Video Monitors inc

OPERATING MANUAL

SERVICING AND OPERATING SAFETY

GROUND THE PRODUCT SECURELY

This product is designed to be grounded through the chassis. To avoid electrical shock, extreme care should be used to ensure that the chassis is solidly grounded. Units with the AC power supply option may be grounded through the grounding connector of the power cord.

CAUTION: upon loss of the protective ground connection, all accessible conductive parts can render an electric shock.

USE THE PROPER FUSE.

To avoid fire hazard, use only those fuses of the correct type, voltage rating, and current rating as specified in the parts list for your product.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

To avoid explosion, do not operate this product in an explosive atmosphere.

DO NOT SERVICE THIS PRODUCT ALONE

Do not perform internal adjustment or service of this product unless another person capable of rendering first aid is present.

USE CAUTION WHEN SERVICING WITH THE POWER ON

Dangerous voltages are present at several points in this product. To avoid injury, do not touch exposed connections and components while the power is on.

Disconnect power before soldering or replacing components.

USE THE PROPER POWER SUPPLY

This product is designed to operate with a power supply that will supply no more than 250 volts rms between the supply conductors or between either supply conductor and ground.

A protective ground connection is essential for safe operation.

SECTION I. GENERAL INFORMATION

1.1 MONITOR DESCRIPTION

The M series monitor is a solid-state display for use in systems requiring exceptionally high quality video.

Printed circuit board construction coupled with the all solid-state circuitry provides high reliability and uniformity. Synchronization circuitry has been designed to simplify the interfacing of this monitor with users systems. Separate vertical and horizontal sync signals are used to eliminate the need for composite sync generation in the standard unit.

Composite sync is available as an option.

1.2 ELECTRICAL SPECIFICATIONS

INPUT DATA SPECIFICATIONS	VIDEO	VERTICAL SYNC	HORIZONTAL SYNC
PULSE RATE OR WIDTH	11 nsec.	49-61/sec.	See specific model details
AMPLITUDE SINGLE ENDED	Black = OV White = .7V	Low = 0 + 0.4 -0.0 Volts High = 4 ± 1.5 Volts	
ECL DIFFERENTIAL OPTIONAL	Low = - .9V High = - 1.35V		
RISE AND FALL (10% - 90%)	5 nsec. max.	100 nsec. max.	100 nsec. max.
INPUT SIGNAL	See Figure No. 1		
COMPOSITE	0.7V min. 2.0V max.	35-45% of video amplitude	

CONNECTOR SPECIFICATIONS	10 PIN Edge Card (Cinch #50-20A-30 or EQ.)	10 PIN Ribbon (ECL) (3M #3473-3000 or EQ)
HORIZONTAL SYNC	9	1
VERTICAL SYNC	10	3
VIDEO POSITIVE	1	5
VIDEO NEGATIVE	N/C	6
GROUND	AF	2,4,7,10
BRIGHTNESS POSITIVE	7	
BRIGHTNESS NEGATIVE	8	
BRIGHTNESS WIPER	6	
KEY WAY	3	
CONTRAST	2	

INPUT IMPEDANCE		MINIMUM RESISTANCE
VIDEO INPUT	Single Ended	75 Ohm or 20 K Min. Switch selectable
	ECL Input	112 Ohm Balanced
HORIZONTAL SYNC		One LS-TTL Load
VERTICAL SYNC		One LS-TTL Load

POWER REQUIREMENTS

MONITORS USING AN EXTERNAL DC POWER SUPPLY

INPUT CONNECTOR (Pin #2 is positive #1 gnd)	Molex: Receptacle #03-09-1022 02091103 - 1 ea. 02042102 - 1 ea.
INPUT VOLTAGE*	55V to 70VDC
INPUT CURRENT	See specific model

* Internal regulation is provided

MONITORS WITH INTEGRAL POWER SUPPLY

INPUT VOLTAGE	100, 120, 220, 260V RMS 50/60 Hz switch selectable
INPUT POWER	125W (Nominal) See specific model

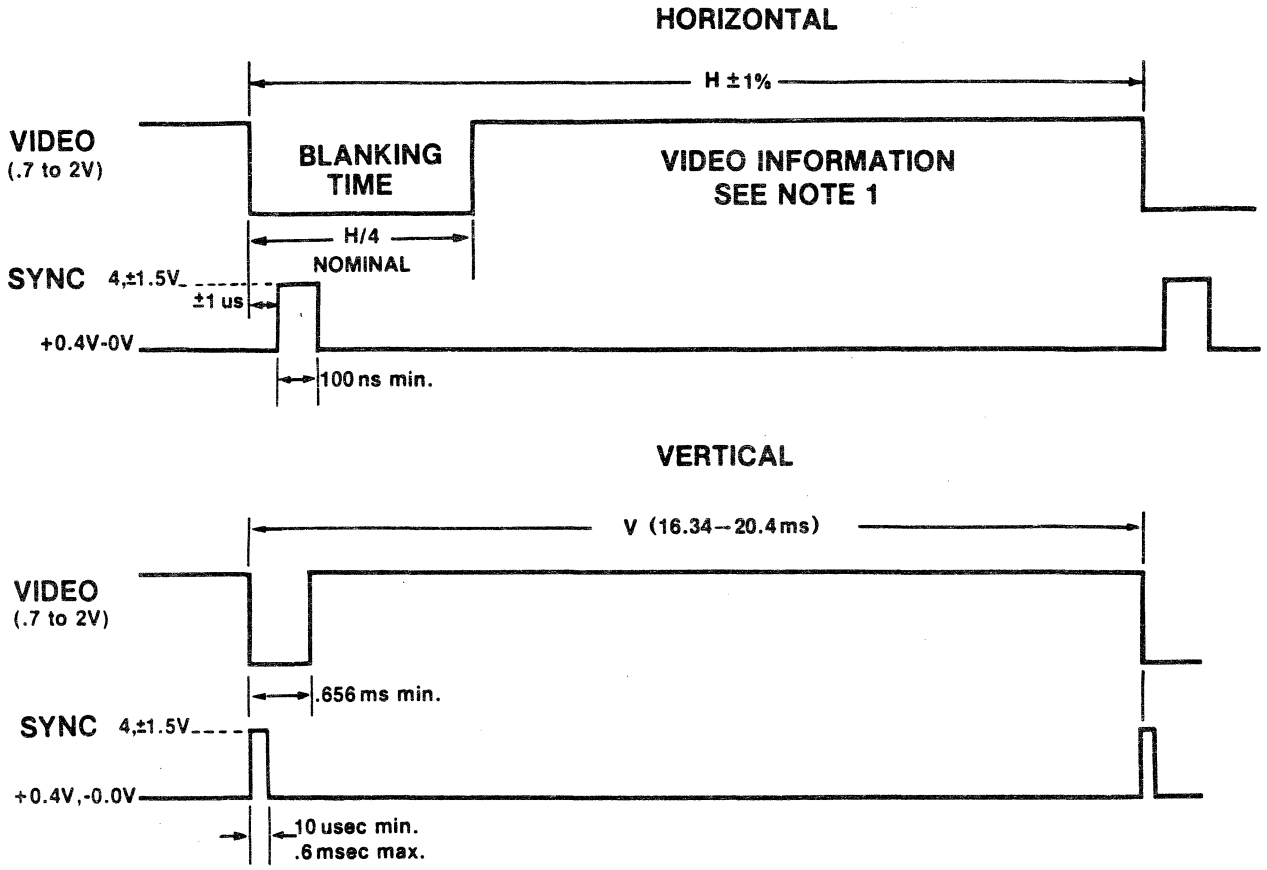
NOTE: Power transformers must be of low external flux design or well removed from CRT.

VIDEO AMPLIFIER

Rise and fall time 5 nsec.
(10% to 90% amplitude)

LINEARITY

Vertical and horizontal linearity will be within ± 1% of the major axis.



Notes: 1. Video pulse width should be 11 nsec or greater.
2. Blanking times are indicative of monitor timing. User must supply blanking in video signal.
3. H=Time from beginning of one scan to the beginning of the next scan.
4. V=Time from beginning of one frame to the beginning of the next frame.
5. Horizontal sync required during vertical retrace.

Fig. 1 SEPARATE SYNC TIMING REQUIREMENTS

1.3 ENVIRONMENTAL SPECIFICATIONS

HUMIDITY

5 to 80 percent (noncondensing)

ALTITUDE

Operating Range up to 10,000 feet

TEMPERATURE

Operating Range	5° to 55° ambient
Storage	-40° to 65° c

1.4 HUMAN FACTOR SPECIFICATIONS

X RAY RADIATION

These units comply with DHEW Rules 21-CFR-Subchapter J.

