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MODEL: GFG-8019G

INSTRUCTION MANUAL

GW GOOD WILL INSTRUMENT CO., LTD.

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MODEL: GFG-8019G

1. GENERAL DESCRIPTION

The function generator is high-steady, high-linearity and low-distortion of design. The generator provides triangle, square, sine, ramp pulse waveforms, and AM/FM capacity. The model can program system and enable control of frequency (auto and manual selector). Either LIN or LOG sweep mode selectable.

Output voltage of no-load up to 20Vpp (10Vpp into 50 ohm load). The MAX. attenuation is 60dB. Internal part can output TTL compatible voltage. This is utilized to logic experiment, and CMOS voltage can continuously adjust from 5Vpp to 15Vpp. So can expand the using range.

In general, the model is suit for electric experiment, instruction, factory production and maintenance uses.

2. SPECIFICATION

1. MAIN

Output Wave	:	Sine wave triangle square TTL pulse and CMOS output
Amplitude	:	>20Vpp open circuit >10Vpp into 50 ohm load
Impedance	:	50 ohm ± 10%
Attenuator	:	-20dB ± 1dB (at 1KHz)
DC Offset	:	<-10V to > +10V for no-load <-5V to > +5V into 50 ohm load.
Duty Control	:	1:1 to 10:1 continue variable
Display	:	5 digit 0.3" led display
Frequency Range	:	0.2Hz to 2MHz (7 ranges)

2. SINE WAVE

Distortion	:	<1%, 0.2Hz to 200KHz
Flatness	:	<0.1dB 0.2Hz to 200KHz <0.5dB 100KHz to 2MHz

3. TRIANGLE WAVE

Linear	:	>98%, 0.2Hz to 100KHz >95%, 100KHz to 2MHz

4. SQUARE WAVE

Symmetry	:	<2%, 0.2Hz to 100KHz
Rise or Fall Time	:	<120nsec.

5. CMOS OUTPUT

Level	:	4Vpp ± 1Vpp to 14.5Vpp ± 0.5Vpp adjustable
Rise or Fall Time	:	<120ns

6. TTL OUTPUT

Level	:	>3Vpp
Rise or Fall Time	:	<25nsec.

7. VCF

Input Voltage	:	0V to 10V (±1V) input for 1000:1 frequency ratio
Input Impedance	:	> 10K ohm

8. FREQUENCY CONTER

Int/Ext	:	Switch selector
Range	:	0.2Hz to 2MHz (5Hz to 10MHz EXT.)
Accuracy	:	± time base accuracy ± 1 count
Time Base	:	Oscillation frequency 10MHz, tem-

perature stability ± 10ppm (23°C± 5°C)

Resolution : 0.1Hz, 1Hz, 10Hz, 100Hz
Sensitivity : ≤25mVrms

SWEEP OPERATION

Sweep/Manual : Switch selector
Sweep Width : 1000:1 ratio max. and adjustable
Sweep Time : 0.5 second ~ 30 second adjustable
Sweep Mode : Lin/Log switch selector

10. AMPLITUDE MODULATION

Depth : 0~100%
Mod. Freq. : 400Hz (INT), DC~1MHz (EXT)
Carrier BW : 100Hz to 2MHz (-3dB)
EXT Sensitivity : <10Vpp for 100% modulation

