INSTRUCTION MANUAL FOR

FUNCTION GENERATOR

MODEL 457

KIKUSUI ELECTRONICS CORPORATION

TABLE OF CONTENTS

1. GENERAL

Kikusui Model 457 Function Generator produces sine, triangle, and square wave signals for a range of 0.01 to 1 MHz being divided into eight decimal ranges. The instrument employs solid state circuits and is compact and lightweight.

The frequency is controllable with an external voltage for 1000:1 within a range through VCG terminal, as well as with a dial in the regular method.

The output also is controllable with an external voltage through VCA (voltage control amplitude) terminal, as well as with an internal attenuator for a range of 0 to -60 dB.

The instrument employs such a circuitry that no substantial transients are produced in the output when waveform or range is switched and provides immediately the output of the switched waveform or frequency. The oscillation can be started simply by depressing the start button on the front panel.

Other than as a regular generator, the instrument can be used as an electron-sweep-type sweep generator having a variable range of 1000 times by applying an external sawtooth or triangle wave through the VCG terminal. Thus, the instrument is usable for wide applications including measurements of frequency response of feedback amplifiers, tests of servo systems of automatic control loops, and also can be used as an AM signal generator for measurements of characteristics of audio equipment and as a signal source for a function generator driver for analog computers.

The VCG terminal and VCA terminal are provided with mutually independent circuits, thereby enabling simultaneous FM and AM modulations.

2. SPECIFICATIONS

Frequency:	0.01 Hz ~ 1 MHz
Ranges (VCG):	x0.01, x0.1, x1 (0.01 ~ 10 Hz), x10 (0.1 ~ 100 Hz), x100 (1 Hz ~ 1 kHz), x1k (10 Hz ~ 10 kHz), x10k (100 Hz ~ 100 kHz), x100k (1 kHz ~ 1 MHz)
Dial scale:	Equal divisions, 0.5 ~ 10 (0.5 ~ 10, equally divided)
Accuracy:	±(2% + 0.5 of dial scale)
Frequency stability:	Less than ±0.5% for ±10% fluctuation of power voltage
Output waveform:	Sine (∿), triangle (⩘), square (⊓)
Maximum open output voltage:	More than 20 Vp-p
Frequency characteristics:	-0.5 dB for 0.01 Hz to 300 kHz, with 1 kHz as reference -1.5 dB for 300 kHz to 1 MHz, with 1 kHz as reference

Distortion factor (sine wave):

20 Hz - 20 kHz ..... Less than 1.5%*
20 kHz - 500 kHz ..... Less than 2%*

(*When VCA NULL knob is turned fully in the "+" direction)

Output impedance:	50 Ω
Attenuator:	0 to -60 dB, in 10-dB steps, continuously variable for more than -10 dB
Amplitude stability:	Less than ±0.5% for ±10% fluctuation of power voltage
Mutual voltage deviation:	Less than 5% with 1 kHz as reference

VCG

Controllable frequency range:	0.01 Hz ~ 1 MHz
Input frequency range:	DC ~ 10 kHz
Variable frequency range:	More than 1000:1 within one range
Control voltage:	Approx. +10 mV ~ +10 V
Input impedance:	Approx. 10 kΩ, unbalanced

VCA

Controllable frequency range:	0.01 ~ 1 MHz
Input frequency range:	DC ~ 100 kHz
Variable range:	Approx. 0 ~ -40 dB, at 1 kHz
Input impedance:	Approx. 600 Ω ~ 2 kΩ
Sync. output:	More than -5 V peak
Pulse width:	Less than 0.4 μsec
Start/stop:	Possible
Power requirements:	100 V, 50/60 Hz, approx. 21.5 VA
Dimensions:	200 (W) x 140 (H) x 380 (D) mm
(Maximum dimensions):	200 (W) x 160 (H) x 425 (D) mm
Weight:	Approx. 6.6 kg
Accessory:	Instruction manual, 1 copy

3. OPERATION METHOD

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

(1) POWER: Pushbutton-type main switch. When this switch is pushed and locked, the power is turned on and the neon lamp lights.

