MODEL 573
ALIGNMENTSCOPE
OPERATION MANUAL

KIKUSUI ELECTRONICS CORP.

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1. INTRODUCTION

The ALIGNMENTSCOPE Model 573, designed and manufactured by Kikusui Electronics Corporation, is an oscilloscope for alignment, featuring suitability for directly viewing the frequency characteristics of a television receiver or a radio receiver, and it is employed in combination with a sweep oscillator.

For the employment of as large a cathode-ray tube as 178mm in size, this model is still designed to be small in size and light in weight. All the circuits are semiconductorized, and comprise a balanced DC amplifier featuring high sensitivity and superb stability, also a stabilized power source circuit; therefore, this model of oscilloscope is negligible in drift and superb in reliability.

Furthermore, this model is furnished with a polarity change-over switch for both horizontal polarization and vertical polarization, respectively, a Z axis marker (luminance modulation) terminal featuring high sensitivity, a stabilized sensitivity calibration voltage terminal, and a light over the scale, thus complete for displaying various functions required of a measuring device for manufacturing radio receivers as well as television receivers.

2. SPECIFICATIONS

Power	-------V, 50/60 Hz, approx. 35 VA
Dimensions	200(W) x 270(H) x 400(D) mm
(Maximum)	206(W) x 295(H) x 460(D) mm
Weight	Approx. 11 kg
Vertical sensitivity	1mVp-p/cm or over
Voltage divider	1/10, 1/100, 1/1,000
Voltage dividing precision	±0.5dB or less
Continuously variable	
Frequency characteristics	AC 2Hz~200kHz, -3dB or less
	DC 0Hz~200kHz, -3dB or less
Input impedance	1MΩ, parallel capacitance, less than 50pF
Input terminal	BNC receptacle
Allowable input voltage	600V (peak value incl. DC)
Horizontal sensitivity	10mVp-p/cm or over
Voltage divider	1/10, 1/100
Voltage dividing precision	±0.5dB or less
Continuously variable	
Frequency characteristics	AC 2Hz~200kHz, -3dB or less
	DC 0Hz~200kHz, -3dB or less
Input impedance	1MΩ, parallel capacitance, 30pF or over

Input terminal	BNC receptacle
Allowable input voltage	600V (peak value incl. DC volt.)
Vertical/horizontal phase difference	3° or less at 20kHz
Calibration voltage	5mVp-p (square wave of stabilized power source frequency)
Precision	±5%
Luminance modulation	
System	Z axis luminance modulation system
Sensitivity	Signals of 1Vp-p being enough for modulation
Frequence characteristics	-3dB or less at 400kHz
Input impedance	Approx. 220kΩ, parallel capacitance 60pF or less
Modulation polarity	Luminance is increased by a signal of positive polarity.
Miscellaneous	Thanks to alimiter, modulation is virtually constant; and to be used free from adjustment in the range of 1Vp-p~10Vp-p.
Allowable input voltage	100V (peak value incl. DC)
Miscellaneous	
Cathode-ray tube	7VP1(F)
Accelerating voltage	Approx. 1,600V
Effective area	10 x 12cm
Accessories	Short bar 1 Operation Manual 1 Test Data 1

