台灣超微光學
OtO Photonics

CERTIFIED COMPANY
ISO 9001:2015
OtO Photonics Inc.

World's SmarTest Spectrometers

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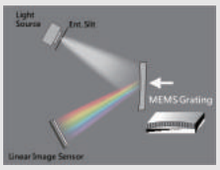
OtO Brand Story



OtO's business started with MEMS concave grating, featuring on both focusing and dispersing capabilities, which are the key to build lightweight spectrometers. Our unique design ultra-micro spectrometers—UltraMmicro™-offers tremendous benefits such as compactness, high temperature & humidity stability, shock & drop resistance, and low cost, provides ideal solutions for online inspection and hand-held product development.

2002 Fundamental research on MEMS gratings

2006 OtO founded

After many iterations, these sophisticated products are now the world's smallest wide-band (200-900nm), high-resolution (5.5nm), and low stray light (<0.5%) ultra-portable spectrometers. With add-on BLE(Bluetooth Low Energy) module, they allow for long-range wireless remote spectral measurement. An optional control board with CPU and memory can provide quick spectral and color calculations as well as OtO's exclusive high-speed exposure mode that captures multiple sets of exposure data for batch transmission back to the measurement system for checking.

In 2013, OtO launched CT structure spectrometer, featuring "temperature & humidity stability with shock & drop resistance"—the biggest advantage of OtO. SmartEngine™ Series provides selectable sensors (8 in total), gratings (more than 15), and software/hardware control models, catering to various needs of different industries, such as electro-optical, LED, biomedical, thin film measurement, etc. With exceptional performance, flexible configuration, wide range of applications, and great price-performance, SmartEngine™ series is now OtO's top seller.

2008 2012 2016
Excellent Electro-Optical Product Award
National Industry Innovation Award
MOEA Innovative Research Award
Excellent Innovative Product Award
Taiwan Outstanding Photonics Product

2009 Mass production of MEMS series

2014 CT type spectrometer starts mass production

2017 High-end infrared & active-cooling series launched

In 2017, OtO launched two high-end series: SideWinder™ and EagleEye™.SideWinder™ Series offers near infrared spectroscopy measurement,featuring InGaAs linear image sensors to provide full NIR band coverage (900-1700nm). EagleEye™ Series features active cooling and back-thinned sensors to decrease noise, providing ultra sensitivity, high resolution, low noise, and hight signal-to-noise ratio, making it an ideal choice for Raman spectroscopy, ellipsometer,thin film measurement, and advanced LED measurement.

2018 National Gold Invention Award

2019
Ultra-micro spectrometer for NIR and high-resolution models will be launched

In 2018, we expanded near-infrared (NIR) product line and used micro-electromechanical systems (MEMS) to develop the ultra-micro model, the RedSparrow™ series, to meet the needs of handheld NIR measurement.

Meanwhile, we committed to miniaturize the CT spectrometers, and launched the Humming Bird™ and PocketHawk™ series with better signal-to-noise ratio (SNR) and sensitivity, providing higher system integration flexibility and performance.

For CT-type NIR spectrometer,SideWinder™ series is upgraded to have thermo electric cooling (TEC) model, with a wide wavelength range of 900 to 2500 nm. With the full deployment of NIR measurement applications, OtO products have a deeper and wider coverage in NIR market, such as thickness measurement, food safety, environment, and biochemistry fields.

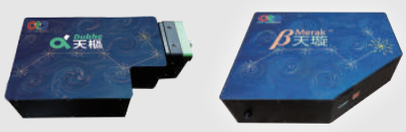
2020 ISO 9001:2015 Quality Management System Certified
2020 The Dun & Bradstreet Top 1000 Elite SME Award

In 2020, We have acquired ISO 9001 : 2015 certification, the quality management system from the International Organization for Standardization and awarded The Dun & Bradstreet Top 1000 Elite SME Award.

2021 2022 Ultra High Resolution for eye-OCT: Dubhe Series
Transmission grating_Ultra High Resolution Spectrometer: Merak Series & Phekda Series.

2023
TI DLP NIR Spectrometer: Dragonfly series
Miniature spectrometer: Bullet series

In 2021-2022, OtO launched a variety of Ultra High resolution products: Dubhe series, Merak series and Phekda series, all series are named by a prominent Chinese star. Dubhe series designed for the spectrometer core of OCT (optical coherence tomography) eye scan, it features extreme high resolution <0.04nm and fast scan 80 KHz line scan camera. Merak series offers high resolution <0.1nm @850nm & @940nm for VCSEL (Vertical-Cavity Surface-Emitting Laser) probing, 3D sensing, LD probing. Phekda series also features a high resolution product; it' s suitable for LIBS (Laser-Induced Breakdown Spectroscopy), Raman analysis, and thickness measurement.



Beside High resolution products, we have researched and developed new product base on TI DLP technology, and launched DragonFly series offers near infrared spectroscopy measurement

OtO keep innovation in spectrometer miniaturization. In Q3/2022, we launched Bullet series spectrometers, included SilverBullet series (UV-VIS) & RedBullet series (NIR), featuring a compact size of 40x36.3x25.1(mm) & 51.4x36.4x29(mm).

We are confident to give you the best service to create the perfect model for you!

OtO has been completing a lot of successful development projects in various industries. In addition to the spectrometers listed on the website, we can also offer higher sensitivity sensors, higher optical resolution, specific wavelength range and grating, or even with custom software, hardware design. OtO is happy to discuss with customers and offering further specifications to meet your needs in the market.

OtO Photonics Inc.
Ivan, General Manager

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Dubhe™ Series

Eye/Skin OCT Spectrometer
Transmission Grating--Dubhe, DB Series

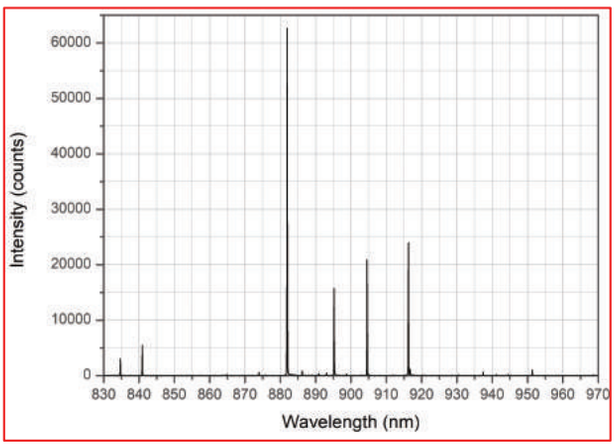
- Wavelength range 800-880nm; Super-high spectral resolution 0.04nm.
- New transmission optical design, integrated system with patented adjustment mechanism.
- Using camera with 80kHz. It can capture double frame per scan, improving the accuracy of diagnosis.
- OtO provides customized transmission gratings. Experts are welcome to explore various applications.

