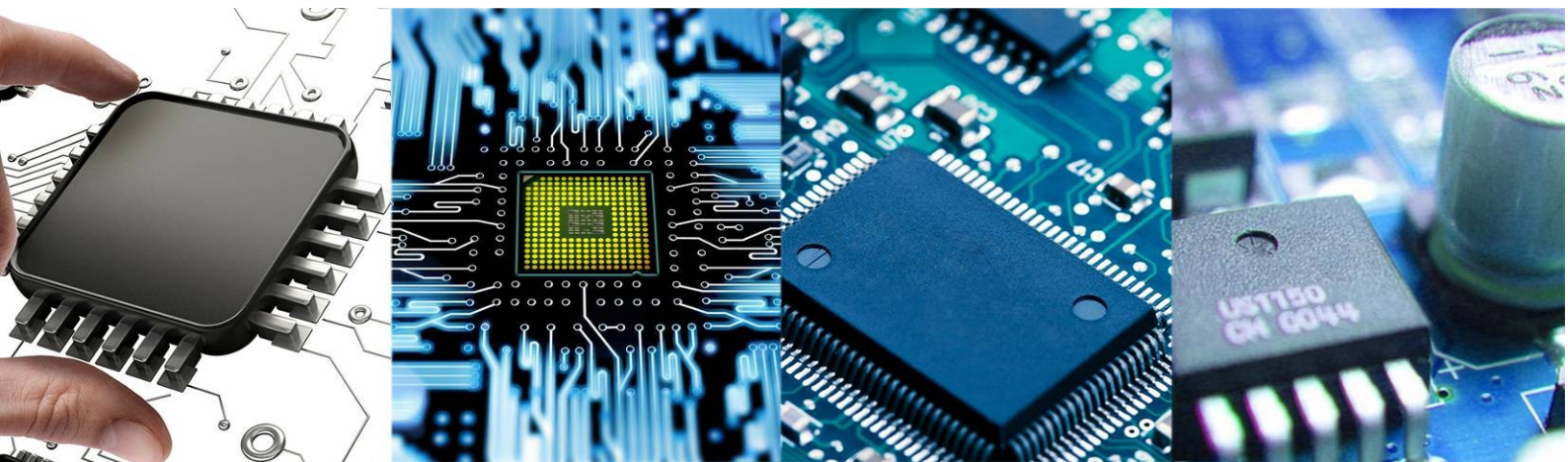# FeelTech

FY6600 Series Fully Numerical Control
Dual Channel Function/Arbitrary Waveform Generator
User's Manual

Rev3.1   March,2019

Guaranty and Declaration

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Contact Us

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

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Contents

Product Introduction

This manual applies to each model of FY6600 series 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 "FY6600-60M" indicates the Sine wave maximum output frequency is up to 60 MHz.

FY6600 series 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. Easy to use.

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...10 V), 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.

◆ 60 mm 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 (5 V_{pp} output quantization error is less than 1 mV), 250 MSa/s sample rate, 14 bits vertical resolution.

◆ 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...10 V), Four channels TTL, Exponential Rise, Exponential Fall, Noise, ECG, DC etc.

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

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

◆ Sweep Function: It can sweep 4 properties of signals including frequency, amplitude, offset and duty cycle; It has Linear and Logarithm two sweep types; 0.01 s...999.99 s sweep time; Up, Down and roundtrip sweep directions.

◆ VCO Function (Voltage Control Output): Can be achieved by an external input signal: voltage controlling frequency, voltage controlling amplitude, voltage controlling offset, voltage controlling duty cycle and PWM modulations.

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

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

◆ Counter Function: DC coupling or AC coupling.

◆ Standard dual full functional independent channels.

◆ Channel SYNC Function: Support waveform copy and state copy between channels.

◆ Support two or more signal generators connected to achieve multi-channel output, the maximum support 16-channel synchronous output, the phase between each channel can be adjusted.

◆ Precisely adjust the phases of the two channels to 0.01°.

◆ Output level range is 0...20 V_{pp} with a resolution of up to 1 mV.

◆ Duty-cycle of each channel can be adjusted independently 0.01%...99.99%, with a resolution is 0.01%.

◆ −10V...+10 V_{DC} Offset function with a resolution of 0.001 V.

◆ Save function: It can save 20 sets user-set parameters and can be loaded at any time.

◆ Communicating function: All functions can be controlled by PC program and the communication protocol is open for secondary development.

◆ Output short-circuit protection > 60 s.

