

2282 GRAPHICS CRT TERMINAL

1. GENERAL

1.1 2282 TERMINAL

The Model 2282 Graphic CRT provides a high contrast, CRT plotting and fully automatic alphanumeric lettering capability to the System 2200. All plotting output from the System 2200 is displayed on the Graphic CRT where it can be modified by the operator. The user interactive plotting capability of the Graphic CRT can be enhanced by the addition of Model 2231W-3 line printer. This matrix printer provides an accurate reproduction of the graphics information displayed on the Model 2282. When the Model 2231W-3 is not used to copy the CRT image, it responds to normal printing commands from the System 2200 CPU.

1.2 DESCRIPTION

The graphics CRT is a plotting CRT that connects to any 2200 system which has a Wang Printer controller board. Its plug is pin for pin compatible with the 2231W printer's plug. The protocol for sending data to the graphics CRT is the same as any Wang printer or plotter. The graphics CRT is compatible with the 2272 plotter.

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WANG

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The graphics CRT terminal is housed in a 2226 case without a keyboard. The CRT is microprocessor controlled (INTEL 8080A). The I/O cable for the 2282 plugs into the Wang Printer controller board for input from the 2200. There is also an output connector, which the 2231W-3 printer may be plugged into.

The 2282 has a 12 inch CRT tube which gives a display field of 800 by 512 dots. There are five printed circuit boards: 7298 Image Memory, 7297 I/O, 7296 CRT Controller, 7067 Regulator and the motherboard, 7295.

The 2231W-3 printer can be plugged into the output connector of the 2282. For normal print operations, information sent out on the controller board is directed to the printer and will print out as if there were no graphics CRT present. Plotting operations will be intercepted by the graphics CRT and be displayed. The plotting operations will not be received by the printer.

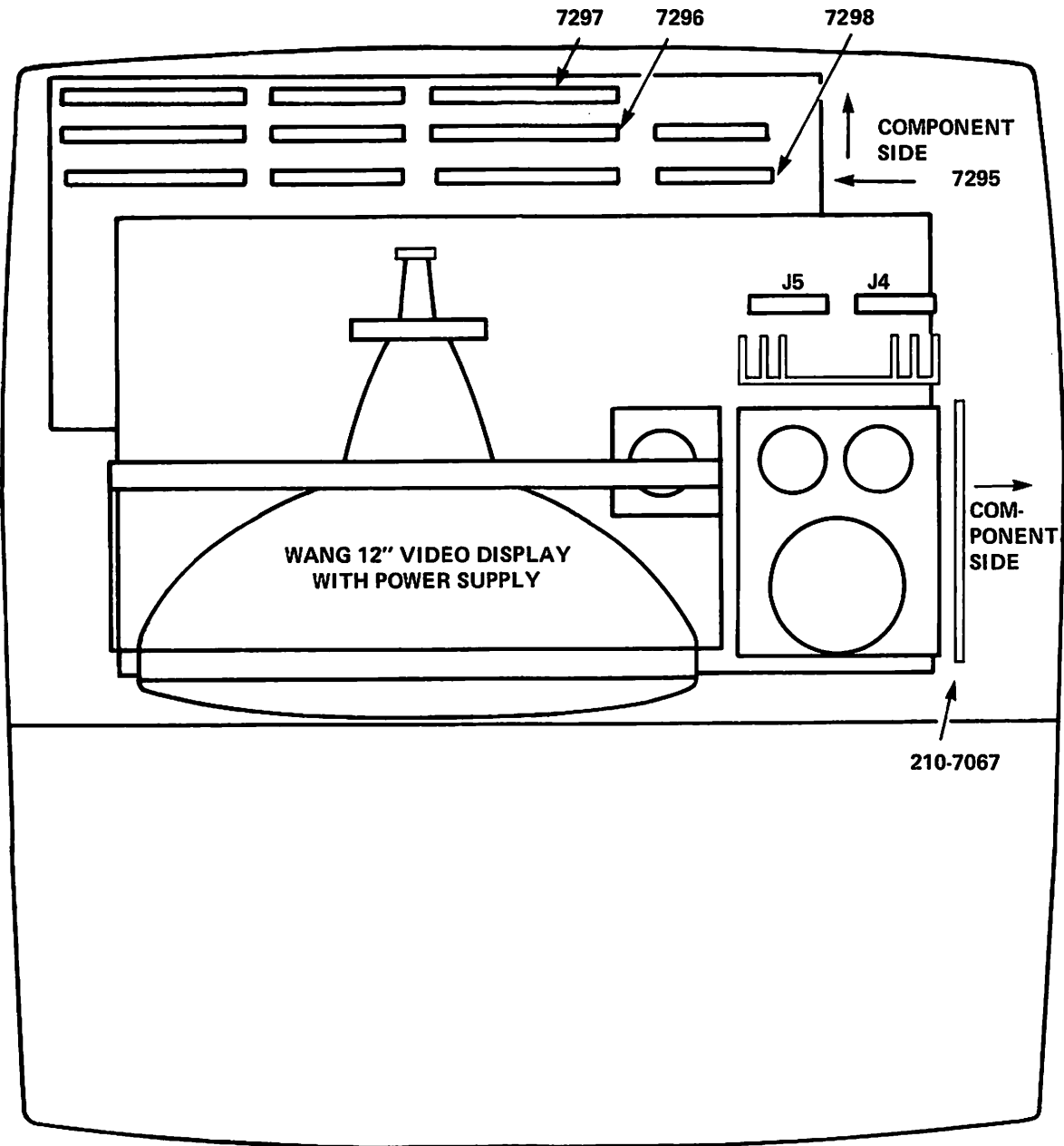
The printer used for this application is the 2231W-3 which is a modification of the 2231W printer that provides plotted output. By sending a Hex (E7) code to the graphics CRT, the image on the CRT will be dumped onto the printer. This is done by printing strips of 800 dots by 8 dots until the image on the CRT is reproduced.

1.3 2282 CHASSIS LAYOUT (See Figure 1)

1.4 REPLACEABLE MODULES

<u>#</u>	<u>Where Used</u>	<u>Description</u>
210-7295	2282 Terminal	Motherboard
210-7296A	2282 Terminal	CRT Controller
210-7297	2282 Terminal	I/O
210-7298A	2282 Terminal	Image Memory
210-7067	2282 Terminal	Power Supply Regulator
270-0360	CRT Chassis with Power Supply	
725-0033-8M 340-0104-02	MONITOR ASS'Y (MOTOROLA) CRT	
270-0364	MONITOR ASS'Y (WANG)	CRT IS ALSO DIFFERENT / PAUL WOLF FROM NSRM

TAG NS
1041W
III D2



MODEL 2282 CHASSIS LAYOUT

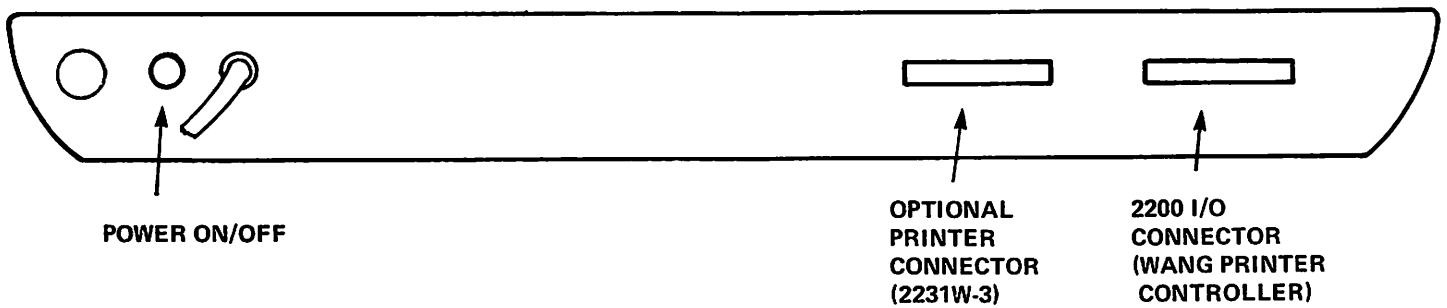


FIGURE 1
MODEL 2282 REAR PANEL

<u>#</u>	<u>Where Used</u>	<u>Description</u>
Not available	Power Supply Assy.	
Not available	Heat Sink Assy.	
378-2162	Microcode Chip #1	
378-2163	Microcode Chip #2	
378-2164	Microcode Chip #3	
378-2165	Microcode Chip #4	

1.5 2282 CRT TERMINAL SPECIFICATIONS

Size (Graphic CRT):

Height	13 1/2 inches (34.3 cm)
Depth	20 1/2 inches (52 cm)
Width	19 3/4 inches (50.2 cm)

Weight:

38 1/2 lb. (17.4 Kg)

CRT:

Display size	12 inches diagonal (30.4 cm)
Viewing area	7" x 6" (17.8 cm x 15.2 cm)
Screen array	800X x 512Y addressable location
Controls	Contrast, Brightness
Phosphor	P39

Refresh Rate:

30 Frames/Second

Plotting Time:

0.048 sec (full screen horizontal vector)

Dot Turn On/Turn Off Time:

60 microseconds

Programmable Control Codes:

Clear CRT, Set Home, Select Dots On, Select Dots Off, Power On/Set Home, Select CRT, Select Printer, Reset, Set Character Spacing, Set Character Size, "Pen" Up, "Pen" Down, Binary Plot Vector.

Character Generation:

112 ASCII, 15 selectable sizes

Cabling:

8 ft. (2.4 cm) to power source
12 ft. (3.66 cm) cable with connector to CPU

Controller:

Standard Wang line printer controller/CPU interface (7079, 7042, 6741, 6742, 2200E, F, PCS II). When used with the Model 2231W-3 line printer, the printer cable plugs into the output connector of the Model 2282.

Power Requirements:

115 or 230 VAC \pm 10%
50 or 60 Hz \pm 1 Hz
65 Watts

Fuse Size:

1.5 amps @ 115V
1 amp @ 230V

OPERATING ENVIRONMENT

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

2. INSTALLATION

2.1 INCOMING INSPECTION

When a 2282 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 display chassis power supply and power supply module is in the correct position.
- c) The DC power cables are securely connected to the motherboard.
- d) The 7296, 7297, and 7298 are properly installed in the terminal.

