GF-232B

DUAL-CHANNEL ARBITRARY WAVEFORM GENERATOR

- 0 MI2103 -

PROMAX

SAFETY NOTES

Read the user's manual before using the equipment, mainly "**SAFETY RULES**" paragraph.

The symbol ⚠ on the equipment means "**SEE USER'S MANUAL**". In this manual may also appear as a Caution or Warning symbol.

WARNING AND CAUTION statements may appear in this manual to avoid injury hazard or damage to this product or other property.

QUICK ACCESS TO CONTENT

You can access instantly to any chapter by clicking on the title of the chapter in the table of contents.

Click on the arrow ← at the top right of the page to return to the table of contents.

USER'S MANUAL VERSION

Version	Date
1.0	May 2016

SAFETY RULES

This chapter contains important safety instructions that you must follow when operating GF-232B and when keeping it in storage. Read the following before any operation to insure your safety and to keep the best condition for GF-232B.

Safety Symbols

These safety symbols may appear in this manual or on GF-232B.

Warning: Identifies conditions or practices that could result in injury or loss of life.

Caution: Identifies conditions or practices that could result in damage to GF-232B or to other properties.

Attention Refer to the Manual

Earth (ground) Terminal

Safety Guideline

- **General**

  * Do not place any heavy object on GF-232B.
  * Avoid severe impacts or handling that leads to damage.
  * Do not discharge static electricity to GF-232B.
  * Use only mating connectors, for the terminals.
  * Do not block or obstruct cooling vent opening.
  * Do not perform measurements at power source and building installation site (Note below).
  * Do not disassemble GF-232B unless you are qualified as service personnel.
  * (Note) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. GF-232B falls under category II.
  * Measurement category IV is for measurement performed at the source of low-voltage installation.
  * Measurement category III is for measurement performed in the building installation.
  * Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation.

- **Power Supply**
  * Input voltage: 100 / 120 / 220 / 240 V AC ±10 %, 50 / 60 Hz (fixed voltage rating, factory installed).
  * The power supply voltage should not fluctuate more than 10 %.
  * Connect the protective grounding conductor of the power cord to earth ground, to avoid electrical shock.

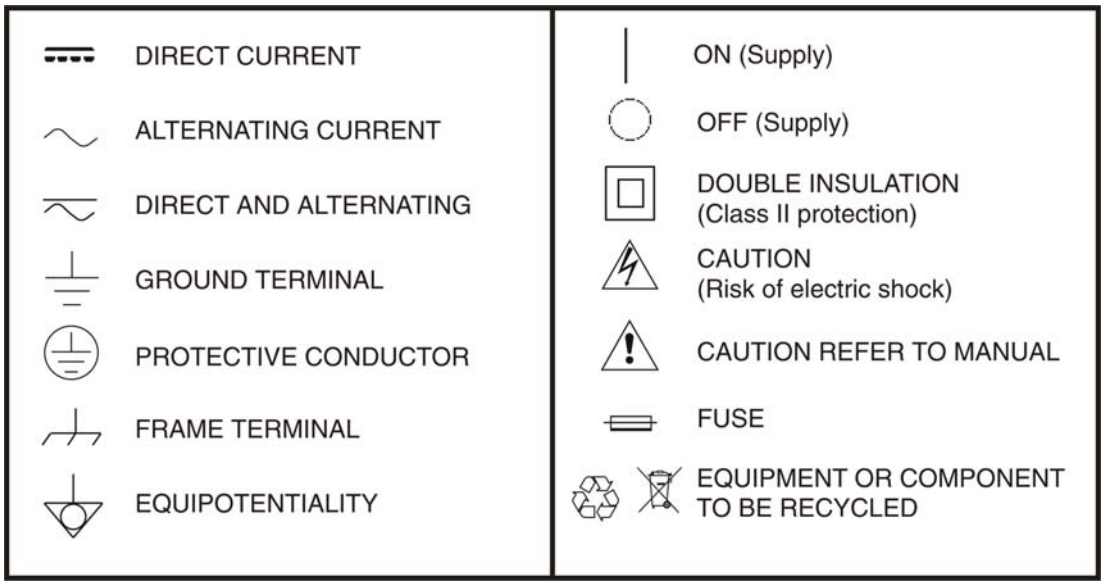
- **Fuse**
  * Fuse type: T0.16 A / 250 V (for 220 V / 240 V ±10 % rating), T0.315 A / 250 V (for 100 / 120 V ±10 % rating).
  * Replace the fuse with the specified type and rating only, for continued fire protection. For fuse replacement details, see page 30.
  * Disconnect the power cord before fuse replacement.
  * Make sure the cause of the fuse blowout is fixed before fuse replacement.

- **Cleaning**
  * Disconnect the power cord before cleaning.
  * Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid into GF-232B.
  * Do not use chemicals or cleaners containing harsh materials such as benzene, toluene, xylene, and acetone.

- **Operation Environment**
  * Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below)
  * Relative Humidity: < 80 %
  * Altitude: < 2000 m
  * Temperature: 0° C to 40° C
    (Note) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. GF-232B falls under degree 2. Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity".
  * Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
  * Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
  * Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

- **Storage Environment**
  * Location: Indoor
  * Relative Humidity: < 70 %
  * Temperature: −10° C to 70° C

- **Symbols related with safety:**



- **Descriptive Examples of Over-Voltage Categories**

  Cat I Low voltage installations isolated from the mains.

  Cat II Portable domestic installations.

  Cat III Fixed domestic installations.

  Cat IV Industrial installations.

Power cord for the United Kingdom

When using GF-232B in the United Kingdom, make sure the power cord meets the following safety instructions.

Note:	This lead / appliance must only be wired by competent persons.

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in main leads may not correspond with the colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol ⏚ or coloured Green or Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75 mm^2 should be protected by a 3 A or 5 A fuse. Larger conductors would normally require 13 A types, depending on the connection method used.

Any moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

TABLE OF CONTENTS

DUAL-CHANNEL ARBITRARY WAVEFORM GENERATOR
GF-232B

1 INTRODUCTION

1.1 Description

GF-232B uses the latest Direct Digital Synthesis (DDS) technology to generate stable, high resolution output frequency. The DDS technology solves several problems encountered in traditional function generators, as follows.

Constant current circuit methodology.

This analog function generating method uses a constant current source circuit built with discrete components such as capacitors and resistors. Temperature change inside the generator greatly affects the components characteristics which lead to output frequency change. The results are poor accuracy and stability.

Figure 1.

1.2 DDS Methodology

In DDS, the waveform data is contained in and generated from a memory. A clock controls the counter which points to the data address. The memory output is converted into analog signal by a digital to analog converter (DAC) followed by a low pass filter. The resolution is expressed as fs/2k where fs is the frequency and k is the control word, which contains more than 28 bits. Because the frequency generation is referred to clock signal, this achieves much higher frequency stability and resolution than the traditional function generators.

1.3 Block Diagram

DDS synthesizer consists of Phase accumulator (counter), lookout table data (ROM), Digital-to-analog converter (DAC), and Low-pass filter (LPF).

