

## DN2.65x - 16 channel 16 bit generatorNETBOX up to 125 MS/s

- 4, 8 or 16 channels with 40 MS/s up to 125 MS/s
- Simultaneous arbitrary generation on all channels
- Output level  $\pm 3.0\text{ V}$  into  $50\ \Omega$  ( $\pm 6\text{ V}$  into high-impedance loads)
- Fixed trigger to output delay
- Large 64 MSample per channel internal memory
- FIFO mode continuous streaming output
- Modes: Single-Shot, Loop, FIFO, Sequence Replay Mode, Gated, ...



- Ethernet Remote Instrument
- LXI Core 2011 compatible
- GBit Ethernet Interface
- Sustained streaming mode up to 100 MB/s
- Direct Connection to PC/Laptop
- Connect anywhere in company LAN
- Embedded Webserver for Maintenance/Updates
- Embedded Server option for open Linux platform

|   |  |   |
|---|--|---|
| <b>Operating Systems</b> <ul style="list-style-type: none"> <li>• Windows 7 (SP1), 8, 10, Server 2008 R2 and newer</li> <li>• Linux Kernel 2.6, 3.x, 4.x, 5.x</li> <li>• Windows/Linux 32 and 64 bit</li> </ul> | <b>SBench 6 Professional Included</b> <ul style="list-style-type: none"> <li>• Acquisition, Generation and Display of analog and digital data</li> <li>• Calculation, FFT</li> <li>• Documentation and Import, Export</li> </ul> | <b>Drivers</b> <ul style="list-style-type: none"> <li>• LabVIEW, MATLAB, LabWindows/CVI</li> <li>• C/C++, GNU C++, VB.NET, C#, J#, Delphi, Java, Python</li> <li>• IVI</li> </ul> |
|---|--|---|

| Model      | Analog output channels |          |         | Output Level     |                        | Internal |         |
|------------|------------------------|----------|---------|------------------|------------------------|----------|---------|
|            | 4 ch                   | 8 ch     | 16 ch   | in $50\ \Omega$  | in $1\ \text{M}\Omega$ | Star-Hub | Modules |
| DN2.653-04 | 40 MS/s                |          |         | $\pm 3\text{ V}$ | $\pm 6\text{ V}$       | no       | 1       |
| DN2.653-08 | 40 MS/s                | 40 MS/s  |         | $\pm 3\text{ V}$ | $\pm 6\text{ V}$       | no       | 1       |
| DN2.653-16 | 40 MS/s                | 40 MS/s  | 40 MS/s | $\pm 3\text{ V}$ | $\pm 6\text{ V}$       | yes      | 2       |
| DN2.656-04 | 125 MS/s               |          |         | $\pm 3\text{ V}$ | $\pm 6\text{ V}$       | no       | 1       |
| DN2.656-08 | 125 MS/s               | 80 MS/s  |         | $\pm 3\text{ V}$ | $\pm 6\text{ V}$       | no       | 1       |
| DN2.656-16 | 125 MS/s               | 125 MS/s | 80 MS/s | $\pm 3\text{ V}$ | $\pm 6\text{ V}$       | yes      | 2       |

### General Information

The general purpose Ethernet-AWG series generatorNETBOX DN2.65x allows generation of arbitrary signals on up to 16 channels in parallel. These Ethernet Remote instruments offer outstanding D/A features both in resolution and signal quality. The combination of high sampling rate and resolution makes these AWGs the top-of-the-range for applications that require high quality signal generation. The generatorNETBOX can be installed anywhere in the company LAN and can be remotely controlled from a host PC.

## Software Support

### Windows Support

The digitizerNETBOX/generatorNETBOX can be accessed from Windows 7, Windows 8, Windows 10 (each 32 bit and 64 bit). Programming examples for Visual C++, C++ Builder, LabWindows/CVI, Delphi, Visual Basic, VB.NET, C#, J#, Python, Java and IVI are included.

### Linux Support



The digitizerNETBOX/generatorNETBOX can be accessed from any Linux system. The Linux support includes SMP systems, 32 bit and 64 bit systems, versatile programming examples for Gnu C++, Python as well as drivers for MATLAB for Linux. SBench 6, the powerful data acquisition and analysis software from Spectrum is also included as a Linux version.

### Discovery Protocol

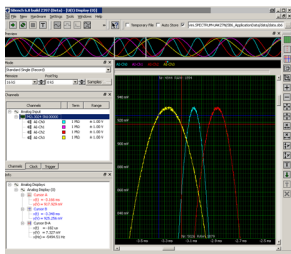
|                   |                                       |
|-------------------|---------------------------------------|
| Physical Location |                                       |
| Bus No            | 0                                     |
| Device No         | 0                                     |
| Function No       | 0                                     |
| Slot No           | 0                                     |
| IP                | 192.168.169.14                        |
| VISA              | TCPIP[0]:192.168.169.14::inst0::INSTR |

The Discovery function helps you to find and identify any Spectrum LXI instruments, like the digitizerNETBOX and generatorNETBOX, available to your computer on the network.

