VDA

Video Distribution Amplifier

Service Manual

PESA

Document No. 80-9700-0084-2 Rev. D

Revision History

Rev.	Date	Description	By
A	09-01-75	Initial release.	Unknown
B	12-01-81	Unknown.	Unknown
C	02-28-01	Deleted Printing Specification per ECO CE00113.	GLT
D	03-12-01	Deleted bills of material, drawings, and schematics per ECO CE00130.	GLT

Equipment Warranty

PESA warrants this equipment against defective workmanship or materials for a period of one (1) year from date of shipment.

During the applicable warranty period, defective parts will be replaced at no charge for the parts. Labor to repair or replace defective parts will be performed at no charge during the warranty period at the PESA Switching Systems factory only. If possible, retain the original packing material for use in the unlikely event that your equipment must be returned to the PESA Switching Systems factory. When shipping your equipment, the shipping charges must be prepaid. The repaired unit will be returned to you freight prepaid.

This warranty does not include shipping damage, or damage caused by abuse, neglect, tampering by unauthorized personnel, damage inadvertently caused by the user, preventative maintenance, or any equipment or part thereof whose serial number has been removed or defaced.

The sole responsibility of PESA Switching Systems shall be to replace or repair in accordance with this warranty. Sellers and manufacturer's only obligation shall be to replace such quantity of the product proved to be defective.

The foregoing is in lieu of all warranties, expressed or implied, including the warranties of merchantability or fitness for purpose.

NEITHER THE SELLER NOR THE MANUFACTURER SHALL BE LIABLE FOR ANY INJURY, LOSS OR DAMAGE, DIRECT OR CONSEQUENTIAL, ARISING OUT OF OR THE INABILITY TO USE THE PRODUCT. BEFORE USING, USER SHALL DETERMINE THE SUITABILITY OF THE PRODUCT FOR HIS INTENDED USE, AND USER ASSUMES ALL RISK AND LIABILITY WHATSOEVER IN CONNECTION THEREWITH.

THIS WARRANTY IS EFFECTIVE ONLY AT THE PESA SWITCHING SYSTEMS FACTORY, HUNTSVILLE, ALABAMA, U.S.A.

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NOTE

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PESA

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LIST OF ILLUSTRATIONS

TECHNICAL SUMMARY

ELECTRICAL

Input	
Type	High impedance-bridging.
Return Loss	>40 dB, 0 - 5 MHz.
Maximum DC Offset	±25 volts.
Level	0.5 - 2.0 volts peak to peak maximum.
	1.0 volts peak to peak nominal.
Outputs (4 each per channel)	
Impedance	75 ohm, source terminated.
Isolation (at 3.58 MHz)	35 dB, same channel.
	50 dB, different channels.
Frequency Response	±.25 dB, 100 Hz - 5 MHz.
	±.5 dB, 5 MHz - 10 MHz.
	<3 dB down at 15 MHz.
Gain	±6 dB.
Low Frequency Tilt	<1% at 50 Hz.
Differential Phase	0.5° maximum.
Differential Gain	0.5% maximum.
Chrominance/Luminance Delay Error	10 nsec maximum.
Input to Output Delay	40 nsec.
Cable Equalization	1000 ft of RG59U to 10 MHz.

POWER REQUIREMENTS

105 - 135 volts, 50 - 400 Hz, 21 watts nominal.

MECHANICAL

Size	1.75 inches high by 17.0 inches wide by 9.30 inches deep. Feet provided for table top use. Mounting kit provided for a standard 19.0 inch equipment rack.
Weight	6 lbs net, 8 lbs shipping.
Connectors	BNC type.

ENVIRONMENTAL

Temperature	0 to 50°C operating.
	-55 to +85°C storage.
Relative Humidity	0 - 90%, no condensation.

GENERAL DESCRIPTION

GENERAL

The 3M Brand Video Distribution Amplifier, Stock No. 80-9700-0074-3, is designed to provide a highly stable means of distributing any wide band video signal. The housing contains three independent amplifier circuits. Each circuit has its own high impedance, bridging (loop thru) inputs and four isolated, 75 ohm outputs. Separate cable equalization and level controls are provided on the front panel for each channel. The unit is all solid state and except for the power supply transformer and regulators, is contained on one printed circuit board. The housing is designed to fit a standard 19 inch equipment rack or operate as a desk top unit.