◆ Provide powerful waveform editing PC software. Users can download arbitrary waveform to this instrument after edit through PC program which is included in user CD. (Windows Only)

◆ Adopt ABS plastic shell with table type design. Use 100...240 V_{AC} wide range voltage power supply.

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

Quick Start

General Inspection

Please follow the items below when you receive a new FY6600 series 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 FeelTech 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 FeelTech sales

representative.

Front Panel Elements

The front panel is divided into several function areas for easy operation.
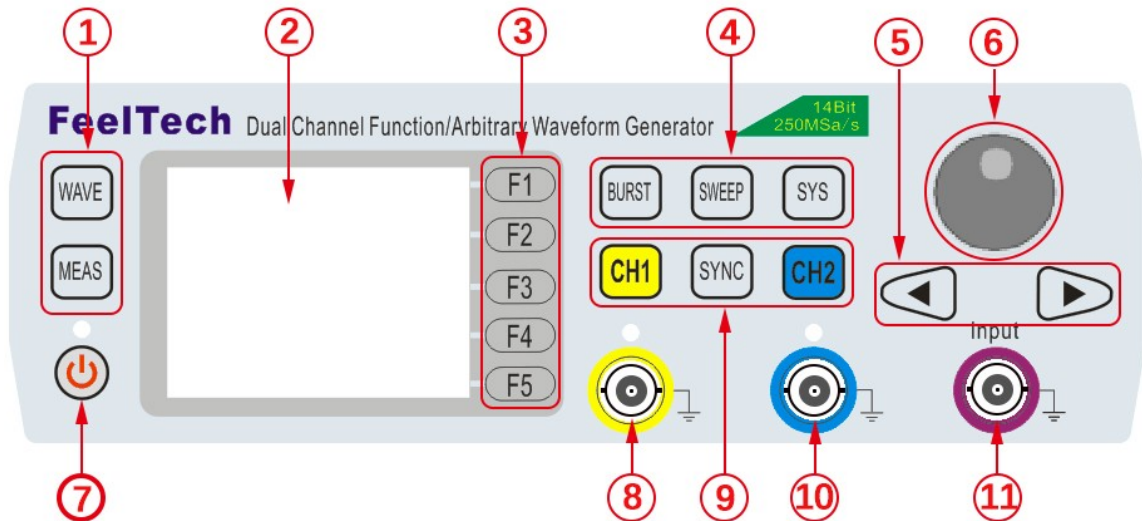
Item	Function	Description
1	Function Buttons Area	**WAVE** Press this buttons to switch waveforms among Sine, Square, Triangle and so on.
		MEAS Press this button to switch between frequency meter and counter to measure frequency, period, duty cycle and pulse width of external signal output. • Both DC and AC are workable. • Gate Time can be 1 s, 10 s or 100 s. • Dual channels output and measurement function can work together at same time.
		SWEEP Can sweep Sine, Square, Arbitrary and so on. • Can sweep frequency, amplitude, offset and phase. • 2 sweep types: Linear, Logarithm. • VCO voltage controls parameters of signal output available (for example: voltage controlled oscillator).
		SYS Auxiliary functions and system configuration setting. • Can save 20 sets waveform parameters including frequency, amplitude, offset, phase

		and so on.
		• System Language has English and Chinese for user's option.
• Buzzer can be turned on/off in this manu.
• Set multimachine uplink.
• Switch Master-Slave status
• Set default status of dual channels at start-up.
		Trigger and modulation function button
Set definite amount of pulse string to output.
Set modulation mode: ASK, FSK, PSK
2	LCD	60 mm TFT（320×240）color LCD. Operation instruction please check chapter "User Interface".
3	Manu Buttons	F1...F5 buttons are matched with Manu displayed on the LCD. Press corresponding button to activate submenu represented.
5	Arrows	Press Arrow buttons to select figure which you want to edit when setting values of each parameter.
6	ADJ Knob	Press the knob as confirmation (OK button).
• Rotate the ADJ Knob to increase or reduce the current value indicated by the cursor.
• Frequency unit can be changed by Press ADJ Knob under Frequency value setting status.
• Press ADJ Knob to Start/Stop sweep under Sweep interface.
7	Power Button	The power indicator keeps illuminating when power on.
Press the power button and the indicator change to notifylight status and the signal output terminates.
8	CH1 channel output connector	CH1 connector, output impedance is 50 Ω.
When CH1 channel activates (indicator illuminates), CH1 outputs signal with parameters set.
9	Output Channels	Control CH1 output. Press it to switch to CH1 parameter setting interface.
• Press it to turn on CH1 output with current configuration. The indicator will illuminate.
• Press it again to turn off CH1 output and the indicator will extinguish.
Control CH2 output. Press it to switch to CH2 parameter setting interface.
• Press it to turn on CH2 output with current configuration. The indicator will illuminate.
• Press it again to turn off CH2 output and the indicator will

