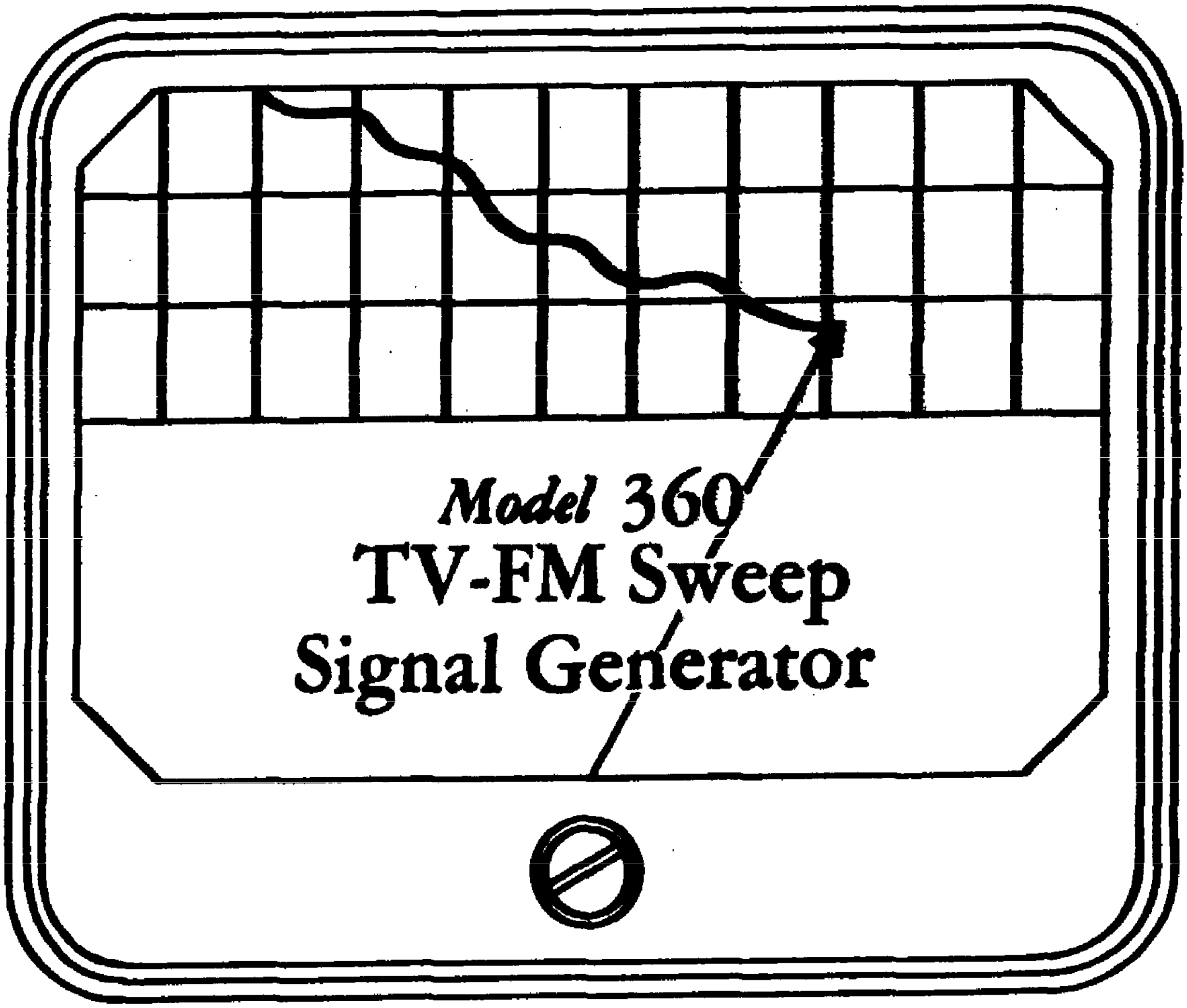
INSTRUCTION MANUAL FOR



EICO

ELECTRONIC INSTRUMENT CO., Inc.

INSTRUCTION MANUAL FOR MODEL 360
TV-FM SWEEP SIGNAL GENERATOR

DESCRIPTION

The Eico Model 360 Sweep Signal Generator covers all television and FM alignment frequencies between 500KC and 228MC. Extremely wide sweepwidth is available, variable from 0 to 30 megacycles. Also included is a crystal marker oscillator with variable amplitude control, for use with external crystals. Frequencies are directly calibrated in three bands 0-60, 0-120 and 168-228. The FM and TV channels are marked directly on the front panel. Also available at the output is an internal oscillator with a frequency range of 54 to 114 MC. for use as a standard signal generator. A phasing control and RF output attenuator are also included together with provisions for external marker injection.

GENERAL OPERATING INSTRUCTIONS

Before using the Eico Model 360 Sweep Generator read the instructions very carefully. The EICO Model 360 Sweep Generator is designed to operate on 110 to 120 volts, 50-60 cycle alternating current. The AC power switch is located on the Phasing Control. For best accuracy the unit should be allowed to warm up at least 15 minutes before using. The controls and output connectors are clearly identified by the markings on the panel and serve the following purpose.

1. MAIN TUNING DIAL: The bottom scale is a reference scale marked from 0 to 100 linearly. The next three scales marked

center sweep frequencies and calibrated from 0-60, 0-120 and 168-228 are the center frequencies about which sweeping takes place. For example, if the main dial pointer is set at 100 megacycles and the sweepwidth control set at a maximum sweepwidth of 30 megacycles, the output will sweep back and forth from 85 to 115 megacycles. The FM band (88 to 108 megacycles) and the center of each of the 13 television channels are marked on the dial for the convenience of the operator.

The uppermost scale is an internal oscillator having a range of 54 to 114 megacycles. This scale is used in calibrating the instrument and also as a useful source of standard RF signals in the above range.

It is to be noted that all output ranges are available without bandswitching.

2. SWEEPWIDTH CONTROL: This control varies the amount of sweepwidth about the center frequency indicated by the main tuning dial pointer. It is calibrated linearly from 0 to 30 megacycles and intermediate points give an approximate indication of the actual amount of sweep.

3. R.F. ATTENUATOR: This control adjusts the strength of the R.F. signals delivered to the R.F. output connector.

4. R.F. OUTPUT CONNECTOR: The coaxial cable supplied with the instrument is connected to this connector and the output fed to the FM or TV receiver being aligned.

