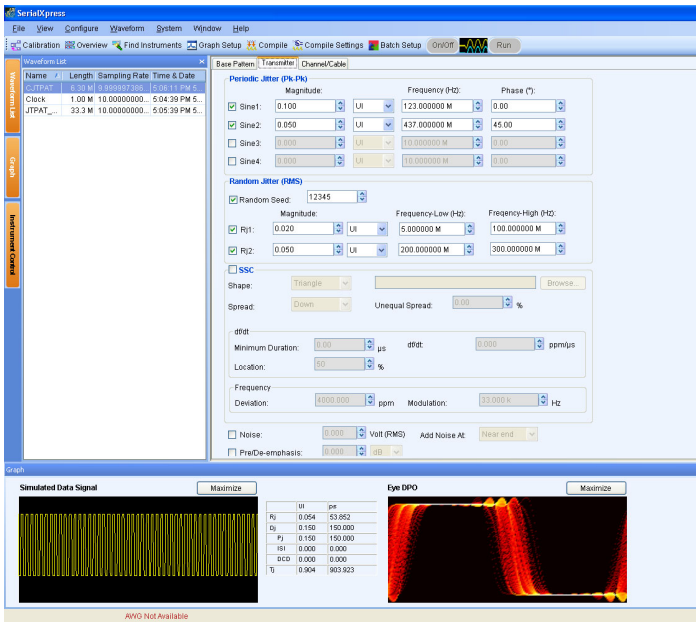
SDX100, SDXUP Data Sheet

SerialXpress® - Advanced Jitter Generation Tool for AWG



Features & Benefits

- **Flexibility**: Jitter generation has become so flexible that the user now has the freedom to try various permutations and combinations of Jitter parameters like Pj, Rj, ISI, Noise, etc.
- **Replicate scenarios**: The signals are digitally synthesized. All AWG setups can be recalled and the scenarios can be replicated on any other AWG within seconds.
- **Analog nature of digital signals**: In reality all digital signals are analog in nature and hence SerialXpress exploits the capabilities of an AWG to generate real-world signals.
- **Ease of use**: It is easy to integrate a multitude of Sj tones into the waveforms at no additional cost. Band-limited Rj can be injected with ease.
- **Simple test setup**: The generation of pre/de-emphasis or arbitrary impairments is a purely numerical process and so is virtually unlimited in the types of signal generation that can be achieved. It also eliminates the need for equipments like power combiners, power dividers, and their associated complexities.
- **Channel emulation through S-parameter filter**: Touchstone files can easily be inserted to simulate the exact behavior of cable emulators, which can be again controlled and modified by adding Jitter and other parameters. You can also tweak the imported touchstone file data to adjust the ISI to see how the receiver responds to those variations. The effect of the channel can also be de-embedded by selecting the Inverse filtering option. Closed EYE can be opened up by adding the right amount of pre-emphasis or by varying the Rise Time.
- **ISI Direct Dial-In**: ISI can be directly dialed-in at ease. It's no longer necessary to use FR4 traces which are inflexible and need frequent calibration when switching from one to another.
- **Supports a wide variety of standards**: SerialXpress supports any emerging standard data rate from 500 Kbps to 8 Gbps when teamed with the appropriate Tektronix AWG.
- **Offline mode**: SerialXpress applications can run on an external PC, thereby reducing the time taken to synthesize large waveforms and leaving the AWG free for continued testing.

Applications

- Design, debug, characterization, and compliance testing of high-speed serial data receivers
- SATA, PCI-E, SAS, DisplayPort, Fibre Channel, HDMI, USB, Receiver Testing

Tektronix®

Jitter Generation Made Easy

SerialXpress is a powerful easy-to-use software package to synthesize high-speed serial data signals, for arbitrary waveform generators (AWG). It runs as an integral part of the AWG7000/AWG7000B and AWG5000/AWG5000B Series arbitrary waveform generators or from an external PC.

SerialXpress enables creation of exact waveforms required for thorough and repeatable design validation, margin/characterization, and conformance testing of high-speed serial data receivers. It considerably simplifies the signal creation and Jitter simulations, thus reducing overall development and test time.

SerialXpress, in addition to supporting generation of Jitter (Random, Periodic (Sinusoidal), Inter Symbol Interference (ISI), and Duty Cycle Distortion (DCD)), also supports Spread Spectrum Clocking (SSC), pre-emphasis, and noise addition. This allows the user to create a combination of various impairments simultaneously to stress the receiver. SerialXpress also allows the waveforms to be captured from Tektronix oscilloscopes and to be replayed using arbitrary waveform generators.

A programmatic interface enables easy integration of SerialXpress into test automation systems.

