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2020 SANTEC CORPORATION

Product Guide 2020



The Photonics Pioneer

Welcome to

OPTOPIA

Santec is a leading manufacturer of products for today's fiber optics industry. Our mission is to contribute to the creation of a utopian society supported by optical technologies — a true Optopia. We pride ourselves in our innovation and dedication to quality developed from 41 years experience in the industry.

Founded in **1979**

1984 *Fiber Test system*

1987 *Bench Top Semiconductor Laser*

1989 *Bench Top Tunable Laser*

1993 *Tunable Filter Variable Attenuator*

1997 *Wavelength Locker*

2000 *Integrated Photodetector*

2002 *MEMS Attenuator*

2003 *System Solutions*

2005 *High Speed Scanning Laser*

2006
High Performance Tunable Laser



2007
OCT system



2012
Wavelength Selective Switch



2013
Premium Performance Tunable Laser



2014
Arbitrary Tunable Filter



2015
LC Based Spatial Light Modulator



2016
Advanced Optical Biometer



2017
All-New 7th Gen Tunable Laser



2018
UV hardened Spatial Light Modulator



2019
Tunable VCSEL



santec



Above: Photonics Valley Ohkusa Campus, Japan

The Photonics Pioneer

For more than four decades, we have been guided by a commitment to the optical technology that is revolutionizing the way we perceive the world and share information. Founded in 1979, Santec produces innovative products with proven quality and reliability. Innovation has had its rewards and Santec has been first to market with many of its products. These include the world's first optical fiber geometry test system in 1984, an external cavity tunable laser in 1987, linear sliding tunable filters in 1993, multi-channel integrated photo detectors in 2000, ultra-wideband light source in 2003, wavelength & bandwidth tunable filter and SS-OCT System in 2007, and LCOS based waveprocessor in 2011. We believe society will be advanced by photonics and look to the future by developing original products based on our advanced technologies.

PRODUCT LINE-UP



Optical Components
Santec is renowned for its quality components for CWDM, DWDM and PON applications.



Optical Subsystems
Our complete knowledge of optical component design and technology makes Santec your best partner for custom development of optical subsystems.



Bench Top Tunable Lasers
Santec was the first company to commercialize tunable lasers for telecommunications. Our current range offers leading edge performance for a plethora of applications.



Test Instruments
Santec has over 41 years of experience designing and manufacturing fiber optic test systems. Developed by fiber optic engineers for fiber optic engineers.



Optical Sensing Applications
Santec has been developping OCT components and software for medical and industrial applications. We provide a wide variety of solution for OCT including high speed swept sources and the other components such as fiber probe and balanced detector.



Medical Applications
The ARGOS® Optical Biometer has been designed to maximize the clinician's ease-of-use while delivering superior precision. It delivers the highest success rate and accuracy, even among the densest of cataracts for accurate selection of IOL(Intra Ocular Lens) using SS-OCT.

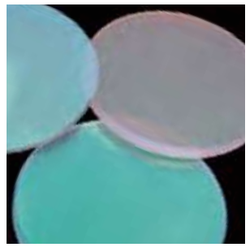


Software Solutions
A range of business productivity software solutions completes Santec's product range.

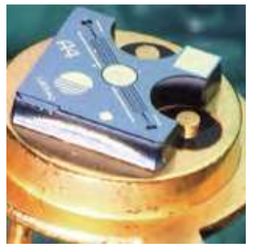
Core Technology

With 41 years of experience in the optics industry Santec has command of the key manufacturing processes to build lasers, instruments and components that meet the stringent demands for excellence by our customers. By committing to innovation as well as listening to our customer requests, Santec has succeeded in introducing solutions for a broad range of new optical applications. Our drive for Optopia has resulted in steps that minimize the timeline for a product to go from conception to commercial applications.

Thin-Film Coating



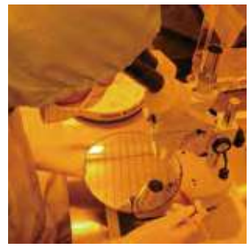
MEMS



Lasers & Instruments



LCOS



Medical Applications

MOVU
a santec company

MOVU is committed to helping clinicians improve Quality of Life with Advanced Optical Imaging. Movu has brought together a team of experts in medical device development, imaging, optical technology, engineering, and medicine. Combining these skill sets to deliver best-in-class optical imaging systems to market. We've combined the Swept-Source OCT(SS-OCT) technique with key technologies to produce ARGOS®, an advanced optical biometer that accurately reads biometric information even for the densest of cataracts. The SS-OCT technique delivers improvements in speed and accuracy over traditional OCT techniques such as SD-OCT or TD-OCT. Movu designed the SS-OCT ARGOS® Biometer to streamline biometry for the clinician. Enhanced ease-of-use and precision yield an accurate picture of the eye with minimal patient discomfort. A near infrared swept laser is scanned across the patient's eye and detects the returned light from boundary layers, accurately reconstructing the eyes' physiology in software.

