ASSEMBLY 2236E
36	320-0300	SQ. MAGNETIC SPEAKER
37	325-0033	TOGGLE SWITCH
38	360-9003	LOCKWASHER
39	360-9002	HEXNUT
40	336-0033	100 OHM POT
41	336-0034	250 OHM POT
42	652-2005	4-40 LOCKNUT KEPS
43	220-3085	FLAT CABLE ASSEMBLY RS/232
44	451-3996	SCREENED REAR PANEL
45	650-2082	4-40x1/4" FLAT HD SCREW
46	360-0000	FUSE HOLDER
47	360-1025-SB	FUSE 2 1/2 AMP 250V

12" MONITOR CRT & REAR PANEL ASSEMBLY (CONT.)

ITEM NO.	PART NO.	DESCRIPTION
48	458-0423	REAR PANEL STATIC GROUND
49	220-1076	POWER CORD ASSEMBLY
50	653-3000	FLAT WASHER #6
51	650-3120	6-32x3/8" SCREW
52	653-4002	FLAT WASHER #8
53	650-4160	8-32x1/2" SCREW
54	270-3139	TRANSFORMER ASSEMBLY
55	458-0436	SUPPORT ROD L.H.
56	458-0437	SUPPORT ROD R.H.

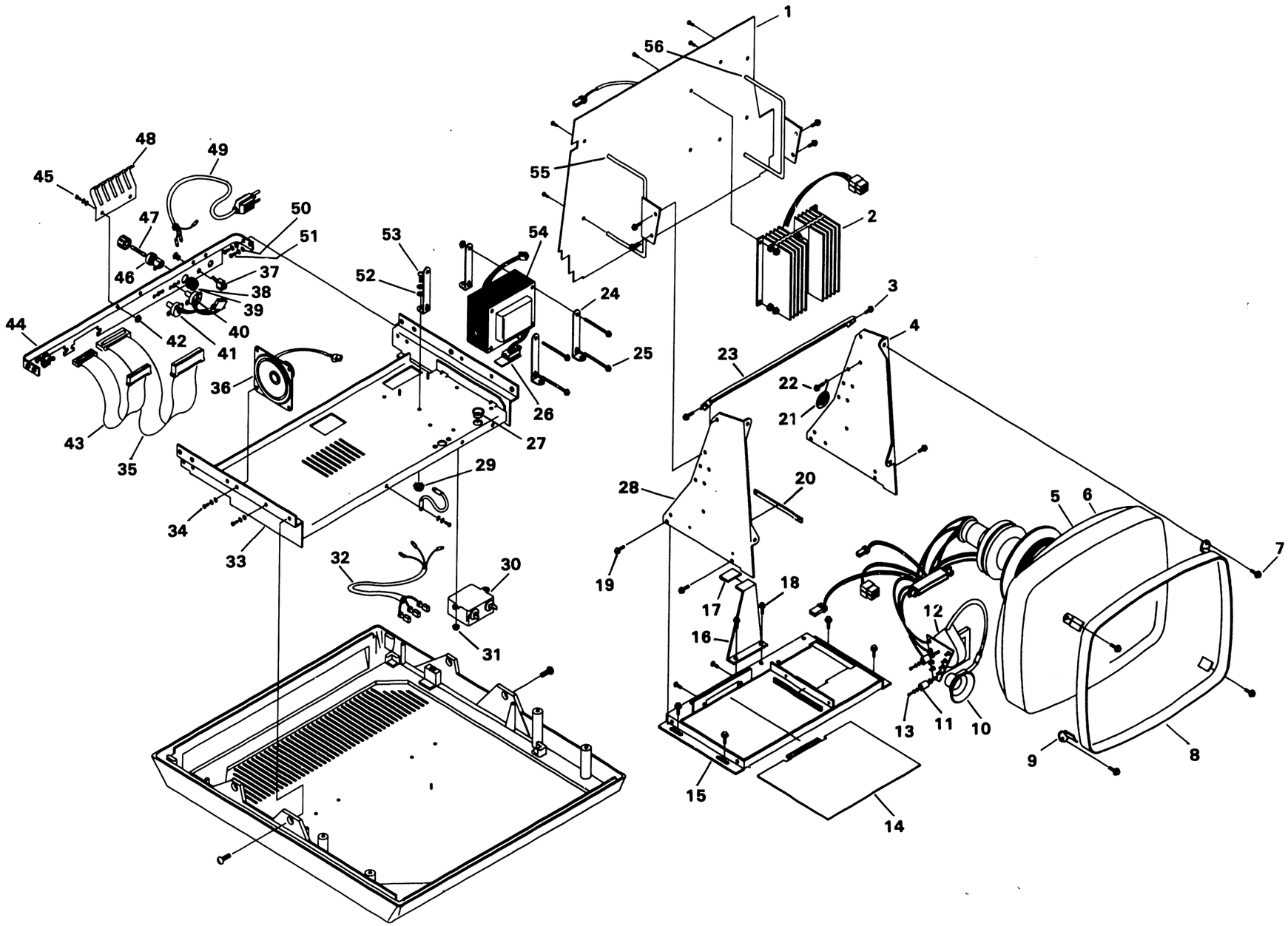


FIGURE 3 12" MONITOR & REAR PANEL ASSEMBLY

APPENDIX B

SERVICE BULLETIN NO.80

SERVICE BULLETIN NO.80

EDITED BY CUSTOMER ENGINEERING DIVISION

2236 INTERACTIVE TRANSACTION TERMINAL

1.1 GENERAL

1.1.1 2236 TERMINAL

The 2236 Interactive Terminal provides multi-user, single task applications for 2200T and 2200VP Systems. There may be from one to four such terminals in a 2200T System and from one to eight terminals in a 2200VP System. When the 2236 terminal is used in a 2200 System, the standard 2226 User Terminal is normally not used. With the exception of the Console Input/Output Terminal, the 2236 is a 'dumb' non-programmable terminal, able to perform tasks only under program control from the 2200. Any one of the terminals can be selected for Console Input/Output and therefore have programming capabilities but not more than one terminal at any one time.

Communication to and from the 2200 CPU is via the 2236MXC controller using RS-232-C asynchronous format. Standard rate is 9600 baud, but 4800, 2400, 1200, 600 or 300 baud may be selected.

The 2236 terminal consists of a 12" CRT, 7229 Hall-effect keyboard, 7292 RS-232-C Controller, 7158 CRT/Printer Controller and power supply with 7067 Regulator. The rear panel has a connector for a 21W or 31W printer and an RS-232-C connector for connection to the 2236MXC controller.

WANG LABORATORIES, INC.

1 INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL. (617) 851-4111, TWX 710 343-6769, TELEX 94-7421

Printed in U.S.A.
13-210A

Data lines between the 2236MXC and each 2236 terminal are Teletype compatible asynchronous full duplex at any one of the above mentioned baud rates. This type of communication lends itself to remote applications by using modems. Direct cable connection up to 1000 feet at 9600 baud is allowed. Above 1000 feet modems must be used.

1.1.2 2236 MXC CONTROLLER

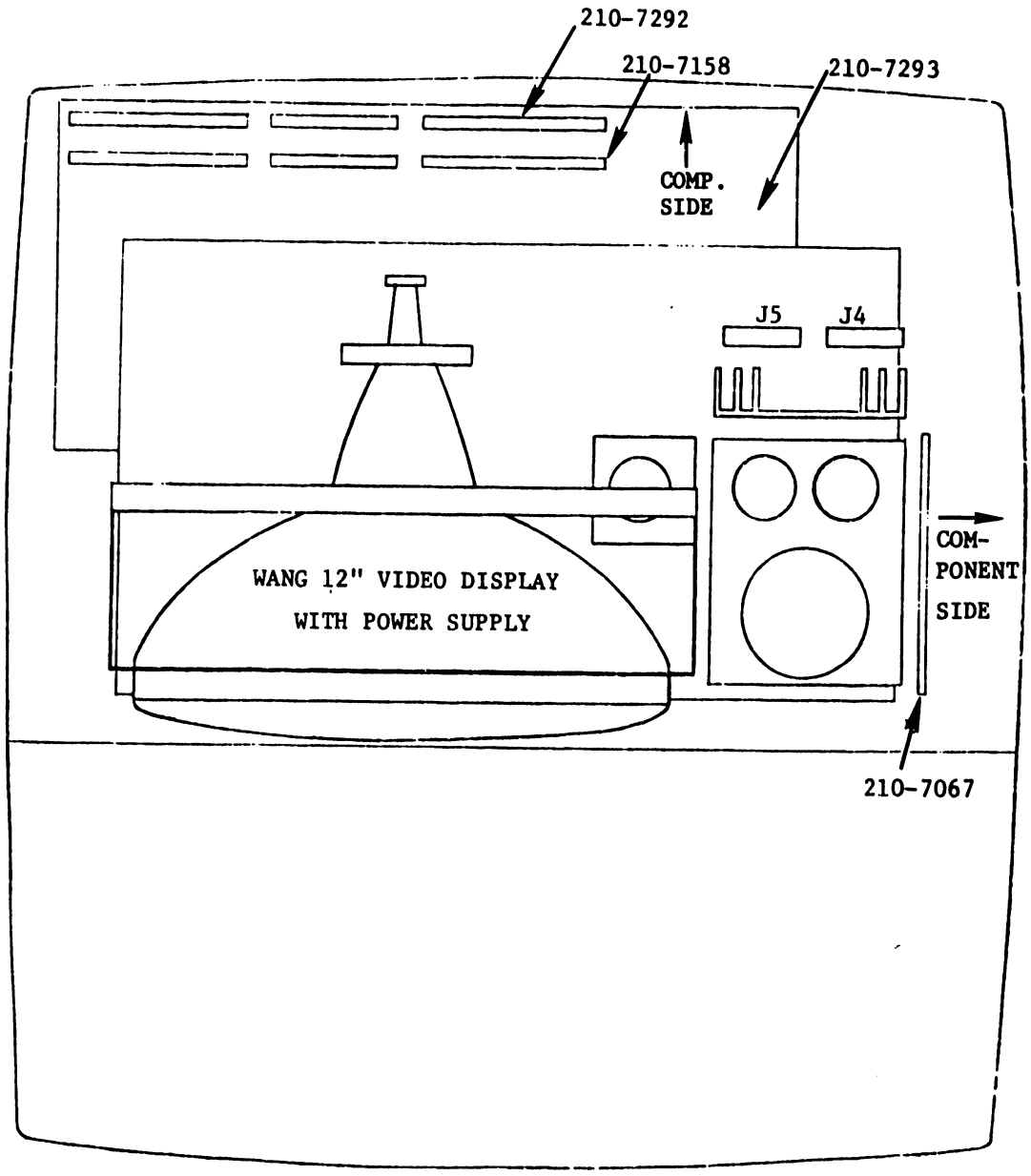
The 2236MXC is the I/O controller for up to four 2236 terminals. Four RS-232-C connectors are mounted on the 2236MXC for connection to the terminals and/or modems. The Console Input/Output connector is the top connector (viewing the controller face plate with the writing top to bottom). When used with the 2200VP, two four-port interconnected controllers may be installed. Each channel is fully buffered under microprocessor control.

