

# AvaSpec-ULS2048 StarLine Versatile Fiber-optic Spectrometer

## AvaSpec-ULS2048



The workhorse of our spectrometer line-up, the AvaSpec-ULS2048. Used in many applications in the UV/VIS-range, it is particularly useful in time-critical situations thanks to its exceptional response speed. Priced affordably, the AvaSpec-ULS2048 is the choice of many of our most demanding customers.

Options include 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 filters to reduce 2<sup>nd</sup> order effects. Furthermore, the AvaSpec-ULS2048 is available with a wide range of slit sizes, gratings and fiber-optic entrance connectors.

The AvaSpec-ULS2048 is also available in dual or multi-channel versions (up to 10 spectrometers in a 19" rack), where all spectra are taken simultaneously.

Connection with your PC is done via USB2-connection, delivering a scan every 1.8 milliseconds. Integration time can be as short as 1.05 milliseconds up to a maximum of 10 minutes. It comes complete with AvaSoft-Basic software, USB cable and an extensive manual, including a quick start guide in four languages.

### Technical Data

<b>Optical Bench</b>	ULS Symmetrical Czerny-Turner, 75 mm focal length
<b>Wavelength range</b>	200-1100 nm
<b>Resolution</b>	0.05 -20 nm, depending on configuration (see table)
<b>Stray-light</b>	0.06-0.19%, depending on the grating
<b>Sensitivity</b>	310,000 counts/ $\mu$ W per ms integration time
<b>Detector</b>	CCD linear array, 2048 pixels
<b>Signal/Noise</b>	200:1
<b>AD converter</b>	16-bit, 2 MHz
<b>Integration time</b>	1.05 ms - 10 minutes
<b>Interface</b>	USB 2.0 high-speed, 480 Mbps RS-232, 115.200 bps
<b>Sample speed with store to RAM</b>	1.05 ms /scan
<b>Data transfer speed</b>	1.8 ms /scan (USB2) 430 ms/scan (RS-232)
<b>Digital IO</b>	HD-26 connector, 2 Analog in, 2 Analog out, 3 Digital in, 12 Digital out, trigger, sync.
<b>Power supply</b>	Default USB power, 350 mA Or with SPU2 external 12VDC, 150 mA
<b>Dimensions, weight</b>	175 x 110 x 44 mm (1 channel), 716 grams

Pre-configured spectrometers can be shipped within 24 hours

## Grating Selection Table for AvaSpec-ULS2048

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	350-610	75-50*	2400	VIS	VE
NIR	500-1050	500	600	750	NB
NIR	500-1050	220-150*	1200	750	NC
NIR	600-1100	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-ULS2048

Grating (lines/mm)	Slit size (μm)					
	10	25	50	100	200	500
<b>300</b>	0.80 - 0.90*	1.10-1.20*	2.30	4.60	9.00	20.0
<b>600</b>	0.40 - 0.50*	0.63	1.15	2.31	4.50	10.0
<b>830</b>	0.28	0.40	0.80	1.60	3.20	8.0
<b>1200</b>	0.18 - 0.22*	0.29	0.61	1.18	2.20	5.4
<b>1800</b>	0.10 - 0.16*	0.19	0.35-0.42*	0.80	1.60	3.6
<b>2400</b>	0.08 - 0.11*	0.10 - 0.15*	0.28	0.55	1.10	2.7
<b>3600</b>	0.05 - 0.08*	0.10	0.18	0.38	0.75	1.8

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

## Ordering Information

### AvaSpec-ULS2048-USB2

- Fiber-optic Spectrometer, 75 mm AvaBench, 2048 pixel CCD detector, USB powered, high-speed USB2 interface, incl. AvaSoft-Basic, USB interface cable.  
Specify grating, wavelength range and options

