

PROBE AND INPUT CAPACITANCE ADJUSTMENT

1. Set VOLTS to 0.01V.
2. Set the probe to 10 : 1 and connect it to INPUT terminal. Apply 1 kHz square wave signal to the probe and adjust its trimmer for optimum square wave. In this case, the input voltage is attenuated to 1/10 but the input resistance and input capacitance are reduced to less than 10 M ohms and 18 pF respectively.
3. Next, set VOLTS to 0.1V and adjust the trimmer. TC 110 on the lower circuit board through the adjusting hole provided on the bottom case so that optimum square wave can be obtained.
4. Finally adjust the trimmers TC111 and TC112 at 1V and 10V ranges respectively.

VERTICAL SENSITIVITY ADJUSTMENT

1. Set VOLTS/DIV to 0.01V and turn VARIABLE fully clockwise to CAL.
2. Apply 0.05V p-p square wave signal to the vertical input.
3. Adjust VR113 (GAIN ADJ) on the lower circuit board through the adjusting hole in the bottom cover for 5 div of vertical amplitude.

CRT CENTERING ADJUSTMENT

1. Remove the case according to the procedures described under "Removing the Case".
2. Short the test terminals TP101 and TP102 on the lower circuit board.
3. With a horizontal bright line displayed on CRT, adjust VR105 on the same circuit board until the bright line is centered.

FREQUENCY RESPONSE AND OVERSHOOT ADJUSTMENT

1. Apply 100 kHz square wave signal having a good rise characteristic to the input.
2. Adjust the middle range of the square wave (after rising) with TC113 on the lower circuit board through the adjusting hole in the bottom cover.
3. Adjust the high range of the square wave (rising portion) with VR104 on the same circuit board through the adjusting hole in the bottom cover.

SWEEP TIME (HORIZONTAL SENSITIVITY) AND BRIGHT LINE LENGTH ADJUSTMENT

1. Remove the case according to the procedures described under "Removing the Case".
2. Set SWEEP TIME/DIV to 0.1 ms and turn VARIABLE fully clockwise to CAL.

3. Apply 1 kHz calibrated sine wave signal to the input and adjust each POSITION so that the waveform is centered and its starting point is positioned to the extreme left of the scale.
4. Adjust VR306 (TIME ADJ) on the side circuit board so that 1 wave length of the sine wave is 10 div on the scale. At this time, the length of the horizontal bright line will vary. Adjust it with VR309 (LENGTH ADJ) on the same circuit board. This adjustment varies only the end portion of the waveform, so the length of the bright line can be adjusted without affecting the starting point and the sweep time. During the adjustment, manipulate \leftarrow POSITION and TRIG LEVEL in order that the starting point may always be held in the center of the extreme left of the scale.
5. The above adjustment applies to the ranges of 0.5s to 0.1ms. For the ranges of 50 μ s to 1 μ s, adjust TC301 on the side circuit board.

X 5 MAG ADJUSTMENT

1. Set SWEEP TIME/DIV switch to 1 ms/div and apply 1 kHz sine wave signal to the input.
2. Adjust the oscillator frequency and \leftarrow POSITION to obtain 11 peaks of waveforms. Each peak should be on the vertical line on the scale.
3. With MAG switch pulled toward you, adjust VR303 (MAG ADJ) on the side circuit board so that the spacing between peaks is 5 div.

MAG CENTER ADJUSTMENT

1. Set SWEEP TIME/DIV to 0.1ms and apply 1 kHz square wave signal to the input. Adjust so that 1 wave length is spread over the entire scale.
2. Set \leftarrow POSITION to its mechanical center position (waveform may deviate in the horizontal direction).
3. With MAG switch pulled toward you, adjust VR304 (MAG CENT) on the side circuit board until the rising portion (or falling portion) in the center of the waveform comes to the point obtained at "X1" (MAG switch depressed).
4. Repeat this adjustment until the position of the rising portion (or falling portion) in the center of the waveform is not varied regardless of the position of the MAG switch.
5. Return MAG switch to "X1" and adjust VR305 (POS ADJ) on the side circuit board until the starting point of the waveform comes to the extreme left of the scale.

