MODEL 553APRM

DUAL TRACE TRIGGER

OSCILLOSCOPE

OPERATION MANUAL

KIKUSUI ELECTRONICS CORPRATION

CONTENTS

1. INTRODUCTION

Kikusui Model 553APRM Oscilloscope is a completely-solid-state highly-reliable dual-channel oscilloscope. It employ a 133-mm herical post-acceleration CRT of an acceleration voltage of 3 KV to produce a bright image.

The vertical axes are electron-switching dual channels, with frequency response of DC - 7MHz and maximum sensitivity of 10 mV/cm.

Field effect transistors are used for the input circuit of the vertical axis, giving superb stability.

The horizontal axis has a time-base oscillator of the range 1 sec/cm ~ 1 μS/cm, and is capable of measuring down to 0.2 μS/cm by means of a 5-times magnifier.

X-Y measurements can be made by applying the vertical (Y) signal to the vertical INPUT connector and the horizontal (X) signal to the EXT HOR terminal.

Model 553APRM also provides CALIB terminals from which regulated 1 kHz squarewaves can be taken off to calibrate the sensitivity of the vertical axis and the probes.

Specifications

VERTICAL

Calibrated Deflection Factor:	10 mV/cm ~ 20/cm, accuracy ±3%, 11 calibrated steps, 1-2-5 sequence
Bandwidth:	For DC connection, DC ~ 7 MHz, within -3 dB For AC connection, 2 Hz ~ 7 MHz, within -3 dB

Input Impedance:	1 MΩ paralleled by 38 pF	
Input Terminal	UHF type receptacle (applicable to M type also)	
Max. Input Voltage:	400V in a range of 10 mV	
	600V in a range exceeding 20 mV	
	Both indicate peak AC value plus DC	
Risetime:	Approx. 0.05 μS	
Display Mode:	CH1:	Channel 1 only
	ALTER:	Dual-trace, alternate between channels
	CHOP:	Dual-trace, choped between channel at 100 kHz
	CH1 INV:	Display signal from channel 1 can be inverted
	CH2	Channels 2 only

TIME-BASE

Sweep Time:	1 μS/cm - 1 sec/cm in 19 calibrated steps, 1-2-5 sequence
Accuracy:	±5%
Sweep Magnifier:	X5, accuracy ±5%

TRIGGERING

Triggering System:	Normal triggering sweep and automatic triggering sweep
Triggering Signal:	+, - of external, internal and line
Trigger Sensitivity	(Internal) 50 Hz - 5 MHz in vertical display of 10 mm
	20 Hz - 7 MHz in vertical display of 20 mm
	(External) 50 Hz - 4 MHz at input of 1 Vp-p and 20 Hz - 7 MHz at input of 2 Vp-p

HORIZONTAL

Sensitivity:	Approx. 1 Vp-p/cm: approx. 0.2 Vp-p/cm in case sweep magnifier is operated
Bandwidth:	2 Hz - 200 kHz, within -3 dB
Input Impedance:	Approx. 1 MΩ paralleled by less than 40 pF

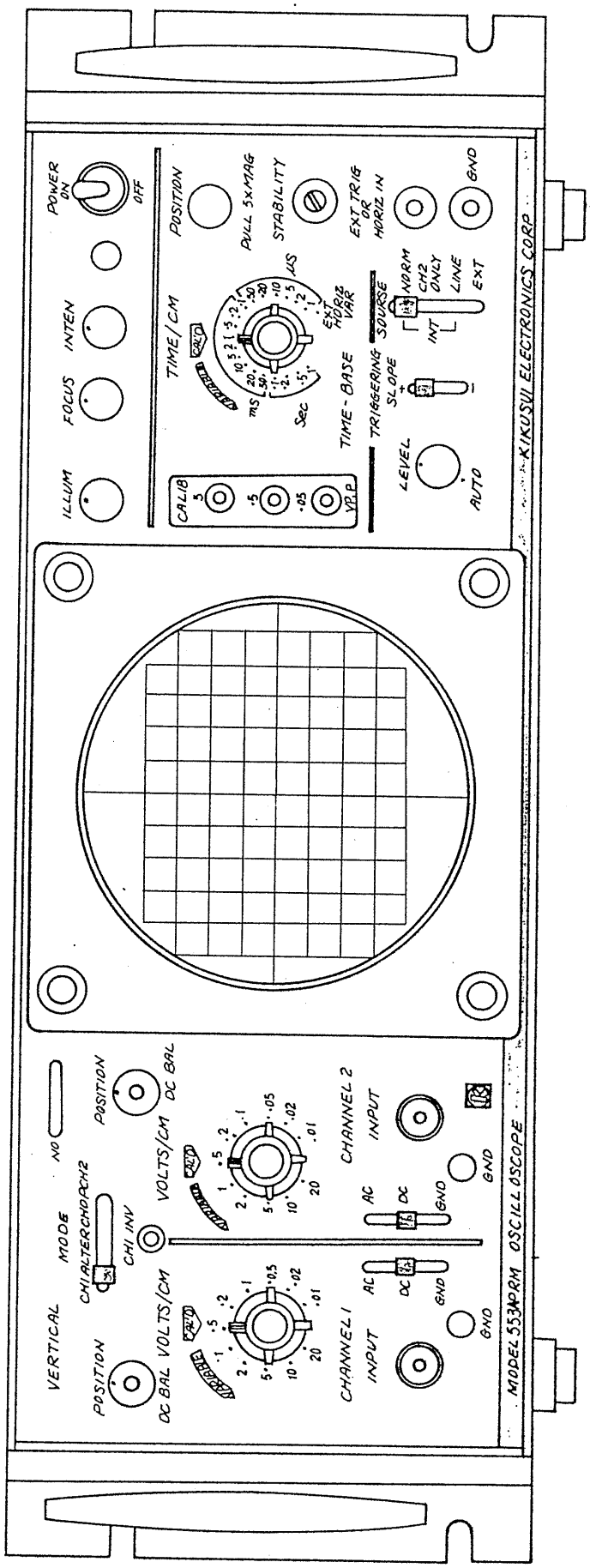
CALIBRATOR

Output Waveform:	Squarewave of 1 kHz
Output Voltage:	3 ranges of 5, 0.5, 0.05 Vp-p
Voltage Accuracy:	± 3%

OTHERS

Cathode-ray Tube:	Post accelerating type
Accelerating Voltage:	Approx. 3000V
Display Area:	10 × 8 cm
Intensity Modulation:	Over 10 Vp-p, coupled to the cathode
Power Source:	------V ±10%, 50/60 Hz
Power Consumption:	Approx. 35 VA
Dimensions (max.):	450 mm in width, 175 mm in height, 450 mm in depth
Weight:	Approx. 11 kg
Included Accessories:	957M probe 2
	941B terminal adaptor 2
	Operation manual 1
	Rack mount bracket 2

