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1 Hardware Specification OR34

1.1 General description

The following specifications concern the OR34 analyzer. OR34 consists of a 3-Series hardware containing optional inputs and processing modules, a PC with an Ethernet interface and NVGate® software with optional plug-in analyzers.

1.1.1 Modules

The following tables detail the complete performances of OR34 hardware. Optional or standard modules may fill the described slots.

Front-end	Dynamic analog inputs	2 slots of 2 inputs (BNC)
	Dynamic analog outputs	1 output (BNC)
	Externals sync	2 trigger/tachometer inputs (BNC)
Processors	Trigger / tachometer / monitoring	1 DSP
	PC communication / recording	1 DSP
	Computation power	1 DSP
Miscellaneous	Remote control	1 with RS232 cable connection (RJ11)

1.2 Case

1.2.1 Mechanicals

Weight	**1.4 kg** (3 lb)	
Dimensions	Case (w.h.d)	**45 mm x 205 mm x 154 mm** (1.8 in x 8.1 in x 8.8 in)
	Overall (w.h.d)	**54 mm x 215 mm x 163 mm** (2.1 in x 8.4 in. x 6.4 in)

1.2.2 Power supply

Power	**< 15 VA**	
External AC Power supply	Voltage	**100 to 240 VAC**
	Frequency	**47 to 63 Hz**
DC	Range	0 V to 28 V
	Overload protection	**31 V** (over this voltage DC poles are short-circuited)
UPS (Uninterrupt-ible Power Supply)	Type	**Internal NiMh battery** (No memory effect)
	Protection against power supply loss or failure	**15 min.**

1.3 Environmental / Compliance with standards

CE	Indicates compliance with EMC Directive **89/336/EEC** and Low Voltage Directive **73/23/EEC**	
Safety	**EN 61010-1 June 2001**	Safety requirements for electrical equipment for measurement, control and laboratory use.
	Over-voltage Category	**II** (Local level mains, appliance, and portable equipment)

	Pollution Degree	**2:** Do not operate in environments where pollutants may be present.
EMC Emission	**EN 50081-1**	Generic emission standard: Residential, commercial and light industry.
	EN 50081-2	Generic emission standard: Industrial environment.
	IEC 61326-A: 2002	Electrical equipment for measurement control and laboratory use EMC requirements. Industrial locations
	CISPR 22	Radio disturbance characteristics of information technology equipment. Class B limits.
	FCC Rules	Complies with the limits for a Class B digital device.
EMC Immunity	**EN 50082-1**	Generic immunity standard: Residential, commercial and light industry.
	IEC 61326-1	Electrical equipment for measurement control and laboratory use EMC requirements.
	EN 50082-2	Generic immunity standard: Industrial environment.
	Linear input response range on interference	Max slew rate on input: **5 V/ µs**
Materials	**ROHS**	**2011/65/EU**
	WEEE	**2002/96/CE ? 2003/108/CE**
Temperature	Operating	**0°C to 50°C** (32°F to 122°F)
	Storage	**-20°C to 65°C** (-4°F to 149°F)
	Absolute maximum rating[ii]	**-35°C to 70°C** (-31°F to 158°F)
Humidity	Max	**93 %** RH at **40°C** non-condensing
Shock	Complies with **IEC 68-2-27**	
	Operating	**100 m/s²** (11 ms, ½ sine) and 700 **m/s²** (3 ms, ½ sine)
	Storage	**200 m/s² (**11 ms, ½ sine) and **1 000 m/s²** (3 ms, ½ sine)
	Absolute maximum rating[ii]	**1 000 m/s²** (3 ms, ½ sine)
Vibration	Complies with **IEC 68-2-6**	
	Operating	**20 m/s², 5-500 Hz, 5mm**
	Storage	**25 m/s², 5-500 Hz, 5mm**
	Absolute maximum rating[ii]	**30 m/s², 5-500 Hz, 5mm**
Bump	Complies with **IEC 68-2-29**	
	Storage	**1000 bumps** in each direction (6) at **400 m/s², 6 ms**
Enclosure	Type	**IP 40**

1.3.1 Radio frequencies sensibility

	Input measured with 50 ? terminator
Radiated RF: 80-1000 MHz, 80% AM 1 kHz, 10 V/m	< 20 µV
Conducted RF: 0.15-80 MHz, 80% AM 1 kHz, 10 V	< 100 µV
Magnetic field: 30 A/m, 50 Hz	< 2 µV

1.4 Front-end

1.4.1 Dynamic inputs

Sampling	Frequencies (Additional decimators allow analysis bandwidth down to 0.8 Hz)	**102.4 kHz, 65.536 kHz, 51.2 kHz, 37.768 kHz, 25.6 kHz, 16.384 kHz, 12.8 kHz, 8.192 kHz, 6.4 kHz, 5.12 kHz, 4.096 kHz, 3.2 kHz, 2.048 kHz**
	Converters	One **24 bit '***sigma-delta ADC'* for each input
	Frequency relative precision	0.5 10^{-4} (typical 1 10 ?5)
	Synchronization	All inputs synchronized on the same sampling clock
Anti-aliasing filter	Type	Over-sampled digital filters
	Slope	**> 400 dB/octave**
	Pass band ripple	**< 0.003 dB**
	Rejection of parasites bands	**> 110 dB (**@ frequency > 0.57 x FS)
	Effective bandwidth	**0.43 x FS** (ex: 23.2 kHz @ 51.2 kS/s)
Range (peak)	With amplifier (included)	**±17.5 mV, ±31.6 mV, ±60 mV, ±100 mV, ±175 mV, ±316 mV, ±600 mV, ±1 V, ±1.75 V, ±3.16 V, ±6 V**
	Direct	**±10 V**
Absolute accuracy	Resolution	**24 bits** (144 dB)
	All input ranges at 1 kHz	±**0.05 dB** (typical ±0.015 dB)
	Temperature variability	**< 0.1 dB** / **10°C**
DC offset	For ranges from **±**1 V to **±**10 V	**< ±0.15 %** of full scale
	For ranges below **±**1 V	**< ±1 mV**
Frequency flatness and phase response	Includes channel to channel match with different gains	
	10 V range, 0 to 20 kHz	**±0.02 dB** / **±0.02** °
	10 V range, 20 to 40 kHz	**±0.05 dB** / **±0.05** °
	175 mV to 6 V ranges, 0 to 20 kHz	**±0.02 dB** / **±0.1** °
	175 mV to 6 V ranges, 20 to 40 kHz	**±0.10 dB** / **±0.5** °
	17.5 mV to 100mV ranges, 0 to 10 kHz	**±0.05 dB** / **±0.3** °
	17.5 mV to 100mV ranges, 10 to 20 kHz	**±0.1 dB** / **±1** °
	17.5 mV to 100mV ranges, 20 to 40 kHz	**±0.4 dB** / **±3** °
Cross-talk	Between N (N is odd) and N+1 inputs:	
	@ 1 kHz: **< -112 dB,** @ 20 kHz: **< -86 dB,** @ 40 kHz: **< -80 dB**	
	Between any inputs excluding: N (N is odd) and N+1 inputs:	
	@ 1 kHz: **< -122 dB,** @ 20 kHz: **< -96 dB,** @ 40 kHz: **< -90 dB**	

Signal to noise ratio	With 50 ? terminators:	
	10 V range, 40 kHz bandwidth: **> 100 dB**, spurious lines **< -115 dB** of full scale	
	10 V range, 20 kHz bandwidth: **> 104 dB**, spurious lines **< -125 dB** of full scale	
Input noise	With 50 ? terminators	
	Thermal input noise	**20 nV/VHz**
	17.5 mV range	20 kHz BW **< 3 µV rms**, 40 kHz BW: **< 4.2 µV rms**
	100 mV range	20 kHz BW **< 3 µV rms**, 40 kHz BW: **< 4.2 µV rms**
	1 V range	20 kHz BW **< 5.4 µV rms**, 40 kHz BW: **< 8.5 µV rms**
	10V range	20 kHz BW **< 44 µVrms**, 40 kHz BW: **< 70 µV rms**
Impedance		**1 M? ±1%, < 100 pF**
Coupling	**AC**	
	DC	
	ICP	**4 mA** power supply with AC coupling
	ICP + TEDS	ICP with reverse current for TEDS reading
	AC and DC float	Independent ground references for each input within the current input range
	GND	Shortcuts input poles to the ground
Protection	On any inputs[ii]	**±60 V** peak without damage
TEDS	Standards	IEEE 1451.4 2001 revision 1
	Templates	Accelerometer/Force meter (**25**) Microphones (**27**, **28** and **29**)
Dynamic	Spectral domain	**> 120 dB**

1.4.2 Dynamic outputs

Sampling	Converters	One **24 bits DAC** for each output
	Synchronization	Same sampling clock as the dynamic inputs
Range	Direct	**±10 V peak**
	With attenuator (included)	**±1 V peak**
	Clipping	**User selectable** in the output range
	Digital gain	**From 10^{-5}** to **10^{3}**
Absolute accuracy	Resolution	**24 bits** (144 dB)
	All output ranges at 1 kHz	**±0.05 dB**
	Temperature drift	**< 0.1 dB / 10°C**
Frequency response	Variation relative to 0 dB at 1 kHz	
	All ranges, at 10 kHz	**±0.05 dB**

	All ranges, at 20 kHz	±**0.15 dB**
	All ranges, at 40 kHz	±**0.8 dB**
Noise floor level	10 V range, 20 kHz bandwidth	**110 dB** of full scale, spurious lines **-125 dB** of full scale
	10 V range, 40 kHz bandwidth	**105 dB** of full scale, spurious lines **-125 dB** of full scale
	1 V range, 20 kHz bandwidth	**99 dB** of full scale, spurious lines **-110 dB** of full scale
	1 V range, 40 kHz bandwidth	**94 dB** of full scale, spurious lines **-110 dB** of full scale
Impedance	Impedance	**50** ?
Current	Max	**±10 mA**
Protection	Sum of injected + generated voltages	±**15 V peak,** On any output[ii] Permanent short circuit supported
Total harmonic distortion	THD @ 1 kHz	**< 0.002%** or **-94 dB** at 20 kHz BW
	THD @ 5 kHz	**< 0.005%** or **-86 dB** at 20 kHz BW
Cross-talk	Output 0 dBV to 50 ? terminated input	Lower than measurable noise

1.4.3 External sync

Sampling	Frequencies	**64 times over-sampling** of the current input sampling (up to **6.4 MHz**)
	Converters	High speed voltage comparator and time counter
Range (peak)	Direct	±**300 mV**, ±**1 V**, ±**3 V**, ±**10 V**
threshold	Amplitude precision	±**1 %** of **range**
Setting	Hystersis	**1%** (of input range) to input range
	Hold off	**0 s** to **500 s**
	Slope	**Rise** or **fall**
	Hardwired pre-divider	From **1** to **255**
Time resolution		**> 160 ns** (0.06° at 1kHz and 1.2 ° at 20kHz)
Pulse rate	Max	**375k pulse/s**
Coupling	**AC**	Cut-off frequency 0.35 Hz ±10% (analog filter)
	DC	
Impedance		**1 M**?, < 100 pF
Protection	on any external sync[ii]	±**60 V peak** without damage

1.5 Digital computation

The following table details the optional DSP modules that can be added to OR34 hardware to fit analysis mode calculation needs.

1.5.1 SPUs

SPU (Signal Processing Units): the following table gives the characteristics of each analysis mode and the associated SPU consumption. For multi-analysis purpose, add the corresponding SPUs of each mode used simultaneously and increase the sum by 10%. "Real-time" means that the analysis speed is faster than the input rate and does not miss any sample.

FFT	Real-time FFT analysis with;
	401 lines (for 801, 1601,3201, 6401 lines multiply requested SPU respectively by 1.25,1.5, 2, 3)
	20 kHz bandwidth (Requested SPU are proportional to bandwidth)
	0% overlap
	1 channel processing = **1 SPU**
1/n Octave	Real-time filter based 1/n octave analysis with:
	1/3rd octave resolution (for 1/12th and 1/24th octave multiply SPU respectively by 2 and 4)
	20 kHz bandwidth (Requested SPU are proportional to bandwidth)
	1 channel processing = **3 SPU**
Order analysis	Real-time order spectrum analysis (re-sampled time signal) with:
	Max order / order resolution = **800**
	Max RPM x Max order = **1 200 000** (requested SPU is proportional to max RPM)
	1 channel processing = **3 SPU**
Recorder	Gap free recording with:
	51.2 kHz sampling rate
	1 channel processing = **1 SPU**

1.5.2 Computation DSPs modules

Type	Sample size	**32 bit floating**
	Computation words	**32/40 bits**
	Memory	**4 MSamples**
Power	Computation capability	**12 SPU** / **DSP module**

1.5.3 Computation DSP module / OR34 unit

Minimum	**1** Computation DSP module	SPU
Maximum	**2** Computation DSP modules	SPU

1.6 Notes

The above specifications describe all the guaranteed capacities and performances of the instrument and are applicable to an OR34-4 hardware, powered for more than 15 minutes, at a stabilized room temperature of 23°C ±5°C and calibrated since less than one year.

