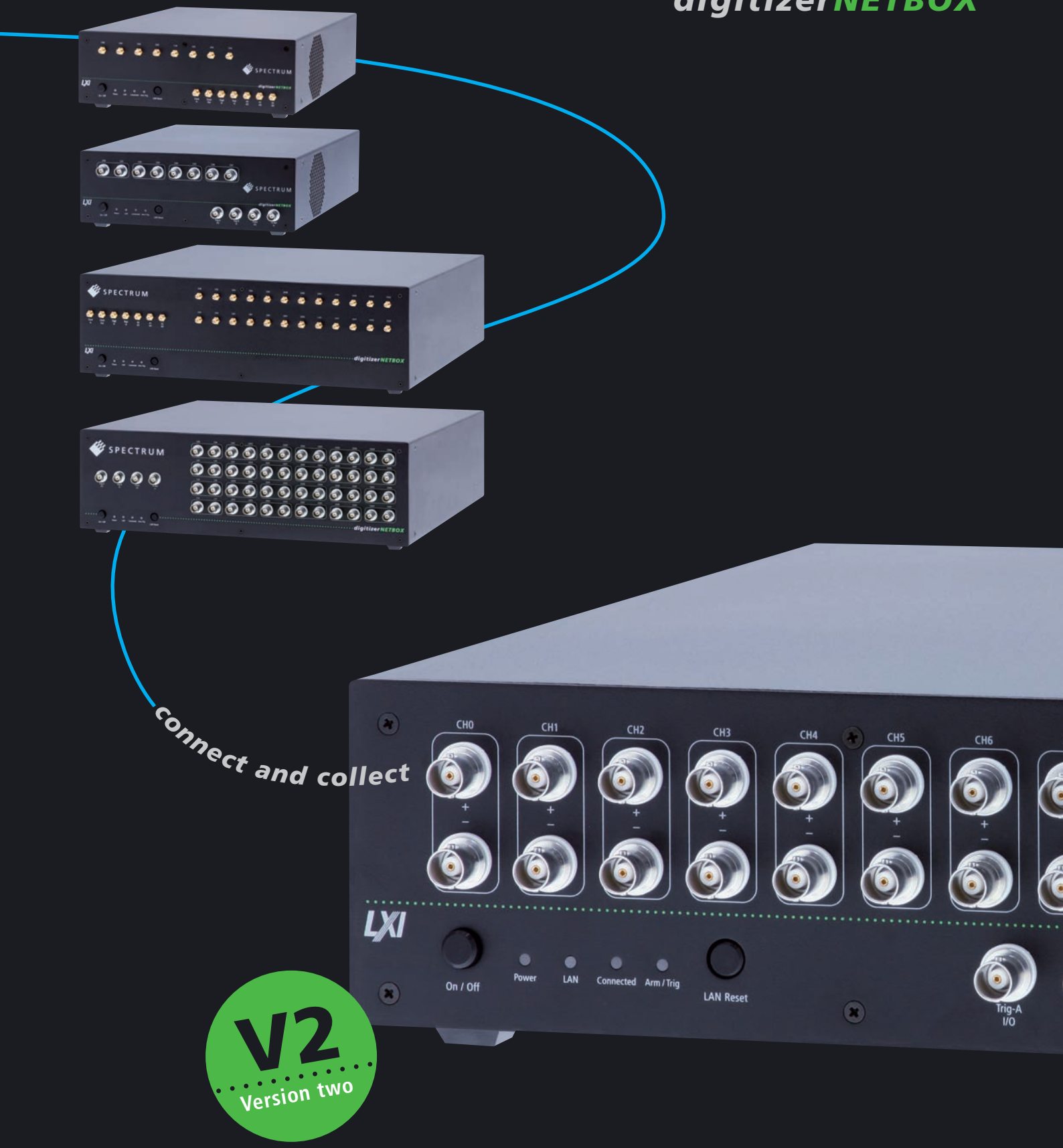
digitizerNETBOX



connect and collect

SPECTRUM
easy instruments

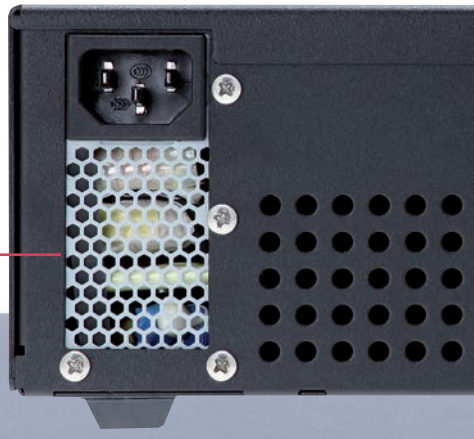
DNx.46x/49x: 200 kS/s to 60 MS/s

Low and mid speed digitizerNETBOX

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

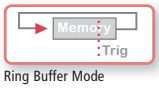
Power Supply

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



Digitizer Hardware

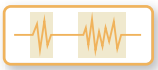
Inside the digitizerNETBOX is proven Spectrum digitizer hardware that offers a high quality analog section and versatile acquisition modes like singleshot, FIFO, Multiple Recording, Gated Sampling and ABA Mode. The digitizerNETBOX is equipped with 64 MSamples of acquisition memory for each channel and can be upgraded to 128 MSamples per channel. Channel memory can be combined if less channels are active.



Ring Buffer Mode


Multiple Recording

FIFO Mode

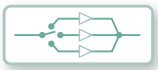

Gated Sampling

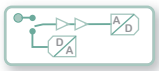

ABA Mode

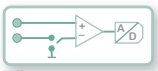
Analog Inputs

Up to 48 synchronous analog inputs are available with selectable input ranges, programmable offset, 50 Ω termination and single-ended or true differential modes.

Programmable Input Offset


Programmable Input Amplifiers


On-board Calibration

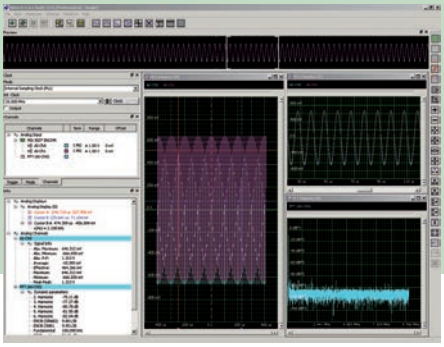

Differential Inputs

LXI Instrument

The digitizerNETBOX is a full LXI instrument that is able to show the status of the box along with the current acquisition information. It offers an IVI compatible interface for the IVI digitizer and IVI scope classes.