BACKGROUND

The distribution of a video signal within a television system is usually accomplished by looping the signal from one piece of equipment to another. The signal line is then terminated at the last piece of equipment connected to it, see figure 2. The main disadvantage of this method is the signal distortions caused by the capacitive buildup as several pieces of equipment are connected together. The input capacitance of each piece of equipment tends to add together with the capacitance within the connecting cables. This buildup attenuates the high frequency portion of the video signal and causes a mismatch in the termination which can cause reflections on the signal line.

Also with this method of signal distribution any disturbance on this one line will disrupt all of the equipment.

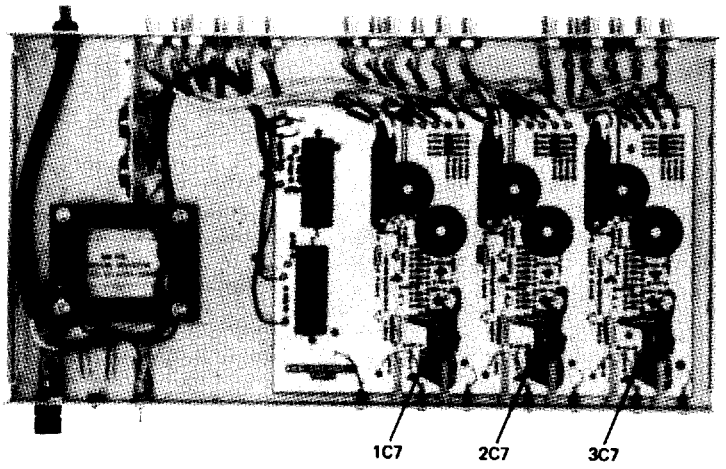


Figure 1. Top View, Video Distribution Amplifier

USING A VIDEO DISTRIBUTION AMPLIFIER

The video distribution amplifier (D.A.) is the basic building block of a television system. It serves primarily to provide isolation and secondarily to provide the operator a measure of control over both signal level and quality, see figure 3. Each channel has built-in circuitry and front panel controls to adjust the output level and the frequency response (cable equalization) to maintain signal quality throughout a complete television system.

