FG700S/F Series

Direct Digital Synthesis Function Generator

Operating Manual

MOTECH

Modern Technology for a Sustainable World

MOTECH INSTRUMENTS

SAFETY PRECAUTION

SAFETY CONSIDRATIONS

The Model FG700S/F series Direct Digital Synthesis Function Generator has been designed and tested according to EN61010-1:2001 and EN61326:1997.

SAFETY PRECAUTIONS
SAFETY NOTES

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. The manufacturer assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage is installed.

SAFETY SYMBOLS

	Caution, risk of electric shock
	Earth (ground) terminal
	Equipment protected throughout by double insulation or reinforced insulation
	Caution (refer to accompanying documents)
	Equipment complies with current EU directives
	Protective earth (ground) terminal
	Chassis terminal
	Indoor use only

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a qualified dealer for service and repair to ensure that safety features are maintained.

INSTRUMENTS WHICH APPEAR DAMAGED OR DEFECTIVE SHOULD BE MADE INOPERATIVE AND SECURED AGAINST UNINTENDED OPERATION UNTIL THEY CAN BE REPAIRED BY QUALIFIED SERVICE PERSONNEL.

WARRANTY INFORMATION

ONE-YEAR-LIMITED WARRANTY

MOTECH INDUSTRIES INC. (MOTECH) warrants to the original user or purchaser that the unit is free from any defects in material or workmanship for a period of one year from the date of purchase. If any defect is discovered within the warranty period, MOTECH will repair or replace the unit, subject to verification of the defect or malfunction, upon delivery or prepaid shipment to MOTECH.

This warranty does not apply to defects or to physical damage resulting from abuse, neglect, accident, improper repair, alteration, or unreasonable use of the unit, resulting in (but not limited to) cracked or broken case or parts, or to units damaged by excessive heat. Except upon initial purchase, this warranty does not cover finish or appearance items nor does it cover items damaged in shipment to MOTECH for repair or calibration.

To receive service under this warranty, you must include proof of purchase, including date and place of purchase, (a copy of your purchase receipt) or MOTECH will not be responsible for repairs or replacement of the unit under warranty.

Any applicable implied warranties, including warranties of merchant ability and fitness for a particular use, are hereby limited to one year from the date of purchase. Consequential or incidental damages resulting from loss of use, or from a breach of any applicable express or implied warranties are hereby excluded.

The warranty is not to substitute all other agreements and warranties, general or special, express or implied, and no representative or person is authorized to assume for us any other liability in connection with the sale or use of this MOTECH product.

Table of Content

1. Introduction

General

The Motech Model FG700S/F series is a high-performance direct digital synthesize (DDS) function generator with very low noise and distortion. Combined with the DDS technology, the FG700S/F series can output high accuracy and stable frequency to meet your test requirement of precision and accuracy. The build-in trigger/gate function allows you to control the waveform generation by internal or external. Also, the PSK and FSK modulation gives you the ability to generate such waveform for experiment or communication purpose. The FG700F series comes with AM/FM module and frequency counter to make the function of this product more comprehensive.

Key Features

➢ Direct digital synthesize multi-function generator
➢ Sine, square, triangle, pulse, DC, synchronize and ramp up/ramp down (FG700F series) output
➢ Ultra low noise and low distortion (down to 1mV peak signal)
➢ PSK and FSK modulation
➢ Digital setting of linear or logarithm sweep function
➢ Trigger and gate function
➢ AM/FM module (FG700F series)
➢ Frequency counter (FG700F series)
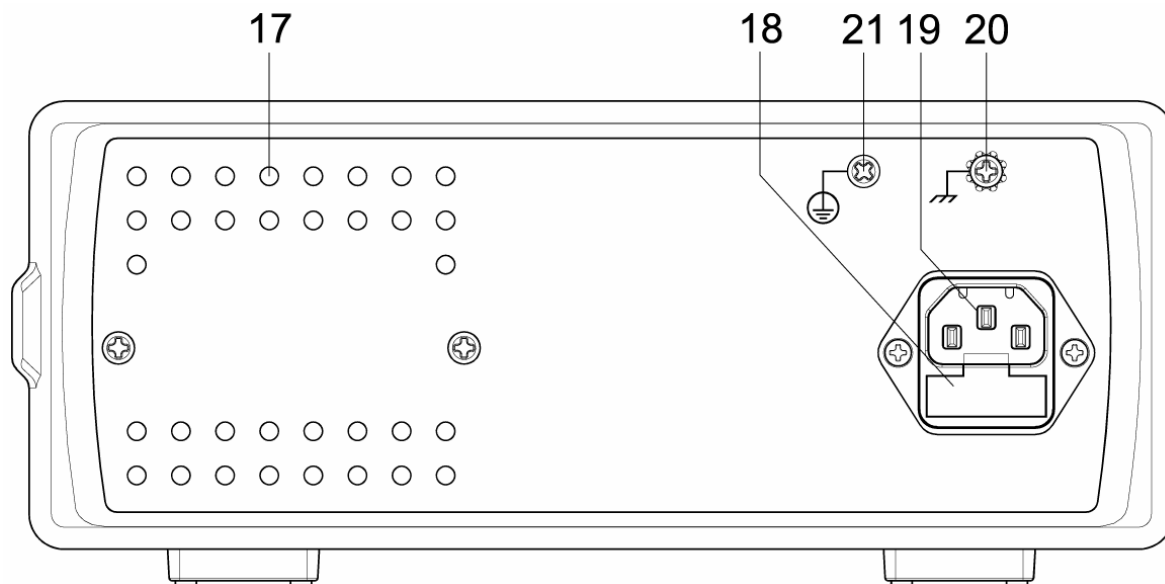
Physical Description