1.5 CONTROLS

INTERNAL SET UP CONTROLS (See Fig. 2)

- P1 Video gain
- P2 Video bias
- P3 Brightness
- P4 G2 voltage
- P5 DC Focus
- P6 Horizontal delay (Sync delay)
- P7 Horizontal centering (not supplied on models with overscan)
- P10 Vertical size
- P11 Vertical shape
- P12 Vertical linearity
- P13 Corner focus
- P14 Scan focus
- P15 Sweep focus
- P33 Vertical centering
- T4 Focus phase
- SW1 Termination switch
- L3 Horizontal width
- L4 Horizontal linearity

REMOTE CONTROLS (Customer Access)

BRIGHTNESS: 100k 0hm potentiometer 1/2 Watt min.

NOTE: Internal brightness control will function as a range control when external brightness control is used

CONTRAST: 250 0hm Potentiometer 1/4 Watt min. (with remote contrast option)

FOCUS: 5M Ohm Potentiometer 1/2 Watt min. 1kV (with remote focus option)

1.6 CONNECTORS (See Fig. 2)

- J1 Power input
- J2 Yoke connector
- J3 Vertical transformer
- J4 Flyback connector
- J5 Composite video input
- J8 Separate video input

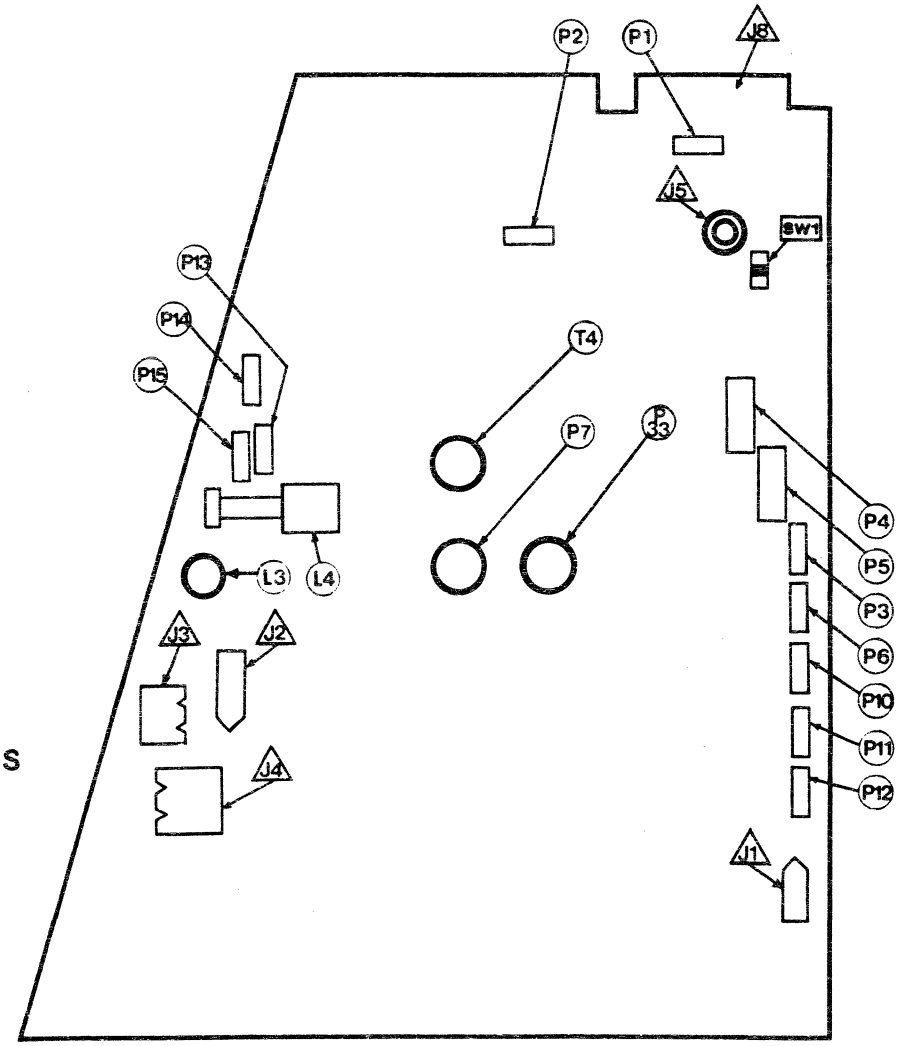


Fig. 2 CONNECTOR AND CONTROL LOCATIONS

SECTION 2
OPERATING PROCEDURES

2.1 INSTALLATION

Power for the M series monitors is supplied in one of two ways, depending on the model. The model with built-in low voltage supply is powered directly from 120 VAC (100/220/240 VAC switch selectable). Units without a built-in low voltage supply are supplied from an external unregulated DC supply. See section one for connector assignments.

Video and sync signals are fed to the appropriate pin as in section one connector description. Mount the monitor so that the ambient temperature surrounding the monitor does not exceed 55^{0}c.

2.2 GROUNDING TECHNIQUES

Arc bypasses are returned to ground at the origin of the driving signals. In turn, all grounds are connected to the monitor chassis. Normally, it is assumed that the chassis of the monitor will be connected to the system ground via the mounting. If this is true, no further grounding should be required. However, ground pins are provided in the I/O connector and should be connected to the driving source to maintain proper impedances and minimize cross talk in the cable.

Due to the high frequency video supplied to the monitor, care should be exercised in the routing and the shielding of the I/O cable.

2.3 VIDEO LEAD

Make the video lead as short as possible to minimize pickup and signal distortion.

As the video lead length increases, the importance that the cable be made to meet the requirements of a terminated transmission line increases.

For single ended input units utilizing gray scale capabilities, the input termination is switched between 75 ohms and high impedance.

For the ECL differential input units the input termination is 112 ohms. This provides a close match to 120 ohm ribbon cable.

Observation of the response of the video should be made at the monitor with a low capacity, high impedance probe. Overshoot and rise time will be most critical with the single ended input with gray scale displays.

2.4 INITIAL TURN ON PROCEDURES

1. The monitor has been factory calibrated, and requires a minimum of adjustment after installation. Check the position of switches SW-1 and SW-2 on the power supply to ensure that the switch settings match the line voltage available to the unit.

2. Visually inspect the interior of the monitor to make sure that ALL connectors are plugged into the proper socket and are secure.

3. Before connecting any video connectors, apply power to the monitor, making sure that monitor powers up correctly and enters the free-run operating mode with no problems. The unit is operating correctly if the background raster is apparant when the brightness pot, P3, is turned clockwise by a small amount.

   If an oscilloscope is available at this point, the supply voltages (+48V, +HV, +5V, -5V, and +6V), the horizontal flyback pulse, and the vertical flyback pulse may be monitored briefly to verify correct operation.

4. Turn off the power to the monitor before connecting the video input. If the monitor has a separate sync input, make sure that the connector to J8 is keyed properly (pin 3), and is inserted such that there are no short circuits between adjacent pins on the edge connector.

5. Check the position of SW-1 on the main PC board to insure that the proper video termination is selected.

6. Apply the video signal to the unit, and then apply power to the unit.

7. Allow approximately 15 minutes to warm-up.

8. Adjust the video bias to the DC level specified by the unit specification using the bias pot, P2.

9. Adjust the video gain to the range specified by the unit specifications using the gain pot, P1.

10. Center the picture within the screen by adjusting the horizontal delay pot, P6.

11. Adjust the brightness of the image to the desired level by adjusting the brightness pot, P3. (If an external brightness control is being used, adjust the internal control to provide the desired range on the external control).

SECTION 3
THEORY OF OPERATION

3.1 VIDEO AMPLIFIER

The video amplifier consists of an input buffer, a differential input transistor pre-amplifier, and a high voltage cascode output stage.

The input buffer consists of transistors Q4 and Q15 acting as emitter followers to provide a high input impedance to give isolation and minimize loading of the drive signal. The output from the emitter of Q15 is AC coupled to the pre-amplifier through capacitors C1 and C2. Gain control is provided by P1 which can be adjusted to give a 5 to 1 attenuation. The diode CR5 acts as a clamp to provide DC restoration to maintain the black level.

The pre-amplifier is a differential amplifier comprised of Q1 and Q3. The base of Q3 is connected to a reference voltage which is set by P2. Transistor Q1 drives the base of Q2, and the collector of Q2 provides the output of the pre-amplifier. The peramp has a nominal gain of 3, which is controlled by R5 and R6. Resistor R6 sets the basic gain of the preamp. Resistor R5 provides feedback to the emitter of the output stage for stability and gain control. R12 and C3 provide high frequency compensation for the preamp. If any additional compensation is needed, C26 is added. Diode CR1 gives base protection to Q1. Resistor R11 acts as the load resistance to the circuit.

