

WAVEFORM OSCILLOSCOPE MODIFIED KS-19763, L1A DESCRIPTION, OPERATION, AND MAINTENANCE

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1. GENERAL

1.01 This section contains a general description, method of operation, and the maintenance procedures for the KS-19763, L1A waveform oscilloscope modified for PICTUREPHONE® use. The oscilloscope, which is shown in Fig. 1, is intended for use as a part of the 15A test desk,

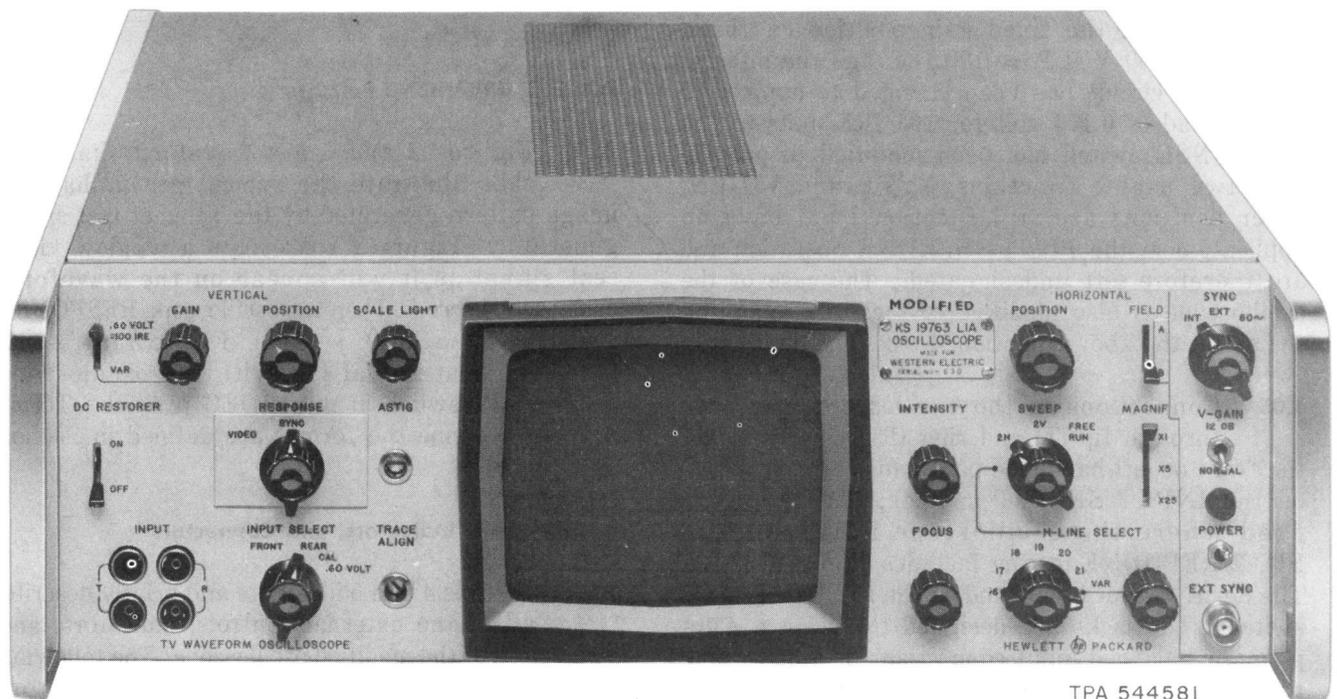


Fig. 1—KS-19763, L1A Oscilloscope Modified for PICTUREPHONE Use

the 23A testboard, or the wideband mobile test bay (WBMTB) used for maintenance of PICTUREPHONE trunks and loops. It may also be used as a portable set for testing PICTUREPHONE facilities on customer premises.

1.02 This section is reissued to change the input voltage corresponding to 100 IRE units on the oscilloscope graticule.

1.03 The oscilloscope is a precision instrument which is capable of measuring video signals with an accuracy of ± 1 percent. The oscilloscope has a high impedance and is intended to be used in a bridged manner, across the circuit under test, or across a termination or other test equipment. The accuracy applies only if the impedance which it bridges is 100 ohms within the frequency of the test signals being used. The test equipment provided in the above mentioned testing facilities meets this requirement. Hence simultaneous measurements can be made with the oscilloscope and other receiving measuring equipment provided.

1.04 The modification of the KS-19763, L1A oscilloscope includes changes in the sweep circuits to provide for viewing PICTUREPHONE video signals having the MOD II C format and changes in the filters to provide deemphasis. ♦The designation of the fixed gain position has been changed to .60 VOLT = 100 IRE and the internal calibrating circuit has been changed to apply 0.60 volt instead of 0.174 volt for 100 IRE units.♦ The RESPONSE switch has been modified to provide only two usable functions, SYNC and VIDEO; other positions are still functional but have no application in the PICTUREPHONE operation and are therefore left undesignated. The case of the oscilloscope is also modified to facilitate mounting the set in the above mentioned test facilities.

1.05 Connections to the oscilloscope are made through tip (T) and ring (R) jacks on either the front or left-hand side panels (designated REAR on the INPUT SELECT switch). The latter are used where the oscilloscope is mounted in PICTUREPHONE testing facilities discussed above. The desired input is selected by the INPUT SELECT switch. The jacks are designed to accept a 408A plug for balanced input connections or a 358A plug for unbalanced input connections. However, only balanced connections are used in PICTUREPHONE maintenance.

1.06 Although the oscilloscope can be operated from either a 115- or a 230-Vac supply, it is always operated from 115 Vac when used in the facilities noted in 1.01. The oscilloscope is wired at the factory for 115-volt operation. A 1.0-amp slow-blow fuse is used to protect the set.

Warning: *To protect operating personnel from possible electrical shock, the oscilloscope case is connected to source ground through the ground lead in the 3-conductor power cable. The oscilloscope should never be operated in an ungrounded condition.*

1.07 The oscilloscope is approximately 17 inches deep, 21 inches wide, 5-1/2 inches high, and weighs about 34 pounds. The oscilloscope should be operated in an ambient temperature range of 32°F to 122°F. Forced air ventilation may be necessary to achieve this when the instrument is mounted in an enclosed rack or cabinet. The facilities noted in 1.01 provide such ventilation.

