

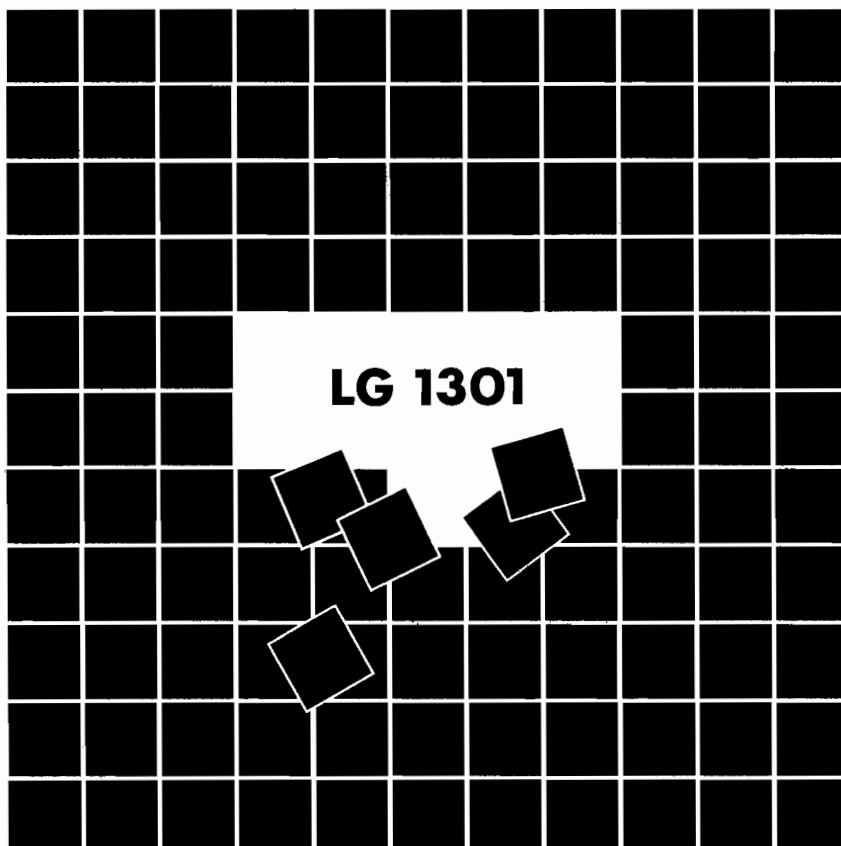
LEADER

2MHz FUNCTION GENERATOR

INSTRUCTION MANUAL

2MHz ファンクション ジェネレータ

取扱説明書



LEADER ELECTRONICS CORP.

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1. INTRODUCTION

1.1 Precautions in operation

1.1.1 Line Voltage and Fuse CAUTION

Confirm that the power line voltage is correct before connecting the power cord.

The voltage range and fuse rating are indicated on the rear panel.

The instrument must be connected to the rated line voltage and line frequency of 50 Hz or 60 Hz.

When replacing the fuse, turn the power switch off and disconnect the power cord from the mains. Use specified fuse only.

Rated Voltage	Voltage Range	Fuse	
		Rating	Leader Parts Number
100 V 115 V	90 to 110 V 104 to 126 V	0.375 A or 0.4 A time-lag	4363745000
230 V	207 to 250 V	0.25 A, time-lag	4363735007

1.1.2 Maximum Allowable Input Voltage CAUTION

The maximum allowable input voltage to the input connectors is shown in Table below.

Do not apply excessive voltage to prevent damage the instrument.

Input Connector	Maximum Allowable Input Voltage
VCG IN	± 15 V
MOD IN	± 15 V

1.1.3 Installation CAUTION

Do not use the instrument in the following environments.

- High temperature environments

Do not place the instrument under direct sunlight or near a heater (e.g., stove) .

Do not move the instrument from cold to warm environment abruptly, it may cause condensation.

Operating temperature range : 0 to 40°C

- High humidity environments

Do not place the instrument in the high humidity environment (e.g., bathroom, near a humidifier) .

Operating humidity range : 10 to 85% RH

- Dusty environments

1.1.4 Short circuiting output connector pins, external inputs CAUTION

- Short circuiting of output connectors

Do not short circuit output connector pins. It could damage the Instrument.

- Input of external signals to the output connector

Do not apply an external signal to the output connectors.