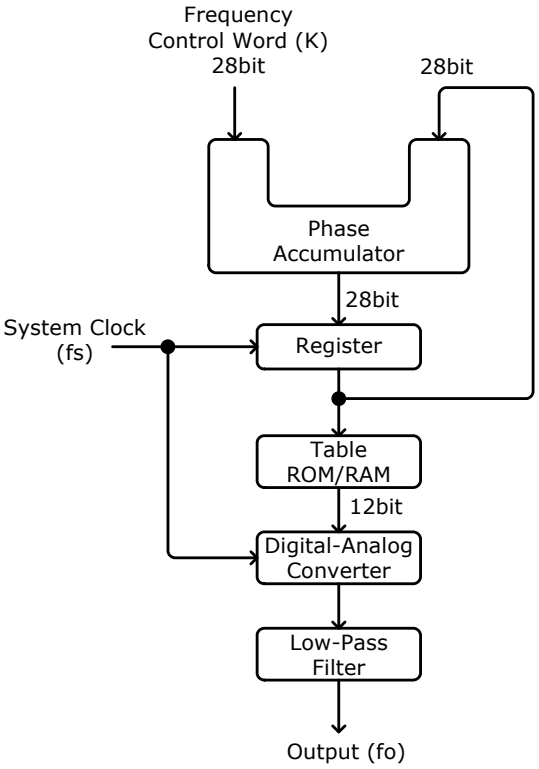


Figure 2.

The phase accumulator adds the frequency control word K at every clock cycle fs. The accumulator output points to a location in the Table ROM/RAM. The DAC converts the digital data into an analog waveform. The LPF filters out the clock frequency to provide a pure waveform.

1.4 Main features

► **Performance**:

- High resolution using DDS technology
- High frequency accuracy: ±20 ppm
- Low distortion: −55 dBc @ ≤200 kHz
- High resolution 100 MHz

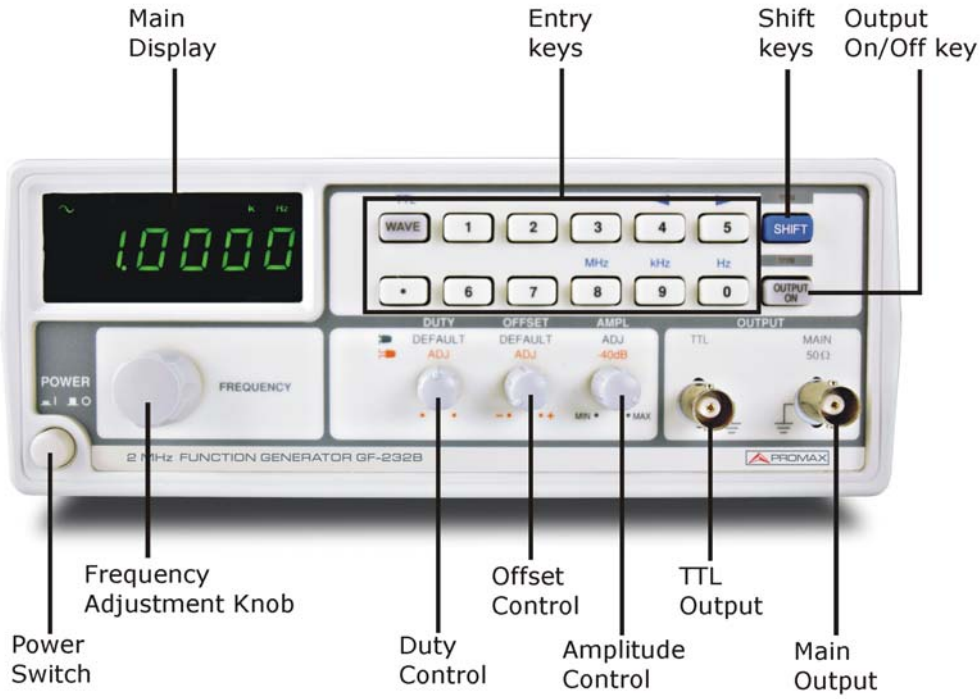
► **Features**:

- Digital user interface with 6-digit LED display
- Various output waveforms: Sine, Square, and Triangle
- TTL output
- Amplitude control
- −40 dB attenuation
- Duty control
- Variable DC offset control
- Output On/Off control
- Voltage display
- Output overload protection

► **Interface**:

- Frequency output
- TTL output

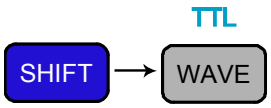
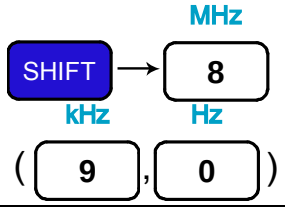
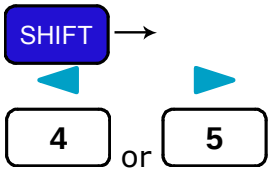
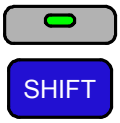
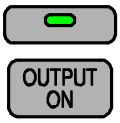
1.5 Front Panel



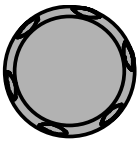
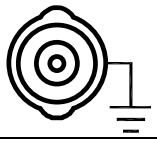
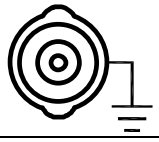
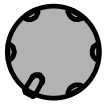
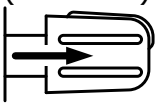
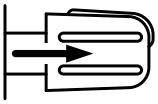
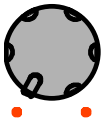
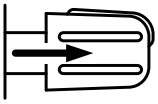
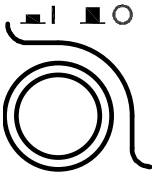
Main Display

7 segment LED		Shows frequency and voltage.
TTL indicator	TTL	Indicates that the TTL output is enabled.
Waveform indicator		Indicates the waveform shape: Sine, Square, and Triangle.
Frequency indicator	MkHz	Indicates the output frequency: MHz, kHz, or Hz.

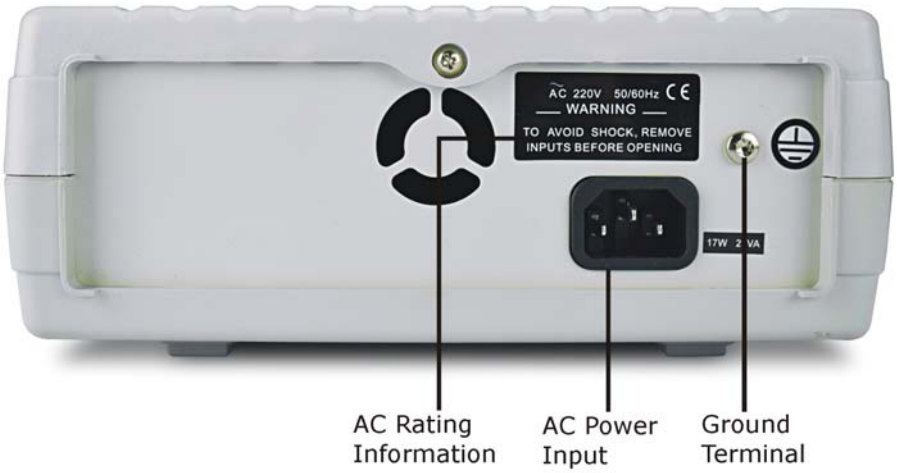
Entry keys

Waveform key		Selects the waveform: sine, square, and triangle.
TTL activation		Activates TTL output.
Numerical keys		Specifies frequency.
Frequency unit selection		Specifies the frequency unit: MHz, kHz, or Hz.
Cursor selection		Moves the cursor (frequency editing point) left or right.
Shift key		Selects the 2nd function associated to the entry keys. The LED lights when Shift is activated.
Output On/Off key		Turns the output On/Off. The LED lights when the output is On.