Model Name	DB1020F	DB1080F
Imaging Depth	4mm	
Wavelength Range	800-880nm	
Bandwidth	80nm	
Spectral Resolution	0.04nm	
Input Fiber	5um single-mode fiber(FC/PC)	
Camera	e2V octoplus CMOS OCT Camera USB3.0/20kHz	e2V octoplus CMOS OCT Camera USB3.0/80kHz
Dimension	180 (L) x 120 (W) x 60 (H) mm	
Weight	3.0 KG	

★5um Singel-mode FC/PC optical fiber is recommended

Merak™ Series

High-Resolution and High-Sensitivity Spectrometer Transmission Grating--Merak, MR Series



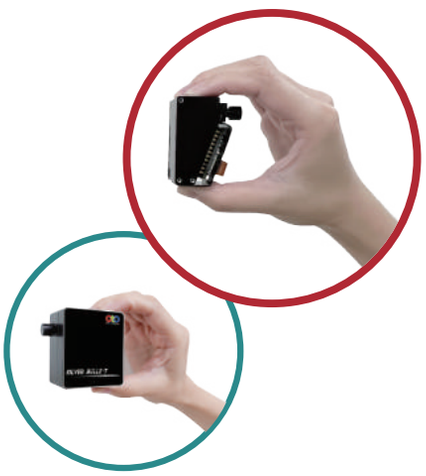
Wavelength	840nm	881nm	937nm
Resolution	0.076	0.088	0.079

- Wavelength range 830-970 nm; The best resolution beyond the same class model < 0.1nm.
- Especially suitable for Laser Diode, VCSEL, 3D sensing, LIBS and other related applications.
- New transmission optical design, integrated system with patented adjustment mechanism. Built-in LED indicator.
- Using fast exposure COMS sensor. It can provide high sensitivity and high resolution at the same time.
- Support continuous high-speed exposures mode.
- Proprietary stray light calibration algorithm (Stray light can be eliminated to 0.01%).
- OtO provides customized transmissive gratings. Experts are welcome to explore various applications.

Type	Merak Series
Model	MR1080
Sensor	4096 pixel CMOS
Wavelength Range	830~970nm
Slit(μm)	5
Resolution	< 0.1 nm
SNR	350
Dynamic Range	2200
Dark Noise	30~40
Exposure Time	100μs
Dimension (L) x (W) x (H)	230 x 170 x 60

Ultra Micro Spectrometer
Silver Bullet™/Red Bullet™ Series

Ultra Micro UV-VIS / NIR Spectrometer
The Best Choice for Portable Handheld Spectormeter System



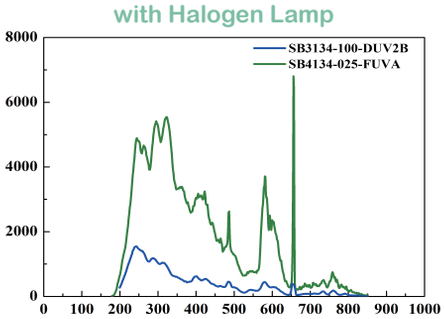
Silver Bullet Series:

- Wavelength Range from 200 to 850nm ; Resolution < 7nm (Slit: 50um).
- New Concave Mirror Czerny-Turner Optical Design, Dimension: 40 x 36.3 x 25.1 mm.
- CMOS 1024pixels Sensor, High Speed FX2 CPU.

Red Bullet Series:

- For NIR Application, wavelength range 900~1700nm, Resolution < 13.5nm (Slit : 50um).
- New Concave Mirror Czerny-Turner Optical Design, Dimension: 51.4 x 36.4 x 29 mm .
- InGaAs 128 Pixel Sensor. High Speed FX2 CPU.

SB series Wavelenght Response with Halogen Lamp



Groove Density (line/mm)	Wavelength Range (nm)	Resolution(nm) (slit 25um)	Resolution(nm) (slit 50um)
300	300~1100	<6.5	<10.8
500	180~850	<4.2	<6.2
600	180~700	NA	<6.5
900	180~470	<2.3	<3.9
1000	180~430	NA	<3.5
1200	180~350	NA	<2.9

Bullet Series Spectrometer

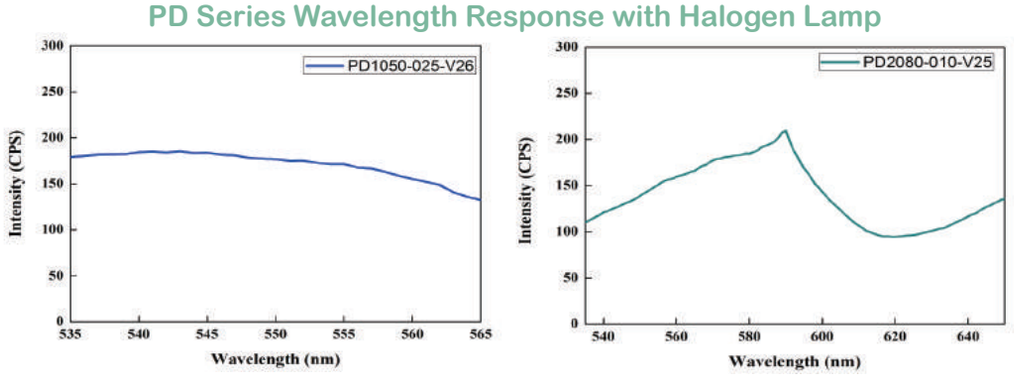
Model	Silver Bullet	Red Bullet	
	SB3134/SB4134	RB4524	RB4564
Sensor	1024pixels CMOS	128pixels InGaAs	256pixels InGaAs
Spectral range (nm)	200~850 nm	900~1700 nm	
Slit width (um)	25/50	50	25
Resolution (nm)	3nm / 5.5nm	13.5nm	8.5nm
	(*Typical value, Small deviations are possible.)		
SNR	350	2000 (High gain) 6000 (Low gain)	3000 (High gain) 6000 (Low gain)
Dynamic Range	4000	6250 (High gain) 7200 (Low gain)	7000 (High gain) 9000 (Low gain)
Dark Noise	< 19	< 14 (High gain) < 10 (Low gain)	< 12 (High gain) < 10 (Low gain)
Shortest Integration time	6us (Sensor Clock rate 10mHz) 21us (Sensor Clock rate 2.5mHz)	6us	
Dimensions	40(W) x 36.3(D) x 25.1(H)	51.4(W) x 36.4(D) x 29(H)	
Connector	Micro USB / UART		
Interface	SMA905		

Phekda™ Series

New T-R-T (Transmissive-Reflection-Transmissive) Optical Design High Resolution Spectrometer

- Optimized for LIBS/LD/Raman appilication, wavelength range 535~650nm(Can be customized within the range of 400-1000 nm), resolution < 0.1nm.
- New Transmissive-Reflection-Transmissive optical design, the dimension 180(L) x 175(W) x 60.7(H) mm.
- CMOS 4096pixels Sensor, Continuous High-Speed Exposures Mode, USB 2.0 & 8pin GPIO Interface.
- Able to be customized design for customers' requirements.

