

MODEL 536A
OSCILLOSCOPE
OPERATION MANUAL

KIKUSUI ELECTRONICS CORP.

1. GENERAL

The Model 536A is a compact, portable and general-use oscilloscope employing a 75 mm cathode-ray tube and possessing superior electric characteristics and facility in operation.

This oscilloscope is suitable for measurement in extensive use because of the vertical axis provided with a push-pull type DC amplifier of high sensitivity, wideband and good stability and phase characteristics, together with the time base oscillator of good linearity which is variable in a wide range.

Furthermore, this is an oscilloscope of high reliability by adoption of printed circuits and by construction in rational mechanism,

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2. SPECIFICATION

Vertical axis

Deflection sensitivity	More than 20mV/cm AC and DC
Frequency characteristic	(DC) 0 1.5MHz within -3dB (AC) 2Hz~1.5MHz within -3dB
Voltage divider circuit	1/10, 1/100 at frequency characteristic compensated
Voltage divider accuracy	Within ± 0.5 dB
Input impedance	1 M Ω 33pF ± 1 pF determined at every range

Maximum Input Voltage

400 volts DC + AC (1 kHz or less). Peak - to - Peak

AC not to exceed 400 volts. at 1/1 range.

600 volts DC + AC (1 kHz or less). Peak - to - Peak

AC not to exceed 600 volts. at 1/10, 1/100 range

Horizontal axis

Deflection sensitivity	More than 300mV/cm
Frequency characteristic	2Hz ~ 500kHz within -3dB
Input impedance	Approx. 220k Ω less than 30pF

Time base

Sweep frequency	continuously variable in the respective ranges
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TV.H

10 Hz ~ 100 Hz

100Hz ~ 1 kHz

1 kHz ~ 10kHz

10kHz ~ 100kHz

Sync. input	Internal Sync. (plus or minus) External Sync. Line Sync.
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Calibration voltage

Output	0.05Vp-p, 0.5Vp-p power supply waveform
Accuracy	within $\pm 10\%$ in case of power supply voltage being -----V

Power supply

Voltage	-----V, 50/60h Z
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Power consumption	Approx. 40VA
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Dimensions

(Maximum)	140 W x 190 (215) H x 310 (358) Dmm
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Weight	Approx. 6kg
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3. DESCRIPTION OF FUNCTION

3.1 Description of preparation

Model 536A Oscilloscope shall be always used within the power supply voltage range of -----V $\pm 5\%$ in the room temperature lower than 40 °C and where the direct rays of the sun and high temperature are avoided, in order to ensure to this oscilloscope the high reliability for a long period of time and the long life of the component parts.

3.2 Initial Operation

Connect the line cord to the power line of -----V 50 ~ 60Hz , after setting the front panel knobs of this oscilloscope as being mentioned below.

- | | |
|--------------------|--------------------------|
| ◦ INTEN | POWER OFF |
| ◦ FOCUS | at or near to the center |
| ◦ VERT GAIN | 1/10 |
| ◦ VARIABLE (red) | at or near to the center |

- o SYNC SELECT INT +
 - o SWEEP FREQ. 10 ~ 100
 - o VARIABLE (red) to be turned counter clockwise
 to the extreme
 - o POSITION at or near to the center
 - o AC
 (slide switch) AC
 - o DC
- After setting as above, then
- o POWER ON

At or about 20 seconds after switching on the line power, a bright line appears on the screen of the cathode-ray tube (abbreviated CRT hereinafter)

When the bright line appeared, adjust the position of the bright line by means of the POSITION knob so that it is positioned at or near to the center of the CRT screen, and also adjust the thickness of the bright line by means of the FOCUS knob so that it is the finest.

Change the VERT GAIN knob to the position of CAL 0.5Vp-p, and the calibration voltage will appear on the CRT screen.

