INSTRUCTION MANUAL

AUTO COMPRESSOR

MODEL OP-4600

KIKUSUI ELECTRONIC CORPORATION

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 ☐ mark.)

☐ Power Supply Voltage: to _ _ _ _ _ V AC

☐ Line Fuse: to _ _ _ _ _ A

☐ Power Cable: to 3-core cable (See Fig. 1 for the colors.)

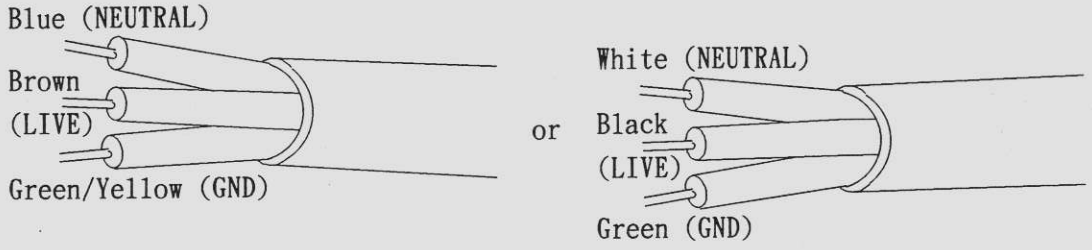

Fig. 1

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

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* 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. GENERAL

This instrument is an optional unit of the sweep generator for a function of automatically keeping constant the output signal voltage.

The instrument has a frequency range of 20 Hz to 20 kHz and has an automatic gain compression function from 0 dB to 40 dB in 10-dB steps.

The controllable input level range is as wide as from -80 dBv to +10 dBv. High and low limit level indicator lights are provided for ease of gain adjustment. The maximum output voltage is 5 V rms or over and the output impedance is low--a very convenient feature when actually operating the instrument.

The instrument has been designed for such purposes that, when testing frequency response of microphones, a constant sound pressure can be obtained by compensating for the frequency response characteristics of the speaker used for the test, and that an output signal with low output resistance can be obtained.

2. SPECIFICATIONS

Instrument name:	Auto Compressor
Model No.:	OP-4600
Correction frequency range:	20 Hz - 20 kHz
Correction signal input	
Input resistance:	100 kΩ approx.
Input level:	-80 dBv to +10 dBv
Gain ranges:	0 dB - 20 dB, 20 dB - 40 dB, and 40 dB - 60 dB
Compression	
Ranges:	0 dB, 10 dB, 20 dB, 30 dB, and 40 dB
Accuracy:	±1 dB (at 0 dB - 30 dB, 1 kHz)
Response speed:	SLOW and FAST (selectable)
Compressed output signal	
Output current:	Approx. 2 A max.
Output voltage:	5 V rms max. or over (at compression 0 dB, 1 kHz)
Frequency response:	Within ±0.3 dB with reference to 1 kHz (compression 0 dB)
	Within ±2 dB with reference to 1 kHz
Regulation:	±0.5% or better for ±10% line voltage change
Distortion factor (at 0 dB compression)	
20 Hz to less than 100 Hz:	2%
100 Hz to 20 kHz:	1.5%
Operating ambient temperature:	5°C to 35°C (41°F to 95°F)

Power requirements:	100 V, 50/60 Hz AC, approx. 14 VA (Main Unit 4600)
Weight:	Approx. 1 kg (2.2 lbs)
Accessory:	Instruction manual 1

3. OPERATION METHOD

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

(1) AUTO LEVEL: Main switch for Auto Compressor operation which starts operating when this switch is depressed and locked. The output terminal of the Main Unit (Model 4600 Sweep Generator) is used in common for the Auto Compressor also, with the output resistance changed to a low output resistance from the 600-ohm resistance when in the 4600 operation. (Before switching to the Auto Compressor operation, reduce the output to the minimum.)

(2) COMP INPUT: This compression signal input terminal accepts a signal of frequency 20 Hz to 20 kHz and level -80 dBv to +10 dBv.

(3) LEVEL: These HIGH and LOW lights (LED's) indicate whether the signal applied to the COMP INPUT terminal (2) is within the acceptable level or not. The LOW light turns on if the input signal level is too low or the HIGH light turns on if it is too high. When the input signal level is normal, both lights are off. (Note, however, that both lights may turn on when the input signal frequency is low.)

(4) GAIN SET VARIABLE: Sets a gain for the signal applied to the COMP INPUT terminal (2). The outer dial selects one of the three ranges covering 0 dB to 60 dB. The inner knob is for continuously-variable adjustment. These dial and knob must be so set that both LEVEL lights (3) are off. The relationships between GAIN SET values and COMP VOLTAGE RANGE values are shown in the following table:

GAIN SET (dB)	COMP VOLTAGE RANGE (dB)			
	10	20	30	40
0	+10 dBv	0 dBv	-10 dBv	-20 dBv
20	-10 dBv	-20 dBv	-30 dBv	-40 dBv
40	-30 dBv	-40 dBv	-50 dBv	-60 dBv
60	-50 dBv	-60 dBv	-70 dBv	-80 dBv

(5) COMP VOLTAGE RANGE: This compression voltage range dial selects a compression range in 10-dB steps for a total range of 0 dB to 40 dB. When set at 0 dB, an output voltage of 5 V rms maximum is delivered.