		turn off.
		Synchronization function button. Can set synchronization of CH1 and CH2 (Frequency, amplitude, Offset and so on).
10	CH2 channel output connector	CH2 connector, output impedance is 50 Ω. When CH2 channel activates (indicator illuminates), CH2 outputs signal with parameters set.
11	AC coupling measuring terminal	BNC connector, input impedance 100 Ω. For inputting signal of meter or counter.

Back Panel Elements

The back panel of FY6600 is 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.
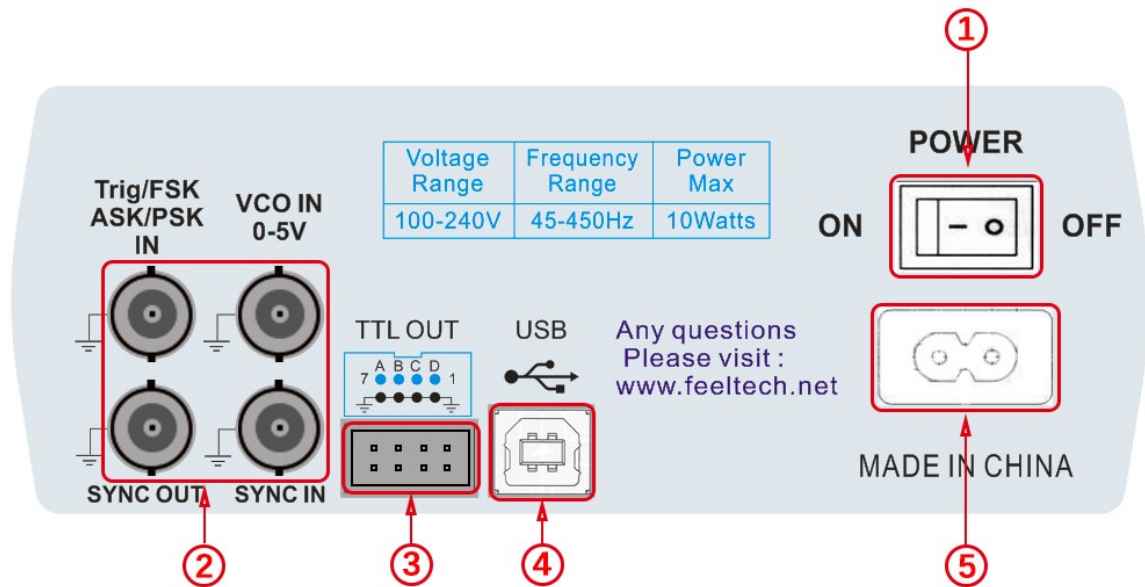
1. Power switch
2. BNC connector.
   Trig/FSK/ASK/PSK IN: DC coupling measuring terminal and ASK/PSK/FSK modulation trigger input terminal.
   VCO IN: External signal sweep input terminal can realize voltage controlling frequency, voltage controlling amplitude, voltage controlling offset, voltage controlling 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.
3. 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°).
4. USB Device interface for communication with a PC.
5. Power input socket (voltage range AC 100 V...240 V).

⚠ Warning: To avoid instrument damage, voltage of signal input from Input must not exceed ±20 V_{AC+DC}. Voltage of signal input from Trig/FSK/ASK/PSK IN must not exceed 5 V_{DC}.

Note
To ensure the normal work, please use 100…240V AC power supply voltage.

Power On and Inspection

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

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

FY6600 series Function/Arbitrary Waveform Generator supports Chinese and English system languages. You can press SYS→CONF to switch the system language.
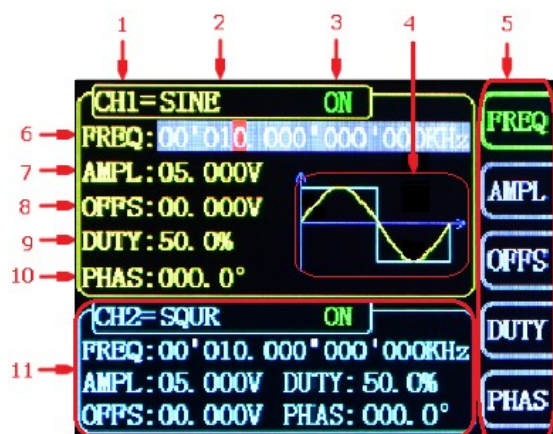
The user interface of FY6600 provides four types of display modes: Dual Channels Parameters (default), Single Channel Extension, Auxiliary Functions and System Interface.
Dual Channels Parameters (default)
The upper half of LCD displays the channel selected currently and the parameters can be set. Press CH1 or CH2 to change current channel selected.

