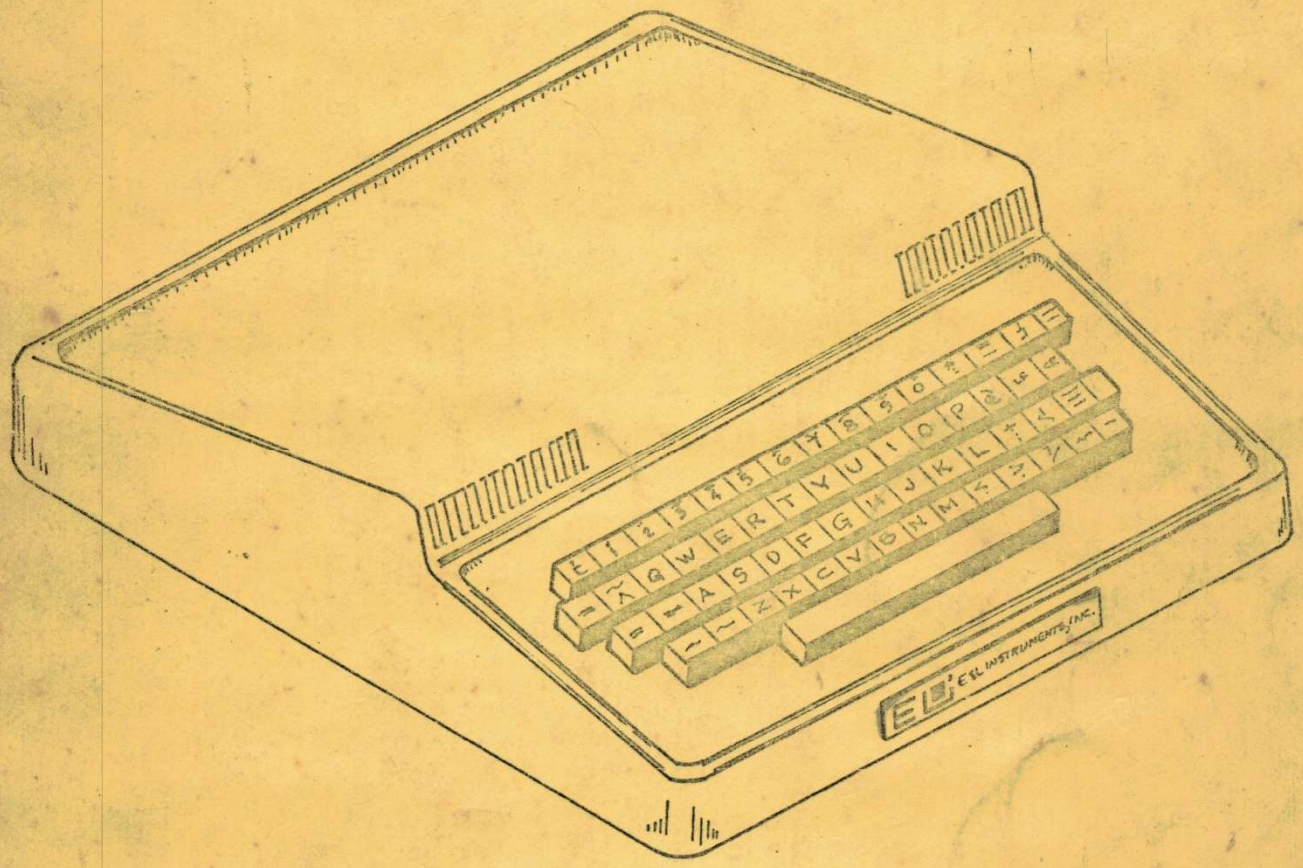
VTE-1

VIDEO TERMINAL ELECTRONICS



OPERATING MANUAL

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E&L INSTRUMENTS, INCORPORATED
61 FIRST ST. — DERBY, CT. 06418

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I. INTRODUCTION

The VTE, "Video Terminal Electronics" system, is used with a television set or video monitor and includes a full ASCII keyboard for input and 75 ohm composite video output. The one piece molded housing supports the output CRT at a comfortable viewing angle. Full Duplex and local operation are possible, with RS232C and 20mA current loop interfaces operating at speeds of 75 to 9600 baud.

The standard character set contains 64 upper case alphanumeric ASCII characters. Lower case is optional, and the character generator is user-reprogrammable to provide any user defined characters in an 8 x 14 field. The 128 character ASCII decoder supplied is also user-reprogrammable to accommodate alternate control character codes or code sets.

The blinking full field cursor can be directly positioned to any screen location, or turned off for a clean graphic display. A nondestructive read screen function transmitts the ASCII code for the character at the cursor position to the user, with automatic forespace. Other features include clear screen, bell code, and wrap around.

The VTE-1® provides a 75 ohm composite video output that will directly drive any U.S. compatible black and white television monitor or the optional MON-1 monitor, a 9" high quality unit, available from E & L. Standard T.V. sets may be connected through readily available VHF converters, or modified by a qualified serviceman to provide a direct video input connection.

The VTE-1 is a compact instrument that is a complete, self-powered, full function terminal (less the actual video monitor). It interfaces to the MMD-1®, "MINI-MICRO DESIGNER", thru the the M/I, "MEMORY INTERFACE BOARD", and has a great number of features not found in other low priced terminals and rarely found in expensive ones....

....PROGRAMMABLE CHARACTER GENERATOR -
You can program (pop) your own 2708 proms and change the displayed screen characters.

....PROGRAMMABLE CONTROL CHARACTERS -
You can assign your own unique control keys.

....1K RAM on board -
You do not use any of the CPU's memory to hold screen data.

....FULL CURSOR CONTROL -
Left, right, up, down and cursor on/off, including the ability to place the cursor remotely at any X-Y location and to read what is at any X-Y location.

....BLACK ON WHITE and WHITE ON BLACK -
Jumper selectable on p.c. board.

The VTE-1 is a complicated piece of equipment and it is not recommended to a first time kit builder. The front portion of this manual is dedicated solely to the kit building instructions, the rear portion contains very useful information and tables applicable to both the kit and assembled purchaser.

II. SPECIFICATIONS

DISPLAY FORMAT: 1024 characters, 16 lines of 64 characters.

CHARACTER SET: 64 Alphanumeric ASCII characters, upper case standard, lower case optional.

CHARACTER GENERATION: 2708 Prom, factory programmed, 5 x 7 dot matrix, USER RE-PROGRAMMABLE.

CHARACTER FIELD: 8 x 14, continuous from character to character to facilitate graphic display characters.

ALTERNATE CHARACTER GENERATION: Socketed PROM provides for DIP cable interfacing to down-loaders driven from other sources, such as, computers or dedicated hardware generators.

INTERNAL RAM: 1K x 8, type 2102, for stand-alone screen refresh.

CURSOR FEATURES:

A) Upline, downline, forespace, backspace.
B) Horizontal and vertical wrap-around.
C) Line feed, carriage return.
D) Auto line feed/carraige return on last printing character of a logical line.
E) Clear screen and homes upper left.
F) Direct cursor positioning (X,Y).
G) Blinking full field cursor enhances character in cursor position.
H) Cursor on/cursor off for "clean" graphic display.
I) Bell code.
J) Read screen: Transmitts character at cursor position to user non-destructive read with auto forespacing.
K) Repeat character function.

RE-PROGRAMMABLE ASCII DECODER: Full 128 character ASCII Decoder factory supplied (1702A PROM) is user re-programmable to accommodate different user character codes or code sets. Socketed PROM allows for down-loading codes or code sets from computers or dedicated hardware via DIP cable and an interface.

COMMUNICATIONS: UART FORMATTED. RS232C and 20mA current loop. 75 to 9600 BAUD. Line (Full duplex) or local transmission.

POWER SUPPLY: Self-contained 115/230 volt A.C.

OUTPUT: Composite Video, 75 ohm.

MECHANICAL: 15" D. (38 cm) x 14" W. (35, 5 cm) x 5" H (12, 7 cm)
8 1/2 pounds (3, 8 kg.)

III. REPLACEMENT PARTS LIST

PACKING BAG	DESCRIPTION	QTY	P/N	CHECK
HARDWARE	6-32 x 5/8" Pan-Head Screw	2	605-0004	
	6-32 x 1/2" Pan-Head Screw	14	605-0002	
	1416-6 Ground Lug	1	545-0020	
	1416-4 Ground Lug	1	545-0022	
	#4 INT-Tooth LockWasher	14	607-0009	
	Standoff	7	615-0028	
	4-40 x 1/4" Pan-Head Black	16	605-0060	
	4-40 x 3/16 Hex Nut	21	606-0009	
	6-32 Hex Nut	4	606-0012	
	#6 INT-Tooth LockWasher	13	607-0008	
	Tinnerman Fastener	3	609-0017	
	Rubber Feet	4	611-0003	
	Capacitor Mount	1	616-0005	
	4-40 x 3/8" Pan-Head Black	4	605-0008	
SEMI-CONDUCTOR	IC Packing Template	1	805-0029	
	SN74LS04	4	503-0185	
	SN74LS74	6	503-0218	
	SN74LS161	3	503-0219	
	SN74LS27	1	503-0220	
	SN74LS193	3	503-0221	
	SN74LS93	9	503-0222	
	SN74LS00	4	503-0223	
	SN74LS08	5	503-0103	
	SN74LS266	3	503-0224	
	SN74LS83	3	503-0225	
	GE 4N35 Opto Isolator	1	503-0076	
	SN74LS157	6	503-0226	
	SN74LS11	2	503-0186	
	SN74LS166	1	503-0228	
	SN74LS32	4	503-0229	
	SN74LS42	3	503-0081	
	SN74LS02	2	503-0194	
	SN74LS05	1	503-0122	
	U/ART	1	503-0077	
	SN74LS123	1	503-0230	
	SN74LS10	1	503-0231	
	GI AY5-2376 Encoder	1	503-0232	
	LM1458CN Dual Op-Amp	1	503-0135	
	IC Packing Template	1	805-0030	
	2102A-2	8	503-0227	
	2708 (350NS) PROM (Upper Case)	1	660-0061	
	INTEL 1702-A (Control PROM)	1	660-0062	
SOCKET	Socket Packing Template	1	805-0031	
	14 Pin DIP Socket	42	542-0005	
	16 Pin DIP Socket	30	542-0008	
	24 Pin Dip Socket	3	542-0017	
	40 Pin Dip Socket	2	542-0016	

III. REPLACEMENT PARTS LIST

PACKING BAG	DESCRIPTION	QTY	P/N	CHECK
RESISTOR & CAPACITOR	CCRES 1/4W 10K OHM 5%	9	511-0062	
	CCRES 1/4W 1K OHM 5%	9	511-0039	
	CCRES 1/4W 470 OHM 5%	2	511-0031	
	CCRES 1/4W 680 OHM 5%	1	511-0035	
	CCRES 1/4W 75 OHM 5%	2	511-0014	
	CCRES 1/4W 5.6K OHM 5%	1	511-0056	
	CCRES 1/4W 2.7K OHM 5%	1	511-0048	
	CCRES 1/4W 100 OHM 5%	1	511-0017	
	CCRES 1/4W 220 OHM 5%	1	511-0022	
	CCRES 1/4W 1MEG 5%	1	511-0089	
	CCRES 1/4W 2.2K OHM 5%	1	511-0046	
	CCRES 1/4W 100K OHM 5%	1	511-0080	
	CCRES 1/4W 4.7K OHM 5%	3	511-0054	
	CCRES 1/4W 22K OHM 5%	2	511-0068	
	CCRES 1/4W 680K OHM 5%	1	511-0102	
	CCRES 1/2W 47 OHM 5%	1	512-0011	
	CCRES 1W 100 OHM 5%	1	513-0008	
	CER Cap 100 PF	1	520-0010	
	CER Cap .001 MFD	1	520-0011	
	TANT Cap 10 MFD	8	524-0037	
	ELEC Cap 1000 MFD	2	523-0041	
	ELEC Cap 2200 MFD	1	523-0044	
	CER Cap .01 MFD	29	520-0008	
	ELEC Cap 100 MFD	1	523-0025	

PACKING BAG	DESCRIPTION	QTY	P/N	CHECK
MISC.	Ty-Rap Mounts	3	602-0002	
	Ty-Rap	8	602-0001	
	E & L Nameplate	1	632-0001	
	Power Switch	1	570-0019	
	Fuse Post	1	563-0019	
	1/2 Amp Slow Blow Fuse	1	563-0013	
	Heyco Strain Relief	1	617-0002	
	Terminal Strip	1	545-0042	
	Monitor Connector-Male	1	549-0024	
	Toggle Switch	1	570-0011	
	Mini Red LED	2	551-0005	
	2N2222 Transistor	3	500-0030	
	6A 200PIV Bridge Rectifier	1	502-0007	
	1.5A 50PIV Bridge Rectifier	2	502-0002	
	IN914 Diode	4	501-0006	
	IN751A Diode	4	501-0003	
	IN4739 Diode	1	501-0020	
	11.088MHZ Crystal	1	509-0008	
	8 OHM 2 Inch Speaker	1	565-0001	
	Keyboard Connector Pins	2	545-0043	
	MOT 7805C Regulator	1	504-0005	
	LM 340 T-12 Regulator	2	504-0009	
	Momentary Pushbutton	1	572-0003	
	Monitor Connector Bracket	1	622-0013	
	1/8" Heatshrinkable Tubing	12"	583-0004	
	Monitor-to-VTE-1 Cable	1	549-0027	
	Terminal Strip Label	1	633-0060	

III. REPLACEMENT PARTS LIST

PACKING BAG	DESCRIPTION	QTY	P/N	CHECK
MISC.	PC Board	1	711-0196	
	BP-25 Breadboarding Pin	18	544-0004	
	Molded Housing	1	620-0008	
	6-32 x 1/2" Pan-Head Screw	4	605-0002	
	Chassis	1	629-1021	
	Line Cord With Molded Plug	1	567-0002	
	Transformer	1	531-0017	
	ASCII Keyboard	1	575-0003	
	Warranty Card	1	801-0137	

IV. Assembly Instructions, General

A. The material has been prepacked in plastic bags in general categories for ease of assembly. Check the contents of the bags to make certain all the correct parts are there. Inspect packing material for any loose parts before discarding.

Bring all shortages or discrepancies to the immediate attention of E&L Instruments.

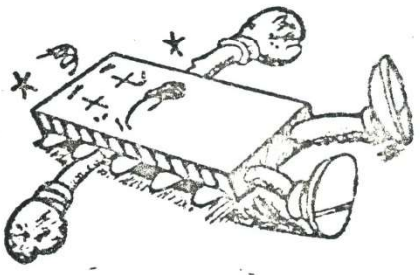
B. Certain features of construction instruction are followed throughout the building of this kit as outlined below.

1. When soldering diodes and transistors, it is most important that the heat used is minimal - a 35W soldering iron is quite adequate for all of the assembly and a larger wattage iron should not be used.

2. The instructions are given line by line with two "Check-Off" columns. The first is for checking off as you actually do that step; the second is for rechecking if a problem is encountered.

3. Use rosin core solder only. The use of corrosive (acid core) solder or paste fluxes void any and all warranties on the unit.

CAUTION!



STATIC ELECTRICITY
KILLS
IC's

Although protection against electrostatic effects is provided by built-in circuitry, the following handling precautions should be taken:

1. Soldering iron tips and test equipment should be grounded.
2. Devices should not be inserted in non-conductive containers such as conventional plastic snow or trays.
3. Assembly work surfaces should be grounded.
4. Avoid carpeting or other furnishings that encourage electrostatic charging of assembly personnel.

V. KIT BUILDING INSTRUCTIONS

Since the differences between the 115 VAC operation and the 230 VAC operation are slight, this manual will serve for both. Whenever a reference is made to the 230 VAC operation it will be done in italics. Italics will not appear in any other place in this manual.

1. SOLDERING TIPS

The quality of your unit is going to depend on the quality of your assembly and soldering techniques. We have outlined, below, some standard practices that you should adhere to.

1.1 There is more to a soldered connection than two or more pieces of metal held together by a "blob" of solder. When molten solder is applied to a metal, the solder actually disolves some of the metal's surface. Thus, metals which have been soldered together are bonded by a solidified solution of solder and parts of the metals which were joined. Soldering is an easy task, but it is a task that must be done correctly. If your soldering techniques are poor you will have a great deal of trouble with the kit that you are about to assemble.

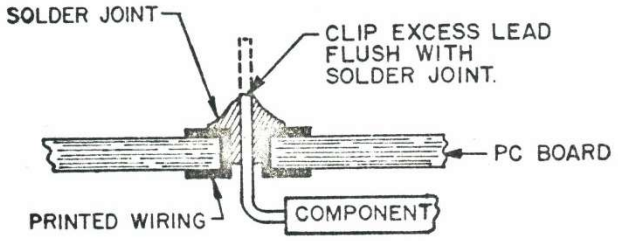
1.2 In order for molten solder to perform its function of joining metals together, the oxides on the surfaces of the metals must be removed. The oxides are removed by a FLUX. A flux is a material which, when heated, dissolves surface oxides and suspends them away from the surface of the metal. With the surface oxides removed, the molten solder can dissolve some of the surface metal and bond itself tightly to the metal.
We recommend the use of Rosin flux core solder with a mixture of 63% tin and 37% lead. This is the only mixture that goes directly from liquid state to solid state thus, bypassing the plastic state which causes cold solder joints.

1.3 A good solder connection is made in two steps: The first step is to make the mechanical connection. Then the molten solder is applied to the connection. After you have stripped a wire, always check to see that the wire is clean and free from heavy oxidation, grease or oil. Oxidation can be scraped off, and oil or grease can be removed with a rag. Steel wool or sandpaper is excellent for cleaning badly oxidized wires. Stranded wire should be tinned (covered with solder) to prevent the bare ends from fraying and possibly causing a short circuit.

The next step in making a solder connection is to secure the wire or wires to the terminal or lug. The wire should make sufficient contact with the terminal or lug, but should not be tightly fastened. The solder will provide both mechanical strength and a low resistance junction.

After the mechanical connections are complete, the next step is to apply the solder. First heat the mechanical connection, with the iron, to allow the solder to flow on the hot metal. Apply the solder to the point where the iron meets the contact to be soldered. The flux should melt and flow freely over the contact, dissolving all oxides, and aiding heat transfer from tip to connection. The solder should then melt and flow freely, covering the area to be soldered. Make sure you apply enough solder to cover the contact.

1.4 To prepare p.c. boards for soldering, clean the area to be soldered on the printed wiring by rubbing with a pencil eraser, and clean the component leads with a piece of steel wool. Place the component on the board, on the side with the nomenclature printed on it, with the leads extending through the holes indicated for the component. Flip the board over and solder the leads. The same general rule for soldering conventional circuitry should be adhered to.



2. CHASSIS ASSEMBLY, MECHANICAL

CONST. CHECK

2.1 Start by first locating all the parts.

1- Chassis	___	1- Transformer	___
1- Line Cord	___	1- #4 Ground Lug	___
1- Strain Relief	___	1- #6 Ground Lug	___
1- Power Switch	___	4- 4-40 x 1/4" Screw	___
1- Fuse Post	___	4- 4-40 x 3/8" Screw	___
1- Terminal Strip	___	2- 6-32 x 1/2" Screw	___
1- 1/2 Amp Fuse	___	2- 6-32 x 5/8" Screw	___
1- Monitor Connector	___	8- 4-40 Hex Nut	___
1- Mon. Conn. Bracket	___	4- 6-32 Hex Nut	___
1- Toggle Switch	___	7- #4 Lockwasher	___
4- Rubber Feet	___	5- #6 Lockwasher	___
		1- Terminal Strip Label	___

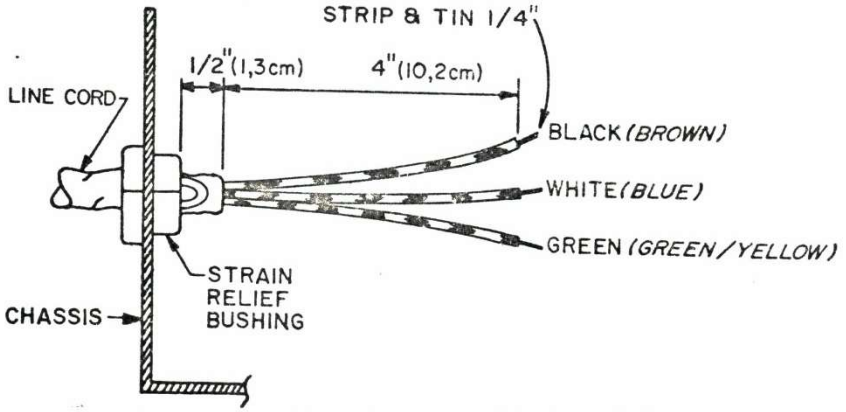
2.2 Reffering to illustration #1 (page 13) install the parts into the chassis. Place the chassis in front of you with the short vertical lip facing you. ____ ____

Install the parts as follows:

2.2.1 Power Switch- located in the vertical rectangular hole on the right hand side of the short vertical lip. Terminal 3 should be towards the top.

