

MODEL 559
OSCILLOSCOPE
INSTRUCTION MANUAL

KIKUSUI ELECTRONICS CORP.

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.

(Revision should be applied to items indicated by a check mark ☒)

☐ Input voltage

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC. Use the product within this range only.

☐ Input fuse

The rating of this product's input fuse is _____ A, _____ VAC, and _____.

WARNING

- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

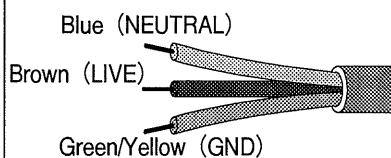
☐ AC power cable

The product is provided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

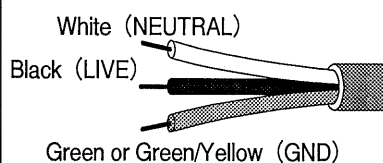
WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.

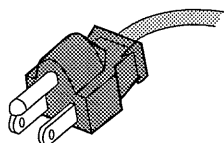
☐ Without a power plug



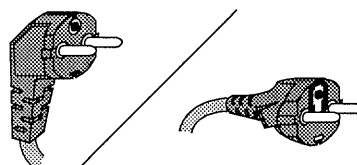
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

☐ Another Cable _____

TABLE OF CONTENTS

	Page
1. GENERAL	1
2. SPECIFICATIONS	2
3. EXPLANATION OF PANEL	4
4. OPERATING PROCEDURE	9
4-1 First Operation	9
4-2 General method for using	10
4-3 Application	11
5. CAUTION ON OPERATION	13
5-1 Supply Line Voltage	13
5-2 Fuse	13
5-3 Ambient Temperature	13
5-4 Maximum Input Voltage	13
5-5 Maximum Input Voltage to EXT HORIZ IN terminal without Distortion of Waveform	14
5-6 Life of the CRT	14
6. MAINTENANCE AND CALIBRATION	15
6-1 Case Removal	15
6-2 Change of Supply Line Voltage	15
6-3 Exchange of the Fuse	15
6-4 Adjustment of DC Balance	15
6-5 Phase Compensation for VERT GAIN switch	16
6-6 Adjustment of High Frequency Response Compensation of the Vertical Amplifier	16
6-7 Adjustment of Horizontal DC Balance	17
6-8 Adjustment of Trace Alignment	17

1. GENERAL

The Model 559 is a highly reliable oscilloscope which employs 133 mm round screen cathode-ray tube, low power consumption circuit, and unique housing.

The vertical system provides a sensitivity of 10mV/div or over and a frequency bandwidth of DC ~ 1.5 MHz. It provides direct input terminals on the rear. It is utilized for observation of parastic oscillation or amplitude modulation waveform of CB TRANSCEIVER or general transmitter.

The time axis circuit provides sweep frequencies of 10Hz ~ 100kHz sweep, and synchronizing with INT " -" only. When this circuit is switched over to the external sweep mode, it provides a deflection sensitivity of 250mV/div or over and a frequency band of DC ~ 500kHz. The external signal is appicable through a front panel terminal.

This mode can be employed for X-Y operation at the DC coupling of the oscilloscope.

Since solid-state electronics is employed throughout the circuits, the drift is very small and the oscilloscope can start operating only in less than 20 seconds after its power is turned on.

2. SPECIFICATIONS

VERTICAL DEFLECTION SYSTEM

Characteristics	Specification	Remarks
Sensitivity	10 mV/ DIV or over	1 DIV 9.5 mm
Frequency bandwidth	AC: 2 Hz ~ 1.5 MHz DC: DC ~ 1.5 MHz	within - 3 dB
Attenuator	1/1, 1/10; 1/100 and GND	
Attenuator accuracy	within $\pm 3\%$	
Input impedance	1 M Ω $\pm 5\%$ within 35pF	
Input terminals	3/4" Binding-post	
Sensitivity variable range	continuously variable 1 ~ 1/10 or more	
Maximum allowable input voltage	600 Vp-p (less than 1 min.)	DC + ACp-p (AC: 1 kHz or less)
Direct CRT terminals	Sensitivity : 10V/ DIV or over	

HORIZONTAL DEFLECTION SYSTEM

Characteristics	Specification	Remarks
Sensitivity	250mV/DIV or over	1 DIV 9.5 mm
Frequency bandwidth	DC ~ 500 kHz	within - 3 dB
Input impedance	1 M Ω $\pm 10\%$ within 35 pF	
Input terminals	Binding-post	
Sensitivity variable range	continuously variable 1 ~ 1/10 or more	
Maximum allowable input voltage	100 Vp-p (less than 1 min.)	DC + ACp-p (AC: 1 kHz or less)

TIME BASE

Characteristics	Specification	Remarks
Sweep frequency	10 Hz ~ 100 kHz continuously variable	4 ranges
Synchronizing	Internal only	negative polarity

SIGNAL OUTPUT

Characteristics	Specification	Remarks
Waveform	square-wave line frequency	
Output voltage	Approx. 0.4 Vp-p	

CRT

Characteristic	Specification	Remarks
Type	133 mm round screen CRT	Phosphor B 31

POWER REQUIREMENTS

Characteristics	Specification	Remarks
Voltage	100V, 110V, 117V 220V, 230V, 240V within $\pm 10\%$	Selected by change of terminal connection.
Frequency	50 ~ 60 Hz	
Wattage	Approx. 10VA	

DIMENSIONS AND WEIGHT

Characteristics	Specification	Remarks
Dimensions	170 mm W x 260mm H x 445mm D 165 mm W x 240mm H x 405mm D	Overall housing only
Weight	Approx. 6kg	

