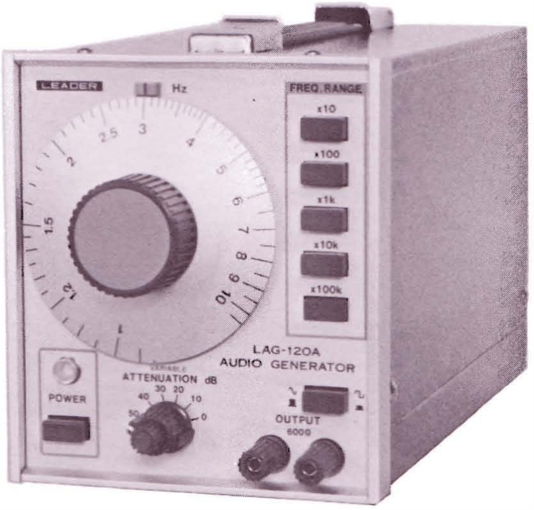
LEADER TEST INSTRUMENTS

MODEL LAG-120A

AUDIO GENERATOR

INSTRUCTION MANUAL



LEADER ELECTRONICS CORP.

CONTENTS

LAG-120A AUDIO GENERATOR

1 GENERAL DESCRIPTION

1.1 Uses

The LAG-120A is a wideband audio generator with sine and square output waveforms. Sine wave signals are available with a distortion of less than 0.4%. Square waves with fast rise time can be used for circuit performance checks. Synchronizing the output frequency is accomplished with an accurate external source. Pushbutton switches are used for rapid operation. The LAG-120A is compactly constructed so that minimum space is required on the service bench.

1.2 Specifications

Frequency Range	10Hz to 1MHz in five decade bands.	
Frequency Accuracy	Dial calibration within ±(3% +1Hz).	
Output Flatness	±0.5dB across 600Ω.	
Output Waveforms		
Sine Wave	Output: Over 3Vrms into 600Ω.	
	Distortion:	0.05% : 500Hz – 20kHz.
		0.4% : 50Hz – 200kHz.
		0.8% : 20Hz – 500kHz.
		1.5% : 10Hz – 1MHz.
Square Wave	Output: Over 3Vp-p into 600Ω.	
	Rise Time:	200ns.
	Sag:	5% at 50Hz.
Output Impedance	600Ω ±10%.	
Output Attenuator	6 step-attenuation and continuously adjustable.	
Output Flatness	Within ±0.5dB across 600Ω at 1kHz reference, 10Hz ~ 1MHz	
Sync Signal Terminal	Input Impedance: Approx. 10kΩ.	
	Control Range: ±1%/V	
Power Supply	100-115V, or 200-230V, 50/60Hz; approx. 6.5VA.	
Size and Weight	170(H) x 132(W) x 300(D) mm;	
	(Approx. 6-3/4" x 5-1/4" x 12")	
	approx. 3kg (6.5 lbs.)	
Accessory	LT-2044 (600Ω terminator)	

1.3 Control Functions

1.3.1 Front Panel, Fig. 1-1:

① Pilot lamp: Indicates when the power is on.

② POWER switch: Push-push type for turning on the AC power.

③ ATTENUATION dB: 6 step (10, 20, 30, 40, 50dB)

④ VARIABLE: Continuously adjustable.

⑤ ⑥ OUTPUT terminals: Black for ground connection; red for high potential, or "hot" side.

⑦ Switch for output waveform selection, sine or square, as marked.

⑧ FREQ. RANGE switches: For selection of the output frequency ranges:

x10	10 – 100Hz	
x100	100 – 1000Hz	(1kHz)
x1k	1 – 10kHz	
x10k	10 – 100kHz	
x100k	100 – 1000kHz	(1MHz)

⑨ Frequency dial: Marked in Hz: 1 to 10; actual output frequency depends on the setting of the FREQ. RANGE switches.

1.3.2 Rear Panel, Fig. 1-2:

⑩ ⑪ SYNC terminals: For connection to an external frequency control source; black terminal is for ground.

⑫ Shorting-link: Normally connected across the SYNC terminals when the synchronizing input signal is not used.