Others

Frequency editing knob		Increases (right turn) or decreases (left turn) the frequency.
Main output	OUTPUT 50 Ω 	Outputs sine, square, and triangle waveform. BNC, 50 Ω output impedance.
TTL output	TTL OUTPUT 	Outputs TTL output waveform, BNC terminal.
Amplitude contro	AMPL  MIN MAX -40dB	Sets the sine/square/triangle waveform amplitude. Turn left (decrease) or right (increase).  When pulled out, attenuates the sine / square / triangle waveform amplitude by −40 dB.
DC offset control	OFFSET  ADJ	 When pulled out, sets the DC offset level for sine/square/triangle waveform. Turn left (decrease) or right (increase). The range is −5 V ~ +5 V, in 50 Ω load.
Duty cycle control	DUTY  ADJ	 When pulled out, sets the square or TTL wave duty cycle. Turn left (decrease) or right (increase). The range is 25 % ~ 75 %.
Power switch	POWER 	Turns the main power On/Off.

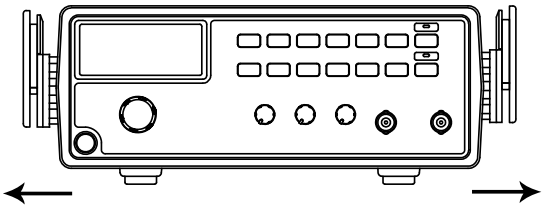
1.6 Rear Panel



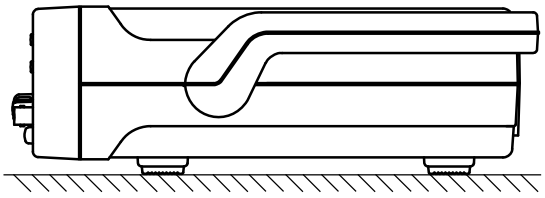
AC Rating Information	Fixed AC line voltage: 100,120, 220, or 240 V (factory installed setting). The label shows the applicable rating.
AC Power Input	Accepts the AC power cord. 100,120, 220, or 240 V, ±10%, 50/60 Hz.
Ground Terminal	The safety ground terminal. Use this terminal for common ground connection.

1.7 Set Up

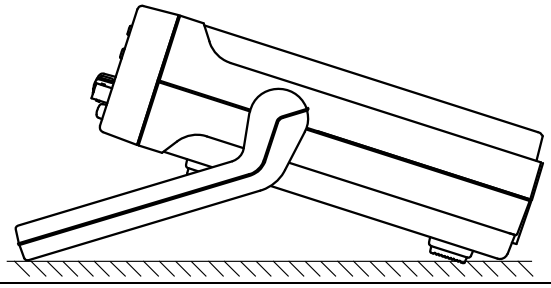
Tilt stand



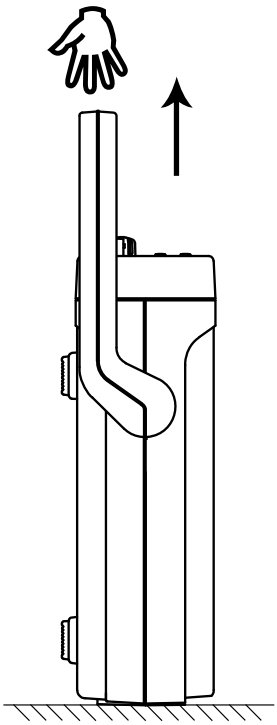
Pull out the handle sideways and rotate it.



Place horizontally.



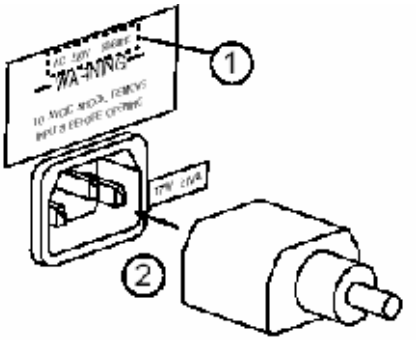
Or tilt stand.



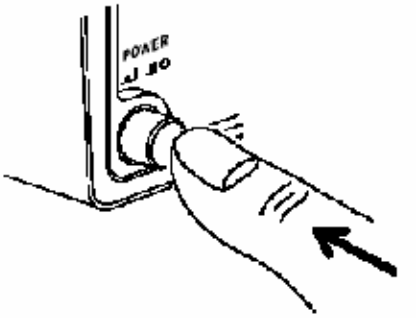
Place the handle vertically for hand carry.

Power up

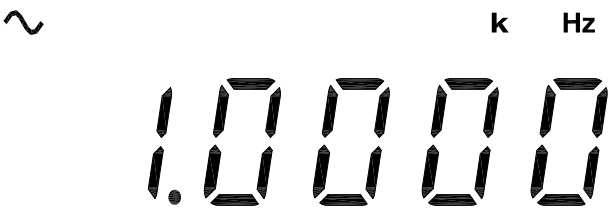
Check the voltage level displayed on the label(1) and make sure it is identical to the AC line. Then connect the power cord(2).



Push and turn On the main power switch on the front panel.

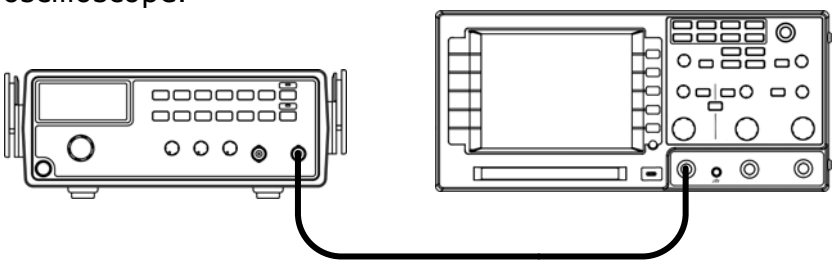


The display shows the default setup: Sine wave, 1 kHz

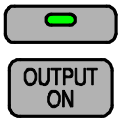


Functionality check

Connect the main output to measurement device such as oscilloscope.



Press the output key. The output is activated and the LED turns On.

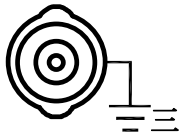


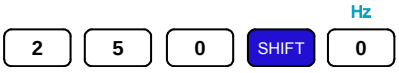
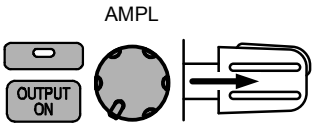
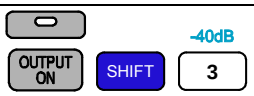
Observe the output waveform: 1 kHz, sine wave.

