OPERATION MANUAL

FOR MODEL 5505

OSCILLOSCOPE

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.

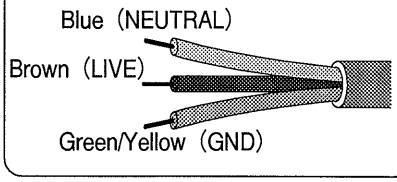
☐ AC power cable

The product is porvided 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.

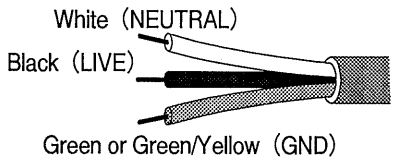
WARNING

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

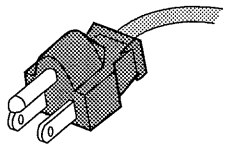
☐ Without a power plug



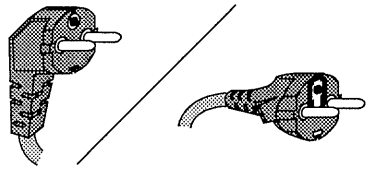
☐ Without a power plug



☐ 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 _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

C O N T E N T S

1. GENERAL

Kikusui's Model 5505 is a triggered type oscilloscope designed compact and light using a 133 mm cathode-ray-tube.

The vertical axis has a maximum 10 mV sensitivity and a bandwidth of DC to 5 MHz, and the horizontal axis provides with a time base generator of 1μS/CM to 0.1S/CM.

Use of many transistors and diodes and above all use of dual FET for the vertical axis ensures very stable performance, minimized drift and low noise level.

The pushbutton type vertical and horizontal axis change-over switches light up when pressed. This permits the user to check a selected range from the remote side, and simplifies operation of the oscilloscope.

Model 5505 also provides with the terminals from which regulated 1 kHz square waves can be taken off to calibrate the sensitivity of the vertical axis or probe.

Composition

Model 5505 comprises the main body and accessories:

Main body

Accessories

957M type probe	1
941B type terminal adaptor	1
Operation manual	1

2. SPECIFICATIONS

Vertical deflection

Sensitivity	4-range of 10mV/CM to 10V/CM in 1/10 attenuation step
Voltage dividing accuracy of attenuator	Within 3%
Continuously variable sensitivity	Sensitivity can be continuously attenuated below 1/10 of VOLTS/CM indicated value. At 10V/CM range, less than 100V/CM obtainable.
Frequency bandwidth	-3 dB attenuation range: DC to 5 MHz by DC coupling 2 Hz to 5 MHz by AC coupling With reference to 4 cm amplitude
Rise time	Approx. 117nS (calculated value)
Input impedance	1 megohm ±2%, with 38pF±2pF in parallel
Input terminal	UHF type receptacle, M type applicable
Max. allowable input voltage	400Vp-p at 10mV/CM range 600Vp-p at other ranges Applied voltage is DC+ACp-p (AC: less than 1 kHz)

Input coupling mode	AC and DC
Trace deviation by DC offset	Within 2 mm in 10mV/CM sensitivity

Horizontal deflection

Sweep time	6-ranges of 1μS to 100mS/CM in 1/10 attenuation step
Continuously variable sweep time	Up to more than 10 times of TIME/CM in indicated value variable. Max. sweep time is more than 1S/CM.
Sweep time error	Within 5% of TIME/CM indication value with VARIABLE at CAL'D. (power voltage:_____V)

Triggering

Trigger signal source	INT : waveform on CRT screen EXT : external signal
Connection	AC
Polarity	+ and -
Internal trigger sensitivity	5 mm from 50 Hz to 1 MHz 10 mm from 20 Hz to 5 MHz
External trigger sensitivity	0.5Vp-p from 50 Hz to 1 MHz 1Vp-p from 20 Hz to 5 MHz
AUTO	Satisfies trigger sensitivity at more than 50 Hz.

Triggering mode	Trigger sweep and self-exciting sweep
External trigger input impedance	Approx. 100k ohms, with less than 100pF in parallel
Max. allowable input voltage	100Vp-p when voltage is DC+ACp-p (AC: less than 1 kHz)
Input terminal	Binding post (common to external sweep)

External sweep amplifier

Sensitivity	More than 500mV/CM
Continuously variable sensitivity	Attenuation down to 1/10 or less possible.
Frequency bandwidth	DC to 200 kHz within -3 dB attenuation
Input impedance	Approx. 220k ohms, with 40pF or less in parallel.
Maximum allowable input voltage	100Vp-p
Input terminal	Binding post (common to external trigger)

Calibration voltage

Waveform	Approx. 1 kHz square wave
Polarity	Positive polarity, reference level: 0V

Output voltage	2-range of 50mVp-p and 500mVp-p
Output voltage accuracy	Within 3%

Cathode-ray tube

Model name	130ARBI, 133 mm circular type
Accelerating voltage	Approx. 1600V
Effective area	10 cm (horizontal) × 8 cm (vertical)

Power supply

Voltage	AC_____V ±10%
Frequency	50/60 Hz
Power consumption	Approx. 24VA

Mechanical characteristics

Dimensions	260H × 175W × 445D mm (maximum) 235H × 165W × 406D mm (cabinet only)
Weight	Approx. 5.9 kg

Accessories

957M type probe	1
941B type adaptor	1
Operation manual	1
Test data	1

3. PRINCIPLE OF OPERATION

3.1 Front Panel Description

INTEN	Knob for adjusting brightness of CRT. It also serves as a power switch.
POWER OFF	Power is turned off at the POWER OFF position. Power is switched on by turning this knob clockwise. The extreme clockwise position provides maximum brightness.
FOCUS	Knob for making the spot or trace on the CRT screen clear.
CALIBRATOR	Square wave generator for calibrating sensitivity and probe. The 1 kHz square wave starts from the OV reference to the positive side with short rise time. Two ranges of 50mVp-p and 500mVp-p are provided.

Vertical deflection

INPUT	Input terminal of vertical axis. A UHF type receptacle is used. Input signal or the probe is connected to it.
GND	Ground terminal which has been connected to cabinet and panel.