1.08 This section covers the features of the modified KS-19763, L1A oscilloscope used in PICTUREPHONE maintenance. For a more detailed description of the oscilloscope, reference should be made to the manufacturer's Operating and Service Manual that is supplied with the oscilloscope.

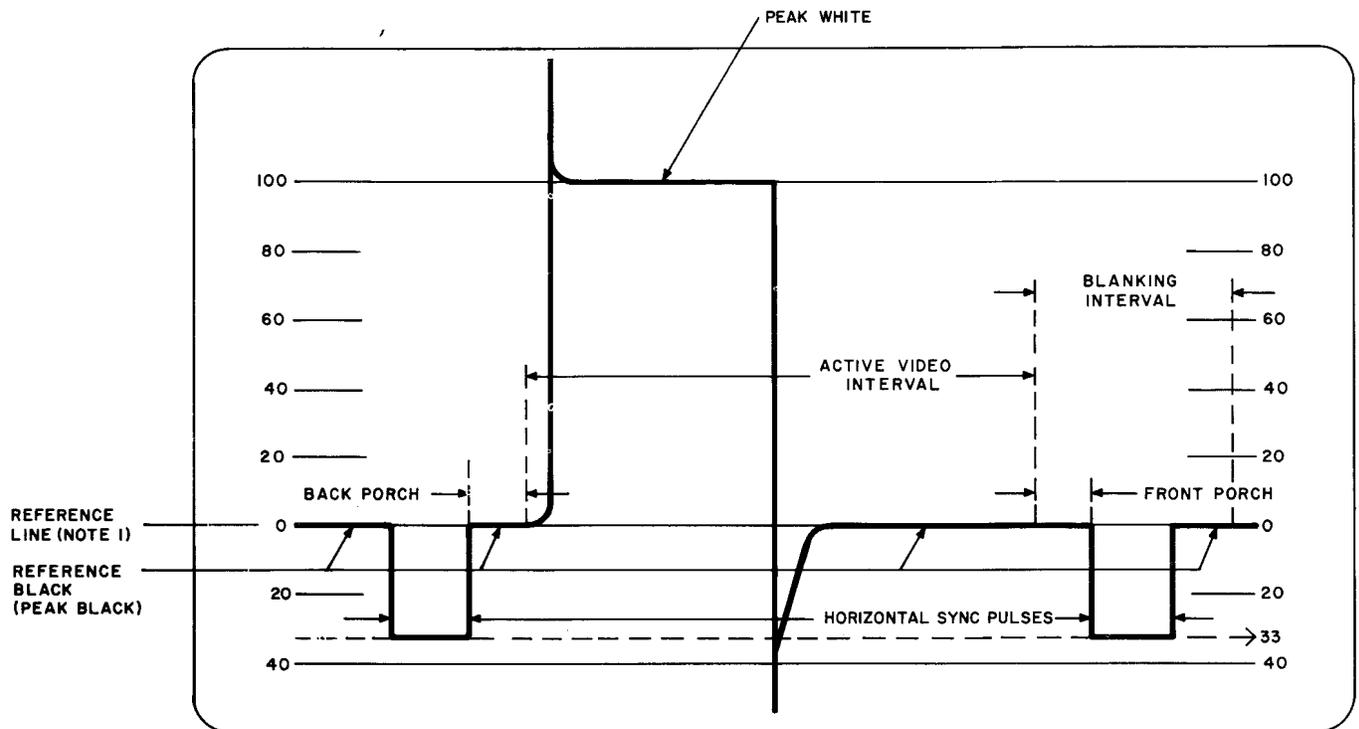
2. OPERATION

A. PICTUREPHONE Formats

2.01 Figures 2 and 3 are waveform diagrams that illustrate the typical preemphasized image pattern generated by the Telemet test signal generator. Figure 2 represents a window video test signal as it will appear on the waveform oscilloscope screen when the oscilloscope RESPONSE switch is in the SYNC position. Figure 3 represents the same test signal but with the oscilloscope RESPONSE switch in the VIDEO position. Terms used to describe the format are defined in Section 341-100-101.

B. Controls, Indicators, and Connectors

2.02 Figures 4 and 5 illustrate and briefly describe all of the external controls, indicators, and connectors of the modified oscilloscope. The following paragraphs provide more specific information on those controls that have been modified or are operated differently for PICTUREPHONE operation.



SWITCH POSITION
 RESPONSE - SYNC
 SWEEP - 2H
 MAGNIF - X1
 GAIN - .60V

NOTES:

1. REFERENCE LINE AND REFERENCE BLACK SHOULD BE COINCIDENT.
2. POSITIVE AND NEGATIVE OVERSHOOTS ARE A RESULT OF PRE-EMPHASIZED VIDEO AT THE TRANSMIT END.
3. VIDEO = .60V
 SYNC = .20V
 $\frac{.60V}{.20V} = \frac{100 \text{ IRE}}{33.3 \text{ IRE}}$

