

MODEL 5091

ALIGNMENT SCOPE

INSTRUCTION MANUAL

KIKUSUI ELECTRONICS CORPORATION, JAPAN

17.5.20 高倉

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# 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 provided 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.

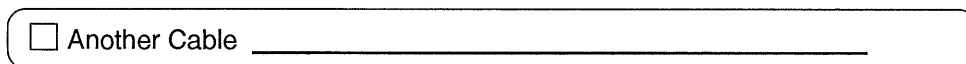
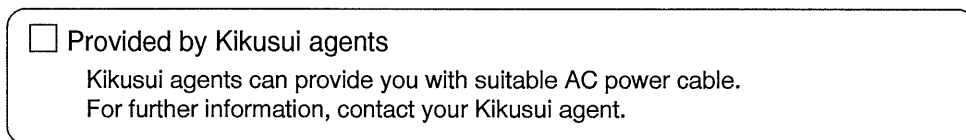
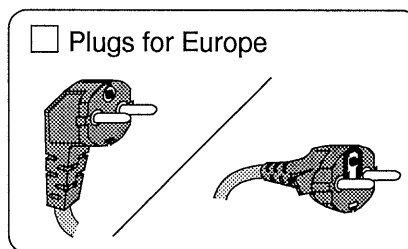
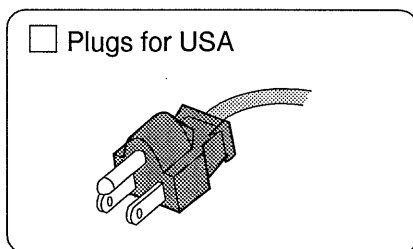
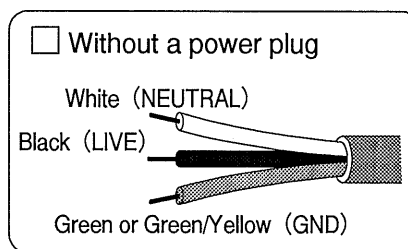
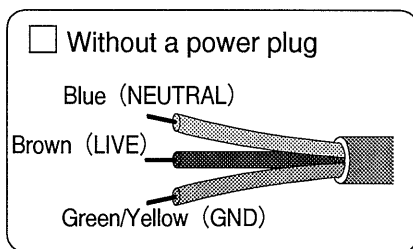


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## 1. GENERAL

Kikusui Model 5091 is an alignment scope with a 9-inch electro-magnetic deflection cathode-ray tube.

The vertical axis is sensitivity 1 mV/DIV, bandwidth 10 kHz; and horizontal axis is external sweep sensitivity 100 mV/DIV or over, bandwidth 1 kHz. Both axis are of DC-coupling. An automatic spot killer circuit is incorporated to prevent CRT screen burning. A marker signal (a pulse marker signal or an intensity modulation marker signal) can be externally applied.

The 5091 can be effectively used as an adjusting instrument on a production line of TV or radio sets as well as it can be flexibly used as a general purpose X-Y scope.

## 2. SPECIFICATION

CRT

Item	Spec.	Remarks
Type and size	Round type, 9 in.	230 BYB4
Fluorescent material	B4	
Acceleration voltage	Approx. 6.3 kV	
Effective screen area	10 DIV x 14 DIV	1 DIV = 10 mm

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Vertical Axis

Item	Spec.	Remarks
Sensitivity	1 mV/DIV, 10 mV/DIV	2 ranges
Sensitivity accuracy	Better than $\pm 5\%$ of deflection amplitude on screen, with GAIN control set in CAL position.	At the center of screen, with amplitude of 5 DIV.
Continuously-variable sensitivity adjustment	Continuously variable to zero	
Frequency bandwidth	DC: DC ~ 10 kHz AC: 3 Hz ~ 10 kHz	With 1 kHz 10 DIV as reference, within -3 dB
Input resistance	500 k $\Omega$ $\pm 30\%$	
Maximum allowable input voltage	100 V peak	DC + AC peak
Input coupling	AC, DC	Selectable with switch on panel
Vertical axis linearity	Better than 5%	
Input terminal	BNC receptacle	