5. 60 CYCLE OUTPUT TIP JACKS: These tip jacks are used to supply 60 cycle AC voltage to the horizontal deflection amplifiers of the oscilloscope used. Connect

two test leads from these tip jacks to the horizontal binding posts on the oscilloscope or use a shielded cable with the black tip jack to ground and the red tip jack to the high side of the oscilloscope.

6. PHASING CONTROL: This control varies the phase of the 60 cycle AC supplied through the tip jacks. Always adjust this control to obtain a single trace on the oscilloscope screen.

When turned to the extreme counterclockwise position, the sweep generator is turned off.

7. CRYSTAL SOCKET: External crystals are inserted in this socket to obtain marker points on the trace being observed for calibration purposes and for use as a crystal controlled R.F. signal for external applications. When a crystal is inserted, it is connected in an oscillator circuit which oscillates at the crystal frequency, also producing higher harmonics such as the 2nd, 3rd, 4th, 5th, 6th... etc. For example, a 5 MC. crystal will produce harmonics at 10 MC., 20 MC.,25MC., 30 MC...etc.

8. CRYSTAL AMPLITUDE CONTROL: This control varies the strength of the crystal marker oscillator. It should be adjusted for minimum output observable so that it has the least effect on the pattern observed. The output of the crystal marker oscillator is connected so that its output together with that of the sweep generator output is varied simultaneously with the R.F. attenuator control.

9. EXT. MARKER BINDING POSTS: These binding posts allow injection of an external marker such as a standard AM signal generator. The ground lead of the external

AM signal generator is connected to the binding post marked GND while the high side is connected to that marked EXT. MARKER. The output of the external marker can be varied simultaneously with the sweep generator output using the R.F. attenuator control.

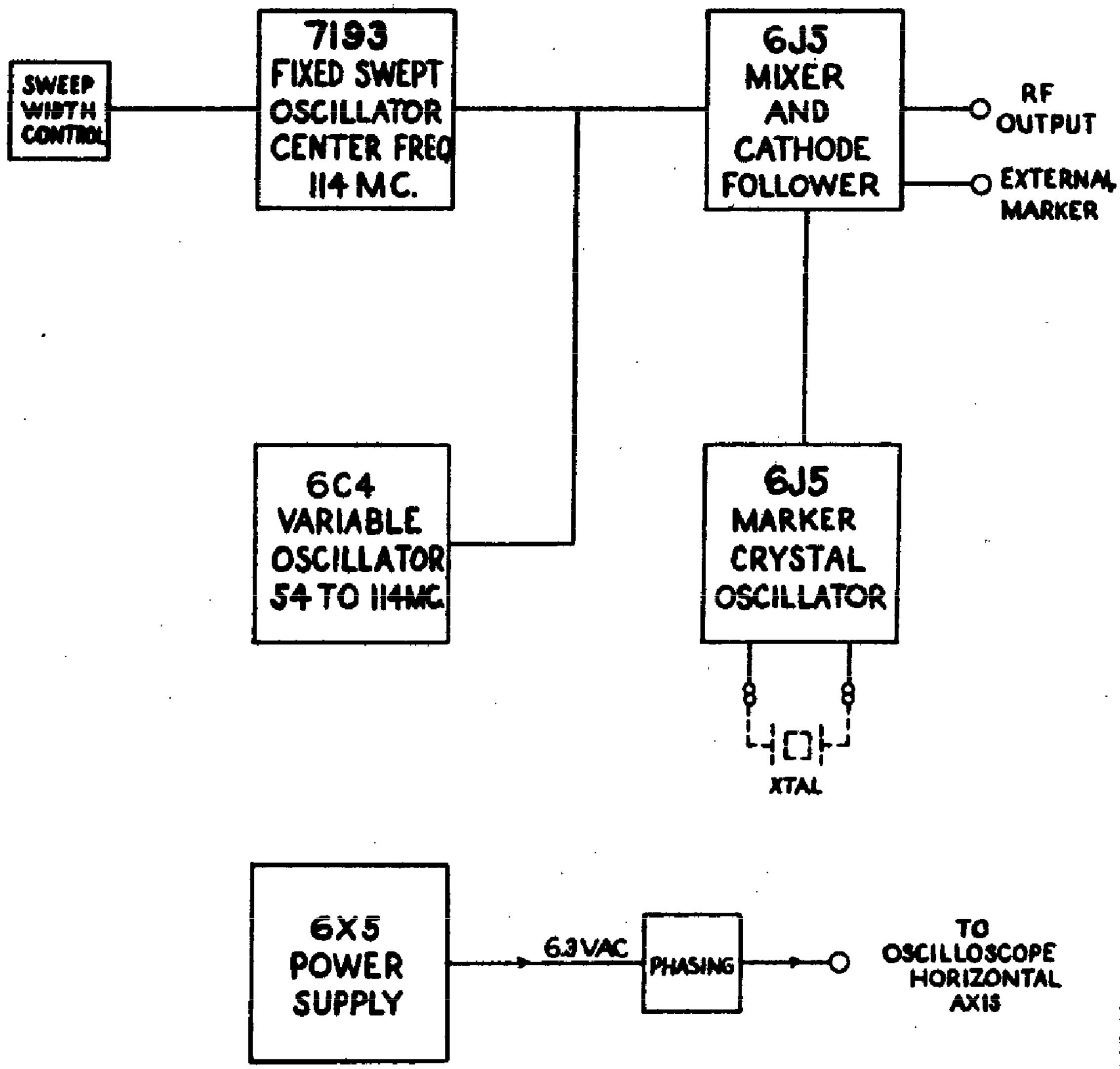
DESCRIPTION OF CIRCUIT

A block diagram of the system used in the EICO Model 360 Sweep Signal Generator is shown. An oscillator with a fixed center frequency of 114 megacycles is frequency modulated to a maximum sweepwidth of 30 megacycles, sweeping this fixed oscillator back and forth from 99 to 129 megacycles. The amount of frequency modulation is controlled by the sweepwidth control setting.

From the block diagram it is seen that the output of the fixed swept oscillator is heterodyned or mixed with that of a variable oscillator. The latter variable oscillator is a standard Hartley oscillator having a frequency range of 54 to 114 MC. which is controlled by the main tuning dial pointer setting. The resultant beats or heterodynes between these two oscillators (one fixed and frequency modulated and the other variable) provide the frequency ranges of the instrument. For example, the difference frequencies between the 114 MC. fixed swept oscillator and the 54-114 MC. variable oscillator provide the frequency range of 60 to 0 MC. The sun frequencies of the two oscillators provide the range of 168 to 228 MC. The second harmonic of the difference frequencies gives the range 120 to 0 MC.