⑬ AC cord hooks.

⑭ AC input cord.

⑮ FUSE holder: For the AC line fuse.

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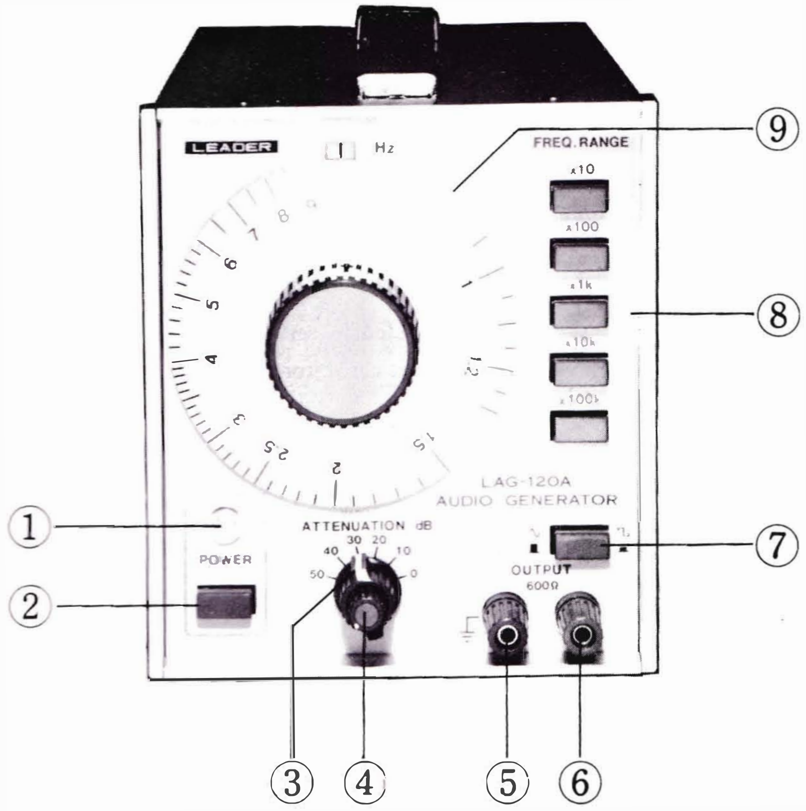


Fig. 1-1 Front panel functions.

side.

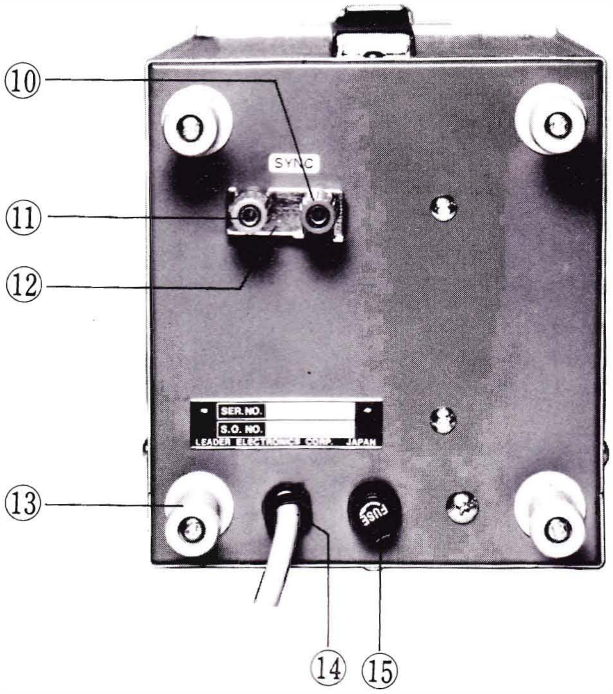


Fig. 1-2 Rear panel functions.

