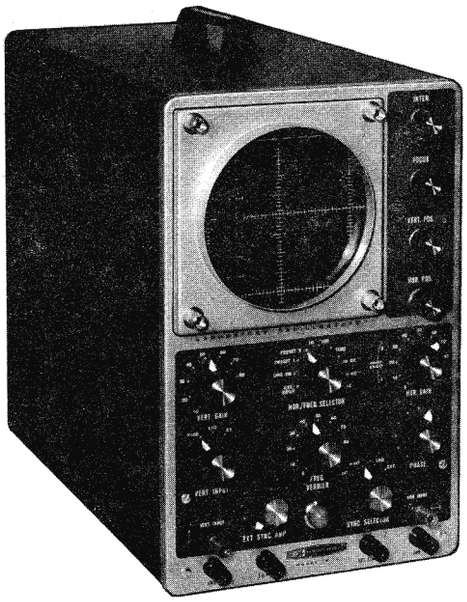
Assembly
and
Operation
of the

HEATHKIT
by Daystrom

LABORATORY 5" OSCILLOSCOPE

MODEL IO-12

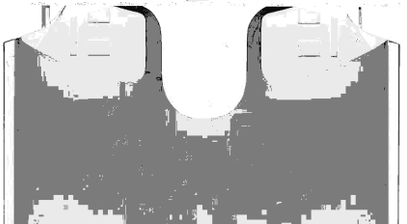


CONDENSED MANUAL

HEATH COMPANY,
BENTON HARBOR,
MICHIGAN

a subsidiary of
DAYSTROM, INCORPORATED

595-561



SPECIFICATIONS

VERTICAL CHANNEL:

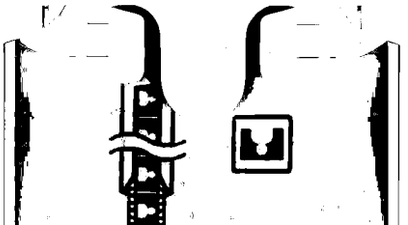
Sensitivity:	0.025 volts (rms) per inch at 1 kc.
Frequency Response:	±1 db from 8 cps to 2.5 mc. +1.5 to -5 db from 3 cps to 5 mc. Response at 3.58 mc: - 2.2 db. (All response measurements referred to 1 kc.)
Rise Time:	0.08 microseconds or less.
Overshoot:	10% or less.
Input Impedance:	In X1 attenuator position, 2.9 megohms shunted by 21 $\mu\mu$f. (1 kc impedance: 2.7 megohms). In X10 and X100 positions, 3.4 megohms shunted by 12 $\mu\mu$f. (1 kc impedance: 3.3 megohms).
Attenuator:	Three-position, switch-type, fully compensated; no visible change in wave shape at any attenuator setting.
Input Characteristics:	Special low-capacity input terminal; built-in blocking capacitor rated at 600 volts DC.
Vertical Positioning:	DC type; permits placement of undeflected trace at any horizontal level on usable area (±1-1/2" from center) of screen; positioning is almost instantaneous and free of drift.

HORIZONTAL CHANNEL:

Sensitivity:	0.3 volts (rms) per inch at 1 kc.
Frequency Response:	±1 db from 1 cps to 200 kc. ±3 db from 1 cps to 400 kc.
Input Impedance:	30 megohms shunted by 31 $\mu\mu$f. (1 kc impedance: 4.9 megohms).
Attenuator:	Low-impedance type in cathode follower output.
Input Characteristics:	Selector switch permits use of external input through panel terminal, line-frequency sweep of variable phase, either of two preset sweep frequencies, or variable internal sweep from the sweep generator.
Horizontal Positioning:	DC type; permits wide range of positioning to examine any part of trace even with full horizontal gain.

SWEEP GENERATOR:

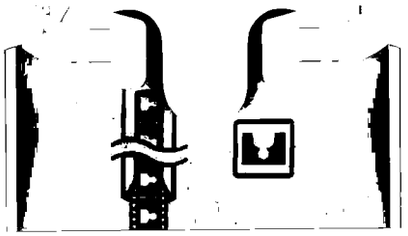
Type:	Recurrent type, utilizing HEATHKIT sweep circuit.

