Functional comparison of the R&S RTB2000, Siglent SDS2000X Plus and Keysight InfiniiVision DSOX 1000 Oscilloscope series

Made by Rudi's Electronics Lab. Video episodes of this comparison are at:

Document Version 0.57. This is a document under construction.
Comments, corrections, additions etc. are welcome, please share here:

LEGEND

Aspect 1	Advantage over other two
Aspect 2	Very significant advantage over other two
Aspect 3	Disadvantage over other two
Aspect 4	Very significant disadvantage over other two

Acknowledgements

INTRODUCTION

General

Series	R&S RTB2000	Siglent SDS2000X Plus	Keysight InfiniiVision 1000 X
Model/version reviewed	RTB2K-COM4	SDS2104X Plus, 16LA, AWG	DSOX1204G
Market introduction	March 2017	January 2020	March 2017 (4ch. version January 2019)[2]
Market position	Low mid-range	Low mid-range	Low range
FW version reviewed	FW 2.4 (released 06 December 2021)	FW 1.3.9R6 (released 25 October 2021)	FW 2.12 (released 10 September 2021)
FW updates	10 updates in 56 months	6 updates in 22 months	~ 5 + 3 updates in 56 months

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[1] RTB: Version 11 (for 2.4 FW); SDS: version EN01C (undated and no reference to which FW version); DSOX: Fourth edition, September 2021 (for FW 2.12).
[2] Some report that the 2019 models, recognizable by their black case, run on Linux OS whereas earlier models run on Windowa CE. (Source)

Physical construction

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Physical design	Very solid	OK, but not top notch[3]	Very solid
Front panel color	Grey	Beige	Black
Power switch (front panel)	Hard (back panel) Soft (front panel) Auto power-on	Soft (front panel) Auto power-on selectable `Utility > Menu > Power On Line. M29` Turn off, Reboot `Utility > Shutdown / Reboot`	Hard (front panel)
Start-up time	8-10 sec	55 sec	44 sec (was longer before FW2.01)
Settings on power-on	From last session `M34`	From last session `(Not discussed in manual)`	From last session `(Not discussed in manual)`
Button/control layout	Very logical	I do not find it always logical[4], but opinions differ across users	Not always logical
Rotary dials	6, all have clicks Shared V scale, V position H scale, H position Trigger Multifunction	6, two have clicks Shared V scale, V position H scale, H position Trigger Multifunction	9, three have clicks Shared V scale, V position M/FFT scale, M/FFT position (not very useful, and not used for REF) H scale, H position Trigger Cursor Multifunction
Recessed buttons		Default, Auto-setup	Auto Scale, Default Setup
Channel indicators for shared vertical controls[5]	Active Ch: lighted button, screen Selected Ch.: matching colour LEDs in both vertical dials[6]	Active Ch.: screen only Selected Ch.: lighted button	Active Ch.: lighted button, screen Selected Ch.: matching colour LED[7] indicator next to vertical dials
Channel indicators for shared vertical controls	Matching colour LED in Trigger button	Screen only	Screen only
Painted front panel colour indicators for channels	None	Around BNC[8]	Around BNC
Fan noise	Silent to very low	Very loud	Notable
Energy use[9]	45 Watt (on, measured) 0.5 Watt (standby, measured) Manual: "max. 60 W" `M33`	55 Watt (on measured) 4 Watt (standby, measured) Manual: "Up to 100 Watt" `M14`	1
Weight	2.6 kg	3.5 kg	3.2 kg
Transport accessories	Plastic front cover, Soft carry bag, Hard transit case	Soft carry bag	Soft carry bag

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[3] Rotary dials wobble a bit. Rubber feet come off regularly. Overall, a more 'plastic' feel.

[4] Examples: "Start/Stop" button is away from "Single" button, whereas on most other oscilloscopes these are together. Yet, in the EVVBlog Forum, some users express they find the SDS button layout intuitive.

[5] Across digital oscilloscopes, the implementation to have channel button lights indicate active channels (like the RTB and SDOX) seems to be the dominant one. We see it in various LeCroy models (WavePro HD, WaveRunner 8000HD, HDO6000B, WaveSurfer 4000HD), on Tektronix models (3 series, 4 series, 5 series), on R&S models (RTM3000, RTA4000, RTE1000, RTO2000 and RTP RTP), and Keysight models (2000X, 3000X, 4000X), to name a few. While it is my own preference too, others may prefer the Siglant choice to show on selected channels.

[6] In some versions (recent years?) the colors around the rotary dials do not look constant.

[7] Sever color mismatch for Channel 1 (dark yellow on button, bright yellow on the screen).

[8] On pictures on the internet, all the SDS2000X Plus scopes I see also have colors printed around the channel selection buttons. But on my unit, these colors are gone. Perhaps when FR1.3.7R5 introduced the selectable color for analogue traces (and changed the LED colours in the buttons accordingly with the chosen user color), Siglent decided to remove the paint on the front panel. But why they remove it only for one of the two places ?!?

[9] Measured with GW-INSTEK GPM-8310 Power Meter. Here, 'on' means turned on, showing one channel, no special processing, no USB devices connected, etc.

I/O connectors

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
BNC connectors	Goldplated (all)	Not goldplated automatic x10 probe sense for supported probes; but cannot be overridden, creating creates problems with incompatible probes[10]	Not goldplated
USB (Flash, Mouse, Keyboard, Power)	1x host (FMKP) 1x device	2x host (FMKP) 1x device	1x host (FPK)[11] (keyboard since FW2.10) 1x device
Provides error information for connected USB devices?	Yes, detailed error information is provided for unsupported devices/file systems or when multiple devices in same device class are connected.	No messages shown	An error is shown when unsupported USB devices are connected.
Allows USB hub	Manual says a hub is not supported[12] M177, but in practice, a hub works just fine.	Manual is silent on this; experiences with hubs seem to differ across connected devices.[13]	Manual is silent on this but in practice, a hub works just fine.
Network	Ethernet (1Gbps)	Ethernet (100Mbps)	Ethernet (100Mbps) Recessed socket, gives problem with some plugs[14]
Ext. trigger In	Front (dedicated) Sensitivity 300mV, level -5/5V, max. 300 V (RMS), max. 400 V (Vp)	Back (dedicated) Max. 1.5Vrms; max. 7.5Vrms with EXT/5 attenuator	Back (dedicated) Max 30 Vrms, 40 Vpk
Trigger out	Front (shared conn.) Polarity: positive or negative pulse Level: 4.8V (2.4@50Ω) Pulse width (250ns to 1s) and polarity (pos or neg pulse) can be set via remote command; default 250ns (measured)[15] Trigger > Action on Trigger. M77, 86, 461, 462; remote command 461, 462, 87.	Back (shared conn.) Polarity: negative pulse Level: 2.6Vpp (900mVpp @ 50Ω) (measured) Pulse width varies with horizontal scale (measured): 600ms @ 100ms/div 860µs @ 100µs/div 90µs @ 100ns/div (but duty cycle at 99%)	Front (shared conn.) Polarity: positive pulse Level: 5.3Vpp (2.7Vpp @ 50Ω) (measured) Pulse width varies with horizontal scale (measured): 500ms @ 100ms/div 520µs @ 100µs/div 20µs @ 100ns/div (but duty cycle at 85%)
Mask test out	Pass, fail Front (shared conn.)	Pass, fail Back (shared conn.)	Fail (5V) Front (shared conn.)
Generator out	Front (shared conn.)	Front (dedicated)	Front (shared conn.)
10MHz reference in/out	–/+ (shared conn.)	–/–	–/–
Combined in multifunction out connector	Trigger Out, 10MHz ref, Mask, Function Generator (labelled Aux Out) Setup > Aux out. M27,177/178 Via SCPI commands, more flexible routing options are possible[16]	Trigger Out, Mask (labelled Auxiliary Out) (Output is Trigger, except when Mask analysis is activated))	Trigger Out, Mask, Function Generator (labelled GEN OUT) UTILITY > Options > Auxiliary. M242-243
Probe compensation	1kHz, 2.5V (measured)	1 kHz (meas.), 2.5Vpp (measured)	1 kHz (meas.), 2.5Vpp (measured)
Other IO	4 pin pattern generator		

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[10] As there are differences across manufacturers of scopes and probes in terms of which attenuation modes are implemented and what their coding resister value is, incompatibilities can arise. Not being able to override the autosense means that probes whose sensing is not picked up well become useless.

[11] Mouse does not make sense because the device does not have a graphic UI.

[12] Maybe they wrote this in the manual because connecting two storage devices may cause problems.

[13] In my own tests, the SDS did not work with a Anker type A7516 (a fairly straightforward, recent 4 port hub) and a HP H3C52AA keyboard (a fairly standard PC keyboard) or an Apple A1243 keyboard (both keyboards did work with the same hub on the RTB and DSOX. Yet, the SDS with hub did accept 'original' Raspberry Pi keyboard and the Logitech wireless K270 keyboard with its supplied proprietary (not 'unity') Logitech dongle.

[14] The socket is recessed by about 5.5mm in the case. This makes it difficult to read the latch clip to remove the plug again, and connectors that have plastic/rubber covers over the latch clip (which is increasingly common) may have problems fitting in this instrument.

[15] A 50% duty cycle square with 260ns positive pulse has a period of 520ns and a frequency of 1.9MHz. So, with trigger actions above this frequency one will want to shorten the pulse width.

[16] For instance, with the SCPI command :WGENerator:OUTPut:DESTination BNC | P3 you can also switch the output from the Function Generator to the Pattern Generator P3. Such documents are not documented in the user manual, though.

Documentation

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
User manual	Available here (609 pages). Well written and informative Updated with each new FW versions (now FW2.4) Also: interactive online web version with very good search function, available here.[17]	Available here (352 pages). Less informative, (specified) functions often poorly explained and some are missing altogether. Often, figures are not readable.[18] Manual is not dated and not (systematically?) updated with new firmware versions.	Available here (332 pages) Well written and informative Updated with each new FW versions (now FW2.12)
Programming guide (SCPI)	Part of User Manual List if commands is here in the interactive online web version (adapted to online environment)[19]	Separate document, available here (585 pages) Also: SDS2000X Plus IVI-C Programming Guide	Separate, available here (952 pages) Offers some information missing in the user manual[20] There is also a Windows HTML Help (*.chm) format file, available here[21]
Service Guide		Functional test, interface test, performance test, disassembly procedure, troubleshooting Available here. (70 pages).	Verification, calibration etc. Available here (57 pages)
Educator's Training Kit			For physics/EE students, , the Educator's Training Kit is quite informative and specifically highlights functions in this instrument. Available here (96 pages)
Other	Lots of white papers, application notes, etc.		Lots of white papers, application notes, etc.
Datasheet / specifications document	Available here	Available here	Available here
Product brochure	Available here (Version 06.00)		Available here

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[17] https://www.rohde-schwarz.com/webhelp/RTB_HTML_UserManual_en/Content/welcome.htm
[18] See for instance the pictures on page 68, 84, 97
[19] https://www.rohde-schwarz.com/webhelp/RTB_HTML_UserManual_en/Content/welcome.htm
[20] Example: detailed description of all training signals on p.818 of Programming Guide.
[21] https://www.keysight.com/nl/en/assets/9018-17471/help-files/9018-17471.chm

User interface

Screen and graphical UI

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Screen	10.1" (1280 × 800 pixel) 1.0 Mpixel Glossy[22]	10.1" (1024x600) 0.611 Mpixel Matte Backlight adjustable `Display > Backlight. M303`	7" (800x480) 0.32 Mpixel Matte
Touch screen	Capacitive touch Gestures: Touch/select, Swipe, Drag, Pinch, Two finger swipe[23]	Capacitive touch Gestures: Touch/select, Swipe, Drag, Pinch, Draw	
Languages	13 languages (FW1.203) `Setup > Language. M198`	10 languages `Utility > Menu > System Setting > Language. M53,330`	15 languages
Trigger indicator LEDs	Triggered	Ready, Triggered	
Screen/ control UI	Highly functional and consistent (but some misses)	Usable but with some misses. Many 'small' submenus, and apart from some selected module such as measure or math, the device does not take real advantage from having a touch screen and seems a migration from a soft-button UI like the Keysight.[24] Sometimes rather ambiguous terminology.[25]	No touch screen, a bit cumbersome menu structure
Toolbar	User-definable with 8 out of 24 icons selectable		
Undo, Redo	Undo: Reverses last actions step by step Redo: Recovers the undone steps in reverse order		
Menu History	Displays all menus used during the current session		
Other	`QuickAccess`: up to 10 parameters can be changed any moment in their own movable window (FW02.101)		
Help mode	Extensive context-based help `Screen shortcut`	Book style help pages `Utility > Help`	Extensive context-based help `3 second button push`
UI responsiveness (buttons, controls and screen)	High. Responsiveness seems totally unrelated to system load.	Medium, somewhat sluggish. Under significant load, the instrument can become unresponsive to front panel controls[26]	High. Generally, responsiveness seems totally unrelated to system load. sometimes temporary hickups after entering slow USB flash drive
Experienced hangs/glitches	Extremely rare, none experienced since FW02.300	Infrequent hangs in UI when doing more advanced settings	None experiences.

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[22] Those that do not like a glossy display, can consider adding a matte screen protector (the other way round is not possible).
[23] In history segments.
[24] To see all the parameters to serial decode and trigger a SPI signal, no less than seven menu pages need to be looked at (plus a couple of others to gain access to these). On the RTB, in contrast, the user is presented one single screen in which all the relevant serial decode and serial trigger can be seen and changed.
[25] One example of this is provided in footnote 45.
[26] Confirmed by others, see here.

Trace display

	RTB2000	SDS 2000X+	DSOX 1200
Temperature map waveform colour	Temperature, Fire, Rainbow, Individual per channel For A, R, M `Vertical > Channel. M62`	Rainbow Only global `Display > Color Grade. M306`	*"Signal detail is displayed using 256 levels of intensity."* `M35`
Trace intensity	{0-100%} `INTENSITY` `Display > Intensities. M194`	{0-100%} Default for front-panel dial `UNIVERSAL` `Display > Intensity. M303`	{0-100%} `PUSH TO SELECT`
Inverse Brightness	Supported `Display. M194`		
Persistence	Fully variable {50 ms to 12.8 s, ∞} `Display. M193`	{1, 5, 10, 30s, ∞} `Display > Persistence. M306`	Fully variable {100 ms to 60s, ∞} `DISPLAY > Persistence. M85`
Display types	{Vectors, dots} `Display. M194`	{Vectors, dots} `Display > Type. M304`	
Custom trace colour (Analog, Math, Ref)	R, M (not A) Individual colour per channel, also for math (FW02.300) and ref Individual colour per math channel `Ref. M106,62`	A (1.3.7R5), R, M Individual colour per channel, also for math and ref For A, LED buttons change colour accordingly `Display > Color setting. M306`	

Labels and annotations

	RTB2000	SDS 2000X+	DSOX 1200
Analogue channel labels	Full text (8char) 39 presets[27] `Vertical > Label. M63-64`	Full text (20char) No presets	Full text (10 char) 75 presents
Digital channel labels	Full text (8char) 38 presets ("Clock", "MOSI", etc.) `Logic > Label. M275`	Full text (8char) (input is truncated[28]) Preset "ADR[0-15]" Preset "DATA[0-15]"	
Reference channel labels	Full text (8char) 7 presets `Ref > Label. M106`	Full text (20char) No presets	Full text (10 char) 75 presents
Math channel labels (scales)	Library of 75 scales (V, A, Ω, etc.) `Math > Label`	21 scales that adapt to input channels (e.g.: V·A=W)	9 scales that adapt to input channels (e.g.: V·A=W)
Serial bus labels	Full text (8char) 15 presents (specific for busses) `Decode > Label. M217`		Fixed label (according to chosen serial protocol)
Parallel bus labels	Full text (8char) 15 presents (specific for busses) `Decode > Label. M217`		Full text (10 char) 75 presents "AnalogBus"
Label readability	Labels small but well readable	Analogue labels poorly readable Digital labels almost unreadable (no shadow)	
Screen annotation	Text (50+ characters), pencil drawings, colours `Screen shortcut.M182`		Text, 10 lines of 30 characters each, 10 colours, inverted
Keyboard options for label or annotations entry	Onscreen keyboard USB keyboard PC keyboard in web interface	Onscreen keyboard USB keyboard PC keyboard in web interface	Rotary dial USB keyboard (FW2.10) Not via PC keyboard in web interface
Character sets[29]	Full	Full	Labels: no lower case Annotations: Full
Other	In edit window, the input field shows last entered label (for any channel), not current label of selected channel		

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[27] Preset set for analogue channels is different from that for digital channels.
[28] The input field does not have a character limit. But after hitting enter, it becomes clear that all character beyond position 8 are discarded.
[29] Here, 'full' refers to a set of upper case, lower case, numerical, and symbols.

