
X-Y TRON INC.
SYLMAR, CALIF. 91342
MODEL NO. A21-7A
SERIAL NO. 1047

SERIAL NO. 1047

INSTRUCTION MANUAL

MODEL A21-7

GRAPHIC CRT MONITOR

XYtron, Inc.
13010 San Fernando Rd. #3
Sylmar, Ca. 91342

9/20/78

XYTRON, INC.

13010 San Fernando Rd. #3
Sylmar, Calif. 91342
(213) 365-0819
365-0810

CERTIFICATE OF COMPLIANCE

Material shipped under this Purchase Order conforms with current applicable specifications and is in compliance with and meets all contractual requirements. All required tests were made and found satifactory and records are on file for examination by the Buyer on request.

Customer: Evans + Sutherland

Customer P.O.#: 1417

Date Shipped: 7-23-79

XYTRON, INC. Shipper #: 6658

XYTRON, INC.

By W Rall

XYTRON INC.
Sylmar, CA. 91342

SUMMARY SHEET S/N 1047

UNIT SERIAL NO.:
SALES ORDER: 390
DATE: 7-23-7

MODEL NO. A21-7A-4	CUSTOMER: EVANS & SUTHERLAND
FINAL ASSY. A0820	CUSTOMER SPEC NO.: 801189-004
OUTLINE DWG. X0588	CRT PHOSPHOR p4M
BLOCK DIAG. E0372	CRT SERIAL NO. 94292
CONTROLS & LOCATION FRONT PANEL	YOKE FS7015012W BEZEL NONE MASK ——— X ———
INPUTS & LOCATION REAR PANEL MANUAL: 1 LINE CORD: 15'	REMARKS

	DESCRIPTION	SCHEM	REV	ASSY	REV			SER.#
1	L.V.P.S. ASSY.	E0033	J	A0928	—			
	P.C. BOARD ASSY.			A0068	E		✓	5393
2	X DEFL. AMP	E0414	E					
	HEAT SINK ASSY + & - DRIVE	"		A0821	—			
	P.C. BOARD ASSY	"		A0092-1	—		✓	5369
3	Y DEFL. AMP	E0414	E					
	HEAT SINK ASSY + & - DRIVE	"		A0821	—			
	P.C. BOARD ASSY.	"		A0092-1	—		✓	5366
4	VIDEO AMP. P.C. BD. ASSY.	E0379	C	A0380	B		✓	5364
5	PHOSPHOR PROT. P.C.BD. ASSY	E0392	C	A0391	C		✓	5381
6	PRE-AMP P.C. BD. ASSY	E0376	C	A0259-2	—		✓	1047
7	STD. FOCUS P.S. ASSY.							
8	DYN. FOCUS P.S. ASSY.	E0524	D	A0523	A		✓	532
				A0056-2 A0219-2	H E			
9	HIGH VOLT. P.S. ASSY.	15KV						18329

PREPARED BY: [signature] DATE: 7-23-7 APPROVED BY: [signature] DATE: 7-23-7

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7.0 DRAWINGS		
A 0005 HS ASSY		✓
E 0033 SCHEM LVPS	J	✓
SCHEM FOCUS POWER SUPPLY		
E0376 SCHEM PRE-AMP	C	✓
VIDEO PRE-AMPL.		
E0414 SCHEM DEFL AMPL	E	✓
E0379 SCHM VIDEO AMPL	C	✓
SCHEM INPUT CIRCUIT		
E0372 WIRING DIAGRAM	B	✓
E0392 SCHEM PHOSPHOR PROTECT	C	✓
E0524 SCHEM DYN. FOCUS SUPPLY	D	✓
E0420 TRANSFORMER DIA.	A	✓

1.0 INTRODUCTION

1.1 GENERAL DESCRIPTION

MODEL A21

GENERAL DESCRIPTION

The XYtron Model A21 Random Scan CRT Monitor consists of a magnetic deflection cathode ray tube, two direct coupled amplifiers driving a single 2 axis deflection yoke on the neck of the CRT, low voltage power supplies, high voltage power supplies for the CRT, a video amplifier, controls for gain, position, intensity and focus, and a frame assembly housing all components. On the rear is a connector panel for signal inputs for horizontal (X) vertical (Y) and intensity control (Z) and a 3 prong power connector and input power fuse. Cooling fans are located one on each deflection amplifier heat sink assembly. Magnetic shielding is used around the fans, transformers and neck of the CRT. Assemblies that are replaceable are X amplifier card, Y amplifier card, video amplifier card, low voltage power supply assembly, high voltage power supply, X deflection amplifier heat sink assembly and Y deflection amplifier heat sink assembly.

Options available are phosphor protect and dynamic focus. The phosphor protect option is contained on one plug in card which senses X and Y deflection. Should either or both signals fail, the CRT is biased off the prevent damage to the phosphor.

1.2 WARRANTY

WARRANTY

XYtron agrees to correct, either by repair or replacement, any defect in material or workmanship in XYtron-manufactured units or components which develop within one year after delivery of the equipment to the original purchaser-provided the equipment has bee subjected only to normal and proper use.

Any item claimed to be defective during the warranty period must be returned to XYtron with transportation charges prepaid. The item will be repaired and returned to the purchaser with return transportation prepaid by XYtron unless, of course, the item is found not to be defective, or found to be damage by misuse-in which case it will be returned to the purchaser with repair and transportation costs billed collect.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty, and include the Model Number and Serial Number. Upon receipt of this information, we will give you service data or shipping instructions.

2. On receipt of shipping instructions, forward the instrument prepaid, to the factory. If requested, an estimate of the charges will be made before the work begins, should the instrument not be covered by the Warranty.

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2.0 SPECIFICATIONS

XYTRON
LARGE SCREEN RANDOM SCAN CRT MONITOR
MODEL A-21

SPECIFICATIONS

CRT	21 inch diagonal rectangular with bonded safety panel, magnetic deflection and electrostatic focus
Anode Voltage	15 KV
Phosphor	P40 standard-other phosphor available
Usable Screen Area	13" X 16" without mask 13" X 14" with -1 mask 12" X 16" with -2 mask
Brightness	12 ft. Lamberts at 500,000 inches/sec. writing rate with 40 Hz refresh rate and P40 phosphor
Spot Size	.020" at specified brightness in 9" dia. circle. .010" with dynamic focus in 12 in. 2 area
Geometric Distortion	±1% includes orthogonality-linearity-hysteresis-pin cushioning-keystoning and line bowing
Orthogonality	within 1^{o}
On Axis Linearity	within ±1%
Hysteresis	less than .1%
Spot Motion and Jitter	less than .005 inches
Drift.	less than .5% over 8 hour period after 15 minute warm up

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DEFLECTION AMPLIFIERS

Large Step Response 12" Deflection	8 usec maximum to within 1.15% of final position
Small Step Response	200 nsec maximum to within 0.1% of final position
Maximum Linear Writing Speed	1.25 inches per usec
Large Signal Sine Wave Response	50 KHz at 12"
Small Signal Sine Wave Response	2.5 MHz
Phase Match	less than $.5^{\circ}$ DC to 1 MHz in linear operating range
Sensitivity	adjustable from less than one inch per volt to greater than 2 inches per volt. Zero volts is center screen. Other sensitivities available.
Input	single ended DC coupled 75 ohm to 10 K ohm as specified. 1 K ohm normal
Large Signal Protection	will accept 2 times maximum signal without affecting performance

Z AXIS AMPLIFIER

Unblank Input (Digital)	+2.5V to unblank beam and enable analog input. 15 nsec delay time. 20 nsec rise time. 75 ohms input impedance.
Video Input (Analog)	0 to 2.5 volts for full intensity control from DC to 20 MHz. 15 nsec delay time. 20 nsec rise time. 75 ohms input impedance.

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CONTROLS

X Axis gain and position

Y Axis gain and position

Intensity

Focus

Control Location: Front panel standard, side or rear optional

MOUNTING

Rack mount with long axis vertical. Unit may be mounted with long axis horizontal if provision is made for side exhaust of cooling air

COOLING

INternal fans

POWER

107 to 127 VAC 50/60 Hz 1100 Watts. Single fuse 12A or 10 A.S.B. located at rear-may be connected for 220/230 V operation

PHYSICAL

Height 21" Width 19" Depth 23" behind rack mount or bezel. Bezel depth 4". CRT face protrudes 3" beyond frame. Weight 125 lbs. Bezel and mask optional at extra cost

ENVIRONMENTAL

Operating-temperature 0^{o} to $45^{o}C$. Humidity 0 to 90% RH. Shock and vibration-not for mobile installation

Non Operating-temperature -40^{o} to $+85^{o}C$. Humidity 0 to 100%. Shock and vibration-as encountered in normal handling and shipping

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3.0 INSTALLATION AND OPERATION

MODEL A21

INSTALLATION

The A21 when shipped by common carrier must be adequately protected to prevent damage. It may be shipped by padded van uncrated, otherwise a double container carton or crate should be used with shock mounting and/or non-compressible packing materials. Loose particle packaging materials must not be used. Before attempting to operate the equipment, inspect carefully for shipping damage. Damage claims should be submitted immediately to the carrier.

Do not place the equipment on top of foam plastic or rubberized hair: use wood or cardboard to prevent scratches or other damage.

Do not unpack or operate the equipment in any areas where metal chips or clipped leads could enter the circuitry. It is especially important to observe this precaution. Clipped leads can be propelled 20 ft. or more from an assembly or rework station and be the cause of problems that are difficult to locate, expensive to repair and be straining to the customer-vender relationship.

After unpacking the equipment, check the accompanying list to determine that all accessories listed are present. Standard accessories are one line cord and one instruction manual.

OPERATION

To perform initial operational checkout of the equipment follow this procedure:

Place the equipment so that the operator controls are accessible and the fans are vertical or to either side. Rotate the intensity control full counter-clockwise.

Center X and Y gain and position and focus controls.

Obtain 2 signal or function generators and connect one each to the X and Y signal inputs of the monitor. Adjust the generator outputs to sine wave, 5 volts peak to peak at approximately 2 KHz.

Connect a plus 2.5 volt D.C. source to the unblank and video inputs of the monitor.

Connect the monitor power cord to the monitor and a power outlet having the characteristics indicated on the identification decal. This is generally 115 VAC 50/60 Hz at 10 to 20 amps.

If the monitor has a power switch place it in the on position. Check that air is blowing from both fans.