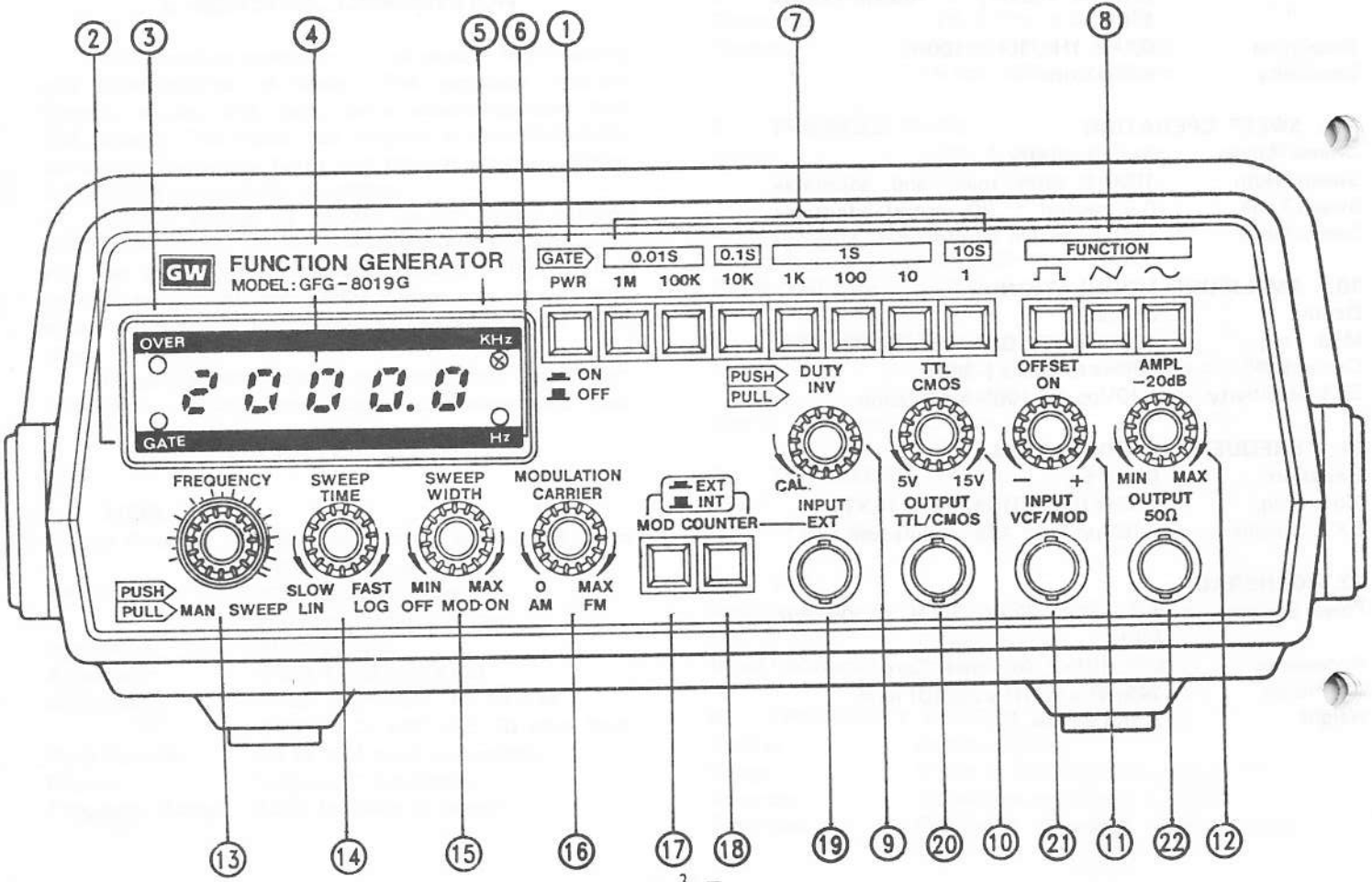
11. FREQUENCY MODULATION

Deviation : 0 to ± 5%
Mod. Freq. : 400Hz (INT), DC~20KHz (EXT)
EXT. Sensitivity : <10Vpp for ± 10% modulation

12. GENERAL

Power Source : AC 120V, 220V, 240V ± 10% 50/60Hz
Accessories : GTL-101x2, AC Power Cord
Dimension : 245(W) x 95(H) x 280(D) m/m
Weight : 3.5Kg typical

3. FRONT PANEL INDICATION DESCRIPTION AND FUNCTION



INDEX NO.	FUNCTION	DESCRIPTION
1.	Power Switch	Connect the AC power and then press powerswitch.
2.	Gate Time Indicator	When the power switch pushed. Gate time indicator begin to flash. The flash time equal to the cycle time of the internal counter implement a full measurement and just depended on which key of⑦you pushed.
3.	Over Indicator	When implement EXT counter operation. If the input signal frequency larger than the capacity of the counter in the range. Over indicator will light up.
4.	Counter Display	Indicate the INT/EXT frequency by 5 x 0.3" red display.
5.	Hz Indicator	When (7c) or (7d) was pushed. Hz indicator will light up in such a model. The counter display frequency in the unit of Hz.
	KHz indicator	When (7a) or (7b) was pushed. KHz indicator light up and the counter display frequency in the unit of KHz.
7.	Frequency Range Selector & Gate time selector	A. Select the disired frequency range. Press the correspondent push botton switch on the panel. The frequency range of each push bottom show in Table 1. B. Select the require gate time when EXT counter operation mode are used.
8.	Function Selector	Press one of the three push button then the corresponded wave can be output. If none of these buttons is depressed, the signal shall be not output.

