MODEL 557A

OSCILLOSCOPE

OPERATION MANUAL

KIKUSUI ELECTRONICS CORP.

1. GENERAL

This unit is a very reliable high class oscilloscope specially designed and manufactured for measurement and observation of wave form and consists of a 133mm aperture Braun tube and numerous semi-conductors. As for the vertical axis, it is a DC broad-band balance amplifier with a band of DC-5MHz and sensitivities higher than 0.02V/cm.

The time base is provided with saw tooth sweep for 10Hz ~ 100kHz and 15.75 kHz/2 and the line sweep for power frequency. It is also provided with the input terminal for horizontal axis amplifier for external sweep.

The horizontal axis amplifier has a band of 2Hz ~ 500kHz and sensitivities higher than 0.3Vp-p/cm. Besides, it is provided with stabilized square wave calibration voltage and the terminal for modulation of Z axis brightness.

CONTENTS

2. SPECIFICATIONS

Vertical Axis	Sensitivity	0.02 V/cm or above
		0.2 V/cm or above with potential divider 1/10
		2 V/cm or above with potential divider 1/100
		20V/cm or above with potential divider 1/1000
	Precision of potential division	Within ± 0.5 dB
	Frequency characteristics	(AC) within 2 Hz ~ 5 MHz -3 dB
		(DC) within 0 ~ 5 MHz -3 dB
	Input impedance	1 MΩ parallel capacitance 30pF
	Input terminal	UHF type receptacle (fit for M type)
	Allowable input voltage	600V (peak value containing DC component)
Time base	Sweep frequency	(1) TV.H .....15.75/2 kHz
		(2) 10 ~ 100 Hz
		(3) 100 ~ 1 kHz
		(4) 1 K ~ 10 kHz
		(5) 10 K ~ 100 kHz
		(6) LINE SWEEP..... line frequency
		As for (2) ~ (5), fine adjustment can be made among ranges. In the case of (1), fine adjustment can be made with 15.75/2 kHz as center.
		As for (6) , adjustment is made on phase
	Synchronism	Internal
		External
		Line

Horizontal axis	Sensitivity	0.3 Vp-p/cm or above
	Frequency characteristics	2 Hz ~ 500 kHz -3 dB or below
	Input impedance	Approx. 220 kΩ parallel capacitance 30 pF or below
	Allowable input voltage	100 V (peak value containing DC component)
Calibration voltage	Output voltage	Square wave of 0.05 V, 0.5 V, 5 Vp-p
	Accuracy	± 5%
Others	Braun tube	5 UP1F or 5 UP7F
	Acceleration voltage	Approx. 1500 V
	Effective area	8 x 10 cm
	Brightness modulation	Positive in polarity voltage 10 Vp-p or above
	Line	AC ____V 50 or 60 Hz
	Power consumption	Approx. 40 VA
	Dimensions	Max. 200(W) x 300(H) x 445(L) mm
	Weight	Approx. 10 kg
	Accessories supplied	957M type low capacitance probe ... 1
		941B type terminal adaptor 1
		Operation Manual 1
		Test Data 1

3. OPERATION

3.1 Line voltage

This unit can be used safely in a range of ___VAC ±10% primary supply voltage. It is very ideal to operate this unit at the center of the range of ___VAC ±10% for attaining the high reliability and long life for parts so far as practicable.

3.2 Installation Place

The ambient temperature of the installation place must be within 0°C ~ 35°C.

Be sure to avoid selecting a dusty place. If this unit is used near the machines and apparatuses generating heat, approprite drafting must be provided. Be sure to avoid selecting such places where there exist strong magnetic field or corrosive gas in case this unit is installed.

3.3 Allowable Voltage should be given to the terminal

If overvoltage should be given to the terminal, there will be a possibility that the interior circuit parts will be damaged seriously.

Accordingly, pay attention to the following points.

- o 600 V for vertical axis input terminal
  (peak value containing DC component)
- o 100 V for horizontal axis input terminal
  (peak value containing DC component)
- o 100 V for external synchronous terminal
  (peak value containing DC component)

The voltages higher than the above should not be applied to the terminals. Take care to prevent the voltage higher than 600 V (peak value containing DC component) from being applied to the low capacitance probe of the attached 957M type.

3.4 Function of Knobs & Terminals

FRONT PANEL

POWER ON OFF	A power switch.
INTENSITY	A knob for adjustment of brightness of Braun tube.
FOCUS	A knob for adjustment on the focus of Braun tube.
CALIB	A square wave output terminal for calibration of voltage sensitivity.

VERTICAL

SENSITIVITY ..... (Black knob)	A sensitivity change-over switch for vertical axis.
VARIABLE ..... (Red knob)	A knob for fine adjustment on sensitivity.
POSITION	A knob for vertical movement of trace.
INPUT	An input terminal for vertical axis.
AC DC	A connection change-over switch for input circuit . Selects the switch on AC connection and DC connection.
DC BAL	A semi-fixed resistor for adjustment on the DC balance of the vertical axis amplifier.

HORIZONTAL

SWEEP RANGE ..... (Black knob)	A change-over switch for sweep frequency. Selects the switch on saw teeth sweep of TV.H and 10Hz ~ 100kHz, line sweep and EXT HORIZ.
VARIABLE (Red knob) PHASE	A knob for fine adjustment on the sweep frequency in the range of TV.H and 10Hz ~ 100kHz. At the time of LINE SWEEP , this will be a knob for adjustment on the phase of sweep.
EXT SYNC IN	An input terminal for external synchronism.
SYNC SELECTIONS	A synchronous change-over switch. Selects the switch on + and - of internal synchronism, line synchronism and external synchronism.

AMPLITUDE ..... A sensitiyity control for horizontal axis amplifier.

POSITION ..... A knob for movement of trace in the horizontal direction.

EXT HORIZ IN ..... An input terminal for horizontal axis amplifier. When the black knob for SWEEP RANGE is changed over to EXT, the input of the horizontal axis amplifier is connected with this terminal.

