

# 100MS/s Four-Channel Arbitrary Waveform / Function Generator

TABOR'S NEW

WW

WONDER WAVE SERIES

NEW

## MODEL WW1074



- Four-channel 100 MS/s waveform generator
- Sine and Square waves generated to 50MHz
- 16 Bit amplitude resolution
- 1M waveform memory, 2M/4M waveform memory, optional
- 10 Separate sequences link and loop segments in user-definable order
- Four separate SYNC outputs for independent channel synchronization
- 10 Vpp into 50Ω, double into open circuit
- Multiple run modes including trigger, re-trigger and trigger delay
- (n)PSK and (n)QAM modulation
- High resolution 3.8" LCD, color display
- Ethernet 10/100, USB 2.0 and GPIB interfaces
- Multi-Instrument synchronization
- ArbConnection software for easy waveform creation&control

The Model 1074, is a four-channel universal waveform synthesizer. It is built in a small case size to save space and cost but without compromising bandwidth and signal integrity. The instrument outputs either standard or user-defined waveforms in the range of 700 μHz to 50 MHz. 16-bit DAC's are used for building waveforms with excellent accuracy and resolution which are suitable for the finest test signals that are needed for today's sensitive instruments. Using the latest technology, you can be assured that the features and capabilities of the Model 1074 will be useful for many years.

### Signal Integrity

As technology is evolving and new devices are developed every day, faster signals are needed to simulate and stimulate these new devices. The 1074 provides the highest bandwidth in its class and hence providing accurate duplication and simulation of test signals. With its wide range of sample clock generator (up to 100 MS/s), 16-bit vertical resolution and wide output bandwidth (over 50 MHz), one can create mathematical

profiles, download the coordinates to the instrument and re-generate waveforms without compromising their fidelity and compatibility to the original design.

### Four Synchronized Channels

The 1074 has four output channels, which are all synchronized to the same reference clock and share the same sample clock. This is not a limitation because the output frequency is a function of the number of points which are used for creating the waveform shape. On the other hand, the advantage of having four synchronized channels is huge in applications that require accurate and controlled phase between channels. Many applications require XY drive so two channels is just what is needed however, for three phase power simulation and four channel MEMS micro engine actuators, the Model 1074 is the most suitable product to use.

### High Speed Function Generator

Care to use the instrument as a function generator? No need to fuss with loading complex waveform coordinates because the

1074 does the work for you. Select the standard waveforms tab and start generating any one from the ten waveforms that are pre-computed and available for immediate use. Included are: sine, triangle, square, pulse, ramp, sinc and others. Remember, however, that waveforms are created from sampling waveform points and therefore some of the waveforms cannot be generated above certain frequencies where the number of points are insufficient to draw a perfect shape. Regardless, using some trick, the 1074 will generate standard sine and square waveforms up to 50 MHz.

### Stable and Accurate Output Signals

As standard, the instrument is equipped with a frequency reference that has 1ppm accuracy and stability over a period of 1 year. An external frequency reference is provided on the rear panel for applications requiring greater accuracy and stability.

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Since 1971

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### **Waveform Memory and Memory Segmentation**

Waveform memory is the internal "black board" where the waveforms are created and reside. Large memory bank provides for longer waveforms. One can use the entire memory for a single waveform or split the length to smaller segments. In this case, many waveforms can be stored in the same memory and replayed, one-at-a-time, when recalled to the output. The memory segmentation is combined with a sequence generator that can take different memory segments and link (and loop) them in any order as required for the test. The ability to loop waveform segments in a sequence saves a lot of memory space and hence, extends the capability of the generator to produce complex and much longer waveforms, which would otherwise require large banks of memory. The 1074 has four sequence generators that can be designed to generate unique sequences for each of its output channels.

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

Model 1074 comes with a complete set of drivers, allowing you to write your application in various environments such as: Labview, CVI, C++, VB, 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.