2. DESCRIPTION OF PANEL CONTROLS



Functions of Knobs, Terminals

POWER ON OFF:	Switches power supply on and off
ILLUM:	An adjusting knob for controllable illumination of graticule
CALIB:	An output terminal for time and amplitude calibration
FOCUS:	An adjusting knob for focusing CRT
INTENSITY:	An adjusting knob for CRT brightness
VERTICAL VOLTS/CM:	A switch for selecting sensitivity: 11 ranges of 0.01 ~ 20 V/cm are calibrated when a knob "VARIABLE" is set at "CAL'D" position
VARIABLE:	A fine adjusting knob of "VOLTS/CM" switch
POSITION:	A knob for vertically shifting the trace
INPUT:	An input terminal of Vertical axis
AC, DC, GND:	A switch for selecting input circuit connection; AC, DC connections are optionally selected; GND cuts off Amplifier/Input terminal connection and Amplifier side is directly connected to GND
CH1 INV:	A push switch; When yellow indication appears, the polarity of CH1 being switched over, the trace waveform is inverted 180°.
DC BAL:	A semi-fixed resistor for DC balance adjustment of Vertical Deflection Amplifier

MODE: A selecting switch with 4 positions performing the following function

CH1: Actuates CH1, only Vertical Deflection Amplifier and CH2 remain stopped

ALTER: Operates alternate sweeping of CH1 and CH2 of the Vertical Deflection Amplifier; by initially sweeping signals of CH1 being traced, then signals of CH2 are traced by a subsequent sweep

CHOP: Channel switching occurs successively at a rate of approx. 100 kHz between CH1 and CH2

CH2: Actuates CH2 only and CH1 stops

TIME/CM: A selecting switch for sweep time; desired sweep time is calibrated by the knob "VARIABLE" positioned at "CAL'D"

When the switch "TIME/CM" is set at the position "EXT HORIZ", sweeping comes to stop and the input of Horizontal Amplifier is connected to the terminal "HORIZ IN". On this occasion, the knob "VARIABLE" acts as a sensitivity controller of the Horizontal Amplifier.

VARIABLE: A knob for fine adjustment of horizontal sweep; this serves concurrently with the sensitivity controller of Horizontal Amplifier.

EXT TRIG or HORIZ IN: Used in combination with the external trigger input terminal and external horizontal input terminal; when the switch "TIME/CM" is set at "EXT HORIZ" this terminal acts as an input terminal of the Horizontal Amplifier.

POSITION: A knob for horizontally shifting the trace

STABILITY: A semi-fixed rheostat for stability adjustment of the horizontal sweep oscillator

PULL 5X MAG.: Upon pulling this knob out, the amplitude of horizontal sweep is enlarged 5 times

TIME-BASE

This magnifies the sensitivity of the Horizontal Amplifier five times

When the HORIZ IN terminal is used, the sensitivity is approximately 0.2 V/cm with this knob pulled out, and approximately 1 V/cm with the knob pushed in

TRIGGERING SOURCE: A selecting switch for the triggering signal source

NORM: External trigger for the waveform to be monitored. Triggerable by two signals of CH1 and CH2.

CH2 ONLY: Triggerable by a single signal of CH2 only

LINE: Triggerable by the power frequency

EXT: Triggerable by a signal applied to the terminal "EXT TRIG"

SLOPE ±: A polarity switchover switch of triggering

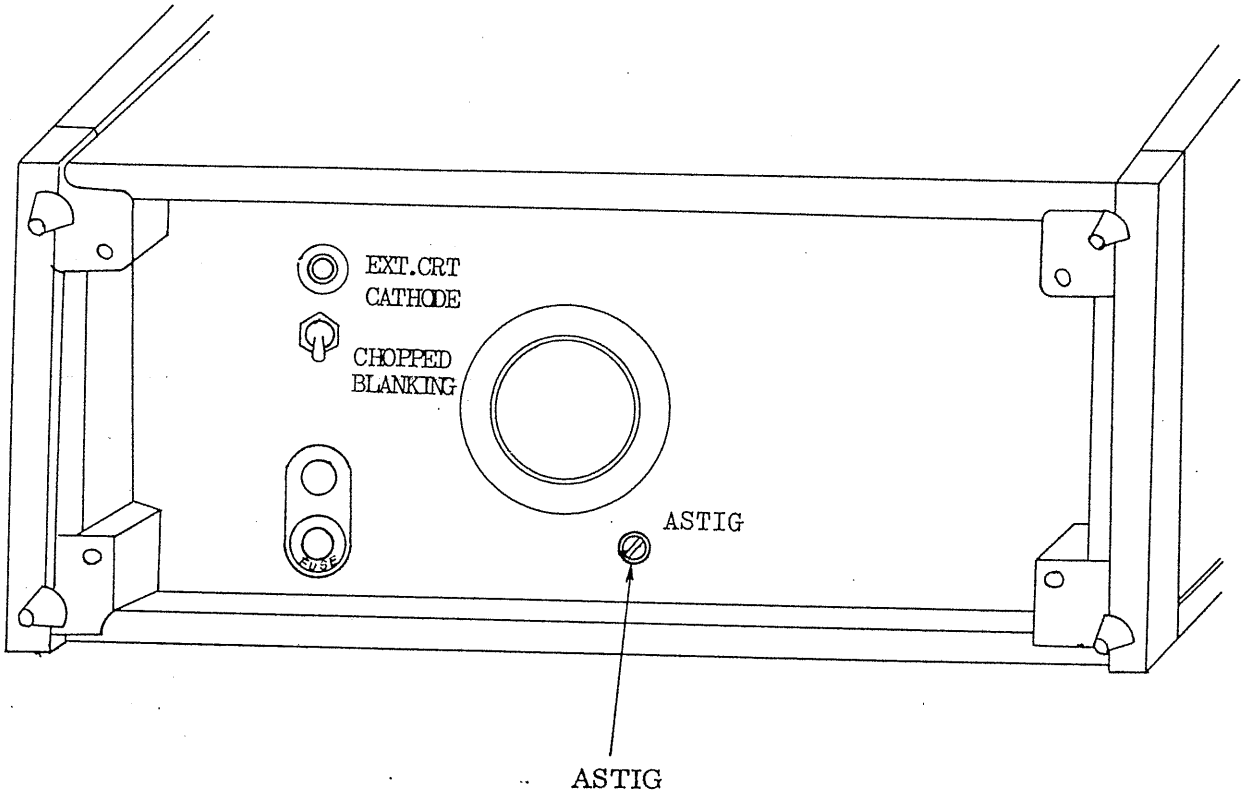
LEVEL: A knob for adjustment of the triggering level

The controller of LEVEL determines portions of the triggering signal waveform where sweeping is started.
At a position the knob is turned to extreme left "AUTO", there is no selection of the triggering level and an automatic sweep is performed.

