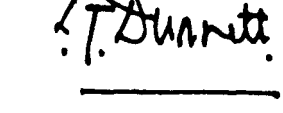
AIR PUBLICATION

II6T-II05-I

TELEVISION MONITORS TYPES RKBA & RLBA

GENERAL, AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL



(Ministry of Defence)

FOR USE IN THE
ROYAL AIR FORCE

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◀ The reference number of this publication was altered from A.P.101S-0202-1, Cover 5 to A.P.116T-1105-1 by A.L. action in Feb. 69. ▶

INSTALLATION AND OPERATING INSTRUCTIONS

CONRAC®

TELEVISION MONITOR

MODELS

RKBA

RLBA

CONRAC DIVISION Covina, California

A DIVISION OF GIANNINI CONTROLS CORPORATION

INSTALLATION AND OPERATING INSTRUCTIONS

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MODEL RLB14A

TECHNICAL SUMMARY

ELECTRICAL SPECIFICATIONS

Input Power: 65 watts nominal at 120/240 volts, 60 Hz (525/60 U.S.), or 50 Hz (625/50 CCIR). All performance specifications will be met while the line voltage varies from 100 to 130 volts AC or 200 to 260 volts AC at any rate.
3-wire line cord, 6 feet long.

Video Signal: 0.3 volt peak-to-peak (minimum for 50 volts at kinescope). Sync negative at input.

Video Input Impedance: High impedance bridging (equivalent to 50K in parallel with 15 pF) can be terminated by an internal 75 ohm load (±1%) through a switch located on rear apron.

Video Response: 10 MHz ±1 db. Differential gain below 5% with 75 volts kinescope drive.

DC Restoration: 100% or zero, sync tip clamp.

External Sync: 1 to 8 volts. Parallel connectors. Operation from either composite video and sync signals or separate external composite sync.

Linearity: Within 2% of picture height.

MECHANICAL SPECIFICATIONS (Dimensions do not include feet, handles and knobs.)

MODEL	WIDTH	HEIGHT	LENGTH	SHIPPING WEIGHT
RKB14A/C (Cabinet)	13-13/16"	12 1/8"	18 5/8"	76 Lbs.
RLB14A/R (Rack)	19"	10 1/2"	17 3/8"	68 Lbs.
RLB14A/RS (Rack Slide)	19"	10 1/2"	17 3/8"	67 Lbs.

Finish: Deep Umber Gray, Textured Vinyl

TUBE COMPLEMENT

V1	1G3	High Voltage Rectifier
V2	14BDP4	14" Kinescope with Laminated Safety Shield

DIODES

D1, D2	1N1613R	25 Volt Supply Rectifier
D3	1N4785	Horizontal Damper
1D1	SC6	Pulse Shaper
1D2 to 1D4	SC6	Voltage Supply Rectifiers
1D5	SC6	DC Gate
2D1, 2D2	1N755	Zener
2D3	1N751	Zener
2D4	1N67A	Video Clamp Sensing
2D5	1N3255	DC Restorer
3D1, 3D2	1N751	Zener
4D1, 4D2	1N456A	Clamp
5D1	1N456A	Clamp
6D1	1N67A	Temperature Compensating
6D2	1N751	Zener
6D3	SC6	Zener
7D1 to 7D3	1N456	Shaper

TRANSISTORS COMPLEMENT

Symbol	Type	Function
Q1	2N3055	Low Voltage Regulator
Q2	2N3055	Vertical Output
Q3, Q4	2N3731	Horizontal Output (Select for Beta 40 or more)
		Video Amplifier Board #162093-1
2Q1	2N3565	Feedback Amplifier
2Q2	2N3643	Video Amplifier
2Q3	2N4122	Video Amplifier
2Q4	40354	Video Output Amplifier
		25 Volt Regulator Board #162091-1
3Q1	2N3565	Current Amplifier
3Q2, 3Q3	SA2206	Differential Amplifier
3Q4	2N3053	Current Amplifier
		Sync Chain Board #162096-1
4Q1	2N3643/2N3565	Sync Amplifier, Inverter
4Q2	2N3643/2N3565	Sync Amplifier
4Q3	2N3565	Sync Clipper
4Q4	2N3566	Phase Splitter
4Q5	2N3565	Vertical Sync Separator, Inverter
4Q6	2N3643	1st Video Current Amplifier
		Vertical Deflection Board #162158-1
5Q1	2N2646	Vertical Oscillator, Unijunction
5Q2	2N3565	Feedback Amplifier
5Q3	2N3566	Vertical Current Amplifier
		Horizontal Multivibrator & Driver Board #162108-1
6Q1, 6Q2	2N3565	Multivibrator
6Q3	2N3565	Current Amplifier
6Q4	2N3643	Current Amplifier
6Q5	2N2891/S17862	Current Amplifier
		High Voltage Regulator Board #162098-1
7Q1	2N3565	Beam Current Amplifier
7Q2	2N3638	Beam Current Amplifier, Inverter

CONRAC MODEL RKB14A AND RLB14A

The Conrac RKB14A and RLB14A are transistorized broadcast quality video monitors designed for continuous operation in broadcast and industrial television applications. Each unit employs a 14" high resolution kinescope with laminated safety shield, type 14BDP4. Each is a complete self-contained unit which may be operated (a) from a line containing composite video and sync, or (b) from separate lines, one carrying video and one carrying composite sync.

INSTALLING AND UNPACKING

Carefully remove all packing material from the equipment received and inspect it for possible damage incurred during shipment. Report any shortage or damage to the carrier. Before applying power to the monitor, make sure that the kinescope components are properly positioned. In addition, check to see that all cable connectors are secure.

CONNECTIONS

The units are connected for 120 volt operation at the factory unless otherwise specified. For operation from 200 to 260 volt source, see schematic for required changes in wiring at terminal strip. Use 3/8 ampere Slo-Blo fuse after changing for 200/260 volt operation.

200/260 VOLT AC OPERATION (Refer to Schematic Diagram, page 15).

1. On transformer T1, remove the jumper between terminal A (blue-yellow) and terminal B (black-red).
2. Remove the jumper between terminal C (blue) and terminal D (black).
3. Place a jumper between terminals B and C of the transformer. (Use the same type of wire as that removed in step 1 or 2).
4. Replace fuse F1 (3/4 ampere Slo-Blo) with a 3/8 ampere Slo-Blo.

Plug into appropriate power source and feed composite video signal into the video input jack marked IN. The line may be terminated by moving SW2 to 75 ohms. It should now be possible to see a picture on the screen.

EXTERNAL SYNC

Parallel connected external sync jacks are provided on the rear apron. When a non-composite video signal is fed to the monitor, a composite sync source from 1 to 8 volts must be connected to one of the sync input jacks located on the rear panel, and the sync switch operated to the EXTernal position.

INITIAL ADJUSTMENTS

MAKE NO ADJUSTMENTS UNTIL THE MONITOR HAS BEEN OPERATING FOR AT LEAST 15 MINUTES.

CENTERING

Using a standard test pattern or grating bar pattern, check picture centering. If centering is off, adjust HEIGHT and VERTical LINearity for best vertical linearity. Center the picture by repositioning the centering tabs on the rear cover of the deflection yoke. For horizontal linearity and secondary vertical linearity adjustments, see MAINTENANCE.

FOCUS

The unit employs a high resolution electrostatic focus picture tube with a focus control mounted on the front control panel. Adjust the FOCUS control for maximum resolution in the high-light areas near the center of the screen.

WIDTH CONTROL

The WIDTH control is a front panel adjustment. The width can be adjusted from underscan (for observing raster corners) to full scan.

CIRCUIT DESCRIPTION

VIDEO INPUT SYSTEM

Two input jacks are wired for loop-through operation to facilitate multiple connection of monitors. The video line at the input may be terminated by moving SW2 to "75 ohms."

The first video stage employs a 2N3643, 4Q6, as an emitter follower, located on sync chain Board #162096-1. The emitter follower is connected to Video Amplifier Board #162093-1 through the CONTRAST control.

The mismatched stages, involving 2Q2 and 2Q3 combine to form a voltage amplifier. Feedback for stability purposes is derived through the use of 2R8, 2R6, 2R7 and 2R10. The actual gain of this double-stage amplifier is essentially controlled by these resistors. The output of 2Q3 provides a voltage source to drive the output stage, 2Q4.

VIDEO CIRCUIT DESCRIPTION

The circuit between the base of 2Q2 and the collector of 2Q4 always functions as a DC amplifier. The operating point of the amplifier is controlled by the sync tip clamp circuit, using the active elements, 2D4 and 2Q1. With no input signal, the three amplifier transistors operate at minimum current. When a composite video signal is applied, negative-going sync

pulses at the emitter of 2Q4 cause 2D4 to conduct which results in increased collector voltage of 2Q1 which in turn raises the current operating point of the amplifier to a new level, yet maintaining the sync tips at the same DC level. The time-constant involved in the system is long enough to allow the lowest usable frequencies, including hum, to be displayed. The negative feedback provided by the clamp circuit also serves to correct for any drift or change in the amplifier.

Frequency response is controlled by adjusting 2C2 and series peaking coil 2L2. 4C12 on the sync chain board is normally adjusted for best square-wave response.

DC coupling to the CRT may be removed by moving the DC restoration switch, SW4, to OUT position.

SYNCHRONIZATION

For internal sync operation, sync information is derived from the output of the first video stage, sync chain board #162096-1. 4Q1 and 4Q2 amplify the composite video (or sync signal where external sync is used) to drive the sync clipper, 4Q3. The clipped sync drives the phase splitter, 4Q4, which in turn drives the phase detector and the vertical sync separator inverter, 4Q5.

The SYNC gain control, 4P1, is set at the factory for best operation from standard EIA sync. For operation from unusually small signals, or from industrial type sync chains, readjust for best operation.

VERTICAL

A unijunction, 5Q1, is used for the vertical oscillator on board #162158-1. The unijunction is essentially a switch that turns on when the emitter voltage reaches a predetermined fraction of the interbase voltage. At the beginning of each sweep the emitter is reverse-biased and hence non-conducting. As the series combination of 5C4 and 5C5 is charged through resistor 5R5, the emitter voltage rises exponentially towards the supply voltage +25 volts. At the end of the vertical trace, the emitter becomes forward-biased and the dynamic resistance between the emitter and B_1 drops to a low value. Capacitors 5C4 and 5C5 discharge through 5Q1. When the emitter voltage has dropped to approximately 2 volts, the unijunction rapidly turns off again. The voltage across 5C4 and 5C5 again starts to rise, starting the next vertical sweep. The voltage at 5C4 and 5C5 is applied to the base of 5Q2, which in turn drives 5Q3. Voltage appearing at the emitter of 5Q3 is applied through the HEIGHT control, P6, to Q2, vertical output transistor.

The voltage at the emitter of 5Q3 is applied back to the base of 5Q2 through the Vertical LINearity control, P5.

The collector of 5Q2 is tied to the collector of 5Q3 as a linearity correction. The amount of this correction is determined by the setting of 5P2 mounted on Vertical board #162158-1.

HORIZONTAL AFC SYSTEM

The HORIZontal HOLD, P7, located on the front panel, controls the AFC voltage and is used for a fine adjustment of horizontal frequency. The HORizontal FREQuency control, P12, located on the chassis, is used for a coarse frequency adjustment by controlling the turn-off time of 6Q1.