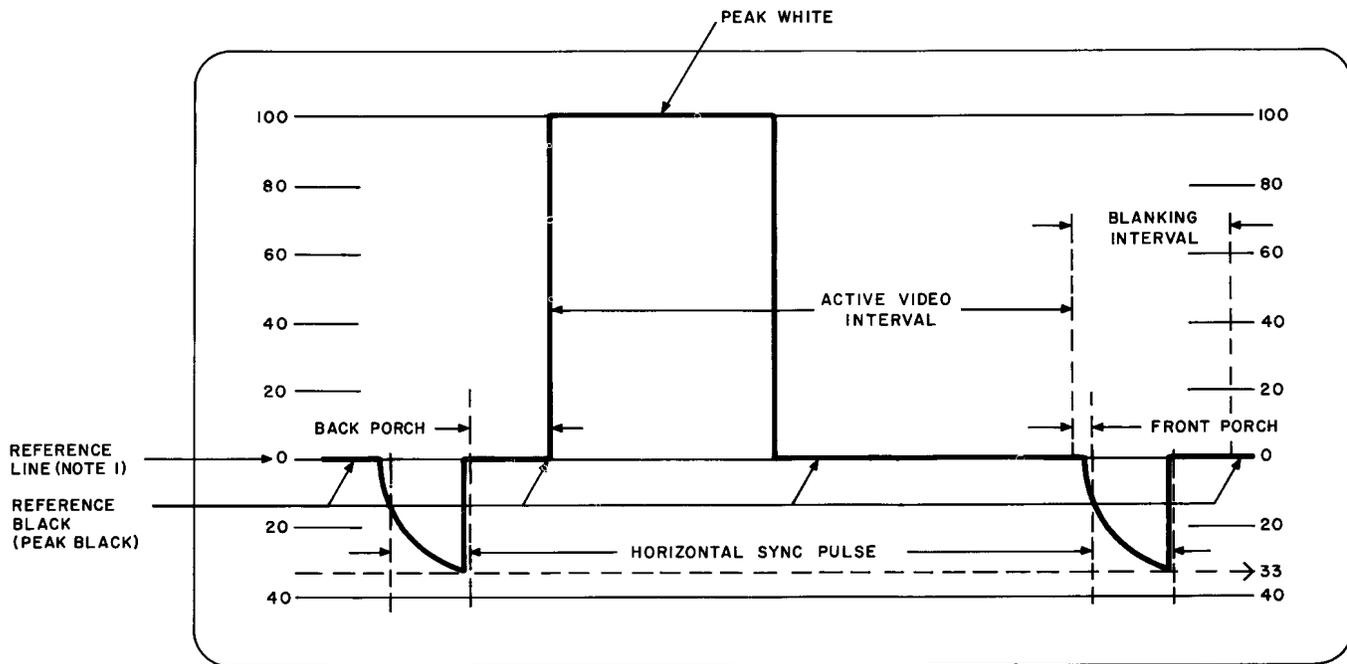
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Fig. 2—Waveform Oscilloscope Presentation of Telemet Test Signal With Oscilloscope RESPONSE Switch in SYNC Position

2.03 $\downarrow .60 \text{ VOLT} = 100 \text{ IRE/VAR}$: The .60 VOLT = 100 IRE position will display 100 IRE units for an internally generated input signal of 0.60 volt peak to peak. This signal is used to calibrate the oscilloscope for a PICTUREPHONE waveform where 0.60 volt peak to peak equals 100 IRE (video) and 0.20 volt peak to peak equals 33 IRE (sync). After an oscilloscope has been calibrated and adjusted for a signal of 1.0 volt peak to peak, the display for a PICTUREPHONE waveform should appear as illustrated in Fig. 2 and 3. Reference black (peak black) must be positioned on the reference line (0) for accurate measurement of the proportion of video and sync.

2.04 FIELD Selector: The PICTUREPHONE signal is comprised of two interlaced "fields." These two fields are designated A and B, either of which can be selected by the FIELD selector switch.

2.05 SWEEP Selector Switch: This switch provides for the selection of four sweep modes. These modes are as follows. (1) The FREE RUN mode provides a display of the video signal envelope for observation of the entire waveform when checking the maximum excursions of the picture signal. (2) The 2V mode provides a sweep length of approximately 1-1/3 fields and a sweep speed (without magnification) of 0.12 V/cm (approximately 2 ms/cm) where V is the duration of 1 field, or 1/60 of a second. (3) The 2H mode provides a sweep length of one complete line in 8.3 cm and a sweep speed (without magnification) of 0.12 H/cm (approximately 15 $\mu\text{s/cm}$) where H is the duration of one line, or 125 microseconds. The display consists of alternate lines above one another. (4) The H—LINE SELECT mode also provides a sweep speed of 0.12 H/cm, and allows for continuous variable selection of any line in the VAR position.



SWITCH POSITION
 RESPONSE - VIDEO
 SWEEP - 2H
 MAGNIF - XI
 GAIN - .60V

NOTES:

1. REFERENCE LINE AND REFERENCE BLACK SHOULD BE COINCIDENT.
2. DISTORTED SYNC PULSES ARE A RESULT OF DE-EMPHASIS FILTER IN SCOPE.
3. VIDEO = .60V
 SYNC = .20V
 $\frac{.60V}{.20V} = \frac{100 \text{ IRE}}{33.3 \text{ IRE}}$

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Fig. 3—Waveform Oscilloscope Presentation of Telemet Test Signal With Oscilloscope RESPONSE Switch in VIDEO Position

2.06 T and R INPUT Jacks: The oscilloscope has a high impedance input circuit and is bridged across the circuit being tested with the circuit terminated in 100 ohms. Each set of input connections consists of two pairs of jacks designated T and R. The two T jacks are connected by an inductor which is center tapped to provide an input to the oscilloscope. The two R jacks are also connected in the same manner. This permits connecting the circuit to be tested to one pair of T and R jacks while the termination is connected to the other pair. The oscilloscope is thus bridged across the terminated circuit. Insertion of the oscilloscope into the test line will offer no measureable loss to that test line in the frequency spectrum used for PICTUREPHONE services. The input circuit is such that if the T jack is positive with respect to the R jack, the trace on the oscilloscope will deflect upwards from the reference line. The

oscilloscope is always connected to PICTUREPHONE circuits so that the video signal produces a trace above the reference line, while the sync pulse produces a trace below the line (see Fig. 2 and 3). Only balanced input connections are used in PICTUREPHONE maintenance.

2.07 RESPONSE Selector Switch: The RESPONSE switch provides for the selection of two response filters for PICTUREPHONE use. These two filters are (1) the VIDEO filter, which provides deemphasis to the sync and video signals, allowing for viewing normal video signals but distorted sync pulses as the sync is transmitted without preemphasis, and (2) the SYNC filter, which provides a flat response for PICTUREPHONE signals and is used for viewing the undistorted sync pulses and preemphasized video signals of the PICTUREPHONE signal.