3. OPERATION

Front Panel

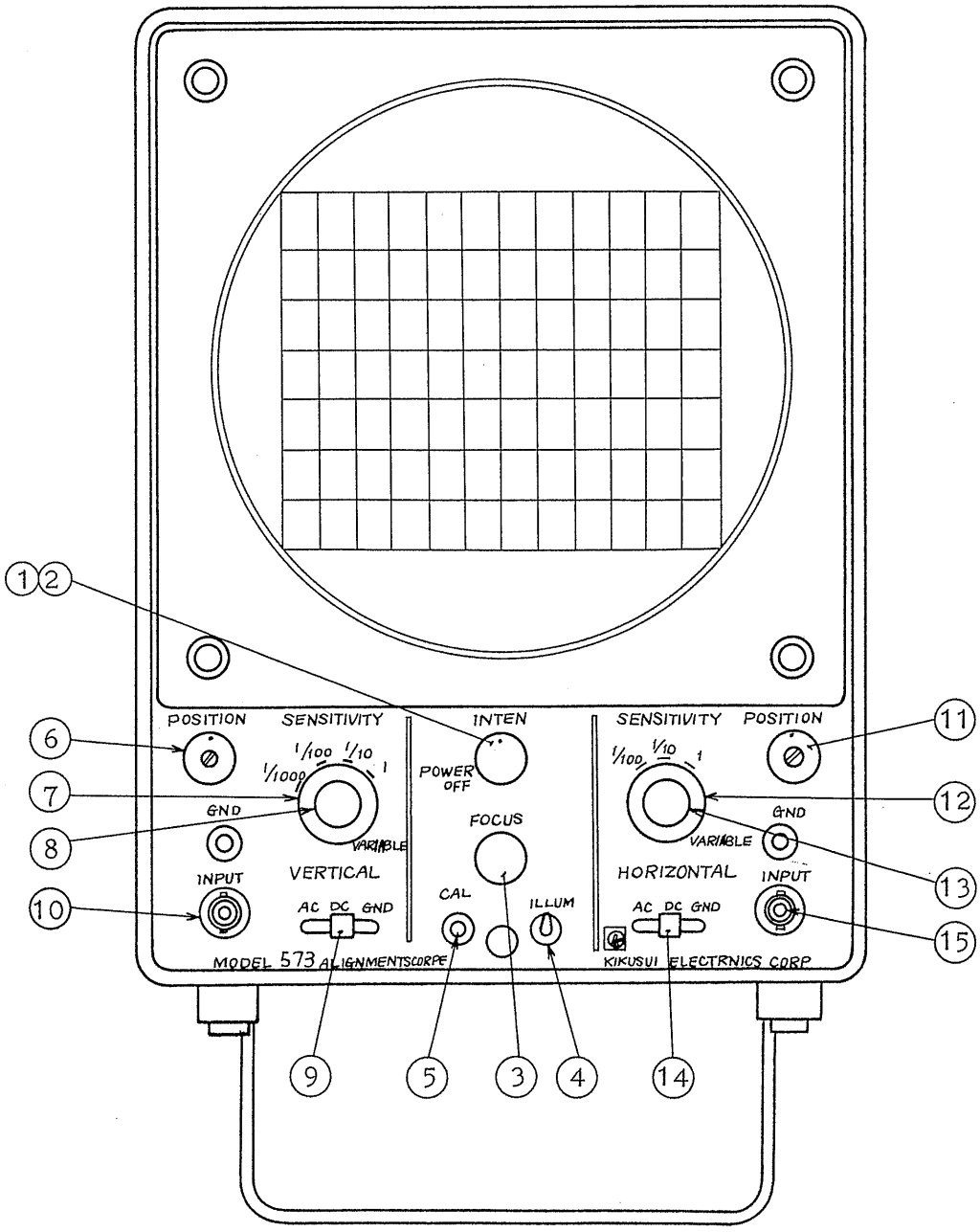


Fig. 1

3.1 Explanation of front panel

(See Fig. 1)

①	POWER OFF	In common use with the INTEN knob, 2 below; power is switched off when this knob is turned counter clockwise to the extreme, power is switched on when this knob is set with a snap by turning clockwise, and the pilot (neon) lamp at the center bottom is turned on.
②	INTEN	The knob to regulate the luminance of the cathode-ray tube. The more it turned clockwise, the more intensity can be obtained.
③	FOCUS	The knob to regulate the focus of the cathode-ray tube. Regulate the focus in a manner that sharpness of the trace can be obtained.
④	ILLUM	The switch for switching on the lamp for illuminating the scale on the front surface of the cathode-ray tube.
⑤	CAL 5mVp-p	Output terminal of deflection sensitivity calibration voltage.

VERTICAL

⑥	POSITION	The knob to move the trace upward or downward. The metal shaft in the center of the knob is the adjuster of the DC balancer of the vertical amplifier. Adjust it with a driver.

⑦ SENSITIVITY

The outside grey knob is for the input voltage divider of the vertical amplifier, and either one of the sensitivity levels, 1, 1/10, 1/100 and 1/1,000, can be selected.

⑧ VARIABLE

The knob red in color, for fine-regulation of sensitivity of the vertical amplifier. Sensitivity can be made continuously variab to approximately 1/10.

⑨ AC, DC, GND

Input of vertical axis can be connected with either AC or DC selectively, and set at GNI the input terminal and the amplifier are disconnected with each other, and the amplifier is grounded.

⑩ INPUT

The vertical input connector.

HORIZONTAL

⑪ POSITION

The knob to move the trace horizontally. The metal shaft in the center of the knob is the adjuster of the DC balancer of the horizontal amplifier. Adjust it with a screw driver.

⑫ SENSITIVITY

The outside grey knob is for the input voltage divider of the horizontal amplifier, and either one of the sensitivity levels, 1, 1/10, and 1/100 can be selected.

