

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:

<https://www.youtube.com/channel/UCSTHQUENuAc2UwmrlHkvGKw>

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<https://www.eevblog.com/forum/testgear/functional-comparison-of-rs-rtb2000-siglent-sds2000x-and-keysight-dsox1000/>

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LEGEND

Keyboard: feature not mentioned in manual but present on the instrument

Blue: significant advantage, not present in other instruments

RED: significant disadvantage

Orange: something to note but not a significant disadvantage

Courier font: the precise naming as used on the instrument

FW02.400: reference to the FW version that first introduced the feature.

DISPLAY > Persistence. M86, S12. Reference to where this can be found on the instrument. **SETUP** refers to a physical knob or rotary dial. Lower key refers to menu item or soft button (DSOCX). For information sources,

M refers to a page in User Manual¹,

S refers to a page in Specification Sheet,

B refers to a page in the product brochure,

OHF refers to onscreen help function.

[statement] something assumed or observed, but not explicitly documented

| | |
|----------|--|
| 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 |

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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 |

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 Windows CE. ([Source](#))

Physical construction

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES 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 | 31 Watt (measured) Manual: "50Wmax" M22 |
| Weight | 2.6 kg | 3.5 kg | 3.2 kg |
| Transport accessories | Plastic front cover, Soft case, Transit case | Soft Carry Bag | Soft carrying case |

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 Siglent choice to show on selected channels.

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

⁷ Severe 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 | | |

¹⁰ As there are differences across manufacturers of scopes and probes in terms of which attenuation modes are implemented and what their coding resistor 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 an 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 mm 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 | <p>Available here (609 pages). Well written and informative Updated with each new FW versions (now FW2.4)</p> <p>Also interactive online web version with very good search function, available here.¹⁷</p> | <p>Available here (352 pages). Less informative, (specified) functions often poorly explained and some are missing altogether. Often, figures are not readable.¹⁸</p> <p>Manual is not dated and not (systematically?) updated with new firmware versions.</p> | <p>Available here (332 pages) Well written and informative Updated with each new FW versions (now FW2.12)</p> |
| Programming guide (SCPI) | <p>Part of User Manual List if commands is here in the interactive online web version (adapted to online environment)¹⁹</p> | <p>Separate document, available here (585 pages)</p> <p>Also SDS2000X Plus IVI-C Programming Guide</p> | <p>Separate, available here (952 pages)</p> <p>Offers some information missing in the user manual²⁰</p> <p>There is also a Windows HTML Help (*.chm) format file, available here²¹</p> |
| Service Guide | | <p>Functional test, interface test, performance test, disassembly procedure, troubleshooting Available here. (70 pages).</p> | <p>Verification, calibration etc. Available here (57 pages)</p> |
| Educator's Training Kit | | | <p>For physics/EE students, the Educator's Training Kit is quite informative and specifically highlights functions in this instrument. Available here (96 pages)</p> |
| 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 |

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 TECHNOLOGIES DSOX 1200 |
|---|---|--|---|
| Screen | 10.1" (1280 x 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 swipe²³ | 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 hiccups 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. |

²² Those that do not like a glossy display, can consider adding a matte screen protector (the other way round is not possible).

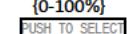
²³ In history segments.

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 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES 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." |
| Trace intensity | {0-100%}  INTENSITY Display > Intensity... 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 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES 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 76 scales (V, A, Q, 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 | | |

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 TECHNOLOGIES DSOX 1200 |
|------------------------------------|--|---|---|
| Grid divisions shown | 12 horizontal, 10 vertical | 10 horizontal, 8 vertical | 10 horizontal, 8 vertical |
| Grid area occupied by menus | <p>Pop-up icon bar takes 5% (% div horizontal) of screen surface</p> <p>Pop-up settings menu takes 22% (2.5 div. horizontal) of screen surface</p> <p>Menu auto-hide: 8 seconds (for multi-option menus)</p> | <p>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 3.7RS]</p> <p>Display > Menu Style. M303</p> <p>Menu auto-hide - Variable {Off, 3, 5, 10, 30, 60s}</p> <p>Display > Hide Menu. M303</p> | <p>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.</p> <p>There is a Menu auto-hide (0-60s) but that brings the default menu in view so still taking space</p> <p>Utility > Options > Menu Timeout</p> |
| Grid display | <p>Grid types:</p> <ul style="list-style-type: none"> • Lines: full line grid; H&V centre lines have tick marks • Recticle: grid crosshairs plus H&V centre lines with tick marks • Off <p>Display > Grid. M195</p> <p>Grid intensity (0-100%)</p> <p>Display > Intensities > Grid. M194</p> | <p>Grid types:</p> <ul style="list-style-type: none"> • 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 <p>Display > Grid. M303</p> <p>Grid Intensity (0-100%)</p> <p>Display > Graticule. M42</p> | <p>Grid intensity (0-100%)</p> <p>DISPLAY > Grid > Intensity. M87</p> <p>Fixed grid type: full line grid; H&V centre lines have tick marks</p> <p>Specific grid type for analogue video (Institute of Radio Engineers)</p> <p>DISPLAY > Grid > Intensity. M86</p> <p>ANALYZE > Features > Video > Grid</p> |
| Grid track | When activated, grid moves horizontally and vertically with waveform repositioning Display > Grid > Track grid. M195 | | |
| Grid axis values | <p>Horizontal and vertical values on the grid axis {On, Off}</p> <p>Values and units ("e.g., 40mV" or "-400 μs") switch automatically with selected channel.</p> <p>Display > Grid > Annotation. M195</p> | <p>Horizontal and vertical values on the grid axis {On, Off} [FW 1.3.9R4]</p> <p>Values and units ("e.g., 40mV" or "-400 μs") switch automatically with selected channel.</p> <p>With four digits after the period the axis values clutter the screen and are not very readable</p> <p>Modes {moving, fixed}</p> <p>Display > Axis label settings (missing in manual)</p> | No axis values shown |

Other customizability

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES 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 > LED light. 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. M66 | Supported Screen shortcut Utility > Menu > System Setting > Date/Time. M334 | Supported UTILITY > Options > Clock. |
| Sound | <p>Can be set at trigger event Trigger. M86</p> <p>Can be set at violation of mask Mask > Actions. M154</p> <p>General control events, e.g. changing the measurement type in the "Measure" menu.</p> <p>Via SCPI command. M465</p> | <p>Can be set at violation of mask Analyze > Mask test. M257</p> <p>General buzzer sound {On, Off}</p> <p>Utility > Menu > System Setting > Sound. M330</p> | |

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.] <small>Acquisition > Menu.. M82.</small> 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 <small>Up to 60,000 wfm/s S.5</small> | Up to 500,000 wfm/s in Sequence mode S.1 Up to 120,000 wfm/s S.4 <small>Reduce waveform update rate {Fast, Slow}</small> <small>Acquire > Menu.. M82..</small> | Up to 200,000 wfm/s 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) <small>S17</small> | 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 840Msample³⁵ | Total 400Msample | Total 4MSa |

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-\(8-bit-10-bit-12-bit-14-bit\)/](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 TECHNOLOGIES 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 ~ 10 ⁷) (V02.3)  Vertical > Channel > Probe Channel shortcut menu. M65 | 3 presents; Fully variable (0.000001 to 1000000) (equals 10 ⁻⁶ ~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 ~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-m 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. M68 For all channels: Autoset  Deeper check | For all channels: Auto Setup AUTO SETUP Acquire > Auto Setup | For all channels: Autoscale  M24 |
| Vertical position | Front-panel dial VERTICAL ▼▲  Vertical > Channel. M61 | Front-panel dial Vertical s-n Screen channel shortcut | Front-panel dial VERTICAL ▼▲ |
| Vertical position setting³⁸ | 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. 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 | | |