FG700S Series Front Panel
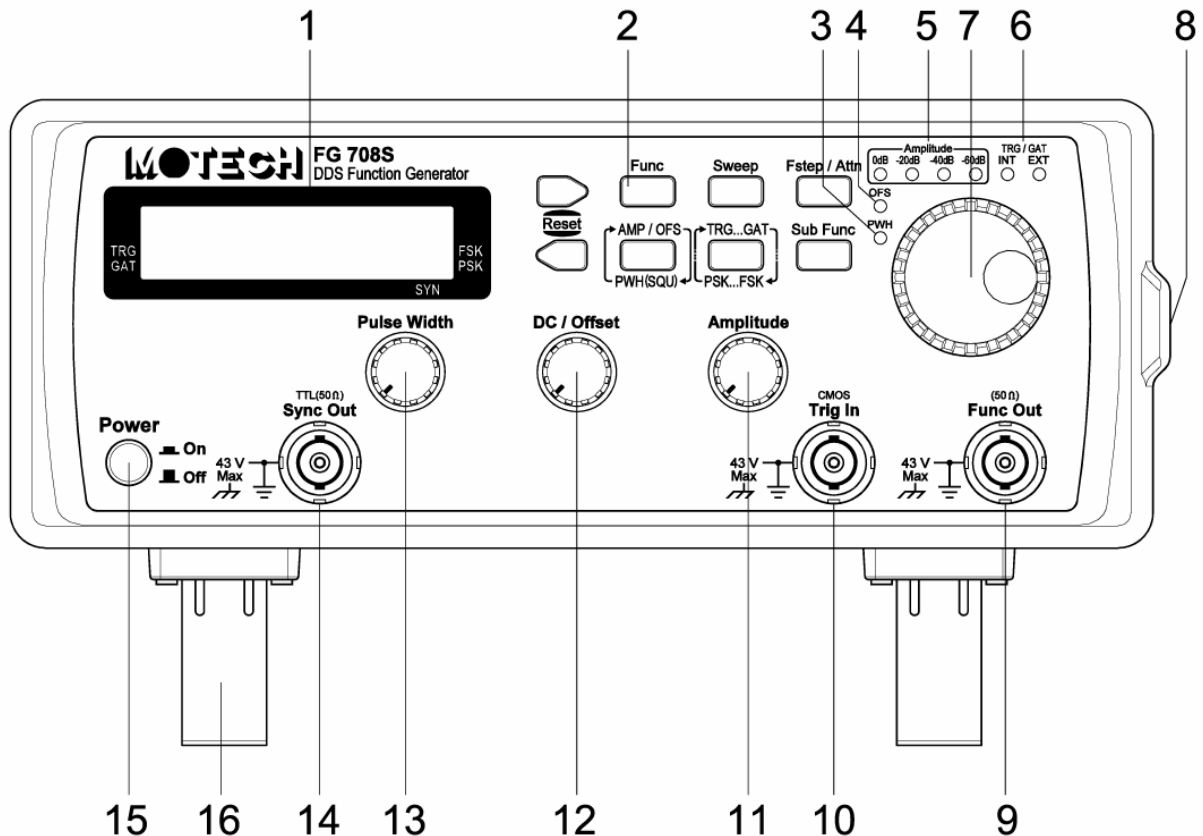
FG700F Series Front Panel
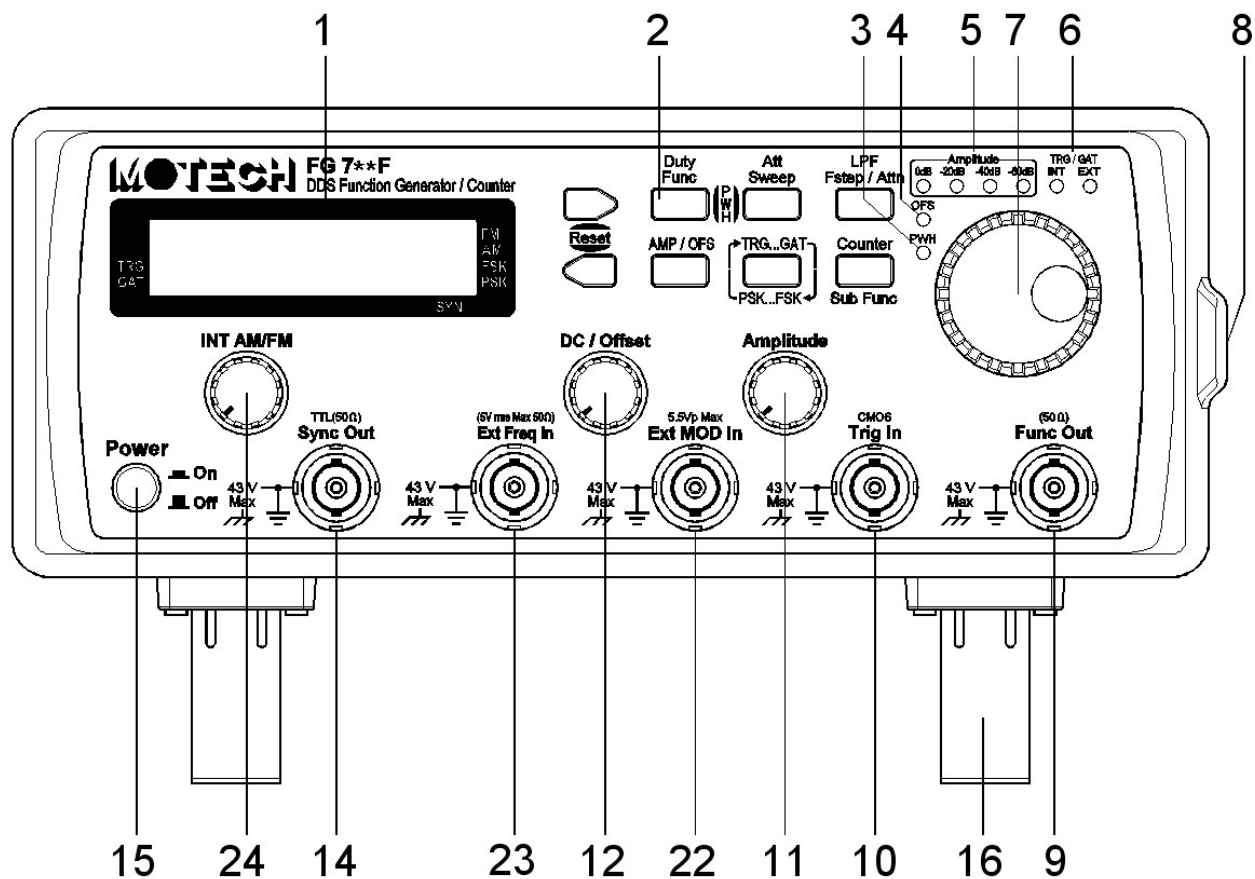
Rear Panel

1   Liquid Crystal Display
2   Keypad
3   Square Wave Pulse Width Adjustment On/Off Indicator
4   Output Offset On/Off Indicator
5   Output Amplitude Attenuation Range Indicator
6   External/Internal indicator of Trigger/Gate or PSK/FSK
7   Rotary with Push Button
8   Handle
9   Function Output BNC Connector (50 Ω output impedance)

10	External input BNC Connector for Trigger/Gate and PSK/FSK (CMOS level)
11	Amplitude Adjustment Knob
12	DC/Offset Adjustment Knob
13	Square Wave Pulse Width Adjustment Knob
14	Sync Output Connector (TTL level with 50Ω output impedance)
15	Power Switch
16	Adjustable Feet
17	Air Ventilation Holes
18	Power-line Fuse Holder
19	Power-line AC Input Socket
20	Chassis Terminal
21	Protective Earth (Ground) Terminal
22	External Modulation Input (5.5Vp Max.) for AM/FM Function
23	External Frequency Input (5Vrms Max. @ 50Ω) for Frequency Counter Function
24	Internal AM/FM Adjustment Knob

Specification

FG708S

Output Characteristics

a.	Frequency Range	: Sine, Square, Pulse and Sync Output : 100mHz ~ 8MHz
		Triangle : 100mHz ~ 1MHz
b.	Frequency Resolution	: 100mHz or 6 digits display
c.	Output Impedance	: 50Ω ±5%
d.	Amplitude	: 1mV to 20Vp-p (open-circuit)
		0.5mV to 10Vp-p (into 50Ω load)
e.	Amplitude Resolution	: 2~3 digits, 1mV min (depending on the attenuation)
f.	Amplitude Accuracy	: Typical 1% test at 1KHz 9Vp-p sine @ 50Ω load
g.	Output Attenuation	: 0, -20, -40 and -60 dB
h.	FUNC_OUT Self Protection	: FUNC_OUT short circuit protection
		Reverse voltage protection below 20Vpeak
i.	DC Offset and DC Output	: ±10V at open-circuit, ±5V at 50Ω load
j.	DC Output Resolution	: 2 digits, ±1mV min (depending on the attenuation)
k.	DC Output Accuracy	: 1% ±5 counts
l.	Sine Wave Harmonic Distortion	: DC ~ 100KHz < -55dBc typical
		100KHz to 1MHz < -45dBc typical
		1MHz ~ 8MHz < -35dBc typical
m.	Spurious (non harmonic)	: DC ~ 1MHz < -55dBc typical
n.	Total Harmonic Distortion	: DC ~ 100KHz < 0.3%
o.	Square Wave	: rise / fall time ≦ 12nS for 10Vp-p @ 50Ω load
		overshoot < 5% of Vp for 10Vp-p @ 50Ω load
p.	Pulse (analog control)	: Frequency range : 100mHz ~ 8MHz
		Amplitude : 0 ~ 10V / 0 ~ -10V / ±10V
		Duty cycle : 100mHz ~ 6MHz: 20% to 80%
		6MHz ~ 8MHz : 40 % to 60%
q.	Triangle Wave Linearity	: 99% up to 100KHz
r.	Sweep (Linear / Logarithm)	: Start frequency, stop frequency and sweep step setting
		Sweep type : up, down and up-down
s.	Sync Output	: Frequency range : 100mHz ~ 8MHz
		Output level : low level ≦0.6V @ 50Ω
		high level ≧1V @ 50Ω
		Output impedance : 50Ω

Modulation Characteristics

a. FSK   : Function   : Sine, Square or Triangle
                                         Frequency range   : 100mHz ~ 8MHz
                                         Internal rate   : 400Hz / 1000Hz
                                         Source   : Internal / External
b. PSK   : Function   : Sine, Square or Triangle
                                         Frequency range   : 100mHz ~ 8MHz
                                         Phase setting   : 0.0000 to 360.0 degree
                                         Internal rate   : 400Hz / 1000Hz
                                         Source   : Internal / External

Trigger/Gate Characteristics

a. Trigger   : Source   : Manual (rotary push) / External
                                         Main frequency setting : 100mHz ~ 100KHz
b. Gate   : Source   : Manual (rotary push) / External
                                         Main frequency setting : 100mHz ~ 8MHz

General Characteristics

a. Power Source   : AC 115V / 230V (internal switchable) ±10%, 50Hz / 60Hz
b. Temperature   : $0°C ~ 40°C$ (Operation)
                           $-20°C ~ 70°C$ (Storage)
c. Relative Humidity   : up to 80%
d. Dimension   : 95mm (H) x 235mm (W) x 280mm(D)
e. Weight   : 3Kg
f. Accessories   : AC power cord   1
                           Operating Manual   1