⑬ VARIABLE

The knob red in color, for fine-regulation

of sensitivity of the horizontal amplifier. Sensitivity can be made continuously variable to approximately 1/10.

⑭. AC, DC, GND — Input of horizontal axis can be connected with either AC or DC selectively, and once set at GND, the input terminal and the amplifier are disconnected with each other, and the amplifier is short-circuited to GND.

⑮. INPUT — The horizontal input connector.

3.2 Explanation of rear panel (See Fig. 2)

① POLARITY VERT. — The vertical polarity change-over switch. In case the polarity of a trace waveform need be reversed vertically by 180°, put the switch downward. Normally, keep the switch set upward.

② POLARITY HOR. — The horizontal polarity change-over switch. Likewise in the case of the vertical polarity change-over switch, in case the polarity of a trace waveform need be reversed horizontally, put the switch downward. Normally, keep the switch set upward.

③ EXT. INTEN. MOD. — The Z axis intensity modulation input terminals the red one being for the input and the black one being for GND. In the case of using either one, remove the short bar in advance.

④ ASTIG

The regulator to make the focus uniform all over the surface of the cathode-ray tube. Turn it by the use of a screw driver. To obtain the most clear-cut view, adjust the ASTIG knob as well as the FOCUS knob.

⑤ GND

The GND terminal.

⑥ FUSE

The fuse put in place on the primary side of the power source transformer. Select the one of 1A (slow blow).

