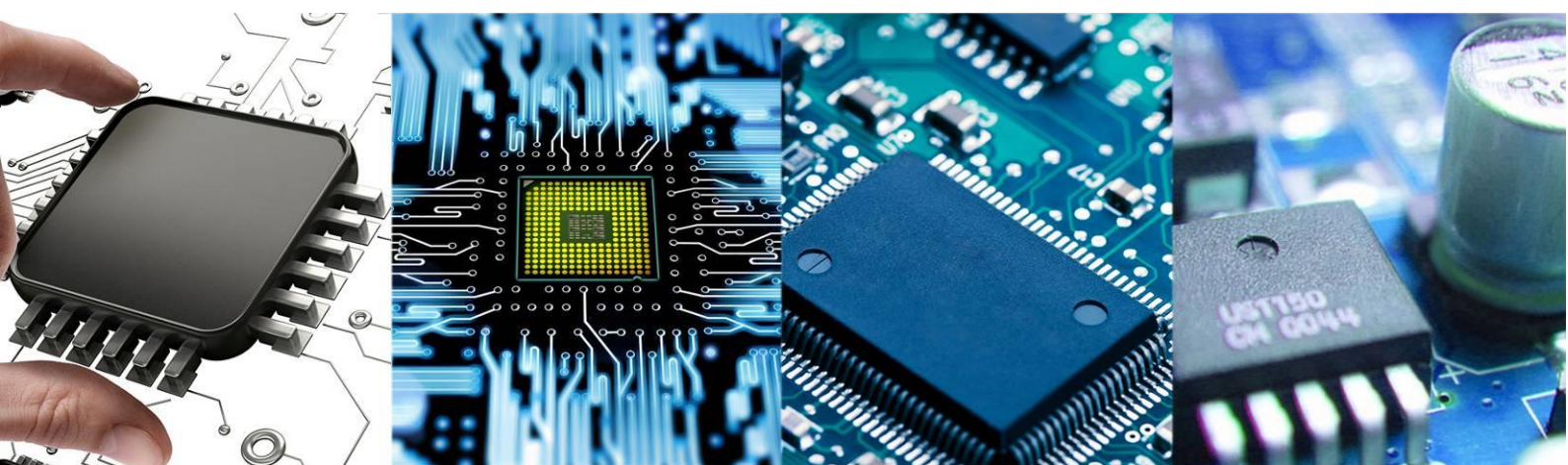# FeelElec

FY6800 Series Fully Numerical Control

Dual Channel Function/Arbitrary Waveform Generator

User's Manual

Rev1.1   April, 2018

Guaranty and Declaration

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Declaration

Contact Us

If you have any problem or requirement when using our products or this manual, please contact **FeelElec**.

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Contents

Product Introduction

This manual applies to each model of FY6800series Function/Arbitrary Waveform Signal Generator. The last three characters of the model indicate the up limit output of Sine Wave (MHz). For example, the "**60M**" of the Model Number "**FY6800-60M**" indicates the Sine wave maximum output frequency is up to 60MHz.

FY6800series Dual-channel Function / Arbitrary waveform generator is a set of Function Signal Generator, Arbitrary Waveform Generator, Pulse Generator, Analog / Digital modulator, VCO, Sweep, Counters and Frequency Meter and other functions in a high Performance, cost-effective, multi-function signal generator. Abundant shortcut keys and graphical user interface simplifies every operation. Users do not have to spend a lot of time to learn and familiar with the operation of the instrument, you can be skilled use. For education, research and development, production, testing, maintenance and other industries to provide a new choice.

The instrument adopt the Direct Digital Synthesizer (DDS) technology and provide stable, precise, pure and low distortion signals. Surface mounting technology improves interference immunity and operational life span. Can output up to 97 groups of functions / arbitrary waveform, contains 33 groups of preset waveforms and 64 groups of user-defined waveforms. Preset waveforms: Sine, Square (Duty Cycle adjustable), Pulse (Pulse width and cycle time can be set accurately), Triangle/Ramp, CMOS(0~10V), Four channels TTL, Exponential Rise, Exponential Fall, Noise, ECG, DC etc.

Main Features:

◆ Adopt the Direct Digital Synthesizer (DDS) technology and provide stable, precise, pure and low distortion signals.

◆ Desktop design with ABS plastic housing, AC 100 - 240V (AC) wide voltage supply;

◆ 2.4 inch TFT Color LCD with 320×240 resolution, displaying parameters and graphics of the two channels at the same time.

◆ The instrument uses 14-bit high-speed D/A converter chip (5Vpp output quantization error is less than 1mV), 250MSa/s sample rate, 14bits vertical resolution.

◆ Fully independent dual-channel output (equivalent to two independent signal sources), able to work synchronously, and the phase difference can be accurately adjusted;

◆ Equipped with channel tracking function, when the tracking function is turned on, all parameters of both channels can be updated according to the user's configuration at the same time;

◆ Two or more instruments can synchronize multiple instruments through the SYNC port;

◆ Up to 98 sets of function/arbitrary waveforms can be output, including 34 sets of preset waveforms and 64 sets of user-defined waveforms. Preset waveforms include: sine wave, square wave (duty ratio adjustable), triangle wave, pulse wave (preset pulse width and frequency can be precisely set), rise sawtooth wave, ramp sawtooth wave, staircase wave, trapezoidal pulse wave, Sink Pulse, narrow pulse, noise, exponential rise, exponential drop, electrocardiogram, Lorentz pulse, multiple audio waves, CMOS (0~10V), four-channel TTL level and DC voltage;

◆ Enable to store 64 arbitrary waveform data files, each one of waveform storage depth 8192 points * 14bits;

◆ High frequency accuracy: Frequency accuracy can reach 10^{-6} orders of magnitude;

◆ The frequency resolution is relatively high: the full-range frequency resolution is 1uHz (0.000001Hz);

◆ Amplitude resolution is higher: Amplitude resolution can be as low as 1mV (0.001V);

◆ With -10V~+10V DC bias function (<20MHz), resolution up to 1mV;

◆ The duty cycle of both channels can be adjusted independently, with an accuracy of 0.01%;

◆ The phase adjustment range of the two channels is 0~359.99°, and the adjustment accuracy is 0.01°;

◆ No range limit: The full range of frequency is not divided into gear switches, program-controlled settings;

◆ With digital signal output function, it can realize any CMOS level with 0~10V amplitude;

◆ Scanning function: It can scan the four properties of the signal: frequency, amplitude, offset, and duty cycle. It has two scanning modes: linear scan and logarithmic scan. The scan time can reach 999.99S. The start and end of the scan can be set arbitrarily ;

◆ Burst Output Function: There has Manual Trigger, internal CH2 Trigger, and External Trigger for your options. It can output 1~1048575 pulse trains.

◆ VCO function: Support VCO voltage control signal output function (such as voltage controlled oscillator).

◆ Various modulation types: AM, FM, PM, ASK, FSK and PSK modulations.

◆ 100M Frequency meter function: It can measure frequency, period, pulse width and duty cycle. Max. frequency workable is 100MHz and Min. frequency workable is 0.01 Hz.

◆ Counter Function: It has 2 coupling measure modes including DC coupling and AC coupling. This design can solve inaccuracy problem of AC coupling.

◆ All parameters can be calibrated by internal procedures;

◆ Equipped with powerful arbitrary waveform editing function, it can edit arbitrary waveform on PC and download to instrument output waveform;

◆ Powerful communication features that can be controlled using a PC. Open communication protocol makes secondary development very simple;

◆ Standard dual full functional channels which are equivalent to two independent generators.

◆ High reliability: Large-scale integrated circuit, surface mount technology, high reliability, long service life;

◆ Output short-circuit protection: All signal outputs can work under load short-circuit conditions 60S or more;

◆ Can choose our FYA2000S series or FPA1000 series power amplifier to output 20W~100W signal in DC-10MHz width without any distortion.

Quick Start

General Inspection

Please follow the items below when you receive a new FY6800series Function/Arbitrary Waveform Generator.

