

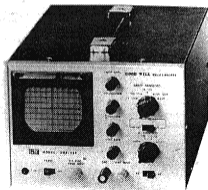
GOOD WILL TEST INSTRUMENTS

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MODEL GOS-935

75MM OSCILLOSCOPE

INSTRUCTION MANUAL



GOOD WILL INSTRUMENT CO., LTD.

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* This unit is to be used by AC V 50/60 Hz.

* Contents of manual on input voltages are to be based on a standard voltage of AC 110V 50/60 Hz.

* Please note beforehand that there is possibility of any difference between the unit itself and the circuit or a part of explanation on manual.

* AC plugs will differ with countries. In case of no plugs, please fix your suitable plugs at your side.

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1. GENERAL

The Model 935 is a compact, highly reliable, universal purpose oscilloscope which employs compact 75mm round screen cathode-ray tube, solid-state electronics, and unique light weight metallic alloy housing.

The vertical system provides a sensitivity of 10 mV/div or over and a frequency bandwidth of DC ~ 5 MHz.

The time axis circuit provides sweep frequencies of 10 Hz - 100 kHz sweep, and negative synchronizing (both INTERNAL and EXTERNAL). When this circuit is switched over to the external sweep mode, it provides a deflection sensitivity of 500 mV/div or over and a frequency band of DC ~ 500 kHz. The external signal is applicable through a front panel terminal. This mode can be employed for X - Y operation of the oscilloscope, providing a high operation flexibility. Since solid-state electronics is employed throughout the circuit, the oscilloscope can start operating only in less than 20 seconds after its power is turned on. Since heat-generating components and hence the instrument wattage are minimized, the drift is very small and an improved operation reliability is attained.

Since this oscilloscope employs blanking-circuit, waveform can easily be observed.

2. SPECIFICATION

VERTICAL DEFLECTION SYSTEM

Characteristic	Specification	Remarks
Sensitivity	10 mV/DIV or over	1kHz, 1DIV = 6mm
Frequency bandwidth	AC: 2 Hz ~ 5 MHz DC: DC ~ 5 MHz	within - 3 dB
Attenuator	1/1, 1/10, 1/100 and GND	
Attenuator accuracy	within ± 3 %	
Input impedance	1 MΩ ± 5% within 35 pF	
Input terminal	3/4" Binding-post	
Maximum allowable input voltage	600 V _{p-p} Less than 1 min.	DC + AC _{p-p} AC: Less than 1kHz

EXTERNAL HORIZONTAL AMPLIFIER

Characteristic	Specification	Remarks
Sensitivity	500 mV/DIV or over	1kHz, 1DIV = 6mm
Frequency bandwidth	DC ~ 500 kHz	within - 3 dB
Input impedance	1 MΩ ± 10% within 35 pF	
Input terminal	Binding-post	
Variable range	1 - 1/10 or more	
Maximum allowable input voltage	100 V _{p-p} Less than 1 min.	DC + AC _{p-p} AC: Less than 1kHz

TIME BASE

Characteristics	Specification	Remarks
Sweep frequency	10 Hz - 100 kHz	
Synchronizing	Internal and external	

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

CRT

Characteristics	Specification	Remarks
Type	75 mm round screen CRT	
Blanking	As G1	

POWER REQUIREMENTS

Characteristics	Specification	Remarks
Voltage	100V, 110V.	Selected by change of internal connection
Frequency	50 - 60 Hz	
Wattage	Approx. 10 VA	

DIMENSIONS AND WEIGHT

Characteristics	Specification	Remarks
Dimensions	202mm W x 160mm H x 305mm D	Overall
Weight	Approx. 3.8kg	

ACCESSORIES

Operation Manual

Front Panel

1	POWER ON OFF	Power on and off switch.
2	POSITION	Horizontal positioning of the spot (or trace) on the CRT screen.
3	POSITION	Vertical positioning of the spot (or trace) on the CRT screen.
4	VERT GAIN	Continuously-variable control of vertical deflection sensitivity.
5	V. GAIN ATT.	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. Do not ground the input signal.
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 INPUT	Input terminal for vertical deflection of trace.
8	GND	Ground terminal.
9	EXT SYNC/ HORIZ INPUT	External signal input terminal for horizontal deflection and external synchronizing.
10	SWEEP RANGE	This selects sweep frequency in 4 steps. When this knob is turned to the extremely clockwise position (EXT position), the input signal for horizontal amplifier is connected to the EXT SYNC HORIZ INPUT terminal to operate in the external sweep mode.