OBSERVE THE FOLLOWING BEFORE MAKING ADJUSTMENTS

1. The items given below are pre-adjusted at the factory before shipment. Should re-adjustment be required, it should be performed after calibrating the power source voltage (no adjustment is required on the probe).
2. All adjustments should be made with the semi-fixed resistors or the trimmers mounted on the printed circuit board. For adjustment, use a well insulated, flat blade screwdriver.
3. A high voltage (2000V) is present on the lower circuit board.
Be sure to turn off the power before removing the bottom cover.
4. For optimum adjustment, turn on the power and warm up the oscilloscope sufficiently before starting.

DC BAL (1) ADJUSTMENT

This adjustment is required when the bright line moves up and down by turning the vertical attenuator (VOLTS/DIV).

1. Set the vertical input selector switch (AC-GND-DC) to GND. Then center the bright line by pulling the PULL AUTO knob.
2. Turn the vertical attenuator (VARIABLE) fully counter-clockwise. Adjust VR111 through the hoel on the left side of the case so that the bright line is not deflected as the attenuator VOLTS/DIV is turned.

DC BAL (2) ADJUSTMENT

This adjustment is required when the bright line moves up or down by turning the vertical attenuator VARIABLE.

1. Remove the case as described previously. For adjustment, use the auxiliary printed circuit board on the bottom. Adjust the VR402 from the top.
2. Turn the variable attenuator VARIABLE fully counter-clockwise so that the bright line is centered on the scale. Then, turn the attenuator (VARIABLE) fully clockwise. If, at this time, the bright line shifts up or down, adjust the VR402 until it stays in the center position.
3. Repeat the above procedures until the bright line is stabilized when the attenuator (VARIABLE) is rotated.

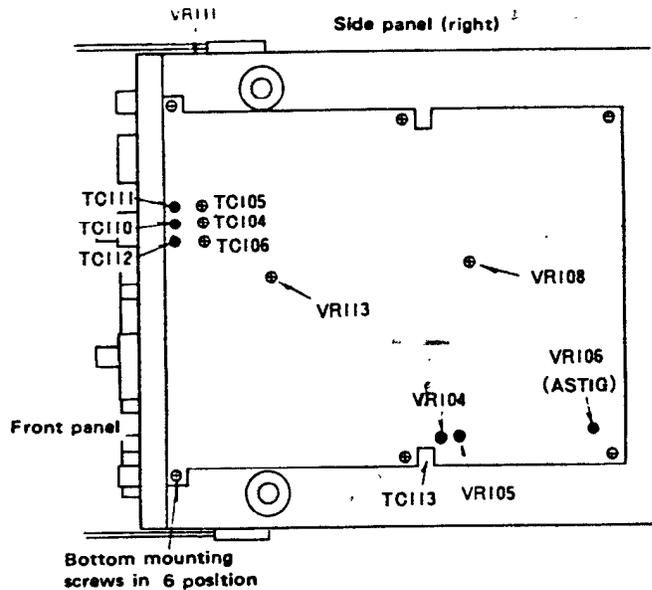


Fig. 7 Adjusting Holes on the Bottom Cover

POWER TRANSFORMER

This oscilloscope is pre-adjusted for 240V AC operation (adjustable for 100V, 120V or 220V AC operation).

VERTICAL ATTENUATOR ADJUSTMENT (VOLTS/DIV)

1. This adjustment should be made with the trimmer capacitor on the lower circuit board, which is accessible through the adjusting hoel provided on the bottom cover.
2. Connect a 1 kHz (output: 0.5V to 100V p-p) square wave signal generator to the vertical input terminal.
3. With VOLTS/DIV set to 0.1V, adjust the trimmer TC 104 until optimum square wave is obtained.
4. Next, change the range to 1V and 10V and adjust the trimmers in the same manner.

HORIZONTAL POSITION ADJUSTMENT

- To adjust the horizontal position during sweep time, proceed as follows:
Set ◀▶ POSITION to its mechanical center position and adjust VR305 (POS ADJ) on the side circuit board until the starting point of the waveform comes to the extreme left of the scale.
- When SWEEP TIME/DIV is set to EXT H, adjust VR 308 on the same circuit board so that the spot comes to the center of the scale.

SYNCHRONIZING LEVEL ADJUSTMENT

- Apply 1 kHz sine wave signal to the input. Set SYNC switch to NORM and SOURCE switch to INT.
- Adjust VR311 (TRIG ADJ) on the side circuit board so that the waveform is started at the same position on the reverse slope when SLOPE is switched to "+" and "-".