2.2.2 Fuse Post- located just to the left of the power switch. The word "TOP" is molded into the body of the plastic. ____ ____

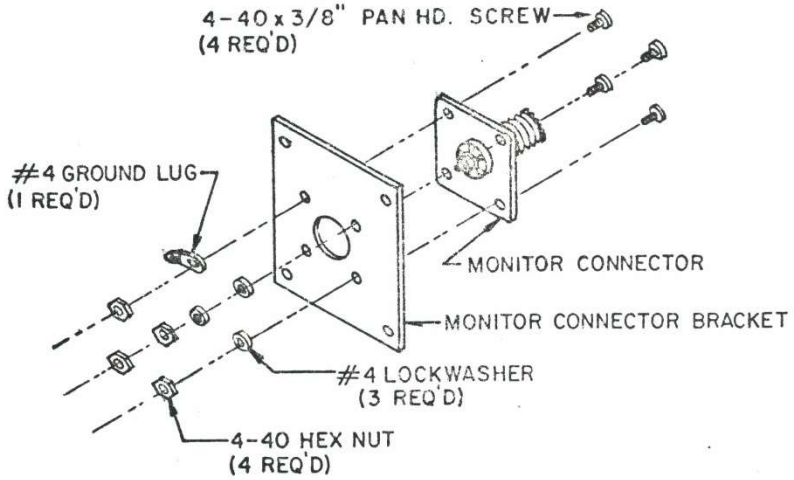
2.2.3 Line Cord- Prepare the line cord, as shown below:



Compress the strain relief and insert the line cord through the hole just to the left of the fuse post. ____ ____

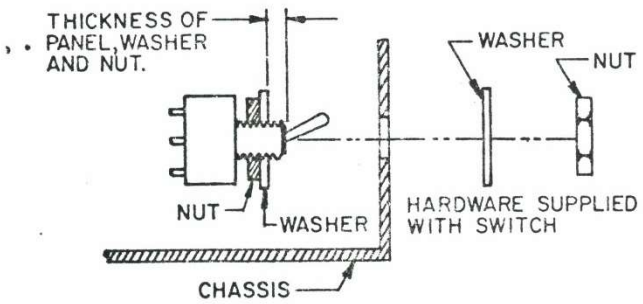
2.2.4 Terminal Strip- Mount this in the oval shaped hole towards the center of the short vertical lip. Mount this using the (2) 6-32 x 5/8" screw, (2) 6-32 hex nuts and (2) #6 lockwashers. ____ ____

2.2.5 Monitor Connector- Prepare the connector by first mounting it to the bracket, as shown below: ____ ____



Now mount the above assembly into the large square hole using (4) 4-40 x 3/8" screws, lockwashers and hex nuts. ____ ____

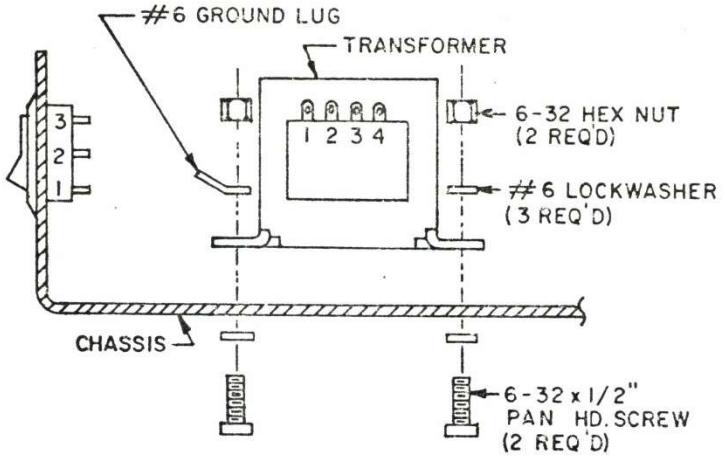
2.2.6 Toggle Switch- Mount as shown below:



2.2.7 Rubber Feet- Peel off backing and mount to underside of chassis. ____ ____

2.2.8 Visually check, the vertical lip should now be full, all that should be left is the transformer, (2) 6-32 screws, (2) 6-32 hex nuts, (3) #6 lockwashers, (1) #6 ground lug and the fuse. ____ ____

2.2.9 Transformer- Mount transformer as shown below: CONST. CHECK



2.2.10 Locate and apply the terminal strip label. You should peel off the backing and apply the label to the chassis directly above the terminal strip. Butt the bottom of the label to the top of the terminal strip. The (-) minus 20 MA OUT should be to your left and directly above the first screw lug.

All that you should have left now is the fuse. You should put this aside as it will be the last item you install before the checkout procedure.

3. CHASSIS ASSEMBLY, ELECTRICAL

3.1 Connect and solder the black (*brown*) line cord wire to the upper most terminal lug on the fuse post.

3.2 Connect and solder the green (*green/yellow*) line cord wire to the #6 ground lug attached to the transformer mounting leg.

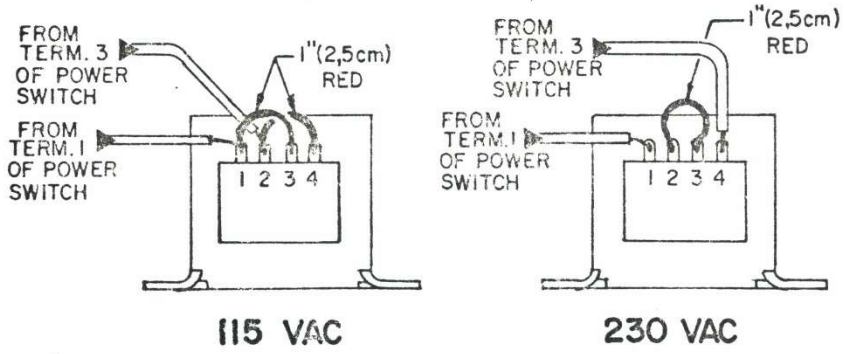
3.3 Connect the white (*blue*) line cord wire to terminal 3 of the power switch. DO NOT SOLDER

3.4 Connect a 4" (10 cm) piece of white wire to terminal 3 of the power switch. SOLDER

3.5 Connect and solder a 1 1/2" (3,8 cm) piece of red wire from terminal 2 of the power switch to the lower terminal of the fuse post.

3.6 Connect and solder a 4" (10 cm) piece of white wire to terminal 1 of the power switch.

3.7 Transformer Wiring- Connect and solder the transformer wires as shown below:



3.8 The chassis wiring is now complete. Visually check that all solder joints were made and are correct. ____ ____

Place chassis assembly aside.

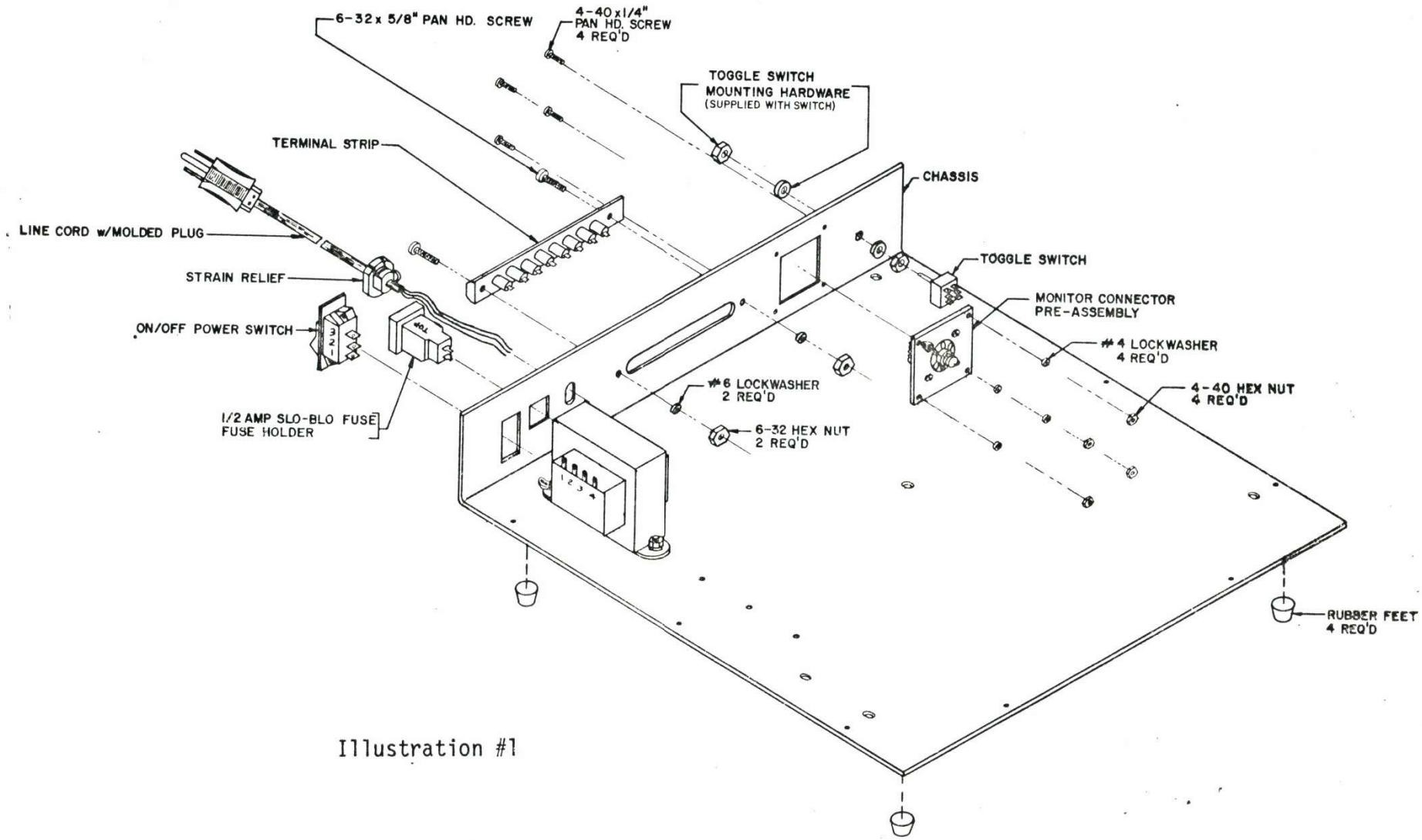


Illustration #1

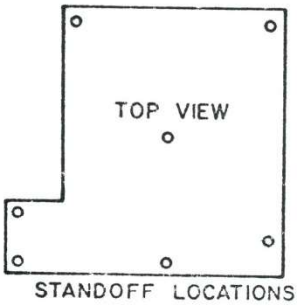
4. PC BOARD COMPONENT PLACEMENT

CONST. CHECK

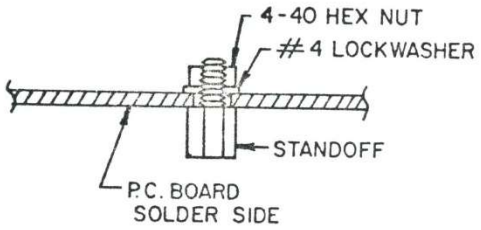
For ease of assembly the p.c. board has been screened on the component side with both the schematic designation and the device number or value. As you gather a group of parts you will install that group by finding the schematic designations on the p.c. board.

4.1 Due to installation difficulty, the (18) BP-25 Breadboarding Pins have been factory assembled. However, they DO have to be soldered on the underside of the board. ____ ____

4.2 Locate and mount the (7) seven standoffs, using #4 lockwashers and 4-40 hex nuts, as shown below:



STANDOFF LOCATIONS



____ ____

4.3 Resistors- Locate the groups of resistors indicated below: (All resistors are 1/4W 5%, unless otherwise specified). See "Special Diagram" on pages 61 & 62.

4.3.1 10K ohms (Brown, Black, Orange)
There should be a total of (9) nine.
Insert and solder these as follows:

R13	__	R18	__	R26	__
R14	__	R20	__	R31	__
R17	__	R22	__	R39	__

____

4.3.2 1K ohms (Brown, Black, Red)
There should be a total of (9) nine.
Insert and solder these as follows:

R 1	__	R 7	__	R28	__
R 2	__	R10	__	R29	__
R 6	__	R27	__	R36	__

____

4.3.3 470 ohms (Yellow, Violet, Brown)
There should be a total of (2) two.
Insert and solder these as follows:

R 3 __ R 4 __ _____

4.3.4 680 ohms (Blue, Gray, Brown)
There should only be (1) one.
Insert and solder this as follows:

R 5 __ _____

4.3.5 75 ohms (Violet, Green, Black)
There should be a total of (2) two.
Insert and solder these as follows:

R 8 __ R 9 __ _____

4.3.6 5.6K ohms (Green, Blue , Red)
There should only be (1) one.
Insert and solder this as follows:

R11 __ _____

4.3.7 2.7K ohms (Red, Violet, Red)
There should only be (1) one.
Insert and solder this as follows:
R12 __ _____

4.3.8 100 ohms (Brown, Black, Brown)
There should only be (1) one.
Insert and solder this as follows:

R15 __ _____

4.3.9 220 ohms (Red, Red, Brown)
There should only be (1) one.
Insert and solder this as follows:

R16 __ _____

4.3.10 1 Meg ohm (Brown, Black, Green)
There should only be (1) one.
Insert and solder this as follows:

R23 __ _____

4.3.11 2.2K ohms (Red, Red, Red)
There should only be (1) one.
Insert and solder this as follows:

R24 __ _____

4.3.12 100K ohms (Brown, Black, Yellow)
There should only be (1) one.
Insert and solder this as follows:

R25 __ ____

4.3.13 4.7K ohms (Yellow, Violet, Red)
There should be a total of (3) three.
Insert and solder these as follows:

R33 __ R38 __ R40 __ ____

4.3.14 22K ohms (Red, Red, Orange)
There should be a total of (2) two.
Insert and solder these as follows:

R34 __ R35 __ ____

4.3.15 680K ohms (Blue , Gray, Yellow)
There should only be (1) one.
Insert and solder this as follows:

R37 __ ____

4.3.16 47 ohms, 1/2 WATT (Yellow, Violet, Black)
There should only be (1) one.
Insert and solder this as follows:

R32 __ ____

4.3.17 100 ohms, 1 WATT (Brown, Black, Brown)
There should only be (1) one.
Insert and solder this as follows:

R30 __ ____

4.4 Capacitors- Locate the groups of capacitors indicated below: (See "Special Diagrams" on pages 61 & 62)

4.4.1 100 pico - farad (PF) ceramic disc.
There should only be (1) one.
Insert and solder this as follows:

C 1 __ ____

4.4.2 .001 micro - farad (MFD) ceramic disc.
There should only be (1) one.
Insert and solder this as follows:

C 5 __ ____

4.4.3 10 micro - farad (MFD) tantalum.
There should be a total of (8) eight.
Insert and solder these as follows:
(NOTE POLARITY-ON BOTH THE PC BOARD SCREENING AND THE ACTUAL CAPACITORS)

C12 __ C15 __ C18 __
C13 __ C16 __ C19 __
C31 __ C33 __ ____

4.4.4 1000 micro - farad (MFD) electrolytic. CHECK
There should be a total of (2) two.
Insert and solder these as follows:
(NOTE POLARITY-ON BOTH THE PC BOARD
SCREENING AND THE ACTUAL CAPACITORS) _____

C14 __ C17 __

4.4.5 2200 micro - farad (MFD) electrolytic.
There should only be (1) one.
Insert and solder this as follows:
(AGAIN, NOTE POLARITY)

C20 __ _____

4.4.6 100 micro - farad (MFD) electrolytic.
There should only be (1) one.
Insert and solder this as follows:
(AGAIN, NOTE POLARITY)

C32 __ _____

4.4.7 .01 micro - farad (MFD) ceramic disc.
There should be a total of (29) twenty-nine.
Insert and solder these as follows:

C 2 __	C10 __	C26 __	C36 __
C 3 __	C11 __	C27 __	C37 __
C 4 __	C21 __	C28 __	C38 __
C 6 __	C22 __	C29 __	C39 __
C 7 __	C23 __	C30 __	C40 __
C 8 __	C24 __	C34 __	C41 __
C 9 __	C25 __	C35 __	C42 __
			C43 __

_____

4.5 Miscellaneous Parts

4.5.1 Locate the diodes IN914.
There should be a total of (4) four.
Insert and solder these as follows:
(NOTE POLARITY-THE DARK BAND IS THE
CATHODE LEAD).

CR 3 __ CR 4 __ CR10 __ CR11 __ _____

4.5.2 Locate the diodes IN751.
There should be a total of (4) four.
Insert and solder these as follows:
(NOTE POLARITY-THE DARK BAND IS THE
CATHODE LEAD).

CR 5 __ CR 6 __ CR 7 __ CR 8 __ _____

4.5.3 Locate the diode IN4739.
There should only be (1) one.
(NOTE POLARITY-THE DARK BAND IS THE
CATHODE LEAD).

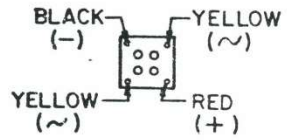
CR 9 __ _____

4.5.4 Locate the 1.5A Bridge Rectifiers (marked PF-05)
There should be a total of (2) two.
Insert and solder these as follows:
(NOTE POLARITY-DO NOT PUSH BODY OF RECTIFIERS ALL THE WAY DOWN TO THE P.C. BOARD, LEAVE ABOUT 1/4" OF SPACE).

CR13 __ CR14 __ ____

4.5.5 Locate the 6A Bridge Rectifier (marked BR-62).
There should only be (1) one.
Insert and solder this as follows:
(NOTE POLARITY-DO NOT PUSH BODY OF RECTIFIER ALL THE WAY DOWN TO THE P.C. BOARD, LEAVE ABOUT 1/4" OF SPACE).

CR12 __ ____

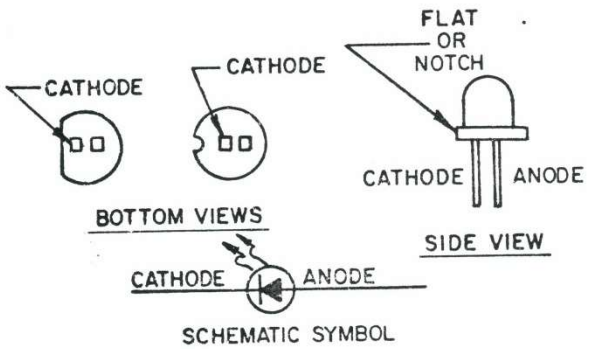


BOTTOM VIEW OF BR-62

4.5.6 Locate the momentary pushbutton switch.
There should only be (1) one.
Insert and solder this as follows:
(POLARITY DOES NOT MATTER).

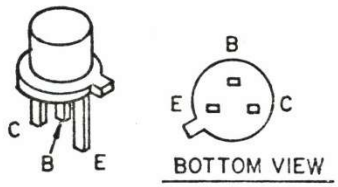
SW 1 __ ____

4.5.7 Locate the red L.E.D.'s.
There should a total of (2) two.
Insert and solder these as follows:
(NOTE POLARITY SHOWN BELOW).



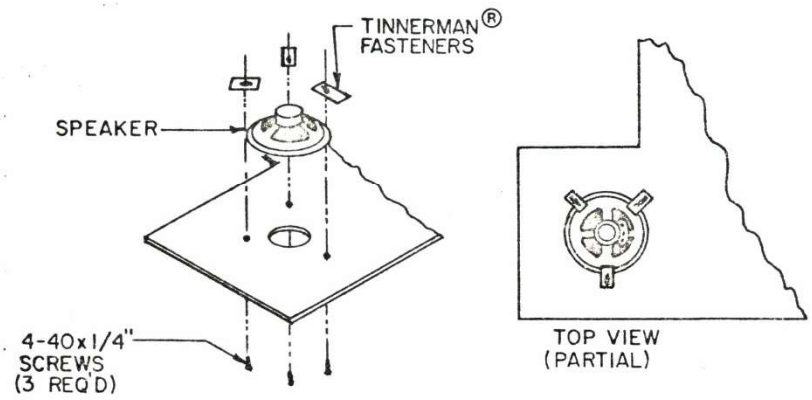
CR 1 __ CR 2 __ ____

4.5.8 Locate the transistors (marked 2N2222). There should be a total of (3) three. Insert and solder these as follows:

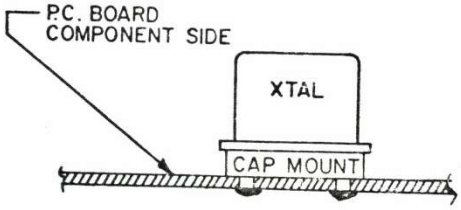


Q 1 __ Q 2 __ Q 3 __

4.5.9 Locate the speaker. Mount the speaker to the p.c. board using (3) 4-40 x 1/4" screws and (3) Tinnerman® type fasteners, as shown below:

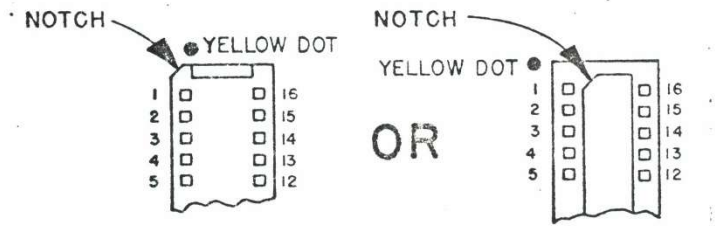


4.5.10 Locate the crystal (marked 11.088 MHz). Insert and solder this using the nylon capacitor mount, located in the hardware bag. Mount as shown below:



XTAL __

4.6 IC Sockets - The sockets have been mounted on foam and grouped according to size. You should insert and solder these, one at a time, starting with the 40 pin sockets and work your way down to the 14 pin sockets. The reason for this is so that you do not inadvertently put a smaller socket into a larger IC pattern. The diagram below indicates how you can easily locate pin #1.



SOCKET INSTALLATION

BE CERTAIN THAT ALL THE PINS ARE PROTRUDING THROUGH THE P.C. BOARD AND NONE ARE FOLDED UNDER BEFORE ATTEMPTING TO SOLDER.

