KENWOOD

OSCILLATOR

AG-252

INSTRUCTION MANUAL

KENWOOD CORPORATION

CONTENTS

A product of

KENWOOD CORPORATION

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1. FEATURES

1. Frequencies generated by the AG−252 range over a broad bandwidth of 10Hz to 1MHz, with a low distortion of 0.004% (Typical) (1kHz, ×100 range).
2. Output voltage is 5Vrms or more at 600Ω load. Desired voltages can be taken out continuously with an attenuator (10dB steps, 6 ranges) and a controller.
3. Output impedance is low (600Ω). The attenuator is guaranteed for a high accuracy of +1.0dB at 600Ω load.
4. A selector switch allows an easy selection between sine and square waveforms.
5. An accurate frequency signal is obtained by synchronizing with an external signal using an external sync input terminal.

2. SPECIFICATIONS

Oscillation frequency:	× 1 range : 10Hz～100Hz
	× 10 range : 100Hz～1kHz
	×100 range : 1kHz～10kHz
	× 1k renge : 10kHz～100kHz
	×10k range : 100kHz～1MHz
Frequency accuracy:	±(3% + 1Hz)
Output impedance :	Approx. 600Ω
Output attenuator :	0dB, −10dB, −20dB, −30dB,
	−40dB, −50dB (6 levels selectable)
	(Accuracy at 600Ω load: ±1dB)

【Sine wave characteristics】

Output voltage : (at 600Ω load)	≧5Vrms
Frequency responce :	30Hz～50kHz, ±0.2dB
	10Hz～1MHz, ±0.5dB
Distortion :	1kHz 0.004% (Typ)
	(×100 range)
	200Hz～20kHz 0.008%
	20Hz～100kHz 0.04%
	(100kHz: 1k range)
	10Hz～1MHz 1.5%

【Square wave characteristics】

Output voltage : ≧10Vp-p
(at 600Ω load)
Rise/fall time : ≦200ns (at maximum output)
Duty ratio : 48 : 52
(at 1kHz, maximum output)

【External sync characteristics】

Sync range : ≧±1%/Vrms
Maximum input voltage :
15V (DC + AC peak)
Input impedance : Approx. 100kΩ

【Environmental】

Within specification temperature/humidity range :
10～35℃, 85% RH
Operation temperature/humidity range :
0～40℃, 85% RH

【Power source】

Power voltage/frequency :
100/120/220/240Vac ±10%
(Max. 250Vac), 50/60Hz
Power consumption : approx. 5W

【Dimensions】

Casing : 212(W) × 133(H) × 272(D)mm
Max. : 212(W) × 156(H) × 312(D)mm

【Weight】 Approx. 3.8kg

【Accessories】 Output signal cable(CA-48): 1
Power cable : 1
Instruction manual : 1
Replacement fuse : 2

3. PANEL EXPLANATION

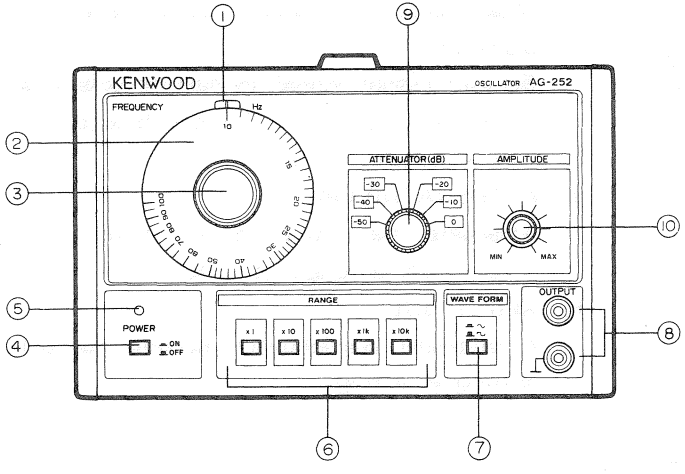

Fig. 1 Front Panel

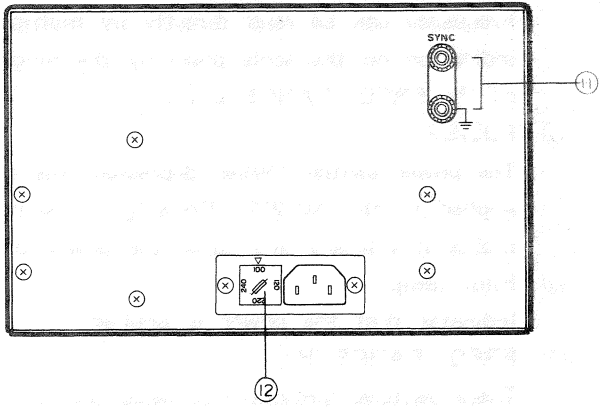

Fig. 2 Rear Panel

Front panel

① Index mark
Indicates dial divisions.

