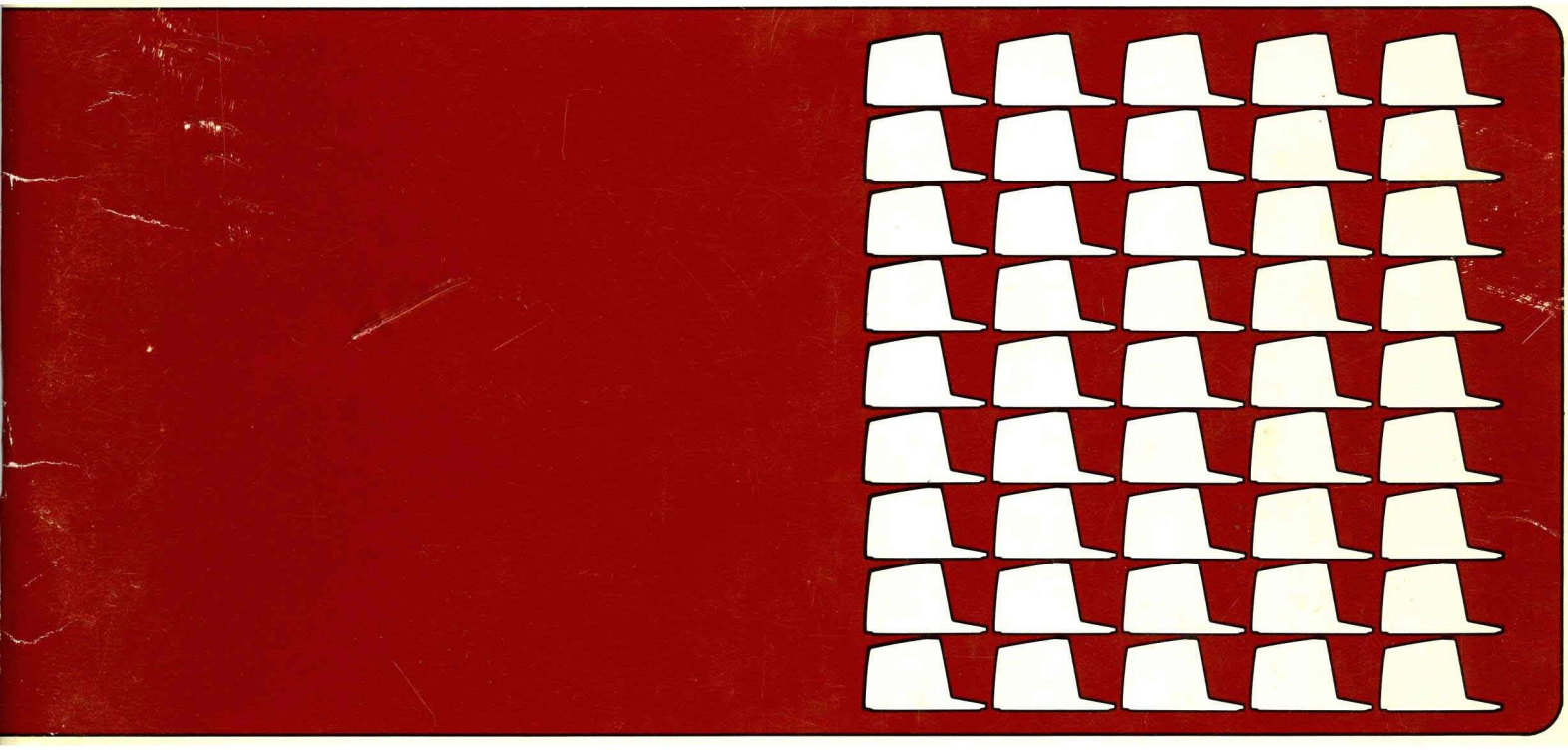
TV MONITOR

Documentation

General Terminal Corporation



General Terminal Corporation 14831 Franklin Avenue Tustin, California 92680

$5.00

TV MONITOR MANUAL

This document was composed and set on an IMS 8000 System using a GT-101 Terminal.

Additional copies of this manual (05018-001, $5.00) may be ordered from GTC, ATT: Sales Administration.

Original JAN/81
GTC Part Number 05018-001

TABLE OF CONTENTS

SAFETY SERVICING GUIDELINES
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 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, paralleled by a 0.15 mfd., 150V AC type capacitor between a known good earth ground (water pipe, conduit, ec.) and the exposed metallic parts, one at a time. Measure the AC voltage across the combination 1500 ohm resistor and 0.15 mid. capacitor. 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 picture tubes are equipped with an integral implosion protection system, but care should be taken to avoid damage during installation. Avoid scratching the tube.

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 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 operationg 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.

Section 1.
GENERAL INFORMATION

1.1 GENERAL DESCRIPTION

The TV 120 series monitor is a raster scan display designed specifically for data terminals. They are designed for high quality display of alphanumeric dot characters.

The data monitor accepts video, horizontal drive and vertical drive as separate TTL level signals, eliminating stripping circuits in the data display unit as well as mixing circuits in the external logic interface.

The 100% solid state silicon circuitry of the PWA provides cool operation and high reliability.

1.2 ELECTRICAL SPECIFICATIONS

Input Data Specifications

Video Input amplitude: Low 0.0 + 0.4 - 0.0 volts
High 4.0 ± 1.5 volts
Video Pulse Width : 50ns or greater
Vertical Drive Rate : 49 to 61 Hz
Horizontal Drive Rate: 15,250 to 16,250 Hz
Rise and Fall Times : Video Less than 20ns
Vert. Less than 100ns
Horiz. Less than 50ns
Input Signal Format : Refer to figure I-1-1

Data Display Specifications

Video Amplifier:

Bandwidth 12 MHz - 3db (Class A mode)
Rise and Fall Time Less than 35ns
(linear mode) (10 to 90% amplitude)
Storage Time 15 ns max (linear mode)

Retrace Time:
Vertical 600us
Horizontal 7us

Display Specifications

CRT Display (without bonded panel) Horizontal Resolution at 15,750 Hz - see Figure I-1-2.

Geometric Distortion Specifications

On-Axis Scan Non-Linearities - No picture elements displaced from true position by more than 2% of active raster height. Measurement mode using "EIA Linearity Chart" in accordance with RS-375A.

If measured on a field of characters, the character height and width are within 10% of that for any adjacent character and within 20% of that for any character on screen.

Perimeter Non-Rectangularity - The perimeter of a full field of characters approaches an ideal rectangle of 4 by 3 aspect ratio to within +1.5% of the rectangle height.

1.3 ENVIRONMENTAL SPECIFICATIONS

	OPERATING RANGE	STORAGE RANGE
Temperature (Ambient)	5 C to 55 C	-40 C to 65 C
Humidity (Non-Condensing)	5 to 80%	5 to 90%
Altitude:	Up to 10,000 ft/3048m	Up to 30,000 ft/9144m

1.4 HUMAN FACTORS SPECIFICATION

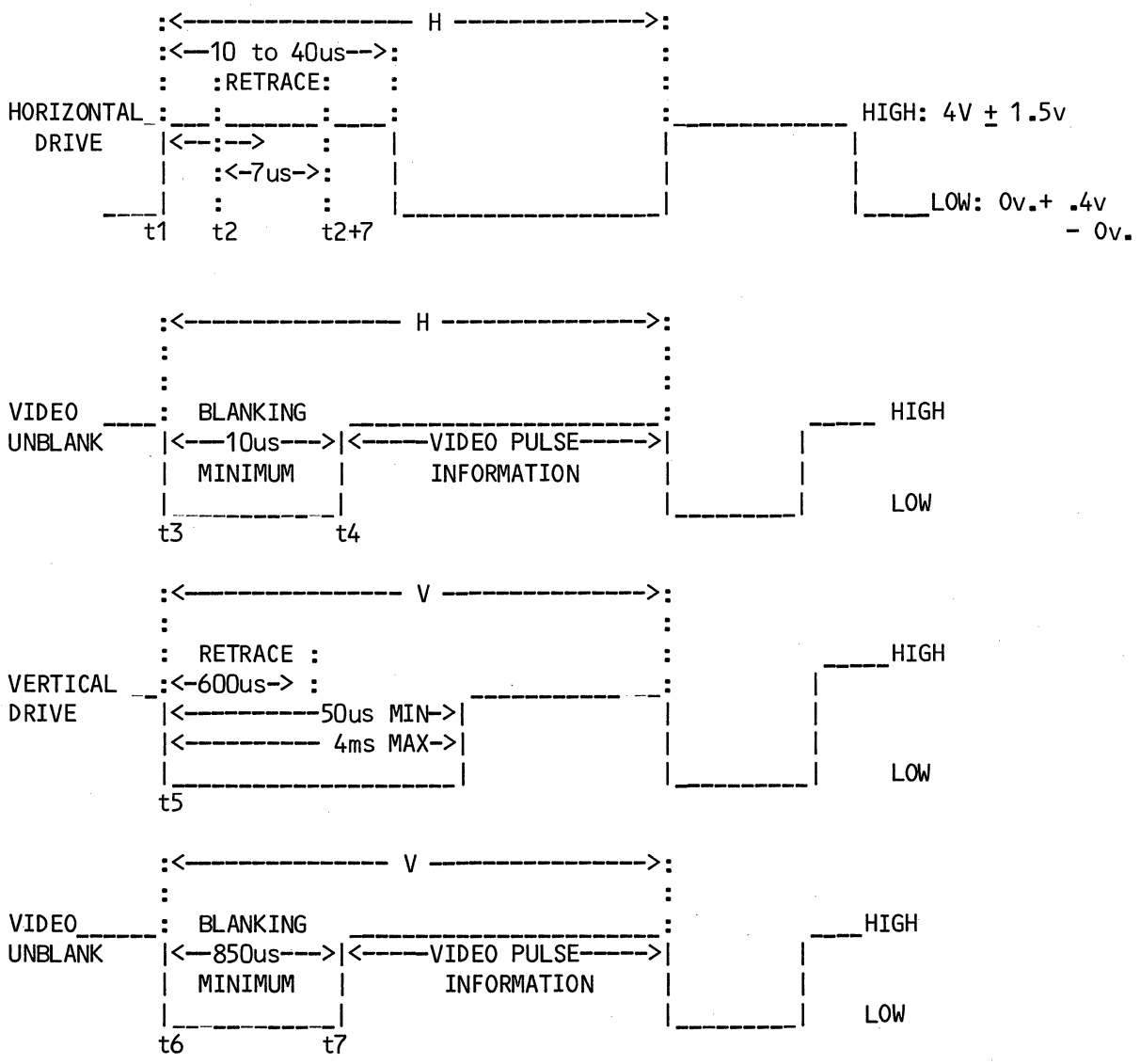
X-Ray Radiation

The TV 120 data monitor complies with the Federal Regulation for Radiation Control as required by the Radiation Control for Health and Safety Act of 1968, and as implemented by Title 21, Subchapter J of the Code of Federal Regulation.

These regulations place certain requirements upon manufacturers of products which can emit x-rays under some conditions of operation or failure. This includes CRT data display monitors.

Label Visibility

Certification of compliance with radiation regulations is shown by label attached to each monitor. Each Monitor is tagged to indicate compliance with these regulations.



NOTES:

1. Horizontal Retrace is initiated at t2 (1.5 to 7.0us after t1, depending on setting of A103).
2. Vertical Retrace is initiated by t5 without delay.
3. H = period of one line: 63.5us ± 3%.
4. V = Period of one field: 16.4ms MIN. to 20.4ms MAX.
5. Video pulse width should be 50 ns MIN.

Figure I-1-1.a. Input Signal Format

HORIZONTAL VIDEO BLANKING	
WIDTH	LEAD/LAG
t4 - t3	t1 - t3
10us	-5.5 TO 0us
12us	-4.5 to 1us
14us	-3.5 to 2us
16us	-2.5 to 3us
18us	-1.5 to 4us
20us	-0.5 to 5us

t3 vs. t1 Timing for Centered Horizontal Video as function of Horiz. Width.

VERTICAL VIDEO BLANKING	
WIDTH	LEAD/LAG
t7 - t6	t5 - t6
850us	125us
900us	150us
1000us	200us
1200us	300us
1400us	400us

t6 vs. t5 Timing for Centered Vertical Video as function of Vert. Blanking Width

Figure I-1-1.b. Input Signal Format (continued)

Nominal Diagonal Measurement Inches/mm	Phosphor	*Resolution (TV lines) Center	**Corner
12/305	P4	900 @ 40 fl	750 @ 40 fl
12/305	P39	900 @ 20 fl	750 @ 20 fl

*Resolution is measured in accordance with EIA RS-375A except burst modulation is adjusted for 100% and burst frequency is then increased to the point where resolution of the lines is just discernible.

**Set reference black to visual cutoff with brightness control and reference white to the indicated fl with contrast control.

Figure I-1-2. Resolution

Power Requirements

The Data monitor is designed to operate and meet radiation requirements when operated within the DC input power specifications.

DC powered monitors have an additional requirement because the DC source is usually regulated. Failure of the series pass element can result in an appreciable increase in the anode voltage and consequent emission of x-rays.

User Operating Controls

The only external control required for operation of the TV 120 display unit is the optional contrast control. This control is a carbon composition variable resistor, 500 ± 20%; 1/4 watt.

The brightness control is mounted on the printed wiring board and is an internal adjustment by the user. An option is available where this control is removed from the board and a remote brightness control supplied by the user is utilized. The remote brightness control is a carbon composition variable resistor, 100k ± 20%; 1/4 watt. GTC models GTX, 200 and 400 utilize the remote brightness controls.

Section 2
OPERATION

2.1 GENERAL

After power, video and drive signals have been applied to the monitor, the contrast and brightness controls may be adjusted to provide the optimum display.

2.2 BRIGHTNESS ADJUST

The monitor is used to display alphanumeric information. The video polarity is usually white characters on a black background. The brightness control should then be adjusted for visual cutoff of the raster. A maximum contrast ratio can now be obtained when video is applied.

2.3 CONTRAST ADJUST

The video amplifier is designed to operate linearly from +.65 to +2.5 V signal input. The contrast control should be adjusted to the point where defocusing sets in and then backed down slightly. This occurs at a 15-20V p-p video swing at the CRT cathode for the TV 120. In no case should contrast be adjusted to cause saturation of Q101, as this impairs the pulse response of the video amplifier.

Section 3
THEORY OF OPERATION

3.1 VIDEO AMPLIFIER

The video amplifier consists of Q101 and its associated circuitry. The incoming video signal is applied to the monitor through J101-8 and R101 to the base of Q101. Transistor Q101 has a nominal gain of 15, and operates as a class B amplifier.

Q101 remains cutoff until a DC coupled, positive-going signal arrives at its base and turns it on. R103 provides series feedback which makes the terminal to terminal voltage gain relatively independent of transistor parameters and temperature variations. R102 and C101 provide emitter peaking to extend the band width to 12MHz.

The negative going signal at the collector of Q101 is direct coupled to the CRT cathode. The class B biasing of Q101 allows a large video output signal to modulate the CRT's cathode and results in a maximum available contrast ratio

The overall brightness at the screen of the CRT is also determined by the negative potential at its grid which is varied by the brightness control.

3.2 VERTICAL DEFLECTION

Q102 is a thyristor used as programmable

unijunction which together with its external circuitry forms a relaxation oscillator operating at the vertical rate. The sawtooth forming network consists of A101, C103 and C104. These capacitors charge exponentially until the voltage at the anode of Q102 exceeds its gate voltage at which time Q102 becomes essentially a closed switch, allowing a rapid discharge through L101. The rate of charge or frequency is adjustable by A101. The oscillator is synchronized by a negative pulse coupled to its gate from the vertical drive pulse applied externally at J101-9.

A divider network internal to A101 sets the free running frequency by establishing a reference voltage at the gate. This programs the firing of Q102 and amounts to resistive selection of the intrinsic standoff ratio. The frequency is controlled by passive components only. CR101 provides temperature compensation for Q102 while controlling the gate impedance to allow easy turn on and off of Q102. L101 forms a tuned circuit with C103 and C104 during conduction of Q102 which provides a stable control on the drop-out time of Q102. Q103 collector to base forward diode clamping action prevents the voltage from swinging too far negative during this flywheel action.

The sawtooth at the anode of Q102 is direct coupled to the base of Q103. This stage functions as a darlington pair emitter follower driver for the output stage Q104. It presents an extremely high impedance in shunt with A101 and prevents the Beta dependent input impedance of Q104 from affecting the frequency of the sawtooth forming network.

Linearity control of the sawtooth is accomplished by coupling the output at Q103 emitter resistively back into the junction of C103 and C104. This provides integration of the sawtooth and inserts a parabolic component. The slope change rate of the sawtooth at Q103 is coupled into a resistive divider.

Height control R110 varies the amplitude of the sawtooth voltage applied to the base of Q104 and controls the vertical raster size on the CRT. C105 is used to limit the amplitude of the flyback pulse at Q104 collector.

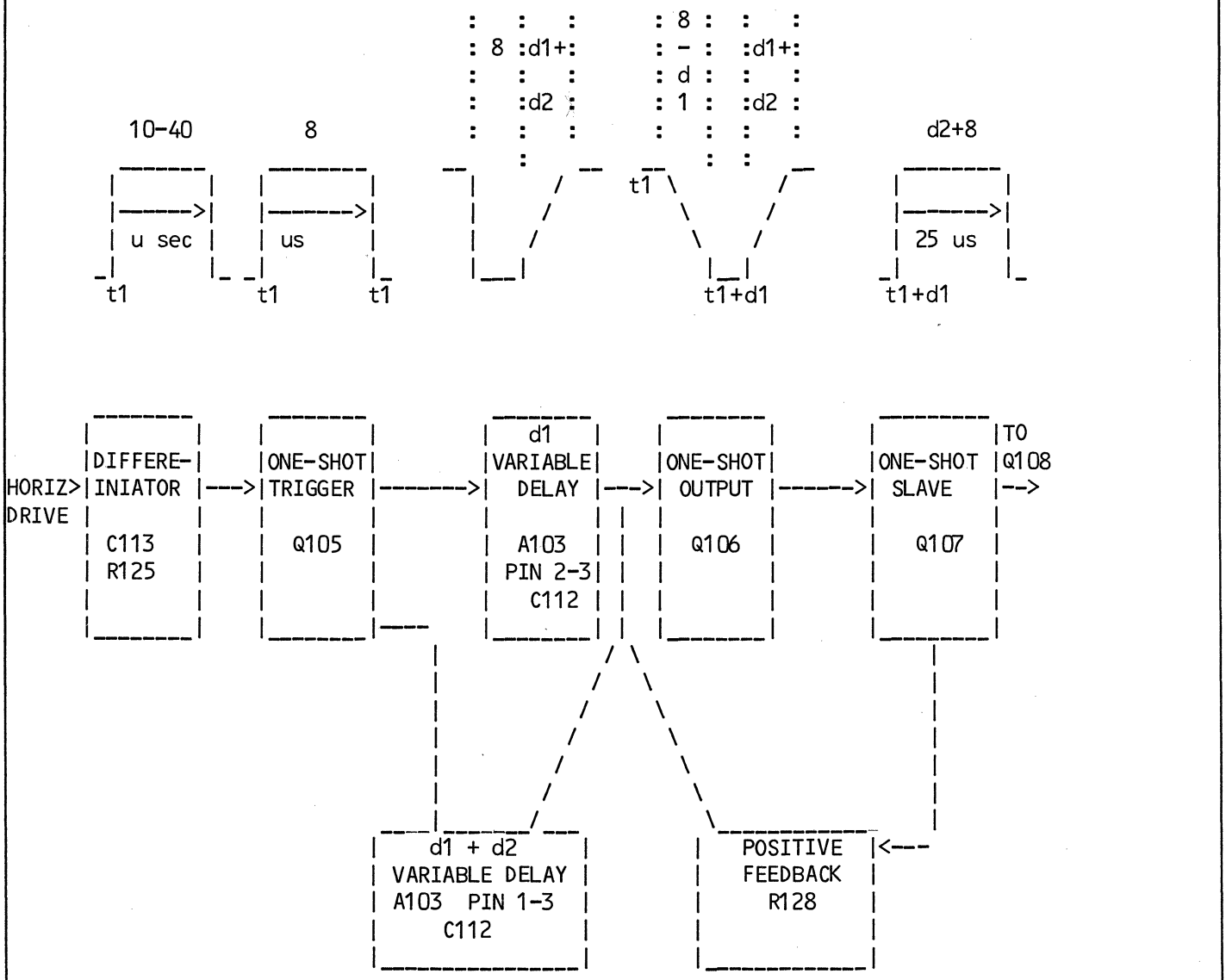
The vertical output stage Q104 uses an NPN power transistor opereating as a class AB amplifier. The output is capacitively coupled to the yoke. L1 provides a DC connection to B+ for Q104; it has a high impedance compared to the yoke inductance which causes most of the sawtooth current of Q104 to appear in the yoke. R114 prevents oscillations by providing damping across the vertical yoke coils.