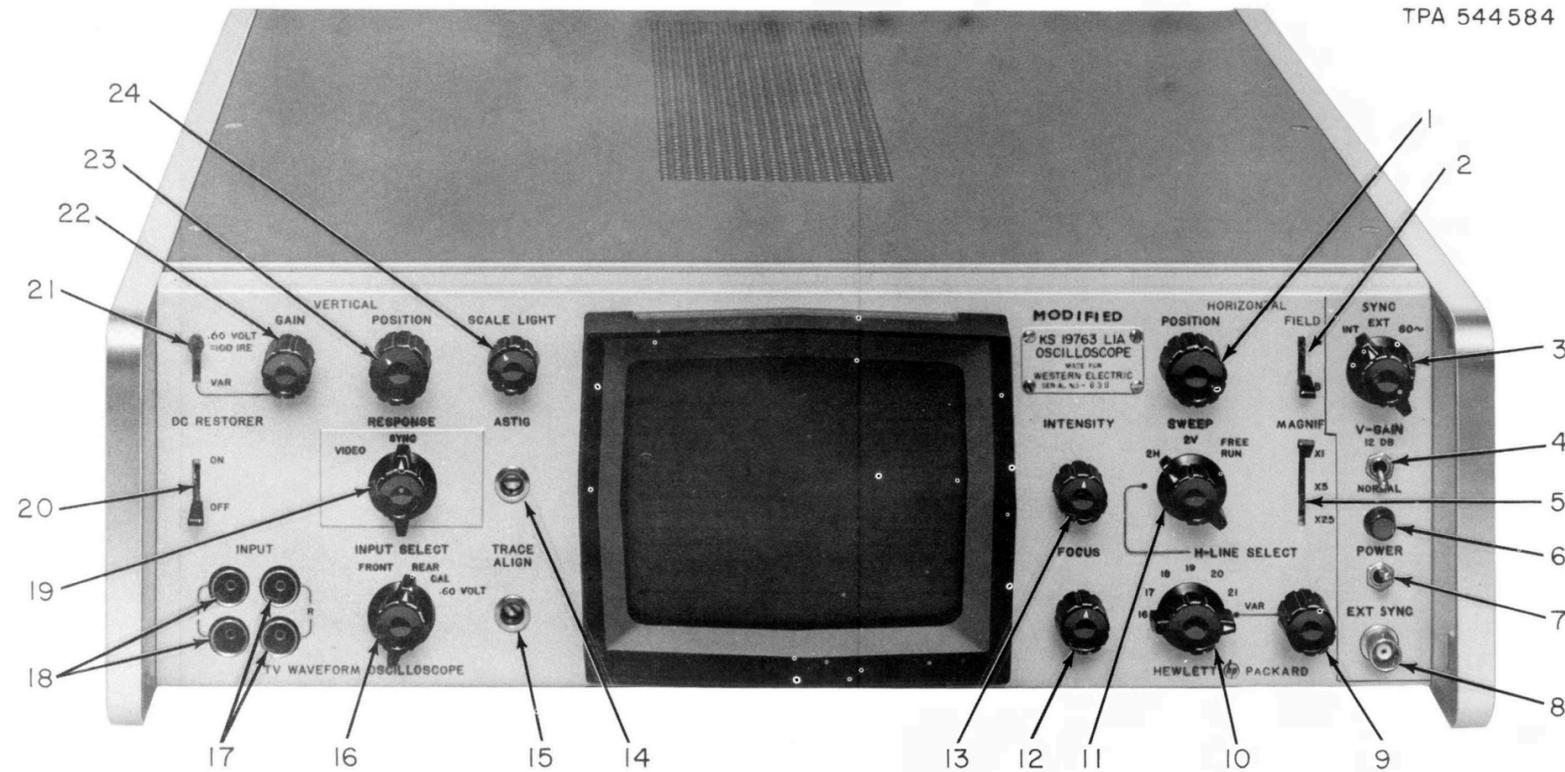
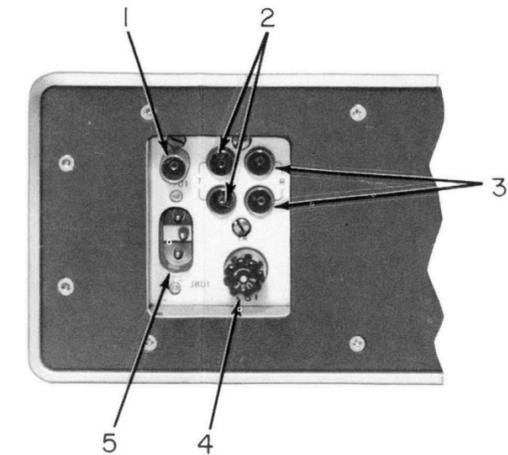


Fig. 4—Controls, Indicators, and Connectors (Front Panel)

