Instructions

PRELIMINARY INSTRUCTIONS

VIDICON FILM CAMERA CHANNEL

MODEL 4PE21A1

EBI-3657

GENERAL ELECTRIC

July 17, 1961

Dear Sir:

The enclosed Vidicon Film Camera Channel, Model 4PE21A1 (EBI-3657) instruction book is a preliminary copy only and must not be considered as a finalized book. However, when this book has been finalized, two new copies will be forwarded to you.

Three drawings have been inserted in the white envelope in order to help install and setup this channel.

Yours very truly,

H. Johnston
Technical Writer
Technical Publications
Building #7 Room 313

GENERAL SERVICE INFORMATION

SAFETY NOTICE

WARNING

VOLTAGES USED FOR THE OPERATION OF THIS EQUIPMENT ARE DANGEROUS TO HUMAN LIFE.

This instruction manual is written for the general guidance of maintenance and service personnel who are familiar with and aware of the dangers of handling electric and electronic circuits. It does not purport to include a complete statement of the safety precautions which should be observed in servicing this or other electronic equipment. The servicing of this equipment by inadequately trained or inexperienced personnel involves risks to such personnel and to the equipment for which the manufacturer can not accept responsibility. Personnel servicing this equipment should familiarize themselves with first-aid treatment for electrical burns and electrical shock.

PRODUCTION CHANGES

From time to time it becomes necessary to make changes in the equipment described in this book. Such changes are made to improve performance or meet component shortages and are identified by a revision letter following the model number stamped on the nameplate. The changes in the equipment as they affect the instruction book are listed on a Production Change Sheet included in the book. If no Production Change Sheet is included, no changes have been made. The revision letter appearing on the title page indicates the equipment revision to which the book corresponds.

This information is provided as a servicing aid; it should not be used to modify earlier equipments to incorporate later revisions except under specific instructions. Please mention the revision letter in any correspondence.

REPLACEMENT PARTS

The parts list contained in this book includes all principal replacement parts. The symbol numbers are the same as those appearing on elementary and other drawings. Whenever possible, replacement parts should be obtained from a local electronics supply dealer. If it is necessary to order a part (other than a tube) from the General Electric Company, please include the symbol number, description, and drawing number of the part and model number of the unit. Orders may be sent to the nearest Electronics Division office appearing on the list at the end of this book or the General Electric Company, Technical Products-Communication Products Department, Electronics Park, Syracuse, N.Y.

REPLACEMENT TUBES

In all cases replacement tubes must be ordered from a local tube distributor.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

DEFENSE ELECTRONICS DIVISION

GENERAL ELECTRIC

ELECTRONICS PARK, SYRACUSE, N. Y.

EBI-17B 5/61 (10M)

PRINTED IN U.S.A.

WARRANTY

The General Electric Company (hereinafter called the Company) warrants to the Purchaser that the equipment will be free from defects in material, workmanship, and title, and will be of the kind and quality designated or described in the contract. The foregoing warranty is exclusive of all other warranties whether written, oral, or implied (including any warranty of merchantability or fitness for purpose). If it appears within one year from the date of shipment by the Company that the equipment described in this instruction book does not meet the warranties specified above and the Purchaser notifies the Company promptly, the Company shall thereupon correct any defect, including non-conformance with the specifications, at its option, either by repairing any defective part or parts or by making available at the Company's plant, a repaired or replacement part. In lieu of the foregoing, the standard published tube warrranties in effect on the date hereof shall apply to new electronic tubes. If the equipment is installed, or its installation supervised, by the Company. said one year shall run from the completion of installation provided same is not unreasonably delayed the Purchaser. The conditions of any test shall be mutually agreed upon and the Company shall be notified of and may be represented at all tests that may be made. The liability of the Company to the Purchaser (except as to title) arising out of the supplying of the said equipment, or its use, whether on warranty, contract or negligence, shall not in any case exceed the cost of correcting defects in the equipment as herein provided and upon the expiration of said one year, all such liability shall terminate. The foregoing warranty does not apply to any used equipment supplied under contract or any equipment supplied under contract which bears a trademark of a manufacturer other than that of the Company. Because of the more restrictive warranties expressed by other manufacturers, the Company under contract can only make available to the Purchaser the warranty of the manufacturer on all such equipment. The Company will secure for the Purchaser at his request copies of the manufacturer's standard published warranty applicable to all such equipment. Used equipment is sold as is without warranty unless otherwise specifically provided in writing in the sales contract. The foregoing shall constitute the sole remedy of the Purchaser and the sole liability of the Company.

VIDICON FILM CAMERA CHANNEL

MODEL 4PE21A1

INTRODUCTION

The General Electric Vidicon Film Camera Channel, Model 4PE21A1, has been designed to receive and transmit monochrome inputs from any standard TV film, slide or opaque projector. Complete control and monitoring facilities have been included in the associated units.

The individual units which make-up this Channel are listed under EQUIPMENT.

EQUIPMENT

The Channel comprises the following units:

Quantity	Name	Model
1	Vidicon Film Camera	4PC13A1
1	Channel Amplifier	4TV99A1
1	Power Supply	4TP23A1
1	Transistor Power Supply	4TP32A1
1	Master Monitor	4TM21A1
1	Vidicon Control Panel	4TC58A1
1	Cabinet	4PR10A1
1	Interconnection Panel	PL-7672021G1
1	Rack Wiring Harness	PL-7170056G1
1	Camera Cable (Rack cable to Console)	PL-7666932G5

ACCESSORIES

Quantity	Name	Model
1	Rack	PR-1-A
1	Optical Multiplexer	TV-86-A,B
	Neutral Density Disc	
	Projector Lamp Voltage Control	
	Termination Plugs	PV-9-A

TECHNICAL SUMMARY

ELECTRICAL

Input Power

110/117/125 volts a-c, 50/60 cycles, 6.5 amps. at approximately 800 watts (from the a-c line to the rack mounted equipment).

110/117/125 volts a-c, 50/60 cycles (for Master Monitor and console blower), 1.5 amps at approximately 180 watts (from the a-c line to the Interconnecting Panel).

Input Signals

Sync Generator

Horizontal drive 4±1/2 volt
Vertical drive 4±1/2 volt
Blanking 4±1/2 volt
Sync 4±1/2 volt

Output Signals

2 Non-composite video: 1 volt each
2 Either composite or non-composite video: 1 volt plus sync.

MECHANICAL

The mechanical specifications for each individual unit are given in their associated instruction book. These books are listed in the EQUIPMENT section.

INSTALLATION

GENERAL

All the units which make-up the Type PE-21-A Vidicon Film Camera Channel, are shipped with all the tubes installed in the units. The Vidicon tube has not been installed in the Vidicon Camera and must, therefore, be installed by service personnel. The installation procedure for the Vidicon tube is described in the Installation of Vidicon Tube section.

When installing the Type TV-99-A Channel Amplifier, TP-23-A Power Supply; TM-21-A Master Monitor; and the PR-10-A Cabinet (this includes the Type PR-12-A Cabinet and the PR-13-A Cabinet), refer to their associated instruction book.

When performing the installation of the units, refer to the drawings that have been included with these instructions.

INSTALLATION OF VIDICON TUBE

In order to install and setup the Vidicon tube, the following procedures must be adhered to. During the installation procedure do not touch either the face of the Vidicon tube or any other optical surface as this will put fingerprints on the surfaces, causing a blurry or fuzzy projected image.

Installation Procedure

a. Remove all power from the Camera Channel.

b. Remove the four screws that secure the Camera cover to the main frame and then remove the cover.

c. Remove the lens holder by unscrewing it with the spanner provided.

d. Remove the retaining ring by unscrewing it fom the front of the deflection assembly with the spanner provided (use the opposite end of the spanner from that used in step-c).

e. Insert the Vidicon tube in the Camera so that its base pins are in alignment with the alignment plate at the rear of the focus assembly.

NOTE

The shortest pin on the Vidicon tubebase must be inserted in the hole designated by the red dot on the alignment plate.

f. Replace the retaining ring by pulling back on the alignment plate, compressing the coil springs. The retaining ring should then drop into place and fit snug against its stop.

g. Plug the Vidicon tube connector into the tube base.

h. When removing the Vidicon tube, reverse the installation procedures steps g through e.

MOUNTING OF UNITS

The Type PC-13-A Vidicon Film Camera is mounted on either a Type TC-86-A or TC-86-B Optical Multiplexer, or a Type PF-11-A Pneumatic Multiplexer, or a mounting bracket secured to a projector., The Type TC-58-A Vidicon Control Panel, TM-21-A Master Monitor, and the Interconnection Panel PL-7672025, are normally mounted in a Console. The Type TV-99-A Channel Amplifier, TP-23-A and the TP-32-A Power Supplies are rack mounted.

1. Vidicon Camera, Model 4PC13A1

a. The Camera must be positioned with extreme accuracy to insure that the projected image is exactly centered on the optical surface of the Vidicon tube. To facilitate ease of positioning the camera, a plastic deflection gauge is provided as an aid for correctly adjusting the sweep sizes and centerings.

b. Depending on which type of Optical or Pneumatic Multiplexer is to be used, the appropriate multiplexer lens must be used. The Vidicon Camera is threaded to accept a standard "C" mount lens. In the event when the image is projected directly onto the Vidicon tube, no multiplexer lenses are required.

2. Vidicon Control Panel, Model 4TC58A1

a. This control panel possesses all the necessary operating controls. The Master Monitor and the Interconnection Panel are shipped, mounted in the Cabinet.

3. Rack

a. The position of the Rack mounted units,when mounted in the Rack, are shown in Fig.1 . When mounting the Type TP-32-A Power Supply in the Rack, place it in a position where it will not be subjected to direct heat radiation from adjacent Rack mounted units.

INTERCONNECTIONS

Refer to the Interconnecting Block Diagram and the Rack Interconnection Diagram when performing the following prodedures. These diagrams have been included with these instructions.

It should be noted that the 117 volts a-c is supplied to the equipment at both the rack and the console. All the interconnecting cables have been supplied except the 75 ohm coaxial cables and the a-c power input cables.

1. Cable Interconnections

a. Two cables (PL-7666932G7) are provided with a combined length of up to 200 feet. One of these cables is to be connected between J1 on the Vidicon Camera, and J1 on the Interconnecting Panel, and the second cable is to be connected between J2 of the Interconnection Panel and J2 on the Type TP-32-A Power Supply.

b. The prepared rack cable harness is to be connected between J1 on the Type TP-32-A Power Supply and J17 on the Channel Amplifier, and J1 on the Type TP-23-A Power Supply.

c. Three RG-58/U 50 ohm cables have been supplied and must be connected in the following manner. These cables are to be connected between the Type TP-32-A Power Supply and the Channel Amplifier.

Channel Amplifier	TP-32-A Power Supply
J1	J1
J9	J9
J10	J10

d. Connect the RG-59/U 75 ohm cable (or similar cable) between J2 on the Channel Amplifier and J2 on the Master Monitor. The video output jack, J3, on the Master Monitor is terminated with 75 ohms or optionally extended to auxilliary monitoring equipment. Additional Channel Amplifier outputs are available at jacks J3, J4, and J5.

e. The Interconnection Panel possesses four cables which are connected as follows:

Cable P1 is connected to J1 on the Master Monitor. The three remaining calbes P3, P4, and P5, are to be connected to their respective jacks on the Type TC-58-A Vidicon Control Panel. Normally the units are shipped with these connections made.

f. Using RG-59/U coaxial cable, make the following connections from the station pulse distribution system:

Signal	Master Monitor	Channel Amplifier
Sync	J4 and J5	
Sync		J15 and J16
Blanking		J13 and J14
Vertical drive		J11 and J12
Horizontal drive		J7 and J8

g. Connect the a-c power to the console through the power plug P6. This inturn connects to the Interconnection Panel jack, J6. The console blower derives its operating power from the a-c outlet, J7. The rack mounted units derive their a-c operating power by twisting a pair of wires and attaching them to the rack cable.

NOTE

Both the rack and console mounted units must be securely grounded to the building ground.

SETUP AND OPERATING PROCEDURES

Before putting the Vidicon Film Camera Channel into operation (do not apply power), the following pre-operational setup procedures must be performed. However, the pre-operational setup of the Type TM-21-A Master Monitor must be obtained from its associated instruction book. When setting the vertical and horizontal linearity, it is advisable to use a grating generator.

1. Vidicon Control Panel, Model 4TC58A1

Control	Symbol	Setting
FOCUS	R22	Mid position
BEAM	R18	Fully counterclockwise
VIDEO	S2	POS
BLANKING	R6	Fully counterclockwise
TARGET	R24	Fully counterclockwise
TARGET AUTO/MAN	S3	MAN
CONTRAST	R10	Mid position
WIDTH	R70	Factory set
H LIN	R64	Factory set
LEFT LIN	R58	Factory set
H CENT	R72	Mid position
H SHADE	R30	Mid position
V SHADE	R34	Mid position

Control	Symbol	Setting
V CENT	R50	Mid position
V LIN	R44	Factory set
HEIGHT	R42	Factory set

2. Channel Amplifier, Model 4TV99A1

Control	Symbol	Setting
BLANKING ADJ POS	R28	Mid position
BLANKING ADJ NEG	R29	Mid position
WHITE CLIP ADJ	R65	Fully clockwise
SYNC HGT	R137	Mid position
FOCUS CURRENT	R143	Mid position
SETUP	R198	Fully counterclockwise
APER CORR	S1	Position 1
GAMMA ON/OFF	S3	Either position

If it is desirable to have one or two composite outputs, connect the jumpers as shown on the Elementary Diagram. Refer to Note #1. This diagram has been included with these instructions.

The amplifier has been factory connected to give a video output of 1.0 volt. If it is desirable to have 0.7 volts video outputs, connect the jumpers as indicated by Note #2 on the Elementary Diagram.

3. Power Supplies, Models 4TP23A1 and 4TP32A1

Although the voltage adjustments have been factory set, they should be rechecked as per the following procedures and the Test Jack Voltage Chart.

1. Place the cap over the camera lens and turn on the power to the Channel. The console blower must be operational.

2. Check the camera blanking by connecting an oscilloscope into test jack, J5, If the correct waveshape is observed, it will indicate that the deflection (sweep) circuits are operational.

TEST JACK VOLTAGES

Jack	Color	Unit	To Jack	Voltage	Adjust on Power Supply TP-32-A
J2	Blue	Camera	J6 Gnd.	-6V(fil)	6V ADJ
J4	Blue	Camera	J6 Gnd.	-20V	-20V
or					
J5	Blue	Pwr. Sup. TP-32-A	J4 Gnd.	-20V	-20V

Jack	Color	Unit	To Jack	Voltage	Adjust on Power Supply TP-32-A
J7 or	Red	Camera	J6 Gnd.	+20V	+20V
J3	Red	Pwr Sup. TP-32-A	J4 Gnd.	+20V	+20V
J6	Green	Pwr Sup TP-32-A	J4 Gnd.	-70V	-70V
J13	White	Pwr Sup TP-32-A	J12 Net Gnd.	+1100V	+1100V

4. Focus Current

Adjust the FOCUS CURRENT control, R143, on the Channel Amplifier to read 5.5 volts at the FOCUS test jack, J21.

5. Master Monitor Calibration, Model 4TM21A1

The Master Monitor should be adjusted so that 1 volt or 0.7 volts produces 0 to 100 percent vertical deflection on the monitors oscilloscope.

a. Adjust the Vidicon Control Panel BLANKING control, R6, until the blanking pedestal is just visible on the monitor oscilloscope. Adjust the H SHADE control, R30, and the V SHADE control, R34, for flat shading. The Channel Amplifier SETUP control, R198, is adjusted for approximately 5 percent pedestal.

b. Depress the Vidicon Control Panel GAIN TEST pushbutton S1, and adjust the CONTRAST control, R10, to produce a 100 percent signal on the oscilloscope screen.

NOTE

If a composite output or outputs are desired from the Channel Amplifier, make the jumper connections as indicated in Note #1 on the Channel Amplifier Elementary Diagram, Fig. 15. Rotate the SYNC HGT control, R137, to produce the desired sync percentage.

c. With a projected picture (preferably a test chart) advance the Vidicon Control Panel TARGET control, R24, to give a reading of 20 volts on the target meter. Adjust the BEAM control, R18; FOCUS control, R22; and the optical focus control to produce a picture. The BEAM control, R18, should be adjusted clockwise

until the picture highlights have been discharged.

6. Deflection Size and Centering

a. Remove the lens holder and insert the deflection gauge in the Vidicon tube retaining ring. Illuminate the deflection gauge using a 100 to 150 watt frosted bulb held approximately four feet from in front of the Vidicon Camera.

b. If the engraved rectangle is not visible on the monitor screen, readjust the Vidicon Control Panel TARGET control, R24; and BEAM control, R18; until it does become visible.

c. Rotate the deflection gauge so that the rectangle is in alignment with the monitor raster. Adjust the Vidicon Control Panel controls HEIGHT, R42; WIDTH, R70; H CENT, R72; and V CENT, R50; until the four sides of the gauge rectangle are just visible within the four sides of the monitor raster.

d. Remove the deflection gauge and replace the lens holder. Focus the Vidicon Camera on the projected test chart then adjust the position of the camera with respect to the test pattern so that the projected picture just fills the monitor raster. Optical focus must be maintained throughout this procedure. If necessary, rotate the deflection assembly for proper positioning.

7. Hi Peaker Adjustment

a. Set the Channel Amplifier switch, APER CORR,S1, in position 1, then adjustthe HI PEAK capacitor, C13, for minimum smear at black to white transitions.

8. Vidicon Alignment

a. Adjust the two Vidicon Control Panel ALIGN controls, R17 and R19 so that when the FOCUS control, R22, is rotated through focus, the center portion of the picture will rotate with no radial motion. Continue this adjustment to obtain maximum flatness of the picture video in both the horizontal and vertical directions. Adjust the H PARAB control, R95, for the flatest horizontal video.

b. Optical alignment must be optimized to prevent shading due to this cause. A nonlinear Vidicon Camera sweep will cause shading in the picture. To correct for minor horizontal shading, adjust the H SHADE control, R30; and the V SHADE control, R34. These controls are on the Vidicon Control Unit.

c. Adjust the Vidicon Control Unit TARGET control, R24; and the BLANKING control, R6; to produce a picture with 10 percent setup and white peaks of 100 percent. These percentages can be observed on the monitor oscilloscope. The Channel Amplifier APR CORR switch, S1, may be set in position 2 if desired. Position 3 is to be used only when the Channel Amplifier is being adapted to image orthicon systems. Set the Channel Amplifier GAMMA switch, S3, to ON. A video picture should now be produced with the horizontal resolution exceeding 600 lines in the center and 500 lines in the corners.

9. Linearity

a. If it is necessary to make linearity adjustments use a grating generator as the test signal input to the monitor and a standard EIA linearity chart. Adjust the Vidicon Control Panel controls V LIN, R44; H LIN, R64; LEFT LIN, R58; HEIGHT, R42; and WIDTH, R70; to obtain a linearity of better than ±2 percent of the picture height.

b. If appreciable changes are evident in the linearity, verify the raster size and centering by repeating step 6.a.

10. Positive and Negative Film

a. Adjust the Channel Amplifier BLANKING ADJUST (POS) control, R28, while adjusting the Vidicon Control Panel CONTRAST control, R10. The correct setting of the BLANKING ADJUST (POS) control is obtained when the blackest part of the picture remains stationery. This can be observed on the monitor oscilloscope.

b. If negative film is used, the Vidicon Control Panel VIDEO switch, S2, must be placed in the NEG position and the Channel Amplifier BLANKING ADJUST control, R29, as for positive film. Gamma correction will be eliminated when the VIDEO switch is set to NEG.

c. Reset the contrast after completing steps 10.a and 10.b. The contrast adjustment is outlined in step 5.b.

11. Manual Operation

a. When the Channel is operating under normal conditions, compenastion for variations in film densities should be made by adjusting the Vidicon Control Panel TARGET control, R24, It is not recommended that the CONTRAST control be used for level riding.

b. The signal electrode (target) voltage controls the sensitivity of the Vidicon tube. By using the TARGET control for level adjustments, advantages can be gained over other gain control methods. Operating in this manner will assure constant signal to noise ratio.

c. Depress the Vidicon Control Panel GAIN TEST switch, S1, This will result in a test signal corresponding to 0.3 microamperes being applied to the camera preamplifier input. The Channel stability is such that only the TARGET and BLANKING controls will have to be adjusted by the operator. The adjustment of these controls will depend on the variations that arise in program material.

12. Automatic Target Control (ATC)

An automatic target control facility is provided for automatically controlling the output level. This control is on the Vidicon Control Panel. The ATC control is set in the following manner:

a. Set the TARGET AUTO/MAN switch, S3, to AUTO then adjust the TARGET control,R24, (use a fairly dense film) for the desired output level. The output level should be between 80 and 100 percent. This can be measured on the monitor oscilloscope. When thin density film is used, it is compensated for by controlling the target voltage. An increase in light will reduce the target voltage to a value under 10 volts. Capping the camera lens will increase the target voltage to 30 volts. If it is necessary, the camera -15V ADJ control, R63, should be adjusted to produce -15 volts as measured at the camera.ATC VOLTAGES test jack, J8. Capping the camera lens will produce a voltage reading of 30 volts as measured on the Vidicon Control Panel TARGET VOLTAGE meter, M1.

b. When substituting thin density film for dense film, the abrupt changes are compensated for in approximately three TV fields. In order to ensure that there will be no white overshoot, adjust the Channel Amplifier WHITE CLIP ADJ control, R65, counter-clockwise to clip the picture portions which exceed the desired level.

c. To prevent momentary beam starving when the Vidicon Control Panel TARGET AUTO/MAN switch is set in the AUTO position, readjust the camera BEAM control slightly above the position which just discharges the normal picture highlights. The increase in beam current will not degrade the picture quality when the Vidicon tube is used in this equipment.

MAINTENANCE

GENERAL

This equipment has been carefully adjusted at the factory for optimum performance and will with ordinary care give satisfactory operation.

It is important that the unit be kept clean and free of dust. A regular inspection and cleaning maintenance schedule will greatly aid in keeping the equipment up to par.

Check all electrical connections, cables, and components for breaks, burning, or looseness and secure or replace as necessary.

Utilize test patterns to show the results of various misadjustments of controls. Any abnormal conditions will usually show up on the picture monitor tube. In using a test chart make certain its edges are coincidental to the edges of the target. In checking for linearity, use a grating generator. The bars will then appear on the Viewfinder and the Monitor. This makes it possible to check all sweeps for best linearity.

The first step in locating trouble is to isolate it to a particular unit. The voltage charts and waveforms included in the instruction books for the various units in the system are useful in point to point checking.

In addition, the book for each unit in the Camera Channel has a special section of THEORY AND CIRCUIT ANALYSIS and MAINTENANCE to further aid the operator in the proper use and maintenance of the equipment.

Replacement of Vidicon Tube

When a new Vidicon tube has to be installed, it is recommended that steps 5 through 8, a and b, be repeated.

If it is necessary to reverse the vertical deflections leads,

interchange the white and green wires on the deflection assembly. If the horizontal deflection leads require reversing, interchange the red and black wires on the deflection assembly.