Such a procedure could damage the generator or the equipment connected to it.

2. SPECIFICATIONS

2.1 Description

The LG 1301 is a Function Generator capable of generating five types of waveforms - sine, triangle, square, pulse, and sawtooth - over a wide frequency range of 0.002 Hz to 2 MHz.

As this has the sweep and AM modulation functions, it can be used as the signal source for frequency characteristic measurements of amplifiers and filters.

It is a function generator suitable in audio equipment production and servicing, and school education.

2.2 Features

- Wide frequency range

It is capable in output of a wide range of frequencies from less than 0.002 Hz up to 2 MHz.

It can be used as a signal source with a cyclic period longer than 50 seconds.

- Various output waveform

It can output five types of waveforms - sine, triangle, square, pulse and sawtooth. Furthermore, the pulse wave can be continuously varied in duty ratio from 1 : 9 through 9 : 1.

- Synchronizing signal output connector

As it can output a 0/5 V square wave, it can be used as a signal source, not only as a synchronizing signal for an oscilloscope but also in digital circuits.

- SWEEP function

It can automatically sweep the frequency over a range of more than 100 times.

As a sawtooth wave is output from the rear panel SWEEP signal output connector, frequency characteristics of amplifiers and filters can be easily observed in combination with an X-Y oscilloscope.

For frequency sweeping methods, it can be selected to the linear sweep "LIN sweep" or the logarithmic changing "LOG sweep."

- AM modulating function

AM (amplitude) modulated signals can be output by application of external signals. It can be used as a signal source for medium band radios. DSB (Double Side Band) signals can be output by the built-in suppressed carrier function.


- External frequency control

The oscillating frequency can be setup by application of an external DC potential. If a DC potential superimposed with a signal is applied, an FM modulated signal can be output.

- Large output level variation

Signals from 1 mVp-p through 20 Vp-p (open output) can be output by combinations of the 10 dB, 20 dB or 40 dB pads and the continuously variable down to 1/10 knob.

2.3 Specifications

Frequencies	0.002 Hz to 2 MHz
Frequency dial setup range	1 : 100
Setup range	8 ranges
Accuracy	Within $\pm 5\%$ of full scale ; at $\times 100$ kHz or lower range.
Output waveforms	Sine, triangle, square, sawtooth, pulse.
Sine wave	
Output flatness	Within $\pm 3\%$ at below the $\times 100$ kHz range
Distortion	Less than 0.5% at 10 Hz to 20 kHz Less than 1% at 20 kHz to 100 kHz
Triangle Wave	
Symmetry	50 : 50, less than 1% at 10 Hz to 100 kHz
Square Wave	
Rise time	Less than 100ns into 50 Ω termination
Symmetry	50 : 50, less than 1% at 10 Hz to 100 kHz
Sawtooth Wave	
Symmetry	85 : 15 or 15 : 85, less than 5% at 10 Hz to 100 kHz
Pulse Wave	
Rise time	Less than 100ns into 50 Ω termination
Symmetry	Continuously variable 9 : 1 to 1 : 9 at 10 Hz to 100 kHz
Output Voltage	Max. 20 Vp-p $\pm 10\%$ into open circuit Max. 10 Vp-p $\pm 10\%$ into 50 Ω termination
Attenuators	
Pads 10 dB, 20 dB, 40 dB	
Variable attenuator	Continuously variable for more than 1/10
Output Impedance	50 $\Omega \pm 5\%$
DC Offset	Max. ± 10 V with 0 dB pad into open circuit
AM Modulation (MOD IN)	
Signal source	External input
Optimum input voltage	0.5 Vrms
Input impedance	10 k $\Omega \pm 20\%$
Modulation depth	0 to 95% or larger
Frequency characteristics	10 Hz to 100 kHz within -3 dB
 Maximum input voltage	± 15 V
Frequency Sweep (SWEEP)	LIN sweep/LOG sweep
Sweep time	10 s to 0.1 s/500 ms to 5 ms, 2 ranges
Frequency sweep ratio	10 : 1 to 100 : 1 or larger
SWEEP Output (SWEEP OUT)	Sweep signal (sawtooth wave)
Output voltage	-1 V to 0 V within $\pm 10\%$
Output impedance	1 k $\Omega \pm 10\%$

External Frequency Control (VCG IN)

Input impedance	10 k Ω \pm 10%
Frequency characteristics	DC to 100 kHz within - 3 dB
Maximum input voltage	\pm 15 V



Synchronous Output (SYNC OUT)

Square wave in sync with the output signal is output.