1. HORIZONTAL POSITION control—Adjusts horizontal position of the display.
2. FIELD lever switch—Selects either of the fields desired (refer to 2.04).
3. SYNC selector switch—Selects the method of syncing the video signal.
4. V-GAIN 12DB/NORMAL—Increases the gain of the vertical amplifier by 12DB when switch is operated from NORMAL to 12DB.
5. MAGNIFIER lever switch—Multiplies the display's horizontal sweep by 1, 5, or 25 times.
6. POWER indicator—Indicator lights when power is on.
7. POWER ON switch—Controls ac power to the instrument.
8. EXT SYNC jack—Provides a means for connecting external sync when SYNC switch is in the EXT position.
9. H-LINE SELECT VAR control—Selects any horizontal line for display when H-LINE SELECT switch is set to VAR.
10. H-LINE SELECT selector switch—Selects specific horizontal line for display when SWEEP switch is set to H-LINE SELECT (serves no purpose for PICTUREPHONE® applications).
11. SWEEP selector switch—Selects the mode of horizontal sweep (refer to 2.05).
12. FOCUS control—Adjusts focus of trace for sharpness.
13. INTENSITY control—Adjusts degree of brightness for display trace.
14. ASTIG adjustment control—Used in conjunction with FOCUS control to adjust sharpness of trace.
15. TRACE ALIGN adjustment control—Aligns display baseline with the horizontal axis.
16. INPUT SELECT selector switch—Selects the vertical input signal source.
17. R INPUT jacks—(refer to 2.06).
18. T INPUT jacks—(refer to 2.06).
19. RESPONSE selector switch—Select vertical amplifier response filters (refer to 2.07).
20. DC RESTORER lever switch—Provides a voltage reference level for positioning the video signal on the CRT.
21. .60 VOLT = 100 IRE/VAR—Selects fixed or variable gain for the vertical amplifier (refer to 2.03).
22. GAIN control—Adjusts vertical amplifier gain to desired level.
23. VERTICAL POSITION control—Adjusts vertical position of the display.
24. SCALE LIGHT control—Controls CRT internal flood gun for varying screen illumination (and better trace/contrast).



1. LINE BRIGHT PULSE OUTPUT jack—can be used when SWEEP switch is in H-LINE SELECT position and is used to feed a TV picture monitor where the line being displayed by the oscilloscope is intensified.
2. T input jacks—(refer to 2.06).
3. R input jacks—(refer to 2.06).
4. 1.0 A fuse—A 1.0-amp slow blow fuse for measuring set protection.
5. Ac power receptacle—a 3-prong receptacle for the special power cord provided for the test set.

Fig. 5—Controls, Indicators, and Connectors (Side Panel)

2.08 DC RESTORER Lever Switch: Because of the presence of picture information in the composite video signal, the average value of the signal changes continually. To make the display stable, the oscilloscope has a dc restorer which, when the DC RESTORER switch is in the ON position, references the display to the reference black level instead of the average value of the signal.

C. Operating Instructions

2.09 The following procedures provide instructions for checking the instrument gain against the internal calibration signal and for several of the standard operation modes.

2.10 Instrument Gain Calibration Check:

STEP	PROCEDURE
1	◆ Set GAIN lever switch to the fixed gain position (.60 VOLT = 100 IRE). ◆
2	◆ Set INPUT SELECT selector switch to CAL .60 VOLT. ◆
3	Set MAGNIFIER lever switch to X1. Requirement: Display should be 100 IRE units in amplitude.
4	If display is not 100 IRE, adjust CAL GAIN ADJ potentiometer (R507) on the filter driver assembly (A7) until 100 IRE is obtained. Note: Calibration of the instrument can be performed with or without input connections and without changing the RESPONSE or SWEEP selector settings.

2.11 Signal Input Connection:

STEP	PROCEDURE
1	<p>Note: In the testing facilities noted in 1.01, the input connections are made by key operation. For portable use, follow the procedure below.</p> <p>Connect the vertical input signal of the circuit to be tested to one pair of T and R jacks. Be sure to note the T and R orientation (tip side of circuit under test to T input jack and ring side of circuit under test to R input jack).</p> <p>2</p> <p>Connect the other pair of T and R jacks of the set used to either another test unit having an impedance of 100 ohms or a 100-ohm termination.</p> <p>Note: Different signals may be connected to the front and side set of jacks with no cross interference. The selection is made by the INPUT SELECT switch.</p>

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2.12 Field Rate Monitoring: (For viewing one field)

STEP	PROCEDURE
1	Connect input signal and select FRONT or REAR (side) input with INPUT SELECT switch.
2	Set SWEEP selector switch to 2V.
3	Set MAGNIFIER lever switch to X1.
4	Set FIELD lever switch for desired field.
5	Set RESPONSE selector switch to SYNC for monitoring sync signals and to VIDEO for monitoring video signals. <i>Note:</i> Composite signal is composed of preemphasized video and normal sync; therefore, a deemphasis network is provided in the VIDEO portion of RESPONSE switch so that normal video can be monitored.
6	Set DC RESTORER lever switch to ON position.
7	Adjust VERTICAL POSITION control to position back porch on the 0 IRE line.
8	Set GAIN lever switch to VAR position.
9	Adjust VAR GAIN control so that the top of the video display is at +100 IRE units; the sync tips should now be at -33 IRE units.

2.13 Line Rate Monitoring: (For viewing composite picture)

STEP	PROCEDURE
1	Connect input signal and select FRONT or REAR (side) input.
2	Set SWEEP selector switch to 2H.
3	Set MAGNIFIER lever switch to X1.
4	Set RESPONSE selector switch to VIDEO.
5	Set DC RESTORER lever switch to ON.
6	Adjust VERTICAL POSITION control to position back porch on the 0 IRE line.
7	Set GAIN lever switch to VAR.
8	Adjust VAR GAIN control so that the top of the video display is +100 IRE units; the sync tips should now be at -33 IRE units.

2.14 Single Line Monitoring: (For viewing one line)

STEP	PROCEDURE
1	Connect input signal and select FRONT or REAR (side) input.
2	Set RESPONSE selector switch to VIDEO.
3	Set MAGNIFIER level switch to X1.
4	Set SWEEP selector switch to H-LINE SELECT.
5	Set H-LINE SELECT selector switch to VAR.
6	Set DC RESTORER lever switch to ON.
7	Adjust VERTICAL POSITION control to position back porch on the 0 IRE line.
8	Set GAIN lever switch to VAR.
9	Adjust VAR GAIN control so that the sync tips are at -33 IRE units.
10	Adjust H-LINE SELECT VAR control for display of discrete line to be observed. A brightened line on the picture monitor (if used) will indicate which line is being displayed.