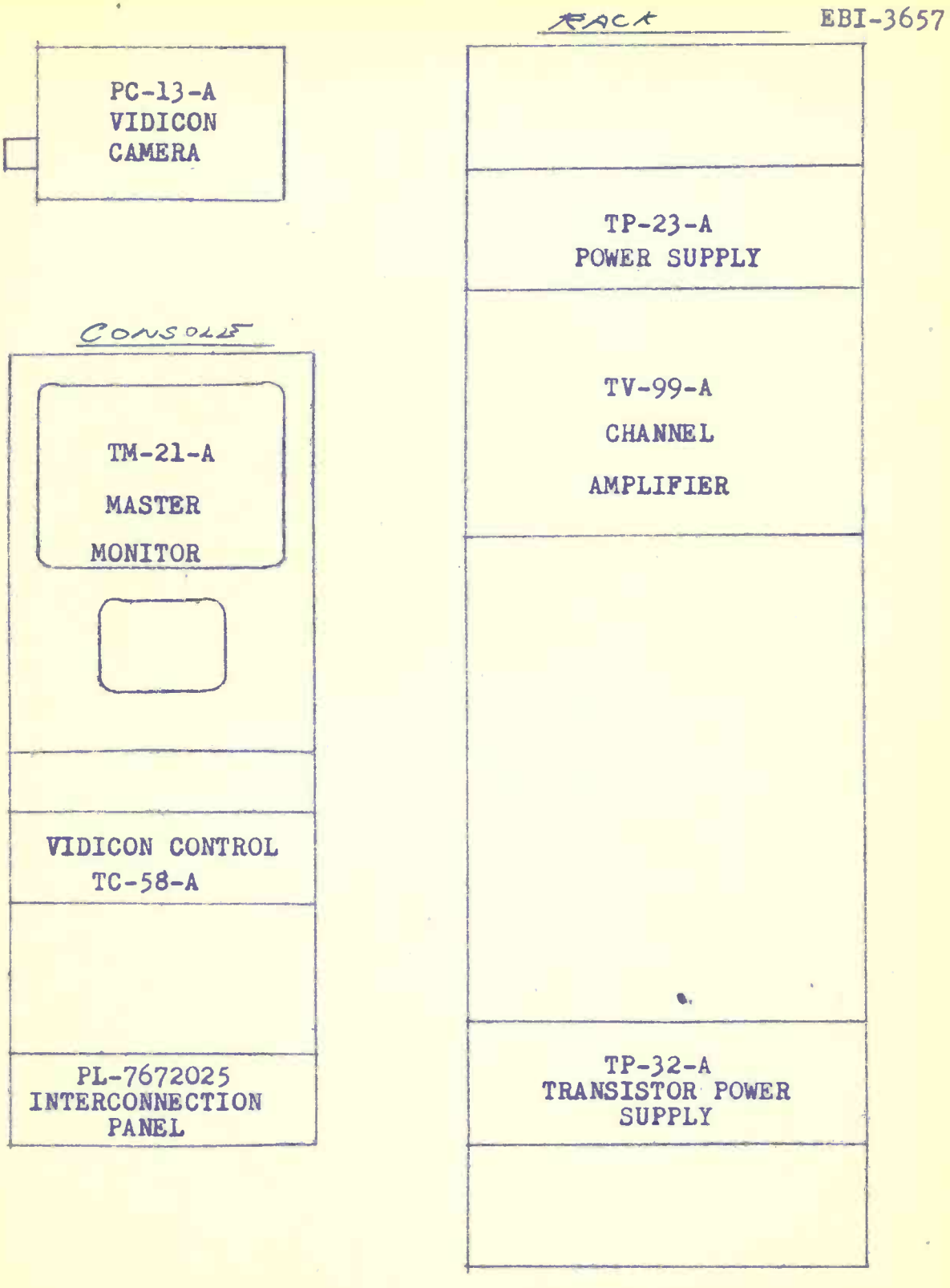

Fig. 1. Rack Mounting Diagram

INSTRUCTIONS

CHANNEL AMPLIFIER

MODEL 4TV99A1

EBI-3641

DEFENSE ELECTRONICS DIVISION
GENERAL ELECTRIC COMPANY
ELECTRONICS PARK, SYRACUSE, N.Y.

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CONTENTS

ILLUSTRATIONS

CHANNEL AMPLIFIER

MODEL 4TV99A1

INTRODUCTION

The General Electric Channel Amplifier, Model 4TV99A1, is designed to be used with General Electric Monochrome, Image Orthicon, and Vidicon cameras. The Channel Amplifier amplifies and processes the video signals from these cameras for application to a Video Switcher, and also for monitoring purposes.

TECHNICAL SUMMARY

ELECTRICAL

Power Input

110/117/125 volts ± 5%, 50/60 cps, 112 watts.
+280 volts d-c, 380 milliamperes.

Power Output

-105 volts d-c to control panel.

Signal Inputs

Video: 0.2 to 1.0 volt peak-to-peak into 51 ohms impedance from camera pre-amplifier.

Horizontal Drive: 4.0 ± 0.5 volt peak-to-peak bridging.

Vertical Drive: 4.0 ± 0.5 volt peak-to-peak bridging.

Blanking: 4.0 ± 0.5 volt peak-to-peak bridging.

Sync: 4.0 ± 0.5 volt peak-to-peak bridging.

Signal Outputs

Video: 4 outputs, each one volt peak-to-peak, 75 ohms impedance. Two outputs can be made composite, and two noncomposite.

One video output at 0.5 volt peak-to-peak, 51 ohms impedance for use at camera viewfinder.

Buffered H Drive: 1.8 ± 0.2 volt peak-to-peak, 51 ohms impedance (to camera).

Buffered V Drive: 3.0 ± 0.2 volt peak-to-peak, 51 ohm impedance (to camera).

Bandwidth: 10 megacycles ± 1 db.

Gain: 5.5.

TUBE COMPLEMENT

2 Type 6BQ5 (V1,V5)
4 Type 6BK7B (V2,V3,V12,V22)
1 Type 6AU6 (V4)
3 Type 5687 (V6,V9,V10)
1 Type 6AQ5 (V23)
1 Type OB2 (V24)
1 Type 6AL5 (V7)
1 Type 6CB6 (V8)
8 Type 5965 (V11,V13,V14,V15,V16,V17,V18,V19)
1 Type 6BX7-GT (V20)
1 Type 12AX7 (V21)

FUSE COMPLEMENT

F1, 0.75 ampere, Type 3AG slow blow on +280 volt d-c line.
F2, 2 ampere, Type 3AG slow blow on 117 volt a-c line.

MECHANICAL

Height: 14 inches.
Width: 19 inches.
Depth: 8.5 inches over-all.
5.5 inches from front of mounting surface.
3.0 inches from behind mounting surface.
Weight: 21 pounds.
Operating Conditions: Rack ambient temperature 50 C for continuous operation, and 55 C for not more than 5% of 24 hour period. Humidity, 95%.

DESCRIPTION

The Channel Amplifier is constructed on a rectangular recessed type alluminum chassis designed for standard rack mounting. All major components are identified by their symbol numbers. Controls are identified by symbol number and functions where possible.

Wiring and output plug connections are accessible from the rear. External wiring connections are made to a 15-pin Jones plug and 17 UHF connectors.

The Channel Amplifier can be used with General Electric Monochrome and Image Orthicon Cameras, or Vidicon Camera Channels. The main function of the Amplifier is to raise the video level, reintroduce low frequency and direct current components, mix shading signals, and insert blanking pulses

in the video signal from the camera. The Amplifier utilizes keyed clamps, black and white clipper stages, and facilities for adding a fixed amount of setup. Other Channel Amplifier features include, regulated focus current for the camera focus coil, gamma correction, aperture correction, camera cable compensation, four one-volt video outputs (two composite and two non-composite, or all noncomposite), H and V buffered drives to the camera, and video reversal for film use. A test input is also provided. A 0.5 volt noncomposite video output is supplied for the camera viewfinder.

INSTALLATION

GENERAL

The Channel Amplifier has been tested and inspected prior to shipping, and should be ready for rack mounting and operation when received.

Exercise care in handling to prevent damaging the components and wiring. Inspect the unit for loose parts. All parts should be securely fastened. Prior to replacement of damaged components, notify the shipping company of the damage.

The Channel Amplifier is furnished with two mounting brackets, P-7772418-P18, which are fastened to either side of the main chassis permitting the unit to be installed in a General Electric 19-inch cabinet rack, Model 4PR1A2 or 4PR1A3.

The Channel Amplifier, Model 4TV99A1, is designed to be operated with an interconnecting panel located near the bottom of the cabinet rack, and an operating control panel near the monitor console. The control and interconnecting panels are a part of the particular General Electric camera channel to be used and are not supplied with this Amplifier. Any reference to interconnection or control panels made within this instruction book indicates a typical installation only.

Fig. 1, shows a typical 19-inch cabinet rack installation, and Fig. 2 shows the physical dimensions and location of the larger type components.

Observe the operating conditions on page 2.

CONNECTIONS

After the Amplifier has been mounted in its associated rack, connect the signal, power, and control voltage leads to the Amplifier as shown on the Interconnection Diagram, Fig. 3, and the System Interconnection Diagram, Fig. 4.

All external signal connections, J1 through J16 including J24, are made to UHF connectors mounted on vertical angle brackets on the back of the main chassis. All external power and control voltage connections are made to a 15-pin Jones plug, P17, mounted on an angle bracket on the back of the main chassis.

Make connections to the Channel Amplifier as follows:

1. Bridge or terminate with 75 ohms, the H and V drives, blanking and sync inputs.

2. Connect the four video outputs, J2 through J5, to the video switcher and monitor. Terminate the unused outputs with 75 ohms.

3. Connect the video input from the camera pre-amplifier through the interconnection panel to the Channel Amplifier jack, J1.

4. Connect the H and V buffered drives, J9 and J10, through the interconnection panel to the camera.

5. If desired, connect the viewfinder video output signal at J6 through the interconnection panel to the camera. The viewfinder video output is normally terminated with 51 ohms at the camera viewfinder.

6. Connect the power and control voltage wiring to Jones plug J17.

7. A test input, J24, is provided which mixes a test signal into the camera channel video at the Channel Amplifier input. This signal will appear on the camera viewfinder as well as the output video.

8. There are two ranges of camera focus coil current available in the Channel Amplifier. With the jumper connected between P17-13 and -10, the range will be from 60 to 120 milliamperes. This range is to be used for an Image Orthicon camera. With the jumper removed, the range will be from 20 to 60 milliamperes. This range is to be used for a Vidicon camera.

CONTROLS AND FUNCTIONS

Control	Symbol	Function
BALANCE	R11	Balances the gain control stage for minimum distortion.
WHITE CLIP ADJ	R65	Adjusts the white clipper level. It is nominally set at 1.5 volts and is adjustable about that point.
SETUP	R198	Adjusts the amount of ADDED SETUP after clipping.
SYNC HGT	R137	Adjusts the sync percentage added to the composite signal outputs.

Control	Symbol	Function
FOCUS CURRENT	R143	Adjusts the camera focus coil current from 20 milliamperes to 120 milliamperes.
BLANKING ADJUST POS	R28	Adjusts proper blanking level when positive video is used.
BLANKING ADJUST NEG	R29	Adjusts proper blanking level when negative video is used.
CABLE COMP	S2	Compensates both phase and frequency response for various camera cable lengths.
APER CORR	S1	Off or two different ratios of high-frequency boost.
GAMMA ON-OFF	S3	Off or a 2.5:1 correction slope factor.

OPERATION

PRE-OPERATIONAL SETUP PROCEDURE

Prior to putting the Channel Amplifier and its associated equipments into operational use, the procedures as set forth below should be performed to ensure proper operation of the Channel Amplifier during actual use.

1. Apply power to the Amplifier and measure the B+ (280 v d-c) at J17-2 and bias voltage (-105 to -110 v d-c) at J23.

2. Measure the H BUFFERED DRIVE output voltage at J9 (1.8 ± 0.2 volt peak-to-peak into 51 ohms impedance) and the V BUFFERED DRIVE output voltage at J10 (3.0 ± 0.2 volt peak-to-peak into 51 ohms impedance).

3. With the camera B+ turned on, measure the FOCUS CURRENT at J21. The current measurement is taken across a 100-ohm, 1% resistor. Using a 20,000-ohm per volt voltmeter, a reading of 7.5 volts d-c will represent 75 milliamps of focus coil current. Set the current required by adjusting the FOCUS CURRENT control, R143. A thin blade screwdriver or tuning wand is necessary to make this adjustment.

4. Obtain a normal video picture on the control monitor from the camera chain by observing the VIDEO input at J18, and the camera viewfinder. The video signal level at J18 must be 0.2 to 2.0 volts peak-to-peak.

ADJUSTMENT OF CONTROL PANEL CONTROLS

By using an oscilloscope or a Type TM-21-A Calibration Monitor, the output waveforms can be viewed at J2 through J5 for the following procedures. Refer to the Control Panel Wiring Diagram, Fig. 5.

1. Set the VIDEO REVERSAL switch to obtain the proper polarity of the video signal. This signal is normally black negative for positive picture material and black positive for negative picture material. The switch should be set for positive picture material.

2. Adjust the BLANKING control to approximately 10% or 0.1 volt level.

3. Adjust the CONTRAST control to 1.0 volt peak-to-peak video output.

4. Adjust the HORIZONTAL SHADING to give a flat field along the horizontal plane.

5. Adjust the VERTICAL SHADING to give a flat field along the vertical plane.

ADJUSTMENT OF CHANNEL AMPLIFIER CONTROLS

Control	Adjustment
BALANCE	Adjust to give maximum gain at video output. This corresponds to minimum distortion.
BLANKING ADJ POS	Adjust until the blanking level does not change when video output is varied from 0 to 1.0 volt with the CONTRAST control.
BLANKING ADJ NEG	With the VIDEO REVERSAL switch in the NEGative position, adjust this control until the blanking level does not change when video output is varied from 0 to 1.0 volt with the CONTRAST control.
SETUP	If added setup is required, adjust this control until the desired amount is obtained.
WHITE CLIP ADJ	This control is nominally set to clip the white video peaks at 1.5 volts peak-to-peak at the video output. The clipping level is adjustable about this voltage
FOCUS CURRENT	Adjust to provide the proper focus coil current. The current will depend on the type of camera being used. Observe the voltage readings between J21 and J22. A reading of 7.5 v d-c will represent 75 milliamps of focus current. Focus current is variable from 20 milliamperes to 120 milliamperes.

Control	Adjustment
SYNC HGT	If one or two composite outputs are desired, connect the jumpers as shown in the Elementary Diagram, Fig. 15. Adjust the sync amplitude as desired. The amplitude is nominally set at 0.4 volt with 1.0 volt peak-to-peak video output.
CABLE COMP	Set to closest length of camera cable used. Do not use for cable lengths under 200 feet.
APER CORR	Set to the amount of high-frequency boost desired. The signal-to-noise ratio of the video signal may determine the amount of boost that can be tolerated. If no boost is desired, set the control to OFF.
GAMMA ON-OFF	This control is normally used with Vidicon cameras. If black stretch is desired, set to ON. For no gamma correction, set to OFF. Gamma correction is automatically removed when using negative video.

THEORY AND CIRCUIT ANALYSIS

Refer to the Block Diagram, Fig. 14, and the Elementary Diagram, Fig. 15.

The Channel Amplifier is designed to amplify and mix shading and blanking signals with the camera video signal to provide output signals suitable for transmission and monitoring.

APERTURE CORRECTION

The generated video signal from the television camera is fed to the Amplifier through J1, and to the shunt peaked video amplifier, V1. APER CORRection switch S1 is used to select a capacitive value to be in parallel with cathode resistor R7, which will result in a rising frequency response to 10 megacycles. This rising frequency response compensates for the loss of resolution due to the finite spot size of the camera tube beam.

The amplified video signal is coupled to the gain control amplifier, V2, through capacitor C3. BALANCE control R11 is adjusted to provide a minimum distortion by equalizing the current in both sections of the gain control stage, V2.

VIDEO REVERSAL

Phase splitter V3A, which is part of the aperture correction circuit, provides phase correction and video reversal of the video signal. The

aperture corrected video signal from both the plate and cathode of V3A is mixed through the time constant of either R33 and C25, or R33 and C26. White overshoots are eliminated from the resulting phase corrected video signal.

Relay K1 determines the polarity of the input signal to V4, providing either a black negative or black positive video signal. This video reversal feature is necessary when negative film is used. This relay is deenergized when black negative video is used.

V3B is a cathode follower.

V4 is a shunt peaked amplifier. The cathode resistor is shunted by different values of capacity depending on the position of the CABLE COMPensation switch, S2. This alters the frequency response in such a way as to compensate for the loss of high frequencies due to the common cable attenuation.

V5 is a shunt peaked amplifier whose output drives cathode follower V6A through C39.

V6B is a voltage regulator used to furnish a regulator voltage for V6A. The grid of V6A is clamped by diodes CR4 and CR6, which are keyed with pulses from the clamp keyer, V13.

CLIPPER

The first half of clipper stage V7 is the white clipper with WHITE CLIPPER ADJ R65 provided for level adjustment. CR10 is used as a transient suppressor. The second half of V7 is the black clipper with CR11 in series to lower the capacity across the clipper. CR16 is used to protect CR11 by not allowing the voltage to rise above ground.

Blanking pulses are added to the clipper stage by V12B.

GAMMA CORRECTION

CR12 and CR14 are used for gamma correction. When GAMMA ON-OFF switch S3 is placed in the ON position and relay K1 is deenergized (black negative video output), both diodes turn on, but at different levels.

Diode CR14 is biased with a higher positive voltage than CR12 and requires a higher signal level to turn it on. Until the first diode turns on, the clipper load, R67, is 1000 ohms. As the level increases above the black level, diode CR12 conducts, placing 510-ohm resistor R68 in parallel with R67 (neglecting the forward resistance of the diode). As a higher voltage is approached, diode CR14 will conduct placing another 510-ohm resistor, R74, in parallel with R67 and R68. The resulting signal waveshape is shown in Fig. 10.

With the GAMMA ON-OFF switch, S3, set to the OFF position, diode CR12 will conduct and CR14 will be cut off. This makes the clipper load equal to the effective load at the white level; therefore, the gain for GAMMA ON and GAMMA OFF is equal. It is possible, therefore, to change from one position to the other with negligible change in level.

The gamma correction feature is usually used only when the Channel Amplifier is used with television cameras employing Vidicon tubes. The transfer curve of the Image Orthicon tube is of such a nature that gamma correction is not normally necessary. However, if an Image Orthicon tube is used below the "knee," it may be desirable to add gamma correction.

When video reversal relay K1 is energized, the gamma correction feature is disabled because normally processed negative film does not require gamma correction.

FEEDBACK OUTPUT

The video input signal to V8 is amplified and fed to the grid of V10. Video outputs V9 and V10 are series connected with V8, V9, and V10 forming the feedback output circuit.

The output video at C88 is fed back to the cathode of V8. Trimmer capacitors C50, in the cathode circuit of V8, and C53, in the feedback loop, are adjustments for frequency response alignment.

Four 1.0 volt outputs, J2 through J5, and one 0.5 volt output are furnished. The 0.5 volt output at J6 is intended for use at the camera viewfinder.

SYNC ADDER

External sync is applied to the grid of sync adder V11B through J15. The sync peaks are clamped at 0 volt by CR20 with the broad part of the pulse going below the cutoff point of V11A.

The gain of V11A is controlled by the SYNC HGT control, R137, which is used to adjust the percentage of sync to be used. The sync output of V11A is coupled through C90 to J4 and J5 via a jumper to mix the sync signal with the video signal for a composite signal output.

BLANKING ADDER

A negative blanking input signal is connected to J13 and applied to the grid of V22A where the signal is amplified. The tips of this signal are clipped by diode CR22. The resulting waveshape is then applied to the grids of V22B and V12B. The blanking signal is added to the video signal by V12B at clipper stage V7. V22B adds blanking to the video signal in the feedback output to introduce added setup. The mixing of these signals is performed in the cathode circuit of V8. SETUP control R198 is adjusted to provide the correct amount of desired setup. CR23 clips the broad part of the blanking pulse.

H CLAMPS, SHADING, AND BUFFERED DRIVE

Horizontal pulses are fed to the Amplifier through J7, then applied to the grid of the pulse amplifier, V14A. The pulses are inverted and amplified for use at the clamp keyer, V13A. Positive and negative clamp pulses are taken off the cathode and plate of V13A respectively, and fed to the key clamping diodes, CR1-CR2 and CR4-CR6.

Horizontal drive input pulses are also applied to the grid of the H pulse buffer, V19A, through C98 and R196. The positive output pulse of V19A is coupled to the horizontal sawtooth waveform for mixing with the vertical saw in V16. The positive horizontal drive pulses are applied simultaneously to the grid of V15 which turns the tube on. During the time interval between the positive pulses, C66 in the plate circuit will charge towards the voltage applied to R97. This voltage can be adjusted between +100 and -100 volts at the control console. If the voltage is negative, the sawtooth will be generated in a negative direction; and if positive, the sawtooth will be generated in a positive direction. During the horizontal pulse time, capacitor C66 will discharge through either V15A or V15B.

The positive horizontal drive pulses from the output of V19A are also coupled to clamp keyer V13B which supplies negative and positive keying pulses to blanking adjustments R28, BLANKING ADJ POS, and R29, BLANKING ADJ NEG. The positive horizontal drive pulses from V19A are coupled to V19B through C101 which inverts the pulses for buffered horizontal drive to the camera jack, J9.

V BUFFERED DRIVE AND SHADING

Vertical drive pulses applied to J12 are coupled through C95 to the vertical pulse buffer, V18A, and the positive output is coupled in turn to V18B which inverts the pulse to the camera jack, J10. The vertical drive input pulses are also coupled through C78 to V14B, where the pulses are amplified and inverted to provide a positive input to the vertical saw generator, V17. Vertical saw generator V17 operates in the same manner as V15, with the positive and negative saw control connected to the control console through J17-11.

SHADING MIXER

Both the horizontal and vertical sawtooth generator outputs are fed to the separate grids of V16 and mixed by virtue of the common plate of the sawtooth mixer with the output coupled to the grid of shading adder V12A through C64 and R93. During the clamping pulse, the grid of V12A is clamped to ground, and because of the large value of C64 and R93, the vertical sawtooth is not affected except during the clamping pulse, resulting in a waveform as shown in Fig. 7. Therefore, it is possible to mix the shading output from the cathode of V12A with the video signal ahead of the video clamp without clamping out the vertical sawtooth.

FOCUS REGULATOR

The focus current regulator, V20, and the focus current regulator amplifier, V21, are used to regulate the focus current used for the various camera focus coils. The range of operation is large enough for both Vidicon and Image Orthicon focus coils. A jumper in the power plug, P17, selects the range by shunting part of the focus coil current through resistor R172 when the high range is used.

Both V23 and V24 are used to regulate the -105 volts d-c bias voltage obtained from transformer, T1.

MAINTENANCE

PREVENTIVE

To obtain the maximum life and proper operation from the Channel Amplifier, a regular preventive maintenance schedule should be followed.

1. Inspection

Look for evidence of component overheating such as, discoloration of resistors or wiring. Feel transformer cases for overheating. Check for buldging sides or discolored paint. Check all oil filled capacitors for leakage. Check tubes for low emission or noisy operation. Look for flickering in the gas type regulator tube, V24. Replace any questionable component.

2. Records

Where feasible, operating current and voltage readings of tubes should be recorded at regular intervals. These records provide an excellent basis from which to predict tube life and plan future tube replacements.

3. Cleaning

Keep the equipment as clean and dry as possible. An air blower or brush with long soft bristles, makes a very good dust remover. When a high pressure air hose is used for cleaning, care should be taken not to disturb components or wiring.

4. Replacement of Components

Before installation of replacement parts, check the circuit for the cause of failure. When replacing components, select the proper replacement part from the parts list. All components are listed by symbol number and have their G-E drawing number and a complete description given. When replacing semi-conductor diodes, exercise caution not to overheat them, otherwise the diodes will be damaged.

CORRECTIVE

1. High-Frequency Response Alignment

The following procedures should be followed for high-frequency response alignment. See Fig. 8 for the test equipment setup.

1. Remove the VIDEO INPUT coax lead from J1. Do not remove any of the remaining connections.

2. Terminate the four 1.0 volt VIDEO OUTputs, J2 through J5, with 75 ohms.

3. Set the Channel Amplifier and control panel controls to the following positions:

a. Control panel CONTRAST control to OFF.
b. Channel Amplifier GAMMA ON-OFF switch S3 to OFF.
c. Channel Amplifier CABLE COMP switch S2 to zero.
d. Channel Amplifier APER CORR switch S1 to 1.
e. Control panel VIDEO REVERSAL switch to POSITIVE.
f. Channel Amplifier SETUP control R198 to OFF.
g. Control panel BLANKING control to midrange.
h. Remove tube V12 in the Channel Amplifier.

4. Connect the detector probe and oscilloscope to one of the non-composite video outputs, J2 or J3.

5. Connect the sweep generator output to V8-1, and adjust C50 and C53 for a flat response to 10 megacycles ± 1 db. Use the detector and sweep probe as shown in Fig. 8.

6. When sweeping the Channel Amplifier, keep the oscilloscope gain high and the sweep generator output low. This prevents overloading.

7. Connect the sweep generator output to V5-2 and adjust the BLANKING control for maximum over-all gain without affecting the sweep envelope. Adjust L6 and C38 for a flat response to 10 megacycles ± 1 db.

8. Connect the sweep generator output to V3A-2 and adjust L5 and C31 for a flat response to 10 megacycles ± 1 db.

9. Connect the sweep generator output to J1 and adjust the CONTRAST control for maximum gain (cw). Adjust the BLANKING ADJ POS control, R28, for minimum modulation of sweep envelope. Set the VIDEO REVERSAL switch to NEGative and adjust the BLANKING ADJ NEG control, R29, for minimum modulation of the sweep envelope. Return the VIDEO REVERSAL switch to POSitive.

10. Connect the sweep generator output to V2-2 and adjust L2 and C11 for a flat response to 10 megacycles ± 1 db.

11. Connect the sweep generator output to J1 and adjust L1 for a flat response to 10 megacycles ± 1 db.

12. Readjustment of C50 and C53 may be necessary to provide the most uniform over-all response to 10 megacycles ± 1 db.

13. Replace V12 and reset the controls for normal operation as described in the OPERATION section under Pre-Operational Setup Procedures.

2. Socket Voltages

To facilitate isolation of trouble not a result of tube failure, reference should be made to the voltages on the socket voltage chart below. Use a 20,000-ohm per volt meter, except where values are marked with an asterisk (*), where a VTVM should be used. All voltages were measured with respect to chassis ground. Filament voltages are marked "f". Waveform pictures and a-c voltage amplitudes are in Figs. 9 through 13. The voltages should be measured with a noncomposite 0.5 volt video input signal.

