User's Guide

TFG1900P Series

Pulse/Function Generators

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Introduction of TFG1900P Series Pulse/Function Generators

The present guide is valid for four models of TFG1900P Series Pulse/Function generators: TFG1903P, the maximum frequency of sinewave is 3MHz; TFG1905P, the maximum frequency of sinewave is 5MHz; TFG1910P, the maximum frequency of sinewave is 10MHz; TFG1920P, the maximum frequency of sinewave is 20MHz. With Direct Digital Synthesis (DDS) technology, TFG1900P series Pulse/Function generator are of the high performance indexes and function characteristics which are necessary for the fast completion of measuring. The simple and clear front panel design and VFD fluorescent display interface are convenient for the users to operate and observe.

The generators are of the following advanced specifications and powerful function characteristics:

- **High frequency accuracy:** up to the level of 10^{-5}.
- **High frequency resolution:** 10μHz frequency resolution for whole frequency range.
- **Unlimited measurement range:** without limitation for the whole range, digital setting directly.
- **Non-intergraded process:** up to the stable value immediately when switching, continuous signal phase and amplitude without deflection.
- **High waveform accuracy:** the output waveform is synthesized by the computation value of functions with higher waveform accuracy and less distortion.
- **Multi-waveform:** 16 types of waveforms can be output.
- **Pulse characteristics**: precise pulse width can be set.
- **Square characteristics**: Accurate square duty cycle can be set.
- **Ramp characteristics:** May set accurate ramp symmetry
- **Pulse string characteristics:** the set signal of pulse string and gate can be output.
- **External trigger:** external trigger is available under frequency sweeping, FSK modulation and burst function.
- **Computation function:** Frequency or period, amplitude virtual value or peak-peak value can be selected.
- **Operation mode:** Keyboard operation, fluorescent display screen, direct digital setting or continuous adjusting by knobs.
- **High reliability:** Large scale integrated circuit, surface-mount technology, high reliability and long service life
- **Programmable interface:** Equipped with USB device interface.

Package List

TFG19xxP pulse/ function generator	1
3-core power supply	1
CD (user's guide, programmer's guide, interface demonstration)	1

Summary of this Guide

Chapter 1 Getting started

To learn the basic operation of the generator now.

Chapter 2 Principle introduction

To describe the basic working principle of the generator.

Chapter 3 Reference

To introduce the functions, operations and applications of the generator in detail.

Chapter 4 Service and support

To promise warranty and technological support of the generator.

Chapter 5 Specification

To list the function characteristics and specifications of the generator.

Note: This document is just a guide of operation of this instrument, it is unavoidable for not-so-adequate description of technology and wrong printing, please excuse any modification of the contents without special notification.

Content

Chapter 1 Getting started

The front and rear panels, operations and functions of the TFG1900P series function /pulse generator are described in this chapter so as to help users to master the basic operation as quickly as possible. The main contents of this chapter are as follows:

1.1 Preparing the generator for use:

1.1.1 Check the generator and the accessories:

Check the completeness of the generator and its accessories based on the package list. If the packing box is damaged badly, please keep it till the generator passes the performance test.

1.1.2 Connect to power supply:

Boot the generator only under the following conditions.

