200MHz

MULTIFUNCTION GENERATOR

WF1967/WF1968

An original function generator with features
beyond high-performance and multi-functions

NF Corporation

NF's concept of a function generator that covers all the basics and fully responds to the demand for high quality signals.
And equipped with NF-only features that are not available in other products.

NF's concept of basic performance and functions, based on our continuous development of function generators

Maximum frequency 200MHz with high-accuracy and high-resolution

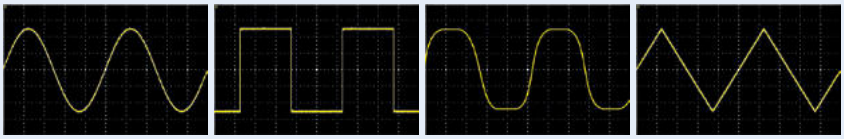
This generator supports a wide band range with sine wave output from 0.01 μHz to a maximum of 200 MHz, and square wave and pulse wave output from 0.01 μHz to 70 MHz.
The frequency output accuracy is ± (3 ppm of setting + 6 pHz) and 0.01 μHz(less than 50 MHz) of high resolution frequency settings are available.

Waveform amplitude resolution: 16-bit

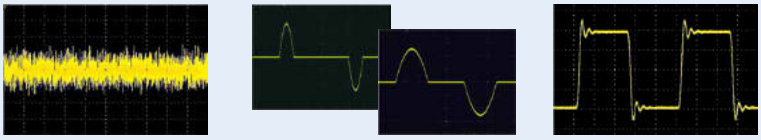
With its original circuit configuration, this model achieves 16 bit amplitude resolution that is typically not available in 100 MHz class function generators. Waveforms of every type — sine wave, square wave, arbitrary wave, etc. — can be obtained with low spurious signal levels.

Waveform

Wide array of output waveform and various oscillation modes

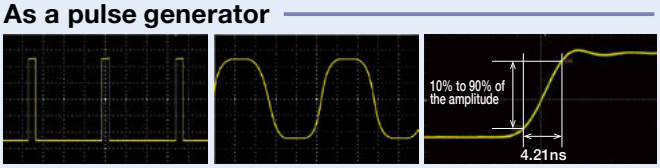


Sine wave | Square wave | Pulse wave | Ramp wave



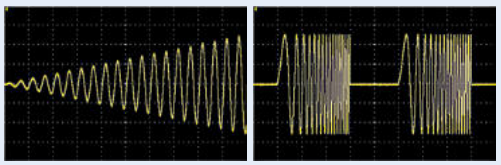
Noise (Gaussian distribution) | Parameter-Variable Waveform (CF controlled sine) | Arbitrary waveform (overshoot)

As a pulse generator



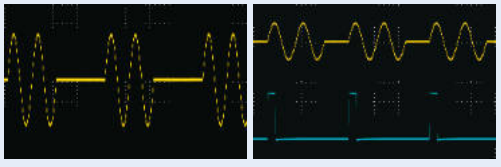
Pulse width variable | Rising/Falling time variable | Rising time | X-axis: 2.5 ns/div, Y-axis: 300 mV/div

Sweep

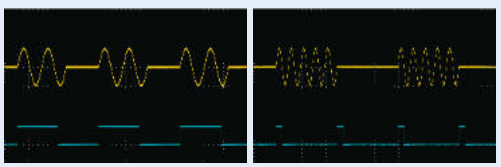


Sweep | Gated sweep

Burst, trigger, gate



Auto burst | Trigger burst



Gate | Triggered gate

Amplitude setting: maximum 20 Vp-p / open

The maximum output voltage is 20 Vp-p below 110 MHz. The minimum setting resolution is 0.1 mVp-p, and a setting of 0 V p-p is also possible.
The auto range function enables the optimal output voltage range to always be selected from the full output voltage range. By setting the level to reduce the degradation of the amplitude setting accuracy, very high amplitude setting accuracy can be achieved. In addition, when amplitude discontinuity due to range switching becomes a problem, it is also possible to select range hold.

Wide array of output waveform

The basic waveforms as sine wave, square wave (duty variable), pulse waves (pulse width, duty, rising/falling time variables), ramp wave (symmetry variable), noise (Gaussian distribution), and DC can be generated, and preinstalled 25 types of waveforms (parameter-variable waveform) that commonly used in various fields are supported also.
In addition, the user can define arbitrary waveforms up to 1Mi* words in maximum, and these can be easily set on the control panel or created using the included arbitrary waveform editor.

* Mi represents 2^{20} = 1048576. (IEC 60027-2, IEEE 1541-2002)

Parameter-variable waveform, arbitrary waveforms P.5

Various oscillation modes

Equipped with various oscillation modes: continuous, sweep (frequency, phase, amplitude, DC offset, duty), burst (auto burst, trigger burst, gate, triggered gate), sequence, internal modulation and external modulation (FM, FSK, PM, PSK, AM, DC offset modulation and PWM).
The variety of settings available in each mode supports the output of various test signals and complex testing efficient.

Sequence function

The sequence function, can output parameters sequentially such as waveform, frequency, amplitude, DC offset, phase, and square wave duty, has equipped. The sequence function can be programmed on the unit itself or using the included software.

Sequence function P.6

2-channel ganged operation (WF1968 only)

In addition to two independent channel settings, 2-phase and constant frequency difference setting is possible. While the 2-channels are ganged, each sweep oscillation modes can be operated. The output of each channel is isolated from the chassis.

- Independent ● 2-phase (same frequency)
- Constant frequency difference ● Constant frequency ratio
- Differential output (same frequency, amplitude, and DC offset, reverse phase waveforms)
- Differential output 2 (same frequency and amplitude, reverse phase waveforms of DC offset are reverse polarity)

Floating

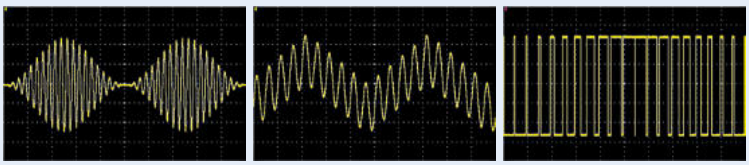
The signal ground of waveform output is isolated from the chassis and can be connected to different potential devices.
Based on this, the noise caused by ground loop, can reduced also. Channels are also isolated from each other in the 2-channel model.

External addition input

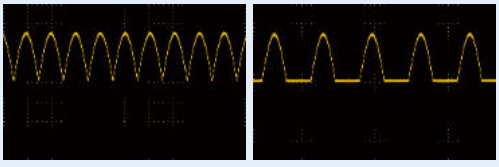
An external signal can be added to the waveform generated internally when output.
Input frequency is from DC to 100 MHz.