The Discovery function will also locate any Spectrum card products that are managed by an installed Spectrum Remote Server somewhere 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.

### SBench 6 Professional



The digitizerNETBOX and generatorNETBOX 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. It has a variety of display windows as well as analysis, export and documentation

functions.

- Available for Windows XP, Vista, Windows 7, Windows 8, Windows 10 and Linux
- Easy to use interface with drag and drop, docking windows and context menus
- Display of analog and digital data, X-Y display, frequency domain and spread signals
- Designed to handle several GBytes of data
- Fast data preview functions

### IVI Driver

The IVI standards define an open driver architecture, a set of instrument classes, and shared software components. Together these provide critical elements needed for instrument interchangeability. IVI's defined Application Programming Interfaces (APIs) standardize common measurement functions reducing the time needed to learn a new IVI instrument.

The Spectrum products to be accessed with the IVI driver can be locally installed data acquisition cards, remotely installed data acquisition cards or remote LXI instruments like digitizerNETBOX/generatorNETBOX. To maximize the compatibility with existing IVI based software installations, the Spectrum IVI

driver supports IVI Scope, IVI Digitizer and IVI FGen class with IVI-C and IVI-COM interfaces.

### Third-party Software Products

Most popular third-party software products, such as LabVIEW, MATLAB or LabWindows/CVI are supported. All drivers come with examples and detailed documentation.

### Embedded Webserver



|                                  |   |
|----------------------------------|---|
| Instrument Welcome Page          |   |
| Instrument Model                 | DN2.465-08                                  |
| Manufacturer                     | Spectrum GmbH                               |
| Serial Number                    | 1234  |
| Description                      | Spectrum GmbH, DN2.465-08, 1234, 3.32.13608 |
| LXI Features                     | LXI Core 2011                               |
| LXI Version                      | LXI Device Specification 2011 rev. 1.4      |
| Host Name                        | 192.168.169.20                              |
| mDNS Host Name                   | DN2_465-08_sn1234.local                     |
| MAC Address                      | 0C:C4:7A:B3:C2:A2                           |
| TCP/IP Address                   | 192.168.169.20                              |
| Firmware Revision                | 40  |
| Software Revision                | 3.32.13608                                  |
| Instrument Address String [VISA] | TCPIP::192.168.169.20::INSTR                |
| LAN ID Indicator                 | <input type="checkbox"/> Enable             |

The integrated webserver follows the LXI standard and gathers information on the product, set up of the Ethernet configuration and current status. It also allows the setting of a configuration password, access to documentation and updating of the complete instrument firmware, including the embedded remote server and the webserver.

## Hardware features and options

### LXI Instrument



The digitizerNETBOX and generatorNETBOX are fully LXI instrument compatible to LXI Core 2011 following the LXI Device Specification

2011 rev. 1.4. The digitizerNETBOX/generatorNETBOX has been tested and approved by the LXI Consortium.

Located on the front panel is the main on/off switch, LEDs showing the LXI and Acquisition status and the LAN reset switch.

### digitizerNETBOX/generatorNETBOX chassis version V2



The chassis version V2 got a complete re-design to allow some new features that improve the handling especially for mobile and shared usage:

- 8 bumper edges protect the chassis, the desk and other components on it. The bumper edges allow to store the chassis either vertically or horizontally and the lock-in structure allows to stack multiple chassis with a secure fit onto each other. For 19" rack mount montage the bumpers can be unmounted and replaced by the 19" rack mount option
- The handle allows to easily carry the chassis around in juts one hand.
- A standard GND screw on the back of the chassis allows to connect the metal chassis to measurement ground to reduce noise based on ground loops and ground level differences.

### Front Panel



Standard BNC connectors are used for all analog input or output signals and all auxiliary signals like clock and trigger. No special adapter cables are needed and the connection is secure even when used in a moving environment.

Custom front panels are available on request even for small series, be it SMA, LEMO connectors or custom specific connectors.

**Ethernet Connectivity**



The GBit Ethernet connection can be used with standard COTS Ethernet cabling. The integration into a standard LAN allows to connect the digitizerNETBOX/generatorNETBOX either directly to a desktop PC or Laptop or it is possible to place the instrument somewhere in the company LAN and access it from any desktop over the LAN.

**DC Power Supply Option**



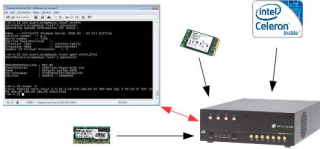
The digitizerNETBOX/generatorNETBOX can be equipped with an internal DC power supply which replaces the standard AC power supply. Two different power supply options are available that range from 9V to 36V. Contact the sales team if other DC levels are required.

Using the DC power supply the digitizerNETBOX/generatorNETBOX can be used for mobile applications together with a Laptop in automotive or airborne applications.

**Boot on Power on Option**

The digitizerNETBOX/generatorNETBOX can be factory configured to automatically start and boot upon availability of the input power rail. That way the instrument will automatically become available again upon loss of input power.