1.8 Operation Shortcuts

Sine wave 250 Hz, −40 dB amplitude

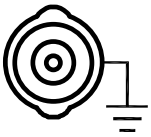
OUTPUT 50 Ω

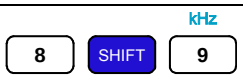
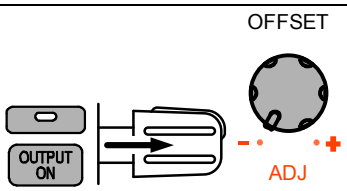


Press Wave key and select Sine	
Press 2 + 5 + 0 + Shift + 0(Hz) key	
Press Output key, then pull Amplitude knob	
Press Output key, then press Shift + 3 (−40 dB) key	

Triangle wave 8 kHz,+2 V FOCET

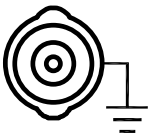
OUTPUT 50 Ω

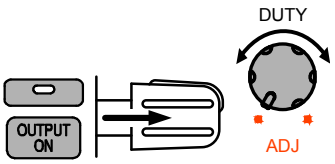


Press Wave key and select Triangle	
Press 8 + Shift + 9(kHz) key	
Press Output key, then pull Offset knob	

Square Wave 1 MHz, 45 % duty

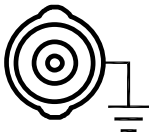
OUTPUT 50 Ω



Press Wave key and select Square	
Press 1 + Shift + 8(MHz) key	
Press Output key, then pull Duty knob and rotate	

TTL Output 10 kHz

TTL OUTPUT



Press Output key	
Press Shift + Wave (TTL) key	
Press 1 + 0 + Shift + 9(kHz) key	

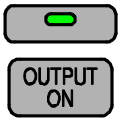
2 SINE/SQUARE/TRIANGLE/WAVE

2.1 Activate waveform

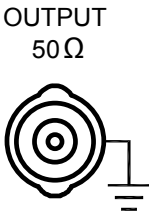
Sine / Square / Triangle

Press the wave key repeatedly. The corresponding indicator appears on the display.

	Sine waveform
	Square waveform
	Triangle waveform



Press the output key. The LED turns On.



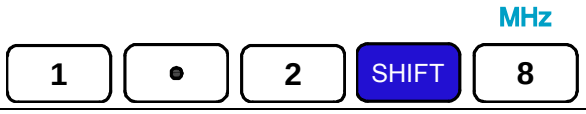
The waveform comes out from the main terminal. 10 Vp-p (50 Ω load)
20 Vp-p (no load)

2.2 Set Frequency

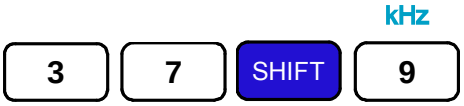
Enter frequency

Enter the waveform frequency using the numerical keys.

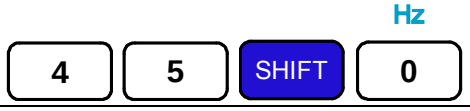
1.2 MHz



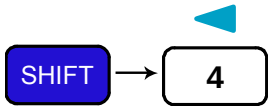
37 kHz



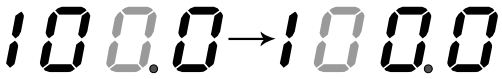
45 Hz

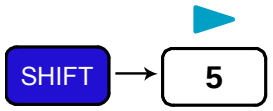


Edit frequency

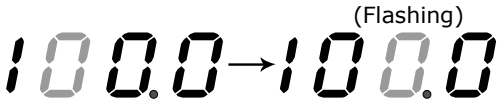


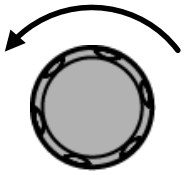
Left cursor key moves the active cursor left.



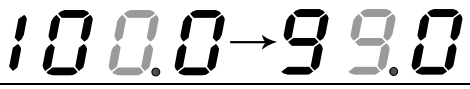


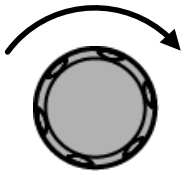
Right cursor key moves the active cursor right.



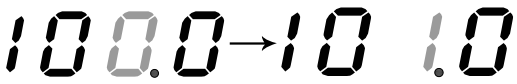


Turn the Frequency knob left to decrease the frequency.



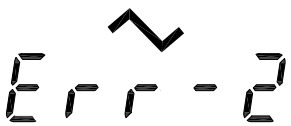


Turn the frequency knob right to increase the frequency.



Maximum frequency limit error

Sine and square waveform frequency is limited to maximum
3 MHz. When the input exceeds it, an error message (Err-1) appears and forces the frequency to 3 MHz.



Triangle waveform frequency is limited to maximum 1 MHz. When the input exceeds it, an error message (Err-2) appears and forces the frequency to 1 MHz.

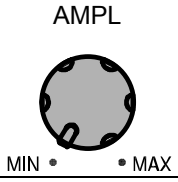
Minimum frequency limit error

The minimum frequency is 0.1 Hz. When the frequency input becomes less than 0.1 Hz, an error message (Err-4) appears and forces the frequency to 0.1 Hz.

2.3 Set Amplitude

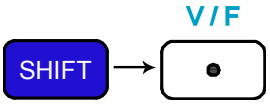
Amplitude setting does not apply to TTL output.

Set Amplitude

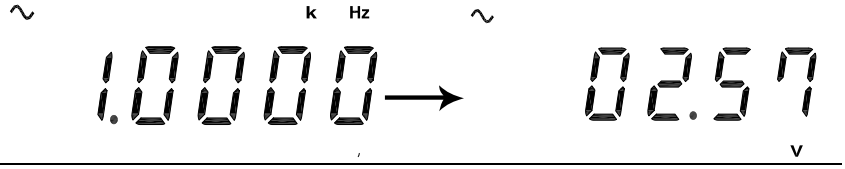


Turn the Amplitude knob right (increase) or left (decrease). The range is 2 mVpp ~ 10 Vpp for 50 Ω output impedance.

View amplitude

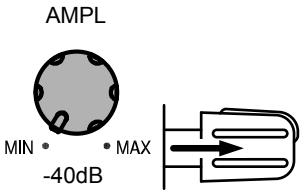


To view the voltage level (amplitude), press the Shift key and dot (V/F) key. The display shows the voltage level. Repeat this procedure to go back to the frequency level view.

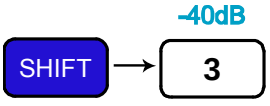


Attenuate by −40 dB

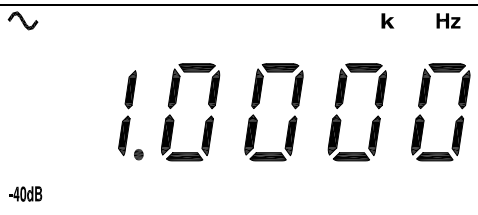
Can attenuate the main output by −40 dB, in different method.



Pull out the Amplitude knob. The output amplitude is attenuated by −40 dB.

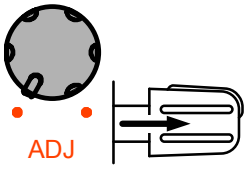


Press the Shift key, then 3 (−40 dB). The main output is attenuated by −40 dB, and the −40 dB display indicator in the display turns On.

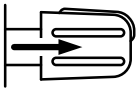


2.4 Set Duty Cycle (Square Waveform)

The duty cycle setting is not available in sine/triangle waveform.

