digitizerNETBOX

easy instruments

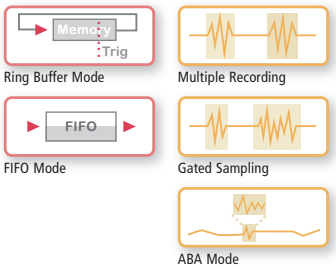
SPECTRUM

SYSTEMENTWICKLUNG MICROELECTRONIC GMBH

Ethernet/LXI 16 Bit Digitizer with Single-Ended / True Differential Inputs

Digitizer Hardware

Inside the digitizerNETBOX the proven Spectrum digitizer hardware is used offering a high quality analog section and versatile acquisition modes like singleshot, FIFO, Multiple Recording, Gated Sampling or ABA Mode. The digitizerNETBOX is equipped with 512 MSamples (1 GByte) of acquisition memory and can be upgraded to 2 GSamples (4 GByte) of memory.

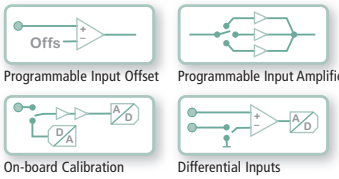


Power Supply

The system can be either powered by 110/230 VAC or as an option by a DC power supply for mobile acquisition applications.

Analog Inputs

Up to 8 synchronous analog inputs with selectable input range, programmable input offset, selectable 50 Ω termination and selectable single-ended or true differential mode.



LXI Instrument

The digitizerNETBOX is a full LXI instrument showing some status information of the box and the current acquisition. It offers an IVI compatible interface for the IVI digitizer class.

LXI approval in process

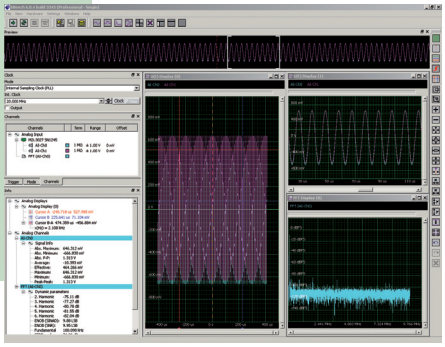
Easy Instrument

- Easy connectivity with standard BNC connectors
- Proven and powerful digitizer hardware
- GBit Ethernet/LXI Instrument
- SBench 6 – professional transient capture and streaming software included
- Tabletop or 19" rack mount
- Direct access from Workstation or Laptop
- Integration into factory LAN

SBench 6 – Powerful Data Acquisition and Analysis Software

The digitizerNETBOX can be accessed with the Spectrum standard software SBench 6 – a Professional license for the software is already installed on the box. SBench 6 supports all features of the box and has a bunch of display windows, analysis functions, export and documentation functions.

- Available for Windows XP, Vista, Windows 7, Windows 8 and Linux
- Easy to use interface with drag and drop, docking windows, context menus
- Display of analog and digital data, X-Y display, frequency signals, spread signals
- Designed to handle several GByte of data
- Fast data preview functions



Ethernet Connection

The digitizerNETBOX can be accessed using standard GBit ethernet connection or using a special industrial grade ethernet cabeling. The digitizerNETBOX can be either connected directly to a host system or placed somewhere in the factory LAN environment.

19" Rack Mount Option

For integration into larger systems the digitizerNETBOX can be ordered with a 19" front plate for rack mounting.

Timestamps

All trigger events can be timestamped with a resolution of 1 sample. A timestamp reference signal from a GPS receiver or a IRIG-B receiver can be fed into the card.

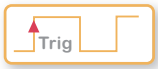

Timestamp

Trigger Engine

Each channel can be trigger source with a bunch of different trigger modes. In addition, there are two external trigger inputs. All sources (internal and external) can be combined with OR and AND. One external trigger connector can also be used for trigger output.

Channel Trigger

Pulsewidth Trigger



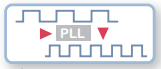
External Trigger

Spike Trigger

Clock Engine

The digitizerNETBOX can run with internal clock as well as an external clock source or an external reference clock (for example 10 MHz). The internal clock allows to be set with a fine stepsize making it possible to adopt to different measuring tasks.