FG700F Series

Output Characteristics

a. Frequency Range   : Sine, Square, Pulse and Sync Output: 100mHz ~ **MHz
                                    Triangle   : 100mHz ~ 1MHz
                                    Ramp Up, Ramp Down   : 100mHz ~ 20KHz
b. Frequency Resolution   : 100mHz or 6 digits display
c. Output Impedance   : 50Ω ±5%
d. Amplitude   : 1mV to 20Vp-p (open-circuit)
                                    0.5mV to 10Vp-p (into 50Ω load)
e. Amplitude Resolution   : 3 digits, 1mV min (depending on the attenuation)
f. Amplitude Accuracy   : Typical 1% test at 1KHz 9Vp-p sine @ 50Ω load
g. Output Attenuation   : 0, -20, -40 and -60 dB
h. FUNC_OUT Self Protection   : FUNC_OUT short circuit protection
                                    Reverse voltage protection below 20Vpeak
i. DC Offset and DC Output   : ±10V at open-circuit, ±5V at 50Ω load
j. DC Output Resolution   : 3 digits, ±1mV min (depending on the attenuation)
k. DC Output Accuracy   : 1% ±5mV
l. Sine Wave Harmonic Distortion : DC ~ 100KHz < -55dBc typical
                                    100KHz to 1MHz < -45dBc typical
                                    1MHz ~ **MHz < -35dBc typical

m.	Spurious (non harmonic)	: DC ~ 1MHz < -55dBc typical
n.	Total Harmonic Distortion	: DC ~ 100KHz < 0.3%
o.	Square Wave	: rise / fall time $\leqq$ 12nS for 10Vp-p @ 50Ω load
		overshoot < 5% of Vp for 10Vp-p @ 50Ω load

p.	Pulse (digital control)	: Frequency range	: 200mHz ~ 20KHz
			20KHz ~ 200KHz
		Amplitude	: 0 ~ 10V / 0 ~ -10V / ±10V
		Duty cycle	: 200mHz ~ 1KHz : 0.1% ~ 99.9%
			1KHz ~ 200KHz : (*)

q.	Triangle Wave Linearity	: 99% up to 100KHz
r.	Sweep (Linear / Logarithm)	: Start frequency, stop frequency and sweep step setting
		Sweep type : up, down and up-down
s.	Sync Output	: Frequency range : 100mHz ~ **MHz
		Output level : low level $\leqq$ 0.6V @ 50Ω
		high level $\geqq$ 1V @ 50Ω
		Output impedance : 50Ω

Modulation Characteristics

a.	AM	: Function	: Sine or Triangle
		Modulation ratio	: 0% ~ 100%
		Source	: Internal/External
		Internal source	: 400Hz/1000Hz Sine Wave
		External source	: Max. 5.5Vpeak any waveform
b.	FM	: Function	: Sine, Suqare or Triangle
		Frequency range	: 100mHz ~ 10KHz
		Peak deviation	: 4 ~ 5% of Max. frequency
		Source	: Internal/External
		Internal source	: 400Hz/1000Hz Sine Wave
		External source	: Max. 5.5Vpeak any waveform
c.	FSK	: Function	: Sine, Square or Triangle
		Frequency range	: 100mHz ~ **MHz
		Internal rate	: 400Hz / 1000Hz
		Source	: Internal / External
d.	PSK	: Function	: Sine, Square or Triangle
		Frequency range	: 100mHz ~ **MHz
		Phase setting	: 0.0000 to 360.0 degree
		Internal rate	: 400Hz / 1000Hz
		Source	: Internal / External

Trigger/Gate Characteristics

a.	Trigger	: Source	: Manual (rotary push) / External
		Main frequency setting	: 100mHz ~ 100KHz
b.	Gate	: Source	: Manual (rotary push) / External
		Main frequency setting	: 100mHz ~ **MHz

Frequency Counter

a.	Range	: 2Hz to 100MHz
b.	Accuracy	: ±5 counts
c.	Resolution	: 7 digits or (99.9999)
d.	Low pass filter	: Manual activate

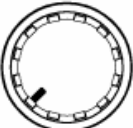| e.	Timebase accuracy	: 50MHz ±25 ppm (23.5 ±5 ˚C) or TCXO optional
f.	Input Attenuation	: 0dB, 20dB
g.	Sensitivity	: 2Hz ~ 50MHz/-20dBm @ 50Ω typical
		50MHz ~ 80MHz/-10dBm @ 50Ω typical
		80MHz ~ 100MHz/-5dBm @ 50Ω typical

General Characteristics
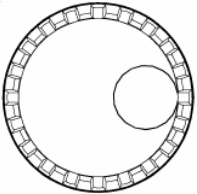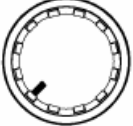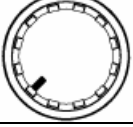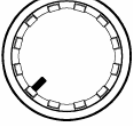
a.	Power Source	: AC 115V / 230V (internal switchable) ±10%, 50Hz / 60Hz
b.	Temperature	: 0°C ~ 40°C (Operation)
		-20°C ~ 70°C (Storage)
c.	Relative Humidity	: up to 80%
d.	Dimension	: 95mm (H) x 235mm (W) x 280mm(D)
e.	Weight	: 3Kg
f.	Accessories	: AC power cord 1
		Operating Manual 1

$*：(1us \times Fset) \times 100\% \sim 【1-(1us \times Fset)】 \times 100\%$

2. Operation

2.1   Keypad and Knob Description

Key and knob	Function
Right Key (FG700S/F Series)	**Right Key (FG700S/F Series)** a. Change to the next selection. b. In frequency editing, the frequency will x10 if the cursor is off. c. In frequency editing, the cursor goes to right position if the cursor is on.
Func	**Function Key (FG700S Series)** a. Select the function output of sine, square, triangle or DC.
Duty Func	**Function Key (FG700F Series)** a. Select the function output of sine, square, triangle, DC, ramp up or ramp down.
Sweep	**Sweep Key (FG700S Series)** a. Enter the sweep menu to select and set the linear or logarithm frequency sweep.
Att Sweep	**Sweep Key/Counter Attenuation Key (FG700F Series)** a. Enter the sweep menu to select and set the linear or logarithm frequency sweep. b. In counter mode, select the attenuator on/off of the external counter input.
Duty Func Att Sweep	**Both Key Pressed Simulteniously (FG700F Seires)** a. Enter the pulse width duty adjustment of square wave and adjust by rotary.
Fstep / Attn	**Frequency Step/Attenuation Key (FG700S Series)** a. Enter the attenuation menu to change the output attenuation. b. Enter the frequency step menu to select and set the frequency step function.
LPF Fstep / Attn	**Frequency Step/Attenuation Key/Counter LPF Key (FG700F Series)** a. Enter the attenuation menu to change the output attenuation. b. Enter the frequency step menu to select and set the frequency step function. c. In counter mode, select the low pass filter on/off.
Left Key	**Left Key (FG700S/F Series)** a. Change to the previous selection. b. In frequency editing, the frequency will /10 if the cursor is off. c. In frequency editing, the cursor goes to left position if the cursor is on.
AMP / OFS PWH(SQU)	**Amplitude/Offset/Pulse Width Display Key (FG700S Series)** a. Select the display of amplitude, offset and pulse width of square wave.
AMP / OFS	**Amplitude/Offset Key (FG700F Series)** Select the display of amplitude and offset.
TRG...GAT PSK...FSK	**Trigger/Gate and PSK/FSK key (FG700S/F Series)** a. Enter the trigger/gate menu to select and set the trigger/gate function. b. Enter the PSK/FSK menu to select and set the PSK/FSK function.
Sub Func	**Sub Function Key (FG700S Series)** a. Enter the sub function menu to select and set the sync output, pulse width of square wave and offset function.
Counter Sub Func	**Sub Function/Counter Key (FG700F Series)** a. Enter the sub function menu to select and set the sync output, pulse width of square wave, offset, AM, FM and counter function.

	Rotary with Push button (FG700S/F Series) a. Change to the next selection when turning clockwise. b. Change to the previous selection when turning counterclockwise. c. In frequency editing, turn clockwise to increase the frequency setting. d. In frequency editing, turn counterclockwise to decrease the frequency setting. e. When the cursor shows up in frequency editing, press the rotary push button to cancel the cursor. f. In rotary push trigger/gate function, press the rotary push button to generate trigger/gate signal manually.
Pulse Width 	**Pulse Width Adjustment Knob (FG700S Series)** a. Adjust the pulse width of the square wave.
DC / Offset 	**DC/Offset Adjustment Knob (FG700S/F Series)** a. Adjust the DC level if the function output is set to DC. b. Adjust the offset level if the output offset is on.
Amplitude 	**Pulse Width Adjustment Knob (FG700S/F Series)** a. Adjust the amplitude of the function out.
INT AM/FM 	**Internal AM/FM Adjustment Knob (FG700F Series)** a. Adjust the internal AM/FM modulation factor output.

