

SBench 6 - the fast and easy data acquisition software

SBench 6 provides a way for the user of Spectrum hardware to have a powerful and versatile software package for viewing, logging and post processing of captured signals. No text programming is required and the set up is very rapid. An easy-to-use pull down menu allows full control over the hardware set up, logging settings, type and size of displays, export functions and post processing:

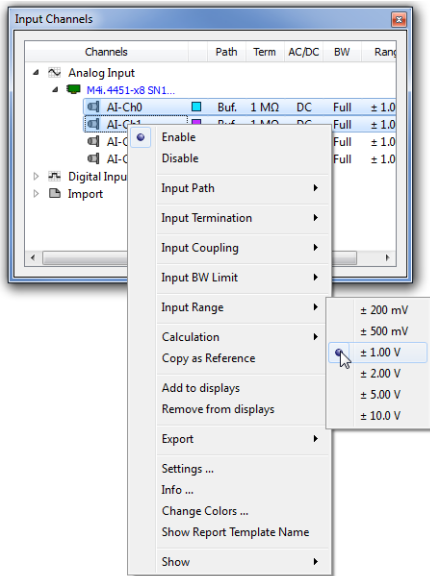
- **Designed to acquire and handle GBytes of data**
- **Fast data acquisition includes support for RAID disk arrays**
- **Fast data preview function of big files; isolate areas and zoom in!**
- **Handles analog, digital and frequency spectrum data**
- **Y(t), FFT and logic analyzer displays**
- **Enhanced display cursor functions with dynamic XY values**
- **Integrated signal analysis functions**
- **Import and export filter for data files**
- **Free base version**
- **Upgrade possible for enhanced post processing and multiple cards**
- **Fully functional 30-start Professional trial version available**
- **State-of-the-art drag-and-drop technology**
- **Thread based program structure**
- **Easy usage with docking windows and context menus**
- **Available for Linux KDE, Gnome, Unity**
- **Available for Windows 7, 8, 10, 11 and Windows Server 2008 R2 and newer**



SBench 6 is a powerful and intuitive interactive measurement software. Besides the possibility to commence the measuring task immediately, without programming, SBench 6 combines the setup of hardware, data display, oscilloscope, transient recorder, analysing functions and export functions under one easy-to-use interface. All current Spectrum digitizerNETBOX and generatorNETBOX products, all M2p, M2i, M3i, M4i, M4x and M5i cards as well as all MI, MC and MX data acquisition cards are supported.

The software is available for Windows and Linux. Both versions are based on the same source code to ensure that the Windows and the Linux version are equally provided for. The software development is based on a common API that is available for Windows, KDE, Gnome and Unity still providing the look and feel of the specific window manager.

Using SBench 6

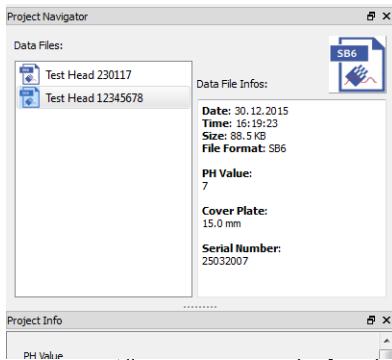


Data Storage

The SBench 6 Engine controls the complete data transfer to the PC. This software component has been designed for fast data transfer. The strict separation within SBench between the display layer and hardware control provides maximum performance for data acquisition; this allows the same average streaming speed that is also possible with standard C++ text programming. Data is stored in an intelligent and compact data format allowing maximum system performance. To make post process of data even more manageable, the Professional version allows data to be automatically split into multiple files at set size intervals.