Adjust the (red) knob of SWEEP FREQ. as that is, and the reposed figure of the calibration voltage can be viewed. Since commercial line power is utilized as the calibration voltage, the wave form is distorted by no trouble is caused notwithstanding.

It may be very useful in the section of how to operate to be described herein after that, in the aforesaid state, the SYNC SELEST and VERT GAIN (red) knobs are rotated.

3.3 Description of knobs and terminals

「INTEN & POWER OFF」 Knob for the intensity control of the cathode-ray tube . The clockwise rotation increases the intensity, and the counterclockwise rotation to the extreme switches OFF the power supply.

「FOCUS」 Knob for the focus control of the cathode-ray tube.

「SYNC SELECT」 The synchronizing selector switch of the time base oscillator : and synchronizing

LINE - to power frequency

INT - to the negative travelling portion of the observed wave form

INT + to the positive travelling portion of the observed wave form

EXT to external signal given to the EXT SYNC terminal

「SWEEP FREQ VARIABLE」 Selector knob of the sweep frequency of the time base oscillator, enabling the selection of TV.H and 10Hz ~ 100kHz . If rotated clockwise fully to " HOR AMP " , the sweep stops, and the horizontal axis amplifier is connected to the "EXT HOR" terminal on the panel face.

The fine adjustment of the sweep frequency is performed by the internal red knob.

「HOR GAIN」 Knob for the sensitivity control of the horizontal axis amplifier

「EXT	Terminal to be used for both the input of external
SYNC	synchronization and the input of the horizontal
HOR」	axis amplifier
「GND」	Connected to the panel and chassis
「VERT GAIN	Voltage divider of the vertical axis amplifier,
VERIABLE」	enabling the selection of sensitivity to 1/10 and 1/100. When turned to the position of " CAL " 0.5V, 0.05Vp-p, the internal sensitivity calibration voltage can be connected to the amplifier and the vertical axis input terminal can be separated at the same time.
	The fine adjustment of the sensitivity is performed by the internal red knob.
「VERT IN」	Input terminal for the vertical axis amplifier
「AC	Slide switch to block (AC) and pass (DC) the DC
DC」	portion of the observed wave form
「POSITION」	Knob to move the bright spot position to the vertical direction by 「VERT POSITION」 and to the horizontal direction by 「HOR POSITION」
(VERT DC BAL)	Provided inside the right side of the casing and to be adjusted with a driver for correcting the vertical movement of the bright line that may be caused by the rotation of the VERIABLE (red) knob at the VERT GAIN

(INTEN MOD)

Terminal provided inside the rear of the casing which is used for the intensity modulation of the cathode-ray tube together with the " GND "terminal on the front panel

(ASTIG)

Provided inside the rear of the casing, and is the semi-fixed resistor for controlling the ASTIGMATISM of the cathode-ray tube bright spot.

3.4 Function of synchronism and time base oscillator

The time base oscillator is a device to produce saw tooth wave, and the oscillation frequency is controlled by the " SWEEP FREQ. " knob on the front panel, and the horizontal axis is swept by the saw tooth wave form, so that the observing wave form is drawn on the CRT screen. The synchronizing circuit is a circuit to synchronize the oscillation frequency of the time base oscillator to the frequency of the observing wave form, and is used in internal synchronization or power synchronization and external synchronization.

3.5 Function of horizontal axis amplifier

The horizontal axis amplifier is an amplifier that amplifies the output of the time base oscillator and sweeps the CRT screen, and is designed so that the sufficient adjustment of the amplitude and position of the bright line (sweep) can be performed.

This amplifier is used, being separated from the time base oscillator, in combination with Lissajous' figure, phase measurement and sweep generator.

3.6 Function of vertical axis amplifier

The vertical axis amplifier is an amplifier that amplifies observing signals and controls to an amplitude required for and a position suitable to the CRT screen.

All the circuit is a push-pull type DC coupled wideband amplifier, and a signal given to the input terminal VERT IN passes through the voltage divider VERT GAIN 1, 1/10 and 1/100, and further through the FET, SOURCE follower amplifier Q101, the output of which is continuously varied by the transistors Q104, Q105 at the third stage.