FRONT PANEL

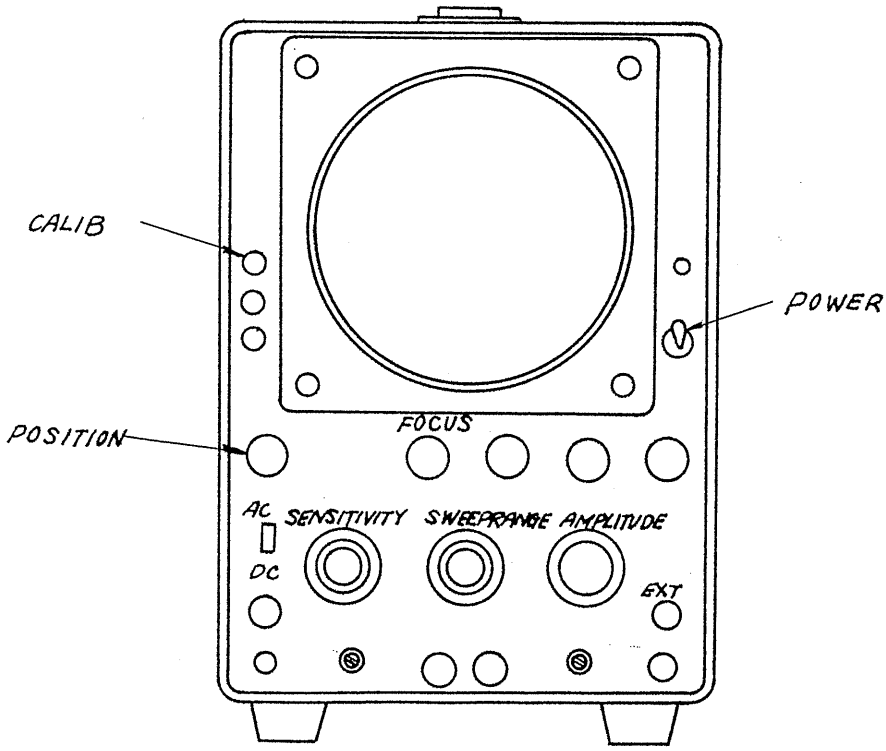


Fig.1

BACK PANEL

EXT INTEN MOD ..... A terminal for modulation of Z axis.

ASTIG ..... A semi-fixed resistor for adjustment of astigmatism of Braun tube.

FUSE ..... Fuse holder.

BACK PANEL

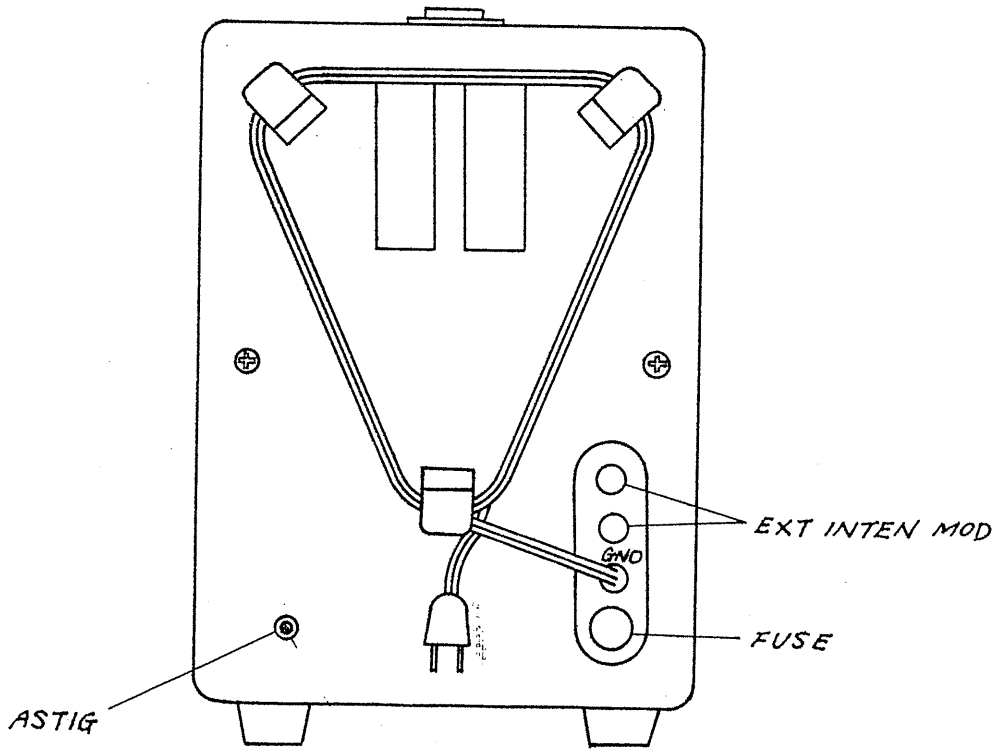


Fig.2

3.5 First time operation

The following procedure is very useful for mastery of the operation procedure for OSCILLOSCOPE MODEL 557A.

1. FOCUS ..... Almost center

   INTENSITIVITY ..... Turn fully in the clockwise direction.

   SENSITIVITY 1/10

   SENCITIVITY VARIABLE ..... Turn fully in the clockwise direction.

   POSITION (VERTICAL) ..... Almost center

   AC DC ..... DC

   SWEEP RANGE ..... 10 ~ 100

   SWEEP RANGE VARIABLE ..... Almost center

   SYNC SELECT ..... INT +

   AMPLITUDE ..... Almost center

   POSITION (HORIZONTAL) ..... Almost center

2. After adjusting the respective knobs as instructed here above, connect the power cord with the specified power source.

3. POWER ON OFF ON

   In several tens of seconds after making the power, a few cm bright line appears on the screen of the C.R.T.

4. When the 0.5 V p-p output of CALIB is given to the VERTICAL INPUT terminal, the wave form shown in Fig.3 will appear in the screen of the C.R.T.

5. When the wave form is not static, turn the VARIABLE knob for SWEEP RANGE to gently C.C.W or C.W, , synchronize it.

6. Turn the FOCUS knob gently, checking the wave form for adjusting it to the sharpest image.

7. The wave form shown in Fig.3 can be moved at both horizontal and vertically by means of the knobs of VERTICAL and HORIZONTAL POSITION.