The adapted control software NVGate® is described separately.

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[i] Prepared for future use: the related specifications or options are in development.

[ii] Exceeding absolute maximum ratings damages the system and voids guarantee.

2 Hardware Specification OR3X TW

2.1 General description

The following specifications concern $OR35_2$, $OR36_3$ & $OR38_3$ Teamwork instruments. These systems consist of OR3x hardware containing optional inputs and processing modules, a PC with an Ethernet interface, and NVGate® software with optional plug-in analyzers.

2.1.1 Modules

The following tables detail the complete capacity of $OR35_2$, $OR36_3$, & $OR38_3$ hardware system. Optional or standard modules may fill the described slots.

2.1.1.1 OR35

Front-end slots	Dynamic and/or parametric analog inputs	2 slots of 4 universal inputs (BNC)
	Dynamic analog outputs	1 slot of 2 outputs (BNC)
	Externals sync	1 slot of 2 trigger/tachometer inputs (BNC)
	Dynamic Inputs (+2)	1 slot of 2 dynamic inputs shared with Externals sync BNCs
Auxiliary slots	1 slot for: TEDS	
Processor slots	PC, Disk, Bus interfaces	1 slot
	Clock synchronization	1 slot
	Trigger / tachometer / monitoring	1 slot of 1 ForceDSP
	Real-time Processing power	2 slots of 1 ForceDSP
Miscellaneous	Internal hard drive	64 GB internal SSD
	High speed serial ports	1 port for CAN Bus probe
	Remote control (power control, NVTerm)	1 RS232 cable connection (RJ11)

2.1.1.2 OR36

Front-end slots	Dynamic and/or parametric analog inputs	4 slots of 4 universal inputs (BNC)
	Dynamic analog outputs	1 slot of 2 outputs (BNC)
	Externals sync	1 slot of 2 trigger/tachometer inputs (BNC)
	Auxiliary	2 slots of 2 inputs/outputs for optional outputs, Ext. sync or DC (parametric) inputs (BNC)
Auxiliary slots	1 slot for: TEDS	
Processor slots	PC, Disk, Bus interfaces	1 slot
	Clock synchronization	1 slot
	Trigger / tachometer / monitoring	1 slot of 1 ForceDSP
	Real-time Processing power	4 slots of 1 ForceDSP
Miscellaneous	Internal hard drive	128 to 256 GB removable SSD with USB 3.0 port

	High speed serial ports	2 ports for CAN Bus probe
	Remote control (power control, NVTerm)	1 RS232 cable connection (RJ11)

2.1.1.3 OR38

Front-end slots	Dynamic and/or parametric analog inputs	4 slots of 8 universal inputs (BNC)
	Dynamic analog outputs	1 slot of 2 outputs (BNC)
	Externals sync	1 slot of 2 trigger/tachometer inputs (BNC)
	Auxiliary	2 slots of 2 inputs/outputs for optional outputs or Ext. sync or DC (parametric) inputs (BNC)
Auxiliary slots	1 slot for: TEDS	
Processor slots	PC, Disk, Bus interfaces	1 slot
	Clock synchronization	1 slot
	Trigger / tachometer / monitoring	1 slot of 1 ForceDSP
	Real-time Processing power	8 slots of 1 ForceDSP
Miscellaneous	Internal Hard drive	128 to 256 GB removable SSD with USB 3.0 port
	High speed serial ports	2 ports for CAN Bus probe
	Remote control (power control, NVTerm)	1 RS232 cable connection (RJ11)

2.1.2 Basic hardware configuration

Hardware unit contains at least the following modules. All the other modules are optional.

2.1.2.1 OR35

Font end	4 universal analog inputs, 2 analog outputs, 2 trigger/tachometer inputs + 2 analog dynamic inputs
Processors	1 interface board (Ethernet, CAN, Disk, USB)
	1 Clock synchronization module
	1 master ForceDSP module for Trigger / tachometer / monitoring.
	1 ForceDSP computation module
Disk	64 GB internal SSD

2.1.2.2 OR36

Font end	4 universal analog inputs, 2 analog outputs, 2 trigger/tachometer inputs
Processors	1 interface board (Ethernet, CAN, Disk, USB)
	1 Clock synchronization module
	1 master ForceDSP module for Trigger / tachometer / monitoring.

	1 ForceDSP computation module
Disk	128 GB removable SSD with USB 3.0 port

2.1.2.3 OR38

Front-end	8 universal analog inputs, 2 analog outputs, 2 trigger/tachometer inputs
Processors	1 interface board (Ethernet, CAN ,Disk, USB)
	1 Clock synchronization module
	1 master ForceDSP module for Trigger / tachometer / monitoring.
	1 ForceDSP computation module
Disk	128 GB removable SSD with USB 3.0 port

2.2 Connections

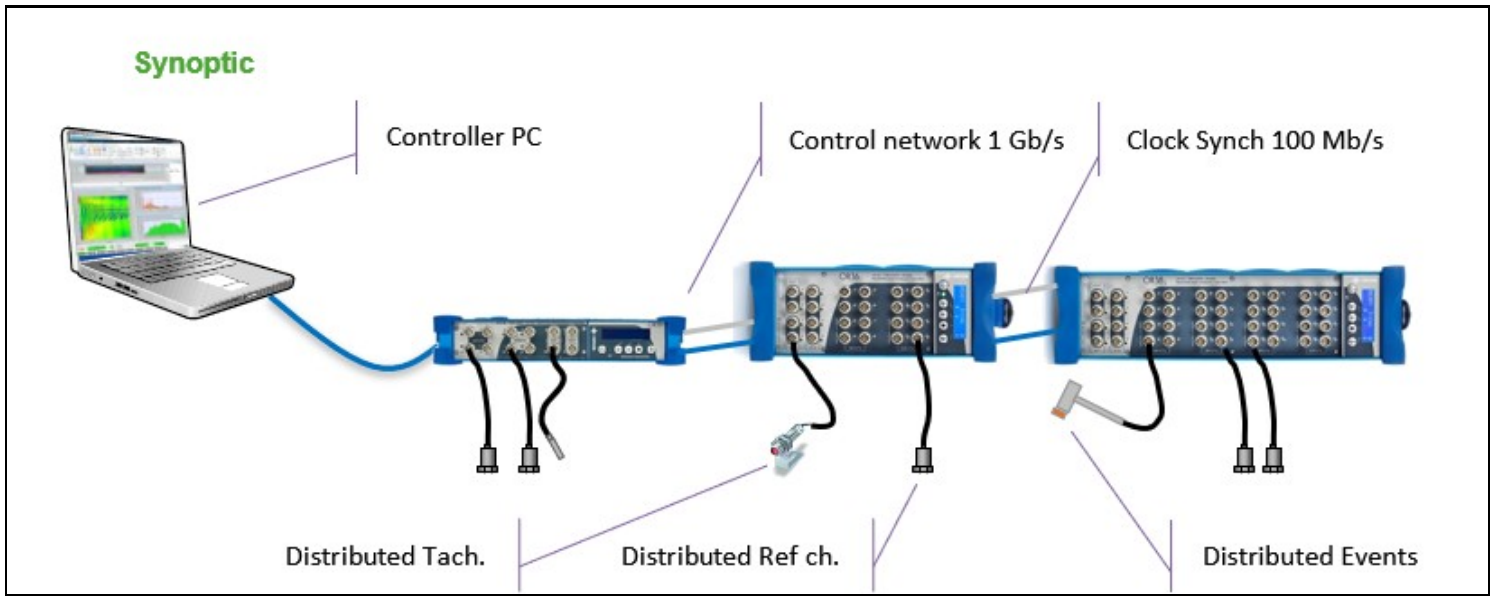
2.2.1 Network

$OR35_2$, $OR36_3$ & $OR38_3$ can operate over multiple network configurations.

Connection to PC	**Ethernet 1 Gb/s** / > 100 m / Cat 5E
Security	Support **SSH tunneling connections**
IP management	TCP/IP / The instrument can be **DHCP server** (non-authoritative)
Supported Networks	**WAN** (Internet) / **LAN** (Company) / **Wi-Fi** (wireless)

2.2.2 Cascade

$OR35_2$, $OR36_3$ & $OR38_3$ can be cascaded flexibly.



Specifications

Configuration	**Switchless daisy-chain** / **30+** cascaded analyzers / **Mixed** analyzer's type
Connections	NVGate: Ethernet **1Gb/s** / Clock sync & Reference distribution : Ethernet **100 Mb/s**
Cables	**> 100 m** per connection / Variable lengths / Cat 5E
Master/Slave	Undifferentiated analyzers' type
Accuracy	**Phase : > ±0.2°** @ 20 kHz / **> 8 ns** @ 51.2 kS/s / **Amplitude: > ±0.02 dB**
Synch. protocol	**IEEE 1588.2** Precision Time Protocol / **SyncE** (synchronous Ethernet) - No phase shift
IP management	**Automatic IP** check and resolution at NVGate start / **DHCP server** (non-authoritative)

2.3 Case

2.3.1 Mechanicals

OR35

Weight	**3 kg** (6.6 lb)	
Dimensions	Case (w.h.d)	**303 mm x 52 mm x 236 mm** (11 15/16" in x 2 1/16" in x 9 9/32" in)
	Overall (w.h.d)	**310 mm x 58 mm x 245 mm** (12 7/32" in x 2 9/32" in x 9 21/32" in)

OR36

Weight	**5.6 kg to 6.1 kg** (12.3 lb to 13.4 lb)	
Dimensions	Case (w.h.d)	**102 mm x 260 mm x 311 mm** (4 1/32" in x 1 1/4" in x 12 25/32" in)
	Overall (w.h.d)	**114 mm x 280 mm x 325 mm** (4 1/2" in x 11 1/32" in x 12 25/32" in)

OR38

Weight	**7.9 kg to 8.8 kg** (17.4 lb to 19.4 lb)	
Dimensions	Case (w.h.d)	**102 mm x 380 mm x 311 mm** (4 1/32" in x 15" in x 12 25/32" in)
	Overall (w.h.d)	**114 mm x 400 mm x 325 mm** (4 1/2" in x 15 3/4" in x 12 25/32" in)

2.3.2 Power supply

OR35

Power	**< 30 VA**	
External AC Power supply	Voltage	**100 to 240 VAC** / 1.7 A max
	Frequency	**50/60 Hz**
DCin	Range	**0 V to 28 V**
	Overload protection	Absolute maximum **< 40 V** / > 31 V poles are disconnected
Battery	Type	Built-in **89 Wh Li-ion** 8 modules
	Autonomy	**3 h**

	safety	Certified under **UN38.3** and **IEC 62133** regulations
	Charge time	**3 h** (typical)
	Charge conditions	DC power supply > 12 V

OR36

Power	**< 60 VA**	
External AC Power supply	Voltage	**100 to 240 VAC** / 1.7 A max
	Frequency	**50/60 Hz**
DCin	Range	**DC power voltage > 17 V will discard the battery to 28 V**
	Overload protection	**31 V** (over this voltage DC poles are short-circuited)
Battery	Type	**NiMh** 11 modules (no memory effect)
	Autonomy	**2 h**
	Charge time	**2 h 30 min** (typical)
	Charge conditions	DC power supply > 18 V

OR38

Power	**< 100 VA**	
External AC Power supply	Voltage	**100 to 240 VAC** / 2.0 A max
	Frequency	**50/60 Hz**
DCin	Range	**DC power voltage > 22 V will discard the battery to 28 V**
	Overload protection	**31 V** (over this voltage DC poles are short-circuited)
Battery	Type	**NiMh** 17 modules (no memory effect)
	Autonomy	**2 h**
	Charge time	**3 h** (typical)
	Charge conditions	DC power supply > 24 V

2.4 Environmental / Compliance with standards

CE/CB/FCC	Indicates compliance with EMC Directive **89/336/EEC** and Low Voltage Directive **73/23/EEC**	
Safety	**EN 61010-1**	Safety requirements for electrical equipment for measurement, control and laboratory use.
	Over-voltage Cat.	**II** (Local level mains, appliance, and portable equipment)
	Pollution Degree	**2:** Do not operate in environments where pollutants may be present.
EMC Emission	**EN 50081-1**	Generic emission standard: Residential, commercial and light industry.
	EN 50081-2	Generic emission standard: Industrial environment.
	IEC 61326-1	Electrical equipment for measurement control and laboratory use EMC requirements.
	CISPR 22	Radio disturbance characteristics of information technology equipment: 22 Class B limits.

