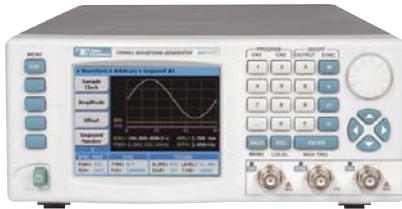




40 Years  
Celebration



## MODELS WW1071/2

### 100MS/s Single/Dual Channel Arbitrary Waveform Generators

- Single / Dual Channel 100MS/s waveform generator
- 1M standard waveform memory (2M/4M option)
- Sine waves to 50MHz, Square to 30MHz
- SINE OUT to 100MHz, 1Vp-p
- 11 Built-in popular standard waveforms
- 10Vp-p into 50Ω, double into high impedance
- 14 Bit amplitude resolution
- 11 digits frequency resolution (limited by 1μHz)
- AM, FM, Arbitrary FM, FSK, Ramped FSK modulation
- Comprehensive memory management
- Linear and Logarithmic Sweep
- 1 ppm clock accuracy and stability
- User friendly and menu driven 3.8" color LCD display
- LAN, USB and GPIB interfaces
- Multi-Instrument synchronization
- ArbConnection software for easy waveform creation

The WW1071/2 represents a new dimension in arbitrary waveform generator design. With an unprecedented combination of arbitrary generator and synthesizer, versatility, high resolution and wide frequency range, and outstanding performance-to-price ratio, the WW1071/2 delivers diverse benefits that will facilitate tasks in many fields.

#### **100MS/s Sample Rate**

New technology requirements are driving communications systems to use increasingly narrow channel widths. A high sample rate of 100MS/s makes the WW1071/2 an ideal modulation source for troubleshooting new encoding schemes. The WW1071/2 also provides high-speed waveforms to simulate signal distortion, video signals, component failures, and power supply line cycle dropouts and transients.

#### **High Performance**

Each channel of the WW1071/2 delivers precise waveforms with 14 bits of amplitude resolution and up to 14 digits of frequency resolution from remote with extremely low phase noise. Exceptional

electrical performance includes up to 10Vp-p into 50Ω over the full frequency range. Selectable filters ensure clean stimulus waveforms enabling the generator to simulate modulation waveforms.

#### **14 Bit Resolution**

The 14-bit resolution provides 16,384 output levels. This means that even audio waveforms can be generated with excellent fidelity. It also allows video and other complex waveforms to be generated with small details superimposed on large signals, in order to test the response of receiving systems.

#### **Function Generator**

When used as a simple function generator the instrument offers ten basic waveforms with adjustable parameters all of which are accessible from the front panel. These are sine, triangle, square, pulse, ramp, sinc, Gaussian, exponential (up and down), noise, as well as DC. Sine and square waves can be generated at up to 50MHz.

#### **Up to 4M Waveform Memory**

The WW1071/2 offers 1M word memory standard and 2M or 4M word optional for arbitrary waveforms. In addition, the memory can be divided into as many as 2048 segments, which can be looped and linked in many different ways. Using 4M word at 100MS/s to generate a video signal, for example, the duration is 0.04 seconds, 25Hz, even without any looping of repetitive elements.

#### **Sequence Generator**

When the sequencing facilities are employed, the WW1071/2's uniqueness is obvious. The memory segments can be linked and repeated in any combination both manually and under programmed control. This allows test software to switch between many different waveforms rapidly without the need to download multiple times, enhancing test throughput in a way that is unmatched by competing products. The sequence generator has four advanced modes: automatic, stepped, single and mixed, which make it even a more powerful tool.

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## **High-Quality Modulation Signal Source**

One of the many attractive features of the WW1071/2 is the sample clock modulation function. In ordinary arbitrary waveform generators, to make a frequency modulated sine wave you have to enter the complete mathematical function. Not so with the WW1071/2: all that is necessary is generating the carrier signal, and then modulating the clock to obtain the required result. The sample clock modulation can be done using internal waveforms such as sine, square, triangle, and ramp or using downloaded arbitrary modulating waveforms. This allows you to generate signals that would be difficult or impossible to define using an equation. AM, Linear and Logarithmic Sweeps, FSK and Ramped FSK are available as well.