(6) RESPONSE: Selects the response speed between SLOW and FAST.

(7) OUTPUT: This output voltage adjustment dial controls the output voltage. When the COMP VOLTAGE RANGE switch (5) is set at 0 dB, the output voltage is continuously-variable for a range of 0 to 5 V rms maximum. The output signal is delivered to the output terminal (BNC type) below this dial. The output circuit is switched between main unit (Model 4600 Sweep Generator) output and Auto Compressor output with the AUTO LEVEL switch (1). To the output terminal, connect a load of higher than 4 ohms.

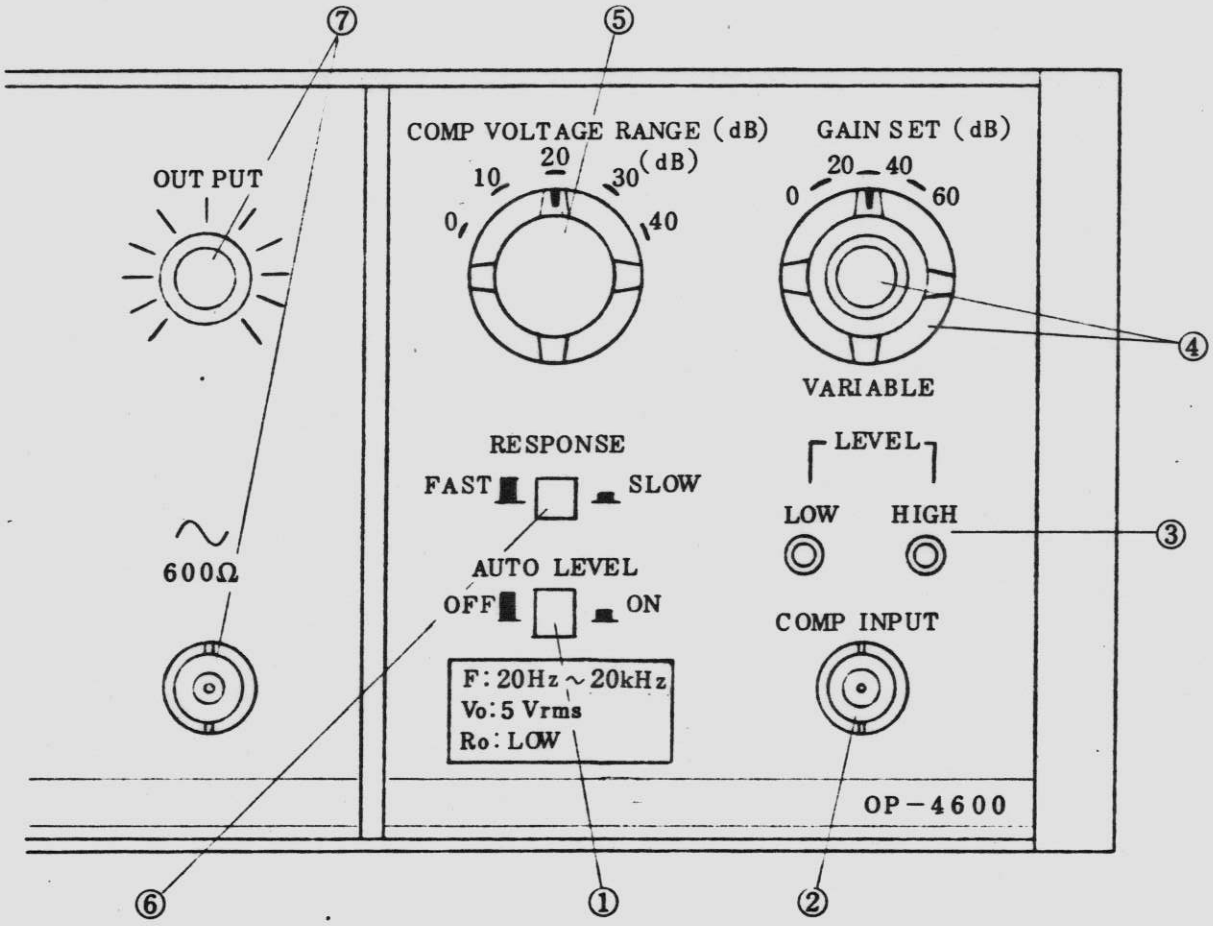


Figure 3-1. Front panel

3.2 Notes for Operation

(1) Do not connect to the COMP INPUT terminal an input voltage higher than +10 dBv (3.16 V rms).

