

**ADM 5  
Dumb Terminal®  
Video Display**

**MAINTENANCE MANUAL**



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# SECTION I

## GENERAL DESCRIPTION

### 1.1 INTRODUCTION

This section describes the primary functions of the Lear Siegler ADM 5 Video Display Terminal shown in figure 1-1. Other information in this section includes specifications, operating features and ranges, physical dimensions, and a list of available options.

### 1.2 PURPOSE AND USE

There are numerous applications of the ADM 5, all involving the transfer of asynchronous data. In some applications, data transfer may be exclusively unidirectional; either from the ADM 5 to a host computer, or from the computer to the ADM 5. However, a more frequent application is one in which an operator communicates with the computer, and the computer reacts in accordance with its stored program.

The ADM 5 Video Display Terminal has the following general capabilities:

- Full 128 ASCII character set with 80 x 24 character nonglare display
- Lower case standard with full two-dot descenders
- CAP LOCK Key
- Edit Keys
- Visual Attributes
- TAB Key
- Numeric Keypad with 15 keys
- Program Mode
- Five separate cursor control keys

- 10 communication rates in full-duplex and half-duplex send/receive modes
- Scrolling
- Absolute cursor positioning
- Variable 9-, 10-, or 11-bit word structures
- Selectable Auto New Line operation
- Selectable standard RS-232C or 20mA current-loop interface, with RS-232C extension interface, for auxiliary devices. (Selectable keyboard lock or gated EXTENSION port.) Optional current-loop interface on EXTENSION port.
- Special control character sequences
- Selectable refresh rate

### 1.3 PHYSICAL DESCRIPTION

The ADM 5 is a self-contained unit consisting of three major assemblies: (1) base and cover assembly, (2) main logic board and (3) the CRT monitor. The power transformer, a beeper, and interconnect cabling are located on the base portion of the terminal. Supports and guide pins are also located on the base, and these are used for installing the main logic board.

The cover portion of the terminal contains the CRT monitor and its associated subassemblies. The cover is hinged to the base at the rear, and when swung open (see 2.5.3), all components of the ADM 5 are exposed.

The main logic board contains all other operating elements of the ADM 5 that are not contained in the CRT monitor and the base

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assembly. This includes the keyboard. The keyboard is made up of integrated key rows, or modules. It is built directly on the main logic board. The logic board rests on supports within the base, and is held in place by guide pins. Two connectors at the rear edge of the logic board provide the RS-232C/current-loop interface and the RS-232C extension interface.

The CRT monitor is a transistorized unit consisting of three subassemblies: (1) the CRT itself, (2) a printed circuit board that contains most of the video circuitry, and (3) the flyback subassembly. The monitor display screen measures 12 inches diagonally, and resembles the CRT of a small black and white television set.

## **1.4 OPERATIONAL DESCRIPTION**

The ADM 5 is an interactive device which is used to enter, display, and send information to a host computer, and to receive and display information from the computer. Using a keyboard similar to that of a teletypewriter, the operator may enter information which is immediately transmitted to the computer and may be simultaneously displayed on a cathode ray tube (CRT). Data from the computer is received and displayed at baud rates as high as 19200 (the maximum baud rate when using the current loop option is 9600). Figure 1-2 illustrates the functional areas of the ADM 5 with corresponding data flow between these functional areas.

### **1.4.1 Keyboard**

The keyboard contains 83 keys from which data entry and control functions are initiated. Each keystroke is encoded into a corresponding ASCII character which is immediately transmitted to the host computer. The character is also routed back to the CRT display; directly via the I/O interface in half-duplex operation, or echoed from the host computer via the I/O interface in full-duplex operation.

### **1.4.2 Input/Output (I/O) Port**

The MODEM (I/O) port is the link, or interface, that handles the flow of data in both directions between the ADM 5 and the computer. In half-duplex operation, each

character entered from the keyboard is transmitted and simultaneously routed back to the control logic and display memory for CRT display.

### **1.4.3 ADM 5 Control Logic**

ADM 5 Control Logic interprets the control codes that originate either at the keyboard or host computer, and directs the activities of the ADM 5 accordingly. These activities include data handling, and formatting.

### **1.4.4 Display Memory**

The display memory contains random access memory (RAM), video logic, and character generation circuits appropriate for controlling the CRT display. The memory is capable of holding 1920 characters, which are stored in sequentially scanned locations. The scanned data is then sent to the CRT for displaying. Input to the display memory consists of the data character codes from the I/O port or keyboard, under the control of signals from the control logic circuits.

### **1.4.5 CRT Display Monitor**

The CRT display monitor is a rectangular screen measuring 12 inches diagonally. Data characters are displayed on 24 equally-spaced rows, each consisting of 80 (maximum) characters. The 80 character lines are displayed clearly at a refresh rate of either 50 or 60 Hz, corresponding to the AC line frequency.

## **1.5 SPECIFICATIONS**

The ADM 5 specifications are listed in Table 1-1. In addition, several operation features, such as send/receive modes, character format, word structure, data entry and overflow, and configuration control are discussed in the paragraphs that follow. Specific operational information regarding configuration control, format and work structure, modes, etc., is contained in Section II of this manual.

### **1.5.1 Send/Receive Modes**

Two switch-selectable send/receive modes are available in the ADM 5: half-duplex and

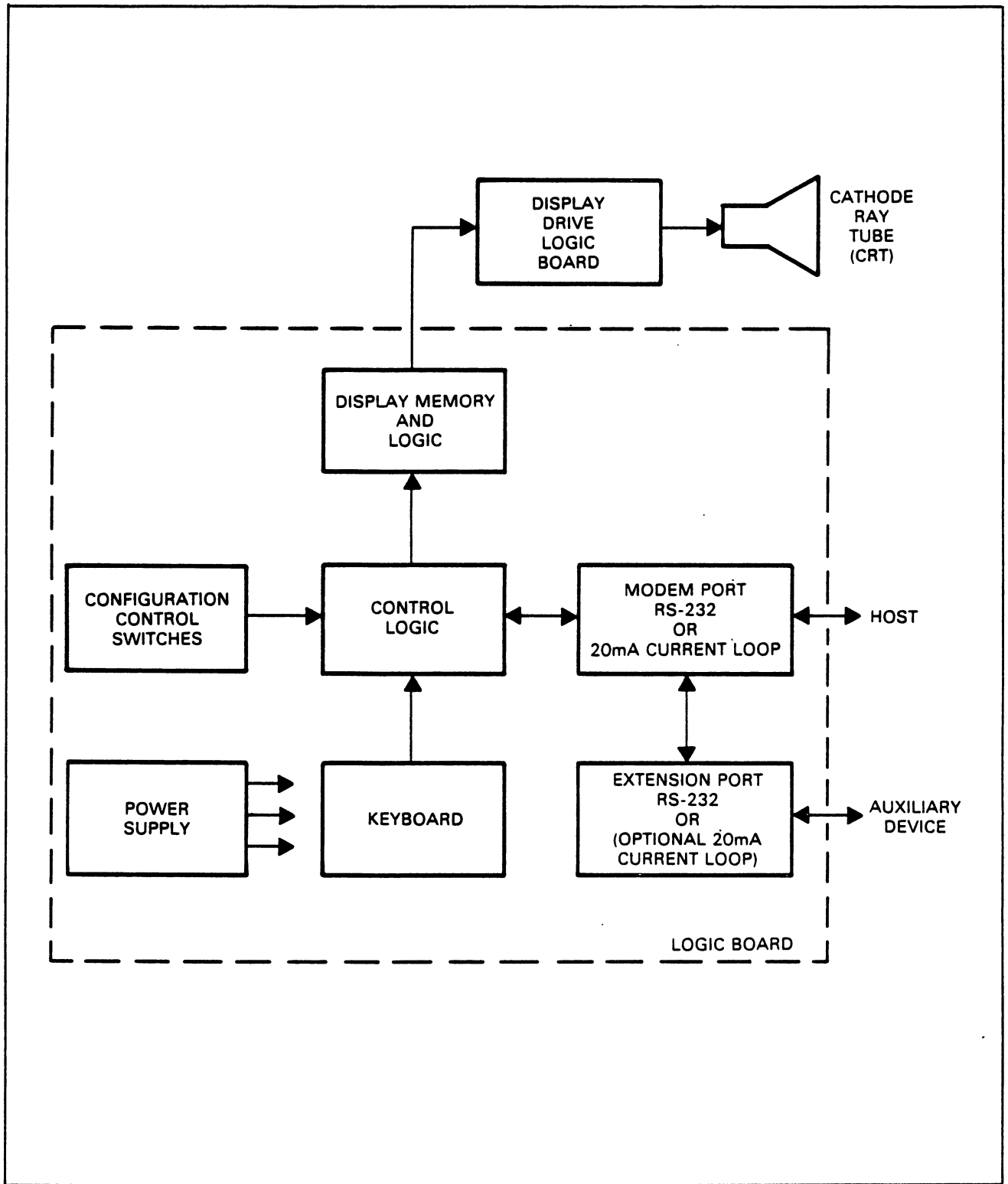


Figure 1-2. ADM 5 Data Flow Block Diagram

**Table 1-1. ADM 5 Specifications**

SPECIFICATION	DESCRIPTION
<b>DISPLAY</b>	
Display Format	24 lines x 80 characters
CRT Screen	12-inch (30.5 cm) diagonal, P4 Phosphor, antireflective surface
Refresh Rate	50 Hz or 60 Hz, depending on line frequency (switch selectable).
Horizontal Sweep Rate	16.2k Hz
Display Area	5.8 inches (14.7 cm) high x 8.3 inches (21 cm) wide.
Character Set	128 ASCII characters, upper and lower case, punctuation, and 32 control characters.
Character Matrix	5 x 9 dot matrix, including full 2 dot descenders, 0.074 inch (1.88 mm) wide x 0.218 inch (5.53 mm) high.
Character Field	7 x 10 dot matrix, 0.103 inch (2.62 mm) wide x 0.241 inch (6.14 mm) high
Cursor	7 x 10 dot matrix. Reverse image block cursor. Homes to upper left of screen.
Cursor Controls	Individual cursor control keys; Backspace, Forespace, Up, Down, Home, Return, Line Feed.
Video Attributes	Reverse video, reduced intensity and reverse video/reduced intensity combination.
<b>KEYBOARD</b>	
Configuration	83 keys, 26-letter alphabet with upper and lower case, numerics 0 through 9, punctuation, caps lock. All keys are automatic repeating at a rate of 22 characters per second.

**Table 1-1. ADM 5 Specifications (continued)**

SPECIFICATION	DESCRIPTION
Numeric Key Pad	15 keys, 0 through 9, Return, Tab, Comma, Period, and Minus.
Edit Keys	Erase to end of line and erase to end of page.
Functional Command Keys	Escape, Rubout, (delete), Break, Control, Line Feed, Return, Tab, Shift, Clear, Program Mode, Here Is, Caps Lock.
Data Entry	Data entry on progressive lines from top to bottom. Upward scrolling of entire display with top-of-page overflow. Auto New Line is switch selectable.
<b>COMMUNICATIONS</b>	
Transmission	Conversation mode/full duplex, conversation mode/half duplex.
Control Characters	32 control characters may be transmitted to the computer and/or entered on the screen.
Computer Interfaces (Modem)	RS-232C point-to-point or 20mA current loop.
Data Rates	75, 110, 150, 300, 1200, 2400, 4800, 9600, 19,200. (Current Loop: 75 to 9600).
Parity	Even, odd, mark, space, or none.
Word Structure:	
Total Word Length:	9, 10, or 11 bits
Data:	7 or 8 bits (8th bit 0 or 1)
Start:	1 bit
Stop:	1 or 2 bits

**Table 1.1. ADM 5 Specifications (continued)**

SPECIFICATION	DESCRIPTION
Extension Interface	Extension RS-232C port for interfacing serial asynchronous ASCII hard copy printer, magnetic tape recorder, or other serial asynchronous devices using selectable keyboard lock or gated EXTENSION port.
Switch Selectable Settings	All Baud Rates Half-Full Duplex RS-232C/Current Loop (MODEM) Auto New Line ON/OFF Odd/Even Parity 7 or 8 Data Bits 1 or 2 Stop Bits Parity/Inhibit Bit 8 = 0 or 1 Keyboard Lock/Gated EXTENSION port Secondary Channel Code Turnaround Local 103 Modem 202 Modem
<b>PHYSICAL</b>	
Operating Environment:	
Temperature:	41° F to 104° F (5°C to 40°C)
Humidity:	5% to 95%, noncondensing
Altitude:	10,000 feet (3.048 km) maximum
Power Requirements:	
Standard:	115 VAC ±10%, 60 ±3 Hz, 60 Watts nominal.
Optional:	230 VAC ±10%, 50/60 ±3 Hz, 60 Watts nominal.
Heat Dissipation:	205 BTU per hour.

**Table 1.1. ADM 5 Specifications (continued)**

<b>SPECIFICATION</b>	<b>DESCRIPTION</b>
<p><b>Dimensions and Weight:</b></p> <p>    <b>Width:</b></p> <p>    <b>Depth:</b></p> <p>    <b>Height:</b></p> <p>    <b>Weight:</b></p> <p><b>OPTIONS</b></p> <p>    Answerback</p> <p>    20mA Current Loop or     EXTENSION port</p> <p>    Green Phosphor Screen</p>	<p>    <b>15.6 inches (39.6 cm)</b></p> <p>    <b>20.2 inches (51.3 cm)</b></p> <p>    <b>13.5 inches (34.3 cm)</b></p> <p>    <b>32 pounds (14.5 kg)</b></p>

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full-duplex. In the half-duplex mode, each character is transmitted to the computer as it is entered on the keyboard and is simultaneously displayed on the CRT monitor. To simulate data entry, when the ADM 5 is not connected to a computer, the half-duplex mode should be selected (see Table 2-2, switch S2-5).

In full-duplex operation, the ADM 5 can transmit and receive information in both directions simultaneously. Characters are transmitted as they are entered at the keyboard, but are displayed only upon reception. In order to display transmitted characters, they must be echoed back from the host computer or data set.

### 1.5.2 Character Format (Figure 1-3)

The standard ADM 5 character set consists of 128 ASCII characters. Of these, 32 are control characters which can be displayed on the CRT screen if the terminal is operating in the PROGRAM mode. The terminal can be placed in the PROGRAM mode by means of the PROG key only. Placing the control characters on display is a feature of special use to the programmer. The normally displayable 95 characters (plus space) consist of upper and lower case letters, numerics, and punctuation marks. (See figure 1-4).

### 1.5.3 Word Structure

The ADM 5 can transmit and receive data characters in any one of the asynchronous character formats shown in figure 1-5. These word format codes are selected by means of DIP switches located on the PC board.

### 1.5.4 Data Entry and Overflow

New data enters on progressive lines, from top to bottom. A line feed will cause upward scrolling of the entire display page, when the cursor is at the bottom line. When overflow occurs, the entire display page is scrolled upward one line as new data enters at the beginning of the new bottom line. If AUTO NEW LINE is not enabled, a CR/LF must be sent.

## 1.5.5 Configuration Control

Default conditions for the ADM 5 are established by the selected positions of configuration switches, which are located on the main logic board. The switches are factory set in accordance with instructions established at the time of purchase of the ADM 5. Section 2 of this manual shows the locations of these switches so that they may be checked and/or reset at the time of the ADM 5 installation.

## 1.6 OPTIONAL FEATURES

The following features can be incorporated into the ADM 5 by installation of the appropriate option.

### 1.6.1 Answerback

When installed, this option is activated by means of the HERE IS key. Momentarily pressing this key initiates an identification message (stored in a special ADM 5 memory) that identifies the terminal. The HERE IS key is included in the keyboard of the ADM 5; however, this key has no function if the Answerback option is not installed. Answerback is also activated upon receipt of an ENQ control code from the host device.

### 1.6.2 20mA Current Loop on Extension Port

This option permits the EXTENSION port to be used in a current-loop application.

### 1.6.2 230 VAC

For this option, a 230-volt transformer and appropriate power cord are provided to make the ADM 5 suitable for 230-volt operation.

### 1.6.4 Alternate Configuration - Green Phosphor Screen

This option provides a green phosphor display screen.

## 1.7 RELATED DOCUMENTS

ADM 5 Illustrated Parts Catalog DP719.



00 NUL	01 SOH	02 STX	03 ETX	04 EOT	05 ENQ	06 ACK	07 BEL	08 BS	09 HT	0A LF	0B VT	0C FF	0D CR	0E SO	0F SI
10 DLE	11 DC1	12 DC2	13 DC3	14 DC4	15 NAK	16 SYN	17 ETB	18 CAN	19 EM	1A SUB	1B ESC	1C FS	1D GS	1E RS	1F US
20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F

Figure 1-3. Standard ADM 5 Character Format (By Ascending ASCII Codes) with Hex Code

HEX BYTE		CONTROL CHARACTERS		DISPLAYABLE CHARACTERS						
		1ST	0	1	2	3	4	5	6	7
2ND	BITS 4321	BITS 765	0 <sub>00</sub>	0 <sub>01</sub>	0 <sub>10</sub>	0 <sub>10</sub>	1 <sub>00</sub>	1 <sub>01</sub>	1 <sub>10</sub>	1 <sub>11</sub>
0	0000		NUL	DLE		0	@	P	'	p
1	0001		SOH	DC1	!	1	A	Q	a	q
2	0010		STX	DC2	"	2	B	R	b	r
3	0011		ETX	DC3	#	3	C	S	c	s
4	0100		EOT	DC4	\$	4	D	T	d	t
5	0101		ENQ	NAK	%	5	E	U	e	u
6	0110		ACK	SYN	&	6	F	V	f	v
7	0111		BEEP	ETB	'	7	G	W	g	w
8	1000		BS ( ← )	CAN	(	8	H	X	h	x
9	1001		(SKIP) HT	EM	)	9	I	Y	i	y
A	1010		LF ( ↓ )	SUB	*	:	J	Z	j	z
B	1011		VT ( ↑ )	ESG	+	;	K	[	k	{
C	1100		FF ( → )	FS	'	<	L	\	l	
D	1101		CR	GS	-	=	M	]	m	}
E	1110		SO	(HOME) RS	.	>	N	^	n	~
F	1111		SI	(NEW LINE) US	/	?	O	—	o	DEL

CONTROL CODES

CONTROL CODES IN COLUMN  
0 - USE COLUMN 4  
CONTROL CODES IN COLUMN  
1 - USE COLUMN 5

USE CONTROL KEY  
WITH DISPLAYABLE  
CHARACTER KEYS  
TO PRODUCE  
CONTROL CODES

CTRL/CHARACTER

Figure 1-4. ADM 5 Graphic Set and CTRL Codes

WORD FORMAT	PCB SWITCHBANK S2					9, 10, OR 11-BIT WORD STRUCTURE												
	S2-10	S2-9	S2-8	S2-7	S2-6	BITS												
						0	1	2	3	4	5	6	7	8	9	10		
Eleven-Bit Word with EVEN Parity and 2 STOP Bits	7 BIT	EVEN	2 STOP	ENPR*	X	START				ACTIVE BITS = 1 OR 0						EVN PAR	STOP	STOP
Eleven-Bit Word with ODD Parity and 2 STOP Bits	7 BIT	ODD	2 STOP	ENPR	X	START				ACTIVE BITS = 1 OR 0						ODD PAR	STOP	STOP
Ten-Bit Word with EVEN Parity and 1 STOP Bit	7 BIT	EVEN	1 STOP	ENPR	X	START				ACTIVE BITS = 1 OR 0						EVN PAR	STOP	X
Ten-Bit Word with ODD Parity and 1 STOP Bit	7 BIT	ODD	1 STOP	ENPR	X	START				ACTIVE BITS = 1 OR 0						ODD PAR	STOP	X
Eleven-Bit Word with No Parity and 2 STOP Bits	8 BIT	X	2 STOP	DISPR**	BIT 8 = 0 OR BIT 8 = 1	START				ACTIVE BITS = 1 OR 0						1 OR 0	STOP	STOP
Ten-Bit Word with No Parity and 1 STOP Bit	8 BIT	X	1 STOP	DISPR	BIT 8 = 0 OR BIT 8 = 1	START				ACTIVE BITS = 1 OR 0						1 OR 0	STOP	X
Eleven-Bit Word with EVEN Parity and 1 STOP Bit	8 BIT	EVEN	1 STOP	ENPR	BIT 8 = 0 OR BIT 8 = 1	START				ACTIVE BITS = 1 OR 0						1 OR 0	EVN PAR	STOP
Eleven-Bit Word with ODD Parity and 1 STOP Bit	8 BIT	ODD	1 STOP	ENPR	BIT 8 = 0 OR BIT 8 = 1	START				ACTIVE BITS = 1 OR 0						1 OR 0	ODD PAR	STOP
Nine-Bit Word with No Parity and 1 STOP Bit	7 BIT	X	1 STOP	DISPR	X	START				ACTIVE BITS = 1 OR 0						STOP	X	X

\*ENPR - Enables Parity  
\*\*DISPR - Disables Parity

Figure 1-5. Word Format Codes with Switch Configurations



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## **SECTION II INSTALLATION**

### **2.1 GENERAL**

Installation procedures involving unpacking, site requirements, initial set-up, and operation checkout of the ADM 5 Video Display Terminal are contained in this section of the manual.

### **2.2 SPECIAL SAFETY REQUIREMENTS**

Observe normal safety procedures when installing the ADM 5. No special safety precautions are required for ADM 5 installation.

### **2.3 UNPACKING AND INITIAL INSPECTION**

Each ADM 5 is thoroughly inspected and carefully packaged prior to shipment. Every precaution is taken to ensure that each unit is complete and ready for installation at the customer's site. However, it is recommended that each unit be inspected upon receipt for transit damage. Start by examining the exterior of the package for evidence of rough or careless handling; then perform a thorough visual inspection of the internal components and subassemblies. As a rule, most transportation companies will not honor claims for damage for damage unless they are filed promptly; therefore, the following steps should be taken:

1. Verify that each item shown on the Sales Order Packing Slip has been included in the shipment. Contact Lear Siegler or your distributor immediately in the event of packing shortage.

2. Verify that the serial number of the unit corresponds to that shown on the invoice.
3. Check the hardware to determine if any assemblies or screws were loosened during shipment. Tighten as required.
4. Inspect for dust or foreign material which may impair electrical contact when cable connections are made. Vacuum to remove any loose dirt.
5. Install and test the ADM 5 as soon as possible after delivery. (This is very important since internal damage to the equipment cannot be determined by visual inspection alone.)
6. If, in your opinion, the equipment has been damaged - either internally or externally - notify the agent of the transportation company immediately, and ask him to make an inspection. If assistance is needed to describe the extent of the damage or the repairs that will be necessary, contact your local Sales and Service Office.

### **2.4 SITE REQUIREMENTS**

The ADM 5 may be used conveniently in a normal office environment, as no special mounting provisions are required. However, it is recommended that a weather protected environment with an ambient temperature range of 41°F to 104°F (5°C to 40°C), and relative humidity of less than 95 percent be maintained for equipment use.

## CAUTION

*To prevent internal condensation from developing, allow the ADM 5 to temperature stabilize when changing locations. Condensation will adversely affect the operation of the ADM 5.*

Whenever the ADM 5 is physically moved to a warmer environment than its former location, be sure to allow sufficient time for the equipment temperature to equalize with the warmer location before activating the terminal. Condensation developed by the temperature differential may possibly impair ADM 5 operation.

Refer to Section 1 of this manual for physical dimensions of the ADM 5, as well as installation power and environmental parameters. The basic requirements for reliable installation of the ADM 5 are as follows:

- Table or desk for mounting.
- Standard three-pronged, 115-volt, power outlet.
- Cable connection to the host, modem, serial printer, or other auxiliary device. If connection to a remote computer is desired, a modem or data set may be required.

## 2.5 INITIAL PREPARATION

Initial preparation includes; making sure that the ADM 5 will not be plugged into an AC line power outlet that will damage the equipment; and checking and/or resetting the configuration control switches as necessary.

### 2.5.1 Line Voltage Selection

The ADM 5 is shipped properly wired for either 115-volt or 230-volt AC line power, as specified in the purchase order. Any change for operation on a different line voltage requires changing components in the ADM 5, which should be accomplished only by authorized Lear Siegler Maintenance

Personnel. (Unauthorized circuit or component changes invalidate the equipment warranty.)

### 2.5.2 Configuration Control Switch Settings

DIP switches located on the main logic board are provided for establishing the default state of selected system operating characteristics. These switches are initially set at the factory in accordance with customer requirements, as expressed on the Terminal Ordering Form. Any required switch settings should be made before attempting to operate the terminal. Figure 2-1 shows the location and identity of the configuration control switches, as well as connector/pin designations. Tables 2-1 and 2-2 describe the function and factory setting of each switch.

## WARNING

*Dangerous voltages exist within the ADM 5. Always disconnect the AC power cord before opening the ADM 5 case to access any internal components.*

## CAUTION

*Set DIP switches ON or OFF using DIP switch Setting Tool 857001. DO NOT use a ball point pen or pencil; the switches could become contaminated with conductive debris.*

### 2.5.3 Access to Configuration Control Switches

Access to the configuration control switches is obtained by opening the cover of the ADM 5, as follows:

1. Disconnect the AC power cord from source receptacle.
2. Remove the two screws located under the front corners of the base and lift the cover upwards and to the rear of the terminal, until it rests on the table or desk supporting the equipment.

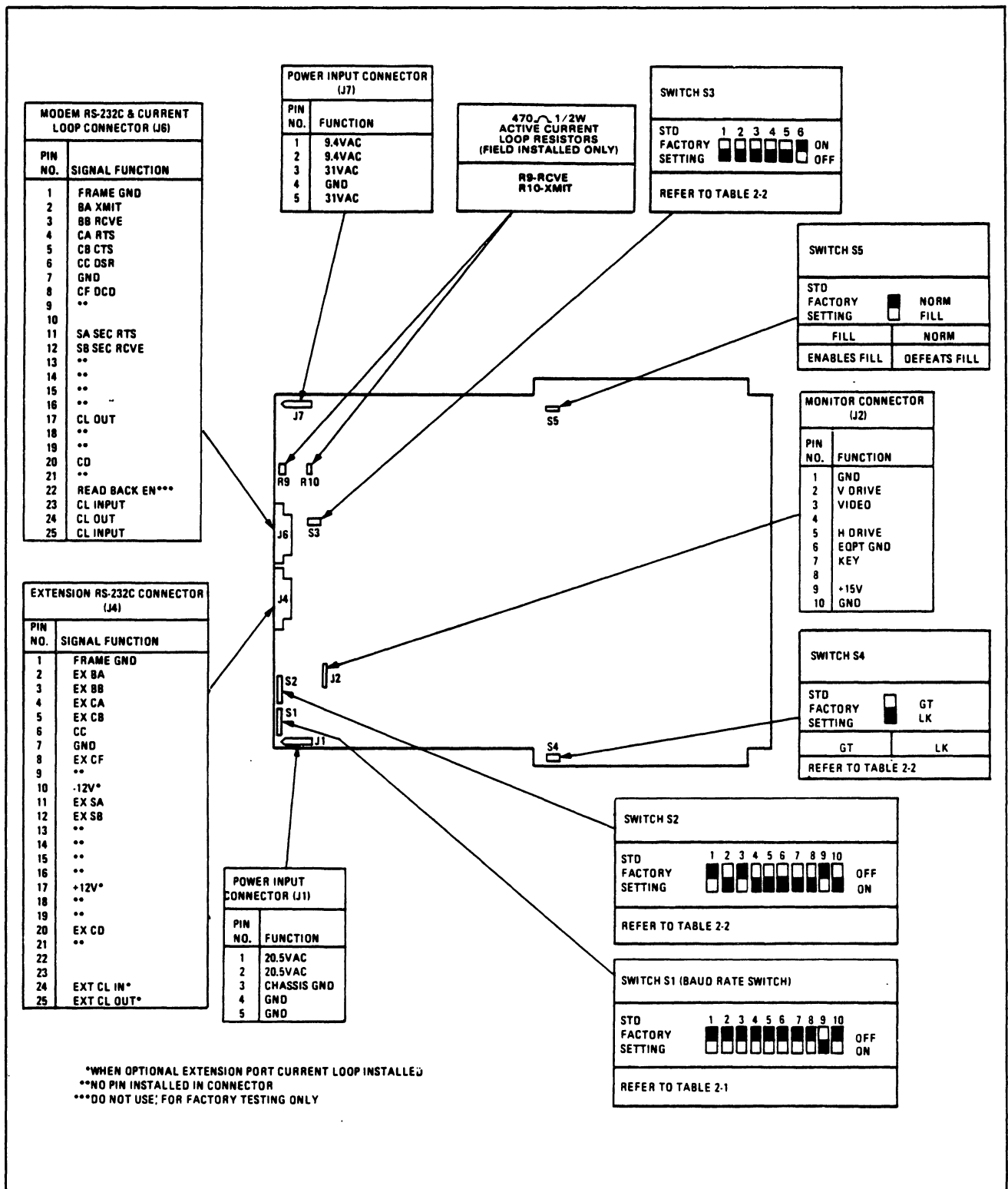


Figure 2-1. ADM 5 Connector and Configuration Switch Locations

**Table 2-1. Baud Rate Switch Functions**

SWITCH NO.	NAME	FUNCTION
S1-1	75 BAUD	BAUD RATE switches for selecting MODEM port baud rate. SELECT ONE ONLY.
S1-2	110 BAUD	
S1-3	150 BAUD	
S1-4	300 BAUD	
S1-5	600 BAUD	
S1-6	1200 BAUD	
S1-7	2400 BAUD	
S1-8	4800 BAUD	
S1-9	* 9600 BAUD	
S1-10	** 19200 BAUD	

\* Factory Setting

\*\* Not applicable for current-loop operation

## 2.6 INTERFACE INFORMATION

The ADM 5 may be cabled directly to a local computer, or it may be connected via telephone data lines to a remote computer located anywhere in the world. Remote computer connections require the use of a modem or data set. Refer to **figure 2-1** for the connector/pin assignments for the MODEM and EXTENSION ports. **Figure 2-2** shows a typical ADM 5 application.

### 2.6.1 RS-232C Modem Port Interface

The MODEM port interface is used to connect the terminal directly to a computer, modem or data set, in RS-232C or current-loop application. See **figures 2-3** and **2-4**.

### 2.6.2 RS-232C Extension Port Interface

The EXTENSION port interface extends the standard RS-232C capabilities of the ADM 5 by allowing the connector of a serial RS-232C peripheral.

The gated EXTENSION port mode, when selected by switch S4, allows selective transmission of data from the keyboard, in Half-Duplex mode, or the communication line through the EXTENSION port.

#### Note

*The peripheral device that is attached to the EXTENSION port must operate at the same baud rate as the communication line.*



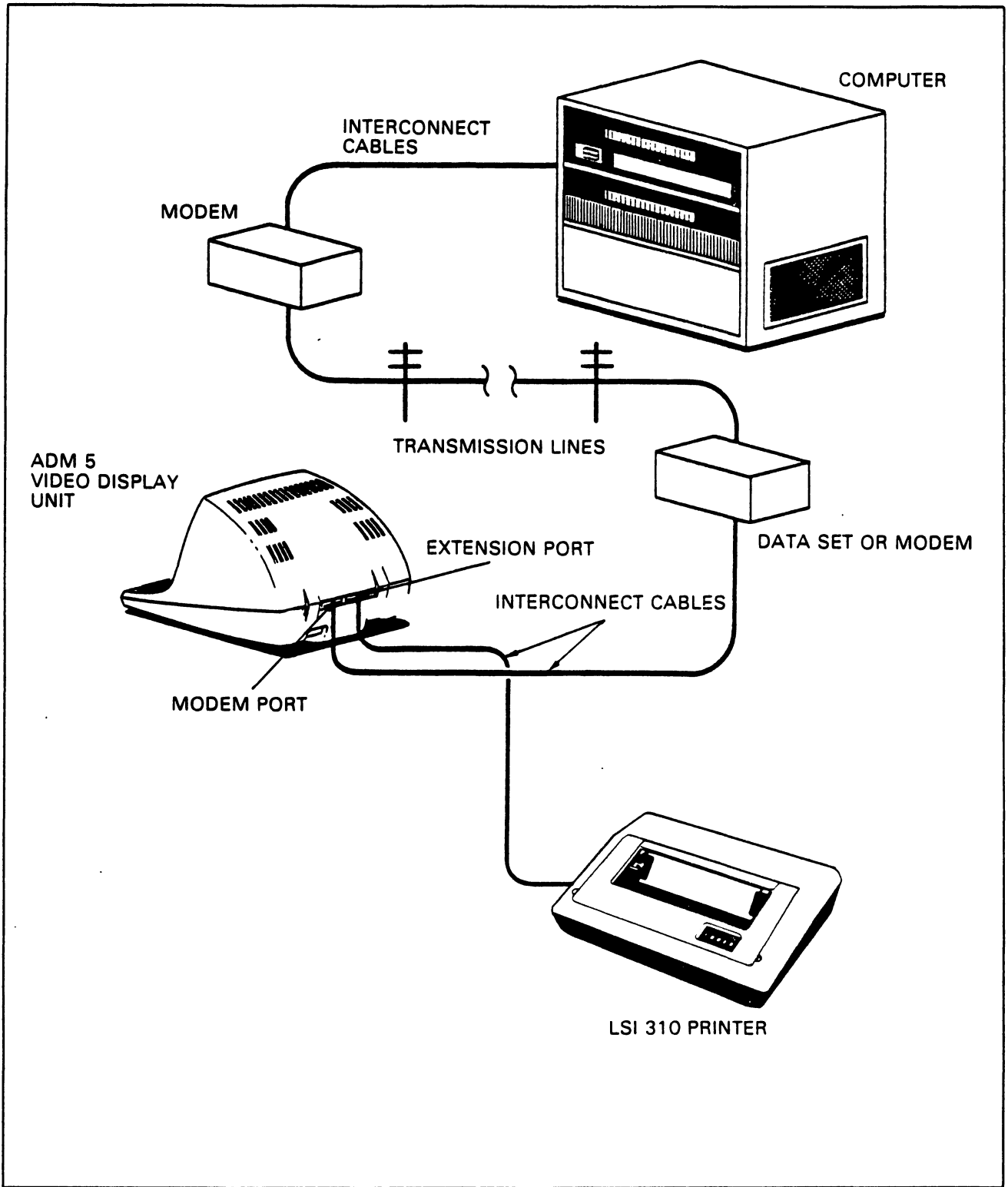
**Table 2-2. Configuration Control Switch Functions**

SWITCH NO.	NAME	SETTING (UP = OFF DOWN = ON)	FUNCTION
S2-1	Reserved		
S2-2	AUNL EN - AUNL DIS	ON	AUNL EN (Auto New Line Enable): Causes the cursor to move to the beginning of the next line automatically after the 80th character position is typed. If the cursor was previously on the bottom line, the display will scroll upward one line. The operator continues typing on the next new line.
		OFF	AUNL DIS (Auto New Line Disable): Disables Automatic New Line Function.
S2-3	50 Hz - 60 Hz	ON	Selects 50 Hz.
		OFF	Selects 60 Hz refresh rate for data on CRT. Refresh rate is not synchronized to line frequency, but should be set to correspond with powerline frequency.
S2-4	RS232 - CUR LP	ON	RS232: Selects RS-232C interface for communication through MODEM connector.
		OFF	CUR LP (Current Loop): Selects 20mA current-loop interface for communication through MODEM connector. (9600 Baud max)
S2-5	HDX - FDX	ON	HDX: Places ADM 5 in half-duplex mode. Each character is sent to the computer as it is entered on keyboard and displayed on CRT.
		OFF	FDX: Places ADM 5 in full-duplex mode. ADM 5 transmits and receives in both directions simultaneously. Each character must be echoed back from the host or modem to be displayed.
S2-6	BIT 8 = 0 - BIT 8 = 1		NOTE This switch is active only when S2-10 is in position BIT 8
		ON OFF	BIT 8 = 0: Forces bit 8 to a zero value. BIT 8 = 1: Forces bit 8 to a one value.
S2-7	ENPR - DISPR	ON	ENPR (Enable Parity): Enables parity bit after 7- or 8-bit data word.
		OFF	DISPR (Disable Parity): No parity bit after 7- or 8-bit data word.
S2-8	1 STOP - 2 STOP	ON	1 Stop: Selects 1 STOP bit
		OFF	2 Stop: Selects 2 STOP bits

Note: Switch banks S1 and S2 UP = OFF DOWN = ON

**Table 2-2. Configuration Control Switch Functions (cont'd)**

SWITCH NO.	NAME	SETTING	FUNCTION
S2-9	ODD - EVEN	ON OFF	<p>NOTE This switch is active only when S2-7 is in position ENPR</p> <p>ODD: Selects ODD parity EVEN: Selects EVEN parity</p>
S2-10	7 BIT - 8 BIT	ON OFF	<p>7 BIT: Selects 7-bit data word 8 BIT: Selects 8-bit data word</p>
S3-1 S3-2	ET (EOT)- OFF EX (ETX)- OFF	(See Function)	One switch active only in conjunction with 202 - type modem operation to select the primary channel turnaround code. (See Function Description for S3-3 and S3-4)
S3-3	CD (CODE)	(See Function)  ON  OFF	<p>Active only when S3-4 (22) is ON. Used to select method of line turnaround for half-duplex operation as follows:</p> <p>ON Enables line turnaround using primary channel. Turnaround code may be either ETX or EOT.</p> <p>OFF Enables line turnaround using secondary channel. Both S3-1 (EOT) and S3-2 (ETX) must be OFF.</p>
S3-4 S3-5 S3-6	22 (202) 13 (103) LC (LOCAL)	See Function	<p>Only one switch may be active at any time. Used to select one of the following methods of communicating with host computer.</p> <p>22: ON enables connection to 202-type modem. Secondary channel or line turnaround code changes direction of data in primary channel.</p> <p>13: ON enables connection to 103-type modem. Request to Send (CA) line is held high.</p> <p>LC: ON enables direct computer connection without modems. Request to Send (CA) line rises and falls with each character transmitted.</p>
S4	GT - LK	GT  LK	<p>Enables gated EXTENSION port mode which allows ON/OFF control of the EXTENSION port.</p> <p>Used to enable the keyboard Enable/Disable operation.</p>
S5	NORM - FILL	NORM  FILL	<p>Disables FILL function.</p> <p>Enables FILL function. Display is filled with zeroes for test purposes.</p>



*Figure 2-2. Typical ADM 5 Application*

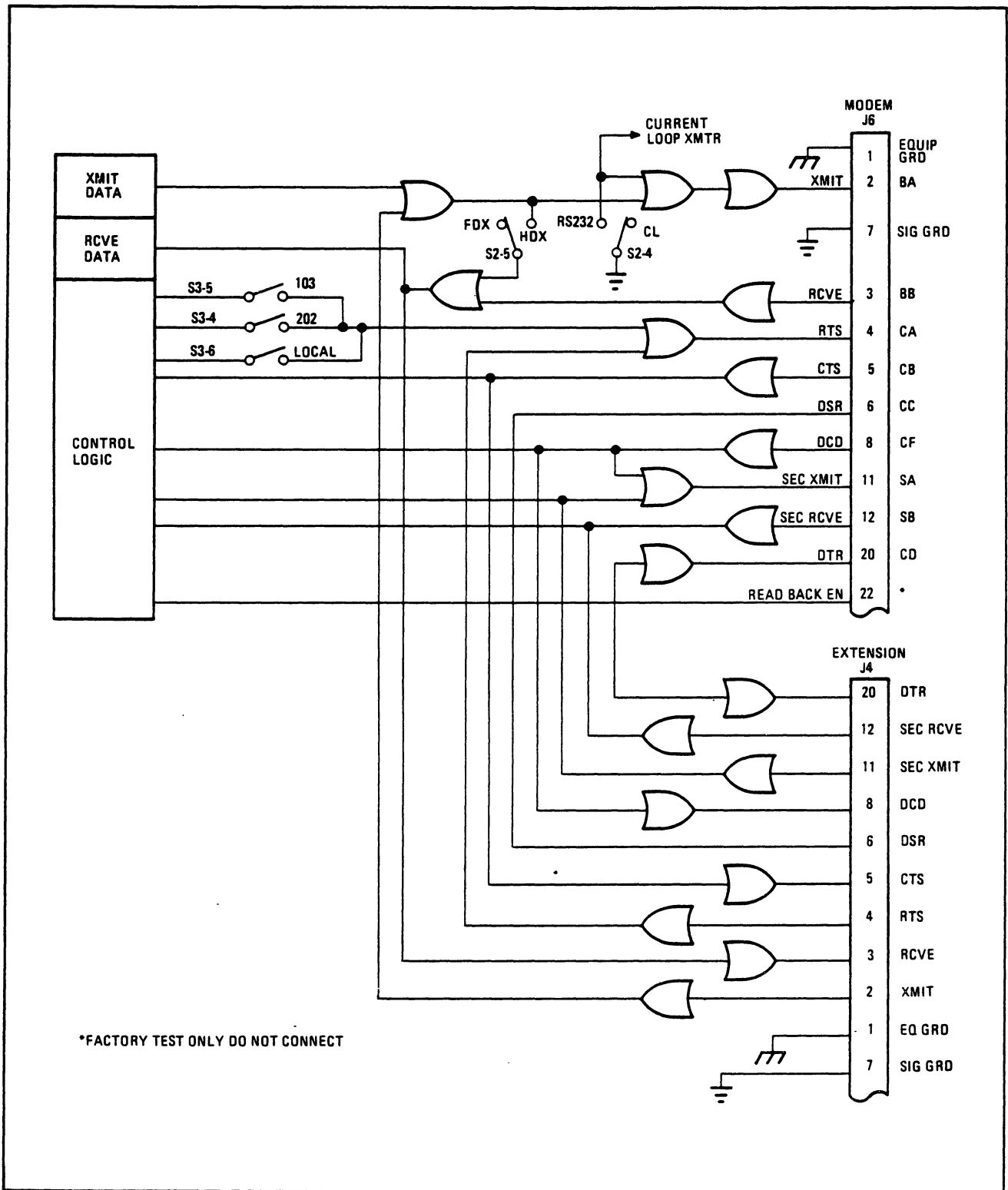
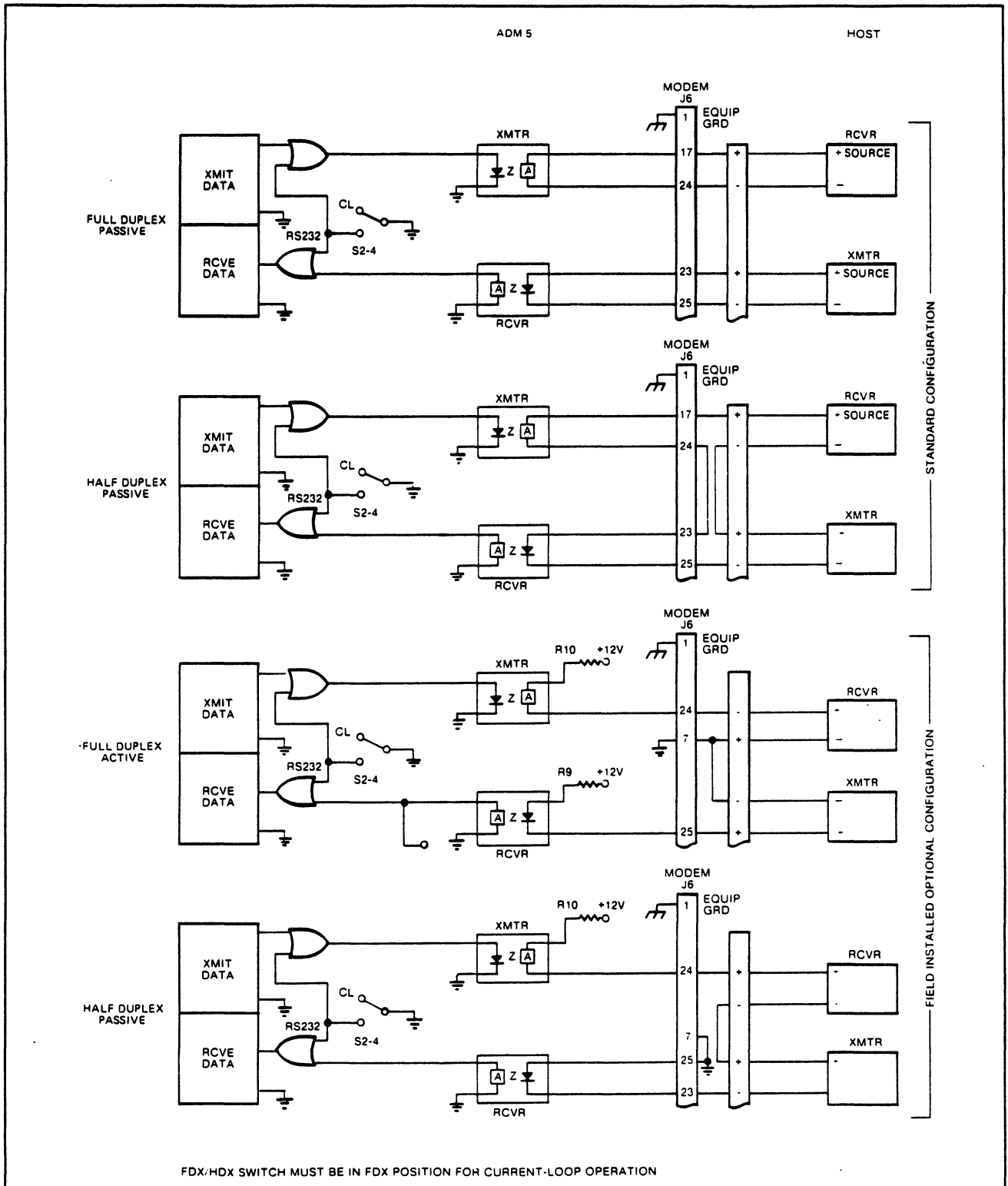


Figure 2-3. RS-232C MODEM and EXTENSION Interface Logic



*Figure 2-4. Current-Loop Interface Logic*

## 2.7 INSTALLING THE ADM 5

To install the ADM 5, proceed as follows:

1. Verify that the POWER ON/OFF switch is OFF. See figure 2-5.
2. Connect the interconnect cable(s) using the appropriate information in figure 2-1 and 2-2.
3. Set the configuration control switches to the positions desired. Refer to Table 2-2.
4. Set S1 (Baud Rate Switch) for the desired baud rate. Refer to Table 2-1.
5. Connect the power cord to a grounded AC outlet of the proper voltage.

## 2.8 POWER TURN-ON AND TURN-OFF

Proceed as follows:

1. Set the POWER ON/OFF switch to ON. See figure 2-5.
2. Wait approximately 20 seconds for the ADM 3 to warm up. A reverse block cursor should appear in the upper left corner of the screen.

### CAUTION

*If power is recycled ON and OFF using the POWER ON/OFF switch, wait 10 seconds between the OFF and ON operations to prevent possible damage to the ADM 5 electronics.*

3. If the cursor does not appear, momentarily press HOME key. If this fails to produce the cursor, adjust the CONTRAST control on the front panel. The cursor should be present.

### Note

*If the Full-Duplex mode is selected, typing at the keyboard will not display characters unless echo-back from the host computer or modem is provided. If Half-*

*Duplex mode is selected, data will be displayed only if CLEAR TO SEND is present or interface cable is disconnected.*

## 2.9 CARE OF THE ADM 5

This portion of the manual provides the required operator instructions pertaining to routine maintenance for the ADM 5. Preventive maintenance procedures are limited primarily to cleaning and inspection steps.

### 2.9.1 Cleaning

At periodic intervals, clean the exterior housing and lightly dust the unit using a soft brush or damp lint-free cloth. However, paper towels may be substituted if desired. Remove smudges from the CRT exterior housing with conventional spray cleaners or alcohol. Do not use petroleum base cleaners, such as lighter fluid, as this could be harmful to the painted surface. Use only a lint-free soft cloth to clear the CRT screen filter. Be careful not to scratch the CRT screen, and do not use freon cleaners, alcohol, or ammonia.

### 2.9.2 Inspection

Periodically, inspect keyboard assembly for freedom of movement. Determine that the intensity of character trace on the CRT screen has not diminished. Any required mechanical or electrical adjustment should only be performed by an authorized Lear Siegler Service representative to insure warranty.

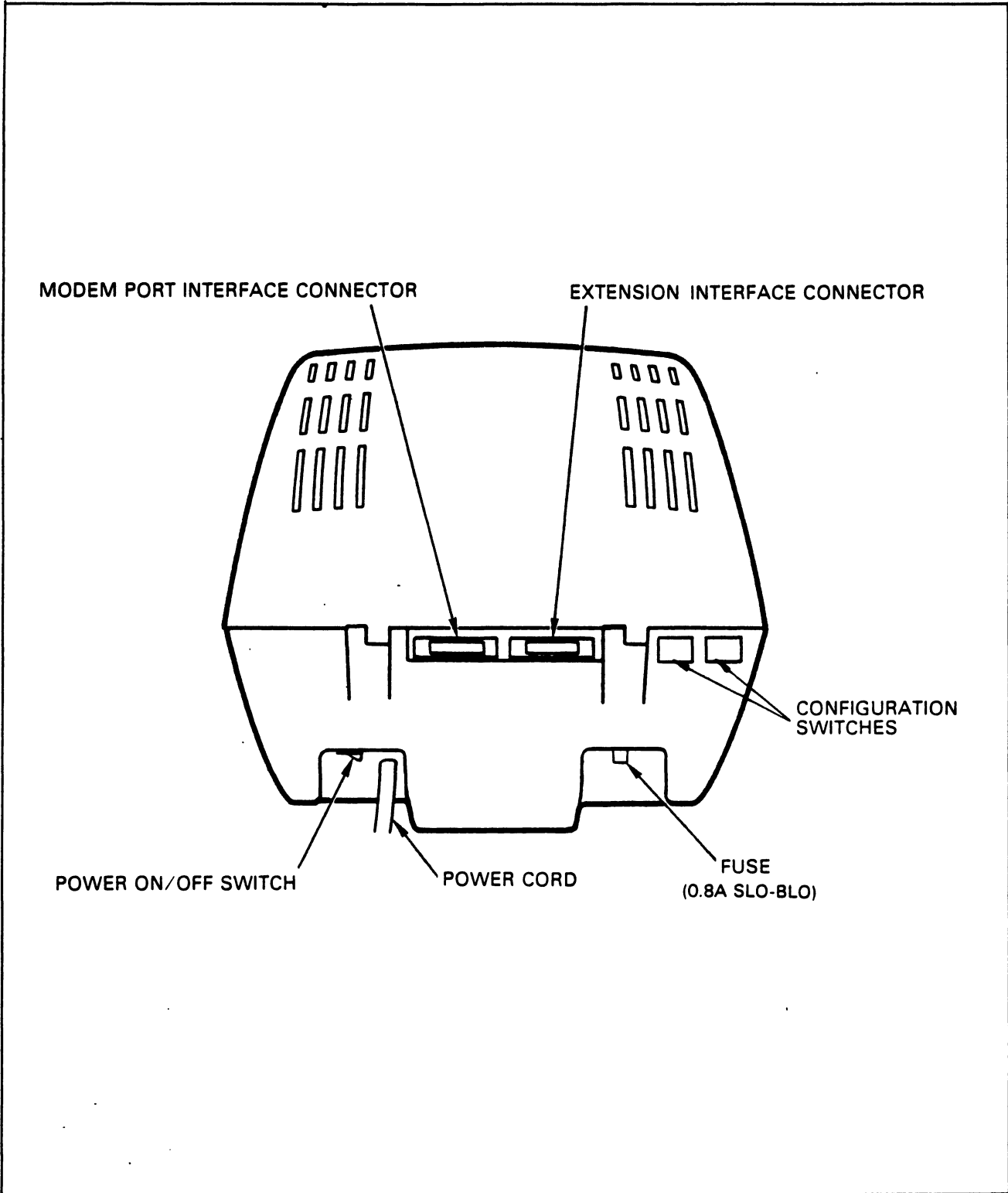


Figure 2-5. ADM 5 Rear Panel Controls





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## SECTION III OPERATION

### 3.1 GENERAL

The ADM 5 is used to enter, display, and send information to a host computer. It performs a similar function by accepting information from the host and displaying the information on the CRT screen or acting on control information. In this section of the manual, the various keys and specific control codes are described.

### 3.2 KEYBOARD OPERATION

The operator uses a keyboard very similar to the keyboard of a teletypewriter to enter data. Information typed by the operator may be displayed on the CRT screen immediately, as during Half-Duplex operation, or as an echo from the remote computer, as during Full-Duplex operation.

Figures 3-1A and 3-1B show the layout of a standard ADM 5 keyboard. Functionally, the keyboard consists of displayable character keys and special function keys. Some of the special function keys can also be used in conjunction with certain displayable character keys to command specific control operation. All keys repeat automatically when held down longer than approximately 400 milliseconds.

In the standard ADM 5, 96 characters (including space) are displayed. These include upper and lower case alphabet, numbers, punctuation marks, and most symbols. For special applications, usually at the discretion of the Programmer, all 128 ASCII characters may be displayed in Program Mode. Control characters (CR, LF, FS, etc.) are written as they are typed, and the appropriate symbols are displayed. For example: CR, LF, and FS would be displayed as CR, LF, and FS.

#### Note

*Typing at the keyboard always generates codes which are transmitted. However, in order for characters to be displayed and for control codes to affect the ADM 5 in FDX Mode, the characters must be echoed back from the host computer. All display actions described below assume that the generated codes are properly echoed.*

Except for a number of special operation keys, the keyboard is equipped with key roll-over protection (i.e. each key which is pressed must be released before the next key code can be produced).