Enter duty cycle	DUTY 	Pull out the Duty knob. Turn right (left) to increase (decrease) the duty cycle. The default is set at 50 %.
Range	25 % ~ 75 %	

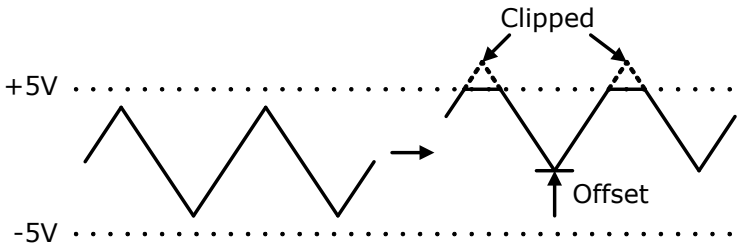
2.5 Set Offset

Activate offset	Can add or delete offset to the sine/square/triangle waveform, thus changing the waveform vertical position.	
		Pull the OFFSET knob to turn On Offset setting.
Adjust offset	OFFSET 	Turn the knob right (higher position) or left (lower position).
	Range	−5 V ~ +5 V for 50 Ω output load

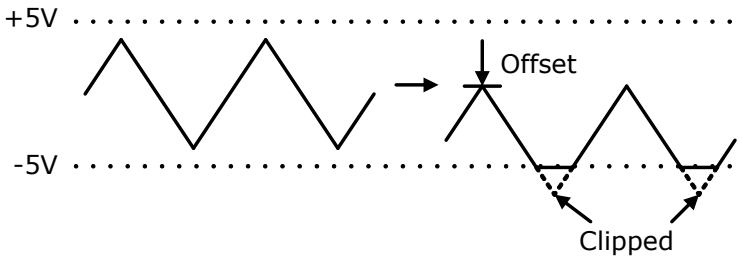
Limitation

Note that the output amplitude, including the offset, is still limited to:
−5 ~ +5 V (50 Ω load)
−10 ~ +10 V (no load)
Therefore excessive offset leads to peak clip as below.

Positive peak clip (50 Ω)



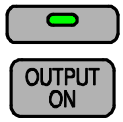
Negative peak clip (50 Ω)



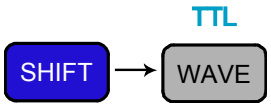
3 TTL OUTPUT

3.1 Activate TTL

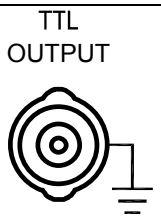
Select TTL



Press the Output key. The LED turns On. (TTL does not activate unless the output is already On)



Press the Shift key, then the Wave key. TTL indicator appears on the display.



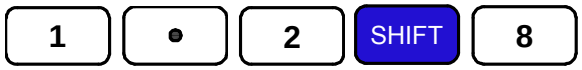
The waveform comes out from the TTL output terminal. Level: ≥3 Vp-p

3.2 Set Frequency

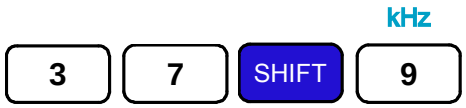
Enter frequency

Enter the waveform frequency using the numerical keys.

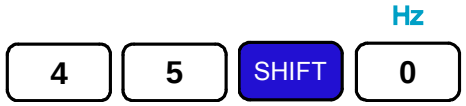
1.2 MHz



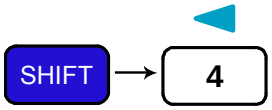
37 kHz



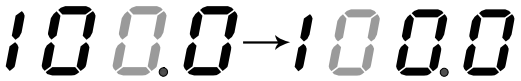
45 Hz

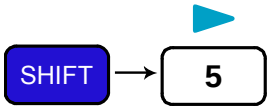


Edit frequency

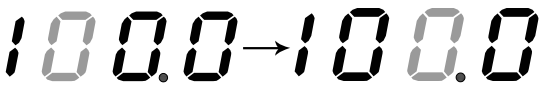


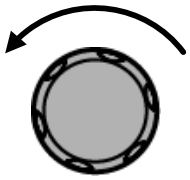
Left cursor key moves the active cursor left.



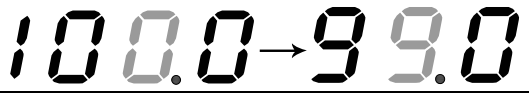


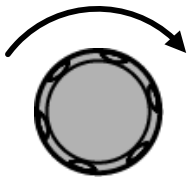
Right cursor key moves the active cursor right.



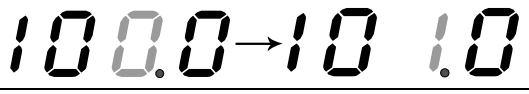


Turn the Frequency knob left to decrease the frequency.

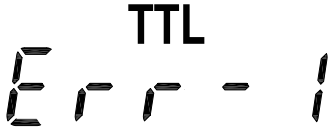




Turn the frequency knob right to increase the frequency.



Maximum frequency limit error



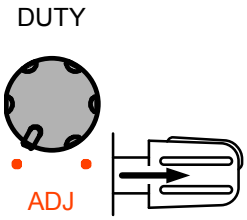
TTL frequency is limited to maximum 3 MHz. When the input exceeds it, an error message (Err-1) appears and forces the frequency to 3 MHz.

Minimum frequency limit error

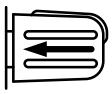
The minimum frequency is 0.1 Hz. When the frequency input becomes less than 0.1 Hz, an error message (Err-4) appears and forces the frequency to 0.1 Hz.

3.3 Set Duty Cycle

Enter duty cycle



1. Pull out the Duty knob. Turn right (left) to increase (decrease) the duty cycle. The default is set at 50 %.



2. Press the Duty knob. The duty cycle is reset to 50 %.

Range 25 % ~ 75 %

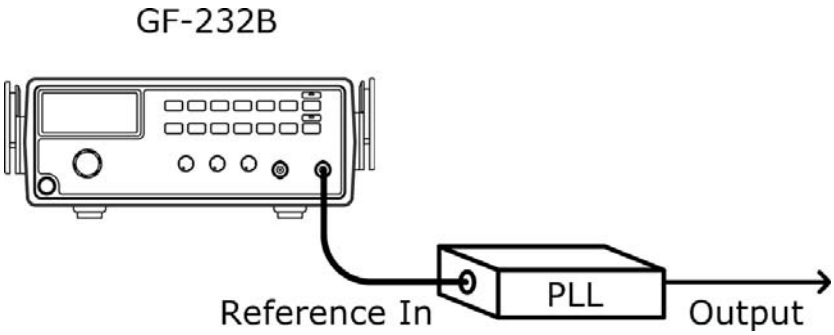
4 APPLICATION EXAMPLES

4.1 Referente Signal for PLL System

Description

The output can be used as a cost-effective reference signal for Phase-Locked-Loop system. Directly connect GF-232B output to PLL input.

Block diagram

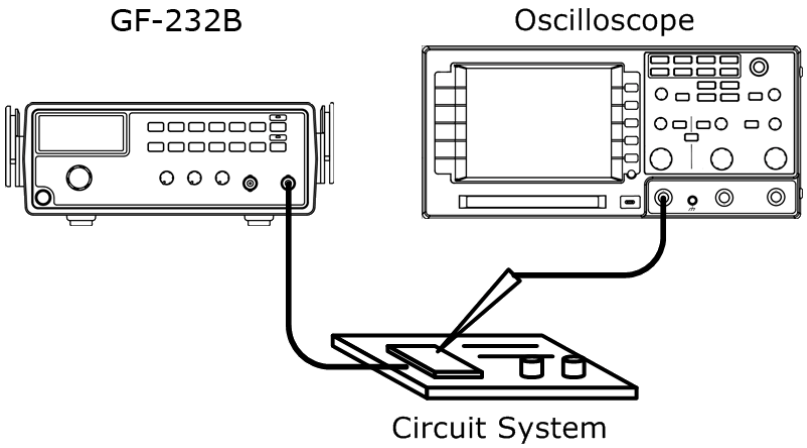


4.2 Trouble-Shooting Signal Source

Description

The output can be used as the signal source to test the failed part in a circuit system. Isolate the problematic part from the rest, feed the GF-232B output as a stimulus, and observe the outcome using an oscilloscope.