(2) Note that the resistance of the load connected to the output terminal must be higher than 4 ohms.

(3) Before switching to the Auto Compressor operation, be sure to make the output voltage minimum (turn the OUTPUT dial to the counterclockwise extreme position).

(4) Do not detach the OP-4600 Auto Compressor without turning off the power of the 4600 Sweep Generator.

(5) Do not operate the instrument in a place where is not well ventilated, is subjected to direct sunlight or radiation from a source of heat, or where is highly humid or dusty.

(6) Note that the input signal level is within a range of +10 dBv to -80 dBv and the instrument is set at an appropriate operation level.

3.3 Example of Measurement

An example of measurement of frequency response of a microphone for a range of 20 Hz to 20 kHz is explained in this section.

3.3.1 Measure the frequency response of the speaker and determine the compression gain and reference frequency.

(1) Set the MODE switch of the 4600 to WIDE and the sweep mode to CONT.

(2) Set the FREQ RANGE switch of the 4600 to WIDE "1".

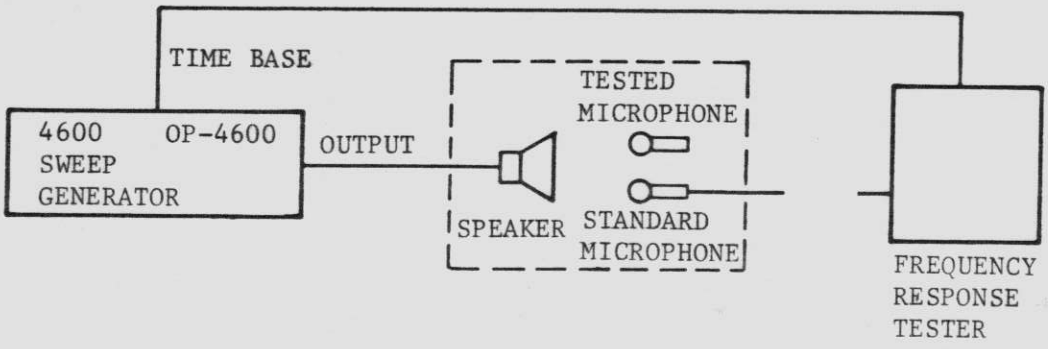
(3) Set the LOWER FREQ dial of the 4600 to "20".

(4) Set the UPPER FREQ dial of the 4600 to "20k".

(5) Set the output voltage at minimum (turn the output voltage adjustment dial to the counterclockwise extreme position) and press the AUTO LEVEL switch to operate the Auto Compressor.

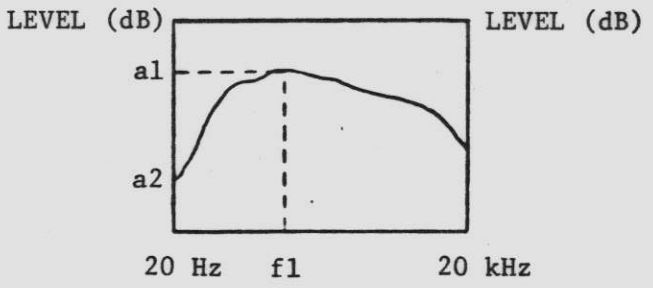
(6) Set the COMP VOLTAGE RANGE switch at 0 dB.

(7) Connect a speaker to the output terminal. Connect a standard



(8) Set a sweep time with the SWEEP TIME switch and VARIABLE knob of the 4600.

(9) Increase the output voltage and measure the frequency response of the speaker.



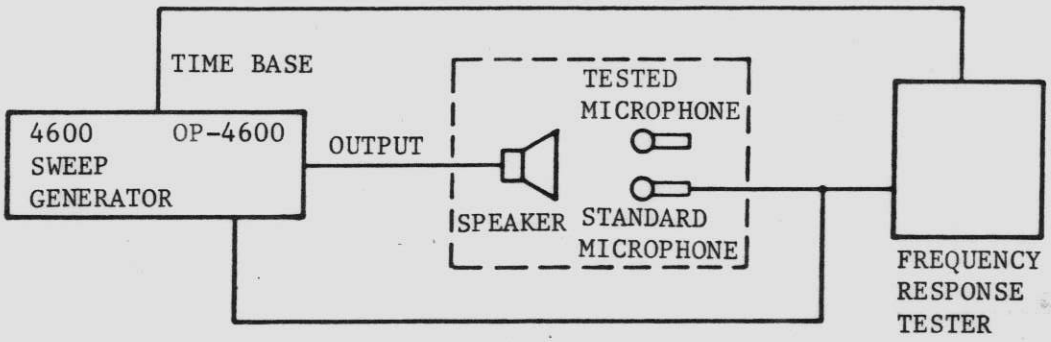
(10) From the above test on the speaker, it can be known that the required compression gain is the difference between the maximum sound pressure point (a1) and the minimum sound pressure point (a2), that is, (a1 - a2) dB. The reference frequency is f1 of the maximum sound pressure point a1.