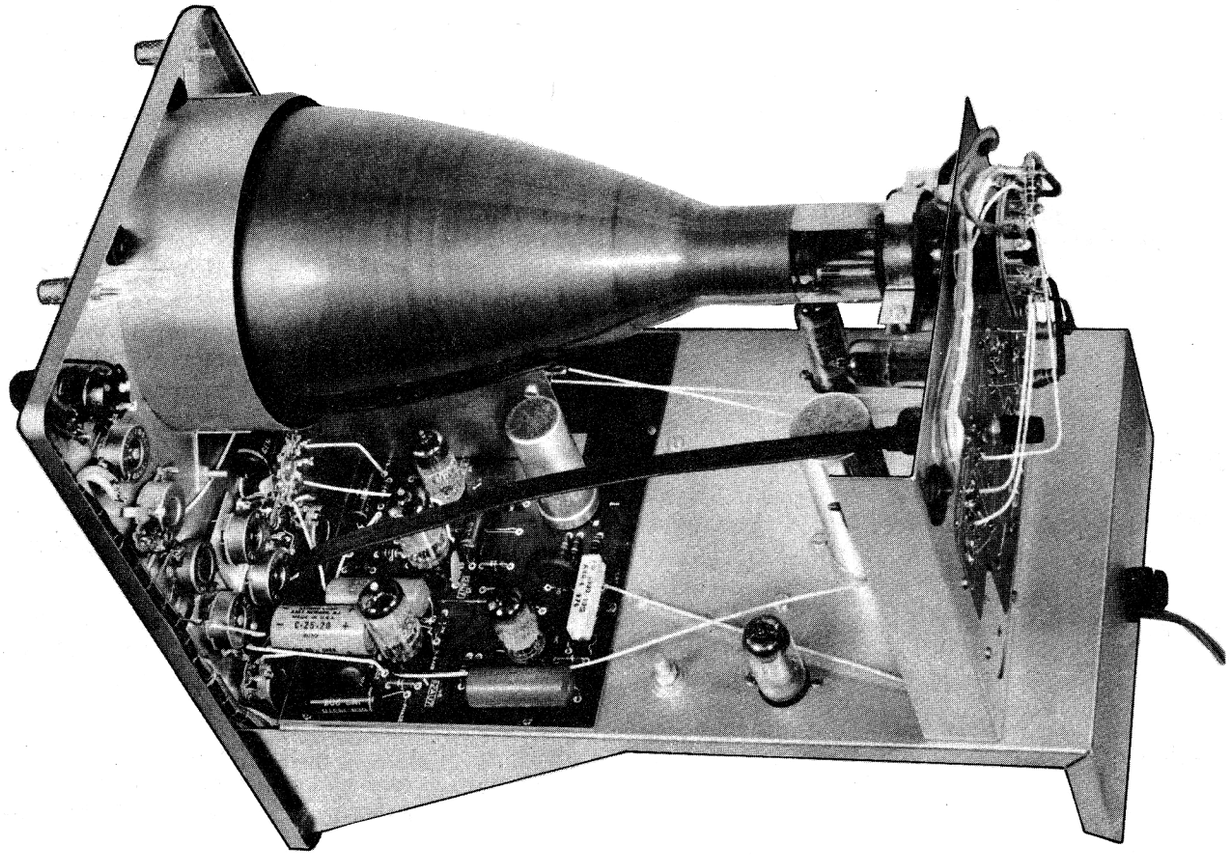


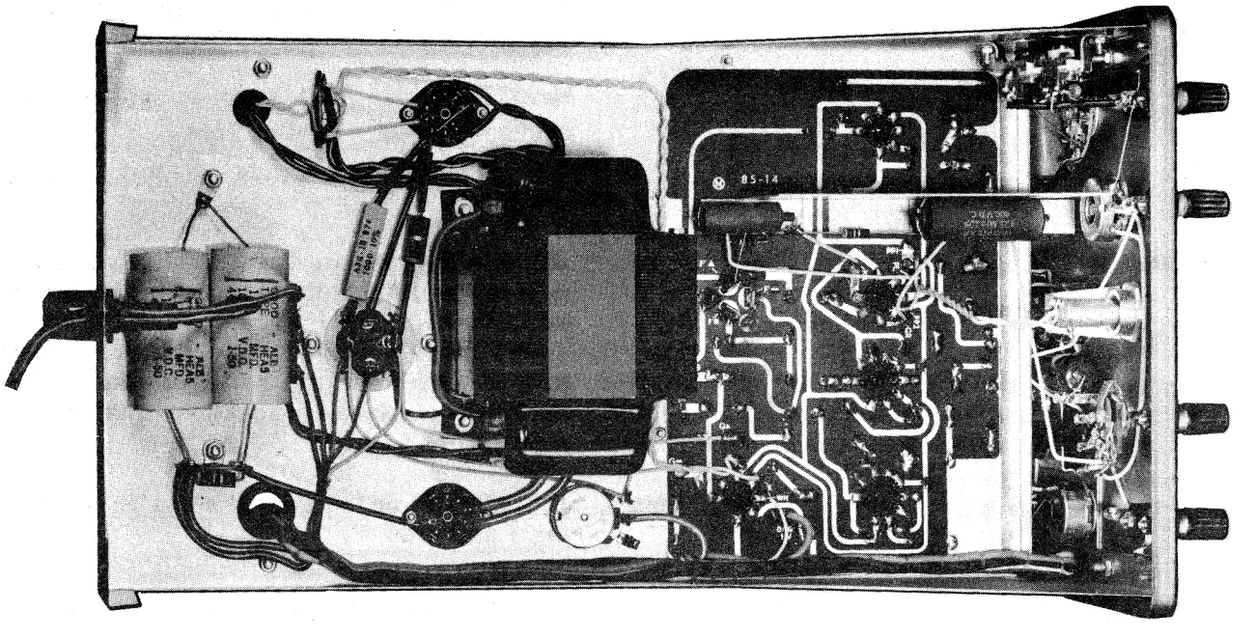
Range:	10 cps to 500 kc in five steps; each range is approximately as follows: 10 to 100 cps, 100 to 1000 cps, 1 to 10 kc, 10 to 100 kc, 100 to 500 kc.
Preset Control Range:	Preset number 1, 10 to 100 cps; preset number 2, 1000 to 10,000 cps. May be easily changed to cover any frequency between 10 cps and 500 kc.
Synchronizing:	Automatic lock-in circuit using self-limiting synchronizing cathode follower. Holds sweep speed essentially independent of vertical gain settings. Selector switch permits synchronizing with either positive or negative signal pulses internally, with external source through panel terminal, or with line frequency.

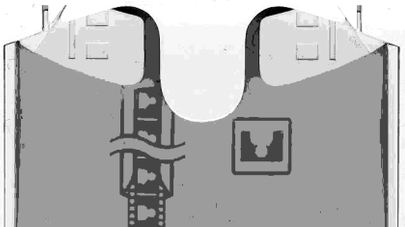
GENERAL:

Retrace Blanking:	Blanking interval less than 30% of sweep rate regardless of sweep speed. Blanking amplifier provided.
Phasing Control:	Provides fully controlled phase shift for line sweep applications. Phasing is continuously variable from zero to over 135 degrees.
Voltage Calibrator:	Built-in source, 1 volt peak-to-peak; calibrated grid screen and input attenuator permit voltage measurements over range of 10,000 to 1.
Z-Axis Modulation:	Provision for intensity modulation of electron stream through high-voltage isolation capacitor; 8 to 20 volts (rms) required for complete blanking of trace.
Access Panel:	Removable panel at rear of cabinet for easy access to Z-axis binding post.
Cathode Ray Tube:	5UP1, 5" screen, green, medium-persistence phosphor.
Power Supplies:	High-voltage supply: transformer-rectifier type, developing 1200 volts at output of RC filter system. Low-voltage supply: transformer-rectifier type, full electronic voltage regulation for all critical amplifier, sweep generator, and positioning potentials.
Power Requirements:	105-125 volt 50/60 cycles AC at 80 watts; fused for 1 ampere.
Dimensions:	8-5/8" wide x 14-1/8" high x 16" deep.
Net Weight:	20-1/2 lbs.
Shipping Weight:	21 lbs.