The keyboard contains the following functional keys:

- Terminal control keys
- Lower and upper case alpha characters
- Numeric characters on main and auxiliary keyboards
- Numeric characters with SHIFT (main keyboard only)
- Special characters
- Special characters with SHIFT
- Operational control keys

#### 3.2.1 Terminal Control Keys

The SHIFT key is similar to the shift key of a conventional typewriter (refer to Table 3-1, Item 7). The key is used to produce shifted ASCII codes associated with upper case alpha characters (A to Z) and with the upper symbols of keys capable of producing two

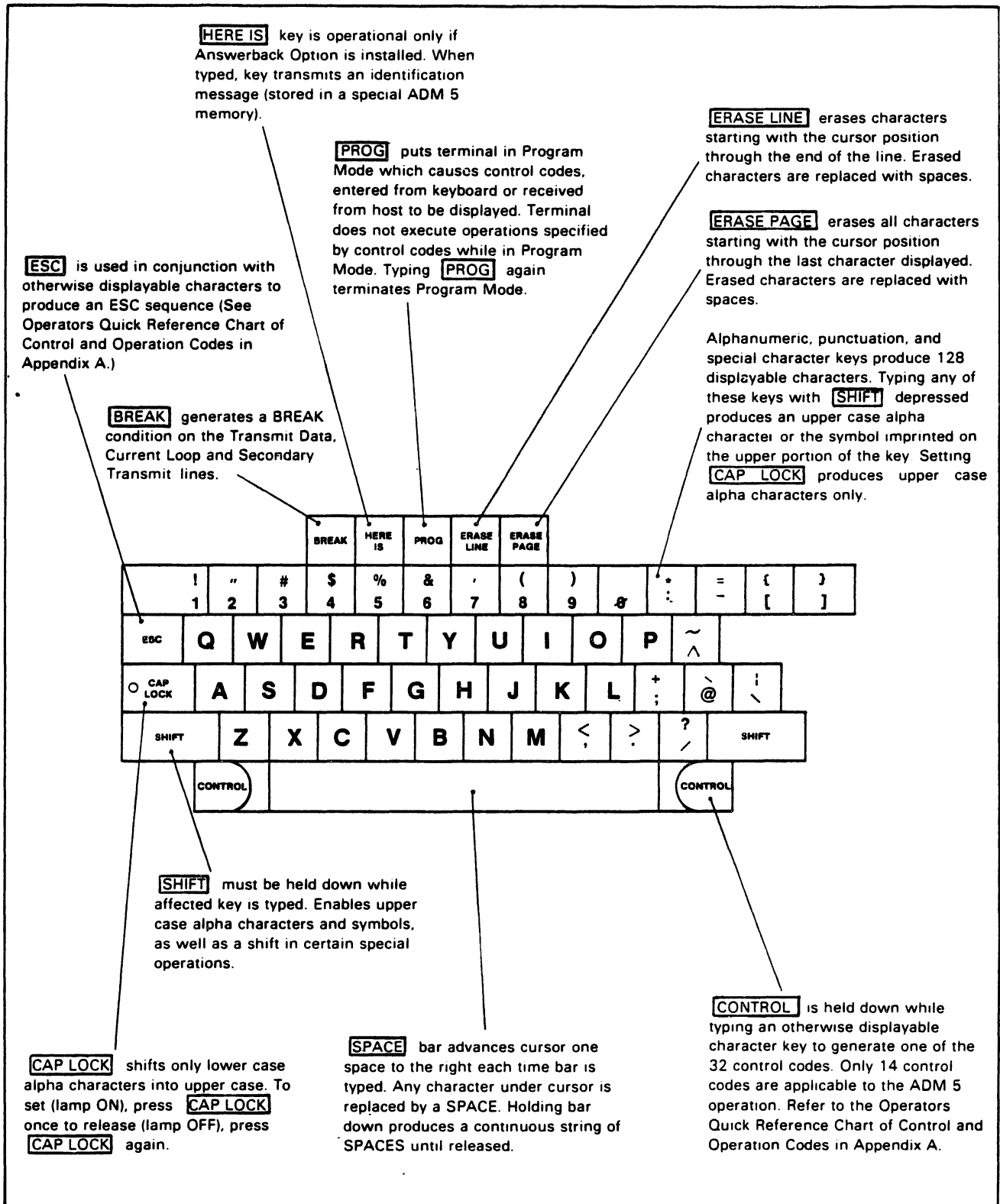


Figure 3-1A. ADM 5 Standard Keyboard Operational Characters

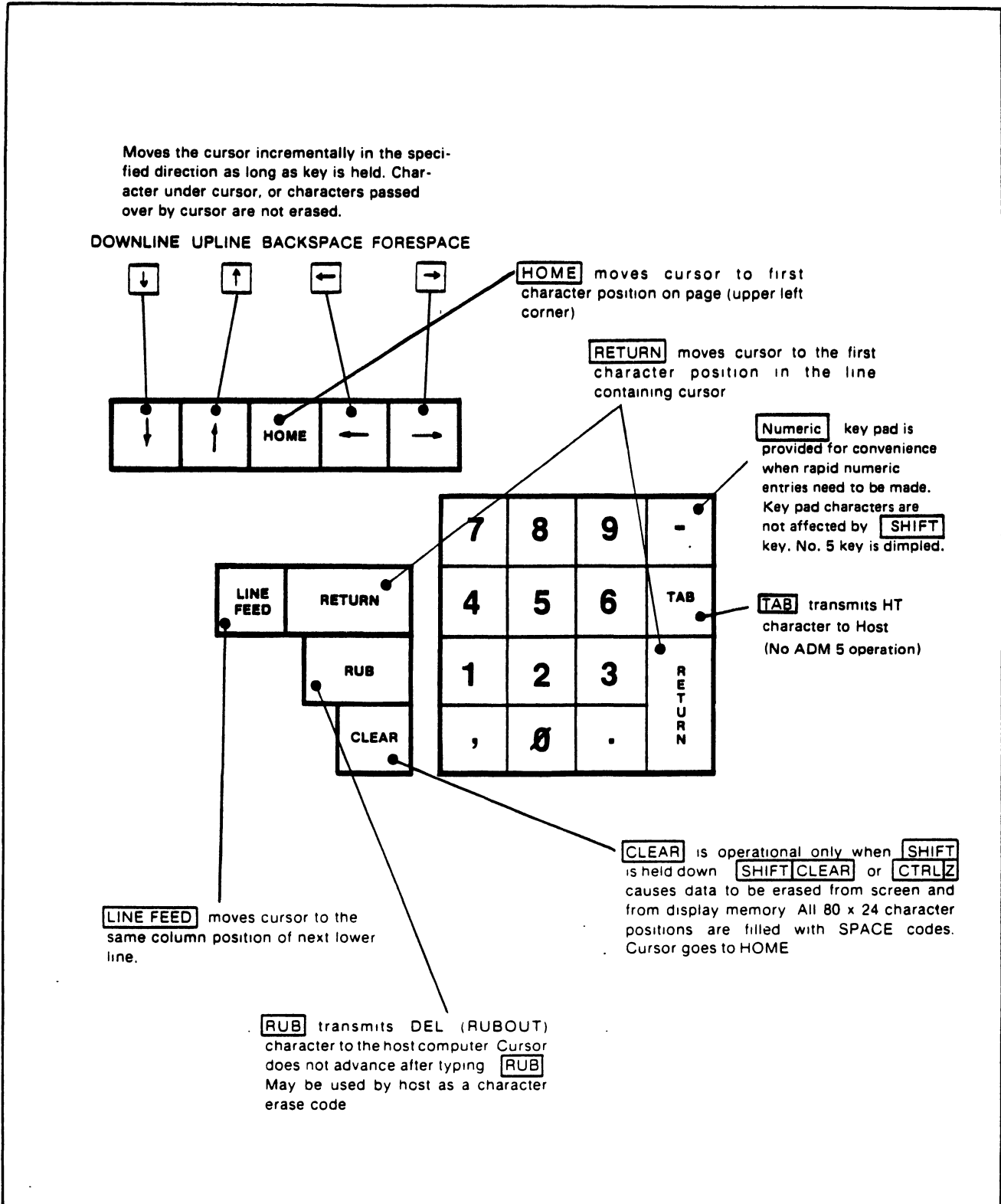


Figure 3-1B. ADM 5 Standard Keyboard Operational Characteristics (continued)

different symbols. No character is produced when the SHIFT key is operated by itself.

The CAP LOCK key allows the operator to type a series of shifted alpha characters (but not shifted numeric or special characters) continuously, without using the SHIFT key. Pressing the CAP LOCK key sets the CAP function and lights a lamp in the key. Pressing CAP LOCK a second time releases the function and extinguishes the lamp. No character is produced when CAP LOCK is pressed.

The space bar generates an ASCII space code for transmission. A space character (blank) also appears on the CRT display.

### 3.2.2 Alphanumeric Keys

The alphanumeric keys (refer to Table 3-1, Items 1, 2, and 3) are used to write any of the standard ASCII characters shown in ascending ASCII sequence referred to in Figure 1-3. Pressing any alpha (A to Z) or numeric (0 to 9) key produces the ASCII 7-bit binary code associated with the unshifted character. When used in conjunction with the SHIFT key, the ASCII code is shifted to that associated with the upper case character on an alpha (A to Z) key and the upper symbol on a double-operation key. Such keys include main keyboard numeric keys (which are double-operation keys) but not auxiliary keyboard keys (0 to 9 and special characters TAB,.). The auxiliary (numeric) key pad is mainly for convenience when performing a large number of numeric entries. The arrangement of these keys facilitates making the numeric entries, as opposed to using the main keyboard keys.

Only alpha key-operations are shifted by means of the CAP LOCK key. Numeric key operations (on main and auxiliary keyboards), as well as all special character key operations are not functionally affected by the CAP LOCK key. Typically, the ASCII code produced by an alpha numeric key closure represents simply the character typed. Thus, a typed y, Y, or 7 represents a y, Y, or 7. When preceded by an ESC, or FUNCTION code, however, the ASCII code has an entirely different significance, depending upon which special operation has

been selected. These special operations are described under Programming Considerations.

### 3.2.3 Special Character Keys

Functionally similar to the alpha numeric keys, the special character keys (shifted and unshifted) when used in the fashion of a conventional typewriter, produce ASCII codes which express the symbol on the key (refer to Table 3-1, Items 5 and 6).

### 3.2.4 Operational Control Keys

The keyboard contains a number of operational control keys which are used unshifted or shifted to provide specific terminal operations. These keys consist of those keys not previously categorized as alphanumeric and special character keys (Items 1 through 6, Table 3-1) with the exception of the ESC, CTRL, and FUNCTION keys. For the purpose of this discussion the operational control keys have been grouped according to specific operations, each of which is discussed in detail in the specified paragraphs, as follows:

- Terminal Control Operations (paragraph 3.2.1)
- Cursor Control Operations (paragraph 3.3)
- Data Editing Control (paragraph 3.4)
- Data Transmission Control Operations (paragraph 3.5)

## 3.3 CURSOR CONTROL OPERATIONS

The cursor is a bright rectangular marker on the ADM 5 display that indicates the entry point for the next character to be displayed. As characters are entered, the cursor moves from left to right across the display. When the cursor is positioned over a character already displayed, that character appears as a reverse image in the cursor. Cursor positioning may be controlled from the keyboard or from the remote computer. Operational control of the cursor is accomplished by using appropriately labeled operational control keys (unshifted and shifted) on the keyboard.

**Table 3-1. Keyboard Operation**

CONTROL	PAR. REF.	FUNCTION
1. Alphabet Keys	3.2.2	Lower case a to z
2. Alphabet, with SHIFT or CAP LOCK	3.2.2	Upper case A to Z
3. Numeric (Main and Numeric Keyboards)	3.2.2	Numerals 0 to 9
4. Numeric (Main Keyboard) with SHIFT	3.2.2	Special Characters: -!"#\$%&'()
5. Special Characters (Main and Numeric Keyboards)	3.2.3	Special Characters: - ^ \ [ ; : @ , /
6. Special Characters (Main Keyboard) with SHIFT	3.2.3	Special Characters: = ~ ! } { + * ^ > < ?
7. Terminal Control: <b>CAP LOCK</b> <b>SHIFT</b> <b>SPACE BAR</b>	3.2.2 3.2.2 3.2.2	Locks/unlocks keyboard CAP status Lower/upper case alpha character; special characters and operations ASCII space character on display
8. Cursor Control: <b>HOME</b> <b>↑ ↓ ← →</b> <b>RETURN</b> <b>LINE FEED</b>	3.3	Cursor to HOME position Increment up, down, left, right Left margin, same line Same column, next line

**Table 3-1. Keyboard Operations (continued)**

CONTROL	PAR. REF.	FUNCTION
9. <b>ERASE LINE</b>  <b>ERASE PAGE</b>  <b>SHIFT CLEAR</b>	3.4	Erase line containing cursor to spaces from right of cursor to end of line  Erase page to spaces from cursor position to the end of the page  Clear screen to spaces
10. Data Transmission Control:  <b>BREAK</b>  <b>TAB</b>	3.5	Sets BREAK condition on transmit data line  Transmits HT character to host (host should place cursor in selected location)
11. Programming Considerations  <b>CONTROL (ASCII CHARACTER)</b>  <b>ESC</b>  <b>PROG</b>  <b>HERE IS</b>	3.6	Generate control codes  Generate ESC code for special functions  Puts terminal in Program Mode for display of control codes  Transmits identification message (operational only if Answerback Option is installed)

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The following operational control keys affect cursor position.

- **HOME** Moves the cursor to the first character position on the page (top line, most left-hand position).
- **↓** "Down Line" moves cursor to the same column of the next lower line.
- **↑** "Up Line" moves cursor to the same column of the next higher line.
- **←** "Back Space" moves cursor one position to the left.
- **→** "Fore Space" moves cursor one position to the right.
- **RETURN** Moves cursor to first character position in the line in which cursor rests.
- **LINE FEED** Moves cursor to the same column of the next lower line.

### **3.4 DATA EDITING CONTROL OPERATIONS**

The ADM 5 is equipped with data editing capabilities. At the keyboard, the operator may use the appropriately labeled special editing keys to accomplish the following editing activities:

- Character type-over
- Clear entire screen to spaces
- Erase to end of line
- Erase to end of page

The following special operation keys are used for data editing:

- **ERASE LINE** erases all characters, beginning with the cursor position, through the end of the line field that contains the cursor. Erased characters are replaced with spaces.
- **ERASE PAGE** erases all characters, starting at the cursor position and progressing through to the end of the data

on display. Erased characters are replaced with spaces.

- **CLEAR** operates only in combination with the SHIFT key to erase data from the display screen memory to spaces.

### **3.5 DATA TRANSMISSION CONTROL**

#### **3.5.1 BREAK Key**

The BREAK key generates a break condition on the Transmit Data, Current Loop and Secondary Transmit lines.

#### **3.5.2 TAB KEY**

The TAB key is used to transmit HT character to host (NO ADM 5 Operation).

### **3.6 PROGRAMMING CONSIDERATIONS**

#### **3.6.1 CONTROL Key**

The CONTROL key is held down while typing an otherwise displayable character key to generate one of the 32 control codes. Only 14 control codes are applicable to the ADM 5 operation. Refer to the Operators Quick Reference Chart of Control and Operation Codes in Appendix A.

#### **3.6.2 ESC Key**

The ESC key is used in conjunction with otherwise displayable characters to produce an ESC sequence. (See Operators Quick Reference Chart of Control and Operation Codes in Appendix A.)

#### **3.6.3 PROG Key**

The PROG key puts the terminal in Program Mode which causes control codes, entered from keyboard or received from host, to be displayed. The terminal does not execute operations specified by control codes while in Program Mode. Typing PROG key again terminates Program Modes.

#### **3.6.4 HERE IS Key**

The HERE IS key is operational only if the Answerback Option is installed. When typed, this key transmits an identification message (stored in a special ADM 5 memory).

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## 3.7 INTERFACE CONTROL OPERATIONS

### 3.7.1 Data Communication Ports

Communications between the ADM 5 and the host computer or modem is accomplished using the MODEM port. Transmission may be in one direction at a time, as in Half-Duplex operation; or in both directions simultaneously, as in Full-Duplex operation.

### 3.7.2 Request to Send Operation

The ADM 5 may receive data at any time over the RCVE line (BB). Data transmission is controlled by Request to Send (RTS) over line CA, Clear to Send (CTS) over line CB, and Carrier Detect (DD) over line CF (Secondary Channel).

Request to Send (RTS) is set (high) to inform the host that the ADM 5 wishes to transmit. RTS may be controlled in one of five ways, as follows:

1. RTS may originate from a peripheral device connected to the EXTENSION port.
2. RTS remains low (XMIT disable) if LOCAL (S3-6), 103 (S3-5), and 202 (S3-4) switches are all set to OFF (open).
3. LOCAL (S3-6) switch set to ON (closed): RTS rises before transmission of each character and falls when character has been transmitted.
4. 103 (S3-5) switch set to ON (closed); RTS remains high all the time.
5. 202 (S3-4) switch set to ON (closed): RTS is controlled through the ADM 5 interface by either code turnaround or reverse-channel turnaround operation. Transmission may be in only one direction at a time (Half-Duplex).

#### 3.7.2.1 Secondary Channel Turnaround Operation

Secondary channel turnaround operation is enabled by setting switch 202 (S3-4) to ON and switch CODE (S3-3) to OFF. Both switches EOT (S3-1) and ETX (S3-2) must be set to OFF. In this operation, RTS is

controlled by secondary channel signals, instead of turnaround codes on the primary channel.

ADM 5 transmission takes place when the host raises SEC RCVE (Secondary Receive Data) over line SB, and DCD (Carrier Detect) on line CF falls to indicate that the host has completed (character transmission). RTS (Request to Send) over line CA goes high; the CTS (Clear to Send) over line CB from the host initiates ADM 5 transmission.

When SEC RCVE (Secondary Receive Data) over line SB goes low while DCD over line CF is high, RTS is unconditionally reset, thus inhibiting ADM 5 transmission.

SEC XMIT (Secondary Transmit Data) over line SA rises, allowing the host to transmit. Each time RTS switches between high and low, the ADM 5 ignores any further commands or codes for approximately 250 milliseconds, to allow time for the host to propagate signals.

#### 3.7.2.2 Code Turnaround Operation

Code turnaround operation is enabled by setting switch 202 (S3-4) to ON and switch CODE (S3-3) to ON. Additionally, either switch EOT (S3-1) or ETX (S3-2) must be set to ON. RTS over line CA is set (high) when DCD (Carrier Detect) over line CF falls as the result of decoding the ETX (EOT) code from the host, indicating that (character) transmission is complete. Data transmission from the ADM 5 may take place when CTS (Clear to Send) from the host over line CB is set (high).

When ETX (EOT), terminating each character, is again decoded, RTS (and CTS from the host) are reset to the marking state. ADM 5 transmission is inhibited, and the terminal will not recognize any further commands or codes for approximately 250 milliseconds, to allow time for the host to propagate its signals.



## 3.8 PROGRAMMING CONSIDERATIONS

### 3.8.1 Remote CTRL Operation

The host computer has full control over the ADM 5. All control operations which are possible from the keyboard can also be executed from the computer by transmitting the appropriate CTRL codes. (Refer to the Chart of Control and Operation Codes in Appendix A.) Displayable characters will be recognized and acted upon, in the same manner as that described for keyboard operations.

### 3.8.2 Remote Load-Cursor Operation

The computer may command the ADM 5 cursor to any absolute screen position, as shown in the Chart of Absolute Cursor Positions in Appendix A.

## 3.9 GATED EXTENSION PORT OPERATION

The RS-232C EXTENSION port provides a convenient method for attaching an auxiliary serial asynchronous device to the ADM 5. The device may be an additional terminal;

however, a more common application is for a hard copy device such as a Lear Siegler Model 310 Printer. The EXTENSION port parallels the RS-232C MODEM port, such that any data sent to the terminal through MODEM port is also passed through the EXTENSION port, unless the port is disabled using the gating function described below.

### 3.9.1

The gating function allows the host computer to turn the EXTENSION port ON and OFF, using control codes. This function is enabled by setting DIP switch S4 on the main logic board to the GT position. With S4 in this position, the CTRL O (ASCII-SI) command disables the port, while CTRL N (ASCII-SO) enables the port.

When a Model 310 Printer is connected to the EXTENSION port, several control and operation codes used for controlling ADM 5 operations will be passed through the port and affect printer operations also, as shown in the following chart: Codes will execute the required functions and pass the commands through the EXTENSION port when switch S4 is in the GT (gated EXTENSION port) position.

Table 3-2. ADM Codes for Model 310 Printer

COMMAND	ADM 5	LSI MODEL 310 PRINTER
CTRL L	Increments Cursor by 1	Performs form feed
CTRL N	Enables EXTENSION port when in gated mode	Turns ON elongated print
CTRL O	Disables EXTENSION port when in gated mode	Turns OFF elongated print *
ESC G	Sets reverse video or restores standard video	Clears horizontal tabs
CTRL K	Upline	Vertical tab

\*NOTE: If more data is to be transmitted to the printer after turning off elongated print, the CTRL O should be followed with a CTRL N when in the gated mode. The CTRL N will not be sent out the port if it was previously disabled.

### 3.10 VIDEO ATTRIBUTES

Video attributes (Reverse Video, Reduced Intensity, and Reverse Video/Reduced Intensity combination) highlight selected fields in the display. The selected fields will

apply only to the line containing the attribute. The attributes are established by appropriate operation codes. (Refer to the Chart of Control and Operation Codes used by the ADM 5 in Appendix A.)



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## SECTION IV THEORY OF OPERATION

### 4.1 GENERAL

This section contains the theory of operation for the ADM 5.

### 4.2 FUNCTIONAL DESCRIPTION

The functional block diagram for the ADM 5 is shown in figure 4-1. The diagram illustrates the flow of data through the functional areas of the ADM 5.

#### 4.2.1 Display Generation

Signals that cause a display to be generated and maintained on the screen are furnished by a string of counters (display counter logic).

The first counter (dot counter) is clocked by pulses which are generated by a crystal controlled oscillator of 10.8664 MHz. These clock pulses are the primary timing signals in the ADM 5. The purpose of the dot counter is to time the presentation of the sequential address to the character generator and the presetting of the video serializer. Each increment of the counter defines the position of a single dot in any line (dot row) of any character in the display. Each character is made up of a 5 x 9 array of dots (figure 4-2). A character position is seven dots wide and ten dots high to provide 2-dot spacing between characters both horizontally and vertically.

A single horizontal sweep of the CRT beam produces the dots specified for all the characters in a given dot row. The character position counter is incremented for every seventh dot column to define the position of each character in the row. At the end of each dot row, the line counter is incremented and

the next dot row is scanned out. The character row counter is incremented by every tenth dot line to define the position of the next character row.

The four display counter outputs control memory addressing, character generation, and many other functions of the ADM 5 logic. Figure 4-3 shows the timing relationship of the four outputs from a 5 x 9 display counter.

#### 4.2.2 Display Refresh Operation

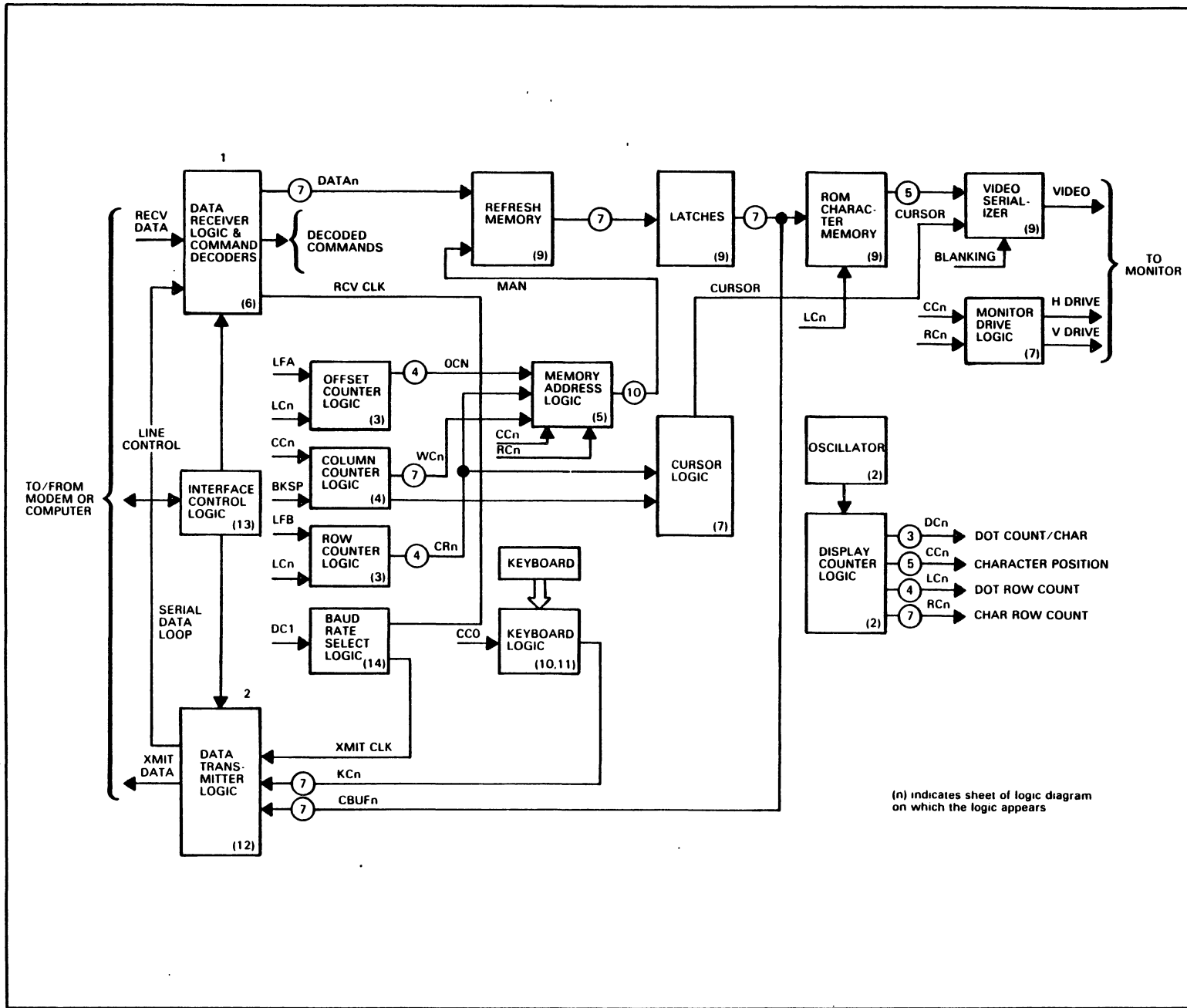
The contents of the refresh memory (an entire page of data) are continuously presented on the screen. Memory address logic requires only sequential character and row counts (CCn and RCn) to read out the memory contents of the storage latches.

Each character read from the refresh memory is stored for presentation to the ROM character memory (and to data transmitter logic for read-back test operation). Figure 4-4 shows the organization of display data in the refresh memory.

The refresh memory is made up of four 1k, 4-bit semiconductor RAM devices for upper/lower case, 24-line display (the 8th bit is used for reduced intensity).

The ROM character generator decodes the stored ASCII coded characters and produces a string of five-bit words which specify the dot pattern to be displayed for each character in a given dot row (line). The bits in each word are position coded to establish the dot pattern. The count CCn causes the individual dot patterns to be assigned the appropriate character positions in each dot row as it is presented to the ROMs.

Figure 4-1. ADM 5 Functional Block Diagram



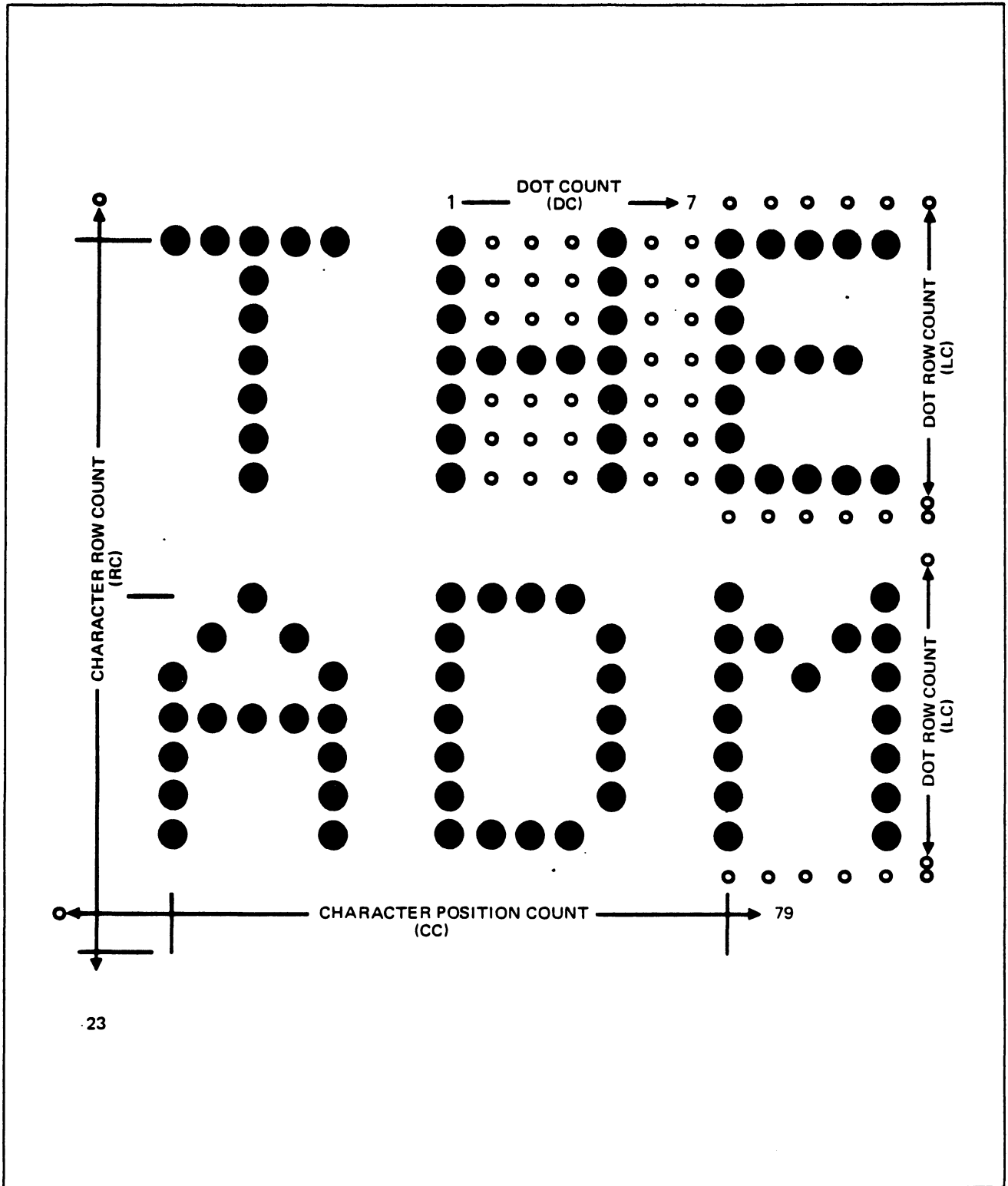


Figure 4-2. Character Position Layout (5 x 9 Character)

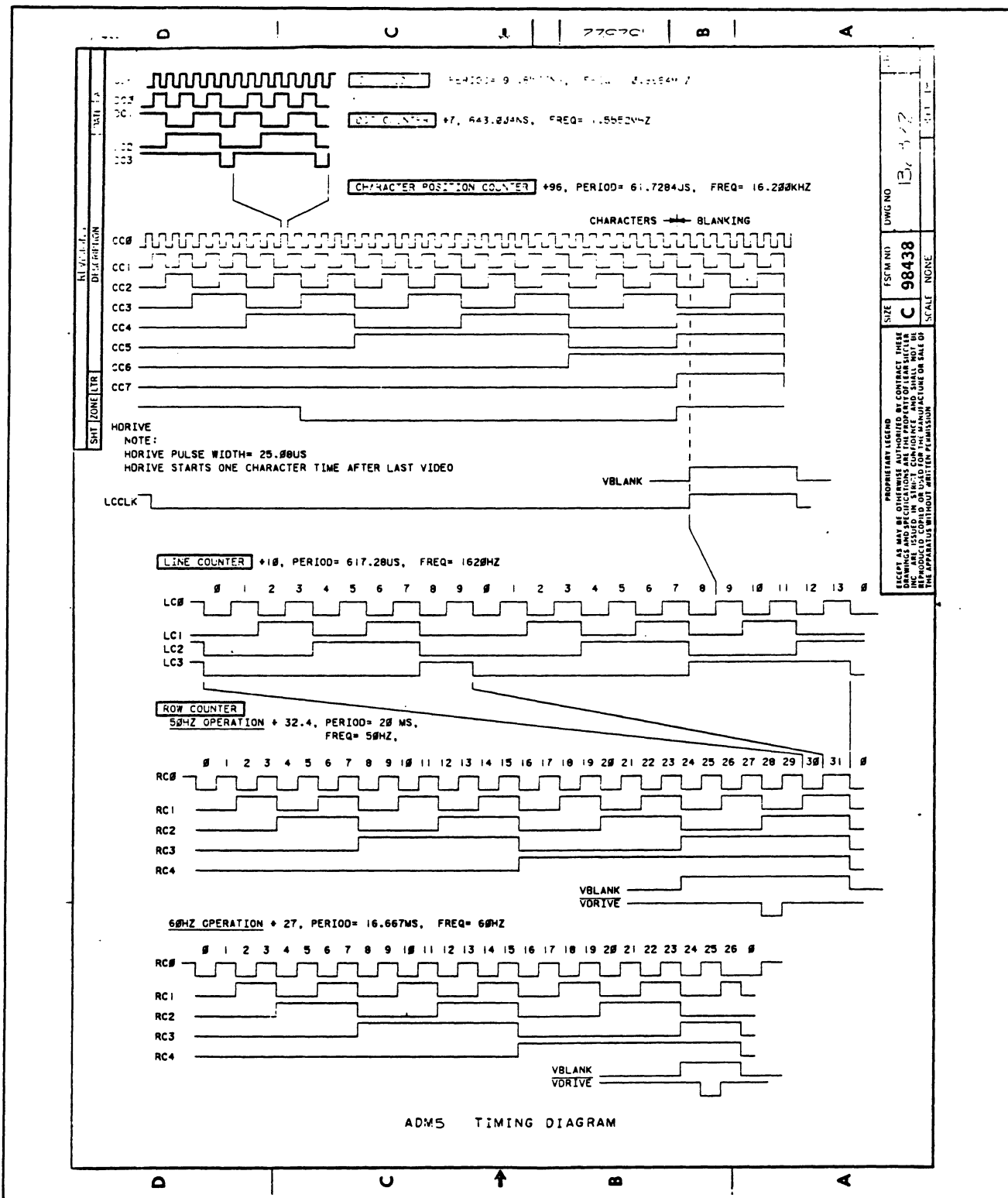


Figure 4-3. Display Counter Timing for 5 x 9 Character

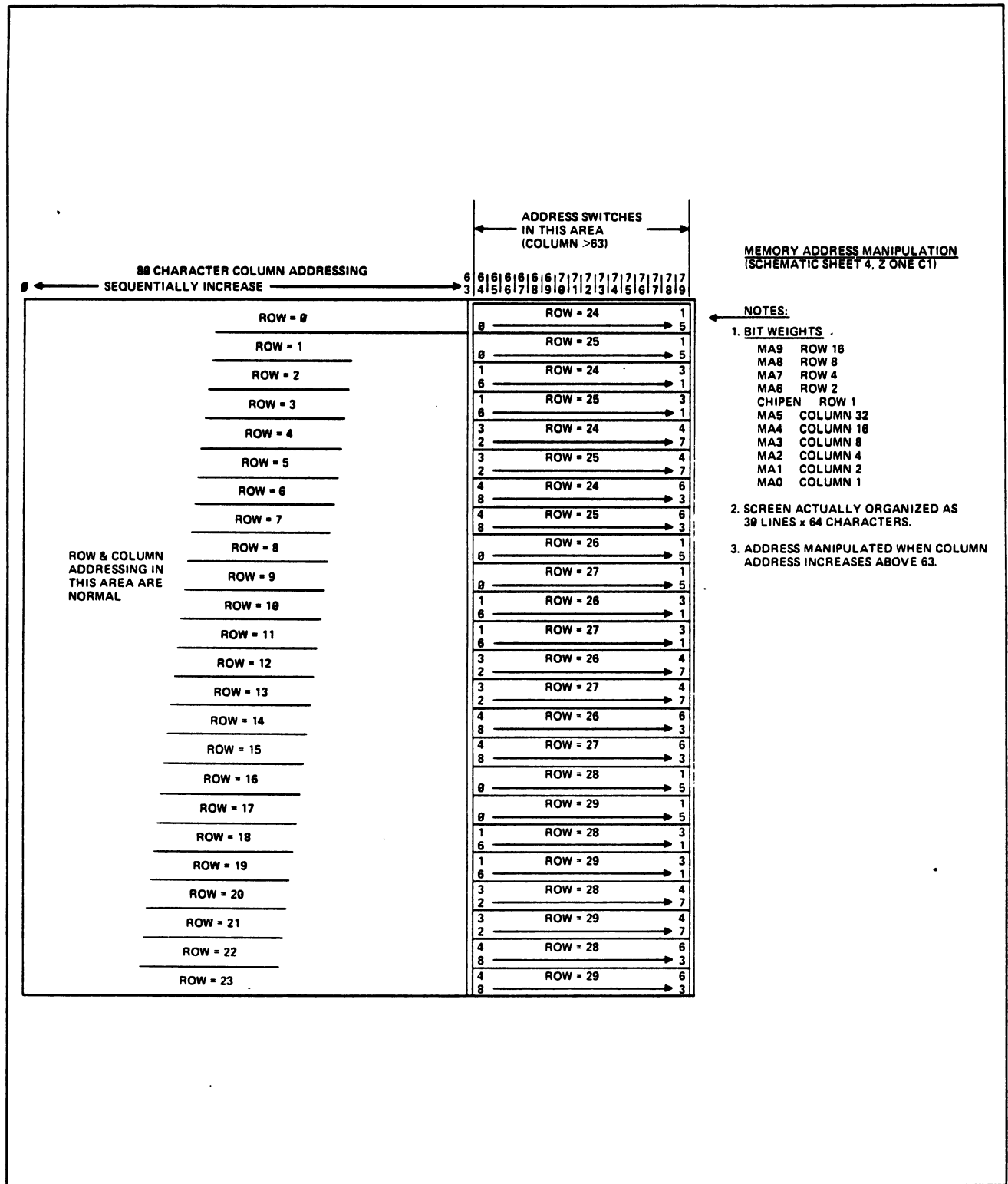


Figure 4-4. Organization of Display Data in Refresh Memory

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### 4.2.3 Monitor Video and Drive Circuits

The character position counter (CCn) and character row counter (RCn) count data read from the refresh memory and sent to the ROM character generator. Data is then presented to the monitor video circuits as a continuous serial dot stream, except during CRT retrace periods. The CCn count is used to trigger the CRT horizontal drive. The vertical drive is triggered when the RCn count reaches 24.

### 4.2.4 Receiving and Storing Data

Data transmission rates are selected in the ADM 5 to match those devices on the other end of the line. The receive clock and the transmit clock may be the same or different rates (split baud rate option). Baud rates (from 75 to 19,200 baud) are obtained from the 3.1104 MHz pulse stream (dot count DC1) which originates at the display dot counter. Baud rates are selected by means of a BAUD RATE switch.

The received data is clocked into the refresh memory which is addressed by the memory address logic. During loading, the memory address is formed by summing the Cursor Row Position Count (CRn) which represents the true position of the cursor on the screen and the Offset Count (OCn), which represents the number of lines that the display has scrolled. The virtual address which is thus derived corresponds to the refresh address for that data row. The Refresh Address is determined by another circuit which sums the current Display Row Count (RCn) and the Offset Count (OCn). Received commands (control codes) are decoded and used to control ADM 5 logic. Commands include Line Feed, Backspace, Carriage Return, and other functions.

### 4.2.5 Cursor Generation

The cursor marks the position on the display in which the next character will appear. Cursor information is OR gated into video output logic along with character bits read from the ROMs.

The cursor is displayed as a 7 x 10 reverse block containing the character over which the cursor currently rests.

The cursor position count WCn is used to address the refresh memory in Write Operation. Readback test operation (factory test only), also uses the WCn count.

### 4.2.6 Keyboard Logic

The Keyboard and associated logic is used to compose data for display and simultaneous transmission. In Half-Duplex transmission a character typed by an operator appears as KCn at the data transmitter logic and is sent to the receiver via the HDX/FDX Switch prior to being loaded into the refresh memory for display. In Full-Duplex transmission, characters originating at the keyboard are always transmitted and appear on the display only if they are echoed back from the computer or modem.

The keyboard is encoded by generating the 128 complete sequence of 7-bit ASCII codes at high speed and trapping the code that matches a depressed key. The code sequence is repeated continuously unless a key is pressed. The code sequence is clocked at a counter by KBCKL which is the gated character rate signal, CCO. The keyboard logic timing is shown in figure 4-5.

### 4.2.7 Data Transmitter Logic

The data transmitter logic receives a 7-bit character generated at the keyboard or at the optional answerback logic through the KCn lines. The transmitter logic then converts the 7-bit character into serial-bit form, along with start, parity, and stop bits, and sends the formatted data work to a modem or computer. The data that may apply to the transmitter are;

- a. Keyboard characters KCn and the XLOAD signal from keyboard logic, when READ is false (normal operation).
- b. Characters of the answerback message applied through KCn lines, when the Answerback option is included in the ADM 5 and READ is false.
- c. The contents of the refresh memory buffer (CBUFn) when READ is true (in read back test operation).



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The gated XMIT CLK that clocks the transmitter is selected by the BAUD rate select logic and is 16 times the baud rate.

In read back test operation (factory only) the contents of the memory buffer (CBUF<sub>n</sub>) may be accepted for transmission in the same manner as data on the KC<sub>n</sub> lines.

### 4.2.8 Interface Logic Control

The interface control logic controls the Clear-to-Send and Request-to-Send exchanges between the modem or computer and the ADM 5. Either a code-turnaround or a reverse channel system may be used to transfer control from one end of the communication line to the other. Switches adapt the logic to interface with type 103 or 202 modems or to operate under internal control.

CLR TO SEND (high) permits data transmission logic to produce XMIT CLK, sending data from the ADM 5. If CLR TO SEND falls when a byte is being transmitted, the transmit clock is maintained until the byte has been completed, then falls to shut off the clock and return the line to the marking state. REQ TO SEND (RTS) may be controlled in one of five ways as follows:

- a. RTS may originate at an extension port.
- b. If switches 202, 103, and LOCAL are all open, RTS remains low all the time.
- c. If only switch 103 is closed, RTS remains high all the time.
- d. If only the LOCAL switch is closed, RTS rises to transmit each character, and falls when the character has been shifted out of the ADM 5.
- e. If only the 202 switch is closed, RTS may be controlled through the ADM 5 interface in either code turnaround, or reverse-channel operation.

#### 4.2.8.1 Code Turnaround Control

Either an ETX or an EOT code may be selected, depending upon the position of the ETX and EOT switches, to initiate turnaround operation. When the selected code appears in the input data, LATCHED CODE is set. When CARRIER DETECT falls

(figure 4-15) indicating that the remote end of the line has dropped, RTS is set.

RTS is reset when ETX or EOT is again decoded and the logic switches to the receive mode. Following a turnaround command, no further command will be recognized for approximately 250 milliseconds. This interval gives the modem time to propagate its signals. The interval is timed-out by two flip-flops, a counter, and the signal SBEN that controls resetting of RTS.

#### 4.2.8.2 Reverse Channel Control

During reverse channel operation, RTS is controlled by SEC RECV DATA (SB) and CARRIER DETECT (CF) from the modem. When SB goes low, RTS is unconditionally reset (figure 4-16) switching the interface to receive data. In normal reverse channel receive operation, CF is high at this time, causing SEC XMIT DATA to rise.

When the remote end of the line raises SB and then drops its RTS (and CF), the ADM 5 will activate its RTS. The ADM 5 will then ignore further commands for a 250 millisecond period while the modem propagates its signals.

### 4.2.9 CRT Display Monitor

The CRT display monitor employed in the ADM 5 is a solid-state unit for use in industrial and commercial installations where reliability and high-quality video reproduction are desired.

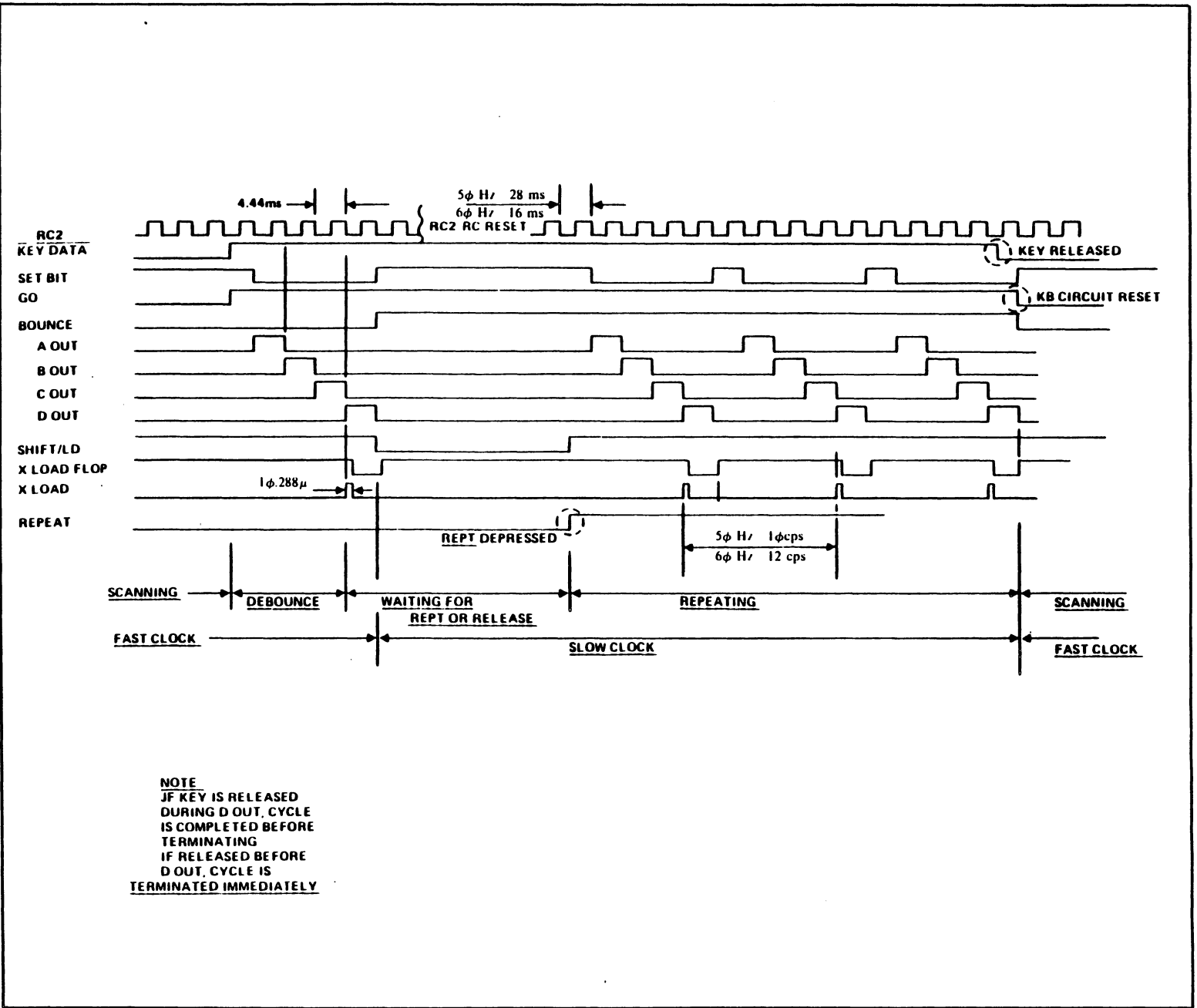
The monitor features printed circuit board construction for reliability and uniformity. All circuits of the monitor are transistorized.

Several different monitor assemblies have been utilized in the ADM 5. For details on operation, layout, and parts information refer to Section 6 which includes the various assemblies.

#### 4.2.10 Power Supplies

AC power is applied to the transformer through the ON/OFF switch on the rear of the ADM 5. The different stepped down AC voltages are connected to the main circuit board connectors. Rectifiers, filter

Figure 4-5. Keyboard Logic Timing



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capacitors, and voltage regulators are all located on the main circuit board.

A +15V DC supply required by the monitor is made up of a type 7815 device and a simple transistor shunt regulator. Located at the bottom of the terminal pan is a primary fuse. It is a 0.8 Ampere Slo-Blo 115V fuse or a 0.4 Ampere Slo-Blo 230V fuse.

### 4.3 LOGIC DESCRIPTION

The following paragraphs describe the operation of logic represented by each block in the overall block diagram, figure 4-1, as well as logic and circuits performing functions not indicated in figure 4-1. Refer to block and timing diagrams that accompany the text, as well as to the logic diagram included in Section 6 in this manual.

#### 4.3.1 General Clear Circuit

Circuits shown on sheet 7 of the logic diagram cause all control logic in the ADM 5 to be initialized when applied power causes the +5V DC supply to rise.

As the supply voltage reaches trigger level of a retriggerable one-shot, the one-shot creates the reset signal CLEAR, which is distributed to ADM 5 logic through inverters.

#### 4.3.2 Display Counters

The display counters provide a count of dot positions and dot rows, character position in a character line, and character rows. These counts define the position of each dot in a character matrix, and the position of each character in the total display. Figure 4-6 is a block diagram of this logic, and timing is shown in figure 4-3.

The basic clock is a 10.8864-MHz signal generated by a simple oscillator circuit. The clock (CLK) drives the dot counter.

The dot counter counts the seven dot columns comprising each character. The counter is preset to 10 at the count of zero, counts through the overflow at 15, and is again preset at zero. Its final count, DC3, clocks successive addresses to the character ROMs, and triggers the character position counter.

The eight-stage character position counter controls the position of each character on the 80-character raster line, and controls horizontal retrace time. The counter provides a total count of 96 (80 counts for character position, and 16 count for the retrace). The character position counter counts from zero to 79, presets to 240, counts through the overflow at 255, and then wraps to zero. Outputs CC0 through CC6 are binary counts, but CC7 has a value of 80. That is, CC7 is low while 80 character position are counted, and high during retrace time. CC7 is clocked to the frequency of 16.2K Hz.

A flip-flop produces the signal ICC80 for the first count of retrace time. ICC80 indicates the time at which a command at the I/O interface may be acted upon. The output of the LCCLK flip-flop clocks the character line counter.

The character line counter counts the lines that form each row of characters. The counter counts modulo 10. Counts 0 and 9 form spaces between characters, and dot rows are formed by counts 1 through 8. The last count, LC3, clocks the character row counter at a frequency of 1620 Hz.

The character row counter counts the 24 character rows appearing vertically on the display, and counts through vertical retrace time. A switch S2 (60 EN) sets up logic to produce 60 STOP at the proper time, resetting the counter to zero to begin the next character row count (the retrace time will be longer when S2 is in the 50 Hz position).

#### 4.3.3 Row Counter and Offset Counter Logic

The Row Counter (figure 4-7 and Logic sheet 3) defines the actual row in which the cursor resides, and consequently, the row in which new data entered into memory will appear on the screen. This counter will be cleared to zero by a power-up clear, key-clear operation, or a clear screen command.

The Offset Counter relates absolute memory addresses, during data entry and refresh, to the virtual (apparent visual) row addresses which are generated by scrolling operation. The OC, like the RC, is initially cleared by any

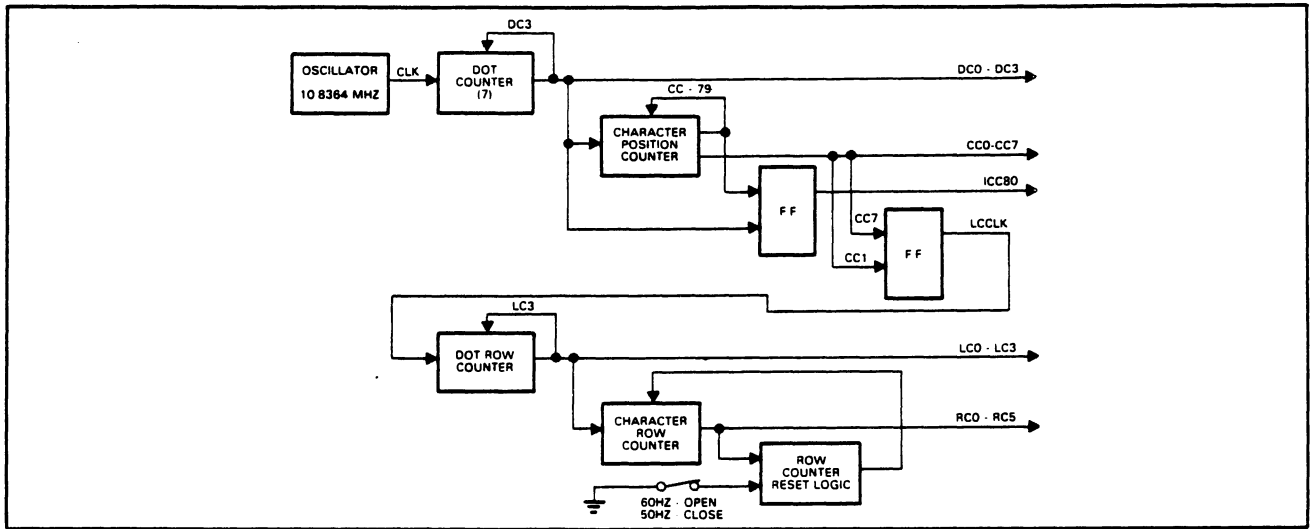


Figure 4-6. Display Counters, Block Diagram

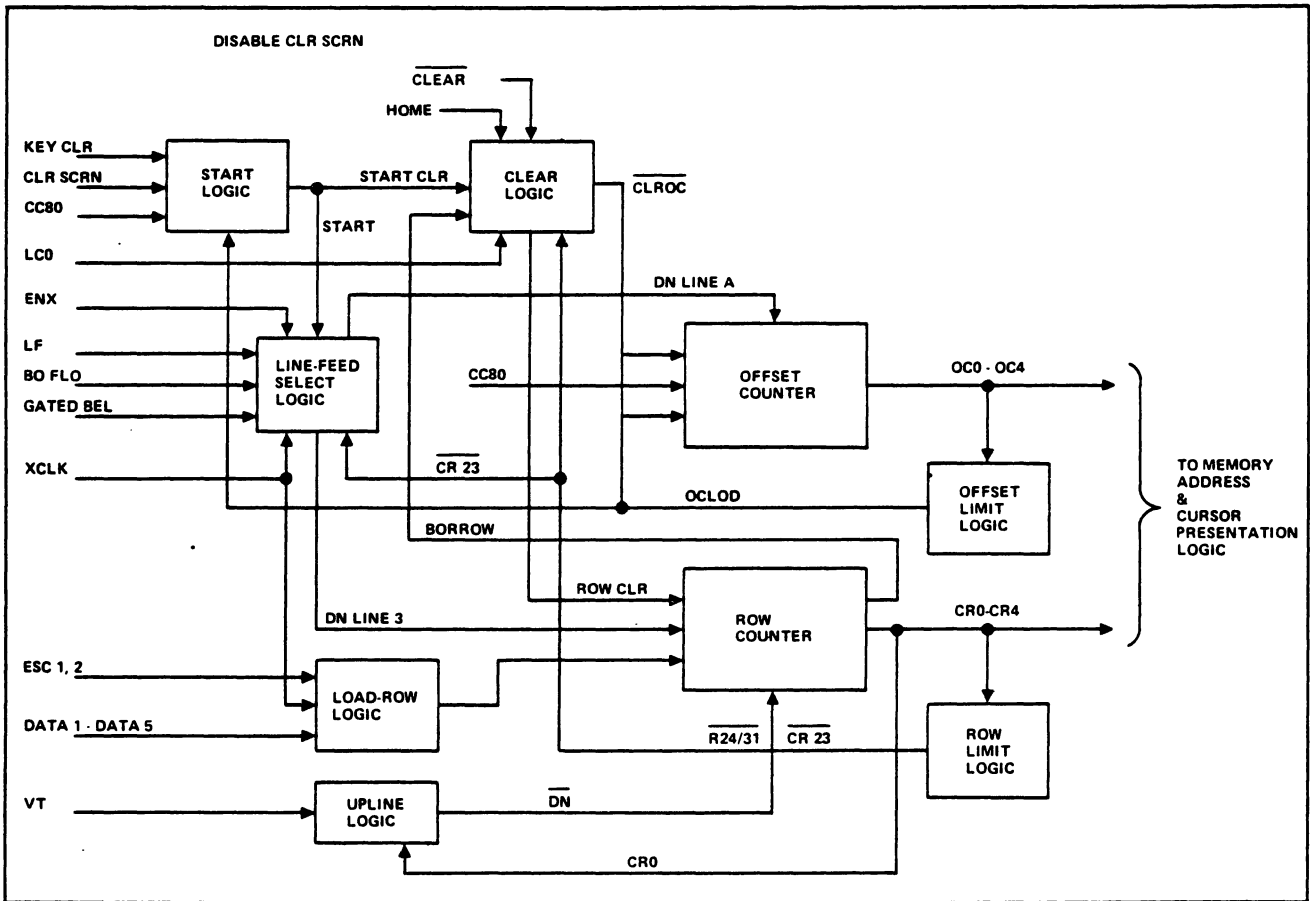


Figure 4-7. Row Counter and Offset Counter Logic, Block Diagram

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one of the clear-screen operations noted above, however, a sequence is then initiated by the START logic, which causes space-codes to be written into each character cell of the current row during first 80 character-periods of one line-scan period. At the end of the line-scan, CC80 will generate a line-feed signal, DNLINEA, which will increment the OC. The process is then repeated, with the OC pointing to the next row of memory addresses, which are also filled with space-codes.