The output of these two oscillators

BLOCK DIAGRAM
MODEL 360
FM-TV SWEEP GENERATOR



is "mixed" in the mixer tube which also serves as a cathode follower output tube.

PRODUCING FREQUENCY MODULATION OF THE FIXED SWEPT OSCILLATOR

The fixed swept oscillator at a center frequency of 114 MC. is frequency modulated by mechanical means. The mechanical means of producing frequency modulation makes possible the extremely wide sweepwidth of the instrument. Using present day tubes as reactance tube modulators such large sweepwidths usually cannot be obtained. Also, using mechanical sweep means positive sweeping action independent of varying tube characteristics. The oscillator coil consists of a specially designed, flat open wound spiral coil embossed on a bakelite base plate. A flat metal membrane is placed parallel to and very close to this coil, and is mounted on the diaphram of a speaker. When the diaphram is vibrated, the metal membrane vibrates varying the inductance of the oscillator coil which is very close to it. The oscillator frequency is thus varied.

The amount of frequency modulation (sweepwidth) is determined by the amplitude of the diaphram vibration (voltage applied to the speaker voice coil). The sweeping frequency or sweep rate is determined by the frequency of the voltage applied to the speaker voice coil and is 60 cycles per second in this instrument.

USING THE PHASING CONTROL

Part of the 60 cycle AC voltage which is applied to the speaker voice coil is supplied through the 60 cycle tip jacks mounted on the front panel. The phase of this voltage can be varied by means of the PHASING CONTROL so that a single trace appears on the oscilloscope screen.

THE ALIGNMENT OF FM AND TELEVISION RECEIVERS

GENERAL INSTRUCTIONS

The oscilloscope to be used in conjunction with the EICO Model 360 Sweep Generator can be any STANDARD type such as the EICO Model 400. It does NOT have to have wide frequency range since the only frequencies it has to reproduce are from 50 to 5000 cycles. Also it does NOT have to have high sensitivity, ½ volt RMS per inch being sufficient. The oscilloscope does not have to have blanking circuits or phasing control since the latter is included on the EICO Model 360 Sweep Generator.

NOTE: Under certain circumstances it is desirable to place a 50 to 100 ohm carbon resistor across the alligator clips at the end of the coaxial output cable, at the point where it is fed into the receiver being aligned. This is to prevent standing waves and stray radiation from occurring in the coaxial cable, which is likely to occur at frequencies above 80 MC. This resistor will decrease the output from the sweep generator and to determine if it is necessary, fasten the resistor across the alligator clips and observe whether any change in the pattern shape occurs. If such a change occurs, leave the resistor in. Otherwise it is unnecessary. Follow the pictorial diagram given.

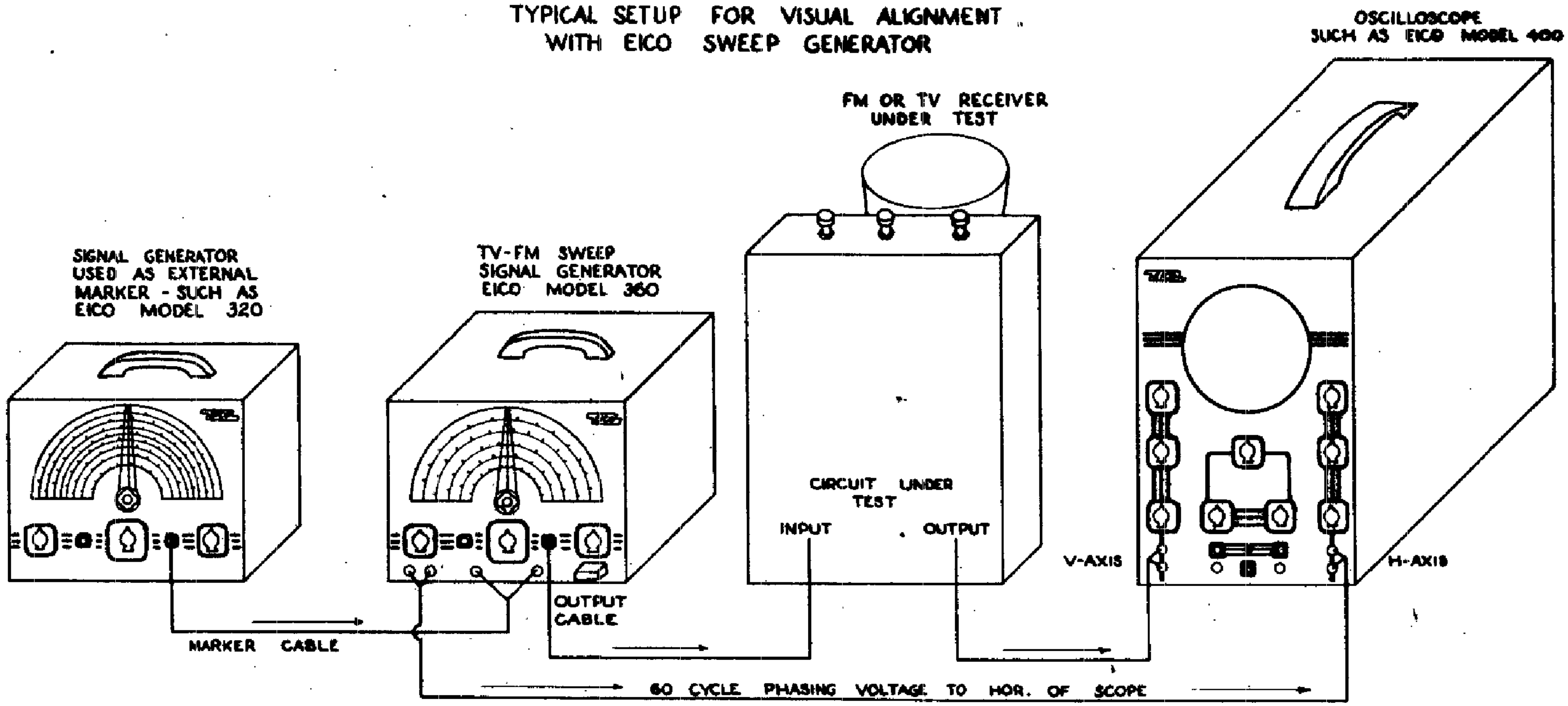
In using the sweep generator it is extremely important to obtain a low resistance ground connection between it, the receiver under test and the oscilloscope. Otherwise unstable or highly questionable shapes will appear on the oscilloscope screen. If the trace tends to change when chassis or instruments are touched, use additional grounding leads.