PD Series Wavelength Response with Halogen Lamp

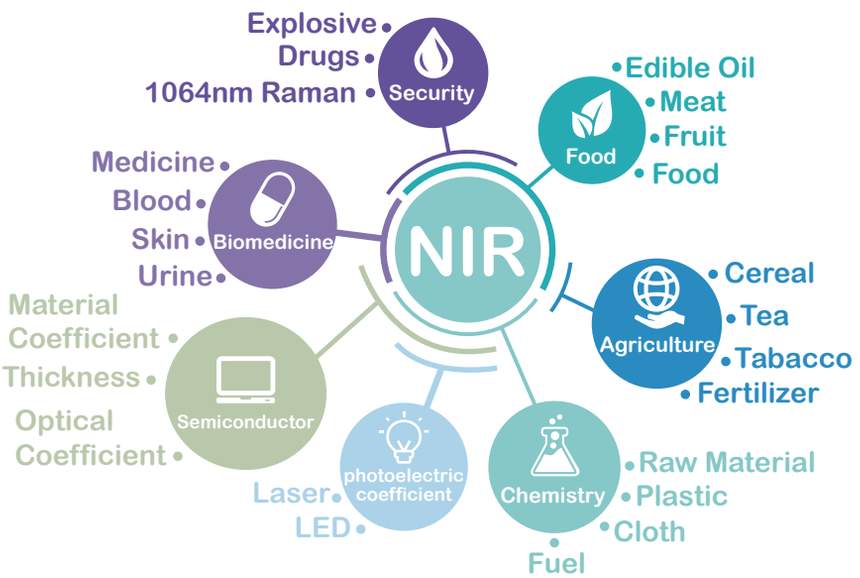


Specification

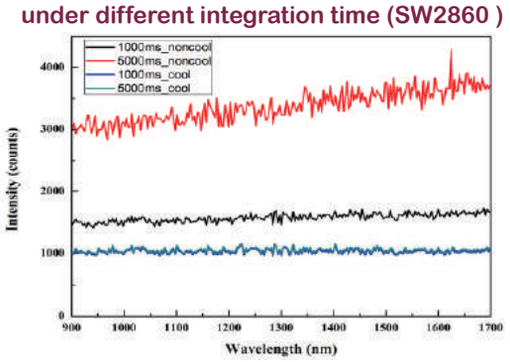
Type	PD Series	
Model	PD1050	PD1080/2080
Sensor	2048pixel CCD	4096pixel CMOS
Wavelength Range	535~565 nm	535~650 nm
Slit(μm)	10	
Resolution	< 0.1 nm	
SNR	500	350
Dynmica	4700	3200
Dark Noise	< 20	< 32
Integration Sime	5ms	0.1ms
Size	180 x 175 x 60.7 mm^3	
Connector	USB 2.0 / UART	
Interface	SMA905 or FC/PC	

SideWinder™ Series with TE-cooler

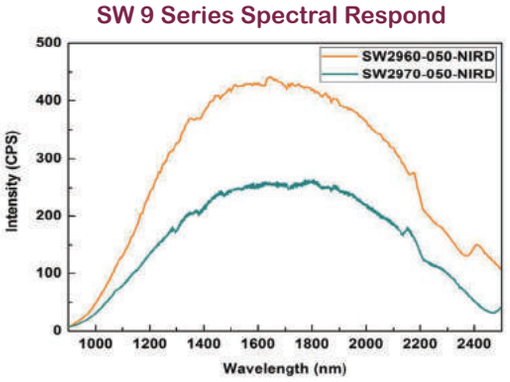
Excellent Performance & Robust Design



Dark Noise of TEC ON vs TEC OFF
under different integration time (SW2860)



SW 9 Series Spectral Respond



- The Smallest NIR TECooling Spectrometer, the Volume is 130 x 96 x 58.3 mm^3
- New product release : SW2930, wavelength range 910-2200nm
- SW2960、SW2970 : High-Level TECooling Spectrometer, The Wavelength Range is 900~2500nm
- High Sensitivity、High Dynamic Range、High SNR
- TEC One Stage (SW2860、SW2870)、TEC Two Stage(SW2930、SW2960、SW2970)
- Competitive Price for High-End Market

  High Gain mode & Low Gain mode is selectable. The Sensetivity of High Gain is 10 times higher than of Low Gain
- The Best Choise of 1064nm Raman, Film Thickness Measurement, Food Safety, Enviroment and Biochemical Detection

Specification

Model	Groove Density (g/mm)	Best Efficiency Wavelength	Band Width	Selectable Band	25um	50um	100um	150um	200um
SW2860	236.8	1350nm	800nm	900~1700nm	-	6nm	9nm	11nm	15nm
	400	1200nm	340nm	1090~1450nm	2nm	3nm	5nm	6nm	7nm
SW2870	236.8	1350nm	800nm	900~1700nm	4nm	5nm	7nm	10nm	14nm
SW2930	150	1250nm	1290nm	910-2200nm	-	7nm	12nm	-	-
SW2960	120	1800nm	1600nm	900~2500nm	-	12nm	18nm	-	30nm
SW2970	120	1800nm	1600nm	900~2500nm	-	9nm	15nm	-	28nm
	400	1600nm	350nm	1600-1950nm	1.5nm	2nm	4nm	6nm	7nm

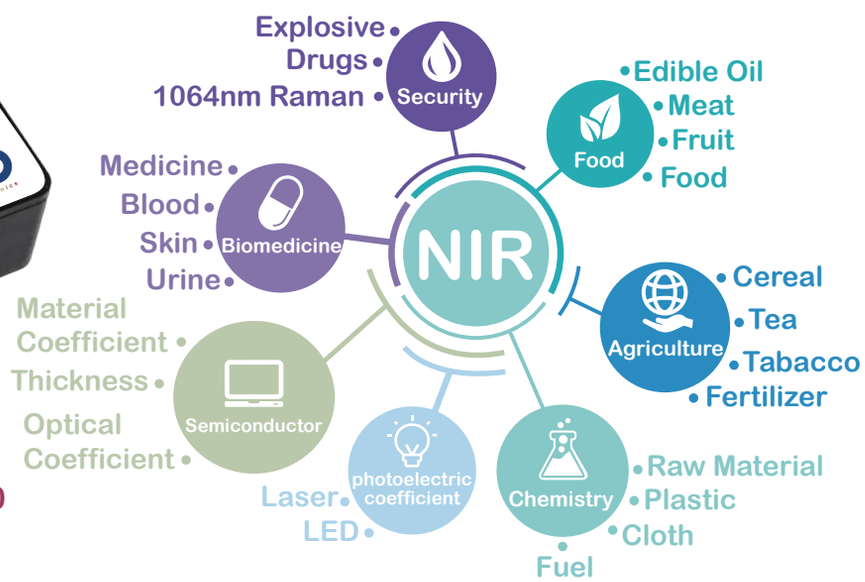
(*Typical value, Small deviations are possible.)

Specification

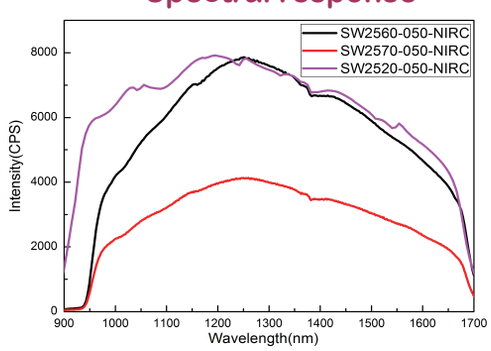
Model		SW2860	SW2870	SW2960	SW2960	SW2970
Sensor Pixel		256 pixels	512 pixels	256 pixels	256 pixels	512 pixels
TE-Cooled		One Stage (Ambient temperature 25℃ can be reduced to 0℃)		Two Stage (Ambient temperature 25℃ can be reduced to -20℃)		
Wavelength Range		900-1700nm		910-2200nm	900-2500nm	
Optical Resolution (*Typical value, Small deviations are possible.)	Slit : 50um	6nm	5nm	7nm	12nm	9nm
	Slit : 100um	9nm	7nm	12nm	18nm	15nm
Integration Time	High Gain	100 μs ~ 24s		100 μs ~ 24s	100us-20ms	
	Low Gain	100 μs ~ 24s		100 μs ~ 24s	100us-200ms	
SNR	High Gain	3300	2800	3000		
	Low Gain	5500	3500	6000		
Dark Noise	High Gain	14	14	15		
	Low Gain	10	10	10		
Dynamic Range	High Gain	6800	7000	5900		
	Low Gain	9500	9300	9300		
Shutter		Option (Build-in Shutter or External Shutter)				
Wavelength Accuracy		<1nm				
On-Board Computation		V				
Continuous High-Speed Exposures		V				

SideWinder™ Series

2nd Order Completely Eliminated
18 Times(SW2520) or 10 time (SW2560/2570) Sensitivity Enhancement