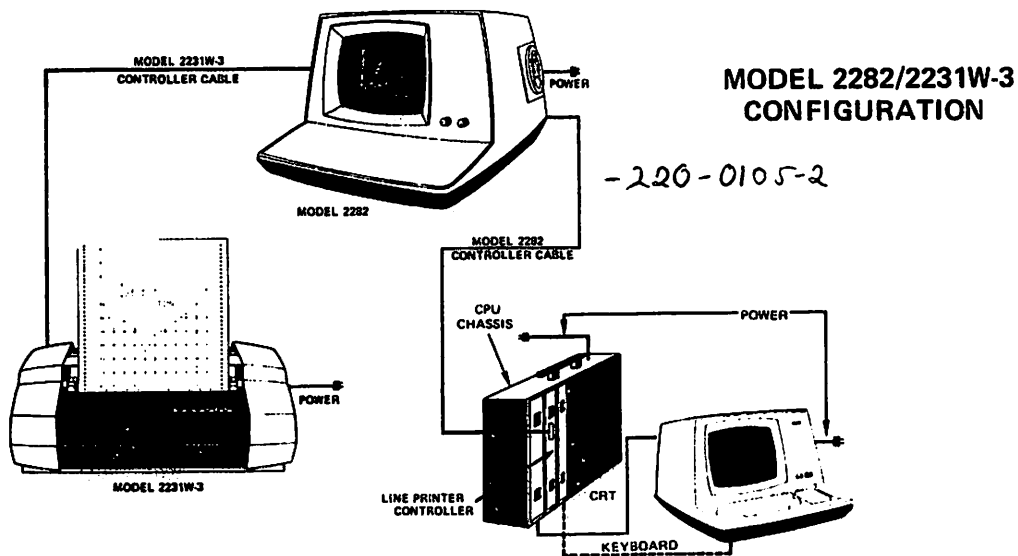
Reassemble the 2282 ensuring the fan cable has been connected.

2.2 DEVICE ADDRESS ASSIGNMENT

Set the Device Address Switch to Hex 15. When using a 2200 VP as the CPU, the Printer Controller is addressed as C15 and any other 2200 CPU as 415.

2.3 TYPICAL CONFIGURATION

A typical 2282 configuration is shown below. The graphics CRT is plugged into the Wang printer controller board in the CPU and if a 2231W-3 line printer is going to be used it is plugged into the printer output connector of the graphics CRT.



3. OPERATION

3.1 FUNCTIONAL TEST

The following program is a good test to tell if the system is working. It will check both pages of the CRT image memory and will test each PC board for operation.

The following program tests the 'even page' of the CRT image memory.

```

10  SELECT PLOT C15 (or 415 if not 2200VP)
20  PLOT ( , , Hex (03E5))
30  FOR I = 1 to 32
40  PLOT (799, , D)
50  PLOT ( , 16, U)
60  PLOT (-799, , D)
70  PLOT ( , 16, U)
80  NEXT I
90  PLOT ( , , HEX (E5))
100 FOR K = 1 to 50
110 PLOT ( , 512, D)

```

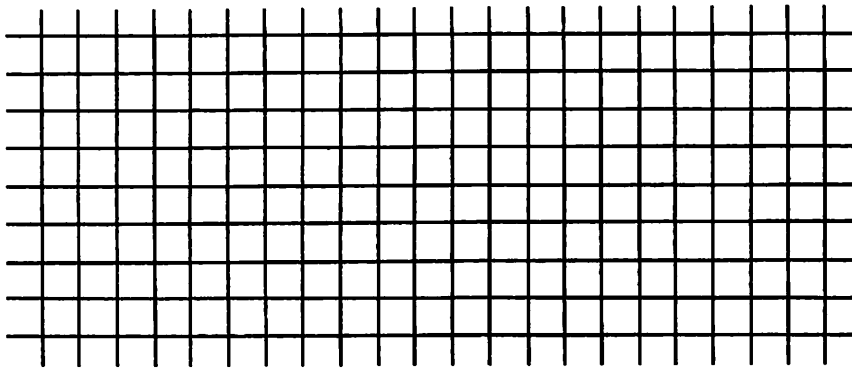
```
120 PLOT (16, , U)
130 PLOT (, -511, D)
140 PLOT (16, , U)
150 NEXT K
160 PLOT (, , HEX (E5))
170 GO TO 30
```

To test the 'odd page' of the image memory, add line 25 and change line 170 of the previous program to the following:

```
25 PLOT (, 1, U)
170 GO TO 25
```

In both uses you will get the following output on the graphics CRT display but one output will be in the even page field and the other will be in the odd page field.

This output will cover the graphics CRT screen.



If you receive no display, a number of problems could exist.

- a) Check to see if your device address is set properly on the Wang Printer controller board.
- b) Replace controller board.
- c) If problem still persists chances are the 7296 board of the graphics CRT has problems.

- d) If you receive a display but the display is not what is expected at all, the problem is probably with the I/O board of the graphics CRT (7297).

- e) If parts of the graphics CRT display are blanked, then you have problems with the image memory board (7298).

4. THEORY OF OPERATION (See Figure 2)

4.1 GENERAL

The graphics CRT is controlled by the 8080 which sends data to the controller by means of OUT commands. The 8080's OUT command sends its accumulator to a specified output port (in most cases the controller). The controller receives the 8 bit data word and decodes it so it will plot the various function it represents. For example, see Table 1.

TABLE 1

- OUT 01 - Sets the high order half of the CRT's X address with bits 0-6 of the accumulator. This should be a binary number between 0-79 inclusive.

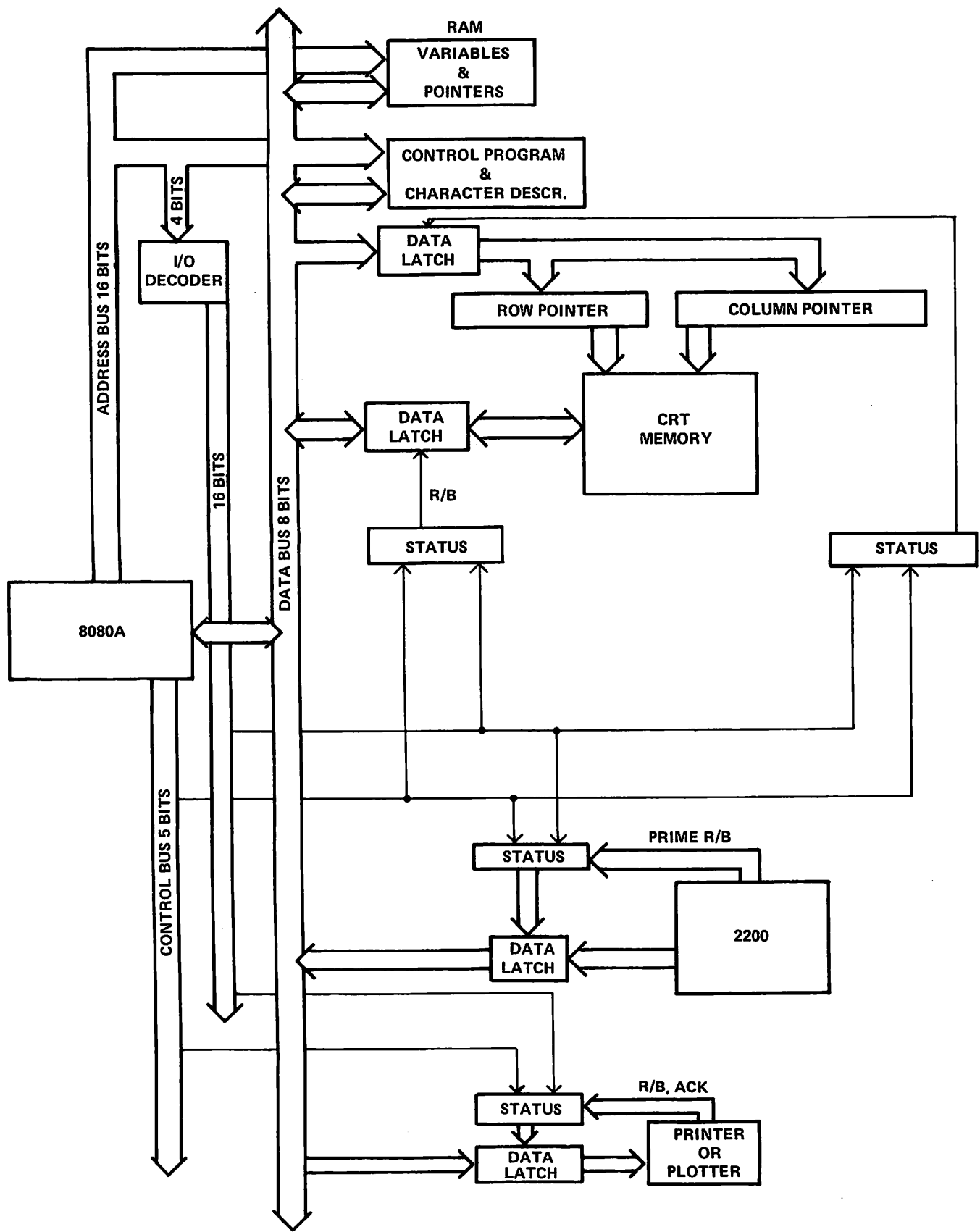
- OUT 04 - This sets bit 0-7 of the CRT's Y address with bits 0-7 of the 8080's accumulator.

- OUT 07 - This clears the CRT and sets the row and column pointers to 0,0.

- OUT 08 - This sets bits 0-7 of the CRT data latch with bits 0-7 of the 8080's accumulator.

As seen from Table 1, the CRT gets its plotting address and also the data to be plotted from the 8080's accumulator through the data bus which is decoded by the controller's data latch.

FIGURE 2
 GRAPHICS CRT



The 8080's OUT commands are controlled by its software which receives Hex codes from a 2200. The 2200 is programmed in Basic and the PLOT commands are used for output to the 8080 to plot various functions. The 8080 receives these various Hex codes, and through its software, sends out the corresponding OUT commands to plot the various functions. For examples of Hex codes, see Table 2.