3. DESCRIPTION OF REAR PANEL DESIGN

Rear Panel

CRT SELECTOR	A switch for the Cathode connection of the cathode ray tube (hereafter called CRT); when pushing up the switch, a terminal "EXT CRT CATHODE" comes into connection, while an internal chopped blanking signal is kept connected when pulling it down. Ordinarily, the switch is desirable, pulled down.
EXT CRT CATHODE (Z-Axis Terminal)	A terminal for transmitting an external signal to the Cathode of CRT; the terminal serves to transmit trace-brightness modulation signals.



ASTIG: An Astigmatism controller of CRT

4. OPERATION

Power Supply Voltage

This model is so designed to operate safely under the fluctuating range of the rated voltage within 10% in the primary supply. For the sake of obtaining high reliability and long durability of the components, it is recommended to use this model at the rated voltage as practicable as possible.

The high voltage supply power for CRT is being stabilized, this model has a characteristic that there occurs a considerably less change in the deflection sensitivity caused either by controlling CRT's intensity or by the voltage fluctuation of the primary power supply and brightness control in monitoring can be easily done without affecting other functions.

Installation Location

The recommended ambient temperature around the location where the model is to be installed should be kept in a range from 0 °C to 40 °C.

For best operation refrain from selecting a location with dust and high humidity. Also take into consideration air ventilation in case of using the model near any other instruments generating heat. Also, please refrain from using this model in the vicinity of intensive magnetic fields or in corrosive gas, surroundings otherwise the model will be unfavourably effected.

Allowable Voltage at Terminals

If each terminal should be applied an excessive Voltage, the interior component may be damaged, so it is to be observed with caution that the vertical input terminal is to be applied with a voltage not exceeding 600V, 400V at 10mV range and horizontal input terminal is not exceeding 100V (AC peak plus DC), respectively.

Take care, also, not to apply any voltage exceeding 600V (AC peak plus DC) for the attached low input resistance probe, 957M type.

Caution on Deflection Characteristics

In waveform monitoring of high frequencies over 4 - 5 MHz, please observe with care that the amplitude used is kept below 4 cm, as deformation occurs otherwise.

5. INITIAL OPERATION

Initial Operation

Trace will appear by following the below, sequence procedure. By repetitive performance of this sequence procedure the user will become pro-efficient in the operation of this model.

1. Set the position of each control knob as follows:

Control Knob	Position
INTENSITY	Approx. middle
FOCUS	"
ILLUM	"
MODE	ALTER
CH1 INV	Pushed in
CHANNEL 1	
POSITION	Approx. middle
VOLTS/CM	2
VARIABLE	CAL'D
AC DC GND	AC
CHANNEL 2	
POSITION	Approx. middle
VOLTS/CM	2
VARIABLE	CAL'D
AC DC GND	AC
TIME/CM	1 mS
VARIABLE	CAL'D
POSITION PULL 5X MAG	As pushed in approx. middle

TRIGGERING

LEVEL	AUTO
SLOPE	+
SOURCE	NORM

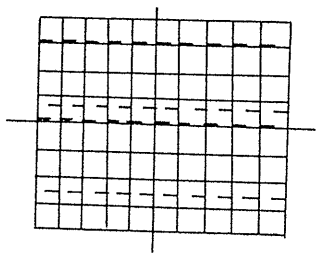
2. Upon completion of the above knob positioning, the power supply cord is connected to a power source as stipulated.

3. Set the knob "POWER" at "ON" position. About twenty seconds later, two luminous lines should appear on the CRT screen.

4. Turn "INTENSITY" for proper luminance.

5. When connecting "CALIB 5 Vp-p" to the input terminal of Channel 1 (hereafter called CH1) and Channel 2 (hereafter called CH2), two squarewaves with amplitude of 2.5 cm as shown in Fig. 3 appear on the screen.

Fig. 3



6. Turn the knob "POSITION" to shift the trace vertically and horizontally. For the convenience of monitoring, the trace of CH1 is desirably appears above the scale while that of CH2 appears below the scale.

7. When the knob "PULL INV CH1" is pulled out, the trace of CH1 is only inverted 180°. Normally, the knob is to be kept pushed in.

8. By turning the switch "VOLTS/CM" and the knob "VARIABLE" counterclockwise, the amplitude in Fig. 3 will become smaller.

9. Check the varying sweep time by turning the switch "TIME/CM" and knob "VARIABLE".

10. Switch "MODE" from "ALTER" to "CH1". CH1 only traces and CH2 will disappear. If the switch is set at "CH2", then CH2 only trace, and CH1 will disappear.

11. Set the "MODE" switch at "CHOP". The traces of CH1 and CH2 appear in dual-trace pattern on the screen, however those traces look instabilized as the waveforms of CH1 and CH2 are alternately switched over at a rate of approx. 10 μS (100 kHz).
As long as the switch "TRIGGERING SOURCE" is positioned at "NORM", the time base is triggered by the outputs of CH1 and CH2. Accordingly, at "CHOP", the output of CH1, CH2 are alternately chopped at a rate of approx. 100 kHz, wherein the time base is triggered. In this case, the trace is not stabilized unless there exists synchronous relation (a ratio of multiple in integral number) between the horizontal sweep time and the chopping frequency. When positioning the switch "TRIGGERING SOURCE" at "CH2 ONLY", then the trigger is generated by the output of CH2 ONLY and the trace becomes stabilized.
It is necessary to select a setting position for the switch "MODE" between "ALTER" and "CHOP", depending upon the sweep time.

12. Set the switch "MODE" at "CH1" and the switch "TRIGGERING SOURCE" at "NORM" position.

13. When turning the knob "TRIGGERING LEVEL" clockwise from "AUTO" position, the trace disappears for a moment, but appears again while turning. Under this condition, the elimination of the input signal for CH1 (by setting the switch "AC DC GND" at "GND") results in a stop of the sweep.
For purpose of normal monitoring, the knob "LEVEL" is to be set at "AUTO".

14. After returning the knob "TRIGGERING LEVEL" to "AUTO" position, set the switch "TRIGGERING SLOPE" at ⊖ side. Triggering starts from renegative going portion of the squarewave, with tracing moving from the upper side into the lower side. If the switch is set at ⊕ side, then triggering starts from a positive going position.

15. Pull out the knob "POSITION" of TIME-BASE to actuate a X5 magnifier. The trace width is enlarged 5 times. The sweep time in this enlarged condition is equivalent to 1/5 of the value indicated by the knob "TIME/CM". Ordinarily, the knob is kept pushed in.

16. Turn the switch "TIME/CM" to "HORIZ", and connect "5 Vp-p" of "CALIB" to the terminal "HORIZ IN". The knob "VARIABLE" for "TIME/CM", then acts as a sensitivity controller of the horizontal axis enabling a lissajous figure to be worked out.