Transistors Q7 and Q8 form the differential amplifier which is the driver for the output stage. In the output stage, the output signal from the preamp is applied to the base of Q7. Transistor Q8 provides bias reference and temperature compensation. The gain is set by R22 and R23. Capacitor C10 couples resistor R21 with R22 and R23, to provide high frequency boost gain. Transistor Q7 operates in the linear mode with a minimum quiescent current of approximately 30 ma. The collector of Q7 drives the emitter of Q6 which is connected as a grounded base with its base biased at +5 volts. The 30 ma. quiescent current of Q7 keeps Q6 from being completely turned off, thus holding its collector voltage at approximately 40 volts.

The bias control, P2 is used to adjust the quiescent operating point of the Q6 collector. With the input of a positive video signal, the Q7 collector current will rise, thus lowering the video output voltage. This will cause the screen to display a white signal. Note that too high a video signal will cause Q6 to saturate and the resulting excessive turn-off times will result in smearing of the white to black transitions.

Current through inductor L5 provides boost or peaking voltage. The diode CR4 clamps to 48 volts to protect Q6 from arcs. Resistor R17 and the 48 ohm resistor provide current limiting against arc transients. Component AG1 is a neon arc gap, which fires at 70 to 75 volts, providing voltage protection against arc transients.

3.2 HORIZONTAL DEFLECTION

Pin 12 of one shot Z1, and Pin 13 of one shot Z2 are outputs of the two sections of the horizontal oscillator. In the absence of the horizontal sync input, this oscillator will free-run at a nominal frequency which is approximately 10 percent faster than the locked-in frequency. When horizontal sync signal is presented to pin 2 of Z1, the oscillator locks into synchronization with the input signal with a phase difference that is determined by the setting of P6. Adjustments on P6 determine the horizontal delay

Pin 5 of Z2 is the output pin of the drive section of the oscillator. The pulse width of this section is set to provide a duty cycle of approximately 40 percent at the locked-in frequency.

Transistor Q10 is an emitter follower buffer which supplies sufficient current gain to drive Q11. Transistor Q11 is an inverter. When the voltage from pin 5 of Z2 rises, Q10 turns on, supplying current to Q11 which also turns on, pulling current through the primary of transformer T3. Since the primary of T3 acts as an inductor, no current flows initially, and thus the voltage at the collector of Q11 is pulled down. This accomplished four objectives:

1.) Energy is stored in T3
(This energy will be used to turn Q12 on during the second half of the cycle.)
2.) The base of Q12 is driven negative, turning Q12 off quickly.
3.) A positive pulse is driven through diode CR23 charging capacitor C53 giving raw 10 volts.
4.) Current flows through CR24 which charges C51 to produce minus 5 voltage supply.
(CR24 is also used to protect the base against overshoot.)

Diode CR25 is present to provide a low impedance path during turn-off to drive the base of Q12 harder. Inductor LI is a high frequency filter for the minus 5 volt supply.

When the voltage from pin 5 of Z2 drops, Q10 turns off, which causes Q11 to turn off. The inductive energy present in T3 swings the collector of Q11 positive to approximately 90 volts. Diodes CR21, and CR22 provide over-voltage protection to Q11 by clamping at 100 volts, via a zener drop through CR21 to 48 volts. In normal operation, the collector of Q11 will never reach 100 volts.

This voltage rise causes the base of Q12 to be driven positive at a 1:8 voltage ratio. The amount of base current is determined by R61. (Base current is approximately 0.4 amps when Q12 is an MJ10009, and is approximately 0.2 amps when Q12 is an SVT6253.)

Capacitors C46, 47, and 48 provide AC decoupling. R89 and C49 form an AC snubber, which prevents voltage at the collector of Q11 from rising instantaneously. This provides noise reduction and reduces dissipation in Q11. Resistor R61 provides current limitation during start up.

3.3 HORIZONTAL OUTPUT

Shortly before the end of the sweep, while the beam is at the right hand side of the screen, Q12 is still turned on, effectively shorting C64 and C65. At this time the currents from the flyback transformer T2, the yoke L2, the width coil, L3, and the linearity coil L4, are flowing into the collector of Q12. When horizontal sync arrives and Q12 turns off, current continues to flow through T2, L2, L3, and L4 due to the energy stored by the inductance of these components. This current charges up capacitors C64 and C65, which are no longer shorted out by Q12. Thus the voltage across capacitors C64 and C65, rises until the energy in T2, L2, L3, and L4 is depleted. At this point, the current through the inductors is zero and the voltage across C64 and C65 is at a maximum (approximately 450 volts), the middle of the flyback has been reached and the beam is in the center of the screen.

Once the energy in the coils has been discharged into the capacitors, the current reverses, and begins flowing from the capacitors back into the coils. This process constitutes the second half of the flyback operation. Current continues to flow back into T2, L2, L3, and L4 from the capacitor until the voltage across the capacitor reaches zero. At this point, current flow into the windings is at a maximum, and the beam is at the left of the screen.

The current continues to flow in the reverse direction, through the yoke and the transformer and would tend to charge C64 and C65 in the reverse direction. This is prevented by the damping diode which is internal to Q12. These voltage and current waveforms are exhibited in figure 3.

The desired waveform for the current through the yoke is an "s" shaped curve as shown in figure 3. This is primarily because the beam must travel slower at the edges of the screen than it does in the center. This waveform is approximated by the natural resonance of the tuned circuit that is formed by the yoke, L2, and the capacitor, C62. Due to the resistances inherant in these devices, these oscillations decay at an exponential rate. Because of this, the beginning of the sweep has more amplitude than the end of the sweep causing the left side of the screen to be too wide. This effect is compensated by the linearity coil, which as an inductance which is inversely proportional to current. This decrease in inductance with increasing current compensates for the resistive loss and linearizes the sweep.

The width coil, L3, is a variable inductor which varies the amount of current through the yoke, thus adjusting width. The RC network composed of R63 and C61, provides damping to eliminate oscillations at the end of the flyback pulse.

Capacitor C62 is present for two reasons. First, it adds to the "s" shaped component of the current waveform of the yoke. Second, its voltage waveform is the integral of the current waveform, thus giving the parabolic waveform used for dynamic horizontal focus.

3.4 FLYBACK OUTPUTS

Pin 1 = G2 voltage = 1kv during flyback
CR11 and C34 rectifies and filters the raw G2 voltage.

Pin 4 = -150 V pulse during flyback
This is rectified and filtered by CR12 and C35. Resistor R43 provides current limitation to protect CR12.

The second anode provides 17 kv to the CRT.

The raw G2 voltage is fed to P4, which adjusts the G2 voltage to approximately 750 volts.

P3 sets the brightness operating point of the external brightness pot on J8.
Resistors R40 and R41 control the net range of the external brightness control.
Capacitors C30, C32, and C33 are arc capacitors to control transients.

3.5 VERTICAL DEFLECTION

Vertical sweep is generated by a free running oscillator consisting of a programmable unijunction transistor and its associated circuitry. The three resistors, R79, R82, and R83, determine the switching threshold of the unijunction transistor, Q21. Transistor Q20 operates as a switch which adds R79 to the circuit when the vertical sync pulse arrives to change the switching threshold of the unijunction.

This oscillator free runs at a slightly lower frequency than the lock-in frequency. This free run frequency is primarily determined by the RC network formed by R84 and C72 and C74 in combination with the switching threshold of the unijunction Q21.

Vertical size is adjusted by P10 which adjusts the supply voltage to the unijuntion. Transistor Q22 acts as a buffer to drive Q23 without loading Q21.

Feedback networks, R87, P12, and R86, P11, C73 modify the ramp waveform which is the normal output of the oscillator into an "s" shaped curve for vertical linearity.

Transformer T1 provides DC isolation, impedance matching and curve shaping to drive the vertical deflection yoke.

R93 and P33 provide DC bias current through the yoke for vertical centering. Resistor R90 provides damping on the yoke at the end of retrace. The capacitor C76 integrates the current to give the voltage parabolla waveform needed for dynamic vertical focusing.

During retrace, current continues to flow through T1 causing the voltage to rise. C42 and C43 clamps this voltage at 150 volts above the horizontal clamp of 100V (i.e. Vertical is clamped at 25V). This large positive voltage pulse reverses the current in the yoke and moves the beam from the bottom to the top of the screen.

3.6 CRT PROTECTION CIRCUIT

In the event of a failure in the horizontal or vertical deflection electonics, the brightness voltage to the CRT is switched to -150 volts (black level) to prevent phospher burns on the CRT, face plate. This protection is accomplished in the following manner:

Transistor Q25 supplies +48 volts to the top end of the brightness potentiometer. When Q25 is turned off the brightness voltage drops to -150 volts, and the CRT screen becomes black.

In normal operation both the horizontal parabolic waveform and the vertical parabolic waveform are present. The vertical parabolic waveform is presented to the base of transistor Q26, causing this transistor to shut off once each vertical cycle. This allows the horizontal parabola from C62 to activate transistor Q24. Capacitor C68 is thus discharged each cycle, and transistor Q25 remains turned on.