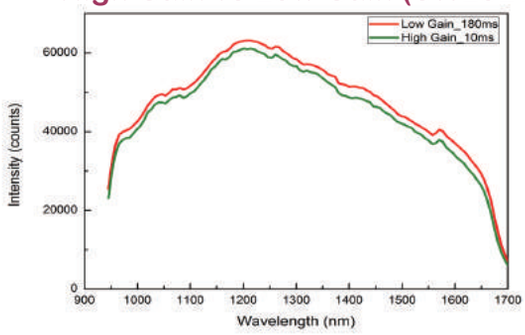


SW2520 & SW2560 & SW2570 Spectral response

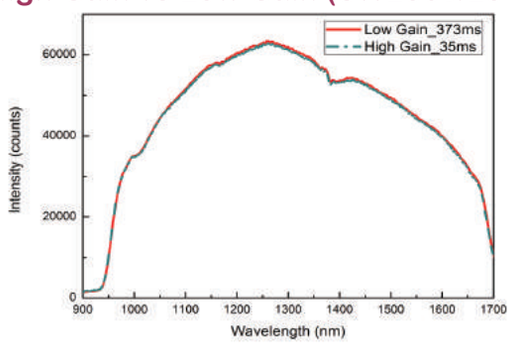


- **Small and Convenient to Carry, Compact Size : 110 x 86 x 32 mm^3**
- **Specially Designed for Near Infrared Region Covering from 900~1700nm**
- **High SNR=6000, High Sensitivity and High Resolution**
- **High Gain Mode & Low Gain Mode for Options. Sensitivity of High Gain Mode is at Average 10 or 18 Times Higher than Low Gain Mode**
- **High Cost–Performance Ratio, the Best Choice for Film Thickness, Food, Pharma and Bio-chemistry Applications**

High Gain vs Low Gain (SW2520)



High Gain vs Low Gain (SW2560/2570)



Specifications

Model Name	Groove Density (g/mm)	Best Efficiency Wavelength	Band Width	Selectable Band	25um	50um	100um	150um	200um
SW2520	120	1000nm	800nm	900-1700nm	-	11nm	17nm	19nm	24nm
SW2560	236.8	1350nm	800nm	900-1700nm	-	6nm	9nm	11nm	15nm
SW2570	236.8	1350nm	800nm	900-1700nm	4nm	5nm	7nm	10nm	14nm

(*Typical value, Small deviations are possible.)

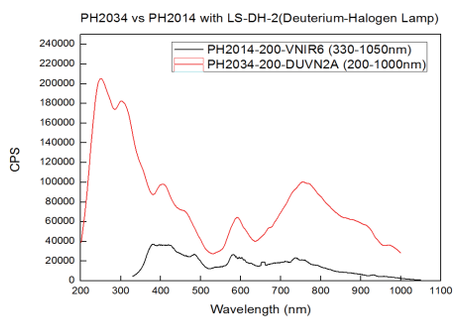
Specifications

Model Name		SW2520	SW2560	SW2570
InGaAs Sensor		128 pixels	256 pixels	512 pixels
Wavelength Range		900~1700nm		
Resolution (slit : 50um)		11nm	6nm	4nm
		(*Typical value, Small deviations are possible.) (*Resolution of 1083.84nm, 1262.34nm & 1473.28nm with Xenon lamp.)		
Wavelength Accuracy		<2nm (by 128-pixel sensor) <1nm (by 256、512pixel sensor)		
SNR (Single acquisition)	High Gain	2000	2800	2600
	Low Gain	4000	5400	4300
DarkNoise (Upper Limit)	High Gain	13.5	14	
	Low Gain		10	
Dynamic Range (Single acquisition)		6750	6000	6000
		na	9300	9300
Shortest Integration time		100 μs		
On-Board Computation		V		
Continuous High-Speed Exposures		V		

-PocketHawk Series-
-PocketHawk Series-NIR-

Pocket Hawk™ Series

The Small General Type Spectrometer--PH Series
High Sensitivity and High SNR Spectrometer -- PH-NIR Series



PH:

- Size only 65 x 65 x 29.8 mm³
- Cover from 330-1050nm、400-1000nm、200-1050nm
- High Sensitivity & Low Stray Light
- Attractive Cost to Implement Ultra-small & Smart Spectrometer Systems
- Support Continuous High-Speed Exposures Mode
- Proprietary Stray Light Calibration Algorithm
  (Stray light can be eliminated to 0.01%)
- On-board CPU Supporting Optical and ColorParameters Calculation

PH-NIR:

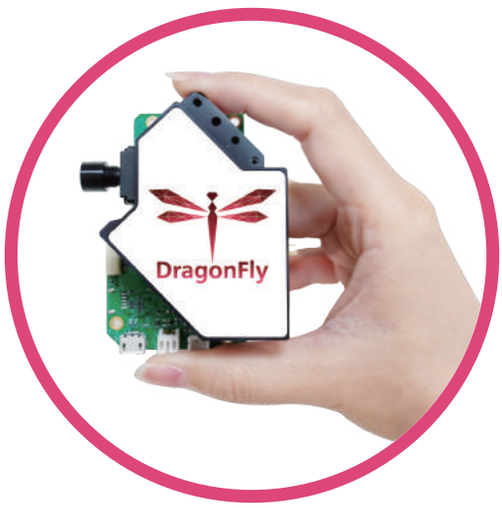
- Size Only 65 x 65 x 29.8 mm³
- Cover from 900~1650nm、950~1700nm
- High Sensitivity & Low Stray Light
- Attractive Cost to Implement Ultra-small & Smart Spectrometer Systems
- Support Continuous High-Speed Exposures Mode
- Proprietary Stray Light Calibration Algorithm
  (Stray light can be eliminated to 0.01%)
- On-board CPU Supporting Optical and Color Parameters Calculation

Specification

Type	PH Series			PH-NIR series	
Model	PH2014	PH1034/2034	PH4134	PH2524	PH2534
Sensor	2048 Pixels	512 Pixels	1024 Pixels	128 Pixels	256 Pixels
Wavelength Range	330-1050nm	200-1050nm	400-1000nm	900-1700nm	
Slit(um)	10/25/50/100/200um			50/100	
Resolution	~2.2/ ~2.5/~3.1 ~6/ ~12nm	~NA/~NA/~10/ ~16/~34nm	~1.85/~2.45/ ~3.8/~7.4/~15	14nm/18nm	6nm/9nm
SNR	200	330	430	High Gain	2000
				Low Gain	6000
Dynamic Range	2000	5650	4500	High Gain	6250
				Low Gain	6554
Stray Light	<0.2%			<0.2%	
Exposure Time	1.5ms	0.1ms	21us	100μs	
Size(W) x (L) x (H)	65 x 65 x 29.8 mm³				

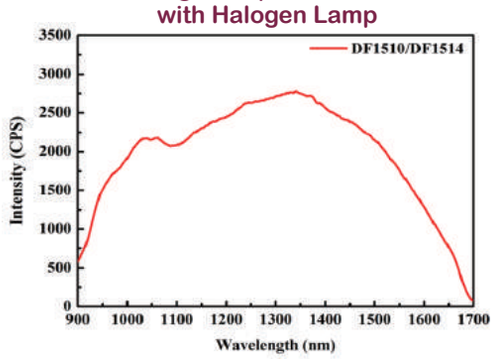
DragonFly™ Series

Digital Light Processing NIR Spectrometer



- Developed base on Texas Instrument DLP Digital Micromirror Device.
- Excellent signal-to-noise ratio performance and improved measurement stability.
- 900-1700nm (non-cooled) and 1340-2280nm (2 stage TEC).
- The most cost-effective near-infrared spectrometer.