	Pin								
Tube	1	2	3	4	5	6	7	8	9
V1	-	25.5*	29.0	f	f	-	133.0	-	178.0
V2	275.0	61.8*	60.0	f	f	266.0	61.8*	60.0	-
V3	175.0	-0.45*	1.8	f	f	280.0	157.0	159.0	-
V4	0.45*	2.0	f	f	157.0	170.0	2.0	-	-
V5	-	-2.1*	0.0	f	f	-	120.0	-	142.0
V6	162.0	-8.0*	0.1	f	f	162.0	157.0	f	280.0
V7	1.0	1.2	f	f	0.1	-	1.2	-	-
V8	-0.05*	1.5	f	f	188.0	130.0	1.5	-	-
V9	280.0	128.0*	132.0	f	f	132.0	128.0	f	280.0
V10	127.0	-3.6*	0.0	f	f	0.0	-3.6*	f	127.0
V11	183.0	-16.2*	0.1	f	f	165.0	0.32*	1.5	f
V12	162.0	20.8*	23.0	f	f	1.2	-112.0*	-105.0	-
V13	247.0	-0.5*	4.6	f	f	255.0	-1.6*	4.8	f
V14	93.0	-0.02*	1.3	f	f	93.0	-0.02*	1.3	f
V15	0.0	-26.7*	-0.5	f	f	-0.5	-26.7*	0.0	f
V16	220.0	0.0*	3.6	f	f	220.0	0.0*	3.1	f
V17	0.2	-35.0*	0.0	f	f	0.0	-35.0*	0.2	f
V18	213.0	0.0*	2.2	f	f	192.0	-26.2*	0.0	f
V19	195.0	0.05*	2.4	f	f	185.0	-28.0*	0.0	f
V20	1.9	127.0	7.5	1.9	127.0	7.5	f	f	-
V21	104.0	4.8	7.5	f	f	113.0	-2.7	0.0	f
V22	220.0	0.0*	2.9	f	f	205.0	0.1*	3.9	-
V23	-	5.9	f	f	210.0	220.0	0.0	-	-
V24	0.0	-110.0	-	-110.0	0.0	-	-110.0	-	-

PARTS LIST

Symbol	Description	G-E Drawing
	CAPACITORS (Paper, molded plastic, ± 20%, 400 v d-c w, unless otherwise specified)	
C1	Electrolytic, polarized twist prong base, 40-40-40 mfd +100% -10%, 350-350-350 v d-c w, max impedance 10 ohms at 10 mc.	C-7776308-P36
C2	Mylar-dielectric, 0.1 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P9
C3	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C4	Silver mica, 330 mmfd ± 5%, 500 v d-c w.	P-3R122-P59
C5	Silver mica, 180 mmfd ± 5%, 500 v d-c w.	P-3R122-P53
C10	Mylar-dielectric, 0.1 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P9
C11	Ceramic, variable, 3 to 12 mmfd, 500 v d-c w. Erie Type #TS2A-NP0.	M-7484389-P2
C12	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C13	0.047 mfd. Sprague Cat. #109P47304.	B-7491096-P31
C14	Mica, Class B, 1000 mmfd ± 5%, 500 v d-c w. EIA Type #RCM30B102J.	C-3R139-P57
C15	Mylar-dielectric, 0.01 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P5
C18	Electrolytic, polarized twist prong base, 40-40-40 mfd +100% -10%, 350-350-350 v d-c w, max impedance 10 ohms at 10 mc.	C-7776308-P36
C20	Electrolytic, polarized twist prong base, 125 mfd +100% -10%, 350 v d-c w.	C-7776308-P10
C21	Mica, Class B, 1000 mmfd ± 5%, 500 v d-c w. EIA Type #RCM30B102J.	C-3R139-P57
C22	0.047 mfd. Sprague Cat. #109P47304.	B-7491096-P31

Symbol	Description	G-E Drawing
	CAPACITORS (CONTINUED) (Paper, molded plastic, ± 20%, 400 v d-c w, unless otherwise specified)	
C23	Mylar-dielectric, 0.47 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P12
C24	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C25	Silver mica, 470 mmfd ± 5%, 300 v d-c w.	B-7489162-P43
C26	Silver mica, 560 mmfd ± 5%, 500 v d-c w. Similar to Electromotive Mfg. Co. Type DM20.	A-7147203-P2
C29	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C30	Mylar-dielectric, 0.47 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P12
C31	Ceramic, variable, 3 to 12 mmfd, 500 v d-c w. Erie Type #TS2A-NPO.	M-7484389-P2
C32	Silver mica, 330 mmfd ± 5%, 500 v d-c w.	P-3R122-P59
C33	Silver mica, 220 mmfd ± 5%, 500 v d-c w.	P-3R122-P55
C34	Silver mica, 100 mmfd ± 5%, 500 v d-c w.	P-3R122-P47
C37	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C38	Ceramic, variable, 3 to 12 mmfd, 500 v d-c w. Erie Type #TS2A-NPO.	M-7484389-P2
C39	Mica, Class B, 8200 mmfd ± 5%, 300 v d-c w. EIA Type #RCM35B822J.	C-3R139-P79
C40	0.047 mfd. Sprague Cat. #109P47304.	B-7491096-P31
C41	Electrolytic, polarized twist prong base, 40-40-40 mfd +100% -10%, 350-350-350 v d-c w, max impedance 10 ohms at 10 mc.	C-7776308-P36
C42	Mylar-dielectric, 0.01 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P5
C43	0.047 mfd. Sprague Cat. #109P47304.	B-7491096-P31

Symbol	Description	G-E Drawing
	CAPACITORS (CONTINUED) (Paper, molded plastic, ± 20%, 400 v d-c w, unless otherwise specified)	
C44	Metallized plastic, hermetically sealed, 4.0 mfd ± 20%, 200 v d-c w. Sprague Cat. #118P40502S4.	B-7489159-P16
C47	Metallized plastic, hermetically sealed, 4.0 mfd ± 20%, 200 v d-c w. Sprague Cat. #118P40502S4.	B-7489159-P16
C48	Electrolytic, polarized twist prong base, 20-20-20-20 mfd +100% -10%, 350-350-350-350 v d-c w, max impedance 10 ohms at 10 mc.	C-7776308-P42
C49	Silver mica, 33 mmfd ± 5%, 500 v d-c w.	P-3R122-P35
C50	Ceramic, variable, 7 to 45 mmfd, 500 v d-c w. Erie Type #TS2A-N500.	M-7484389-P6
C51	0.047 mfd. Sprague Cat. #109P47304.	B-7491096-P31
C52	0.22 mfd. Sprague Cat. #109P22404.	B-7491096-P35
C53	Ceramic, variable, 7 to 45 mmfd, 500 v d-c w. Erie Type #TS2A-N500.	M-7484389-P6
C57 and C58	0.22 mfd. Sprague Cat. #109P22404.	B-7491096-P35
C59	Metallized plastic, 1.00 mfd ± 20%, 200 v d-c w. Sprague Cat. #118P10502S4.	B-7489159-P13
C60	Mylar-dielectric, 0.47 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P12
C64	Paper, hermetically sealed, 0.47 mfd ± 20%, 300 v d-c w. Sprague Cat. #188P47403.	C-7772473-P57
C65 and C66	Mica, Class B, 1500 mmfd ± 5%, 500 v d-c w. EIA Type #RCM30B152J.	C-3R139-P61
C67	Mylar-dielectric, 0.47 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P12

Symbol	Description	G-E Drawing
	CAPACITORS (CONTINUED) (Paper, molded plastic, ± 20%, 400 v d-c w, unless otherwise specified)	
C71	0.001 mfd. Sprague Cat. #109P10204.	B-7491096-P21
C72	Mica, Class B, 1500 mmfd ± 5%, 500 v d-c w. EIA Type #RCM30B152J.	C-3R139-P61
C73	Silver mica, 330 mmfd ± 5%, 500 v d-c w.	P-3R122-P59
C74	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C77	0.01 mfd. Sprague Cat. #109P10304.	B-7491096-P27
C78	0.047 mfd. Sprague Cat. #109P47304.	B-7491096-P31
C80	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C81 and C82	0.22 mfd. Sprague Cat. #109P22404.	B-7491096-P35
C83	Electrolytic, low inductance, polarized twist prong base, 20-20-20 mfd +100% -10%, 350-350-350 v d-c w.	C-7776308-P134
C84 and C85	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C86	0.22 mfd. Sprague Cat. #109P22404.	B-7491096-P35
C87	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C88	Electrolytic, low inductance, polarized twist prong base, 125 mfd +100% -10%, 350 v d-c w.	C-7776308-P110
C89	Ceramic, Hi-K disk, 0.02 mfd +100% -0%, 500 v d-c w.	C-7774750-P15
C90	Electrolytic, insulated tubular; 5 mfd +100% -10%, 350 v d-c w. PR Mallory Cat. #TC60.	C-7774786-P81
C92 thru C94	Mylar-dielectric, 0.01 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P5

Symbol	Description	G-E Drawing
	CAPACITORS (CONTINUED) (Paper, molded plastic, ± 20%, 400 v d-c w, unless otherwise specified)	
C95 and C96	0.22 mfd. Sprague Cat. #109P22404.	B-7491096-P35
C97	Electrolytic, low inductance, polarized twist prong base, 80 mfd +100% -10%, 350 v d-c w.	C-7776308-P108
C98	Mylar-dielectric, 0.01 mfd ± 20%, 100 v d-c w. Goodall Type #663-UW.	B-7491930-P5
C101	0.01 mfd. Sprague Cat. #109P10304.	B-7491096-P27
C102	0.22 mfd. Sprague Cat. #109P22404.	B-7491096-P35
C105	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C106	0.22 mfd. Sprague Cat. #109P22404.	B-7491096-P35
C107	Paper, hermetically sealed, 0.47 mfd ± 20%, 300 v d-c w. Sprague Elec. Co., Cat. #188P47403.	P-7772473-P57
C110 and C111	0.1 mfd. Sprague Cat. #109P10404.	B-7491096-P33
	RECTIFIERS	
CR1 and CR2	Diode, silicon. Hughes Type 1N629.	C-5494923-P5
CR4	Diode, silicon. Hughes Type 1N629.	C-5494923-P5
CR5	Germanium diode. Hughes Type HD2051.	C-7777146-P18
CR6	Diode, silicon. Hughes Type 1N629.	C-5494923-P5
CR7	Germanium diode. Hughes Type HD2051.	C-7777146-P18
CR10	Diode, silicon. Hughes Type 1N629.	C-5494923-P5
CR11	Silicon computor diode, JETEC #1N905.	A-7168098-P1

Symbol	Description	G-E Drawing
	RECTIFIERS (CONTINUED)	
CR12 thru CR15	Diode, silicon. Hughes Type 1N629.	C-5494923-P5
CR16	Germanium diode. Hughes Type 1N90.	C-7777146-P3
CR18 and CR19	Diode, silicon. Hughes Type 1N629.	C-5494923-P5
CR20	Germanium diode. Hughes Type 1N198.	C-7777146-P9
CR22	Germanium diode. Hughes Type 1N90.	C-7777146-P3
CR23	Silicon computor diode. JETEC #1N905.	A-7168098-P1
CR24	Germanium diode. Hughes Type 1N90.	C-7777146-P3
CR25 thru CR30	Silicon rectifier, halfwave, hermetically sealed, max forward drop 0.9 v d-c, 400 v peak max. G-E Type 1N1695, Westinghouse Type 1N1169.	B-5490415-P2
	FUSES	
F1	Slow blow, 3/4 amp, 250 v, Type 3AG. Bussman Cat. #MDL-3/4.	B-7487942-P4
F2	Slow blow, 2 amp, 125 v, Type 3AG. Bussman Cat. #MDL-2.	B-7487942-P27
	JACKS AND RECEPTACLES	
J1 thru J16	Receptacle. Amphenol Cat. #83-1R. Signal Corps #SO-239.	M-2R22-P3
J17	Receptacle, 15 pin male. Jones Cat. #P-315-EB.	P-7772322-P1
J18 thru J21	Test point jack, nylon. EF Johnson Cat. #105-602-1, red.	A-7143959-P2
J22	Test point jack, nylon. EF Johnson Cat. #105-603-1, black.	A-7143959-P3

Symbol	Description	G-E Drawing
	FUSES (CONTINUED)	
J23	Test point jack, nylon. EF Johnson Cat. #105-602-1, red.	A-7143959-P2
J24	Receptacle. Amphenol Cat. #83-1R, Signal Corps #SO-239.	M-2R22-P3
	RELAY	
K1	Telephone type, nominal coil rating 11 ma d-c, picks up at 8 ma or less, drop out 5 ma to 0.8 ma, resistance 10,000 ohms ± 10%, 1 form A, 1 form B, 3 form C contacts.	C-7775879-P7
	INDUCTORS	
L1	Coil, variable, inductance 9 to 18 uh, 1.21 ohm approx. d-c resistance. North Hills Type 120-D.	A-7140206-P24
L2	Coil, variable, inductance 5 to 9 uh, 0.92 ohm approx d-c resistance. North Hills Type 120-C.	A-7140206-P23
L5	Coil, variable, inductance 5 to 9 uh, 0.92 ohm approx d-c resistance. North Hills Type 120-C.	A-7140206-P23
L6	Coil, variable, inductance 3 to 5 uh, 0.7 ohm approx d-c resistance. North Hills Type 120-B.	A-7140206-P22
	PLUGS	
P2 thru P8	2 piece straight. Amphenol Cat. #83-1SP, Signal Corps #PL-259.	M-2R22-P1
P11 thru P16	2 piece straight. Amphenol Cat. #83-1SP, Signal Corps #PL-259.	M-2R22-P1
P24	2 piece straight. Amphenol Cat. #83-1SP, Signal Corps #PL-259.	M-2R22-P1

Symbol	Description	G-E Drawing
	RESISTORS (Composition, ± 5%, ½ w, unless otherwise specified)	
R1	51 ohms.	C-3R77-P510J
R2	100 ohms.	C-3R77-P101J
R3	1.2 megohm.	C-3R77-P125J
R4	1.0 megohm.	C-3R77-P105J
R5	Wirewound, 5000 ohms ± 5%, 10 w. Sprague Elec. Co. Style C, Type 10KT.	M-7478633-P98
R6	1300 ohms, 2 w.	C-3R79-P132J
R7	750 ohms, 2 w.	C-3R79-P751J
R8	0.10 megohm.	C-3R77-P104J
R10	1200 ohms.	C-3R77-P122J
R11	Potentiometer, composition: 500,000 ohms ± 20%, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P24
R12	91,000 ohms.	C-3R77-P913J
R14	Wirewound, non-inductive, 3100 ohms ± 5%, 5 w. Sprague Elec. Co. Style C, Type 5NIT.	M-7478635-P86
R15	240 ohms, 1 w.	C-3R78-P241J
R16	0.68 megohm.	C-3R77-P684J
R17	910 ohms, 1 w.	C-3R78-P911J
R18	100 ohms.	C-3R77-P101J
R19	0.47 megohm.	C-3R77-P474J
R20 and R21	0.10 megohm.	C-3R77-P104J
R24	Wirewound, 8000 ohms ± 5%, 5 w. Sprague Elec. Co. Style C, Type 5KT.	M-7478632-P100

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R25 and R26	130 ohms.	C-3R77-P131J
R27	2.0 megohm.	C-3R77-P205J
R28 and R29	Potentiometer, composition: 25,000 ohms ± 20%, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P16
R30	0.30 megohm.	C-3R77-P304J
R31	3300 ohms.	C-3R77-P332J
R32	2400 ohms.	C-3R77-P242J
R33	220 ohms.	C-3R77-P221J
R34 and R35	51,000 ohms, 2 w.	C-3R79-P513J
R39	1.5 megohm.	C-3R77-P155J
R40	0.91 megohm.	C-3R77-P914J
R41	100 ohms.	C-3R77-P101J
R42	150 ohms.	C-3R77-P151J
R43	8200 ohms, 2 w.	C-3R79-P822J
R44	1300 ohms.	C-3R77-P132J
R45	13,000 ohms, 2 w.	C-3R79-P133J
R49	1.5 megohm.	C-3R77-P155J
R50	100 ohms.	C-3R77-P101J
R51	1.0 megohm.	C-3R77-P105J
R52	Wirewound, 2500 ohms ± 5%, 10 w. Sprague Elec. Co. Style B, Type 10KT.	M-7478633-P235
R53	560 ohms.	C-3R77-P561J

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R56	10,000 ohms, 1 w.	C-3R78-P103J
R57	51,000 ohms.	C-3R77-P513J
R58	30,000 ohms, 2 w.	C-3R79-P303J
R59	100 ohms.	C-3R77-P101J
R60	39,000 ohms, 2 w.	C-3R79-P393J
R61	5600 ohms, 2 w.	C-3R79-P562J
R64	Wirewound, 31,000 ohms ± 5%, 5 w. Sprague Elec. Co. Style B, Type 5KT.	M-7478632-P246
R65	Potentiometer, composition: 15,000 ohms ± 20%, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P15
R66	1.0 megohm.	C-3R77-P105J
R67	1000 ohms.	C-3R77-P102J
R68	510 ohms.	C-3R77-P511J
R69	62,000 ohms.	C-3R77-P623J
R70	0.12 megohm.	C-3R77-P124J
R73	47,000 ohms.	C-3R77-P473J
R74	510 ohms.	C-3R77-P511J
R75	18,000 ohms.	C-3R77-P183J
R76	0.10 megohm.	C-3R77-P104J
R77	0.47 megohm.	C-3R77-P474J
R78	10,000 ohms, 2 w.	C-3R79-P103J
R79	68,000 ohms, 2 w.	C-3R79-P683J
R80	1.5 megohm.	C-3R77-P155J
R81	330 ohms.	C-3R77-P331J

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R82	20,000 ohms, 2 w.	C-3R79-P203J
R85	0.47 megohm.	C-3R77-P474J
R86	2.2 megohm.	C-3R77-P225J
R87	1.0 megohm.	C-3R77-P105J
R88	100 ohms.	C-3R77-P101J
R91	5100 ohms, 2 w.	C-3R79-P512J
R92	470 ohms.	C-3R77-P471J
R93	20,000 ohms.	C-3R77-P203J
R94	680 ohms.	C-3R77-P681J
R95	100 ohms.	C-3R77-P101J
R96	1.0 megohm.	C-3R77-P105J
R97	0.68 megohm.	C-3R77-P684J
R100	15,000 ohms.	C-3R77-P153J
R101	1.0 megohm.	C-3R77-P105J
R102	5100 ohms.	C-3R77-P512J
R103	1.0 megohm.	C-3R77-P105J
R104	100 ohms.	C-3R77-P101J
R107	47,000 ohms, 1 w.	C-3R78-P473J
R108	330 ohms.	C-3R77-P331J
R109	47,000 ohms, 2 w.	C-3R79-P473J
R110	330 ohms.	C-3R77-P331J
R111	100 ohms.	C-3R77-P101J
R112 and R113	1.0 megohm.	C-3R77-P105J

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R116	4700 ohms, 1 w.	C-3R78-P472J
R117	150 ohms.	C-3R77-P151J
R118 and R119	1000 ohms.	C-3R77-P102J
R120	150 ohms.	C-3R77-P151J
R121 and R122	1000 ohms.	C-3R77-P102J
R123	56,000 ohms, 1 w.	C-3R78-P563J
R124	1.0 megohm.	C-3R77-P105J
R125 and R126	0.10 megohm.	C-3R77-P104J
R127	36,000 ohms.	C-3R77-P363J
R130	100 ohms.	C-3R77-P101J
R131	10,000 ohms, 2 w.	C-3R79-P103J
R132	110 ohms.	C-3R77-P111J
R133	1.0 megohm.	C-3R77-P105J
R135	5100 ohms, 2 w.	C-3R79-P512J
R136	10,000 ohms.	C-3R77-P103J
R137	Potentiometer, composition: 2500 ohms ± 20%, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P10
R138	10.0 megohm.	C-3R77-P106J
R139	2000 ohms.	C-3R77-P202J
R140	100 ohms.	C-3R77-P101J

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R141	0.47 megohm.	C-3R77-P474J
R142	0.15 megohm.	C-3R77-P154J
R143	Wirewound potentiometer, miniature, 25 turns, 10,000 ohms ± 10%, 0.25 w, linear taper. Bourns Part #273-1-103.	B-7493478-P2
R145	0.15 megohm.	C-3R77-P154J
R146	100 ohms.	C-3R77-P101J
R147	110 ohms.	C-3R77-P111J
R148	100 ohms.	C-3R77-P101J
R149	220 ohms.	C-3R77-P221J
R151	1.0 megohm.	C-3R77-P105J
R152	100 ohms.	C-3R77-P101J
R153	6800 ohms, 2 w.	C-3R79-P682J
R154	220 ohms.	C-3R77-P221J
R155	47,000 ohms, 2 w.	C-3R79-P473J
R156	100 ohms.	C-3R77-P101J
R157	1.0 megohm.	C-3R77-P105J
R158	1000 ohms.	C-3R77-P102J
R159	0.47 megohm.	C-3R77-P474J
R162	100 ohms.	C-3R77-P101J
R163	7500 ohms, 2 w.	C-3R79-P752J
R164	220 ohms.	C-3R77-P221J
R165	47,000 ohms, 2 w.	C-3R79-P473J
R166	100 ohms.	C-3R77-P101J

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R167	62,000 ohms, 2 w.	C-3R79-P623J
R168	0.47 megohm.	C-3R77-P474J
R169	1000 ohms.	C-3R77-P102J
R172	Wirewound, 3100 ohms ± 5%, 25 w. Ward Leonard Cat. #25F3100.	M-2R14-P86
R173	100 ohms.	C-3R77-P101J
R174	Precision, wirewound, 100 ohms ± 1%, 5.0 w.	C-7778027-P303
R175	100 ohms.	C-3R77-P101J
R176 and R177	Carbon film on ceramic, 0.25 megohm ± 1%, 1 w.	C-7707244-P313
R178	Precision, wirewound, 237,000 ohms ± 1%, ½ w. Mepco Type WM-3A.	A-7166713-P3
R182 thru R185	Carbon film on ceramic, 0.25 megohm ± 1%, 1 w.	C-7707244-P313
R188	1.0 megohm.	C-3R77-P105J
R189	100 ohms.	C-3R77-P101J
R190	22,000 ohms, 2 w.	C-3R79-P223J
R191	10,000 ohms.	C-3R77-P103J
R192	220 ohms.	C-3R77-P221J
R193	22,000 ohms, 2 w.	C-3R79-P223J
R194	4.7 megohm.	C-3R77-P475J
R195	47,000 ohms, 2 w.	C-3R79-P473J
R196	2000 ohms, 2 w.	C-3R79-P202J

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R197	15,000 ohms, 2 w.	C-3R79-P153J
R198	Potentiometer, composition: 500 ohms ± 20%, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P6
R199	0.62 megohm.	C-3R77-P624J
R200	100 ohms.	C-3R77-P101J
R201	1000 ohms.	C-3R77-P102J
R202	0.82 megohm.	C-3R77-P824J
R203	100 ohms.	C-3R77-P101J
R204	0.10 megohm.	C-3R77-P104J
R205	0.27 megohm.	C-3R77-P274J
R206	0.62 megohm.	C-3R77-P624J
R207	100 ohms, 2 w.	C-3R79-P101J
R208 and R209	750 ohms, 2 w.	C-3R79-P751J
R210 and R211	100 ohms, 2 w.	C-3R79-P101J
R212	10,000 ohms, 2 w.	C-3R79-P103J
R213	0.33 megohm.	C-3R77-P334J
R214	130 ohms.	C-3R77-P131J
R215	160 ohms.	C-3R77-P161J
R216 and R217	130 ohms.	C-3R77-P131J
R218 and R219	1200 ohms.	C-3R77-P122J

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R220	130 ohms.	C-3R77-P131J
R221	160 ohms.	C-3R77-P161J
R222	130 ohms.	C-3R77-P131J
R223	160 ohms.	C-3R77-P161J
R224	300 ohms.	C-3R77-P301J
R225	0.10 megohm.	C-3R77-P104J
	SWITCHES	
S1	Sub-miniature rotary, 1 section, 2 pole, 3 positions, non-shorting.	B-7493886AA-P1
S2	Miniature rotary, 1 section, 1 pole, 4 positions, non-shorting type contacts. Centralab Series 100 or Oak Type A.	C-5494644-P5
S3	Rotary, spdt, non-shorting type contacts, shaft flatted at top. Oak Type 23.	A-7136232-P1
	TRANSFORMER	
T1	Filament and rectifier, single phase. Pri: 88/110/117/125 v, 50/60 cycles; sec #1: 500 v CT ± 25 v, 0.06 amp; sec #2: 6.3 v ± 0.189 v, 3 amp; sec #3: 6.3 v ± 0.126 v, 12 amp.	B-7493889-P1
	FUSE HOLDERS	
XF1 and XF2	Fuse holders, 3 AG. Bussman Mfg. Co. Type HKP.	K-7115179-P1
	TUBE SOCKETS (Mica filled phenolic)	
XV1 thru XV3	9 pin miniature, 4 ground lugs.	M-7480532-P8