4.6.1 40 pin IC sockets.
There should be a total of (2) two.
Insert and solder these, one at a time, as follows:

IC53 __ IC66 __

4.6.2 24 pin IC sockets.
There should be a total of (3) three.
Insert and solder these, one at a time, as follows:

IC29 __ IC34 __ IC40 __

4.6.3 16 pin IC sockets.
There should be a total of (30) thirty.
Insert and solder these, one at a time, as follows:

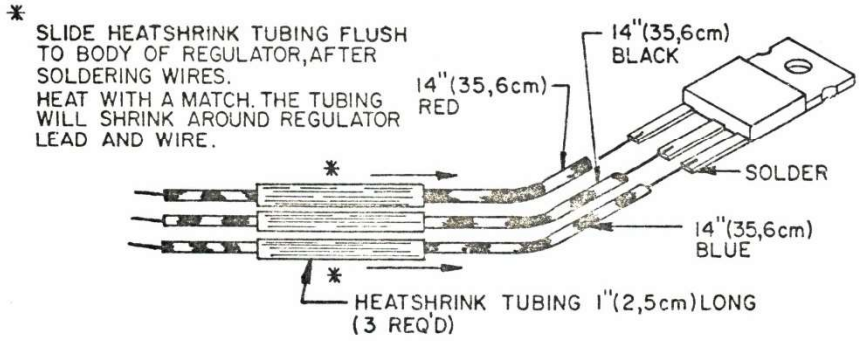
IC 3 __	IC25 __	IC46 __
IC 8 __	IC26 __	IC52 __
IC 9 __	IC28 __	IC54 __
IC10 __	IC32 __	IC58 __
IC15 __	IC33 __	IC59 __
IC18 __	IC35 __	IC60 __
IC20 __	IC37 __	IC64 __
IC22 __	IC39 __	IC65 __
IC23 __	IC41 __	IC71 __
IC24 __	IC45 __	IC77 __

4.6.4 14 pin IC sockets.
There should be a total of (42) forty-two. Insert and solder these, one at a time, as follows:

IC 1	__	IC27	__	IC56	__
IC 2	__	IC30	__	IC57	__
IC 4	__	IC31	__	IC61	__
IC 5	__	IC36	__	IC62	__
IC 6	__	IC38	__	IC63	__
IC 7	__	IC42	__	IC67	__
IC11	__	IC43	__	IC68	__
IC12	__	IC44	__	IC69	__
IC13	__	IC47	__	IC70	__
IC14	__	IC48	__	IC72	__
IC16	__	IC49	__	IC73	__
IC17	__	IC50	__	IC74	__
IC19	__	IC51	__	IC75	__
IC21	__	IC55	__	IC76	__

_____

4.7 Voltage Regulators.
Locate the three terminal regulators. There should be a total of (3) three. One is marked 7805C and two are marked LM340T-12. Prepare them for mounting, as shown below:



_____

The 7805C is designated VR-1 and the LM340T-12's are designated VR-2 and VR-3. The actual devices will mount to the chassis, later on in the text. For now you will just insert and solder the three lead wires into the appropriate holes on the p.c. board, as follows: (INSERT WIRES FROM UNDERSIDE OF BOARD AND SOLDER ON TOPSIDE)

VR-1		VR-2	
in (red) to pad #11	__	in (red) to pad #14	__
out (blue) to pad #13	__	out (blue) to pad #16	__
gnd (black) to pad #12	__	gnd (black) to pad #15	__

VR-3	
in (red) to pad #17	__
out (blue) to pad #19	__
gnd (black) to pad #18	__

VR-1 _____
VR-2 _____
VR-3 _____

4.8 Wire Mounting

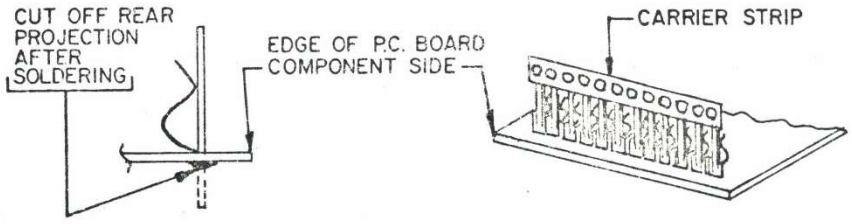
For your convenience, in assembly and possible trouble shooting later on, the VTE-1 wiring has been color coded. It is highly recommended that you follow the colors listed below and throughout the rest of this manual.

4.8.1 Insert and solder the following wires to the appropriate pads on the p.c. board, as listed below:

1 1/2" (3, 8cm)	red	to pad # 1	__	
1 1/2" (3, 8cm)	red	to pad # 2	__	
22" (55, 9cm)	black	to pad # 3	__	twist approx. 2 turns, per inch
22" (55, 9cm)	red	to pad # 4	__	
8" (20, 3cm)	red	to pad # 5	__	
8" (20, 3cm)	black	to pad # 6	__	
8" (20, 3cm)	green	to pad # 7	__	
8" (20, 3cm)	yellow	to pad # 8	__	
8" (20, 3cm)	blue	to pad # 9	__	
8" (20, 3cm)	orange	to pad #10	__	
14" (35, 6cm)	white	to pad #20	__	
14" (35, 6cm)	brown	to pad #21	__	
14" (35, 6cm)	red	to pad #22	__	
14" (35, 6cm)	black	to pad #23	__	
14" (35, 6cm)	green	to pad #24	__	
14" (35, 6cm)	yellow	to pad #25	__	
14" (35, 6cm)	blue	to pad #26	__	
14" (35, 6cm)	orange	to pad #27	__	
19" (48, 3cm)	green	to pad #28	__	
19" (48, 3cm)	yellow	to pad #29	__	
19" (48, 3cm)	blue	to pad #30	__	
19" (48, 3cm)	orange	to pad #31	__	
1 1/2" (3, 8cm)	red	to pad # 2 of J1	__	
1 1/2" (3, 8cm)	red	to pad # 2 of J2	__	
1 1/2" (3, 8cm)	red	to pad # 2 of J3	__	

4.9 Keyboard Connector Pins

We have saved these for last, as they are easily damaged. There should be (2) two groups of twelve pins. Each group is connected by a carrier strip. Insert and solder these, as shown below:
DO NOT BREAK OFF CARRIER STRIP AT THIS TIME.



4.10 The assembly of the p.c. board is now complete with the exception of the IC's themselves. At this time there should be NO IC's plugged into any sockets. Visually inspect your board for missed or cold solder joints.

5. MOUNTING THE PC BOARD AND WIRING TO THE CHASSIS

5.1 To prevent excessive voltage drop to critical circiuts, you are going to add (2) two stranded wire jumpers to the underside of the board. Insert and solder these wires, from the underside, as indicated below:

8" (27, 9cm) black from pad "A" to pad "A". ___
6 1/2" (16, 5cm) black from pad "B" to pad "B". ___

5.2 Start the actual wiring of your unit by placing the chassis assembly in front of you so that the vertical lip is in the rear. Place the pc board assembly on top of the chassis, just to the right of the transformer, with the components facing up. ___

5.3 For checkout purposes your unit will be set up at a rate of 110 baud.

5.3.1 Insert a 1" (2, 5cm) piece of solid 22 gage wire into the breadboarding pin, marked "J5", located directly under IC #73 (SN74LS74). Insert the free end into the pin just to the left of "J5" marked "110". ___

5.3.2 Insert a 2 1/2" (6, 4cm) piece of solid 22 gage wire into the breadboarding pin, marked "16X", located in between IC #75 and IC #76 (SN74LS93's). Insert the free end into the pin, marked "9600/110". ___

When you have completed the "checkout" portion of this manual and your unit is fully operational you may find it necessary to change the baud rate in order to match a communications type piece of equipment such as a teletype. If you do find it necessary to change the baud rate then you can refer to section VIII-1- "Selecting a Baud Rate" at the rear of this manual.

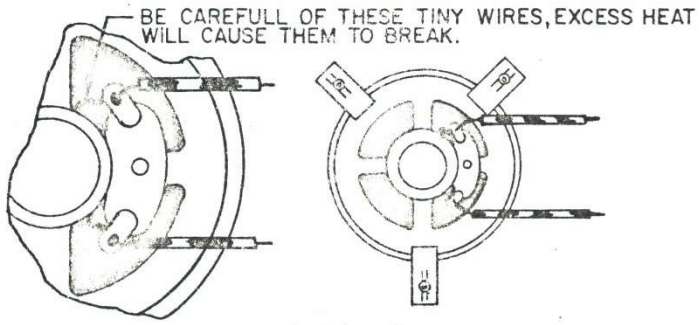
5.4 Upper case/lower case jumper

If you have purchased your unit without the lower case PROM, then the jumper, marked "J4", located just to the right of IC 35 (SN74LS166), will have to be connected. This is accomplished by inserting a 1" (2, 5cm) piece of solid 22 gage wire from J 4 pin 1 to J 4 pin 2. If you should, at a later date, purchase a lower case PROM then simply remove this jumper and insert the PROM into the socket, marked IC-29. ___

5.5 White on Black/Black on White

Take note of the pair of breadboarding pins, in the upper right hand corner of your board. The pins are marked B/W (J6), in between IC 9 and IC 10. When these two pins are left empty your video monitor output will be white characters on a black background. When you insert a 1" (2, 5cm) solid wire jumper, your video monitor output will change to black characters on a white background.

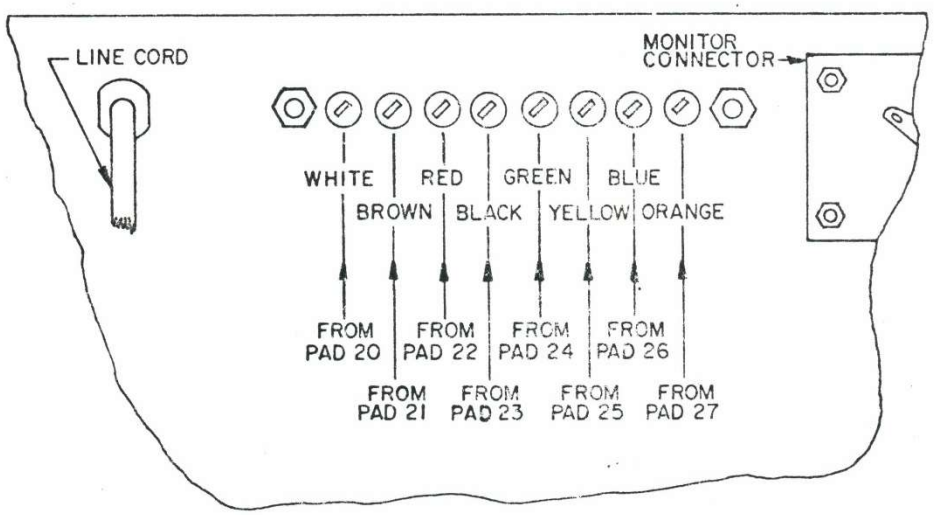
5.6 Connect and solder the speaker wires as shown below:



5.7 Connect and solder one at a time, the following wires:

Pad	5	(red)	to lug 5 on transformer	___
Pad	6	(black)	to lug 6 on transformer	___
Pad	7	(green)	to lug 7 on transformer	___
Pad	8	(yellow)	to lug 8 on transformer	___
Pad	9	(blue)	to lug 9 on transformer	___
Pad	10	(orange)	to lug 10 on transformer	___

5.8 Connect and solder, one at a time, the wires from pads 20 to 27 to the terminal strip, as shown below:



White ____
Brown ____
Red ____
Black ____
Green ____
Yellow ____
Blue ____
Orange ____

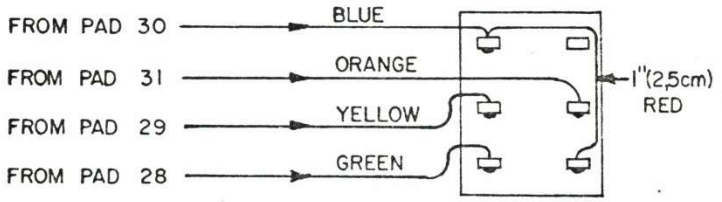
CHECK

5.9 Connect and solder, one at a time, the wires from pads 3 and 4 to the monitor connector. These (2) two wires are red and black and should be twisted approximately 2 turns per inch. Connect and solder the black wire to the terminal lug and the red wire to center lug on the connector itself.

Black _____

Red _____

5.10 Connect and solder, one at a time, the wires from pads 28 to 31 to the line/local (toggle) switch, as shown below:



1" Red _____

Blue _____

Orange _____

Yellow _____

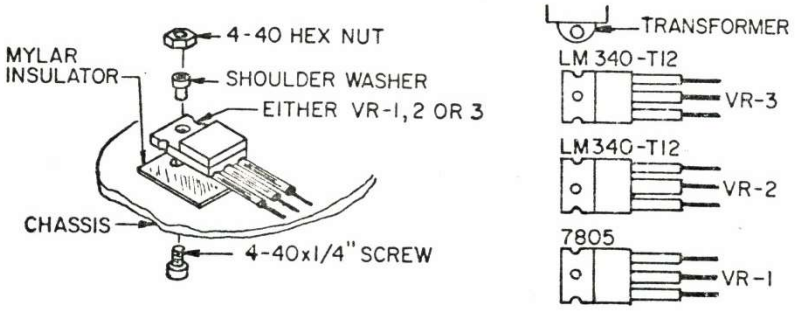
Green _____

5.11 You should now visually check and make certain that all wires are connected, with the exception of J1, J2 and J3. Once you are certain then you can strategically place 7 of the ty-raps around the bundles of wire. _____

5.12 Mounting the Regulators

5.12.1 Locate (3) 4-40 x 1/4" screws, (3) 4-40 hex nuts, (3) transistor insulators, (3) fiber shoulder washers, (3) ty-rap mounts and (3) ty-raps. _____

5.12.2 Mount the (3) regulators as shown below:



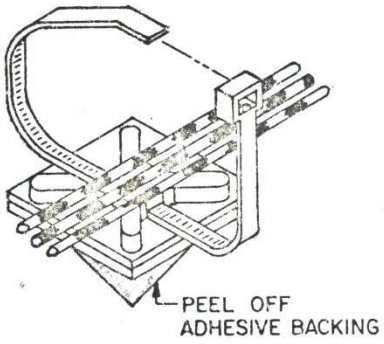
DO NOT OVERTIGHTEN THE NUTS, AS YOU MAY CRACK THE INSULATOR.

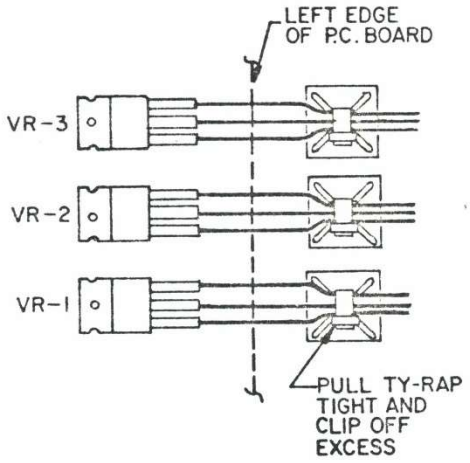
VR 3 _____

VR 2 _____

VR 1 _____

5.12.3 Mount the ty-raps and ty-rap mount as shown below:





VR 3 _____
VR 2 _____
VR 1 _____

5.13 Locate (7) 4-40 x 1/4" screws. Mount the pc board to the chassis. The center standoff in the front of the pc board does not have a mating hole in the chassis. This standoff is for support only. _____

5.14 Insert the fuse into the fuse post. _____

VI CHECKOUT AND FINAL ASSEMBLY

CHECK

1. PRELIMINARY CHECKOUT

1.1 Be certain of the following before starting:

....NO IC's have been put into any of the sockets. _____

....Power switch is OFF (down position). _____

....Line cord is unplugged. _____

....The case and keyboard have not been mounted to the chassis. _____

....The wires at J1, J2 and J3 are soldered at pad 2 only, and are standing up vertical. The free ends are to be used as test points. _____

Read each step carefully and be certain you understand the statement before you actually perform the instruction.

1.2 Power Supply

1.2.1 Turn the rear of the unit towards you. _____

1.2.2 Plug line cord into A-C outlet. Turn power switch ON (up position). The switch actuator should light up. If it doesn't, then re-check that you have wired the power switch correctly by referring back to page 11. _____

1.2.3 Once the power switch lites in the ON (up) position, turn switch OFF and rotate unit so that the front of the unit is towards you. _____

1.2.4 Attach the negative end (-) of a DC voltmeter to the negative end (-) of C20 (2200 MFD electrolytic capacitor). _____

1.2.5 Without rotating unit, turn power ON and check for the following voltages at the free end of the vertical wires at J1, J2 and J3.

....J1 = not lower than +4.75 VDC or higher than +5.25 VDC _____

....J2 = not lower than +11.4 VDC or higher than +12.6 VDC _____

....J3 = not lower than -12.6 VDC or higher than -11.4 VDC _____ _____

1.2.6 If the above voltages do not appear, turn power switch OFF and check the following components for improper installation and/or unsoldered wires. (Refer to Raster Scan Schematic on page 40).

T 1	__	CR14	__	VR-3	__
CR12	__	VR-1	__	C12 thru C20	__
CR13	__	VR-2	__	Wires A & B	__

_____

1.2.7 If the voltage indicated in step 1.2.5 did appear, then turn the power OFF, unplug unit from A-C outlet and do the following:

....Insert the free end of the wire at J3 into pad #1 and solder on the top side of the board. BE CERTAIN not to push wire into hole so that it makes contact with chassis. ____

....Insert the free end of the wire at J2 into pad #1 and solder on the top side of the board. BE CERTAIN not to push wire into hole so that it makes contact with chassis. ____

....Insert the free end of the wire at J1 into pad #1 and solder on the top side of the board. BE CERTAIN not to push wire into hole so that it makes contact with chassis. ____

!!! CAUTION !!!
The power supply voltages are now present and are available to the circuits of the VTE-1

Visually examine your entire board for bits of wire clippings and/or solder, and remove any that may exist. ____

1.3 Board Logic and Pulse Indicator Circuits

1.3.1 Be certain that power is OFF and unplug unit is unplugged. ____

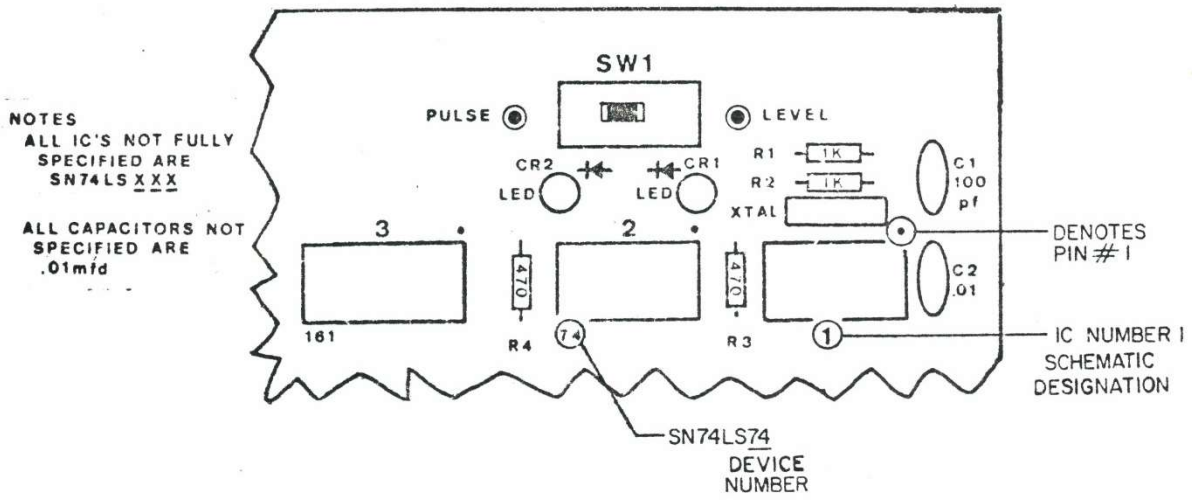
1.3.2 Referring to the Raster Scan Schematic (page 40) and the yellow printing on the p.c. board, take note of the following:

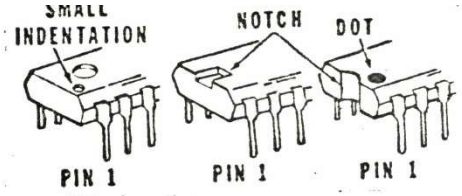
....The large number next to each IC socket is the schematic designation. ____

....The small number next to each IC socket is the actual devices' (IC's) number. ____

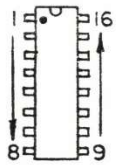
....The dot next to each IC socket denotes pin #1 for that IC. ____

Study the illustrations below before proceeding.

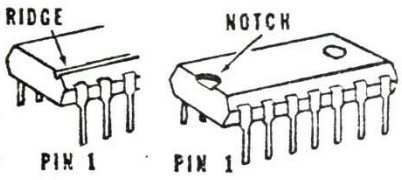




PIN #1 OF AN IC IS ALWAYS IN THE UPPER LEFT HAND CORNER OF THE DEVICE, NO MATTER WHAT SIZE THE IC IS (14,16,24,40 etc.). COUNT DOWN TO THE END OF THE LEFT SIDE THEN MOVE TO THE RIGHT AND CONTINUE COUNTING UP THE RIGHT SIDE.