3.3 HORIZONTAL DEFLECTION

Low Level Stages (Figure 3-1)

The purpose of Q105 and Q106 is basically to process the incoming horizontal drive signal into a form suitable to drive the output stage Q108. The duty cycle of Q108 becomes essentially independent of the amplitude and pulse width of the drive pulse. This is a necessary condition to assure stability and reliablity in the output stage. In addition, these stages provide a horizontal video centering adjustment by delaying retrace with respect to the horizontal drive pulse.

The drive pulse is presented to Q105 via J101-6. The base circuit of Q105 includes a clamp and a differentiator which makes Q105 output insensitive to drive pulse amplitude and width changes. The only requirement is that pulse amplitude be of 2.5 volts minimum and pulse width should be 10-40us. Q105 together with Q106 functions as a monostable multivibrator with Q107 being a slave that provides a positive feedback. Specifically, when Q105 is turned on by the drive pulse, it discharges C112 at a rate determined by the setting of A103. When C112 is discharged to 2.75 volts, Q106 turns off. This change of state turns Q107 on and the base drive to Q105 from R128 is shunted thru Q107. Q106/Q107 remains in this state for nominally 25us until C112 recharges through A103 to 8.25 volts. At this time, Q106 is biased on again by the current through A103. The multivibrator is now in a state that Q106 is on and Q105/Q107 is off. It will remain in this state until the next drive pulse occurs or power is turned off. C112 is the only timing capacitor in the circuit and has two time constants associated with it. Primarily, the charge path between pin 1 and pin 3 of A103 determines the on time of Q107 while the discharge path through the video centering control and Q105 determines the delay between application of the drive pulse and start of retrace (turn on of Q107).



d1 = 0.5-6.0u sec
d2 = 17u sec
d1 +d2 = 17.5-23u sec

Figure I-3-1. Horizontal Drive Processing and Timing Chart

High Level Stages

These stages consist of Q107 driving the output stage, Q108 and its associated circuitry thru T101. Q107 is an inverting slave of Q106 and is driven alternately into saturation and cutoff as are all stages in the horizontal circuit. Q107 output is transformer coupled to the output stage with phasing of T101 chosen such that Q108 turns off when Q107 turns on. This allows Q108 to turn off quickly, thus minimizing dissipation. A careful review will show that Q108 turns off at a variable delay time after receipt of the drive pulse. This action causes retrace to begin.

During conduction of the driver transistor, energy is stored in the coupling transformer. The polarity at the secondary is then phased to keep Q108 cut off. As soon as the primary current of T101 is interrupted due to the base signal driving Q107 into cut off, the secondary voltage changes polarity. Q108 now saturates due to the forward base current flow. This gradually decreases at a rate determined by the transformer inductance and circuit resistance. However, the base current is sufficient to keep Q108 in saturation until the next polarity change of T101.

The horizontal output stage has two main functions: 1) to supply the deflection coil with the correct horizontal scanning currents: 2) to develop high voltage for the CRT anode and DC voltage for the CRT bias, focus and accelerating grids as well as the DC voltage for the video output stage.

Q108 acts as a switch which is turned on or off by the rectangular waveform on the base. When it is turned on, the supply voltage plus the charge on C123 causes deflection current to increase in a linear manner and moves the beam from near the center of the screen to the right side. At this time, the transistor is turned off by a polarity change of T101 which causes the output circuit to oscillate. A high reactive voltage in the form of a half cycle negative voltage pulse is developed by the deflection coil inductance and the primary of T2. The peak magnetic energy which was stored in the deflection coil during scan time is now transferred to C122 and the deflection coil distributed capacity. During this cycle, the beam is returned to the center of the screen.

After slightly less than half a cycle, the decreasing voltage across C122 biases the damper diode CR111 into conduction and prevents the flyback pulse from further oscillation. The magnetic energy that was stored in the deflection coil from the discharge of the distributed capacity is now released to provide sweep for the left half of scan and to charge C123 through the rectifying action of the damper diode. The beam is now at the center of the screen. The cycle will repeat as soon as the base of Q108 becomes positive with respect to its emitter.

C123 serves to block DC current from the deflection coil and to provide "S" shaping of the current waveform. "S" shaping compensates for stretching at the left and right sides of the picture tube because the curvature of the CRT face and the deflected beam do not follow the same arc.

L103 is an adjustable width control placed in series with the horizontal deflection coils. The variable inductance allows a greater or lesser amount of deflection current to flow through the horizontal yoke and varies the width of the horizontal scan.

Linearity control is provided by modifying the deflection coil voltage. During retrace, an auxilliary winding on the flyback transformer supplies a pulse which charges C119 through rectifier diode CR112 and L102. This voltage is then applied in series with the deflection coil when the damper diode turns on at the start of trace. The voltage is sawtooth shaped and has the effect of decreasing the deflection coil current as a function of the sawtooth shape. This compensates for the stretch normally found on the left side of the screen due to the deflection coil and system RL time constant. Linearity is optimized by adjustment of L102 which acts as an impedance to the pulse from T2.

The negative flyback pulse developed during horizontal retrace time is rectified by CR2, CR113 and CR114 to produce rectified voltage of approximately 12KV, 400V and 32V respectively. 12KV is the anode voltage for the CRT, while 32V is used for the video output stage, and the 400V source is used for G2 and G4 voltages for the CRT.

Section 4
ADJUSTMENTS

4.1 CENTERING ADJUST

If the raster is not properly centered, it may be repositioned by rotating the ring magnets behind the deflection yoke. This ring magnet should not be used to offset the raster from its nominal center position because this degrades the focus and resolution of the display and may cause neck shadow. To perform the adjustment, decrease width of the raster using L103 until both edges of the raster are visible. Adjust the centering rings until the raster is in the center of the CRT.

4.2 HORIZONTAL ADJUSTMENTS

With data on the screen, adjust video centering control, A103 to center the video within the raster horizontally. Adjust L102 for best horizontal linearity. Do not adjust L102 core out farther than necessary as this causes excessive power to be consumed. Adjust L103 for desired width.

4.3 VERTICAL ADJUSTMENTS

With data on the screen, adjust vertical hold control A101 to lock in the picture.

Adjust vertical linearity control A102 for best overall linearity. This control affects the vertical frequency slightly and might require a readjustment of the hold control. Adjust vertical height control R110 for desired height.

Always start by centering A101, A102 and R110 in the center of their rotation and then make small incremental changes until the screen is properly filled, locked, and linear.

4.4 FOCUS ADJUST

Adjust focus control R122 for best overall focus of the picture. Usually the center and corners of the screen do not focus at the same setting and a compromise must be made.

4.5 TROUBLE SHOOTING GUIDE

Symptom	Possible Remedy
1. Screen is dark	Check 15V bus, Q108, Q107, CR2, CR113, F101
2. Loss of Video	CR114, Q101
3. Power consumption too high	Check horizontal drive waveform; adjust horizontal linearity coil; Q107, Q108

Section 5
SERVICE DATA

5.1 GENERAL

This section contains the replaceable electrical parts list, schematic, PWB component layout and waveforms for servicing of the TV 120 data monitor.

5.2 ORDERING PARTS

Most parts contained in the monitor are available commercially from electronic parts outlets. When it is necessary to order spare or replacement parts from GTC please indicate the Model Number of your terminal including the Part Number and Serial Number in your written or telephone request. Orders may be directed to:

GENERAL TERMINAL CORPORATION
14831 Franklin Avenue
Tustin, CA 92680
(714) 730-0123
(800) 854-6925

Full servicing is available for either your complete terminal, the monitor module or printed circuit assembly. Prior to return you should call Field Service at the following number for a return authorization. East of Mississippi River: 800-225-0976. West of the Mississippi River: 800-854-6985. Unnecessary delays may be avoided when items are returned to GTC for repair using the following procedures:

1) Package the unit or part in accordance with safe shipping practices. Enclose a list of the material being returned and the reason for returning it. Enclose your return authorization number!
2) Send the unit or part, transportation prepaid, to the address stipulated for returning parts.

All warranty repairs will be made provided examination discloses that the defects are within the limits of the warranty. If damages or defects are not within the limits of the warranty, the customer will be notified of the extent of repairs required and the cost. The unit will be repaired and returned upon agreement.

5.3 WAVEFORMS

The waveforms on the component layout were taken with 1.5 V peak to peak crosshatch signal applied to the monitor. These waveforms can be used as a check point to localize problems to a specific circuit area. The waveforms indicate the actual peak amplitude for each test point.

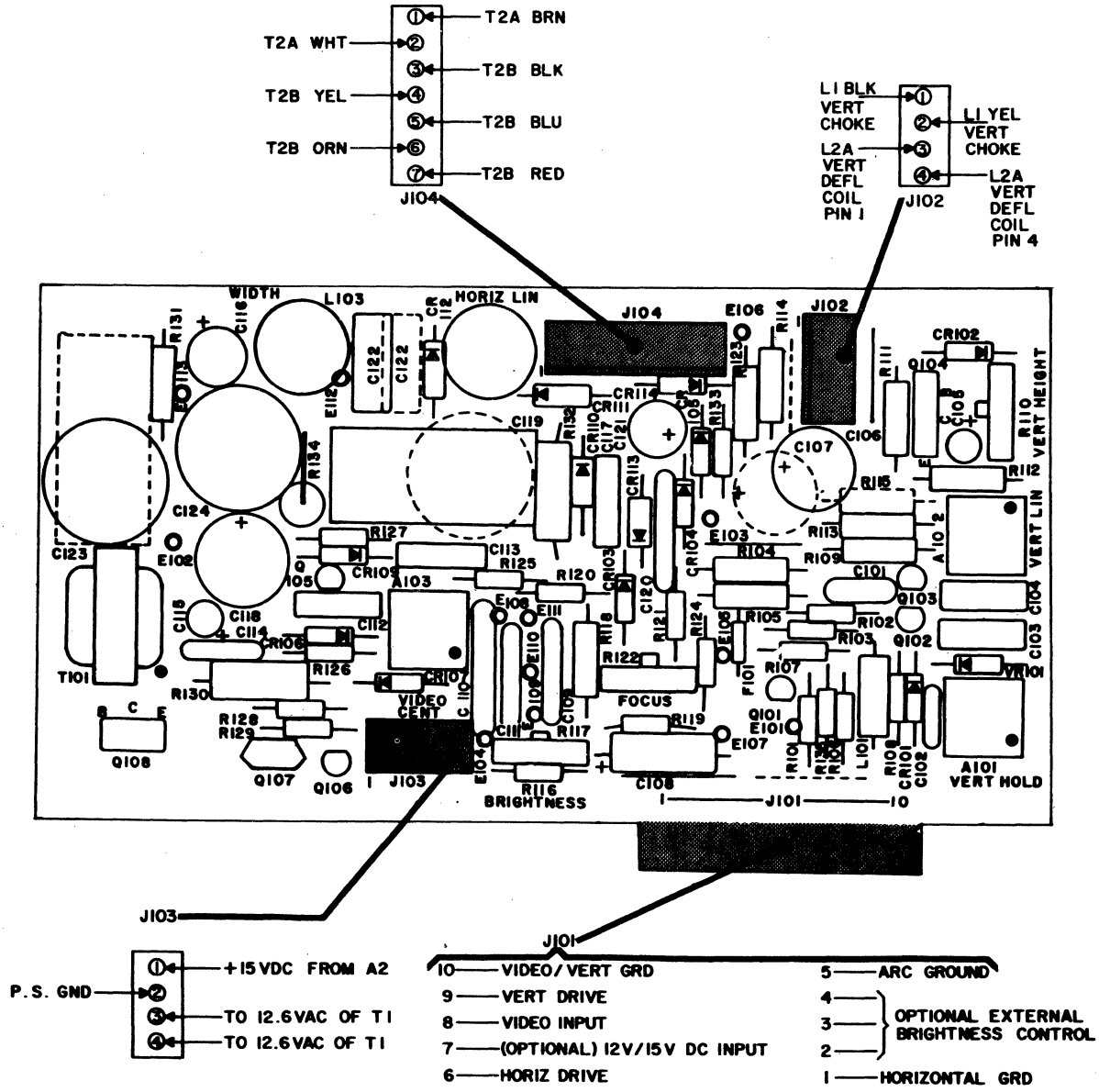


Figure I-5-1. TV-120 Locations

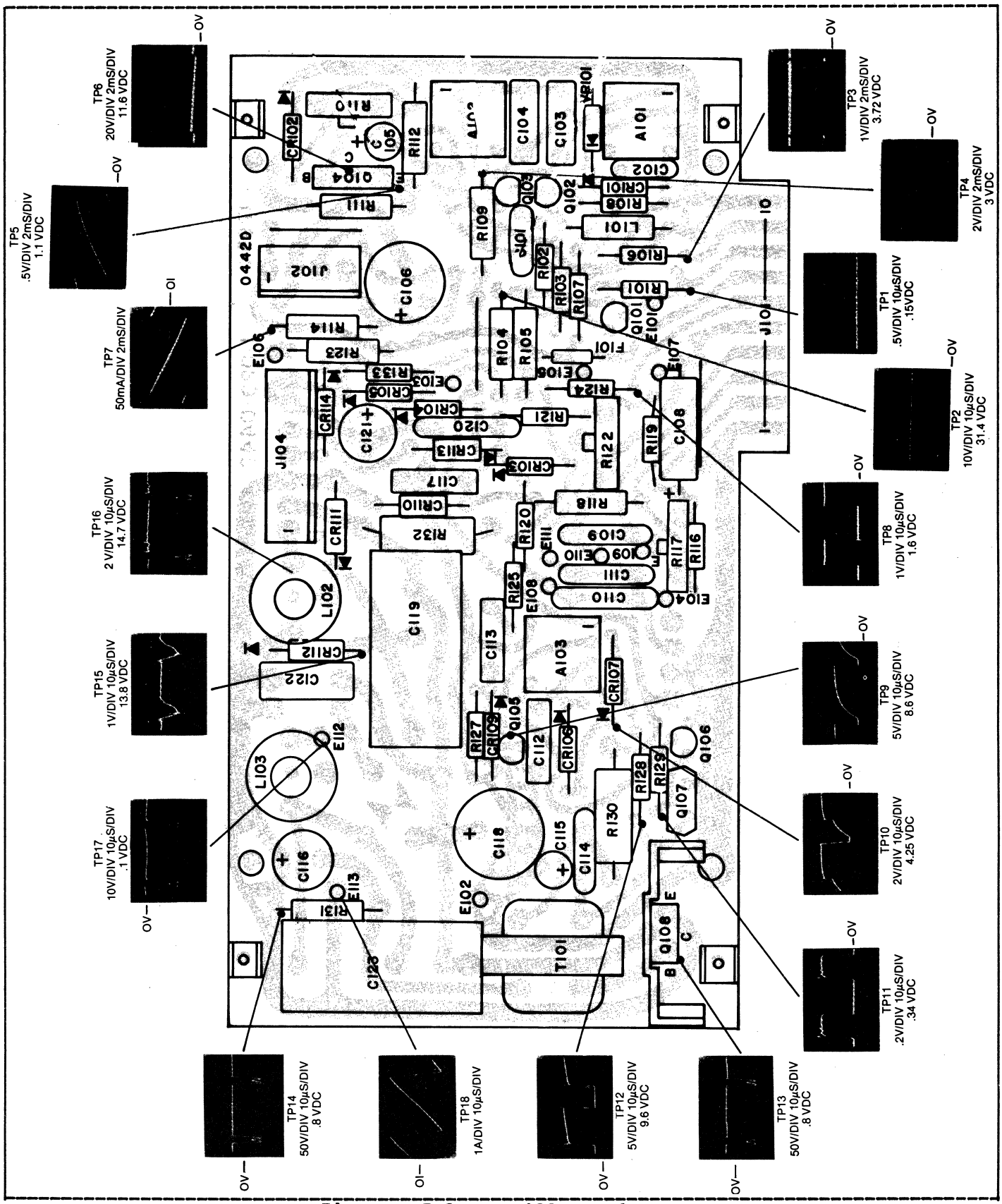


Figure I-5-2. TV-120 Waveforms

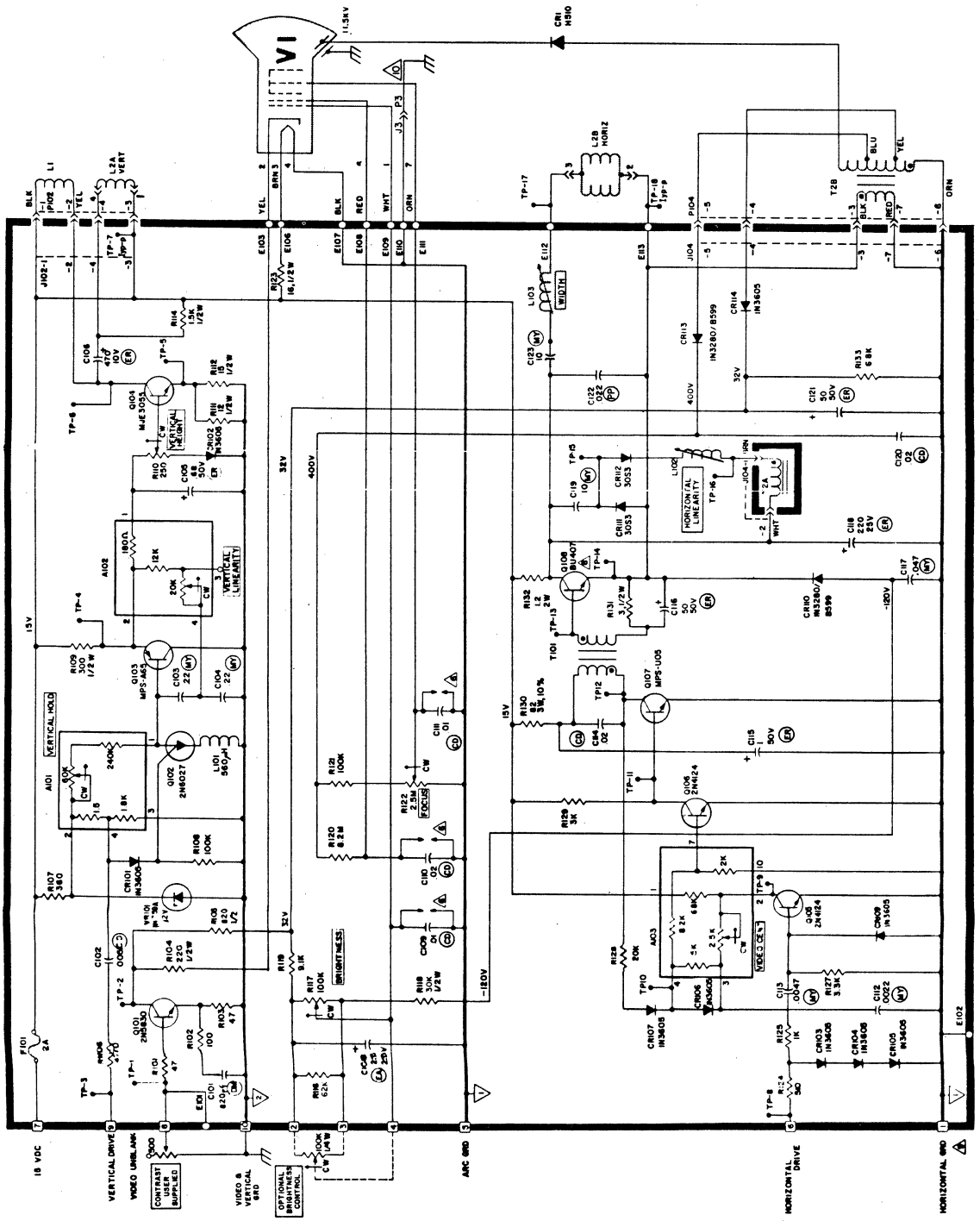


Figure I-5-3. TV-120 Schematic

TV-120 SPARE PARTS LIST

TV-120
MONITOR KIT - BALL BROTHERS - GTC P/N 2830-003

COMPONENT:	SYMBOL	GTC PART NO
FRAME, Chassis GT-100		03374-G01
FRAME, Chassis GT-400		99999-218
PICTURE TUBE, CRT; White		99999-158
PICTURE TUBE, CRT; Green		99999-213
COIL, Vertical Choke	L1	040015-001
Housing 4-Pin	P102	01021-116
Terminal (2 ea)		01022-337
COIL, Deflection Yoke	L2	040014-001
TRANSFORMER, Hi Voltage Flyback	T2	050012-001
DIODE, H510, H-V Rectifier	CR1	01007-015
CONNECTOR, Housing, 7-pin	P104	02021-117
Terminal (7 ea)		01022-337
PINCUSSION ADJUSTING MAGNETS		
ORANGE £1		99999-268
SMALL YELLOW £2		99999-269
SILVER £3		99999-270
GREEN £4		99999-271
YELLOW £5		99999-272
		03452-002

PRINTED CIRCUIT BOARD ASSEMBLY
COMPONENT PARTS LISTED AS FOLLOWS

CAPACITORS:

SYMBOL	VALUE*	VOLTAGE	MATERIAL	%TOL	GTC PART NO
C101	820 pf	500	MICA	5	01008-115
C102	0.01	100	DISC	20	01008-078
C103	0.22	100	MYLAR	10	01008-116
C104	0.22	100	MYLAR	10	01008-116
C105	0.68	50	----	-	01008-117
C106	470	10	LYTIC	-	01008-118
C108	25	25	LYTIC	-	01008-083
C109	0.01	1000	DISC	20	01008-119
C111	0.01	1000	DISC	20	01008-119
C110	0.02	1000	DISC	20	01008-100
C112	0.022	630	MYLAR	10	01008-120
C113	0.0047	630	MYLAR	10	01008-121
C114	0.02	100	DISC	20	01008-122
C115	1	50	LYTIC	-	01008-073
C116	50	50	LYTIC	-	01008-123
C117	0.047	250	MYLAR	10	01008-114
C118	220	25	LYTIC	-	01008-103
C119	10	100	POLY	10	01008-124
C123	10	100	POLY	10	01008-124
C120	0.02	500	DISC	20	01008-125
C121	33	25	LYTIC	-	01008-126
C122	0.022	250	MYLAR	10	01008-127

* in micro farads unless otherwise noted.