In the event of a failure in the horizontal drive circuitry, the horizontal parabola will not be present at the base of Q24 to turn it on. This allows capacitor C68 to charge up, shutting off transistor Q25, and preventing damage to the CRT.

If the failure is in the vertical drive circuit, the vertical parabola will not be generated. In the situation, capacitor C91 will charge up, causing transistor Q26 to saturate, which shorts out the base of Q24. Thus Q24 remains off, capacitor C68 charges up, transistor Q25 shuts off, and the +48 volt supply to the CRT is shut off.

3.7 STANDARD DYNAMIC FOCUS

The vertical focus parabola from C76 is supplied to the emitter of Q32 through P15 which acts as an attenuator. C98, and R122 provide DC biasing.

The horizontal parabola from C62 is supplied to the base of Q32 through P14 which acts as an attenuator. R117 and C69 provide DC biasing.

The collector of Q32 supplies the amplified sum of the horizontal and vertical parabolas. This is fed into the focus grid through C103 which provides AC coupling. Resistors R44 and R66 provide current limiting for Q32 from the focus grid and the focus wiper respectively. The zener diodes CR36 and CR37, limit the maximum voltage at the collector of Q32 to 360 volts. The diode, CR29, and capacitor, C66, rectify the peak voltage from the flyback pulse to produce approximately 450 volts for the supply voltage needed by the dynamic focus amplifier. The dynamic focus is AC coupled to P5 and therefore rests at the DC focus voltage.

The normal adjustment procedure is to:

1.) Turn P14, P15, and P5 off.
2.) Adjust P5 until the center of the screen is in focus.
3.) Adjust P14 until the top of the screen is in focus.
4.) Adjust P15 until the left side of the screen is in focus.

3.8 LOW VOLTAGE REGULATED SUPPLY

The on-board power supply converts a raw DC voltage which varies between 60 volts and 70 volts to a regulated supply of 48 volts, and a regulated High Voltage supply which is also set to 48 volts.

Transistor Q30 provides preregulation at a nominal voltage of 56 volts. This level is set by CR50. The biasing of Q30 is provided by R100 and CR50. The diode CR49 protects the base of Q30 during the power down cycle. Capacitor C81 provides a soft power on.

Regulators, Z3 and Z4, regulate the +48 volt output and the High Voltage output respectively. The output voltage of Z3 is set by the voltage dividers R102 and R101. The output voltage of Z4 is set by the voltage dividers R104 and R103. The two diodes, CR51 and CR52, limit the voltage across Z3 and Z4 to 39 volts for protection during short circuits.

The High Voltage power supply has a crowbar circuit to comply with HEW regulations. The High Voltage supply is monitored by the diode CR53. When the HV supply rises above 52 volts, the voltage across the gate of the silicon controlled rectifier, CR54, causes that device to trigger. The triggering of CR54 crowbars the power supply off.

3.7 PREMIUM FOCUS OPTION

The heart of the dynamic focus circuit is the focus transformer T4 which, when tuned properly by C100 and C101, oscillates at the horizontal frequency with an amplitude which is controlled by the collector current through Q31.

The horizontal porabola waveform is AC coupled to the emitter of Q31 through C92, and is DC restored to 0.7 volts through CR32. The total voltage of the horizontal parabola is attenuated to 3% of its original value by resistors R117 and R118. The DC bias voltage at the base of Q31 is set by P14. The vertical parabola is attenuated by P13 and AC coupled to the base of Q31 via capacitor C93. The two diodes CR38 and CR39 are present to limit the drive on the base of Q31, and thus limit the power dissipation of Q31.

The output of transformer T4 is thus a sinusoid at the horizontal frequency whose amplitude is modulated by the vertical parabola. This sinusoidal waveform is AC coupled to the focus grid by capacitor C102 and is DC restored to the voltage level present at pin 6 of the focus transformer by CR34.

The DC voltage level of pin 6 is set by the focus pot, P5, and ranges from +1100 volts (G2 voltage) to -150 volts. This voltage is DC coupled to pin 6 at transform T4 through the diode CR35.

The vertical parabola is coupled to this DC level in the following manner: The vertical parabola waveform is attenuated by P15 and AC coupled to the emitter of Q32 by C95. The D.C. level of that emitter is set by R122 and R123, while the base of Q32 is set to +5 volts. This causes a vertical parabola to be at the collector of Q32. This parabolic waveform is AC coupled to pin 6 of transformer T4 by C103, and is DC restored to the focus wiper voltage by CR35.

Thus, the voltage that appears at the focus grid is a sinusoid at the horizontal frequency that is modulated by the vertical parabola and is added to the sum of the focus wiper voltage and an amplified vertical parabola. Under certain conditions, this voltage can exceed 2 kv. Since voltages greater than 1.1 kv can damage the CRT, the diode CR46 is present to clamp the Focus Grid voltage to the G2 voltage (approx. 1 kv).

The normal adjustment procedure is as follows:

1.) Turn P5, P13, P14, and P15 to minimum.
2.) Adjust the Focus Pot, P5, for best focus in the center of the CRT.
3.) Adjust the Sweep Control, P15, for best focus at the extremes of the vertical sweep.
4.) Adjust the Scan Control, P14, for best focus at the extremes of the horizontal scan.
5.) Adjust the Corner Control, PB for best focus in the corners of the CRT.
6.) Minor side to side differences may be improved by adjusting the phase of the horizontal scan voltage component by turning the set screw of transformer T4.

3.11 REMOTE CONTRAST OPTION

Units with the optional remote contrast control have the output of the video preamplifier coupled to the base of transistor Q9 via resistor R10. Photo resistor PC-1 and R10 create a variable voltage divider to the base of Q9. Q9 operates as an emitter follower to drive the output amplifier at the base of Q7. The photo resistor PC-1 can be varied remotely by adjusting the current through its internal LED. This will vary the amplitude of the signal applied to the output stage, and thus, contrast is adjusted.

3.12 COMPOSITE SYNC OPTION

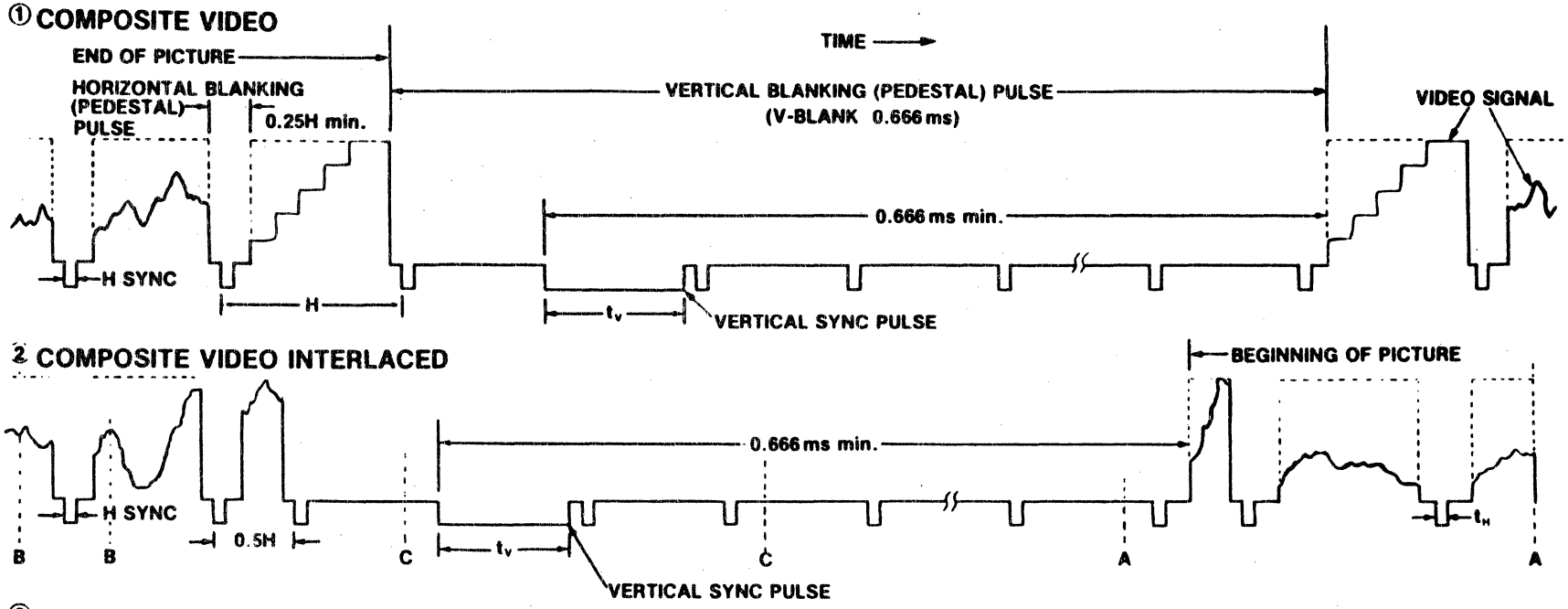
In units having composite video capability, Z8 and Z7 provide the sync stripping and separation functions, while Z9 functions as the black clamp.

