

MODELS 531 531A

OSCILLOSCOPES

OPERATION MANUAL

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KIKUSUI ELECTRONICS CORP.

MODELS 531 531A

OSCILLOSCOPES

The Model 531 Oscilloscope is a compact, general-purpose, oscilloscope employing a 3-inch cathode-ray tube, push-pull vertical amplifier having pass-band of 3 cps to 5 mc, and push-pull horizontal amplifier having pass-band of 1.5 cps to 500 kc.

Two voltage calibration signals are available simply by turning vertical attenuator switch. Horizontal sweep oscillator is capable to sweep at 10 cps to 100 kc and TV.H (15.75/2 kc) for observation of television signal, and it can be synchronized either internally or externally. Horizontal sweep at line frequency is also made, and phase of sweep can be varied from 0 to 135 degrees.

The Model 531A Oscilloscope is identical to Model 531 except that aluminum cabinet and steel chassis are used and a slight modifications are made in circuitry. The weight is therefore increased by 0.8 kg and now measures 8.8 kgs total, and the followings are changes made in schematic diagram.

1. A 5-pF capacitor is connected between pin #2 and pin #6 of V3 12BH7.
2. V7 12AU7 is replaced with 12AT7.

However, the performance remains the same as it of Model 531, and the user of 531A may also refer to this operation manual.

SPECIFICATION

Power Requirement	100 volts, 50 to 60 cps, approx. 80 VA
Size - Cabinet	170 W x 230 H x 350 D mm
Maximum	180 W x 245 H x 400 D mm
Weight	Model 531 - approx. 8.0 kgs Model 531A - approx. 8.8 kgs

Items Supplied with Equipment

- 1 - 951A Low Capacitance Probe
- 1 - 941B Terminal Adaptor
- 1 - Inclining Angle

Tubes Used

- 1 - 3WPL cathode-ray tube
- 1 - 6AU6
- 1 - 6U8
- 3 - 12AU7 (2 - 12AU7 and 1 - 12AT7 in Model 531A)
- 2 - 12BH7
- 1 - 6CA4
- 1 - 1X2B

Vertical Axis

Deflection Sensitivity	At range 1/1 and 1 kc: More than 100 mV/cm p-p.
Frequency Response	In reference to 1 kc between 3 cps and 5 mc. Within ± 1 and -3 db.
Attenuator	Frequency compensated. 1/10 and 1/100. Accuracy within ± 1 db.
Frequency Response of Vernier Control	Drop of relative gain as referred to maximum gain position at 5 mc. Within -3 db.
Maximum Input Voltages	In range 1/1 DC component ± 350 volts max. AC component 12 volts p-p max. (1) In range 1/10 DC component ± 350 volts max. AC component 120 volts p-p max. (1) In range 1/100 DC component ± 350 volts max. AC component 1000 volts p-p max. (1) Using 951A Low Capacitance Probe and in range 1/1 DC component ± 250 volts max. AC component 120 volts p-p max. (1)
Input Impedance	In all ranges: 1 megohm plus 20 ± 2 pF Using 951A Low Capacitance Probe. 10 megohms plus less than 12 pF.
Direction of Deflection	Positive signal moves spot upward.
Calibration Voltage	When line voltage is 100 volts. 1 volt p-p and 0.2 volt p-p within $\pm 10\%$.

Note (1) Assuming positive peak value and negative peak value are equal.

Horizontal Axis

Deflection Sensitivity	At 1 kc. More than 0.7 volts/cm p-p
Frequency Response	In reference to 1 kc between 1 cps and 500 kc. Within ± 1 and -3 db.
Input Impedance	1 megohm plus less than 20 pF.
Maximum Input Voltage	DC component ± 350 volts max. AC component 50 volts p-p max. (1)
Direction of Deflection	When signal is applied to input terminal: Positive signal moves spot leftward. When internal sweep oscillator is used: Spot moves from left to right.

Sweep Oscillator Frequencies

TV.H	When frequency is adjusted at 30 cps in range 10 - 100: 15.75/2 kc ± 0 -5%.
10 - 100	10 cps to 100 cps continuously variable.
100 - 1K	100 cps to 1 kc continuously variable.
1K - 10K	1 kc to 10 kc continuously variable.
10K - 100K	10 kc to 100 kc continuously variable.
100K - 400K	100 kc to 400 kc continuously variable. (2)

Synchronization inputs Internal (positive), Internal (negative), line, and external.

Note (1) Assuming positive peak value and negative peak value are equal.

Note (2) 400 kilocycles $\pm 20\%$.

FUNCTIONS OF CONTROLS AND TERMINALS

INTENSITY/OFF -- this knob is a combined power switch and intensity control. Turning this knob clockwise from OFF position, power is turned on and pilot lamp lights on. Within 30 seconds of warm-up, the equipment attains the operating condition. As this knob is further turned clockwise, intensity of the spot increases. However, excessive intensity results in poor sharpness due to halation and simultaneously injures the fluorescence screen of the cathode-ray tube.

FOCUS -- This knob is to adjust the sharpness of the trace, and the best focus is usually obtained around the center position.

VERT POSITION and HOR POSITION -- These knobs are to move the position of spot or trace on the screen vertically or horizontally. Turning these knobs clockwise, the spot or trace moves upward and leftward respectively. Note - Using VERT POSITION when spot is kept more than 3 cm above or below centerline for long period, V3 may be damaged.

Input Terminals

VERT INPUT -- This is an input terminal to vertical amplifier. This terminal accepts M-type or UHF-type plug, and input signal is applied through coaxial cable. This terminal also accepts 941-B Terminal Adaptor which is supplied with equipment, and when this terminal adaptor is used, input signal is applied between this terminal and GND terminal.