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 TECHNOLOGIES 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, LVCMS03.3, LVCMS02.5, 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 TECHNOLOGIES DSOX 1200 |
|--|--|--|---|
| |  References |  References | |
| 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 TECHNOLOGIES DSOX 1200 |
|------------------------------|---|--|---|
| |  Math > Menu |  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 possible via 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 <ul style="list-style-type: none"> • 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 • FFT⁴¹ <p>Almost no information in manual, actual working not so clear.⁴² Note the formulae length limitations</p> | 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.: VxA=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 TECHNOLOGIES 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 or Log(10) | | Y | Y(FE) | |
| Natural Log. | ln or 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) | |
| Low Pass | LPF | | BW: 0Hz to 300 MHz | | BW: 0Hz to 70 MHz |

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.

| | | | | | |
|--|-----|---|--|--|----------------------------------|
| | | | 2nd order infinite impulse response filter (IIR) | | 4th order Bessel-Thompson filter |
| High Pass | HPF | | BW: 0Hz to 300 MHz 1 st order infinite impulse response filter (IIR) | | |
| Track Period | | | Upper Level (UL); Hyst, Edge (FW02.400) | [No track functions in Math, but track is available in measurements] | |
| Track Frequency | | | | | |
| 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') (13.7R5) | |
| Total functions (excl. FFT) | | | 19 | 18 | 5 |

Horizontal system & trigger

Horizontal mode XT

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES 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. M65 | 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 > Roll. 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. M64 | 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 |

⁴³ <https://www.eevblog.com/forum/testgear/siglent-sds2000x-plus-coming/>

⁴⁴ Cannot be set to in-between values (say, 12ms/div), also not 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.

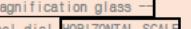
⁴⁵ I find the terminology used here rather confusing, especially because both for the "Fixed Delay" and "Fixed position" mode, the word 'delay' is left away on the instrument's screen. With just 'position' left on the screen, you think you can change a position, but in fact you cannot do so. But in Fixed Delay, 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 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES 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 O/HF 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 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|-----------------------------|--|---|---|
| Type of zoom | Horizontal, Vertical (FW02.202)  Screen shortcut | Horizontal, Vertical  Front-panel dial Zoom (click) Acquire, Zoom, M92 | Horizontal  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 (½ and ¾) | Fixed windows (about ¼ and ¾) |

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 don't 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  Trigger > Trigger type.. M76 | Auto, Normal  Trigger > Auto Trigger > Normal | Auto, Normal |
| Trigger start and stop | Run, Stop, Single Force trigger    Screen shortcut | Run, Stop, Single   Trigger > Single | Run, Stop, Single Force trigger    |
| 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  >Features >Video > Standard  >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 True 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.. M86 | | |
| 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) |

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 width 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 > Auxiliary.. 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+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|--|---|---|--|
| Location on instrument | All settings in Cursor  | All settings in Cursor > Menu  | All settings  |
| Mode | <ul style="list-style-type: none"> Manual (H, V, H+V) Track (H+V) ("V-Marker"⁵⁴) | <ul style="list-style-type: none"> Manual (H, V, H+V) Track (H+V) Measure (linked to a selected position in measure mode) (FW 1.3.9R4) | <ul style="list-style-type: none"> Manual (H+V) Track (H+V) Binary⁵⁵ Hex⁵⁶ |
| 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 } |

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.

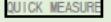
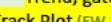
⁵⁶ Logic levels of displayed waveforms at the current X1 and X2 cursor positions are displayed in hexadecimal. Meaning: 0x8 is higher than trigger level, 0x0 is lower than trigger level.

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  | All settings in Measure > Menu  | All settings  |
| Regular measure positions | 6 (FW02.400) Shown in columns (6 next to each other) Shown in rows (6 vertical) when statistics on | 5 in M1 mode Shown in columns (5 horizontal) Shown in rows (5 vertical) when statistics on 12 in M2 mode Shown in 4:3 matrix Shown in rows (12 vertical) when statistics on | 4 Shown in columns (4 horizontal) Statistics display comes in addition to regular measurements, in in rows (4 vertical) |
| Quick measurement | 9 measurement overlay with live trace (Quick Meas)  | Table with 12 measurements Menu > Simple | Table with 26 measurements (Snapshot All) Can be assigned to "Quick Action" button via  > Quick Action > Quick Measure All... M159, 249 |
| Source (Analog, Digital, Math, Ref) (Zoom) | 4A, 16D, 5M, 4R | 4A, 16D, 2M, 4R, 4Z, 4ZA, 16ZD  S13 | 4A, M, (FFT: 6 only) |
| Measurement types | 40 (incl. 2 in-between channel delays) M123 | 63 (inc. 10 in-between channel delays) | 30 |
| Functions | | Trend, gates ,  FW 1.3.9R4 TBA | |
| On-screen explanation of measurements | Detailed icons | Small icons, and a one line text which cannot be seen when you need it. ⁶⁰ | Small icon. When the soft key is pressed, an extensive explanation with pictures is shown. |
| Histogram | | Small histogram for each measurement position, one histogram can be zoomed | |
| Link measurements to trace display | | In Cursor Measure Mode, H and V cursors show relevant measure points (gate positions, selected edges, rise time, duty cycle, etc.) | H and V cursors show relevant measure points (gate positions, selected edges, rise time, duty cycle, etc.) |
| Threshold settings for relevant measurements | 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)  | Lower, Middle and /or Upper Level can be set manually (e.g., 10%, 50%, 90%), or in voltages. (ANALIZE soft key) > 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, ∞ | 5 (Value, Min, Max, Mean, SD) + count (from FW02.12)  > Statistics Count limit: 1-2000, ∞ (from FW02.12)  > Statistics > Max Count Option to show standard deviation/mean ("Relative σ") (which is a dimensionless value)  > Statistics > Relative σ |
| Reset statistics |  M45 Via icon shown right of statistics table, or touch any setting or button that affects measurements |  M208 Via 'reset statistics' icon |  > 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)  > Statistics > Increment Statistics |

⁶⁰ 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.

| Graphic/textual explanation of measurement type | graphic and textual | graphic and textual | Small graphic and textual |
|---|--|---------------------|---------------------------|
| Save measurements and statistics | Save measurements and statistics set to file (CSV) (See below at Save and Recall section) | | |
| Other | No global on/off for measurements display (only for individual positions) | | |