Capture to the limit of the cards on-board memory can be utilised with no restriction on sample speed. Long-term continuous data storage to current hard disks of multi GByte files is possible too and when combined with RAID real-time transfer speeds in excess of 100 MB/s are easily achieved. Data exports are possible, currently SBench 5, SBench 6, MATLAB, ASCII, Wave (*.wav) and binary

Project Organization



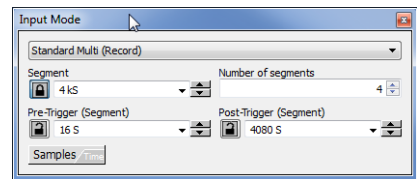
All configuration, acquired data, reports, calculations and stored files are placed within a separate project folder. Projects can be used to organize measurement setups in production, to store, archive and share complete data sets, including all calculation and display details, or to generate default and write protected project templates for specific measurement jobs. A project is either stored as a set of sub-folders with separate files, that can be accessed individually, or it can be stored as a zip-archive which can be easily exchanged.

The project and also the separate data acquisitions can be extended by a user defined number of additional information fields. These can be made mandatory in cases that need to have a defined data set for each acquisition. The information fields can hold environmental details like temperature, used equipment, operator, additional test settings or it can be used to describe the DUT (device under test).

A project can hold a single acquisition as well as a number of automatically or manually stored acquisitions. All acquisitions can be found in a separate project data browser that also displays the acquisition information on the side.

Hardware Setup Windows

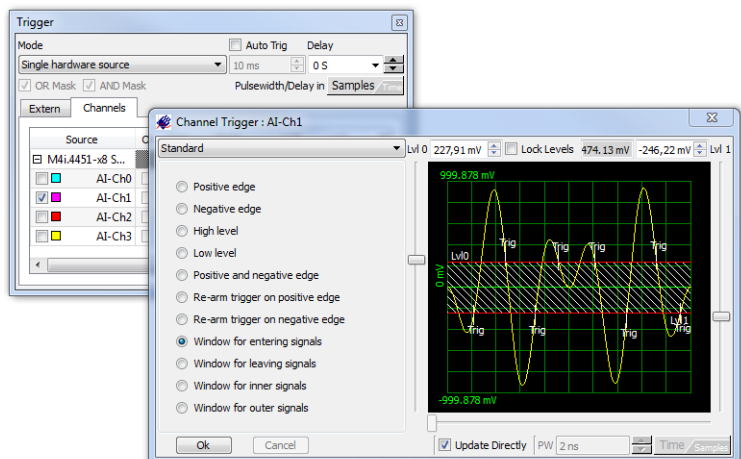
All hardware settings can be accessed using neat yet sophisticated setup windows for many aspects of the card operation, this includes sample (clock) rate, desired number of samples, trigger type and card capture mode (short capture or continuous streaming). Individual card channel amplification and impedance can be set and any channel disabled to reduce memory requirements. The target for data storage can be selected, be it cards own memory or the PC memory. If more than one card is used in a system individual sampling rate and memory settings can be assigned (licence option SBench6-Multi required).



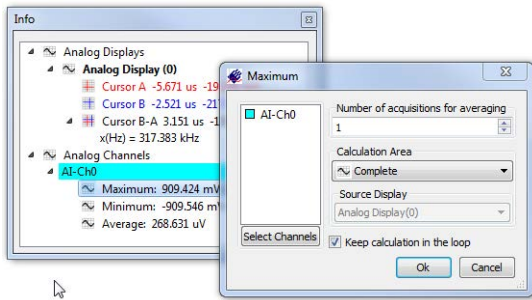
Trigger Setup

One of the main strengths of Spectrum hardware is the versatility and variety of available trigger options. SBench 6 allows access to all the trigger options including edge, level, steepness, gradient, pulse width and window. New for version 6 are illustrative windows to help in the selection of trigger type, level(s) and time (pulse width).

All available trigger sources can be accessed from SBench 6 including OR and AND combination of channel triggers and external sources. Even trigger sources that are only available as an option like BaseXIO have been incorporated into SBench 6 allowing to set up any trigger combination that is supported by the hardware.