A DC blocking condenser is equipped between the input terminal and voltage divider and can be shortcircuited by the slide switch on the panel face as necessity arises.

The DC amplifier is, unless keeping DC-like balance always, not easily usable, so that DC BAL semi-fixed resistor for balance adjustment is provided. Refer to ADJUSTMENT of DC BAL in the section of Maintenance as to the aforesaid adjustment.

4. HOW TO OPERATE

4.1 Vertical axis amplifier

Your attention is required that the maximum voltage value of the observing wave form is determined as being mentioned below in order to protect the oscilloscope.

4.2-Maximum input voltage

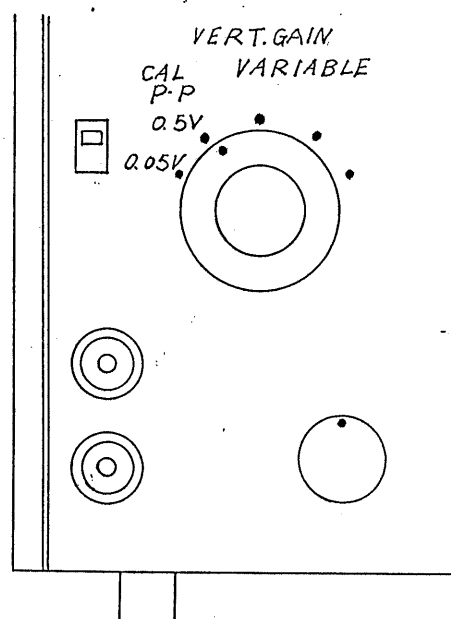
Be careful that the maximum input voltage of this oscilloscope is determined, (see SPECIFICATION). Particularly in case of such wave forms as ripple voltage, etc., where AC is included in DC, it is required that the total of DC and AC values is less than 400V or 600V.

4.3 Sensitivity calibration of vertical axis amplifier

When the voltage of the observing wave form is measured, the sensitivity is calibrated as follows.

When the external knob of "VERT GAIN " is turned to the position of " CAL " , the internal calibration voltage is given to the amplifier.

The sensitivity is read by the scale in the CRT screen, and the adjustment can be performed in the method that 0.05Vp-p of the calibration voltage is set at the time of using 1 cm as 20 mV and the calibration voltage is adjusted by means of the internal red knob so as to be 2.5 cm.



If the external knob is turned to the position of 1 leaving the red knob as it is at this time, measurement can be made in the aforesaid sensitivity, and it becomes 0,2 V/cm at the position of 1/10, and 2 V/cm at 1/100.

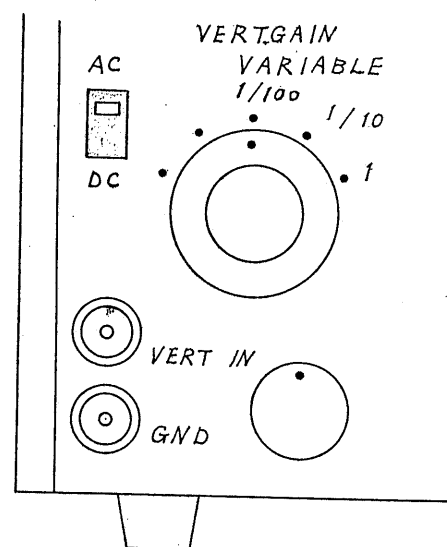
4.4 Vertical axis amplifier

Connect the observing signal between the input terminal VERT IN and terminal GND. When the amplitude of the observing signal is unknown, put the VERT GAIN at the position of the minimum, and set the AC DC selector switch to the position of AC, and then furnish the signal.