Block diagram

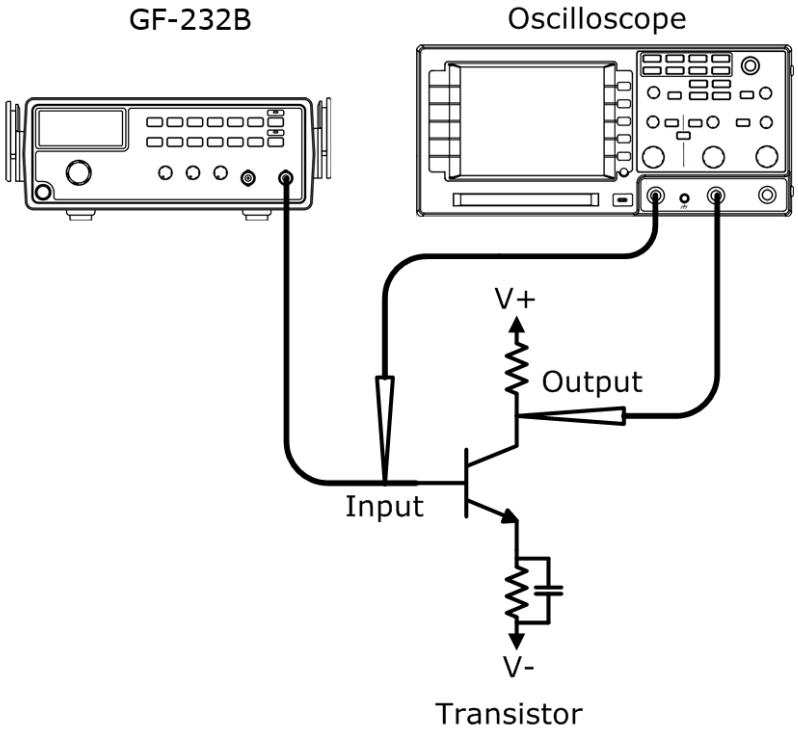


4.3 Transistor DC Bias Characteristics Test

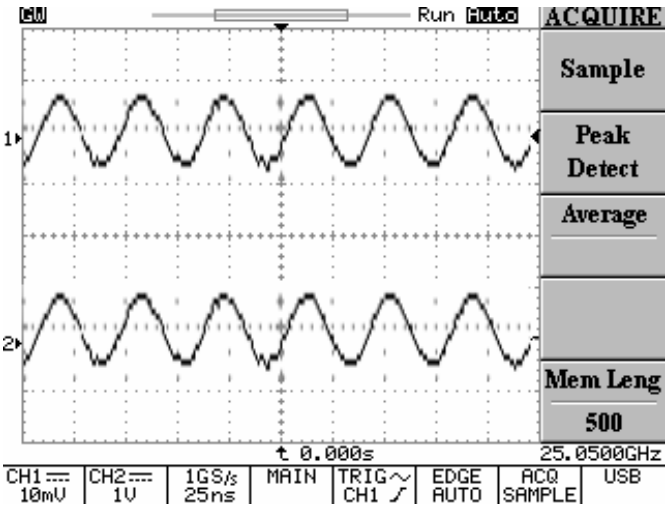
Description

Use as the signal source for a transistor. Compare the transistor input/output waveform using the oscilloscope. Adjust the DC voltage source to find out the maximum output without distorting the waveform.

Block diagram



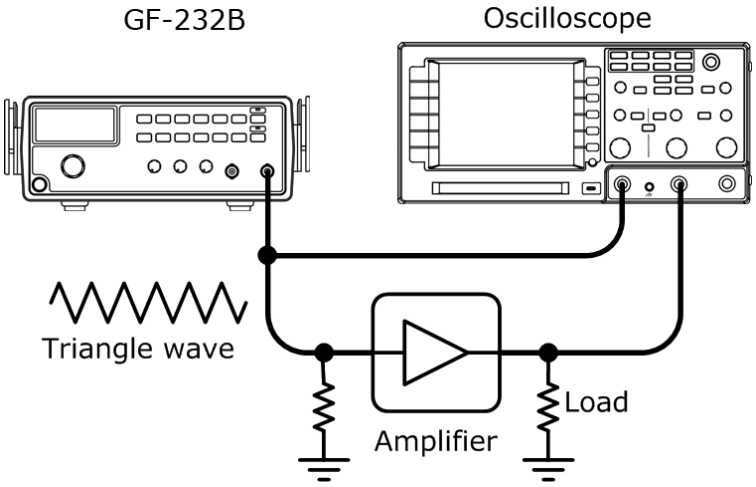
Oscilloscope display



4.4 Amplifier Over-Load Characteristic Test

Description Use the triangle wave output to check the amplifier output distortion caused by overload. The common sine wave is not the ideal source in this case. Observe the linearity of the triangle waveform using an oscilloscope.

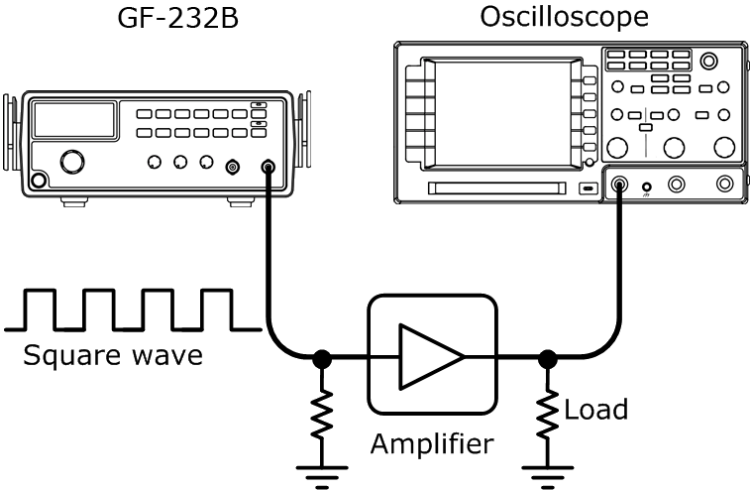
Block diagram



4.5 Amplifier Transient Characteristics Test

Description Use the square wave output to check the transient frequency response of an amplifier. The common sine wave is not the ideal source in this case. Observe the waveform using an oscilloscope.

Block diagram



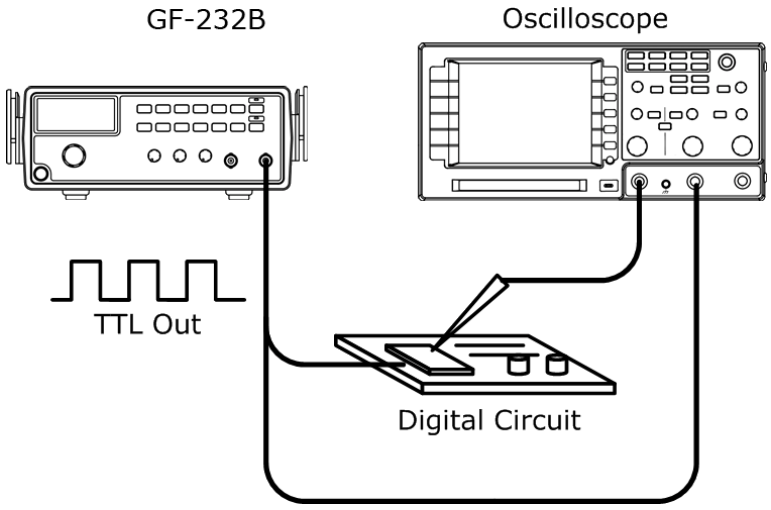
Test step	Apply a triangle waveform to the amplifier first. Adjust the waveform amplitude to make sure there is no clipping. Switch to square waveform and adjust its frequency to the middle of the amplifier pass band, such as 20 Hz, 1k Hz, and 10 kHz. 3. Observe the shape of the amplifier output. The following table shows the possible output distortions and their explanations.	
Transient characteristic list		Amplitude reduction at low frequency No phase shift
		Low frequency boosted (accentuated fundamental)
		High frequency loss No phase shift
		Low frequency phase shift Trace thickened by hum-voltage
		High frequency loss Phase shift
		Low frequency loss Phase shift
		Low frequency loss Low frequency phase shift
		High frequency loss Low frequency phase shift
		Damped oscillation

Note: For narrow band amplifier testing, square wave may not be suitable.