After 24 such operations, the OCLOD signal is generated, which terminates the START operation, and freezes the OC at a count of zero. At this point, both the Row and Offset counters will contain "minimum count" and the true and virtual row-addresses will be the same (MS-A).

After completion of a clear operation, the Offset Counter will be disabled until the Row Counter has been advanced or set to 23 (bottom row).

Whereas the Offset Counter can only be incremented (DNLINEA), the Row Counter can be incremented, decremented, cleared or loaded with an absolute value (DNLINEB, VT, ROWCLR, LDROW). In the event a value in excess of 23 is loaded, the counter will be disable for maximum (23) count. If the Row Counter is decremented when it currently holds the minimum count, BORROW will occur, and the counter will be forced back to minimum count (ROWCLR). ROWCLR is also generated if a HOME (RS), directive is received.

#### 4.3.4 Column Counter Logic

The Column Counter (figure 4-8) and logic sheet 4) and its associated logic define the character-position of the cursor. The counter is bidirectional, to accommodate both backspace and foospace operations, and is capable of being loaded, via an associated multiplexor, with either of two fixed values, or a variable position-code which is obtained as the last character of the four-part Load Cursor sequence.

Back-spacing (count-down) is affected only by a local or remote backspace command (BKSP), while forward-spacing may be

accomplished by either a character-entry, a foospace command or a 'Read' operation. All received characters will cause a foospace after the character is written into memory, except control characters and the three non-control characters which follow ESC during a Load Cursor sequence. For the character-entry and foospace commands (FF), the counter is advanced during CC80 time. During Read operation (test only), a foospace is generated each time XLOAD occurs, indicating, the initiation of character transmission.

The Column Counter is cleared in any one of four situations:

- a. A Carriage Return (CR) command is received, either from the keyboard or a remote source.
- b. A Home (RS) command is received.
- c. An underflow occurs, due to attempts to back-space from column 0.
- d. A start-sequence is initiated by one of the power-up/clear operations.

When the Column Counter is incremented past the 80th column-count (code=79), an overflow signal is generated, causing an absolute count value to be loaded into the counter at the next LCCLK transition (CC81-time). If the auto-new-line switch is open, a 79<sub>10</sub> code will be loaded, forcing the cursor back to the last column position. If auto-new-line is closed, a zero-code will be loaded (carriage return) and a line-feed enable signal (BOFLO) will be generated, to enable either the Row or Offset counter to be incremented.

#### 4.3.5 Cursor Presentation Logic

The cursor logic (see figure 4-8 and logic sheet 7) performs the function of detecting the current character-cell in which the cursor resides. The logic consists of a set of three comparators, a pair of unit-delay flip-flops and video mixing circuits. One comparator relates the current cursor row, as defined by the cursor Row Counter, to the Display Row Count. When coincidence occurs, an equality signal (ROWCOG) is generated.

ROWCOG is gated to the two column comparators. The two column comparators

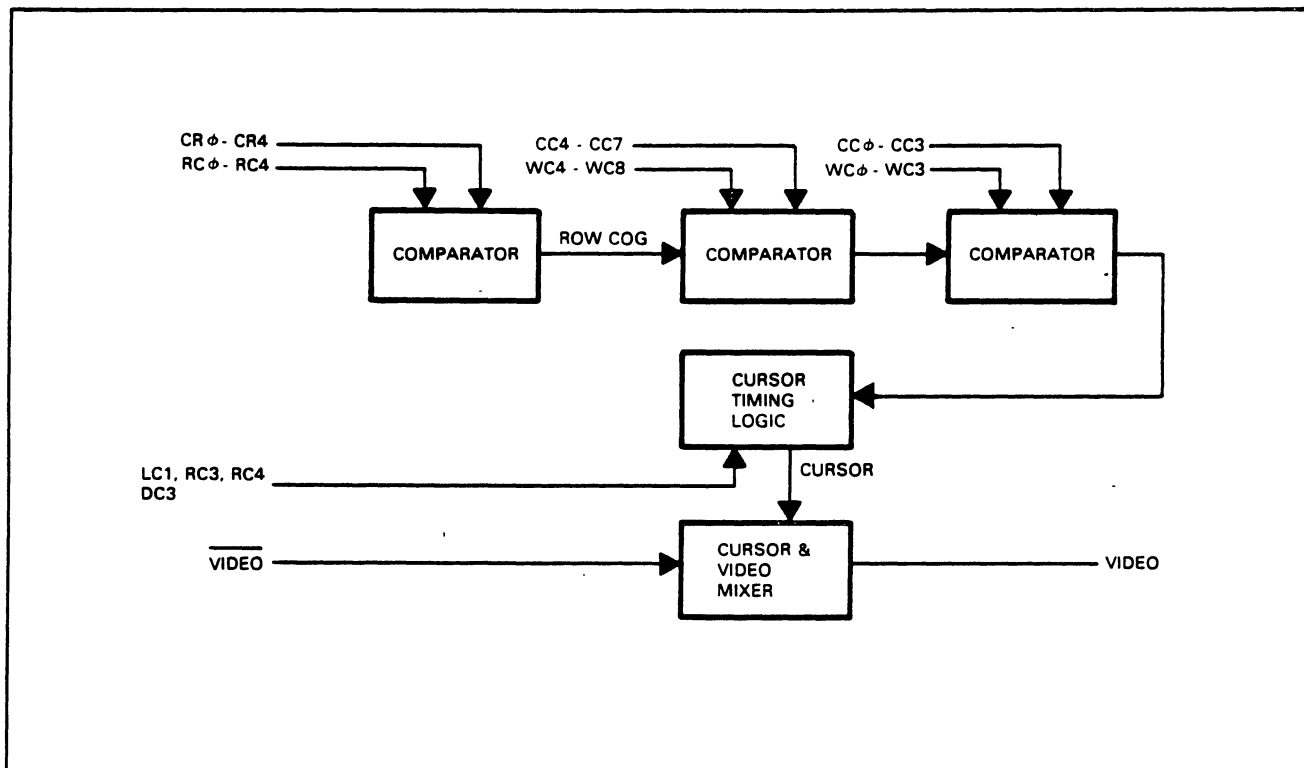
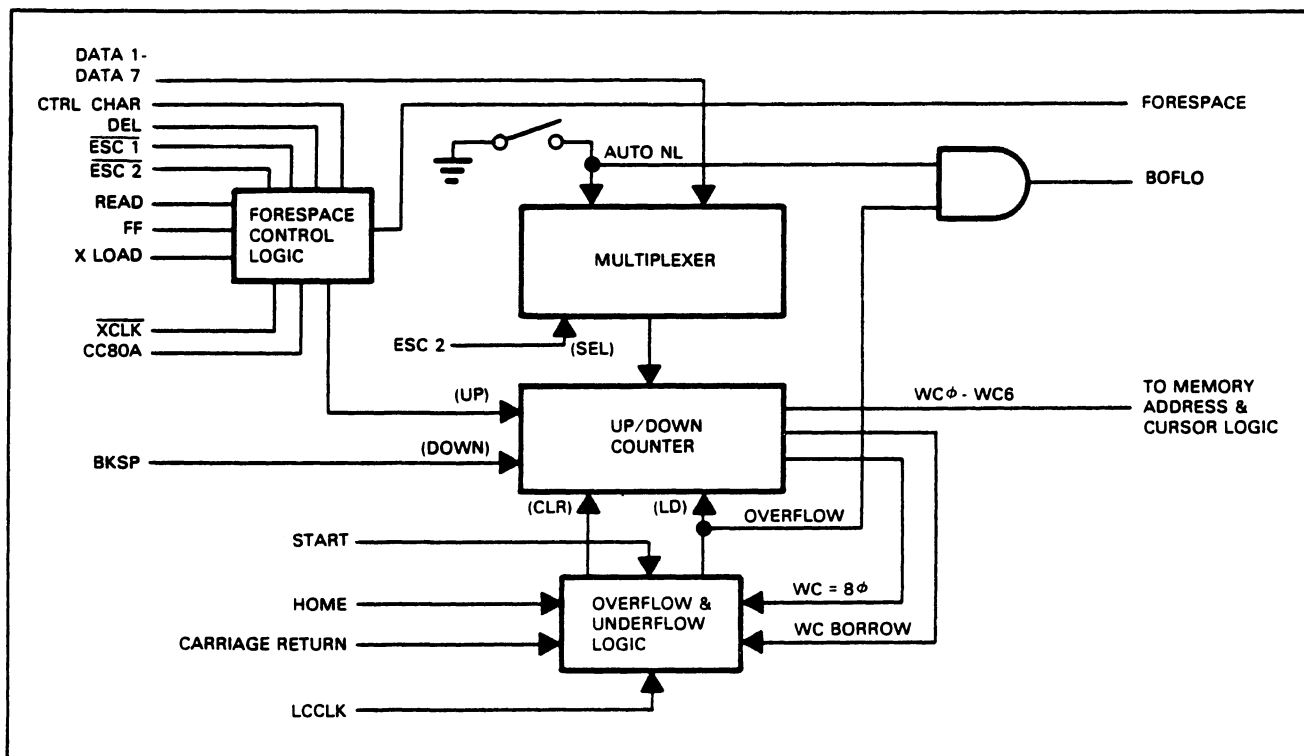


Figure 4-8. Logic Block Diagrams

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relate the 7-bit WC counter code to the Display Column Count. When coincidence occurs an equality signal (CURDET) is generated for the line erase logic and is also sent to the delay flip-flops which are clocked by DC3 from the row counter logic to delay the detected coincidence signal two character periods to synchronize the cursor with the displayed characters on the screen. The delayed (CURSOR) signal is gated with the character video data in an exclusive OR element, causing the character to appear as a reverse image in the cursor.

### 4.3.6 Memory Address Logic

The logic group shown in figure 4-11 and Logic Sheet 5 performs all the functions related to reconciling the current entry-row (Cursor Row Counter) and virtual row (Offset Counter) positions to a physical row-address in memory, and additionally, converting the visual 80-character by 24-row visual format to a 64 by 30 byte memory array. The first task is accomplished by two five-bit and two two-bit full adders, while the second is performed by a set of multiplexors.

The first five-bit adder produces a sum equal to:

$$\text{Display Row Count} + \text{Offset Count} + 1 = \text{SUMR}$$

This function provides the required relationship between current display rows and the virtual row-address during refresh scanning, in order that the data might be displayed on the proper row of the screen, consistent with the scroll history since the last clear-screen operation. If no scrolling has occurred, the offset count will be zero, and data for the top row of the display will be obtained at memory-row 1 ( $0 + 0 + 1 = 1$ ). Likewise, data for display-row 22 will come from memory-row 23, and data for the bottom row will come from memory-row zero. One of the two-bit adders, plus associated gates, performs the function of reconciling sums greater than 23 to a 24-row universe, by adding an appropriate adjustment factor to all such sums ( $23 + 0 + 1 = 24 \quad 0$ ).

If the display has been scrolled one time, data for the top row will be obtained from memory-row 2 ( $0 + 1 + 1 = 2$ ) and data for the bottom row from memory-row 1, thus, it can be demonstrated that all the data in memory will appear to have moved upward on the display by one row, after the scrolling operation, even though its actual physical location in memory is unchanged. The only physical alteration, in this example, occurs in memory-row 1, which is erased (see Section 4.3.8) during the scroll operation, leaving the new bottom row address locations clear for new data-entry.

Each subsequent scroll operation will, therefore, cause a successively higher memory-row address to assume the top display-row position, with the row previously associated with that position erased and "rolled" to the bottom of the display.

The second five-bit adder produces a sum equal to:

$$\text{Cursor Row Count} + \text{Offset Count} + 1 = \text{SUMW}$$

This function reconciles the current cursor row-position, which is the row on which new data-entries must appear on the display, to the scroll-history, which determines the last memory-row that was erased and rolled to the bottom of the display. If no scrolling has occurred and the cursor is on the top row, the resultant sum will be memory-row 1, which is the desired row for data-entry, since that is the row from which data will be obtained for the top row of refresh. If the cursor were moved to the bottom row, the sum would be zero ( $23 + 0 + 1 = 24 \quad 0$ ), due to the action of a second adder and gate set which reconciles all  $\text{CR} + \text{OC} + 1$  sums greater than 23 to values between 0 and 23. This also is consistent with the refresh adder-set, since any data entered under these circumstances will be routed to memory-row zero.

As scrolling occurs, the second adder group maintains the proper relationship between the cursor position and the virtual display-rows, such that data-entry will always occur in the memory row which is displayed during the same row-scan time as the cursor. Consider as another example, a display which has been scrolled six rows, after which

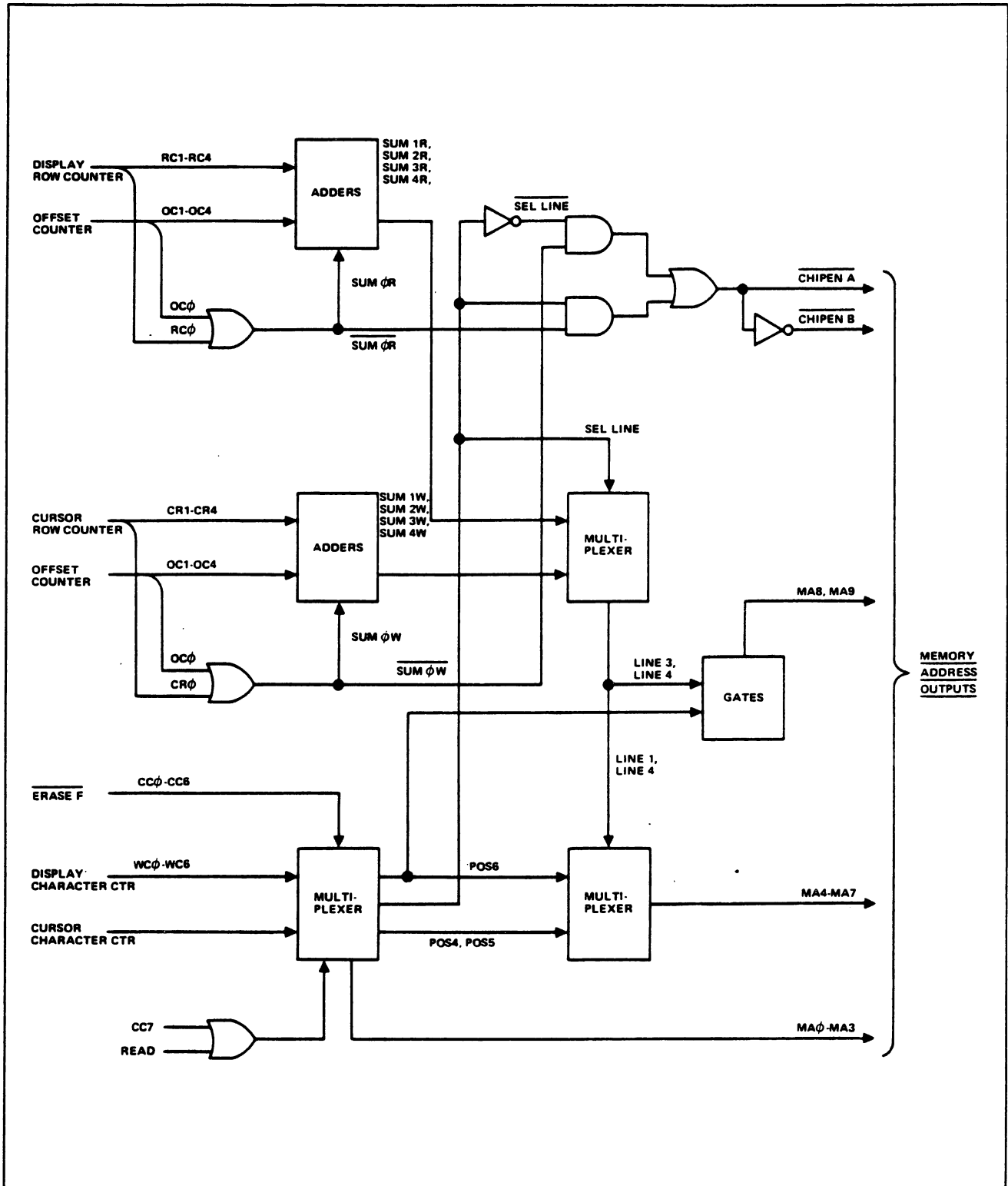


Figure 4-9. Memory Address Logic Block Diagram



the cursor is positioned to row 20. The memory-row actually displayed on row 20 will be:

$$20 + 6 + 1 = 27 \rightarrow 3$$

If an entry is made at the current cursor position, the same summation will occur using the Cursor Row and Offset Counter values, and the entry will be made in row 3.

The multiplexor section of the Memory Address Logic manipulates the CR + OC and RC + OC sums derived above, plus the information from the Display Column Counter (CC0 - CC7) and Cursor Column Counter WC0 - WC6) in order to resolve the 80 x 24 display matrix to a 64 x 30 memory matrix. The first-stage multiplexors distinguish between Refresh accesses to memory and write accesses, since the former are governed by the RC + OC sum and the CC Counter information, while the latter are governed by the CR + OC sum and the WC counter.

The time-period when CC7 is false is the active display-time for each scan-line, and therefore, defines Refresh-access time. During horizontal retrace, when CC7 is true, the memory is available for data-entry. During test read-back, the first-stage multiplexor is locked into the "Write" mode in order to expedite the transfer of information, since display functions are not necessary during this operation.

The most significant position of the CC/WC multiplexor is used as a selection signal for the SUMR/SUMW multiplexor, and in the write-phase will always cause selection of SUMW (CR + OC) for the LINE1 - LINE4 and Chip-Enable functions. In Refresh mode the SUMR (RC + OC) outputs will normally be selected, however, during Clear Screen or Line Erase (when scrolling) operations the term ERASEF will force selection of the SUMW terms, in order that all erasures can take place during CC7 time and thereby minimize the total time required for such operations (see Section 4.3.8).

The selected low-order column terms (MA0 - MA3) require no additional modification, since the smallest increment of memory

allocated to a given line is 16 characters. The three high-order column terms (POS4 - POS6) and the four high-order row terms (LINE1 - LINE4), however must be modified to account for the maximum column-width of the memory matrix of 64 characters. Accordingly, the final multiplexor stage uses the column-term POS6 to distinguish between column-positions greater (or equal to) and less than 64. For positions less than 64, the high-order address functions MA4 - MA9 are derived from POS4, POS5 and LINE1 - LINE4 respectively. This translation provides a direct relationship between a 24 x 64 section of memory, and that position of the display defined by 18WS 0-23 and columns 0-63. For column positions 64-79, POS6 switches the multiplexor to derive MA4 - MA7 from LINE1 - LINE4, respectively, and forces MA8 and MA9 true. This translation relates a 6 x 64 section of memory to the last 16 column positions of the 24 display rows, by allocating one-quarter of each memory-row progressively, to the remainder of each display row. The chip-enable functions define even and odd display rows and memory-groups, and therefore, require no translation. The organization of display data in memory, is shown on figure 4-4.

#### 4.3.7 Refresh Memory and Character ROM Logic

Logic Sheet 9 shows the logic associated with the Refresh Memory RAM and the Character Memory ROM.

Data from the input buffer (DATA1 - DATA8) is loaded into, or read from, the RAM Refresh Memory by address lines MA0 - MA9. A memory cell is loaded for each character by the Write Pulse.

CHIPENA is low as data is loaded into, or read from, RAMs storing the 12 odd lines of display data. CHIPENB enables the RAMs storing the 12 even lines in a 24-line display.

At the end of each character period, DC3 clocks an addressed character into buffer latches which store the character to be encoded by the ROM. The buffer latches are cleared by ICC80 and with CC7, for horizontal blanking.

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The 2K ROM decodes CBUF<sub>n</sub> characters and produce an 8 bit output code that provides the dot pattern for each line in the character matrix. Each of the nine lines in the character matrix is identified by the line count LC0-LC3. The parallel-bit information output by the ROM is serialized by a shift register for presentation to the video monitor.

### 4.3.8 Erase Logic

A display line is erased by the Logic shown on Schematic page 8 and 3.

The ERASEF signal is turned on by SETERA. SETERA describes the condition in which both PGMOD and LFI are true, causing the offset counter to begin counting and the lines to scroll each time a line-feed is caused by the column counter overflowing (BOFLO).

ERASEF is turned off by CC80A after a single character row has been cleared, during scrolling.

However, when START is raised by a CLR SCRN or KEY CLR Code, ERASEF remains high until START is turned off by an overflow of the offset counter. Consequently the entire screen is erased.

The erase page logic is shown on pages 8 and 12. The ERASE pulse is generated by keyboard action after debounce circuitry is applied. A page erase is synchronized from the cursor detection logic signal (CURDET) and is clocked from DC2. The erase page logic is also one of the ESC functions when decoded as ESC Y. Erase page is terminated when the row counter goes to 23 and count row 24 is set for LDCUR, which loads the cursor to the location it resided before the start of ERASE PAGE.

### 4.3.9 WRITE PULSE Logic

The WRITE PULSE signal loads data into the refresh (RAM) memory. Logic that generates WRITE PULSE is shown in sheet 8 of the logic diagram.

WRITE PULSE consists of gated pulses clocked by dot count DC1, and is normally gated on by FORESPACE or ERASE LINE.

### 4.3.10 Keyboard Logic

Keyboard logic is shown on sheets 10 and 11 of the logic diagram. Timing of keyboard logic functions is shown in figure 4-10.

The keyboard is encoded by generating the complete sequence of 7-bit USASCII codes at high speed, and trapping the code that matches a depressed key. The codes are generated continually and repetitively unless a key is pressed. This code sequence is clocked at a counter by KBCLK, which is a gated character rate signal CC0.

The four least-significant bits of the count (KC1-KC4) encode the 16 rows of the USASCII code chart. The three remaining bits (KC5-KC7) encode the eight columns of the chart.

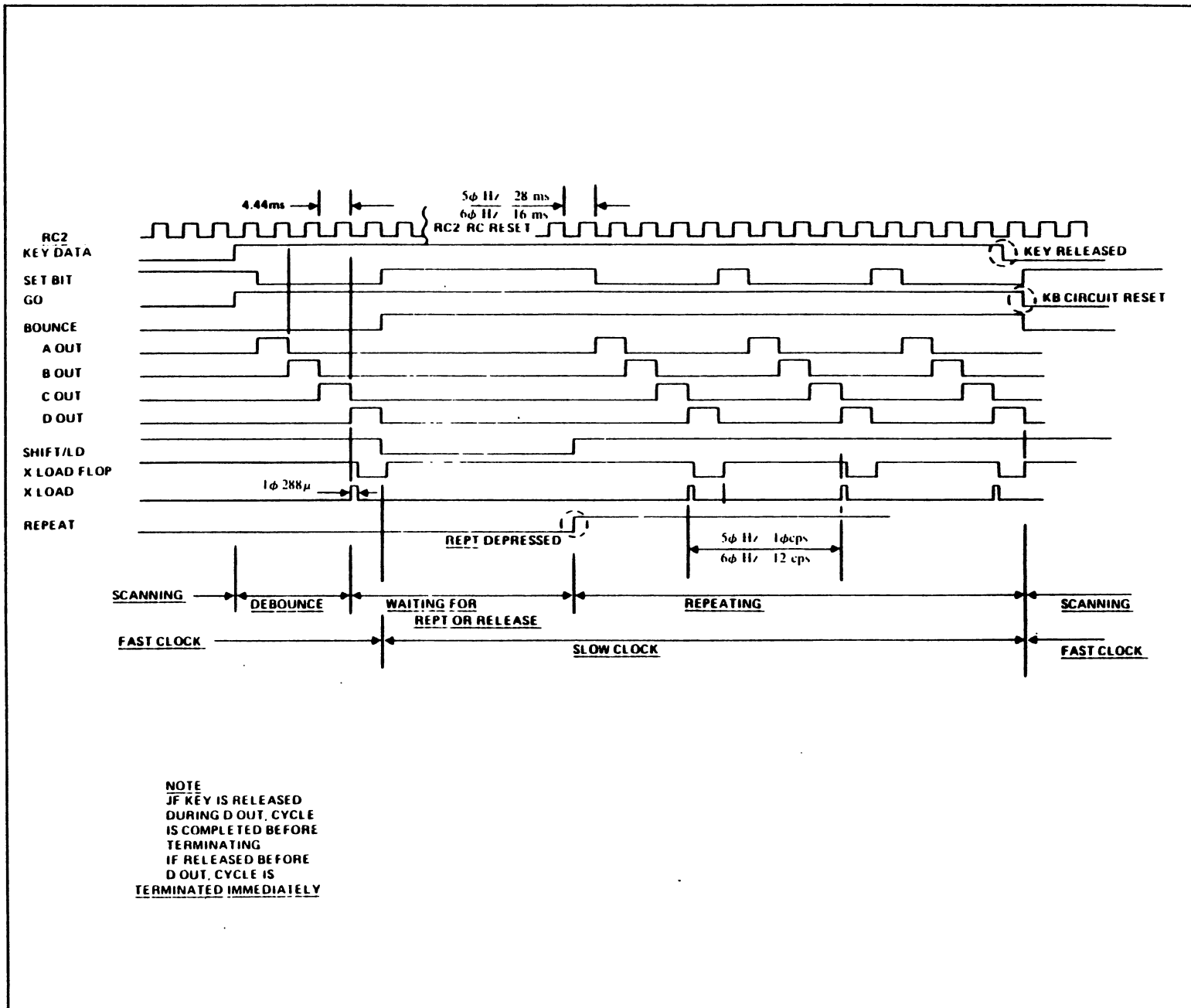
When no key is depressed, KEY DATA is high and KBCLK cycles the counter, and bounce logic holds BOUNCE high. When a key is depressed and then the corresponding code appears on lines KC1-KC7, KEY DATA falls, preventing generation of further KBCLK pulses so that the code is held on KC<sub>n</sub> lines. KEY DATA also causes GO to rise causing bounce logic to count 900Hz RC0 pulses until a fifth pulse has completed a 5.56-msec delay period.

At the end of the key-bounce delay period, BOUNCE becomes true, inhibiting further counts of RC0. If the key is released, KEY DATA immediately rises and counter cycling resumes. If the key is held down for more than 1/2 second repeat will set. Repeat and the high BOUNCE signal permits RCRESET pulses (at the AC power line frequency) to clock the bounce delay period, generating the GO signal at a rate of 12.5 characters per second at 60-Hz, or 10 characters per second at a 50-Hz line rate. Consequently, the character is repeated at that rate until the key is released.

The term THRE limits the repeat rate if the period of the selected baud rate creates a character time longer than the repeat cycle.

When the CTRL (control) key is pressed, bits KC6A and KC7A are forced to zero, forcing any generated code into column 0 or 1 of the USASCII code chart. Bit KC5A selects either

Figure 4-10. Keyboard Logic Timing



column 0 (when false) or column 1 (when true). For example, when the "2" key is pressed (0110010) along with CRTL, the effective code becomes control code DC2 (0010010).

With either SHIFT key depressed, bit 6 (KC6A) is inverted to select upper-case alpha characters (USASCII column 4 or 5, instead of column 6 or 7). Also, INVERT 5 selects codes in USASCII column 2 instead of column 3, to encode the "upper-case" symbols on numeral and symbol keys. Terms COL2 and COL3 identify those codes in the shift logic. Row 0 codes in columns 2 and 3 (SP and 0) are excluded from this action because they have no "upper-case" functions.

The CAP LOCK key is used when lower-case alpha characters are not needed. When CAP LOCK is on, use of the shift key has no effect on alpha keys. Lower-case alpha codes are encoded in USASCII columns 6 and 7. Therefore, the gated term KC6/KC7 causes INVERT6 to maintain upper-case codes without use of the SHIFT key. Other codes in columns 4 through 7 are identified by KC7/SHIFT EN which permits normal shifting up and down.

The BREAK key is depressed to signal the computer that the operator wishes to terminate data transfer. The Break function is maintained for as long as the key is held down. The signal BREAK appears at interface control logic where it forces the primary data transmit line to the "space" state if the unit is transmitting, or forces the secondary transmit line to the "mark" state if data is being received and the interface is in the secondary-channel mode of operation.

When the CLEAR key is pressed, and the SHIFT key is also depressed (SHIFT EN); KEY CLR will clear keyboard lock logic, the refresh memory, and interface control logic.

The HERE IS key activates an optional Answerback function which causes a unique, fixed message to be sent to the computer. The message, up to 32 characters long, is contained in a PROM device. Either the level from the HERE IS key, or an ENQ command received from the computer, causes the IDENT signal to activate logic on the

Answerback board.

Keyboard lock logic (sheet 5) permits the computer to enable or disable the keyboard logic. The KBLOCK signal is set-enabled locally by KEY CLR, or by the decoded UNLOCK command, and reset-enabled by the decoded LOCK command. Keyboard lock logic by CC80, KBLOCK prevents DOIT from generating GO, inhibiting any keyboard action. A switch can disable KBLOCK regardless of received LOCK commands.

#### 4.3.11 Beeper Logic

Beeper logic (sheet 12 of the logic diagram) produces an audible signal as a near-end warning. The signal that drives the speaker is the character row rate LC2, which has a rate of 2025 Hz.

The one-shot is triggered when a BEL code is received at the I/O interface.

Because a read-back operation (for testing only) is initiated by BEL code, the term READ is used to disable the one-shot so that the BEL code cannot cause the audible signal.

#### 4.3.12 Data Receiver and Command Decoder Logic

This logic (figure 4-11, schematic 6 and 13) receives data from the computer through either a standard RS232 interface, or a current loop interface. Serial data is received through the RS232 interface by an RS232 receiver which sends the data to an OR circuit which also receives data from the current loop receiver.

The received serial data, from whatever source, it clocked into the UART by RECV CLK (at the selected baud rate). In the UART, each received character is stored and presented in parallel-bit form to latches, with the most-significant bit appearing on the IN7 line. (IN8 is not used in the ADM 5).

The character stored in the UART is clocked into latches by INPUT as DATA RDY is output by the UART (unless ERASEF inhibits INPUT). INPUT rises when DATA RDY is present and CC6 occurs. Then LCCLK turns on DOIT, which remains on for the next

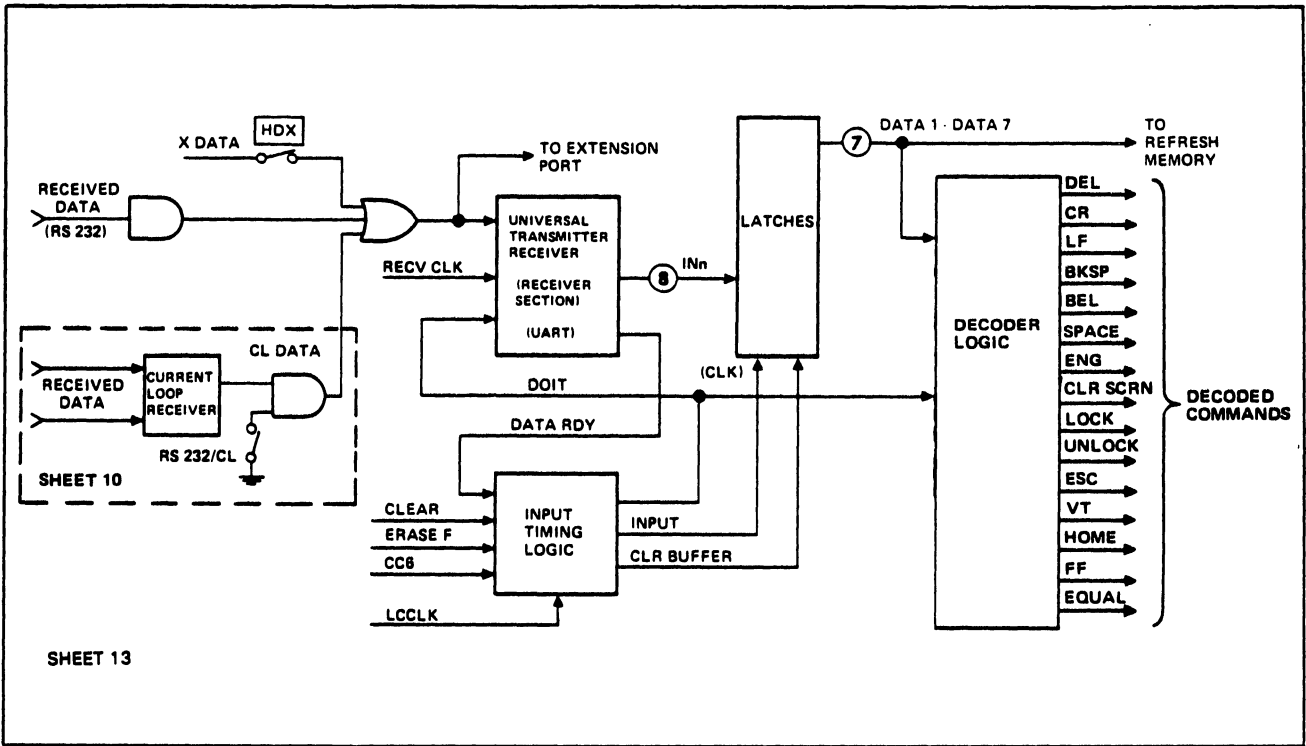


Figure 4-11. Data Receiver Logic and Command Decoders

full horizontal scan period during which the last received command is executed.

The data character stored in the latches is decoded to obtain the different control command signals. The three least-significant bits are used as chip-enable codes and are made effective by DOIT. Consequently, control commands are not effective until execution time.

The current loop receiver is a bipolar circuit and responds to current in either direction. The receiver comprises a rectifier/limiter which drives an optical coupler, and a single-transistor amplifier driven by the optical coupler. If the RS232/CL switch is open, the amplifier output appears at the OR logic that furnishes the UART input.

A third input to the OR logic is data being transmitted from the ADM 5 (XDATA) and appears in the HDX (half duplex) switch is closed.

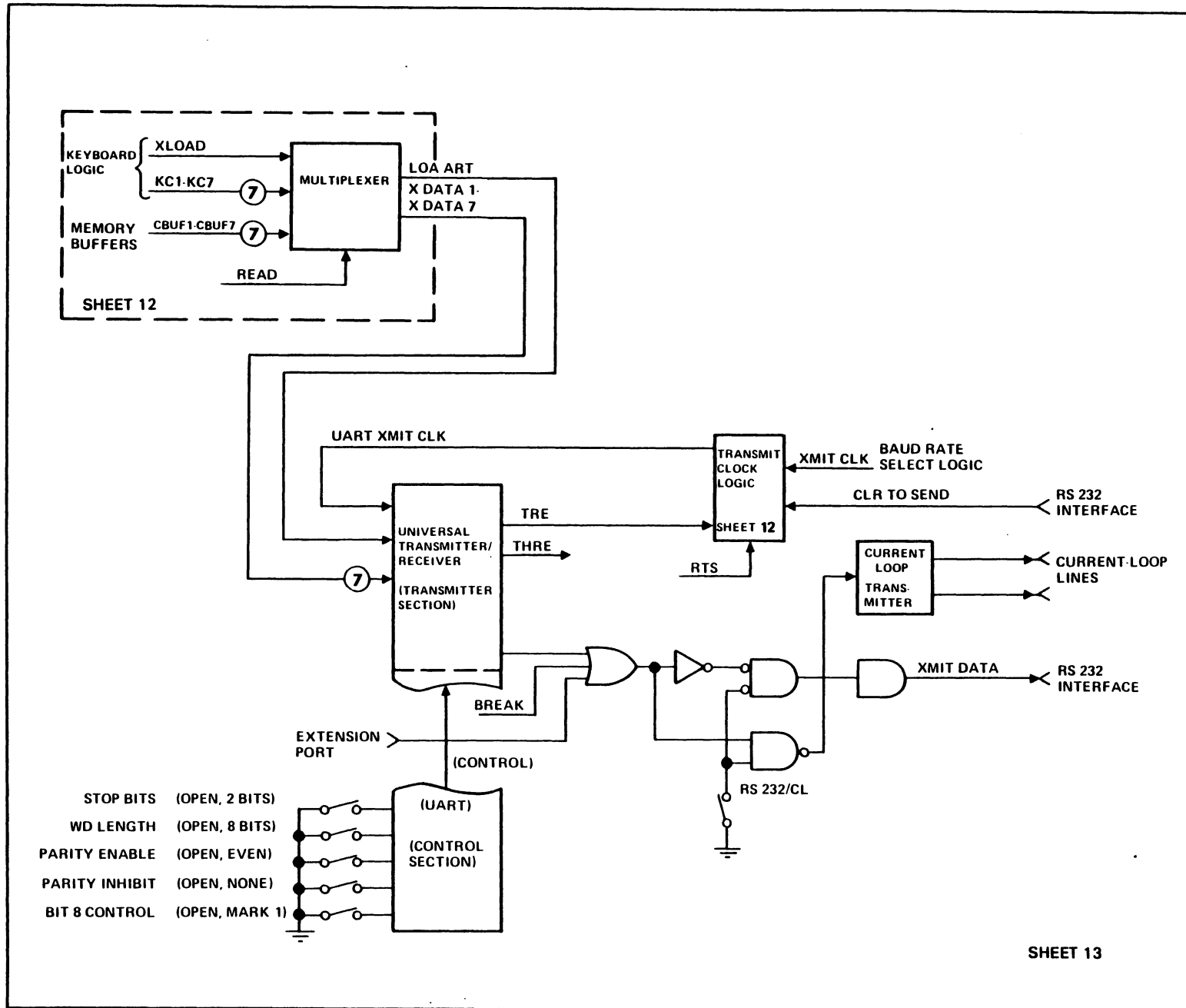
### 4.3.13 Data Transmitter Logic

Data transmitter logic is shown in Figure 4-14 (schematic sheet 13). Data that may be applied to the transmitter section of the UART are:

- Keyboard characters  $KC_n$ , and the XLOAD signal from keyboard logic, when READ is false (normal operation).
- Characters of the answer-back message, applied through  $KC_n$  lines, when the answer-back option is included in the ADM 5, and READ is false.
- The contents of the refresh memory buffer (CBUF $_n$ ) when READ is true (in read-back test operation).

The UART XMIT CLK that clocks the UART is the gated XMIT CLK selected at baud rate select logic and is 16 times the baud rate. The UART is loaded from XDATA $_n$  lines by LOA ART, which is normally high.

Figure 4-12. Data Transmitter Logic, Block Diagram



SHEET 13

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The UART XMIT CLK is enabled when CLR TO SEND appears at the interface, and further controlled by TRE. TRE and THRE are output by the UART. THRE falls when XDATA loads the holding register in the UART. If the serializer (which is loaded from the holding register) is empty, TRE is high. With the holding register full and the serializer empty, the UART automatically transfers the character into the serializer. At this time THRE rises, ready to accept the next character, and TRE falls to indicate that the serializer is busy. Both THRE and TRE are high when the UART holds no data.

Transmit clock logic is reset when TRE is high and there is no Clear to Send (CTS) signal from the interface.

Five switches permit formatting the transmitted character. First transmitted is always the Start bit, followed by the seven data bits (LSB first). The parity bit, odd or even, then follows (if enabled); followed by one or two Stop bits.

The serial bit stream is ORed to transmitter circuits through a gate which also receives data which may appear (from another device) at the extension port.

If the BREAK key is depressed, the XMIT DATA line is forced to the high (SPACE) level.

Data is sent through either the RS232 or current loop interface, depending on the position of the RS232/CL switch. The RS232 interface comprises a simple driver. The current loop interface uses an optical coupler to couple the TTL data to an amplifier, and then through a diode output network to the current loop.

The optical coupler electrically isolates the current loop transmitter from the ADM 5. One leg of the current loop may be tied through a resistor to + 12V DC to create a current source. As an alternative, a ground strap may be used instead of the resistor, to act as a sink for an external positive source, or a current source for an external negative voltage.

#### 4.3.14 Video Blanking and Serializer Logic

Logic that controls blanking during horizontal and vertical retrace time, and converts the parallel-bit ROM outputs to a serial bit stream, is shown in figure 4-13 and logic sheet 9.

Horizontal blanking is accomplished by ICC80 and CC7 clearing the CBUF latches.

Terms RC24/31, and LCCLK control blanking for row counts of 24 and higher.

During a read-back test operation, READ blanks the video but permits sending CBUF<sub>n</sub> data to transmitter logic.

The video serializer is an 8-bit shift register. Term DC3 loads it with the ROM output character bits every 643 nsec, and the bits are shifted (by CLK) at a rate of 10.8864 MHz. VIDEO BLANK is clocked with a signal from the video serializer to produce VIDEO. VIDEO and CURSOR are exclusive ORed to show when a character is coincident with the cursor it will be in REVERSE IMAGE. The signal is then coupled with the attribute (Reduced Intensity and Reverse Video) circuits to produce MONITOR VIDEO via the "Contrast" potentiometer.

#### 4.3.15 Monitor Drive Logic

The logic (shown on sheet 7 of the logic diagram) generates signals that trigger horizontal drive signal HDRIVE, character position counts are decoded to set HDRIVE false at the count of 32 (CC3 and CC4). HDRIVE is set true one count after the rise of CC7 to start the video retrace period.

The vertical drive cycle is begun by VDRIVE. This signal is generated by decoding character row counts RC<sub>n</sub>, and setting the VDRIVE flip-flop one count after the last character of the last line has been written. The flip-flop is clocked by the HDRIVE signal for the line just completed. VDRIVE is set for a count of 27 for 60 Hz and 32.4 for 50 Hz.

The level 60EN controls timing for 50 Hz or 60 Hz power lines. Refer to figure 4-3 for timing diagrams.

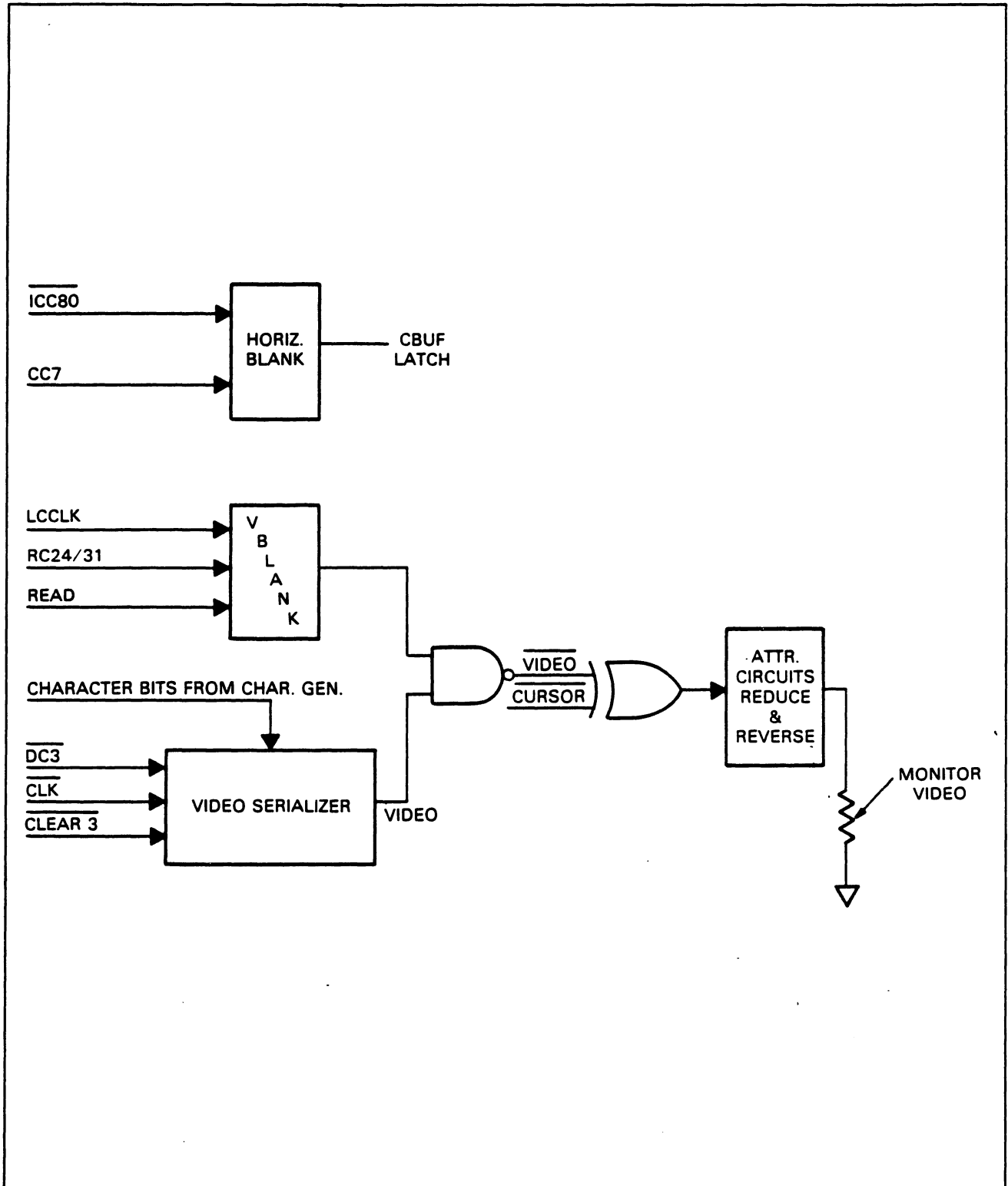


Figure 4-13. Video Blanking and Serializer Logic, Block Diagram



### 4.3.16 Baud Rate Select Logic

Figure 4-14 illustrates the logic used to generate and select baud rates for data transmission and reception. See logic sheet 14.

The basic clock used in this logic is the 3.1104-MHz pulse stream DC1, which originates at the display dot counter. The three binary counters divide pulse rates by 5, 16, and 16 respectively except when 110 baud rate is selected. These rates are obtained from the counters and are selected by means of a BAUD RATE Switch.

When BAUD RATE switch 110 is on, the counters divide the pulse rate by 5, 16 and 11 respectively and CLK9 is the double clock.

The double clock rate is divided by flip-flops to provide the RECV CLK and XMIT CLOCK signals.

### 4.3.17 Interface Control Logic

Interface control logic appears on sheet 15 of the logic diagrams. This controls request-to-send and clear-to-send communications for the ADM5.

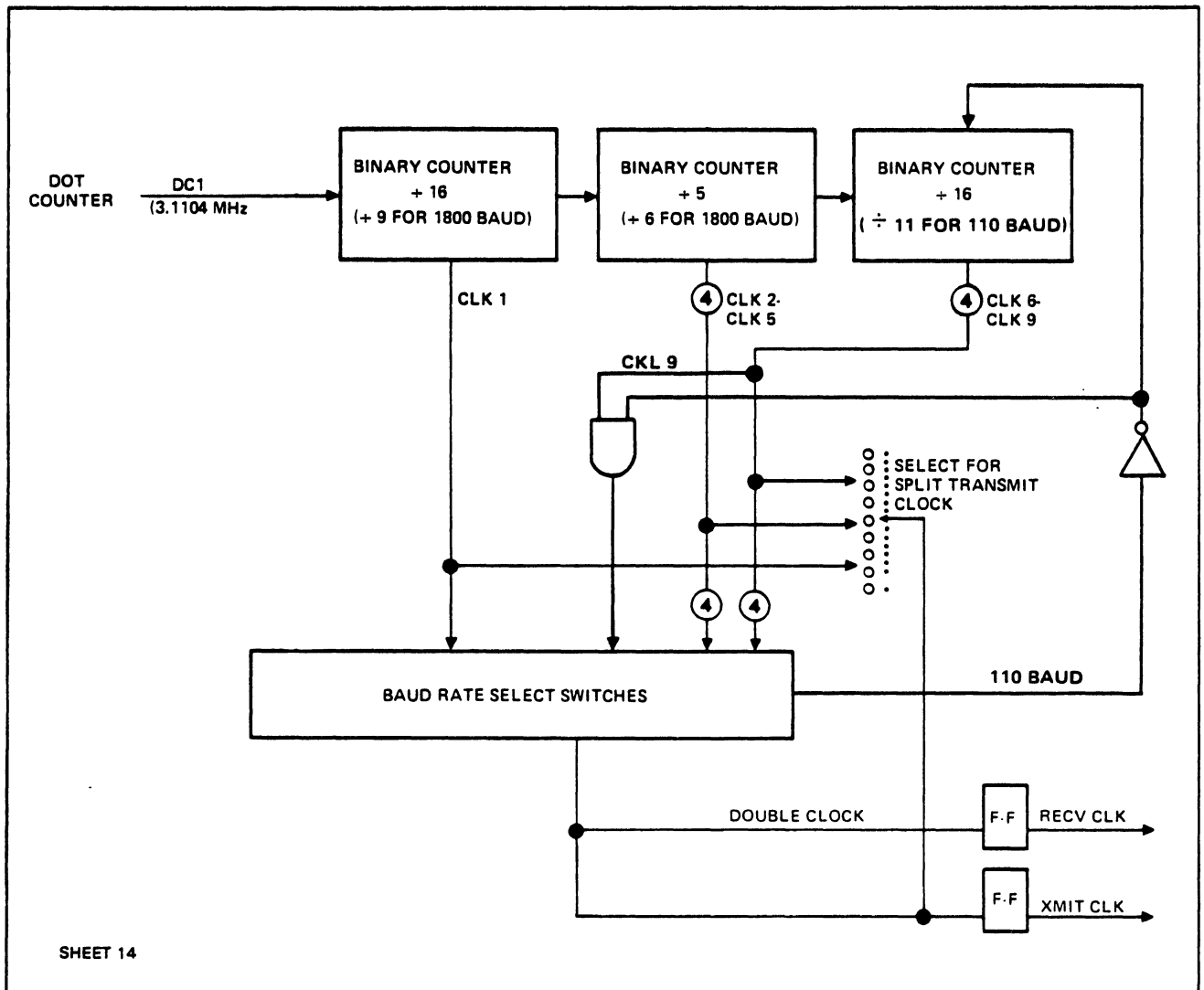


Figure 4-14. Baud Rate Select Logic, Block Diagram

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CLR TO SEND (high) permits data transmission logic to produce UART XMIT CLK, sending data from the ADM 5. If CLR TO SEND falls while a byte is being transmitted, TRE maintains the transmit clock until the byte has been completed, and then falls to shut off the clock and return the line to the marking state.

REQ TO SEND (RTS) may be controlled in any of four ways, as follows:

- a. RTS may originate at an extension port.
- b. If switches 202, 103, and LOCAL are all open RTS remains low all the time.
- c. If only switch 103 is closed, RTS remains high all the time.
- d. If only the LOCAL switch is closed, signals THRE and TRE control RTS. RTS rises to transmit each character, and falls when the character has been shifted out of the ADM 5.
- e. If only the 202 switch is closed, RTS may be controlled through the ADM 5 interface in either code-turnaround, or reverse-channel operation.

#### 4.3.17.1. Code-Turnaround Control

Either an ETX code or an EOT code may be selected to initiate turnaround, depending on the position of the ETX-EOT switch. When the selected code appears in the input data, LATCHED CODE is set. When CARRIER DETECT falls (figure 4-15), indicating that the remote end of the line has dropped, RTS is set.

RTS is reset when ETX or EOT is again decoded, and the logic switches to the received mode. Following a turnaround command, no further command will be recognized for approximately 250 msec. This interval gives the modem time to propagate its signals. The interval is timed-out by two flip-flops and a counter, and the signal SBEN controls resetting of the RTS.

#### 4.3.17.2 Reverse-Channel Control

In reverse-channel operation RTS is controlled by SEC RECV DATA (SB) and CARRIER DETECT (CF) from the modem.

When SB goes low, RTS is unconditionally reset (figure 4-16), switching the interface to receive data. In normal reverse-channel receive operation, CF is high at this time, causing SEC XMIT DATA to rise.

When the remote end of the line raises SB, and then drops its RTS (and CF), the ADM 5 turns on its RTS. The ADM 5 will then ignore further commands for a 250-msec period while the modem propagates its signals.

#### 4.3.18 Attribute Logic

The Attribute Logic for Reverse Video and Reduced Intensity is logic sheet 16. Logic sheet 8 shows the sequence timing for the ESC function which generates the attributes logic. ESC G (HEX 47) when decoded sets the reverse video or restores the standard video. ESC ( (HEX 28) restores standard video intensity and ESC ) (HEX 29) sets the reduced intensity logic.

#### 4.3.19 Program Mode Logic

The program mode logic is shown on logic sheet 12. This logic allows control codes entered from the keyboard or received from the host computer to be displayed. The terminal does not execute the control operations specified while in the program mode of operation. The program key signal is debounced and is then used to clock a D type flip-flop which enables the control characters to be displayed. The INTERP signal prevents the execution of the control operations.

#### 4.3.20 Keyboard Lock Logic

The logic for the keyboard lock/gated function is shown on logic sheet 13. With the switch S4 in the lock position the keyboard will be locked out after a CTRL O signal either from the keyboard or the host. A CTRL N from the host only will unlock the keyboard. With S4 in the gated position the GATED EXTENSION PORT is enabled. A CTRL N enables the extension port and a CTRL O disables the extension port.