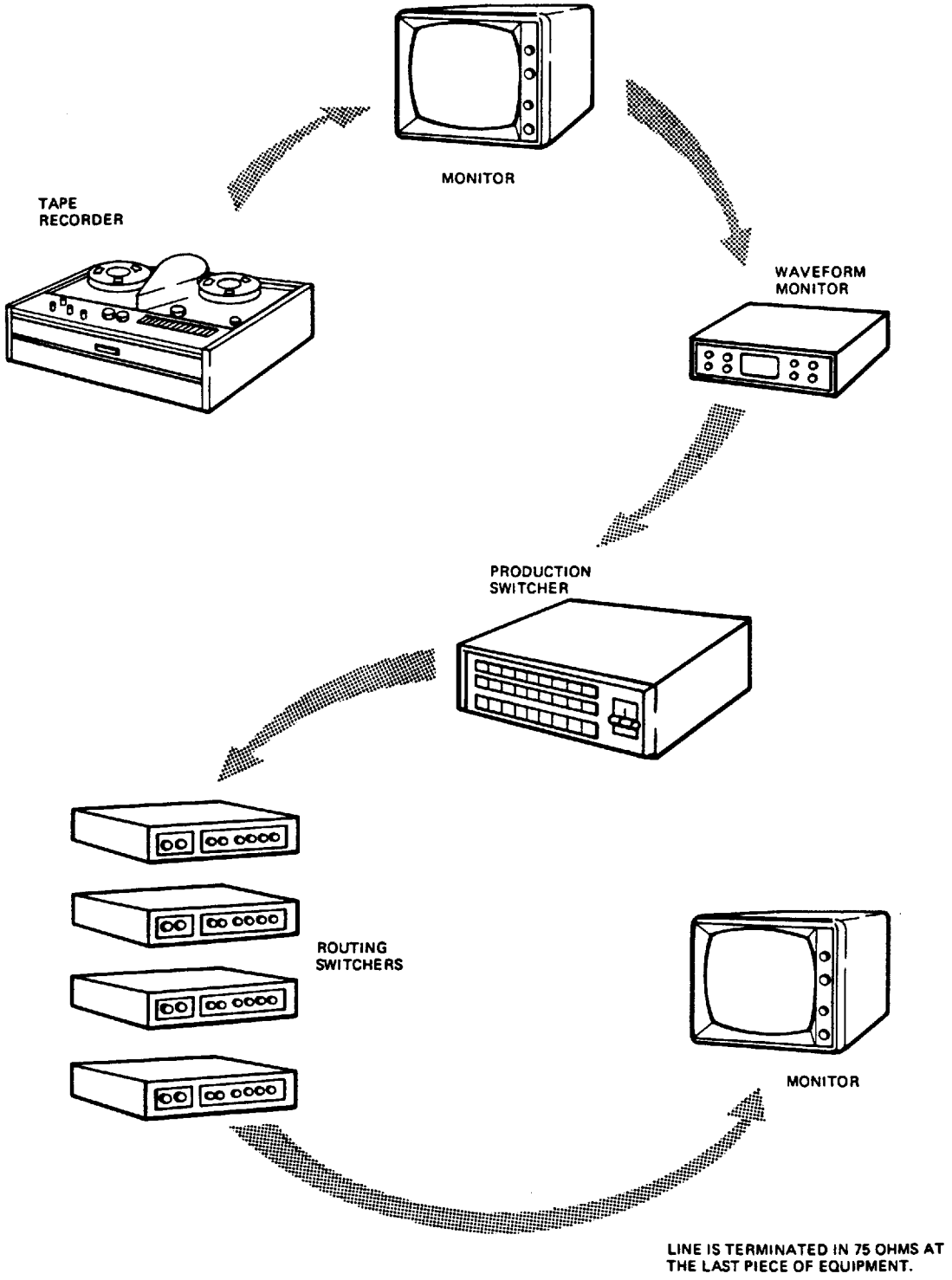


Figure 2. Video Signal Looping

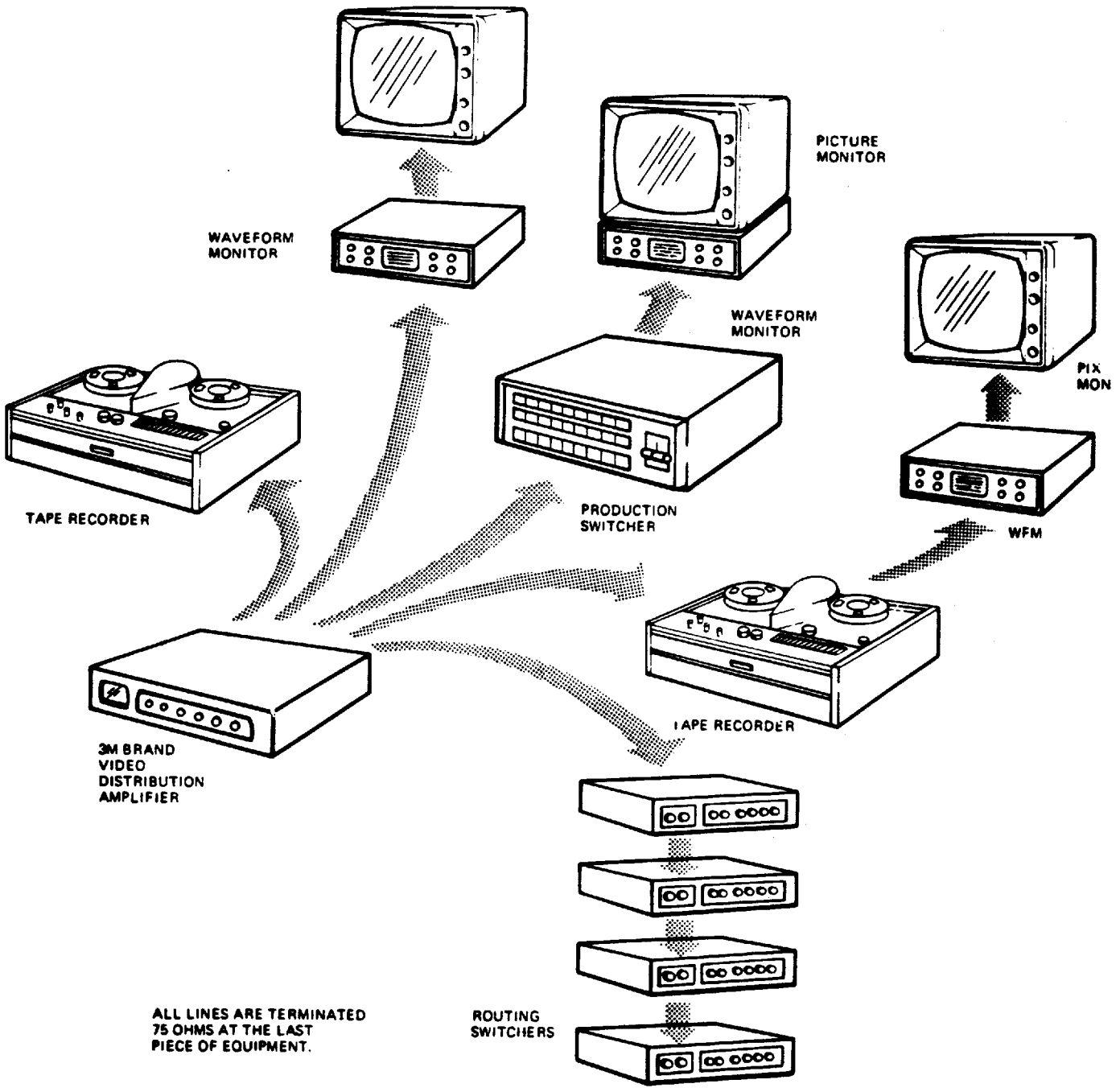


Figure 3. Video Distribution Amplifier, Signal Connections

The length of a cable run, the type of cable and the equipment connected to it will all effect the signal. The system should be planned out such that any equipment that is to be looped together is in the same vicinity. The best case would be where the cables connecting looping inputs are no more than a few feet long. Select the component values from figure 4 for the type and length of cable to be used with each channel. After installation, monitor the signal at the termination of each line and adjust the controls for a flat frequency response and the correct level. To maintain the best signal to noise ratio, it is better to put the D.A. on the sending end of a long cable run rather than on the end where the signal is terminated.

	100 ft	200	300	400	500	600	700	800	900	1000 ft
RG-59										
C8	15	15	15	18	20	18	15	18	24	30
C9	75	68	68	68	68	68	68	91	180	300
R19	13K	15K	13K	16K	12K	12K	11K	9.1K	7.5K	6.8K
R20	4.3K	2.7K	3.0K	3.3K	3.3K	3.3K	3.0K	3.0K	3.6K	6.2K
RG-11										
C8	30	30	30	30	30	30	30	30	30	30
C9	100	100	100	100	100	100	100	100	100	100