1-4 User Interface (CH1 selected)

Item	Description
1	Current channel selected.
2	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. (On/Off). It can be switched by pressing CH1 or CH2.
4	Waveform Display diagram of current waveform（Including Arbitrary）. Yellow indicates CH1 and blue indicates CH2.
5	Menu 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 **(wrong by definition: should be called V_{pp} instead)** 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
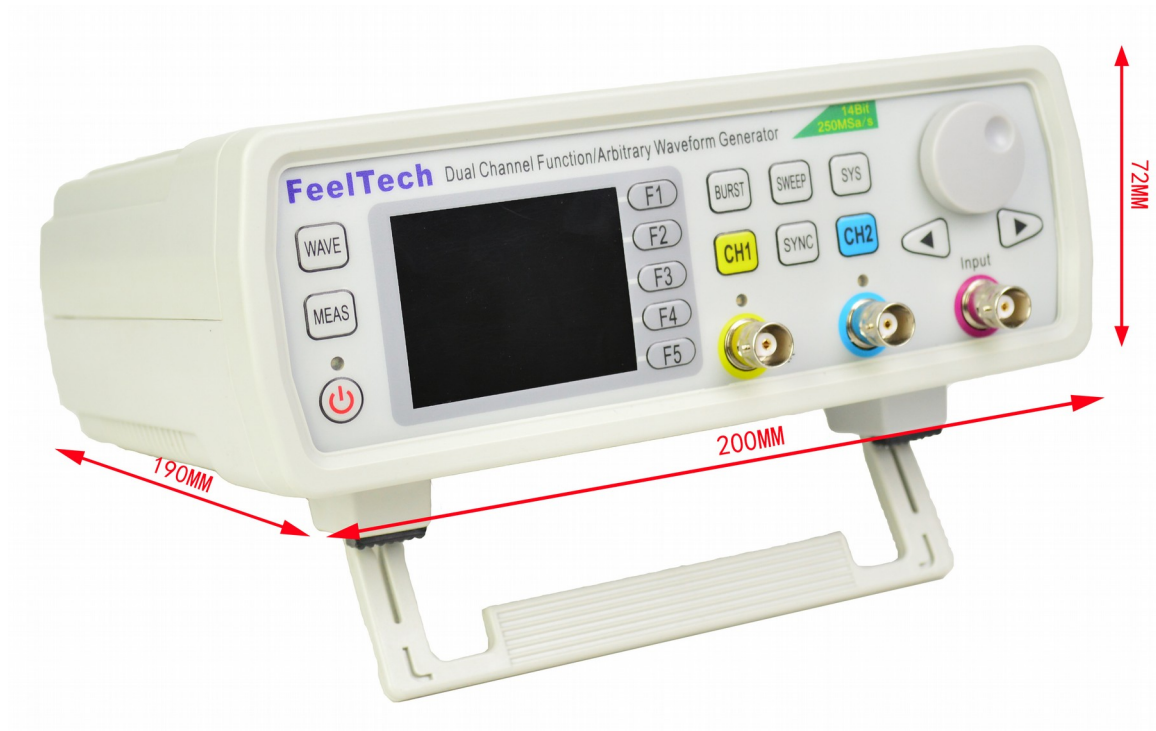
Front Panel Operations

FY6600 series 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 10 kHz frequency and 5 V$_{pp}$ 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.

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

FY6600 can output Function/Arbitrary Waveform including:

- Sine
- Square
- CMOS
- Adj. Pulse
- DC
- Triangle
- Rise Sawtooth
- Fall Sawtooth
- Triangle Stairsteps
- Rise Stairsteps
- Fall Stairsteps
- Positive Exponent
- Negative Exponent
- Positive Falling Exponent
- Negative Falling Exponent
- Positive Logarithm
- Inverse Logarithm
- Positive Falling Logarithm
- Inverse Falling Logarithm
- positive abs(sin)
- negative abs(sin)
- pos sin part
- neg sin part
- Lorenz Pulse
- Multitone
- Noise
- Electrocardiogram (ECG)
- Trapezoidal Pulse
- Sinc Pulse
- Narrow Impulse
- Gauss White Noise (AWGN)
- AM
- FM
- Chirp
- 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 FeelTech. The relevant software and driver can be downloaded from our website: www.feeltech.net .