Place the ground alligator clip lead of the sweep generator at a ground point as close as possible to the point at which the high side alligator clip is connected. The R.F. oscillator of the FM or TV receiver MUST be made inoperative when aligning the I.F.'s. Otherwise confusing and spurious traces will appear on the screen. To do this, remove the oscillator tube or disconnect the B+ to that stage.

ALIGNING FM RECEIVERS

In aligning FM receivers, it is very important to follow the specific instructions given by the manufacturer. General instructions are given here. The I.F. tuned circuits are first aligned before the discriminator. In order to accomplish this, the oscilloscope vertical amplifier is connected across the limiter tube grid leak as shown in the diagram. A resistor of from 25,000 to 250,000 ohms is used in series with the high side of the oscilloscope at the grid leak resistor to prevent

TYPICAL SETUP FOR VISUAL ALIGNMENT
WITH EICO SWEEP GENERATOR



PRECAUTIONARY NOTES

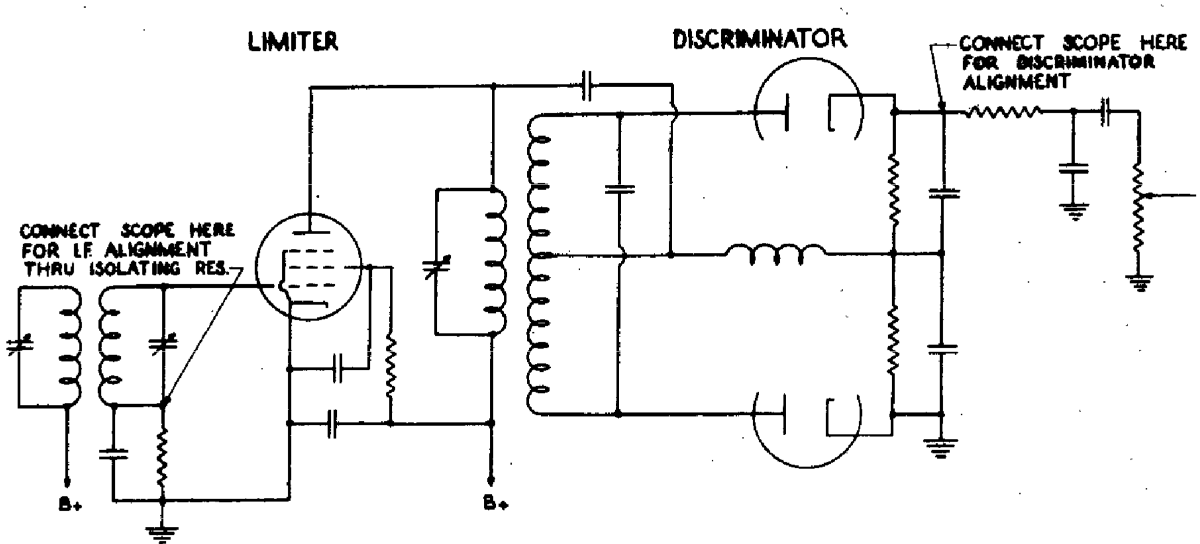
1. Follow the manufacturer's instructions as to alignment procedure.
2. Whenever a pattern of unstable or highly questionable shape appears on the oscillograph screen, always check the grounding connections between the instruments and use additional grounding leads.
3. For video I.F. alignment, disconnect the R.F. oscillator to prevent confusing and spurious traces, by removing the oscillator tube, shorting it or disconnecting the B+.
4. Marker signals should always be made as small as possible to minimize distortion of the response curve shape.
5. Sometimes a terminating resistor of from 50 to 100 ohms is used to prevent stray radiation from coaxial output cable. It decreases the output and to determine if it is necessary, place it across the output clip leads. If the pattern shape changes, leave it in. Otherwise it is unnecessary.

loading the grid leak circuit of the limiter. The ground lead of the oscilloscope is connected to the chassis ground. For this purpose a shielded lead may be desirable to minimize hum pickup.

The output of the EICO Model 360 Sweep Generator is fed to the grid of the first detector or converter tube with the ground alligator clip connected to the chassis.

The horizontal amplifier of the oscilloscope is connected through two test leads to the 60 cycle output tip jacks, with the black tip jack to ground and the red tip jack to the high side.

Turn the Sweep Generator on and set the main tuning dial pointer at the I.F. frequency (usually 10.7 MC.). Turn the sweepwidth control to a sweepwidth of about 5 MC.



FOSTER - SEELEY DISCRIMINATOR

Adjust the oscilloscope horizontal amplifier to external position and adjust the length of the horizontal trace to a little less than the width of the screen.

Bring the R.F. attenuator up, the oscilloscope vertical gain up and the FM receiver gain up until the characteristic double humped I.F. curve appears. A typical curve is shown in the oscillogram diagrams.

Adjust the phasing control until the double trace is synchronized to form a single trace. The horizontal width will vary with the phasing control so that some adjustment of the oscilloscope horizontal gain is necessary. Sometimes, the FM receiver oscillator will cause a spurious pattern to appear on the scope screen. To determine if this is happening, tune the receiver tuning dial and see if the image moves. If so, it is not the I.F. The oscillator should be disconnected or the tube removed to prevent spurious images. Lower the Sweep Generator output increasing the receiver gain. Adjust the sweepwidth control for a convenient bandwidth (somewhat greater than the skirts of the I.F. curve).

An external marker signal generator may be fed into the binding posts on the signal generator marked EXT. MARKER and the frequency set at the center I.F. frequency. An irregularity or marker "pip" will appear at the point on the trace corresponding to the marker frequency. The marker amplitude should be reduced until it is BARELY perceptible to minimize its effect upon the shape of the pattern.

The I.F. transformer primaries and secondaries are then adjusted so that the marker pip is at the center of the curve and for maximum amplitude of the curve.