## **Triggering Facilities**

However versatile the waveform generation systems are made, the need for external control of generation is vital. The triggering facilities of the WW1071/2 match the generation functions in versatility. In the simplest mode, signals are output continuously. The WW1071/2 also offers the triggered mode, gated mode, external burst mode, and internal burst mode, all of which can use an external trigger signal or an internal trigger. The use of external sources to prompt the switching of segments has already been mentioned.

## **Inter-Channel Phase Control (WW1072)**

In the WW1072, both channels share a common sample clock, and both channels are triggered from the same source assuring tightly synchronized channel-to-channel timing. Precise control over channel-to-channel phase offset is achieved by allowing control over channel start phase with a resolution down to as small as 1 waveform point. This enables extremely accurate timing or phase dependencies to be studied, such as those found in high speed digital communication systems.

## **Easy to use**

Large and user-friendly 3.8" back-lit color LCD display facilitates browsing through menus, updating parameters and displaying detailed and critical information for your waveform output. Combined with numeric keypad, cursor position control and a dial, the front panel controls simplify the often complex operation of an arbitrary waveform generator.

## **High Speed Access**

Access speed is an increasingly important requirement for test systems. Included with the instrument is a variety of interfaces: LAN, USB and GPIB so one may select the interface most compatible to individual requirements. Using any of the external interfaces, controlling instrument functions and features as well as downloading waveforms and sequences is fast, time saving and easily tailored to every system regardless if it is just a laptop to instrument or full-featured ATE system. IVI drivers and factory support will speed up system integration thus minimizing time-to-market and reduce system development costs significantly.

## **Multiple Environments to Write Your Code**

Model WW1071/2 comes with a complete set of drivers, allowing you to write your application in various environments such as: Labview, CVI, C++, VB and MATLAB. You may also link the supplied dll to other Windows based API's or, use low level SCPI commands (Standard Commands for Programmable Instruments) to program the instrument, regardless if your application is written for Windows, Linux or Macintosh operating systems.

## **Multi-Instrument Synchronization**

Multiple WW1071/2s can be synchronized using a Master-Slave arrangement allowing users to benefit from the same high quality performance in their multi-channels needs.

## **ArbConnection**

ArbConnection is a graphical tool that provides an unlimited source of Arbitrary Waveforms. With the ArbConnection software you can control instruments functions, modes and features. You can also create a virtually infinite amount of test waveforms. Freehand sketch allows you to draw your own custom waveform for quick analysis of analog signals. You can use the built-in equation editor to create your own exotic functions. Add or subtract components of a Fourier series to characterize digital or analog filters or inject random noise into a signal to test immunity to auxiliary noise.

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## Specification

### CHANNELS

**No. of Channels:** 1/2, semi-independent

### STANDARD WAVEFORMS

**Waveforms:** Sine, Triangle, Square, Pulse, Ramp, Sine(x)/x, Gaussian, Exponential, Repetitive Noise, DC.

**Frequency Range:**

Sine 100µHz to 50MHz  
Square, Pulse 100µHz to 30MHz  
All others 100µHz to 15MHz

### SINE

**Start Phase:** 0 to 360°

**Phase Resolution:** 0.1°

**Harmonics Distortion, 3Vp-p (typ.):**

DC to 2.5MHz <-55dBc  
2.5MHz to 25MHz <-40dBc  
25MHz to 40MHz <-35dBc  
40MHz to 50MHz <-22dBc

**Non-Harmonic Distortion (typ.):**

DC to 15MHz <-70dBc  
15MHz to 50MHz <-60dBc

**Total Harmonic Distortion:**

DC to 100kHz 0.1%

**Flatness (1kHz):**

DC to 1MHz 1%  
1MHz to 25MHz 5%  
25MHz to 50MHz 20%

**Phase Noise (8 points Sine, Max. SCLK)**

100Hz Offset <-103dBc/Hz  
1kHz Offset <-110dBc/Hz  
10kHz Offset <-118dBc/Hz  
100kHz Offset <-124dBc/Hz  
1MHz Offset <-135dBc/Hz