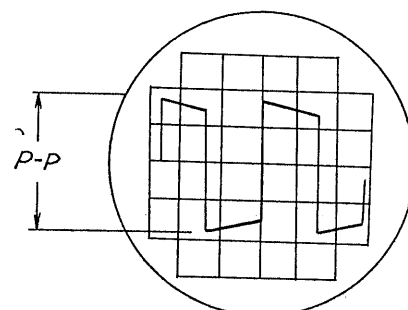
Furnish the signal to the input terminal, and adjust by means of the VERT GAIN so that the observing wave form appears on the CRT screen in a suitable size.

In case that the square wave of repeated frequency is observed and even the DC portion included in the observing signal has to be observed, use it in DC coupling. For example, if the square wave of positive polarity is observed, it will be as shown at the right drawing.

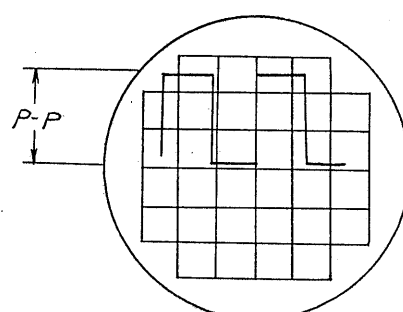
In case of observing ripple voltage included in DC power supply, etc., the DC portion is generally far larger in comparison with the AC portion so that,



AC COUPLING



DC COUPLING



if it is used in DC coupling, the CRT is largely deflected by the DC portion and the ripple observation becomes impossible.

In the aforesaid case, if it is turned to AC coupling, the DC portion is blocked and only the AC portion can be observed,

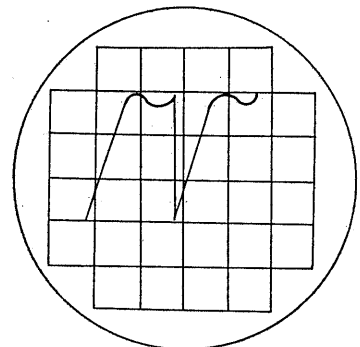
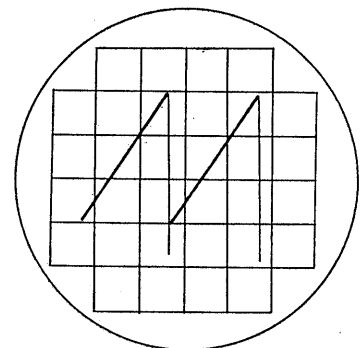
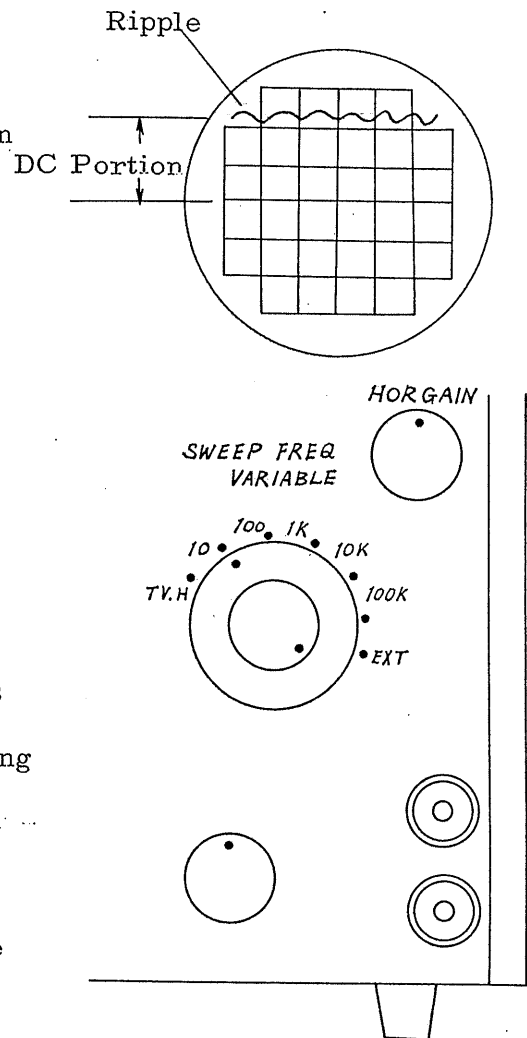
4.5 Operation of time base oscillator

Adjust the sweep frequency by means of the "SWEEP FREQ" knob according to the repeated frequency of the observing signal.