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 10 kHz.

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 (better V_{pp})

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

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.

The term Amplitude is a BUG !!!

If you set an "Amplitude" of a sine wave of 5 V, it outputs 1.7677 V_{rms}, whereas the real amplitude, according tho definition is the maximum deviation from the average value, which would be 3.5355 V_{rms} for an Amplitude of 5 V. So in fact what you set should not be called "Amplitude" it should be called V_{pp}. This is even more confusing, as the term Amplitude is exclusively defined for a sine wave, For any other wave form the correct term would be "peak value".

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 1 mV. i.e. 0.001 V.

If f < 20 MHz, offset setting range is −10 V…+10 V.

If f > 20 MHz, offset setting range is −2.5 V…+2.5 V.

Set Duty Cycle (Square wave only)

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.

Duty Cycle=t/T*100%
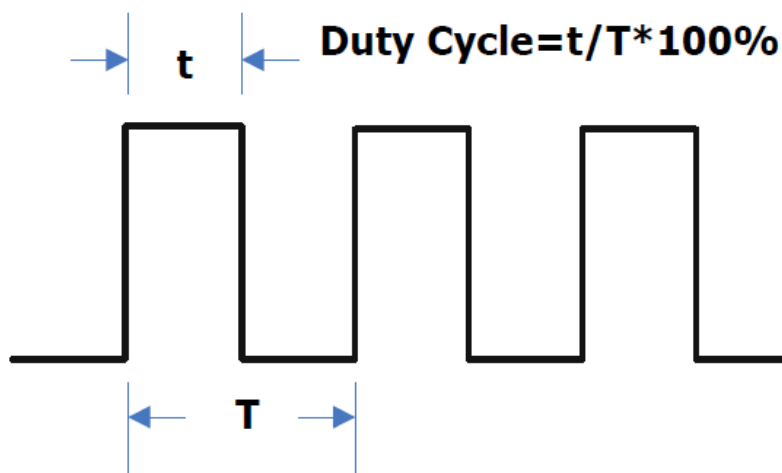
The setting range of duty cycle is limited by the "FREQ" setting. Please refer to "Waveform Characteristics" in "Specifications". The default value is 50 %.

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 configuring the parameters of the waveform selected, waveform output could be enabled.

At start-up output of CH1 and CH2 are both turned on as default. At this time indicator lights of dual channels illuminate.

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: 20 kHz, Peak-to-peak level (amplitude): 2.5 V_{pp}, DC Offset: 1.6 V_{DC}, 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 Peak-to-peak level (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.
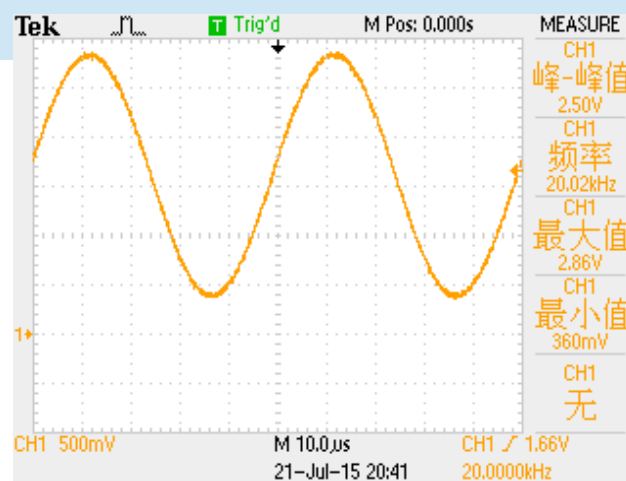
   PHAS: 090.9°

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.

Burst

FY6600 can output waveform with specified number of cycles (called Burst) from the CH1 channel. FY6600 supports control of burst output by CH2 (internal), manual or external trigger source; The signal generator can generate burst using Sine wave, Square wave, Ramp wave, Pulse, Noise wave or arbitrary waveform (except DC).

Enable Burst Function

Press the front panel MOD button, then press MODE button to enter burst function. The instrument supports [CH2], [Ext. AC], [Ext. DC] and [manual] four trigger output modes, which can be selected by the corresponding button. When the burst function is enabled, press the PARA button to set the burst output pulse number. Use arrow buttons and ADJ Knob to set the numbers from 1 to 1048575. Then the generator will output burst waveform according to current configuration.