The 2236MXC is controlled by 2200 BASIC routines, known as Terminal Access Method (TAM) subroutines.

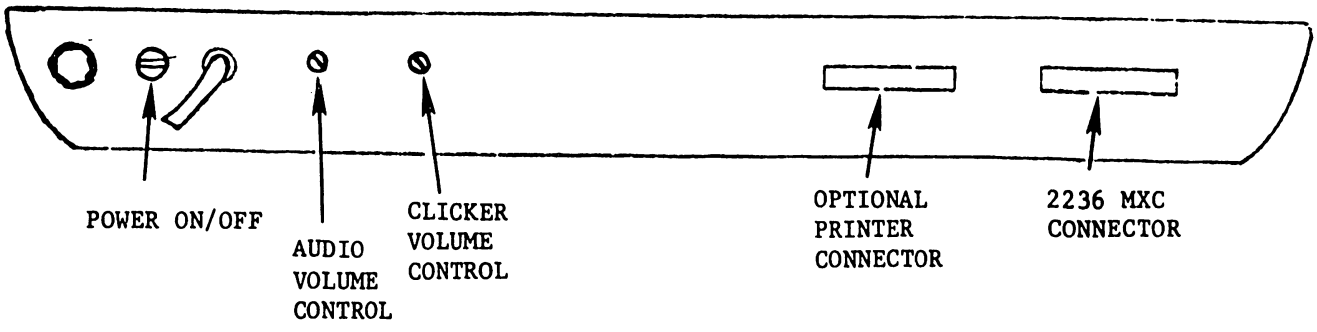
1.1.3 TAM SUBROUTINES

The TAM subroutines are incorporated into the user's BASIC program and facilitate polling tasks. The TAM subroutines also allow multiple display prompts and entry fields to appear in a fixed screen form format where the operator "fills in the blanks". Cursor positioning, which allows multiple input fields on a display screen, is also provided by RAM.

1.2 2236 CHASSIS LAYOUT



MODEL 2236 CHASSIS LAYOUT



MODEL 2236 REAR PANEL

1.2.4 CIRCUIT BOARD SUMMARY

#	Where Used	Description
7067	2236 Terminal	Power Supply Regulator
7292	2236 Terminal	Terminal CPU Electronics
7158	2236 Terminal	Terminal CRT/Printer Controller
7293	2236 Terminal	Motherboard
7229-2	2236 Terminal	Keyboard
7291	2236MXC-1	2236MXC Memory Daughterboard
7290	2236MXC-1	2236MXC Controller Motherboard
7294	2236MXC-2	2236MXC-2 Granddaughter board

1.3 SPECIFICATION

1.3.1 2236 TERMINAL

Size	
Height	13 1/2 in. (34.3 cm)
Depth	20 1/2 in. (52 cm)
Width	19 3/4 in. (50.2 cm)
Weight	
51 lb (23.1 kg)	
CRT	
Display Size	12 in. diagonal (30.4 cm)
Capacity	24 lines, 80 characters/line
Character Size	
Height	0.16 in. (0.4064 cm)
Width	0.09 in. (0.2286 cm)
Power Requirements	
115 or 230 VAC $\pm$ 10%	
50 or 60 Hz $\pm$ 1/2 Hz	
40 Watts	
Fuses	
2.5 a. @ 115V/60 Hz	
1.2 a. @ 230V/50 Hz	

1.3.2 OPERATING ENVIRONMENT

50 degrees F to 90 degrees F (10 degrees C to 32 degrees C)
20% to 80% relative humidity, allowable
35% to 65% relative humidity, recommended

1.3.3 CABLE

One 8 foot (2.4m) cord to power source. One length of 25 feet (7.6m) direct connection cable is provided with each Model 2236, unless an optional direct connection cable is ordered for that terminal. Cables are optionally available in 100 foot (30.5m) increments for direct connection up to 1,000 feet (304.8m) and are non-extendable. Modem cables are optionally available in lengths of 12 feet (3.7m), with extensions of 25 feet (7.6m) and 50 feet (15.2m); however, combined cable distance from Wang equipment to its modem is 50 ft (15.2m) maximum according to EIA standards.

1.3.4 2236MXC SPECIFICATIONS

Operating Environment

Same as 2200 CPU

Power Requirements

Operates using CPU Power Supply

Communication Modes

Full-Duplex Asynchronous Wang mode for Model 2236's.

Full-Duplex Asynchronous Teletype mode for Teletype-compatible terminals.

Number of I/O Slots Required

Model 2236MXC-1 requires one I/O slot and supports up to four terminals.

Model 2236MXC-2 requires two I/O slots and supports up to eight terminals (2200VP only).

SECTION 2
INSTALLATION

2.1 INCOMING INSPECTION

1. When a 2236 shipment arrives, remove the top cover and check the following:

   a) The 7256 board is fully inserted into the Wang display chassis.
   b) The 115V/230V AC line voltage selector switch on the Power Supply module is in the correct position.
   c) The 115V/230V AC line voltage selector switch on the Display Chassis power supply is in the correct position.
   d) The DC power cables are securely connected to the motherboard.
   e) The 7292 and 7158 boards are properly installed in the terminal.

2. Reassemble the 2236, ensuring the fan cable has been reconnected.

2.2 DEVICE ADDRESS ASSIGNMENTS

2.2.1 2236MXC-1

The 2236MXC-1 normally operates at hardwired addresses of 01/05, 02/06, 03/07 and 04/08. If the 2236MXC-1 is installed in a system using a 2226 with addresses of 01 and 05, then the 2236MXC-1 must be set to addresses 81/85, 82/86, etc., by setting one switch on. This switch changes the high order address bit from 0 to 8 and is located on the 7290 controller. Set switch ON for 8 and OFF for 0.

2.2.2 2236MXC-2

None.

2.3 SETTING THE BAUD RATE SWITCHES

2.3.1 2236 TERMINAL

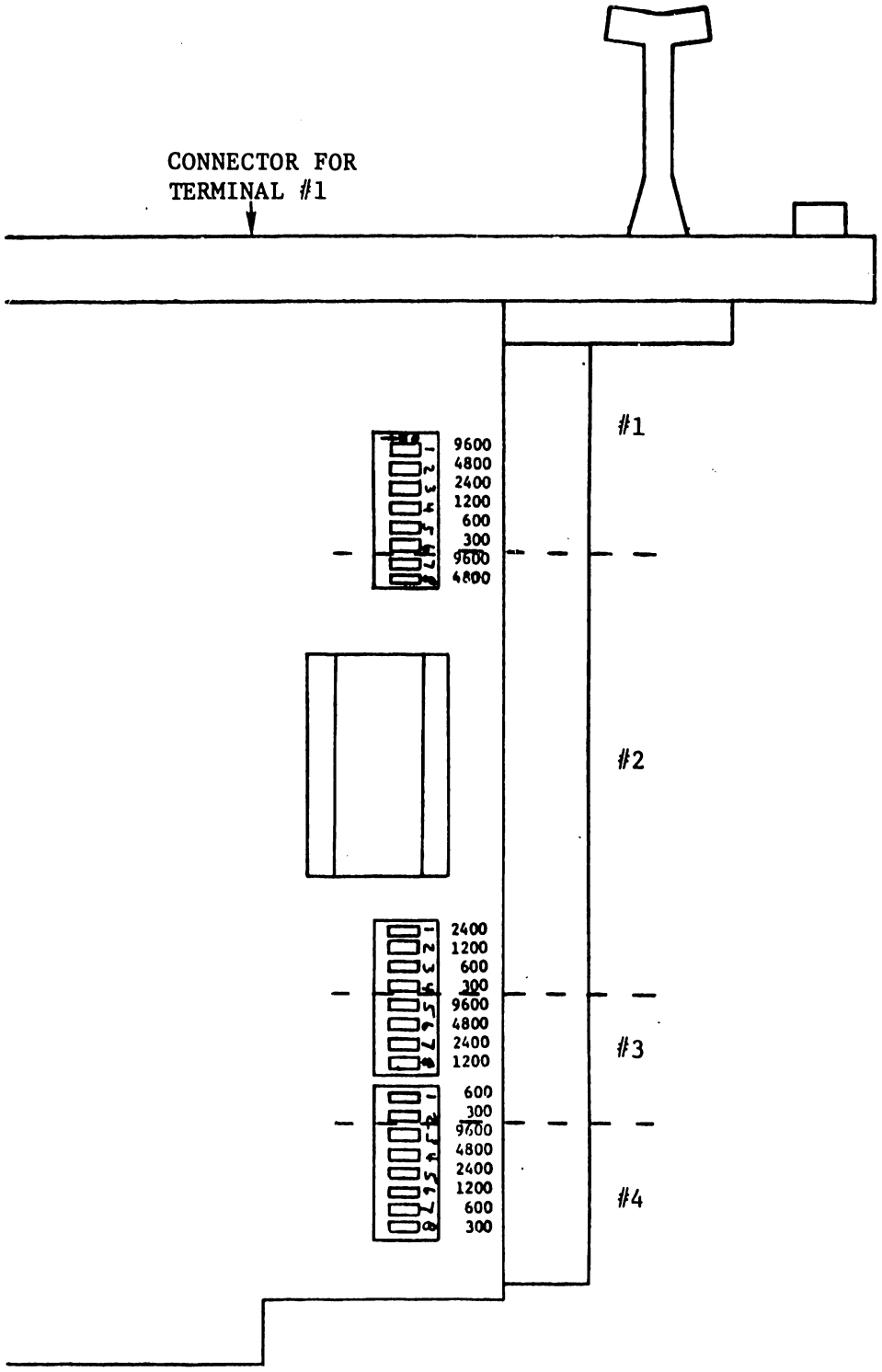
Access to the baud rate switch in the 2236 is through the large plug-button on the rear of the cover. Remove the plug and set the three rightmost switches of the five bank switch as follows (the two leftmost switches are OFF):

Switch:	1	2	3	4	5	Baud Rate
	ON	OFF	OFF	OFF	OFF	300
	ON	OFF	OFF	OFF	ON	600
	ON	OFF	OFF	ON	OFF	1200
	ON	OFF	OFF	ON	ON	2400
	ON	OFF	ON	OFF	OFF	4800
	ON	OFF	ON	OFF	ON	9600

2.3.2 2236MXC-1

There are three 8 bank switches located on the 7290 controller. The three switches are divided into groups of six switches, each group corresponding to a connector on the top panel.

Only one switch in any group of six is ON at any time. Each switch corresponds to a specific baud rate for its corresponding RS-232-C connector, as shown.