The frequency range indicated by the external knob can be continuously adjusted by means of the internal red knob, and the observing wave form is reposed. Generally, the sweep frequency must be lower than the frequency of the observing signal.

o Concerning TV_H

This is provided for convenience in observing the performance waveform of each component part of TV receiver. Adjust the red knob so that two wave forms of the vertical wave form group of TV receiver can be obtained at the



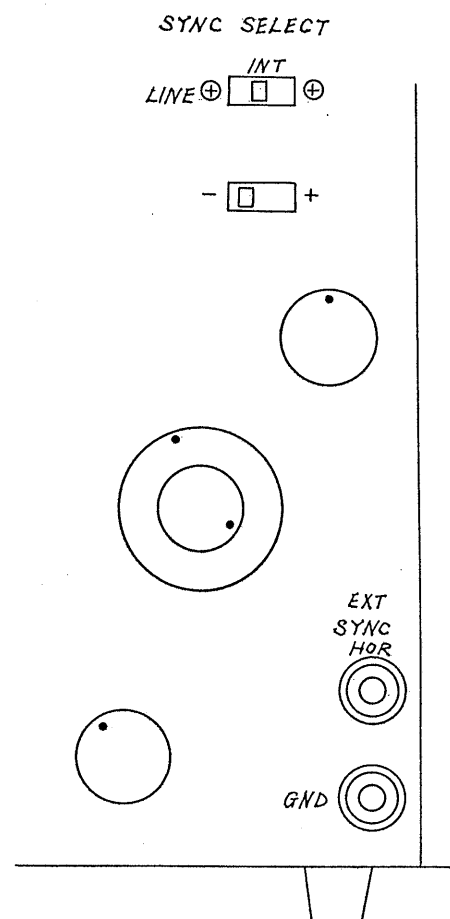
position of "10 ~ 100Hz" of the "SWEEP
FREQ". Change the external knob to
"TV.H" leaving the red knob where it
is, and two wave forms of the horizontal
wave form group will automatically be
viewed.

4.6 Operation of Synchronism

Adjust the "SYNC SELECT" knob as being mentioned below according
to the wave form to be observed. In case of general wave form observa-
tion, use it with the slide switch set to

"INT - or + ". In case of observing
ripple voltage included in DC power
supply, etc., use it to "LINE".

At the time when synchronization may
become unstable in observing a parti-
cularly high frequency, use it by
changing the "SYNC SELECT" switch
to "EXT" and by giving the signal of
the same frequency as the observing
wave form from the "EXT SYNC"
terminal. The external synchronizing
signal is sufficient with about 0.2Vp-p
or more.

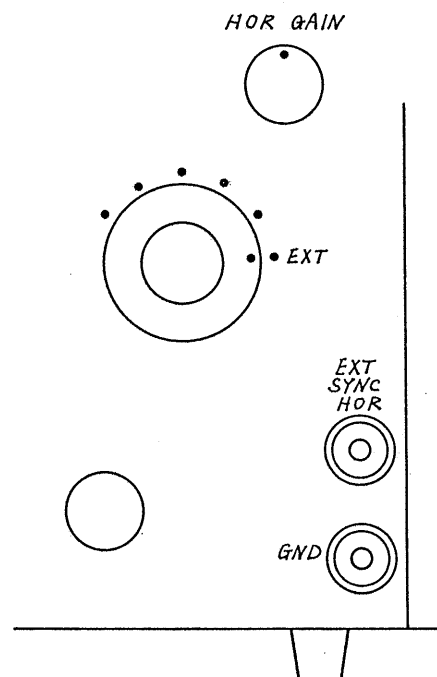


4.7 Horizontal axis amplifier

In case that, by giving a signal from the outside to the horizontal axis
amplifier, Lissajous figure or phase is measured, or the characteristics
of the synchronizing circuit, etc., are directly viewed in combination

with the sweep generator, change the " SWEEP FREQ " knob to the position of " EXT " , and give the external signal to the " EXT HOR " terminal.