GND DC AC	Switch for selecting input coupling mode. By pushing GND, the input terminal is disconnected from the vertical amplifier, whose input is grounded. The DC range allows the DC coupling mode in which the input signal can be observed including all components. The position of the trace in the GND mode is then zero volt. By pushing AC, the vertical amplifier's input is AC-coupled. Thus, only the AC components can be displayed, with the DC components cut off.
VOLTS/CM	Switch for changing over the deflection sensitivity of the vertical axis from 0.01V/CM to 10V/CM in 4-step. The indicated value of each range shows a voltage per 1cm vertical amplitude on the screen at the extreme clockwise position CAL'D of VARIABLE.
VARIABLE	Knob for attenuating input signal continuously. The extreme counter-clockwise position gives less than 1/10 of value at CAL'D. Thus, this knob allows a voltage in each range of VOLTS/CM to be continuously varied.
POSITION	Knob for shifting trace vertically to easy-to-measure position.

Horizontal deflection

TIME/CM	Switch for changing over sweep time within a range of 1μS/CM to 0.1S/CM in 6 steps. The indicated value at each range is a sweep time per cm on the screen at the extreme clockwise position CAL'D.
EXT HOR	Sweep is switched from the internal mode to the external mode by pushing this switch. The spot is then shifted horizontally in proportion to the voltage applied to the EXT HOR OR TRIG IN input terminal (red binding post).
VARIABLE	Knob for varying sweep time continuously during internal sweep. The extreme counterclockwise position allows sweeping one tenth slower than at CAL'D. Thus, sweep time in each range TIME/CM can be continuously varied. The lowest speed is 1 sec/cm or less. During external sweep, this is used as an attenuator for the horizontal input signal applied to EXT HOR OR TRIG IN. The CAL'D position provides the maximum deflection sensitivity (0.5V/CM or more). The extreme counter-clockwise position attenuates deflection sensitivity down to about 1/10 of maximum.

TRIGGERING LEVEL

Knob for selecting trigger mode and adjusting trigger level. The extreme counterclockwise position AUTO allows the self exciting sweep mode in which sweep is maintained even when there is no input signal.
Whenever more than 50 Hz input signal is applied, sweeping synchronizes with it.
The trigger mode is brought by turning the knob clockwise from AUTO.
With no input signal, the spot stays at the left edge of the screen, ready for input. Whenever input signal is applied, sweeping starts.
The sweep starting point of the input waveform can be set by adjusting the knob.

SOURCE

Switch for selecting types of trigger signal. With the INT button pushed, waveform signal displayed on the screen is used as the trigger signal.
When the EXT button is pushed, external signals applied to the EXT HOR OR TRIG IN input terminal are used as trigger signals.

SLOPE

This switch determines types of slope at sweep starting point of trigger signal waveform. Pushing the + switch allows triggering at the ascending slope of the waveform, and the - position allows triggering at the descending slope.

EXT HOR OR TRIG IN	During internal sweep, this is used as an input terminal for the external trigger signal. During external sweep, it is DC-coupled to the horizontal amplifier as a horizontal axis input terminal.
POSITION	Knob for shifting spot or trace horizontally.

3.2 Cabinet Side Plate Description

The side plates of the cabinet provide four holes for adjusting semi-fixed resistors (three on the left side and one on the right side) which permit adjusting by means of a screwdriver.

(Left side plate)

DC BAL	Semi-fixed resistor for adjusting DC balance in vertical axis. This should be adjusted so that the vertical position of the trace is not shifted by turning VARIABLE.

(Right side plate)

STABILITY	Semi-fixed resistor for adjusting stability of horizontal sweep oscillator. Once this is adjusted, the oscilloscope maintains stability normally. If it is unstable due to variation in ambient temperature, etc., adjust it as follows; 1. Set GND DC AC to GND with no input signal applied to the vertical axis.

2. Turn TRIGGERING LEVEL fully clockwise. (opposite position of AUTO)

3. Set TIME/CM to 1mS.

4. Set SOURCE to INT.

5. Turn STABILITY fully clockwise, and a free running state is attained. Unlike the self-exciting sweep, free running is a state in which the sweep generator sweeps automatically. Even when sweep speed is high, the trace remains bright.

6. Slowly turns STABILITY counter-clockwise, and free running is stopped. In this position, optimum stability is obtained.

7. Check synchronizing by means of a sine wave generator of a range of 50 Hz to 5 MHz. (CALIBRATOR may be used instead of the sine wave generator.) Set TRIGGERING LEVEL to AUTO. Connect the output of the sine wave generator to the vertical axis INPUT. Adjust the set until the amplitude of waveforms on the screen is approx. 2 cm at 50 Hz, 10 kHz and 5 MHz.

Check if waveform is held when changing TIME/CM or VARIABLE. If the waveform is duplicated, it may be corrected by turning STABILITY slightly counterclockwise. However, be careful not to turn it too far. Otherwise, synchronization may not be attained at 5 MHz even if it is attained at 50 Hz and 10 kHz.

3.3 Cautions Regarding Operation

Power supply voltage

Model 5505 is best operated on a power supply within a range of 100 V ±10%. Since a power supply above this range causes trouble, maintain the voltage within 100V±10% by a suitable method.

Ambient temperature

Model 5505 operates best within an ambient temperature of 0°C to +40°C. However, to satisfy the specifications perfectly, a range of +10°C to +35°C is advisable.

Withstand voltage in each input terminal

The maximum allowable input voltages in each input terminal and accessory probe are specified as follows:

Vertical axis input terminal:

400Vp-p at 0.01V/CM range of VOLTS/CM

600Vp-p at other ranges

Accessory probe : 600Vp-p

Terminal EXT HOR OR TRIG IN : 100Vp-p

Brightness of cathode-ray-tube

Avoid increasing brightness excessively or leaving the spot on the screen for a long time. Otherwise, the phosphors of CRT may be burnt.

3.4 Operation

Before turning on the power switch, set each knob on the front panel as follows:

INTENSITY	POWER OFF
FOCUS	Center
VERTICAL POSITION	"
HORIZONTAL POSITION	"
TIME/CM	1mS/CM
TRIGGERING LEVEL	AUTO

Connect the power cord to _____V AC power source.

Turn INTENSITY fully clockwise, and a bright trace appears 10 sec later. Turning INTENSITY slightly counterclockwise, adjust for optimum brightness.

Turn FOCUS until the trace is sharpest.

Apply input signal, and waveform appears on the screen or, apply the calibrating voltage of the oscilloscope to the vertical axis input terminal, and a waveform appears on the screen.