Voltage: AC 100～240V Frequency: 45～65Hz

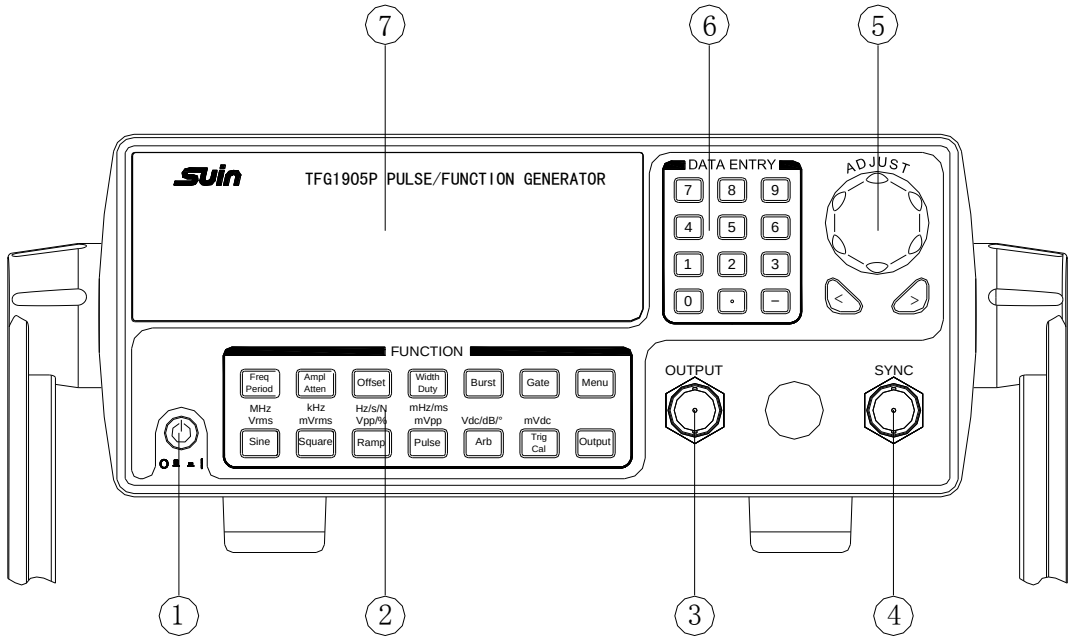
Power consumption: ＜20VA

Temperature: 0～40℃ Humidity: ＜80％

Plug the attaching plug into an AC100~240V outlet with grounding conductor, press the mains switch on the panel in to turn on the generator. The generator now is initializing itself and obtaining the default parameters, outputting sine waveform under continuity working state, with frequency and amplitude of the signal displayed.

Warning: In order to ensure the security of the operator, use triple-core socket outlet with grounding conductor.

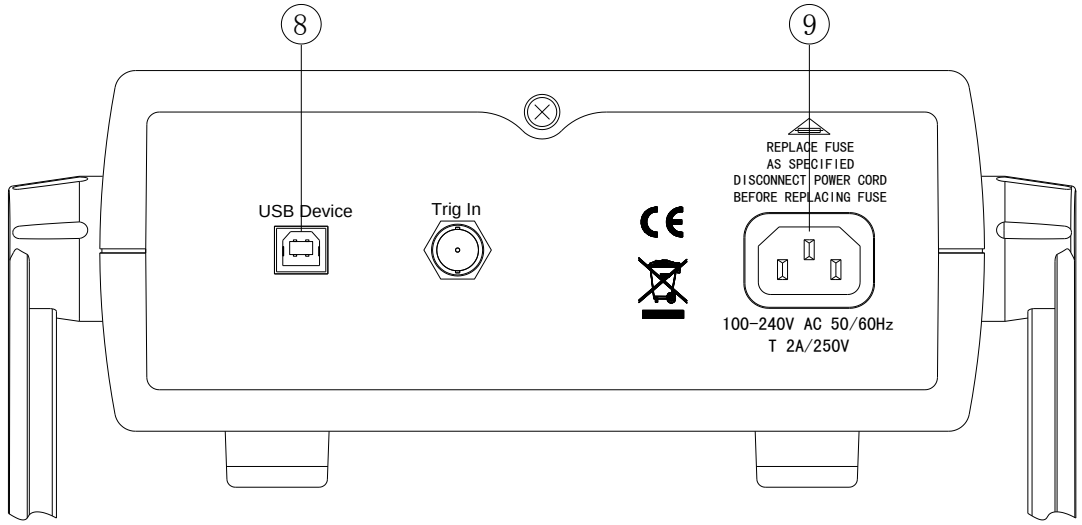
1.2 Front panel



1. Power 2. Function keys 3. Waveform output 4. Sync output Power

5. Adjusting knob 6. Numeric keys 7. Display screen

1.3 Rear panel



8. USB device interface 9.Power outlet

1.4 Display introduction

The display screen display two groups of digits, the group on the left with 6 digits shows frequency, period, attenuation, duty cycle and so on of the signals. And the four digits on the right show amplitude, offset and so on of the signals. There are also letter and letter indicator lights on the display screen, to indicate present waveform signal, parameter options and also units of parameters.

1.5 Keyboard introduction

There are totally 28 keys on the front panel (see front panel picture), the functions of which respectively are:

【0】【1】【2】【3】【4】【5】【6】【7】【8】【9】keys: Digits inputting key.

【.】key: Point inputting key.

【-】key: Minus inputting key, press this key to input minus under "offset" option. Press this key to enable or disable the key-tone circularly under other options.

【＜】key: Move the cursor left; delete the input when inputting digits.

【＞】key: Move the cursor right.

【Freq】【Period】key: select frequency and period circularly, disable calibration process when calibrating.

【Ampl】【Atten】key: select amplitude and attenuation circularly.

【Offset】key: select offset.

【Sine】【Square】【Ramp】【Pulse】key: shift key, select respectively Sine, Square and Ramp and Pulse waveforms.

【Arb】key: shift key, select 16 kinds of waveforms with the waveforms sequence number.

【Width /Duty】key: shift key, select pulse width of Pulse and duty cycle of Square and symmetry of Ramp.

【Burst】key: select or exit Burst function.

【Gate】key: select or exit Gate function.

【Trig / Cal】key: select external trigger or manual trigger of Burst or Gate, and select parameter of calibration of continuous function.

【Output】key: open and close output signal circularly.