The emitter followers, 6Q3, 6Q4 and 6Q5, serve as current amplifiers to provide sufficient drive to the horizontal output stage, consisting of Q3 and Q4. P8 is used to adjust for proper saturation of Q3 and Q4. See MAINTENANCE for correct adjustment method.

Q3 and Q4 are saturated during horizontal trace time, allowing current to flow through the deflection yoke and in the primary of the flyback transformer. When reverse drive turns Q3 and Q4 off, the rapid flux collapse causes a large negative pulse to appear across Q3 and Q4 and the flyback primary. Energy is also induced into the tertiary where the ultor voltage is derived. Third harmonic tuning is used. When the resonant primary voltage returns to the supply voltage level, the damper diode, D3, conducts, thus preventing further oscillation.

Horizontal linearity control is achieved with a resonant tank circuit in series with the flyback primary. This circuit adds a sawtooth and a parabolic component to the sawtooth current in the yoke. L4 determines linearity by controlling the amount and shape of the correction voltage wave.

The horizontal width control, L2, employs a series and a parallel coil coupled with a movable core. As width is varied by moving the core, the impedance of one coil is increased while the other is decreased. Thus width can be varied while presenting a constant load to the flyback and, therefore, maintaining constant high voltage. See MAINTENANCE.

HIGH VOLTAGE REGULATION

The high voltage regulator assembly board #162098-1, located in front of the high voltage box, employs a saturable reactor in parallel with the flyback primary winding.

As the kinescope anode current increases, the regulator senses this increased current through the bottom of the tertiary winding. 7Q1 and 7Q2 amplify the current to drive the control winding of L5. As control winding current increases, the saturable winding inductance is reduced, thereby allowing the winding to store more energy during trace time.

This stored energy, delivered to the flyback transformer during retrace time, produces additional voltage at the plate of the high voltage rectifier, V1/1G3, thus maintaining the kinescope anode voltage at a constant level.

25-VOLT POWER SUPPLY AND REGULATOR

A full-wave rectifier is used to supply power through a series-type regulator. The differential amplifier, an SA2206 transistor, senses output voltage changes, due to load variance, in the first half (3Q3) and compares it to a fixed reference voltage (developed across 3D1 and 3D2) which is connected to the base of 3Q2, the second half of SA2206. The error or difference is amplified by 3Q2 and is coupled to 3Q1/2N3565 which drives 3Q4, an emitter follower, controlling Q1, the 2N3055 regulator. The error-voltage is adjusted by the setting of 3P1, 25-volt adjustment potentiometer, mounted on power supply board #162091-1.

PULSE FORMER AND RECTIFIER

Board #162180-1 is used to obtain the necessary miscellaneous voltages not available from the regular power supply.

FOCUS

A high-peak pulse from the horizontal output transformer is coupled to terminal R and is rectified by 1D4 and 1D2, supplying approximately 600 volts for the focus, a portion of which is divided across 1R8 and 1R9 for coupling to G_2 of the kinescope.

SPOT KILLER

1D5 serves as a DC gate to keep G_2 positive when the unit is turned OFF, causing the kinescope to draw current momentarily, thereby discharging the high voltage and eliminating a bright spot on the kinescope.

120-VOLT SUPPLY

A medium amplitude pulse from the horizontal output transformer is coupled to terminal U and rectified by 1D3. The 120-volt DC drives the video output stage on board #162093-1 and is connected to the BRIGHTNESS potentiometer, as bias for the kinescope.

RETRACE BLANKING

A pulse from the vertical output, coupled to terminal X, and a pulse from the horizontal output, coupled to terminal V, are mixed, clipped by 1D1 and coupled to G_1 (grid) of the kinescope, as retrace blanking.

SAWTOOTH INTEGRATOR

The horizontal pulse is integrated by 1R3 and 1C4 with 1R6 and 1C5, forming a sawtooth, which is coupled to sync board #162096-1 as an AFC reference.

MAINTENANCE

THE VOLTAGES EMPLOYED IN THIS EQUIPMENT ARE SUFFICIENTLY HIGH TO ENDANGER LIFE. MAKE CERTAIN POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TOUCHING ANY COMPONENT.

Plug line cord into the appropriate line voltage source and turn monitor ON. Connect a source of composite video (test pattern or grating bar signal preferred) into one of the input jacks marked IN and move the termination switch to "75 ohms."

25-VOLT POWER SUPPLY

Connect an accurate DC meter to point A on regulator board #162091-1, and adjust potentiometer 3P1, 25 volt adjustment, on the board until the meter reads 25 volts.

HORIZONTAL SATURATION AND DRIVE COIL ADJUSTMENTS

Normally the horizontal saturation control, P8, and boost coil, L7, being adjusted at the factory, do not require adjustment. In the event that one or both output transistors, Q3/2N3731 or Q4/2N3731, is replaced, the control adjustments should be checked as follows:

1. After replacing the transistors, turn set ON.
2. Connect an oscilloscope to the collector of Q3 (or pin 10 of the flyback transformer). Adjust oscilloscope to observe voltage variations during trace time, i.e., time between negative pulses.
3. Adjust BRIGHTness and CONTRAST controls fully clockwise.
4. Adjust saturation control, P8, located in the high voltage box, until the collector voltage at the end of trace time, i.e., just prior to the negative pulse, drops about one volt from the saturation level.
5. Connect oscilloscope to point CC on Horizontal Driver board #162108-1 and adjust horizontal boost coil, L7, to produce a peak voltage of about 60 volts. Refer to waveform 10 on page 12.
6. Check high voltage regulator adjustment.

HORIZONTAL LINEARTIY, HORIZONTAL TRIM, HIGH VOLTAGE REGULATION

Horizontal Linearity

There are two positions of the core in L4 where good linearity can be obtained. The correct position is where the coil has the higher inductance (screw turned into the coil).

Width Trim Coil Adjustment

A high voltage meter capable of measuring at least 20 KV is needed for this adjustment.

1. Adjust the WIDTH control for maximum width, and note the high voltage measured at the picture tube or at C7 located in the high voltage box.
2. Adjust the WIDTH control for minimum width, and then adjust the width trim coil until the high voltage returns to the value measured in step 1.
3. Repeat steps 1 and 2 as often as necessary to obtain good tracking.
4. Check high voltage regulator adjustment.

High Voltage Regulator

1. Turn the BRIGHTness control and regulator control, 7P1, on Regulator board #162098-1 to minimum.
2. Note the value of high voltage. It should be at least 17KV nominal.
3. Turn the BRIGHTness control fully clockwise, and note value of high voltage.
4. Adjust the regulator control until the high voltage returns to the value measured in step 2.
5. Turn the BRIGHTness control down again, and repeat steps 2, 3, and 4, if necessary. Regulation should be within 2% to 200 microamperes.
6. Check horizontal SATURATION control adjustment.

VERTICAL

Frequency Range Adjustment

1. Adjust the VERTical HOLD control to the extreme counterclockwise position.
2. Adjust the frequency range, 5P1 on vertical board #162158-1, until the picture rolls down slowly. Readjust so that the picture locks-in.
3. Adjust the VERTical HOLD control clockwise as necessary for most stable operation.

Vertical Linearity Adjustment

If good vertical linearity cannot be obtained with the front panel control, it will be necessary to adjust 5P2 on the vertical board. The board linearity potentiometer controls linearity only on the upper portion of the picture; therefore, use the front control to change linearity on the bottom portion of the picture, and the board control to change linearity on the top portion of the picture until good over-all linearity is obtained. Recheck vertical frequency range adjustment.

HORIZONTAL

Frequency Range Adjustment

The HORizontal FREQuency control, P12, located on chassis, is used for a coarse setting of horizontal frequency. This control should be adjusted with the HORIZontal HOLD control, P7, located on the front panel, set at mid-range so that the picture remains "locked-in" at any setting of P7.

VIDEO ALIGNMENT INSTRUCTIONS

Equipment Required

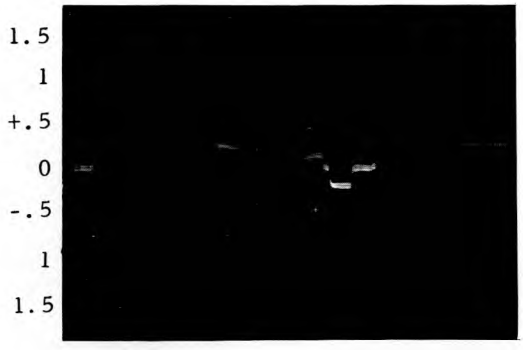
1. Video sweep generator capable of producing flat sweep to 12 MHz.
2. Oscilloscope with suitable low frequency response.
3. Low capacitance detector probe.
4. Window generator or square-wave generator.

Procedure

1. Turn on monitor and allow to operate for 15 minutes. Set controls as follows:
   a. CONTRAST control between 25% and 50% rotation
   b. BRIGHTness control at minimum.
   c. Input termination switch to "75 ohms."
2. Connect window generator or square-wave generator to the video input jack marked IN. Connect oscilloscope to pin L of the sync chain board #162096-1 and adjust 4C12 for best square-wave response.
3. Remove window or square-wave generator and connect sweep signal. Connect oscilloscope to cathode of CRT (pin H on video board #162093-1) and adjust 2C2 and 2L2 for best frequency response.

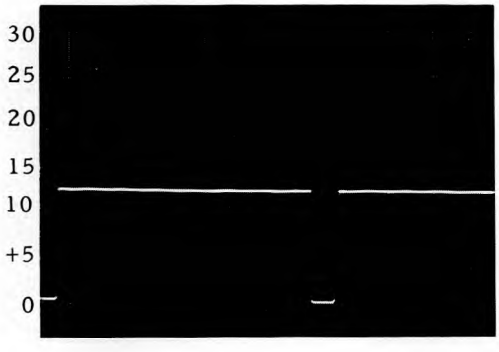
CAUTION: FOR VIDEO AMPLIFIER ALIGNMENT SYNC MUST BE ADDED TO SWEEP SIGNAL.

REPRESENTATIVE WAVEFORMS

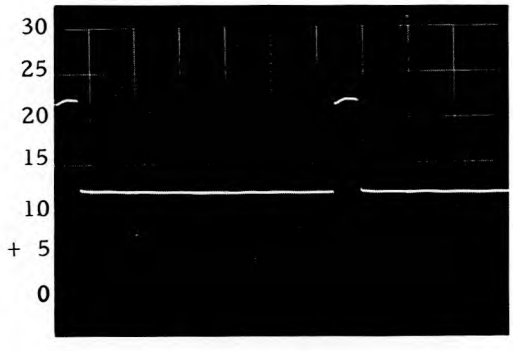


1. Base Voltage, 4Q1
.5V/cm, 10 microsec/ div.

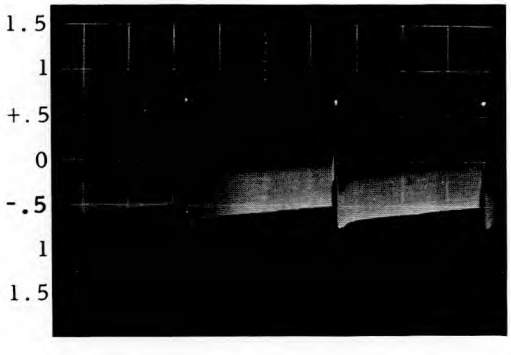
2. Base Voltage, 4Q3
.5V/cm, 10 microsec/div.