Overview of all measurement types

| | | | RTB2000 | SIGLENT SDS 2000X+ | KEYSIGHT DSOX 1200 |
|---------------------------------------|---|-----------|--|--|--|
| | | | | | |
| | Measurement types | Dimension | 40 (inc. 2 in-between channel delays) NEW 33 | 63 (inc. 10 in-between channel delays) NEW 58 | 30 NEW 33 |
| horizontal (time) | Frequency | Hz | Frequency | Freq | Frequency (Freq) |
| | Period | s | Period | Period | Period |
| | Duty Cycle + | % | Duty Cycle + | +Duty | + Duty Cycle (+ Duty) |
| | Duty Cycle - | % | Duty Cycle - | -Duty | - Duty Cycle (- Duty) |
| | 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 ⁶¹ | Rise Time (Rise) |
| | Fall Time | s | Fall Time | Fall Time; 90-10%Fall | Fall Time (Fall) |
| | 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 ⁶² | s | | T@M | |
| | Time of max value | s | | Time@max | |
| | Time of min value | s | | Time@min | |
| Horizontal delay between two channels | Difference between two consecutive periods | s | | CCJ | |
| | X at Min Y | s | | | X at Min Y (X@Min) |
| | X at Max Y | s | | | X at Max Y (X@Max) |
| | Delay | s | "Delay" Settings on either channel: (Rising, Falling) (**) (4 combinations) ⁶³ | "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 (degrees) |
| | Skew | s | | Skew | |
| | Peak to Peak | V | Peak Peak | Pk-Pk | Peak-Peak (Pk-Pk) |
| | Peak + | V | Peak + | Max | Maximum (Max) |
| | Peak - | V | Peak - | Min | Minimum (Min) |
| | Amplitude (top to base) | V | Amplitude | Amplitude | Amplitude (Ampl) |
| Vertical (amplitude) | Top Level | V | Top Level | Top | Top |
| | Base Level | V | Base Level | Base | Base |
| | Mean Value | V | Mean Value | Mean | Average Full Screen (Avg-FS) |
| | Mean Value First Cycle | V | Mean Cycle | Cycle Mean | Average - Cyc (Avg-Cyc) (N cycles) |
| | Median (50% above 50% below) | V | | Median | |
| | Median First Cycle | V | | Cycle Median | |
| | RMS Value | V | RMS Value | RMS | DC RMS Full Screen (DC RMS - FS) |
| | RMS Value First Cycle | V | RMS Cycle | Cycle RMS | DC RMS - N Cycles (DC RMS - Cyc) (N cycles) |
| | RMS Value AC only (σ-Std. Deviation) | V | σ-Std. Deviation | Stdef | AC RMS Full Screen (Std. Deviation) (AC RMS - FS) |
| | RMS Value AC only (σ-Std. Deviation) First Cycle | V | σ-Std. Dev. Cycle | Cycle Stdef | AC RMS - N Cycles (AC RMS - Cyc) (N cycles) |
| | Crest Factor | ratio | Crest Factor | | |
| | Level at trigger | V | | L@T | |
| | Pos. Overshoot | % | Pos. Overshoot | ROV | Overshoot (Over) ⁶⁴ |
| | Neg. Overshoot | % | Neg. Overshoot | FOV | |

⁶¹ 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.

⁶² 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.

⁶³ Older FW02.300 had 36 combinations.

⁶⁴ 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.

| | | | | | |
|----------|---|------------------|----------------|----------------------|--------------------------------------|
| | Overshoot before a falling edge | % | | Preshoot(FPRE) | Preshoot (Pre) ⁶⁵ |
| | Overshoot before a rising edge | % | | Preshoot(RPRE) | |
| Counting | # of positive pulses on display | Cnt. | Positive Pulse | Ppulses | Positive Pulse Count (+ Pulse Count) |
| | # of negative pulses on display | Cnt. | Negative Pulse | Npulses | Negative Pulse Count (- Pulse Count) |
| | # of rising edges on display | Cnt. | Positive Slope | Rising Edges | Rising Edge Count (Rise Edge) |
| | # of falling edges on display | Cnt. | Negative Slope | Falling Edges | Falling Edges Count (Fall Edge) |
| | # of edges in a waveform | Cnt. | | Edges | |
| | # of cycles in a periodic waveform | Cnt. | | Cycles | |
| | Bit Rate | Mbps | | | Bit Rate |
| | Counter trigger level crossings during gate time | Hz | | | Counter |
| Area | .. waveform above zero | Wb ⁶⁶ | | +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) | |

DSOX xcheck Counter check in manual

Digital Voltmeter (DVM)

| | RTB2000 | SDS 2000X+ | KEYSIGHT TECHNOLOGIES DSOX 1200 |
|----------------------------------|--|------------|---|
| Location on instrument | | | |
| | App > Meter Quick Toolbar > Meter M165; S7 | | ANALYZE > Feature > DMM M195; S7,717 DVM standard since FW2.10 |
| Positions (shown simultaneous) | 4 positions | | 2 (one selected voltage plus frequency) |
| | 3 digits | | 3 digits |
| Scale | Via analogue channel settings | | <ul style="list-style-type: none"> • Via analogue channel settings⁶⁷ • Auto range mode for inactive channels (channel must not be selected for trigger) |
| Source (Analog) | 4A, active or inactive | | 4A, active or inactive |
| Measurements | DC, AC, ACrms, DC+ACrms <i>(shown DC measurements are wrong when channel itself is set to AC coupling, no warning⁶⁸)</i> | | DC, DCrms, ACrms (DC only when channel set to DC, otherwise automatic switch to AC) (Frequency shown simultaneously) |
| Other | | | Also works for disabled channels |
| Bandwidth (voltage measurements) | BW=1MHz | | 20 Hz to 100 kHz (for RMS) (warning when outside range) |
| Display | Display colour adapts to channel. Show in overlay window than can be moved. | | <p>Large readout seven-segment readout style. Display colour adapts to channel.</p> <ul style="list-style-type: none"> • While in analysis mode: Results shown in overlay window (transparency selectable).⁶⁹ Small analogue scale showing measurement extrema over last 3 seconds. • While not in analysis mode: results shown left bottom. |

⁶⁵ 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.

⁶⁶ See discussion at <https://electronics.stackexchange.com/questions/562058/siglent-sds1104x-e-integrate-function-units-of-measure>

⁶⁷ But asynchronous from oscilloscope's acquisition system.

⁶⁸ 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).

⁶⁹ When switching from Analysis to Measurement menu, there is weird interference with measurement window.

Frequency counter

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|---------------------------------------|--|--|---|
| Location on instrument | App > Counter, M167, S7 | Analysis > Counter, M264, S14 | ANALYZE > Feature > DVM, M195, S7,17 |
| Implementation | Separate from DMM (Separate freq. counter in Measurements) (Separate freq. track in Math) | (Trigger frequency is shown on the screen independent of the counter) (Separate freq. counter in Measurements) | Part of DMM (results shown simultaneously with voltage) (Separate freq. counter 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 ⁷⁰) | 4A (Independent of channel selected for trigger but only works if trigger (level) for that channel is properly set ⁷¹) Also works for serial trigger (1.3.7R5) | 4A (Same channel as DMM) (Only works when channel is also selected for trigger ⁷² , 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, Stdev, Count ⁷³) | |
| Range | Up to scope bandwidth (350MHz), (limited if trigger filter is set) | Not specified | check (In Measurement Module, counter is up to scope bandwidth; 70MHz) |

⁷⁰ 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.

⁷¹ Alternatively, a "Level" setting can 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).

⁷² If user selects other channel for trigger, the frequency counter automatically changes to voltmeter for the selected channel.