CALIBRATING VOLTAGE ADJUSTMENT

Adjust VR301 on the side circuit board for 1 V p-p of square wave calibrating output voltage.

ASTIG ADJUSTMENT

Adjust VR106 on the lower circuit board through the adjusting hole in the bottom cover to uniform the width of the waveform bright line while adjusting FOCUS. Once adjusted, no readjustment is required because ASTIG is stabilized.

HIGH VOLTAGE ADJUSTMENT

- Connect a DC voltmeter having high input impedance (more than 100M ohms) to CRT's socket terminal 1 or 3 and to the chassis.
- Adjust VR107 on the lower circuit board for a reading of -1.9kV on the voltmeter.

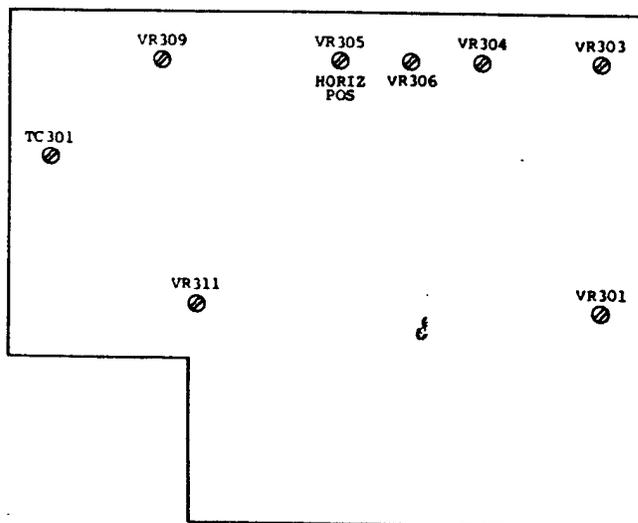
BLANKING VOLTAGE ADJUSTMENT

- By using PULL AUTO, display a bright line on the screen of CRT.
- Adjust VR108 on the lower circuit board through the adjusting hole in the bottom cover so that the bright line disappears at 9 ~ 11 o'clock position of the brightness control knob.

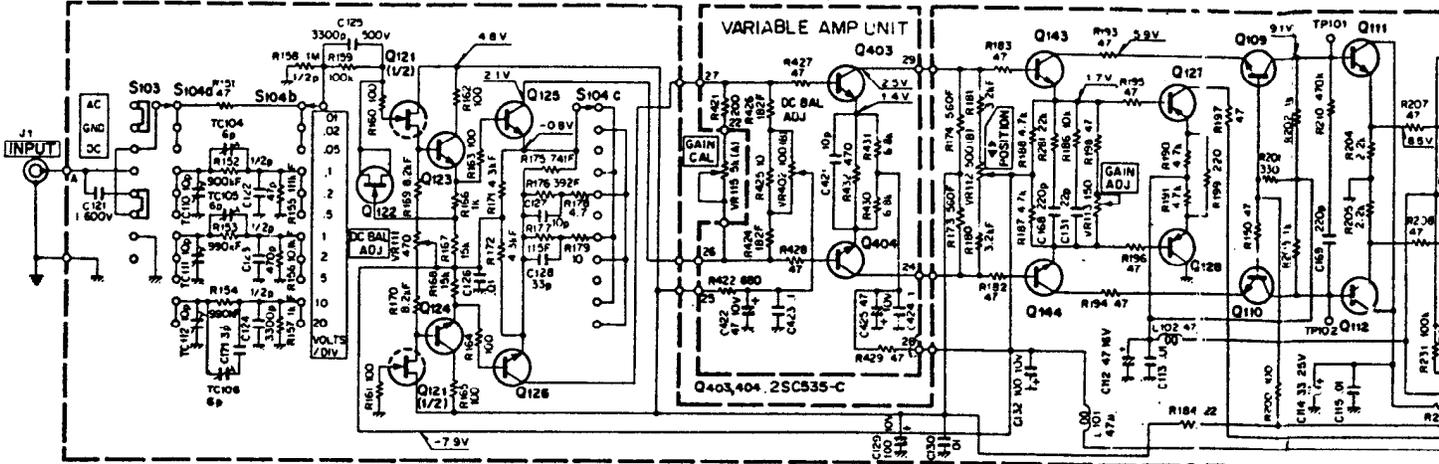
180V ADJUSTMENT

Adjust VR109 on the lower circuit board until the voltage of No. 15 pin of the connector P110 on the same circuit board reaches 180V.