Grid customizability

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Grid divisions shown	12 horizontal, 10 vertical	10 horizontal, 8 vertical	10 horizontal, 8 vertical

Grid area occupied by menus	Pop-up icon bar takes 5% (½ div horizontal) of screen surface
	
	Pop-up settings menu takes 22% (2.5 div. horizontal) of screen surface
	
	Menu auto-hide: 8 seconds (for multi-option menus)
		Pop-up settings menu takes 14% (2.5 div. horizontal) of screen surface. With Embedded mode activated, the waveform screen is compressed and no div are lost. (1.3.7R5)
		`Display > Menu Style. M303`
		
		Menu auto-hide - Variable {Off, 3, 5, 10, 30, 60s)
		`Display > Hide Menu. M303`
			16% of the screen is always occupied by the menus. Does not cost horizontal divisions but makes the waveform area small on the already small screen.
			
			There is a Menu auto-hide (0-60s) but that brings the default menu in view so still taking space
			`Utility > Options > Menu Timeout`

Grid display	Grid types:
	• Lines: full line grid; H&V centre lines have tick marks
	• Recticle: grid crosshairs plus H&V centre lines with tick marks
	• Off
	`Display > Grid. M195`
	
	Grid intensity (0-100%)
	`Display > Intensities > Grid. M194`
		Grid types:
		• Full: dashed line grid; H&V centre lines with tick marks; 25% and 75% dashed horizontal lines
		• Light: H&V centre lines with tick marks; 25% and 75% dashed horizontal lines (no horizontal divisions visible)
		• No grid
		`Display > Grid. M303`
		
		Grid Intensity (0-100%)
		`Display > Graticule. M42`
			Grid intensity (0-100%)
			`DISPLAY > Grid > Intensity. M87`
			
			Fixed grid type: full line grid; H&V centre lines have tick marks
			
			Specific grid type for analogue video (Institute of Radio Engineers)
			`DISPLAY > Grid > Intensity. M86`
			`ANALYZE >Features >Video >Grid`

Grid track	When activated, grid moves horizontally and vertically with waveform repositioning `Display > Grid > Track grid. M195`		
Grid axis values	Horizontal and vertical values on the grid axis {On, Off} Values and units ("e.g., 40mV" or "−400 µs") switch automatically with selected channel. `Display > Grid > Annotation. M195`	Horizontal and vertical values on the grid axis {On, Off} (FW 1.3.9R4) Values and units ("e.g., 40mV" or "−400 µs") switch automatically with selected channel. With four digits after the period the axis values clutter the screen and are not very readable Modes {moving, fixed} `Display > Axis label settings` (missing in manual)	No axis values shown

Other customizability

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Device name	Can be changed (for screen prints and device information fields) (FW02.400)		

LED lights/buttons brightness	Brightness (20-100%)
	`Front panel button INTENSITY`
	`Display > Intensities. M194`
		Brightness (0-100%)
		`Display > LEDlight. M303`	

Screen saver		Screen goes black after set time (Off, 1, 5, 10, 30, 60 min.) (not really off...) `Utility > System Setting > Screen saver. M332`	

Date/time	Supported. Time display on screen can be disabled (FW02.300)
	`Screen shortcut`
	`Setup. M??`
		Supported
		`Screen shortcut`
		`Utility > Menu > System Setting > Date/Time. M334`
			Supported
			`UTILITY > Options > Clock.`

Sound	Can be set at trigger event
	`Trigger. M86`
	Can be set at violation of mask
	`Mask > Actions. M154`
	General control events, e.g. changing the measurement type in the "Measure" menu.
	`Via SCPI command. M465`
		Can be set at violation of mask
		`Analyze > Mask test. M257`
		General buzzer sound {On, Off}
		`Utility > Menu > System Setting > Sound. M330`	

Acquisition system & memory

Acquisition system

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Analogue channel sample resolution (ADC)	10-bit ADC 16-bit high-res decimation "mode", Does not require repetitive signals. [limited in bandwidth[30]] _{S.4, 68}	8-bit ADC[31] 10-bit "mode" using oversampling[32] Maximum bandwidth approx. 100MHz.]Its workings are comparable to what other scopes call a 'High-Res' acquisition mode.] [Does not require repetitive signals.] _{Acquisition > Menu. M82.} ENOB enhancement at lower bandwidth (see ERES at Math section) _{M222}	8-bit ADC High Resolution Acquisition "Mode", claimed to be equivalent to up to 12 bits at 20 μs/div time base setting. Does not require repetitive signals. _{M140}
Analogue channel sample rate (ADC)	2.5GSa/s (interleaved 2ch mode) 1.25 GSa/s (normal)	2 GSa/s (interleaved 2ch mode) 1 GSa/s (normal)	2 GSa/s interleaved 2ch mode) 1 GSa/s (normal)
Available bandwidth in series	70, 100, 200, 300 MHz (All possible via software upgrades)	100, 200, 350 MHz 500MHz (two channels only) (All possible via software upgrades)	70, 100, 200 MHz (All possible via software upgrades)
Digital channel sample rate	1.25 GSa/s every channel	Up to 500 MSa/s	
Waveform update rate	Up to 300,000 wfm/s in fast segmented memory mode[33] _{Up to 50,000 wfm/s S.5}	Up to 500,000 wfm/s in Sequence mode _{S.1} Up to 120,000 wfm/s _{S.4} Reduce waveform update rate {Fast, Slow} _{Acquire > Menu. M82.}	200,000 wfm/s, ambiguity[34] (FW2.10) _{S.12}

Memory

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Analogue channel memory depth (per channel)	10 Msample 20 Msample (interleaved 2ch mode)	100 Msample 200 Msample (interleaved 2ch mode) (Both half for 10-bit mode)	1 Msample 2 Msample (interleaved 2ch mode) (FW2.10)
Segmented memory depth (per channel)	160Msample 320Msample (interleaved 2ch mode) _{s17}	Not specified ?!?	Not specified (?!?)
Digital channel memory depth (per channel)	10 MSa every channel	"Up to" 50 MSa every channel	
Total instrument sample memory	Total 840Msample[35]	Total 400Msample	Total 4MSa

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[30] Precise specs not provided, but the manual mentions this mode works "if the waveform sample rate is less than the ADC sample rate". M68.
[31] See
https://www.eevblog.com/forum/testgear/high-resolution-adc-converters-in-oscilloscopes-(8-bit-10-bit-12-bit-14-bit)/
[32] Https://www.eevblog.com/forum/testgear/siglent-sds2000x-plus-coming/
[33] Specification, p. 17: "continuous recording of waveforms in acquisition memory without interruption due to visualization; blind time between consecutive acquisitions less than 2.5 μs".
(up to 300 000 waveforms/s)
[34] Specifications are inconsistent. "≥ 200,000 waveforms/sec" (p.12), "Up to 200,000 waveforms/sec update rate" (p. 5)
[35] In 4 channel operation, the RTB has 10Msample per analogue channel plus 160Msample deep memory per analogue channel, plus 10Msample per digital channel, totaling 840Msample. In interleave (2 channel) mode, the RTB has 20Msample per analogue channel plus 320Msample deep memory per analogue channel, , plus 10Msample per digital channel, totaling (again) 840Msample. S17.

Channels

Analogue channels

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Input impedance	1 MΩ, 9pF S4	1 MΩ, 17pF; 50 Ω note[36] S10	1 MΩ, 16pF S12
Max voltage at channel input (Vpp)	400Vpp S4	400Vpp S10	200 Vpk S12
Channel overload warning	Yes (positive, negative)		
Probe Attenuation	4 presents; Fully variable (100μ to 10M) (equals $10^{-4} \sim 10^{7}$) (V02.3) Vertical > Channel > Probe Channel shortcut menu. M65	3 presents; Fully variable (0.000001 to 1000000) (equals $10^{-6} \sim 10^{6}$) automatic x10 probe sense for supported probes Channel shortcut menu. M67	16 presets (0.1X to 10,000X) (100m to 10M) in 1-2-5 sequence (equals $10^{-1} \sim 10^{7}$)
Channel BW limit modes	20 MHz (also any value via math LPF) Vertical > Channel Channel shortcut menu. M60	20 MHz, 200 MHz	20 MHz (also any value via math LPF)
Coupling	DC, AC, GND AC: 2Hz HPF S4 Channel shortcut menu. M60	DC, AC, GND AC : 5Hz HPF S10	DC, AC
Vertical scale / Sensitivity (@ 1MΩ)	1 mV/div to 5 V/div Front-panel dial VERTICAL SCALE Vertical > Channel. M61	500 µV/div – 10 V/div (50 Ω: 500 µV/div – 1 V/div) Front-panel dial Vertical V-mV Screen channel shortcut	1 mV/div to 10 V/div (500 µV/div mode is digital zoom[37])
Auto scale	Per channel: Autoscale (V02.101) Channel shortcut menu. M58 For all channels: Autoset AUTOSET Deeper check	For all channels: Auto Setup AUTO SETUP Acquire > Auto Setup	For all channels: Autoscale AUTO SCALE. M24
Vertical position	Front-panel dial VERTICAL ▼▲ Vertical > Channel. M61	Front-panel dial Vertical s-nS Screen channel shortcut	Front-panel dial VERTICAL ▼▲
Vertical position setting[38]	Position and Offset are simultaneously available in as menu items. The vertical rotary dial behaviour can be switched between the above modes (FW02.202) Note[39] Vertical[40]. M57	{Position, Offset} Utility > Menu > Reference position. M337 Is placed in a bit odd position in the menu system (not a menu related to the vertical system)	Offset (in Volt)
(De)skew (time compensation)	-500 to 500ns Vertical > Channel Channel shortcut menu. M61-62	-100 to 100ns	-100 to 100ns
Invert	Yes Vertical > Channel. M61	Yes	Yes
Channel hide	No (but inactive channel can be used for trigger, math, etc.)	Yes (hidden channel can trigger but inactive channel cannot trigger) (FW1.3.5R5) Screen channel shortcut	No (but inactive channel can be used for trigger, math, etc.)
Copy settings to another channel		Yes ('Fast apply to") Screen channel shortcut	
Vertical scale units displayed on screen	V, A (attenuation adjusts) Vertical > Channel > Probe. M66	V, A (attenuation adjusts)	V, A (attenuation adjusts)
Turning analogue channel into digital (for Boolean logic)	Yes Threshold, hysteresis Vertical > Channel > Threshold. M64		
Zero adjust (compensate for different ground levels of DUT)	Yes Vertical > Channel. M61-62		

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[36] Generally, this should be regarded as a plus, a facility that is usually limited to higher class scopes. But I don't use it myself. Why? If I get across older scopes, if they are broken, it's quite often because people used the 50Ω setting and accidentally connect, say, 10V or more to that channel. Then you make very serious damage to the scope with high repair costs. I always use 50Ω termination true adapters (R&S HZ22, Rigol ADP0150BNC). If I ever blow one, I do not have to send the oscilloscope back into repair.

[37] Instrument has 500 µV/div mode but the specifications (p.12) mention "500 µV/div is a 2X digital magnification of 1 mV/div setting."

[38] For 'Position' (in div) the entire wave goes up or down on the screen. For 'Offset' (in Volt): When AC wave is superimposed on, say, 8V DC, then this allows to put 8V at centre line and zoom in or out while the wave stays in position.

[39] While this is by no means a hidden menu, it is one not many people will ever visit at all because all of us will use the channel buttons [1-4], which are handy shortcuts but don't bring you to the top-level hierarchy in this menu.

[40] Is in the top-level vertical menu (so tap the 'vertical' icon at right hand size of screen).

Digital channels

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Digital channels	16 channels	16 channels	
Predefined logic levels	TTL , CMOS 5.0 V, CMOS 3.3 V, CMOS 2.5 V, ECL, Custom Logic. M274	TTL, CMOS, LVCMOS3.3, LVCMOS2.5, Custom Screen (digital) channel shortcut	
Custom level	−2 V to +8 V in 10 mV steps Logic. M274	−10V to +10V in 1mV steps	
Hysteresis	{Low, Medium, High} Logic. M275, 80		
Display modes digital channels	Individual per channel, show 8 ch. as small block or large block, move as block	Fixed block; position and height of block can be set via menu (not vertical position rotary!)	

Reference waveforms

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
	REF References	REF	
Number	4	4	2
Copy source (Analog, Digital, Math)	4A, 5M (specs: also D, R, spectrum)	4A, 16D, 2M	4A, 1M
Disk load/save	Load, Save From internal or external (See section Save and Recall below for details)	Save, Recall Only to external (See section Save and Recall below for details)	Save, Recall Only to external (See section Save and Recall below for details)
Other			Skew (takes hundreds of turns to cover the range)
			Scale and offset only via menu (unlike math that can use rotary button for that)

Math channels (excl. FFT)

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
	MATH Math > Menu	MATH Math > Menu	
Math channels	5 channels (FW02.202)	2 channels	1 channel
Source (Analog, Math) (Zoom)	4A, (5-1M), constant No D	4A, (2-1)M (Zoom), No D (constant only when using formula editor)	4A
Total functions (excl. FFT)	19 (see below)	18 (see below)	5 (see below)
Filters	LPF (0-300MHz) (FW02.300) HPF (0-300MHz) (FW02.300)	No	LPF (0-70MHz)
Tracking	Period, Freq, PW, Duty cycle (FW02.400)	No	No
Formulae editor	No	Basic formulae editor. Supports • 16 math functions as indicated in the below table with 'FE' • the four analogue channels, the four zoom channels, the Math functions F1 and F2 • Pi, e, and own constants • Parenthesis • FFT[41] Almost no information in manual, actual working not so clear.[42] [Formulae length limited to 26 char.]	No
Labels / scales of result	Library of 75 scales (V, A, Ω, etc.)	21 scales that adapt to input channels (e.g.: V.A=W)	9 scales that adapt to input channels (e.g.: V.A=W)
Other functions	11 trace colours Save & load math sets with up to 5 formularies (See section Save and Recall below for details);	Gate, Full text label (20char) check seems inconsistent with above.	

Overview of all Math Functions

Series	Symbol	Function inputs	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
				(FE: operator available in formulae editor)	
Addition	+	2	Y	Y (FE)	Y
Subtraction	−	2	Y	Y (FE)	Y
Multiplication	X	2	Y	Y (FE)	Y
Division	/	2	Y (special treatment to prevent infinity)	Y (FE)	Y (divide by zero shown as zero result)
Identity ("Y" "Output of the trace itself")	y			Y	
Absolute value	|y|		Y	Y (FE)	
Inverse	-y		Y	Y (Negation)	
Sign				Y (1.3.5R3) (FE)	
Reciprocal	1/x		Y (special treatment of second input is small to prevent infinity)		
Square	y^2		Y		
Square root	√		Y	Y(FE)	
Common Log.	lg / Log(10)		Y	Y(FE)	
Natural Log.	ln / Log(e)		Y	Y(FE)	
Exponential	e^x			Y(FE)	
Exponential10	10^x			Y(FE)	
Derivate (differential)	f' or d/dt		Y (const.) (FW02.202)	Y (Differential Interval Dx) (FE)	
Integral	∫dt		Y (time range via V-marker cursor) (FW02.202)	Y (DC Offset, time range via Gate values) (FE)	

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[41] Basically starts FFT view like in the 'regular' FFT function, but can be used to do FFT on, say, "C1+6" or "C3/C1". The RTB can do the same thing as you can select a math channel (made with own calculation) as input to FFT.

[42] Experimenting with it is a bit of a mixed experience. It seems to light up red if a formula is not allowed but at the same time, "F1=F1/2" or "F1=C1+C2/F1" is allowed, while these are recursive formulae.