Output voltage	0/5 V into open circuit
Output current	Larger than 10 mA
Rise time	Shorter than 25 ns into open circuit

Frequency Setup Voltage Output (GCV OUT)

Voltage corresponding to setup frequency is output.

Output voltage	0 to 5 V \pm 10%
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Environmental Conditions

Spec. Guaranteed	Temperature 0 to 40°C Humidity 10 to 85%RH
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Power Supply

AC100 V, 115 V, 230 V \pm 10% (Max. 250 V),
50/60 Hz

Power Consumption

20 VA \pm 20% (at no load)

Dimensions, Weight

300 (W) \times 100 (H) \times 300 (D) mm, ,
Approx. 3.7 kg

Accessories

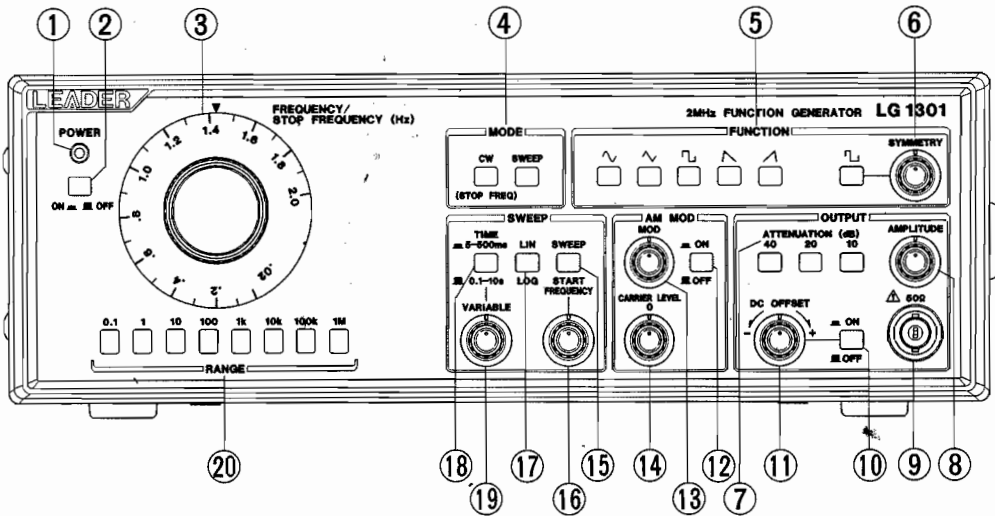
BNC - Alligator clip cable 1
Power cord 1
Spare fuse 1
Instruction Manual 1

Option

50 Ω terminator LT-2049.

3. PANEL CONTROLS

3.1 Front panel



① Pilot lamp [POWER]

The green lamp will light when power is switched on.

② Power switch [ON / OFF]

Power is switched on at ON () and switched off at OFF ().

③ Frequency dial [FREQUENCY/STOP FREQUENCY (Hz)]

Match the desired frequency with the ▼ mark. The oscillating frequency is determined by this dial setting and the frequency range switch ⑳.






In the frequency sweep mode (SWEEP), the sweep end frequency is set.

④ Operating mode selector switch [CW/SWEEP]

Operating mode is selected by this switch.

- CW : A single frequency signal will be output.
- SWEEP : Frequency sweep will be carried out.

⑤ Output waveform selector switch [FUNCTION]

Sine wave (), triangle wave (), square wave (), sawtooth wave (), or pulse wave () is selected by pressing the corresponding button. If all buttons are switched OFF (), DC voltage will be output.

⑥ Symmetry knob [SYMMETRY]


Duty ratio of the pulse wave is setup by this knob. Duty ratio is approximately 1 : 1 when knob is at center, and when rotated CCW, the wave positive section will be reduced. Frequency will not change even though the duty is changed.

⑦ Fixed output attenuator [ATTENUATION (dB)]


This is the attenuator for a fixed output voltage. When the 50 Ω terminator is used, the output voltage can be attenuated a maximum 70 dB in 10 dB steps depending on the combination.



⑧ Variable output attenuator [AMPLITUDE]


Output voltage can be continuously varied by this. Maximum output is obtained by full CW rotation.