Unit key: The six keys with unit characters above them on the bottom of the instrument are not shift keys, but double-function keys, press these keys directly to execute the functions marked on themselves; when inputting digits with numeric keys, press these six keys to select the unit of the inputting and end the digits inputting at the same time.

【Menu】key: key for menu, select different options circularly under different functions, see below list:

Options list of menu

Menu	Option
Continuity	Output Phase, Output Polarity, Version No..
Burst	Period, pulse count, start phase
Calibration	Calibration value: zero, offset, amplitude, frequency, amplitude flatness

1.6 Basic operation

Below are some samples to describe the basic operation of the generator, for more complex usage and problems, please refer to the details in chapter 3.

1.6.1 Continuity function: continuity function is default after booting, and the instrument outputs signal with continuous frequency.

Frequency setting: Set the frequency value at 3.5 kHz

【Freq】【3】【.】【5】【kHz】.

Frequency adjusting: Press【＜】or【＞】key to move the cursor, switch the adjusting knob left or right to decrease or increase the digit on the cursor position, borrowing from or carry to the former digit continuously. Move the cursor left to do rough adjusting, and right to do fine adjusting. The adjusting knob is applicable for adjusting digits of other options too, which will not be described any more.

Period setting: set the period as 2.5ms

【Period】【2】【.】【5】【ms】.

Amplitude setting: set the amplitude as 1.5Vpp

【Ampl】【1】【.】【5】【Vpp】.

Attenuation setting: set the attenuation as 0dB（Auto attenuation is default after booting）

【Atten】【0】【dB】.

Offset setting: set DC offset as -1Vdc

【Offset】【-】【1】【Vdc】.

Common waveform selection: select square（sine wave is default after booting）

【Square】.

Duty cycle setting: set the duty cycle of square as 20%

【Duty】【2】【0】【%】.

Waveforms selection: Select exponent waveform (sequence number 9, see sequence number list)

【Arb】【1】【2】【N】.

Below content shows the function setting, in order to observe and measure, users may set the continuous signal as sinewave, with amplitude of 1Vpp,and offset of 0Vdc.

1.6.2 Burst function: set continuous frequency as 1kHz.

【Burst】key, output burst signal.

Repeated period setting: set repeated period as 5ms

【Menu】key, light "Period" character, press【5】【ms】.

Pulse count setting: set pulse count as 1

【Menu】key, light "Ncyc" character, press【1】【N】.

Start phase setting: set start phase as 180 °.

【Menu】key, light "Phase" character, press【1】【8】【0】【°】.

Trigger setting: press【Trig】key to stop the output of burst, then each time you press【Trig】key, the generator triggers a burst once. Press【Burst】key to resume continuous burst.

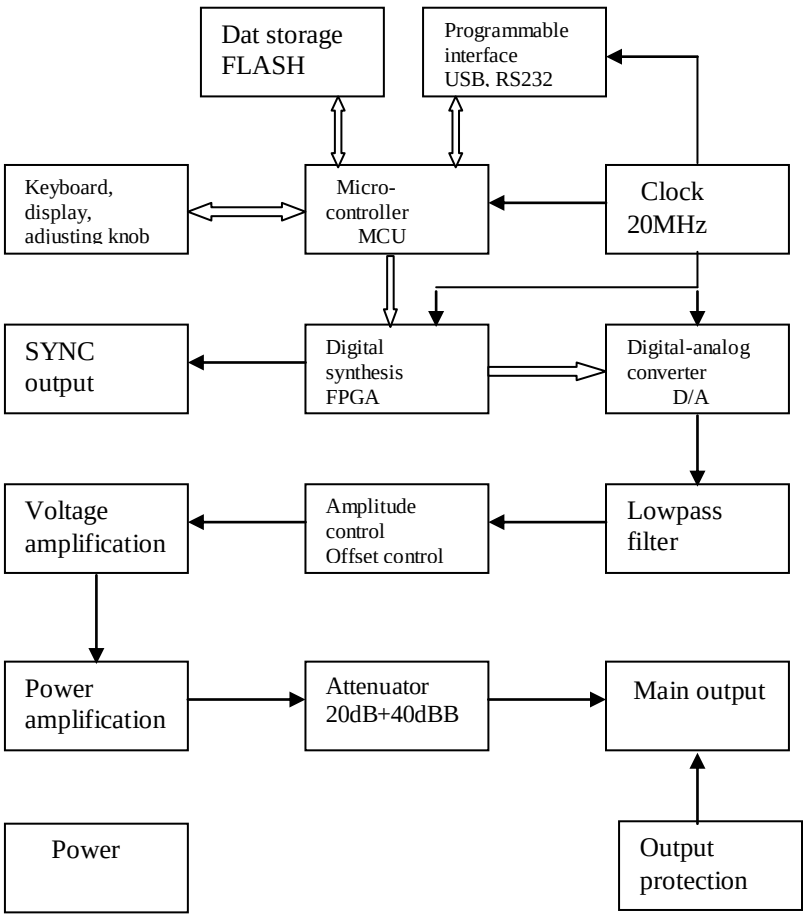
Gate setting: Set the external gate mode.