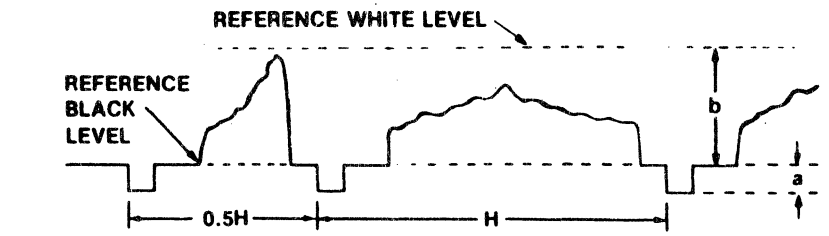
The video signal from the collector of QZ is AC coupled to pin 2 of Z8, via capacitor C9, and is DC restored to -0.7 volts by diode CR2. The threshold of comparator Z8 is set at -0.4 volts by R111 and R13.

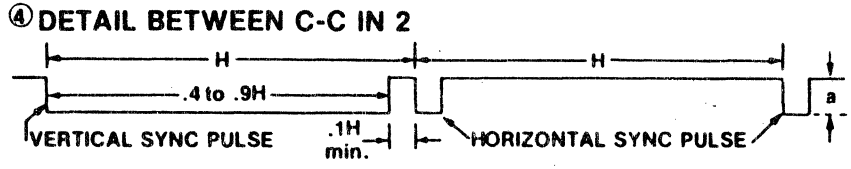
In this manner, the sync pulse, which is a negative going pulse from 0 volts to -.7 volts, is stripped from the video signal, and is presented at the outputs of Z8.

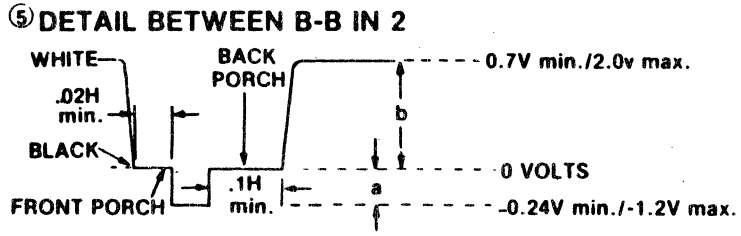
The positive output of Z8 (pin 7) is sent to pin 2 and pin 10 of Z7. The output of Z7 (pin 13) produces a positive pulse of approximately one third of the horizontal scan time. This pulse is the horizontal sync pulse. The trailing edge of this pulse is differentiated by C15 and triggers the other section of Z7 (pin 9) if the sync pulse at pin 10 is still high (this is true at vertical sync). The output of Z7 (pin 9) is the vertical sync pulse.

The negative output of Z8 (pin 6) discharges capacitor C96. At the trailing edge of the sync pulse, pin 6 of Z8 rises, causing the input pin 3 of Z9 to rise. This triggers Z9 which acts as a one-shot whose time constant is determined by the decay time of the C96 and R96 combination and the threshold level set by R97 and R89. (nominally 50% of back porch. The positive pulse at pin 7 of Z9 turns Q14 on and clamps the video signal to ground.





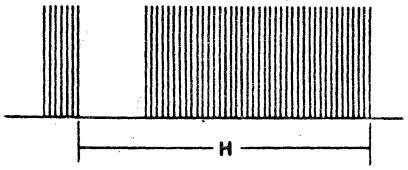




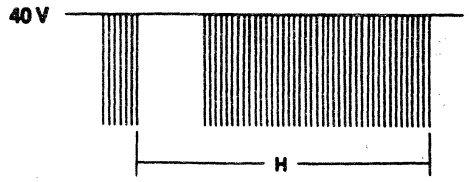
NOTE:

1. H Time from start of one line to start of next.
2. V Time from start of one frame to start of next.
3. t_H = Horizontal sync pulse width (.02H ≤ t_H ≤ .125H).
4. t_V = Vertical sync pulse width (.4H ≤ t_H ≤ .9H).
5. Double frequency serrations or vertical equalizing pulses are allowed but not necessary. (see EIA standard RS 170).
6. Leading and trailing edges of vertical blank pedestal shall not be less than .666 ms apart.
7. All rise and fall times will be ≤ 15 ns.
8. Horizontal blank will be .25 H unless otherwise ordered.
9. Vertical blanking interval shall be .666 ms unless otherwise ordered.
10. Overshoot on blanking (pedestal) signal shall not exceed 0.02 b at the beginning of the front porch and shall not exceed 0.05 b at the end of the back porch. The overshoot on sync signals shall not exceed 0.05 a. Any other extaneous signals on the blanking (pedestal) signal shall not exceed 0.02 b.

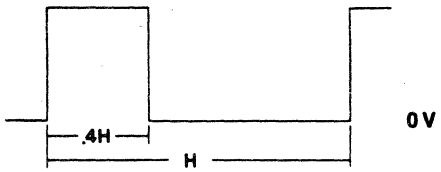
Fig. 1a VIDEO REQUIREMENTS FOR COMPOSITE SYNC



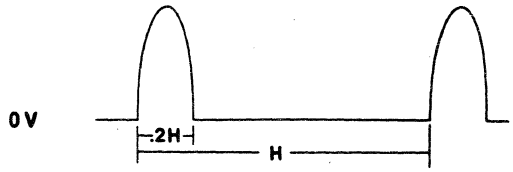
Q7 - BASE
2.3 V P-P



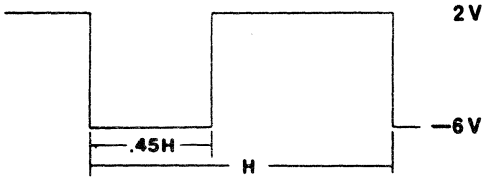
CRT - CATHODE
30 V P-P



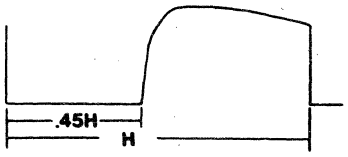
Q10 - BASE
2 V P-P



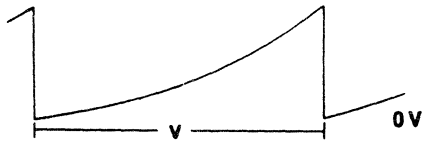
Q12 - COLLECTOR
400 V P-P
SEE SPEC SHEET