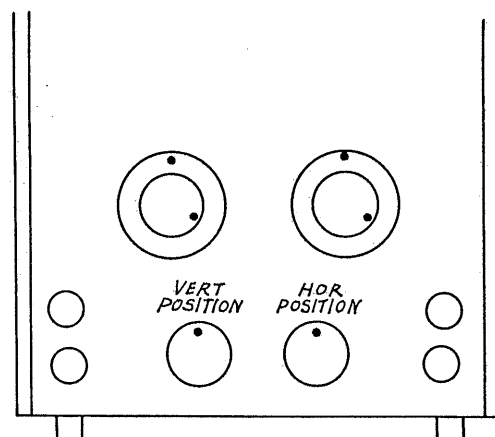
The sensitivity of the horizontal axis is controlled by " FOR GAIN " knob.



4.8 Adjusment of bright spot position of the CRT

Adjust the bright spot position of the CRT screen by means of the " POSITION " knob.

The " VERT POSITION " is an adjusting knob to the vertical direction, and the bright spot moves upwards by rotating it clockwise and moves downwards by rotating counterclockwise.



The " HOR POSITION " is an adjusting knob to the horizontal direction , and the bright spot moves towards the right by rotating it clockwise and moves towards the left by rotating counterclockwise.

4.9 Polarity of signal and moving direction of bright spot

As for the vertical axis, the bright spot of the CRT moves upwards by a positive signal and downwards by a negative signal.

The vertical axis sweeps the CRT screen from the left to the right by means of the rime base oscillator. In case of the horizontal axis used as an amplifier, the bright spot moves towards the left by the signal of positive polarity and towards the right by the signal of negative polarity.

o Adjustment of cathode-ray tube

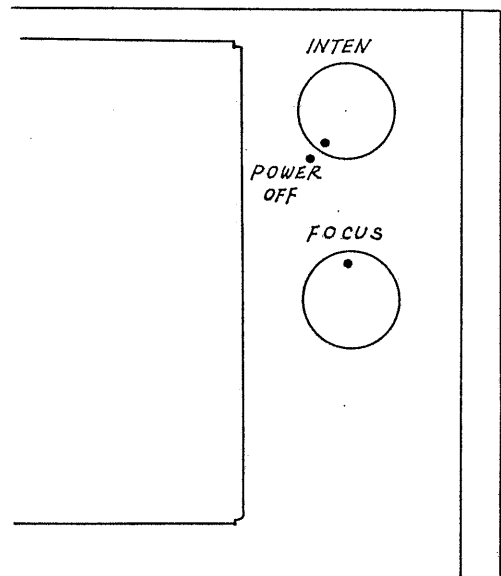
The intensity and focus of the cathode-ray tube are controlled by the "INTEN" and "FOCUS".

o Operation of power supply switch

The power supply switch is interlocked with the "INTEN" adjusting knob, and POWER is turned OFF at the position of having been rotated counterclockwise to the extreme.

o Intensity modulation

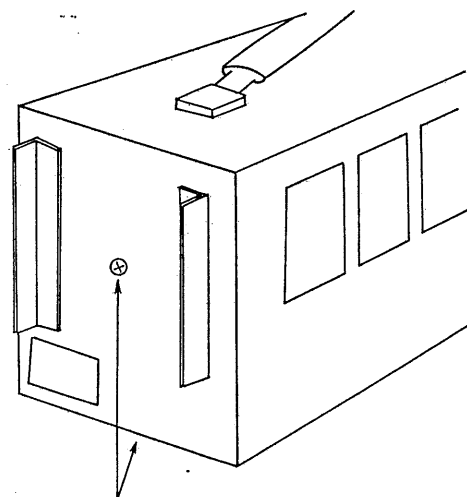
The terminal for intensity modulation is provided at the rear of the casing, and the intensity is increased by the signal of negative polarity.