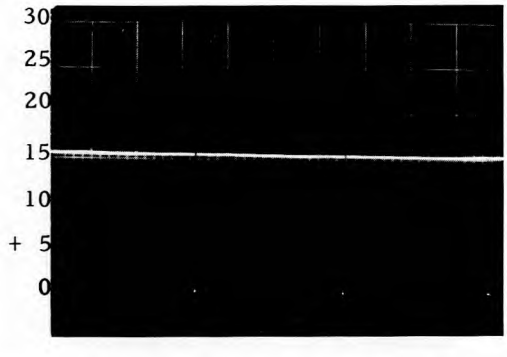
3. Collector Voltage, 4Q3
10 microsec/div.



4. Collector Voltage, 4Q4
10 microsec/div.

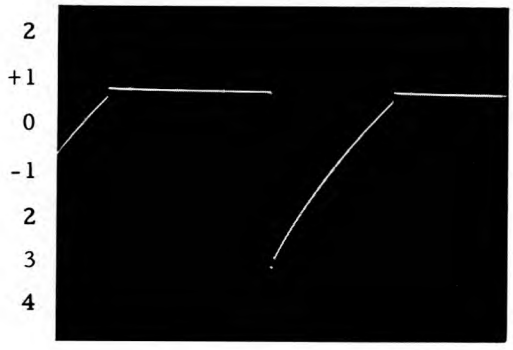


5. Base Voltage, 4Q5
5 msec/div.

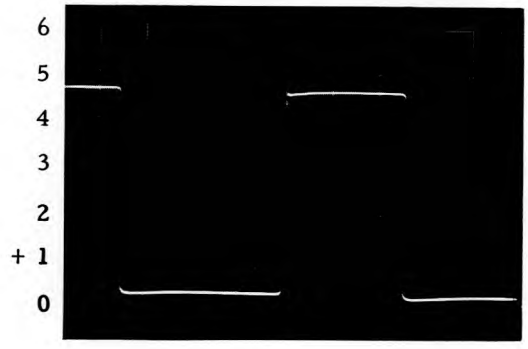


6. Collector Voltage, 4Q5
5 msec/div.

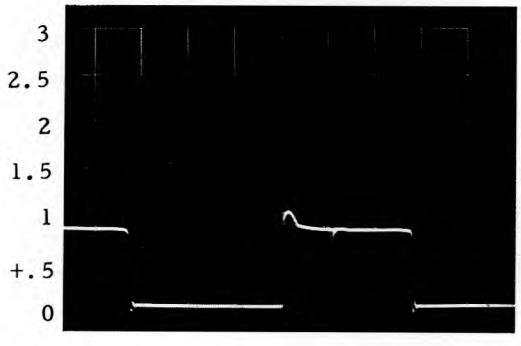
REPRESENTATIVE WAVEFORMS



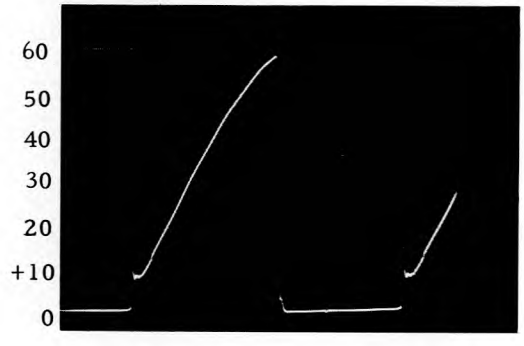
7. Base Voltage, 6Q2
10 microsec/div.



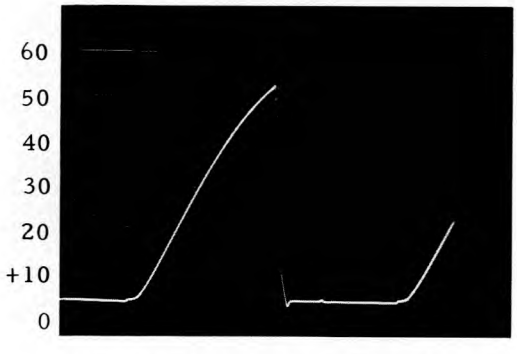
8. Collector Voltage, 6Q2
10 microsec/ div.



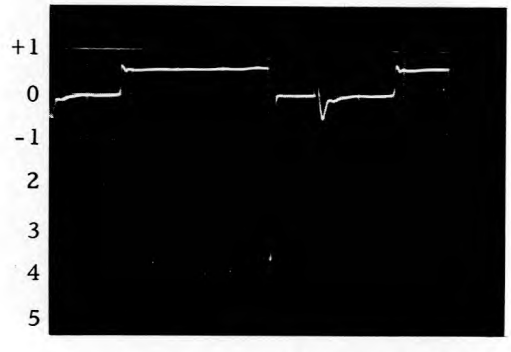
9. Base Voltage, 6Q5
10 microsec/div.



10. Voltage at CC, H. Board
10 microsec/div.

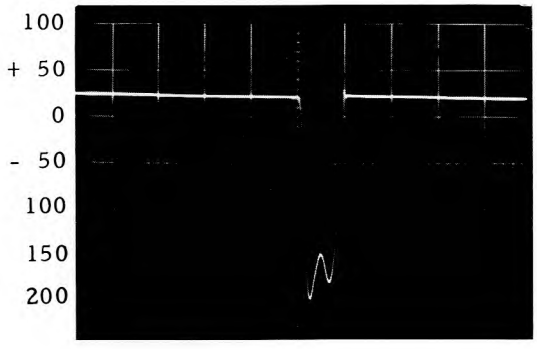


11. Voltage at BB, H. Board
10 microsec/div.

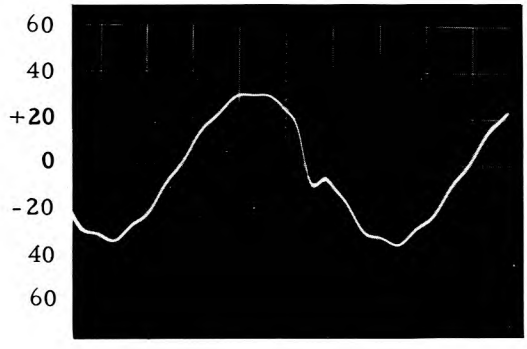


12. Base Current (Amps.) Q3, Q4
10 microsec/div.

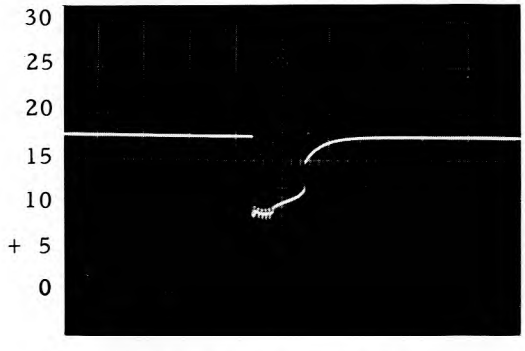
REPRESENTATIVE WAVEFORMS



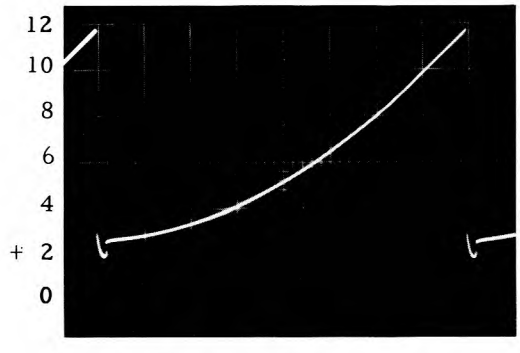
13. Collector Voltage, Q3
10 microsec/div.



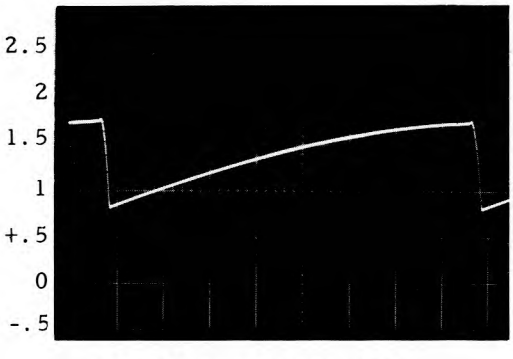
14. Flyback Voltage #2
10 microsec/div.



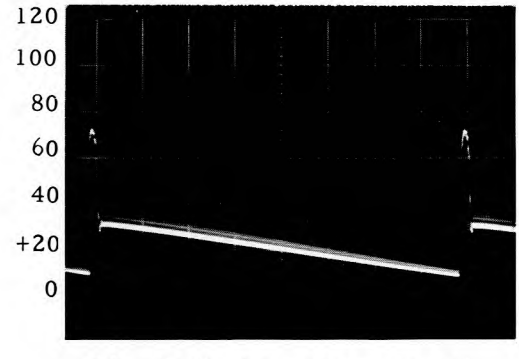
15. Base 2 Voltage, 5Q1
400 microsec/div.



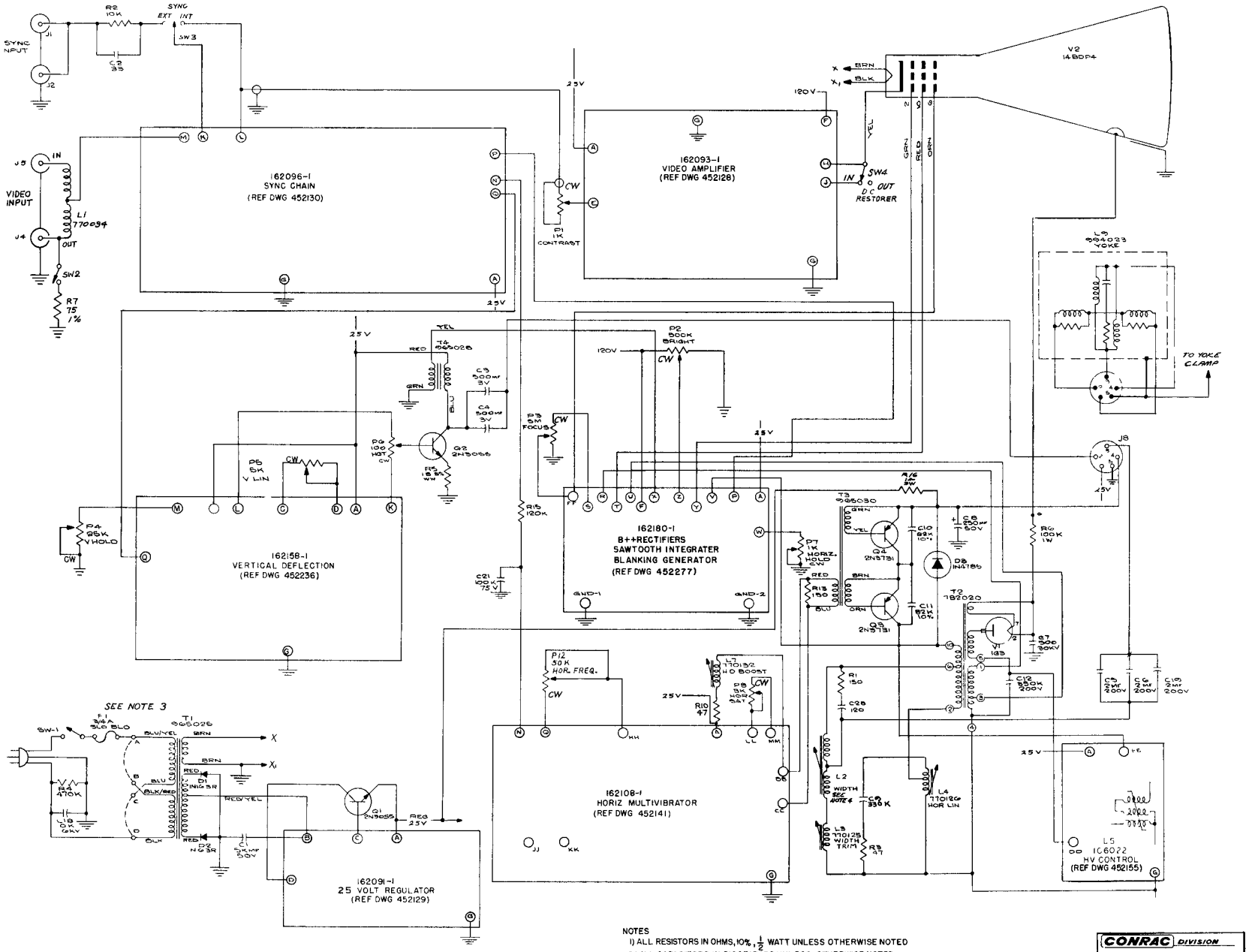
16. Emitter Voltage, 5Q1
2 msec/div.