Set the switch knobs as follows:

AC DC GND	DC
VOLTS/CM	0.01V/CM

VARIABLE		CAL'D
TIME/CM		1mS/CM
VARIABLE		CAL'D
TRIGGERING	LEVEL	AUTO
	SOURCE	INT
	SLOPE	+

Use 50mV calibrating voltage, and square waves having 5 cm amplitude can be displayed on the screen.

As the switch VOLTS/CM is changed over step by step, vertical amplitude is attenuated.

The amplitude is also attenuated by turning VARIABLE counterclockwise.

Through the above operation, relation between input signal and VOLTS/CM/VARIABLE can be checked.

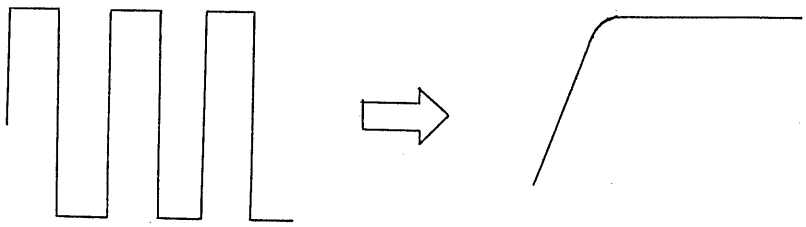
Time base and triggering

Since the calibrating voltage is a square wave of approx. 1 kHz, with TIME/CM at 1mS, one cycle of square wave can be displayed in 1 cm length horizontally.

As TIME/CM is changed over step by step, sweeping of the time base becomes faster. Sweep time can also be varied continuously by means of VARIABLE.

Therefore, the square waveform of the calibrating voltage can be displayed in many cycles or part of one cycle.

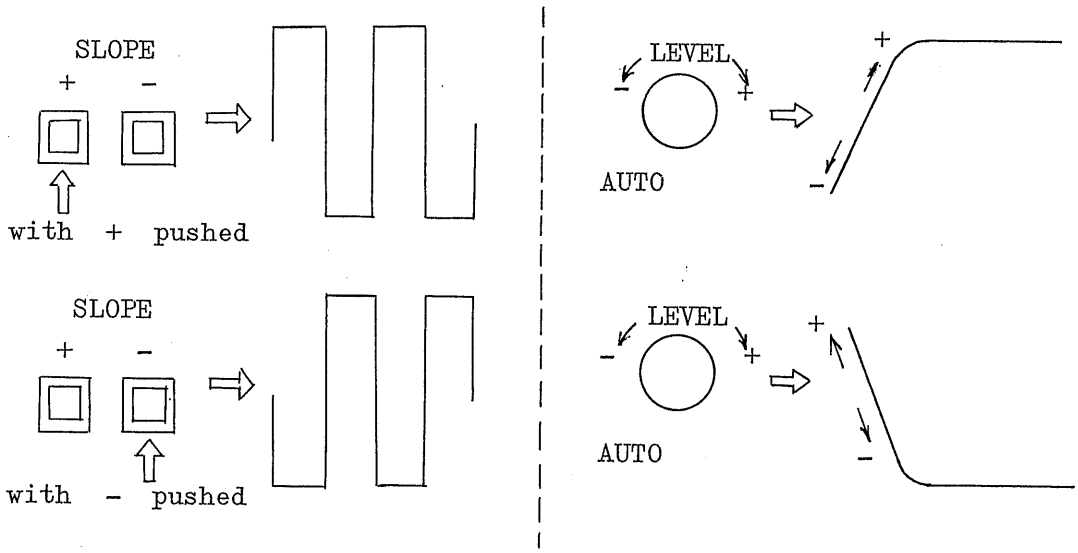
Namely, as shown in Fig. 3-1, the square wave can be observed with the leading edge enlarged.



Variation in waveform on screen by means of sweep time switching.

Fig. 3-1

Referring to Fig. 3-2, push + or - SLOPE and turn LEVEL clockwise or counterclockwise to observe variation in the triggering point. By turning LEVEL, sweep will start from a selected point on the leading edge or tailing edge of the square wave.



SLOPE change-over and waveform on screen

Turning direction of LEVEL and variation in triggering point of screen waveform

Fig. 3-2

Triggering signal source

To display the still waveform of input signal on the screen, apply the input signal waveform or a signal with a certain timing relationship with the input signal to the trigger circuit of the time base.

Internal trigger

Push the INT button of TRIGGERING SOURCE. Input signal is amplified by the vertical axis amplifier to a sufficient level and is applied to the trigger circuit. Thus, stable synchronization is attained and operation is easy. This is called internal trigger.

External trigger

Push the EXT button of TRIGGERING SOURCE, and the input of the trigger circuit is connected to the EXT HOR OR TRIG IN terminal. Apply external trigger signal to the trigger circuit through this terminal.

This is called external trigger.

External trigger permits the trigger circuit to operate without being affected by the vertical deflection system.

Therefore, it is effective to measure ripple waveforms superimposed on high frequency signals or complexly variable TV video signals, etc., whose waveforms are not easily held.

4. MEASUREMENT

4.1 Input Signal Connection

Model 5505's input impedance is 1 megohm with 38pF capacitance in parallel. When the accessory probe is connected, it is 10 megohms with less than 14pF capacitance in parallel.

There are many methods of connecting model 5505 with a signal source to be measured. In most methods, covered wire, shielded wire, coaxial cable or the probe is used.

These methods should be selected according to the following conditions:

Output impedance of input signal source

Input signal level and frequency

Induction from outside

Distance between input signal source and oscilloscope.

Table 4-1 shows connection methods classified according to types of input signals.

Table 4-1

Type of input signal / Connection method			Covered wire	Shielded wire	Probe	Coaxial cable	Miscellaneous
Low frequency	Low impedance	Near	○	○	○	○	
		Far		○		○	
	High impedance	Near		○	○		
		Far		○			
High frequency	Low impedance	Near			○	○	
		Far				○	
	High impedance	Near			○		
		Far					

Method using rubber-covered wire

Attach a M type adaptor to the input terminal of the vertical axis. Connect rubber-covered wire to this adaptor. This method is simple and has the advantage that the input signal does not attenuated. However, when the covered wire is comparatively long or the output impedance of an input signal source is high, this method is subject to induction from the outside, resulting in incorrect measurement. Since stray capacitance between the wire and ground is also large, this method affects the circuit to be measured greatly, as compared with the method using the accessory probe of attenuation ratio of 10 : 1.