Symbol	Description	G-E Drawing
	TUBE SOCKETS (CONTINUED) (Mica filled phenolic)	
XV4	7 pin miniature, 4 ground lugs.	P-7768887-P14
XV5 and XV6	9 pin miniature, 4 ground lugs.	M-7480532-P8
XV7 and XV8	7 pin miniature, 4 ground lugs.	P-7768887-P14
XV9 thru XV19	9 pin miniature, 4 ground lugs.	M-7480532-P8
XV20	Octal. Cinch Type #9886.	K-7103053-P1
XV21 and XV22	9 pin miniature, 4 ground lugs.	M-7480532-P8
XV23 and XV24	7 pin miniature, 4 ground lugs.	P-7768887-P14

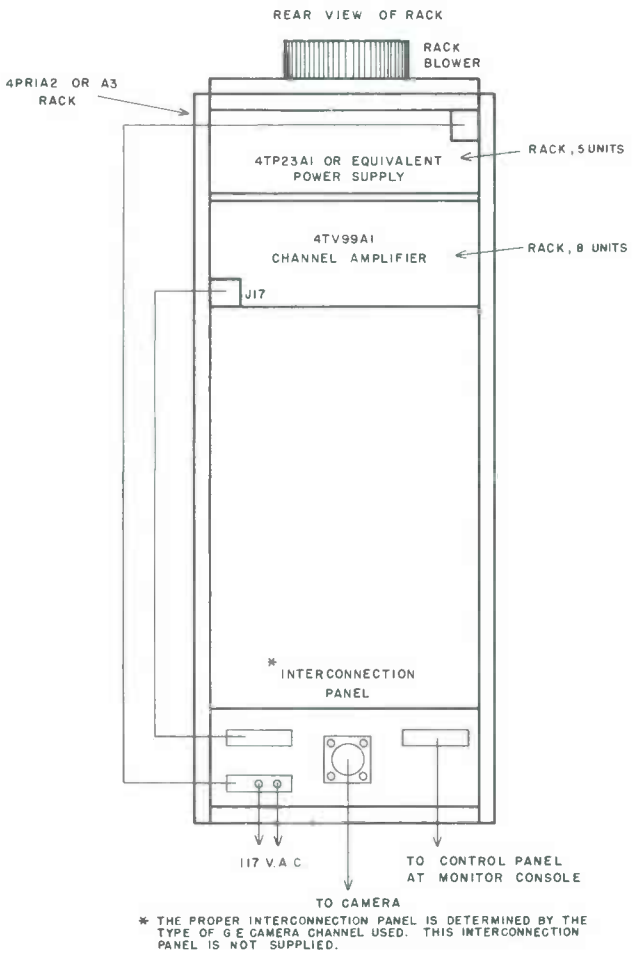


Fig. 1 Typical 19-Inch Cabinet Rack Installation, Channel Amplifier, Model 4TV99A1

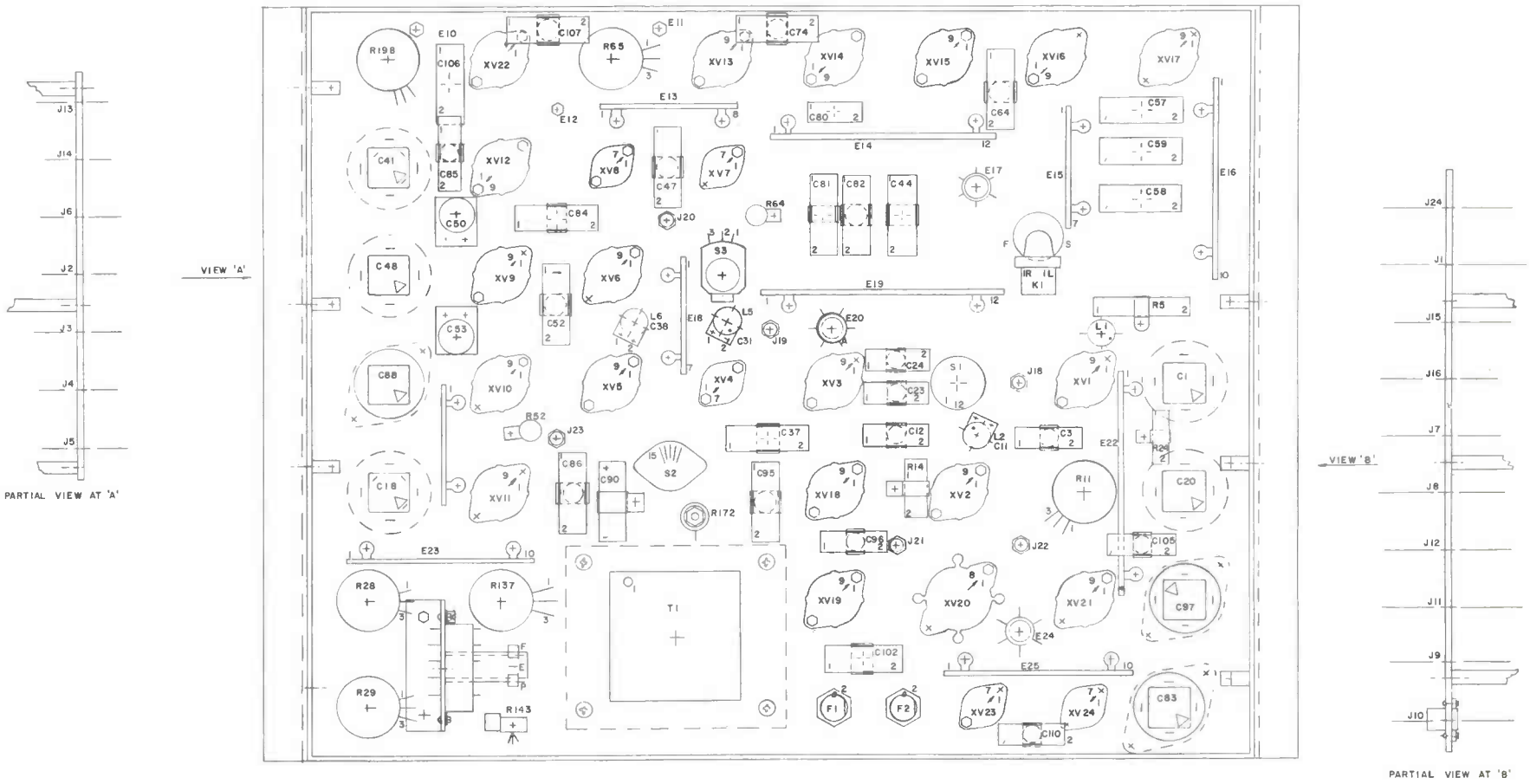


Fig. 2 Component Location Diagram (D-7672046)

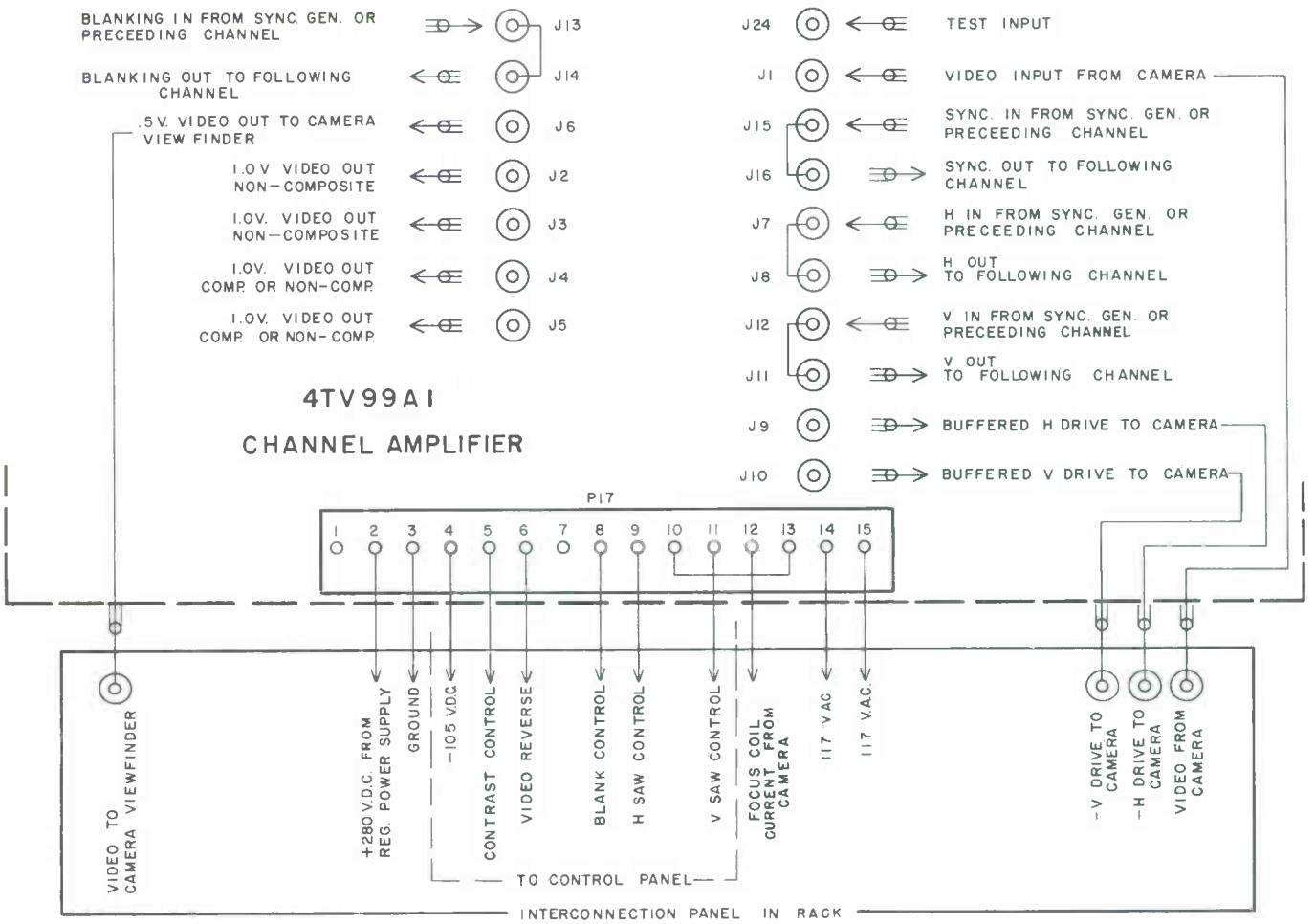


Fig. 3 Interconnection Diagram, Channel Amplifier, Model 4TV99A1

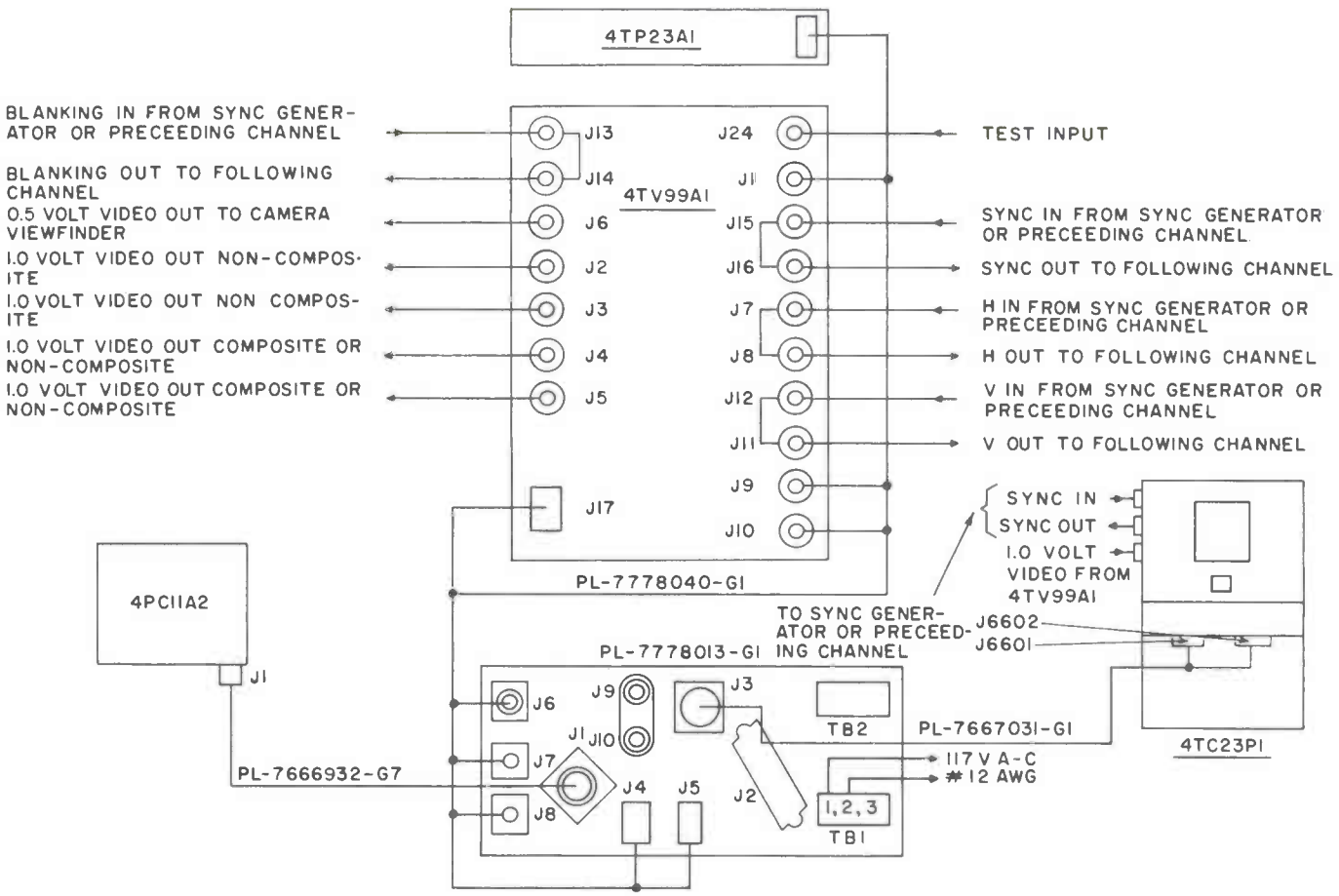


Fig. 4 System Interconnection Diagram (B-7494762)

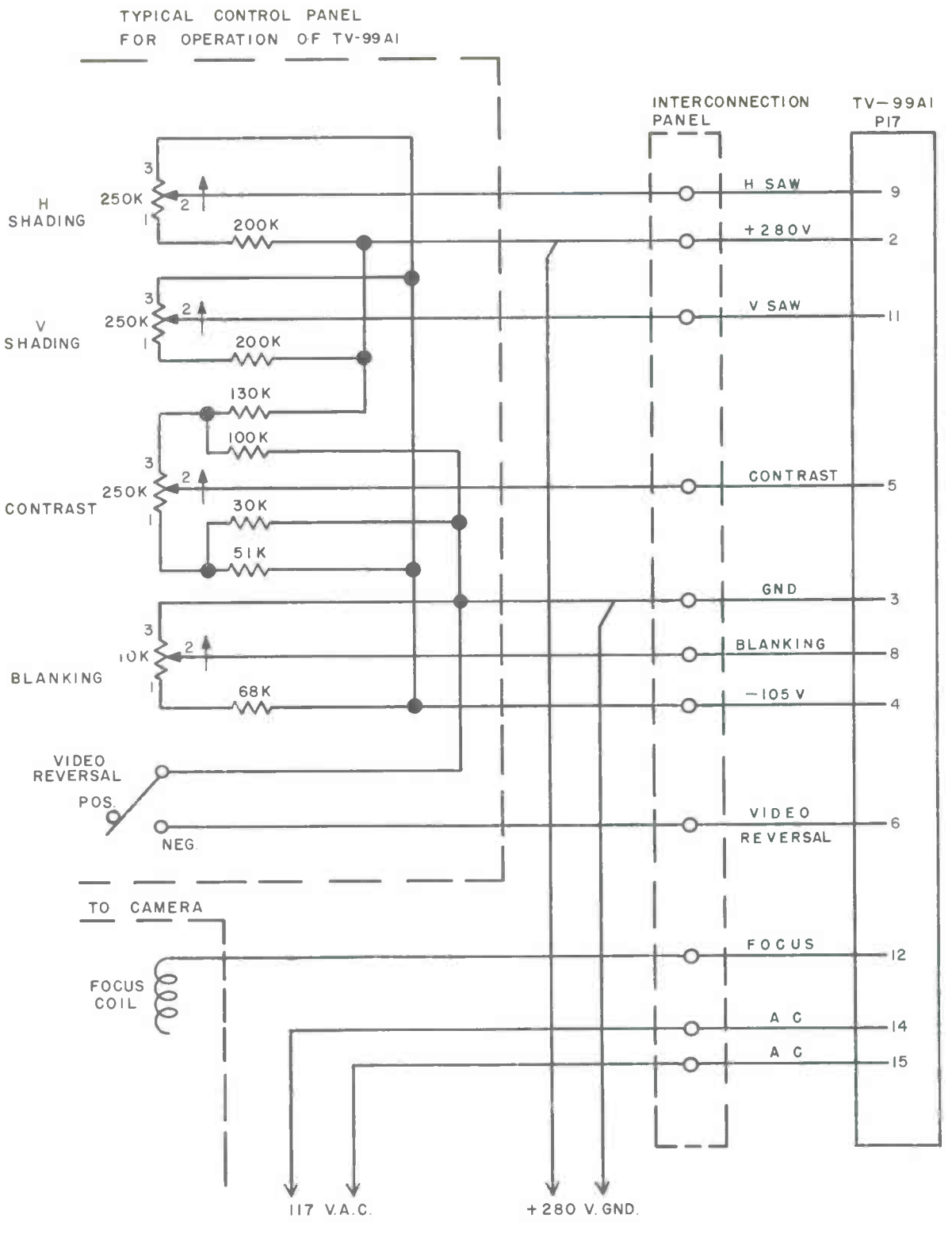


Fig. 5 Control Panel Wiring Diagram, Channel Amplifier, Model 4TV99A1

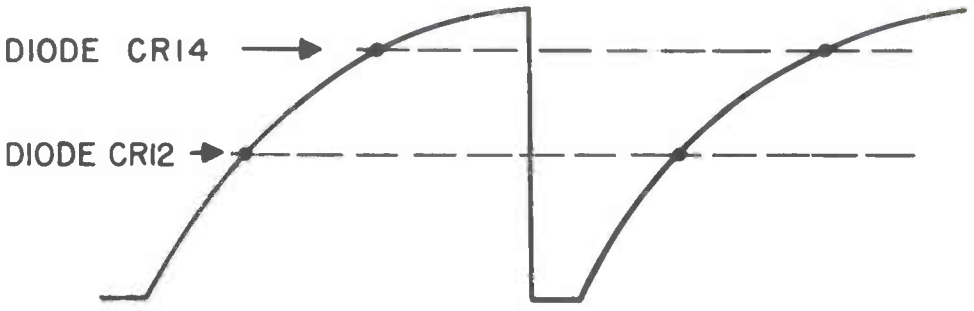


Fig. 6 Gamma Correction Slope

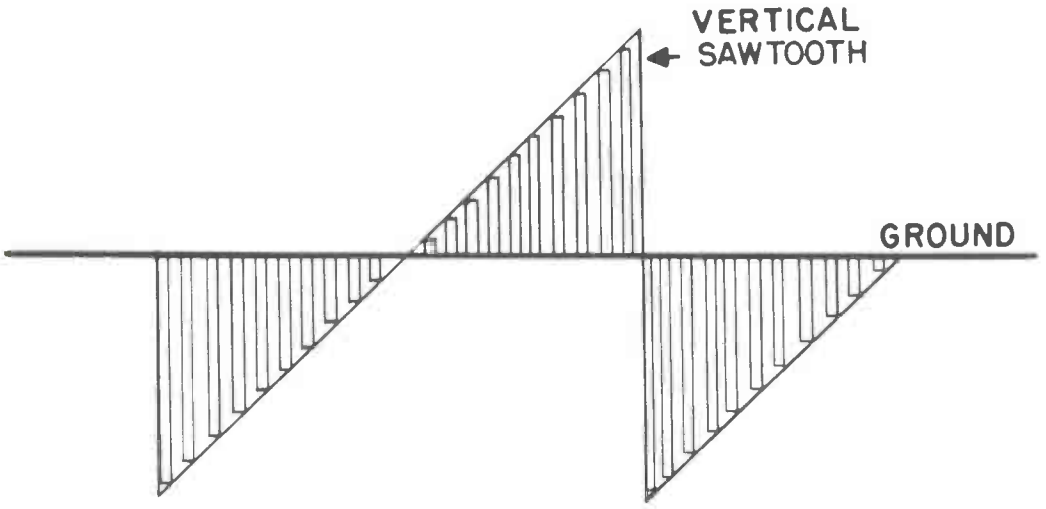


Fig. 7 Vertical Shading Adder

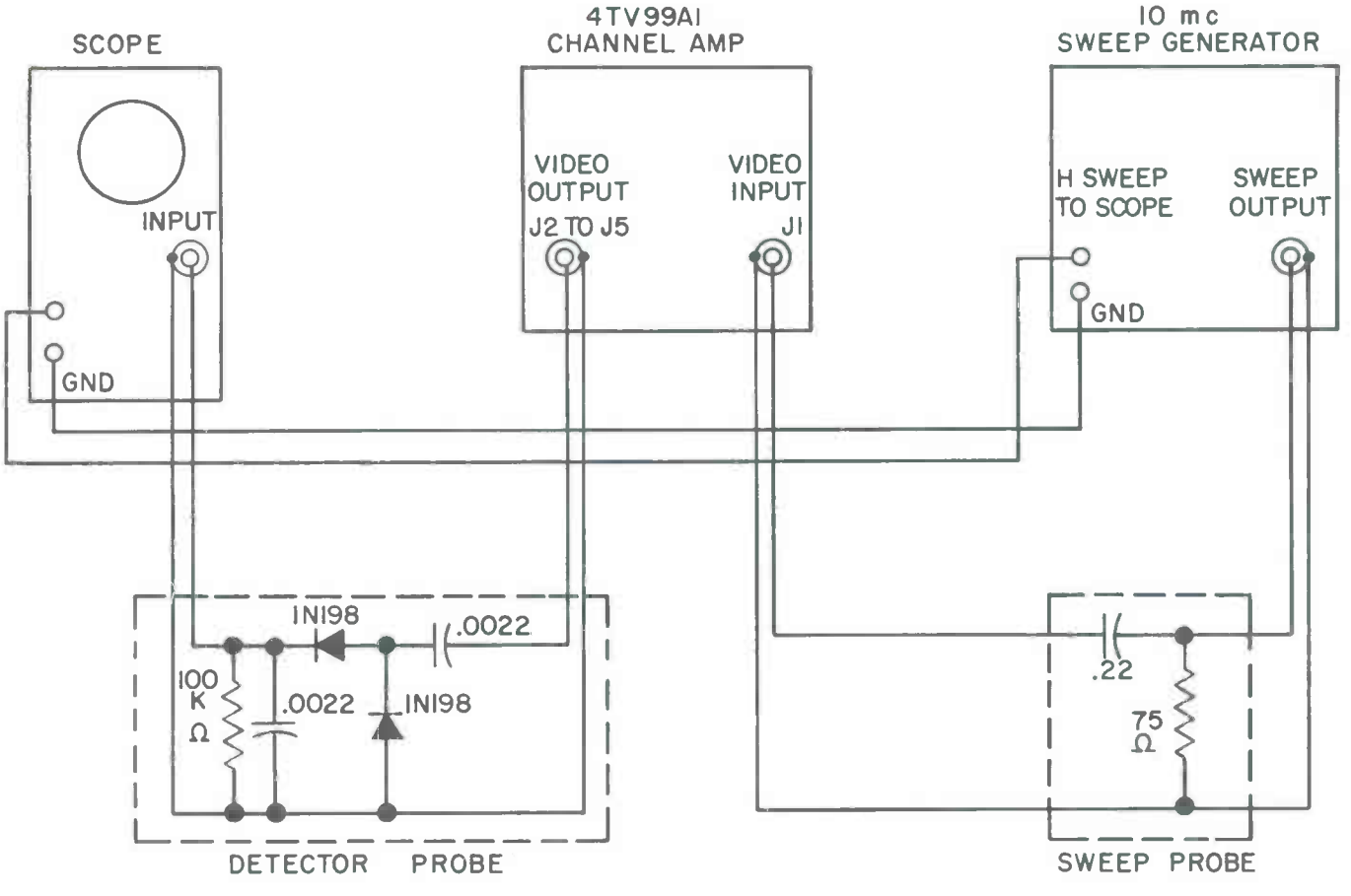
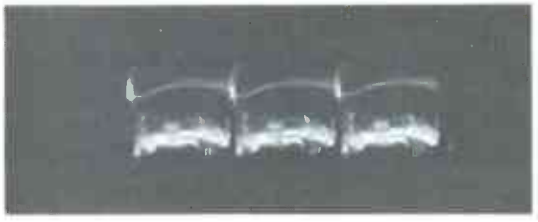
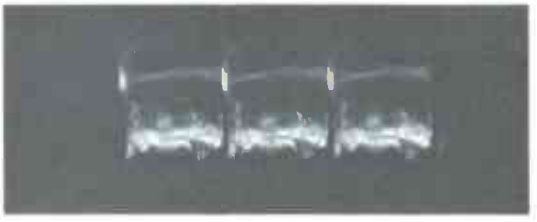