Wavelength response of DF1514 with Halogen Lamp



Specification

Type	Dragonfly Series	
Model	DF1514	DF1824
Wavelength Range	900-1700nm	1340-2280nm
TE Cooling	1mm InGaAs PD	2 stage TEC InGaAs PD
Slit(μm)	25um	25um
Resolution	<10nm	
SNR	10000	na
Dynamic Range	na	na
Stray Light	<0.25%	na
Scan mode	linear/Hadamard/Slew Scan	
Dimension (L x W x H)	53.17x 72.99 x 27.90	59.95x 72.99x 42.10

EagleEye™ Series-TE-cooler Model

For Raman System•Thin-Film Measurement• LED Measurement

EagleEye Series

- Cooled Back-thinned TEC Sensor, High Sensitivity, High SNR(=500) & Extremely Low Thermal Noise
- Default:0℃ at Ambient of 25℃
- Proprietary Algorithms of Stray Light Calibration (Only 0.01% after Calibration)
- EE series support Pixel Binning mode to increase Sensitivity, 2/4/8/16 Pixel Binning optional)

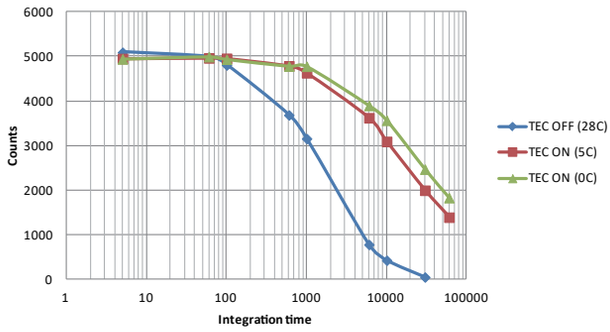
EagleEye-No.11 (EE2111)

- NIR (800~1100nm) Enhanced Back-Thinned TEC Sensor
- Best Wavelength Range for Applications: 500~1100nm
- Raman Spectral Range Can be up to 3500 cm^{-1} and Spectral Resolution Can Reach to 5 cm^{-1}
- Best Choice for 532/785nm Raman Measurement

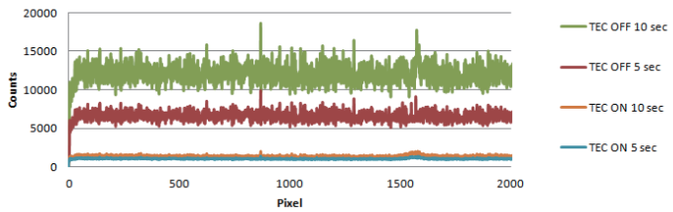
EagleEye-No.6/ No.9 (EE2063/EE2093)

- UV (800~1100nm) Enhanced Back-thinned TEC Sensor
- Best Wavelength Range for Applications: 180~1100nm
- 5ms High-speed Exposure Time
- "Best Choice for Ellipsometer, Thin-film Measurement & High-end LED Test"

Dynamic Range



Dark Signals in 5, 10 sec



OtO-EE Series with Selection of Grating & Resolution

Groove Density (g/mm)	Best Efficiency Wavelength(nm)	Bandwidth	Selectable Band	Resolutions (nm) Under Different Slit Sizes					
				10um	25um	50um	100um	200um	300um
2400	240/VIS	100nm UV 150nm	180~520 nm	0.2	0.3	0.4	0.8	1.2	-
1800	180/250/500	150nm UV 210nm	180~700 nm	0.3	0.4	0.6	1.0	1.8	-
1600	200	160nm UV 240nm	180~780 nm	0.4	0.5	0.7	1.2	2.0	-
1200	200/300/500/600/750/850	220nm	180~1010 nm	0.5	0.6	0.9	1.7	3.4	4.5
1000	250/900	300nm UV 400nm	180~1100 nm	0.6	0.7	1.1	1.9	3.0	-
900	500	360nm UV 450nm	180~1100 nm	0.6	0.8	1.3	2.3	4.6	-
830	800	410nm	180~1100 nm	0.9	1.0	1.5	2.5	4.5	-
600	300/400/500/800/1000	670nm	180~1100 nm	1.0	1.2	1.9	3.3	6.7	10.0
500	300/560/770	825nm	180~1100 nm	1.1	1.4	2.4	3.5	7.5	11.5
300	230/300 /500/422	920nm	180~1100 nm	1.7	2.3	3.2	6.0	12.8	20.0

Specifications

Model	EE2113	EE2063	EE2093
CCD Cooling	0°C at Ambient of 25°C		
Selectable Wavelength Range	500~1100nm	180~1100nm	180~1100nm
Resolution	0.4nm~10nm	0.2nm~10nm	0.2nm~10nm
Shutter	Optional		
SNR	500		
DarkNoise	20	25	25
Dynamic Range	4700	4100	4100
Shortest Integration Time	5 ms ~ 65s		1.5ms~65s
On-Board Computation	V		
Continuous High-Speed Exposures	V		
Size(mm^3)	130*96*58.3 mm		

SmartEngine™ Series

Display Panel or Semiconductor Inspection/ Raman System/ Biomedical Detection Environmental Monitoring Analysis

SmartEngine Series Lineup

Model Name	Detector Type	Characteristic
SE-3	CMOS with Fast Exposure	Shortest Exposure Time (0.2ms)
SE-4	Front-illuminated CCD	Excellent Cost Performance Value
SE-5	CCD with NIR-enhancement	NIR Range with High SNR
SE-7	High Pixel-Resolution CCD	High Pixel-Resolution
SE-8	CMOS with Fast Exposure	Short Exposure Time (0.4ms) & High Pixel-Resolution
SE-9	CCD with Fast Exposure	Full Wavelength Range with Fast Exposure Time (1.5ms)
SE-10	CCD with High Sensitivity	Excellent Sensitivity
SE-12	CMOS with Fast Exposure	High Sensitivity & Shortest Exposure Time

- Excellent Thermal, Humidity, Vibration and Shock Stability
- Support Continuous High-Speed & Multiple Exposures Mode
- Proprietary Stray Light Calibration Algorithm (Stray light can be eliminated to 0.01%)
- On-board CPU Supports Optical and Color Parameters Calculation
- More than 8 Different Sensors and 30 Different Gratings for Your Options
- An Extremely Low(near-zero) Coefficient of Thermal Expansion of Gratings, Dual Blazed Wavelength Gratings for Selection
- Option for Wireless Spectrometer with Built-in Wifi Module
- Full Wavelength Range Model: 180~1100 nm
- High SNR Model: SNR=500
- Short Exposure Time Model: 0.2ms
- High Resolution Model: 0.2nm
- Smart Engine No.3 FX2: High Speed CPU with High sensitivity sensor, shorter integration time 6us is achievable
  Data Transfer Speed 1ms/frame (Max 0.8ms/frame)
- Smart Engine No.5/9/10 support Pixel Binning mode to increase Sensitivity, 2/4/8/16 Pixel Binning optional)

Recommended Models

Application	Model Name	Wavelength Range	Resolution	SNR	Exposure Time	Dark Noise	Dynamic Range	Thermal Stability
LED Test	SE-3/9/12, SE-3 FX2, SE-12 FX2	350-1020 nm	1.9 nm	330/500	100/1500/ 100/10 /6 us	22/29	3000/3540	0.027 nm/℃
Display Detection	SE-3/12	380-780 nm	1.3 nm	330	0.1 ms	22	3000	0.027 nm/℃
Water Quality Analysis	SE-3	180-500 nm	1.9 nm	330/500	0.1 ms	22	3000	0.027 nm/℃
Air Analysis	SE-3/9	180-500 nm	0.2-0.6 nm	330/500	0.1/1.5 ms	22/29	3000/3540	0.015 nm/℃
Raman Detection	SE-3/5/12	790-1090 nm	1.1 nm	330/500	0.1/ 5/ 0.1 ms	22/20	3000/4400	0.015 nm/℃
Educational Requirement	SE-4	350-1020 nm	1.9 nm	200	1 ms	34	2220	0.027 nm/℃
Film Thickness Measurement	SE-3/9	180-1100 nm	3.2 nm	330/500	0.1/ 1.5 ms	22/29	3000/3540	0.039 nm/℃
Gem Stone Examination	SE-3	400-500 nm	0.5 nm	330	0.1 ms	22	3000	0.015 nm/℃
Food Analysis	SE-3	180-1100 nm	3.2 nm	330	0.1 ms	22	3000	0.039 nm/℃
Blood Analysis	SE-3/12	300-850 nm	1.9 nm	330	0.1 ms	22	3000	0.027 nm/℃
Fluorescence Detection	SE-3/8/12	340-850 nm	1.9 nm	330/350	0.1 /0.42 ms	22/50	3000/2200	0.027 nm/℃
OCT Application	SE-3/8	790-1010 nm	0.9 nm	330/350	0.1 /0.42 ms	22/50	3000/2200	0.027 nm/℃