17. Base Voltage, Q2
2 msec/div.



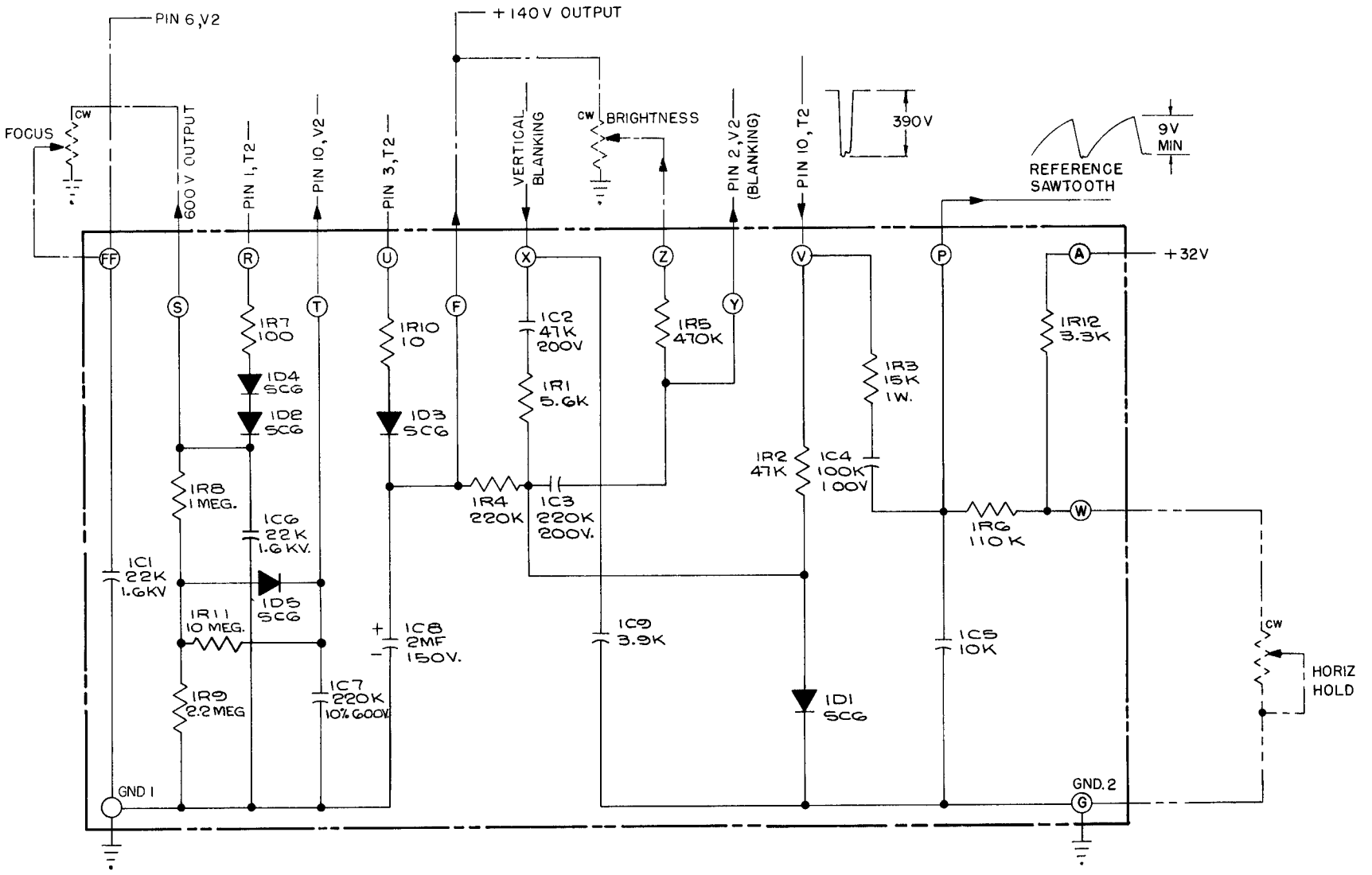
18. Collector Voltage, Q2
2 msec/div.



NOTES

1) ALL RESISTORS IN OHMS, 10%, $\frac{1}{2}$ WATT UNLESS OTHERWISE NOTED
2) ALL CAPACITORS IN PICOFARADS UNLESS OTHERWISE NOTED
3) FOR 240VOLT OPERATION REMOVE JUMPERS FROM 'A TO B' AND 'C TO D' PLACE A JUMPER FROM 'B TO C' REPLACE F1 WITH $\frac{3}{8}$ AMP SLO-BLO FUSE
4) FOR RLB-14A USE 770124, FOR RKB-14A USE 770144

CONRAC DIVISION		
BLOCK DIAGRAM MODEL RKB-14A & RLB-14A		
8-10-65	452159	M



NOTES:

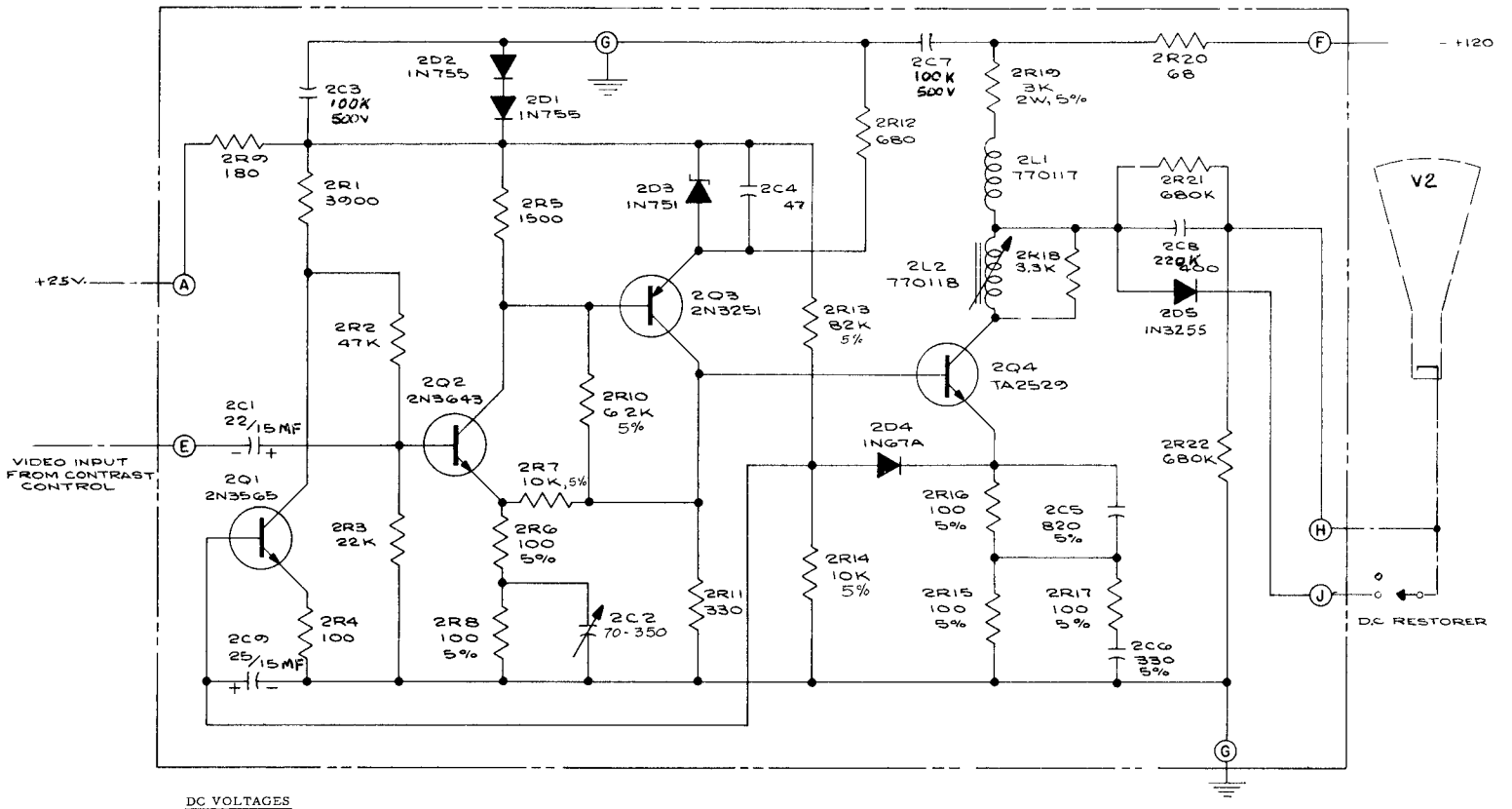
1 ALL RESISTORS IN OHMS, 10%, $\frac{1}{2}$ WATT UNLESS OTHERWISE NOTED.