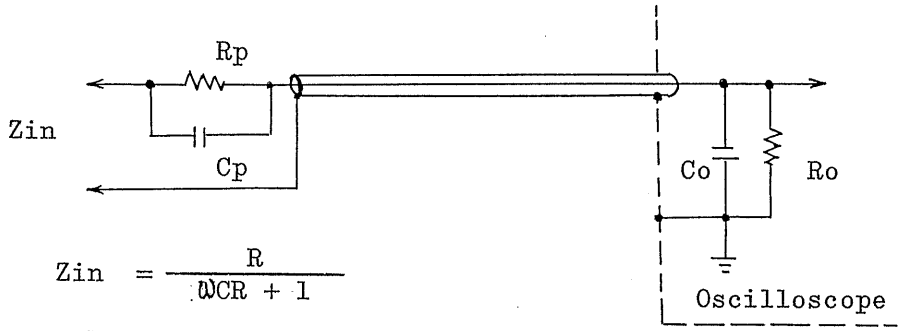
Method using shielded wire

Use of shielded wire protects the circuit to be measured from induction from the outside. However, the capacitance of shielded wire is comparatively large, ranging from 50pF/m to 100pF/m. Therefore, when the output impedance of the input signal source is high or input signal has high frequency, this method is unsuitable.

Method using probe

This method uses the accessory probe whose attenuation ratio is 10 : 1. As shown in Fig. 4-1, its lead is shielded, and the attenuating resistor Rp and its parallel capacitor Cp composes a wide-band attenuator. Therefore, when the output impedance of the input signal source is high, or input signal is high frequency, this method is suitable.

Input impedance in case of method using probe



$$Zin = \frac{R}{\omega CR + 1}$$

$$R = Rp + Ro$$

$$C = \frac{Cp \times Co}{Cp + Co} \quad \text{(Co includes cable capacity.)}$$

$$Cp = \frac{Co \times Ro}{Rp}$$

Fig. 4-1

Method using coaxial cable

When the output impedance of the input signal source is 50 ohms or 75 ohms, etc., use coaxial cable having corresponding impedance to make impedance match. The input signal will then be transmitted without attenuation up to high frequency.

As shown in Fig. 4-2, make impedance match on the input side of the oscilloscope.

Circuit measured

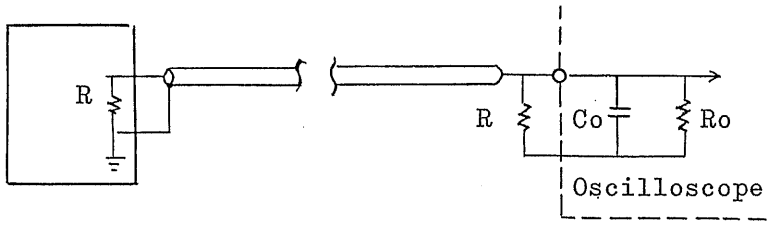


Fig. 4-2

4.2 Voltage Measurement

DC voltage measurement

With the time base in the self-exciting mode, set TIME/CM to about 1mS/CM to display the sweep line on the screen.

Push GND of the vertical axis input switch AC DC GND.

The sweep line is then located at the OV position of vertical input as shown in Fig. 4-3. Shift the sweep line to an easily measurable position.

Push the DC button of AC DC GND. Apply a voltage of the point to be measured to the vertical axis input. Then, by means of the scale on the screen, read how much the sweep line has shifted.

If the sweep line is extended beyond the screen, switch VOLTS/CM to a lower range so that the sweep line is shifted to an easy-to-measure position.

When the sweep line is shifted to position further up than the former position, voltage polarity is positive. If lower, polarity is negative.

Input voltage is obtained by applying the reading (cm) of vertical amplitude to the following (4-1) or (4-2) formula.

In case of method using probe of 10 : 1 attenuation ratio:

$$\text{Voltage (V)} = \text{Indicated value of VOLTS/CM} \times \text{Amplitude (cm)} \times 10 \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (4\text{-}1)$$

In case of directly applying input to terminal:

$$\text{Voltage (V)} = \text{Indication value of VOLTS/CM} \times \text{Amplitude} \quad .. \quad (4\text{-}2)$$

AC voltage measurement

If as shown in Fig. 4-3, the DC voltage is higher than its superimposed AC voltage to be measured, the sweep line disappears from the screen due to DC voltage, with AC DC GND set to DC.
As a result, it is impossible to measure the AC voltage.
Although the vertical POSITION knob may then permit the AC component to be shifted within the screen, avoid this method since it tends to cause measurement error.
The AC component waveform can also be shifted within the screen by switching VOLTS/CM to a lower range. However, amplitude becomes too small to allow accurate measurement. In such cases, push the AC button of AC DC GND. A capacitor is then connected to the vertical input terminal in series, thus cutting off DC voltage.
Thus, AC voltage only is enlarged enough to be displayed on the screen.

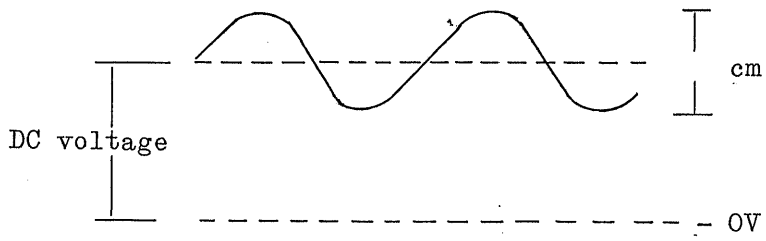


Fig. 4-3

This amplitude (cm) can be calculated by using (4-1) and (4-2) formulas.

(The AC measurement mode causes input signal voltage to be -3 dB attenuated at 2 Hz or less.)

AC voltages calculated by using (4-1) and (4-2) formulas are peak values (Vp-p). The effective values (Vrms) of sine wave are obtained from the following (4-3) formula:

$$\text{Voltage (Vrms)} = \frac{\text{Voltage (Vp-p)}}{2\sqrt{2}} \quad \cdots\cdots\cdots\cdots\cdots \quad (4\text{-}3)$$

4.3 Time Measurement

Time interval measurement

To measure time interval between two optional points on a waveform, set VARIABLE of TIME/CM switch to CAL'D and read indication value of TIME/CM.

First, set the TRIGGERING LEVEL knob to AUTO. Then, as shown in Fig. 4-4, switch TIME/CM so that interval between two points on the waveform is easy to measure.

