# MODEL VAU-15 VIDEO AMPLIFIER UNIT

designed for use with the Model TMR-15 Telemetry Receiver Group

**INSTRUCTION BOOK** 

AF 08(606)-5923

**27** April 1965

Defense Electronics, Inc., Rockville, Maryland

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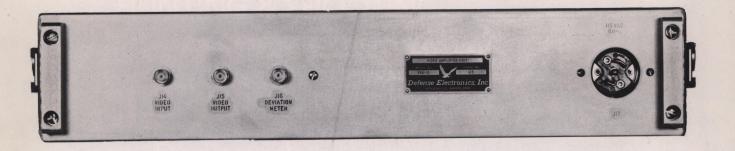
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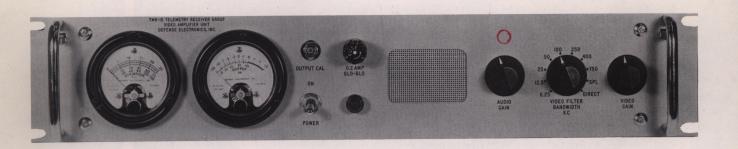
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Rear View



Front View

Figure 1. Model VAU-15 Video Amplifier Unit

# SECTION I GENERAL DESCRIPTION

The Model VAU-15 Video Amplifier Unit is the video amplifier section of a telemetry receiver. It is normally used in conjunction with the Model ADU-15 Second IF Amplifier/Demodulator Unit and the Model FCU-15 Frequency Converter Unit, the three of which constitute the Model TMR-15 Telemetry Receiver Group. A simplified block diagram of the receiver group is shown in figure 1-1.

The VAU-15 consists basically of a video preamplifier, nine selectable video filters, a video output amplifier, an audio amplifier, and a power supply; all of which are printed-circuit plug-in cards. Each card is keyed to fit only the applicable receptacle within the main chassis. Solid-state circuitry is used to obtain optimum performance with minimum power input and small physical size. Ten selectable video bandwidths are provided; eight plug-in filters cover the range of 6.25 kc to 750 kc, a direct connection provides maximum bandwidth with no filtering, and provisions for a plug-in custom filter satisfy the requirements for special applications. A video output meter and facilities for aural monitoring of the input video signal is also provided.

The video amplifier unit has a frequency response within +1 db to -3 db (referenced to 10 kc) from 5 cps to one megacycle. It has excellent transient response characteristics with typically less than 5% overshoot on a step function input.

The Model VAU-15 Video Amplifier Unit is a complete unit in itself, requiring only a source of power and a video input to be operational. All input and output connectors are located on the rear apron of the chassis to facilitate its use in standard relay racks. The unit is designed to have a 75-ohm input impedance and to operate into a 75-ohm load to eliminate interface problems.

The electrical and physical specifications are given in table 1-1, a transistor complement in table 1-2, and a block diagram of the unit is shown in figure 1-2.



Figure 1-1. Model TMR-15 Telemetry Receiver Group, Simplified Block Diagram

## TABLE 1-1

### ELECTRICAL AND PHYSICAL SPECIFICATIONS

Input Sensitivity

45 mV RMS for rated output.

Frequency Response

within +1 db to -3 db (referenced to 10 kc) from 5 cps to 1 mc; within  $\pm 0.5$  db from 100 cps to

500 kc (referenced to 10 kc).

Input Impedance

75 ohms.

Output Load

75 ohms.

Rated Output

4 volts peak-to-peak.

Distortion

less than 0.25% at rated output at 1 kc.

Video Bandwidth

(selectable from front panel)

A. maximally-linear-phase-response low-pass filters with -3 db response of 6.25 kc, 12.5 kc, 25 kc, 50 kc, 100 kc, 250 kc, 400 kc, and 750 kc (asymptotic slope of 36 db per octave).

B. direct connection for maximum video bandwidth; nominally 1 mc.

C. provision for special filter.

117 + 10% VAC, 60 CPS, 12 watts.

16 pounds.

3-1/2 inches.

19 inches.

Width Depth

Power

Weight

Height

19-1/16 inches.

1-2

TABLE 1-2

TRANSISTOR COMPLEMENT					
Subchassis	Symbol	Transistor	Function		
	Q1	2N706	Amplifier		
Video Preamplifier, A13	Q2	2N706	Amplifier		
Treampriner, 1110	Q3	2N706	Output Interface Amplifier		
HUNTING	Q1	2N706	Amplifier		
Video Output	Q2	2N706	Amplifier		
Amplifier, A12	Q3 Q4	2N706 2N697	Darlington Output Amplifier		
	Q1	2N697	Input Interface Amplifier		
Dedica	Q2	2N697	Preamplifier		
Audio Amplifier,	Q3	2N697	Driver Amplifier		
	Q4	2N697	Power Output Amplifier		
	Q5	2N1132	Power Output Amplifier		
	Q1	2N697	Current Amplifier		
Power Supply,	Q2	2N1701	Series Regulator		
A10	Q3	2N697	Voltage Amplifier		

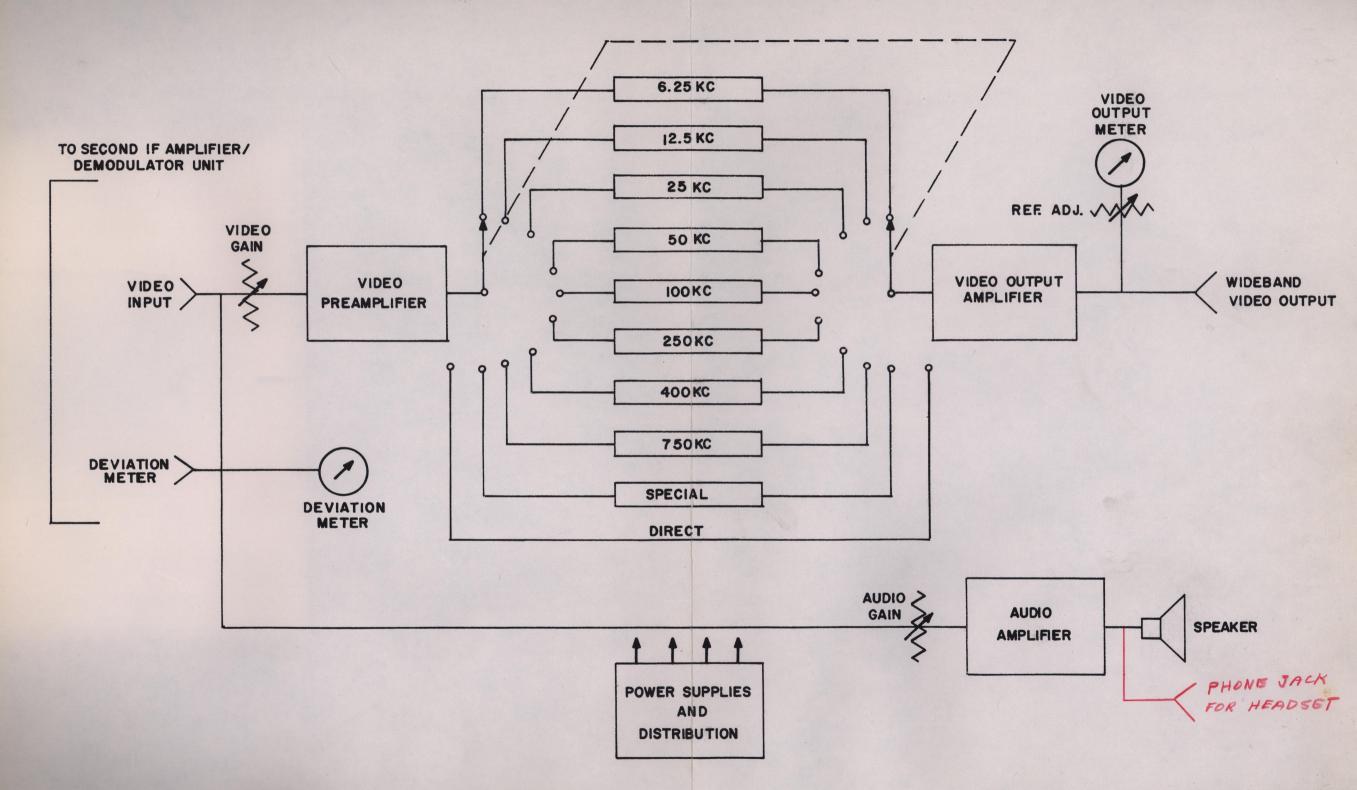


Figure 1-2. Model VAU-15 Video Amplifier
Unit, Block Diagram

# SECTION II THEORY OF OPERATION

### 2-1 VIDEO PREAMPLIFIER (refer to figure 7-2)

The video preamplifier consists basically of two voltage amplifiers, A13Q1 and A13Q2, and an emitter-follower, A13Q3. The entire video preamplifier is mounted on a plug-in printed circuit card, A13; all component designations are therefore prefixed A13.