ACCESSORIES

Instruction Manual1

3. EXPLANATION OF PANEL (Fig. 1 and 2)

Front Panel

①	POWER ON OFF	Power on and off switch.
②	↑ ↓ POSITION	Vertical positioning of the spot (or trace) on the CRT screen.
③	VERT GAIN VARIABLE	Continuously-variable control of vertical deflection sensitivity.
④	VERT INPUT	Input terminal for vertical deflection of trace. The distance from terminal ⑤ is 19mm.
⑤⑨	GND	Ground terminal.
⑥	AC DC	This selects the method of coupling signal to the input of the vertical amplifier. AC : Signal is capacitively coupled to the vertical amplifier. DC component of signal is blocked. DC : All components of the input signal are passed to the vertical amplifier.
⑦	VERT GAIN	Vertical deflection sensitivity in 3 steps. The sensitivity is maximum (unity) when 1/1 range. It is reduced by a factor of 1/10 or 1/100 range respectively. GND: Input signal is removed and the input circuit is grounded. Dose not ground the input signal.
⑧	SWEEP RANGE	This selects sweep frequency in 4 steps. When this knob is turned on the extremely clockwise position (EXT HOR position), the input signal for horizontal amplifier is connected to the EXT HORIZ IN terminal to operate in the external sweep mode.
⑩	EXT HORIZ IN	External signal input terminal for horizontal deflection.
⑪	SWEEP VARIABLE	For continuously-variable control of time axis sweep frequency.

⑫	↔ POSITION	Horizontal position of the spot (or trace) on the CRT screen.
⑬	HORIZ GAIN	For continuously-variable control of horizontal deflection sensitivity.

Rear

⑭	INTEN	CRT intensity (brightness) control. The spot (trace) becomes brighter as the knob is turned clockwise.
⑮	FOCUS	For CRT spot (trace) focussing.
⑯	SIGNAL OUT	Output terminal for line frequency square-wave. Output voltage is approximately 0.4Vp-p.
⑰	GND	Grounding terminal.
⑱	DIRECT	Direct deflection terminal for vertical axis. Direct deflection is utilized by turning the NORMAL/DIRECT selector ⑲ to the DIRECT position.
⑲	NORMAL DIRECT	A selector for method of vertical deflection. In the NORMAL position , the vertical deflection plates are connected to the vertical amplifier, and input signal is applied to the VERT INPUT ④ . In the DIRECT position, input signal is applied to the DIRECT terminals ⑱ .

Bottom

⑳	1/100 ATT	Phase compensator for 1/100 ATT. (Do not touch, for adjusting perfectly at factory)
㉑	1/10 ATT	Phase compensator for 1/10 ATT. (Do not touch, for adjusting perfectly at factory)
㉒	VERT DC-BAL	This control should be so adjusted (with a screw-driver) that the baseline of trace is not vertically shifted when the VERT GAIN VARIABLE knob is turned.
㉓	COMPEN	A semi-fixed resistor for frequency response compen- sation of vertical amplifier. (Do not touch, for adjusting perfectly at factory)
㉔	HOR DC BAL	A semi-fixed resistor for DC balance of horizontal amplifier. Adjust it for no trace shift on the screen , when setting ⑧ to EXT HORIZ and rotating ⑬ .