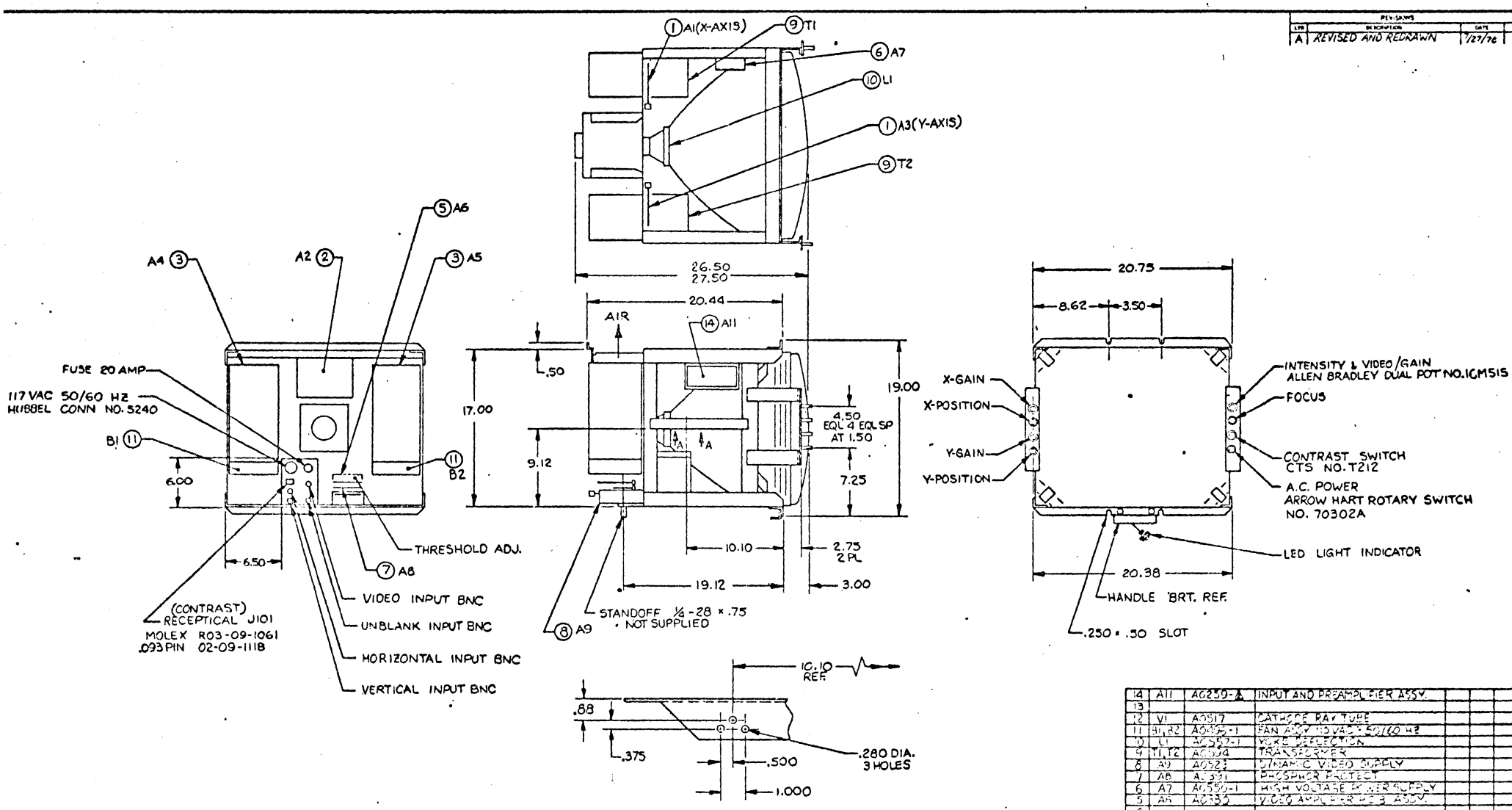
Wait 2 minutes then slowly rotate the intensity control clockwise until a display appears. It should be a square pattern of non-synchronized sine waves. (If no pattern appears refer to troubleshooting section.)

The equipment may now be shut down and connected to the operational processor or graphic terminal. Always keep the intensity control full counter-clockwise when turning on equipment for the first time. After turning on the monitor in the final system rotate the intensity control slowly clockwise observing the entire screen for bright spots which could cause burning of the phosphor.

After the unit has been connected to the system and is operational, the threshold adjust R31 may be adjusted to optimize the appearance of the display regarding end point match and levels of grey. The inter-relation of the intensity control, video amplitude and threshold

level, requires that some experimentation be done to obtain the best performance. Read the video amplifier circuit description for an explanation of the function of the threshold control.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	REVISED AND REDRAWN	1/27/76	



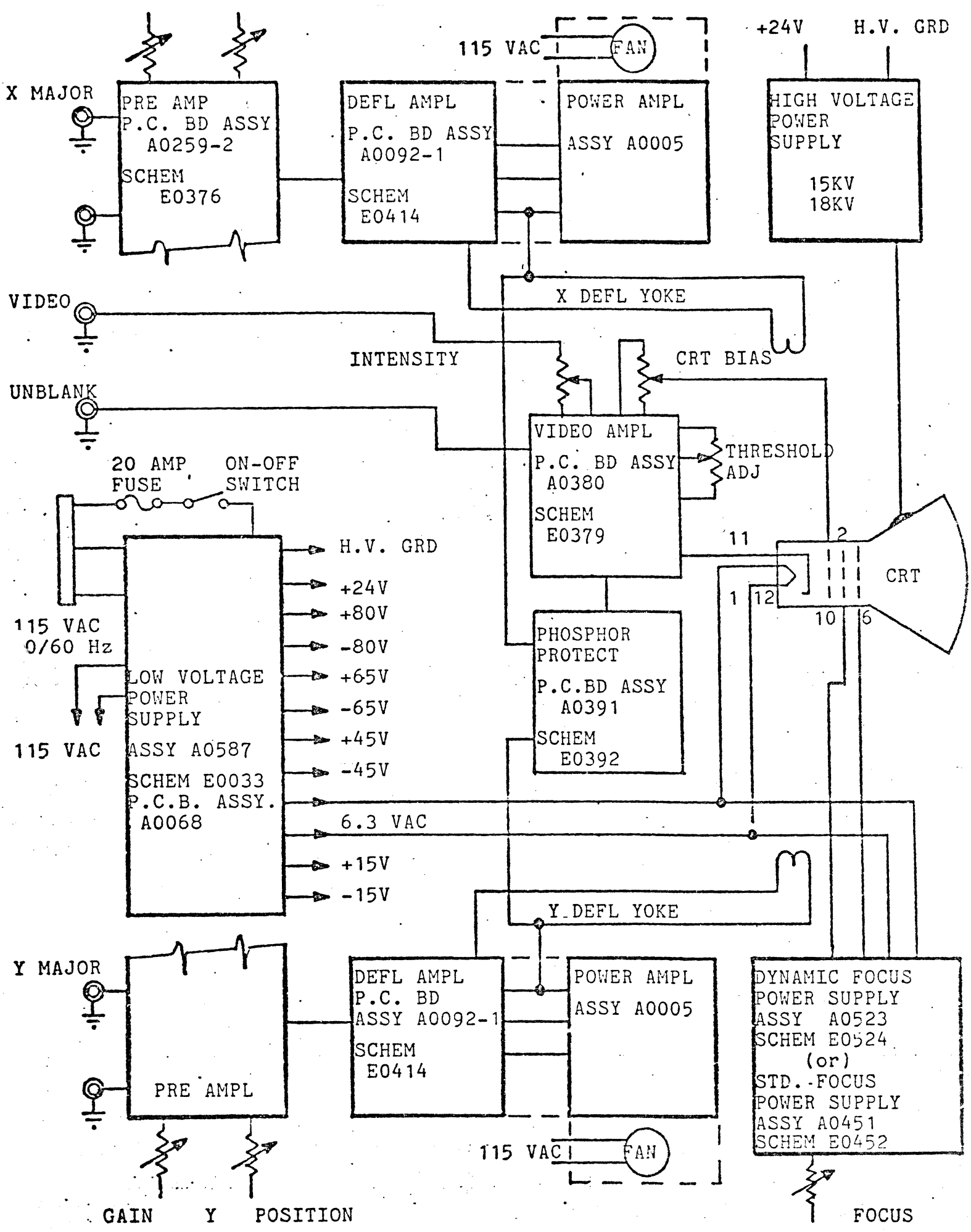
VIEW A-A
SCALE 1/2
TYPICAL BOTH SIDES

ITEM NO	QTY REQ	PART NO.	DESCRIPTION	-1	-2	-3
14	1	A0259-A	INPUT AND PREAMPLIFIER ASSY.			
13						
12	1	A0517	CATHODE RAY TUBE			
11	1	A0[illegible]	FAN ASSY 115VAC 50/60 HZ			
10	1	A0257-1	YOKE DEFLECTION			
9	1	A0254	TRANSFORMER			
8	1	A0252	DYNAMIC VIDEO SUPPLY			
7	1	A0331	PHOSPHOR PROTECT			
6	1	A0250-1	HIGH VOLTAGE POWER SUPPLY			
5	1	A0255	VIDEO AMPLIFIER PCB ASSY.			
4						
3	1	A0[illegible]	POWER SUPPLY AMP PCB			
2	1	A0[illegible]	LOW VOLTAGE POWER SUPPLY			
1	1	A0[illegible]	DEFLECTION AMP. PC B ASSY			

PART LIST

		XYTRON INC.	
		OUTLINE DRAWING	
		21 INCH CRT MONITO	
		SIZE D	DRAWING NO. X0585
		DO NOT SCALE DRAWING	SHEET

4.0 THEORY OF OPERATION



BLOCK DIAGRAN
MODEL A21-7

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CIRCUIT DESCRIPTION DEFLECTION AMPLIFIER (REF SCM DE0414)

Each axis of the deflection yoke is driven by a constant current power amplifier. The circuit has a voltage amplifier section located on a plug in card and the power output section which is a heat sink assembly and integral cooling fan. The voltage amplifier has a differential input stage Q2 and Q3 with the signal applied to Q2 and negative feedback to Q3. Q2 is cascode connected with Q1 which lowers the voltage to and dissipation of both transistors. Q1 drives emitter follower Q4 and amplifier Q5 which produces the 90 volt peak to peak voltage swing needed to drive the output stages. Q5 collector has 3 diodes in series to produce a voltage drop to bias the positive driver Q7 and negative driver Q6, "on" at zero volts crossover to prevent glitches when the output stages are driven from positive to negative. Diodes are used rather than resistors because they maintain a constant voltage drop that varies with temperature and offsets the base emitter temperature varation of the following stages Q6 and Q7. This helps maintain a constant quiescent output current. Q7 and Q8 are inverting stages that have sufficient gain to equal the gain of negative driver Q6, this balances the positive and negative drive which helps maintain a constant phase output signal for both polarity signals. The high current output to the deflection yoke is supplied by 5 paralleled transistors per side with one power driver per side. The output stage is connected in the standard quasi complementary symmetry manner. One half conducts negative current only and the other half conducts positive current only. This configuration is convenient for bipolar signals because negative feedback is easily obtained. All out-

put transistors have fairly large emitter resistors to equally balance the current each one supplies to the load. This avoids problems of chain reaction failure caused when improper balance allows one transistor to carry a greater share of the load current. The output transistors conduct current through the deflection yoke then through a small value current sense resistor which is used to pick off a feedback voltage. Deflection distance of the CRT beam by the deflection yoke is in direct proportion to the current that flows in the yoke. The yoke has inductance which means that in order to maintain a CRT beam deflection that follows the input signal over a wide frequency range the voltage applied to the yoke must be increased as the input frequency is increased. For example, a square wave applied to the input will not result in a square wave of current at the sense resistor because the yoke inductance is in series with it. The voltage amplifier would not see any negative feedback instantaneously and would increase the yoke voltage to maximum until yoke current through the sense resistor produced a voltage equal to the input. For this reason a square wave input will produce a voltage wave form across the deflection yoke that has high voltage spikes on the leading and lagging edges. Q3 base where negative feedback is applied may also have a small signal from the other axis. This signal will rotate one axis of the display one direction or the other depending upon polarity, to offset small orthogonality errors of the deflection yoke. The yoke is a mechanical device and it is impractical to attempt to align the axis to exactly 90^{o}; for this reason orthogonality correction is used when necessary. This signal should not be confused with non-intentional cross coupling that can occur in the wiring and can cause abberations of the display.

CIRCUIT DESCRIPTION LOW VOLTAGE POWER SUPPLY (REF SCM E0033)

The operation of the ±65 volt and ±15 volt power supplies is essentially the same so only the +15V power supply will be described.

The supply is a series regulated feed back type with current limiting. The power pass transistor Q16 is driven by emitter follower Q4 which is driven by voltage amplifier Q5. Q5 emitter is tied to a stable 9 volt reference source CR2. Operation is as follows. If the output of the supply is loaded and the voltage drops, this negative change is coupled through R16 to the base of Q5 which amplifies and inverts the error signal causing a positive signal at Q4 and Q16 emitters which is almost equal to and of the opposite polarity of the original change cancelling the change and maintaining a stable output voltage from the supply. Should the supply be overloaded or short circuited the current flow in R15 will develop a voltage base to emitter of Q6 causing it to conduct bringing its collector and Q4 emitter and Q16 emitter less positive until only enough output voltage remains to cause 600 milliamps to flow through R15. In the case of a short circuit the output voltage from Q16 would be 600 millivolts. Q16 transistor type was chosen to have an adequate second breakdown characteristic to operate safely at 600 milliamps with 80 volts collector to emitter..