CHECK



1.3.3 Locate IC position number 2 (upper right hand corner). Remove IC 2 (SN74LS74) from the foam and install it into the socket. BE CERTAIN that pin #1 of the IC aligns with the yellow dot on the p.c. board.
NOTE: When installing IC's place one row of pins half way into the socket and then rock the other side in and gently push the IC into the socket. ____

1.3.4 Locate the 19" piece of solid white wire. Plug one end into the breadboarding pin marked "PULSE", located to the left of switch SW-1. Leave the other end free making sure that it does not touch anything. ____

1.3.5 Check that the power switch is OFF.
Plug line cord into A-C outlet. ____
Turn power ON. ____
Watch for smoke or excessive HUM from transformer(T-1) or p.c. board. ____
Power switch should be lit as well as the red LED's CR1 and CR2. ____
....If transformer should HUM or be excessively hot then go back and repeat step 1.2.6. ____
....If everything is okay then depress the pushbutton switch (SW-1). The "PULSE" LED (CR2) should go out. If it should not, then check the following:

IC-2 in backwards ___
CR-2 in backwards ___
No +5VDC on power supply ___
Wrong IC in IC-2's position ___
Bent pins on IC-2 ___
Socket pins missed being soldered ___ ____

1.4 Using an ohmeter check for No continuity (open circuit) between the ground lug on the transformer leg and the ground lug on the monitor connector mounting screw. ____

2. RASTER SCAN CHECKOUT

2.1 Turn power OFF and unplug unit from wall.
Refer to Raster Scan Schematic.

2.2 Locate and install the following IC's:

IC--1 (SN74LS04)	___	IC-10 (SN74LS161)	___
IC--3 (SN74LS161)	___	IC-11 (SN74LS93)	___
IC--4 (SN74LS04)	___	IC-12 (SN74LS93)	___
IC--5 (SN74LS74)	___	IC-13 (SN74LS00)	___
IC--6 (SN74LS27)	___	IC-19 (SN74LS266)	___
IC--7 (SN74LS74)	___	IC-30 (SN74LS11)	___
IC--9 (SN74LS161)	___	IC-36 (SN74LS08)	___

2.3 Using an ohmeter check for continuity (zero ohms) between GND (negative end of C20) and the following points:

IC--1--pin 7	___	IC-10-pins 4	___
IC--2--pin 7	___	5	___
IC--3-pins 4	___	6	___
5	___	8	___
8	___	IC-11--pin10	___
IC--4--pin 7	___	IC-12--pin10	___
IC--5--pin 7	___	IC-13--pin 7	___
IC--6--pin 7	___	IC-19--pin 7	___
IC--7--pin 7	___	IC-30--pin 7	___
IC--9--pin 8	___	IC-36--pin 7	___
IC-10--pin 3	___		

Locate trouble and repair, if necessary.

2.4 Turn power ON.
Using a voltmeter check for +5VDC (± 5%) at the following points:

IC--1-pins14	___	IC--4--pin14	___	IC--9-pins10	___
13	___	IC--5-pins14	___	1	___
11	___	10	___	16	___
9	___	1	___	9	___
IC--2-pins14	___	4	___	IC-10-pins 7	___
4	___	IC--6--pin14	___	10	___
1	___	IC--7-pins14	___	1	___
10	___	13	___	16	___
IC--3-pins 3	___	10	___	IC-11--pin 5	___
6	___	IC--9-pins 3	___	IC-12--pin 5	___
7	___	4	___	IC-13--pin14	___
10	___	5	___	IC-19--pin14	___
1	___	6	___	IC-30--pin14	___
16	___	7	___	IC-36--pin14	___

Locate trouble and repair, if necessary.

2.5 Pulse Indicator Operation.

The following tests will be performed using the "Pulse Indicator Circuit", located in the upper right hand corner of the p.c. board. You will insert one end of the 19" (48, 3cm) solid white wire into the breadboarding pin labeled "PULSE". The free end will be connected to the point that you are going to verify. You will then depress the pushbutton switch, SW-1. The LED will go out and should remain out. This will indicate that there are no pulses or clocks at the point of measurement. If the LED does not go out or does go out and then starts to flicker then there are pulses or clocks present at that point.

LED OFF = NO CLOCKS OR PULSES PRESENT.
LED ON = CLOCKS OR PULSES ARE PRESENT.

2.5.1 Turn power ON.
You will now verify that continuous pulses exist at the following points:
IF THEY DO NOT OCCUR, THEN IT WILL BE NECESSARY TO CORRECT THE CIRCUIT UNDER TEST BEFORE PROCEEDING TO THE NEXT TEST.

IC	FUNCTION	PINS	CHECK
1	Oscillator	4	
		5	
		6	

2.6 Logic Level Indicator Operation.

The "Logic Level Indicator" will be used to service circuits not working. You will insert one end of the 19" (48, 3cm) solid white wire into the breadboarding pin labeled "LEVEL". The free end will be connected to the point that you are going to measure. If the LED lights, then a logic 1 is present. If the LED does not light, then a logic 0 is present.

LED ON = LOGIC 1: +3.0 to +5.25 VDC
LED OFF = LOGIC 0: 0.0 to +0.8 VDC

2.7 Pulse Train Checkout

2.7.1 Turn power ON.
You will now verify that continuous pulses exist at the following points:
IF THEY DO NOT OCCUR, THEN IT WILL BE NECESSARY TO CORRECT THE CIRCUIT UNDER TEST BEFORE PROCEEDING TO THE NEXT TEST.

IC	FUNCTION	PINS	CHECK
3	Counter	2	
		13	
		12	
		11	
		9	
4	Inverter	13	
		12	
9	Counter	2	
		14	
		13	
		12	
4	Inverter	11	
		10	
10	Counter	14	
		13	
		12	
		11	
		9	
13	Decoder	12	
		13	
		11	
36	Decoder	10	
		9	
		8	
5	Decoder	2	
		3	
		5	
11	Counter	1	
		12	
		9	
		8	
		11	
		3	
		2	

IC	FUNCTION	PINS	CHECK
30	Decoder	3	
		4	
		5	
		6	
12	Counter	14	
		1	
		12	
		9	
		8	
		11	
		2	
		3	
4	Inverter	9	
		8	
5	Decoder	11	
		12	
		9	
		8	
13	Decoder	1	
		2	
		3	
7	Decoder	12	
		11	
		9	
		8	
19	Decoder with current sink output	12	
		13	

Having satisfied the above tests it is probable that your "Raster Scan" circuit is working properly. However, this circuit generates a very complex analog signal, known as "composite video". Testing this signal normally requires a high speed oscilloscope and an extensive knowledge of television theory. It is unlikely that you have either the equipment or the knowledge necessary to verify this signal. Thus we shall use a simpler method for checking your composite video and hope for the best. This simpler method requires that you connect your unit to some sort of monitor and analyze the resultant picture on the screen

.... If you have purchased a commercial T.V. monitor it will work directly with the VTE-1's composite video signal. Bear in mind that your units composite video signal is about 1 volt peak to peak and designed to drive a 75 ohm load.

THE MONITOR TO VTE-1 CABLE SUPPLIED IS ASSEMBLED FOR THIS PURPOSE.

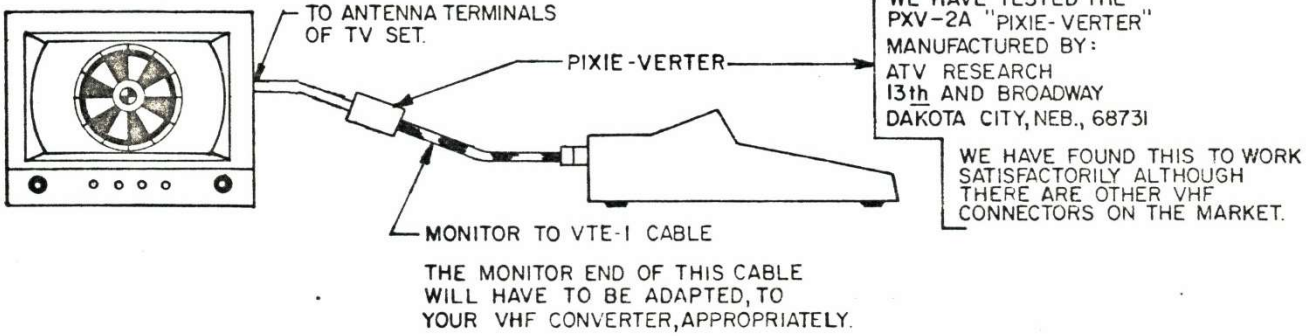
.... If you have modified a commercial T.V. set it too will work directly with the VTE-1's composite video signal. However, cautious methods for shielding and grounding may be required to prevent "ghosts" or "smearing" on the screen.

.... If you have purchased a VHF Converter and thus you are coming into the antenna connections of a commercial T.V. set you should use cautious methods for shielding and grounding and have some level of confidence that the VHF converter is working.

SEE DIAGRAM BELOW

NOTE: If you are using a modified T.V. or a VHF converter you will have to adjust the vertical height and horizontal width in order to view complete screen data. In some cases it may be necessary to modify your T.V. to obtain these adjustments in which case it may be more practical to purchase a standard T.V. monitor.

VHF CONVERTER CONNECTIONS



2.8 Connecting the Video Monitor.

2.8.1 Be certain power is OFF, on the VTE-1. ____

2.8.2 Connect your version of "Video Monitor" to the "Video Monitor Connector". ____

2.8.3 Turn power, to both units, ON. ____

2.8.4 Turn your "contrast" control up fully and adjust the "brightness" control for a light gray screen. ____

2.8.5 Adjust your vertical and horizontal hold controls for a stable blank screen. If these controls seem to have no effect on the screen it is likely that something is not working! When you are certain that your Video Monitor and it's connections to the VTE-1 are in order and if the problem still persists, then test the following components, on the VTE-1 p.c. board:

R 5	__	CR 3	__
R 6	__	CR 4	__
R 7	__	Q 2	__
R 8	__	IC 6	__
R 9	__	IC19	__

Repair if necessary. ____

NOTE: You can assume that you have a composite video signal if you can force Vertical roll bars to occur on your monitor's screen by adjusting the "Vertical Hold" control on the monitor. IT'S NOT POSSIBLE TO GET VERTICAL ROLL BARS IF A COMPOSITE VIDEO SIGNAL IS NOT PRESENT. ____

2.9 Bell Circuit

2.9.1 Turn power OFF, on the VTE-1.

2.9.2 Locate and install the following IC's:

IC-54 (SN74LS123) __ IC-61 (SN74LS08) __ ____

2.9.3 Ground pin 9 of IC 54, on a temporary basis. ____

2.9.4 Turn power ON. The Bell may or may not beep during power on.

2.9.5 Momentarily ground pin 10 of IC 54. The Bell should beep when you remove this ground. ____

2.9.6 If the Bell does not beep, check the following components:

IC54	__	C31	__	R40	__
IC61	__	CR10	__	speaker	__
Q 3	__	R34	__		

2.10 The Shotgun.

The remainder of the VTE-1 construction is fairly complicated and not conducive to separate testing. The only practical way to get it operating is a fairly common practice called "shot-gunning". This consists of turning the power OFF, locating and installing the remainder of the IC's and then turning the power back ON and seeing what happens. Since the majority of the VTE-1 uses digital IC's it is very likely that everything will work properly, provided that:

1) You didn't plug any IC's in backwards.
2) All of the IC pins went into the sockets and are not folded under the IC's or hanging outside the sockets.
3) You have installed all of the analog components where they belong and have paid strict attention to observing polarity.
4) You were careful when soldering and didn't make cold solder joints or "splashes" (i.e. shorts) between adjacent pins.

2.11 Performing the Shotgun.

2.11.1 Turn power OFF, on both the monitor and the VTE-1. _____

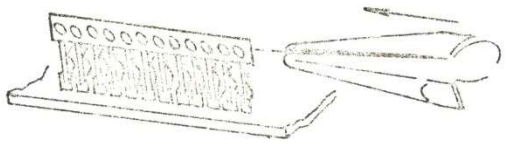
2.11.2 Unplug both units.

2.11.3 Review the components already installed and review your solder connections. _____

2.11.4 Locate and install the remainder of the IC's, as follows:

IC	DESIG.	CHK	IC	DESIG.	CHK	IC	DESIG.	CHK
8	SN74LS93		37	SN74LS83		57	SN74LS32	
14	SN74LS08		38	SN74LS32		58	2102A-2	
15	SN74LS193		39	2102A-2		59	SN74LS157	
16	SN74LS266		40	1702-A		60	SN74LS157	
17	SN74LS266		41	SN74LS42		62	SN74LS00	
18	SN74LS83		42	SN74LS74		63	SN74LS11	
20	4N35		43	SN74LS32		64	SN74LS42	
21	SN74LS93		44	SN74LS02		65	2102A-2	
22	SN74LS157		45	2102-A		66	AY-S-2376	
23	SN74LS157		46	SN74LS42		67	SN74LS74	
24	SN74LS157		47	SN74LS05		68	SN74LS02	
25	SN74LS157		48	SN74LS04		69	SN74LS08	
26	SN74LS193		49	SN74LS00		70	SN74LS93	
27	SN74LS04		50	SN74LS32		71	2102A-1	
28	2102A-2		51	SN74LS08		72	SN74LS00	
31	SN74LS93		52	2102A-2		73	SN74LS74	
32	SN74LS83		53	UART		74	SN74LS93	
33	2102A-2		55	SN74LS10		75	SN74LS93	
34	2708		56	SN74LS93		76	SN74LS93	
35	SN74LS166					77	1458	

3.1 Turn power OFF.
The carrier strip now has to be broken off the keyboard connector pins.
Do this as illustrated below:



3.1.1 Grab the carrier strip with a pair of long nose pliers. The pliers should be parralel to the p.c. board so that you can grab the entire carrier strip. Gently rock the strip back and forth until the strip breaks away, leaving 12 individual pins. _____

3.1.2 Repeat above step for the other set of pins. _____

3.2 Place the VTE-1 so that the front of the unit is facing you. _____

3.3 Lay the keyboard, face down, in front of the VTE-1, with the mylar flex circuit strips facing the VTE-1. _____

3.4 Grab one flex circuit, using thumb and index fingers of both hands. Thumbs facing you and the keyboard. _____

3.5 Notice that the circuit side of the flex circuit is at your index finger and should be facing the back of the VTE-1. _____

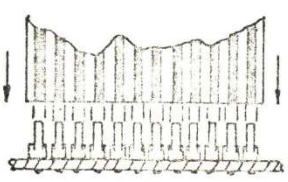
3.6 Carefully insert the flex circuit in between the back support and contact fingers of the connector pins. _____

3.7 Follow the same procedure for the other flex circuit. _____

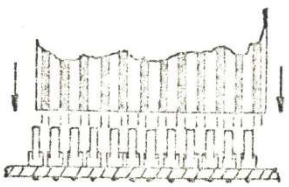
3.8 Place an 8 1/2" x 11" piece of paper over the p.c. board, covering the front most section of IC's. _____

3.9 Gently, flip keyboard over, on top of the piece of paper.

3.10 Check to see if the circuit on the flex circuit lines up with the connector pins. _____



RIGHT



WRONG

4. FINAL CHECK

CHECK

4.1 Power should still be OFF. Place the toggle (line/local) switch in the down position. This is the local position. _____

4.2 Turn power ON. Screen will flash random characters then the flashing cursor should appear in the upper left hand corner of your monitor, no other characters should be present. _____

4.3 For UPPER CASE character set, perform the following steps:

4.3.1 Press letters A thru Z. They should appear on the screen, as you type them. _____

4.3.2 Press CR. Cursor should return to the left most position. _____

4.3.3 Press LF. Cursor should move down one line. _____

4.3.4 Press numbers 0 thru 9. They should appear on the screen, as you type them. _____

4.3.5 Press down and hold CTRL, with your left hand. With your right hand press the following keys:

G - VTE will beep. _____

C - VTE will clear screen. _____

H - Cursor will back-space, wrap-around and locate in the upper-most right hand corner. _____

U(twice) - Cursor will move to the bottom of the screen and then up one line.

D - Cursor will move down one line. _____

4.3.6 Press down and hold CTRL, with your left hand. With your right hand press X. Nothing visually will happen but internally the unit has just set up for cursor positioning of the X co-ordinate. _____

4.3.7 Press [-Cursor will move to the middle of the line. _____

4.3.8 Press down and hold CTRL, with your left hand. With your right hand press Y. Nothing visually will happen but internally the unit has just set up for cursor positioning of the Y co-ordinate. _____

4.3.9 Press 7 -Cursor will move to the center of the screen. _____

4.3.10 Type the word TEST. Then press back-space four times. The screen will have the word test printed with the cursor blinking over the first "T" in test. _____

4.3.11 Press down and hold CTRL, with your left hand. With your right hand, press the following keys:

E(twice) - TTSS should appear on the screen. _____

W - Cursor will disappear. _____

V - Cursor will reappear. _____

4.3.12 Press down and hold the blank (or repeat) key with your right hand. With your left hand, press and hold down the space bar. The cursor will move right and upon reaching the right, lower most position, it will move the letters "TTSS" upward until they disappear off the top of the screen. _____

4.4.13 Press LOCK, then press the following characters: [! " # $ % & ' ( ) * =] ^ (note: this one will look like ↑) <> ? + \ @ These should all appear on the screen as you type them. _____

4.4.14 Press SHIFT, then press the following charcters: : — ; , . / These should appear on the screen as you type them. _____

4.4 For [redacted] lower case [redacted] character set, perform the following steps:
NOTE: You must have purchased and installed the lower case PROM to perform these functions.

4.4.1 Press letters a thru z. They should appear on the screen, as you type them. _____

4.4.2 Press and hold down SHIFT, with your left hand. With your right hand, press { } ~ They should appear on the screen, as you type them. _____

4.5 For communications interface perform the following steps:

4.5.1 Turn VTE-1 power OFF. _____

4.5.2 Connect (—) 20MA OUT to (—) 20MA IN. _____

4.5.3 Connect (+) 20MA OUT to (+) 20MA IN. _____

4.5.4 Place toggle (line/local) switch in the up (line) position. _____

4.5.5 Turn power ON. _____

4.5.6 Press A thru Z. They should appear on the screen, as you type them. _____

4.5.7 Turn power OFF. _____

4.5.8 Remove connections on the terminal strip. _____

4.5.9 Connect (—) 20MA IN to (+) 20MA IN. _____

4.5.10 Connect RS 232 SIG OUT to RS 232 SIG IN. _____

4.5.11 Turn power ON. _____

4.5.12 Press A thru Z. They should appear on the screen, as you type them. _____

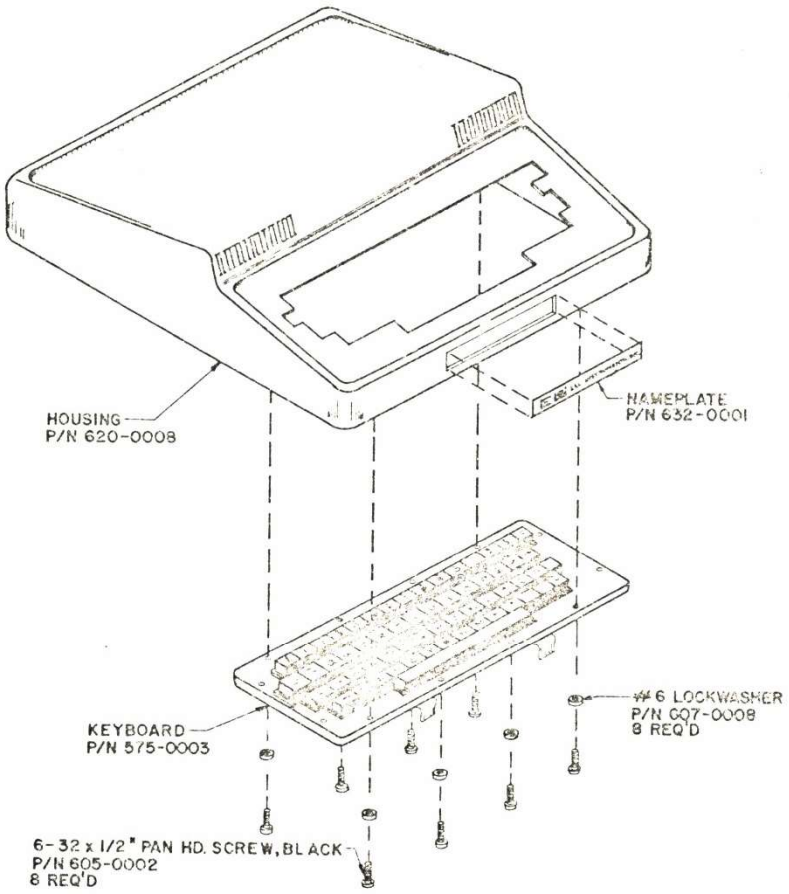
5. FINAL ASSEMBLY

CHECK

5.1 Case and Keyboard Assembly

5.1.1 Carefully remove the keyboard and the piece of 8 1/2" x 11" paper. Lift the mylar flex circuits up and away from the connector pins. _____