The video input signals at J14 are applied to the first voltage amplifier, A13Q1, through the VIDEO GAIN control, R3. After being amplified by A13Q1 and A13Q2, the signal is applied to the emitter follower, A13Q3, which provides impedance matching for the video filters. A type 1N756A silicon zener diode, A13CR1, is used to stabilize the power supply voltage being applied to the voltage amplifiers, A13Q1 and A13Q2.

Each stage employs negative feedback and overall negative feedback is used to provide low distortion. The response of the video preamplifier is virtually flat up to one megacycle with approximately 18 db gain provided.

## 2-2 VIDEO FILTERS (refer to figure 7-3)

Eight video filters are provided on plug-in printed circuit cards designated A1 through A8. These filters provide 3-db bandwidths of 6.25 kc, 12.5 kc, 25 kc, 50 kc, 100 kc, 250 kc, 400 kc, and 750 kc; selectable from the front panel. Space has been provided for a future filter with the designation A9. A schematic diagram of a typical filter is shown in figure 7-3. Since the only difference between filters is the value of the components, only one schematic diagram is shown.

Each filter consists of three inductors and three capacitors providing a six-pole, maximally-linear-phase-response filter. The asymptotic slope of each filter is 36 db per octave. This filter configuration provides optimum square-wave response with the least possible overshoot.

Each filter is designed to operate from a low source impedance and to work into a load of 600 ohms. A portion of the 600-ohm load impedance is located on the filter printed circuit card.

#### 2-3 VIDEO OUTPUT AMPLIFIER (refer to figure 7-4)

The video output amplifier, mounted on printed circuit card, A12, consists of two wideband voltage amplifiers and a Darlington-type output stage. All component designations in this amplifier have the prefix A12. The voltage amplifiers, A12Q1 and A12Q2, are type 2N706, while the Darlington output stage, A12Q3 and A12Q4, employs a type 2N706 and a type 2N697. The total gain of the video output amplifier is approximately 13 db.

The Darlington output stage has high input impedance, good frequency response, and an extremely low output impedance. The output impedance of the video output amplifier is approximately 5 ohms and is designed to work into a 75-ohm load. The amplifier is capable of working into a load impedance of between 75 ohms and several megohms without affecting distortion and frequency response. The rated output is 4 volts peak-to-peak but a typical unit is capable of handling more than 6 volts peak-to-peak before clipping.

## 2-4 METERING CIRCUIT (refer to figure 7-1)

The metering circuit consists of a bridge rectifier and its associated load and multiplying resistors. It is located on a printed circuit card which is mounted on the back of the OUTPUT meter. Calibration potentiometer, R6, provides an adjustment to set the meter to 0-db for any output voltage from 2 volts peak-to-peak to approximately 6 volts peak-to-peak. The frequency response of this circuit is virtually flat from 5 cps to one megacycle.

## 2-5 AUDIO AMPLIFIER (refer to figure 7-5)

The input signal, besides being fed to the video preamplifier, is also applied to the audio amplifier. The AUDIO GAIN control, R5, is a logarithmic potentiometer controlling the amount of input signal applied to the audio amplifier. An emitter-follower input stage, A11Q1, provides the required high input impedance. This is followed by a voltage amplifier, A11Q2, and a driver stage, A11Q3. A complementary symmetry output stage, A11Q4 and A11Q5, drives the speaker. A 1N270 germanium diode, A11CR1, is used for temperature compensation of the output transistors.

### 2-6 POWER SUPPLY (refer to figure 7-6)

The regulated power supply, located on plug-in printed circuit card A10, consists of a full-wave rectifier, a Darlington-type series regulator, and a voltage amplifier. It provides 15 volts at approximately 375 milliamperes, regulated to within approximately 1%. The output is adjustable to +15V by the use of R5. Power transformer, T1, is the only component of the power supply mounted on the chassis.

The Darlington series regulator consists of a type 2N697 transistor, A10Q1, and a type 2N1701 transistor, A10Q2. The voltage amplifier, A10Q3, employs a 2N697 transistor in a feedback loop to compensate for voltage changes. A type 1N3681B silicon zener diode, A1CR3, provides a constant reference voltage for the error amplifier, A10Q3.

# SECTION III OPERATION

### 3-1 CONTROL FUNCTIONS

POWER switch, S1, controls power to the equipment with the red light indicating when power is on.

VIDEO FILTER BANDWIDTH KC switch, S2, selects the video filter with cutoff frequency as indicated. The DIRECT position bypasses all filters to employ the full bandwidth of the video amplifier unit. An SPL position is provided for future filters.

VIDEO GAIN control, R3, adjusts the input video signal level being applied to the video preamplifier and thus determines the video output signal level.

AUDIO GAIN control, R5, adjusts the amount of input signal being applied to the audio amplifier and thus determines the aural output.

OUTPUT CAL control, R6, is a screwdriver control that adjusts the db reference point of the video output meter. It is adjustable, for zero db reference, from 2V p-p to 4V p-p.

#### 3-2 OPERATING PROCEDURE

Place the POWER switch in the ON position. Since the video amplifier unit employs solid-state circuitry, no warm-up period will be necessary.

Set the VIDEO FILTER BANDWIDTH KC switch to the desired bandwidth.

The desired bandwidth being determined by the type of signal that is to be applied to the video amplifier unit.

NOTE: The VAU-15 is supplied with a bypass card in the special receptacle. With this card in place, the SPL and DIRECT positions of the switch both provide maximum video bandwidth.

The OUTPUT meter indicates the level of the video output signal. The OUTPUT meter has a standard VU meter calibration with the zero db reference point indicating a particular video output voltage during operation. The OUTPUT meter can be adjusted for a 0-db indication for output voltages from 2V p-p to approximately 6V p-p. The reference-level adjustment procedure is given in

AU-15

paragraph 4-2.2.1.

The VIDEO GAIN control is used to maintain the output voltage at a predetermined level.

Adjust the AUDIO GAIN control to provide a suitable audio output level.

The DEVIATION meter indicates the peak frequency deviation of the FM

signals at the output of the demodulator in the Model ADU-15 Second IF Ampli-

fier/Demodulator Unit.

## SECTION IV MAINTENANCE

#### 4-1 PREVENTIVE MAINTENANCE

4-1.1 General. The Model VAU-15 Video Amplifier Unit has been carefully designed to give long trouble-free operation. High quality components, conservatively rated, are used throughout. Therefore, during normal operation, no preoperational, weekly, monthly, quarterly, or semiannual preventive maintenance checks will be required.

Lubrication is not required and should be avoided since damage to the controls could result. Keeping the unit relatively clean and dust-free, as well as in good mechanical condition, is considered to be in keeping with good engineering practices and is therefore not spelled out here.

- 4-1.2 Preoperational. None.
- 4-1.3 Weekly. None.
- 4-1.4 Monthly. None.
- 4-1.5 Quarterly. None.
- 4-1.6 Semiannual. None.
- 4-1.7 Annual. Gain, maximum output, frequency response, and distortion checks should be performed annually.

Equipment Required:

VTVM

**HP 400D** 

Distortion Analyzer

HP HO2 330B

Audio Oscillator

**HP 200CD** 

Signal Generator

HP 650A

Oscilloscope

Tektronix 545A or equivalent

4-1. 7.1 Gain. Feed a 1-kc signal into J14 with the HP 200CD Audio Oscillator. Terminate the output jack, J15, with a 75 ohm load (a 75-ohm  $\pm$  5% 1/2 watt resistor will suffice). Turn the VIDEO GAIN control to its maximum clockwise position and the bandwidth selector to DIRECT. Adjust the output of the signal

- VAU-15
  - generator to give a 4V p-p voltage at J15 as indicated on the oscilloscope. The required input voltage should be less than 45 millivolts rms.
  - 4-1. 7.2 Maximum Output Voltage. With the video amplifier unit connected for normal operation (fed into a 75-ohm load) the maximum output voltage should be approximately 6 volts peak-to-peak before clipping occurs.
  - 4-1. 7.3 Frequency Response of VAU-15. Feed a signal into J14 with the HP 200CD and vary the frequency from 10 kc to 5 cps while monitoring the terminated output and the input with the Tektronix 545A. Now feed a signal into J14 with the HP 650A and vary the signal from 10 kc to one megacycle while monitoring the input and output with the HP 400D. The frequency response of the VAU-15 should be within +1 and -3db from 5 cps to one megacycle.
  - 4-1. 7.4 <u>Distortion</u>. Terminate the output of the video amplifier unit with a 75-ohm load as in 4-1. 7.1. Feed a 1-kc signal into J14 with the HP 200CD. Adjust the output level of the HP 200CD for 4V p-p at the output of the VAU-15 as indicated on the oscilloscope. Connect the HP HO2 330B Distortion Analyzer across the output of the VAU-15 and note the amount of distortion. The distortion level should be less than 0.25%.