Low Pass	LPF		BW: 0Hz to 300 MHz 2nd order infinite impulse response filter (IIR)		BW: 0Hz to 70 MHz 4th order Bessel-Thompson filter
Hight Pass	HPF		BW: 0Hz to 300 MHz 1st order infinite impulse response filter (IIR)		
Track Period				[No track functions in Math, but track is available in measurements]	
Track Frequency			Upper Level (UL); Hyst, Edge (FW02.400)		
Track Pulse Width					
Track Duty Cycle					
Average (*"Averages multiple traces [in time] and displays the resulting trace"*)		2		Y (#, count, reset) (FE)	
ERES (*"Average adjacent data into a point and rebuilds the trace"*) *(removes HF noise)*				Y (enhanced bits 0.5 to 3) (FE)	
Interpolate (*"Produce more points in the trace using sin(x)/x algorithm"*) *(called 'Intrp' in formulae editor)*				Y (Upsample Coef.) (FE: 'Intrp') (1.3.7R5)	
Total functions (excl. FFT)			19	18	5

Horizontal system & trigger

Horizontal mode XT

	RTB2000	**SIGLENT SDS 2000X+**	**KEYSIGHT DSOX 1200**
Acquire mode * decimation mode: sample rate > ADC rate ** arithmetic mode: consecutive acquisitions	Sample, Peak Detect * High Resolution * Average (2-100k) ** Envelope ** Envelope+ Peak Detect Nx (samples per acq) selectable {1-13k} Screen shortcut Acquisition. M55	Sample ("normal") Peak Acquire, Menu. M83 Has 10-bit acquisition mode, whose workings are comparable to what other scopes call a 'High-Res acquisition mode. It uses oversampling[43] and maximum bandwidth is approx. 100MHz. Acquisition > Menu. M82. Also, averages are an available function in the math channel.	Sample ("normal") Peak Detect High Resolution Average (2-64k) ACQUIRE > Time Mode > Acq Mode
Horizontal Time scale X(t) (time base range)	1ns /div to 500s/div Front-panel dial HORIZONTAL SCALE Screen shortcut Horizontal > Time Scale. M68	1 ns/div – 1000 s/div (0.5 ns/div – 1000 s/div if 500 MHz bandwidth option installed) Only in 1-2-5 steps, no fine control[44]	5 ns/div to 50 s/div Front-panel dial HORIZONTAL SCALE
Roll	Roll (default 500ms/div, selectable 50ms/div to 500s/div) (FW02.000) Start position left Math available (except HPF, LPF and tracking) Acquisition. M69	Roll (50 ms/div and slower) Start position right Math disabled Acquire, Roll	Roll (50 ms/div and slower) Start position right Math disabled ACQUIRE > Time Mode > Rol. M41
Interpolation modes (when there are less ADC sample points than screen values needed)	Sin(x)/x, Linear, S&H Acquisition. M70	Sin(x)/x (Sinc), Linear (X) Acquire > Menu. M82	Not specified
Offset positions	Check PS. Activate grid axis to see what you are doing!	Offset mode selectable in Utility > Menu > Reference position. M337 PS. Activate grid axis (default off) to see what you are doing!	
Horizontal reference point position (so the horizontal zoom is centered from this point)	Left (~10%), Centre (50%), Right (~90%) Horizontal. M54	From 0% to 100%. Ambiguous terminology[45] Is placed in a bit odd position in the menu system Utility > Menu > Reference position. M337	Left (~10%), Centre (~50%), Right (90%) ACQUIRE > Rime Ref Center. M36

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[43] Https://www.eevblog.com/forum/testgear/siglent-sds2000x-plus-coming/
[44] Cannot be set to in-between values (say, 12ms/div), also net when entering manual values via screen 'calculator' input. Can be an issue to get exactly a wave into view, or a specific sequence in a serial bus decode.
[45] I find the terminology used here rather confusing, especially because both for the "Fixed Delay" and "Fixed position" mode, the word 'delay' is left away on the instrument's screen. With just 'position' left on the screen, you think you can change a position, but in fact you cannot do so. But in Fixed Delayt, the position can be changed.
, 'position' vs. 'delay', quite confusing. Calling this "Centre Position" and "Adjustable" Position", or simply a single parameter that is default at 50% (like in other devices) would be much more intuitive. Just my two cents.

Horizontal mode XY

	RTB2000	SDS 2000X+	DSOX 1200
	App > XY. M163	Acquire, XY Mode	ACQUIRE > Time Mode > XY. M43
Number of simultaneous Y channels shown	2	1	1
Sources	4A (any analogue channel)	Input hardwired Ch1-Ch2[46]	Input hardwired C1-Ch2
Simultaneous time domain (XT) traces shown	Yes, in two separate grids		
Trigger and time base functions	Present[47]		Horizontal scale adjusts sample rate OHF check
Trace intensity control ('Z-axis'; 'blanking')	[not specified or documented in manual, but possible via SCPI remote commands, with limitations [48]]		Yes, via ext. trigger input. If above threshold of 1.4V, trace is blanked
Allows use of cursors measurements	Two horizontal and two vertical cursors	Two horizontal and two vertical cursors	Two horizontal and two vertical cursors

Zoom
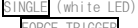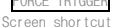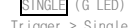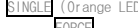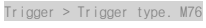
	RTB2000	SDS 2000X+	DSOX 1200
Type of zoom	Horizontal, Vertical (FW02.202) ZOOM Screen shortcut	Horizontal, Vertical ZOOM Front-panel dial Zoom (click) Acquire, Zoom. M92	Horizontal -- magnification glass -- Front-panel dial HORIZONTAL SCALE
Select horizontal zoom area	Draw zoom area Pinch zoom trace Timebase dial (position & scale) Menu with numerical values	Pinch zoom trace Timebase dial (position & scale) Menu with numerical values Draw zone area	Timebase dial (position & scale)
Select vertical zoom area	Draw zoom area Pinch zoom trace Vertical dial (position & scale) Menu with numerical value	Pinch zoom trace Vertical dial (position & scale) Menu with numerical values Draw zone area	
Split screen	Selectable windows size	Fixed windows (⅓ and ⅔)	Fixed windows (about ½ and ½)

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[46] Hence, the front panel has "X" and "y" printed under the BNC for channels 1 and 2…

[47] This means that if the timebase is set such that only a part of a waveform is shown in the time domain graphs, then the XY graph will only show those parts of the traces.

[48] The RTB responds to the same Z-mode commands (DISPlay:XY:ZSOurce, DISPlay:XY:ZMODe, DISPlay:XY:ZTHReshold) as the RTM and HMO series (see the R&S RTM2000 manual, page 464). These commands allow to turn the Z mode on, select the blanking input channel, and choose analog or digital control (the latter with a selectable threshold). There are some observed limitations. In analogue mode, it seems from min to max channel values there are four equal 'zones' in which brightness goes from low to high. In digital mode, the threshold can be set from -100 to +100 (different from the RTM) but value 0 puts the threshold at the minimum channel value (next to negative overload) and other values dont change this behavior. Having this said, this is not a claimed or documented feature, so we should not complain. After some experimentation it's useful for those that need it.

Trigger system

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Source	4A, 16D, Ext., AC Line, 2 Serial Dedicated source button with colour code	4A, 16D, Ext., AC Line, 2 serial (varies by trigger type)	4A, Ext., AC Line, Wavegen, Wavegen Modulation
Ext. trigger in	Front (dedicated) Sensitivity 300mV, level -5/5V, max. 300 V (RMS), max. 400 V (Vp)	Back (dedicated) Max. 1.5Vrms; max. 7.5Vrms with `EXT/5` attenuator	Back (dedicated) Max 30 Vrms, 40 Vpk
Channel selection	Always (on, off)[49]	When active or hidden (not off)	Always (on, off)[50]

Trigger mode	Auto, Normal
	`AUTO/NORM`
	`Trigger > Trigger type. M76`
		Auto, Normal
		`AUTO`, `NORM`
		`Trigger > Auto`
		`Trigger > Normal`
			Auto, Normal

Trigger start and stop	Run, Stop, Single
	Force trigger
	`RUN/STOP` (R/G LED)
	`SINGLE` (white LED)
	`FORCE TRIGGER`
	`Screen shortcut`
		Run, Stop, Single
		`RUN/STOP` (R/G LED)
		`SINGLE` (G LED)
		`Trigger > Single`
			Run, Stop, Single
			Force trigger
			`RUN/STOP` (R/G LED)
			`SINGLE` (Orange LED)
			`FORCE`

Trigger types	6 (see below)	10 (see below)	7 (see below)
Type: Edge	{Rise, fall, alternate} `Trigger > Trigger type. M76`	{Rise, fall, alternate} `Trigger > Menu. M101`	{Rise, fall, alternate, either} `M101`
Type: Pulse width	Polarity {> < = ≠ inside outside} Delta Δ Threshold Hysteresis `Trigger > Trigger type. M78`	Polarity {> < inside outside} `Trigger > Menu. M105`	Polarity {> < inside}
Type: Video	Polarity, 5SD 3HD video standards, 3 interlace modes, line select `Trigger > Trigger type. M80`	Polarity, 4SD 4HD video standards, custom standard, 2 interlace modes, line select `Trigger > Menu. M106`	Polarity, 4 SD video standards, 3 interlace modes, line select `ANALYZE` >Features >Video > Standard Supports auto setup `ANALYZE` >Features >Video > Auto Setup
Type: Pattern	Up to 20 bits (4A 16D) {AND, OR} State: {H, L, don't care} {True, False, Goes True, Goes False} Analogue channels thresholds Time limitation {> < = ≠ inside outside} with Δ `Trigger > Trigger type. M82`	{AND, OR, NAND, NOR} State: {H, L, don't care} Goes Tru for OR and NAND, To False for AND and NOR Time limit range (AND and NOR only) Check in practice	"State"
Type: Serial	Supported `Trigger > Trigger type. M342`	Supported `Trigger > Menu.`	Supported
Type: Timeout	Supported (FW1.203) `Trigger > Trigger type. M85`		
Type: Edge within vertical window		"Window" `Trigger > Menu. M111`	
Type: Runt		Polarity, {> < inside outside}, upper time value `Trigger > Menu. M116`	
Type: Interval		Supported `Trigger > Menu. M114`	
Type: Dropout		Supported `Trigger > Menu. M114`	
Type: Setup and hold			Supported
Type: Slope (Rise/fall time)		Supported `Trigger > Menu. M102`	Supported
Trigger Zone		`Trigger zone` `Trigger > Zone. M124-130`	
Hold-off	For all trigger types (FW02.000) Time. `Trigger > Trigger type. M76`	For all trigger types except video and serial. By Time (8ns to 30s; 8ns step) By # of events (1 to 10^8) `Trigger > Menu. M120-121`	Time
Trigger coupling	AC, DC `Trigger > Coupling. M77`	DC, AC (AC: 20Hz HPF, Ext. trig: 8 Hz HPF) `Trigger > Menu. M122`	AC, DC (AC: 10Hz HPF) (DC ext. trigger: 50Hz)

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[49] Digital channels available while logic probe connected
[50] Digital channels available while logic probe connected

			`TRIGGER` > Coupling. M124
LF Reject	15kHz HPF[51] `Trigger > Coupling. M77`	1.2MHz HPF (EXT trig: 33kHz HPF) `Trigger > Menu (part of Coupling menu)). M122, S11`	50kHz HPF (ext. 50Hz) `TRIGGER > Coupling > M124`
HF Reject	5kHz LPF[52] `Trigger. M77`	600kHz LPF (EXT trig: 967kHz LPF) `Trigger > Menu (part of Coupling menu)). M122, S11`	50kHz LPF `TRIGGER > Coupling > Reject. M124`
Noise reject	Yes (extends the hysteresis to avoid unwanted trigger events)[53] `Trigger. M77, 334`	Yes (increases the trigger hysteresis) `Trigger > Menu. M122`	Yes (adds additional hysteresis to the trigger circuitry) `TRIGGER > Coupling > Reject. M124`
BNC pulse out (For pulse amplitude and with see IO/connections, above)	BNC pulse out ("`AUX`", front side) Shared connector, settings via: `Trigger. M86`	BNC pulse out ("`Auxiliary Out`", front side) (Output of Auxiliary Out connector is Trigger, except when Mask analysis is activated)	BNC pulse out ("`GEN OUT`", front side) Shared connector, settings via: `UTILITY > Options > Auxilary. M242-243`
Actions on mask (other than BNC Pulse out)	Sound Screenshot Save waveform Save all channels to references `Trigger. M86` (FW02.300)	BNC pulse out ("Auxiliary Out") see (Output of Auxiliary Out connector is Trigger, except when Mask analysis is activated)	

Tools

Cursor

	RTB2000	SDS 2000X+	DSOX 1200
Location on instrument	`All settings in Cursor` `CURSOR`	`All settings in Cursor > Menu` `CURSOR`	`All settings` `CURSOR`
Mode	• Manual (H, V, H+V) • Track (H+V) ("V-Marker"[54])	• Manual (H, V, H+V) • Track (H+V) • Measure (linked to a selected position in measure mode) (FW 1.3.9R4)	• Manual (H+V) • Track (H+V) • Binary[55] • Hex[56]
Source (Analog, Digital, Math, Ref) (Zoom)	4A, 16D, 5M, 4R	4A, 16D, 2M, 4R	4A, M, FFT, 2R
Different source for X1 and X2	Yes (FW02.400)	Yes	Yes
Cursor control rotary dial	Multifunctional dial	Multifunctional dial	Dedicated dial
Track scaling (when time base or vertical scale is changed)	Selectable ("Track Scaling")	Selectable separately for X and Y `CursorX Ref` `CursorY Ref`	
Coupling of cursor lines	Via "Coupling" {Off, On}	Via "X2-X1" or "Y2-Y1"	Via "X1-X2 Linked" or "Y1-Y2" Linked"
Measurement results in cursor mode	7 measurements: t1, t2, Δt, V1, V2, ΔV and ΔY/ΔX (in kV/s) (FW02.000)	7 measurements: t1, t2, Δt, V1, V2, ΔV and 1/ΔX (in MHz)	6 measurements: t1, t2, Δt, V1, V2, ΔV
Position of measurement results	Overlay of waveform	Overlay of waveform or movable table	Table (bottom)
Unit definition			X units {Sec., Hz., Phase[57], Ratio[58]} Y units {Base, Ratio[59]}

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[51] Inconsistent with Specifications (p.5): "LF reject (attenuates < 50 kHz (meas.)"
[52] Inconsistent with Specifications (p.5): "HF reject (attenuates > 50 kHz (meas.)"
[53] Manual page 334 also mentions additional 100 MHz LPF.
[54] V-Marker is in Type menu.
[55] Logic levels of displayed waveforms at the current X1 and X2 cursor positions are displayed in binary. The display is color coded to match the color of the related channel's waveform. Meaning: 1 is higher than trigger level, 0 is lower than trigger level.
[56] Logic levels of displayed waveforms at the current X1 and X2 cursor positions are displayed in hexadecimal. Meaning: 0x8 is higher than trigger level, 0X0 is lower than trigger level.
[57] With phase, X cursor = 360°.
[58] With ratio, X cursor is 100%.
[59] With ratio, Y cursor is 100%.

Measure

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Location on instrument	All settings in Measure `MEASURE`	All settings in Measure > Menu `MEASURE`	All settings `MEASURE`
Regular measure positions	6 positions (FW02.400) Shown in columns (6 horizontal) Shown in rows (6 vertical) when statistics on Measure `MEAS`	5 positions in M1 mode Shown in columns (5 horizontal) Shown in rows (5 vertical) when statistics on `MEASURE` > Mode > Advanced *plus* Config > Display Mode M1 12 positions in M2 mode Shown in 4:3 matrix Shown in rows (up to 12 vertical, variable) when statistics on `MEASURE` > Mode > Advanced *plus* Config > Display Mode M2	4 positions Shown in columns (4 horizontal) Statistics display comes in addition to regular measurements, in rows (4 vertical)
Quick measurement	9 measurement overlay with live trace `QUICK MEAS`	Table with 12 measurements `MEASURE` > Mode > Simple	Table with 26 measurements `MEAS` > Type > Snapshott All. M159 Can be assigned to "Quick Action" button via `UTILITY` > Quick Action > Quick Measure All. M159,249
Turn on/off measurements display (without deleting settings)	Turn on: individual measurements not global Turn off: individual or global[60]	Global `MEASURE`	Not at all
Adding measurements to show	First choose measurement position in menu, then select type, bit cumbersome	By "+" shortcut in measurement table	Via selection rotary in FIFO queue[61], very cumbersome
Source (Analog, Digital, Math, Ref) (Zoom)	4A, 16D, 5M, 4R	4A, 16D, 2M, 4R, 4Z, 4ZA, 16ZD History S13	4A, M, (FFT: 6 only)
Measurement types	33 types (see table below)	51 types (see table below)	32 types (see table below)
Measurements update rate for 1kHz / 10MHz wave[62]	16 meas/sec 260 meas/sec	3 meas/sec 20 meas/sec	36 meas/sec 667 meas/sec
On-screen explanation of measurements	Detailed icons	Small icons, and a one-line text which cannot be seen when you need it.[63]	Small icon; with soft key is pressed, extensive explanation with pictures is shown
Display of dimensions (V, A)	Types are described dimensionless but in results view, some measurements show voltage as fixed dimension, where it may actually also be current[64]	All dimensionless	All dimensionless
Histogram		Small histogram for each measurement position, one histogram can be zoomed `MEASURE` > Statistics Settings (menu name confusion[65])	
Trend display		Track display can be selected for one active measurements. Shown in floating window that can be set to two sizes. `MEASURE` > Tools > Track. M207	
Track display		Track display (FW 1.3.9R4) Not documented. Track display can be selected for [up to three] active measurements. Shown in floating window. Auto or manual scales `MEASURE` > Tools > Track	
Gate (to measure specific time period)		"Gate mode". Gate open and gate close moment are visible alike cursors. `MEASURE` > Config > Gate. M213	By via changing measurement window between the main screen and the zoom screen. `MEAS` > Settings > Meas Window. M168
Show relevant measurement data points in the waveform display		In Cursor Measure Mode (FW 1.3.9R4) not documented, H and V cursors show relevant data points (horizontal,	H and V cursors show relevant data points (horizontal, vertical)

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[60] By activating Statistics, and in the "Measure" tap click the tab close "X" icon.

[61] The first selected goes into measurement position #1, second in #2, etc. When the four positions are full, the first is deleted, the others move one place, and the new one comes in #4.

[62] Tested as follows: an RMS type full screen measurement on a 1kHz or 10MHz sine wave on channel 1; statistics on, everything else deactivated.

[63] To see the on-line text you need to select the measurement in question. But by selecting it, the instrument automatically closes the window and the text disappears. So you have to re-open the menu again to see what text appeared there. Very cumbersome if you need to figure out what measurement type you need for a certain job.