RESISTORS:

SYMBOL	VALUE*	WATTAGE	MATERIAL	%TOL	GTC PART NO
R101	47	1/4	FCC	5	01009-052
R103	47	1/4	FCC	5	01009-052
R102	100	1/4	FCC	5	01009-057
R104	100	1/4	FCC	5	01009-057
R106	220	1/4	FCC	5	01009-128
R105	820	1/2	FCC	5	01009-150
R108	100k	1/4	FCC	5	01009-098
R121	100k	1/4	FCC	5	01009-098
R109	360	1/4	FCC	5	01009-133
R110	500	1/8	VCC	20	01009-135
R111	12	1/2	FCC	5	01009-134
R112	15	1/2	FFC	5	01009-136
R114	1.5k	1/2	FFC	5	01009-137
R116	62k	1/4	FFC	5	01009-138
R117	100k	1/8	VCC	20	01009-121
R118	30k	1/2	FCC	5	01009-139
R119	9.1k	1/4	FCC	5	01009-140
R120	22meg	1/4	FCC	5	01009-141
R122	2.2meg	1/8	VCC	20	01009-120
R123	16	1/2	FCC	5	01009-142
R124	510	1/4	FCC	5	01009-259
R125	1k	1/4	FCC	5	01009-070
R127	3.3k	1/4	FCC	5	01009-078
R128	15k	1/4	FCC	5	01009-089
R129	3k	1/4	FCC	5	01009-077
R130	82	3	WW	10	01009-144
R131	3	1/2	FCC	5	01009-145
R132	1.2	2	WW	10	01009-125
R133	6.8k	1/4	FCC	5	01009-084
R134	1.8	2	WW	10	01009-146
U101	60k		RP		01009-147
U102	20k		RP		01009-148
U103	2.5k		RP		01009-149

* in OHMS

DIODES:

SYMBOL	GENERIC	GTC PART NO
CR101	1N 3605	01007-012
thru		
CR107	1N 3605	01007-012
CR109	1N 3605	01007-012
CR110	1N 3280	01007-017
CR113	1N 3280	01007-017
CR111	30 S3	01007-019
CR112	MR850	01007-018
CR114	1N 4148	01007-016

TRANSISTORS:

SYMBOL	GENERIC	TYPE	GTC PART NO
Q101	2N 5830	NPN	01006-025
Q102	2N 6027	SCR	01006-026
Q103	MPS-A65	PNP	01006-030
Q104	MJE-3055	NPN	01006-010
Q105	2N 4124	NPN	01006-031
Q106	2N 4124	NPN	01006-031
Q107	MPS-U05	NPN	01006-028
Q108	BU-407	NPN	01006-032

TRANSFORMERS:

SYMBOL	TYPE	GTC PART NO
T101	HORIZ.DRIVER	050004-001

COILS:

SYMBOL	VALUE	TYPE	GTC PART NO
L101	560uh	- - - -	040002-001
L102	- - -	LIN.ADJ.	040003-001
L103	- - -	WID.ADJ.	040001-001

FUSES:

SYMBOL	VALUE	TYPE	GTC PART NO
F101	3 amp	PICO-FUSE	99999-219

CONNECTORS:

SYMBOL	TYPE	PINS£	GTC PART NO
J102	WAFER, MALE	4 (Molex)	01021-118
J104	WAFER, MALE	7 (Molex)	01021-119
TERMINAL,	SINGLE MALE (11 ea)		01022-336

Section 1
GENERAL INFORMATION

1.1 GENERAL DESCRIPTION

The TV-12 data display monitor 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. This feature simplifies the sync processing and mixing and allows the unit to operate without requiring composite sync.

1.2 ELECTRICAL SPECIFICATIONS Fig.II-1-1

Video amplifier
(a) Bandwidth: 12 MHz (-3 db)
(b) Rise and Fall Times Less than 35 ns (10 to 90% amplitude): (linear mode)
(c) Storage Time: 15 ns max. (linear mode)

Retrace and Delay times
(a) Vertical: 900us retrace max.
(b) Horizontal: 7 us retrace plus 4us delay max.

Display Specifications
Cathode Ray Tube (without bonded panel)

Nominal Diagonal Measurement	Phosphor	*Resolution (TV lines) Center	Corner
12	P4	900 at 40 fl	750 at 40 fl
12	P39	900 at 20 fl	750 at 20 fl

*Resolution is measured in accordance with EIA RS-375 except Burst Modulation (or Depth of Modulation) is adjusted for 100 percent.

Geometric Distortion
The perimeter of a full field of characters shall approach an ideal rectangle to within + 1.5% of the rectangle height.

Power Requirements
Input voltage 15V DC ± .2V
Ripple <100 mV p-p
Input Current 900 mA DC nominal

Environmental Specifications
Temperature
Operating Range: 5 C to 55 C Ambient
Storage Range: -40 to 65 C
Humidity
5 to 80% (noncondensing)
Altitude
Operating Range Up to 10,000 feet

1.3 HUMAN FACTORS SPECIFICATIONS

X-Ray Radiation. The TV units comply with DHEW Radiation Performance Standards 21 CFR, subchapter J.

1.4 CONTROLS (OPTIONAL)

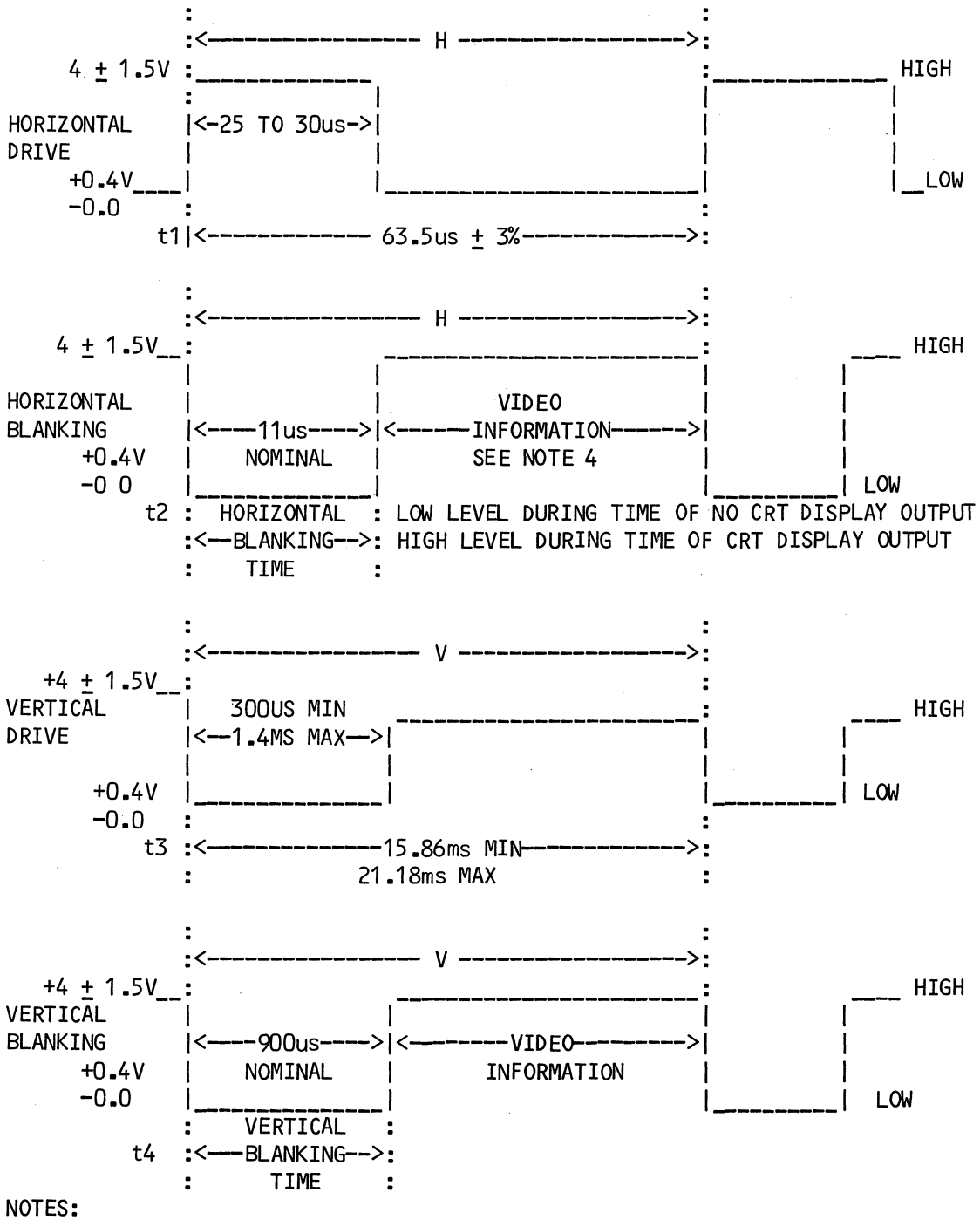
a. Contrast, 500 OHM potentiometer carbon composition 1/8 Watt
b. Brightness, 100k potentiometer 1/8 Watt
Optional: The brightness control can be mounted on the printed circuit board as an internal set up. The GTX, GT200, and GT400 utilize the optional remote brightness and contrast control.

Section 2
THEORY OF OPERATION

2.1 VIDEO AMPLIFIER

The video amplifier consists of Q101 and its associated circuitry.The incoming video signal is applied to the monitor through the contrast control and R109 to the base of transistor Q101.

Transistor Q101 and its components comprise the video output driver with a gain of about 17. Q101 operates as a class B amplifier and remains cutoff until a DC-coupled, positive-going signal arrives at its base. R111 provides series feedback which makes the terminal-to-terminal voltage gain relatively independent of transistor variations as well as stabilizes the device against voltage and current changes caused by ambient temperature variation. C118 bypasses the AC signal around the bias network.



NOTES:

1. t1 and t3 initiate horizontal and vertical retrace respectively. The relative difference between t1 and t2 and t3 and t4 should be chosen to center the video within the raster horizontally and vertically.
2. H= time from start of one line to start of next line.
3. V= time from start of one field to start of next field.
4. Video pulse width should be equal to or greater than 100ns.

Figure II-1-1. Synchronization and Blanking Generator Waveforms

The negative going signal at the collector of Q101 is DC-coupled to the cathode of the CRT. The class B biasing of the video driver allows a larger video output signal to modulate the CRT's cathode and results in a maximum available contrast ratio.

The overall brightness at the screen of the CRT is determined by the negative potential at the grid and is varied by the brightness control.

2.2 VERTICAL DEFLECTION

Transistor Q102 is a programmable unijunction transistor, and together with its external circuitry, forms a relaxation oscillator operating at the vertical rate. Resistor R115, variable resistor R116 and capacitors C105 and C106 form a RC network providing proper timing.

When power is applied, C105 and C106 charge exponentially through R115 and R116 until the voltage at the junction of R116 and C105 equals the anode "A" firing voltage. At this time, one of the unijunction's diodes that is connected between the anode and anode gate "G" becomes forward biased allowing the capacitors to discharge through another diode junction between the anode gate and the cathode "K" and on through R120.

R117 and R118 control the voltage after which the diode (anode-to-anode gate) becomes forward biased. This feature "programs" the firing of Q102 and prevents the unijunction from controlling this parameter. Therefore, the changing of firing points from one device to another, together with the temperature dependency of this parameter, is not a problem.

The vertical oscillator is synchronized externally to the vertical interval, an external negative pulse is applied through R113, C104, and CR101 to the gate of Q102, causing the firing level of the unijunction to decrease.

The sawtooth voltage at the anode of Ql02 is directly coupled to the base of Q103. Q103 is a driver amplifier and has two transistors wired as a Darlington pair; their input and output leads exit as a three-terminal device. This device exhibits a high input impedance to Q102, and therby maintains excellent impedance isolation between Q102 and Q104.

The output waveform from the unijunction oscillator is not suitable, as yet, to produce a satisfactory vertical sweep. Such a waveform would produce severe stretching at the top of the picture and compression at the bottom. C105 and C106 modify the output waveform to produce satisfactory linearity. The sawtooth waveform output at Q103 is coupled through R122, the vertical linearity control R121, and on to C106 where the waveform is shaped into a parabola. This parabolic waveform is then added to the oscillator's waveform and changes its slope. Slope change rate is determined by the position of R121.

Q103 supplies base current through R123 and R124 to the vertical output transistor, Q104. Height control R124 varies the amplitude of the sawtooth voltage present at the base of Q104 and varies the size of the vertical raster on the CRT.

The vertical output stage, Q104, uses a power type transistor which operates as a class A amplifier. No output transformer is required since the output impedance of the transistor permits a proper impedance match with the yoke connected directly to the collector. C107 is a DC blocking capacitor which allows only AC voltages to produce yoke current. L1 is a relative high impedance compared to the yoke inductance. During retrace time, a large positive pulse is developed by L1 which reverses the current through the yoke and moves the beam from the bottom of the screen to the top. Resistor R126 prevents oscillations by providing damping across the vertical deflection coils.

2.3 HORIZONTAL DEFLECTION

A driver stage consisting of Q105 and T101 is used to obtain a signal to drive Q106, the horizontal output transistor. The circuitry associated with Q105 and Q106 has been designed to optimize the efficiency and reliability of the horizontal deflection circuits.

A positive going pulse is coupled through R127 to the base of Q105. The amplitude and duty cycle of this waveform must be as indicated in the electrical specifications (Section 1.2) for proper circuit operation.

The driver stage is either cut off or driven into saturation by the base signal. The output signal appears as a rectangular waveform and is transformer-coupled to the base of the horizontal output stage. The polarity of the voltage at the secondary of the driver transformer is chosen such that Q106 is cut off when Q105 conducts and vice versa.

During conduction of the driver transistor, energy is stored in the coupling transformer. The voltage at the secondary is then positive and keeps Q106 cut off. As soon as the primary current of T101 is interrupted due to the base signal driving Q105 into cut off, the secondary voltage changes polarity. Q106 starts conducting and its base current starts to flow. This gradually decreases at a rate determined by the transformer inductance and circuit resistance.

The horizontal output stage has five main functions; to supply the yoke with the correct horizontal scanning current; develop 400V for use with the CRT; develop 34V for the video output stage; and develop -160V for the CRT bias.

Q106 acts as a switch which is turned on or off by the rectangular waveform on the base. When Q106 is turned on, the supply voltage plus the charge on C113 causes yoke current to increase in a linear manner and moves the beam from near the center of the screen to the right side. At this time, the transistor is turned off by a positive voltage on its base which causes the output circuit to oscillate. A high reactive voltage in the form of a half cycle negative voltage pulse is developed by the yoke's inductance and the primary of T2. The peak magnetic energy which was stored in the yoke during scan time is then transferred to C109 and the yoke's distributed capacity. During this cycle, the beam is returned to the center of the screen.

The distributed capacity now discharges into the yoke and induces a current in a direction opposite to the current of the previous part of the cycle. The magnetic field thus created around the yoke moves the scanning beam to the left of the screen.

After slightly more than half a cycle, the voltage across C109 biases the damper diode CR103 into conduction and prevents the flyback pulse from oscillating. The magnetic energy that was stored in the yoke from the discharge of the distributed capacity is released to provide sweep for the first half of scan and to charge C113 through the rectifying action of the damper diode. The beam is then at the center of the screen. The cycle will repeat as soon as the base voltage of Q106 becomes negative.

C113, in series with the yoke, also serves to block DC currents through the yoke and to provide "S" shaping of the current waveform. "S" shaping compensates for stretching at the left and right sides of the picture tube because the curvature of the CRT face and the deflected beam do not describe the same arc.

L101 is an adjustable width control placed in series with the horizontal deflection coils. The variable inductive reactance allows a greater or lesser amount of the deflection current to flow through the horizontal yoke and, therefore, varies the width of the horizontal scan.

The negative flyback pulse developed during horizontal retrace time is rectified by CR104 and filtered by C110. This voltage is coupled through the brightness control to the grid of the CRT (V1).

This same pulse is transformer-coupled to the secondary of transformer T2 where it is rectified by CR2, CR106 and CR105 to provide the CRT anode voltage, the focus and video amplifier operating voltages.

Section 3
PRELIMINARY ADJUSTMENTS

3.1 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.

To perform the adjustment, decrease width of the raster using L103 until both edges of the raster are visible. Adjust the centering rings until the raster is in the center of the CRT. If the picture is tilted, rotate the entire yoke.

3.2 SYNCHRONIZATION AND DRIVE SIGNALS

Whenever the Terminal is "ON" the logic board provides the horizontal drive signal which is required to initiate horizontal scan and high voltage. No adjustments are made to sync or drive signals as these are fixed by the traminle logic.

3.3 BRIGHTNESS

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

The 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.

3.4 VIDEO CONTRAST

Q101 is designed to operate linearly when a +2.5V signal is applied to its base. The GTX, GT-200 and GT-400 incorporate a 500 ohm external contrast control to maintain this level. This control, or a fixed resistor allows 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.

3.5 VERTICAL ADJUSTMENTS

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

(1) Apply video and synchronization signals to the monitor.
(2) Set the vertical frequency control R116 near the mechanical center of its rotation.
(3) Adjust the vertical height control R124 for desired height.
(4) Adjust the vertical linearity control R121 for best vertical linearity.
(5) Remove the vertical drive signal from the unit. Or, alternatvely, use a short jumper lead, and short the vertical drive input terminal of the printed circuit card edge connector to ground.
(6) Readjust the vertical frequency control R116 until the picture rolls up slowly.
(7) Restore vertical drive to the monitor.
(8) Recheck height and linearity.

3.6 HORIZONTAL ADJUSTMENTS

Raster width is affected by a combination of the low voltage supply, width coil L101, and horizontal linearity sleeve located on the neck of the CRT beneath the yoke.

(1) Apply video and synchronization signals to the monitor. Insert the horizontal linearity sleeve about 2/3 of its length under the yoke. (If you received a monitor from the factory in which the placement of the linearity sleeve has been determined, make a mark on the sleeve and re-insert the sleeve to this mark when removal of the yoke and linearity sleeve are required.) If the linearity sleeve is inserted farther than necessary, excessive power will be consumed, and the horizontal output circuitry could be overstressed.
(2) Adjust the horizontal width coil L101 for the desired width.
(3) Insert the linearity sleeve farther under the yoke to obtain the best linearity. Although this adjustment will affect the raster width, it should not be used solely for that purpose. The placement of the linearity sleeve should be optimized for the best linearity.
(4) Readjust L101 for proper width.

(5) Observe final horizontal linearity and width, and touch up either adjustment if needed.

No horizontal hold contol is used in this monitor. The raster should be properly locked and centered by the terminal logic.

3.7 FOCUS ADJUSTMENT

The focus control R107 provides an adjustment for maintaining best overall display focus. This control does not have a large effect on focus because of the CRT gun assembly construction, however a small range of adjustment is possible.

Section 4
TROUBLESHOOTING AND MAINTENANCE

4.1 TROUBLE SHOOTING GUIDE

Symptom: No control of brightness level.

Check	Action
Check for a DC volt at pin 4 of 10 pin edge connector (or wiper of brightness control) for a - 150V DC to +30V DC as brightness control is rotated.	If - 150 V DC isn't present check CR105 If - 150V DC is present replace CRT.

Symptom: Insufficient Vertical Hold Range

Check	Action
	Replace Q102

Symptom: Low High Voltage

Check	Action
	Replace HV rectifier CR2

Symptom: No brightness

Check	Action
Observe lighted filamament in CRT	If filament isn't lighted, check with ohmmeter. If no continuity, replace CRT.

Symptom: Monitor is dead

Check	Action
Check for HV on CRT anode (11kV). If no HV is present, check LV supply +15V DC	If LV isn't present remove plug P104. If B+ is restored replace Q106. with P104 removed and B+ is still not present, check for approximately 22V DC on collector of Q1. If voltage is present, with P104 removed check Q202 Q203, and VR 201. On models without PS check fuse F101.