**Option Embedded Server**



The option turns the digitizerNETBOX/generatorNETBOX in a powerful PC that allows to run own programs on a small and remote data acquisition system. The digitizerNETBOX/generatorNETBOX is enhanced by more memory, a powerful CPU, a freely accessible internal SSD and a remote software development access method.

The digitizerNETBOX/generatorNETBOX can either run connected to LAN or it can run totally independent, storing data to the internal SSD. The original digitizerNETBOX/generatorNETBOX remote instrument functionality is still 100 % available. Running the embedded server option it is possible to pre-calculate results based on the acquired data, store acquisitions locally and to transfer just the required data or results parts in a client-server based software structure. A different example for the digitizerNETBOX/generatorNETBOX embedded server is surveillance/logger application which can run totally independent for days and send notification emails only over LAN or offloads stored data as soon as it's connected again.

Access to the embedded server is done through a standard text based Linux shell based on the ssh secure shell.

**Singleshot output**

When singleshot output is activated the data of the on-board memory is played exactly one time. The trigger source can be either one of the external trigger inputs or the software trigger. After the first trigger additional trigger events will be ignored.

**Repeated output**

When the repeated output mode is used the data of the on-board memory is played continuously for a programmed number of times

or until a stop command is executed. The trigger source can be either one of the external trigger inputs or the software trigger. After the first trigger additional trigger events will be ignored.

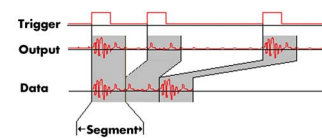
**Single Restart replay**

When this mode is activated the data of the on-board memory will be replayed once after each trigger event. The trigger source can be either the external TTL trigger or software trigger.

**FIFO mode**

The FIFO mode is designed for continuous data transfer between PC memory or hard disk and the generation board. The control of the data stream is done automatically by the driver on an interrupt request basis. The complete installed on-board memory is used for buffering data, making the continuous streaming extremely reliable.

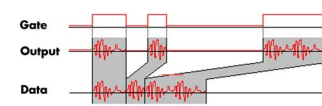
**Multiple Replay**



The Multiple Replay mode allows the fast output generation on several trigger events without restarting the hardware. With this option very fast repetition rates can be

achieved. The on-board memory is divided into several segments of the same size. Each segment can contain different data which will then be played with the occurrence of each trigger event.

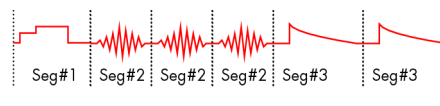
**Gated Replay**



The Gated Sampling mode allows data replay controlled by an external gate signal. Data is only replayed if the gate signal has attained a

programmed level.

**Sequence Mode**



The sequence mode allows to split the card memory into several

data segments of different length. These data segments are chained up in a user chosen order using an additional sequence memory. In this sequence memory the number of loops for each segment can be programmed and trigger conditions can be defined to proceed from segment to segment. Using the sequence mode it is also possible to switch between replay waveforms by a simple software command or to redefine waveform data for segments simultaneously while other segments are being replayed. All trigger-related and software-command-related functions are only working on single cards, not on star-hub-synchronized cards.

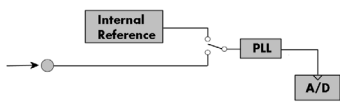
**External trigger input**

All boards can be triggered using up to two external analog or digital signals. One external trigger input has two analog comparators that can define an edge or window trigger, a hysteresis trigger or a rearm trigger. The other input has one comparator that can be used for standard edge and level triggers.

**External clock input and output**

Using a dedicated connector a sampling clock can be fed in from an external system. Additionally it's also possible to output the internally used sampling clock on a separate connector to synchronize external equipment to this clock.

**Reference clock**



The option to use a precise external reference clock (normally 10 MHz) is necessary to synchronize the instrument for high-quality

measurements with external equipment (like a signal source). It's also possible to enhance the quality of the sampling clock in this way. The driver automatically generates the requested sampling clock from the fed in reference clock.