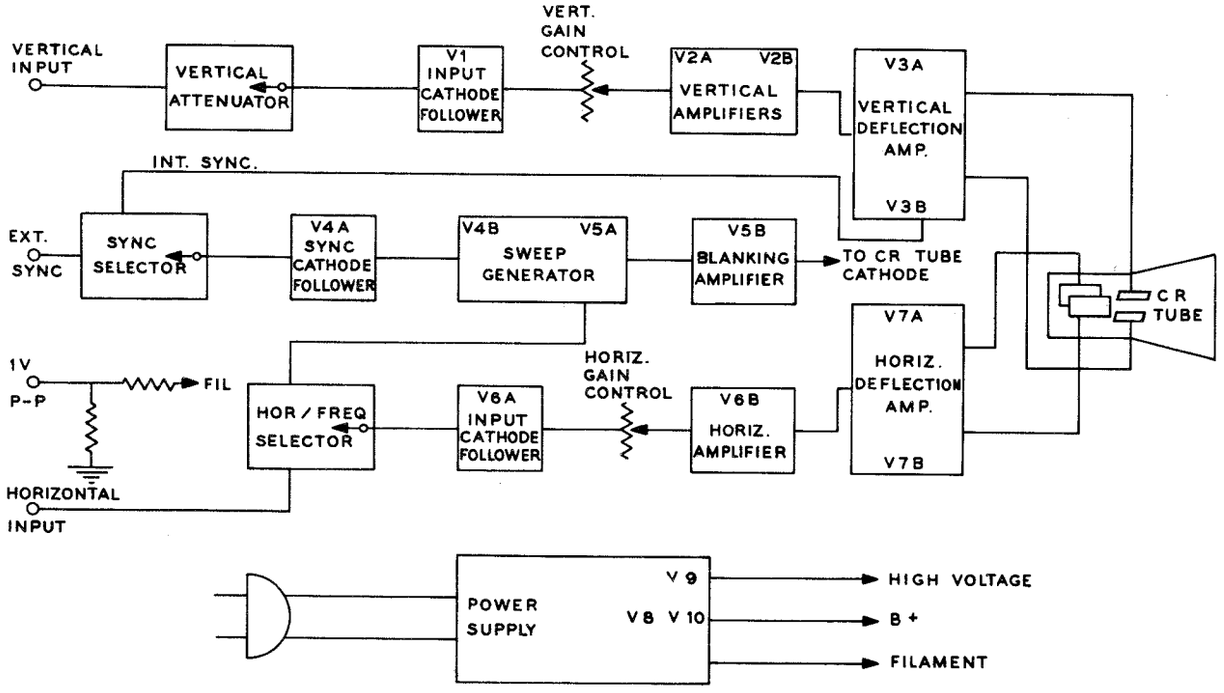
INTRODUCTION

The HEATHKIT Model IO-12 Oscilloscope is a wide-range, general-purpose oscilloscope, designed to satisfy the needs of both the electronic serviceman and the ham operator, or hobbyist. Many years of refinements on earlier models have culminated in this troublefree performer.

The use of two preset adjustments in the horizontal oscillator circuit facilitate instantaneous horizontal lock-in for often-used sweep frequencies. This is especially handy in servicing the vertical and horizontal circuits of television receivers.

CIRCUIT DESCRIPTION

Reference to the fold-out Schematic at the rear of the manual, and to the Block Diagram which follows, will prove helpful in thoroughly understanding this description.

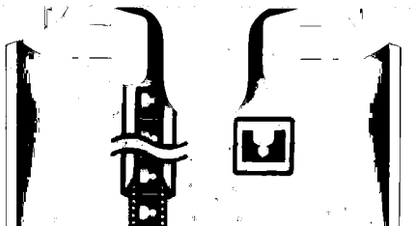


VERTICAL AMPLIFIER

A signal applied to the VERT. INPUT terminals is coupled through the frequency-compensated vertical attenuator to V1. From input cathode follower V1, the signal is coupled through VERT. GAIN control R8 to amplifiers V2A and V2B.

From V2B, the signal is applied through the series peaking coil to the push-pull vertical deflection amplifier. Positioning of the trace is accomplished by adjusting VERT. POS. control R18, which changes the relative DC grid voltages between the halves of the push-pull amplifier. The fixed tap of control R18 provides the reference voltage for V3A.

Push-pull output stage V3A and V3B drives the vertical plates of the CR tube to provide balanced deflection of the electron beam. (Common cathode coupling applies the signal from V3A to V3B.) A small portion of the signal is coupled from the plate circuits of the push-pull stage to the SYNC. SELECTOR switch to facilitate positive or negative internal sweep synchronization.



SWEEP GENERATOR

The SYNC SELECTOR switch is used to select the desired sweep synchronizing signal. This signal is applied to the sweep generator by means of the common cathode resistor, R38, of V4A and V4B. V4A is the sync cathode follower. V4B and V5A, the sweep multivibrator, with their associated circuit components, create the horizontal sweep waveform. The sweep timing capacitor that is switched into the cathode circuit of V5A, determines the coarse horizontal sweep frequency as it discharges through R47 and FREQ. VERNIER control R48. Fine frequency adjustment of this sawtooth waveform is obtained by varying the FREQ. VERNIER control (or the PRESET ADJUST controls).

A retrace blanking signal is coupled to the CR tube through blanking amplifier V5B from the sweep generator. The positive going portion of the sweep waveform is used for this purpose.

