

# TE-5201

## 100 MS/s Arbitrary Waveform Generator

### Features

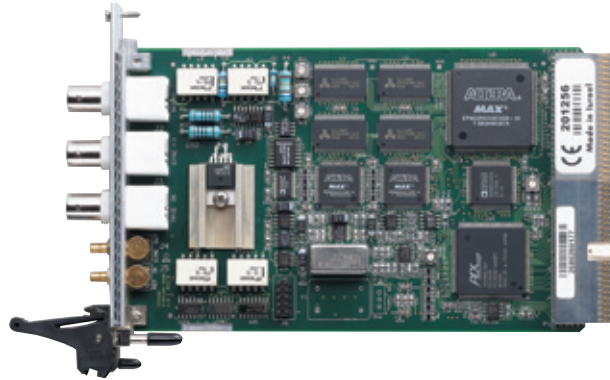
- 100 MS/s clock
- 10 digits resolution
- Multiple instrument synchronization
- 14-bit vertical resolution
- 2 MS memory depth
- Ultra fast waveform downloads using DMA
- Low phase noise carrier
- Internal trigger generation
- Frequency agility: FSK, ramped FSK, sweep, FM
- Sequence generator controls 128 k segments

### Operating Systems

- Windows 98/NT/2000/XP/2003

### Recommended Software

- ARBDetector



### Introduction

The TE-5201 is a 100 MS/s, full performance, arbitrary waveform generator on a 3U PXI form factor. The single channel AWG generates waveforms with up to 2 MS in length. Clock in/clock out connector provides a synchronized platform for up to six plug-in arbitrary generators, as well as for other plug-in instruments. Built in sequencing technology links up to 4096 memory segments and repeats each segment up to 32 k times.

### Specifications

#### Number of Output Channel: 1

#### Multiple 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 & Resolution: Same as Sample Clock range and resolution
- Initial Skew: <15 ns to the first master; 15 ns cumulative to additional slaves
- Sample Clock: Internal
  - Range: 50 S/s to 100 MS/s
  - Resolution: 10 digits limited by 1  $\mu$ Hz
  - Accuracy: Same as reference
  - Stability: Same as reference
    - ♦ Standard  
System clock > 0.01% (100 ppm)
    - ♦ Option  
System clock > 0.0001% (1 ppm TCXO) initial tolerance over a 19 °C to 29 °C temperature range ; 1 ppm/ °C below 19 °C and above 29 °C ; 1 ppm/year aging rate
    - ♦ External  
10 MHz TTL, 50 %  $\pm$  2 % duty cycle

#### Sample Clock Modulation

##### FM

- Description: Sample clock can be frequency modulated by internal waveforms that are resident in internal memory (fixed waveforms)
- Modulation Source: Internal sine square, triangle and ramp
- Modulation Freq. Range: 2 mHz to 100 kHz
  - ♦ Resolution: 10 digits
  - ♦ Accuracy: 0.1 %
- Peak Freq. Deviation: DC 50 MHz

- Advance: Automatic, triggered, gated or software command
- Marker
  - ♦ Output and level same as SYNC output.
  - ♦ Position: Fixed at carrier frequency

#### FM-Downloaded Arbitrary Waveforms

- Description: Sample clock can be frequency modulated arbitrary waveforms that are downloaded by the user (user waveforms)
- Modulation Source: User waveform, any shape, 10 to 20000 waveform points
- Mod. Sample Clock Range: 1 mS/s
  - Resolution: 7 digits
  - Accuracy: 0.1%
- Peak Sample Clock Dev: DC to 100 MHz
- Advance: Automatic, triggered, gated or software command
- Marker:
  - Output and Level: Same as SYNC output
  - Position: Programmable for selected sample clock frequency
- Waveform Download: 5 M points per second.

#### FSK

- Description: Current segment is sampled continuously. External low TTL level programs carrier sample clock, external high TTL level programs shifted sample clock frequency. Sample clock changes coherently between frequencies. FSK operates in arbitrary waveforms only.
- Carrier Sample Clock Range: 50 S/s to 100 MS/s



#### FSK Stimuli

- External: Front panel Trigger input BNC
- Low level =carrier sample clock
- High level =hop frequency
- Frequency: Range From 10 MHz to DC
- Internal: Same as internal trigger range
- FSK Delay: Minimum 1 waveform cycle +50 ns

#### Ramped FSK

- Description: Same as FSK except carrier sample clock ramps to shifted frequency at a rate defined by the ramp time parameter. External low TTL level programs carrier sample clock, external high TTL level programs shifted frequency
- Ramp Time Range 10  $\mu$ s to 1 s, 3 digits,  $\pm$ 0.1 %

#### Sweep

- Description: Sample Clock sweeps continuously from start to stop, at a rate defined by the sweep time. More complex sweep modes and types can be generated using the FM mode in conjunction with the FM composer program
- Type: Linear or logarithmic
- Direction: Up or down, depending on the start and stop setting

- Range: 50 mS/s to 100 MS/s
- Time: 1 ms to 1000 s, 7 digits,  $\pm 0.1\%$
- Advance: Automatic, triggered, gated or software command
- Marker
  - Output and Level: Same as SYNC output.
  - Position: Programmable for selected frequency

## Operating Modes

- Normal: Continuous waveform is generated
- Triggered: Each input cycle generates a single output cycle
- Gated: External signal enables generator. First output cycle synchronous with the active slope of the triggering signal. Last cycle of output waveform always completed
- External Burst: Preset number of up to 128 k cycles stimulated by an internal, or external. This mode is not available in Sequencer mode