⑨ Output connector [ 50 Ω]


Output impedance is 50 Ω .

 **Caution:** Do not short circuit the output connector pins or apply external signals to it. Such procedures could damage the instrument.


⑩ DC offset switch [ ON/  OFF]

When this is switched ON (), DC voltage can be superimposed on the output signal. The DC voltage level to be superimposed is set with the DC offset setting knob ⑪ .

⑪ DC offset setup knob [DC OFFSET]

Level of DC voltage to be superimposed can be set by switching ON () the DC offset switch ⑩ . Voltage to be superimposed will change in the plus direction by CW rotation or in the minus direction by CCW rotation.

⑫ AM (amplitude) modulation switch [AM MOD  ON/  OFF]



When this is switched ON (), output signal will be amplitude modulated by the signal input to the AM (amplitude) modulation signal input connector ⑫ .



⑬ Modulation depth setup knob [MOD]

Modulation depth in the AM (amplitude) modulation mode is set by this knob.

⑭ Carrier level setup knob [CARRIER LEVEL]

Carrier level in the AM (amplitude) modulation mode is set by this knob.

⑮ Sweep start frequency setup switch [ SWEEP/  START FREQUENCY]

If this switch is set to START FREQUENCY () while in the frequency sweep mode, sweep will stop at the sweep start frequency. The sweep start frequency can be confirmed if a frequency counter is connected to the output connector ⑨ . If this is set to SWEEP () , it is entered in the sweep mode.

⑯ Sweep start frequency setup knob [START FREQUENCY]

The sweep start frequency will decrease if this knob is rotated CCW.

- ⑰ Sweep mode selector switch [LIN/ LOG]

The sweep mode is selected by this switch.

LIN (): Frequency will change at a constant rate against the sweep time.

LOG (): Frequency will change logarithmically against the sweep time.

- ⑱ Sweep time range switch [TIME 5 — 500 ms/ 0.1 — 10 s]

Sweep time range is selected by this switch.

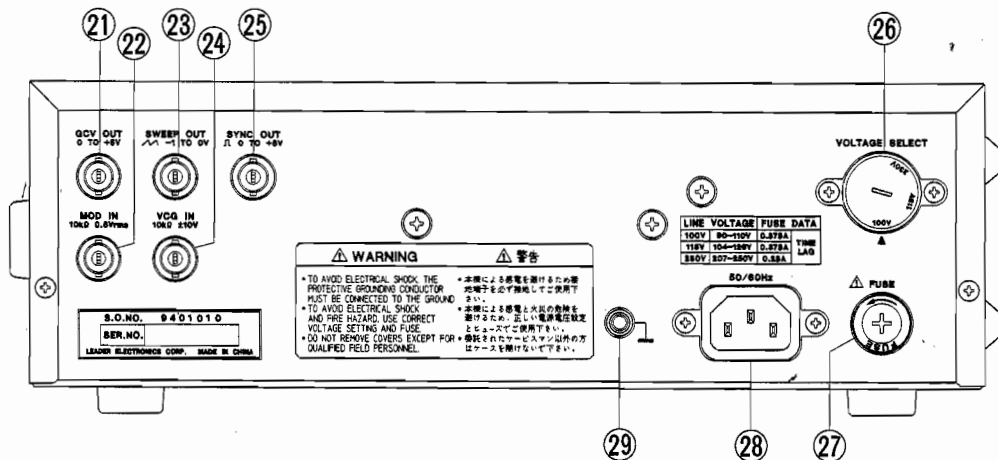
- ⑲ Sweep time setup knob [VARIABLE]

Sweep time can be set by this knob to within the range selected by the sweep time range switch ⑱. Sweep time will be shorter this knob is if rotated CCW.

- ⑳ Frequency range switch [RANGE]

This switch in combination with the frequency dial ③, determines the oscillating frequency.

3.2 Rear Panel



- ⑳ Oscillating frequency monitoring connector [GCV OUT]

Voltage corresponding to the frequency dial ③ setting for each frequency range will be output.

- ㉑ AM (amplitude) modulating signal input connector [MOD IN]

The signal for AM (amplitude) modulation is input here.

Optimum input level is 0.5Vrms.

⚠ Caution: Do not apply a voltage exceeding ± 15 V. It could damage this equipment.

②③ Sweep signal output connector [SWEEP OUT]

Sweep signal is output here when in the frequency sweep mode.