4.6 Logic Circuit Test

Description Use the TTL output to test digital circuits. Observe the timing relation of input/output waveform using an oscilloscope.

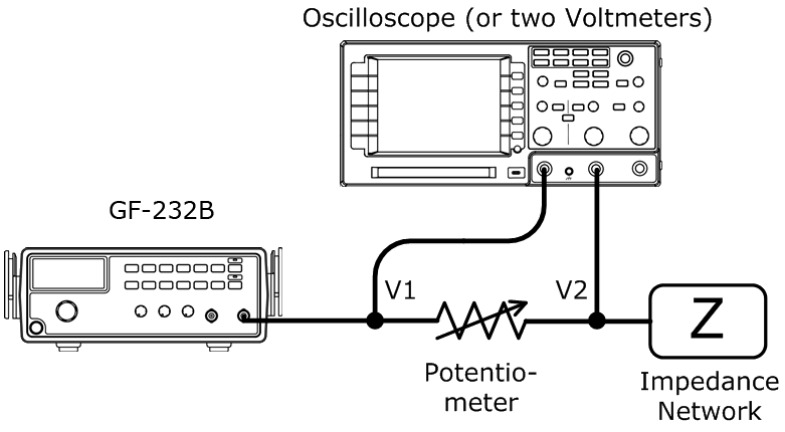
Block diagram



4.7 Impedance Matching Network Test

Description Use for impedance matching network: testing its frequency characteristic and matching the impedance.

Block diagram

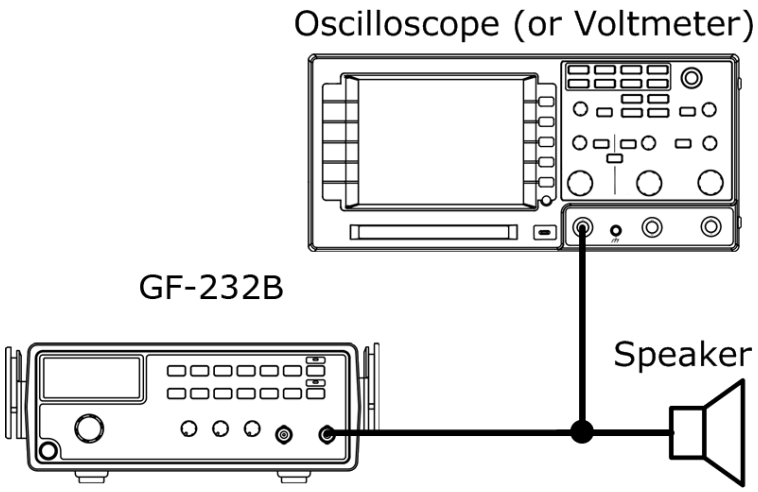


Test step Adjust the potentiometer until V2 becomes the half of V1 (V2=0.5 V1). Then the impedance Z of the network becomes identical to the potentiometer.

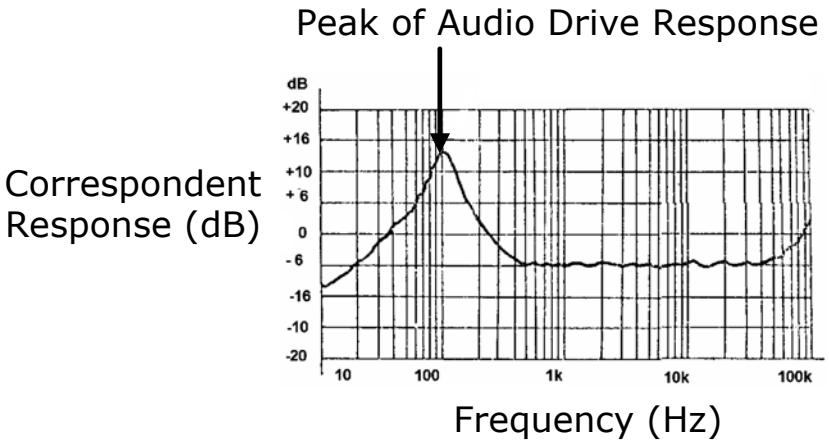
4.8 Speaker Driver Test

Description Use for testing the frequency characteristics of audio speakers. Record the volt reading versus the input signal frequency.

Block diagram



Graph The peak voltage occurs on the resonant frequency of the speaker.



5 TROUBLESHOOTING

- **I pressed the Power switch on the front panel but nothing happens.**

  Make sure the AC source voltage is set at the rating ±10 %, 50/60 Hz. For power up sequence, see page 14. Otherwise the internal fuse might be blown out.

- **TTL does not activate (pressed Shift + Wave key)**

  You need to turn On the output first. Press the Output key, then press Shift+Wave.

- **How can I get out of TTL/−40 dB mode?**

  For TTL: press the Shift key, then the wave key. For −40 dB mode, press the Shift key, then 3.

- **The device accuracy does not match the specification.**

  Make sure the device is powered On for at least 30 minutes, within +18° C~+28° C. This is necessary to stabilize the unit to match the specification.

- **What are these error messages?**

  Several messages appear when trying to set the frequency in irregular ways.

- **Error Messages**

Frequency error

Err-1	Sine, square, and TTL wave frequency over range. This message appears when entering sine / square / TTL waveform frequency larger than 3 MHz. The frequency is automatically forced to 3 MHz.
Err-2	Triangle wave Frequency over range. This message appears when entering triangle waveform frequency larger than 1 MHz. The frequency is automatically forced to 1 MHz.
Err-4	Frequency over resolution. This message appears when trying to enter frequency less than 0.1 Hz. The frequency is automatically forced to 0.1 Hz.

