Data Sheet

Digital Storage Oscilloscope
Model 2194

The 2194 combines performance and value all in one portable solution. This oscilloscope provides 100 MHz of bandwidth in a 4-channel configuration with a maximum sample rate of 1 GSa/s and a maximum memory depth of 14 Mpts. Equipped with a 7" LCD display and a waveform update rate of 100,000 waveforms per second, this device is able to capture infrequent glitches with excellent signal fidelity.

Increase productivity with free PC software for remote connectivity through LAN or USBTMC-compliant device ports. Access all the oscilloscopes functions without the need for programming and conveniently capture, save, and analyze measurement results.

Select from a variety of trigger modes including serial bus triggering with decoding support for I²C, SPI, UART, CAN and LIN protocols. In applications where signals are transmitted over long periods of time, segmented acquisition mode and history can extend waveform recording up to 80,000 segments.

Collect data using automatic measurements for 38 different parameters including statistical analysis. Display signals in the frequency domain using the FFT math operation with a maximum memory depth of 128 kpts. Rich in features for its class, the 2194 is the ideal solution for educational settings and hobbyists.

Model	2194
Bandwidth	100 MHz
Channels	4 Analog
Sampling Rate	1 GSa/s (Single channel active)
Memory	14 Mpts (Single channel active)

USB LAN

Features and benefits

- 100 MHz bandwidth
- 4 analog channels
- Maximum sample rate of 1 GSa/s
- 14 Mpts memory depth
- Maximum waveform update rates of 100,000 (normal mode) and 400,000 (sequence mode) waveforms per second
- 7" TFT-LCD with 800 x 480 resolution
- Color temperature display mode and 256 level intensity grading
- Trigger types: Edge, Slope, Pulse Width, Window, Runt, Interval, Dropout, Pattern and Serial
- Segmented acquisition and history function (up to 80,000 segments)
- Automatic measurements for 38 parameters and statistics feature
- FFT and 7 additional math operations
- Masking tool with adjustable limits for pass/fail testing
- USB host port for saving and recalling setups, data, and screenshots
- USBTMC-compliant device port and LAN interfaces standard
- Multi-language support

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Digital Storage Oscilloscope
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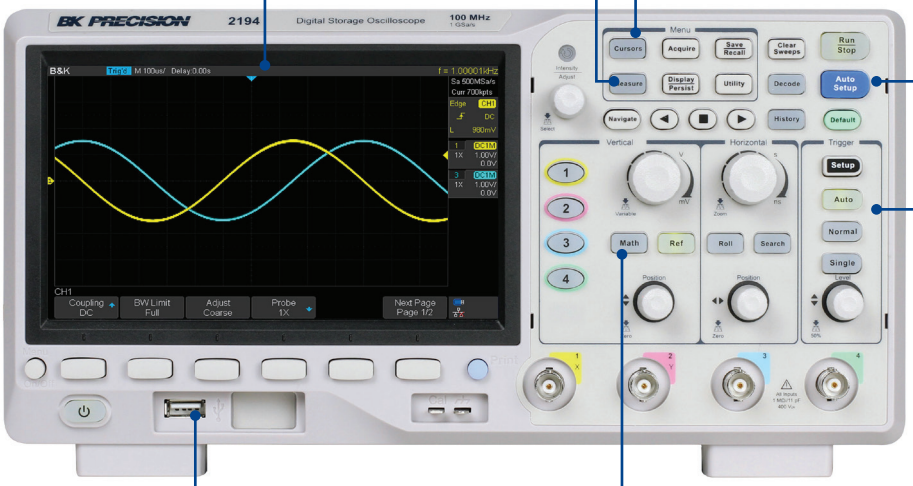
Front panel

7-inch TFT-LCD Display
800 x 480 resolution with 256 level intensity grading and color temperature mode.

Measure
Access a library of 38 built-in automatic measurements and an acquisition statistics feature.

Cursors
Acquire custom measurements easily using up to four cursors.



Auto Setup
Vertical, horizontal, and trigger controls are automatically adjusted for fast signal acquisition.

Advanced Triggering
Isolate the signal with various triggers including video and serial bus trigger types.

USB Host Port
Connect USB flash drive to conveniently store and recall waveform data, setups and screenshots.

Waveform analysis with math and FFT
Access a menu with math operators including an FFT function to view the signal in the frequency spectrum.