2 ALL CAPACITORS IN PICOFARADS UNLESS OTHERWISE NOTED.

CONRAC DIVISION
GIANNINI CONTROLS CORPORATION
GLENDORA CALIFORNIA

SCHEMATIC
PULSE FORMER AND RECTIFIER

DATE 12-29-66 | 452277 | A
APPROVED BY:



DC VOLTAGES

No Signal

	2Q1	2Q2	2Q3	2Q4
C	5.4	9.6	12	110
B	9	1.1	96	12
E	.25	.52	10 2	08

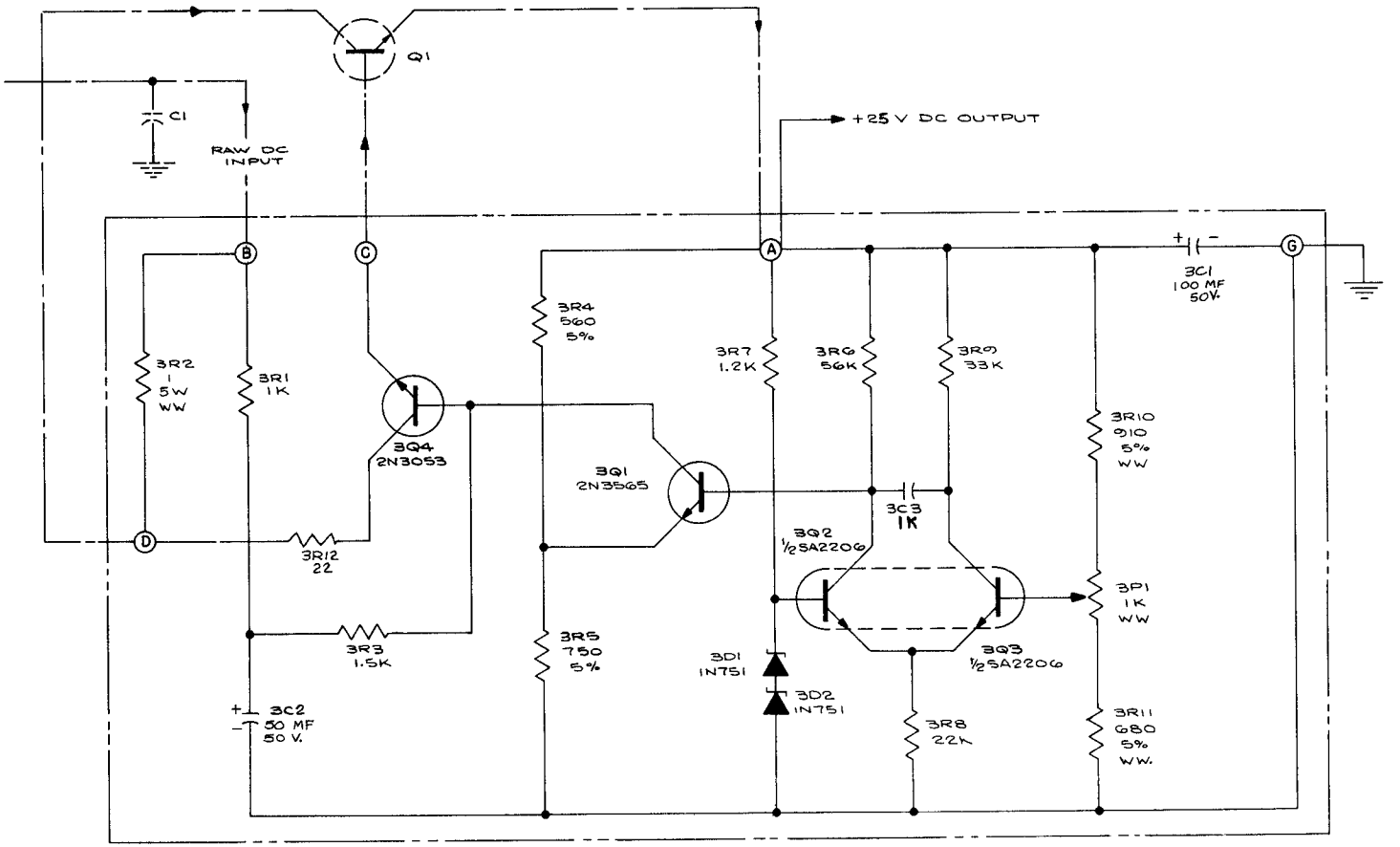
NOTES:

1. ALL RESISTORS IN OHMS, 10%, ½ WATT, UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN PICOFARADS, UNLESS OTHERWISE NOTED.

CONRAC DIVISION

SCHEMATIC
VIDEO AMPLIFIER
(BOARD NO 162093)

DATE	1-19-65	452128	F
APPROVED BY			



DC VOLTAGES

Normal Operating Conditions

±10%

	3Q1	3Q2	3Q3	3Q4
C	21.5	16.0	12.5	33.0
B	16.0	10.0	10.0	24.5
E	15.5	9.5	9.5	24.5

TERMINAL D - 33.5
TERMINAL B - 34.5

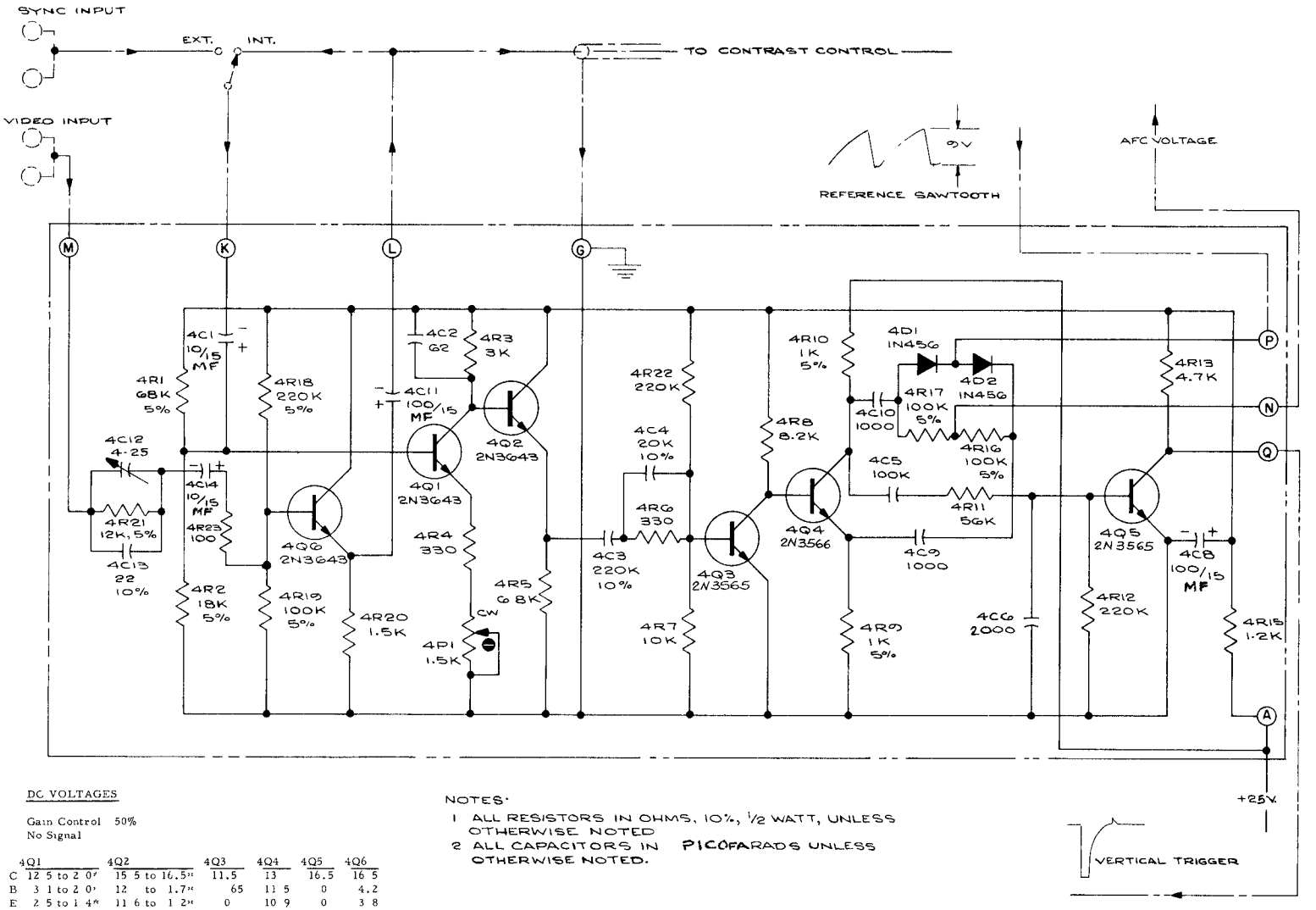
NOTES:

1. ALL RESISTORS IN OHMS, 10%, ½ WATT, UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN PICOFARADS, UNLESS OTHERWISE NOTED.

CONRAC DIVISION

SCHEMATIC
25 VOLT REGULATOR
(BOARD NO 162091)

DATE 1-20-65 APPROVED BY | 452129 | G



DC VOLTAGES

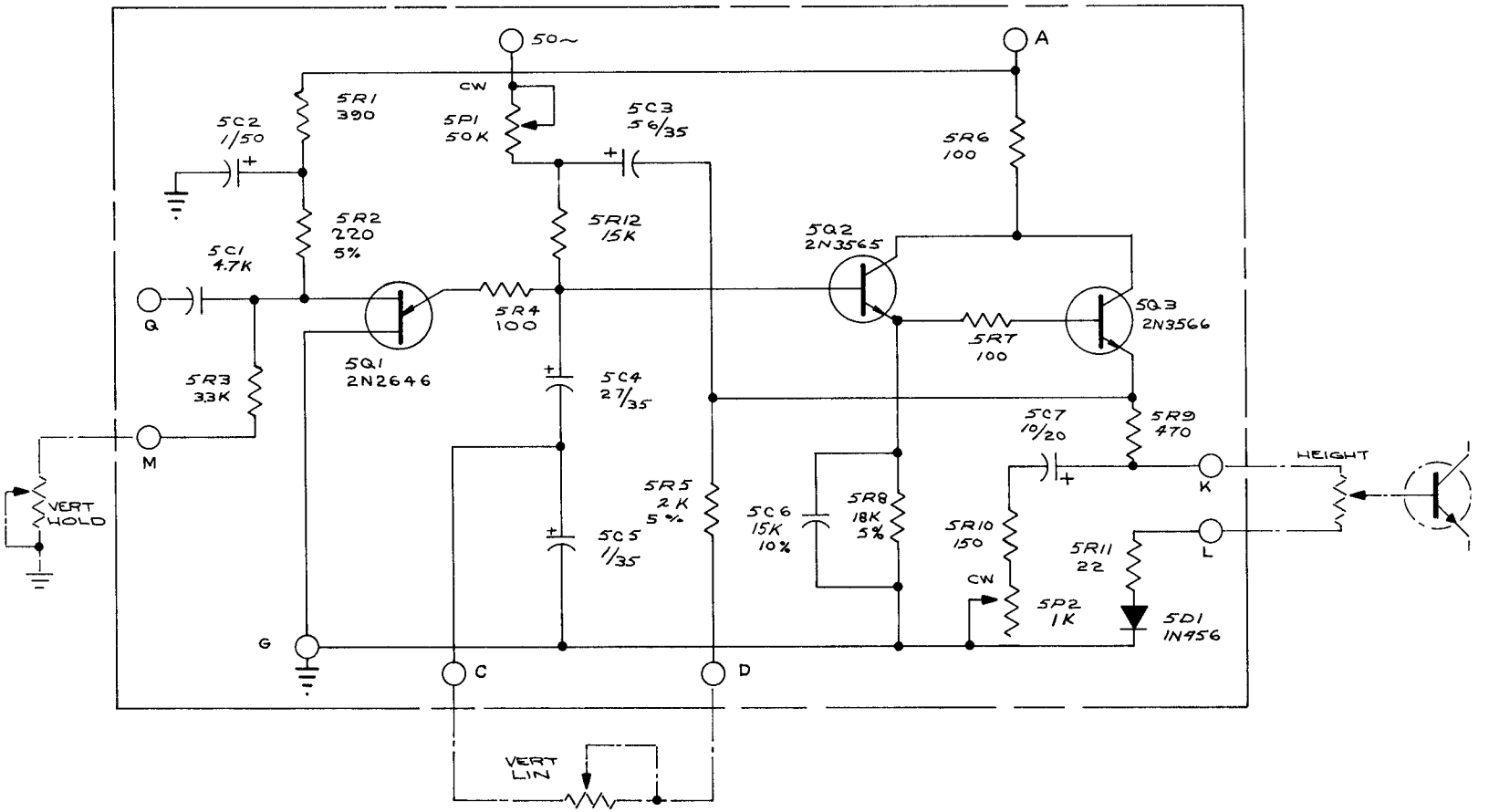
Gain Control 50%
No Signal

	4Q1	4Q2	4Q3	4Q4	4Q5	4Q6
C	12 5 to 2 0*	15 5 to 16.5**	11.5	13	16.5	16 5
B	3 1 to 2 0*	12 to 1.7**	65	11 5	0	4.2
E	2 5 to 1 4**	11 6 to 1 2**	0	10 9	0	3 8

Varies with Sync Gain Adjustment

NOTES:
1 ALL RESISTORS IN OHMS, 10%, 1/2 WATT, UNLESS OTHERWISE NOTED
2 ALL CAPACITORS IN PICOFARADS UNLESS OTHERWISE NOTED.