Time interval between two points is obtained from the following formula:

$$\text{Time T (sec)} = \text{TIME/CM (sec)} \times \text{Length on screen (cm)} \quad (4\text{-}4)$$

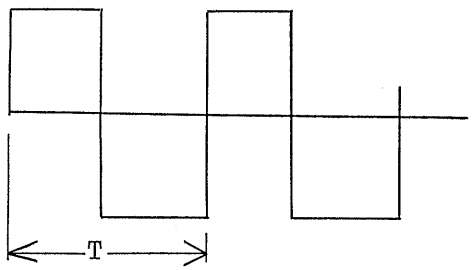


Fig. 4-4

Frequency measurement

To measure frequency, there are the following three methods:

In the first method, find time per cycle from (4-4) formula, and calculated frequency using the following (4-5) formula.

$$\text{Frequency (Hz)} = 1/\text{Period T (sec)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4\text{-}5)$$

In the second method, find time per cycles within 10 to 20. Count the number (N) of cycles contained within 10 cm divisions on the horizontal scale. Frequency can then be calculated by using the following (4-6) formula:

$$\text{Frequency (Hz)} = \frac{N}{\text{Indicated value of TIME/CM (sec)} \times 10} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4\text{-}6)$$

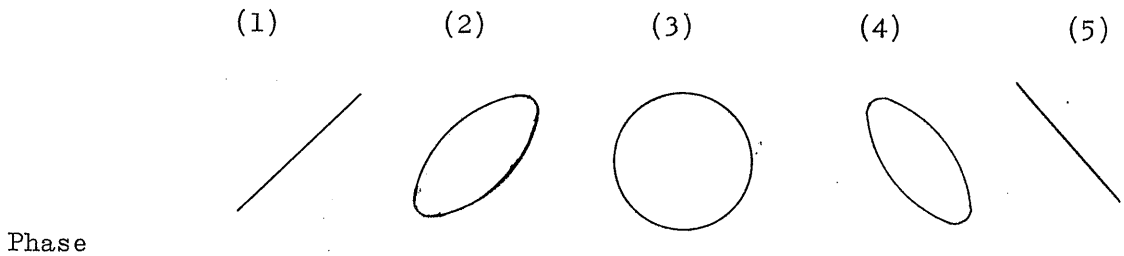
This method allows smaller measurement error than in the first method by giving a large value to N.

In the above two methods, time is measured to find frequency. When frequency is less than 5 kHz and waveform is simple such as sine wave, frequency can be measured by means of Lissajous' figure drawn in the XY scope mode.

To set to the XY scope mode, push the EXT HOR switch. Apply unknown signal and given signal to the vertical axis INPUT terminal and EXT HOR OR TRIG IN terminal respectively.

Adjust VOLTS/CM and HOR VARIABLE until both vertical and horizontal amplitudes are 4 cm.

Next, as the frequency of the given signal is varied, the Lissajous' figures of 1 : 1 are drawn as shown in Fig. 4-5.



Phase difference					
	0°	45°	90°	135°	
	360°	315°	270°	225°	180°

Fig. 4-5

The Lissajous' figure of 1 : 1 frequency ratio is either a circle, an ellipse, or linear line. When frequency ratio gets near 1 : 1, the figure varies continuously in the sequential order of (1)—(5)—(1). The sequential variation becomes slow, as difference between both frequencies is smaller. When both coincide with each other, the figure stops in either form.

Unknown frequency equals the frequency given in this time.

Although in case of various frequency ratio, unknown frequency can be found from Lissajous' figure, utilize the figure of 1 : 1 frequency ratio by means of a generator allowing a wide range of continuously variable frequencies. This method is the easiest and most accurate.

Phase difference measurement

Measurement by means of Lissajous' figure (between two signals having the same frequency).

As described in the section dealing with frequency measurement, make the oscilloscope draw Lissajous' figure in the XY scope mode.
In Fig. 4-6, angular phase is obtained from the following formula:

$$\text{Sin } \theta = \frac{A}{B} \quad \ldots\ldots\ldots\ldots \quad (4\text{-}7)$$

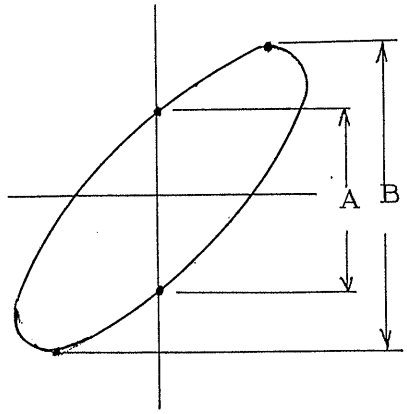


Fig. 4-6

Caution: Since error may result from phase difference of the oscilloscope in a high frequency range, use less than 5 kHz frequency for measuring phase difference. (Phase difference of the oscilloscope is less than 3° at 5 kHz. However, when the horizontal axis sensitivity control VARIABLE is set to CAL'D, phase difference becomes less than 3° at 20 kHz, thus allowing the working range to be expanded.)

5. CALIBRATION

After operating Model 5505 for a certain length of time, be sure to calibrate it. After repairing it, also calibrate it according to repair contents.

5.1 How to Remove Covers

Since almost all adjusting points for calibration are provided inside the cabinet, to calibrate the oscilloscope remove the top cover and bottom plate. Be sure to maintain AC power supply at _____V during calibration.