Rear Panel

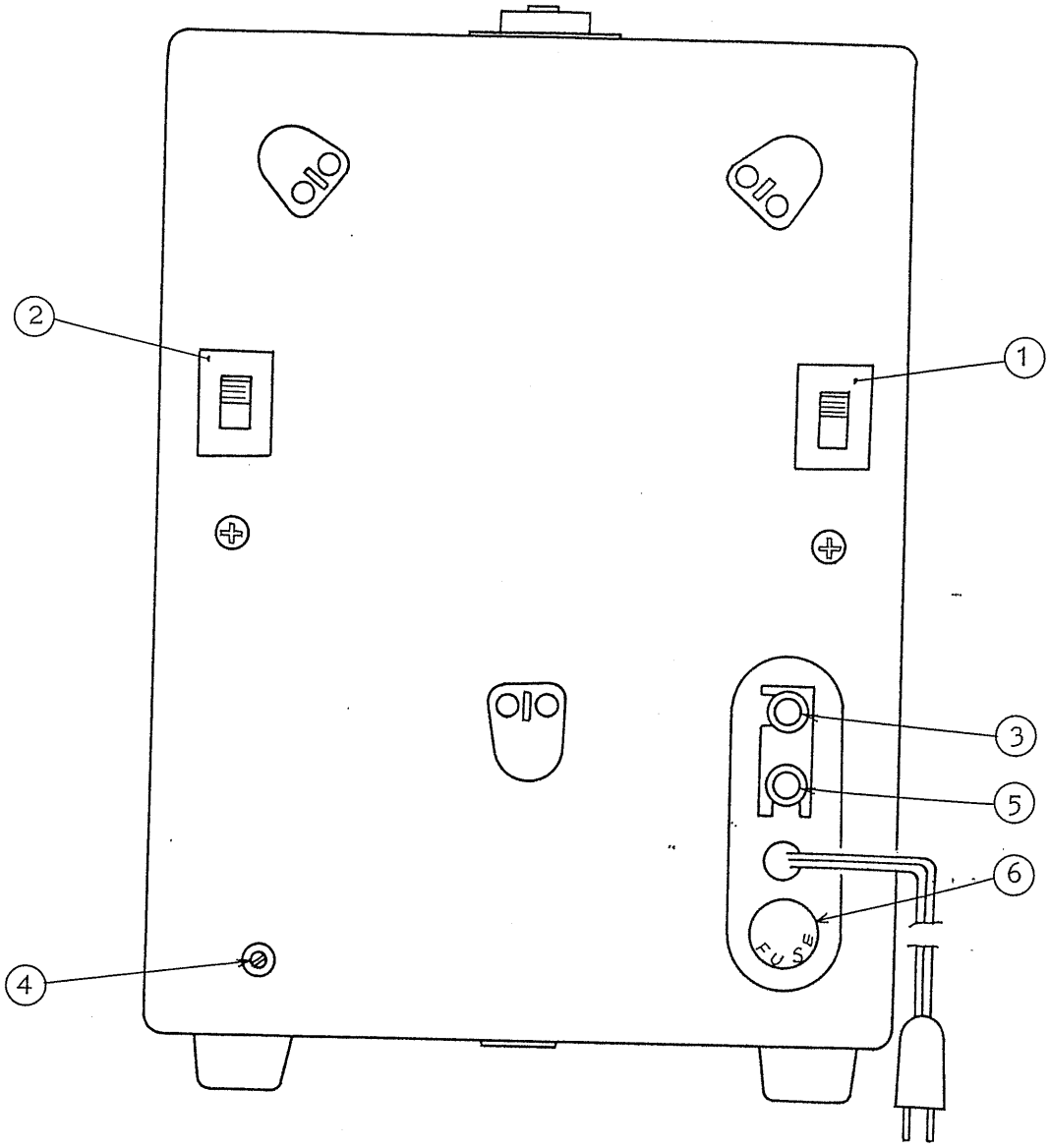


Fig. 2

3.3 Cautions to be exercised in operation

Power source — The line voltage for this model to be operated with stability is in the range of the rated voltage ±10%. For the maintenance of the maximum reliability and the longest life of each component, select the line voltage of such a value as near to the center of this range as possible.

Installation — Install this model for use in the ambient temperature range of 0 - 40°C. Avoid a place exposed to sunbeams directly or to high humidity, or a place filled with dusts; and in case it is employed at such a place adjacent to other equipment generating heat, install a proper ventilation system for it.

Other miscellaneous cautions

Avoid its use adjacent to an intense magnetic field, since otherwise electron beams of the cathode-ray tube might possibly be subjected to electromagnetic deflection, pick up noise, or the trace might possibly be distorted. Also avoid its use or preservation in a place corrosive gas is present, since it reduces by far the life of each electronic component.

Allowable input voltage

Set the maximum input voltage applied on both the

vertical and horizontal inputs at the specified value. Excessive input voltage might possibly damage an input attenuator or the like.

How to use the EXT. INTEN. MOD. (Z axis luminance modulator) terminal

Take off the short bar of the EXT INTEN MOD terminal arranged on the rear side of the case, and apply a luminance modulating signal thereon. The input voltage necessary for modulation is 1Vp-p or over, and the polarity of the voltage waveform may be either that of the plus or minus pulse-shaping waveform or that of a sine wave. Adjust the "INTEN" knob slightly for obtaining the best luminance modulation and distinctness.

4. MEASUREMENT

4.1 Measurement of phase difference

Make use of the Lissajous figures, to measure the phase difference between two signals of the same frequency. The caution to be exercised in the application of this measuring method is that the proper phase difference should be measured in advance before measuring the phase difference, since the phase difference between the vertical and horizontal amplifiers assembled in the main body of the oscilloscope cannot be neglected in some frequency. Keep the lever switch in DC connection for both the vertical and horizontal axis, apply the sine wave output of the low frequency oscillator on the vertical and horizontal input terminals in such a manner as shown in Fig. 3, and measure the proper phase difference of the oscilloscope.

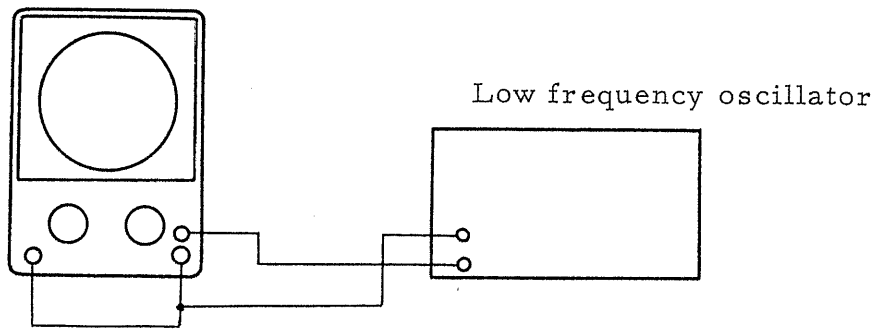


Fig. 3

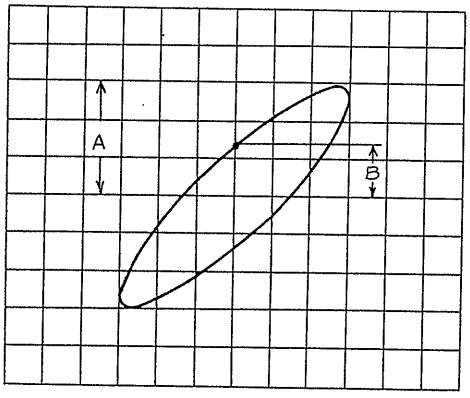


Fig. 4

Adjust the SENSITIVITY switch and the VARIABLE knob, then have the oscillator trace a figure of a proper size, as shown in Fig. 3.