### TRIANGLE, RAMP

**Start Phase:** 0 to 360°

**Phase Resolution:** 0.1°

**Timing Ranges:** 0%-99.9% of period

### SQUARE, PULSE

**Duty cycle:** 1% to 99%  
**Timing Ranges:** 0%-99.9% of period  
**Rise/Fall time:** <8ns  
**Aberration:** <5%

### SINC (SINE(x)/x)

**“0” Crossing:** 4 to 100 cycles

### GAUSSIAN PULSE

**Time Constant:** 1 to 200

### EXPONENTIAL FALL/RISING PULSE

**Time Constant:** -100 to 100

### DC

**Range:** -5V to 5V

### DIGITAL PULSE GENERATOR OPTION

**Pulse Mode:** Single or double, programmable  
**Polarity:** Normal, inverted, complement  
**Period:** 40ns to 1000s  
**Resolution:** 10ns  
**Pulse Width:** 20ns to 1000s  
**Rise/Fall Time:**  
Fast <6ns (typ.)  
Linear 10ns to 1000s

**High Time, Delay &**

**Double Pulse Delay:** 10ns to 1000s

**Amplitude Window:** 10mVp-p to 10Vp-p<sup>(1)</sup>

Low Level -5V to +4.995V<sup>(1)</sup>  
High Level -4.995V to +5V<sup>(1)</sup>

<sup>(1)</sup>Double into high impedance

### NOTES:

- All pulse parameters, except rise and fall times, may be freely programmed within the selected pulse period provided that the ratio between the period and the smallest incremental unit does not exceed the ratio of 1,000,000 to 1. With the 2M option, the ratio is extended to 2,000,000 to 1, hence the specifications below do not show maximum limit as each must be computed from the above relationship.
- Rise and fall times, may be freely programmed provided that the ratio between the rise/fall time and the smallest incremental unit does not exceed the ratio of 100,000 to 1.
- The sum of all pulse parameters must not exceed the pulse period setting

### ARBITRARY WAVEFORMS

**Sample Rate:** 100mS/s to 100MS/s

**Vertical Resolution:** 14 Bits

**Waveform Memory:** 1M points standard, 2M/4M option (per channel)

**Min. Segment Size:** 16 points

**Resolution:** 4 points

**No. of Segments:** 1 to 2k

### SEQUENCED ARBITRARY WAVEFORMS

**Operation:** Permits division of the memory bank into smaller segments. Segments may be linked, and repeated in user-selectable fashion to generate extremely long waveforms.

**Sequencer steps:** 1 to 2k

**Min. Seg. Duration:** 1µs

**Segment loops:** 1 to 1M

### ADVANCE MODES

**Automatic:** No triggers required to step from one segment to the next. Sequence is repeated continuously through a pre-programmed sequence table.

**Stepped:** Current segment is sampled continuously, external trigger advances to next programmed segment.

**Single:** Current segment is sampled to the end of the segment including repeats and idles there. Next trigger advances to next segment.

**Mixed:** Each step of a sequence can be programmed to advance either: a) automatic (Automatic mode), or b) with a trigger (Stepped mode)

**Advance Source:** External (TRIG IN), Internal or software

### MODULATION

#### COMMON CHARACTERISTICS

**Carrier Waveform:** Sine, Triangle, Square, Pulse, Ramp, Sine(x)/x, Gaussian, Exponential, Repetitive Noise, DC and Arb

**Carrier SCLK:** 100mS/s to 100MS/s

**Carrier Frequency:** Waveform dependent

**Resolution:** 12 digits, limited by 1µHz

**Accuracy:** 0.1%

**Freq. Distortion:** <0.1%

**Modulation Source:**

Internal FM, Arbitrary FM, Sweep  
External AM, FSK

#### FM

**Modulating Shape:** Sine, Square, Triangle / Ramp

**Modulation Freq.:** 1mHz to 100kHz

**Deviation Range:** 100mS/s to 50MS/s

#### ARBITRARY FM

**Modulating Shape:** Arbitrary waveform, 10 to 20000 waveform points

**Modulating SCLK:** 1mS/s to 2MS/s

**Deviation Range:** 100mS/s to 50MS/s

#### AM

**Envelope Freq.:** 1µHz to 500kHz

**Sensitivity:** 0V to +5V (5Vp-p)

**Modulation Depth:** 0% to 100%

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## Specification

### FSK

<b>Type:</b>	Hop or Ramp
<b>Low level:</b>	Carrier sample clock
<b>High level:</b>	Hop frequency
<b>Baud Rate Range:</b>	1bits/sec to 10Mbits/sec
<b>Min. FSK Delay:</b>	1 waveform cycle + 50ns
<b>Ramp FSK:</b>	
Time	10µs to 1s
Resolution	3 digits