Trigger setting: press【Trig】key to can open or close Burst output circularly, press 【Gate】key again then exit Gate function.

Chapter 2 Principle introduction

This chapter describes the basic concept of signal shaping and internal operation of the generator, to help users to learn more about the performance and specifications, then operate the generator more smoothly.

2.1 Principle diagram of generator



2.2 DDS working principle

To generate a voltage signal, traditional analog function generator adopt electronic

components to consist oscillator by many different means, the signals generated are of poor frequency accuracy and stability, low resolution, inconvenient to set frequency and programmed with computer, but request complex techniques. Direct Digital Synthesis (DDS) technology is an up-to-date technique to generates signals, it need no oscillator but digital synthesis technique to generate series of data-current which convert to analog signals through digital-analog converter.

To generate a sine signal, for example, the function of y＝sinx should be digitally quantized first, and then taking x as the address and y as the quantized data to store them into waveform memorizer. DDS uses phase adding technique to control the address of waveform memorizer. Add a phase increment on the present result of phase accumulator in each sampling clock period so as to change the output frequency value by change phase increment. According to the address from the phase accumulator, take the quantized data out from the wave memorizer and then convert it into analog voltage via digit-analog converter and operation amplifier. Since the waveform data are discontinuous sampling, stair sine waveform is output from DDS generator. The included high-level harmonic wave should be filtered by lowpass filter so to output a continuous sine wave. With high accurate reference voltage source in digit-analog converter, the output waveform is if high amplitude accuracy and stability.

Amplitude controller is a multiplication digital-analog converter, analog signal that has been filtered is the voltage standard of the digital-analog converter, this standard multiplies amplitude value inputting with the numeric key to make output signal frequency be equal to this inputting value. Offset controller is also a multiplication digital-analog converter, a high-accuracy DC voltage standard of which multiplies offset value inputting with the numeric key to make the output signal offset be equal to this inputting value. The synthesized signal from amplitude and offset controllers is amplified by the power amplifier and voltage amplifier then output from output port.

2.3 Control working principle

Micro-controller controls the keyboard and display parts with interface circuit, when a key is pressed, the micro-controller recognizes the code of pressed key and executes corresponding command program of this key. The display circuit will work to display the instrument's working state and each parameter.

Switch the adjusting knob on the panel to change the digit on the cursor position,

generating a trigger pulse every 15°rotation. The microprocessor could judge the rotation is left or right, if it is left, the number in the position of cursor will be subtracted by 1; if it is right, the number in the position of cursor will be added by 1 with continuous carry or borrow.

Chapter 3 Operation Guide

3.1 Data input

3.1.1 Input with the numeric keys

Select an option and input with the numeric keys the parameters of this option. The ten digit keys are of the function of inputting data from left to right one by one. Point is allowed in this data, but only the first one is valid when more than one points inputted. Under "offset" function, minus may be input. The digit keys input digit to the display area which do not work yet and could be deleted by pressing【＜】, or select this option again , to input right one if it is a wrong input, but these must happen before pressing an unit key. End the digits input and make them valid by pressing an unit key.

For any input by pressing the point key and the units, the generator will display this input in its own certain form. Such as, the generator displays 1.50000 kHz for both of input of 1.5 kHz and 1500 Hz.

3.1.2 Adjust with the adjusting knob

In actual operations, users may use the adjusting knob to continuously adjust the signal. Press 【＜】or【＞】to move the cursor left or right. Rotate the adjusting knob on the front panel right to add the digit on the cursor position by 1, it can do a carry to the former; rotate the adjusting knob left to subtract the digit on the cursor position by 1, it can borrow digit from the former. The digit adjusted by the adjusting knob works immediately and no need to press unit key. Move the cursor to the left to do rough adjusting by the knob, and to the right to do fine adjusting.

3.1.3 Selection of the inputting means

For known data, it is the most convenient to use numeric keys to input as it can be gotten easily without the generating of transient data no matter how big the change of the data is, which is so important in some operations. For the modifying of the entered data or for entering sequence data to observe, it will be more convenient to use the adjusting knob. So user should select flexibly according to the different applications.

3.2 Continuity function

After booting, the generator enters continuity function automatically, continuity function means the output signal is stable and continuous, of which the waveform, frequency, amplitude and phase will not change along with the time change.

3.2.1 Frequency setting

Press【Freq】key, the light of which will be on, to display present frequency value. Input frequency value with numeric keys or adjusting knob and the signals of this frequency will be output from the output port.

3.2.2 Period setting

Press【Freq】key, the light of "Period" will be on, to display present period value, input period value with numeric keys or adjusting knob. Frequency is synthesized in the internal of the generator, and converted to period when inputting and displaying.