②④ Frequency control voltage input connector [VCG IN]

Oscillating frequency of the output signal can be changed by applying a DC voltage here.

⚠ Caution: Do not apply a voltage exceeding ± 15 V. It could damage this equipment.

②⑤ Synchronizing signal output connector [SYNC OUT]

Square wave (0/5 V) in sync with the output signal is output here.

②⑥ Power supply voltage selector [VOLTAGE SELECT]

Power supply voltage for this equipment is listed under the section marked with ▲.

⚠ Caution: When changing the power line voltage, the fuse and power cord must be changed at the same time.

②⑦ Fuse

The fuse can be removed together with the cap by rotating the cap CCW with a Phillips screwdriver.

⚠ Caution: One spare fuse is included with this equipment. If a fuse other than this spare is to be used, the specified type and rating is indicated on the rear panel.

②⑧ AC inlet [50/60 Hz]

Power cord included with the equipment is plugged in here.






②⑨ Ground terminal 

This is connected to the metal housing.

⚠ Caution: For the sake of safety, it is recommended to connect this terminal to a ground.

4. BASIC OPERATION

4.1 Selecting the output waveform

Sine wave (), triangle wave (), square wave (), sawtooth wave (), or pulse wave () is selected by pressing the corresponding button of the output waveform selector switch ⑤.

Duty ratio of the pulse waveform can be varied a maximum 1 : 9 to 9 : 1 by setting the symmetry knob ⑥.

DC voltage will be output if all buttons are switched OFF ().

If this generator is to be used as a DC voltage source, set the frequency range switch ⑳ to $\times 100$ or lower.

4.2 Setting the frequency

Output frequency is set with the frequency dial ③ and the frequency range switch ㉑. Frequency adjusting range is as shown in Table 4.1.

If the frequency must be set accurately, use a frequency counter connected to the sync signal output connector ㉒.

Table 4.1 Frequency range

Setting of frequency range switch	Frequency (Adjusting range of the frequency dial)
	MIN to MAX
$\times 0.1$	0.002 Hz to 0.2 Hz
$\times 1$	0.02 Hz to 2 Hz
$\times 10$	0.2 Hz to 20 Hz
$\times 100$	2 Hz to 200 Hz
$\times 1$ k	20 Hz to 2 kHz
$\times 10$ k	200 Hz to 20 kHz
$\times 100$ k	2 kHz to 200 kHz
$\times 1$ M	20 kHz to 2 MHz

4.3 Setting the output amplitude

Output amplitude is set with the fixed output attenuator ⑦ and the variable output attenuator ⑧. Output amplitude adjusting range when terminated with 50 Ω is as shown in Table 4.2.

Table 4.2 Output amplitude adjusting range with 50 Ω termination

Setting of fixed output attenuator			Output amplitude (Adjusting range using variable output attenuator)
60 dB	20 dB	10 dB	MIN to MAX
			1 Vp-p to 10 Vp-p
			0.32 Vp-p to 3.2 Vp-p
			0.1 Vp-p to 1 Vp-p
			32 mVp-p to 0.32 Vp-p
			10 mVp-p to 0.1 Vp-p
			3.2 mVp-p to 32 mVp-p
			1 mVp-p to 10 mVp-p
			0.32 mVp-p to 3.2 mVp-p

4.4 Method of using the frequency sweep mode

When the operating mode selector switch ④ is set to SWEEP and the sweep start frequency setup switch ⑮ set to SWEEP (), the oscillator frequency can be continuously varied more than 100 times automatically. If the sweep waveform is to be observed on an oscilloscope, the scope is synchronized with the signal from the sweep signal output connector ⑳.

[Procedures]

- Setting frequency at sweep completion point C :
 - (1) Connect a frequency counter or oscilloscope to the sync signal output connector ㉕.
 - (2) Select CW on the operating mode selector switch ④ and set the sweep completion frequency with the frequency dial ③ and frequency range switch ㉔.
- Setting frequency at sweep start point A :
 - (1) Connect a frequency counter or oscilloscope to the sync signal output connector ㉕.
 - (2) Select SWEEP on the operating mode selector switch ④.
 - (3) Set the sweep start frequency setup switch ⑮ to START FREQUENCY () and setup the sweep start frequency with the sweep start frequency setup knob ⑯.
- Setting the sweep time B :
 - (1) Connect a frequency counter or oscilloscope to the SWEEP signal output connector ㉓.
 - (2) Set the sweep start frequency setup switch ⑮ to SWEEP (), and start the frequency sweep mode.