#### 4-2 SERVICING

4-2.1 General. In the event of equipment failure, a thorough knowledge of the theory of operation as contained in Section II and the use of the schematic diagrams contained in Section VII should facilitate servicing the equipment. Note that all major sections of the video amplifier unit are located on plug-in printed circuit cards as shown in figure 4-1. The cards are numbered in sequence from A1 to A13 and are keyed to fit only the appropriate receptacle. Table 4-1 gives the plug-in card numbers in accordance with the circuit contained thereon. Table 4-2 is a voltage chart indicating the DC voltage readings at the pins of all transistors.

No specific overhaul procedures are required for this unit. However, each time the unit is serviced a visual inspection should be made of the unit's interior. A clean interior is necessary to insure optimum performance by preventing corrosion and dirt from damaging parts or causing arc-over or leakage between circuit points. Blow out dust from inside of chassis. Be careful that air pressure is not great enough to damage parts or disturb wiring.

After cleaning, make a visual inspection of parts and wiring for corrosion, loose connections, frayed and burned insulation, loose screws, and burned or charred resistors.

TABLE 4-1
PRINTED CIRCUIT CARDS

THE CHICOTT CITIES
Circuit
6.25 kc video filter
12.5 kc video filter
25 kc video filter
50 kc video filter
100 kc video filter
250 kc video filter
400 kc video filter
750 kc video filter
special video filter
power supply
audio amplifier
video output amplifier
video preamplifier

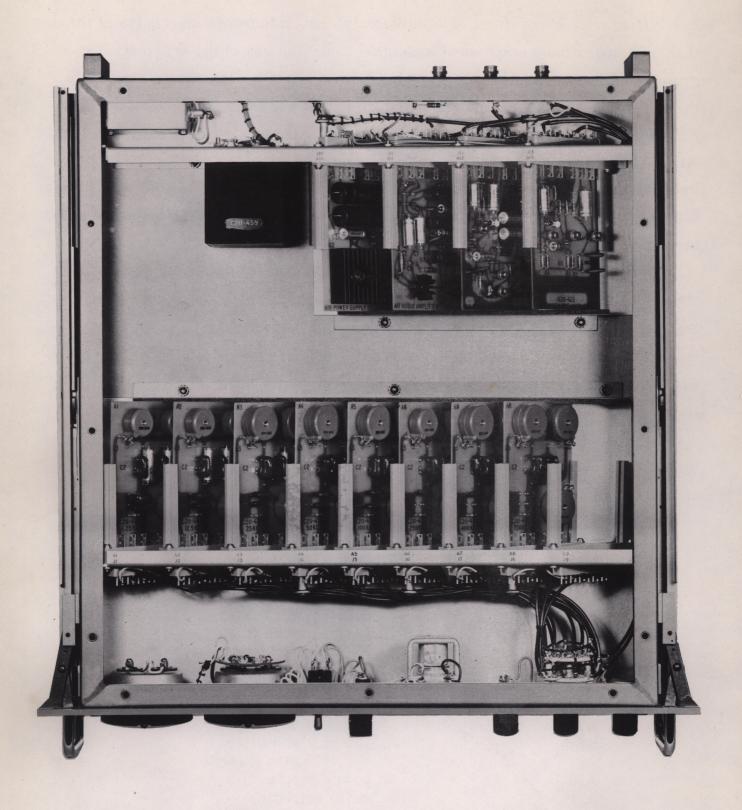


Figure 4-1. Model VAU-15 Video Amplifier Unit, Top View with cover removed

### 4-2.2 Calibration.

Equipment Required:

DC Voltmeter HP 412A

Audio Oscillator HP 200CD

Oscilloscope Tektronix 545A or equivalent

4-2.2.1 Reference Level Adjustment. The output voltage used as a 0-db reference level must be determined by the user. An output voltage of 2V p-p to 4V p-p can be used for this reference level. For simplicity, a reference level of 4V p-p will be used in this procedure.

Connect the oscilloscope and a 75 ohm termination to J15 and the HP 200CD, adjusted to 1 kc, to J14. Adjust the output of the HP 200CD for a 4V p-p indication on the oscilloscope. Adjust the OUTPUT CAL control on the front panel of the VAU-15 for a 0-db indication on the OUTPUT meter.

If a higher input frequency is used, be certain that the VIDEO FILTER BAND-WIDTH switch is in a position that will pass the signal without attenuation.

4-2.2.2 Power Supply. With the unit operating normally, measure the DC voltage at J10, Pin 4. Adjust A10R5 for a 15 VDC indication on the DC voltmeter.

TABLE 4-2
VOLTAGE CHART

					ard Socket	
Test Point	Emitter	Base	Collector	Pin 2	Pin 4	Pin 13
A10Q1	16.0	16.5	25.0			
A10Q2	15.0	16.0	25.0			
A10Q3	12.0	12.7	16.5			
A11Q1	5.5	6.0	13.2			
A11Q2	4.5	5.2	7.3			
A11Q3	0.35	1.1	6.0			
A11Q4	6.6	7.2	15.0			841
A11Q5	6.6	6.0	0			
A12Q1	0.9	1.6	5.3			
A12Q2	1.0	1.7	9.4			
A12Q3	8.7	9.4	15.0			
A12Q4	8.0	8.7	15.0			
A13Q1	0.3	1.0	5.2			The same
A13Q2	0.3	1.0	5.2			
A13Q3	4.5	5.2	15.0			
J10			7		15.0	
J11				15.0		
J12						15.0
J13		₹				15.0

All voltages have been measured between the indicated test point and chassis ground using a VTVM with an 11-megohm input impedance. These voltages are nominal values and may vary under normal conditions.

#### SECTION V

#### INSTALLATION

The Model VAU-15 Video Amplifier Unit weighs approximately 16 pounds and is designed to occupy 3-1/2 inches of standard 19-inch rack space with a depth of approximately 19 inches behind the panel. The power input and signal input and output connectors are located on the rear apron of the chassis.

A three-contact twistlock connector, J17, is provided for connection to the power line. The VAU-15 power requirements are  $117 \pm 10\%$  VAC, 60 cps, approximately 12 watts.

Three BNC connectors are provided for the deviation meter input-J16, signal input-J14, and the signal output-J15.

Jonathan 120 QDP slides, modified per DEI D40-310, are provided to allow servicing of the unit while mounted in the rack and provide positive lock-in while in operation.

## SECTION VI PARTS LIST

MAIN CH	IASSIS	Need - Nome	Federal
Ref. Symbol	Description	Mfr's Name and Part Number	Stock No.
Byllibor			
A1	Filter, max. linear phase, 6.25 KC	DEI C20-468	
A2	Filter, max. linear phase, 12.5 KC	DEI C20-469	
A3	Filter, max. linear phase, 25 KC	DEI C20-470	
A4	Filter, max. linear phase, 50 KC	DEI C20-471	
A5	Filter, max. linear phase, 100 KC	DEI C20-472	
A6	Filter, max. linear phase, 250 KC	DEI C20-473	
A7	Filter, max. linear phase, 400 KC	DEI C20-474	
A8	Filter, max. linear phase, 750 KC	DEI C20-475	
A9	Filter, Special		
A10	Power Supply, regulated, see page 6-11	DEI D20-423	
A11	Amplifier, audio, see page 6-9	DEI C20-264	
A12	Amplifier, video output, see page 6-7	DEI D20-424	
A13	Preamplifier, video, see page 6-5	DEI D20-422	
A14	Signal Strength Circuits, see page 6-13		
A15	Deviation Meter Circuits, see page 6-13		
C1	Capacitor, ceramic, disc, 3300 UUF	Erie HD 15-3300	
C2	Capacitor, ceramic, feed-thru, 1000 UUF ± 20%	Erie GP 2-327	
C3	Capacitor, ceramic, disc, 3300 UUF	Erie HD 15-3300	
C4	Capacitor, ceramic, feed-thru, 1000 UUF ± 20%	Erie GP 2-327	
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	Study Material to Carriery for the Status of Coopeal	of human a sign of wood	with the NHSA