External signal　Internal waveform　Output waveform

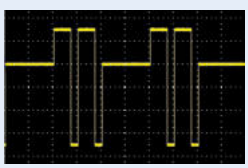
Modulation



Amplitude modulation (AM)　DC offset modulation　Pulse-width modulation (PWM)

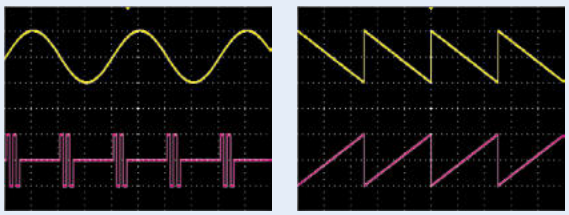


Full-wave rectified waveform (burst/trigger)　Half-wave rectified waveform (burst/trigger)



3-value pulse (burst/trigger)

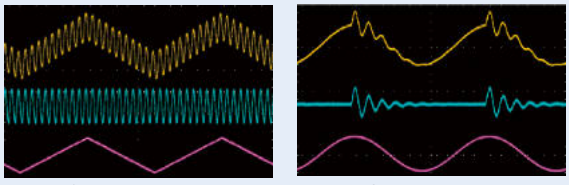
2-channel ganged operation



2-channels independent　Differential output

External addition Input

Output waveform
Addition input waveform
Setting waveform



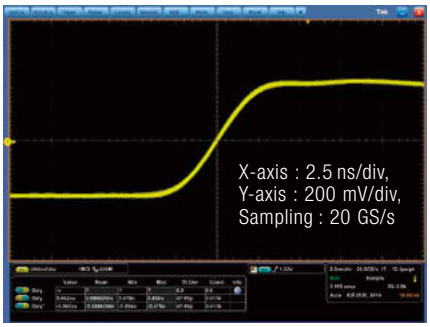
DC offset modulation　Surge waveform

Generates high-quality signals to meet advanced testing needs

Low jitter < 85 ps rms

Compared with previous models, jitter is significantly reduced to 85 ps rms or less(typ. 100 Hz or more), achieves stable square wave output.
In addition, trigger jitter is also reduced to 0.2 ns rms or less (typ.)

Rise of waveform observed on an oscilloscope
Square wave 5 MHz, 1 Vp-p, offset 0 V



Low distortion < 0.04 %

This function generator achieves sine wave output with total harmonic distortion (THD) of 0.04 % or less (guaranteed value) and low distortion.

High-speed, large-capacity arbitrary wave form: 420 MS/s, 4 Mi* words

Achieves a high-speed sampling rate of 420 MS/sec for arbitrary waveforms, which is faster compared with the previous models. Equipped with large capacity total memory of 4 Mi words and supports a maximum of 1 Mi words per waveform. Arbitrary waveforms can also be saved to external USB memory and used. In addition, the amplitude resolution of 16 bits enables the accurate output of complex signals defined by the user.

* Mi represents 2^{20} = 1048576.

High-resolution setting

From ultra-low frequency to high frequency, we have maintained a high setting resolution for the frequency setting resolution: 0.01 µHz at less than 50 MHz and 0.1 µHz at 50 MHz or more.
In addition, high-precision signals can be output since the various parameters are possible to set at a high resolution, such as the amplitude setting resolution: 0.1 mVp-p, the phase setting resolution: 0.001°, and the square wave and pulse wave duty setting resolution: 0.0001%.

Real-time frequency response correction

Automatically corrects the amplitude in real time depending on the oscillation frequency.
This reduces amplitude fluctuations in frequency modulation and frequency sweep.

Original functions available only in NF's function generators

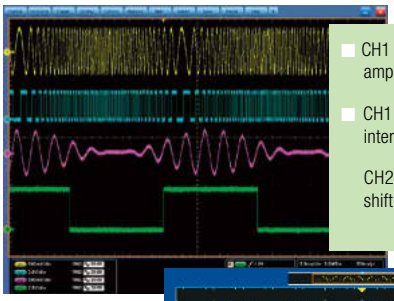
Equipped with Plus One Channel sub-output

A four-phase signal generator in WF1968, a two-phase signal generator in WF1967.

The sub-output can be used to output a continuous signal independent from the main output. It is possible to set waveform, phase, amplitude, DC offset and a phase difference between the sub-output and main-output. In addition, when using the internal modulation function in the main output, the modulation waveform can be output from the sub-output. With freely settable sub-output, one function generator can be used as a multi-phase signal generator.

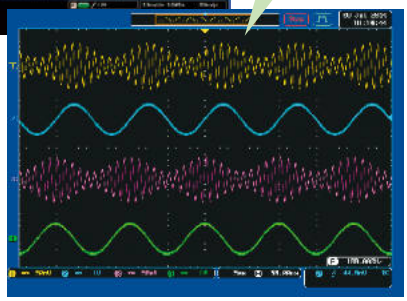
Output waveforms

Sine wave, square wave (50% duty cycle), ramp wave (50% symmetry), rising ramp wave, falling ramp wave, noise, arbitrary wave.



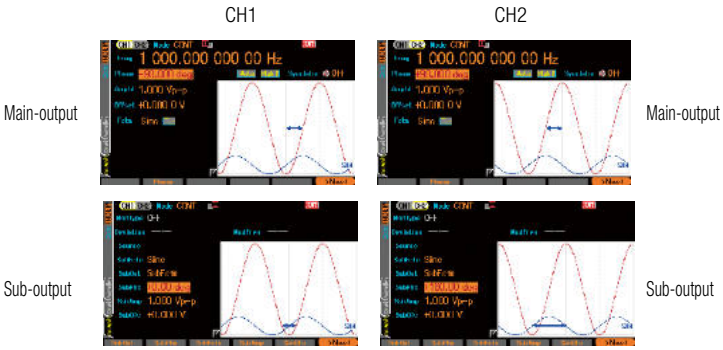
- CH1 and CH2 main-output generate amplitude modulated sine wave
- CH1 and CH2 sub-output generate internal modulation waveforms

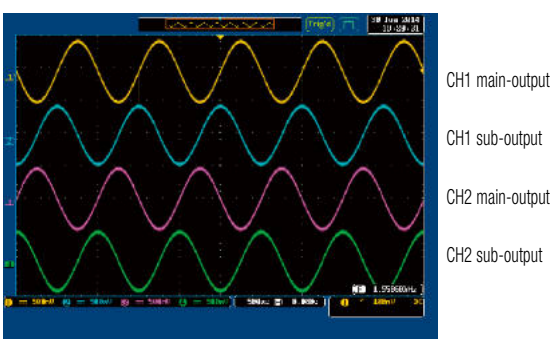
CH2 sub-output waveform is 90° shift from reference phase



Outputs 90° phase shift waveforms per channel with WF1968.

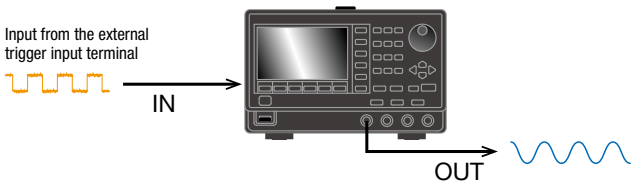
[WF1968 settings]

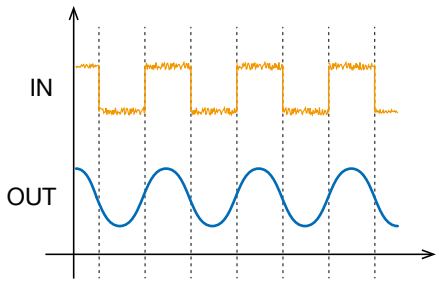




Synclator function (synchronized with external signal)

This function automatically synchronizes with a signal input from an external source and the main-output signal. It is also possible to adjust the phase difference between the external input signal and the main-output.
This is useful function for waveform conversion or shaping for fluctuating signals and rotating equipment applications.