The above sequence is a basic way of operation procedure.

6. FUNDAMENTAL USE

Measurement of AC Voltage

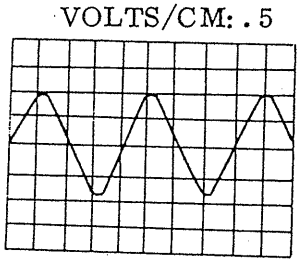
For measuring either AC waveforms, excluding DC or AC components, only extracted from AC waveforms combined with DC, the vertical switch "AC, DC, GND" is to be set at "AC" position.

1. By setting the switch "AC, DC, GND" at "AC" and the knob "VARIABLE" for the vertical at "CAL'D" position, determine the value of VOLTS/CM in a way that the waveform displays a suitable amplitude within the scale area.

2. Read the amplitude of the waveform in "cm". The value of voltage is, obtained by the following formula:

   Voltage = Vertical amplitude length × VOLTS/CM × Probe magnifications, wherein, the magnification ratio of attached 955M type probe is 10, the length of vertical amplitude is 4 cm, VOLTS/CM is 0.5, therefore,

   Voltage = 4 × 0.5 × 10 = 20 Vp-p



Measurement of Instantaneous Voltage

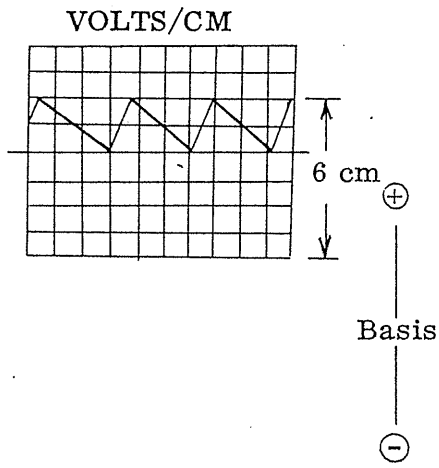
To measure the DC level at an optionally selected point of the waveform, the following steps are to be performed.

1. Set the position of the switch "AC, DC, GND" at "DC".

2. Set "TRIGGERING LEVEL" at "AUTO" position.

3. Adjust the position of the trace in conformity with the lowest line of the scale, to determine a basis on the graticule, after positioning the switch "AC, DC, GND" at "GND".
   If the voltage to be measured is negatively less than the standard voltage, the position of the trace should be adjusted to the top line of the scale.

   The basis thus set up acts also as that for DC measurement, therefore, the Vertical POSITION should not be moved while measuring.
   Return the switch to "DC".



4. The Vertical is applied the measuring voltage.
   For reading the voltage, the distance between the basis and a position to be read out is measured in cm, and from formula:
   Instantaneous voltage = Vertical amplitude measured from the basis × VOLTS/CM × probe magnifications, the voltage in question is obtained as 6 × 1 × 10 = 60 V.

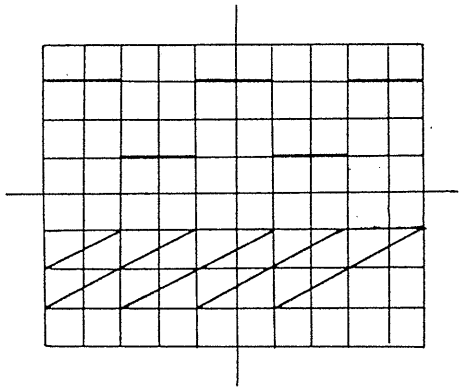
How to trigger in dual-trace operation

The Time Base can be triggered by either or both of the two signals in monitoring (applied to CH1 and CH2).

1. When triggering by the two signals, the switch "TRIGGERING SOURCE" and the switch "MODE" of the Vertical are to be positioned at "NORM" and "ALTER", respectively.

2. When triggering by either of them, it should be strictly observed to select a signal of a lower frequency for triggering, otherwise the trace of the lower frequency signal is not stabilized resulting in difficult monitoring.

3. When triggering only with one of the two signals, it observed conclusively that the signal used for triggering be applied to CH2 and the switch "TRIGGERING SOURCE" be positioned at "CH2 ONLY".
   Under this condition, a trigger is generated with the output of CH2 ONLY.
   Alternatively, the switch, "TRIGGERING SOURCE" may be positioned at "EXT" and a triggering signal be applied to the terminal "EXT TRIG".
   The voltage necessary for a triggering 1 - 2Vp-p.
   The switch "MODE" can be used at a position of either "ALTER" or "CHOP".



Signal A

Signal B

When triggering with the signal A, the trace of the signal B is not stabilized making the monitor impracticable.

Signal A is higher in frequency than signal B. The frequency ratio is always kept as multiples of integral number.

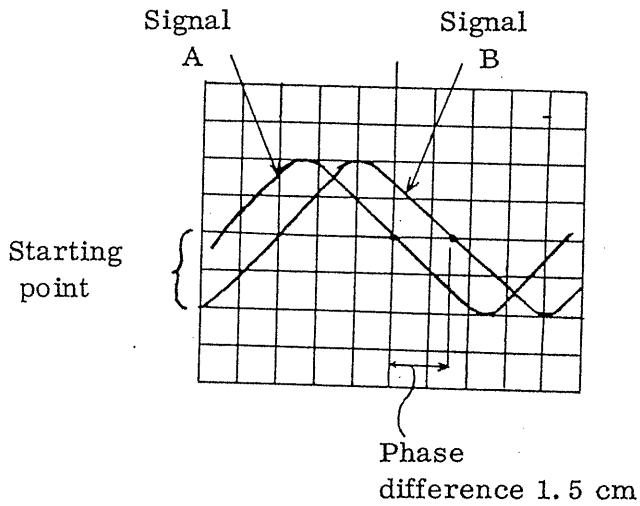
Measurement of Phase Difference

For comparative measurement of the phase difference in two sinewaves of identical frequencies, the dual-trace operation mode can be suitably applied.

1. Signals to be measured are applied to the input terminals of CH1 and CH2 respectively. The switch "MODE" and the switch "TRIGGER SOURCE" are positioned at either "ALTER" or "CHOP" and "CH2 ONLY", respectively.

2. The knob "VERTICAL POSITION" is adjusted so that both vertical center lines of the two signals traced on the screen come together.

3. By adjusting the switch "TIME/CM" and knob "VARIABLE" of TIME-BASE, one cycle period of signals to be monitored is set at approx. 9 cm horizontally. Under this condition, a horizontal distance of 1 cm represents a phase angle of 40°.



Example:

Supporting that the horizontal distance between points of signal intersect, is 1.5 cm, therefore, the phase difference would be

$$40^\circ \times 1.5 = 60^\circ$$

In Fig. , signal B is 60° behind signal A in phase angle, and a positive trigger is applied by signal A.