**DN2 / DN6 Technical Data**

**Analog Outputs**

|                                      |                         |   |
|--------------------------------------|-------------------------|---|
| Resolution                           |                         | 16 bit  |
| D/A Interpolation                    |                         | no interpolation  |
| Output amplitude                     | software programmable   | ±1 mV up to ±3 V in 1 mV steps into 50 Ω termination<br>(resulting in ±2 mV up to ±6 V in 2mV steps into high impedance loads)  |
| Output Amplifier Path Selection      | automatically by driver | Note: Gain values below ±300 mV into 50 Ω are reduced by digital scaling of the samples<br>Low Power path: Selected Gain of ±1 mV to ±960 mV (into 50 Ω)<br>High Power path: Selected Gain of ±940 mV to ±3 V (into 50 Ω) |
| Output Amplifier Setting Hysteresis  | automatically by driver | 940 mV to 960 mV (if output is using low power path it will switch to high power path at 960 mV. If output is using high power path it will switch to low power path at 940 mV)   |
| Output amplifier path switching time |                         | 1.2 ms (output disabled while switching)  |
| Output offset                        | software programmable   | Low Power path: ±960 mV in 1 mV steps into 50 Ω (±1920 mV in 2 mV steps into high-Z)<br>High Power path: ±3 V in 1 mV steps into 50 Ω (±6 V in 2 mV steps into high-Z)  |
| Filters                              | software programmable   | One of 4 different filters (refer to „Bandwidth and Filters“ section)   |
| DAC Differential non linearity (DNL) | DAC only                | ±2.0 LSB typical  |
| DAC Integral non linearity (INL)     | DAC only                | ±4.0 LSB typical  |
| Output resistance                    |                         | 50 Ω  |
| Minimum output load                  |                         | 0 Ω (short circuit save)  |
| Max output swing in 50 Ω             |                         | ±3.0 V (offset + amplitude)   |
| Max output swing in 1 MΩ             |                         | ±6.0 V (offset + amplitude)   |
| Slewrate (using Filter 0)            |                         | Low power path (0 to 900 mV): 250 mV/ns<br>High power path (0 to 3000 mV): 850 mV/ns  |
| Crosstalk @ 1 MHz signal ±3 V        | 1 to 4 channel AWG      | 95 dB   |
| Crosstalk @ 1 MHz signal ±3 V        | 8 channel AWG           | 84 dB   |
| Output accuracy                      |                         | Low Power path: ±TBD mV ±TBD % of programmed output amplitude<br>High Power path: ±TBD mV ±TBD % of programmed output amplitude   |

**Trigger**

|                                   |                       |  |
|-----------------------------------|-----------------------|--|
| Available trigger modes           | software programmable | External, Software, Pulse, Re-Arm, Or/And, Delay |
| Trigger edge                      | software programmable | Rising edge, falling edge or both edges          |
| Trigger pulse width               | software programmable | 0 to [4G - 1] samples in steps of 1 sample       |
| Trigger delay                     | software programmable | 0 to [4G - 1] samples in steps of 1 samples      |
| Trigger holdoff (for Multi, Gate) | software programmable | 0 to [4G - 1] samples in steps of 1 samples      |

|                              |                       |   |
|------------------------------|-----------------------|---|
| Trigger edge                 | software programmable | Rising edge, falling edge or both edges                                       |
| Multi, Gate: re-arming time  |                       | < 24 samples (+ programmed holdoff)   |
| Trigger to Output Delay      |                       | 63 sample clocks + 7 ns   |
| Memory depth                 | software programmable | 16 up to [installed memory / number of active channels] samples in steps of 8 |
| Multiple Replay segment size | software programmable | 8 up to [installed memory / number of active channels] samples in steps of 8  |
| External trigger accuracy    |                       | 1 sample  |

|  |                       |                                |   |
|--|-----------------------|--------------------------------|---|
| External trigger   |                       | <b>Ext</b>                     | <b>X1, X2, X3</b>   |
| External trigger type  |                       | Single level comparator        | 3.3V LVTTTL logic inputs  |
| External trigger impedance                                   | software programmable | 50 Ω / 5 kΩ                    | For electrical specifications refer to „Multi Purpose I/O lines“ section. |
| External trigger input level                                 |                       | ±5 V (5 kΩ), ±2.5 V (50 Ω),    |   |
| External trigger over voltage protection                     |                       | ±20 V (5 kΩ), 5 Vrms (50 Ω)    |   |
| External trigger sensitivity (minimum required signal swing) |                       | 200 mVpp                       |   |
| External trigger level                                       | software programmable | ±5 V in steps of 1 mV          |   |
| External trigger bandwidth                                   | 50 Ω<br>5 kΩ          | DC to 400 MHz<br>DC to 300 MHz | n.a.<br>DC to 125 MHz   |
| Minimum external trigger pulse width                         |                       | ≥ 2 samples                    | ≥ 2 samples   |

### Multi Purpose I/O lines

|  |                       |   |   |
|--|-----------------------|---|---|
| Number of multi purpose output lines       |                       | one, named X0   |   |
| Number of multi purpose input/output lines |                       | three, named X1, X2, X3   |   |
| Multi Purpose line                         |                       | <b>X0</b>   | <b>X1, X2, X3</b>   |
| Input: available signal types              | software programmable | n.a.  | Asynchronous Digital-In, Logic trigger  |
| Input: signal levels                       |                       | n.a.  | 3.3 V LVTTTL  |
| Input: impedance                           |                       | n.a.  | 10 kΩ to 3.3 V  |
| Input: maximum voltage level               |                       | n.a.  | -0.5 V to +4.0 V  |
| Input: maximum bandwidth                   |                       | n.a.  | 125 MHz   |
| Output: available signal types             | software programmable | Run-, Arm-, Trigger-Output, Marker-Output, Synchronous Digital-Out, Asynchronous Digital-Out, ADC Clock Output, | Run-, Arm-, Trigger-Output, Marker-Output, Synchronous Digital-Out, Asynchronous Digital-Out, |
| Output: impedance                          |                       | 50 Ω  |   |
| Output: drive strength                     |                       | Capable of driving 50 Ω loads, maximum drive strength ±48 mA  |   |
| Output: type / signal levels               |                       | 3.3V LVTTTL, TTL compatible for high impedance loads  |   |
| Output: update rate (synchronous modes)    |                       | sampling clock  |   |