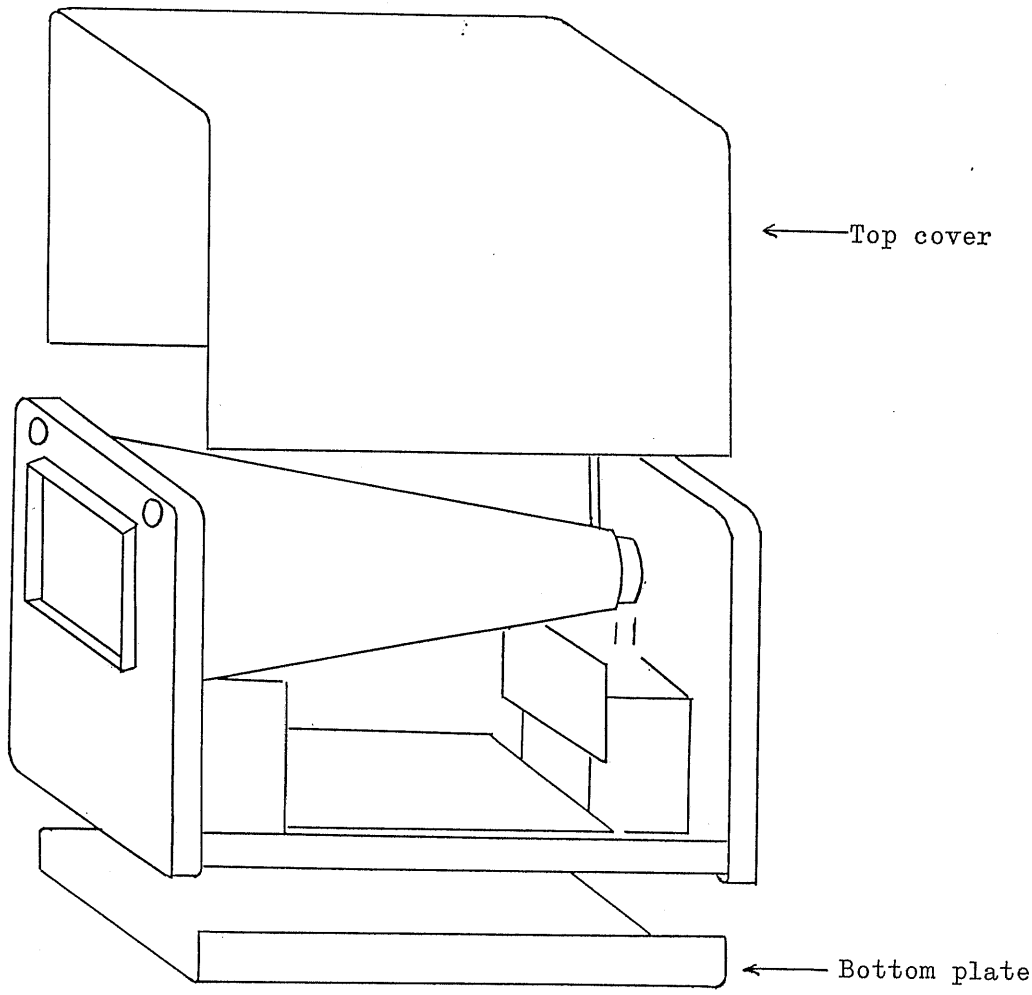


Fig. 5-1

5.2 Power Supply

Fig. 5-2 shows the power system of Model 5505.

Since +15V and -15V in the figure should be regulated, occasional calibration is needed for them.

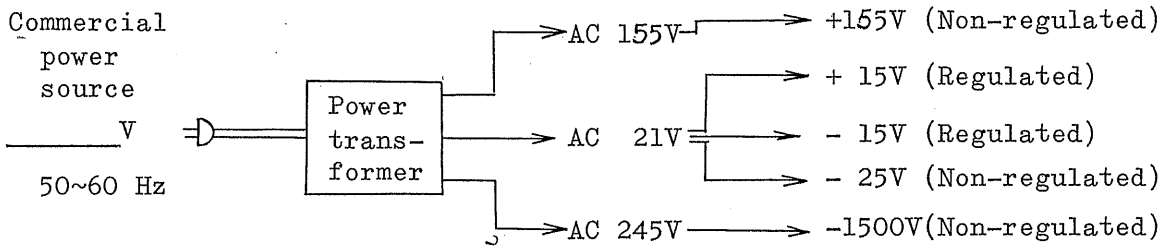


Fig. 5-2

During adjustment, first, turn R114 shown in Fig. 5-4 with a screwdriver until -15V is obtained.

Then, turn R111 for +15V. Since +15V deviates by adjusting for -15V, be sure to start from -15V.

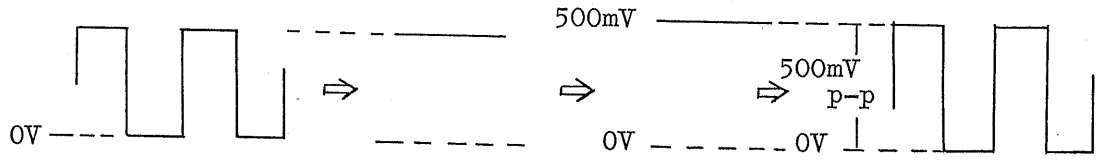
5.3 INTEN ADJ

INTEN ADJ is a semi-fixed resistor for adjusting a variable range of INTENSITY (R174 in Fig. 5-4).

Adjust it until the trace disappears when setting the INTENSITY knob on the panel at angle of 45° rightward.

5.4 CAL

CAL is a semi-fixed resistor for adjusting the output voltage of CALIBRATOR (R708 in Fig. 5-5).



Connect the test point to GND to obtain DC output.

Set DC voltage to 500mV.

Disconnect the test point from GND. 500mVp-p square wave is obtained.