⁷³ 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)⁷⁴

| |  RTB2000 |  SDS 2000X+ |  DSOX 1200 |
|--|---|---|--|
| Location on instrument | All settings in Protocol PROTOCOL | All settings in Analysis > Decode DECODE | ANALYZE >Features >Serial |
| 'Bundle' protocols⁷⁵ | 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, I ² S, CAN FD. Manchester ⁷⁶ , SENT (since 1.3.7R5) | |
| Simultaneous decode buses | 1 bidirectional ⁷⁷ , 2 unidirectional | 2 bidirectional | 1 bidirectional |
| Signal sources | 4A, 16D (not M ⁷⁸ or R) | 4A, 16D (not M ⁷⁹ or R!!) | 4A (not M ⁸⁰ 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 ⁸¹) | | |
| 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 ⁸² 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 option⁸³ | 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 ⁸⁴ } (non-valid ASCII values shown as HEX) | {Bin, Hex, Dec, ASCII} (Problem with 'non-valid' ASCII character values ⁸⁵) | 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 ⁸⁶ | |

⁷⁴ Descriptions in this table are based on the 'Bundle' protocols' (i.e., SPI, I²C, UART, CAN, LIN) and do not consider the optional protocols.

⁷⁵ Protocols that are either included with any device version, or bundled together with specific device offers.

⁷⁶ Implemented without serial trigger function.

⁷⁷ If a bidirectional bus is used (e.g. UART RX/TX or SPI MOSI/MISO), two bus decoders are occupied. S9.

⁷⁸ Not being able to decode from a math channel is a pity. Busses such as CAN 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.

⁷⁹ Ibid.

⁸⁰ Ibid.

⁸¹ 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 off to save screen estate (in the RTB, the serial decode can also work from a channel turned off).

⁸² 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.

⁸³ 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.

⁸⁴ If a value is observed that does not correspond to a valid ASCII character, then the instrument shows the HEX value instead.

⁸⁵ ASCII characters other than regular characters are shown as, for instance, ☰ or ☱, effectively meaningless for decoding purposes.

⁸⁶ 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 ⁸⁷ | Manual | Manual |
| Hysteresis for serial decode⁸⁸ | Yes, for all analogue and digital channels, in channel menu. ⁸⁹ Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274 | | Perhaps ⁹⁰ |
| Data symbol size | {5 to 9 bit} supports 'multi slave' schemes ⁹¹ | {5 to 8 bit} | {5 to 9 bit} supports 'multi slave' schemes ⁹² |
| 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 ⁹³ Several time settings ⁹⁴ | Time, Rx, Rx error, Tx, Tx error | Time, Rx [data], Tx [data], Errors. Several time settings ⁹⁵ |
| Error states, warnings or status shown in Bus Table / Bus Display / Lister | <ul style="list-style-type: none"> Start error (no start bit found) Stop error (no stop condition found) Parity error (transmission error) INSufficient⁹⁶ (warning) Break condition found (warning) (a) (Column is rather small⁹⁷) <small>Additional options for observing UART errors available in SCPI for both frames (M497) and words (M497).</small> | "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 | <ul style="list-style-type: none"> Start bit Start of frame Break⁹⁸ | <ul style="list-style-type: none"> Start bit Stop .. Tx, Rx | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Stop bit error Parity error (not available if protocol parity is set to 'none') | <ul style="list-style-type: none"> [Parity] error M149, S12 | <ul style="list-style-type: none"> 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 |

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

⁸⁷ For both analogue and digital channels, thresholds can be manually set and the threshold can be automatically determined.

⁸⁸ 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.

⁸⁹ While this setting is not in the digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.

⁹⁰ Not entirely clear. But since noise reject is available during serial decode trigger, and that function is described in the manual as "increases the trigger hysteresis", it might be.

Trigger > Menu. M122

⁹¹ The '9th bit' is to support single master/multiple slaves bus schemes. See [here](#).

⁹² ibid.

⁹³ The status table can show errors (see next row) but also it can also show values [OK, Break].

⁹⁴ 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".

⁹⁵ Time can be selected to be relative to trigger or relative to previous row in table.

⁹⁶ INSufficient: the frame is not completely contained in the acquisition; but the acquired part of the frame is valid.

⁹⁷ The width of the column showing errors can be small, especially for showing multiple errors (they are still 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.

⁹⁸ 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.

I²C protocol decoding

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|---|---|---|--|
| | | s12 |  >Features >Serial, mode I ² C, Addr Size, M287, S16 |
| Supported I²C 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 ⁹⁹ | Manual | Manual |
| Hysteresis for serial decode¹⁰⁰ | Yes, for all analogue and digital channels, in channel menu. ¹⁰¹ Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274 | | |
| Treatment of R/W bit | | Consider R/W bit as the 8 th bit in the address (instead of showing the 7 bit address value) M141 | Consider R/W bit as the 8 th 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 <small>Additional options for I²C errors available in SCPI (M484)</small> | 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 | <ul style="list-style-type: none"> Address Error Data error Stop error INSufficient¹⁰² (warning) Restart (status) OK (status) <p>(Acknowledgement bits after each data and address byte are shown in the telegram, not in the table¹⁰³) (column rather small¹⁰⁴) (a)</p> | No errors shown. ¹⁰⁵ | Missing Ack. No other errors shown. M294 |
| Other | | Bus table has long data mode (can show long strings of texts) ¹⁰⁶ Analysis > Decode > Results List > Long Data | |
| I²C Trigger: Timing event | <ul style="list-style-type: none"> Start Stop Restart (Repeated start condition) | <ul style="list-style-type: none"> Start Stop Restart (Repeated start condition) | <ul style="list-style-type: none"> Start Stop Restart ("triggers when another start condition occurs before a stop condition.") |
| I²C Trigger: No Ack. | <ul style="list-style-type: none"> No Ack (bytes with missing acknowledgement bit) | <ul style="list-style-type: none"> No Ack (bytes with missing acknowledgement bit) | <ul style="list-style-type: none"> Missing Acknowledge Address with no Ack |
| I²C 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 ¹⁰⁷ .. up to 4k offset | .. Slave address (7 bit, 10 bit) .. {Read, Write, Ether} .. 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 |
| I²C Trigger: Data length | | .. Slave address (7 bit, 10 bit) .. SDA Data length 1-12 | |
| I²C 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 |
| I²C searching | | | |

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

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 the digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.

¹⁰² INSufficient: the frame is not completely contained in the acquisition; but the acquired part of the frame is valid.

¹⁰³ Unlike the DSOX, the RTB shows full lines of data values instead of just a single value per line in the table; therefore it would be difficult to show acknowledgement data for each of the bytes in a table row.

¹⁰⁴ The width of the column showing errors can be small, especially for showing multiple errors (they are still 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.

¹⁰⁵ There is no column to show errors, and also when there are known errors in the signal, none are shown.

¹⁰⁶ SPI, UART, CAN and LIN do not have such a function.

¹⁰⁷ 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 |  SDS 2000X+ |  DSOX 1200 |
|---|---|---|--|
| | M222 | s12, M142 | M303, s15 |
| Bus speed | up to 25 Mbps | [Not specified] ¹⁰⁸ | Up to 25 Mbps |
| Polarity for MOSI, MISO | Independent for MOSI, MISO | [¹⁰⁸] | No adjustable |
| Clock | {Rise, Fall} | {Rise, Fall} | {Rise, Fall} |
| Threshold | Auto determine, manual ¹⁰⁹ | Manual | Manual |
| Hysteresis for serial decode¹¹⁰ | Yes, for all analogue and digital channels, in channel menu. ¹¹¹ 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) | <ul style="list-style-type: none"> • CS high • CS low • Idle time: 25.6ns to 53ms See also M277 | <ul style="list-style-type: none"> • CS Active High • CS Active Low • CLK timeout: 100ns to 5ms | <ul style="list-style-type: none"> • 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 ¹¹² | Frame, Time, MISO [data], MOSI [data] | Time, MOSI [data], MISO [data] |
| Error states, warnings or status shown in Bus Table / Bus Display / Lister | <ul style="list-style-type: none"> • Data error • INsufficient¹¹³ (warning) (a) <p>Additional options for observing SPI errors available in SCPI (M476)</p> | No errors shown. ¹¹⁴ | Aliased data is shown in pink colour. |
| SPI Trigger: Timing event | .. selectable MISO or MOSI ¹¹⁵ <ul style="list-style-type: none"> • 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

¹⁰⁸ The decode module has no polarity option, but the user can change invert the associated channel to achieve a polarity switch.