[64] For instance, when channel is set to current, the screen shows units such as V_{pp}, V_{top}, V_{base}, V_{amp}, V_{p+}, V_{p-}, which chould be A_{pp}, A_{top}, etc. Having that said, after the value there is the right dimensions. So: 'V_{tt} = 0.5A'. So the confusion is limited but this could be improved.

[65] Once selected, this menu is called "Statistics Config" instead of "Statistics Settings"

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		vertical) for almost any measurement[66] Also shows selected wave parts for First Cycle measurements. `MEASURE` > Tools > Measure cursor (which actually brings you to the cursor menu with Measure Cursor mode activated)	for almost any measurement . `CURSORS` > Mode > Track Waveform
Threshold settings for relevant measurements (middle for pulse width etc., lower and upper for rise time etc.)	Lower, Middle and /or Upper Level can be set manually (e.g., 10%, 50% 90%).@@@	Lower, Middle and /or Upper Level can be set manually (e.g., 10%, 50%, 90%), or in voltages. (1.3.7R5) M216	Lower, Middle and /or Upper Level can be set manually (e.g., 10%, 50%, 90%), or in voltages. `ANALIZE` > Feature > Measure thresholds. M175
Statistics	5 (Value, Min, Max, Mean, SD) + count (from FW02.400) @@@	6 (Value, Min, Max, Mean, PP, SD) + count Count limit: 1-1024, ∞ `MEASURE` > Statistics Settings (menu name confusion[67])	5 (Value, Min, Max, Mean, SD) + count (from FW02.12) `MEASURE` > Statistics Count limit: 1-2000, ∞ (from FW02.12) `MEASURE` > Statistics > Max Count Option to show standard deviation/mean ("Relative σ") (which is a dimensionless value) `MEASURE` > Statistics > Relative σ
Reset statistics	`CLEAR SCREEN`. M45 Via icon shown right of statistics table, or touch any setting or button that affects measurements	`CLEAR SWEEPS` M208 Via 'reset statistics' icon	`MEASURE` > Statistics > Reset Statistics
Increment statistics			Incremental statistics add the currently measured waveform to the collected statistical data (only when acquisition is stopped and segments are off) `MEASURE` > Statistics > Increment Statistics
Save measurements and statistics	Save measurements and statistics set to file (CSV) (See below at Save and Recall section)		

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[66] After changing a measurement, you need to go to item `CURSORS`. and change value from "NULL" to the new measurement.
[67] Once selected, this menu is called "Statistics Config" instead of "Statistics Settings"

Overview of all measurement types

			RTB2000	SDS 2000X+	DSOX 1200
	Measurement types[68]	Dimen-sion	33 types	51 types[69]	32 types
Horizontal (time)	Frequency	Hz	Frequency	Freq	Frequency
	Period	S	Period	Period	Period
	Duty Cycle +	%	Duty Cycle +	+Duty	+ Duty Cycle
	Duty Cycle −	%	Duty Cycle −	−Duty	− Duty Cycle
	Pulse Width +	S	Pulse Width +	+Width	+ Width
	Pulse Width −	S	Pulse Width −	−Width	−Width
	Burst Width	S	Burst Width		
	Rise Time	S	Rise Time	Rise Time; 10-90%Rise[70]	Rise Time
	Fall Time	S	Fall Time	Fall Time; 90-10%Fall	Fall Time
	Slew rate+	MV/s	Slew rate+ (FW02.000)	PSlope (FW 1.3.9R4)	
	Slew rate-	MV/s	Slew rate- + (FW02.000)	NSlope (FW 1.3.9R4)	
	Delay to Trigger	S	Delay to Trigger (FW02.400)	Delay (same?)	
	Time from trigger to each rising edge[71]	S		T@M	
	Time of max value	S		Time@max	
	Time of min value	S		Time@min	
	Difference between two consecutive periods	S		CCJ[72]	
	X at Min Y	S			X at Min Y
	X at Max Y	S			X at Max Y
Horizontal delay between two channels	Delay	S	"Delay" Settings on either channel: {Rising, Falling} (**) (4 combinations)[73]	"FRFR", "FRFF", etc. Settings on either channel: {Rising, Falling} {First, Last } (8 combinations)	"Delay" Settings on either channel: {Rising, Falling} (4 combinations) (did not get falling edges working)
	Phase	°deg	Phase (**)	Phase	Phase
	Skew	S		Skew	
Vertical (amplitude)	Peak to Peak	V	Peak Peak	Pk-Pk	Peak-Peak
	Peak +	V	Peak +	Max	Maximum
	Peak −	V	Peak −	Min	Minimum
	Amplitude (top to base)	V	Amplitude	Amplitude[74]	Amplitude
	Top Level	V	Top Level	Top[74]	Top
	Base Level	V	Base Level	Base[74]	Base
	Mean Value	V	Mean Value	Mean	Average Full Screen
	Idem, First Cycle	V	Mean Cycle	Cycle Mean	
	Idem, integral cycles only[75]	V			Average − Cyc
	Median (50% above 50% below)	V		Median	
	Median First Cycle	V		Cycle Median	
	RMS Value	V	RMS Value	RMS	DC RMS Full Screen
	Idem, First Cycle	V	RMS Cycle	Cycle RMS	
	Idem, integral cycles only[75]	V			DC RMS − N Cycles
	FrPos/neg pulses, Rising/falling edges,	V	σ-Std. Deviation	Stdef	AC RMS Full Screen (Std. Deviation)
	Idem, First Cycle	V	σ-Std. Dev. Cycle	Cycle Stdef	
	Idem, integral cycles only[75]	V			AC RMS − N Cycles
	Crest Factor	ratio	Crest Factor		
	Level at trigger	V		L@T	
	Pos. Overshoot	%	Pos. Overshoot	ROV	Overshoot[76]
	Neg. Overshoot	%	Neg. Overshoot	FOV	
	Overshoot before a falling edge	%		Preshoot(FPRE)	Preshoot[77]
	Overshoot before a rising edge	%		Preshoot(RPRE)	
Counting	# of positive pulses on display	Cnt.	Positive Pulse	Ppulses	Positive Pulse Count
	# of negative pulses on display	Cnt.	Negative Pulse	Npulses	Negative Pulse Count
	# of rising edges on display	Cnt.	Positive Slope	Rising Edges	Rising Edge Count
	# of falling edges on display	Cnt.	Negative Slope	Falling Edges	Falling Edges Count
	# of edges in a waveform	Cnt.		Edges	
	# of cycles in a periodic waveform	Cnt.		Cycles	
	Bit Rate	Mbps			Bit Rate

[68] Not counting multiple variants possible in the delay section.

[69] Not considering "10-90%Rise" and "90-10%Fall" because these functionally overlap with "Rise Time" and "Fall Time".

[70] The first variant measures between low threshold and high threshold (which can be manually set, like the other scopes, see above). The second variant is between 10% and 90%, which overlaps with the first variant.

[71] Creates multiple values in a single trace. So, if there are three edges after the trigger on the screen, the values may be 1µS, 2µS and 3µS. The histogram function can show these clearly. The shown "Value" is the last one (3µS) and the average would be 1.5 µS.

[72] Not sure what this exactly means and no information is offered in the manual. Screen says: 'Time difference between two *continuous* periods'. Somewhat different but not any clearer.

[73] Older FW02.300 had 36 combinations.

[74] A menu item MEASURE. > Config > Amplitude Strategy allows different strategies how to calculate top and bottom. M215.

[75] Looks for at least three full waveforms on the display and then takes only these three waveforms. With less than three detected edges, an error is shown.

[76] The edge that is closest to the trigger is measured (which can be seen by the shown X cursor). To switch between positive and negative overshoot, change the trigger.

[77] The edge that is closest to the trigger is measured (which can be seen by the shown X cursor). To switch between rising edge and falling edge, change the trigger.

	Counter trigger level crossings during gate time	Hz			Counter some specifics[78]
Area	.. waveform above zero	Wb[79]		+Area@DC	
	.. waveform below zero	Wb		-Area@DC	
	.. waveform	Wb		Area@DC	
	Absolute area of the waveform	Wb		AbsArea@DC	
	.. waveform above average	Wb		+Area@AC (1.3.7R5)	
	.. waveform below average	Wb		-Area@AC (1.3.7R5)	
	.. above average minus area of the waveform below average	Wb		Area@AC (1.3.7R5)	
	.. above average add area of the waveform below average	Wb		AbsArea@AC (1.3.7R5)	

Digital Voltmeter (DVM)

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
	aapje		
Location on instrument	App > Meter Quick Toolbar > Meter M165; S7		ANALYZE > Feature > DMM M195; S7,717 DVM standard since FW2.10
Source (Analog, Digital, Math, Ref) (Zoom)	4A (does not works for channels turned off)		4A (works for channels turned off)
Positions (shown simultaneous)	4 positions		2 (one selected voltage plus frequency but only if channel is selected for trigger)
Resolution	3 digits		3 digits
Scale	Via analogue channel settings		• Via analogue channel settings[80] • Auto range mode, is especially useful for inactive channels. Overwrites the channel gain and position setting for active channels.[81] Not available for channels selected for trigger
Source (Analog)	4A, active or inactive		4A, active or inactive
Measurements	DC, AC, ACrms, DC+ACrms (shown DC measurements are wrong when channel itself is set to AC coupling, no warning[82])		DC, DCrms, ACrms (DC only when channel set to DC, otherwise automatic switches to AC)
Bandwidth (for AC signals)	1MHz		20 Hz to 100 kHz (for RMS), warning when outside range
Display	Display colour adapts to channel. Show in overlay window (screen position can be dragged)		Seven-segment readout style. Display colour adapts to channel. • While DVM menu is selected: results shown in large font in overlay window (transparency selectable).[83] (Frequency shown simultaneously but only if channel is selected for trigger). Small analogue scale showing measurement extrema over last 3 seconds. The scale's blue triangle pointer shows the most recent measurement. If measurement statistics is also on, the display jumps erratically between both. But disappears when leaving DVM menu. • Always: results shown in small font at left bottom. Only voltage or frequency (not both). No scale.

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[78] This counter is hardware implemented, only for the channel selected for trigger and edge or pulse width trigger is selected, and uses trigger threshold. See Frequency Counter section below. See M168 as well as some additional information on on-screen help (press "Type" softbutton for 3 seconds).

[79] See discussion at https://electronics.stackexchange.com/questions/562058/siglent-sds1104x-e-integrate-function-units-of-measure

[80] But asynchronous from oscilloscope's acquisition system.

[81] This is important o be aware of when auto-range is activated and DVM menu is left. After than, any moment you attempt change the channel gain, a second later, that change is undone (as auto-range overrides the new selected setting)…

[82] This suggests the DVM is located after the AC coupling capacitor of the channels. While this is apparently also the case for the DSOX, that device takes a better approach: it disables the DVM DC mode when the channel is coupled AC (and if the DVM was already on DC before the channel was put into AC, it switches the DVM back to AC).

[83] When switching from Analysis to Measurement menu, there is weird interference with measurement window.

Frequency counter

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Location on instrument	App > Counter. M167, S7	Analysis > Counter. M264, S14	ANALYZE > Feature > DVM. M195, S7,17
Implementation	Separate from DMM Show in overlay window (screen position can be dragged) (Separate freq. counter in Measurements) (Separate freq. track in Math)	Show in overlay window (screen position can be dragged) (Trigger frequency is shown on the screen independent of the counter) (Separate freq. counter in Measurements)	Part of DMM (results shown simultaneously with voltage), hardware implemented (Same freq. counter shown in Measurements) (Separate event counter with gate in Measurements)
Modes	Frequency, Period (shown simultaneous)	Freq, Period, Totalizer	Frequency
Inputs	4A, trigger, ext. trigger (Independent of DMM) (Independent of channel selected for trigger[84])	4A (Independent of channel selected for trigger but only works if trigger (level) for that channel is properly set[85]) Also works for serial trigger (1.3.7R5)	4A (Same channel as DMM) (Only works when channel is also selected for trigger[86], but independent of proper trigger level)
Digits	6 digits	7 digits	5 digits
Measurement rate	[Not specified]	100 times/second	[Not specified]
Totalizer gate / trigger modes		Totalizer can count rising or falling edges Gate mode: Voltage level, Polarity Trigger "After Edge" mode: Rising or falling edges (on gate channel); Level	
Statistics		Statistics for Freq. and Period (Value, Mean, Min, Max, Stdef, Count[87]). Update rate ~0.5 meas/sec	

[84] In the FW02.400 manual (p. 167) it is called the "Trigger Counter" and the screenshot also shows this at the icon, suggesting its use is limited for the channel serving as trigger. But on the instrument, the text at the icon is different (just 'counter') and when used, it can just measure the frequency of any channel, whether selected for trigger or not.

[85] Alternatively, a "Level" setting van be used in the counter menu which is linked to the trigger level setting for that channel (if moved, trigger level moves, if trigger level moved, this level moves).

[86] If user selects other channel for trigger, the frequency counter automatically changes to voltmeter for the selected channel.

[87] Here, count represents is how many frequency data points have been gathered for the statistical analysis.

Bus decode

Serial bus decoding (general aspects; for specific protocols see below)[88]

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Location on instrument	All settings in Protocol PROTOCOL	All settings in Analysis > Decode DECODE	ANALYZE >Features >Serial
'Bundle' protocols[89]	SPI, I^{2}C, UART, CAN, LIN	SPI, I^{2}C, UART, CAN, LIN	SPI, I^{2}C, UART, CAN, LIN
Optional		FlexRay, MIL-STD-1553B, I2S, CAN FD. Manchester[90], SENT (since 1.3.7R5)	
Simultaneous decode buses	1 bidirectional[91], 2 unidirectional	2 bidirectional	1 bidirectional
Signal sources	4A, 16D (not M[92] or R)	4A, 16D (not M[92] or R)	4A (not M[92] or R)
Decoder works with channels turned off	Yes	No, but does work from hidden channels	Yes
Logic bit level display	Yes, shown just above telegram (various useful purposes[93])		
Relation decode module to trigger module	Relevant decode settings automatically shared with trigger. Serial trigger settings shown on same screen as decode settings	Protocol settings can be copied to and from trigger[94] Analysis > Decode > Protocol copy	Relevant decode settings automatically shared with trigger
Color-coding for message elements telegram display	Yes	Yes	Yes
Refresh rate telegram display	Very fast	Very fast	Very fast
Event table ('tabular view', 'table', 'lister'): Number of lines shown simultaneous	Variable, up to 20 lines shown (scroll option) Special pointer shows selected	Variable, up to 7 lines shown S12 (scroll option)	(Lister since FW2.10) Fixed 9 lines shown (scroll option) Table disappears each time you leave the specific lister menu.
Track frame option[95]	Available. Also shows purple flag at selected frame (regardless of track frame activated)		Available
Refresh event table	Low (observed as approximately 2 times per second)	Medium (observed as approximately 6 times per second)	Very fast (observed as more than 25 times a second)
Export event table	Yes, to CSV file icon next to table	Yes [to CSV file] Analysis > Decode > Save icon	Yes, to CSV file SAVE/RECALL Format > Lister data
Base display format	{Bin, Hex, Dec, Oct, ASCII[96]} (non-valid ASCII values shown as HEX)	{Bin, Hex, Dec, ASCII} (Problem with 'non-valid' ASCII character values[97])	UART: {Hex, Bin, ASCII} Other protocols: only {Hex}
Label Lists ('symbolic ID')	Label list (Protocol Translation Table) for I^{2}C, CAN and LIN can be loaded from file. Examples provided. (FW1.203)		
Other		For SPI, I^{2}C, CAN, LIN, no errors are shown in telegram or table. This is especially problematic because in identified cases, the instrument shows garbage data as if it were correct decoded data[98]	

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[88] Descriptions in this table are based on the 'Bundle' protocols' (i.e., SPI, I^{2}C, UART, CAN, LIN) and do not consider the optional protocols.

[89] Protocols that are either included with any device version, or bundled together with specific device offers.

[90] Implemented without serial trigger function.

[91] If a bidirectional bus is used (e.g. UART RX/TX or SPI MOSI/MISO), two bus decoders are occupied. S9.

[92] Not being able to decode from a math channel is a pity. Busses such as CAN or RS485 are differential, and the ability to use a math function to create a proper differential signal from two channels (allowing floating measurements) can prevent the purchase of a differential probe.

[93] This shows the actual logic levels that are input to the decoder and are useful for various reasons: (1) they tell whether the thresholds are well set, (2) they inform whether the sample rate is sufficient for the decode at stake, (3) they tell there are enough horizontal sample points (as some scope use decimation and thus use only 1 out of every N samples as input to the decoder), (4) they show you the bit levels also when you decide to turn the channel of to save screen estate (in the RTB, the serial decode can also work from a channel turned off).

[94] At first, it sounds nice that protocols settings (serial protocol type, channel selection, thresholds) can be copied to and from the trigger section. At second thought: why? In the other scopes, these settings are already automatically shared with the trigger section, and there is no need to go into this copy action at all. Having the possibility to have different settings in the decode section and in the trigger section can only lead to confusion.

[95] A track frame function makes the trace and telegram jump to the selected frame in the table. Note that this only works when acquisition is stopped.