1. Inspect the shipping container for damage

Keep the damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the instrument has passed both electrical and mechanical tests. The consigner or carrier shall be liable for the damage to instrument resulting from shipment.
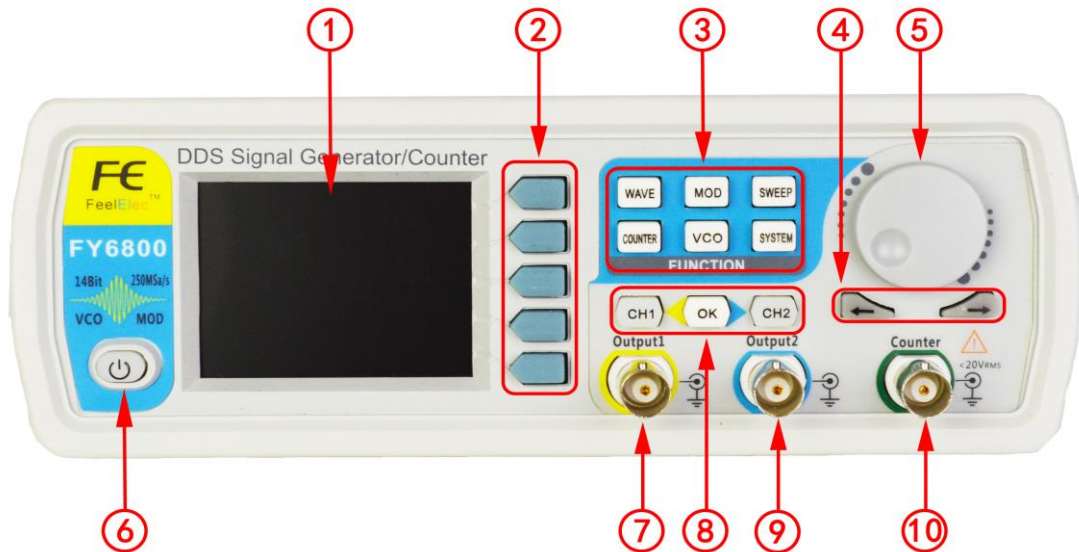
2. Inspect the instrument

In case of any damage, or defect, or failure, notify your **FeelElec** sales representative.

3. Check the accessories

Please check the accessories according to the Appendix C (packing lists). If the accessories are incomplete or damaged, please contact your **FeelElec** sales representative.

Front Panel Overview

The front panel is divided into several function areas for easy operation.

Front Panel

Item	Function	Description
1	LCD	2.4 inch TFT（320×240）color LCD. Operation instruction please check chapter "**User Interface**".
2	Manu Buttons	Manu buttons are matched with Manu displayed on the LCD. Press corresponding button to activate submenu represented.
3	Function Buttons Area	**WAVE** — Waveform selection button: — You can switch between sine, square wave, triangle wave, and any type of arbitrary wave. — Change the selected channel signal type.
		MOD — Trigger and modulation function buttons — Can set a specific number of pulse train output function（BURS） — Modulation mode can be set :ASK、FSK、PSK、AM、FM、PM
		SWEEP — Sine, square, sawtooth and arbitrary waveforms can be scanned. — Supports scanning of four parameters of frequency, amplitude, offset, and duty cycle. Supports two linear and logarithmic scanning methods.
		COUNTER — Can switch to frequency meter and counter function, measure frequency, period, duty cycle, positive pulse width of external input signal — Supports DC and AC signal input.

		— Supports 1 s, 10 s and 100 s gate time switching. — Dual channel output can work with frequency meter measurement.
		VCO VCO function can be set — Support VCO voltage control signal generator's frequency, amplitude, offset, duty cycle and other parameter output functions (such as voltage-controlled oscillator).
		SYSTEM Used to set auxiliary function parameters and system parameters. — Supports storage of 20 sets of parameters such as frequency, amplitude, offset, and phase — Support Chinese and English switching — Support tone off/on — Supports multi-machine cascading — Supports master/slave switchover in cascaded state — Supports dual-channel power-on default output state setting
4	Arrows	Press Arrow buttons to select figure which you want to edit when setting values of each parameter.
5	ADJ Knob	When using the knob to set parameters, you can increase (clockwise) or decrease (counterclockwise) the value at the current cursor.
6	Power Button	The power indicator will remain on when it is turned on. When the signal generator is turned off, the indicator light will enter the breathing lamp state and CH1 and CH2 will stop outputting (the output will remain at 0 volts).
7	CH1 channel output connector	BNC connector, nominal output impedance 50Ω. When channel CH1 is on (the CH1 button indicator lights up), the connector outputs the waveform in the current configuration of CH1.
8	Channel control, OK button	**CH1** It is used to control the output of the CH1 channel and can be switched to the CH1 parameter setting interface in any interface. — Press this button, the CH1 light will turn on, and the CH1 output will turn on. At this point, the [CH1] connector outputs the signal in the current configuration. — Press this button again, the indicator light goes off, and at this point, the CH1 output is turned off.
		OK Confirm button — When editing frequency parameters, press this key to change the frequency unit. — When scanning the interface, press this button to start/stop scanning.

10			It is used to control the output of the CH1 channel and can be switched to the CH1 parameter setting interface in any interface. —Press this button, the CH2 light will turn on, and the CH2 output will turn on. At this point, the [CH2] connector outputs the signal in the current configuration. — Press this button again, the indicator light goes off, and at this point, the CH2 output is turned off.
9	CH2 channel output connector		BNC connector, nominal output impedance 50Ω. When channel CH2 is on (the CH2 button indicator lights up), the connector outputs the waveform in the current configuration of CH2.
10	AC coupling measuring terminal		BNC connector, input impedance 100Ω. For inputting signal of meter or counter.

Back Panel Overview

The back panel of FY6800is as picture 1-2 below. 4 BNC terminals on the left are DC coupling measuring terminals Trig/FSK/ASK/PSK IN, external sweep input VCO IN, Synchronization output connector SYNC OUT, and Synchronization input connector SYNC IN. Then follows TTL output terminal, USB terminal, power switch and power input socket.
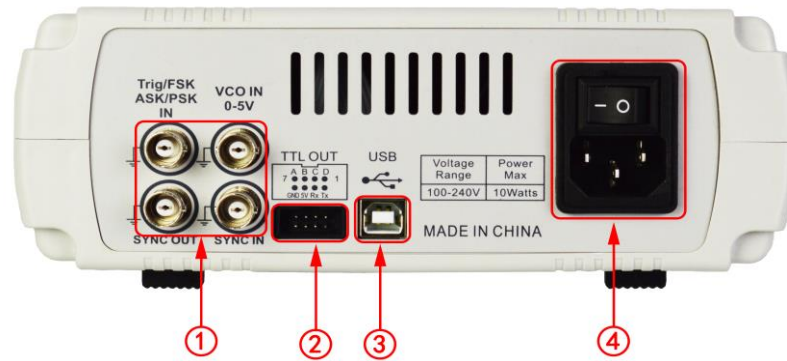
1. BNC connector

Trig/FSK/ASK/PSK IN: DC coupling measuring terminal and ASK/PSK/FSK modulation trigger input terminal.

VCO IN: External signal sweep input terminal can realize voltage controlling frequency, voltage controlling amplitude, voltage controlling offset, voltage controlling duty cycle and so on. Frequency of external signal input should be lower than 500 Hz.

SYNC OUT: Synchronization signal output terminal.

SYNC IN: Synchronization signal input terminal.

2. TTL signal output

Frequency of Port A is same with frequency of CH1 output. Frequency of Port B is same with frequency of Port A but with reverse phase (180°). Frequency of Port C is same with frequency of CH2. Frequency of Port D is same with Port C but with reverse phase (180°).

3. USB Device interface

It's for communication with PC (This is a USB-TTL serial port and driver is needed). Can programming by host computer.

4.Power switch&Power input socket(voltage range AC100V-AC240V).

Warning

To avoid instrument damage, voltage of signal input from EXT.IN CANNOT exceed ±20Vac+dc. Voltage of signal input from Trig/FSK/ASK/PSK IN CANNOT exceed DC5V.

Note

To ensure the normal work, please use 100-240V AC power supply.