(2) FUNCTION: Selects output waveform for sine, triangle, and square wave. The new waveform is usable immediately after switching is made. Switching does not cause any substantial output voltage variation. Time relationships among output waveforms are of the same phase for the sine and triangle waveforms and 90 degrees lag for the square wave.

(3) FREQUENCY: (VCG OFFSET) This knob is located in the panel center and is used for continuous variation of frequency. The frequency increases as the knob is turned clockwise. When the instrument is operated in the VCG oscillation mode, the dial indicates the offset voltage (frequency) in the measuring unit of volt. When no offset function is required, the dial should be turned to the extremely counterclockwise position (mechanical zero position) so that the offset circuit is isolated.

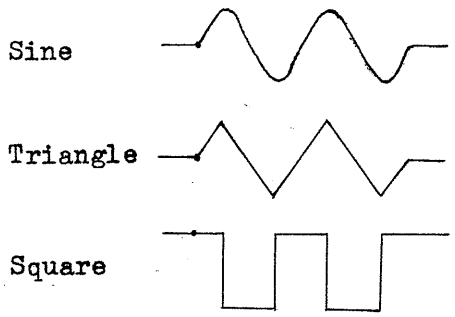
(4) FINE: (CAL'D) This knob is for fine frequency adjustment for a range of approximately 10% of the range. The frequency increases as the knob is turned clockwise. The CAL'D position corresponds to calibrated position of the FREQUENCY dial.

(5) RANGE: Selects frequency range. The product of multiplication between dial reading and selected range (0.01 Hz to 100 kHz) is the output frequency. The output voltage remains almost constant even when this switch is turned and the newly selected frequency is immediately usable.

(6) OUTPUT ATTEN: Attenuates the output voltage up to -60 dB in 10-dB steps. Since a continuously variable knob to cover 10 dB or over also is incorporated, any attenuation within the total range of 0 to -60 dB is attainable.

(7) OUTPUT: This output terminal (BNC-type receptacle) provides the oscillating output of sine, triangle, or square wave for a range of 0.01 Hz to 1 MHz. The output impedance is 50 ohms.

(8) START: Oscillation starts when this pushbutton switch is depressed and locked; oscillation stops when the switch is pressed and unlocked. The starting level and slope are as illustrated below.



Note: The above-illustrated phases are when the VCA NULL knob is set in the "+" position. When the knob is set in the "-" position, the phases are shifted by 180 degrees.

(9) VCG INPUT: This input terminal is used to apply an external voltage signal (+10 mV to +10 V) with which to control the frequency for 1000:1 within one range. Note that induction noise or FM modulation may be introduced if an undesirable signal is applied or a cable is connected to the terminal.

(10) VCA INPUT: This input terminal is used to control the output voltage with an external DC or AC voltage signal.

(11) VCA NULL: This knob is used when the instrument is used as an AM modulator. Normally the knob is set in the extremely clockwise ("+") or counterclockwise ("-") position. The phase differs by 180 degrees between the two extreme positions. The center position is for zero output voltage. AM modulation is affected by VCA gain. By means of this knob, adjustment can be made from no-modulation to 100% modulation and for balanced modulation. For balanced modulation the knob should be set in the center position.

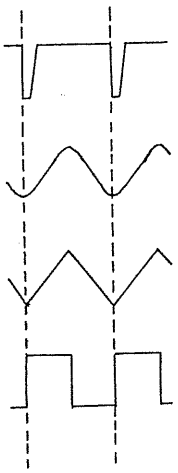
Note: When the VCA terminal is not used, waveform may be degraded if the knob is slightly turned in the "-" direction. Turn the knob fully in the "+" direction.

(12) VCA GAIN: Adjusts the modulation signal gain. The output amplitude increases as this knob is turned clockwise.

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

(13) SYNC OUTPUT: This BNC-type terminal provides an output voltage of -5 V peak of sine wave or triangle wave synchronized with the maximum negative point or of square wave synchronized with the rise point.

Sinc. pulse



Note: The phases of the illustrated waveforms are when the VCA NULL knob is set in the "+" direction. When it is set in the "-" direction, the phases are shifted by 180 degrees.

(14) FUSE: AC mains fuse.

(15) Power cord: To be connected to AC mains (100 V, 50/60 Hz).