TABLE 2

- HEX 03 - The CRT is cleared, the current plot position is set to the current home position, and the pen indicator is set to pen up.
- HEX F0 - Initializes plot mode. This places the 8080 in the plot mode, turns off the spacing mode, and sets the plot vector to (0,0).
- HEX F6 - South, this causes the plotter to move down. A Hex (0001) is added to the ordinate of the plot vector.
- HEX F8 - West, this causes the plotter to move left. A Hex (FFFF) is added to the abscissa of the plot vector.
- HEX F1 - Southwest, this causes the plotter to move down and to the left. A Hex (FFFF) is added to the ordinate.

4.2 HARDWARE SPECIFICATIONS

4.2.1 GRAPHICS CRT

The Graphics CRT contains an array of 800 dots across by 512 dots down. Each dot is an addressable memory location that can be written into or read from by the 8080. Storing a 1 (+5V) will cause the corresponding dot to be displayed on the CRT and storing a 0 (+0V) will cause no dot.

To store a point on the CRT, the 8080 selects a row address and a column address. Then the desired value (0 or 1) is written to a data latch and an R/B (Ready or Busy) status bit is turned on to indicate that the data latch is in use. Every 60 microseconds a 'window' exists allowing the contents of the data latch to be written to the CRT memory. When the data transfer takes place, the R/B status bit is turned off.

To read a bit from the CRT memory, the 8080 selects a row address and a column address. Then a command is issued to read one bit (or 10 bits) from the CRT memory into the data latch. The R/B status bit is turned on to indicate the memory latch is in use. When the window opens up allowing the data transfer to take place, the data is read from the CRT memory into the data latch and the R/B status bit is turned off. When the 8080 senses that the R/B status bit is off, it reads the contents of the data latch into its accumulator.

4.2.2 2200

When the 2200 writes a byte of data to the printer controller board, the data gets strobed into the 8080's input data latch. This also causes the R/B status bit for the input latch to be turned on. When the 8080 senses that the R/B status bit is turned on and it is ready to process another character, it reads the contents of the data latch into its accumulator. Reading the contents of the data latch into the accumulator causes the R/B status bit to be turned off.

4.2.3 PRINTER

The printer provides an R/B status line which indicates that the printer's power is on, the printer is selected, and it is operational and ready for data. The printer also provides an acknowledge strobe. The R/B status line, the acknowledge strobe from the printer control, and the R/B status bit in the CRT electronics can be read by the 8080. The 8080's software will only write to the printer only when

this status bit is off (printer ready). When it is ready, the 8080 sends the contents of its accumulator to the printer. This automatically turns the R/B status bit on to indicate that the printer is busy. When the printer has received the character and either stored it in its buffer or processed it, the printer sends back an acknowledge strobe. This returns the R/B status bit to ready.

When the printer's buffer becomes full or a carriage return is encountered, it automatically prints the contents of the buffer. During the print operation, the printer's R/B status bit goes to busy and stays there while the printer prints the line, does a carriage return, and line feed. The R/B status bit then returns to ready.

4.2.4 I/O INTERFACE (PCB #7297 - Figure 3)

The I/O Interface is the link between the 2200 and the graphics controller. To read or write from the graphics controller, a select 415 address will be used.

Hex commands are sent from the 2200 to the CRT through the data latches. The I/O interface checks ready and busy signals and sends this status to the 2200 to let it know whether the CRT is ready or busy.

Also, information to be sent to the printer/plotter is sent through the I/O interface either from the 8080 or 2200. Status of the printer is also controlled on this board by the printer out status flip flops.

4.2.5 IMAGE MEMORY (PCB #7298 - Figure 4)

The Image Memory is set up so that each point on the CRT has a separate location in memory all its own. The interlace technique is used for displaying data on the CRT. This technique involves two pages of memory (page 1 and page 2). Page 1 of the memory contains

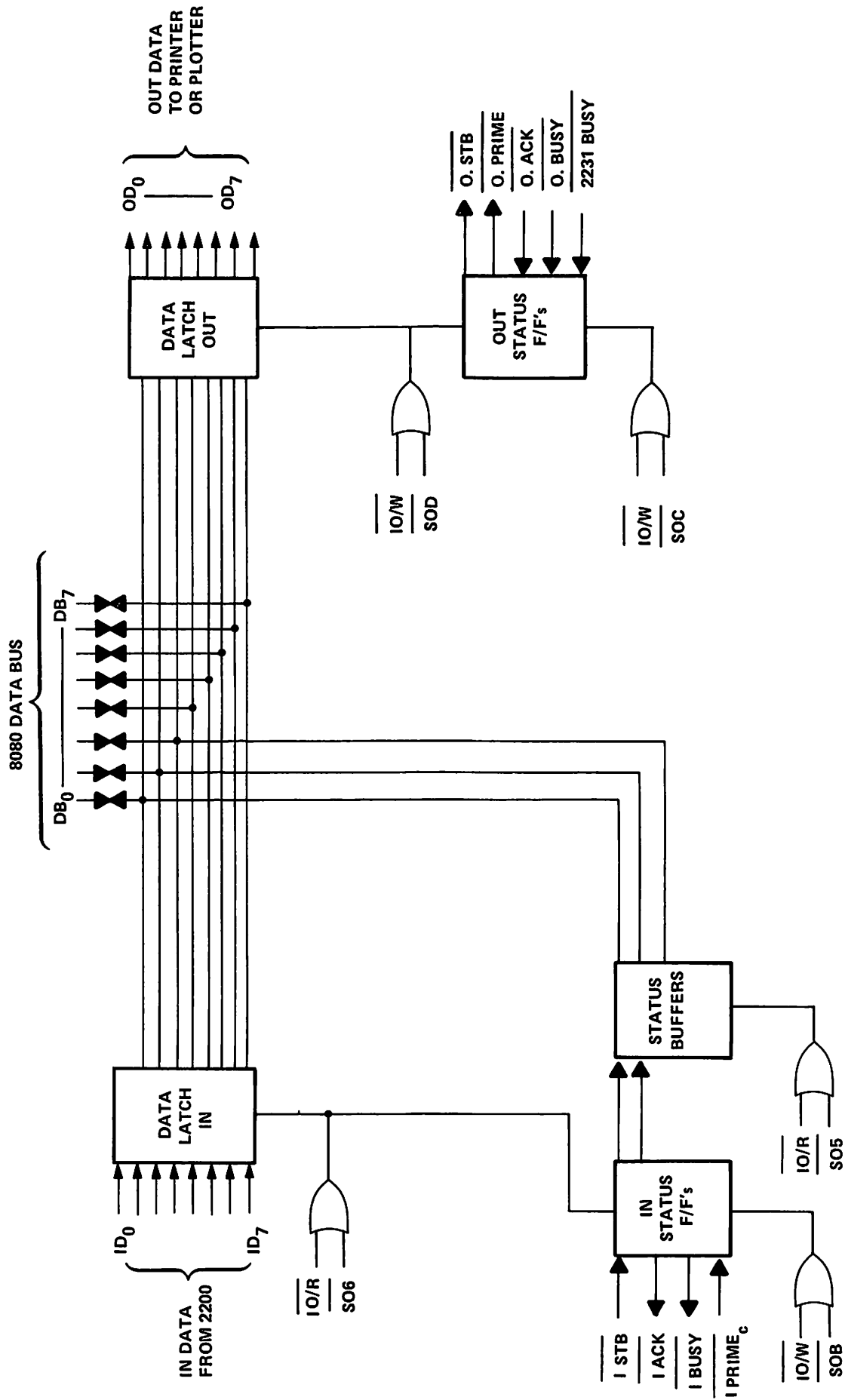


FIGURE 3
I/O INTERFACE 7297

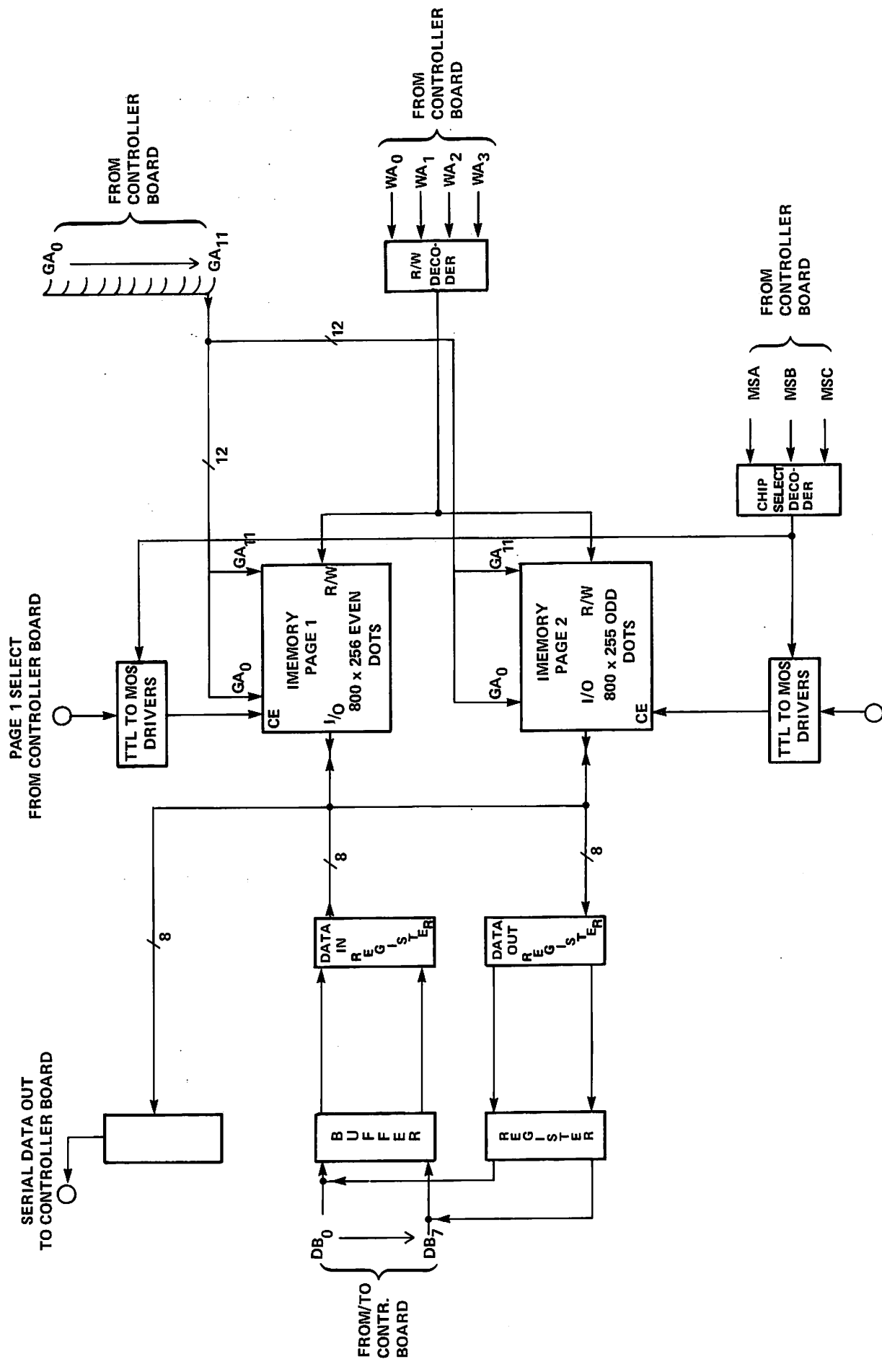


FIGURE 4
IMAGE MEMORY PCB #7298

PAGE 2 SELECT
FROM CONTROLLER BOARD

800 columns and 256 rows. The rows are all the even numbered rows to 512 which are displayed at 30 Hz line frequency. Page 2 contains 800 columns and 256 rows, but these rows are the odd numbered rows to 511 which are also displayed at 30 Hz line frequency. This makes the total display field displayed at 60 Hz line frequency.