#### 4.3.21 Power Supplies

AC power is applied to the transformer through the ON/OFF switch on the rear of

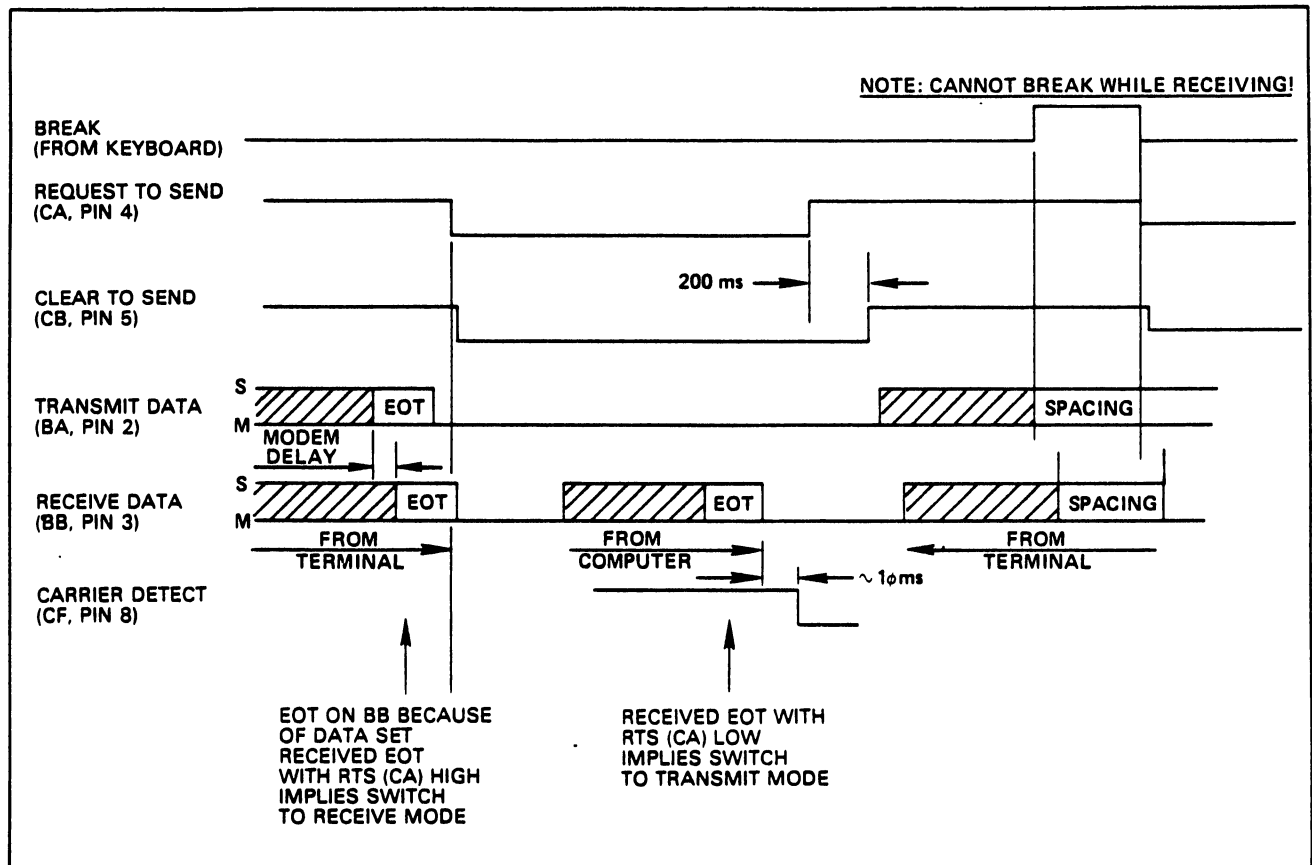


Figure 4-15. Interface Timing for Code Turnaround

the ADM 5. The different stepped-down AC voltage connect to the main circuit board through connectors J1 and J7 (Sheet 17).

Rectifiers, filter capacitors, and voltage regulators are all located on the main circuit board. Three type 7805 devices provide the +5V DC logic supply, and one type 7812 and one 7912 devices furnish 12V DC to operate memory devices and interface drivers.

A +15V DC supply required by the monitor is made up of a type 7815 device and a simple transistor shunt regulator. Located at the bottom of the terminal pan is a primary fuse. It is an 8/10 amp Slo-Blo 115V fuse or a 4/10 amp Slo-Blo 230V fuse. Schematics of the various power supply sections are shown on sheet 17 of Section 6.

#### 4.3.22 ADM 5 Answerback (Option)

The ADM 5 answerback option provides the

transmission of a programmed prom message of up to 32 characters in length. This message can be sent by depressing the "HERE IS" key on the keyboard or by the computer command "ENQ". The message is stored in a read only memory (ROM) and is supplied at time of purchase. This message can be also supplied by Lear Siegler Customer Service.

#### 4.3.23 ADM 5 Extension Port Current Loop (Option)

The extension port of the ADM 5 provides an auxiliary port for interfacing other peripheral devices in a loop through or daisy chain environment.

The addition of current loop to this port adds to the flexibility and allows more devices to hook up in this manner.

The transmitted data output for current loop

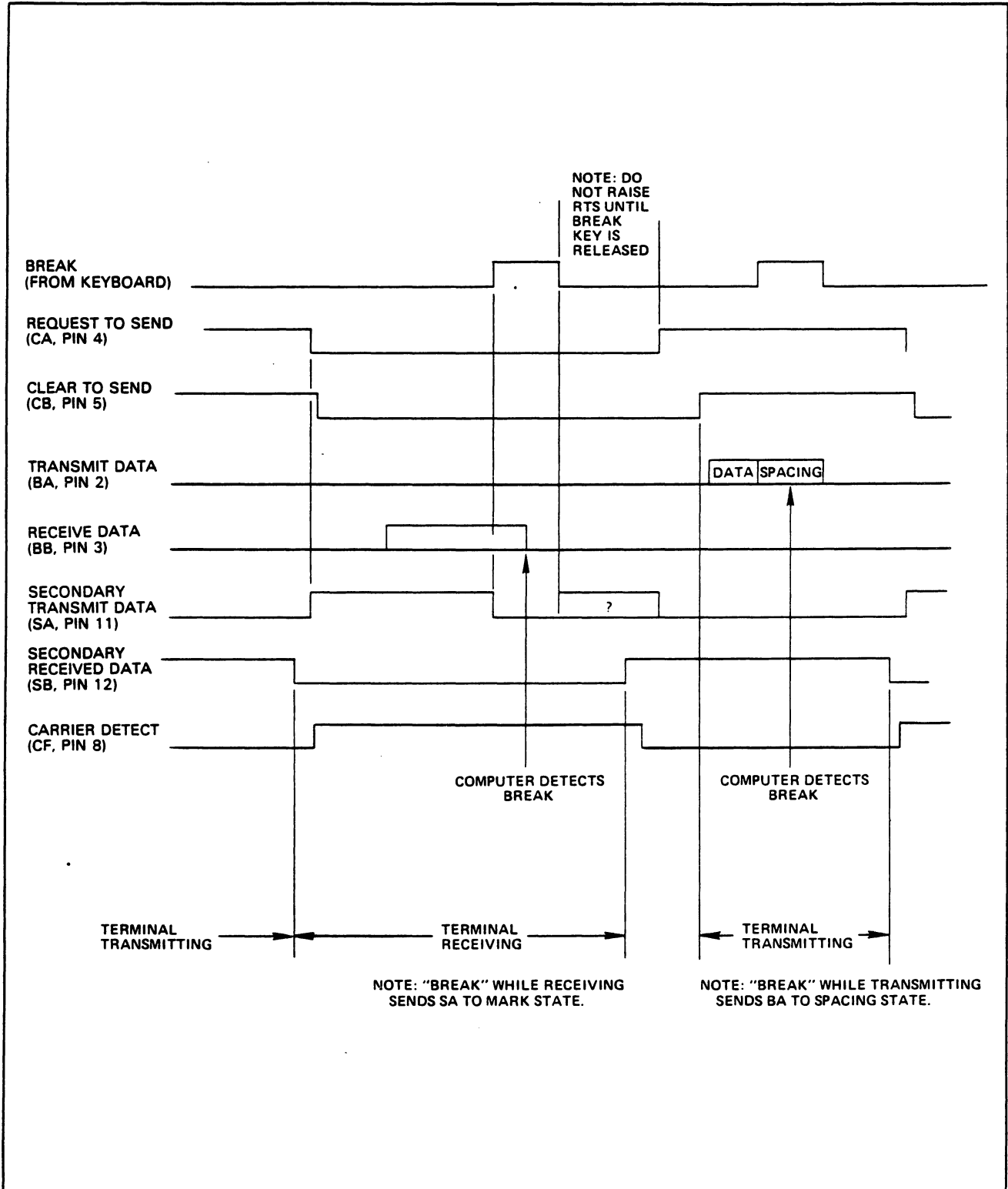


Figure 4-16. Interface Timing for Reverse-Channel Operation

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is on pin 25 of connector J2 and does not supply current (external source). Received data is inputted on pin 2 and is internally grounded (Terminal ground). Note that if this option is installed and nothing is connected to the extension port, the modem port will not operate.



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## SECTION V MAINTENANCE

### 5.1 INTRODUCTION

This section contains information and instructions for performing routine and corrective maintenance for the ADM 5 Video Display Terminal.

The maintenance technician should be thoroughly familiar with the information contained in Sections 1 through 4 of this manual before attempting to perform any of the procedures outlined in this section.

### 5.2 PREVENTIVE MAINTENANCE

The only preventive maintenance required on the ADM 5 is the occasional cleaning of the exterior surfaces, and periodic visual inspections.

The ADM 5 casing should be cleaned using a household cleaner and a paper towel or a soft, lint-free cloth. NEVER use lighter fluid or other petroleum base solvents to clean the casing. Damage to the plastic or painted surfaces could result. Avoid wiping dust into the keyboard and do not let spray cleaner run between the keys.

Periodically, inspect switches and keyboard assembly for freedom of movement. Determine that the intensity of the character trace on the CRT screen has not diminished. Any required mechanical and electrical adjustment shall only be performed by an authorized Lear Siegler service representative.

### 5.3 CORRECTIVE MAINTENANCE

#### WARNING

*Dangerous voltages exist within the ADM 5. Observe all possible precautions when taking measurements, making adjustments to the power supply and CRT monitor, and when installing/removing the CRT.*

#### 5.3.1 Fault Isolation

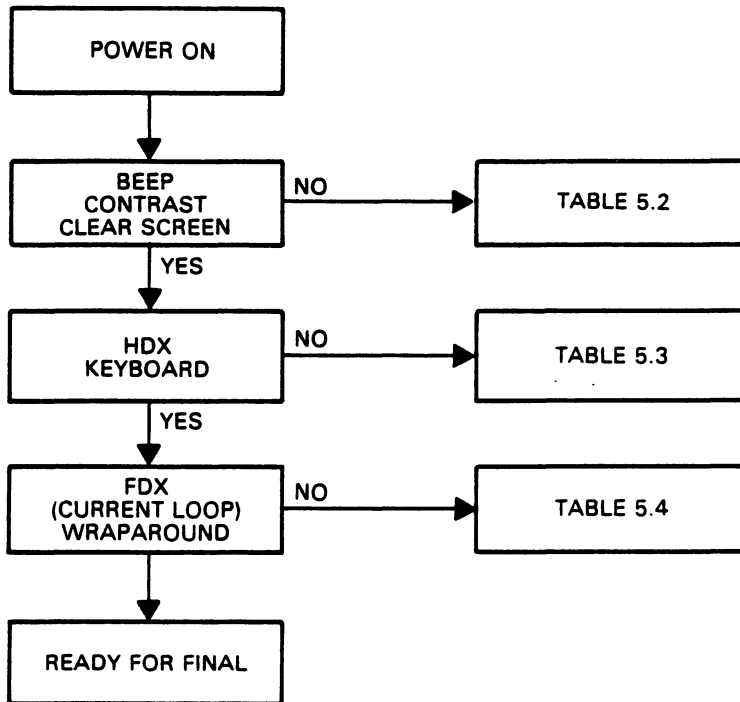
Table 5-1 lists the most probable Power, Off-Line and On-Line problems encountered when operating the ADM 5. Most problems result from improper DIP switch settings, loose or incorrect cable connections, or improper adjustment of controls. Tables 5-2 through 5-4 provide sufficient data to solve such problems.

#### 5.3.2 Failure Analysis

Troubleshooting of the ADM 5 is straightforward and conventional. Suggested steps in troubleshooting are:

- a. Get the facts. Learn the state of the machine when the malfunction occurred. Look for operator error, blown fuses, or modem or computer failure.
- b. Operate the ADM 5 to determine which functions have failed. For example: Does it receive but not transmit? Has a single function (like Clear Screen or Backspace) failed? Intelligent use of this information will speed fault isolation.

**Table 5-1. ADM 5 Fault Isolation**



**Table 5-2. Beep and Contrast Fault Isolation**

SYMPTOM	FAILURE OR CAUSE
1. No Audible beep	No +5V (check Regulators) Speaker (Connection) Molex connector Beep (logic circuit)
2. No Cursor, No Raster	Monitor Control Board 15 volt filament supply (7815 Reg) Bad Connection 5 Volt Regulators T.V. Sweep signals (J7) CRT Yoke
3. Raster, No Cursor	Monitor Control Board Bad Connection No Video (J7-4) Bad Pot.
4. Six cursors displayed on screen	Vert. Freq. Adjust
5. Screen Flickers	Connector loose, wrong refresh rate
6. One or two characters displayed	RAM's (2114)



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**Table 5-3. HDX Keyboard Fault Isolation**

<b>SYMPTOM</b>	<b>FAILURE OR CAUSE</b>
1. No Keyboard Control	Baud Rate (XMIT, CLK or RECV CLK) UART Keyboard lock circuit
2. Prints double & triple characters (Multiple strobe)	Bad keyboard (dirty contacts) Keyboard mod. not installed
3. Sluggish or sticky keys	Flux or sticky material on key plunger (Clean with fine or light oil).
4. Certain keys not printing	Bad key contacts
5. Prints wrong character; should be "A" "B" "D" "H" "P" "1" for odd and even rows	RAMS Keyboard inputs (KC1 through KC7) XMIT DATA MUX (U144 or U128) Recv Buff (U126 or U143) Character Gen.
6. Characters Changing	RAM's Character Gen.
7. Wavy lines or Jittery screen	15V power supply, MDA970 Monitor Control Board
8. Bad Focus	Horizontal Linerarity Sleeve

**Table 5-4. FDX (Wraparound Plug) or Current Loop Fault Isolation**

<b>SYMPTOM</b>	<b>FAILURE OR CAUSE</b>
1. No Character on Display RS232	1488's or 1489's (Modem connector pin 2) RTS to CTS (Modem connector pin 4 and 5) Modem configuration switch
2. No Character on Display Current Loop	MCT2 2N3904
3. No receiving at 19.2k or 9600 baud in current loop	Wrong value resistor in receive circuit of current loop.

- c. Isolate the cause of failure to a specific module (for example, to the CRT, a keyboard row, the flyback assembly, or the main circuit board).
- d. Replace the failed module or component and test by running the ADM 5 in the same mode of operation in which the failure occurred.
- e. Record the symptoms, cause, troubleshooting procedure, and mode of repair for future reference.
- f. After warmup, the cursor should appear at its "home" position (over the first character position of the top character row), with no data in the unit. If it does not, enter data from the keyboard (with the HDX/FDX switch in the HDX position) and see if it appears on the screen. If it does not, proceed to check power supply voltages, intensity and contrast control settings, clock and display counter operation, monitor sweep drive signals, and monitor video and drive circuits, in that order.
- g. To verify operation of transmitter logic, simply see that data generated at the keyboard appears on the screen (HDX/FDX switch in the HDX position only!). This checks all transmitter logic except for the input NOR gate at 8B-4, the inverter at 7B-10, and the driver at 9A-3. To check FDX operation, position the HDX/FDX switch in the FDX position, short pins 2 and 3 at connector J4, and type on the keyboard. Characters should appear on the CRT screen, if not, the logic board is suspect.

## 5.4 ADJUSTMENTS

All adjustments in the ADM 5 are associated with the CRT monitor. Either a Zenith or Samsung monitor may be provided in your ADM 5 (to determine which, lift the cover and the brand will be visible on the monitor). Troubleshooting and adjustment instructions are provided in Section 6 for Zenith and Samsung monitor assemblies.

## 5.5 REMOVING AND REPLACING MONITOR CRT AND SUB-ASSEMBLIES

### WARNING

*Be sure to discharge anode voltage to ground before attempting to remove any monitor subassembly or CRT.*

The monitor assembly is comprised of the CRT with its aluminum mounting ears, the flyback assembly, and the circuit board.

### 5.5.1 Removing and Replacing CRT

To remove the CRT, proceed as follows:

- a. Remove connector from the base of the CRT.
- b. Remove the anode connector from the right surfaces of the CRT.
- c. Using the appropriate tool loosen the metal clamp around the back of the yoke assembly.
- d. Disconnect yoke wires from the monitor control board.
- e. Using a 5/16" socket or wrench, loosen the clamps at both sides of the CRT frame until the clamps can be turned to clear the CRT frame.
- f. Grasping the CRT securely, lift it upwards and out of the ADM 5 cover and set it aside.
- g. Remove yoke assembly from neck of CRT.

To install a new CRT, follow the preceding steps in reverse order.

### 5.5.2 Removing and Replacing Flyback Assembly (not applicable to Samsung monitors)

To remove the flyback assembly, proceed as follows:

- a. Disconnect anode connector from CRT.
- b. Disconnect Molex connector that connects flyback assembly to the monitor control board.
- c. Using a 1/4" socket, loosen the two hex screws that clamp on flyback assembly to the monitor control board mounting plate.
- d. Lift flyback assembly upwards until it clears the mounting plate, then remove assembly from the cover.

To install a new flyback, follow the preceding steps in reverse order.

### 5.5.3 Removing and Replacing Monitor Control Board

To remove the monitor control board, proceed as follows:

- a. Disconnect all Molex connectors from the monitor control board.
- b. Remove the flyback assembly (if applicable), refer to the previous steps. (or remove mounting hardware).
- c. Slide the circuit board from the slots in the molded cover and remove.

To install a new monitor control board, follow the preceding steps in reverse order.

## 5.6 TROUBLESHOOTING THE MAIN CIRCUIT BOARD

Troubleshooting of the main circuit board is based essentially on the principles outlined in Corrective Maintenance - that is, the technician must be equipped with suitable test equipment. With the ADM 5 cover opened, all components on the main circuit board are accessible to probes and other test devices. Components are generally identified on the board, but reference may be made to the component layout drawing, and the logic diagrams. Table 5.5 lists connectors on the board and defines all terminal assignments. Note: Component level troubleshooting of main logic board should be done only by trained personnel.

## 5.7 REMOVING AND REPLACING THE MAIN CIRCUIT BOARD

To remove the main circuit board, proceed as follows:

- a. Remove external cables from connectors J3 and J4 at the rear of the ADM 5.
- b. Remove all cable connectors from the upper surface of the circuit board.
- c. Lift circuit board straight upwards to clear the guide pins, then remove from the base.

Note that there are no fasteners to hold the circuit board, which is kept in place by the two steel guide pins and the closed cover. Replace the circuit board by performing removal procedures in reverse order.

## 5.8 REMOVING AND REPLACING KEY SWITCH CONTACTS

The tools required to remove the key switch contacts from the keyboard are:

soldering iron (low temperature)  
wicking device  
short-nosed needle-nose pliers with serrated jaws

The procedure is as follows:

- a. Remove the solder from the contact (dewick) with a low-heat soldering iron so as not to damage circuit pads. The contacts will protrude about 1/32" beyond the back of the logic board. Make sure that the contacts are completely free of any solder by moving them with the needle-nosed pliers; the contacts should move freely.
- b. Turn the board over so that the keyboard is up.
- c. Remove the key top whose contacts need to be replaced.
- d. Use your fingers to apply upwards pressure to the unsoldered contacts, and push the key retaining tangs inward with the needle-nosed pliers. The key will pop free of its mounting bracket.
- e. Place the new key assembly into the

mounting plate, pushing downward until the key retaining tangs snap into position; turn board over and solder contacts.

f. Replace key top.

**Table 5-5. Main Circuit Board Connector Terminals**

CONNECTOR/SYMBOL	PIN	SIGNAL
RS232 Interface (J6)	1	Equipment Ground
	2	Transmit Data (BA)
	3	Receive Data (BB)
	4	Request to Send (CA)
	5	Clear to Send (CB)
	6	Data Set Ready (CC)
	7	Ground
	8	Carrier Detect (CF)
	9, 10	(not used)
	11	Secondary Transmit Data (SA)
	12	Secondary Receive Data (SB)
	13 - 16	(not used)
	17, 24	Current Loop Transmitter
	20	Data Terminal Ready (CD)
	18 - 22	(not used)
23, 25	Current Loop Receiver	
RS232 Extension (J4)	1	Equipment Ground
	2	Transmit Data (BA)
	3	Receive Data (BB)
	4	Request to Send (CA)
	5	Clear to Send (CB)
	6	Data Set Ready (CC)
	7	Ground
	8	Carrier Detect (CF)
	9, 10	(not used)
	11	Secondary Transmit Data (SA)
	12	Secondary Receive Data (SB)
13 - 19	(not used)	
20	Data Terminal Ready (CD)	

**Table 5-5. Main Circuit Board Connector Terminals (continued)**

CONNECTOR/SYMBOL	PIN	SIGNAL
Low-Voltage AC Power (J5)	1, 2 3 4	Input to +5V DC rectifier Input to 15V DC rectifier Ground
Monitor Low-Voltage AC Power (J1)	1, 2 3, 4, 5	Input to + 15V DC rectifier Ground
Monitor Interface (J2)	1 2 3 5 6 9 10	Ground Vertical drive Video Horizontal drive Ground +15 V.D.C. Ground



---

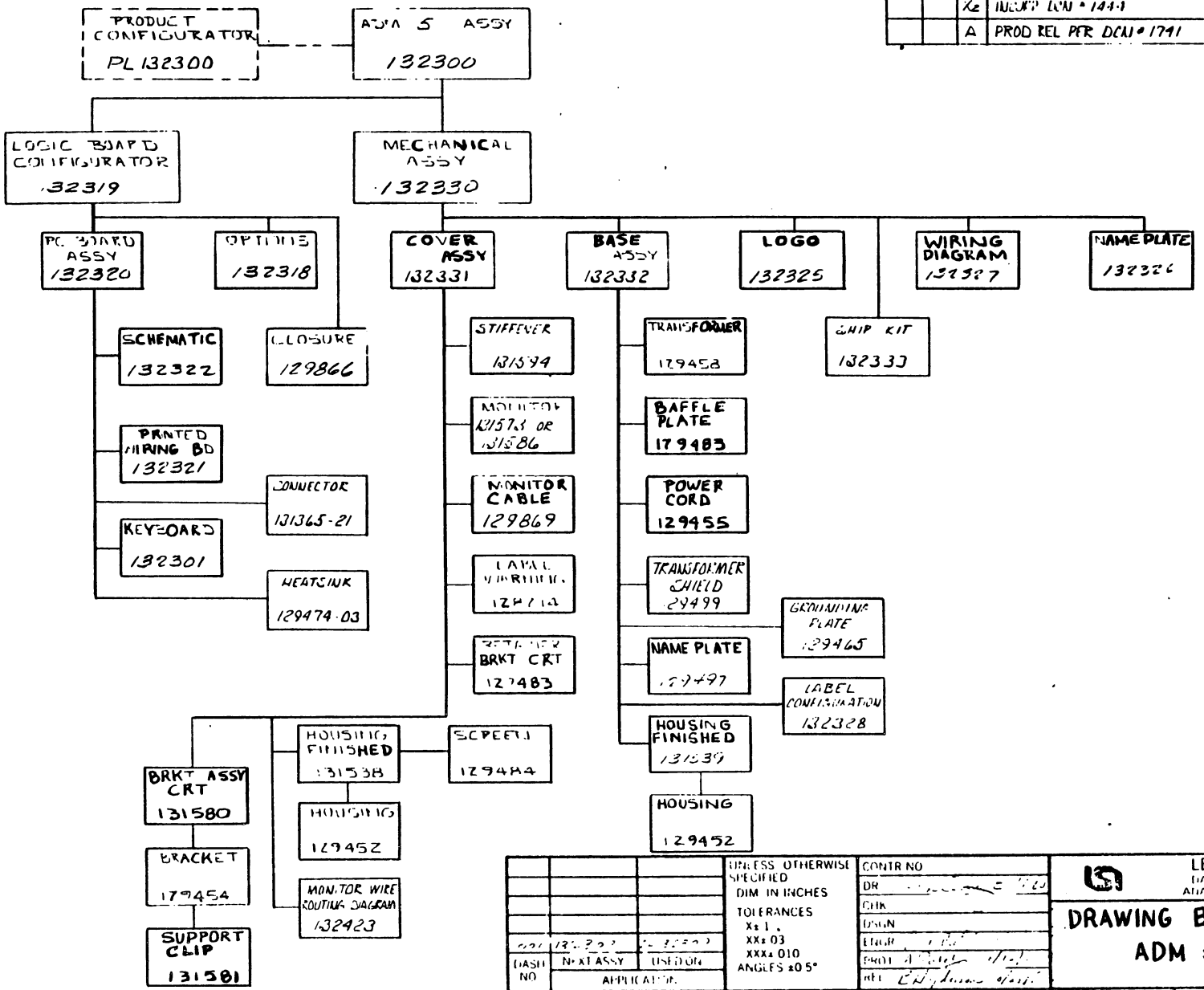
## SECTION VI REFERENCE DRAWINGS

### 6.1 REFERENCE DRAWINGS

The reference drawings required for servicing the ADM 5 Video Display Terminal are included in numerical sequence in this section. These drawings include the schematics, wiring diagrams, and miscellaneous reference drawings, as listed below. Assembly drawings and parts list are contained in Illustrated Parts Catalog DP-719.

Drawing Title	ADM 5 Assembly
Family Tree	132324, Rev. A
Wiring Diagram	132327, Rev. A
Schematic, Main Logic Board	132322, Rev. E
Configuration Control Switch Setting	132329, Rev. B
Zenith Monitor	
Samsung Monitor	

SHT	ZONE	LTR	DESCRIPTION	DATE	APPROV
		1	PILOT REL PER DCAI 1743		
		X2	INCOMP LON # 144-1		
		A	PROD REL PER DCAI # 1741		



UNLESS OTHERWISE SPECIFIED			CONTR NO
DIM IN INCHES			DR
TOLERANCES			CHK
X ± 1			DATE
XX ± 03			ENGR
XXX ± 010			PROJ
ANGLES ± 05°			REV
DASH NO			APD
NEXT ASSY			APPD
APPLICATION			

LEAR SILENT INC DATA PROGRAM		
<b>DRAWING BREAKDOWN</b>		
<b>ADM 5</b>		
SIZE	EST NO	DWG NO
C	98438	132324
SCALE		

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6-2

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6-3

REVISIONS					
SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		X1	PILOT REL PER DC11 1453		
		A	PROD REL PER DCU # 1791		

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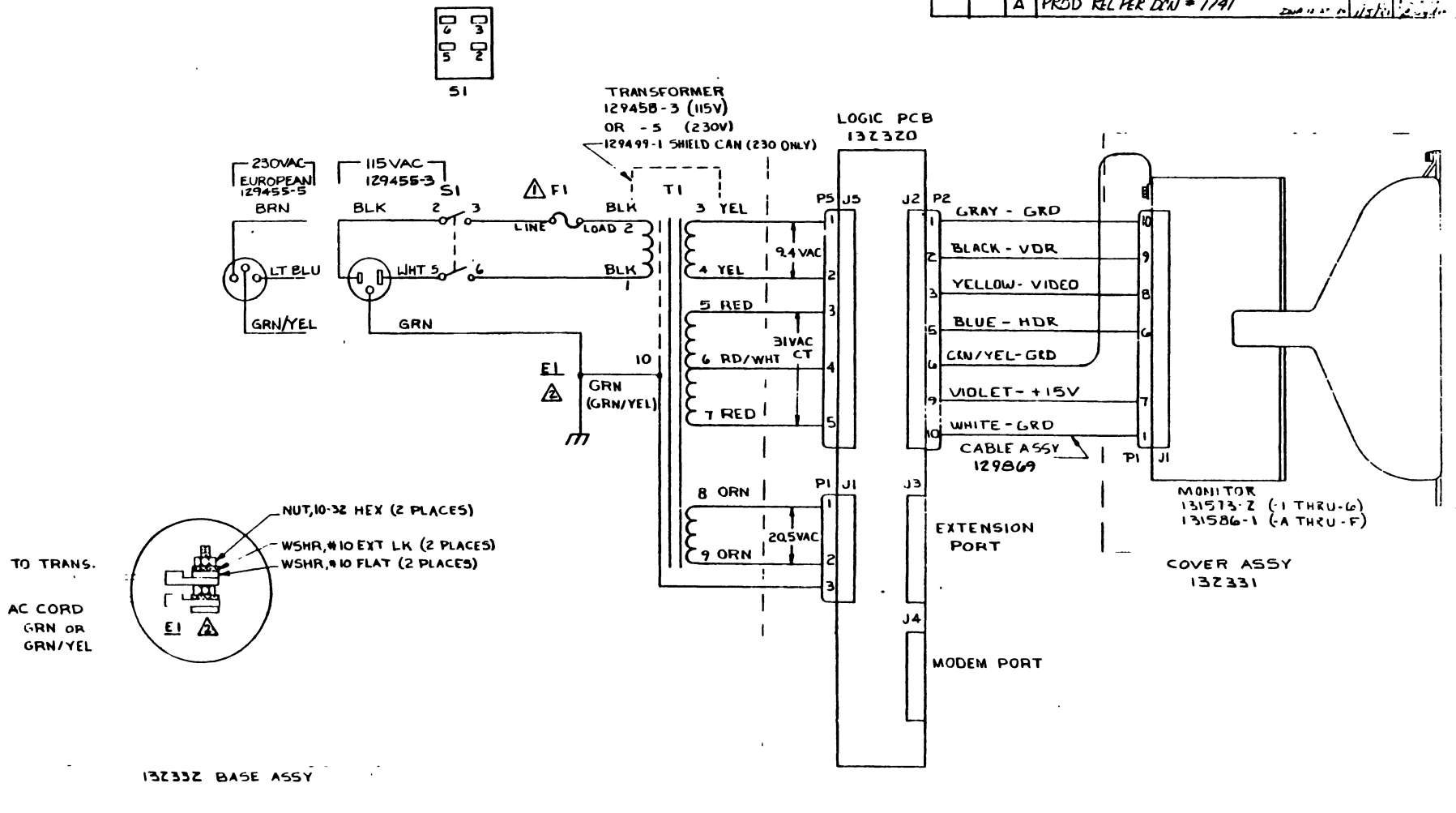
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132332 BASE ASSY

132300 ADM S ASSY

⚠ EI IS STUD ON BOSS OF HOUSING.

⚠ 115VAC - 8 AMP SLO-BLO FUSE  
230 VAC - 4 AMP SLO-BLO FUSE

NOTES UNLESS OTHERWISE SPECIFIED

DASH NO	NEXT ASSY	USED ON APPLICATION
-	132300	DL 132300

UNLESS OTHERWISE SPECIFIED  
DIM IN INCHES  
TOLERANCES  
X ± 1  
XX ± 03  
XXX ± 010  
ANGLES ± 05°

CONTR NO	
DR	<i>P. J. M...</i>
CHK	<i>M. P. K...</i>
DSGN	<i>W. Kelly 10-30-72</i>
ENGF	<i>M. P. K... 10-1-72</i>
PROJ	<i>A. P. ... 10/1/72</i>
REL	<i>P. J. M... 10/1/72</i>

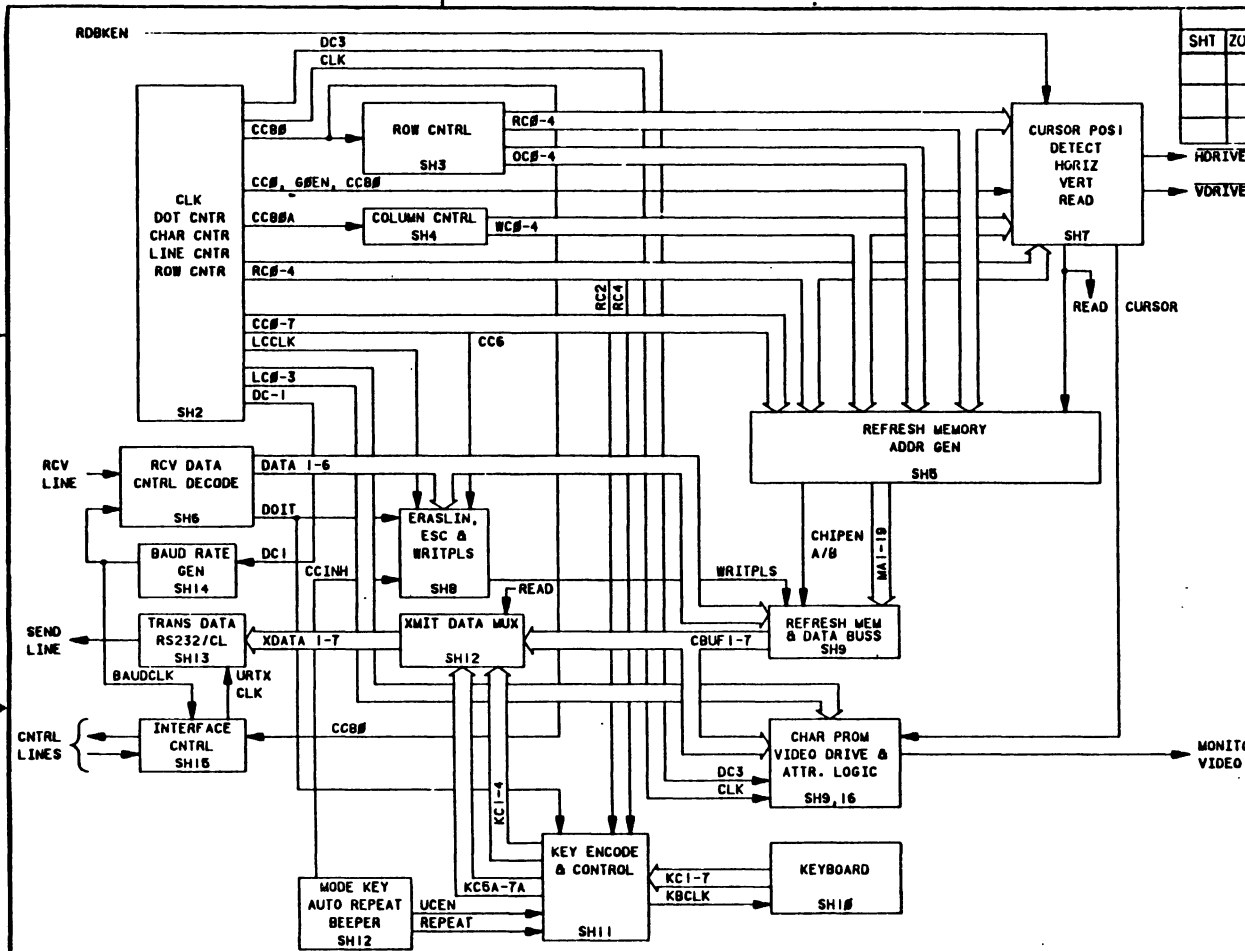
**LEAR SIEGLER, INC**  
DATA PRODUCT DIVISION  
ANAHEIM CALIF. 92803

**WIRING DIAGRAM**  
ADM 5

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APPD	<i>R. De...</i>
APPD	

SIZE	FSCM NO	DWG NO	REV
<b>C</b>	<b>98438</b>	132300-7	
SCALE			



REVISIONS					
SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	RELEASE PER DEN 1551	7.5. 11-2-80	
		B	INCRP D'W #1670		
		C	INCRP D'W #1674		

SEE SHEET 4 FOR REVISIONS

- NOTES (UNLESS OTHERWISE SPECIFIED):
- FOR PRINTED WIRING BOARD 132321-2, ASSY 132320.
  - [XXXX] DEFINES HEXIDECIMAL ADDRESS.
  - CAPACITOR VALUES ARE IN MICROFARADS.
  - RESISTOR VALUES ARE IN OHMS, 5%, 1/4W.
  - PREFIX DEVICE TYPE WITH 74. EXAMPLE: 74LS161
  - DEVICE DESIGNATION INDICATES LOCATION. EXAMPLE: U15
  - DEVICE POWER PINS ARE:  
 FOR 14 PIN -7 (GND), 14 (+5);  
 FOR 16 PIN -8 (GND), 16 (+5);  
 FOR 18 PIN -9 (GND), 18 (+5);  
 FOR 24 PIN -12 (GND), 24 (+5);  
 FOR 1488 ONLY -7 (GND), 11 (-12), 14 (+12).
  - LAST PREFERENCE DESIGNATION USED:  
 C-48 ;CR-13 ;J-7 ;Q-3  
 R-49 ;S-4 ;VR-6 ;Y-1.
  - R31 & CR11 ARE NOT USED.
  - UNUSED GATES  
 L500 U138(1,2,3)(4,5,6) U123(4,5,6)  
 L504 U135(12,13) L508 U127(4,5,6) U102(1,12,13)  
 L527 U42(8,9,10,11) L532 U40(1,2,3)(13,12,11)  
 505(U122(1,2)(13,12) 574(U47) 601(U44(8,9,10) 133(U27))

UNLESS OTHERWISE SPECIFIED		CONTR NO
DIM IN INCHES		DR 7.5. 10-27-80
TOLERANCES:		CHK 1 (Date 10/30/79)
X ± .1		DSGN
XX ± .03		ENGR 10.1. 10.30.80
XXX ± .010		PROJ A.P. 10.10.80
ANGLES ± 0.5°		REL
DASH NO	NEXT ASSY USED ON	APPD
	APPLICATION	APPD

LEAR SIEGLER, INC DATA PRODUCTS DIVISION ANAHEIM CALIFORNIA 92801		
SCHEMATIC DIAGRAM, ADM5		
SIZE	FSCM NO	DWG NO
C	98438	132322
SCALE NONE		

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G-4

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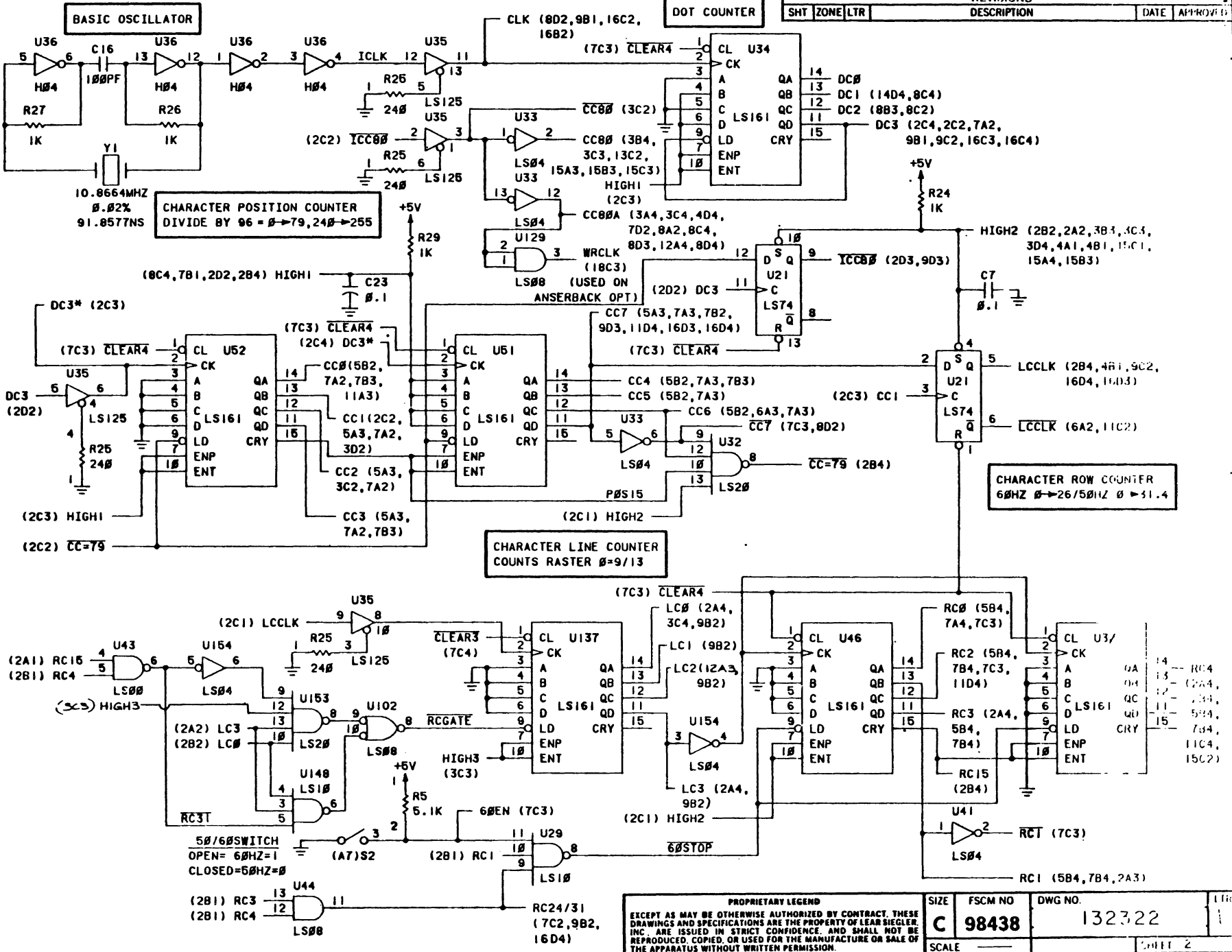
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REVISIONS

SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVED



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SIZE	FSCM NO	DWG NO.	116
<b>C</b>	<b>98438</b>	132322	1
SCALE		SHEET 2	

REVISIONS			DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION	

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132322

132322

132322

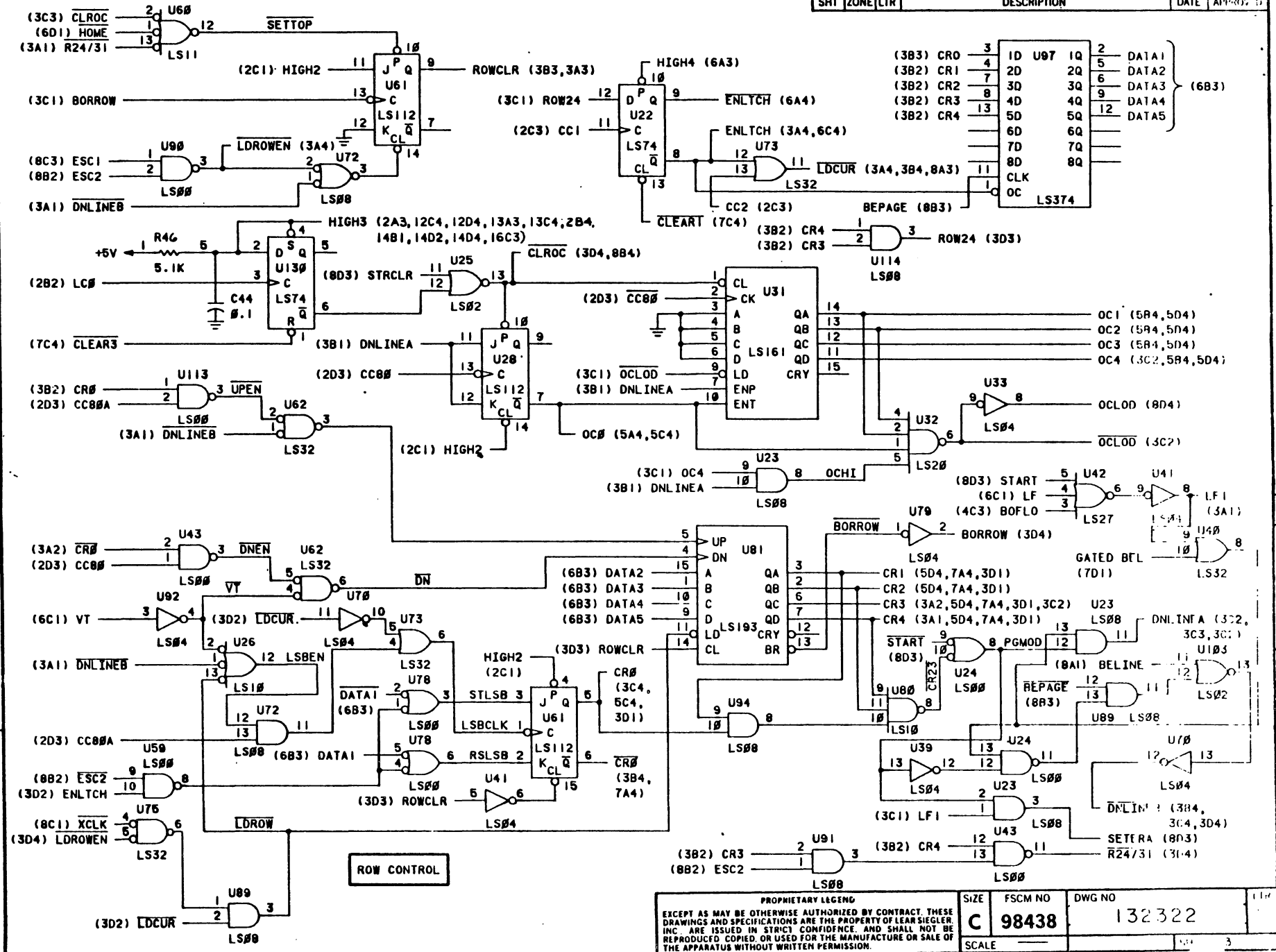
132322

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132322



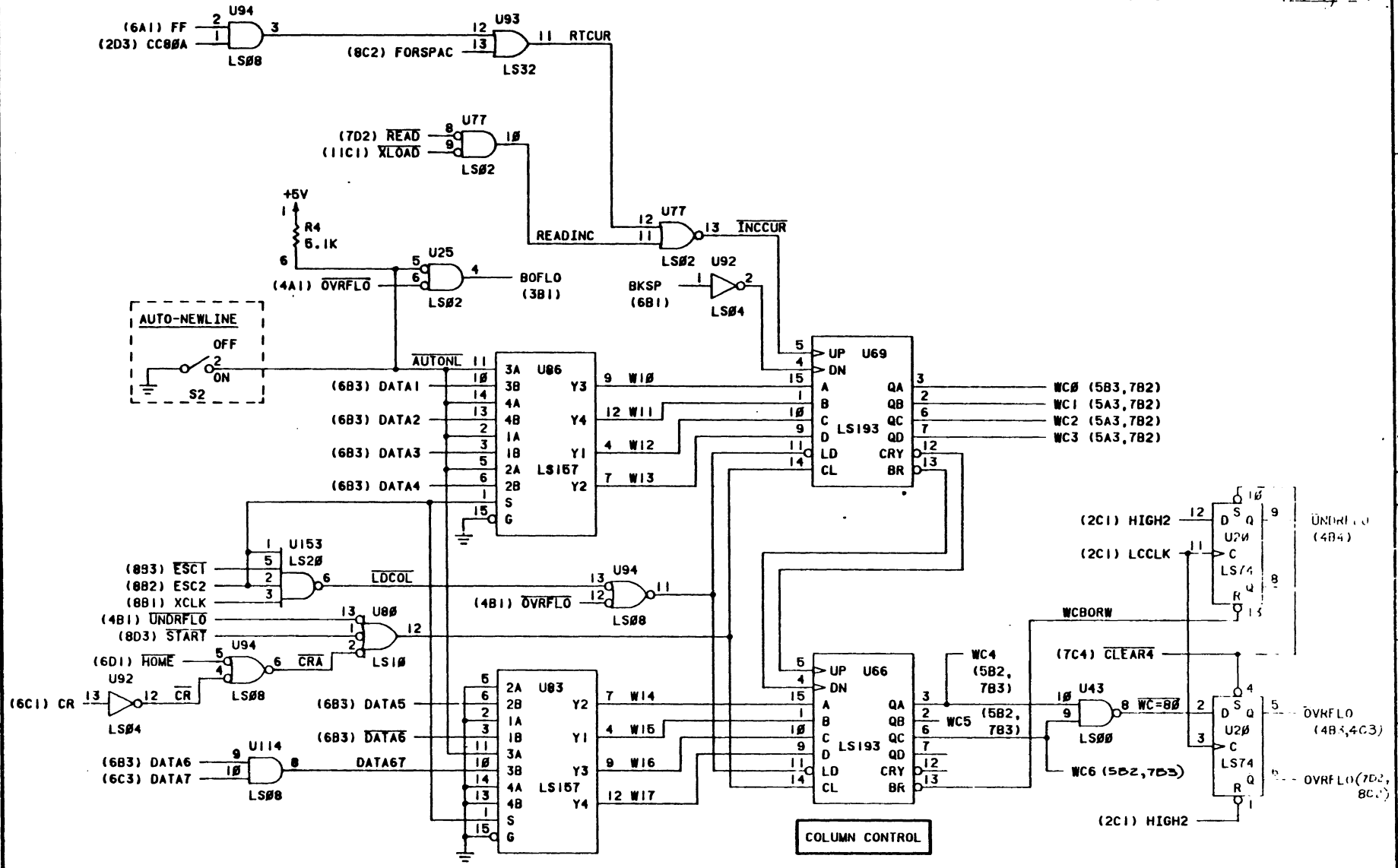
DP319

PROPRIETARY LEGEND		SIZE	FSCM NO	DWG NO	REV
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SCALE					3

DP319

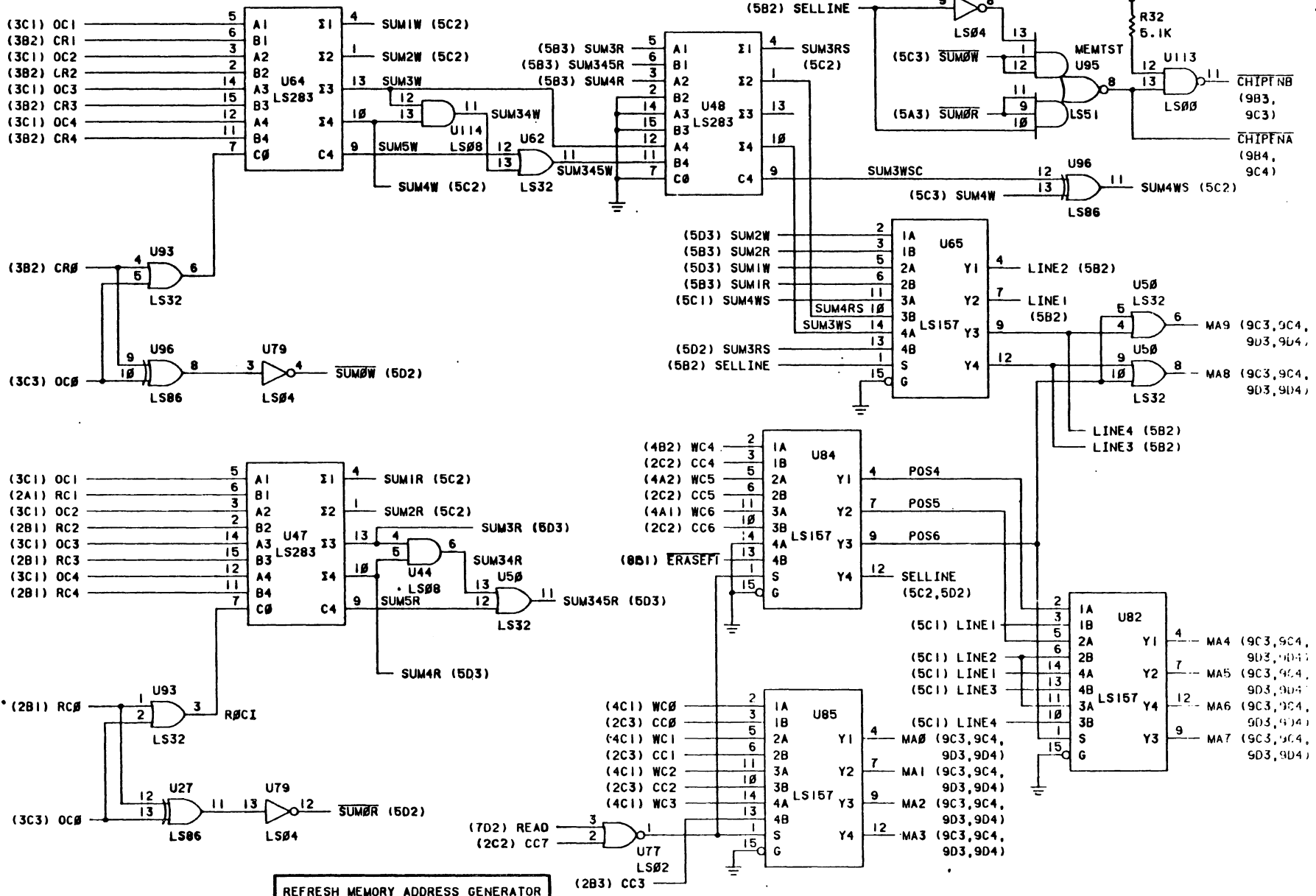
6-7

REVISIONS					
SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		D	INCORP DCN # 2289 D-7750	8-6-81	
		E	INCORP DCN # 2797	8-11-81	



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<p>SCALE</p>						<p>SHEET 4</p>	

REVISIONS				DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION		



REFRESH MEMORY ADDRESS GENERATOR

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SIZE	FSCM NO	DWG NO	LTR
C	98438	132322	1
SCALE		SHEET	

