AVANTES' EVO SERIES

Avantes is proud to announce the latest additions to our EVO series spectrometers in UV/VIS and NIR range:

EVO series; why?

With the introduction of the AS7010 electronics board, Avantes brought new and improved functionality to their spectrometers. This Electronics board brings USB3 and ETHernet communication options to you. This is enabling faster data speeds, longer distances and network integration for your application. Improved electronics delivers more noise-free signals for your measurements and the on-board memory capabilities ensure plenty of capabilities for future features. Spectrometers using this AS7010 electronics platform are the next EVOlutionary step in spectrometry. Avantes bundled these series of spectrometers in the EVO family of products which are described in this brochure.

EVO Series; UV/VIS spectrometer AvaSpec-ULS2048CL-EVO

GigaEthernet and USB3.0 communication, more memory and fast data processing. Using the latest CMOS technology, this spectrometer offers you the latest technology; ready for the next decade!

Timing and Triggering

A lot of applications require for a spectrometer to be triggered at a time sensitive moment. For example when you are measuring in production lines, or pulsed/ flashed events like solar simulators or led measurements .
State of the art electronics in combination with the right detector choice will provide you with an excellent tool for continuous, repetitive, stable measurements.
Since decades Avantes spectrometers are well known for their excellent timing and trigger performance.

CMOS and CCD

Avantes offers a broad range of spectrometers with different detector technologies..
For our Starline spectrometers the standard Si CCD technology was the dominant technology for years.
However this dominant position is losing ground to CMOS technology. Being ready for the future Avantes embrased the CMOS technology in an early stage and now offers this latest state of the art technology as the new standard to you.
For the NIRline spectrometers we use InGaAs detectors and for the Sensline Backthinned CCD detectors.

EVOlutionary spectroscopy:

- SPEED
- NETWORK INTEGRATION
- MULTICHANNEL BENEFITS

AvaSpec-HERO

The AvaSpec-HERO is the answer for those who are in need of high resolution and high sensitivity! It combines high end cooled backthinned detector technology , a 100mm symmetrical Czerny Turner optical bench and state of the art electronics to enable you to measure noise free signals in a demanding environment. The ideal choice in the EVO series. A real Hero for your application!

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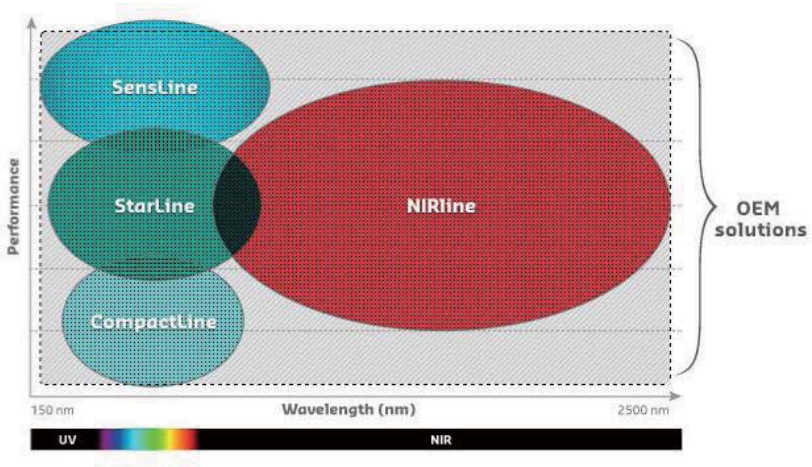
EVO SERIES

Overview of our Product Lines



EVO series in our Product Lines

Productlines		
Starline	**Sensline**	**NIRline**
AvaSpec-ULS2048CL-EVO	AvaSpec-HERO	AvaSpec-NIR256/512-1.7-EVO
AvaSpec-ULS4096CL-EVO	AvaSpec-ULS2048XL-EVO	AvaSpec-NIR256/512-1.7-HSC-EVO
AvaSpec-ULS2048L-EVO	AvaSpec-HS2048XL-EVO	AvaSpec-NIR256/512-2.5-HSC-EVO

USB 3.0

Gigabit Ethernet

More memory

EVO Series, with CMOS detector: StarLine AvaSpec-ULS2048CL-EVO Spectrometer

EVO series: AvaSpec-ULS2048CL

Using CMOS technology instead of the conventional CCD technology, this spectrometer offers you the latest technology. New technologies like CMOS have evolved and become a suitable alternative.
In combination with our latest AS-7010 electronics it offers you a versatile device including USB3.0
Communication with 10x higher speed compared to USB2, and a second communication port which offers Gigabit Ethernet for integration in your company network and possibility for long distance communication.
Besides the high speed communication options, the EVO also offers a fast microprocessor and 50x more memory which can help you to store more spectra onboard and realise more functionality.

Options include a detector collection lens to enhance sensitivity in the 200-1100 nm range and order-sorting filter to reduce 2nd order effects. Furthermore,the AvaSpec-2048CL is available with a wide range of slit sizes, gratings and fiber-optic entrance connectors.
It comes complete with AvaSoft-Basic software, USB cable and an extensive manual.

The AvaSpec-ULS2048CL-EVO is also available as OEM unit, Bench only or Rackmount version.

Technical Data

Optical Bench	ULS Symmetrical Czerny-Turner, 75 mm focal length
Wavelength range	200-1100 nm
Resolution	0.06 –20 nm, depending on configuration (see table)
Stray-light	0.19-1.0%, depending on the grating
Sensitivity	375,000 counts/µW per ms integration time
Detector	CMOS linear Image Sensor
Signal/Noise	300:1
AD converter	16-bit, 6 MHz
Integration time	30 µs – 59s
Interface	USB 3.0 high-speed, 5 Gbps Gigabit Ethernet 1 Gbps
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 13 Digital bidirectional, trigger, sync., strobe, laser
Power supply	Default USB3 power, 500 mA Or 12VDC, 300 mA
Dimensions, weigh	177 x 127 x 44,5 mm (1 channel), 1135 grams

Timing and triggering

Sample speed with on-board averaging	0.38 ms /scan
Data transfer speed	0.38 ms/scan (USB3), 1.0 ms (ETH)
Min. Delay / Jitter	0.9 / 0.02µs
Sample speed Store to Ram	0.38 ms

Detector specifications

Sensitivity Photons/ count @600 nm	Sensitivity in cts/µW per ms int. time	QE (%) @peak	Signal/ Noise	Dark Noise (counts RMS)	Dynamic Range
2	375,000	80%	300:1	16	4000