② Scale plate
Calibrated with 10～100 divisions.

③ Frequency dial
Adjusts oscillation frequency.
Frequency can be read directly by multiplying the indication on the scale plate by the magnification of the FREQ. RANGE switch.

④ POWER
The power switch. When depressed, the power is applied to the AG-252. Pressing the switch again makes it released and turns the power off.

⑤ Pilot lamp
Indicates that the power is applied.

⑥ FREQ. RANGE (Hz)
These switches provide five selections of oscillation frequency range :

× 1 : 10Hz～100Hz
×10 : 100Hz～1kHz
×100 : 1kHz～10kHz
× 1k : 10kHz～100kHz
×10k : 100kHz～1MHz

⑦ WAVE FORM
Selects a waveform of output signal. When depressed, it selects sine wave(～).
When released, it selects square wave(⊓⊔).

⑧ OUTPUT
Delivers output signal in sine or square waveform whichever is selected. The one labeled ⊥ is the GND (case GND) terminal.

⑨ ATTENUATOR (dB)
Attenuates the output to one of six levels : 0 to −50dB in steps of 10dB.

⑩ AMPLITUDE
A controller continuously changing the amplitude of output voltage.

Rear panel

⑪ SYNC

An input terminal for an external sync signal. When synchronizing the AG-252 with an external signal, apply the sync signal to this terminal. The terminal labeled ⏚ is the GND terminal.

⑫ Fuse holder/Line voltage selector

The fuse in the fuse holder is rated at 0.3A for 100/120V type, or 0.2A for 220/240V type. To change the power voltage, unplug the power cord from the power socket, then switch to the required voltage. (See "MAINTENANCE" for details.)

4. PRECAUTIONS FOR USE

1. Ensure that 10Vrms or higher voltage is not applied to the OUTPUT or SYNC terminals. When DC voltage is applied, make a connection via a capacitor.
2. Use short connecting leads. Long shield wires would cause amplitude characteristics to be changed by the capacity between shield wires. Ordinary leads, if long, also tend to pick up induced noise. Long leads of any type cause various troubles.
3. Connect the power cord after checking that the power voltage to use is correct. The power voltage should be within ±10% of the rated voltage.
4. Oscillation level may change soon after turning the FREQ. DIAL or pressing a FREQ. RANGE switch. It is not an accident.
5. Be sure to press one FREQ. RANGE switch at a time. Note that the function will not operate correctly if more than one button is pressed at a time or all the buttons are released.

6. When connecting an instrument to the OUTPUT terminal, first match it with the output impedance (600Ω) of the AG-252.
7. When the SYNC terminal is unused, always attach a short bar to the terminal. Otherwise, external noise may be drawn from the SYNC terminal and superimposed on the output.
8. The ON/OFF switch of unit is designed to act on the secondary side of the power transformer. The primary side of the transformer remains energized even if the ON/OFF switch is set to OFF. Therefore, if the unit is to be unused for a long time, the power cord should be unplugged from the receptacle outlet.

5. OPERATING PROCEDURES

1. Starting
   Connect the accessory power cable to the AC socket after checking that your power voltage is within ± 10% of 100Vac. Then press the POWER switch ④ to apply the power. Once the power is applied, the pilot lamp is on and the AG-252 is in active state. Age the instrument for 20 to 30 minutes until the operation becomes stable.
2. Selecting an output waveform
   If output of sine wave is required, press and lock the WAVE FORM switch ⑦. If output of square wave is required, press again and release the switch.
3. Setting a frequency
   Select a required frequency range with the FREQ. RANGE switches ⑥. Then turn the FREQ. DIAL ③ to adjust the desired frequency to the index mark ①.
   Example : Setting frequency to 1.5kHz
   1) Select the FREQ. RANGE switches ⑥ labeled ×100.

2) Turn the FREQ. DIAL ③ to align "15" on the scale plate to the index mark ①.
Now 1.5kHz has been selected.
$15 \times 100 = 1500\text{Hz} = 1.5\text{kHz}$

4. Adjusting the output voltage
The voltage output to the OUTPUT terminal ⑥, whether sine or square wave, can be continuously varied with the AMPLITUDE ⑩ and stepped down with the ATTENUATOR ⑨.
Example : Adjusting output voltage to 10mVrms
1) Connect a voltmeter capable of measuring 1Vrms of AC voltage to the OUTPUT terminal ⑧.
2) Set the ATTENUATOR ⑨ 0dB and adjust the AMPLITUDE ⑩ so that the voltmeter may indicate 1Vrms. Now a 1Vrms voltage is output to the OUTPUT ⑧.
3) Set the ATTENUATOR ⑨ to −40dB. The voltmeter indicates nearly 0V, but in fact the voltage of 10mVrms is correctly output to the OUTPUT ⑧.