2.2   Opening Screen

Connect the power cord and turn on the function generator.

FG700S Series

FG700FSeries
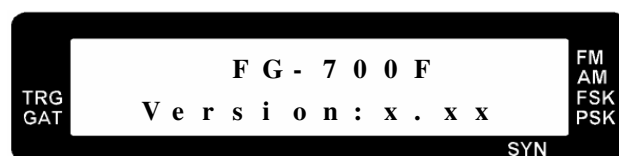
a. Press the ▢ and ▢ together to reset the function generator. This reset function sets the function generator to default of 1KHz sine wave output at 20dB attenuation amplitude.

b. To turn off the beep of the keypad, please press ▢ and ▢ keys together for FG700S series.

c. To turn off the beep of the keypad, please press ▢ and ▢ key together for FG700F series.

Warning ⚠️

Please make sure that the correct power rating feeds to the function generator. If the higher voltage (230V) feeds to 115V version of function generator, the chance of damage the function generator may happen and the fuse will blow. Please use the following rating of fuse for replacement.

115V version function generator :   0.5A/250V fuse (slow blow)
230V version function generator :   250mA/250V fuse (slow blow)
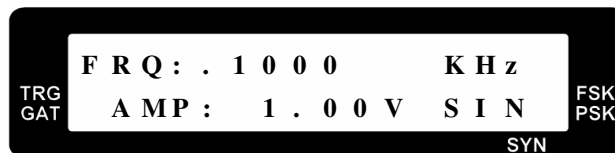
2.3   Setting Group Name
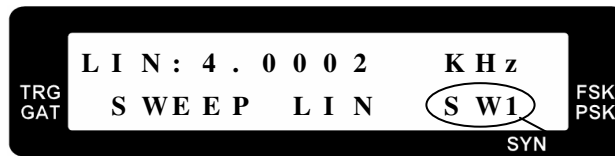
Setting Group Name

a. The setting group name is to show which parameter is set currently. For example, SW1 sets the sweep mode of linear or logarithm, SW2 sets the type of sweep and SW3 sets the sweep start frequency, etc.

2.4   Adjust Frequency

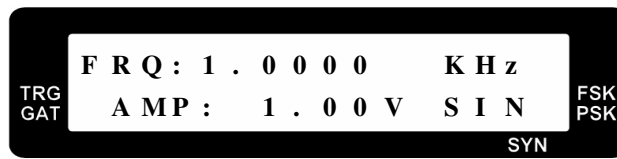a. When the cursor does not appear on the LCD, use ⟱ and ⟱ key to adjust frequency x10 and /10.
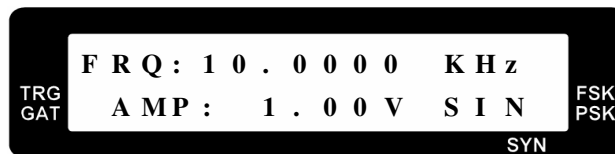
b. Adjust the ⟲ to make the cursor appear and to change the frequency, use ⟱ or ⟱ key to change the cursor position right or left. To cancel the cursor, please press the rotary button.
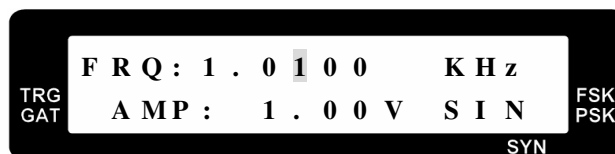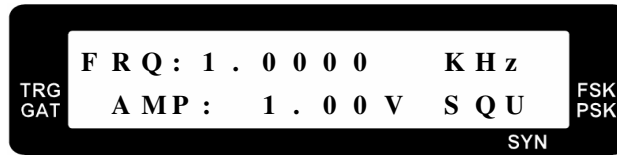

2.5   Select Waveform

a. In FG708S series, press the **Func** key to select output waveform. There are four waveforms to be selected (**sine**, **square**, **triangle** and **DC**).
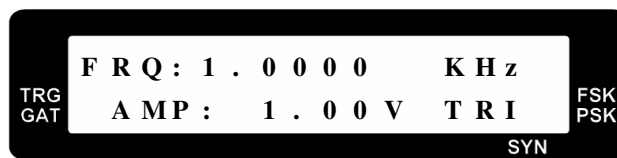
b. In FG708F series, press the [Duty Func] key to select output waveform. There are six waveforms to be selected (**sine, square, triangle, ramp up, ramp down and DC**).
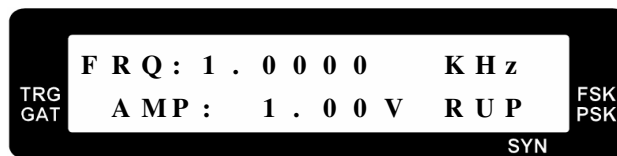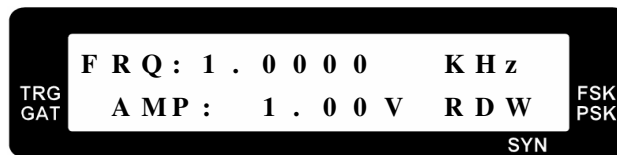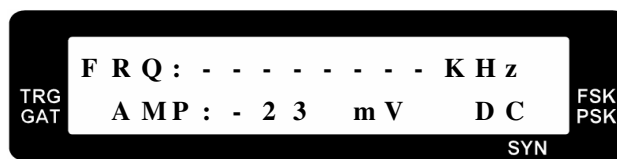
```
F R Q : 1 . 0 0 0 0      K H z
AMP :    1 . 0 0 V    S I N
```
TRG GAT   FSK PSK   SYN

Sine Wave Output

```
F R Q : 1 . 0 0 0 0      K H z
AMP :    1 . 0 0 V    S Q U
```
TRG GAT   FSK PSK   SYN

Square Wave Output

```
F R Q : 1 . 0 0 0 0      K H z
AMP :    1 . 0 0 V    T R I
```
TRG GAT   FSK PSK   SYN

Triangle Wave Output

```
F R Q : 1 . 0 0 0 0      K H z
AMP :    1 . 0 0 V    R U P
```
TRG GAT   FSK PSK   SYN

Ramp Up Output

```
F R Q : 1 . 0 0 0 0      K H z
AMP :    1 . 0 0 V    R D W
```
TRG GAT   FSK PSK   SYN

Ramp Down Output

```
F R Q : - - - - - - - - K H z
AMP : - 2 3    m V      D C
```
TRG GAT   FSK PSK   SYN

DC Function Output

2.6   Frequency Sweep

a. Press the [Sweep] or [Att Sweep] key to enter the sweep selection menu. Use ▷, ◁ key or ⊙ to select **linear** or **logarithm** frequency sweep.

```
F R Q : 1 . 0 0 0 0      K H z
S WE E P    O F F    S W1
```
TRG GAT   FSK PSK   SYN

Frequency Sweep Off

```
LIN: 4.0002        KHz
TRG
GAT    SWEEP   LIN    SW1    FSK
                             PSK
                             SYN
```
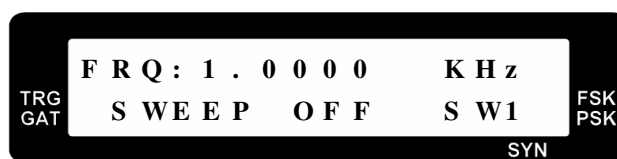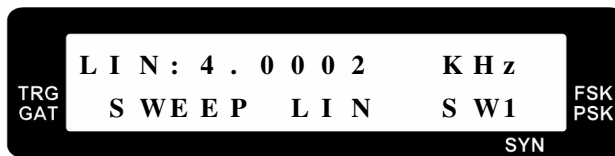
Linear Frequency Sweep

```
LOG: 4.0002        KHz
TRG
GAT    SWEEP   LOG    SW1    FSK
                             PSK
                             SYN
```
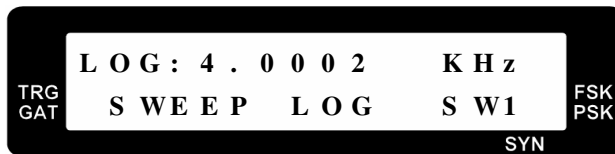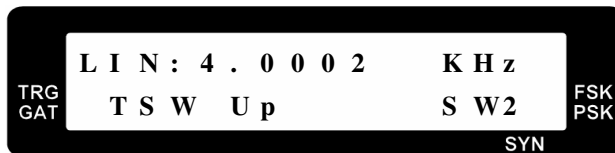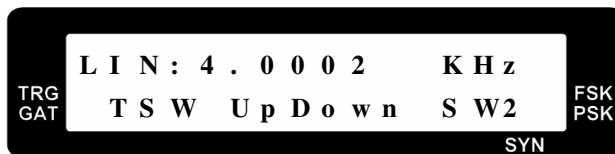
Logarithm Frequency Sweep

b. When linear or logarithm is selected, press the **Sweep** or **Att Sweep** key to select the **type of sweep**, **sweep start frequency**, **sweep stop frequency** and **sweep step frequency or ratio**. Use the ▷, ◁ key or ⟳ to select the desired sweep type or frequencies.

```
LIN: 4.0002        KHz
TRG
GAT    TSW  Up         SW2   FSK
                             PSK
                             SYN
```

