MODEL 539A
OSCILLOSCOPE
OPERATION MANUAL

印刷表紙使用のこと

KIKUSUI ELECTRONICS CORP.

CONTENTS

1. Characteristics

General Characteristics

Model 539A is a compact oscilloscope employing a 75-mm CRT for general use.

The vertical axis is provided with a wide-band push-pull amplifier of high stability and low distortion factor, and the time base has an external sweep terminal and a widely variable sweep range.

With a remarkably stable synchronous circuit, these render the Model 539A Oscilloscope a handy measuring instrument.

Functional Characteristics

Sensitivity of the vertical axis is higher than 150 mV p-p/cm. It can be switched to either 1/10 or 1/100 by means of an attenuator, and adjusted in a range from 150 mV p-p/cm to 15 V p-p/cm. Further, a continuously from 1 to approximately 1/10.

Frequency response of the vertical axis covers from 5 Hz to 700 kHz.

Sweep frequency of the time base is switched to 4 ranges covering from 10 Hz to 100 kHz. Each range can be continuously adjusted by means of a continuous variable adjuster.

This instrument is provided with an input terminal for an external horizontal amplifier. Sensitivity is higher than 1.5 V p-p/cm, and frequency response covers from 2 Hz to 400 kHz.

Specifications

Vertical Axis :

Deflection Sensitivity	Higher than 150 mV p-p/cm
	At 1/10 (voltage divider) : higher than 1.5 V p-p/cm
	At 1/100 (voltage divider) : higher than 15 V p-p/cm
	Variable to lower than 1 - 1/10 by continuous variable attenuator
Voltage Divider Accuracy	± 0.5 dB
Frequency Response	5 Hz - 700 kHz -3 dB or less
Input RC Characteristics	1 MΩ ; parallel capacitance less than 30 pF
Maximum Input Voltage	600 V p-p/ (DC + AC p-p)

Time Base :

Sweep frequency	10 Hz - 100 kHz 4 ranges : each continuously variable by adjuster
Synchronization	Internal (positive polarity)

External Horizontal Amplifier :

Deflection Sensitivity	Higher than 1.5 V p-p/cm
Frequency Response	2 Hz - 400 kHz -3 dB or less
Input RC Characteristics	Approx. 2.2 MΩ ; parallel capacitance - less than 75 pF

Maximum Input Voltage	100 V p-p (DC + AC p-p)	
Power Supply :		
Voltage	_____V 50 or 60 Hz	
Power Consumption	Approx. 40 VA	
Overall Dimension (Maximum)		
	110 W x 190 (210) H x 310 (355) D mm	
Weight	Approx. 5 kg.	
Accessories	Operation Manual	1

2. Function

Power Supply Voltage

Safety power supply voltage for Model 539A oscilloscope is within a range of the rated value ± 10%.

To maintain its maximum reliability and long life of component parts, however, it is desired that this instrument be used at the rated voltage.

Caution for Installation

Be sure to use this instrument in a place where ambient temperature is between 0° C and 35° C. Avoid direct rays of the sun, high humidity, or any dusty place. The installation place must be well ventilated when this instrument is used adjacently to any other heat-radiating equipment.

Other Cautions

When it is used in the proximity of strong magnetic fields, its CRT electron beam is deflected by the magnetic fields, and as the result, noise or trace distortion may be generated.

Avoid using it in a place where any corrosive gas is present. Such gas will extremely shorten the life of electronic component parts.

Maximum values are specified with respect to input voltages to be impressed on the input terminals of both vertical and horizontal axes.

It is to be noted that any voltage above the rated value may cause breakdown of such component parts as the input voltage divider and others.

Control Knobs and Terminals

*	POWER ON	A switch for turning line power on and off.
*	VERT POSITION	A knob for positioning a trace vertically.
*	VERT GAIN	(Gray) A switch for selectively setting deflection
	VARIABLE	sensitivity of vertical axis to 1/10 or 1/100. (Red) A knob for continuously varying deflection sensitivity of vertical axis from about 1/10 to maximum.
*	VERT INPUT	A vertical amplifier input terminal.
*	SWEEP RANGE	(Gray) An internal sweep range selector.
	VARIABLE	Its full clockwise rotation stops internal sweep, and switches over to external sweep. (Red) A knob for continuously adjusting internal sweep range.