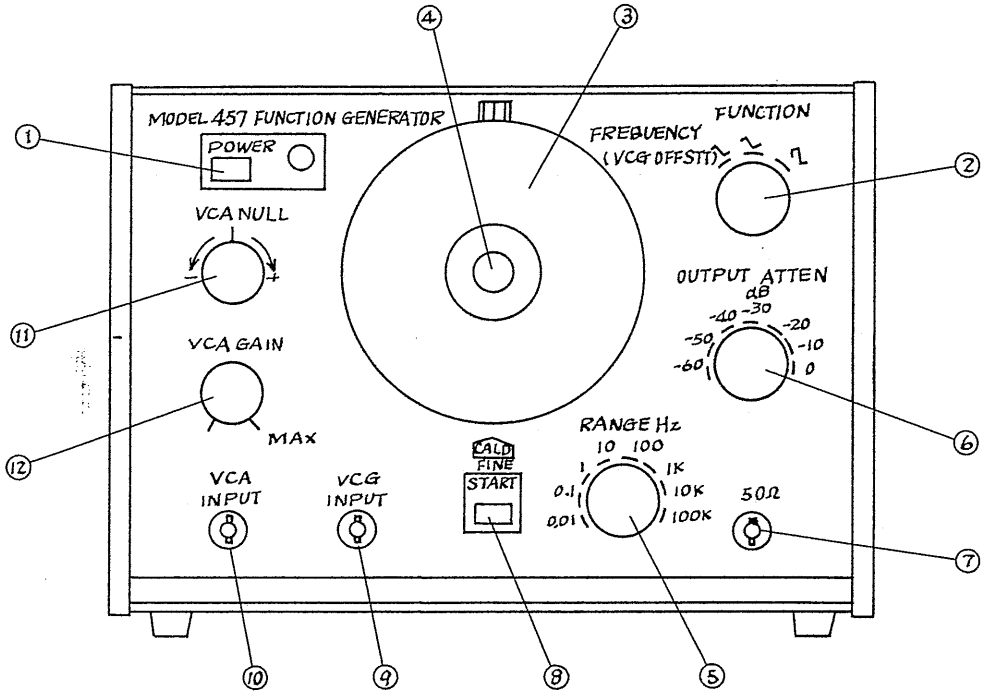

MODEL 457 FUNCTION GENERATOR
POWER
FREQUENCY
(VCG OFFSET)
FUNCTION
VCA NULL
OUTPUT ATTEN
dB
-40
-30
-20
-50
-10
-60
0
VCA GAIN
MAX
RANGE Hz
10
100
1
1K
0.1
10K
0.01
100K
CALD
FINE
START
VCA
INPUT
VCG
INPUT
50Ω
1
2
3
4
5
6
7
8
9
10
11
12