Rear panel

Communication
LAN and USB ports enable remote control from a PC

Pass/Fail or Trig Out Output

Kensington Lock
Helps secure oscilloscope and prevent theft

AC Input and Fuse Holder

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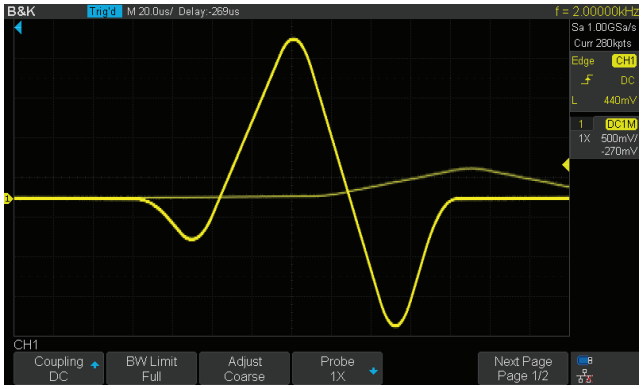
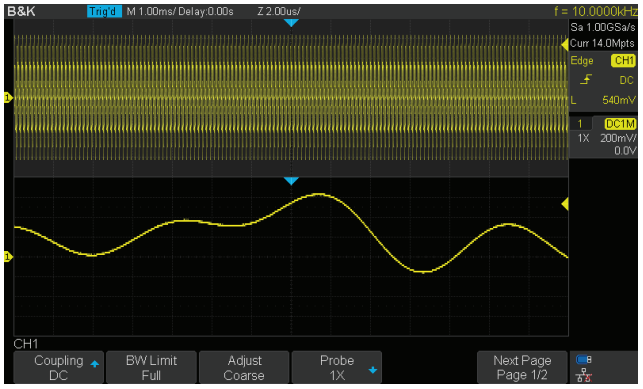
Operation highlights

100,000 wfms/s Update Rate



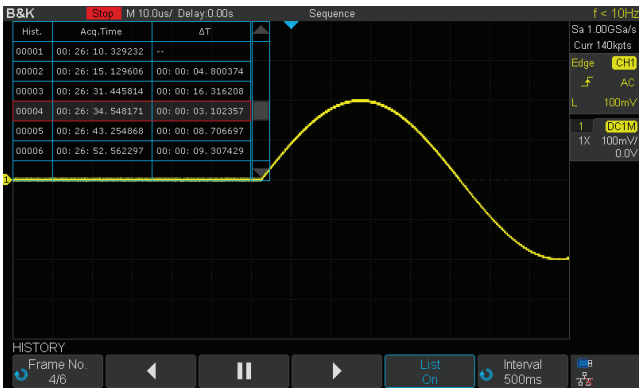
With update rates of 100,000 wfms/s, the 2194 captures infrequent glitches with excellent signal fidelity and reduces time spent debugging.

Memory depth of up to 14 Mpts



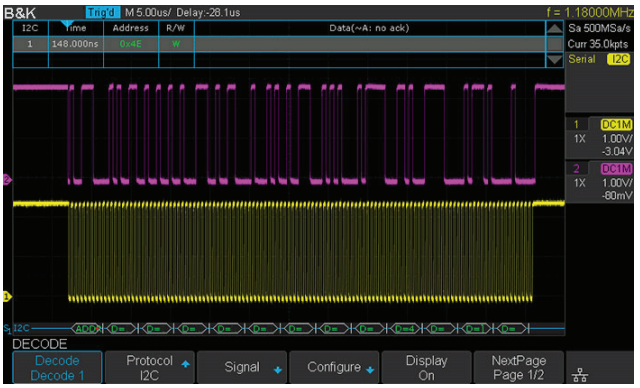
Capture longer time periods at higher resolution with a maximum memory depth of 14 Mpts. Enable zoom feature to display specific events in more detail.

Segmented acquisition



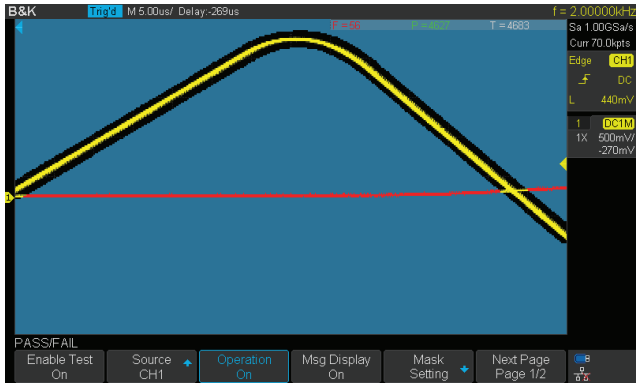
Segmented acquisition partitions the memory into multiple segments (up to 80,000) of the signal when trigger conditions are met. Recall stored segments using the History function.

