

Torus Concave Grating Spectrometers

New Spectrometer Delivers Low Stray Light and High Throughput



Torus introduces a family of aberration-corrected concave diffraction grating spectrometers that delivers low stray light, high throughput and excellent thermal stability for a wide range of research and OEM applications.

Our first Torus model is a Visible spectrometer (360-825 nm) whose spectral range and low stray light render it especially useful for measuring color, while its increased sensitivity and throughput make it ideal for low light level applications.

Like most Ocean Optics spectrometers, Torus interfaces with a computer via the USB port and couples to our line of SMA 905-terminated optical fibers, light sources and accessories. Spectrometer operation is as simple as installing SpectraSuite spectroscopy software and then connecting the USB cable from the spectrometer to the computer. Wavelength calibration coefficients unique to each spectrometer are programmed into a memory chip right on the unit; the software simply reads these values from the spectrometer.

Key Features

Concave Grating-based Spectrometer

Toroidal diffraction grating ensures low stray light and high throughput

Visible Wavelength Range

First of a family of concave grating spectrometers ideal for a range of applications from 360-825 nm

Low Stray Light with Excellent Throughput

Provides viable alternative to standard miniature spectrometers for applications such as dosimetry, high-concentration absorbance measurements and precision light metrology

Physical	
Dimensions:	149.9 mm x 119.4 mm x 63.5 mm (5.9 in. x 4.7 in. x 2.5 in.)
Weight:	954 g (2.1 lb.)
Operating temp.:	-10 to +50 °C
Detector	
Detector type:	Sony ILX511B
Detector range:	200-1100 nm
Pixels:	2048
Pixel well depth:	~62,500 e-
Optical Bench	
Design:	Flat field
Focal length:	85 mm
Entrance aperture:	5, 10, 25, 50 or 100 μ m wide slit or fiber with user-selectable aperture (tested at F3 and F4)
Gratings:	Toroidal concave holographic (blazed @ 400 nm)
Mechanical interface	8-32 threaded holes at base (3 places)
Optical input interface:	SMA 905 fiber connector and C-mount lens adapter
Spectroscopic	
Wavelength range:	360-825 nm
Optical resolution:	≤ 2.0 nm FWHM over the spectral range
Signal-to-noise ratio:	250:1 (at full signal)
A/D resolution:	16 bits
Dark noise:	50 RMS counts, 300 counts peak to peak
Dynamic range:	2×10^3 (system); 1300:1 (single acquisition)
Integration time:	1 ms-20 s
Stray light:	0.01% @ 400 nm
Corrected linearity:	>99.8%
Electronics	
Power consumption:	250 mA @ 5 VDC
Power options:	USB or GPIO port
Data transfer speed:	Full spectrum every 1 ms with USB 2.0 port, 15 ms with USB 1.1 port, 200 ms with serial port
Connector:	USB or GPIO port
Inputs/Outputs:	Yes, 8 onboard digital user-programmable GPIOs
Analog channels:	0
Breakout box:	Supported
Trigger modes:	4 modes
Strobe functions:	Yes
Computer Requirements	
Computer interface:	USB 2.0, RS-232
Operating systems:	Any supported by OmniDriver/SeaBreeze or RS-232
Compliance	
CE mark:	Yes
RoHS:	Yes
Software	
Operating software:	SpectraSuite support (extra)
Dev. software:	OmniDriver/SeaBreeze driver (extra)

Torus Concave Grating Spectrometers

Low Stray Light, High Throughput

Concave Grating Design

Reflective concave gratings are concave mirrors that disperse light; the concavity of the grating reflects and focuses the light and the grating groove pattern disperses the light. These aberration-corrected concave gratings are known for their low stray light and high efficiency. The toroidal (the radius of curvature in the focusing and dispersion directions are different) grating used in Torus further enhances the aberration correction and efficiency.

For our Visible Torus spectrometer, we use a variable line spacing grating with 550 (+/-2) grooves/mm groove density at center and a blaze wavelength of 400 nm. Blaze wavelength is the wavelength of maximum diffraction efficiency and depends on bench design and other considerations.

Next Generation of High-value Miniature Spectrometers

Torus is the first of a new line of Ocean Optics spectrometers distinguished by scientific-grade spectral performance in the compact, flexible bench design that is our hallmark.

Like our flagship USB2000+ Spectrometer, Torus uses a Sony ILX511B linear CCD-array detector. However the Torus debuts a novel flat field optical bench design. The Torus has the same robust, high-speed electronics that distinguish the USB2000+, but with improved throughput and less stray light due to the aberration-corrected toroidal grating. What's more, Torus has good thermal stability – wavelength drift is mitigated and peak shape stays the same over a wide temperature range. As a result, Torus makes possible precision metrology, fluorescence and absorbance applications with demanding stray light and thermal stability requirements.

Typical Applications

Torus works well for applications where low stray light, high throughput and great thermal stability are necessary. Here are some examples:

- Trace gas amounts in the atmosphere
- Absorbance of optically dense solutions (the smaller the amount of stray light present, the higher the absorbance values that can be measured)
- Precision measurement of LEDs, lasers and other light sources
- Medical dosimetry in tissue and biological media
- Fluorescence from solid surfaces, backscattering and fluorescence in solutions and powders

Torus Options

Our initial Torus offering is responsive from 360-825 nm and is available with the same optical bench accessories – slits, order-sorting filters and the like – as our USB2000+ Spectrometer. The Torus accommodates SMA 905-terminated optical fibers, light sources and accessories. Free-space optical coupling is accommodated with standard C-mount adapters. Torus is fully operational in SpectraSuite software and is compatible with our OmniDriver and SeaBreeze software development platforms. Software is priced separately.

Sample Results with Torus Spectrometer