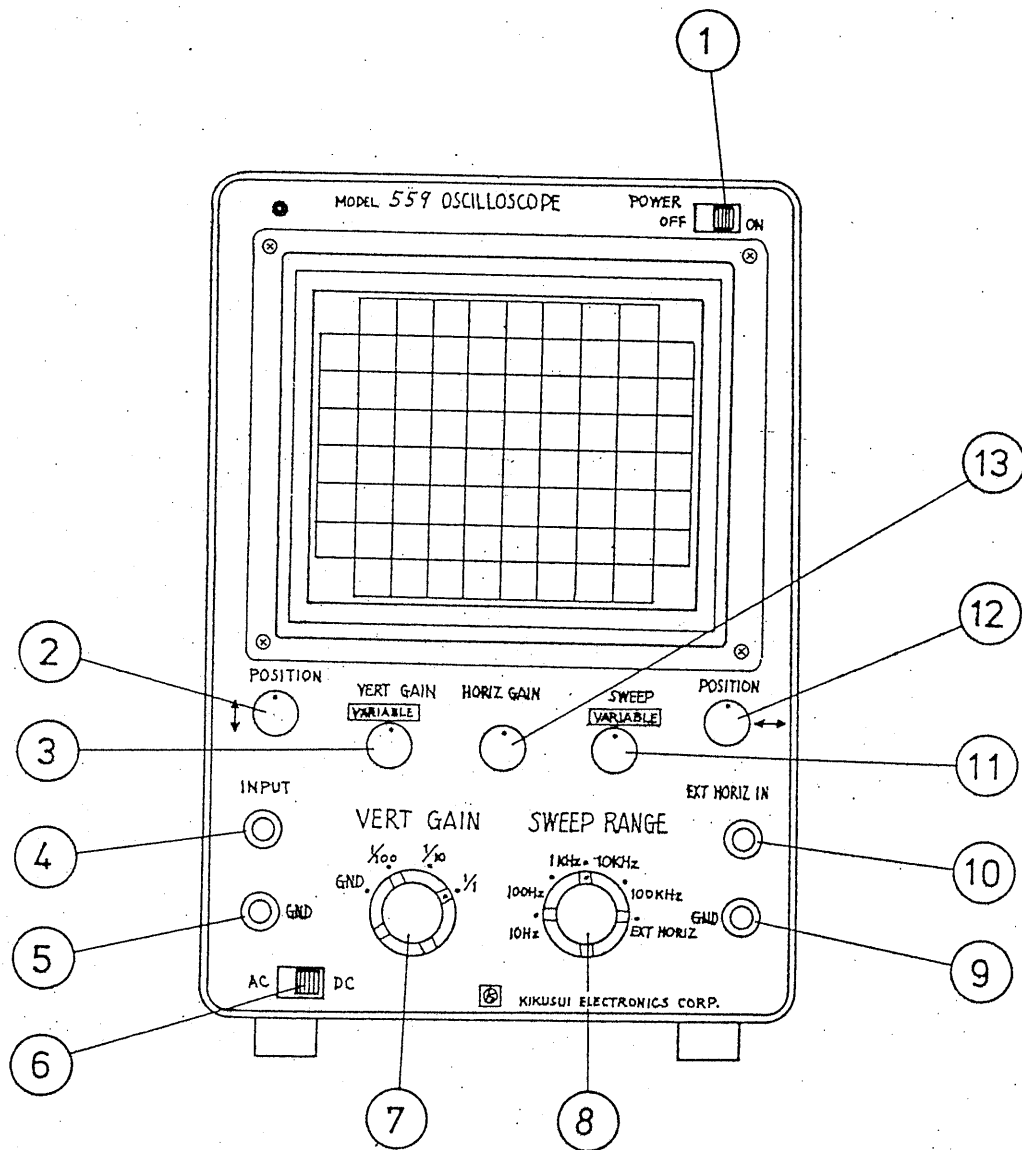


Fig. 1

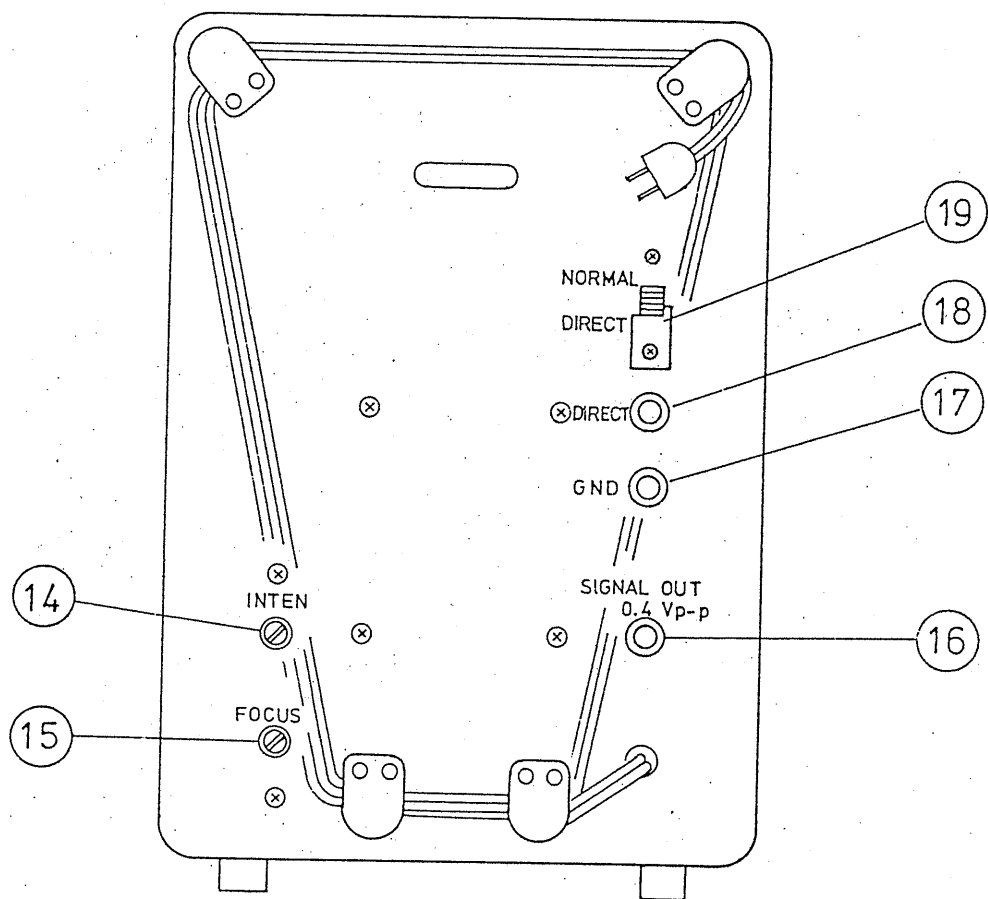


Fig. 2

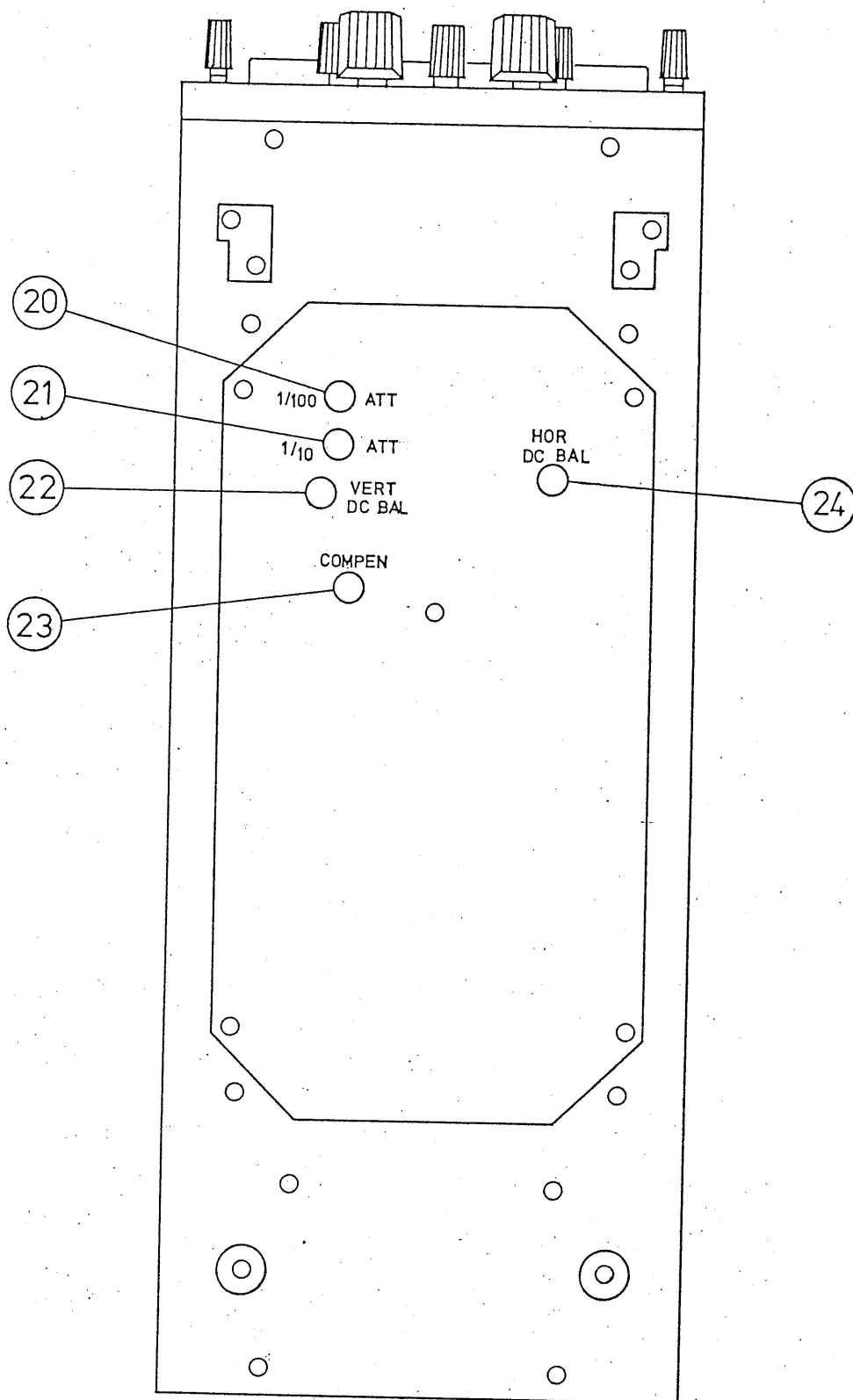


Fig. 3

4. OPERATING PROCEDURE

4-1 First Operation (Refer to Fig. 1)

Before operating; Set the respective knobs on front panel as follows.

POSITION	⑫	about center position
POSITION	②	about center position
VERT GAIN VARIABLE	③	fully clockwise rotation
VERT GAIN	⑦	GND position
AC DC	⑥	AC position
SWEEP RANGE	⑧	10Hz : 100Hz
HORIZ GAIN	⑬	about center
SWEEP VARIABLE	⑪	about center

After setting the knobs as above, connect the power cord with a power source.
Then, operate as follows.

POWER ON OFF	①	turn to ON position
--------------	---	---------------------

In ten seconds or so after power is turned on, a horizontal trace appears on the CRT screen. Adjust the position of a horizontal trace to the center of the CRT screen by following procedure.

POSITION	②	Set a horizontal trace to the center of the horizontal graticule line.
POSITION	⑫	Set a horizontal trace to the center of the vertical graticule line.
VERT GAIN	⑦	Set to 1/1 position

As preparation for operating terminates with above procedure, general method for using is explained as follows.