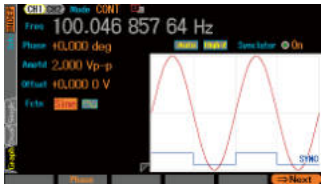




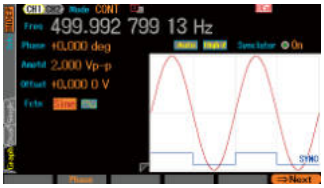
Input of 100 Hz and 500 Hz external signals

[Synchronizing frequency display]

100Hz



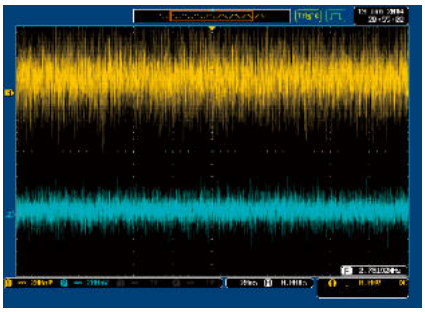
500Hz



■ Can be used as a simple frequency counter

Noise equivalent bandwidth setting

The noise waveform can be set to the equivalent bandwidth in seven steps of 100 M, 30 M, 10 M, 3 M, 1 M, 300 k and 100 kHz. By limiting the bandwidth using an external filter, the amplitude will also be small. However, by using the noise equivalent bandwidth setting function, an external filter will not be required, and the noise bandwidth can be limited while the amplitude (noise rms) is in a constant state.



●Output : 1 Vp-p setting

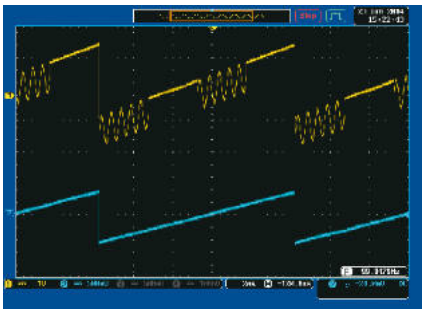
CH1 :
bandwidth setting : 30 MHz

CH2 :
bandwidth setting : 100 MHz, band-limited by 30 MHz cut-off frequency low-pass filter (LPF)*

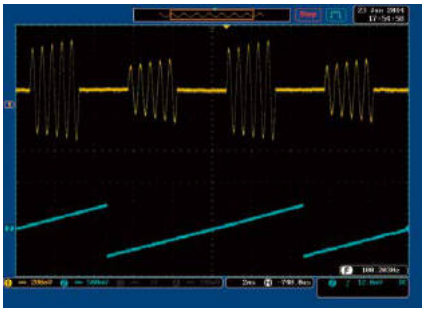
* NF filter 3660 A

Burst and modulation, sweep and modulation

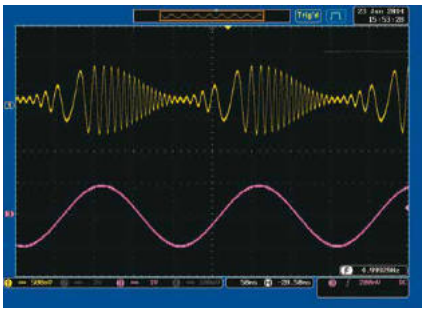
Internal modulation or external modulation is possible at the same time as the burst oscillation.
Also, external modulation can be used in an oscillation sweep.



DC offset modulation of burst oscillation with rising ramp wave



Amplitude modulation of burst oscillation with rising ramp wave



Amplitude modulation with frequency sweep of sine wave

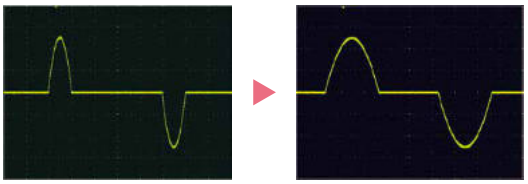
Generate complex waveforms freely. Also have the fulfilled functions of arbitrary waveform generator.

Parameter-variable waveforms

Recently, the arbitrary waveform needs has increasing in the market, the “Parameter-variable waveform” has been appreciated from users. It is the original function of NF’s function generator equipped since previous models.
The 25 types of waveforms that must generally be created as arbitrary waveforms and are commonly used waveforms as simulated signals in such fields as electronic circuit, communications and machinery are built in as standard waveforms.
The specific parameters related to waveforms can be set by operating control panel of the generator. While waveforms are being output, it is also possible to change multiple parameters.

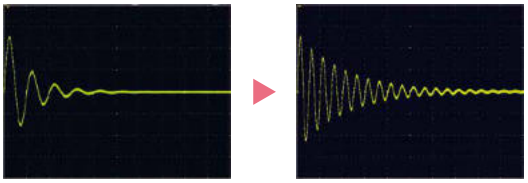
CF controlled sine

Variable parameter: crest factor



Damped oscillation

Variable parameters: oscillation frequency, damping time constant



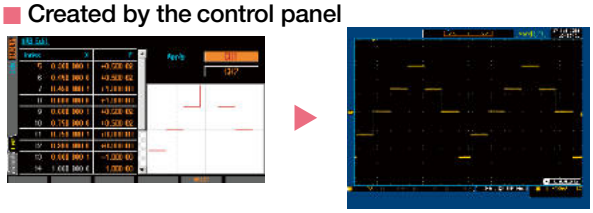
Arbitrary waveforms

Based on maximum 1Mi words/waveform and on-board 4Mi words memory, maximum 128 of arbitrary waveforms can be output.

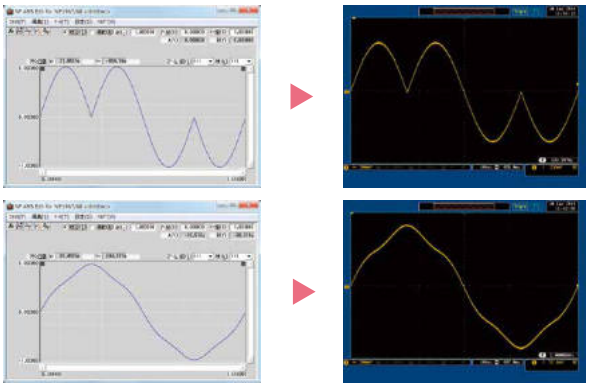
* Mi represents 2^{20}=1048576

- Waveforms can be created by the control panel or by using the included arbitrary waveform editor
- Waveform data can also be stored in an external USB memory
- Parameter-variable waveforms can be saved as arbitrary waveforms and reused

Created by the control panel



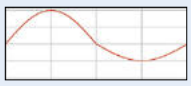
Created using the arbitrary waveform editor



Waveform

25 types of Parameter-variable waveforms

steady group



- 1st half amplitude
- 2nd half amplitude

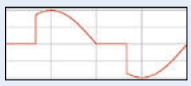
Unbalance sine

- Clip rate

Clipped sine

- Crest factor

CF controlled sine

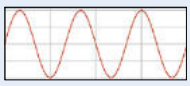


- Conduction angle

Conduction angle controlled sine

- Number of steps

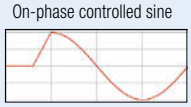
Staircase sine



- Number of cycles
- Start phase

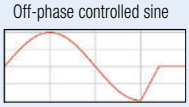
Multiple cycle sine

Transient sine group



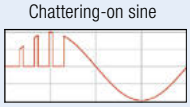
- Complete-on phase
- On-slope time

On-phase controlled sine



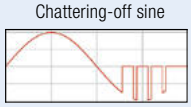
- Off-phase
- Off-slope time

Off-phase controlled sine



- On-phase
- Number of chattering
- On-state time
- Off-state time

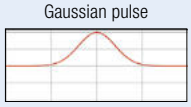
Chattering-on sine



- Off-phase
- Number of chattering
- On-state time
- Off-state time

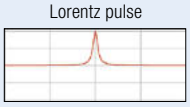
Chattering-off sine

Pulse waveform Group



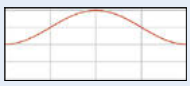
- Standard deviation

Gaussian pulse



- Half value of width

Lorentz pulse

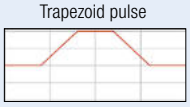


- Width

Haversine

- Width

Half-sine pulse



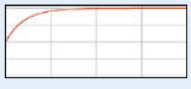
- Slope width
- Upper base width

Trapezoid pulse

- Number of zero crossings

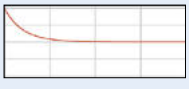
Sin (x) / x

Transient response group



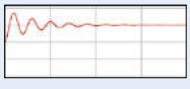
- Time constant

Exponential rise



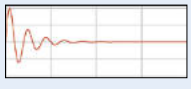
- Time constant

Exponential fall



- LPF natural frequency
- LPF Q

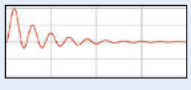
2nd-order LPF step response



- Oscillation frequency
- Damping time constant

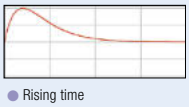
Damped oscillation

Surge group



- Oscillation frequency
- Damping time constant
- Trailing time constant

Oscillation surge



- Rising time
- Duration time

Pulse surge

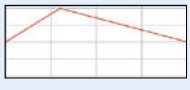
Other group

- Leading delay
- Rising-slope width
- Upper base width
- Falling-slope width
- Offset