¹⁰⁹ For both analogue and digital channels, thresholds can be manually set and the threshold can be automatically determined.

¹¹⁰ 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.

¹¹¹ While this setting is not in the digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.

¹¹² 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".

¹¹³ INsufficient: the frame is not completely contained in the acquisition; but the acquired part of the frame is valid.

¹¹⁴ There is no column to show errors, and also when there are known errors in the signal, none are shown.

¹¹⁵ Via trigger > type > source.

CAN protocol decoding

| |  RTB2000 |  SDS 2000X+ |  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] ¹¹⁶ | 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 ¹¹⁷ ; 10 presets | Manual form 10 kb/s to 5Mb/s ¹¹⁸ ; 15 presets |
| Polarity | {Active High, Active Low} | [¹¹⁹] | {CAN_H, CAN_L, Differential L-H, Differential H-L, Rx,Tx} M278-279 |
| Threshold | Auto determine, manual ¹²⁰ | Manual | Manual |
| Hysteresis for serial decode¹²¹ | Yes, for all analogue and digital channels, in channel menu. ¹²² Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274 | | |
| Sample point¹²³ | 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 ¹²⁴ | CAN [Frame], time, Frame type, ID, Data length, CRC, Ack. | Time, ID, Type, Data length (DLC), Data, CRC, Errors Several time settings ¹²⁵ |
| Errors, warnings or status shown in Bus Table / Bus Display / Lister | <ul style="list-style-type: none"> • NACK (Acknowledge is missing) • OVL (Overload frame) • Stuff (bit stuffing error) • CRC (Cyclic redundancy check failed) • Data error • Error-frame • Form error <p>(a) Can show multiple errors per packet (column rather small)¹²⁶ Additional options for observing CAN errors available in CAN searching (see below) and via SCPI (M506)</p> | Acknowledgement is confirmed (when they are lacking, sometimes there is a 'no' in the column, sometimes simply no value). But otherwise no errors shown. ¹²⁷ 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 ¹²⁸ 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 ¹²⁹ | combination of ¹³⁰ .. 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 ¹³¹ .. 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 |

¹¹⁶ From testing I infer that both CAN version 2.0A and 2.0B are supported.

¹¹⁷ 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 1Mbps/s so I used this value in the table.

¹¹⁸ Fractional user-defined baud rates between 4 Mb/s and 5 Mb/s are not allowed.

¹¹⁹ The CAN bus setting have 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 the digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.

¹²³ Position of the sample point within the bit, in percent of the horizontal bit time.

¹²⁴ 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".

¹²⁵ Time can be selected to be relative to trigger or relative to previous row in table.

¹²⁶ The width of the column showing errors can be small, especially for showing multiple errors (they are still 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.

¹²⁷ There is no column to show errors, and also when there are known errors in the signal, none are shown.

¹²⁸ THM: If the header exceeds the length specified in the standard.

¹²⁹ 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".

¹³⁰ There is also a "Curr ID Byte" setting but this is not additional selection criteria but determines the byte changed by the rotary control (if you do not want the direct entry mode).

¹³¹ 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 ('0XX') 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: <ul style="list-style-type: none">• 'Stuff bit',• 'Form',• 'Acknowledge',• 'CRC' <p>Any combination of these errors can be selected. (See also the two <i>error frame types</i> above)</p> | Yes, [but error type not specified or selectable] ¹³² | Selectable error type: <ul style="list-style-type: none">• 'Error Frame',• 'All Errors',• 'Acknowledge Error',• 'Overload Frame' <p>No combination of errors possible</p> |
| CAN searching | (continued on next page) | | |
| CAN searching ¹³³ | <ul style="list-style-type: none"> • 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 <small>Also here must know data length¹³⁴</small> • Search Error { Stuffbit, 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 |

¹³² 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.

¹³³ In contrast to trigger, search can identify/show *all* events that meet the set criteria.

¹³⁴ 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 ('0XX') 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 data [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) <small>S16 S269</small> | v1.3, v2.0 <small>S13</small> Auto recognition (allows mixed traffic) | v1.3, v2.x Only manual setting. Mixed traffic not supported. |
| Bus speed (baud rate) | 6 presets ¹³⁵ ; User defined from 1 kbps to 2.5 Mbps <small>s16</small> | 6 presents; User defined from 300 bps to 20 Mbps <small>s16</small> | 6 presents; User defined from 2.4 kbps to 625kb/s |
| Polarity [in protocol menu] | Active high, Active low | No setting, device expects idle <i>low</i> . [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 <i>high</i> . [if required change polarity in channel menu] |
| Threshold | Auto determine, manual ¹³⁶ | Manual | Manual |
| Hysteresis for serial decode¹³⁷ | Yes, for all analogue and digital channels, in channel menu. ¹³⁸ Vertical > Channel > Threshold > Hysteresis M64; Logic > Hysteresis M274 | | |
| Sample point¹³⁹ | | | 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 ¹⁴⁰ | Frame, Time, ID, Data length, ID Parity, Data, Checksum | Time, ID (problem ¹⁴¹), Data, Checksum, Error ¹⁴² Several time settings ¹⁴³ |
| Error states shown in Bus Table / Bus Display / Lister | <ul style="list-style-type: none"> Sync Parity error Data error Checksum error Wakeup frame (status) <p>Can show multiple errors per packet (column rather small¹⁴⁴)</p> <p>Additional options for observing LIN errors available in LIN searching (see below) and via SCPI (M521)</p> | No errors shown. ¹⁴⁵ 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 (> < = ≠) ¹⁴⁶ .. A user Symbolic ID ¹⁴⁷ | 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 (> < = ≠) ¹⁴⁸ | .. 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: <ul style="list-style-type: none"> Checksum Parity Synchronisation Any combination of these errors can be selected. | Selectable error types: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> Checksum Parity No combination of errors possible |

¹³⁵ Presets including 10.417 bps, the maximum SAE J602 speed.

¹³⁶ For both analogue and digital channels, thresholds can be manually set and the threshold can be automatically determined.

¹³⁷ 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.

¹³⁸ While this setting is not in the digital decoder menu itself, tests have confirmed it indeed works for the serial decoder.

¹³⁹ Position of the sample point within the bit, in percent of the horizontal bit time.

¹⁴⁰ 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".

¹⁴¹ 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.

¹⁴² 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

¹⁴³ Time can be selected to be relative to trigger or relative to previous row in table.

¹⁴⁴ The width of the column showing errors can be small, especially for showing multiple errors (they are still 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.

¹⁴⁵ There is no column to show errors, and also when there are known errors in the signal, none are shown.

¹⁴⁶ If a wildcard is used, only {=} – which is of course logical...

¹⁴⁷ 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".