The voltage waveforms are shown in Figure II-4-1 and Figure II-4-2 is the interconnecting cabling diagram. Figure II-4-3 shows the circuit board component locations. Figure II-4-4 is the circuit schematic.

Section 5
SERVICE DATA

5.1 GENERAL

This section contains the replaceable electrical parts list, schematic, PWB component layout and waveforms for servicing of the TV 12 data monitor.

5.2 ORDERING PARTS

Most parts contained in the monitor are available commercially from electronic parts outlets. When it is necessary to order spare or replacement parts from GTC please indicate the Model Number of your terminal including the Part Number and Serial in your written or telephone request. Orders may be directed to:

GENERAL TERMINAL CORPORATION
14831 Franklin Avenue
Tustin, CA 92680
(714) 730-0123
1-800-854-6925

Full servicing is available for either your complete terminal, the monitor module or printed circuit assembly. Prior to return you should call Field Service at the following number for a return authorization. East of Mississippi River: 800-225-0976. West of the Mississippi River: 800-854-6985.

Unnecessary delays may be avoided when items are returned to GTC for repair using the following procedures:

1) Package the unit or part in accordance with safe shipping practices. Enclose a list of the material being returned and the reason for returning it. Enclose your return authorization number.
2) Send the unit or part, transportation prepaid, to the address stipulated for returning parts. All warranty repairs will be made provided examination discloses that the defects are within the limits of the warranty If damages or defects are not within the limits of the warranty, the customer will be notified of the extent of repairs required and the cost. The unit will be repaired and returned upon agreement.

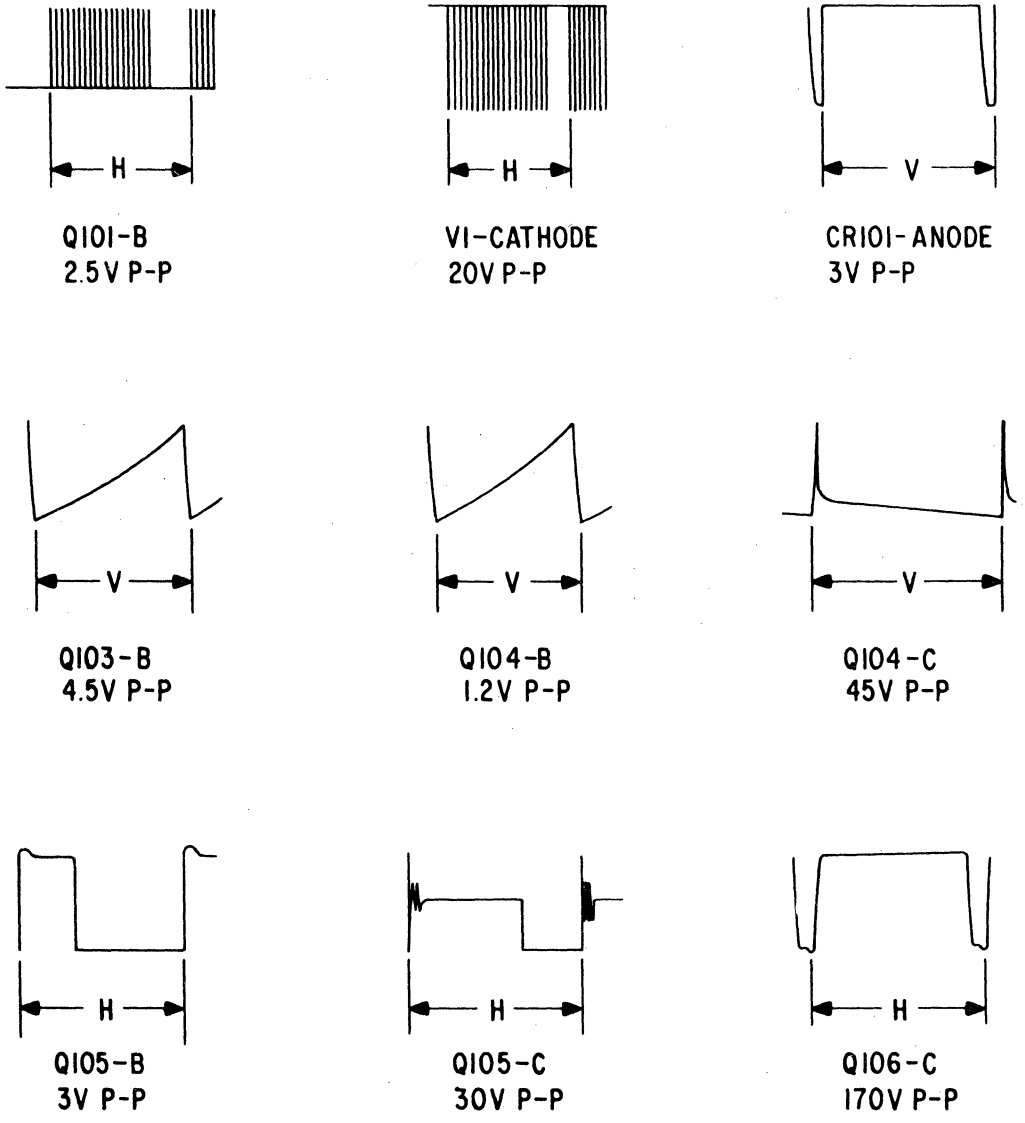


Figure II-4-1. TV-12 Waveforms

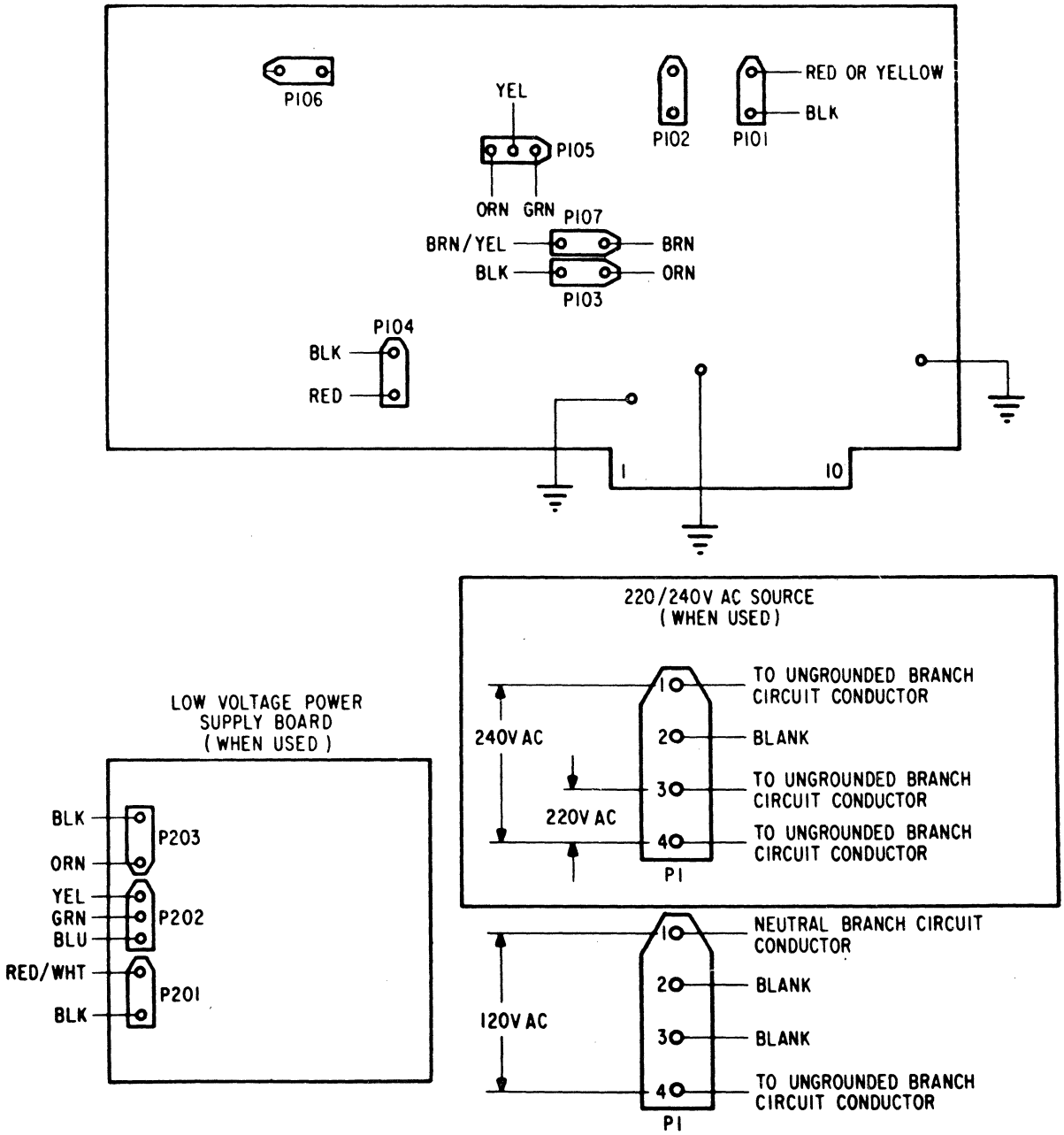
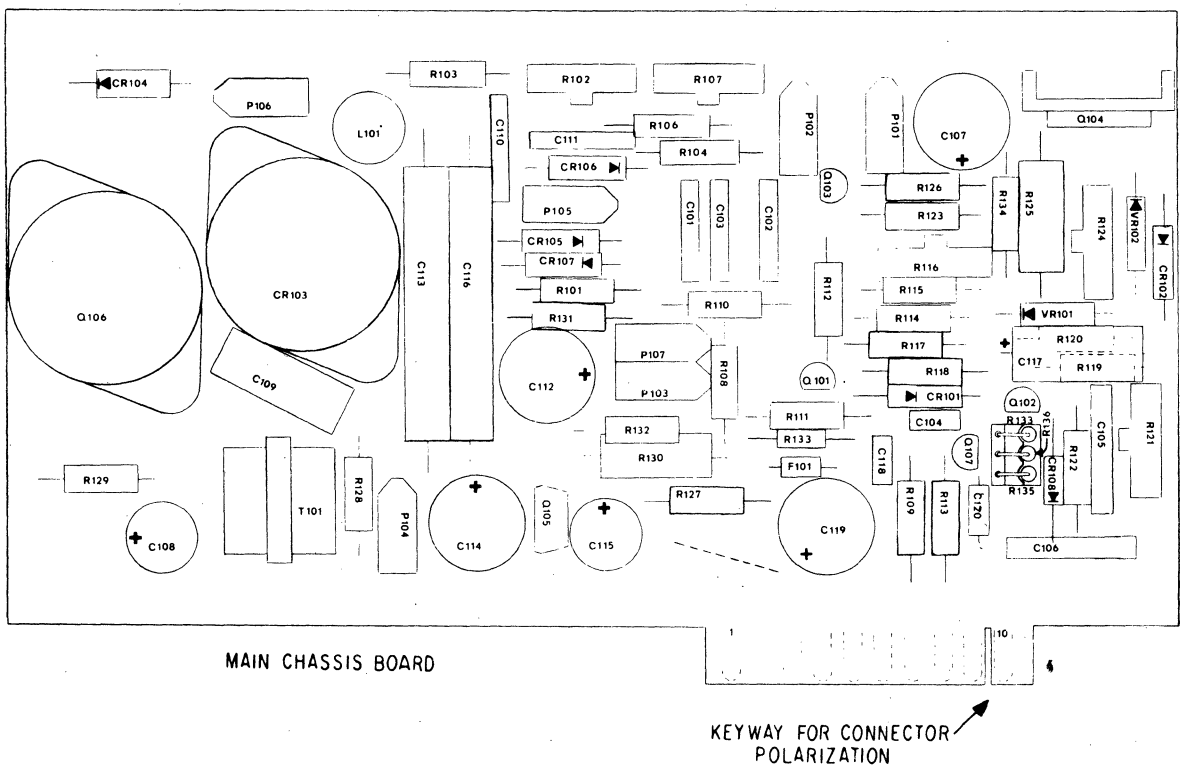


Figure II-4-2. Cable Diagram



NOTE:

F101 AND R108 ARE USED ONLY WHEN LOW VOLTAGE POWER SUPPLY IS NOT SUPPLIED.

C116 IS USED ON 5 INCH MODELS ONLY

R102 (BRIGHTNESS POT) IS OPTIONAL

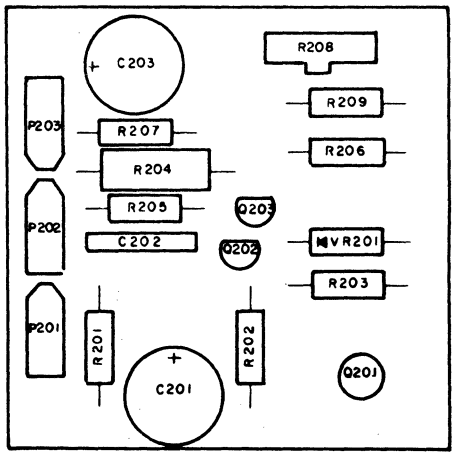


Figure II-4-3. Component Locations

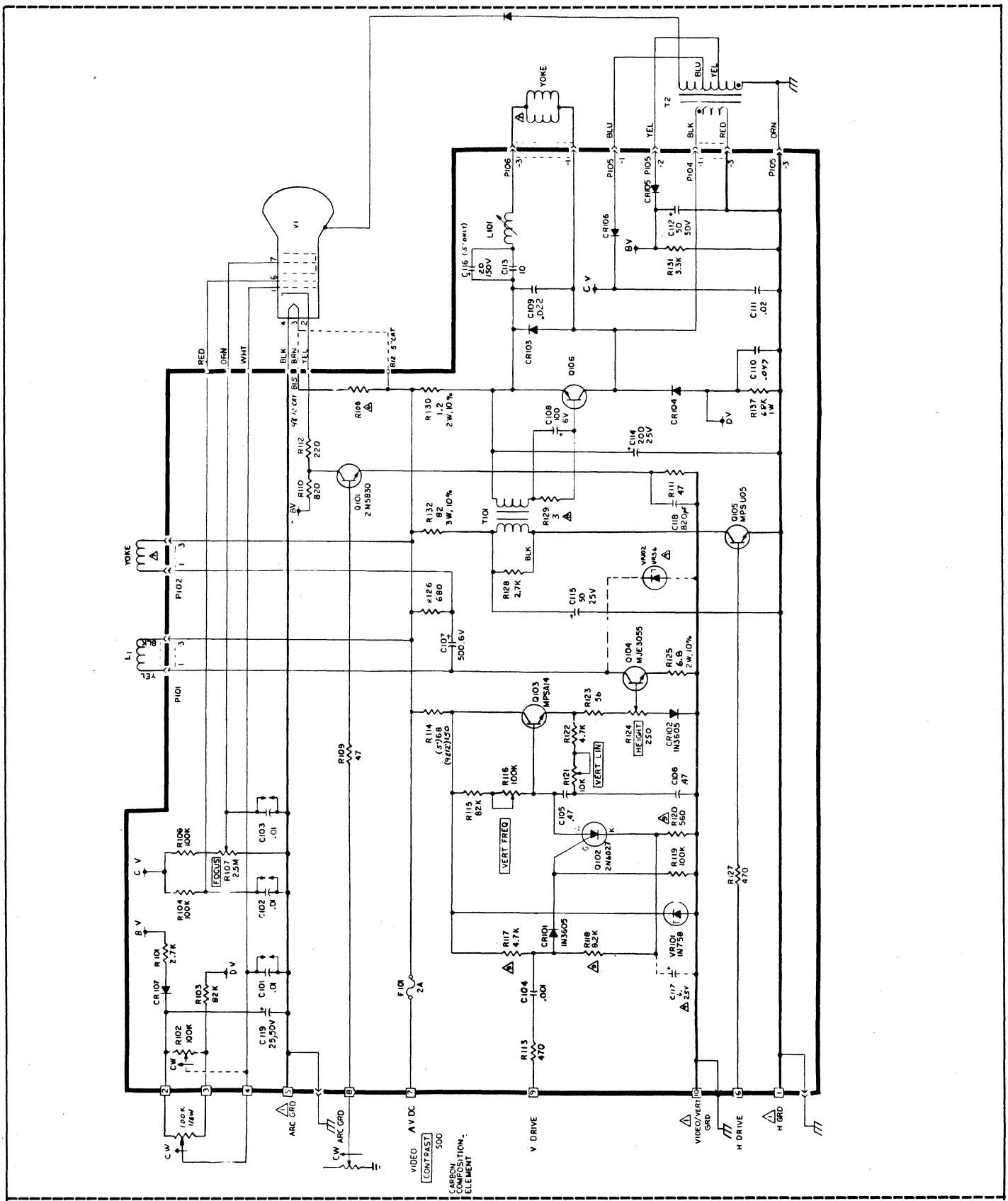


Figure II-4-4. TV-12 Schematic

SPARE PARTS LIST

TV-120

MONITOR KIT - BALL BROTHERS -		GTC PART NO
WHITE PHOSPHOR W/GT400 FRAME		2830-001
GREEN PHOSPHOR W/GT400 FRAME		2830-002

COMPONENTS:	SYMBOL	GTC PART NO
FRAME, CHASSIS GT-100		03374-G01
FRAME, CHASSIS GT-400		9999-218
PICTURE TUBE, CRT;White	V1	9999-158
PICTURE TUBE, CRT;Green	V1	9999-213
COIL, Vertical Choke	L1	040013-001
CONNECTOR, 3 PIN	P101	01021-115
TERMINALS (2EA)		01022-334
COIL, DEFLECTION YOKE	V1	040016-001
CONNECTOR, 3 PIN	P102	01021-115
CONNECTOR, 3 PIN	P106	01021-115
TERMINALS (4 EA)		01022-334
TRANSFORMER, HI-VOLTAGE FLYBACK	T2	050011-001
DIODE, H510 HV RECTIFIER	CR 2	01007-015
CONNECTOR, 3 PIN	P104	01021-115
CONNECTOR, 3 PIN	P105	01021-115
TERMINALS (5 EA)		01022-334
PINCUSSION ADJUSTING MAGNETS		
ORANGE £1		99999-268
SMALL YELLOW £2		99999-269
SILVER £3		99999-270
GREEN £4		99999-271
YELLOW £5		99999-272
PRINTED CIRCUIT BOARD ASSEMBLY		03452-001

COMPONENT PARTS LISTED AS FOLLOWS

CAPACITORS:

SYMBOL	VALUE*	VOLTAGE	MATERIAL	%TOL	GTC PART NO
C101	0.01	1000	DISC	-	01008-108
C102	0.01	1000	DISC		01008-108
C103	0.01	1000	DISC	-	01008-108
C104	0.001	1000	DISC	20	01008-109
C105	0.47	100	MYLAR	10	01008-110
C106	0.47	100	MYLAR	10	01008-110
C107	470.	6.3	LYTIC	-	01008-111
C108	100	10	LYTIC	-	01008-112
C109	0.022	400	MYLAR	10	01008-113
C110	0.047	250	MYLAR	10	01008-114
C111	0.02	1000	DISC	20	01008-100
C112	47	50	LYTIC	-	01008-101
C113	10	50	POLY	10	01008-102
C114	220	25	LYTIC	-	01008-103
C115	47	25	LYTIC	-	01008-104
C117	10	25	LYTIC	-	01008-105
C118	470pf	500	MICA	5	01008-106
C119	22	50	LYTIC	-	01008-107

* in micro farads unless otherwise noted.