SBench 6 – Powerful Data Acquisition and Analysis Software

SBench 6 – The digitizerNETBOX can be used with Spectrum's powerful software SBench 6 – a Professional license for the software is already installed in the box. SBench 6 supports all of the standard features of the instrument (see page 6 for more details).



Ethernet Connection

The digitizerNETBOX can be accessed using a standard GBit ethernet connection or using special industrial grade ethernet cabling. 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" rack mounting kit.

Timestamps

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

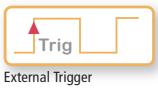

Timestamp

Trigger Engine

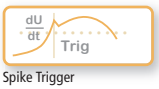
Each channel can be a trigger source with a number of different trigger modes. In addition, there are two external trigger inputs. All sources (internal and external) can be combined with OR and AND logic. One external trigger connector can also be used for a trigger output.

Channel Trigger

Pulsewidth Trigger



External Trigger

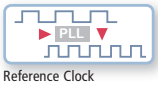


Spike Trigger

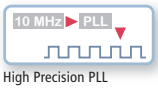
Clock Engine

The digitizerNETBOX can run with an internal clock as well as an external clock source, or an external reference clock (for example 10 MHz). The internal clock provides a fine stepsize making it possible to perform a wide variety of different measuring tasks.


External Clock



Reference Clock



High Precision PLL

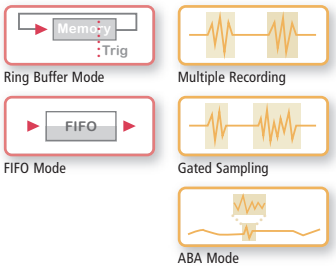
DNx.44x
130 MS/s to
500 MS/s

High speed digitizerNETBOXes

Ethernet/LXI high bandwidth 16/14 Bit Digitizer with Single-Ended Inputs

Digitizer Hardware

Inside the digitizerNETBOX is proven Spectrum digitizer hardware that offers a high quality analog section and versatile acquisition modes like singleshot, FIFO, Multiple Recording, Gated Sampling and ABA Mode. The digitizerNETBOX is equipped with 512 MSamples of acquisition memory for each channel. Channel memory can be combined if less channels are active.

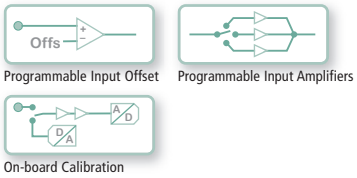


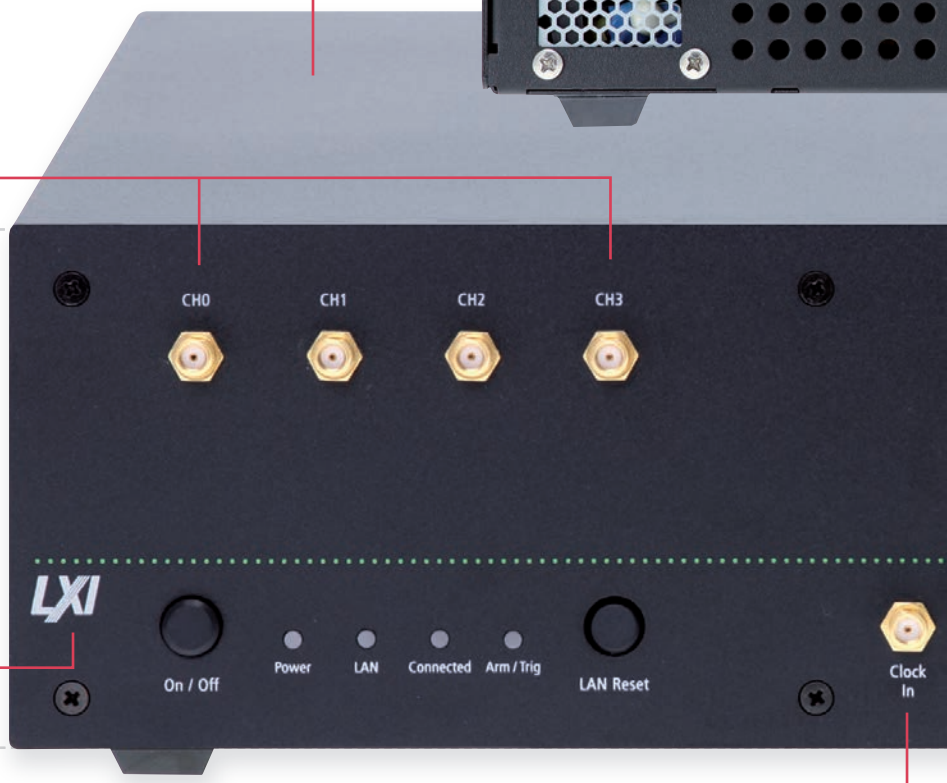
Power Supply

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

Analog Inputs

Up to 24 synchronous analog inputs are available with selectable input path (high impedance or high quality 50 Ω), input ranges and AC/DC coupling. For each input a noise reduction filter with limited bandwidth can be activated.



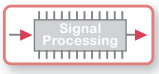


LXI Instrument

The digitizerNETBOX is a full LXI instrument that is able to show the status of the box along with the current acquisition information. It offers an IVI compatible interface for the IVI digitizer and IVI scope classes.

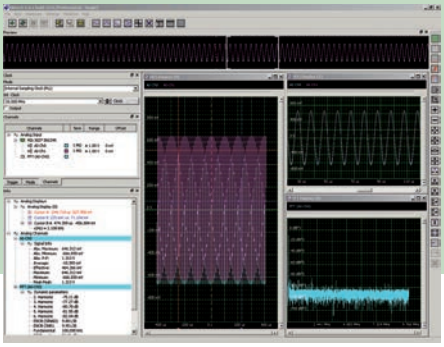
Integrated Signal Processing

The digitizer hardware can be extended by some integrated signal processing functions that are just to be activated by software command. Use block average function or block statistics function (peak detect) to reduce memory usage and transfer bandwidth.