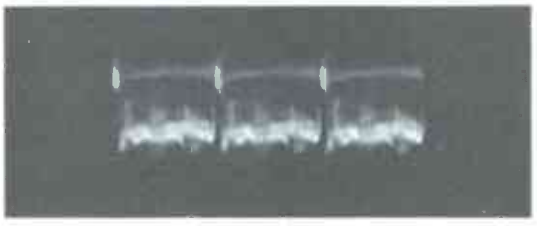
Fig. 8 High-Frequency Response Alignment Test Equipment Setup



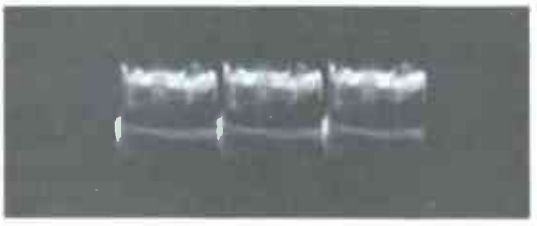
(a) V2, pin 2, 0.75 volt P-P



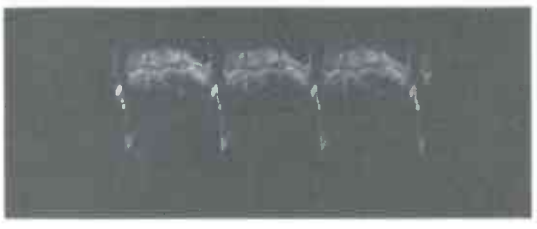
(b) V3, pin 2, 1.5 volts P-P



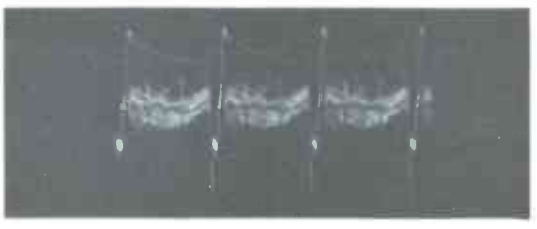
(c) V3, pin 8, 2 volts P-P



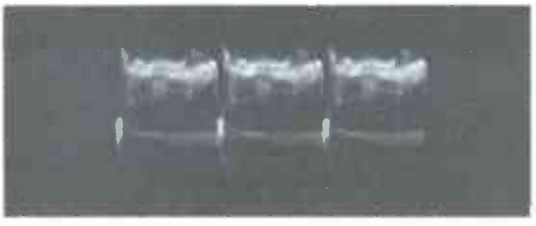
(d) V4, pin 1, 0.8 volt P-P



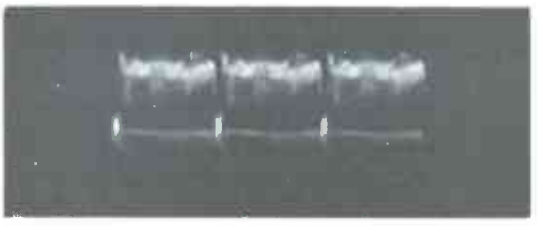
(e) V6, pin 2, 8 volts P-P, positive video, H rate



(f) V6, pin 2, 8 volts P-P, negative video, H rate

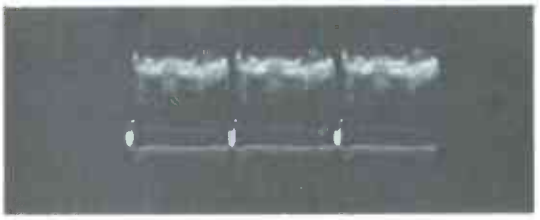


(g) V6, pin 2, 10 volts P-P, H rate

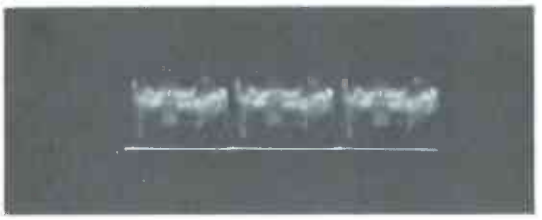


(h) V6, pin 3, 9 volts P-P, H rate

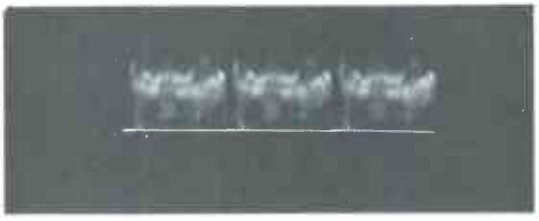
Fig. 9 Waveforms; V2, V3, V4, V6



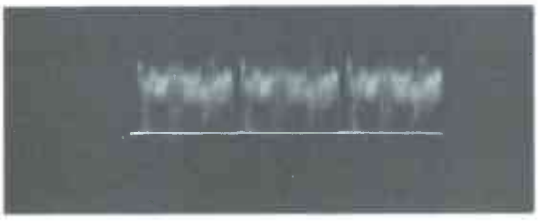
(a) V7, pins 2 and 7, 6 volts P-P



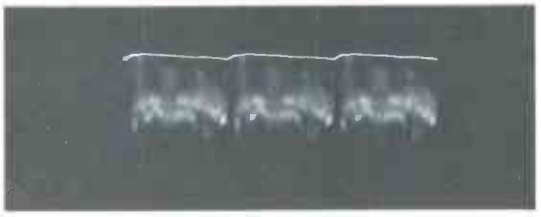
(b) V7, pin 1, 2 volts P-P



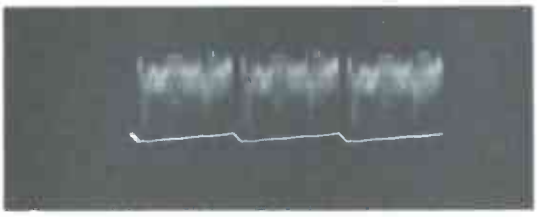
(c) V8, pin 1, 1.5 volts P-P



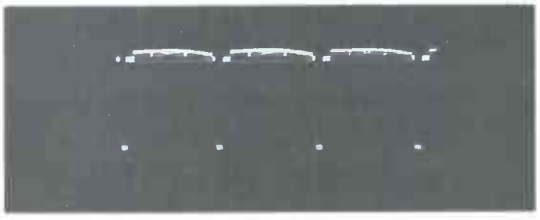
(d) V8, pin 2, 1.5 volts P-P



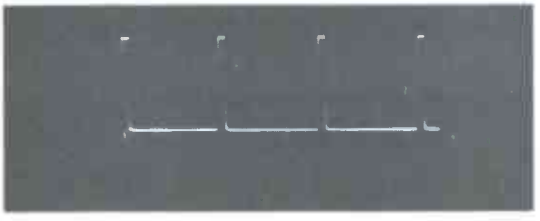
(e) V8, pin 5, 1.5 volts P-P



(f) V9, pin 6, 4 volts P-P

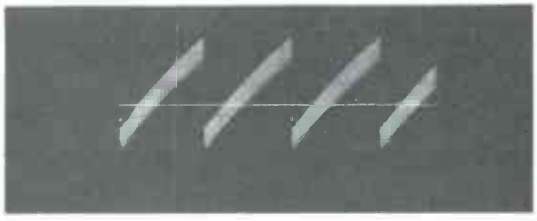


(g) V11, pin 1, 8 volts P-P, H rate

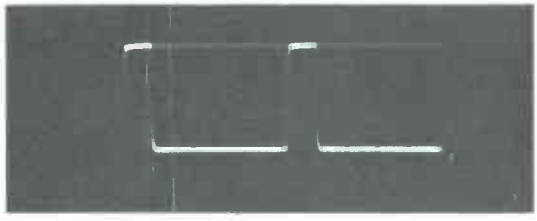


(h) V11, pin 6, 22 volts P-P, H rate

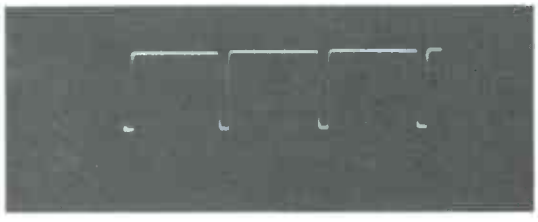
Fig. 10 Waveforms; V7, V8, V9, V11



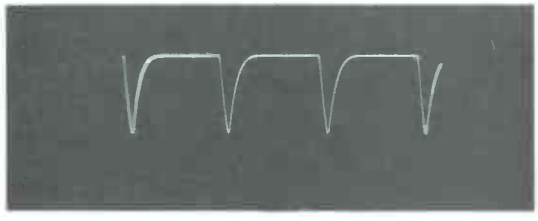
(a) V12, pin 3, 8 volts P-P, V rate



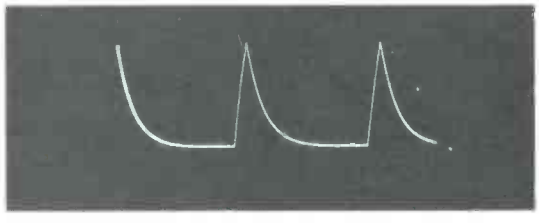
(b) V12, pin 7, 12 volts P-P, H rate



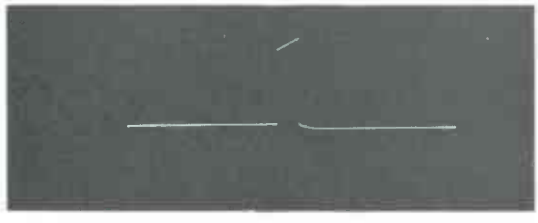
(c) V13, pin 1, 32 volts P-P, H rate



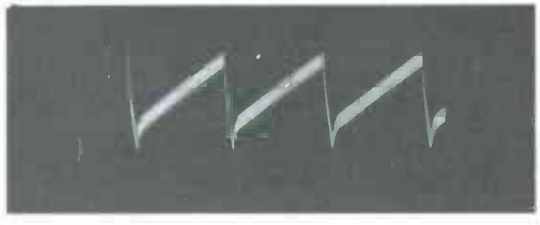
(d) V13, pin 6, 32 volts P-P, H rate



(e) V14, pin 1, 32 volts P-P, H rate



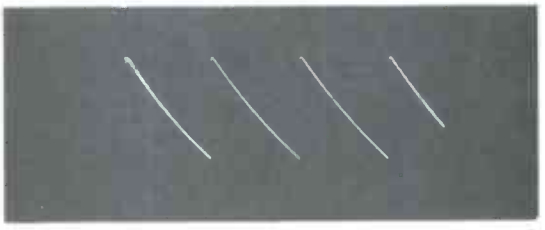
(f) V14, pin 6, 50 volts P-P, V rate



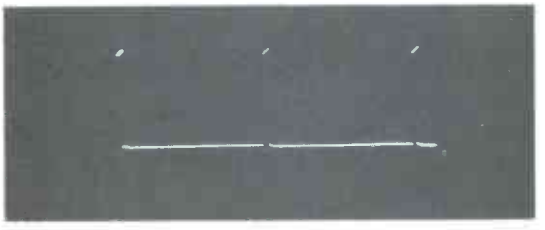
(g) V16, pins 1 and 6, 1.7 volts P-P, H rate

(h) V16, pin 2, 0.4 volt P-P, H rate

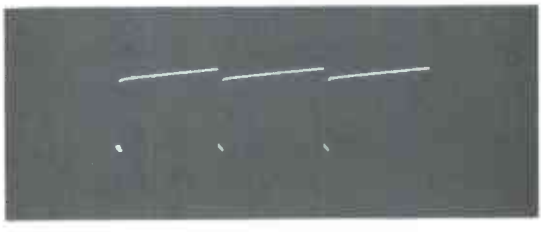
Fig. 11 Waveforms; V12, V13, V14, V16



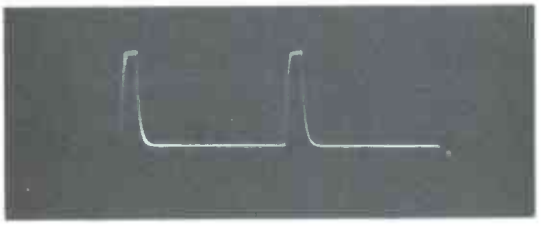
(a) V16, pin 7, 0.8 volt P-P, V rate



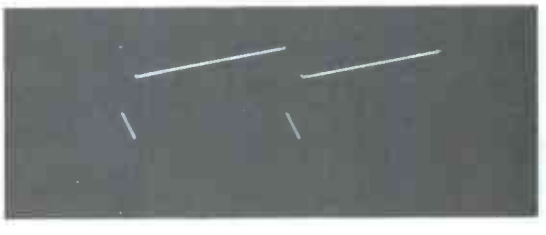
(b) V18, pin 1, 50 volts P-P, V rate



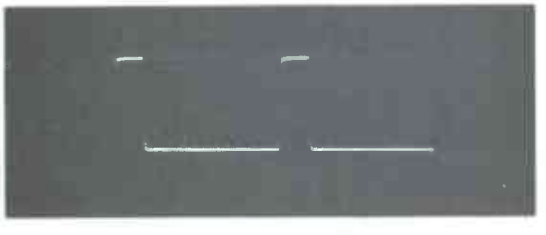
(c) V18, pin 6, 2 volts P-P, V rate



(d) V19, pin 1, 30 volts P-P, H rate

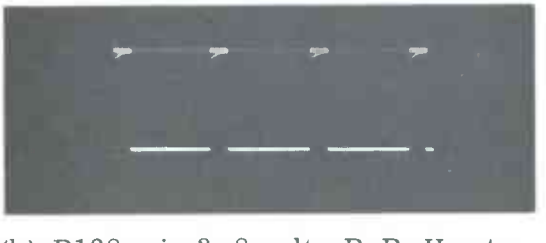


(e) V19, pin 6, 2 volts P-P, H rate



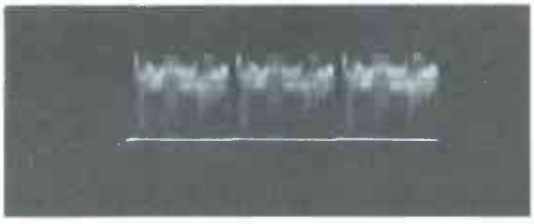
(f) V22, pin 1, 12 volts P-P, H rate

(g) V22, pin 8, 9 volts P-P, H rate

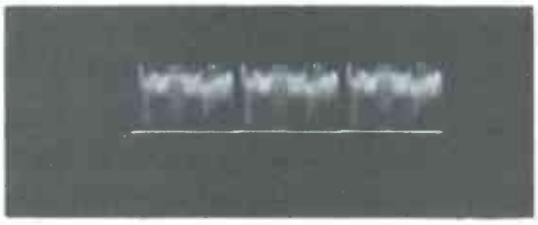


(h) R198, pin 3, 8 volts P-P, H rate

Fig. 12 Waveforms; V16, V18, V19, V22, R183

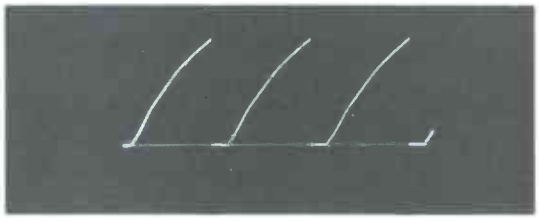


(a) Video out J2 through J5, noncomposite, 1 volt P-P

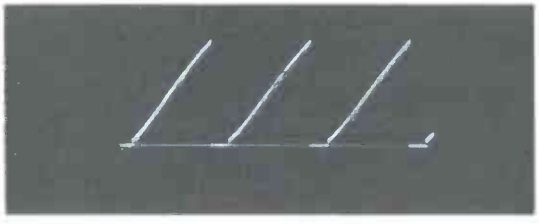


(b) Viewfinder video out J6, 0.3 volt P-P

(c) Video out J3, sync added, sync set max, 1.5 volts P-P, H rate



(d) Video out J2 through J5, no video, no sync, gamma on, H rate



(e) Video out J2 through J5, no video, no sync, gamma off, H rate

Fig. 13 Waveforms; Video Out, Viewfinder Video Out

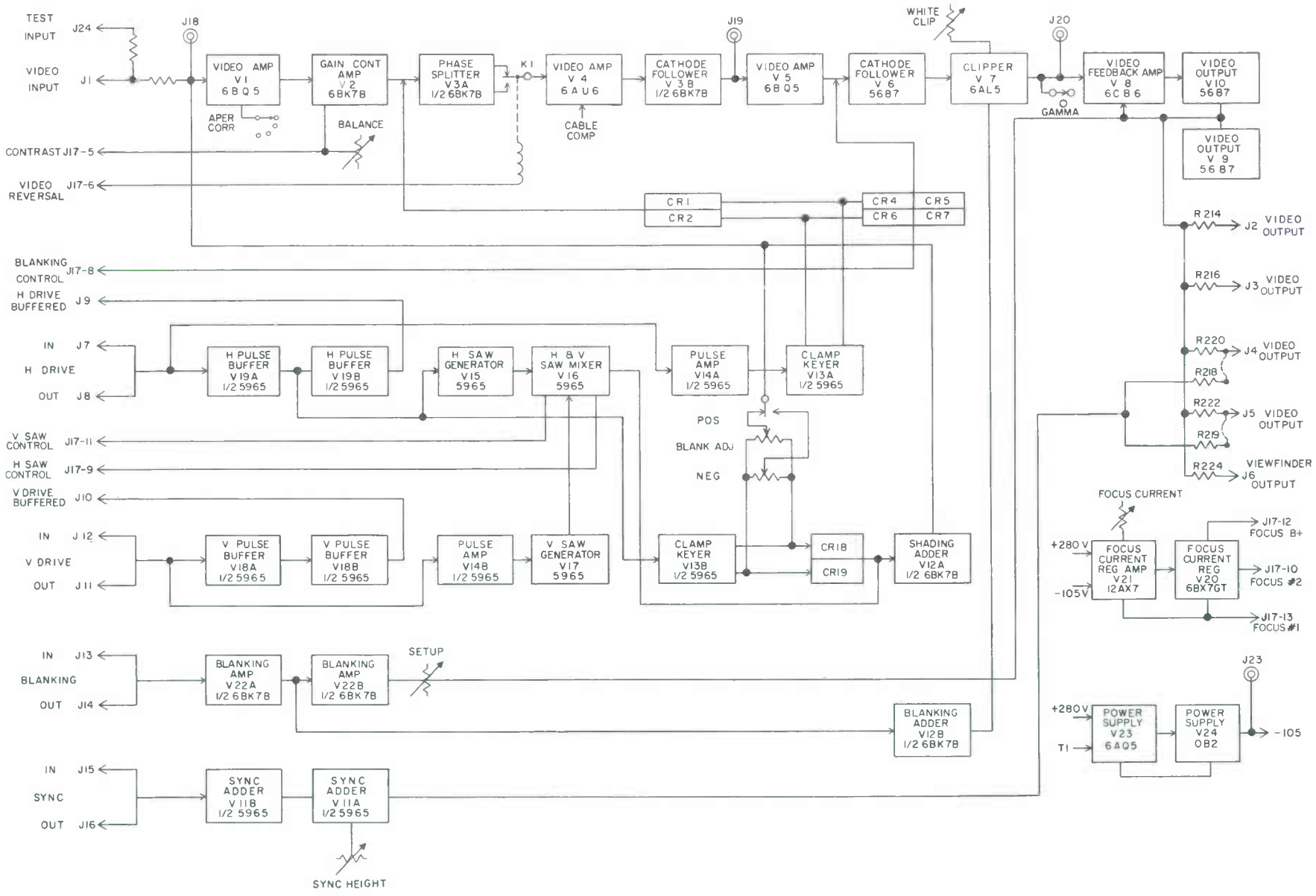
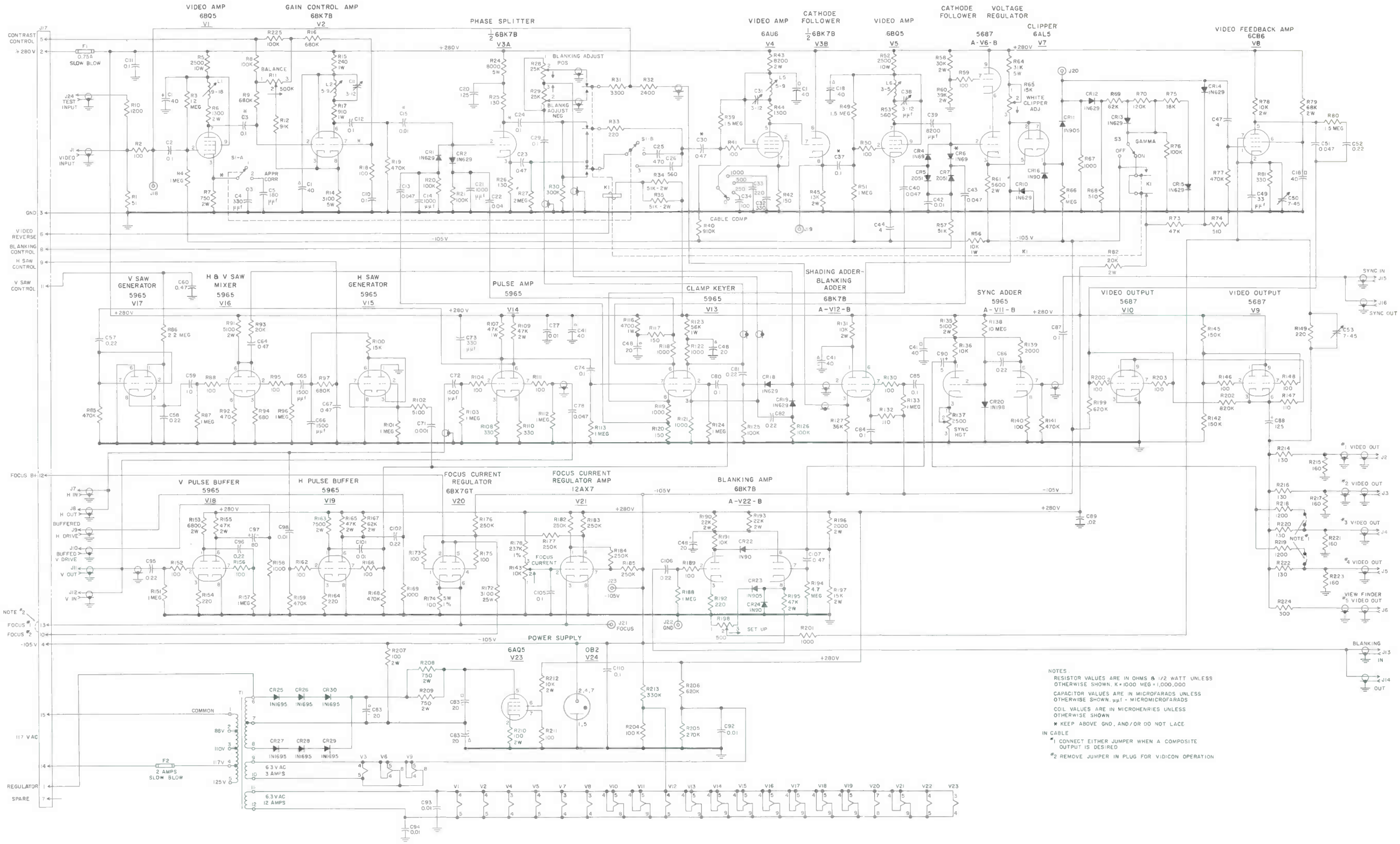


Fig. 14 Block Diagram, Channel Amplifier, Model 4TV99A1 (C-7778420)



NOTES

RESISTOR VALUES ARE IN OHMS & 1/2 WATT UNLESS OTHERWISE SHOWN. K = 1000 MEG = 1,000,000

CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SHOWN. μμf = MICROMICROFARADS

COIL VALUES ARE IN MICROHENRIES UNLESS OTHERWISE SHOWN

* KEEP ABOVE GND. AND/OR DO NOT LACE IN CABLE

#1 CONNECT EITHER JUMPER WHEN A COMPOSITE OUTPUT IS DESIRED

#2 REMOVE JUMPER IN PLUG FOR VIDICON OPERATION

Fig. 15 Elementary Diagram, Channel Amplifier, Model 4TV99A1 (EE-7354346, Rev. A)

INSTRUCTIONS

POWER SUPPLY

MODEL 4TP23A1 , REVISION B

EBI—3527B

DEFENSE ELECTRONICS DIVISION

GENERAL ELECTRIC

ELECTRONICS PARK, SYRACUSE, N. Y.

4/61 (1000)

PRINTED IN U.S.A.

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ILLUSTRATIONS

PRODUCTION CHANGE SHEET

POWER SUPPLY
MODEL 4TP23A1

REVISION A

Parts List

Symbol	Was	Changed To
C6	Not used.	Paper, molded plastic, 0.10 mfd ± 20% 600 v d-c w. Sprague Cat. #109P10406. G-E Drawing B-7491096-P53.
R28	Not used.	Composition, 1000 ohms ± 5%, 2 w. G-E Drawing C-3R79-P102J.

Elementary Diagram, Fig. 2

C6 and R28 have been added in series with terminal post E10-E and ground.