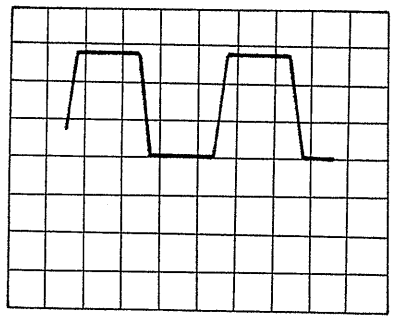


Fig.3

8. The height of wave form shown in Fig.3 can be changed continuously by means of the knob for SENSITIVITY VARIABLE. At present, 0.5 Vp-p square wave form calibration voltage is under observation. Therefore, when the height of wave form is adjusted to 1 cm by means of the said knob, the sensitivity of the vertical axis is calibrated to 0.5 V/cm.

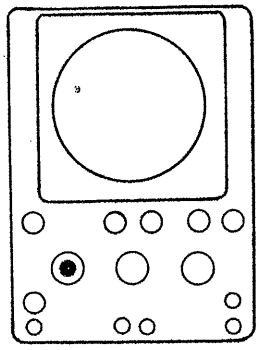


Fig.4

9. When the SYNC SELECT switch is changed over to INT -, the starting point of wave form will be changed as shown in Fig.5.
When the switch is turned clockwise further and changed over to EXT, the internal synchronism will be separated, resulting in external synchronous action. Accordingly, EXT SYNC IN TERMINAL add to the external synchronous signal, use it.

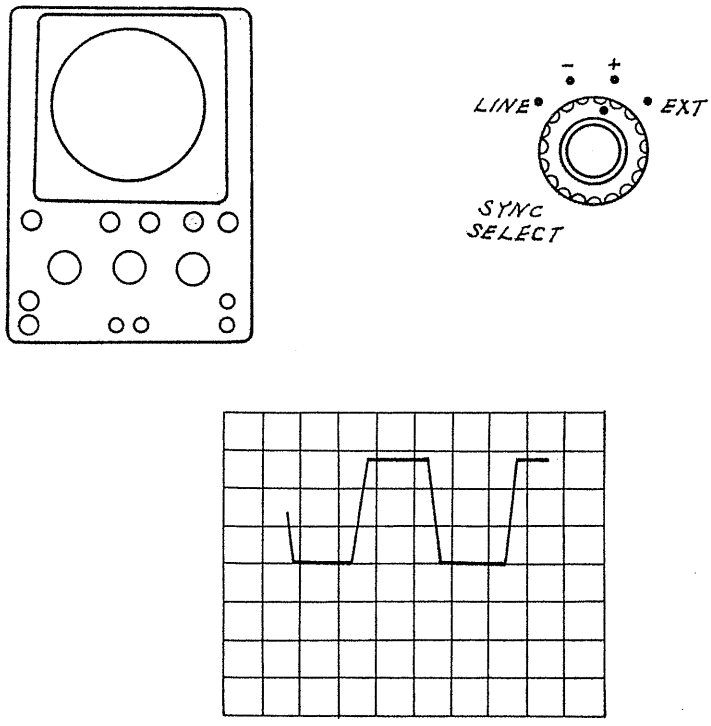


Fig. 5

As signal for externalsynchronism, the frequency which is the same as that for wave form under observation or one integral numberth will be needed. However, it can be operated with internal synchronism for general observation.
The external synchronism is used for observation of external synchronoussignal, frequency among observation wave forms or observation

of phasing relations. It is also used when the wave form in observation is very complicated and it is very hard to attain internal synchronism.

At the position of LINE for SYNC SELECT SWITCH, synchronism is attained with the power frequency.

Accordingly, it is very convenient to observe the wave form in connection with the power frequency.

10. At the position EXT where the SWEEP RANGE switch has been turned fully clockwise, the time base oscillator stops and the input of the horizontal axis amplifier is connected with the EXT HORIZ IN terminal.

It is used for measurement on the frequency employing the Lissajous' figure as well as the difference in phase between 2 signals.

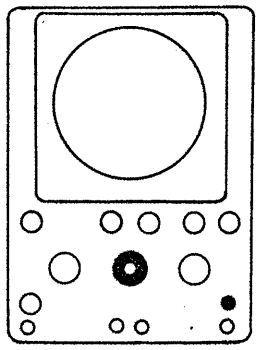


Fig 6

11. As for the position of LINE SWEEP for SWEEP RANGE switch, sweeping is effected with the sine wave of power frequency.

The phase can be changed for the sine wave of power by means of the red knob of PHASE.

The red knob for adjustment on PHASE is in common use with VARIABLE between 10 ~ 100k of the SWEEP RANGE.

The LINE SWEEP is very advantageous to observe the characteristics of turned circuits in combination with other Sweep Generators.

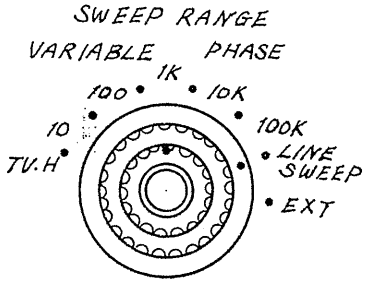


Fig. 7

12. Adjustment can be made on the amplitude of observation wave form in the horizontal direction as well as amplitude of LINE SWEEP by means of the knob AMPLITUDE.

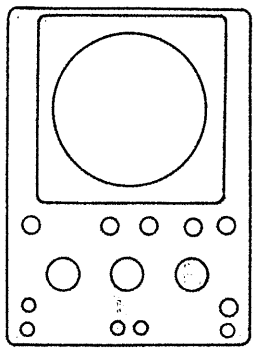


Fig.8

The above is the standard procedure for operation of the Oscilloscope Model 557A.

4. BASIC APPLICATIONS

Peak-to-peak voltage Measurement

The vertical input change-over switch must be set at position AC for observation of only the AC component from the AC wave form free from DC component and DC overlapped wave form.

Position DC must be used for measurement on the wave form containing DC component.

1. After the sensitivity of vertical axis is calibrated by taking advantage of calibration of voltage beforehand, add wave form and read off the wave height value from the scale on the Braun tube or read off the wave height value after the input is substituted for calibration voltage.