4-2 General method for using (Refer to Fig. 4)

Feed a signal to be displayed to the VERT INPUT terminal④ and the GND terminal ⑤ by using a coaxial cable or a shielded wire.

Connect center conductor to terminal ④ , outer conductor to terminal⑤ .

Then, a trace is displayed.

Operate as follows to obtain a suitable pattern for measurement.

- 1) Adjust the VERT GAIN ⑦ and the VERT VARIABLE ③ to obtain a suitable amplitude of the signal measured.
- 2) Adjust the SWEEP RANGE ⑧ and SWEEP VARIABLE ⑪ to obtain suitable cycles of the signal measured. When the frequency of a signal is 1000Hz, set the SWEEP RANGE ⑧ to 100Hz.1kHz position. Adjust the SWEEP VARIABLE ⑪ to obtain the suitable number of cycles of the signal on the screen.
- 3) Adjust the HORIZONTAL GAIN ⑬ to obtain the suitable horizontal length of the figure on the screen.
- 4) Control the position of the figure on the screen by the POSITION ② and ⑫.

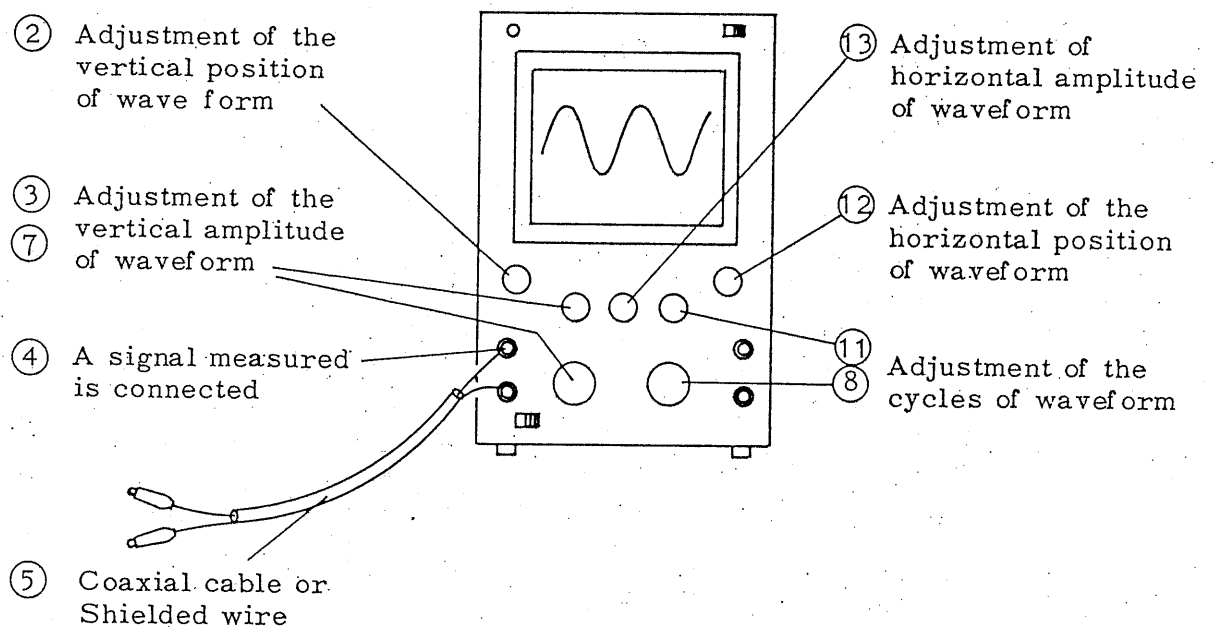


Fig. 4

4 - 3 Application

(1) Measurement of voltage

AC DC switch (6) should be used at AC position, when it is required for dc component to be blocked or dc component is not included in signal.