5.1.2 Referring to the illustration below mount the nameplate and keyboard onto the case.



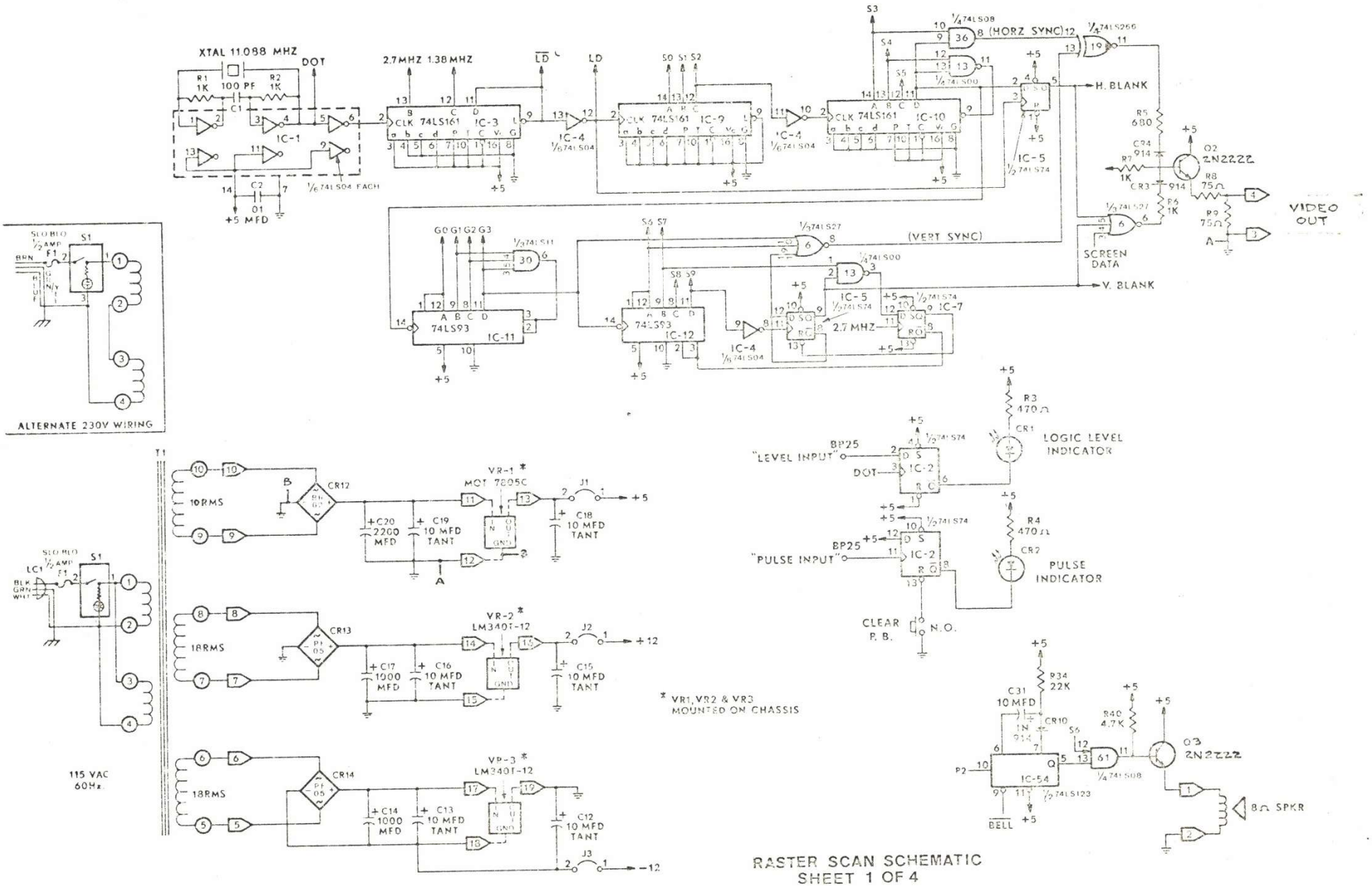
_____

5.1.3 Place case assembly face down in front of the chassis assembly similiar to the way you placed them when you originally mounted the keyboard, in section 3. _____

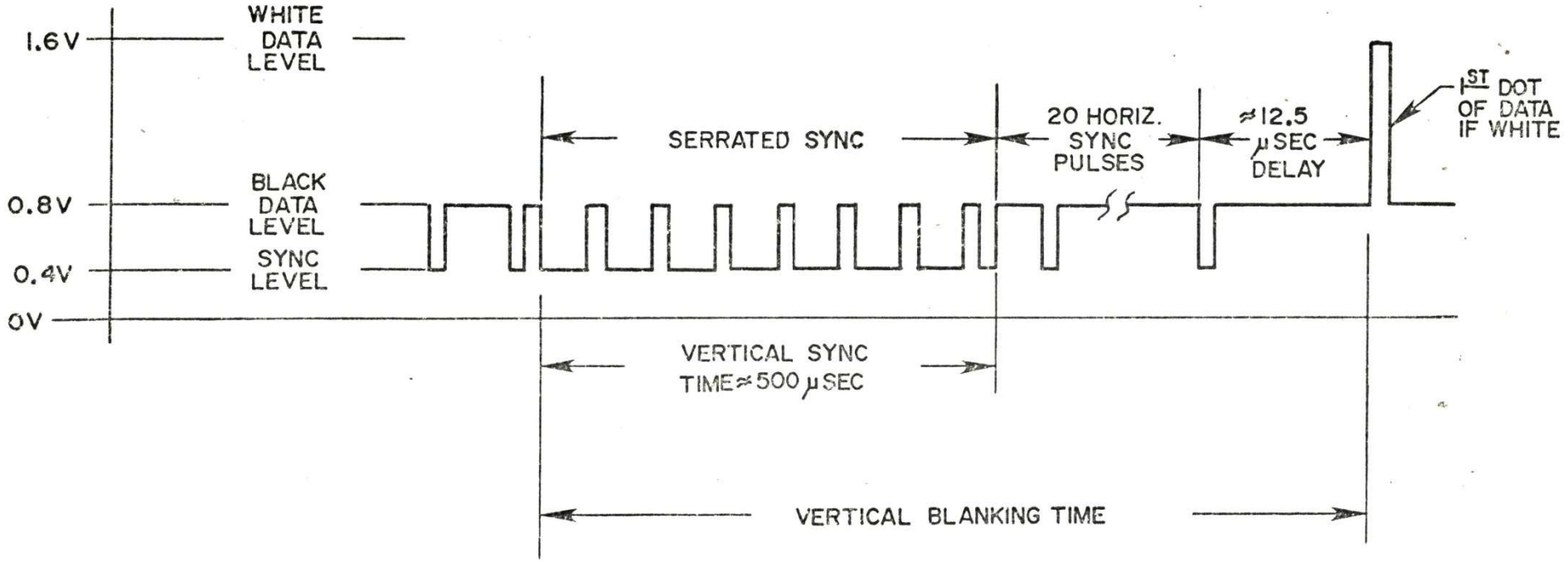
5.1.4 Once the flex circuits are in place then you can rotate the case up and away from you, on top of the chassis assembly. The rear lip of the chassis will fit up inside the rear groove of the case. _____

5.1.5 Carefully flip unit over and put in the (8) 6-32 screws. _____

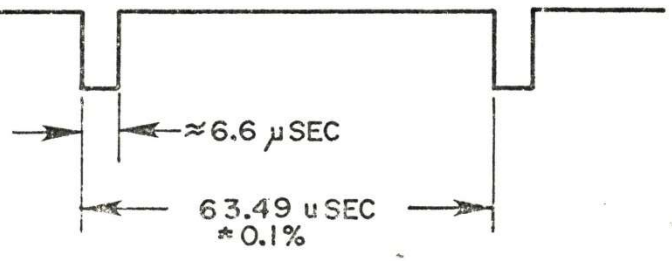
5.1.6 Your unit is now ready for operation.


XTAL 11.088 MHZ
DOT
2.7MHZ 1.38MHZ
LD
H. BLANK
V. BLANK
(HORZ SYNC)
(VERT SYNC)
SCREEN DATA
VIDEO OUT
ALTERNATE 230V WIRING
115 VAC 60Hz
10RMS
18RMS
18RMS
VR-1 * MOT 7805C
VR-2 * LM340T-12
VR-3 * LM340T-12
+12
-12
* VR1, VR2 & VR3 MOUNTED ON CHASSIS
BP25 "LEVEL INPUT"
BP25 "PULSE INPUT"
LOGIC LEVEL INDICATOR
PULSE INDICATOR
CLEAR P. B. N.O.
8Ω SPKR
RASTER SCAN SCHEMATIC
SHEET 1 OF 4