The +24 volt supply that provides power for the high voltage power supply is interlocked with the +65 and -65 volt power supplies to shut down the high voltage in the event of a failure or short circuit of the ±65

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volt power supplies. The +65 volt power supply biases the CRT cathode and the -65 volt power supply biases the CRT grid. The failure of either supply could cause loss of CRT bias and result in burned CRT phosphor. In normal operation Q13 is biased off by R18 and R19, the junction of which is at zero volts. This allows R20 and R21 to hold the base of emitter follower Q14 at +24 volts. Q14 drives Q17 which supplies the higher current necessary for the high voltage power supply. Should the -65 volt power supply fail the junction of R18, R19 would go positive turning on Q13 bringing its collector to ground. This in turn causes the output of Q14 and Q17 to drop to zero volts shutting off the high voltage. Should the +65 volt power supply fail or be short circuited the base of Q14 would drop to zero volts causing the output of Q17 to drop to zero volts which shuts down the high voltage power supply.

CIRCUIT DESCRIPTION
VIDEO AMPLIFIER
REF. SCM. CE0379

The video amplifier output stage Q3 drives the CRT cathode to control the CRT intensity and turn the beam on and off. Q3 is driven by two emitter followers Q1 and Q2 which are connected so that no signal can pass unless an unblank signal is applied. With an unblank signal present, Q1 is cut off and Q2 establishes a bias for Q3 to begin conduction. This conduction level may be adjusted by a bias circuit (threshold adj) in Q3 emitter that permits setting the DC voltage at Q3 collector at some desired level depending upon CRT cut off bias. Generally this would be just beyond CRT cut off with the intensity control full on. This permits use of the full dynamic range of the video amplifier and also allows adjusting parallel monitors for identical video response. The video input to Q2 now effects Q3 current which controls the CRT brightness.

Q4 which shuts off the CRT at power down to prevent phosphor burn is normally conducting which places its collector at zero volts and biases the CRT on. When power is shut down and the +65 volt power supply collapses by 14 volts the drop across CR3 stops current flow in the circuit shutting off Q4. This allows its collector to go toward minus 65 volts which is the temporary charge stored on C4. With the collapse of the +65 volt power supply an additional charge is placed on C4 by C5 bringing the total bias to about minus 120 volts which is sufficient to completely cut off the CRT. This

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charge remains on C4 because it is isolated by diodes CR8, CR6, CR9, CR1 and the collector of Q4. When the phosphor protect option is used and a cut off signal is detected by Q4 base due to loss of deflection signal, the CRT is cut off out under these conditions the cut off bias on C4 is minus 80 volts as supplied by R14 and CR8.

R25 is selected to limit CRT anode current to a level just below blooming of the beam with full intensity and maximum video and unblank.

The high frequency currents in the video amplifier are decoupled by R1, C1 and C3 to prevent interference with other circuits.

Network C7 and R24 add boost to the amplifier response at high frequencies to flatten the total response.

Protection circuits R36, CR9 and R2 provide cut off bias to the CRT in the event the cathode lead E1 is disconnected or if the video card is not installed when power is applied.

CIRCUIT DESCRIPTION-PRE AMPLIFIER (REF SCM CE0376)

The delfection amplifier consists of a pre-amplifier, voltage amplifier and power amplifier sections. The input signal or signals are applied thru a resistive voltage divider network to input emitter follower Q1 which presents a high impedance to the input signal and has a low output impedance which is capable of driving the gain control. The gain control is returned to a forward biased diode which has the same temperature coefficient and voltage drop as the base emitter junction of the input emitter follower. This places the same potential at both ends of the gain control which eliminates DC shift as the control is rotated. The next stage emitter follower is a PNP type which cancels the DC shift of the input stage NPN transsistor, presents a high impedance to the gain control and a low driving impedance to the following positioning and signal clipping circuits. The positioning voltage is summed with the signal at the point where the reverse biased signal clippers Q5, 7 are connected so changes of the position control will not shift the point where clipping takes place, the clipping transistors are normally cut off and present a high impedance to the signal. If the input signal should exceed the preset level, the clip transistor emitter becomes forward biased which presents a very low impedance to the signal preventing any further signal increase. The output stage of the pre-amplifier Q9-11 has a very low output impedance for both positive and negative exursions. Feed back is taken from the collector or Q9 to the base of Q11 which is returned to a

negative power supply. For positive going signals Q9 acts as an emitter follower with Q11 as a current source. For negative going signals Q11 acts as a low impedance source to the negative power supply. The diode in Q3 emitter, level shifts the signal by the same amount as the bias of Q9, so the signal is returned to zero volts reference as it leaves the pre-amplifier section.

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CIRCUIT DESCRIPTION DYNAMIC FOCUS POWER SUPPLY (REF SCM E0524)

In order to achieve minimum spot size over the entire usable area of the CRT, the spot must be refocused as it is deflected away from center screen.. This is necessary because the radius of curvature of the CRT face is usually much greater than the radius of deflection. Refocusing is accomplished by extracting a signal from the deflection signals and modifying it to produce a voltage at the CRT focus anode that changes in the correct proportion to maintain optimum focus as the beam is deflected. Refer to block diagrams as circuit operation is described. Assuming the CRT beam is deflected full screen on the X axis only the signal at point A will be maximum negative which we will arbitrarily assign a value of 1 volt. This signal will always be negative because CR1 will pass only negative signals and Q1 will invert positive signals so that only negative signals are present at point A. With A at 1 volt and B at zero, C is .7 volts (due to a fixed attenuator at the input of Q8) D is .5 volt due to voltage dividing action of R8 and R18. E is the sum of .7 and .5 which is .6 volts. This voltage corresponds to the on axis signal and is linear with respect to it. If the CRT beam is deflected to one corner, both signals at A & B are minus 1 volt which causes D to be 1 volt, however C is still .7 volts which when summed with D at 1 volt produces .85 V at point E. Thus with the CRT beam at the corner, we have a voltage at point E that is 1.41 times the voltage with the beam at one side. This is the correct ratio for the vector addition of the X and Y components of the deflection signal.

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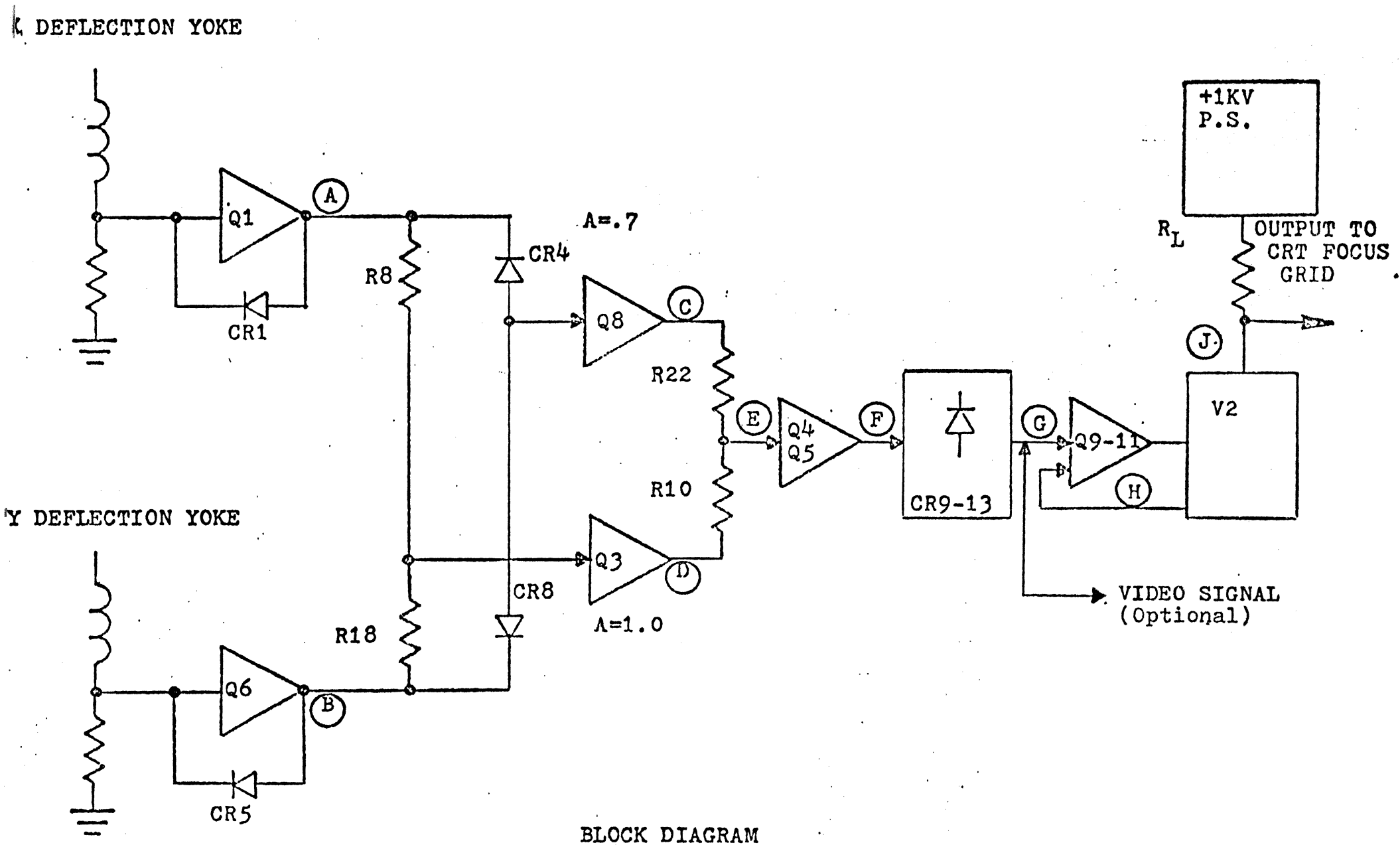
The signal is now amplified by Q4 and Q5 which also drive diode shaping networks CR9-13. The diodes are biased so all diodes are conducting at zero volts and as the signal increases and the diodes become individually reverse biased with the increasing signal, less loading at point G increases the gain of Q4 and Q5 causing a non linear increase in signal output at point G. This signal is now converted by variable current source Q9-11 and V2 to a 600 volt peak to peak correction voltage for the CRT focus.

Q9 and 10 is a differential input stage driving Q11 which drives the grid of V2. With the CRT beam at center screen and the voltage at point G at zero the feedback voltage at H must also be zero. A negative voltage is injected into the cathode of V2 by the focus control which requires V2 to conduct sufficiently to exactly offset this voltage so point H remains at zero. This cathode current flows through R_L establishing the proper voltage at J to focus the CRT at center screen. This voltage is approximately +400 volts. As the CRT beam is deflected away from center screen the resulting negative signal atG causes V2 cathode current to decrease causing its output voltage at J to go more positive by an amount required to maintain the CRT beam at optimum focus.

The regulated 1KV power supply uses a transformer and voltage tripler to supply 1.2 KV to regulator Q1. A string of series zener diodes keeps Q1 base at 1KV which holds Q1 base at 1KV under all conditions of line and load change. A vacuum tube is used in the circuit because it can withstand high voltage arcing without damage. Almost all CRT's arc intermittently and semi-conductor circuits when used to drive the CRT are more susceptible to failure when arcing occurs.

On power supplies with video compensation, video signal is summed with the dynamic correction signal at the base of Q9. This causes the focus voltage output to decrease with higher brightness caused by increasing video signal. This offsets a characteristic of the CRT which normally requires lower focus voltage for brighter display. The result is a well focussed display over the entire brightness range.



BLOCK DIAGRAM
DYNAMIC FOCUS POWER SUPPLY
REF SCM DE0055
and
REF SCM DE0524

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CIRCUIT DESCRIPTION PHOSPHOR PROTECT (REF SCM E0392)

The phosphor protection (PP) circuit detects CRT beam movement in both the X and Y axis. If a deflection signal is not present in either axis for a period of 30 milliseconds the circuit applies 80 volts of negative bias to the CRT control grid which shuts off the beam preventing burning of the phosphor. Signals are taken from the drive side of the deflection yoke because the yoke inductance causes large voltage spikes with small deflection excursions so steps of .1 to .2 inches are detected. The PP circuit has 2 channels, one for each axis. Either channel can shut off the CRT. Diodes CR3 and CR6 isolate each channel from each other. The deflection signal is connected to amplifier Q2 which provides a low impedance drive to discharge C4. If no signal is present, C4 will begin to charge positive through R4. If after 10 milliseconds no deflection signal discharges C4 it will have charged positive to +15 volts. This signal is connected through diode CR3 and source follower Q1 to the CRT shut off transistor. The positive signal is connected to the base of a PNP transistor which cuts off, putting a negative bias on the CRT. X and Y channel operation is identical.