2.15 Free Run Monitoring: (For viewing video signal without sync pulses)

STEP	PROCEDURE
1	Connect input signal and select FRONT or REAR input.
2	Set MAGNIFIER lever switch to X1.
3	Set SWEEP selector switch to FREE RUN.
4	Set RESPONSE selector switch to SYNC.
	<p>Note: The oscilloscope triggers itself automatically and sweeps at approximately the 2H sweep speed. This mode provides a display of signals with no sync pulses, such as sine-wave test signals. Do not use the VIDEO position on the RESPONSE selector switch as it does not have a flat response.</p>

3. CIRCUIT DESCRIPTION

A. Introduction

3.01 Figure 6 shows a block diagram of the modified KS-19763, L1A oscilloscope. Changes over the unmodified set consist of modifications in five of the card circuits (assemblies) to condition the oscilloscope for the PICTUREPHONE signal. These modifications are discussed in the following paragraphs. Detailed description of the remainder of the circuit is covered in the manufacturer's Operating and Service Manual.

B. Vertical Amplifier System

3.02 *Input Amplifier Assembly:* The input amplifier assembly has been modified by adding a resistor-capacitor circuit (C3,R4) to the output that feeds the sync separator assembly (see Fig. 7). This circuit is a low-pass filter that is used to prevent the preemphasized video, used in the MOD II C format, from dropping below the reference black level and interfering with the sync pulses.

3.03 *Filters and Interstage Amplifier Assembly:*

The RESPONSE switch on the front panel provides for selecting five different filter configurations. Only two of these positions are designated (VIDEO and SYNC) since they are the only positions that provide useful functions in conjunction with PICTUREPHONE operation. Before the modification, these two positions were designated IRE and FLAT, respectively. The filter used with the VIDEO position has been modified as shown in Fig. 8 to provide deemphasis so that the video portion of the PICTUREPHONE signal can be viewed in its normal shape before preemphasis (see Fig. 3). The sync pulse is smeared in this case. The video filter consists of a network (R6, C7, C8) and an impedance matching resistor (R5) inserted between diodes CR552 and CR563 of the original circuitry. The response of this filter is shown in Fig. 9. No change has been made in the circuit used with the SYNC position other than the change in designation indicated above. In this position a flat response up to about 4.5 MHz is provided as shown in Fig. 9. This permits viewing the sync pulse in its normal shape and the preemphasized shape of the video portion of the signal (see Fig. 2). The connections to pins 2 and 3 of the filters and interstage amplifier assembly have been reversed, as indicated in Fig. 8, to provide for connecting the video response filter to the RESPONSE switch.

C. Sync System

3.04 *Sync Separator Assembly:* This assembly provides video stripping, regeneration of the sync pulse train, automatic sync level adjustment, and separation of the vertical and horizontal sync pulses. The field rate multivibrator section of this assembly is modified (see Fig. 10) to make the oscilloscope compatible with the PICTUREPHONE MOD II C signal format. This modification consists of adding capacitor C1 between ground and the junction of diode CR115 and resistors R133 and R134. This capacitor gives the sync pulses a higher, sharper amplitude that is needed because of the narrower PICTUREPHONE pulses (and at the same time suppresses the 8-kHz horizontal pulses). Another modification to this section of the assembly consists of transistor Q1, resistors R1 and R2, and capacitor C2 installed between diode CR117 and the junction of resistor R141 and transistor Q112 (see Fig. 10). This modification provides a trigger from the trailing edge of both the long and short vertical pulses encountered in the MOD II C format.

3.05 *Line Field Select Assembly:* This assembly receives the vertical and horizontal sync pulses from the sync separator assembly, time compares them, and generates a field identification pulse. This assembly also contains the delay trigger circuitry for line selection and pre-bias gate for the sweep system. The horizontal rate multivibrator section of this assembly is modified (see Fig. 11) to make the circuit compatible to the MOD II C format. This consists of adding a resistor (R3) which slows down the horizontal rate multivibrator from the rate used in a TV format to the rate used in PICTUREPHONE MOD II C format.

D. Sweep System

3.06 *Sweep Circuit Assembly:* This assembly receives a sweep start pulse from the sync separator assembly, and a sweep arming pulse from the line field select assembly. The two pulses are used to initiate the sweep signal for the 2H, 2V, or H-LINE SELECT sweep modes. In the FREE RUN sweep mode, the sweep is internally armed and triggered. This assembly has also been modified (see Fig. 12) for compatibility to PICTUREPHONE MOD II C format. Although the frame and field rates are the same as in standard TV format, it was desirable to change the vertical sweep length of 2 fields to a sweep length of approximately 1-1/3 fields to obtain a more desirable display.

This was accomplished by replacing C318 with C4, C319 with C5, C316 with C6, and moving the connection from the C pin to the B pin on the J301 jack, thereby connecting the modified circuit to the sweep switch.

4. MAINTENANCE

4.01 The KS-19763, L1A is inspected, internally calibrated, and tested by the Hewlett-Packard Company before it is shipped for modification and incorporation into the PICTUREPHONE testing facilities. The oscilloscope is of a solid-state design and is expected to be extremely stable.

4.02 If maintenance is required at any time, the manufacturer's Operating and Service Manual

should be consulted for maintenance, calibration, troubleshooting methods, and schematics.

4.03 Since the manufacturer's manual was written for the unmodified KS-19763, L1 and KS-19763, L1A oscilloscopes, the modifications described in this section will have to be taken into consideration during maintenance procedures.

4.04 The modified KS-19763, L1A may be sent to Western Electric Service Centers for necessary repairs if desired. It is recommended that the oscilloscope be returned to the Service Center every 24 months for calibration under the Red Ball plan.