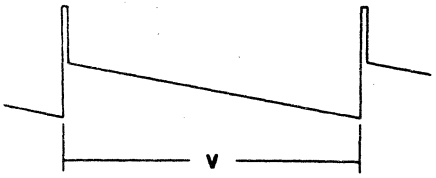
Q12 - BASE



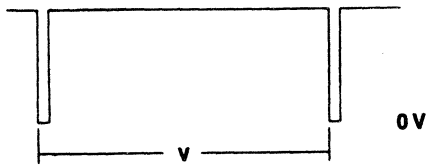
Q11 - COLLECTOR
100 V P-P



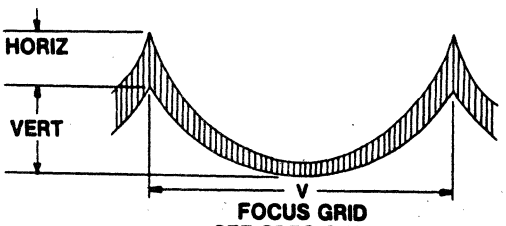
Q22 - EMITTER
5 V P-P



Q23 - COLLECTOR
250 V P-P

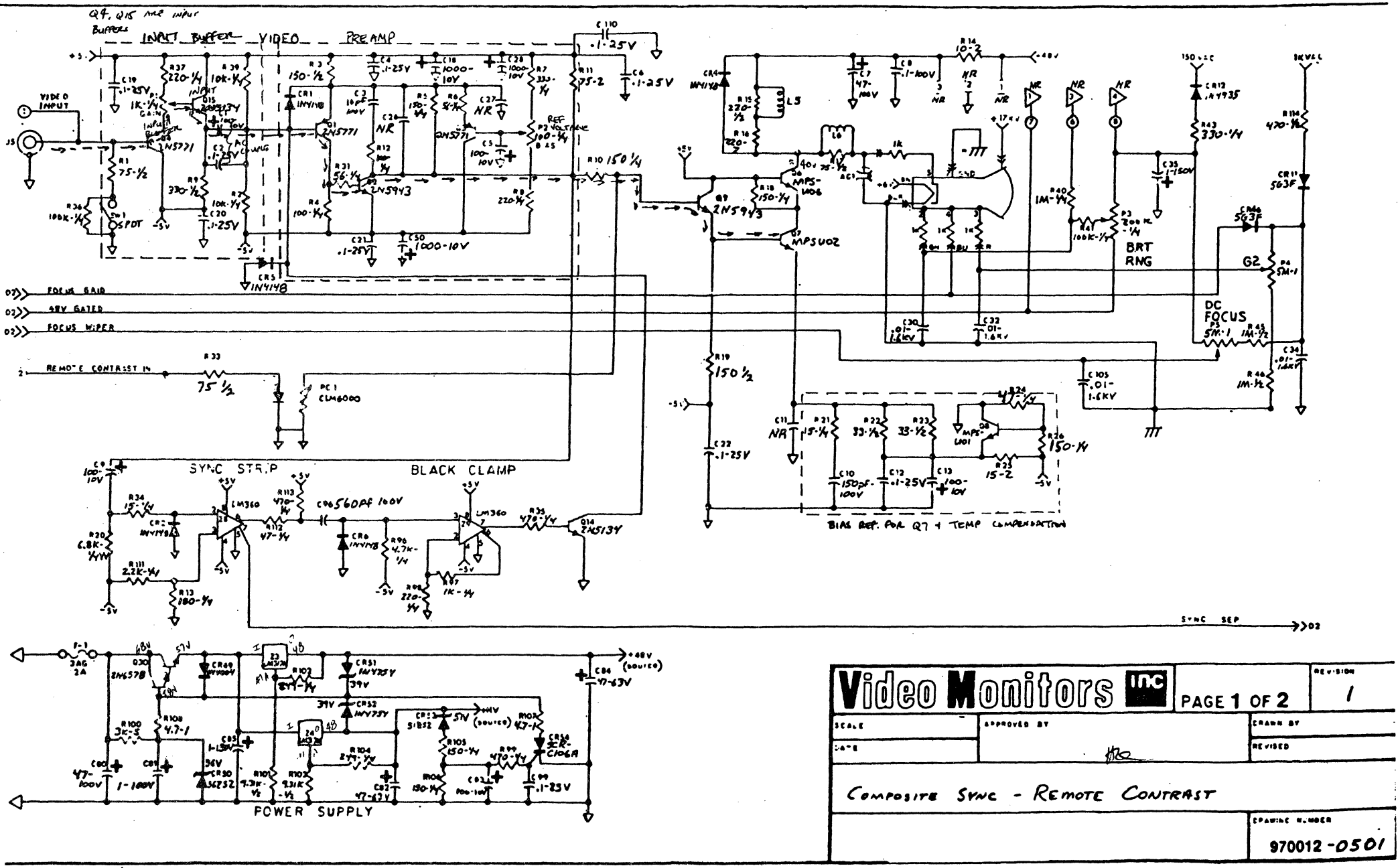


Q20 - COLLECTOR
5 - 10 V P-P



FOCUS GRID
SEE SPEC SHEET

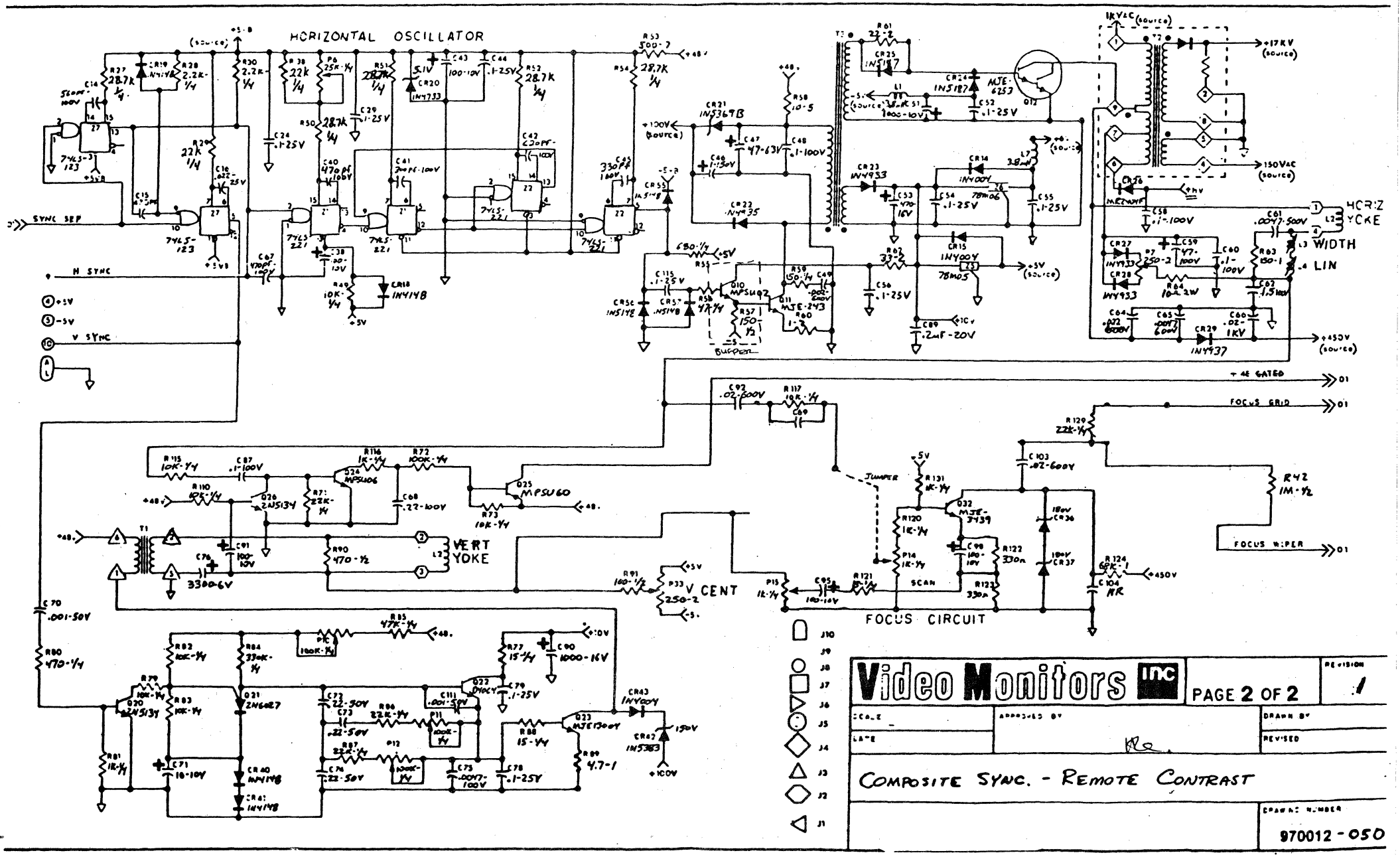
FIG. 3 VOLTAGE WAVEFORMS

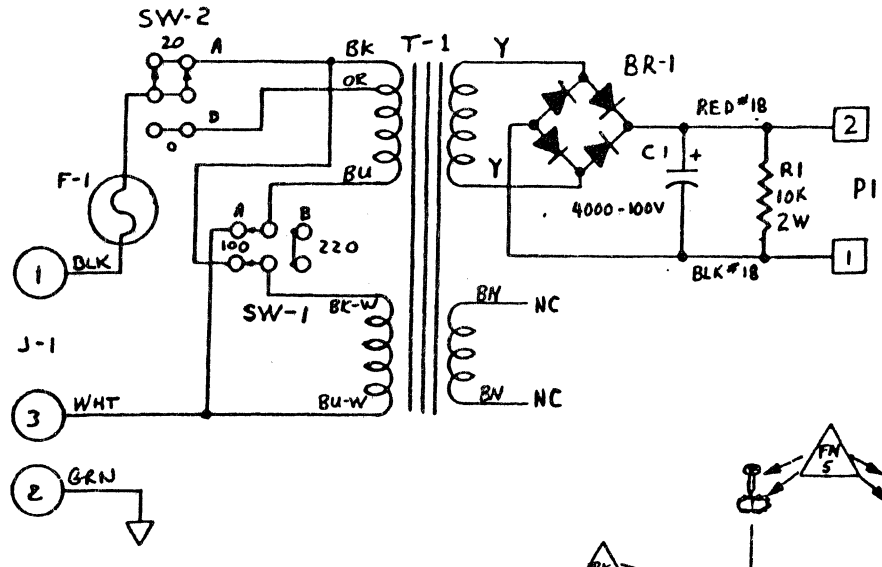


Video Monitors Inc	PAGE 1 OF 2		REVISION 1
SCALE	APPROVED BY		DRAWN BY
DATE			REVISED