When measurement of all component of input signal is required. It should be used at DC position. Before measurement of voltage, vertical sensitivity should be calibrated by VERT GAIN VARIABLE

(for example: 10mV/DIV, 50mV/DIV or others).

Connect a signal to input terminal and measure amplitude on screen by scale.

(If signal is too large to measure it must be attenuated by VERT GAIN (7)).

Voltage is calculated by following equation.

$$\text{Voltage [V]} = \frac{\text{Signal amplitude [DIV]} \times \text{Sensitivity [mV/DIV]}}{\text{Value of VERT GAIN}}$$

Sensitivity can be calibrated by connecting an input signal with calibrated amplitude to VERT INPUT terminal (4) .

Example: When an input signal is 50mV, VERT GAIN VARIABLE (3) is adjusted for the amplitude of 5 DIV on a CRT screen.

In this case, the sensitivity is 10mV/DIV.

(2) Measurement of current by voltage drop (Refer to Fig. 5)

Circuit current I can be measured indirectly by measuring the voltage E across a small resistor in series with the circuit under test on CRT screen.

Current I is calculated from following equation using the familiar Ohm's equation.

$$I = \frac{E}{R} \text{ [A]}$$

The resistor R must be very small value, so as not to disturb the normal operation.

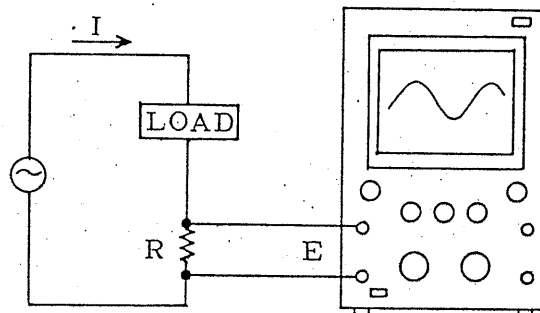


Fig. 5

(3) Measurement of frequency by Lissajous figure (Refer to Fig. 4)

When SWEEP RANGE (8) is set to EXT HORIZ, the MODEL 559 operates as X - Y oscilloscope which input is VERT INPUT (Y axis) (4) and EXT HORIZ IN (X axis) (10) .

This operation is used for observation of Rissajous figure and others. Connect a signal generator between (9) and (10) , and a signal between (4) and (5) .

Adjust VERT GAIN (7), VERT GAIN VARIABLE (3) and HORIZ GAIN (12) to obtain a figure all over the screen.

Adjust the frequency of the signal generator so as to stop the motion of a figure on the screen.

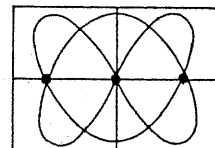
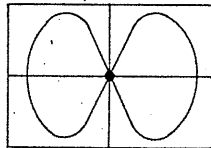
An unknown frequency can be caluculated from the patterns by a following equation.

$$\text{An unknown Frequency} = \frac{\text{Number of lines which cross the horizontal graticule line}}{\text{Number of lines which cross the vertical graticule line}} \times \text{A frequency of the signal generator}$$

$$\frac{4}{2} = \frac{2}{1} \quad \begin{matrix} (H) \\ (V) \end{matrix}$$

$$\frac{6}{4} = \frac{3}{2} \quad \begin{matrix} (H) \\ (V) \end{matrix}$$

Fig. 4



The number of cross points of an above figure are regarded as two.

(4) Measurement of the phase difference from the Lissajous pattern.
(Refer to Fig. 5)

The phase difference between two signals can be caluculated from the Lissajous pattern, connecting two signal of the same frequency to input terminal (4) and (10) . (for example, output signal of stereo amplifier)

phase difference : θ

$$\theta = \sin^{-1} \frac{B}{A}$$

Fig. 8

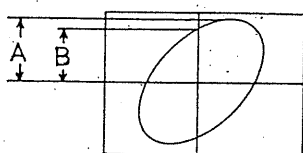
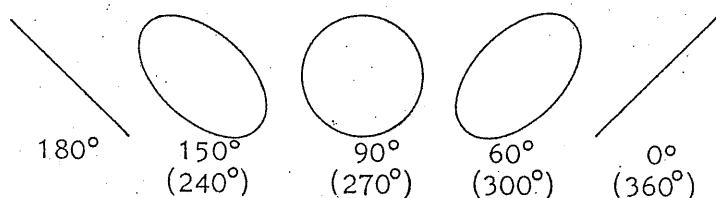


Fig. 7



5. CAUTION ON OPERATION

5 - 1 Supply Line Voltage (See Fig.10)

This instrument can be operated safely under the fluctuating range of the rated voltage within 10%.

Change the wiring of the transformer when operating at the voltage over the range of the rated voltage.

See " Change of Supply Line Voltage " for changing of wiring of the transformer.

5 - 2 Fuse

0.5A is used for a nominal 100V ~ 117V supply line voltage. 0.2A is used for a nominal 220V ~ 240V supply line voltage.

See " Exchange of Fuse" for exchanging the fuse.

5 - 3 Ambient Temperature

Do not expose to direct sunlight and do not put on the amplifier or the other instrument generating heat.

Operate at the range of 5°C ~ 35°C of the ambient temperature.

The specifications may not be satisfied and the life may be shorten, when operating over the appointive ambient temperature.

5 - 4 Maximum Input Voltage

Maximum allowable input voltage is specified so that the input voltage exceed the withstand voltage of electronic parts using for this instrument. Do not apply excessive voltage over the rated voltage to the input terminal for protecting the parts from the damage.

VERT INPUT terminal (4)

Maximum 600Vp-p
(1 min. max. AC: 1kHz or less)

EXT HORIZ IN terminal (10)

Maximum 100Vp-p
(1 min. max. AC: 1kHz or less)

5 - 5 Maximum Input Voltage to EXT HORIZ IN Terminal without
Distortion of Waveform

The horizontal axis of this instrument is desired by taking serious view of phase. For this purpose, the source follower is used for the impedance convertor between the HORIZ GAIN control and EXT HORIZ IN terminal. The dynamic range of the horizontal amplifier is a little narrow for above reason. The waveform is saturated for approximately 8Vp-p or more input.