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Main Ch	Main Chassis, cont'd				
Ref. Symbol	Description	Mfr's Name and Part Number	Federal Stock No.		
CR1 through CR4	Diode, germanium, 1N283	NHSA			
DS1	Indicator Lamp, incandescent, 28V, .04A	GE 327			
F1	Fuse, .2 amp, 3AG, Slo-Blo				
J1 through J13	Connector, jack, 14 contact	Elco 005023- 014-216			
J14 through J16	Connector, BNC, UG1094/U				
J17	Connector, AC receptacle	Hubbell 7486G			
J18	PHONE JACK	SWITCHCRAFT L-12A			
L1	Inductor, fixed, 1.8 UH	DEI A10-280			
L2	Inductor, fixed, 1.8 UH	DEI A10-280			
	madetor, rixed, 1.0 cm				
LS1	Speaker, PM, 3 inch, 12 ohm V.C.	Quam 09386			
M1	Meter, output, modified per DEI B20-466	Phaostron Inst & Elect Co. 200-09357			
M2	Meter, deviation, modified per DEI B20-465	Phaostron Inst & Elect Co. 200-09357	NHSA		

Main Chassis, cont'd					
Ref. Symbol	Description	Mfr's Name and Part Number	Federal Stock No.		
R1	Resistor, composition, 12K ±5%, 1/4W	Allen Bradley CB 1235			
R2	Resistor, composition, 300 ohm ±5%, 1/4 W	Allen Bradley CB 3015			
R3	Resistor, potentiometer, 100 ohm, modified per DEI B40-294-2	Allen Bradley CU-1011			
R4	Resistor, composition, 510 ohm ±5%, 1/4W	Allen Bradley CB 5115			
R5	Resistor, potentiometer, 100 K, modified per DEI B40-294-3	Centralab NCP9-104-A	•		
<b>R</b> 6	Resistor, potentiometer, composition, 2.5K ±10%	Int'l Resistance Co. CTS65LT MILRV5LAXSB			
	Sport Person				
R10	Resistor, composition, 20K ±5%, 1/2W	Allen Bradley			
		EB 2035			
S1	Switch, toggle, DPST	HH Smith 522			
S2	Switch, rotary, modified per DEI DEI B40-294-1	Centralab PA-2005			
	bludy Material to Quality for the Status of Cadicated Hu	is: 8 Sport-Person with	Ine NHSA		

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Ref. Symbol	Description	Mfr's Name and Part Number	Federal Stock No.
T1	Transformer, power, 38V RMS CT, 500 RMS MA, modified per DEI C20-459	Balt. Trans- former Co. BX-3614	
н	NATIONAL NTING & SHOOTING		
	ASSOCIATION		
	Dedicated		
	Hunter 8		
	port Francis 201		
	aterial to Govern Rushies Status of the survey Historia	to earliegh with the lat	

A13 VIDEO PREAMPLIFIER

Ref. Symbol	DEO PREAMPLIFIER  Description	Mfr's Name and Part Number	Federal Stock No.
C1	Capacitor, tantalum, 68 UF ±20%, 15V	Sprague 150D686 X0015R2	
C2	Capacitor, tantalum, 68 UF ±20%, 15V	Sprague 150 <b>D</b> 686 X0015R2	
C3	Capacitor, tubular, 5.1 UUF ±.25 UUF	Erie NPO-A	
C4	Capacitor, ceramic, disc, .1 UF +80-20%, 25V	Erie 5815	7
C5	Capacitor, ceramic, disc, .1 UF +80-20%, 25V	Erie 5815	
C6	Capacitor, tantalum, 220 UF ±20%, 10V	Sprague 150D22 7X0010S2	
CR1	Diode, zener, 1N756A		
Pi	Connector, plug	DEI B20-409 ELCO 5001.1913	
Q1 through Q3	Transistor, NPN	Motorola 2N706	590-824-8448
R1	Resistor, composition, 680 ohm ±5%, 1/4W	Allen Bradley CB 6815	
R2	Resistor, composition, 33K ±5%, 1/4W	Allen Bradley CB 3335	
R3	Resistor, composition, 5.1K ±5%, 1/4W	Allen Bradley CB 5125	·

#### VAU-15

A13 Video Preamplifier. cont'd Mfr's Name Federal Ref. Stock No. and Part Number Description Symbol Resistor, composition, 2.2K ±5%, 1/4W Allen Bradley R4 **CB 2225** Resistor, composition, 220 ohm ±5%, Allen Bradley R5 CB 2215 1/4W Resistor, composition, 33K ±5%, 1/4W Allen Bradley R6 **CB 3335** Resistor, composition, 5.1K ±5%, 1/4W Allen Bradley R7 CB 5125 Resistor, composition, 2.2K ±5%, 1/4W Allen Bradley R8 CB 2225 Resistor, composition, 220 ohm ±5%, Allen Bradley R9 CB 2215 1/4W Resistor, composition, 2.2K ±5%, 1/4W Allen Bradley R10 CB 2225 Resistor, composition, 330 ohm ±5%, Allen Bradley R11 CB 3315 1/4W Resistor, composition, 510 ohm ±5%, Allen Bradley R12 CB 5115 1/4W

A12 VIDEO OUTPUT AMPLIFIER

Ref. Symbol	Description	Mfr's Name and Part Number	Federal Stock No.
C1	Capacitor, tantalum, 68 UF ±20%, 15V	Sprague 150D686 X0015R2	
C2	Capacitor, tantalum, 68 UF ±20%, 15V	Sprague 150D686 X0015R2	
C3	Capacitor, ceramic, disc, .1 UF +80-20%, 25V	Erie 5815	
C4	Capacitor, tantalum, 100 UF ±20%, 20V	Sprague 150D107 X002S2	
C5	Capacitor, mica, 160 UUF ±5%	Elmenco DM15- 161J	94 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)
C6	Capacitor, ceramic, tubular, 5.1 UUF ±.25 UUF	Erie NPO-A	
C7	Capacitor, ceramic, disc, .2 UF +80-20%, 25V	Erie 5815	
C8	Capacitor, tantalum, 270 UF, 15V	Int'l Electronics Ind. CL65- BE271MP3	
C9	Capacitor, tantalum, 270 UF, 15V	Int'l Electronics Ind. CL65- BE271MP3	
EQ4	Heat sink, transistor	Wakefield NF207	
P1	Connector, plug	DEI B20-409 ELCO 5001.1913	
Q1 through Q4	Transistor, NPN	Motorola 2N706	590-824-8448

### VAU-15

A12 Video Output Amplifier, cont'd

Ref. Symbol		Amplifier, cont'd  Description	Mfr's Name and Part Number	Federal Stock No.
R1	Resistor, ±1%, 1/10	deposited carbon, 820 ohm	Int'l Resistance Co. DM	
R2	Resistor,	composition, 33K $\pm 5\%$ , 1/4W	Allen Bradley CB 3335	
R3	Resistor,	composition, 5.1K ±5%, 1/4W	Allen Bradley CB 5125	
R4	Resistor,	composition, 2.2K $\pm 5\%$ , 1/4W	Allen Bradley CB 2225	
R5	Resistor, 1/4W	composition, 220 ohm ±5%,	Allen Bradley CB 2215	
R6	Resistor,	composition, $5.1K \pm 5\%$ , $1/4W$	Allen Bradley CB 5125	•
R7	Resistor,	composition, 1K ±5%, 1/4W	Allen Bradley CB 1025	
R8	Resistor, 1/4W	composition, 220 ohm ±5%,	Allen Bradley CB 2215	
R9	Resistor, 1/4W	composition, 100 ohm ±5%,	Allen Bradley CB 1015	
R10	Resistor,	composition, 16K ±5%, 1/4W	Allen Bradley CB 1635	
R11	Resistor,	composition, 2.2K ±5%, 1/4W	Allen Bradley CB 2225	
R12	Resistor,	composition, 51 ohm ±5%,	Allen Bradley CB 5105	- 94 (1987) - 241
R13	Resistor,	composition, 68 ohm ±5%,	Allen Bradley HB 6805	

A11 AUDIO AMPLIFIER

Ref. Symbol	Description	Mfr's Name and Part Number	Federal Stock No.
C1	Capacitor, tantalum, 2.2 UF ±20%, 35V	Sprague 150D225 X0035B2	
C2	Capacitor, tantalum, 100 UF ±20%, 20V	Sprague 150D107 X0020S2	
СЗ	Capacitor, ceramic, disc, .001 UF ±10%	Erie HR-809- X5T	
C4	Capacitor, tantalum, 100 UF ±20%, 10V	Sprague 150D107 X0010R2	
C5	Capacitor, tantalum, 68 UF ±20%, 15V	Sprague 150D686 X0015R2	
C6	Capacitor, ceramic, disc, .0033 UF	Erie 875-Y5E	1
C7	Capacitor, tantalum, 220 UF ±20%, 10V	Sprague 150D227 X0010S2	
CR1	Diode, germanium, 1N270		
		il y androgelle.	
EQ4	Heat sink, transistor	Wakefield NF207	
EQ5	Heat sink, transistor	Wakefield NF207	
P1	Connector, plug	DEI B20-409 ELCO 5001.1913	
Q1 through Q4	Transistor, NPN	Motorola 2N697	5960-837-7262
Q 5	Transistor, PNP, 2N1132		