¹⁴⁸ If a wildcard is used, only {=} – which is of course logical...

| | | | |
|---------------|---|--|--|
| LIN searching | <ul style="list-style-type: none"> ● Search Frame <ul style="list-style-type: none"> Start of frame Wakeup ● Search Error <ul style="list-style-type: none"> {'Checksum', 'Parity', 'Synchronisation'}. Any combination of these errors can be selected. In a bus table, each error is then identified by type. ● Search ID <ul style="list-style-type: none"> .. 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 ($> < = \neq$)¹⁴⁹ .. A user Symbolic ID¹⁵⁰ ● Search ID and data <ul style="list-style-type: none"> .. 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 ($> < = \neq$)¹⁵¹ ● Search ID and data <ul style="list-style-type: none"> .. 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

¹⁴⁹ If a wildcard is used, only {=} – which is of course logical...

¹⁵⁰ 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".

¹⁵¹ If a wildcard is used, only {=} – which is of course logical...

Parallel bus decode

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|---|--|---|---|
| Location on instrument | All settings in Protocol PROTOCOL | All settings: select digital channels, then Bus | Analysis > Features > Analog Bus ('ABUS') <i>Uses the analogue channels, with individual threshold</i> |
| 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 ¹⁵²) | | |
| Routing support for busses | Allows flexible routing of each of the 16 digital channels | Allows flexible routing of each of the 16 digital channels | |
| Height of bus display | Flexible (from 1 to 13 characters vertically) | Fixed (1 character vertically) | |
| Maximum number of values than can be shown horizontally¹⁵³ | 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 TECHNOLOGIES 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 width 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, Fail} see above (Output of Auxiliary Out connector is Trigger, except when Mask analysis is activated) | TBA |
| Actions on mask (other than BNC Pulse out) | <ul style="list-style-type: none"> Sound Stop acquisition Screenshot Save waveform Mask > Actions. M154 | <ul style="list-style-type: none"> 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 | |

¹⁵² CS = Chip Select.

¹⁵³ For this test an 8 bit bus is configured, so values can vary from 0 to 127 (3 three digits). For a 16 bit bus (values 0 thru 65,535) the results are the same.

Bode plots (Frequency Response Analysis) (TBA)

| |  RTB2000 |  SDS 2000X+ |  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 ¹⁵⁴ | |
| 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} Single sweep (FW 1.3.9R4) | |
| | Amplitude zones, 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 | |

¹⁵⁴ "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)

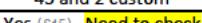
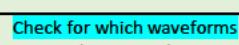
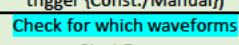
| |  RTB2000 |  SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|-------------------------------|---|--|---|
| Location on instrument | All settings in APP > FFT App > FFT | All settings in Analysis > Mask | |
| | Yes | Yes up to 2 Mpts | Yes |
| | @@ FFT scaling dBuV at some point added (see specifications 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)

| |  |  |  |
|-------------------------------|---|--|---|
| 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 TECHNOLOGIES DSOX 1200 |
|---|---|---|---|
| Location on instrument | All settings in Gen GEN | All settings in Utility > AWG Menu AWG |  |
| Resolution, sample rate, waveform memory | 14 bit, 250 MSa/s ARB: 10 MSa/s | 14 bit, 125 MSa/s ARB check |  |
| ARB waveform memory | 32 kpts ¹⁵⁵ | 16 kpts | |
| Amplitude | High Z: 20mV to 5V(Vpp) 50Ω: 10mV to 2.5V(Vpp) |  |  |
| DC Offset | High Z: ±5V 50Ω: ±2.5V |  |  |
| 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 ¹⁵⁶ | 12Vpp ¹⁵⁷ |
| 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  |
| 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) ¹⁵⁸ | |
| 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 (S16).  | |
| 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 |  Yes (# cycles, idle time, start phase, trigger {Const./Manual}) | | |
| Sweep |  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 |

¹⁵⁵ Specifications from document R&SRTx-B6: ARBITRARY WAVEFORM AND 4 BIT PATTERN GENERATOR. This conflicts with the specifications that mention 16k points

¹⁵⁶ Yet, in Bode plot, the amplitude 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

¹⁵⁷ The manual states 5Vpp but on the device one can select up to 20Vpp

¹⁵⁸ 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 (check¹⁵⁹) | check | |

¹⁵⁹ Specifications from document R&SRTx-B6: ARBITRARY WAVEFORM AND 4 BIT PATTERN GENERATOR. This conflicts with the specifications that mention 16k points

Pattern generator

| | | | |
|--|---|--|---|
| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|--|---|--|---|

| | | | |
|---|---|--|---|
| Location on instrument | All settings in Patt. Gen. | | <input checked="" type="checkbox"/> Training Signals |
| Number of output pins | 4 pins (bits) | | <input checked="" type="checkbox"/> 1 pin |
| Sample rate | 50 Mbit/s ¹⁶⁰ | | |
| 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 ¹⁶¹ User utility allows Excel creation ¹⁶² | | |
| Burst | [part of arbitrary pattern, see above] | | <ul style="list-style-type: none"> 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. ¹⁶³ | | |
| 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. ¹⁶⁴ | | Training signal: 1 pin (CAN-L), 125 kbp DEMO signal: 1 pin (CAN-L), 125 kbp, very useful sequence ¹⁶⁵ Check Same or not?! |
| LIN | 2 pin (High, Low) 9.6, 10.417, 19.2 kBit/s [LIN2.0 protocol] ¹⁶⁶ Instrument own decode shows CHECKSUM, PARITY and SYNC errors in various frames. ¹⁶⁷ | | 1 pin, 19.2 kbs, [LIN1.3] ¹⁶⁸ |

¹⁶⁰ Specifications from document R&SRTx-B6: ARBITRARY WAVEFORM AND 4 BIT PATTERN GENERATOR

¹⁶¹ See <https://www.eevblog.com/forum/testgear/rohde-schwarz-rtb2002-rtb2004-question-importing-cvs-in-pattern-generator/>

¹⁶² See <https://www.eevblog.com/forum/testgear/rohde-schwarz-rtb2002-rtb2004-question-importing-cvs-in-pattern-generator/>

¹⁶³ Not clear whether these errors are inserted intentionally or not; this is not documented.

¹⁶⁴ Not clear whether these errors are inserted intentionally or not; this is not documented.

¹⁶⁵ 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 sequence, you will want to trigger it properly to a steady point. To do so, you can trigger on a data frame with ID = 0x7F and first data byte 0xE4 and set trigger holdoff to 35ms.

¹⁶⁶ 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.

¹⁶⁷ Not clear whether these errors are inserted intentionally or not; this is not documented.

¹⁶⁸ 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 TECHNOLOGIES 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) ^{169, 170} 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 (TBA)

(For memory specifications, see above)

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|-------------------------------|--|---|---|
| Location on instrument | @@ | @@ | @@ |
| 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) (TBA)

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

¹⁶⁹ 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 allows different bus speeds, the demo's have the following speeds: CAN: 9.6 kbps, @@@

¹⁷⁰ 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 were 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 <i>Save and Recall</i> 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 ¹⁷¹ -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: <ul style="list-style-type: none">• CSV data (*.csv)• ASCII XY data (*.csv)• Reference Waveform data (*.h5)¹⁷² {Ch1, Ch2, Ref} (No Ch.3, Ch.4, Math, Ref)• Multi Channel Waveform data (*.h5)¹⁷³• 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 <i>Save and Recall</i> 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 <i>Save and Recall</i> 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 HTML 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 | |

¹⁷¹ FLT is a Floating Point format.

¹⁷² A format that can be recalled to one of the oscilloscope's reference waveform locations, or opened by the N8900A Infinium Offline oscilloscope analysis software.waveform locations or read by the N8900A Infinium Offline oscilloscope analysis software..