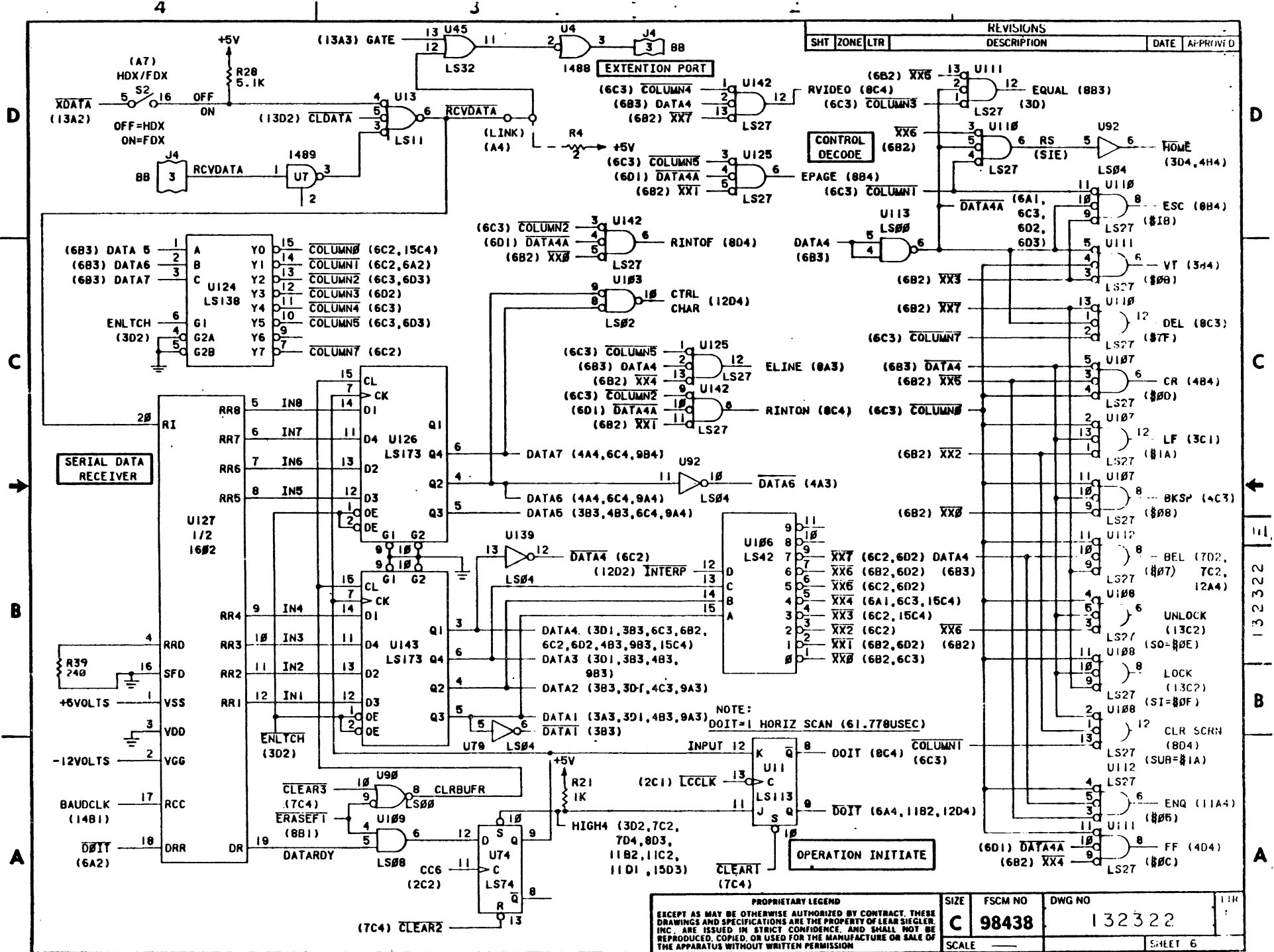
6-8

DP319

132322

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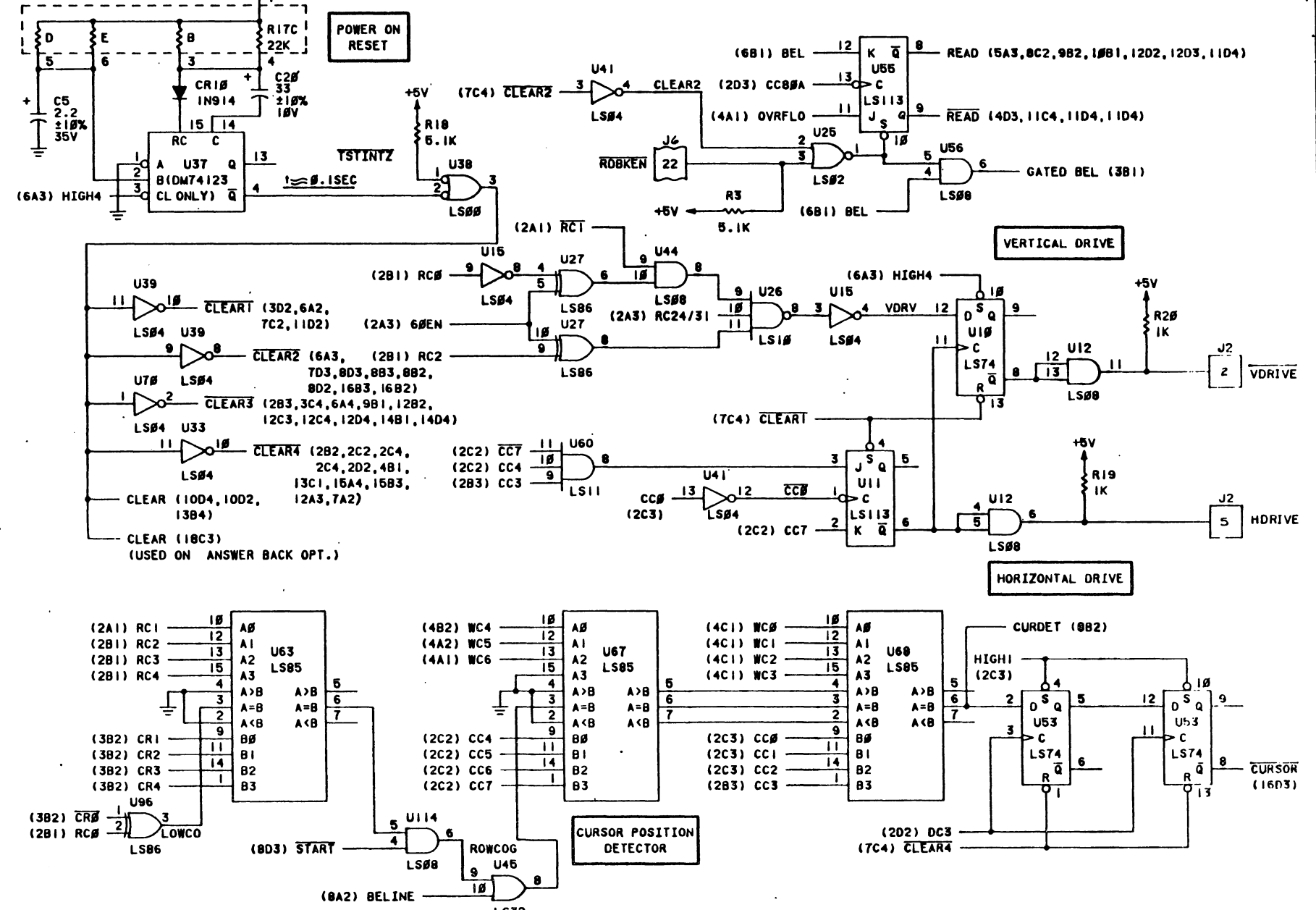


REVISIONS		DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION

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SIZE	FSCM NO	DWG NO	11R
C	98438	132322	7
SCALE		SHEET 6	

REVISIONS			
SHT	ZONE	LTR	DESCRIPTION



6-10

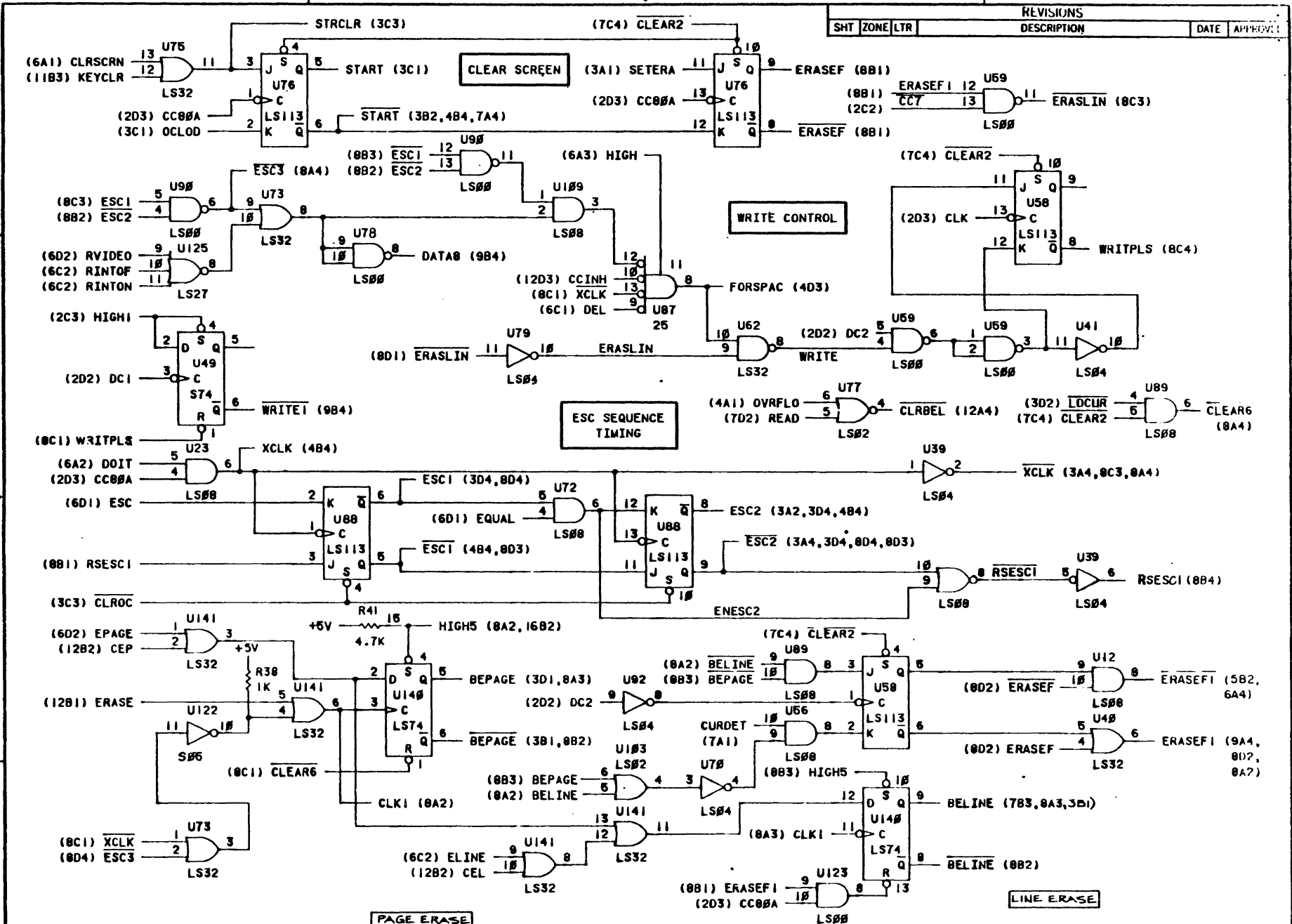
DP319

132322

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SCALE NONE						



REVISIONS					
SHT	ZONE	LTR	DESCRIPTION	DATE	APPROV



132322

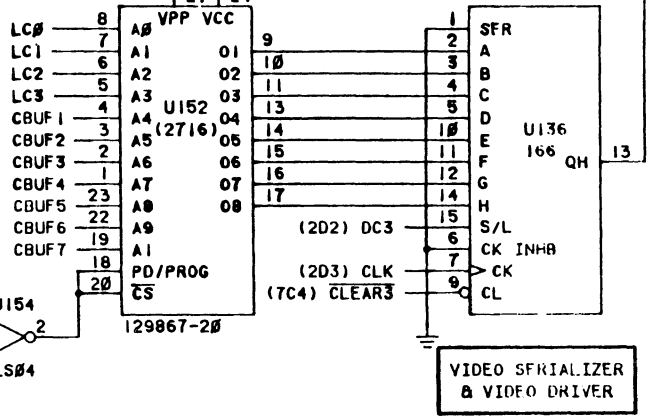
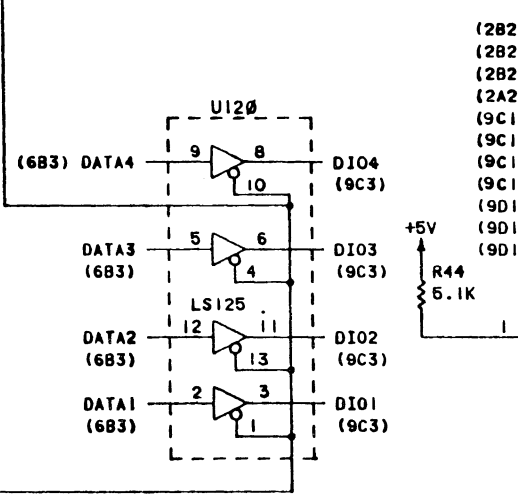
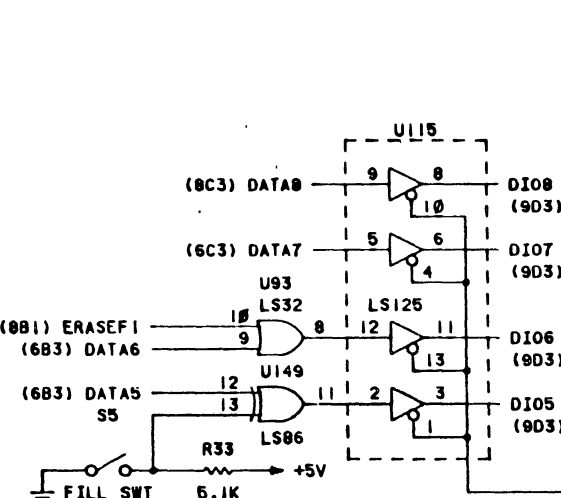
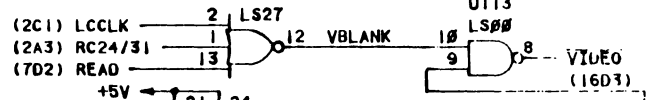
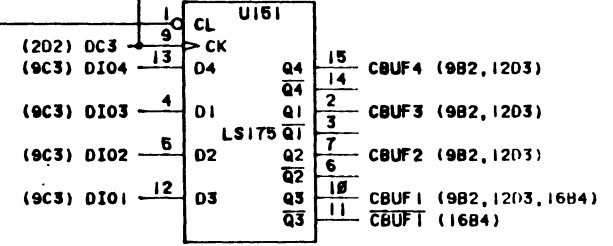
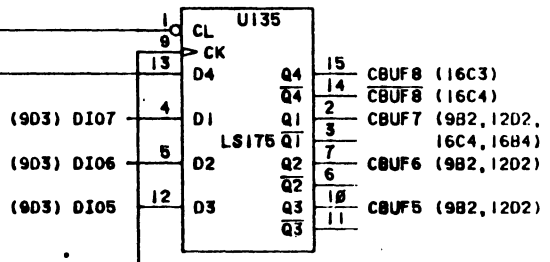
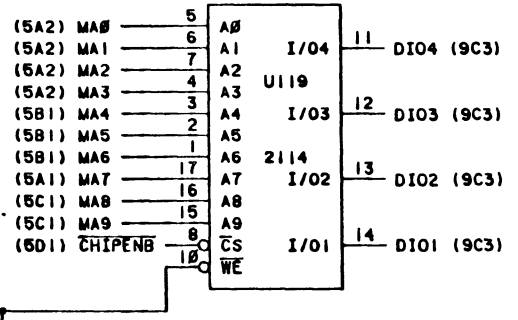
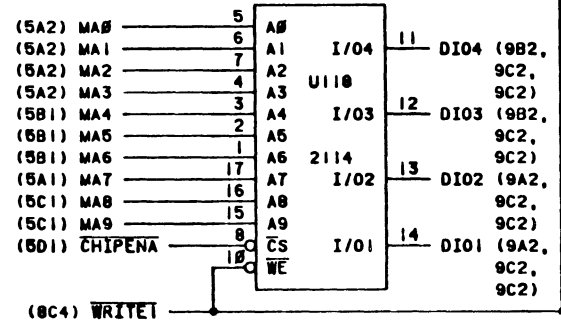
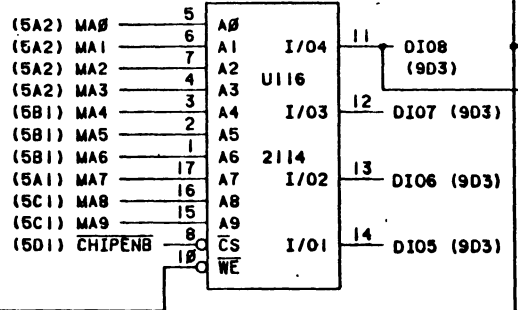
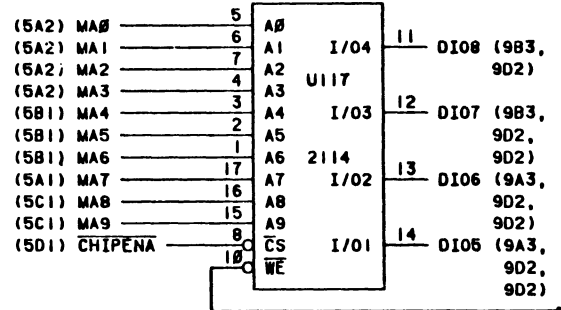
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SIZE	FSCM NO	DWG NO.	110
C	98438	132322	!
SCALE		SHEET 8	

REVISIONS		DATE	APPROVED
SHT	ZONE	DESCRIPTION	

REFRESH MEMORY

(2C2) ICCB $\bar{0}$  U8 $\bar{0}$   
 (2C3) CC7 LS1 $\bar{0}$



VIDEO SERIALIZER & VIDEO DRIVER

REFRESH MEMORY DATA BUS

PROPRIETARY LEGEND		SIZE	FSCM NO.	DWG NO.	SHEET
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6-12

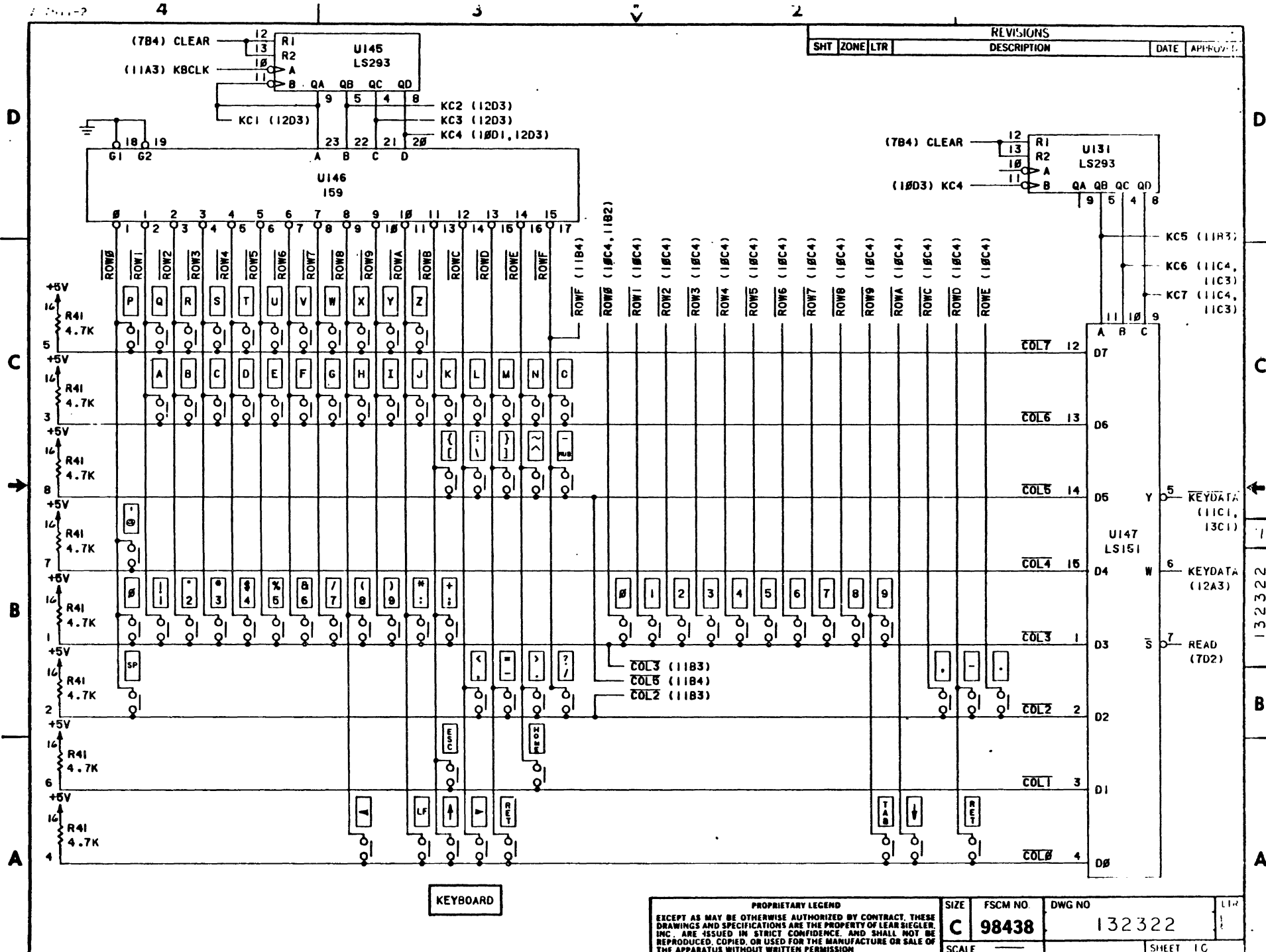
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DP319

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REVISIONS			
SHT	ZONE	LTR	DESCRIPTION

KEYBOARD

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SIZE	FSCM NO.	DWG NO.	L14
C	98438	132322	1
SCALE	—	SHEET	1C

132322

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REVISIONS				DATE	APPROV'D
SHT	ZONE	LTR	DESCRIPTION		
(7C4)			CLEAR		
(13C1)			LOCK		
			GO	(11C2, 12A2, 11D3)	

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6-14

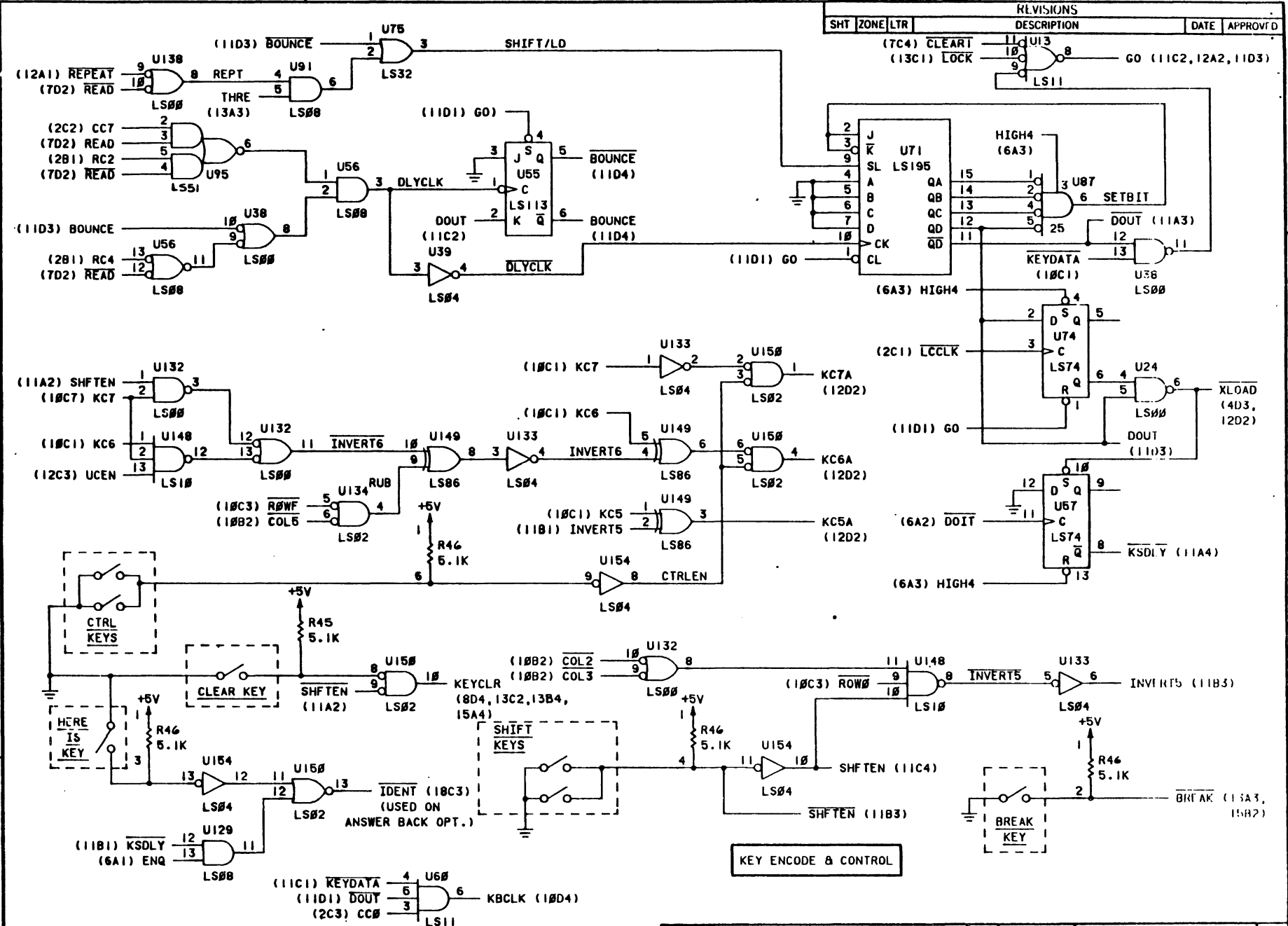
←

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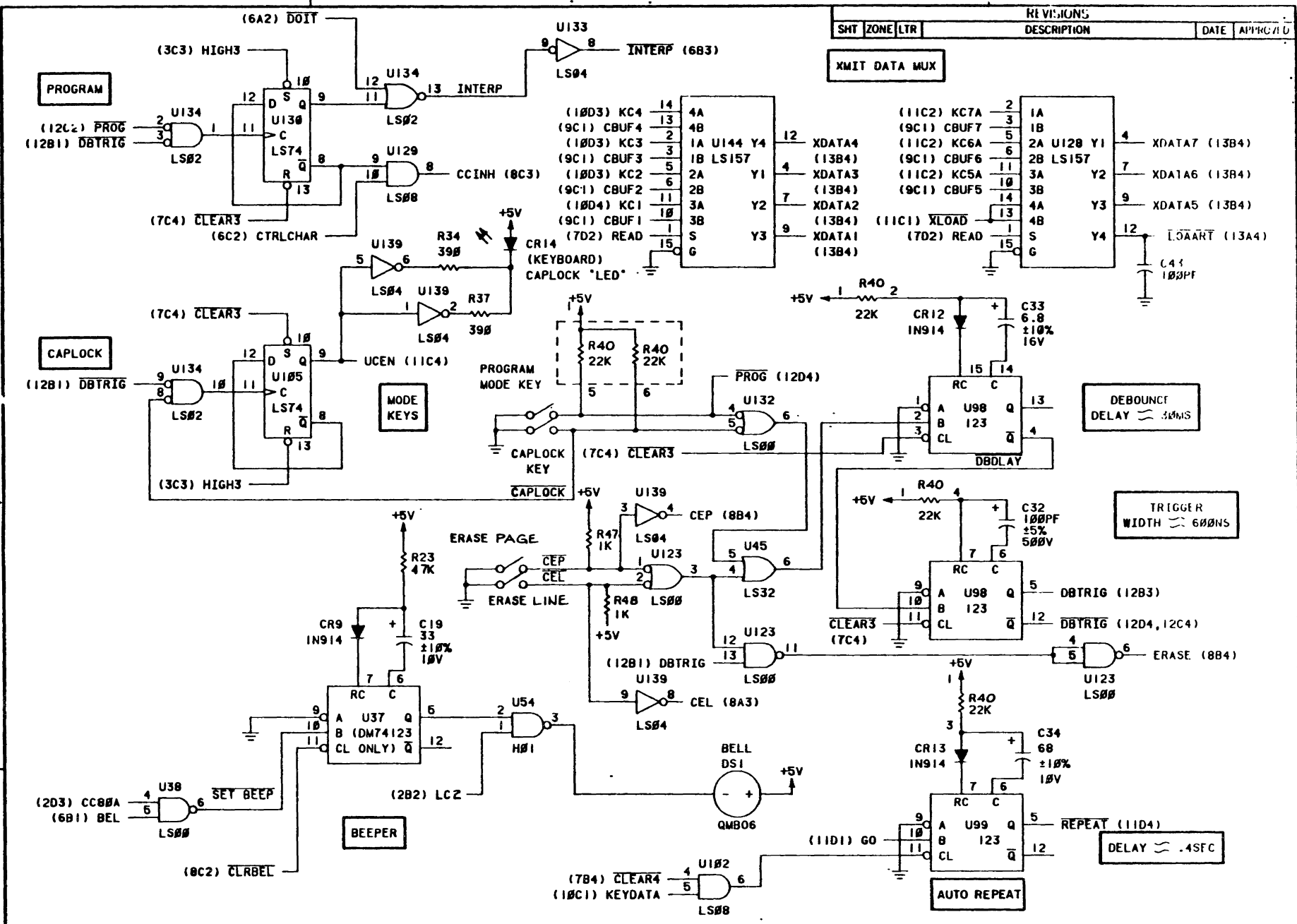
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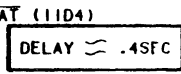
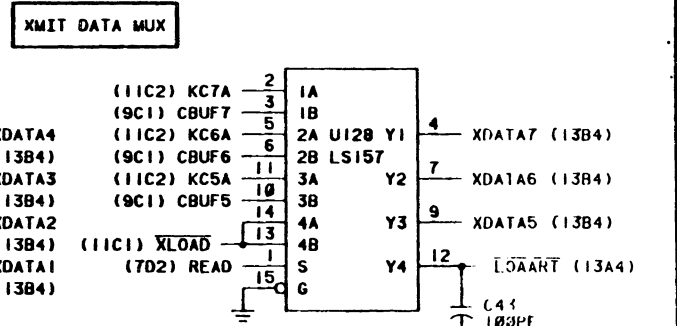
132322

PROPRIETARY LEGEND				SIZE	FSCM NO	DWG NO	REV
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				SCALE		SHEET 11	

DP319



REVISIONS			
SHT	ZONE	LTR	DESCRIPTION



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SIZE	FSCM NO	DWG NO	11P
C	98438	132322	
SCALE		SHEET 12	



DP319

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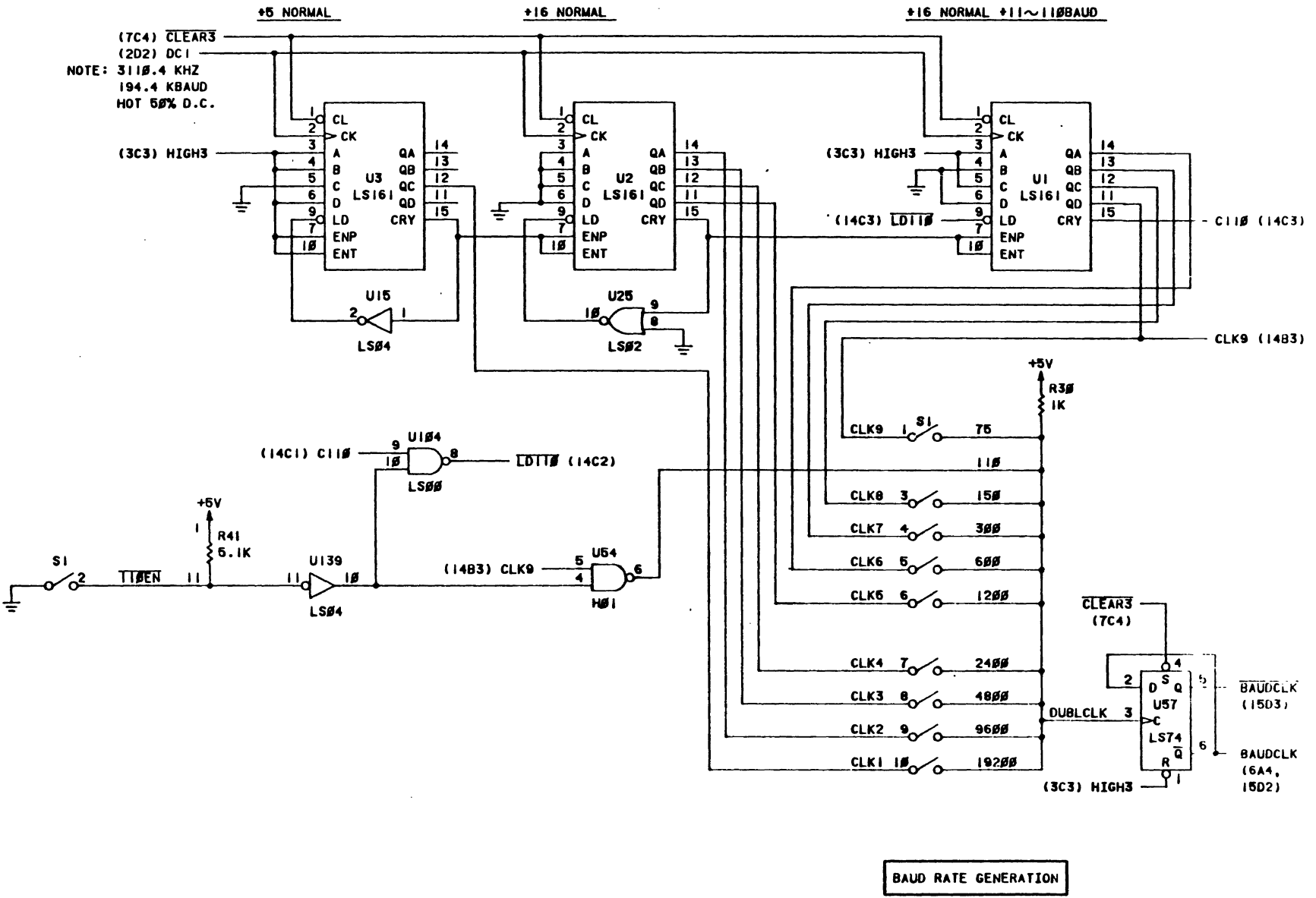
C

6-17

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REVISIONS			
SHT	ZONE	LTR	DESCRIPTION



D

C

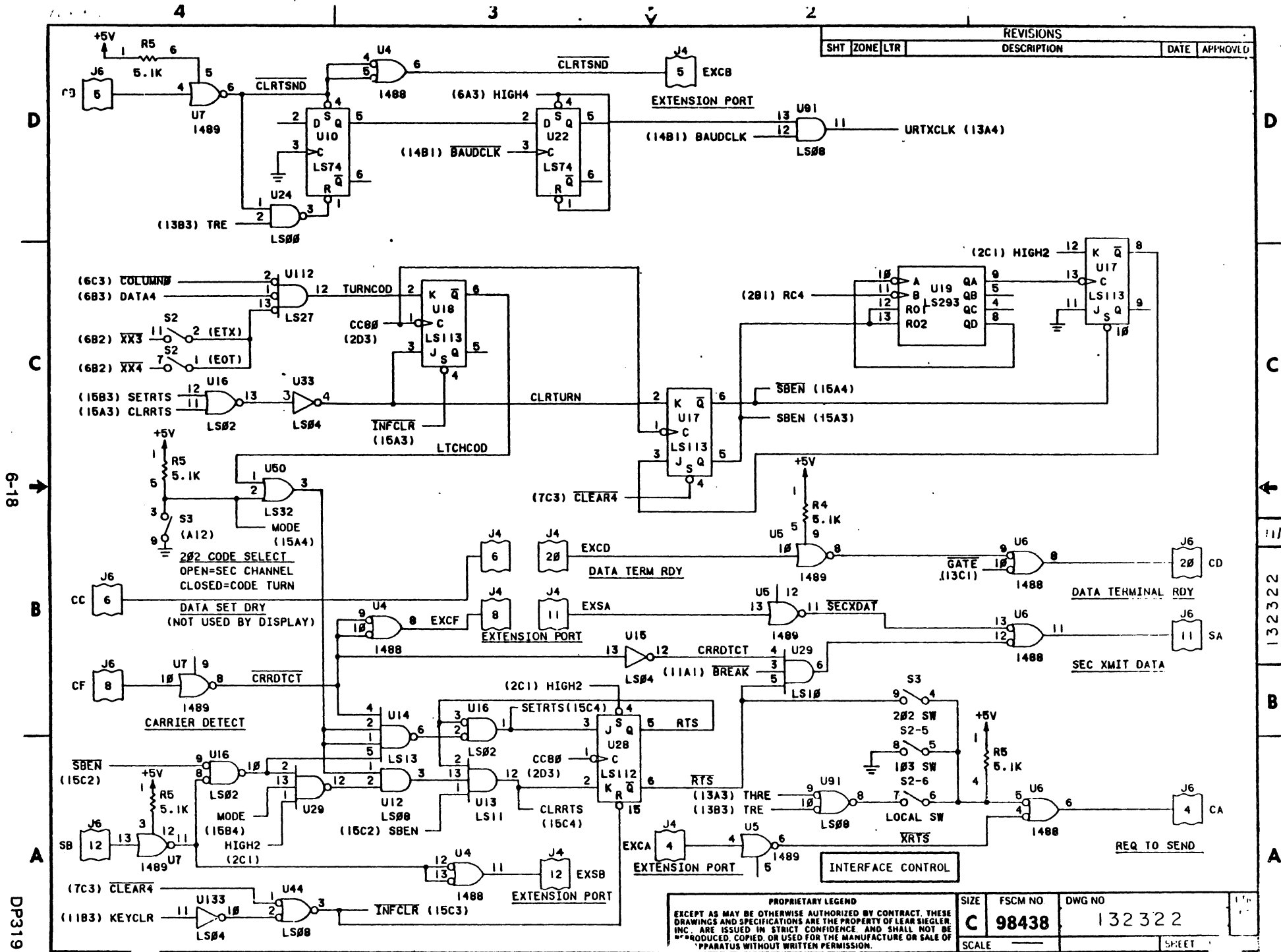
6-17

B

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SIZE	FSCM NO	DWG NO	117
C	98438	132322	
SCALE			1/4

REVISIONS					
SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVAL



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 APPARATUS WITHOUT WRITTEN PERMISSION.

SIZE	FSCM NO	DWG NO	11
C	98438	132322	11
SCALE			SHEET



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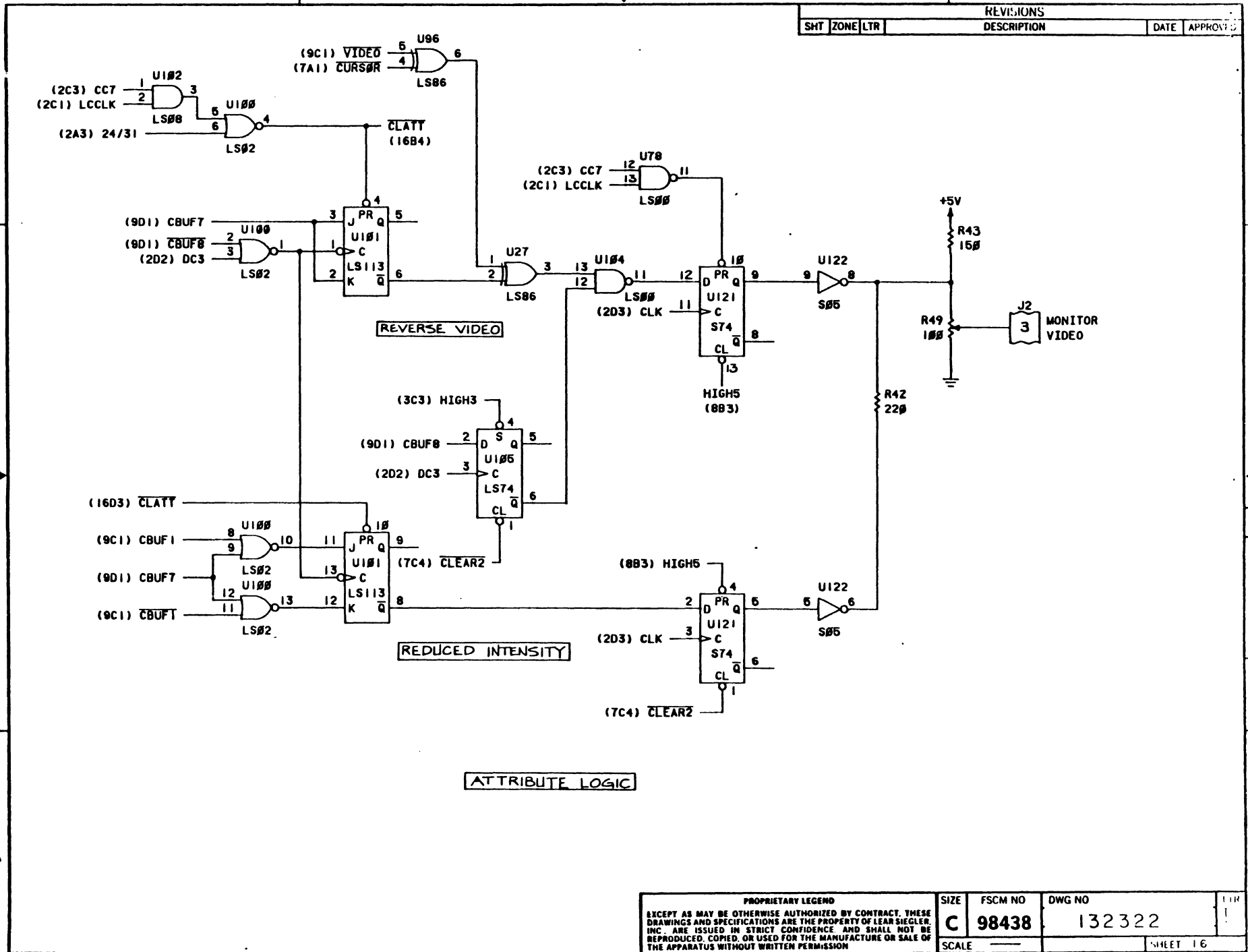
10

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REVISIONS			
SHT	ZONE	LTR	DESCRIPTION

DATE	APPROVED



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132322

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SIZE	FSCM NO	DWG NO	
C	98438	132322	
SCALE			SHEET 16

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## REVISIONS

SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVED

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D

C

C

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B

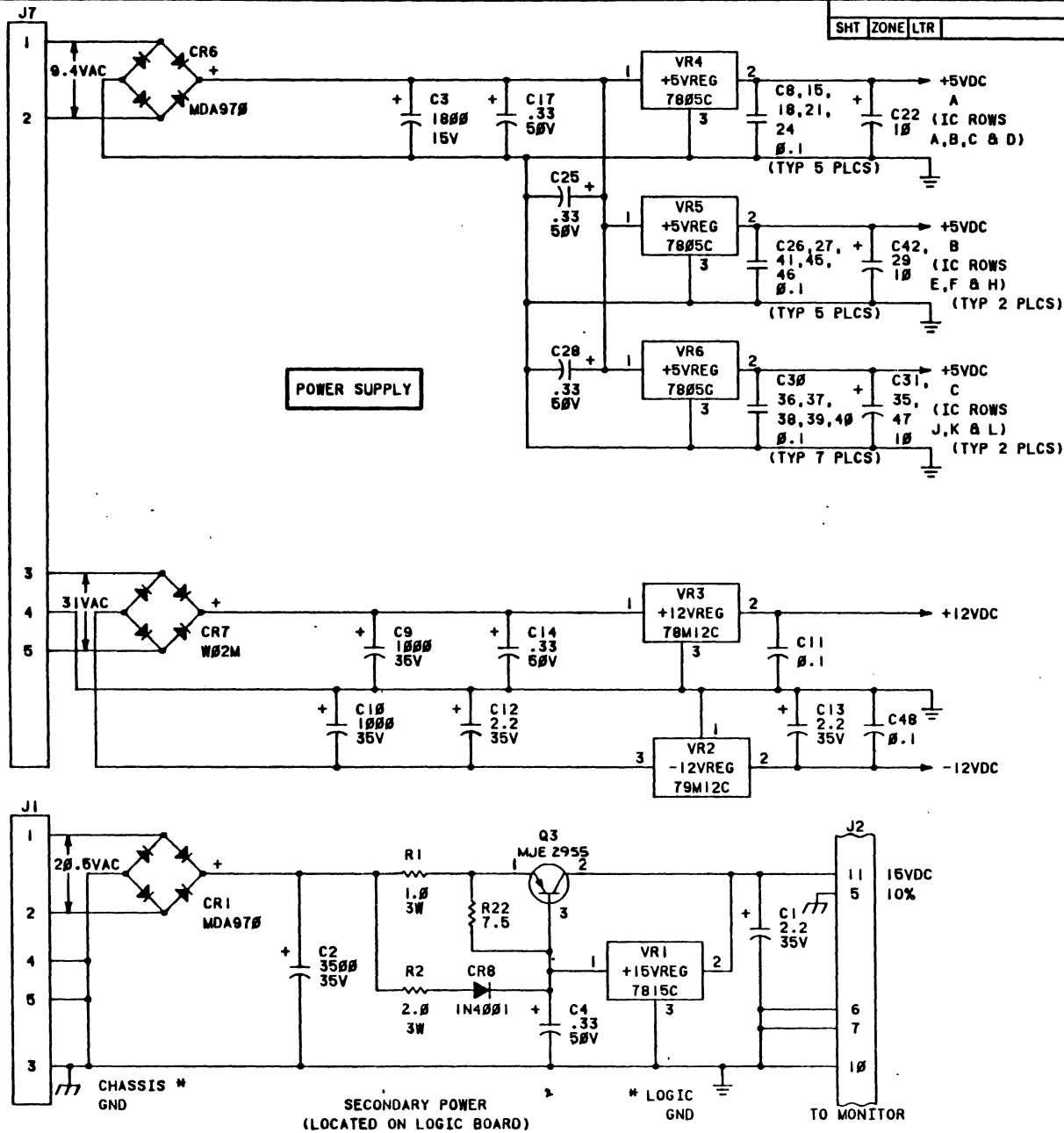
B

132322

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\*NOTE: LOGIC GND AND CHASSIS GND ARE TIED ONLY ONE PLACE ON THE P.C.B.

## PROPRIETARY LEGEND

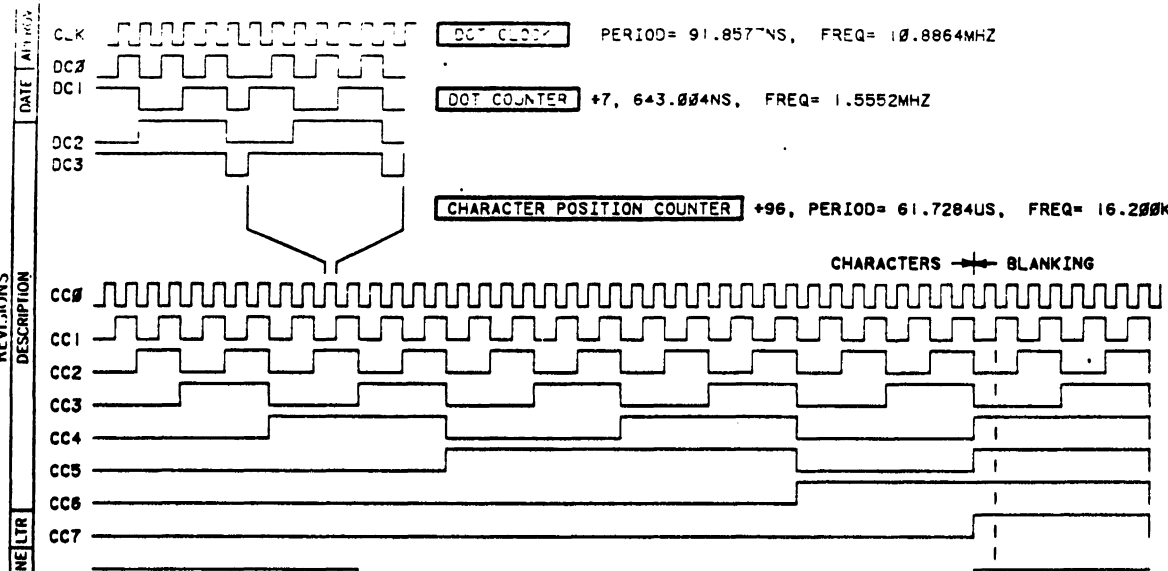
EXCEPT AS MAY BE OTHERWISE AUTHORIZED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF LEAR SIEGLER, INC. ARE ISSUED IN STRICT CONFIDENCE, AND SHALL NOT BE REPRODUCED, COPIED, OR USED FOR THE MANUFACTURE OR SALE OF PARTS WITHOUT WRITTEN PERMISSION.

SIZE	FSCM NO	DWG NO	LTN
C	98438	132322	1
SCALE		SHEET 17	

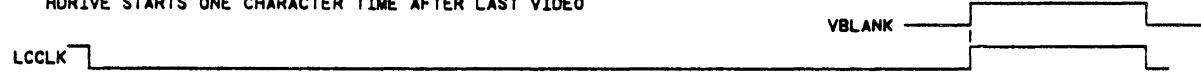
DP319

LTN  
 DWG NO 132322  
 FSCM NO 98438  
 SIZE C  
 SCALE NONE  
 SHEET 1B

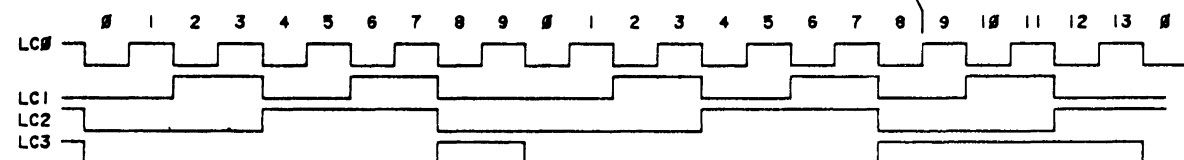
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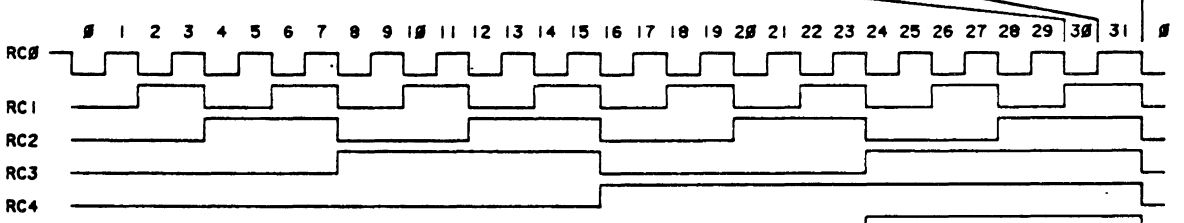
**HDRIVE**  
 NOTE:  
 HDRIVE PULSE WIDTH= 25.00US  
 HDRIVE STARTS ONE CHARACTER TIME AFTER LAST VIDEO



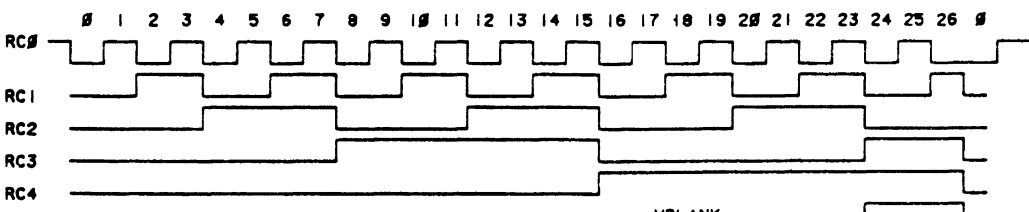
**LINE COUNTER** +10, PERIOD= 617.20US, FREQ= 1620HZ



**ROW COUNTER**  
 50HZ OPERATION + 32.4, PERIOD= 20 MS, FREQ= 50HZ



**60HZ OPERATION** + 27, PERIOD= 16.667MS, FREQ= 60HZ



ADM5 TIMING DIAGRAM

CONN PIN ASSIGNMENTS

REVISIONS			DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION	

SWITCH ASSIGNMENTS

J1 POWER INPUT

PIN NO.	FUNCTION	SHEET
1	2Ø.5VAC	17B4
2	2Ø.5VAC	17B4
3	CHASSIS GND	17A4
4	GND	17A4
5	GND	17A4

J6 MODEM RS 232 & CURRENT LOOP

PIN NO.	FUNCTION	SHEET
1	FRAME GND	
2	BA	13A1
3	BB	6D4
4	CA	15A1
5	CB	15D4
6	CC	15B4
7	GND	
8	CF	15B4
9	**	
1Ø	NOT USED	
11	SA	15B1
12	SB	15A4
13	**	
14	**	
15	**	
16	**	
17	CL OUT	13B1
18	**	
19	**	
2Ø	CD	15B1
21	**	
22	READ BACK EN	7D2
23	CL INPUT	13D4
24	CL OUT	13A1
25	CL INPUT	13D4

S1

SEC-TION	FUNCTION	SHEET
1	75	14C2
2	110	14B4
3	150	14B2
4	300	14B2
5	600	14B2
6	1200	14B2
7	2400	14B2
8	4800	14B2
9	9600	14B2
10	19200	14A2

S3

SEC-TION	FUNCTION	SHEET
1	EOT	15C4
2	ETX	15C4
3	CODE	15B4
4	202	15B?
5	103	15A1
6	LOCAL	15A?

