

MODEL 454A
FUNCTION GENERATOR
OPERATION MANUAL

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G 1 1 4

KIKUSUI ELECTRONICS CORP.

On Power Supply Source, it is requested to replace the related places in the instruction manual with the following items.

(Please apply the item of \checkmark mark.)

- Power Supply Voltage: to _____ V AC
- Line Fuse: to _____ A
- Power Cable: to 3-core cable (See Fig. 1 for the colors.)

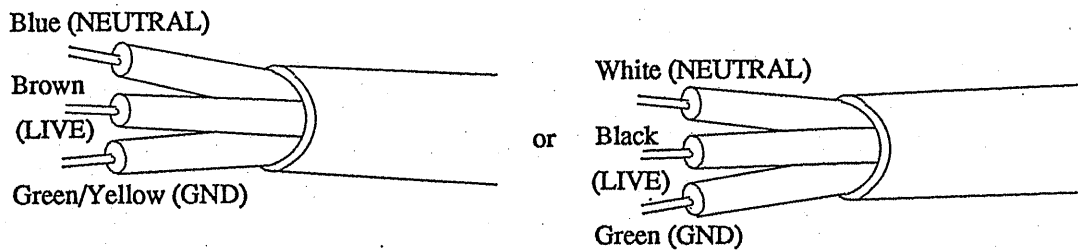


Fig. 1

Please be advised beforehand that the above matter may cause some alteration against explanation or circuit diagram in the instruction manual.

- * AC Plug: In case of Line Voltage 125V AC or more, AC Plug is in principle taken off and delivered, in view of the safety.
(AC Plug on 3-core cable is taken off in regardless of input voltages.)
To connect the AC Plug to the AC power cord, connect the respective pins of the AC Plug to the respective core-wires (LIVE, NEUTRAL, and GND) of the AC power cord by referring to the color codes shown in Fig. 1.

Before using the instrument, it is requested to fix a suitable plug for the voltage used.

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1. Outline

Type Function Generator Model 454A is an ultra-low frequency oscillator which divides sine wave, triangular wave and square wave from 0.005 Hz - 100 kHz into 7 ranges based on the decimal system and generates them.

Transistors have been adopted for all the circuits of Model 454A, resulting in compact design and light weight.

The frequency characteristics of the oscillation output voltage is essentially flat for the reason of its principle. Almost no transient is caused when wave form and range are changed over. It starts oscillating immediately with newly given wave form. By means of the start switch located on the operation panel, sine wave and triangular wave can be oscillated from (-) electric potential and square wave, from plus (+) electric potential respectively optionally.

This unit can be used for measurement on low pass characteristics of feedback amplifiers, test of servo-mechanism of automatic controllers and serve as signal source for oscillation driver. This unit can be applied to various kinds of measurements and in a very wide range.

Square wave output voltage (50 Ω terminal, at output open)	1V _{p-p} or above
Building-up time (at 50 Ω termination)	70 nsec or below
Sag overshoot (")	5% or below
Synchronous output	-10 V _{peak} or above
Pulse width	5 μ sec or below
Start. stop	Operated with control panel switch Possible

3. Operation Procedure




3-1. Description for Panel Surface

(Refer to Fig.3-1: P. 8)

(1) POWER

This is a push type power switch. When it is pushed and locked, the power will be turned on and the neon lamp, be lighted.

(2) FUNCTION

This is a change-over knob for output wave forms and  (sine wave)  (triangular wave) and  (square wave) can be taken out from it.

Simultaneously with change-over, a stable newly-changed-over wave form can be utilized. Almost no change takes place in output voltage due to wave form.

As for the correlated relations of time of respective output wave forms, sine wave and triangular waves are in-phase and the square wave is delayed at 90° as compared with the former wave forms.

(3) FREQ CONT

This is a knob for continuous variation of frequency located at panel. When it is turned clockwise, frequency will be increased.

(4) FREQ FINE

↘ CAL'D

This knob is used for fine adjustment of frequency. It has an approx. 10% variable range. When it is turned clockwise, frequency will be increased. The dial scale has been calibrated at position of CAL'D.

(5) RANGE

This is a frequency change-over switch.

The frequency of output wave form is calculated by multiplying 0.01 Hz 10 kHz by dial number.

The output voltage has no relations with frequency is almost fixed.

Simultaneously with change-over, newly-set output can be utilized.

(6) OUTPUT

This is an output voltage variable knob for sine wave, triangular wave and square wave.

When it is turned clockwise from 0, output voltage will be increased.