	FCC Rules	Complies with the limits for a Class B digital device.
EMC Immunity	**EN 50082-1**	Generic immunity standard: Residential, commercial and light industry.
	IEC 61326-1	Electrical equipment for measurement control and laboratory use EMC requirements.
	EN 50082-2	Generic immunity standard: Residential, commercial and light industry.
	Linear input response range on interference	max slew rate on input**: 5 V/ µs**
Materials	**ROHS**	**2011/65/EU**
	WEEE	**2002/96/CE - 2003/108/CE - 2012/19/EU**
Temperature	OR35, OR36 Operating	**-20°C Requires a warmup (power on + run NVGAte) which last 1 min per 1 Celsius degree below zero. to 50°C** (-4°F to 122°F)
	OR38 Operating	**-20°C**[4] **to 45°C** (-4°F to 113°F)
	Storage	**-20°C to 65°C** (-4°F to 149°F)
	Absolute maximum rating[ii]	**-35°C to 70°C** (-31°F to 158°F)
Humidity	Max **80 % RH** at 40°C non condensing	
Shocks	Complies with **IEC 68-2-27**	
	Operating	**100 m/s²** (11 ms, ½ sine) and **700 m/s²** (3 ms, ½ sine)
	Storage	**200 m/s² (**11 ms, ½ sine) and **1 000 m/s²** (3 ms, ½ sine)
	Absolute maximum rating[ii]	**1 000 m/s²** (3 ms, ½ sine)
Vibrations	Complies with **IEC 68-2-6**	
	Operating	**10 m/s², 5-500 Hz, 5mm**
	Storage	**25 m/s², 5-500 Hz, 5mm**
	Absolute maximum rating[ii]	**30 m/s², 5-500 Hz, 5mm**
Enclosure	OR35	**IP 40**
	OR36, OR38	**IP 42**

2.4.1 Radio frequencies sensibility

	Input measured with 50 ? terminator
Radiated RF: 80-1000 MHz, 80% AM 1 kHz, 10 V/m	< 20 µV
Conducted RF: 0.15-80 MHz, 80% AM 1 kHz, 10 V	< 100 µV
Magnetic field: 30 A/m, 50 Hz	< 2 µV

2.4.2 OR36 & OR38 Removable Disk

Performances	Type	**1.8" - SSD - 128 GB** or **256 GB - MLC NAND** Flash Memory
	Shock	**15 000 m/s²** - 0.5 ms ½ sine
	Vibrations	**50 m/s²** - 10 to 2 kHz

	Throughput	**32 inputs + 6 aux.** @20 kHz BW ? **10h 40min** gap free
	MTBF	*'2 x 106* **'hours**
Case	Case (w.h.d)	**83 mm x 20 mm x 97 mm** (3.24 in x 0.78 in x 3.79 in)
	weight	**0.200 kg** (0.55 lb)
Connection	Into the analyzer	**SATA** - **1.5 Gb/s** sustained read/write
	To the PC	**USB 3.0** - **200 Mb/s** sustained read
Power supply	On PC	**USB** powered
	On analyzer	**Internal** power supply

2.5 Front-end

Each front end slot of the OR35 (4 BNC + 2 BNC), OR36 (4 BNC) and the OR38 (8 BNC) can be occupied by one of the following inputs type:

- Universal inputs
- Dynamic inputs
- Parametric inputs

2.5.1 Universal inputs

The universal inputs gather both dynamics and parametric input in the same board and connector. The universal inputs are necessary to support the XPod signal conditioners. The type of use of the universal inputs is selectable by software (NVGate) during the analyzer operations.

The universal inputs fulfill all the performances, precision and operability of each specific input type.

2.5.2 Dynamic inputs

Sampling	Sampling frequencies (Additional decimators allow analysis bandwidth down to 0.8 Hz)	**102.4 kHz, 65.536 kHz, 51.2 kHz, 37.768 kHz, 25.6 kHz,** **16.384 kHz, 12.8 kHz, 8.192 kHz, 6.4 kHz, 5.12 kHz, 4.096 kHz, 3.2 kHz, 2.048 kHz**
	Converters	One **24 bit '***sigma-delta ADC'* for each input
	Frequency relative precision	**0.5 10^{-4}** (typical 1 10 $^{?5}$)
	Synchronization	All inputs synchronized on the same sampling clock
Anti-aliasing filter	Type	Over-sampled digital filters
	Slope	**> 400 dB/octave**
	Pass band ripple	**< ± 0.005 dB**
	Rejection of parasites bands	**> 100 dB (**@ frequency > 0.57 x FS)
	Effective bandwidth	**0.45 x FS** (ex: 23.4 kHz @ 51.2 kS/s)
Range (peak)	With amplifier (included)	**±100 mV, ±300 mV, ±1 V**
	Direct	**±10 V**
	With attenuator (included)	**±40 V**

Absolute accuracy	Resolution	**24 bits** (144 dB)
	All input ranges at 1 kHz	**±0.05 dB** (typical ±0.015 dB)
	Temperature variability	**< 0.002 dB** / **10 °C**
DC offset	±100 mV, ±300 mV and ±1V ranges	**<** ± **100 µV**
	±10 V range	**<** ± **1 mV**
	±40 V range	**<** ± **2 mV**
Frequency flatness and phase response *(Includes channel to channel match with different ranges*)	*Inside one front-end*	
	±10 V range, DC to 20 kHz	**< ±0.02 dB** / **< ±0.02 °**
	±10 V range, 20 kHz to 40 kHz	**< ±0.05 dB** / **< ±0.05 °**
	±0.1 V, ±0.3 V , ±1 V ranges, DC - 20 kHz	**< ±0.02 dB** / **< ±0.1 °**
	±0.1 V, ±0.3 V, ±1 V ranges, 20 kHz - 40 kHz	**< ±0.1 dB** / **< ±0.5 °**
	±40 V range, DC - 20 kHz	**< ±0.1 dB** / **< ±0.4°**
	±40 V range, 20 kHz - 40 kHz	**< ±0.1 dB** / **< ±0.8 °**
	Mixed front-ends	
	±10 V range, DC to 20 kHz	**< ±0.02 dB** / **< ±0.2 °**
Cross-talk	*Between N (N is odd) and N+1 inputs:*	
	@ 1 kHz: **< -120 dB,** @ 20 kHz: **< -96 dB,** @ 40 kHz: **< -90 dB**	
	Between any inputs excluding: N (N is odd) and N+1 inputs:	
	@ 1 kHz: **< -140 dB,** @ 20 kHz: **< -114 dB,** @ 40 kHz: **< -108 dB**	
Signal to noise ratio	*With 50 ? terminators:*	
	±10 V range, 40 kHz bandwidth: **> 100 dB**, spurious lines **< -115 dB** of full scale	
	±10 V range, 20 kHz bandwidth: **> 104 dB**, spurious lines **< -125 dB** of full scale	
Input noise	*With 50 ? terminators:*	
	Thermal input noise	**20nV/VHz**
	±100 mV and ±300 mV ranges	20 kHz BW **< 3.5 µV** rms, 40 kHz BW: **< 5 µV** rms
	±1 V range	20 kHz BW **< 5.4 µV** rms, 40 kHz BW: **< 8.5 µV** rms
	±10 V range	20 kHz BW **< 44 µV** rms, 40 kHz BW: **< 70 µV** rms

Impedance		**1 M? ±1 %, < 100 pF**
Protection	Overvoltage	**±60 V peak without damage - On any input**[ii]

Dynamic	Spectral domain	**140 dB 25601 lines** / **30 sec. averaging**
Coupling	AC	**-3dB Cut-off frequency 0.35 Hz ±10% (first order analog filter)** See curve
	DC	
	ICP	**2 mA** or **4 mA** power supply with AC coupling (±10%)
	ICP + TEDS	ICP + reverse current on TEDS reading operations
	GND	Shortcut to ground - **Automatic current limitation** to 50 mA
Floating	Coupling	**AC** or **DC** / All ranges / overall voltage **< ±40 V**
	Common mode voltage (all ranges)	Max: **±12 V**
TEDS	**Standards**	**IEEE 1451.4 2001 revision 1**
	Supported templates	Accelerometer/Force meter (**25**) Microphones (**27**, **28** and **29**)

2.5.3 Parametric (DC) inputs

The following parametric inputs can be added to the standard $OR36_3$ or $OR38_3$ hardware configuration as follows:

- On the **auxiliary slots** by set of 2 inputs (max 4) *DC inputs on auxiliary slots features 16 bit dedicated converters*
- On the **OR36** as replacement of 4 dynamics inputs (max 12)
- On the **OR38** as replacement of 8 dynamics inputs (max 24)

The following specifications apply to the universal inputs.

Sampling	Bandwidth / Sampling	**-3 dB @ 3.5 Hz** Independent from dynamic sampling clock
	Converters	One **24 bit sigma-delta ADC** for each input
Range (peak)	Direct	**±10 V**
	With attenuator (included)	**±40 V**
Frequencies rejection	Notch filters frequencies	**50 Hz** & **60 Hz @ ±1%**
	Rejection	**> 120 dB**
Amplitude	Effective resolution	**22 bits** (out of noise)
	Linearity	Typ. **0.0003 %** of input range peak
	Gain drift	**20 ppm** of input range peak/**°C** typ.
Offset	Offset	±10 V range: < ±**1 mV** / ±40 V range: < ±**2 mV**
	Offset drift	±10 V range: **< 40 µV**/**°C** / ±40 V range: **< 160 µV**/**°C**
Impedance		**1 M?, 5 nF** typ.
Protection	On any input[ii]	**±60 V** peak
Input Noise	*With 50 ? terminators, excepted* ±40 V range*:*	
	Input noise	**< 4 µV** rms in 0.1 to 2 Hz BW ? Typ **2 µV rms**
	Max. Deviation	**< 6 µV** peak

Dynamic outputs

Sampling	Converters	One **24 bit DAC** for each output
	Synchronization	Same sampling clock as the dynamic inputs
Range	Direct	**±10 V peak**
	With attenuator (included)	**±1 V peak**
	Clipping	**User selectable** in the output range
	Digital gain	From **10^{-5}** to **10^{3}**
Absolute accuracy	Resolution	**24 bits** (144 dB)
	All output ranges at 1 kHz	**±0.05 dB**
	Temperature variability	**< 0.1 dB** / **10 °C**
Frequency response	*Variation relative to 0 dB @ 1kHz*	
	All ranges, at 10 kHz	< **±0.05 dB**
	All ranges, at 20 kHz	< **±0.15 dB**
	All ranges, at 40 kHz	< **±0.8 dB**

Dynamic outputs (continued)

Noise floor level	10 V range, 20 kHz bandwidth	
	10 V range, 40 kHz bandwidth	
	1 V range, 20 kHz bandwidth	
	1 V range, 40 kHz bandwidth	
Impedance	User selectable	**50** ?, **600** ? or **Grounded**
Current	Max	**±10 mA**
Protection	Sum of injected + generated voltages	**±15 V peak,** On any output[ii] Permanent short circuit supported
Total harmonic distortion	THD @ 1 kHz	**< 0.002%** or **-94dB** at 20 kHz BW
	THD @ 5 kHz	**< 0.005%** or **-86dB** at 20 kHz BW
Cross-talk	Output 0 dBV to 50 ? terminated input	**Lower than measurable noise**

External sync

Sampling	Frequencies	**64 times over-sampling** of the current input sampling (up to **6.4 MHz**)
	Converters	High speed voltage comparator and time counter
Ranges (peak)		**±300 mV**, **±1 V**, **±3 V**, **±10 V**, **±40 V**
Resolution	Amplitude accuracy	**±1%** of **range**
Setting	Hysteresis	**1%** (of input range) to input range
	Hold off	**0 s** to **500 s**
	Slope	**Rise** or **fall**

	Hardwired pre-divider	**1** to **255**
Accuracy	**Time resolution**	**> 160 ns** (0.06° at 1 kHz and 1.2° at 20 kHz)
Pulse rate	Max	**375 kpulse/s**
Coupling	**AC**	**-3dB Cut-off frequency 0.35 Hz ±10% (first order analog filter)**
	DC	
Impedance		**1 M**?, < 100 pF
Protection	on any external sync[ii]	±**60 V peak** without damage

2.5.4 Expander modules (XPod)

With the universal inputs the $OR35_2$, $OR36_3$ and $OR38_3$ can receive signal conditioning modules called XPod. Different Xpod types are available.

Wheatstone bridge XPod

Connectors	Type	**Sub-D9 ? Female**
Bridges	Mounting	**Full**, **Half** and **quarter**
	½ bridge completion resistors	2 * **10 k?** - 0.1% - 10 ppm
	¼ bridge completion resistors	120 **?** or 350 **?** - 0.1% - 25 ppm
	Excitation voltages	**0 to 10 V**
	Excitation currents	0 to 4 V: **< 30 mA -** 4 V to 10 V: < **12 mA**
	Sensing	**Negative** and **positive** probes
Amplifiers	Type	Differential - DC capable
	Gains	**10** or **100**
	Error	**< 0.01 dB**
Inputs	Ranges	±**100 mV -** ±**1 V**
	Common mode voltage	**±7** V without limiting differential input
	Impedance	**1 M?**
	Noise floor levels (100 Hz to 20 kHz)	Gain 100: **2 µVrms** - Gain 10: **4 µVrms**
DC offset	Temperature drift	**1 µV/°C**
	Compensation resolution	**3 %** of present offset
Protection	Overvoltage	Device on: max **±30 V** - device off: max **±15 V**

Temperature XPod

The temperature XPod operates on the universal or parametric inputs. The XPod support thermocouple and RTDS conditioning, cold point compensation and linearization. Amplified signal are injected in the analyzer on the ±10 V range.