RESISTORS:

SYMBOL	VALUE*	WATTAGE	MATERIAL	%TOL	GTC PART NO
R101	2.7K	1/4	FCC	5	01009-076
R103	82K	1/4	FCC	5	01009-119
R104	100K	1/4	FCC	5	01009-098
R106	100K	1/4	FCC	5	01009-098
R107	2.5meg	1/8	VCC	20	01009-120
R108	15	1/4	FCC	5	01009-049
R109	47	1/4	FCC	5	01009-052
R110	820	1/4	FCC	5	01009-069
R111	47	1/4	FCC	5	01009-052
R112	220	1/2	FCC	5	01009-128
R113	470	1/4	FCC	5	01009-066
R114	150	1/2	FCC	5	01009-129
R115	82k	1/4	FCC	5	01009-119
R116	100k	1/8	VCC	20	01009-121
R117	4.7k	1/4	FCC	5	01009-080
R118	8.2k	1/4	FCC	5	01009-086
R119	100k	1/4	FCC	5	01009-098
R120	560	1/4	FCC	5	01009-067
R121	10k	1/8	VCC	20	01009-132
R122	4.7k	1/4	FCC	5	01009-080
R123	56	1/4	FCC	5	01009-054
R124	250	1/8	VCC	20	01009-122
R125	6.8	2	WW	10	01009-123
R126	680	1/2	FCC	5	01009-130
R127	470	1/4	FCC	5	01009-066
R128	2.7k	1/4	FCC	5	01009-076
R129	3	1/2	FCC	5	01009-124
R130	1.2	2	WW	10	01009-125
R131	3.3k	1/2	FCC	5	01009-131
R132	82	2	WW	10	01009-126
R137	68k	1	FCC	5	01009-127

* in OHMS

DIODES:

SYMBOL	P/N GENERIC	TYPE	GTC PART NO
CR101	1N3605		01007-012
CR102	1N3605		01007-012
CR103	1N4785	TO-3 Pkg.Metal	01007-013
CR104	1N3279		01007-014
CR105	1N3279		01007-014
CR106	1N3279		01007-014
CR107	1N3279		01007-014
VR101	1N758	10 volt Zener	01007-020
VR102	VR 56	56 volt Zener	01007-021

TRANSISTORS:

SYMBOL	GENERIC	TYPE	GTC PART NO
Q101	2N5830	NPN	01006-025
Q102	2N6027	SCR	01006-026
Q103	MPS-A14	NPN	01006-027
Q104	MJE-3055	NPN	01006-003
Q105	MPS-U05	NPN	01006-028
Q106	B 1182	PNP TO-3	01006-029

TRANSFORMERS:

SYMBOL	TYPE	GTC PART NO
T101	HORIZONTAL DRIVER	050017-001

COILS:

SYMBOL	TYPE	GTC PART NO
L101	WID.ADJ.	040001-001

FUSE:

SYMBOL	VALUE	TYPE	GTC PART NO
F101	3 amp	PICO-FUSE	99999-219

CONNECTOR PINS:*

SYMBOL	#PINS	TYPE	GTC PART NO
P101	2	MOLEX R62-4	01022-334
P102	2	MOLEX R62-4	01022-334
P103	2	MOLEX R62-4	01022-334
P104	2	MOLEX R62-4	01022-334
P105	3	MOLEX R62-4	01022-334
P106	2	MOLEX R62-4	01022-334
P107	2	MOLEX R62-4	01022-334

* All are single bead pins, male, mounted individually.

This page intentionally left blank.

Section 1
GENERAL INFORMATION

1.1 GENERAL DESCRIPTION

This service manual introduces the Zenith D-12 series of video Displays.

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.

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 mainteined 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 of interruption of synchronizing signals. Vertical and horizontal synchronization is automatic and stable throughout the entire specified operating frequency range.

1.2 SPECIFICATIONS CATHODE RAY TUBE

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

The nominal display area is 51 sq.in. defined by a rectangle 8 1/2" x 6" centered on the CRT.

1.3 INPUT SIGNALS (TTL LEVEL)

Horizontal
4 to 40 micro sec. duration (positive going standard).

Vertical
50 to 1400 micro sec. duration (negative going standard).

Video
1.0V to 1.5V P-P (user supplies 500 ohm contrast control for higher input levels). Positive polarity for white characters.

Power Supply
15V DC at 800 ma. max.

Brightness Control

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

Resolution

900 vertical lines minimum at center of display and 700 vertical lines at the corners. Pulse rise time less than 20 nano seconds, 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 ± 2.0 percent of height at right side.

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

Horizontal

a. Width of display at top shall be within ±2.5 percent of width at bottom.

b. Side pincushion or barrel shall be within 1.0% of the average width.

Linearity

No character shall vary in width or height by more than ±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 ± 10% of an adjacent character.

1.4 SYNCHRONIZATION

HORIZONTAL
15.75 ± 0.5KHz
Horizontal blanking
10.0 millisec. min.
Horizontal Phasing Control
10.0 millisec. min. adjustment
VERTICAL
47 to 63 Hz
VERTICAL RETRACE TIME
850 microsec. mac.

1.5 STORAGE

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

1.6 ENVIRONMENT

Operating temperature
55 max. (free air temperature of display electronics).
Altitude
40,000 ft. storage & shipment.
10,000 ft. max. operating.

Section 2
THEORY OF OPERATION

2.1 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) or Q101 through injection network C101, C111, R101, R110, and CR101. By varing 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.

The 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.

2.2 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. One feature of this vertical circuit is the addition of transistor Q308. This transistor doubles B+ during retrace, thus maintaining less than 800 microsec. of retrace time.

2.3 VIDEO

The video amplifier circuit consists of transistors Q401 and Q402 and associated circuitry. The circuit comprises a cascade 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

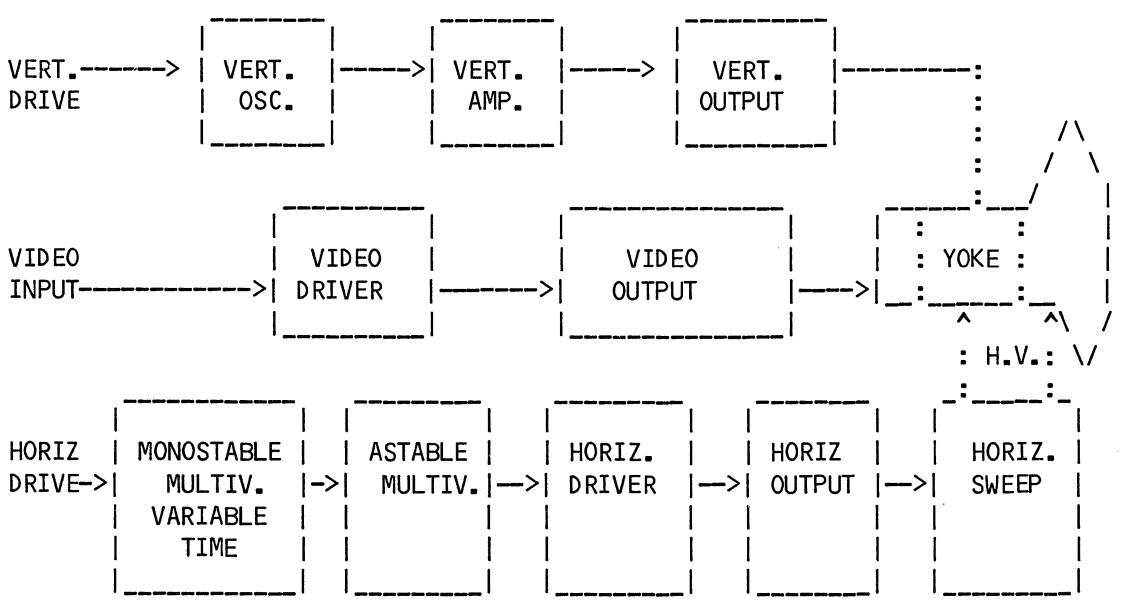
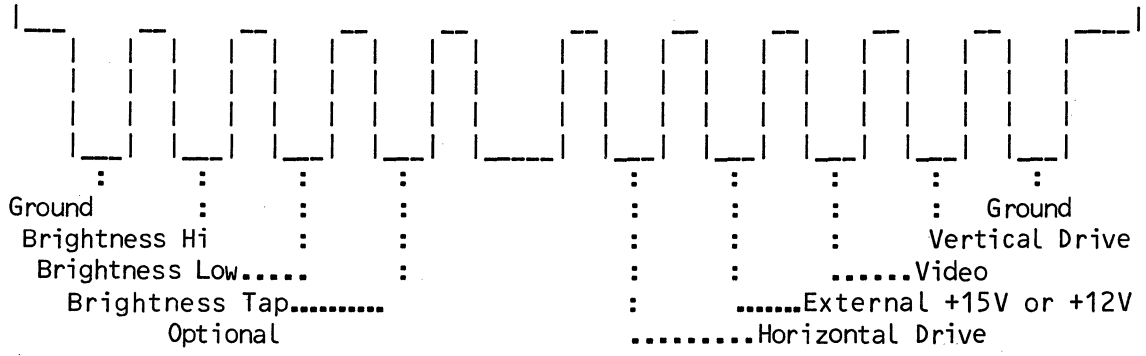


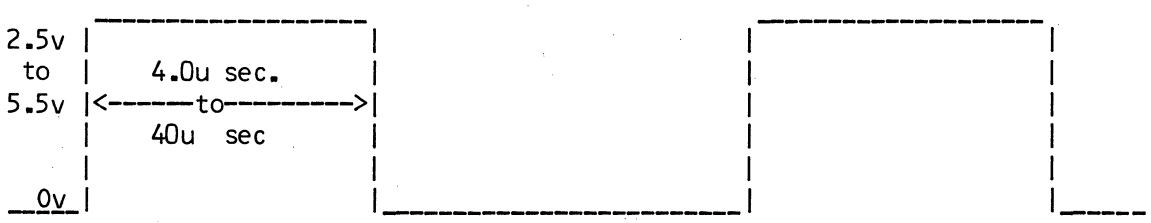
Figure III-2-1. Zenith D-12 Block Diagram

INPUT SIGNALS: Input signals are connected to the display board through a 10 pin edge connector.

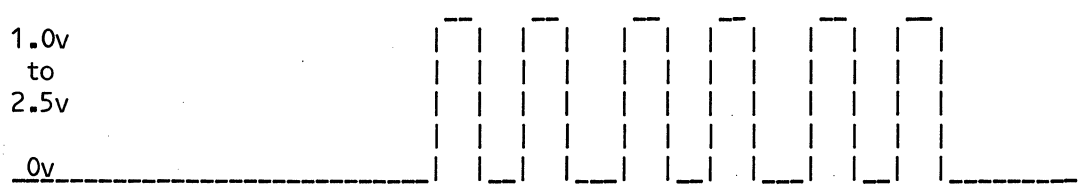
Component Side of Display Board



A. Horizontal drive signal - 15750Hz ± 500 Hz



B. Video drive signal



At a horizontal frequency of 15.KHZ the video drive signal should start 11 microseconds ± 5u seconds after the leading edge of horizontal sync, and 900 microseconds greater after the leading edge of vertical sync.

C. Vertical drive signal - 47 Hz to 63 Hz

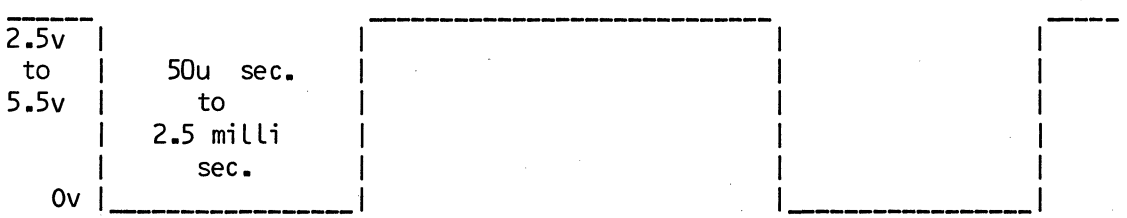


Figure III-2-2. Zenith D-12 Connector and Signals

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.

2.4 GENERAL OPERATION AND ADJUSTMENTS

1. INPUT SIGNALS: input signals are connected to the display board through a 10 pin edge connector.

   In normal operation the horizontal and vertical drive signals and signal ground are connected to the edge connector through a cable assembly. The GTC models GTX, GT-200 and GT-400 utilize a remote contrast control to adjust the drive level.
   The video drive signal is connected to the top end of the 500 ohm pot, the bottom end is grounded and the wiper arm connects to the video input of the edge connector as shown.

2. Once power is applied to the display and the input signals connected, adjust the brightness control until the edges of the raster are visible. Center to raster in the CRT as necessary using the centering rings on the back of the yoke.

3. Depending on the requirements for height and width of the video presentation, the vertical size control and width coil should be adjusted accordingly.

4. Adjust the phase control to center the video information within the raster.

5. Adjust brightness contrast control for visual cutoff of the raster.

6. Adjust external contrast control for desired luminance.

7. 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 of T-band through a terminal lug. This grounding procedure provides adequate high voltage filtering and arc protection.
Figure III-2-1 shows adjustment locations, Figure III-2-2 shows component locations and Figure III-2-3 is the circuit schematic.

Section 3
SERVICE DATA

3.1 GENERAL

This section contains the replaceable electrical parts list, schematic, PWB component layout and waveforms for servicing of the Zenith D-12 Data Monitor.

3.2 ORDERING PARTS

Most parts contained in the monitor are available commercially from electronic parts outlets. When it is necessary to order spare or replacement parts from GTC please indicate the Model Number of your terminal including the Part Number and Serial Number in your written or telephone request. Orders may be directed to:

GENERAL TERMINAL CORPORATION
14831 Franklin Avenue
Tustin, CA 92680
(714) 730-0123
(800) 854-6925

Full servicing is available for either your complete terminal, the monitor module or printed circuit assembly. Prior to return you should call Field Service at the following number for a return authorization. East of Mississippi River: 800-225-0976. West of the Mississippi River: 800-854-6985. Unnecessary delays may be avoided when items are returned to GTC for repair using the following procedures:

1) Package the unit or part in accordance with safe shipping practices. Enclose a list of the material being returned and the reason for returning it. Enclose your return authorization number!
2) Send the unit or part, transportation prepaid, to the address stipulated for returning parts.

All warranty repairs will be made provided examination discloses that the defects are within the limits of the warranty. If damages or defects are not within the limits of the warranty, the customer will be notified of the extent of repairs required and the cost. The unit will be repaired and returned upon agreement.

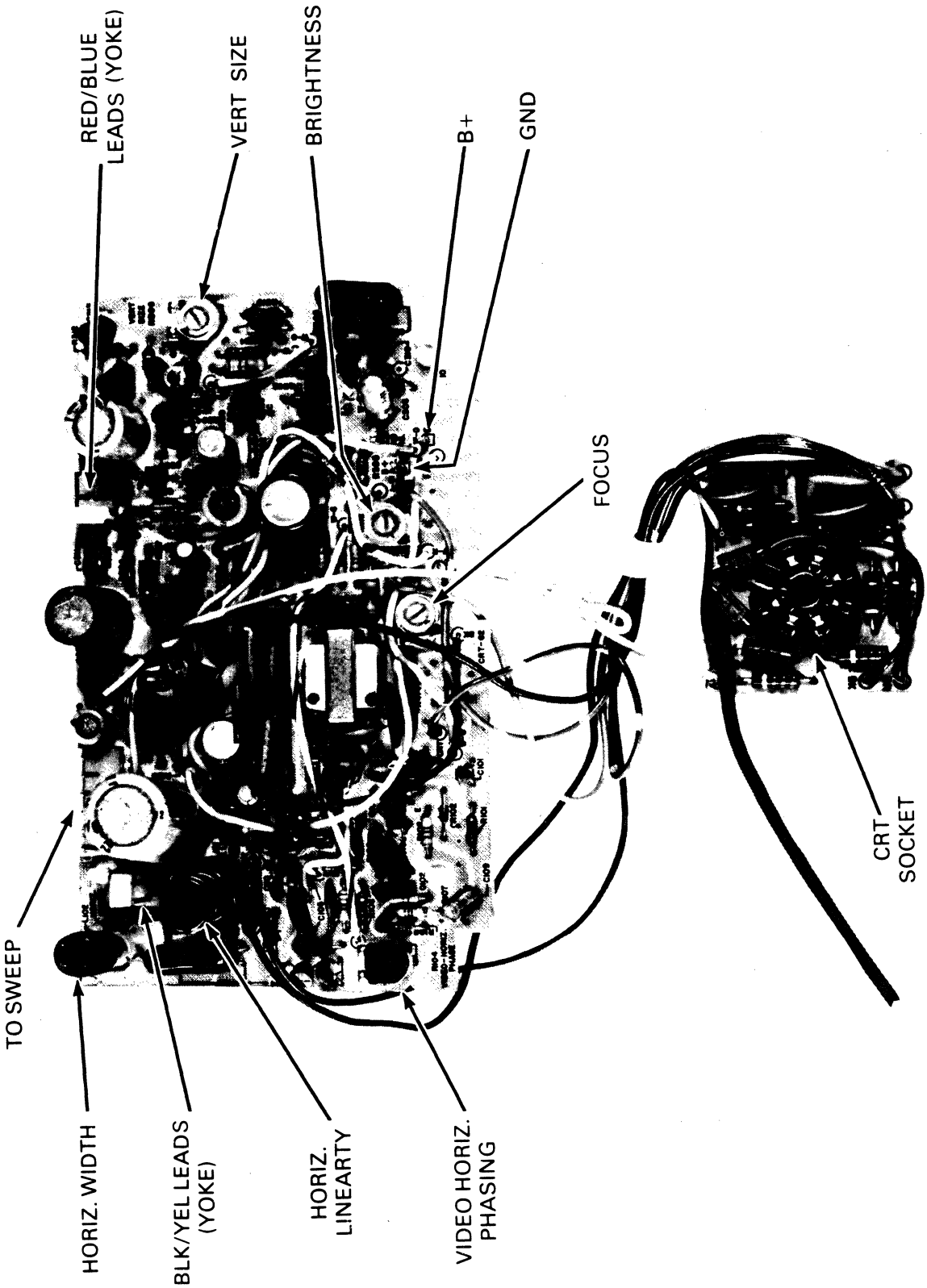


Figure III-2-1. Zenith Video Board and CRT Socket

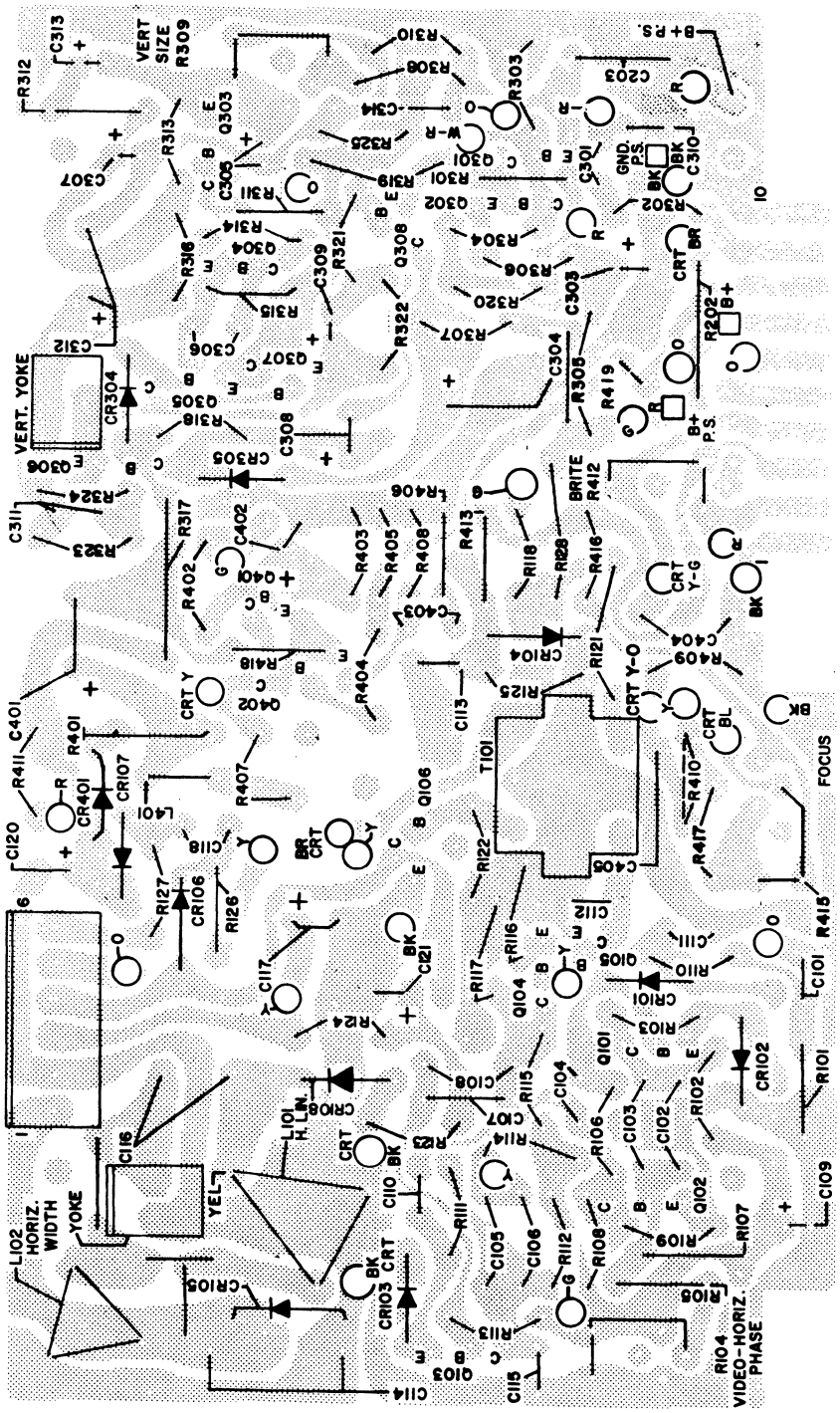
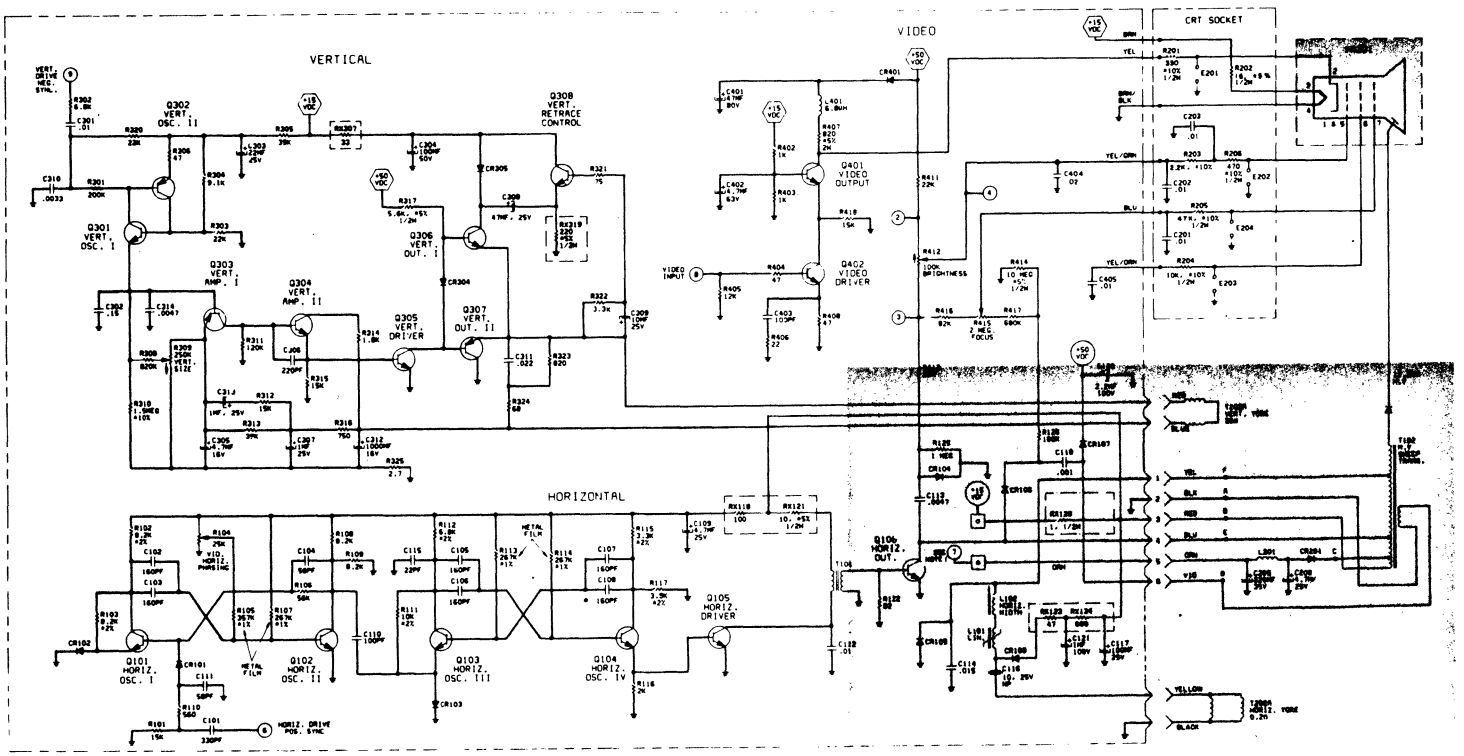
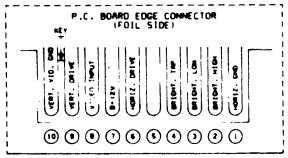