### **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 simplifies the often complex operation of an arbitrary waveform generator.

### **Remote Control**

Access speed is an increasingly important requirement for test systems. Included with the instrument is a variety of interfaces: Ethernet, USB and GPIB so one may select the most suitable interface for the application. Remote control of instrument functions, parameters and waveform download is easily tailored to specific system environment regardless if it is just a laptop to instrument or full-featured ATE system. IVI drivers and factory support will speed up system integration and hence minimize time-to-market as well as significantly reduce system development costs.

### **Multi-Instrument Synchronization**

Multiple 1074 can be synchronized using a Master-Slave arrangement allowing users to benefit from the same high quality performance in their multi-channels system.

### **Remote Calibration**

Normal calibration cycles in the industry range from one to three years where instruments are sent to a service center, opened to allow access to trimmers, calibrated and certified for repeated usage. Leading-edge technology was implemented to allow calibration from any interface, USB, GPIB or LAN. Calibration factors are stored in a flash memory thus eliminating the need to open instrument covers.

### **MODULAR**

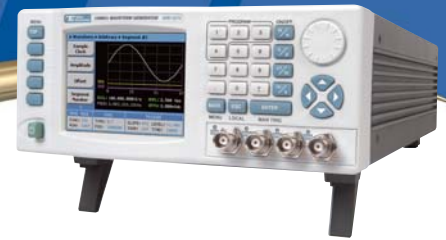
Tabor's MODULAR software package supplies wireless design and manufacturing engineers with virtually all their test stimulus needs at baseband or IF/RF levels, whether required signals are analog or digital. With none of the limitations of traditional generators, Tabor's Wonder Wave Series allow any signal, simple or composed, clean or noisy, ideal or impaired, to be downloaded and played back.

### **ArbConnection**

The ArbConnection software provides you with full control of instrument functions, modes and features. ArbConnection is a powerful editorial tool that allows you to easily design any type of waveform. Whether it is the built in wave, pulse or Serial data composers, or the built in equation editor with which you can create your own exotic functions, with ArbConnection virtually any application is possible.

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### Service and Support

Beyond providing precision Test & Measurement instruments, Tabor Electronics provides unparalleled service and support, and is continuously finding new ways to bring added value to its customers.

Our after-sales services are comprehensive. They include all types of repair and calibration, and a single point of contact that you can turn to whenever you need assistance. As part of our extensive support, we offer individualized, personal attention Help Desk, both online and offline, via e-mail, phone or fax.

Tabor Electronics maintains a complete repair and calibration lab as well as a standards laboratory in Israel and USA. Service is also available at regional authorized repair/calibration facilities.

Contact Tabor Electronics for the address of service facilities nearest you.

### Applications

For expert technical assistance with your specific needs and objectives, contact your local sales representative or our in-house applications engineers.

### Manuals, Drivers, and Software Support

Every instrument comes equipped with a dedicated manual, developer libraries, I/O drivers, and software. However, if your specific manual is lost or outdated, Tabor Electronics makes it possible to log-on to its Download Center and get the latest data "in a click".

### Product Demonstrations

If your application requires that you evaluate an instrument before you purchase it, a hands-on demonstration can be arranged by contacting your local Tabor Electronics representative or the Sales Department at our Corporate Headquarters.

### Five-year Warranty

Every instrument from the Wonder Wave series comes with a five-year warranty. Each one has full test results, calibration certificate, and CD containing product's manual and complete software package. Our obligation under this warranty is to repair or replace any instrument or part thereof which, within five years after shipment, proves defective upon examination. To exercise this warranty, write or call your local Tabor representative, or contact Tabor Headquarters and you will be given prompt assistance and shipping instructions.

