SPECIFICATIONS

Unless otherwise spesified, the value assumes the following conditions:continuous oscillation, load of 50 Ω, oscillation setting of 10 Vp-p / 50 Ω, DC offset setting of 0 V, auto range, waveform amplitude range of ±FS, external addition turned off, AC voltage is the rms value.

*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

Frequency and Phase

Frequency setting range

Oscillation mode /Function / Waveform	Continuous, modulation, sweep (continuous and single)	Sweep (gated single), burst, sequence
Sine	0 to 60 MHz	0 to 20 MHz
Square	0 to 30 MHz	0 to 20 MHz
Pulse	0 to 30 MHz	0 to 20 MHz (not available for sequence)
Ramp	0 to 10 MHz	
Parameter-variable	0 to 5 MHz	
Noise	Noise Equivalent bandwidth: Select from FULL / 30 M / 10 M / 3 M / 1 M / 300 k / 100 kHz	
DC	Frequency setting is invalid	
Arbitrary	0 to 15 MHz (Limited by number of samples and sampling rate)	

Frequency setting resolution	0.01 μHz (< 50 MHz), 0.1 μHz (50 MHz ≤)
Frequency setting with a period	Setting with frequency that is inverse number of set period. (less than 0.01 μHz is rounded half up)
Frequency accuracy at shipping time*1	±(1 ppm of setting + 4 pHz)
Frequency aging rate*1	±1 ppm / 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	0 Vp-p to 21 Vp-p / open, 0 Vp-p to 10.5 Vp-p / 50 Ω AC+DC ≤ ±10.5 V / open or less
Setting resolution	2.9999 Vp-p or less : 0.1 mVp-p / open 3.000 Vp-p or more : 1 mVp-p / open
Accuracy*1	±(1 % of amplitude setting [Vp-p] + 2 mVp-p) / open (1 kHz sine, amplitude setting 20 mVp-p or greater)
Setting unit	Vp-p, Vpk, Vrms, dBV, dBm
Range	Auto or hold selectable
Resolution of waveform amplitude	Approx. 16 bit (8 mVp-p or greater / open)

DC offset

Setting range	±10.5 V / open, ±5.25 V / 50 Ω
Setting resolution	-2.9999 V to 2.9999 V : 0.1 mV / open -3.000 V or less, 3.000 V or more : 1 mV / open
Accuracy*1	±(l 1 % of DC offset setting [V] l +5 mV +0.5 % of amplitude setting [Vp-p]) / open (10 MHz or less, sine, 20°C to 30°C)

Waveform output（Main-output） <FCTN OUT>

Output on/off control	Switchable (output terminal is released when output off.)
Output impedance	50 Ω, unbalanced
Signal GND	Insulated from enclosure

Synchronization / Sub-output <SYNC / SUB OUT>

Output signals	Reference phase synchronization, sequence step synchronization, internal modulation synchronization, burst synchronization, sweep synchronization, sub-waveform, internal modulation signal, and off selectable
Sub-waveform	Analog waveform output independent of the mainoutput. Phase, amplitude and offset are adjustable. Available waveform : sine, square (duty 50%), ramp (symmetry 50%), rising ramp, falling ramp, noise and arbitrary waveform. Frequency setting range : 0 to 5 MHz (resolution 0.01 μHz)
Internal modulation waveform	Modulation waveform at the internal modulation. Amplitude and offset are adjustable independent from the modulation depth.
Output voltage	Each type of synchronized signal : TTL level (low level 0.4 V or less, high level 2.7 V or more / open) Sub-waveform / internal modulation waveform : -3.3 V to +3.3 V / open
Output impedance	50 Ω, unbalanced

Signal Characteristics

Sine wave

Amplitude frequency characteristics*1	Up to 100 kHz : ±0.1 dB 100 kHz to 5 MHz : ±0.15 dB 5 MHz to 20 MHz : ±0.3 dB 20 MHz to 30 MHz : ±0.5 dB 30 MHz to 60 MHz : ±0.7 dB (50 mVp-p to 10 Vp-p / 50 Ω, reference frequency 1 kHz)
Total harmonic distortion	10 Hz to 20 kHz: 0.03 % or less (2 Vp-p / 50 Ω, sum up to 7th harmonic,noise is not included)
Harmonic spurious	Up to 1 MHz : –65 dBc or less typ. Up to 10 MHz : –60 dBc or less typ. 10 MHz to 60 MHz : –60 dBc + 20 dB / dec or less typ. (2 Vp-p / 50 Ω, Synchronization / Sub-output off)
Non-harmonic spurious	Up to 10 MHz : –70 dBc or less typ. 10 MHz to 60 MHz : –65 dBc or less typ. (2 Vp-p / 50 Ω, Synchronization / Sub-output off)

Square wave

Duty variable	Normal : setting range 0.0001 % to 99.9999 % (resolution 0.0001 %, Limited by frequency) Jitter 40 ps rms or less typ. (100 Hz or more) Extended : setting range 0.0000 % to 100.0000 % (resolution 0.0001 %) Jitter 1.3 ns rms or less typ.
Duty accuracy*1	Up to 100 kHz : ±0.1 % of period (duty setting 1 % to 99 %) 100 kHz to 1 MHz : ±1 % of period (duty setting 5 % to 95 %) 1 MHz to 3 MHz : ± 3% of period (duty setting 40 % to 60 %)
Rising / Falling time	8.0 ns or less, continuous oscillation mode only
Overshoot	2 % or less typ.