   The range of SENSITIVITY consists of such 4 sub-ranges as 1 ~ 1/1000.

   The sensitivity can be changed continuously by VARIABLE knob.

   When the sensitivity is adjusted to 0.05V/cm by employing VARIABLE in Range 1, the following is among 1 ~ 1/1000.

   RANGE 1 ..... 0.05V/cm

   RANGE 1/10 .....0.5 V/cm

   RANGE 1/100 ..... 5 V/cm

   RANGE 1/1000 ..... 50 V/cm

   CAUTION

   After setting the sensitivity of VARIABLE, care must be taken for prevention of this knob from being moved when the above range is changed over. For setting of the sensitivity, the calibration voltage 0.05/0.5/5Vp-p inside 557A must be used.

If the 957M type low capacity probe is used, the sensitivity will be 1/10.

After calibration of sensitivity as described hereabove, when measurement was made on wave form, the sine wave shown in Fig.9 appeared in 1/100 range. Read off the value as follows.

2. Read off the vertical amplitude of wave form in "cm" .

Voltage = Vertical amplitude x sensitivity of range x magnification of probe

Vertical amplitude : 4 cm

Range 1/100 : 5 V

- Probe : 10×

The voltage sought = 4 x 5 x 10 = 200 Vp-p

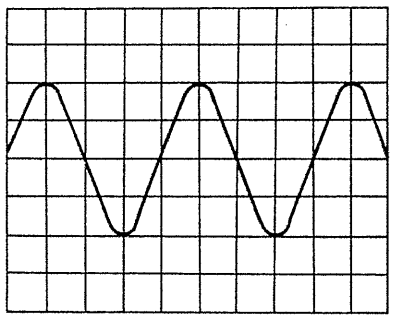


Fig.9

Instantaneous Voltage Measurements

1. For this measurement, the wave form containing DC component is used. Accordingly, the vertical input change-over switch must be placed at position DC. SIDE.

2. A decision must be made on reference line of electric potential on the dial. In this decision, when the voltage to be measured is positive from the reference voltage (in normal cases, earth electric potential is used as reference, the input of the vertical axis must be connected with the GND terminal), the bright line must be adjusted to the lowermost position.

The reference line set as instructed above is a reference for measurement on DC. Accordingly, be sure to avoid moving the vertical POSITION in measurement.

3. The voltages for measurement must be added to the vertical input. For reading off voltage, read off the section from reference line up to the position to be read off in " cm ".

Calculation must be made by the following equation.

Instantaneous voltage = vertical amplitude from reference line x sensitivity of range x magnification of probe

As for the polarity of voltage, the upper section from the reference line is positive and the lower section, negative.

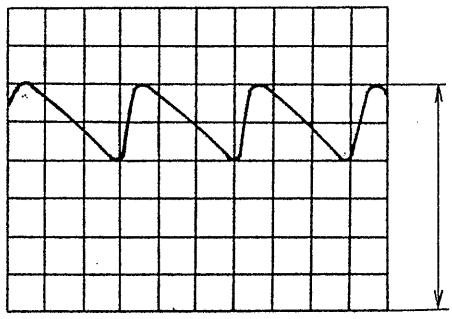


Fig.10

A reference line

Vertical amplitude : 6 cm
Range 1/10 : 0.5 V
Probe : 10×

o Voltage to be sought = 6 x 0.5 x 10 = 30 V

Phase Difference Measurements

The phase difference between two signals of the same frequency can be made using Lissajous'figure.

In this measurement method, attention must be paid to the following point. That is, as there is a difference where the phase difference between vertical and horizontal amplifiers of the oscilloscope body can not be neglected, measurement must be made after measurement on the inherent phase difference.

1) Set the SWEEP RANGE swich to EXT.

Add the sine wave output of the low frequency oscillator shown in Fig.11 to the vertical INPUT terminal and EXT HORIZ IN terminal and measure the phase difference which is inherent in the oscilloscope.

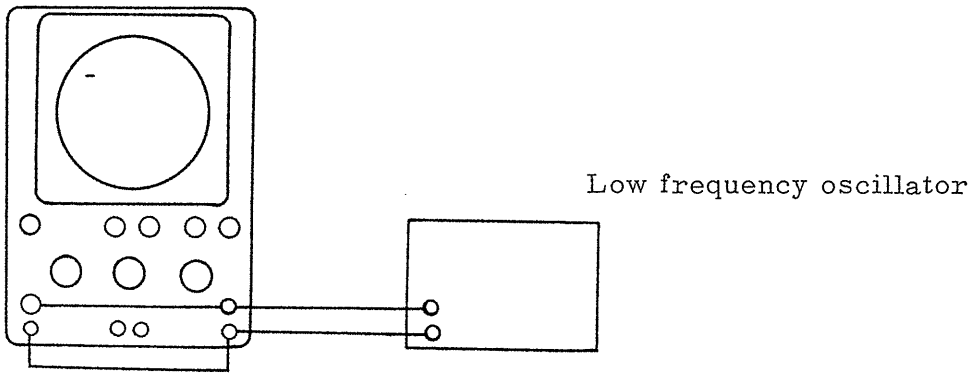


Fig. 11

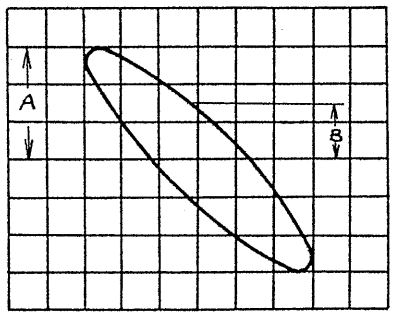


Fig. 12

Adjust the SENSITIVITY switch, VARIABLE and AMPLITUDE knob in such a way that it is an appropriate length figure as shown in Fig. 12. Change the frequency of the low frequency oscillator. The position where the loop shown in Fig. 12 is shown at several tens of kHz or above is the frequency where the phase difference between vertical and horizontal axis amplifications appears.

Read off the phase difference from the Figure as instructed hereunder. Use Fig. 12 and adjust the horizontal and vertical amplitude to the scale as shown in the Fig., and seek the following from the dimensions of A.B.