Assuming that (a1 - a2) = 25 dB, the COMP VOLTAGE RANGE switch should be sent at 30 dB. (Explanation hereunder is done assuming that the compression gain is 30 dB and the reference frequency is 1 kHz.)

3.3.2 Check that the speaker is producing a constant sound pressure.

(1) Set the 4600 in the DIAL sweep mode.

(2) Set the output voltage at the minimum (turn the output voltage adjustment dial to the counterclockwise extreme position). Connect the standard microphone to the COMP INPUT terminal of the OP-4600. (Connect the standard microphone also to the Frequency Response Tester.)



(3) Set the COMP VOLTAGE RANGE switch at 30 dB.

(4) Set the LOWER FREQ dial of the 4600 at "1k".

(5) Turn the output voltage adjustment dial to the clockwise extreme position.

(6) Adjust to an optimal level the input signal of the COMP INPUT terminal with the INPUT RANGE dial and VARIABLE knob.

(7) Set the LOWER FREQ dial of the 4600 at "20".

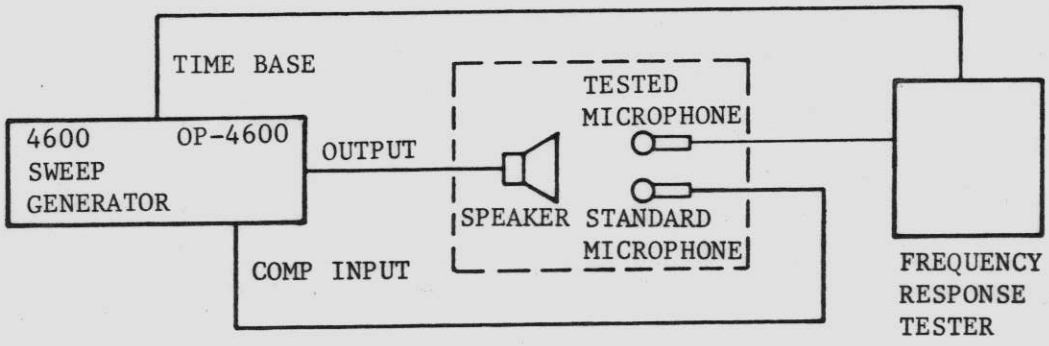
(8) Set the 4600 in the CONT sweep mode and check whether the speaker is producing sound at a constant pressure or not.

(9) If the speaker is producing a constant sound pressure, perform the procedure of 3.3.3.

(10) If the speaker is not producing a constant sound pressure due to insufficient compensation, perform the procedure of 3.3.4, using Model 8520 Frequency Response Tester in conjunction.

3.3.3 Measure the frequency response of the microphone.

(1) Disconnect the standard microphone from the Frequency Response Tester and connect the tested microphone in its stead to the tester.

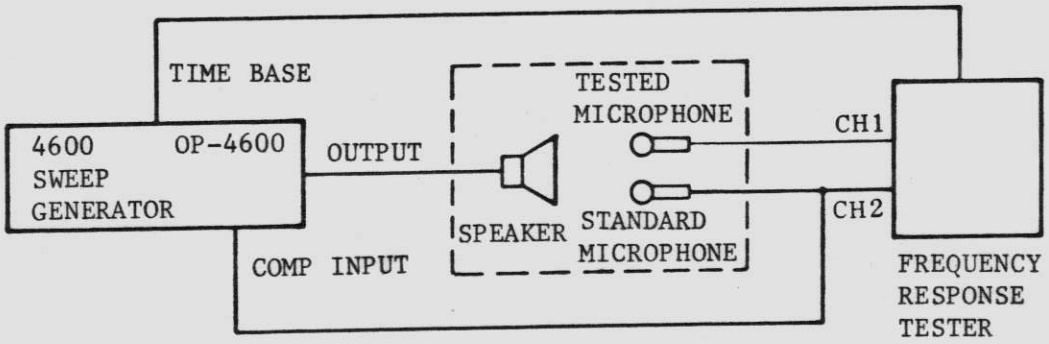


(2) The Frequency Response Tester will display the frequency response characteristics of the tested microphone.

3.3.4 Measure the frequency response of the microphone.
(When the sound pressure produced by the speaker is unable to be compensated for at a constant pressure)

(1) Connect the tested microphone to the CH1 input terminal of Model 8520 Frequency Response Tester.

(2) Connect the standard microphone to the CH2 input terminal of Model 8520 Frequency Response Tester.



(3) Set the VERT MODE switch of the 8520 in the "CH1 - CH2" position for frequency response compensation.