A11 Audio Amplifier, cont'd

Ref. Symbol		Description	on version in	Mfr's Name and Part Number	Federal Stock No.
R1	Resistor,	composition,	39K ±5%, 1/4W	Allen Bradley CB 3935	
R2	Resistor,	composition,	33K ±5%, 1/4W	Allen Bradley CB 3335	
R3	Resistor,	composition,	680 ohm ±5%,	Allen Bradley CB 6815	
R4	Resistor, 1/4W	composition,	200 ohm ±5%,	Allen Bradley CB 2015	
R5	Resistor, 1/4W	composition,	510 ohm ±5%,	Allen Bradley CB 5105	
R6	Resistor,	composition,	5.1K ±5%, 1/4W	Allen Bradley CB 5125	
R7	Resistor,	composition,	2.2K ±5%, 1/4W	Allen Bradley CB 2225	
R8	Resistor, 1/2W	composition,	220 ohm ±5%,	Allen Bradley EB 2215	
R9	Resistor,	composition,	12 ohm ±5%,	Allen Bradley EB 2005	
R10	Resistor, 1/2W	composition,	10 ohm ±5%,	Allen Bradley EB 1005	

A10 REGULATED POWER SUPPLY						
Ref. Symbol	Description	Mfr's Name and Part Number	Federal Stock No.			
C1	Capacitor, electrolytic, 400 UF, 25V	Int'l Electroni Ind. APD 136	3. //			
C2	Capacitor, electrolytic, 450 UF, 20V	Int'l Electronics Ind. APD 135				
C3	Capacitor, tantalum, 100 UF ±20%, 20V	Sprague 150D10 7X0020S2				
CR1	Diode, silicon, 1N4001					
CR2	Diode, silicon, 1N4001					
CR3	Diode, zener, 1N3681B					
		<b>i</b> .				
EQ2	Heat sink, transistor	Augat 9014-1G1				
P1	Connector, plug	DEI B20-409 ELCO 5001.1913				
U						
Q1 ,	Transistor, NPN	Motorola 2N697	5960-837-7262			
Q2 "	Transistor, NPN	RCA 2N1701				
Q3	Transistor, NPN	Motorola 2N697	5960-837-7262			
R1	Resistor, composition, 1K ±5%, 1/4W	Allen Bradley CB 1025				
R2	Resistor, composition, 1K ±5%, 1/4W	Allen Bradley CB 1025				
and the Contract of the Contra						

A10 REGULATED POWER SUPPLY

Ref. Symbol	Description	Mfr's Name and Part Number	Federal Stock No.
C1	Capacitor, electrolytic, 500 UF, 50V	Cornell-Dublier BBR500-50	
C2	Capacitor, electrolytic, 400 UF, 20V -10% to +100%	Int'l Electronics Ind. APD 136	
C3	Capacitor, tantalum, 100 UF ±20%, 20V	Sprague 150D10 7X0020S2	
CR1	Diode, silicon, 1N4001		
CR2	Diode, silicon, 1N4001		
CR3	Diode, zener, 1N3681B	1	
EQ2	Heat sink, transistor	Augat 9014-1G1	
		DEI D20 400	
P1	Connector, plug	DEI B20-409 ELCO 5001.1913	
Q1	Transistor, NPN	Motorola 2N697	5960-837-7262
Q2	Transistor, NPN	RCA 2N1701	
Q3	Transistor, NPN	Motorola 2N697	5960-837-7262
R1	Resistor, composition, 1K ±5%, 1/4W	Allen Bradley CB 1025	
R2	Resistor, composition, 1K ±5%, 1/4W	Allen Bradley CB 1025	

VAU-15

Ref. Symbol		Description		Mfr's Name and Part Number	Federal Stock No.
R3	Resistor,	composition, 3	30 ohm ±5%,	Allen Bradley CB 3315	
R4		composition, 1	50 ohm ±5%,	Allen Bradley CB 1515	
R5		potentiometer,	wire-wound,	Bourns 3067P	
R6	Resistor,	composition, 2	.2K ±5%, 1/4W	Allen Bradley CB 2225	
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#### NOTE:

1. UNLESS OTHERWISE NOTED:

CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.

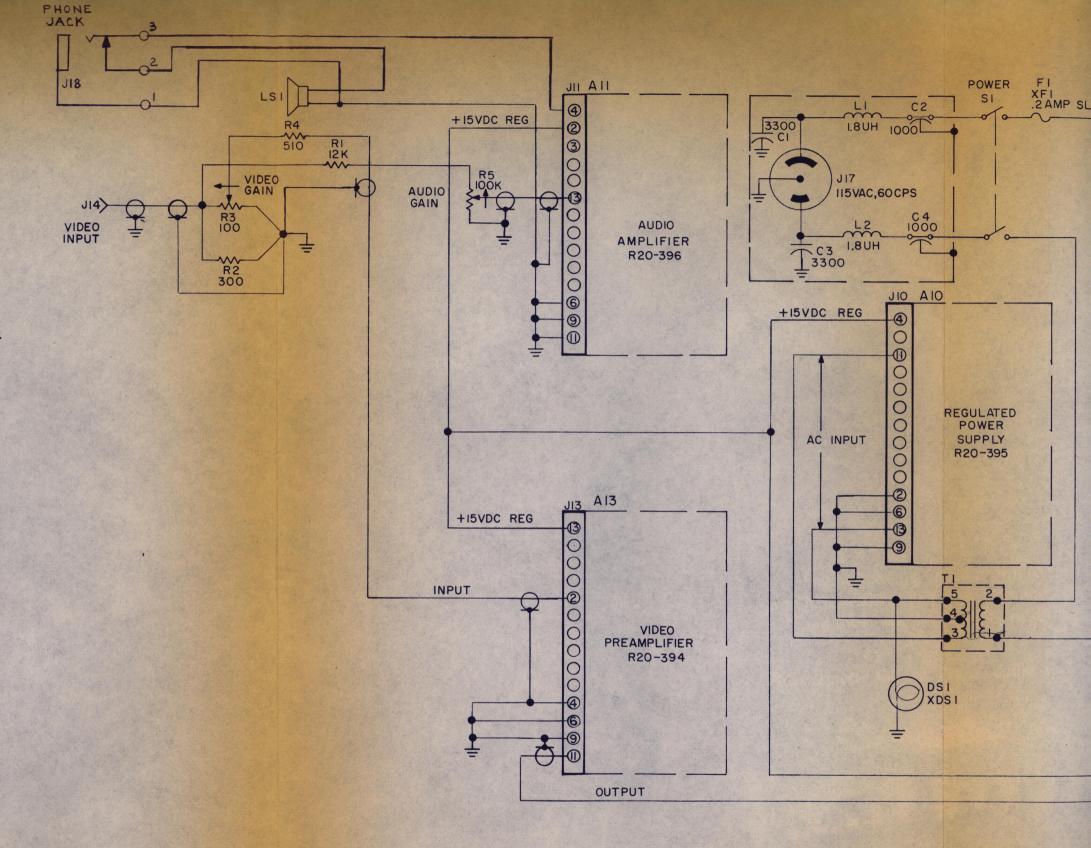
CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS (MICROMICROFARADS).

INDUCTANCE VALUES ARE IN MICROHENRYS.

RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

- 2. SINTERNAL ADJUSTMENT.
- 3. ARROW DENOTES CLOCKWISE ROTATION.
- 4. O OPERATING CONTROL.
- 5. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE IDENTIFICATION PREFIX WITH THE UNIT NUMBER OR SUB-ASSEMBLY DESIGNATION.
- 6. \* TYPICAL VALUE.