R19	10K	10K	7.5K	7.5K	7.5K	7.5K	7.5K	7.5K	7.5K	6.8K
R20	2.4K	2.4K	2.4K	2.4K	2.4K	2.4K	2.4K	2.4K	2.4K	2.2K
8281										
C8	20	24	24	24	24	24	24	24	24	24
C9	68	68	68	68	68	68	68	68	82	82
R19	11K	10K	7.5K	6.8K	6.2K	6.2K	6.2K	6.2K	6.2K	6.2K
R20	2.7K	2.4K	2.2K	2.2K	2.2K	2.2K	2.0K	2.0K	2.0K	2.0K
8221										
C8	15	15	18	18	20	27	36	36	36	36
C9	150	220	250	300	300	300	300	180	200	200
R19	18K	16K	16K	16K	18K	18K	18K	18K	18K	18K
R20	7.5K	5.6K	5.1K	4.7K	4.3K	5.6K	5.6K	4.7K	4.3K	4.7K

NOTES:

RESISTOR VALUES ARE IN OHMS, ±2%, 1/4 WATT.

CAPACITOR VALUES ARE IN PICOFARADS, 5%.

Figure 4. Cable Equalization, Component Selection

RECEIPT INSPECTION

The Video Distribution Amplifier was inspected, tested and adjusted before leaving the factory. Upon receipt, inspect the unit for any shipping damage. If any damage is detected, notify the carrier immediately. If everything is normal, proceed with the installation and checkout.

LOCATION

The unit does not require forced air cooling; however, sufficient space must be allowed around it for the free circulation of air. It should not be installed where the temperature will exceed 50°C. Hardware is provided so that the unit may be mounted as needed.