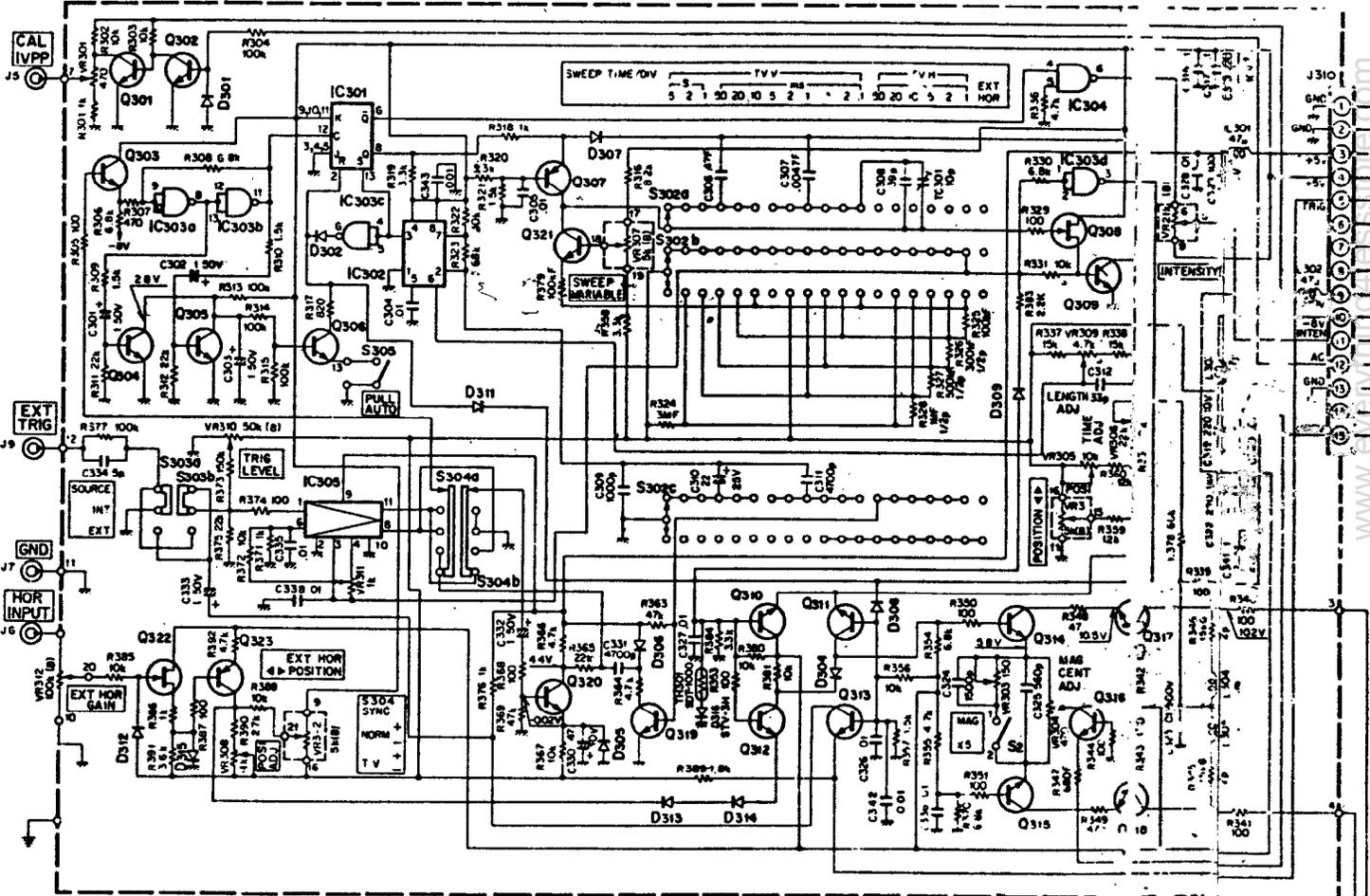
Fig. 8 Adjustment Points of Printed Circuit Board (X74)