HIGHEST REF. DESIGNATION USED						
J16	R10	C4				
	05 1					
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R8	R9	Take .				
	J16 DESIGNAT	J16 R10  DESIGNATION NOT				



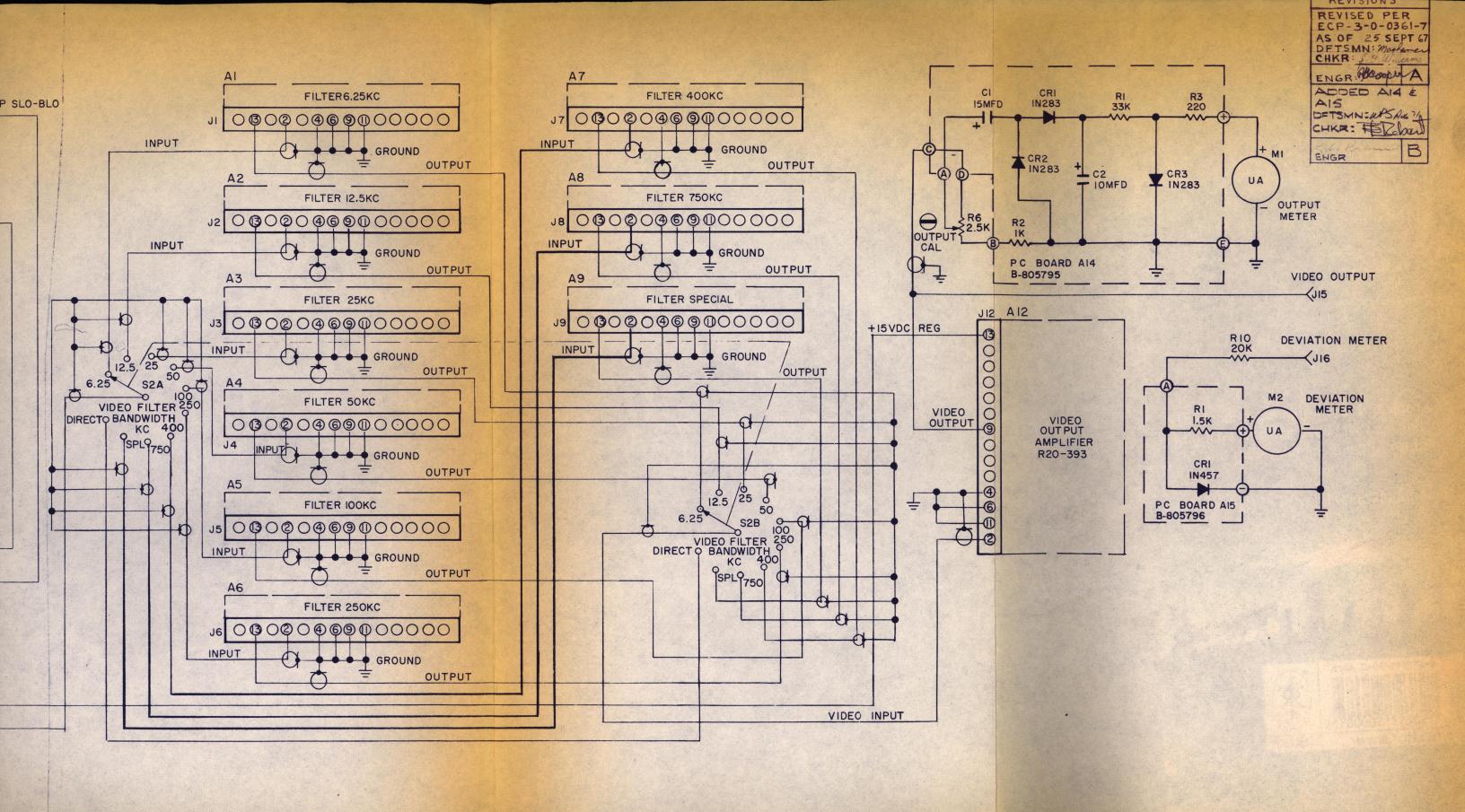


Figure 7-1. Model VAU-15 Video Amplifier Unit Schematic Diagram R20-397

#### NOTE:

1. UNLESS OTHERWISE NOTED:

CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.

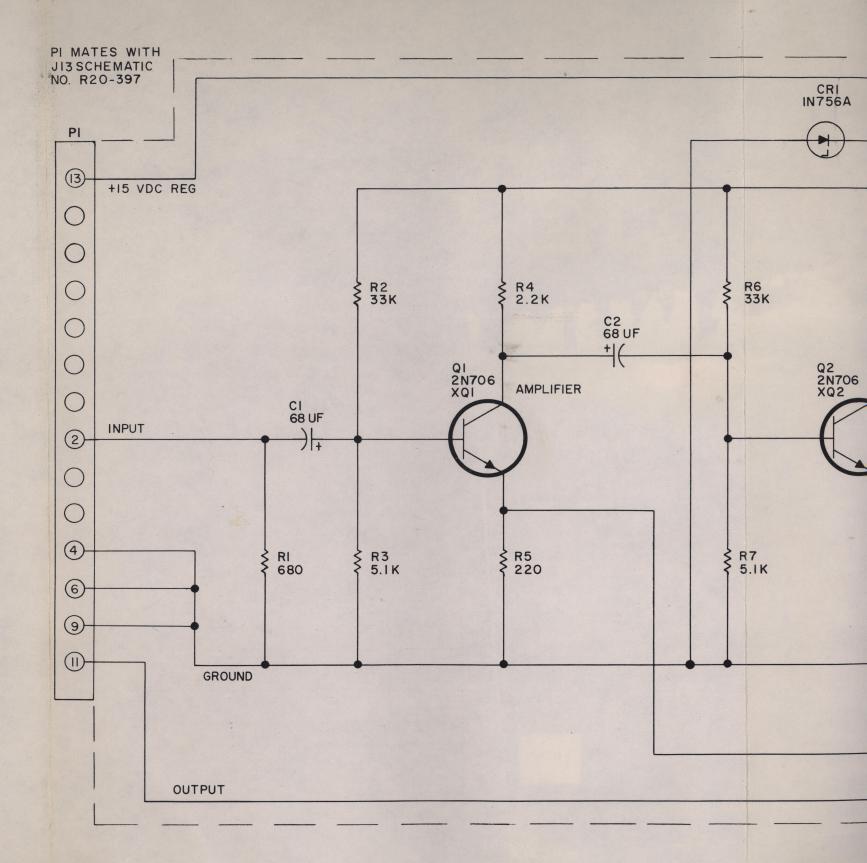
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INDUCTANCE VALUES ARE IN MICROHENRYS.

RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

- 2. NITERNAL ADJUSTMENT.
- 3. ARROW DENOTES CLOCKWISE ROTATION.
- 4. O OPERATING CONTROL.
- 5. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE IDENTIFICATION PREFIX WITH THE UNIT NUMBER OR SUB-ASSEMBLY DESIGNATION.
- 6. \* TYPICAL VALUE.

HIGHEST REF. DESIGNATION USED						
C6	CR1	Q3	R12			
P1						
REF. D	ESIGNATI	ON NOT	USED			



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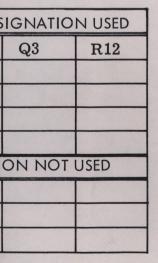
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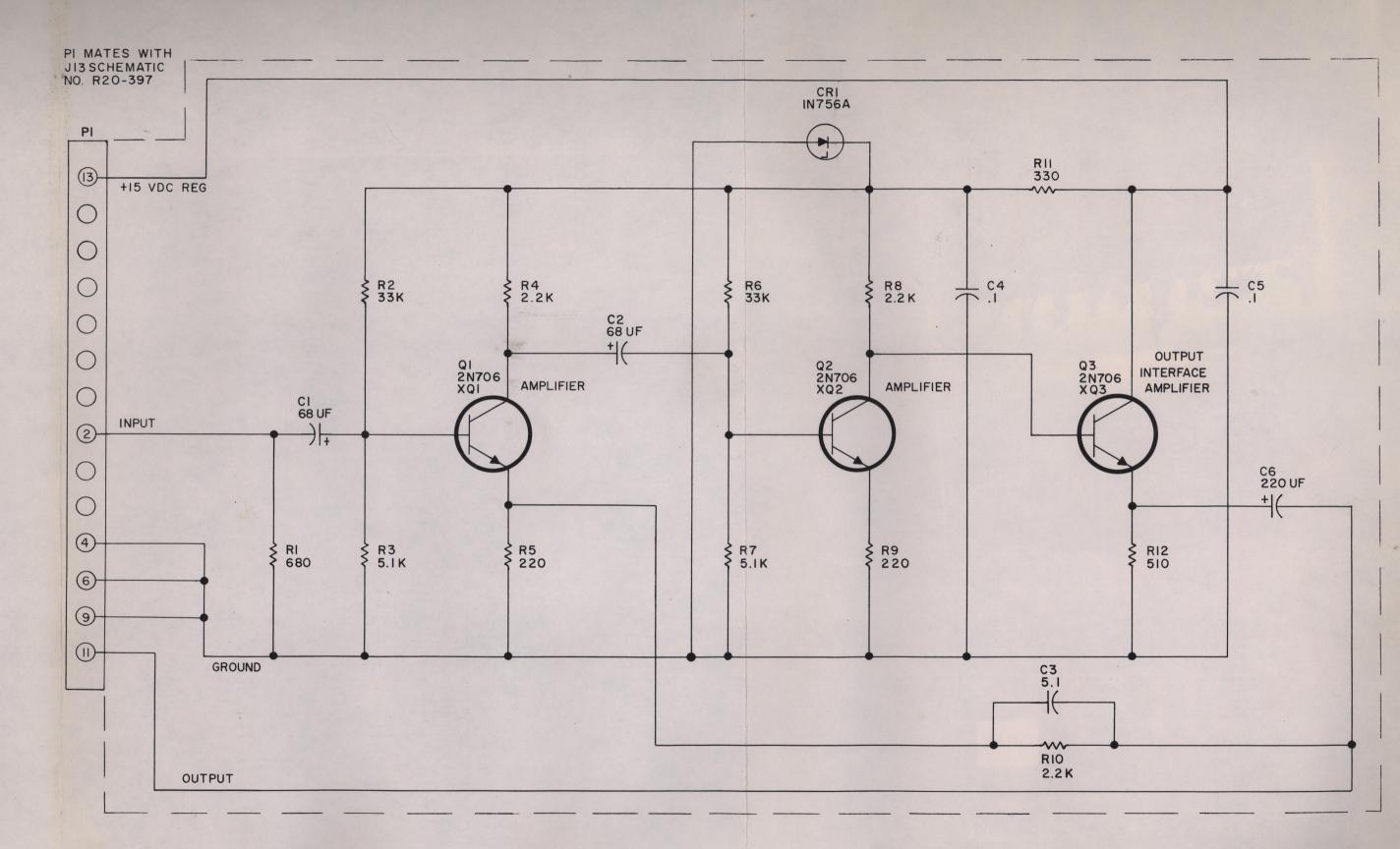