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5.0 MAINTENANCE AND TROUBLESHOOTING

TROUBLESHOOTING GUIDE

CAUTION

BEFORE REMOVING OR INSTALLING ANY CARDS, POWER SUPPLIES OR CONNECTORS, REMOVE THE POWER CORD FROM THE UNIT.

DO THIS AT EVERY STEP OF THE TROUBLE SHOOTING PROCEDURE WHERE CARD OR CONNECTOR REMOVAL OR INSERTION IS CALLED FOR OR WHEN MAKING HIGH VOLTAGE MEASUREMENT.

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SYMPTOM

A UNIT BLOWS FUSES
B NO DISPLAY
C NO DEFLECTION ONE OR BOTH AXIS
D DISPLAY JITTERS

In case of any malfunction except Symptom A, measure all low voltage power supplies first.

+45	±5V	
-45	±5V	
+65	±5V	
-65	±5V	
+15	±1.5V	
-15	±1.5V	
+24	±4V	
+500	±50V	when used
+300	±5-V	when used

If any of the power supplies are out of tolerance, check for a short circuit in the external circuitry by removing all plug in cards except the low voltage power supply then rechecking the voltages. If they are still incorrect exchange the low voltage power supply assembly. If the voltages are correct, insert all other cards one at a time measuring the power supplies each time until the card that is causing the problem is identified. Replace the defective card with a new card. The power supplies are current limited and will not have been damaged by a short circuit.

SYMPTOM A UNIT BLOWS FUSES

Probable Causes

a) Shorted transistor(s) in X or Y heat sink assembly

b) Defective X or Y amplifier card
c) Shorted bridge rectifier

Problem Isolation and Correction

a) Remove amplifier P.C. cards one at a time. Apply power each time. If fuse blows with both cards out remove deflection amplifier assemblies and check for shorted output transistors by measuring with ohmeter on X1 scale, for a short between collector and emitter. Replace shorted transistors and any burned components.
b) If fuse blows with one amplifier card installed, install other card in same connector. If fuse does not blow, amplifier card not installed is defective. Replace with new card.
c) Measure between adjacent terminals of the power bridge rectifier with ohm meter, on X1 range, in both directions. If meter shows conduction in both directions on any leg of the rectifier, replace with new rectifier.

SYMPTOM B NO DISPLAY

Probable Causes

a) No high voltage
b) No unblank and/or video input signal
c) Defective video amplifier
d) No CRT filament voltage or CRT filament open
e) Beam deflected off screen
f) Phosphor protect enabled
g) No G2 and/or focus voltage

Problem Isolation and Correction

a) With high voltage power supply connected to CRT measure high voltage with 20 KV meter. Reading should be at least 10 KV. See specification for correct value. If value is correct move to step.(b). If no voltage or reduced voltage is present shut off power, remove anode cap from CRT and connect to 20 KV meter. Apply power, if reading is normal CRT may be shorted internally. Substitute spare high voltage power supply if available. If results are the same, replace the CRT. If no voltage or reduced voltage is measured at the anode cap with the supply not connected to the CRT measure the input voltage of the supply. The voltage should be 24 volts $\pm$4 volts. If the correct voltage is present replace the high voltage power supply.

b) With laboratory oscilloscope, check for unblank and video signals at the monitor input connectors.

c) If unblank and video signals are present at input, check CRT cathode pin 11 for negative video pulses of at least 35 volts amplitude using laboratory oscilloscope. If signals are not present replace video amplifier card.

d) If video signals are present at CRT cathode look into neck of CRT for reddish orange glow that indicates hot filament. If glow is not visable measure 6.3V AC $\pm$.5V at CRT socket pins 1 & 12. If voltage is present remove socket and check resistance between pins 1 and 12 of the CRT. Reading should be less than 200 ohms. If filament measures open, heat pins 1 and 12 with soldering iron and feed solder into end of each pin. Remeasure filament continuity. If filament is still open CRT must be replaced.

e) Using laboratory oscilloscope observe voltage at X and Y feedback resistors located on chassis between amplifier cards. Signals should go from + to - or within ½ volt of zero. If not, check X and Y signal inputs. If signal input appears OK trouble shoot deflection amplifiers as indicated in symptom A.
f) If monitor has phosphor protect option turn intensity control full counter clockwise. Remove phosphor protect card and apply power to monitor. Carefully rotate intensity clockwise. If display appears install new phosphor protect card.

SYMPTOM C NO DEFLECTION ONE OR BOTH AXIS

Probable Causes

a) Defective deflection amplifier output transistor
b) Defective amplifier card
c) No signal to deflection amplifier

Problem Isolation and Correction

a) Follow procedure outlined in Symptom A (a)
b) Follow procedure outlined in Symptom A (a) and (b)
c) Using laboratory oscilloscope check for presence of deflection signals at input to amplifier card. If signal is not present check input to preamplifier. If signal is not present check at input BNC. Look for broken wire, unsoldered connection, improper assembly of BNC cable coming to monitor.

SYMPTOM D DISPLAY JITTERS

Probable Causes

a) Magnetic component near monitor
b) High voltage ripple

c) Low voltage ripple
d) Ground problem
e) Amplifier oscillating

Problem Isolation and Correction

a) Magnetic interference is difficult to detect since equipment designed for this function is not readily available. The surest way to determine if interference is originating externally is to move the monitor to another location. Avoid close proximity to logic power supplies and particularly resonating magnetic components, high current power wiring, large relays, fans, motors and any transormer having an air gap. The monitor is shielded to exclude low intensity interference only. High intensity field generating components must be shielded or the monitor must be oriented and/or located so as to minimize pick up.

b) Check the +24 volt supply to the high voltage power supply with an A. C. coupled laboratory oscilloscope. If low frequency (under 20 Hz) ripple is detected the high voltage power supply may be motorboating. Replace the supply. Inspect the aquadag and grounding spring on the outside of the CRT. If the black coating is worn away from the spring move the spring to another place on the CRT. This coating acts as a filter capacitor for the high voltage and should be grounded.

c) Check with AC coupled oscilloscope the $\pm$65, $\pm$15 and +24 Volt power supplies. Ripple on the $\pm$65 and +24 Volt supplies should be less than 500 millivolts The $\pm$15 Volt supplies should be less than 50 millivolts. If these values are exceeded on any supply replace or repair the power supply assembly.

d) The monitor does not have a direct connection

between signal ground and chassis ground. With all connectors disconnected from the monitor, measure resistance from circuit ground to chassis ground. Reading should be greater than 1000 ohms. If less resistance is indicated make a visual inspection of the entire ground system. Check mica insulating washers at the BNC connectors. Look for pinched wires. Occasionally hum pick up can eliminated by grounding circuit ground to chassis and should be tried but not used unless there is a definite major reduction of interference.

e) Using oscilloscope, observe signal on the deflection yoke high voltage side, that is the end away from the feedback resistor. Look for bursts of high frequency oscillation. If may appear only as fuzziness on the signal. If oscillation is observed replace amplifier card then deflection amplifier assembly if oscillation persists.

INSTRUCTIONS-INPUT POWER CONNECTIONS FOR 115 OR 230 VAC 50/60 Hz

Disconnect power from unit.

Remove top cover from transformer (s). Tag hot and netural wires. These wires connect to pins 1 or 6 only. Connect jumpers as shown on drawing E0420 or E0442 for desired input voltage.

Reconnect jumpers on primary only. Be very careful not to change the input hot and neutral wires which should always remain on pins 1 and 6.

10/2/78

INSTRUCTIONS
CATHODE RAY TUBE REPLACEMENT
XYTRON MODEL B21 - A21

Protective goggles or face shield and non slip gloves should be worn when handling CRT. For safety reasons two persons are required to replace CRT.

Unit, in which CRT is installed, should be accessible from all sides as on a bench top and be disconnected from all cables.

Never put stress on end of CRT neck.

1. Remove mask from in front of CRT by removing 4 No. 10 x 32 screws.
2. Remove anode connector from CRT
3. Remove base connector from CRT
4. Slide grey cylindrical shield off neck of CRT
5. Loosen deflection yoke clamp
6. Disconnect 2 yoke connectors and slide yoke off rear of CRT.
7. Loosen 4, $\frac{1}{4}$" nuts holding CRT corner brackets near front of chassis. Do not remove nuts yet.
8 To prevent the neck of CRT from being stressed or striking framwork, one person should support CRT at point where the neck joins the bulb while the second person removes the holding nuts and withdraws the CRT from the frame. The CRT is placed face down on a resilient surface or placed directly into a carton for shipment or disposal.

The new CRT is installed in the reverse manner. One layer of masking tape should be placed on the neck of the CRT in the area where the yoke clamp will be. Deflection yoke lead break out is at the top. To rotate the display after installation of the new CRT.

the unit should be placed in operation before cabinet is installed and the yoke rotated by hand slightly as required to orient the image. The yoke clamp should be fairly snug during the adjustment.

6.0 PARTS INFORMATION

RECOMMENDED SPARES

MODEL A21-7

QTY.	DESC. ASSEMBLIES	NO.	PRICE
1	Dynamic Video Focus Power Supply	A0842	$ 295.00
1	High Voltage Power Supply 15KV		225.00
1	Deflection Amplifier PC Bd. Assy.	A0092-1	140.00
1	Video Amplifier Card Assy.	A0380	120.00
1	Deflection Amplifier Heat Sink Assy.	A0008-1	225.00
1	Low Voltage Power Supply	A0587	225.00

QTY	COMPONENTS	UNIT COST	PRICE
10	RCA 410 Transistor	$ 3.20	$ 32.00
5	2N6261 Transistor	3.20	16.00
5	2N2222 Transistor	1.50	7.50
5	2N4036 Transistor	2.80	14.00
5	2N3053 Transistor	1.90	9.50
4	2N4258 Transistor	1.50	6.00
1	VT400T Rectifier Bridge	15.00	15.00
5	Fuse 20A 314020 Littlefuse	.75	3.75
2	1N914 Diode	.50	1.00
5	2N2405 Transistor	4.10	20.50
5	2N2907 Transistor	1.50	7.50

XYTRON, INC.

8/30/78

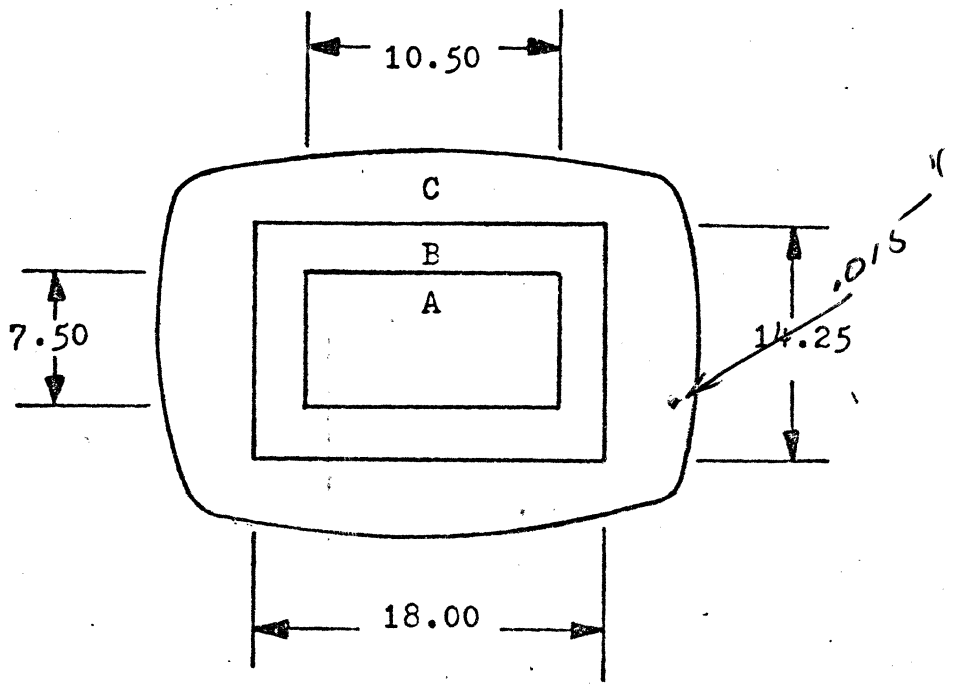
21 INCH RECT. CRT INSPECTION SHEET

CRT SERIAL NO. 92292 DATE 7-23-9

INSTALLED ON UNIT NO. 1047 INSP. BY BTG

ZONE	ZONE SIZE	SPOT SIZE GREATER THAN	NO OF DEFECTS	MAX. NO. DEFECTS
A	50% H	.009	7	
	55%	.019	3	7
		.029	1	
		.060	0	
B	95% H	.009	18	
		.019	10	18
		.029	5	
		.060	0	
C	LESS A & B	DISREGARD DEFECTS		