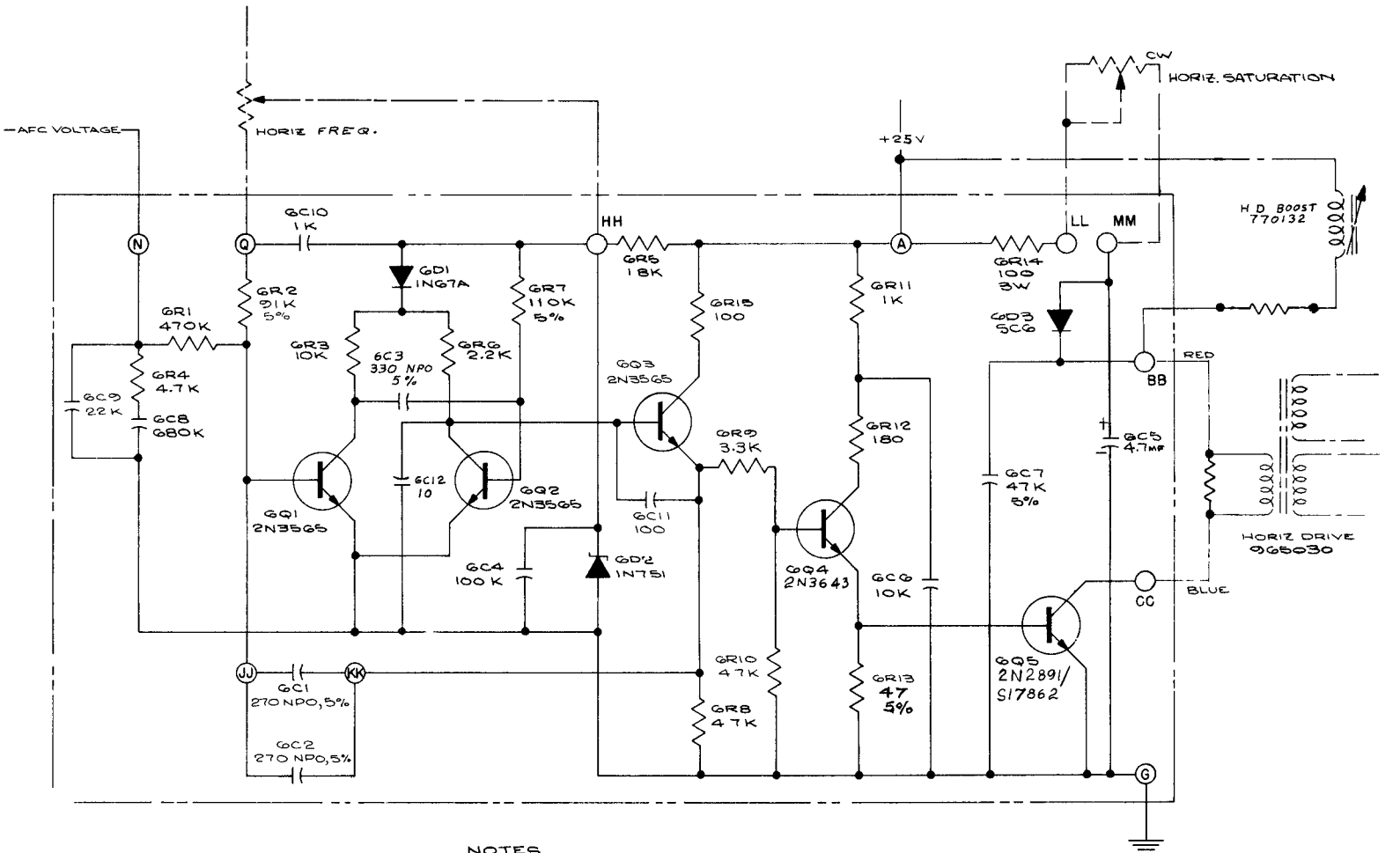
CONRAC DIVISION
SCHEMATIC
SYNC CHAIN
(BOARD NO 162096)
DATE 1-21-65
APPROVED BY
452130 F



NOTE:

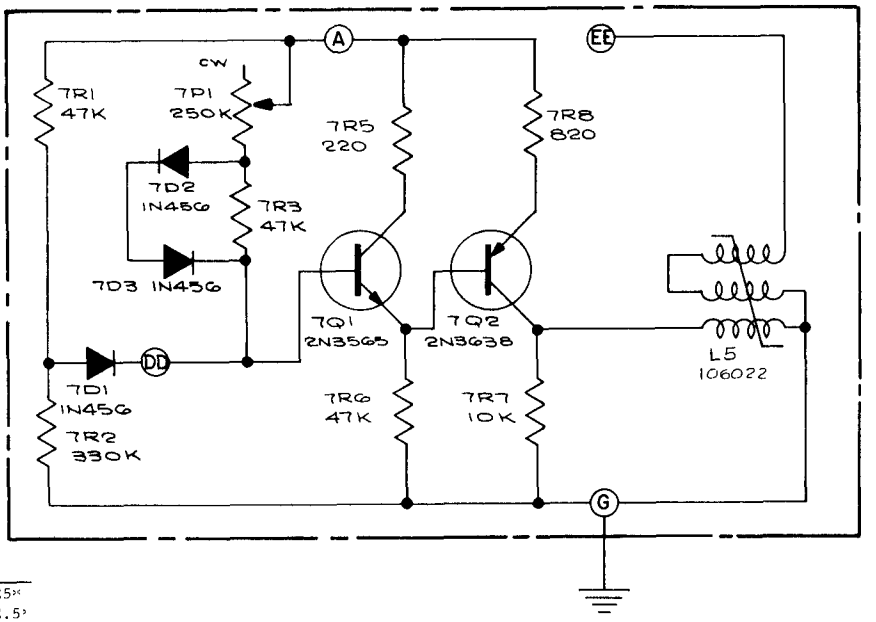
1. ALL RESISTORS IN OHMS, 10%, 1/2 WATT UNLESS OTHER WISE NOTED.
2. ALL CAPACITORS IN PICOFARADS UNLESS OTHER WISE NOTED.

CONRAC DIVISION	
GIANNINI CONTROLS CORPORATION GLENDORA CALIFORNIA	
SCHEMATIC VERT. DEFLECTION	
DATE 4-7-66 APPROVED BY	452236 D



NOTES
1 ALL RESISTORS IN OHMS, 10%, 1/2 WATT UNLESS OTHERWISE NOTED
2 ALL CAPACITORS IN PICOFARADS UNLESS OTHERWISE NOTED.

CONRAC DIVISION GANN CONTROLS CORPORATION GLENDORA CALIFORNIA		
SCHEMATIC HORIZ MULTIVIBRATOR & DRIVER (BOARD NO 162108)		
DATE 5-7-65 APPROVED BY:	452141	E



DC VOLTAGES

	7Q1	7Q2
C	23.0	7.0 to .25*
B	18.0 to 22.5	17.5 to 22.5
E	17.0 to 22.5	18.0 to 23.0*

*Varies with Brightness and Contrast Control Setting

NOTE:
1) ALL RESISTORS IN OHMS, 10%, 1/2 WATT UNLESS OTHERWISE NOTED.

ITEM NO	QUAN	DESCRIPTION
USED ON 106022	NEXT DRWG	CONRAC DIVISION GIANNINI CONTROLS CORPORATION GLENDORA CALIFORNIA
DRAWN BY Walters	CHECKED BY	
MATERIAL		SCHEMATIC H.V. REGULATOR
FINISH		DATE 6-19-65 APPROVED BY HJ 452155 B

REPLACEABLE PARTS

SYMBOL	DESCRIPTION	PART NO.	MFR. *
	CAPACITORS		
C1	Electrolytic, 5000 mF, 50 V	DCM5M/50539-264081	SP
C2	Ceramic Disc, 33 pF, 10%, 500 V	N150	DI
C3, C4	Electrolytic Tubular, 500 mF, 3 V	30D120A1	SP
C5, C6	Electrolytic Metallized, 2 mF, 200 V	H2-205E	PE
C7	Ceramic, 500 pF, 30,000 V	TM300T5	CD
C8	Electrolytic Tubular, 250 mF, 50 V	TC50025	MAL
C9	Paper Mylar, 330,000 pF, 10%, 200 V	WMF2P33	CD
C10, C11	Paper Mylar, 82,000 pF, 10%, 400 V	PKM-4S82	CD
C12	Paper Mylar, 330,000 pF, 10%, 200 V	WMF2P33	CD
C18	Ceramic Disc, 10,000 pF, 20%, 1600 V	DD16103	CRL
C19	Electrolytic Metallized, 2 mF, 200 V	H2-205E	PE
C21	Ceramic Disc, 100,000 pF, 75 V	DDA-104	CRL
C28	Mica, 120 pF, 5%, 500 V	DM15-121J	ELM
	DIODES		
D1, D2	Silicon Rectifier	1N1613R	RCA
D3	Germanium	1N4785	RCA
	COILS		
L1	Video Input	770094	CONRAC
L2	Width (RKBA Only)	770144	CONRAC
L2	Width (RLBA Only)	770124	CONRAC
L3	Width Trim	770125	CONRAC
L4	Horizontal Linearity	770126	CONRAC
L5	Saturable Reactor	106022	CONRAC
L7	Horizontal Drive, Boost (7 millihenrys)	770132	CONRAC
L9	Yoke	994023	CONRAC
	POTENTIOMETERS		
P1	Composition, 1000 ohms (Contrast) RKBA Only	928033	CONRAC
P1	Composition, 1000 ohms (Contrast) RLBA Only	928097	CONRAC
P2	Composition, 500,000 ohms (Brightness) RKBA Only	928205	CONRAC
P2	Composition, 500,000 ohms (Brightness) RLBA Only	928089	CONRAC
P3	Composition, 5 megohms (Focus) RKBA Only	928107	CONRAC
P3	Composition, 5 megohms (Focus) RLBA Only	928090	CONRAC
P4	Composition, 25,000 ohms (Vertical Hold) RKBA Only	928131	CONRAC
P4	Composition, 25,000 ohms (Vertical Hold) RLBA Only	928130	CONRAC
P5	Composition, 5000 ohms (Vertical Linearity) RKBA Only	928132	CONRAC
P5	Composition, 5000 ohms (Vertical Linearity) RLBA Only	928035	CONRAC
P6	Wirewound, 100 ohms (Vertical Height) RKBA Only	928105	CONRAC
P6	Wirewound, 100 ohms (Vertical Height) RLBA Only	928088	CONRAC
P7	Composition, 1000 ohms (Horizontal Hold) RKBA Only	928109	CONRAC
P7	Composition, 1000 ohms (Horizontal Hold) RLBA Only	928104	CONRAC
P8	Composition, 3000 ohms (Horizontal Saturation)	928103	CONRAC
P12	Composition, 50,000 ohms (Horizontal Frequency)	928093	CONRAC

*See Manufacturers of Replaceable Parts List On Last Page.