Figure 7-2. A13, Video Preamplifier Schematic Diagram R20-394

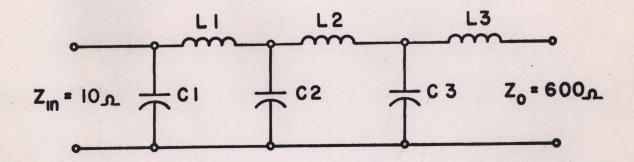


FIGURE 7-3
TYPICAL VIDEO FILTER

#### NOTE:

1. UNLESS OTHERWISE NOTED:

CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.

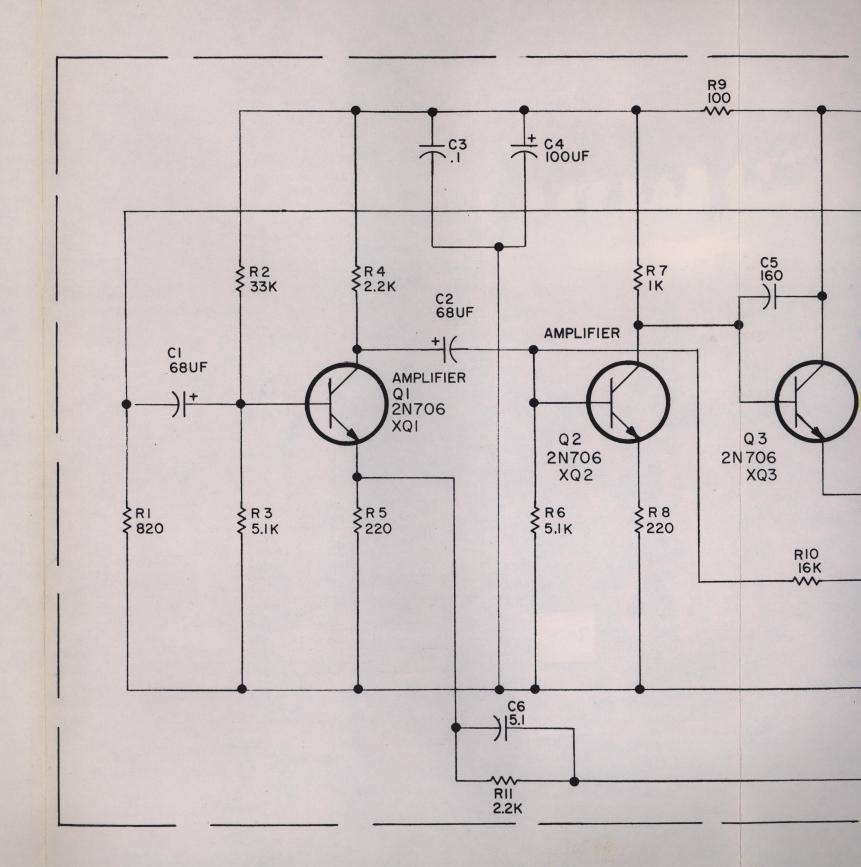
CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS (MICROMICROFARADS).

INDUCTANCE VALUES ARE IN MICROHENRYS.

RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

- 2. NITERNAL ADJUSTMENT.
- 3. ARROW DENOTES CLOCKWISE ROTATION.
- 4. O OPERATING CONTROL.
- 5. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE IDENTIFICATION PREFIX WITH THE UNIT NUMBER OR SUB-ASSEMBLY DESIGNATION.
- 6. \* TYPICAL VALUE.

HIGHEST REF. DESIGNATION USED					
R13	C9	Q4			
REF. D	ESIGNATI	ON NOT	USED		



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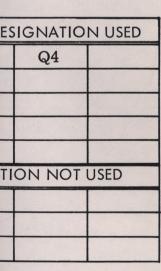
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E DESIGNATIONS ARE MPLETE IDENTIFICATION JUST NUMBER OR SUB-



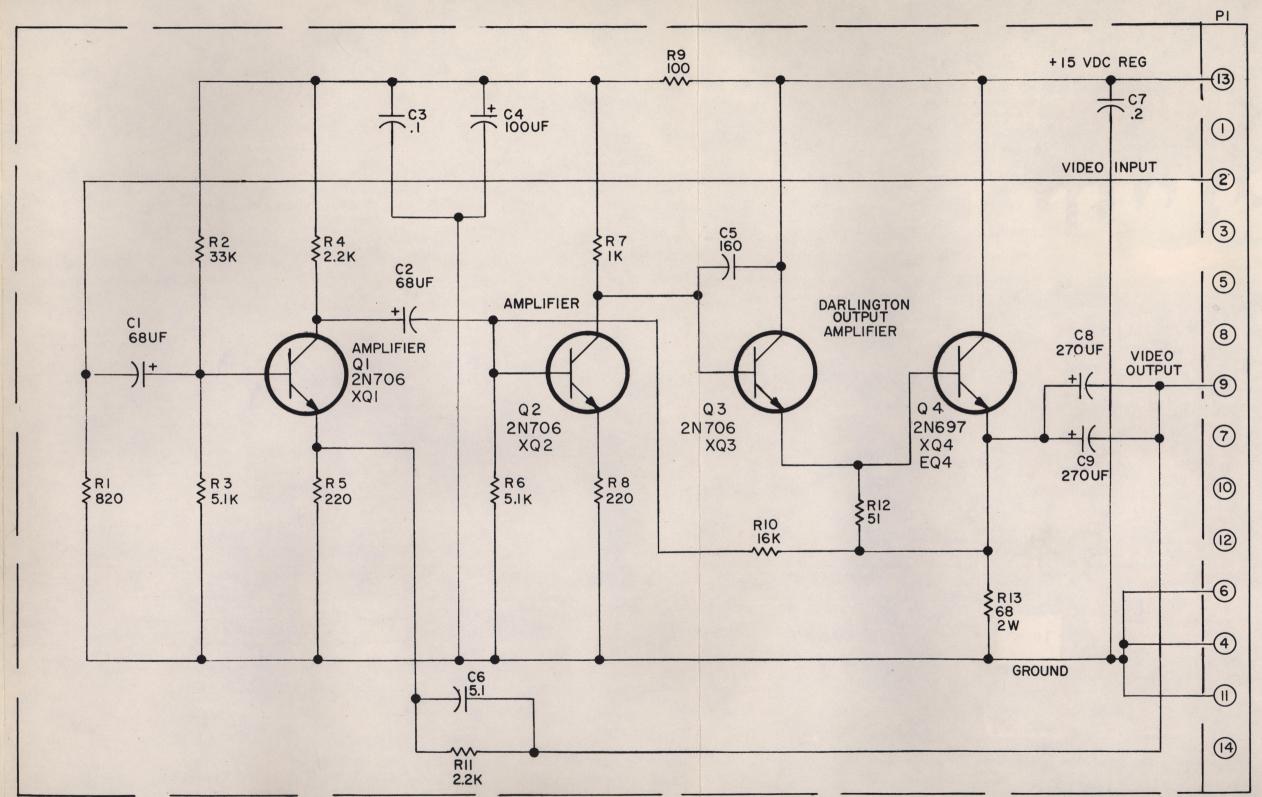


Figure 7-4. A12, Video Output Amplifier Schematic Diagram R20-393

#### NOTE:

1. UNLESS OTHERWISE NOTED:

CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.