ELONGATED SPOT = $\frac{L + W}{2}$



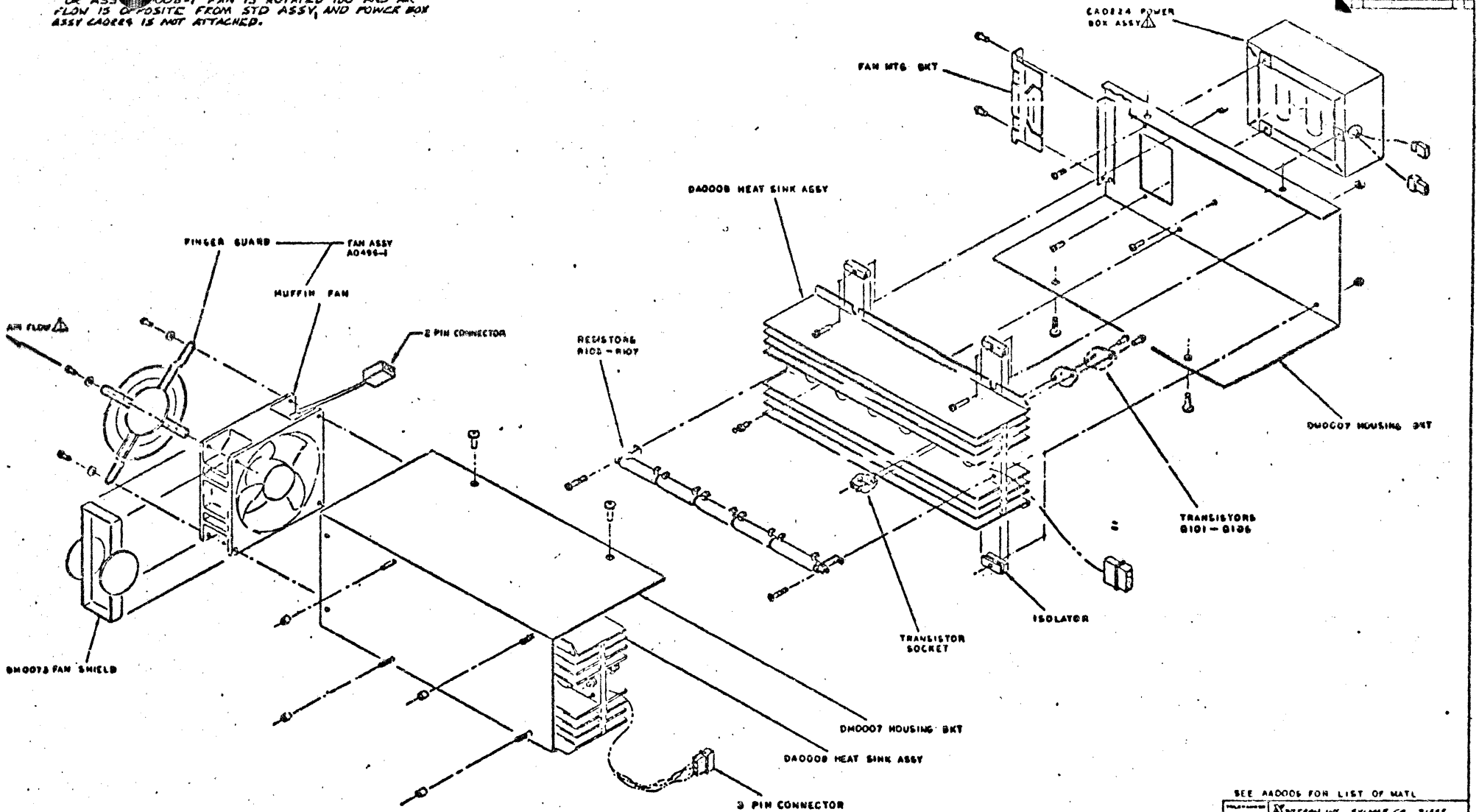
8/4/78

7.0 DRAWINGS

10/2/78

NOTE

OR ASS'Y DA0005-1 FAN IS ROTATED 180° AND AIR FLOW IS OPPOSITE FROM STD ASS'Y, AND POWER BOX ASS'Y CA0824 IS NOT ATTACHED.