RACK MOUNTING

The unit can be rack mounted in a standard 19" equipment rack. Remove the two (2) screws near the front panel, one on each side. With the four (4) screws provided with the mounting hardware, mount the two (2) rack ears. Sufficient space must be allowed behind the unit for the coaxial cables.

DESK TOP MOUNTING

Four (4) rubber feet are provided if the unit is to be used in a desk top configuration. They can be easily installed by removing the protective paper covering and pressing them against the bottom of the unit, in the four corners.

INTERFACE

The video D.A. can be used anywhere the need exists for distributing 75 ohm, source terminated video signal. The unit is intended for use with 1.0 vpp terminated signals and, as such, should not be used with 4.0 vpp sync or 2.0 vpp subcarrier type signals.

The D.A. is shipped from the factory with the components in the cable equalization circuit selected to give a flat frequency response for approximately 500 feet of RG-59 coax cable. If a different type of cable is used, or a greatly different length of cable, refer to figure 4 and change the values, as indicated, to give the front panel control sufficient range to maintain a flat response. Each channel should be adjusted as needed due to the different requirements for each signal line.

If additional signal distribution is received, one or more of the 3M Brand Distribution Amplifiers can be installed to make up a complete system.

The following units are available:

Pulse Distribution Amplifier
Stock No. 80-9700-0072-7

Subcarrier Distribution Amplifier
Stock No. 80-9700-0073-5

ELECTRICAL CONNECTIONS

The BNC connectors on the rear panel provide four (4) separate sources for each signal. Each is driven by a 75 ohm, source terminated line driver to prevent any crosstalk or interaction. Make connections as needed, terminating the line in 75 ohms at the last piece of equipment. The unused outputs need not be terminated.

POWER CONNECTIONS

The unit is shipped with a built-in three wire power cord with a grounding plug. For safety, the unit should only be used with a 115 VAC outlet with a ground connection.

OPERATION

GENERAL

The 3M Brand Video Distribution Amplifier functions whenever power is applied and requires no attention by the operator. During initial operation, or if it is necessary to verify performance specs, the outputs should be checked to ensure that they are present and correct. If any outputs are not correct, refer to the Maintenance Section for troubleshooting aid.

POWER SWITCH

Power is controlled by a toggle switch, located at the left-hand edge of the front panel. To turn the power on, place this switch in the up position. The red indicator light should come on. The unit is designed for stability and minimum current drain so that the power may be left on continuously, except for maintenance and test purposes.

OUTPUT LEVEL

The output level for each of the three (3) separate channels is controlled by the front panel controls, see figure 1.

CABLE EQUALIZATION

The amount of high frequency peaking added to the signal is adjusted through the front panel for each channel. Insure that the correct components have been installed to center the range of the front panel control, see figure 4 and the Interface portion of this manual.

GENERAL

The Video Distribution Amplifier is designed and manufactured to produce a very stable instrument that requires no scheduled maintenance. If there is no output, or if the output is incorrect, refer to the Troubleshooting section. Reference designations in each channel will be prefixed by a channel designator, i.e., R3 in channel 1 will appear on the printed circuit board as 1R3.

TROUBLESHOOTING

If a malfunction of the unit is suspected, first insure that the input power line voltage is correct. The problems most likely to be encountered are presented in figure 5.

The best troubleshooting tool, however, is a familiarity with the equipment and a thorough understanding of its operation.

The waveforms provided in this section illustrate the dynamic circuit conditions when the unit is operating correctly. These waveforms, when compared with those of a malfunctioning unit will help isolate the problem to a particular area. The faulty component may then be determined by conventional circuit analysis techniques.

REPLACEMENT PARTS

Only parts of the highest quality have been used in the design and manufacture of the Video D.A.. If the inherent stability and reliability are to be maintained, replacement parts must be of the same quality. A complete replacement parts list is included in this manual. When replacing parts, avoid excessive solder on the printed circuit board. Always make sure the solder does not short two circuits together. It is good practice to use a solder removal device when removing components from the printed circuit board. Be sure the replacement part is identical to the original, and is placed in exactly the same position with the same lead lengths.

CAUTION

MOS devices, such as Q1, are subject to damage by electrostatic discharge. Insure that all tools and persons handling this devise are properly grounded.