(4) The frequency response curve of the tested microphone will be displayed on the 8520.

4. OPERATING PRINCIPLE

4.1 Instrument Construction

Model OP-4600 Auto Compressor consists of preamplifiers, AC-DC converter, comparator, compressor, output amplifier and other circuits as shown in Figure 4-1.

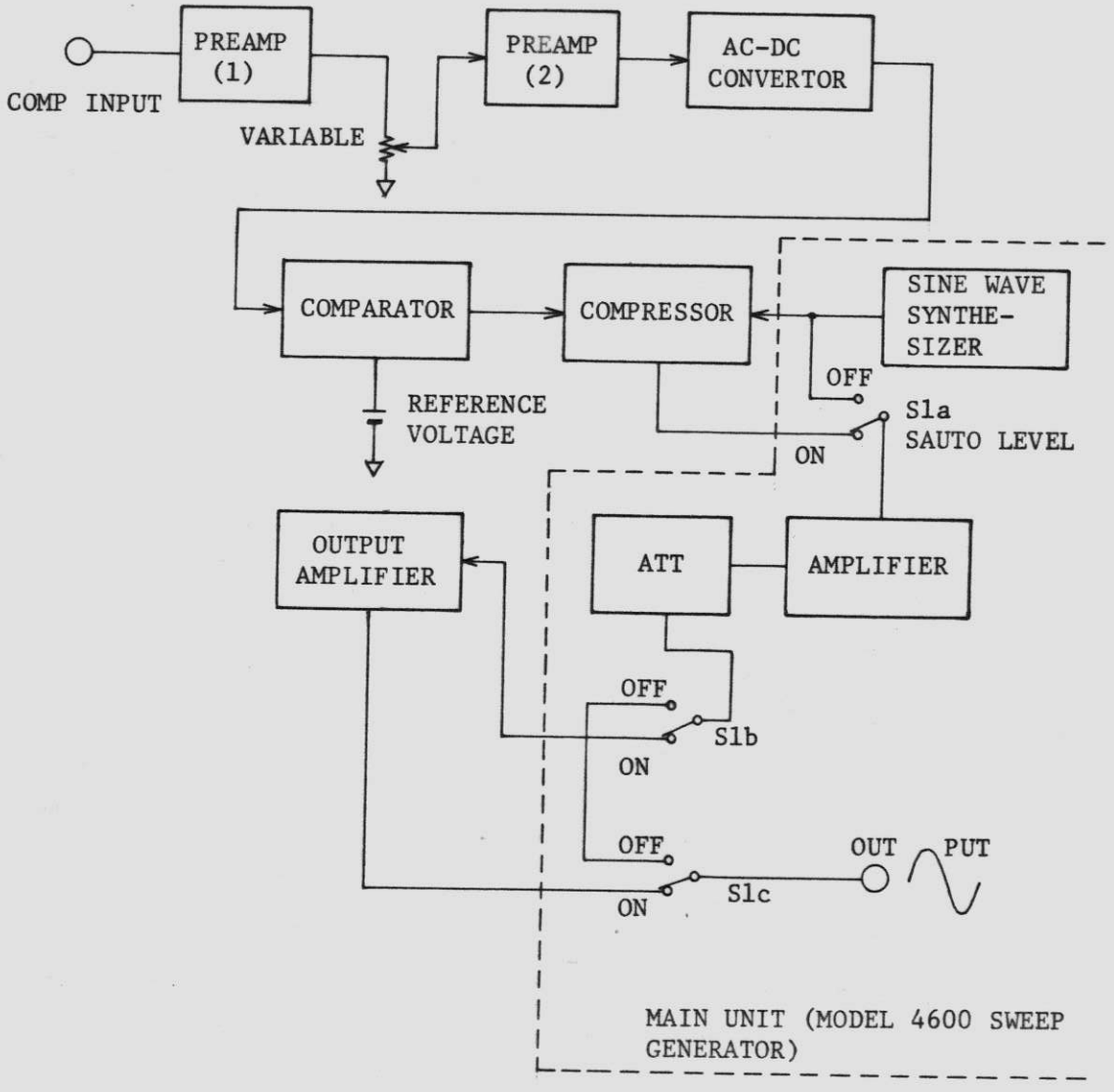


Figure 4-1

4.2 Operating Principle

Referring to Figure 4-1, the input signal applied to the COMP INPUT terminal is amplified by preamplifiers (1) and (2), converted into a DC signal by the AC-DC converter, and then fed to the comparator. The comparator compares the input signal with the reference voltage signal and generates an error signal which is fed to the compressor circuit in order to make the input signal equal to the reference voltage signal.

The output signal of the 4600 Sweep Generator is applied to the compressor circuit which has a function of controlling its output amplitude with an externally applied control voltage signal with its function as a multiplier circuit. The output signal of the comparator circuit is used as the external signal to control the amplitude of the signal applied from the 4600 Sweep Generator.