Fig. 3-1

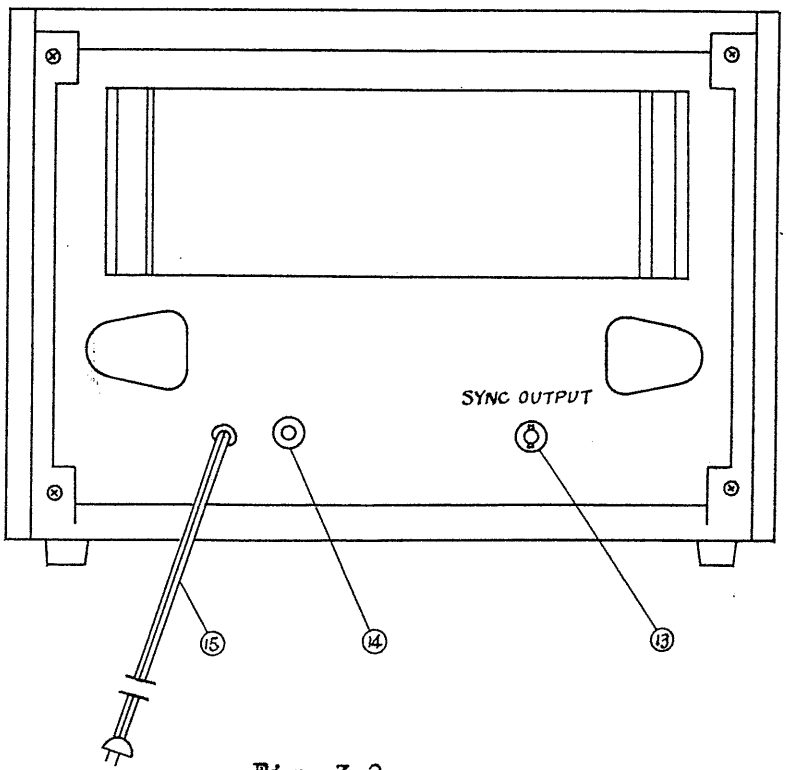

SYNC OUTPUT
13
14
15

Fig. 3-2

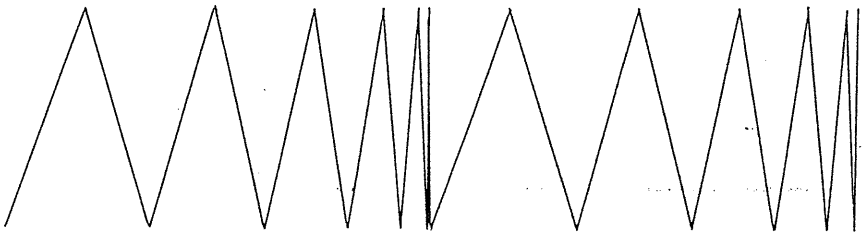
4. APPLICATIONS

4.1 Linear Sweep of 100 Hz - 100 kHz in 10-sec Repetition Period

The operating procedure is as follows:

- o Set the RANGE switch in the 10 kHz position.
- o Apply an external 10 Vp-p sawtooth signal to the VCG INPUT terminal.
- o Set the repetition period of the sawtooth wave at 10 sec. If the amplitude varies both positive and negative, apply the offset function.
- o If the amplitude is positive only, turn off the offset function by turning the dial to the extremely counterclockwise position.

Example of output waveform (triangle)



VCG
Input waveform

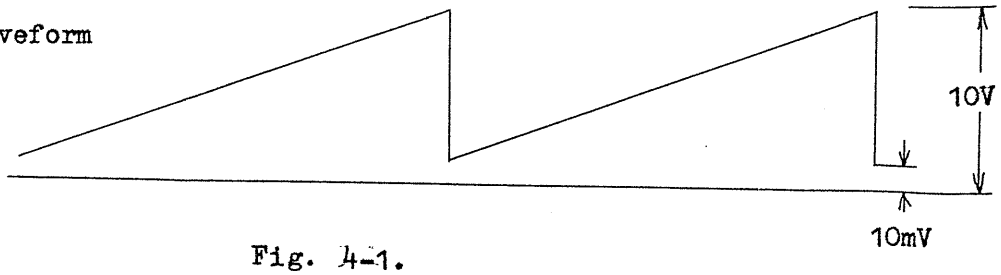


Fig. 4-1.

Other than triangle, waveforms of sine and square also can be obtained.

4.2 FM Modulation of 50 kHz ±5 kHz

The operating procedure is as follows:

- Set the RANGE switch in the 10 kHz position.
- Set the dial at 5 so that the oscillating frequency is made 50 kHz.
- Apply the modulation signal (±500 mV) to the VCG terminal. When this is done, an FM modulated signal of 50 kHz ±5 kHz is obtained. When more accurate oscillation frequency is used, calibrate the instrument with a counter and a DC power supply.