Table 1.

PUSHBOTTOM	1	10	100	1K	10K	100K	1M
FREQUENCY RANGE	0.2Hz | 2Hz	2Hz | 20Hz	20Hz | 200Hz	200Hz | 2KHz	2KHz | 20KHz	20K | 200K	200K | 2M

9.	Symmetric and Inverse Function	(1) Rotate the turning switch can change the output waveform of symmetric, rotate the turning switch in CAL position, the output waveform can be symmetrized. (2) The output waveform can be inversed by pulling the turning switch up.
10.	TTL/CMOS Selector	When the turning switch was pushed. The BNC terminal of (20) will output a TTL compatible waveform, if the pull position was selected by the user, rotate the turning switch, we can observe the CMOS output (5-15Vpp) from the output of BNC (20).
11.	DC Offset Control	When the turning switch was pushed, the DC offset was determined by internal circuit. Pull up the turning switch, we can set any DC level of the waveform between ± 10V. Turning clockwise to observe a positive DC level and reverse to a negative DC level.
12.	Output Amplitude Control with Attenuation Operation	Turning clockwise to have MAX. output and reverse for -40dB output. We can also pull up the turning switch to observe a -20dB output.
13.	MANU./SWEEP. Selector and Frequency Adjustment	When the turning switch was pushed turning clockwise to observe MAX. frequency and reverse for MIN. frequency. (Keep the white color pointer within the scale range on the panel.) When pull up, the auto sweep operation begin, the up limit frequency are just depended on the position of the turning switch.
14.	Sweep Time Control and LIN/LOG Selector	(1) Rotate the turning switch clockwise, sweep time can be adjusted to MAX., and reverse for MIN. (2) When turning switch was pushed, output will be implement linear sweep operation otherwise LOG sweep will be selected.
15.	Sweep Width & Control MOD ON/OFF Selector	(1) Sweep width can be controlled from 0 to 1000 times. (2) When turning switch was pulled up, the output can be modulated by internal 400Hz sinewave or external signal from BNC (21)

16.	Modulation Carrier and AM/FM Selector FM Selector	(1) To adjust modulation ratio, turn the switch clockwise for MAX., and reverse for MIN. (2) Push position implement AM function and pull up for FM function.
17.	INT/EXT MOD. Selector	Pull the turning switch up for internal modulation or push for external modulation. (External signal input from BNC (21)
18.	INT/EXT Counter Selector	Pull for internal counter operation (count the model's frequency) or depress for a independent counter (input signal from BNC(19).
19.	EXT. Counter Input Terminal	An external signal input from here to count the frequency by an independent internal counter.
20.	TTL/CMOS Output Terminal	TTL/CMOS compatible signal output from here.
21.	VCF/MOD Input Terminal	Input the require signal to performance the "voltage control frequency" operation or the EXT modulation operation.
22.	Main Output Terminal	Main signal output from here.

4. USAGE DESCRIPTION

The function generator featured with function can provide versatile waveforms. Completely understand these functions not only reaching high efficiency but convenient operation.

Familiarity one of best ways is connected with oscilloscope to observe waveforms. Watch the effect in different control waveforms. Refer the usage manual, until familiarize the operation procedure.

1. First-step check:

(1) The model's back panel having a AC socket, connect the AC line, careful the voltage shall similar to label voltage.

(2) Press PWR switch (1) make other pushbuttons in pulling state, turn AMPL (12), OFFSET (11) the white indication point should be up forward.

(3) Turn DUTY (9), make white indicating point toward CAL position, then FREQ (13) put counter-clockwise direction to buttom. In this time, will be no output.

2. Triangle, square and sine wave

(1) First select Function 8, ⎍, ∿, ∿ ; and select Range (7), turn FREQ (13), set in requiring frequency. (read out from display window)

(2) In this time, output signal of generator from Output (22), connect to oscilloscope for observing, or connect to other experiment circuit.

(3) Again turn AMPL (12), used to control waveforms amplitude or pull up Duty (9) to get reverse signal.

(4) If need attenuation output signal, can pull up AMPL (12) to get 20dB attenuation.