## Options

<b>-SPU2</b>	<ul style="list-style-type: none"> <li>incl. switch for USB powered USB2 or external power for RS-232</li> </ul>
<b>-RS</b>	<ul style="list-style-type: none"> <li>Replaceable slit</li> </ul>
<b>DUV</b>	<ul style="list-style-type: none"> <li>Deep-UV detector coating &gt;150 nm</li> </ul>
<b>DCL-UV/VIS</b>	<ul style="list-style-type: none"> <li>Detector Collection Lens to enhance sensitivity, Quartz, 200-1100 nm</li> </ul>
<b>SLIT-XX</b>	<ul style="list-style-type: none"> <li>Slit size, please specify XX = 5, 10, 25, 50, 100, 200 or 500 <math>\mu\text{m}</math></li> </ul>
<b>SLIT-XX-RS</b>	<ul style="list-style-type: none"> <li>Replaceable slit with SMA connector, specify slit size XX=25, 50, 100, 200 or 500 <math>\mu\text{m}</math>. Only in combination with AvaSpec-ULS2048-USB2-RS</li> </ul>
<b>SLIT-XX-RS-FCPC</b>	<ul style="list-style-type: none"> <li>as SLIT-XX-RS, but with FC/PC connector</li> </ul>
<b>OSF-YYY</b>	<ul style="list-style-type: none"> <li>Order-sorting filter for reduction of 2<sup>nd</sup> order effects please specify YYY= 305, 395, 475, 515, 550 or 600 nm</li> </ul>
<b>OSC</b>	<ul style="list-style-type: none"> <li>Order-sorting coating with 600 nm long-pass filter for VA, BB (&gt;350 nm) and VB gratings</li> </ul>
<b>OSC-UA</b>	<ul style="list-style-type: none"> <li>Order-sorting coating with Linear Variable Filter for UA gratings</li> </ul>
<b>OSC-UB</b>	<ul style="list-style-type: none"> <li>Order-sorting coating with 350 and 600 nm long-pass filter for UB or BB (&lt;350 nm) gratings</li> </ul>
<b>-FCPC</b>	<ul style="list-style-type: none"> <li>FC/PC fiber-optic connector</li> </ul>

To calibrate your spectrometer, take a look at the AvaLight-CAL calibration light source. Alternatively Avantes has in-house calibration possibilities. Contact an application specialist for more information.

# AvaSpec-ULS3648 StarLine High-resolution Fiber-optic Spectrometer

When you're looking for high-resolution, then take a look at the AvaSpec-ULS3648. Featuring an electronic shutter, it can support integration times as short as 10 microseconds, making it also ideal for CW laser measurements.

Options include order-sorting filters to prevent 2<sup>nd</sup> order effects, deep-UV detector coating for better sensitivity in the deep-UV-range, and a detector collection lens to enhance overall sensitivity. Also, a wide range of slit sizes, gratings and fiber-optic entrance connectors are available.

Configurations with two to ten channel spectrometers are available. These give you the possibility for multiple simultaneous

readouts or higher optical resolution in which several spectrometers are arrayed with each covering a short range with high-resolution. For more information, see pages 62 and 63.

The connection to your computer is done through USB2 at 480 Mbps. This translates into 3.7 ms per scan data transfer speed. Of course it's supplied with AvaSoft-Basic, USB cable and an extensive manual, including a quick start guide in four languages.

**AvaSpec-ULS3648**



## Technical Data

<b>Optical Bench</b>	ULS Symmetrical Czerny-Turner, 75 mm focal length
<b>Wavelength range</b>	200 - 1100 nm
<b>Resolution</b>	0.05 -20 nm, depending on configuration (see table)
<b>Stray-light</b>	0.38-0.53%, depending on the grating
<b>Sensitivity</b>	160,000 counts/ $\mu$ W per ms integration time
<b>Detector</b>	CCD linear array, 3648 pixels
<b>Signal/Noise</b>	350:1
<b>AD converter</b>	16-bit, 1 MHz
<b>Integration time</b>	10 $\mu$ s - 10 minutes
<b>Interface</b>	USB 2.0 high-speed, 480 Mbps RS-232, 115.200 bps
<b>Sample speed with store to RAM</b>	3.7 ms /scan
<b>Data transfer speed</b>	3.7 ms /scan (USB2) 750 ms/scan (RS-232)
<b>Digital IO</b>	HD-26 connector, 2 Analog in, 2 Analog out, 3 Digital in, 12 Digital out, trigger, synchronization
<b>Power supply</b>	Default USB power, 350 mA Or with SPU2 external 12VDC, 150 mA
<b>Dimensions, weight</b>	175 x 110 x 44 mm (1 channel), 716 grams