The "TRIGGERING LEVEL" knob determines the starting positions of both signals.

In the case of less phase difference between both signals and accordingly impracticable reading on the scale "HORIZONTAL POSITION" knob should be pulled thereby actuating a X5 magnifier which enlarges readings. Under this situation, a distance of 1 cm corresponds to a phase difference of 8°.

Measurement of Phase Difference by Use of Lissajous Figure

For comparative measurements of the phase difference in two signals of identical frequencies, a measurement by use of a lissajous figure also is applicable.

For this method, it is necessary to take care of a phase difference between the vertical amplifier and horizontal amplifier in the oscilloscope itself. Prior to measuring, determine the value of that particular phase difference in the oscilloscope.

1. Set the switch "TIME/CM" at "EXT HORIZ" position.

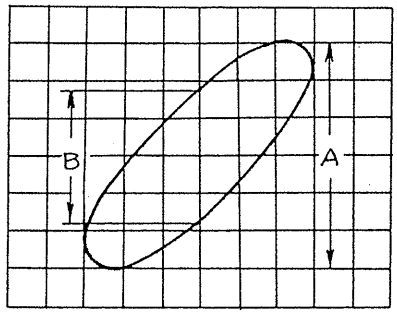
2. Apply signals to be measured at the terminals "VERTICAL INPUT" and "HORIZ IN".

   Then adjust the vertical and horizontal amplitudes according to the scale and read A, B values.

   Thus, the value of phase difference in question is obtained below.

Phase angle between two signals $\theta = \text{Sin}^{-1} \frac{B}{A}$

Value of real phase angle = θ - Amplifier's particular phase angle

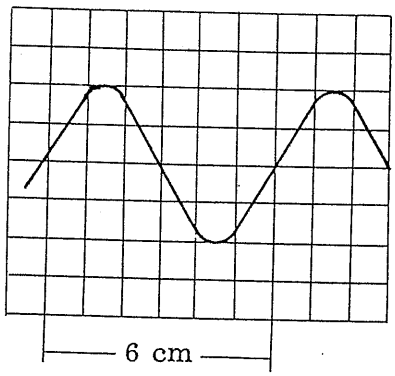


Measurement of Time

The measurement capabilities for periods, frequencies and risetimes of signals to be monitored are offered with use of the calibrated Time Base. The time indicated by the switch "TIME/CM" implies a time length necessary to sweep horizontally one division of 1 cm on the scale.
When the switch indicates 1 ms and 1 µs, said time is $1/10^3$ sec per cm and $1/10^6$ sec per cm, respectively. For measuring the time length between two difference points on the waveform, the following sequence steps are to be performed.

1. By adjusting the switch "TIME/CM", the distance between two points is set within the scale area with the highest possible range.

2. By the knob "VERTICAL POSITION", the middle of both points is shifted to coincide with the horizontal center, adjust the first point to be measured in a position according to the scale, by the knob "HORIZONTAL POSITION".



Length of horizontal distance: 6 cm

Value of TIME/CM: 1 mS

Time: 6 × 1 = 6 mS

In case the pull-acting X5 magnifier is used, the value is obtained below in TIME/CM.

$$\text{Time distance} = \frac{\text{Length of horizontal distance} \times \text{TIME/CM}}{5}$$

Measurement of Frequency

The frequency of a repetitively periodic wave can be obtained, as already described before, by measuring the time period and pitch distance.

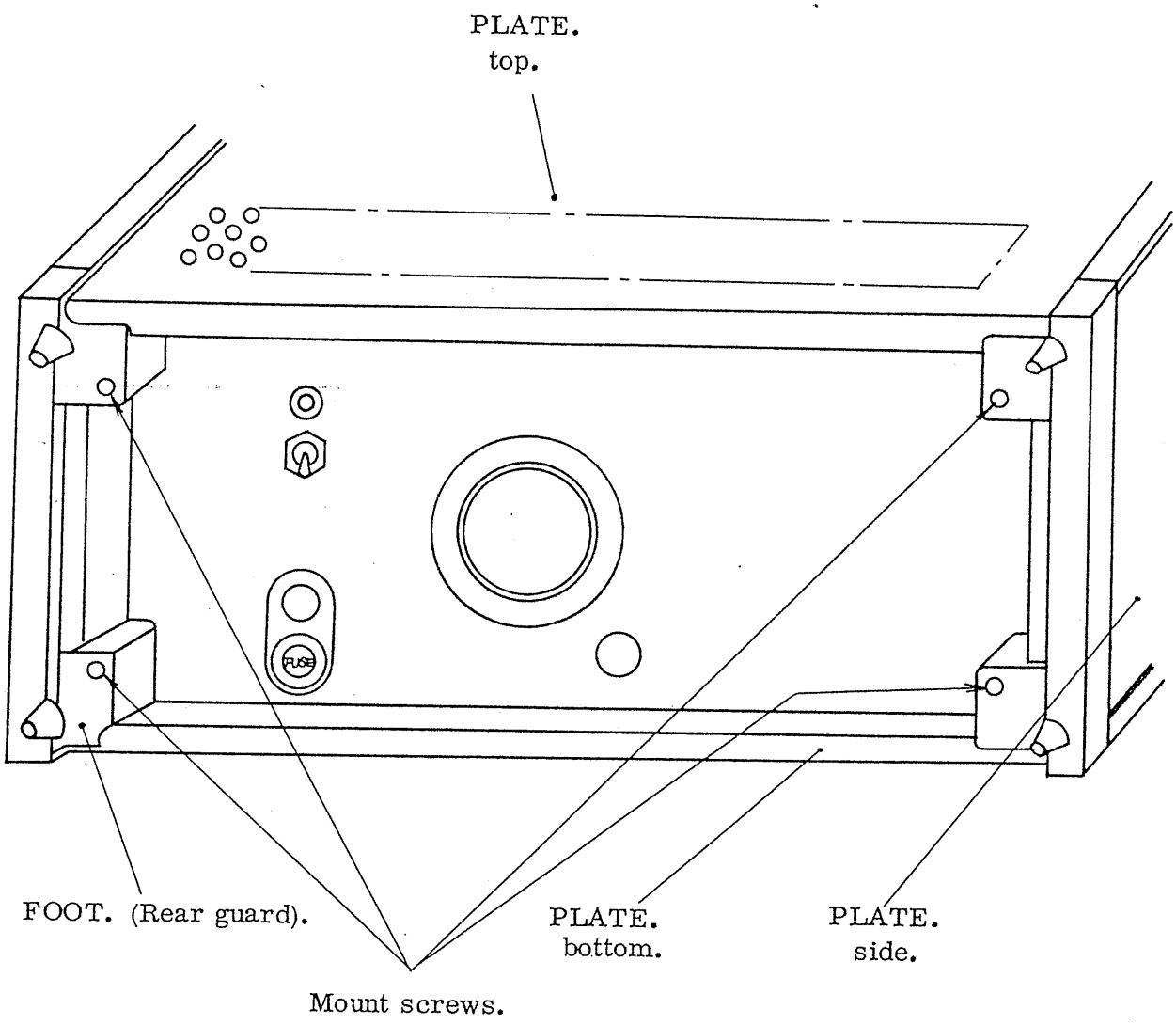
$$\text{Frequency} = \frac{1}{\text{One cycle time}}, \text{ wherein}$$

Horizontal length of one cycle : 6 cm

TIME/CM : 1 mS

Frequency = 1/6 mS ≒ 167 Hz

Maintenance
Inspection of Inside.