Serial decoding



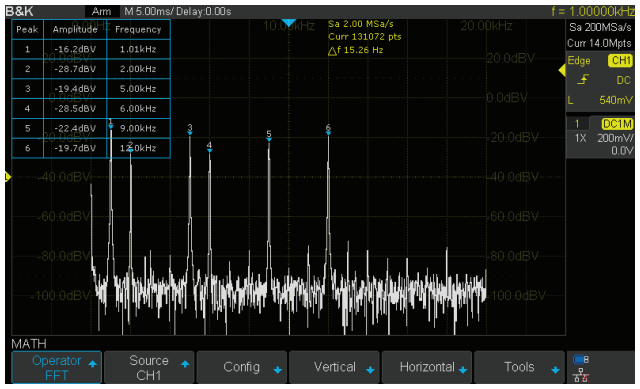
Serial bus decoding supports I²C, SPI, UART, CAN and LIN protocols. Information can be quickly displayed in a tabular format.

Pass/Fail testing



Generate a mask based on user defined parameters to identify pass/fail test results. Useful in long term signal monitoring or automated production line testing applications.

FFT function



Displays signal in the frequency domain to ease measuring wave harmonics or discovering applications potential noise induced by frequency dependent components.

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Specifications

Note: All specifications apply to the unit after a temperature stabilization time of 15 minutes over an ambient temperature range of 23 °C ± 5 °C. Specifications are valid for single unit operation only.

Model	2194	
Performance Characteristics		
Bandwidth (-3 dB)	100 MHz	
Rise Time (10% to 90%)	< 3.5 ns	
Sampling Rate	Single Channel	1 GSa/s
	Dual Channel	500 MSa/s
	All Channel	250 MSa/s
Memory Depth (timebase ≥ 1 ms/div)	Single Channel	14 Mpts
	Dual Channel	7 Mpts
	All Channel	3.5 Mpts
Waveform Update Rate	Normal Mode	100,000 wfms/s
	Sequence Mode	400,000 wfms/s
Bandwidth Limit	20 MHz ± 40%	
Input	Input Channels	4 analog channels
	Input Coupling	DC, AC, GND
	Input Impedance	DC: 1 MΩ ± 2%, 11 pF ± 2 pF
	Ch to Ch Isolation	DC - Max bandwidth > 40 dB
	Probe Attenuation	0.1x to 10000x
Vertical System		
Vertical Resolution	8 bits	
Sensitivity Range	1 mV/div to 10 V/div (1-2-5 sequence)	
Bandwidth Flatness	DC to 10% (BW): ± 1 dB 10 to 50% (BW): ± 2 dB 50 to 100% (BW): + 2 dB / - 3 dB	
DC Gain Accuracy	≤ ± 3.0%: 5 mV/div to 10 V/div ≤ ± 4.0%: ≤ 2 mV/div	
Maximum Input Voltage	1 MΩ: ≤ 400 Vpk (DC + Peak AC ≤ 10 kHz)	
Offset Range	1 mV to 200 mV: ± 2.000 V 206 mV to 10 V: ± 100.0 V	
Offset Accuracy	± (1% of Offset+1.5% of div+2 mV): ≥ 2 mV/div ± (1% of Offset+1.5% of div+500 uV): 1 mv/div	
Noise	Std-dev ≤ 0.2 division (< 2 mV/div) Std-dev ≤ 0.1 division (≥ 2 mV/div)	
SFDR Including Harmonics	≥ 35 dB	
Overshoot (500 ps Pulse)	< 10%	