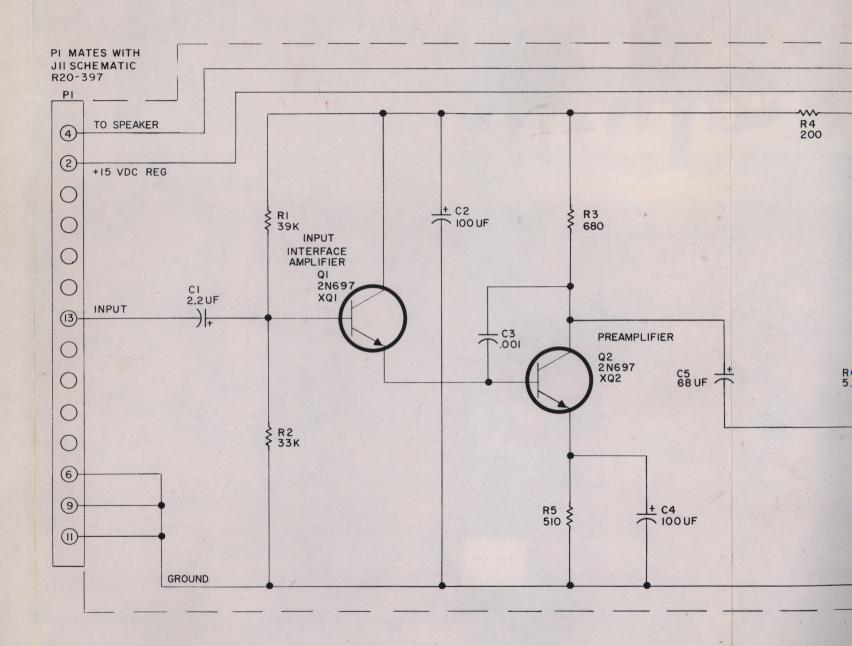
CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS (MICROMICROFARADS).

INDUCTANCE VALUES ARE IN MICROHENRYS.

RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

- 2. NITERNAL ADJUSTMENT.
- 3. ARROW DENOTES CLOCKWISE ROTATION.
- 4. O OPERATING CONTROL.
- 5. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE IDENTIFICATION PREFIX WITH THE UNIT NUMBER OR SUB-ASSEMBLY DESIGNATION.
- 6. \* TYPICAL VALUE.

HIGHEST REF. DESIGNATION USED					
C7	CR1	Q5	R10		
P1			7		
REF.	DESIGNAT	TON NOT	USED		



NOTED:

LESS THAN ONE ARE

GREATER THAN ONE (MICROMICROFARADS).

S ARE IN MICROHENRYS.

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TROL.

S CLOCKWISE ROTATION.

DESIGNATIONS ARE

PLETE IDENTIFICATION IT NUMBER OR SUB-TION.

Q5 R10

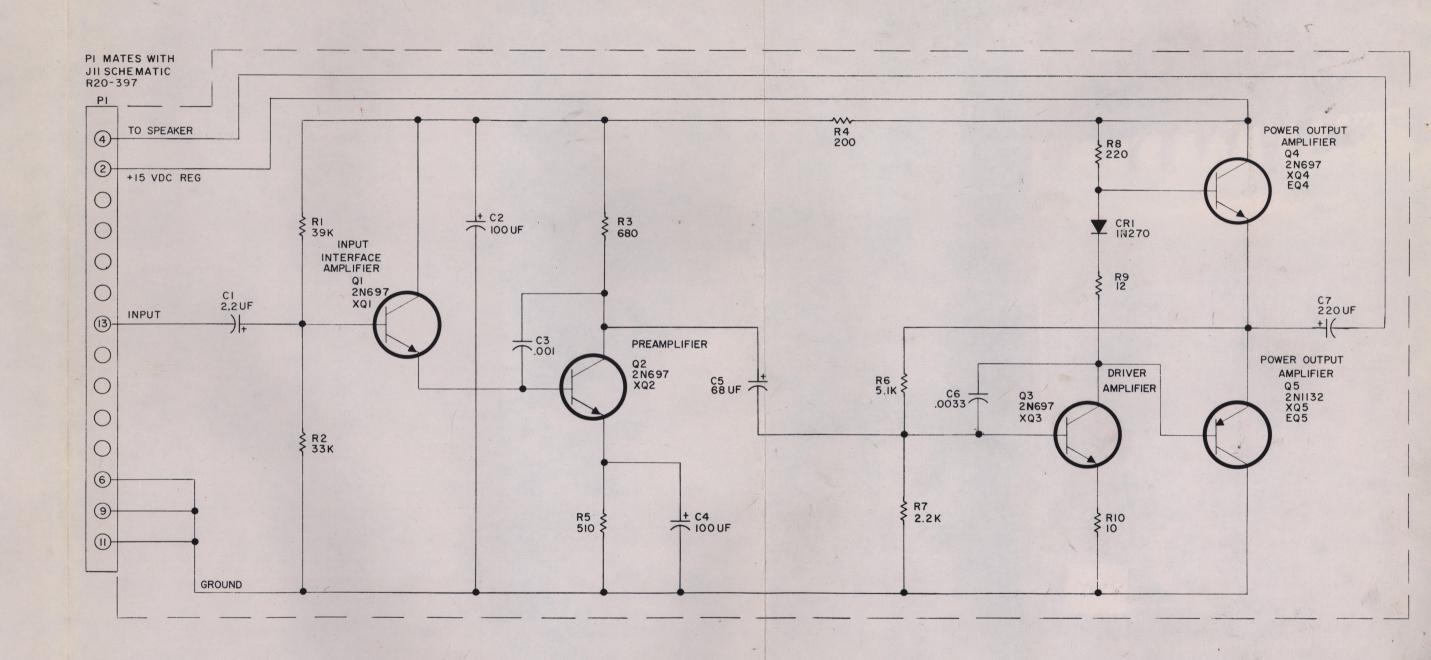


Figure 7-5. A11, Audio Amplifier Schematic Diagram R20-396

#### NOTE:

1. UNLESS OTHERWISE NOTED:

CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.

CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS (MICROMICROFARADS).

INDUCTANCE VALUES ARE IN MICROHENRYS.

RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

- 2. NITERNAL ADJUSTMENT.
- 3. ARROW DENOTES CLOCKWISE ROTATION.
- 4. O OPERATING CONTROL.
- 5. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE IDENTIFICATION PREFIX WITH THE UNIT NUMBER OR SUB-ASSEMBLY DESIGNATION.
- 6. \* TYPICAL VALUE.

HIGHEST REF. DESIGNATION USED						
C4	R6	CR3	P1			
Q3		(A) (A)				
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REF. D	ESIGNATI	ON NOT	USED			
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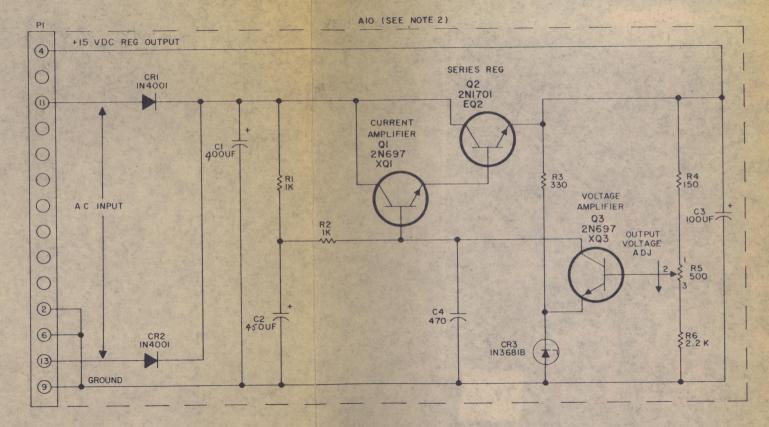


Figure 7-6. A10, Regulated Power Supply Schematic Diagram R20-395

# MODEL VAU-15 VIDEO AMPLIFIER UNIT

designed for use with the Model TMR-15 Telemetry Receiver Group

# INSTRUCTION BOOK ADDENDUM

### NOTE

This addendum covers the Audio Output for VAU-15 Video Amplifier.

AF 08(606)-5923

8 August 1967

A phone jack, J18, is provided to connect a 600 ohm headset to the audio output. When the headset is connected, the loudspeaker, LS1, is disconnected.

Main Chassis, cont'd Ref. Mfr's Name Federal Description Symbol and Part Number Stock No. Jack, Phone J18 Switchcraft L-12A