7290 BAUD RATE SWITCH IDENTIFICATION

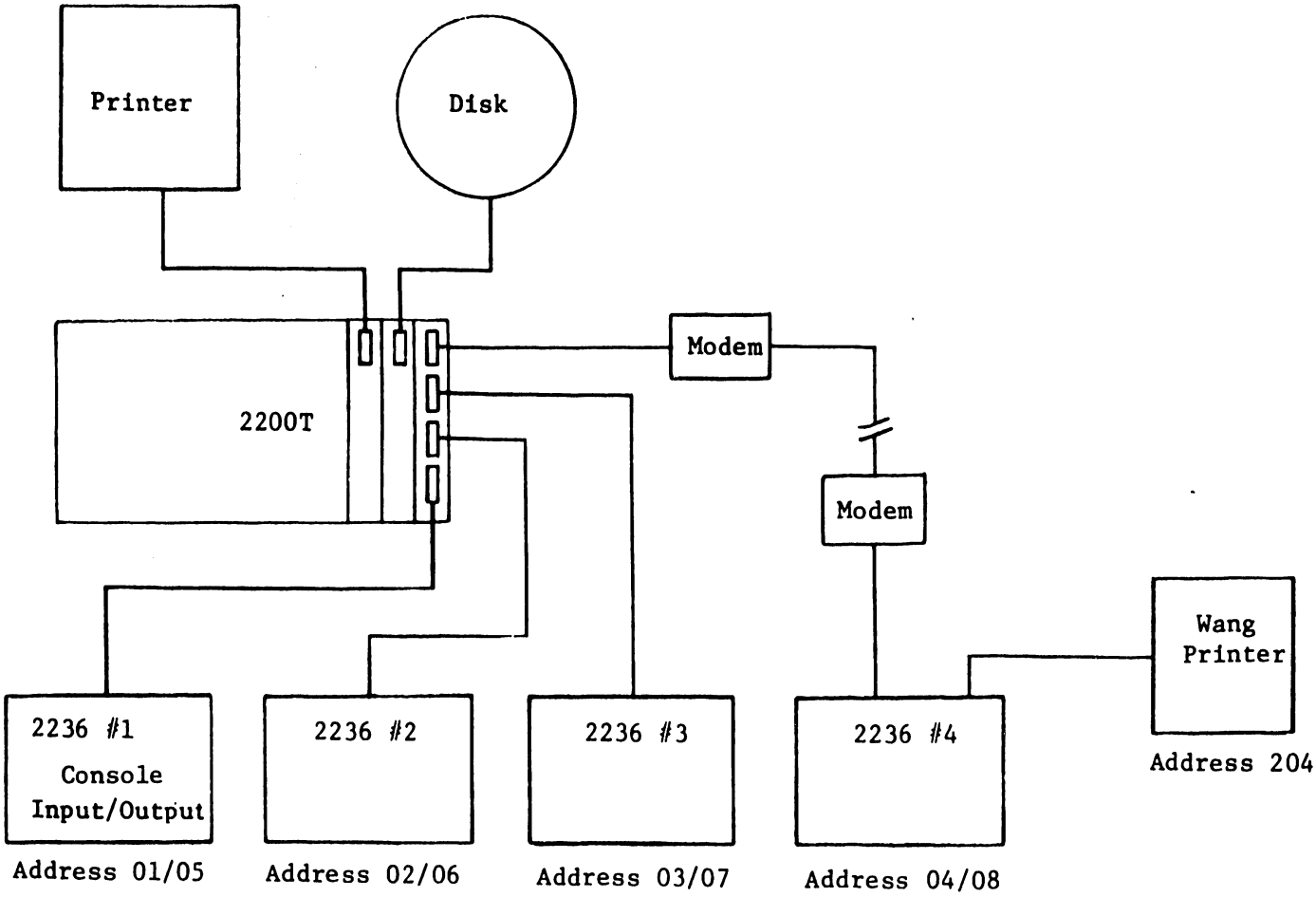
2.3.3 2236MXC-2

The baud rate switches are set the same as in 2.3.2. In addition, the switch settings are etched on the 7294 controller.

2.4 SYSTEM CONFIGURATION

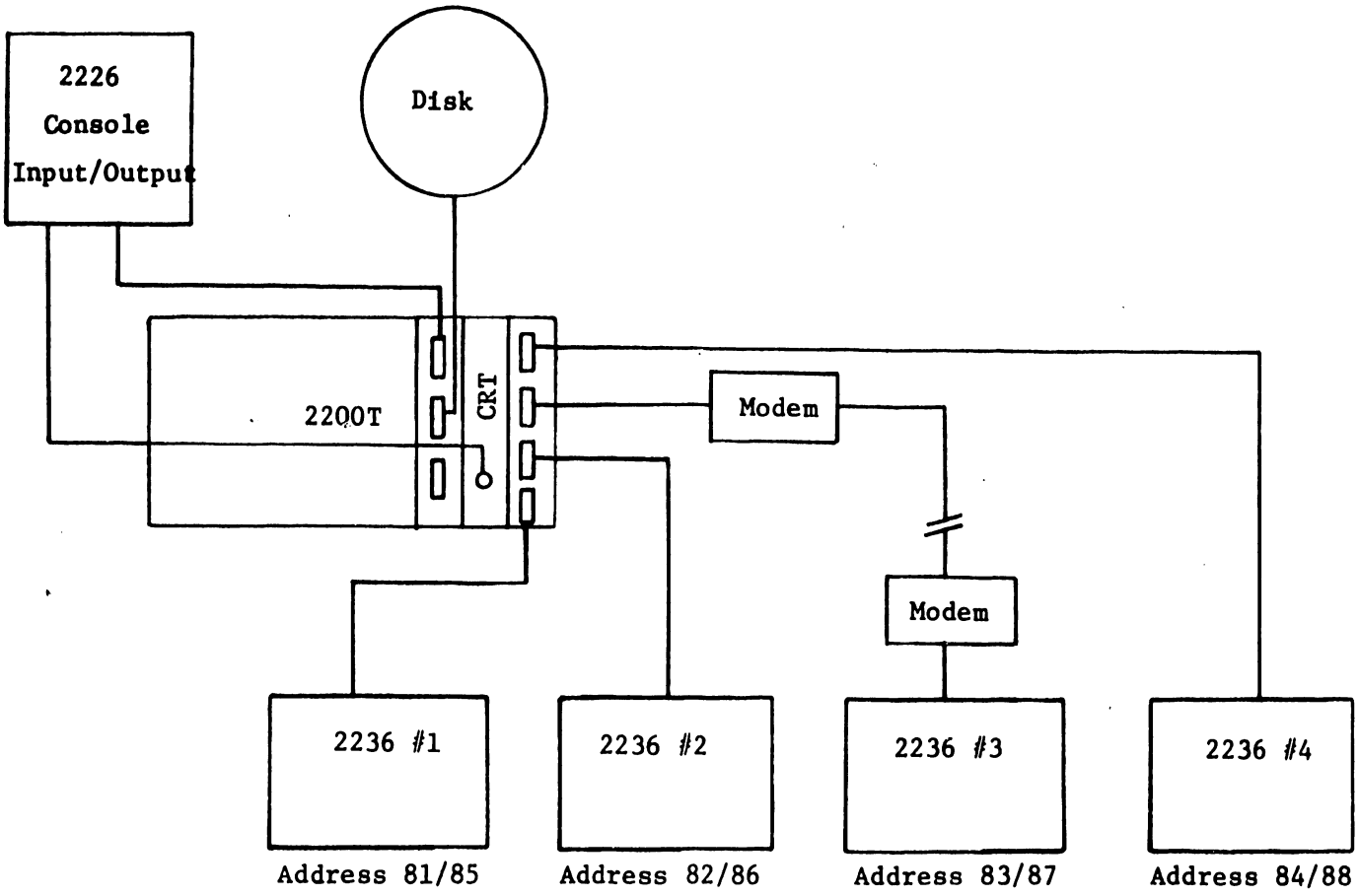
2.4.1 TYPICAL CONFIGURATION

A typical 2236 system is shown below.



2.4.2 CONFIGURATION WITH 2226 AND 2236

Alternatively, a system could be configured as follows:



2.4.3 MODEM CONFIGURATIONS

2.5 CABLES

There are two types of cables available for the 2236. They are non-extendable direct connection type, and extendable modem types.

2.5.1 DIRECT CONNECTION CABLES

Each direct connection cable is marked to specify the correct end for connection to the 2236 terminal and 2236MXC. The end that **MUST** connect to the 2236 terminal is marked TERM on the connector.

2.5.2 MODEL CABLES

When using modems, connect the modem cable between the 2236MXC controller and the modem.

At the remote end, connect the CONTROLLER end of the connector to the modem, and the TERM end to the 2236 terminal.

2.5.3 CABLE SUMMARY

OPTIONAL CABLE STATISTICS

Type of Cable: Direct Connection (non-extendable)

Length	Part Number
25 feet (7.6m)	120-2236-25 (standard, see note)
50 feet (15.2m)	120-2236-50
100 feet (30.5m)	120-2236-1
200 feet (70.0m)	120-2236-2
300 feet (91.4m)	120-2236-3
400 feet (122m)	120-2236-4
500 feet (152m)	120-2236-5
600 feet (183m)	120-2236-6
700 feet (213m)	120-2236-7
800 feet (244m)	120-2236-8
900 feet (274m)	120-2236-9
1000 feet (305m)	120-2236-10

Type of Cable: Modem Connection

Length	Part Number
12 feet (3.7m)	220-0113 (Extendable)
25 feet (7.6m)	120-2227-25 (Extension Cable)
50 feet (15.2m)	120-2227-50 (Extension Cable)

SECTION 3
OPERATION

3.1 GENERAL

In a system using all 2236 terminals, console Input/Output is assigned to one 2236. By default, this is always #1, but any can be selected for console input/output by a SELECT statement to the address of the 2236 desired. Typically,

```
SELECT CO 006:  SELECT CI002
```

would be used to select the second 2236.

The other 2236s in the system would be under PROGRAM CONTROL. They CANNOT function independently.

3.2 TAM

A software package is available for controlling the 2236s. It is known as Terminal Access Method subroutines (TAM). Refer to the TAM Operating Manual.

SECTION 4

THEORY OF OPERATION

TO BE PROVIDED AT A LATER DATE.

SECTION 5
DIAGNOSTICS

A 2236 system diagnostic has been added to the 2200 Peripheral Platter (701-2180B). The 2236 diagnostic has sixteen functional tests, each self-explanatory, with instructions displayed.

SECTION 6

CONVERSIONS AND UPGRADES

NO CONVERSIONS OR UPGRADES ARE AVAILABLE AT THIS TIME.

SECTION 7
MAINTENANCE

7.1 DISASSEMBLY

To disassemble the 2236 terminal:

a) Remove the Special Function strip and the two keyboard faceplate screws beneath it.
b) Remove one screw from each side of the 2236 cover.
c) Lift the keyboard faceplate and cover away from the chassis.