At 600 Ω load, 15 V_{p-p} or above can be taken out.

The output terminal is the UHF type receptacle located under the knob.

The metal terminal is connected electrically with the outer circumference of the receptacle. It is GND of the circuit.

GND terminal is floated in DC from case.

(7) OUTPUT

50 Ω This is an output voltage variable knob only for square wave.



When turned clockwise from 0, output will be increased.

This UHF type receptacle is the square wave output terminal of output impedance 50Ω.

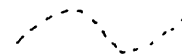
In open output, voltage of 1Vp-p can be taken out.

(8) START

This is a black color push switch. When the pilot lamp is lighted, it starts oscillating. When it is pushed once again, resulting in putting out of the lamp, it will stop oscillating.

The following are the start level and slope at the time of starting oscillating.

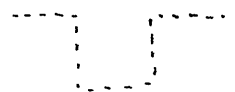
Sine wave FROM (-) ELECTRIC POTENTIAL



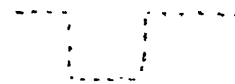
Triangular wave FROM (-) ELECTRIC POTENTIAL



Square wave FROM (+) OUTPUT VOLTAGE



Square wave (50 Ω) FROM (+) OUTPUT VOLTAGE



3-2. Description for Panel Pack (Refer to Fig.3-2: P.8)

(9) Synchronous Output Terminal

This is an output terminal by UHF receptacle. An output voltage of - 10 Vpeak which has been synchronized with the positive max. point of sine wave and triangular wave, building-down point of square wave, and building-down point of square wave (50Ω terminal) can be taken out.

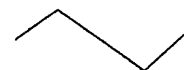
Synchronous pulse



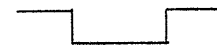
Sine wave



Triangular wave



Square wave



Square wave (50Ω terminal)



(10) GND terminal

As in the case of metal terminal located on the front panel, the terminal is connected with GND of the circuit.

(11) FUSE

This is a fuse holder used for AC power.

(12) Power cord

Connection is made AC V 50/60 Hz.

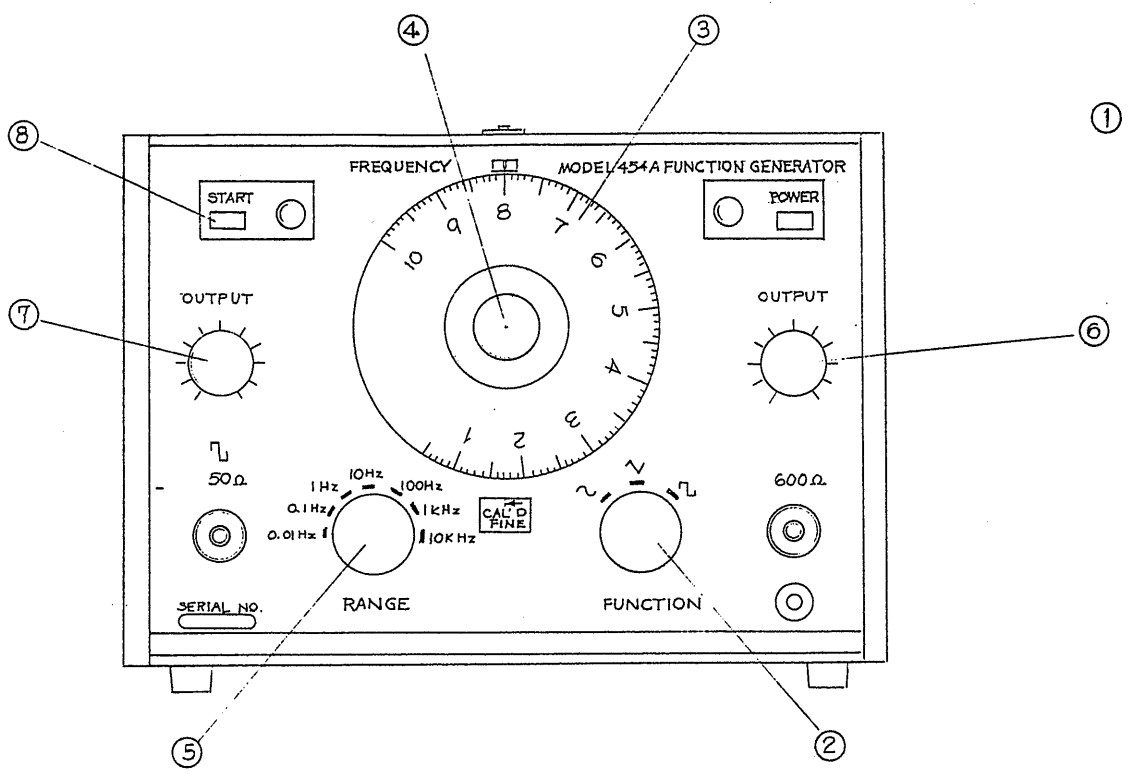
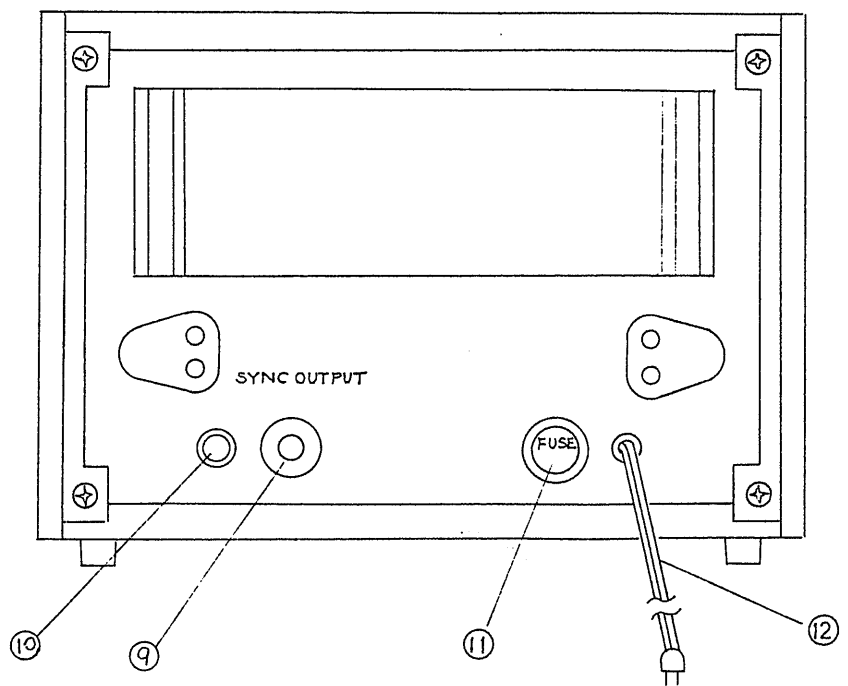