*	HOR POSITION	A knob for positioning a trace horizontally.
	HOR GAIN	A semi-fixed sensitivity adjuster of the horizontal amplifier is provided in the center of this knob. Sensitivity can be adjusted by means of a screw-driver.
*	EXT HOR IN	An input terminal for an external horizontal amplifier. Full clockwise roation of the sweep range selector connects input of the horizontal amplifier with this terminal.

Rear Panel

*	FOCUS	A focussing knob for obtaining distinct traces.
*	ASTIG	A knob for obtaining uniform distinction over the entire CRT screen.

Front Panel

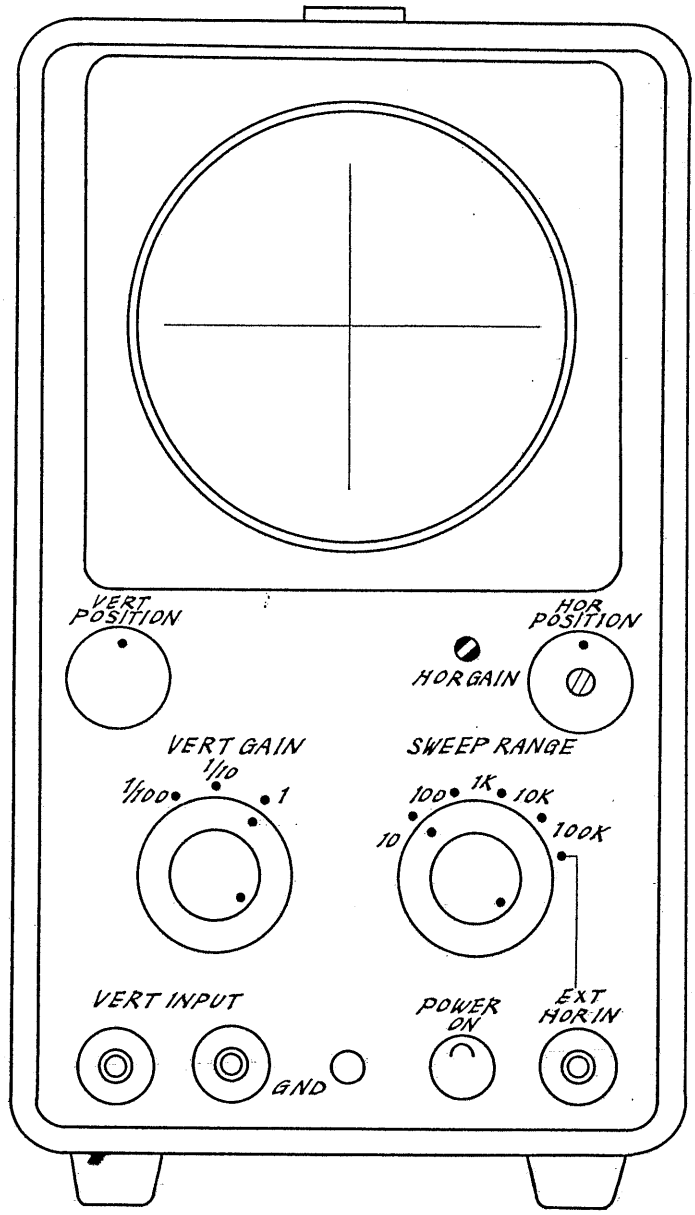


Fig. 1

First Operation

To display waveforms on the CRT screen, operate this instrument in the following procedure, which will enable a user to become proficient in the use of the knobs and terminals on the front panel.

First, set the respective knobs as follows.