## Grating Selection Table for AvaSpec-ULS3648

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	145-100*	1800	500	VD
VIS	350-610	75-50*	2400	VIS	VE
NIR	500-1050	500	600	750	NB
NIR	500-1050	220-150*	1200	750	NC
NIR	600-1100	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 3648 pixels will be used for the useable range

## Resolution Table (FWHM in nm) for AvaSpec-ULS3648

Grating (lines/mm)	Slit size (μm)					
	10	25	50	100	200	500
<b>300</b>	0.60 - 0.70*	1.10-1.30*	2.20-2.40*	4.60	9.00	20.0
<b>600</b>	0.30 - 0.36*	0.58-0.68*	1.17	2.20	4.50	10.0
<b>830</b>	0.25	0.48	0.93	1.70	3.40	8.0
<b>1200</b>	0.14 - 0.18*	0.30	0.62	1.08	2.20	5.0
<b>1800</b>	0.09 - 0.11*	0.18	0.36-0.40*	0.78	1.50	3.7
<b>2400</b>	0.07 - 0.09*	0.13 - 0.15*	0.26-0.32*	0.52-0.64*	1.10	2.7
<b>3600</b>	0.05 - 0.06*	0.10	0.19	0.40	0.80	2.0

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

## Ordering Information

### AvaSpec-ULS3648-USB2

- Fiber-optic Spectrometer, 75 mm AvaBench, 3648 pixel CCD detector, USB powered, high-speed USB2 interface, incl. AvaSoft-Basic, USB interface cable.
- Specify grating, wavelength range and options

## Options

<b>-SPU2</b>	<ul style="list-style-type: none"><li>• incl. switch for USB powered or external power for RS-232</li></ul>
<b>-RS</b>	<ul style="list-style-type: none"><li>• Replaceable slit</li></ul>
<b>DUV</b>	<ul style="list-style-type: none"><li>• Deep-UV detector coating &gt;150 nm</li></ul>
<b>DCL-UV/VIS-200</b>	<ul style="list-style-type: none"><li>• Quartz Detector Collection Lens (200-1100 nm)</li></ul>
<b>SLIT-XX</b>	<ul style="list-style-type: none"><li>• Slit size, please specify XX = 5, 10, 25, 50, 100, 200 or 500 <math>\mu\text{m}</math></li></ul>
<b>SLIT-XX-RS</b>	<ul style="list-style-type: none"><li>• Replaceable slit with SMA connector , specify slit size XX=25, 50, 100, 200 or 500 <math>\mu\text{m}</math>. Only in combination with AvaSpec-ULS3648-USB2-RS</li></ul>
<b>SLIT-XX-RS-FCPC</b>	<ul style="list-style-type: none"><li>• as SLIT-XX-RS, but with FC/PC connector</li></ul>
<b>OSF-YYY</b>	<ul style="list-style-type: none"><li>• Order-sorting filter for reduction of 2nd order effects please specify YYY= 305, 395, 475, 515, 550 or 600 nm</li></ul>
<b>OSC</b>	<ul style="list-style-type: none"><li>• Order-sorting coating with 600 nm long-pass filter for BB (&gt;350 nm) and VB gratings, recommended with OSF-305</li></ul>
<b>OSC-UA</b>	<ul style="list-style-type: none"><li>• Order-sorting coating with Linear Variable Filter for UA, VA gratings</li></ul>
<b>OSC-UB</b>	<ul style="list-style-type: none"><li>• Order-sorting coating with 350 and 600 nm long-pass filter for UB or BB (&lt;350 nm) gratings</li></ul>
<b>-FCPC</b>	<ul style="list-style-type: none"><li>• FC/PC fiber-optic connector</li></ul>

The grating can only be changed by Avantes.

Therefore, choose your grating wisely.

Our application specialists are available to support you with your choice.

In general, a higher resolution means a lower bandwidth.

By combining multiple spectrometers in our AvaSpec-Dual or rack-mountable versions, you can create one virtual spectrometer with high-resolution and high bandwidth.

# AvaSpec-ULS2048L StarLine Versatile Fiber-optic Spectrometer

## AvaSpec-ULS2048L



A close cousin to the AvaSpec-ULS2048 but with larger pixels, is the AvaSpec-ULS2048L. It provides enhanced sensitivity at an affordable price. The AvaSpec-ULS2048L has pixels that are almost four times higher than those in the AvaSpec-ULS2048. It gives you a better signal to noise ratio and 40% less dark noise.