FIG. 3-1. Arrangement Plan of Panel Front

FIG. 3-2. Arrangement Plan of Panel Back



Working Principle

Fig.4-1 shows a block diagram for the working principle of 454 A type function generator.

FUNCTION GENERATOR BLOCK DIAGRAM

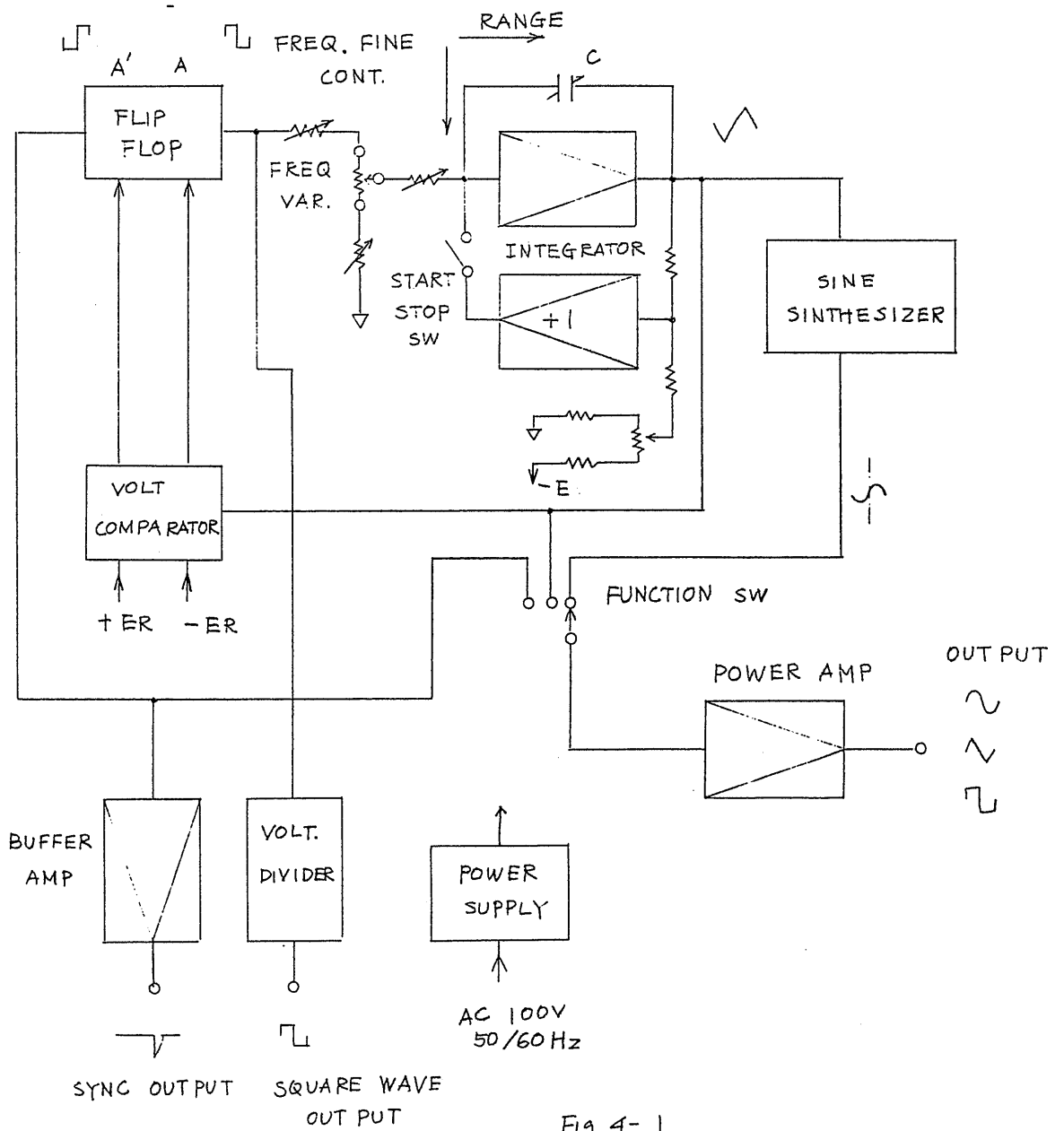


Fig 4-1

This oscillator is quite different in principle from the RC oscillator of Win Bridge and Sauture System. It is a kind of relaxation oscillator with a close circuit by flip flop, integrator and voltage comparing device. Its action is as follows.

In Fig.4-1, the output A of flip flop which is reversed to negative or positive is assured to be negative.

The output is divided with the potentiometer for variation of frequency and added to the integrator. The integrator consists of a high gain d-c amplifier and negative feed back to input at capacitor C from output.

The integrated output increases gradually with a fixed inclination according to size of input voltage and integrating time constant for time because input voltage is negative.

The integrated output voltage enters a voltage comparing device and compared with the preset reference voltage $+ E_r$. When it is equal, a trigger pulse is generated, resulting in reversal of flip flop.

Due to its reversal action, the output A of flip flop is turned to positive voltage and integrated in the same way. And, its output voltage drops.

When the dropping voltage reaches $- E_r$, the trigger pulse is generated by the comparing device and the flip flop will be reversed again to its original condition.

When the above-mentioned action is repeated, the oscillating condition will continue.

Accordingly, the range of oscillated frequency is changed over by capacitor C and register R and it can be varied by changing the volume of integrating voltage with potentiometer.

Then, the triangular wave is made to be sine with the sine wave synthesizer by tangential approximation employing diodes and its amplitude is adjusted together with the triangular wave of the integrator output and square wave made of flip flop.

Then, it is amplified at output amplifier and turned to be output voltage.

5. Maintenance

5-1. Inspection of Inside

Remove the 4 screws shown in Fig. 5-1 and take off the legs. Pull out the side plates at both sides, upper plate and bottom plate gently backwards.

Thus, inspection can be made on the inside of the unit.