1. POWER OFF
   VERT GAIN 1
   VERT GAIN VARIABLE Full clockwise rotation
   VERT POSITION About center
   SWEEP RANGE 10 - 100
   SWEEP RANGE VARIABLE About center
   HOR POSITION About center

2. After setting the knobs as above, connect the power cord with a power source of_____V 50 or 60 Hz, and turn on the POWER switch.

3. In ten seconds or so after line power is turned on, a trace being about 6 cm long appears on the CRT screen.

4. Adjust the trace position to the center of the CRT screen by means of the VERT POSITION and HOR POSITION knobs.

   The above procedure terminates preparation for display of waveform.

Now, just feed a signal to be displayed to the vertical axis, and ajust the SWEEP RANGE and VERT GAIN knobs. Then the waveform will be observed.

The following is how to display output waveform by using an oscillator.

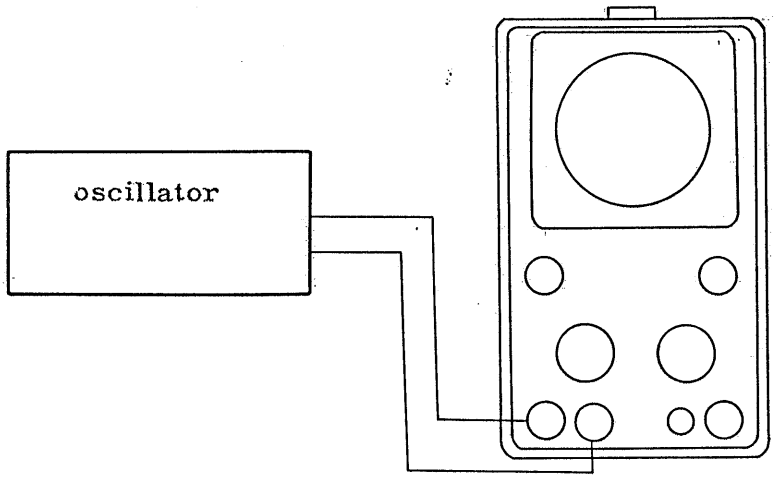


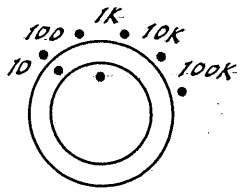
Fig. 2

Feed the output of an oscillator to the vertical input terminal as illustrated in Fig. 2. When the output and frequency of the oscillator are properly adjusted, the output waveform will appear on the CRT screen.

As the SWEEP RANGE knob is now set to 10 - 100 Hz, a range of frequencies to be synchronized covers from 10 to 100 Hz.

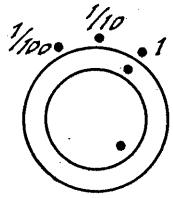
Therefore the oscillator frequency has been changed to a 100 - 1000 Hz. range, set the SWEEP RANGE knob to 100 - 1 kHz, and synchronize the frequency by adjusting the SWEEP VERIABLE (red) knob.

SWEEP RANGE



As the oscillator output voltage increases, the waveform being displayed will spread vertically out of the CRT screen.

VERT GAIN



In such a case, adjust the waveform to a proper amplitude by means of the VERT GAIN switch and the GAIN VERIABLE (red) knob.

Note : The GAIN VARIABLE (red) knob is capable of adjusting sensitivity continuously from about 1/10 to maximum.

3. Application

Display of General Waveform

Operation is the same as described in "First Operation".

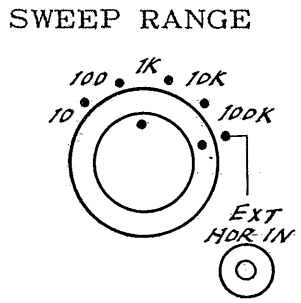
Connect the signal to be displayed with the VERT INPUT terminal, and adjust the VERT GAIN and SWEEP RANGE knobs. Then the waveform will be displayed.