SYMBOL	DESCRIPTION	PART NO.	MFR.
	TRANSISTORS		
Q1, Q2	Silicon NPN	2N3055	RCA
Q3, Q4	Germanium Power	2N3731	RCA
	RESISTORS		
R1	Composition, 150 ohms, 10%, $\frac{1}{2}$ w		AB
R2	Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w		AB
R3	Wirewound, .47 ohms, 5%, $\frac{1}{2}$ w BWH		IRC
R4	Composition, 470,000 ohms, 10%, $\frac{1}{2}$ w		AB
R5	Wirewound, 1.8 ohms, 5%, $\frac{1}{2}$ w BWH		IRC
R6	Composition, 100,000 ohms, 10%, 1 w		AB
R7	Composition, 75 ohms, 1%, $\frac{1}{2}$ w		AB
R10	Composition, 47 ohms, 10%, $\frac{1}{2}$ w		AB
R13	Composition, 150 ohms, 10%, $\frac{1}{2}$ w		AB
R15	Composition, 120,000 ohms, 10%, $\frac{1}{2}$ w		AB
R16	Wirewound, 1 ohm, 10%, 3 w VAL 3		TO
	TRANSFORMERS		
T1	Power	965025	CONRAC
T2	Flyback	782020	CONRAC
T3	Horizontal Driver	965030	CONRAC
T4	Vertical Choke	965028	CONRAC
	MISCELLANEOUS		
	Cap: Yoke and Centering Magnet	609007	CONRAC
	Connector: Anode (Neoprene Cap and Button)	886060	CONRAC
J1, J2	Connector: Video-Sync	886028	CONRAC
J4, J5	Connector: Video-Sync	886028	CONRAC
	Cord: Line	987013-3	CONRAC
	Feet: (RKBA Only)	2120	CONRAC
F1	Fuse: 3/4 Ampere, Slo-Blo (For 120 V Operation)	313.750	LF
F1	Fuse: 3/8 Ampere, Slo-Blo (For 240 V Operation)	313.375	LF
	Handle: Carrying (RKBA Only)	361006	CONRAC
	Handle: Control Panel Cover, Black (RLBA Only)	361010	CONRAC
	Holder: Fuse	342012	LF
	Knob: Control (RKBA Only)	361024	CONRAC
	Knob: Control, Black, (RLBA Only)	361026-1	CONRAC
	Mask: (RKBA Only)	390020	CONRAC
	Mask: (RLBA Only)	390008	CONRAC
	Socket: Transistor	935026	CONRAC
J8	Socket: Yoke	935024	CONRAC
	Socket: Tube (1G3)	938001	CONRAC
SW1	Switch: Toggle, S.P.S.T., Ball Handle (RKBA Only)	950017	CONRAC
SW1	Switch: Slide, D.P.D.T. (RLBA Only)	950036-1	CONRAC
SW2, SW3	Switch: Slide, D.P.D.T.	950036-1	CONRAC
SW4	Switch: Slide, D.P.D.T. (RKBA Only)	950036-1	CONRAC
SW4	Switch: Toggle, S.P.S.T., Ball Handle (RLBA Only)	950030	CONRAC

SYMBOL	DESCRIPTION	PART NO.	MFR.
	Pulse Former and Rectifier Board #162180-1		
	CAPACITORS		
1C1	Dipped Mylar, 22,000 pF, 1600 V	16DP5-223	ELM
1C2	Mylar, 47,000 pF, 200 V	WMF-2S47	CD
1C3	Mylar, 220,000 pF, 200 V	WMF-2P22	CD
1C4	Paper Mylar, 100,000 pF, 10%, 100 V	1DP-2-104	ELM
1C5	Mylar, 10,000 pF, 200 V	WMF-2S1	CD
1C6	Dipped Mylar, 22,000 pF, 1600 V	16DP5-223	ELM
1C7	Paper, 220,000 pF, 10%, 600 V	220P22496	SP
1C8	Electrolytic, 2 mF, 150 V	40D205F150CC4	SP
1C9	Mica, 3900 pF, 10%	DM19-392K	ELM
	DIODES		
1D1 to 1D5	Silicon Rectifier	SC6	SEM
	RESISTORS		
1R1	Composition, 5600 ohms, 10%, $\frac{1}{2}$ w		AB
1R2	Composition, 47,000 ohms, 10%, $\frac{1}{2}$ w		AB
1R3	Composition, 15,000 ohms, 10%, 1 w		AB
1R4	Composition, 220,000 ohms, 10%, $\frac{1}{2}$ w		AB
1R5	Composition, 470,000 ohms, 10%, $\frac{1}{2}$ w		AB
1R6	Composition, 110,000 ohms, 5%, $\frac{1}{2}$ w		AB
1R7	Composition, 100 ohms, 10%, $\frac{1}{2}$ w		AB
1R8	Composition, 1 megohm, 10%, $\frac{1}{2}$ w		AB
1R9	Composition, 2.2 megohms, 10%, $\frac{1}{2}$ w		AB
1R10	Composition, 10 ohms, 10%, $\frac{1}{2}$ w		AB
1R11	Composition, 10 megohms, 10%, $\frac{1}{2}$ w		AB
1R12	Composition, 3300 ohms, 10%, $\frac{1}{2}$ w		AB
	Video Amplifier Board #162093-1		
	CAPACITORS		
2C1	Electrolytic, 22 mF, 15 V Tantalum	150D226X0015B2	SP
2C2	Trimmer, 70-350 pF	PC-428	ELM
2C3	Ceramic Disc, 100,000 pF, 500 V	5HKP10	DI
2C4	Ceramic Disc, 4700 pF, 20%, 500 V		DI
2C5	Mica, 820 pF, 5%, 300 V	DM15-821J	ELM
2C6	Mica, 330 pF, 5%, 500 V	DM15-331J	ELM
2C7	Ceramic Disc, 100,000 pF, 500 V	5HKP10	DI
2C8	Paper Mylar, 220,000 pF, 10%, 400 V	4DP-5-224	ELM
2C9	Electrolytic, 25 mF, 15 V	40D	CD
	DIODES		
2D1, 2D2	Zener, 7.5 V	1N755	TI
2D3	Zener, 5.1 V, 5%, 400 ma	1N751	TI
2D4	Germanium	1N67A	SYL
2D5	Silicon Rectifier	1N3255	RCA

SYMBOL	DESCRIPTION	PART NO.	MFR.
	COILS		
2L1	Peaking	770117	CONRAC
2L2	Peaking	770118	CONRAC
	TRANSISTORS		
2Q1	Silicon Planar	2N3565	FC
2Q2	Silicon Planar	2N3643	FC
2Q3	Silicon PNP	2N4122	MOT
2Q4	Silicon	40354	RCA
	RESISTORS		
2R1	Composition, 3900 ohms, 10%, $\frac{1}{2}$ w		AB
2R2	Composition, 47,000 ohms, 10%, $\frac{1}{2}$ w		AB
2R3	Composition, 22,000 ohms, 10%, $\frac{1}{2}$ w		AB
2R4	Composition, 100 ohms, 10%, $\frac{1}{2}$ w		AB
2R5	Composition, 1500 ohms, 10%, $\frac{1}{2}$ w		AB
2R6	Composition, 100 ohms, 5%, $\frac{1}{2}$ w		AB
2R7	Composition, 10,000 ohms, 5%, $\frac{1}{2}$ w		AB
2R8	Composition, 100 ohms, 5%, $\frac{1}{2}$ w		AB
2R9	Composition, 180 ohms, 10%, $\frac{1}{2}$ w		AB
2R10	Composition, 6200 ohms, 5%, $\frac{1}{2}$ w		AB
2R11	Composition, 330 ohms, 10%, $\frac{1}{2}$ w		AB
2R12	Composition, 680 ohms, 10%, $\frac{1}{2}$ w		AB
2R13	Composition, 82,000 ohms, 5%, $\frac{1}{2}$ w		AB
2R14	Composition, 10,000 ohms, 5%, $\frac{1}{2}$ w		AB
2R15 to 2R17	Composition, 100 ohms, 5%, $\frac{1}{2}$ w		AB
2R18	Composition, 3300 ohms, 10%, $\frac{1}{2}$ w		AB
2R19	Composition, 3000 ohms, 5%, 2 w		AB
2R20	Composition, 68 ohms, 10%, $\frac{1}{2}$ w		AB
2R21, 2R22	Composition, 680,000 ohms, 10%, $\frac{1}{2}$ w		AB
	25 Volt Regulator Board #162091-1		
	CAPACITORS		
3C1	Electrolytic, 100 mF, 50 V	30D107G050DH4	SP
3C2	Electrolytic, 50 mF, 50 V	30D506G050DD4	SP
3C3	Ceramic Disc, 1000 pF, 10%, 500 V		DI
	DIODES		
3D1, 3D2	Zener, 5.1 V, 5%, 400 ma	1N751	TI
	POTENTIOMETER		
3P1	Wirewound, 1000 ohms (25 Volt Adjustment)	928125	CONRAC
	TRANSISTORS		
3Q1	Silicon Planar	2N3565	FC
3Q2, 3Q3	Differential Pair, NPN, Silicon	SA2206	AML
3Q4	Silicon Planar	2N3053	RCA