Connectors	Type	Mini Thermocouple/RTD type
	Pins	**3 polarized pin** - spring-loaded - compatible with 2 point plugs

	Material	Glass filled thermoplastic - White body
Thermocouples	**Type J**	-**210 °C to +1 100 °C** - Yellow LED
	Type K	**-200 °C to +1 300 °C** - Green LED
	Type T	**-200 °C to +390 °C** - Brown LED
	Type N<ref>) Add 0.1°C to absolute temperature error</ref>	**-200 °C to +1 200 °C** - Pink LED
	Type E	**-200 °C to +800 °C -** Purple LED
	Cold compensation	Integrated - 2 sensors - user on/off
	Absolute temperature error	> -150 °C : ±**0.9°C** / < -150 °C : ±(**0.4°C** + **0.1%** of MT<ref>) MT is Measured Temperature</ref>)
RTDS	PT 100	-**190 °C to +880 °C*** ? Blue LED
	PT 1000	**-190 °C to +880 °C*** - Grey LED
	Absolute temperature error	±(**0.4°C** + **0.3%** of MT[9])
	Wires	3 wires connections
	Current	PT100: **500 µA to 4 mA** - PT1000: **500 µA** to **1 mA**

*Calibrated up to +800 °C

2.5.5 CAN BUS probe

The CAN bus probe is connected to the $OR35_2$, $OR36_3$ and $OR38_3$ via the high speed serial ports. It offers a passive CAN bus listener with the following specifications.

Type	Standards	**CAN 2.0A** & **CAN 2.0B** / Compliant with **J1939 protocol**
	Speed	**125 kb/s** to **500 Mb/s**
Probe	Probe	**High Z** / **Analyzer** or **bus** powered
	Connectors	CAN : **Sub-D 15** / Analyzer: **High speed serial port** (1,5 m)
Capacity	Channels	**24 @ 10 Hz** refresh rate / **Synchronous** with analyzer inputs

2.6 Digital computation

The following table details the calculation needs (SPUs) for each analysis plug-in of NVGate software.

Narrow band analysis (FFT)	Real-time FFT analysis with;
	401 lines (for 801, 1601,3201, 6401 lines, multiply requested SPU respectively by 1.25, 1.5, 2, 3)
	20 kHz bandwidth (Requested SPU are proportional to bandwidth)
	0% overlap
	1 channel processing requires **1 SPU**
Synchronous order analysis	Real-time order spectrum analysis (re-sampled time signal) with:
	Any duration of visualization, any averaging
	20 kHz bandwidth (Requested SPU are proportional to bandwidth)

	1 channel processing requires **3 SPUs**
Time Domain analysis	Real-time time domain monitor and statistical analysis with:
	Simultaneous time view and statistical extraction. Any duration of visualization, any averaging
	20 kHz bandwidth (Requested SPU are proportional to bandwidth)
	1 channel processing requires **3 SPU**
1/n Octave	Real-time filter based 1/n octave analysis with:
	1/3rd octave (for 1/12th and 1/24th octave multiply requested SPU respectively by 2 and 4)
	20 kHz bandwidth (Requested SPU are proportional to bandwidth)
	1 channel processing requires **3 SPUs**
Recorder	Gap free recording with:
	51.2 kHz sampling rate gap free recording
	1 channel processing requires: **0.66 SPU**

2.6.1 Signal Processing Units

SPU (Signal Processing Units): the previous table gives the characteristics of each analysis mode and the associated SPU consumption. For multi-analysis purpose, add the corresponding SPUs of each mode used simultaneously and increase the sum by 10%. "Real-time" means that the analysis speed is faster than the input rate and does not miss any sample.

2.6.2 Special DSPs modules

The following DSPs are always integrated in OR35, OR36 & OR38 hardware.

Master DSP module	Monitor computations	**FFT 401 lines** (max 4 Channels)
	Time domain detectors	**DC, Max, Min, RMS, Kurtosis** (on the monitor Channels)
	Special	Auxiliary inputs, Events, Tachs, Torsion, Generators

2.6.3 Computation DSPs modules

The following computation DSP modules are optional

ForceDSP

Type	Sample size	**32 bit floating**
	Computation words	**32/40 bit**
	Internal memory	**16 MSample**
Power	**Computation capability**	**Up to 48<ref>: SPUs are variable in ForceDSPs. Consult customer.care@oros.com for advanced real-time analysis</ref> SPU / DSP module**
Input sharing	Inputs per DSP	**8 max**

Number of DSPs/unit

Minimum	**1** Computation DSP module	**Up to 4810 SPU**

OR35 Max.	**2** Computation DSP modules	**Up to 9610 SPU**
OR36 Max.	**4** Computation DSP modules	**Up to 19210 SPU**
OR38 Max.	**8** Computation DSP modules	**Up to 38410 SPU**

2.7 Notes

The previous specifications describe all the guaranteed capacities and performances of the instrument and are applicable to an $OR35_2$-10, $OR36_3$-16 or $OR38_3$-32 hardware powered for more than 15 minutes at a stabilized room temperature of 23°C ±5°C and calibrated since less than one year.

The adapted control software NVGate is described separately.

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[i] Prepared for future use: the related specifications or options are in development.

[ii] Exceeding absolute maximum ratings damages the system and voids guarantee.

Specifications not binding; OROS reserves its right to change these specifications without notice.

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3 NVGate Specification

The following official specifications concern NVGate® software for OR10, OR34, OR35, OR36, OR38 and Mobi-Pack® multi-analyzer instruments. These specifications apply for on-line analysis and post analysis with or without the instrument connected to the PC. This specification applies for NVGate version 12 or upper and Teamwork instruments.

3.1 Modules

NVGate® software is based on a general-purpose platform where optional analysis modules called plug-in analyzers are added.

The FFT plug-in features specific add-on for specialized analysis.

3.1.1 NVGate®Platform

NVGate® platform provides a comprehensive set of tools for noise and vibration acquisition, recording and analysis.

These functions are arranged in 4 parts:

- ***Signal sources*** that condition, provide and store time domain signals.
- ***Shared resources*** that apply simultaneously or independently on distributed signal to plug-in analyzers.
- ***Operational tools*** that increase measurement efficiency and reliability.
- ***General-purpose analysis*** for monitoring and result tracking.

Signal sources	**Front-end**	Controls dynamic inputs, generators, external synchronization/tach. input and parametric (DC) inputs.
	Recorder	Record and store time domain signal on analyzer or PC hard disc. Records dynamic, parametric (DC) and ext. synch/tach inputs with multiple frequencies.
	Player	Visualize, listen, playback on output or generate signals for post-analysis purpose. Based on recorded or imported time domain signal file.
Shared resources	**Filters**	High/low pass, Band/Stop pass, single and double integrator, differentiator, A and C acoustic laws
	Events	Edge detection, DC levels, Delta DC levels, RPM, Delta RPM, Manual, Time period, combinations.
	Weighting windows	Programmable Force and response, Hanning, Hamming, Kaiser Bessel, flat-top, uniform.
	Tachometers	Compute RPM from ext. sync and input pulses, DC, CAN. Fractional, simulated and combined tach.
Operational tools	**Transducers management**	Automatic calibration, database management, calibration history, automatic setup of inputs, TEDS management.
	Masks	Mask editor for spectra, profiles, 1/n octave, order spectra
	Report	On-line report editor, automated report generation, word or Excel files.
	Automation tools	Macros, sequence from Excel® sheet, alarms based on mask comparison, customizable control panel, restricted user profiles, remote controller interface.
General purpose analysis	**Monitor**	4 channels FFT analyzer with input hot swap. Statistical extraction (RMS, Max, Min, Kurtosis) from time domain with programmable band-pass filter.
	Waterfall	Synchronized stack for 2D (spectra) and scalar (order, overall). 3D, color map and profiles displays. Extraction capabilities.

NVGate® Plug-ins analyzers

In addition to the standard functions featured in the software platform, NVGate® can receive additional plug-in analyzers that offer flexible configuration of independent analysis modes.

FFT	**Fast Fourier Transform** - Time to Frequency conversion with multiple average domains, combinable trigger, zooms and cross functions.	General-purpose frequency analysis, machinery signature, modal analysis acquisition (hammer or shaker), machinery diagnostic.
FFT Add-ons		
CBT	**Constant Band Tracking** - Order extraction at constant bandwidth	Gears mesh analysis, gearboxes noise and vibration tracking.
FFTDiag	**Cepstrum, Auto** and cross **correlation**, **DC**, **Min**/**Max, Pk, pk**/**pk** and **crest factor**.	Set of functions dedicated to the diagnostics of industrial machineries.
TDA	**Time Domain Analysis** ?Time view (oscilloscope). True statistical extraction, averaging.	Machinery diagnostic, long term acquisition monitoring, critical acquisition control, large structure damping control, shocks determination, machinery health control, trend analysis.
SOA	**Synchronous Order Analysis** - Time to Order re-sampling with angle or order averaging, acoustic weightings, multiple tach management.	Rotating machinery balancing. In vehicle order to noise correlation R&D. Pump, compressors, turbines and speed reducer/multiplier test.
SOADiag (SOA Add-on)	**Copstrum?,** Auto and cross **correlation**, Revolution **synchronous statistics**, Order transmission Function (**ORF?**), **X** functions	Set of diagnostic functions based on the synchronous order analysis for rotating part transmission and forced vibration extraction.
OCT	**1**/**n Octave Constant Percentage Band filters** - 1/n octave detectors set with multiple averaging modes.	General-purpose industrial noise analysis. Vehicle acoustics R&D. Noise test.
OVA	**Overall Acoustics Detectors** - 3 detectors + 1 peak detection per channel with parallel averaging and acoustic weightings.	Industrial acoustic, sound power measurements. Machinery with cycles, R&D and test.

3.1.2 NVGate® Options

Beside the plug-ins analyzers and their add-on, the 3-Series analyzers software also features options:

IVC	Instantaneous angular velocity converter	Torsional measurements from Ext. Synch inputs
CTE	Combined Tachometer editor	Tachometer math editor - 2 inputs, 1 output
VIN	Virtual Inputs	Real-time math combination of dynamic inputs
VDC	Virtual DC	Real-time math combination of parametric inputs
A-Samp	Angular sampling for SOA	Real-time Angular sampling of inputs

3.2 Signal sources

NVGate®/OROS 3-Series multi-analyzers platform can process signal coming from different sources. These sources are detailed in this section as modules.

3.2.1 Front-end

The front-end module gathers the different input and output settings available in the instrument unit. In addition, the front-end module generates virtual signals (synthesized) when running the office mode (no unit connected to the PC) which is useful for set-up.

Front-end settings

Dynamic inputs	Sampling clock	**102.4 kS/s to 2,048 S/s** or **65.536 kS/s to 3,200 S/s**
		200 V polarization **on**/**off** per block of 8 input

	LEMO[2] connectors management	
	Coupling[3,4]	**AC** (0.35 Hz) - **DC** - **ICP** - **ICP + TEDS** - **AC float - DC float** - **Grounded**
	Node information[3]	**Label** - **component** - **node** - **direction** (± X ,Y,Z) - **type** (translation, rotation)
	Physical quantity[3,4]	Any physical quantity can independently be associated to inputs.
	Sensitivity[3,4]	User defined in **V/unit.**
	Range[2]	**Pk to pk** expressed in the associated unit, (taking in account sensitivity) - **linear** or **dB**
	External conditioner compensation[3]	**Gain** - **polarity** - **offset**.
	Filter[3]	**Any NVGate** filter can independently be applied to each dynamic input (See Filters §)
	Auto-range	Enable/disable auto-ranging independently on any input
Ext. sync inputs	Sampling	over-sampled 64 time the dynamic inputs sampling
	Coupling[3]	**AC** (0.35 Hz) - **DC**
	Information[3]	Label
	Physical quantity[3,4]	Any physical quantity can be associated to inputs.
	Sensitivity[3,4]	User defined in **V/unit**.
	Range[3]	**Pk to pk** expressed in the associated unit, (taking in account sensitivity) - **linear or dB**
	External conditioner compensation[3]	**Gain**, **offset**.
	Edge detection[3]	**Threshold** (in associated unit) - **Edge** (rise, fall) - **Hystersis** - **hold off** (sec)
	Pre-divider[3]	**Hardware - 1** to **255** pulses ? accept up to **375 kpulses/sec**
	Post-multiplier[3]	**1 to 50 pulses/trigger** - Generate higher frequencies on low rate triggers. (ex. GPS)
	Tachometer mode[3]	**Pulse per rev**: 0.5 to 4096 - **average** (n rev) - **min** (detect stopped shaft) and **max RPM** speed - **hold off** (in % of revolution) - **rotation** (clockwise/counterclockwise)
	Torsional mode[2]: Instantaneous angular velocity converter	**Pulse per rev**: 1 to 4096 - **min** (detect stopped shaft) and **max RPM** speed - **sliding average** (1 to 20 samples) - **Missing pulse number**: 0 to 5, **Missing pulses detection** :1 to ±20%: of previous pulses duration- **Filters** (dt, dt², 1/dt)
	Angular sampling[2]: multi-pulse/rev clock used for signal sampling	for **SOA** - **Pulse per rev**: 1 to 4096 continuously (no power of 2 limitation) - Real time, in line **anti-aliasing** - **Missing pulse number**: 0 to 5, **Missing pulses detection**: 1 to ±20% of previous pulses duration ? **Phase reference**: Any tachometer including same input