HORIZONTAL AMPLIFIER

The HOR./FREQ. SELECTOR is used to select the desired sweep signal and apply it to input cathode follower V6A. This sweep signal may be from the sweep generator, 60 cycle line sweep, or an external sweep signal from the HOR. INPUT.

The sweep signal is coupled from V6A through the HOR. GAIN control and through amplifier V6B to the push-pull horizontal deflection amplifier, V7A and V7B. The HOR. POS. control is used to position the trace by changing the relative DC grid voltages of the push-pull amplifier.

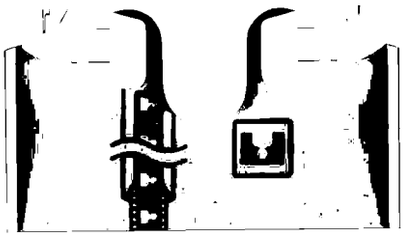
The push-pull horizontal deflection amplifier drives the horizontal plates of the CR tube to provide balanced horizontal deflection of the electron beam.

CATHODE RAY TUBE

Operating and accelerating voltages are supplied to the cathode ray tube (CR tube) by a bleeder network connected from the high voltage power supply to ground. This network contains the FOCUS and INTEN. controls, and supplies bias voltage to regulator tube V10. Intensity modulation of the electron beam may be accomplished by connecting an external signal to the Z-AXIS input of the CR tube.

POWER SUPPLY

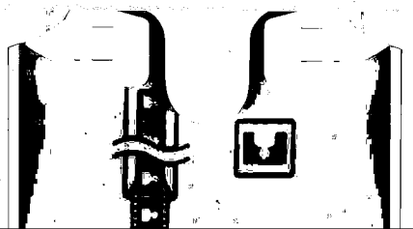
High voltage for the CR tube is supplied by V9, the high-voltage rectifier. B+ is supplied by full-wave rectifier V8 and its associated circuitry. V10 is used to prevent power line surges from appearing on the B+ voltages. Two separate filament windings are used on the power transformer, one for the CR tube alone. The other winding supplies filament voltage to all other tubes, and supplies AC voltage to the HOR./FREQ. switch for line sweep, to the PHASE control, and to the 1-V, P-P binding post.



PARTS LIST

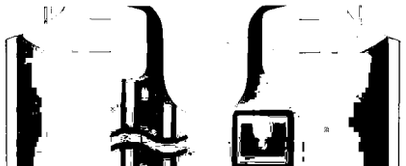
Refer to the fold-out Parts Pictorial on page 13 of this manual.

PART No.	PARTS Per Kit	DESCRIPTION
Resistors		
1-84	1	62 Ω 1/2 watt (blue-red-black)
1-3	5	100 Ω 1/2 watt (brown-black-brown)
1-45	3	220 Ω 1/2 watt (red-red-brown)
1-6	1	470 Ω 1/2 watt (yellow-violet-brown)
1-8	1	820 Ω 1/2 watt (gray-red-brown)
1-9	1	1 KΩ 1/2 watt (brown-black-red)
1-90	2	2 KΩ 1/2 watt (red-black-red)
1-57	3	2.2 KΩ 1/2 watt (red-red-red)
1-13	1	2.7 KΩ 1/2 watt (red-violet-red)
1-14	3	3.3 KΩ 1/2 watt (orange-orange-red)
1-46	2	3.9 KΩ 1/2 watt (orange-white-red)
1-19	1	6.8 KΩ 1/2 watt (blue-gray-red)
1-20	3	10 KΩ 1/2 watt (brown-black-orange)
1-21	1	15 KΩ 1/2 watt (brown-green-orange)
1-22	2	22 KΩ 1/2 watt (red-red-orange)
1-24	2	33 KΩ 1/2 watt (orange-orange-orange)
1-88	1	36 KΩ 1/2 watt (orange-blue-orange)
1-25	1	47 KΩ 1/2 watt (yellow-violet-orange)
1-26	2	100 KΩ 1/2 watt (brown-black-yellow)
1-27	4	150 KΩ 1/2 watt (brown-green-yellow)
1-87	1	330 KΩ 1/2 watt (orange-orange-yellow)
1-33	3	470 KΩ 1/2 watt (yellow-violet-yellow)
1-35	3	1 megohm 1/2 watt (brown-black-green)
1-38	2	3.3 megohm 1/2 watt (orange-orange-green)
1-71	2	4.7 megohm 1/2 watt (yellow-violet-green)
1-40	3	10 megohm 1/2 watt (brown-black-blue)
1-70	1	22 megohm 1/2 watt (red-red-blue)
1A-2	2	1 KΩ 1 watt (brown-black-red)
1A-22	1	1.5 KΩ 1 watt (brown-green-red)
1A-27	2	33 KΩ 1 watt (orange-orange-orange)
1A-28	1	100 KΩ 1 watt (brown-black-yellow)
1A-32	1	470 KΩ 1 watt (yellow-violet-yellow)
1A-34	1	1 megohm 1 watt (brown-black-green)
1A-37	1	3.3 megohm 1 watt (orange-orange-green)
1B-19	1	1.2 KΩ 2 watt (brown-red-red)
1B-1	2	2.7 KΩ 2 watt (red-violet-red)
1B-2	1	4.7 KΩ 2 watt (yellow-violet-red)
1B-22	1	12 KΩ 2 watt (brown-red-orange)
2-129	1	3.3 megohm 1/2 watt 5% precision
3G-15	1	1000 Ω 7 watt wire-wound
3G-4	1	5000 Ω 7 watt wire-wound
Controls-Switches		
10-65	1	2000 Ω linear control with dummy lug
10-31	1	10 KΩ linear control
10-41	1	20 KΩ control, center-tapped
10-13	1	200 KΩ control, center-tapped
10-26	1	500 KΩ linear control
10-32	1	1 megohm linear control
10-39	2	2 megohm linear control
10-45	1	7.5 megohm linear control
10-115	2	7.5 megohm linear control, tab-mounting
19-40	1	500 KΩ control with SPST switch and dummy lug
63-47	1	3-position switch
63-88	1	4-position switch
63-237	1	9-position switch