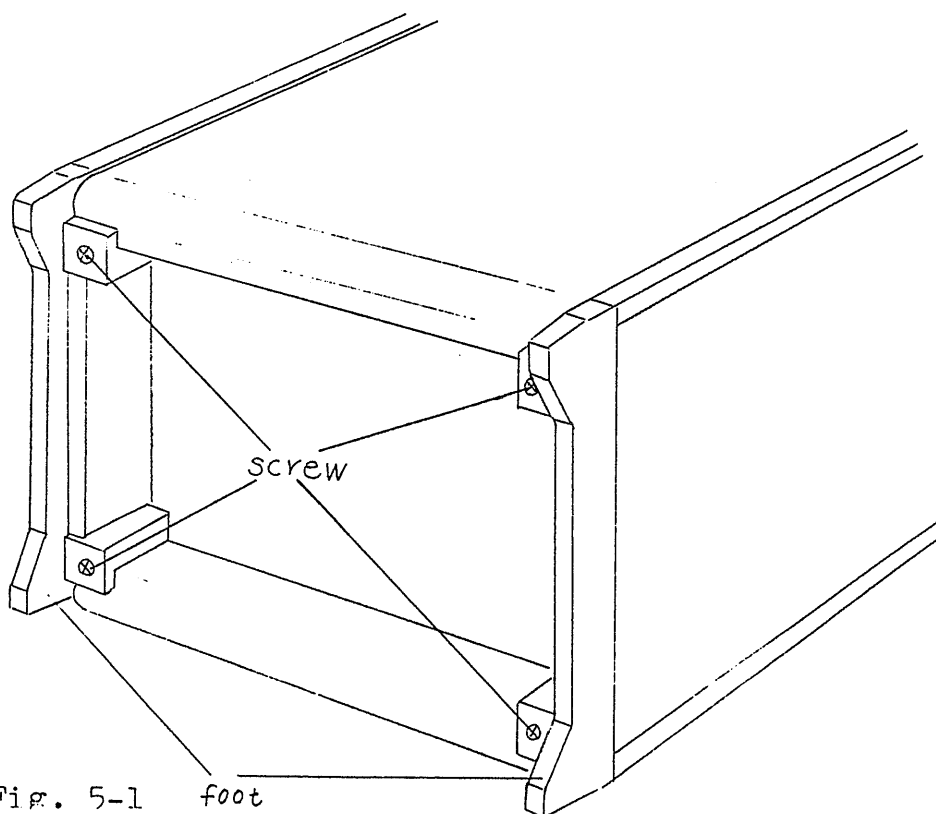


Fig. 5-1 foot

CAUTION

With the foot of the back plate removed, if the panel front is inclined with the handle, the upper plate is removed from the frame. Attention must be paid to this point.

5-2. Arrangement

Figs. 5-2, 5-3 ~ , 5-9 shows the arrangement of main parts of this unit.