(X65) VERTICAL AMP/POWER SUPPLY UNIT

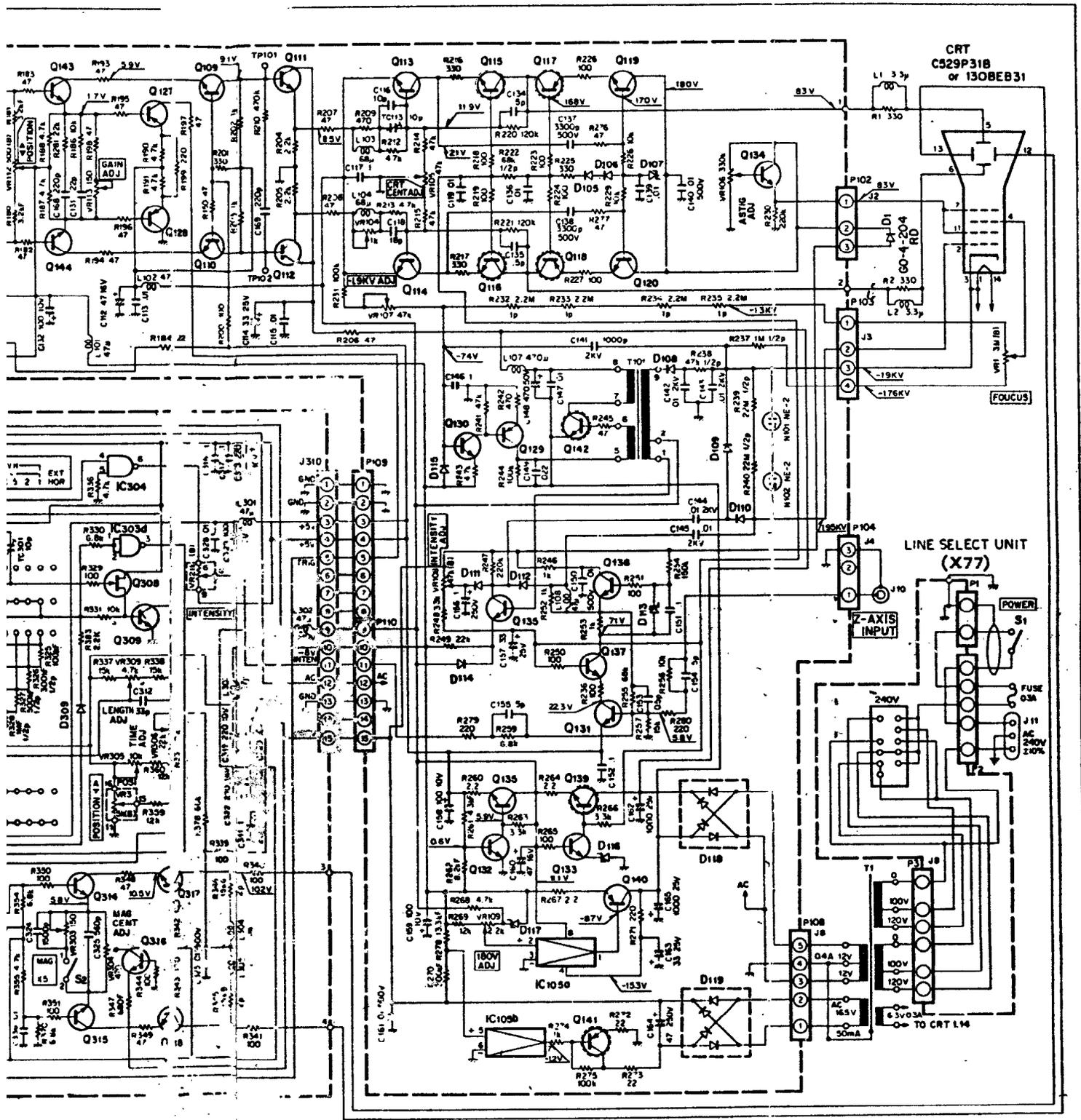


(X74) SWEEP/HOR AMP UNIT



- Q301~306, 309~316, 319~321:2SC945(P),
- Q307, 323:2SA733(Q), Q308, 322:2SK30A(O),
- Q317, 318:2SC1507, D301, 302, 304~306, 308,
- 309: 311~315:1S1555, D307:1S1587,
- IC301:TD3472AP, IC302:RC555DN,
- IC305:AN606, IC303, 304:TD3400AP