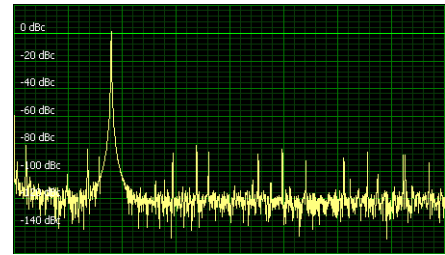
Calculation Routines and Measuring Results



A special info window shows extended information on the current cursor positions on the signal trace. With only one mouse click it is possible to use additional calculation routines on any signal. The signal used as calculation base can be any acquired signal, any loaded signal or even a freshly calculated signal like FFT. The calculation area can be selected to be the whole signal, visible display window area, or that defined by two cursor positions. The version overview on the next page shows the available calculation routines and suggestions for new calculation routines are always welcome!

FFT Analysis and Display (Professional Version)

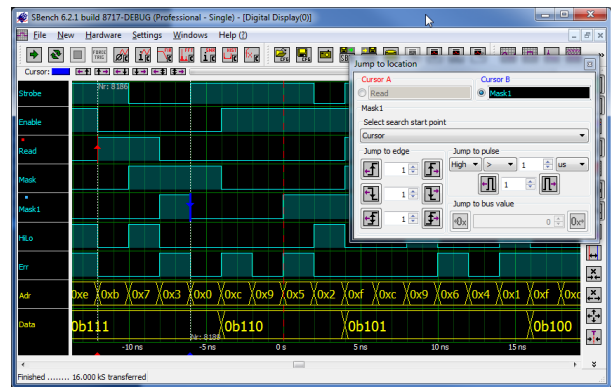
Using the FFT calculation adds a Spectrum analyzer to SBench's time-based oscilloscope functionality, with FFT analysis providing the frequency domain information of the signal. The input signal can be weighted by different window functions such as Hanning, Hamming, Blackman, (many being available). The resulting FFT plot is shown as dBc, dBFS, dBuV, dBm or plain voltage. The same calculation function can also output a Phase over Frequency plot and a Power Spectrum Density Plot.



The FFT signal can be used for further calculations, such as SNR, THD, MAX value - with others available. A harmonics cursor is available for FFT display in addition to the standard measurement cursor. This cursor shows a programmable number of harmonics based on the current cursor position.

Digital Data Display (Logic Analyzer)

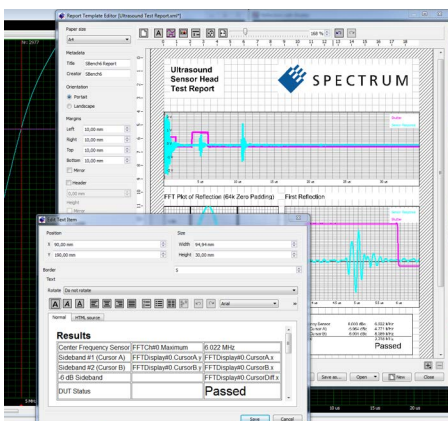
Besides the acquisition and display of analog data SBench 6 also contains a powerful digital data display allowing to group signals to a bus and to navigate through data by edge detection and pulse measurements. The digital data display is available for pure digital acquisition cards as well as for additional digital inputs of an analog data acquisition card.



Analog data can be converted to digital data and vice versa to combine different signals into a mixed mode display.

Digital displays and analog displays can be synchronized to have cursor and zoom settings automatically synchronous between different displays.

Reports (Professional Version)



SBench 6 contains a powerful report editor and generator that documents the use of all components of SBench 6 for individual reports.

A report can contain analog, FFT, digital, histogram, spread and X-Y displays. Furthermore, all measurement results, cursor positions, project information, hardware information and the complete hardware configuration can be added to a report as single values or as overview tables.

Free text fields, lines and pictures can be used to add additional information to the report.

The report template itself is xml code and can be changed manually or archived with standard code managing software.

The report is generated as a pdf and can be printed on any installed printer or stored as a pdf file. Different European and US paper formats are supported with freely definable borders, header and footer area.

The printout can be made in portrait or landscape format.