The output signal of the compressor circuit is fed to the output amplifier via the attenuator. The output signal of the output amplifier is delivered to the OUTPUT terminal.

5. MAINTENANCE

5.1 Inspection of Internal Components

To gain access to the internal components, remove the screws at the four corners of the front panel and pull out the OP-4600 chassis. To remove the heat sink at the rear, remove the four spacers.

5.2 Layout of Components

Layout of major components of the instrument is shown in Figure 5-1. Layout of parts on PCB's is shown in Figures 5-2 and 5-3.

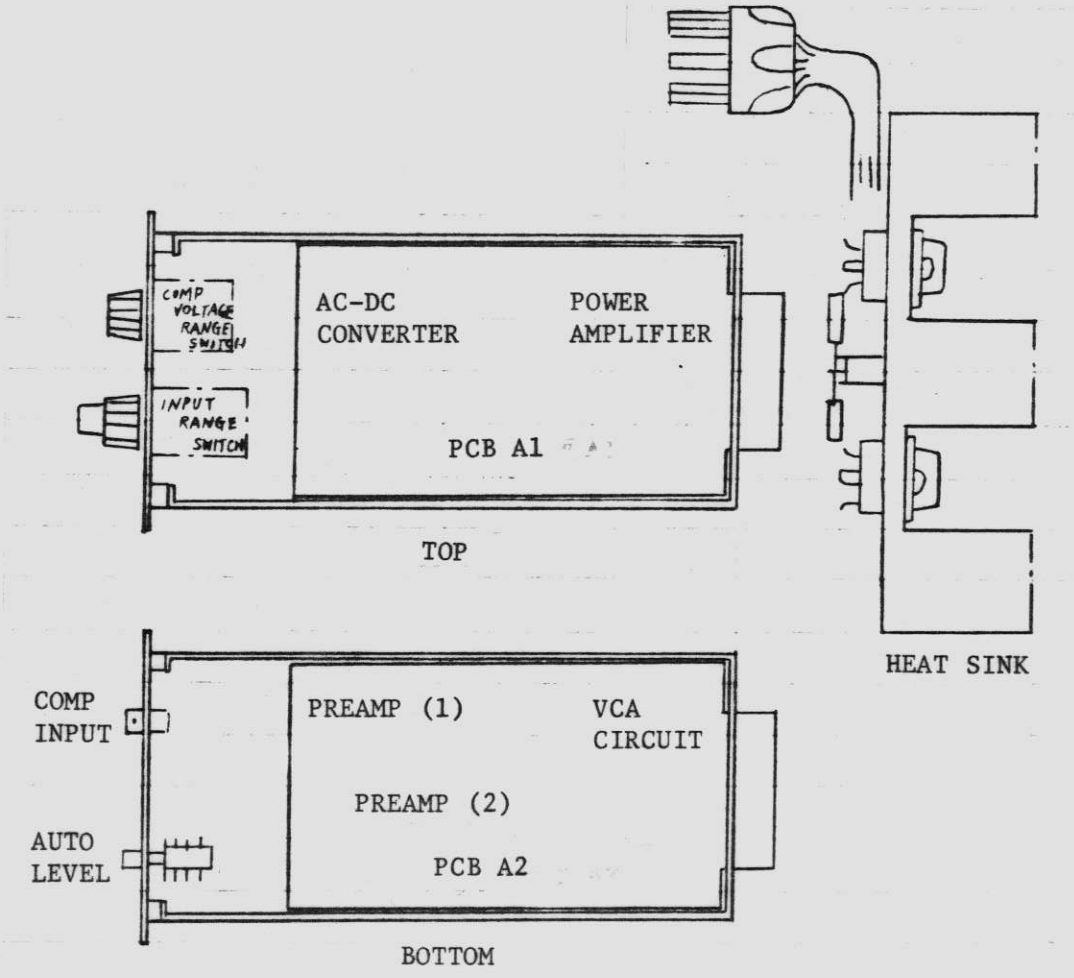


Figure 5-1

PCB A1 (AC-DC Converter, Comparator, and Output Amplifier)