Fig. 5-3

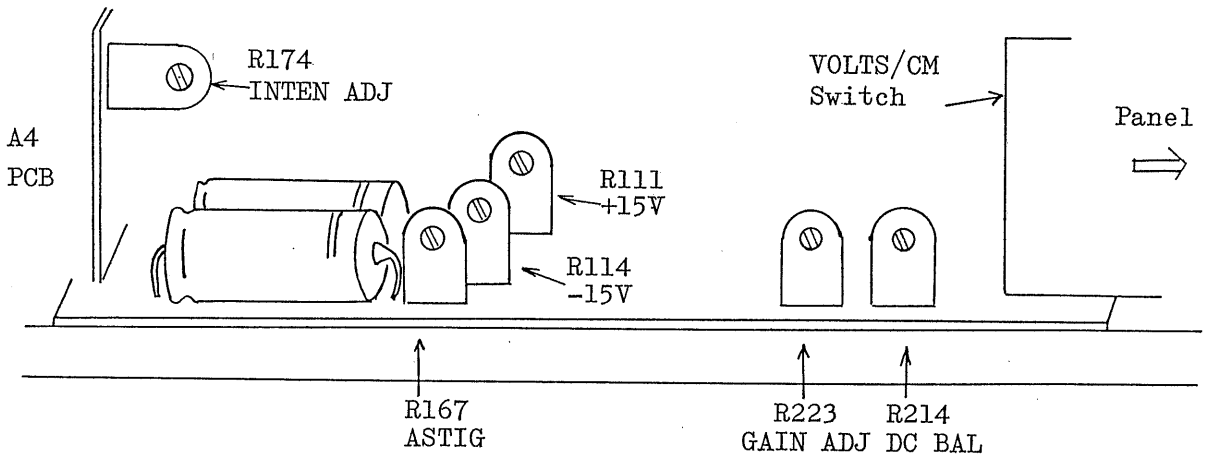


Fig. 5-4

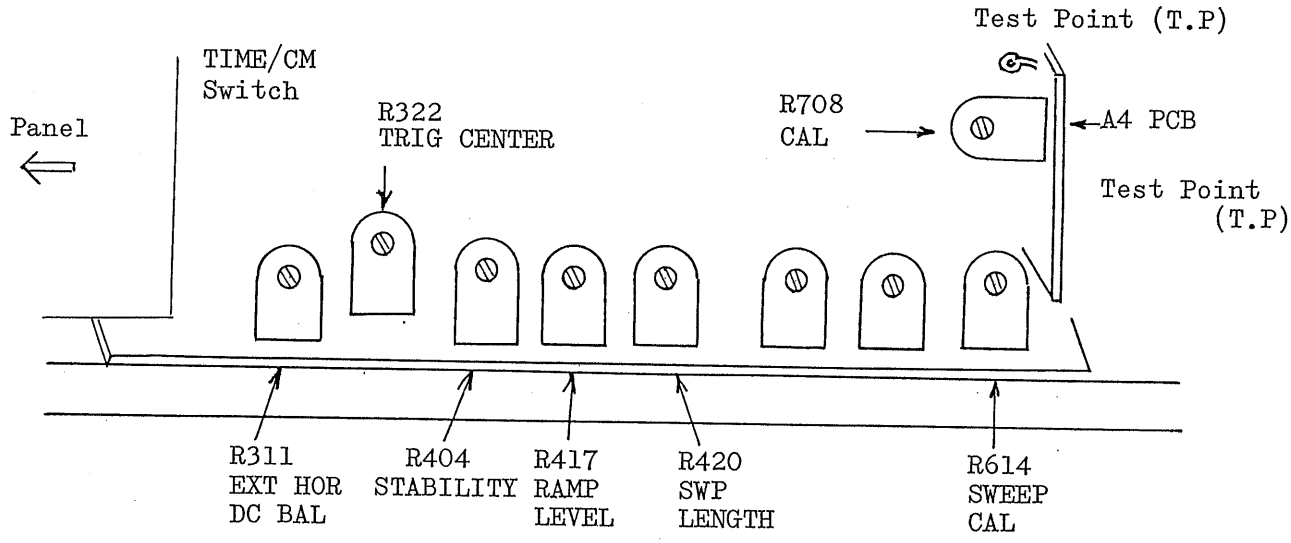


Fig. 5-5

Connect the test point (T.P. in Fig. 5-5) to the chassis or the GND terminal. 1 kHz oscillation stops and two DC voltages only are taken off at the CALIBRATOR output terminal on the panel. Using an accurate voltmeter, set one DC voltage to 500mV. The other output will then be set to 50mV automatically. Disconnect the test point from GND. The square waves of 500mVp-p and 50mVp-p are obtained respectively. (Refer to Fig. 5-3.)

5.5 Vertical Axis Deflection Sensitivity

(1) Set VOLTS/CM to 0.01V.

(2) Set VARIABLE to CAL'D

(3) Apply a square wave of 1 kHz and 50mVp-p (Properly calibrated CALIBRATOR may be used.) to the vertical input terminal.

(4) Adjust R225 (Fig. 5-4) until vertical amplitude is 5 cm.

5.6 VOLTS/CM Adjustment

Adjust this switch for proper input capacitance and phase characteristics (Fig. 5-6).

(1) Connect a capacitance meter reading about 40pF to the vertical input terminal.

(2) With VOLTS/CM at 0.01V, adjust C211 until the input capacitance in this range is 38pF.

(3) Apply a 1 kHz square wave having a rise time of less than 0.1μS to the vertical input terminal.

(4) Switch VOLTS/CM to 0.1V. Turning C203, adjust phase until the upper part of square wave is flat.

(5) As with (4) above, turning C206 and C209, adjust phase in 1V and 10V ranges respectively.

(6) Connect the capacitance meter to the vertical input terminal again. Turning C202, C205 and C208, adjust input capacitance in 0.1V, 1V and 10V ranges respectively.

(7) Repeat adjustment from (1) through (6).

Fig. 5-6 VOLTS/CM switch

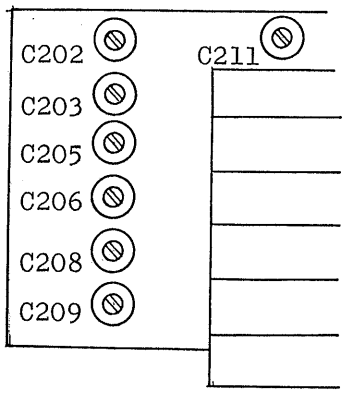
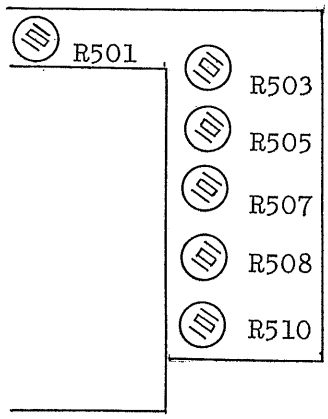


Fig. 5-7 TIME/CM switch



5.7 TIME/CM Adjustment

(1) Connect a time marker generator to the vertical input terminal.

(2) Set VARIABLE to CAL'D.

(3) Set TIME/CM to 0.1S. Adjust semi-fixed resistor R510 until marker signal coincides with the scale divisions.

(4) As with (3) above, adjust R508, R507, R505, R503 and R501 in 10mS, 1mS, 0.1mS, 10μS and 1μS ranges respectively.

(5) Repeat adjustment from (1) through (4).

5.8 Sweep Amplitude Adjustment

Adjust R420 (SwP LENGTH in Fig. 5-5) until the amplitude of the trace is 11 cm. In this case, strict adjustment is unnecessary and rough checking is enough.

However, since too much deviation affects stability in operation, readjustment is advisable.

5.9 For adjustment of STABILITY and vertical DC BAL, see Item 3.2, cabinet side plate description.

These resistors can be adjusted from the outside of the cabinet.