External Clock



Reference Clock

High Precision PLL

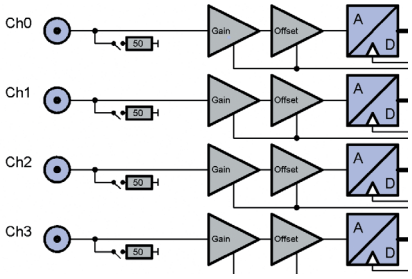
Features

Acquisition Modes

Synchronous Sampling

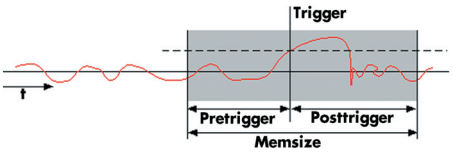
All digitizer boxes from Spectrum are built with a completely synchronous design. Every channel has its own independent input amplifier as well as an independent A/D converter. All input channel related settings can be individually programmed for each channel. Compared with standard products with multiplex technology, where scanning of each channel one after the other with a single A/D converter occurs, the more sophisticated design of the Spectrum products has a lot of advantages:

- Full sampling rate for all channels
- No phase delay between the single channels
- Smallest crosstalk between adjacent channels due to individual input amplifiers
- Direct comparison of acquired values with no need for interpolation



Transient Capture / Ring Buffer Mode

The ring buffer mode is the standard mode of the digitizerNETBOX. Data is written into the buffer until a trigger event occurs. After the event additional posttrigger values are recorded. It is possible to read the acquired data directly after the trigger event, even while the acquisition is still running.

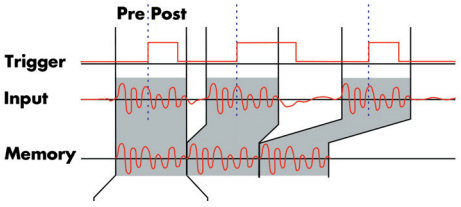


FIFO Mode

The FIFO mode is designed for continuous data transfer between the digitizerNETBOX and the PC memory or hard disk. It uses the complete on-board memory as real FIFO buffer, making the transfer extremely reliable. Data is transferred over Ethernet by the driver without any need for the user to make any special setup.

Multiple Recording

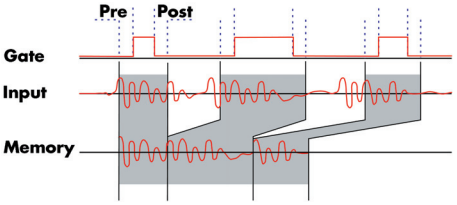
Multiple recording allows the recording of several trigger events without restarting the hardware. The on-board memory is split into segments and at each trigger event one segment is recorded. The segment size, pretrigger and posttrigger can be defined freely, and the small re-arming time and the powerful combination with the FIFO mode makes it easy to adapt to nearly every measurement task.



Gated Sampling

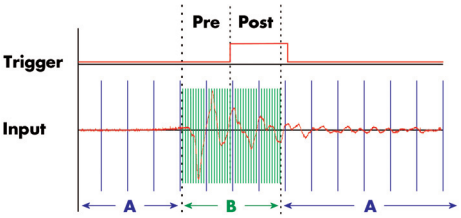
With Gated Sampling the acquisition is controlled by a gate signal. Data is only acquired if the gate signal has a programmed level. Before and after each gate a programmable number of samples will be acquired in addition.

Gated Sampling can be combined with timestamps for time-correct positioning of the gate segments and to determine the length of each acquired gate segment.



ABA mode

The ABA mode is similar to Multiple Recording. Between the segments additional samples are acquired with a slower sampling rate, e.g. for monitoring purposes. The ABA mode works like the combination of data recorder and transient recorder inside one instrument.



Clock

Internal Clock

The digitizerNETBOX uses a high precision PLL to generate its sampling clock. This device is very powerful and allows to set the sampling rate with a very fine step size, in contrast to the fixed steps of many other devices on the market.