5. MAINTENANCE

5.1 Removal of casing

In order to draw out the body from the casing, unfasten one small screw at the rear center of the casing and one small screw at the rear of the bottom of the casing to separate the panel from the casing,

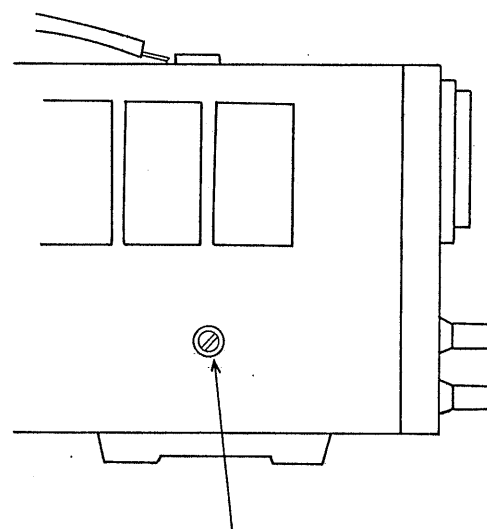


REMOVAL OF CASING SCREW

5.2 Adjustment of DC BAL (VERT AMP)

Adjust the DC BAL as mentioned below, if the bright spot of the CRT screen moves upwards and downwards in the state of no signal being given to the vertical axis input terminal when the red "VERT GAIN" knob is rotated.

Adjust the "DC BAL" so that the bright spot does not move by rotating the red "VERT GAIN" knob, after having operated this oscilloscope for at least 30 minutes after switching on the power supply and having attained the fully stable state of the vacuum tubes and the like.

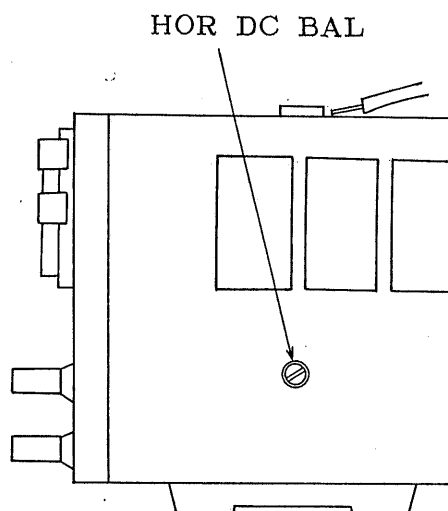


VERT DC BAL

The "DC BAL" is required to be adjusted when the first stage FET Q101 of the vertical axis amplifier is replaced or when the component parts of the first stage FET circuit are replaced.

5.3 Adjustment of DC BAL (HOR AMP)

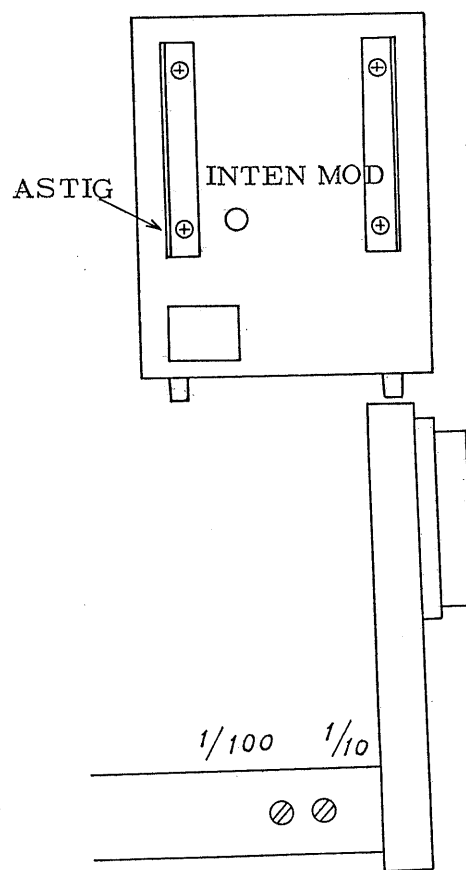
With SWEEP RANGE placed at EXT, when the HOR GAIN knob is turned, if the bright spot of the CRT screen is moved at both sides, adjust the HOR DC BAL and adjust it in such a way that the bright spot does not move when the HOR GAIN knob is turned.