SBench 6 – Powerful Data Acquisition and Analysis Software

SBench 6 – The digitizerNETBOX can be used with Spectrum's powerful software SBench 6 – a Professional license for the software is already installed in the box. SBench 6 supports all of the standard features of the instrument (see page 6 for more details).



Ethernet Connection

The digitizerNETBOX can be accessed using a standard GBit ethernet connection or using special industrial grade ethernet cabling. 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" rack mounting kit.

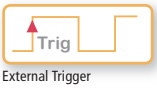
Universal I/O lines

The three universal I/O lines can be used for asynchronous digital I/O, status output (arm, run, trigger), timestamp reference input or as additional synchronous digital inputs

Trigger Engine

Each channel can be a trigger source with a number of different trigger modes. In addition, there are two external trigger inputs. All sources (internal and external) can be combined with OR and AND logic. The X0, X1 or X2 line can be programmed to trigger output.

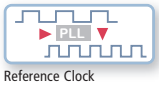
Channel Trigger



External Trigger

Clock Engine

The digitizerNETBOX can run with an internal clock as well as an external reference clock (for example 10 MHz or the desired sampling clock). The internal clock provides a fine stepsize making it possible to perform a wide variety of different measuring tasks.



Reference Clock

High Precision PLL

Configurations

Mobile or shared Instrument

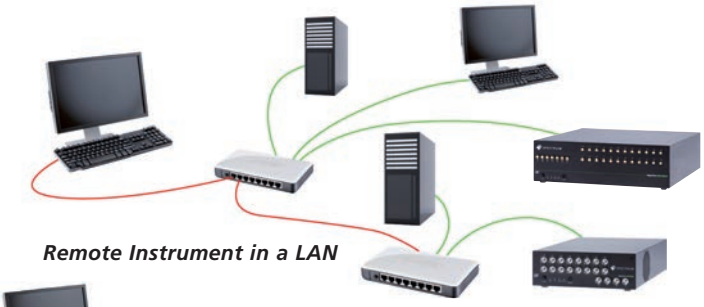
The digitizerNETBOX can be used as a stand-alone unit connected directly to your computer or as a mobile instrument located anywhere that has access to your company network. If you're connected to a network it can be used by your working colleagues or even at a customer's site if remote service measurements are required. An optional DC power supply also makes it possible to use the unit in locations where mains power is not normally available, such as in vehicles or at isolated locations. The digitizerNETBOX is a complete measurement solution and once it's connected to your workstation or laptop it doesn't need any further equipment to use.

Static LAN or WAN setup

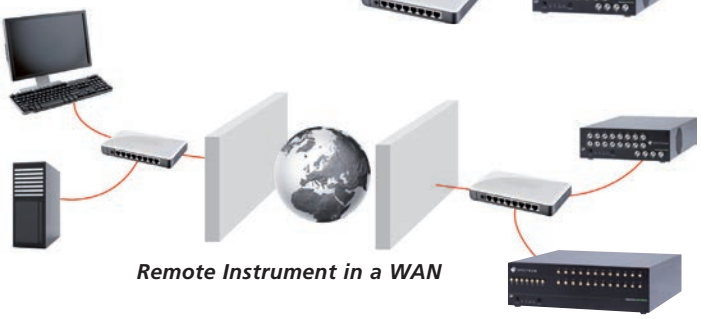
Any digitizerNETBOX can be placed anywhere in the company LAN or even in a WAN and can be controlled from any workstation that is connected to the same network. The digitizerNETBOX gets its IP address from a standard DHCP server and can be reached over an Ethernet connection like any other TCP/IP device. It means you can control the digitizerNETBOX from your desk even when signals need to be acquired in your laboratory or factories testing facility. Remote control also makes it possible to take measurements in unsafe environments such as those associated with chemicals, explosives, radiation or high-voltage and you can control multiple units even when they are spread around big testing areas.

Mobile or service

Shared instrument on desktop



Remote Instrument in a LAN

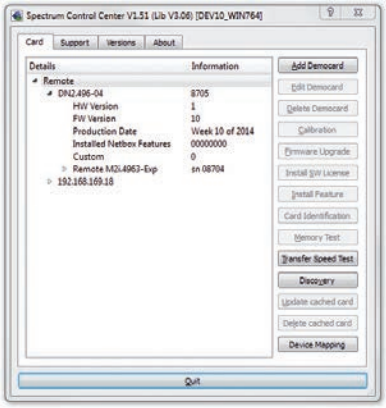


Remote Instrument in a WAN

Detection

After connecting the GBit Ethernet and Power the digitizerNETBOX is shown in the network environment of your computer. The integrated webserver follows the LXI standard and gathers information on the product, set up of the Ethernet configuration and current status. It also contains the latest software versions and documentation for download – no separate installation devices such as a CD or internet access are needed to run the digitizer-NETBOX.

The Discovery function of the Spectrum Control Center helps you to find and identify any digitizerNETBOX connected to your computer on the network. After running the discovery function the card information is cached and can be directly accessed by SBench 6. Furthermore, the qualified VISA address is returned and can be used by any software to access the remote instrument.



Drivers and Examples

The digitizerNETBOX can be accessed from any 32 bit or 64 bit Windows or 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 for 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 and LabWindows/CVI.

IVI Drivers

As part of the LXI standard the digitizerNETBOX also supports the IVI class drivers IVI digtizer and IVI scope. The IVI drivers allow users to access instruments of one function class with a common software interface independent of the manufacturer of the hardware. This makes it possible to use software, based on an IVI instrument driver, with many of the different digitizers or scopes available on the market.

LabVIEW

LabVIEW – the most common graphical programming language for measurement applications – is very well 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 immediately checked against the latest version.

MATLAB

The math software packet MATLAB from The Mathworks Inc. is supported starting from version 5.0. Both Windows and Linux versions are supported. The MATLAB driver 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 control of the digitzerNETBOX under MATLAB only the base version of the software package is necessary, no additional software options like the data acquisition tool kit are required.