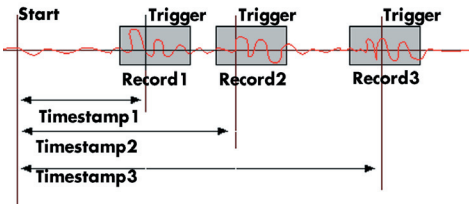
External Clock

The clock connector can be used as input or output. You can either input the sampling clock directly or use the signal as a reference for the internal PLL to generate a high-quality sampling clock.

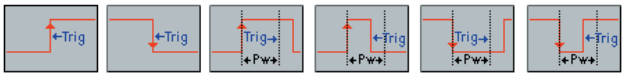
Trigger

Timestamp

With each trigger event the time position of the event is stored in an extra memory. Timestamps are relative to the start of the recording, to a defined zero time or externally synchronized to a radio clock or a GPS receiver. You can feed in this signal using the TS-Ref input. Timestamps are fully compatible with FIFO mode.

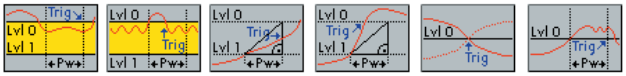


External Trigger



The digitizerNETBOX has two independent external TTL trigger input connectors, one of these can be used as trigger output alternatively. The trigger inputs can be used to trigger the card using one of the many different trigger modes like rising or falling edge, or they can be used as a gate signal when combined with other trigger signals. You can define a minimum or maximum pulsewidth for a signal that has to be reached to trigger the acquisition.

Channel Trigger



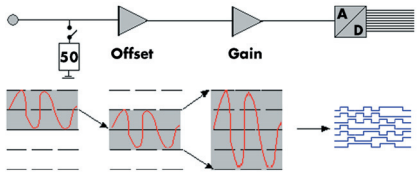
In addition to the dedicated trigger connectors one can also setup independent trigger conditions on the channels themselves. The trigger engine can check for edges, levels, and window triggers. A re-arm level can also be defined to avoid false triggers on noisy signals, and a spike trigger to detect slopes that are too steep. Again there is a pulsewidth available to define minimum or maximum durations.

All channel triggers and the external triggers can be combined with AND and OR function to build very complex trigger conditions.

Input Settings

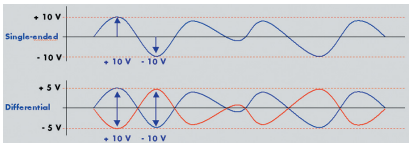
Programable Input Amplifier

To fully utilize the resolution of the digitizerNETBOX each channel can be individually set to one of the up to 8 different input ranges. Additionally each channel has programmable termination and a programmable input offset. This offset in combination with the input ranges makes it possible to perfectly match each channel to the real world signals.



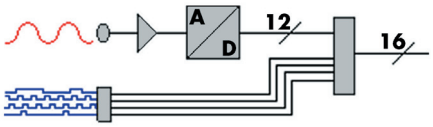
Differential Inputs

The inputs can be changed by software command between single-ended (related to a common ground) and true differential. Unlike the common pseudo-differential inputs which only allow the feed-in of a single ground signal, the true differential inputs allow the feed-in of the two complementary phases of a differential signal. Especially when using high resolution converters, the usage of true differential signals can greatly reduce the noise and distortion of the recorded signal.



Option Digital Inputs

This option acquires additional synchronous digital channels phase-stable with the analogue data. When the option is installed there are 16 additional digital inputs on 4 channel versions and 32 digital inputs on 8 channel versions. The digital inputs can be multiplexed into the analogue data by software command using many different formats:



- Each 16 digital inputs can replace one analogue channel.
- Each 2 digital inputs can be multiplexed into an analogue channel with the analogue resolution reduced to 14 bit.
- Each 4 digital inputs can be multiplexed into an analogue channel with the analogue resolution reduced to 12 bit.

This option is not available for DN1.46x.