Specially Selected Models

Types	Model Name	Wavelength Range	Resolution	SNR	Exposure Time	Thermal Stability
Best-Sold Model	SE-3	350-1020 nm	1.9 nm	330	0.21 ms	0.027 nm/℃
Best CP Value Model	SE-4	350-1020 nm	1.9 nm	200	1 ms	0.027 nm/℃
Full Wavelength Range Model	SE-3/9	180-1100 nm	3.2 nm	330/500	0.21/1.5 ms	0.039 nm/℃
High SNR Model	SE-5/9	180-1100 nm	3.2 nm	500/500	5/1.5 ms	0.039 nm/℃
Short Exposure Time Model	SE-3/8/9/12	180-1100 nm	3.2 nm	330/350/500	0.21/0.42/1.5 ms	0.027 nm/℃
High Resolution Model	SE-7/8	400-500 nm	0.5 nm	400/350	4/0.42 ms	0.007 nm/℃

Make A Spectrometer for Your Own Special Need

Groove Density (g/mm)	Best Efficiency Wavelength (nm)	Bandwidth	Selectable Band	Resolutions (nm) Under Different Slit Sizes					
				10um	25um	50um	100um	200um	300um
2400	240/VIS	100nm UV 150nm	180-520 nm	0.2	0.3	0.4	0.8	1.2	-
1800	180/250/500	150nm UV 210nm	180-700 nm	0.3	0.4	0.6	1.0	1.8	-
1600	200	160nm UV 240nm	180-780 nm	0.4	0.5	0.7	1.2	2.0	-
1200	200/300/500/600/750/850	220nm UV 320nm	180-1010 nm	0.5	0.6	0.9	1.7	3.4	4.5
1000	250/900	300nm UV 400nm	180-1100 nm	0.6	0.7	1.1	1.9	3.0	-
900	500	360nm UV 450nm	180-1100 nm	0.6	0.8	1.3	2.3	4.6	-
830	800	410nm	180-1100 nm	0.9	1.0	1.5	2.5	4.5	-
600	300/400/500/800/1000	670nm	180-1100 nm	1.0	1.2	1.9	3.3	6.7	10.0
500	300/560/770	825nm	180-1100 nm	1.1	1.4	2.4	3.5	7.5	11.5
300	230/300/500/422	920nm	180-1100 nm	1.7	2.3	3.2	6.0	12.8	20.0

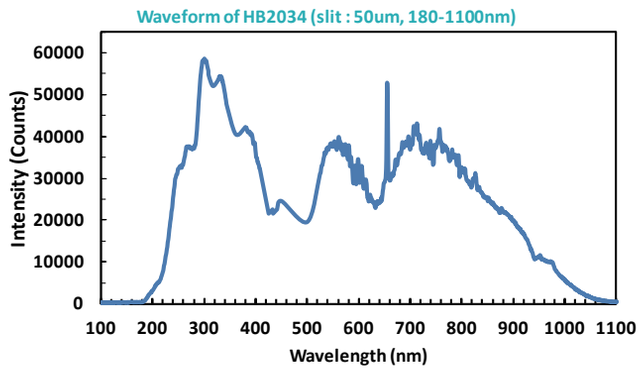
HummingBird™ Series

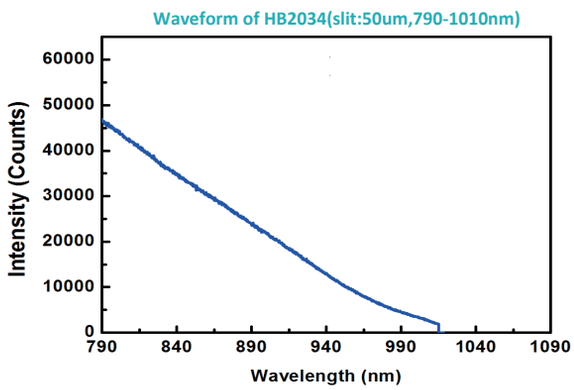
Display Detection /Raman Detection /Air & Water Quality Analysis/Blood, DNA, Fluorescence Detection/OCT Application/Industry 4.0

Optional Sensor Model

Model Name	Sensor type	Feature
HB-3	High Sensitivity CMOS	Short Exposure time
HB-5	IR-enhanced Type Back-thinned CCD	Best Performance for NIR
HB-8	High Sensitivity CMOS	Short Exposure Time High Pixel Resolution
HB-9	High-speed Type Back-thinned CCD	High-speed for Full Wavelength Range

- The Device Has Been Miniaturized and Can Be Handheld for High-resolution Measurement.
- Size Includes Mainboard Only 83mm (length) x 75.5mm (width) x 26.75mm (height).
- Inheriting the Excellent Performance of the SE Series in Many Aspects.
- Optimized for Size and Weight , the Best Choice for System Integration.
- The Main Model : Short Exposure Time(0.2ms)_HummingBird-3, Low Noise (SNR = 500)_HummingBird-5/6/9 and High Resolution _HummingBird-8
- More than 3 Types of Sensors and 20 Types of Gratings for Selection, the Number of Sensors and Gratings Continues to Increase.
- Can Choose a Grating with Different Materials, Such as ""Zero"" Thermal Expansion Coefficient Grating.





Recommended Models

Application	Model Name	Wavelength Range	Slit	Resolution	SNR	Exposure Time	Dynamic Range	Thermal Stability
LED Test	HB-3/9	350-1020 nm	50 um	1.9 nm	330	0.1/1.5 ms	4369/2920	0.04 nm/℃
Display Detection	HB-3/9	380-780 nm	300 um	8 nm	330	0.1/1.5 ms	4369/2920	0.04 nm/℃
Film Thickness Measurement	HB-3/9	180-1100 nm	50 um	3.4 nm	330	0.1/1.5 ms	4369/2200	0.04 nm/℃
Water Quality	HB-3/9	180-850 nm	50 um	1.9 nm	330	0.1/1.5 ms	4369/2920	0.04 nm/℃
Air Analysis	HB-3/9	180-500 nm	10/25 um	0.2~0.6 nm	330	0.1/1.5 ms	4369/2920	0.04 nm/℃
Food Analysis	HB-3	180-1100 nm	50 um	2.3 nm	330	0.1 ms	4369/4400	0.04 nm/℃
Raman Detection	HB-3/5	790-1090 nm	25 um	0.6 nm	500	0.1/5 ms	4369	0.04 nm/℃
OCT Application	HB-3/8	790-1090 nm	25 um	0.6 nm	330	0.1/0.42 ms	4369/2200	0.04 nm/℃
Blood Analysis	HB-3	300-850 nm	25 um	2.3 nm	330	0.1 ms	4369	0.04 nm/℃