J2 MONITOR

PIN NO.	FUNCTION	SHEET
1	GND	17B2
2	VDR	7C1
3	VID	16C1
4	N/U	
5	HDR	7B2
6	EQ GND	17B2
7	KEY	
8	N/U	
9	+15V	17B2
1Ø	GND	17B2

U12B

(7D2) READ	Ø 1	16 Ø	+5VOLTS
(11C2) KC7A	Ø 2	15 Ø	GND
(9D1) CBUF7	Ø 3	14 Ø	XLOAD (11C1)
(12D1) XDATA7	Ø 4	13 Ø	XLOAD (11C1)
(11C2) KC6A	Ø 5	12 Ø	XDATA7 (12C1)
(9D1) CBUF6	Ø 6	11 Ø	KC5A (11B2)
(12D1) XDATA6	Ø 7	1Ø Ø	CBUF5 (9D1)
GND	Ø 8	9 Ø	XDATA5 (12C1)
(11A3) IDENT	Ø 17	18 Ø	THRE (13A3)

S2

SEC-TION	FUNCTION	SHEET
1	N/U	-
2	AUTO NEW LINE	4C4
3	50/60HZ	2A3
4	RS232/CL	15C3
5	HDX/FDX	6D4
6	BIT 8 CONTROL	15B4
7	PARITY/INHIBIT	15B4
8	STOP BIT	15C4
9	ODD PARITY EN	15C4
10	WORD LENGTH	15C4

ANSWER BACK OPT 2

J4 EXTEN RS232

PIN NO.	FUNCTION	SHEET
1	FRAME GND	
2	EX BA	13A4
3	EX BB	6D3
4	EX CA	15A2
5	EX CB	15D2
6	CC	15B3
7	GND	
8	EX CF	15B3
9	**	
1Ø	-12V*	
11	EX SA	15B3
12	EX SB	15A3
13	**	
14	**	
15	**	
16	**	
17	+12V*	
18	**	
19	**	
2Ø	EX CD	15B3
21	**	
22	NOT USED	
23	NOT USED	
24	EXT CL IN*	
25	EXT CL OUT*	

J7 POWER INPUT

PIN NO.	FUNCTION	SHEET
1	9.4VAC	17D3
2	9.4VAC	17D3
3	31VAC	17B3
4	GND	17B3
5	31VAC	17B3

U144

(2C3) WRCLK	Ø 17	18 Ø	CLEAR (7B4)
(7D2) READ	Ø 1	16 Ø	+5VOLTS
(1ØD3) KC3	Ø 2	15 Ø	GND
(9C1) CBUF3	Ø 3	14 Ø	KC4 (1ØD3)
(12D2) XDATA3	Ø 4	13 Ø	CBU4 (9C1)
(1ØD3) KC2	Ø 5	12 Ø	XDATA4 (12C2)
(9C1) CBUF2	Ø 6	11 Ø	KC1 (1ØD4)
(12D2) XDATA2	Ø 7	1Ø Ø	CBUF1 (9C1)
GND	Ø 8	9 Ø	XDATA1 (12C2)

S4

FUNCTION	SHEET
GATE & LOCK	15C1

S5

SEC-TION	FUNCTION	SHEET
FILL SWITCH	9A4	

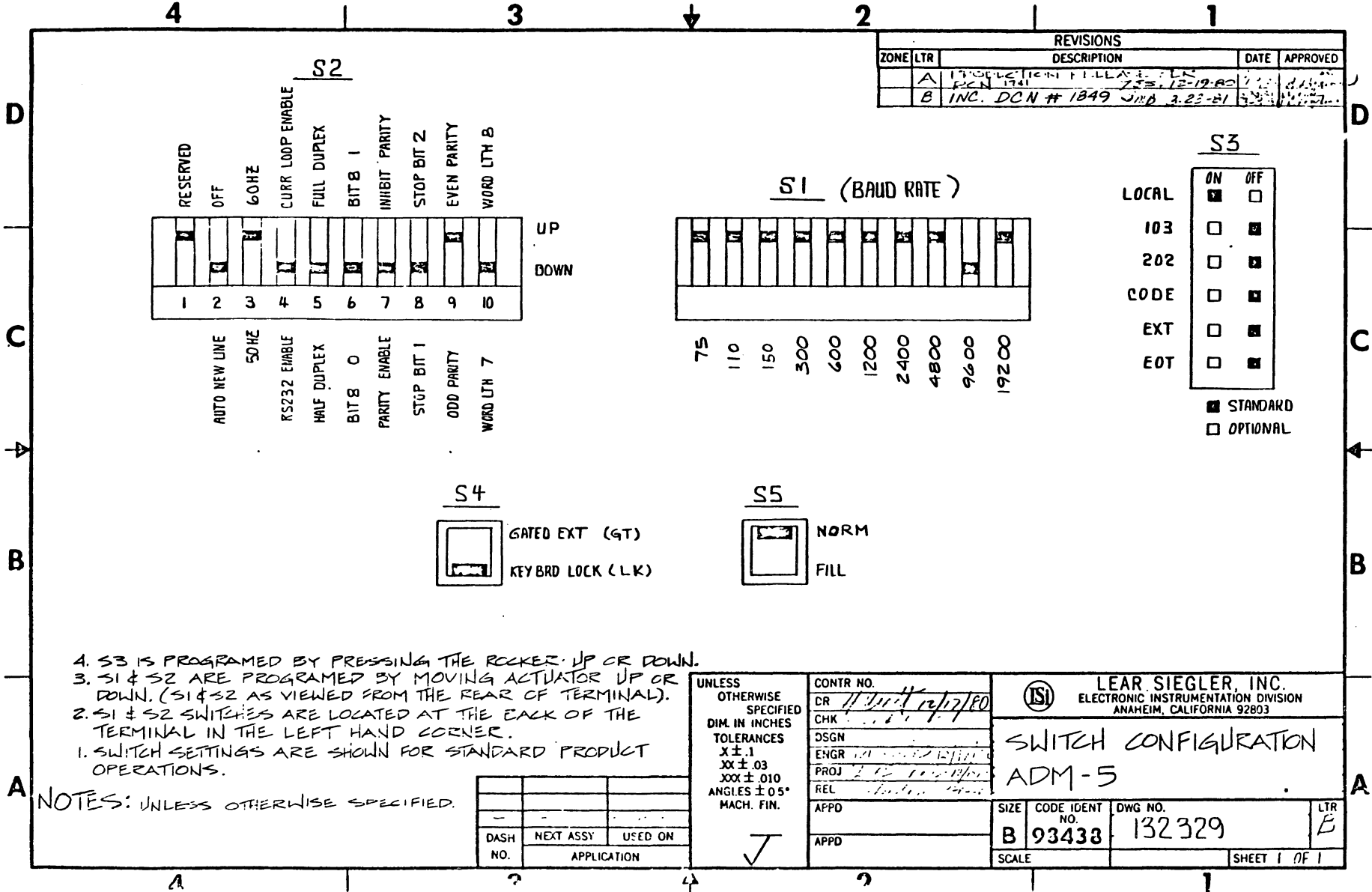
\*WHEN OPTIONAL EXTENSION PORT CURRENT LOOP INSTALLED  
 \*\*NO SOCKET INSTALLED IN CONNECTOR

PROPRIETARY LEGEND	SIZE	FSCM NO	DWG NO	114
EXCEPT AS MAY BE OTHERWISE AUTHORIZED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF LEAR SIEGLER, INC. ARE ISSUED IN STRICT CONFIDENCE, AND SHALL NOT BE REPRODUCED, COPIED, OR USED FOR THE MANUFACTURE OR SALE OF THE STATUS WITHOUT WRITTEN PERMISSION.	C	98438	132322	
	SCALE	NONE		SHEET 7

6-22

DP319

132322



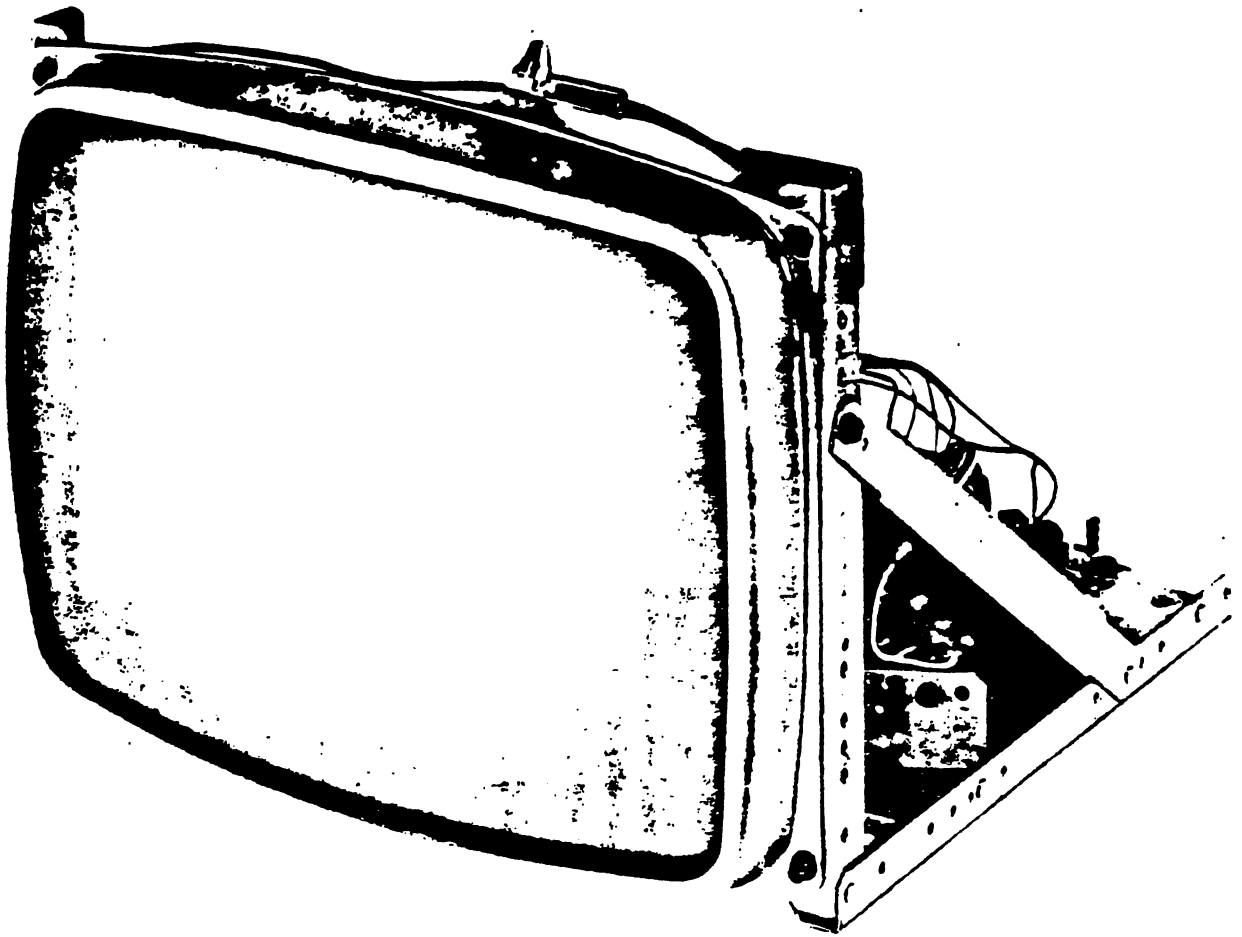


DT2

DT2



# SERVICE MANUAL



DT2

D12 SERIES DATA DISPLAY TERMINALS

ZENITH RADIO CORPORATION

1000 MILWAUKEE AVENUE, GLENVIEW, ILLINOIS 60025

## PRODUCT SAFETY SERVICING GUIDELINES FOR ZENITH DATA DISPLAY TERMINALS

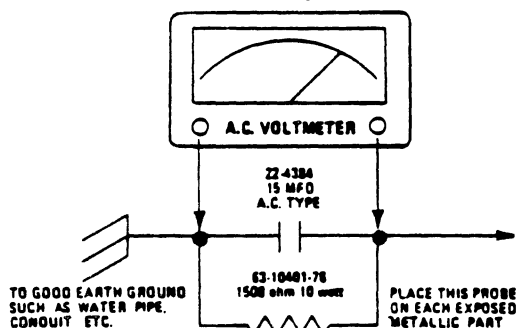
**CAUTION:** No modification of any circuit should be attempted. Service work should be performed only after you are thoroughly familiar with all of the following safety checks and servicing guidelines. To do otherwise increases the risk of potential hazards and injury to the user.

### SAFETY CHECKS

After the original service problem has been corrected, a check should be made of the following:

#### SUBJECT: FIRE & SHOCK HAZARD

1. Be sure that all components are positioned in such a way to avoid possibility of adjacent component shorts. This is especially important on those chassis which are transported to and from the repair shop.
2. Never release a repair unless all protective devices such as insulators, barriers, covers, shields, strain reliefs, and other hardware have been reinstalled per original design.
3. Soldering must be inspected to uncover possible cold solder joints, frayed leads, damaged insulation, solder splashes or sharp solder points. Be certain to remove all loose foreign material.
4. Check "across-the-line" capacitor (if used) and other components for physical evidence of damage or deterioration and replace if necessary. Follow original layout, lead length and dress.
5. No lead or component should touch a resistor rated at 1 watt or more. Lead tension around protruding metal surfaces must be avoided.
6. All critical components (shaded on the schematic diagram and parts lists) such as: fuses, flameproof resistors, capacitors, etc., must be replaced with exact Zenith types. Do not use replacement components other than those specified or make unrecommended circuit modifications.
7. After re-assembly of the terminal always perform an AC leakage test on all exposed metallic parts of the cabinet and screws to be sure the terminal is safe to operate without danger of electrical shock. **DO NOT USE A LINE ISOLATION TRANSFORMER DURING THIS TEST.** Use an AC voltmeter having 5000 ohms per volt or more sensitivity in the following manner: Connect a 1500 ohm 10 watt resistor (63-10401-76), paralleled by a 0.15 mfd., 150V AC type capacitor (22-4384) between a known good earth ground (water pipe, conduit, etc.) and the exposed metallic parts, one at a time. Measure the AC voltage across the combination 1500 ohm resistor and 0.15 mfd. capacitor. Reverse the AC plug and repeat AC voltage measurements for each exposed metallic part. Voltage measured must not exceed 0.75 volts RMS. This corresponds to 0.5 milliamp AC. Any value exceeding this limit constitutes a potential shock hazard and must be corrected immediately.



#### SUBJECT: IMPLOSION PROTECTION

1. All Zenith picture tubes are equipped with an integral implosion protection system, but care should be taken to avoid damage during installation. Avoid scratching the tube.
2. Use only Zenith replacement tubes.

#### SUBJECT: X-RADIATION

1. Be sure procedures and instructions to all service personnel cover the subject of X-radiation. The only potential source of X-rays is the picture tube. However, this tube does not emit X-rays when the HV is at the factory-specified level. It is only when the HV is excessive that X-radiation can be generated. The basic precaution which must be exercised is to keep the HV at the factory-recommended level. Refer to the X-ray Precaution Label which is located inside each terminal for the correct high voltage. The proper value is also given in the schematic diagram. Operation at higher voltages may cause a failure of the picture tube or high voltage supply and, also, under certain circumstances, may produce radiation in excess of desirable levels.
2. Only Zenith-specified CRT anode connectors must be used.
3. It is essential that the serviceman has available at all times an accurate high voltage meter. The calibration of this meter should be checked periodically against a reference standard.
4. When the high voltage circuitry is operating properly there is no possibility of an X-radiation problem. Every time a chassis is serviced, the brightness should be run up and down while monitoring the high voltage with a meter to be certain that the high voltage does not exceed the specified value and that it is regulating correctly. We suggest that you and your service organization review test procedures so that voltage regulation is always checked as a standard servicing procedure, and that the reason for this prudent routine be clearly understood by everyone.
5. When trouble shooting and making test measurements in a terminal with a problem of excessive high voltage, do not operate the chassis longer than is necessary to locate the cause of excessive voltage.

#### IMPORTANT NOTE: DAG GROUNDING.

Each unit provides for grounding of the main P.C. Board and CRT socket board to the dag of the CRT through the dag grounding spring.

The ground wires are connected to the shell bond or T-band through a terminal lug. Upon installing the Video Display in a terminal, this grounding procedure should be followed to provide adequate high voltage filtering and arc protection. This especially pertains to mounting the video display as a kit version.

### CAUTION

NO WORK SHOULD BE ATTEMPTED ON ANY EXPOSED MONITOR CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.



## GENERAL INFORMATION

This service manual introduces the Zenith D12 series of Video Displays. The series includes three basic forms: the D12-PF which is complete with power supply and frame, the D12-NF without power supply, the D12-NK in kit form which comes without frame or power supply.

The D12 series incorporate precision CRT's which provide uniformity of display and controlled spot size and geometry. The display may be operated from a standard 15 volt D.C. supply (or optional 12 V.D.C.) or from 120 volts A.C.

Input and output connections for the displays are made through a 10 pin edge connector on the main circuit board. Provision has been made for an optional remote brightness control. Schematic reference numbers are printed on

the circuit board to aid in the location and identification of components for servicing.

Vertical and horizontal linearity is maintained within specifications without the use of linearity controls or adjustable devices. Excellent vertical linearity is assured by the extensive use of current feedback and horizontal linearity is achieved with a fixed saturable reactor.

Vertical and horizontal deflection systems sustain scan even in the absence or interruption of synchronizing signals. Vertical and horizontal synchronization is automatic and stable throughout the entire specified operating frequency range.

## SPECIFICATIONS

### CATHODE RAY TUBE

12" diagonal measure, 90° deflection, 12.5KV nominal high voltage at 50 $\mu$  A. beam current. Available with bonded anti-reflective face plate option. P4 phosphor is standard and other EIA phosphors are available.

### NOMINAL DISPLAY AREA

51 sq. in. defined by a rectangle 8 1/2" x 6" centered on the CRT. (Other display dimensions optional.)

### INPUT SIGNALS (TTL LEVEL)

#### HORIZONTAL

4 to 40 $\mu$  sec. duration (positive going standard).

#### VERTICAL

50 to 2500 $\mu$  sec. duration (negative going standard).

#### VIDEO

1.0V to 2.5V P-P (internal or customer supplied 500 $\Omega$  contrast control for higher input levels).

Positive polarity for white characters. (Other polarities are available for horizontal and vertical sync.)

### POWER SUPPLY

120V  $\pm$  10% or 240V  $\pm$  10%  
(customer strappable) 47 to 63 Hz., or  
15V DC at 800 ma. max., or  
12V DC at 1100 ma. max.

### BRIGHTNESS CONTROL

Internal or Customer supplied 100 K $\Omega$  potentiometer (accessible at pins 2, 3 and 4 of edge connector).

### INTERCONNECT TO CUSTOMER SYSTEM

Via standard 10-pin edge connector.

VIKING #25V10S/1-2  
AMP #225-21031-101  
CINCH #250-10-30-170

### RESOLUTION

900 vertical lines minimum at center of display and 700 vertical lines at the corners. Pulse rise time less than 20 nanoseconds, for 30V rise at CRT. Bandwidth is within 3db from 10 Hz. to 18 MHz.

### GEOMETRY

NOTE: Measurements made with an input of 1.0-2.5V P-P and with the display adjusted to 6" high x 8 1/2" wide.

#### VERTICAL

a. Height of display at left side shall be within  $\pm$  2.0 percent of height at right side.

b. Top and bottom pincushion or barrel shall be within  $\pm$  1.25% of the average height.

#### HORIZONTAL

a. Width of display at top shall be within  $\pm$  2.5% of the width at bottom.  
b. Side pincushion or barrel shall be within  $\pm$  1.0% of the average width.

### LINEARITY

No character shall vary in width or height by more than  $\pm$  10% of the average width or height of all the characters in a row or column respectively. No specific character shall vary in width or height more than  $\pm$  10% of an adjacent character.

### SYNCHRONIZATION

#### HORIZONTAL

15.75  $\pm$  0.5KHz.  
18.60  $\pm$  0.5KHz. (Optional)

#### Horizontal Blanking

9.0 $\mu$  sec. min.

#### Horizontal Phasing Control

11.0  $\mu$  sec. nominal range

#### VERTICAL

47 to 63 Hz.

#### VERTICAL RETRACE TIME

850 $\mu$ sec. max.

### STORAGE

55° C. max. with bonded anti-reflective faceplate.  
65° C. max. for plain faced CRT's.

### ENVIRONMENT

#### Operating temperature

55° max. (free air temperature of display electronics).

#### Altitude

40,000 ft. + storage & shipment.  
10,000 ft. max. operating.

### WEIGHT

11.5 lbs. max. without optional power supply.  
13.5 lbs. max. with optional power supply.  
9.0 lbs. max. without frame.

# THEORY OF OPERATION

## POWER SUPPLY

Power Transformer TX201 is designed for use with 120V or 240V A.C. source. The secondary provides power to bridge rectifier (CR501, CR502, CR503 and CR504). The positive output of the bridge rectifier (junction of CR503 and CR504), forms the raw B+ supply ( ~ 20VDC).

Voltage regulation is accomplished in the negative leg of the power supply through a feedback network consisting of transistors QX501 and QX502 and their associated circuitry. The emitter voltage of QX501 is maintained by diodes CR505, CR506 and CR507. The base voltage is provided by potentiometer RX506.

If B+ increases, diodes CR505, CR506 and CR507 will draw more current to maintain the emitter voltage of QX501. Additionally, the voltage developed across RX506 will increase, resulting in a higher positive voltage at the base of QX501 which will result in less conduction. This reduces the base current of QX502 since QX501 provides the emitter/base current path for QX502. When QX502 conducts less, the voltage drop across Q502 is increased thus lowering B+.

If B+ decreases, diodes CR505, CR506 and CR507 will reduce conduction to maintain the emitter voltage of QX501. Additionally, the base voltage provided by RX506 will decrease. Less voltage on the base of QX501 will cause it to increase conduction, resulting in a greater emitter/base current flow in QX502. With this condition the voltage drop for Q502 is less and B+ is increased.

## HORIZONTAL

The low-level horizontal section, which consists of transistors Q101 and Q102 (and associated circuitry), functions as a variable time delay monostable multivibrator. The input trigger for this circuit is provided by the horizontal drive pulse. The pulse is injected into the base or emitter (for either positive or negative pulse respectively) of Q101 through injection network C101, C111, R101, R110 and CR101. By varying the recovery time of the multivibrator, potentiometer R104 adjusts video information position (with respect to raster scan). Output of the monostable multivibrator, derived at the collector of Q102, is injected through a coupling network consisting of C110 and CR103. The resulting "Lock" signal is rereceived by one side of a precision astable multivibrator at the

emitter of Q103. The astable multivibrator circuit is completed through Q104 and associated circuitry. This circuit will act as a free running oscillator until the "Lock" signal is received from the previous stage. Once locked, an output pulse is formed at the emitter of Q104 which is then D.C. coupled to the base of the horizontal driver transistor, Q105.

Remainder of the horizontal circuit is straightforward. Features to be noted are: Width and Linearity Coils LX102 and LX101 in series with the yoke (TX202). Linearity is fixed and an adjustable coil is provided for width. The linearity coil has a magnetically biased core which makes the inductance of the coil dependent upon its current. Pincushion and geometric corrections are made at the factory by the addition of rubber magnets around the plastic ring of the yoke. D.C. operation of 12 volts is accomplished by the (optional) addition of a boost circuit at the horizontal sweep transformer.

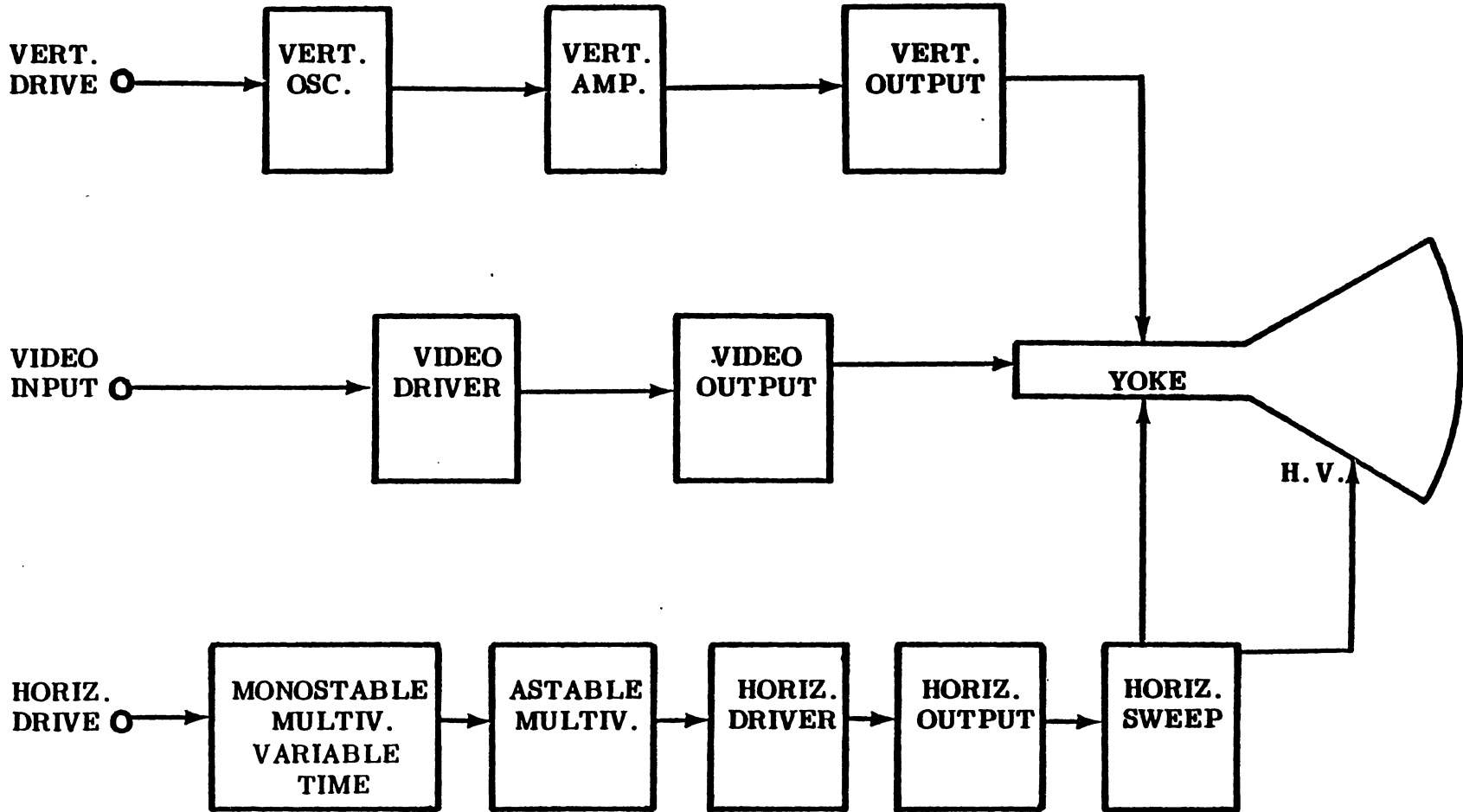
## VERTICAL

The vertical circuit includes an oscillator consisting of transistors Q301 and Q302 and associated circuitry. Amplification is provided by transistors Q303 and Q304 with the emitter of Q304 feeding the base of the vertical driver Q305. The vertical output transistors, Q306 and Q307 are wired in the standard push-pull configuration. Transistor Q308 doubles B+ during retrace, maintaining less than 800  $\mu$  sec. of retrace time.

## VIDEO

The video amplifier circuit consists of transistors Q401 and Q402 and associated circuitry. The circuit comprises a cascode amplifier which is triggered by a positive pulse at pin 8 of the edge connector. Upon receiving the input pulse, conduction is initiated and the collector voltage of Q402 is lowered. Amplification of low frequency voltage gain is fixed by the ratio of R407 and R408. Gain is maintained to 18 MHz by the bandwidth enhancing components R406, C403, and L401. Resistors R402 and R403 provide bias for the amplifier.

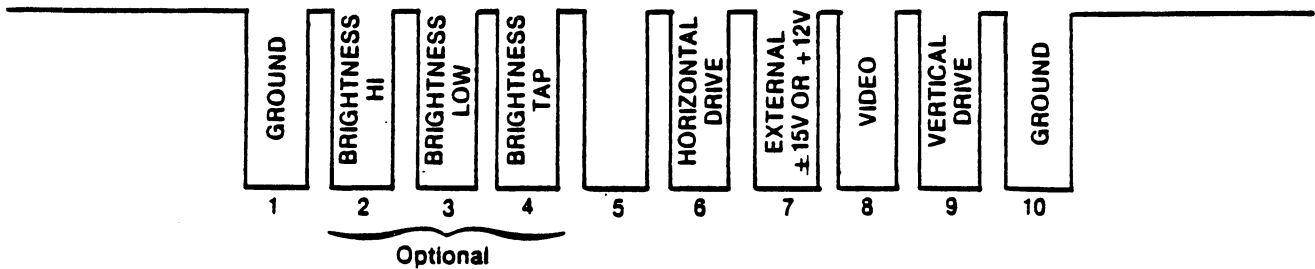
The collector output of Q401 is D.C. coupled to the cathode of the C.R.T. through resistor R201. Raster cut-off is adjusted with the brightness control R114 which is connected to G1 of the C.R.T.



## ADJUSTMENT PROCEDURES FOR D12 VIDEO DISPLAY

1. External power is applied to the monitor through an AC line cord or a 4 pin molex connector. The unit is wired for 120 VAC 50/60 Hz operation. (240 VAC 50/60 Hz optional)
2. INPUT SIGNALS: Input signals are connected to the display board through a 10 pin edge connector.

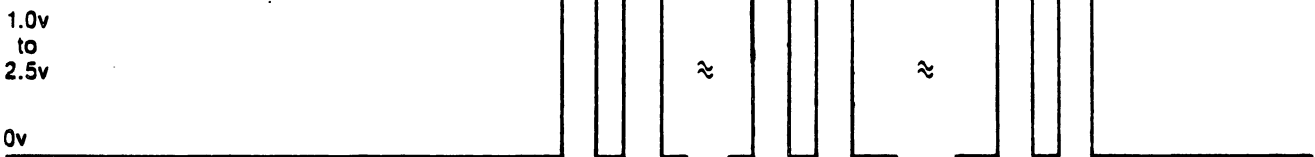
**Component Side of Display Board**



### A. Horizontal drive signal — 15,750Hz ± 500Hz, 18,600Hz ± 500Hz

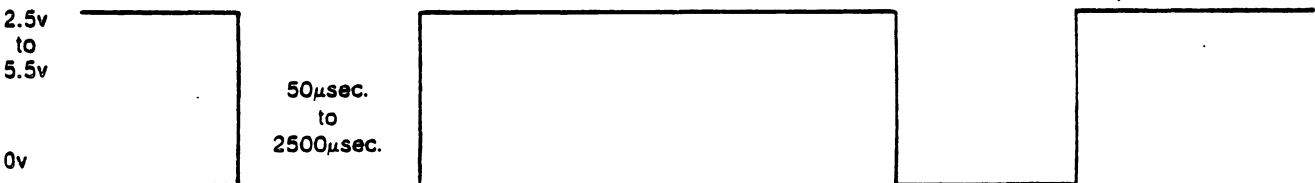


### B. Video drive signal

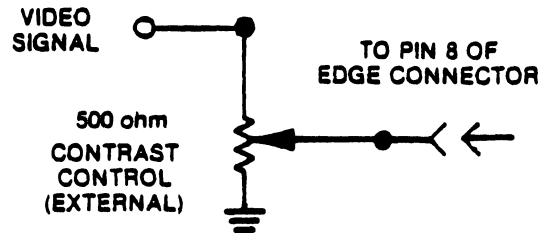


At a horizontal frequency of 15.7KHZ the video drive signal should start 11 microseconds ± 5μ sec. after the leading edge of horizontal sync, and 900 microseconds or greater after the leading edge of vertical sync.

### C. Vertical drive signal - 47Hz to 63Hz



Should the video drive level exceed the 2.5 volts specified, an external contrast control must be provided. The video drive signal is connected to the top end of the 500Ω pot, the bottom end is grounded and the wiper arm connects to the video input of the edge connector as shown.



3. Once power is applied to the display and the input signals connected, adjust the brightness control until the edges of the raster are visible.
4. Depending on the requirements for height and width of the video presentation, the vertical size control and width coil should be adjusted accordingly.
5. The power supply board also has a control to adjust the regulated B+ of the monitor to +15V. Check for proper adjustment.
6. Adjust the phase control to center the video information within the raster. (The contrast control may have to be adjusted to obtain a display of the video information.)
7. Adjust brightness control for visual cutoff of the raster.
8. Adjust external contrast control for desired luminance.
9. Adjust focus control for best possible overall focus.

#### **IMPORTANT NOTE: DAG GROUNDING.**

Each unit provides for grounding of the main P.C. Board and CRT socket board to the dag of the CRT through the dag grounding spring.

The ground wires are connected to the shell bond or T-band through a terminal lug. Upon installing the Video Display in a terminal, this grounding procedure should be followed to provide adequate high voltage filtering and arc protection. This especially pertains to mounting the video display as a kit version.

ITEM NUMBER	PART NUMBER	DESCRIPTION	ITEM NUMBER	PART NUMBER	DESCRIPTION
C112	22-7070	3033 WFO CAPACITOR -10% DISC	R321	63-9921-45	15 OHM RESISTOR -5% FILM
C113	22-7448	3047 WFO CAPACITOR -10% DISC	R322	63-9921-46	1 3K OHM RESISTOR -5% FILM
C114	22-7530-07	015 WFO CAPACITOR SPECIAL	R323	63-9921-73	1 1K OHM RESISTOR -5% FILM
C116	22-7313	10 WFO CAPACITOR SPECIAL	R324	63-9921-66	500 OHM RESISTOR -5% FILM
C117	22-7156-08	100 WFO CAPACITOR -100-10% ELEC	R325	63-9921-10	2 7 OHM RESISTOR -5% FILM
C118	22-3748	301 WFO CAPACITOR -10% DISC	R402	63-9921-72	1K OHM RESISTOR -5% FILM
C120	22-7712-03	10 WFO CAPACITOR -50-10% ELEC	R403	63-9921-72	1K OHM RESISTOR -5% FILM
C121	22-7152-03	1 WFO CAPACITOR -100-10% ELEC	R404	63-9921-48	47 OHM RESISTOR -5% FILM
C126	22-7150-03	100 WFO CAPACITOR -100-10% ELEC	R405	63-9921-90	12K OHM RESISTOR -5% FILM
C127	22-7380-08	1 WFO CAPACITOR 200-5% ELEC	R406	63-9921-32	22 OHM RESISTOR -5% FILM
C200	22-7160-02	220 WFO CAPACITOR -100-10% ELEC	R407	63-10311-70	620 OHM RESISTOR -5% FILM
C301	22-7613-248	01 WFO CAPACITOR -10% DISC	R408	63-9921-40	47 OHM RESISTOR -5% FILM
C302	22-7520	15 WFO CAPACITOR -10% POLYESTER	R409	63-9921-40	47 OHM RESISTOR -5% FILM
C303	22-7152-05	22 WFO CAPACITOR -100-10% ELEC	R410	63-9922-42	620 OHM RESISTOR -5% FILM
C304	22-7152-09	220 WFO CAPACITOR -100-10% ELEC	R411	63-9922-44	1 MEG OHM RESISTOR -5% FILM
C305	22-7300-10	0 WFO CAPACITOR ELEC -10%	R412	63-9922	15K OHM RESISTOR -5% FILM
C308	22-7613-02A	150 WFO CAPACITOR -10% DISC	R413	63-10013-02	CONTROL 100K OHM BRIGHTNESS
C309	22-7152-07	47 WFO CAPACITOR -100-10% ELEC	R414	63-9922	15K OHM RESISTOR -5% FILM
C308	22-7152-04	10 WFO CAPACITOR -100-10% ELEC	R415	63-10013-01	CONTROL 2 MEG OHM FOCUS
C310	22-7614-100	3033 WFO CAPACITOR -20% DISC	R416	63-9922-16	60K OHM RESISTOR -5% FILM
C311	22-7613-25A	012 WFO CAPACITOR -10% DISC	R418	63-9922	15K OHM RESISTOR -5% FILM
C312	22-7578-07	470 WFO CAPACITOR -10% ELEC	L101	20-7000	COIL RCF LINEARITY
C314	22-7610-203	3847 WFO CAPACITOR -20% DISC	L102	20-7002-08	COIL RCF TUNABLE WITH
C401	22-7150-03	22 WFO CAPACITOR -100-10% ELEC	L401	20-3007-10C	COIL RCF 6 B W
C402	22-7153-03	4 7 WFO CAPACITOR -100-10% ELEC	TX101	95-3136-03	TRANSFORMER HORIZ. DRIVER
C403	22-7613-648	220 WFO CAPACITOR -10% DISC	TX201	95-3407	H V SWEEP TRANSFORMER
C404	22-7726	02 WFO CAPACITOR -60-20% DISC	TX202	95-3207-02	DEFLECTION Yoke
C405	22-7312	01 WFO CAPACITOR -40-10% DISC	CR104	103-200-03A	DIODE
CR121	63-10200-10	3 9 OHM RESISTOR -5% FAILSAFE	CR105	103-204	DIODE
R122	63-9921-60	62 OHM RESISTOR -5% FILM	CR106	103-251-02 A	DIODE
CR123	63-10200-40	100 OHM RESISTOR -5% FAILSAFE	CR107	103-323-00A	DIODE
R126	63-9921-60	600 OHM RESISTOR -5% FILM	CR108	212-70 -02	DIODE
R125			CR111	103-142-01	DIODE
R128	63-10106-20	1000 OHM RESISTOR -10% CARBON COMP	CR201	103-200-03	DIODE
R127			CR301		
R129	63-10200-2A	1 OHM RESISTOR -5% WIREWOUND	CR302		
R130	63-10200-203	270 OHM RESISTOR -5% WIREWOUND	CR303	103-142-01	DIODE
R202	63-7718	27 OHM RESISTOR -5% CARBON COMP	CR304	212-70 -02	DIODE
R201	63-9922-27	200 K OHM RESISTOR -5% FILM	CR308	103-204-02	DIODE
R302	63-9921-02	0 04 OHM RESISTOR -5% FILM	Q100	121-1040	TRANSISTOR HORIZ. DRIVER
Q302	63-9922-04	22K OHM RESISTOR -5% FILM	Q100	121-1030	TRANSISTOR HORIZ. OUTPUT
Q303	63-9921-05	9 1K OHM RESISTOR -5% FILM	Q301	121-075	TRANSISTOR VERT OSC. I
Q305	63-9922-10	390 OHM RESISTOR -5% FILM	Q302	121-090	TRANSISTOR VERT OSC. II
Q307	63-9921-00	47 OHM RESISTOR -5% FILM	Q303	121-090	TRANSISTOR VERT AMP I
Q310	63-10200-30	33 OHM RESISTOR -5% FAILSAFE	Q304	121-075	TRANSISTOR VERT AMP II
Q300	63-9922-42	620K OHM RESISTOR -5% FILM	Q305	121-072-01	TRANSISTOR VERT DRIVER
Q300	63-10001-13	CONTROL 750K OHM VERT SIZE	Q306	121-1030	TRANSISTOR VERT OUTPUT I
Q316	63-9922-40	1.0 MEG OHM RESISTOR -5% FILM	Q307	121-1030	TRANSISTOR VERT OUTPUT II
Q311	63-9922-22	12K OHM RESISTOR -5% FILM	Q308	121-1040	TRANSISTOR VERT RETRACE CONTROL
Q313	63-9922-00	27K OHM RESISTOR -5% FILM	Q401	121-1050	TRANSISTOR 121-1034 ALT VIDEO OUTPUT
Q314	63-9921-70	1 0K OHM RESISTOR -5% FILM	Q402	121-095	TRANSISTOR VIDEO DRIVER
Q315	63-9922	15K OHM RESISTOR -5% FILM	VE201	100-640	12" CRT
Q310	63-1023	0 2K OHM RESISTOR -5% CARBON COMP			
Q310					
Q3310	63-10300-50	220 OHM RESISTOR -5% FAILSAFE			
Q320	63-9922-04	22K OHM RESISTOR -5% FILM			

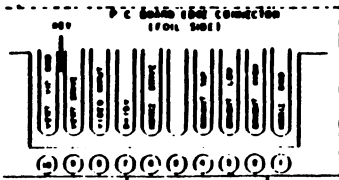
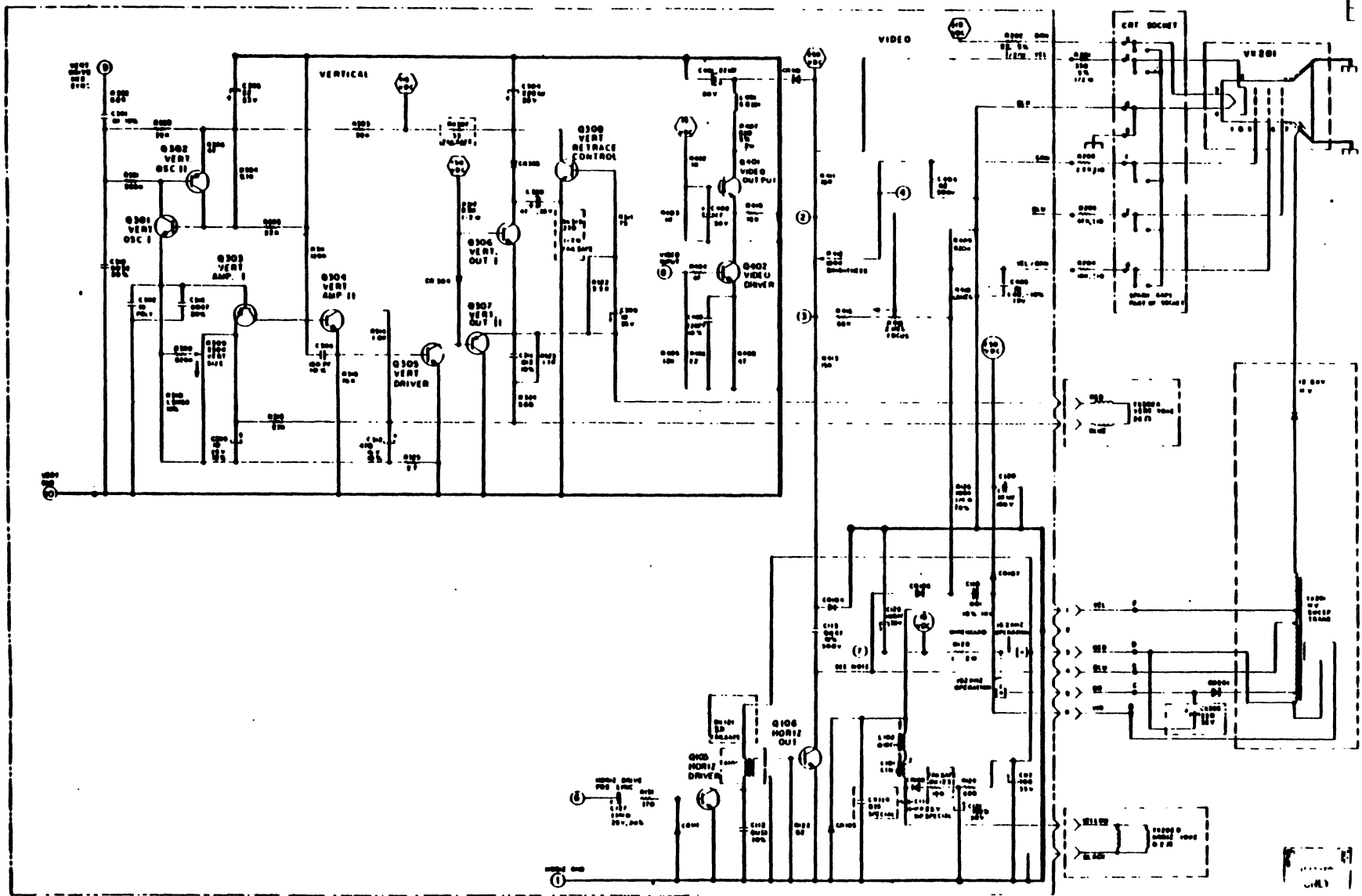
BOTTOM VIEWS OF TRANSISTORS

Q NUMBER	PART NUMBER	A	B	C	D	E	F	G	H	I	J	K	L	M
Q100	121-1040													
Q100	121-1030													
Q301	121-075													
Q302	121-090													
Q303	121-090													
Q304	121-075													
Q305	121-072-01													
Q306	121-1030													
Q307	121-1030													
Q308	121-1040													
Q401	121-1034													
Q402	121-095													

TRANSISTOR TYPES

LEGEND FOR DIVIDED DISPLAY 162/19.2KH HORIZ SCAN FREQ

ZENITH RADIO CORP. CHICAGO, ILL. 123-5498



- = DC VOLTAGE SOURCE
  - ⊙ = DC VOLTAGE APPLIED
- NOTE: CUSTOMER SUPPLIED EXTERNAL DC SOURCE ON PWR TAP CONNECTION

SHEET 2

SCHEMATIC FOR  
D12 VIDEO DISPLAY  
16.2 KHZ HORIZ SCAN FREQ

ZENITH  
RADIO CORP  
CHICAGO, ILL.

123-5498

**SM-12DN4KA**  
**DATA DISPLAY MONITOR**

**SAMSUNG ELECTRON DEVICES CO., LTD.**





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SECTION I. SPECIFICATIONS

A. Cathode Ray Tube (12 ZB)

1. Size : 12 inch diagonal.
2. Deflection angle : 90°
3. Glass area : 74 square inches.
4. Implosion protection : Tension band with mounting lugs.
5. Phosphor : P4
6. Anode voltage : Approx. 11.5KV
7. Display size : 8.3/8"(H) x 5.3/4"(V)
8. Face : Direct etched.

B. Electrical characteristics

1. Video : TTL positive going pulse(4.0Vp-p+1.5V)  
 Input impedance: More than 3.3Kohms shunted  
 by 60PF.  
 Rise and fall time: 35nano-seconds or less.  
 Video bandwidth: 18MHZ
2. Horizontal : TTL positive going pulse(4.0Vp-p+1.5V)  
 Input impedance : More than 470ohms shunted  
 by 40PF.  
 pulse width: 22 to 30 micro-seconds at 16.2KHZ  
 18 to 24 micro-seconds at 19.2KHZ  
 Scan frequency: 19.2+ 0.5KHZ  
 16.2+ 0.5KHZ by changing a  
 jumper(JPR1B to JPR1C)  
 Retrace time: Approx. 7.5micro- seconds.
3. Vertical : TTL negative going pulse(4.0Vp-p+1.5V)  
 input impedance : More than 3.3Kohms shunted  
 by 40PF  
 pulse width: 5 to 1000 micro-seconds.  
 Scan frequency : 47 to 63 HZ  
 Retrace time : 926 micro-seconds.

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4. Power : 15VDC $\pm$ 0.2V/0.8AMP or less nominal

\* Note : Refer to timing chart figure 1.

C. Picture quality

1. Resolution : 900TV lines at center.  
800TV lines at corners at 40 footlambert.

2. Geometric distortion: The outside dots of all outside rows and columns shall fall within the area defined by the space between the two rectangles shown in FIG 6. This alignment shall fulfill the Pincushioning, barreling, parallelogram and trapezoidal distortion requirements of the monitor display area.

3. Horizontal linearity: Less than 10% for adjacent characters.  
Less than 20% for any two characters on the entire display field.

4. Vertical linearity : Same as for horizontal linearity.

5. Display capability : 80 characters per row. 24 rows.

D. Controls

1. Brightness : Internal.

2. Contrast : External (User will supply external control volume and wire)

3. Vertical hold : Internal.

4. Vertical height : Internal.

5. Vertical linearity : Internal.

6. Horizontal width : Internal.

7. Horizontal linearity: Internal.

8. Focus-static : Internal.

E. Environmental

1. Operating temperature: +5°C through +55°C

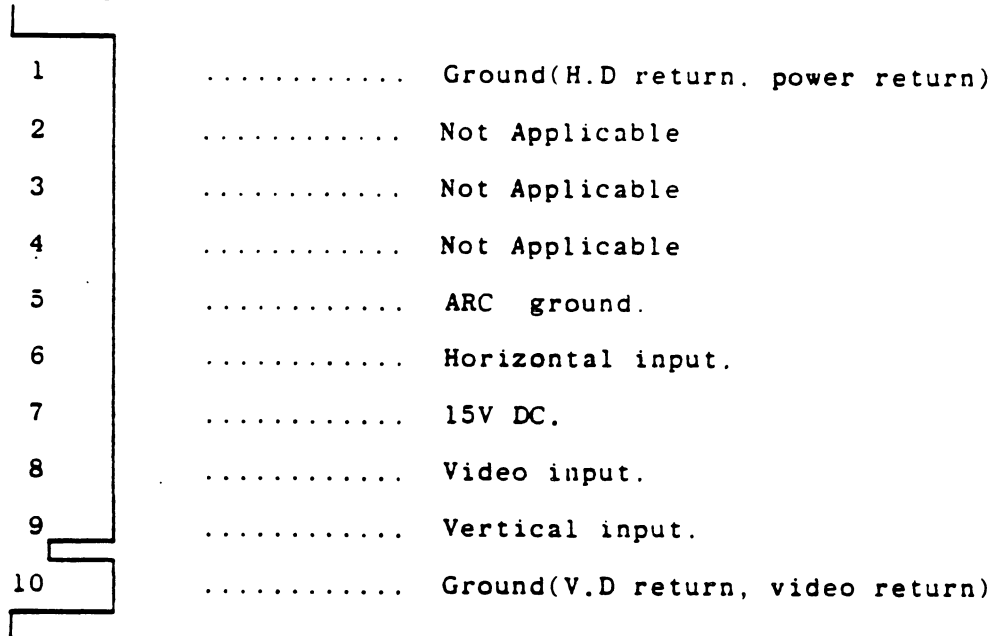
2. Storage temperature : -35°C through +60°C

F. Weight

1. Kit form : Approx. 4 Kg

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G. Input signal connection



H. Input connector

Board edge connector

- \* Viking # 2VK 10S/1-2
- \* Amphenol # 225-21031-101
- \* Hirose # CR8E-20DA-3.96E
- \* Or equivalent

I. Others

All components are capable of meeting UL,CSA and DHEW requirement.

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## SECTION II. SERVICE INFORMATION

### A. ADJUSTMENTS

#### 1. BRIGHTNESS

Normally, the monitor will be used to display alphanumeric or other black and white information. Moreover, the video polarity is usually white characters on a black background.

The internal brightness control should be adjusted at a point where the white raster is just extinguished. The CRT will then be at its cutoff point, and a maximum contrast ratio can be obtained when a video signal is applied.

#### 2. VIDEO CONTRAST

Q201 is designed to operate linearly where a +2.5V signal is applied to its base. This control, or a fixed resistor, should be adjusted for a typical signal level of +2.5V peak-to-peak when measured at the video input terminal of the printed circuit board edge connector.

In all cases, the output DC impedance of the video signal source must be 500ohms, or less.

#### 3. VERTICAL ADJUSTMENTS

There is a slight interaction among the vertical frequency, height, and linearity controls. A change in the height of the picture may affect linearity.

- a. Set the vertical-hold control, R302 near the mechanical center of its rotation.
- b. Adjust the vertical linearity control, R306 for best vertical linearity.
- c. Adjust the vertical height control, R304 for desired height
- d. Readjust the vertical hold control, R302 until the picture "locks" on vertical sync.
- e. Recheck height and linearity, and readjust if necessary.
- f. Slight readjustment of vertical hold control, R302, may be required if the picture "rolls" up or down after a power OFF/ON sequence.

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#### 4. HORIZONTAL ADJUSTMENTS

Raster width is affected by a combination of the DC power supply, horizontal width coil L402 and the horizontal linearity coil L403.

##### a. Horizontal linearity.

When character width variation is observed in characters of one row, turn the core of adjustor L403 so that character widths should become uniform.

##### b. Horizontal width.

Adjust horizontal width by turning the core of L402 with a plastic hexdriver for the desired width.

##### c. Readjust horizontal linearity and width coil, for proper width.

##### d. Observe final horizontal linearity and width, and touch up either adjustment if needed.

The raster should be properly locked and centered when the horizontal drive signal adjustments (described in steps a-d above) have been completed.

#### 5. DEFLECTION YOKE ASSEMBLY ADJUSTMENTS

##### a. Raster centering

If the raster is not properly centered, it may be repositioned by rotating the ring magnets behind the deflection yoke.

The ring magnets should not be used to offset the raster from its nominal center position because it would degrade the resolution of the display.

If the picture is tilted, rotate the entire yoke.

##### b. Geometric corrections

The magnets on the yoke assembly shall be polarized so as to provide adjustment of pin-cushion, barreling and other geometric deformities by simply rotating the magnets until the desired display is achieved. Readjust if necessary.

#### 6. FOCUS ADJUSTMENT

Although the focus control, R508, does not have a large effect on focus because of the CRT gun-assembly construction. It provides some adjustment for maintaining the best overall display focus.

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SECTION III. TROUBLESHOOTING FOR RESPECTIVE SYMPTOMS

A. No Raster

1. Turn the internal brightness control clockwise fully.

If raster appears : Good

If raster does not appear : No good. To next check.

2. Is CRT heater on?

It is not on : Check CRT, heater voltage, power supply circuit and CRT socket for normality.

It is on : Proceed to next check item.

3. Check high voltage by high-voltage voltmeter.

High voltage is not obtained :

Check of flyback transformer T402. Check of collector pulse of Q404. check of base pulse of Q404, check of collector and base waveforms of Q403, check of input HD.

High voltage is obtained : To next check item.

4. Check respective CRT electrode voltages for normality with a multi-tester.

G2 : 350V - 450V

G4 : -100V - +400V

G1 : -100V - +20V

K : 0 - +50V

When voltages of G2 and G4 are not obtained :

Check of CR501, CR503, C501, C503, R501, R503, R505, R507, R508, R509, and T402.

Voltage of G1 is not obtained :

Check of CR502, CR503, C502, C503, C504, R502, R506, R510, R511, E502 and T402.

Voltage of K is not obtained :

Check of CR502, C502, R204, R206, E501, and T402

Voltages of G2, G4, G1, and K are normal :

CRT is faulty Replace CRT.

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B. Only one raster line appears in horizontal direction.

Check of deflection yoke vertical coil  
When deflection yoke vertical coil is shorted or opened.  
deflection yoke is faulty and should be replaced. When  
30-50 OHMS, the coil is good.

C. Only one raster line appears in vertical direction

Wire breakdown or deflection yoke horizontal coil or L402, L403,  
or C413 open.

D. Raster is deformed abnormally.

Rare shorting of deflection yoke coil, replace deflection yoke.

E. Raster runs abnormally as if winding or excessive picture  
fluctuation is caused.

Check by measurement that ripples of power supply is less  
than 10mV p-p. when ripples are normal, check to determine  
whether there is any such source that causes alternating  
magnetic field near the unit.

F. When power is turned off, spot remains.

Check C502, C503, and CRT for deterioration.

G. Brightness range is abnormal.

Deterioration of CR503, C503. or CRT, Check of voltage of G2.  
Check of heater voltage.  
Check of Q201, and E501. check of R203, R204, R205, and  
check of CR502. and C502

H. Raster size is small and picture is abnormally bright (high voltage  
is abnormally high.).

Check of C409, and C410. Check of T402

I. Vertical synchronization is not achieved.

Check of VD. Check of C301, C302, CR301, R301, R302, and U301

J. Raster position is deviated relative to CRT face.

Turn deflection yoke centering magnet so that raster should be  
positioned at center.