SYMBOL	DESCRIPTION	PART NO.	MFR.
	RESISTOR		
3R1	Composition, 1000 ohms, 10%, $\frac{1}{2}$ w		AB
3R2	Wirewound, 1 ohm, 10%, 5 w, VAL 3		TO
3R3	Composition, 1500 ohms, 10%, $\frac{1}{2}$ w		AB
3R4	Composition, 560 ohms, 5%, $\frac{1}{2}$ w		AB
3R5	Composition, 750 ohms, 5%, $\frac{1}{2}$ w		AB
3R6	Composition, 56,000 ohms, 10%, $\frac{1}{2}$ w		AB
3R7	Composition, 1200 ohms, 10%, $\frac{1}{2}$ w		AB
3R8	Composition, 22,000 ohms, 10%, $\frac{1}{2}$ w		AB
3R9	Composition, 33,000 ohms, 10%, $\frac{1}{2}$ w		AB
3R10	Wirewound, 910 ohms, 5%, 1 w	1X910WL	WL
3R11	Wirewound, 680 ohms, 5%, 1 w	1X680WL	WL
3R12	Composition, 22 ohms, 10%, $\frac{1}{2}$ w		AB
	Sync Chain Board #162096-1		
	CAPACITORS		
4C1	Electrolytic, 10 mF, 15 V	40D	CD
4C2	Mica, 62 pF, 5%, 500 V	DM15-620J	ELM
4C3	Paper Mylar, 220,000 pF, 10%, 100 V	WMF1P22	CD
4C4	Film, 20,000 pF, 100 V	1DP-1-203	ELM
4C5	Ceramic Disc, 100,000 pF, 500 V, GMV	5HKP10	DI
4C6	Ceramic Disc, 2000 pF, 20%, 500 V		DI
4C8	Electrolytic, 100 mF, 15 V	40D	CD
4C9, 4C10	Mica, 1000 pF, 5%, 100 V	DM15-102J	ELM
4C11	Electrolytic, 100 mF, 15 V	40D	CD
4C12	Trimmer, 4-25 pF	PC-421	ELM
4C13	Ceramic Disc, 22 pF, 10%, 500 V		DI
4C14	Electrolytic, 10 mF, 15 V	40D	ELM
	DIODES		
4D1, 4D2	Silicon	1N456A	SYL
	POTENTIOMETER		
4P1	Wirewound, 1500 ohms (Sync Gain)	928121	CONRAC
	TRANSISTORS		
4Q1, 4Q2	Silicon Planar	2N3643 or	FC
		2N3565	FC
4Q3	Silicon Switching, NPN	2N3565	RCA
4Q4	Silicon Planar	2N3566	FC
4Q5	Silicon Switching, NPN	2N3565	RCA
4Q6	Silicon Planar	2N3643	FC
	RESISTORS		
4R1	Composition, 68,000 ohms, 5%, $\frac{1}{2}$ w		AB
4R2	Composition, 18,000 ohms, 5%, $\frac{1}{2}$ w		AB
4R3	Composition, 3000 ohms, 5%, $\frac{1}{2}$ w		AB
4R4	Composition, 330 ohms, 10%, $\frac{1}{2}$ w		AB

SYMBOL	DESCRIPTION	PART NO.	MFR.
4R5	Composition, 6800 ohms, 10%, $\frac{1}{2}$ w		AB
4R6	Composition, 330 ohms, 10%, $\frac{1}{2}$ w		AB
4R7	Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w		AB
4R8	Composition, 8200 ohms, 10%, $\frac{1}{2}$ w		AB
4R9, 4R10	Composition, 1000 ohms, 5%, $\frac{1}{2}$ w		AB
4R11	Composition, 56,000 ohms, 10%, $\frac{1}{2}$ w		AB
4R12	Composition, 220,000 ohms, 10%, $\frac{1}{2}$ w		AB
4R13	Composition, 4700 ohms, 10%, $\frac{1}{2}$ w		AB
4R15	Composition, 1200 ohms, 10%, $\frac{1}{2}$ w		AB
4R16, 4R17	Composition, 100,000 ohms, 5%, $\frac{1}{2}$ w		AB
4R18	Composition, 220,000 ohms, 5%, $\frac{1}{2}$ w		AB
4R19	Composition, 100,000 ohms, 5%, $\frac{1}{2}$ w		AB
4R20	Composition, 1500 ohms, 10%, $\frac{1}{2}$ w		AB
4R21	Composition, 12,000 ohms, 5%, $\frac{1}{2}$ w		AB
4R22	Composition, 220,000 ohms, 10%, $\frac{1}{2}$ w		AB
4R23	Composition, 100 ohms, 10%, $\frac{1}{2}$ w		AB
	Vertical Deflection Board #162158-1		
	CAPACITORS		
5C1	Ceramic Disc, 4700 pF, 20%, 500 V		DI
5C2	Electrolytic, 1 mF, 50 V	30D105G050BA4	SP
5C3	Electrolytic, 5.6 mF, 35 V 150D	565X9035B2	SP
5C4	Electrolytic, 2.7 mF, 35 V 150D	TAS275M035P1B	MAL
5C5	Electrolytic, 1 mF, 35 V 150D	105X9035A2	SP
5C6	Mylar, 15,000 pF, 10%, 200 V	75FIR2-A-153	GE
5C7	Electrolytic, 10 mF, 20 V 150D	106X9020B2	SP
	DIODE		
5D1	Silicon	1N456A	SYL
	POTENTIOMETERS		
5P1	Composition, 50,000 ohms (Vertical Frequency Range)	928119	CONRAC
5P2	Composition, 1000 ohms (Top Linearity)	928185	CONRAC
	TRANSISTORS		
5Q1	Silicon Unijunction	2N2646	GE
5Q2	Silicon Planar NPN	2N3565	FC
5Q3	Silicon Planar NPN	2N3566	FC
	RESISTORS		
5R1	Composition, 390 ohms, 5%, $\frac{1}{2}$ w		AB
5R2	Composition, 220 ohms, 5%, $\frac{1}{2}$ w		AB
5R3	Composition, 3300 ohms, 10%, $\frac{1}{2}$ w		AB
5R4	Composition, 100 ohms, 10%, $\frac{1}{2}$ w		AB
5R5	Composition, 2000 ohms, 5%, $\frac{1}{2}$ w		AB
5R6, 5R7	Composition, 100 ohms, 10%, $\frac{1}{2}$ w		AB
5R8	Composition, 18,000 ohms, 5%, $\frac{1}{2}$ w		AB
5R9	Composition, 470 ohms, 10%, $\frac{1}{2}$ w		AB
5R10	Composition, 150 ohms, 10%, $\frac{1}{2}$ w		AB
5R11	Composition, 22 ohms, 10%, $\frac{1}{2}$ w		AB
5R12	Composition, 15,000 ohms, 10%, $\frac{1}{2}$ w		AB

SYMBOL	DESCRIPTION	PART NO.	MFR.
	Horizontal Multivibrator & Driver Board #162108-1		
	CAPACITORS		
6C1, 6C2	Mica, 270 pF, 5%, 500 V	DM10E271J	ELM
6C3	Mica, 330 pF, 5%, 500 V	DM15C331J	ELM
6C4	Ceramic Disc, 100,000 pF, 500 V		DI
6C5	Electrolytic, 4.7 mF, 15 V Tantalum	475X9015B2	SP
6C6	Ceramic Disc, 10,000 pF, 20%, 500 V		DI
6C7	Paper Mylar, 47,000 pF, 5%, 100 V	WMF1S47	CD
6C8	Paper Mylar, 680,000 pF, 10%, 100 V	WMF1P68	CD
6C9	Paper Mylar, 22,000 pF, 10%, 100 V	WMF1S22	CD
6C10	Mica, 1000 pF, 10%, 100 V	DM15-102K	ELM
6C11	Mica, 100 pF, 10%, 500 V	DM10-101K	ELM
6C12	Ceramic Disc, 10 pF, 500 V		DI
	DIODES		
6D1	Germanium	1N67A	SYL
6D2	Zener	1N751	TI
6D3	Silicon	SC6	SEM
	TRANSISTORS		
6Q1 to 6Q3	Silicon Planar	2N3565	FC
6Q4	Silicon Planar	2N3643	FC
6Q5	Silicon Planar	2N2891/S17862	FC
	RESISTORS		
6R1	Composition, 470,000 ohms, 10%, $\frac{1}{2}$ w		AB
6R2	Composition, 91,000 ohms, 5%, $\frac{1}{2}$ w		AB
6R3	Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w		AB
6R4	Composition, 4700 ohms, 10%, $\frac{1}{2}$ w		AB
6R5	Composition, 1800 ohms, 10%, $\frac{1}{2}$ w		AB
6R6	Composition, 2200 ohms, 10%, $\frac{1}{2}$ w		AB
6R7	Composition, 110,000 ohms, 5%, $\frac{1}{2}$ w		AB
6R8	Composition, 4700 ohms, 10%, $\frac{1}{2}$ w		AB
6R9	Composition, 3300 ohms, 10%, $\frac{1}{2}$ w		AB
6R10	Composition, 4700 ohms, 10%, $\frac{1}{2}$ w		AB
6R11	Composition, 1000 ohms, 10%, $\frac{1}{2}$ w		AB
6R12	Composition, 180 ohms, 10%, $\frac{1}{2}$ w		AB
6R13	Composition, 47 ohms, 5%, $\frac{1}{2}$ w		AB
6R14	Wirewound, 100 ohms, 10%, 3 w, VAL 3		TO
6R15	Composition, 100 ohms, 10%, $\frac{1}{2}$ w		AB
	High Voltage Regulator Board #162098-1		
	DIODES		
7D1 to 7D3	Silicon	1N456	SYL
	POTENTIOMETER		
7P1	Composition, 250,000 ohms (H.V. Regulator)	928121	CONRAC
	TRANSISTORS		
7Q1	Silicon Planar	2N3565	FC
7Q2	Silicon, PNP	2N3638	FC

SYMBOL	DESCRIPTION	PART NO.	MFR.
	RESISTORS		
7R1	Composition, 47,000 ohms, 10%, $\frac{1}{2}$ w		AB
7R2	Composition, 330,000 ohms, 10%, $\frac{1}{2}$ w		AB
7R3	Composition, 47,000 ohms, 10%, $\frac{1}{2}$ w		AB
7R5	Composition, 220 ohms, 10%, $\frac{1}{2}$ w		AB
7R6	Composition, 47,000 ohms, 10%, $\frac{1}{2}$ w		AB
7R7	Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w		AB
7R8	Composition, 820 ohms, 10%, $\frac{1}{2}$ w		AB

MANUFACTURERS OF REPLACEABLE PARTS

CODE	MANUFACTURER	LOCATION
AB	Allen-Bradley Co.	Milwaukee, Wisconsin 53204
AML	Amelco, Inc.	Mountain View, California 94042
CD	Cornell-Dubilier Electronics	Newark, New Jersey 07101
CONRAC	Conrac Division of Giannini Controls Corp.	Covina, California 91722
CRL	Centralab	Milwaukee, Wisconsin 53201
DI	Dilectron Div., Bestran Corp.	Monrovia, California 91016
ELM	Electro-Motive Mfg. Co., Inc.	Willimantic, Connecticut 06226
FC	Fairchild Semiconductor	Mountain View, California 94040
GE	General Electric Co.	Schenectady, New York 12305
IRC	International Resistance Co.	Philadelphia 8, Pennsylvania 19108
LF	Littelfuse Inc.	Des Plaines, Illinois 60016
MAL	P. R. Mallory & Co., Inc.	Indianapolis, Indiana 46206
MOT	Motorola Semiconductor Products Inc.	Phoenix, Arizona 85008
PE	Polycarbonate Electron Products	Monrovia, California 91016
RCA	Radio Corporation of America	Camden, New Jersey 08101
SEM	Semtech Corporation	Newbury Park, California 91320
SP	Sprague Electric Co.	North Adams, Massachusetts 01248
SYL	Sylvania Electric Products	Seneca Falls, New York 13148
TI	Texas Instruments, Inc.	Dallas, Texas 75080
TO	Tru-Ohm Products	Chicago, Illinois 46750
WL	Ward Leonard Electric Co.	Mount Vernon, New York 10550

WARRANTY

The CONRAC Division, Giannini Controls Corporation, warrants each new broadcast and industrial product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to us or to our authorized dealer or wholesaler from whom purchased, intact, for our examination, with all transportation charges prepaid to our factory, within one year from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective.

This warranty does not extend to tubes after six months, or to any of our products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been altered outside of our factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio and television products.

CONRAC DIVISION

GIANNINI CONTROLS CORPORATION

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