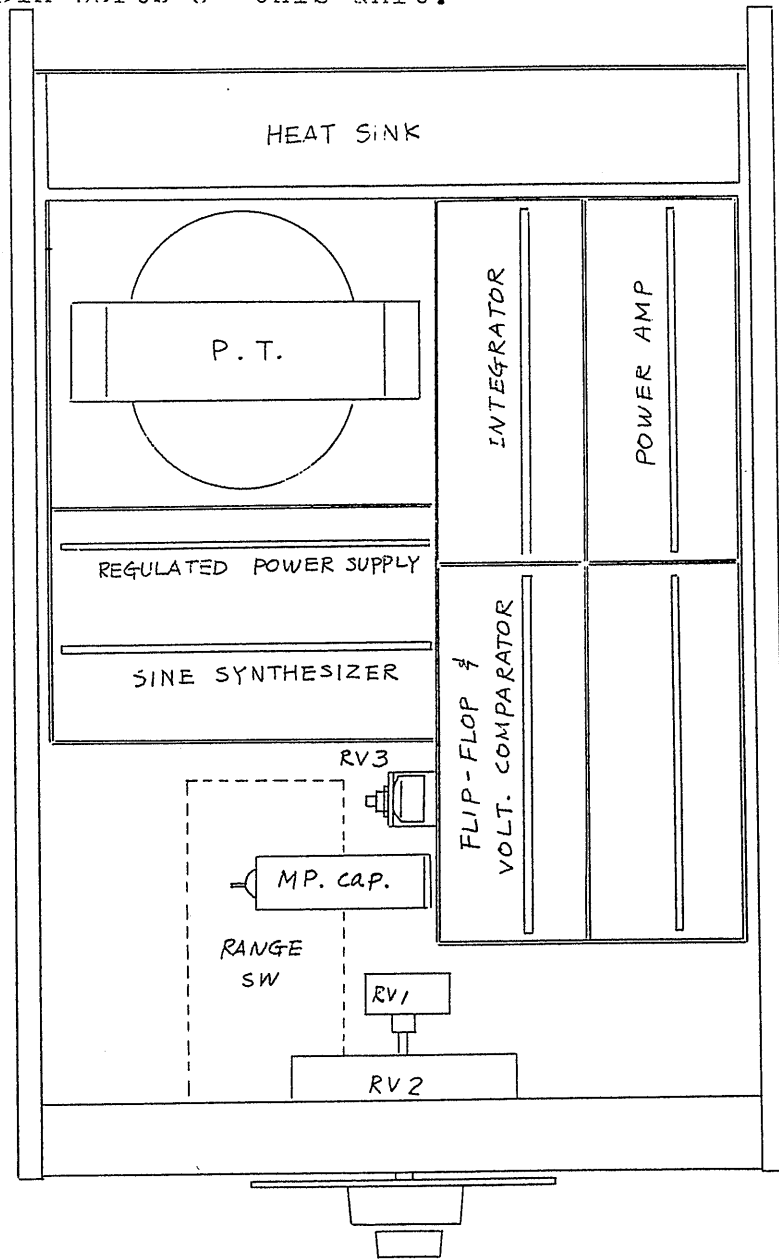


Fig.5-2. Arrangement Plan for Parts

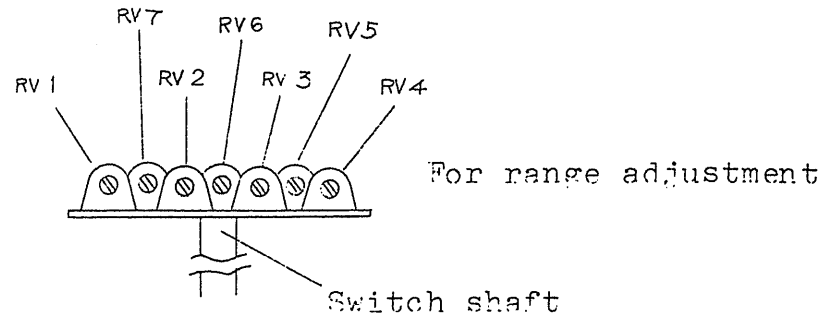


Fig.5-3. Arrangement Plan for Parts

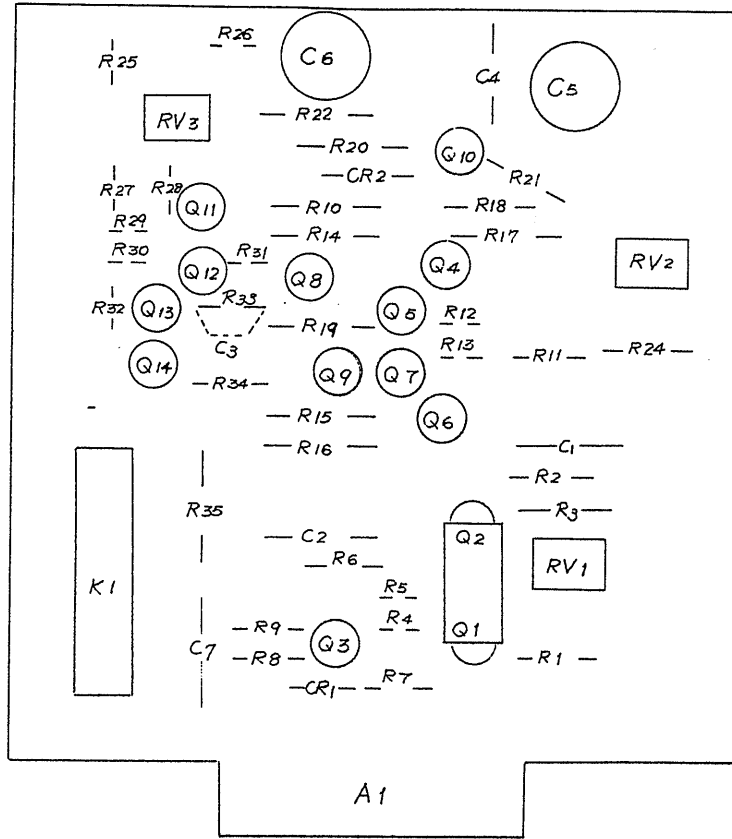


Fig.5-4 Integrator

- RV1 DC balance
- RV2 Adjustment of amplitude for triangular wave output
- RV3 Adjustment of start. level