5.4 Adjustment of ASTIG

This adjuster is of adjusting the astigmatism of the CRT, and can be adjusted by removing the cord winding reel at the rear of the casing.

The adjustment is scarcely required except the time of CRT having been replaced.



5.5 Adjustment of vertical axis voltage divider and input capacity

The adjustment must be performed when the component parts of the voltage divider and the like were replaced.

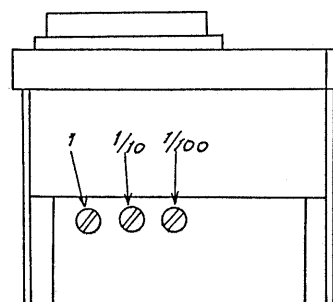
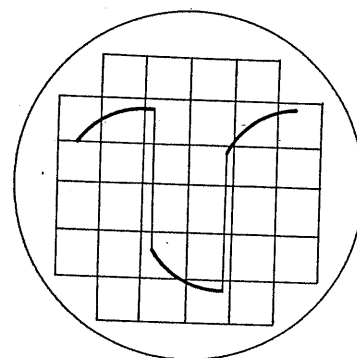
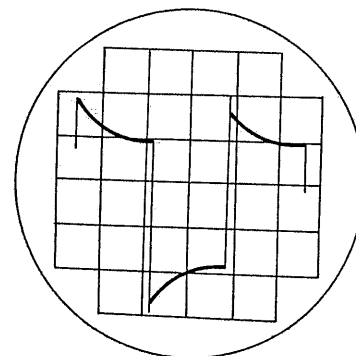
Make sure of the frequency characteristics of the voltage divider by giving the square wave of high quality to the "VERT IN" of this oscilloscope in the state of the casing having been removed.

FREQUENCY COMPENSATION CONDENSER

If the characteristics are inferior as being shown at the drawings, rotate the semi-fixed condenser for frequency compensation.

As for the input capacity, connect a capacity meter to the " VERT IN " and adjust the semi-fixed condenser for input capacity adjustment so that 33pF is attained at every range of the voltage divider.

The sequency of this adjustment is begun from the range 1, and is proceeded to 1/10 and 1/100.



6. DESCRIPTION OF REPAIR

When a trouble occurred, almost all the troubles are caused by damage in vacuum tubes. Such troubles can be immediately repaired by replacing the damaged tubes with good ones, but other circuit component parts, etc., may occasionally be over-heated being followed by damages in vacuum tubes.

When the repair of this oscilloscope become impossible, please contact with our agent or our sales office direct for requesting us the repair.

7. DESCRIPTION OF ACCESSORIES TO ORDER

Various accessories are prepared for the convenient use of Model 536A Oscilloscope. If they are required, place the order with our agent or our sales office.

1. "957M" low capacitance probe

the low capacitance probe to become

Input capacity	Approx. 10pF
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Input resistance	10 MΩ
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Attenuation	20 dB
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in combination with Model 536A, and to require two "conversion adapters".

2. Binding post UHF receptacle adapter

UHF receptacle suitable to binding posts having intervals of 19 mm (3/4"), and "957M" probe and each "M type" "UHF type" plug is usable.