5 - 6 Life of the CRT

The life of the CRT will be shorten if the trace should be brighten, the spot should be kept or the supply line voltage should be kept excessive high for a long time.

6. MAINTENANCE AND CALIBRATION

6 - 1 Case Removal (See Fig. 11)

- (1) Remove the four screws on the side of the case and the four screws on the upper part of the case.
- (2) Hold a handle of the case and raise it. It will be removed.
- (3) The panel for the check on the bottom is removed by five screws.

6 - 2 Change of Supply Line Voltage (Refer to Fig. 10)

- (1) Disconnect the instrument from the source when changing a supply line voltage.
- (2) Change the wiring of the transformer to match the power source. Caution the relation between the color of the wire and the supply voltage.

6 - 3 Exchange of the Fuse (Refer to Fig.10)

- (1) The fuse is located on the printed circuit board in the case. 0.5A is under for a 100V~117V nominal line voltage and 0.2A is used for a 220V~240V nominal line voltage.
Change the fuse after the repair of the cause when a fuse is broken.

6 - 4 Adjustment of DC Balance (See Fig.3)

The horizontal trace may shift when rotating the VERT VARIABLE control

- (4). Adjust the DC BAL control (20) as shown below for no baseline shift of a CRT display.
- (1) Set the VERT GAIN switch to GND, and the SWEEP RANGE (10) to 1k - 10k.
- (2) Position the trace to the center horizontal graticule line with the VERT POSITION control.
- (3) Rotate the VERT VARIABLE control (3) through its range.
adjust the DC BAL control (22) for no trace shift on the CRT screen.

6 - 5 Phase Compensation for VERT GAIN Switch (See Fig.3)

- (1) A 1kHz square-wave with 0.1 μ s or less and without overshoot is required for the adjustment.
- (2) Set the VERT GAIN switch (7) to 1/10 and adjust the square-wave amplitude for a four division display.
- (3) Adjust the semi-fixed capacitor (21) in Fig.6 for the correct wave form.
- (4) Set the VERT GAIN switch (7) to 1/100 and adjust the square-wave amplitude for a four division display.
Repeat the adjustment of procedure (3).
(the semi-fixed resistor adjusted is (20))

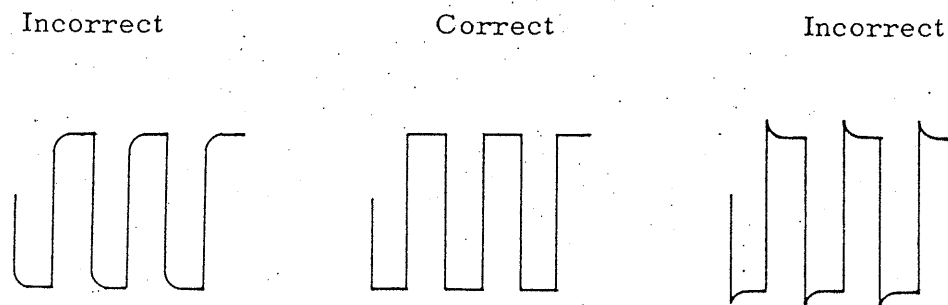


Fig. 9

6 - 6 Adjustment of high frequency response compensation of the vertical amplifier. (See Fig. 3)

This adjustment is the phase compensation of the vertical amplifier at high frequency. It is necessary to use a 100 kHz square-wave with 1 ns or less, risetime for this adjustment. Such a square-wave generator is a special instrument. This procedure is only method for the adjustment of the this compensation. Do not adjust the COMPEN (23) without the appropriate square-wave generator.

- (1) Set the VERT GAIN switch (7) to 1/1.

- (2) Connect a 100kHz square-wave with 1 ns or less risetime to the VERT INPUT terminal between (4) and (5).
- (3) Adjust the SWEEP RANGE switch 8 and the SWEEP VARIABLE control (11) for 2 or 3 cycles on the CRT screen.
- (4) Turn the VERT VARIABLE control fully clockwise, for the rising part of the waveform is changed a little when rotating the VERT VARIABLE control (3).
Adjust the control (21) for minimum of the overshoot and the undershoot.

6 - 7 Adjustment of Horizontal DC Balance (See Fig. 3)

This is the adjustment of the DC balance of the horizontal amplifier.

- (1) Set the SWEEP RANGE switch (8) to EXT.
- (2) Adjust the control (24) so that the spot on the CRT screen does not move when rotating the HOR GAIN control through its range.

6 - 8 Adjustment of Trace Alignment (See Fig. 9)

The trace may not be parallel to the horizontal graticule line, for the CRT beam is reflected by terrestrial magnetism. In such a case, remove the case and rotate the CRT so that the trace parallel to the horizontal graticule line.

- (1) Loosen the CRT clamping screw and rotating the CRT by holding the body of the CRT.
Do not rotate by holding the socket of the CRT.

