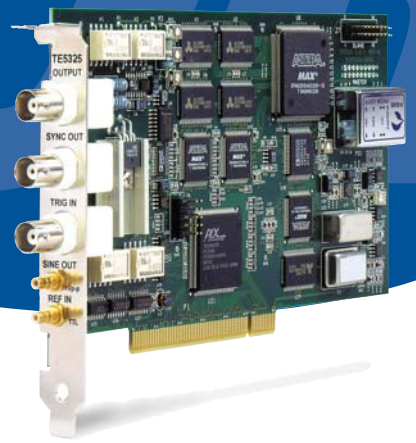
# 50MS/s PCIBus Arbitrary Waveform Generator




# MODEL TE5325

- **Single-channel 50MS/s waveform generator**
- **Multiple instrument synchronization**
- **14 Bit vertical resolution**
- **1 Meg waveform memory**
- **1 ppm clock accuracy and stability**
- **Extensive modulation capabilities AM, FM, Arbitrary FM, FSK, Ramped FSK and Sweep**
- **10 digits sample clock frequency setting, limited by 1µS/s**
- **Waveform sequencing with up to 4096 segments and sequences**
- **Occupies a single PCI slot only**
- **Ultra fast waveform downloads using DMA**
- **Extremely low phase noise carrier**
- **ArbConnection software for easy waveform creation & control**

Model 5325 is a Single-Channel PCI-based Arbitrary Waveform Generator. It is a high performance waveform generator that combines many powerful functions in one small package. Supplied free with the instrument is ArbConnection software, which is used for controlling the 5325 and for generating, editing and downloading waveforms from a remote computer.

**PCIbus: A Cost Effective Format**
The 5325 is a sensible alternative to a GPIB-based waveform generator when developing a PCI-based test system. The 5325 provides a synergistic combination of a function generator, arbitrary waveform synthesizer, programmable sequencer, pulse generator, and modulation generator in one instrument. The 5325 delivers all this at a lower cost than comparable bench-type, or VXI-based instruments. This versatility ensures that the Model 5325 will adapt to future testing needs as well as current ones.

**50 MS/s Sample Rate**
New technology requirements are driving communications systems to use increasingly narrow channel width. A high sample rate of 50 MS/s makes the 5325 an ideal modulation source for troubleshooting new encoding schemes. The 5325 also provides high-speed waveforms to simulate signal distortion, power line cycle dropouts, video signals, component failures and power supply transients.

**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.

**1M Waveform Memory**
The 5325 provides 1M of waveform memory as standard, far more than competitive models. This waveform memory is accessible via a high-speed interface. Also, waveform memory is segmentable, allowing the storage of up to 4096 different waveforms of variable size. This allows test software to switch between many different waveforms rapidly and without having to download multiple times, enhancing test throughput in a way that cannot be duplicated by other competing products.

**Sequences of up to 4096 Waveforms**
Powerful sequencing capability allows linkage of up to 4096 waveform segments and/or bursts (repeated segments) into strings. A segment can be repeated up to 128K times in burst mode. Sequenced functions run continuously or are initiated by a trigger. It is also possible to mix continuous and triggered segments within one sequence. These sequencing features permit the creation of complex waveform or pulse patterns using minimal amounts of memory. Sequences are created by writing a sequence table. Sequence table download is extremely fast because ArbConnection writes to registers and does not require the overhead of an embedded controller.

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# 50MS/s PCIBus Arbitrary Waveform Generator

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**Flexible Triggering Capability**
Combining PCIbus trigger lines with the 5325 sync capability transforms the instrument into an Arbitrary Trigger Generator. In addition to continuous output, the instrument can also wait for a trigger to initiate a single waveform, a burst of waveforms or a sequence of waveforms. Triggers can also be used to advance a sequence of waveforms one segment at a time. The 5325 accepts the trigger s for multiple sources: eight backplane trigger lines plus STAR trigger, front panel trigger input, and manual commands such as *TRG

**Sample Clock Agility**
The Model 5325 has outstanding low phase noise characteristics and carrier stability. Such characteristics are very much needed for telecommunication and channel separation applications. On the other hand, the output of the 5325 can be made extremely agile for applications needing sweep, FSK and FM. The sample clock of the instrument is derived from a DDS (Direct Digital Synthesis) circuit so controlling instantaneous frequency is a matter of changing its input bits. You, as a user, should not really care how it is done but the end result is magnificent: functions like wide-band FM, wander, linear and logarithmic sweep are easily created and executed by the generator. A unique and extremely useful feature of ArbConnection is the FM Composer. The FM composer screen looks very much like the Wave Composer screen except the "Y" axis is given in units of frequency, so waveforms you create using the FM composer generate frequency change over time. You can create any arbitrary waveform shape or even use the equation editor to generate exotic shapes which eventually you can use to frequency modulate your main output.