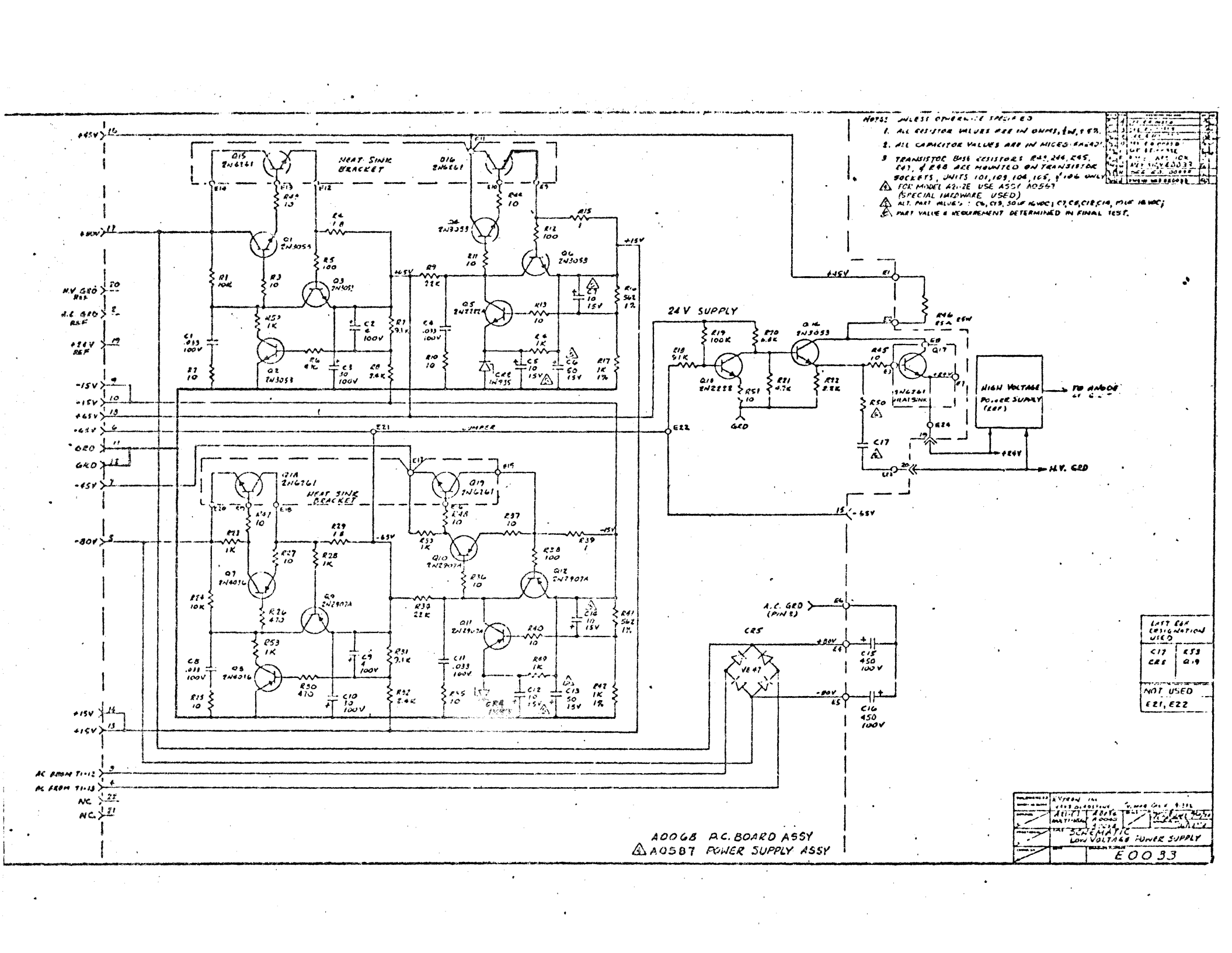


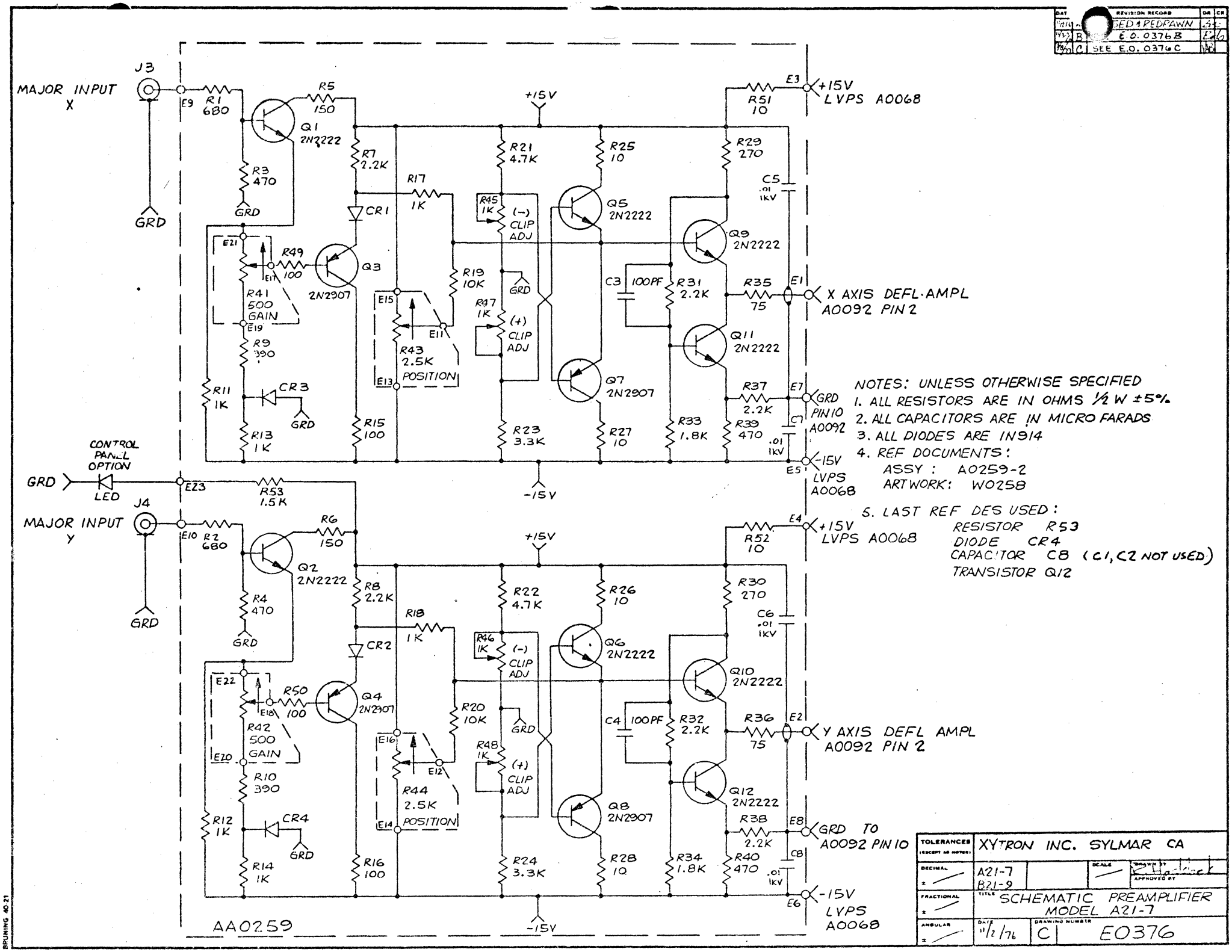
SEE AA0005 FOR LIST OF MATL

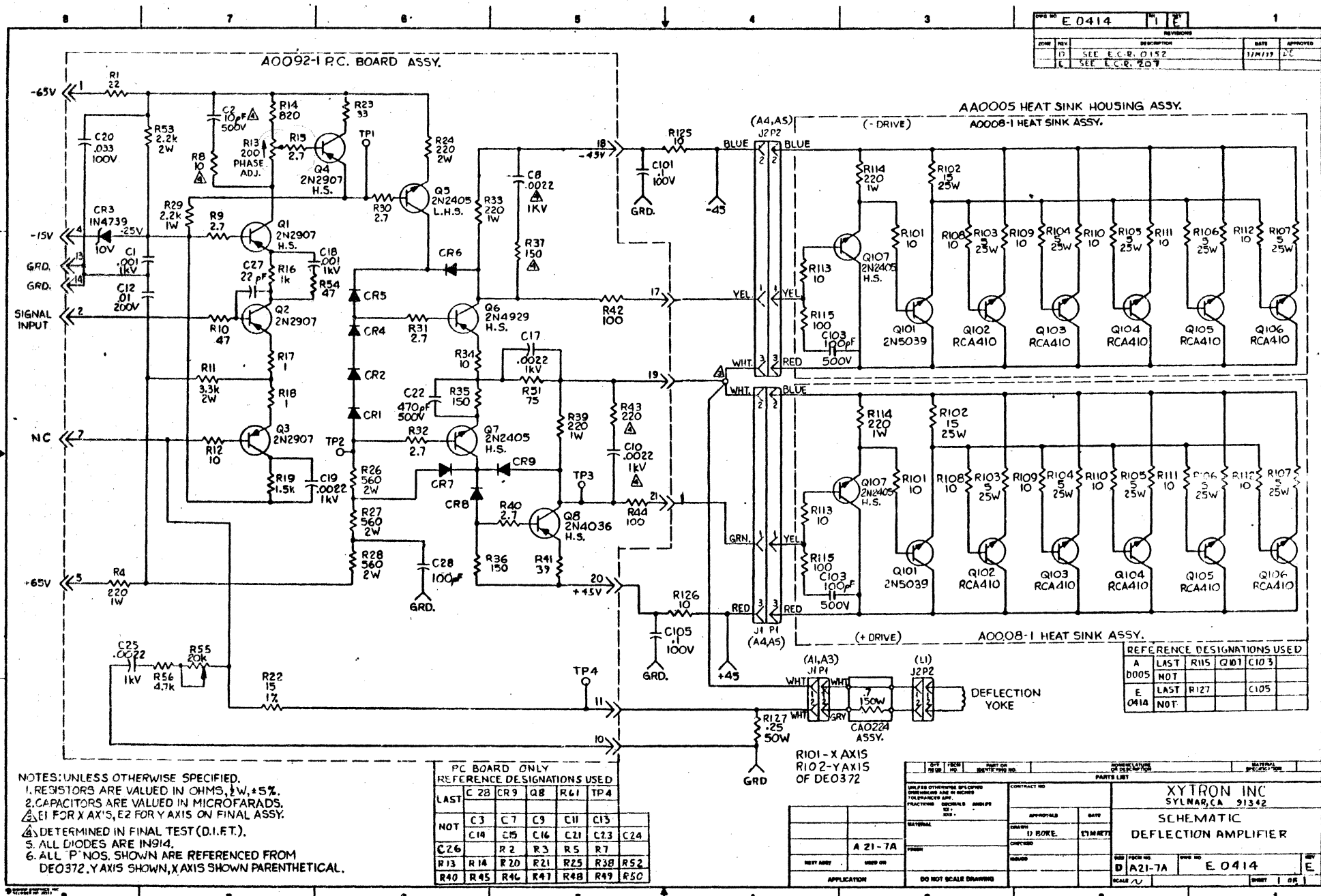
SYSTRON INC. SYLMAR CA 91342

DEFLECTION AMPLIFIER HEAT SINK HOUSING ASSEMBLY

DA0005


NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ± 5%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. TRANSISTOR BASE RESISTORS R45, R46, R65, R67, & R68 ARE MOUNTED ON TRANSISTOR SOCKETS, UNITS 101, 103, 104, 105, & 106 ONLY.
4. FOR MODEL 42-7E USE ASSY A0567 (SPECIAL HARDWARE USED)
5. ALT. PART VALUES: C6, C13, 50uF 15 VDC; C7, C8, C18, C19, 75uF 15 VDC;
6. PART VALUE & REQUIREMENT DETERMINED IN FINAL TEST.
HEAT SINK BRACKET
HEAT SINK BRACKET
24 V SUPPLY
HIGH VOLTAGE POWER SUPPLY (REF)
TO ANODE
H.V. GRD
+24V
JUMPER
A.C. GRD (PIN 8)
CR5
VE 47
LAST E&K ORIGINATION USED
C17 K53
CR5 Q19
NOT USED
E21, E22
A0068 A.C. BOARD ASSY
A0587 POWER SUPPLY ASSY
AVTRON INC.
SCHEMATIC
LOW VOLTAGE POWER SUPPLY
E0033


REVISION RECORD
DR CR
A RED 1 PEDPAWN
B E.O. 0376B
C SEE E.O. 0376C
J3
MAJOR INPUT X
GRD
E9
R1 680
Q1 2N2222
R5 150
R3 470
GRD
+15V
E3
R51 10
+15V LVPS A0068
R7 2.2K
R17 1K
CR1
R21 4.7K
R25 10
R29 270
C5 .01 1KV
R45 1K
(-) CLIP ADJ
Q5 2N2222
Q9 2N2222
E21
R49 100
Q3 2N2907
E17
R41 500 GAIN
E19
R9 390
R11 1K
CR3
GRD
R13 1K
E15
E11
R43 2.5K POSITION
E13
R19 10K
GRD
R47 1K
(+) CLIP ADJ
C3 100PF
R31 2.2K
R35 75
E1
X AXIS DEFL AMPL A0092 PIN 2
Q11 2N2222
Q7 2N2907
R37 2.2K
E7
GRD PIN 10 A0092
C7 .01 1KV
E5
-15V LVPS A0068
R15 100
R23 3.3K
R27 10
R33 1.8K
R39 470
-15V
CONTROL PANEL OPTION
GRD
LED
E23
R53 1.5K
J4
MAJOR INPUT Y
E10
R2 680
Q2 2N2222
R6 150
R4 470
GRD
+15V
E4
R52 10
+15V LVPS A0068
R8 2.2K
R18 1K
CR2
R22 4.7K
R26 10
R30 270
C6 .01 1KV
R46 1K
(-) CLIP ADJ
Q6 2N2222
Q10 2N2222
E22
R50 100
Q4 2N2907
E18
R42 500 GAIN
E20
R10 390
R12 1K
CR4
GRD
R14 1K
E16
E12
R44 2.5K POSITION
E14
R20 10K
GRD
R48 1K
(+) CLIP ADJ
C4 100PF
R32 2.2K
R36 75
E2
Y AXIS DEFL AMPL A0092 PIN 2
Q12 2N2222
Q8 2N2907
R38 2.2K
E8
GRD TO A0092 PIN 10
C8 .01 1KV
E6
-15V LVPS A0068
R16 100
R24 3.3K
R28 10
R34 1.8K
R40 470
-15V
AA0259
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS 1/2 W ±5%
2. ALL CAPACITORS ARE IN MICRO FARADS
3. ALL DIODES ARE IN914
4. REF DOCUMENTS:
ASSY : A0259-2
ARTWORK: W0258
5. LAST REF DES USED:
RESISTOR R53
DIODE CR4
CAPACITOR C8 (C1, C2 NOT USED)
TRANSISTOR Q12
TOLERANCES (EXCEPT AS NOTED)
DECIMAL ±
FRACTIONAL ±
ANGULAR ±
XYTRON INC. SYLMAR CA
A21-7
B21-9
SCALE
DRAWN BY
APPROVED BY
TITLE SCHEMATIC PREAMPLIFIER MODEL A21-7
DATE 11/2/76
DRAWING NUMBER C E0376
BRUNING 40 21



REFERENCE DESIGNATIONS USED					
A D005	LAST	R115	Q107	C103	
	NOT				
E 0414	LAST	R127		C105	
	NOT				

NOTES: UNLESS OTHERWISE SPECIFIED.
1. RESISTORS ARE VALUED IN OHMS, ½W, ±5%.
2. CAPACITORS ARE VALUED IN MICROFARADS.
3. E1 FOR X AXIS, E2 FOR Y AXIS ON FINAL ASSY.
4. DETERMINED IN FINAL TEST (D.I.F.T.).
5. ALL DIODES ARE IN914.
6. ALL 'P' NOS. SHOWN ARE REFERENCED FROM DE0372. Y AXIS SHOWN, X AXIS SHOWN PARENTHETICAL.

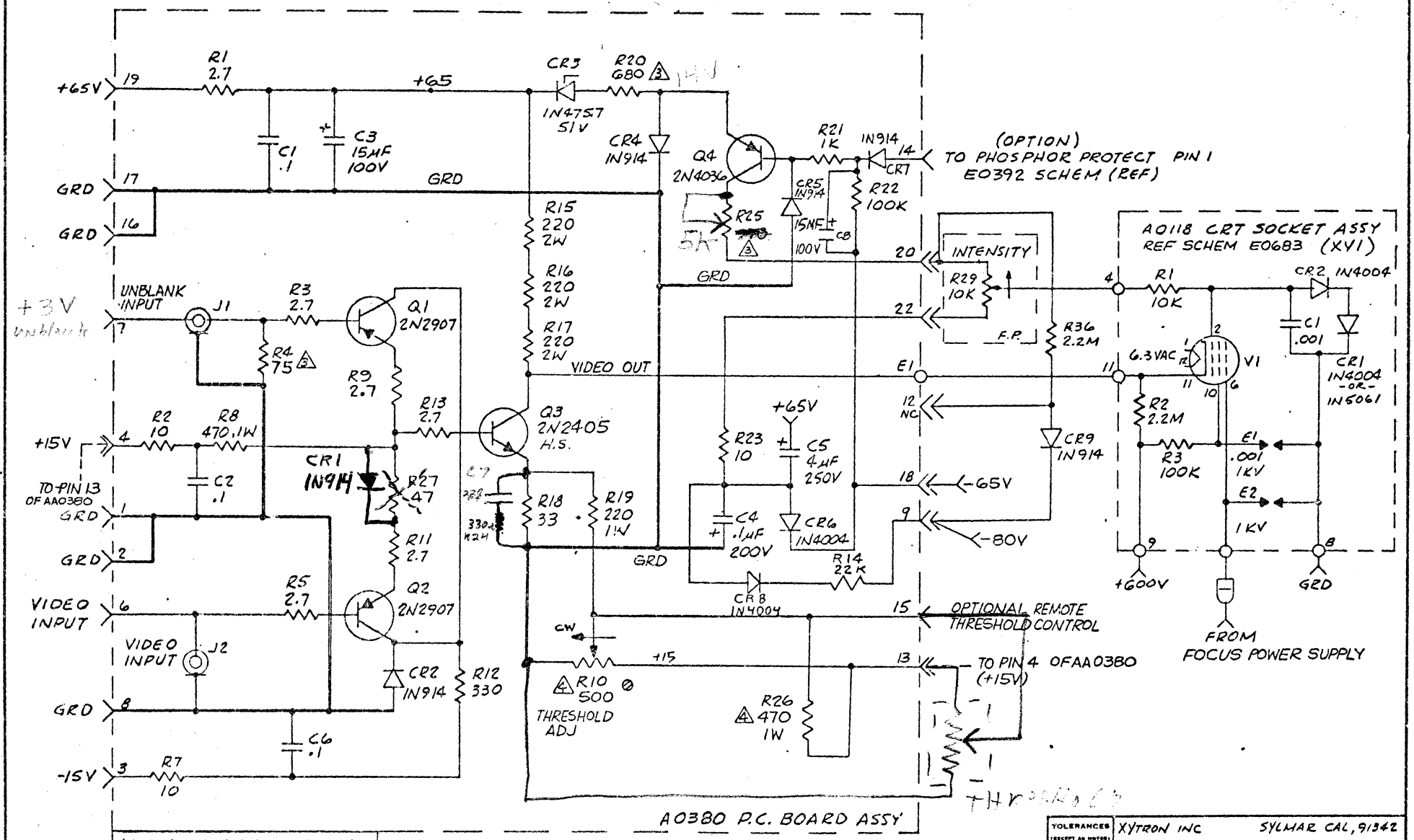
PC BOARD ONLY
REFERENCE DESIGNATIONS USED