(5) Output waveform's phase-relation show in Figure 1.

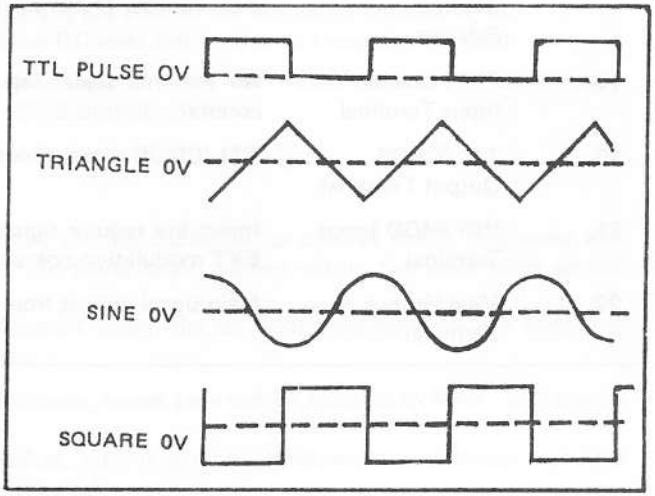


Figure 1.

3. **Pulse wave generation**
   (1) First press the switch (⎍) of Function (8); then select Range (7), turn FREQ (13), set frequency range of requiring.
   (2) Connect output from output-terminal (22) to oscilloscope for observation.
   (3) Turn Duty (9), make be left CAL position, used to adjust the width of pulse wave and frequency can change at a time. From oscilloscope seeing can understand.
   (4) Turn AMPL (12) switch, can control pulse amplitude; pull up Duty (9) switch to get reverse signal.
   (5) Pull up AMPL (12) switch, can get 20dB attenuation from attenuator.

4. **Ramp wave generation**
   (1) First press the switch (∿) of Function (8), then select Range (7), turn FREQ (13) switch to set frequency range of requiring.
   (2) Connect output signal from output-terminal (22) to oscilloscope for observation.
   (3) Turn Duty (9), make it left CAL position, used to adjust the slope of ramp wave and frequency can change at any time. From oscilloscope seeing can understand.
   (4) Turn AMPL (12) switch, can control output amplitude of ramp wave.
   (5) Pull up AMPL (12) switch, can get 20dB attenuation from attenuator.

5. **TTL/CMOS signal output**
   (1) First select Range (7), turn FREQ (13) switch to set frequency of requiring.
   (2) From BNC connector of TTL/CMOS (20), can connect to oscilloscope or other experiment circuit in order to observe output signal.
   (3) In this time, output is square wave of fixed TTL level. Suit for general TTL intergrated circuit.
   (4) If need square wave of CMOS level, can pull up CMOS (10) switch and adjust voltage level.

6. **Variation of external voltage-controlled frequency**
   (1) Select Function (8) first, ⎍, ∿ or ∿; then select Range (7), turn FREQ (13) and set frequency range of requiring.
   (2) From VCF (21) connector input to external voltage-controlled (0±10V), its generation signal from Output (22) output.
   (3) Other adjustments are the same as AMPL (12) switch can change amplitude of signal; adjust Offset (11) providing DC level.
   Use AMPL (12) switch can get attenuation. Turn Duty (9) switch can change output signal of pulse or ramp wave. As requirement, will be suitable adjustment.

7. **Auto sweep**
   (1) First press Function (8) switch ⎍, ∿, ∿; then select range (7)
   (2) Connect output from output terminal (22) to oscilloscope for observation.

(3) Turn frequency (13) to determine the up limit frequency.
(4) Pull up frequency (13) to performance autosweep operation.
(5) Turn sweep time (14) and sweep width (15) to require sweep time and width.
(6) Pull up (push) LIN/LOG (14) to observe LOG (LIN) sweep operation.