**Arbitrary Waveforms**
The last but not least is flexibility of the 5325 as an Arbitrary Waveform Generator. Combined with the power of ArbConnection, there is no limit to what you can create and generate. Waveform coordinates can be imported from a variety of sources such as MathLab, ASCII files etc. Anything you can show on one of the composer screens is downloaded in a split of a second and generated by the main output. Place 2 or more Model 5325`s in a chassis and harness the power of multi-instrument synchronization to create multiple, phase-controlled output channels. Then vary module-to-module phase offsets to create multi-phase signal source. Really exciting!

**ArbConnection**
Unlimited Source of Arbitrary Waveforms. With the ArbConnection software you can control instruments functions, modes and features. You can also create virtually an unlimited variety 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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**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, IVI 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.

**Three-year Warranty**
Every Tabor Electronics instrument comes with a three-year warrantee. 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 three 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 50MS/s PCIBus Arbitrary Waveform Generator

# Model TE5325



## STANDARD WAVEFORMS

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

**Frequency Range:** Waveform dependent
**Source:** Internal synthesizer

### SINE

**Frequency Range:** 100µHz to 25MHz
**Band Flatness:** 5% to 10MHz; 20%, to 25MHz
**Programmable Parameters:** Start phase, 0 to 360°
**Harmonics and non-related spurious:** at 5Vp-p < -55dBc for carrie frequencies 1MHz
< -45dBc for carrier frequencies 5MHz
< -35dBc for carrier frequencies 10MHz
**Total Harmonic Distortion:** 0.05% to 100kHz

### TRIANGLE

**Frequency Range:** 100µHz to 6.25MHz
**Start phase:** 0 to 360°C

### SQUARE

**Frequency Range:** 100µHz to 25MHz
**Duty cycle:** 1% to 99%
**Rise/Fall time:** <10ns
**Aberration:** <5% ±10mV

### PULSE

**Frequency Range:** 100µHz to 6.25MHz
**Adjustable Parameters:**
- Delay 0% to 99.9% of period
- Rise Time 0% to 99.9% of period
- High Time 0% to 99.9% of period
- Fall Time 0% to 99.9% of period

**Rise/Fall time:** <10ns
**Aberration:** <5% ±10mV

### RAMP

**Frequency Range:** 100µHz to 6.25MHz
**Adjustable Parameters:**
- Delay 0% to 99.9% of period
- Rise Time 0% to 99.9% of period
- Fall Time 0% to 99.9% of period

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

**Frequency Range:** 100µHz to 3.125MHz
**"0" Crossing:** 4 to 100 cycles

### GAUSSIAN PULSE

**Frequency Range:** 100µHz to 3.125MHz
**Time Constant:** 10 to 200

### EXPONENTIAL FALL/RISING PULSE

**Frequency Range:** 100µHz to 3.125MHz
**Time Constant:** -20 to 20

### REPETITIVE NOISE

**Bandwidth:** 25MHz

### DC

**Range:** -100% to 100% of amplitude

## ARBITRARY WAVEFORMS

### SAMPLE CLOCK

**Range:** 100mS/s to 50MS/s
**Vertical Resolution:** 14bits
**Waveform Memory:** 1M points standard
**Download Rate:** 5M points per second

### MEMORY SEGMENTATION

**No. of Segments:** 1 to 4096
**Min Segment Size:** 16 points
**Memory Interleave:** 4 (All trace lengths must be multiples of 4)

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

**Stepped Sequence Advance:** Current segment is sampled continuously, external trigger advances to next programmed segment. Control input is TRIG IN connector.

**Single Sequence Advance:** Current segment is sampled to the end of the segment including repeats and idles there. Next trigger advances to next segment. Control input is TRIG IN connector.