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Grating selection table for AvaSpec-ULS2048CL-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
UV/VIS/NIR	200-1100**	891**	300	300	UA
UV/VIS/NIR	200-1100**	891**	300	300/1000	UNA-DB
UV/VIS	200-850	515	600	300	UB
UV	200-750	247-218*	1200	250	UC
UV	200-650	163-143*	1800	UV	UD
UV	200-580	113-69*	2400	UV	UE
UV	200-400	69-45*	3600	UV	UF
UV/VIS	250-850	515	600	400	BB
VIS/NIR	300-1100**	792**	300	500	VA
VIS	360-1000	495	600	500	VB
VIS	300-800	247-218*	1200	500	VC
VIS	350-750	142-89*	1800	500	VD
VIS	350-640	74-49*	2400	VIS	VE
NIR	500-1050	495	600	750	NB
NIR	500-1050	218-148*	1200	750	NC
NIR	600-1160	346-297	830	800	SI
NIR	600-1100**	495**	300	1000	IA
NIR	600-1100	495	600	1000	IB

* depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the smaller the range to select.
** please note that not all 2048 pixels will be used for the useable range

Resolution table (FWHM in nm) for AvaSpec-ULS2048CL-EVO

	Slit size (µm)					
Grating (lines/mm)	**10**	**25**	**50**	**100**	**200**	**500**
300	1.0	1.4	2.5	4.8	9.2	21.3
600	0.40-0.53*	0.7	1.2	2.4	4.6	10.8
830	0.32	0.48	0.93	1.7	3.4	8.5
1200	0.20-0.28*	0.27-0.38*	0.52-0.66*	1.1	2.3	5.4
1800	0.10-0.18*	0.20-0.29*	0.34-0.42*	0.8	1.6	3.6
2400	0.09-0.13*	0.13-0.17*	0.26-0.34*	0.44-0.64*	1.1	2.7
3600	0.06-0.08*	0.10	0.19	0.4	0.8	1.8

* depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the better the resolution

Options

-RS	• Replaceable slit
DCL-UV/VIS-200	• Quartz Detector Collection Lens (200-1100 nm)
SLIT-XX	• Slit size, please specify XX = 5, 10, 25, 50, 100, 200 or 500 µm
SLIT-XX-RS	• Replaceable slit with SMA connector , specify slit size XX=25, 50, 100, 200 or 500 µm. Only in combination with AvaSpec-ULS2048CL-EVO-RS
SLIT-XX-RS-FCPC	• as SLIT-XX-RS, but with FC/PC connector
OSF-YYY	• Order-sorting filter for reduction of 2nd order effects please specify YYY= 305, 395, 475, 515, 550 or 600 nm
OSC	• Order-sorting coating with 600 nm long-pass filter for BB (>305 nm) and VB gratings in AvaSpec-ULS2048CL-EVO, recommended with OSF-305
OSC-UA	• Order-sorting coating with 350 and 600 nm long-pass filter for UA, VA gratings in AvaSpec-ULS2048CL-EVO
OSC-UB	• Order-sorting coating with 350 and 600 nm long-pass filter for UB or BB (<350 nm) gratings in AvaSpec-ULS2048CL-EVO
-FCPC	• FC/PC fiber-optic connector

NEW

EVO Series, with 4k CMOS detector: StarLine AvaSpec-ULS4096CL-EVO Spectrometer

EVO series: AvaSpec-ULS4096CL

Another new member in our new EVO series: the AvaSpec-ULS4096CL-EVO. Using CMOS technology instead of the conventional CCD technology, this spectrometer offers you the latest technology; ready for the next decade. The dominant position of CCD detectors in the spectrometer field is fading and new technologies like CMOS have evolved and become a suitable alternative. The AvaSpec-ULS4096CL-EVO offers you this latest technology ensuring a spectrometer platform for the coming years.
In combination with our latest AS-7010 electronics it offers you a versatile device including USB3.0 Communication with 10x higher speed compared to USB2, and a second communication port which offers Gigabit Ethernet for integration in your company network and possibility for long distance communication at an affordable price.
Besides the high speed communication options, the EVO also offers a fast microprocessor and 50x more memory which can help you to store more spectra onboard and realise more functionality.

Options include a detector collection lens to enhance sensitivity in the 200-1100 nm range and order-sorting filter to reduce 2nd order effects. Furthermore,the AvaSpec-4096CL is available with a wide range of slit sizes, gratings and fiber-optic entrance connectors.
It comes complete with AvaSoft-Basic software, USB cable and an extensive manual.

The AvaSpec-ULS4096CL-EVO is also available as OEM unit, Bench only or Rackmount version.
With the 4096 pixels these spectrometers are tailored for high resolution applications like Plasma and LIBS.

Technical Data

Optical Bench	ULS Symmetrical Czerny-Turner, 75 mm focal length
Wavelength range	200-1100 nm
Resolution	0.05 –20 nm, depending on configuration (see table)
Stray-light	0.19-1.0%, depending on the grating
Sensitivity	261,000 counts/µW per ms integration time
Detector	CMOS linear Image Sensor
Signal/Noise	300:1
AD converter	16-bit, 6 MHz
Integration time	30 µs – 50s
Interface	USB 3.0 high-speed, 5 Gbps Gigabit Ethernet 1 Gbps
Sample speed with on-board averaging	0.75 ms /scan
Data transfer speed	0.75 ms/scan (USB3), 1.9 ms (ETH)
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 13 Digital bidirectional, trigger, sync., strobe, laser
Power supply	Default USB3 power, 500 mA Or 12VDC, 300 mA
Dimensions, weight	177 x 127 x 44,5 mm (1 channel), 1135 grams

Detector specifications

Sensitivity Photons/ count @600 nm	Sensitivity in cts/µW per ms int. time	QE (%) @peak	Signal/ Noise	Dark Noise (counts RMS)	Dynamic Range
2	261,000	80%	300:1	16	4000

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Grating selection table for AvaSpec-ULS4096CL-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
UV/VIS/NIR	200-1100**	891**	300	300	UA
UV/VIS/NIR	200-1100**	891**	300	300/1000	UNA-DB
UV/VIS	200-850	515	600	300	UB
UV	200-750	247-218*	1200	250	UC
UV	200-650	163-143*	1800	UV	UD
UV	200-580	113-69*	2400	UV	UE
UV	200-400	69-45*	3600	UV	UF
UV/VIS	250-850	515	600	400	BB
VIS/NIR	300-1100**	792**	300	500	VA
VIS	360-1000	495	600	500	VB
VIS	300-800	247-218*	1200	500	VC
VIS	350-750	142-89*	1800	500	VD
VIS	350-640	74-49*	2400	VIS	VE
NIR	500-1050	495	600	750	NB
NIR	500-1050	218-148*	1200	750	NC
NIR	600-1160	346-297	830	800	SI
NIR	600-1100**	495**	300	1000	IA
NIR	600-1100	495	600	1000	IB

* depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the smaller the range to select.
** please note that not all 4096 pixels will be used for the useable range