COMPOSITE SYNC - REMOTE CONTRAST

DRAWING NUMBER 970012-0501

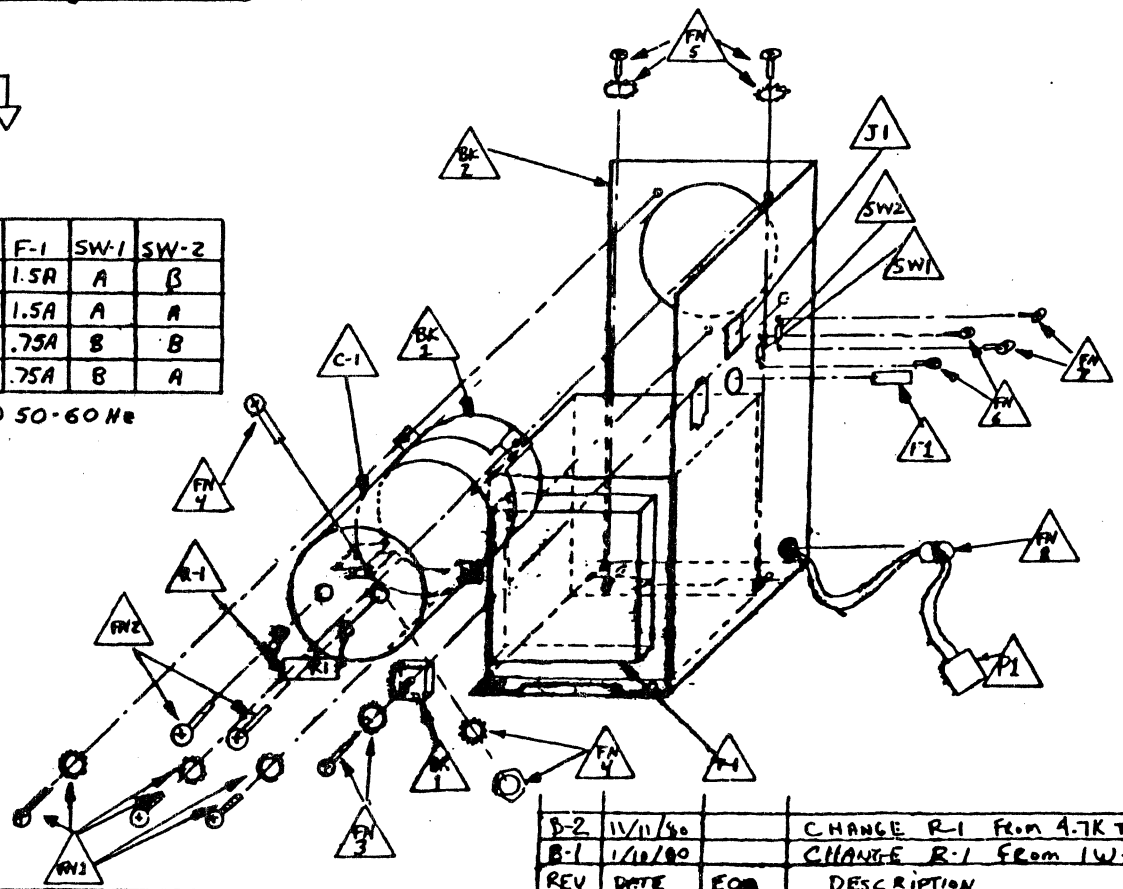

HORIZONTAL OSCILLATOR
SYNC SEP
H SYNC
V SYNC
VERT YOKE
V CENT
FOCUS CIRCUIT
FOCUS GRID
FOCUS WIPER
SCAN
JUMPER
HORIZ YOKE
WIDTH
LIN
1KVAC (source)
+17KV (source)
150VAC (source)
+450V (source)
+5V (source)
+100V (source)
-5V (source)
+48 GATED
Video Monitors inc
PAGE 2 OF 2
REVISION 1
COMPOSITE SYNC. - REMOTE CONTRAST
DRAWING NUMBER
970012-050



NOTES:

VOLTS*	F-1	SW-1	SW-2
100	1.5A	A	B
120	1.5A	A	A
220	.75A	B	B
240	.75A	B	A

*AC @ 50-60 Hz



REV	DATE	ECO	DESCRIPTION
B-2	11/11/80		CHANGE R-1 FROM 4.7K TO 10K
B-1	1/10/80		CHANGE R-1 FROM 1W to 2W

QTY	PART NUMBER	PART DESCRIPTION	LOC
1	720011-0003	TRANSFORMER	T-1
1	540001-0001	BRIDGE RECTIFIER KBPC-102	BR-1
1	762260-4007	4000μF/100V CAPACITOR CGS	C-1
1	610044-1002	10kΩ/2W RESISTOR - CARBON	R-1
2	850020-3016	SWITCH DPDT	SW-1,2
1	330002-0006	CAPACITOR BRACKET 2"	BK-1
1	350000-0002	FUSE HOLDER	F-1
1	850011-1501	FUSE 100/120V	F-1
1	850011-7500	FUSE 220/240V (Alternate)	F-1 (ALT)
1	100003-0001	POWER SUPPLY CHASSIS	BK-2
7	850015-0014	CIRCLE LUGS 18GA #10 Hole	BK1, R1, C2
1	800002-0002	2 PIN MOLEX PLUG MALE	P-1
1	800002-1003	3 PIN MOLEX SOCKET	J-1
2	800004-1101	FEMALE MOLEX CRIMP PIN	P-1
3	800004-0101	MALE MOLEX CRIMP PIN	J-1
1	300632-0012	6-32 × 3/4 P.H. SCREW	FN-4
1	310632-0004	6-32 1/4 NUT	FN-4
3	300632-0004	6-32 × 1/4 P.H. SCREW	FN-1
9	320000-0612	#6 EXTERNAL LOCKWASHER	FN-1,4,3
2	301032-0006	10-32 × 3/8 P.H. SCREW	FN-5
1	300632-0006	6-32 × 3/8 P.H. SCREW	FN-3
2	320000-1012	#10 EXTERNAL LOCKWASHER	FN-5
4	300440-0304	4-40 × 1/4 Self TAP SCREW	FN-6,7
1	210004-0812	HEYCO BUSHING SB375-4	FN-8
2	301032-1006	10-32 × 3/8 P.H NYLOCK SCREW	FN-2
2.8'	812000-1822	18 GA RED WIRE	HARNESS
4.0'	812000-1800	18 GA BLK WIRE	HARNESS
.4'	812000-1899	18 GA WHT WIRE	HARNESS
.5'	812000-1855	18 GA GRN WIRE	HARNESS

VIDEO MONITORS, INC.

SCALE: NONE	APPROVED BY:	DRAWN BY MRS
DATE: 12-5-80		REVISED

POWER SUPPLY

SCHEMATIC - PARTS LIST - ASSEMBLY

DRAWING NUMBER 930001-0002

VIDEO MONITOR TURN ON PROCEDURES

1.) Check the position of switches SW-1 and SW-2 on the power supply to ensure that the switch settings match the line voltage available to the unit.

2.) Visually inspect the interior of the monitor to make sure that ALL connectors are plugged into the proper socket and are secure.

3.) Before connecting any video connectors, apply power to the monitor, making sure that monitor powers up correctly and enters the free-run operating mode with no problems. The unit is operating correctly if the background raster is apparant when the brightness pot, P3, is turned clockwise by a small amount.

    If an oscilloscope is available at this point, the supply voltages (+48V, +HV, +5V, -5V, and +6V) the horizontal flyback pulse, and the vertical flyback pulse may be monitored briefly to verify correct operation.

4.) Turn off the power to the monitor before connecting the video input. If the monitor has a separate sync input, make sure that the connector to J8 is keyed properly (pin 3), and is inserted such that there are no short circuits between adjacent pins on the edge connector.

5.) Check the position of SW-1 on the main PC board to insure that the proper video termination is selected.

6.) Apply the video signal to the unit, and then apply power to the unit.

7.) Adjust the video bias to the DC level specified by the unit specification, using the bias pot, P2.

8.) Adjust the video gain to the range specified by the unit specifications using the gain pot, P1.

9.) Center the picture within the screen by adjusting the horizontal delay pot, P6.

10.) Adjust the brightness of the image to the desired level by adjusting the brightness pot, P3.

VMI TROUBLESHOOTING GUIDE

VMI #03000-0006

CONTENTS

NOTE: For best results, it is recommended that each section be followed in a serial manner.

1.0 SYMPTOM: Presence of background raster but absence of video image.

This symptom indicates that the failure is in the video portion. The presence of background raster indicates that the rest of the drive circuitry is functional.

Note: Video measurements should be made by probes with short ground return leads.

1.0 Possible Problem: Video amplifier is not biased correctly.

Remedy: Monitor collector of Q6 with oscilloscope probe (scale = 10 v/div @ 5 ms/div). Adjust bias control pot, P2, until video signal reaches 40 volts peak (50 volts, for units with 10 volt boost). Adjust gain control pot, P1, until video signal range is 30 volts peak-to-peak (40 volts peak to peak for units with 10 volt video boost).