### SWEEP

<b>Sweep Time:</b>	1ms to 1000s
<b>Sweep Step:</b>	Linear, Logarithmic or Arb
<b>Sweep Direction:</b>	Up or down

### COMMON CHARACTERISTICS

#### FREQUENCY

<b>Resolution:</b>	
Display	11 digits (limited by 1µHz)
Remote	14 digits (limited by 1µHz)
<b>Accuracy/Stability:</b>	Same as reference

#### ACCURACY REFERENCE CLOCK

Internal	0.0001% (1ppm TCXO) initial tolerance over a 19°C to 29°C temperature range; 1ppm/°C below 19°C and above 29°C; 1ppm/year aging rate
External	10MHz TTL, 50% duty cycle

#### AMPLITUDE

<b>Range:</b>	10mV to 10Vp-p, into 50Ω; Double into open circuit
<b>Resolution:</b>	4 digits
<b>Accuracy (1kHz):</b>	
100mV to 1Vp-p	±(1% + 5mV)
1Vp-p to 10Vp-p	±(1% + 25mV)

#### OFFSET

<b>Range:</b>	0 to ±4.5V
<b>Resolution:</b>	2.2 mV
<b>Accuracy:</b>	1%

#### FILTERS

<b>Type:</b>	25MHz / 50MHz Elliptic
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#### OUTPUTS

##### MAIN OUTPUTS

<b>Coupling:</b>	DC coupled
<b>Connector:</b>	Front panel BNC
<b>Impedance:</b>	50Ω, ±1%
<b>Protection:</b>	Protected against temporary short to case ground

### SYNC/MARKER OUTPUT

<b>Connector:</b>	Front panel BNC
<b>Impedance:</b>	50Ω, ±1%
<b>Level:</b>	>2V into 50Ω, 4V into 10kΩ
<b>Validators:</b>	BIT, LCOM
<b>Protection:</b>	Protected against temporary short to case ground
<b>Position:</b>	Point 0 to n
<b>Width:</b>	4 to 100000 points
<b>Resolution:</b>	4 points
<b>Source:</b>	Channel 1

### SAMPLE CLOCK OUTPUT

<b>Connector:</b>	Rear panel SMB
<b>Level:</b>	ECL
<b>Impedance:</b>	50Ω, terminated to -2V

### SINEWAVE OUTPUT

<b>Connector:</b>	Rear panel BNC
<b>Impedance:</b>	50Ω, ±1%
<b>Level:</b>	1V into 50Ω
<b>Protection:</b>	Protected against temporary short to case ground
<b>Source:</b>	Sample clock frequency
<b>Frequency Range:</b>	100mHz to 100MHz
<b>Resolution:</b>	Same as Sample clock
<b>THD:</b>	0.05% to 100kHz
<b>SFDR:</b>	<-30dBc to 100MHz

### INPUTS

#### TRIGGER INPUT

<b>Connector:</b>	Rear panel BNC
<b>Input Impedance:</b>	10kΩ, ±5%
<b>Polarity:</b>	Positive or negative
<b>Threshold Level:</b>	TTL
<b>Min. Pulse Width:</b>	20ns

#### EXTERNAL REFERENCE INPUT

<b>Connector:</b>	Rear panel BNC
<b>Frequency:</b>	10MHz
<b>Impedance &amp; Level:</b>	10kΩ ±5%, TTL, 50% ±5%

#### AM INPUT

<b>Modulation Input:</b>	Rear panel BNC
<b>Impedance:</b>	1MΩ, ±5%
<b>Max. Input Voltage:</b>	12V

#### SAMPLE CLOCK INPUT

<b>Connector:</b>	Rear panel SMB
<b>Input Level:</b>	ECL
<b>Impedance:</b>	50Ω, terminated to -2V
<b>Range:</b>	100mHz to 100MHz
<b>Min. Pulse Width:</b>	4 ns

### SYNCHRONIZATION CONNECTOR

<b>Connector:</b>	Rear panel 9-pin D-SUB
<b>SYNC Cable:</b>	Optional, consult factory at the time of purchase