6 SPECIFICATIONS

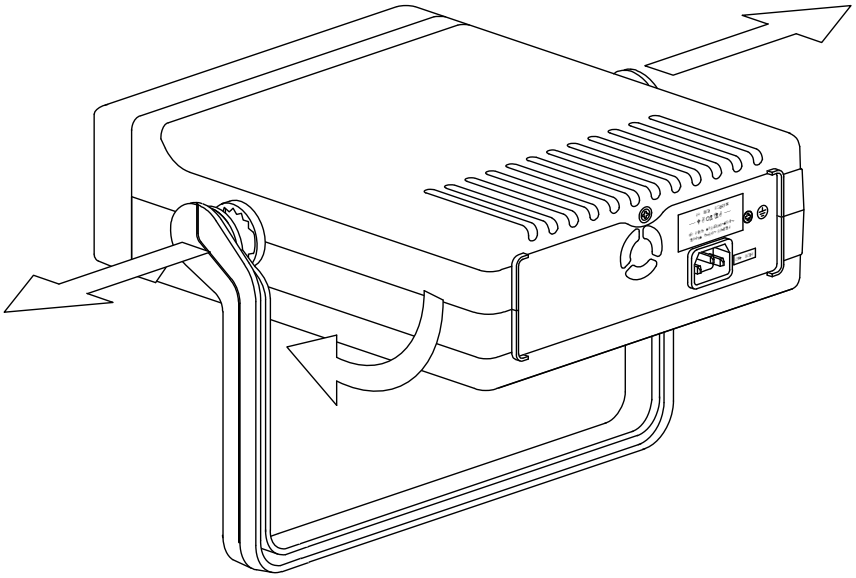
Must be powered for at least 30 minutes within the ambient temperature 18° C ~ 28° C to meet this spec.

Main	Output Function	Sine, Square, Triangle
	Amplitude Range	10 Vpp (50 Ω load)
	Amplitude Accuracy	±20 % at maximum position
	Impedance	50 Ω ± 10 %
	Attenuator	−40 dB ± 1 dB x1
	DC Offset	< −5 V ~ >+5 V (50 Ω load)
	Duty Range	25 % ~ 75 %, ≤1 MHz (Square Wave)
	Display	6 digits LED display
Frequency	Sine/Square Waveform Range	0.1 Hz ~ 3 MHz
	Triangle Waveform Range	0.1 Hz ~ 1 MHz
	Resolution	0.1 Hz maximum
	Stability	±20 ppm
	Accuracy	±20 ppm
	Aging	±5 ppm/year
Sine Wave	Harmonic Distortion	≥−55 dBc, 0.1 Hz ~ 200 kHz ≥−40 dBc, 0.2 MHz ~ 2 MHz ≥−35 dBc, 2 MHz ~ 3 MHz (At maximum position without any attenuation to 1/10 of any combination setting, TTL Off)
	Flatness	< ± 0.3 dB, 0.1 Hz ~ 1 MHz < ± 0.5 dB, 1 MHz ~ 2 MHz < ± 1 dB, 2 MHz ~ 3 MHz (At the max amplitude relating to 1kHz)
Triangle Wave	Linearity	≥ 98%, 0.1 Hz ~ 100 kHz ≥ 95%, 100 kHz ~ 1 MHz
Square Wave	Symmetry	±5 % of period + 4ns, 0.1 Hz ~ 100 kHz
	Rise/Fall Time	≤ 100ns at maximum output, 50 Ω load
TTL Output	Level	≥ 3 Vpp
	Fan Out	20 TTL Load
	Rise/Fall Time	≤ 25ns
General	Power Source	AC100/120/220/240 V ±10 %, 50/60 Hz (Line voltage setting is factory installed)
	Operation Environment	Indoor Use, Altitude Up to 2000 m Ambient Temperature 0 ~ 40° C Relative Humidity ≤ 80 %, 0 ~ 40° C Install Category II / Pollution Degree 2
	Storage Environment	Temperature −10 ~ 70° C Humidity ≤70 %
	Accessories	Instruction Manual x 1 GTL-101 x 1
	Dimension	251 (W) x 91 (H) x 291 (D)
	Weight	Approx. 2.1 kg

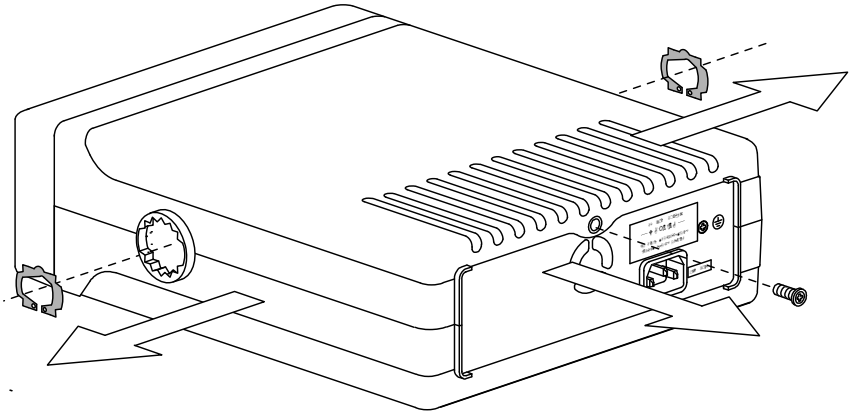
7 APPENDIX

7.1 Fuse Replacement

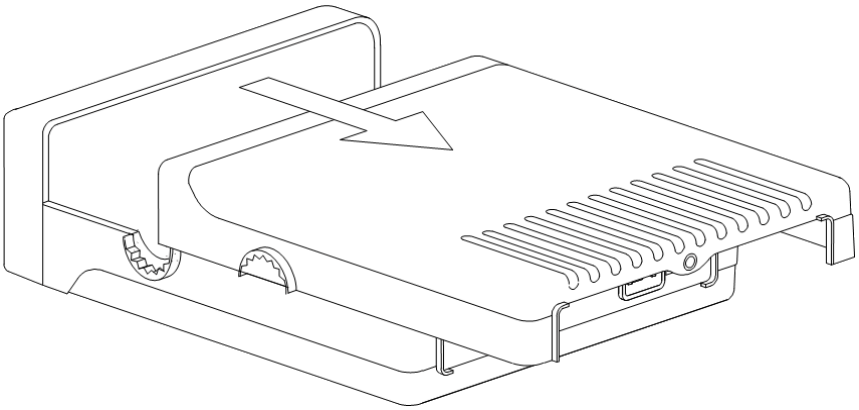
1. Take off the Handle In order to detach the handle from the unit, turn the handle down 90 degrees, then pull it off sideways.



2. Take off the Cover Take off the two metal holdings from the handle joint. Then take the top screw off from the rear panel.

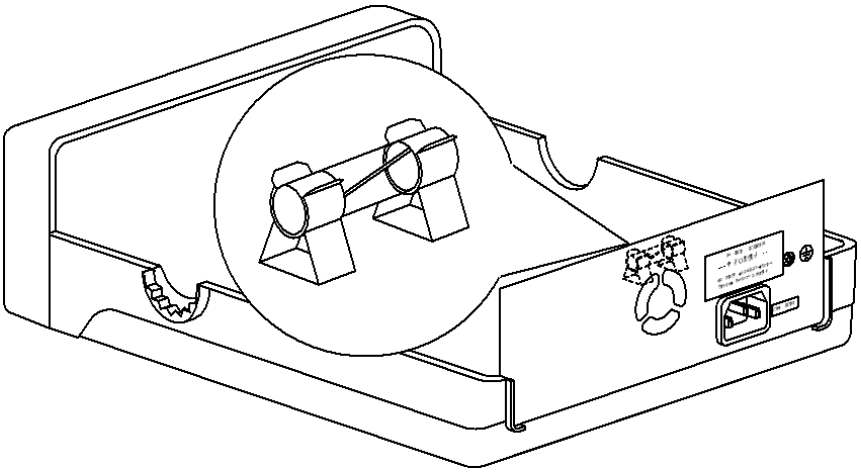


Slide the upper case to the rear side and take off the top cover.



3. Replace the Fuse

Replace the blown fuse located on the rear printed circuit board.



Fuse rating	AC 100 / 120 V	T0.315 A / 250 V
	AC 220 / 240 V	T0.16 A / 250 V

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