On-Board Calibration

All parts used on any electronic device in the world are subject to external influences and ageing and therefore slightly change their behaviour over time. On high precision analogue data acquisition cards this results in an offset and gain error that will increase over the operating time. Therefore the on-board calibration can be run on user request and calibrates the amplifier against a dedicated internal high precision calibration source. After this calibration data is stored permanently in an on-board EEPROM and is automatically used for further acquisitions.

SBench 6

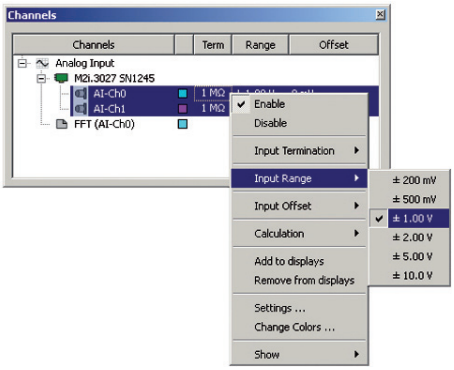
Comfortable and fast data acquisition and analysis of GByte of analog and digital data together with powerful export functions.

- Available for Windows XP / Vista / Windows 7 / Windows 8
- Available for Linux KDE / GNOME
- Fast data acquisition supporting RAID disk arrays
- Designed to acquire and handle GBytes of data
- Display of analogue data (scope), X-Y data, chart recorder and frequency spectrum
- Integrated analysis functions
- Import and export filter
- Enhanced cursor functions
- Fast data preview function
- State-of-the-art drag-and-drop technology
- Thread based program structure, optimized to run with todays multi processor technology
- Easy usage with docking windows and context menus

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.

Setup Windows

All hardware settings can be reached using sophisticated tabbed setup windows for every aspect of the digitizerNETBOX hardware. All setup windows can be docked wherever it is required to have full overview of the setup. Input signals can be scaled and given an individual unit to show real world measured values by compensating sensor re-scaling. This scaling and unit is used throughout the complete SBench software be it in the display screen or in the calculation results. The look and feel of SBench 6 can be individually set-up by locating setup widgets wherever necessary and by individual configuration of toolbars and shortcuts. The layout can be stored separately in a user file that can be used for all sessions of SBench 6.

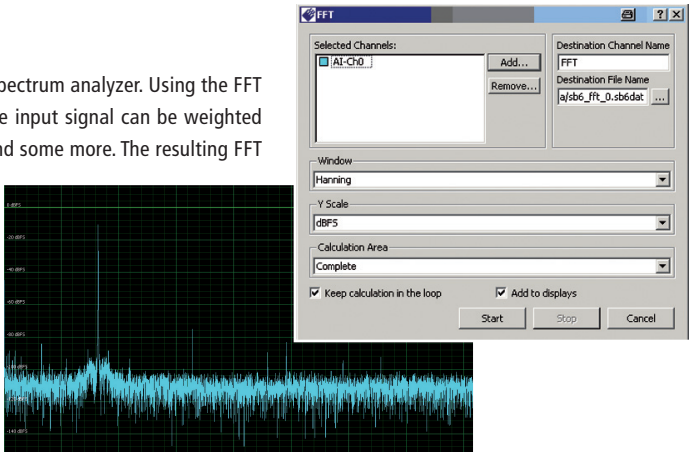


Data Storage

The SBench 6 engine controls the complete data transfer whether into the PC RAM or onto hard disk. The streaming engine supports different binary formats that can directly be used for data storage. This eliminates all time-consuming conversion jobs after the end of the acquisition. Data files can automatically be split into smaller pieces even while writing data. SBench 6 has been optimized for the work with multi GBytes data files. With this technology it is possible to work within SBench 6 with data from up to 4 GBytes on-board memory as well as hard disk recordings of several GBytes.