RESISTANCE VALUES IN Ω , 1/4W AND CAPACITANCE IN μ F, P, UNLESS OTHERWISE SPECIFIED

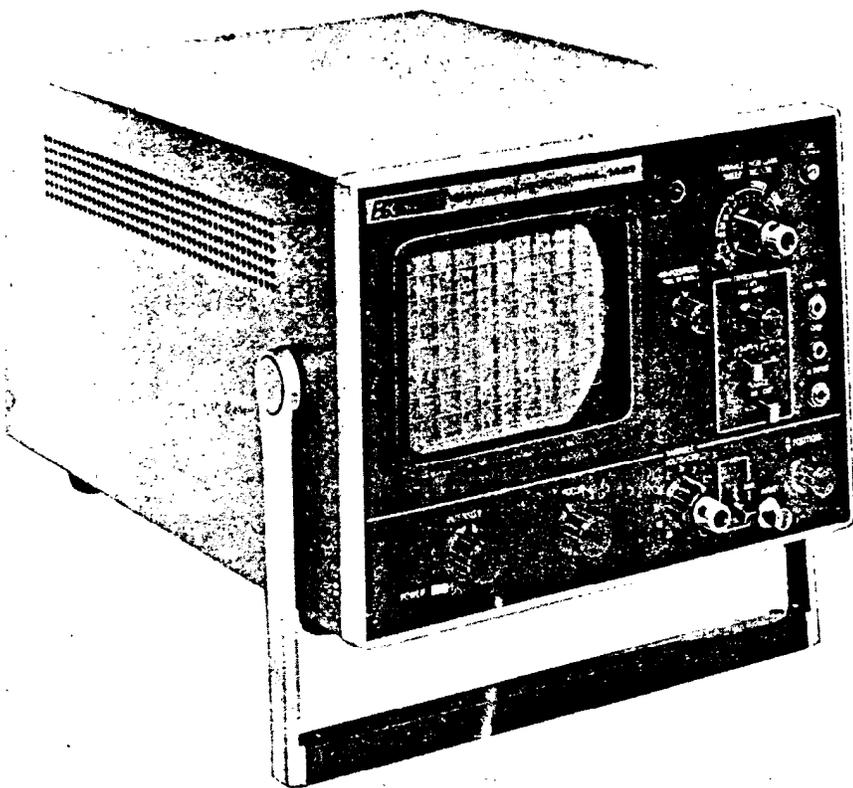


- Q 109~112, 119, 120, 123, 124, 130, 132, 133, 25C945 (P), Q113, 114, 125, 126, 131, 143, 44 : 25C535 (C), Q115, 116 : 25C1628 (Y)
- Q117, 118 : 25A818 (Y), Q121 : E412S, Q122 : 25K30A (O), Q127~129 : 25A7:3 (Q)
- Q134~137 : 25C983 (Y), Q138 : 25C1213 (C), Q139 : 25C1419 (C), Q140 : 2S1755 (C), Q141 : 2S8536 (2) LM
- Q142 : 2SD401 (M), IC105 : RC4558T
- D105, 106, 114, 115 : IS1555, D107, 116 : WZ-100, D108 : Y16JA, D109~111 : WJ6C, D112 : 1S1705, D113 : WZ-050
- D117 : WZ-090, D118, 119 : 1SQ860

DISTANCE IN μF, F, UNLESS OTHERWISE SPECIFIED

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10MHz Triggered Sweep 5" Oscilloscope



MODEL 1461

- 18 sweep range selections
- DC-10mV/cm sensitivity
- Fully regulated...calibration is accurate from 105-130 V line.
- Automatic selection of horizontal or vertical TV signals
- Built-in calibration signal
- Triggered and automatic sweep
- Built-in TV vertical and horizontal sync separation circuits

This is one scope that's equally at home in an R&D lab or on a technician's bench. Top styling and performance form a blend uncommon in this price category.

The Model 1461 offers all the advantages of triggered sweep with automatic sync plus very high 10mV/cm sensitivity. The eleven-position vertical attenuator is conveniently calibrated in 1/2/5 step sequence.