Horizontal System		
Time Base Range	2 ns/div to 100 s/div	
Timebase Accuracy	± 25 ppm	
Channel Skew	< 100 ps	
Display Format	Y - T, X - Y, Roll X: Channel 1, Y: Channel 2	
Roll Mode	50 ms/div to 100 s/div (1-2-5 sequence)	
Trigger System		
Types	Edge, Slope, Pulse, Video, Window, Interval, Dropout, Runt, Pattern, and Serial	
Modes	Auto, Normal, Single	
Level	Internal: ± 4.5 div from center of screen	
Hold off Range	80 ns to 1.5 s	
Coupling	DC	Passes all components of the signal
	AC	Blocks all DC components and attenuates signals < 8 Hz
	LFRJ	Blocks the DC component and attenuates components < 2 MHz
	HFRJ	Attenuates high-frequency components above 1.2 MHz
Source	CH1 to CH4, AC Line	
Accuracy (typical)	Internal: ± 0.2 div	
Sensitivity	DC to Max bandwidth 0.6 div	
Jitter	< 100 ps	
Displacement	Pre-Trigger: 0 to 100% Memory Delay Trigger: 0 to 10,000 div	
Acquisition Modes		
Peak Detect	Capture glitches as narrow as 2 ns at all time base settings	
Average	Waveform averaged selectable: 4, 16, 32, 64, 128, 256, 512, 1024	
Enhance Resolution (ERES)	Enhance bits: 0.5, 1, 1.5, 2, 2.5, 3	
Interpolation	Sin(x)/x, Linear	

Specifications (cont.)

Waveform Measurements and Math		
Source	CH1 to CH4, Zoom, Math, All references, History	
Measurement Range	Screen or Gate region	
Measurement Parameters	Vertical	Max, Min, Pk-Pk, Ampl, Top, Base, Mean, Cmean, Stdev, Cstd, VRMS, Crms, FOV, FPRE, ROV, RPRE, Level@X
	Horizontal	Period, Freq, +Width, -Width, Rise Time, Fall Time, Bwidth, +Dut, -Dut, Delay, Time@level
	Delay	Phase, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF, Skew
Statistics	Current, Mean, Min, Max, Std-Dev, Count	
Counter	Hardware 6-digit counter (Channels are selectable)	
Math Operations	Add, subtract, multiply, divide, FFT, derive, integrate, square root	
FFT	Window types: Rectangular, Blackman, Hanning, Hamming, Flattop	
Cursors		
Mode	Manual, Tracking	
Measurements	Time: X1, X2, ΔX, 1/ΔX, Voltage: Y1, Y2, ΔY	
Search		
Event	Edge, Slope, Pulse, Interval, Runt	
Event Number	Y – T: 700 Roll: No limitation Stop After ROLL: 700	
Display System		
Display	7" color TFT LCD, 24-bit, 800 x 480 pixels	
Intensity Grading	256 levels	
Display Contrast (Typical State)	500:1	
Backlight Intensity (Typical State)	300 nits	
Display Range	8 x 14 divisions	
Persistence	Off, 1 sec, 5 sec, 10 sec, 30 sec, Infinite	
Waveform Display	Dot, Vector	
Screen Saver	1 min, 5 min, 10 min, 30 min, 1 hour, Off	
Language	English, Simplified Chinese, Traditional Chinese, French, Japanese, Korean, German, Russian, Italian, Portuguese	
I/O Interface		
Standard	USB Host, USB Device, LAN, Pass/Fail, Trig Out	
Pass/Fail	3.3 V TTL Output	

Serial Decoder		
Decoders	2	
I^2C	Signal	SCL, SDA
	Address	7-bit, 10-bit
	Threshold	- 4.5 to 4.5 div
	List	1 to 7 lines
SPI	Signal	SCL, MISO, MOSI
	Edge Level	Rising, Falling
	Idle Level	Low, High
	Bit Order	MSB, LSB
	Threshold	- 4.5 to 4.5 div
	List	1 to 7 lines
UART	Signal	RX, TX
	Data Width	5-bit, 6-bit, 7-bit, 8-bit
	Parity Check	None, Odd, Even, Space, Mark
	Stop Bit	1-bit, 1.5-bit, 2-bit
	Idle Level	Low, High
	Threshold	- 4.5 to 4.5 div
	List	1 to 7 lines
CAN	Signal	CAN_H, CAN_L
	Source	CAN_H, CAN_L
	Threshold	- 4.5 to 4.5
	List	1 to 7 lines
LIN	Specification Package Revision	Ver1.3, Ver2.0
	Threshold	-4.5 to 4.5 div
	List	1 to 7 lines
Environment		
Temperature	Operating: 0 °C to 40 °C, Storage: < -20 °C > 60 °C	
Humidity	Operating: 85% RH, 40 °C, 24 hrs. Storage: 85% RH, 65 °C, 24 hrs	
Altitude	Operating: ≤ 3000 m, Storage: ≤ 15,000 m	
Electromagnetic Compatibility	EMC directive (2014/30/EU), IEC 61326-1:2012/EN61326-1:2013 (Basic)	
Safety	UL 61010-1:2012/R: 2018-11; CAN/CSA-C22.2 No. 61010-1:2012/A1:2018-11. UL 61010-2-030:2018; CAN/CSA-C22.2 No. 61010-2-030:2018.	
General		
AC Input	100 to 240 VAC 50/60 Hz, 100 to 120 VAC 400 Hz	
Dimensions (W x H x D)	12.28" x 5.94" x 5.22" (312 x 151 x 132.6 mm)	
Weight	5.7 lbs (2.6 kg)	
Warranty	3-Years	
Standard Accessories	Power cord (1), USB cable (1), passive probe (4), certificate of calibration	