PART No.	PARTS Per Kit	DESCRIPTION
Capacitors		
21-3	1	10 μμf ceramic
21-5	1	20 μμf ceramic
20-1	1	47 μμf mica (yellow-violet-black)
21-9	1	100 μμf ceramic
21-21	1	200 μμf ceramic
20-43	1	390 μμf mica (orange-white brown)
21-13	1	500 μμf ceramic
21-36	2	.002 μfd ceramic
21-16	1	.01 μfd ceramic
23-3	1	.01 μfd paper tubular, 400 V
21-31	1	.02 μfd ceramic, 500 V
21-38	2	.02 μfd ceramic, 1600 V
23-59	2	.05 μfd plastic molded tubular, 200 V
23-11	1	.1 μfd paper tubular, 600 V
23-28	6	.1 μfd plastic molded tubular, 200 V
23-62	2	.1 μfd paper tubular, 1600 V
23-58	2	.2 μfd plastic molded tubular, 200 V
23-63	3	.25 μfd plastic molded tubular, 400 V
25-20	2	40 μfd electrolytic, 150 V
25-28	1	100 μfd electrolytic, 50 V
25-31	1	20-20-20 μfd at 250 V-250 V-250 V electrolytic
25-32	1	40-20-20-50 μfd at 450 V-450 V- 450 V- 300 V electrolytic
31-12	1	Dual trimmer
Chokes-Transformer		
45-25	1	30 μh (green band)
45-12	2	33 μh on 3300 Ω 1 watt resistor
45-23	2	61 μh (red band)
45-24	2	90 μh (blue-band)
54-103	1	Power transformer
Insulators-Wire		
73-1	2	3/8" grommet
73-2	2	3/4" grommet
73-3	4	1/2" grommet
73-5	1	Cushion strip
75-24	1	Line cord strain relief
89-1	1	Line cord
134-19	1	Cable assembly
340-8	1	Length bare wire
341-1	1	Length black test lead
341-2	1	Length red test lead
344-1	1	Length hookup wire
346-1	1	Length 1/16" sleeving
347-2	1	Length 300 Ω twin lead

PART No.	PARTS Per Kit	DESCRIPTION
Connectors-Terminal Strips-Sockets		
70-5	1	Banana plug sleeve, black
70-6	1	Banana plug sleeve, red
75-17	12	Binding post insulator
100-M16B	5	Binding post cap, black
100-M16R	2	Binding post cap, red
260-1	2	Alligator clip
427-2	11	Binding post base
431-1	1	Dual-lug terminal strip
431-2	3	2-lug terminal strip
431-12	3	4-lug terminal strip
434-16	2	9-pin socket
434-22	1	Pilot lamp socket
434-41	1	12-pin socket
434-45	3	7-pin socket - circuit board type
434-46	5	9-pin socket - circuit board type
438-13	2	Banana plug
481-1	1	Capacitor mounting wafer, metal
Sheet Metal Parts		
90-234	1	Cabinet
100-M294	1	Chassis
100-M296	1	Panel ring
203-219F752, 753, 754	1	Front panel
204-M361	1	Rear support bracket
204-M362	1	Control mounting bracket
204-M363	2	CR tube mounting bracket
206-M144	1	Top shield plate
206-M145	1	Bottom shield plate
207-M1	2	CR tube clamp
210-21F	1	Bezel
Hardware		
250-8	3	#6 sheet metal screw
250-29	2	6-32 x 3/4" screw
250-48	4	6-32 x 1/2" screw
250-49	18	3-48 x 1/4" screw
250-83	2	#10 sheet metal screw
250-89	20	6-32 x 3/8" screw
250-137	4	8-32 x 3/8" screw
252-1	18	3-48 nut
252-3	37	6-32 nut
252-4	4	8-32 nut
252-7	13	3/8"-32 control nut
252-35	4	Thumbnut
253-9	4	#8 flat washer
253-10	13	Steel flat washer, 5/8" OD (control)
253-39	4	Steel flat washer, 9/16" OD
254-1	33	#6 lockwasher
254-2	4	#8 lockwasher
254-4	9	Control lockwasher
259-1	10	#6 solder lug
259-10	4	Control solder lug



PART No.	PARTS Per Kit	DESCRIPTION
Tubes*-Lamp		
411-4	1	6C4 tube
411-153	3	12AU7/ECC82 tube
411-49	1	5UP1 cathode ray tube (CR tube)
411-58	1	6AB4 tube
411-65	1	1V2 tube
411-68	1	6AN8 tube
411-73	1	12BH7 tube
411-79	1	6J6 tube
411-110	1	EZ81/6CA4 tube
412-1	1	#47 lamp

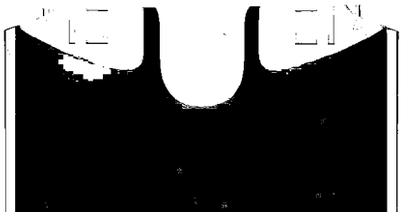
*The type markings on the tubes furnished with this kit may or may not be followed by the letter "A."

PART No.	PARTS Per Kit	DESCRIPTION
Miscellaneous		
85-12F179	1	Small circuit board
85-14F178	1	Large circuit board
211-15	1	Handle
261-9	4	Rubber feet
414-11	1	Green grid screen
414-10	1	Grid screen window
421-23	1	1 ampere slow-blow fuse
423-1	1	Fuseholder
462-138	4	Small knob
462-139	8	Large knob
463-27	8	Knob pointer
595-561	1	Manual

ADJUSTMENT

CAUTION: The voltages in the instrument are dangerous. Extreme care should be exercised whenever the instrument is connected to the AC line without being installed in its case. DO NOT connect the line cord to an AC outlet until you have read and fully understand the following instructions on testing the oscilloscope.