Outputs	Sampling	Same as dynamic inputs
	Generated signals[3]	Any **outputs signals**, see §outputs - play-back of signal file tracks - DC levels - Inputs playback (Delay > 256 samples)
	Filters[3]	**Any NVGate** filter can independently be applied to each dynamic output (See Filters §)
	Impedance[3]	**50 ohm**, **600 ohm** (only OR36 and 0R38) or grounded

	Gain[3]	**-100 dB** to **+ 120 dB**
	Synchronization[3]	**Free run** or **linked** to acquisitions **runs**
	Level and phase transition[3]	No (**Steps**) - controlled (**ramp**) - user selectable ramp time
	Clipping	User selectable - **protects shaker** and **amplifier**.
	Events (can trig analysis or record)[3]	Outputs **stabilized** - new **step reached** - **start & stop sweep**
	Controls	**Emergency stop** - **mute**/un-mute all
Parametric[1](DC) inputs	Sampling	**12.3 to 12,8 S/s -** 10 Hz to 100 Hz harmonics rejection
	Information[3]	Label
	Physical quantity[3,4]	Any physical quantity can be associated to inputs.
	Sensitivity[3,4]	User defined in V/unit.
	Range[3]	Pk to pk expressed in the associated unit (taking in account sensitivity) - **linear** or **dB**
	External conditioner compensation[3]	**Gain** (-120 dB to +20 dB) - **polarity** - **offset** (< range).
	Auto-range	**Enable**/**disable** auto-ranging **independently on any input**
Auto-ranging	Type	**Normal** - on **Peak** detection
	Margin	Select the first highest range with **0 dB - 3 dB** or **20 dB** margin
	Duration (apply for normal auto-range)	**0** to **10 sec**.
	Peak detection	User select input were to detect peak, auto-range applies on all enabled input at each peak detection.
	Peak parameters settings	**1 to 10** peaks - **sensitivity** (low, normal, high) - **rise**, **fall** or **any edge**.
Checking	ICP *(check not available on OR34)*	Test and report (**Open**, **shortcut**, **ok**) all enabled inputs.
	TEDS	Transducers automatic recognition - Complies with **IEEE 1451.4 2004 Rev. 1.0**

2: Optional features

3: Independent for each input

4: Linked with the transducer database

3.2.2 Front-end results & connections

The following results are available for monitoring and connection to analysis mode (plug-in analyzers)

Dynamic inputs & torsional[1] inputs	Monitoring[3]	Time domain instantaneous signal - Size **256 samples**
	Status led[3] (docking tool bar)	**Overloaded** = red - **overload occurred since last start** = red with yellow center - **ok** = green - **under load** (20 dB below range) = green with yellow center
	Connection[3]	To any: **plug-in analyzer channel, monitor channel, Virtual inputs**, **recorder track**, **edge event detector** & **tachometer**

Ext. Sync inputs	Monitoring[3]	Time domain **instantaneous status** (1 = threshold crossed, 0 = no event) - Size **256 samples**.
	Connection[3]	To any: **start** or **stop averaging** of plug-in analyzers, recorder **start** or **stop recording**, **waterfall start** or **stop acquisition**, **new block trigger** for FFT and SOA and **new slice** for **waterfall** acquisition. To **torsional**, **tachometer** & **angular sampling**
Parametric[1] (DC) inputs & CAN[1]parameters	Monitoring[3]	**Profiles** versus time (**160 ms to 163 sec** user selectable), and **digital/analog view meter**.
	Status led[3]	**Overloaded** = red - **ok** = yellow - **under load** (20 dB below range) = Cyan
	Connection[3]	To any: **recorder track**, **waterfall reference (Z/X axis)** and **profiles**, **level delta level detectors** and **virtual DC**

3.2.3 Recorder / Player

OROS 3-Series/NVGate instruments feature a recorder and a player module that allows users to:

- Record time domain signal, torsional inputs, trigger and parametric input.
- Export or import time domain files.
- Playback time domain files on analyzers outputs during analysis
- Listen to recorded tracks on the PC speakers.
- Post-analyze time domain files using the available plugs-in.

3.2.4 Recorder

The recorder module saves time domain signal into files located on 3-Series analyzer HD, Mobi-Disk™ or PC HD. This is available on 2 different modes:

- **On-line record**, the chosen inputs (Dynamic, ext. sync, parametric) are recorded at selected sampling frequency during acquisition. Real-time analysis is available simultaneously.
- **Time and tracks split**, the chosen recorded tracks (from signal file) are played back in the recorder using the post-analysis mode. The sampling frequency, duration, and/or track arrangement can be changed.

Recorder settings

Bandwidths	Dynamics inputs	**2 groups** of user selectable sampling frequency - From **102.4 kS/s** to **2.048 S/s** (**40 kHz** to **800 mHz**) - available simultaneously
	Ext. sync inputs	**Automatic selection** at Front-end sampling frequency - Resolution is **64 time Front-end sampling frequency**
	Parametric (DC) inputs	**12.5 S/s** (**50 Hz** rejection) - **15 S/s** (**60 Hz** rejection)
Tracks	Number	**14 tracks<ref>For OR34, OR35 and Office-8 licenses.</ref>** (8 + 6 ext. sync) or **38 tracks<ref>For OR36, OR38 and Office licenses.</ref>** (32 + 6 ext. Sync) Sum of connected licenses using multiple hardware
	Saved settings / track	**Label** - **Coupling** - **External gain** - Input **range** - **Sampling frequency** and **signal bandwidth - Component** - **Node** number - **Direction** - **Type** - Associated **transducer** - **Unit - Sensitivity** and **Offset** compensation.
Modes	Start to time	Start recording on run or any activated event - **Stop recording when duration ends** - Duration **10 ms** to **available space on target HDD.**
	Start to stop	**Start recording** on **run** or **any activated event** - Stop recording on stop on any activated event - Start and stop event can be the same - Duration **10 ms** to **available space on active drive** (PC or OR3x).
	Time to stop	

		Memorize the **earliest x seconds** - Stop = **stop** or any **activated event** - Duration **10 ms** to **2 GSamples** (limited by the drive available space)
Triggering	Start recording (new record)	Any **NVGate® event** plus **manual** and **free run**
	Stop recording (end current record)	Any **NVGate® event** plus **manual** and **free run**
	Start delay	Positive = **unlimited** - negative = **128 kSamples**
	Stop delay	Positive = **unlimited** - negative = **0**
Markers	Saved in the record files	Added by tool bar or shortcut - **comment fields** editable during record or at end of acquisition
Signal file	Record on PC HDD	Up to **10** dynamic inputs ? Up to 4 parametric inputs - max total bandwidth **512 kS/s** - (2 MB/s)
	Record on Analyzer SSD	Up to **40 channels** (32 inputs + 6 ext. sync or DC)/instruments - max bandwidth **3.2 MS/s** (12.5 MB/s)
	Format	**Normal**: **32 bits**/sample - **Compressed 16 bits**/sample

Recorder settings (continued)

Management	Download	Discard Analyzer SSD on PC HDD **- Batch download** available - Rate **4 MB/s**
	Upload	Load PC HDD records on the analyzer SSD - Rate **1.4 MB/s**
	Location	All records accessible from the project manager tree
	Hard drive management	**Format** SSD - **Selective delete** - **Sorting** tools

Mobi-Disk™

OR36 Mobi-Pack and OR38 multi analyzers/recorders feature a removable hard drive with 2 ports:

- Parallel High speed port for direct data throughput to the Mobi-Disk™.
- USB 2.0 port for post processing and data management without the instrument.

Connection	1 to 8 Mobi-Disc™	Up to **8 Mobi-disc** connected - Active Mobi-Disc: **1** (user selectable) - **hot swap**
Transfer	Based on the USB 3.0 link	**Download 15 MB/s**

Recorder monitoring

The following displays are available during real-time or post-analysis.

RMS	Overall RMS / input	**Digital** or **analog view-meter**
Signal	Real-time	**Compressed view of entire** recorded signals - Automatic update of time axis.

3.2.5 Player

The player module plays the recorded signal files. This is done one of the following two ways:

- **Post-analysis**, the player tracks take place of the corresponding inputs (Dynamics, Ext. Sync and parametric) to be processed by the plug-in analyzers, recorder, trigger and tachometer
- **Playbacks**, the recorded dynamic input are generated on the instrument outputs simultaneously with standard analysis of the inputs.

Player settings

Played section	File selection	NVGate® **recorded files** - **Imported files** - located on **instrument SSD, Mobi-Dsic™** or on **PC HDD**.
	Record selection	**Record number selection** (for multi record files)
	Section definition	User selectable **Start** and **stop offsets** (in sec.) - available in the **file overview window** (marker and slider)
	Duration	**Play backed duration** (User information)
	Repeat	**On/off** - repeat continuously the selection (available only for playback on analyzer output)
Mode	File swap	**Swap loaded files with same tracks number** - applies **identical post-analysis** setup to multiple files.
	Playback	Continuous or step by step (5 ms to 360,000 s)
	Bandwidth	All tracks at lowest frequency (compatible with all plugs-in) or initial record frequencies (no track mix in plugs-in)
Tracks	Number	**Up to 352** according to user's fleet
	Type	**Dynamic input** record (2 sampling frequencies), **parametric** (DC) input record and **ext. sync** record.
	Fixed setting (information) / track	**Label**, **Coupling**, **external gain**, input **range**, **sampling frequency** and **signal bandwidth**
	Modifiable measurement point information settings (apply for post analysis or re-recording) / track	**Component** - **node** number - **direction** - **type**
	Modifiable settings (apply for post analysis or re-recording) / track	Associated **transducer** - **unit** - **sensitivity** - **offset** compensation

Player settings (continued)

Listening	File location	**Analyzer HD** - **Mobi-Disk™** connected with USB or inside the analyzer - **PC HD**
	Playback	One track - from cursor position - repeat displayed signal
Markers	Display	Recorded markers are available in the **file overview**
	Use	Set the start and stop playback offset (user selectable)

Player connections

The following table describes the available connections to the analysis modes (plug-in analyzers and recorder) during post-analysis operation:

Dynamic inputs & torsional Tracks	Preview (multiple file simultaneously)	**Entire file fast overview** (pre-compressed at recording time) - **Track contents** preview, independently (multi-graph display)
	Monitoring (loaded file only)	**Zoom** on selected **play-back section**
	Connection3 (loaded file only)	To any: **plug-in analyzer channel, monitor channel, recorder track**, **edge event detector** and **tachometer**
Ext. sync Tracks	Preview (multiple file simultaneously)	**Entire file fast overview** (pre-compressed at recording time) - **Track contents preview**, independently (multi-graph display)
	Monitoring (loaded file only)	**Zoom** on selected **play-back section**

	Connection[3] (loaded file only)	To any: **start** or **stop averaging** of plug-in analyzers, recorder **start** or **stop recording**, **waterfall start** or **stop acquisition**, **new block trigger** for FFT and SOA and **new slice** for **waterfall** acquisition. To **torsional**, **tachometer** & **angular sampling**
Recorded parametric[1](DC) inputs & CAN parameters	Preview (multiple file simultaneously)	Entire file **fast overview** - **Track contents** preview
	Monitoring (loaded file only)	**Profiles** versus time and **digital** or **analog view meter**.
	Connection[3] (loaded file only)	To any: **recorder track**, **waterfall reference (Z/X axis)** and **profiles**, **level** and **delta level events**.

3.3 Plug-ins analyzers

The following plug-in analyzers are available as options of NVGate® software platform.

3.3.1 Time Domain Analysis - TDA

The TDA plug-in analyzer provides time domain based analyses and visualizations. This plug-in analyzer computes statistical extractions and data compression of long duration oscilloscope views. All results are real time and operations are possible on-line or in post processing. The TDA plug-ins can operate free run or synchronized with the other plug-in analyzers.