Horizontal Axis

Item	Spec.	Remarks
Sensitivity	100 mV/DIV or over	Non-calibrated
Continuously-variable sensitivity adjustment	Continuously variable to zero	
Frequency bandwidth	DC ~ 1 kHz	With 100 Hz 14 DIV as reference, within -3 dB
Input resistance	500 k $\Omega$ $\pm$ 30%	
Maximum allowable input voltage	100 V peak	DC + AC peak
Input coupling system	DC	
Horizontal axis linearity	Better than 5%	
Horizontal input mode	External sweep only	
Input terminal	BNC receptacle	

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Marker Input

Pulse Marker

Item	Spec.	Remarks
Sensitivity	1 V/DIV	1 DIV or more of amplitude on screen with input of 1 V <sub>p-p</sub> pulse width 20 μsec.
Continuously-variable sensitivity adjustment	Continuously variable to zero	
Input resistance	100 kΩ ±30%	
Maximum allowable input voltage	50 V peak	DC + AC peak
Pulse polarity	Selectable with rear switch	
Input terminal	BNC receptacle	In common for intensity modulation input terminal

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Intensity Modulation

Item	Spec.	Remarks
Sensitivity	Modulation is discernible with signal of 1 Vp-p pulse width 10 $\mu$ sec or over	
Polarity	Automatic switching for both positive and negative polarities	
Maximum allowable input voltage	50 V peak	DC + AC peak
Input terminal	BNC receptacle	In common for pulse marker input terminal

Orthogonality and Deflection Distortion

Item	Spec.	Remarks
Orthogonality	Better than $90^\circ \pm 2^\circ$ at graticule center	
Deflection distortion	Better than 5% within graticule, for both vertical and horizontal axes	Including linearity

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Power Supply

Item	Spec.	Remarks
AC input voltage	100/110/117 V 200/220/234 V	±10%
Frequency	50/60 Hz	
Power consumption	Approx. 45 VA	

Dimensions and Weight

Item	Spec.	Remarks
External dimensions (maximum dimensions)	222 W x 220 H x 300 D mm (227 W x 238 H x 323 D mm)	
Weight	Approx. 8 kg	

Accessory

Item	Spec.	Remarks
Documentation	Instruction manual	1 copy
MODEL 942A terminal adapter		2