SBench 6

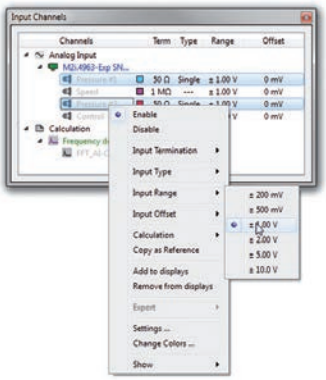
This easy-to-use software provides convenient and fast data acquisition and analysis of GBytes of analog and digital data together with powerful export functions.

SBench 6 is 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.

- 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

Setup Windows

All the hardware settings of the digitizerNETBOX can be accessed using sophisticated tabbed setup windows. All setup windows can be docked whenever it is required to have a full overview of the configuration. Input signals can be scaled and given an individual unit to show real world measured values, compensating for sensor characteristics. The scaling and units are then 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 customized by locating setup widgets wherever necessary and by the individual configuration of toolbars and shortcuts. Each layout can be stored separately in a user file that can be used for future sessions of SBench 6.

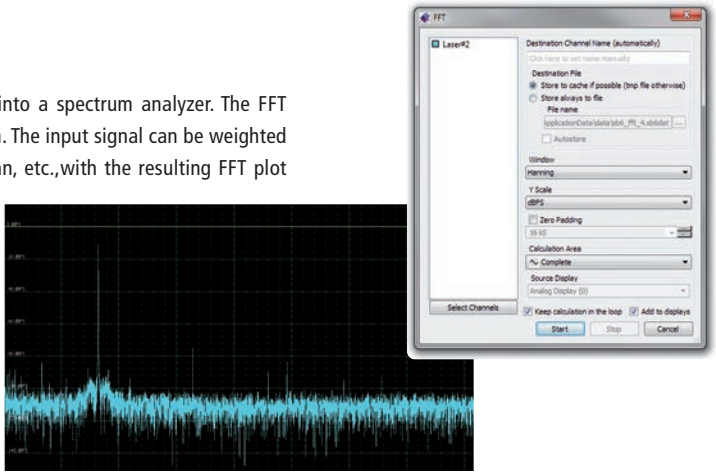


Data Storage

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 may be used for data storage. This eliminates all time-consuming conversion jobs after the end of the acquisition. Data files can be automatically split into smaller pieces even while writing data. SBench 6 has been optimized for working with multi GByte data files. The technology makes it possible for SBench 6 to handle data from up to 4 GBytes of on-board memory as well as hard disk recordings of several GBytes.

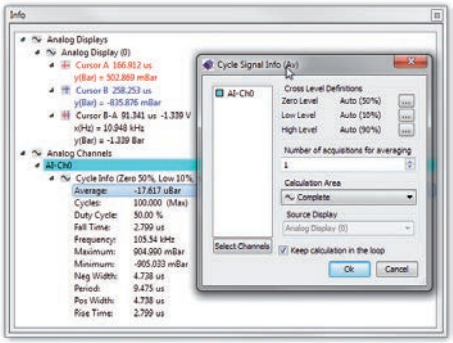
FFT Analysis and Display

Using the FFT calculation turns the oscilloscope like software into a spectrum analyzer. The FFT function converts time domain signals into the frequency domain. The input signal can be weighted by different window functions like Hanning, Hamming, Blackman, etc.,with the resulting FFT plot being shown as dBc, dBFS, dBuV, dBm or plain Voltage. The resulting FFT signal can also be used for further calculations like SNR, THD, MAX value or others.



Calculation Routines and Measuring Results

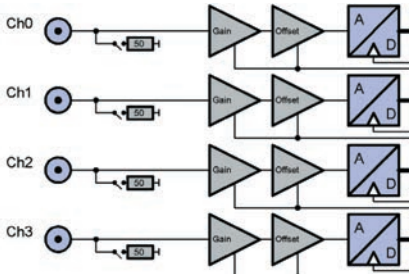
A special info window shows extended information on the current cursor positions within the display windows. Each cursor can be locked on a signal showing the precise values for the signal. Using both cursors makes it possible to obtain some simple measurement functions and, with only one mouse click, it is possible to use additional calculation routines on any signal. The signal used can be any acquired signal, any loaded signal or even a freshly calculated signal like an FFT, allowing fully nested calculations. The calculation area can be selected to be the whole signal, an area that is shown inside the display window, or the segment defined by the two cursor positions.



Features

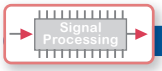
Synchronous Sampling

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 the input channel related settings can be individually programmed. Compared with standard products that use multiplex technology, where scanning of each channel is done one after the other with a single A/D converter, 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

Acquisition Modes



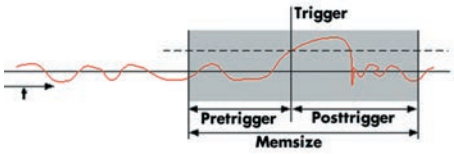
Integrated Signal Processing (44x)

The embedded digitizing modules of DN2.44x and DN6.44x series can be extended by integrated signal processing functions.

The Block Average Processing Module allows the accumulation and averaging of multiple repetitive signals. The function removes random noise from the signal, improving the signal-to-noise ratio and measurement resolution. Ultrafast triggering also ensures the dead-time between each acquisition is kept to a minimum.

The Block Statistics Processing Module is a hardware based data analysis and reduction function. Each acquisition block is scanned for minimum and maximum peaks and a summary including min, max, average, timestamps and peak position information is stored in memory.

Transient Capture / Ring Buffer Mode



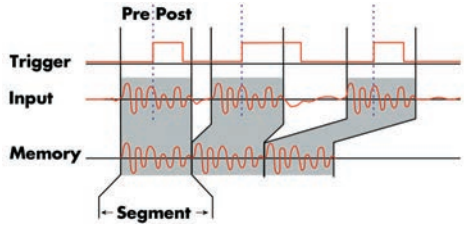
The standard mode of the digitizerNETBOX is the ring buffer mode. In this mode data is written into the buffer until a trigger event occurs. After the event additional posttrigger values are recorded enabling both pre and post trigger data to be acquired. It is also possible to read the acquired data 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 a real FIFO buffer, making the transfer extremely reliable. Data is transferred over Ethernet by the driver without the need for the user to make any special setup.