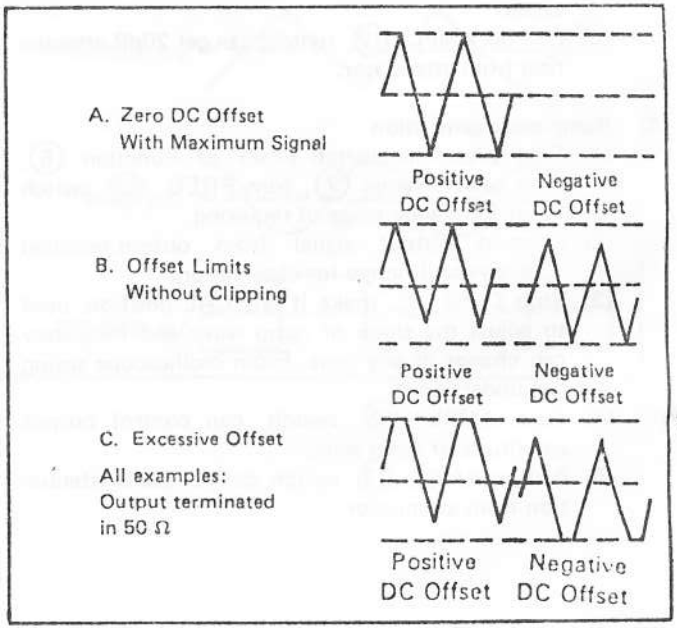
8. AM/FM operation

(1) Select Function (8) first ⊓, ∿, ⌒; then select Range (7). Turn FREQ (13) and set frequency range of requiring.
(2) Connect output from output terminal (22) to oscilloscope for observation.
(3) Pull MOD. (15) up and pull up (push) MOD (16) to observe FM/AM modulation operation.
(4) Adjust MOD (16) to achive disiring modulation ratio.

9. Precaution item

(1) Adjust DC OFFSET, will provide to change voltage of ± 10V (no load) or ± 5V (50Ω load). However, signal added DC level, still be limited to ± 20V (no load) or ± 10V (50Ω load). In case of overvoltage, will happen to clip. As showed in Figure 2, may be encountered with different operation.
(2) Output connector label 50Ω, indicated that signal source impedance is 50Ω. Connect to any of impedance circuit, but output volt and terminal impedance will be rated. For the prevent of oscillation, terminal will be connected to 50Ω (When using of high frequency and square output). And connecting line shall be as short as possible.
(3) When Duty switch be adjusted to leave in CAL position. The ratio of positive state to negative state, expand to not less 10:1. Square wave can expand to pulse wave, triangle wave can expand to ramp wave, sine wave can expand to a unsymmetrical sine wave. As showed in Figure 3 suitable adjustment of Duty switch will generate of requiring wave.

Figure 2



5. APPLICATION NOTE

This section describes the application of the model Function Generator in detail as well as a brief description relating to the block diagram. Only for the essential application method.

(A) Trouble-shooting using signal-tracing method.

This method is similar to signal replacing way. The signal of model with be fixedly send to input terminal. With oscilloscope from front stage to rear stage, orderly observe signal wave. Stage by stage until find the one that with normal input but unnormal output.

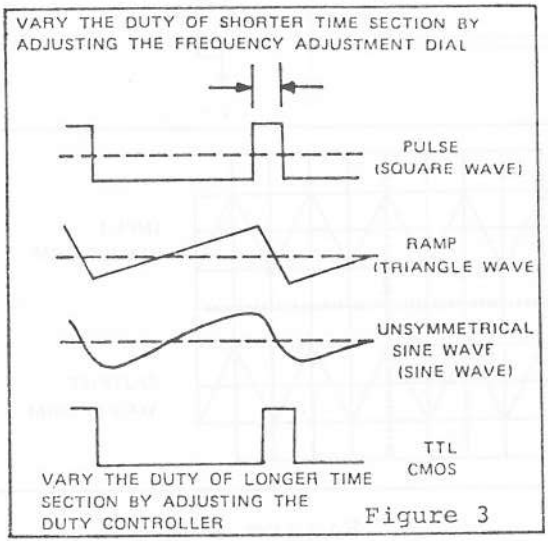


Figure 3

(B) Use as bias source and signal source circuit.

Utilized to Figure 4 of connecting type, can be provided bias of a transistor and signal input. From oscilloscope can observe the output waveform. Adjust to the best condition, will be output max. amplitude and no distortion. Adjust DC OFF-SET, will see the different effect of different bias condition.

(C) Amplifier over-load characteristics

With sine wave input, will be different to output the overload point. Using triangle wave will easily observe the display for scilloscope. It can decide the linear range of output waveform. And the largest no-distortion output amplitude.

(D) Using the square wave test the characteristics of amplified circuit.