7.2 PREVENTIVE MAINTENANCE

The 2236, like other Wang products, must be properly maintained for trouble-free operation. This requires periodic cleaning and visual and electrical checks.

7.2.1 CLEANING

Thorough cleaning should be performed periodically. Cleaning intervals are determined by the amount of use and environmental conditions. Under normal use and conditions, cleaning should be once every six months. In areas of excessive air contamination (smoke, dust, etc.) more frequent cleaning is required.

Clean the 2236 terminal as follows:

a) Remove the keyboard face plate, front panel and cover.
b) Remove the CRT electronics, voltage regulator and logic board from the 2236.
c) Using a soft bristle brush, remove any accumulation of dust and dirt from the 2236 chassis and each of the pc boards, paying particular attention to the CRT chassis.

d) Clean the finger connectors of each pc board with an eraser.

e) Use a mild detergent to clean the outside covers and the face of the CRT.

f) Return all pc boards to the 2236.

g) Reassemble the unit.

7.2.2 LUBRICATION

None required.

7.3 TROUBLESHOOTING

Determining where a problem exists in the 2236/2236MXC configuration can be accomplished by isolating the problem to the 2236 terminal or the MXC controller.

7.3.1 2236 TERMINAL

The terminal can be tested functionally by inserting a "loopback" connector on the rear panel. The loopback connector is an RS-232-C connector with pins 2 and 3 connected together with the loopback connector installed, keys depressed on the keyboard will be echoed back and displayed on the CRT.

This procedure will not completely check the 2236 terminal, but will verify that approximately 90% of the 2236 is functioning properly.

7.3.2 2236MXC CONTROLLER

Once each 2236 terminal has been functionally tested, connect one of the terminals to connector #1 on the 2236MXC controller.

Turn the CPU ON, and READY should be displayed on the 2236 terminal. If not, try a different 2236 terminal. If READY does not appear, check the address switch on the 2236MXC controller for all switches OFF.

Finally, replace the 2236MXC controller or the CPU logic modules.

7.4 ADJUSTMENTS

7.4.1 RECOMMENDED TEST EQUIPMENT/TOOL LIST

a) Digital Voltmeter, with an accuracy of at least ± .1% of full scale and 1 mv. resolution factor. Multimeter/VTVM accuracy and resolution factors are unacceptable for certain critical measurements.

   Acceptable Type/Equivalent: FLUKE #8000A

b) Multimeter, 20,000 Ω /v (min.); 2% or greater full scale accuracy; for less critical measurements.

   Acceptable Type/Equivalent: TRIPLETT VOM #630NA

c) Oscilloscope, with two x 1 probes and two x 10 probes.

   Acceptable Type/Equivalent: TEKTRONIX #465

d) Plastic Alignment Screwdriver for video display adjustments.

e) Heavy Duty Screwdriver with heavily insulated handle and shaft, for discharge of video display anode voltage.

f) Insulated Heavy-Gauge Ground Wire with insulated Aligator clips (for use with item (g), above).

g) Small screwdriver with insulated shaft, used mostly for voltage adjustments.

7.4.2 2236 TERMINAL VOLTAGE ADJUSTMENTS

TABLE 7-1

2236 POWER SUPPLY ADJUSTMENTS (7067 REGULATOR)

LOCATION	VOLTAGE	LIMITS	ADJ	RIPPLE	
TP+5	+ 5VR	+4.95 vdc to +5.10 vdc	R4	20 mvp-p	7067, pin S/15
TP-5	- 5VR	-4.90 vdc to -5.10 vdc	R19	15 mvp-p	7067, pin 12
TP+12	+12VR	+11.80 vdc to +12.20 vdc	R10	50 mvp-p	7067, pin F/6
TP-12	-12VR	-11.80 vdc to -12.20 vdc	R16	50 mvp-p	7067, pin H/7

SECTION 8

BILL OF MATERIALS

ASSEMBLY PART NUMBER 177 2236 B
ASSEMBLY DESCRIPTION 2236 TRANS TERMINAL(80X24) 6621-91

LEGEND
*=KIT TAG #=STATUS ITEM ###=FRACTIONA

PART NUMBER			DESCRIPTION		QUANTITY
210 7067		*	7067 MODULE (PRELIM 928 & 2200F)	EC6845	1.00
210 7158 A		*	7158-A MODULE 2236		1.00
	209 7158		7158 W/UNLOADED SOCKETS (PRELIM)		1.00
		220 1069	CABLE,CRT BD (7054)(F)B6482-86		1.00
210 7292 A			7292 MODULE (2236)		1.00
	209 7292	*	7292 W/UNLOADED SOCKETS		1.00
270 0360			12" MONITOR ASSY(WITH PWR SUPPLY)		1.00
	210 7256	*	7256 MODULE	EC6047	1.00
	220 0160		BRIGHTNESS POT CABLE ASSY C6482-140	EC6389	1.00
	270 3068		12" CRT HARNESS ASSY D6482-139	EC6389	1.00
270 0400			2236 WORK ST CHASSIS ASSY 6621-92		1.00
	210 7293	*	7293 MODULE (2236)		1.00
		220 3014	24 COND 14"FLAT CABLE C-6482-79	PATREL	1.00
	220 1001		6 1/2" BLACK WIRE + LUG D6482-12		2.00
	220 1042		P022 WIRE & LUG ASSY(2LCRT)D6482-12		1.00
	220 1074		CABLE PS/MB(F CHASSIS)B6482-91		1.00
	220 1076		POWER CORD ASSY(F CHAS)B6482-95		1.00
	220 1077		P043 WIRE & LUG ASSY(F CHAS)B648296		1.00
	220 1094		P048 WIRE & LUG ASSY B		1.00
	220 1101		P054 WIRE&LUG ASSY(E CHAS)6482-12		2.00
271 1130			2236KEYBOARD&BEAR PLATE ASY 6621-90		1.00
279 1012			BASE ASSY(2200E/F)D6829-12		1.00
360 1011 SB			1 AMP FUSE SLO BLO 250 V	EC6934	1.00
360 1016 SB			1 1/2 AMP FUSE SLO BLO 250V	EC6934	1.00
400 1010			FAN,SKELETON(75CFM)ROTRON WR2H2		1.00
449 0101 9			FAN GUARD 4"(WHITE)D5300-1085		1.00
449 0111 9		A	BEZEL-12"CRT(WHITE)D6646-104		1.00
449 0186			COVER,MACHINING(CL VENTS)E6621-63	EC6934	1.00
452 2342			FINISH PLATE WLD & SILKSCR D6621-94		1.00
452 2517			700 PROGRAM CLAMPS B5900-39	(2	2.00
462 0265			SPACER,PC BOARD(E/F)C6815-13	EC6934	6.00
478 0061			700 PROGRAM CLAMP NUTS B5900-27	(2	2.00
615 0390			PROGRAM STRIP(SILK SCR) C6857-2	EC6934	1.00
650 4133			8-32 X 3/8 FLANGE WHIZ-LOCK MS ZINC		4.00
650 4243 W			8-32 X 3/4 PAN HD PHL(OYSTER WHITE)		4.00
650 6121			10-32X3/8 TRUSS HD PHL MS SS		4.00
650 6241			SCR 10-32 3/4 PHIL FLAT H MS SS	EC6934	3.00
650 6243			10-32 X 3/4 TR. HD. PH. MS. SS.		4.00
650 6360 W			10-32X1 1/8 TRUSS HD PHL SS(WHITE)	EC6934	2.00
651 0021 W			SCR.#8X1/2 SELF TAP TRUSS HD(WHITE)		6.00
652 0029			8-32 LOCK-NUT KEPS 511-081800-50		4.00

ASSEMBLY PART NUMBER 177 2236 B

ASSEMBLY DESCRIPTION 2236 TRANS TERMINAL(80X24) 6621-91

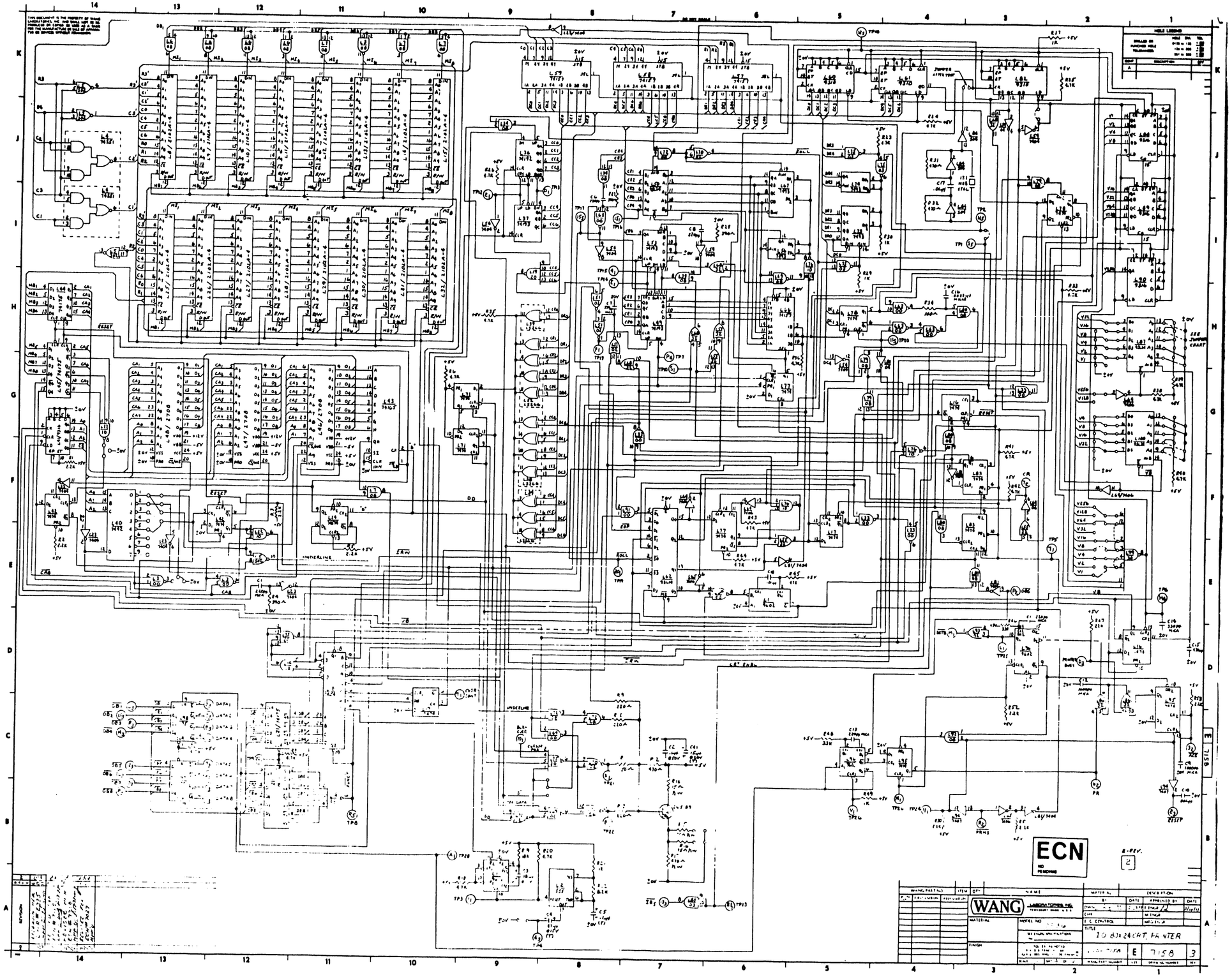
LEGEND
*=KIT TAG #=STATUS ITEM ###=FRACTION/