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Specifications (cont.)

Trigger Types	
Edge Trigger	
Slope	Rising, Falling, Rising & Falling
Source	All Channels / AC Line
Slope Trigger	
Slope	Rising, Falling
Limit Range	<, >, < >, > <
Time Range	2 ns to 4.2 s
Resolution	1 ns
Pulse Width Trigger	
Polarity	+width, -width
Limit Range	<, >, < >, > <
Pulse Width Range	2 ns to 4.2 s
Resolution	1 ns
Video Trigger	
Signal Standard	NTSC, PAL, 720p/50, 720p/60, 1080p/50, 1080p/60, 1080i/50, 1080i/60, Custom
Sync	Any, Select
Trigger Condition	Line, Field
Window Trigger	
Window Type	Absolute, Relative
Interval Trigger	
Slope	Rising, Falling
Limit Range	<, >, < >, > <
Time Range	2 ns to 4.2 s
Resolution	1 ns
Dropout Trigger	
Timeout	Edge, State
Slope	Rising, Falling
Time Range	2 ns to 4.2 s
Resolution	1 ns
Runt Trigger	
Polarity	+width, -width
Limit Range	<, >, < >, > <
Time Range	2 ns to 4.2 s
Resolution	1 ns
Pattern Trigger	
Pattern Setting	Invalid, Low, High
Logic	AND, OR, NAND, NOR
Limit Range	<, >, < >, > <
Time Range	2 ns to 4.2 s
Resolution	1 ns

Serial Trigger	
I²C Trigger	
Condition	Start, Stop, Restart, No Ack, EEPROM, 7-bit Address & Data, 10-bit Address & Data, Data Length
Source (SDA/SCL)	CH1 to CH4
Data Format	Binary, Decimal, Hex, ASCII
Limit Range	EEPROM: =, >, <
Data Length	EEPROM: 1 byte Address & Data: 1 to 2 bytes Data Length: 1 to 12 bytes
R/W bit	Address & Data: Read, Write, Do not care
SPI Trigger	
Condition	Data
Source (CS/CL/Data)	CH1 to CH4
Data Format	Binary, Decimal, Hex, ASCII
Data Length	4 to 96 bits
Bit Value	0, 1, X
Bit Order	LSB, MSB
UART Trigger	
Condition	Start, Stop, Data, Parity Error
Source (RX/TX)	CH1 to CH4
Data Format	Binary, Decimal, Hex, ASCII
Limit Range	=, >, <
Data Length	1 byte
Data Width	5-bit, 6-bit, 7-bit, 8-bit
Parity Check	None, Odd, Even, Space, Mark
Stop Bit	1-bit, 1.5-bit, 2-bit
Idle Level	High, Low
Baud Rate (Selectable)	600/1200/2400/4800/9600/19200/38400/57600/115200 bit/s
Baud Rate (Custom)	300 bit/s to 20 Mb/s
CAN Trigger	
Condition	Start, Remote, ID, ID + Data, Error
Source	CH1 to CH4
ID	STD (11 bit), EXT(29 bit)
Data format	Binary, Decimal, Hex, ASCII
Data Length	1 to 2 byte
Baud Rate (Selectable)	5k/10k/20k/50k/100k/125k/250k/500k/800k/1 Mb/s
LIN Trigger	
Condition	Break, Frame ID, ID+Data, Error
Source	CH1 to CH4
ID	1 bytes
Data format	Binary, Decimal, Hex, ASCII
Data Length	1 to 2 bytes
Baud Rate (Selectable)	600/1200/2400/4800/9600/19200 bit/s
Baud Rate (Custom)	300 bit/s to 20 Mb/s