### Sequence Replay Mode

|                                       |                       |  |
|---------------------------------------|-----------------------|--|
| Number of sequence steps              | software programmable | 1 up to 4096 (sequence steps can be overloaded at runtime)   |
| Number of memory segments             | software programmable | 2 up to 64k (segment data can be overloaded at runtime)  |
| Minimum segment size                  | software programmable | 32 samples in steps of 8 samples.  |
| Maximum segment size                  | software programmable | 512 MS / active channels / number of sequence segments (round up to the next power of two)   |
| Loop Count                            | software programmable | 1 to (1M - 1) loops  |
| Sequence Step Commands                | software programmable | Loop for #Loops, Next, Loop until Trigger, End Sequence  |
| Special Commands                      | software programmable | Data Overload at runtime, sequence steps overload at runtime, readout current replayed sequence step   |
| Limitations for synchronized products |                       | Software commands changing the sequence as well as „Loop until trigger“ are not synchronized between cards. This also applies to multiple AWG modules in a generator/NETBOX. |

### Clock

|   |                       |   |
|---|-----------------------|---|
| Clock Modes   | software programmable | internal PLL, external clock, external reference clock, sync  |
| Internal clock range (PLL mode)   | software programmable | see „Clock Limitations“ table below   |
| Internal clock accuracy   | after warm-up         | ≤ ±1.0 ppm (at time of calibration in production)   |
| Internal clock aging  |                       | ≤ ±0.5 ppm / year   |
| PLL clock setup granularity (int. or ext. reference)                            |                       | 1 Hz  |
| External reference clock range  | software programmable | 128 kHz up to 125 MHz   |
| Direct external clock to internal clock delay                                   |                       | 4.3 ns  |
| Direct external clock range   |                       | see „Clock Limitations and Bandwidth“ table below   |
| External clock type   |                       | Single level comparator   |
| External clock input level  |                       | ±5 V (5 kΩ), ±2.5 V (50 Ω),   |
| External clock input impedance  | software programmable | 50 Ω / 5 kΩ   |
| External clock over voltage protection  |                       | ±20 V (5 kΩ), 5 Vrms (50 Ω)   |
| External clock sensitivity (minimum required signal swing)                      |                       | 200 mVpp  |
| External clock level  | software programmable | ±5 V in steps of 1 mV   |
| External clock edge   |                       | rising edge used  |
| External reference clock input duty cycle                                       |                       | 45% - 55%   |
| Clock output electrical specification   |                       | Available via Multi Purpose output X0. Refer to „Multi Purpose I/O lines“ section.  |
| Synchronization clock multiplier „N“ for different clocks on synchronized cards | software programmable | N being a multiplier (1, 2, 3, 4, 5, ... Max) of the card with the currently slowest sampling clock. The card maximum (see „Clock Limitations and Bandwidth“ table below) must not be exceeded. |
| Channel to channel skew on one card   |                       | < 200 ps (typical)  |
| Skew between star-hub synchronized cards  |                       | TBD   |

## Clock Limitations

|  | M2p.653x<br>DNx.653-xx | M2p.656x<br>DNx.656-xx |
|--|------------------------|------------------------|
| max internal clock (non-synchronized cards)          | 40 MS/s                | 125 MS/s               |
| min internal clock (non-synchronized cards)          | 1 kS/s                 | 1 kS/s                 |
| max internal clock (cards synchronized via star-hub) | 40 MS/s                | 125 MS/s               |
| min internal clock (cards synchronized via star-hub) | 128 kS/s               | 128 kS/s               |
| max direct external clock                            | 40 MS/s                | 125 MS/s               |
| min direct external clock                            | DC                     | DC                     |

## Bandwidth and Filters

|  | Filter   | -3dB bandwidth | Filter characteristic   |
|--|----------|----------------|-------------------------|
| Analog bandwidth does not include Sinc response of DAC | Filter 0 | 70 MHz         | third-order Butterworth |
|  | Filter 1 | 20 MHz         | fifth-order Butterworth |
|  | Filter 2 | 5 MHz          | fourth-order Bessel     |
|  | Filter 3 | 1 MHz          | fourth-order Bessel     |

## Dynamic Parameters

| M2p.653x/DNx.653-xx    |             |             |             |             |
|------------------------|-------------|-------------|-------------|-------------|
| Test - Samplerate      | 40 MS/s     |             | 40 MS/s     |             |
| Output Frequency       | 800 kHz     |             | 4 MHz       |             |
| Output Level in 50 Ω   | ±900mV      | ±3000mV     | ±900mV      | ±3000mV     |
| Used Filter            | 1 MHz       |             | 5 MHz       |             |
| NSD (typ)              | -142 dBm/Hz | -132 dBm/Hz | -142 dBm/Hz | -132 dBm/Hz |
| SNR (typ)              | 90.7 dB     | 91.1 dB     | 83.7 dB     | 84.1 dB     |
| THD (typ)              | -74.0 dB    | -74.0 dB    | -70.5 dB    | -70.5 dB    |
| SINAD (typ)            | 73.9 dB     | 73.9 dB     | 69.8 dB     | 69.8 dB     |
| SFDR (typ), excl harm. | 97.0 dB     | 95.0 dB     | 88.0 dB     | 88.0 dB     |
| ENOB (SINAD)           | 12.0        | 12.0        | 11.3        | 11.3        |
| ENOB (SNR)             | 14.7        | 14.8        | 13.5        | 13.6        |