**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)
**Advance Source:** External, Internal or software trigger
**Sequencer steps:** From 1 to 4096
**Segment loops:** From 1 to 128k

## COMMON CHARACTERISTICS

### MAIN OUTPUT

**Connector:** Front panel BNC
**Stand-by:** Output Off or Normal
**Impedance:** 50Ω, ±1%
**Protection:** Protected against temporary short to case ground

### FREQUENCY

**Resolution:** 10 digits limited by 1S/s
**Accuracy:** 1ppm
**Stability:** 1ppm

### REFERENCE

**Standard:** 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% ±2% duty cycle

### AMPLITUDE

**Range:** 100mV to 10Vp-p, into 50Ω; Double into open circuit
**Resolution:** 4 digits

# Specification 50MS/s PCIBus Arbitrary Waveform Generator

# Model TE5325



### ACCURACY(1kHZ)

| | |
|---|---|
| 1V to 10Vp-p | ±(1% + 10mV) |
| 100mV to 999.9mVp-p | ±(1% + 1mV) |

### OFFSET

| | |
|---|---|
| **Range:** | 0 to ±4.5V, amplitude dependent |
| **Resolution:** | 2.2mV |

### ACCURACY

| | |
|---|---|
| 4V window: | ±(1% of reading + 1% of amplitude + 2mV) |
| 400mV window: | ±(1% of reading + 1% of amplitude + 200V) |

| | |
|---|---|
| **FILTERS** | 50MHz Elliptic<br>25MHz Elliptic |

### SYNC/MARKER OUTPUT

| | |
|---|---|
| **Outputs:** | Front panel SYNC Output BNC connector |
| **Impedance:** | 50Ω, ±1% |
| **Level:** | >2V into 50Ω, 4V nominal into 10kΩ |
| **Protection:** | Protected against temporary short to case ground |
| **Validators:** | BIT, LCOM |
| **Position:** | Point 0 to n, Programmable with 4-point resolution |
| **Width Control:** | Programmable |
| Range: | 4 to 100000 waveform points |
| Resolution: | 4 points |
| **Source:** | Main output |

### SINEWAVE OUTPUT

| | |
|---|---|
| **Connector:** | Front panel SMB |
| **Impedance:** | 50Ω, ±1% |
| **Level:** | 1V into 50Ω |
| **Protection:** | Protected against temporary short to case ground |
| **Source:** | Sample clock frequency |
| **Frequency Range and Resolution:** | Same as Sample clock |
| **Flatness:** | -3dB at 100MHz |
| **Total Harmonic Distortion:** | 0.3% to 100kHz |
| **Harmonics and non-related spurious:** | -55dBc to 1MHz<br>-45dBc to 10MHz<br>-35dBc to 50MHz |

### INPUTS

#### TRIG Input

| | |
|---|---|
| **Connector:** | Front panel BNC |
| **Impedance:** | 10kΩ, ±5% |
| **Threshold Level:** | TTL |
| **Min Pulse Width:** | 20ns |
| **Slope:** | Positive or negative going edge. |

#### 10 MHz REFERENCE INPUT

| | |
|---|---|
| **Connector:** | Front panel SMB |
| **Impedance:** | 10kΩ, ±5% |
| **Threshold Level:** | TTL |
| **Duty Cycle:** | 50%, ±5% |

## MODULATION

### FM

| | |
|---|---|
| **Waveform Modulation:** | Sine, Triangle, Square, Pulse, Ramp, Sinc (Sine(x)/x), Gaussian Pulse, Exponential Fall, Rising Pulse, Noise, DC, Arb |
| **Source:** | Internal |
| **Resolution:** | 10 digits |
| **Accuracy:** | 0.1% |
| **Modulating Frequency Distortion:** | <0.1% |
| **Deviation Range:** | 100mS/s to 50MS/s |
| **Trigger Advanced Mode:** | Automatic, Triggered, Gated or Software Command |
| **Marker** | |
| Output & Level: | Same as SYNC output. |
| Position: | Fixed at carrier frequency |

#### FM - BUILT-IN STANDARD WAVEFORMS

| | |
|---|---|
| **Carrier Waveforms:** | Sine, Square, Triangle and Ramp |
| **Modulation Frequency Range:** | 1 mHz to 100 kHz |

#### FM - DOWNLOADED ARBITRARY WAVEFORMS

| | |
|---|---|
| **Modulation Source:** | User waveform, any shape, 10 to 20000 waveform points |
| **Modulation sample clock Range:** | 1mS/s to 2MS/s |
| **Download Rate:** | 5M points per second |

### FSK

| | |
|---|---|
| **Carrier Sample Clock Range:** | 100mS/s to 25MS/s |
| **Source:** | External, Front panel Trigger input BNC.<br>Low level Carrier sample clock<br>High level Hop frequency |
| **Frequency Range:** | From 10MHz to DC |
| **FSK Delay:** | Minimum 1 waveform cycle + 50ns |