Pulse wave

Selectable edge waveform	Pulse transition part can be selected from cosine, straight line, parameter-variable waveform, and arbitrary waveform
Pulse width*2	Duty setting range : 0.0001 % to 99.9999 % (resolution 0.0001 %) Time setting range : 20 ns to 99.9999 Ms (resolution 0.0001 % or less or 0.01 ns)
Rising / Falling time*2	Setting range : 7.70 ns to 59.03 Ms (resolution 4 digits or 0.01 ns) Rising / Falling time independently set Minimum setting value : 0.0001 % of period or 7.70 ns, whichever is larger
Overshoot*2	2 % or less typ.
Jitter*2	40 ps rms or less typ. (100 Hz or more) 1.3 ns rms or less typ. (100 Hz less)

*2 Cosine in the edge waveform

Ramp wave

Setting range of symmetry	Setting range of symmetry : 0.00 % to 100.00 % (resolution 0.01 %)

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,double pulse, half-sine edge pulse and bottom referenced ramp
Use of waveform	Can be used after converted into arbitrary waveform with sequence function

Arbitrary waveform

Waveform length	Number of control points 2 to 10,000 or 16 Mi to 64 Mi words (Conrol points are linearly interpolated)
Total amount of saved waveforms	Approximately 4 Gi words (shared by all channels).
Resolution of waveform data amplitude	16 bit
Sampling rate	0 to 240 MS/s Resolution : 16 digits or 100 nS/s

Modulation

Modulation type	FM, FSK, PM, PSK, AM, DC offset modulation and PWM PM and PSK are not available for parameter-variable waveform and arbitrary waveform
Modulation source	Internal / external selectable
Simultaneous Burst/Sweep Modulation Operation	Modulation (limited) available in burst and sweep oscillation modes

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 %)
Frequency	0 to 5 MHz (resolution 0.01 µHz)
Waveform output	Output voltage : -3.3 V to +3.3 V / open. Output connector : Shared with synchronization / sub-output connector

External modulation

Input	Other than FSK, PSK	Input voltage range : ±1 V full scale Maximum allowable input : ±2 V Input impedance : 10 kΩ, unbalanced Input frequency : DC to 50 kHz (-3 dB) Input connector : BNC receptacle (MOD / ADD IN)
	FSK, PSK	Polarity : Positive / Negative selectable, Frequency : DC to 5 MHz Input connector : BNC receptacle (TRIG IN)

Modulation types and conditions

FM	Carrier waveform : standard waveform except for noise, pulse wave and DC, arbitrary waveform. Peak deviation : 0.00 µHz to less than 30 MHz (resolution 8 digits or 0.01 µHz).
FSK	Carrier waveform : standard waveform except for noise, pulse wave and DC, arbitrary waveform. Hop frequency : within the allowable range of frequency for each carrier waveform (resolution 8 digits or 0.01 µHz).
PM	Carrier waveform : standard waveform except for noise and DC, arbitrary waveform and parameter-vaviable waveform Peak deviation : 0.000 ° to 180.000 ° (resolution 0.001 °)
PSK	Carrier waveform : standard waveform except for noise and DC, arbitrary waveform and paramete-vaviable waveform Deviation : -1800.000 ° to +1800.000 ° (resolution 0.001 °)
AM	Carrier waveform : standard waveform except for DC, arbi trarywaveform Modulation depth : 0.00 % to 100.00 % (resolution 0.01%) (DSB-SC and Non-DSB-SC available)
DC offset modulation	Carrier waveform : standard waveform and arbitrary waveform Peak deviation : 0V to 10.5 V / open Setting resolution : 4 digits or 0.1 mV (3 mV or less), 5 digits or 1 mV (3 V or more).
PWM	Carrier waveform : square wave and pulse wave Peak deviation : square 0.0000 % to 49.9999 % (resolution 0.0001 %) pulse 0.0000 % to 49.9000 % (resolution 0.0001 %)

Sweep

Sweep types	Frequency, phase, amplitude, DC offset and duty. Phase and duty are not available for arbitrary waveforms and parameter-variable waveforms.
Sweep function	One way (ramp) / shuttle (triangular) selectable Linear / logarithmic (frequency only) selectable
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.
Setting range of sweep time	0.1 ms to 10,000 s (resolution 5 digits or 10 µs)
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	Usable for single-shot sweep and gated single-shot sweep Internal / external input terminal selecatble (CH2 can select from the same trigger source as CH1) Triger delay setting is invalid. Manual trigger is available.
Internal trigger	Usable for single-shot sweep and gated single-shot sweep Period setting range : 0.1 µs to 10,000 s (res 7 digits or 2.5 ns)
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 external control input (multi input / output connector) Sweep external trigger input (external trigger input terminal)
Use of modulation function	Modulation other than sweep type is simultaneously available