Figure III-2-2. Zenith Component Locations

D12 VIDEO DISPLAY 15.7KHz





= DC VOLTAGE SOURCE

= DC VOLTAGE APPLIED

NOTE : CUSTOMER SUPPLIED EXTERNAL DC SOURCE ON PIN 7 EDGE CONNECTOR

*C108 IS 130PF ON I200/I400
C108 IS 100PF ON I100/I101

IMPORTANT SAFETY NOTICE

When servicing this chassis, under no circumstances should the original design be modified or altered without permission from the Zenith Radio Corporation. All components should be replaced only with types identical to those in the original circuit. Special components are used to prevent shock and fire hazard. These critical components are shaded on the schematic and parts list for easy identification.

This circuit diagram may occasionally differ from the actual circuit used. This way, implementation of the latest safety and performance improvement changes into the set is not delayed until the new service literature is printed.

IMPORTANT SAFETY NOTICE

FOR X-RADIATION, FIRE OR SHOCK HAZARD PREVENTION, CERTAIN SPECIAL OR REDUNDANT PARTS ARE USED. USE ONLY EXACT REPLACEMENTS. DO NOT ALTER THE CIRCUIT OR DEFEAT THE FUSES. FAILURE TO COMPLY MAY BE UNLAWFUL.

Figure III-2-3. Zenith D-12 Schematic

ZENITH MONITOR,		GTC PART NO
D12 SERIES	(Specify Zenith)	2830-003

COMPONENTS

SYMBOL		GTC PART NO
FRAME, CHASSIS GT-100		03374-G01
FRAME, CHASSIS GT-400		99999-218
PICTURE TUBE, CRT; White V1		99999-158
PICTURE TUBE, CRT; Green V1		99999-213
TRANSFORMER,		
DEFLECTION YOKE	Tx202	040009-001
HI-VOLTAGE, SWEEP	Tx201	050010-001
CRT SOCKET BOARD ASSEMBLY		

CAPACITORS:

SYMBOL	VALUE*	VOLTAGE	MATERIAL	%TOL	GTC PART NO
C201	0.01	500	DISC	+80-20	01008-155
C202	0.01	500	DISC	+80-20	01008-155
C203	0.01	500	DISC	+80-20	01008-155

* in micro farads

RESISTORS:

SYMBOL	VALUE*	WATTAGE	MATERIAL	%TOL	GTC PART NO
R201	330	1/2	FCC	5	01009-118
R203	2.2K	1/2	FCC	10	01009-197
R204	10K	1/2	FCC	10	01009-198
R205	47K	1/2	FCC	10	01009-199
R206	470	1/2	FCC	10	01009-200

* In ohms

PINCUSSION ADJUSTING MAGNETS

ORANGE £1	99999-268
SMALL YELLOW £2	99999-269
SILVER £3	99999-270
GREEN £4	99999-271
YELLOW £5	99999-272
PRINTED CIRCUIT BOARD ASSEMBLY	03452-003
PRINTED CIRCUIT BOARD ASSEMBLY COMPONENTS	03452-003

CAPACITORS:

SYMBOL	VALUE	VOLTAGE	MATERIAL	%TOL	GTC PART NO
C101	330pf	50	DISC	20	01008-040
C102	160pf	50	DISC	5	01008-129
C103	160pf	50	DISC	5	01008-129
C104	56pf	50	DISC	10	01008-130
C105	160pf	50	DISC	5	01008-129
C106	160pf	50	DISC	5	01008-129
C107	160pf	50	DISC	5	01008-129
C108	160pf	50	DISC	5	01008-129
C109	4.7	25	LYTIC	+100-10	01008-131
C110	560pf	50	DISC	10	01008-132
C111	56pf	50	DISC	10	01008-130
C112	0.01	50	DISC	20	01008-078
C113	0.0047	500	DISC	10	01008-133
C114	0.022	400	POLY	5	01008-154
C115	22pf	50	DISC	10	01008-134
C116	10	25	LYTIC	20	01008-135
C117	100	35	LYTIC	20	01008-136
C118	0.001	1000	DISC	10	01008-109
C120	2.2	100	LYTIC	20	01008-137
C121	1	100	LYTIC	20	01008-138
C122**	560pf	50	DISC	10	01008-139
C123	560pf	50	DISC	10	01008-139
C301	0.01	50	DISC	10	01008-140
C302	0.15	50	POLY	10	01008-141
C303	22	25	LYTIC	+100-10	01008-142
C304	100	50	LYTIC	20	01008-143
C305	4.7	16	LYTIC	10	01008-144
C306	l50pf	50	DISC	10	01008-145
C307	1	25	LYTIC	20	01008-146
C308	47	25	LYTIC	20	01008-104
C309	10	25	LYTIC	+100-10	01008-105
C310	0.0039	50	DISC	20	01008-147
C311	0.01	50	DISC	10	01008-140
C312	1000	16	LYTIC	10	01008-148
C313	1	25	LYTIC	20	01008-146
C314	0.0047	50	DISC	20	01008-149
C401	47	100	LYTIC	20	01008-150
C402	4.7	63	LYTIC	20	01008-151
C403	100pf	50	DISC	10	01008-001
C404	0.02	500	DISC	+80-20	01008-152
C405	0.01	1000	DISC	+40-10	01008-153

* in micro farads unless otherwise noted.
** C122 soldered across R109

RESISTORS:

SYMBOL	VALUE*	WATTAGE	MATERIAL	%TOL	GTC PART NO
R101	15k	1/4	FCC	5	01009-089
R102	8.2k	1/4	FFC	2	01009-157

R103	8.2k	1/4	FFC	2	01009-157
R104	25k	1/8	VCC	20	01009-158
R105	357k	1/4	MF	1	01009-159
R106	56k	1/4	FFC	5	01009-160
R107	267k	1/4	MF	1	01009-161
R108	8.2k	1/4	FCC	5	01009-086
R109**	8.2k	1/4	FCC	5	01009-086
R110	560	1/4	FCC	5	01009-054
R111	5.1k	1/4	FFC	2	01009-164
R112	3.3k	1/4	FFC	2	01009-165
R115	3.3k	1/4	FFC	2	01009-165
R116	2k	1/4	FFC	5	01009-074
R117	3.9k	1/4	FFC	2	01009-167
R118	100	1/4	FFC	5	01009-168
R121	10	1/4	FCC	5	01009-048
R122	82	1/4	FFC	5	01009-170
R123	100	1/4	FFC	5	01009-168
R124	680	1/4	FCC	5	01009-055
R126	100k	1/4	FCC	5	01009-098
R202	16	1/2	FCC	5	01009-142
R301	200k	1/4	FFC	5	01009-172
R302	6.8k	1/4	FCC	5	01009-084
R303	22K	1/4	FFC	5	01009-091
R304	9.1k	1/4	FFC	5	01009-175
R305	39k	1/4	FCC	5	01009-094
R306	47	1/4	FFC	5	01009-177
R307	33	1/4	FFC	5	01009-267
R308	820k	1/4	FFC	5	01009-178
R309	250k	1/8w	VCC	20	01009-179
R310	1.5meg	1/4	FFC	10	01009-180
R311	120k	1/4	FCC	5	01009-099
R312	27k	1/4	FCC	5	01009-092
R313	39k	1/4	FCC	5	01009-094
R314	1.8k	1/4	FFC	5	01009-073
R315	15k	1/4	FCC	5	01009-089
R316	1k	1/4	FCC	5	01009-070
R317	5.6k	1/2	FCC	5	01009-185
R319	220	1/2	FFC	5	01009-128
R320	22k	1/4	FCC	5	01009-091
R321	75	1/4	FFC	5	01009-186
R322	3.3k	1/4	FFC	2	01009-165
R323	1.1k	1/4	FFC	5	01009-187
R324	68	1/4	FFC	5	01009-188
R325	2.7	1/4	FFC	5	01009-189
R402	1k	1/4	FFC	5	01009-070
R403	1k	1/4	FFC	5	01009-070
R404	47	1/4	FFC	5	01009-177
R405	12k	1/4	FCC	5	01009-088
R406	22	1/4	FFC	5	01009-191
R407	820	2	FFC	5	01009-192
R408	47	1/4	FFC	5	01009-177
R411	15k	1/4	FCC	5	01009-089
R412	100k	1/8	VCC	20	01009-193
R413	15k	1/4	FFC	5	01009-228
R415	2meg	1/8	VCC	20	01009-194
R416	68k	1/4	FCC	5	01009-096
R417	680k	1/4	FFC	5	01009-196
R418	15k	1/4	FCC	5	01009-089

* in OHMS unless otherwise noted.
** C122 soldered across R109

DIODES:

SYMBOL	TYPE	GTC PART NO
CR101	ZEN SPCIAL	01007-028
CR102	ZEN SPCIAL	01007-028
CR103	ZEN SPCIAL	01007-028
CR104	ZEN SPCIAL	01007-029
CR105	ZEN SPCIAL	01007-030
CR106	ZEN SPCIAL	01007-031
CR107	ZEN SPCIAL	01007-032
CR108	ZEN SPCIAL	01007-033
CR109	ZEN SPCIAL	01007-028
CR304	ZEN SPCIAL	01007-028
CR305	ZEN SPCIAL	01007-033
CR401	ZEN SPCIAL	01007-033

TRANSISTORS:

SYMBOL	P/N GENERIC	TYPE	GTC PART NO
Q101	ZEN SPCIAL	NPN	01006-042
Q102	ZEN SPCIAL	NPN	01006-042
Q103	ZEN SPCIAL	NPN	01006-042
Q104	ZEN SPCIAL	NPN	01006-042
Q105	ZEN SPCIAL	NPN	01006-043
Q106	ZEN SPCIAL	NPN	01006-044
Q301	ZEN SPCIAL	NPN	01006-042
Q302	ZEN SPCIAL	PNP	01006-045
Q303	ZEN SPCIAL	PNP	01006-045
Q304	ZEN SPCIAL	NPN	01006-042
Q305	ZEN SPCIAL	PNP	01006-046
Q306	ZEN SPCIAL	NPN	01006-043
Q307	ZEN SPCIAL	PNP	01008-047
Q308	ZEN SPCIAL	NPN	01006-043
Q401	ZEN SPCIAL	PNP	01006-048
Q402	ZEN SPCIAL	PNP	01006-049

TRANSFORMERS:

SYMBOL	TYPE	GTC PART NO
TX101	HORIZ. DRIVER	050009-001

COILS:

SYMBOL	VALUE	TYPE	GTC PART NO
L101	---	LINEARITY ADJUSTMENT	040010-001
L102	---	WIDTH ADJUSTMENT	040011-001
L401	6.8uH	- - - -	040012-001

This page intentionally left blank.

SECTION 1
GENERAL INFORMATION

1.1 GENERAL DESCRIPTION

The AK-12K is a high-reliability and high-performance CRT Alphanumeric Display Monitor specifically designed for use in computer terminals and similar information display systems. All components are mounted on a single printed circuit board and chassis. The monitor has been designed to accept separate horizontal drive, vertical drive, and video signals at TTL levels. See Figure IV-1-1.

1.2 ELECTRICAL CHARACTERISTICS

Video Signal

Signal Polarity	Positive pulse
Input impedance	
Resistive	2K Ohm minimum
Capactive	47 pf maximum
Voltage levels	
Low (black)	0.0 to + 0.4 volts
High (white)	+2.5 to +5.5 volts
Pulse width	50 nano seconds minimum
Rise and Fall times	less than 35 nano seconds
Storage time	15 ns maximum
Bandwidth	20 MHZ ' -3DB minimum

Horizontal Drive

Signal polarity	Positive
Input impedance	
Resistive	10K Ohm minimum
Capacitive	40pf maximum
Voltage levels	
High	+2.5 to +5.5 volts
Low	0.0 to 0.4 volts
Pulse Width	3 to 23 uSec.
Pulse Repetition Rate	15,250 to 16,250
Rise & Fall times	less than 50 nano seconds

Vertical Drive

Signal Polarity	Negative
Input Impedance	
Resistive	1.8K Ohm minimum
Capacitive	40pf maximum
Voltage Levels	
High	+2.5 to 5.5 volts
Low	0.0 to +0.4 volts
Pulse width	300 micro seconds to 1 ms
Pulse Repetition Rate	47 to 63 HZ
Rise and Fall times	Less than 100 nano seconds

1.3 POWER REQUIREMENTS

Input voltage	15VDC + .5VDC
Input Current	700MA DC Nominal 1.15ADC max.
Ripple	100mv p-p

1.4 ENVIRONMENTAL SPECIFICATIONS

Temperature	
Operating Range	+5 C to +55 C
Storage Range	-40 C to +65 C
Humidity	0% to 80% (non-condensing)
Altitude	up to 10,000 feet

1.5 INTERFACE

All interface signals are compatible with DTL/TTL integrated circuit logic.

Power, signal, and control lines enter the unit by means of the 10-pin printed circuit edge connector shown in Figure IV-4-4.

The Horizontal Return and Vertical Return are tied together at the connector.

Pin	Description
1	Horiz Return (1)
2	Not used
3	Not used
4	Not used
5	Not used
6	Horizontal Drive
7	DC Power Supply Input
8	Video
9	Vertical Drive
10	Vertical Return (1)

1.6 CONTROLS AND ADJUSTMENTS

PC Board Mounted

Brightness	Screwdriver adjust
Vertical Height	"
Vertical Hold	"
Vertical Linearity	"
Focus	"
Horizontal Size	Plastic hex tool

External to PC Board

Centering magnets on Yoke	Hand adjust
Brightness Control -	GTC Models-GTX, GT-200, GT-400
Contrast Control -	GTC Models-GTX, GT-200, GT-400

1.7 PERFORMANCE PARAMETERS

Scan Characteristics

Vertical Retrace Time - 900 usec max.
Horizontal Retrace Time - 9 usec max.
Horizontal Delay Time - 2 usec max.

Linearity

Using the largest dimension of any 20% smaller in height or width. In addition, adjacent characters shall not differ in height or width by more than 10 percent.

1.8 SAFETY STANDARDS

X-Ray Radiation

Less than 0.5 mR/H @ maximum high voltage (meets DHEW rules - 21-CFR-Subchapter J).

Underwriters Laboratories

Recognized per UL 478 - (standard for Electronic Data Processing Units and Systems).

Canadian Standards Association awaiting recognition.

Section 2
INSTALLATION OPERATING PROCEDURES

2.1 GENERAL

Service Adjustments

The monitor should not normally require adjustments to these controls. If it does, however, the following are the procedures to follow:

2.2 VERTICAL ADJUSTMENTS

a. Set the vertical hold control R20 so that the monitor stops rolling. Continue travel of vertical hold control another 1/4 turn.

b. Adjust vertical size control R22 to approximate desired height.

c. Adjust vertical linearity control R26 for best vertical linearity.

d. Readjust vertical size control for desired height, if necessary.

2.3 CENTERING

If the raster is not properly centered, it may be repositioned by rotating the ring magnets behind the deflection yoke, it should be noted that excessive movement of the ring magnets may distort character display geometric alignment. If the picture is tilted, rotate the entire yoke. Adjustment of centering is done by reducing the horizontal width using width coil L1, until both edges of the raster are visible, then using the centering rings center the raster on the screen.

2.4 HORIZONTAL ADJUSTMENTS

Adjust the horizontal width coil (L1) for the desired width.

The width coil should only be adjusted with the proper plastic hex tool. Adjustment with other improper devices may damage brittle ferrite coil slug.

No horizontal linearity control is used.

2.5 FOCUS ADJUSTMENTS

The focus control R36 provides an adjustment for maintaining best overall display focus. In general, whenever the display center is set for sharpest focus, the display corners are significantly defocused. For best overall results the display center should be slightly defocused.

Section 3
THEORY OF OPERATION

3.1 VIDEO AMPLIFIER

Positive video pulses are applied at pin 8 of the PCB edge connector through the contrast control. Video is then applied to the base of Q1 through R1. Q1 operates as a class B amplifier with a gain of about 15 and remains cut off until a DC-coupled positive going signal of at least 0.7v in amplitude arrives at its base. R3 provides series feedback which stabilizes the voltage gain against initial transistor variations as well as transistor variations caused by ambient temperature changes. C1 bypasses the AC signal around the bias network.