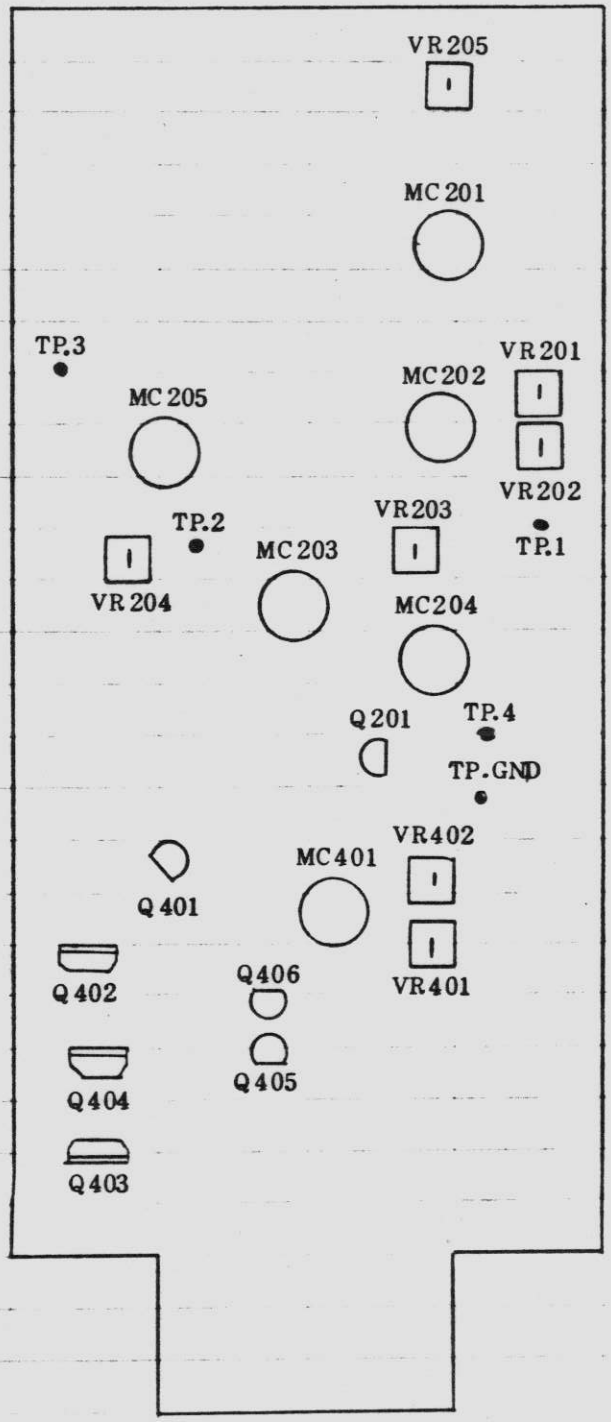


Figure 5-2

PCB A2 (Preamplifiers and Compressor Circuit)

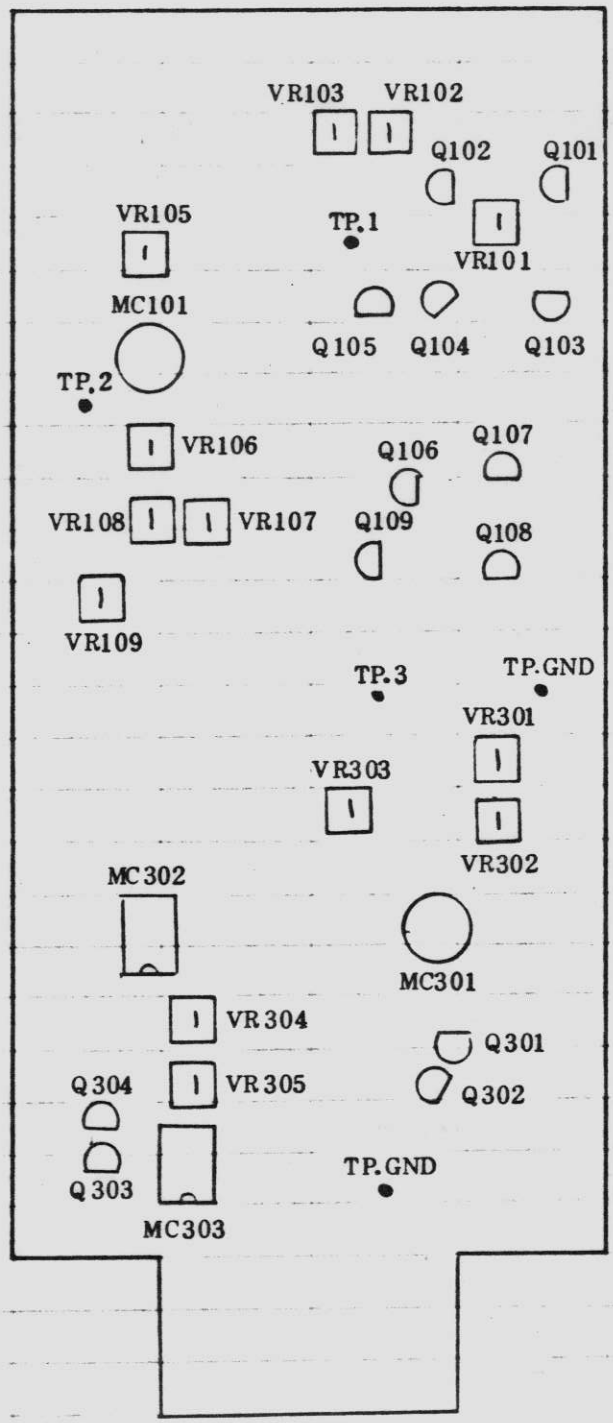


Figure 5-3

5.3 Adjustment and Calibration

It is recommended to adjust and calibrate the instrument at every 6 to 12 months. Calibration should be done at a place where ambient temperature is approximately 25°C and does not change largely.