The FM discriminator is then aligned by moving the oscilloscope output leads until they are across the discriminator load resistances as shown in the diagram. A typical S shaped discriminator curve will appear as shown in the oscillograms. The discriminator transformer secondary is then adjusted for a symmetrical "S" on both sides of the base line with the trace line between the two humps as straight as possible and the marker pip centered on this line. At the exact center of the discriminator, the marker pip will disappear or be greatly attenuated. The discriminator transformer primary is adjusted for maximum output (greatest total vertical deflection of the S curve). The quality of the audio output is critically dependent upon the discriminator alignment.

<u>NOTE</u>: Do not take the discriminator output from the audio volume control since phase shift may occur in the coupling condenser from the discriminator load resistances, causing the base line on one side to be below that on the other side.

OSCILLATOR ALIGNMENT

For adjustment of the receiver oscillator, connect the generator to the antenna terminals of the receiver according to the manufacturer's instructions. Turn the sweepwidth control to 0 sweepwidth and the center frequency to that specified. Adjust the receiver dial setting to the same frequency. Connect a vacuum tube voltmeter or DC meter (20,000 ohms per volt) across the grid leak of the limiter using the series isolating resistor. Adjust the sweep generator output (used as a signal generator) for a convenient reading. Adjust the oscillator trimmer for maximum deflection.

R.F. ALIGNMENT

The R.F. alignment is usually a touching up operation. With the sweep generator and VTVM connected as above, adjust the R.F. trimmers for maximum output.

ALIGNING TV RECEIVER

Before attempting to test, repair and align TV receivers, the operator should be well schooled in the theory and practical aspects of television receiver servicing. The manufacturers of TV receivers give specific procedures for the alignment of their sets and these should be followed implicitly for best results. General instructions are given below. The basic steps in TV receiver alignment are as follows:

1. Video (picture) I.F. traps
2. Picture I.F. transformers
3. Sound discriminators
4. Sound I.F. transformers (if separate from video I.F.'s)

5. R.F. Oscillator alignment
6. R.F. Alignment

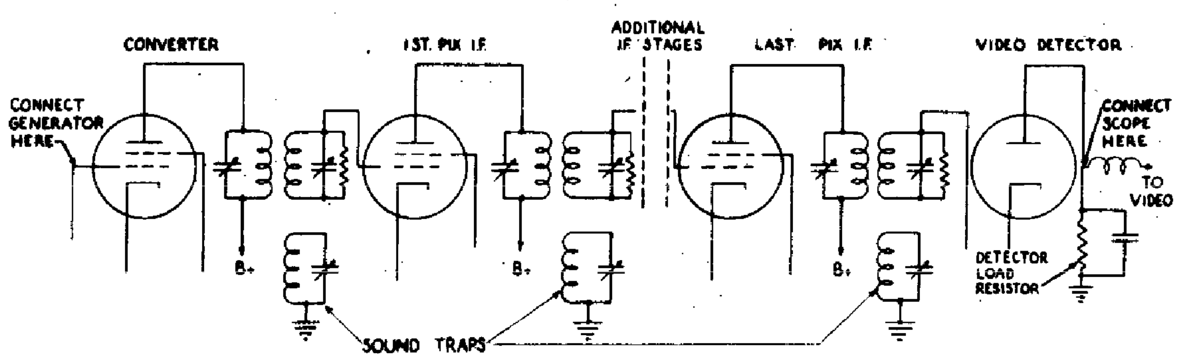
ALIGNMENT OF VIDEO (PICTURE) I.F. TRAPS

A vacuum tube voltmeter such as the EICO Model 221 is connected across the video second detector load resistor. An accurate signal generator tuned to the trap frequencies is fed into the R.F. converter grid and the trap trimmers adjusted for minimum indication on the VTVM. Each trap must be adjusted for minimum at its specified frequency. If crystals at the trap frequencies are available, these may be plugged into the crystal oscillator socket of the sweep generator and its output fed into the converter grid. Alternatively a crystal of known frequency may be used to calibrate a standard AM generator. Thus the crystal marker oscillator in the EICO Model 360 serves the dual purpose of providing both an internal marker source for visual alignment purposes and a crystal controlled R.F. signal for external applications such as trap alignment signal generator calibrations, etc.

After completing the entire video alignment and a picture I.F. pattern is obtained on the oscillograph (procedure described below) an external variable marker generator may be used to obtain a traveling pip on the oscillograph pattern. As the traveling "pip" approaches the trap points on the pattern, the pip will decrease in amplitude and disappears at trap points, providing a rapid and approximate check.

VIDEO I.F. TRANSFORMERS

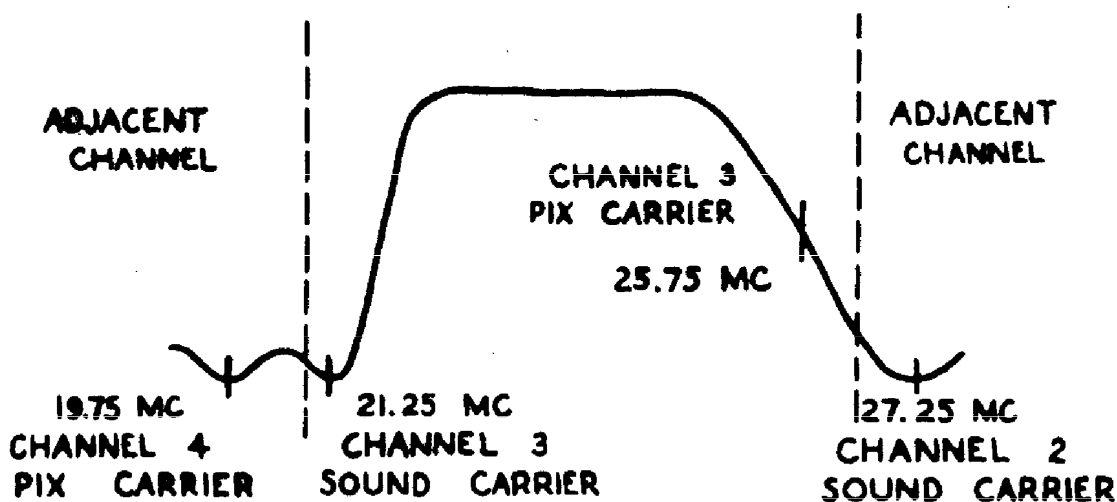
In order to obtain the unusually wide bandwidths in the I.F., the video I.F. transformers are stagger tuned (each peaked to a slightly different frequency). Therefore, each transformer is peaked to its specified frequency. For an overall check the sweep generator input is fed to the R.F. converter grid and sweepwidth set to 10 MC. The R.F. oscillator MUST be made unoperative to eliminate spurious images, by removing the oscillator tube or disconnecting the B/ to that stage.