Trapezoid with offset

- Leading edge time
- Trailing edge time
- Duty

Half-sine edge pulse



- Symmetry

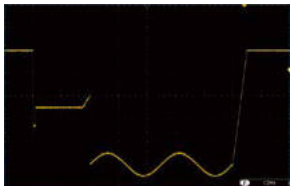
Bottom-referenced ramp

Parameter-variable waveforms + Arbitrary waveforms + Sequence function

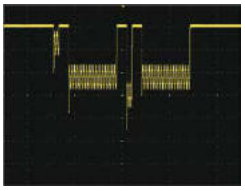
Sequence function

The waveform, frequency, phase, amplitude, DC offset, square wave duty can all be output while being changed one after another.
Variety of parameters change, like rapid change and sweep or repeat and jump, can be set freely.
As a result, not only ever-changing signals, such as mechanical vibrations and voltage fluctuations, but also long and complex output pattern can be programmed easily even.
Using the included sequence editor, you can efficiently create complex programs in a short time.
The combination of parameter-variable waveforms is also possible.

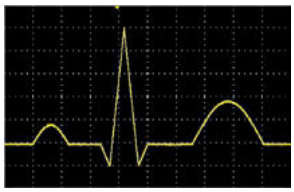
Sequence waveform example



Automotive equipment standard test



Environmental conditions and electrical testing for electrical and electronic equipment: ISO 16750:2006

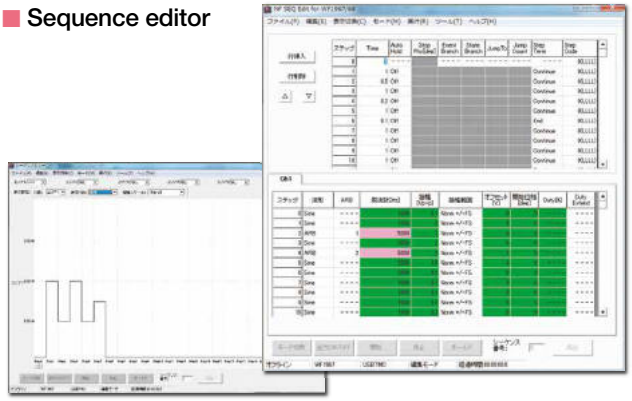


Basic electrocardiogram waveform

Sequence function overview

- Channel parameters in step:
  Waveform, frequency, phase, amplitude, DC offset, square wave duty
- Step control parameters:
  Step time, hold operation, jump destination, jump count, step stop phase, branch operations, step termination control, step sync code output
- Number of steps: 1 to 255 (per sequence)
- Number of saving memory : 10 sequences. (saved in the non-volatile memory, can also be saved to USB memory)
- Available waveforms: sine wave, square wave, noise, DC, arbitrary waveform (ramp wave and parameter-variable waveforms can be saved and used as arbitrary waveforms)
- Maximum number of usable waveforms: 128
- Automatic execution possible when the power is turned on

Sequence editor



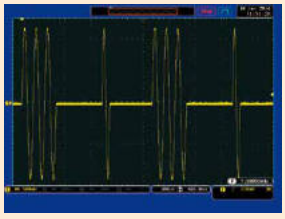
Application-specific waveform example using a variety of functions

Arbitrary waveform example created based on a customer request

Staircase waveform

Staircase waveform

Full-wave rectifier circuit ripple waveform

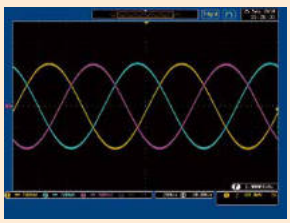


Intermittent sine wave (3 waves + 1 wave)

Three-phase alternating current waveform

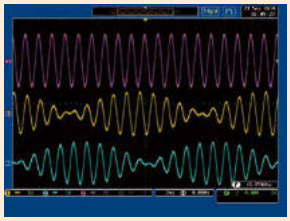
- Used functions: 2-channel ganged operation, sub-output

The main output from CH1 and CH2 is ganged, a sine wave is output from the sub-output, and a synchronized three-phase AC signal is generated. The frequency can be continuously changed, even keep 120°phase differences for each output.

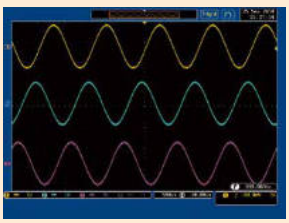


Resolver signal (motor)

- Used function: Amplitude modulation

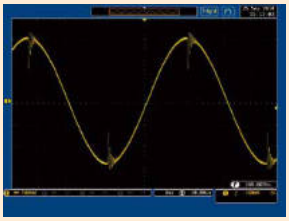


The sine wave is amplitude modulated and output from CH1, and the another sine wave modulated by forward 90° phase shift modulation wave, has output from CH2.



LED dimmer noise

- Used function: Parameter-variable waveform

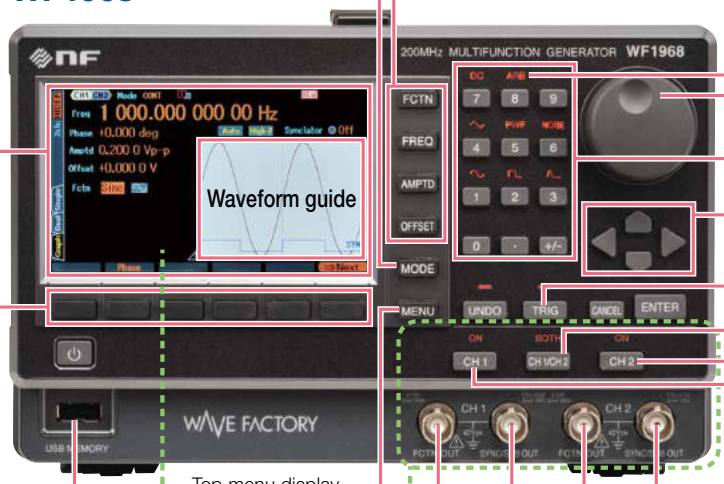


Output as an arbitrary waveform by adding the damped oscillation wave of the parameter-variable waveform to the sine wave.

Easy-to-read display and an easy-to-understand key layout. Make reliable settings using agile operations.