[96] If a value is observed that does not correspond to a valid ASCII character, then the instrument shows the HEX value instead.

[97] ASCII characters other than regular characters are shown as, for instance, ◆ or □, effectively meaningless for decoding purposes.

[98] See https://www.eevblog.com/forum/testgear/siglent-sds2000x-plus-coming/3125/

UART protocol decoding

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
	s15	s12	s15
Bus speed (baud rate)	Manual from 300b/s to 3Mb/s; 10 presets	Manual from 300b/s to 20Mb/s; 9 presets	100 bps to 8 Mbps 27 presets
Polarity	{Active High, Active Low} for Rx and Tx	Idle High, Idle Low	Idle High, Idle Low
Threshold	Auto determine, manual[99]	Manual	Manual
Hysteresis for serial decode[100]	Yes, for all analogue and digital channels, in channel menu.[101] `Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274`		Perhaps[102]
Data symbol size	{5 to 9 bit} Supports 9th bit for addressing in RS485 and other schemes.[103]	{5 to 8 bit} Does not supports 9th bit for addressing in RS485 and other schemes.[105]	{5 to 9 bit} Supports 9th bit for addressing in RS485 and other schemes.[105]
Parity	{none, even, odd}	{none, even, odd, mark, space}	{none, even, odd}
Stop bits	{1, 1.5 or 2}	{1, 1.5 or 2}	
Idle time for end-of-frame	78us to 53ms		
Bit order	[Always LSB first]	{LSB, MSB}	{LSB, MSB}
Max decoded frames	[not specified]	15,000	[not specified]
Columns shown in Bus Table / Bus Display / Lister	Frame, Start time, Source {RX, TX}, Data, Status[104] Several time settings[105]	Time, Rx, Rx error, Tx, Tx error	Time, Rx [data], Tx [data], Errors. Several time settings[106]
Error states, warnings or status shown in Bus Table / Bus Display / Lister	• Start error (no start bit found) • Stop error (no stop condition found) • Parity error (transmission error) • INSufficient[107] (warning) • Break condition found (warning) (a) (Column is rather small[108]) `Additional options for observing UART errors available in SCPI for both frames (M497) and words (M497)`	"Stop error" "Parity Error" "Over Length" (a)	"Parity error" "Unknown error" (a) M324
Content shown in Bus Table / Bus Display / Lister	Shows entire frame in a line (e.g., a full text string)	New line for every value /character in a frame	New line for every value /character in a frame
UART Trigger: Timing event	• Start bit • Start of frame • Break[109]	• Start bit • Stop .. Tx, Rx	• Start • Stop .. Tx, Rx
UART Trigger: Symbol position	`Symbol <n>`, where n is the signal position (offset) from 0 to 4k		
UART Trigger: Specific symbol	`Any symbol`: A specific word content (where the word is 5 to 9 bits depending on protocol setting). Supports wildcards ('don't care') for individual bits and for HEX digits	`Data` .. specific word between 00 and FF .. =, <, > .. Tx, Rx	`Data` .. specific word in HEX (00 and FF) or ASCII (scrolls through all ASCII values) .. =, ≠, <, > .. Tx, Rx
UART Trigger: Specific symbol and position	`Pattern`: … symbol offset position from 0 to 4k .. specific pattern of up to 32 bits. Supports wildcards ('don't care') for individual bits and for HEX digits		
UART Trigger: Errors	• Stop bit error • Parity error (not available if protocol parity is set to 'none')	• [Parity] error M149, S12	• Parity error (not available if protocol parity is set to 'none')
Hold off	Can be used in combination with any of the above trigger functions		Can be used in combination with any of the above trigger functions
UART searching			
Other			UART bus statistics (`Real-time totalizer`) shows bus quality and efficiency. Shows frame count and error rates M323

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[99] For both analogue and digital channels, thresholds can be manually set and the threshold can be automatically determined.

[100] This is relevant if noise or imperfect digital signals cause oscillation across the threshold value and as a result hinder the decoder doing its work properly.

[101] While this setting is not in de digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.

[102] Not entirely clear. But since noise reject is available during serial decode trigger, and that function is described in the manual as as "increases the trigger hysteresis", it might be. Trigger > Menu. M122

[103] The '9th bit' can be used in RS485 and other UART schemes to implement an addressing system. This 9th bit indicates whether the preceding 8-bits should be interpreted as 'address' or as 'data'. If the 9th bit is a '1', the preceding 8-bits should be interpreted as an 'address' byte. If the 9th bit is a '0', then the preceding 8-bits should be interpreted as a 'data' byte. See here and here.

[104] The status table can show errors (see next row) but also It can also show values [OK, Break].

[105] Time can be selected to be relative to trigger or relative to previous frame. In the latter case, the column name changes to "time difference".

[106] Time can be selected to be relative to trigger or relative to previous row in table.

[107] INSufficient: the frame is not completely contained in the acquisition; but the acquired part of the frame is valid.

[108] The width of the column showing errors can be small, especially for showing multiple errors (they are shill shown but in shorted form (e.g., 'NACK+Fo' for NACK plus Form error). Occasionally, after you come back from a menu, making a small switch in time base (and back) makes the column somewhat wider.

[109] Triggers if a start bit is not followed by a stop bit, the data line remains at logic 0 for longer than a UART word.

(a) These error values are not documented but have been observed in practice. There might be others

I^{2}C protocol decoding

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
		s12	`ANALYZE` >Features >Serial, mode I2C, Addr Size. M287, S15
Supported I^{2}C protocol speeds	High-speed, fast mode plus, fast mode, and standard mode. M229	[not specified]	[not specified]
Bus speed	up to 10 Mbps	[not specified]	Up to 3.4 Mbps S16
Threshold	Auto determine, manual[110]	Manual	Manual
Hysteresis for serial decode[111]	Yes, for all analogue and digital channels, in channel menu.[112] Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274		
Treatment of R/W bit		Consider R/W bit as the 8th bit in the address (instead of showing the 7 bit address value) M141	Consider R/W bit as the 8th bit in the address (instead of showing the 7 bit address value) M292
Max decoded frames	[not specified]	2,000	[not specified]
Columns shown in Bus Table / Bus Display / Lister	Frame, Start time, Type, ID, Length, Data, State Additional options for I2C errors available in SCPI (M484)	Time, Address, R/W, Data	Time, Restart flag, Address (including R/W flag), Data, Missing Ack
Error states, warnings or status shown in Bus Table / Bus Display / Lister	• Address Error • Data error • Stop error • INSufficient[113] (warning) • Restart (status) • OK (status) (Acknowledgement bits after each data and address byte are shown in the telegram, not in the table[114]) (column rather small[115]) (a)	No errors shown.[116]	Missing Ack. No other errors shown. M294
Other		Bus table has long data mode (can show long strings of texts) [117] Analysis > Decode > Results List > Long Data	
I^{2}C Trigger: Timing event	• Start • Stop • Restart (Repeated start condition)	• Start • Stop • Restart (Repeated start condition)	• Start • Stop • Restart ("triggers when another start condition occurs before a stop condition.")
I^{2}C Trigger: No Ack.	• No Ack (bytes with missing acknowledgement bit)	• No Ack (bytes with missing acknowledgement bit)	• Missing Acknowledge • Address with no Ack
I^{2}C Trigger: Address and data	.. Slave address {7 bit, 10 bit} .. {Read, Write} .. Address (7 bits/HEX 00-7F or 10 bits/HEX 000-3FF) or "Any Address" .. Specified bit pattern, 1 to 3 bytes or 24 bits, supports wildcards ('don't care') for individual bits and for HEX digits .. A user Symbolic ID[118] .. up to 4k offset	.. Slave address {7 bit, 10 bit} .. {Read, Write, Either} .. Address (7 bits/HEX 00-7F or 10 bits/HEX 000-3FF). No wildcard .. Two specified data bytes in HEX (00-FF). Does not support other lengths than exactly two bytes, BIN or wildcards	For 7-bit address: .. {Read, Write} .. .. Address (7 bits/HEX 00-7F or 10 bits/HEX 000-3FF) or "Any Address" .. One or two specified data bytes in HEX (00-FF), or "any byte" Does not wildcards or BIN For 10-bit address .. {Write} no read .. .. Address (10 bits HEX 000-3FF) or "Any Address" .. One data bytes in HEX (00-FF),), or "any byte" Does not wildcards or BIN
I^{2}C Trigger: Data length		.. Slave address {7 bit, 10 bit} .. SDA Data length 1-12	
I^{2}C Trigger: EEPROM		The trigger searches for EEPROM control byte value 1010xxx on the SDA bus. And there is a Read bit and an ACK bit behind EEPROM. See M136	The trigger looks for EEPROM control byte value 1010xxx on the SDA line, followed by a Read bit and an Ack bit. See M289
Hold off	Can be used in combination with any of the above trigger functions		Can be used in combination with any of the above trigger functions
I^{2}C searching			

(a) These error values are not documented but have been observed in practice. There might be others

[110] For both analogue and digital channels, thresholds can be manually set and the threshold can be automatically determined.
[111] This is relevant if noise or imperfect digital signals cause oscillation across the threshold value and as a result hinder the decoder doing its work properly.
[112] While this setting is not in de digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.
[113] INSufficient: the frame is not completely contained in the acquisition; but the acquired part of the frame is valid.
[114] Unlike the DSOX, the RTB shows full lines of data values instead of just a single value per line in the table; therefor it would be difficult to show acknowledgement data for each of the bytes in a table row.
[115] The width of the column showing errors can be small, especially for showing multiple errors (they are shill shown but in shorted form (e.g., 'NACK+Fo' for NACK plus Form error). Occasionally, after you come back from a menu, making a small switch in time base (and back) makes the column somewhat wider.
[116] There is no column to show errors, and also when there are known errors in the signal, none are shown.
[117] SPI, UART, CAN and LIN do not have such a function.
[118] If the user loaded a 'Label List' (see above), then the trigger menu allows to select the names in that list, like "Ignition" or "Valve".

SPI protocol decoding

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
	M222	s12, M142	M303, s15
Bus speed	up to 25 Mbps	[Not specified]	Up to 25 Mbps
Polarity for MOSI, MISO	Independent for MOSI, MISO	[119]	No adjustable
Clock	{Rise, Fall}	{Rise, Fall}	{Rise, Fall}
Threshold	Auto determine, manual[120]	Manual	Manual
Hysteresis for serial decode[121]	Yes, for all analogue and digital channels, in channel menu.[122] `Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274`		
Word size	1 to 32 bit	1 to 32 bit	4 to 16 bit
Bit order	{MSB, LSB}	{MSB, LSB}	{MSB, LSB}
Chip Select (CS)	• CS high • CS low • Idle time: 25.6ns to 53ms `See also M277`	• CS Active High • CS Active Low • CLK timeout: 100ns to 5ms	• CS • Not CS • Clock timeout: 100ns to 10s
Max decoded frames	[not specified]	15,000	[not specified]
Columns shown in Bus Table / Bus Display / Lister	Frame, Start time, Source (MISO, MOSI), Length, Data, Status Several time settings[123]	Frame, Time, MISO [data], MOSI [data]	Time, MOSI [data], MISO [data]
Error states, warnings or status shown in Bus Table / Bus Display / Lister	• Data error • INSufficient[124] (warning) (a) `Additional options for observing SPI errors available in SCPI (M475)`	No errors shown.[125]	Aliased data is shown in pink colour.
SPI Trigger: Timing event	.. selectable MISO or MOSI[126] • Frame Start `See also M27` • Frame End `See also M27`		[Possible to trigger on frame start by using bit pattern triggering and set all bits to don't care]
SPI Trigger: Specific bit position withing frame	.. selectable MISO or MOSI Offset 0-32k		
SPI Trigger: Bit pattern	.. selectable MISO or MOSI .. Specified bit pattern, max 8 nibbles (each 4 bits) or 32 bits supports wildcards ('don't care') for individual bits and for HEX digits .. up to 32k offset	.. selectable MISO or MOSI .. selectable ANY (at any position) or VALUE (offset position 0 to 64) *Then..* (A) Specified bit pattern, between 4 bits and 96 bits. Value can be entered as bits or HEX, no wild cards *OR* (B) all bits zero (e.g., 0000), all bits one (e.g., 1111), or all bits don't care (e.g., xxxx)	.. selectable MISO or MOSI .. Specified bit pattern, between 4 bits and 64 bits. Supports wild cards. No HEX input.
SPI searching			

(a) These error values are not documented but have been observed in practice. There might be others

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[119] The decode module has no polarity option, but the user can change invert the associated channel to achieve a polarity switch.
[120] For both analogue and digital channels, thresholds can be manually set and the threshold can be automatically determined.
[121] This is relevant if noise or imperfect digital signals cause oscillation across the threshold value and as a result hinder the decoder doing its work properly.
[122] While this setting is not in de digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.
[123] Time can be selected to be relative to trigger or relative to previous frame. In the latter case, the column name changes to "time difference".
[124] INSufficient: the frame is not completely contained in the acquisition; but the acquired part of the frame is valid.
[125] There is no column to show errors, and also when there are known errors in the signal, none are shown.
[126] Via trigger > type > source.

CAN protocol decoding

	R&S RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
	M244–257	M151–154 (3.5 pages)	ANALYZE >Features >Serial, mode CAN. M277–285
Supported CAN protocols	CAN version 2.0A and 2.0B M245	[unspecified][127]	CAN version 2.0A and 2.0B M279
Bus speed (baud rate)	manual from 100b/s to 2Mb/s; 10 presets	manual from 5kb/s to 1Mb/s[128]; 10 presets	Manual form 10 kb/s to 5Mb/s[129]); 15 presets
Polarity	{Active High, Active Low}	[130]	{CAN_H, CAN_L, Differential L-H, Differential H-L, Rx,Tx} M278–279
Threshold	Auto determine, manual[131]	Manual	Manual
Hysteresis for serial decode[132]	Yes, for all analogue and digital channels, in channel menu.[133] Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274		
Sample point[134]	25 to 90%		7 presets (from 60% to 87.5%)
Max decoded frames	[not specified]	2,000	[not specified]
Columns shown in Bus Table / Bus Display / Lister	Frame, Start time, Frame type, ID, Data length (DLC), Data, CRC, State Several time settings[135]	CAN [Frame], time, Frame type, ID, Data length, CRC, Ack.	Time, ID, Type, Data length (DLC), Data, CRC, Errors Several time settings[136]
Errors, warnings or status shown in Bus Table / Bus Display / Lister	• NACK (Acknowledge is missing) • OVL (Overload frame) • Stuff (Bit stuffing error) • CRC (Cyclic redundancy check failed) • Data error • Error-frame • Form error (a) Can show multiple errors per packet (column rather small[137]) Additional options for observing CAN errors available in CAN searching (see below) and via SCPI (M506)	Acknowledgement is confirmed (when they are lacking, sometimes there is a 'no' in the column, sometimes simply no value). But otherwise no errors shown.[138] CRC values are shown without indicating they are erroneous.	Acknowledge [missing] (Ack, A), Form [error] (Fo) Frame [error] (Fr) Can show multiple errors per packet. Telegram (but not lister) can also show THM[139] error. M284
CAN Trigger: Timing event	Start of frame End of frame	Start (of frame)	SOF - Start of Frame
CAN Trigger: frame type	combination of .. FRAME TYPE {'Data', 'Remote', 'Data or Remote', 'Error', 'Overload'} .. ID TYPE {'11bit', '29bit', 'any'}		[Could be created by CAN Trigger Identifier and wildcards for full address]
CAN Trigger: Identifier	combination of .. FRAME TYPE {'Data', 'Remote', 'Either'} .. ID TYPE {'11bit', '29bit'} .. Specific identifier for the 11 or 29 bits ID in HEX or in BIN, supports wildcards ('don't care') for individual bits and for HEX digits .. Compare ID (> < = ≠) ... A user Symbolic ID[140]	combination of [141] .. FRAME TYPE {'Data', 'Remote'}, not either .. ID TYPE {'11bit', '29bit'} .. Specific identifier for the 11 or 29 bits in HEX or BIN, does not support wildcards	combination of .. FRAME TYPE {'Data', 'Remote', 'Either'} .. ID TYPE {'11bit', '29bit'} .. Specific identifier for the 11 or 29 bits in HEX or BIN, supports wildcards ('don't care') for individual bits and for HEX digits
CAN Trigger: ID & Data pattern	Options as for ID above, combined with a data pattern up to 8 bytes / 32 bits, supports wildcards ('don't care') for individual bits and for HEX digits Must know data length[142] .. Compare data (= ≠)	Options as for ID above, combined with a data pattern of up to 16 bits, does not support wildcards. Cannot specify frame type (data or remote).	Options as for Remote Frame ID above, a data pattern up to 32 bits, supports wildcards ('don't care') for individual bits and for HEX digits. Cannot use data filter for remote frames

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[127] From testing I infer that both CAN version 2.0A and 2.0B are supported.

[128] Specifications (p12_ are somewhat confusing: "Nominal Baud Rate: 10 kbps, 25 kbps, 50 kbps, 100 kbps, 250 kbps, 1 Mbps, custom" and "Data baud rate: 500 kbps, 1 Mbps, 2 Mbps, 5 Mbps, 8 Mbps, 10 Mbps, custom". But on the device, the maximum selectable speed is 1Mb/s so I used this value in the table.