The frequency response curve get using sine wave, can't actually realize the transient response of amplifier. Using the high oder poly wave-square wave and the oscilloscope can get many characteristics of amplifier.

(a) Using the circuit of Figure 5, the 50Ω connector trim the oscillation effect of square wave.

(b) Use the output of triangle wave, adjust the amplitude until there are no clipping happened in the applied frequency.

(c) Select square wave, adjust frequency, choose to watch the wave-form of middle of amplifier pass band, like 20Hz, 1KHz, 10KHz etc.

(d) The output waveform of (c), must get something with frequency Figure 6 shows come possible condition.

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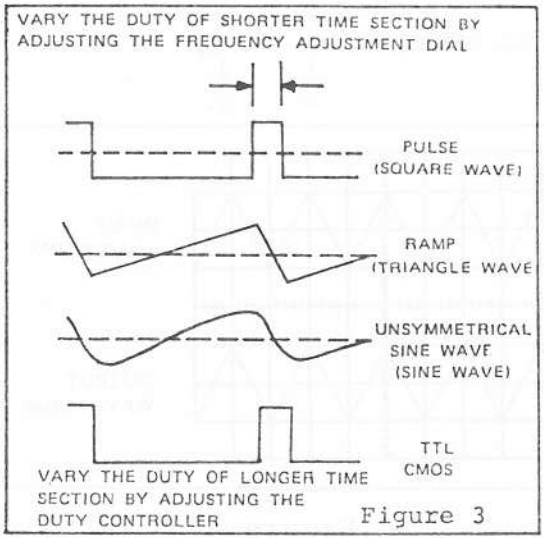

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Caution: The composed poly-wave frequency of square wave is quite large, so square wave is quite large, so square wave is not suitable for testing the narrow band amplifier.

(E) Test of logic circuit

This equipment is suitable for logic circuit test, use square or pulse wave can analyzer or watch the frequency waveform of a designed testing circuit. Also the DC Offset effect, drive the plug-in model board or logic circuit trouble-shooting etc. Used as signal tracing and signal replacing operation.

(a) Connected the lines as Figure 7.
(b) According to the operation guide in this manual, set square wave or pulse wave output.
(c) Use the label TTL, CMOS output terminal in testing TTL logic circuit.
(d) If test CMOS circuit, must pull-up the switch of TTL/CMOS, adjust CMOS level by twist the switch use when the proper level set.
(e) Can use dual-trace scope to show the input-output timing relationship judged by the two waves showed.

(F) Testing of speaker and impedance network

This equipment can be used to test the frequency characteristics of speaker or any impedance network. Also can get the resonant frequency of network.