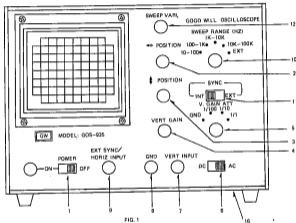
11	SYNC INT-EXT.	As the INT position, synchronization is effected by INPUT voltage and, at the EXT position, the signal voltage applied to the "9" terminal is synchronized.
12	SWEEP VARI.	<p>Sweep frequency fine adjustment and external signal gain control. When the SWEEP RANGE selector switch "10" is in the internal frequency range (10-100K), this control acts as the fine adjustment of sweep frequency to the number of the cycles in the signal waveform on the cathode ray tube screen.</p> <p>When the SWEEP RANGE selector switch "10" is in the EXT position, this control provides facilities to adjust the Gain of the signal connected to the HOR EXT. INPUT terminal "9" to change the amplitude of the horizontal signal on the cathode ray tube screen.</p> <p>Note that the horizontal frequency response varies with the position of this control. (Refer to specifications)</p>

Rear Panel

13	INTENSITY	CRT intensity (brightness) control. The spot (trace) becomes brighter as the knob is turned clockwise.
14	FOCUS	For CRT spot (trace) focussing.
15	Cord	Power supply cord.

Bottom

16	DC-BAL.	This control should be so adjusted (with a screwdriver) that the baseline of trace is not vertically shifted when the VERT GAIN VARI knob is turned.
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4. OPERATING PROCEDURE

4-1 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.

At first, set the respective knobs as follows.

- | | |
|---------------|-------------------------|
| 1. POWER | OFF |
| V. GAIN ATT | GND |
| VERT GAIN | Full clockwise rotation |
| VERT POSITION | About center |
| SWEEP RANGE | 10 - 100 |
| SWEEP VARI. | About center |
| HOR POSITION | About center |
- After setting the knobs as above, connect the power cord with a power source and turn on the POWER switch.
 - In 10 seconds or so after line power is turned on, a trace appears on the CRT screen.
 - 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 adjust 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.

Feed the output of an oscillator to 50k vertical input terminal as illustrated in Fig. 1 or 3. 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 100Hz - 1kHz, and synchronize the frequency by adjusting the SWEEP VARI. knob.

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

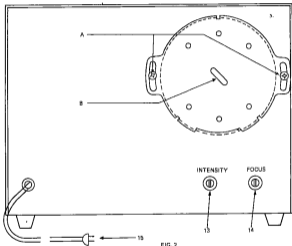


FIG. 2

In such a case, adjust the waveform to a proper amplitude by means of the V. GAIN ATT switch and the VERT GAIN knob.

Note: The VERT GAIN knob is capable of adjusting sensitivity continuously from about 1/10 to maximum.

4-2 Application

(1) Measurement of the frequency response of the amplifier

The measurable part of the audio amplifier are the input terminal and the output terminal to the speaker, because it is difficult for the capacitance of the shielded wire to the input terminal to the oscilloscope. Generally, the output terminal to the input terminal to the oscilloscope. Generally, the output terminal to the speaker is affected little, for the impedance of the output terminal to the speaker is fully lower than the impedance of the shielded wire. (See Fig. 4)

Connect the VERT INPUT terminal (7) and (8) to the output terminal to the speaker and the sine-wave from the audio frequency generator to the AUX terminal. Keep the amplitude of the sine-wave and change the frequency through its range. The frequency response at each frequency is represented as the amplitude on the CRT screen. (See Fig. 4)

(2) Monitor of output signal of stereo amplifier (See Fig. 5)

1. Set the SWEEP RANGE switch (10) of the oscilloscope to the EXT sweep variable terminal.
2. Set the SWEEP VAR. control (11) to the approximate center through its range.
3. Sync int and ext switch to ext.
4. Set the V. GAIN ATT switch (5) to 1/100.
5. Set the VERT GAIN control (4) to the fully clockwise.
6. Connect the LEFT + terminal to the speaker of the stereo amplifier to the VERT INPUT terminal (7) of the oscilloscope and the LEFT - terminal to the speaker to the VERT INPUT terminal (8) with the shielded wire.
7. Connect the RIGHT + terminal to the speaker to the EXT SYNC HORIZ INPUT terminal (9) with the shielded wire.
8. Operate the stereo amplifier.
Lissajous pattern by the left and right signal of the stereo amplifier is represented on the CRT screen.
9. Adjust the amplitude with the control (4) and (10), and set the position of the figure on the CRT screen to the center with the control (2) and (3).