# Specification 100MS/s Four-Channel Arbitrary Waveform / Function Generator

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### CONFIGURATION

**Output Channels** 4, semi-independent

### INTER-CHANNEL CONTROL

#### LEADING EDGE OFFSET

**Description:** Channel 1 used as start reference channel 2, 3 and 4 can be offset by a programmable number of points. Channels 3&4 must have the same duration in one of the following run modes: Triggered, Burst, or gated.

**Jitter Between Channels:** 0 ps

**Offset Range:** 0 to  $\pm 1$ M points (2M/4M option), each CH. in reference to CH 1

**Resolution and Accuracy:** 1 point, channel 1/2; 4 points, channels 3/4

**Initial Skew:**  $\pm 1$  (SCLK +1 ns) between channels; 1 ns between channels 3 and 4.

### INTER-CHANNEL DEPENDENCY

**Separate controls:** Output on/off, amplitude, offset, standard waveforms, user waveforms, user waveform size, sequence table

**Common Controls:** Sample clock (Arb), frequency (Std), reference source, trigger modes, trigger advance source, SYNC output, Modulation

### STANDARD WAVEFORMS

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

**Frequency Range:** Waveform dependent

**Source:** Internal synthesizer

### SINE

**Frequency Range:** 700 $\mu$ Hz to 50MHz

**Start Phase Range:** 0-360 $^{\circ}$

**Start Phase**

**Resolution:** 0.01 $^{\circ}$

#### Harmonics Distortion:

	$\leq 3$ Vpp	$\leq 5$ Vpp	$\leq 10$ Vpp
DC to 1MHz	-55dBc	-48dBc	-37dBc
1 to 10MHz	-50dBc	-43dBc	-35dBc
10 to 50MHz	-35dBc	-30dBc	-28dBc

#### Non-Harmonic Distortion:

DC to 50MHz -65dBc

#### Total Harmonic Distortion:

DC to 100kHz 0.1%

#### Flatness (1kHz):

DC to 1MHz	1%
1MHz to 10MHz	3%
10MHz to 25MHz	5%
25MHz to 50MHz	10%

#### Phase Noise - Internal SCLK

100Hz Offset	-70dBc/Hz
1kHz Offset	-85dBc/Hz
10kHz Offset	-92dBc/Hz
100kHz Offset	-112dBc/Hz
1MHz Offset	-140dBc/Hz