2. OPERATION

2.1 Preliminary Notes

1. The generator output impedance is 600Ω, and may be directly connected to loads of 600Ω or higher impedances. When the impedances require matching, use a high grade matching transformer; for square wave output, use a suitable resistance pad to insure "clean" waveforms.
2. A blocking capacitor should be connected in series with the "hot" output lead when DC voltage is present in the test circuit. This capacitor must have low reactance at the lowest test frequency and proper voltage rating.
3. Do not apply more than 10Vrms at the OUTPUT and SYNC terminals.
4. Use short connecting leads. Long unshielded leads will pick up extraneous noise; long shielded leads will degrade the high frequency characteristics, especially at square wave output.
5. Allow about one minute for circuit stabilization after the AC power has been turned on. (Sine wave signals will show effects of clipping unless this precaution is taken.)
6. Press only one FREQ. RANGE switch at one time.

2.2 Interconnections

The basic equipment interconnections are shown in Fig. 2-1 and recommended Leader test instruments as designated.

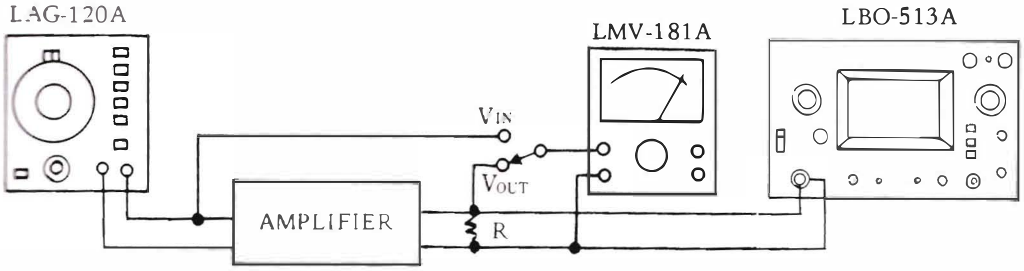


Fig. 2-1 Equipment and connections for measurements.

The specified load resistance, R, is connected across the output of the amplifier, or test circuit. It should be non-inductive and have a wattage rating at least twice the expected maximum power output.

In measuring the input/output voltages, an electronic voltmeter, LMV-181A, or equivalent, is required.

An oscilloscope is required for testing when using square wave signals. With the dual-trace type, the input and output waveforms can be compared.

2.3 Use of Sine Waves

In most amplifier measurements, sine wave signals are used. Typical uses will be described.

Control settings:

POWER switch at on.

Waveform selector at sine, or "out" position.

Output control: ATTENUATION at 50dB and VARIABLE set fully counterclockwise.

A. Input/Output Characteristic

Set the FREQ. RANGE switch at x100 and dial at 10.

The input voltage to the amplifier is gradually increased by advancing ATTENUATION and VARIABLE. The amplifier output voltage will increase as the input voltage is raised.

When the amplifier is overloaded, there will be no apparent increase in output and wave form distortion will be observed, i.e., flattening of one or both peaks of the trace.

By noting the input and output voltages, these values can be plotted on log-log paper. In this manner the input voltage range of the amplifier can easily be observed.

When the voltage ratio V_{OUT}/V_{IN} is calculated, the voltage gain is given by the relation

$$\text{VOLTAGE GAIN in dB} = 20 \log \frac{V_{OUT}}{V_{IN}}$$

Reference should be made to a decibel table for the dB figures.

The power output is calculated from the relation –

$$\text{POWER OUTPUT, } P_{OUT} \text{ in } \underline{\text{WATTS}} = \frac{V^2_{OUT}\ (\text{volts})}{R\ (\text{ohms})}$$

B. Frequency Response

The frequency response of an amplifier is determined by applying a constant voltage to the amplifier input. This voltage is chosen so that the amplifier is operated below the overload point.

Set the reference frequency at 1kHz or 400Hz, and set ATTENUATION and VARIABLE for suitable amplifier output.

Note the input and output voltages.

With the FREQ. RANGE switches and dial, set the different input frequencies to 10kHz or higher as required.

Since the generator output is practically constant, the input voltage will not require any adjustment. However, for highest accuracy, the input at each frequency can be adjusted to the predetermined value.

Response measurements can be simplified by noting the output level at the reference frequency (1kHz or 400Hz) on the decibel scale of the output voltmeter. At each test frequency, the dB indication is noted and used in plotting the response curve. (NOTE: Disregard the 0dBm = 0.775V, etc. in this case. The dB readings can be directly used since the voltmeter is connected across a constant impedance.)