Jitter Addition

Up to 4 different sinusoidal jitters with different amplitudes, frequencies, and phases can be added to base pattern. Two independent band-limited random jitters can also be added to the base pattern.

SSC Addition

SSC can be added with precisely controlled profile, spread, deviation, modulation, df/dt, and noise. It supports Triangular, Sinusoidal, and Custom SSC profiles, where the custom SSC profile allows you to import your own user-defined profile by literally allowing any kind of shape to be added as SSC to the base pattern. You can also define the exact location and duration of df/dt on the SSC slope.

Pre/De-emphasis and Noise

Many standards such as PCI-E require the output waveform to be pre/de-emphasized. SerialXpress allows easy addition of pre/de-emphasis with all other Jitter parameters. Vertical Noise can also be added at both near and far end of the channel.

ISI Creation

SerialXpress allows creation of ISI in two ways. First, the ISI value can be directly dialed-in. Second, an S-parameter file generated from a Tektronix sampling oscilloscope or a vector network analyzer can be directly convolved with the base pattern to recreate the channel characteristics. By applying inverse filtering the effects of the channel can be de-embedded from the system. Also, ISI within the S-parameter can be scaled upwards or downwards, which will alter the characteristics of the channel.

Base Pattern

SerialXpress is bundled with several sample patterns for various standards like SATA, Display Port, SAS, PCI-E, HDMI, USB, and Fibre Channel. Patterns can also be directly entered in a Binary or HEX editor or loaded as a file.

Idle State

Standards like SATA call for OOB signaling which requires idle state followed by a burst. Now the user can directly create this idle state without the need of using additional power dividers. Noise can also be added to these idle state waveforms.

Calibration

SerialXpress has a built-in calibration routine which controls a Tektronix oscilloscope and calibrates the output of the AWG for Periodic Jitter and Random Jitter thereby reducing the need of time-consuming manual calibration.

Bandwidth Expansion Filter

Rise Time of the AWG can be expanded further by applying the bandwidth expansion filter. For example, when used with AWG7102 with option 06, this compensates for the DAC roll-off at higher frequencies thereby extending the bandwidth up to 9 GHz.

Marker Outputs

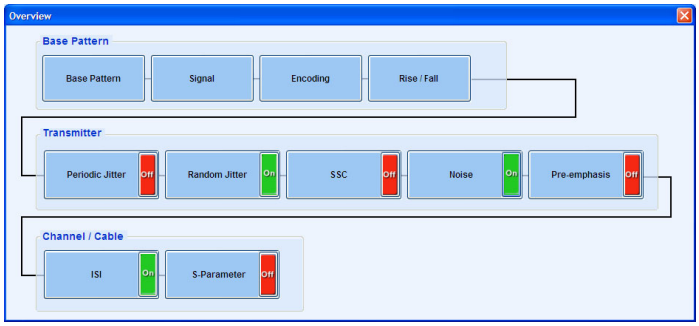
Marker outputs can be configured to be the same as the input base pattern or to generate clocks at a user-defined frequency including subdata rates.

Batch Processing

When more than one pattern needs to be synthesized, you can use batch processing that enables creation of multiple waveforms with a combination of Random Jitter and Sinusoidal Jitter with a maximum of 4 different frequencies.

Overview Window

All the Jitter parameters can be switched ON/OFF from the Overview window.



Overview Window

Characteristics

User Interface – Can reside and run on either Windows XP Professional or Windows Vista.

Instrument Control

Characteristic	Description
Tektronix Arbitrary Waveform Generators	
Controls	SerialXpress® runs on an external PC or an integral part of the AWG7000/AWG7000B and AWG5000/AWG5000B Series. Waveform transfer and control of the AWG5000/B and AWG7000/B Series can be performed directly from SerialXpress.
Analog	Interleave and Zeroing ON/OFF, DAC Resolution, Sampling Frequency, Amplitude, Offset, Run, Stop, and Channel Output ON/OFF.
Digital Markers	Amplitude High, Low, and Delay
Tektronix Oscilloscopes	
Controls	Remote control Tektronix oscilloscope parameters from SerialXpress.
General settings	Run, Stop, Single, and Autoset
Vertical settings	Channel, Scale
Horizontal settings	Scale, Record length, Sampling rate

Compatibility for Import of Waveform/Pattern Files

- Tektronix TDS6000, DSA/DPO70000, and DSA/DPO7000 Series Oscilloscopes.
- Tektronix Data Timing Generators DTG5000 Series