3.2.3 Amplitude setting

Press【Ampl】key, the light of which will be on, to display present amplitude value, input amplitude value with numeric keys or adjusting knob and the signals of this amplitude will be output from the output port.

The relation between maximum amplitude and offset value should be below formula, if the setting of amplitude exceeds specification, the generator will modify it until it is within the range of allowed maximum amplitude value.

$$Vpp \leq 2 \times (10 - |offset|)$$

3.2.4 Amplitude value form

There are two forms for amplitude input and display: peak-peak form and RMS form. Press【Vpp】or【mVpp】to input amplitude peak-peak value after inputting the digits, press【Vrms】or【mVrms】to input amplitude RMS value. RMS value is applicable only to sinewave, square wave and ramp wave, and other waveforms could only be shown by amplitude peak-peak value.

3.2.5 Amplitude attenuation setting

Press【Ampl】key to light "Atten" and show the present attenuation value. Amplitude attenuation is auto as default of booting and there display "Auto",the generator will select automatically proper attenuation proportion according to the amplitude setting value, higher amplitude resolution, higher signal-noise ratio and less waveform distortion could be realized at the same time regardless of the

amplitude magnitude of the signal. The output signal makes a momentary hop when the attenuation changes, which is not welcome in some operations, but the generator has fixed attenuation function to avoid this circumstance. Input attenuation values of 0dB,20dB,40dB and 60dB with the numeric keys, input 80dB to select auto attenuation. Users may use the adjusting knob as well, the attenuation changes to next one for every step of the rotation. When select fixed attenuation mode, the attenuation is fixed while the signal amplitude changes, and the output signal could changes continuously within the whole amplitude range. But higher distortion of the waveform and poor signal-noise ratio maybe appear when the attenuation is 0dB and the amplitude of the signal is small.

The relationship between the maximum attenuation and amplitude value should be in agree with below formula, if the setting of attenuation exceeds, the generator will modify it until it is within the limit of the maximum attenuation value.

$$dB \leq 20 \times \log(20 \div Vpp)$$

3.2.6 Output load

The setting value of amplitude is calibrated when the output end is open. The real voltage of output load is the setting value of amplitude multiplied by the assignment ratio of load impedance （including inductance and condensance）and output impedance. The output impedance of the generator is fixed at 50Ω. When the load impedance is high enough, the assignment ratio approaches to 1. The voltage loss of output impedance can be neglected. The real voltage approaches to the setting value of amplitude. But when the load impedance is lower, the voltage loss of output impedance cannot be neglected. It should be paid more attention that the real voltage does not accord with the setting value of amplitude.

With 50Ω output resistance, a momentary short-circuit of the output port makes no damage to the generator, but the users should try to avoid long time short-circuit under high voltage output as a danger of making damage to the generator. The generator has function of opposite voltage protection, with which the generator close output automatically, make an alarm with the output indicating light off when carelessly connect a high voltage(less than 30V) to the output port. Open the output by pressing 【Output】 key only after the fault cleared.

3.2.7 Offset setting

Press【Offset】key, the light of which will be on, to display present offset value.

Input offset value with the numeric keys or adjusting knob for the output signal to generate this DC offset.

The relationship between the maximum DC offset and amplitude value should be below formula, if the setting of offset exceeds, the generator will modify it until it is within the limit of the maximum offset value.

$$|offset| \leq 10\text{-}Vpp \div 2$$

When it comes to adjust the DC offset of the output signals, it is more convenient to use the adjusting knob than the numeric keys. As usual, taking no account of the sign of the present DC offset, right rotation makes the DC level up, while left rotation makes it down, the sign of the DC offset value changes automatically when passing the zero point.

3.2.8 DC voltage output Set amplitude at 0V, the offset value could be set arbitrarily within ±10V range, the generator is now a DC voltage power supply and outputs specified DC voltage signal.

3.2.9 Output waveform selection

The generator could output 16 kinds of waveforms, press【Sine】,【Square】,【Ramp】and 【Pulse】keys to directly select these four kinds of common waveforms, the corresponding waveform character will be displayed. Users may select all 16 kinds of waveforms with waveforms sequence numbers, press【Arb】key to show current waveforms sequence numbers, users may also input waveforms sequence numbers with numeric keys or adjusting knob to select the corresponding waveforms defined by the sequence numbers. The waveform sequence numbers of 4 common waveforms can be displayed accordingly. Except three common waveforms, the waveform characters of other waveforms are "Arb".