REVISION B

Parts List

Symbol	Was	Changed To
XV1 thru XV4	Octal. Cinch Type 9886. G-E Drawing K-7103053-P1.	Amphenol Cat. #59-103. G-E Drawing A-7165474-P1.

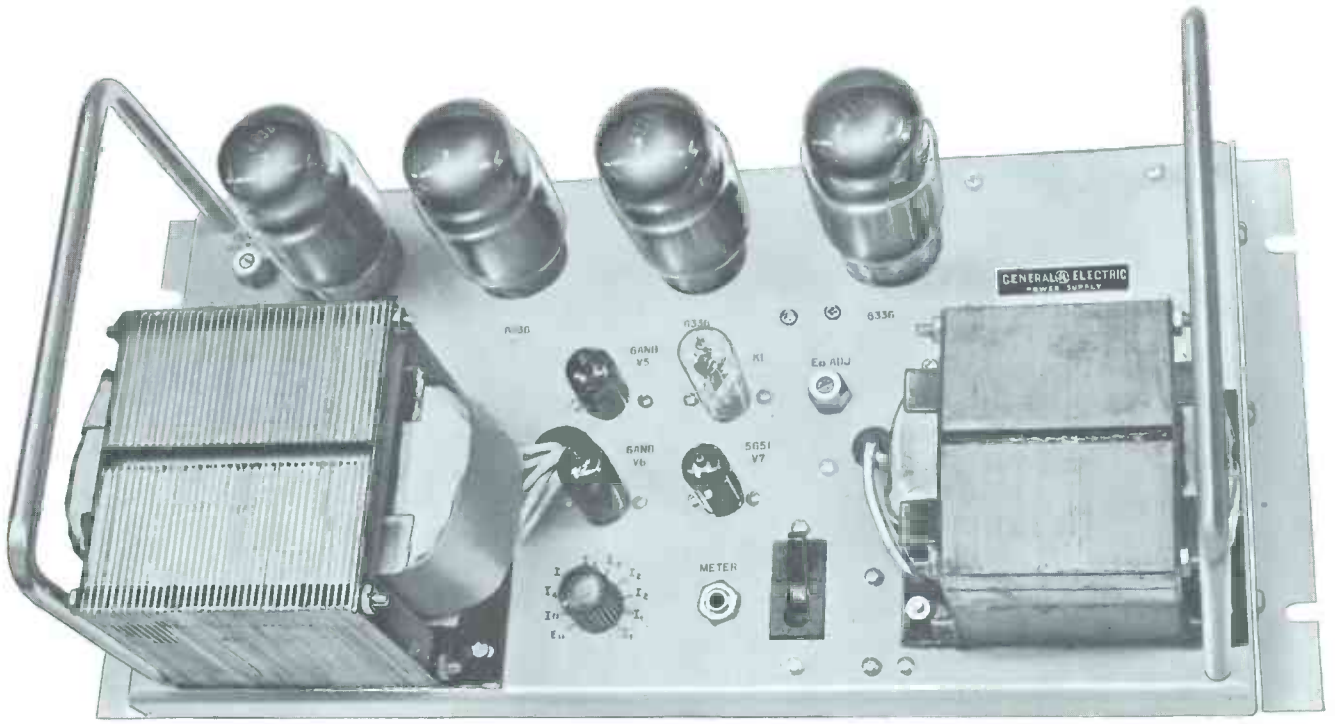


Fig. 1 Power Supply, Model 4TP23A1 (6-6475)

INTRODUCTION

The General Electric Power Supply, Model 4TP23A1, is designed for general use with television studio and transmitting equipment requiring regulated d-c voltage in the range of 260 to 333 volts and current up to 1.6 amperes (see Fig. 1).

TECHNICAL SUMMARY

Electrical

POWER INPUT

110/117/125 volts ± 5%, 50/60 cps single phase, 1000 watts.

POWER OUTPUT

+260 to 300 volts d-c (280 volts nominal), regulated, to 1.6 amp (300 ma minimum).

+380 volts d-c, regulated (total current not to exceed 1600 ma).

HUM AND NOISE

10.0 millivolts peak-to-peak.

DC REGULATION

Less than 0.1 volt, 350 ma to 1600 ma load.

AC IMPEDANCE

Less than 0.1 ohm from 10 cps to 50 kc.

OVER-ALL EFFICIENCY

45% to 50% at full load.

TUBE COMPLEMENT

4 Type 6336 (V1, V2, V3, V4)
2 Type 6AN8 (V5, V6)
1 Type 5651 (V7)

CIRCUIT BREAKER

S1, 10 amp, in the a-c line.

Mechanical

Width:	19 inches
Height:	8-3/4 inches
Depth:	$4\frac{1}{2}$ inches front protrusion
	$3\frac{1}{2}$ inches rear protrusion
Weight:	40 pounds (nominal)

DESCRIPTION

The Power Supply is constructed on a rectangular recessed aluminum chassis designed for standard rack mounting. All major components and controls are identified by symbol numbers. Controls are also identified by name. Other components are identified by symbol number where possible. Wiring and connections are accessible from the rear. External connections are made to a multiple contact plug located on the back of the chassis.

A rotary switch and meter jack on the front panel are available for checking the output voltage and current, and the current balance of the Type 6336 regulator tubes. A circuit breaker on the front panel turns the supply on and off and affords overload protection. If desired, the high voltage may be switched remotely.

INSTALLATION

The Power Supply has been tested and inspected before being shipped, and should be ready for operation when received and properly installed. Unpack the unit carefully and inspect it for any damage that may have occurred during shipment. Notify the shipping company of any such damage immediately.

The unit is furnished with two Short Mounting Brackets, P-7772418-P16, firmly secured to either side of the chassis, permitting it to be installed in any General Electric television cabinet rack. Mounting hardware is furnished with each cabinet rack. Special Long Mounting Brackets, P-7772418-P5, are available on separate order for installations in other than a General Electric rack. When using these, the Short Mounting Brackets must first be removed before the Long Mounting Brackets can be installed. Use the same mounting hardware that secured the Short Brackets.

The Power Supply should be operated at an ambient cabinet temperature not to exceed 50 C (122 F). A maximum of 55 C (131 F) can be tolerated for not more than 5% of the annual operating hours. The unit dissipates 550 watts. This requires cooling by moving air at 98 cfm with room ambient at 35 C (95 F), to keep temperature rise below 10 C (28 F).

The Elementary Diagram, Fig. 2, shows all electrical connections.

The unit as shipped is wired for 117 volts ± 5% input voltage. For nominal 110 volts input, change the wire from E11-2 to E11-3 and E12-B to E12-C. For nominal 125 volts input, change the wire from E11-2 to E11-1 and E12-B to E12-A. The unit is designed for a nominal 280 volts d-c output voltage.

For remote plate voltage switching, remove the jumper between terminals 4 and 5 of P1, and connect the remote switch wires to terminals 4 and 5 of P1. A low current switch (about 1 amp) may be used, since it is only required to energize relay K2.

Centering voltage available at J3 is adjustable at R1. If centering voltage is not

used, turn the CENTERING VOLTAGE ADJ control (R1) full counterclockwise.

The Power Supply may be grounded at a remote point by removing the wire at V4-G2 to ground, and connecting the remote ground wire to P1-8.

OPERATION

Apply power to the unit by turning the circuit breaker to ON. This energizes the time delay relay, K1, which cycles for about 30 seconds before actuating relay K2, thus allowing sufficient time for the filament to heat before plate power is applied. K2 is a d-c relay operating on voltage supplied from the rectifier, V5B. With S2 set at E_o, adjust the voltage control, R38, marked E_o ADJ, to obtain the desired operating voltage, as indicated on the Plug-In Meter, Type TX-15-A*. E_o should not normally require readjustment for a given voltage unless the Type 5651 tube is changed. To read current, set the selector switch, S2, to I_o. The settings I_1 through I_4 read the regulator tube (V1 through V4) cathode currents, which should balance within 10%.

With short power line failures of about five seconds or less, relay K1 will not recycle and B+ power will return immediately. For longer failure intervals, K1 will recycle but will not require the full relay time to pick up again. This is true because of its thermal time delay operating principle.

THEORY AND CIRCUIT ANALYSIS

The Power Supply, Model 4TP23A1, is an electronically regulated d-c supply with a nominal output voltage of 280 volts and a maximum current of 1600 ma. The Power Supply provides a steady power source independent of fluctuations in input voltage or load variations within the specified limits.

The input circuit uses a germanium rectifier stack in a bridge rectifier configuration. This, together with the choke-input filter L1-C1 through C5, provides the highest utilization factor of T1 and allows the use of a smaller transformer. This supply uses electrolytic capacitors in the filter circuit to reduce size and weight. It should be noted that the normal life expectancy of these capacitors at 55 C (131 F) is five years or more. At 25 C (77 F) the figure is 15 years. The supply uses open-frame transformers with Class B insulation, which allows considerable saving in size and weight. It is perfectly normal for these transformers to run hotter than the older Class A units.

The series regulator section is conventional, using four dual triode series-parallel-connected regulator tubes, Type 6336. The d-c output voltage is dependent almost entirely on the voltage reference and the ratio of the dividing resistors, R35 through R38. A Type 5651 tube is used as the reference and 1.0% resistors are used in the dividing network. V6B is the first d-c amplifier, cathode coupled via V6A into V5A to obtain the proper polarity of feedback voltage.

The action of the regulator circuit is best explained by considering the effect of a variation of the output load. An increase in load current tends to decrease the output voltage because of greater drop across the Type 6336 regulators. A sampling of the output voltage appears across the divider network at the grid of V6B, which operated at 75 to 85 volts positive, or several volts more negative than the plate of the voltage reference tube, V7, normally about 85 volts positive. The decreased voltage at the grid of V6B causes it to become more negative, decreasing its plate current. The grid voltage at V6B is thereby increased, causing the cathodes of V6A and V5A and the plate of V5A to go more positive, resulting in a plate resistance drop across V1-V4, which returns the output voltage to normal. The amount that it will deviate from normal is a function of the gain of the d-c amplifier.

*Required accessory equipment.

In this unit the gain is very high, in the order of several thousand. Additional regulating action is accomplished by having the control grid of V5 connected into the divider network at V5-E1. When the output voltage decreased, the grid of V5A went more negative with respect to the cathode of V5A, causing the plate to go positive, thereby slightly increasing the regulating effect at the grids of V1-V4.

MAINTENANCE

To assure continuous and satisfactory operation of the Power Supply, a regular maintenance schedule should be set up. Check the unit for over-heating and discoloration of components. Check the tubes for emission. Check the voltages at the tube sockets against the tube socket voltage chart below. It should be noted that due to the feedback nature of the regulator circuit, a fault at any given point in the circuit may produce erroneous voltage readings at any other point of the circuit.

Clean the unit with an air hose or soft brush regularly. Do not disturb the leads or components positions. If a component requires replacement, obtain its description from the Parts List. Do not replace a faulty component without first checking the circuit to determine the cause of the failure. When a component has been replaced, check the tube socket voltage against those shown in the tube socket voltage chart to be certain of proper functioning of the new part.

Tube Socket Voltage Chart

The voltages below were measured with a 20,000 ohm-per-volt meter.

	PIN								
TUBE	1	2	3	4	5	6	7	8	9
V1 thru V4	260*	375**	287	260*	375**	287	fil	fil	-
V5	-	-	-	fil	fil	260*	280	140	145
V6	260	140	145	fil	fil	140	115	84	86

*Will vary with load current and line voltage.
**At nominal line voltage, 117 volts.

PARTS LIST

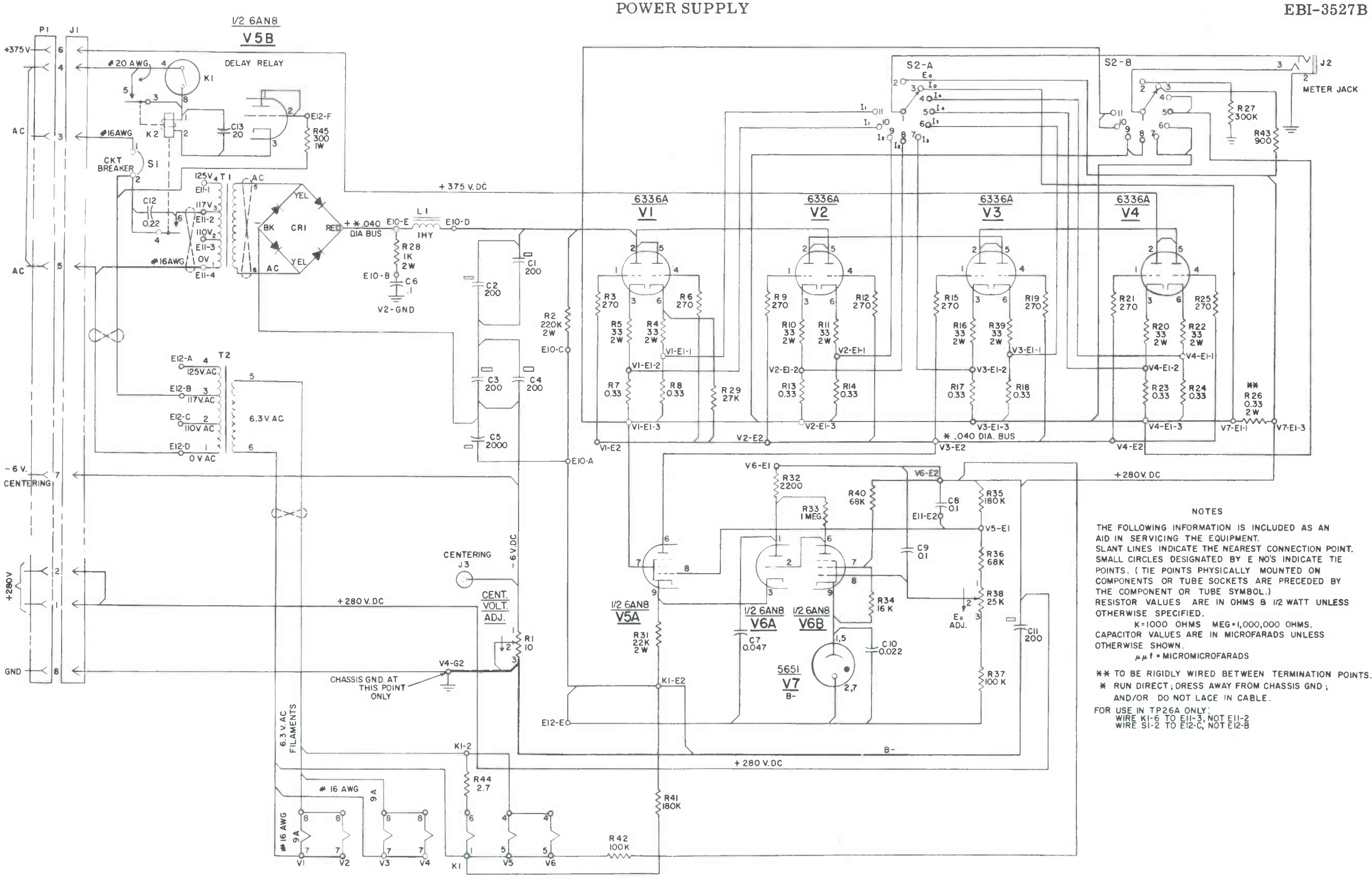
Symbol	Description	G-E Drawing
	CAPACITORS (Paper, molded plastic, ± 20%, 400 v d-c w, unless otherwise specified)	
C1 thru C4	Electrolytic, polarized twist prong base; 200 mfd +100% -10%, 350 v d-c w. Mallory Type FP with insulating sleeve.	P-7772471-P19
C5	Electrolytic, polarized twist prong base; 2000 mfd +250% -10%, 15 v d-c w. Mallory Type WPO 41.	P-7770994-P11

Symbol	Description	G-E Drawing
	CAPACITORS (CONTINUED) (Paper, molded plastic, ± 20%, 400 v d-c w, unless otherwise specified)	
C6	0.10 mfd, 600 v d-c w. Sprague Cat. #109P10406.	B-7491096-P53
C7	0.047 mfd. Sprague Cat. #109P47304.	B-7491096-P31
C8 and C9	0.10 mfd. Sprague Cat. #109P10404.	B-7491096-P33
C10	0.022 mfd. Sprague Cat. #109P22304.	B-7491096-P29
C11	Electrolytic, low inductance, polarized twist prong base; 200 mfd +100% -10%, 350 v d-c w.	C-7776308-P112
C12	0.22 mfd. Sprague Cat. #109P22404.	B-7491096-P35
C13	Electrolytic, tubular; 20 mfd +100% -10%, 250 v d-c w. Mallory Cat. #TC55.	C-7774786-P24
	RECTIFIER	
CR1	Germanium, single phase, bridge. G-E Model 4JA211CB3AC1.	B-7489131-P2
	JACKS AND RECEPTACLES	
J1	Receptacle: 8 pin male. HB Jones Cat. #P-408-SB.	A-7144145-P1
J2	Jack: 3-conductor type to accommodate phone plug type PL-68 and all standard 3-conductor plugs.	K-7109613-P2
J3	Jack, tip: dark green head. EF Johnson Type 105-522-25.	A-7142648-P3
	RELAYS	
K1	Thermostatic, delay: heater voltage (a-c or d-c) 6.3 v; 15 sec ± 3 sec delay at 20° C, spst NO. circuit, 2 amp a-c non-inductive, 115 v, ½ amp d-c. Amperite Cat. #6NO15T.	A-7150695-P1
K2	D-C resistance 5000 ohms; pickup 90 v d-c, operates at 112 v d-c; dpdt contacts rated 15 amp, 110 v a-c. Allied Control Co. Type BO6D112.	M-7464579-P8

Symbol	Description	G-E Drawing
	REACTOR	
L1	Inductance 1.0 h at 1.6 amp, d-c resistance 10 ohms max.	B-7491114-P1
	PLUG	
P1	8 female contacts. Jones Cat. #S-408-CCE.	B-7488663-P10
	RESISTORS (Composition, ± 5%, ½ w, unless otherwise specified)	
R1	Rheostat, wirewound, 10 ohms ± 10%, 25 w, linear taper. Ohmite Model "H"; Cat. #0145.	M-2R33-P29
R2	0.22 megohm, 2 w.	C-3R79-P224J
R3	270 ohms.	C-3R77-P271J
R4 and R5	33 ohms, 2 w.	C-3R79-P330J
R6	270 ohms.	C-3R77-P271J
R7 and R8	Wirewound, 0.33 ohm ± 5%, ½ w at 25° C. IRC Type BW.	P-3R18-P45
R9	270 ohms.	C-3R77-P271J
R10 and R11	33 ohms, 2 w.	C-3R79-P330J
R12	270 ohms.	C-3R77-P271J
R13 and R14	Wirewound, 0.33 ohm ± 5%, ½ w at 25° C. IRC Type BW.	P-3R18-P45
R15	270 ohms.	C-3R77-P271J
R16	33 ohms, 2 w.	C-3R79-P330J

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R17 and R18	Wirewound, 0.33 ohm ± 5%, ½ w at 25° C. IRC Type BW.	P-3R18-P45
R19	270 ohms.	C-3R77-P271J
R20	33 ohms, 2 w.	C-3R79-P330J
R21	270 ohms.	C-3R77-P271J
R22	33 ohms, 2 w.	C-3R79-P330J
R23 and R24	Wirewound, 0.33 ohm ± 5%, ½ w at 25° C. IRC Type BW.	P-3R18-P45
R25	270 ohms.	C-3R77-P271J
R26	Wirewound, precision; 0.333 ohm ± 1%, 2 w. Shallcross Type 220 RA.	K-7119855-P9
R27	Deposited carbon on ceramic; 0.30 megohm ± 1%, ½ w. IRC Type DCC.	C-7774319-P125
R28	1000 ohms, 2 w.	C-3R79-P102J
R29	27,000 ohms.	C-3R77-P273J
R31	22,000 ohms, 2 w.	C-3R79-P223J
R32	2200 ohms.	C-3R77-P222J
R33	1.0 megohm.	C-3R77-P105J
R34	16,000 ohms.	C-3R77-P163J
R35	Deposited carbon on ceramic, 0.18 megohm ± 1%, ½ w. IRC Type DCC.	C-7774319-P120
R36	Deposited carbon on ceramic, 68,000 ohms ± 1%, ½ w. IRC Type DCC.	C-7774319-P110
R37	Deposited carbon on ceramic, 0.10 megohm ± 1%, ½ w. IRC Type DCC.	C-7774319-P114
R38	Potentiometer, composition; 25,000 ohms ± 20%, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P56

Symbol	Description	G-E Drawing
	RESISTORS (CONTINUED) (Composition, ± 5%, ½ w, unless otherwise specified)	
R39	33 ohms, 2 w.	C-3R79-P330J
R40	68,000 ohms.	C-3R77-P683J
R41	0.18 megohm.	C-3R77-P184J
R42	0.10 megohm.	C-3R77-P104J
R43	Wirewound, non-inductive, 900 ohms ± 1%, 0.5 w. Shallcross Type BX-183.	K-7109249-P9
R44	Wirewound, 2.7 ohms ± 10%, ½ w at 25° C. IRC Type BW.	P-3R18-P13
R45	300 ohms, 1 w.	C-3R78-P301J
	SWITCHES	
S1	Circuit breaker; single pole, 120 v a-c, 10 amp, time overload curve 5. Heineman Cat. #AM12-10.	P-7772732-P16
S2	Rotary type, 2 section, 2 pole, 10 position, non-shorting. Oak Type FX.	C-7774853-P3
	TRANSFORMERS	
T1	Rectifier, single phase. Pri: 110/117/125 v, 50/60 cycles; sec: 440 v ± 3%, 1.62 amp.	B-7491113-P1
T2	Filament, single phase. Pri: 110/117/125 v, 50/60 cycles; sec: 6.3 v, 21 amp.	B-7491115-P1
	RELAY SOCKET	
XK1	Mica filled phenolic 9 pin miniature, 4 ground lugs.	M-7480532-P8
	TUBE SOCKETS (Mica filled phenolic)	
XV1 thru XV4	Amphenol Cat. #59-103.	A-7165474-P1
XV5 and XV6	9 pin miniature, 4 ground lugs.	M-7480532-P8
XV7	7 pin miniature, bottom mount flat top, 4 ground lugs.	P-7768887-P14



NOTES

THE FOLLOWING INFORMATION IS INCLUDED AS AN AID IN SERVICING THE EQUIPMENT.
SLANT LINES INDICATE THE NEAREST CONNECTION POINT.
SMALL CIRCLES DESIGNATED BY E NO'S INDICATE TIE POINTS. (TIE POINTS PHYSICALLY MOUNTED ON COMPONENTS OR TUBE SOCKETS ARE PRECEDED BY THE COMPONENT OR TUBE SYMBOL.)
RESISTOR VALUES ARE IN OHMS & 1/2 WATT UNLESS OTHERWISE SPECIFIED.
K=1000 OHMS MEG=1,000,000 OHMS.
CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SHOWN.
$\mu\mu$f = MICROMICROFARADS

** TO BE RIGIDLY WIRED BETWEEN TERMINATION POINTS.
* RUN DIRECT; DRESS AWAY FROM CHASSIS GND; AND/OR DO NOT LACE IN CABLE.

FOR USE IN TP26A ONLY:
WIRE K1-6 TO E11-3, NOT E11-2
WIRE S1-2 TO E12-C, NOT E12-B

Fig. 2 Elementary Diagram, Power Supply, Model 4TP23A1 (D-7669361, Rev. 7)

Fig. 2
Elementary

INSTRUCTIONS

CABINET UNITS

MODELS

4PR10A1, 4PR10B1, 4PR10C1
4PR11A1, 4PR11B1
4PR12A1
4PR13A1
4PR14A1
4PR15A1
4PR16A1, 4PR16B1, 4PR16C1
4PR17A1, 4PR17A2, 4PR17A3
4PR18A1
4PR19A1, 4PR19B1, 4PR19C1
4PR20A1

EBI-3163C

ELECTRONICS DIVISION
GENERAL ELECTRIC
ELECTRONICS PARK, SYRACUSE, N. Y.

12-55 (3M)

PRINTED IN U.S.A.

DRAWINGS

Fig. 1	Cabinet Units Installation Drawing
Fig. 2A and 2B	Cabinets, Types PR-12-A, PR-13-A, PR-14-A, and PR-15-A, Outline and Clearances Drawing
Fig. 3A and 3B	Cabinets, Types PR-17-A and PR-16-A, B, and C, Outline and Clearances Drawing
Fig. 4	Installation Drawing, Rack Mounting Kits, Types PR-19-A, PR-19-B, PR-19-C
Fig. 5	Installation Drawing, Chassis Mounting Bracket, Type PR-20-A

CABINET UNITS

MODELS

4PR10A1, 4PR10B1, 4PR10C1
4PR11A1, 4PR11B1
4PP12A1
4PR13A1
4PR14A1
4PR15A1
4PR16A1, 4PR16B1, 4PR16C1
4PR17A1, 4PR17A2, 4PR17A3
4PR18A1
4PR19A1, 4PR19B1, 4PR19C1
4PR20A1

APPLICATION

The General Electric Cabinet Units are specially designed cabinets for supporting and housing studio control, master control and transmitter control equipment.