TYPICAL TELEVISION INTERMEDIATE FREQUENCY AMPLIFIER AND DETECTOR

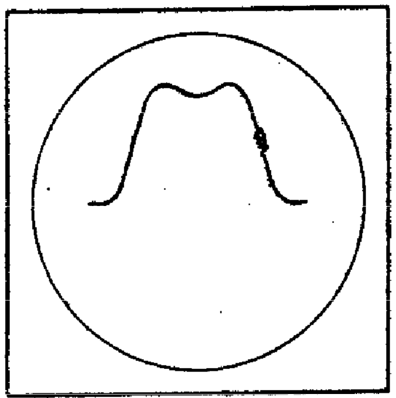
The oscilloscope vertical input leads are connected across the video detector load resistance. Shielded cable is preferable for connecting the oscilloscope to the video load resistance to minimize stray pickup. The overall I.F. response should appear as shown in the oscillograms. The I.F. pattern may appear inverted depending upon the particular receiver and oscilloscope and is of no consequence. Connect the 60 cycle output to the horizontal scope amplifier. The phasing control should be adjusted to obtain a single trace.

The sweep generator output should be adjusted so as not to produce an overload in the video I.F. An external variable marker oscillator can be fed to the binding posts on the sweep generator indicating whether the alignment of the video I.F. is at the proper specified frequencies. The I.F. trimmers may be touched up to obtain the desired response curve.

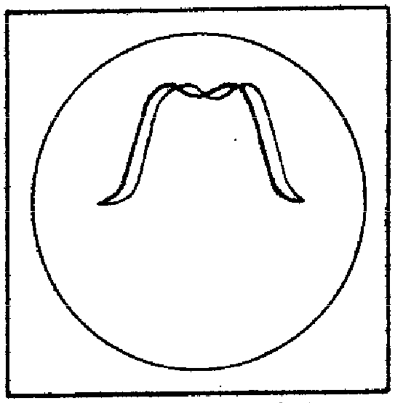


TYPICAL VIDEO IF RESPONSE CURVE

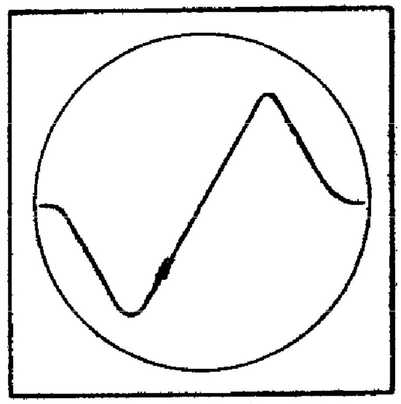
TYPICAL VISUAL RESPONSE CURVES



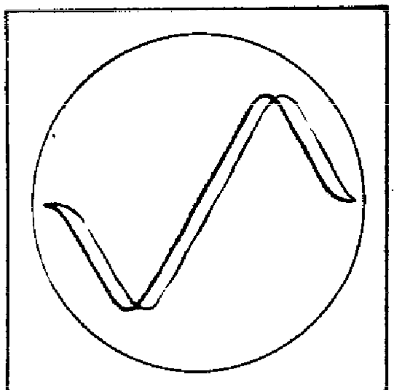
TYPICAL F-M I.F RESPONSE CURVE WITH MARKER PIP



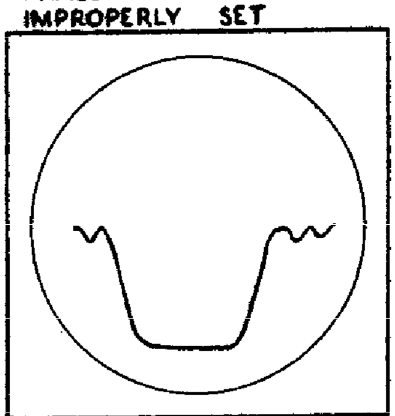
F-M I.F. RESPONSE CURVE PHASE CONTROL IMPROPERLY SET



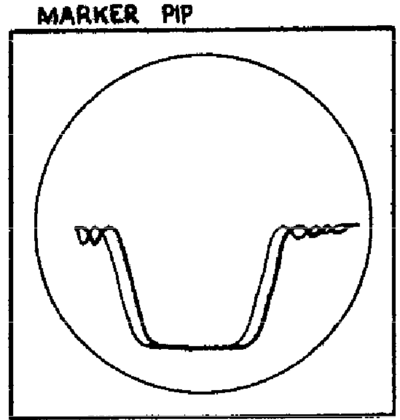
F-M DISCRIMINATOR I.F. RESPONSE CURVE WITH MARKER PIP



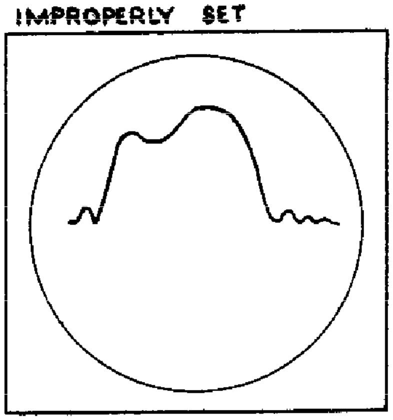
F-M DISCRIMINATOR RESPONSE CURVE -"PHASE CONTROL" IMPROPERLY SET



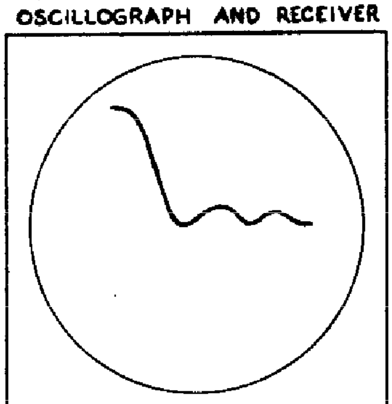
VIDEO I.F. RESPONSE CURVE INVERTED - DEPENDENT UPON OSCILLOGRAPH AND RECEIVER



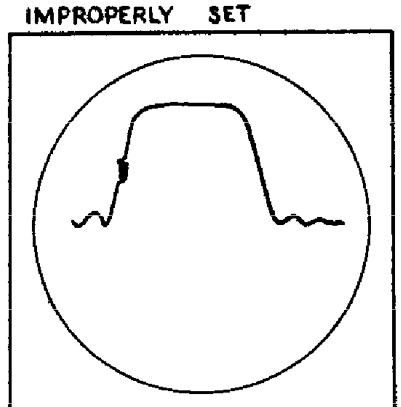
VIDEO I.F. RESPONSE CURVE "PHASE CONTROL" IMPROPERLY SET