TDA Settings

Bandwidths	Oscillator 1	**800 mHz** to **40 kHz** (sampling oscillator 102.4 kS/s to 2,048 S/s)
	Oscillator 2	**512 mHz** to **25.6 kHz** (sampling oscillator 65.536 kS/s to 3,277 S/s)
Time views	Depth	**7200/ABW ABW: the plug-in Analysis Bandwidth.** sec to **100 000** sec (27 hours) - **Independent** on each channel
	Time base (resolution)	**Depth/2048**- **Independent** on each channel
Time span for extraction (averaging)	Type	Continuous sliding with refresh each 256 sample**s** (**Exponential**) - One shot (**Linear**) - Repeated shot (**Repeated linear**)
	Duration	**1/ABW** to **2 10^6/ABW** (ex: 50 ms to 1000 sec @ 2 kHz)
Channels	OR36 & OR38 analyzers	**32 channels** per plug-in for **on line** 32 to 256 in **post-analysis**
	OR34 & OR35 analyzers	**8 channels** per plug-in for **on line** and **post-analysis**
Filters	On each channel	**Any NVGate** filter can independently be applied to each dynamic input (See Filters §)
Triggering	Start analysis	Any **NVGate® event** plus **manual** and **free run**
	End analysis	Any **NVGate® event** plus **manual** and **free run**
	Repeat analysis	On **new start** or **end of averaging**
	Trigger delay	Positive = **unlimited** - negative = **32k Samples**

TDA Results

The following results are available for real time or post-analysis display, report and saving.

Time Views	Overview	**Signal envelope:** Min/Max line for each time step -
	Statistical values	**DC - RMS - Min- Max - Peak - Peak to Peak - Crest factor - Skewness - Kurtosis -** computed on a user defined area of the time view
Extractions	Statistical values	**DC - RMS - Min- Max - Peak - Peak to Peak - Crest factor - Kurtosis -** computed on the Time span ? All values available for **View-meter** and/or **Waterfall profiles**

3.3.2 Fast Fourier Transform analysis - FFT

The FFT plug-in analyzer features multiple vibrations results depending on applied setting. This type of plug-in analyzers computes real-time (on-line or post-processing) Fast Fourier Transform algorithms with multiple averaging domain and trigger capabilities. Up to 4 FFT plug-ins can operate at the same time.

FFT Settings

Bandwidths	Oscillator 1	**800 mHz** to **40 kHz** (sampling oscillator 102.4 kS/s to 2,048 S/s)
	Oscillator 2	**512 mHz** to **25.6 kHz** (sampling oscillator 65.536 kS/s to 3,277 S/s)
Resolution	Lines	**101**, **201**, **401**, **801**, **1601**, **3201**, **6401, 12801<ref>With force DSP</ref> and 25601 lines**
	Frequency resolution	**80 µHz** (512 mHz/6401 lines) to **400 Hz** (40 kHz/101 lines)
Averaging	Domain	**Spectral** (power) - **time** (with phase) - **FDSA** (Synchronized with one frequency)
	Type	**Exponential** - **linear** - **repeated linear** - **referenced peak hold** (eq. to tracking filter locked on reference channel frequency) - **peak hold**
	Size	**Duration** or **number of blocks**, unlimited size
	Overlap	**0%** to **99.9%** depending on block size - **retrigger**
Channels	OR36, MP & OR38 analyzers	**32 to 256 ch.** per plug-in for **on line** and **post-analysis**
	OR34 & OR35 analyzers	**8 channels** per plug-in for **on line** and **post-analysis**
Weighting	General	**Uniform - Hanning - Hamming - Kaiser Bessel**
	Modal acquisition	User defined **Force** (rect.) and **Response** (Rect. + exp)
	Assignment	Independently on any channels
Filters	On each channel	**Any NVGate** filter can independently be applied to each dynamic input (See Filters §)
Cross functions	Reference selection	**Full** or **partial matrix** available (all channels can be references)
Zoom	Magnification factor	**2 to 128** by step power of 2
	Min., max and center frequencies	Graphically selectable on wide band spectrum
Triggering	Start averaging	Any **NVGate® event** plus **manual** and **free run**
	End averaging	Any **NVGate® event** plus **manual** and **free run**
	New block	Any **NVGate® event** plus **manual** and **free run**

	Repeat averaging	On **new start** or **end of averaging**
	Trigger delay	Positive = **unlimited** - negative = **32k Samples**
	Automatic	Reject **overloaded blocks**
Blocks rejection Overall	Manual	**Accept** or **Reject** after preview of averaged results (FRF, Coherence)
	Normal	**Accept** all blocks
Overall	Detector	**Quadratic sum of spectra lines** taking in **account weighting window equivalent noise bandwidth**
	Lower and upper frequencies	Selectable into the current FFT bandwidth

FFT Results

The following results are available for real time or post-analysis display, report and saving.

Time averaging	Time domain	**Filtered signal - Triggered block - Averaged Triggered block - Weighted Block - Lissajoux of triggered blocks**
	Spectra	**Complex spectra**
	Cross-functions	Instantaneous **cross-spectra** - averaged **cross-spectra** - **FRF H1** - **FRF H2** - **Coherence**
	Overall	**Overall RMS value** in specified band - **Overall RMS profile** in specified band.
Spectral averaging	Time domain	**Filtered signal - Triggered block - Weighted Block - Lissajous of triggered blocks**
	Spectra	Instantaneous **complex spectra** - averaged **power spectra**
	Zoomed spectra	**Zoomed** instantaneous **complex spectra** - **zoomed** averaged **power spectra**
	Cross-functions	**Instantaneous cross-spectra** - averaged **cross-spectra** - **FRF H1** - **FRF H2** - **Coherence**
	Zoomed cross-function	Instantaneous **zoomed cross-spectra** - **averaged zoomed cross-spectra** - **zoomed FRF H1** - **zoomed FRF H2** - **zoomed Coherence**
	Overall	**Overall RMS value** in specified band - **Overall RMS profile** in specified band.
Synchronous averaging on one frequency (FDSA)	Time domain	**Filtered signal - Triggered block - Averaged Triggered block - Weighted Block - Lissajous of triggered blocks**
	Spectra	Instantaneous **complex spectra** - time domain averaged **power spectra**
	Overall	**Overall RMS value** in specified band - **Overall RMS profile** in specified band.

3.3.3 Constant Band Order Tracking Add-on (CBT)

Constant band order tracking is an optional add-on to the FFT plug-in analyzers. This add-on computes spectrum lines power related to RPM speed. This option adds settings and results to the FFT Plug-ins. Constant band tracking can operate on up to 4 different tachometers at the same time.

CBT Settings

Tracked Order	Number	**8 per channels**
	Max	**0.001** to **800**

	Constant bandwidth	**User selectable per channel** - minimum depend on weighting windows
Computation	Associated tachometer	**Any front end**, **recorded** or **virtual tachometer**
	Peak tracking	On/Off **center bandwidth on nearest peak**
	Order amplitude	Weighting windows eq. noise bandwidth correction

CBT Results

The following results are available for real time or post-analysis display, report and saving.

Scalar	Tracked order	**Digital** (magnitude and phase) or **analog** view-meter
	Cross phase tracking	**Order phases** are **relative** to the same order from a ref. channel
	Overall	**Digital** or **analog view-meter**
Monitoring	Continuous profiles of tracked order	**Profiles** vs. **time** - **profiles** vs. **RPM** - max depth **2048 pts** - user selectable **delta time** - user selectable **delta RPM**
Profiles	One shot acquisition	Tracked order (complex), cross phase orders and overall level can be collected by the *waterfall* profiles.
	References	Time, RPM and DC levels

3.3.4 Diagnostic Add-on (FFTDiag)

FFT Diagnostic is an optional add-on to the FFT plug-in analyzers. This add-on computes a set of useful analysis for machinery diagnostic. Up to 4 FFTDiag can operate on 4 different FFT plug-ins at the same time.

This option adds settings and results to the FFT Plug-ins.

FFTDiag Settings

Envelop demodulation	Activation	Enable/disable on all channels **-** requires **zoom activation**
	Averaging	Spectral domain - FDSA
	Bandwidth	**½ of zoom span - ¼ of FFT bandwidth**
Correlation	Activation	Enable/disable on all channels **-** All other FFT results are affected
	Weighting window	**Uniform - Left** zero padding **- Centred** zero padding

FFTDiag Results

The following results are available for real time or post-analysis display, report and saving.

Scalar	Min/Max	Minimum and maximum amplitude per trigger block
	Peak detectors	**Peak level - Peak to Peak level - Crest Factor -** per trigger block
Others	Cepstrum	**Cepstrum - Zoomed cepstrum**
	Correlation	**Auto-correlation** block **- Cross correlation** block
	Shaft view	Time domain signal on first rotation - angular representation

3.3.5 Synchronous Order Analysis (SOA)

The SOA plug-in analyzer features several results depending on applied settings. Up to 2 SOA plug-ins can operate in parallel.

SOA Settings

Bandwidths	Order span	**6.25** to **400** ? up to **800** with ***ForceDSP***
	Frequency bandwidth	Up to **40 kHz**
	RPM span	Up to **384 000 RPM - Ratio of 64** between Min & Max RPM
Resolution	Lines	**101 - 201 - 401 ? 801 ? 1601** with ***ForceDSP***
	Order resolution	**1 -** ½ - ¼ **- 1/8 - 1/16 - 1/32**
Averaging	Domain	**Spectral** (power) - **revolution** (re-sampled blocs)
	Type	**Exponential** - **linear** - **repeated linear** - **peak hold**
	Size	**Number of blocks**, unlimited size
	Overlap	**0 to 31 revolutions** depending on resolution ? **0 to 359°** into revolution ? Retrigger on **multi-pulse/rev**
Tachometer	Computation base	Any **NVGate'® tachometer** (ext. sync, regular input, DC input, CAN, simulated, Fractional, and combined tach.)
	Phase reference	Tachometer pulse **edge** or pulse **center** requires to analyze the tachometer input
	0° Phase reference	Cosine or sine
RPM	Max speed variation	**1** to **99%** per analyzed block - blocks with higher variation are rejected. No control (set @ 100%)
	RPM range	User selectable **max** & **min RPM**, under and over speed blocks are rejected
Tracked order	Number	**Up to 8** per channels
	Min-Max	**1/32** to **400** ? up to **800** with ***ForceDSP***
	Cross phase tracking	**Order phases** are **relative** to the same order from a ref. channel
Channels	OR36 & OR38 analyzers	**32 channels** per plug-in for **on line** - 32 to 256 in **post-analysis**
	OR34 & OR35 analyzers	**8 channels** per plug-in for **on line** and **post-analysis**
Weighting	Windows selection	**Uniform - Hanning - Hamming - Kaiser Bessel** Applied independently on any channels
Filters	On each channel	**Any NVGate** filter can independently be applied to each dynamic input (See Filters §)
Triggering	Start averaging	Any **NVGate® event** plus **manual** and **free run**
	End averaging	Any **NVGate® event** plus **manual** and **free run**
	New block	Any **NVGate® event** plus **manual** and **free run**
	Repeat averaging	On **new start** or **end of averaging**
	Trigger delay	Positive = **unlimited** - negative = **1/order res** revolution
	Trigger block phase shift	**±720°** - independent for each channel

Overall	Detector	**Quadratic sum of order spectra lines** taking in account **weighting window equivalent noise bandwidth**
	Lower and upper orders	Selectable into order span - from **0,03125** to **800** with ***ForceDSP***

SOA Results

The following results are available for real time or post-analysis display, report and saving.

Revolution averaging	Time domain	**Filtered** signal
	Angle domain (Revolution)	**Triggered** block **- Averaged Triggered** block **- Weighted** block
	Order spectra	**Complex spectra**
	Tracked orders	**Digital** (magnitude & phase) view-meter **- Analog** view -meter
	Overall	**Overall RMS value** in specified order band (digital or analog view-meter)
Spectral (order) averaging	Time domain	**Filtered** signal
	Angle domain (Revolution)	**Triggered block - Weighted Block**
	Order spectra	Instantaneous **complex order spectra** - averaged **power order spectra**
	Tracked orders	**Digital (module and phase)** and/or **Analog** view-meter.
	Overall	**Overall RMS value** in specified order band (digital or analog view-meter)

3.3.6 Diagnostic Add-on (SOADiag)

Order based Diagnostic is an optional add-on to the SOA plug-in analyzers. This add-on computes a set of useful synchronous order transmission extraction tools and analyses. Up to 2 SOADiag can operate on 2 different SOA plug-in at the same time.

This option adds settings and results to the SOA Plug-ins.

SOADiag Settings

Cross-functions	Reference selection	**Full** or **partial matrix** available (all channels can be references) - order domain averaging only.
Angular Correlation	Activation	Enable/disable on all channels **-** All other SOA results are affected simultaneously
	Weighting window	**Uniform - Left** zero padding **- Centred** zero padding

SOADiag Results

The following results are available for real time or post-analysis display, report and saving.

Rev. synchronous Scalars	Min/Max	Minimum and maximum amplitude per trigger block (n rev.)
	RMS, DC	Per trigger block (n rev.)
	Peak detectors	**Peak level - Peak to Peak level - Crest Factor -** per trigger block (n rev.)
Others	Copstrum?	**Cepstrum** of the order spectra
	Cross-functions	**Instantaneous order cross-spectra** - averaged order **cross-spectra** - **ORF? H1** / **H2** -**Coherence ? angular** or **order** domain averaging**.**
	Angular Correlation	**Auto-correlation** block **- Cross correlation** block - angular averaged

	Re-sampled Shaft view	Time domain signal on first rotation ? **angular representation** - **instantaneous** or **revolutions** averaged

3.3.7 1/n octave constant percentage band filter analysis - OCT

The OCT plug-in analyzer features multiple acoustic results depending on applied setting. This plug-in analyzer computes real-time signal (on-line or post-processing analysis) based on digital filters (CPB) and detectors.