| M2p.656x/DNx.656-xx    |             |             |             |             |             |             |
|------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Test - Samplerate      | 125 MS/s    |             | 125 MS/s    |             | 125 MS/s    |             |
| Output Frequency       | 800 kHz     |             | 4 MHz       |             | 16 MHz      |             |
| Used Filter            | 1 MHz       |             | 5 MHz       |             | 20 MHz      |             |
| Output Level in 50 Ω   | ±900mV      | ±3000mV     | ±900mV      | ±3000mV     | ±900mV      | ±3000mV     |
| NSD (typ)              | -142 dBm/Hz | -132 dBm/Hz | -142 dBm/Hz | -132 dBm/Hz | -142 dBm/Hz | -132 dBm/Hz |
| SNR (typ)              | 90.7 dB     | 91.1 dB     | 83.7 dB     | 84.1 dB     | 77.7 dB     | 78.1 dB     |
| THD (typ)              | -74.0 dB    | -74.0 dB    | -70.5 dB    | -70.5 dB    | -66.0 dB    | -61.9 dB    |
| SINAD (typ)            | 73.9 dB     | 73.9 dB     | 69.8 dB     | 69.8 dB     | 65.7 dB     | 60.9 dB     |
| SFDR (typ), excl harm. | 97.0 dB     | 95.0 dB     | 88.0 dB     | 88.0 dB     | 90.0 dB     | 89.0 dB     |
| ENOB (SINAD)           | 12.0        | 12.0        | 11.3        | 11.3        | 10.6        | 9.8         |
| ENOB (SNR)             | 14.7        | 14.8        | 13.5        | 13.6        | 12.5        | 12.6        |

THD and SFDR are measured at the given output level and 50 Ohm termination with a high resolution M3i.4860/M4i.4450-x8 data acquisition card and are calculated from the spectrum. Noise Spectral Density is measured with built-in calculation from an HP E4401B Spectrum Analyzer. All available D/A channels are activated for the tests. SNR and SFDR figures may differ depending on the quality of the used PC. NSD = Noise Spectral Density, THD = Total Harmonic Distortion, SFDR = Spurious Free Dynamic Range.

## DN2 specific Technical Data

### Environmental and Physical Details DN2.xxx

|  |           |                                       |
|--|-----------|---------------------------------------|
| Dimension of Chassis without connectors or bumpers | L x W x H | 366 mm x 267 mm x 87 mm               |
| Dimension of Chassis with 19" rack mount option    | L x W x H | 366 mm x 482.6 mm x 87 mm (2U height) |
| Weight (1 internal acquisition/generation module)  |           | 6.3 kg, with rack mount kit: 6.8 kg   |
| Weight (2 internal acquisition/generation modules) |           | 6.7 kg, with rack mount kit 7.2 kg    |
| Warm up time                                       |           | 20 minutes                            |
| Operating temperature                              |           | 0°C to 40°C                           |
| Storage temperature                                |           | -10°C to 70°C                         |
| Humidity   |           | 10% to 90%                            |
| Dimension of packing (single DN2)                  | L x W x H | 470 mm x 390 mm x 180 mm              |
| Volume weight of Packing (single DN2)              |           | 7.0 kgs                               |