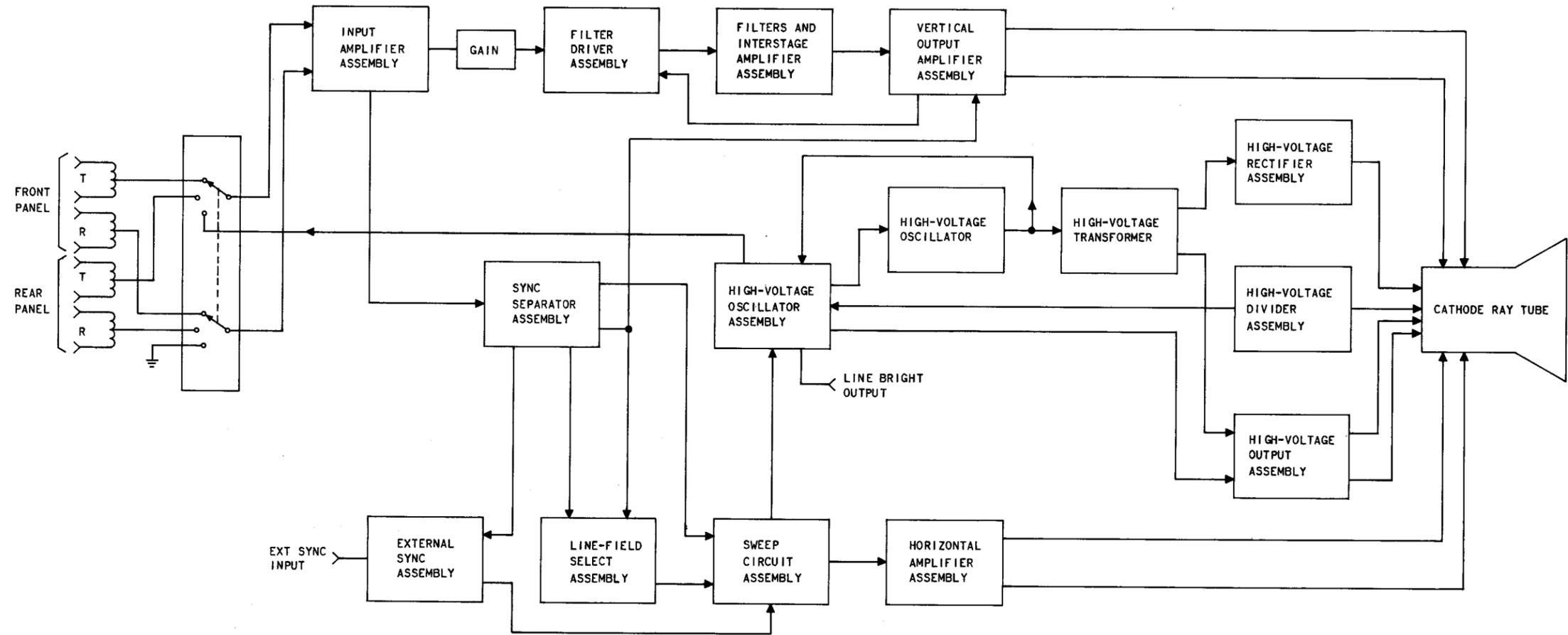
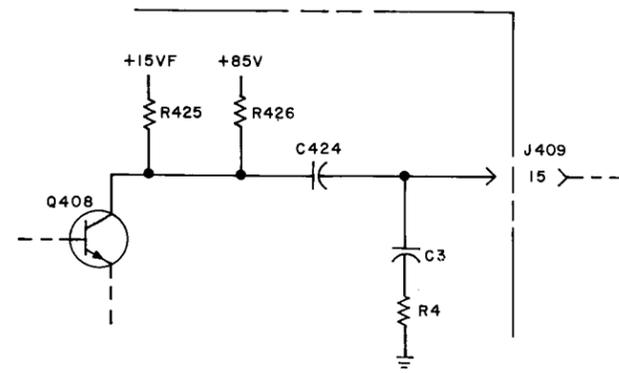


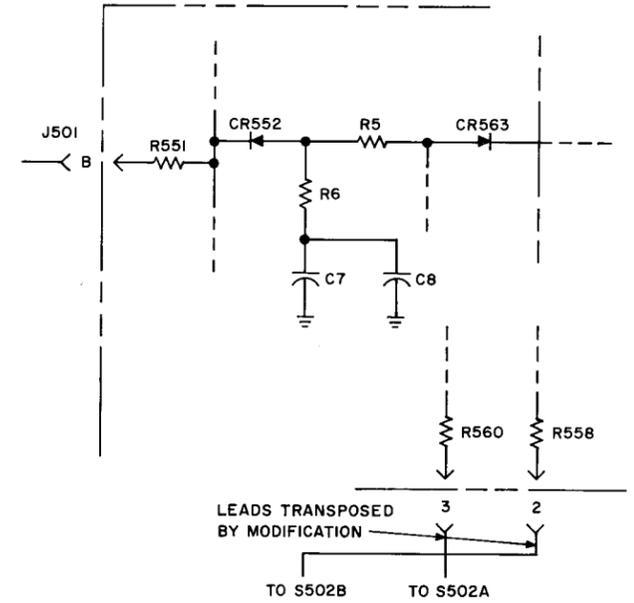
Fig. 6—Block Diagram of KS-19763, L1A Oscilloscope



COMPONENTS ADDED BY MODIFICATION

DESIGNATION	TYPE	VALUE
C3	KS-16742, L1	1620 PF
R4	237A	100Ω

Fig. 7—Modification to Sync Driver Section—Input Amplifier Assembly Card A5



COMPONENTS ADDED BY MODIFICATION

DESIGNATION	TYPE	VALUE
R5	237A	562Ω
R6	237A	68.1Ω
C7	KS-16591, L1	2210 PF
C8	KS-16958, L3	90.9 PF

Fig. 8—Modification to Filter Section—Filters and Interstage Amplifier Assembly Card A8