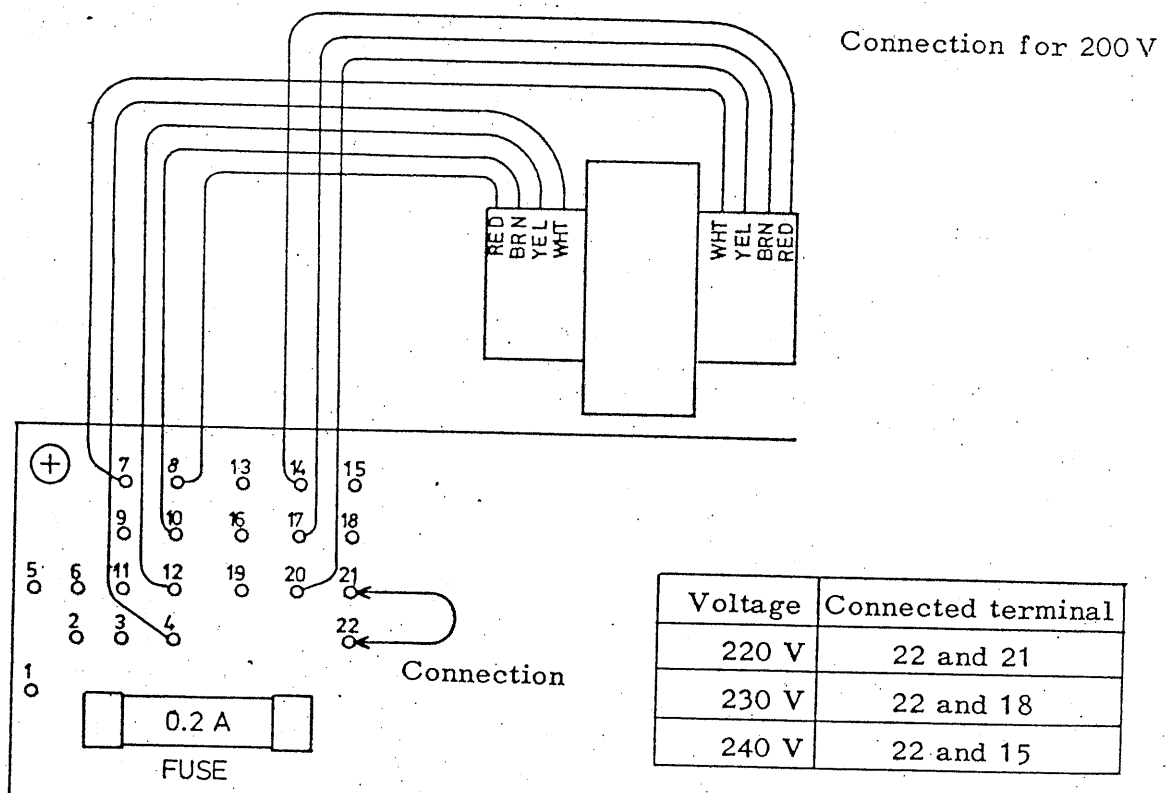
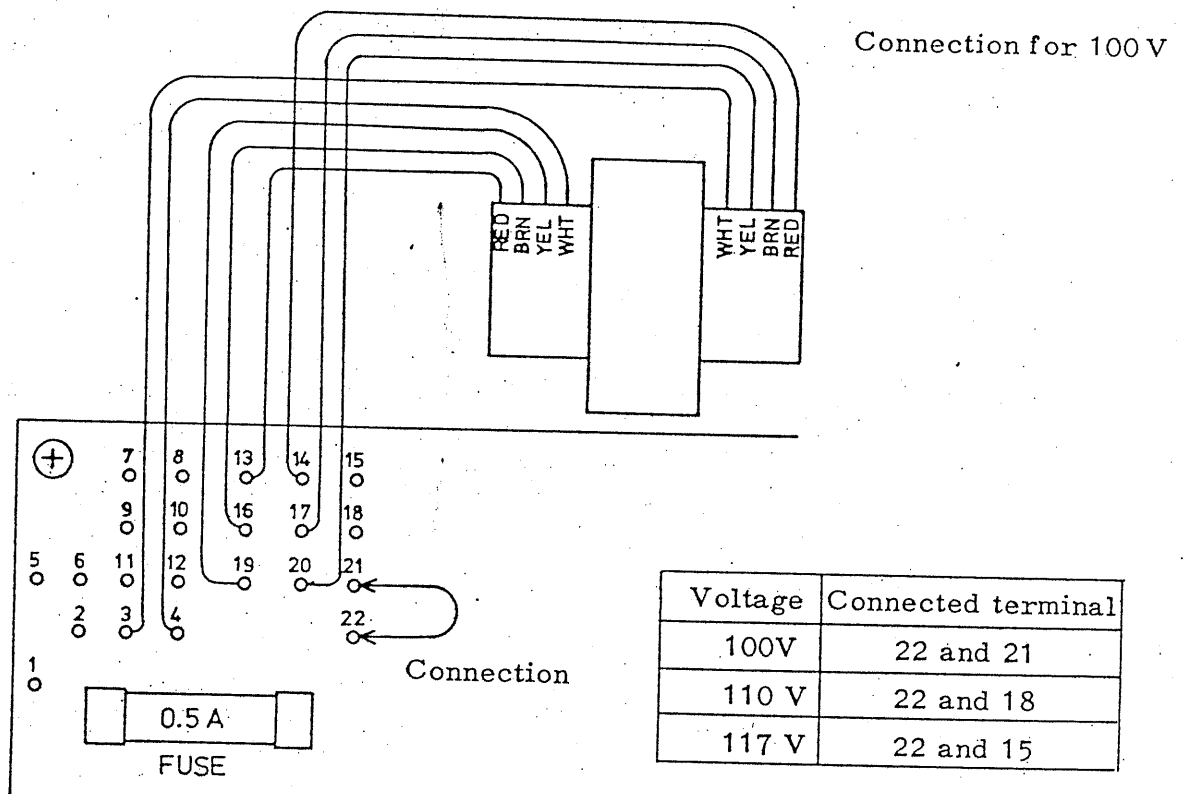