Type of Sweep : Up

```
LIN: 4.0002        KHz
TRG
GAT    TSW  UpDown    SW2    FSK
                             PSK
                             SYN
```

Type of Sweep : Up/Down

```
LIN: 4.0002        KHz
TRG
GAT    TSW  Down     SW2     FSK
                             PSK
                             SYN
```

Type of Sweep : Down
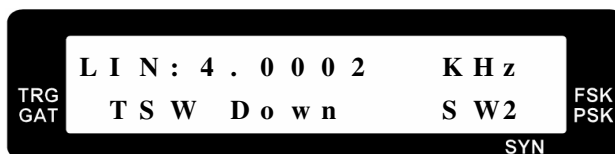
```
STA: 50.0          Hz
TRG
GAT    SweStarSet    SW3     FSK
                             PSK
                             SYN
```

Sweep Start Frequency Setting

```
STO: 8.00000       MHz
TRG
GAT    SweStopSet    SW4     FSK
                             PSK
                             SYN
```

Sweep Stop Frequency Setting

```
         LIN: 10.0000   KHz
TRG
GAT      SweStepSet    SW5        FSK
                                  PSK
                                  SYN
```
Linear Sweep Step Frequency Setting
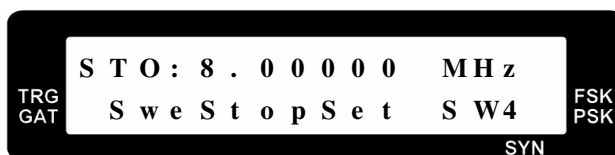
```
         LOG: 10.0
TRG
GAT      SweStepSet    SW6        FSK
                                  PSK
                                  SYN
```
Logarithm Sweep Step Ratio Setting
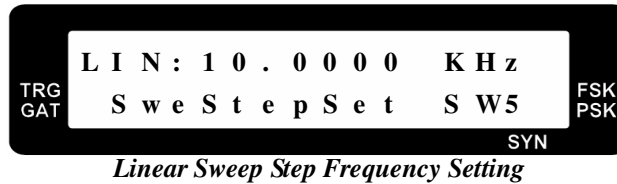
The actual logarithm sweep step ratio is calculated by following equation:

$$\text{Actual Ratio} = \frac{F_{n+1}}{F_n} = 1 + \frac{\text{Logarithm Sweep Step Ratio Setting}}{1000}$$

For Example, if the logarithm sweep step ratio setting is set to 5 and the F_n is 1000Hz, the actual ratio is the following:

$$\text{Actual Ratio} = 1 + \frac{5}{1000} = 1.005$$

The F_{n+1}, F_{n+2} and F_{n+3} are the following:

$$F_{n+1} = \text{Actual Ratio} \times F_n = 1.005 \times 1000\text{Hz} = 1005\text{Hz}$$

$$F_{n+2} = \text{Actual Ratio} \times F_{n+1} = 1.005 \times 1005\text{Hz} = 1010.025\text{Hz}$$

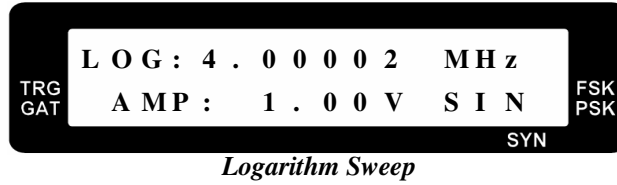$$F_{n+3} = \text{Actual Ratio} \times F_{n+2} = 1.005 \times 1010.025\text{Hz} = 1015.075125\text{Hz}$$

Note : The maximum value of the logarithm sweep step ratio setting is 10.0 and the minimum value of the logarithm sweep step ratio setting is 0.0001.

```
         LIN: 1
TRG
GAT      SweTimeSet    SW7        FSK
                                  PSK
                                  SYN
```
Linear Sweep Time Setting

```
         LOG: 1
TRG
GAT      SweTimeSet    SW7        FSK
                                  PSK
                                  SYN
```
Logarithm Sweep Time Setting

The sweep time sets the delay time between two frequencies step. It is set from 1 to 1000. The higher value will put longer delay of two frequencies step.

c. After finishing the linear or logarithm sweep setting, the ▭, ▭ key or ⊙ can be used to select sine, square, triangle, ramp up (FG700F series) or ramp down (FG700F series) output

waveform.

```
                   LIN: 4.00002   MHz
TRG                AMP:    1.00V   SIN               FSK
GAT                                                 PSK
                                              SYN
```
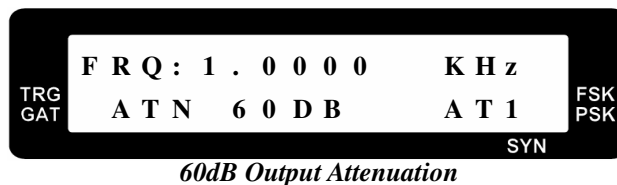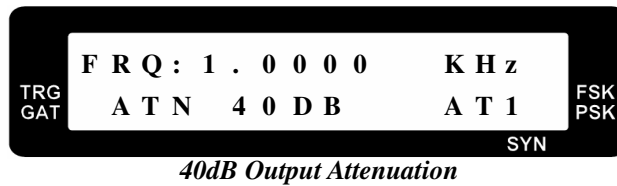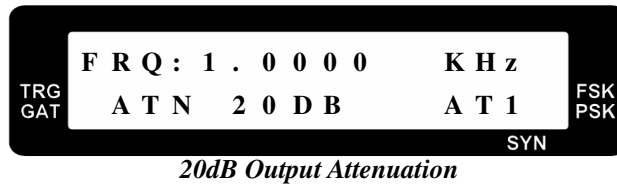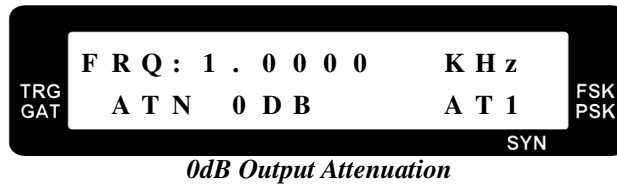*Linear Sweep*

```
                   LOG: 4.00002   MHz
TRG                AMP:    1.00V   SIN               FSK
GAT                                                 PSK
                                              SYN
```
Logarithm Sweep
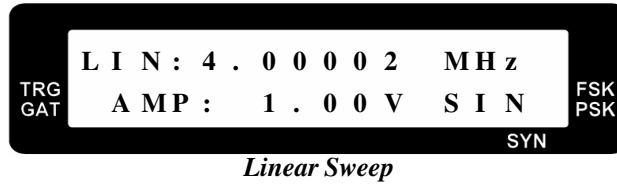
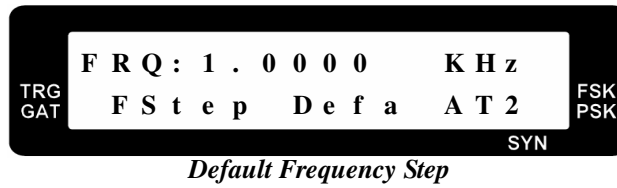## 2.7   Output Attenuation

a. Press the [Fstep / Attn] or [LPF Fstep / Attn] key once to enter the attenuation select menu. Use the ▷, ◁
key or ⊙ to select the output attenuation of **0**, **20**, **40** and **60** dB. The corresponding
amplitude indicator will show the current output attenuation setting.
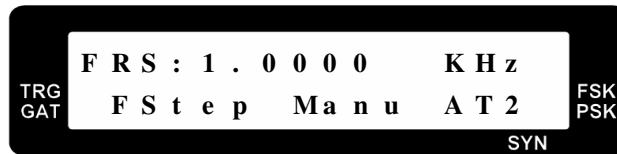
```
                   FRQ: 1.0000    KHz
TRG                ATN  0DB        AT1               FSK
GAT                                                 PSK
                                              SYN
```
0dB Output Attenuation

```
                   FRQ: 1.0000    KHz
TRG                ATN  20DB       AT1               FSK
GAT                                                 PSK
                                              SYN
```
20dB Output Attenuation

```
                   FRQ: 1.0000    KHz
TRG                ATN  40DB       AT1               FSK
GAT                                                 PSK
                                              SYN
```
40dB Output Attenuation

```
                   FRQ: 1.0000    KHz
TRG                ATN  60DB       AT1               FSK
GAT                                                 PSK
                                              SYN
```
60dB Output Attenuation