LAST	C 28	CR 9	Q8	R61	TP4	
NOT	C3	C7	C9	C11	C13	
	C14	C15	C16	C21	C23	C24
C26		R2	R3	R5	R7	
R13	R14	R20	R21	R25	R38	R52
R40	R45	R46	R47	R48	R49	R50

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	D	SEE E.C.R. 0152	3/14/69	JC
	E	SEE E.C.R. 209		

XYTRON INC
SYLMAR, CA 91342
SCHEMATIC
DEFLECTION AMPLIFIER
D A21-7A E 0414 E
SHEET 1 OF 1
DRAWN D BORE 2/14/67
DO NOT SCALE DRAWING

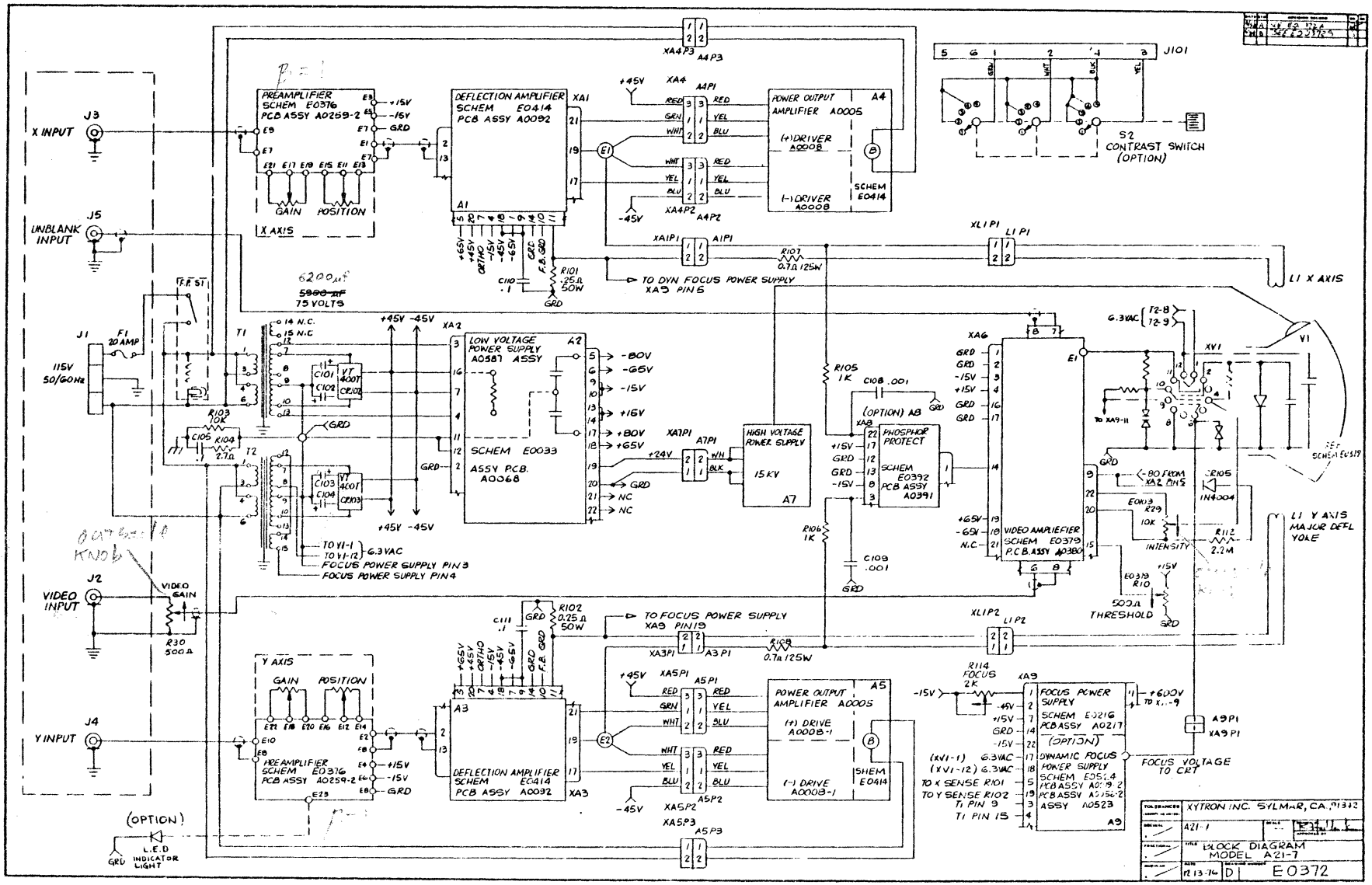
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 1/2 W, ±5%.
2. ALL CAPACITORS ARE IN MICRO-FARADS.
3. FACTORY SELECT COMPONENT
4. DELETE R26 WHEN R10 THRESHOLD POT IS USED.

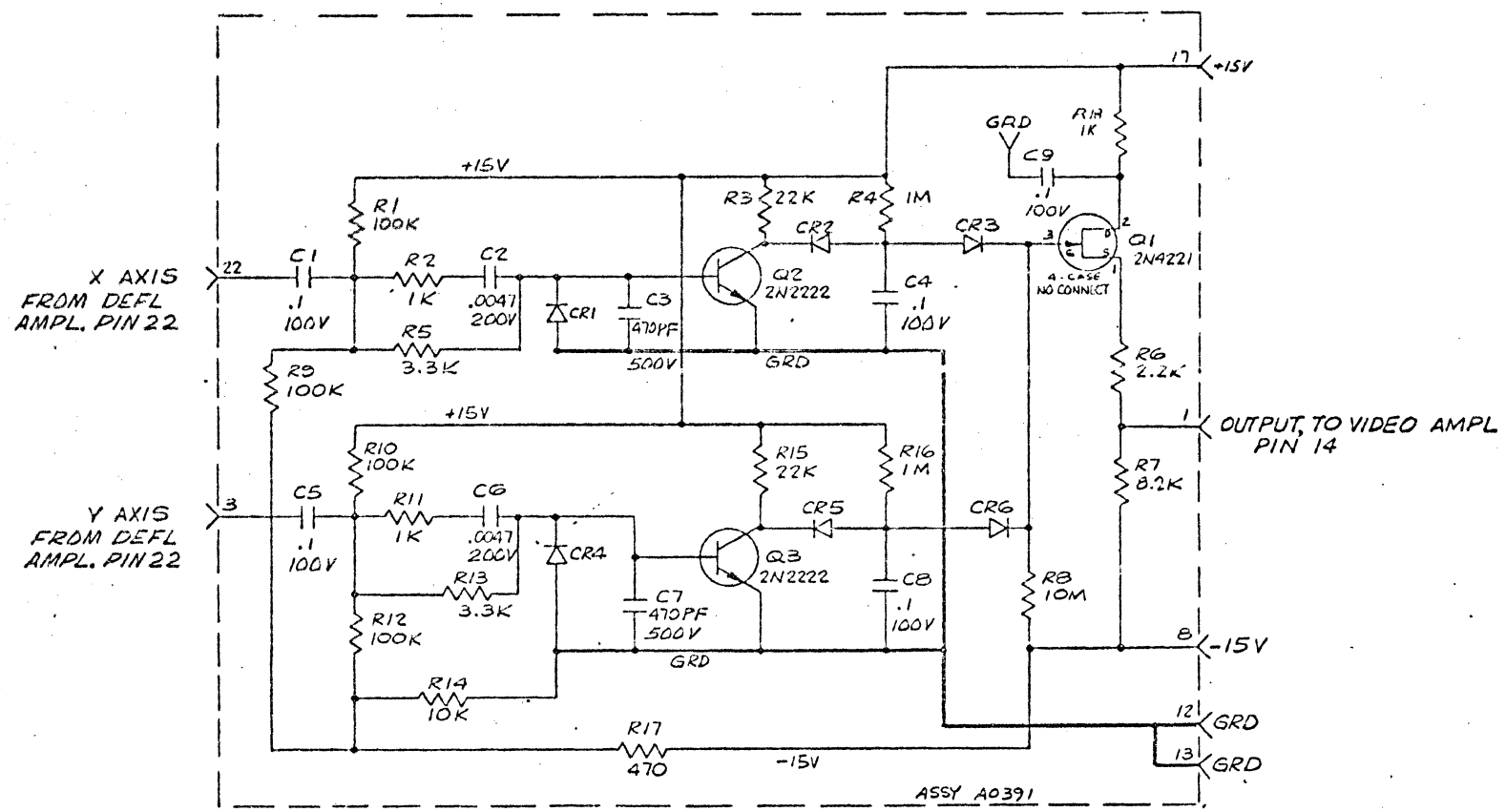


LAST REF DESIGNATION USED AA 0380 ASSY			
R27	CB	CR9	Q4

TOLERANCES (EXCEPT AS NOTED)	XYTRON INC		SYLMAR CAL, 91342
DECIMAL ± ——	A21-7	A0380	SCALE —— DRAWN 8-23-76 APPROVED BY
FRACTIONAL ± ——	TITLE SCHEMATIC, VIDEO AMP		
ANGULAR ± ——	DATE 12-27-74	DRAWING NUMBER C E0379	

BRUNING 40-21


X INPUT
J3
UNBLANK INPUT
J5
115V 50/60Hz
J1
F1 20 AMP
T.F.ST
T1
T2
PREAMPLIFIER SCHEM E0376 PCB ASSY A0259-2
GAIN
POSITION
X AXIS
DEFLECTION AMPLIFIER SCHEM E0414 PCB ASSY A0092
XA1
A1
POWER OUTPUT AMPLIFIER A0005
(+) DRIVER A0008
(-) DRIVER A0008
A4
SCHEM E0414
XA4P3
A4P3
XA4P1
A4P1
XA4P2
A4P2
J101
S2 CONTRAST SWITCH (OPTION)
6200μF
5900 μF
75 VOLTS
C110 .1
R101 .25Ω 50W
TO DYN FOCUS POWER SUPPLY XA9 PIN 6
XA1P1
A1P1
R107 0.7Ω 125W
XL1P1
L1P1
L1 X AXIS
LOW VOLTAGE POWER SUPPLY A0587 ASSY
SCHEM E0033
ASSY PCB. A0068
A2
XA2
-80V
-65V
-15V
+16V
+80V
+65V
+24V
NC
+45V -45V
TO V1-1
TO V1-12
6.3VAC
FOCUS POWER SUPPLY PIN 3
FOCUS POWER SUPPLY PIN 4
HIGH VOLTAGE POWER SUPPLY 15 KV
A7
XA7P1
A7P1
R105 1K
C108 .001
(OPTION) A8
PHOSPHOR PROTECT SCHEM E0392 PCB ASSY A0391
XA8
R106 1K
C109 .001
XA6
VIDEO AMPLIFIER SCHEM E0379 P.C.B. ASSY A0380
6.3VAC T2-8 T2-9
XV1
V1
R105 INTENSITY
1N4004
L1 Y AXIS MAJOR DEFL YOKE
R112 2.2M
E0393 R29 10K
E0393 R10 500Ω THRESHOLD
+15V
VIDEO INPUT
J2
VIDEO GAIN
R30 500Ω
Y INPUT
J4
Y AXIS
GAIN
POSITION
PREAMPLIFIER SCHEM E0376 PCB ASSY A0259-2
DEFLECTION AMPLIFIER SCHEM E0414 PCB ASSY A0092
A3
XA3
R102 0.25Ω 50W
C111 .1
TO FOCUS POWER SUPPLY XA9 PIN 15
XA3P1
A3P1
R108 0.7Ω 125W
XL1P2
L1P2
POWER OUTPUT AMPLIFIER A0005
(+) DRIVE A0008-1
(-) DRIVER A0008-1
A5
SCHEM E0414
XA5P1
A5P1
XA5P2
A5P2
XA5P3
A5P3
(OPTION)
L.E.D INDICATOR LIGHT
R114 FOCUS 2K
XA9
FOCUS POWER SUPPLY SCHEM E0216 PCB ASSY A0217 (OPTION)
DYNAMIC FOCUS POWER SUPPLY SCHEM E0514 PCB ASSY A0516-2 ASSY A0523
A9
+600V TO XL-9
A9P1
XA9P1
FOCUS VOLTAGE TO CRT
(XV1-1) 6.3VAC
(XV1-12) 6.3VAC
TO X SENSE R101
TO Y SENSE R102
T1 PIN 9
T1 PIN 15
XYTRON INC. SYLMAR, CA. 91342
A21-1
BLOCK DIAGRAM MODEL A21-7
11-13-76
D
E0372