For adjustment and calibration of the instrument, turn on the instrument power and allow about an hour of stabilization time and then proceed as follows:

(1) Set the 4600 Sweep Generator as follows:

   (a) Set the MODE switch to DEVI and the sweep mode to DIAL.

   (b) Set the FREQ RANGE switch at DEVI "×100".

   (c) Set the CENTER FREQ dial at "10".

   (d) Set the output voltage at minimum.

   (e) Connect a 600-ohm attenuator to the output terminal.

(2) Set the OP-4600 Auto Compressor as follows:

   (a) Set the AUTO LEVEL switch in the OFF state.

   (b) Set the COMP VOLTAGE RANGE switch at 40 dB.

   (c) Set the GAIN SET dial at 40 dB to 60 dB and the VARIABLE dial at the counterclockwise extreme position.

(3) Connect an AC millivoltmeter to the 600-ohm attenuator output terminal. Adjust the attenuator output at 100 mV rms by adjusting the 4600 output and the attenuator.

Preparation for adjustment and calibration of the OP-4600 is complete by the above procedure. For actual adjustment and calibration, proceed as follows:

(4) Adjust the preamplifiers on PCB A2 as follows:

(a) Short the COMP INPUT terminal circuit, connect a DC millivoltmeter to TP1, and adjust DC offset with VR101.

(b) Connect a DC millivoltmeter to TP2 and adjust DC offset with VR105.

(c) Set the GAIN SET dial at 0 dB to 20 dB and the VARIABLE knob at the counterclockwise extreme position. (Hereafter, keep the VARIABLE knob at the counterclockwise extreme position.)

(d) Connect the output of the 600-ohm attenuator to the COMP INPUT terminal of the OP-4600.

(e) Connect an AC millivoltmeter to TP1 and check that its voltage is 100 mV rms.

(f) Adjust the 600-ohm attenuator output at 1 mV rms (set the attenuator for +40 dB.)

(g) Set the GAIN SET dial at 20 dB to 40 dB and adjust the TP1 voltage at 100 mV rms with VR103.

(h) Set the 600-ohm attenuator output at 10 mV rms (set the attenuator for -20 dB).

(i) Set the GAIN SET dial at 40 dB to 60 dB and adjust the TP1 voltage at 100 mV rms with VR102.

(j) Set the GAIN SET dial at 0 dB to 20 dB and adjust the 600-ohm attenuator output at 100 mV rms (set the attenuator for -40 dB).

(k) Connect an AC millivoltmeter to TP2 and adjust its voltage at 1 V rms with VR106.

(l) Set the COMP VOLTAGE RANGE switch at 30 dB. Adjust the TP2 voltage at 316 mV rms with VR107.

(m) Set the COMP VOLTAGE RANGE switch at 20 dB. Adjust the TP2 voltage at 100 mV rms with VR108.

(n) Set the COMP VOLTAGE RANGE switch at 10 dB. Adjust the TP2 voltage at 31.6 mV rms with VR109.

(5) Set the COMP VOLTAGE RANGE switch at 0 dB.

(6) Disconnect the 600-ohm attenuator from the output terminal. Make the output voltage minimum. Turn ON the AUTO LEVEL switch of the OP-4600.

(7) Connect a DC voltmeter to TP3 of PCB A1 and adjust its voltage at 10 V with VR204.

(8) Connect an AC voltmeter to the output terminal and turn the output voltage adjustment knob to the clockwise extreme position. Under this state, adjust the output voltage at 5 V rms with VR401 on PCB A1.

(9) Turn the output voltage adjustment knob to the counterclockwise extreme position. Connect the output terminal to the COMP INPUT terminal.

(10) Set the COMP VOLTAGE RANGE switch at 20 dB. Turn the output voltage adjustment knob to the clockwise extreme position.

(11) So adjust the signal level with the GAIN SET dial and VARIABLE knob that both HIGH and LOW level limit lights are off.

(12) Set the COMP VOLTAGE RANGE switch at 40 dB. So adjust VR301 on PCB A2 that both HIGH and LOW level limit lights are off.

(13) Turn the output voltage adjustment knob to the counterclockwise extreme position and set the COMP VOLTAGE RANGE switch at 0 dB.

(14) Disconnect the output terminal from the COMP INPUT terminal. Connect an oscilloscope to the output terminal and adjust DC offset of the output signal with VR402 on PCB A1.