¹⁷³ A format that can be opened by the N8900A Infinium 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. ¹⁷⁴ (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) | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> [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] <ul style="list-style-type: none"> 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 manual¹⁷⁵ 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 |

¹⁷⁴ Siglent has a Windows program called 'EasyScopeX', which controls a variety of their scopes. According to the software documentation and revision history, those include the SDS1000, SDS1000X/X+, SDS1000X-E, and SDS2000X/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 bit 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.

¹⁷⁵ Might be similar to the Tek mode in the Siglent SDS5000X, see [here](#).

System

Save and recall

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|-----------------------------|--|--|--|
| Device setup | <p>Save, Load To and from internal or external File format: SET (instrument-specific¹⁷⁶), based on SCPI commands</p> <p>Precise content of setup not specified¹⁷⁷</p> <p>Setup files have small screenshot embedded for easy identification. These are visible in file manager in instrument when loading a file.</p> <p> File > Setup. M177</p> | <p>Save, Load To and from internal (10 positions max) or external File format: XML (instrument-specific¹⁷⁸), in XML style format</p> <p>Precise content of setup not specified¹⁷⁹</p> <p>(I cannot reproduce the steps in Manual p.32 on the instrument...)</p> <p>Current setting can be saved as default set-up.</p> <p> Utility > Save/Recall. M317, 319</p> | <p>Save, Load To and from internal (10 positions max) or external File format: SCP (instrument-specific¹⁸⁰), in XML style format</p> <p>Saves the horizontal timebase, vertical sensitivity, trigger mode, trigger level, measurements, cursors, and math function settings</p> <p> P219</p> |
| Waveform data (save) | <p>Save To internal or external File formats {TXT, CSV¹⁸¹, BIN-MDB, BIN-LSB, FLT¹⁸²-MSB, FLT-LSB}.</p> <p>Source: <ul style="list-style-type: none"> Selected waveform (4A, 16D) All visible waveforms </p> <p>Choice of <ul style="list-style-type: none"> Displayed waveform(s) Acquisition Memory (for stopped acquisitions) History Data (waveform plus CSV file with information about segments) </p> <p>Waveform data formats are discussed in detail, including examples, on p.180-182 of the manual; History & Segment files on p. 114-115</p> <p> File > Setup. M180 114</p> <p>Waveforms can also be saved as a "Trigger Action" or a "Mask Action".</p> | <p>Save (3 formats) Only to external File formats: CSV, MAT (Matlab format), BIN</p> <p>Source (only for CSV and MAT): <ul style="list-style-type: none"> Selected waveform (4A, 2M (1.3.7R5)). Not FFT All visible waveforms (1.3.7R5) </p> <p>For BIN, I guess all data are saved ?!?</p> <p>For CVS, option to include the scope configuration parameter information (horizontal time base, vertical scale, etc.) ParaSwitch</p> <p>For BIN, a Windows-PC Bin2CSV Tool is available. This way, the file from instrument to PC can be smaller.</p> <p> Utility > Save/Recall. M318</p> | <p>Save Only to external File formats: CSV, ASCII XY, BIN, H5 (single waveform/reference waveform¹⁸³), H5 (Multi Channel Waveform data¹⁸⁴)</p> <p>Detailed information on waveform formats is in manual on pages 266, 273, 274.</p> <p>Number of data points to be saved (Length); detailed explanation M221</p> <p>If segmented memory is active {Selected segment only, All segments}</p> <p>Setup Info option saves additional setup information in a separate TXT file (vertical, horizontal, trigger, acquisition, math, and display settings).</p> <p> P220</p> |
| 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 ¹⁸⁶ | Save, Load Only to external File format: H5 ¹⁸⁹ |

¹⁷⁶ This is a device specific format and files are not intended for analysis outside the instrument.

¹⁷⁷ But the file can be opened in a standard text editor and shows some 1400 comment lines of setup data.

¹⁷⁸ This is a device specific format and files are not intended for analysis outside the instrument.

¹⁷⁹ But the file can be opened in a standard text editor – there are roughly 3000 lines of XML language, a bit harder to understand by humans but might still be investigated.

¹⁸⁰ This is a device specific format and files are not intended for analysis outside the instrument. Yet, it is in an XML type of language so can be investigated.

¹⁸¹ Files stored as *.CSV can be later loaded in the instrument again as reference waveforms.

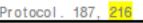
¹⁸² FLT is a Floating Point format.

¹⁸³ A format that can be recalled to one of the oscilloscope's reference waveform locations, or opened by the N8900A Infinium Offline oscilloscope analysis software.waveform locations or read by the N8900A Infinium Offline oscilloscope analysis software.

¹⁸⁴ A format that can be opened by the N8900A Infinium Offline oscilloscope analysis software.

¹⁸⁶ Manual, p.320: "Save/Recall only supports saving Reference to external memory. However, the reference waveform itself can be saved to internal memory. See the chapter "Reference" for details."

¹⁸⁹ A format that can be recalled to one of the oscilloscope's reference waveform locations, or opened by the N8900A Infinium Offline oscilloscope analysis software.waveform locations or read by the N8900A Infinium Offline oscilloscope analysis software.

| | | | |
|---|--|--|--|
| | <p>File formats: CSV (load only), TRF (instrument-specific¹⁸⁵)</p> <p>Waveform files saved as CSV format can also be loaded as reference and are converted into TRF by the instrument</p> <p>Reference files have small screenshot embedded for easy identification. These are visible in file manager in instrument when loading a file.</p>  Reference, M187 | <p>File format: REF (instrument-specific¹⁸⁷)</p> <p>Bit confusing and possible mismatch between instrument and manual. On the instrument it seems you can:</p> <ul style="list-style-type: none"> - save a source (4A, 2M) into *.REF. - recall (load) a *REF file into REFA to REFD position <p>But this is at odds with the manual.¹⁸⁸</p>  Utility > Save/Recall, M317 |  P222 |
| Math sets (equation sets; formularies) | <p>Load, Save</p> <p>To and from internal or external</p> <p>File format: FML (instrument-specific¹⁹⁰)</p> <p>FML files are instrument-specific¹⁹¹</p> <p>To/from internal or external (sets with up to 5 formularies)</p>  Math, M187, 101 | | |
| Statistics | <p>Save</p> <p>To internal or external</p> <p>File format: CSV; content described on page 134 of manual.</p> <p>Save icon overlaps with other icon¹⁹²</p> <p>Save button shown right of statistics table, M133</p> | | |
| Decoded busses (results table) (see also above at @@) | <p>Save</p> <p>To internal or external</p> <p>File format: CSV</p> <p>Possible for any parallel or serial bus</p>  Protocol, 187, 216 | | <p>Save</p> <p>Only to external</p> <p>File format: CSV</p>  M222 |
| Search results | <p>Save (CSV file)</p>  Search, M117 | | |
| Screenshots | <p>Save (PNG, BMP)</p> <p>To internal (FW02.300) or external</p> <p>File formats: PNG, BMP</p> <p>Resolution 1280x824 {Color, Greyscale} {Non-inverted, Inverted}</p> <p>Option to disable device logo in screenshot (FW02.300)</p> <p>Option to close all menu's before screenshot (so they do not mask the results)</p>   File > Screenshots, M187 | <p>Save</p> <p>Only to external</p> <p>File formats: PNG, BMP, JPG</p> <p>Resolution 1024x600 {Normal, Inverted}</p> <p>Print Area {Grid, Full} (FW 1.3.9R4)</p>  Utility > Print | <p>Save</p> <p>Only to external</p> <p>File formats: PNG (24 bit), BMP (8 or 24 bit)</p> <p>Resolution 800x503 {Color, Greyscale} {Normal, Inverted} (Invert Grat)</p> <p>Setup Info option saves additional setup information in a separate TXT file (vertical, horizontal, trigger, acquisition, math, and display settings).</p>   M19 |
| Patterns (for pattern generator) | <p>Load, Save</p> <p>To/from internal or external</p> <p>File format: SCP (remote commands format; command for</p> | | |

¹⁸⁵ This is a device specific format and files are not intended for analysis outside the instrument.

