

# AvaSpec-ULS2048x16 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 spectrometer. Unlike many back-thinned CCD spectro-meters, which have two dimensional arrays the ULS2048XL 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 2<sup>nd</sup> order effects, purge ports for deep-UV measurements. The AvaSpec-

ULS2048XL comes with a wide range of slit sizes, gratings and may be configured with SMA or FC/PC fiber-optic entrance connectors.

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

Connection to your PC is handled via a USB2-connection, delivering a scan every 2 milliseconds. The instrument comes complete with AvaSoft-basic software, USB cable and an extensive manual, including a quick start guide in four languages.

### Technical Data

|                                      |                                                                                                    |
|--------------------------------------|----------------------------------------------------------------------------------------------------|
| Optical Bench                        | ULS, Symmetrical Czerny-Turner, 75 mm focal length                                                 |
| Wavelength range                     | 200 - 1160 nm                                                                                      |
| Resolution                           | 0.06 –20 nm, depending on configuration (see table)                                                |
| Stray-light                          | < 0.2%                                                                                             |
| Sensitivity                          | 200,000 counts/μW per ms int. time                                                                 |
| Quantum efficiency                   | 60% (200-300 nm), 78% (600 nm)                                                                     |
| Detector                             | Back-thinned CCD image sensor 2048x16 pixels                                                       |
| Signal/Noise                         | 500:1                                                                                              |
| AD converter                         | 16-bit, 1.33 MHz                                                                                   |
| Integration time                     | 1.82 ms – 60 seconds                                                                               |
| Interface                            | USB 2.0 high-speed, 480 Mbps<br>RS-232, 115.200 bps                                                |
| Sample speed with on-board averaging | 1.82 ms / scan                                                                                     |
| Data transfer speed                  | 1.82 ms / scan (USB2)<br>432 ms / scan (RS-232)                                                    |
| Digital IO                           | HD-26 connector, 2 Analog in, 2 Analog out, 3 Digital in, 12 Digital out, trigger, synchronization |
| Power supply                         | Default USB power, 450 mA. Or with SPU2 external 12VDC, 200 mA                                     |
| Dimensions, weight                   | 175 x 110 x 44 mm (1 channel), 855 grams                                                           |

Grating selection table for AvaSpec-2048x16

| 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 | 200-1160**         | 960**               | 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-ULS2048x16

| Grating (lines/mm) | Slit size (μm) |            |            |            |     |      |
|--------------------|----------------|------------|------------|------------|-----|------|
|                    | 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

### Ordering Information

AvaSpec-ULS2048x16-USB2

- Ultra-low Stray-light Fiber-optic Spectrometer, 75 mm AvaBench, 2048 large 200 μm pixel back-thinned CCD detector, USB powered, high-speed USB2 interface, incl. AvaSoft-Basic, USB interface cable.
- Specify grating, wavelength range and options

## Options

|                 |                                                                                                                                          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| -SPU2           | • incl. switch for USB power or external power for RS-232                                                                                |
| -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 or 200 µm.                                                      |
| SLIT-XX-RS-FCPC | • as SLIT-XX-RS, but with FC/PC connector                                                                                                |
| OSF-YYY         | • Order-sorting filter for reduction of 2 <sup>nd</sup> order effects, 1 mm thick, please specify YYY= 305, 385, 475, 515, 550 or 600 nm |
| OSC             | • Order-sorting coating with 600 nm long-pass filter for VA, BB (>350 nm) and VB gratings in AvaSpec-2048x16, recommended with OSF-305   |
| OSC-UA          | • Order-sorting coating with 350 and 600 nm long-pass filter for UA gratings in AvaSpec-ULS2048x16                                       |
| OSC-UB          | • Order-sorting coating with 350 and 600 nm long-pass filter for UB or BB (<350 nm) gratings in AvaSpec-ULS2048x16                       |
| -FCPC           | • FC/PC fiber-optic connector                                                                                                            |

We can also calibrate  
your AvaSpec series  
spectrometer

## AvaSpec-ULS2048x64 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 spectrometer. Unlike many back-thinned CCD spectro-meters, which have two dimensional arrays the ULS2048XL 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 2<sup>nd</sup> order effects, purge ports for deep-UV measurements. The AvaSpec-

ULS2048XL comes with a wide range of slit sizes, gratings and may be configured with SMA or FC/PC fiber-optic entrance connectors.