Some of the adjustments which must be made on the instrument cannot be performed with the cabinet in place. Whenever the oscilloscope is operated without the cabinet, be sure to remove the line cord from the outlet before attempting to change the position of the scope on the bench. Some of the highest voltages in the circuit appear on the INTEN. and FOCUS control terminals, just below the top edge of the panel. It is easy to get a finger on one of these terminals.



( ) Set the controls as follows BEFORE connecting the line cord to an AC outlet:

INTEN. - Full counterclockwise.
FOCUS - At approximate center of rotation.
VERT. POS. - At approximate center of rotation.
HOR. POS. - At approximate center of rotation.
VERT. GAIN - Full counterclockwise.
HOR./FREQ. SELECTOR - Full counterclockwise.
HOR. GAIN - 0.
VERT. INPUT - X100.
FREQ. VERNIER - 50.
PHASE - At approximate center of rotation.
EXT. SYNC. AMPLITUDE - Full counterclockwise.
SYNC. SELECTOR - EXT. Spot Shape (on chassis) - At approximate center of rotation.

( ) Connect the line cord to a 105-125 volt 50/60 cycle AC outlet. CAUTION: This instrument will not operate and may be seriously damaged if connected to a DC or 25 cycle AC power source, or to an AC line of more than 125 volts.

( ) Turn the INTEN. control full clockwise. The pilot light should light and all tube filaments (except IV2) should show color. Allow about one minute for the tube filaments to reach operating temperature.

( ) Watch the screen of the CR tube carefully until a green spot appears. Reduce the brightness of the spot at once by rotating the INTEN. control counterclockwise. Now, adjust the FOCUS control to reduce the size of the spot to a minimum.

CAUTION: DO NOT PERMIT A HIGH INTENSITY SPOT TO REMAIN STATIONARY ON THE SCREEN FOR ANY LENGTH OF TIME. THIS MAY DESTROY THE FLUORESCENT MATERIAL ON THE SCREEN AND LEAVE A DARK SPOT.

( ) Rotate the HOR. POS. control and notice that the spot moves horizontally across the screen. Now, using the VERT. POS. control, move the spot up and down. Adjust these two controls so that the spot is centered on the screen.

If no spot appears, rotate the HOR. control, since this control may position the spot well off the screen. It may also be necessary to readjust the FOCUS and INTEN. controls to form the spot. If still no spot can be seen, refer to the IN CASE OF DIFFICULTY section of this manual.

( ) With the spot centered on the screen, adjust the Spot Shape control (at the right side of the chassis) to make the spot as round as possible. It may be necessary to readjust the FOCUS and INTEN. controls several times during this procedure as there is some interaction between the circuits. The result should be a sharply defined spot of small size, the brightness of which can be varied with the INTEN. control. CAUTION: In making this adjustment, be careful not to touch any of the wiring at the rear of the chassis.

( ) Using one of the test leads, connect a jumper from the 1-V, P-P terminal to the HOR. INPUT terminal. Turn the HOR. GAIN control clockwise. The spot should now become a horizontal line, whose length increases to a maximum of about 1-1/4" as the HOR. GAIN control is advanced. If the trace is not level, turn off the power, loosen the tube clamp on the base of the CR tube and rotate the tube slightly to make the trace horizontal. Tighten clamp and check trace to see that it is level.

CAUTION: DO NOT ATTEMPT TO MAKE THIS ADJUSTMENT WITHOUT TURNING OFF THE INSTRUMENT. SOME SOCKET CONTACTS ON THE CR TUBE ARE APPROXIMATELY 1200 VOLTS "HOT". CONTACT WITH THESE TERMINALS WOULD CAUSE A SEVERE ELECTRIC SHOCK.

( ) Next, connect the jumper from the 1-V, P-P terminal to the VERT. INPUT terminal. Turn the HOR. GAIN to "0." Rotate the VERT. GAIN control clockwise and notice that the trace is now vertical and controlled in length by the VERT. GAIN control setting. Switch the VERT. INPUT to X10. The line now can be extended to the same length at a fairly low setting of the VERT. GAIN control.

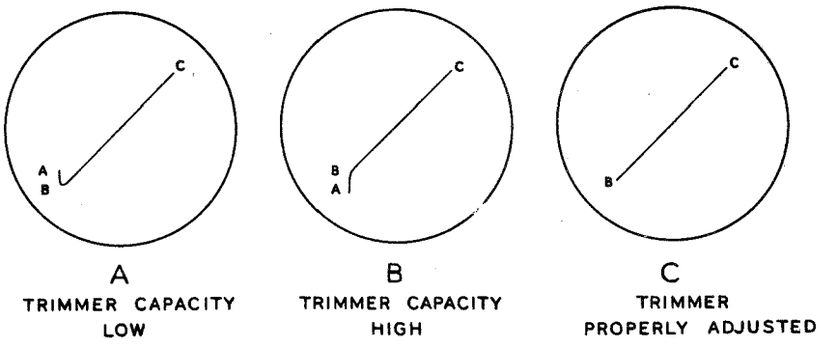


Figure 2

( ) Set the SYNC. SELECTOR switch to the +INT. position, the HOR. GAIN control to 30, the VERT. INPUT switch to X10, and the VERT. GAIN control to 100. Now set the HOR./FREQ. selector to the dot between 10 and 100, and adjust the FREQ. VERNIER to obtain a pattern consisting of four complete sine waves similar to that shown in Figure 1. This check indicates that the sweep generator is operating normally at a frequency of 60/4, or 15 cycles per second. Reduce the HOR. GAIN setting if necessary. The breaks in the trace are caused by the fields of the power transformer. This will not be present with external signals.

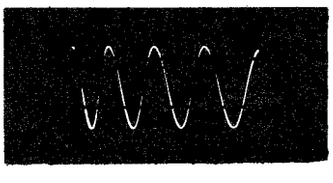


Figure 1

( ) Disconnect the jumper from the 1-V, P-P terminal. Turn off the power and connect the free end of the jumper to the excess lead coming from HOR. IN. on the rear circuit board. Set the HOR./FREQ. SELECTOR to the dot between 1000 and 10 kc, and the FREQ. VERNIER to 0. Now turn on the power. You should get a trace similar to that in Figure 2A or B. Reduce both GAIN control settings so that the trace is about 2" long.