Multiple Recording

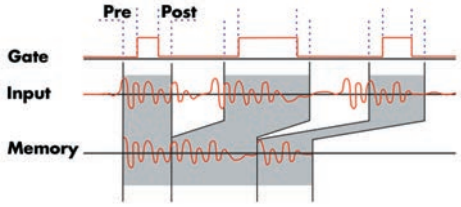
Multiple recording allows the acquisition of several trigger events without restarting the hardware. The on-board memory is split into segments and for each trigger event one segment is recorded. The segment size and the pre and post trigger settings can be freely defined. The powerful combination of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



Gated Sampling

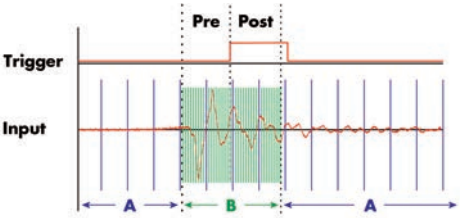
With Gated Sampling the acquisition is controlled by an external gate signal. Data is only acquired if the gate signal has reached a programmed level. Before and after each gate a programmable number of samples will be acquired.

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 (Dual Timebase)

The ABA mode is similar to Multiple Recording. However, 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 a data logger and transient recorder inside one instrument.



Clock

Internal Clock

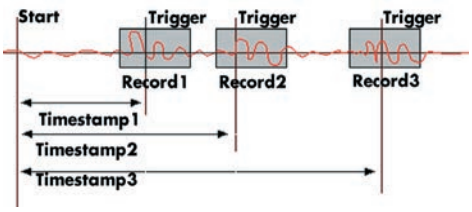
The digitizerNETBOX uses a high precision PLL to generate its sampling clock. This device is very powerful and allows the sampling rate to be set with a very fine step size, in contrast to the large fixed steps of many other devices on the market.

External Clock

An external clock can be fed into the digitizerNEBOX and can either be used directly or as reference clock for the internal PLL. If using internal sampling clock this clock the clock output can be used to feed the internal sampling clock into external equipment.

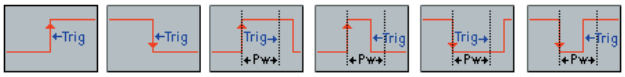
Trigger

Timestamp



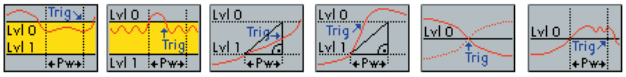
With each valid trigger the time position of the event is stored in an extra memory. Timestamps are relative to the start of the recording, to a defined zero time or externally synchronized to a radio clock or a GPS receiver. Such signals can be fed in using the TS-Ref input. Timestamps are fully compatible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

External Trigger



The digitizerNETBOX has two independent external TTL trigger input connectors. The trigger inputs can be used to trigger the digitizerNETBOX using one of the many different trigger modes such as rising or falling edge, or they can be used as a gate signal when combined with other trigger signals. An internally recognized trigger event is available on the trigger output for external equipment.

Channel Trigger

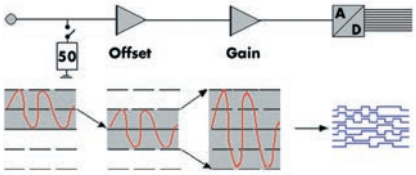


In addition to the dedicated trigger connectors one can also setup independent trigger conditions on the channels themselves. The trigger engine can check for edges, levels, and window triggers. A re-arm level can also be defined to avoid false triggers on noisy signals, and a spike trigger (low and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

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

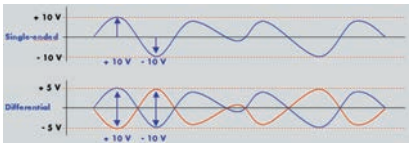
Input Settings

Programable Input Amplifier



To fully utilize the resolution of the digitizerNETBOX each channel can be individually set to different input voltage ranges. Additional individual input settings are available depending on the series: 46x, 49x: programmable termination and signal offset, 44x: programmable input path with high impedance input and HF input, 44x: programmable AC/DC coupling. These settings make it possible to perfectly match each channel to real world signals.

Differential Inputs (46x and 49x)



The inputs of the 46x and 49x series can be changed by software command between single-ended (related to a common ground) and true differential. Unlike common pseudo-differential inputs which only allow the feed-in of a single ground signal, true differential inputs allow the feed-in of the two complementary phases of a differential signal. Especially when using high resolution converters, the use of true differential signals can greatly reduce the noise and distortion of the recorded signal.

On-Board Calibration

All electronic parts are subject to external influences and ageing and therefore slightly change their behaviour over time. On high precision analogue data acquisition products this results in offset and gain errors that will increase over the operating period. To correct for these errors an on-board calibration can be run on user request. The function calibrates the amplifier against a dedicated internal high precision source. The calibration data is stored permanently in an on-board EEPROM and is automatically used for all further acquisitions.

Technical Details

DN2.46x and DN6.46x

16 Bit Digitizer with 200 kS/s up to 3 MS/s,
single-ended or differential inputs, up to 48 channels

Analog Inputs

Resolution	16 bit
Channel Selection	1, 2, 4, 8, 16, 24, 32, 40 or 48 channels
Input Type	Single-Ended or True Differential
Input Ranges	±50 mV, ±100 mV, ±250 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V
Single-Ended Input Offset	±5 V for single-ended ranges < ±10 V
Input Impedance	1 MΩ to GND
Analog Input Coupling	DC
Offset Error	≤ 0.1% of range (after warm-up and calibration)
Gain Error	≤ 0.1% (after warm-up and calibration)
Over Voltage Protection	±30 V all ranges (activated card)
Crosstalk @ 100 kHz	≤ -110 dB, 50 Ω termination
CMRR for 100 kHz signal	70 dB (≤ ±500 mV range) or 46 dB (≥ ±1 V range)