### Power Consumption

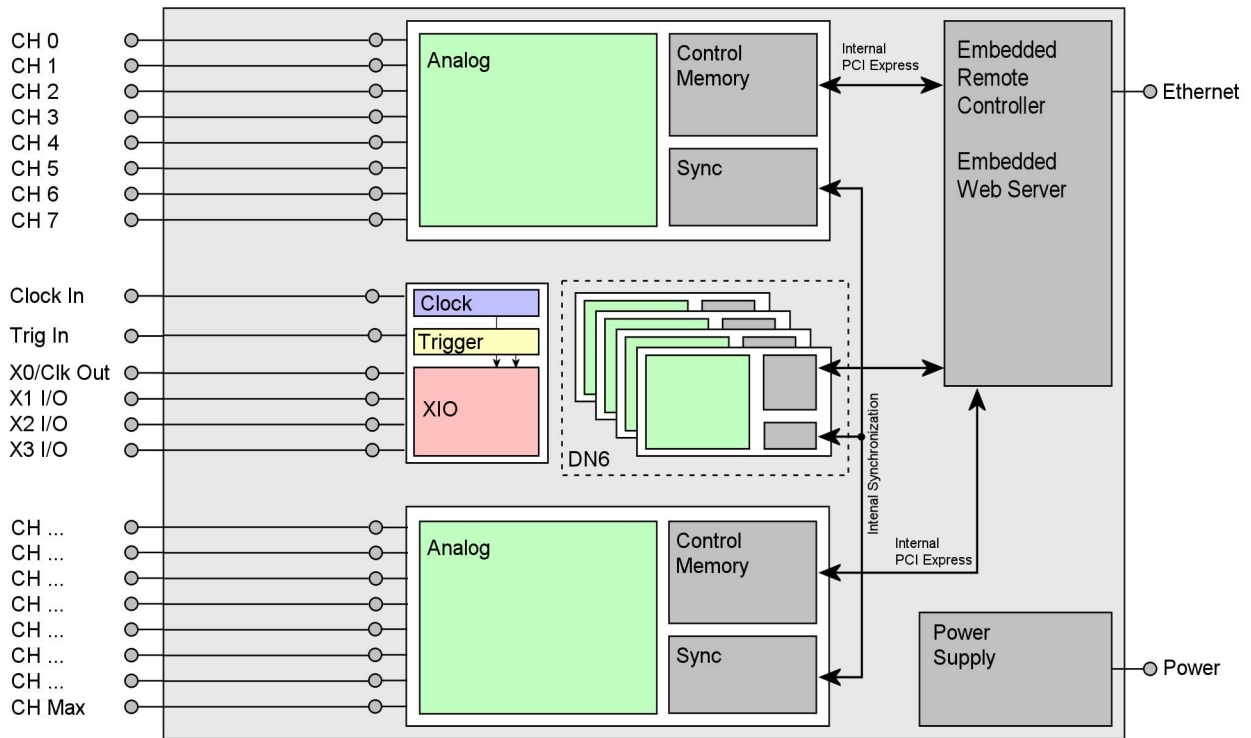
|                        | 230 VAC |     | 12 VDC |     | 24 VDC |     |
|------------------------|---------|-----|--------|-----|--------|-----|
| DN2.653-04, DN2.666-04 | TBD     | TBD | TBD    | TBD | TBD    | TBD |
| DN2.653-08, DN2.656-08 | TBD     | TBD | TBD    | TBD | TBD    | TBD |
| DN2.653-16, DN2.656-16 | TBD     | TBD | TBD    | TBD | TBD    | TBD |

### MTBF

|      |     |
|------|-----|
| MTBF | TBD |
|------|-----|

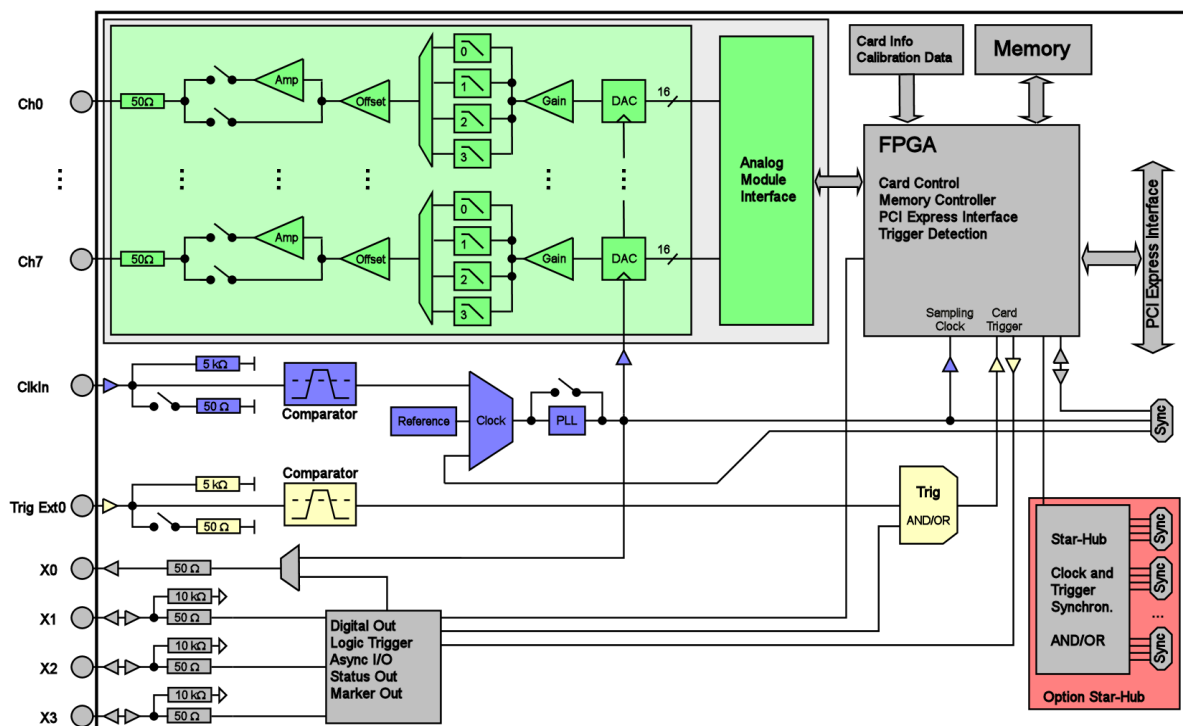


### Block diagram of generatorNETBOX DN2



- The number of maximum channels and internal AWG modules and existence of a synchronization Star-Hub is model dependent.