For checking the interior of the instrument.

Loosen the four screws and remove each FOOT (rear guard), then all the plates. (top, bottom and both sides).

CAUTION

High voltage is very dangerous. Be sure to carry out the aforementioned operations after turning off the power switch.

It is strongly suggested to do the above only after the power source is disconnected, otherwise the repair-man may become another statistic!

Adjustment

Adjustment of DC BAL

1. Set the switch "MODE" at "CH1" position and switch "AC DC GND" at "GND" position.

2. Put the trace in the middle of the scale by adjusting the knob "VERTICAL CH1 POSITION".

3. Try to turn the knob "VARIABLE" for "VOLTS/CM".
   If the trace shifts up and down, set "DC BAL" which will put the trace in position.
   As the vertical position of the trace moves up and down by turning "DC BAL", try to stop the trace in the middle of the scale by repetitive adjustment of "VERTICAL POSITION".
   The same way is applied in adjustment of CH2.

STABILITY

1. A sinewave of 10 kHz ~ 50 kHz is applied to the vertical input of CH1.

2. A test waveform with a vertical amplitude of 1 cm formed by the switch "VOLTS/CM" and one or two cycles formed by the switch "TIME/CM" is traced on the screen.

3. The knob "TRIGGERING LEVEL" is set at "AUTO", "TRIGGERING SOURCE" at "NORM" and "TRIGGERING SLOPE" at +.

4. As the sweep comes to a stop turn to the right, the semi-fixed variable rheostat on the printed base for adjusting stability, the variable resistor set for effect a little before the sweep stops.
   The semi-fixed variable resistor is mounted on the panel.

5. By alternately turning the switch "TIME/CM" and knob "VARIABLE", check all the ranges synchronization which is stabilized.

6. With a monitored frequency ranging 20 Hz ~ 7 MHz, it is checked to confirm synchronizing performance. If not stabilized yet, another adjustment is needed.

ASTIG Adjustment

This is done by the semi-fixed variable resistor provided on the printed base.

1. Trace sinewave all over the scale area.

2. Adjust "ASTIG" in combination with "FOCUS" so that overall luminous lines present an identical thickness.

GEOMETRY Adjustment

The GEOMETRY control (semi-fixed resistor) is mounted on a printed board with a spacer at a lower section beneath the rear section of the chassis.

1. Display 15~20 cycles of a sine wave of approximatoly 1 MHz for full scale of the CRT.

2. Adjust the GEOMETRY control so that the displayed waveform becomes uniform without distortion even at its both ends.

Vertical Sensitivity

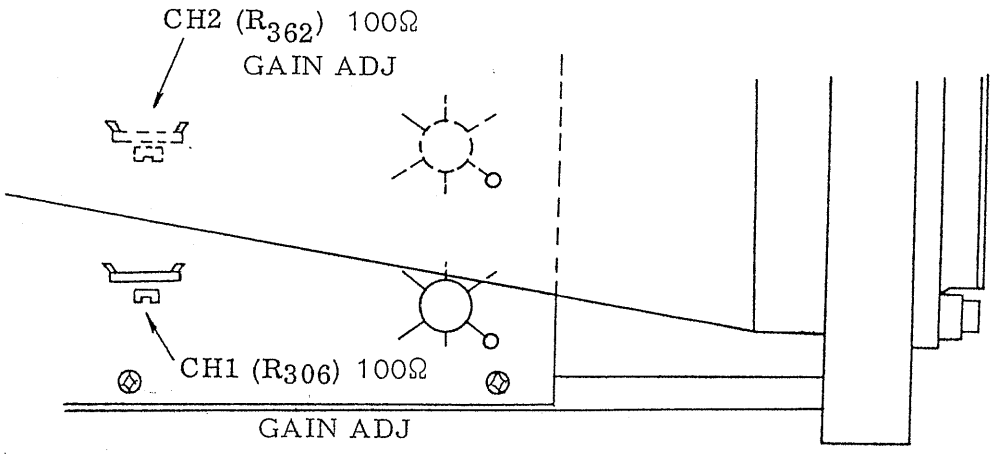
1. Set "VOLTS/CM" at 0.01X.

2. Set "VARIABLE" at "CAL'D".

3. Apply a squarewave of 0.04 Vp-p to the vertical input.

4. Adjust R_{306} (CH1), R_{362} (CH2) so that the vertical amplitude appears 4 cm in length.

To plan view



Correcting Calibration of "VOLTS/CM" switch

This switch functions to control both the input capacity and phase characteristics.

Input capacity:

1. Connect a capacity meter of 38 pF to the vertical input terminal.

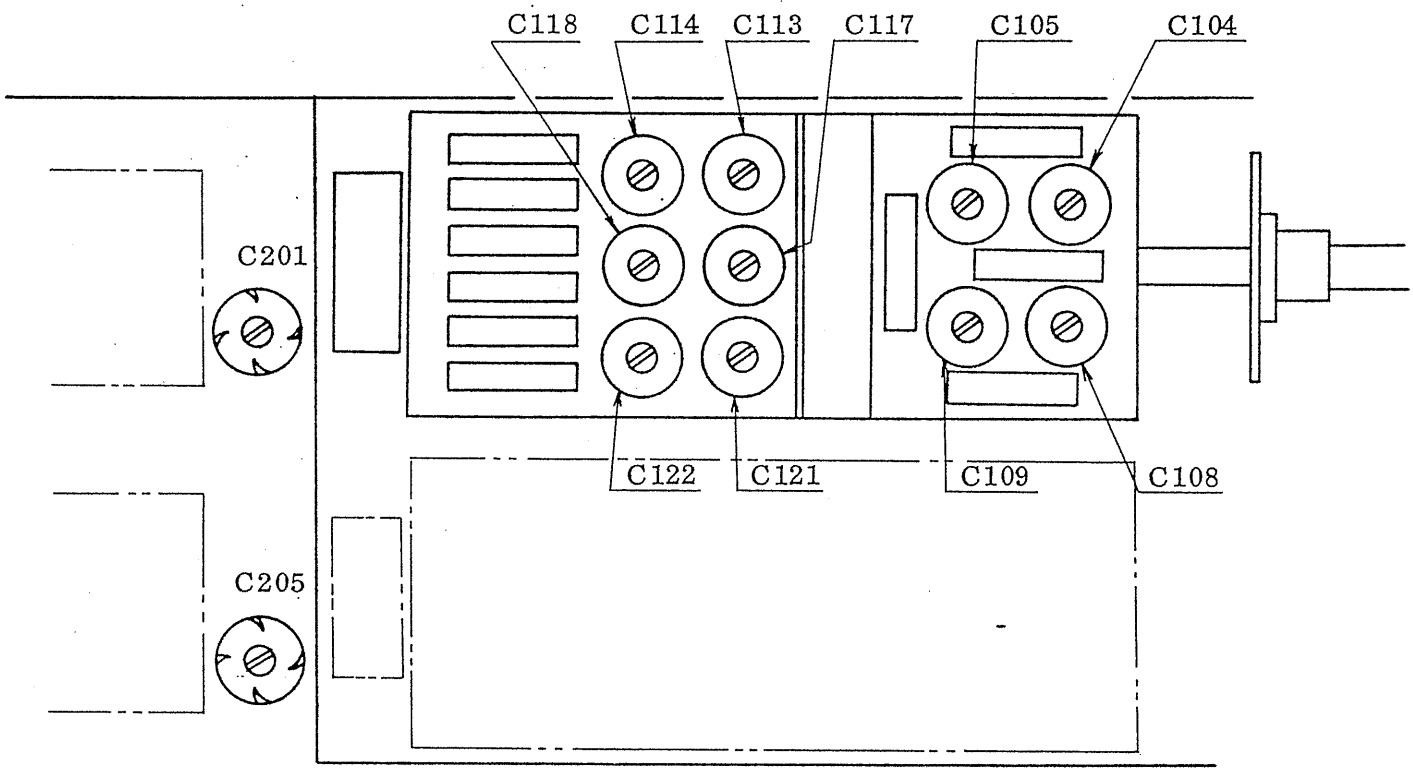
2. Set "VOLTS/CM" at 0.01.

3. Adjust the input capacity to 38 pF by C_{201} (CH1), C_{205} (CH2).

4. Set "VOLTS/CM" at 0.02.

5. Adjust the input capacity to 38 pF by C_{104}.
   Further adjustments are done in sequence by the following table.

VOLTS/CM	Trimmer Capacitor	Capacitance value to be adjusted
0.01	C_{201}(CH1), C_{205}(CH2)	38 pF
0.02	C_{104}	"
0.05	C_{108}	"
0.1	C_{113}	"
1	C_{117}	"
10	C_{121}	"



For CH1 and CH2, trimmer capacitors are mounted in a similar position arrangement between both channels, however printed boad are separated.

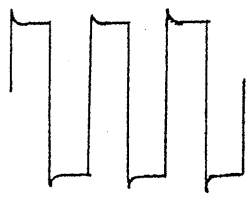
Phase Characteristics (Compensator)

1. A high-performance squarewave generator producing repetitively periodic frequency of 1 kHz, output voltage of 0.04 - 80 Vp-p is connected to the vertical input terminal.

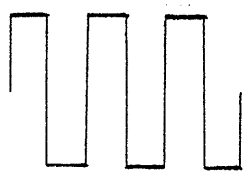
2. "VOLTS/CM" is set at 0.02.

3. The waveform is adjusted by C_{105} - C_{122} as shown in the figure. Further adjustments are accomplished as follows.

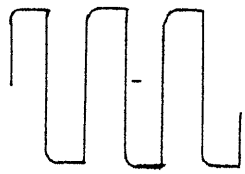
VOLTS/CM	Trimmer Condenser
0.02	C_{105}
0.05	C_{109}
0.1	C_{114}
1	C_{113}
10	C_{122}



NO GOOD



GOOD



NO GOOD

For CH1 and CH2, trimmer condensers are mounted in a similar position arrangement between both channels, however, printed boad have been separated.

4. With the above adjustment performance, there usually occurs a slight change in the value of the input capacity. Please adjust the input capacity again.

Calibrated Voltage Adjustment (CALIB Vp-p)

In every range, "VOLTS/CM" needs to be correctly calibrated for voltage sensitivity.

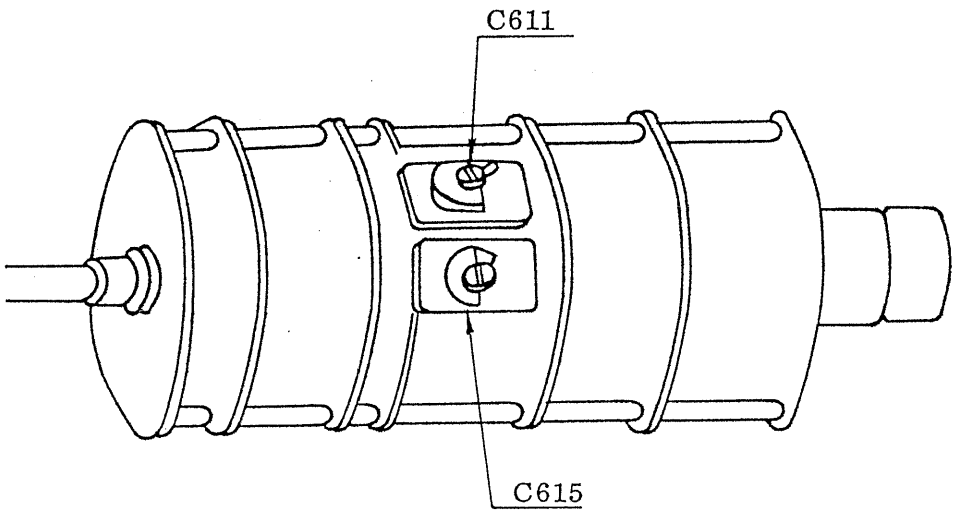
1. Set "VOLTS/CM" of CH1 at 1V.
2. Set "VARIABLE" at "CAL'D".
3. Apply 5Vp-p output of "CALIB" to the input terminal of CH1.
4. Adjust R810 to obtain a vertical amplitude of 5 cm.

Sweep Time Adjustment

1. Connect a time-mark generator to the vertical input terminal.
2. Set "TIME/CM" and "VARIABLE" at 1 mS and "CAL'D", respectively.
3. Set the output of the time-mark generator at 1 mS.
4. Conform the marker signal to the scale of the graticule by R_{728} semi-fixed resistor.
5. Pull out "PULL 5X MAG" and adjust the magnifier by R_{734}.

The above adjustment covers a range of 1 sec - 50 μS, and for a range of 20 μS - 1 μS, trimmer capacitor are used.