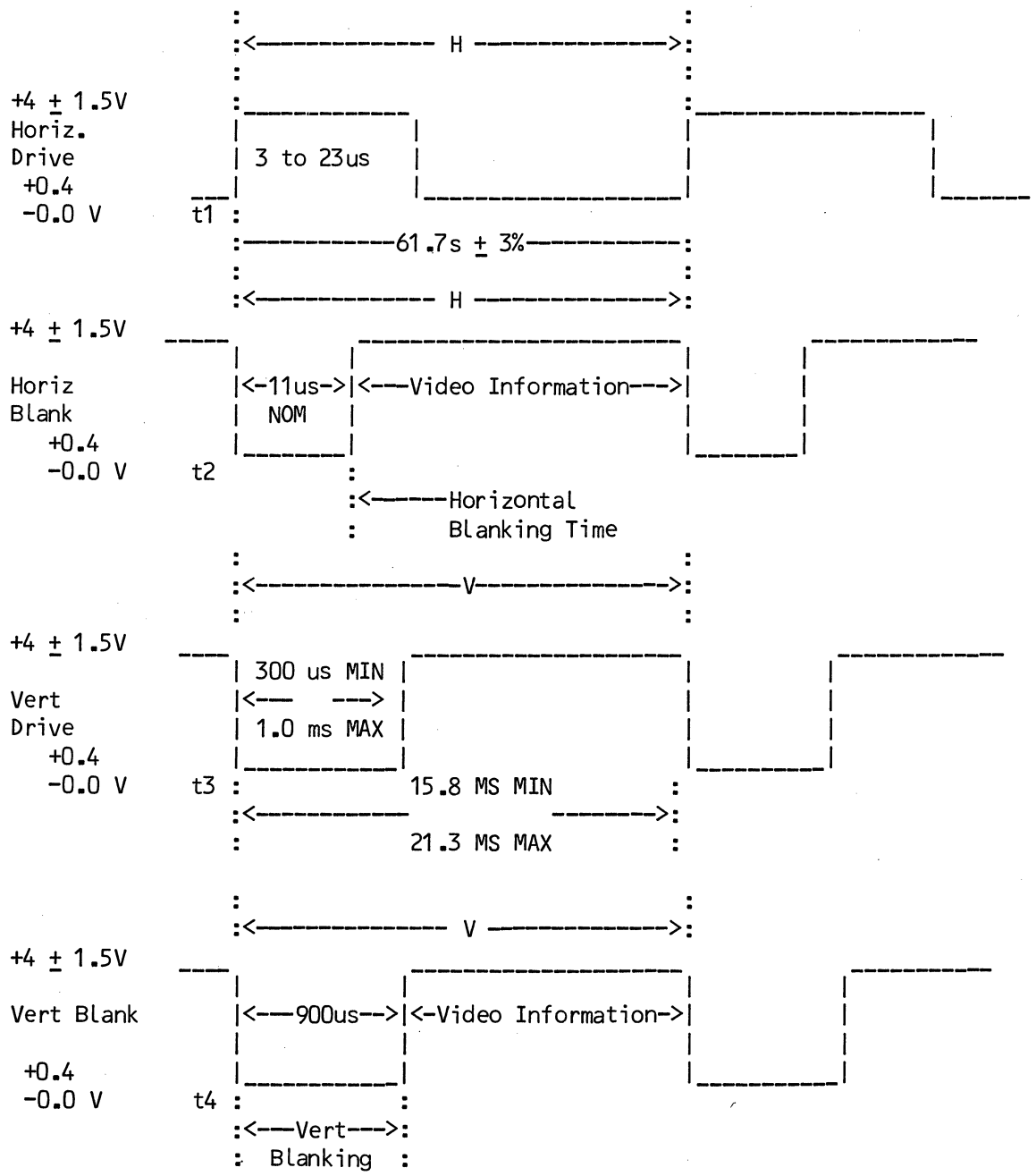
The negative going signal at the collector of Q1 is DC-coupled through R4 to the cathode of the CRT. The video amplifier allows a greater than 30v video drive signal for maximum available contrast ratio.

The overall brightness at the screen of the CRT is determined by the negative potential at grid £1 and is varied by the brightness control, R41.

3.2 VERTICAL DEFLECTION

Negative vertical sync is applied at pin 9 of the PCB edge connector through R17, where it is inverted by switch Q2. Q2 also serves to buffer and impedance transform the input signal for use by vertical processor M1. M1 is a silicon monolithic integrated circuit in a 12 lead quad in line plastic package designed to provide the necessary current through the yoke to vertically deflect the beam. M1 is made up of a stable oscillator, a voltage ramp generator, a flyback generator, and a high power output amplifier. Also included is an internal stabilized power supply to make the output independent of power supply variations. R20, R21, and C12 control the frequency of the internal oscillator which is set at a somewhat lower frequency than the vertical sweep frequency. Vertical sync pulses at M1 pin 9 synchronize the internal oscillator. The internal ramp generator is connected between pins 7 and 12. The ramp amplitude, and thus the output current ramp amplitude, is controlled by R23, R22, C14 and C15. Resistors R24, R25, and R26, along with an internal buffer amplifier connected between pins 12 and 1, serve to modify the normally linear ramp produced at pin 12 to an "S" shaped ramp. This is necessary because a linear ramp would produce stretching at the top of the screen and compression at the bottom. The modified ramp voltage also appears at pin 1, which through R31 provides an input to the differential feedback power amplifier.

The power amplifier is connected between pins 10 and 4. The output current of the amplifier flows through the vertical yoke and Resistor R33. The voltage drop in R33 is compared at pin 10 (high impedance summing point), with the voltage at pin 1 by means of Resistors R31 and R32, on which the gain depends. The DC voltage at pin 4 is determined by R29, R30, and R32, and is set to approximately 5V. The output stage, operating as a class A amplifier, consists of an npn darlington for currents flowing into the load and a pnp-npn combination for currents flowing out of the load. During flyback, a voltage greater than twice the power



NOTES:

1. t1 and t3 initiate horizontal and vertical retrace respectively.
2. H = time from start of one line to start of next line.
3. V = time from start of one field to start of next field.
4. Video pulse width should be equal to or greater than 50ns.

Figure IV-1-1 Sync and Blanking Waveforms

supply voltage is applied by an internal flyback generator to pin 4, and thus the yoke. Since this voltage is much greater than that applied during scan, the flyback time becomes sigificantly shorter than scan time, with very little associated power dissipation. C16 and R27 are used to frequency compensate the feedback power amplifier.

The flyback generator is connected between pins 3 and 5. During scan, pin 3 is at ground and C13 is charged to +15V. During flyback, +15V is suddenly applied to pin 3, consequently raising pin 5 to +30V. This voltage is then applied to the power amplifier output to affect the required short flyback times.

3.3 HORIZONTAL DEFLECTION

The positive going horizontal sync pulse is applied to pin 6 of the PCB edge connector. The sync signal is then applied to two sections of the quad comparator M2, through R43. The two sections of M2 serve as a one-shot multivibrator which triggers on the positive leading edge and sets the positive pulse width of the sync signal to 25 microseconds. The width of this pulse is controlled by R6, R7, R8, and C3.

Q3 and T1 make up a driver stage to provide proper drive pulses to horizontal output transistor Q4. The drive stage is either cut off or driven into saturation by the base signal which is the delayed sync signal. The output signal appears as a rectangular waveform and is transformer coupled to the base of Q4. The polarity of the voltage at the secondary of T1 is chosen such that Q4 is cut off when Q3 conducts and vice versa.

The horizontal output stage has five main function; to supply the yoke with the correct horizontal scanning current; develop 400V for CRT grid £2 bias and focus voltage; develop +40V for the video output stage; develop -150V for CRT grid £1 bias; and develop the high voltage for the anode of the CRT.

Q4, the horizontal output transistor, acts as a switch which is turned on and off at a horizontal scan rate by the rectangular driving signal applied to its base. When Q4 is turned on, the supply voltage plus the charge on C9 cause yoke current to increase from zero to maximum in a direction to move the beam from near the center of the screen to the right side. At this time, Q4 is turned off by a negative voltage on its base which interrupts the current supplied to the yoke causes the output circuit to oscillate. The energy stored in the yoke inductance is then very quickly transferred to C8, causing a large positive voltage (flyback pulse) to appear at Q4 collector. During this cycle, the beam is moved from the right side to the center of the screen. As soon as the energy transfer between the yoke inductance and C8 has been completed, C8 starts returning its acquired energy back to the yoke, causing the beam to move from the center to the left side of the screen. The voltage at Q4 collector quickly falls, but is prevented from going below zero by clamp diode CR2 (part of Q4 in some devices). Once diode CR2 is driven into conduction, the large initial negative yoke current gradually decreases to zero, allowing the beam to return to the center of the screen. Q4 is then turned on again, repeating the cycle.

L1 is an adjustable width control placed in series with the hoizontal deflection coils. The variable inductance allows a greater or lesser amount of deflection current to flow in the yoke and, thus, varies the width of the horizontal scan. L3 is a factory adjusted, magnetically biased, linearity coil which shapes the deflection current for optimum trace linearity. The yoke contains internal resistance which would cause a stretching at the left and compression at the right if a linear sawtooth current were to pass through it. The linearity coil compensates for these system losses.

The positive flyback pulse developed during horizontal retrace time is transformer-coupled to the secondary of transformer T2, where it is rectified by CR8, CR3, CR4, and CR5 to provide the various operating voltages required by the CRT.

R39, CR6, and C25 serve to discharge the high voltage anode capacitance quickly upon power turn-off by increasing the beam current. R13, R14, R15, C10, and two sections of quad comparator M2 serve to delay the horizontal sweep upon power-up so that it does not begin until after the vertical sweep is fully operational.

Section 4
TROUBLESHOOTING

The charts in IV-4-1, IV-4-2 and IV-4-3 will aid if determining failing components.

Section 5
SERVICE DATA

5.1 GENERAL

This section contains the replaceable electrical parts list, schematic, PWB component layout and waveforms for servicing of the Amkor AK-12K.

5.2 ORDERING PARTS

Most parts contained in the monitor are available commercially from electronic parts outlets. When it is necessary to order spare or replacement parts from GTC please indicate the Model Number of your terminal including the Part Number and Serial Number in your written or telephone request. Orders may be directed to:

GENERAL TERMINAL CORPORATION
14831 Franklin Avenue
Tustin, CA 92680
(714) 730-0123
(800) 854-6925

Full servicing is available for either your complete terminal, the monitor module or printed circuit assembly. Prior to return you should call Field Service at the following number for a return authorization. East of Mississippi River: 800-225-0976. West of the Mississippi River: 800-854-6985. Unnecessary delays may be avoided when items are returned to GTC for repair using the following procedures:

1) Package the unit or part in accordance with safe shipping practices. Enclose a list of the material being returned and the reason for returning it. Enclose your return authorization number!

2) Send the unit or part, transportation prepaid, to the address stipulated for returning parts.

All warranty repairs will be made provided examination discloses that the defects are within the limits of the warranty. If damages or defects are not within the limits of the warranty, the customer will be notified of the extent of repairs required and the cost. The unit will be repaired and returned upon agreement.

5.3 WAVEFORMS

The waveforms on the component layout were taken with 1.5 V peak to peak crosshatch signal applied to the monitor. These waveforms can be used as a check point to localize problems to a specific circuit area. The waveforms indicate the actual peak amplitude for each test point. See Figure IV-5-1.

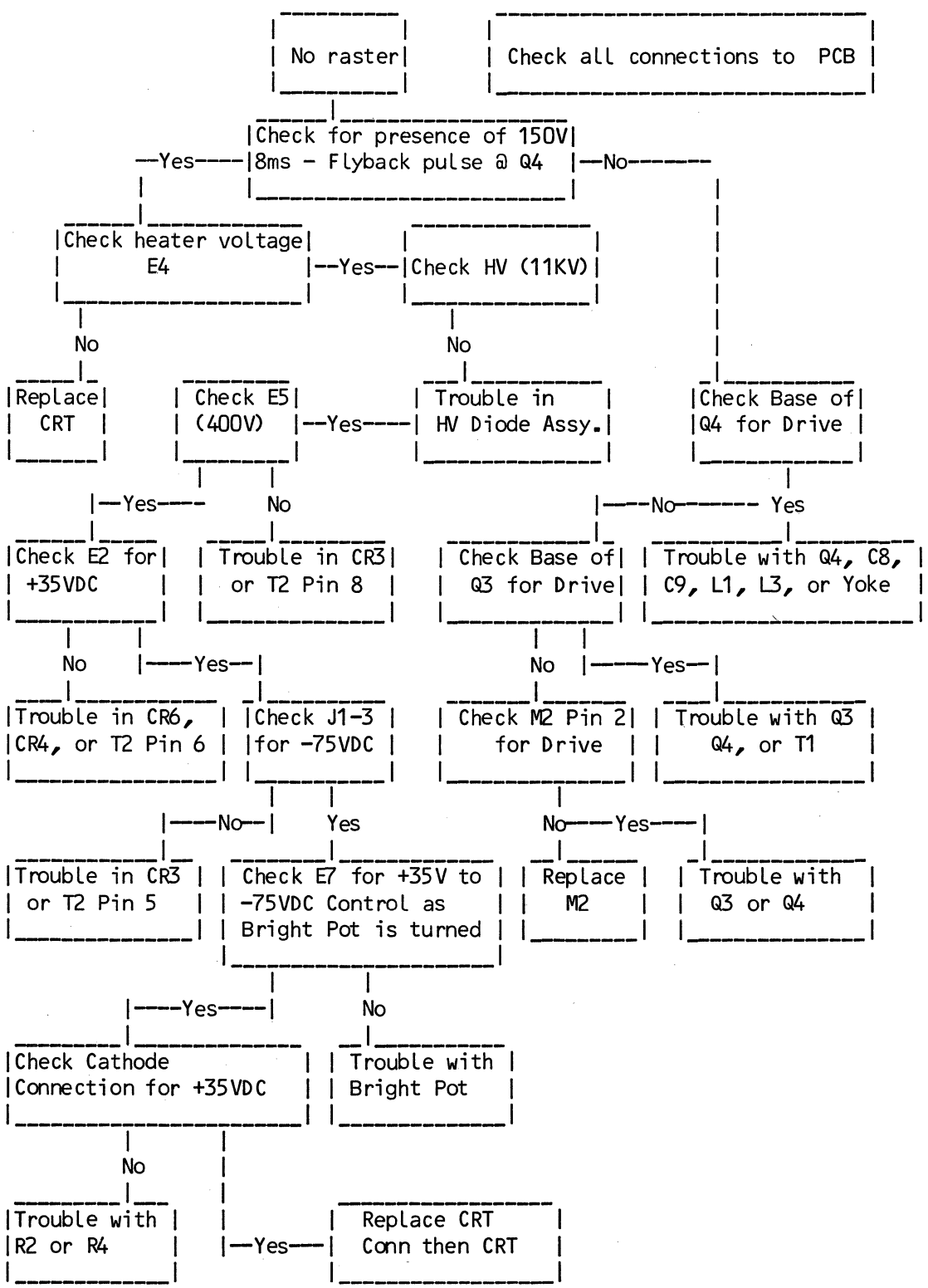
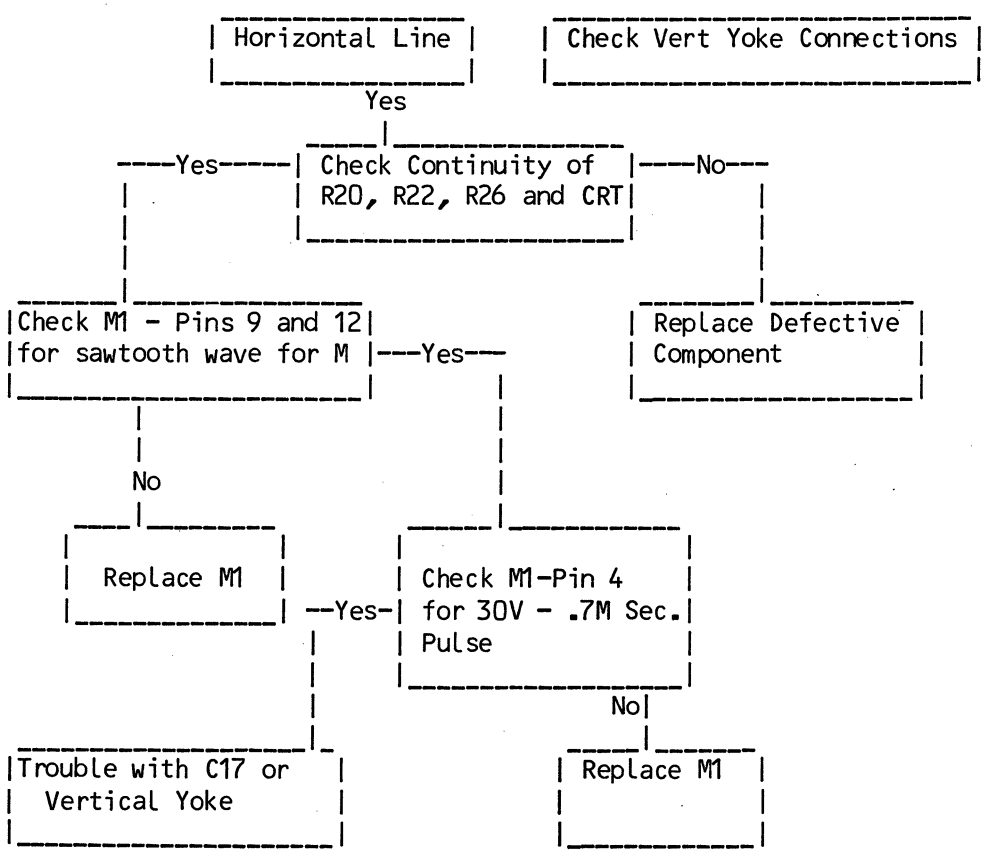


Figure IV-4-1. Horizontal Trouble Shooting Guide



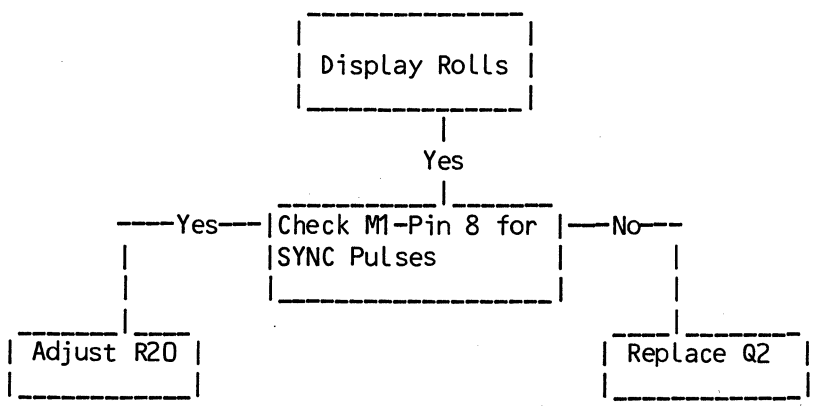
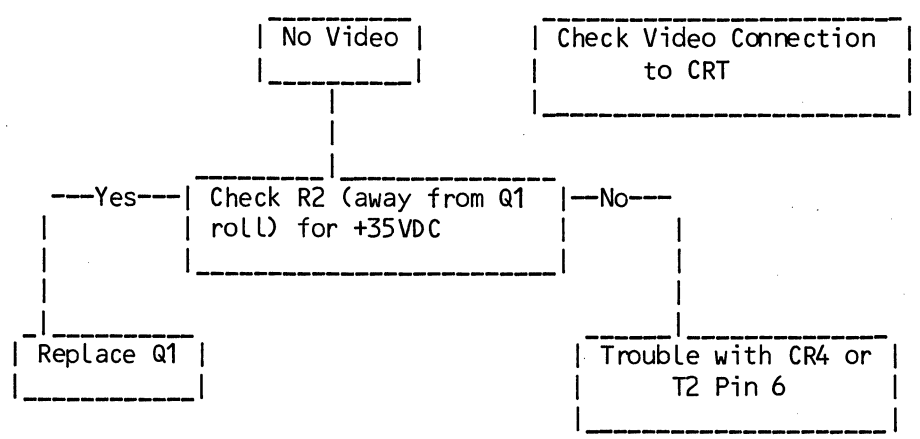


Figure IV-4-2. Vertical Trouble Shooting Guide



NOTE: Always check for proper input signals at the PCB edge connector before any further trouble shooting procedures are attempted.

Always discharge the anode of the CRT to chassis before removing HV connector.