VIDEO I.F. RESPONSE CURVE TOO MUCH SIGNAL INPUT



VIDEO I.F. RESPONSE CURVE "SWEEP WIDTH" CONTROL TOO LOW



VIDEO I.F. RESPONSE CURVE WITH MARKER ON SLOPE

SOUND I.F. AND DISCRIMINATORS

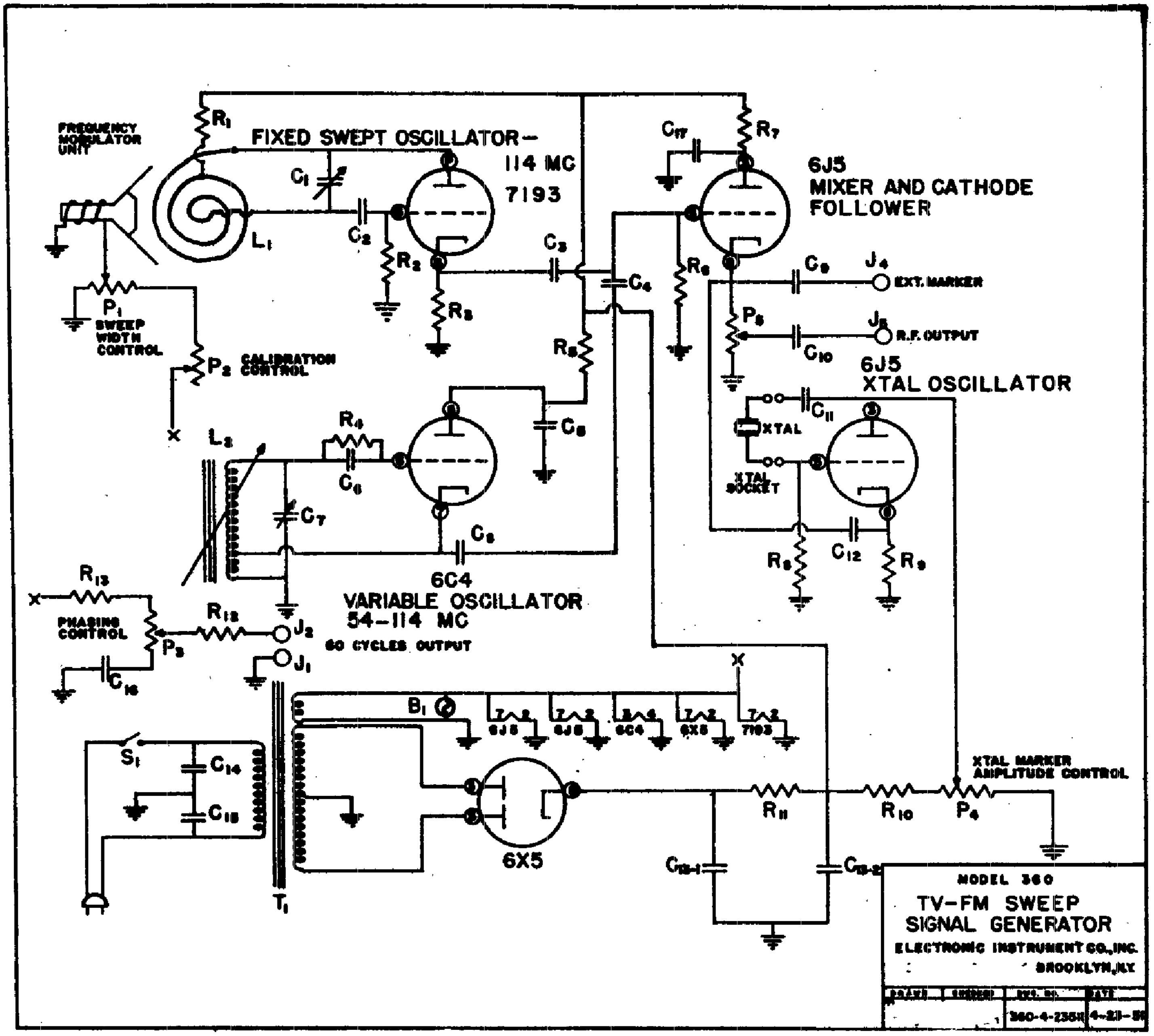
These are aligned according to the procedure given under FM alignment using the manufacturer's specified frequencies.