The 7298 board contains decoding for the memory select, memory drivers, and R/W selection; the parallel to serial shift register also resides on this board along with the data in/out buffers to the memory.

4.2.6 CONTROLLER (PCB #7296 - Figure 5)

This board contains the 8080, its ROM and RAM and all the logic to control the CRT display and image memory read and write which makes up the following.

HORIZONTAL TIME (See Figure 6)

COLUMN DIVISION

Each column is broken into 10 equal sub-times by a decode counter. Each column has its own sub-time period as its time.

Other signals generated by the column division counter are Write Page and Page Select.

COLUMN COUNTER

The Column Counter consists of two synchronous binary counters. One, a divide by sixteen, and the other a divide by five, yielding a total division of 80. Each count represents one vertical column out of the 80 possible columns on the CRT.

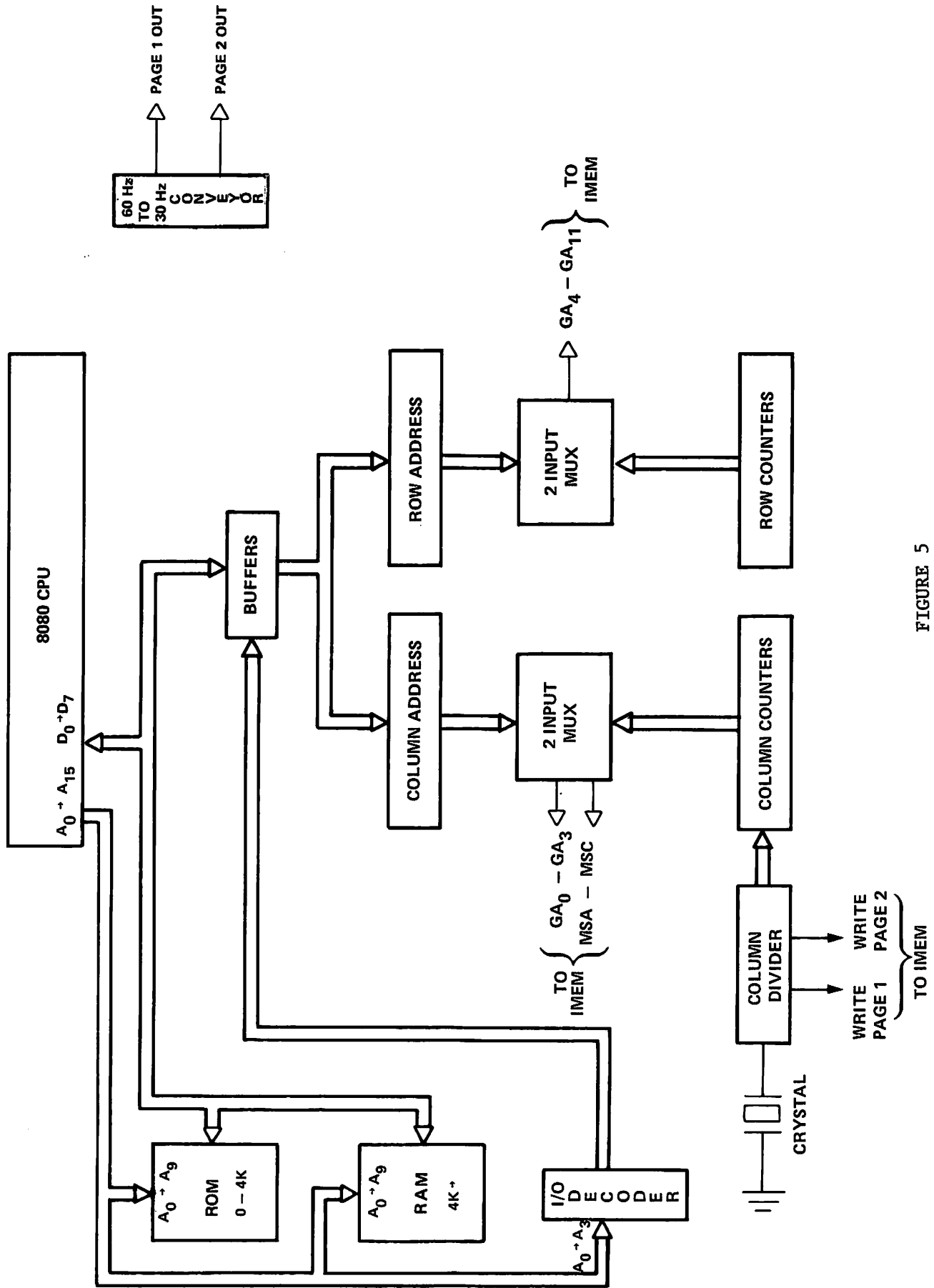


FIGURE 5
CRT CONTROLLER 7296

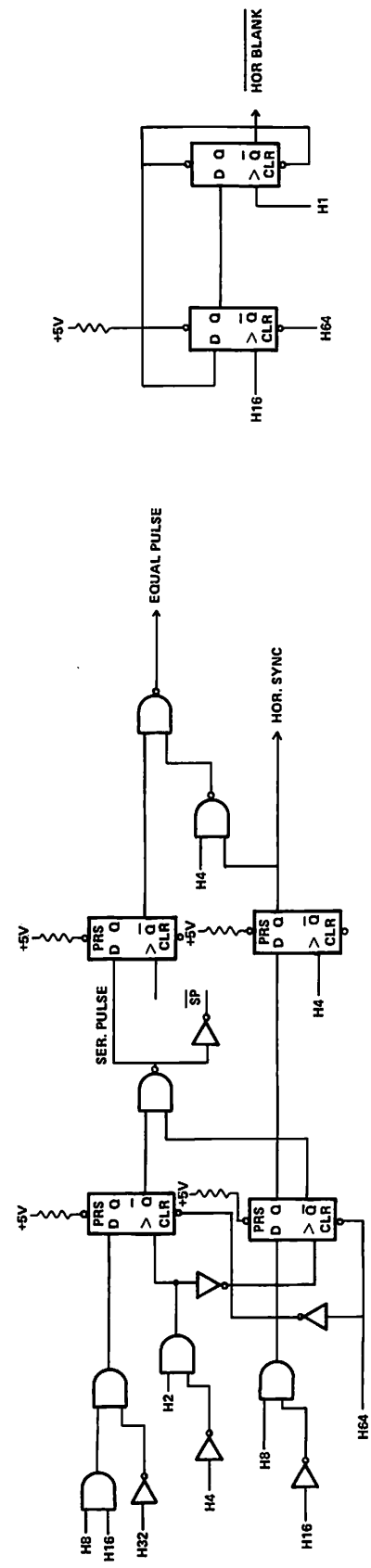
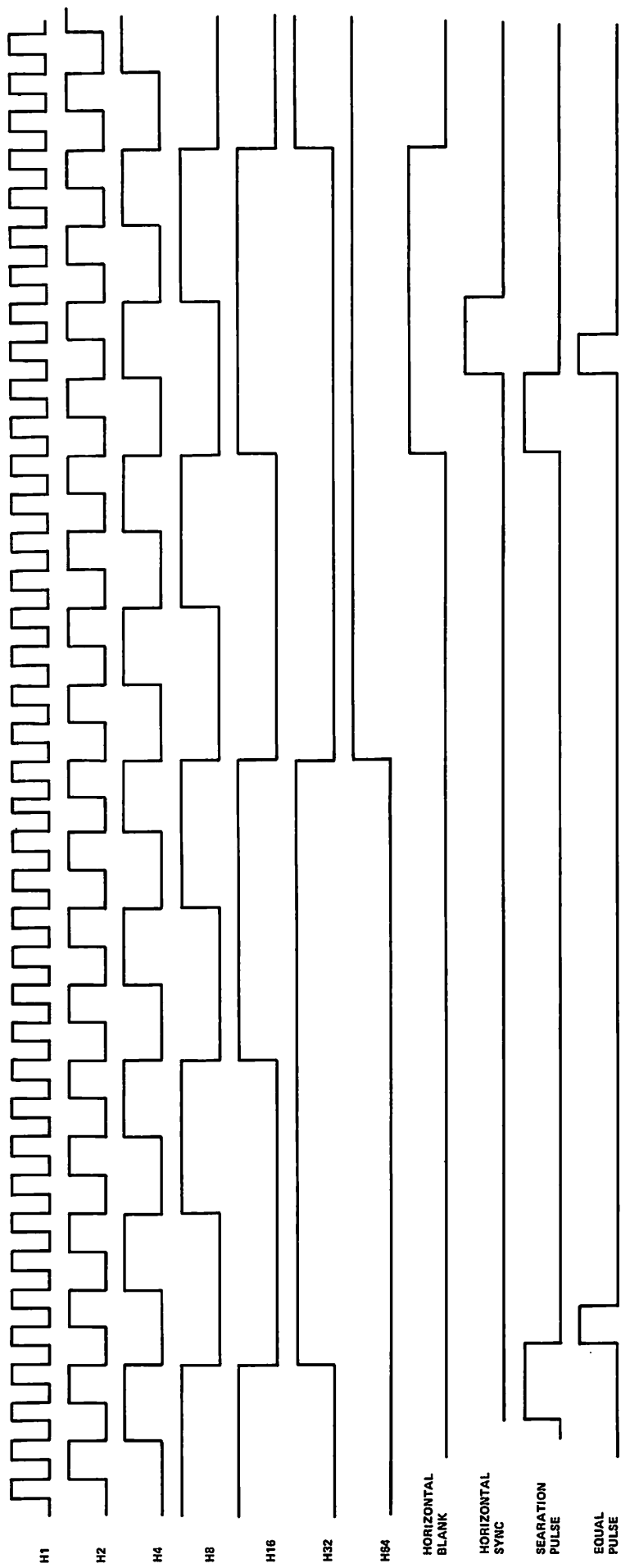


FIGURE 6
HORIZONTAL TIMING

HORIZONTAL BLANK

The purpose of the Horizontal Blank is to disable the data logic during the retrace of the CRT beam. Also, Horizontal Blank allows time for housekeeping chores within the CRT controller, register, and counter updating, allowing page memory, writing, etc.