Power On and Inspection

Connect to Power

Please connect the generator to AC power supply using the Power cable supplied in the accessories. The power supply use 100-240V AC power. The power of this instrument is less than 5W.

Power On

Turn on the power switch after the power cord is connected. The generator will execute self-inspection. The LCD will show welcome interface after the inspection is over. If the generator cannot work normally, please check the Chapter "Troubleshooting" for solution.

Set the System Language

FY6800series Function/Arbitrary Waveform Generator supports Chinese and English system languages. You can press SYSTEM→CONF to switch the system language.
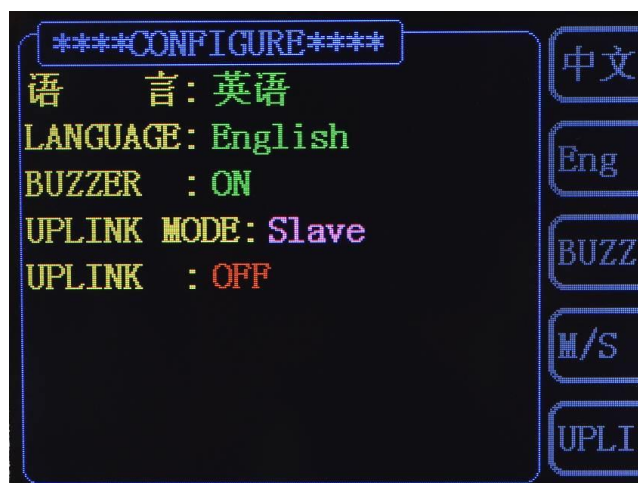
User Interface

The user interface of FY6800provides four types of display modes: Dual Channels Parameters (default), Single Channel Extension, Auxiliary Functions and System Interface.

Dual Channels Parameters (default)

The upper half of LCD displays the channel selected currently and the parameters can be set. Press CH1 or CH2 to change current channel selected.
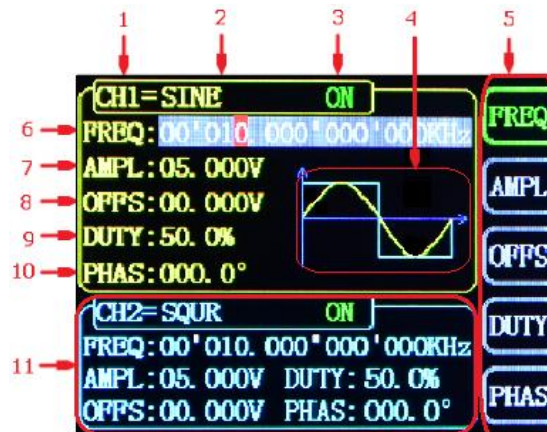
1-4 User Interface (CH1 selected)

Item	Description
1	Current channel selected. Display current channel selected for operation.
2	Current waveform selected. Display the name of current waveform selected. For example, "CH1=Sine" means current waveform selected of CH1 is Sine Wave. It can be changed by press WAVE button. Meanwhile, waveform can be changed quickly by rotating ADJ Knob when waveform switch function is activated.
3	Output status of current channel. Display On/Off status of current channel. It can be switched by Press CH1 or CH2.
4	Waveform Display diagram of current waveform（Including Arbitrary）. Yellow indicates CH1 and blue indicates CH2.
5	Manu Bar Display current operable options .

6	Frequency
	Display frequency value of current channel. Press **FREQ** button to highlight it and use ADJ Knob and Arrows to change the value.
7	Amplitude
	Display amplitude value of current channel. Press **AMPL** button to highlight it and use ADJ Knob and Arrows to change the value.
8	Offset
	Display DC Offset value of current channel. Press **OFFS** button to highlight it and use ADJ Knob and Arrows to change the value.
9	Duty Cycle
	Display Duty Cycle value of current channel. Press **DUTY** button to highlight it and use ADJ Knob and Arrows to change the value.
10	Phase
	Display Phase value of current channel. Press **PHAS** to highlight it and use ADJ Knob and Arrows to change the value.
11	Parameters of the channel unselected.
	Display parameters of the channel unselected including frequency, amplitude, offset, phase, duty cycle and output status. These Parameters cannot be changed directly in this interface. If you need to change them, Please switch the channel to be selected.

Appearance and Dimensions

Front Panel Operations

Waveform Output

FY6800series can output waveforms (Sine, Square, Triangle/Ramp, Pulse and Noise etc.) from one of the channels separately or from the two channels at the same time. At start-up, the dual channels are configured to output a sine waveform with 10kHz frequency and 5Vpp amplitude by default. Two channels use default setting saved at Position 1 when power on. Users can configure the instrument to output various waveforms.

Select Output Channel

CH1 and **CH2** buttons are used to change current channel selected. At start-up, CH1 is displayed on the top with yellow color and CH2 is displayed on the bottom with blue color. Press **CH1** or **CH2** to select channel needed. When selecting CH2 as output channel, CH2 parameters displays on the top for configuration.

KEY POINT:
CH1 and CH2 can not be selected at the same time. Users can first select CH1 and then select CH2 after configuring the waveform and parameters of CH1. If you need to change the parameters of two channel at same time, please refer to Chapter "**Synchronization**".

Select Waveform

FY6800 can output Function/Arbitrary Waveform including:

- Sine
- Square
- Triangle/Ramp
- Rise Sawtooth
- Fall Sawtooth
- Lorenz Pulse
- Multitone
- Noise
- Electrocardiogram (ECG)
- Trapezoidal Pulse
- Sinc Pulse
- Narrow Pulse
- Gauss White Noise
- Step Triangle
- Positive Step
- Inverse Step
- Positive Exponent

- Inverse Exponent
- Positive Falling Exponent
- Inverse Falling Exponent
- Positive Logarithm
- Inverse Logarithm
- Positive Falling Logarithm
- Inverse Falling Logarithm
- Linear FM
- AM
- FM
- Positive Half Wave
- Negative Half Wave
- Positive Half Wave Rectification
- Negative Half Wave Rectification
- User-defined waveform

Press **WAVE** to change waveform selected. Or rotate ADJ Knob under waveform switching status to change waveform. The waveform diagram displays on the screen. Pressing the knob can change to arbitrary waveform directly when choosing waveform. At start-up Sine is selected by default. (Users can also configure start-up waveform. Please check Chapter "Save and Load".

Waveforms		Sine	Square	Triangle	Sawtooth	Arbitrary
Function Name		SINE	SQUR	TRGL	Ramp	Arb
Parameters	Frequency	√	√	√	√	√
	Amplitude	√	√	√	√	√
	Offset	√	√	√	√	√
	Phase	√	√	√	√	√
	Duty Cycle		√			

Note: Arbitrary waveforms can be edited and downloaded from PC software provided by **FeelElec**. The relevant software and driver can be downloaded from our website: www.feelelec.com .

Set Frequency

Frequency is one of the most important parameters of waveforms. For different instrument models and waveforms, the setting ranges of frequency are different. For detailed information, please refer to "**Frequency**" in "**Specifications**". The default frequency is 10kHz.

Press **FREQ** button to highlight value of Frequency. Then use Arrow buttons and ADJ Knob to set the value. Press Arrows button to move the cursor and rotate ADJ Knob to set the value.

Under setting frequency status, press ADJ Knob to change frequency units among MHz, KHz, Hz, mHz, μHz.

Set Amplitude

The amplitude setting range is limited by the "Attenuation" and "Frequency" settings. Please refer to "**Output Characteristics**" in **"Specifications"**. The default value is 5Vpp.

Press **AMPL** button to highlight amplitude value. Then use Arrows button and ADJ Knob to set the value. Press Arrows button to move the cursor and rotate ADJ Knob to set the value.

Key Points：

1. What's the difference of amplitude in Vpp and the corresponding value in Vrms?

Answer:
Vpp is the unit for signal peak-peak value and Vrms is the unit for signal effective value. The default unit is Vpp.