Resolution table (FWHM in nm) for AvaSpec-ULS4096CL-EVO

	Slit size (µm)					
Grating (lines/mm)	**10**	**25**	**50**	**100**	**200**	**500**
300	0.50-0.70	1.20-1.30*	2.17	4.6	9.00	20.0
600	0.30-0.36*	0.58-0.60	1.17	2.20	4.5	10.0
830	0.25	0.48	0.93	1.7	3.4	8.0
1200	0.14-0.18*	0.30	0.62	1.08	2.2	5.0
1800	0.09-0.11*	0.18	0.36-0.40*	0.78	1.5	3.7
2400	0.07-0.09*	0.13-0.15*	0.26-0.32*	0.40-0.64*	1.1	2.7
3600	0.05-0.06*	0.10	0.19	0.4	0.8	2.0

* depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the better the resolution

Options

-RS	• Replaceable slit
DCL-UV/VIS-200	• Quartz Detector Collection Lens (200-1100 nm)
SLIT-XX	• Slit size, please specify XX = 5, 10, 25, 50, 100, 200 or 500 µm
SLIT-XX-RS	• Replaceable slit with SMA connector , specify slit size XX=25, 50, 100 or 200 µm. Only in combination with AvaSpec-ULS4096CL-EVO-RS
SLIT-XX-RS-FCPC	• as SLIT-XX-RS, but with FC/PC connector
OSF-YYY	• Order-sorting filter for reduction of 2nd order effects please specify YYY= 305, 395, 475, 515, 550 or 600 nm
OSC	• Order-sorting coating with 600 nm long-pass filter for BB (>305 nm) and VB gratings in AvaSpec-ULS4096CL-EVO, recommended with OSF-305
OSC-UA	• Order-sorting coating with 350 and 600 nm long-pass filter for UA, VA gratings in AvaSpec-ULS4096CL-EVO
OSC-UB	• Order-sorting coating with 350 and 600 nm long-pass filter for UB or BB (<350 nm) gratings in AvaSpec-ULS4096CL-EVO
-FCPC	• FC/PC fiber-optic connector

EVO Series: StarLine AvaSpec-ULS2048L-EVO Spectrometer

EVO series: AvaSpec-ULS2048L

Unique is the second communication port which offers Gigabit Ethernet for integration in your company network and possibility for long distance communication..

This unique, first to the market combination enables you to create high speed multichannels systems, perfectly suited for most industrial applications.

Options include a deep-UV detector coating, for better performance in the deep-UV-range, a detector collection lens to enhance sensitivity in the 200-1100 nm range and order-sorting filter to reduce 2nd order effects. Furthermore, the AvaSpec-2048L is available with a wide range of slit sizes, gratings and fiber-optic entrance connectors.

It comes complete with AvaSoft-Basic software, USB cable and an extensive manual.

Technical Data

Optical Bench	ULS Symmetrical Czerny-Turner, 75 mm focal length
Wavelength range	200-1100 nm
Resolution	0.06 –20 nm, depending on configuration (see table)
Stray-light	0.04-0.1%, depending on the grating
Sensitivity	470,000 counts/µW per ms integration time
Detector	CCD linear array, 2048 pixels
Signal/Noise	300:1
AD converter	16-bit, 2 MHz
Integration time	1.11 ms – 10 minutes
Interface	USB 3.0 high-speed, 5 Gbps Gigabit Ethernet 1 Gbps
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 13 Digital bidirectional, trigger, sync., strobe, laser
Power supply	Default USB3 power, 500 mA Or 12VDC, 300 mA
Dimensions, weight	177 x 127 x 44,5 mm (1 channel), 1135 grams

Timing and triggering

Sample speed with on-board averaging	1.1 ms /scan
Data transfer speed	1.1 ms/scan (USB3), 3.8 ms (ETH))
Min. Delay / Jitter	3.28 / 0.02 µs
Sample speed Store to Ram	1,05 ms

Detector specifications

Sensitivity Photons/ count @600 nm	Sensitivity in cts/µW per ms int. time	QE (%) @peak	Signal/ Noise	Dark Noise (counts RMS)	Dynamic Range
4	470,000	40%	300:1	20	3300

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Grating selection table for AvaSpec-ULS2048L-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
UV/VIS/NIR	200-1100**	900**	300	300	UA
UV/VIS/NIR	200-1100**	900**	300	300/1000	UNA-DB
UV/VIS	200-850	520	600	300	UB
UV	200-750	250-220*	1200	250	UC
UV	200-650	165-145*	1800	UV	UD
UV	200-580	115-70*	2400	UV	UE
UV	200-400	70-45*	3600	UV	UF
UV/VIS	250-850	520	600	400	BB
VIS/NIR	300-1100**	800**	300	500	VA
VIS	360-1000	500	600	500	VB
VIS	300-800	250-200*	1200	500	VC
VIS	350-750	145-90*	1800	500	VD
VIS	350-640	75-50*	2400	VIS	VE
NIR	500-1050	500	600	750	NB
NIR	500-1050	220-150*	1200	750	NC
NIR	600-1160	350-300	830	800	SI
NIR	600-1100**	500**	300	1000	IA
NIR	600-1100	500	600	1000	IB

* depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the smaller the range to select.
** please note that not all 2048 pixels will be used for the useable range

Resolution table (FWHM in nm) for AvaSpec-ULS2048L-EVO

	Slit size (µm)					
Grating (lines/mm)	**10**	**25**	**50**	**100**	**200**	**500**
300	1.0	1.4	2.5	4.8	9.2	21.3
600	0.40-0.53*	0.7	1.2	2.4	4.6	10.8
830	0.32	0.48	0.93	1.7	3.4	8.5
1200	0.20-0.28*	0.27-0.38*	0.52-0.66*	1.1	2.3	5.4
1800	0.10-0.18*	0.20-0.29*	0.34-0.42*	0.8	1.6	3.6
2400	0.09-0.13*	0.13-0.17*	0.26-0.34*	0.44-0.64*	1.1	2.7
3600	0.06-0.08*	0.10	0.19	0.4	0.8	1.8

* depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the better the resolution

This first to the market combination enables you to create high speed multichannel systems

AvaSpec-HERO SensLine

AvaSpec-HERO

The AvaSpec-Hero is the top of the line spectrometer!
Based on High Sensitivity Compact optical bench (f=100mm; NA=0.13) and a 1024x58 backthinned CCD detector, it offers the best of both worlds: Sensitivity and Resolution!

The instrument is equipped with a TE Cooling enabling long integration times in low light applications. In conjunction with our AS7010 electronics, including a high end AD convertor, noise is kept to a minimum, which offers you an excellent Signal to Noise and Dynamic Range performance.

From low light fluorescence applications to demanding Raman applications, the AvaSpec-Hero is your ideal companion.

Of course the Digital IO ports enabling external triggering, control of shutters, and pulsed light sources from the Avantes line of instruments are available as well.

The Avaspec-HERO is standard equipped for use with replaceable slits, offering optimal flexibility for a variety of applications.