( ) With the VERT. INPUT switch in the X10 position, adjust the front trimmer of the dual trimmers until the AB portion of the trace disappears and only a straight sloping line remains. (The dual trimmer is located on the left front part of the chassis.)

( ) Switch the VERT. INPUT to X100 and adjust the rear trimmer of the dual trimmer to obtain the same result as in the preceding step. In this adjustment, you will notice that the slope of the BC portion of the trace is more nearly horizontal because of the lower vertical gain being employed. The adjustment can still be made very accurately. Turn power off and disconnect jumper from rear circuit board. Clip off the excess wire at HOR. IN.

The adjustments just made are to compensate the vertical input attenuators so that they are not frequency conscious. This compensation preserves the excellent frequency response of the vertical amplifier even with high input attenuation.

NOTE: Adjustment of the PRESET ADJUST controls is described in the OPERATION section of this manual on Page 32.

( ) The chassis should now be installed in the cabinet. Pass the line cord through the large hole in the back of the cabinet, then slide the chassis in and fasten it in place, using two #6 sheet metal screws through the back of the cabinet and into the rear chassis apron. Be careful not to pinch the wires along the edge of the front panel when installing the cabinet.

OPERATION

The operation of an oscilloscope and its many controls is quite simple once the basic principles are clear.

The controls can be divided into groups with specific functions.

Two knobs, marked INTEN. and FOCUS, control the quality of the trace. The INTEN. control adjusts the brightness and the FOCUS control adjusts the sharpness of the trace on the oscilloscope screen.

Two knobs, marked VERT. POS. and HOR. POS., control the location of the trace on the screen. Turning the VERT. POS. knob shifts the trace up or down; the HOR. POS. knob is used to move the trace left or right.

The knob marked HOR. GAIN, varies the width of the pattern on the screen.

Two knobs, marked VERT. GAIN and VERT. INPUT, control the height of the pattern on the screen.

The PHASE knob controls the phase shift of the line-frequency voltage and is used for LINE sweep (LINE SW.).

Three knobs, marked HOR./FREQ. SELECTOR, FREQ. VERNIER and EXT. SYNC. AMPLITUDE, control the operation of the sweep generator. The HOR./FREQ. SELECTOR and FREQ. VERNIER permit selection of the desired sweeping rate to provide a clear pattern. The EXT. SYNC. AMPLITUDE control operates only on external synchronization to adjust the voltage input to the synchronizing circuit.

The HOR./FREQ. SELECTOR switch also performs the following functions:

EXT. INPUT: The HOR. INPUT binding post is connected directly to the input grid of the horizontal amplifier system. The sweep generator is not operating and external sweep can be applied to the binding posts.

LINE SW.: Line frequency voltage, controlled in phase by the PHASE control, is applied to the horizontal amplifier system. The sweep thus applied to the amplifier is sinusoidal in waveform.

PRESETS #1 and #2: Often used horizontal sweep frequencies (such as the sweep frequencies of a TV set) can be preadjusted by means of the screwdriver adjustments available on the front panel of the oscilloscope.

See the ADJUSTMENT section (Page 33) for these controls.

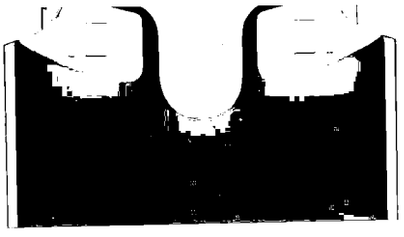
The SYNC. SELECTOR switch operates as follows when the sweep generator is operating.

-INT. and +INT.: The sweep generator is synchronized internally with the signal applied at the VERT. INPUT binding post.

LINE: The sweep generator is synchronized with the line frequency or its harmonics.

EXT.: The sweep generator is synchronized with any signal applied to the EXT. SYNC. binding post.

The 1-V, P-P binding post supplies a voltage for establishing the overall gain of the vertical amplifier. When this voltage is applied to the VERT. INPUT terminal and the VERT. GAIN control and VERT. INPUT switch are set for a given measured vertical deflection on the grid screen, it becomes a simple matter to determine the peak-to-peak value of any unknown voltage. For example; a service specification refers to a particular waveform, designating the normal peak-to-peak voltage as 25 volts. Connect the 1-V, P-P terminal to the VERT. INPUT terminal. With the VERT. INPUT switch in the X10 position, adjust the VERT. GAIN control for a deflection of 1" on the grid screen. Do not touch the VERT. GAIN control again until the measurement is completed. Disconnect the calibrating voltage and apply the unknown voltage to the VERT. INPUT post. Set the VERT. INPUT switch to the X100 position. Now, a 1" deflection indicates a peak-to-peak voltage of 10 volts. (With the VERT. INPUT switch in the X1 position, it would indicate 0.1 volts.) Adjust the sweep controls to lock the waveform and adjust the positioning controls for convenient vertical measurement. Observe that the unknown voltage shows a peak-to-peak deflection of 2.5", or 25 volts.



ADJUSTING THE PRESET ADJUST CONTROLS

Adjustment of the PRESET ADJUST controls may be made directly from the front panel of the oscilloscope with a screwdriver, making possible two completely preadjusted horizontal sweep frequencies. The instrument does not need to be removed from its case for these two adjustments. The frequency range of PRESET ADJUST control number 1 is from 10 cps to 100 cps, and the frequency range of PRESET ADJUST control number 2 is from 1000 cps to 10 kc. By changing the values of C22 or C23 to the values of C17, C18, or C20, the PRESET controls may be used to set fixed sweep frequencies at any frequencies within the range of the sweep generator.

Since the most common use of this facility will be in television repair work, we will describe the adjustment procedure for presetting them for the vertical and horizontal sweep frequencies of a television set.