Note：
For different waveforms, the relation between Vpp and Vrms is different. The relation of the two units is as shown in the figure below (take sine waveform as an example).
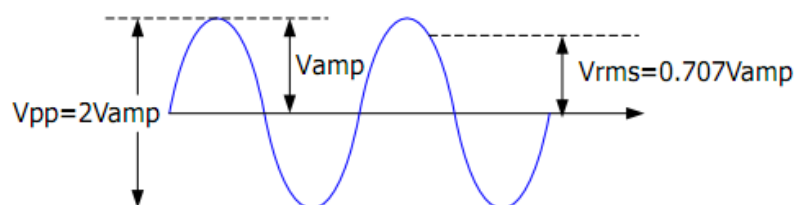
According to the figure above, the conversion relation between Vpp and Vrms fulfills the following equation:

$$Vpp = 2\sqrt{2}\ Vrms$$

For example, if the current amplitude is 5Vpp, For sine waveform, the converted value is 1.768Vrms.

Set Offset

Press **OFFS** button to highlight offset value. Then use Arrows button and ADJ Knob to set the value. Press Arrows button to move the cursor and rotate ADJ Knob to set the value.

The offset accuracy is 1mV. i.e. 0.001V.

When frequency output is lower than 20MHz, the offset can be adjusted during -10V~+10V.

When frequency output is higher than 20MHz, the offset can be adjusted during -2.5V~+2.5V.

Set Duty Cycle (Square)

Duty cycle is defined as the percentage that the high level takes up in the whole period (as shown in the figure below). This parameter is only available when square is selected.
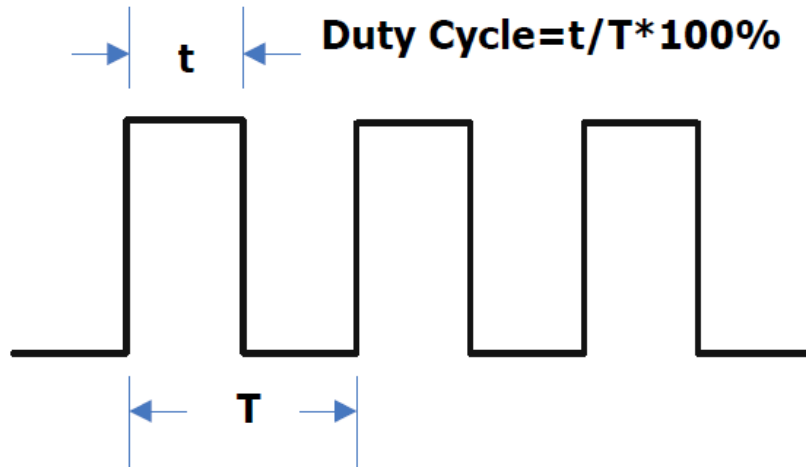
The setting range of duty cycle is limited by the "FREQ" setting. Please refer to "**Waveform Characteristics**" in "**Specifications**". The default value is 50%.

1. Press DUTY button to highlight duty cycle value. Then use Arrows button and ADJ Knob to set the value. Press Arrows button to move the cursor and rotate ADJ Knob to set the value.

- The setting range of duty cycle is 0.1%-99.9%；
- Press ADJ Knob under duty cycle setting status will initial the value to 50%.

Set pulse wave pulse width ('Adj-Pulse' wave)

Adjustable pulse wave refers to the square wave that can hold the fixed pulse width at any frequency, that is, the pulse width set by the user does not change with the frequency.

Pulse width setting method: in the adjustable pulse wave is selected, press PULS button key to adjust the pulse wave pulse width time (Unit ns).The pulse width can be set by the arrow button and the knob. Use the arrow button to move the cursor to select the bit you want to edit, and then turn the knob to modify the value. (Note: Do not set the length of the positive pulse width greater than or equal to the cycle time of the output waveform).

Set Phase

The setting range of phase is from 0° to 359.9°. The phase resolution is 0.1°. The default phase value is 0°

The start phase displayed on the screen is the default value or the phase previously set.

Then press **PHAS** button to highlight phase value. Then use Arrows button and ADJ Knob to set the value. Press Arrows button to move the cursor and rotate ADJ Knob to set the value.

Enable Output

After completing the parameter settings for the selected waveform, you need to turn on the channel to output the waveform. When the output is off, the LED below the corresponding channel button is off; when the output is on, the LED is on.
The default output of both `CH1` and `CH2` is enabled at power on, and the LEDs below the `CH1` and `CH2` buttons are lit.
The default status can be modified. Press【SYS】button and then press【MORE】button to set the output status of dual channels.

For CH1 there are two status:
1) Generator is in parameter setting status and current channel selected is CH1, then press `CH1` to switch between output ON/OFF.
2) Generator is in other working status or current channel selected is not CH1, then press `CH1` to make CH1 as channel selected and press `CH1` again to switch between output ON/OFF.

For CH2 there are two status:
3) Generator is in parameter setting status and current channel selected is CH2, then press `CH2` to switch between output ON/OFF.
4) Generator is in other working status or current channel selected is not CH2, then press `CH2` to make CH2 as channel selected and press `CH2` again to switch between output ON/OFF.

Example：Output Sine Waveform

This section mainly introduces how to output a sine waveform (Frequency: 20kHz, Amplitude:2.5Vpp, DC Offset: 1.6VDC, Start Phase: 90.9°) from the [CH1] channel.

1. Select output channel

Press CH1 to select CH1. Now all characters and border of the channel is displayed in yellow.

2. Select the Sine

Press WAVE button to select Sine. Then the diagram of Sine displays on the screen.

3. Set the frequency

Press FREQ button to highlight the frequency value. Press Arrow buttons to move the cursor to the position "2" below. Then rotate the ADJ Knob to get "2".

FREQ：00'020. 000'000'000kHz

4. Set the Amplitude

Press AMPL to highlight the amplitude value. Press Arrow buttons to move the cursor and rotate the ADJ Knob to get the figures below.

AMPL：02. 500V

5. Set Offset

Press OFFS to highlight the offset value. Press Arrow buttons to move the cursor and rotate the ADJ Knob to get the figures below.

OFFS：01. 600V

6. Set Phase

Press ▼ button to page down and press PHAS button to highlight phase value. Then Press Arrow buttons to move the cursor and rotate the ADJ Knob to get the figures below.

PHAS：090. 9°

7. Enable the output

Press CH1 button to turn CH1 output on. The [CH1] connector outputs the configured waveform.

8. Observe the output waveform

Connect the [CH1] connector to the oscilloscope with BNC cable. The waveform is as shown below.
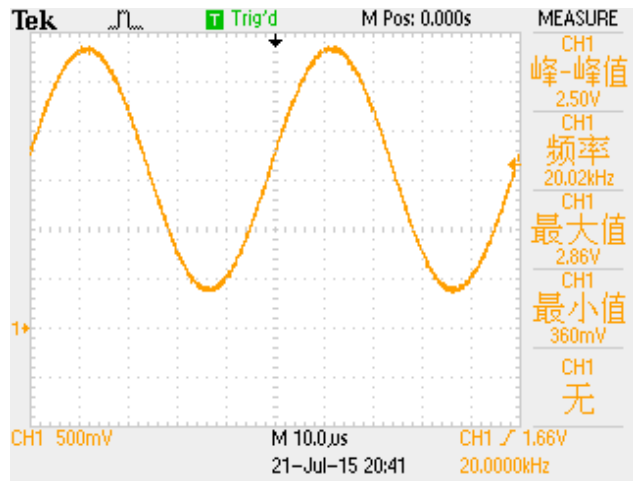
Modulation Function