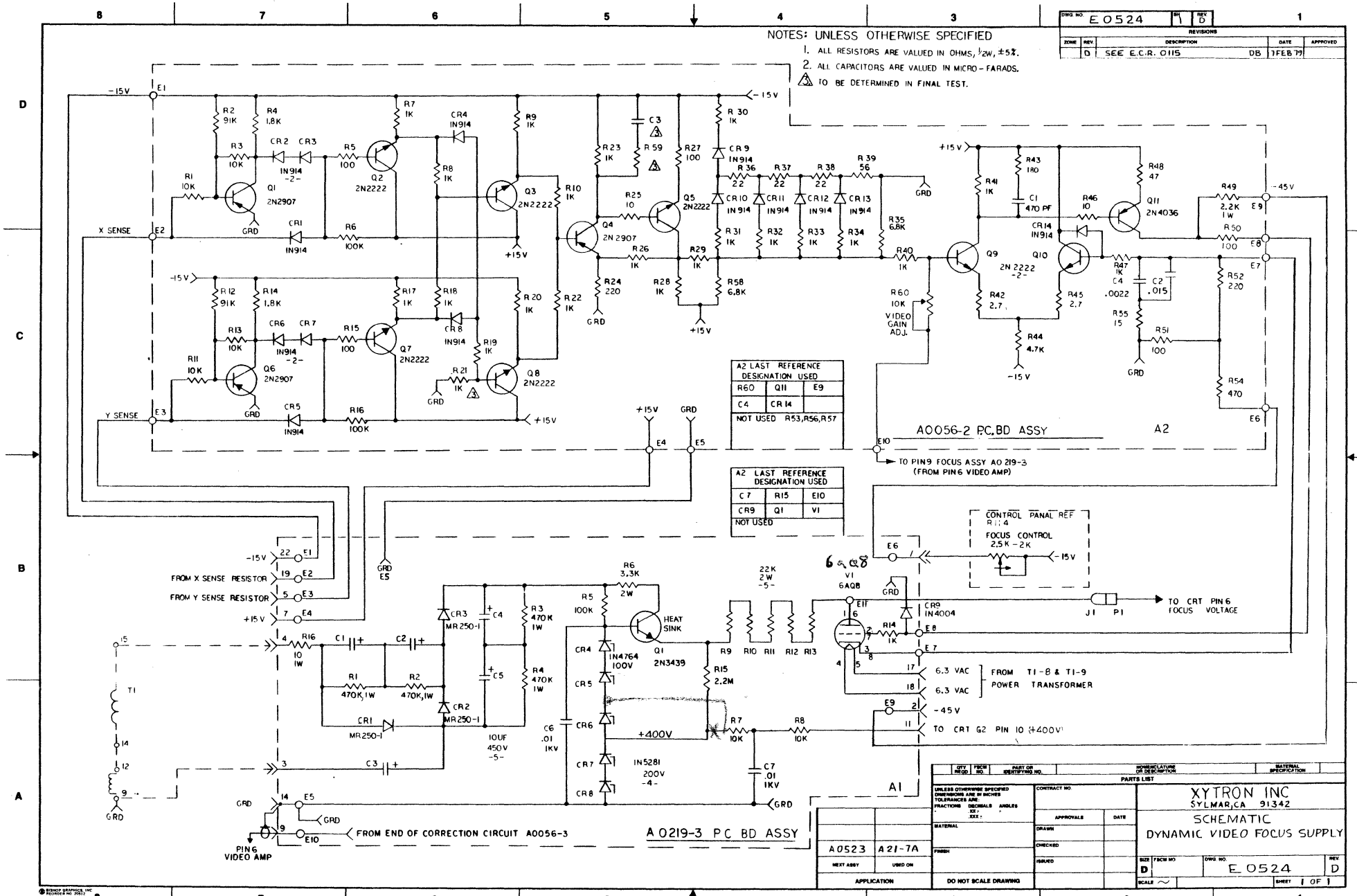


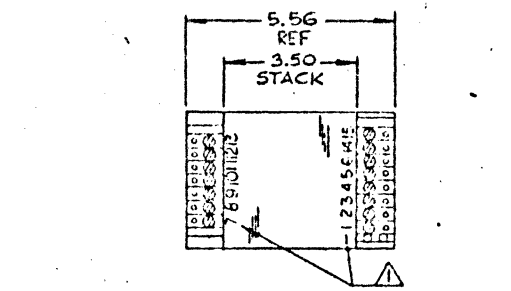
NOTES: UNLESS OTHERWISE SPECIFIED

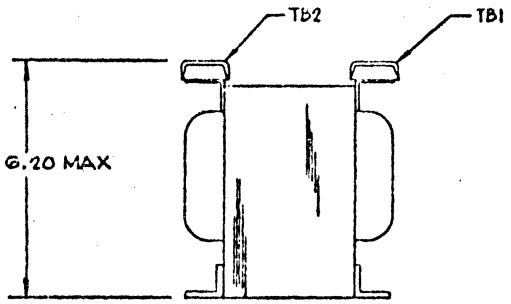
1. ALL RESISTOR VALUES ARE IN OHMS, 1/2 W, ± 5%
2. ALL CAPACITORS ARE IN MICRO-FARADS
3. ALL DIODES ARE IN914
4. REF DWGS : ARTWORK W0390, ASSY A0391.

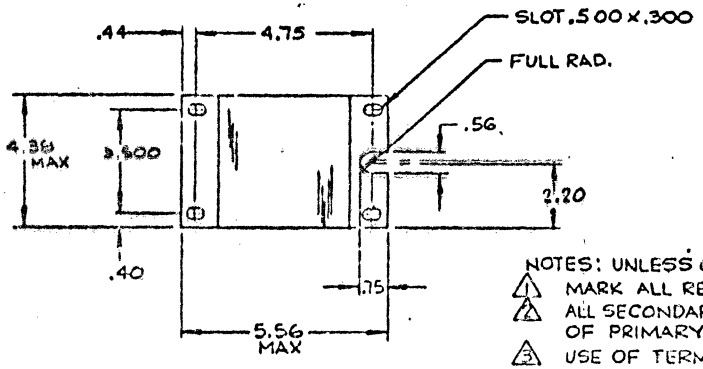
5. LAST REF DES :
   R1E
   C9
   CR6
   Q3

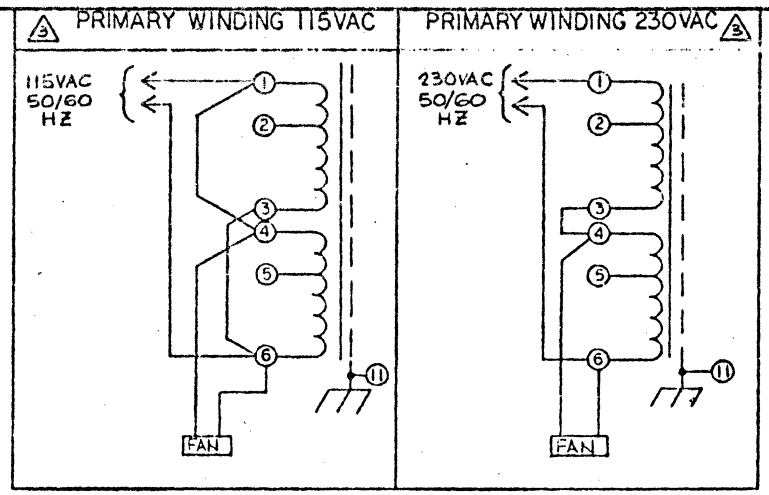
TOLERANCES (UNLESS NOTED)	XYTRON INC SYLMAR CA
DECIMAL	A21 - ALL A23 ALL
SCALE	
FRACTIONAL	TITLE: SCHEMATIC PHOSPHOR PROTECT
ANGULAR	DATE: 10-6-77
	DRAWING NUMBER: E0392

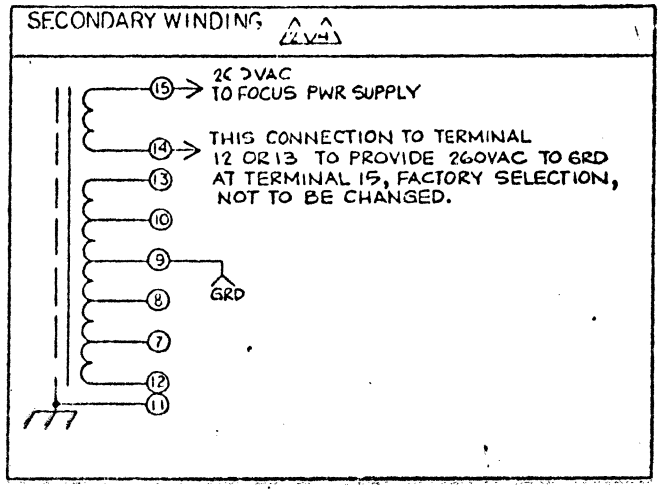

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE VALUED IN OHMS, ½W, ±5%.
2. ALL CAPACITORS ARE VALUED IN MICRO-FARADS.
3. TO BE DETERMINED IN FINAL TEST.
DWG NO E0524 REV D
REVISIONS
ZONE REV DESCRIPTION DATE APPROVED
D SEE E.C.R. 0115 DB 7FEB 79
A2 LAST REFERENCE DESIGNATION USED
R60 Q11 E9
C4 CR14
NOT USED R53,R56,R57
A0056-2 PC.BD ASSY A2
TO PIN9 FOCUS ASSY A0219-3 (FROM PIN6 VIDEO AMP)
A2 LAST REFERENCE DESIGNATION USED
C7 R15 E10
CR9 Q1 V1
NOT USED
CONTROL PANAL REF R14
FOCUS CONTROL 2.5K-2K
TO CRT PIN 6 FOCUS VOLTAGE
6.3 VAC FROM T1-8 & T1-9 POWER TRANSFORMER
6.3 VAC
-45V
TO CRT G2 PIN 10 (+400V)
+400V
FROM END OF CORRECTION CIRCUIT A0056-3
PIN6 VIDEO AMP
A0219-3 PC BD ASSY A1
PARTS LIST
XYTRON INC
SYLMAR,CA 91342
SCHEMATIC
DYNAMIC VIDEO FOCUS SUPPLY
A0523 A21-7A
DWG NO E0524 REV D
SIZE D SCALE ~ SHEET 1 OF 1
DO NOT SCALE DRAWING











NOTES: UNLESS OTHERWISE SPECIFIED

1. MARK ALL REF DESIGNATIONS APPROX AS SHOWN
2. ALL SECONDARY CONNECTIONS ARE INDEPENDENT OF OF PRIMARY VOLTAGE CONNECTIONS.
3. USE OF TERMINALS 2 AND 5 NOT RECOMMENDED.
4. CONNECTIONS TO TERMINALS 14 & 15 ARE USED ON ONE OF TWO TRANSFORMERS PER ASSY.

TOLERANCES	XYTRON INC SYLMAR CA.		
DECIMAL	ALL MODEL SERIES "A"	SCALE NONE	
FRACTIONAL	TITLE TRANSFORMER, ENVELOPE AND HOOK-UP DIAGRAM		
ANGULAR	DATE 1/5/77	DRAWING NUMBER E0420	