DESCRIPTION

GENERAL

The cabinet units are of steel construction and consist of both floor-mounted and desk-mounted units. They can be bolted together and will match and line-up to form a Studio Control Desk or Master Control Desk. Space on top of the floor-mounted units is available for installing desk cabinets and control panels. Desk cabinets house monitors or control panels.

Pull tapes are furnished with cabinets 4PR10A1, 4PR10B1, and 4PR10C1 to permit the monitors to be operated drawer fashion. Normally these are already installed as located on Fig. 1.

Mounting hardware for floor-mounted units must be furnished by the customer. Units such as the 4PR13A1, 4PR14A1, 4PR15A1 and 4PR12A1 normally are shipped as consoles with one or more monitors installed.

Fig. 1 shows the outline, dimensions and mounting of each cabinet as well as the various cabinet arrangements. For installation details including installation of control panels, monitor and spring tapes, see Figs. 2 and 3.

CAMERA MONITOR CONSOLE CABINET, MODEL 4PR10A1

The Camera Monitor Console consists of a Monitor Cabinet Base, Model 4PR12A1, and a Monitor Top Cabinet, Model 4PR13A1, bolted together. It is used to house the Dual Monitor or the Calibration Monitor. See 4PR12A1 and 4PR13A1 below.

PICTURE MONITOR CONSOLE CABINET, MODEL 4PR10B1

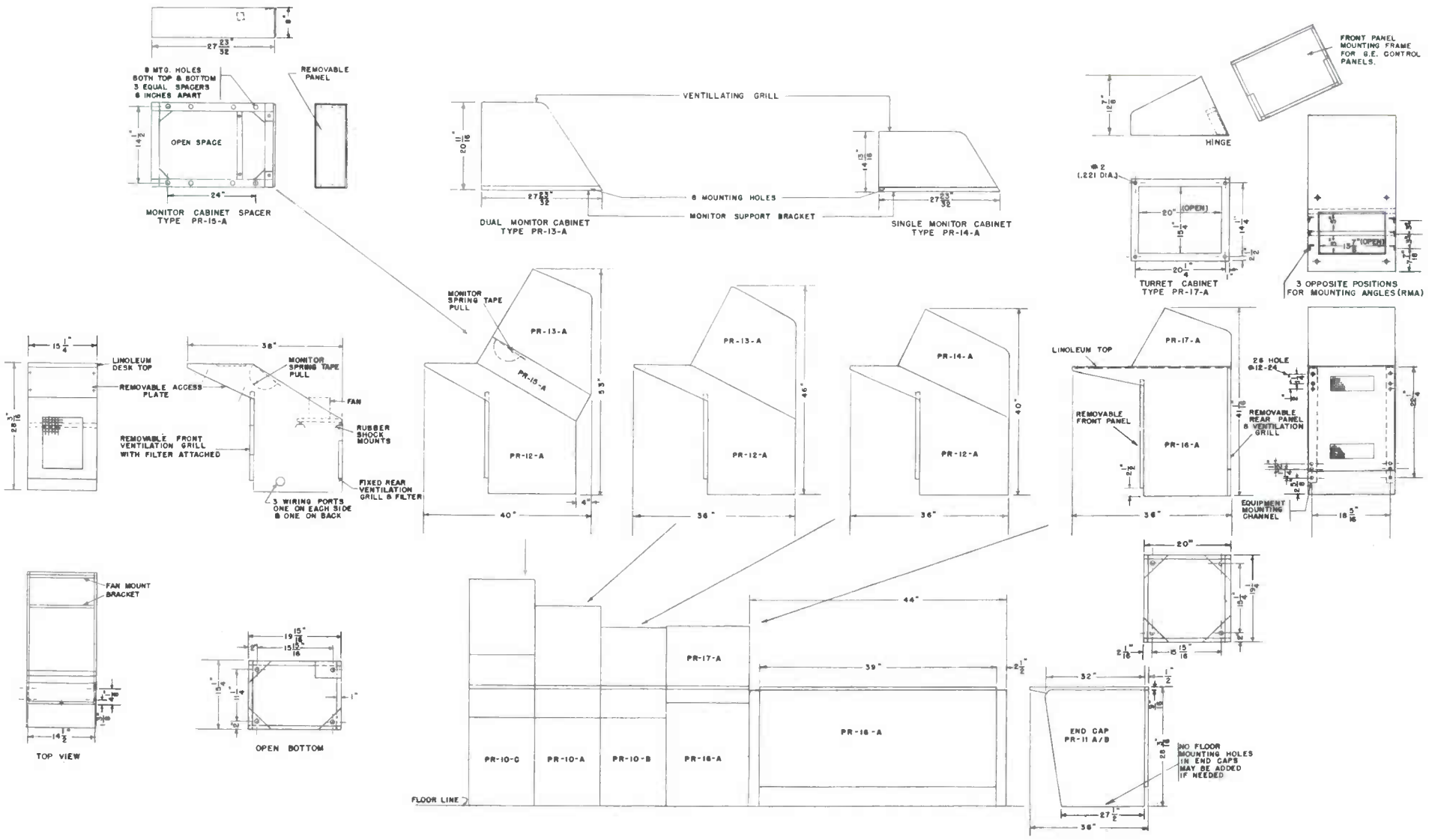
The Picture Monitor Console Cabinet consists of a Monitor Cabinet Base and a Monitor Top Cabinet bolted together. It is used to house the Picture Monitor. Also see 4PR12A1 and 4PR14A1.

CAMERA MONITOR CONSOLE CABINET WITH SPACER, MODEL 4PR10C1

The Camera Monitor Console Cabinet with Spacer consists of a Monitor Cabinet Base, a Spacer and Monitor Top Cabinet bolted together with the Spacer in the middle. It houses either a Dual Monitor or a Calibration Monitor. See 4PR12A1, 4PR15A1 and 4PR13A1.

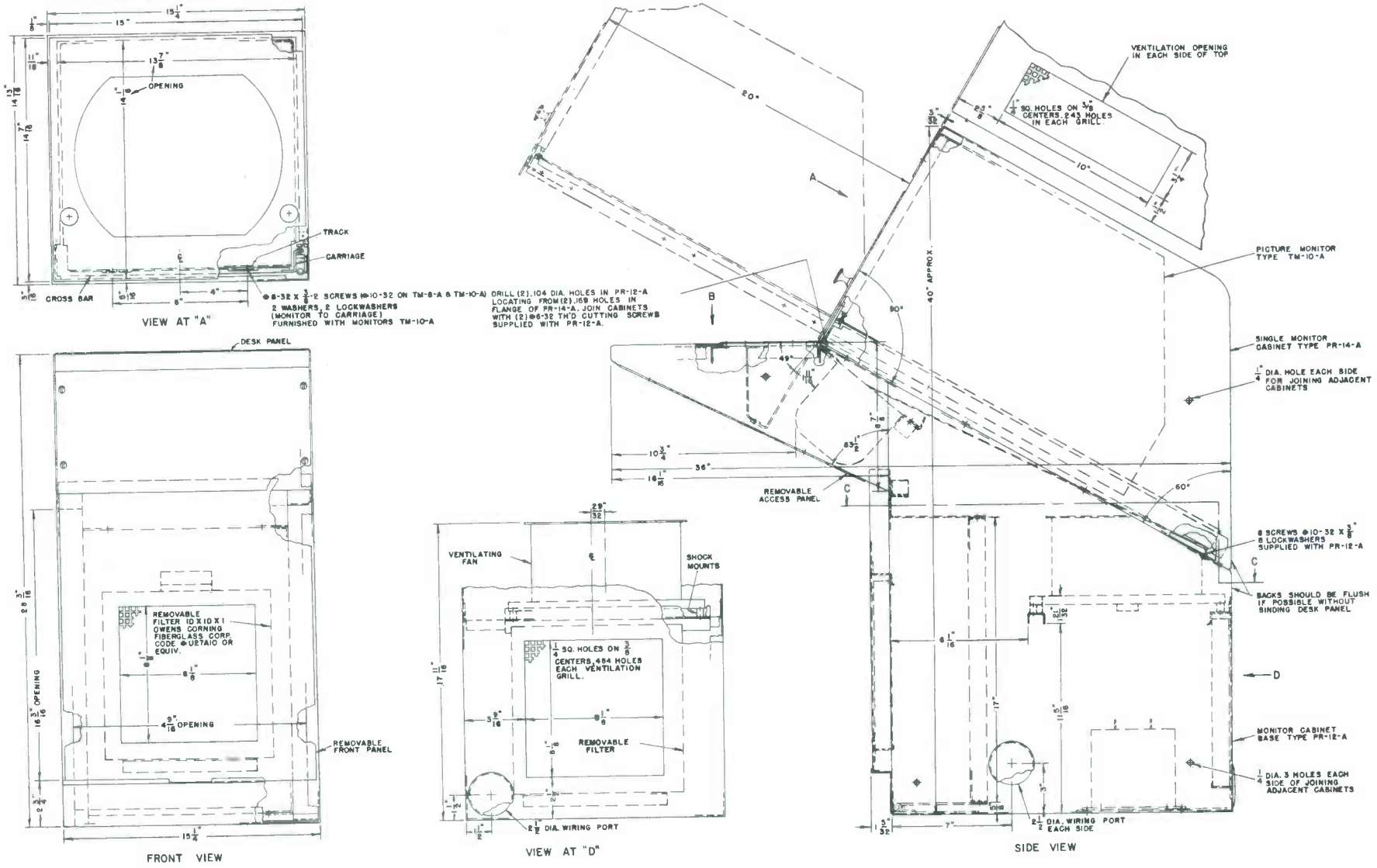
END CAPS, MODELS 4PR11A1, 4PR11B1

The End Caps are formed steel end-sections used to dress up the appearance of a Base Cabinet, Monitor Base Cabinet, a Control Console or Control Desk. They are also used as supporting sides for the Desk. 4PR11A1 is a right End Cap. 4PR11B1 is a left End Cap.



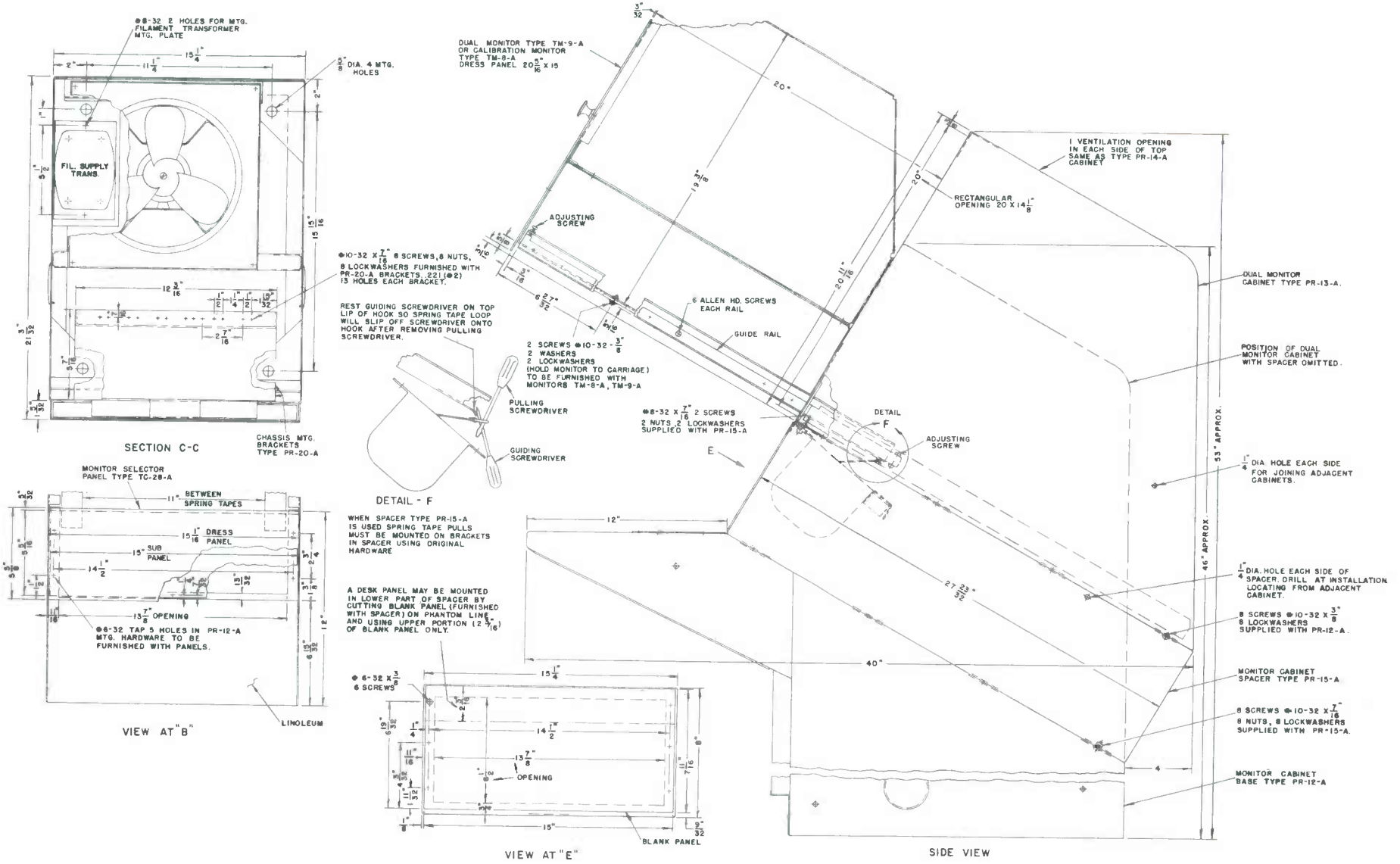
(D-7667129, Rev. 1)

Fig. 1 Cabinet Units Installation Drawing



(D-7667512, Sheet 1, Rev. 0)

Fig. 2A Cabinets, Types PR-12-A, PR-13-A, PR-14-A, PR-15-A, Outline and Clearances Drawing



(D-7667512, Sheet 2, Rev. 0)

Fig. 2B Cabinets, Types PR-12-A, PR-13-A, PR-14-A, PR-15-A, Outline and Clearances Drawing

MONITOR CABINET BASE, MODEL 4PR12A1

The Monitor Cabinet Base is a floor-mounted unit used with top cabinets, Models 4PR13A1, 4PR14A1 or 4PR15A1. The desk is linoleum covered and has an opening for mounting control panels. Both the front and rear have ventilation grilles and air-filter mounting brackets. Cable ports are located on both sides and rear. Buttons are available to close the ports not used. The bottom is also open to receive interconnection wiring. On either side are four ¼-inch holes through which several cabinets can be connected or End Caps attached. In the bottom are four ⅝-inch diameter mounting holes. The front panel and an access panel beneath the desk are both readily removable. In the center are brackets and rubber shock mounts on which is located a ventilating fan. Spring pull tapes are mounted on either side. These hook to the back end of a monitor and unwind as the monitor is lowered into position.

DUAL MONITOR TOP CABINET, MODEL 4PR13A1

The Monitor Top Cabinet is a top cabinet unit containing the slides and guides for housing a Dual Monitor or Calibration Monitor. A ventilation grille is located in the top. The unit is designed to be mounted on a Monitor Cabinet Base or on a Monitor Cabinet Spacer.

SINGLE MONITOR CABINET, MODEL 4PR14A1

The Single Monitor Cabinet is a top cabinet unit containing the slides and guides for housing a Picture Monitor. A ventilation grille is in the top. The unit is designed to be mounted on a Monitor Cabinet Base.

MONITOR CABINET SPACER, MODEL 4PR15A1

The Monitor Cabinet Spacer is an open rectangular unit designed to be located between a Monitor Base Cabinet and a Dual Monitor Cabinet. It increases the height of the Dual Monitor Cabinet by approximately 7 inches. The front contains a removable panel which can be replaced with a desk type control panel. Extra space is covered by a spacer panel.

BASE CABINET, MODEL 4PR16A1

The Base Cabinet is a flat-topped floor-mounted unit used with Top Cabinet, Model 4PR17A1. The top is partially covered with matte black linoleum. Openings are available in the uncovered part for interconnection wiring. Front and rear panels are removable. The rear panel contains ventilation grilles. Inside are angles for mounting standard-size rack chassis up to 24 inches in height. Cable ports are located on both sides and rear. The side ports line up with those in the 4PR12A1 base. Buttons are available to close the ports not used. The bottom is also open to receive interconnection wiring. On either side are ¼-inch holes through which several cabinets can be connected or End Caps attached. In the bottom corners are four ½-inch diameter mounting holes.

BASE CABINET, MODEL 4PR16B1

The 4PR16B1 Base Cabinet is similar to 4PR16A1 except that it has desk mounting space for two 5½-inch by 15 1/16-inch studio control panels. If only one control panel is used, a blank panel is available to cover the remaining space. The entire surface, except panel area, is covered with matte black linoleum. In case an 11-inch panel is used, the center supporting angle for the 5½-inch panel may be readily removed by taking out the screws.

BASE CABINET, MODEL 4PR16C1

Base Cabinet 4PR16C1 is similar to 4PR16A1 except it has no top openings, the entire surface being covered with matte black linoleum.

TOP CABINET, MODELS 4PR17A1, 4PR17A2, 4PR17A3

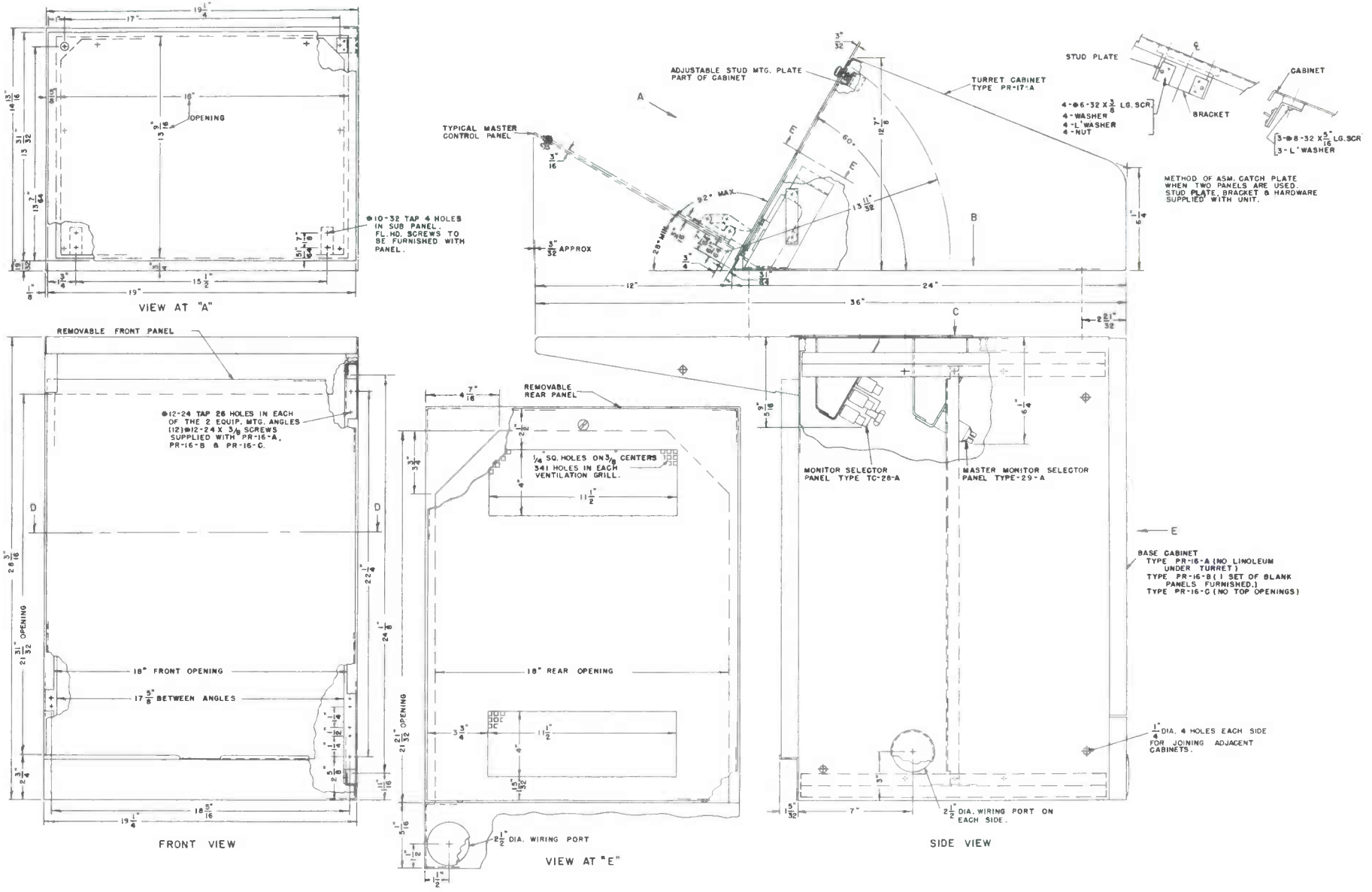
The Top Cabinet is a desk-mounted unit with a hinged front bracket for mounting audio and master control panels. The unit mounts on the Base Cabinet 4PR16A1 and is secured through four mounting holes which mate those in the Base Cabinet. The Top Cabinet base is open permitting easy access of interconnection wiring.

Model 4PR17A2 is identical with Model 4PR17A1 except that it is constructed to take a frame with a piano hinge instead of being equipped with a throw-out hinge.

Cabinet 4PR17A3 is supplied with throw-out type hinges, with additional provision for mounting panels with a piano hinge. This unit may be used in place of either the 4PR17A1 or 4PR17A2. It may be necessary to remove the throw-out hinge, when using the piano hinge, in order to meet space requirements.

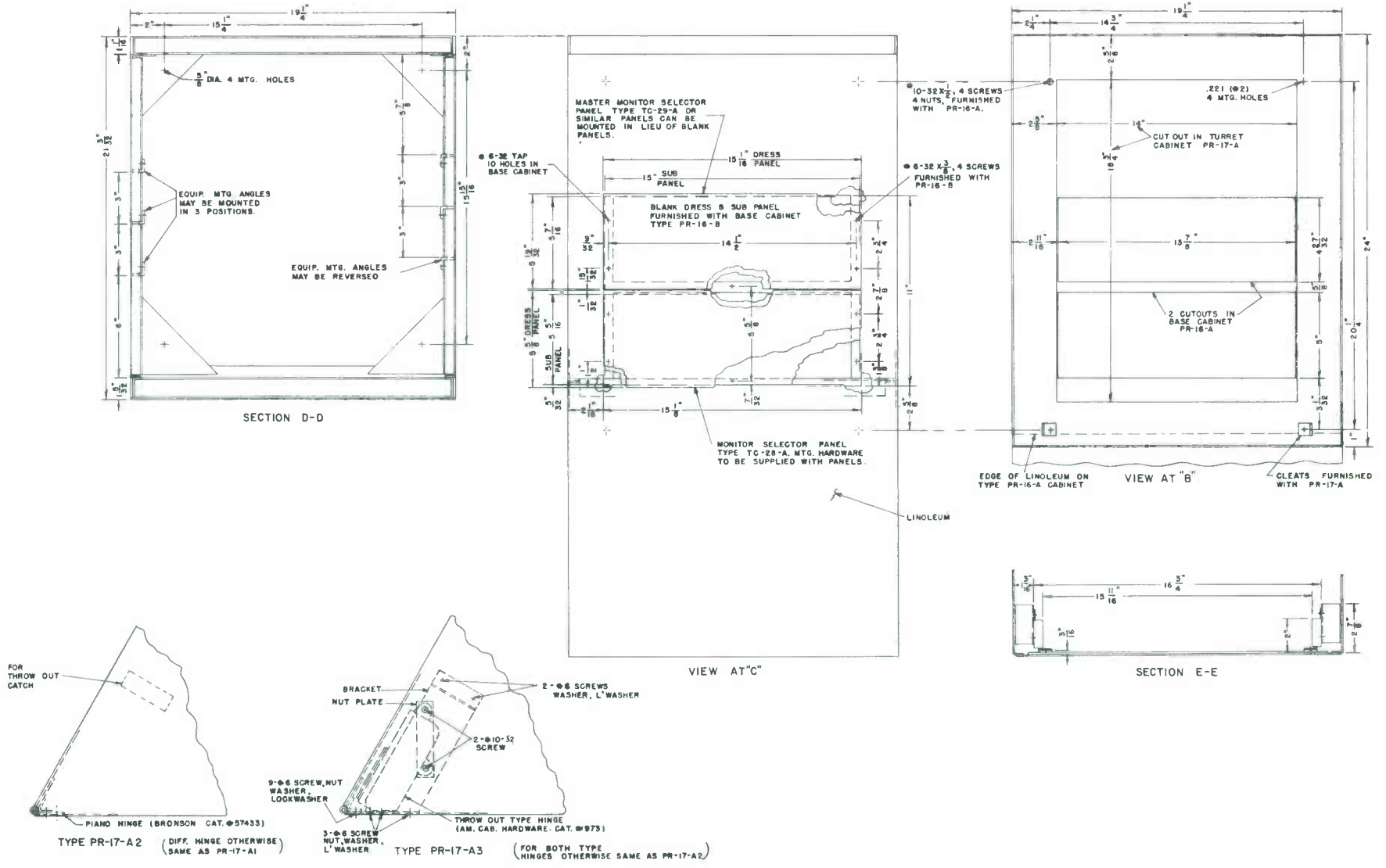
DESK, MODEL 4PR18A1

The Desk consists of a sturdy, matte black linoleum-surfaced top, supported on either end by End Caps 4PR11A1 and 4PR11B1 and enclosed by a rear panel. It can be used to support a Top Cabinet, a consolette, or other types of control equipment; or it can be used as a desk which matches the Base Cabinets, Models 4PR16A1, -B1, -C1, and the Monitor Cabinet Base, Model 4PR12A1.