Figure IV-4-3. Video Trouble Shooting Guide

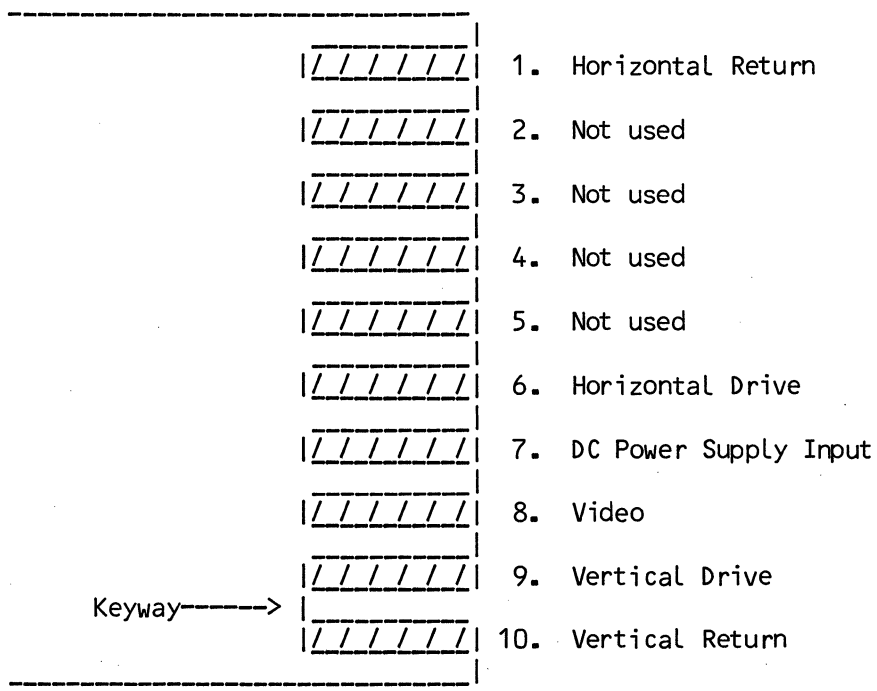


Figure IV-4-4. Edge Connector

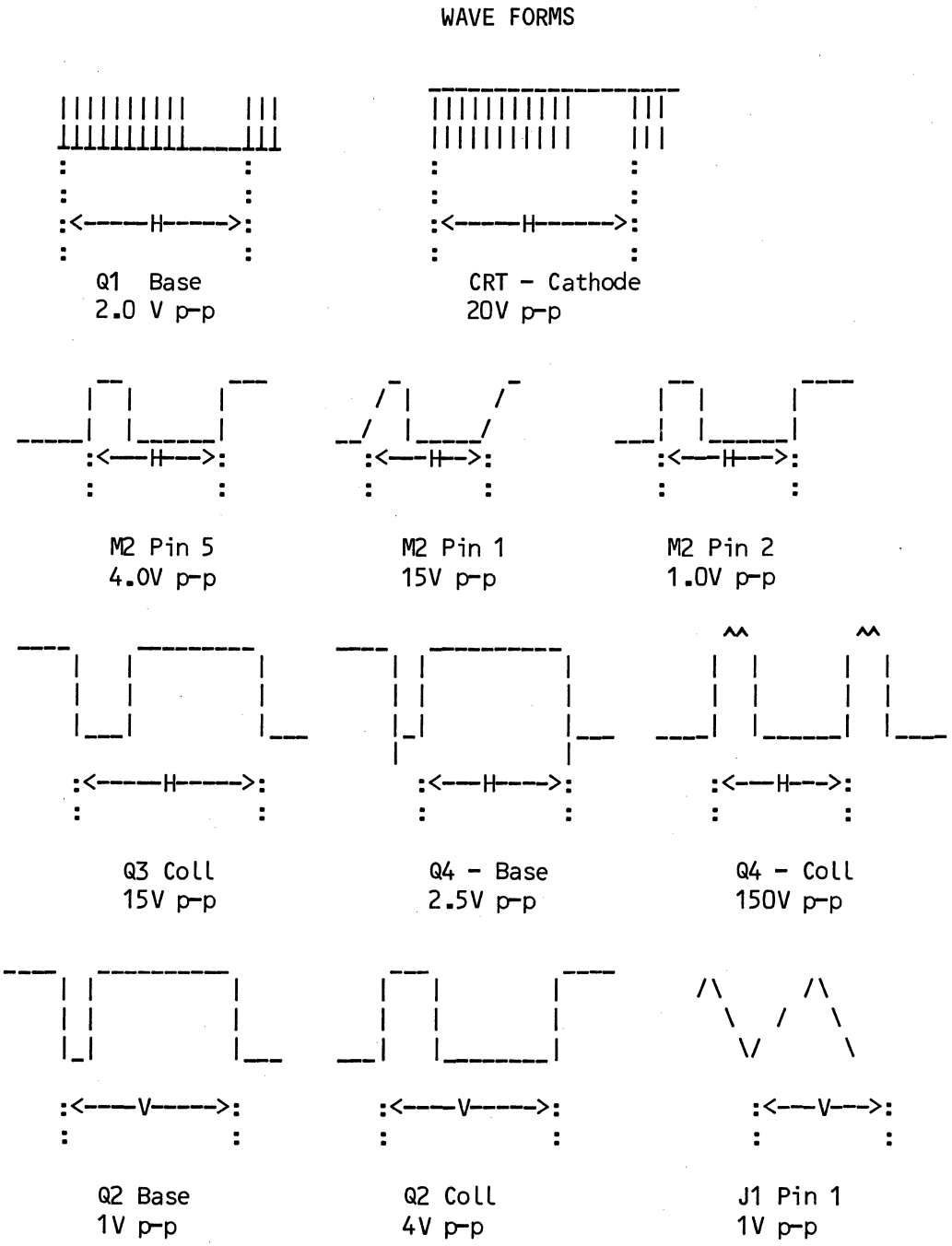


Figure IV-5-1. Waveforms

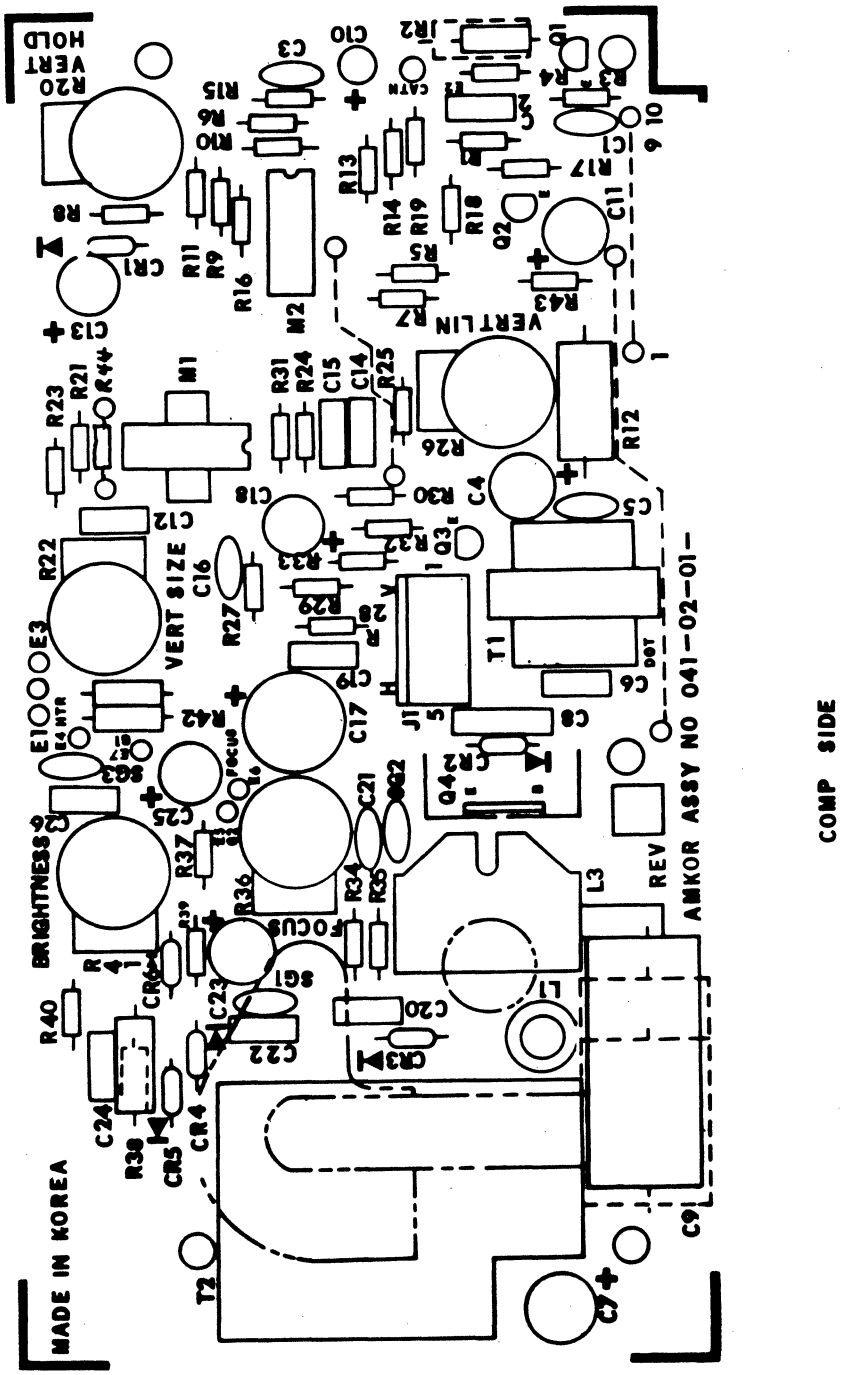


Figure IV-5-2. AMKOR AK-12K Component Locations

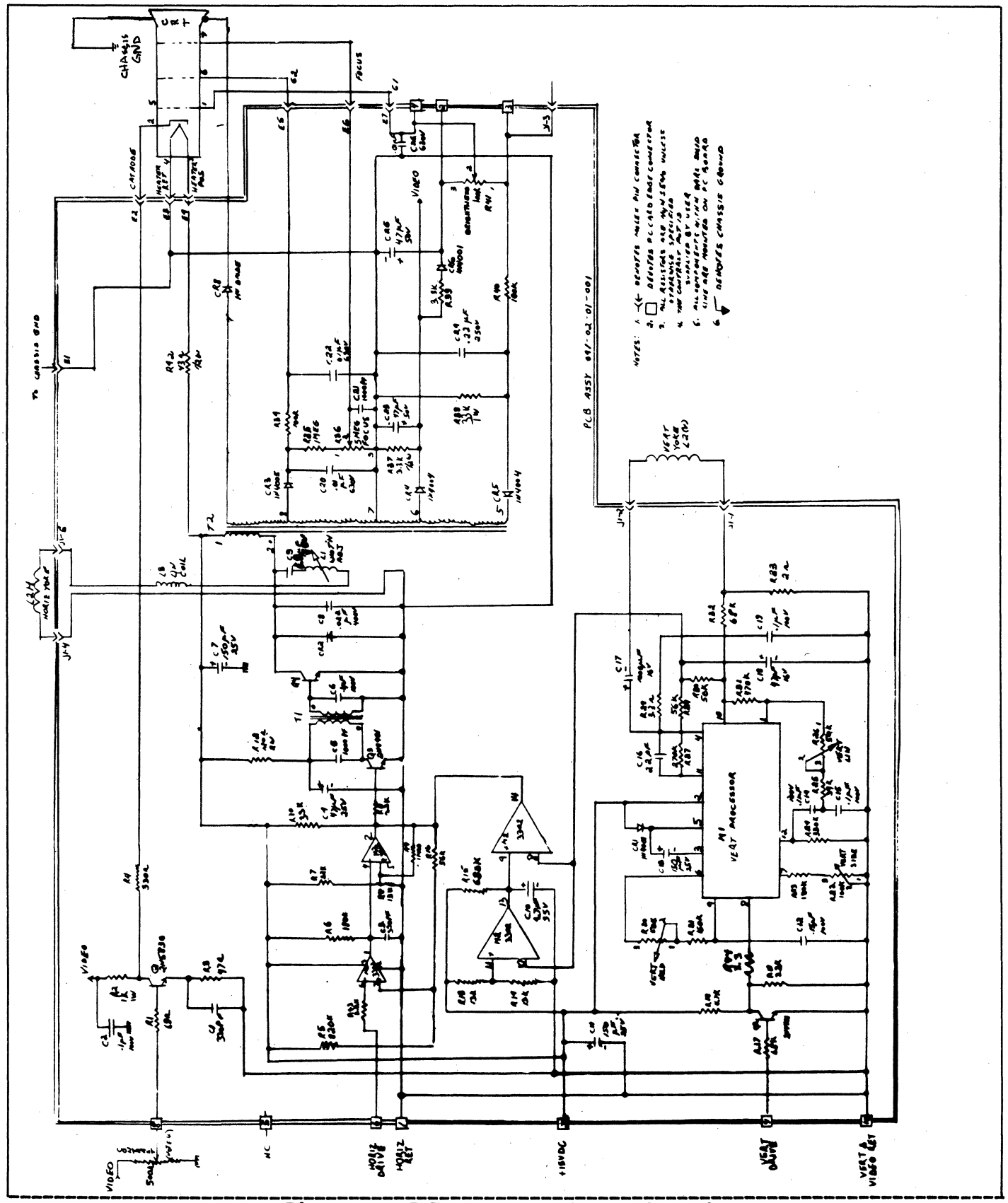


Figure IV-5-3 AMKOR AK-12K Schematic

AMKOR MONITOR AK-12K KIT GTC PART NO 02830-003

COMPONENT	SYMBOL	GTC PART NO
FRAME, CHASSIS GT-100		03374-G01
FRAME, CHASSIE GT-400		99999-218
PICTURE TUBE, CRT; White	V1	99999-158
PICTURE TUBE, CRT; Green	V1	99999-213
YOKE	L2	040018-001
TRANSFORMER	T2	050014-001
PINCUSSION ADJUSTING MAGNETS		
ORANGE £1		99999-268
SMALL YELLOW £2		99999-269
SILVER £3		99999-270
GREEN £4		99999-271
YELLOW £5		99999-272
PRINTED CIRCUIT BOARD ASSEMBLY (Component parts listed below)		03452-005

CAPACITORS:

SYMBOL	VALUE*	VOLTAGE	MATERIAL	%TOL	GTC PART NO
C1	330pf	1k	DISC	-	01008-090
C2	0.1	100	MYLAR	10	01008-190
C3	330pf	1k	DISC	-	01008-090
C4	47	25	LYTIC	-	01008-104
C5	1000pf	1000	DISC	20	01008-109
C6	0.1	100	MYLAR	10	01008-190
C7	150	25	LYTIC	-	01008-216
C8	0.022	400	MYLAR	10	01008-113
C9	7.0	200	MYLAR	10	01008-217
C10	4.7	35	LYTIC	-	01008-199
C11	150	25	LYTIC	-	01008-216
C12	0.15	100	MYLAR	10	01008-218
C13	150	25	LYTIC	-	01008-216
C14	0.1	100	MYLAR	10	01008-190
C15	0.1	100	MYLAR	10	01008-190
C16	22pf	1000	DISC	-	01008-212
C17	1000	16	LYTIC	-	01008-219
C18	47	16	LYTIC	-	01008-220
C19	0.1	100	MYLAR	10	01008-190
C20	0.01	630	MYLAR	10	01008-221
C21	1000pf	1000	DISC	20	01008-109
C22	0.01	630	MYLAR	10	01008-221
C23	47	50	LYTIC	-	01008-101
C24	0.22	250	MYLAR	10	01008-222
C25	47	50	LYTIC	-	01008-101
C26	0.01	630	MYLAR	10	01008-221

* in micro farads unless otherwise noted.

RESISTORS:

SYMBOL	VALUE*	WATTAGE	MATERIAL	%TOL	GTC PART NO
R1	68	1/4	FFC	5	01009-249
R2	1k	1	WW	5	01009-250
R3	47	1/4	FFC	5	01009-177
R4	330	1/4	FFC	5	01009-155
R5	820k	1/4	FFC	5	01009-178
R6	180k	1/4	FFC	5	01009-239
R7	22k	1/4	FFC	5	01009-091
R8	13k	1/4	FFC	5	01009-240
R9	1meg	1/4	FFC	5	01009-111
R10	3.3k	1/4	FFC	5	01009-230
R11	3.3k	1/4	FFC	5	01009-230
R12	120	2	FCC	5	01009-262
R13	13k	1/4	FFC	5	01009-240
x14	13k	1/4	FFC	5	01009-240
R15	680k	1/4	FFC	5	01009-196
R16	56k	1/4	FFC	5	01009-160
R17	1.5l	1/4	FFC	5	01009-072
R18	4.7k	1/4	FFC	5	01009-080
R19	2.2k	1/4	FFC	5	01009-080
R21	160k	1/4	FFC	5	01009-251
R23	180k	1/4	FFC	5	01009-239
R24	330k	1/4	FFC	5	01009-252
R25	39k	1/4	FFC	5	01009-094
R27	270k	1/4	FFC	5	01009-253
R28	3.3	1/4	FFC	5	01009-254
R29	56k	1/4	FFC	5	01009-160
R30	56k	1/4	FFC	5	01009-160
R32	68k	1/4	FFC	5	01009-096
R33	2	1/4	FFC	5	01009-255
R34	100k	1/4	FFC	5	01009-098
R35	3.3k	1/4	FFC	5	01009-230
R37	3.3l	1/2	WW	5	01009-256
R38	33k	1	WW	5	01009-257
R39	3.3k	1/4	FFC	5	01009-230
R40	100k	1/4	FFC	5	01009-098
R42	43	1/2	WW	5	01009-258
R43	2.2k	1/4	FFC	5	01009-075
R44	3.3	1/4	FFC	5	01009-254

* in OHMS unless otherwise noted.

POTENTIOMETERS:

SYMBOL	VALUE*	MATERIAL	GTC PART NO
R20	50k	VCC	01019-025
R22	100k	VCC	01019-026
R26	50k	VCC	01019-025
R36	5meg	VCC	01019-027
R41	100k	VCC	01019-026

* in OHMS unless otherwise noted.

DIODES:

SYMBOL	GENERIC P/N	GTC PART NO
CR1	IN 4001	01007-007
CR3	IN 4005	01007-038
CR4	IN 4004	01007-037
CR5	IN 4004	01007-037
CR6	IN 4001	01007-007

INTEGRATED CIRCUITS:

SYMBOL	GTC PART NO
M1	01000-204
M2	01000-205

TRANSISTORS:

SYMBOL	P/N GENERIC	TYPE	GTC PART NO
Q1	2N 5830	NPN	01006-025
Q2	2N 4401	NPN	01006-054
Q3	2N 4401	NPN	01006-054
Q4	BU 407D	NPN	01006-032

TRANSFORMERS:

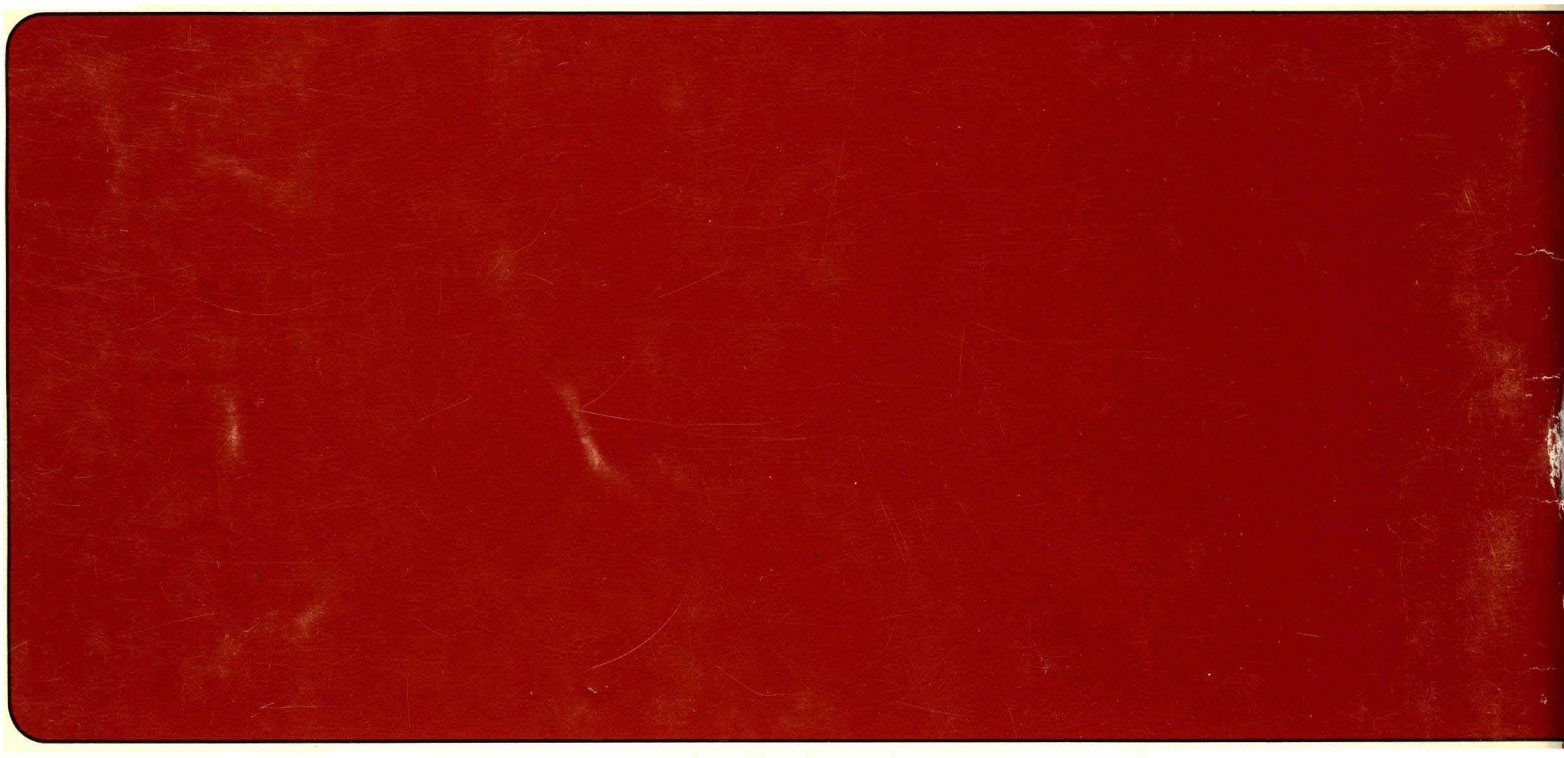
SYMBOL	TYPE	GTC PART NO
T1	BUFFER	03382-032

COILS:

SYMBOL	TYPE	GTC PART NO
L1	WIDTH ADJUSTMENT	040016-001
L3	LINEARITY ADJUSTMENT	040017-001

MISCELLANEOUS:

SYMBOL	DESCRIPTION	GTC PART NO
J1	CONNECTOR, 5-PIN WAFER	01021-125
HS1	HEAT SINK (Q4)	99999-277
	SOCKET, CRT, 7-CONTACT	01029-022
	SCREW, 6-32X1/4, PH-HD-MS	01043-001
	NUT, 6-32, HEX	01043-022
	NUT,4-40, HEX	01043-020



General Terminal Corporation

14831 Franklin Avenue
Tustin, California 92680
(800) 854-6925

Part Number
05018-001