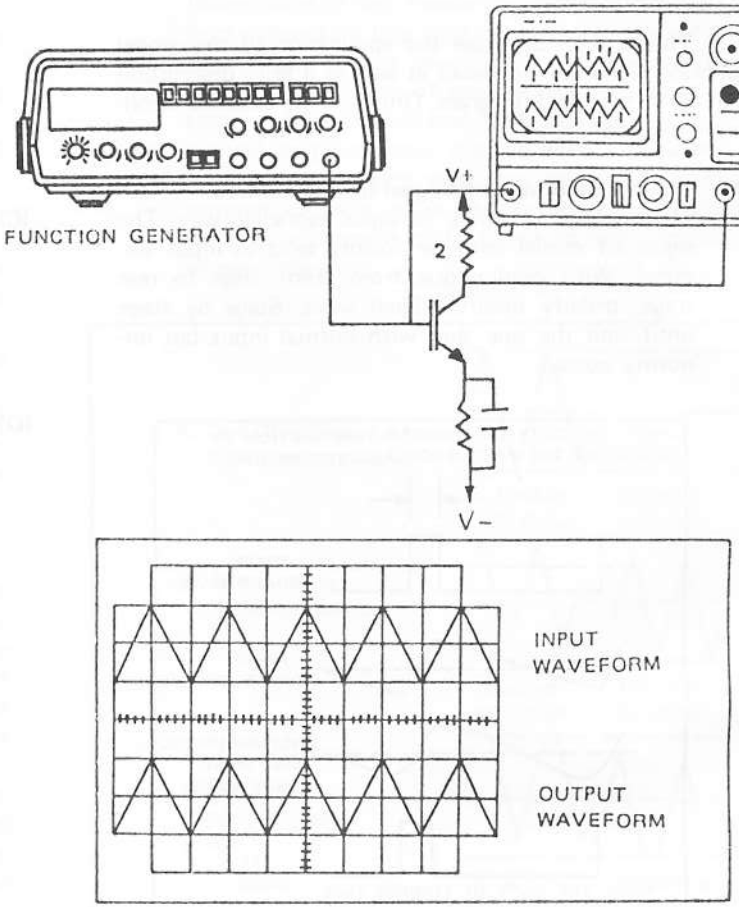

Figure 4

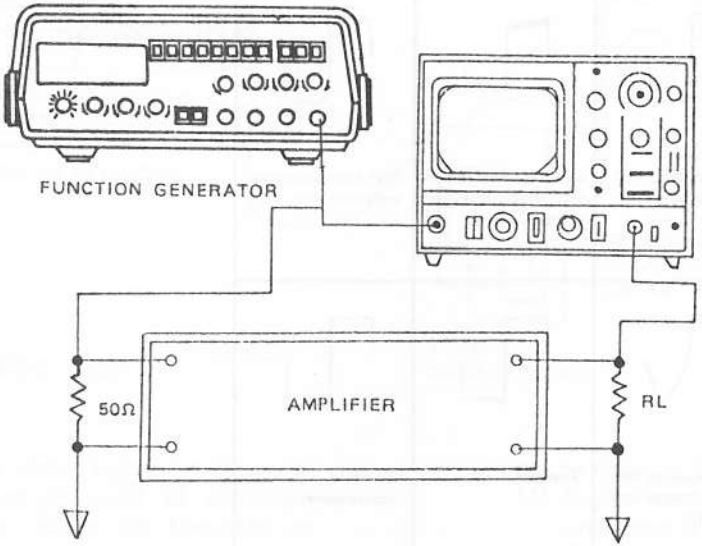

Figure 5

				
Frequency distoriton (amplitude reduction of low frequency). No phase shift	Low frequency boost (accentuated fundamantal)	High frequency loss, No phase shift	Low frequency phase shift (trace thickened by hum-voltage	High frequency-loss and phase shift
				
Low frequency phase shift	Low frequency loss and phase shift	High frequency loss and low frequency phase shift	Damped oscillation	Standard square wave

Figure 6

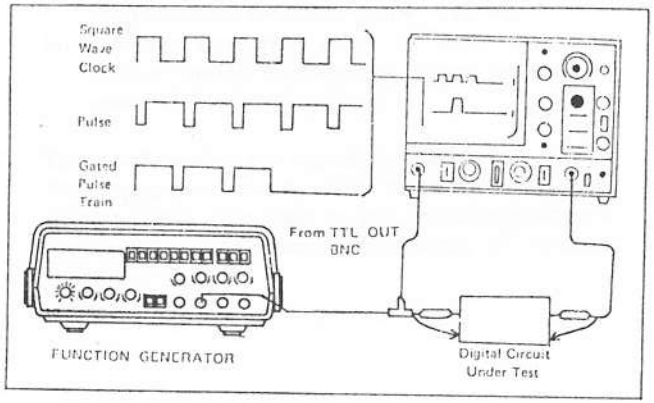

Figure 7

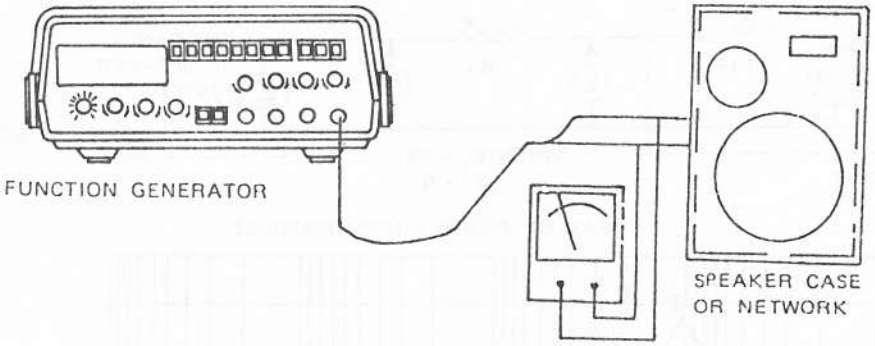

Figure 8

A. TEST SET

(a) Connect the device under test as in Figure 8, can use oscilloscope in stead of voltmeter.