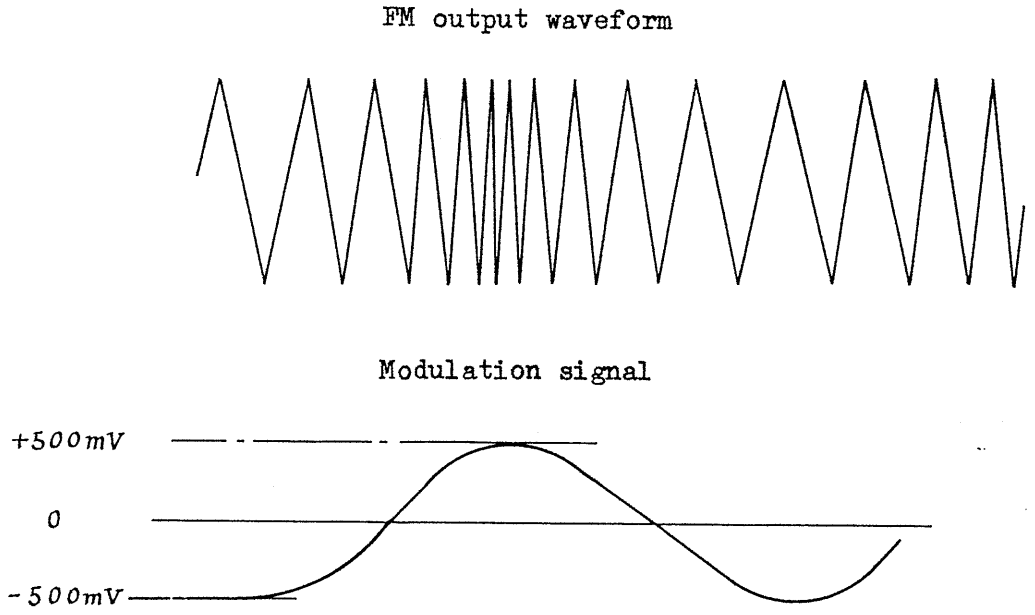
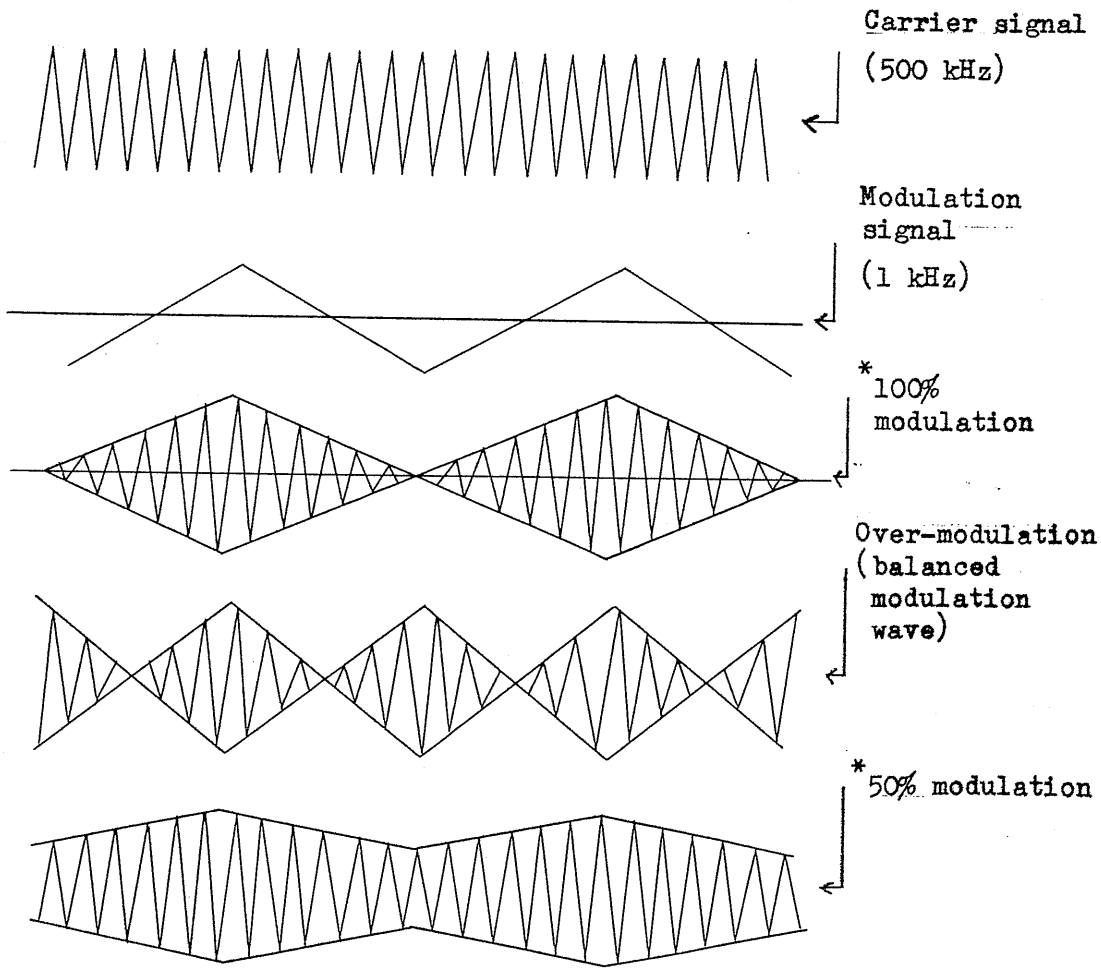


Fig. 4-2.