PART NUMBER	DESCRIPTION		QUANTITY
654 1274	CABLE CLAMP ADH.BACK DKLSP 021-0375	EC6934	1.00
655 0009	PLUG BUTTON(BLACK)SS51338 P5001		2.00
655 0012	VENT.AIR D6815-17		3.00
655 0018 9	PLUG.BUTTON (OYSTER WHITE)	EC6934	1.00
655 0157	612/712 KNOB ALCO KN700BA	EC6934	2.00

SECTION 9

NEW SCHEMATICS

BOARD PART #	DESCRIPTION
210-7158	I/O 80 x 24 CRT, PRINTER
210-7290	INTERACTIVE TERMINAL CONTROLLER
210-7291	8080 INTERACTIVE TERMINAL MEMORY
210-7292	W.S. ELECTRONICS
210-7293	INTERACTIVE TERMINAL MOTHERBOARD
210-7294	8080 MXC GRAND DAUGHTER BOARD


ECN
WANG
WANG LABORATORIES, INC.
10 DIGIT 24 CHAR. PRINTER
E 7158 3

LOCATION	WL. PT. NO.	VCC	GND
L1, 96	376 - 0109	16	8
L2	376 - 0124	8	1
L3, 32, 63, 64, 95	376 - 0002	16	7
L4	376 - 0186	14	7
L5	376 - 0139	14	7
L6, 7, 34, 72, 73, 94, 97, 98	376 - 0081	14	7
L8-15, 25-31	377 - 0069	10	9
L16, 17, 33, 35, 71, 74, 75, 83, 87	376 - 0006	16	7
L18	376 - 0090	24	12
L19, 36	376 - 0004	14	7
L20, 21, 44, 45, 47, 48	376 - 0119	16	8
L22, 76	376 - 0003	14	7
L23, 78, 81	376 - 0018	14	7
L24	376 - 0202	14	7
L26	376 - 0190	16	8
L38, 39, 52	376 - 0168	14	7
L40	376 - 0008	16	8
L41, 88, 89, 90	376 - 0094	16	8
L43	376 - 0105	16	8
L46, 47, 48	377 - 0217	24	12
L37, 49, 53	376 - 0083	16	8
L50, 81, 100	376 - 0120	16	8
L51, 70, 93	376 - 0016	14	7
L55, 58, 86	376 - 0093	14	7
L56, 67, 72, 74	376 - 0011	5	10
L57, 58, 59, 66	376 - 0082	16	8
L60, 61, 82	376 - 0191	16	8
L62	376 - 0162	16	8
L64, 65	376 - 0055	14	7
L75, 85	376 - 0028	14	7
L84	376 - 0197	14	7
L96	376 - 0056	14	7
L99	376 - 0031	14	7
L8-15, 25-32	376 - 9002		
L40, 44-48	376 - 9003		

SPARES		
LOCATION	TYPE	QTY
L3	7400	1
L22	7410	1
L23	7404	1
L26	74S74	1
L51	7402	1
L64	7406	1
L65	7406	4
L72	7408	1
L79	7408	1
L81	7409	1
L85	7403	3
L86	7432	2
L91	7400	3
L92	7408	3
L93	7402	3
L94	7407	4
L75	7483	1
L84	74LS04	3

PARTS LIST	
COMPONENT	WL. PT. NO.
W1, 2, 3, 5, 41, 50-53	330 - 3022
R4, 27, 28	330 - 2039
R6, 7, 8, 10, 29, 32, 34, 35, 36, 37, 38, 39, 40-44	330-3047
R9, 14, 15	330 - 2022
R11	330 - 3015
R12, 30, 31	330 - 2047
R16	331 - 1015
R17, 26	331 - 1026
R19	330 - 4018
R21, 33, 37, 49, 50	330 - 3010
R22	330 - 3082
R24	330 - 2010
R25	330 - 4047
R46, 48	330 - 4033
R47	331 - 2047
Q1	375 - 1021
Q1 TRANSISTOR	375 - 9001
XTAL	321 - 0018
C1, 11, 13	300 - 5004
C9, 12	300 - 5006
C3	300 - 4018
C4	300 - 6020
C5	300 - 4002
C6, 8	300 - 1220
C7, 16	300 - 5007
C10	300 - 1906
C15	300 - 1970
C16	300 - 2022
C17, 18	300 - 1902
C19, 20, 38 - 41	300 - 6022
C21 - 37	300 - 1900
C2	300 - 1930

JUMPER CHART

	7158-1	7158
COMMON	60HZ	60HZ

ECN
NO PENDING

WANG PART NO.	ITEM	QTY	NAME	MATERIAL	DESCRIPTION

WANG LABORATORIES, INC.

MATERIAL

FINISH

MODEL NO 2236

MFR'S SPECIFICATIONS

TOL EX AS NOTED

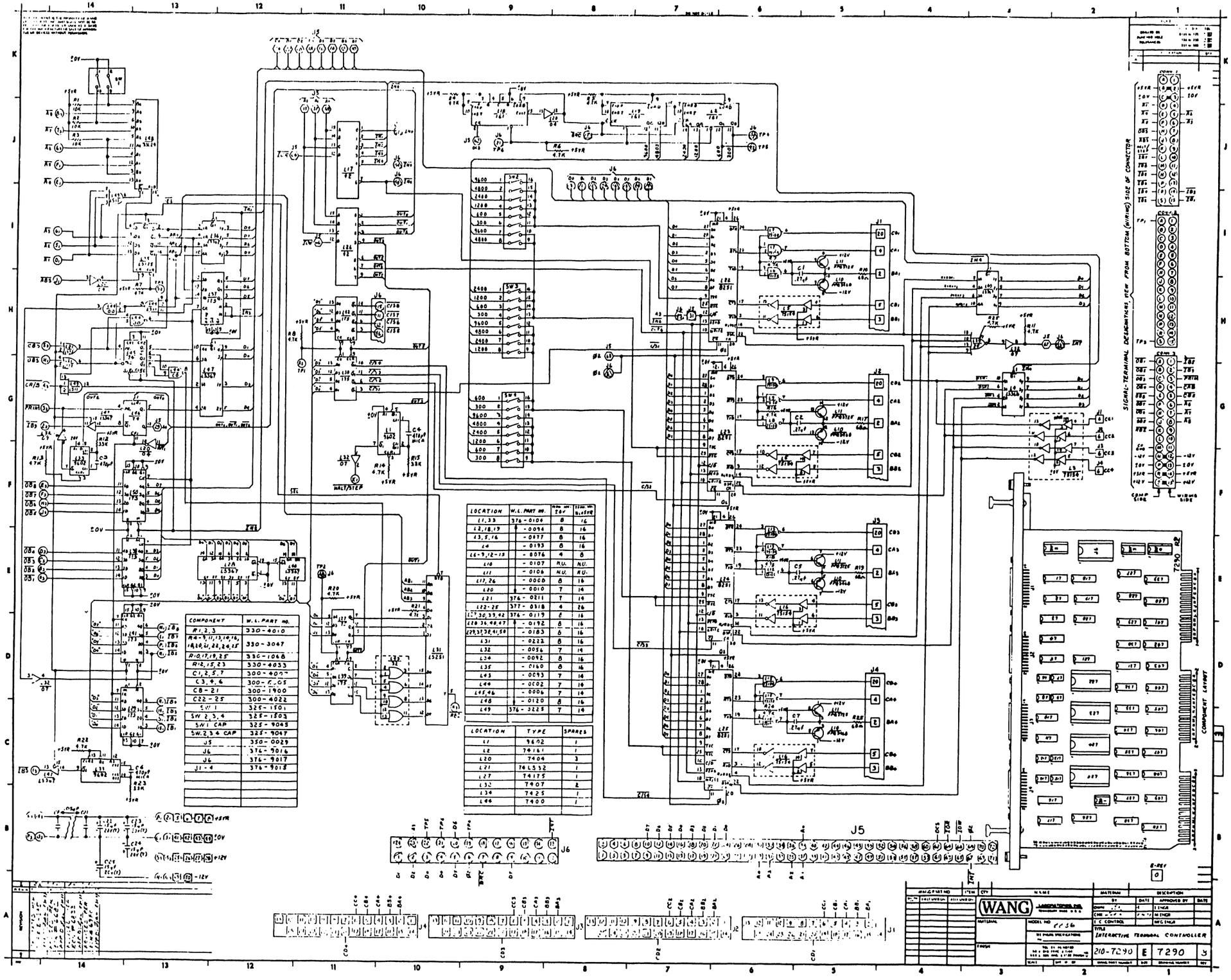
SCALE NONE SHT 5 OF 6

	BY	DATE	APPROVED BY	DATE
DWN			E. ENGR	
CHK			M. ENGR	
E.C. CONTROL			MFG. ENGR	

TITLE

IO, 80 X 24 CRT, PRINTER

WANG PART NO.	REV	DRAWING NUMBER	REV
210-7158	E	7158	3



COMPONENT	W.L. PART NO.
R1, 2, 3	330 - 4010
R4 - 9, 11, 13, 14, 16, 18, 20, 22, 24, 26	330 - 3047
R10, 17, 19, 28	330 - 1046
R12, 15, 23	330 - 4033
C1, 2, 5, 7	300 - 4007
C3, 4, 6	300 - 4005
C8 - 21	300 - 1900
C22 - 25	300 - 4022
SW 1	325 - 1501
SW 2, 3, 4	325 - 1503
SW1 CAP	325 - 9045
SW 2, 3, 4 CAP	325 - 9047
J5	350 - 0029
J6	376 - 9016
J6	376 - 9017
J1 - 4	376 - 9015