HOR INPUT -- This is an input terminal to horizontal amplifier and also serves as input terminal for external synchronizing signal. With SYNC/H SELECT knob placed in EXT position, this terminal serves as input terminal for external synchronizing signal, and with SYNC/H SELECT knob placed in AMP position, this terminal serves as input terminal for horizontal amplifier.

Vertical Amplifier

VERT GAIN -- This is a knob to control the gain of the vertical amplifier and can control continuously from zero gain to maximum gain. When this knob is put at 9 o'clock position and trace still appears more than 6 cm in height, such trace may be distorting. In such case, input signal should be attenuated using VERT ATT.

GAL/VERT ATT -- This is a knob to select the attenuation ratio and the calibration voltage sources. Placing this knob in 1V P-P or 0.2V P-P position, calibration voltage of 1 volt p-p or 0.2 volt p-p is supplied to vertical amplifier. As this knob is placed in 1/100, 1/10, or 1/1 position, input signal is fed to vertical amplifier, and these figures express the attenuation ratios.

Horizontal Amplifier

HOR GAIN -- This is a knob to control the gain of the horizontal amplifier and can control the gain continuously from zero to maximum. When this knob is put below 9 o'clock position and the trace still appears more than 6 cm in width, such trace may be distorted due to saturation within tube V6A.

SYNC/H SELECT -- This is to select synchronization inputs to sweep oscillator and also to change the function of horizontal amplifier as follows:

- | | |
|------------|--|
| - INT | To synchronize the sweep to negative going excursion of the observed waveform. |
| + INT | To synchronize the sweep to positive going excursion of observed waveform. |
| LINE | To synchronize the sweep to power line frequency. |
| EXT | To synchronize the sweep to external signal applied to HOR INPUT terminal |
| LINE SWEEP | At this position, sweep oscillator does not work, and AC signal from power line is applied to horizontal amplifier. The phase of AC signal can be varied continuously from 0 to 135 degrees using PHASE. |
| AMP | At this position, sweep oscillator does not work, and external signal applied to HOR INPUT terminal is fed to horizontal amplifier. |

Sweep Oscillator

SWEEP RANGE -- This is to select the frequency range of sweep oscillator. At TV.H position, sweep oscillator generates a sweep frequency of 15.75/2 kc for convenience in trouble-shooting and alignment of horizontal circuit in television receivers.

In positions 10 - 100, 100 - 1K, 1K - 10K, 10K - 100K, and 100K - 400K, the frequency can be varied continuously within the range using VERNIER knob, and the ends of each frequency range are overlapping with the ends of next frequency ranges.

VERNIER -- This is to control the frequency of the sweep oscillator precisely, and as this knob is turned clockwise, the frequency increases.

SYNC ADJ -- This is to control the amplitude of the synchronization signal fed to the sweep oscillator.

Scaled Green Filter

Green filter is scaled in 1-cm squares, and in addition, its center lines are scaled at 2-mm spacings. White dots on left and right edges are to indicate decibels in reference to 4 cm point, and dots on left edge indicate from top to bottom -3 db, -6 db, -10 db, and -20 db, and dots on right edge indicate from bottom to top -3 db, -6 db, -10 db, and -20 db.

Accessories

951A Low Capacitance Probe -- When 951A Low Capacitance Probe is connected to the end of input cable, input impedance increases to 10 megohms plus 12 pF, however, the signal is attenuated by 10. Signal is applied between tip of the probe and alligator clip of the probe. The alligator clip is electrically connected to the chassis of the oscilloscope, therefore, if this clip is used, it is not necessary to use GND terminal on the panel.

941B Terminal Adaptor -- When applying signal directly to input terminal, 941B Terminal Adaptor is used. This Terminal Adaptor, connected to input terminal, is convenient to hold various types wires and lugs.

MAINTENANCE AND ADJUSTMENT

Similarly to handling of ordinary test equipment, this equipment should also be kept away from severe vibration or shock, high temperatures above 40°C, low temperatures below 0°C, subject to rain fall or direct sun light, and dusty place. In operation, it is preferred that line voltage is kept within $\pm 5\%$ of rated voltage.

How to Remove Side Board -- Side board can be removed by simply unlocking two screw-type locks provided on the upper corner of the side board using a screw driver or a coin. In mounting, screw-type locks are first turned counter clockwise by 1/4 rotation, and bottom edge of side board is put inside of bottom board, then, placing side board in position, screw-type locks are fastened.

Caution -- The oscilloscope uses a high voltage of 1,000 volts and this voltage is exposed inside the cabinet. Every care should be exercised to avoid the shock hazard and resultant accident.

How to Remove Cathode-Ray Tube -- Lefthand side board is removed and socket for cathode-ray tube is removed. Then, a screw on mounting band at the base of cathode-ray tube is loosened, and further, the frame for scale is removed by turning it counter clockwise. Now cathode-ray tube is ready to pull out front side.

Adjustment of C2 and C5

Adjustment of frequency response compensating capacitors in vertical attenuator circuit are made using a precision square-wave generator. Removing lefthand side board, and applying square-wave of about 1 kc, these compensating capacitors are adjusted to obtain the best square-wave on the screen.

Adjustment of C1 and C4

Adjustment of input capacitance adjustment trimmers in vertical

attenuator circuit are made using a capacitance meter. Removing lefthand side board, and connecting a capacitance meter between VERT INPUT and GND, these trimmers are adjusted so that input capacitance in these positions are same as input capacitance in 1/1 position.

Adjustment of ASTIG

When lefthand side board is removed, a screw driver adjustment variable resistor appears on the chassis. This resistor is provided to adjust for minimum astigmatism of the cathode-ray tube. Viewing a trace on the screen, this resistor is adjusted for maximum sharpness at all points of the trace.