Press the **MOD** button on the front panel to enable the modulation function. The FY6800 can output the modulating waveform from the CH1 channel. This function uses the waveform signal of CH1 as the carrier wave, the waveform signal of CH2, the external signal or the manual pulse signal as the modulation wave, and performs signal modulation. It can realize FSK, ASK, PSK digital modulation, trigger pulse train output, and AM, FM, PM analog signal modulation function. The modulation signal is input by the Trig/FSK/ASK/PSK IN at the end of the signal generator.
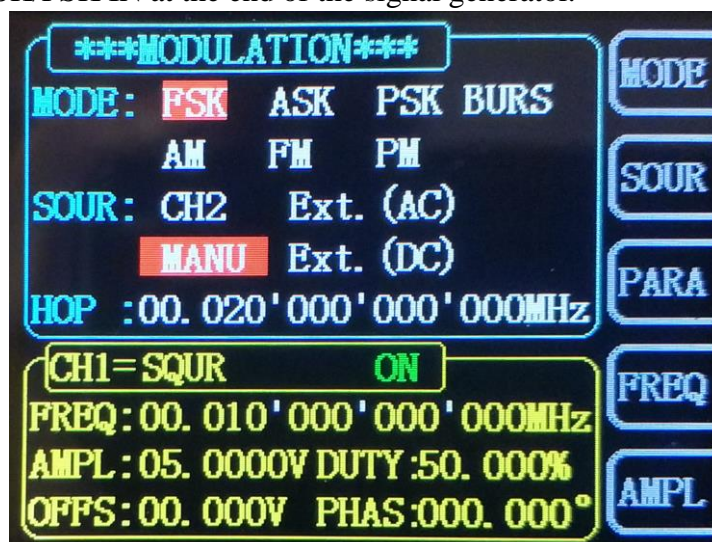
Modulation parameter setting interface

(Note: The signal generator will execute the current modulation function immediately after entering the modulation interface)

Modulation mode

Press the "Mode" key under the modulation function to switch the modulation mode. These modes include
① FSK (frequency keying).
② ASK (amplitude keying).
③ PSK (phase keying).
④ trigger (controllable burst output).
⑤ AM (Amplitude Modulation).
⑥ FM (FM).
⑦ PM (phasing).

Each time the "Mode" button is pressed, the function will switch down once.

Modulation source

Under the modulation function, click the "SOUR" button to switch the modulation source, that is, select the modulation signal.

There are four types of sources in FSK, ASK, PSK, and trigger modes:
① CH2: Use the signal of channel 2 as a modulation signal.
② External (AC): External signals are AC-coupled through the EXT.IN port.
③ Manual: Use the manual "OK" button as the modulation signal.
④ External (DC): External signal input via TTL_IO port in DC-coupled form.

There are two sources in the AM, FM, and PM modes:
① CH2: Use the signal of channel 2 as a modulation signal.
② External (Ext.IN): External signals are connected in DC-coupled form via the EXT.IN port.

Each time the "Source" button is pressed, the function will switch down once.

Modulation parameters

Under the modulation function, click the "Parameters" button to adjust the modulation parameters.
E.g:
① In the "FSK" mode, the frequency of frequency hopping can be adjusted.
② In the "trigger" mode, the number of output pulse trains can be adjusted.
③ In the "AM" mode, you can adjust the modulation rate of the amplitude modulation (0 to 200%).
④ In FM mode, frequency offset parameters can be adjusted.
⑤ In the "PM" mode, the degree of phase deviation can be adjusted.

Other key functions

Click "FREQ" button under the modulation function to adjust the frequency of CH1.
Click the "AMPL" button under the modulation function to adjust the amplitude of CH1.

Burst

The FY6800 can output a waveform with a specified number of cycles (called Burst) from the CH1 channel. The FY6800 supports internal, manual or external trigger source control of the pulse train output from CH2. The signal generator can generate pulse trains using sine, square, sawtooth, pulse, noise, or arbitrary waves (except DC).

Turn on burst function

Press **MOD** key, and then press the soft key corresponding to "Mode" to select "Trigger" mode to enter the burst output function. The instrument supports three trigger output modes [CH2], [External], and [Manual], which can be selected with the corresponding soft keys. Press the corresponding soft key of "Parameter" to set the number of pulse train pulses. When the number of pulses is selected, use the arrow keys and parameter adjustment knob to change the number of pulses output by a single burst. The default is 1, The range is from 1 to 1048575. After parameter setting is completed, the signal generator will output the burst waveform from the CH1 channel (if currently open) according to the current trigger configuration.

- Normal mode, burst off mode.
- CH2 trigger mode, that is, CH2 has a pulse, then CH1 outputs a burst of burst waveform.
- External trigger mode, that is, there is a pulse input on the Trig.IN terminal, then CH1 outputs a burst of burst waveform.
- Manual trigger mode, the user can press the [OK] button to trigger CH1 to output a series of burst pulse waveforms.

Frequency Meter/Counter

FY6800provides a counter which can measure various parameters of external input signal such as frequency, period, duty cycle, positive pulse width and negative pulse width. Dual channels output can work together with counter.

Enable the Counter

Press **COUNTER** button of the front panel to enable the counter and measurement Manu. External signal for measurement can be inputted by Input connector(AC coupling) or Trig IN(DC coupling). The result will be displayed on the screen in real time. The lowest frequency workable is 0.01 Hz. （GATE TIME:100S）。

Press **COUNTER** button to enter external pulse counter function. At this time **COUN** button is turned into **FREQ** button.

Repeat pressing this button to switch between **FREQ** and **COUN**.
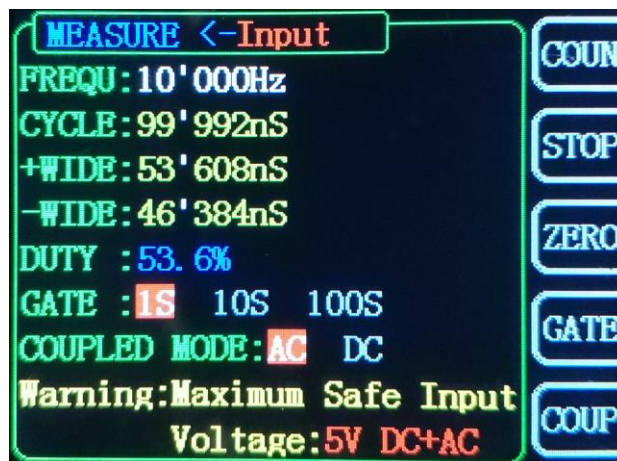
2-1 Frequency Meter/Counter Interface

When the Frequency Meter/Counter is turned on, press **STOP** button to pause and press **ZERO** button to reset.

Key Point：

Amplitude of signal inputted should be bigger than 1.5V.   Maximum safe voltage inputted from Input and Trig IN is 5V. The Uplink function need to be turned off when using Counter/Meter.

Set the Counter

Gate Time

Press **GATE** button to select gate time. The default is "1S". It's better to use "10S" or "100S" as gate time for low frequency signal.

Gate Time	Frequency Resolution
1S	1Hz
10S	0.1Hz
100S	0.01Hz

Coupling

Set the coupling mode of the input signal to "AC" or "DC" and the default is "AC".
When the AC coupling mode is selected, signal should be inputted from Input terminal.
When the DC coupling mode is selected, signal should be inputted from Trig IN terminal.

Sweep

Press **SWEEP** button of front panel to enable sweep function. FY6800can output sweep from CH1. In sweep mode, the generator outputs signal variably from the start frequency to stop frequency within the specified sweep time. It can generate sweep output for Sine, Square, Triangle/Ramp and arbitrary waveform.
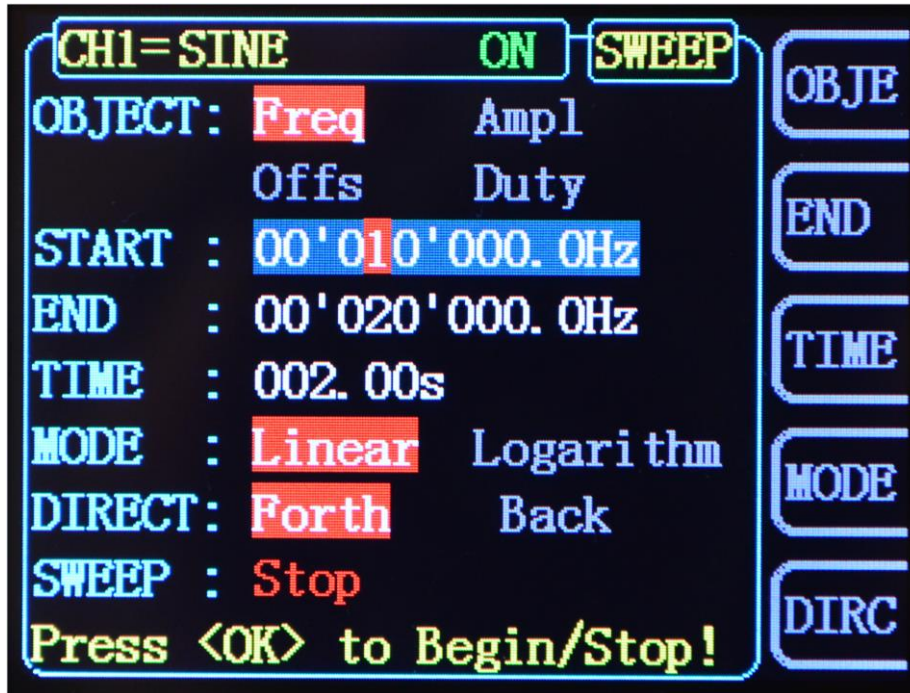
2-2 Sweep setting interface

Sweep Object

FY6800Can output sweep from CH1. The sweep objects include frequency, amplitude, offset, duty cycle. It can be selected by pressing **OBJE** button.