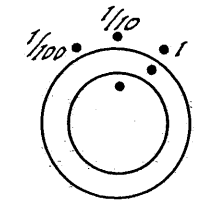
Be careful in this operation not to impress an excessive voltage on the VERT INPUT terminal. As rated in the specifications, the maximum voltage to be impressed is 600 V p-p (DC + AC p-p). In a waveform containing DC component, for example, the total voltage of both AC and DC must be less than 600 V p-p.

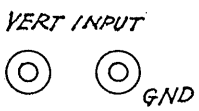
Measurement of Phase Difference

To measure phase difference between two signals of the same frequency, a Lissajous figure is applied.

Turn the SWEEP RANGE switch clockwise to its extreme position, and feed the respective signals to the VERT INPUT terminal and the EXT HOR IN terminal. Then adjust the figure displayed on the CRT screen to the shape of Fig. 3 by means of the VERT GAIN and HOR GAIN knobs.







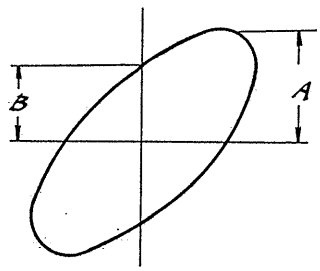


Fig. 3

The phase difference is obtained from Fig. 3 by Sin θ = B/A.

Frequency Measurement

Lissajous figures for phase difference between two signals of different frequencies become stationary when the ratio between both frequencies is integral fraction, and such patterns as shown in Fig. 4 are observed.

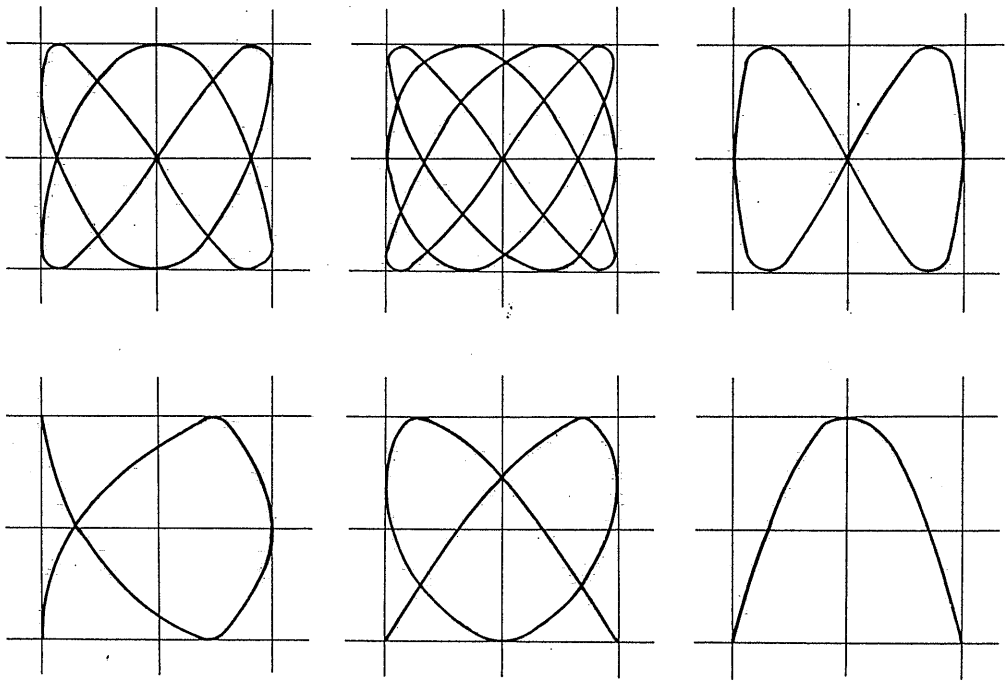


Fig. 4

From the figures, obtain :

number of loops in contact with vertical tangent : Nv

number of loops in contact with horizontal tangent : Nh

vertical input frequency : fv

horizontal input frequency : fh

Since $\frac{fv}{fh} = \frac{Nh}{Nv}$, $fv = fh \times \frac{Nh}{Nv}$.