## Trigger Sources

- External
  - Input: Front panel BNC
  - Level: TTL
  - Slope Positive or negative, programmable
  - Frequency: 5 MHz to DC
- Internal
  - Range: 100 mHz to 2 MHz
  - Resolution: 7 digits
  - Accuracy: 0.1%
- Backplane: TTL Trig0 through TTL Trig7, STAR
- Software: SCPI command

## System Delay

- Trigger to waveform out: 1 Sample Clock +120 ns

## Standard Waveforms Library

- Waveforms: Sine, Triangle, Square, Pulse, Ramp, Sinc, Gaussian Pulse, Exponential decay/ Rise Pulse, Noise, DC
- Frequency Range: Waveform dependent

## Arbitrary Waveform

- Waveform Memory: 1 M points, 2 M points optional
- Memory Segmentation
  - Number of Segments: 1 to 64 K (128 K with 2 Mb option)
  - Min Segment Size: 16 points
  - Memory Interleave: 4 (All trace lengths must be multiples of 4)
  - Vertical Resolution: 14 bits (16,384 points)
- Sine Wave Performance
 

Sine wave performance is measured using the maximum sample clock rate, at 5 Vpp, the maximum amplitude resolution of the DAC (14-bit) and without filters. Spectrum analyzer settings: Start frequency =0 MHz; stop frequency =50 MHz (Nyquist frequency)
- Sine wave Total Harmonic Distortion: 0.3 % to 1 MHz

- Harmonics and non-related spurious
- Below 10 MHz
  - <-55 dBc for carrier frequencies <1 MHz
  - <-40 dBc for carrier frequencies <5 MHz
  - <-25 dBc for carrier frequencies <25 MHz

## Sequenced Arbitrary Waveform

- Operation: Permits division of the memory bank into smaller segments. Segments may be linked, and repeated in user-configurable 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 soft trigger
- Sequencer steps From: 1 to 4096
- Segment loops From: 1 to 128 k

## Outputs

- Waveform Output
  - Connector: Front panel BNC
  - Stand-by: Output Off or Normal
  - Impedance: 50  $\Omega$ ,  $\pm 1\%$
  - Protection: Protected against temporary short to case ground
  - Amplitude:
    - Range: 80 mVpp to 8 Vpp, at 50  $\Omega$  load; 160 mVpp to 16 Vpp, for open circuit
    - Resolution: 3.5 digits
    - Accuracy (1 kHz):
      - $\pm(1\%+25\text{ mV})$ , 1.000 V to 10 Vpp
      - $\pm(1\%+5\text{ mV})$ , 80 mV to 999.9 mVpp
  - Offset: Offset is attenuated with amplitude
    - Range: 0 to  $\pm 3.6\text{ V}$ , amplitude dependent
    - Resolution: 22 mV
- Accuracy
  - $\pm 4\text{ V}$  window  $\pm(1\%$  of reading +1 % if amplitude +2 mV)
  - $\pm 400\text{ mV}$  window  $\pm(1\%$  of reading +1 % if amplitude +200  $\mu\text{V}$ )
  - Filters: 25 MHz and 50 MHz, 7-pole elliptic

## Square Wave, Pulse

- Rise/Fall time:<10 ns,10 % to 90 % of amplitude
- Aberration: < 5 %

- SYNC/Marker Output
 

Description: Provides dual functionality. All functions and modes, this output generates sync pulse, which is synchronous with the output waveform. In FM and sweep modes only, this output generates a marker having properties similar to the sync pulse output

  - Connector: Front panel BNC
  - Impedance: 50  $\Omega$ ,  $\pm 1\%$
  - Level: > 2 V into 50  $\Omega$ , 4 V nominal into 10 k $\Omega$
  - Protection: Protected against temporary short to case ground
  - Position: Point 0 to n, Programmable with 4-point resolution

## Sine Output

- Description: An output that is directly derived from the sample clock generator and has an output frequency equal to the programmed sample clock frequency. This output generates sine waveforms that corresponds to sample clock setting, including modulated waveform, such as FM, sweep and FSK
- Connector: Front panel SMB
- Impedance: 50  $\Omega$ ,  $\pm 1\%$
- Level: 1 V into 50  $\Omega$
- Protection: Protected against temporary short to case ground
- Source: Sample clock frequency
- Frequency Range and Resolution: Same as Sample clock
- Flatness: -3 dB at 100 MHz
- Total Harmonic Distortion: <40 dBc to 1 MHz
- Harmonics & non-related spurious:
  - <50 dBc to 10 MHz
  - <38 dBc to 100 MHz

## Trigger Input

- Connector: Front panel BNC
- Impedance: 10 k $\Omega$ ,  $\pm 5\%$
- Threshold Level: TTL
- Minimum Pulse Width: 20 ns
- Slope: Positive or negative going edge

## 10 MHz Reference Input

- Connector: Front panel SMB
- Impedance: 10 k $\Omega$ ,  $\pm 5\%$
- Threshold Level: TTL
- Duty Cycle: 50 %,  $\pm 5\%$

## Ordering Information

- TE-5201**  
100 MS/s Arbitrary Waveform Generator

1	Software Solutions
2	PXI/CompactPCI Platforms
3	Modular Instrument
4	PXI/CompactPCI Modules
5	Bus Interface
6	GPIO Interface
7	PCI/PCI Express DAQ Cards
8	PCI/PCI Express DIO Cards
9	PC/104-Plus Modules
10	ISA DAS/DIO Cards
11	System Product
12	Wiring Termination Boards
13	Motion, HSL, Vision, COM & GEME
14	Remote I/O Modules
15	Industrial Computers