DN2.49x and DN6.49x

16 Bit Digitizer with 10 MS/s up to 60 MS/s,
single-ended or differential inputs, up to 48 channels

Analog Inputs

Resolution	16 bit (±32000 values)
Channel Selection	1, 2, 4, 8, 16, 24, 32, 40 or 48 channels
Input Type	Single-Ended or True Differential
Input Ranges	±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V
Input Offset	±100% of input range
Input Impedance	50 Ω or 1 MΩ to GND
Analog Input Coupling	DC
Offset Error	≤ 0.1% of range (after warm-up and calibration)
Gain Error	≤ 0.1% (after warm-up and calibration)
Over Voltage Protection	±5 V (≤ 1 V range) or ±40 V (≥ ±2 V range)
Crosstalk @ 1 MHz	≤ -100 dB, 50 Ω termination (range ≤ ±1 V) ≤ -58 dB, 50 Ω termination (range ≥ ±2 V)
CMRR for 100 kHz signal	80 dB (≤ ±1 V range) or 59 dB (≥ ±2 V range)

DN2.46x and DN6.46x | DN2.49x and DN6.49x

Clock

External Clock Impedance	50 Ω / > 4 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
ABA Mode Divider	8 up to 512k

Environmental and Physical Details

Connector Types	BNC (custom specific types on request)
Available Front Connections	All analog channels Trigger A (programmable input/output) Trigger B (input only) Clock (programmable input or output) Timestamp Reference Clock input
Gigabit Ethernet Connector	RJ-45 (Cat. 5E; ruggedized)
Dimension DN2 chassis (W x H x L)	267 mm x 87 mm x 366 mm (2U)
Dimension DN6 chassis (W x H x L)	432 mm x 131 mm x 420 mm (3U)
Operating Temperature	0°C – 50°C

Trigger

Acquisition Modes	Single-Shot, FIFO, Multiple Recording, Gated Sampling, ABA Mode
Trigger Sources	Software, Channel, External A + B, AND/OR
Trigger Modes	Edge, Level, Window, Pulse, Re-Arm, Spike, Delay
Trigger Edge	Rising, Falling, Both
Channel Trigger Resolution	14 bits
Trigger Accuracy	1 sample
Multi, Gate: Re-Arming Time	4 samples (+ programmed pretrigger)
Max Number of Segments	unlimited
Max Pretrigger at Multi, Gate, FIFO	up to 8 kSamples
External Trigger Type	3.3 V LVTTL compatible (5 V tolerant)
External Trigger Impedance	50 Ω / > 4 kΩ programmable
Trigger Output	TTL levels, capable of driving 50 Ω load
Timestamp Modes	Internal Sampling Clock, External Reference Clock
Timestamp Resolution	1 sample

Dynamic Performance

	DN2.462-xx DN6.462-xx	DN2.464-xx DN6.464-xx	DN2.465-xx DN6.465-xx
Max Internal Clock	200 kS/s	1 MS/s	3 MS/s
Min Internal Clock	1 kS/s	1 kS/s	1 kS/s
Max External Clock (Special Mode)	200 kS/s (200 kS/s)	1 MS/s (800 kS/s)	3 MS/s (2 MS/s)
Min External Clock (Special Mode)	DC (DC)	1 kS/s (DC)	1 kS/s (DC)
-3 dB Bandwidth	> 100 kHz	> 500 kHz	> 1.5 MHz
Zero Noise Level (≥ ±500 mV)	< 0.8 LSB	< 1.1 LSB	< 3.0 LSB
Zero Noise Level (< ±500 mV)	< 8 µV rms	< 17 µV rms	< 30 µV rms
Test Sampling Rate	200 kS/s	1 MS/s	3 MS/s
Test Signal Frequency	10 kHz	10 kHz	10 kHz
SNR (typ)	91.5 dB	90.7 dB	82.5 dB
THD (typ)	-101.7 dB	-100.8 dB	-90.1 dB
SFDR excl. Harm. (typ)	111.5 dB	111.2 dB	105.5 dB
ENOB (SNR)	14.9	14.7	13.4
ENOB (SFDR)	14.8	14.6	13.3

	DN2.491-xx DN6.491-xx	DN2.496-xx DN6.496-xx
Max Sampling Clock (half channels)	10 MS/s	62.5 MS/s
Max Sampling Clock (all channels)	10 MS/s	31.25 MS/s
Min Internal Clock	1 kS/s	1 kS/s
Min External Clock	3 MS/s	3 MS/s
-3 dB Bandwidth	> 5 MHz	> 30 MHz
Zero Noise Level (±200 mV, ±2 V)	< 5.0 LSB	< 7.0 LSB
Zero Noise Level (other ranges)	< 4.0 LSB	< 5.0 LSB
Test Sampling Rate	10 MS/s	60 MS/s
Test Signal Frequency	1 MHz	1 MHz
SNR (typ)	77.0 dB	74.5 dB
THD (typ)	-80.0 dB	-80.0 dB
SFDR excl. Harm. (typ)	94.3 dB	92.2 dB
ENOB (SNR)	12.5	12.1
ENOB (SFDR)	12.2	12.0

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

DN2.44x and DN6.44x

14/16 Bit Digitizer with 130 MS/s up to 500 MS/s, single-ended inputs, up to 24 channels

Analog Inputs

Resolution (DNx.441 and DNx.442)	16 bit
Resolution (DNx.445)	14 bit
Channel Selection	1, 2, 4, 8, 12, 16, 20 or 24 channels
Input Type	Single-Ended

Input Path Type	HF (50 Ω) Path	Buffered (High Impedance) Path
Input Impedance	50 Ω	1 MΩ or 50 Ω
Input Ranges	±500 mV, ±1 V, ±2.5 V, ±5 V	±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V
Input Offset	not available	not available
Analog Input Coupling	AC/DC	AC/DC
Offset Error (full speed)	≤ 0.1% of range	≤ 0.1% of range
Gain Error (full speed)	≤ 1.0% of value	≤ 0.5% of value
Over Voltage Protection	2 Vrms (range ≤ ±1 V) 6 Vrms (range ≥ ±2.5 V)	±5 V (range ≤ ±1 V) ±30 V (range ≥ ±2 V)
Max DC voltage at AC coupling	±30 V	±30 V
Crosstalk @ 1 MHz signal	≤ 96 dB (±1 V range) ≤ 97 dB (±5 V range)	≤ 93 dB (±1 V range) ≤ 85 dB (±5 V range)
Crosstalk @ 20 MHz signal	≤ 82 dB (±1 V range) ≤ 82 dB (±5 V range)	≤ 82 dB (±1 V range) ≤ 82 dB (±5 V range)