A vertical and horizontal sync separation circuits are built-in, allowing you to synchronize and expand any portion of a complex TV waveform. TVH (line) and TVV (frame) sync are switched automatically by the SWEEP TIME/CM switch. TV sync polarity is selected by an independent SYNC switch. Other time saving special features include built-in vectorscope capability, automatic triggering, and an internal 1Vp-p calibration source.

APPLICATIONS

General purpose design engineering... Medium speed logic design work... Display smallest transistor and IC signal levels with positive sync... Display "back porch" of horizontal sync with color burst information, automatically synchronized... Lock in and expand Vertical Interval Test Signal (VITS) for viewing... Accurately reproduce high frequency (3.58 MHz) color burst... Display and expand any portion of a complex TV waveform.

FEATURES

Ultra-fast writing speeds of up to .2uSEC/cm (with 5x magnification). Syncs waveform displays with amplitudes as low as 1cm p-p... DC amplifier for measurement of AC and DC signal components... Exclusive B&K-PRECISION circuit regulates high voltage on accelerating anode for sharp, bright patterns even at fastest writing speeds... 100% solid state circuitry... Front-panel Vectorscope capability—Exclusive sync separator locks sweep for jitter-free TV waveform displays... Fully regulated supply voltages—calibration applies over full input voltage range.

SEE PAGE 38 FOR PROBE INFORMATION

SPECIFICATIONS

VERTICAL AMPLIFIER
 Sensitivity: 10mV/cm-20V/cm ±5%, divided into 11 calibrated ranges, each with fine adjustment.
 Frequency Response: DC, DC-10MHz (3dB); AC, 2Hz-10MHz (-3dB).
 Rise time: 35nSEC.
 Overshoot and Ringing: 3% or less at 100KHz square wave display.
 Input Impedance: 1 megohm shunted by 22pF (± 3pF)
 Maximum input Voltage: 300VDC plus AC peak, or 600V p-p.

SWEEP
 Sweep System.: Automatic and triggered.
 Sweep Time: 1μSEC/cm-.5SEC/cm, ±5%, divided into 18 calibrated ranges (1/2/5 step sequence), each with fine adjustment.
 Magnification: 5x at all speeds; increases maximum sweep to .2μSEC/cm.

Linearity: 5SEC/cm-2μSEC/cm ranges 3% or less, 1μSEC/cm 5% or less.

TRIGGERING
 Source: Internal and external. Slope: Positive or negative, continuously variable level control (pull for automatic triggering).
 Range: 20Hz-10MHz (minimum 1.0cm deflection on CRT screen).
 TV Sync: Vertical and horizontal sync separator circuit provided so that any portion of complex TV waveform can be synchronized and expanded for viewing. TV sync polarity is selected by SYNC switch. TVH (line) and TVV (frame) sync switched automatically by SWEEP TIME/CM switch.
 TVV (Frame) = 0.5 SEC/cm to 0.1 mSEC/cm.
 TVH (Line) = 50 μSEC/cm to 1 μSEC/cm.

HORIZONTAL AMPLIFIER
 Sensitivity: 100mV/cm. Response: DC-800kHz (-3dB) (-3dB) 100

Input Impedance: 100 k ohms (nominal), shunted by 40pF.
Maximum Input Voltage: 300V (DC+AC Peak) or 600V p-p.
X-Y Operation: Y (vertical) signal supplied to scope INPUT jack; X (horizontal) signal supplied to H INPUT jack. 1V p-p square wave (±5%) at line frequency.
Intensity Modulation: 0-5 Vp-p (TTL logic-compatible). High logic-increases brightness; low logic-decreases brightness.
Input Resistance 10KΩ (nominal).
Power Requirements: 117 or 230 VAC, ±10%, 50/60 Hz, 20 watts. (3-wire line cord, CSA approved for oscilloscopes.) Calibration accuracy applies over full input voltage range.
Size: (HWD) 19 x 26 x 36 cm (7 x 10.25 x 14.5")
Net Weight: 8 kg. (17.3 lbs.)
Probes (Not included) Requires PR-31 or PR-35 combination 10:1 and direct probe.
FOR FURTHER INFORMATION, SEE PAGE 38.