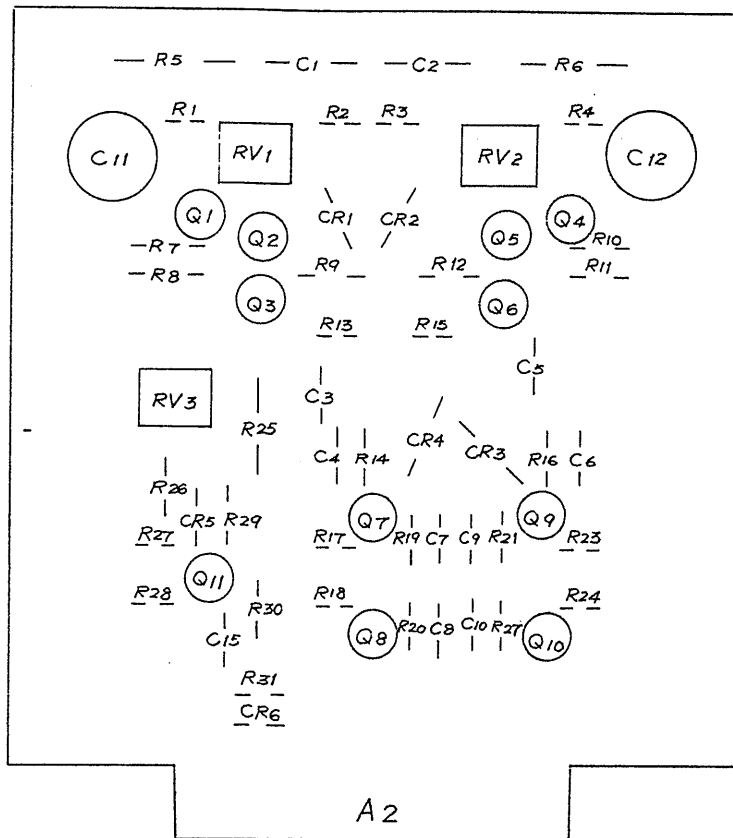


Fig.5-5. Flip flop voltage comparing device synchronous pulse

- RV1 Adjustment of triangular wave (+) amplitude
- RV2 Adjustment of triangular wave (-) amplitude
- RV3 Adjustment of square wave output amplitude

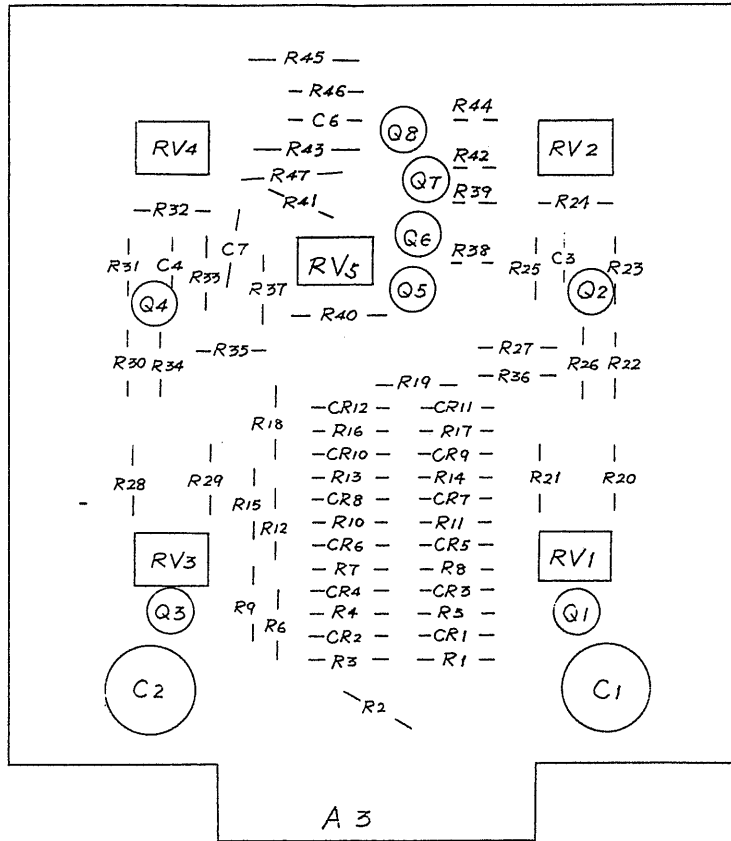


Fig.5-6 Sine Wave Synthesizer

- | | |
|-----------|------------------------------------|
| RV1 - RV4 | Adjustment of sine wave distortion |
| RV5 | DC balance adjustment |