¹⁸⁷ This is a device specific format and files are not intended for analysis outside the instrument.

¹⁸⁸ 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.

¹⁹⁰ This is a device specific format and files are not intended for analysis outside the instrument.

¹⁹¹ This is a device specific format and files are not intended for analysis outside the instrument.

¹⁹² The SAVE icon overlaps with the R&S Menu logo on the right bottom. While one can still select either, one must take care.

¹⁹³ 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 ¹⁹⁴ 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 ¹⁹⁵ File format: MSK (instrument specific) ¹⁹⁶  > Mask App > Mask. M147 | | Save, Load (MSK) To and from internal (4 positions max) or external File format: MSK (instrument specific) ¹⁹⁷  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).  P219 |
| File Manager or similar functions | Copy between internal memory and USB drive Supported File > Setup ¹⁹⁸ 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 > References. M187 | Windows-like file manager available in the Save/Recall menu Icons and explanation somewhat unclear  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 ¹⁹⁹ , 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.  Utility > Save/Recall > Recall | Performs a secure erase of all non-volatile memory in compliance with National Industrial Security Program Operation Manual (NISPM) Chapter 8 requirements.  > 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) |

¹⁹⁴ See <https://www.eevblog.com/forum/testgear/rohde-schwarz-rtb2002-rtb2004-question-importing-cvs-in-pattern-generator/>

¹⁹⁵ But can be copied with file manager to external storage.

¹⁹⁶ This is a device specific format and files are not intended for analysis outside the instrument.

¹⁹⁷ This is a device specific format and files are not intended for analysis outside the instrument.

¹⁹⁸ Even though this is in the ‘Setup’ [file] menu, this function works for any type of file.

¹⁹⁹ Waveform is saved according settings possible in Waveform Save menu. These settings are shown in the OneTouch menu.

Other system features (TBA)

| |  RTB2000 |  SIGLENT SDS 2000X+ |  KEYSIGHT TECHNOLOGIES DSOX 1200 |
|--|---|---|---|
| Self alignment / user calibration | <p>Self alignment “The self-alignment aligns the data from several input channels vertically and horizontally to synchronize the timebases, amplitudes and positions.”</p> <p>Can save log file. Setup > Self alignment. M196</p> | <p>Self-calibration “The self-calibration program can quickly calibrate the oscilloscope to reach the best working state and the most precise measurement.”</p> <p>Yes TBA Utility > Do Self Cal. M343</p> | <p>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.”</p> <p>Follow key sequence explained on page 246 of user manual</p> <p>To display the user calibration status UTILITY > Service > User Cal Status. M247</p> |
| Hardware test | | <p>Screen test LED test Keyboard/button test. Also fairly cool in its implementation</p> <p>Utility > Do Self-Test > Screen Test Utility > Do Self-Test > LED Test Utility > Do Self- Test > Keyboard Test M340-342</p> | <p>Hardware self-test Front panel self-test. Quite cool in its implementation; check the three function check of rotary dials!</p> <p>UTILITY > Service > Diagnostics / Hardware Self Test. M346 UTILITY > Service > Diagnostics / Front Panel Self Test. M246</p> |
| Probe compensation | <p>Extensive visually aided procedure  > Probe Vertical > Channel > Probe Setup > Probe Adjust. M86, 461, 462</p> | <p>Via general auto-setup procedure, no specific procedure. AUTO SETUP. M32</p> | <p>Aided procedure.  > Probe > Probe check. M26</p> |
| Settings on power-on | From last session M34 | [From last session] (Not discussed in manual) | [From last session] (Not discussed in manual) |
| Default setting | <p>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.”</p> | <p>Default can be set as either:</p> <ul style="list-style-type: none"> Factory set-up A saved user set-up <p> Acquire > Default Saving user setup:  Utility > Save/Recall. M317</p> <p>For both, the device pops up a screen window for confirmation. But you can also tap the button just twice.</p> | <p>Returns device to a default setup but ‘leaving some user settings (not specified). Also described as bringing the “oscilloscope in a known operating condition”</p> <p> DEFAULT SET. M24  > Default/Erase / Default Setup</p> <p>It is also possible to restore the device to factory setting via de</p> <p> > Default/Erase / Factory Defaults. M225</p> |
| Autoset | <p>Per channel: Autoscale  “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</p> <p>For all channels: Autoset See manual, page 51 for what Autoset exactly does.</p> <p></p> | <p>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).</p> <p>“Press the Auto Setup button, and the oscilloscope will set the trigger type to Edge.” (p. 101)</p> <p>Is also used for probe compensation (p. 32)</p> <p>Error in manual.²⁰⁰  Acquire > Auto Setup. M58, 63</p> | <p>For all channels: Autoscale “to automatically configure the oscilloscope to best display the input signals.”</p> <p> M24</p> |
| Print to external printer | | | Print to a USB of network-attached print.  The printer must support Direct PDF printing over USB/IPP (Internet Printing |

²⁰⁰ Here, the manual, page 58, indicates “Trigger ->Auto Setup” but that is likely a mistake.

| | | | |
|------------------------|--|--|---|
| | | | <p>Protocol).²⁰¹ A standard PCL3 or PCL5 printer will not work.</p> <p>Various setting options SAVE/RECALL > Print. M229-232</p> |
| Export crash log files | | | <p>Export crash log files. Never needed this because it never crashed!</p> <p>UTILITY > Service > Diagnostics > Export Log. M246</p> |

Not yet in any of the above categories

| | | | |
|--|--------------|--------------------------------------|--|
| | CLEAR SCREEN | CLEAR SWEEP Acquire > Clear sweep | |
|--|--------------|--------------------------------------|--|

SCPI

²⁰¹ See <https://edadocs.software.keysight.com/kkbopen/which-printers-are-supported-by-the-infinivision-oscilloscopes-588283271.html>

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 |  SDS 2000X+ |  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. | |
| | 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 | Improve user manual, especially on implementations which are not trivial | 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) | |
| | Increase labels length from 8 to 12 or 16 characters; slightly increase label display size | Improve readability of labels (add clear background) | |
| | 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 ²⁰² | 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) | | |
| | 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. | | |
| Desired changes that would (assumingly) require more drastic effort | Allow the entire (segmented) memory to be used entirely by <i>any</i> channel | Reduce over-hierarchical menu structure (for instance, show all four PIN settings of SPI in one menu, not 4) | Improve web interface update rate |
| | Allow serial decode of two bidirectional buses | Integrate relevant serial decode settings into the serial trigger module (instead of having to copy them there) | |

²⁰² 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.

| | | | |
|-------------------|--|--|--|
| | Show small histograms for measurements (and a large histogram for a selected measurement) | Speed up boot time | |
| | | Make on-screen help contextual | |
| | | Reduce ventilator noise (e.g., adaptive ventilator) ²⁰³ | |
| 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.) | |

²⁰³ 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.