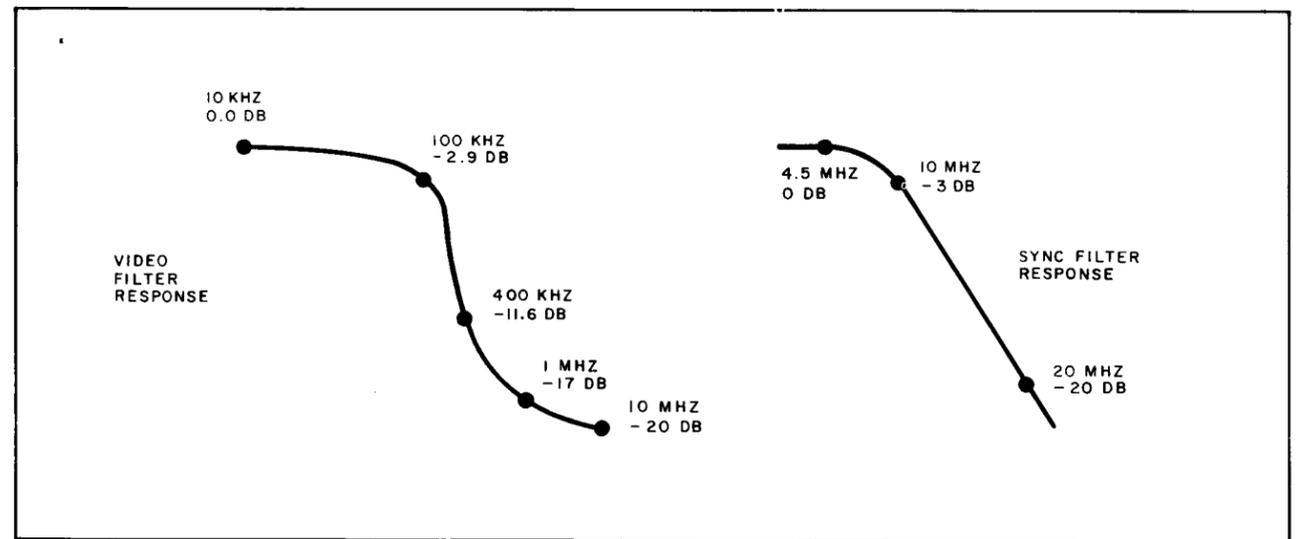
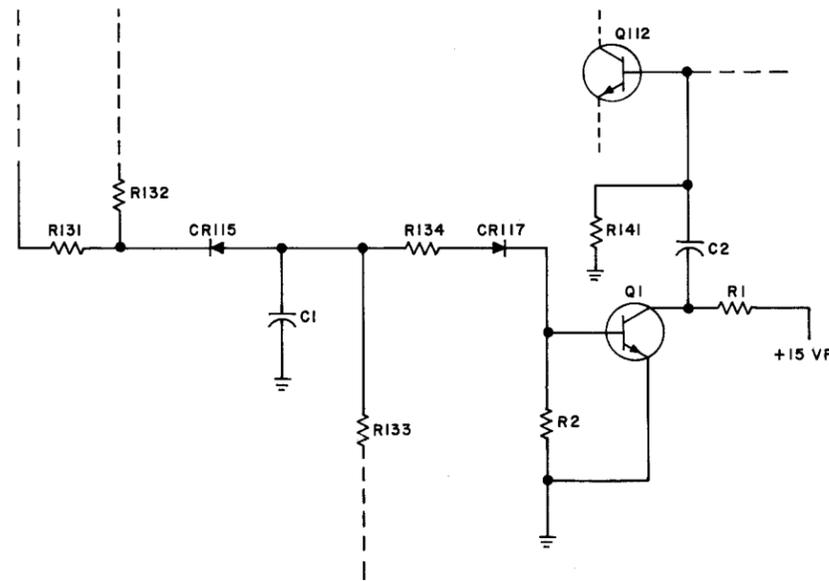


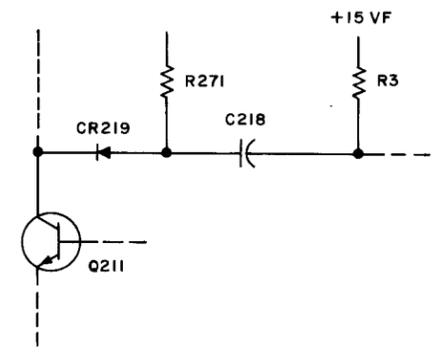
Fig. 9—Filter Response Curves



COMPONENTS ADDED BY MODIFICATION

DESIGNATION	TYPE	VALUE
C1	KS-16591, L2	4700 PF
C2	KS-16742, L1	200 PF
Q1	16F	—
R1	237A	1 K Ω
R2	237A	12.1 K Ω

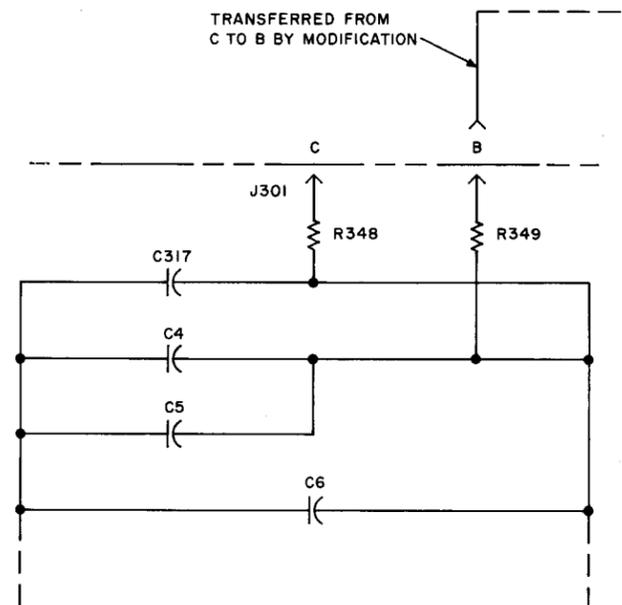
Fig. 10—Modification to Field Rate Multivibrator Section—Sync Separator Assembly Card A1



COMPONENTS ADDED BY MODIFICATION

DESIGNATION	TYPE	VALUE
R3	221A	133K Ω

Fig. 11—Modification to Horizontal Rate Multivibrator Section—Line Field Select Assembly Card A2



COMPONENTS ADDED BY MODIFICATION

DESIGNATION	TYPE	VALUE
C4	570 CA	.0511 UF
C5	570 C	.0332 UF
C6	KS-16742, L1	2210 PF

Fig. 12—Modification to Miller Integrator Section—Sweep Circuit Assembly A3