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### 3. OPERATION METHOD

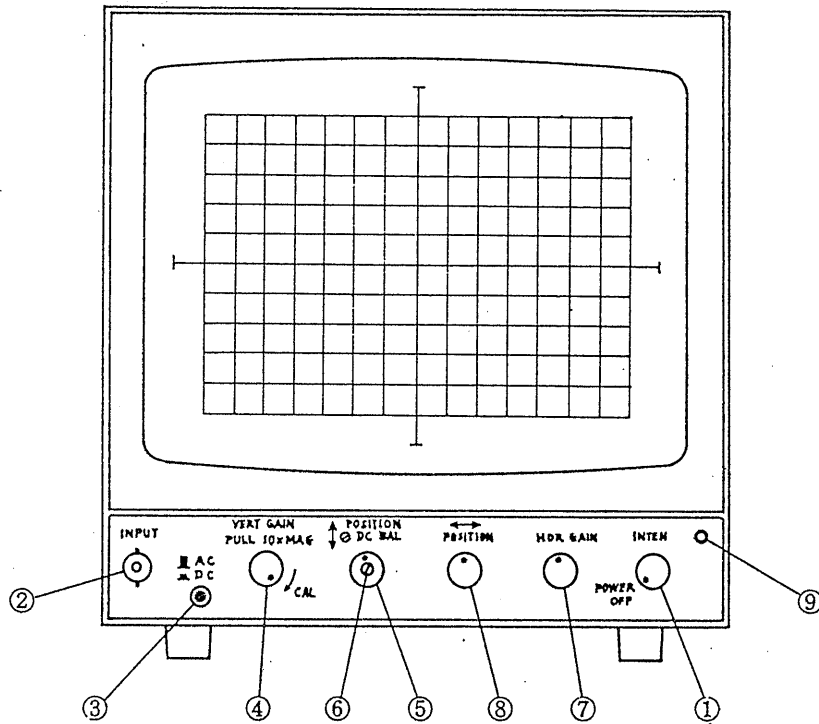


Fig. 3-1 Front panel

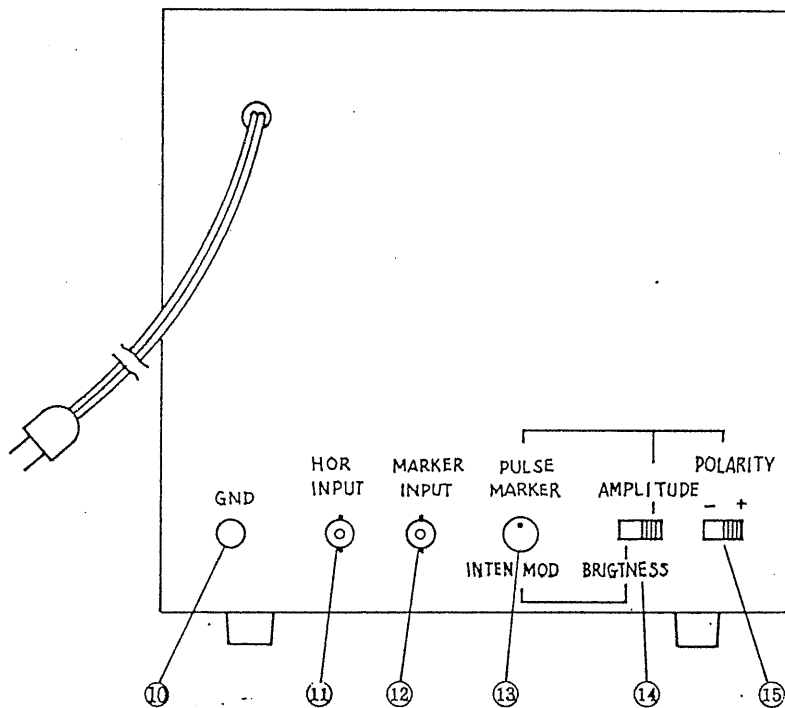








Fig. 3-2 Rear panel

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### 3.1 Explanation of Front Panel (Fig. 3-1)

- (1) INTEN                      Intensity control knob with power switch.  
POWER OFF                    Intensity increases as this knob is turned clockwise. The extreme counterclockwise position is the power OFF position.
- (2) INPUT                      Vertical input terminal.  
                                 BNC type receptacle. The vertical input connected to this terminal is fed through AC-DC selector switch and attenuator to vertical amplifier. The maximum allowable input voltage is 100 V peak.
- (3)  AC                      Vertical axis input selector button.  
 DC                      Popped up state () for AC coupling -- DC component superimposed on input is stopped and AC component alone is measured; depressed state () is for DC coupling -- for measurement of input including DC component.
- (4) VERT GAIN                   Vertical sensitivity range switch and continuously variable adjustment. Pulled-out state for 1 mV/DIV and pushed-in state for 10 mV/DIV. Extremely clockwise position is calibrated position. As turned counterclockwise, sensitivity can be continuously reduced to zero.  
 CAL
- (5)  POSITION                      Vertical positioning of trace. Trace moves upward as this knob is turned clockwise, and vice versa.