### TRIANGLE

**Frequency Range:** 700 $\mu$ Hz to 12.5MHz

**Start Phase Range:** 0-360 $^{\circ}$

**Start Phase**

**Resolution:** 0.01 $^{\circ}$

### SQUARE

**Frequency Range:** 700 $\mu$ Hz to 50MHz

**Duty Cycle Range:** 0% to 99.9%

**Rise/Fall Time:** <6ns

**Aberration:** <5%+10mV

### PULSE

**Frequency Range:** 700 $\mu$ Hz to 12.5MHz

**Delay, Rise/Fall Time,**

**High Time Ranges:** 0%-99.9% of period (each independently)

**Rise/Fall Time:** <6ns

**Aberration:** <5%+10mV

### RAMP

**Frequency Range:** 700 $\mu$ Hz to 12.5MHz

**Delay, Rise/Fall**

**Time Ranges:** 0%-99.9% of period (each independently)

### SINC (Sine(x)/x)

**Frequency Range:** 700 $\mu$ Hz to 12.5MHz

**"0 Crossings":** 4-100

### GAUSSIAN

**Frequency Range:** 700 $\mu$ Hz to 12.5MHz

**Time Constant:** 10-200

### EXPONENTIAL PULSE

**Frequency Range:** 700 $\mu$ Hz to 12.5MHz

**Time Constant:** -100 to 100

### REPETITIVE NOISE

**Bandwidth:** 50MHz

### DC

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

### HALF-CYCLE WAVEFORMS

**Function Shape:** Sine, Triangle, Square

**Frequency Range:** 100Hz to 1MHz

**Phase Start Range (Sine/triangle only):** 0 to 360 $^{\circ}$

**Start Phase**

**Resolution:** 0.1 $^{\circ}$

**Run Modes:** Continuous, Triggered

**Delay Between Half Cycles**

**(Continuous only):** 200ns to 20s

Delay Resolution 20ns

### ARBITRARY WAVEFORMS

**Sample Rate:** 1.5S/s to 100MS/s

**Vertical Resolution:** 16 bits

**Waveform Memory:** 1M points (2M/4M optional)

### MEMORY SEGMENTATION

**No. of Segments:** 1 to 10k

**Min. Segment Size:** 16 points

**Resolution:** 4 points size increments from 16 to 1M points (2M/4M optional)

### SEQUENCED WAVEFORMS

**Operation:** Segments may be linked and repeated in a user-selectable order to generate extremely long waveforms. Segments are advanced using either a command or a trigger

### ADVANCE MODES

#### Automatic Sequence

**Advance:** No trigger required to step from one segment to the next. Sequence is repeated continuously per a pre-programmed sequence table.

#### Stepped Sequence

**Advance:** Current segment is sampled continuously until a trigger advances the sequence to the next programmed segment and sample clock rate.

#### Single Sequence

**Advance:** Current segment is sampled the specified number of repetitions and then idles at



# Specification

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### Mixed Sequence

**Advance:** Each step of a sequence can be programmed to advance either a) automatically (Automatic Sequence Advance), or b) with a trigger (Stepped Sequence Advance).

**Sequencer Steps:** 1 to 4096  
**Segment Loops:** 1 to 1M  
**Min. Seg. Duration:** 600ns  
**Multi Sequence:** 1 to 10, Selectable

### DIGITAL PULSE GENERATOR

**Channel Dependency:** All 4 channels share pulse parameters except level, polarity, delay and state On/Off

**Pulse State:** On/Off  
**Pulse Mode:** Single or double, programmable  
**Polarity:** Normal, inverted or complemented  
**Period:** 160 ns minimum, programmed with 4 ns increments

**Pulse Width:** 6 ns minimum, 1e3 Sec max.  
**Rise/Fall Time:** <6ns  
**High Time:** 0 ns minimum, 1e3 Sec max.  
**Delay:** 0 ns minimum, 1e3 Sec max.  
**Double Pulse Delay:** 0 ns minimum, 1e3 Sec max.  
**Amplitude Window:** 10mVp-p to 10Vp-p  
 Low Level -5V to +4.995V  
 High Level -4.995V to +5V

### 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

### COMMON CHARACTERISTICS

#### FREQUENCY

**Resolution:** 11 digits (limited by 1µHz)  
**Accuracy & Stability:** Same as reference

#### 10MHz REFERENCE CLOCK

Internal 0.0001% (1 ppm 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% ±2% duty cycle

### AMPLITUDE

**Range:** 10mV to 10Vp-p into 50Ω; Double into open circuit  
**Resolution:** 4 digits  
**Accuracy (1kHz):** 10mV to 99mVp-p ±(1% + 5mV)  
 100mV to 999mVp-p ±(1% + 10mV)  
 1V to 10Vp-p ±(1% + 70mV)

### OFFSET

**Range:** 0 to ±4.995V, into 50Ω  
**Resolution:** 1mV  
**Accuracy:** ±(1%+1% of Amplitude +5mV)

### FILTERS

**Type:** 25MHz Bessel  
 50MHz Bessel  
 60MHz Elliptic  
 120MHz Elliptic

### OUTPUTS

#### MAIN OUTPUTS

**Connectors:** Front panel BNC, each channel  
**Impedance:** 50Ω ±1%  
**Protection:** Short Circuit to Case Ground, 10s max  
**Standby:** Output On or Off (Output Disconnected)

#### SYNC OUTPUTS

**Connectors:** Rear panel BNC, separate for each channel.  
**Level:** TTL  
**Sync Type:** Pulse with Arbitrary and Standard Waves; LCOM in Sequence and Burst Modes

