



MODELS 52591/2

2.3GS/s Single/Dual Channel PXIBus Arbitrary Waveform Generators

- Single / Dual Channel 2.3GS/s, 14 Bit waveform generator, configurable as fully synchronized channels
- Inter-channel control from -3ns to +3ns with 5ps resolution
- 1GHz sine and 500MHz square waves
- 8M waveform memory, 16/32M memory optional
- 2 Optional output paths:
 - 1.2Vp-p into 50Ω with 1GHz bandwidth, Differential DC output
 - 2Vp-p into 50Ω with 700MHz bandwidth, Differential DC output
- AM, FM, FSK, PSK, ASK, Amp. Hop, Freq. Hop, Sweep & Chirp
- Powerful pulse composer for analog, digital and mixed signals
- Advanced sequencer for step, loop, nest and jumps scenarios
- Smart trigger allows: trigger hold-off, detect \Leftrightarrow pulse width, as well as wait-for-waveform-end or abort waveform and restart
- Multiple sampling modes (NRZ,RZ,RF) for Bandwidth and SFDR optimization
- Two markers with programmable positions and width
- Optional 12-bit fast segments/sequence dynamic jump control
- Multi instrument synchronization to form multi-channel system
- Occupies dual slot only

The 52591/2, 2.3GS/s Single / Dual Channel Arbitrary Waveform Generator, is the world's fastest PXIBased IQ/AWG generator having, by far, the highest benchmarked bandwidth of 1GHz. It offers unrivaled performance, even when compared to instruments designed to generate fewer types of signals or higher sampling rates. Its unique 2-slot width, saves valuable chassis space and cost without compromising bandwidth and signal integrity.

Signal Integrity and Purity

One of the most important requirement in today's testing and measurement applications is high signal quality. With a typical SSB phase noise of $<-115\text{dBc}$ at 100MHz, and $<-95\text{dBc}$ at 1GHz, at 10 kHz carrier offset and with exceptionally good SFDR of $<-70\text{dBc}$ at 1GHz carrier, Tabor's 52591/2 unique platform delivers one of the best quality signals available on the market today, answering the ever-growing demand for clear and precise signals.

Universal Waveform Source

Aside from its natural ability to generate arbitrary shapes with waveform granularity of 1 point, the 52591/2 can also be used as a full-featured standard, modulation or pulse generator to solve various applications. Equipped with 2.3GS/s 14-bit DAC and 8M points (16M/32M optional) memory, the 52591/2 can generate literally any waveform, short or long, at frequencies up to 1GHz with 12 digits of resolution, resulting in the highest precision signal creation and regeneration without compromising signal fidelity or system integrity.

Direct or DC Coupled Outputs

The 52591/2 offers two alternative DC coupled, single or differential ended, output paths. The standard output configuration is a 1.2Vp-p into 50Ω with 1GHz bandwidth for applications demanding optimized transitions and aberrations, whereas the optional 2Vp-p configuration offer 2Vp-p into 50Ω with 700MHz bandwidth, for applications demanding higher voltage.

Common Clocks

The 52592 has two fully synchronized output channels. The advantage of having two synchronized channels with less than 5ps skew and skew control is very significant in applications that require an accurate and controlled phase between the two channels, which is ideal for many X-Y modes and I&Q output applications.

Powerful Segmentation and Sequencing

Solving almost every complex application, powerful segmentation and sequencing produces a nearly endless variety of complex waveforms. The waveform memory can be divided into multiple waveform segments and sequenced in user-selectable fashion to create complex waveforms that have repeatable segments, jump and nest, saving you precious memory space. The 52591/2 also allows you to generate up to 1000 sequence scenarios and sequence between them to generate an even higher level of flexibility in waveform creation.

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Dynamic Segment / Sequence Control

Working in the real-time world and need fast waveform switching? The 52591/2 has an optional add-on slot, front panel control, designed specifically for that. Having the dynamic control feature, in effect, can serve as replacement of the sequence table where the real-time application can decide when and for how long a waveform will be generated. For much more complex applications, this same input may serve as a dynamic switch for complete sequences, creating real-life scenarios for real-time applications.