CRT ROTATOR (cathode-ray tube rotating mechanism)

The function of the CRT ROTATOR is to rotate the CRT mechanically for fine adjustment so that the horizontal trace of the CRT is made parallel with the horizontal scale lines of the graticule. An outstanding feature of the CRT ROTATOR is that the adjustment can be made without removing the casing.

The adjusting provision is located on the right-hand side panel (as viewed from the oscilloscope front) as shown in Fig. 1. This adjustment should be made when the horizontal trace apparently is not parallel with the horizontal scale lines of the graticule.

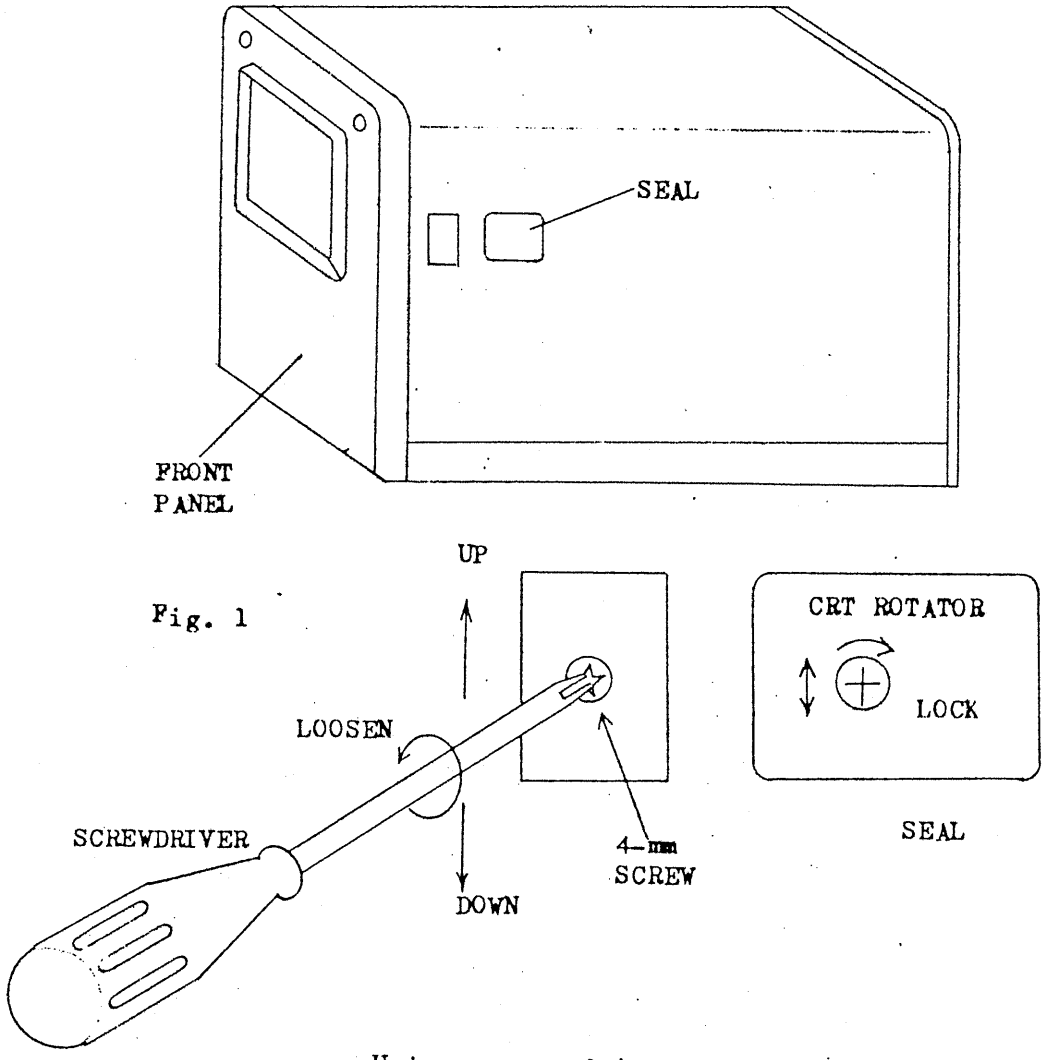


Fig. 1

Using a screwdriver, move the 4-mm screw upward or downward so that the horizontal trace is made parallel with the horizontal scale lines of the graticule.

ADJUSTING PROCEDURE

1. With a screwdriver (+), rotate the 4-mm screw counterclockwise for approximately 3 turns to loosen it. Note that the screw will come off if it is turned further.

2. When the screw si loosened, it can be moved upward and downward and in response the CRT is slightly rotated and thus the horizontal trace angle is adjustable. This adjustment should be made under the state that the power of the oscilloscope is turned on and it is displaying its horizontal trace.

Fig. 2

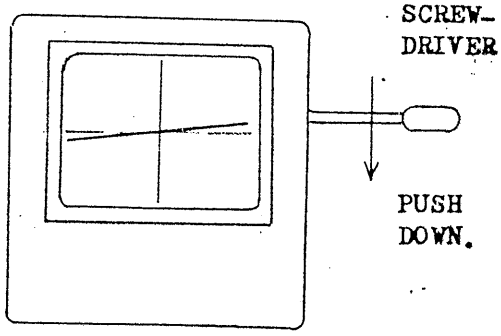
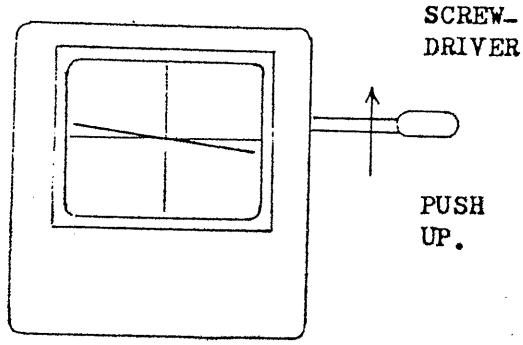


Fig. 3



3. Fig. 2 illustrates the case the right-hand side of the trace is high. In this case, set the screwdriver to the 4-mm screw and move it downward so that the trace is made parallel with the graticule. The 4-mm screw is heavy and should be pushed downward strongly.

4. Fig. 3 illustrates the case the left-hand side of the trace is high. In this case, move the 4-mm screw upward.

5. When the trace is made parallel with the graticule, lock tightly the 4-mm screw by turning it clockwise (LOCK) with the screwdriver.

The adjustment is complete by the above procedure.