4.3 Application of VCA (1)

AM modulation of 500 kHz carrier with 1 kHz modulation signal:

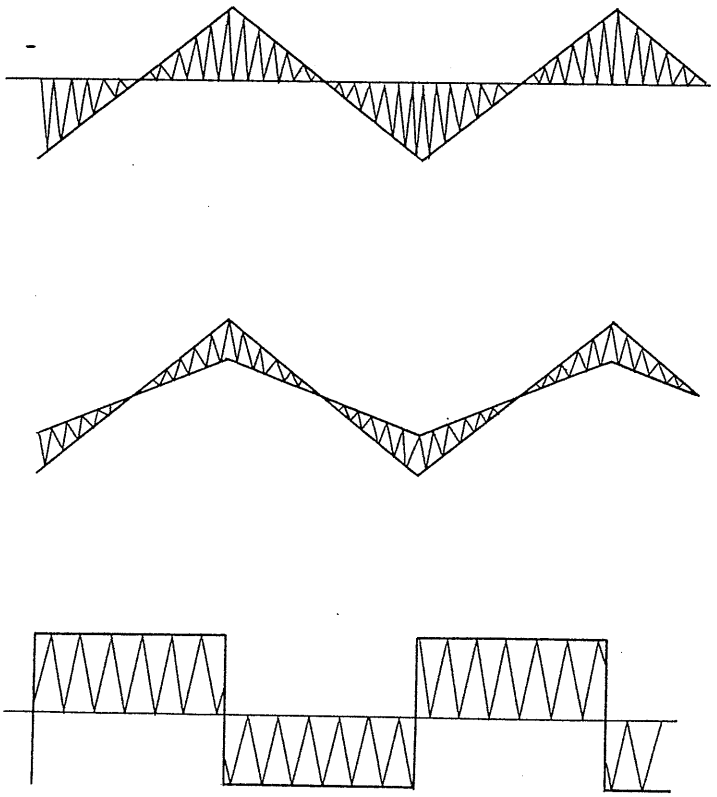
- o Set the oscillating frequency of the instrument at 500 kHz.
- o Apply an external 1 kHz signal to the VCA terminal.
- o Set the required output amplitude and modulation degree by means of the VCA GAIN and NULL adjustments. When the VCA GAIN is maintained constant, modulation degree is continuously variable to 50% modulation, 100% modulation, and over-modulation. When modulation degree is varied from 100% modulation to balanced modulation, the output is reduced to approximately a half. However, the amplitude can be increased by means of the VCA GAIN.



*: When the NULL knob is in the "-" position, the phase is inverted by 180 degrees.

4.4 Application of VCA (2)

When the instrument is used for a modulation signal, waveforms as shown below can be obtained by adjusting the VCA NULL.



(1) The waveform of (1) is obtained when the oscillating frequency of the instrument is set at 1 kHz triangle signal, the VCA is set in the NULL state, and a triangle signal of approximately 10 kHz is applied to the input terminal.

(2) The waveform of (2) is obtained by adjusting the VCA NULL under the same condition as (1).

(3) The waveform of (3) is obtained when the square wave is used instead of the triangle wave and the VCA is set in the NULL state under the same condition as (1).

5. MAINTENANCE

5.1 Internal Inspection

To gain access to the internal components, undo the four screws at the four corners at the rear of the instrument and remove the studs, and slowly pull backward and remove the side, top, and bottom panels.

Note: Note that the chassis may drop off the frame if the front surface is positioned downward by holding the instrument by its handles after the studs of the rear panel have been removed.

5.2 Components Location

For location of the major components of the instrument, refer to Fig. 5-1.