SerialXpress for Jitter Creation

Characteristic	Description
Base Data	
Standard Patterns	
SATA	Idle state, LFTP, MFTP, HFTP, SFCPAlignR12, SFCPAlignR12-badbit, Gen1R12FCP4A, Gen1R25FCP4A, Gen1R10FCP2AnewLBP, Gen1R10FCP2AnewLBPErr, Gen2R8FCP2AnewLBP, Gen2R8FCP2AnewLBPErr, LTDP RD-, LTDP RD+, HTDP RD-, HTDP RD+, LFSCP RD-, LFSCP RD+, SSOP RD-, SSOP RD+, LBP, COMP RD-, COMP RD+
PCIE	Compliance Pattern
SAS	CJTPAT, JTPAT RD+, JTPAT RD-
Display Port	PRBS7, D24.3, D10.2, Frequency Lock, and Symbol Lock
HDMI	480P Gray RGB, 720P Gray RGB, 1080P 8-bit Gray RGB, 1080P 10-bit Gray RGB, 1080P 12-bit Gray RGB
Fibre Channel	JTPAT, CJTPAT, SPAT, CSPAT
USB	minadd1N, minadd1P
General	Clock, PRBS (7, 9, 15, 16, User Defined)
File Input	txt - Binary (1,0) and Symbol (D, K Words)
Pattern Editor	Binary, Hex, Symbol
Data Rate	500 Kbps to 8 Gbps (Direct Synthesis with X3 Oversampling) and 12 Gbps (Binary data with X2 Oversampling)
Encoding	NRZ, NRZI, 8B/10B with starting disparity RD+, RD-
Rise Time	10/90, 20/80 1/sampling rate to 1/data rate
DCD	0 to 1 UI
Periodic Jitter	Up to a maximum of 4 Sinusoidal Jitter
Amplitude	0 to 50 UI
Frequency	10 kHz to data rate / 2
Phase	0 to 360 degrees
Random Jitter	Up to max of 2 (Rj1 and Rj2) with Random seed ON/OFF
Amplitude	0 to 0.5 UI
Frequency	1 Hz to data rate / 2
Idle State	53 nS to 100 µS
SSC	
Shape	Triangle, Sinusoidal, Custom
Spread	Up, Down, Equal, Unequal (0 to 100%)
Df/dt	
df/dt	0 to 5000 ppm/µsec
Minimum Duration	0 to 5 µsec
Location	20% to 80%
Frequency deviation	0 to 200,000 ppm
Frequency modulation	0 to 500 kHz
Noise	0 to 100 ppm
Vertical Noise	0 to 0.5 V_{RMS} with Far end and Near end
Pre-emphasis	0 to 20 dB
ISI Direct Dial-In	0 to 1 UI
S-parameter	
File formats	s1p, s2p, and s4p (single-ended and differential)
ISI scaling	0 to 10
Inverse filter	ON/OFF

Characteristic	Description
Batch Processing	
Random Jitter	0 to 0.5 UI with 0.01 increments
Sinusoidal Jitter	0 to 50 UI with 0.01 increments
Sinusoidal frequency	10 kHz to 1 GHz (max of 4 frequencies)
Bandwidth enhancement filter	ON/OFF
Calibration	Periodic Jitter, Random Jitter
Marker Setting	
Base Pattern	
Clock Frequency	Data rate, data rate / 2, data rate / 4, data rate / 8, user defined (in Hz)
Graphs	DPO EYE
	Normal EYE
	Rise/Fall Time
	Simulated Data
	Random, Periodic, and Total Jitter
	Jitter summary
	TIE Spectrum

System Requirements

The following PC configuration is required to install the offline version:

- PC with genuine Intel Pentium class >1.2 GHz processor recommended
- Intel or 100% compatible motherboard chipset
- Windows XP or Windows Vista Operating System
- 1 Gigabytes (GB) RAM
- 2 GB of available hard disk space for the applications and documentation
- XVGA 1024×768 with 120 dpi font size recommended CD-ROM or DVD drive
- Keyboard and Microsoft mouse or compatible pointing device

Note: The hardware requirements detailed here are the minimum required. Additional processing power and memory will increase the performance of the generation software.

Ordering Information

SerialXpress®

Jitter Generation Software Package for Tektronix AWG7000/B and AWG5000/B.

Includes: USB dongle.

Software Packages and Options

Option	Description
SDX100	Jitter generation software package for AWG7000/B and AWG5000/B (includes USB dongle)
Opt. ISI	S-Parameter and ISI creation option (requires SDX100 as prerequisite)
Opt. SSC	Spread Spectrum Clock addition option (requires SDX100 as prerequisite
Upgrade Options	
SDXUP	Base software upgrade for SDX100
Opt. ISI	Upgrade to include S-Parameter and ISI creation option for SDX100
Opt. SSC	Upgrade to include Spread Spectrum Clock option for SDX100

CE

ISO 9001 Product(s) are manufactured in ISO registered facilities.

GPIB IEEE-488 Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

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www.tektronix.com/signal_generators

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