### Block diagram of generatorNETBOX module DN2.65x





## Order Information

The generatorNETBOX is equipped with a large internal memory and supports standard replay, FIFO replay (streaming), Multiple Replay, Gated Replay, Continuous Replay (Loop), Single-Restart as well as Sequence. Operating system drivers for Windows/Linux 32 bit and 64 bit, drivers and examples for C/C++, IVI (Function Generator class), LabVIEW (Windows), MATLAB (Windows and Linux), LabWindows/CVI, .NET, Delphi, Java, Python and a Professional license of the oscilloscope software SBench 6 are included.

The system is delivered with a connection cable meeting your countries power connection. Additional power connections with other standards are available as option.

### generatorNETBOX DN2 - Ethernet/LXI Interface

| Order no.  | Resolution | Output Channels                            | Memory           | Output@50Ω | Output@1MΩ |
|------------|------------|--|------------------|------------|------------|
| DN2.653-04 | 16 Bit     | 4 channels 40 MS/s                         | 1 x 512 MSamples | ±3V        | ±6V        |
| DN2.693-08 | 16 Bit     | 8 channels 40 MS/s                         | 1 x 512 MSamples | ±3V        | ±6V        |
| DN2.653-16 | 16 Bit     | 16 channels 40 MS/s                        | 2 x 512 MSamples | ±3V        | ±6V        |
| DN2.656-04 | 16 Bit     | 4 channels 125 MS/s                        | 1 x 512 MSamples | ±3V        | ±6V        |
| DN2.656-08 | 16 Bit     | 4 channels 125 MS/s<br>8 channels 80 MS/s  | 1 x 512 MSamples | ±3V        | ±6V        |
| DN2.656-16 | 16 Bit     | 8 channels 125 MS/s<br>16 channels 80 MS/s | 2 x 512 MSamples | ±3V        | ±6V        |

## Options

| Order no.     | Option   |
|---------------|--|
| DN2.xxx-Rack  | 19" rack mounting set for self mounting  |
| DN2.xxx-Emb   | Extension to Embedded Server: CPU, more memory, SSD. Access via remote Linux secure shell (ssh)        |
| DN2.xxx-DC12  | 12 VDC internal power supply. Replaces AC power supply. Accepts 9 V to 18 V DC input. Screw terminals. |
| DN2.xxx-DC24  | 24 VDC internal power supply. Replaces AC power supply. Accepts 18 V to 36 V DC input. Screw terminals |
| DN2.xxx-BTPWR | Boot on Power On: the digitizerNETBOX/generatorNETBOX automatically boots if power is switched on.     |

## Calibration

| Order no.     | Option   |
|---------------|--|
| DN2.xxx-Recal | Recalibration of complete digitizerNETBOX/generatorNETBOX DN2 including calibration protocol |

## BNC Cables

The standard adapter cables are based on RG174 cables and have a nominal attenuation of 0.3 dB/m at 100 MHz.

| for Connections | Connection | Length | to SMA male    | to SMA female  | to BNC male   | to SMB female |
|-----------------|------------|--------|----------------|----------------|---------------|---------------|
| All             | BNC male   | 80 cm  | Cab-9m-3mA-80  | Cab-9m-3fA-80  | Cab-9m-9m-80  | Cab-9m-3f-80  |
| All             | BNC male   | 200 cm | Cab-9m-3mA-200 | Cab-9m-3fA-200 | Cab-9m-9m-200 | Cab-9m-3f-200 |

### Technical changes and printing errors possible

SBench, digitizerNETBOX and generatorNETBOX are registered trademarks of Spectrum Instrumentation GmbH. Microsoft, Visual C++, Windows, Windows 98, Windows NT, Window 2000, Windows XP, Windows Vista, Windows 7, Windows 8 and Windows 10 are trademarks/registered trademarks of Microsoft Corporation. LabVIEW, DASYLab, Diadem and LabWindows/CVI are trademarks/registered trademarks of National Instruments Corporation. MATLAB is a trademark/registered trademark of The Mathworks, Inc. Delphi and C++Builder are trademarks/registered trademarks of Embarcadero Technologies, Inc. Keysight VEE, VEE Pro and VEE OneLab are trademarks/registered trademarks of Keysight Technologies, Inc. FlexPro is a registered trademark of Weisang GmbH & Co. KG. PCIe, PCI Express and PCI-X and PCI-SIG are trademarks of PCI-SIG. LXI is a registered trademark of the LXI Consortium. PICMG and CompactPCI are trademarks of the PCI Industrial Computation Manufacturers Group. Oracle and Java are registered trademarks of Oracle and/or its affiliates. Intel and Intel Core i3, Core i5, Core i7, Core i9 and Xeon are trademarks and/or registered trademarks of Intel Corporation. AMD, Opteron, Sempron, Phenom, FX, Ryzen and EPYC are trademarks and/or registered trademarks of Advanced Micro Devices. NVIDIA, CUDA, GeForce, Quadro and Tesla are trademarks/registered trademarks of NVIDIA Corporation.