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- (6)  $\text{\textcircled{O}}$  DC BAL      Semi-fixed resistor for DC balance.  
This resistor is so adjusted that trace  
(base line) does not shift when sensitivity  
range is switched.
- (7) HOR GAIN      Horizontal sensitivity adjustment knob.  
Continuously variable to zero.
- (8)  $\longleftrightarrow$  POSITION      Horizontal positioning of trace. Trace  
moves rightward as this knob is turned  
clockwise, and vice versa.
- (9)      Pilot lamp

### 3.2 Explanation of Rear Panel (Fig. 3-2)

- (10) GND                      Ground terminal
- (11) HOR INPUT                Horizontal input terminal (BNC receptacle) connected through attenuator to horizontal amplifier. Maximum allowable input voltage is 100 V peak.
- (12) MARKER INPUT            Marker signal input terminal (BNC receptacle). Maximum allowable input voltage is 50 V peak.
- (13) PULSE    INTEN            Marker signal amplitude adjustment knob.  
      MARKER    MODU            Extremely clockwise position is maximum sensitivity position. Continuously variable to zero.
- (14) AMPLI-    BRIGHT-    Slide switch for selection between pulse  
      TUDE        NESS            marker and intensity modulation marker. Right side position is for pulse marker and left side position for intensity modulation marker.
- (15) POLARITY                Pulse marker polarity selector for  
      -    +                selection of marker polarity displayed on screen. Polarity "+" is for upward pulse on screen with positive input marker pulse, and vice versa.

### 3.3 Notes in Operation

1. If the horizontal base line does not conform with the graticule line due to terrestrial magnetism or other external cause, loosen the clamping-screw of the deflection yoke and so rotate the yoke that the lines are made parallel.
2. An automatic spot killer circuit is incorporated in order to prevent CRT screen buring when the spot is stationary. However, if the intensity knob is set deeply in a clockwise position, the spot appears on the screen overcoming the effect of the spot killer circuit. Do not leave the instrument in this state for a long time -- turn the intensity knob to a point where the spot disappears from the screen.

The CRT screen may be damaged (burnt) if the horizontal input is reduced to zero (the horizontal input is disconnected) while the instrument is operating with the maximum intensity without vertical input or if the sensitivity is reduced to zero. When there is a possibility of causing the above state, reduce the intensity beforehand.

3. The extremely clockwise position of the vertical sensitivity knob is the calibrated position.
4. The maximum allowable input voltage of the vertical axis is 100 V (DC component + AC component peak).
5. This strument can be converted to 100 V, 110 V, 117 V, 200 V, 220 V, or 234 V by means of the transformer taps. (Refer to Item 5.3 of Section 5 "Maintenance.")
6. The ambient temperature range for satisfying the specification performance is 5°C to 35°C.

### 3.4 Operating Procedure

1. Before turning-on the instrument power, adjust the control knobs as tabulated below:

INTEN (POWER OFF)	Fully counterclockwise (power OFF)
VERT GAIN	Depressed state, extremely counterclockwise position
↕ POSITION	Mid-position
HOR GAIN	Mid-position
↔ POSITION	Mid-position

2. Apply an sweep signal to the HOR INPUT terminal. Turn clockwise the INTEN knob. The instrument power is turned on and the LED (light emitting diode) in an upper right position on the front panel is turned on.
3. The trace appears in approximately 10 seconds. Adjust the trace intensity and position.
4. Connect the marker signal to the MARKER INPUT terminal (if required), set the marker selector slide switch in the AMPLITUDE or BRIGHTNESS position and adjust the marker amplitude/intensity with the PULSE-MARKER/INTEN-MOD knob.
5. If the base trace line vertically shifts when the VERT GAIN switch (SW302) is pushed in or out, so adjust the DC BAL control (R306) that the trace line does not shift. (Before this adjustment, allow approximately 30 minutes of stabilization period.)

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#### 4. CIRCUIT DESCRIPTION

Refer to the attached block diagram and schematic diagram.

##### 1. Vertical Axis

The vertical input signal is fed through the AC/DC selector switch (SW301) and attenuator (R301) to the vertical amplifier. The vertical amplifier is a differential amplifier and its gain is adjustable with semi-fixed resistors R312 and R314. The current of the final stage is controlled at approximately 300 mA with semi-fixed resistor R330.