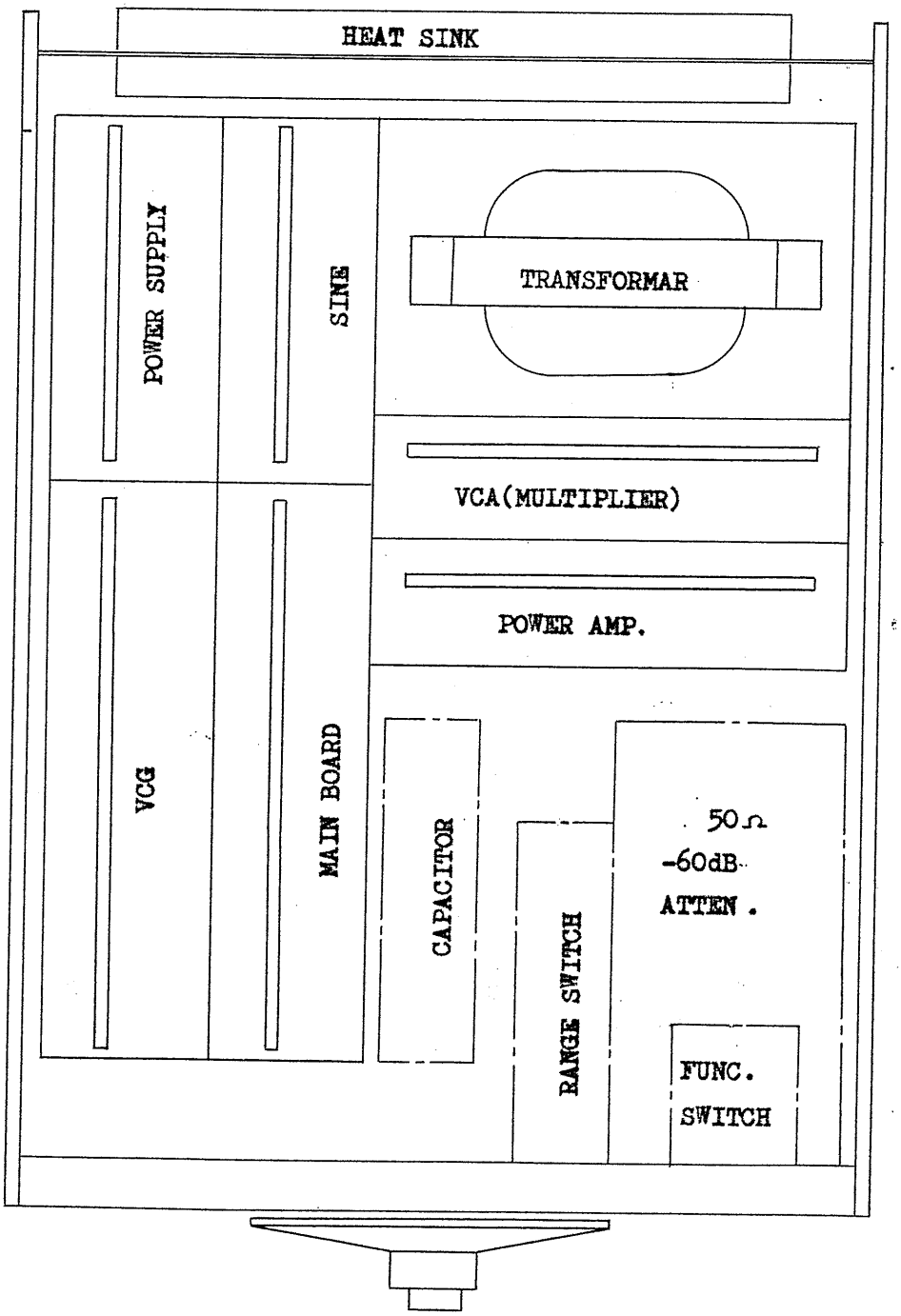

HEAT SINK
POWER SUPPLY
SINE
TRANSFORMAR
VCA(MULTIPLIER)
POWER AMP.
VCG
MAIN BOARD
CAPACITOR
RANGE SWITCH
50Ω
-60dB
ATTEN.
FUNC.
SWITCH

Fig. 5-1