The dB readings are added or subtracted from the 1kHz reference level.

Example: Let "dB" at 1kHz = –2dB. Assume that the measured values are as in (A) in the following data.

FREQ (Hz)	20	60	200	600	1k	2k	6k	20k
(A) dB, measured	–6	–5	–2	–2	–2	–2	–1	–6
(B) dB	–4	–3	0	0	0	0	+1	–4

The dB figures for (B) are used in plotting on semi-log graph paper with the X-axis for frequency and Y-axis for the relative response in dB.

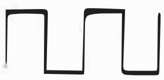
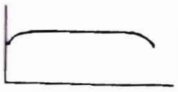
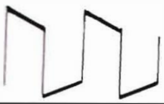
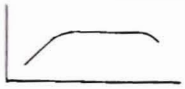
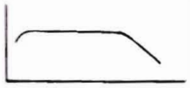
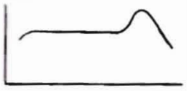
2.4 Square Wave Output

Square wave signals are useful in the rough determination of response characteristics of amplifiers at high and low frequency.

The interconnections are identical with those for sine wave operation, see Fig. 2-1.

The scope for waveform observation should have fast rise time characteristics.

The chart given below shows the waveforms at the amplifier output for different responses.

Waveshape	Amplifier Response	Condition
RECTANGULAR 	 FLAT	SATISFACTORY
SAG 	 DEFICIENT LOW FREQUENCIES	LOW PRIMARY INDUCTANCE INOUTPUT TRANSFORMER: INCORRECT VALUES OF THE COUPLING ELEMENTS
ROUNDING 	 DEFICIENT HIGH FREQUENCIES	HIGH LEAKAGE INDUCTANCE IN OUTPUT TRANSFORMER OR HIGH DISTRIBUTED CAPACITANCE IN CIRCUIT
RINGING 	 PEAKING AT HIGH FREQUENCY	MALADJUSTMENT IN THE NEGATIVE FEEDBACK CIRCUIT; INCORRECT CONSTANTS; INSTABILITY

For an amplifier with good characteristics, the response will be flat up to about the 11th harmonic of the input fundamental. As an example. If a 1kHz square wave is reproduced without distortion, the amplifier response is flat to about 11kHz.

NOTES:

1. Output voltage settings are initially made with ATTENUATION and VARIABLE adjustments and the waveform switch set at the sine wave position.
   The indicated value on the scope will be equal to the peak-to-peak output voltages.
   The waveform selector switch is then set at the square wave position. Disregard the voltmeter reading.
   If in doubt, check the p-p output voltage with a calibrated scope.
2. It is advisable to check the input waveform on a scope before application.
3. Connection from the SYNC output terminal to the scope sync input will make adjustments easier when displaying waveforms.

The low frequency response will start to fall off at about 1/11 of the fundamental when there is a sag, or droop, in the displayed waveform.

2.5 Use of SYNC Connections

A. General

The sync connections, on the rear panel, can be used in several applications as described below.

The "input" or "output" impedance is approximately 10kΩ.

B. Output Frequency Control

The oscillator frequency can be synchronized with an accurate source over a range of ±1% per rms volt input, see Fig. 2-2.

For example, when the oscillator is set at some point between 990 and 1010Hz, and a signal of exactly 1000Hz is applied, the oscillator will automatically lock in at 1000Hz. Thus, high accuracy can be achieved with the use of a precision frequency standard.

In another application, a distorted waveform can be "purified", or filtered, by passing it through the oscillator.

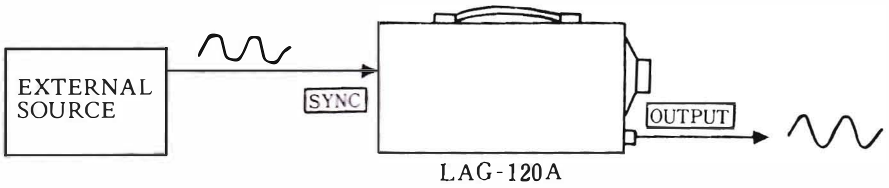


Fig. 2-2 Use of the SYNC terminals.