HORIZONTAL SYNC

The purpose of Horizontal Sync is to return the CRT electron beam at completion of its horizontal sweep, to the leftmost position of the CRT screen enabling the next horizontal sweep.

VERTICAL TIMING

The purpose of Vertical Timing is to control the number of horizontal raster lines on the face of the CRT. The number of raster lines determines the total vertical size of the display and the length of the horizontal raster determines the width of the display.

VERTICAL COUNTER

The Vertical Counter is comprised of synchronous binary counters cascaded together yielding a total vertical position count of 512.

VERTICAL BLANK

The Vertical Blank is used to disable data display logic past the page field size. The page field size (display area) is smaller than the vertical time frame.

VERTICAL SYNC

The purpose of the Vertical Sync is to return the CRT electron beam to the top of the screen enabling a new display page.

5. DIAGNOSTICS

No 2282 diagnostics have been developed at this time. The 2272 Diagnostic Program on the 2200 Peripheral Plotter (701-2180) may be used as a general test. Also, refer to the Functional Test given in Section 3.

6. CONVERSIONS AND UPGRADES

No conversions or upgrades are available at this time.

7. MAINTENANCE

7.1 DISASSEMBLY

To disassemble the 2282 terminal:

- a) Remove the blank keyboard panel by removing the two screws in the upper right and left hand corners respectively.
- b) Remove screws from each side of the terminal.
- c) Lift cover up away from the chassis and disconnect fan connector.

7.2 PREVENTIVE MAINTENANCE

The 2282, like other Wang products, must be properly maintained for trouble free operation. This requires periodic cleaning, 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 contaminants (smoke, dust, etc.) more frequent cleaning is required.

Clean 2282 Terminal as follows:

- a) Disassemble as above.
- b) Remove the CRT electronics, voltage regulator, and all logic boards from the 2282.
- c) Using a soft bristle brush, remove any accumulation of dust and dirt from the terminal chassis and back of the PC boards.
- d) Clean finger connectors of each PC board with an eraser.
- e) Use a mild detergent to clean the covers and the face of the CRT.
- f) Return all PC boards to the 2282.
- g) Reassemble unit.

7.3 ADJUSTMENTS

7.3.1 RECOMMENDED TEST EQUIPMENT

- a) Digital Voltmeter, with an accuracy of at least $\pm .1\%$ 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) Insulated Heavy-Gauge Ground Wire with insulated Alligator clips (for use with item (g), above).
- f) Small screwdriver with insulated shaft, used mostly for voltage adjustments.

7.3.2 2282 VOLTAGE ADJUSTMENTS

Adjust voltages at following pins without PC boards 7296, 7297, 7298. Insert PC boards and readjust voltages if necessary.

LOCATION	VOLTAGE	LIMITS	ADJ.	RIPPLE
Pin S/15 of 7067	+5VR	+4.95Vdc to +5.10Vdc	R4	20 MVP-P
Pin 12 of 7067	-5VR	-4.90Vdc to -5.10Vdc	R19	15 MVP-P
Pin F/6 of 7067	+12VR	+11.80Vdc to +12.20Vdc	R10	50 MVP-P
Pin 4/7 of 7067	-12VR	-11.80Vdc to -12.20Vdc	R16	50 MVP-P

7.3.3 CRT ADJUSTMENTS

Refer to Service Bulletin 73 (Wang Monitor).

8. ELECTRICAL SCHEMATICS

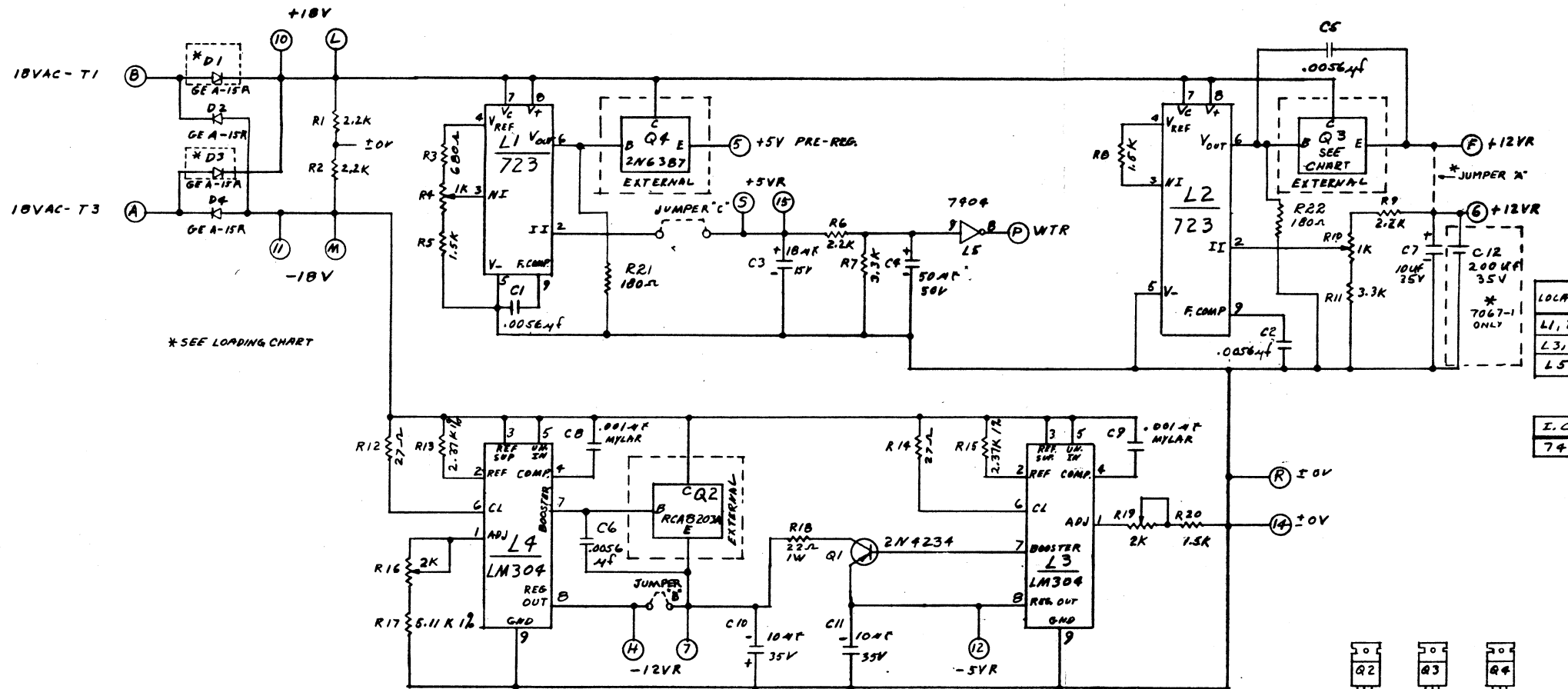
- D7067 Regulator
- E7295 Motherboard
- E7296 CPU/CRT Controller
- D7297 I/O Interface
- E7298 Image Memory

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MILLIMETERS IN PARENTHESES. TOLERANCES TO BE EQUIVALENT TO INCH DIMENSIONS.

DO NOT SCALE

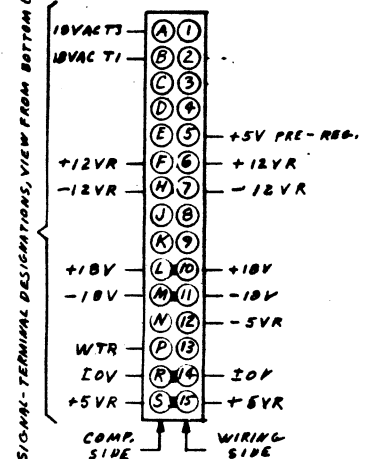
HOLE LEGEND & TOLERANCES		
SYMBOL	DESCRIPTION	QTY.
A		



* SEE LOADING CHART

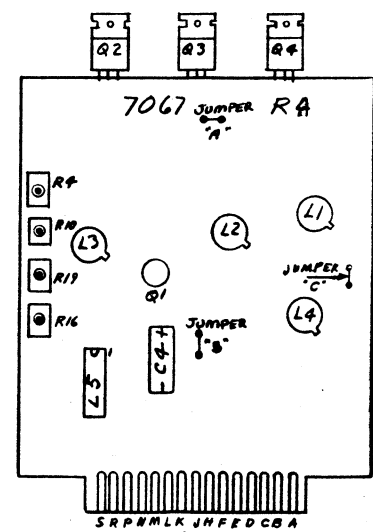
LOCATION	W.L. PART NO.	PIN NO.	PIN NO.
L1, 2	376-0066	5	15
L3, 4	376-0134	9	
L5	376-0010	7	14

I.C. TYPE	LOCATION	SPARE
7404	L5	5



COMPONENT	W.L. PART NO.
R1, 2, 6, 9	330-3022
R3	330-2068
R4, 10, 11	336-1014
R5, 8, 20	330-3015
R7, 11	330-3035
R16, 19	336-1022
R13, 15	333-0093
R12, 14	330-1027
R17	333-0088
R18	332-1022
R21, 22	330-2018
C1, 2, 5, 6	300-1935
C3	300-2018
C4	300-3010
C8, 9	300-2010
C7, 10, 11	300-4032
C12	300-4033
D1, 2, 3, 4	380-3008
Q1	375-1024
Q2	375-1053
Q3, 4	375-1052
Q1 PAD	375-9001