Technical Data: AvaSpec-HSC1024x58TEC-EVO

Optical Bench	HSC Symmetrical Czerny-Turner, 100 mm focal length, NA: 0.13
Wavelength range	200-1160 nm
Resolution	0.2-7 nm, depending on configuration (see table)
Stray-light	0.5%, depending on the grating
Sensitivity	445,000 counts/µW per ms integration time
Detector	CCD array image sensor with one stage TE Cooled, 1024 pixels
Signal/Noise	1200:1
Dynamic Range	40.000
AD converter	16-bit, 250 kHz
Integration time	5.2 ms– 60 sec
Interface	USB 3.0 high-speed, 5 Gbps Gigabit Ethernet 1 Gbps
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 3 Digital bidirectional, trigger, sync., strobe, laser.
Power supply	12VDC, 1.5A
Dimensions, weight	185 x 161 x 185mm, 3500 grams

Timing and triggering

Sample speed with on-board averaging	5.2 ms /scan
Data transfer speed	5.2 ms/scan (USB3 and ETH)
Min. Delay / Jitter	-5220µs / 5220µs
Sample speed Store to Ram	5.2 ms

Detector specifications

Sensitivity Photons/ count @600 nm	Sensitivity in cts/µW per ms int. time	QE (%) @peak	Signal/ Noise	Dark Noise (counts RMS)	Dynamic Range
16	445,000	92%	1200:1	2	40.000

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Grating selection table for AvaSpec-HSC1024x58TEC-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
UV/VIS/NIR	200-1160	770-760*	300	300	HSC0300-0.30
UV/VIS/NIR	200-1160	770-760*	300	420	HSC0300-0.42
VIS/NIR	200-1160	577-553	400	550	HSC0400-0.55
UV/VIS	200-1160	373-340*	600	400	HSC0600-0.40
VIS/NIR	200-1160	373-340*	600	650	HSC0600-0.65
VIS/NIR	200-1160	268-220*	830	900	HSC0830-0.90
UV/VIS	200-930	182-130*	1200	400	HSC1200-0.40
VIS/NIR	200-930	182-130*	1200	750	HSC1200-0.75
UV/VIS	200-500	84-61*	2400	270	HSC2400-0.27

** depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the smaller the range to select.*

Resolution table (FWHM in nm) for AvaSpec-HSC1024x58TEC-EVO

	Slit size (µm)				
Grating (lines/mm)	**10**	**25**	**50**	**100**	**200**
300	1.70	1.90	2.45	3.0	5.50
400	1.40	1.55	2.00	2.55	4.70
600	0.80	0.85	1.10	1.70	3.00
830	0.60	0.70	0.9	1.25	2.00
1200	0.32	0.35	0.48	0.80	1.30
2400	0.18	0.20	0.29	0.40	0.65

** Above values are average values. Due to optical properties resolution will be better in the lower wavelengths than in the higher wavelength range.*

Options

SLIT-XX-RS	• Replaceable slit with SMA connector, specificy slit size XX=10, 25, 50, 100, 200 or 500 µm.
SLIT-XX-RS-FCPC	• As SLIT-XX-RS, but with FC/PC connector
SLITKIT-SMA	• Slit kit containing 25, 50, 100, 200 or 500 µm slits, and the tools to replace the slit. SMA-connectors
SLITKIT-FCPC	• As SLITKIT-SMA, but with FC/PC connectors
OSF-YYY-3	• Order sorting filter for reduction of 2nd order effects, 3 mm thick, please specify YYY= 305, 395, 475, 515, 550, 600 nm
OSC-HSC300	• Order sorting coating for use with grating HSC0300-xx
OSC-HSC600	• Order sorting coating for use with grating HSC0600-xx and HSC0400-xx

The new AvaSpec-HERO is the answer for those who are in need of high resolution ánd high sensitivity!

AvaSpec-ULS2048XL-EVO SensLine High UV- and NIR-sensitivity back-thinned CCD Spectrometer

Combining exceptional quantum efficiency with high-speed is the value proposition of the AvaSpec-ULS2048XL-EVO spectrometer. Unlike many back-thinned CCD spectro-meters, which have two dimensional arrays, the ULS2048XL-EVO has large monolithic pixels of 14x500 microns with exceptional efficiency in the UV, from 200-400 nm, and the NIR, from 950-1160 nm. The instrument also has an electronic shutter, which enables integration times as low as 2 microseconds. To further enhance sensitivity, a detector collection lens is available which improves sensitivity up to 60% when combined with larger core fibers.

Options include order-sorting filter, to reduce 2nd order effects and purge ports for deep-UV measurements. The AvaSpec-ULS2048XL-EVO comes with a wide range of slit sizes, gratings and may be configured with SMA or FC/PC fiber-optic entrance connectors.
Connection to your PC is handled via a USB3-connection or Ethernet, delivering a scan every 2 milliseconds. The instrument comes complete with AvaSoft-basic software, USB cable and an extensive manual.

AvaSpec-ULS2048XL-EVO

Technical Data

Optical Bench	ULS, Symmetrical Czerny-Turner, 75 mm focal length
Wavelength range	200 - 1160 nm
Resolution	0.09 –20 nm, depending on configuration (see table)
Stray-light	< 0.5%
Sensitivity	460,000 counts/µW per ms int. time
UV Quantum efficiency	60% (200-300 nm)
Detector	Back-thinned CCD image sensor 2048 pixels
Signal/Noise	525:1
AD converter	16-bit, 1 MHz
Integration time	2 µs – 20 seconds
Interface	USB 3.0 high-speed, 5 Gbps Gigabit Ethernet 1 Gbps
Readout Noise	9.8 cnt RMS
Dark Noise	4.5 cnt RMS
Dynamic Range	13.700
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 3 Digital in, 12 Digital out, trigger, synchronization
Power supply	Default USB power, 700 mA. Or external 12VDC, 360 mA
Dimensions, weight	175 x 127 x 44,5 mm (1 channel), 1180 grams

Timing and triggering

Sample speed with store to RAM	2.44 ms /scan
Data transfer speed	2.44 ms/scan (USB3)
Min. Delay / Jitter	0.37 / 25ns
Store to Ram	2,44 ms

Detector specifications

Sensitivity Photons/ count @600 nm	Sensitivity in cts/µW per ms int. time	QE (%) @peak	Signal/ Noise	Dark Noise (counts RMS)	Dynamic Range
4	460,000	78%	525:1	5	13.700

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Grating selection table for AvaSpec-ULS2048XL-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
UV/VIS/NIR	200-1160**	960**	300	300	UA
UV/VIS/NIR	200-1100**	900**	300	300/1000	UNA-DB
UV/VIS	200-850	520	600	300	UB
UV	200-750	250-220*	1200	250	UC
UV	200-650	165-145*	1800	UV	UD
UV	200-580	115-70*	2400	UV	UE
UV	200-400	70-45*	3600	UV	UF
UV/VIS	250-850	520	600	400	BB
VIS/NIR	300-1160**	860**	300	500	VA
VIS	360-1000	500	600	500	VB
VIS	300-800	250-200*	1200	500	VC
VIS	350-750	145-100*	1800	500	VD
VIS	350-640	75-50*	2400	VIS	VE
NIR	500-1050	500	600	750	NB
NIR	500-1050	220-150*	1200	750	NC
NIR	600-1160	350-300	830	800	SI
NIR	600-1160**	560**	300	1000	IA
NIR	600-1160	500	600	1000	IB

** depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the smaller the range to select.*
*** please note that not all 2048 pixels will be used for the useable range*

Resolution table (FWHM in nm) for AvaSpec-ULS2048XL-EVO

	Slit size (µm)					
Grating (lines/mm)	**10**	**25**	**50**	**100**	**200**	**500**
300	1.40	1.50	2.5	4.8	9.2	21.3
600	0.70 - 0.80*	0.75-0.85*	1.2	2.4	4.6	10.8
830	0.42 - 0.48*	0.50-0.58*	0.93	1.7	3.4	8.5
1200	0.25 – 0.31*	0.37 – 0.43*	0.52-0.66*	1.1	2.3	5.4
1800	0.17 – 0.21*	0.26 – 0.32*	0.34-0.42*	0.8	1.6	3.6
2400	0.12 – 0.18*	0.18 – 0.24*	0.26-0.34*	0.44-0.64*	1.1	2.7
3600	0.09 – 0.12*	0.11 – 0.15*	0.19	0.4	0.8	1.8

** depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the better the resolution*

Options

-RS	• Replaceable slit
DCL-UV/VIS-200	• Quartz Detector Collection Lens (200-1100 nm)
SLIT-XX	• Slit size, please specify XX = 10, 25, 50, 100, 200 or 500 µm
SLIT-XX-RS	• Replaceable slit with SMA connector , specify slit size XX=25, 50, 100, 200 or 500 µm. Only in combination with AvaSpec-ULS2048XL-EVO-RS
SLIT-XX-RS-FCPC	• as SLIT-XX-RS, but with FC/PC connector
OSF-YYY	• Order-sorting filter for reduction of 2nd order effects, 1 mm thick, please specify YYY= 305, 395, 475, 515, 550 or 600 nm
OSC	• Order-sorting coating with 600 nm long-pass filter for BB (>350 nm) and VB gratings in AvaSpec-2048XL, recommended with OSF-305
OSC-UA	• Order-sorting coating with 350 and 600 nm long-pass filter for UA, VA gratings in AvaSpec-ULS2048XL
OSC-UB	• Order-sorting coating with 350 and 600 nm long-pass filter for UB or BB (<350 nm) gratings in AvaSpec-ULS2048XL
-FCPC	• FC/PC fiber-optic connector

AvaSpec-HS2048XL-EVO SensLine High UV and NIR sensitivity back-thinned CCD Spectrometer

AvaSpec-HS2048XL-EVO

For high sensitivity applications where high resolution is not of paramount concern, the AvaSpec-HS2048XL-EVO is an exceptional instrument. Featuring Avantes' HS optical bench which has a full 0.22 numerical aperture for superior throughput, the AvaSpec-HS2048XL has a back-thinned CCD detector with 2048 pixels measuring 14X500 microns.

Unlike many back-thinned CCD spectrometers, which have two dimensional arrays, the HS2048XL has large monolithic pixels with exceptional efficiency in the UV, from 200-400 nm, and the NIR, from 950-1160 nm, while retaining sensitivity in the visible range.

The unique optical design features toroid collimating and focusing mirrors to control image magnification and enhance efficiency. The instrument also features an electronic shutter, which enables integration times as low as 2 microseconds. For configurations, which require second order filtering, order-sorting filters are available. The AvaSpec-HS2048XL is available with a wide range of slit sizes, gratings and may be configured with SMA or FC/ PC fiber-optic entrance connectors.

Technical Data

Optical Bench	High-sensitivity asymmetrical design, 37.5 mm focal length; NA – 0.22, f/2.27
Wavelength range	200 - 1160 nm
Resolution	1 - 20 nm, depending on configuration (see table)
Stray-light	< 1 %
Sensitivity	1,250,000 counts/µW per ms int. time
UV Quantum efficiency	60% (200-300 nm)
Detector	Back-thinned CCD image sensor 2048 pixels
Signal/Noise	525:1
AD converter	16-bit, 1 MHz
Integration time	2 µs – 600 seconds
Interface	USB 3.0 high-speed, 5 Gbps Gigabit Ethernet, 1 Gbps
Dynamic Range	14.900
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 3 Digital in, 12 Digital out, trigger, synchronization
Power supply	Default USB power, 700 mA. or external 12VDC, 360 mA
Dimensions, weight	175 x 165 x 85 mm, 1,950 kg

Timing and triggering

Sample speed with on-board averaging	2.44 ms /scan
Data transfer speed	2.44 ms/scan (USB3)
Min. Delay / Jitter	0.37µs / 25ns
Sample speed Store to Ram	2.44 ms

Detector specifications

Sensitivity Photons/ count @600 nm	Sensitivity in cts/µW per ms int. time	QE (%) @peak	Signal/ Noise	Dark Noise (counts RMS)	Dynamic Range
4	1,250,000	78%	525:1	5	14.900

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Grating selection table for AvaSpec-HS2048XL-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
UV/VIS/NIR	200-1160	900	500	330	HS500-0.33
UV/VIS	200-660	440	1000	250	HS1000-0.25
UV	200-850	520	600	300	HS600-0.30
UV/VIS	200-850	520	600	400	HS600-0.40
UV/VIS	300-1160	860	500	560	HS500-0.56
VIS	360-1000	500	600	500	HS600-0.50
NIR	500-1050	500	600	750	HS600-0.75
VIS	350-850	460	900	550	HS900-0.55
VIS	400-722	322	1200	500	HS1200-0.5
NIR	600-1100	500	600	1000	HS600-1.0
NIR	600-1160	350	830	900	HS830-0.9
NIR	750-990	240	1200	1000	HS1200-1.0

Resolution table (FWHM in nm) for AvaSpec-HS2048XL-EVO

	Slit size (µm)					
Grating (lines/mm)	**10**	**25**	**50**	**100**	**200**	**500**
500	2.6	4.5	5.5	6.5	10.0	22.0
600	2.2	3.8	4.5	5.5	7.5	18.0
830*	2.1	3.6	4.0	5.0	7.0	15.0
900*	2.0	3.5	3.8	4.8	6.8	14.5
1000*	1.9	3.3	3.6	4.6	6.6	14.0
1200*	1.8	3.0	3.3	4.3	6.2	13.5

** theoretical values*

Options

SLIT-XX	• Slit size, please specify XX = 10, 25, 50, 100, 200 or 500 µm
OSF-YYY	• Order-sorting filter for reduction of 2nd order effects, 1 mm thick, please specify YYY= 305, 385, 475, 515, 550 or 600 nm
OSC-HS500	• Order-sorting coating with 350 and 600 nm long-pass filter for HS500 gratings in AvaSpec-HS
OSC-HS600	• Order-sorting coating with 350 and 600 nm long-pass filter for HS600 gratings in AvaSpec-HS
OSC-HS900	• Order-sorting coating with 600 nm long-pass filter for HS900 gratings in AvaSpec-HS
OSC-HS1000	• Order-sorting coating with 350 nm long-pass filter for HS1000 gratings in AvaSpec-HS
FCPC	• FC/PC fiber optic connector

Spectrometers using this AS7010 electronics platform are the next EVOlutionary step in spectrometry.
Avantes bundled these series of spectrometers in the EVO family

The **AvaSpec-HS2048XL-EVO** is ideally suited for diffuse reflection measurements (UV, VIS, NIR) and fluorescence.