[129] Fractional user-defined baud rates between 4 Mb/s and 5 Mb/s are not allowed.

[130] The CAN bus setting have no polarity option, but the user can change invert the associated channel to achieve a polarity switch.

[131] For both analogue and digital channels, thresholds can be manually set and the threshold can be automatically determined.

[132] This is relevant if noise or imperfect digital signals cause oscillation across the threshold value and as a result hinder the decoder doing its work properly.

[133] While this setting is not in de digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.

[134] Position of the sample point within the bit, in percent of the horizontal bit time.

[135] Time can be selected to be relative to trigger or relative to previous frame. In the latter case, the column name changes to "time difference".

[136] Time can be selected to be relative to trigger or relative to previous row in table.

[137] The width of the column showing errors can be small, especially for showing multiple errors (they are shill shown but in shorted form (e.g., 'NACK+Fo' for NACK plus Form error). Occasionally, after you come back from a menu, making a small switch in time base (and back) makes the column somewhat wider.

[138] There is no column to show errors, and also when there are known errors in the signal, none are shown.

[139] THM: If the header exceeds the length specified in the standard.

[140] If the user loaded a 'Label List' (see above), then the trigger menu allows to select the names in that list, like "Ignition" or "Valve".

[141] There is also a "Curr ID Byte" setting but this is not additional selection criteria but determines the byte changed by the rotary control (of you do not want the direct entry mode).

[142] While the wildcards are very flexible, there is one thing to be aware: you do need to set the number of bytes to the actual message length. So, finding any message where the first byte is "0xAF" is not possible. You need to know that message is, say, 1, 2 or 5 bytes and set that; even if you can set the other bytes to wildcards ('0xXX') and can set even the full message ID to wildcards, you do need to know the number of bytes. A quick workaround is to set up the data pattern you look for, select the date [length] field, and then turn that slowly up from 1 to 8 bytes. While doing so, watch the trigger light on the front panel, the moment it goes on, you found the data length for which such a message exists. A workaround, but not perfect.

CAN Trigger: Message length	Possible by 'ID & Data pattern', set both message ID and all data to wildcard (XX) and select the message length in bytes.	check	check
CAN Trigger: Error	Selectable error type: • 'Stuff bit', • 'Form', • 'Acknowledge', • 'CRC'} Any combination of these errors can be selected. (See also the two *error frame types* above)	Yes, [but error type not specified or selectable[143]]	Selectable error type: • 'Error Frame', • 'All Errors', • 'Acknowledge Error', • 'Overload Frame' No combination of errors possible
CAN searching	*(continued on next page)*		
CAN searching[144]	• **Search Frame** Start of frame End of frame Overload Error (frame) Data ID 11 bit Data ID 29 bit Remote ID 11 bit • **Search Identifier** Same settings as 'Identifier' at trigger section • **Search ID & data** Same settings as 'Identifier & data' at trigger section Also here must know data length[145] • **Search Error** {'Stuff bit', 'Form', 'Acknowledge', 'CRC'} Any combination of these errors can be selected. In a bus table, each error is then identified by type. • **Search ID & error** Combines the settings as 'Identifier' at trigger section with the settings at 'Error', above.		
Other			CAN bus statistics (`Real-time totalizer`) shows bus quality and efficiency. Shows total CAN frames, flagged error frames, overload frames, and bus utilization

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[143] Manual only notes *"Error—The oscilloscope triggers on the error frame."* M152. It's surprising that in LIN mode several error types can be selected but in CAN mode this is not the case.

[144] In contrast to trigger, search can identify/show *all* events that meet the set criteria.

[145] While the wildcards are very flexible, there is one thing to be aware: you do need to set the number of bytes to the actual message length. So, finding *any* message where the first byte is "0xAF" is not possible. You need to know that message is, say, 1, 2 or 5 bytes and set that; even if you can set the other bytes to wildcards ('0xXX') and can set even the full message ID to wildcards, you do need to know the number of bytes. A quick workaround is to set up the data pattern you look for, select the date [length] field, and then turn that slowly up from 1 to 8 bytes. While doing so, watch the trigger light on the front panel, the moment it goes on, you found the data length for which such a message exists. A workaround, but not perfect.

LIN protocol decoding

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Supported LIN protocol versions	v1.3, v2.0, V2.1, SAE J602 Manual selection or auto recognition (allows mixed traffic) S16 S259	v1.3, v2.0 S13 Auto recognition (allows mixed traffic)	v1.3, v2.x Only manual setting. Mixed traffic not supported.
Bus speed (baud rate)	6 presets[146]; User defined from 1 kbps to 2.5 Mbps s16	6 presents; User defined from 300 bps to 20 Mbps s16	6 presents; User defined from 2.4 kbps to 625kb/s
Polarity [in protocol menu]	Active high, Active low	No setting, device expects idle *low*. [if required change polarity in channel menu] When polarity is wrong, the SDS shows a completely wrong decoded signal as if it's a correct decode!	No setting, device expects idle *high* [if required change polarity in channel menu]
Threshold	Auto determine, manual[147]	Manual	Manual
Hysteresis for serial decode[148]	Yes, for all analogue and digital channels, in channel menu.[149] Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274		
Sample point[150]			7 presents from 60% to 87.5%
Sync break lengths			Sync break {>=11, >=12, >=13 clocks} ANALYZE >Features >Serial, mode LIN. > Signals. M285
Max decoded frames	[not specified]	3,000	[not specified]
Columns shown in Bus Table / Bus Display / Lister	Frame, Start time, ID, Length, Data, Checksum, State Several time settings[151]	Frame, Time, ID, Data length, ID Parity, Data, Checksum	Time, ID (problem[152]), Data, Checksum, Error[153] Several time settings[154]
Error states shown in Bus Table / Bus Display / Lister	• Sync • Parity error • Data error • Checksum error • Wakeup frame (status) Can show multiple errors per packet (column rather small[155]) Additional options for observing LIN errors available in LIN searching (see below) and via SCPI (M521)	No errors shown.[156] Checksum values are shown without indicating they are erroneous.	Parity [error] Checksum [error] (a) Can show multiple errors per packet
LIN Trigger: Timing event	Start of frame (sync break) Wakeup frame	Start of frame (break)	Start of frame (sync break)
LIN Trigger: Identifier	.. Specific identifier for the ID in HEX (00-3F) or in BIN (000000 to 111111), supports wildcards ('don't care') for individual bits and for HEX digits .. Compare (> < = ≠)[157] ... A user Symbolic ID[158]	Specific identifier for the ID in HEX (00-3F), does not support BIN or wildcards	Specific identifier for the ID in HEX (00-3F), does not support BIN or wildcards
LIN Trigger: ID & Data pattern	.. Options as for ID above, combined with a data pattern up to 8 bytes / 32 bits, supports wildcards ('don't care') for individual bits and for HEX digits .. Compare (> < = ≠)[159]	.. Options as for ID above, combined with two specified data bytes in HEX (00-FF). Does not support other lengths than exactly two bytes, BIN or wildcards	Options as for ID above, combined with a data pattern up to 8 bytes / 32 bits, supports wildcards ('don't care') for individual bits and for HEX digits
LIN Trigger: Error	Selectable error types: • Checksum • Parity • Synchronisation Any combination of these errors can be selected.	Selectable error types: • Checksum • Parity ('Header Parity) • Synchronisation ('Sync Byte') Any combination of these errors can be selected. Checksum error option only available if one also specifies specific message ID, LIN version, and first data byte.	Selectable error types: • Checksum • Parity No combination of errors possible

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[146] Presets including 10.417 bps, the maximum SAE J602 speed.
[147] For both analogue and digital channels, thresholds can be manually set and the threshold can be automatically determined.
[148] This is relevant if noise or imperfect digital signals cause oscillation across the threshold value and as a result hinder the decoder doing its work properly.
[149] While this setting is not in de digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.
[150] Position of the sample point within the bit, in percent of the horizontal bit time.
[151] Time can be selected to be relative to trigger or relative to previous frame. In the latter case, the column name changes to "time difference".
[152] Then protocol option 'show parity' is selected, the ID value is made to include the parity but the column still simply says 'ID' which is very confusing.
[153] Table based on the actual device screen. Manual says "Frame ID, Data, Checksum, Errors" and also notes that LIN1.3 and 2.0 slightly different table formats. M302
[154] Time can be selected to be relative to trigger or relative to previous row in table.
[155] The width of the column showing errors can be small, especially for showing multiple errors (they are shill shown but in shorted form (e.g., 'NACK+Fo' for NACK plus Form error). Occasionally, after you come back from a menu, making a small switch in time base (and back) makes the column somewhat wider.
[156] There is no column to show errors, and also when there are known errors in the signal, none are shown.
[157] If a wildcard is used, only {= ≠} – which is of course logical…
[158] If the user loaded a 'Label List' (see above), then the trigger menu allows to select the names in that list, like "Ignition" or "Valve".
[159] If a wildcard is used, only {= ≠} – which is of course logical…

LIN searching	• **Search Frame** Start of frame Wakeup • **Search Error** {'Checksum, 'Parity', 'Synchronisation'}. Any combination of these errors can be selected. In a bus table, each error is then identified by type. • **Search ID** .. Specific identifier for the ID in HEX (00-3F) or in BIN (000000 to 111111), supports wildcards ('don't care') for individual bits and for HEX digits .. Compare (> < = ≠)[160] ... A user Symbolic ID[161] • **Search ID and data** .. Options as for Search ID above, combined with a data pattern up to 8 bytes / 32 bits, supports wildcards ('don't care') for individual bits and for HEX digits .. Compare (> < = ≠)[162] • **Search ID and data** .. Options as for Search ID above combined with Search Error above.		

(a) These error values are not documented but have been observed in practice. There might be others

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[160] If a wildcard is used, only {= ≠} – which is of course logical…
[161] If the user loaded a 'Label List' (see above), then the trigger menu allows to select the names in that list, like "Ignition" or "Valve".
[162] If a wildcard is used, only {= ≠} – which is of course logical…

Parallel bus decode

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Location on instrument	All settings in Protocol `PROTOCOL`	All settings: select digital channels, then Bus	`Analysis` > Features > Analog Bus ('ABUS') *Uses the analogue channels, with individual threshold*
Busses, word size	2 bus, 1-16 bit	2 bus, 1-16 bit	1 bus, 1-4 bit
Base display format	{Bin, Dec, Oct, Hex, ASCII}	{Bin, Dec, Unsigned Dec, Hex}	{Hex, Bin}
Screen position	Flex position & height	Flex position	Fixed
Support for clocked busses	Yes. Bus word size up to 15 bit (leaving 1 bit for CLK) or up to 14 bit (leaving 2 bits for CLK and CS[163])		
Routing support for busses	Allows flexible routing of each of the 16 digital channels	Allows flexible routing of each of the 16 digital channels	
Hight of bus display	Flexible (from 1 to 13 characters vertically)	Fixed (1 character vertically)	
Maximum number of values than can be shown horizontally[164]	48 for 2 char HEX (0 thru FF) 48 for 3 char DEC (0 thru 255) 48 for 5 char DEC (0 thru 65,535) 14 for 16 char BIN (0 thru ⸻)	19 for 2 char HEX (0 thru FF) 19 for 3 char DEC (0 thru 255) 19 for 5 char DEC (0 thru 65,535) 5 for 16 char BIN (0 thru ⸻)	
Number of lines shown simultaneous in tabular form ('table', 'lister')	20 lines shown (scroll option to see more) Lines show frame#, timing (abs or rel), and up to 16 char value		
Bus labels (repeated from above)	Yes		

Analyses

Mask (TBA)

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Location on instrument	All settings in `APP` > Mask App > Mask	All settings in Analysis > Mask	TBA
Mask	See page8 secs	Yes (80,000 Pass / Fail decisions each second.) on BNC	TBA
BNC pulse out (For pulse amplitude and with see IO/connections, above)	BNC pulse out ("AUX", front side) Pulse on check Mask > Actions. M154 Output settings AUX connector: Setup > Aux out. M27,177/178 Mask > Actions. M 154	BNC pulse out ("Auxiliary Out") Pulse on {Pass, Pail} see above (Output of Auxiliary Out connector is Trigger, except when Mask analysis is activated)	TBA
Actions on mask (other than BNC Pulse out)	• Sound • Stop acquisition • Screenshot • Save waveform Mask > Actions. M154	• Sound ('beep') • Stop acquisition '(Stop on Fail') • Screenshot ('Capture on fail') • Failure to history (The above are not mutually exclusive operations, i.e., you can combine them.) TBA	TBA
		Advanced polynom graphic mask editor	

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[163] CS = Chip Select.
[164] For this test an 8 bit bus is configured, so values can vary from 0 to 127 (3 three digits). For a 16 but bus (values 0 thru 65,535) the results are the same.

Bode plots (Frequency Response Analysis) (TBA)

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Location on instrument	All settings in APP > Bode App > Bode	All settings in Analysis > Mask	ANALYZE > Features > Frequency Response Analysis
	Available (FW02.202)		TBA
Bode	A & φ Dual I think	, table	TBA
Number of measured simultaneous DUT outputs	dual pair of tracking gain and phase cursors	3 DUT check Traces can be turned on and off Trace Visibility M298	One
Signal source	Internal wave generator	Internal wave generator of external (compatible) Siglent SDG series connected signal generators via LAN or USB	Internal wave generator
Selectable channels for DUT in and out	4A	4A	4A
	10 Hz to 25 MHz S17	10 Hz to 120 MHz Mode: Linear, Logarithmic	10 Hz to 20 MHz S17
DUT input amplitude levels	20 mV to 5 V into high Z 10 mV to 2.5 V into 50 Ω S17		1 mVpp to 9 Vpp into 50-Ω S17
Amplitude zones profile (e.g. for testing sensitive circuits and/or high dynamic range)	check. Up to 16 points/zones	Supports Vari-level and automatic gain. You can have 4 Vari-level profiles (curves) predefined and saved. I don't recall if there is any preset point limit on curve complexity. TBA	
Channel gain (adapts to possible overload channel)		Supported[165]	
Vertical scale (frequency)		Gain {Vpp, Vrms, dBV, dBu, dBm, Arbitrary dB} in Vout mode or {Linear or Logarithmic} in ratio Vout/Vin mode. M296 Phase in degrees or rad M297	gain (logarithmic, dB) phase (linear, degrees)
Horizontal scale (frequency)			Logarithmic
Auto or manual scale	Auto-scale and manual scaling and positioning	Manual, auto set (for amplitude and phase independently) . M296	Auto-scaled during test with user-defined scaling after test
Sweep modes	single sweep or repeated sweep	{Simple, Vari-level} Singe sweep (FW 1.3.9R4)	
Waveform view	waveform view		waveform view
Test points	10 points to 500 points per decade		1 to 1000 points
Amplitude profile	Yes: You can then define different amplitudes for different frequency; useful when testing sensitive circuits, where the amplitude gets too high. Up to 16 points	Bode plot (FRA) it supports Vari-level and automatic gain.. You can have 4 Vari-level profiles (curves) predefined and saved. I don't recall if there is any preset point limit on curve complexity. TBA	
Measurement results		5 measure modes (Upper cutoff frequency, Lower cutoff frequency, Bandwidth, Gain margin, Phase margin)	
Measurement results table		Measurement results table for each scanning point	
Sweep:			
Markers / cursors		, X and Y cursors,	A single pair of tracking gain and phase markers at user-defined frequency setting S17
Other			The graph is particularly nice looking Autoscale Load of output can be set (on Ω) so shown value best match the actual amplitude S17
Save and recall		Yes M300 check	

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[165] "Channel gain. When it is set to Auto, the oscilloscope will automatically adapt the vertical scale according to the signal amplitude. When it is set to Hold, it will always keep the currently selected vertical scale. If signals overload the selected range in Hold mode, the data may not accurately represent the physical test." M293

FFT (TBA)

	RTB2000	SDS 2000X+	DSOX 1200
Location on instrument	All settings in APP > FFT App > FFT	All settings in Analysis > Mask	
	Yes	Yes up to 2 Mpts	Yes
	@@ FFT scaling dBuV at some point added (see specifications V15 p8 but missing in V13)	Markers, auto peak	
		Length: 2 Mpts, 1 Mpts, 512 kpts, 256 kpts, 128 kpts, 64 kpts, 32 kpts, 16 kpts, 8 kpts, 4 kpts, 2 kpts Window: Rectangular, Blackman, Hanning, Hamming, Flattop Display: Full Screen, Split, Exclusive Mode: Normal, Max hold, Average Tools: Peaks, Markers	

Power Analysis (TBA)

		SIGLENT	KEYSIGHT TECHNOLOGIES
Location on instrument		All settings in Analysis > Power Analysis	
		Power quality, Current Harmonics, Inrush current, Switching loss, Slew rate, Modulation, Output ripple, Turn on/turn off, Transient response, PSRR, Efficiency	