Output waveform sequence numbers list

Sequence Number	Waveform	Sequence Number	Waveform
00	Sine	08	Limit sine
01	Square	09	Exponent
02	Ramp	10	Logarithm
03	Pulse	11	Tangent
04	PPulse	12	Sin(x)/x
05	Stair	13	Half round
06	Noise	14	Cardiac
07	Half sine	15	Quake

3.2.10 Duty cycle setting

When the present selection of waveform is square (including pos-square), users may press shift key【Duty】to display present duty cycle value, input duty cycle value with numeric keys or adjusting knob, then the output will be square with a fixed duty cycle value. When Square frequency is changing, the duty cycle will remain unchanged. The definition of square duty cycle is the ratio of high level time of one square to the period of this square. When the frequency of square is comparatively high, the setting of duty cycle is limited by the edge time, in a relationship as below formula:

Duty cycle× Period≥2× Edge time or Duty cycle ×Period≤ Period－（2× Edge time）

3.2.11 Symmetry setting

When the present selection of waveform is ramp, users may press shift key【Duty】to display present symmetry value, input symmetry value with numeric keys or adjusting knob, then the output will be ramp with a fixed symmetry value. When Ramp frequency is changing, the symmetry will remain unchanged. The definition of ramp symmetry is the ratio of rising time of one ramp to the period of this ramp. When symmetry is 100% is usually named rising ramp, when symmetry is 0％ is named falling ramp, and when symmetry is 50% is named triangle wave.

3.2.12 Pulse width setting

When the present selection of waveform is Pulse, press 【Width】key to display present pulse width value, input pulse width value with numeric keys or adjusting knob, then the output will be Pulse with a fixed pulse width value. When Pulse

frequency is changing, the pulse width will remain unchanged. The definition of pulse width is the ratio of high level to time value, when the Pulse frequency is high, the setting of pulse is limited by the edge time, and be agree with the following formular:

Pulse width ≥2×edge time or Period- Pulse Width≥2×edge time

3.2.13 Output phase setting

Press 【Menu】and select option 'Phase' to display output phase value, input phase value with numeric keys or adjusting knob. The definition of output phase value is the phase difference between output signal to SYNC signal. And output signal is more advance than SYNC signal.

3.2.14 Output mode setting

Press 【Menu】and select option 'Mode_f' to display output mode value, input output mode value with numeric keys or adjusting knob. There are only two output mode values, 0 and 1. When setting the value as 0, the mode is normal output mode, while, when setting the value as 1, the model is inversion output mode and the output signal is reverse one.

3.2.15 Software version number

Press【Menu】to show the software version number: 1554.05, which is helpful for maintain and could not be set or changed.

3.3 Burst Function

It is explained that in burst mode, the word "burst" means one cycle or multi-cycle of any waveform, not mean the pulse in common. All the 16 waveforms could be used as burst waveform, Of course, using noise signal as burst signal is invalid.

There are two output modes for burst out function: trigger burst and gate burst.

3.3.1 Trigger burst mode: press 【Burst】key then the "Burst" keyboard light will be on, start the trigger burst mode. According to repeated period of inner trigger source, input signal of external trigger source or manual trigger signal, the instrument ,starting from the set start phase, output one set pulse every time then stop the level point corresponding to starting phase and wait for next trigger.

3.3.2 Gate burst mode: press 【Gate】key then the "Gate" keyboard light will be on, the gate burst mode is started. According to repeated period of inner trigger source, input signal of external trigger source or manual trigger signal, output signal

will be open or closed through gate function. When trigger signal is high level, open continuous waveform output. When trigger signal is low level, wait the finishing of end cycle, then stop the level point corresponding to start phase and wait for next trigger. In gate burst mode, the setting of pulse counting can be neglected if two period waveforms are output at least.

3.3.3 Repeated Period: press【Menu】key to light "Period" character, and then set repeated period. Period represents time from the start of one pulse string to the start of the next one which must be long enough to contain the pulse numbers of setting, as the following formula shows:

Repeated period＞Pulse count ÷Pulse frequency

If the repeated period setting is too short, the instrument will modify it to the allowable minimum value.

3.3.4 Burst count: press【Menu】key to light "Ncyc" indicator, and then set the burst count. Burst count represents the number of cycles of pulse string in a repeated period, which must be small enough to be contained in one repeated period, as following formula shows:

Pulse count＜(repeated period × pulse frequency)

If the pulse count setting is too big, the instrument will modify it to the allowable maximum value.

3.3.5 Start phase: press【Menu】key to light "Phase" character, and then set start phase value. The start and end of the pulse string are always on the same phase of the waveform, this phase is named as the start phase. The start phase setting range is 0 °to 360 °.

3.3.6 Trigger source: In continuous burst mode, the generator uses internal continuous trigger source to output continuous burst based on the repeated period and burst count set in advance. Press【trig】key to light "trig" keyboard indicator, then select external trigger source. Input TTL trigger signal from the instrument rear panel "Trig In" connector. The generator outputs a burst at each rising edge of the trigger signal, then keeps on the start phase point and waits for the next trigger. Of course, the trigger signal cycle should conform to the restricted conditions of burst period. When trigger burst, the setting of period is ignored.