LOCATION	W.L. PART NO.	TERM. NO. +5V	TERM. NO. GND/+5VB
L1, 33	376 - 0106	8	16
L2, 18, 19	- 0094	8	16
L3, 5, 16	- 0077	8	16
L4	- 0193	8	16
L6 - 9, 12 - 15	- 0076	4	8
L10	- 0107	N.U.	N.U.
L11	- 0106	N.U.	N.U.
L17, 26	- 0060	8	16
L20	- 0010	7	14
L21	376 - 0211	7	14
L22 - 25	377 - 0318	4	26
L27, 30, 33, 42	376 - 0119	8	16
L28, 34, 40, 47	- 0192	8	16
L29, 35, 36, 41, 58	- 0183	8	16
L31	- 0222	8	16
L32	- 0056	7	14
L34	- 0092	8	16
L35	- 0160	8	16
L43	- 0093	7	14
L44	- 0102	7	14
L45, 46	- 0004	7	14
L48	- 0120	8	16
L49	376 - 3225	7	14

LOCATION	TYPE	SPARES
L1	9602	1
L2	74161	1
L20	7404	3
L21	74LS32	1
L27	74175	1
L32	7907	2
L34	7425	1
L44	7400	1

WANG	WANG LABORATORIES, INC.
MODEL NO	7256
TITLE	INTERACTIVE TERMINAL CONTROLLER
210-7290	E 7290

LOCATION	W.L. PT NO	GND	VCC
L1	377-0337	8	16
L2	376-0606	7	14
L3, 17A	376-0081	7	14
L4	376-0006	7	14
L5	376-0010	7	14
L6	376-0106	8	16
L7L	376-0008	7	14
L8	377-0338	14	28
L9	376-0160	8	16
L10	376-0089	7	14
L11	376-0178	7	14
L13	376-0069	8	16
L14	376-0093	7	14
L15, 16, 17, 32	377-0317	12	
L18	377-0269	2	20
L19, 30, 33	376-0192	8	16
L20	376-0005	11	4
L21, 35	376-0085	8	16
L22-29, 34-42	377-0316	18	
L31	376-0098	8	16
L34	376-0011	10	8
L37	376-0209	7	14

SMDS		
LOCATION	TYPE	SMDS
L6	7674	1
L6	9602	1
L7	74LS40	1
L19	7432	3
L24	7400	3
L2	7820	1

COMPONENT	W.L. PT NO
Q1	352-0013
Q2,3	352-1020
Q4	376-0002
XTAL 1	321-0022
D1	880-MM
L15-17, 32	376-7003
L8 (SOCKET)	376-9015
L18 (SOCKET)	376-9011
L22-29, 34-42 (SOCKET)	376-9016
R21	330-6662
R13, 14, 44, 45, 48-50, 53-55, 61-31	330-3061
R4, 5	330-1011
R6-13	330-6010
R17	330-7033
R22	330-6022
R24	330-3010
C1-8, 87	308-1930
C9-24, 31-33	166-1121
C25, 29, 46	308-6017
C34	308-6020
C18	300-1068
C30	300-1713
C33-44	300-1900
C45	300-6022

CONN 1

CIRCUIT SIDE J1 COMP SIDE

ECN 10 PENDING

ECN 8

E REV 0

WANG PART NO	ITEM	QTY	NAME
MATERIAL			MODEL NO 2236
FINISH			MATERIAL SPECIFICATIONS

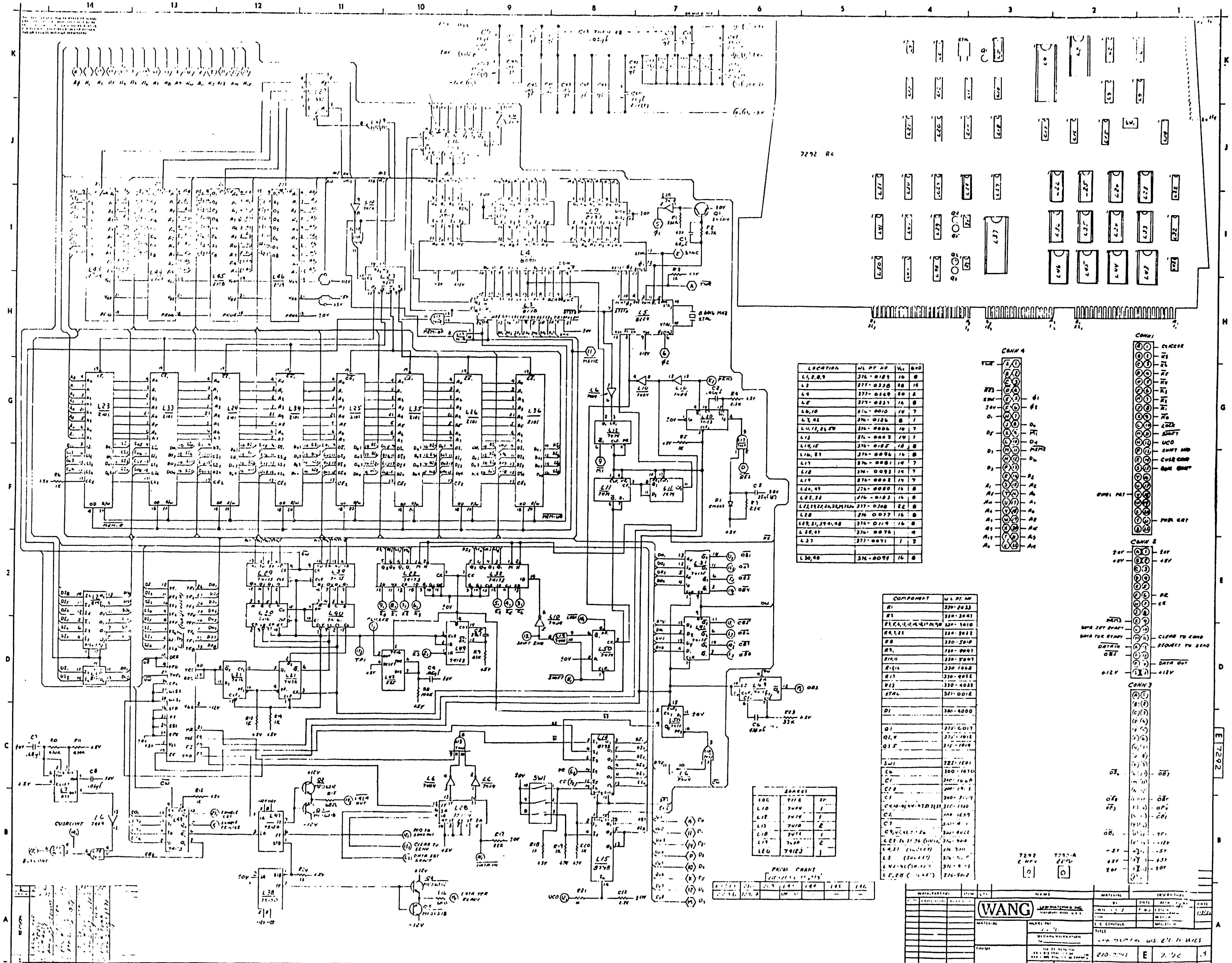
WANG LABORATORIES, INC.

MATERIAL	DESCRIPTION
BY	DATE APPROVED BY DATE
CHK 484	3 8 1142
CHK	MFG ENGR
E.C. CONTROL	MFG ENGR

TITLE NO. INTERACTIVE TERMINAL
PC BOARD VA SUPER BOARD

210-7291 E 7291 2

WANG PART NUMBER | E.C.I. | DRAWING NUMBER | REV.


WANG
7292
E
L4
L5
L23
L33
L24
L34
L25
L35
L26
L36
CONN 1
CONN 2
CONN 3
CONN 4
SW1
7292 CHPY
7292-A

MILLIMETERS IN PARENTHESIS
TOLERANCES TO BE EQUIVALENT TO INCH DIMENSIONS

CRT/PTR

CPU

7293 R1

COMPONENT	W. L. PART NO.
CONNECTOR	350-0021
CONNECTOR	350-0039
CONNECTOR	350-0011
J1	350-1038
J2	350-1031
J3	220-3014
J4	654-1193
J5	654-1194
J6	654-1198

QTY	ITEM	WANG PART NO	DRAWING NO	DESCRIPTION
NEXT ASSY				

WANG LABORATORIES, INC. TEWKSBURY, MASS. U.S.A.

MODEL NO 2236

SEE ENGR SPECIFICATIONS No.

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH

	BY	DATE	APPROVED BY	DATE
DWN			E ENGR	
CHK			M ENGR	
			MFG ENGR	

TITLE INTERACTIVE TERMINAL W.S. MOTHERBOARD

210-7293 | D | 7293 | 0

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

7293

HOLE LEGEND		
	HOLE DIA	TOL
DRILLED SIZE	.075 to .125	± .003
PUNCHED HOLE	.126 to .250	± .004
TOLERANCE	.251 to .500	± .005

ASSY	DESCRIPTION	QTY
A		

SW.1 SW.2 SW.3

9600 4800 2400 1200 600 300 9600 4800

2400 1200 600 300 9600 4800 2400 1200

600 300 9600 4800 2400 1200 600 300

4800 9600

200 400 1800 2400

+5V

$\overline{CS}_E$ ϕ_E $\overline{OUT}_6$ $\overline{IN}_6$ A_3 $\overline{CS}_6$ $\overline{CS}_7$ $\overline{CS}_8$

D_0 D_1 D_2 D_3 D_4 D_5 D_6 D_7

J5 J6 J7 J8

CA_5 CB_5 BA_5 BB_5 CC_5 — CH. GND

CA_6 CB_6 BA_6 BB_6 CC_6 — CH. GND

CA_7 CB_7 BA_7 BB_7 CC_7 — CH. GND

CA_8 CB_8 BA_8 BB_8 CC_8 — CH. GND

$\overline{IN}_4$ $\overline{INT}$ $\overline{IN}_0$

CC_5 -J5 CC_6 -J6 CC_7 -J7 CC_8 -J8

J4

$\overline{INT}$ $\overline{IN}_4$ $\overline{CS}_5$ $\overline{CS}_6$ $\overline{CS}_7$ $\overline{CS}_8$ $\overline{IN}_0$ D_0 D_1 D_2 D_3 D_4 D_5 D_6 D_7 ϕ_E $\overline{RST}$ $\overline{OUT}_0$ A_2 A_3 $\overline{CS}_7$ $\overline{CS}_8$

CONN. 1 — +5V, ±12V

CONN. 2 — TP

CONN. 3 — -12V, ±12V, +5V, +12V

LOCATION	WIL. PART NO.	GND	VCC
L1,3,7,9,10	376-0076	4	
L2,4,20	376-0077	8	15
L5	376-0157		
L6	376-0166		
L11-18	377-0311	8	16
L15,16	376-0098	8	16
L17	376-0092	7	16
L18	376-0092	8	16
L19	376-0093	8	16

LOCATION	TYPE	SPARE
L17	7425	1
L19	74LS368	2

COMPONENT	WIL. PART NO.
R1,4,7,8	330-3043
R2,5,6,9	330-M68
C1,2,3,4	300-4007
C5,6,7,8	300-402L
C9-18	300-1900
L11-16	376-0015
SW1,2,3	316-1503
J4 CABLE ASSY	830-3019

ECN

WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
			WANG LABORATORIES, INC.		
			MODEL NO 2236 MXC		
			MATERIAL		
			FINISH		
					8086 MXC GRAND DAUGHTER BOARD
					610-7296 B 7296 1

	BY	DATE	APPROVED BY	DATE
DSGN			E ENGR	
CHK			M ENGR	
E C CONTROL			MFG ENGR	
WIL				

7296

APPENDIX C

SERVICE BULLETIN NO.80A

SERVICE BULLETIN NO. 80A

EDITED BY CUSTOMER ENGINEERING DIVISION

November 29, 1977

ADDENDUM TO SERVICE BULLETIN #80
FOR 2236 INTERACTIVE TERMINAL

This addendum provides clarification of installation and operating procedures for the 2236 Interactive Terminal and 2236 MXC Controller. The sections contained herein replace the original sections of SB #80.