Quality Products for Fiber Optic Applications

Santec manufactures a full range of passive optical components based on dielectric filter deposition, MEMS and other optical materials. These include interference filter products such as add/drop multiplexers and tunable filters, a range of variable attenuators, optical switches, and power monitoring devices, all specifically designed for WDM systems.
Santec's bench top tunable lasers are noted for their high optical output power, excellent wavelength and power stability, and competitive price. The tunable laser line includes laser products for the complete characterization, test, and manufacture of optical fibers, and optical components.
A full line of test and measurement equipment completes Santec's fiber optics product range. Built on Santec's expertise as an optical specialist, the test and measurement group provides the solutions that optical engineers demand, specializing in measurement equipment for the characterization, and manufacturing test of optical fibers and optical components.

ISO Certifications

ISO9001 ISO14001 ISO13485

High Performance Tunable Laser

TSL-770 (Flagship model/ All-new 7th generation)

Santec has brought all the experience and knowledge gained over the past 30 years, to the all-new 7th generation of their High Performance, High Speed TSL series tunable laser. A ground up redesign of the laser resonator and control electronics make the TSL-770 our fastest tuning, widest scanning, lowest noise and narrowest linewidth laser ever. TSL-770 is ideal for a wide range of applications: improving throughput, accuracy and precision in production, R&D and basic research. A proprietary resonator design enhances Q value and wavelength stability, opening doors for photonic investigations in the most cutting-edge of research applications.

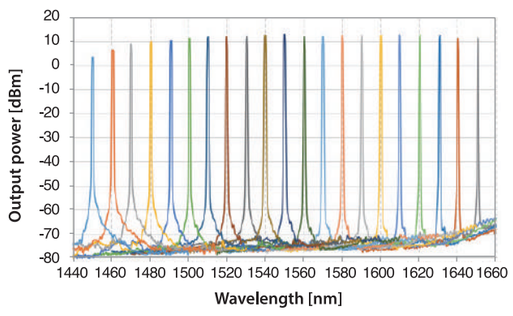


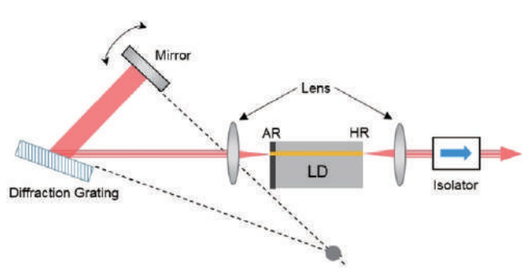
Features

- Wide tuning range from 1480-1640 nm
- Mode-hop-free with rapid sweeps up to 200 nm/s sweeps
- High output power +13 dBm
- High signal-to-noise ratio 90 dB/0.1 nm
- High wavelength accuracy 0.3 pm(typ.)
- Narrow linewidth <60 kHz

Applications

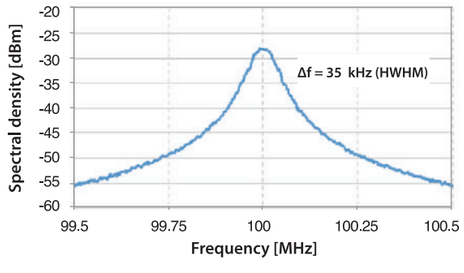
- Optical component & photonics material characterization
- Fiber optic transmission testing
  (Carrier LD, Local oscillator, etc.)
- Interferometry, Spectroscopy, Metrology
  (OFDR, Gas sensing, Terahertz, etc.)



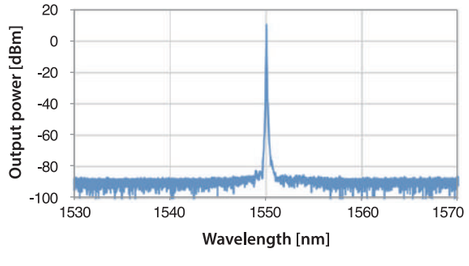


Littman-Metcalf configuration

Linewidth @Delayed Self-Heterodyne



High power and high signal-to-noise ratio



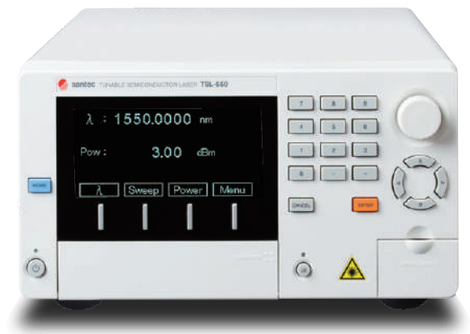
TSL-770は最新の第7世代となる高性能・高速波長可変レーザです。レーザ共振器および制御回路を完全に新設計することで、従来比2倍の高速スキャンが可能となり、かつ狭スペクトル線幅と低ノイズ化を実現しました。本製品は最大160 nmの広帯域波長可変が可能で、測定のスループット、精度を向上させることができます。これにより評価現場、R&D、基礎研究など様々なアプリケーションで理想的なツールとなっております。また、光学系の振動対策、制御系のノイズ低減により外部共振器型波長可変光源の特長である非常に高いQ値特性を活かした狭スペクトル線幅と、高周波数安定度の両立を実現したことにより、シリコンフォトニクス等、非常に高い周波数精度を求められる最先端の研究分野でもご利用いただけます。