##### 2. Horizontal Axis

In a similar manner as for the vertical axis, the horizontal input signal is fed through the attenuator (R410) to a differential amplifier. The gain is set with fixed resistors. Non-linearity is compensated for with a varistor and a semi-fixed resistor (R418). The current of the final stage is controlled at approximately 180 mA with semi-fixed resistor R413.

##### 3. Spot Killer Circuit

Part of the horizontal amplifier output is detected and the detected signal is applied to No. 1 grid of the CRT in order to cut off the electron beam. Note that the spot may appear on the CRT screen despite the spot killer circuit is operating, if the INTENSITY knob is set deeply in a clockwise position. (Refer to 3.3 "Notes in Operation.")

##### 4. Pulse Marker

The pulse marker signal is applied through the marker attenuator (R204) to the vertical amplifier. The polarity of the marker displayed on the screen can be inverted by means of the pulse marker POLARITY switch.

#### 5. Intensity Modulation Marker

The intensity modulation marker signal is applied through the marker attenuator (R204) and amplifier to the CRT cathode. The displayed trace is automatically intensity modulated either with a positive or negative marker signal.

#### 6. Power Supply Circuit

The 18 V AC secondary power of the transformer is rectified with CR101 - 104 and is regulated into +15V supply and -15V supply.

#### 7. High Voltage Circuit

The high voltage generator in the high voltage unit oscillates at a frequency of approximately 45 kHz for flyback voltage boosting. The boosted voltage is rectified and a high voltage of approximately 6.3 kV as an acceleration voltage is applied to the CRT.

## 5. MAINTENANCE

### 5.1 Adjustment Trace/Graticule of Parallelism

If the horizontal base line is not parallel with the horizontal graticule line, apply a horizontal input signal of 1 kHz, apply no vertical input, and proceed as follows:

- (1) Remove the clamping-screws of the casing and pull out the instrument chassis.
- (2) Loosen the clamping-screw of the deflection yoke at the CRT neck, and so rotate the yoke that the base trace line is made parallel with the horizontal graticule line.
- (3) Tighten the clamping-screw, with the deflection yoke being pressed toward the SCT screen as far as it goes.

#### Precautions:

- 1) Note that the high acceleration voltage is being applied to the CRT.
- 2) Do not disturb the set states of the deflection yoke centering and compensation magnet.
- 3) Pay attention so that no large vibration or shock is applied to the CRT neck.

### 5.2 Internal Adjustment

For inspection and adjustment of the internal circuits of the instrument, refer to the components layout diagram. The instrument has been critically adjusted at the manufacturer's factory. No internal circuit adjustment is required unless a circuit has become malfunctioning or a component has been replaced.

## Routine Calibration Procedure

(1) -15V

Check that the -15V supply is within a range of  $-15\text{ V} \pm 0.5\text{ V}$ .

(2) +15V

Check that the +15V supply is within a range of  $+15\text{ V} \pm 0.5\text{ V}$ .

(3) HOR BIAS ADJ (R413)

For current control of final stage of horizontal amplifier and for linearity compensation. Controls the final stage transistor current at approximately 180 mA with positioning the spot at the center of horizontal line.

(4) LINEARITY ADJ (R418)

For linearity adjustment of horizontal deflection (for compensation of linearity of trace displayed on CRT screen).

(5) VERT BIAS ADJ (R330)

For current control of final stage of vertical amplifier and for linearity compensation. Controls the final stage transistor current at approximately 300 mA with positioning the spot at the center of vertical line.

(6) VERT GAIN (R314)

Gain adjustment for 10 mV/DIV range. Must be adjusted with the GAIN knob set in the CAL position.

(7) VERT x 10 GAIN (R312)

Gain adjustment for 1 mV/DIV range. Must be adjusted with the GAIN knob set in the CAL position.

Note: Adjustments of (3), (4) and (5) above are not required unless a relative circuit component is replaced.