- (3) Rotate the modulation percentage setup knob ⑬ fully CCW, the carrier level setup knob ⑭ fully CW or CCW, and switch ON the AM (amplitude) modulation switch ⑫.
- (4) When the modulation percentage setup knob ⑬ is gradually rotated clockwise, the output signal will be AM modulated.

Adjust the modulation percentage setup knob ⑬ to the required percentage of modulation.


The required percentage modulation cannot necessarily be obtained if input level of the modulation signal is low. In such a case, rotate fully CW the modulation percentage setup knob ⑬, and set the modulation percentage by adjusting the carrier level setup knob ⑭.

Note that linearity of modulation will be inferior when the modulating signal level is too low.

DSB modulation

Rotate the modulation depth setup knob ⑬ fully CCW and carefully adjust the carrier level setup knob ⑭ so that the output amplitude is minimum. As the modulation depth setup knob ⑬ is gradually rotated CW, the carrier suppressed DSB (Double Side Band) modulated signal can be obtained.

4.6 DC offset

When the DC offset switch ⑩ is set to ON (), a DC voltage can be superimposed on the output signal. Level of the superimposed DC voltage is set with the DC offset setup knob ⑪.

The "+" potential will increase if the knob is rotated CW from center, and the "-" potential will increase if rotated CCW.

Although maximum adjustable range at open output is $\pm 10V$ but be careful as it will decrease in step with the fixed output attenuator ⑦.



Caution: Maximum output amplitude of this generator is $\pm 10 V_{p-p}$.

Should the signal superimposed with a DC potential exceeds maximum output amplitude, it must be noted that the waveform will be clipped.

(Refer to Fig. 4.3.)

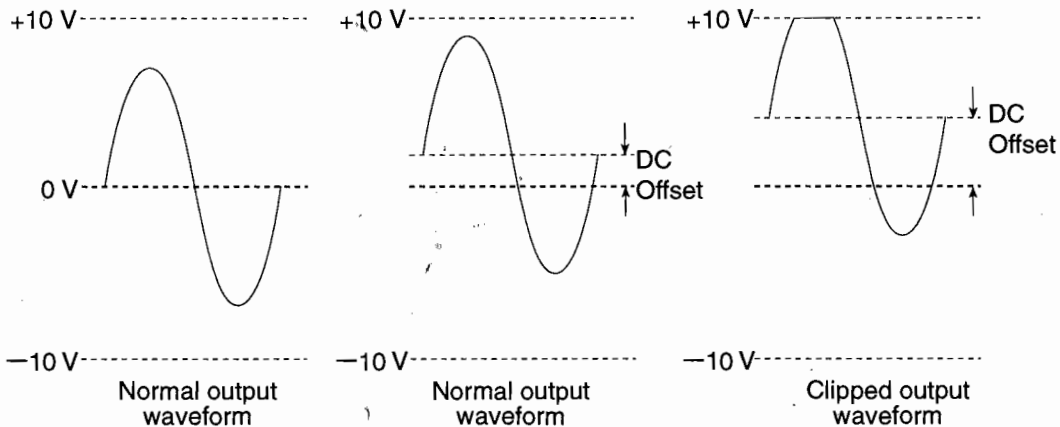


Figure 4.3 Clipping of output waveform

4.7 External frequency control (VCG IN) method

Frequency of the output signal can be controlled by applying a potential to the frequency control voltage input connector ②. Maximum controllable frequency range will be limited to the frequency dial adjustable range of each frequency range. (Refer to Table 4.1.)

- (1) If the applied voltage is changed from 0 V through +10 V with the frequency dial ③ rotated fully CW, the output signal frequency can be varied over full scale of the frequency dial.
- (2) If the applied voltage is changed from 0 V through -10 V with the frequency dial ③ rotated fully CCW, the output signal frequency can be varied over 1/100 of full scale of the frequency dial.
- (3) Frequency is continuously controllable by more than 100 times from DC through 100 kHz. If a sawtooth waveform is input, a signal identical to the frequency sweep mode can be output.

5. MAINTENANCE

The LG 1301 is designed to provide stable performance when used properly. If the instrument requires adjustment or calibration after extended use, be sure to contact your local Leader agent.