#### SAMPLE CLOCK OUTPUT

**Connector:** Rear panel SMB  
**Level:** 400mVp-p  
**Impedance:** 50Ω

#### COUPLE OUTPUT

**Connector:** Rear panel SMB  
**Level:** LVPECL  
**Impedance:** 50Ω, terminated to +1.3V

### INPUTS

#### TRIGGER INPUT

**Connector:** Rear panel BNC  
**Impedance:** 10kΩ  
**Slope:** Positive or Negative (selectable)  
**Programmable Level:** ±5V  
**Sensitivity:** 200mV  
**Damage Level:** ±12V  
**Pulse Width:** >10ns minimum

### EXTERNAL REFERENCE INPUT

**Connector:** Rear panel SMB  
**Frequency:** 10MHz  
**Impedance&Level:** Default 10kΩ ±5%, TTL, 50% ±2% duty cycle  
 Option 50Ω ±5%, 0dBm Sinewave (with internal jumper)

### SAMPLE CLOCK INPUT

**Connector:** Rear panel SMB  
**Input Level:** 300mVp-p to 1Vp-p  
**Impedance:** 50kΩ  
**Minimum Pulse Width:** 4 ns

### COUPLE INPUT

**Connector:** Rear panel SMB  
**Input Level:** LVPECL  
**Impedance:** 50Ω, terminated to +1.3V  
**Minimum Pulse Width:** 4 ns

### MODULATION

**Carrier Waveform:** Sinewave  
**Modulation Source:** Internal  
**Run Modes:** Off (Outputs CW), Continuous, Triggered, Delayed Trigger, Burst, Re-trigger and Gated  
**Advance Source:** Front panel button, Software commands, Rear panel TRIG IN

### (n)PSK and (n)QAM

**Carrier Waveform:** Sine wave  
**Carrier Frequency:** 1Hz to 45MHz  
**Carrier Control:** On/Off  
**Modulation Type:** PSK, BPSK, QPSK, OQPSK, PI/4 DQPSK, 8PSK, 16PSK, 16QAM, 64QAM, 256QAM and User Defined

**Symbol Rate Range:** 1S/s to 1MS/s  
**Carrier Control:** On/Off  
**Symbol Period Accuracy:** ±(500ns + Carrier Period)  
**Table Size:** 2 to 4096

### WIRELESS SIGNAL GENERATION

#### EVM (Error Vector Magnitude)

	0.1 MS/s	1 MS/s	5 MS/s
10 MHz	0.15%	0.30%	1.40%

Test conditions:

Sample Clock Frequency = 100 MS/s  
 Sample Clock = External  
 Modulation = QPSK  
 Baseband Filter = Raised Cosine  
 Alfa = 0,35

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### ACLR (Adjacent Channel Leakage Power Ratio)

	0.1 MS/s	1 MS/s	5 MS/s
10 MHz	73 dB	73 dB	65 dB

#### Test conditions:

Sample Clock Frequency = 100 MS/s  
Sample Clock = External  
BW = Symbol Rate;  
Offset = 1.35 x Symbol Rate

### TRIGGER CHARACTERISTICS

#### EXTERNAL

**Source:** Rear panel BNC  
**Trigger Level:**  $\pm 5V$   
**Resolution:** 1mV  
**Input Frequency:** DC to 5MHz  
**Min. Pulse Width:** >10ns  
**Slope:** Positive/Negative transitions, selectable  
**Trigger Jitter:**  $\pm 1$  sample clock period

#### DELAYS (Trigger input to waveform output)

**System Delay:** 6 sample clock cycles+150ns  
**Trigger Delay:** [(0; 200ns to 20s) + system delay]  
**Trigger Resolution:** 20ns  
**Trigger Delay Error:** 6 sample clock cycles+150ns +5% of setting