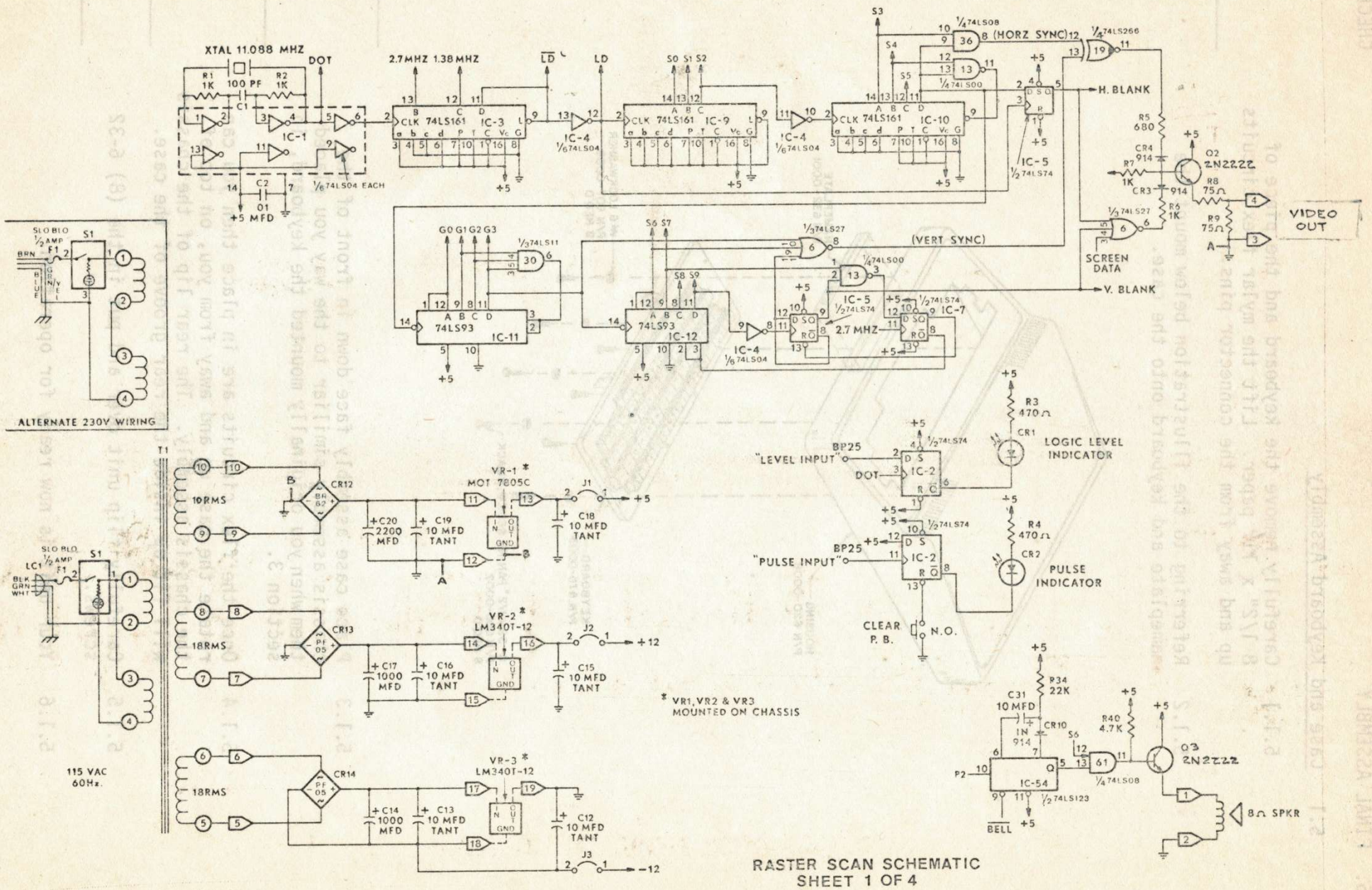
COMPOSITE VIDEO COMPONENTS



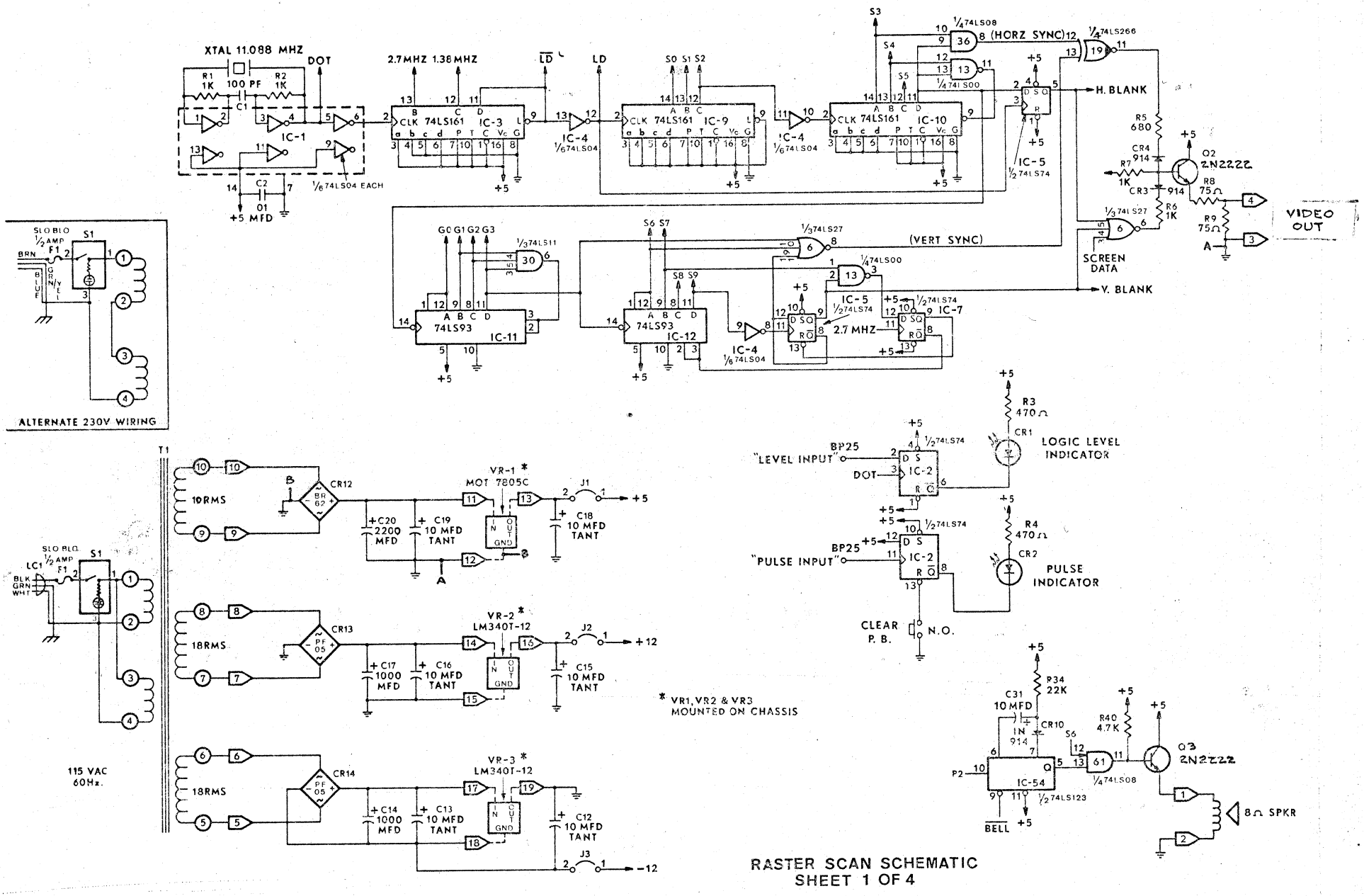
HORIZ. PULSE DETAIL



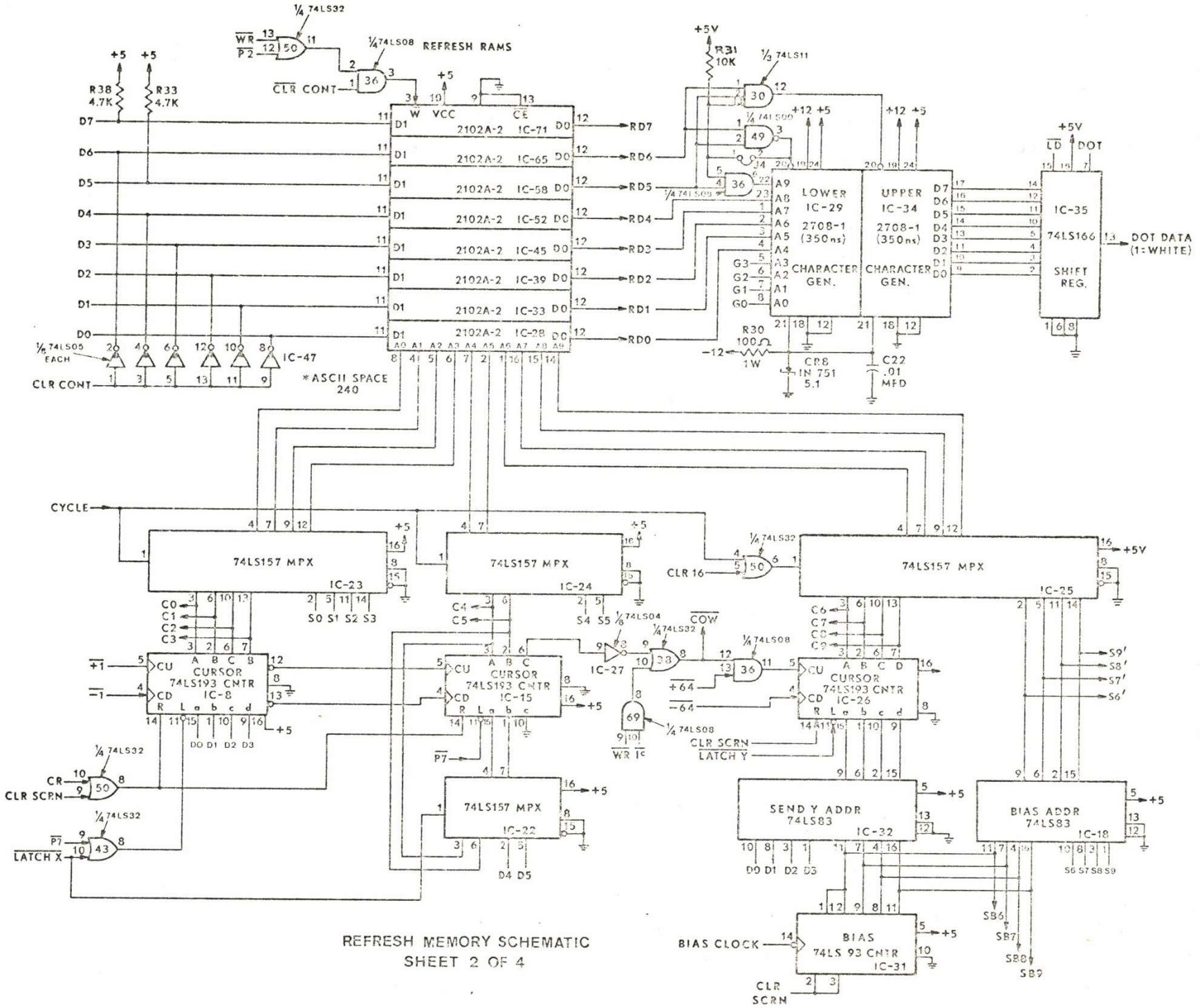
15,750.5 KC ±0.1%



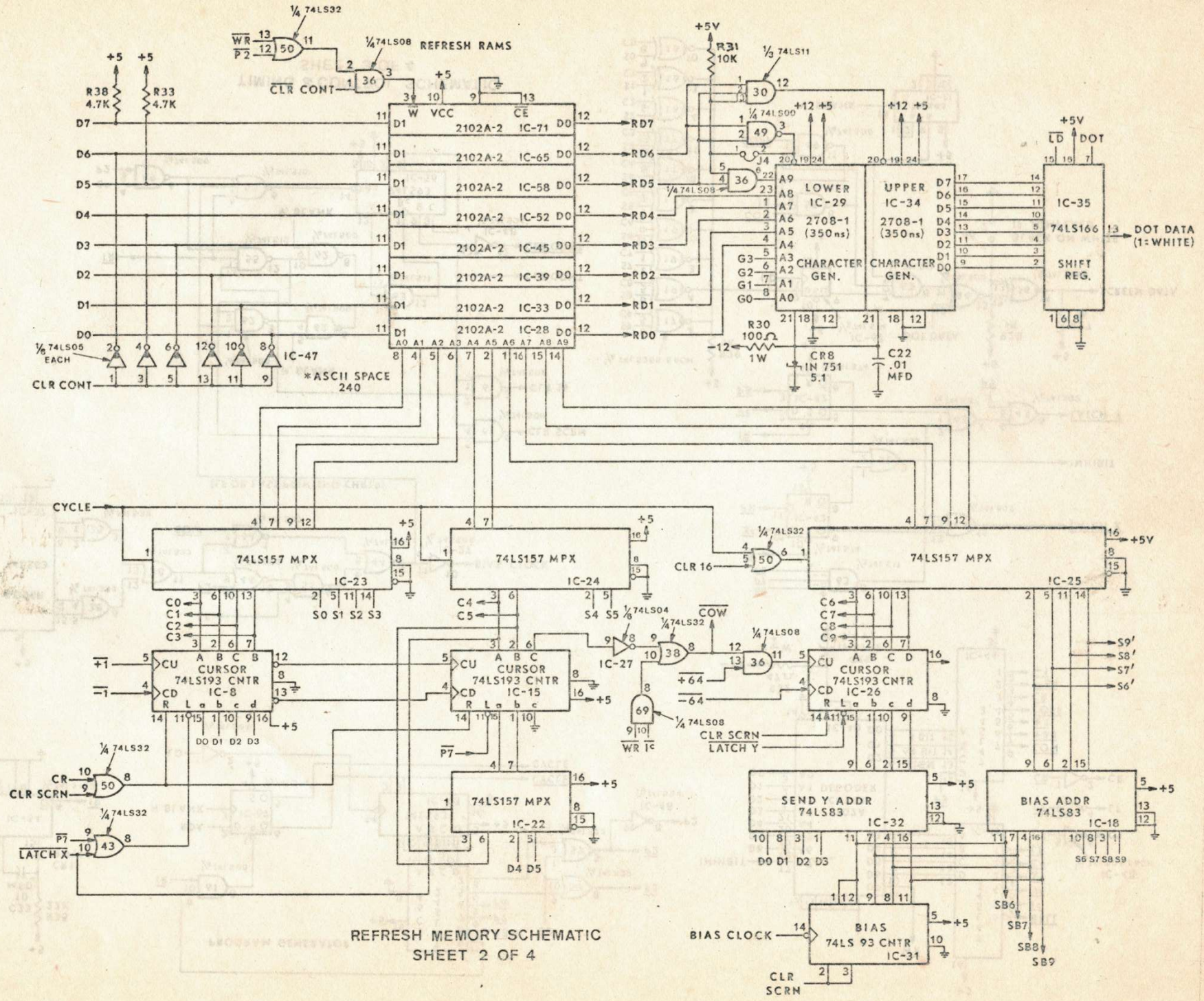
RASTER SCAN SCHEMATIC
SHEET 1 OF 4



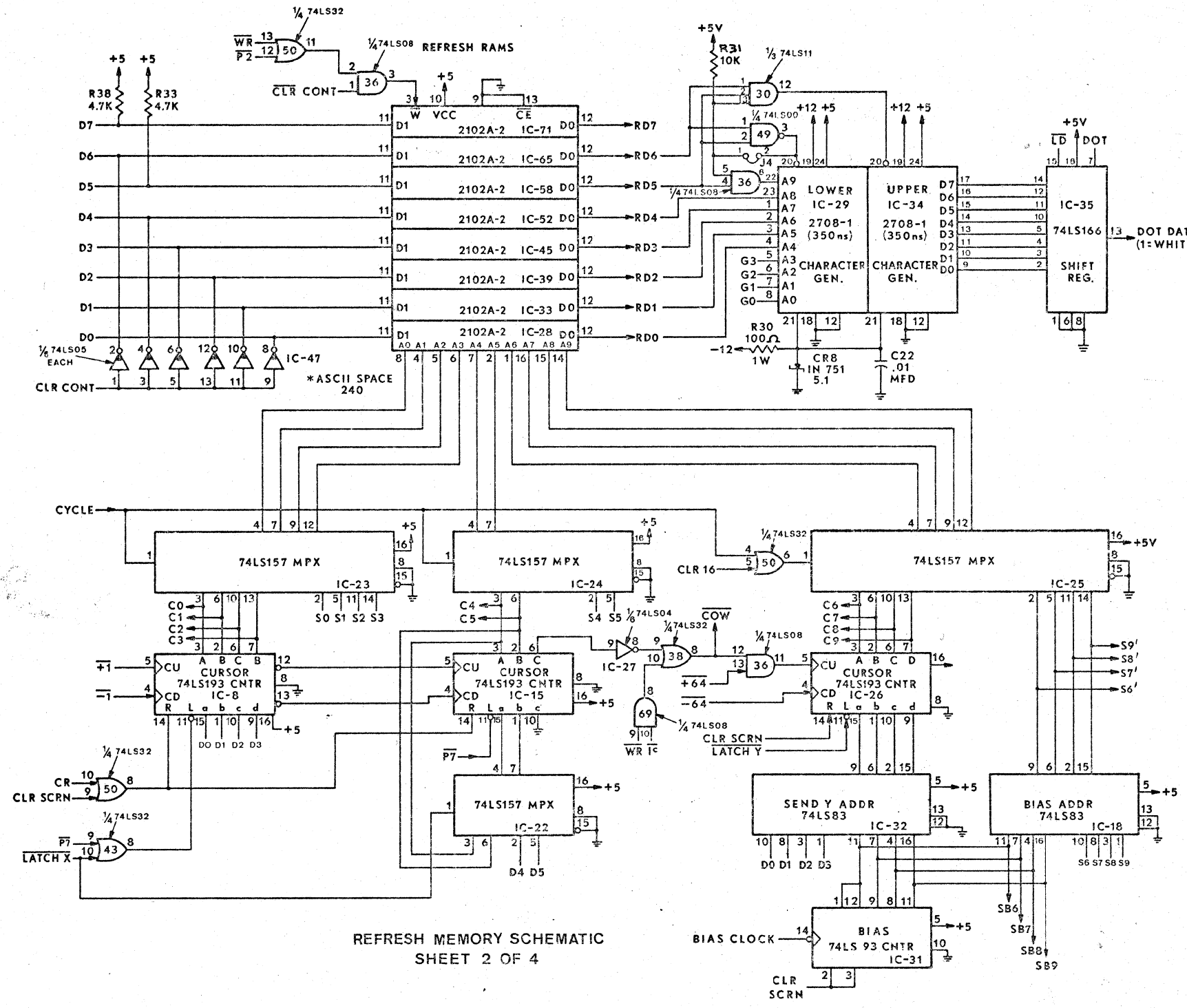
RASTER SCAN SCHEMATIC
SHEET 1 OF 4



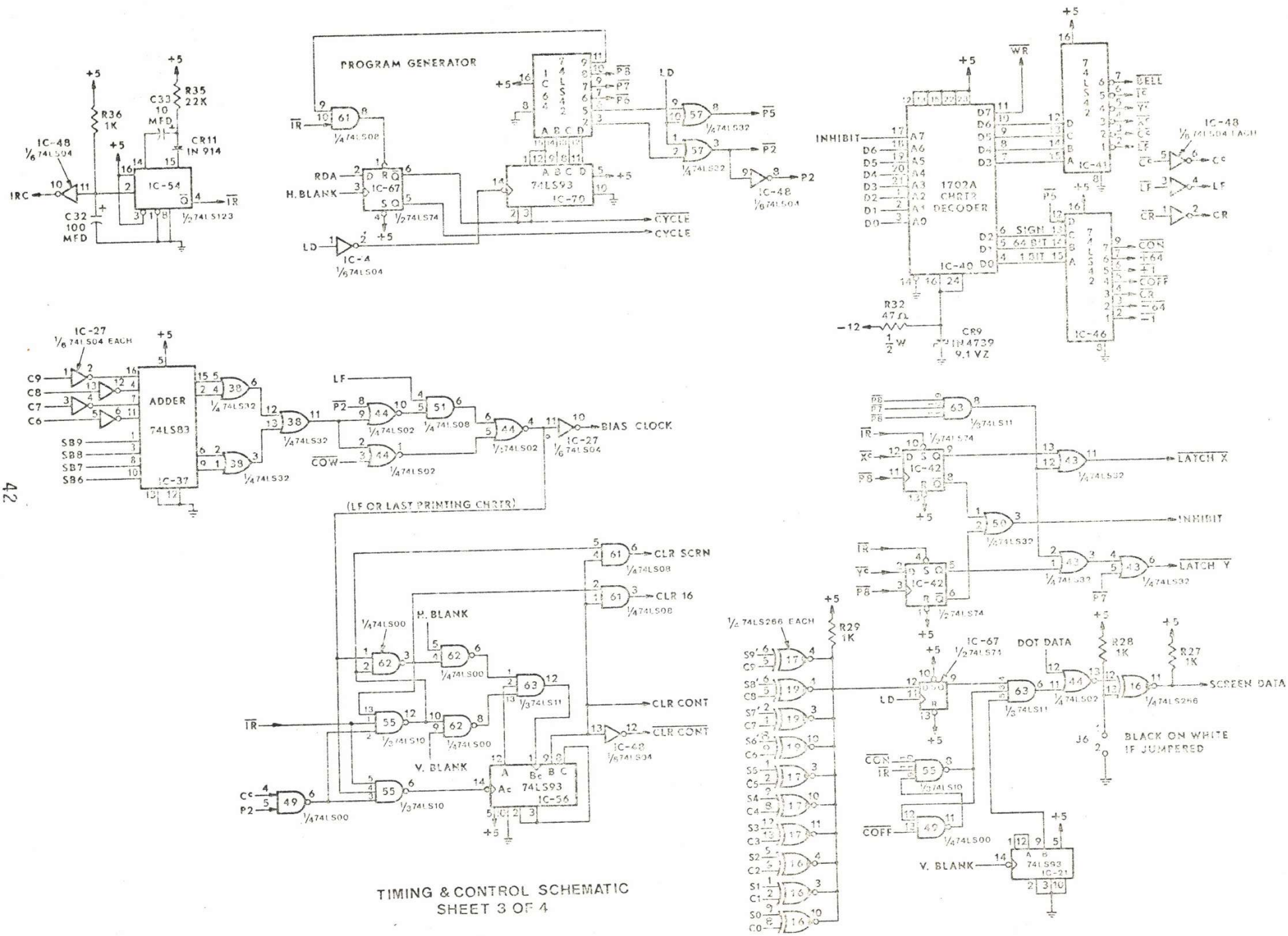
REFRESH MEMORY SCHEMATIC
SHEET 2 OF 4



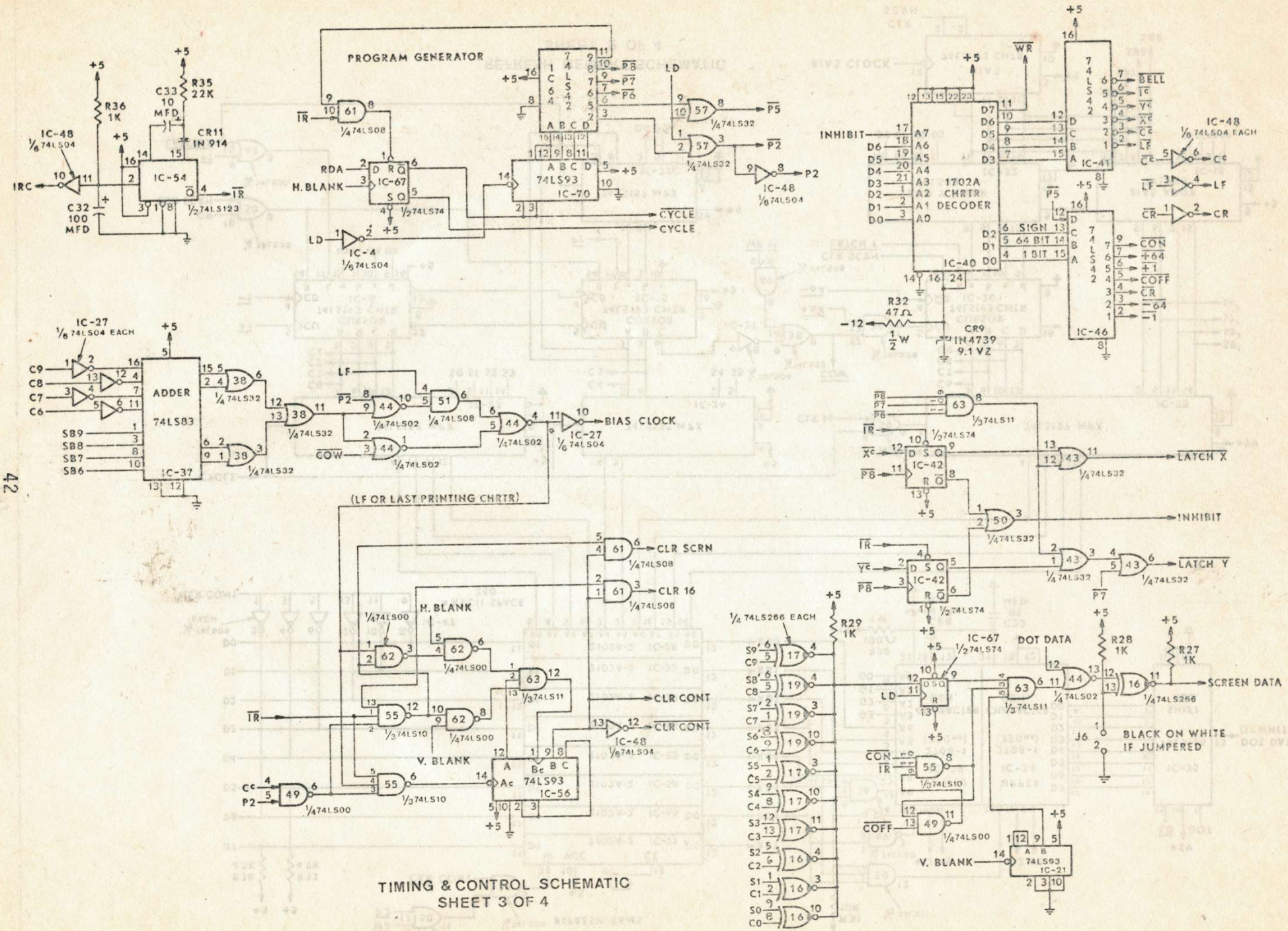
REFRESH MEMORY SCHEMATIC
SHEET 2 OF 4



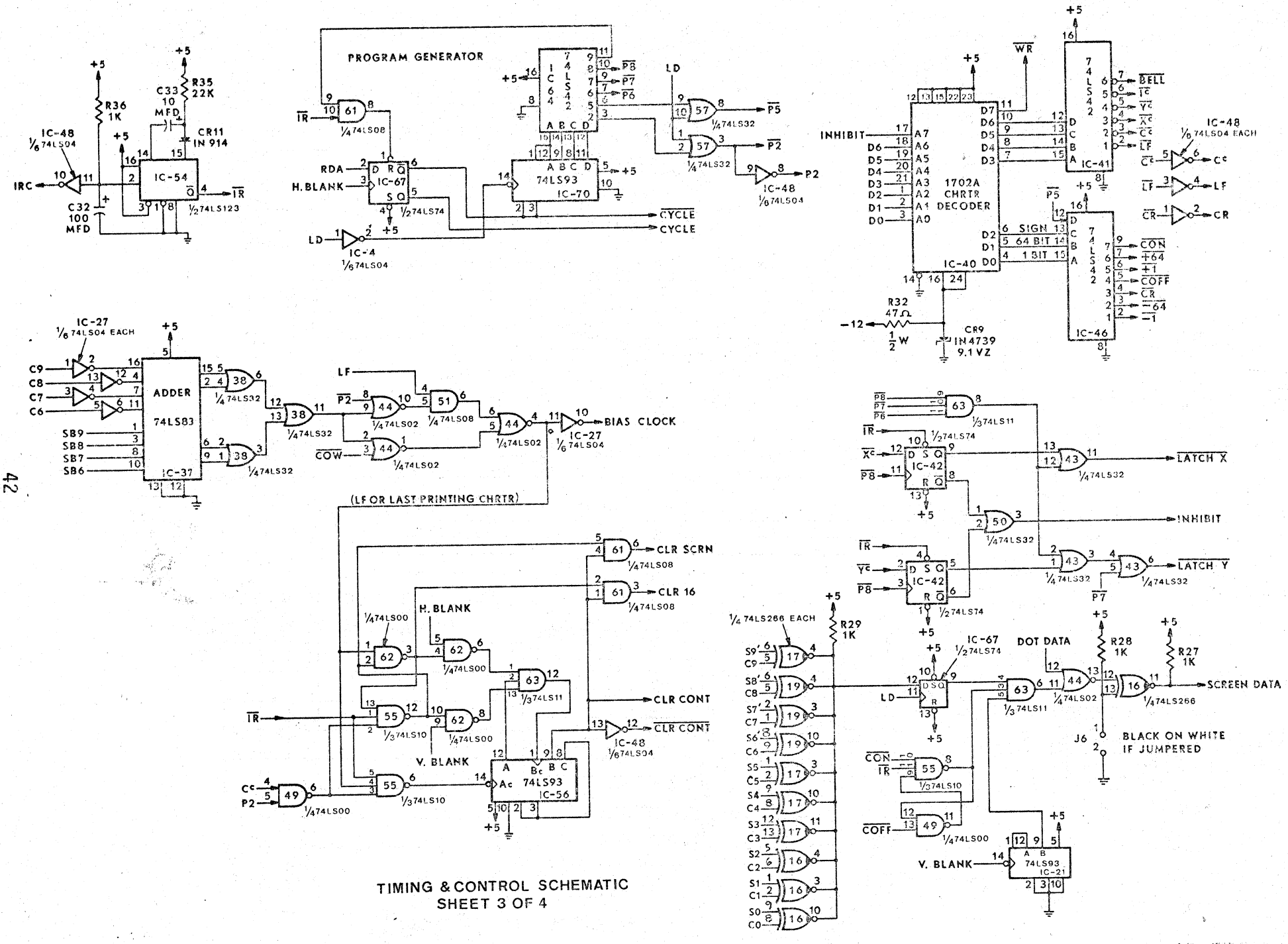
REFRESH MEMORY SCHEMATIC
SHEET 2 OF 4



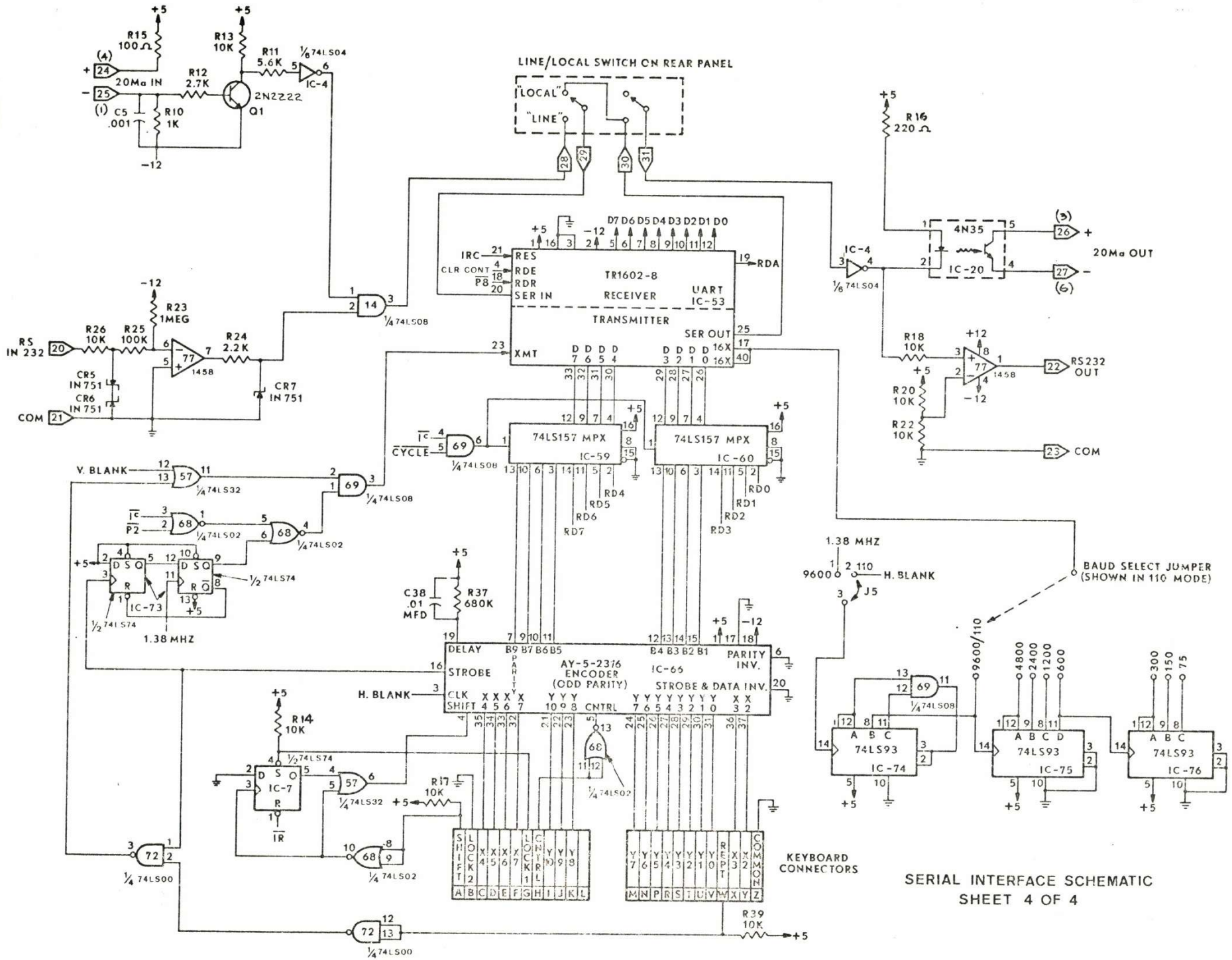
TIMING & CONTROL SCHEMATIC
SHEET 3 OF 4

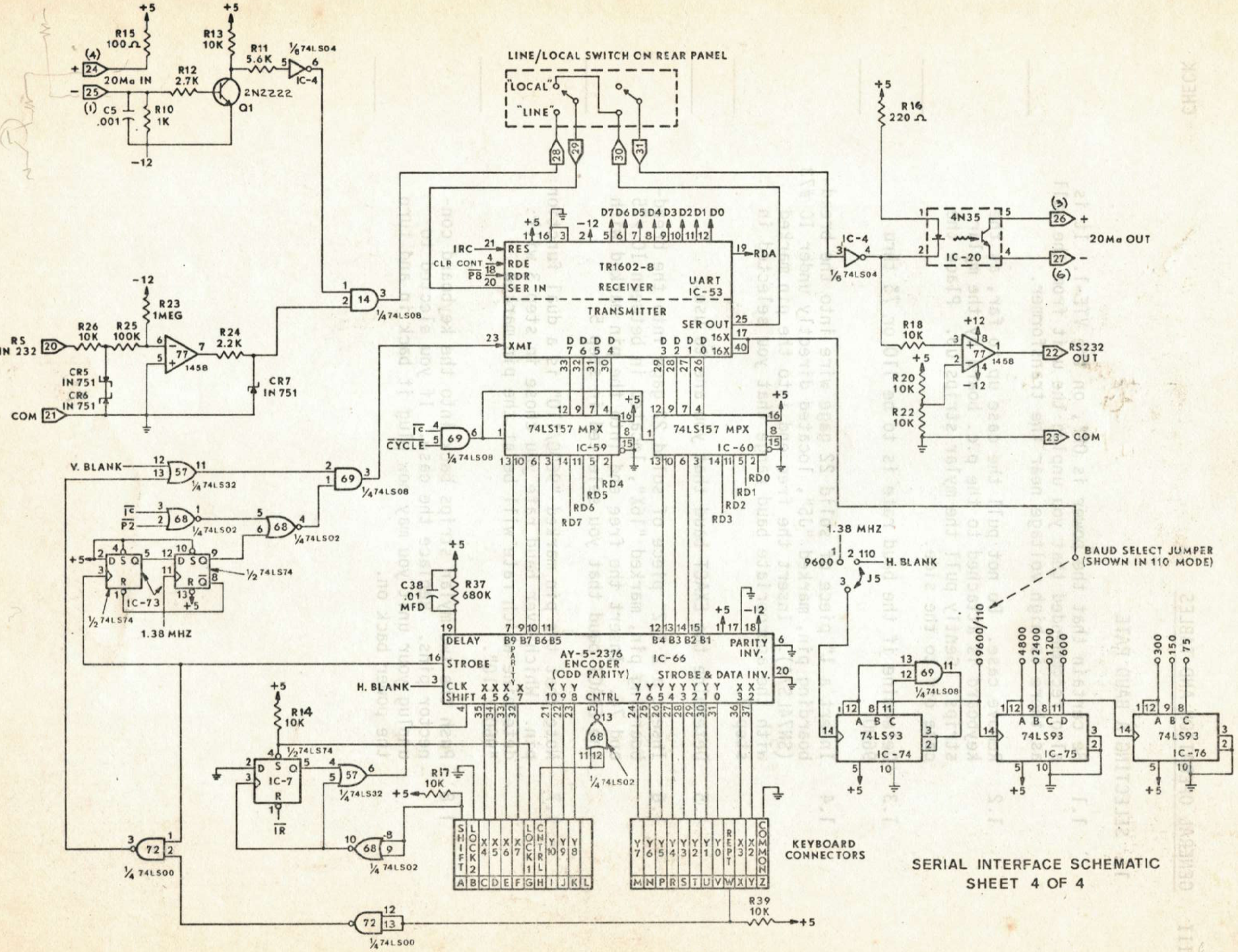


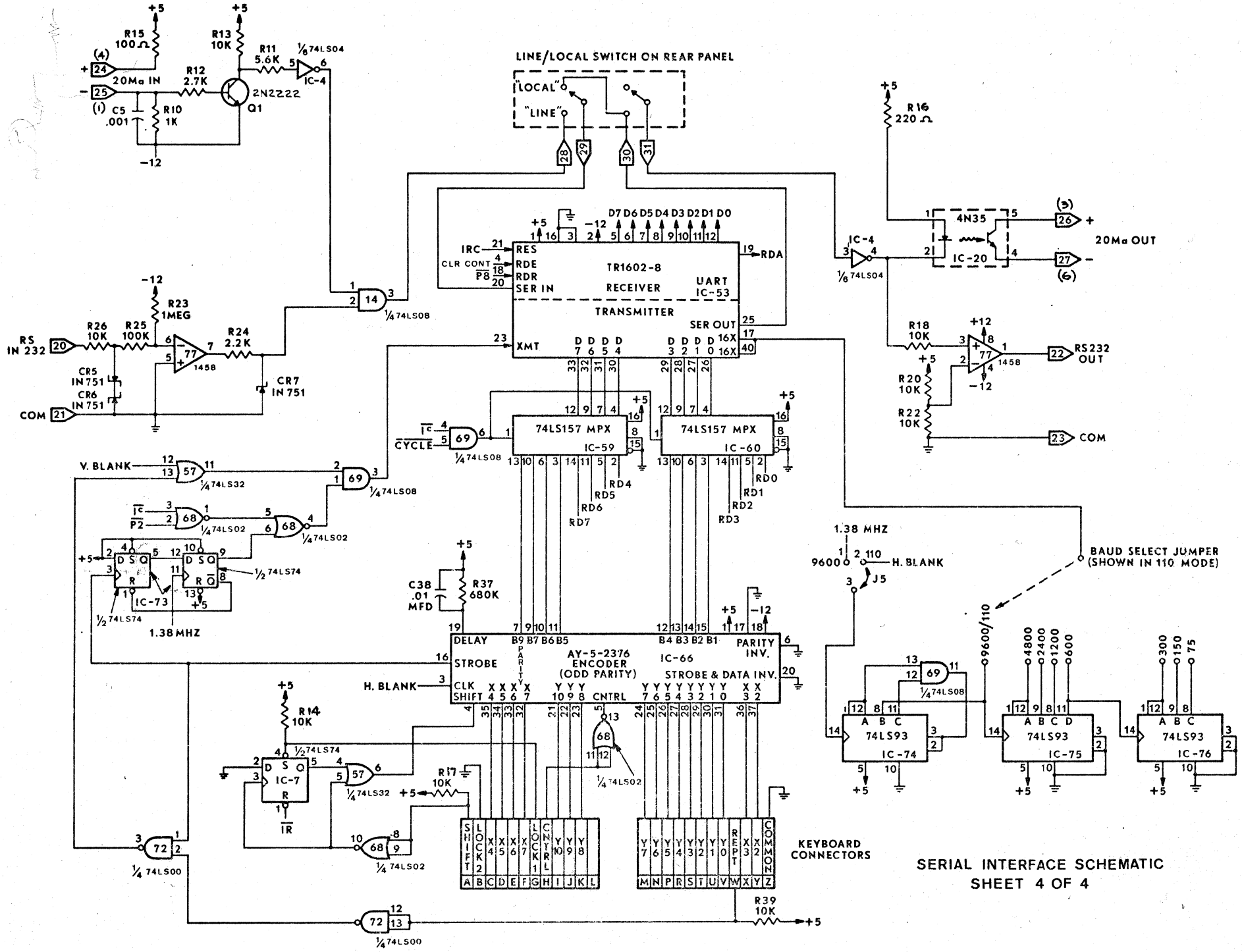
TIMING & CONTROL SCHEMATIC
SHEET 3 OF 4



TIMING & CONTROL SCHEMATIC
SHEET 3 OF 4


LINE/LOCAL SWITCH ON REAR PANEL
"LOCAL"
"LINE"
20Ma IN
2N2222
Q1
IC-4
IC-20
4N35
20Ma OUT
TR1602-8
UART
IC-53
RECEIVER
TRANSMITTER
RES
RDE
RDR
SER IN
SER OUT
XMT
RDA
CLR CONT
RS IN 232
COM
RS232 OUT
74LS157 MPX
IC-59
IC-60
CYCLE
V. BLANK
H. BLANK
1.38 MHZ
BAUD SELECT JUMPER
(SHOWN IN 110 MODE)
AY-5-2376
ENCODER
(ODD PARITY)
IC-66
DELAY
STROBE
CLK
SHIFT
PARITY INV.
STROBE & DATA INV.
74LS93
IC-74
IC-75
IC-76
KEYBOARD
CONNECTORS
SERIAL INTERFACE SCHEMATIC
SHEET 4 OF 4


LINE/LOCAL SWITCH ON REAR PANEL
"LOCAL"
"LINE"
20Ma IN
20Ma OUT
TR1602-8
UART IC-53
RECEIVER
TRANSMITTER
74LS157 MPX
IC-59
IC-60
AY-5-2376 ENCODER
(ODD PARITY)
IC-66
STROBE & DATA INV.
1.38 MHZ
BAUD SELECT JUMPER
(SHOWN IN 110 MODE)
74LS93
IC-74
IC-75
IC-76
KEYBOARD CONNECTORS
SERIAL INTERFACE SCHEMATIC
SHEET 4 OF 4


LINE/LOCAL SWITCH ON REAR PANEL
"LOCAL"
"LINE"
20Ma IN
20Ma OUT
2N2222
Q1
IC-4
IC-20
4N35
TR1602-8
RECEIVER
TRANSMITTER
UART
IC-53
74LS157 MPX
IC-59
IC-60
AY-5-2376
ENCODER
(ODD PARITY)
IC-66
74LS93
IC-74
IC-75
IC-76
IC-73
IC-7
1458
RS232 OUT
RS IN 232
COM
V. BLANK
CYCLE
H. BLANK
1.38 MHZ
9600
110
BAUD SELECT JUMPER
(SHOWN IN 110 MODE)
KEYBOARD CONNECTORS
SERIAL INTERFACE SCHEMATIC
SHEET 4 OF 4
(43)

VIII GENERAL OPERATION AND TABLES

CHECK

1. SELECTING A BAUD RATE

1.1 Be certain that the power is OFF, on the VTE-1. It is also recommended that you unplug the unit from the wall as there is high voltage near the transformer. _____

1.2 Remove case. Do not pull the case up to far, as the keyboard is attached to the p.c. board by the mylar strips. Gently pull the mylar strips up. Place the case off to the side. _____

1.3 Determine if the baud rate is to be 110 or 75 thru 9600. _____

1.4 Insert a 1" piece of solid 22 gage wire into the bread-boarding pin, marked "J5", located directly under IC #73 (SN74LS74). Insert the free end into the pin marked with the appropriate baud range that you selected in step 3. _____

1.5 Determine the EXACT baud that you are to use. _____

1.6 Insert a 2 1/2" piece of solid 22 gage into the bread-boarding pin, marked "16X", located in between IC #75 and 76. Insert the free end into the pin marked with the EXACT baud that you selected in step 5. _____

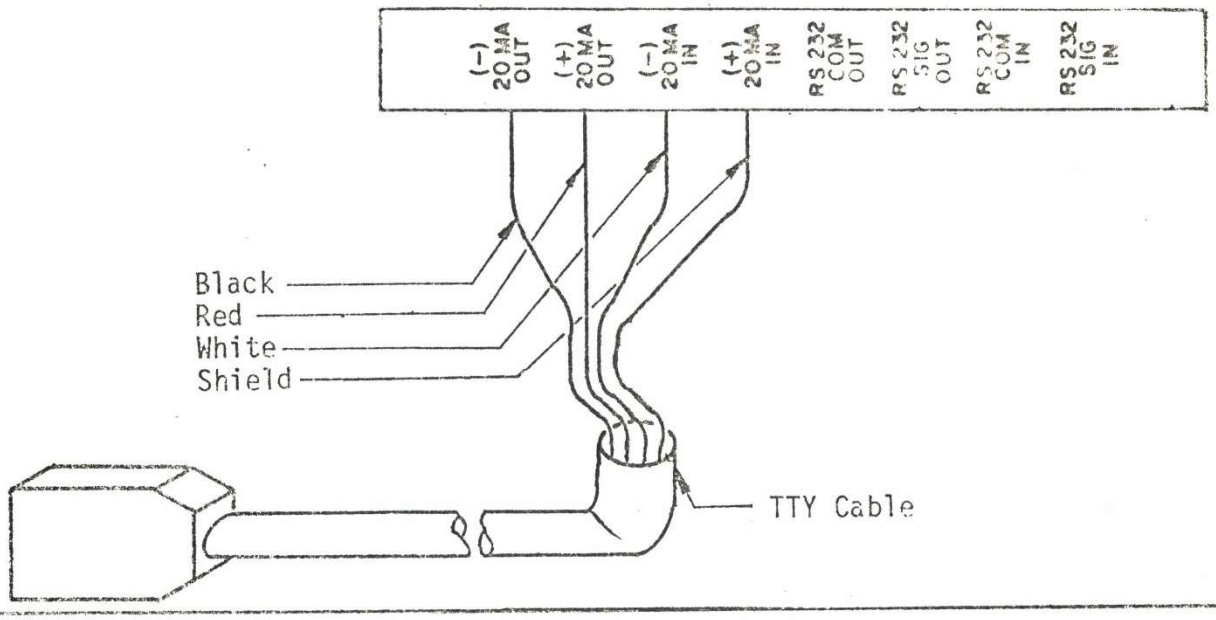
1.7 Note that the pin marked "9600/110" is a dual function pin. Which-ever baud rate you chose in step 3 will determine which rate will be at the pin marked "9600/110". _____

1.8 Push the two mylar strips back into the keyboard connector pins. Replace the case. If you elected to unplug your unit you may now plug it back in and turn the power back on. _____

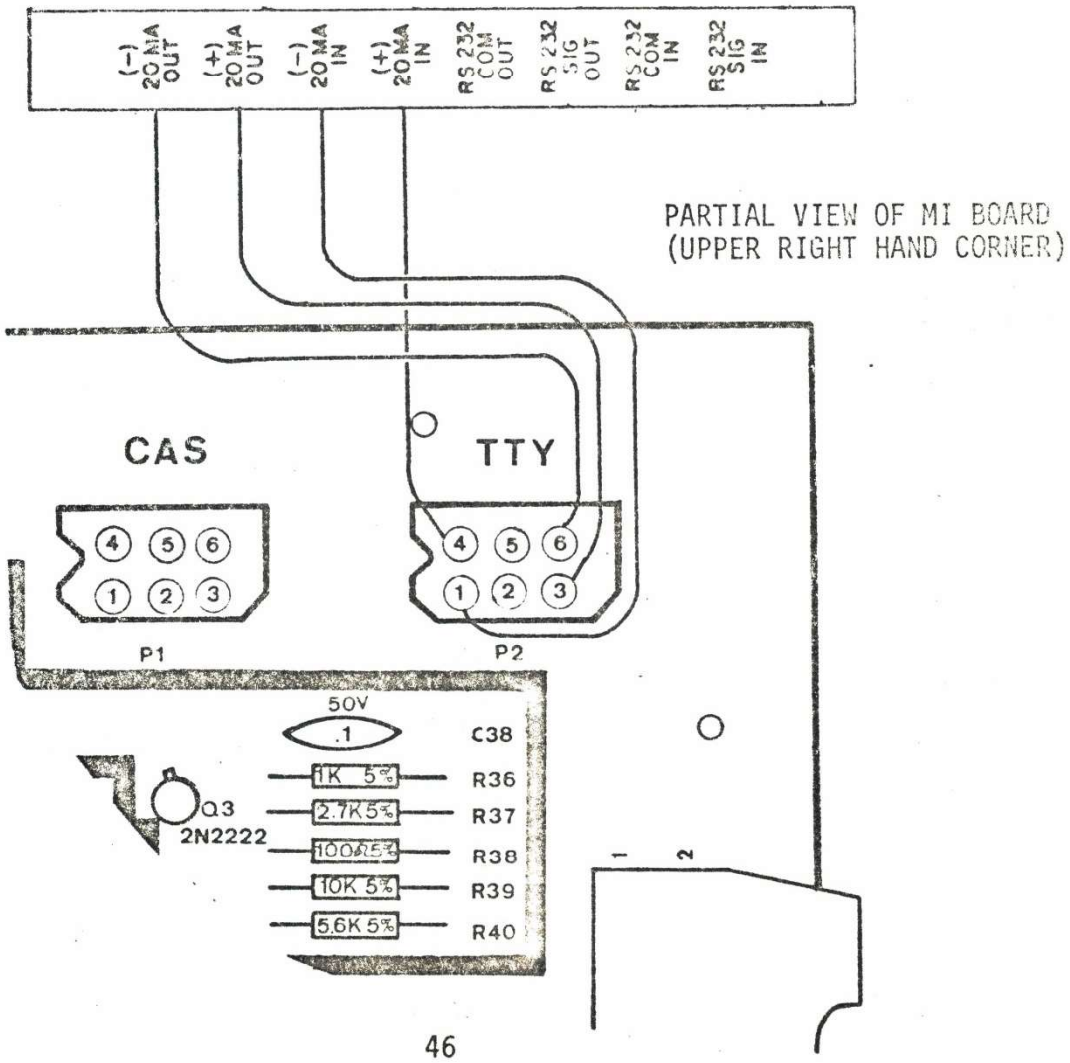
2. KEY FUNCTIONS

KEY	Function
C control	Clears the screen and Homes the Cursor
Line feed	Causes a line feed
Carriage Return	Causes a carriage return
G control	Makes the beeper "beep"
E control	Causes the "READ SCREEN" function
V control	Cursor on
W control	Cursor off
U control	Moves the cursor Up
D control	Moves the cursor Down
L control	Moves the cursor Left
R control	Moves the cursor Right
X control	Sets DIRECT X mode
Y control	Sets DIRECT Y mode

3. HOOKUP FOR E & L MI OWNERS HAVING E & L TTY CABLE (P/N 341-9000)