- CH2 Trigger: CH1 will generate a burst when CH2 generates a pulse.
- Ext. AC: CH1 will generate a burst when [Input] connector was inputted a pulse.
- Ext. DC: CH1 will generate a burst when [Trig IN] connector was inputted a pulse.
- MANU Trigger: User can trigger a burst by pressing ADJ Knob (OK button).
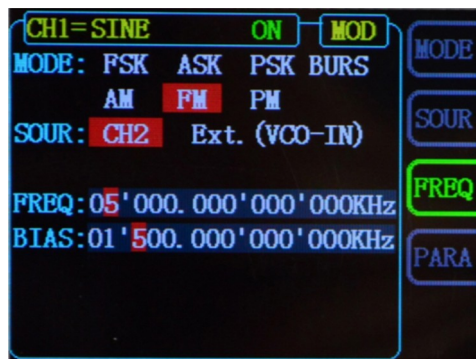
Press the [WAVE] button to change the current burst output signal waveform.
Press the [FREQ] button to change the current burst output signal frequency.
Press the [AMPL] button to change the current burst output signal amplitude.

Modulation Function

Press the MOD button to enter the modulation function interface. Press [MODE] soft key, you can choose different modulation types.
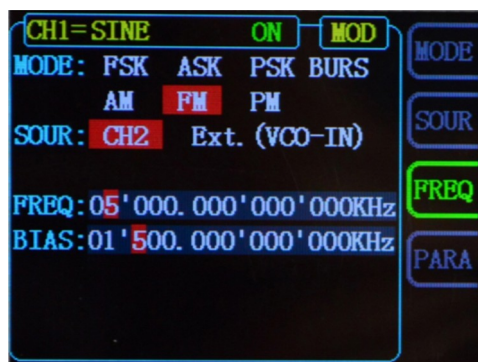
Modulation Type	AM, FM, PM, ASK, FSK, PSK
Carrier Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform (Except DC)

<div align="center">

AM, Amplitude Modulation

</div>

Source	Internal (CH2) / External (VCO IN Port)
Modulating Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform
Depth	0 %...120 %
Modulating Frequency	Internal : 1 µHz...1 MHz; External: 1 µHz...2 KHz;

<div align="center">

FM, Frequency Modulation

</div>

Source	Internal (CH2) / External (VCO IN Port)
Modulating Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform
Modulating Frequency	Internal : 1 µHz......1 MHz; External: 1 µHz...2 KHz;

<div align="center">

PM, Phase Modulation

</div>

Source	Internal (CH2) / External (VCO IN Port)
Modulating Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform
Phase Deviation	0° to 360°
Modulating Frequency	Internal : 1 µHz...1 MHz; External: 1 µHz...2 KHz;

<div align="center">

ASK, Amplitude Shift Keying

</div>

Source	Internal (CH2), External (ASK IN Port), Manual
Modulating Waveform	Square with 50 % duty cycle.
Key Frequency	1 µHz...10 MHz

<div align="center">

FSK, Frequency Shift Keying

</div>

Source	Internal (CH2), External (FSK IN Port), Manual
Modulating Waveform	Square with 50 % duty cycle.
Key Frequency	1 µHz...10 MHz

<div align="center">

PSK, Phase Shift Keying

</div>

Source	Internal (CH2), External (PSK IN Port), Manual
Modulating Waveform	Square with 50 % duty cycle.
Key Frequency	1 µHz...10 MHz

Frequency Meter/Counter

FY6600 provides 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 MEAS 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:100 s）。

Press COUN 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.
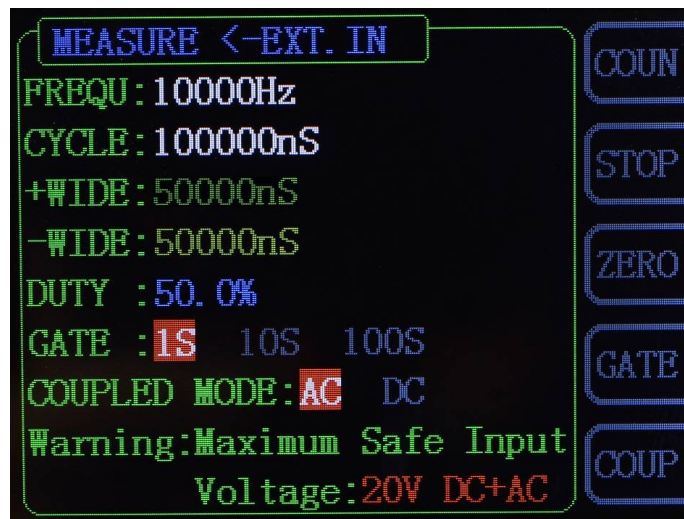
2-1 Frequency Meter/Counter Interface

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

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

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

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

Set the coupling mode of the input signal to "AC" or "DC" and the default is "AC". For AC coupling the signal should be inputted from Input terminal on the device front. For DC coupling the signal should be inputted from Trig IN terminal on the back.