### 5.3 AC Line Voltage Change

The Alignment scope is shipped from the manufacturer's factory being set for AC line voltage of 100 V  $\pm 10$  V AC. To convert it for other AC line voltage of 110 V, 117 V, 200 V, 220 V, or 234 V  $\pm 10\%$ , change the transformer primary circuit taps referring to Fig. 5-1.

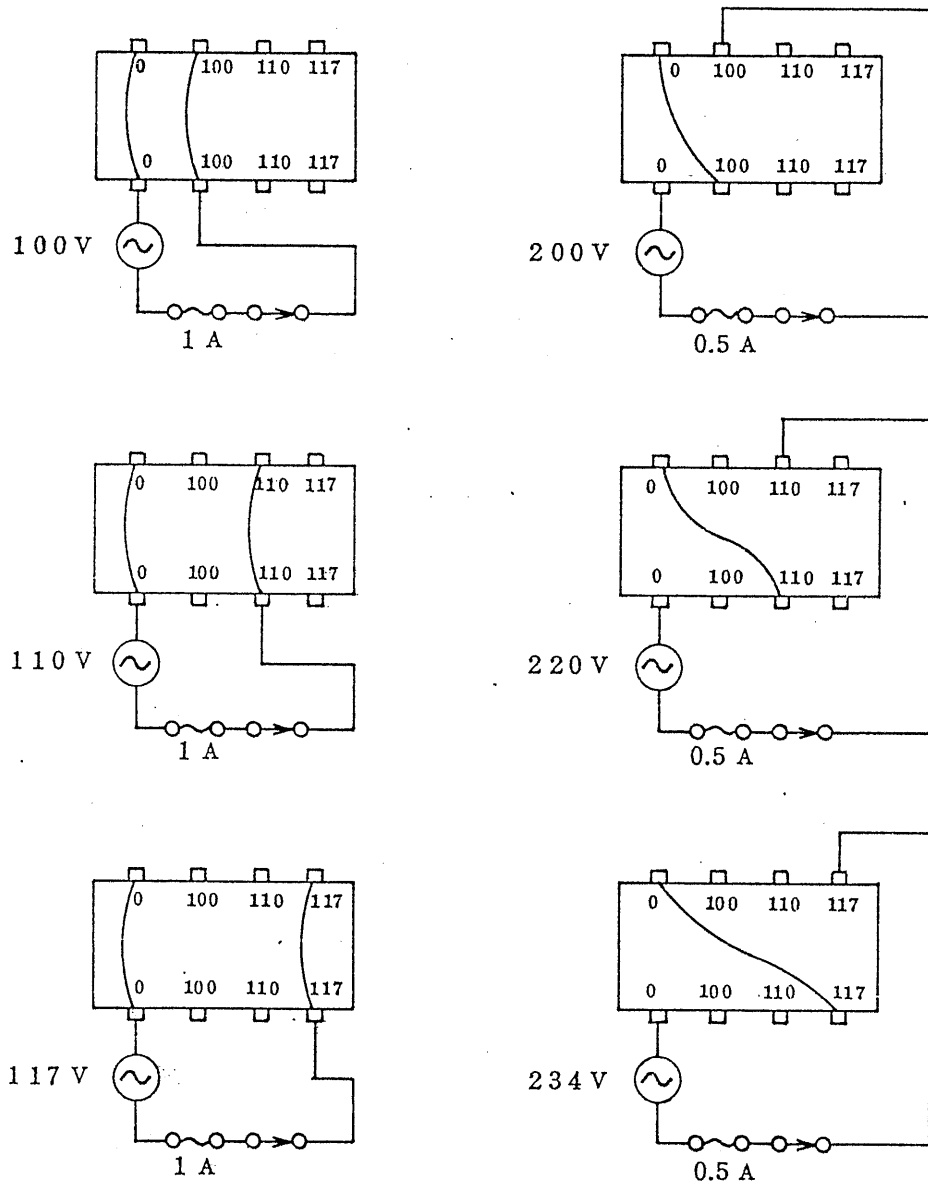


Fig. 5-1 Transformer tap connections for different AC line voltages

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5.4 Components Layout