NEW

AvaSpec-NIR256/512-1.7-EVO NIRLine Near-Infrared Fiber-optic Spectrometer

AvaSpec-NIR256-1.7-EVO

For measurements in the near infrared range out to 1.7 µm, Avantes offers a new series of uncooled spectrometer configurations. The AvaSpec-NIR256-1.7-EVO and the AvaSpec-NIR512-1.7-EVO offer the same high sensitivity optical bench with the next generation of electronics. Both instruments deliver the same exceptional performance specifications such as a sample speed of only 0.53 ms/scan and integration times as fast as 20 µs, as the Avantes instruments you have come to trust.

For applications where resolution is key, or more datapoints for modelling is required, the 512 pixel detector will be the best choice.

The AvaSpec-NIR256/512-1.7-EVO spectrometers pair the same trusted InGaAs array detectors with our ultra low-noise electronics board featuring USB3 and Giga-Ethernet connection port. Digital and analog I/O ports enable external triggering and control over the shutter and pulsed lightsources and choose from two distinct software-controlled gain-setting modes, high-sensitivity mode (HS, default) and the low-noise (LN) mode.

These affordable uncooled instruments are USB powered and are available with a choice of four gratings and replaceable slits to match the bandwith and requirements fitting your application.

This NIR Instrument is planned for release in Q2 2018.

Spectrometer	AvaSpec-NIR256-1.7-EVO	AvaSpec-NIR512-1.7-EVO
Optical Bench	Symmetrical Czerny-Turner, 50 mm focal length,	
Wavelength range	900-1750 nm	
Resolution (slit & grating dependent)	2 - 50 nm	
Stray-light	<1%	
Sensitivity HS in counts /µW per ms	1.300.000 (integral 1000-1750 nm)	600.000 (integral 1000-1750 nm)
Dynamic Range HS	6000:1	
Integration time HS	20 µs – 500 ms	
Signal/Noise HS	1900:1	
Sensitivity LN in counts /µW per ms	74.000 (integral 1000-1750 nm)	34.500 (integral 1000-1750 nm)
Dynamic Range LN	9000:1	
Integration time LN	20 µs – 20 seconds	
Signal/Noise LN	5000:1	
Detector	InGaAs linear array, 256 pixels, 50 µm x 500 µm	InGaAs linear array, 512 pixels, 25 µm x 500 µm
AD converter	16-bit, 500 kHz	16-bit, 500 kHz
Interface	USB3.0 high speed, 5 Gbps, Gigabit Ethernet 1 Gbps	
Sample speed with store to RAM	0.53 ms /scan	
Data transfer speed	0.53 ms /scan (USB3)	
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 13 Digital IO bi-directional, trigger, synchronization, strobe, laser	
Power supply	Default USB power, 600 mA or external 12VDC, 320mA (4W)	
Dimensions, weight	185 x 100 x 184 mm, 2.7 kg	

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Grating selection table for AvaSpec-NIR256/512-1.7-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
		256/512			
NIR	900-1750	850	200	1500	NIR200-1.5
NIR	1000-1700	340	400	1600	NIR400-1.6
NIR	900-1400	200	600	1200	NIR600-1.2
NIR	1300-1600	152	600	1600	NIR600-1.6

Resolution table (FWHM in nm) for AvaSpec-NIR256/512-1.7 - EVO

	Slit size (µm)				
Grating (lines/mm)	25*	50	100	200	500
200	5	6	12	24	50
400	2.5	3	6	12	25
600	n.a.	2	4	8	18

* only for AvaSpec-NIR512

Options

SLIT-XX-RS	• Replaceable slit with SMA connector, specify slit size XX=25*, 50, 100 or 200 µm
SLIT-XX-RS-FCPC	• as SLIT-XX-RS, but with FC/PC connector

** only for AvaSpec-NIR512*

For external triggering Avantes offers the AvaTrigger featuring optical triggering, external TTL or manually through the pushbutton.

NEW

AvaSpec-NIR256/512-1.7-HSC-EVO NIRLine Near-Infrared Fiber-optic Spectrometer

AvaSpec-NIR256-1.7-HSC-EVO

For measurements in the near infrared range out to 1.7 µm, Avantes offers a new series of cooled spectrometer configurations. The AvaSpec-NIR256-1.7-HSC-EVO and the AvaSpec-NIR512-1.7-HSC-EVO offer the high sensitivity 100mm optical bench (HSC) with the next generation of electronics (EVO). Both instruments deliver exceptional performance specifications such as a high sample speed and integration times as fast as 20 µs, as the Avantes instruments you have come to trust.

For applications where resolution is key, or more datapoints for modelling is required, the 512 pixel detector will be the best choice.

The AvaSpec-NIR256/512-1.7-HSC-EVO spectrometers pair the same trusted InGaAs array detectors with our ultra low-noise electronics board featuring USB3 and Giga-Ethernet connection port. The instruments are standard equiped with a Replaceable Slit. Digital and analog I/O ports enable external triggering and control over the shutter and pulsed lightsources and choose from two distinct software-controlled gain-setting modes, high-sensitivity mode (HS, default) and the low-noise (LN) mode.
Cooling ensures optimal noise condition even at longer integration times. All NIR-1.7 instruments are available with a choice of four different gratings, making it possible to choose the bandwidth fitting your application.

This NIR Instrument is planned for release in Q2 2018.