If external trigger source is selected, manual trigger can be used. In trigger burst mode, a burst can be output when press【trig】key every time. In gate burst mode, press【trig】key again and again, output signal can be open and closed circularly. Users should noted that only close output in manual trigger mode the external trigger signal in real panel can be used.

In trigger burst mode, press【Burst】key, the "trig" keyboard light will be off, select inner trigger source and output pulse continuously. Press【Burst】key again, the "Burst" keyboard light will be off, and the generator will exit Pulse function and resume to continuous function.

In gate burst mode, press 【Gate】key, the "trig" keyboard light will be off, select inner trigger source and output pulse continuously. Press【Gate】key again, the "Gate" keyboard light will be off, and the generator will exit Pulse function and resume to continuous function.

3.3.7 Sync output: In burst function, a sync signal can be outputted from the front panel "Sync" connector. It is a TTL level's pulse wave, its rising edge is corresponding to the burst starting point, while the falling edge is corresponding to the end of the burst. That is to say, during the continuation of burst, sync output keeps high level; during the stop period of burst, sync output keeps at low level.

3.4 Output port

There are two output ports on the front panel of the instrument, users must not input signal to the output port as a possibility of damaging the instrument.

3.4.1 Signal output port《Output》: the signals that the instrument generates are all output from the signal output port, press 【Output】key to open or close the signal from the output port circularly. The output port is open when the "Output" light is on, and closed when the "Output" is off. If wrongly connect external high voltage to signal output port, instrument will suffer "inverse filling" danger, and then instrument will turn on the protection function, close immediately signal output port and make an alarm with the "Output" light off. In this case, you must check external load, only after eliminating the failure can press【output】key to open signal output port.

3.4.2 Sync output port《Sync》: output pulse wave compatible with TTL, high level＞4V,low level ＜0.3V.

①. Under continuity function, sync signal is a square signal with TTL level, the frequency of sync signal is the same as the frequency of the signal from《Output》port, the phase of sync signal is later than one of the signal from《Output》port. The phase difference of these two signal can be set through menu option "phase".

②. Under Burst function, sync signal is a Pulse, during the period of burst output, SYNC remain high level, during the period of burst stop, SYNC remain low level. While, the sync signal will be determined by trigger signal if external or manual trigger is used.

3.5 Input port

There is a trigger input port《Trig In》on the rear panel of the generator, which could be used only as the input channel of external signal, but not output channel. This port could be also used as the input channel of pulse signal which is compatible with TTL, the high level of which is higher than 4V, and low level is lower than 0.3V.

3.6 Programmable interface

There is an USB device interface 《USB Device》on the rear panel of the instrument, through which the instrument could be program-controlled by connecting to computer with an USB cable,the use method of this interface is described in detail in the CD that attached with the instrument.

3.7 Parameter calibration

The instrument is calibrated before shipment, but some specifications may change a bit lot during long time of use. To ensure the accuracy, the instrument should be calibrated termly. Users may regain the accuracy of the instrument by operating the keyboard to calibrate the main specifications without removing the cover of the instrument.

3.7.1 Enable calibration

After booting, the calibration is in off state, and the generator could not be calibrated without inputting calibration password, this is a way to protect calibrated parameters which may be changed carelessly. To enable calibration, select sine wave and then press shift key【Cal】, the calibration password displayed as 0, input calibration password 1900, press【N】key to enable calibration.

3.7.2 Parameters calibration

Press【Menu】key to display calibration value on the left, and calibration sequence number on the right when setting calibration conditions automatically. Adjust calibration value to calibrate present selected calibration option and make the output expected. Continue to press 【Menu】key and the calibration sequence number will increase step by step, users could calibrate all those options respectively, which is shown in the following list. During calibration process, press shift key【Cal】at any time then press【Menu】key to return the calibration sequence number to 00.

Parameter calibration table

Sequence No.	Default calibration value	Output nominal value	Adjust the calibration value till the output is within the error range
00	2047	0Vdc	Zero calibration: output DC voltage －20～20mVdc
01	870	10Vdc	Offset calibration: output DC voltage 9.88～10.12Vdc
02	873	7Vrms	Amplitude calibration: output AC voltage 6.928～7.072Vrms
03	300	0.71Vrms	Amplitude calibration: output AC voltage 0.701～0.719Vrms
04	500	1MHz	Frequency calibration: output frequency 1MHz±20Hz
05～**	100	5Vpp	Flatness calibration: output amplitude 4.5Vpp～5.5Vpp

3.7.3 Disable calibration

After finishing the calibration, press【Cal】key and there display 1900, press any numeric keys then【N】key to store the calibration parameters, disable calibration and exit the process.

During the calibration process, if wrong calibration occurred, press 【Freq】key at any time to disable calibration and exit without storing calibration parameters.

After rebooting, the generator automatically recalls and uses the calibration parameters stored during last calibration.