(D-7667513, Sheet 1, Rev. 2)

Fig. 3A Cabinets, Types PR-17-A and PR-16-A, -B, -C, Outline and Clearances Drawing



(D-7667513, Sheet 2, Rev. 2)

Fig. 3B Cabinets, Types PR-17-A and PR-16-A, -B, -C, Outline and Clearances Drawing

PICTURE MONITOR RACK MOUNTING KIT, MODEL 4PR19A1

The kit includes a 15¾-inch panel, brackets and slides for mounting a Picture Monitor in the G-E Cabinet Rack, Type PR-1-A. See Fig. 4.

DUAL MONITOR RACK MOUNTING KIT, MODEL 4PR19B1

This kit includes a 21-inch panel, brackets and slides for mounting a Dual Monitor in the G-E Cabinet Rack, Type PR-1-A See Fig. 4.

CALIBRATION MONITOR RACK MOUNTING KIT, MODEL 4PR19C1

This kit includes a 21-inch panel, brackets and slides for mounting a Calibration Monitor in the G-E Cabinet Rack, Type PR-1-A. See Fig. 4.

CHASSIS MOUNTING BRACKET, MODEL 4PR20A1

The 4PR20A1 Mounting Bracket is a hinged bracket which can be installed inside the Base Cabinet PR-12-A. It provides convenient mounting facilities for equipments such as the TV-19-A Video Mixer used with the TC-21-A Control Panel. The bracket is hinged so that it can be swung out, permitting access to both front and rear of the chassis installed. See Fig. 5.

ASSEMBLY INSTRUCTIONS

CABINETS

See Fig. 1.

CONTROL PANELS

See Figs. 2B, 3A, and 3B.

FAN, SPRING TAPE AND FILAMENT TRANSFORMER

See Figs. 2A and 2B.

MONITORS

See Figs. 2A and 2B.

A. Before assembling monitors into cabinets, check the squareness of the monitor cabinets. If out of square, slight body pressure applied at the top corners while holding the cabinet at its junction with the PR-12-A cabinet base will usually bring the unit back into square.

B. Next, attach the spring tape pulls to the rear of monitor slide carriage. Be careful not to let the tape snap off maneuvering tools or carriage hook as the tape end loop may be bent out of position and pulled down inside the spring pull housing, thus making the unit worthless. See the instructions on Fig. 2B for the method of maneuvering the spring tape to hook on the rear of the slide carriage.

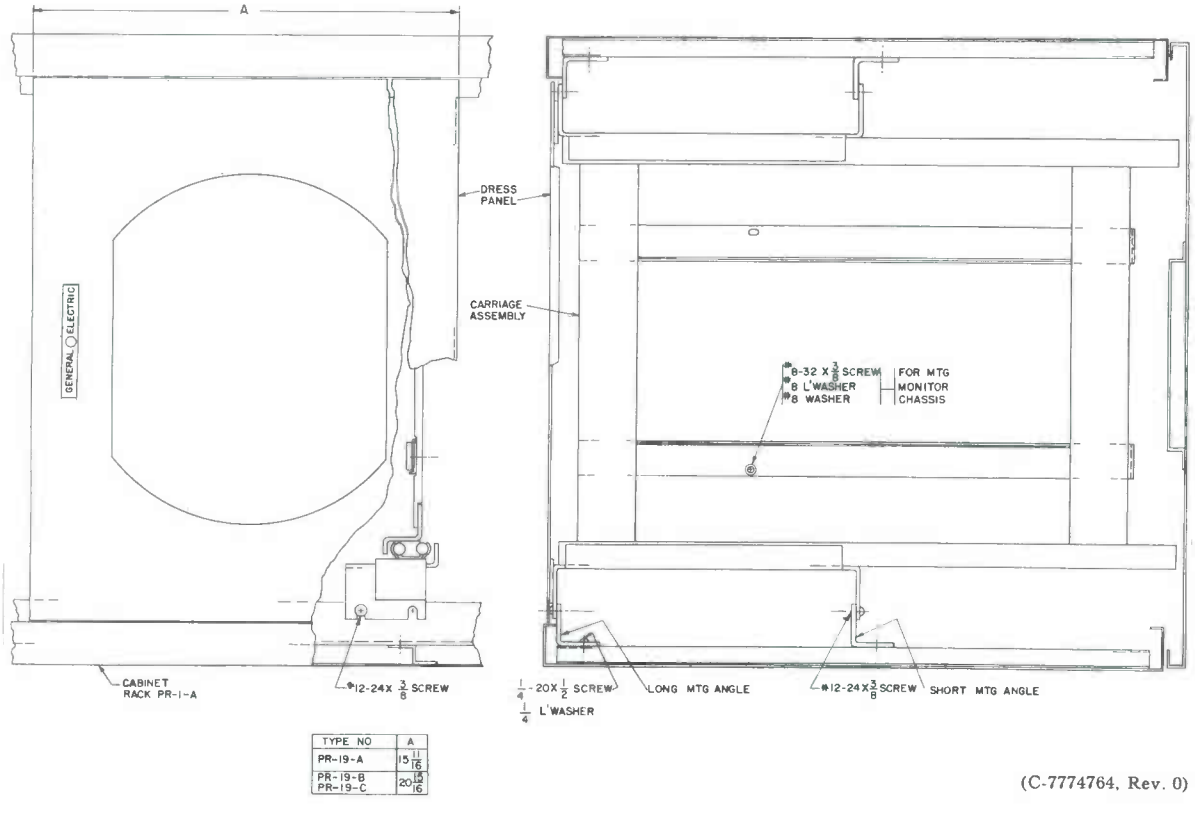


Fig. 4 Installation Drawing, Rack Mounting Kits, Types PR-19-A, PR-19-B, PR-19-C

C. Place the monitor on its slide carriage. The monitor should rest against the bent-up lips at the rear of the two center tracks. The center tracks should be adjusted (loosen four screws attaching track to carriage cross bars on under side of carriage) so that the bent-up outer side is adjacent to the outside of the monitor mounting surface. The two screws supplied with the monitor can now be used to attach it to the slide carriage tracks.

D. Monitor center position with relation to the cabinet can be adjusted by proper positioning of the two center tracks. Screws holding the center tracks to the cross bar can be loosened from the under side and the monitor slipped to proper center position.

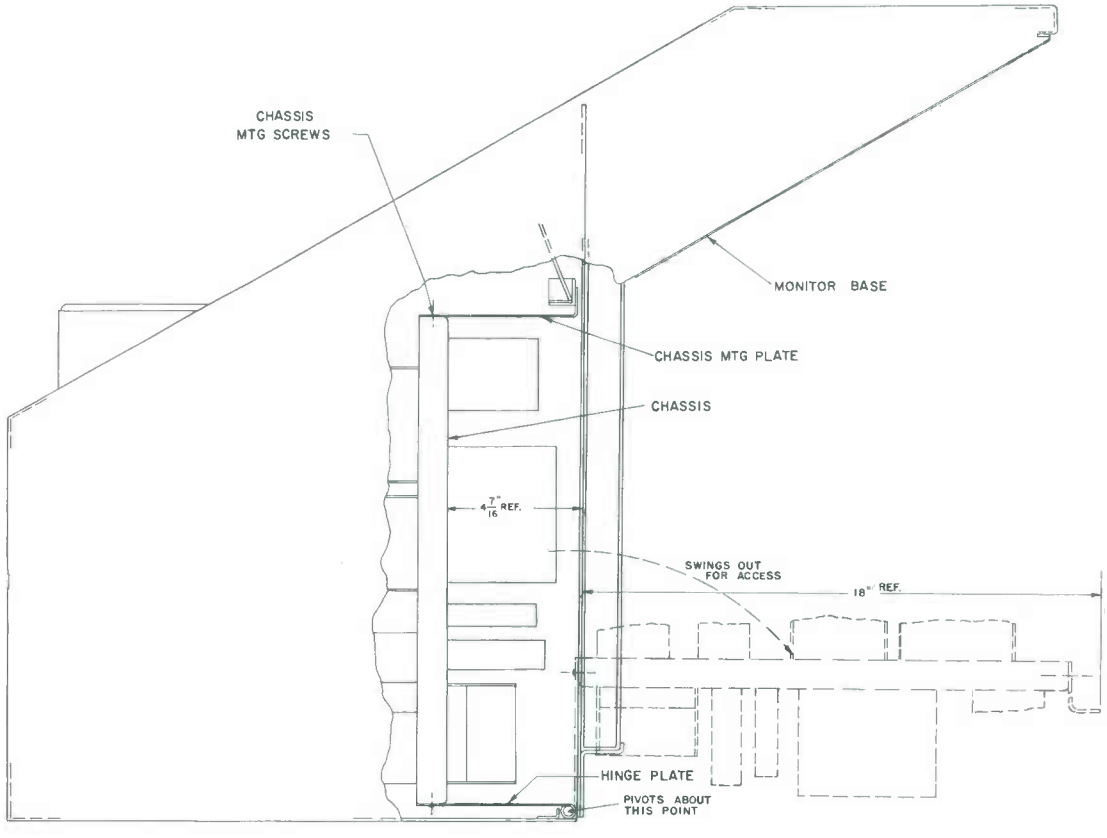
E. If the monitor panel is skewed with relation to the sides of the monitor cabinet, loosen the 12 flat Allen socket head screws in the guide rails (use the Allen wrench provided with the monitor) and turn the adjusting screws on the front and rear (at the side) of the slide carriage until correct positioning is secured. This adjustment will also correct for too high or too low a position of the monitor and for improper tilt of the monitor panel with respect to the front surface of the monitor cabinet. After making the desired adjustment, tighten the socket head Allen screws along the side of the rails.

F. Lubricate the slides of the monitors every six months with a grease-type lubricant.

PARTIAL PARTS LIST

MONITOR CABINET BASE, MODEL 4PR12A1

Balance. Pullman Mfg. Corp. Cat. No. 15-LA, with stainless steel tape.	
Blower: includes Universal motor, frame 18M1, 1/150 hp, 1550 rpm, 115 v, single phase, 50/60 cycles with composition lifetime bearings.	P-7769725-P1
Screen, blower.	PL-7139826-G1
Filter: 10″ x 10″ x 1″. Owens Corning Fiberglass Corp. Code No. U21A10.	



(C-7774765, Rev. 1)

Fig. 5 Installation Drawing, Chassis Mounting Bracket, Type PR-20-A

WHERE TO OBTAIN SERVICE

Requests for engineering service information or replacement parts not obtainable from a local dealer may be directed to the nearest office listed below or to the General Electric Company, Service Engineering, Technical Products Operation, Communication Products Department, Division Street Plant, Syracuse, N.Y.

ATLANTA	Room 517 1330 W. Peachtree St. N.W.	TRinity 5-6691
CHICAGO	478 Northwest Highway Desplanes, Illinois	CYpress 9-3369
CLEVELAND	1013 Williamson Bldg.	SUperior 1-6822
DALLAS	4447 N.Central Expressway Room 400	LAkeside 6-0426
DETROIT	700 Antoinette St. Room 417	TRinity 2-2600
KANSAS CITY, MO.	3628 West 95th St. Shawnee Mission, Kansas	MItchell 9-7131
LOS ANGELS	Suite 210, North Lake Bldg. 232 North Lake Ave. Pasadena, Calif.	SYcamore 5-1209 MUrray 1-5965
NEW YORK	2801 Graybar Bldg. 420 Lexington Ave.	PLaza 1-1311, Ext. 2663
SAN FRANCISCO	565 Broadway Redwood City, Calif.	EMerson 8-4681
SCHENECTADY	1 River Road Bldg. 33, Room 204	EXpress 3-9110
SEATTLE	2 Hanford St.	MUtual 2-8208
SYRACUSE	Service Engineering Technical Products Operation Communication Products Department Division Street Plant	GRanite 6-4411 Ext. 6357
WASHINGTON	927 Wyatt Bldg. 777 14th St. N.W.	EXecutive 3-3600, Ext. 210

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REVISIONS					SIZE		REV
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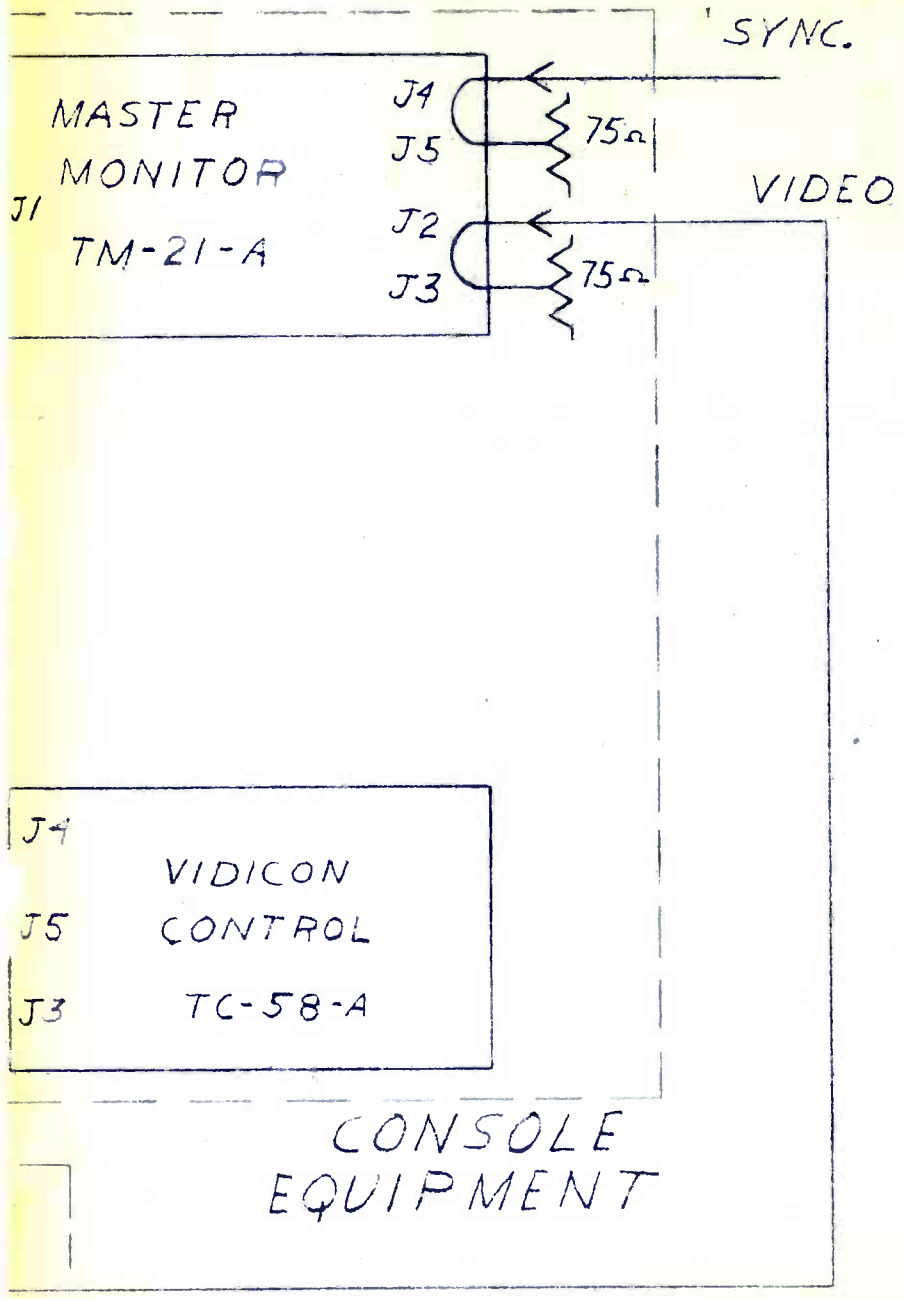

RACK MOUNTED EQUIPMENT

SIZE	7778806	REV
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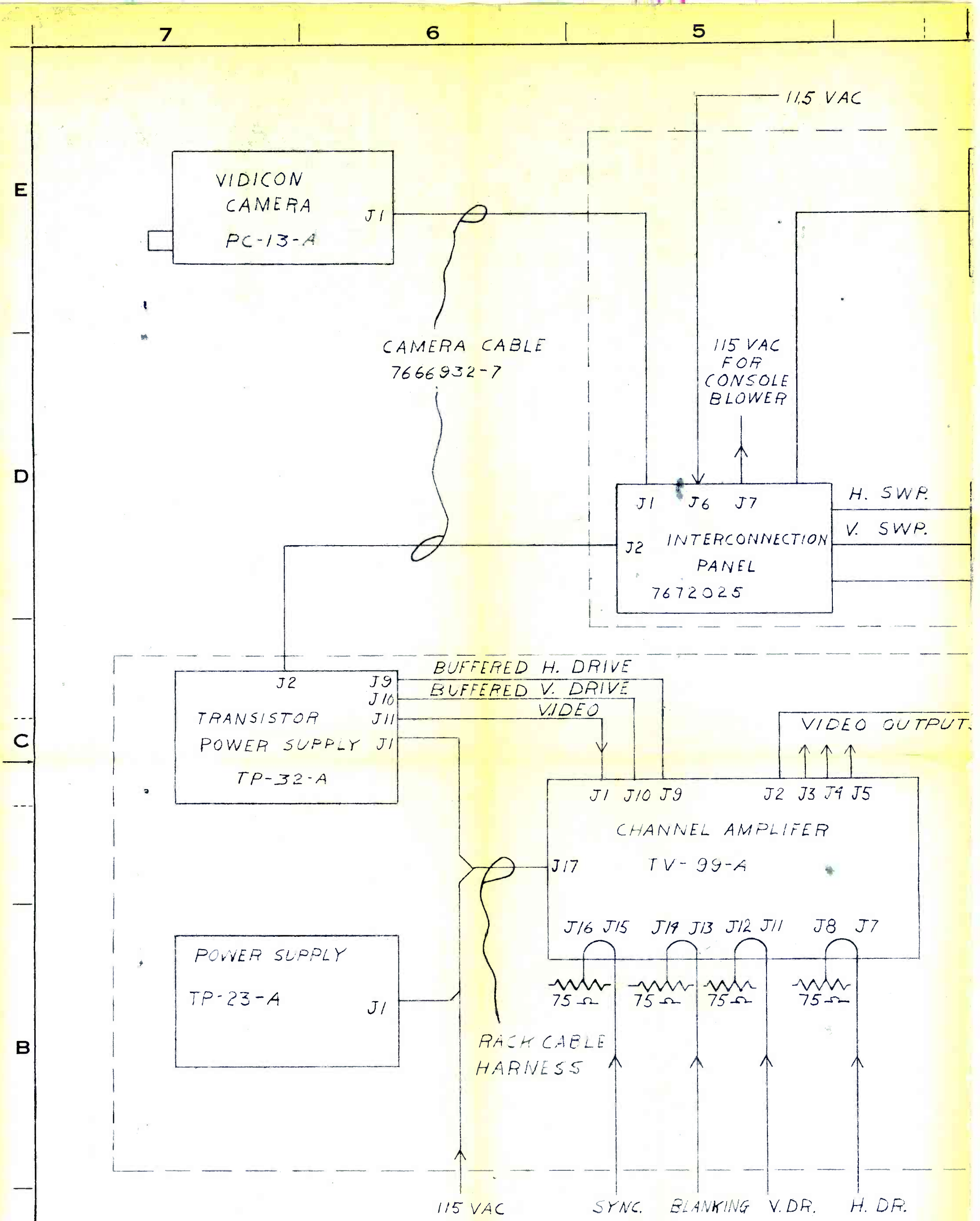
PRINTS TO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS ± DECIMALS ± ANGLES ± ALL SURFACES ✓	DRAWN K. McDonald DATE July 10, 61 APPD ISSUED	DIAGRAM, BLOCK INTERCONNECTION VIDICON FILM CAMERA CHANNEL PE-21-A	GENERAL ELECTRIC TPO/CPD DIV OR DEPT SYRACUSE LOCATION
MATERIAL GOVT. OR COM G-E	APPROVED / DATE: ENGR, MFG, MATL	SCALE	WT CALC ACTUAL
			SIZE C 7778806 CONT ON. SHEET SH NO.
			EC-3 CODE IDENT NO.



FF-754 (3-61)
PRINTED IN U. S. A.

GENERAL ELECTRIC

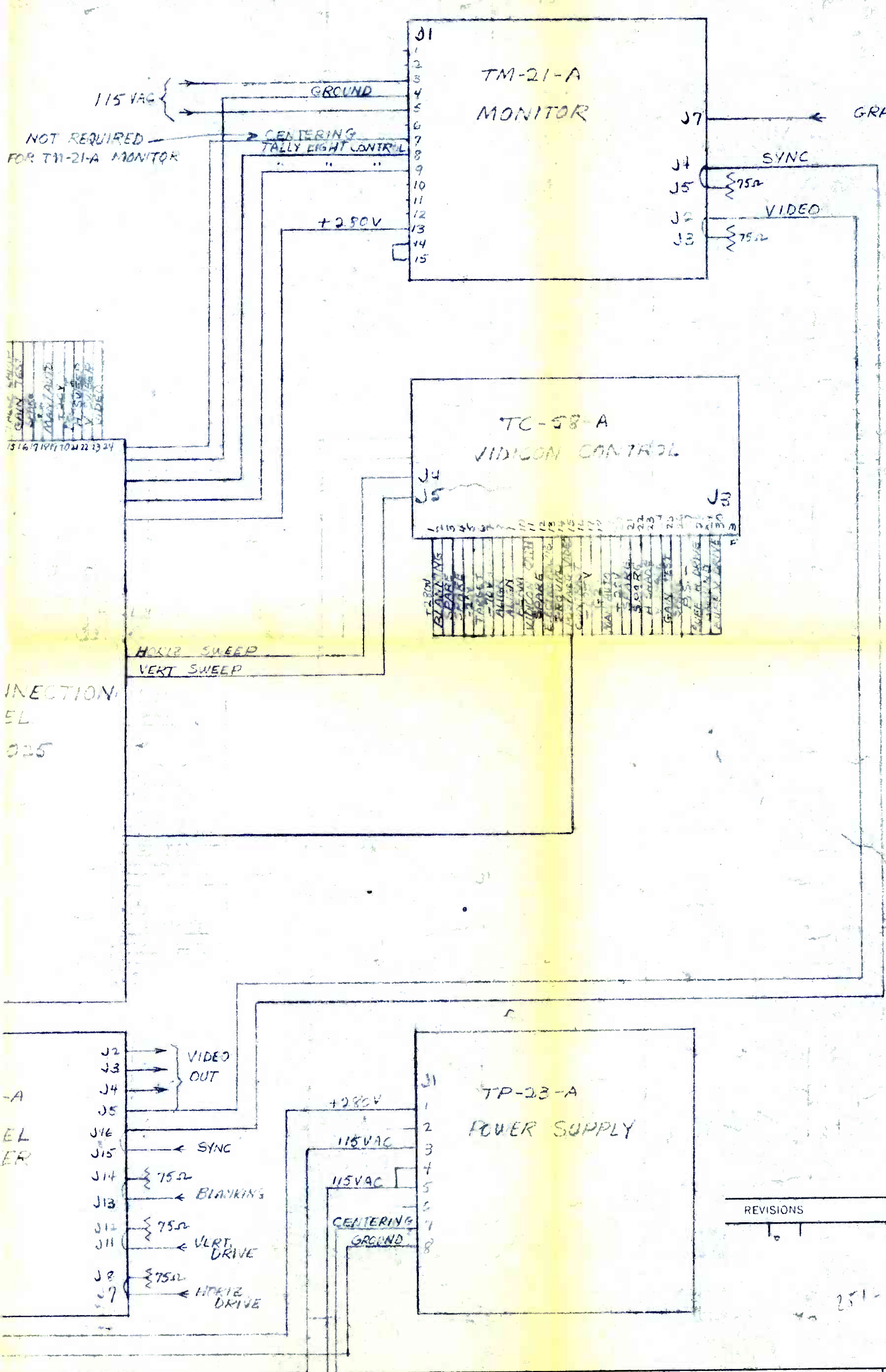
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING:

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

TITLE: INTERCONNECTION DIAGRAM
TYPE PE-21-A
VIDICON FILM CAMERA CHANNEL

FIRST MADE FOR

CONT ON SHEET — SH NO



REVISIONS

PRINTS TO

251-167

DRAWING NO. D-7672280

CONT ON SHEET — SH NO

REV NO.

MADE BY	APPROVALS	DIV OR DEPT	CONT ON SHEET	SH NO
H.H. MARTIN		BCSI SIDD-TPO		
ISSUED JULY 6, 1960		LOCATION		

FOLD