- In Frequency Sweep Mode, the generator will output signal variably from start frequency to end frequency within the specified sweep time.
- In Amplitude Sweep Mode, the generator will output signal variably from start amplitude to end amplitude within the specified sweep time.
- In Offset Sweep Mode, the generator will output signal variably from start offset to end offset within the specified sweep time.
- In Duty Cycle Sweep Mode, the generator will output signal variably from start duty cycle to end duty cycle within the specified sweep time.

Sweep Start Position

When Sweep function is enabled. Sweep start position need to be set according to sweep objects.

- Frequency Sweep: Press **STAR** button to highlight start frequency parameter. Press the Arrow buttons and rotate the ADJ Knob to set the specified value. For example:

START：00'010.000'000'000kHz

- Amplitude Sweep: Press **STAR** button to highlight start amplitude parameter. Press the Arrow buttons and rotate the ADJ Knob to set the specified value. For example:

START：10.00V

- Offset Sweep: Press **STAR** button to highlight start offset parameter. Press the Arrow buttons and rotate the ADJ Knob to set the specified value. For example:

START：00.00V

- Duty Cycle Sweep: Press **STAR** button to highlight start duty cycle parameter. Press the Arrow buttons and rotate the ADJ Knob to set the specified value. For example:

START：50.0%

Sweep End Position

When Sweep function is enabled. Sweep end position need to be set according to sweep objects.

- Frequency Sweep: Press END button to highlight end frequency parameter. Press the Arrow buttons and rotate the ADJ Knob to set the specified value. For example:

  END：00'020. 000'000'000kHz

- Amplitude Sweep: Press END button to highlight end amplitude parameter. Press the Arrow buttons and rotate the ADJ Knob to set the specified value. For example:

  END：20. 00V

- Offset Sweep: Press END button to highlight end offset parameter. Press the Arrow buttons and rotate the ADJ Knob to set the specified value. For example:

  END：10. 00V

- Duty Cycle Sweep: Press END button to highlight end duty cycle parameter. Press the Arrow buttons and rotate the ADJ Knob to set the specified value. For example:

  END：80. 0%

Sweep Time

When Sweep function is enabled, press SOUR button to select it and press it again to change between TIME and external sweep (VCO Sweep). Press the Arrow buttons and rotate the ADJ Knob to set the specified value of weep time. The default is "10S". The work range is 10mS~999.99S. For Example:

SOUR: TIME 999.99S

VCO (Voltage Control Output) Sweep

Function instruction: External voltage can control signal output by External Sweep (VCO) function. It can realize voltage controlling frequency (VCF), voltage controlling amplitude (VCA), voltage controlling offset, voltage controlling duty cycle and so on.

Operation method: Press [VCO] button to enter sweep function interface. After Sweep Object, Start, End and Sweep Mode being set, connect the external signal from VCO IN terminal on the back panel. Then press the ADJ knob (OK button) to enable VCO sweep function. Press ADJ knob (OK button) again to disable it.

Note: Signal input for External Sweep (VCO) need to be input from VCO IN port of back panel. Its frequency need to be less than 500 Hz and its voltage amplitude need to be among 0~5V.

Sweep Type

FY6800provides Linear, Logarithm sweep types. The default is Linear sweep. The sweep type can be switched by pressing "MODE" button.

Linear Sweep

In linear sweep type, the signal parameter varies linearly. For example, in the frequency sweep the output frequency of the instrument varies linearly in the way of "Changing several Hertz per second". The variation is controlled by "Start Frequency", "End Frequency" and "Sweep Time".

The step value of linear sweep object is computed by the generator, the formula is as follows:

Step value=（End value － Start value）/（Sweep time*100）

Logarithm Sweep

In linear sweep type, the signal parameter varies logarithmically.

For example, in the frequency sweep the output frequency changes in the way of "octave per second" or "decade per second". The variation is controlled by "Start Frequency", "End Frequency" and "Sweep Time".

When Logarithm Sweep is enabled, users can set the following parameters: Start Frequency (F_{start}), Stop Frequency (F_{end}) and Sweep Time (T_{sweep}).

The function prototype of Logarithm Sweep:

$$F_{current} = P^T$$

$F_{current}$ is the instantaneous frequency of the current output. P and T could be expressed as shown below by the above-mentioned parameters:

$$P = 10^{\,lg(F_{stop}/F_{end})/T_{sweep}}$$

$$T = t + lg(F_{start})/lg(P)$$

Wherein, t is the time from the start of the sweep and its range is from 0 to T_{sweep}.

Enable Sweep Function

Press **SWEEP** button of front panel to enable sweep function. Then press ADJ Knob to start sweep process. Press ADJ Knob again to stop sweep.
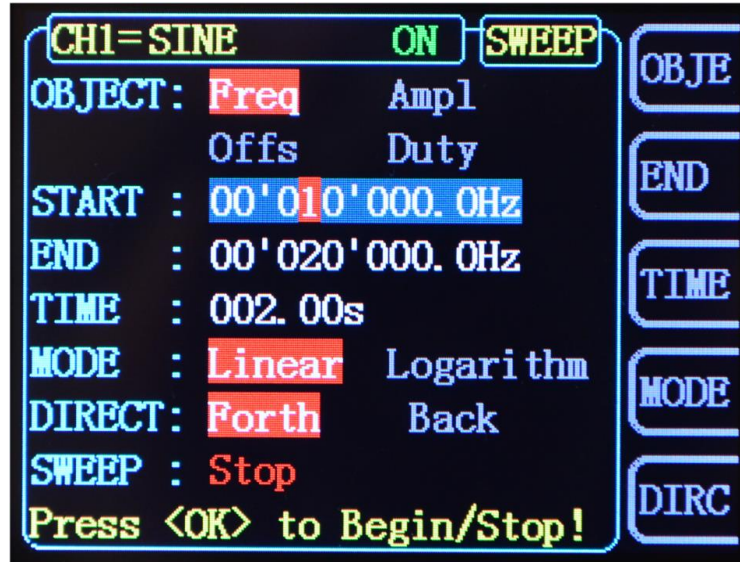
Start value and End value

Start value and stop value are the upper and lower limits of sweep for specified parameter. sweep. The generator always sweeps from the start value to the end value and then returns back to the start value and continues indefinitely.

For example, in Frequency Sweep function:
- Start Frequency < End Frequency: the generator sweeps from low frequency to high frequency.
- Start Frequency > End Frequency: the generator sweeps from high frequency to low frequency.
- Start Frequency = Stop Frequency: the generator outputs with a fixed frequency.

When Sweep function is enabled, press **STAR** button to highlight start value. Use arrow buttons and ADJ Knob to set the specified value. Different frequency sweep corresponds to different start frequency and end frequency range.
- Sine： 10mHz to 25MHz~60MHZ (Varies according to different model)
- Square： 10mHz to 25MHz
- Ramp： 10mHz to 10MHz
- Arbitrary：10mHz to 10MHz

The generator will restart sweep (according to the current new configuration) from the specified "start frequency" after start or end frequency is changed.