Output Sweep signals

Press SWEEP button of front panel to enable sweep function. FY6600 can 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.
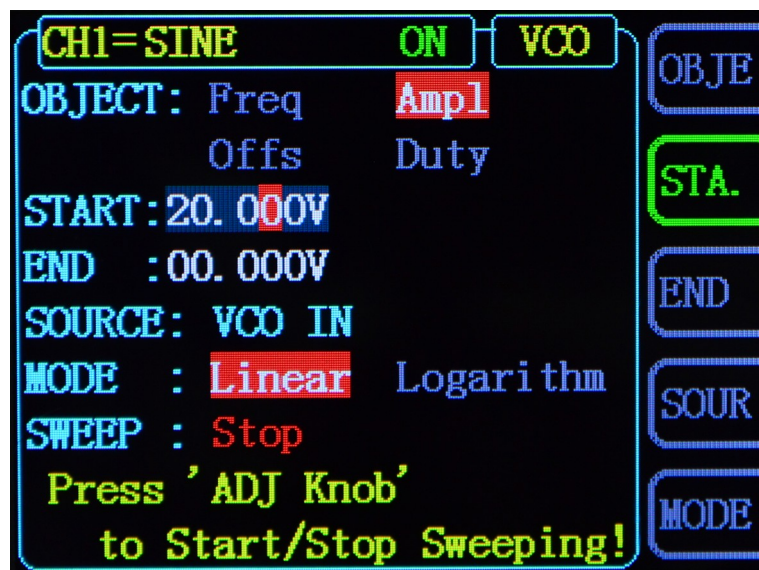
2-2 Sweep setting interface

 FY6600 Can 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.

Set 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%

Set 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%`

Set 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 "10 s". The work range is 10 ms…999.99 s. 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 [`SWEEP`] button to enter sweep function interface. Then press[`F4 SOUR`] button to switch the source to VCO IN. 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) must be input from `VCO IN` port of back panel. Its frequency must be less than 500 Hz and its voltage amplitude must be 0…5 V.

Sweep Type

FY6600 provides 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 (Fstart), Stop Frequency (Fend) and Sweep Time (Tsweep).

The function prototype of Logarithm Sweep:

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

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

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

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

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： 10 mHz to 25 MHz...60 MHz (Varies according to different model)
Square： 10 mHz to 25 MHz
Ramp： 10 mHz to 10 MHz
Arbitrary： 10 mHz to 10 MHz

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 SYS button of front panel to enter System interface. The interface displays the instrument parameter storage [SAVE] , parameter loading [LOAD] , configuration [CONF] and other functional [MORE] information.

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 parameter sets

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.

- FY6600 provides 20 positions for saving.

- The generator will load default parameters from Position 01 automatically after start-up.

System Configuration

Press SYS 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

FY6600 supports 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 FY6600 as master machine. Press SYS -> 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 SYS -> 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 FY6600 in 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

Press the [SYNC] button to enter the synchronization function setting interface. Press corresponding buttons on the right to highlight or cancel selecting status.
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.
When WAVE is highlighted, the waveform of CH2 will vary according to variation of CH1.
When FREQ is highlighted, the frequency of CH2 will vary according to variation of CH1.
When AMPL is highlighted, the amplitude of CH2 will vary according to variation of CH1.
When OFFS is highlighted, the offset of CH2 will vary according to variation of CH1.
When DUTY is highlighted, the duty cycle of CH2 will vary according to variation of CH1.

Troubleshooting

This chapter lists the commonly encountered failures of FY6600 and their solutions. When you encounter these problems, please solve them following the corresponding steps below. If the problem remains still, please contact FeelTech and provide the device information (Press SYS 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 FeelTech.
CH2 is locked.	1) Check that the signal generator is operating in synchronous state. Press the 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 FeelTech.