#### INTERNAL

**Retrigger Delay:** 200ns to 20s, Waveform end to waveform restart  
**Retrigger Delay Error:** 3 sample clock cycles+20ns +5% of setting  
**Retrigger Delay Resolution:** 20ns

#### MANUAL

**Source:** Soft trigger command through the front panel or external interface

#### GATED MODE

External signal enables generator. First output cyclesynchronous with the active slope of the triggering signal. Last cycle of output waveform always complete

### BURST

**Waveforms:** Sine, Triangle, Square, Pulse, Ramp, Sinc (Sine(x)/x), Gaussian Pulse, Exponential Fall, Rising Pulse, Noise, DC.  
**Counted Burst Cycles:** 1 to 1M, programmable  
**Source:** Manual, Internal or External

### FREQUENCY COUNTER / TIMER

**Measurements:** Frequency, Period, Averaged Period, Pulse Width and Totalize  
**Trigger Input:** 10Hz to 100MHz (typically 120MHz)  
**Source:** 500mVpp  
**Range:** 1ppm  
**Sensitivity:** Positive/Negative transitions  
**Accuray:** 100µSec to 1 Sec  
**Slope:**  $\pm 5V$   
**Gate Time:** Continuous, Hold and Gated  
**Input Range:** Period Averaged  
**Trigger Modes:** Range 10ns to 50ms  
**Period Averaged:** Resolution 7 digits / Sec  
**Period and Pulse Width:** Range 1µSec to 50ms  
**Resolution:** 100ns  
**Totalize:** Range  $2^{32}-1$   
**Overflow:** Led indication

### MULTI-INSTRUMENT SYNCHRONIZATION

**Description:** Multiple instruments can be daisy-chained together and synchronized to provide multi-channel synchronization.  
**Initial Skew:** <15 ns + 1 sample clock cycle, depending on cable length and quality, typically with 1m cables  
**Waveform Types:** Standard, Arbitrary and Sequenced using the automatic sequence advance mode only  
**Run Modes:** Continuous, Triggered, Gated and Counted Burst

### LEADING EDGE OFFSET

**Description:** Leading edge offset is programmable for master and slave units.  
**Run Mode:** Continuous run mode only  
**Offset Range:** 200 ns to 20 s  
**Resolution&Accuracy:** 20 ns

### GENERAL

**Power Supply:** 85 to 265Vac, 48-63 Hz  
**Power Consumption:** 60W  
**Front Panel Display:** Color LCD, 3.8" reflective, 320 x 240 pixels, back-lit  
**Operating temperature:** 0°C - 50°C  
**Humidity (non-condensing):** 11°C - 30°C 85%  
31°C - 40°C 75%  
41°C - 50°C 45%  
**Storage temperature:** -40°C to + 70°C.  
**Interface:** Ethernet 10/100, USB 2.0 and GPIB standard

**Language:** IEEE-488.2 - SCPI - 1993.0  
**Dimensions:** 212 x 88 x 415 mm (WxHxD)  
**Weight:** Approximately 7 lb  
**Safety:** CE marked. Designed to meet VDE 0411/03.81 and UL 1244  
**EMC:** MTBF per MIL-HDBK-217E, 25°C, Ground Benign  
**Reliability:** Conform to IPC-A-610D  
**Workmanship Standards:** Power Cord, USB cable, CD containing Operating Manual, ArbConnection software and developer libraries.  
**Supplied Accessories:** 5 years standard

#### Warranty:

### ORDERING INFORMATION

**MODEL** WW1074  
100MS/s Four-Channel ArbitraryWaveform Generator

#### OPTIONS

**Option 1:** 2 M Memory  
**Option 2:** 4 M Memory

#### ACCESSORIES

**S-Rack mount:** 19" Single Rack Mounting Kit  
**D-Rack mount:** 19" Dual Rack Mounting Kit  
**Case Kit:** Professional Carrying Bag

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