C. SYNC Output Application

The sync output voltage, approximately 2.5Vrms, should be sufficient to synchronize or trigger the sweep in a scope or to operate a frequency counter. This voltage is not affected by the setting of ATTENUATION and VARIABLE.

3 MAINTENANCE

3.1 Fuse Replacement

When replacing the AC line fuse (at rear of the case), make certain that the proper rating is used, see below:

LINE VOLTAGE	FUSE RATING
100 – 115V	0.3A
200 – 230V	0.3A

If the fuse blows after replacement, check the DC power supply circuits for defective capcitors, or shorts in the supply lines.

3.2 Exposing the Chassis

The cover can be removed be unscrewing two screws at the top and 4 screws at the sides.

3.3 AC Input Connections

The primary of the power transformer is wired at the factory as specified.
Refer to Fig. 3-1 when a change is required.

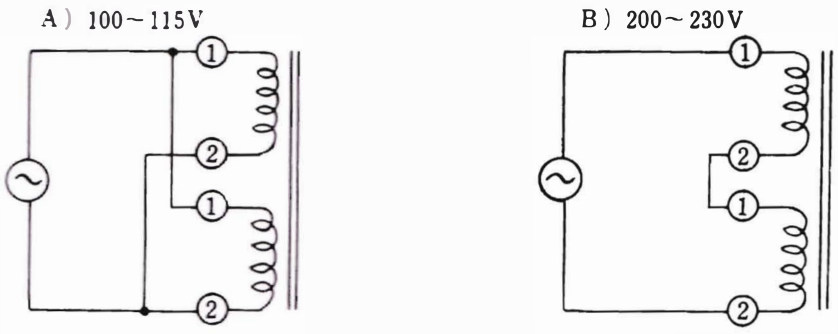


Fig. 3-1 AC input connections.

3.4 Circuit Checks and Adjustments

The location of the principal test points and adjusters is shown in Fig. 3-2.

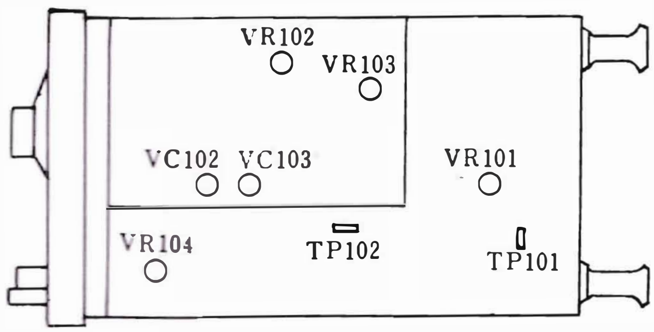


Fig. 3-2 Location of test points and adjusters.

A. DC Output Voltage:

At TP101, the voltage should be +40 ±0.5V.

If not, adjust VR101.

B. Oscillator Bias Voltage:

Set the output frequency at 1kHz.

At TP102, the voltage should be +17 ±0.3V.

If not, adjust VR103.

C. Square Wave Symmetry:

Set the output frequency at 1kHz and the waveform switch at square.

Set ATTENUATION at 0dB and VARIABLE at full clockwise.

Connect the output to a scope with a fast rise time.

As shown in Fig. 3-3, the distances, A and B, should be equal.

If not, adjust VR104.

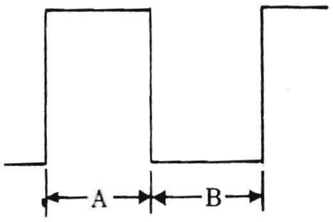


Fig. 3-3 Square wave adjustment.

D. Frequency Adjustment:

Connect a frequency counter to the OUTPUT terminals.

1. Set the FREQ. RANGE switch at x1k, and the dial at "1"
   Set the waveform switch at sine.
2. The counter reading should be 1000Hz within ±3% (or between 970 and 1030Hz). If considerably off, then set the dial so that the counter reads 1000Hz. Loosen the set screw on the dial knob and position the dial at "1" against the index.
   Tighten the set screw.
3. Adjustments at other ranges are made with the dial set at "10" and the FREQ. RANGE set at appropriate position.