HOOKUP FOR E & L MI OWNERS NOT HAVING E & L TTY CABLE



4. ASCII CODE TABLE (with Parity bit = 0)

DIGITS		
	OCTAL	HEX
0	060	30
1	061	31
2	062	32
3	063	33
4	064	34
5	065	35
6	066	36
7	067	37
8	070	38
9	071	39

LETTERS					
UPPER CASE	OCTAL	HEX	HEX	OCTAL	LOWER CASE
A	101	41	61	141	a
B	102	42	62	142	b
C	103	43	63	143	c
D	104	44	64	144	d
E	105	45	65	145	e
F	106	46	66	146	f
G	107	47	67	147	g
H	110	48	68	150	h
I	111	49	69	151	i
J	112	4A	6A	152	j
K	113	4B	6B	153	k
L	114	4C	6C	154	l
M	115	4D	6D	155	m
N	116	4E	6E	156	n
O	117	4F	6F	157	o
P	120	50	70	160	p
Q	121	51	71	161	q
R	122	52	72	162	r
S	123	53	73	163	s
T	124	54	74	164	t
U	125	55	75	165	u
V	126	56	76	166	v
W	127	57	77	167	w
X	130	58	78	170	x
Y	131	59	79	171	y
Z	132	5A	7A	172	z

SYMBOLS		
	OCTAL	HEX
!	041	21
"	042	22
#	043	23
$	044	24
%	045	25
&	046	26
'	047	27
(	050	28
)	051	29
*	052	2A
+	053	2B
,	054	2C
-	055	2D
.	056	2E
/	057	2F
:	072	3A
;	073	3B
<	074	3C
=	075	3D
>	076	3E
?	077	3F
@	100	40
[	133	5B
\	134	5C
]	135	5D
^	136	5E
←	137	5F
`	140	60
{	173	7B
|	174	7C
}	175	7D
~	176	7E

CONTROL CHARACTERS			
KEYS	OCTAL	HEX	TTY DEFINITIONS
	000	00	NUL - null, or all zeros
A and control	001	01	SOH - start of heading
B and control	002	02	STX - start of text
C and control	003	03	ETX - end of text
D and control	004	04	EOT - end of transmission
E and control	005	05	ENQ - enquiry
F and control	006	06	ACK - acknowledge
G and control	007	07	BEL - bell
H and control or BACK SPACE	010	08	BS - back space
I and control TAB	011	09	HT - horz. tab
J and control or LF	012	0A	LF - line feed
K and control	013	0B	VT - vert. tab
L and control	014	0C	FF - form feed
M and control or CR	015	0D	CR - carriage return
N and control	016	0E	SO - shift out
O and control	017	0F	SI - shift in
P and control	020	10	DLE - data link escape
Q and control	021	11	DC1 - device control 1
R and control	022	12	DC2 - device control 2
S and control	023	13	DC3 - device control 3
T and control	024	14	DC4 - device control 4
U and control	025	15	NAK - negative acknowledge
V and control	026	16	SYN - syncnronous idle
W and control	027	17	ETB - end of trans block
X and control	030	18	CAN - cancel
Y and control	031	19	EM - end of medium
Z and control	032	1A	SUB - substitute
ESC	033	1B	ESC - escape
	034	1C	FS - file separator
	035	1D	GS - group separator
	036	1E	RS - record separator
	037	1F	US - unit separator
SPACE BAR	040	20	SP - space
BREAK or RUB OUT	177	7F	DEL - delete

5. CONTROL PROM TABLE

The VTE is controlled by incoming ASCII through a mapping technique using a 1702A PROM.

Seven bits (D0 thru D6) of the ASCII code received by the UART are placed on the address lines of this control PROM (the parity bit B7 is ignored). Thus for every ASCII character there is a corresponding 8 bit control pattern stored in the control PROM. The response of the VTE to a particular ASCII character is determined by the control pattern stored in the PROM. These patterns and the responses which they will cause are listed below.

PATTERN		RESPONSE
(OCTAL)	(HEX)	
020	10	Clears the screen
216	8E	Causes a line feed
203	83	Causes a carriage return
260	B0	Makes the beeper "beep"
255	AD	Causes the "READ SCREEN" function
005	05	Causes the ASCII character to be displayed on the screen
207	87	Turns the cursor on
204	84	Turns the cursor off
202	82	Moves the cursor UP
206	86	Moves the cursor DOWN
201	81	Moves the cursor LEFT
205	85	Moves the cursor RIGHT
230	98	Sets DIRECT X mode
240	A0	Sets DIRECT Y mode
200	80	NOP - No response

A complete map of the contents of the control PROM as factory programmed is given in table 6.

CONTROL PROM

Re-assigning ASCII responses: It is possible for you to change the response of the VTE to any ASCII character if you so desire by simply re-programming the 1702A control PROM. The following example best demonstrates how to do it.

Problem: A customer has determined that using the factory assigned control "C" to clear the screen is inconvenient and would prefer to have the capitol letter "J" clear the screen.