5. How to use the sync input terminal
Oscillation frequency generated in the AG-252 can be synchronized with an external signal by applying an external sine wave to the SYNC terminal ⑪ on the rear panel. The sync range is more than 1% per 1Vrms input, with the characteristics as shown below :

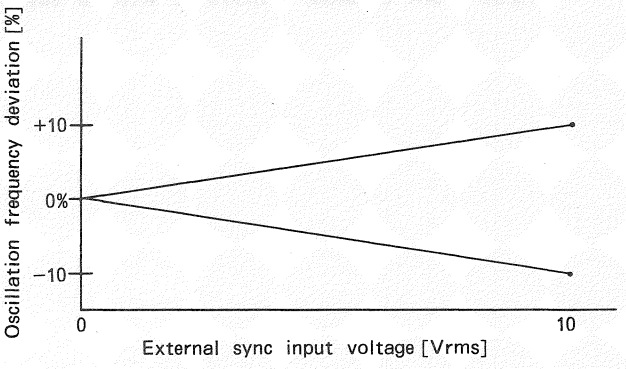

Fig. 3

Note that higher voltages of sync signal (≧2Vrms) results in larger amplitude, which may cause clipping of waveform or larger distortion.

Also remember that the instrument may be damaged if voltage of more than 10Vrms is applied. If a DC component is mixed in the sine wave input from outside, remove it with a capacitor.

6. APPLICATIONS

6–1 Using as Sine Wave Oscillator

AG-252 can be used as a sine wave oscillator as outlined below.

1. Since the unit features low distortion factor, it can be used for measurement of distortion characteristic of amplifier.
2. Since the unit features wide bandwidth, it can be used for measurement of frequency characteristic of amplifier.
3. The built-in high accuracy attenuator permits measurement of amplifier gain.
4. Can be used as a signal source of impedance bridge.

6–1–1 Measurement of Amplifier Gain

An example of measurement of amplifier gain is described below.

First connect AG-252, amplifier to be tested and AC volt-meter as shown in Fig. 4 .

1) Adjust ATTENUATOR ⑨ and AMPLITUDE ⑩ so that AC volt-meter indicates the rated output

(supposed to be 1V in this example) of the amplifier. To facilitate the measurement, it is advisable to set ATTENUATOR ⑨ as low as possible. Assume that ATTENUATOR ⑨ is set −50dB for the rated output.

2) Disconnect the amplifier and connect the AC volt-meter to AG-252 to measure the output voltage. Note that the use of ATTENUATOR ⑨ eliminates the need for connecting a high sensitivity volt-mater. If ATTENUATOR ⑨ is set to 0dB and the voltmeter indicates 2V, it means that the input voltage of the amplifier is 50dB below 2V. Therefore, the gain obtained is as follows :

$$50\text{dB} + 20 \log 10 \frac{1\text{V}}{2\text{V}} \text{ dB}$$

$$= 50\text{dB} - 6\text{dB}$$

$$= 44\text{dB}$$

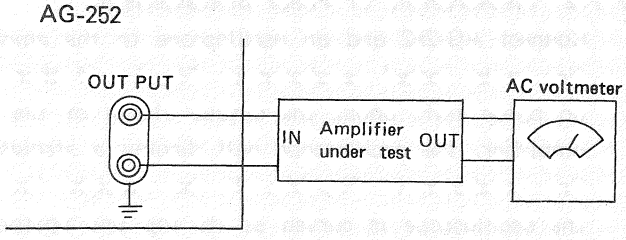

Fig. 4

6–1–2 Measurement of Phase Characteristic

Connect AG-252 and an oscilloscope to the amplifier to be tested as shown in Fig. 5 . If there is no phase shift about the output signal of the amplifier, the oscilloscope will display a straight line as shown in Fig. 5A . If the straight line on the oscilloscope is curved at its top and bottom sections as shown in Fig. 5B . it indicates that the output signal of amplifier is suffering from an amplitude distortion. In this case, reduce the output level of AG-252 a little to vary the frequency. This causes the straight line on the oscilloscope to expand gradually to turn into an ellipse. By utilizing the configuration of this ellipse, the phase shift can be calculated as follows :

First, measure the maximum horizontal deflection and suppose that this deflection is "X" and that the section at which the ellipse crosses the horizontal axis is "x", as shown in Fig. 6 . And, the phase shift angle θ is given by the following.

$$\text{Sin } \theta = \frac{\chi}{X}$$

Find θ from the table of trigonometric functions and the value obtained gives the angle of phase shift.