### RUN MODES

<b>Continuous:</b>	Free-run output of a waveform Upon trigger, outputs one waveform cycle. Last cycle always completed
<b>Triggered:</b>	External signal enables generator. First output cycle synchronous with the active slope of the triggering signal. Last cycle of output waveform always completed
<b>Gated:</b>	Upon trigger, outputs a single or multiple pre-programmed number of waveform cycles from 1 through 1M
<b>Burst:</b>	External signal enables generator. First output cycle synchronous with the active slope of the triggering signal. Last cycle of output waveform always completed

### TRIGGER CHARACTERISTICS

<b>System Delay:</b>	1 Sample Clock + 150ns
<b>Trigger Start, Stop &amp; Phase Control:</b>	0 to 1M (2M/4M optional)
<b>Resolution:</b>	4 points
<b>Breakpoint Error:</b>	±4 points
<b>Breakpoint Source:</b>	External, Manual, or command

### EXTERNAL

<b>Connector:</b>	Rear panel BNC
<b>Level:</b>	TTL
<b>Slope:</b>	Positive or negative
<b>Frequency:</b>	DC to 2MHz
<b>Impedance:</b>	10kΩ, DC coupled

### INTERNAL

<b>Range:</b>	100mHz to 2MHz
<b>Resolution:</b>	14 digits, limited by 1µHz
<b>Accuracy:</b>	0.1%

### MANUAL

<b>Source:</b>	Soft trigger command from the front panel or remote
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### INTER-CHANNEL DEPENDENCY (WW1072)

**Separate controls:** Output on/off, amplitude, AM, offset, standard waveforms, user waveforms, waveform size, sequence table, channel 2 clock divider, trigger start phase, breakpoints

**Common Controls:** SCLK, frequency, reference source, trigger and sequence advance mode, SYNC OUT, FM, FSK, sweep and arm

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## Specification

### PHASE OFFSET (LEADING EDGE)

**Range:** 0 to 1M points (2M/4M optional)  
**Resolution/Accuracy:** 1 point, or 1 SCLK of CH. 2  
**Initial Skew:**  $<\pm 2\text{ns}$ , with sclk divider = 1;  
 $<\pm 3\text{ns}$ , with sclk divider > 1

### CHANNEL 2 SAMPLE CLOCK DIVIDER

**Range:** 1 to 65,535 points  
**Resolution:** 1 point

### MULTI-INSTRUMENT SYNCHRONIZATION

#### PHASE OFFSET (LEADING EDGE)

**Range:** 0 to 1M points (2M/4M optional)  
**Resolution:** 4 point  
**Initial Skew:**  $<\pm 15\text{ns}$ , depending on cable length and quality, typically with 0.5 meter coax cables

### GENERAL

**Voltage Range:** 85 to 265V  
**Frequency Range:** 48 to 63Hz  
**Power Consumption:** 60W max  
**Display Type:** Color LCD, back-lit  
Size: 3.8" reflective  
Resolution: 320 x 240 pixels,  
**Interfaces:**  
USB Device: 1 x rear, USB device, (A type)  
LAN: 100/10 BASE-T  
GPIB: IEEE 488.2 standard interface  
**Dimensions:**  
With Feet: 212 x 102 x 415mm (WxHxD)  
Without Feet: 212 x 88 x 415mm (WxHxD)  
**Weight:**  
Without Package: 3.5Kg  
Shipping Weight: 4Kg  
**Temperature:**  
Operating: 0 - 50°C  
Storage: -40°C to + 70°C.  
**Humidity:**  
11°C to 30°C: 85%;  
31°C to 50°C: 75%  
**Safety:** EN61010-1, 2nd revision  
**Calibration:** 1 year  
**Warranty <sup>(1)</sup>:** 5 years standard

### ORDERING INFORMATION

MODEL	DESCRIPTION
WW1071	100MS/s Single Channel Arbitrary Waveform Generator
WW1072	100MS/s Dual Channel Arbitrary Waveform Generator

### OPTIONS

<b>Option 1:</b>	2M Memory (per channel)
<b>Option 2:</b>	4M Memory (per channel)

### ACCESSORIES

<b>Sync Cable:</b>	Multi-instrument synchronization
<b>S-Rack Mount:</b>	19" Single Rack Mounting Kit
<b>D-Rack Mount:</b>	19" Dual Rack Mounting Kit
<b>Case Kit:</b>	Professional Carrying Bag

**Note:** Options and Accessories must be specified at the time of your purchase.

<sup>(1)</sup> Standard warranty in India is 1 year.