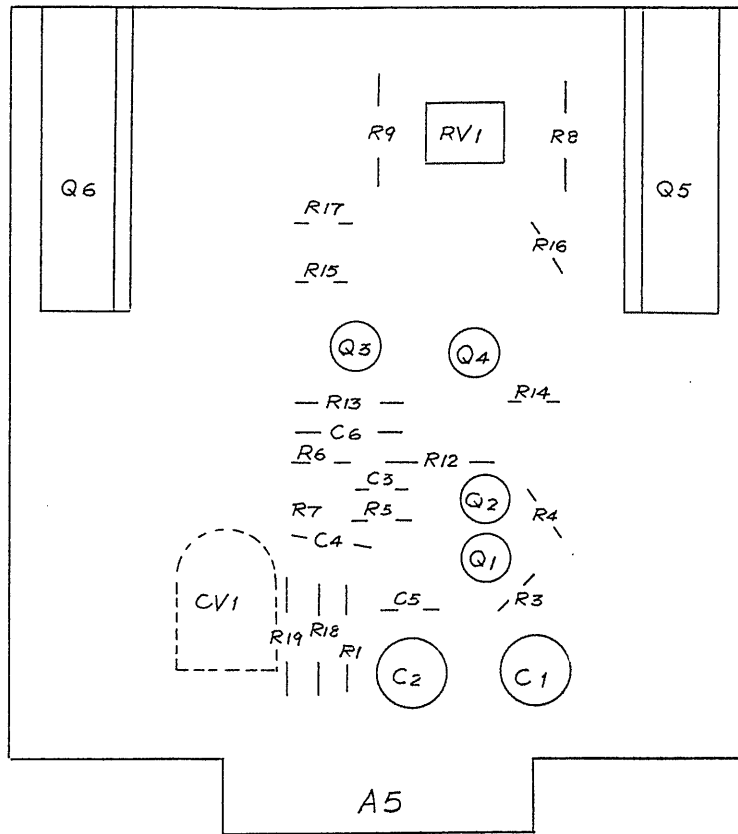


Fig. 5-7 Power Amplifier

- RV1 (Sine wave, triangular wave, square wave) DC balance adjustment
- RV2 (Ramp wave) DC balance adjustment
- CV1 Adjustment of wave form distortion

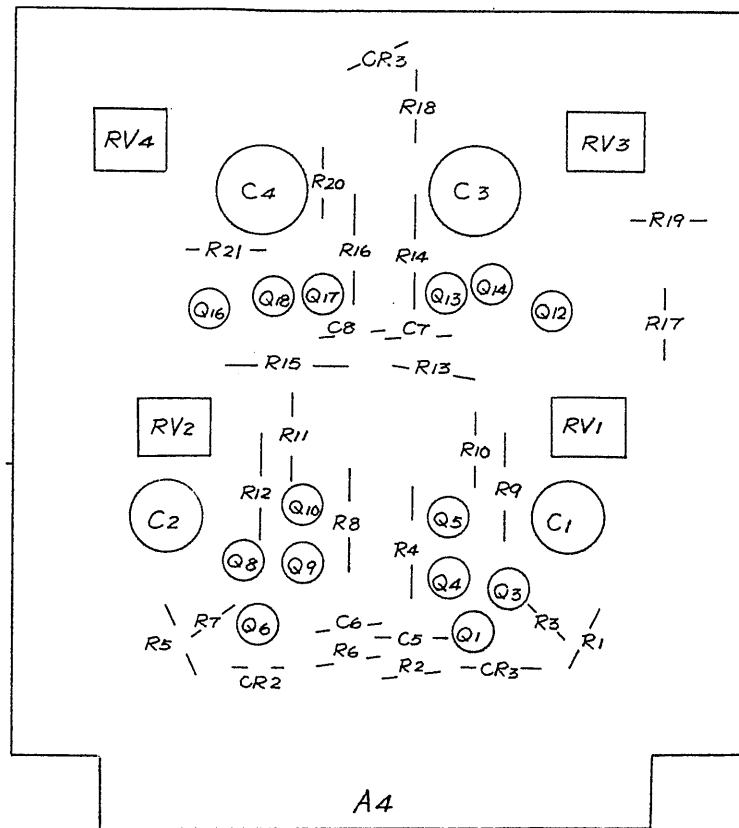


Fig. 5-8. Power Part

- | | |
|-----|--------------------|
| RV1 | (+) 25V adjustment |
| RV2 | (-) 25V adjustment |
| RV3 | (+) 15V adjustment |
| RV4 | (-) 15V adjustment |

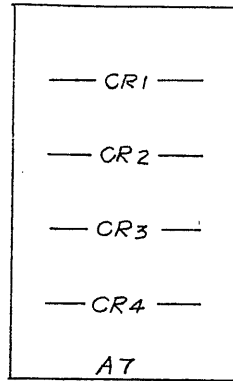


Fig.5-9. Rectification Part