Spectrometer	AvaSpec-NIR256-1.7-HSC-EVO	AvaSpec-NIR512-1.7-HSC-EVO
Optical Bench	Symmetrical Czerny-Turner, 100 mm focal length, 1 stage TE-cooled	
Wavelength range	900-1750 nm	
Resolution (slit & grating dependent)	1.9 - 32 nm	1.7 - 32 nm
Stray-light	<1%	
Sensitivity HS in counts /µW per ms	4.800.000 (integral 1000-1750 nm)	2.500.000 (integral 1000-1750 nm)
Dynamic Range HS	4900:1	
Signal/Noise HS	5000:1	
Integration time HS	20 µs – 500ms	
Sensitivity LN in counts /µW per ms	160.000 (integral 1000-1750 nm)	83.000 (integral 1000-1750 nm)
Dynamic Range LN	7600:1	
Signal/Noise LN	5000:1	
Integration time LN	20 µs – 20 seconds	
Detector	TE-cooled InGaAs linear array, 256 pixels, 50 µm x 500 µm	TE-cooled InGaAs linear array, 512 pixels, 25 µm x 500 µm
AD converter	16-bit, 1,2 MHz	16-bit, 1,2 MHz
Interface	USB3.0 high speed, 5 Gbps, Gigabit Ethernet 1 Gbps	
Sample speed with store to RAM	0.13 ms /scan	0.24 ms /scan
Data transfer speed	0.4 ms /scan (USB3)	0.53 ms /scan (USB3)
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 13 Digital IO bi-directional, trigger, synchronization, strobe, laser	
Power supply	12VDC, 12W	
Dimensions, weight	185 x 160 x 184 mm, 3.6 kg	

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Grating selection table for AvaSpec-NIR256/512-1.7-HSC-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
		256/512			
NIR	900-1700	800-660*	150	1250	NIR150-1.2
NIR	994-1280	278	300	1200	NIR300-1.2
NIR	950-1800	262-230*	400	1200	NIR400-1.2
NIR	960-1800	262-230*	400	1600	NIR400-1.6

Resolution table (FWHM in nm) for AvaSpec-NIR256/512-1.7-HSC- EVO

	Slit size (µm)				
Grating (lines/mm)	**25***	**50**	**100**	**200**	**500**
150	4.0	5.7	7.0	12.8	32
300	1.8	2.3	3.0	4.0	10
400	1.7	1.9	2.5	3.3	8.3

* only for AvaSpec-NIR512

Options

SLIT-XX-RS	• Replaceable slit with SMA connector, specify slit size XX=25*, 50, 100 ,200 or 500 µm
SLIT-XX-RS-FCPC	• as SLIT-XX-RS, but with FC/PC connector

** only for AvaSpec-NIR512*

For external triggering Avantes offers the AvaTrigger featuring optical triggering, external TTL or manually through the pushbutton.

AvaSpec-NIR256/512-2.5-HSC-EVO NIRLine Near-infrared Fiber Optic Spectrometer

The NIR spectrometers in our EVO series offer more sensitivity, less weight and less size. They are based on a 100mm optical bench with a NA of 0.13 offering optimal balance between resolution and sensitivity.

The 2.5-HSC series feature 256 or 512 pixel InGaAs detectors and are available in multiple configurations. These instruments are perfect for grain, corn, wheat, soya, polymers but also for medical uses, process monitoring and other analysis. The 256 pixel detectors offer best sensitivity for most applications.

For applications where resolution is key, or more datapoints for modelling is required, the 512 pixel detector will be the best choice.

Also available on the –HSC is the userselectable gain setting mode: LN(low- noise, standard setting), which gives you a longer integration time and higher signal to noise ratio, or HS (high-sensitivity) for measuring in lowlight conditions. Analog and digital IO ports enable external triggering and control of shuttered and pulsed light sources from the AvaLight series. T

Technical Data

Spectrometer platform	AvaSpec-NIR256-2.5-HSC-EVO	AvaSpec-NIR512-2.5-HSC-EVO
Optical Bench	TE-cooled Symmetrical Czerny Turner, 100 mm focal length	
Wavelenght Range	1000 - 2500 nm	
Resolution (slit & grating dependent)	4.4 - 85.0 nm	2.6 - 85.0 nm
Pixel Dispersion (with NIR 075-1.7 grating)	6.2 nm	3.1 nm
Stray-light	<1.0%	
Sensitivity HS in counts / µW per ms (1000-2500 nm)	990,000	990,000
Signal/Noise HS	1800:1	1900:1
Integration time HS	10µs -5ms	
Sensitivity LN in counts / uW per ms (1000-2500nm)	55,000	55,000
Signal/Noise LN	4000:1	3700:1
Integration time LN	10 µs - 100 ms	
Detector	inGaAs linear array with 2-stage TE-cooling, 256 pixel	inGaAs linear array with 2-stage TE-cooling, 512 pixel
Pixel size (WxH)	50x250µm	25x250µm
AD converter	16 bit, 500kHz	
Interface	USB 3.0 high-speed, 5 Gbps Gigabit Ethernet 1 Gbps	
Sample speed with on-board averiging	0.54 ms/scan (USB3)	
Data transfer speed	1.11ms/scan (USB3)	
Digital IO	HD-26 connector, 2 Analog in, 2 Analog out, 13 Digital bi-directional, trigger, sync, strobe, laser	
Power supply	12 V, 40W	
Operating Temperature range	0 - 40 ºC	
Cooling	45 ºC versus ambient	
Dimensions, weight	185 x 145 x 185 mm, 3.5 kg.	

Grating selection table for AvaSpec-NIR 256/512-2.5-HSC-EVO

Use	Useable range (nm)	Spectral range (nm)	Lines/mm	Blaze (nm)	Order code
NIR	1000-2500	1500	75	1700	NIR075-1.7
NIR	1000-2500	1173 - 1150*	100	2500	NIR100-2.5
NIR	1000-2500	800 - 660*	150	2000	NIR150-2.0
NIR	1000-2500	815 - 700*	150	2600	NIR150-2.6
NIR	1000-2500	574 - 530*	200	1500	NIR200-1.5

**Depends on the starting wavelength of the grating; the higher the wavelength, the bigger the dispersion and the smaller the range to select.*

Resolution table (FWMH in nm) for AvaSpec-NIR256/512-2.5-HSC-EVO

	Slit size (µm)				
Grating (lines/mm)	**25***	**50**	**100**	**200**	**500**
75	8.9	12.9	16.0	33.9	84.5
100	7.2	9.5	12.0	20.0	50.0
150	4.0	5.7	7.0	12.8	32.0
200	2.6	4.4	5.2	9.3	23.3

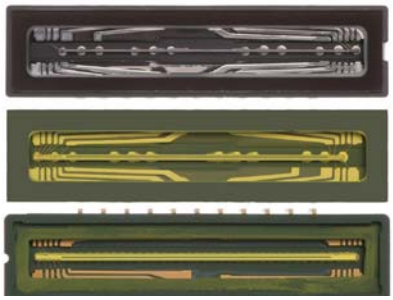
** Only for AvaSpec-NIR 512*

Options

SLIT-XX-RS	• Slit size, please specify XX = 25, 50, 100, 200 or 500 µm

This instrument is perfect for grain, corn, wheat, soya and other analysis.