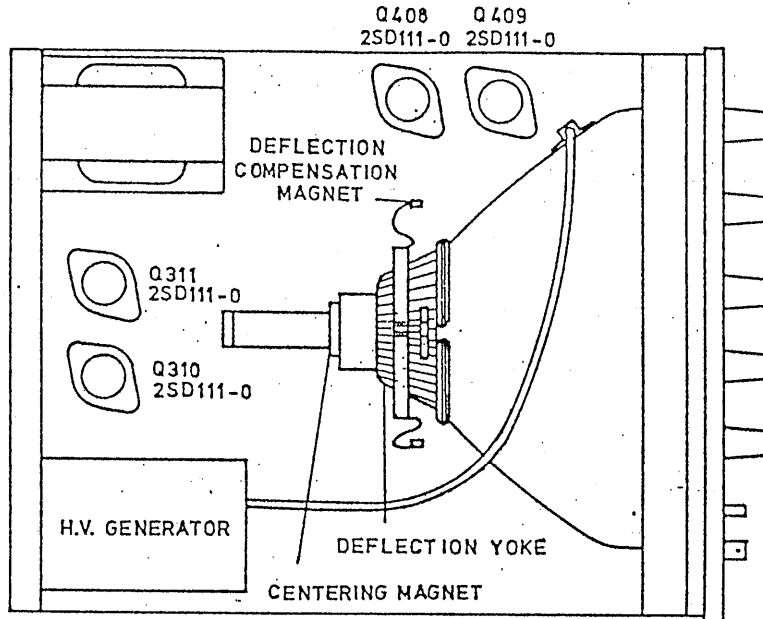


Fig. 5-2 Top view

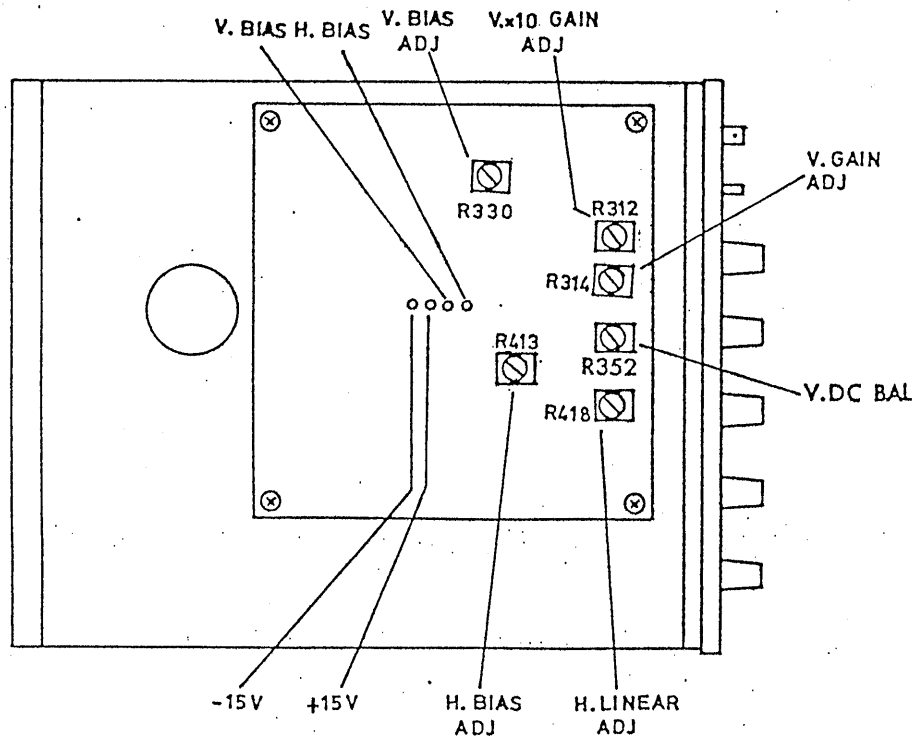
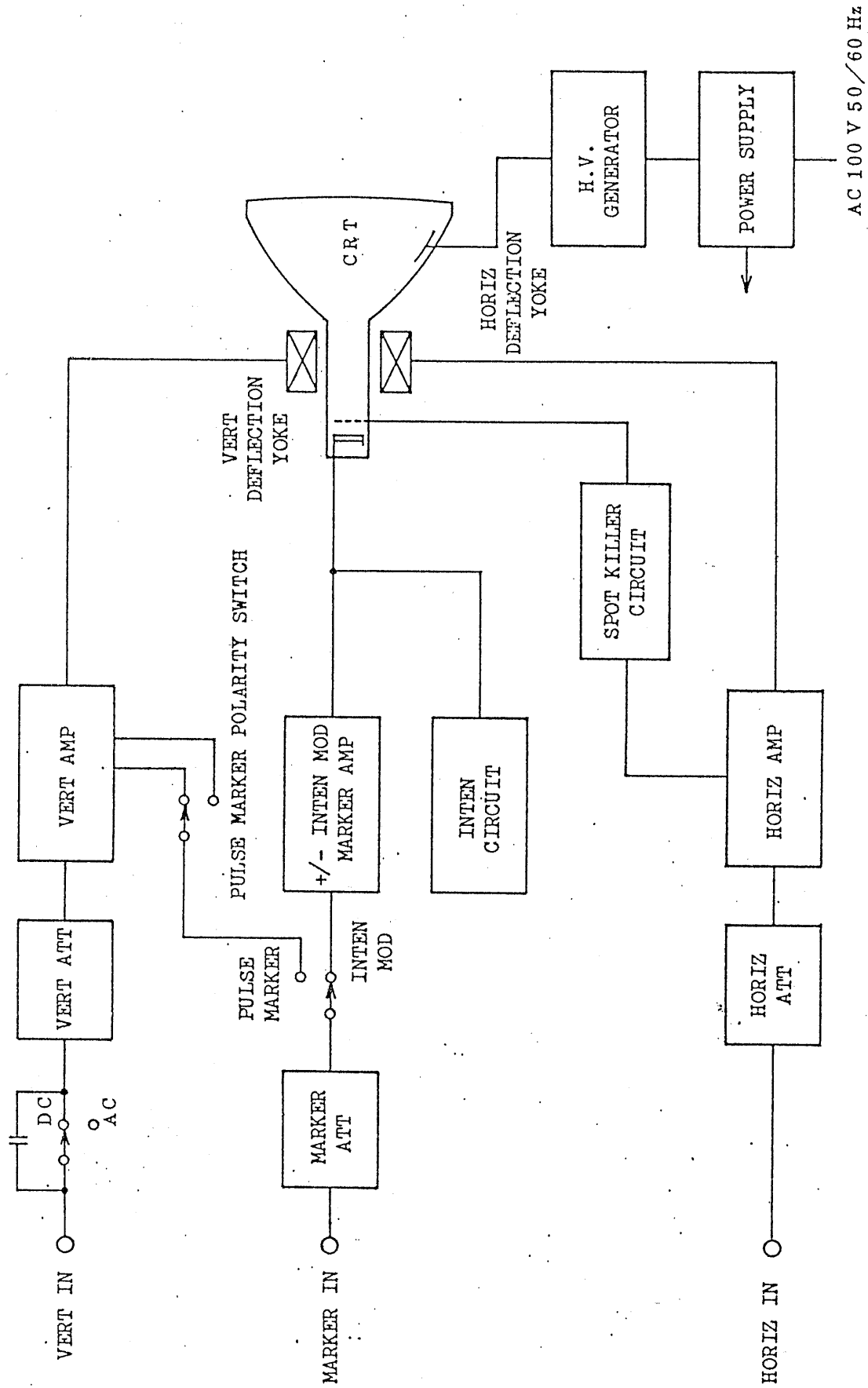


Fig. 5-3 Bottom view

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Block diagram of Model 5091