FREQ. RANGE	FREQUENCY	ADJUSTER
x1k	10kHz	VC102
x10	100Hz	VR102
x100k	1MHz	VC103

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osen the set
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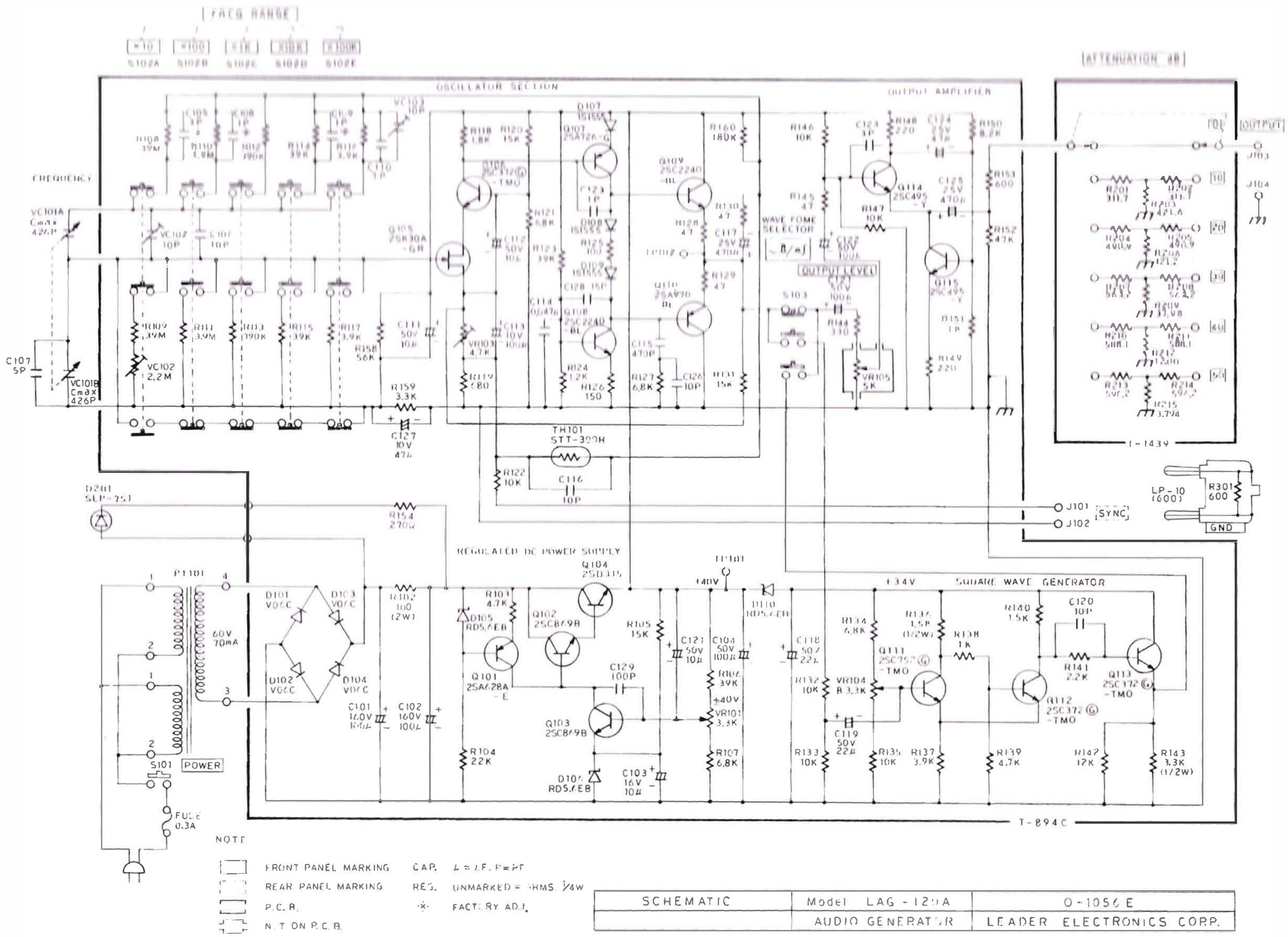

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