Make A Spectrometer for Your Own Special Need

Groove Density (g/mm)	Best Efficiency Wavelength (nm)	Bandwidth	Selectable Band	Resolutions (nm) Under Different Slit Sizes					
				10um	25um	50um	100um	200um	300um
2400	240	140nm	180-540 nm	0.25	0.35	0.5	0.9	1.4	-
1800	250	200nm	190-380 nm	0.3	0.4	0.6	1.0	1.8	-
1400	230	240nm	180-920 nm	0.4	0.6	0.9	1.5	2.9	-
1200	200/250/850	220nm	180-1010 nm	0.5	0.6	0.9	1.7	3.4	4.5
1000	900	300nm	180-1100 nm	0.6	0.7	1.1	1.9	4.0	-
900	550	400nm	180-1100 nm	0.7	1.0	1.5	2.5	5.0	8.0
600	300/500	670nm	180-1100 nm	1.0	1.2	1.9	3.4	6.7	10.0
500	300/330/560/770	825nm	180-1100 nm	1.1	1.4	2.4	4.4	8.4	12.0
300	230/300	920nm	180-1100 nm	1.7	2.3	3.4	7.0	13.5	-

UltraMicro™ Series

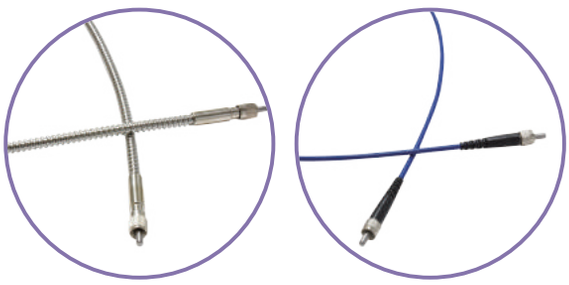
- Cover from 200~900 nm but 19 gw & 23 x 31 x 8.5 mm^3 Only
- High Ssensitivity & Low Stray Light
- Support Continuous High-Speed Exposures Mode
- Proprietary Stray Light Calibration Algorithm (Stray light can be eliminated to 0.01%)
- On-board CPU Supporting Optical and Color Parameters Calculation
- Attractive Cost to Implement Ultra-small & Smart Spectrometer Systems

Specification

Type		Ultra-Mirco Type	Extreme Ultro-Micro Type	
Product Photo				
Model		UM1280	UM1380	UM1390
Sensitivity Enhanced Edition	Model	UM2280	UM2380	UM2390
	Times of Enhancement	2.5 times	2~3 times	
Wavelength Range		V: 380-780nm V2: 330-850nm		
Selectable Slits		10 / 25 / 40 /100um		
Resolution		~3/ ~5.5/ ~10 / ~20nm ~3/ ~6.1/ -10.5 / ~20nm(Sensitivity Enhanced Edition)		
SNR		150	200	
Dark Noise		49	75	
Stray Light		1%		
Shortest Integration Time		1ms~65s		
Size(mm^3)		39.3x43.5x10.1 mm^3	23.2x31x10 mm^3	23.2x 31x8.5 mm^3
Weight		19g	13g	

Collimator & Optical Fiber

COL-1 & COL-2 has a f/2 fused silica lens for 200-1000 nm or a K9 glass for 400-2500nm. When focused for collimation, beam divergence is 2° or less, depending on the fiber diameter. The COL can be adjusted for UV-VIS or VIS-NIR setups.



Model	COL-1-UV	COL-2-UV	COL-1-NIR
Connector	SMA 905, 3/8-24 external thread	SMA 905 Fiber Stub, 3/8-24 external thread	SMA 905, 3/8-24 external thread
Back Focal Length (mm)	10		
Clear Aperture (mm)	5		
Material	UV Grade Fused Silica		K9 glass
Range	200 nm~1000 nm		400~2500nm
Numerical Aperture (N.A)	0.2		

OtO Photonics provides optical fibers for customers to satisfy the various needs of spectrum measurement. We offer the optical fibers with excellent optical performance, wide-band spectral transmittance, good bending and mechanical properties.
All of our Optical fibers are terminated with standard SMA-905 connecter and easily to connect with OtO Photonics spectrometers, light sources and other accessories. These fibers belong to multimode step Index and are available with fused silica optical fibers.
Base on different waveband, fiber length and numerical aperture, we offer various optical fiber models as below. OtO Photonics also offer customized products, but can not guarantee the transmittances.

For UV-VIS Waveband Optical Fibers

- Better transmission in the UV-VIS range (200-1100 nm)
- High OH ion concentration
- Assembly length 1m

OF-600-100-UVS
OF-600-100-UVB

For UV-VIS Waveband Short Optical Fibers

- Better transmission in the UV-VIS range (200-1100 nm)
- High OH ion concentration
- Assembly length 25.4mm & 40mm (double nut)

OF-S-0400-UV
OF-S-0600-UV
OF-S-1000-A
OF-DS-1000-A

For VIS-IR Waveband Optical Fibers

- Better transmission in the VIS-IR range (400-2200 nm)
- Low OH ion concentration
- Two types of numerical aperture(NA) : NA 0.22 fiber and NA 0.37
- Assembly length 1m

OF-600-100-NIRS2
OF-600-100-NIRS3

For VIS-IR Waveband Short Optical Fibers

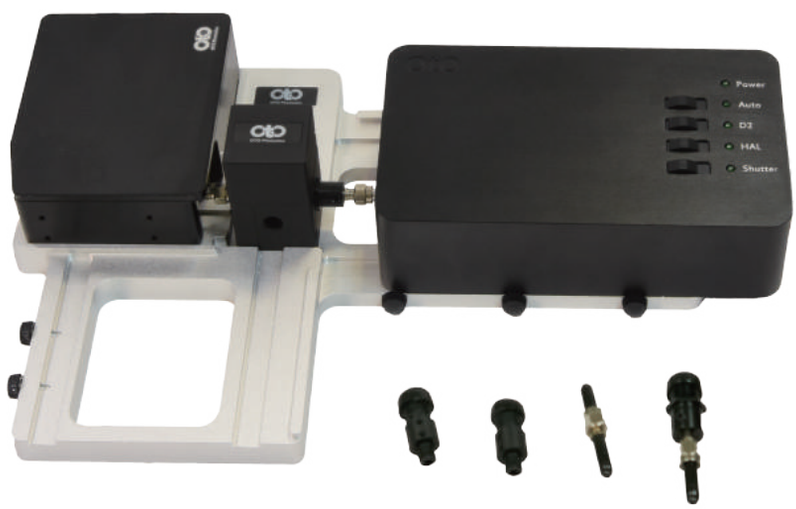
- Better transmission in the VIS-IR range (400-2200 nm)
- Low OH ion concentration
- Assembly length 25.4mm

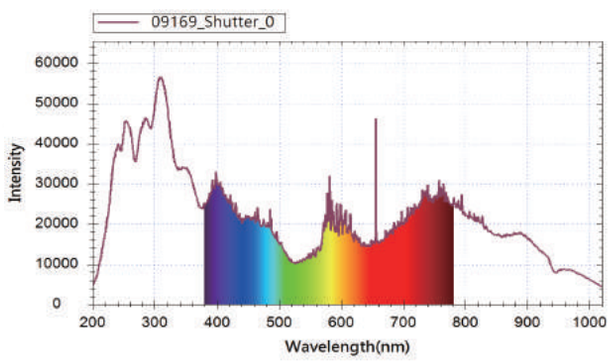
OF-S-1000-NIR

Customized Y-type Optical Fibers & Multicore Optical Fiber

Spectral Measurement Kit
PKG-SE12-DH/BA

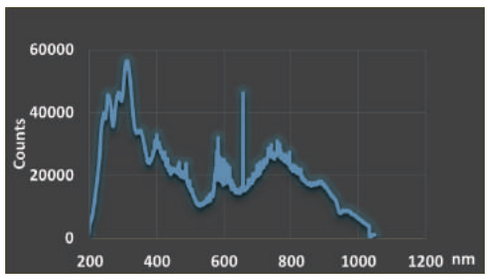
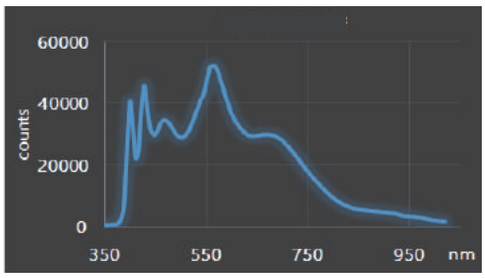
The Best Choice for Teaching,Laboratory Research and Optical Analysis