NOTE: When making these adjustments, be careful not to come into contact with the high voltages present in television sets.

PRESET ADJUST 1

( ) Connect the vertical input of the oscilloscope to a point where a waveform is present in the vertical section of a television set.

( ) Allow sufficient time for both the television set and the oscilloscope to warm up thoroughly, and turn the SYNC. SELECTOR switch of the oscilloscope to the EXT. position. Turn the HOR./FREQ. SELECTOR to PRESET 1.

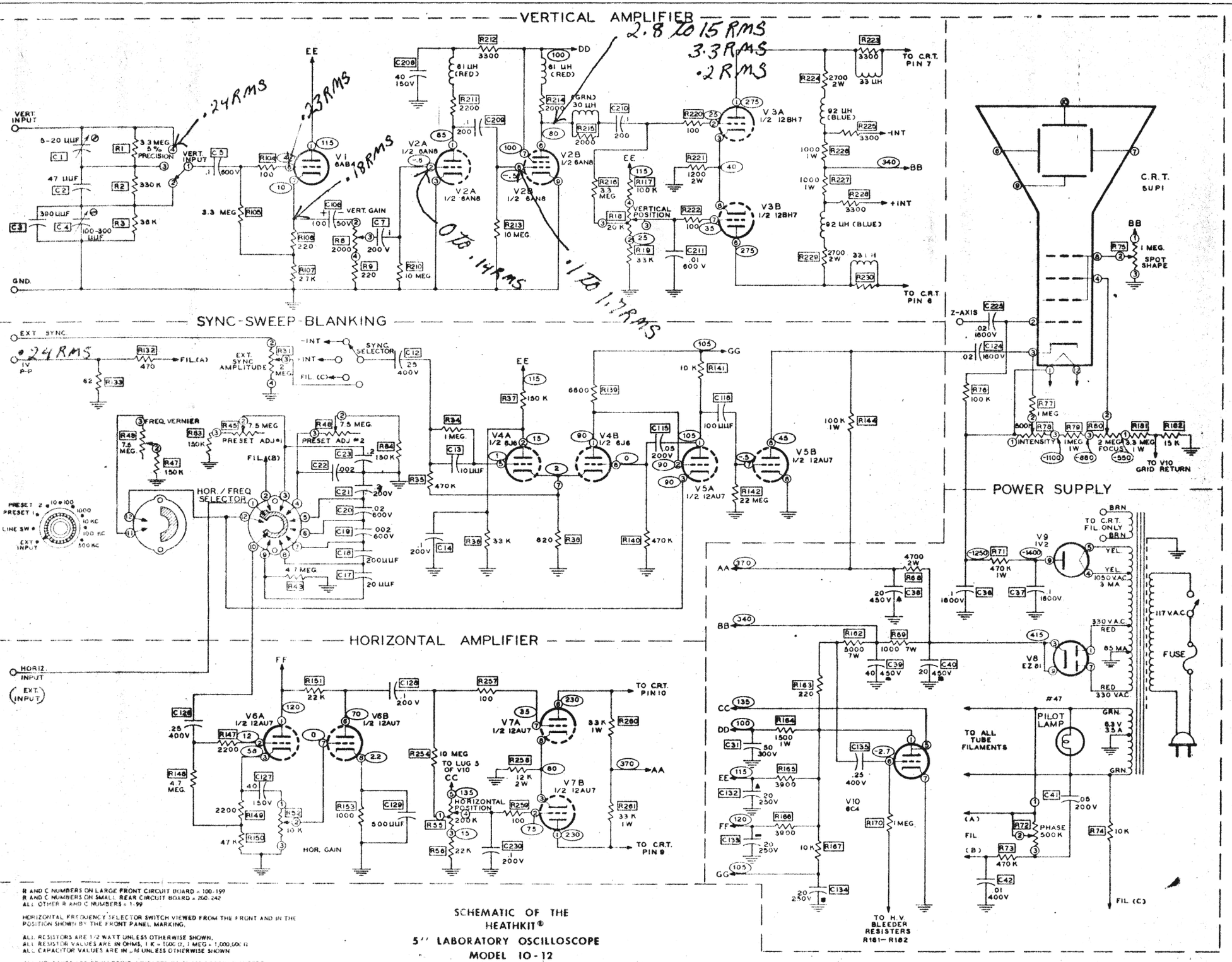
( ) Turn PRESET ADJUST control number 1 until two complete cycles appear on the oscilloscope. Now check this adjustment by turning the SYNC. SELECTOR to the INT. position to make sure the waveforms lock in solidly.

PRESET ADJUST 2

( ) Turn the HOR./FREQ. SELECTOR to PRESET 2. Turn the SYNC. SELECTOR back to the EXT. position.

( ) Connect the vertical input of the oscilloscope to a point where a waveform is available in the horizontal section of a television set.

( ) Turn PRESET ADJUST control number 2 until two complete cycles of the horizontal waveform appear on the oscilloscope. Now check the waveform for stability by turning the SYNC. SELECTOR back to the INT. position.



R AND C NUMBERS ON LARGE FRONT CIRCUIT BOARD = 100-199
R AND C NUMBERS ON SMALL REAR CIRCUIT BOARD = 200-242
ALL OTHER R AND C NUMBERS = 1-99

HORIZONTAL FREQUENCY SELECTOR SWITCH VIEWED FROM THE FRONT AND IN THE POSITION SHOWN BY THE FRONT PANEL MARKING.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SHOWN.
ALL RESISTOR VALUES ARE IN OHMS, 1 K = 1000 Ω, 1 MEG = 1,000,000 Ω
ALL CAPACITOR VALUES ARE IN μf UNLESS OTHERWISE SHOWN

ALL VOLTAGES ARE FROM POINT INDICATED TO CHASSIS GROUND EXCEPT AC VOLTAGES ON POWER TRANSFORMER WINDINGS. READINGS WERE TAKEN WITH AN 11 MEGOHM INPUT VTVM.

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