System Configuration and Auxiliary Functions

Press the SYSTEM button on the front panel to open the operation interface shown in the figure below. This interface displays function information such as instrument parameter storage, parameter loading, synchronization, and configuration.
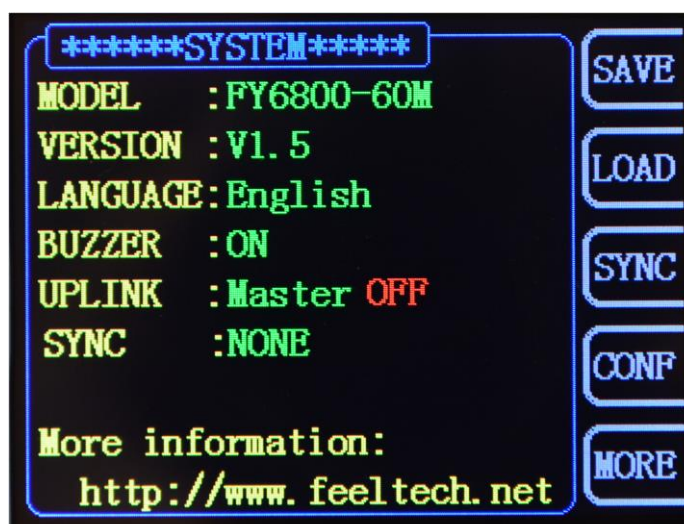
SAVE: To save current parameters of waveform to save positions (20 sets).
LOAD: To load parameters to current working status from save positions.
CONF: To set system language, turn on/off Buzzer and Uplink mode.
MORE: To set default output status of dual channels.

CH1 BOOT：ON

The default CH1 channel is on to turn on the output state，can press the [F1] button to set the default output status of the CH1 channel.

CH2 BOOT：ON

The default CH2 channel is on to turn on the output state，can press the [F2] button to set the default output status of the CH2 channel.

Save and Load

Press **SAVE** button in System interface to save parameters of current waveform to specified position. Press **LOAD** button to load parameters of waveforms previously set to current system status.

Select **S xx** on the right to save current parameters to corresponding position.

Select **L xx** on the right to load parameters from corresponding position to current system status.

- FY6800provides 20 positions for saving.
- The generator will load default parameters from Position 01 automatically after start-up.

Configuration

Press SYSTEM button to enter system interface. Then press CONF button to enter system configuration interface. Press corresponding buttons to select system work mode.

- Press 中文 button to select Chinese as system language.

- Press Eng button to select English as system language.

- Press BUZZ button to turn on/off buzzer. On is the default.

- Press M/S button to set uplink mode: Master/Slave. Master is the default.

- Press UPLI button to turn on/off uplink function. Off is the default.
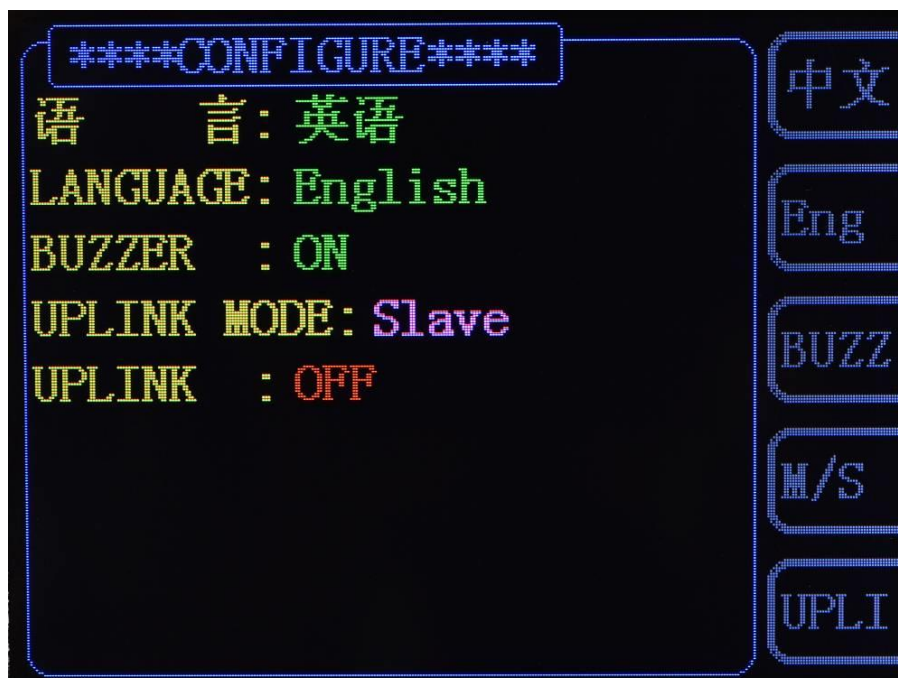
Uplink

FY6800supports multi-machine uplink, which can provide users more channels for output. In uplink network, only one master machine can exist. Others must be set as slave machine. The setting method is as follows:

- Select on FY6800as master machine. Press **SYSTEM** -> **CONF** -> **M/S**, to set the UPLINK MODE to be "Master". Press **UPLI**, to set the UPLINK to be "ON".
- Set all other machines to be slave machines. Press **SYSTEM** -> **CONF** -> **M/S**, to set the UPLINK MODE to be "Slave". Press **UPLI**, to set the UPLINK to be "ON". Repeat this step to set all slave machines.
- Connect all FY6800in parallel by SYNC connecter.
- The uplink machines cannot exceed 8 because the driving ability.

When the setting above has been finished, all machines in network will work synchronously according to the start phase of master machine. When outputting signal with same frequency, multi channels output can be executed with phase adjustable.

Synchronization

After pressing the **SYSTEM** button, press the [SYNC] soft key to enter the synchronization function setting interface. Press the right parameter soft key to switch it in the selected (highlighted)/canceled state.

When the synchronization of corresponding parameters are activated, the corresponding parameters of CH2 will vary according to variation of CH1 automatically. The parameters workable for synchronization include waveform, frequency, amplitude, offset, and duty cycle, which can be set separately.

- The **WAVE** soft key is highlighted. The waveform type of CH2 and the waveform type of CH1 change synchronously.
- The **FREQ** soft key is highlighted. The waveform frequency of CH2 and the waveform frequency of CH1 change synchronously.
- The **AMPL** soft key highlights, the waveform amplitude of CH2 and the waveform amplitude of CH1 change synchronously.
- The **OFFS** soft key is highlighted. The waveform offset of CH2 and the waveform offset of CH1 change synchronously.
- The **DUTY** soft key is highlighted. The duty cycle of CH2 and the duty cycle of CH1 change synchronously.

Troubleshooting

This chapter lists the commonly encountered failures of FY6800and their solutions. When you encounter these problems, please solve them following the corresponding steps below. If the problem remains still, please contact **FeelElec** and provide the device information (Press SYSTEM to get it).

Failure Phenomena	Solutions
The screen of the generator is still dark (no display) after switch on.	1) Check whether the power is correctly connected. 2) Check whether the power switch has been pulled in place. 3) Restart the instrument after finishing the above inspections. 4) If it still does not work correctly, please contact **FeelElec**.
CH2 is locked.	1) Check that the signal generator is operating in synchronous state. Press the SYSTEM -> SYNC button to enter the synchronization settings interface to cancel all synchronization parameters. 2) If the problem is still, please restart the generator.
Set correctly, but no waveform output	1) Check whether the BNC cable is connected tightly with CH1 or CH2 connector. 2) Check whether the BNC cable has internal damage. 3) Check whether the BNC cable is connected tightly with the test instrument. 4) Check whether the indicators of CH1 or CH2 is turned on. If not press corresponding button to turn it on. 5) If the problem is still, please contact **FeelElec**.

Technical Specification

Unless specified, all specifications can be guaranteed if the following two conditions are met.
- The generator has passed self-inspection.
- The generator has been working continuously for at least 30 minutes under the specified temperature (18℃~28℃).