Clock

Clock Modes	Internal divider (maximum gain accuracy), internal PLL (reduced gain accuracy), external reference clock
PLL Clock Setup Granularity	1 Hz with gaps around 70 MHz, 140 MHz, 280 MHz
Internal Clock Accuracy	≤ 20 ppm
Reference Clock Input Range	≥ 10.0 MHz and ≤ 1.0 GHz
External Clock Impedance	50 Ω
External Clock Coupling	AC
External Clock Type	single-ended, sine wave or square
External Clock Input Swing	0.3 V peak-peak up to 3.0 V peak-peak
External Clock Max DC voltage	±30 V
ABA Mode Divider	16 up to 128 k

Trigger

Acquisition Modes	Single-Shot, FIFO, Multiple Recording, Gated Sampling, ABA Mode
Trigger Sources	Software, Channel, External 0, External 1, AND/OR
Trigger Modes	Edge, Level, Window, Re-Arm, Delay
Trigger Edge	Rising, Falling, Both
Channel Trigger Resolution	14 bits
Internal Trigger Accuracy	1 sample
Multi, Gate: Re-Arming Time	40 samples (+ programmed pretrigger)
Max Number of Segments	unlimited
Max Pretrigger at Multi, Gate, FIFO	up to 8 kSamples
Timestamp Modes	Internal Sampling Clock, External Reference Clock
Timestamp Resolution	1 sample

External Trigger	Trig0	Trig1
Impedance	50 Ω / 1 kΩ programmable	1 kΩ
Coupling	AC/DC	DC
Trigger Type	Window comparator	Level comparator
Input Level	±10 V (1 kΩ) or ±2.5 V (50 Ω)	±10 V
Level Setup Granularity	1 mV	1 mV
Maximum Voltage	±30 V	±30 V
Bandwidth DC coupling	DC to 200 MHz	DC to 200 MHz
Bandwidth AC coupling	20 kHz to 200 MHz	not available

Multi Purpose I/O Lines X0, X1 and X2

Input Functions	Asynchronous Digital-In, Synchronous Digital-In, Timestamp Reference Clock
Input Impedance	10 kΩ to 3.3 V
Input Signal Level	3.3 V LVTTL (max -0.5 V to +4.0 V)
Output Functions	Asynchronous Digital-Out, Trigger Output, Run, Arm, PLL Refclock
Output Impedance	50 Ω
Output Signal Levels	3.3 V LVTTL compatible, TTL compatible for high impedance load
Output Drive Strength	±48 mA (external 50 Ω termination possible)

Dynamic Performance

	DN2.445-xx DN6.445-xx	DN2.442-xx DN6.442-xx	DN2.441-xx DN6.441-xx
Max Sampling Clock	500 MS/s	250 MS/s	130 MS/s
ADC Resolution	14 Bit	16 Bit	16 Bit
Min Internal Clock	5 kS/s	5 kS/s	5 kS/s
Min External Clock	9 MS/s	9 MS/s	9 MS/s
-3 dB Bandwidth HF path	250 MHz	125 MHz	65 MHz
Flatness within ±0.5 dB HF path	160 MHz	80 MHz	40 MHz
-3 dB Bandwidth Buffered path	125 MHz	85 MHz	50 MHz
-3 dB Bandwidth with filter enabled	20 MHz	20 MHz	20 MHz
Zero Noise (HF path) in LSB	1.9	6.9	5.9
Zero Noise (Buf, full BW) in LSB	2.0 to 3.8	7.1 to 12.0	5.9 to 11.0
Zero Noise (Buf, 20 MHz BW) in LSB	2.0 to 3.2	6.9 to 9.8	5.9 to 9.6

Environmental and Physical Details

Connector Types	SMA (custom specific types on request)
Available Front Connections	All analog channels Clock Input Clock Output Trigger 0 Input Trigger 1 Input Multi Purpose I/O X0, X1 and X2
Gigabit Ethernet Connector	RJ-45 (Cat. 5E; ruggedized)
Dimension DN2 chassis (W x H x L)	267 mm x 87 mm x 366 mm (2U)
Dimension DN6 chassis (W x H x L)	432 mm x 131 mm x 420 mm (3U)
Operating Temperature	0°C – 50°C

	DN2.445-xx DN6.445-xx				DN2.442-xx DN6.442-xx				DN2.441-xx DN6.441-xx			
Input Path	HF path, AC coupled, fixed 50 Ohm		Buffered path, full BW		HF path, AC coupled, fixed 50 Ohm		Buffered path, full BW		HF path, AC coupled, fixed 50 Ohm		Buffered path, full BW	
Test Sampling Clock	500 MS/s	500 MS/s	500 MS/s	500 MS/s	250 MS/s	250 MS/s	250 MS/s	250 MS/s	130 MS/s	130 MS/s	130 MS/s	130 MS/s
Test Signal Frequency	10 MHz	40 MHz	10 MHz	40 MHz	1 MHz	10 MHz	1 MHz	10 MHz	1 MHz	10 MHz	1 MHz	10 MHz
Input Range	± 1 V	± 1 V	± 500 mV	± 500 mV	± 1 V	± 1 V	± 500 mV	± 500 mV	± 1 V	± 1 V	± 500 mV	± 500 mV
THD (typ)	< -75.8 dB	< -72.5 dB	< -65.0 dB	< -58.6 dB	< -73.1 dB	< -74.1 dB	< -72.2 dB	< -67.5 dB	< -72.6 dB	< -77.5 dB	< -73.5 dB	< -73.4 dB
SNR (typ)	> 67.9 dB	> 69.5 dB	> 67.3 dB	> 65.8 dB	> 71.9 dB	> 71.5 dB	> 71.7 dB	> 71.0 dB	> 72.2 dB	> 71.9 dB	> 71.1 dB	> 71.0 dB
SFDR excl. Harm. (typ)	> 88.6 dB	> 88.0 dB	> 89.0 dB	> 88.9 dB	> 92.1 dB	> 90.8 dB	> 90.0 dB	> 91.4 dB	> 92.4 dB	> 96.0 dB	> 88.8 dB	> 93.5 dB
SINAD/THD+N (typ)	> 67.2 dB	> 67.7 dB	> 63.9 dB	> 57.9 dB	> 69.8 dB	> 69.6 dB	> 68.8 dB	> 66.4 dB	> 69.4 dB	> 70.8 dB	> 69.2 dB	> 69.2 dB
ENOB (SINAD)	> 10.9 bit	> 10.9 bit	> 10.3 bit	> 9.3 bit	> 11.3 bit	> 11.2 bit	> 11.1 bit	> 10.7 bit	> 11.2 bit	> 11.5 bit	> 11.2 bit	> 11.2 bit
ENOB (SNR)	> 11.0 bit	> 11.0 bit	> 10.9 bit	> 10.6 bit	> 11.7 bit	> 11.6 bit	> 11.6 bit	> 11.5 bit	> 11.7 bit	> 11.6 bit	> 11.6 bit	> 11.6 bit