FFT Analysis and Display

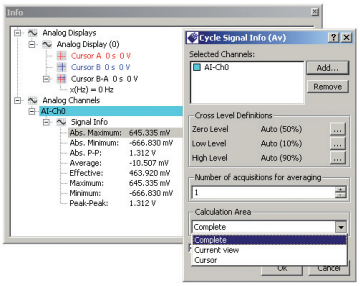
Using the FFT calculation turns the oscilloscope like software to a Spectrum analyzer. Using the FFT analysis shows the frequency domain information of the signal. The input signal can be weighted by different window functions like Hanning, Hamming, Blackman and some more. The resulting FFT plot is shown as dBc, dBFS, dBuV, dBm or plain Voltage giving the best suitable view on the data. The resulting FFT signal can be used for further calculations like SNR, THD, MAX value or others.



Calculation Routines and Measuring Results

A special info window shows extended information on the current cursor positions within the display windows. Each cursor can be locked on a signal showing the precise values for this signal. By utilising both cursors it is already possible to obtain some simple measurement functions.

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 allowing to run nested calculations. The calculation area can be selected to be the whole signal, just the area that is shown inside the display window, or the segment defined by the two cursor positions.



Drivers and Examples

The digitizerNETBOX can be accessed from any 32 bit or 64 bit Windows and Linux system starting with Windows XP and with Linux Kernel 2.6. The Ethernet communication is included inside the standard Spectrum library making all programming as easy as programming a locally installed hardware. The digitizerNETBOX is recognized by a simple button click using the Spectrum Control Center.

All Spectrum text language examples are available to access the digitizerNETBOX: C/C++, Visual Basic, Delphi, C#, J#, VB.NET, Python, LabWindows/CVI

IVI drivers

As part of the LXI standard the Spectrum digitizerNETBOX also support the IVI class drivers. The IVI drivers allow to access instruments of one function class with a common software interface independent of the manufacturer of the hardware. It is simply possible to use a software based on an IVI instrument driver with different digitizers or scopes available on the market.

LabVIEW

LabVIEW – the most common graphical programming language for measurement applications – is excellently supported by the Spectrum digitizer hardware with the use of dedicated LabVIEW drivers. They combine different functions into functional blocks and make them available within LabVIEW. The LabVIEW driver package consists of several different dynamic libraries (LLBs) and some open example VIs showing the use of the driver. Besides these libraries all driver functions can also be directly called.

The LabVIEW driver supports all LabVIEW for Windows versions starting with version 6 up to the current version. All new product releases are installed on our test systems and all examples are checked against the new version immediately.

MATLAB

The math software packet MATLAB from The Mathworks Inc. is supported starting with version 5.0 and supporting both, the Windows and the Linux version. The MATLAB driver itself consists of a set of Mex-files to access the Spectrum library and a bunch of examples in m-language. All features of the hardware can be accessed. The interface also offers an easy way to use the Spectrum cards with Simulink.

For the usage of the cards under MATLAB only the base version of the software package is necessary, no additional software options like the data acquisition tool kit are necessary.

Technical Details

Analog Inputs	
Resolution	16 bit
Channel Selection	any 1, 2 , 4 or 8 channels
Offset Error	≤ 0.1% of range (after warm-up and calibration)
Gain Error	≤ 0.1% (after warm-up and calibration)
Over Voltage Protection	DN1.46x: ±30 V all ranges (activated card) DN1.49x: ±5 V (≤ 1V ranges), ±50 V (> 1V ranges)
Programmable Input Ranges	DN1.46x: ±50 mV, ±100 mV, ±250 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V DN1.49x: ±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V
Programmable Input Offset	DN1.46x: ±5 V for single-ended ranges < ±10 V DN1.49x: ±100% of input range
Crosstalk @ 500 kHz	DN1.46x: ≤ -110 dB, 50 Ω term DN1.49x: TBD
Input Impedance	DN1.46x: 1 MΩ to GND DN1.49x: 50 Ω / 1 MΩ

Environmental and Physical Details	
Connector Types (Analog Inputs, Clock, Trigger)	BNC (custom specific types on request)
Gigabit Ethernet Connector	RJ-45 (Cat. 5E; ruggedized)
Dimension	410 mm x 230 mm x 90 mm (2 U)
Operating Temperature	0°C - 50°C