Front

WF1968



Oscillation mode setting

Basic parameter settings (waveform, frequency, amplitude, DC offset)

Waveform setting (lighted waveforms are selectable)

Modify knob (used to select items, and increase or decrease values)

Numeric keypad

Arrow keys (used to select items, and increase or decrease values)

Manual trigger (used to trigger sweeps and bursts)

CH1 and CH2 setting switchover

Waveform output on/off (switches on/off of CH1 and CH2)

CH2 sync/sub-output

CH2 main output

CH1 sync/sub-output

CH1 main output

WQVGA (480 x 272) high-resolution TFT color LCD

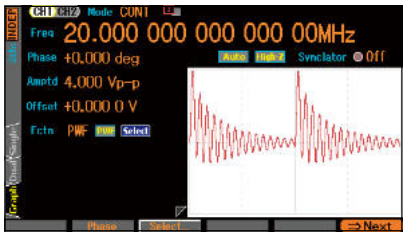
Soft-keys (used for operating the items on the LCD screen)

USB memory interface

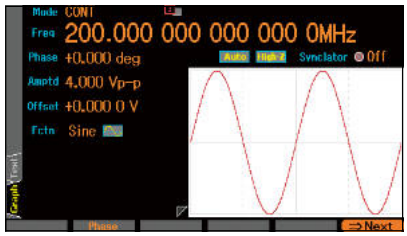
Top menu display

Note : This photograph shows all of the panel's surface lighted for the purpose of explanation.

Display examples



WF1968



WF1967

WF1967

Waveform output on / off

Main output

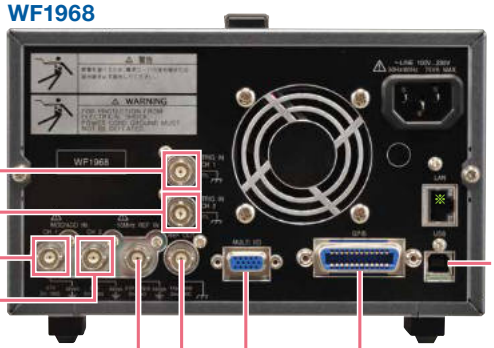
Sync/ sub-output

External modulation / addition input

External trigger input

Rear

WF1968



CH1 external trigger input

CH2 external trigger input

CH1 external modulation / addition input

CH2 external modulation / addition input

External 10 MHz frequency reference input

Frequency reference output

USB interface

GPIB interface

Multi-input and output connectors (used for external sweep control and external sequence control)

WF1967

External 10 MHz frequency reference input

Frequency reference output

USB interface

GPIB interface

Multi-input and output connectors (used for external sweep control and external sequence control)

*LAN interface (factory option)

Packed with various features that can improve usability and expand the range of applications.

- High-resolution TFT color LCD display.
- USB memory interface for load and save files
  For managing the files for various settings and arbitrary waveforms
- Waveform guide
  Displays the set waveform, and supports intuitive operations
- Setting memory: 10 sets
- User-defined units
  Set arbitrary units using a specified conversion formula (for frequency, cycle, amplitude, DC offset, phase, duty)
- Load impedance
  Set and display the output voltage at a specified load impedance
- External 10 MHz frequency reference input
  Inputting an external 10 MHz frequency standard signal to the external 10 MHz frequency reference input (10 MHz REF IN) enables highly accurate frequency output.
- Multiple unit synchronization
  Synchronous operation of up to six units is possible through master-slave connections
- USB and GPIB interfaces equipped.
- Arbitrary waveform editor and sequence editor are included as standard.
- Interchangeable Virtual Instruments (IVI) instrument drivers are included as standard.

SPECIFICATIONS

Unless otherwise specified, the value assumes the following conditions: continuous oscillation, load of 50Ω, oscillation setting of 10 Vp-p/50Ω, DC offset setting of 0 V, auto range, waveform amplitude range of ±FS, external addition turned off, AC voltage is the rms value.
*Ki and Mi represent 2^{10}=1024 and 2^{20}=1048576, respectively. IEC 60027-2/IEEE 1541-2002
*1 : Guaranteed numeric value. Other numeric values are norminal or typical (typ.) values.

Waveform and Oscillation Mode

Output waveform	Standard waveform (sine, square, pulse, ramp, parameter-variable, noise (Gaussian distribution), DC), and arbitrary waveform.
Oscillation mode	Continuous, modulated, burst, sweep, sequence In burst mode, modulation function is available and in sweep mode, modulation function is available

Frequency and Phase

Frequency setting range

Oscillation mode /Function / Waveform	Continuous, modulation, sweep (continuous and single)	Sweep (gated single), burst, sequence
Sine	0.01μHz to 200MHz	0.01μHz to 100MHz
Square	0.01μHz to 70MHz	
Pulse	0.01μHz to 70MHz (not available for sequence)	
Ramp	0.01μHz to 20MHz	
Parameter-variable	0.01μHz to 20MHz	
Noise	Equivalent bandwidth: Select from 100M/30M/10M/3M/1M/300k/100kHz	
DC	Frequency setting is invalid	
Arbitrary	0.01μHz to 20MHz	

Frequency setting resolution	0.01μHz (< 50MHz), 0.1μHz (50MHz≤)
Frequency setting with a period	Setting with frequency that is inverse number of set period (less than 0.01μHz is rounded half up)
Frequency accuracy at shipping time*1	±(3ppm of setting + 6pHz)
Frequency aging rate*1	±1ppm/year

Phase setting range

Main-output	-1800.000° to +1800.000°(resolution 0.001°)
Sub-output/Sub-waveform	-180.000° to +180.000°(resolution 0.001°)

Output Characteristics

Amplitude

Setting range	0Vp-p to 20Vp-p/open, 0Vp-p to 10Vp-p/50Ω AC+DC≤±10V/open or less, ±2V/open (exceeding 110MHz)
Setting resolution	999.9mVp-p or less: 4 digits or 0.1mVp-p 1Vp-p or more: 5 digits or 1mVp-p
Accuracy*1	±(1% of amplitude setting [Vp-p] + 2mVp-p)/open (1kHz sine wave, load open, amplitude setting 20mVp-p or greater)
Setting unit	Vp-p, Vpk, Vrms, dBV, dBm
Resolution of waveform amplitude	Approx. 16 bit (8mVp-p or greater / open)

DC offset

Setting range	±10V/open, ±5V/50Ω AC+DC≤±10V open/or less, ±2V/open(exceeding 110MHz)
Setting resolution	±499.9mV or less : 4 digits or 0.1mV ± 0.5V or more : 5 digits or 1mV
Accuracy*1	±(|1% of DC offset setting [V]|+10mV +0.5% of amplitude setting [Vp-p])/open (10MHz or less, sine wave, load open, 20°C to 30°C)

Waveform output（Main-output） <FCTN OUT>

Output on/off control	On/Off (switch) (output terminal is released when out put off)
Output impedance	50Ω, unbalanced
Signal GND	Insulated from enclosure, maximum 42Vpk (DC + AC-peak)Each channel independent. Between channels is also maximum 42Vpk.