Pulse / Pattern Creation

Generating complex pulse trains has never been easier. The Pulse Composer is a powerful built-in tool that converts the 52591/2 to a very sophisticated Pulse/Pattern Generator, allowing to create literally any complex pulse train / pattern, whether it's a single pulse, multi-level, linear-points, initialization or preamble pattern definition, user-defined or even standard random patterns with programmable resolution, so it doesn't matter if your application is radar communications, nanotechnology or serial bus testing, the pulse/pattern composer is the right tool for your application. Moreover, all the 52591/2 advanced trigger modes are applicable, hence one can choose to use the "step" mode to advance every bit independently or the "once" mode to advance a complete data block in one trigger event, enabling even more applications, such as trigger, clock and data protocols.

Smart Trigger

Until now, you've been forced to trigger on a specific event. Tabor's all-new SmarTrigger feature was designed to enhance the trigger capability and facilitate wider flexibility of a specific pulse event. It allows triggering on either a pulse having a larger pulse width than a programmed time value (<time), a pulse having a smaller pulse width than a programmed time value (>time), or even on a pulse having a pulse width between two limits (<>time). In addition, the SmarTrigger has a hold-off function, in which the output is held idle after the first trigger and starts a waveform cycle only with the first valid trigger after a hold-off interval has lapsed, allowing you to solve endless "negotiation" scenarios.

Two Programmable Markers

The 52591/2 is equipped with two programmable markers. The programmability allows you to set position and width for any required peripheral triggering need. Alternatively, you can use the markers as digital bits or create multiple markers with different marker properties, allowing various triggering profiles.

Multi-Channel Capability

Need more than two channels to drive your application? Multiple 52591/2 can be synchronized, allowing users to benefit from the same high quality performance even for multi-channel needs.

Multiple Environments to Write Your Code

Model 52591/2 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.

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, ArbConnection makes virtually any application possible.

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Arbitrary Waveform Generators



Specification

CONFIGURATION

Output Channels 1/2, Fully synchronized

STANDARD WAVEFORMS

Type: Sine, triangle, square, ramp, pulse, sin(x)/x, exponential rise, exponential decay, gaussian, noise and DC.

Frequency Range:

Sine 10kHz to 1GHz
Square, Pulse 10kHz to 500MHz
All others 10kHz to 250MHz

SINE

Start Phase: 0 to 360°

Phase Resolution: 0.1°

Harmonics Distortion (typ.):

	1Vpp ^{DC}	2.4Vpp ^{HV}
5MHz to 100MHz	<-44dBc	<-40dBc
200MHz to 375MHz	<-40dBc ⁽¹⁾	<-40dBc ⁽¹⁾
375MHz to 500MHz	<-35dBc ⁽¹⁾	<-35dBc ⁽¹⁾
500MHz to 700MHz	<-32dBc ⁽¹⁾	<-32dBc ⁽¹⁾
700MHz to 1GHz	<-70dBc ⁽¹⁾	<-70dBc ⁽¹⁾

⁽¹⁾ Measured with 1GHz lowpass filter

Non-Harmonics Distortion (typ.):

1MHz to 100MHz	<-80dBc
100MHz to 250MHz	<-75dBc
250MHz to 500MHz	<-70dBc
500MHz to 1GHz	<-65dBc

SSB Phase Noise (10kHz offset):

1MHz Carrier	<-120dBc/Hz
10MHz Carrier	<-118dBc/Hz
100MHz Carrier	<-115dBc/Hz
250MHz Carrier	<-108dBc/Hz
500MHz Carrier	<-100dBc/Hz
1GHz Carrier	<-95dBc/Hz

PULSE

Pulse Mode: Single or double, programmable

Polarity: Normal, inverted or complement

Period: 2ns to 1.6s

Resolution: 500ps

Pulse Width: 1ns to 1.6s

Rise/Fall Time:

Fast
DC Path 600ps (typical < 500ps)
HV Path 1ns (typical < 900ps)
Linear 1ns to 1.6s

Delay: 1ns to 1.6s

Double Pulse Delay: 1ns to 1.6s

Amplitude:

Range
DC Path 50mVp-p to 2Vp-p into 50Ω
HV Path 100mVp-p to 4Vp-p into 50Ω

Levels

Low Level -2V to +1.95V
High Level -1.95V to +2V

NOTES:

1. 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 16,000,000 to 1.
2. 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 1,000,000 to 1.
3. The sum of all pulse parameters must not exceed the pulse period setting.

PULSE / PATTERN COMPOSER

MULTI-LEVEL / LINEAR-POINTS

Number of Levels: 1 to 1000

Dwell Time: 500ps to 10s

Transition type: Fast or Linear

Memory: 100k

Amp. Resolution: 4 digits

Time Resolution: 500ps to 100ns (auto or user)

PATTERN

Pattern Source: PRBS or user-defined

PRBS Type: PRBS7, PRBS9, PRBS11, PRBS15, PRBS23, PRBS31, USER

Data Rate: 10Bit/s to 500MBit/s

Number of Levels: 2, 3, 4, 5

High/Low Levels: ±2.5V

Resolution: 4 digits

Loops: 1 to 1e6

Preamble: 1 to 16e6

Length: 1 to 16e6

ARBITRARY WAVEFORMS

Sample Rate: 1.6GS/s to 2.3GS/s

Vertical Resolution: 14 bits

Waveform Memory: 16M points standard, 32M points optional

Min. Segment Size: 192 points

Resolution: 16 points

No. of Segments: 1 to 16k

Waveform Granularity: 1 point

Dynamic control: Software command or rear panel segment control port

Jump Timing: Coherent or asynchronous

SEQUENCED WAVEFORMS

Multi Sequence: 1 to 1,000 unique scenarios

Sequencer Steps: 1 to 48k steps.

Segment Loops: 1 to 16M cycles, each segment

Sequence Loops: 1 to 1M ("Once" mode only)

Step Advance Modes: Continuous, once (x "N") and stepped

SEQUENCED SEQUENCES

Sequence Scenarios: 1 Scenario

Dynamic Control: Command or dynamic port

Table Length: 1 to 1k steps

Advance Control: Continuous, once and stepped

Sequence Loops: 1 to 1,000,000 cycles

MODULATION

COMMON CHARACTERISTICS

Carrier Waveform: Sine, square, triangle

Carrier Frequency: 10kHz to 1GHz

Modulation Source: Internal

FM

Modulation Shape: Sine, square, triangle, ramp

Modulation Freq.: 100Hz to 100MHz

Deviation Range: 10mHz to 500MHz

FSK / FREQUENCY HOPPING

FSK Baud Rate: 10mbps to 500Mbps

Hop Table Size: 2 to 256

Hop Type: Fast or Linear

Dwell Time Mode: Fixed or programmable per step

Dwell Time: 2ns to 10s

Dwell Time Res.: 2ns

SWEEP / CHIRP

Sweep Type: Linear or log

Sweep Direction: Up or down

Sweep Time: 1.4 μs to 10ms

Modulation Shape: Pulse

Pulse Repetition:

Range 200ns to 20s

Resolution 3 digits

Accuracy 100ppm

AM

Modulation Shape: Sine, square, triangle, ramp

Modulation Freq.: 100Hz to 1MHz

Modulation Depth: 0.1 to 200%

ASK / AMPLITUDE HOPPING

ASK Baud Rate: 10mbps to 500Mbps

Hop Table Size: 2 to 256

Hop Type: Fast or Linear

Dwell Time Mode: Fixed or programmable per step

Dwell Time: 2ns to 10s

Resolution 2ns

(n)PSK and (n)QAM

Modulation Type: PSK, BPSK, QPSK, OQPSK,

PI/4 DQPSK, 8PSK, 16PSK,

16QAM, 64QAM, 256QAM

and User Defined

Symbol Rate Range: 10mbps to 500Mbps

Symbol Accuracy: 1ppm

Table Size: 2 to 256

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COMMON CHARACTERISTICS

FREQUENCY

Resolution: 12 digits
Accuracy/Stability: Same as reference

ACCURACY REFERENCE CLOCK

Internal	1 ppm from 19°C to 29°C; 1 ppm/°C below 19°C or above 29°C; 1 ppm/year aging rate
External	Same as accuracy and stability of the external ref.