Clock	
External Clock Impedance	50 Ω / 5 kΩ
Clock Modes	Int. PLL / Quartz, Ext. Direct / Divided, Ref. Clock
Internal Clock Range (PLL Mode)	1 kS/s to max sampling clock
Internal Clock Accuracy	≤ 20 ppm
Internal Clock Granularity	< 1% of range (1M, 100k, 10k, ...)
Reference Clock Input Range	≥ 1.0 MHz and ≤ 125.0 MHz
External Clock Delay to Internal Clock	5.4 ns
Clock Output	TTL levels, capable of driving 50 Ω load
Clock Input	Rectangle of 3.3 V LVTTL

Trigger	
Trigger Sources	Channel, External A + B, AND/OR
Channel Trigger Resolution	14 bits
Internal Trigger Accuracy	1 sample
Multi, Gate: Re-Arming Time	< 4 samples
Max Number of Segments	unlimited
Max Pretrigger at Multi, Gate, FIFO	8176 samples as sum of all active channels
External Trigger Type	3.3 V LVTTL compatible (5 V tolerant)
External Trigger	Impedance 50 Ω / 5 kΩ programmable
Trigger Output	TTL levels, capable of driving 50 Ω load

Dynamic Performance

	DN1.462-xx	DN1.464-xx	DN1.465-xx	DN1.491-xx	DN1.496-xx
Max Sampling Clock	200 kS/s	1 MS/s	3 MS/s	10 MS/s	62.5 MS/s
-3 dB Bandwidth	> 100 kHz	> 500 kHz	> 1.5 MHz	> 5 MHz	> 30 MHz
Zero Noise Level (±500 mV)	< 8 µV rms	< 17 µV rms	< 30 µV rms	< 55 µV rms	< 76 µV rms
Test Sampling Rate	200 kS/s	1 MS/s	3 MS/s	10 MS/s	62.5 MS/s
Test Signal Frequency	10 kHz	10 kHz	10 kHz	1 MHz	1 MHz
SNR (typ) in dB	91.5 dB	90.7 dB	82.5 dB	77.0 dB	74.5 dB
THD (typ) in dB	-101.7 dB	-100.8 dB	-90.1 dB	-82.9 dB	-83.2 dB
SFDR excl. Harm. (typ) in dB	111.5 dB	111.2 dB	105.5 dB	94.5 dB	94.0 dB
ENOB (SNR)	14.9	14.7	13.4	12.5	12.0
ENOB (SFDR)	14.8	14.6	13.3	12.3	12.1

Pure low pass filtered sine signal measured at ±5 V range, 1 MΩ

Model Overview and Options

Card Versions	SE Channels	Diff Channels	Speed
DN1.462-04	4	4	200 kS/s
DN1.464-04	4	4	1 MS/s
DN1.465-04	4	4	3 MS/s
DN1.491-04	4	2	10 MS/s
DN1.496-04	4	2	30 MS/s
	2	2	60 MS/s

Card Versions	SE Channels	Diff Channels	Speed
DN1.462-08	8	8	200 kS/s
DN1.464-08	8	8	1 MS/s
DN1.465-08	8	8	3 MS/s
DN1.491-08	8	4	10 MS/s
DN1.496-08	8	4	30 MS/s
	4	4	60 MS/s

The digitizerNETBOX includes 512 MSample (1 GByte) of acquisition memory, SBench 6 License, Multiple Recording, Gated Sampling, ABA mode, Timestamps, Timestamp refclock input

Options	
DN1.xxx-2GS	Memory upgrade to 2 GSample (4 GB) total memory
DN1.49x-Dig16 / DN1.49x-Dig32	Additional 16/32 synchronous digital inputs with multiple data formats. Digital inputs can replace an analog channel or be combined into data reducing the analog resolution. Option -Dig32 only available for 8 channel boxes.
DN1.xxx-DC	12 V DC power supply
DN1.xxx-Rack	19" rack mount installation chassis

3rd Party Drivers	
DN1.xxxx-ml	MATLAB driver for digitizerNETBOX
DN1.xxx-lv	LabVIEW driver for digitizerNETBOX
DN1.xxx-vee	Agilent VEE driver for digitizerNETBOX

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