All the specifications are guaranteed unless those marked with "typical"

Frequency

Model	FY6800-20M	FY6800-30M	FY6800-50M	FY6800-60M
Sine	0~20MHz	0~30MHz	0~50MHz	0~60MHz
Square	0~15MHz	0~25MHz	0~25MHz	0~25MHz
Ramp, Triangle	0~10MHz	0~10MHz	0~10MHz	0~10MHz
Pulse	0~10MHz	0~10MHz	0~10MHz	0~10MHz
TTL/CMOS	0~10MHz	0~10MHz	0~10MHz	0~10MHz
Arbitrary Waveform	0~10MHz	0~10MHz	0~10MHz	0~10MHz
Minimum pulse width	20ns(All models of pulse wave minimum width can reach 20ns)			
Min. Resolution on all frequency range	1µHz (Min. resolution can reach 1µHz on all frequency range to ensure adjusting accuracy under high frequency. For example, it can output 10.000000000001MHz signal).			
Accuracy	±20ppm			
Stability	±1ppm/ 3hours			

Waveform Characteristics

Waveforms	Sine, Square (Duty Cycle adjustable), Pulse (Pulse width and cycle time can be set accurately), Triangle/Ramp, Sawtooth Wave, CMOS, Four channels TTL, DC, Half wave, Full wave, Positive Step, Inverse Step, Positive Exponent, Inverse Exponent, Lorenz Pulse, Multitone, Noise, ECG, Trapezoidal Pulse, Sinc Pulse, Narrow Pulse, Gauss White Noise, AM, FM, and other 64 sets customer-defined waveform.
Non-Volatile Storage	Can store 64 user-defined arbitrary waveforms, (8K 14bits) * 64
Waveform Length	8192 points * 14bits
Sampling Rate	250MSa/s
Vertical Resolution	14 bits

Sine	Harmonic Suppression	≥50dBc(<1MHz); ≥45dBc(1MHz~20MHz);
	Total Harmonic Distortion	<0.5% (20Hz~20kHz,0dBm)

Square	Rise/Fall Time	≤7ns (VPP<5V)
	Overshoot	≤5%
	Duty Cycle	0.01%~99.99% (Resolution 0.01%)
Sawtooth wave	Linearity	>99% (0.01Hz~10kHz)

Output characteristics

Amplitude（VPP）	Frequency≤10MHz: 1mVpp~20Vpp; 10MHz<Frequency≤20MHz: 1mVpp~10Vpp; Frequency>20MHz: 1mVpp~5Vpp;
Resolution	1mV
Amplitude Stability	±0.5%/ 5 Hours
Amplitude flatness	±2.5%(<10MHz);±5%(>10MHz);

Waveform Output

Impedance	50Ω±10%（Typical）
Protection	All channels can work more than 60 seconds when the load is short-circuited.

DC Offset

Offset Range	Frequency≤20MHz: ±10V; Frequency>20MHz: ±2.5V;
Offset Resolution	1mV
Phase Feature	
Phase range	0~359.99°
Phase resolution	0.01°

TTL Output

TTL Level Amplitude	>3Vpp
Fan-out	>8 TTL LOAD
Rise/Fall Time	≤10ns

CMOS Output

Low Electric Level	<0.3V
High Electric Level	1V~10V
Rise/Fall Time	≤18ns

External Measurement

Function	Frequency, Period, Positive/Negative Pulse Width, Duty Cycle	
Input Voltage Range	1Vpp~20Vpp	
Frequency Meter	Resolution	0.01Hz (Gate Time = 100S)
	Range	0.01Hz~100MHz
	Sensitivity	Gate Time 3 grades (1S, 10S, 100S) adjustable

Counter	Range	0-4294967295		
	Coupling	DC, AC		
	Working Mode	Manual		
Period	Measurement Range		5ns ~ 20s	DC coupling measurement
Pulse Width	Measurement Range		0ns ~ 20s	
	Resolution		5ns	
Duty Cycle	Range (Display)		0% ~ 100%	

Sweep

Carrier Waveform	Sine, Square, Ramp, Arbitrary (except DC)
Sweep Type	Linear or Logarithm
Sweep Direction	Up, Down and roundtrip sweep directions;
Sweep Objects	Frequency, Amplitude, Offset, Duty Cycle
Sweep Time	0.01S~999.99S/Step
Setting range	Starting position and Finishing position can be set arbitrarily.
Sweep Range	Decided by Parameters setting.

VCO (Voltage Control Output)

Modulation signal range to input	0~5V
VCO signal frequency range	0-2000Hz
VCO control object	voltage controlling frequency (VCF), voltage controlling amplitude (VCA), voltage controlling offset, voltage controlling duty cycle.
VCO special function	Can Amplitude Modulate (AM) or Frequency Modulate (FM) by external analog signal.

Modulation

Modulation Type	AM, FM, PM, ASK, FSK, PSK
Carrier Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform (Except DC)
AM	
Source	Internal (CH2) / External (VCO IN Port)
Modulating Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform
Depth	0% to 120%
Modulating Frequency	Internal : 1μHz~1MHz; External: 1μHz~2KHz;
FM	
Source	Internal (CH2) / External (VCO IN Port)
Modulating Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform
Modulating Frequency	Internal : 1μHz~1MHz; External: 1μHz~2KHz;
PM	
Source	Internal (CH2) / External (VCO IN Port)

Modulating Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform
Phase Deviation	0° to 360°
Modulating Frequency	Internal : 1μHz~1MHz; External: 1μHz~2KHz;
ASK	
Source	Internal (CH2), External (ASK IN Port), Manual
Modulating Waveform	Square with 50% duty cycle.
Key Frequency	1μHz~10MHz
FSK	
Source	Internal (CH2), External (FSK IN Port), Manual
Modulating Waveform	Square with 50% duty cycle.
Key Frequency	1μHz~10MHz
PSK	
Source	Internal (CH2), External (PSK IN Port), Manual
Modulating Waveform	Square with 50% duty cycle.
Key Frequency	1μHz~10MHz

Burst Function

Carrier Waveform	Sine, Square, Ramp, Arbitrary (except DC)
Burst Count	1~1048575
Trigger Source	Manual, Internal, External (AC/DC)

General Specifications

Display	Type	2.4 inch, TFT Color Display.
Save & Load	Amount	20
	Position	01 to 20 (01 for start default value)
Interface	Type	USB to Serial interface
	Protocol	Command line mode, providing communication protocols.
	Communicating Speed	9600bps (Industrial standard)
Power	Voltage Range	AC100V~240V
Technic	SMD, LSI, Reliable and durable	
Buzzer	Can be turned on/off by setting.	
Operation	Buttons and knob continuously.	
Environment	Temp.: 0~40℃, Humidity: ＜80%	
Size	200mm * 190mm * 90mm (L * W * H)	
Weight	850g	
Package Size	25cm * 21cm * 10cm (L * W * H)	
Package Weight	0.98kg(Main engine, accessories and packing materials)	

Appendix

Appendix A：Safety Notes

1. Before using this instrument, please check if the power supply is normal, to ensure the normal use and personal safety.
2. This instrument must be used in the technical index range.
3. Please do not change the instrument circuit arbitrarily, so as to avoid damaging equipment or endangering the safety.

Appendix B：Warning and personal injury

Do not apply the product in the safety protection device or emergency stop device, or any other applications that the product failure could result in personal injury, unless there is special purpose or use authorization. Before the installation and use, each parameter of the technical indexes in this manual should be referred to. If this suggestion is not obeyed, death or serious personal injury could be caused. In this condition the company will not be responsible for any compensation of personal injury or death, and all the company managers and employees and auxiliary agents, distributors, other personnel concerned will be released from any claim (including all the costs, expenses, attorney fees etc.) that may result in.

Appendix C：Accessories and Options

	Description	Quantity
Model	FY6800 Series DDS Signal Generator	1
Standard Accessories	Power Cable	1
	USB Data Cable	1
	BNC-Clip Cable	2
	BNC-BNC Cable	1
	Warranty Card	1
Options	FYA2000 Series Amplifier	
	FPA1000 Series Amplifier	

Note: Options can be ordered from local **FeelElec** distributors.

Appendix D：Warranty

FeelElec warrants that its products mainframe and accessories will be free from defects in materials and workmanship within the warranty period. If a product is proven to be defective within the respective period, **FeelElec** guarantees the free replacement or repair of products which are approved defective. This product enjoy 1 year warranty since its delivery. Damages caused by misuse, vandalism, improper maintenance or force majeure are not covered by the warranty. Any disassembly or amendment without permission will be deemed giving up warranty rights consciously.