OUTPUTS

MAIN OUTPUTS

Type: Single-ended or differential
Connectors: Front panel SMAs
Coupling: DC-coupled
Impedance: 50Ω nominal, each output
Protection: Protected against temporary
short to case ground
Resolution: 4 digits
Accuracy: ±(3% +5 mV), offset = 0V
Overshoot: 5%, typical

DC PATH / DIRECT

Rise/Fall Time: <350ps (typical <300ps)
Amplitude Range:
Single-ended 0.1Vp-p to 1.2Vp-p*
Differential 0.2Vp-p to 2.4Vp-p

HV PATH (OPTION 1)

Rise/Fall Time: <600ps (typical <500ps)
Amplitude Range:
Single-ended 1Vp-p to 2Vp-p*
Differential 2Vp-p to 4Vp-p

* Double into high impedance

OFFSET

Offset Range: -1.0V to +1.0V into 50Ω
Offset Resolution: 4 digits
Offset Accuracy: ±(5% +10mV)

MARKER OUTPUTS

Number of Markers: Two markers
Type: Single-ended outputs
Connectors: SMA
Skew Between Markers: 100ps, typical
Impedance: 50Ω
Amplitude Voltage: TTL
Width control: 2 SCLK to segment length
Position control:
Range 0 to segment length
Resolution 2 points
Initial delay: 4ns±½ clock (Output to marker)

TRIGGER OUTPUT (OPTION 4)

Connector: Front panel SMA
Source: Channel 1 or channel 2
Type: Single ended
Waveform Type:
Pulse 16 points width
WCOM Waveform complete
Programmable Arbitrary pattern
Impedance: 50Ω
Amplitude: 1V; doubles into high impedance
Variable Position Control:
Range 0 to segment length
Resolution 2 points
Rise/Fall Time 1ns, typical
Variable Width control:
Range 16 points to segment length
Resolution 2 points

INPUTS

TRIGGER INPUT

Connector: Front panel SMA
Input Impedance: 10kΩ
Polarity: Positive, negative, or both
Damage Level: ±20Vdc
Frequency Range: 0 to 15MHz
Trigger Level Control:
Range -5V to 5V
Resolution 12 bit (2.5mV)
Accuracy ±(5% of setting + 2.5mV)
Sensitivity 0.2Vp-p
Min. Pulse Width: 10ns

DYNAMIC CONTROL INPUT (OPTION 4)

Connectors: Front panel D-sub, 12 bit lines
Input Control: Segment or Sequence
Input Impedance: 10kΩ
Input Level: TTL

EXTERNAL REFERENCE INPUT (OPTION 4)

Connector: Front panel SMA
Input Frequency: 10MHz to 100MHz
Input Impedance: 50Ω
Voltage Swing: -5dBm to 5dBm
Damage Level: 10dBm

EXTERNAL SAMPLE CLOCK INPUT

Connector: Front panel SMA
Input Impedance: 50Ω
Voltage Swing: 0dBm to 10dBm
Input Frequency: 1.6GHz to 2.3GHz
Damage Level: 15dBm

BACKPLANE TTL0 to TTL3

General TTL0 to TTL3 can be used as Event input, Trigger input or Trigger output
TTL Event Input Used to branch in or out of a sequence loop. Also used for enabling or disabling the output in armed mode.
TTL Trigger Input Used to trigger the instrument from external device
TTL Trigger Output Used to trigger external device