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

As for the application example, it is adopted for measurement on the phase difference between input and output of amplifiers etc.

Actual phase difference = θ - phase angle inherent in amplifier.

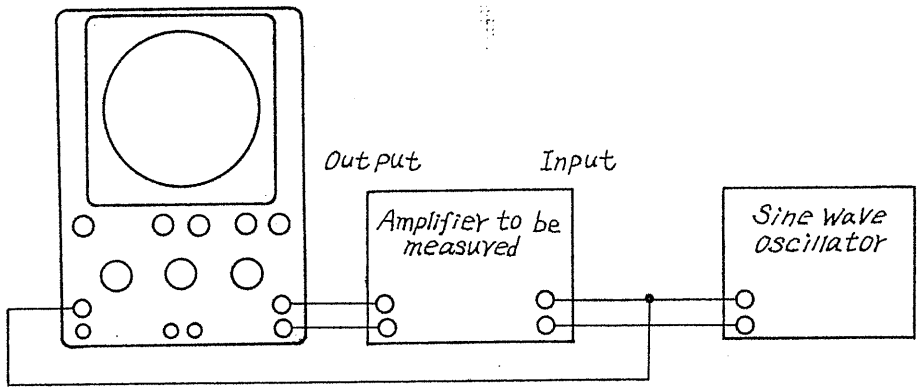


Fig.13

Frequency Measurements

When two different kinds of AC voltages are added to the vertical and horizontal axis at the same time, the Lissajous figure is shown.

By taking advantage of this figure, measurement can be made on the freqency of a signal with the already-known frequency as reference.

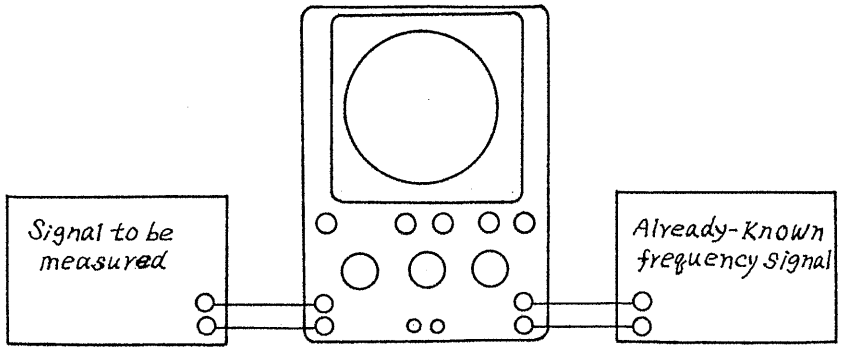


Fig.14

When the ratio of vertical frequency/horizontal frequency is an integral number ratio, the figure will be static as shown in Fig.15.

If the following are sought from the figure,

Number of loops which come in contact with the tangent of vertical : Nv

Number of loops which come in contact with the tangent of horizontal : Nh

the vertical and horizontal input frequencies fv, fh can be sought by the following.

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

For the phase relations of both signals, there are two kinds in Nv and Nh as shown in the upper and lower parts of Fig. 15. Accordingly, take care to avoid making a mistake in its number.

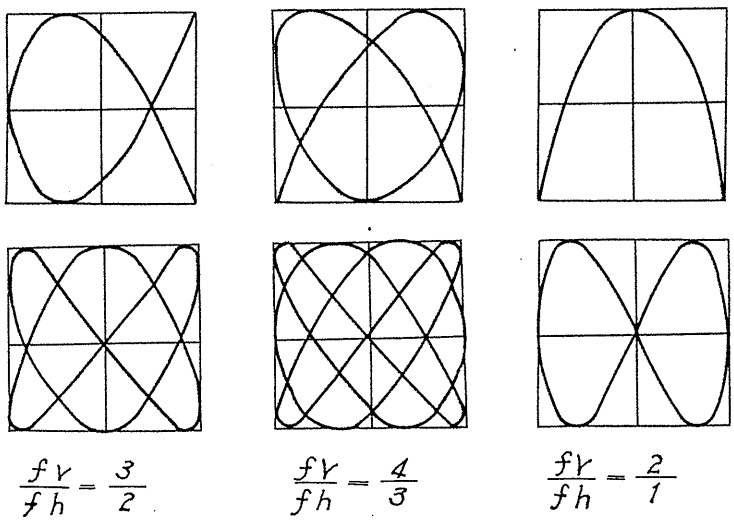


Fig.15

5. MAINTENANCE

Over casing Removal

Remove the two screws located at the back of the outer casing and one s screw located at the bottom of the outer casing. Then, disassemble the outer casing and sub-panel part and pull out the chassis gently.

If touched with high voltage, it will be very dangerous. Accordingly, the aforementioned operation must be carried out after turning off power.