Remedy: If output of Q6 is correct, troubleshoot the tube socket and tube.

1.2 Possible Problem: +5 volt supply not functioning (check J8-Pin 4)

Remedy: Troubleshoot the raw +10 volt supply at input of +5 volt regulator Z5.

Remedy: Examine +5 volt supply line for short circuits or poor solder joints.

Note: +5 volt supply will indicate a 0 volt reading due to current limiting action if a short is present on the supply line.

Remedy: Replace +5 volt regulator. Z5.

Remedy: Replace any active or passive component along the supply line that seems suspect.

1.3 Possible Problem: -5 volt supply not functioning (check J8 - Pin 5).

Remedy: Troubleshoot -5 volt supply line as in section 1.2.

1.4 Possible Problem: Incorrect video input. The input video voltage range should be 0.7 volts minimum and 2.5 volts maximum.

Remedy: Check the video termination switch. The impedance at the input of the last unit should match the impedance of the cable.

Remedy: Check out video generator.

Remedy: Check R1 and R36 for proper value.

1.5 Possible Problem: Non functional input buffer.

This buffer is a non-inverting emitter follower buffer composed of Q4 and Q15 with a gain adjustment provided by P1. When properly adjusted, the video range at the emitter of Q15 should be 0.7 volts.

Remedy: Check for shorts, opens, and poor solder connections visually.

Remedy: Check values of all passive components.

Remedy: Troubleshoot Q4 and Q15.

1.6 Possible Problem: Non-functional preamplifier.

The preamplifier is composed of Q1, Q2, and Q3 with a bias adjustment provided by bias pot, P2. The collector of Q2 should have a waveform similar to the following:

Remedy: Check for shorts, opens, solder voids, etc.. Measure passive resistors. Troubleshoot Q1, Q2, and Q3.

1.7 Possible Problem: Nonfunctional output stage.

The output stage is a differential amplifier comprised of Q7 and Q8, with an output transistor, Q5 and a total gain of 16. (The gain is 24 for units with the 10 volt boost video option).

Remedy: Make sure supply voltage (+48V for standard units, +58V for units with 10 volt boost) is present at one end of R15. Make sure that there is continuity between this supply voltage and the collector of Q6.

Remedy: Troubleshoot Q6, Q7, Q8, CR4, and other suspect components.

2.0 SYMPTOM: Absence of background raster.

This failure mode causes the screen to become dark. Verification of this failure mode can be made by turning the brightness pot, P3, clockwise until backgrould raster can be observed. If the potentiometer hits the stop before raster appears, this failure mode is evident.

2.1 Possible Problem: +48V supply or +HV supply not functioning.

The outputs of both Z3 and Z4 should be +48 VDC.

Remedy: Check fuses - 2 amp fuse on PC board and 1.5 amp fuse in Power Supply.

Remedy: Make sure unit is not in crowbar condition (Power down the unit, short accross CR54 temporarily, power unit back up, and check for correct video image).

Remedy: Check input to Q30 to insure that 60 VDC is present. If not, troublshoot the off-board power supply.

Remedy: Check tht output of Q30 (voltage level should be approx. 56 volts). An incorrect level at this point indicates a failure in one of the following components: CR50, Q30, CR51, CR52, CR49, R100, Z3, or Z4.

Remedy: Check the output of Z3 (voltage level should be approx. 48 VDC). An incorrect level at this point indicates a failure in one of the following components: Z3, R102, or R101. Other components to check are Q11 and Q23.

Remedy: Check the output of Z4 (approx. 48 VDC). An incorrect level at this point indicates a failure in one of the following components: Z4, R103, R104, Q12, or the flyback transformer.

2.2 Possible Problem: Missing horizontal deflection.

This problem is evidenced by the absence of the horizontal flyback pulse at the collector of Q12 (See wave form guide at the back of the Operating Manual).

Remedy: Check Z2 pin 5 for presence of horizontal oscillator pulses. Pulses should have standard TTL signal levels and occur at the horizontal scan rate with a duty cycle of approximately 45%. Absence of pulses indicates a failure in Z1 or Z2.

Remedy: Check collector Q11 for proper output (see waveform guide at the back of the Operating Manual). In the absence of correct signals. troubleshoot Q11, Q10, CR22, CR21, and +48 volt supply.

Remedy: Check collector Q12 for correct output (see waveform guide at the back of the Operating Manual). Possible failures include: flybacks, Q12, CR25, CR24, and poor connections.

2.3 Possible Problem: Absence of vertical deflection.

The absence of vertical deflection will cause the unit to enter the vertical shutdown mode, which has the effect of turning the screen dark. If the vertical deflection waveform (see the waveform guide in the Operating Manual) is absent from the collector of Q23, this problem exists.

Remedy: Check the output of Q21 for a ramp waveform. If it is not present, troubleshoot the vertical oscillator circuit.

Remedy: Check for Raw +10 volt supply at the collector of Q22.

Remedy: Troubleshoot Q23, Q22, CR43, CR42, and R89.

Remedy: Check for short circuits accross T1 accross R90, and in the vertical yoke.

2.4 Possible Problem: Absence of +6 volt heater supply.

Remedy: Check continuity of tube socket, R109, CR31 and CR30.

Remedy: Check +10 volt raw supply at input of CR30.

2.5 Possible Problem: Failure in vertical shutdown circuit.

Remedy: Check for presence of +48 volts at collector of Q25. If supply voltage is missing, troubleshoot Q25, and Q24.

2.6 Possible Problem: Absence of G2 supply voltage.

Note: Use of high voltage probe required.

Remedy: Check pin 1 of flyback connector for unfiltered G2 supply voltage (1.2 KV peak). Absence of this voltage indicates flyback failure.

Remedy: Check for G2 supply voltage at red lead on PCB. Troubleshoot CR11, P4, C34, and tube socket continuity.

2.7 Possible Problem: Absence of 17KV supply voltage.

Note: Use of high voltage probe required.

Remedy: Check second anode from flyback for proper supply voltage by inserting tip of high voltage probe between the rubber cap of the anode lead and the CRT (See unit specification for value of correct voltage). Incorrect value is indicative of flyback failure.

CAUTION: VERY HIGH VOLTAGE: 17,000 volts.

2.8 Possible Problem: Bent pins on CRT.

Remedy: Straighten all bent pins on the CRT.

3.0 SYMPTOM: Poor Focus.

3.1 Possible Problem: Misadjusted focus pots.

Remedy: Follow adjustment procedure in operating manual to readjust focus.

3.2 Possible Probmem: Failure in focus circuit.

Remedy: Check DC focus range of pot P5 (should be -150V to +800V range.

Remedy: Check for presence of horizontal focus parabola at base of Q13.

Remedy: Check for presence of vertical focus parabola at the emitter of Q13.

Remedy: Replace Q13.

4.0 SYMPTOM: Insufficient, varying or excessive brightness.

4.1 Possible Problem: Poorly adjusted video bias and gain.

Remedy: See section 1.1

4.2 Possible Problem: Incorrect brightness supply voltage.

Remedy: Check collector of Q25 (should be approximately 48VDC). If value is incorrect, see section 2.1 and 2.5 for correction.

Remedy: Check adjustability of pot P3.

Remedy: Check tube socket continuity.

4.3 Possible Problem: Incorrect G2 Voltage.

Remedy: See section 2.6

4.4 Possible Problem: Incorrect HV supply voltage.

Remedy: See section 2.1

4.5 Possible Problem: Incorrect 17KV supply voltage.

Remedy: See section 2.7

4.6 Possible Problem: Incorrect heater voltage (+ 6 volt supply)

Remedy: See section 2.4

4.7 Possible Problem: In operative black clamp.

Remedy: For units with seperate sync input, check the value of R2, and check operation of CR5.

Remedy: For units with composite sync, sync stripper circuit (Collector of Q5 should be +5 volt positive pulse at time of horizontal sync).

Verify the correct operation of the black clamp circuit (the collector of Q14 should produce a clamping pulse at the trailing edge of the horizontal sync pulse.

5.0 SYMPTOM: Rolling Picture.

5.1 Possible Problem: Missing horizontal sync signal.

Remedy: For separate sync units, check the horizontal sync input, J8 - Pin 9.

Remedy: For composite sync units, check the video input for proper sync waveform.

Remedy: Troubleshoot Z1.

5.2 Possible Problem: Faulty sync strip circuit (not present on separate sync units).

Remedy: See section 4.7.

Remedy: Troubleshoot Q5 and Z7.

5.3 Possible Problem: Missing vertical sync signal.

Remedy: For separate sync units, check the vertical sync input, J8 - pin 10.

Remedy: For composite sync units, check the video input for proper vertical sync waveform.

Remedy: Troubleshoot Q20.

5.4 Possible Problem: Faulty sync separator (not present on separate sync units).

Remedy: Troubleshoot Z7. Q20 and Q21.