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 2<sup>nd</sup> order effects. Furthermore, the AvaSpec-ULS2048L is available with a wide range of slit sizes, gratings and fiber-optic entrance connectors.

The AvaSpec-2048L is also available in dual or multi-channel versions (up to 10 spectrometers), where all spectra are taken simultaneously.

Connection to your PC is handled via USB2-connection, delivering a scan every 1.8 milliseconds. Integration time can be as short as 1.05 milliseconds up to a maximum of 10 minutes. It comes complete with AvaSoft-Basic software, USB cable and an extensive manual, including a quick start guide in four languages.

### Technical Data

<b>Optical Bench</b>	ULS Symmetrical Czerny-Turner, 75 mm focal length
<b>Wavelength range</b>	200-1100 nm
<b>Resolution</b>	0.06 -20 nm, depending on configuration (see table)
<b>Stray-light</b>	0.16-0.28%, depending on the grating
<b>Sensitivity</b>	470,000 counts/ $\mu$ W per ms integration time
<b>Detector</b>	CCD linear array, 2048 pixels
<b>Signal/Noise</b>	300:1
<b>AD converter</b>	16-bit, 2 MHz
<b>Integration time</b>	1.05 ms - 10 minutes
<b>Interface</b>	USB 2.0 high-speed, 480 Mbps RS-232, 115.200 bps
<b>Sample speed with store to RAM</b>	1.05 ms /scan
<b>Data transfer speed</b>	1.8 ms/scan (USB2) 430 ms/scan (RS-232)
<b>Digital IO</b>	HD-26 connector, 2 Analog in, 2 Analog out, 3 Digital in, 12 Digital out, trigger, sync.
<b>Power supply</b>	Default USB power, 350 mA Or with SPU2 external 12VDC, 150 mA
<b>Dimensions, weight</b>	175 x 110 x 44 mm (1 channel), 716 grams

Add flexibility  
to your spectrometer with  
the Replaceable Slit (-RS) option

## Grating Selection Table for AvaSpec-ULS2048L

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	350-610	75-50*	2400	VIS	VE
NIR	500-1050	500	600	750	NB
NIR	500-1050	220-150*	1200	750	NC
NIR	600-1100	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

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

## Ordering Information

### AvaSpec-ULS2048L-USB2

- Fiber-optic Spectrometer, 75 mm AvaBench, 2048 pixel CCD detector 14 x 200 μm, USB powered, high-speed USB2 interface, incl. AvaSoft-Basic, USB interface cable. Specify grating, wavelength range and options

We can also calibrate  
your AvaSpec series  
spectrometer



## Options

<b>-SPU2</b>	• incl. switch for USB powered USB2 or external power for RS-232
<b>-RS</b>	• Replaceable slit
<b>DUV</b>	• Deep-UV detector coating >150 nm
<b>DCL-UV/VIS-200</b>	• Detector Collection Lens to enhance sensitivity, Quartz, 200-1100 nm
<b>SLIT-XX</b>	• Slit size, please specify XX = 5, 10, 25, 50, 100, 200 or 500 $\mu\text{m}$
<b>SLIT-XX-RS</b>	• Replaceable slit with SMA connector, specify slit size XX=25, 50, 100, 200 or 500 $\mu\text{m}$ . Only in combination with AvaSpec-ULS2048L-USB2-RS
<b>SLIT-XX-RS-FCPC</b>	• as SLIT-XX-RS, but with FC/PC connector
<b>OSF-YYY</b>	• Order-sorting filter for reduction of 2nd order effects, please specify YYY= 305, 395, 475, 515, 550 or 600 nm
<b>OSC</b>	• Order-sorting coating with 600 nm long-pass filter for BB (>350 nm) and VB gratings, recommended with OSF-305
<b>OSC-UA</b>	• Order-sorting coating with Linear Variable Filter for UA, VA gratings
<b>OSC-UB</b>	• Order-sorting coating with Linear Variable Filter for UB or BB (<350 nm) gratings
<b>-FCPC</b>	• FC/PC fiber-optic connector

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For extra sensitivity:  
take a look at the  
AvaSpec-ULS2048XL