Synchronization/Sub-output <SYNC/SUB OUT>

Output signals	Reference phase synchronization, internal modulation synchronization, burst synchronization, sweep synchronization, sub-waveform, internal modulation signal, sweep X drive and off switching.
Sub-waveform	Analog waveform output synchronized with the main-output. Phase is variable to the reference phase synchronization signal, and the amplitude and offset are also adjustable. Available waveform : sine, square (duty 50%), ramp (symmetry 50%), rising ramp, falling ramp, noise and arbitrary waveform.
Internal modulation waveform	Modulation waveform at the time of internal modulation oscillation. Phase is variable to the reference phase synchronization signal, and which amplitude and offset are also adjustable independent from the modulation depth.
Output voltage	Each type of synchronized signal • TTL level (low level 0.4V/open or less, high level 2.7V/open or more) Sub-waveform/internal modulation waveform • Amplitude setting range: 0Vp-p to 6Vp-p/open, setting resolution 1mVp-p • DC offset setting range: ±3V/open, setting resolution 1mVp-p • A peak value combining waveform amplitude and DC offset is limited to ±3V/open or less. Sweep X drive : 0Vp-p to 6Vp-p/open
Output impedance	50Ω, unbalanced

Signal Characteristics

Sine wave

Amplitude frequency characteristics*1	Up to 100kHz : ±0.1dB 100kHz to 5MHz : ±0.15dB 5MHz to 20MHz : ±0.2dB 20MHz to 50MHz : ±0.5dB 50MHz to 100MHz : ±0.7dB 100MHz to 200MHz : ±0.8dB [50mVp-p to 10Vp-p/50Ω, when 100MHz or greater, 50mVp-p to 2Vp-p/50Ω, reference frequency 1kHz]
Total harmonic distortion*1	20Hz to 20kHz: 0.04% or less (1Vp-p/50Ω, sum up to 7th harmonic,noise is not included)
Harmonic spurious*1	Up to 1MHz : –60dBc or less 1MHz to 5MHz : –50dBc or less 5MHz to 30MHz : –40dBc or less 30MHz to 200MHz : –30dBc or less [1Vp-p/50Ω, sum up to 5th harmonic]
Non-harmonic spurious*1	Up to 8MHz : –55dBc or less 8MHz to 80MHz : –55dBc+20dB/dec or less 80MHz to 200MHz : –35dBc or less (2Vp-p/50Ω, measured at 500MHz bandwidth)

Square wave

Duty variable	Normal : setting range 0.0100% to 99.9900%(resolution 0.0001%) Upper limit(%): 100–frequency[Hz]/1,400,000 Lower limit(%): frequency[Hz]/1,400,000 Jitter 85ps rms or less typ.(100Hz or more) Extended: setting range 0.0000% to 100.0000%(resolution 0.0001%) Jitter 700ps rms or less typ.
Duty accuracy*1	Up to 300kHz : ±0.1% of period (duty setting is 1% to 99%) 300kHz to 3MHz : ±1% of period (duty setting is 5% to 95%) 3MHz to 10MHz : ±3% of period (duty setting is 40% to 60%)
Rising/Falling time	4.6ns or less,*1 4.4ns or less typ. (2Vp-p/50Ω)
Overshoot	5% or less typ.

Pulse wave

Pulse width	Duty setting range:0.0001% to 99.9999% (resolution 0.0001%) Time setting range:6.88ns to 99.9999Ms (resolution 0.001% or less of period or 0.01ns)
Rising/Falling time	Setting range: 4.21ns to 58.8Ms (resolution 3 digits or 0.01ns or 1ppm of period) Rising/Falling time independently set Minimum setting value: 1ppm or 4.21ns, whichever is larger
Overshoot	5% or less typ.
Jitter	90ps rms or less typ. (100Hz or more)

Ramp wave

Setting range of symmetry	Setting range of symmetry : 0.00% to 100.00% (resolution 0.01%) At sub-output, symmetry is 0%, 50%, 100% only

Noise

Noise equivalent bandwidth setting range	Select from 100M/30M/10M/3M/1M/300k/100kHz

Parameter-variable waveform

Steady sine group	Unbalance sine, clipped sine, CF controlled sine, conduction angle controlled sine, staircase sine and multiple-cycle sine
Transient sine group	On-phase controlled sine, off-phase controlled sine, chattering-on sine and chattering-off sine
Pulse waveform group	Gaussian pulse, lorentz pulse, haversine, half-sine pulse, trapezoid pulse and Sin(x)/x
Transient response group	Exponential rise, exponential fall, second order LPF step response and damped oscillation
Surge group	Oscillation surge, pulse surge
Other group	Trapezoid with offset, half-sine edge pulse and bottom referenced ramp
Use of waveform	Can be used after converted into arbitrary waveform with sequence function (sub-output is not selectable)

Arbitrary waveform

Waveform length	Number of control points 2 to 10,000 or 4Ki to 1Mi words (2^n, n=12 to 20)(Control points are linearly interpolated)
Total amount of saved waveforms	Maximum 128 waves or 4Mi words (total of channels 1 and 2). Waveforms can be saved in the nonvolatile memory or external USB memory
Resolution of waveform date amplitude	16bit
Sampling rate	420MS/s

Modulation

Operation in the burst/sweep mode	Partly possible in the burst and sweep oscillation mode.
Modulation type	FM, FSK, PM, PSK, AM, DC offset modulation and PWM • Frequency setting is higher than 160MHz, external modulation of FM, FSK and AM are only selectable. • Simultaneously using the sweep function, FSK, PSK and the same modulation type as the sweep type are not selectable. • Simultaneously using the burst function, FSK, PSK can select in auto burst mode only.
Modulation source	Internal/external (selectable) • CH2 (WF1968 only) can select internal/external/CH1. (When trigger source of CH1 is external, CH1 is not available other than FSK and PSK) • Simultaneously using the sweep function, internal modulationsource is not selectable.

Internal modulation

Internal modulation waveform	Other than FSK, PSK :Sine, square (duty 50%), triangle (symmetry 50%), rising ramp, falling ramp, noise, arbitrary waveforms FSK, PSK: Square wave (duty 50%) Noise equivalent bandwidth: Select from 100M/30M/10M/3M/1M/300k/100kHz
Internal modulation frequency	Other than FSK, PSK:0.1mHz to 20MHz (resolution 12 digits or 1μHz) FSK, PSK: 0.1mHz to 5MHz (resolution 11 digits or 1μHz)
Internal modulation synchronization output	Output waveform : A square wave with duty 50% rising at the zero phase of the internal modulation waveform. When internal modulation waveform is noise, the level is fixed to low. Output connector : Shared with synchronization/sub-output connector
Internal modulation waveform output	Output voltage : -3V to +3V/open. Output connector: Shared with synchronization/sub-output connector

External modulation

External modulation input	Other than FSK, PSK	Input voltage range: ±1V full scale Maximum allowable input: ±2V Input impedance: 10kΩ, unbalanced Input frequency: DC to 400 kHz (-3 dB) Input connector: BNC receptacle (MOD/ADD IN)
	FSK, PSK	Polarity: Positive/Negative (switch) Input frequency: DC to 5MHz Input connector: External trigger input (TRIG IN)
Signals selectable for synchronization/sub-output		Reference phase synchronization, internal modulation synchronization (when modulation source is internal), internal modulation signal (when modulation source is internal and other than FSK and PSK). Off (forcibly turned off also when the oscillation frequency may exceed 160MHz)

Modulation types and conditions

FM	Carrier waveform : Standard waveform except for noise, pulse wave and DC, and arbitrary waveform. Peak deviation : 0.00μHz to less than 100MHz (resolution 8 digits or 0.01μHz).
FSK	Carrier waveform : Standard waveform except for noise, pulse wave and DC, and arbitrary waveform. Hop frequency : Within the allowable range of frequency for each carrier waveform (resolution 8 digits or 0.01μHz).
PM	Carrier waveform :Standard waveform except for noise and DC, and arbitrary waveform Peak deviation: 0.000° to 180.000° (resolution 0.001°)
PSK	Carrier waveform :Standard waveform except for noise and DC, and arbitrary waveform Deviation : -1800.000° to +1800.000° (resolution 0.001°)
AM	Carrier waveform : Standard waveform except for DC, and arbitrary waveform Modulation depth: 0.0 % to 100.0 % (resolution 0.1%) (DSB-SC and Non-DSB-SC)
DC offset modulation	Carrier waveform : Standard waveform and arbitrary waveform Peak deviation : 0V to 10V/open Setting resolution : 4 digits or 0.1mV (499.9mV or less), 5 digits or 1mV (0.5V or more).
PWM	Carrier waveform : Square wave and pulse wave Peak deviation : Square wave Duty variable range standard 0.0000% to 49.9900% (resolution 0.0001%) Duty variable range extend 0.0000% to 50.0000% (resolution 0.0001%) Pulse wave 0.0000% to 49.9000%(resolution 0.0001%)