LOADING CHART	
210-7067	AVG. LOAD CIR. LOAD 375-1052 ON Q3
210-7067-1	DO NOT LOAD D1, D2 & JUMPER "A"; CHG. C3 TO A 300-4020-474F; CHG. C7 TO A 300-4033-2008F LOAD 375-1052 ON Q3
210-7067-2	LOADING SAME AS 7067, BUT REMOVE JUMPER "B". LOAD 375-1052 ON Q3



ECN
NO. PENDING 7067

ECN
NO. PENDING 7067

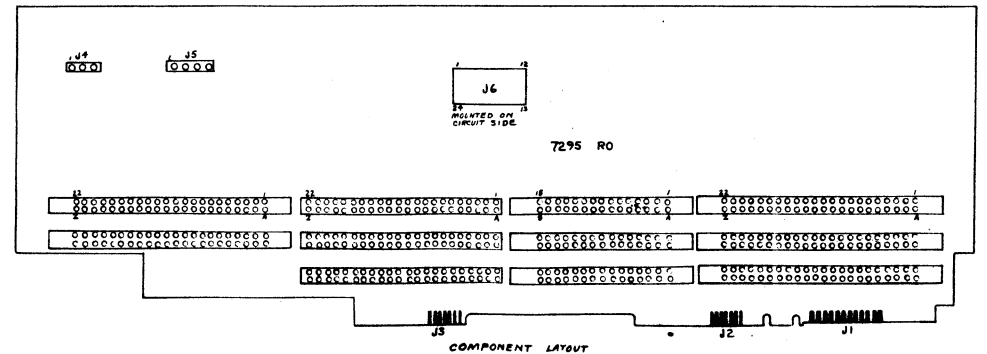
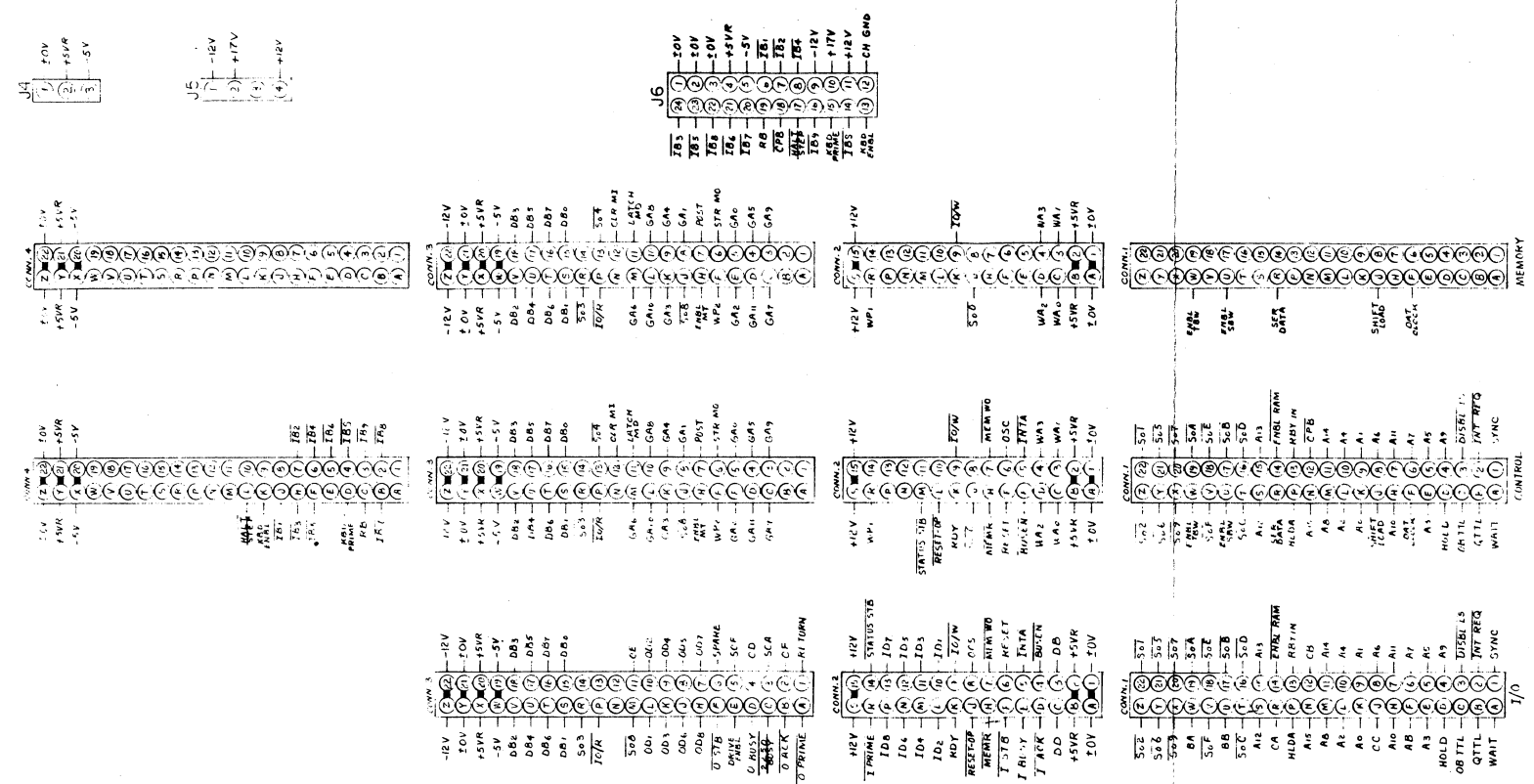
7067	7067-1	7067-2
E-REV	E-REV	E-REV
6	6	5

REV.	DATE	BY	DESCRIPTION
0	3-30-76	D.W.H.	ORG. DES. & APP'D.
1	4-18-76	G.D.	REVISED PER 5876
2	6-13-76	G.D.	REVISED PER 5537
3	8-22-76	G.D.	REVISED PER 5876
4	2-11-77	G.D.	REVISED PER N.C.D.
5	5-27-77	G.D.	REVISED PER 6215
6	7-18-77	G.D.	REVISED PER 6099
7	8-11-77	G.D.	REVISED PER 6215
8	8-27-77	G.D.	REVISED PER 7279
9	8-27-77	G.D.	REVISED PER 7280
10	8-27-77	G.D.	REVISED PER 7506
11	10-11-77	G.D.	REVISED PER 7524

QTY.	ITEM	WANG PART NO.	DRAWING NO.	DESCRIPTION
	NEXT ASSY.			
		WANG LABORATORIES, INC. TOWERSVILLE, MARYLAND U.S.A.		
		MATERIAL	MODEL NO. 2200F	BY: D.W.H. DATE: 9/29/76
		FINISH	SEE ENGR. SPECIFICATIONS	APPROVED BY: H.C.D. DATE: 4/24/76
			TITLE: SCHEMATIC POWER SUPPLY REGULATOR	CHK: G.D. DATE: 4-30-76
			TOL. EX. AS NOTED	MFG ENGR.
			XX ± FRAC ± FINISH	
			SCALE: 1/4" = 1"	SEE CHART
			WANG PART NUMBER	D 7067
			SIZE	10
			DRAWING NUMBER	
			REV.	

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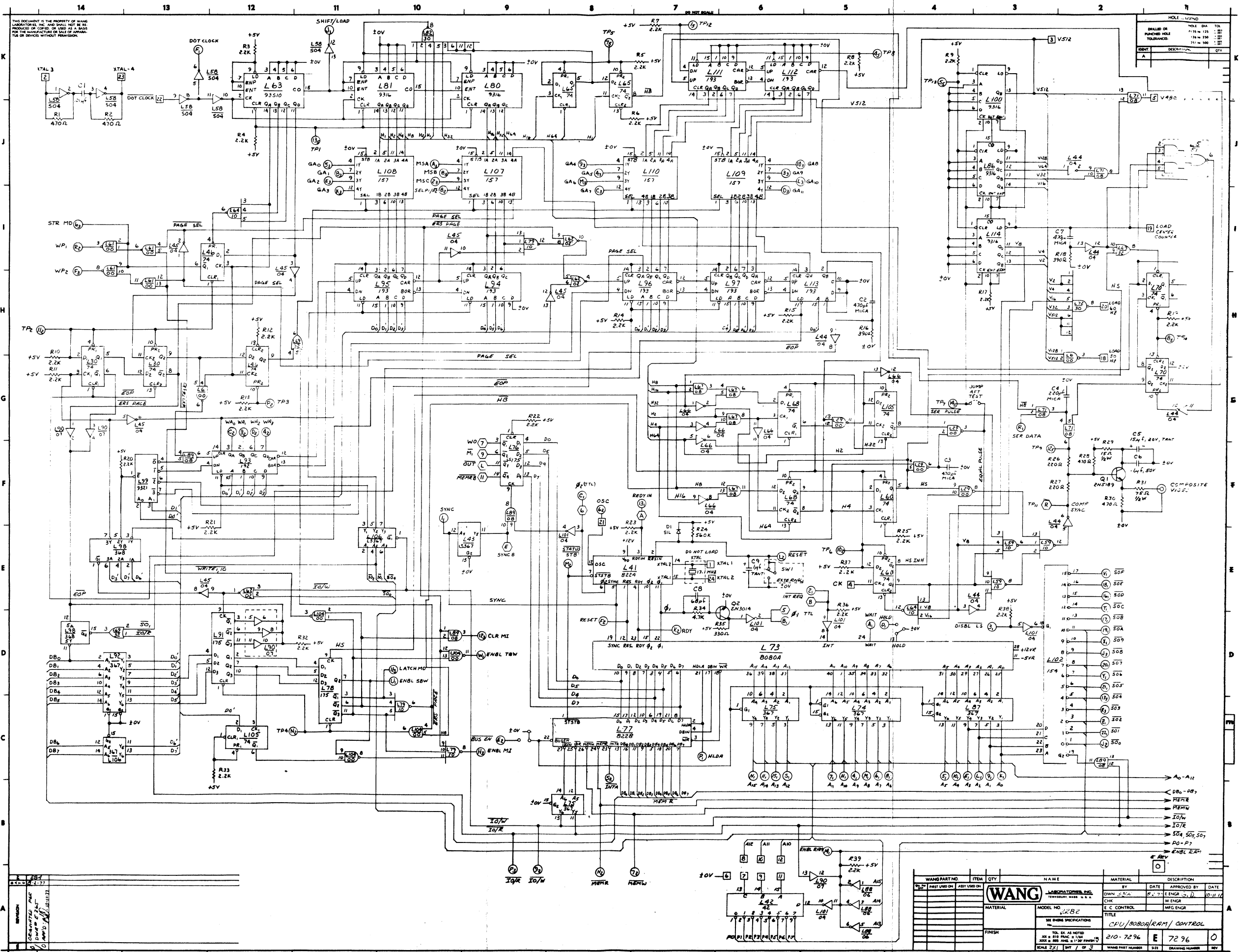
HOLE LEGEND	
DRILLED OR PUNCHED HOLE TOLERANCES	HOLE DIA. TOL.
	0.35 - 1.25 ±.01
	1.26 - 2.00 ±.02
	2.01 - 3.00 ±.03
	3.01 - 5.00 ±.05
	5.01 - 10.00 ±.08
	10.01 - 25.00 ±.12
	25.01 - 50.00 ±.18
	50.01 - 100.00 ±.25
	100.01 - 250.00 ±.38
	250.01 - 500.00 ±.50
	500.01 - 1000.00 ±.75