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Model Overview and Options

Model Number	Speed	Resolution	SE Channels	Diff Channels
DN2.445-02	500 MS/s	14 Bit	2	–
DN2.445-04	500 MS/s	14 Bit	4	–
DN2.445-08	500 MS/s	14 Bit	8	–
DN6.445-12	500 MS/s	14 Bit	12	–
DN6.445-16	500 MS/s	14 Bit	16	–
DN6.445-20	500 MS/s	14 Bit	20	–
DN6.445-24	500 MS/s	14 Bit	24	–
DN2.442-02	250 MS/s	16 Bit	2	–
DN2.442-04	250 MS/s	16 Bit	4	–
DN2.442-08	250 MS/s	16 Bit	8	–
DN6.442-12	250 MS/s	16 Bit	12	–
DN6.442-16	250 MS/s	16 Bit	16	–
DN6.442-20	250 MS/s	16 Bit	20	–
DN6.442-24	250 MS/s	16 Bit	24	–
DN2.441-02	130 MS/s	16 Bit	2	–
DN2.441-04	130 MS/s	16 Bit	4	–
DN2.441-08	130 MS/s	16 Bit	8	–
DN6.441-12	130 MS/s	16 Bit	12	–
DN6.441-16	130 MS/s	16 Bit	16	–
DN6.441-20	130 MS/s	16 Bit	20	–
DN6.441-24	130 MS/s	16 Bit	24	–
DN2.496-04	60 MS/s	16 Bit	2	2
	30 MS/s	16 Bit	4	2
DN2.496-08	60 MS/s	16 Bit	4	4
	30 MS/s	16 Bit	8	4
DN2.496-16	60 MS/s	16 Bit	8	8
	30 MS/s	16 Bit	16	8
DN6.496-24	60 MS/s	16 Bit	12	12
	30 MS/s	16 Bit	24	12
DN6.496-32	60 MS/s	16 Bit	16	16
	30 MS/s	16 Bit	32	16
DN6.496-40	60 MS/s	16 Bit	20	20
	30 MS/s	16 Bit	40	20
DN6.496-48	60 MS/s	16 Bit	24	24
	30 MS/s	16 Bit	48	24

Model Number	Speed	Resolution	SE Channels	Diff Channels
DN2.491-04	10 MS/s	16 Bit	4	2
DN2.491-08	10 MS/s	16 Bit	8	4
DN2.491-16	10 MS/s	16 Bit	16	8
DN6.491-24	10 MS/s	16 Bit	24	12
DN6.491-32	10 MS/s	16 Bit	32	16
DN6.491-40	10 MS/s	16 Bit	40	20
DN6.491-48	10 MS/s	16 Bit	48	24
DN2.465-04	3 MS/s	16 Bit	4	4
DN2.465-08	3 MS/s	16 Bit	8	8
DN2.465-16	3 MS/s	16 Bit	16	–
DN6.465-16	3 MS/s	16 Bit	16	16
DN6.465-24	3 MS/s	16 Bit	24	24
DN6.465-32	3 MS/s	16 Bit	32	–
DN6.465-40	3 MS/s	16 Bit	40	–
DN6.465-48	3 MS/s	16 Bit	48	–
DN2.464-04	1 MS/s	16 Bit	4	4
DN2.464-08	1 MS/s	16 Bit	8	8
DN2.464-16	1 MS/s	16 Bit	16	–
DN6.464-16	1 MS/s	16 Bit	16	16
DN6.464-24	1 MS/s	16 Bit	24	24
DN6.464-32	1 MS/s	16 Bit	32	–
DN6.464-40	1 MS/s	16 Bit	40	–
DN6.464-48	1 MS/s	16 Bit	48	–
DN2.462-04	200 kS/s	16 Bit	4	4
DN2.462-08	200 kS/s	16 Bit	8	8
DN2.462-16	200 kS/s	16 Bit	16	–
DN6.462-16	200 kS/s	16 Bit	16	16
DN6.462-24	200 kS/s	16 Bit	24	24
DN6.462-32	200 kS/s	16 Bit	32	–
DN6.462-40	200 kS/s	16 Bit	40	–
DN6.462-48	200 kS/s	16 Bit	48	–

SBench 6 Professional License included

Options	
DN2.xxx-xx1GS / DN6.xxx-x1GS	Different memory upgrade options for 46x and 49x series to 1 GSample per digitizer (8 channels)
DN2.xxx-DC12 / DN2.xxx-DC24	12V / 24V DC power supply. Accepts 9V to 18V / 18V to 36V DC input
DN6.xxx-DC	Individual DC power supply options available upon request
DN2.xxx-Rack / DN6.xxx-Rack	19" rack mount installation kit
DN2.44x-spavg / DN6.44x-spavg	On-board signal processing option: Block Averaging
DN2.44x-spstat / DN6.44x-spstat	On-board signal processing option: Block Statistics (Peak Detect)

SPECTRUM
SYSTEMENTWICKLUNG MICROELECTRONIC GMBH

Spectrum Systementwicklung Microelectronic GmbH
Ahrensfelder Weg 13-17 | 22927 Grosshansdorf / Germany
Phone +49 (0)4102-69 56-0 | Fax +49 (0)4102-69 56-66
info@spec.de | www.spectrum-instrumentation.com