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 gete : 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) or unlimited
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 oscillation start/stop phase when the stop level is set to off.
Trigger source	Internal / external selectable Manual trigger available, Used except for auto burst
Internal trigger for burst	Period setting range: 0.1 µs to 10,000 s (resolution 7 digits or 2.5 ns) Available except for auto burst
External trigger for burst	Positive / negative / disabled selectable Input connector : External trigger input terminal. Available except for auto burst
Trigger delay	Setting range : 0.00 ns to 1.000 s (res 8 digits or 100 ps) Additional delay : 0.48 µs Valid in the trigger burst only, valid in the internal and external trigger source
Trigger jitter	300 ps rms or less typ.
Use of modulation function	Modulation can use simultaneously with the burst oscillation. FSK nad PSK can be selected in auto burst mode only

Trigger

External trigger input	Available for single-shot sweep, gated single-shot sweep, trigger burst, gate, triggered gate, sequence and synclator function.
Input voltage	TTL level (low : 0.8 V or lower, high : 2.6 V or higher)
Maximum allowable input	-7 V to +7 V
Minimum pulse width	50 ns
Input impedance	10 kΩ (pull up to +3 V), unbalanced
Input connector	BNC receptacle (TRIG IN)
Manual trigger	Available 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	30 Hz × m to 5 MHz / n (m : division ratio, n : multiplication ratio)
Output frequency range	30 Hz to 5 MHz
Division ratio m and multiplication ratio n Setting range	1 to 64 (m and n each)
Synchronization target	External trigger input terminal (TRIG IN) Trigger delay setting is disabled.
Phase difference	The phase difference between the signal input 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 each steps	Waveform, frequency, phase, amplitude, DC offset and square wave duty
Available waveforms	Sine, square, noise DC and arbitrary waveform (the ramp and parameter-variable waveforms can be used after being saved as arbitrary waveform)
Maximum number of waveforms	1023
Number of saving sequences	99 (saved in the built-in non volatile memory)
Number of steps	Up to 1023 steps per sequence
Step time	0.1 ms to 1,000 s (resolution 5 digits or 0.01 ms)
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.
Step end control	Stop or go to next step

2-Channel Ganged Operation (WF1984 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.
Frequency difference setting range	0.00 µHz to less than 60 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*1	±20 ns or less*1 (±10 ns or less typ.) Same waveform (sine or square)

Other Input/Output

External 10 MHz frequency reference input

Input voltage	0.5 Vp-p to 5 Vp-p
Maximum allowable input	10 Vp-p
Input impedance	300 Ω, unbalanced, AC coupled
Input frequency	10 MHz (±0.5 % : ±50 kHz)
Input waveform	Sine or square (50 % ±5 % duty)
Input connector	BNC receptacle (10 MHz REF IN)

Frequency reference output (for synchronized multiple units)

Output voltage	1 Vp-p / 50 Ω square
Output impedance	50 Ω, AC coupled
Output frequency	10 MHz
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 0.8 Vp-p (x0.4), 4 Vp-p (x2) and 20 Vp-p (x10). Unavailable during external modulation
Input voltage	-1 V to +1 V
Maximum allowable input	±2 V
Input frequency	DC to 10 MHz (-3dB)
Input impedance	10 kΩ, unbalanced
Input connector	BNC receptacle (MOD / ADD IN)

Multi-I/O

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

Other Functions

Phase synchronization		Function to restart from the phase where the output waveforms for all the channels are set.
Synchronization of multiple units		Up to 6 units can be connected 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, [log10(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
Limit function for upper and lower limit of set value		Function : upper and lower limits of setting. not apply to external addition. Setting target : Frequency, positive and negative peak of output voltage (amplitude setting [Vp-p] ÷ 2 + DC offset setting [V]), phase, duty Setting range and resolution : According to the setting range of each setting target
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 the power was turned off, the contents of setting memory No.1) output on/off setting, sequence auto run setting
External control interface		GPIB : IEEE-488.1 / IEEE-488.2 USB : USBTMC, USB 2.0 Full-speed LAN : TCP / IP, 10 / 100 Base-T

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 42 Vpk(DC + ACpeak)
Power supply	AC100 V to 240 V 50 Hz / 60 Hz ±2 Hz
Power consumption	WF1983 : 50 VA or lower. WF1984 : 75 VA lower
Overvoltage category	II
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)
Pollution degree	2
Place to install	Indoor use
Dimensions (mm)	215(W) × 88(H) × 306(D) (not including protrusions)
Weight	Approx. 1.8 kg (main unit excluding accessories)
Accessories	•Safety information sheet •Simple instruction manual • Power code set (2 m with 3-prong plug)

*Note: The contents of this catalog are current as of Aug 21th, 2023.
Product 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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