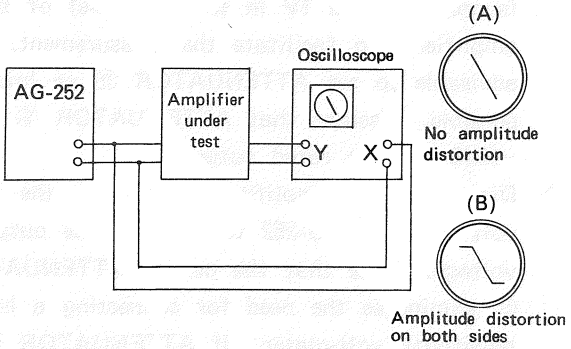

Fig. 5 Measurement of Phase Characteristic

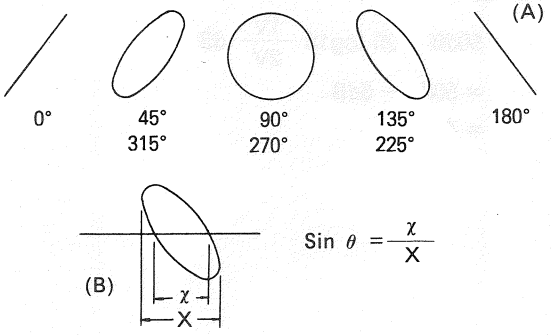

Fig. 6 Check of Phase Shift Angle

6–1–3 Using as Square Wave Oscillator

AG-252 features excellent rising and falling characteristics (120 ns as standard characteristic). It has no coupling capacitors in the output stage, so the sag (deflection of top section) is as low as 5% at 50Hz. By applying such a good square wave to an amplifier input, various characteristics of amplifier can be observed on an oscilloscope.

To test an amplifier, proceed as follows :

1) Connect AG-252 an amplifier to be tested and an oscilloscope as shown in Fig. 7 .
2) Press WAVE FORM ⑦ to the " ⊓⊔ " position to obtain square waves of appropriate frequency and amplitude.
3) During the test, change the frequency as neces sary. The relationship between waveforms and amplifier characteristics is shown in Fig. 8 .

AG-252

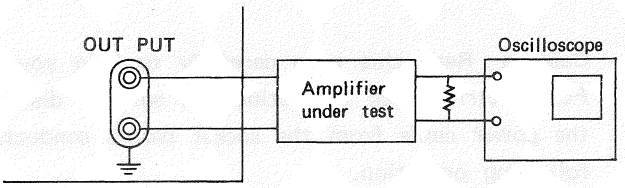

Fig. 7

Output Waveform	Amplifier Characteristic	
⊓⊔⊓	Flat frequency characteristic over 10 times the input frequency.	⊓‾⊓
∿	Frequency of about 10 times the input frequency is cut off.	⊓‾⊓
⊓⊔⊓	Frequency of about 1/10 of the input frequency is cut off.	⊓‾⊓
⊓⊔⊓	Peak appears on frequency of about 10 times the input frequency.	⊓‾⊓

Fig. 8

7. MAINTENANCE

Caution : Read this page carefully to keep your safety. For Electric Shock Protection : Be sure to disconnect the power cable from the socket before conducting the following operation.

REPLACING THE FUSE

In case the fuse has blown, locate the cause. If the fuse itself is the cause, replace it as follows :

1. Pull the plug of the power cord from the power outlet.
2. Remove the fuse holder in the rear panel using a standard screwdriver (see Fig. 6).
3. Take out the blown fuse, and in its place, insert a new fuse.
4. Set the label of your line voltage to the mark ▼, then plug the fuse holder containig the new fuse into the rearpanel.

CHANGING THE SUPPLY VOLTAGE

Remove the fuse holder in the rear panel using a standard screwdriver. Then set the label of your line voltage to the mark ▼ and plug the fuse holder back into place. When changing the supply setting from 100/120V to 220/240V, change the 0.3A fuse for a 0.2A one. (see Fig. 6).

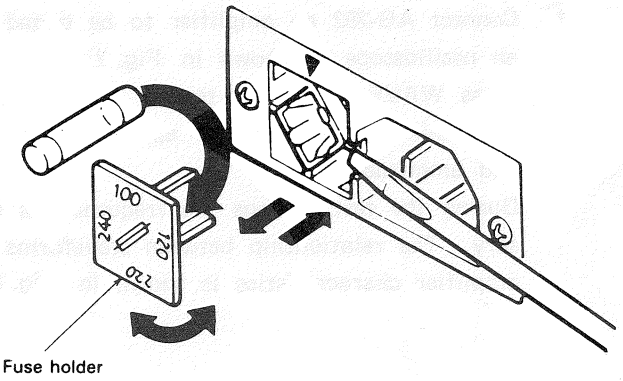

Fig. 9