Change the frequency of the low frequency oscillator, and what is shown by a loop in Fig. 4 at some scores of kilocycles represents the frequency the phase difference between the vertical and horizonta axis takes shape.

Read out the phase difference from the Lissajous figure in a manner as shown below. Set the vertical and horizontal axis true to the established scales as shown in the figure, and find out the phase difference from the A and B dimensions and by the application of the following equation.

$$\text{Phase angle } \theta = \text{Sin}^{-1} \frac{B}{A}$$

An illustration of the application thereof can be employed for the measurement of the phase difference between the input and the output of an amplifier or the like, as shown in the figure below.

In practical application, the phase difference will be as shown below.

Phase difference = θ - (phase angle peculiar to the oscilloscope)

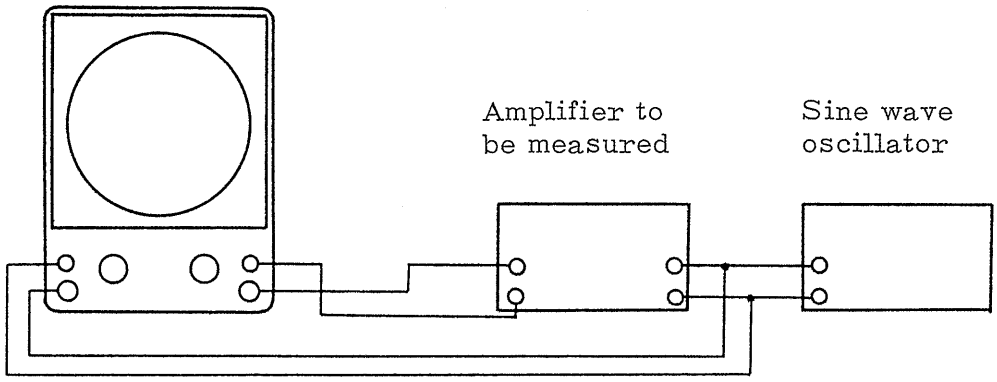


Fig. 5

4.2 Measurement of frequency

Lissajous figures can be obtained by the simultaneous application of two kinds of alternating current voltage on the vertical axis and the horizontal axis.

The frequency of any other signal can be measured by the application of this Lissajous figure, and by taking a certain known frequency as a standard.

The connection diagram thereof is as shown in Fig. 6 below.

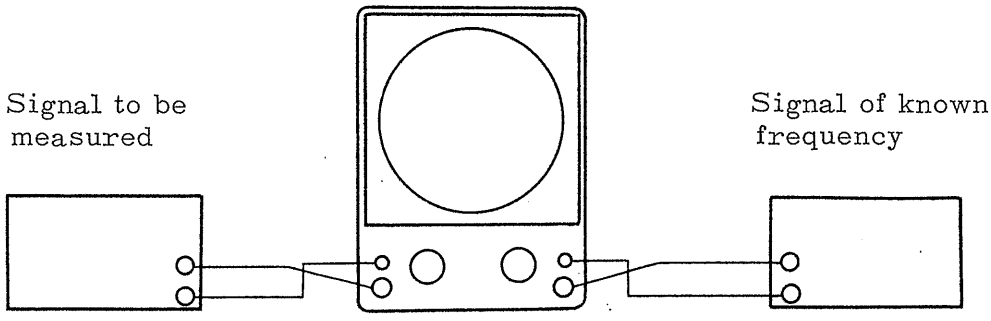


Fig. 6

In case the ratio of the vertical frequency to the horizontal frequency is an integral ratio, the figure stops still, and it takes various figures as shown below.

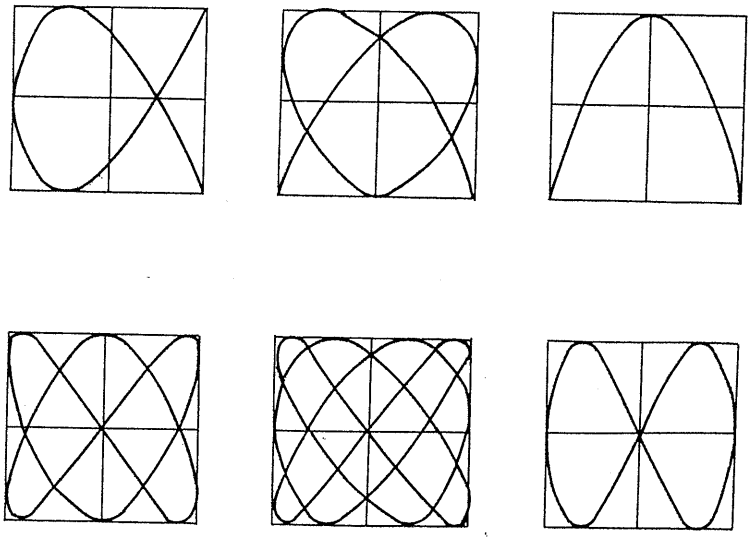
The number of loops in contact with more vertical tangents than those in the figure: NV