Signal generators

Function generator

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Location on instrument	All settings in Gen `GEN`	All settings in Utility > Awg Menu `AWG`	`WAVE GEN`
Resolution, sample rate, waveform memory	14 bit, 250 MSa/s ARB: 10 MSa/s	14 bit, 125 MSa/s ARB check	check
ARB waveform memory	32 kpts [166]	16 kpts	
Amplitude	High Z: 20mV to 5V(Vpp) 50Ω: 10mV to 2.5V(Vpp)	check	check
DC Offset	High Z: ±5V 50Ω: ±2.5V	check	check
Max frequency sine/square/ARB/noise	25/10/10/25 MHz	50/10/5/? MHz	20/10/-/? MHz
Max amplitude (PP) 1MHz sine into open circuit	5Vpp	6Vpp [167]	12Vpp[168]
Basic waveforms	Sine SinC Rectangle (=square) Pulse (Duty Cycle, Edge Time) Triangle (Symmetry (FW02.400)) Ramp (Polarity) ARB (see below) Exponential (Polarity) [Noise as DC+Noise] DC	Sine Square (Duty Cycle) Ramp (Symmetry) Pulse (Pulse Width) Noise (StDev, Mean) ARB (see below)	Sine Square (Duty Cycle) Ramp (Symmetry) Pulse (Pulse width) Noise DC No ARB
DC offset	For all waveforms	For all waveforms except noise	For all waveforms
Invert	For all waveforms except DC		For all waveforms except DC
Add noise	For DC		Add noise {0-66%) for all waveforms except DC and Noise)
ARB waveforms: upload	TRF files (such as saved as a reference waveform) CSV files (such as saved as a regular waveform)	Yes (USBflash drive or EasyWave PC software)[169]	
ARB waveforms: presets		45 and 2 custom	
ARB waveforms: copy from trace	Supported, can copy any active analogue, math or reference channel. Graphic 'cut waveform' editor (FW02.202).	Yes (S15). Need to check	
Modulation	For all waveforms Mod. type {AM, FM, ASK, FSK} Mod. Function {Sine, Rectangle, Triangle, Ramp} Mod. Frequency Mod. Deviation		For Sine, Ramp Modulation type {AM, FM, FSK) Mod. Function {Sine, Square, Ramp} Mod. Frequency (for AM, FM) Mod. Deviation (for AM, FM) Hop Freq (for FSK) FSK Rate (for FSK)
Burst	Check for which waveforms (FW02.202) Yes (# cycles, idle time, start phase, trigger {Const./Manual})		
Sweep	Check for which waveforms Start Freq., Stop Freq., Sweep Time, Sweep {Linear, Log, Triangle}		
Logic level settings			Logic presets for all waveforms {TTL, CMOS 5.0, CMOS 3.3, CMOS 2.5, ECL)
Output definition (for showing correct amplitude and offset)	High-Z, 50Ω	High-Z, 50Ω	High-Z, 50Ω

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[166] Specifications from document R&SRTx-B6: ARBITRARY WAVEFORM AND 4 BIT PATTERN GENERATOR. This conflicts with the specifications that mention 16k points
[167] Yet, in Bode plot, the aplitude is apparently up to 24Vpp. See https://siglentna.com/wp-content/uploads/dlm_uploads/2021/10/SDS2000X-Plus-Firmware-Revision-Record-And-Upgrade-Instructions.pdf
[168] The manual states 5Vpp but on the device one can select up to 20Vpp
[169] In the device menu, there is 'USB' and 'Channel'. The latter is probably to retrieve stored waveforms but I get the error 'File does not exist'. Probably one must first create a waveform using the EasyWave PC software and then 'store' them on the device using this software.
See also manual p. 313.

Other		Over voltage protection {On, Off} when output higher than 4V) Current limit. S15.	
Other		Zero Adjust automatic calibration	
Other	Preview function for waveforms and patterns (check[170])	check	

[170] Specifications from document R&SRTx-B6: ARBITRARY WAVEFORM AND 4 BIT PATTERN GENERATOR. This conflicts with the specifications that mention 16k points

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Pattern generator

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Location on instrument	All settings in Patt. Gen.		HELP, Training Signals
Number of output pins	4 pins (bits)		1 pin
Sample rate	50 Mbit/s[171]		
Square wave	1 pin; Frequency (up to 500kHz) (or Period), Polarity, Duty Cycle		
Digital counter	4 pin counter (0000 0001 0010 etc.) Frequency (up to 50MHz) Direction (Up, Down)		
Arbitrary pattern	4 bits Bit time, Period Burst function (# bursts, idle time between) Pattern length up to 2048 symbols Build-in graphical draw tool Trigger (1 shot or repeat) Load/safe patterns in SCP format (remote commands format; command for pattern is on p.555 of manual). User utility allows Excel creation[172] User utility allows Excel creation[173]		
Burst	[part of arbitrary pattern, see above]		• Burst of digital pulses that occur every 50 µs. • Burst of 6 digital pulses (plus infrequent glitch) that occurs once every 80 µs.
Manual	Manual (static level) setting of the 4 pins		
UART (for RS-232/ RS422/ RS-485)	2 pins (Rx, Tx) 9600 Bit/s, 115.2 kBit/s, 1 MBit/s The "App" training protocol transmit the 115.2 kBit/s version. Instrument own decode shows parity & stop error in "*IDN?" message.[174]		
SPI	4 pins (Clk, Mosi, Miso, CS) 100, 250 kBit/s, 1 MBit/s The "App" training protocol transmit the 100 Mbit/s version. Instrument own decode shows no errors		
I²C	2 pins (SCL, SDA) 100, 400, 1000, 3400 kBit/s The "App" training protocol transmit the 400 kBit/s version. Instrument own decode shows no errors		
CAN	2 pins (CAN-H, CAN-L) 50, 100 kBit/s, 1 MBit/s Instrument own decode shows NACK, CRC and FORM errors in various frames.[175]		Training signal: 1 pin (CAN-L), 125 kbp DEMO signal: 1 pin (CAN-L), 125 kbp, very useful sequence[176] Check Same or not?!?
LIN	2 pin (High, Low) 9.6, 10.417, 19.2 kBit/s [LIN2.0 protocol[177]] Instrument own decode shows CHECKSUM, PARITY and SYNC errors in various frames.[178]		1 pin, 19.2 kbs, [LIN1.3] [179]

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[171] Specifications from document R&SRTx-B6: ARBITRARY WAVEFORM AND 4 BIT PATTERN GENERATOR

[172] See https://www.eevblog.com/forum/testgear/rohde-schwarz-rtb2002-rtb2004-question-importing-cvs-in-pattern-generator/

[173] See https://www.eevblog.com/forum/testgear/rohde-schwarz-rtb2002-rtb2004-question-importing-cvs-in-pattern-generator/

[174] Not clear whether these errors are inserted intentionally or not; this is not documented.

[175] Not clear whether these errors are inserted intentionally or not; this is not documented.

[176] This long training sequence (16 messages) that includes short (11 bit) and long (29 bit) ID, data and remote packets, and varying message lengths (1, 4, 5 and 8 bytes). Quasi randomly inserted over training sequences there are a variety of different errors (CRC error, bit stuffing error, NACK), very suitable for testing serial decoders. Apart from these frames where a NACK error is deliberately inserted, the ACK is already added (unlike most demo/training CAN signals on other oscilloscopes). Occasionally, the ASCII character sequence "!AGILENT" is shown, not "KEYSIGHT" ;-) Tip: because it's such a rich sequency, you will want to trigger it properly to a stead point. To do sone, you can trigger on a data frame with ID = 0x7F and first data byte 0xE4 and set trigger holdoff to 35ms.

[177] The protocol version of this LIN signal is not documented. But when decoded by the DSOX as LIN1.3 on the DSOX it fails altogether, and when on the DSOX as LIN2.x on the DSOX it all works. That's why I assume its LIN2.0.

[178] Not clear whether these errors are inserted intentionally or not; this is not documented.

[179] This long training sequence (21 messages) in LIN1.3 format with various addresses and varying message lengths (2, 4, 8 and 9 bytes). Quasi randomly inserted over training sequences there are a different errors (Checksum error, Parity Errors, but not Synchronization errors),

Training signals, demo modes

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Location on instrument	APP > App > Demo		HELP, Training Signals HELP, Demo
Training signals	Serial protocols (8), using up to 4 wires (see Pattern Generator)		14 (glitches, bursts, distortion) 2 serial busses (CAN, LIN)
DEMO modes	Basic (3) Advanced (9) Serial/parallel protocol (9)[180, 181] Track (2) (FW02.400)		(Demo since FW2.10) Triggering (2) Math (2) Advanced features (4) Serial buses (2: CAN, LIN)

Memory, history, search

Segmented memory and history <mark>(TBA)</mark>

(For memory specifications, see above)

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Location on instrument	<mark>@@</mark>	<mark>@@</mark>	<mark>@@</mark>
History	13,107 segments	Up to 90,000 frames Analyse > Menu > History All settings in Analysis > History HISTORY	
Segments		Acquire > Sequence. M89	Up to 500 (FW2.10)
	@@ In Acquisition memory at Sample etc the Nx Singlwe can set the number of samples into the memory. Acquisition. M69		
	@@ check record length in acquisition memory Acquisition. M67	Acquisition>Menu>	
Record memory depth	Setup > Language. M198	20k, 200k, 2M, 20M, 200M (half for four channel operation) Acquisition > Menu. M80-81	
Navigate		All settings in Analysis > Navigate NAVIGATE	

Search (events) <mark>(TBA)</mark>

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT DSOX 1200
Location on instrument	All settings in Search SEARCH	All settings in Analysis > Search SEARCH	

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[180] The DEMO modes for serial protocols as the same as those that can be generated from the pattern generator (see above). While the pattern generator allos different bus speeds, the demo's have the following speeds: CAN: 9.6 kbps, @@@)

[181] The LIN DEMO works but has some unusual choices. First, it instructs the user to use the P0 pattern generator pin and starts the decode function in Idle Low mode. That works, but can confuse users, because P0 provides an inverted LIN bus signal. Actually, pin P1 provides the correct LIN bus signal, and if you put the decoder at Idle High, the results are the same, but the shown bus is much more correct. Second, this demo puts the decode function in LIN1.3 protocol mode whereas the actual signal is likely a LIN2.x protocol. Can be changed manually in the decoder though. Third, the default vertical amplitude is too high and the channel clips. Easily corrected, but still. Fourth, the LIN signal has quite some errors. As already discussed above, this may be intentional (or not). Such errors can be very useful for problem solving and decode testing but I rather wish it was documented they are there for that purpose.

Computer access and automatization

Web-based remote access

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Remote Front Panel	Remote Front Panel (full panel with screen & buttons) {fixed res, autoscale} Works well with iPads.	Remote Front Panel (screen only) Remote Front Panel does not work properly with Apple iPad (tested regular 10.5" as well as the 10.2" Pro and 12.9" Pro). All have truncation and/or compression problems.	Remote Front Panel (full panel with screen & buttons) Works well with iPads. Remote instrument control requires separate firmware install Slow screen update rate.
Live screen	Live screen {fixed res, autoscale}		Live screen fixed res
Screenprint	Resolution 1280×824 Auto refresh (6 time settings) {PNG, BMP} {Color, Greyscale} {Non-inverted, Inverted}	Resolution 1024×600 (Screenshots part of remote panel)	Via `Get Image`: PNG 800×503 Option for inverted (=printer friendly colours) Via `Save` menu also {PNG (24 bit), BMP (8 or 24 bit} {Color, Greyscale} {Non-inverted, Inverted}
Save waveform from instrument to PC *(See also section Save and Recall for saving to USB).*	Selectable: 4 analogue channels 2 digital sets (D0-D7; D8-D15) 4 Reference waves 5 Math waves File formats {TXT, CVS, BIN-MDB, BIN-LSB, FLT[182]-MSB, FLT-LSB} Type {Display Data, Acq. Mem} Possibility to save to instrument memory itself (instead of to a PC)	Waveform data is saved as *.BIN file. For Windows PC users, a "Convert_bin_to_csv" tool is provided, along with a Python source file and an unreadable read.me file (!). (1.3.5R3) Not clear which waveform is saved (regardless of wave activation, the file is 20MB in size).	(FW2.10) File formats: • CSV data (*.csv) • ASCII XY data (*.csv) • Reference Waveform data (*.h5)[183] {Ch1, Ch2, Ref} (No Ch.3, Ch.4, Math, Ref) • Multi Channel Waveform data (*.h5)[184] • Binary data (*.bin) (See @@ for details) Separate text file contains relevant instrument settings for saved data. For all the above formats, length is selectable.
Save other type of files from instrument to PC *(See also section Save and Recall for saving to USB).*	Setup Self-alignment Report		(FW2.10) Setup Lister data (=serial decode table) Mask Frequency Response Analysis Data
Upload from PC to instrument *(See also section Save and Recall recalling from USB).*	Setup Waveform to Reference 1-4.		(FW2.10) Any file type
SCPI Device Control (direct command entry screen)	SCPI Device Control List if commands is here in the online manual here.	SCPI Device Control	SCPI Device Control (Includes extensive HMTL Quick Reference Guide) (FW2.10)
Device I/O settings information	Extensive	Basic	Very extensive
LAN configuration	See & edit `Setup > Ethernet. M201`	See & edit `Utility > I/O setting > System Setting > LAN conf. M37`	See & edit. `UTILITY > I/O > Configure LAN. M234`
Password for Web Server		Can be set. `Utility > I/O setting > System Setting > Web Server. M334`	

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[182] FLT is a Floating Point format.
[183] A format that can be recalled to one of the oscilloscope's reference waveform locations, or opened by the N8900A Infiniium Offline oscilloscope analysis software.waveform locations or read by the N8900A Infiniium Offline oscilloscope analysis software..
[184] A format that can be opened by the N8900A Infiniium Offline oscilloscope analysis software.

Computer software, automation interfaces

	RTB2000	**SIGLENT SDS 2000X+**	**KEYSIGHT TECHNOLOGIES DSOX 1200**
Microsoft Windows application software	R&S InstrumentView. Download and analyze waveforms on the computer. Very extensive. No license needed.	No scope control software listed in manual or on download pages for this series.[185] (Siglent EasyWave software can be used to make ARB patterns for this instrument but is not general oscilloscope control software)	BenchVue. Connect, record results and visualize measurements across multiple instruments simultaneously. License included with instrument. Very extensive.
Instrument drivers	Drivers for IVI, LabVIEW, LabWindows, VXI, various computer platforms	IVI Driver	Drivers for IVI and MATLAB

USB device modes (USB-B connector on back panel)	• USB TMC (Test & Measurement Class.). For SCPI via VISA library.
	• USB VCP (Virtual Com Port). Supports any terminal program to send SCPI commands
	• USB MTP (Media Transfer Protocol)
	
	`Screen shortcut`
	`Setup > USB. M204`
		USB TMC (Test & Measurement Class.). (S1)
		`Utility > I/O setting > System Setting > USB ID (shows ID).`
			Communication to Keysight IO Libraries [I assume NI VISA]
			
			USB (USBTMC/488)

LAN	• For access to web server
	• For SCPI via VISA library. VXI-11 Port can be set in instrument (default 1024). The assigned VISA address is shown.
	
	`Screen shortcut`
	`Setup > Ethernet. M201`
		• [For access to web server]
		• SCPI commands via NI-VISA, Telnet, or Socket.
		
		VNC number can be set (necessary when accessing more than two Siglent instruments through the web browser)
		`Screen shortcut`
		`Utility > I/O setting > System Setting > LAN conf. M37`
			Communication to Keysight IO Libraries [I assume NI VISA)
			
			• HiSLIP LAN protocol
			• VXI-11 LAN protocol (FW2.10)
			• GPIB over LAN protocol
			• TCP/IP SOCKET protocol
			• TCP/IP TELNET protocol

Emulation modes		Tektronics emulation mode Not documented in manual[186] I `Utility > Menu`	
Network share storage		Network share storage (FW1.3.9R4). Stores on a Windows SMB mounted disk. It is fully supported for any save/recall operations. Not documented in manual. Posts from users not getting this to work, have not checked current status @@ `Utility > Menu > System Settings > I/O > Net storage.`	
			Remote Command Logging `UTILITY > Options > Remote Log. M244`

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[185] Siglent has a Windows program called 'EasyScopeX', which controls a variety of their scopes. According the software documentation and revision history, those include the SDS1000, SDS1000X/X+, SDS1000X-E, and SDS2000/X , SDS1000X-U. The SDS2000X Plus series, however, is not mentioned as supported oscilloscope. Some people seem to have used it with this SDS2000X Plus (see https://www.eevblog.com/forum/testgear/siglent-sds2000x-plus-coming/1875/). I did a little but of testing, it starts up, some functions do work but others (like the remote virtual panel) do not seem to work well (even if it nicely confirms its talking to the X Plus model...). I assume this is the reason Siglent does not mention support for this software.

[186] Might be similar to the Tek mode in the Siglent SDS5000X, see here.