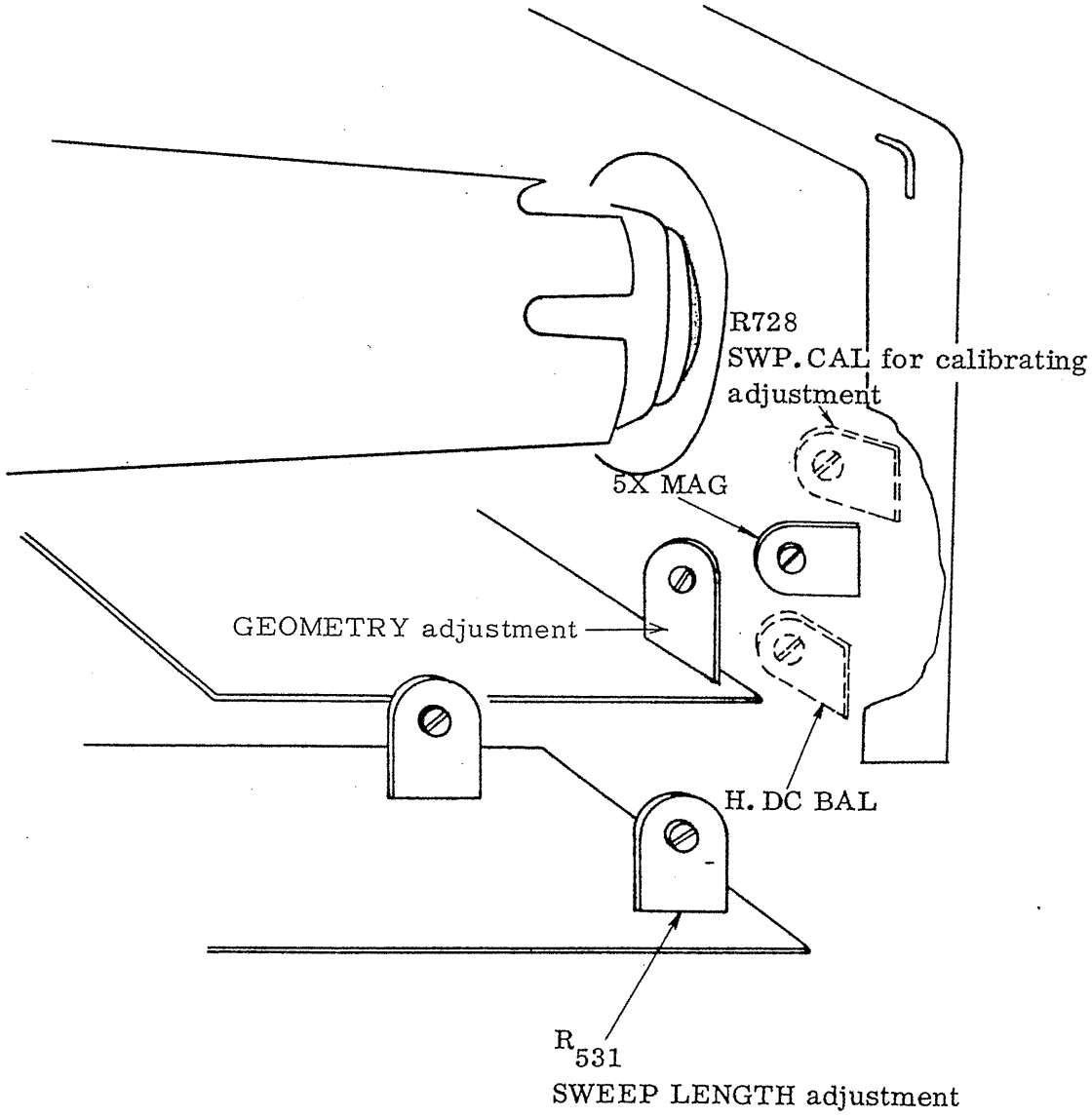
TIME/CM	Adjustors	
1 mS	R_{728}	
10 µS	C_{611}	1 mS range is to be performed after adjustment.
1 µS	C_{615}	



Sweep Length Adjustment

The length of the trace is approx. 10.5 cm at MAG OFF.

This adjustment is usually performed after completing the sweep time adjustment, this is not necessarily required, therefore an easy check is all right. However, if the length is less than 10 cm the semi-fixed resistor R_{531} is used for adjustment.

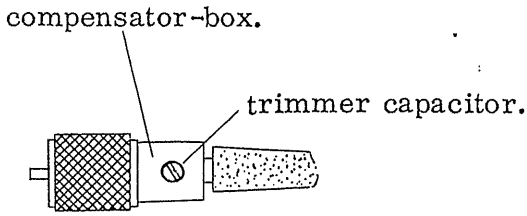


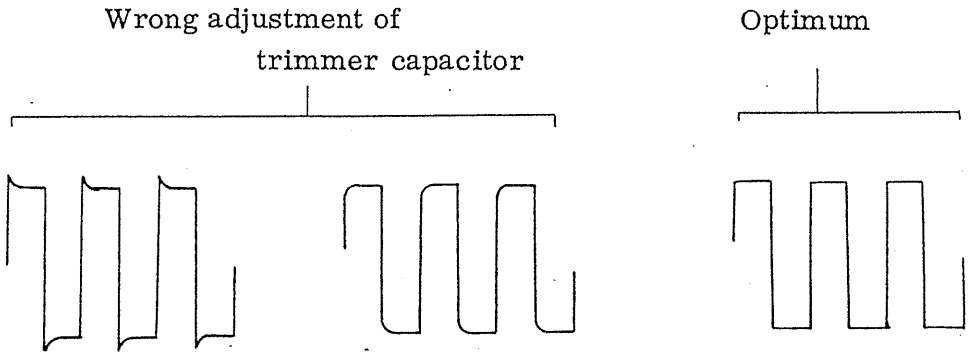
Maintenance of Probe

Occasional adjustments are necessary for the low-capacity probe, 957M type attached to the Oscilloscope Model 553APRM. It may happen that the property of the probe becomes damaged when receiving heavy physical shocks or being applied a voltage exceeding rated value. The probe uses a precision resistor for dividing voltage and a trimmer capacitor, for compensating high frequencies characteristic, therefore the best adapted positions of trimmer capacitor may be changed by a strong shock that results in the necessity of correctly calibrating them.

Adjustment of Trimmer Capacitor

1. Connect the probe to the vertical amplifier.
2. Apply a squarewave of approx. 1000 Hz to the top end of the probe.
3. By turning the trimmer capacitor in compensator-box by use of screw-driver, adjust the waveform trace to the best condition.


compensator-box.
trimmer capacitor.


Wrong adjustment of
trimmer capacitor
Optimum