RUN MODES

Continuous: A selected output function shape is output continuously.
Self Armed: No start commands are required to generate waveforms. The output dwells on a DC level and waits for an enable command and then the output waveform is output continuously; An abort command turns off the waveform.
Armed: A trigger signal activates a single-shot or counted burst of output waveforms and then the instrument waits for the next trigger signal.
Triggered: The first trigger signal activates the output; consecutive triggers are ignored for the duration of the output waveform.
Normal Mode The first trigger signal activates the output; consecutive triggers restart the output waveform regardless if the current waveform has been completed or not.
Override Mode: The first trigger signal activates the output; consecutive triggers are ignored for the duration of the output waveform.
Gated: A waveform is output when a gate signal is asserted. The waveform is repeated until the gate signal is de-asserted. Last period is always completed.
Burst: Upon trigger, outputs a Dual or multiple pre-programmed number of waveform cycles from 1 through 1M.

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TRIGGER CHARACTERISTICS

EXTERNAL

Connector:	SMA
Input Impedance:	10k Ω
Polarity:	Positive, negative, or both
Damage Level:	\pm 20Vdc
Frequency Range:	0 to 15MHz
Trigger Level Control:	
Range	-5V to 5V
Resolution	12 bit (2.5mV)
Accuracy	\pm (5% of setting + 2.5mV)
Sensitivity	0.2Vp-p
Pulse Width:	10 ns, minimum
System Delay:	200 SCLK periods + 50ns
Trigger Delay:	
Range	0 to 4,000,000 SCLK periods
Resolution	4 points
Accuracy	Same as SCLK accuracy
Smart Trigger:	Detects a unique pulse width
Conditioned Trigger:	< pulse width, > pulse width or <>pulse width
Pulse Width Range	50ns to 2s
Resolution	2ns
Accuracy	\pm (5% of setting +20ns)
Trigger Hold-off:	Ignores triggers for a hold-off
Hold-off range	100ns to 2s
Resolution	2ns
Accuracy	\pm (5% of setting +20ns)
Trigger jitter:	4 SCLK periods

INTERNAL

Modes:	
Timer	Waveform start to waveform start
Delayed	Waveform stop to waveform start
Timer:	
Range	200ns to 20s
Resolution	3 digits
Accuracy	100ppm
Delay	
Range	80 to 4,000,000 SCLK periods
Resolution	Divisible by 4

MANUAL

Source:	Soft trigger command from the front panel or remote
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INTER-CHANNEL SKEW CONTROL

Initial skew:	200ps
Control:	
Range	-3ns to +3ns
Resolution	5ps
Accuracy:	(10% of setting + 10ps)

MULTI INSTRUMENTS SYNCHRONIZATION

Initial Skew:	10ns + 0 to 8 SCLK
Offset Control:	0 to Waveform length
Offset Resolution:	4 SCLK increments
Skew Control:	-5ns to 5ns
Skew Resolution:	5ps
Clock Source:	Master sample clock generator
Trigger Source:	Master trigger input

GENERAL

Power Consumption:	10W max
Current Consumption:	
+3.3V	TBD max.
+5V	TBD max.
+12V	TBD max.
Interface:	PXIe
Dimensions:	Dual Slot (Option 4 add 1 slot)
Weight:	
Without Package	0.5Kg
Shipping Weight	1Kg
Temperature:	
Operating	0°C - 50°C
Storage	-40°C to + 70°C.
Humidity:	85% RH, non condensing
Safety:	CE Marked, IEC61010-1
EMC:	IEC 61326-1:2006
Calibration:	2 years
Warranty:	3 years standard

ORDERING INFORMATION

MODEL	DESCRIPTION
52591	2.3GS/s Single Channel PXI Arbitrary Waveform Generator
52592	2.3GS/s Dual Channel PXI Arbitrary Waveform Generator

OPTIONS

Option 1:	2Vp-p (BW = 700MHz)
Option 2:	16M Memory (per channel)
Option 3:	32M Memory (per channel)
Option 4:	Additional slot having 12-bit fast dynamic control of segments and sequences and other ports

Note:

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