COMPONENT	W.L. PART NO.
J1	350-1031
J2,3	350-1036
J4	654-1193
J5	654-1194
J6	376-9617
30 PIN CONN	350-0011
44 PIN CONN (40 pins)	350-0021M1
44 PIN CONN	350-0021

REVISION	DATE	BY	DESCRIPTION
1	11-11-77	W.A.	INITIAL DESIGN
2	11-11-77	W.A.	REVISED FOR MANUFACTURE
3	11-11-77	W.A.	REVISED FOR MANUFACTURE

WANG PART NO.	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
350-1031	J1	1	CONNECTOR	350-1031	CONNECTOR
350-1036	J2,3	2	CONNECTOR	350-1036	CONNECTOR
654-1193	J4	1	CONNECTOR	654-1193	CONNECTOR
654-1194	J5	1	CONNECTOR	654-1194	CONNECTOR
376-9617	J6	1	CONNECTOR	376-9617	CONNECTOR
350-0011	30 PIN CONN	1	CONNECTOR	350-0011	CONNECTOR
350-0021M1	44 PIN CONN (40 pins)	1	CONNECTOR	350-0021M1	CONNECTOR
350-0021	44 PIN CONN	1	CONNECTOR	350-0021	CONNECTOR



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HOLE	NO.	LOC.
DRILLED OR PUNCHED	115	125
TOLERANCES:	175	230
	231	300
	301	360
	361	420
	421	480
	481	540
	541	600
	601	660
	661	720
	721	780
	781	840
	841	900
	901	960
	961	1020

REV.	DESCRIPTION	DATE
1	ORIGINAL P&E DRAWING	10-11-77
2	REVISED P&E DRAWING	10-11-77

WANG PART NO.	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
74LS04	1	10	INVERTER	74LS04	INVERTER
74LS10	1	10	NAND GATE	74LS10	NAND GATE
74LS112	1	10	D-TYPE FLIP-FLOP	74LS112	D-TYPE FLIP-FLOP
74LS163	1	10	COUNTER	74LS163	COUNTER
74LS164	1	10	SHIFT REGISTER	74LS164	SHIFT REGISTER
74LS165	1	10	SHIFT REGISTER	74LS165	SHIFT REGISTER
74LS166	1	10	SHIFT REGISTER	74LS166	SHIFT REGISTER
74LS167	1	10	SHIFT REGISTER	74LS167	SHIFT REGISTER
74LS168	1	10	SHIFT REGISTER	74LS168	SHIFT REGISTER
74LS169	1	10	SHIFT REGISTER	74LS169	SHIFT REGISTER
74LS170	1	10	SHIFT REGISTER	74LS170	SHIFT REGISTER
74LS171	1	10	SHIFT REGISTER	74LS171	SHIFT REGISTER
74LS172	1	10	SHIFT REGISTER	74LS172	SHIFT REGISTER
74LS173	1	10	SHIFT REGISTER	74LS173	SHIFT REGISTER
74LS174	1	10	SHIFT REGISTER	74LS174	SHIFT REGISTER
74LS175	1	10	SHIFT REGISTER	74LS175	SHIFT REGISTER
74LS176	1	10	SHIFT REGISTER	74LS176	SHIFT REGISTER
74LS177	1	10	SHIFT REGISTER	74LS177	SHIFT REGISTER
74LS178	1	10	SHIFT REGISTER	74LS178	SHIFT REGISTER
74LS179	1	10	SHIFT REGISTER	74LS179	SHIFT REGISTER
74LS180	1	10	SHIFT REGISTER	74LS180	SHIFT REGISTER
74LS181	1	10	SHIFT REGISTER	74LS181	SHIFT REGISTER
74LS182	1	10	SHIFT REGISTER	74LS182	SHIFT REGISTER
74LS183	1	10	SHIFT REGISTER	74LS183	SHIFT REGISTER
74LS184	1	10	SHIFT REGISTER	74LS184	SHIFT REGISTER
74LS185	1	10	SHIFT REGISTER	74LS185	SHIFT REGISTER
74LS186	1	10	SHIFT REGISTER	74LS186	SHIFT REGISTER
74LS187	1	10	SHIFT REGISTER	74LS187	SHIFT REGISTER
74LS188	1	10	SHIFT REGISTER	74LS188	SHIFT REGISTER
74LS189	1	10	SHIFT REGISTER	74LS189	SHIFT REGISTER
74LS190	1	10	SHIFT REGISTER	74LS190	SHIFT REGISTER
74LS191	1	10	SHIFT REGISTER	74LS191	SHIFT REGISTER
74LS192	1	10	SHIFT REGISTER	74LS192	SHIFT REGISTER
74LS193	1	10	SHIFT REGISTER	74LS193	SHIFT REGISTER
74LS194	1	10	SHIFT REGISTER	74LS194	SHIFT REGISTER
74LS195	1	10	SHIFT REGISTER	74LS195	SHIFT REGISTER
74LS196	1	10	SHIFT REGISTER	74LS196	SHIFT REGISTER
74LS197	1	10	SHIFT REGISTER	74LS197	SHIFT REGISTER
74LS198	1	10	SHIFT REGISTER	74LS198	SHIFT REGISTER
74LS199	1	10	SHIFT REGISTER	74LS199	SHIFT REGISTER
74LS200	1	10	SHIFT REGISTER	74LS200	SHIFT REGISTER

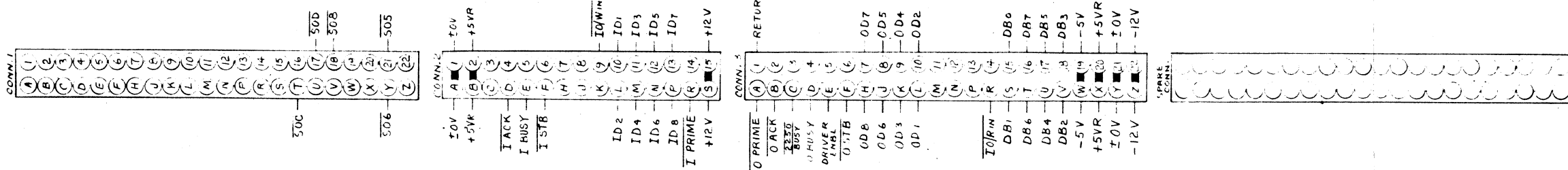
WANG LABORATORIES, INC.
TROY, N.Y. 12180

MODEL NO. 7296
TITLE: CPU/BOBOA/RAM/CONTROL
DATE: 10-11-77
APPROVED BY: [Signature]
E C CONTROL
MFG ENGR
SCALE: 2X
SHEET: 1 OF 3
WANG PART NUMBER: 7296
REV: 0

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MILLIMETERS IN PARENTHESIS. TOLERANCES TO BE EQUIVALENT TO INCH DIMENSIONS.