Solution: Look up the ASCII value of the letter "J" using table 4 of this manual. (i.e. J = 112 octal or 4A HEX)

Look up the control code for "Clear Screen" using table 4 of this manual.
(i.e. Clear Screen = 020 octal or 10 HEX)

Change the code in the control prom at address 112 octal to 020 octal - 4A HEX to 10 HEX.

The VTE will now clear the screen whenever it receives the letter "J".

Note: It will also clear the screen whenever it receives the letter control "C" since no changes were made at the control "C" location in the prom.

NOTICE! DO NOT CHANGE any control codes located at prom locations 200 thru 377. This region of the control prom uses reserved codes for the direct X and direct Y mode of operation.

6-CONTROL PROM MAP

ASCII CHARACTER	CORRESPONDING PROM ADDRESS		FACTORY ASSIGNED CONTROL CODE	
	OCTAL	HEX	OCTAL	HEX
Null	000	00	200	80
A control	001	01	200	80
B control	002	02	200	80
C control	003	03	020	10
D control	004	04	206	86
E control	005	05	255	AD
F control	006	06	200	80
G control Bell	007	07	260	B0
H control or BACKSPACE	010	08	201	81
I control or TAB	011	09	200	80
J control or LF	012	0A	216	8E
K control	013	0B	200	80
L control	014	0C	201	81
M control or CR	015	0D	203	83
N control	016	0E	200	80
O control	017	0F	200	80
P control	020	10	200	80
Q control	021	11	200	80
R control	022	12	205	85
S control	023	13	200	80
T control	024	14	200	80
U control	025	15	202	82
V control	026	16	207	87
W control	027	17	204	84
X control	030	18	230	98
Y control	031	19	240	A0
Z control	032	1A	200	80
ESC	033	1B	005	05
	034	1C	005	05
	035	1D	005	05
	036	1E	005	05
	037	1F	005	05
SPACE	040	20	005	05

6-CONTROL PROM MAP				
	OCTAL	HEX	OCTAL	HEX
!	041	21	005	05
"	042	22	005	05
#	043	23	005	05
$	044	24	005	05
%	045	25	005	05
&	046	26	005	05
'	047	27	005	05
(	050	28	005	05
)	051	29	005	05
*	052	2A	005	05
+	053	2B	005	05
,	054	2C	005	05
-	055	2D	005	05
.	056	2E	005	05
/	057	2F	005	05
0	060	30	005	05
1	061	31	005	05
2	062	32	005	05
3	063	33	005	05
4	064	34	005	05
5	065	35	005	05
6	066	36	005	05
7	067	37	005	05
8	070	38	005	05
9	071	39	005	05
:	072	3A	005	05
;	073	3B	005	05
<	074	3C	005	05
=	075	3D	005	05
>	076	3E	005	05
?	077	3F	005	05
@	100	40	005	05

6-CONTROL PROM MAP

	OCTAL	HEX	OCTAL	HEX
A	101	41	005	05
B	102	42	005	05
C	103	43	005	05
D	104	44	005	05
E	105	45	005	05
F	106	46	005	05
G	107	47	005	05
H	110	48	005	05
I	111	49	005	05
J	112	4A	005	05
K	113	4B	005	05
L	114	4C	005	05
M	115	4D	005	05
N	116	4E	005	05
O	117	4F	005	05
P	120	50	005	05
Q	121	51	005	05
R	122	52	005	05
S	123	53	005	05
T	124	54	005	05
U	125	55	005	05
V	126	56	005	05
W	127	57	005	05
X	130	58	005	05
Y	131	59	005	05
Z	132	5A	005	05
[	133	5B	005	05
\	134	5C	005	05
]	135	5D	005	05
^	136	5E	005	05
-	137	5F	005	05
`	140	60	005	05

	OCTAL	HEX	OCTAL	HEX
a	141	61	005	05
b	142	62	005	05
c	143	63	005	05
d	144	64	005	05
e	145	65	005	05
f	146	66	005	05
g	147	67	005	05
h	150	68	005	05
i	151	69	005	05
j	152	6A	005	05
k	153	6B	005	05
l	154	6C	005	05
m	155	6D	005	05
n	156	6E	005	05
o	157	6F	005	05
p	160	70	005	05
q	161	71	005	05
r	162	72	005	05
s	163	73	005	05
t	164	74	005	05
u	165	75	005	05
v	166	76	005	05
w	167	77	005	05
x	170	78	005	05
y	171	79	005	05
z	172	7A	005	05
{	173	7B	005	05
|	174	7C	005	05
}	175	7D	005	05
~	176	7E	005	05
BREAK OR RUBOUT	177	7F	200	80
RESERVED FOR DIRECT X,Y MODE	200 THRU 377	80 THRU FF	200	80

7- DIRECT POSITIONING USING KEYBOARD

(Positions are given in Decimal)

X	KEY	X	KEY
0	@	32	SPACE BAR
1	A	33	a
2	B	34	b
3	C	35	c
4	D	36	d
5	E	37	e
6	F	38	f
7	G	39	g
8	H	40	h
9	I	41	i
10	J	42	j
11	K	43	k
12	L	44	l
13	M	45	m
14	N	46	n
15	O	47	o
16	P	48	p
17	Q	49	q
18	R	50	r
19	S	51	s
20	T	52	t
21	U	53	u
22	V	54	v
23	W	55	w
24	X	56	x
25	Y	57	y
26	Z	58	z
27	[	59	;
28	\	60	<
29	]	61	=
30	^	62	>
31	RUBOUT KEY	63	?

Y POSITION	KEY
0	SPACE BAR
1	a
2	b
3	c
4	d
5	e
6	f
7	g
8	h
9	i
10	j
11	k
12	l
13	m
14	n
15	o

8-RE-PROGRAMMABLE CHARACTER GENERATOR

The character generator of the VTE uses two 1K by 8 bit PROMs (2708-1, 350 ns) to store the bit patterns required to produce ASCII characters on the screen. Each ASCII character is assigned a region of the PROMs thru a mapping technique using the binary value of the ASCII character as the address of the hi order bits of the PROM.

Since the PROMs are re-programmable any user can modify them to create their own symbols. It is a relatively easy matter to design your own symbols using the table on page 60 and studying the following example.

Problem: A customer wants to put the Greek letter Omega into the character generator, realizing that some other character in the generator PROM must be sacrificed. This particular customer never uses the E symbol and is willing to swap it for Omega.

Solution: Using the table on page 60 we determine that the E symbol is in the Upper CASE PROM. We also determine that the region assigned to E begins at address 0120 Octal or 050 Hex.

If we examine the Upper Case PROM starting at address 0120 (octal) 050 (HEX) and document the contents for the next 13 words we will find the following:

ADDRESS		DATA			
OCTAL	HEX	OCTAL	HEX		ONE/ZERO PATTERN
					B7 B6 B5 B4 B3 B2 B1 B0
0120	050	000	00		0 0 0 0 0 0 0 0
0121	051	000	00		0 0 0 0 0 0 0 0
0122	052	000	00		0 0 0 0 0 0 0 0
0123	053	037	1F		0 0 0 1 1 1 1 1
0124	054	020	10		0 0 0 1 0 0 0 0
0125	055	020	10		0 0 0 1 0 0 0 0
0126	056	034	1C		0 0 0 1 1 1 0 0
0127	057	020	10		0 0 0 1 0 0 0 0
0130	058	020	10		0 0 0 1 0 0 0 0
0131	059	037	1F		0 0 0 1 1 1 1 1
0132	05A	000	00		0 0 0 0 0 0 0 0
0133	05B	000	00		0 0 0 0 0 0 0 0
0134	05C	000	00		0 0 0 0 0 0 0 0
0135	05D	000	00		0 0 0 0 0 0 0 0

Drawing the Ones and Zeros of this out on a piece of paper reveals how the dot pattern for symbols are mapped in the PROM.

Ones will make bright dots, Zeros make dark dots.

A solution for Omega then is;

ADDRESS		DATA			
OCTAL	HEX	OCTAL	HEX		ONE/ZERO PATTERN
					B7 B6 B5 B4 B3 B2 B1 B0
0120	050	000	00		0 0 0 0 0 0 0 0
0121	051	000	00		0 0 0 0 0 0 0 0
0122	052	000	00		0 0 0 0 0 0 0 0
0123	053	000	00		0 0 0 0 0 0 0 0
0124	054	030	18		0 0 0 1 1 0 0 0
0125	055	044	24		0 0 1 0 0 1 0 0
0126	056	102	42		0 1 0 0 0 0 1 0
0127	057	102	42		0 1 0 0 0 0 1 0
0130	058	014	0C		0 0 1 0 0 1 0 0
0131	059	347	E7		1 1 1 0 0 1 1 1
0132	05A	000	00		0 0 0 0 0 0 0 0
0133	05B	000	00		0 0 0 0 0 0 0 0
0134	05C	000	00		0 0 0 0 0 0 0 0
0135	05D	000	00		0 0 0 0 0 0 0 0

Thus for any symbol that you wish to generate you should:

1.) Layout an eight by fourteen grid.

2.) Sketch the symbol on the grid.

3.) Assign ones and zeros for bright and dark spots.

4.) Determine which ASCII character it is to replace.

5.) Use the table on page 60 to find its starting location in the PROM.

6.) Re-program the corresponding fourteen words in the PROM.

NOTE: If you get a spare 2708-1 to experiment with be sure that its access time is 350 NANO-SECONDS or less, otherwise your characters may "flicker" or have "holes" in them when viewed on the VTE.

CHARACTER GENERATOR PROMS
NOTE: (10 BIT BINARY ADDRESSES)

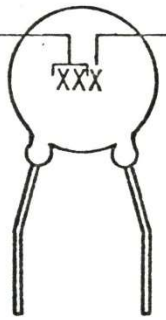
	UPPER	LOWER	1ST OCTAL	ADDRESS HEX
0	*		1400	300
1	*		1420	310
2	*		1440	320
3	*		1460	330
4	*		1500	340
5	*		1520	350
6	*		1540	360
7	*		1560	370
8	*		1600	380
9	*		1620	390
A	*		0020	010
B	*		0040	020
C	*		0060	030
D	*		0100	040
E	*		0120	050
F	*		0140	060
G	*		0160	070
H	*		0200	080
I	*		0220	090
J	*		0240	0A0
K	*		0260	0B0
L	*		0300	0C0
M	*		0320	0D0
N	*		0340	0E0
O	*		0360	0F0
P	*		0400	100
Q	*		0420	110
R	*		0440	120
S	*		0460	130
T	*		0500	140
U	*		0520	150
V	*		0540	160
W	*		0560	170
X	*		0600	180
Y	*		0620	190
Z	*		0640	1A0

	UPPER	LOWER	1ST OCTAL	ADDRESS HEX
a		*	0020	010
b		*	0040	020
c		*	0060	030
d		*	0100	040
e		*	0120	050
f		*	0140	060
g		*	0160	070
h		*	0200	080
i		*	0220	090
j		*	0240	0A0
k		*	0260	0B0
l		*	0300	0C0
m		*	0320	0D0
n		*	0340	0E0
o		*	0360	0F0
p		*	0400	100
q		*	0420	110
r		*	0440	120
s		*	0460	130
t		*	0500	140
u		*	0520	150
v		*	0540	160
w		*	0560	170
x		*	0600	180
y		*	0620	190
z		*	0640	1A0

	UPPER	LOWER	1ST OCTAL	ADDRESS HEX
!	*		1020	210
"	*		1040	220
#	*		1060	230
$	*		1100	240
%	*		1120	250
&	*		1140	260
'	*		1160	270
(	*		1200	280
)	*		1220	290
*	*		1240	2A0
+	*		1260	2B0
,	*		1300	2C0
-	*		1320	2D0
.	*		1340	2E0
/	*		1360	2F0
:	*		1640	3A0
;	*		1660	3B0
<	*		1700	3C0
=	*		1720	3D0
>	*		1740	3E0
?	*		1760	3F0
@	*		0000	000
[	*		0660	1B0
\	*		0700	1C0
]	*		0720	1D0
^	*		0740	1E0
←	*		0760	1F0
`		*	0000	
{		*	0660	1B0
|		*	0700	1C0
}		*	0720	1D0
~		*	0740	1E0
SPACE	*		1000	200

IX. SPECIAL DIAGRAMS

1. General Ceramic Capacitor Identification

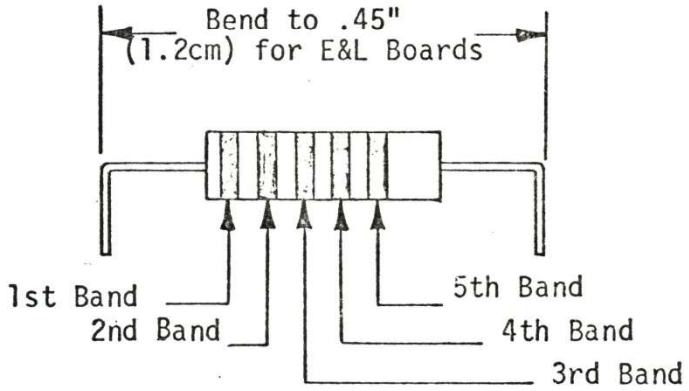


CAPACITANCE — Value in Picofarads (pfd)

MULTIPLIER — Number of zero's following the value

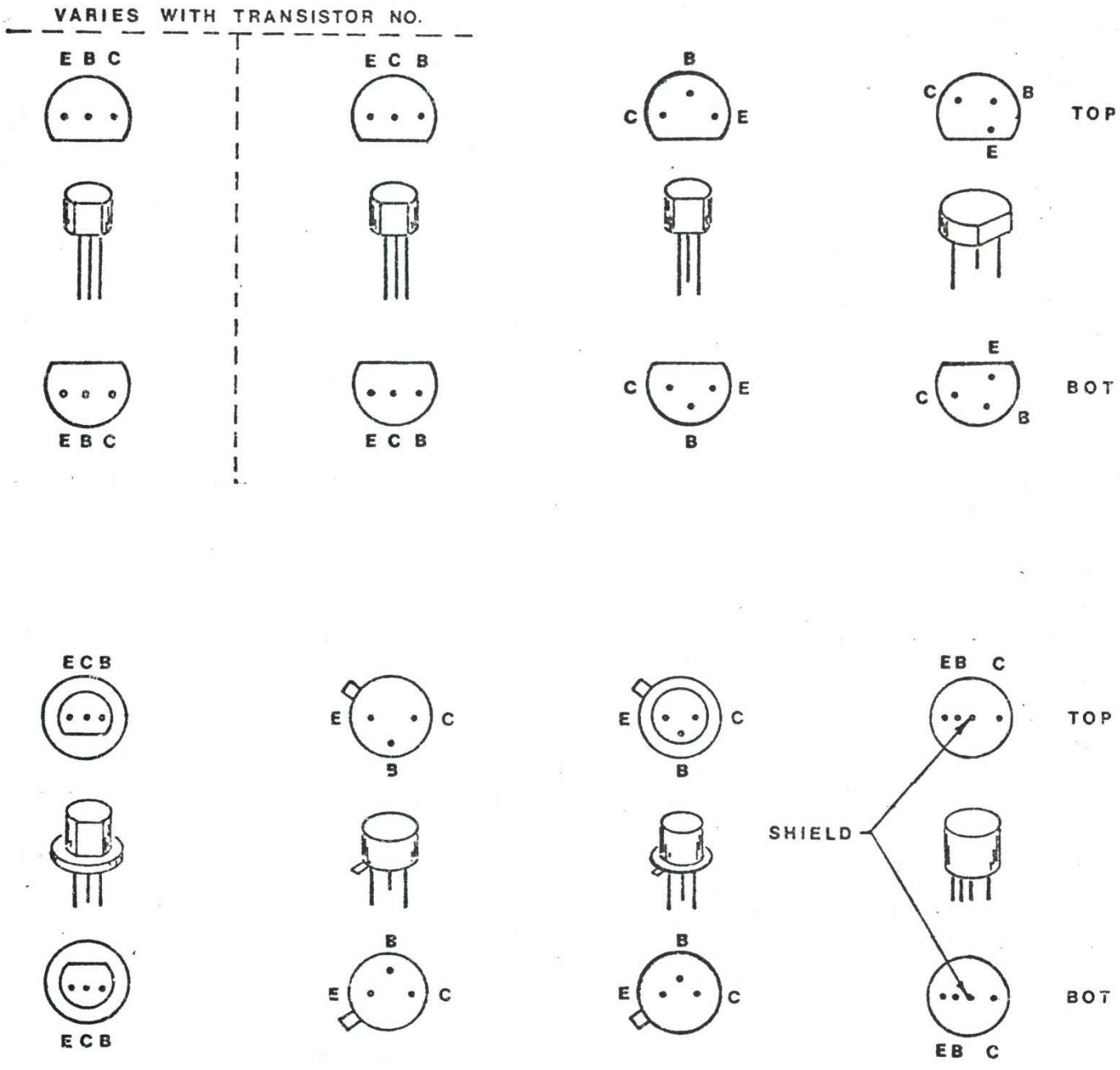
EXAMPLES:
103 = 10,000 pfd or .01 mfd
302 = 3,000 pfd or .003 mfd
676 = 67,000,000 pfd or 67 mfd

2. Resistor Color Code Chart



COLOR	BANDS				
	1st	2nd	3rd	4th	5th
Black	0	0	x1.0	-	
Brown	1	1	x10	-	
Red	2	2	x100	-	
Orange	3	3	x1000	-	
Yellow	4	4	x10000	-	
Green	5	5	x100,000	-	
Blue	6	6	x1000,000	-	RC=MIL-R-39008
Purple	7	7	-	-	
Grey	8	8	-	-	
White	9	9	-	-	
Gold	-	-	÷10	±5%	
Silver	-	-	÷100	±10%	
------	-	-	-	±20%	RC=MIL-R-11

3. TRANSISTOR ORIENTATION



X. WARRANTY INFORMATION

1. ASSEMBLED INSTRUMENTS

E&L Instruments agrees to repair or replace, at no charge, any defects in assembled instruments for a period of one (1) year from date of purchase by the end user, or eighteen (18) months after purchase by an E&L Dealer (whichever comes first).
The Warranty is void if the returned equipment has been subjected to abuse or improper operation. Any attempt by the end user or Dealer to repair an assembled instrument during the warranty period voids the warranty.
E&L makes no warranty concerning components not of E&L's manufacturer (e.g. integrated circuits, relays, transistors, etc.) which carry the original warranty of the manufacturer.
Shipping damages are the responsibility of the Dealer or end user. Prompt claims should be filed with the appropriate carrier if damage in transit has occurred.
No warranty repair will be done on merchandise not returned in compliance with E&L's return Policy (see Return Policy section of this manual). Instruments returned for out-of-warranty repair service will be repaired and billed to the sender at a standard labor rate of $15.00 per hour plus parts.
E&L will perform repairs on non-warranty repairs up to an owner's cost of $50.00 without prior authorization by the sender. If, in the opinion of E&L, the non-warranty repair will cost more than $50.00, an estimate of repair costs will be made. This estimate will be forwarded to the owner for his approval. Repair work will begin upon receipt of the owner's signed approval of the repair estimate.
All repair charges will be on C.O.D. basis. Rated companies desiring credit terms on repair charges must accompany the returned merchandise and/or approved repair estimate with a purchase order covering all repair costs and return freight.

2. KIT (Unassembled) INSTRUMENTS

Terms and conditions of warranty on kit products are identical to those on assembled instruments except for the following changes:
E&L warrantees kit products for a period of 90 days from time of purchased by the end user of 180 days from the date of purchase by the Dealer, whichever comes first.
WARNING: Use of corrosive core solders or fluxes completely void any warranty on kit products. Any kit received for repair and found to have been assembled with corrosive solders or fluxes will be returned to sender unrepaired, postage collect.
E&L cannot warranty the workmanship of the kit builder. All kits returned requiring repair for reasons of wiring mistakes or poor workmanship will be repaired at the standard labor rate of $15.00 per hour plus parts.
On any kit repair which in E&L's opinion will incur repair costs over $25.00, an estimate of repair costs will be made and forwarded to the sender. The kit owner must approve, sign and forward the estimate to E&L before work can be initiated.
All returned kits must comply with E&L's Returned Goods Policy (see Return Policy section in this manual).

** THE LIFETIME GUARANTEE **

All of E&L's SK sockets now carry a lifetime guarantee. If a socket ever fails to meet your requirements, return it to E&L, postpaid, for a free replacement. No questions asked.

All terms and conditions are subject to change without notice.

XI. REPAIR AND SHIPPING

1. REPAIR

All repairs done at the factory and found due to defective components, will be done on a no charge basis for a period of ninety (90) days after the original shipping date of the kit.

After expiration of warranty period, repairs will be billed at materials cost plus a flat charge of $15.00 per kit.

E&L Instruments will return unrepaired, any kit assembled with corrosive solder or fluxes.

2. SHIPPING INFORMATION

If you should find it necessary to return your kit to the factory for repair, please pack carefully and ship prepaid to:

E&L Instruments, Inc.
61 First Street
Derby, Connecticut 06418

ATTENTION: KIT REPAIR DEPARTMENT

3. RETURN POLICY

All merchandise returned to E&L for repair or for any other reason must comply with the following procedures:

Sender, must prior to forwarding any returned merchandise to E&L, request from E&L a Return Merchandise Authorization Number (RMA #). Sender should contact E&L by mail or telephone and request the RMA #.

A separate RMA # must be procured for each item being returned.

E&L, upon request, will forward the RMA Form to the sender. The form should be filled out completely; the reason for returning the merchandise must be included on the RMA form. A short description of any problems occuring with the material being returned for repair will shorten the repair time and is strongly suggested. The RMA form, filled out, must be in the carton with the returned merchandise and the RMA form number displayed prominently on the outside of the shipping container.

Any material recieved at E&L without an RMA number or without an RMA form enclosed will be returned to the sender freight collect.