K. Picture or characters do not appear. contrast is unachievable.

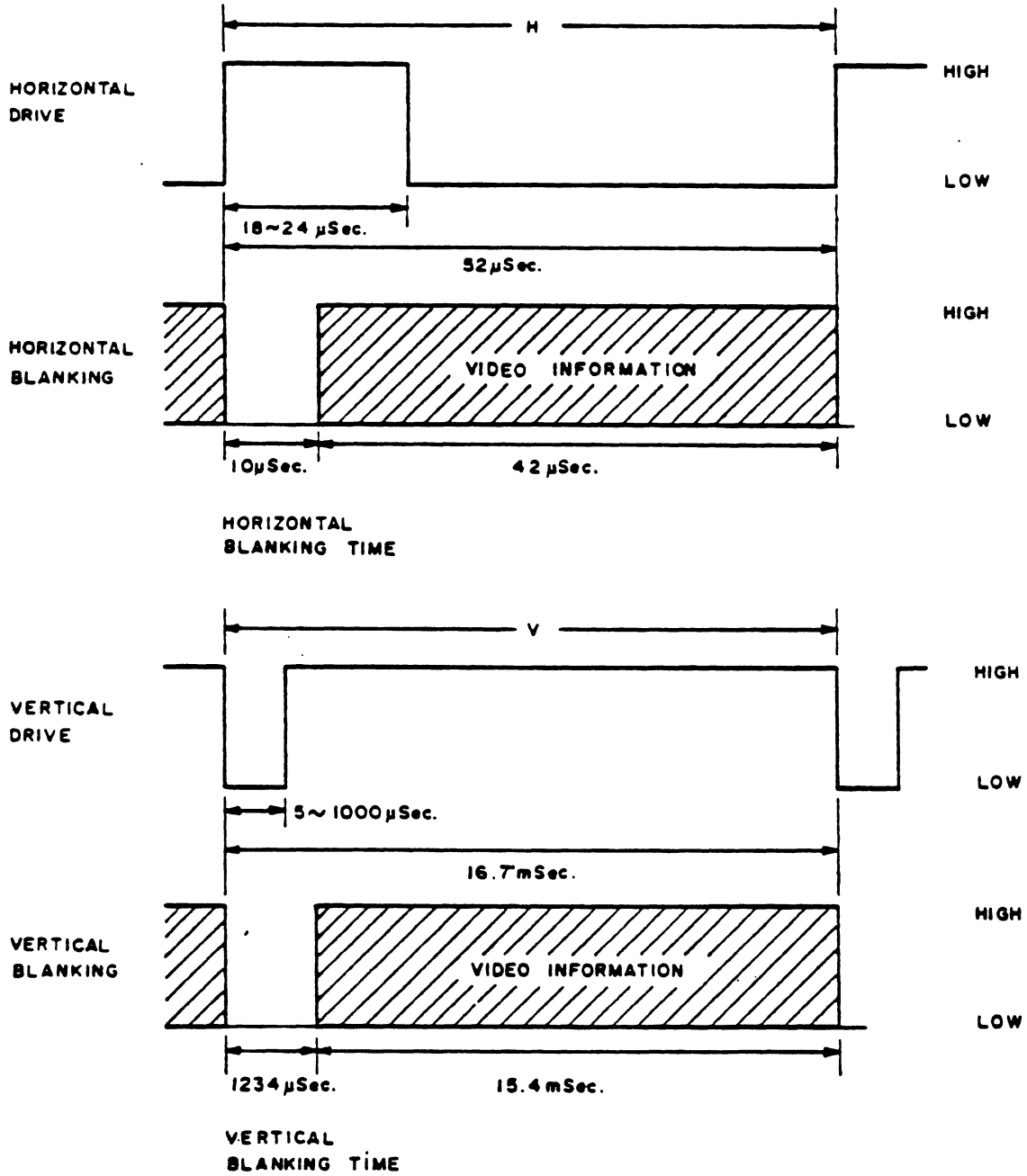
Check of Q201 and associated components. Check of input signal.  
Check of CRT.

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SECTION IV FIGURES

TIMING CHART

AT HORIZONTAL DIRECT DRIVE  
 H = 19200 Hz  
 V = 60 Hz  
 V RETRACE TIME = 926  $\mu$ Sec.



(FIG.1)

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L. Picture or characters are displayed but inclined.

Untighten clamp screw on deflection yoke. Rectify the inclination by turning the entire deflection yoke.

M. Fine noises appear as the picture and characters shiver.

Check high-voltage portion for leakage.  
Check connectors for complete contact.  
Check FBT for wire breakdown.

N. It takes long for picture to appear (more than 15 seconds.)

Service life of CRT has reached. Replace CRT.

O. Sync noise not related with input data appears in picture.

Check grounding wire for poor contact. VIDEO grounding for incompleteness, input signal for normality, and power supply return for incompleteness.

P. Picture appears and disappears alternately.

Check of input signal. Check of card edge connector. Check of video circuit for poor soldering. Check of CRT socket.

Q. Horizontal linearity is not achieved.

Check of L403. C413. and Q404

R. Vertical linearity is not achieved.

Check of R305, R306. R307. C304. C305. and U301

S. Focusing is not achievable.

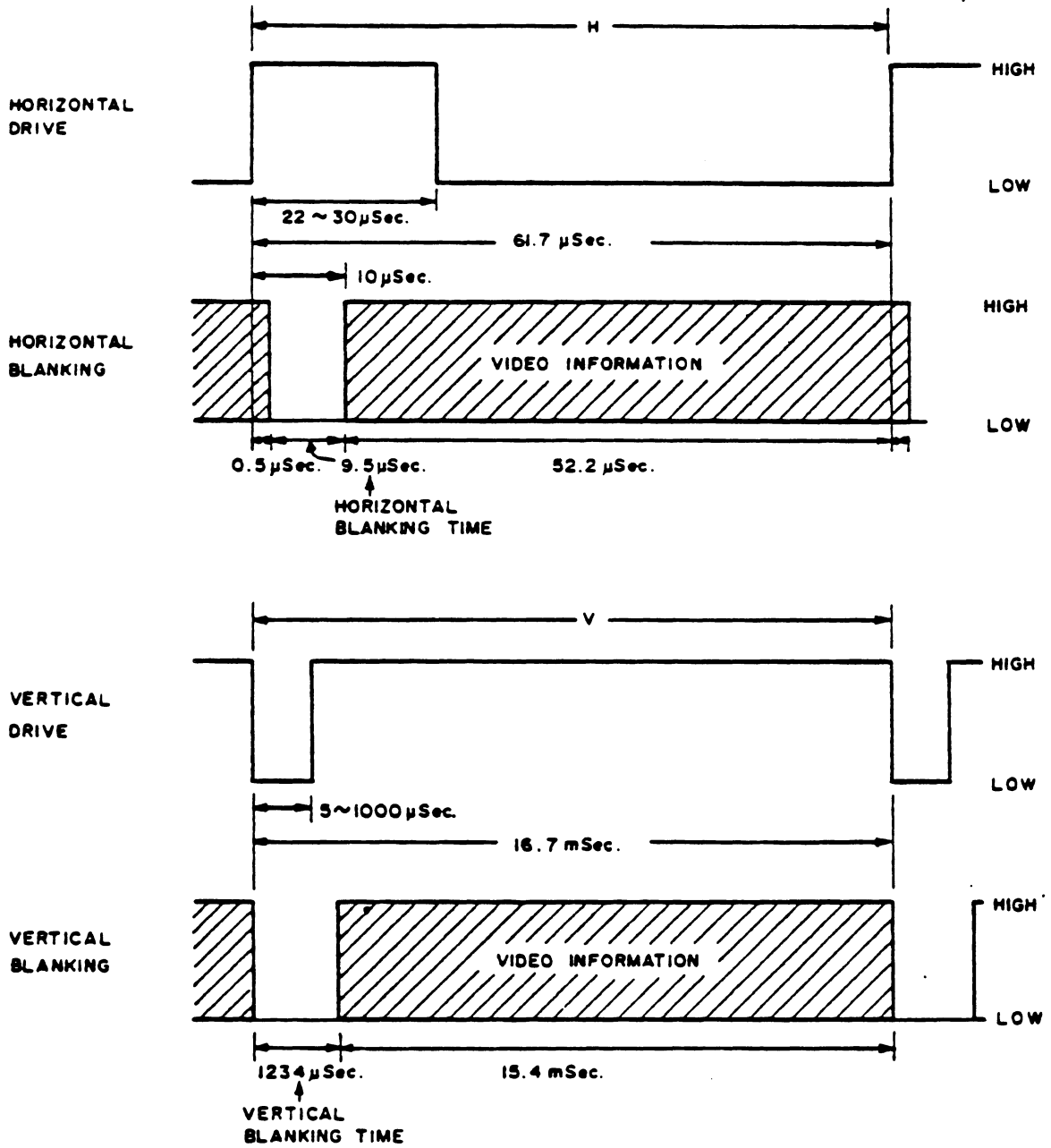
Check of voltages G2 and G4. Readjustment of R508.  
Check of high voltage. Check of CR501, R501, C501, R503, and R509  
When all above items are normal. CRT is faulty and should be replaced.

Note : Refer to voltage waveforms(Figure 1.)

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# TIMING CHART

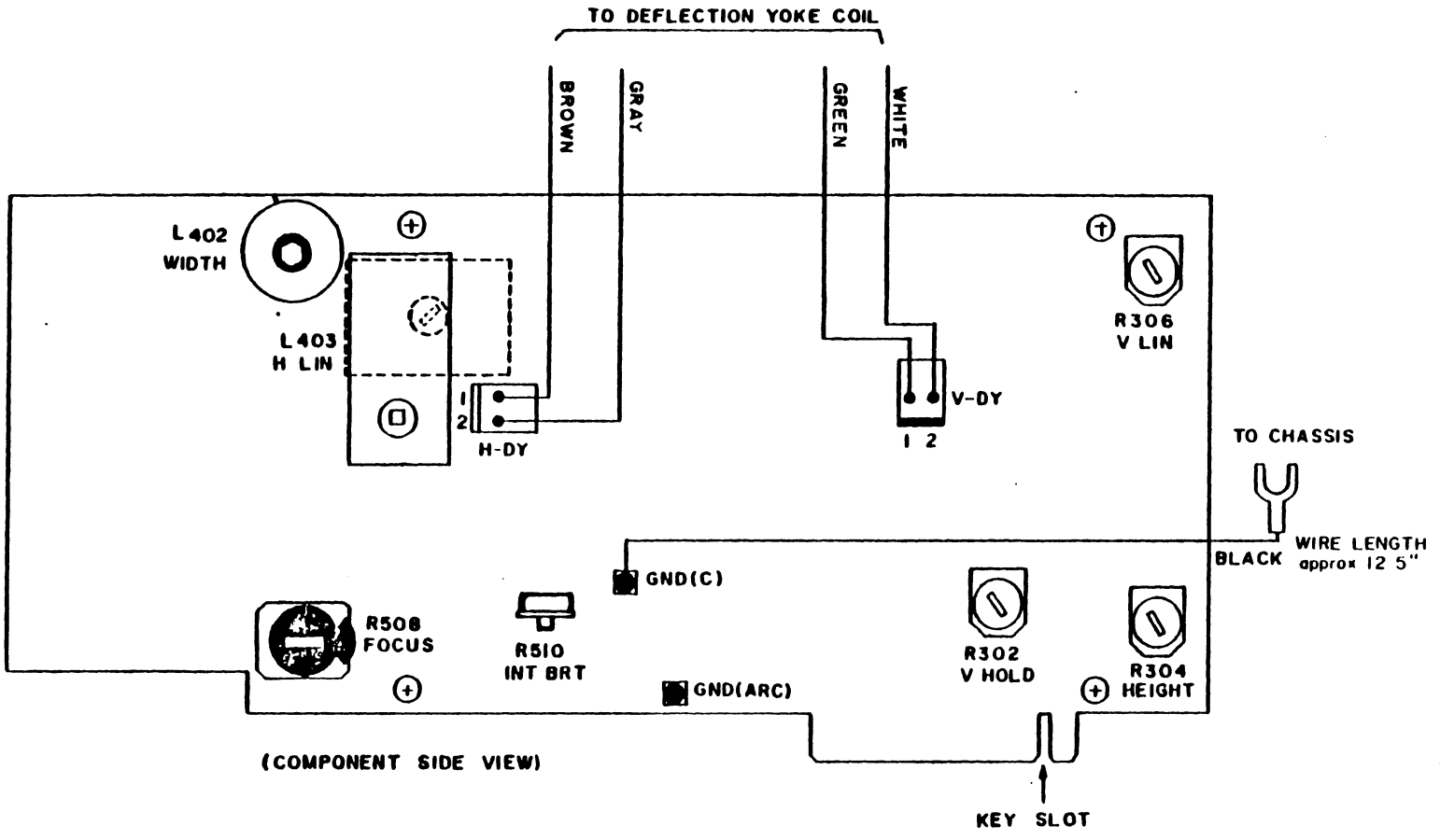
AT HORIZONTAL DIRECT DRIVE  
 $H = 16200 \text{ Hz}$   
 $V = 60 \text{ Hz}$   
 $V \text{ RETRACE TIME} = 926 \mu\text{Sec.}$



(FIG.2)

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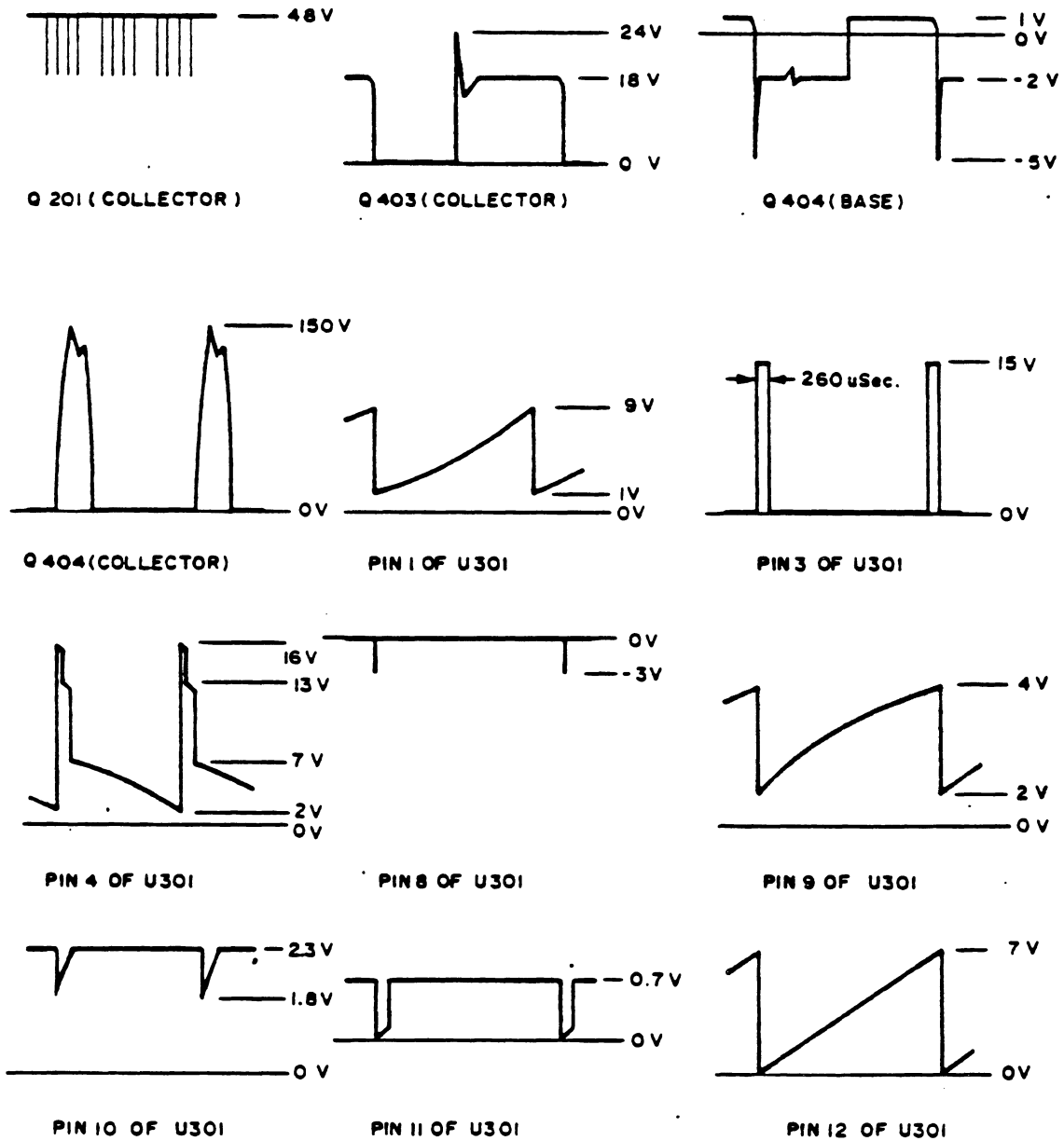
LS-001	SM-12DN4KA	12" monitor ENG. SPEC.	E-018	2 OF IV
CUSTOMER CODE	DEVICE	TITLE	SPEC. NO.	PAGE



ADJUSTORS, CONNECTORS & CABLING LOCATIONS

(FIG. 3)

## VOLTAGE WAVEFORMS

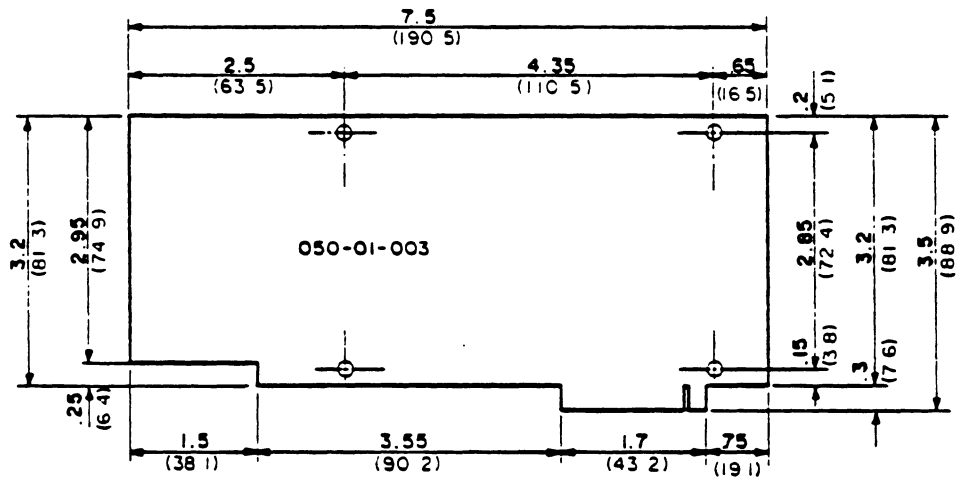


(FIG. 4)

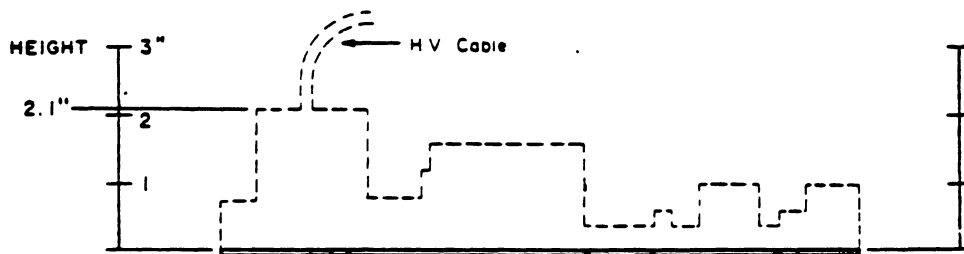
CUSTOMER CODE	DEVICE	TITLE	SPEC. NO.	PAGE
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PC BOARD ASSY DIMENSIONS

INCH  
(mm)



( COMPONENT SIDE VIEW )

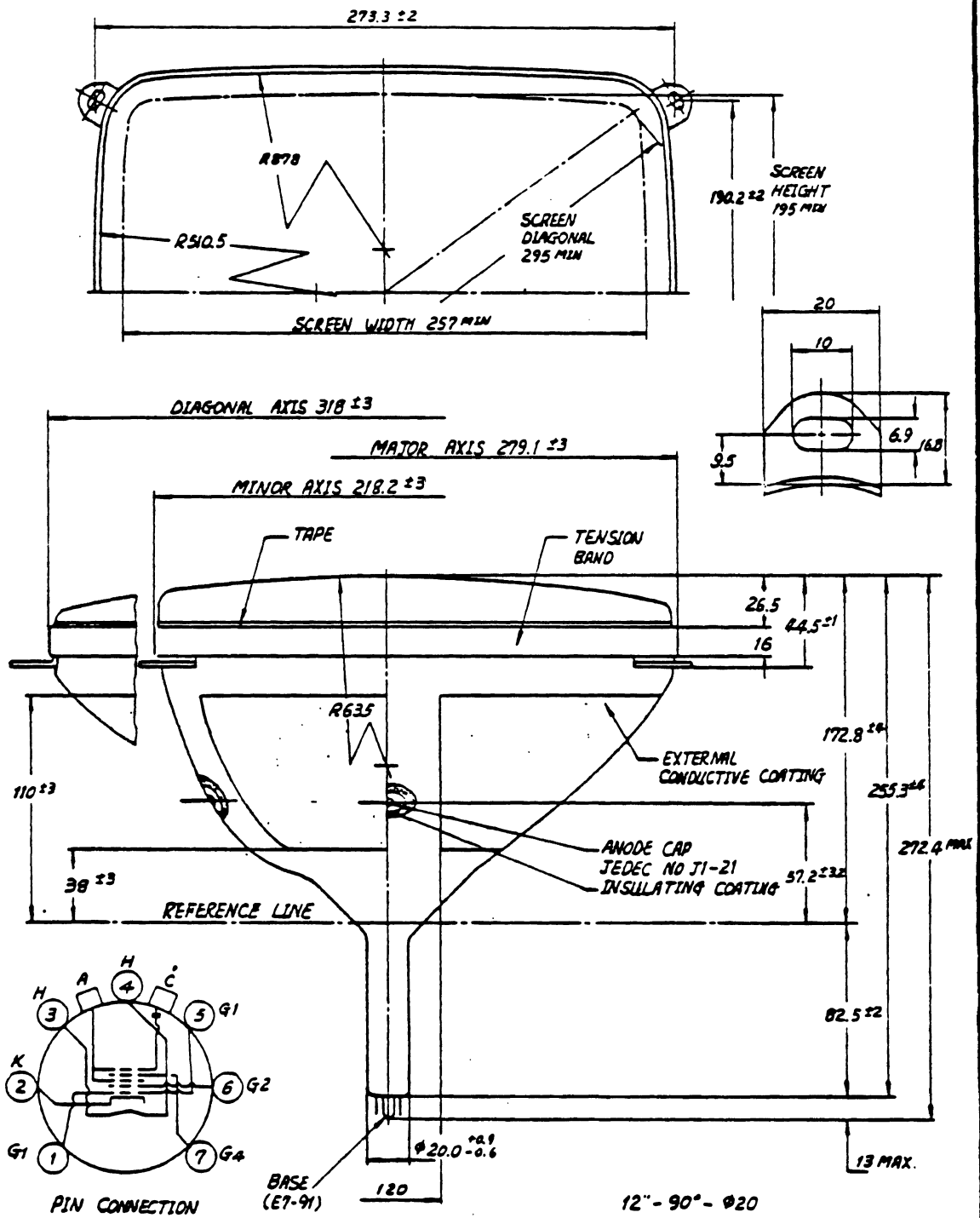


( FRONT SIDE VIEW )

(FIG. 5)

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Mechanical Outline. MECHANICAL DIMENSION Dimension in MM.



1981. 2. 1  
CF 007 - D1200 - 1

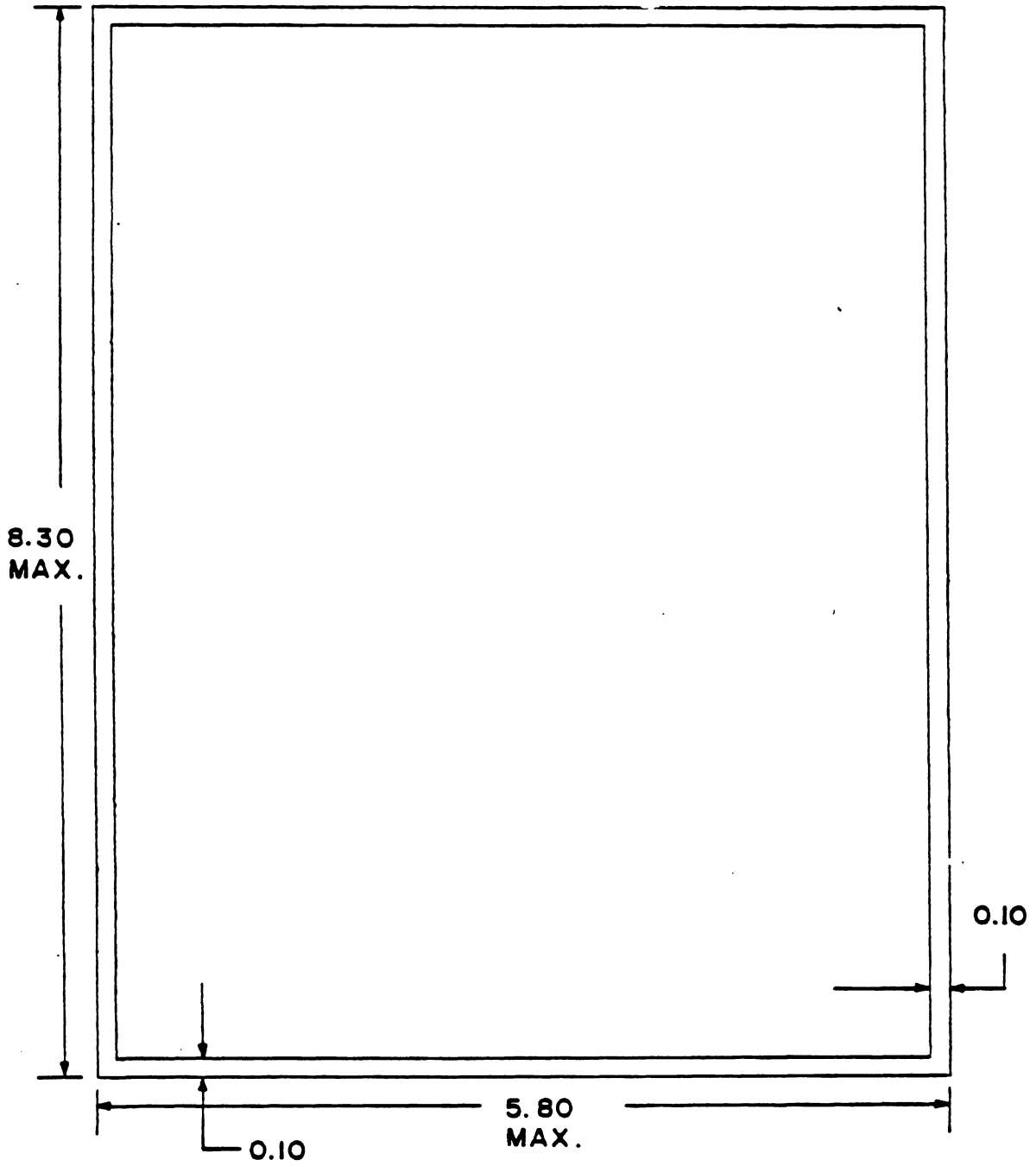
( FIG. 6 )

12" - 90° - Ø20  
12ZB4/4N -31/31N -39/39N -42/42N  
12ZB24/4N -31/31N -39/39N -42/42N

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12" MONITOR DISPLAY AREA



(FIG.7)

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PART NUMBER	DESCRIPTION	QTY	LOCATION
916030	Monitor control board assy SAMSUNG. (when ordering this board, please note if board is for the ADM32 or not, The MCB for the 32 must have an extra long cabde to monitor installed.)	1	see breakdown
919020	TUBE, std crt Samsung	1	
919018	TUBE, Green crt, Samsung		
919019	YOKE Assy, Samsung	1	
902525	Magnet, ring type (for yoke)	A/R	

THE ABOVE PARTS ARE FOR THE SAMSUNG MONITOR ASSY ONLY!

132509-003	Monitor Assy, white (std) Samsung
132509-004	Monitor Assy, Green Samsung

ASSY 916030

MONITOR CONTROL BOARD ASSY, SAMSUNG

PART NUMBER	DESCRIPTION	QTY	LOCATION
905355	Cap 100uf 25V Electro	2	C103,412
905045	Cap 680pf 50V Ceramic	1	C201
905435	Cap 0.001uf 50V mylar	1	C301
905434	Cap 0.15uf 100V mylar	1	C302
805022	Cap 0.1uf 100V mylar	4	C304,305, 306,309
905046	Cap 22pf 50V Ceramic	1	C306
905308	Cap 1000uf 16V Electro	2	C307,411
905365	Cap 47uf 16V Electro	2	C308,408
905436	Cap 0.01uf 100V Mylar	1	C407
905716	Cap 0.01uf 400V Poly	1	C409
905717	Cap 0.022uf 400V poly	1	C410
905366	Cap 16uf 63V bi-polar	1	C413
905718	Cap 0.047uf 630V poly	1	C501
905367	Cap 220uf 50V Electro	1	C502
905437	Cap 0.01uf 200V mylar	1	C503
905368	Cap 3.3uf 50V electro	1	C504
905719	Cap 0.01uf 630V poly	1	C505
908033	Diode IN60FM Germanium	1	CR301
908528	Diode U06E Silicon	2	CR402,403
808022	Diode IN4007 Silicon	1	CR501
908034	Diode IN4003 Silicon	1	CR502
908011	Diode IN4004 Silicon	1	CR503
917039	Coil, Horiz width HW-160	1	L402
917040	Coil, Horiz Linearity DL-284	1	L403
910030	Trans 2N2219	1	Q201
910530	Trans KCS1008	1	Q403
910510	Trans BU407	1	Q404
913025	IC TDA1170	1	U301
916029	Flyback Transf. output TMF-110	1	T402
916988	Transformer, Horiz Drive	1	T401

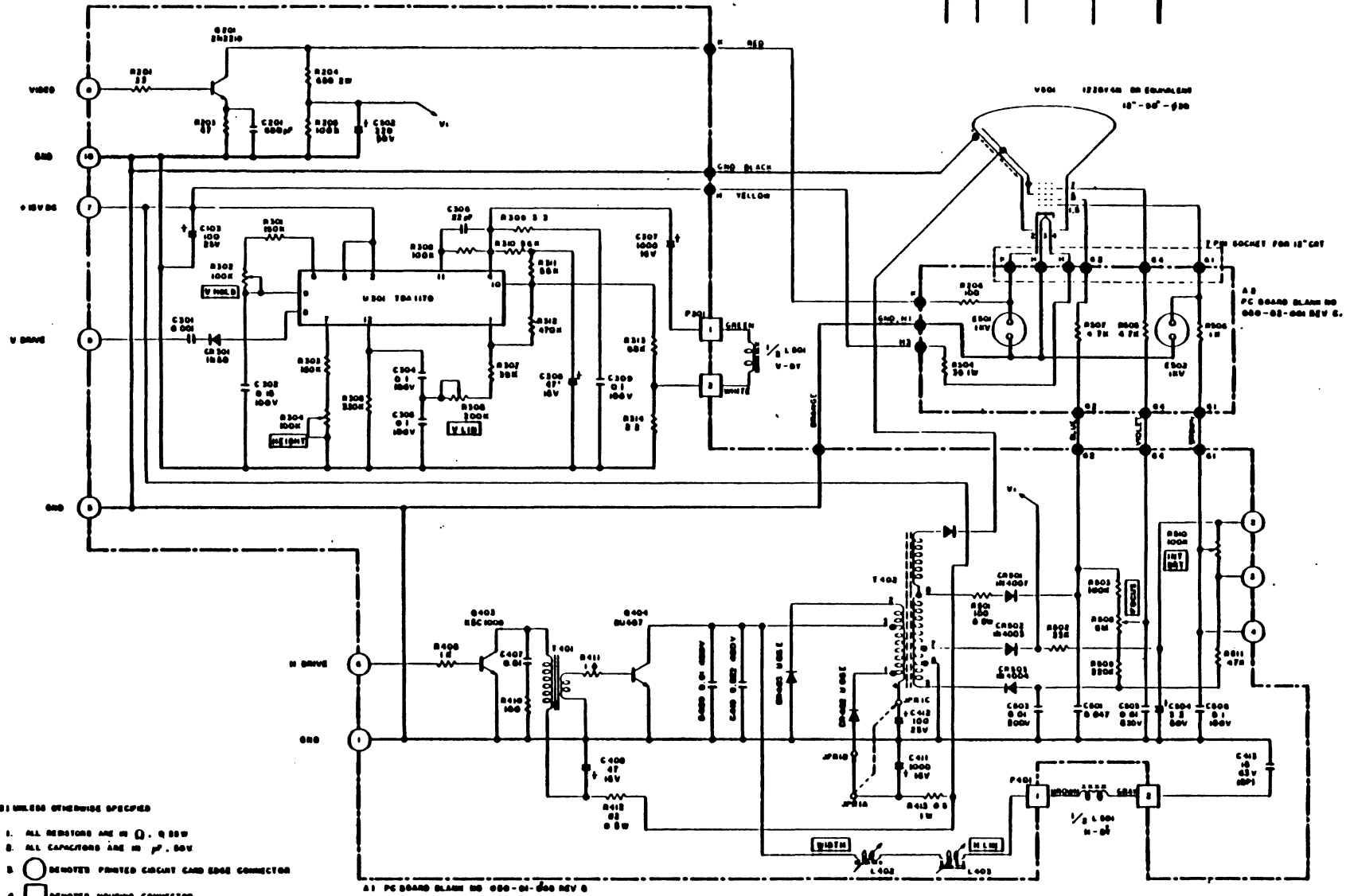
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ASSY 916030 cont.      MONITOR CONTROL BOARD ASSY, SAMSUNG

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PART NUMBER		DESCRIPTION	QTY	LOCATION
128533-330	FS	Res 33 ohm 5% $\frac{1}{4}$ w	1	R201
128533-470	FS	Res 47 ohm 5% $\frac{1}{4}$ w	1	R203
903719		Res 680 ohm 5% $\frac{1}{4}$ w	1	R204
128533-104	FS	Res 100K ohm 5% $\frac{1}{4}$ w	2	R308, 205
128533-101	FS	Res 100 ohm 5% $\frac{1}{4}$ w	5	R206, A08, 410, 501, 503
128533-154	FS	Res 150K ohm 5% $\frac{1}{4}$ w	2	R201, 303
901036		Res 100K ohm 20% 1w VAR	2	R302, 304
903050		Res 330K ohm 5% $\frac{1}{4}$ w carb straight	1	R305
901037		Res 200K ohm 20% 1w VAR	1	R306
128533-393	FS	Res 39K ohm 5% $\frac{1}{4}$ w	1	R307
903044		Res 3.3 ohm 5% $\frac{1}{4}$ w	1	R309
903033		Res 56K ohm 5% $\frac{1}{4}$ w	2	R310, 311
903051		Res 470K ohm 5% $\frac{1}{4}$ w carb straight	1	R312
128533-683	FS	Res 68K ohm 5% $\frac{1}{4}$ w	1	R313
903052		Res 2.2 ohm 5% $\frac{1}{4}$ w	1	R314
903053		Res 1 ohm 5% $\frac{1}{4}$ w	1	R411
903559		Res 82 ohm 5% $\frac{1}{2}$ w	1	R412
903613		Res 0.5 ohm 5% 1w metal oxide	1	R413
128533-333	FS	Res 33K ohm 5% $\frac{1}{4}$ w	1	R502
901038		Res 5M ohm 20% 5w VAR	1	R508
128533-224	FS	Res 220K ohm 5% $\frac{1}{4}$ w	1	R509
901035		Res 100K ohm 20% 2w VAR	1	R510
128533-473	FS	Res 47K ohm 5% $\frac{1}{4}$ w	1	R511
129472-390		Res 39 ohm 5% 1w metal oxide	1	R504
128533-472	FS	Res 4.7K ohm 5% $\frac{1}{4}$ w	2	R505, 507
128533-102	FS	Res 1K ohm 5% $\frac{1}{4}$ w	1	R506

REV NO	DATE	BY	APPD	REVISION DESCRIPTION	ECO NO
1	APR 19 1964	DAW, W. S.		PRODUCTION RELEASE	



- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN  $\Omega$ ,  $\text{K}$  OR  $\text{M}$
  2. ALL CAPACITORS ARE IN  $\mu\text{F}$ ,  $\text{pF}$ , OR  $\text{pF}$
  3.  $\bigcirc$  DENOTES PRINTED CIRCUIT BOARD EDGE CONNECTOR
  4.  $\square$  DENOTES HOUSING CONNECTOR
  5.  $\bullet$  DIRECT

DATE	BY	CHKD	APPD	SCHEMATIC	
APR 9, 1964	DAW	RESON	CHECH	APPD	
SIZE				1A" MANHOLE	
REV				AM-12044A	
SAMSUNG ELECTRON DEVICES CO., LTD. COMPUTER DIVISION				SCALE	DRAWING NO.
				NONE	20-02-010

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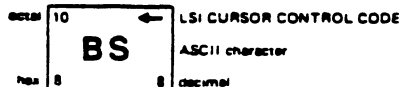
**APPENDIX**

**OPERATORS  
QUICK REFERENCE  
CHARTS**

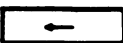


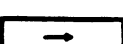
# ASCII CONTROL CODE CHART

BITS	0 0		0 1		1 0		1 1									
B4 B3 B2 B1	CONTROL				NUMBERS SYMBOLS				UPPER CASE				LOWER CASE			
0 0 0 0	NUL	DLE	SP	0	@	P	'	p								
0 0 0 1	SOH	DC1	!	1	A	Q	a	q								
0 0 1 0	STX	DC2	"	2	B	R	b	r								
0 0 1 1	ETX	DC3	#	3	C	S	c	s								
0 1 0 0	EOT	DC4	\$	4	D	T	d	t								
0 1 0 1	ENQ	NAK	%	5	E	U	e	u								
0 1 1 0	ACK	SYN	&	6	F	V	f	v								
0 1 1 1	BEL	ETB	'	7	G	W	g	w								
1 0 0 0	BS	CAN	(	8	H	X	h	x								
1 0 0 1	HT	EM	)	9	I	Y	i	y								
1 0 1 0	LF	SUB	*	:	J	Z	j	z								
1 0 1 1	VT	ESC	+	;	K	[	k	{								
1 1 0 0	FF	FS	,	<	L	\	l									
1 1 0 1	CR	GS	-	=	M	]	m	}								
1 1 1 0	SO	RS	.	>	N	^	n	~								
1 1 1 1	SI	US	/	?	O	_	o	RUBOUT (DEL)								

## LEGEND



## OPERATORS QUICK REFERENCE CHART OF CONTROL AND OPERATORS CODES

CONTROL CODE		HEX CODE	OPERATION
FROM HOST	FROM KEYBOARD		
ETX	<b>CTRL C</b>	03	Secondary channel line turnaround codes for 202 Modem operation (From Host Only)
EOT	<b>CTRL D</b>	04	
ENQ	<b>HERE IS</b>	05	Initiates ID message when Answerback Option is installed
BEL	<b>CTRL G</b>	07	Sounds audible beep in Video Display Unit
BS		08	Backspace
HT	<b>TAB</b>	09	Tab - No local operation (From Host Only)
LF		0A	Line Feed
VT		0B	Upline
FF		0C	Forward Space
CR	<b>RETURN</b>	0D	Return
SO	<b>CTRL N</b>	0E	With S4 in GT position, enables gated EXTENSION port and passes CTRL N through the EXTENSION port  With S4 in LK position, unlocks keyboard (From Host Only)
SI	<b>CTRL O</b>	0F	With S4 in GT position, disables gated EXTENSION port and passes CTRL O through the EXTENSION port  With S4 in LK position, locks keyboard
SUB	<b>SHIFT CLEAR</b>	1A	Clears Screen
ESC	<b>ESC</b>	1B	Lead in for ESC sequences
RS	<b>HOME</b>	1E	Homes Cursor
ESC T	<b>ERASE LINE</b>	54	Starting with cursor position, all characters in the line are erased and replaced with spaces.
ESC Y	<b>ERASE PAGE</b>	59	Starting with cursor position and continuing to end of page, all characters are erased and replaced with spaces.
ESC (	<b>ESC (</b>	28	Restores standard intensity *
ESC )	<b>ESC )</b>	29	Sets reduced intensity *
ESC G	<b>ESC G</b>	47	Sets reverse video or restores standard video and passes ESC G through the EXTENSION port when switch S4 is in the GT (gated) position

\*THESE TWO VISUAL ATTRIBUTES MAY BE USED IN COMBINATION



## OPERATORS QUICK REFERENCE CHART OF ABSOLUTE CURSOR POSITIONS

Keys Used: ESC = ROW  
ASCII COL  
ASCII

ASCII CODES	POSITION		ASCII CODES	POSITION		ASCII CODES	POSITION	
	ROW	COL		ROW	COL		ROW	COL
<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">=</span> <span style="border: 1px solid black; padding: 2px;">SPACE</span>	1	1	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">=</span> <span style="border: 1px solid black; padding: 2px;">;</span>		28	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">=</span> <span style="border: 1px solid black; padding: 2px;">V</span>		55
	2	2		29	29		30	30
	3	3		31	31		32	32
	4	4		33	33		34	34
	5	5		35	35		36	36
	6	6		37	37		38	38
	7	7		39	39		40	40
	8	8		41	41		42	42
	9	9		43	43		44	44
	10	10		45	45		46	46
	11	11		47	47		48	48
	12	12		49	49		50	50
	13	13		51	51		52	52
	14	14		53	53		54	54
	15	15		55	55		56	56
	16	16		57	57		58	58
	17	17		59	59		60	60
	18	18		61	61		62	62
	19	19		63	63		64	64
	20	20		65	65		66	66
	21	21		67	67		68	68
	22	22		69	69		70	70
	23	23		71	71		72	72
	24	24		73	73		74	74
	25	25		75	75		76	76
	26	26		77	77		78	78
	27	27		79	79		80	80
<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">=</span> <span style="border: 1px solid black; padding: 2px;">:</span>			<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">=</span> <span style="border: 1px solid black; padding: 2px;">U</span>			<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">=</span> <span style="border: 1px solid black; padding: 2px;">o</span>		

# **ADM 5 Dumb Terminal® Video Display Maintenance Manual Drawing Package**

## **Contents**

Schematic Diagram .....	132322
Wiring Diagram .....	132327

DP3190582FD





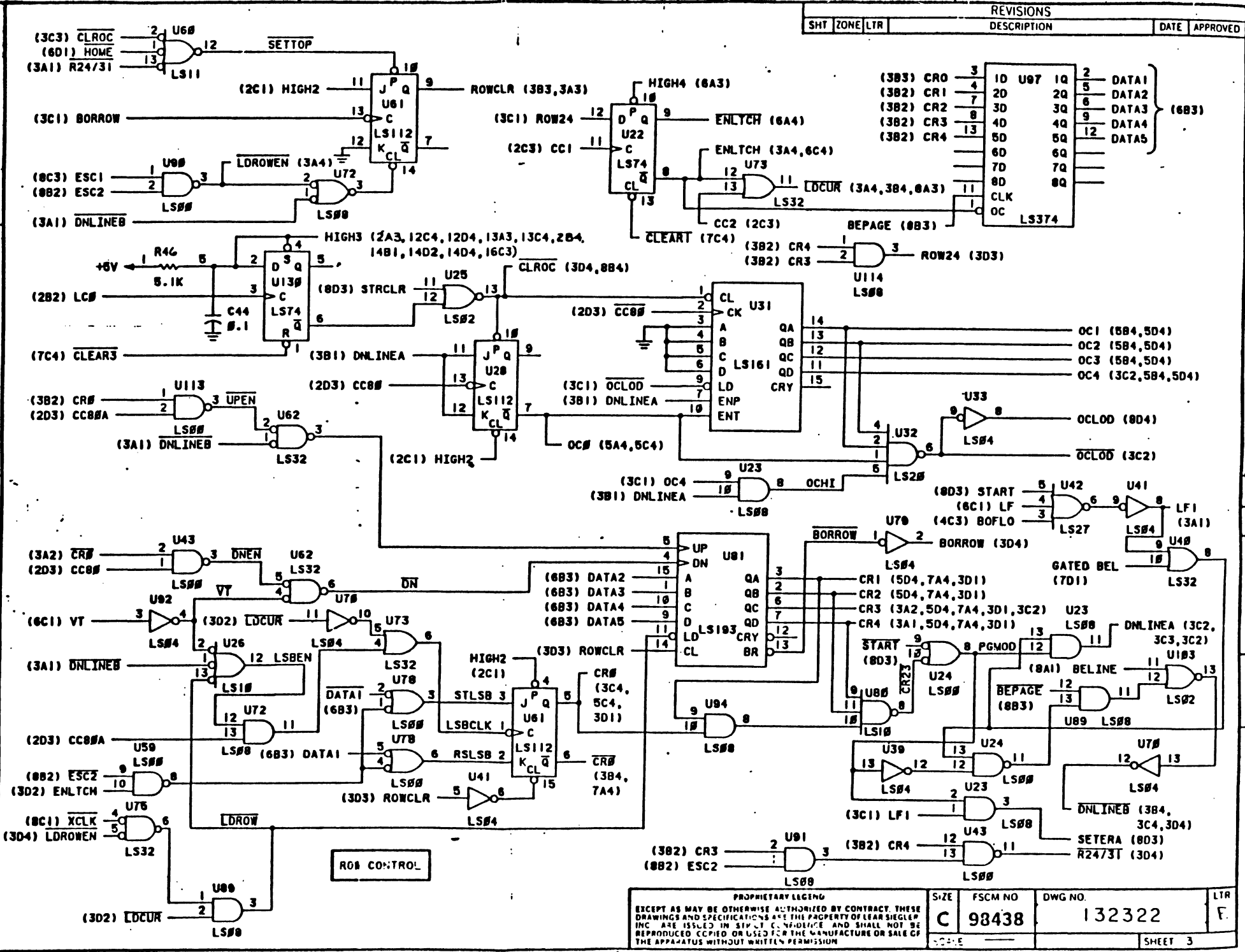
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SHT	ZONE	LTR	DESCRIPTION	

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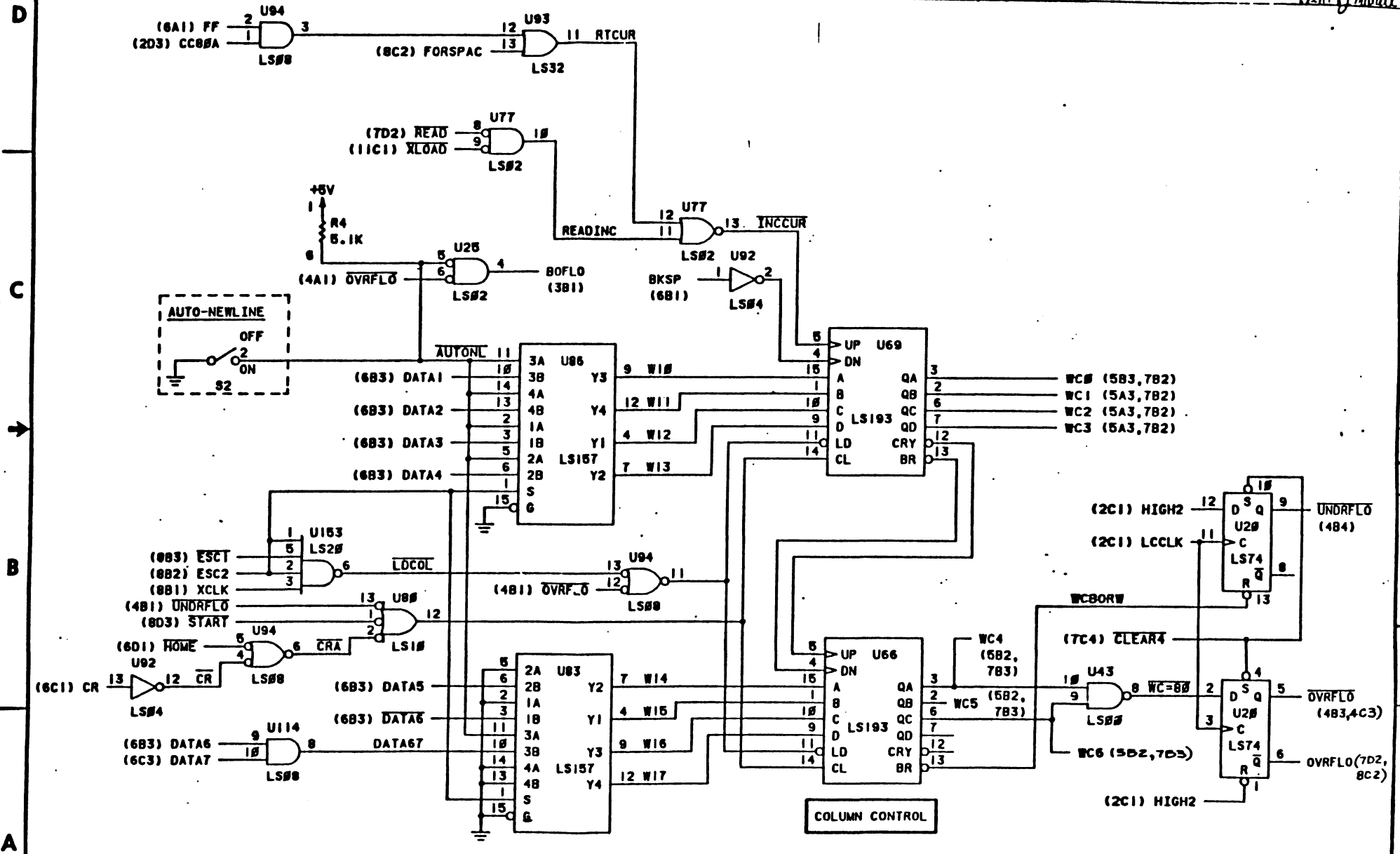


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SHEET 3

REVISIONS					
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	C	98438	132322	E



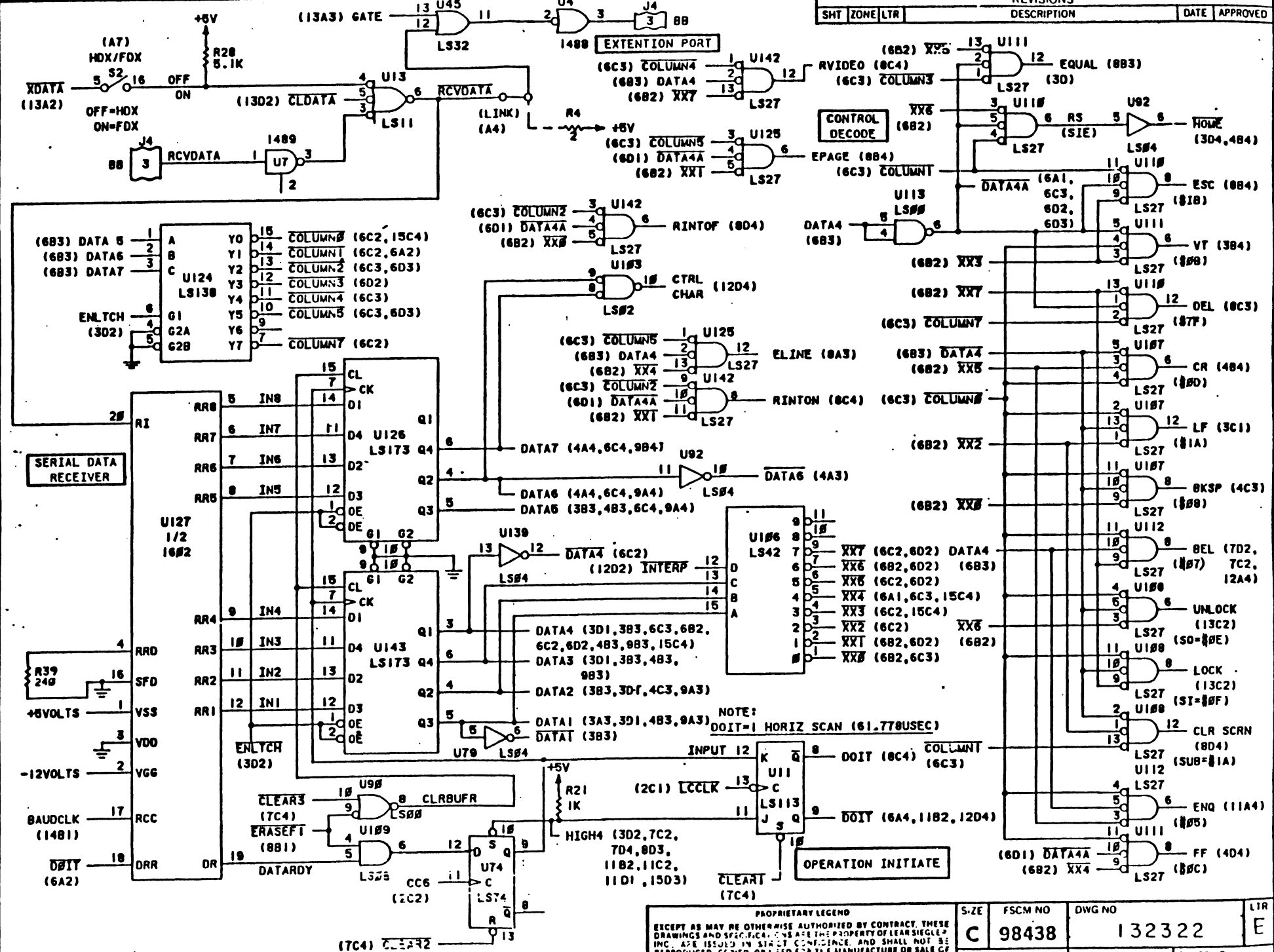
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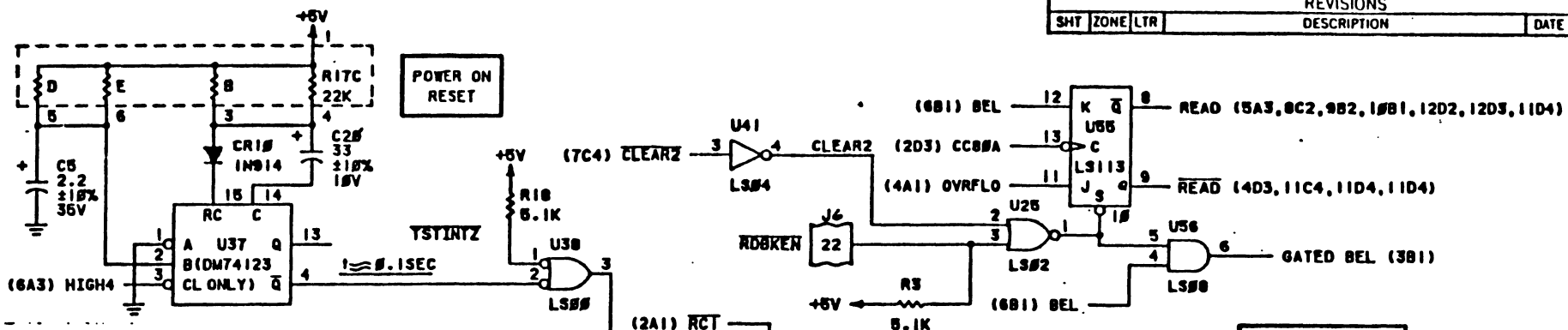