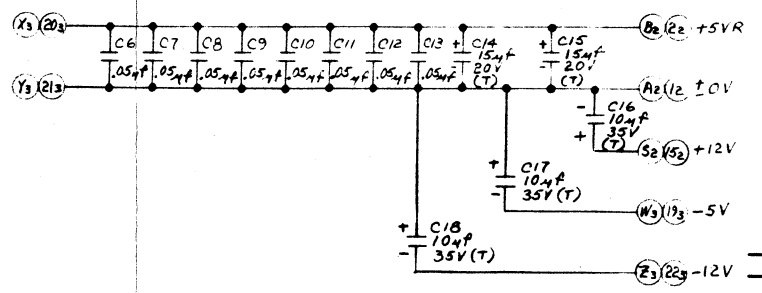
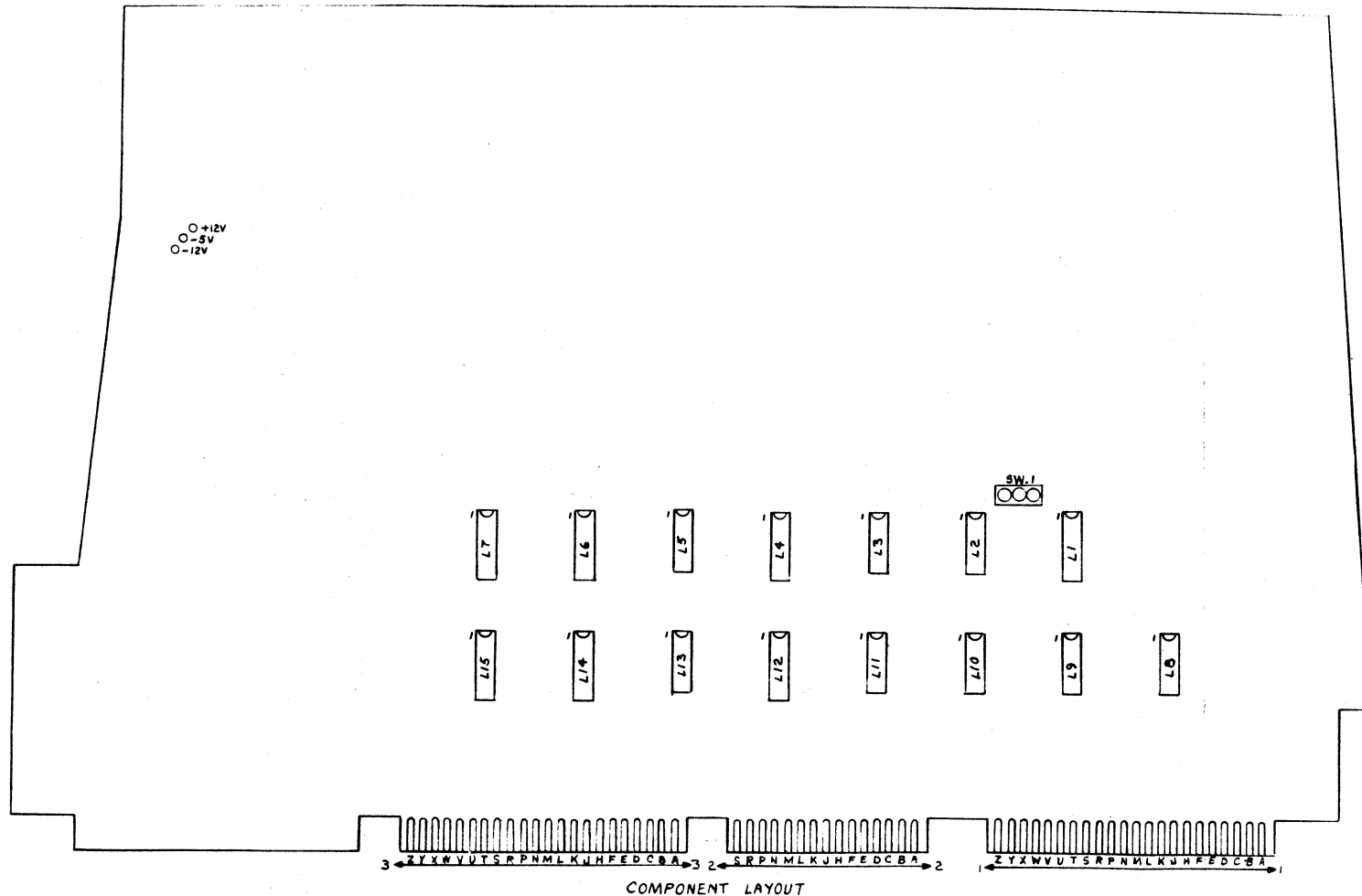
HOLE LEGEND & TOLERANCES			
HOLE DIA	TOLERANCE		
Ø25 - 125	+003 - 001		
126 - 250	+004 - 001		
251 - 500	+005 - 001		
SYM	DESCRIPTION	QTY	
A			



COMPONENT	A.L. PART NO.
R1-8,9,10,12,16-18,20	330-3022
R11	330-4027
R13,14	330-2039
R15,19	330-4033
C1,5	300-1470
C2	300-4000
C3	300-1221
C4	300-5006
C6-13	300-1900
C14,15	300-4022
C16,17,18	300-4032

LOCATION	A.L. PART NO.	TERM. NO.	TERMINAL NO.
L1,4	376-0104	8	6
L2	376-0081	7	4
L3,11	376-0093	7	4
L5,8,13	376-0006	7	4
L6,7,14,15	376-0183	8	16
L9,10	376-0010	7	14
L12	376-0176	8	16

LOCATION	TYPE	SPARES
L1	9602	1
L2	7408	2
L8	7474	1
L9	7404	4



QTY.	ITEM	WANG PART NO.	DRAWING NO.	DESCRIPTION	BY	DATE	APPROVED BY	DATE
	NEXT ASSY.				DWN	1-77	E ENGR	
					CHK		M ENGR	
							MFG ENGR	
MATERIAL		MODEL NO. 2282		TITLE I/O INTERFACE				
FINISH		SEE ENGR. SPECIFICATIONS		TOL. EX. AS NOTED				
		XX ±		FRAC. ±				
		XXX ±		ANG. ±				
		FINISH		210-7297		D 7297 0		
SCALE		SMT 2 OF 2		WANG PART NUMBER		SIZE		DRAWING NUMBER

EDITED BY CUSTOMER ENGINEERING DIVISION

March 10, 1978

SERVICE BULLETIN #84 CORRECTIONS

The sample program on pages 7 and 8 of Service Bulletin #84 is incorrect. Plot statements were shown incorrectly and statement 130 has an incorrect value of -511 which produces an incorrect output. Attached is a correct sheet with pages 7 and 8 to be inserted in Service Bulletin #84.

Submitted by Jim Candler, Southern Area Office.

NOTICE:

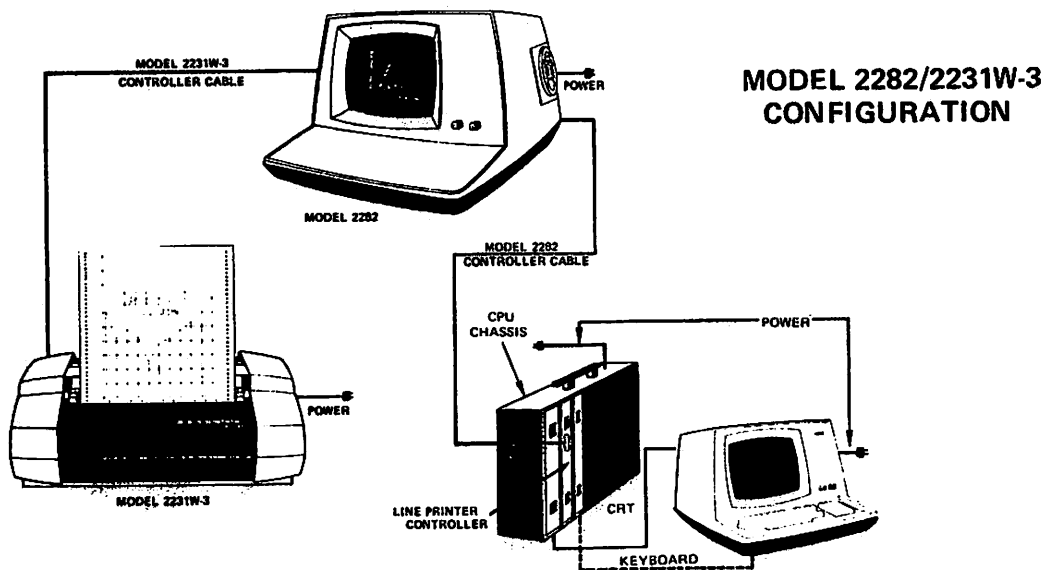
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WANG

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13-210A



3. OPERATION

3.1 FUNCTIONAL TEST

The following program is a good test to tell if the system is working. It will check both pages of the CRT image memory and will test each PC board for operation.

The following program tests the 'even page' of the CRT image memory.

```

10   SELECT PLOTCL5
20   PLOT<,,HEX(03E5)>
30   FOR I=1 TO 32
40   PLOT<799,,D>
50   PLOT<,16,U>
60   PLOT<-799,,D>
70   PLOT<,16,U>
80   NEXT I
90   PLOT<,,HEX(E5)>
100  FOR K=1 TO 50
110  PLOT<,512,D>

```

```

120 PLOT<16,U>
130 PLOT<1572,B>
140 PLOT<16,U>
150 NEXT K
160 PLOT<,,HEX(E5)>
170 GOTO 30

```

To test the 'odd page' of the image memory, add line 25 and change line 170 of the previous program to the following:

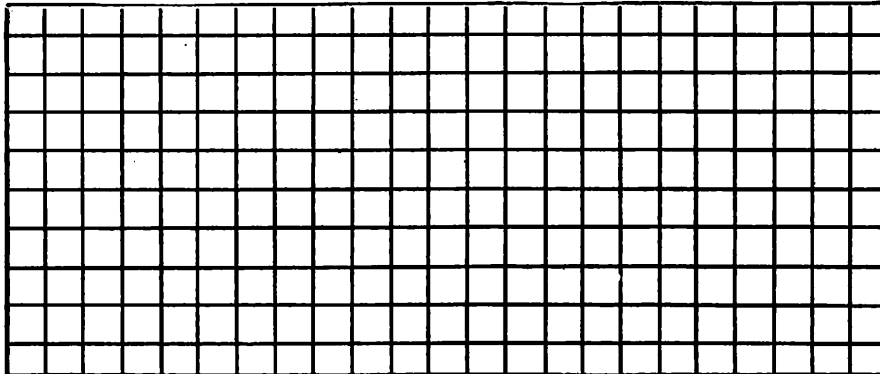
```

25 PLOT<1,U>
170 GOTO 25

```

In both uses you will get the following output on the graphics CRT display but one output will be in the even page field and the other will be in the odd page field.

This output will cover the graphics CRT screen.



If you receive no display, a number of problems could exist.

- a) Check to see if your device address is set properly on the Wang Printer controller board.
- b) Replace controller board.
- c) If problem still persists chances are the 7296 board of the graphics CRT has problems.

Terry, 2282 MONITOR PROBLEM

I understand you are the planner for two monitor assemblies, 725-0033-8M and 270-0373. These monitors are currently coded as interchangeable on the logistics system. The TAC 2200 support engineer, Mike Bahia, is concerned with this situation. Mike states that the 725-0033-8M (Motorola) monitor is a graphics terminal. Conversely, the 270-0373 is not. When the 270-0373 is installed in a graphics terminal, the resulting images are not acceptable. Can you please take the steps necessary to change the status of the monitor assemblies to NOT interchangeable.

If you have any questions, you can call me at x60312, or Mike Bahia at x60256.

Thanks for your help.

Doug MacMillan
TSO VS Product Support

WANG

LABORATORIES, INC.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#10616

III.D.1

PERIPHERALS-TERMINALS, WORKSTATION DISPLAYS, KEYBOARDS-FOR 2200.

IQEIC: 2211M_PRINTER_MULTIPLEXER

There is a problem running the 2211M MUX with a 2282 Graphics terminal. Pin 34 of J1, J2, J3, J4, and J5 must be tied together and also pin 35 of J1, J2, J3, J4, and J5 must be tied together on the 210-7430 MUX card in the 2211M.