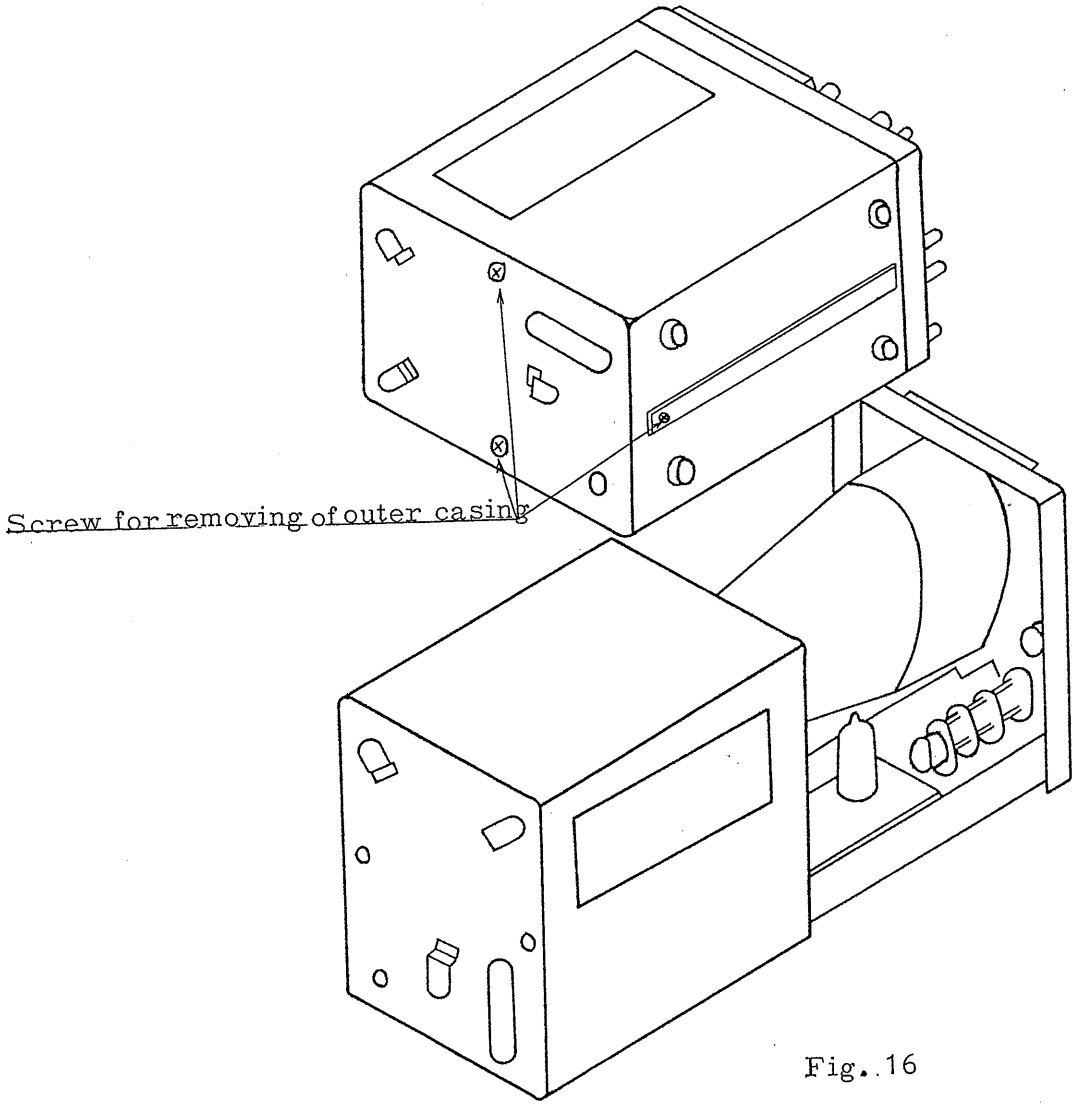


Fig. 16

For fulling out of the chassis from the case, adjust the upper and lower parts of the outer casing well after removing of screws and then, pull it out.

Adjustment on Vertical Axis DC BAL

Adjustment must be made 20 minutes later after making the power.

1) Short between the input terminal of vertical axis and GND terminal.
2) Turn the vertical position and adjust the bright line to the center of the scale.
3) Turn the VARIABLE for SENSITIVITY. If the bright line is moved vertically when turned, turn the DC BAL little by little and adjust it in such a way that the bright line is not moved when VARIABLE is turned.

   When the DC BAL is turned , the position of the bright line will be moved slightly vertically. Adjust it to the center of the scale by POSITION on all such occasions.

Adjustment on Horizontal Axis DC BAL

This adjustment must be made about 20 minutes after making the power switch.

1) Short between the horizontal axis input terminal and GND terminal.
2) Set the SWEEP RANGE to EXT.
3) Turn the horizontal POSITION and adjust the bright point to the center of the scale.
4) Turn the AMPLITUDE. If the bright point is moved horizontally when turned, turn the DC BAL and adjust it to the position where the bright line is not moved.

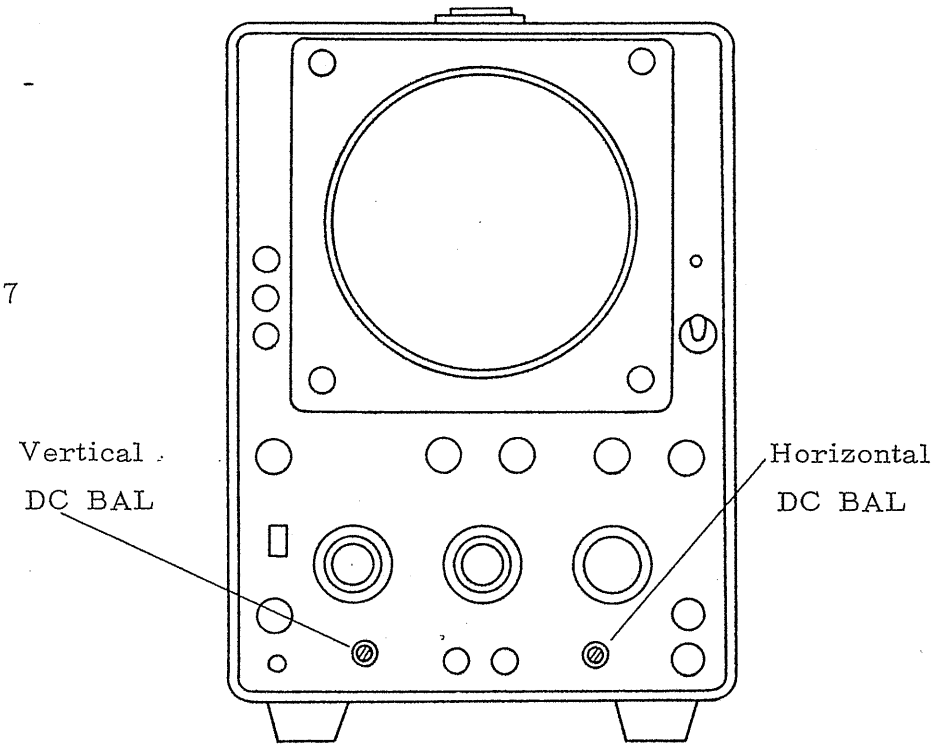
Adjustment on ASTIG

The semi-fixed resistor is shown in Fig.17. This adjustment must be made as follows.

1) Send the sine wave to the whole surface of the scale.

2) Adjust the ASTIG together with the FOCUS knob in such a way that the whole bright line is uniform in size.