SDK, programming own Plug-Ins (Option)

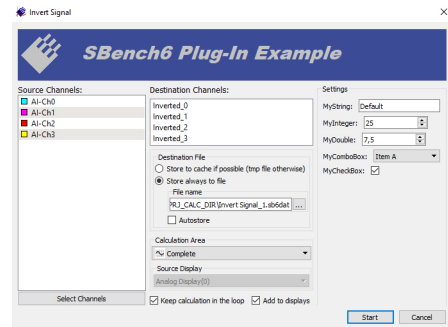
The plug-in interface is an optional SDK that allows the user to add their own advanced calculation functions to SBench 6. The SDK contains the interface and some examples that show how to program certain functionality. The self-compiled plug-in is then automatically linked into the SBench 6 calculation pool.

The SDK is based on C++. Any calculation that can be realized with standard development methods is possible. Programming custom calculation routines can turn SBench 6 software into a powerful application specific tool. Once the routines are developed the resulting plug-in files can then be freely distributed with any SBench 6 Professional license to other end-users. You don't need the SDK to run a previously programmed plug-in.

When using a Plug-in the resulting data files can be also displayed, used for further calculations, exported or can be made part of a report. For example, when using a digitizer together with sensors, the Plug-in could embed specific sensor calibration information into the program. The plug-in itself can be fed with one or more sets of acquired, or calculated, data from SBench 6.

Furthermore, when programming the plug-in the developer can define the necessary configurations for the interface. This can be: single integer or double values, combo boxes, strings or checkboxes. Any files in the system (such as, filter parameters, sensor calibration values or reference signals) can be utilized in the calculation.

The SDK also provides a call-back function for interaction with the user so that simple dialogs and other information, such as cautions or critical warnings, can then be flagged to the user.



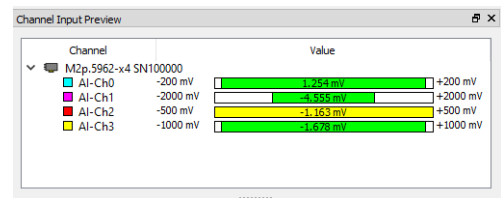
Scripting

The scripting tool provides a simple way to utilize SBench 6 in an automated sequence of operations. It allows SBench 6 to be controlled from a plain ASCII script file running some basic commands. The process allows users to do some elementary remote control and automation with the SBench 6 program. Script commands that are available are:

- Load Project/Config file
- Start/Stop/Loop Acquisitions
- Wait specific time or wait for jobs to finish
- Loop a specific number of iterations
- Export data
- Call an external program

Input Preview

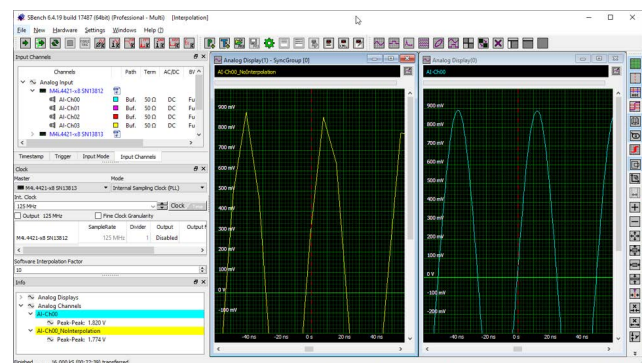
To make setting up the input ranges of a digitizer fast and easy an Input Channel Preview window has been added to SBench 6-Professional. The window works by continuously monitoring the input signals at a low sampling rate and then displaying their key signal characteristics using a bar graph. The Input Channel Preview window reveals, for each active channel, the signals current minimum, maximum and average value. Colour coding (green, red and yellow) then highlights when signals are in and out of range or when an input range has changed status. Users are instantly alerted to each channels condition, making it immediately obvious when changes to the setting of their gain or offset may be required.