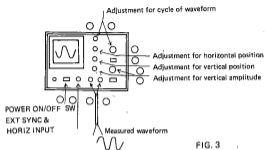


FIG. 3

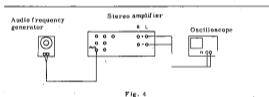


Fig. 4

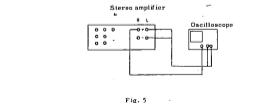


Fig. 5

5. CAUTION ON OPERATION

5-1 Supply Line Voltage (See Fig. 8)

This instrument can be operated safely under the fluctuating range of the rated voltage within 10% in the printed supply line voltage on the rear panel. 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 shortened, when operating over the appropriate 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 ⑦	Maximum	*600V _{p-p}
EXT SYNC HORIZ INPUT terminal ⑨	Maximum	*100V _{p-p}

*AC: Less than 1 kHz, Less than 1 min.

5-5 Life of the CRT

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

5-6 Maximum Input Voltage to EXT SYNC HORIZ INPUT Terminal without Distortion of Waveform

The horizontal axis of this instrument is designed by taking serious view of phase. For this purpose, the source follower is used for the impedance converter between the SWEEP VARL control and EXT SYNC HORIZ INPUT terminal. The dynamic range of the horizontal amplifier is a little narrow for above reason. The waveform is saturated for approximately 8V_{p-p} or more input.

6. MAINTENANCE AND CALIBRATION

6-1 Case Removal (See Fig. 7)

- (1) Remove the six screws on the side of the case and the two screws on the upper part of the case.
- (2) Slide approximately 2 cm the case to the rear and remove the case.
- (3) The panel for the check on the bottom is removed by three screws.

6-2 Change of Supply Line Voltage

- (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

- (1) The fuse is located on the printed circuit board in the case. 0.5A is used 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. 9)

The horizontal trace may shift when rotating the VERT GAIN control (4).

Adjust the DC BAL control (16) as shown below for no baseline shift of a CRT display.

- (1) Set the V. GAIN ATT switch to GND.
- (2) Position the trace to the center horizontal graticule line with the VERT POSITION control.

- (3) Rotate the VERT GAIN control through its range.

Adjust the DC BAL control (18) for no trace shift on the CRT screen.

6-5 Frequency Compensation for V. GAIN ATT Switch (See Fig. 9)

- (1) A 1 kHz square-wave with 0.1 μ s or less and without overshoot is required for the adjustment.
- (2) Set the V. GAIN ATT switch to 1/10 and adjust the square-wave amplitude for a four division display.
- (3) Adjust the semi-fixed capacitor (17) in Fig. 6 for the correct wave form.
- (4) Set the V. GAIN ATT switch (5) to 1/100 and adjust the square-wave amplitude for a four division display.

Repeat the adjustment of procedure (3).



FIG. 6

6-6 Adjustment of high frequency response compensation of the Vertical Amplifier.

(See Fig. 9)

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 μ s 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 high frequency response compensation. Do not adjust the compensator without the appropriate square-wave generator.

- (1) Set the V. GAIN ATT switch to 1/1.
- (2) Connect a 100 kHz square-wave with 1 μ s or less risetime to the VERT INPUT terminal between (7) and (8).
- (3) Adjust the SWEEP RANGE switch (10) and the SWEEP VARI. control (11) for 2 or 3 cycles on the CRT screen.
- (4) Turn the VERT GAIN control fully clockwise, for the rising part of the waveform is changed a little when rotating the VERT GAIN control (4). Adjust the control (19) for minimum of the overshoot and the undershoot.

6-7 Adjustment of Horizontal DC Balance (See Fig. 9)

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

- (1) Set the SWEEP RANGE switch (10) to EXT.
- (2) Adjust the control (20) so that the spot on the CRT screen does not move when rotating the SWEEP VARI. control through its range.

6-8 Adjustment of Trace Alignment (See Fig. 2)

- (1) Loosen the screw (A) holding the CRT Mounting plate at the rear.
- (2) Place the oscilloscope on the normal operating position.
- (3) Put the blade of a screw driver in the slit (B) to turn the CRT mounting plate for setting the bright line correctly against the scale graduation.
- (4) Carefully tighten the screw (A) observing that the horizontal bright line is not deviated.

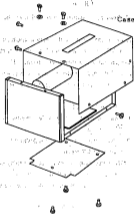
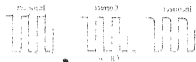


Fig. 7

Top View

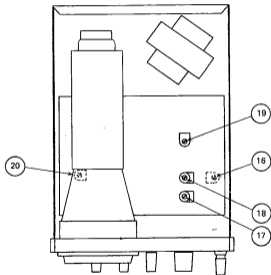


Fig. 9