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

Connection to your PC is handled via a USB2-connection, delivering a scan every 2 milliseconds. The instrument comes complete with AvaSoft-basic software, USB cable and an extensive manual, including a quick start guide in four languages.

### Technical Data

|                                      |                                                                                                    |
|--------------------------------------|----------------------------------------------------------------------------------------------------|
| Optical Bench                        | ULS, Symmetrical Czerny-Turner, 75 mm focal length                                                 |
| Wavelength range                     | 200 - 1160 nm                                                                                      |
| Resolution                           | 0.06 – 20 nm, depending on configuration (see table)                                               |
| Stray-light                          | < 0.4%                                                                                             |
| Sensitivity                          | 600,000 counts/μW per ms int. time                                                                 |
| Quantum efficiency                   | 60% (200-300 nm), 78% (600 nm)                                                                     |
| Detector                             | Back-thinned CCD image sensor 2048x64 pixels                                                       |
| Signal/Noise                         | 500:1                                                                                              |
| AD converter                         | 16-bit, 1.33 MHz                                                                                   |
| Integration time                     | 2.40 ms – 60 seconds                                                                               |
| Interface                            | USB 2.0 high-speed, 480 Mbps<br>RS-232, 115.200 bps                                                |
| Sample speed with on-board averaging | 2.40 ms /scan                                                                                      |
| Data transfer speed                  | 2.40 ms / scan (USB2)<br>432 ms / scan (RS-232)                                                    |
| Digital IO                           | HD-26 connector, 2 Analog in, 2 Analog out, 3 Digital in, 12 Digital out, trigger, synchronization |
| Power supply                         | Default USB power, 450 mA. Or with SPU2 external 12VDC, 200 mA                                     |
| Dimensions, weight                   | 175 x 110 x 44 mm (1 channel), 855 grams                                                           |

## Grating selection table for AvaSpec-2048x64

| 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 | 200-1160**         | 960**               | 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-2048x64

| Grating (lines/mm) | Slit size (μm) |              |            |            |     |      |
|--------------------|----------------|--------------|------------|------------|-----|------|
|                    | 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

## Ordering Information

AvaSpec-ULS2048x64-USB2

- Ultra-low Stray-light Fiber-optic Spectrometer, 75 mm AvaBench, 2048 large 896 μm pixel back-thinned CCD detector, USB powered, high-speed USB2 interface, incl. AvaSoft-Basic, USB interface cable.
- Specify grating, wavelength range and options

## Options

|                 |                                                                                                                                          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| -SPU2           | • incl. switch for USB power or external power for RS-232                                                                                |
| -RS             | • Replaceable slit                                                                                                                       |
| SLIT-XX         | • Slit size, please specify XX = 10, 25, 50, 100, 200 or 500 $\mu\text{m}$                                                               |
| SLIT-XX-RS      | • Replaceable slit with SMA connector , specify slit size XX=25, 50, 100 or 200 $\mu\text{m}$ .                                          |
| SLIT-XX-RS-FCPC | • as SLIT-XX-RS, but with FC/PC connector                                                                                                |
| OSF-YYY         | • Order-sorting filter for reduction of 2 <sup>nd</sup> order effects, 1 mm thick, please specify YYY= 305, 385, 475, 515, 550 or 600 nm |
| OSC             | • Order-sorting coating with 600 nm long-pass filter for VA, BB (>350 nm) and VB gratings in AvaSpec-2048x64, recommended with OSF-305   |
| OSC-UA          | • Order-sorting coating with 350 and 600 nm long-pass filter for UA gratings in AvaSpec-ULS2048x64                                       |
| OSC-UB          | • Order-sorting coating with 350 and 600 nm long-pass filter for UB or BB (<350 nm) gratings in AvaSpec-ULS2048x64                       |
| -FCPC           | • FC/PC fiber-optic connector                                                                                                            |

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.