System

Save and recall

	![R&S] RTB2000	![SIGLENT] SDS 2000X+	![KEYSIGHT] DSOX 1200
Device setup	Save, Load To and from internal or external File format: SET (instrument-specific[187]), based on SCPI commands Precise content of setup not specified[188] Setup files have small screenshot embedded for easy identification. These are visible in file manager in instrument when loading a file. `SAVE/LOAD` File > Setup. M177	Save, Load To and from internal (10 positions max) or external File format: XML (instrument-specific[189]), in XML style format Precise content of setup not specified[190] (I cannot reproduce the steps in Manual p.32 on the instrument…) Current setting can be saved as default set-up. `SAVE/RECALL` Utility > Save/Recall. M317, 319	Save, Load To and from internal (10 positions max) or external File format: SCP (instrument-specific[191]), in XML style format Saves the horizontal timebase, vertical sensitivity, trigger mode, trigger level, measurements, cursors, and math function settings `SAVE/RECALL`. P219
Waveform data (save)	Save To internal or external File formats {TXT, CSV[192], BIN-MDB, BIN-LSB, FLT[193]-MSB, FLT-LSB}. Source: • Selected waveform (4A, 16D) • All visible waveforms Choice of • Displayed waveform(s) • Acquisition Memory (for stopped acquisitions) • History Data (waveform plus CSV file with information about segments) Waveform data formats are discussed in detail, including examples, on p.180-182 of the manual; History & Segment files on p. 114-115 `SAVE/LOAD` File > Setup. M180 114 Waveforms can also be saved as a "Trigger Action" or a "Mask Action".	Save (3 formats) Only to external File formats: CSV, MAT (Matlab format), BIN Source (only for CSV and MAT): • Selected waveform (4A, 2M (1.3.7R5)). Not FFT • All visible waveforms (1.3.7R5) For BIN, I guess all data are saved ?!? For CVS, option to include the scope configuration parameter information (horizontal time base, vertical scale, etc.) `ParaSwitch` For BIN, a Windows-PC Bin2CSV Tool is available. This way, the file from instrument to PC can be smaller. `SAVE/RECALL` Utility > Save/Recall. M318	Save Only to external File formats: CSV, ASCII XY, BIN, H5 (single waveform/reference waveform[194]), H5 (Multi Channel Waveform data[195]) Detailed information on waveform formats is in manual on pages 266, 273, 274. Number of data points to be saved (`Length`); detailed explanation M221 If segmented memory is active {Selected segment only, All segments} `Setup Info` option saves additional setup information in a separate TXT file (vertical, horizontal, trigger, acquisition, math, and display settings). `SAVE/RECALL`. P220
FFT data	@@ check Possible to save FFT results	@@ check Since 1.3.9R4	
Reference waveforms	Save, Load To and from internal or external	Save, Load Only to external[197]	Save, Load Only to external File format: H5[200]

	File formats: CSV (load only), TRF (instrument-specific[196]) Waveform files saved as CSV format can also be loaded as reference and are converted into TRF by the instrument Reference files have small screenshot embedded for easy identification. These are visible in file manager in instrument when loading a file. `REF` Reference. M187	File format: REF (instrument-specific[198]) Bit confusing and possible mismatch between instrument and manual. On the instrument it seems you can: - save a source (4A, 2M) into *.REF. - recall (load) a *REF file into REFA to REFD position But this is at odds with the manual.[199] `SAVE/RECALL` Utility > Save/Recall. M317	`SAVE/RECALL`. P222
Math sets (equation sets; formularies)	Load, Save To and from internal or external File format: FML (instrument-specific[201]) FML files are instrument-specific[202] To/from internal or external (sets with up to 5 formularies) `MATH` Math. M187, 101		
Statistics	Save To internal or external File format: CSV; content described on page 134 of manual. Save icon overlaps with other icon[203] Save button shown right of statistics table. M133		
Decoded busses (results table) (see also above at @@)	Save To internal or external File format: CSV Possible for any parallel or serial bus Protocol. 187, 216		Save Only to external File format: CSV `SAVE/RECALL`. M222
Search results	Save (CSV file) `SEARCH` Search. M117		

Screenshots	Save (PNG, BMP)
	To internal (FW02.300) or external
	File formats: PNG, BMP
	
	Resolution 1280×824
	{Color, Greyscale}
	{Non-inverted, Inverted}
	
	Option to disable device logo in screenshot (FW02.300)
	
	Option to close all menu's before screenshot (so they do not mask the results)
	
	`CAMERA`[204] or `SAVE/LOAD`
	File > Screenshots. M187
		Save
		Only to external
		File formats: PNG, BMP, JPG
		
		Resolution 1024×600
		{Normal, Inverted}
		Print Area {Grid, Full} (FW 1.3.9R4)
		
		`PRINT`
		Utility > Print
		`SAVE/RECALL`
		Utility > Save/Recall. M318
			Save
			Only to external
			File formats: PNG (24 bit), BMP (8 or 24 bit)
			
			Resolution 800x503
			{Color, Greyscale}
			{Normal, Inverted} (Invert Grat)
			
			Setup Info option saves additional setup information in a separate TXT file ((vertical, horizontal, trigger, acquisition, math, and display settings).
			Save to USB or `SAVE/RECALL`. M19

Patterns (for pattern generator)	Load, Save To/from internal or external File format: SCP (remote commands format; command for		

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[196] This is a device specific format and files are not intended for analysis outside the instrument.
[198] This is a device specific format and files are not intended for analysis outside the instrument.
[199] Manual (p.317) *states "The reference waveform data are saved to external memory with the *.ref file extension."* Bit I did not manage to do so.
[201] This is a device specific format and files are not intended for analysis outside the instrument.
[202] This is a device specific format and files are not intended for analysis outside the instrument.
[203] The SAVE icon overlaps with the R&S Menu logo on the right bottom. While one can still select either, one must take care.
[204] If only 'screen shot' is selected in OneTouch, a simple screenshot is saved. If other file types are also selected, a ZIP is created with all files including the screenshot.

	pattern is on p.555 of manual). User utility allows Excel creation[205] `Patt. Gen.`		
Arbitrary waveforms (for signal generator	Load From internal or external File formats: - TRF files (such as saved as a reference waveform) - CSV files (such as saved as a regular waveform)		
Mask	Load, Save (MSK) To/from internal only[206] File format: MSK (instrument specific)[207] `APP` > Mask `App > Mask. M147`		Save, Load (MSK) To and from internal (4 positions max) or external File format: MSK (instrument specific)[208] `SAVE/RECALL`. P223
Bode plot results	Save To internal or external File format: CSV file `Save button shown in bode plot control menu. M171`	Yes M300	Save To external only Format: CSV File with Frequency Response. In the saved file, there are three data columns: frequency (Hz), gain (dB), and phase (degrees). `SAVE/RECALL`. P219
File Manager or similar functions	Copy between internal memory and USB drive Supported `File > Setup²⁰⁹ M187` For reference waveforms, the file can also be converted between file formats. PS if no USB flash drive inserted, the menu stays grey `File > Refences. M187`	Windows-like file manager available in the Save/Recall menu Icons and explanation somewhat unclear `SAVE/RECALL` `Utility > Save/Recall. M323`	
Saving multiple type of files at once	"OneTouch" allows to save any combination of the below at the same time when touching the "photo" button on the front panel: Setup, Waveform[210], Reference Waveforms, Search Results, Decoded Bus Data, Statistical Results. They are saved as up to 7 files in one ZIP container. `File > Onetouch. M187`		
Secure erase	Deletes all configuration and user data. `Setup > Secure Erase. M187`	Not discussed in the User Manual. Is in a weird spot in the menu structure. `SAVE/RECALL` `Utility > Save/Recall > Recall`	Performs a secure erase of all non-volatile memory in compliance with National Industrial Security Program Operation Manual (NISPOM) Chapter 8 requirements. `SAVE/RECALL` > Default/Erase / Secure Erase
Documentation on saved file formats.	Extensive information provided	Minimal or no information, often inconsistent with instrument	Extensive information provided
Free user memory (for local storage)	Approx. 370MB `Setup > Memory Usage. M178`	Approx. 73MB (but user can only save setup files internally, not even screenshots…) `Can be seen in File Manager menu while loading/saving`	
Other			File name entry is via rotary dial (keyboard is no option for saving to external memory as the USB slot is occupied)

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[205] See https://www.eevblog.com/forum/testgear/rohde-schwarz-rtb2002-rtb2004-question-importing-cvs-in-pattern-generator/
[206] But can be copied with file manager to external storage.
[207] This is a device specific format and files are not intended for analysis outside the instrument.
[208] This is a device specific format and files are not intended for analysis outside the instrument.
[209] Even though this is in the 'Setup' [file] menu, this function works for any type of file.
[210] Waveform is saved according settings possible in Waveform Save menu. These settings are shown in the OneTouch menu.

Other system features <mark>(TBA)</mark>

	RS RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200

Self alignment / user calibration	`Self alignment`
	"The self-alignment aligns the data from several input channels vertically and horizon- tally to synchronize the timebases, amplitudes and positions."
	
	Can save log file.
	`Setup > Self alignment. M196`
		`Self-calibration`
		"The self-calibration program can quickly calibrate the oscilloscope to reach the best working state and the most precise measurement. "
		Yes <mark>TBA</mark>
		`Utility > Do Self Cal. M343`
			`User Calibration`
			"User Calibration performs an internal self-alignment routine to optimize the signal path in the oscilloscope. The routine uses internally generated signals to optimize circuits that affect channel sensitivity, offset, and trigger parameters."
			`Follow key sequence explained on page 246 of user manual`
			
			To display the user calibration status
			`UTILITY > Service > User Cal Status. M247`

Hardware test		Screen test
		LED test
		Keyboard/button test. Also fairly cool in its implementation
		
		`Utility > Do Self-Test > Screen Test`
		`Utility > Do Self-Test > LED Test`
		`Utility > Do Self- Test > Keyboard Test M340–342`
			Hardware self-test
			Front panel self-test. Quite cool in its implementation; check the three function check of rotary dials!
			
			`UTILITY > Service > Diagnostics / Hardware Self Test. M346`
			`UTILITY > Service > Diagnostics / Front Panel Self Test. M246`

Probe compensation	Extensive visually aided procedure
	
	`▢ ▢ ▢ ▢ > Probe`
	`Vertical > Channel > Probe Setup > Probe Adjust. M86, 461, 462`
		Via general auto-setup procedure, no specific procedure.
		`AUTO SETUP . M32`
			Aided procedure.
			
			`▢ ▢ ▢ ▢`
			`>Probe > Probe check. M26`

Settings on power-on	From last session `M34`	[From last session] (Not discussed in manual)	[From last session] (Not discussed in manual)

Default setting	PRESET
	"Resets the instrument to the scope mode and to default state, without analyzing the signal. The user-defined configuration, measurements and other settings are removed and all channels and waveforms, except for channel 1, are disabled."
		Default can be set as either:
		• Factory set-up
		• A saved user set-up
		
		`DEFAULT`
		`Acquire > Default`
		
		`Saving user setup: SAVE/RECALL`
		`Utility > Save/Recall. M317`
		
		For both, the device pops up a screen window for confirmation. But you can also tap the button just twice.
			Returns device to a default setup but 'leaving some user settings (not specified). Also described as bringing the "oscilloscope in a known operating condition"
			`DEFAULT SETUP . M24`
			`SAVE/RECALL > Default/Erase / Default Setup`
			
			It is also possible to restore the device to factory setting via de
			
			`SAVE/RECALL > Default/Erase / Factory Defaults. M225`

Autoset	**Per channel:** `Autoscale`
	(V02.101)
	"Performs an autoset process for analog channels: analyzes the enabled analog channel signals, and adjusts the horizontal, vertical, and trigger settings to display stable waveforms"
	`Channel shortcut menu. M58, 313`
	
	For all channels: `Autoset`
	See manual, page 51 for what Autoset exactly does.
	`AUTOSET`
		For all channels: Auto Setup
		"The oscilloscope will automatically set the vertical scale, horizontal scale, and trigger level according to the input signal to get the optimum waveform display' (p. 63).
		
		"Press the Auto Setup button, and the oscilloscope will set the trigger type to Edge." (p. 101)
		
		Is also used for probe compensation (p. 32)
		
		Error in manual.[211]
		`AUTO SETUP`
		`Acquire > Auto Setup. M58, 63`
			For all channels: Autoscale
			"to automatically configure the oscilloscope to best display the input signals."
			`AUTO SCALE . M24`

Print to external printer			Print to a USB of network-attached print. (FW2.10) The printer must support Direct PDF printing over USB/IPP (Internet Printing

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[211] Here, the manual, page 58, indicates "Trigger ->Auto Setup" but that is likely a mistake.

			Protocol).[212]A standard PCL3 or PCL5 printer will not work. Various setting options `SAVE/RECALL` > Print. M229-232
Export crash log files			Export crash log files. Never needed this because it never crashed! `UTILITY` > Service > Diagnostics > Export Log. M246

Not yet in any of the above categories

	`CLEAR SCREEN`	`CLEAR SWEEP` Acquire > Clear sweep	

SCPI

[212] See https://edadocs.software.keysight.com/kkbopen/which-printers-are-supported-by-the-infiniivision-oscilloscopes-588283271.html

Firmware and manual improvements wish list (TBA)

Firmware improvements wish list (TBA)

Below are issues that I would appreciate to be addressed in new firmware releases. On the first two lists, I focus on issues that I believe should not be very hard to tackle. The third list has issues that require (much) more work, and the fourth list presents further wishes.

Why so few comments for the DSOX? Well, I think this instrument has quite some limitations, but these are mostly due to the overall design and focus of the instrument, not things that (I believe) can be easily changed by updating the firmware…

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
Urgent improvements wish list ('bugs or features that should not have been missing')	Switch DVM to AC mode when channel is set to AC (instead of showing incorrect DC values)	For SPI, I2C, CAN, LIN, show occurred errors in telegram or table.	If DVM and measurement statistics are both on, the display jumps erratically between both.
	Solve the problem that "identity and data" in CAN trigger only works when frame length is set (other decoders in the RTB do require that)	Prevent instrument to show serial decoded messages if they are plainly wrong	
		Fix remote web mode for tablets etc.	
		Provide override setting for automatic probe sensing	
		Limit label entry length to actual allowed label length	
		Fine control of time base	
		Overall stability and responsiveness of operating system	
Desired improvements	Increase update rate of bus table in serial decode		Add axis values
	When editing labels, show last value of that label (not last value of another edited label)	On the vertical and horizontal axis, show only digits after the period when it makes sense (not 600.0000)	Keep displaying serial decode lister when leaving submenu
	Increase labels length from 8 to 12 or 16 characters; slightly increase label display size	Improve readability of labels (add clear background)	Keep large DV display window when leaving submenu
	Allow math as input for serial decode	Allow math as input for serial decode	
	Allow reference as input for serial decode	Allow reference as input for serial decode	
	Allow digital channels as input for math	Allow digital channels as input for math	
	Solve some smaller UI quirks[213]	In ASCII mode in serial decode, show HEX for non-valid ASCII characters, and show addresses etc. always in HEX	
	Turn measurements on/off globally (without deleting their settings) e.g., via push MEAS button	Increase update rate of measurements	
	In the parallel clocked mode, allow analogue channels for CS and CLK so the full 16-bit bus can be maintained.		
	Allow (CAN) serial trigger to find a message with a known data content without having to know the length of that message in advance.		

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[213] In modes where the lower half of the screen is used for showing tables or measurement data, the right bottom (text) elements are sometimes masked by the R&S logo or vertical menu. In serial decode, the rightmost column (for most decoders it is 'status') is often not completely seen (especially a problem when two or three errors are observed in a single frame). Also, when closing a menu, the table sometimes does not restore to full size, while sometimes it does.

Desired changes that would (assumingly) require more drastic effort	Allow the entire (segmented) memory to be used entirely by *any* channel	Reduce over-hierarchical menu structure (for instance, show all PIN settings of SPI in one menu, not four separate menu's)	Improve web interface update rate
	Show relevant data for (each) measurement mode as X and Y cursors	Integrate relevant serial decode settings into the serial trigger module (instead of having to copy them there)	
	Allow serial decode of two bidirectional buses	Speed up boot time	
	Show small histograms for measurements (and a large histogram for a selected measurements)	Make on-screen help contextual	
		Reduce ventilator noise (e.g., adaptive ventilator)[214]	
Further wishes…	Add more complex and varied serial decode training signals (timing, ID, payload, (n)ack), including some with deliberately inserted errors	Offer serial decode training signals	
	Offer analogue training signals (glitches, runt, etc.)	Offer analogue training signals (glitches, runt, etc.)	

Manual improvements wish list <mark>(TBA)</mark>

	RTB2000	SIGLENT SDS 2000X+	KEYSIGHT TECHNOLOGIES DSOX 1200
	Some small improvements, including: - Updating text on single cycle measurement (are relative to trigger, not left-most part of screen) - Update part on the counter (since FW2.000 supports all analogue channels)	Vastly improve user manual, especially on implementations which are not trivial	
	Desire to document also many SCPI commands that are not documented	Update user manual with later firmware releases (many functions such as tracking are completely undocumented)	
	Desire to document how user can make 'apps' by saving a file with SCPI commands		

@@ RTB: 'App' is set of SPCI commands, you can make your own

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[214] Not sure this is possible via firmware; it might be when ventilator speed is controlled and there are appropriate temperature sensor(s) in the device.