3.8 Default setting

3.8.1 Continuity function: continuity function is default after booting.

Waveform: Sine Frequency: 1kHz Amplitude: 1Vpp

Attenuation: Auto Offset: 0Vdc Duty cycle: 50%

Output phase: 0° Output Polarity：Normal Output port: open

3.8.2 Burst

Repeated period: 10ms Burst count: 3 Start phase: 0°

Trigger mode: internally continuous

Chapter 4 Service and support

4.1 Warranty

Shijiazhuang Suin Instruments Co.,Ltd. will give one year's warranty to maintaining or replacing since consignment for the verified quality problem of the product.

Except for this explanation and the description in the warranty card, the company has no other warranty, in proclamation or in implication. Under no circumstances, the company will responsible for the direct, indirect or other secondary loss.

4.2 Contact us

If you have any questions or inconvenient during the use of our products please do not hesitate to contact us.

Monday thru Friday 8: 00-17: 00

Telephone: +86-311-86013320(after service) Fax: +86-311-86018511

+86-311-86014314(technical support)

E-mail address: export@suintest.com

You are welcome to visit the website of Shijiazhuang Suin Instruments Co.,Ltd.: http://www.suintest.com

Chapter 5 Specifications (see note 1)

5.1 Output Characteristics

5.1.1 Waveform

Type: 16 waveforms including Sine, Square, Ramp, Exponent, Logarithm, Noise, etc.

Length: 1024 points

Sampling Rate: 100 MSa/s

Amplitude Resolution: 8 bits

5.1.2 Sine Spectrum Purity

Harmonic Distortion: （1Vpp） ≤－40dBc（≤5MHz）

≤－35dBc（＞5MHz）

Total Distortion of Sine: （20Hz～20kHz, 20Vpp） ≤0.5％

5.1.3 Characteristic of Square, Pulse and Ramp

Rising/Falling Edge Time: ≤35ns Overshoot: ≤ 10 ％

Duty cycle of Square: 0.1％～99.9％(Limited by edge time)

Pulse Width of Pulse: 100ns～2000s

Symmetry of Ramp: 0.0％～100.0％

5.1.4 Frequency Range

Range: Sine: 10μHz～20MHz(Note 2) Square and Pulse: 10μHz～5MHz Others: 10μHz～1MHz

Resolution: 10μHz, 6 digits

Accuracy: ±50ppm

5.1.5 Amplitude（Auto Attenuation, offset 0Vdc)

Range：frequency≤8MHz：0～10Vpp(50Ω load) 0～20Vpp(open-circuit load)

frequency＞8MHz：0～9Vpp(50Ω load) 0～18Vpp(open-circuit load)

Resolution：5mVpp(amplitude＞2Vpp) 0.5mVpp(amplitude≤2Vpp)

Accuracy (1kHz,＞5mVrms): ±（Setting×1％＋2mVrms）

Flatness (Sine, compared to 1MHz,5Vpp): ±10％

5.1.6 Offset（Attenuation 0dB,amplitude0Vpp）

Range: ±5Vdc(50Ω load) ±10Vdc(open-circuit load)

Resolution: 5mVdc

Accuracy: ±(Setting×1％＋20mVdc)

5.1.7 Output Characteristic

Mode: Positive/Negative

Phase difference with SYN output: 0°～360° Resolution: 1°

Output impedance: 50Ω(typical)

5.1.8 Burst

Waveform: 16 kinds of waveforms including sine, square, ramp

Repeated period: 1μs～20s

Pulse count: 1～1000000

Start phase: 0°～360°

Output mode: count, gate

Trigger source: Internal continuous, external, manual

5.2 Trigger input

5.2.1 Input Level： TTL compatible

5.2.2 Input Impedance： ＞10kΩ

5.3 SYNC

5.3.1 Waveform: Square, edge time ≤20 ns

5.3.2 Amplitude: TTL compatible

5.3.3 Impedance: 50Ω typical

5.4 Programmable Interface

USB device interface, of which the guide is written into the attached CD.

5.5 General Characteristics

5.5.1 Power condition:

Voltage: AC 100～240V Frequency: 45～65Hz Power consumption: ＜20VA

5.5.2 Environment condition**:** Temperature: 0～40℃ Humidity: ＜80％

5.5.3 Operation characteristics:

Fully key-operation, continuously adjust with the knob.

5.5.4 Display: VFD fluorescence display screen

5.5.5 Dimension: 322 mm×256 mm×102 mm Weight: 1.5kg

5.5.6 Technique: Surface-mount technology, large scale integrated circuit, high reliability, long service life.

Note 1: The test of the specifications should be done around temperature of 18℃ to 28℃, after 30 minutes of booting.

Note 2: Sinewave frequency range of TFG1905P: 10μHz to 5MHz
Sinewave frequency range of TFG1910P: 10μHz to 10MHz
Sinewave frequency range of TFG1920P: 10μHz to 20MHz