The number of loops in contact with more horizontal tangents than those in the figure: Nh

Now, once these numbers can be found out, the vertical and horizontal input frequencies, fv and fh, can be found out by the following equation,

$$\frac{fv}{fh} = \frac{Nh}{Nv}$$

Now that NV and Nh are available with two kinds, in accordance with the relation between the phases of the both signals, as shown in the upper and lower sections in Fig. 7, it is imperative to exercise thorough and meticulous caution not to count the number in a wrong way.



$\frac{fv}{fh} = \frac{3}{2}$ $\frac{fv}{fh} = \frac{4}{3}$ $\frac{fv}{fh} = \frac{2}{1}$

Fig. 7

4.3 Direct view of frequencies in combination with a sweep generator

Connect this model with a sweep generator in such a manner as shown in Fig. 8.

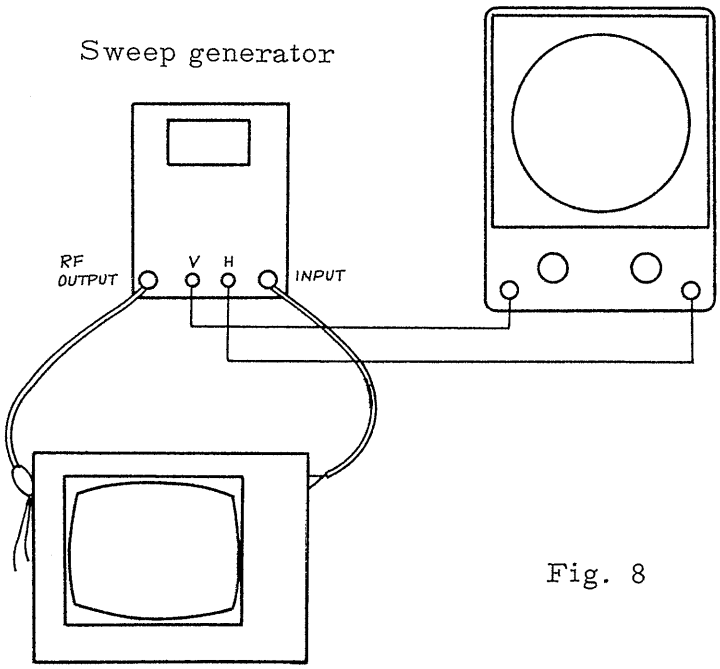


Fig. 8

Regulate the vertical and horizontal sensitivities properly so as to facilitate measurement.

The polarity of the waveform to be observed can be reversed by sliding downward the polarity change-over switch arranged on the rear panel. In case the slide-switch is thus set downward, however, the relation between the revolving direction of the POSITION knob and the moving direction of the trace is reversed as well. In case the slide-switch is set upward in a normal manner, the spot moves upward as the vertical POSITION knob is turned clockwise, and the spot moves

rightward as the horizontal POSITION knob is turned clockwise. respectively.

Now that this model features such high sensitivity as 1mV/cm in deflection sensitivity, it can be employed with perfect stability for measuring the sensitivity of such items of comparatively small output voltage as a tuner or a television receiver employing the circuits of the solid-state system.

5. MAINTENANCE

5.1 Adjustment of vertical axis DC balancer

Conduct this adjustment 15 - 20 minutes after switching it on the power source.

1. Set the lever switch for input connection at GND.
2. Turn the VARIABLE knob for SENSITIVITY clockwise to the extreme end, and turn the vertical POSITION knob until the luminant line is set at the center of the scale.
3. Then turn the VARIABLE knob clockwise to the extreme end. Now that the DC balancer deviates as the luminant line moves either upward or downward thereby, adjust the DC balancer properly enough, in such a manner as shown below.
4. Turn the DC balancer with a screw driver, with the VARIABLE knob set at the extreme end to the right, and set the luminant line at the center of the scale in the same manner as set forth in 2 above.
5. The vertical axis of the DC balancer can thus be adjusted virtually; however, in case slight deviation still remains when the VARIABLE knob is turned to the extreme end either clockwise or counterclockwise, adjust the DC balancer finely once again, until the luminant line is free from fluctuations even when the VARIABLE knob is turned.