Interpolation

The powerful interpolation feature can be used to dramatically improve parameter measurements in situations where the sampling rate of a digitizer is limiting measurement precision. Based on the SinX/x (or sometimes called SinX) algorithm the SBench 6 interpolation function inserts samples in a predictive manner between the actual acquired data points. When done correctly, this produces a waveform with a higher effective sampling rate and a closer approximation to the analogue waveform that's being analysed.

The benefit of interpolation becomes apparent as the input signal frequency begins to approach the Nyquist limit (half the sampling rate). In the right-hand figure a 20 MHz sine wave with 1.82 V amplitude is acquired by a digitizer sampling at 125 MS/s and with 16-bit resolution. The yellow trace on the left shows the signal without interpolation and with the sample points connected by linear lines. The blue trace on the right is the same signal but with interpolation activated. Both traces have been expanded vertically so you can examine the top of the sine wave. Parameter measurements for the Peak to Peak amplitude (lower left corner) made for both traces show the significant improvement in amplitude accuracy that's possible.



Providing the frequency content of the input signal doesn't exceed the Nyquist limit, interpolation can be also be used to improve other parameter measurements (such as rise and fall times, as well as cyclic measurements like frequency and period).

Version Overview

The Base version (with no time limit) is included in the delivery of each card and can also be freely downloaded from Web page www.spectrum-instrumentation.com/sbench6.html. The Professional version requires a license purchase. Updates within an SBench version can be downloaded from the web page at any time free of charge to take advantage of software operational improvements.

	Base	Professional		License		License
Operating Systems			File functions		Basic Calculations	
Windows 7/8/10	Supported	Supported	Auto Storage	Prof	Min/Max	Base
Server 2008 R2 and newer	Supported	Supported	Split Files	Prof	Average	Base
Linux + KDE, Gnome or Unity	Supported	Supported	Round Robin Storage	Prof	Peak-Peak	Base
Card + Configuration			Acquisition format		Effective	Base
Single Card	Supported	Supported	SBench 6	Base	Signal Info	Base
Multiple Cards (one system)	Supported	Option -Multi	Wave File (*.wav)	Prof	Slope	Prof
License	free	purchase	Pure Binary File	Prof	Cycle based Calc	
Project Load/Store	Supported	Supported	Export Functions		Number of Cycles	Prof
Modes and Features			SBench 6	Base	Frequency/Period	Prof
Standard Acquisition/Replay	Supported	Supported	MATLAB	Prof	Duty Cycle	Prof
FIFO Acq of several GSamples	n.a.	Supported	SBench 5.	Prof	Pos/Neg Width	Prof
Firmware Block Average	Std. only	Std.+ FIFO	ASCII	Prof	Cycle Min/Max	Prof
Firmware Boxcar Average	Std. only	Std.+ FIFO	Wave File (*.wav)	Prof	Cycle Average	Prof
Multiple Recording/Replay	Simple display	Segmented display	Pure Binary File	Prof	Cycle Peak-Peak	Prof
Gated Sampling/Replay	Simple display	Segmented display	Signal cut-off	Prof	Cycle Effective	Prof
ABA Mode	Simple display	Segmented display	VCD	Prof	Cycle Rise/Fall Time	Prof
Timestamp	n.a.	Supported	Import Functions		Math Signals	
Digital Inputs/Outputs	Supported	Supported	SBench 6	Base	ADD/SUB/MUL/DIV	Prof
BaseXIO trigger lines	n.a.	Supported	SBench 5	Prof	AND/OR/XOR	Prof
Setup Functions			ASCII	Prof	NAND/NOR/XNOR	Prof
Channel Setup	Included	Included	Wave File (*.wav)	Prof	Copy as Reference	Base
Channel Preview	n.a.	Included	Pure Binary File	Prof	Conversion A-to-D	Prof
Clock Setup	Included	Included	Documentation		Conversion D-to-A	Prof
Trigger Setup	Included	Included	Screenshot	Prof	Signal Averaging	Prof
Mode + Memory Setup	Included	Included	Reports	Prof	Multi Averaging	Prof
Streaming Setup	n.a.	Included	Print	Base	FIR Filter	Prof
Timestamp Setup	n.a.	Included	Display Features		Concatenate	Prof
Interpolation	n.a.	Included	Cursor Measurement	Base	Function Generator	Prof
Display Windows			Physical Units	Prof	Frequency Calc	
Preview Display	Included	Included	Digital Signals Bus	Prof	FFT	Prof
Analog Waveform Display	Included	Included	Digital Bus Inspection	Prof	SNR/THD/SINAD	Prof
Spread Waveform Display	Included	Included	FFT Harmonics Cursor	Prof	SFDR, ENOB	Prof
Digital Waveform Display	Included	Included	Movable Comments	Prof	Enhanced Calc	
History Mode	Included	Included	Automation		RMS Noise	Prof
FFT Display	n.a.	Included	Scripting	Prof	Histogram	Prof
X/Y Display	n.a.	Included			Plug-Ins SDK	Option
Timestamp Table	n.a.	Included			Single Value Formula	Prof
Layout/Auto Layout Functions	Included	Included				
Define Shortcuts	Fixed set	Configurable				