(b) When use voltmeter, adjust the frequency of instrument record down voltage relative to frequency.

(c) When testing speaker, if there is a peak volt value, when in low-freq., this must be the resonant freq. (f_0) of this speaker, see Figure 10. Whether installation may cause any effect to this frequency or not? The proper design of case-installation will cause two small ramp on both sides of this sharp ramp.

(d) In testing other impedance network, the resonant may not occur in low frequency. But in approaching the resonant frequency, there are still increasing in voltage, then the impedance can be tested as following:

(1) Series connected a R1 to the network under test as in Figure 9.

(2) Get voltage read out in E1, E2, adjust R1 until E2 is equal to one half of E1.

(3) Under this frequency, the impedance network is the same as the R1.

(G) Act as automatic test of speaker

Because there provide the auto feature in this equipment, the output can drive to amplifier for testing the frequency response of speaker.

(a) Set Auto/Manu to auto position.

(b) Set function to sine wave.

(c) Range to 20KHz.

(d) Sweep mode (LIN, LOG), sweep width, sweep time can be set in any value.

(e) The line connected is showed on Figure 11.

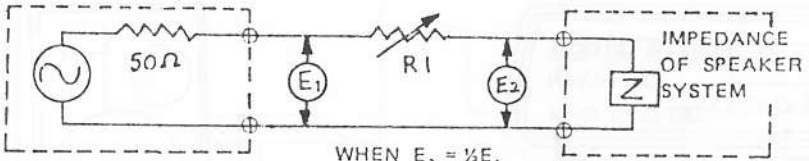

Figure 9

B. EQUIVALENT CIRCUIT

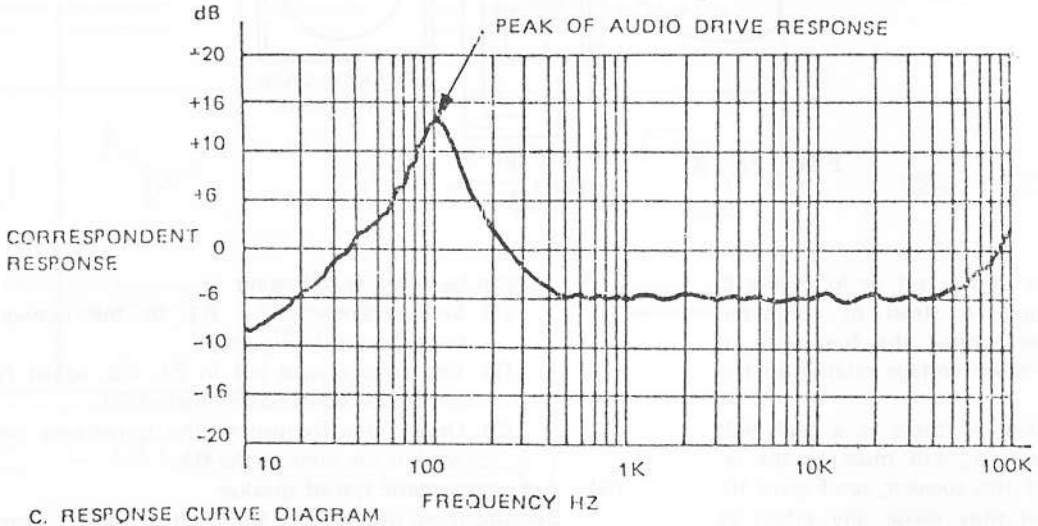

Figure 10

C. RESPONSE CURVE DIAGRAM

FIGURE

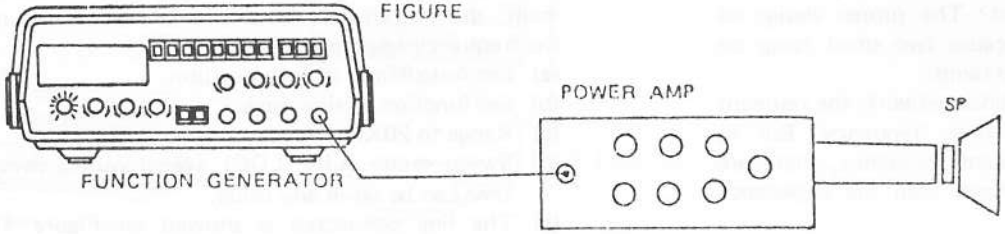

Figure 11

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