Parts for this equipment may be ordered through the 3M Sales and Service Office listed in the front of this manual. Price and delivery information on parts or complete instruments may also be obtained from the Sales and Service Office. It is recommended that whenever possible, and particularly when an instrument is used in a critical application, the user maintain a minimum stock of spare parts.

When ordering parts, the following information should be included:

A. Description of the part, obtained from the parts list.

B. The BRPD Catalog Number, also on the parts list.

C. The schematic reference designator, given on the applicable schematic and on the parts list.

D. The part or type number of the major assembly as shown on the name plate, and the serial number of that assembly.

FACTORY SERVICE

If necessary, units or major assemblies may be returned to the factory for repair or alignment. When a unit or assembly is returned:

a. Repair and alignment of equipment under warranty will be started soon as a unit is received.

b. For out of warranty repair, there is a flat fee service charge for Video Products. This fee can be obtained by calling or writing BRPD Technical Service. The flat fee includes: (a) labor, (b) parts except glass delay lines and disc drive units, and (c) prepaid return shipment (best way) to the customer. If a customer desires special shipment, it will be made at the customer's expense.

c. A purchase order number should be shipped with the equipment so that work can start immediately. Work will not start without a purchase order.

d. Indicate the symptom or defect. State as completely as possible, on a note attached to the unit and on the order from the nature of the problem encountered. Too much information is better than too little if the problem is intermit-

tent, be specific in describing the performance history of the unit.

e. Give special instructions such as any modifications made to the unit, and if it is desired to retain the modifications.

f. Pack securely and label. Proper packaging saves money. The small amount of extra care and time it takes to cushion a unit or assembly properly may prevent costly damage while in transit. Make certain that the address is both legible and complete; failure to do so often results in needless delay. Address all shipments and correspondence to:

BRPD, 3M CO.
2102A West Ferry Way
Huntsville, AL 35801
Atten: Technical Service Dept.

g. Show a return address on all correspondence. Please indicate clearly the exact address the equipment should be returned to after repair is completed. All shipping costs will be borne by the owner of the equipment, not by this company.

h. If a problem can be corrected by telephone, call Mincom Division Technical Service (612) 733-8145 and request assistance from the Video Service Department.

ALIGNMENT PROCEDURE

This alignment procedure is only required if it becomes necessary to replace Q5. It requires the use of a sweep generator and an oscilloscope that has a flat response to 20 MHz.

1. Connect the output of a sweep generator (0-20 MHz) at 1.0 vpp to the input connector and terminate the output in 75 ohms.

2. Observe the output signal on an oscilloscope and set the front panel equalizer control fully counter clockwise.

3. Adjust C7 for a flat response from 0 to 10 MH. Also insure that the response is less then 3 db down at 15 MHz.

THIS COMPLETES THE ALIGNMENT PROCEDURE

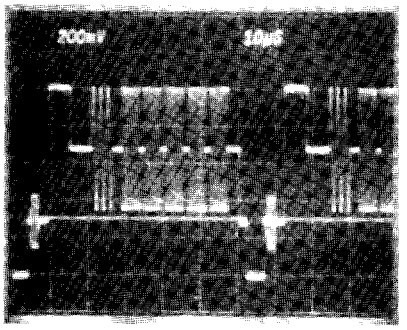
PROBLEM	PROBABLE CAUSE	REMEDY
No output from power supply. Indicator light not on.	Power cord not plugged into receptacle	Connect to a properly rated receptacle.
	Defective fuse	Replace.
	Defective power transformer	Replace.
Power supply voltage(s) incorrect.	Short	Locate with an ohmmeter.
	U1, U2 defective	Replace.
EQ. control will not adjust to a flat freq. response.	C8, C9, R19, R20 value incorrect	See figure 4 and installation section.
	Q7 set incorrectly	See alignment section.
Output signal inverted.	Q3, Q5, Q7, Q8 defective	Replace.

Figure 5. Troubleshooting Guide

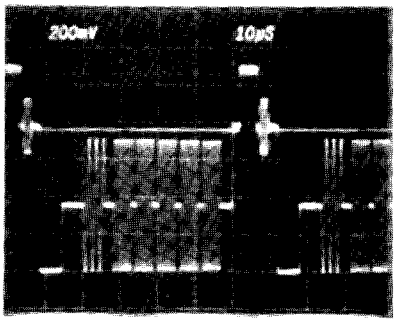
WAVEFORMS

The waveform numbers correspond to the circled numbers on the schematic diagram that illustrate where the particular waveform appears in the circuitry.