### RAMPED FSK

| | |
|---|---|
| **Ramp Time Range:** | 10s to 1s, 3 digits, ±0.1% |

### Sweep

| | |
|---|---|
| **Carrier Waveforms:** | Sine, Square, Triangle, Ramp, Arb |
| **Type:** | Linear or Logarithmic |
| **Direction:** | Up or down, depending on the start and stop setting |
| **Sweep Time:** | 1ms to 1000 s, 7 digits, ±0.1% |
| **Range:** | 100mS/s to 50MS/s |
| **Trigger Advanced Mode:** | Automatic, Triggered, Gated or Software Command |
| **Marker** | |
| Output & Level: | Same as SYNC output. |
| Position: | Programmable for selected frequency |

## TRIGGERING CHARACTERISTICS

### TRIGGER SOURCES

#### EXTERNAL

| | |
|---|---|
| **Connector:** | Front panel BNC |
| **Level:** | TTL |
| **Slope:** | Positive or negative |
| **Frequency:** | DC to 5MHz |
| **Impedance:** | 10kΩ, DC coupled |

#### INTERNAL

| | |
|---|---|
| **Range:** | 100mHz to 2MHz |
| **Resolution:** | 7 digits |
| **Accuracy:** | 0.01% |

| | |
|---|---|
| **Software:** | SCPI command |

# Specification 50MS/s PCIBus Arbitrary Waveform Generator

# Model TE5325



### TRIGGER START PHASE

| | |
|---|---|
| **Description:** | Waveform starts from point n and completes at point n-1. |
| **Range**: | 0 to 1999999 waveform points (1M) |
| **Resolution:** | 4 points |

### START/STOP CONTROL (BREAKPOINT)

| | |
|---|---|
| **Range:** | 0 to 999999 waveform points (1M) |
| **Source:** | External (Rear Panel Trigger Input BNC) or software command |
| **Resolution:** | 4 points |
| **Breakpoint Error:** | ±4 points |

### SYSTEM DELAY

| | |
|---|---|
| **Trigger to waveform output:** | 1 Sample Clock+120ns |

| | |
|---|---|
| **GATED MODE** | External signal enables generator. First output cycle synchronous with the active slope of the triggering signal. Last cycle of output waveform always completed |

### BURST

| | |
|---|---|
| **Waveforms:** | Sine, Triangle, Square, Pulse, Ramp, Sinc (Sine(x)/x), Gaussian Pulse, Exponential Fall, Rising Pulse, Noise, DC, Arb |
| **Number of cycles per burst:** | 1 to 128k |
| **Trigger source:** | Manual, External or Internal |

### MULTI-INSTRUMENT SYNCHRONIZATION

| | |
|---|---|
| **Description** | Multiple instruments can be connected together and synchronized to provide multi-channel synchronization. |

### SAMPLE CLOCK

| | |
|---|---|
| **Source:** | From Master card to slave boards through the local bus |
| **Range and Resolution:** | Same as Sample Clock |
| **Initial Skew:** | <20ns to the first master; 20ns cumulative to additional slaves |
| **Phase Offset Between Instruments:** | Programmable from 0 to n points |

### GENERAL

| | |
|---|---|
| **Power Requirements:** | 10Wmax |
| **Current Consumption:** | +5V - 30mA<br>+12V - 200mA<br>-12V - 200mA<br>+3.3V - 1.4A |
| **Operating temperature:** | 0ºC - 40ºC |
| **Humidity (non-condensing)** | 11ºC to 30ºC: 85 %<br>31ºC to 40ºC: 75 % |
| **Storage temperature:** | -40ºC to + 70ºC. |
| **Dimensions:** | Single width, 3U high |
| **Weight:** | Approx 0.5kg |
| **Safety:** | Designed to meet IEC 1010-1, UL 3111-1, CSA 22.2 #1010 |
| **EMC:** | CE marked. |
| **Reliability:** | MTBF per MIL-HDBK-217E, 25°C, Ground Benign |
| **Workmanship Standards:** | Conform to IPC-A-610D |
| **Supplied Accessories:** | CD containing Operating Manual, ArbConnection software and developer libraries. |
| **Warranty:** | 3 years standard |

### ORDERING INFORMATION

| MODEL | 5325 |
|---|---|
| 50MS/s PCIBus Arbitrary Waveform Generator | |

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