2.2 DEVICE ADDRESS ASSIGNMENTS

2.2.1 2236 MXC-1

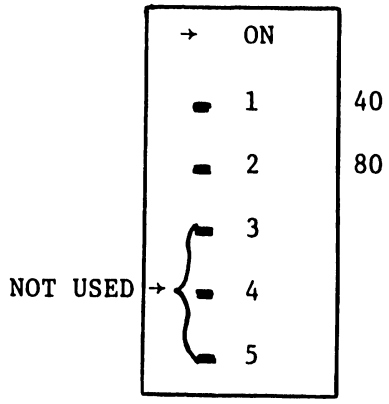
The 2236 MXC-1 normally operates at hardwired addresses 001 and 005. These addresses are for the controller board, NOT for a particular terminal.

If the 2236 MXC-1 is to be used with 2236 Terminal #1 as the Console Input/Output device, the MXC-1 will automatically respond to system initialization and display "READY" on Terminal #1.

In many cases, the 2236 Terminals are used in conjunction with a 2226 User Terminal (which is set for Console Input/Output). In this type of configuration, the MXC-1 must be set to something other than 01/05. This is accomplished by setting the 5-bank address switch on the 7290 board of the 2236 MXC-1. Switches 1, 2, or both may be set. Switches 3, 4 and 5 are not used. Switches 1 and 2 set the high-order address bits 40 and 80.

WANG LABORATORIES, INC.
1 INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851, TEL (617) 851 4111, TWX 710 343 6769, TELEX 94-7421

Printed in U.S.A.
13-210A



Set switches 1 and 2 OFF for a BOARD address of 01/05.
Set switch 1 ON for a BOARD address of 41/45.
Set switch 2 ON for a BOARD address of 81/85.
Set switches 1 and 2 ON for a BOARD address of C1/C5.

The BOARD address is NOT the same as the Terminal address. Once the BOARD is selected, communication to/from the Terminal can begin by using specific I/O operations as described in Section 3.

2.2.2 2236 MXC-2

No address switches are located on the 7294 controller, as the MXC-2 is controlled by the MXC-1 and cannot be addressed directly.

2.5.2 MODEM CABLES

When using modems, connect the modem cable (220-0113) between the 2236 MXC controller and the modem.

At the remote end, also connect a modem cable (220-0113) between the 2236 Terminal and the modem. DO NOT use the 2236 cable (120-2236 series).

SECTION 3

OPERATION

3.1 GENERAL

In a system using all 2236 Terminals (no 2226 type User Terminal), Console Input/Output is assigned to 2236 Terminal #1. This is set by default and CANNOT be changed. Use of the other 2236 Terminals can only be accomplished under program control.

3.2 ACCESSING THE TERMINALS

3.2.1 GENERAL

As described in section 2.2, the 2236 MXC-1 controller has a BOARD address, used to enable the controller. Once the controller is selected, communication to the terminals is accomplished by specific control sequences using $GIO or PRINT statements. $GIO is preferred. Do not confuse the method of selecting the controller with the method of selecting a terminal.

Since most installations use a 2226 as Console Input/Output and the 2236 Terminals for software applications, the method of accessing the terminals in this configuration is described. This method can be used in any configuration, however, by changing the high order address bit in the device select statements.

There are specific control sequences which must be performed in order to communicate with the terminal. The control commands may be sent to the MXC-1 by PRINT statements or $GIO statements. $GIO is preferred. IMPORTANT - IF PRINT STATEMENTS ARE USED, THE CONTROL CODES MUST BE FOLLOWED BY A SEMICOLON (;). Otherwise, the MXC-1 will "Hang".

3.2.2 CONTROL CODES

Assume the controller address has switch #1 ON and switches #2 through #5 OFF. This sets the 40 bit ON in the address.

There are five different addresses the MXC-1 controller will respond to for one device address setting. Each has a specific function. With address switch #1 ON, the controller will respond to addresses 042, 043, 044, 046 and 047.

The function of the addresses are:

1) 046 - Control Command. SELECT PRINT 046, or $GIO/046 allows the 2200 program to define which terminal is to be communicated with and what tasks it is expected to perform.

   In particular,

   a) Cause the flow of data to be directed to and from a particular terminal (select terminal).
   b) Cause cursor positioning to be performed.
   c) Define a line request.
   d) Cause one or all terminals to be initialized.

2) 043 - Receive Terminated Line. SELECT PRINT 043, or $GIO/043 directs the currently selected terminal to transmit a line of data which was terminated by a Hex (0D).

3) 047 - SEND DATA TO CRT. SELECT PRINT 047, or $GIO/047 allows characters to be transmitted to and displayed on the CRT of the currently selected terminal.

4) 044 - SEND LINE TO SLAVE PRINTER. SELECT PRINT 044, or $GIO/044 allows data to be transmitted to and printed on the printer ATTACHED to the currently selected TERMINAL.

5) 042 - RECEIVE CONTROLLER STATUS. $GIO/042 ONLY allows the 2200 to receive 32 bytes of status (4 bytes for each of 8 terminals) from the 2236 MXC-1 controller.

3.2.3 SAMPLE TEST PROGRAMS

In general, when programming the 2200 to communicate with a 2236 Terminal, the first programming statement must be a control command.

10 SELECT PRINT 046	(selects the MXC for a control command)
20 PRINT HEX (F40T);	(selects the terminal described by T. T is from 1 to 8. To select terminal #2, F402 is used.)
30 PRINT HEX (F9);	(Initializes (clears) terminal selected in statement 20)
40 SELECT PRINT 047	(Selects the MXC to receive data from the 2200, transmit and display the data on the CRT of the selected terminal)
50 PRINT "ANY MESSAGE"	(Prints ANY MESSAGE on the CRT of the current selected terminal)

Alternatively, $GIO could have been used:

```
10 $GIO/046 (40F4 4002 40F9, A$)
40 SELECT PRINT 047
50 PRINT "ANY MESSAGE"
```

3.2.3.1 Outputting Characters to a 2236 Terminal

The following program will fill the CRT of Terminal #2 with X's. (The terminal designation can be changed by changing the "02" in the second microcommand to the number of the terminal desired. In this way, any MXC-1 or MXC-2 connector can be tested even though only one 2236 Terminal is available.):

```
10 $GIO/046(40F4 4002 40F9,A$)
50 SELECT PRINT 047: PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX";
60 GOTO 50
```

3.2.3.2 Input and Output from/to a 2236 Terminal

The following program will select Terminal #3, print a prompt to INPUT CHARACTERS on the terminal, then prefill a line with X's. The pre-filled line of X's will be replaced with the characters you input from the 2236 keyboard. When the line has been filled with the desired characters, key EXECUTE on the 2236. The line of characters you input from the 2236 keyboard will then be transmitted to the 2200 and displayed on the 2226 User Terminal.

```
TEST3A

0005 DIM W$33,N$33,A$33
0010 $GIO/046 (40F4 4003 40F9, A$)
0020 SELECT PRINT 047
0030 PRINT "INPUT CHARACTERS"
0040 $GIO/046(4004 4020 4000 4000, A$)
0050 PRINT HEX(08);
0060 $GIO/046 (40F7 4002 4000, A$)
0070 PRINT "XXXXXXXXXXXXXXXXXX";HEX(OD)
0080 $GIO/046(40F5,A$)
0090 $GIO/042(C620,A$)W$
    : IF STR(W$,3,1)="0"THEN 90
0095 A$=HEX(OD)
0100 INIT (20) N$
    : $GIO/043 (C630,A$) N$
0110 $GIO/042 (C620 ,A$) W$
    : IF STR(W$,27,1)<>"0" THEN 110
0120 SELECT PRINT 005
0130 PRINT "2236 INPUT = "; N$
0140 STOP
```

```
2236 INPUT = OUTPUT FROM 2236
```

EXPLANATION OF PROGRAM:

```
5 DIM W$33, N$33, A$33
```

Dimensions each character string buffer to 33 characters.

```
10 $GIO/046 (40F4 4003 40F9, A$)
```

Selects the 2236 Terminal plugged into connector 3 of the 2236 MXC-1 (4003) and clears Terminal #3 (40F9).

```
20 SELECT PRINT 047
```

Initializes terminal that has been previously selected for output of data.

```
30 PRINT "INPUT CHARACTERS"
```

Prompt sent out to selected terminal.

```
40 $GIO/046 (4004 4020 4000 4000, A$)
```

Code 4004 causes the 2236 MXC-1 to set up and receive a field of 20 characters (4020). A line request has also been initialized.

```
50 PRINT HEX (08);
```

Prefill the previous initialized line with the following characters.

```
60 $GIO/046 (40F7 4002 4000, A$)
```

Position cursor to row 2 (4002) and column 0 (4000) of CRT, this is where you want prefill to begin.

```
70 PRINT "XXXX....X"; HEX (0D)
```

Line is prefilled with all X's and carriage return is given.

```
80 $GIO/046 (40F5, A$)
```

End of line request.

```
90 $GIO/042 (C620, A$) W$ : IF STR(W$,3,1)="0" THEN 90
```

Start inputting characters check to see if line is terminated.

95 A$=HEX (0D)

A$ is equal to carriage return.

100 INIT (20) N$: $GIO/043 (C630, A$) N$

2200 receives the inputted characters from the 2236 MXC.

110 $GIO/042 (C620, A$) W$: IF STR(W$,27,1) "0" THEN 110

Checks to see if buffer is empty, therefore all characters are input.

120 SELECT PRINT 005

Select 2226 for printing.

130 PRINT "2236 INPUT="; N$

To check any other terminal, change line 10 to:

10 $GIO/046 (40F4 400X 40F9, A$)

X=whichever # connector the terminal wanted to be tested is plugged into.

Also line 90,

IF STR(W$,X,1) = "0"

X = the same X as in line 10

3.2.3.3 Cursor Positioning

The following program will position 2236 cursor of selected terminal to wherever you want.

Again device address is set at 40 on the controller. Also remembering (4002) selects connector #2 of the controller or whatever controller you happen to be testing.