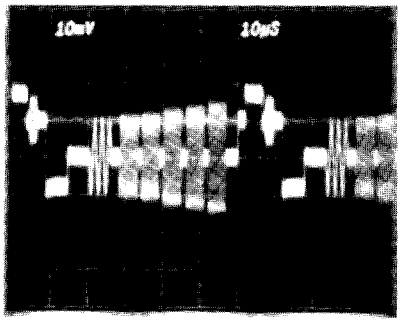
The oscilloscope is set for EXT. NEG. TRIGGER. The source is sync that is in time with the input signal.



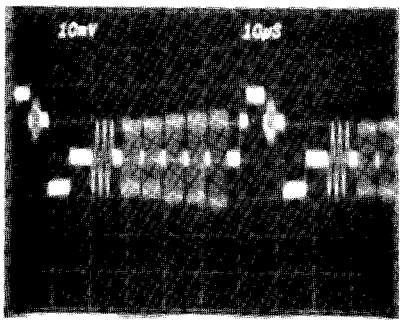
1. TPI, INPUT



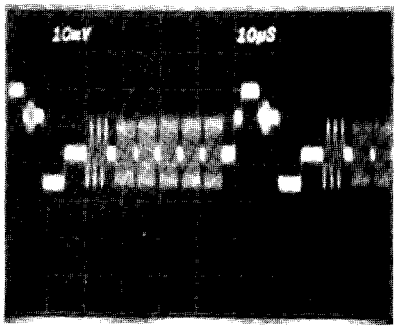
2. COLLECTOR, Q3



3. R18, CW

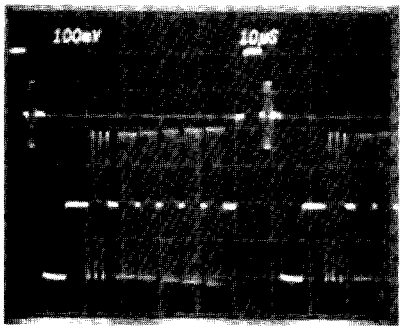


4. R18, CENTER

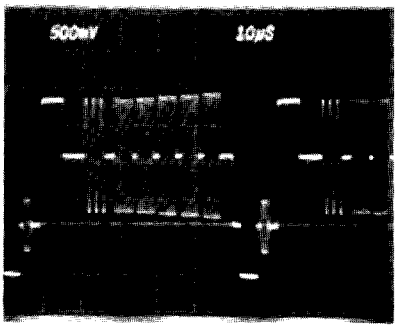


5. R18, CCW

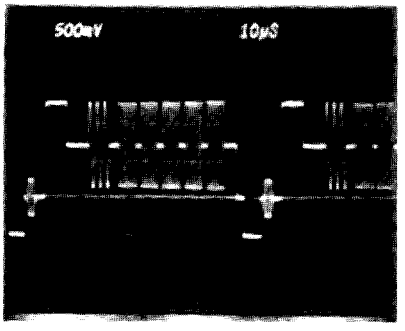
6. COLLECTOR, Q5



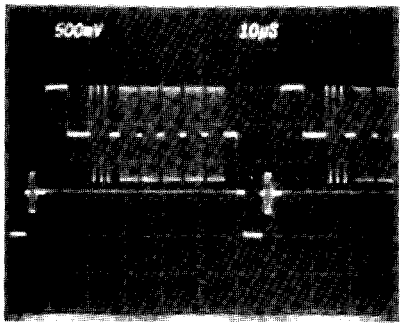
7. COLLECTOR, Q7



8. COLLECTOR, Q8



9. JUNCTION, R48-R49



10. TP2, OUTPUT

GENERAL

For the purpose of this description, the unit has been broken down into five (5) major sections. They are the Input Buffer, Amplifier, Cable Equalization, Feedback Amplifier and Line Driver. Only one channel will be described as they are all similar in operation.

INPUT BUFFER

Capacitor C1 provides DC isolation for the input stage. Q1, connected as a source follower, with its very high input impedance allows the use of bridging connectors on the input. Emitter follower, Q2, prevents only loading of the input FET while providing a low output impedance and sufficient current to drive the amplifier section.