■ Sweep

Sweep types	Frequency, phase, amplitude, DC offset and duty. When the upper limit exceeds 160MHz, only frequency and phase are available
Sweep function	One way (ramp waveform), shuttle (triangular waveform) (switch). Linear, logarithmic (switch). Common regardless of sweep type. However, logarithmic can use only frequency sweep.
Sweep range setting	Start and stop values or the center and span values are specified. Center value is simple average of start and stop value during frequency logarithmic sweep. Assigning a marker value to a center value is possible (inverse setting possible).
Setting range of sweep time	0.1ms to 10,000s (resolution 4 digits or 0.1ms)
Sweep mode	Continuous / Single-shot / Gated single-shot selectable Oscillation only occurs during sweep execution in the gated single-shot mode Gated single-shot is not available at DC waveform.
Operation	Start, stop, hold/resume, starting value output and stop value output.
Trigger source	Used for single-shot sweep and gated single-shot sweep Internal/external input terminal selectable (CH2 can select from the same trigger source as CH1) Trigger delay setting is invalid. Manual trigger is available.
Internal trigger	Used for single-shot sweep and gated single-shot sweep Period setting range:100.0μs to 10,000s (resolution 5 digits or 0.1μs)
Stop level setting	Specifies the signal level when gated single-sweep is stopped. Setting range : -100.00% to +100.00% (amplitude full-scale reference and resolution 0.01%) or off
Oscillation stop unit when gated single	Cycle/Half cycle (selectable)
Sweep input/output	Sweep synchronization/marker output (synchronization/sub-output connector) Sweep X drive output (synchronization/sub-output connector) Sweep external control input (multi input/output connector) Sweep external trigger input (external trigger input terminal)
Signals selectable for synchronization/sub-output	Reference phase synchronization, sweep synchronization/marker, sweep X drive off
Use of modulation function	External modulation other than sweep type is simultaneously available (other than FSK, PSK)

■ Burst/Gate/Trigger

Burst/Gate

Burst mode	Auto burst, trigger burst, gate and triggered gate
Target waveform	Auto, trigger burst : Standard waveform except for noise and DC, and arbitrary waveform Gate, triggered gate: standard waveform except for DC, and arbitrary waveform
Mark/Space wave number setting range	0.5 to 999,999.5 cycles, 0.5 cycle unit
Oscillation stop unit at gate	Cycle/Half cycle (selectable)
Phase setting range	-1800.000° to +1800.000° (resolution 0.001°)
Stop level	The signal level is specified when oscillation is stopped. Setting range : -100.00% to +100.00% (with reference to the full scale of amplitude, resolution 0.01%) or off. Oscillation stops at the set oscillation start/stop phase when the stop level is set to off.
Trigger source	Internal trigger oscillator, external input terminal (selectable) CH2 can select the same trigger source as CH1. (WF1968) Manual trigger available. Used except for auto burst
Internal trigger	Period setting range: 1.0μs to 1,000s (resolution 5 digits or 0.1μs) Used except for auto burst
External trigger input	Positive, negative, disabled (selectable) Input connector: External trigger input terminal. Used except for auto burst
Trigger delay	Setting range: 0.0ns to 1000.0000s (resolution 8 digits or 0.1ns) Additional delay approx. 380ns Valid in the trigger burst only, valid in the internal and external trigger source
Trigger jitter	0.2ns rms or less typ.
Use of modulation function	Internal modulation or external modulation can use simultaneously with the burst oscillation. FSK and PSK can be selected in auto burst mode only

Trigger

External trigger input	Independent for each channel, however CH1 input can be shared with CH2
Input voltage	TTL level (low level is 0.8V or lower, high level is 2.6V or higher)
Maximum allowable input	-0.5V to +5.5V
Minimum pulse width	5ns
Input impedance	10kΩ (pull up to +3.3V), unbalanced
Input connector	BNC receptacle (TRIG IN)
Internal trigger oscillator	For sweep, trigger and independent for each channel (Not available for synclator)
Manual trigger	Used for single-shot sweep, gated single-shot sweep, trigger burst, gate and triggered gate. Panel key operation. (Not available for synclator).

■ Synclator Function

Frequency range	20Hz to 10MHz (Synclator function available)
Synchronization target	External trigger input terminal CH2 can select the same trigger source as CH1(WF1968 only) Trigger delay setting is invalid
Synchronization source input	Positive/Negative (selectable)
Phase difference	The phase difference between the signal input from the synchronization source and the main-output signal is adjustable.

■ Sequences

Step control parameters	Step time, hold operation, jump destination, jump count, step stop phase, branch operation, step termination control and step synchronization code output
Channel parameters in step	Waveform, frequency, phase, amplitude, DC offset and square wave duty
Available waveforms	Sine, square, noise and arbitrary waveform (the ramp and parameter-variable waveforms can be used after being saved as arbitrary waveform)
Maximum number of waveforms	128
Number of saving sequences	10 sequences (saved in the built-in non volatile memory) Allowed saving external USB memory
Number of steps	Maximum 255 steps per sequence
Step time	0.1 ms to 1,000s (resolution 4 digits or 0.01ms)
Operation in step	Constant, keep and linear interpolation (except for waveform switching)
Number of jumps	1 to 9999 or unlimited.
Step stop phase setting range	0.000° to 360.000° (CH1 reference phase. resolution 0.001°) or invalid.
Branch operation	Branches to the specified step when the branch signal is input.

■ 2-Channel Ganged Operation (WF1968 only)

Channel mode	Two channels independent, 2-phases (same frequency), constant frequency difference, constant frequency ratio, differential output (same frequency, amplitude and DC offset at reverse phase waveform), differential output2(same frequency and amplitude. DC offset is reverse phase waveform, reversed polarity)
Equivalent setting, same operation	Set two channels at the same time available.
Frequency difference setting range	0.00 μHz to less than 200 MHz (resolution: 0.01 μHz) CH2 frequency - CH1 frequency
Frequency ratio N:M setting range	1 to 9,999,999 (for each of N and M) N: M= CH2 frequency : CH1 frequency
Time difference between channels for 2-phase	±10ns or less typ. ±20ns or less[*1] Same waveform (sine wave or square wave)

■ Other Input/Output

External 10 MHz frequency reference input

Input voltage	0.5Vp-p to 5Vp-p
Maximum allowable input	10Vp-p
Input impedance	1kΩ, unbalanced, AC coupled
Input frequency	10MHz (±5ppm : ±50Hz)
Input waveform	Sine or square wave (50%±5% duty)
Input connector	BNC receptacle (10MHz REF IN)

Frequency reference output (for synchronize multiple units)

Output voltage	1Vp-p/50Ω square wave
Output impedance	50Ω, AC coupled
Output frequency	10MHz
Output connector	BNC receptacle (REF OUT)