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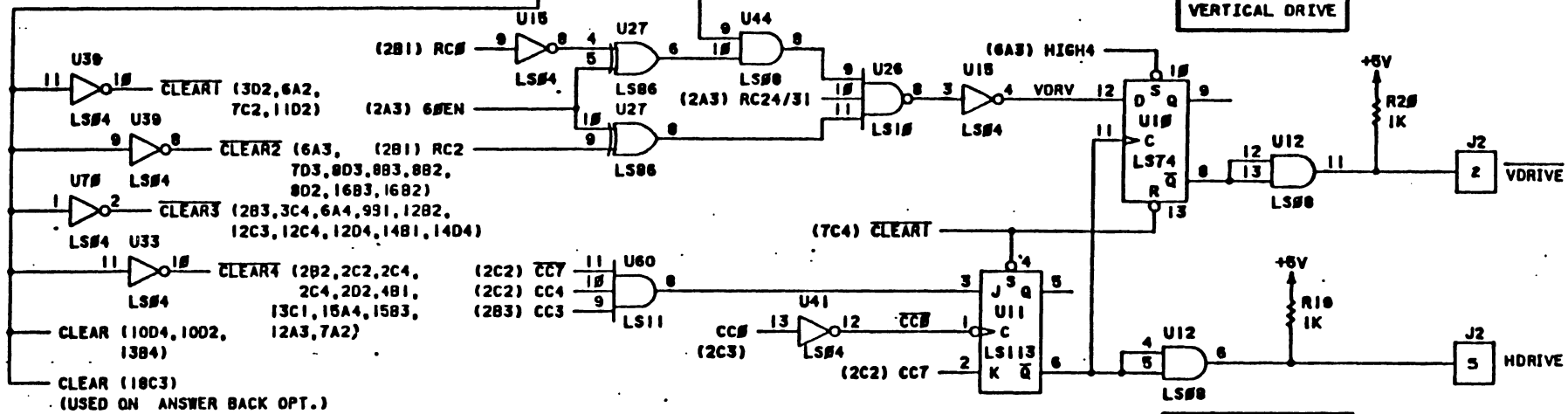


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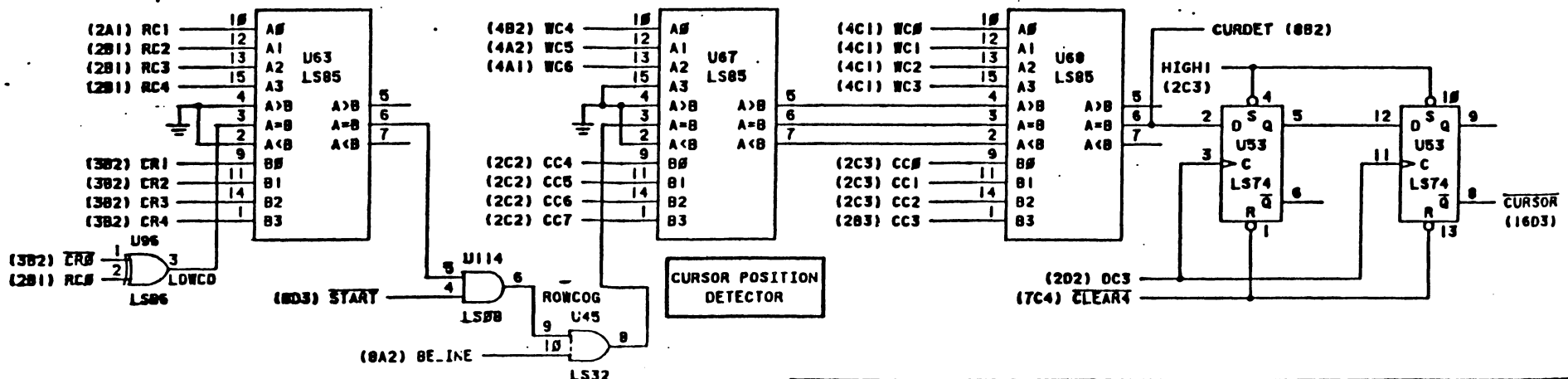
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REVISIONS

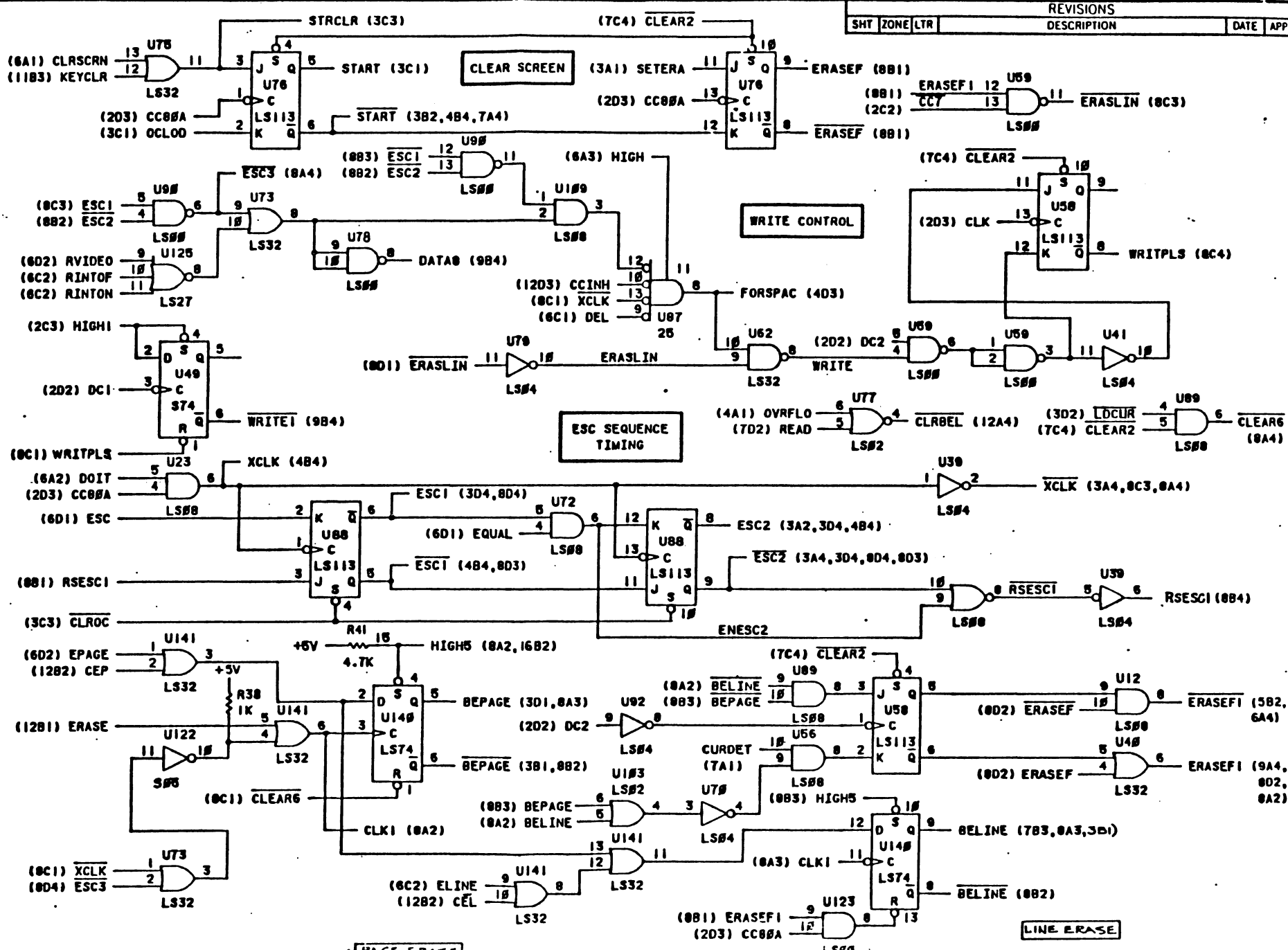
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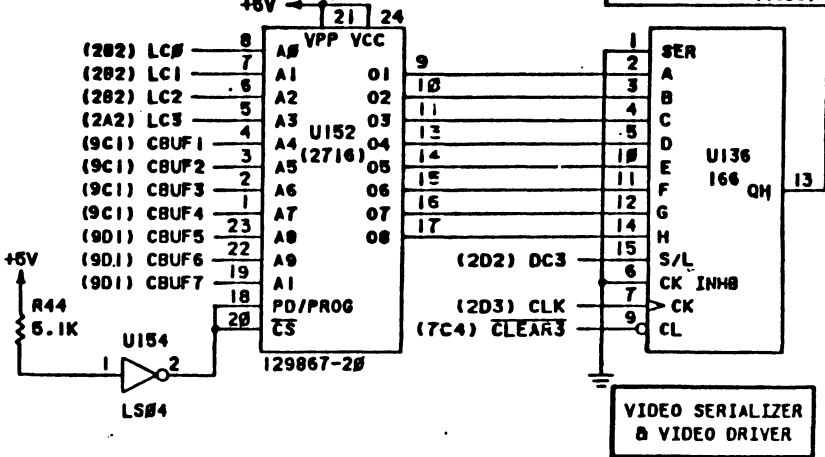
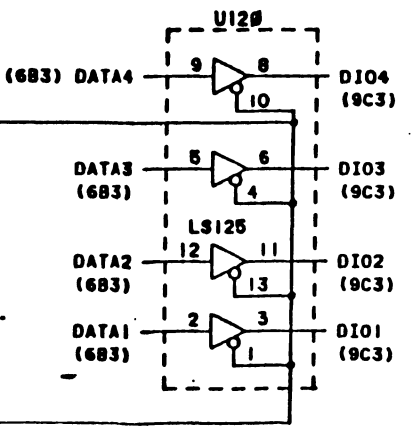
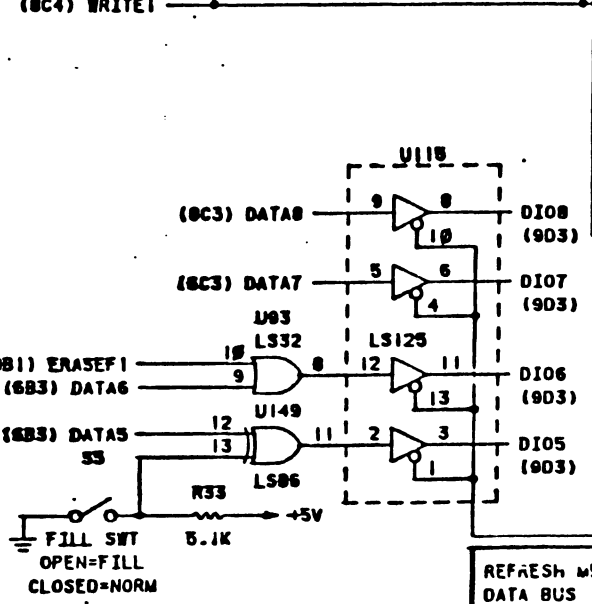
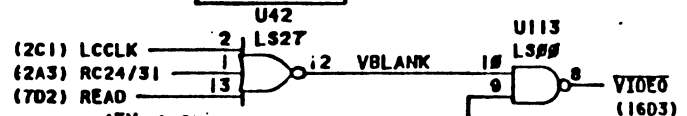
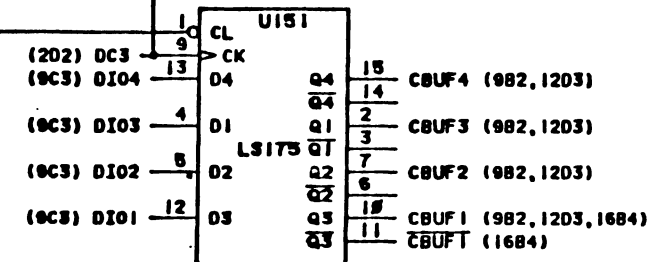
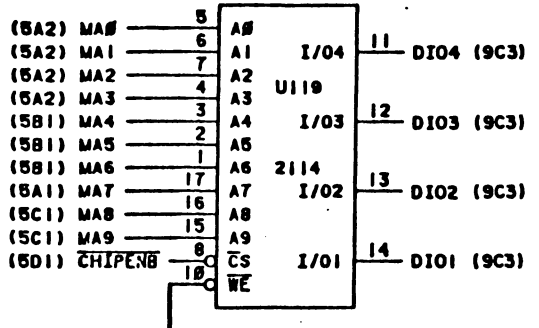
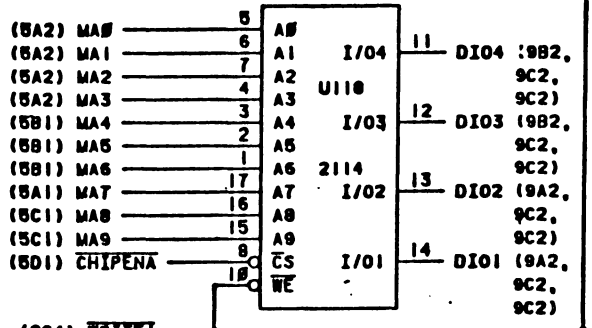
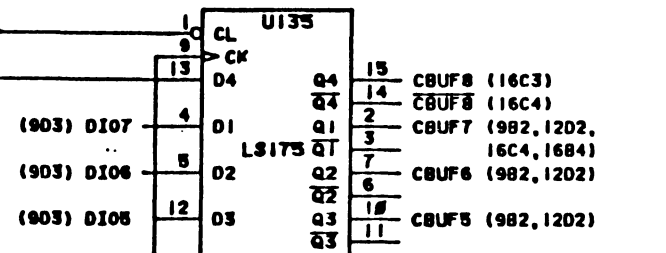
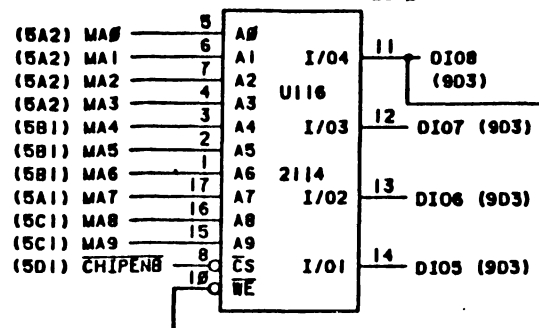
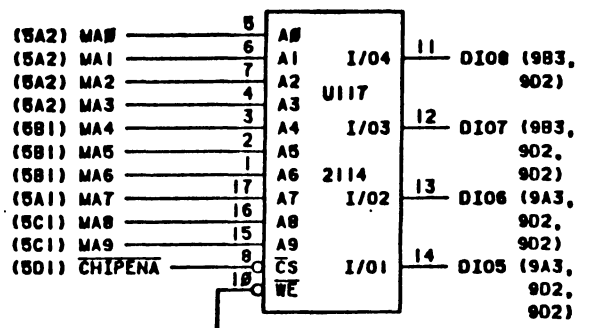
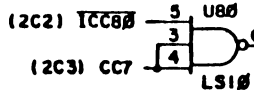
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SCALE		SHEET 8			

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REFRESH MEMORY



REFRESH MEMORY DATA BUS

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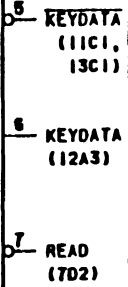
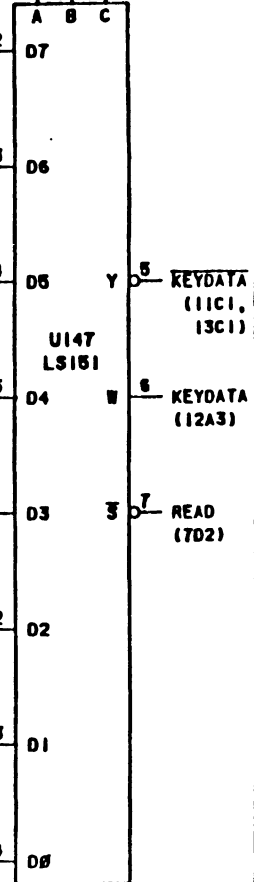
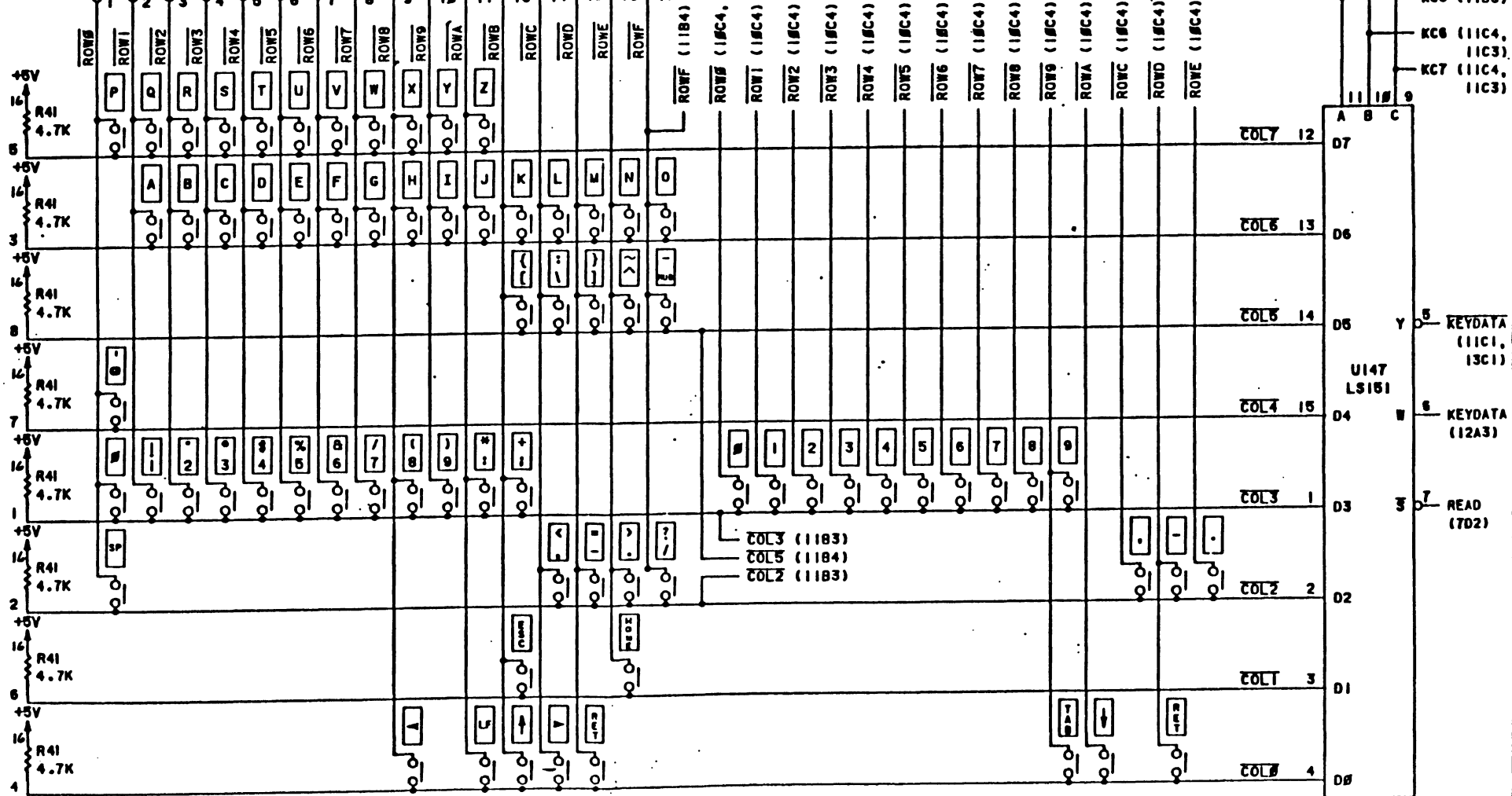
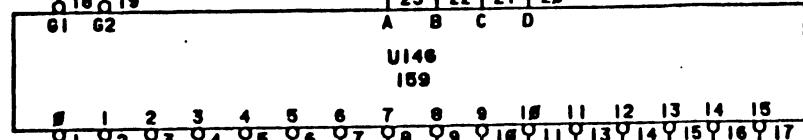
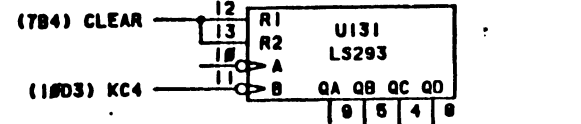
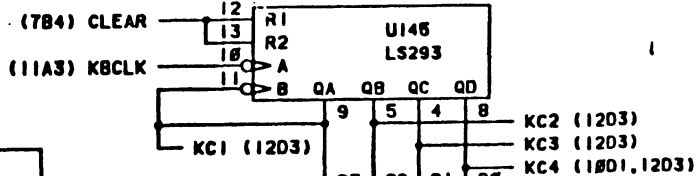
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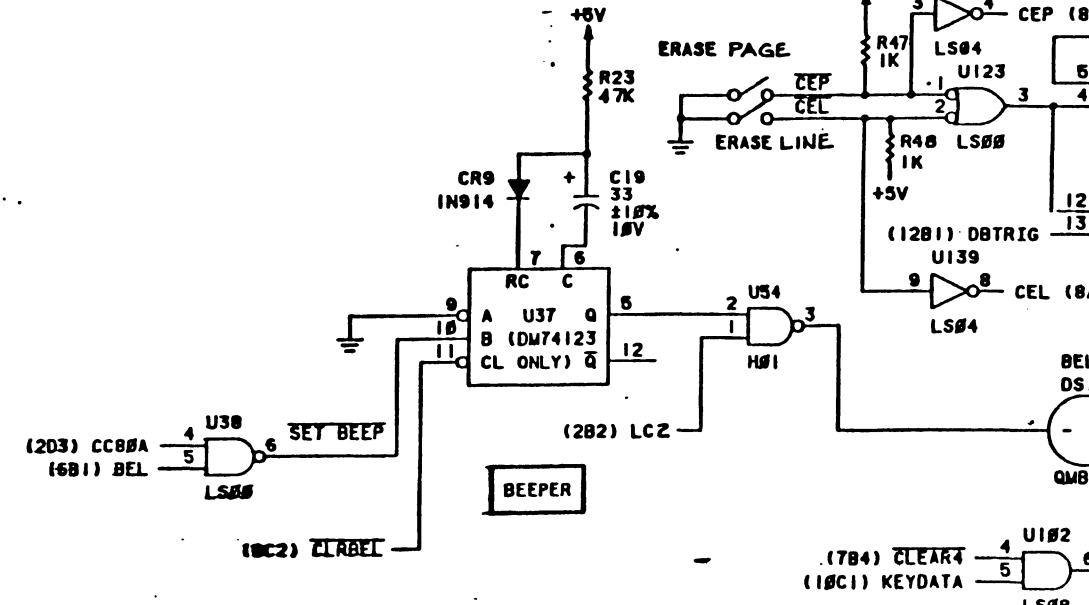
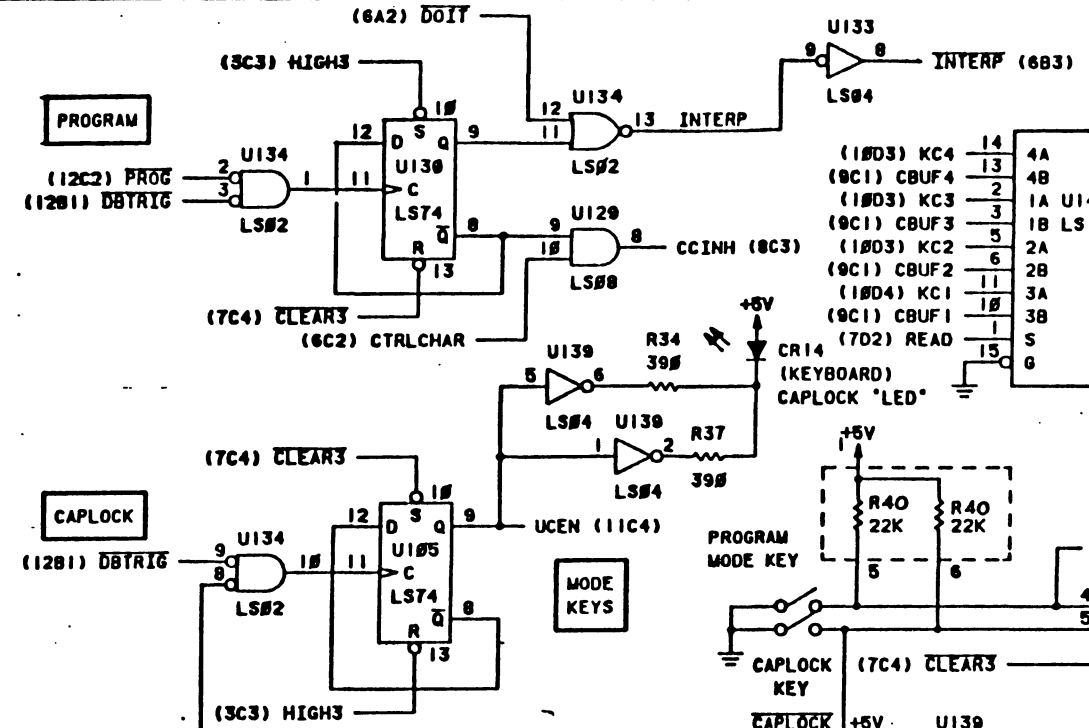
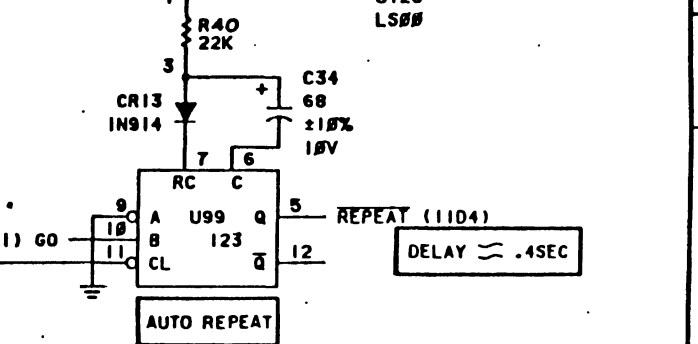
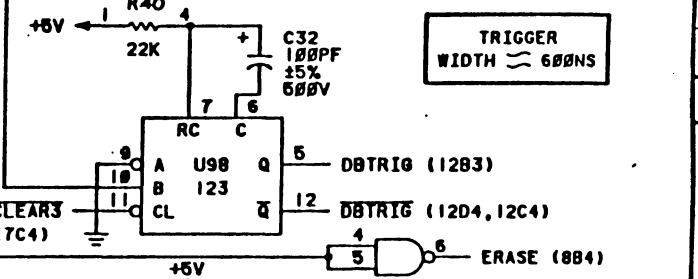
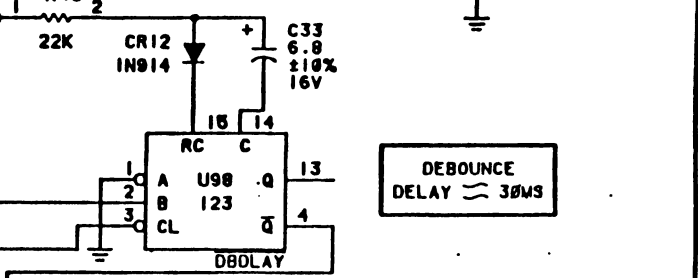
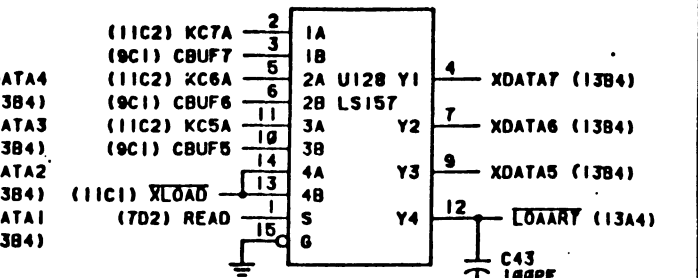
KEYBOARD

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SCALE						SHEET 10	



REVISIONS			DATE	APPROVED
SMT	ZONE	LTR	DESCRIPTION	

XMIT DATA MUX



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SCALE						SHEET 12	



REVISIONS				DATE	APPROVED
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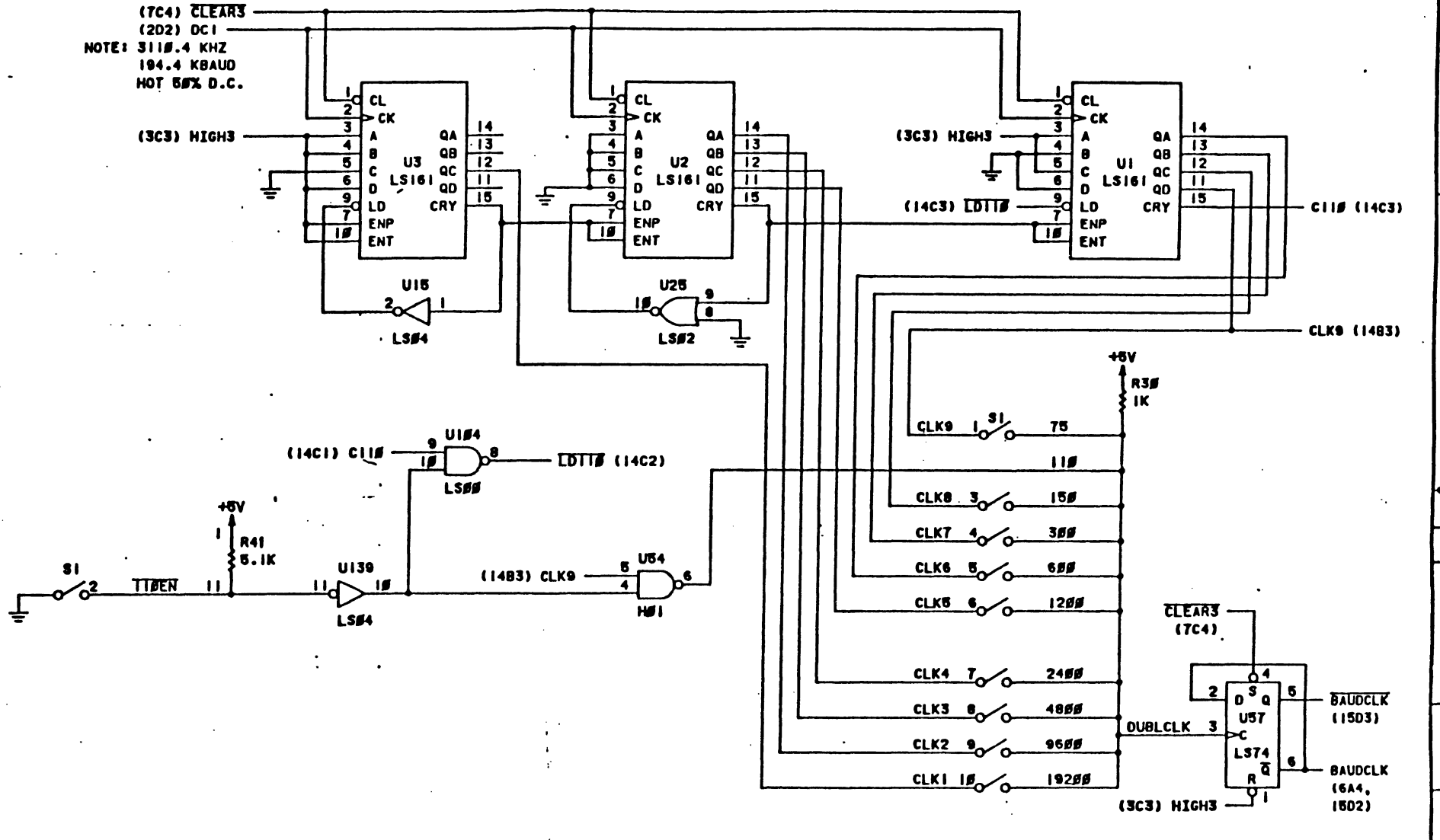
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(7C4) CLEAR3  
 (202) DC1  
 NOTE: 3110.4 KHZ  
 194.4 KBAUD  
 NOT 50% D.C.

+5 NORMAL

+16 NORMAL

+16 NORMAL +11~110BAUD

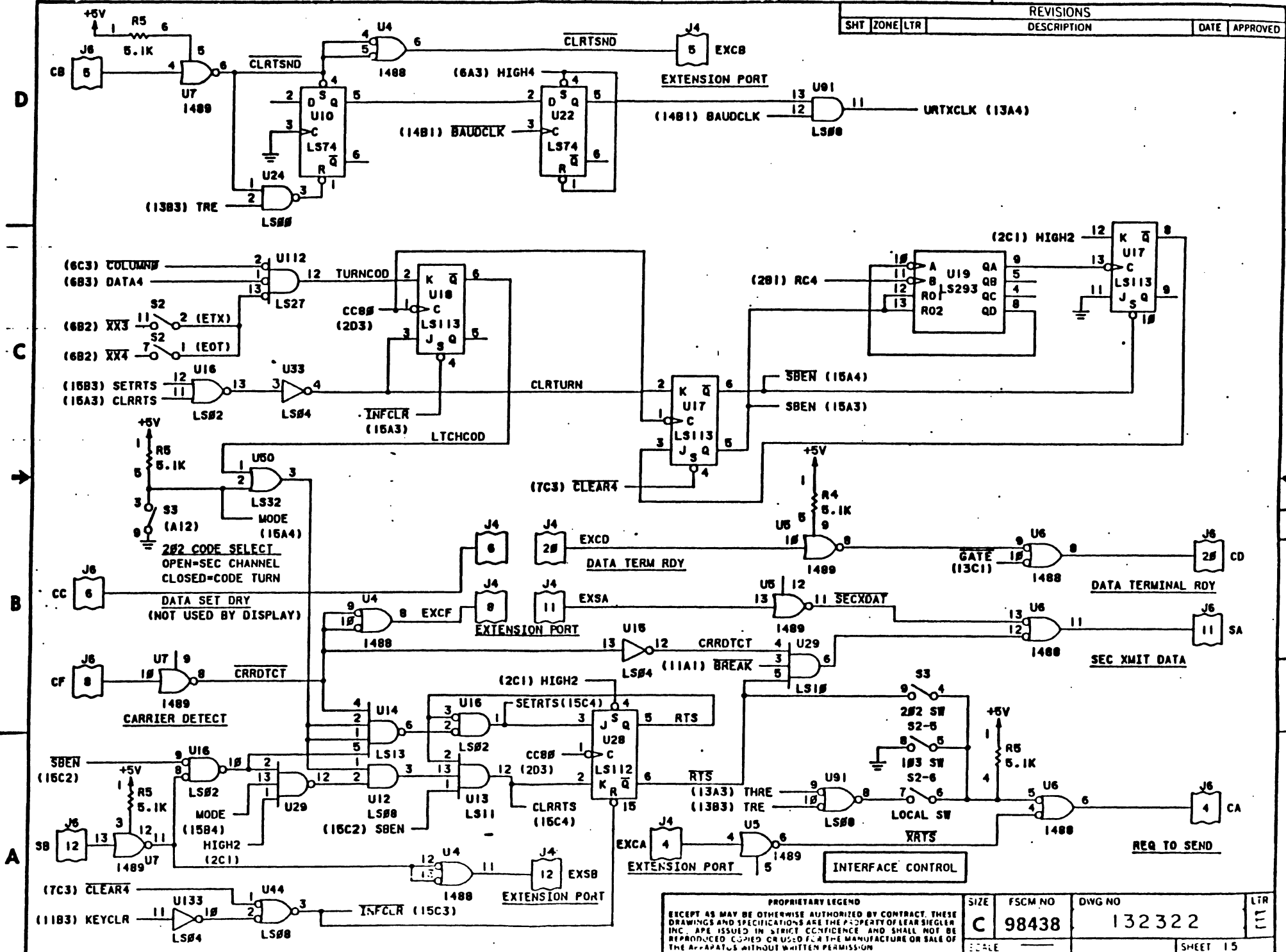


BAUD RATE GENERATION

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SHEET						SHEET 14	



REVISIONS			DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION	



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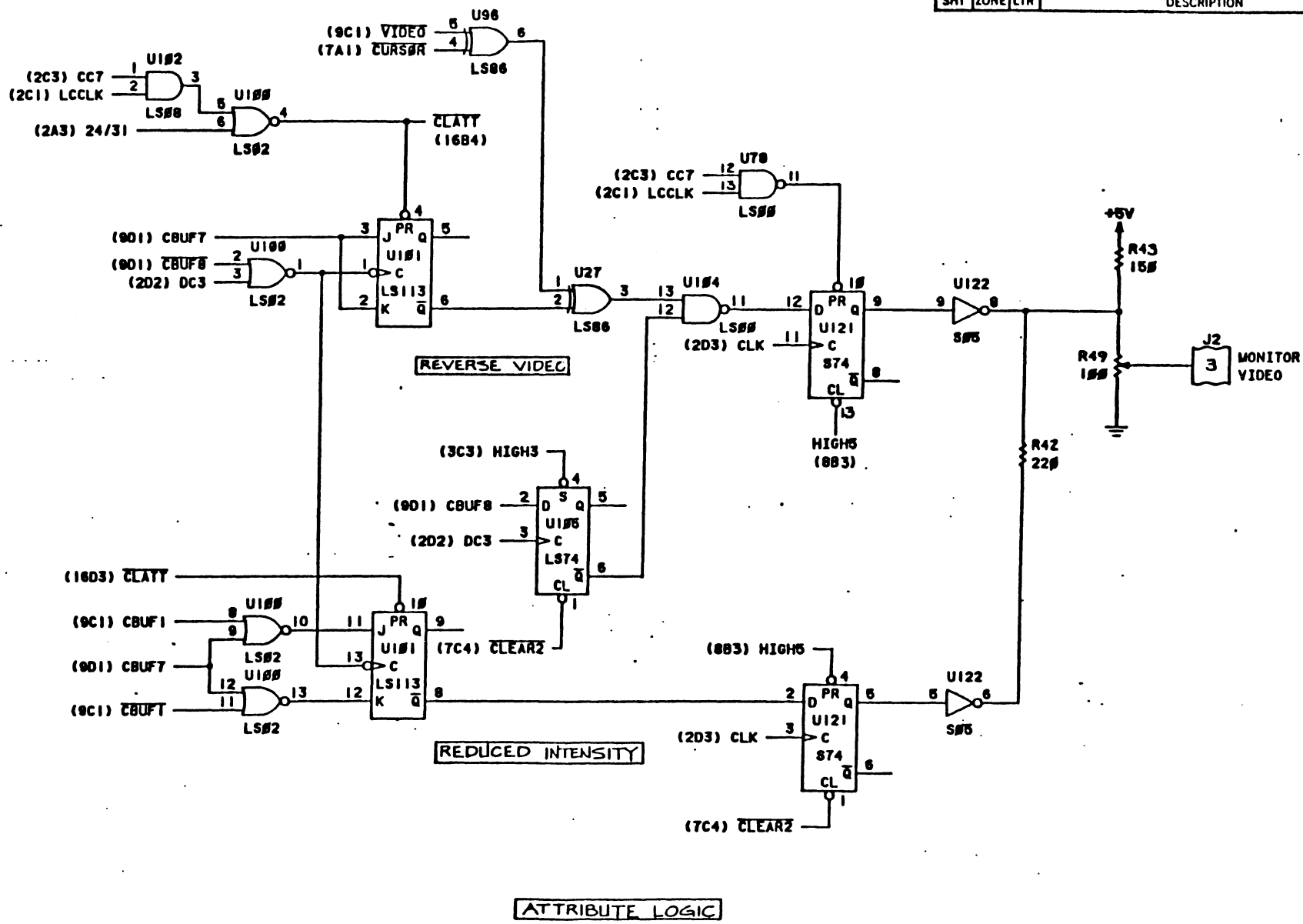
REVISIONS			DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION	

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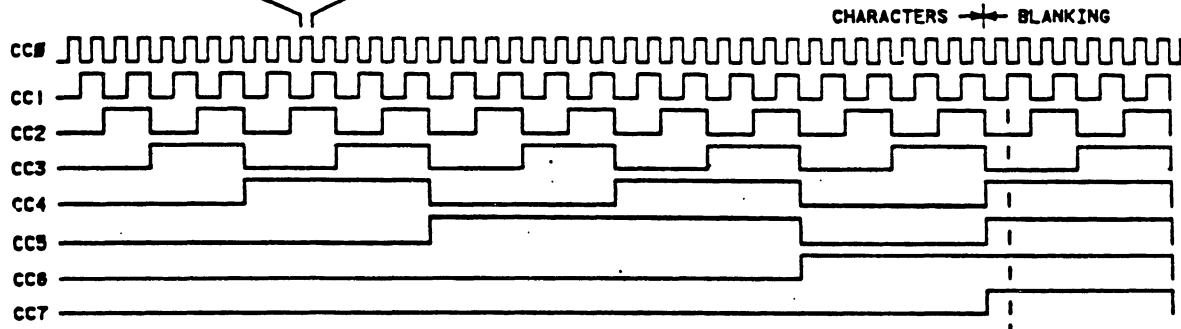
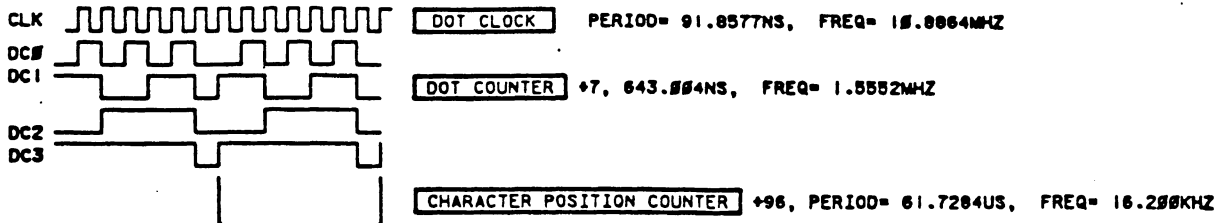
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SCALE				SHEET 16	



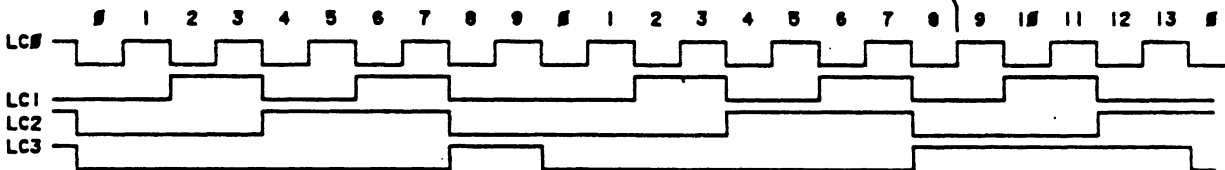
REVISIONS  
DATE APPROVED  
DESCRIPTION  
SHT ZONE LTR



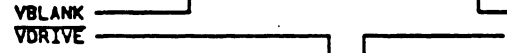
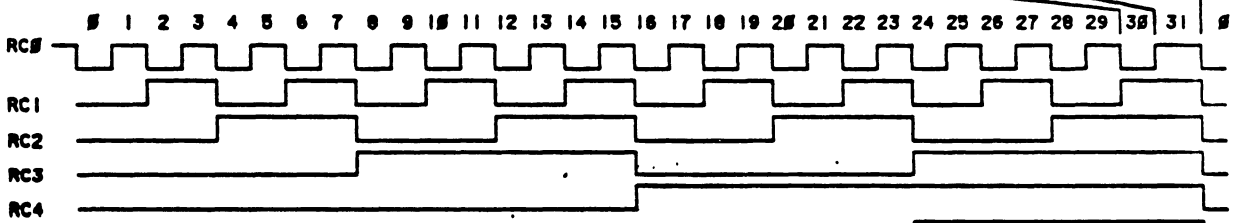
HORIVE  
NOTE:  
HORIVE PULSE WIDTH= 25.80US  
HORIVE STARTS ONE CHARACTER TIME AFTER LAST VIDEO



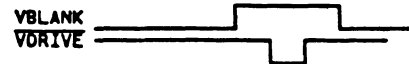
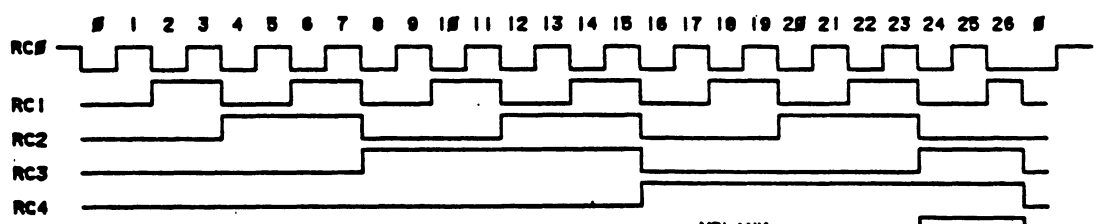
LINE COUNTER +18, PERIOD= 617.28US, FREQ= 1620HZ



ROW COUNTER  
50HZ OPERATION + 32.4, PERIOD= 20 MS, FREQ= 50HZ



60HZ OPERATION + 27, PERIOD= 16.667MS, FREQ= 60HZ



ADMS TIMING DIAGRAM

LTR	F
DWG NO.	132322
FSCM NO.	98438
SIZE	C
SCALE	NONE
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SHEET	18

1  
2  
3  
4

D C A

**CONN PIN ASSIGNMENTS**

REVISIONS				DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION		

**SWITCH ASSIGNMENTS**

**J1 POWER INPUT**

PIN NO.	FUNCTION	SHEET
1	2Ø.5VAC	17B4
2	2Ø.5VAC	17B4
3	CHASSIS GND	17A4
4	GND	17A4
5	GND	17A4

**J6 MODEM RS 232 Ø  
CURRENT LOOP**

PIN NO.	FUNCTION	SHEET
1	FRAME GND	
2	BA	13A1
3	BB	6D4
4	CA	15A1
5	CB	15D4
6	CC	15B4
7	GND	
8	CF	15B4
9	**	
10	NOT USED	
11	SA	15B1
12	SB	15A4
13	**	
14	**	
15	**	
16	**	
17	CL OUT	13B1
18	**	
19	**	
20	CD	15B1
21	**	
22	READ BACK EN	7D2
23	CL INPUT	13D4
24	CL OUT	13A1
25	CL INPUT	13D4

S1		
SEC-TION	FUNCTION	SHEET
1	75	14C2
2	110	14B4
3	150	14B2
4	300	14B2
5	600	14B2
6	1200	14B2
7	2400	14B2
8	4800	14B2
9	9600	14B2
10	19200	14A2

S3		
SEC-TION	FUNCTION	SHEET
1	EOT	15C4
2	ETX	15C4
3	CODE	15B4
4	ZOZ	15B2
5	103	15A1
6	LOCAL	15A2

**J2 MONITOR**

PIN NO.	FUNCTION	SHEET
1	GND	17B2
2	VDR	7C1
3	VID	16C1
4	N/U	
5	HDR	7B2
6	EQ GND	17B2
7	KEY	
8	N/U	
9	+15V	17B2
10	GND	17B2

U12B			
(7D2) READ	Ø 1	16 Ø	+5VOLTS
(11C2) KC7A	Ø 2	15 Ø	GND
(9D1) CBUF7	Ø 3	14 Ø	XLOAD (11C1)
(12D1)XDATA7	Ø 4	13 Ø	XLOAD
(11C2) KC6A	Ø 5	12 Ø	EXDATA (12C1)
(9D1) CBUF6	Ø 6	11 Ø	KC5A (11B2)
(12D1)XDATA6	Ø 7	10 Ø	CBUF5 (9D1)
GND	Ø 8	9 Ø	XDATA6 (12E1)
(17A3) IDENT	Ø 17	18 Ø	THRE (13A3)

S2		
SEC-TION	FUNCTION	SHEET
1	N/U	-
2	AUTO NEW LINE	4C4
3	50/60HZ	2A3
4	RS232/CL	13C3
5	HDX/FDX	6D4
6	BIT B CONTROL	15B4
7	PARITY/INHIBIT	15B4
8	STOP BIT	15C4
9	ODD PARITY EN	15C4
10	WORD LENGTH	15C4

**ANSWER BACK OPT 2**

**J4 EXTEN RS232**

PIN NO.	FUNCTION	SHEET
1	FRAME GND	
2	EX BA	13A4
3	EX BB	6D3
4	EX CA	15A2
5	EX CB	15D2
6	CC	15B3
7	GND	
8	EX CF	15B3
9	**	
10	-12V*	
11	EX SA	15B3
12	EX SB	15A3
13	**	
14	**	
15	**	
16	**	
17	+12V*	
18	**	
19	**	
20	EX CD	15B3
21	**	
22	NOT USED	
23	NOT USED	
24	EXT CL IN*	
25	EXT CL OUT*	

**J7 POWER INPUT**

PIN NO.	FUNCTION	SHEET
1	9.4VAC	17D3
2	9.4VAC	17D3
3	31VAC	17B3
4	GND	17B3
5	31VAC	17B3

U144			
(2C3) WRCLK	Ø 17	18 Ø	CLEAR (7B4)
(7D2) READ	Ø 1	16 Ø	+5VOLTS
(1ØD3) KC3	Ø 2	15 Ø	GND
(9C1) CBUF3	Ø 3	14 Ø	KC4 (1ØD3)
(12D2)XDATA3	Ø 4	13 Ø	CBU4 (9C1)
(1ØD3) KC2	Ø 5	12 Ø	XDATA4 (12C2)
(9C1) CBUF2	Ø 6	11 Ø	KC1 (1ØD4)
(12D2)XDATA2	Ø 7	10 Ø	CBUF1 (9C1)
GND	Ø 8	9 Ø	XDATA1 (12C2)

S4		
	FUNCTION	SHEET
	DATE & LOCK	13C1

S5		
SEC-TION	FUNCTION	SHEET
	FILL SWITCH	9A4

\*WHEN OPTIONAL EXTENSION PORT CURRENT LOOP INSTALLED  
 \*\*NO SOCKET INSTALLED IN CONNECTOR

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	C	98438	132322	E
SCALE	NONE			SHEET 19

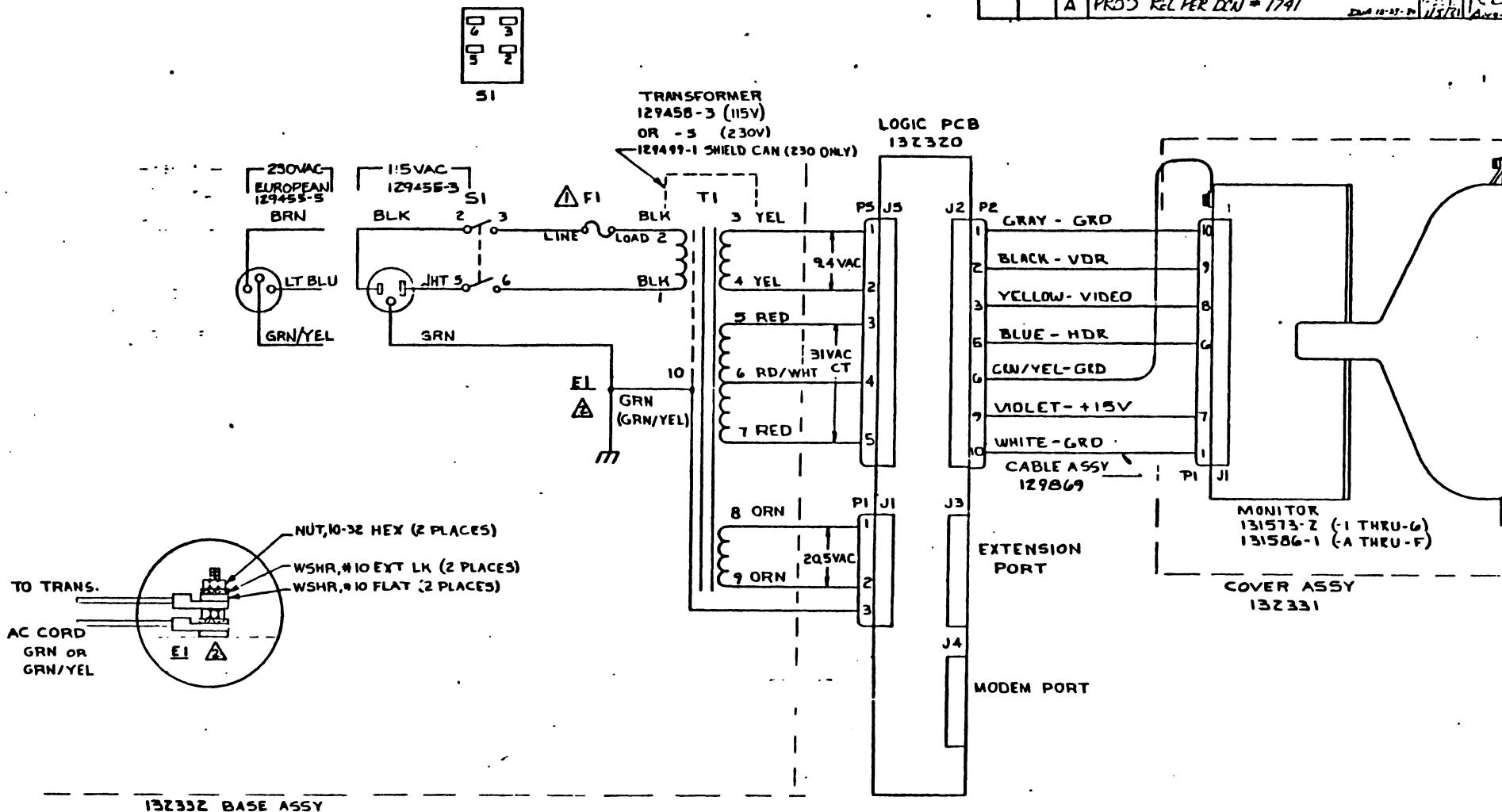
4

3

2

1

REVISIONS				DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION		
		X1	PILOT REL PER DCU 1453	11/21/78	[Signature]
		A	PROD REL PER DCU # 1791	11/21/78	[Signature]



△ EI IS STUD ON BOSS OF HOUSING.

△ 115VAC - .9 AMP SLO-BLO FUSE  
230VAC - .4 AMP SLO-BLO FUSE

NOTES UNLESS OTHERWISE SPECIFIED

DASH NO.	NEXT ASSY	USED ON	APPLICATION
-	132300	132320	

UNLESS OTHERWISE SPECIFIED.  
DIM. IN INCHES  
TOLERANCES:  
X ± .1  
XX ± .03  
XXX ± .010  
ANGLES ± 0.5°

CONTR NO  
DR [Signature]  
CHK [Signature]  
DSGN [Signature]  
ENGR [Signature]  
PRC [Signature]  
REL [Signature]

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LEAR SIEGLER, INC.  
DATA PRODUCTS DIVISION  
ANAHEIM, CALIFORNIA 92903

WIRING DIAGRAM  
ADM 5

SIZE	FSCM NO	DWG NO	LTR
C	98438	132327	A
SCALE		SHEET 1 OF 1	