2.8   Rotary Frequency Step Setting

a. Press the [Fstep / Attn] or [LPF Fstep / Attn] key twice to enter the frequency step setting menu. Use the ▷,

key or ⟲ to select the **default** or **manual** frequency step of rotary up/down adjustment.

```
          FRQ: 1 . 0 0 0 0      KHz
 TRG                                      FSK
 GAT        FStep   Defa    AT2           PSK
                                    SYN
```
Default Frequency Step

```
          FRS: 1 . 0 0 0 0      KHz
 TRG                                      FSK
 GAT        FStep   Manu    AT2           PSK
                                    SYN
```
*Manual Frequency Step*

b. When frequency step sets to manual, press the Fstep / Attn ⟲ key again to adjust the frequency step setting. Use the ▷, ◁ key or ⟲ to adjust this setting.

```
          FRS: 1 . 0 0 0 0      KHz
 TRG                                      FSK
 GAT        FrqStepSet    AT3             PSK
                                    SYN
```
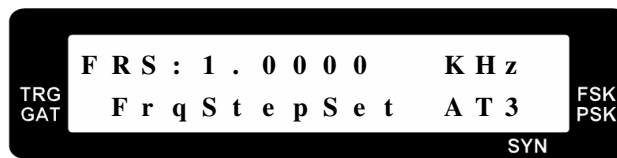
Note : Once the frequency step is set to manual, the output frequency can be controlled by the

▷, ◁ key or ⟲ .

2.9   Amplitude, Offset and Square Wave Pulse Width Display

a. In FG700S series, press the AMP / OFS / PWH(SQU) key to show the amplitude, offset and pulse width of the square wave.

b. In FG700F series, press the AMP / OFS key to show the amplitude, offset.

c. To adjust the amplitude, please turn the Amplitude knob.
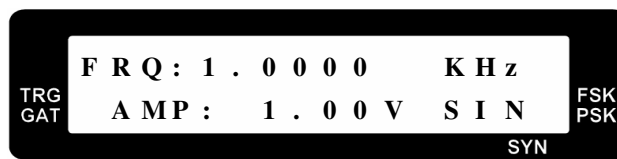
```
          FRQ: 1 . 0 0 0 0      KHz
 TRG                                      FSK
 GAT        AMP:    1 . 0 0 V   SIN       PSK
                                    SYN
```
Amplitude Display

d. To adjust the DC offset, please make sure the DC offset is set to on in the sub function menu (SB3). Turn the DC / Offset knob to adjust.

```
          F R Q : 1 . 0 0 0 0       K H z
TRG
GAT       O F S :    . 0 0 m V   S I N     FSK
                                          PSK
                                      SYN
```
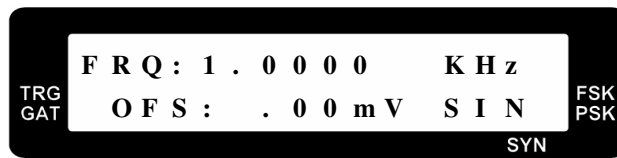
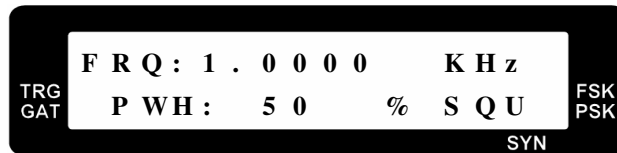*Offset Display*

e. To adjust the pulse width in FG700S series, please select the square waveform first and set the pulse width on in sub function menu (SB2). Turn the **Pulse Width** knob to adjust.

```
          F R Q : 1 . 0 0 0 0       K H z
TRG
GAT       P W H :    5 0       %   S Q U     FSK
                                            PSK
                                        SYN
```

Square Wave Pulse Width Display

Note : The square wave pulse width display can be seen only if the square wave pulse width adjustment is turned on in sub function.

f. The pulse width display value will show below or over if the pulse width is under or above the following values in FG708S:

| Frequency Range / Display Shows	0.1Hz ~ 5.99999MHz	6.00000MHz ~ 8.00000MHz
BELOW	< 18%	< 34%
OVER	> 81%	> 75%

g. To adjust the pulse width in FG700F Series, please select the square wave first and set the pulse width on in the sub function menu (SB4). Press the **Counter / Sub Func** key to select SB5 menu to set the pulse width frequency. Use the ▷, ◁ key or knob to set the frequency. Then, press the **Counter / Sub Func** key the select SB6 menu for the pulse width duty setting. Also, use the ▷, ◁ key or knob to set the duty.

h. To quickly enter the pulse width duty setting, please press the **Duty Func** and **Att Sweep** key simultenously.

```
          P W H : 1 . 0 0 0 0       K H z
TRG
GAT       5 0 0 . 0       u S   S B 5     FSK
                                          PSK
                                      SYN
```

Pulse Width Frequency Setting

```
D T Y :  5 0 . 0              %
        5 0 0 . 0       u S    S B 6
```
TRG GAT   FSK PSK   SYN
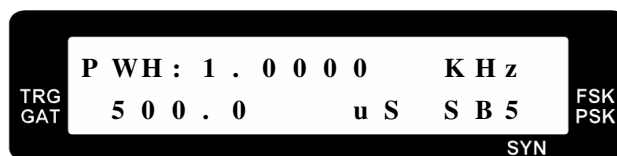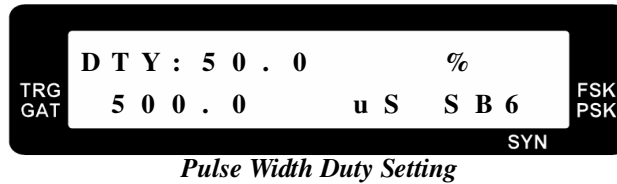
Pulse Width Duty Setting

2.10 Trigger/Gate

a. Press the [TRG...GAT / PSK...FSK] key to enter the trigger/gate selection menu.

b. Use the ⌷, ⌷ key or ◯ to select **external trigger**, **rotary push trigger**, **external gate** and **rotary push gate**. The corresponding internal or external indicator will show up.

```
F R Q :  1 . 0 0 0 0       K H z
        T R G    O F F        T M 2
```
TRG GAT   FSK PSK   SYN

Trigger/Gate Off

```
F R Q :  1 . 0 0 0 0       K H z
  ▪  E X T    T R G        T M 2
```
TRG GAT   FSK PSK   SYN

External Trigger

```
F R Q :  1 . 0 0 0 0       K H z
  ▪  R O T P    T R G      T M 2
```
TRG GAT   FSK PSK   SYN

Rotary Push Trigger

```
F R Q :  1 . 0 0 0 0       K H z
  ▪ E X T    G A T          T M 2
```
TRG GAT   FSK PSK   SYN

External Gate

```
F R Q :  1 . 0 0 0 0       K H z
  ▪ R O T P    G A T
```
TRG GAT   FSK PSK   SYN
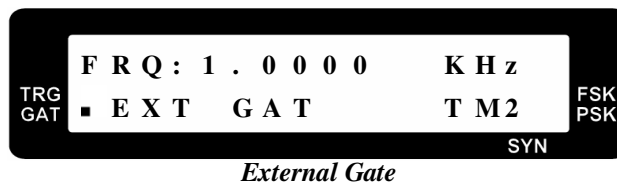
Rotary Push Gate

2.11 Phase-Shift Keying (PSK) and Frequency-Shift Keying (FSK)

Modulation

a. Press the [TRG...GAT / PSK...FSK] key twice to enter the PSK/FSK modulation selection menu.