Detector specifications



Star- and Sensline detectors

Detector Specifications (based on a 16-bit AD converter)

	StarLine			SensLine	
Detector	HAM-2048CL	HAM-4096CL	SONY-2048L	HAM-2048XL	HAM-1024x58
Type	CMOS linear array	CMOS linear array	CCD linear array	Back-thinned CCD array	Cooled Back-thinned CCD array
# Pixels, pitch	2048, 14 µm	2048, 7 µm	2048, 14 µm	2048, 14 µm	1024 x 58, 24 µm
Pixel width x height (µm)	14 x 200	7 x 200	14 x 200	14 x 500	24 x 24 (total height 1.4 mm)
Pixel well depth (electrons)	80,000	80,000	90,000	200,000	1,000,000
Sensitivity Photons/ count @600 nm	2	2	4	4	16
Sensitivity in counts/µW per ms integration time	375,000 (AvaSpec-ULS2048CL)	261,000 (AvaSpec-ULS4096CL)	470,000 (AvaSpec-ULS2048L)	460,000 (AvaSpec-ULS2048XL)	445,000 (AvaSpec-HERO)
Peak wavelength	700 nm	700 nm	450 nm	650 nm	650 nm
QE (%) @ peak	80%	80%	40%	78%	92%
Signal/Noise	300:1	300:1	300 :1	525 :1	1200:1
Dark noise (counts RMS)	16	16	20	5	2
Dynamic Range	4000	4000	3300	3800	40000
PRNU**	± 5%	± 5%	± 5%	± 3%	± 3%
Wavelength range (nm)	200-1100	200-1100	200*-1100	200-1160	200-1160
Frequency	6 MHz	6 MHz	2 MHz	1 MHz	250 kHz

* DUV Coated * * Photo-Responsive Non-Uniformity

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Detector specifications (NIR)

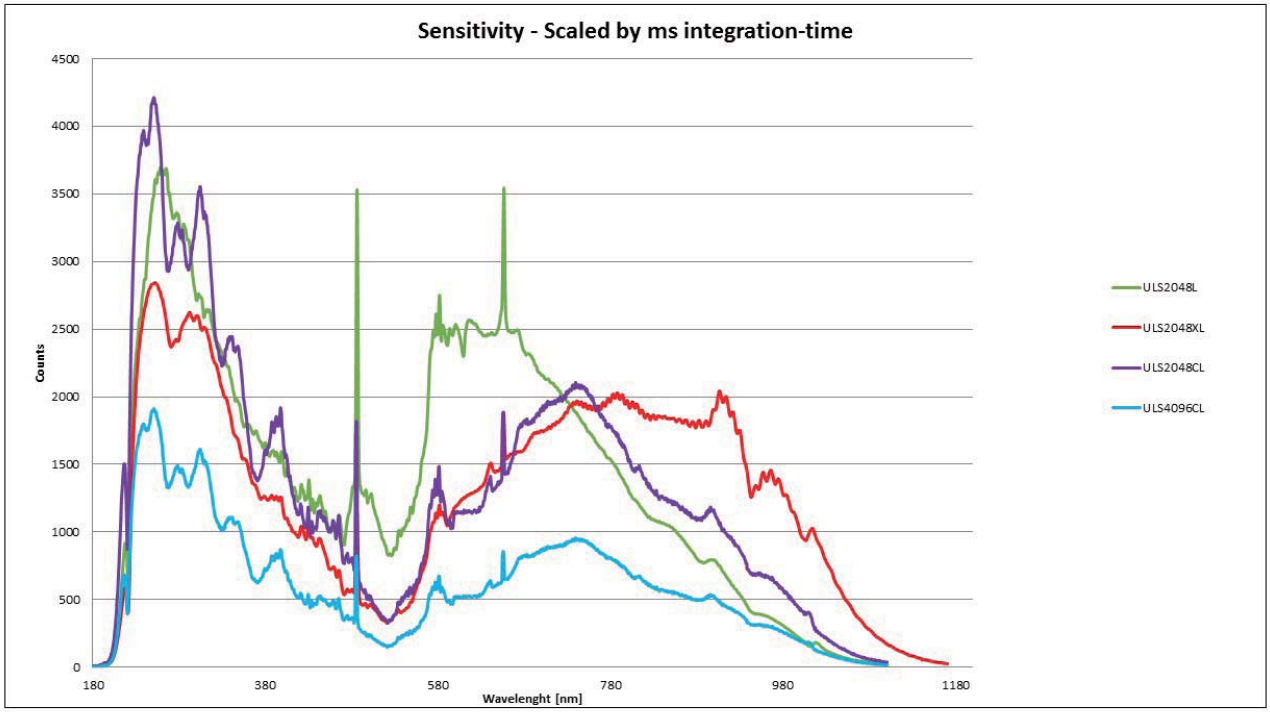
NIR detectors

Detector Specifications (NIR)

	NIRLine					
Detector	HAM-256-1.7	HAM-512-1.7	SU-256-1.7	SU-512-1.7	HAM-256-2.5	HAM-512-2.5
Type	Linear InGaAs array	Linear InGaAs array	Linear InGaAs array with 1-stage TE cooling	Linear InGaAs array with 1-stage TE cooling	Linear InGaAs array with 2-stage TE cooling	Linear InGaAs array with 2-stage TE cooling
# Pixels, pitch	256, 50 µm	512, 25 µm	256, 50 µm	512, 25 µm	256, 50 µm	512, 25 µm
pixel width x height (µm)	50 x 500	25 x 500	50 x 500	25 x 500	50 x 250	25 x 250
Sensitivity HS in counts/µW per ms	1.300,000 (integral 1000-1750 nm)	600,000 (integral 1000-170 nm)	4.800,000 (integral 1000-1750 nm)	2.500,000 (integral 1000-1750 nm)	990,000 (integral 1000-2500 nm)	480,000 (integral 1000-2500 nm)
Signal/Noise (HS)	1900:1	1900:1	5000:1	5000:1	1800:1	1900:1
Dark noise HS (counts RMS)	16	16	16	16	16	15
Dynamic Range HS	6000	6000	4900	4900	3500	4300
Sensitivity LN in counts/µW per ms	74,000 (integral 1000-1750 nm)	34,500 (integral 1000-1750 nm)	160,000 (integral 1000-1750 nm)	83,000 (integral 1000-1750 nm)	55,000 (integral 1000-2500 nm)	55,000 (integral 1000-2500 nm)
Signal/Noise (LN)	5000:1	5000:1	5000:1	5000:1	4000:1	3700:1
Dark noise LN (counts RMS)	12	12	12	12	12	13
Dynamic Range LN	9000	9000	7600	7600	4500	5100
Peak wavelength	1550 nm	1550 nm	1500 nm	1500 nm	2300 nm	2300 nm
QE (%) @ peak	90%	90%	70%	70%	65%	65%
PNRU**	±5%	±5%	10%	10%	±5%	±5%
Defective pixels (max)	0	0	0	0	12	26
Wavelength range (nm)	900-1750	900-1750	900-1750	900-1750	1000-2500	1000-2500
Frequency	500 kHz	500 kHz	1.2 MHz	1.2 MHz	500 kHz	500 kHz

*** Photo-Response Non-Uniformity*

Sensitivity Curve StarLine



Sensitivity Curve SensLine