Now the adjustment of the vertical axis DC balancer is thus completed

5.2 Adjustment of horizontal axis DC balancer

Conduct this adjustment 15 - 20 minutes after switching it on the power source.

Conduct the adjustment of the horizontal axis DC balancer in exactly the same manner as set forth for the adjustment of the vertical axis DC balancer above. However, exercise caution in this case to the fact that the direction in which the luminant line moves is not upward or downward but rightward or leftward.

DC balance is fluctuated by such a reason as a fluctuation in temperature, therefore, in case the ambient temperature has fluctuated by far, it is imperative to keep the DC balance properly enough.

5.3 Removal of case (See Fig. 9)

Take off the two screws from the rear panel and one screw from the bottom of the case of this model, as shown in the figure, and take out the panel from the case softly.

Now that the high voltage constitutes a serious danger to touch on, be sure to conduct the above-mentioned operations only after switching this model off.

Exercise caution among others not to touch a hand on the vertically standing printed circuit board, since it has a rectifier circuit of -1,450V arranged thereon.

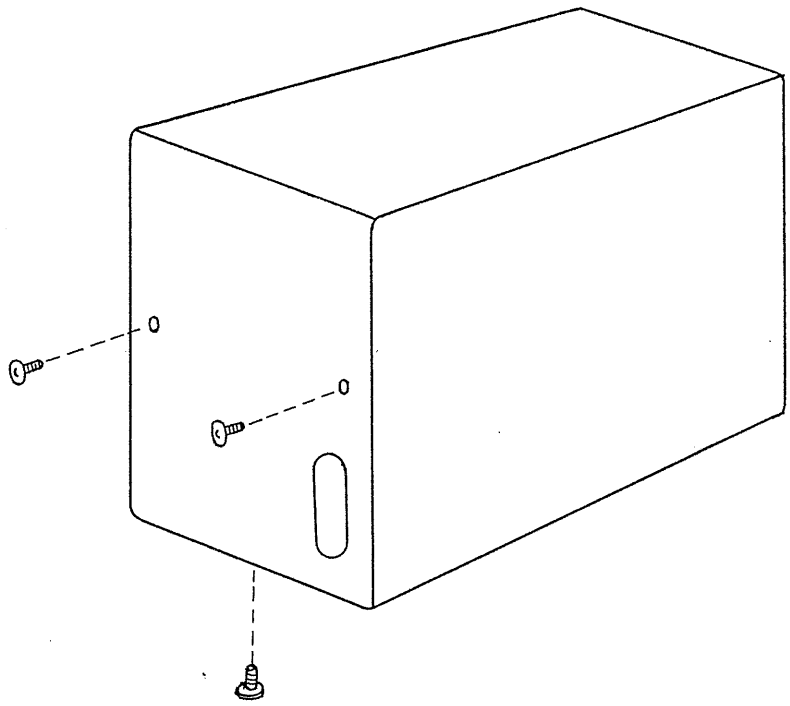


Fig. 9

5.4 Regulation of line voltage (See Fig. 10)

The line available for this model is either one of the following 6 systems: +300V, +20V, +12V, -9V, -70V and -1,450V.

Of those, +12V and -9V systems constitute the constant-voltage lines, and either one can be selected through a semifixed resistor therefor, respectively. For regulation, conduct preliminary regulation first in such a manner that the line voltage is set at +12V ±5% while measuring the voltage at an intermediate point between the position marked +12V or -9V on the printed-circuit board and the point marked GND, then regulate the line voltage to be -9V ±5% likewise, respectively.