AMPLIFIER

The signal from the input buffer stage is amplified and inverted by Q3. R11, R12 and C3 set the gain of the stage at approximately unity and provide low frequency tilt correction. R14 adjusts the level of the signal fed to emitter follower Q4, and so, sets the gain through the channel.

CABLE EQUALIZATION

The front panel control, R18, along with C5, C8, C9, R19 and R20 form a frequency selective band pass filter. R18 is the main path for the low frequency, or luminance, signal, while R18 and C5 in parallel make up the main signal path for the high frequencies. Each type of coax cable in common use today has marked differences in both high frequency roll off and over all signal attenuation. To allow the distribution amplifier to maintain a flat response the filter components must be selected to center the adjustable control. Any slight variations can then be corrected using the front panel control R18. Figure 4 gives the component values for R19, R20, C8 and C9 for the different types and lengths of the most commonly used cables. Above 10 MHz the stray capacity of the circuits tends to cause a high frequency roll off of approximately 3 db per octive.

The unit is shipped from the factory with the filter components selected to give a flat response for approximately 500 feet of RG-59 coax cable.

FEEDBACK AMPLIFIER

The output of the cable equalization filter is a high gain, approximately 40 db, amplifier. C4 provides DC isolation for the input stage Q5. Q6, connected to the emitter of Q5, provides temperature stability and low drift for the DC coupled stages. Q7 and Q8 are inverting amplifiers and Q9 is the output buffer feeding the signal to the output line driver. Feedback, from the output stage, is coupled back to Q5 through R22. C7 is adjusted for the high frequency characteristics of Q5. C6 and R21 provide a high phase-gain stability margin.

LINE DRIVER

The signal from the buffer, Q9, is coupled to the line driver made up of Q10, Q11, Q12 and Q13. This is a complementary symmetery amplifier which provides unity gain with a low output impedance. This type of amplifier operates in the Class AB mode to reduce idle current and still produce a 2.0 vpp terminated output signal if required.

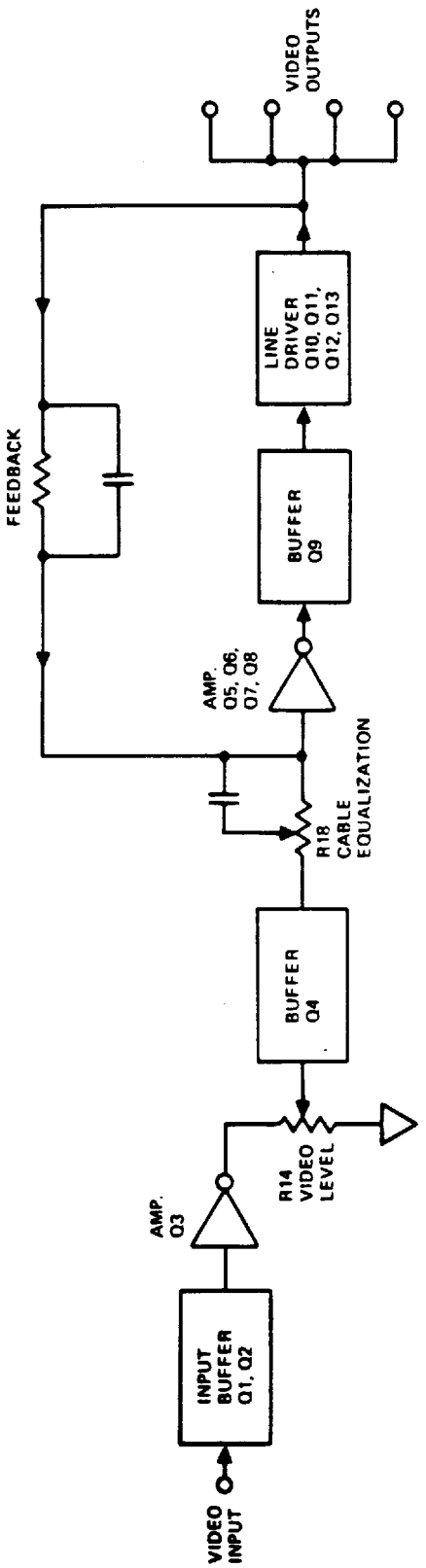


Figure 6. Block Diagram