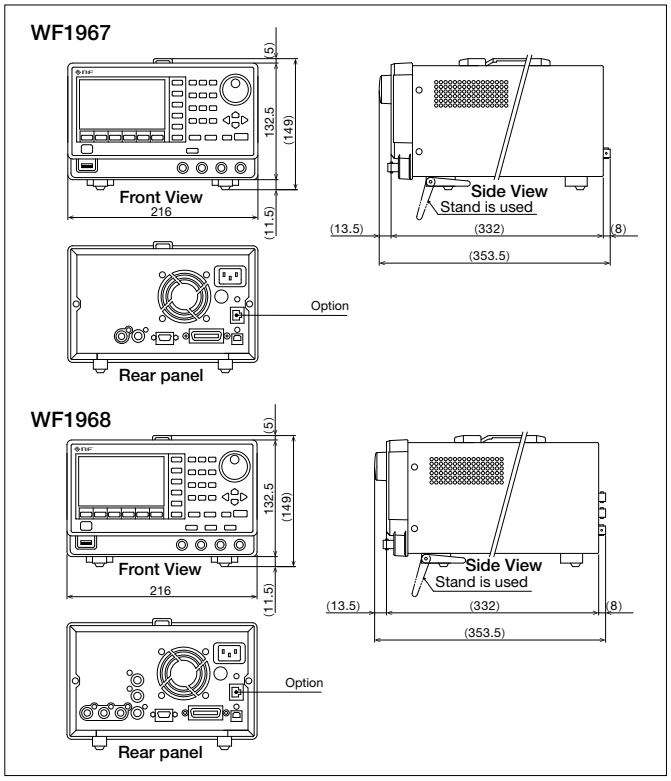
External addition input

Addition gain	x0.4, x2, x10 or off selactable The maximum output voltage range is fixed to 0.8Vp-p (x0.4) , 4Vp-p (x2) and 20Vp-p (x10) During external modulation, it is dedicated to external modulation input.
Input voltage	-1V to +1V
Maximum allowable input	±2V
Input frequency	DC to 100MHz (-3dB)
Input impedance	10kΩ, unbalanced
Input connector	BNC receptacle (MOD/ADD IN)

Multi-I/O

Multi-I/O connector	Used for sweep external control and sequence external control (Multi-I/O cable is optional)

■ Dimensions



■ Other Functions

Phase synchronization		Function to restart from the phase where the output waveforms for all the channels are set, automatic execution at channel mode switching
Synchronization of multiple units		Up to 6 units can be connected in the form of master/slave (including master unit) Connected with BNC cables by using REF OUT and external 10 MHz REF IN
User defined unit	Function	Sets and displays the value in any unit, using a specified conversion expression.
	Setting target	Frequency(Hz), period(sec), amplitude(Vp-p, Vpk), DC offset(V), phase(deg), and duty(%)
	Conversion expression	[(internal setting)+n]×m, [$\log_{10}$(internal setting)+n]×m Specify a conversion formula and values of n and m. (internal setting : the value of setting target)
	Unit character string	Up to four characters
Setting memory		10 sets (saved in the built-in non volatile memory) Allowed saving to external USB memory
Control and setting at power-on operation		Parameter setting(the operation state just before when the power was turned off is restored, the contents of setting memory No.1). Output on/off setting, sequence auto run setting on/off setting
External control interface		GPIB IEEE-488.1/USB USBTMC, USB 1.1 Full-speed SCPI-1997/IEEE-488.2, LAN(optional)

■ General

Display	4.3 inch TFT color LCD
Input/Output ground	• The signal grounds for waveform output, sync/sub output and external modulation/addition input are insulated from the enclosures. (These signal grounds are common within the same channel.) • The signal ground for external 10 MHz REF IN is insulated from the enclosures. • Each signal ground for CH1, CH2 and external 10 MHz REF IN are independent. • Maximum withstand voltage 42Vpk(DC + ACpeak)
Power supply	AC100V to 230V ±10%(250V or lower.) 50Hz/60Hz±2Hz
Power consumption	WF1967 : 65VA or lower. WF1968 : 85VA lower.
Operation temperature/ humidity range	0°C to +40°C, 5% to 85% RH (Absolute humidity: 1 g/m^3 to 25 g/m^3, no condensation)
Dimensions(mm)	216(W)×132.5(H)×332(D)(not including protrusions)
Weight	Approx. 3.0kg (main unit excluding accessories)
Accessories	• Instruction Manual (operation) • CD – PDF manuals Operation, external control, arbitrary waveform editor and sequence editor – Application software Arbitrary waveform editor, sequence editor IVI(I Interchangeable Virtual Instruments) driver • Power code set (2m with 3-prong plug)

■ Application software

•Sequence editor

Editing functions	• Initializes, copies, pastes, inserts and deletes steps • Saves and reads sequence data to/from a file • Sequence can be edited without connecting the device
Display functions	• Editing screen: Lists parameters for each step • Sequence view screen: Graphs changes of up to five parameters
Transfer functions	• Transfers and reads sequence data to/from the device • Transfers to the device the arbitrary waveform used in the sequence
Device control functions	• Output on/off • Starts, stops, and holds the sequence • Can monitor the execution status of sequence
Operating environment	OS : Windows 7/8.1/10(32bit / 64bit) Japanese/English Hard disk free space :50MB or more

•Arbitrary waveform editor

Editing functions	• Generation (standard waveform and a mathematical expression) • Interpolation (straight line, spline and continuous spline) • Math operation (+, –, ×, ÷) of waveform • Contraction and extension (vertical and horizontal directions) • Cuts, copies and pastes some part of waveform • Saves and reads arbitrary waveform data to/from a file • Waveforms can be edited without connecting the device
Display functions	• Zoom in/out • Scroll • Display unit (coordinates) selectable • Cursor (A, B)
Transfer functions	• Transfers and reads arbitrary waveform data to/from the device
Device control functions	• Major parameter setting
Operating environment	OS : Windows 7/8.1/10(32bit / 64bit) Japanese/English Hard disk free space: 10MB or more

Ordering information

Model name	Product Name	Frequency	Number of channels	
WF1967	Multifunction Generator	200MHz	1	Arbitrary waveform editor and sequence editor included as standard.
WF1968	Multifunction Generator	200MHz	2	Arbitrary waveform editor and sequence editor included as standard.

■ Option

PA-001-1318 Multi-I/O cable (Used for external sweep control and external sequence control)

PA-001-2342 LAN interface (Factory Option)

PA-001-2592 Rack Mount Kit (JIS, for 1 Unit)

PA-001-2593 Rack Mount Kit (JIS, for 2 Units)

PA-001-2594 Rack Mount Kit (EIA, for 1 Unit)

PA-001-2595 Rack Mount Kit (EIA, for 2 Units)

Related products : Choose the Best Product for your Application WAVE FACTORY family

Multifunction Generator WF1947/WF1948

1CH

WF1947

2CH

WF1948

- Frequency setting range : 0.01μHz to 30MHz
- Amplitude resolution : 16-bit
- Output waveform :
  Sine wave, square wave, pulse wave, ramp wave, noise (Gaussian distribution), DC, arbitrary waveform
- Internal/external modulation :
  FM, FSK, PM, PSK, AM, DC offset, PWM

Multifunction Generator WF1973/ WF1974

1CH

WF1973

2CH

WF1974

- Frequency setting range : 0.01μHz to 30MHz
- Amplitude resolution : 14-bit
- Output waveform :
  Sine wave, square wave, pulse wave, ramp wave, noise (Gaussian distribution), DC, arbitrary waveform
- Parameter-variable waveform : 25 types
- Internal/external modulation :
  FM, FSK, PM, PSK, AM, DC offset, PWM
- Sequence function

Note: Briefly lists the main differences in these products' specifications, but there are other additional differences in their functions and performance. Be sure to check a detailed catalog or specifications for further information.

Note : The contents of this catalog are current as of September 27, 2019
- Products appearance and specifications are subject to change without notice.
- Before purchase contact us to confirm the latest specifications, price and delivery date.

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