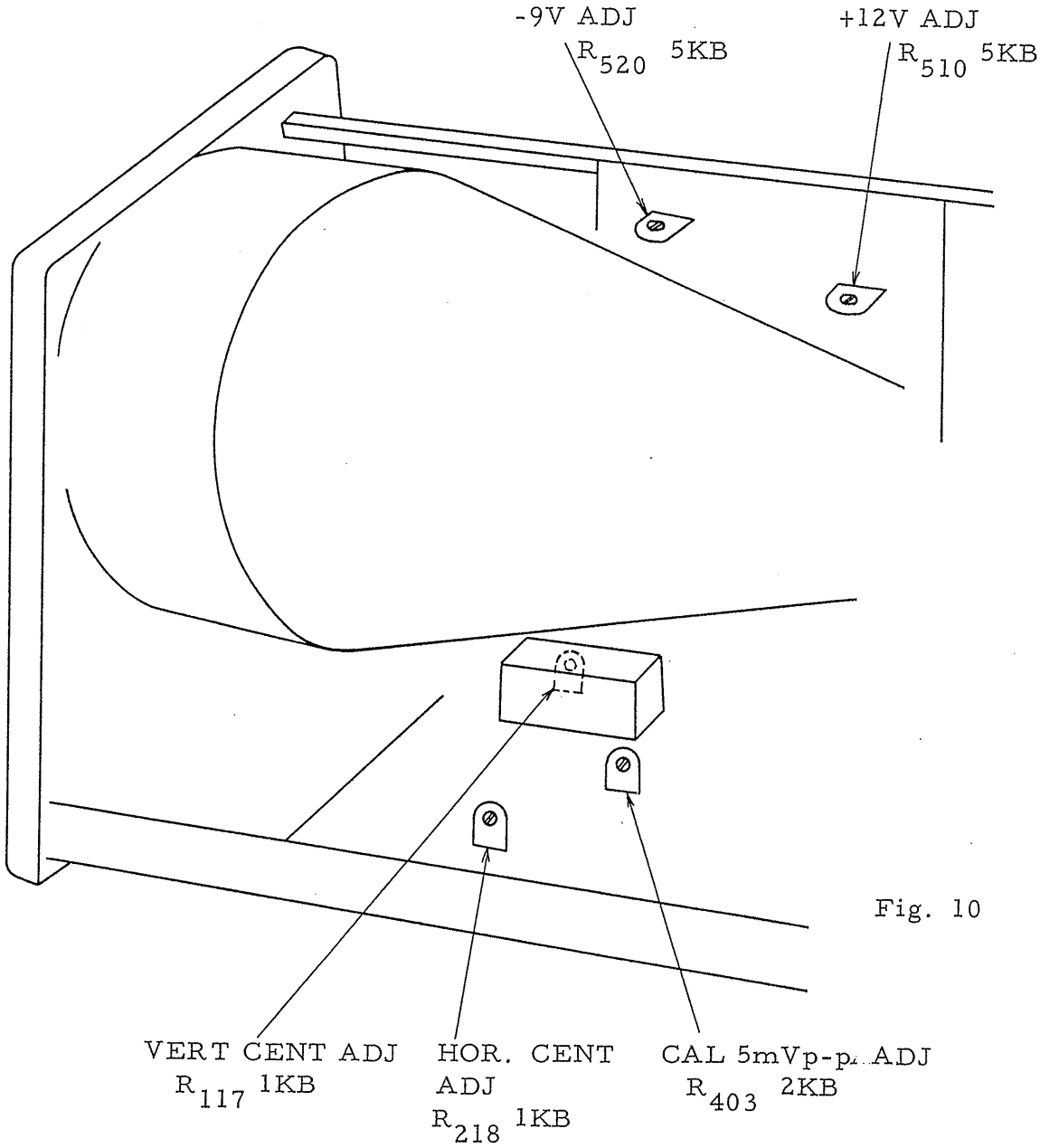

-9V ADJ
R_{520} 5KB
+12V ADJ
R_{510} 5KB
VERT CENT ADJ
R_{117} 1KB
HOR. CENT ADJ
R_{218} 1KB
CAL 5mVp-p ADJ
R_{403} 2KB

Fig. 10

5.5 Regulation of CAL 5mVp-p (Regulation of calibration voltage)

Now that the calibration voltage generator circuit has been stabilized in its line by means of a constant-voltage diode, it may well be left free from adjustment for a long period. In case the said calibration voltage generator circuit need be adjusted, adjust the semificed resistor R_{403} in such a manner that the CAL output voltage becomes 5mVp-p, by the employment of an oscilloscope or a voltmeter of the p-p indication type, of which the voltage sensitivity has been regulated correctly enough.

5.6 Centering (by adjusting R_{117} and R_{218})

R_{117} and R_{218} are semifixed resistors, of which each sets each POSITION knob at such a position as is virtually the center of the revolution range, in case a trace is set at the center of the cathode-ray tube by turning the vertical and horizontal POSITION knobs properly. As to the method of adjusting the resistors, set each POSITION knob at the center of the revolution range, as shown in Fig. 10, without feeding such with input signals, At that time, in case a spot moves either upward or downward, adjust R_{117}, while in case the spot moves either rightward or leftward, adjust R_{218}, thus positioning it at the center. The above-mentioned adjustment of the semifixed resistors has nothing to do with the said DC balancers.