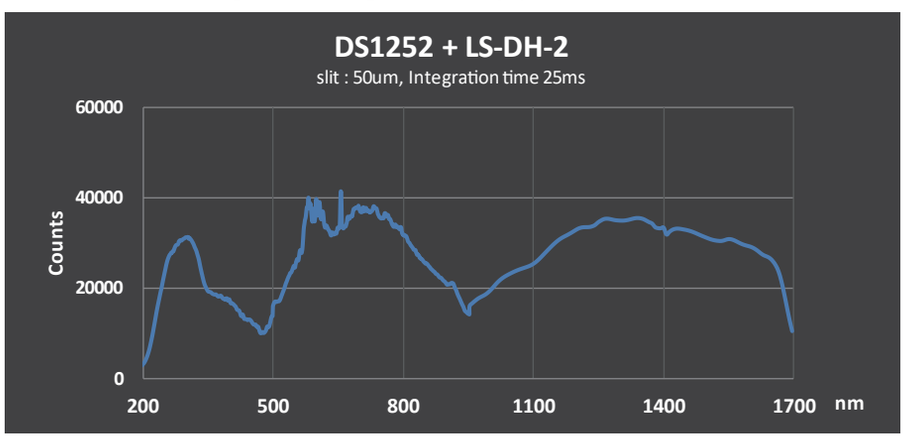
- Provide a Complete, Cost Effective, Wide Band Range Spectral Measurement Solution
- An Excellent Measurement Platform with OtO SmartEngine & SideWinder Series Spectrometer
- Free Sprectra Processing Software That Provides You With the Best User Experience, Technology and Support
- Deuterium-Halogen Light : High Alignment Accuracy, Stable Control, Built-in Shutter Control
- Offering Complete Accessories That Can Fully Meet the Absorbance, Transmittance, Fluorescence, Color, Concentration and Other Measurement Needs
- Directly Calculated Color Temperature, Color Rendering, Color Values, Transmittance, Absorbance ... and Other Parameters (on-board CPU)
- Optional High-Speed Continuous Exposures Mode to Choose from
- Suitable for Applying to Coating, Lens, Water Quality, Environment, Blood Analysis and Biochemical Testing Applications

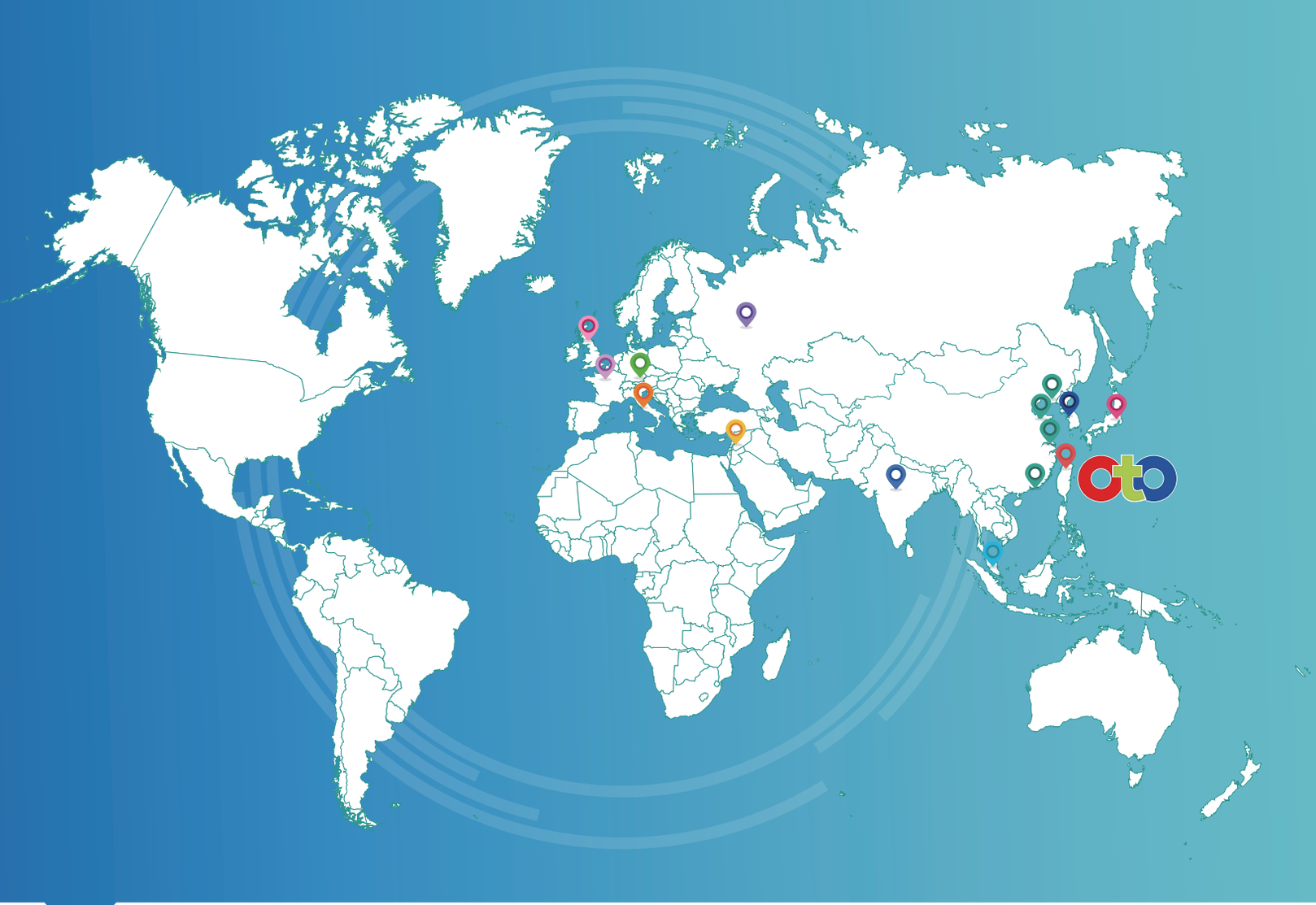
Specification

Model	PKG-SE12-DH	PKG-SE12-BA	
Light Source	LS-DH-2 Deuterium-Halogen Light	LS-BA Balance Light	
Spectrum			
Recommended Applications	Lens and Coating Measurement	Blood, Biochemical Analysis	
Collimator	1	2	pcs
Short Fiber	1	1	pcs
Fiber Collimator	1	1	pcs
Adapter	1	1	pcs
Cuvette Holder	1	1	pcs
Square Cuvette	Quartz*1	Quartz*1, Plastic*1	pcs
RGB Color Film	0	1	set
ND Filter (15%, 50%, 75%)	1	1	set
Multi-function Measurement Platform	1	1	set
Waterproof Outer Box	1	1	pcs
Software (SpectraSmart)	1	1	set

DS Series with LS-DH-2 Measurement Kit

Wide Wavelength Range for Applications: 200-1700nm





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