b. Use the ⬜, ⬜ key or ◯ to select **PSK 1KHz**, **PSK 400Hz**, **PSK external**, **FSK 1KHz**, **FSK 400Hz** and **FSK external**. The corresponding internal or external indicator will show up.

```
TRG   FRQ: 1 . 0 0 0 0      KHz    FSK
GAT   PFM   OFF            TM3    PSK
                                   SYN
```
PSK/FSK Off

```
TRG   FRQ: 1 . 0 0 0 0      KHz    FSK
GAT   PFM   FskExt         TM3 ▪  PSK
                                   SYN
```
FSK External

```
TRG   FRQ: 1 . 0 0 0 0      KHz    FSK
GAT   PFM   Fsk400         TM3 ▪  PSK
                                   SYN
```
FSK 400Hz

```
TRG   FRQ: 1 . 0 0 0 0      KHz    FSK
GAT   PFM   Fsk1K          TM3 ▪  PSK
                                   SYN
```
FSK 1KHz

```
TRG   FRQ: 1 . 0 0 0 0      KHz    FSK
GAT   PFM   PskExt         TM3 ▪  PSK
                                   SYN
```
PSK External

```
TRG   FRQ: 1 . 0 0 0 0      KHz    FSK
GAT   PFM   Psk400         TM3 ▪  PSK
                                   SYN
```
PSK 400Hz
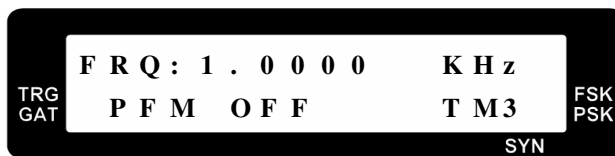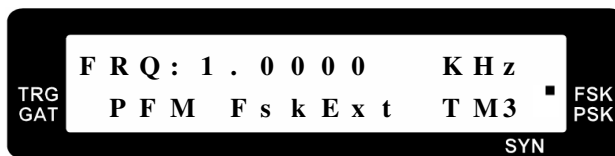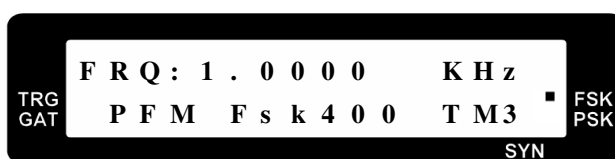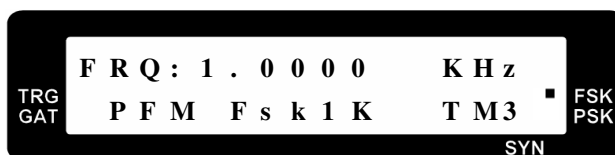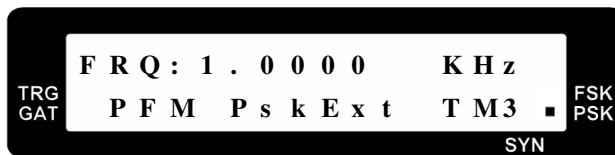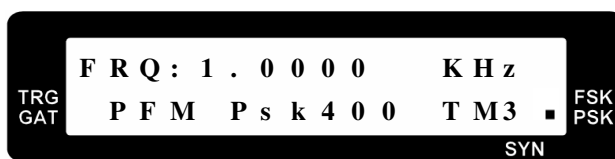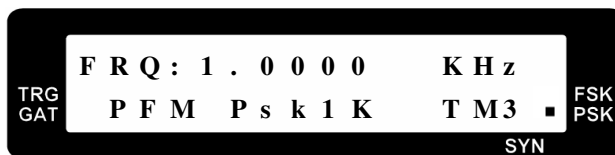
```
TRG   FRQ: 1 . 0 0 0 0      KHz    FSK
GAT   PFM   Psk1K          TM3 ▪  PSK
                                   SYN
```
PSK 1KHz

c. If FSK turns on, press the ⬚ (TRG...GAT / PSK...FSK) key to enter the FSK frequency register 1 and frequency register 0 setting menu. Use the ⬜, ⬜ key or ◯ to set the desired FSK frequencies.

```
                    F R Q : 1 . 0 0 0 0        K H z
TRG                                                      ■  FSK
GAT         F s k F r q 1 S e t     T M 4                   PSK
                                                     SYN
```

FSK Frequency 1 Setting

```
                    F R Q : 1 . 0 0 0 0        K H z
TRG                                                         FSK
GAT         F s k F r q 0 S e t     T M 5          ■        PSK
                                                     SYN
```

FSK Frequency 0 Setting
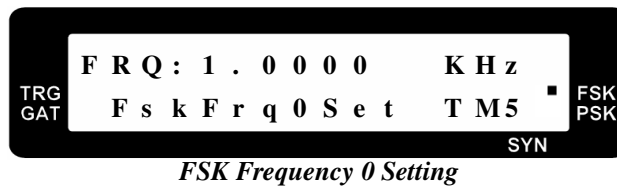
> *Note   : The FSK frequency register 1 setting range is from 12.0Hz to maximum output*
> *frequency of the function generator or 12.000MHz. The FSK frequency register 0*
> *setting range is from 0.100Hz to maximum output frequency of the function*
> *generator or 12.0000MHz.*

d. If PSK turns on, press the ⌷ key to enter the PSK phase setting menu. Use the ▷, ◁

key or ◯ to set the desired PSK phase.

```
                    D E G : 9 0 . 0 0
TRG                                                        FSK
GAT         P S K     P h s S e t     T M 6     ■          PSK
                                                     SYN
```

PSK Phase Setting
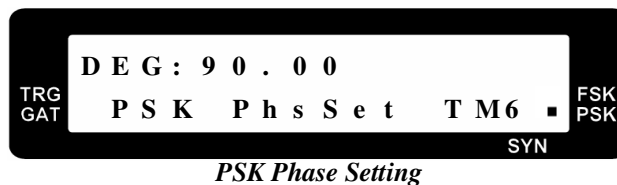
2.12   Sub Function

a. In FG700S series, press the ⌷ key to select **sync output on/off**, **square wave pulse width**

adjustment on/off and **output offset on/off**. Use the ▷, ◁ key or ◯ to select the
desired on/off setting.
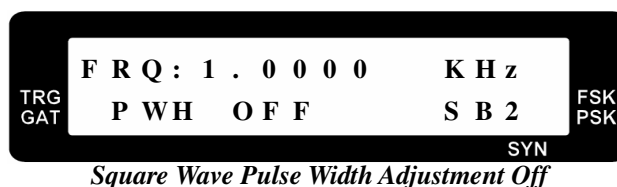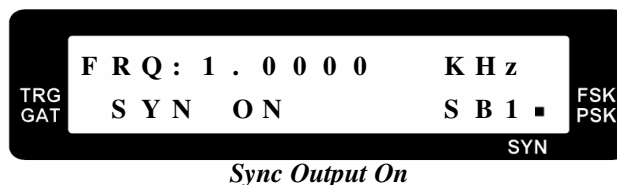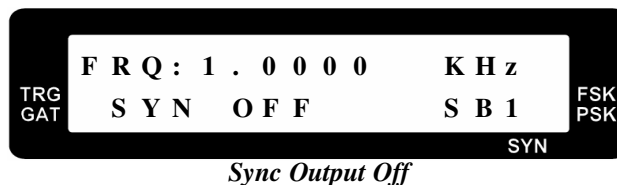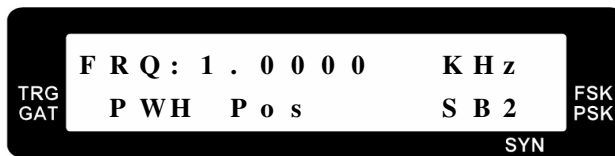
```
                    F R Q : 1 . 0 0 0 0        K H z
TRG                                                        FSK
GAT         S Y N    O F F           S B 1                 PSK
                                                     SYN
```

Sync Output Off

```
                    F R Q : 1 . 0 0 0 0        K H z
TRG                                                        FSK
GAT         S Y N    O N             S B 1  ■              PSK
                                                     SYN
```

Sync Output On

```
                    F R Q : 1 . 0 0 0 0        K H z
TRG                                                        FSK
GAT         P W H    O F F           S B 2                 PSK
                                                     SYN
```

Square Wave Pulse Width Adjustment Off

```
F R Q : 1 . 0 0 0 0      K H z
  P WH    P o s           S B 2
```

Square Wave Pulse Width Adjustment On and Output Positive Pulse

```
F R Q : 1 . 0 0 0 0      K H z
  P WH    N e g           S B 2
```

Square Wave Pulse Width Adjustment On and Output Negative Pulse

```
F R Q : 1 . 0 0 0 0      K H z
  P WH    B o t h O n     S B 2
```
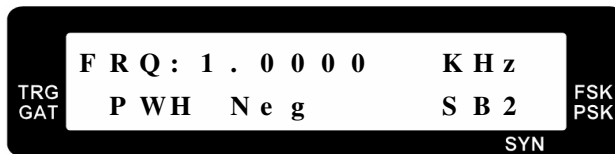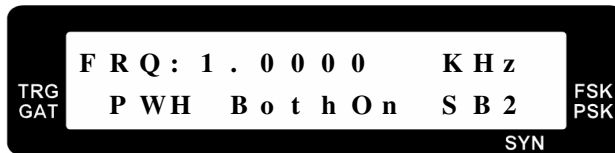
Square Wave Pulse Width Adjustment On and Output Positive and Negative Pulse