R.F. OSCILLATOR ALIGNMENT

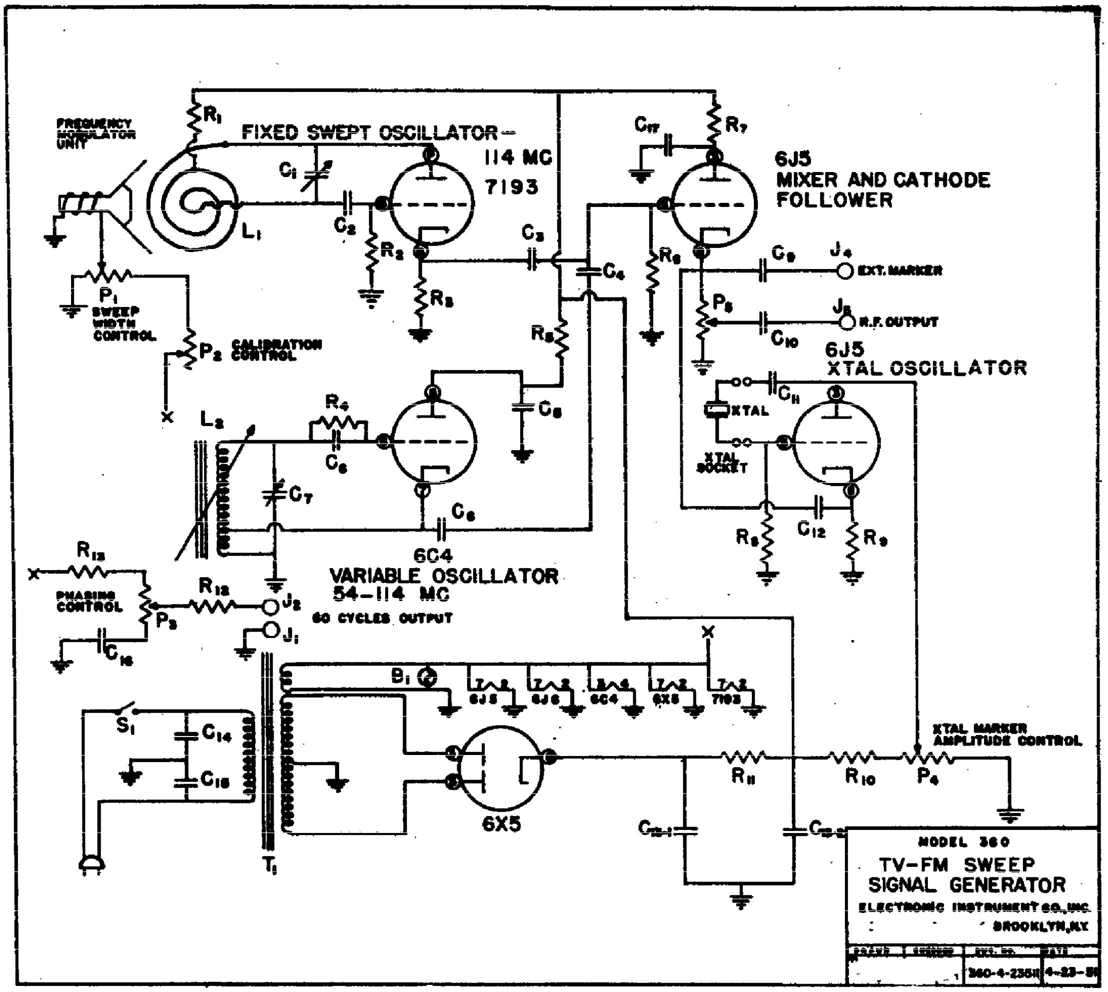
Connect the vertical terminals of the scope as for video I.F. alignment across the video detector load resistance and the 60 cycle output to the scope horizontal amplifier. The sweep generator output is coupled to the receiver input and sweepwidth tuned to 10 MC. sweep. The center frequency is then set at the appropriate TV channel and the video I.F. pattern should be centered on the screen. Otherwise the oscillator trimmer is adjusted. Final adjustment should be made on the station picture itself.

R.F. ALIGNMENT

This is usually a touching up operation and no radical adjustments should be required. With the same set-up as for oscillator alignment the R.F. inductances and trimmers are adjusted for maximum response.



SYMBOL	DESCRIPTION
B1	PILOT LIGHT
C1	3-12 MMFD. CER. COND.
C2	50 MMFD. CER. COND.
C3	20 MMFD. CER. COND.
C4	10 MMFD. CER. COND.
C5	600 MMFD. CER. COND.
C6	50 MMFD. CER. COND.
C7	60 MMFD. TUNING COND.
C8	10 MMFD. CER. COND.
C9	.01 MFD. TUBULAR COND.
C10	.01 MFD. TUBULAR COND.
C11	.01 MFD. TUBULAR COND.
C12	100 MMFD. CER. COND.
C13	DUAL 10 MFD. FILTER COND.
C14	.1 MFD. TUBULAR COND.
C15	.1 MFD. TUBULAR COND.
C16	.01 MFD. TUBULAR COND.
C17	600 MMFD. CER. COND.
J1	GROUND CONNECTION
J2	60 CYCLES OUTPUT
J4	EXT. MARKER INPUT
J5	R.F. OUTPUT
L1	FIXED OSCILLATOR COIL
L2	VARIABLE OSCILLATOR COIL
P1	15 OHM POTENTIOMETER
P2	15 OHM POTENTIOMETER
P3	500K OHM POTENTIOMETER
P4	250K OHM POTENTIOMETER
P5	125 OHM POTENTIOMETER
R1	5100 OHM 2 W RESISTOR
R2	3900 OHM ½ W RESISTOR
R3	33 OHM ½ W RESISTOR
R4	20K OHM ½ W RESISTOR
R5	3300 OHM ½ W RESISTOR
R6	270K OHM ½ W RESISTOR
R7	10K OHM 2 W RESISTOR
R8	47K OHM ½ W RESISTOR
R9	470 OHM ½ W RESISTOR
R10	5100 OHM 1 W RESISTOR
R11	510 OHM 2 W RESISTOR
R12	100K OHM ½ W RESISTOR
R13	10K OHM ½ W RESISTOR
S1	SPST SWITCH
T1	POWER TRANSFORMER



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B1	PILOT LIGHT
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C4	10 MMFD. CER. COND.
C5	600 MMFD. CER. COND.
C6	50 MMFD. CER. COND.
C7	60 MMFD. TUNING COND.
C8	10 MMFD. CER. COND.
C9	.01 MFD. TUBULAR COND.
C10	.01 MFD. TUBULAR COND.
C11	.01 MFD. TUBULAR COND.
C12	100 MMFD. CER. COND.
C13	DUAL 10 MFD. FILTER COND.
C14	.1 MFD. TUBULAR COND.
C15	.1 MFD. TUBULAR COND.
C16	.01 MFD. TUBULAR COND.
C17	600 MMFD. CER. COND.
J1	GROUND CONNECTION
J2	60 CYCLES OUTPUT
J4	EXT. MARKER INPUT
J5	R.F. OUTPUT
L1	FIXED OSCILLATOR COIL
L2	VARIABLE OSCILLATOR COIL
P1	15 OHM POTENTIOMETER
P2	15 OHM POTENTIOMETER
P3	500K OHM POTENTIOMETER
P4	250K OHM POTENTIOMETER
P5	125 OHM POTENTIOMETER
R1	5100 OHM 2 W RESISTOR
R2	3900 OHM ½ W RESISTOR
R3	33 OHM ½ W RESISTOR
R4	20K OHM ½ W RESISTOR
R5	3300 OHM ½ W RESISTOR
R6	270K OHM ½ W RESISTOR
R7	10K OHM 2 W RESISTOR
R8	47K OHM ½ W RESISTOR
R9	470 OHM ½ W RESISTOR
R10	5100 OHM 1 W RESISTOR
R11	510 OHM 2 W RESISTOR
R12	100K OHM ½ W RESISTOR
R13	10K OHM ½ W RESISTOR
S1	SPST SWITCH
T1	POWER TRANSFORMER