OCT Settings

Bandwidths	Sampling oscillator #1 (102.4 kS/s to 2,048 S/s)	Center of **highest 1/3rd** band = **40 kHz** Center of **lowest 1/3rd** band = **100 mHz**
	Sampling oscillator #2 (65.536 kS/s to 3,277 S/s)	Center of **highest 1/3rd** band = **25 kHz** Center of **lowest 1/3rd** band = **100 mHz**
	Frequency span	Highest Band / lowest band **< 2000** (ex. 10Hz - 20kHz)
Resolution	1/n Octave	'*1, 1/3* **rd, 1/12th, 1/24th**
Averaging	Basic	Linear & repeated linear (20 ms to 60,000 s) exponential (20 ms to 60s)
	Acoustics	**Short LEQ 1 s, Short LEQ 1/8 s, Fast, Slow, Impulse**
	Constant Bandwidth * Time	B*T = **0.2dB, 0.5 dB, 1 dB, 2 dB**
Standards	Detectors	Complies with **IEC 651, IEC 804, ANSI/ASA S1.4-2014** / **Part 1** / **IEC 61672-1:2013 class 1**
	CPB filters	Complies with **IEC ANSI/ASA S1.11-2014** / **Part 1** / **IEC 61260:1-2014 and IEC 1260 class 1**

Channels	OR36 & OR38 analyzers	**32 channels** per plug-in for **on line -** 32 to 256 in **post-analysis**
	OR34 & OR35 analyzers	**8 channels** for **on line** and **post-analysis**
Triggering	Start averaging	Any **NVGate® event** plus **manual** and **free run**
	End averaging	Any **NVGate® event** plus **manual** and **free run**
	Repeat averaging	On **new start** or **end of averaging**
Overall	Detectors	**2 parallel overall detectors** linear and weighted (time domain)
	Weighting	**A**, **C**, or **Z** (none) applicable in **10 kHz - 40 kHz** bandwidth

OCT Results

The following results are available for real time or post-analysis display, report and saving.

Spectra	1/n Octave spectra	**Instantaneous** spectra**, averaged** spectra
	Holden spectra	**Minimum** & **maximum** spectra
Overall	Linear	**Digital** & **analog** view meter of time domain overall detector, exact bandwidth is informed
	Weighted	**Digital** & **analog** view meter of **A** or **C** weighted overall levels computed in time domain, exact bandwidth is informed

3.3.8 Overall acoustics sound level meter - OVA

The OVA plug-in analyzer features class 1 sound pressure level measurement according to IEC 61672:2013 standard. This plug-in analyzer computes real-time signal (on-line or post-processing analysis) based on digital filters and detectors.

OVA Settings

Type	Standard	**IEC 651, IEC 804, ANSI/ASA S1.4-2014 / Part 1 / IEC 61672-1:2013 class 1**
	Class	**1**
	Bandwidths	**10 Hz** to **40 kHz** - Adjustable
Channels	OR36 & OR38 analyzers	**32 channels** per plug-in for **on line** - 32 to 256 in **post-analysis**
	OR34 & OR35 analyzers	**8 channels** for **on line** and **post-analysis**
Averaging	Linear	**User selectable** duration **- repeat** mode
	Short leq	**1/8 s - 1 s -** User selectable duration
Triggering	Start averaging	Any **NVGate® event** plus **manual** and **free run**
	End averaging	Any **NVGate® event** plus **manual** and **free run**
	Repeat averaging	On **new start** or **end of averaging**
Detectors	Peak	1 **peak detector/Ch**. - **A**, **C** or **Z** (none) weighting -**Independent** for each channel
	Weighting	**3 overall detectors/Ch. - A**, **C** or **Z** (none) weighting - **Fast**, **Slow**, **Impulse** and **linear** time weighting - **Independent** for each channel

OVA Results

The following results are available for real time or post-analysis display, report and saving. The following levels can be tracked in profiles up to 100 000 pts. each.

SPL	Time weighted	Instant - max hold - min Hold
	Averaged	Short leq - leq
	Peak	Peak - Time weighted - max hold min hold

3.4 Options

3.4.1 Instantaneous angular Velocity Converter (IVC)

The IVC option converts frequency to voltage from the External synch inputs. It covers torsional and acyclism measurements. The converted signals are made available as standard inputs (or player tracks). This option operates real-time computation and operations are possible on-line or in post processing.

IVC Settings & specs

Rate	Pulse/rev	**0.5** to **4096 -** Up to **1 E6** with pre-divider
	Pulse/rev Frequency	**> 40 kpulse/sec** *max*
	Pre-divider	**1** to **255 -** hardware decimation (pulse are not measured)

	Pre-divider frequency	**375 kpulse/sec** max.
Missing pulses	Number	**0 to 5** consecutive pulses **integer or fractional**
	Hold off	**2** consecutive pulses
	Generated signal	'*1st* '**order interpolation**
Tach. phase ref	No missing pulse	First random - continuous offset further
	missing pulse > 0	Last known edge before missing pulse
Resolution	Time	**160 ns** : 1/(SF x 64)
	Angular (with SOA)	350 µRad (20 mdegres) @ 8000 RPM, up to order 10
Pre-processing	Smoothing	Sliding average - **1** to **32** samples
	Filtering	**Any NVGate** filter (See Filters §) incl. dt and 1/dt
Max Speed	Without pre-divider	Max RPM = 2.4 e6/*Pulse per rev* - 12 000 RPM @ 200 pulse/rev
	With pre-divider	Max RPM = 36 e6/*Pulse per rev* - 12 000 RPM @ 200 pulse/rev

IVC Results

The following results are available for real time or post-analysis.

Signals	Number	**1** to **6** (depends on the number of available ext. synch)
	Use	Same as **dynamic inputs** or **recorded** dynamic inputs
	Magnitude	**Torsional** acceleration, velocity & angle ? separated from angular magnitudes (RPM)
View	Type	Signal - filtered signal - **256 samples** frame

3.4.2 Angular sampling (A-Samp)

The angular sampling option allows accurately localizing the order phenomenon angle on cyclic rotating machineries. It uses the pulses delivered by an encoder (or zebra tape or gear teeth) to resample the inputs and torsional signal in the SOA plug-in. This option operates real-time computation and operations are possible on-line or in post processing.

IVC Settings & specs

See front-end/ext. Synch § for details

3.4.3 Virtual inputs (VIn)

The virtual input allows combining front end inputs with polynomial operations to generate a signal (new input). This option covers numerous applications such as vector strain calculation with rosette or dynamic twist measurement on machinery transmission. The virtual inputs are made available as standard dynamic input. A static twist computation based on phase comparison is also available with the Vin + IVC options.

This option operates real-time computation on raw or recorded signal.

VIn Settings

Output	Number	**12** Operators
	Type	**New item** in the active **inputs/tracks list**
	Synchronization	**0° phase shift** with sources and analyzed signal

	Magnitude	**Automatic** or **voltage** if unresolved
Sources	Number	**1** to **32 channels**
	Type	Analyzer **dynamic inputs** or **recorded** dynamic inputs
Output adjustment	Type	***(Input * Coeff + Offset) ^power*** - independent on each output
	Offset	Any real value from **-1 e9 to 1 e9** - ex: -5.67
	Coefficient	Any real value from **-1 e9 to 1 e9** - ex: 12
	Power	Any real value from **-4 to 4** - ex: 0.5
Sources adjustment	Type	***Filtering [(input * Coeff + Offset) ^ power]*** - independent for each source
	Offset	Any real value from **-1 e9 to 1 e9** - ex: -5.67 e-5
	Coefficient	Any real value from **-1 e9 to 1 e9** - ex: 1200
	Power	Any real value from **-4 to 4** - ex: -2.4567
	Filtering	Any NVGate filter
Operators	Type	**Product** - **Sum** - independent on each operator
Twist	Type	**Phase comparison** ? output in **plane angle**
	Correction (zeroing) offset	**-360°** to **+360°**
	Output	**Plane angle** or **torque** with conversion factor

3.4.4 Virtual parameter (VDC)

The virtual parameter (VDC) allows combining front-end parametric inputs (DC) with math operations to generate a calculated parameter (new DC). This option covers numerous applications such as averaged temperature or non linear response transducers. The virtual parameters are made available as standard DC input. This option operates real-time computation on raw or recorded signal.

VDC Settings

Output	Number	**12** Operators
	Type	**New item** in the DC inputs/track list
	Synchronization	**0° phase shift** with sources and analyzed signal
	Magnitude	**User defined**
Sources	Number	**1** to **32 channels**
	Type	Analyzer **DC inputs** or **recorded** DC inputs
Editor	Type	Text
	Variables	**Real** values
	Operators	**+**, **-**, **x**, /, **^**, **=** (affectation)
	Predefined	**Ch x** (Channels signals), **Pi**, **e**
	Trigonometric functions	**Sine**, **Cosine**, **Tangent** - with **Arc** and **Hyperbolic** combination
	Logarithmic functions	**Log2**, **Log10**, **Ln**, **Exp**

	Miscellaneous	**Sqrt**, **Abs, Min, Max, Sum, Avg**
Output characterization	Limits	Min and max: **+/- 1 E9** - In current unit
	Information	**Label** (text)

3.4.5 Combined tachometer editor (CTE)

The CTE option combines 2 actual tachometers with math to generates a calculated angular velocity (new tachometer). It covers various unreachable rotating parts and more specially the CVT gear chain measurements. The combined tachometers are made available as standard tachometer. This option operates real-time computation and operations are possible on-line or post processing.

CTE Settings

Sources	Number	**2**
	Type	**Any NVGate tachometer ?** excepted another CTE
Output	Type	New item in the active tachometers list
	Synchronization	**0° phase shift** with sources and analyzed signal
Editor	Type	Text
	Variables	**Real** values
	Operators	**+**, **-**, **x**, /, **^**, **=** (affectation)
	Predefined	Rmp1, Rpm2 (sources speed), **Pi**, **e**
	Trigonometric functions	**Sine**, **Cosine**, **Tangent** - with **Arc** and **Hyperbolic** combination
	Logarithmic functions	**Log2**, **Log10**, **Ln**, **Exp**
	Miscellaneous	**Sqrt**, **Abs, Min, Max, Sum, Avg, Sign, If, Rint**
Output characterization	Rotation	Clock wise or counter clock wise
	Average	**Sliding** - **1** to **256** revolution
	Speed limits	Min: **0 RPM** - max: **1 200 000 RPM**
	Information	Label (text)

CTE Results

The following results are available for real time or post-analysis

Signals	Number	**4**
	Use	Same as on-line **Tachometer** or **recorded** tachometer
	Magnitude	Angular velocity (RPM)
View	Types	**View meter** - **1** to **100 s** rolling **profile**

3.5 General purpose analysis

The following modules are available as standard features of NVGate® software platform; they feature additional analysis capabilities to regular plug-in analysis modules.

3.5.1 Monitor

The monitor is an independent (dedicated processor) module that continuously processes FFT analysis on 4 channels at the maximum available bandwidth. The aim of this module is to monitor in both domains (time and spectral) 4 inputs and to compute basic indicators for monitoring and triggering purpose.

Monitor settings

Fixed setup	Bandwidth	**ABW = Sampling freq** / **2.56**
	Resolution	**401 lines**
	Average domain	**Spectral** (power)
	Overlap	**0%**
	Average type	**Exponential**
	Weighting windows	**Hanning**
	Trigger	**Free run**
Channels	Number	**4**
	Swap	Between **any active dynamic input - hot swap** capable
Average	Duration	**Instantaneous** (20 ms) to **unlimited**
Overall analysis	Pass band filter	**Butterworth** order **2** to **10 - IIR** type - **Bypass** function
	Upper & lower frequency	**User defined -** can be graphically modified
	Computed indicators	**DC - Max - Min - RMS - Skew - Kurtosis -** Into defined pass band - **overall** if bypass is on
	Average	**User defined** duration **- independent** from spectral averaging

Monitor results and connections

The following results are available for real time or post-analysis display, connection to other modules.

Time domain	Play back	On any output generator - hot swappable
FFT analyzer	Trigger bloc	**1024 samples** - time domain **analyzed bloc**
	Spectra	Instantaneous **complex spectra** - averaged **power spectra**
Overall detectors	Display (digital or analog view-meter)	DC - Max - Min - RMS - Skew - Kurtosis
	Connection	To **level** and **delta level** event detector - to **waterfall profiles**

3.5.2 Waterfall

The waterfall module operates as a stack for plug-in analyzers results. Waterfall module features advanced graphics for 3D and profiles, including extraction tools. It can synchronize results coming from multiple plug-in analyzers and sources in one result.