Note : The square wave pulse width adjustment on/off selection will show up in the sub function only if the output select to square wave. If the pulse width adjustment is on, the pulse width indicator will show up.

```
F R Q : 1 . 0 0 0 0      K H z
  O F F S E T    O F F    S B 3
```

Output Offset Off

```
F R Q : 1 . 0 0 0 0      K H z
  O F F S E T    O N      S B 3
```
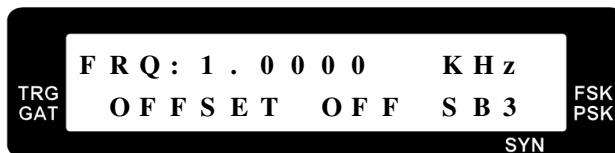
Output Offset On

Note : If the output offset is on, the offset indicator will show up.

b. In FG700F series, press Sub Func key to select **counter display and setting**, **sync output on/off**, **output offset on/off**, **AM on/off**, **square wave pulse width adjustment on/off**, **pulse width frequency setting**, **pulse width duty setting** and **FM on/off**. Use the ⬜, ⬜ key or 🎛 to select the desired on/off setting.

```
L R G : 1 . 0 0 0 0      K H z
  A T T : +    L P F : −
```
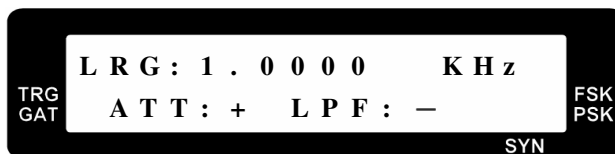
Counter Display and Attenuator/ LPF Setting

Note : Use the ⬜ key to set the attenuator on/off (+/-). Use the ⬜ key to set the low pass filter on/off (+/-).

```
                    1 9 . 6 %
TRG                                       FSK
GAT         D u t y    C y c l e          PSK
                                          SYN
```

Duty Cycle Measurement
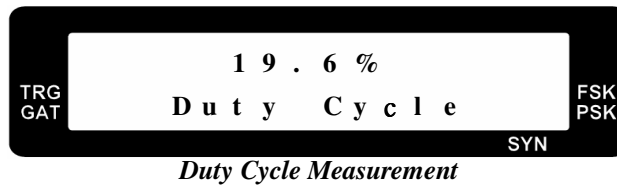
Note : Use the [Duty Func] *key measure the duty cycle of the external input signal.*

```
      F R Q : 1 . 0 0 0 0      K H z
TRG                                       FSK
GAT     S Y N   O F F        S B 1         PSK
                                          SYN
```

Sync Output Off

```
      F R Q : 1 . 0 0 0 0      K H z
TRG                                       FSK
GAT     S Y N   O N          S B 1 ∎       PSK
                                          SYN
```

Sync Output On

```
      F R Q : 1 . 0 0 0 0      K H z
TRG                                       FSK
GAT     O F F S E T   O F F   S B 2        PSK
                                          SYN
```

Output Offset Off

```
      F R Q : 1 . 0 0 0 0      K H z
TRG                                       FSK
GAT     O F F S E T   O N     S B 2        PSK
                                          SYN
```

Output Offset On

```
                                          FM
      F R Q : 1 . 0 0 0 0      K H z       AM
TRG                                       FSK
GAT     A M   O F F          S B 3         PSK
                                          SYN
```

AM Off

```
                                        ∎ FM
      F R Q : 1 . 0 0 0 0      K H z       AM
TRG                                       FSK
GAT     A M   4 0 0 H z       S B 3        PSK
                                          SYN
```

AM On, Internal 400Hz Source

```
                                        ∎ FM
      F R Q : 1 . 0 0 0 0      K H z       AM
TRG                                       FSK
GAT     A M   1 0 0 0 H z     S B 3        PSK
                                          SYN
```

AM On, Internal 1000Hz Source

```
          ┌──────────────────────────┐
          │  F R Q : 1 . 0 0 0 0   K H z  ▪  FM
     TRG  │                               AM
     GAT  │  A M   E X T E R N     S B 3  FSK
          │                               PSK
          │                          SYN
          └──────────────────────────┘
```
AM On, External Source

```
          ┌──────────────────────────┐
          │  F R Q : 1 . 0 0 0 0   K H z
     TRG  │                               FSK
     GAT  │  P WH   O F F         S B 4  PSK
          │                          SYN
          └──────────────────────────┘
```
Square Wave Pulse Width Adjustment Off

```
          ┌──────────────────────────┐
          │  F R Q : 1 . 0 0 0 0   K H z
     TRG  │                               FSK
     GAT  │  P WH   P o s         S B 4  PSK
          │                          SYN
          └──────────────────────────┘
```
Square Wave Pulse Width Adjustment On and Output Positive Pulse

```
          ┌──────────────────────────┐
          │  F R Q : 1 . 0 0 0 0   K H z
     TRG  │                               FSK
     GAT  │  P WH   N e g         S B 4  PSK
          │                          SYN
          └──────────────────────────┘
```
Square Wave Pulse Width Adjustment On and Output Negative Pulse

```
          ┌──────────────────────────┐
          │  F R Q : 1 . 0 0 0 0   K H z
     TRG  │                               FSK
     GAT  │  P WH   B o t h O n   S B 4  PSK
          │                          SYN
          └──────────────────────────┘
```
Square Wave Pulse Width Adjustment On and Output Positive and Negative Pulse

```
          ┌──────────────────────────┐
          │  F R Q : 1 . 0 0 0 0   K H z
     TRG  │                               FSK
     GAT  │  P WH   P u l s e     S B 4  PSK
          │                          SYN
          └──────────────────────────┘
```
Square Wave Pulse Width Adjustment On and Output Pulse

Note : The square wave pulse width adjustment on/off selection will show up in the sub function only if the output select to square wave. If the pulse width adjustment is on, the pulse width indicator will show up.

```
          ┌──────────────────────────┐
          │  P WH : 1 . 0 0 0 0   K H z
     TRG  │                               FSK
     GAT  │  5 0 0 . 0       u S   S B 5  PSK
          │                          SYN
          └──────────────────────────┘
```
Pulse Width Frequency Setting
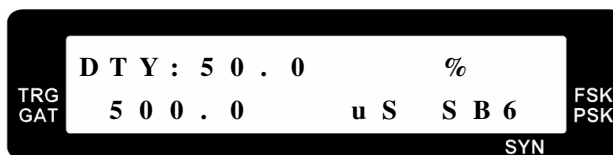
```
          ┌──────────────────────────┐
          │  D T Y : 5 0 . 0       %
     TRG  │                               FSK
     GAT  │  5 0 0 . 0       u S   S B 6  PSK
          │                          SYN
          └──────────────────────────┘
```
Pulse Width Duty Setting

```
                          FRQ: 1.0000      KHz      FM
                                                    AM
              TRG         FM  OFF          SB7      FSK
              GAT                                   PSK
                                                SYN
```

FM Off

```
                          FRQ: 1.0000      KHz  ■   FM
                                                    AM
              TRG         FM  400Hz        SB7      FSK
              GAT                                   PSK
                                                SYN
```

FM On, Internal 400Hz Source

```
                          FRQ: 1.0000      KHz  ■   FM
                                                    AM
              TRG         FM  1000Hz       SB7      FSK
              GAT                                   PSK
                                                SYN
```

FM On, Internal 1000Hz Source

```
                          FRQ: 1.0000      KHz  ■   FM
                                                    AM
              TRG         FM  EXTERN       SB7      FSK
              GAT                                   PSK
                                                SYN
```

FM On, External Source

2.13   Notice of Operating

a. For Waveform Measurement :

- The FG 700S/F series Func Out output impedance is 50Ω, so the oscilloscope input impedance must be matched to 50Ω. Use the coaxial cable for characteristic impedance 50Ω in connecting with both FG 700S/F series Func Out and oscilloscope input terminal.
- Minimizing the cable length and cable stray capacitance is very important for the best performance.
- Because the function generator output is a wideband signal, every connecting path including the transmitter or receiver, must be impedance matched to 50Ω, in order to avoid the reflection from load and the undesired testing results.

b. Output Voltage Definition :

- For FG 700S/F series output impedance is 50Ω, if the load is greater enough than 50Ω, it will result in the load voltage drop equal to the open circuit of the function generator output, approximately. If the load is 50Ω, the load voltage drop is equal to one half of the open circuit of the function generator output voltage.

c. For Small Signal Output :

- For small signal output, it is suggested to add the attenuator, for example: -20 dB, to the function generator output, and adjust the desired output level. This is the method for getting the best

signal / noise ratio.

d. For Large Signal Output :

- In general, the function generator output is 20Vp-p in open circuit, and the output current is limited to less than 100mA. For high voltage and high current output in special applications, the external power amplifier is needed.

ZOM-700ME