Fig.10

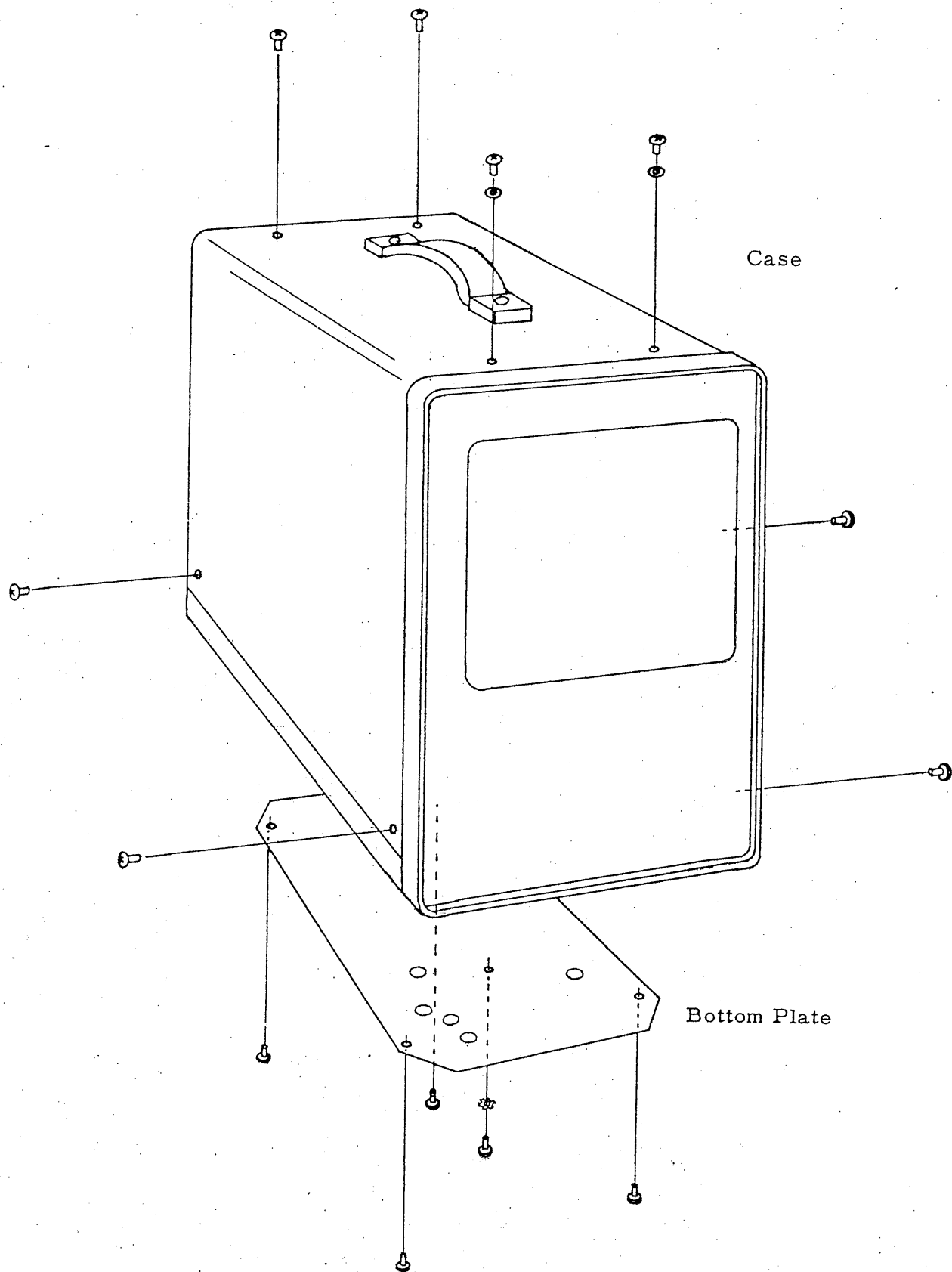


Fig.11

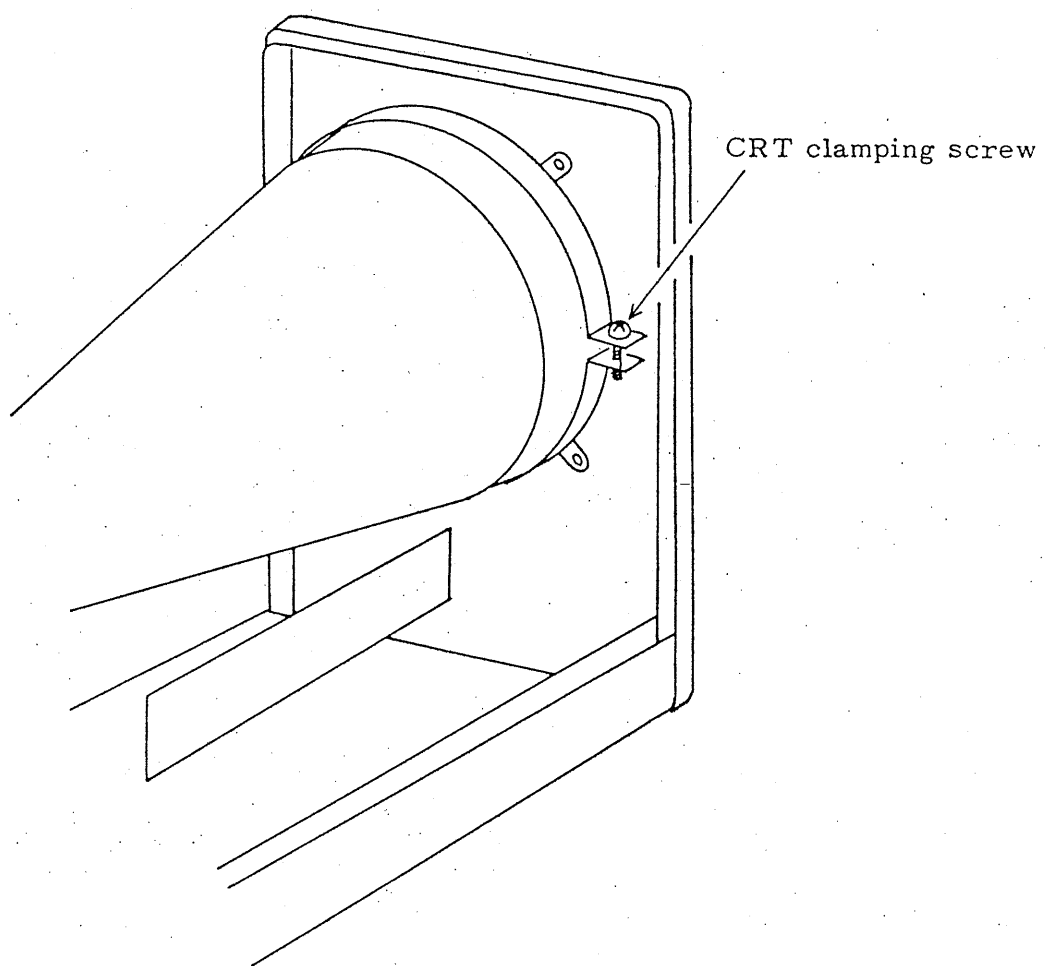


Fig.12