SBench 6 can be used with a Spectrum virtual demo card, this allows for a test of all Professional license software options without time limitation. If you would like to test SBench 6 Professional with your Spectrum hardware it is possible to obtain a demo licence that can be used for 30 starts of the Professional version.



Supported Cards and Features

The following table lists all cards and features that are supported by SBench 6. Note that it may be necessary to purchase a Professional license to use certain features, so please refer to the following version overview for more information. SBench 6 is under permanent development - please check the latest version of the data sheet on the Internet at www.spectrum-instrumentation.com/sbench6.html to see which new features are supported

Supported Cards

M2i.20xx + M2i.20xx-Exp
 M3i.21xx + M3i.21xx-Exp
 M2i.30xx + M2i.30xx-Exp
 M2i.31xx + M2i.31xx-Exp
 M3i.32xx + M3i.32xx-Exp
 M2i.40xx + M2i.40xx-Exp
 M3i.41xx + M3i.41xx-Exp
 M2i.46xx + M2i.46xx-Exp
 M2i.47xx + M2i.47xx-Exp
 M3i.48xx + M3i.48xx-Exp
 M2i.49xx + M2i.49xx-Exp
 M2i.60xx + M2i.60xx-Exp
 M2i.61xx + M2i.61xx-Exp

M2i.70xx + M2i.70xx-Exp
 M2i.72xx + M2i.72xx-Exp

MI/MC/MX.20xx
 MI/MC/MX.30xx
 MI/MC/MX.31xx
 MI/MC/MX.40xx
 MI/MC/MX.45xx
 MC/MX.46xx series
 MC/MX.47xx series
 MX.49xx series
 MI/MC/MX.70xx (input only)
 MX.9010

M4i.44xx-x8 + M4x.44xx-x4
 M4i.22xx-x8 + M4x.22xx-x4
 M4i.66xx-x8 + M4x.66xx-x4
 M4i.77xx-x8
 M2p.59xx-x4
 M2p.65xx-x4
 M2p.75xx-x4
 M5i.33xx-x16

Supported NETBOX products

All digitizerNETBOX and generatorNETBOX models are supported and come with a pre-installed SBench 6 Professional license.

Supported Features

All input settings (range, termination, coupling, threshold, filter, offset, etc.)