Fig 17



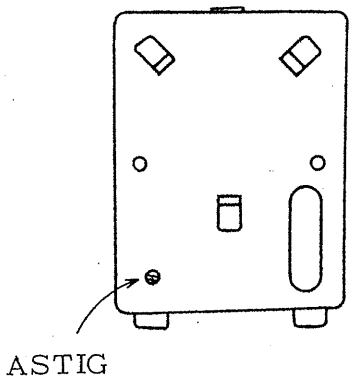


Fig.18

Adjustment on Low Capacity Probe

If strong mechanical shocks or higher voltage than specified should be given to the attached 957 M type low capacity probe, a change will take place in the characteristics.

Accordingly, high quality square wave of approx. 1 kHz must be given to the probe and the trimmer for probe, be adjusted for adjusting it to the wave form shown in Fig. 19 B.

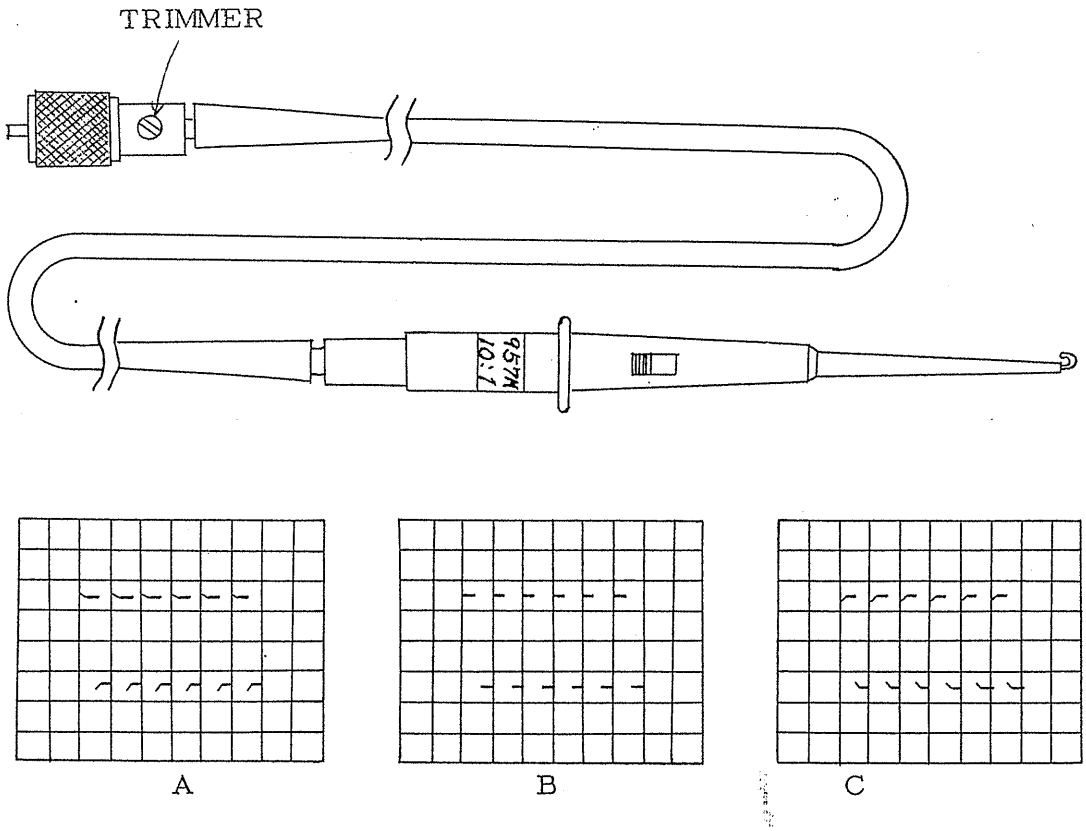


Fig. 19

Adjustment on vertical axis voltage divider (SENSITIVITY SWITCH)

This adjustment must be made by adjusting the input capacity seen from the vertical axis input terminal to the frequency characteristics at respective ranges of the voltage divider.

1) Connect the capacity meter for correct measurement of 30 pF or so with the vertical axis input terminal.
2) Set the SENSITIVITY switch at RANGE 1.
3) The input capacity must be adjusted to 30 pF with the CV 206 semi-fixed condenser shown in Fig. 20.
4) Set the SENSITIVITY switch to RANGE 1/10.
5) The input capacity must be adjusted to 30 pF with the CV 202B semi-fixed condenser shown in Fig.21.
6) Then, advance the range to 1/100, 1/1000 and adjustment must be made to 30 pF by CV 203B and CV 204B.