Technical Specification

Unless specified, all specifications can be guaranteed if the following two conditions are met.
- The generator has passed self-test.
- 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	FY6600-15M	FY6600-30M	FY6600-50M	FY6600-60M
Sine	0...15 MHz	0...30 MHz	0...50 MHz	0...60 MHz
Square		0...25 MHz		
Ramp, Triangle	0...10 MHz			
Pulse				
TTL/CMOS				
Arbitrary Waveform				
Minimum pulse width	20 ns			
Min. Resolution on all frequency range	1 μHz (Min. resolution can reach 1 μHz on all frequency range to ensure adjusting accuracy under high frequency. For example, it can output 10.000000000001 MHz signal).			
Accuracy	±20 ppm			
Stability	±1 ppm/ 3h			
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	250 MSa/s			
Vertical Resolution	14 bits			
Sine	Harmonic Suppression	≥50 dBc (<1 MHz)		
		≥45 dBc (1 MHz...20 MHz);		
	Total Harmonic	<0.5% (20 Hz...20 kHz, 0 dBm)		

	Distortion	
Square	Rise/Fall Time	≤7 ns (V$_{PP}$<5 V)
	Overshoot	≤5%
	Duty Cycle	0.01%...99.99% (Resolution 0.01%)
Sawtooth wave	Linearity	>99% (0.01 Hz...10 kHz)

Output characteristics	
V$_{PP}$ (Amplitude)	1 mV$_{pp}$...20 V$_{pp}$ | f<10 MHz 1 mV$_{pp}$...10 V$_{pp}$ | 10 MHz < f<20 MHz 1 mV$_{pp}$...5 V$_{pp}$ | f>20 MHz
Resolution	1 mV
Level Stability	±0.5 % / 5 h
Level flatness	±2.5 % (f<10 Mhz); ±5% (f>10 MHz);

Signal Output	
Impedance	50 Ω ±10 % (Typical)
Protection	Short-circuit for minimum 60 s

DC Offset	
Offset Range	±10 V (f≤20 MHz); ±2.5 V (f>20 MHz)
Offset Resolution	1 mV
Phase Feature	
Phase range	0...359.99 °
Phase resolution	0.01 °
TTL Output	
TTL Level	>3 V$_{pp}$
Fan-out	>8 TTL LOAD
Rise/Fall Time	≤10 ns

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

External Measurement		
Function	Frequency, Period, Positive/Negative Pulse Width, Duty Cycle	
Input Voltage Range	1 V$_{pp}$...20 V$_{pp}$	
Input impedance	100 Ω	
Frequency Meter	Resolution	0.01 Hz (Gate Time = 100 s)
	Range	0.01 Hz...100 MHz
	Sensitivity	Gate Time 3 grades (1 s, 10 s, 100 s) adjustable
Counter	Range	0...4294967295
	Coupling	DC, AC
	Working Mode	Manual

Period	Measurement Range	5 ns … 20 s	DC coupling measurement
Pulse Width	Measurement Range	0 ns … 20 s	
	Resolution	5 ns	
Duty Cycle	Range (Display)	0 % … 100 %	

Sweep	
Carrier Waveform	Sine, Square, Ramp, Arbitrary (except DC)
Sweep Type	Linear or Logarithmic
Sweep Direction	Up, Down and roundtrip sweep directions;
Sweep Objects	Frequency, Amplitude, Offset, Duty Cycle
Sweep Time	0.01 s…999.99 s/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…5 V
VCO signal frequency range	0…2000 Hz
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, FM	
Source	Internal (CH2) / External (VCO IN Port)
Modulating Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform
Depth	0 % … 120 %
Modulating Frequency	Internal : 1 µHz…1 MHz; External: 1 µHz…2 KHz;

PM	
Source	Internal (CH2) / External (VCO IN Port)
Modulating Waveform	Sine, Square, Triangle, Ramp, Arbitrary waveform
Phase Deviation	0 ° to 360 °
Modulating Frequency	Internal : 1 µHz…1 MHz; External: 1 µHz…2 KHz;

ASK, FSK, PSK	
Source	Internal (CH2), External (ASK/FSK IN Port), Manual
Modulating Waveform	Square with 50 % duty cycle.
Key Frequency	1 µHz…10 MHz

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	60 mm, 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	9600 bps (Industrial standard)
Power	Voltage Range	AC 100 V...240 V
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	200 mm × 190 mm × 90 mm (L ×W×H)	
Weight	850 g	
Package Size	25 cm × 21 cm × 10 cm (L×W×H)	
Package Weight	0.98 kg (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	FY6600 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 FeelTech distributors.

Appendix D： Warranty

FeelTech 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, FeelTech 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.