Waterfall settings

Mode	Continuous	**Circular buffer** of results
	One shot	Fill stack and stop waterfall acquisition
Triggering	Start acquisition	Any **NVGate® event** plus **manual** and **free run**

	Stop acquisition	Any **NVGate® event** plus **manual** and **free run**
	New slice (point or spectra)	Any **NVGate® event** - **manual - free run -** availability of **connected results** - **periodic**

Waterfall settings (continued)

Size	Number of result per acquisition	Up to **95 results + Time**
	Depth	**2** to **100,000** slices or points - depend on PC available memory and requested result - **automatically adjusted** before acquisition
	Depth for stand-alone acquisition	Up to **3 MSamples** per computation DSP
Channels	**Type scalar** (the following results are connectable to waterfall channels)	**Overall levels** (lin and weighted) from OvA and 1/n OCT - **Monitor indicators** (DC, Max, Min, RMS, Kurtosis) - **Orders** (from CBT and SOA) - **Complex orders** (magnitude & phase) - **Overall levels** in selected BW from FFT & SOA (order or frequency) - **TDA** scalar: **DC, Min/max, RMS, Kurtosis, peak, peak-peak, crest factor**
	Type 2D - FFT (the following results are connectable to waterfall channels)	**Triggered** block **- Averaged Triggered** block **- Weighted** Block **- Complex** spectra **- Power** spectra **-Cross-spectra** - **FRF H1** - **FRF H2** - **Coherence - Zoomed** complex spectra - **zoomed power** spectra
	Type 2D - OCT (the following results are connectable to waterfall channels)	**Instantaneous** spectra - **averaged** spectra - **max & min hold** spectra
	Type 2D - SOA (the following results are connectable to waterfall channels)	**Triggered** block **- Averaged Triggered** block **- Weighted** block **- Complex order** spectra **- Power order** spectra

Waterfall results

The following results are available for real time or post-analysis display, report and saving. All stacked results can be saved.

3D	Display	**1 pane** (3D) - **2 panes** (3D + YZ view or 3D + XY view) , **3 panes** (3D + YZ + XY + Extraction view) windows - automatic or user selectable **pane arrangement - Real or imaginary** part and **module or phase** for complex results
	Z axis (X axis for extraction and YZ view)	**Any reference** - **time** - independent for any window - swap reference at any time
	Saving selection	**Entire 3D data** and / or any active **section** (YZ, XY or Extraction)
Profiles	Display	Profile of any scalar - **Real or imaginary** part and **module or phase** for complex results
	X axis	**Any reference** - **Time** ? **Slice** - independent for any window - swap reference at any time

Waterfall Tools

The following results are available for real time or post-analysis display, report and saving.

Sections	YZ Sections (Profiles vs. Ref)	Any order/frequency - **Power** - **Peak** - on selected bandwidth
	XY Sections (Spectra)	Any position in the current ref. - **Min** - **Max** - **Average** - on selected range or all slices
	Order/Frequency extraction (profiles vs. Ref.)	Any order/frequency extraction - **user selectable tach**. - **Power** - **Peak** - on selectable bandwidth - **Max order**
	Number of sections	**Unlimited** - available on result or real-time waterfalls

Linked cursors	General	Single or dual cursor in each view - linked with other graphs
	Linked by value	Linked cursors track the same X value in different windows.
	Linked by reference	Linked cursors track the same acquisition slice in different waterfall windows with different X or Z-axis.

References are: Time - Slice number - DC channels (expressed in physical quantity) - TDA scalars - Monitor levels- any Tachometer

3.6 Shared resources

The following resources are available for each plug-in analyzer (when it is compatible). For example once a trigger is activated it can be applied to FFT and SOA: Then modifying the trigger setting in the resources will apply on all corresponding plug-in.

3.6.1 Triggering

Each plug in analyzer (and recorder) can be started, stopped or triggered (new block) with events defined in the Event module.

Event settings

Edge detector	Source	**Any dynamic input** - Any **recorded** dynamic input
	Label	String for **event identification** (Ex. "Impact" for a hammer impact detection)
	Threshold	Between **min and max range** - use **source unit** (ex. g for an accelerometer)
	Pre-filtering	**A** law - **C** law - any **NVGate filter**
	Slope	**Rise** - **fall**
	Hold off	**0** to **36000** s
	Hystersis	Into source **input range** - use **source unit** (ex. g for an accelerometer)
	Number	**2** edge detectors
RPM speed detector	Source	**Any tachometer -** computed from **dynamic input** or **ext.sync** - any r**ecorded pulses** (through tachometer)
	Label	String for **event identification** (Ex. "start speed" for a run up initial triggering)
	Threshold	Detection into source tachometer RPM range
	Slope	**Run up** - **Run down**
	Hysteresis	**0** to **source** max RPM
	Interpolation	**On** interpolate event occurrence **into revolution** - **Off** event **occur at revolution ends** (new pulse)
	Number	**2 to 6** RPM speed detector
Delta RPM speed detector	Source	**Any tachometer -** computed from **dynamic input** or **ext.sync** - any r**ecorded pulses** (through tachometer)
	Label	String for **event identification** (Ex. "Each 100 RPM" for a run up triggering)
	Lower velocity	**Minimum** RPM speed - Events occurs only for higher source speed
	Higher velocity	**Maximum** RPM speed - Events occurs only for lower source speed
	Delta velocity	Define **velocity step** - **event occur each time** source speed increase or decrease by delta velocity
	Slope	**Run up** - **run down** - **first,** first slope is automatically selected - **any,** event occur on any slope

	Interpolation	**On,** interpolate event occurrence **into revolution** - **Off,** event **occur at revolution end** (new pulse)
	Number	**2 to 6 delta RPM** speed detector
Level detector	Source	Any **parametric (DC)** input - **Monitor scalar** - **Filtered** monitor scalar (Band Pass)
	Label	String for **event identification** (Ex. "temp A" for a recording trigger)
	Type	Monitor scalar - DC - RMS - Max - Min - Kurtosis
	Status	**Above** / **below** - Detection level - available in **lin** or **dB**
	Number	**1** to **4** level detectors

Event settings (continued)

Periodic event	Label	String for **event identification** (Ex. "Hourly" for 1 hour time interval)
	Time interval	**2 ms** to **11 days** - **Synchronized** with analyzer.
	Number	**2** periodic events
Combination	Sources	**Any event - 2** different sources defined as **A** and **B**
	Label	String for **event identification** (Ex. "Time/RPM variation" for a mix between periodic and delta RPM)
	Combination	A **OR** B - A **AFTER** B - A **AND** B (occur in the same bloc)
	Number	**2** event combination
Plug-in synchronization	FFTx result available	Occurs at each **new spectra availability** - Occurs at **end of linear averaging** (repeat and linear) - One event per active FFT plug in (FFT1 to FFT4)
	OCT result available	Occurs at each new 1/n spectra availability - Occur at **end of linear averaging** (leq, short leq, linear repeat)
	SOAx result available	Occurs at each **new spectra availability** - Occurs at **end of linear averaging** (repeat and linear) - One event per active SOA plug in (up to 2)
	TDA result available	Occurs at each new level set (RMS, DC, etc) availability - Occur at **end of linear averaging** (repeat and linear)
	OVA result available	Occurs at each new set of overall level (short LEQ) availability - Occur at **end of short averaging** (repeat and linear)
Generators Synchronization	Event synchronized with **blocks of**:	**Multi-sine** - **random noise** - **chirps**
	Swept sine generator event:	**Swept sine stabilized** (output amplitude established) - **step sine stabilized** (occur x sec after step frequency is reached) - **pure tone stabilized** (output amplitude established)

3.6.2 Output signals

NVGate® proposes a set of generator signals.

Output signals

The following output signals are available as standard and can be independently applied to the front-end outputs.

	Type	Pure tone - Swept sine - Step sine

Sine

	Frequency	**100 µHz** to **40 kHz** - smooth variation between step - resolution **10 µHz**
	Frequency control	Start & stop frequencies - pause/release during sweep - adjustment during pause - step
	Cycle control	One shot - One cycle - continuous sweep between boundaries
	Amplitude control	**Settling time** 100 µs to 10 s - **Stabilization time** 0 s to 1000 s
	Sweep speed	Linear: **300 mHz/s** to **20 kH/s** - Log: **5 mOct/s** to **330 Oct/s**
	Step control	**Synchronized with analysis end** - free run
	Gain control	**-15 dB** to **+60 dB** - **Independent** for each output - Amplitude **variation controlled** by settling time (1 ms to 1000 s)
	Phase control	Offset ±360° - **Independent** for each output - phase **variation controlled** by phase speed (1.5°/s to 360°/s)
	Number	**2 to 6** sine generated simultaneously - with **independent phases and amplitudes** - **synchronized** frequencies
Multi-sine	Frequency span	From **125 mHz** to **40 kHz**
	Amplitude	**0** to **2.5 Vrms** - Settling time **100 µs** to **10 s**
	Resolution	**125 mHz** to **400 Hz** - **101** lines to **6401** lines
	Phase	**Fixed** (all sine have same phase) - **Random**
	Burst	**0** to **100%** - Step **1%**
	Number	**2** to **4 independents** multi-sine

Output signals (continued)

Random noise	Frequency span	From **125 mHz** to **40 kHz** - independent lower and upper frequencies
	Amplitude	**0** to **2.5 Vrms** - Settling time **100 µs** to **10 s**
	Type	**White** - **pink**
	Burst	**0** to **100%** - Step **1% -** Bloc duration**: 2.5 ms to 100 s**
	Number	**2** to **6 independent** and **uncorrelated** random noises
Chirp	Frequency span	From **3.125 Hz** to **40 kHz** - independent lower and upper frequencies
	Amplitude	**0** to **7,07 Vrms** - Settling time **100 µs** to **10 s**
	Size	**256** - **512** - **1024** - **2048** - **4096** - **8192** - **16384**
	Burst	**0** to **100%** - Step **1%**
	Number	**2** to **6 independents** chirps

In addition to these predefined signal, any recorder or imported signal file can be generated synchronously on front-end the outputs.

3.6.3 Filters

The following filters can be applied on front-end inputs, plug-ins analyzers and output generators.

ABW: the analysis bandwidth, of the plug-in or front end where the filter is in use.

High pass	Type	**Butterworth** ? **IIR** type
	Order	**1** to **6**

	Cutoff frequency	**ABW**to **ABW/1024**
Low pass	Type	**Butterworth** ? **IIR** type
	Order	**1** to **6**
	Cutoff frequency	**ABW** to **ABW /102.4**
Stop/pass band	Type	**Butterworth** ? **IIR** type
	Order	**2** to **10**
	Cutoff frequencies	**ABW** to **0.055 * ABW**
	Bandwidth	**ABW/2** to **0.0075 * ABW**
Integrators	Type	**HP, Single** or **double**
	High pass frequency	**ABW /10 000** or **ABW /2 000**
	Integration time	**2 ms** to **500 s**
Differentiators	Type	**Single**
	Average	**Sliding** - **0** to **2 s**
Weightings	Laws	**A** & **C** laws
	Bandwidths	**10** kHz to **40** kHz
All	By-Pass	**Apply/bypass** without stabilisation time - independently on each filter
	Application	Same filters set for each plug-in
	Label	Each filter features a user define name

3.7 Notes

The above specifications describe all the guaranteed capacities and performances of the NVGate V12 or upper. Functionalities may change depending on operation mode (connected to a 3-Series unit or office). Plug-in analyzers, options and channel number availability depend on purchased options.

The instruments hardware are described separately in the "Instruments specifications page" OROS reserves the right to modify the specifications without notification.

4 PC Requirements

Minimum	1 GB (Waterfall depth depends on available memory of RAM) / 250 MB free on HD + storage for measurements and signals / 1024 x 768 display
Minimum	**CPU : Quad core processor** (Desktop : Intel Core i3 or Ryzen 3, Laptop : Intel Core i5 or Ryzen 5) **RAM : 4 GB** **GPU : VRAM 1 GB**, 1024 x 768 display **Storage : HDD**, 1 GB+ storage for signals
Recommended	**CPU : Quad core processor** (Desktop : Intel Core i3 or Ryzen 3, Laptop : Intel Core i5 or Ryzen 5) **RAM : 6 GB** **GPU : VRAM 2 GB**, 1920 x 1080 display (not 4K screen) **Storage : SSD**, 1 GB free + storage for signals
Intensive	**CPU : Six core processor** (Desktop : Intel Core i5 or Ryzen 5, Laptop : Intel Core i5 or Ryzen 5) **RAM : 8 GB** **GPU : VRAM 2 GB**, 1920 x 1080 display (not 4K screen) **Storage : SSD**, 1 GB free + storage for signals
Connections	Type: **Ethernet 1000 BASE-T**, 1 Gb/s : Connector: **RJ45** For removable disk: **USB 3.0** / For dongle key: **USB 2.0**
Operating systems	Windows 7 / **Windows 10** (32 bits or 64 bits) / For report: MS Office (Excel-word Professional edition): **32 bits only** (not 64bits)