All output settings (offset, range, filter, stoplevel)
 All clock and trigger settings
 All memory settings (pretrigger, posttrigger, etc.)
 Standard + FIFO Mode
 All Memory options up to 2 GSample (4 GByte)
 Multiple Recording/Multiple Replay

Gated Sampling/Gated Replay

Timestamps (not for MI, MC, MX cards)
 ABA mode (not for MI, MC, MX cards)
 Synchronization Star-Hub (one system)
 Digital Inputs/Outputs
 Multi Purpose I/O Lines (M3i, M4i, M4x, M2p only)
 BaseXIO Trigger Lines (M2i and M3i only)

Order Information

SBench6

Order no.	
SBench6	Base version which supports standard mode for one card
SBench6-Pro	Professional version for one card: FIFO mode, export/import, calculation functions
SBench6-Pro3	3 Licenses of professional version for one card each
SBench6-Pro5	5 Licenses of professional version for one card each
SBench6-Pro10	10 Licenses of professional version for one card each
SBench6-Multi	Option multiple cards: needs Professional version. Handles multiple synchronized cards in one system.
SBench6-Mul3	3 Licenses of option multiple cards
SBench6-Mul5	5 Licenses of option multiple cards
SBench6-Mul10	10 Licenses of option multiple cards
SBench6-SDK	SDK for programming own plug-ins including C++ examples, one time license cost

Ordering hints

- The software license is stored on-board the Spectrum card and cannot be transferred to another card. Moving a card to another system will also move the license together with the card.
- Each single system needs at least its own Professional licence.
- Systems with multiple synchronized cards (Star-Hub) or multiple non-synchronized cards only need one Professional (Pro) and additionally one Multi (-Multi) license.
- Systems of multiple synchronized cards that are already equipped with a Professional and Multi license can be extended with no extra cost.
- Multiple license packages - also with a different number of licences - can be combined in any way to get the desired number of total licenses.

License Examples:

System 1	System 2	System 3	Professional	Multi
1 Card	-	-	1 x Pro License	-
3 Cards with Star-Hub	-	-	1 x Pro License	1 x Multi License
3 Cards with Star-Hub	-	-	1 x Pro License	1 x Multi License
1 Card	1 Card	1 Card	3 x Pro License	-
3 Cards with Star-Hub	4 Cards with Star-Hub	-	2 x Pro License	2 x Multi License
3 Cards with Star-Hub	3 Cards without Star-Hub	1 Card	3 x Pro License	2 x Multi License

System Requirements

Supported platforms

- Intel x86 and x64, AMD x86 and x64, (ARM is not supported, except Nvidia Jetson and Nvidia Clara installations)
- Windows 7 (SP1), 8, 10, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, Windows Server 2016 and newer - 32 bit platform
- Windows 7 (SP1), 8, 10, 11, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, Windows Server 2016 and newer - 64 bit platform
- Linux with kernel 2.6.x, 3.x, 4.x, 5.x or 6.x - 32 and 64 bit platform
- Linux with KDE/Gnome/Unity

Hardware recommendations

The following recommendations are based on experience and test installations. In general SBench 6 will run on all machines that support the above mentioned platforms but may become slow if not sticking to the hardware recommendations.

- CPU
 - All Intel CPUs starting with Pentium 4, Core2Duo, Core2Quad, Core i3, Core i5, Core i7, Core i9, Xeon + Celeron counterparts.
 - All AMD CPUs starting with Athlon 64: Athlon, Opteron, Sempron (K8 series), Athlon 64 X2 (K9 series), FX, Phenom, Athlon, Opteron, Sempron (K10 series), Ryzen, EPYC (Zen series).
- Memory
 - Standard acquisition: 1 GByte.
 - Usage with high channel counts: 2 GByte or more. Using the 64bit SBench6 version is recommended.
 - Fast FIFO streaming: 3 GByte or more. Using the 64bit SBench6 version is recommended.
- Hard disks and hard disk space
 - Program and supporting files about 40 MB.
 - Temporary data and acquisitions depending on selected acquisition length. May be up to several GBytes.
- Special High-Speed FIFO streaming requirements:
 - Recommended: 1 processor core for each acquisition card in the system.
 - Separate hard disk array for data using RAID 0.
 - Data throughput of hard disk array at least 20% higher than planned acquisition speed.
 - SATA, SAS or SSD hard disks.
- Display resolution of 1024 x 768 pixel or more. A full-HD resolution (1920 x 1080) or more is recommended.