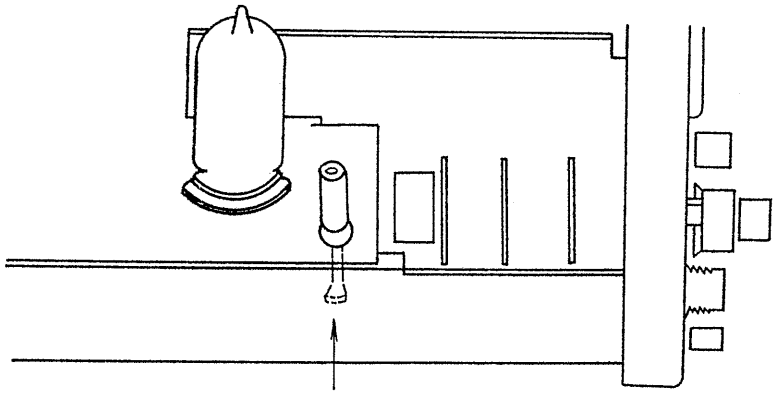


Fig.20

CV 206

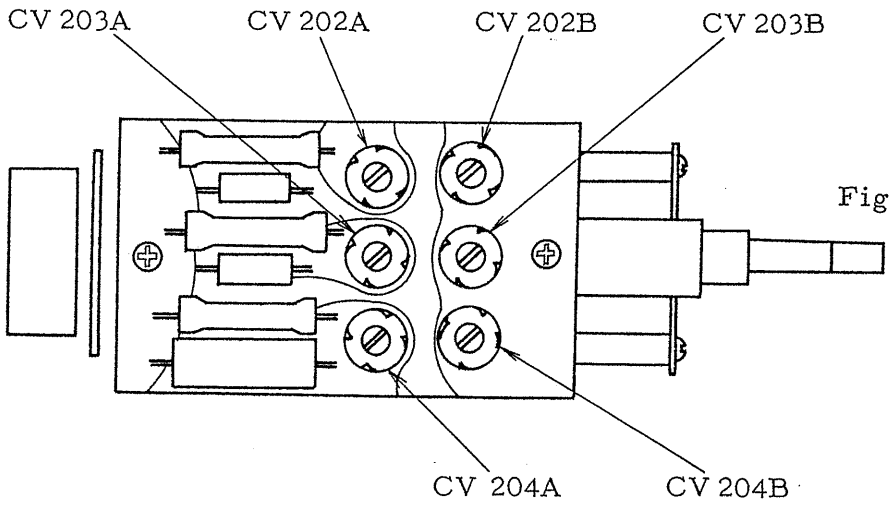


Fig.21

Then, adjustment must be made on frequency characteristics.

7) Connect the square wave voltage of high quality covering 1 kHz of repetitive frequency and 0.05V ~ 100Vp-p of output voltage with the vertical axis input terminal.

8) Set the range of the SENSITIVITY switch at 1/10.

9) Adjust the output of the square wave generator and wark out the square wave shown in Fig. 19.

10) Adjust the wave form as shown in Fig. 19B by CV 202.

Adjustment must be made in the order shown in the following table.

SENSITIVITY	SEMI- FIXED CONDENSER
1/10	CV 202A
1/100	CV 203A
1/1000	CV 204A

Adjustment on SWEEP BALANCE

Adjustment must be made on the horizontal axis DC BAL earlier.

1) Set the SWEEP RANGE switch at EXT and stop the internal sweep and then, adjust the bright point to the scale center.

2) Return the SWEEP RANGE to 100 ~ 1k range.

Hereafter, be sure to avoid moving the horizontal POSITION.

3) Adjust the VARIABLE of SWEEP RANGE almost to the center.

4) Adjust the SYNC SELECT switch to EXT.

5) Adjust the bright line to the scale center by means of the SWEEP BAL semi-fixed resistor shown in Fig. 22.

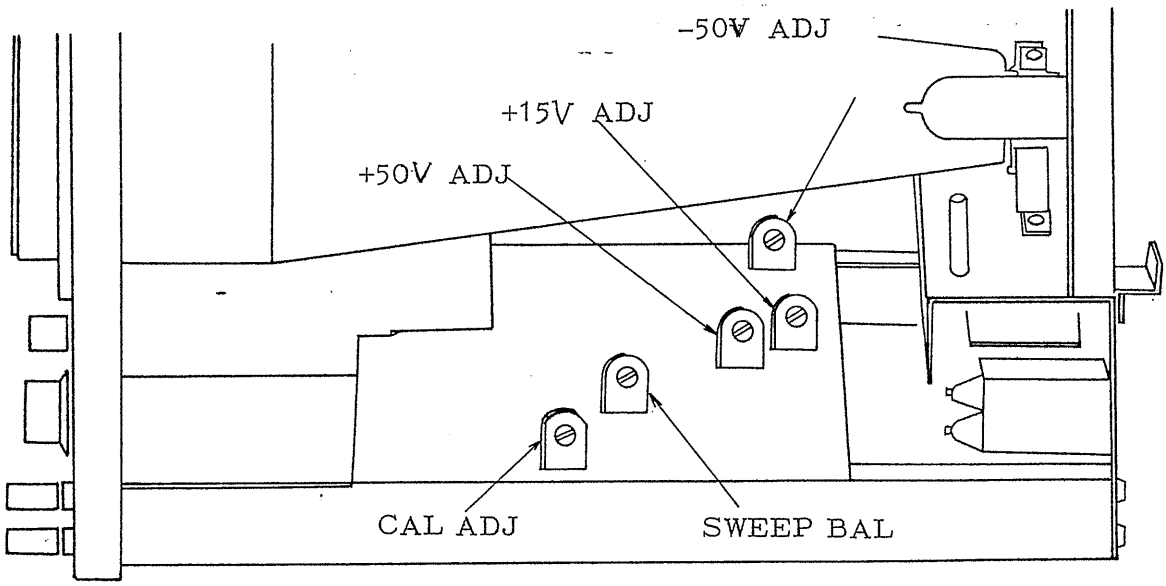


Fig. 22

6) When the frequency of SWEEP RANGE is changed, the position of bright line will be moved slightly at both sides. This is not an abnomal phenomenon.

When the amplitude of wave form and the nunber of repetitions are changed in measurement, the length of the bright line is changed slightly. This is not an abnormal phenomenon.

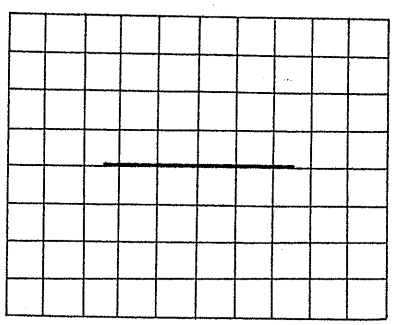


Fig.23

Adjustment on calibration voltage

Adjustment can be made on the output voltage by the CAL ADJ semi-fixed resistor shown in Fig.22.

The power of the calibration voltage circuit is stabilized by constant voltage diode.

Accordingly, adjustment is not needed for a very long time. If adjustment is needed measure the 5Vp-p output on the panel by means of the oscilloscope of which voltage sensitivity has been calibrated correctly or p-p valuve indication type voltmeter and adjust the CAL ADJ.

Adjustment on power circuit

Constant voltage power has been adopted partially for power circuit of Type 557A.

There are such 3 systems in constant voltage power as +50 V, -50 V and +15 V in the diagram for POWER SUPPLY & CRT CIRCUIT.

Adjustment can be made on the respective voltages by semi-fixed resistors The semi-fixed resistors are shown in Fig. 22 respectively.

The output of the constsnt voltage power source is marked on the print board i. e. +50 V or -50 V. Accordingly, measure the voltage at the spot.