Command code 40F7 sets the 2236 up for cursor positioning. In the program above, the cursor will move 20 rows down (4020) and 10 columns across (4010). Any number from 0-23 rows may be chosen and 0-79 columns.

3.3 DETAILED DESCRIPTION OF COMMAND CODES AND PROGRAMMING SEQUENCES

3.3.1 ADDRESS HEX (06), (46), (B6) OR (C6)

3.3.1.1 Select Terminal Hex (F4XX)

Whenever a command code of F4 is received, the next byte will determine to which terminal communication is to be directed to or received from. The data byte must be a hexadecimal representation of the desired terminal (i.e., 01 = terminal #1, 02 = terminal #2, ..., 08 = terminal #8). For the remainder of this memo, the current terminal is the last SELECTed terminal.

Example, select terminal #1

a)
```
10 SELECT PRINT 006
20 PRINT HEX (F401);
```
or

b)
```
10 $GIO/006 (40F4 4001, Q6$)
```

3.3.1.2 Position Cursor HEX (F7XXYY)

A command code of F7 will cause the CRT of the current terminal to be positioned at row XX and column YY. XX and YY must be hexadecimal representation of the desired row or column. The 2236 Interactive Terminal has 24 rows, numbered 0 to 23; and 80 columns, numbered 0 to 79.

Example, position cursor of current terminal at row 10 column 32.

```
10 SELECT PRINT 006
20 PRINT HEX (F70A20);
or
10 DIM R$3
20 R$ = HEX (F7)
30 BIN(STR(R$,2,1)) = 10
40 BIN(STR(R$,3,1)) = 32
50 $GIO/006 (A000, B$) R$
or
10 $GIO/006 (40F7 400A 4020, Q6$)
```

3.3.1.3 Initialize All Terminals HEX (F8)

This command will cause the screens of all terminals to be cleared, and pending requests and input buffer data to be cleared.

Example, clear the screens and buffers of all terminals.

```
10 SELECT PRINT 006
20 PRINT HEX (F8);
or
10 $GIO/006 (40F8, Q6$)
```

3.3.1.4 Initialize Current Terminal HEX (F9)

This command will cause the CRT screen, pending request and input buffer of current terminal, to be cleared.

Example,

```
100 SELECT PRINT 006
110 PRINT HEX (F9);
or
110 $GIO/006 (40F9, Q6$)
```

3.3.1.5 Request Line HEX (03XXAABB)

A command code of 03 will cause the 2236 MXC to setup to receive a field of up to XX characters (a hexadecimal representation of the count, not to exceed 216) starting from the current CRT cursor

position for the currently selected terminal. All field entries will be forced to stay within the field limits. A line request is active until either a carriage return or a special function key is entered. Edit mode may be initiated (BB = 01) or suppressed (BB = 00). The characters previously stored in the keyboard soft buffer may (AA = 01) or may not (AA = 00) be allowed to be treated as entered characters for the line. (In other words, keystrokes received prior to a line request being set, can be either received as part of the line or deleted.) If deleted, they are never echoed back to be displayed on the CRT.

Example, from the current position of the current terminal setup a line request of 20 characters, currently buffered characters may be treated as valid keystrokes and suppress edit mode.

```
10 SELECT PRINT 006
20 PRINT HEX (03140100);
or
10 $GIO/006 (4003 4014 4001 4000, Q6$)
or
10 C$ = HEX (03)
20 BIN(STR(C$,2,1)) = 20
30 STR(C$,3,2) = HEX (0100)
40 $GIO/006 (A000, B$) C$  1,4
```

There are 4 variations of the line request command. These are programmed in the above manner with only 1 change.

a) Command 03 - Set up line request echo characters only. (i.e., no underline)

b) Command 04 - Set up line request echo characters with underline.

c) Command 05 - Set up line request echo characters only and initialize field with spaces on CRT.

d) Command 06 - Set up line request echo characters with underline and initialize the field with underlined spaces on CRT.

3.3.1.6 Initialize Line Request HEX (07XXXX...FF0D)

A command code of 07 is used after a line request command of HEX (03) or HEX (04) to initialize the desired line on the CRT with the supplied characters XXX... starting with the leftmost position in the field. Any non-space characters received are treated as protected characters and are automatically skipped over in entry mode. The string of characters is terminated by a carriage return (0D) or a HEX (FF) code. The cursor is positioned at the leftmost non-protected character.

Example, setup a line request to receive today's data in the form of MM/DD/YY.

```
90 SELECT PRINT 006
100 PRINT HEX (04080000);
110 PRINT HEX (07); "  /  /  "; HEX (0D);
or
110 PRINT HEX (07); "  /  /  "; HEX (FF);
or
110 A$ = "  /  /  ":STR(A$, 9, 1) = HEX (FF)
120 $GIO/006 (4007 A000, Q6$) A$
```

3.3.1.7 PREFILL REQUEST LINE HEX (08XXXX...0D)

A command code of 08 can be sent either after a line request command 03 or 04 or immediately after an Initialize Line Request Command 07 to prefill the desired line with the supplied characters XXX... starting with the leftmost position. The characters are treated as keystrokes and will skip over protected characters, if any exist. The cursor is left at the leftmost non-protected character. The string of characters is terminated by a carriage return, HEX (0D).

Example, initialize today's date as 06/03/77

assuming line request has been made and initialized

```
100 SELECT PRINT 006
110 PRINT HEX (08); "060377"; HEX (0D);
or
110 A$ = "060377":STR(A$, 7, 1) = HEX (0D)
120 $GIO/006 (4008 A000, Q6$) A$
```

3.3.1.8 End of Line Request Sequence HEX (F5)

A special command must be supplied to signal the end of a line request sequence which consists of the setup, any initializes and prefilling desired. Thus a line request, plus any initialization command may be sent out in several statements or as one string of characters in one statement. The last command sent however, must be a HEX (F5), to signal the microcode to invoke the line request.

Example,

assuming setup, initializes and prefill are complete.

```
100 SELECT PRINT 006
110 PRINT HEX (F5);
or
110 $GIO/006 (40F5, Q6$)
```

3.3.2 ADDRESS HEX (07), (47), (87) OR (C7), SEND DATA TO CRT

Address 07 is used to transmit characters to be displayed onto the CRT of the current terminal. Since the CRT output buffer in the controller is limited to 512 characters, it is generally most efficient to send CRT output of blocks 512 bytes or less, waiting for ready (buffer empty) prior to sending the next block. (Or else the CPU will be hung up awaiting the buffer to empty.)

Example,

```
100 SELECT PRINT 007
110 PRINT HEX (030A0A0A0A); TAB (10); "NAME", TAB (30);
    "ADDRESS" etc.
```

3.3.3 ADDRESS HEX (04), (44), (84) OR (C4), SEND LINE TO SLAVE PRINTER

Address 04 is similar to address 07 except that the characters are directed to the printer of the current terminal. Print data is sent a line at a time (up to 160 characters). A test for ready

(printer buffer empty) should be made prior to sending out the next print line for efficient operation. (Or else the CPU will be hung up awaiting the buffer to empty.)

Example,

```
100 SELECT PRINT 204
110 PRINT HEX (0C); "NAME"; N$
120 PRINT "ADDRESS"; A$
```

3.3.4 ADDRESS HEX (03), (43), (83) OR (C3), RECEIVE TERMINATED LINE

Address 03 is used to get the data associated with the terminated line request of the currently selected terminal into the 2200. This will be done by a program after a status check indicating a line has been received and terminated. The alphanumeric variable or array setup to receive the line should be sufficiently large to receive the entire line. If it is not, the additional characters will be truncated.

Example,

```
100 $GIO/003 (C620, Q6$) W$ (line terminated with SF Key)
or
100 Q6$ = HEX (0D) (line terminated with SF key or CR)
110 $GIO/003 (C630, Q6$) W$
```

Termination by either a special function key or a special character, HEX (0D), is determined by the 8th byte of the Arg-2 variable, Q6$.

If the 20-bit is on, termination was by special function key.

If the 40-bit is on, termination was by the special character, HEX (0D).

```
100 AND(STR(Q6$, 8, 1), 60)
110 ON VAL(STR(Q6$, 8, 1)) /32 GOTO 200, 300
.
.
.
200 REM TERMINATED BY SPECIAL FUNCTION KEY
.
.
.
300 REM TERMINATED BY SPECIAL CHARACTER
.
.
.
```

3.3.5 DELETE CURRENT LINE REQUEST HEX (0C)

This command is similar to the initialize current terminal except the CRT screen is not cleared.

Example,

```
100 SELECT PRINT 006
110 PRINT HEX (0C);
or
110 $GIO/006 (400C, Q6$)
```

3.3.6 ADDRESS HEX (02), (42), (82) OR (C2), RECEIVE CONTROLLER STATUS

Address 02 is used to report the statuses of the various buffers to the 2200. When enabled by address 02, the 2236 MXC will send 32 bytes of data and 1 ENDI data byte to be used as a terminator for the input sequence.

Bytes	Buffer	Explanation (HEX Value)
1-8	Line Request	30 - no terminated line request this terminal. 31 - terminated line request this terminal.

Bytes	Buffer	Explanation (HEX Value)
9-16	Terminal On/Off Status	30 - this terminal not powered on. 31 - this terminal powered on.
17-24	CRT	30 - buffer empty this terminal. 31 - buffer not empty this terminal.
25-32	PRINTER	30 - buffer empty this terminal. 31 - buffer not empty this terminal.
33	ENDI Terminator	

Example,

Is the CRT buffer of terminal #4 empty?

```
5 DIM W$ 33
10 $GIO/002 (C620, Q6$) W$
20 IF STR (W$,20,1) = "0" THEN 40
30 GOTO 10
40 REM
```

3.4 MISCELLANEOUS

3.4.1

There are generally three means of communicating with the 2236 MXC. The three methods are:

1) $GIO
2) PRINT HEX (
3) PRINT ALPHA-VARIABLE OR PRINTUSING ALPHA-VARIABLE

$GIO is the recommended method and must be used if control information is sent out via alpha-variable.

3.4.2 SYSTEM HANG-UP

If system CPU hangs up while running a program and the CPU RESET button will not reset the CPU, the system will have to be powered down and reinitialized.

It is recommended that before running any programs that you don't want to be destroyed, store these programs on disk or storage media available.

An ECN will follow to correct the hangup condition of the CPU.

7.3.1 2236 TERMINAL

The terminal can be tested functionally by inserting a "loopback" connector on the rear panel. The loopback connector is an RS-232-C connector with pins 2 and 3 connected together, pins 4 and 5 connected together, and pins 6, 8 and 20 connected together. With the loopback connector installed, keys depressed on the keyboard will be echoed back and displayed on the CRT.

This procedure will not completely check the 2236 Terminal, but will verify that approximately 95% of the 2236 is functioning properly.

WANG LABORATORIES, INC

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851, TEL (617) 459-5000, TWX 710 343-6769, TELEX 94-7421

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