TSL-710 (High-end model)
TSL-550 (Basic model)

The TSL-710 and TSL-550 are the latest in high performance tunable lasers. Combining high output power over +10 dBm with high signal-to-noise ratio over 90 dB/0.1 nm these lasers are invaluable tools for precise optical testing. These lasers are also equipped with features such as fine-tuning and coherence control as standard.
Additionally, santec can provide a full-band, high performance tunable laser system that covers an ultra-wide tuning range from 1260 to 1680 nm (O-band to U-band) by combining up to four Santec tunable lasers (TSL-770, TSL-710 and TSL-550) with the OSU-100 optical switch module and full control software.



TSL-710



TSL-550

Features

- Maximum160 nm tuning range within 1260-1680 nm
- Mode-hop-free with 100 nm/s sweeps
- High Output Power +13 dBm
- High Signal-to-Noise Ratio 90 dB/0.1 nm
- Narrow Linewidth 100 kHz

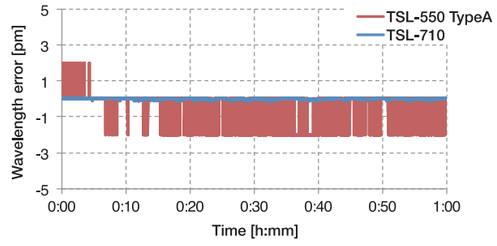
Applications

- Optical component characterization
- Fiber optic transmission testing
- Photonic material characterization
- Optical spectroscopy
- Interferometry

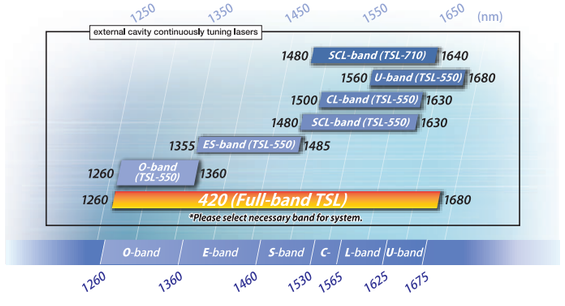
Model Selection (TSL-710/TSL-550)

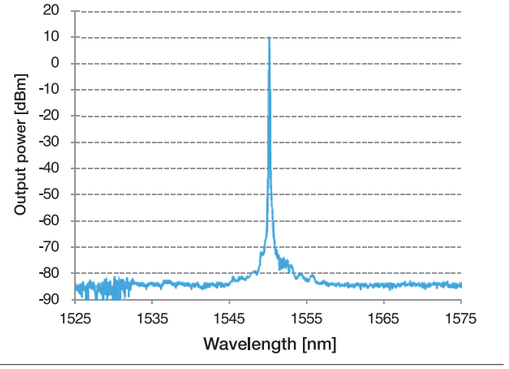
- TSL-710 :
  Premium performance <+/-2 pm wavelength accuracy
- TSL-550 Type A :
  Standard performance <+/-20 pm wavelength accuracy
- TSL-550 Type C :
  High performance <+/-5 pm wavelength accuracy

Wavelength stability



High power and high signal-to-noise ratio



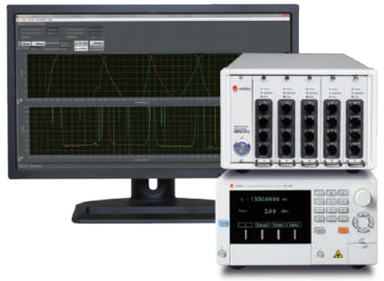


TSL-710/TSL-550は最新の高性能波長可変レーザー光源です。高出力と高い信号対雑音比を両立させ広帯域可変が可能で高精度な評価や実験のマストアイテムとして活用いただけます。 ASE光雑音を低減し90 dB/0.1 nm以上の非常に高い信号対雑音比を実現しながら、同時に+10 dBm以上の高い光出力を維持する革新的な外部共振器を採用しています。TSL-710/TSL-550は、最大160 nm波長可変(1260-1680 nmから選択）、ファインチューニング機能、コヒーレンスコントロール機能などを標準機能として装備し、さまざまな用途に対応可能です。Full-band TSLは1260-1680 nm(O-bandからU-band)の広帯域をカバーする高性能波長可変レーザー光源システムです。最大4台のTSL-770/710/TSL-550と光スイッチ OSU-100で構成されたシステムで、コストパフォーマンスが高く、高波長精度、高速掃引が可能で、R&Dおよび生産ラインにご利用いただけます。

High Speed Swept Test System

Swept Test System

The Santec Swept Test System has been developed to streamline photonic testing, providing a complete solution where high-speed analysis, high resolution and accuracy are key. Combining one of Santec's tunable lasers (TSL-770, TSL-710 or TSL-550) with a Santec optical power meter (MPM-210), a polarization control unit (PCU-100) and custom software, the complete Swept Test System optimizes WDL and PDL measurement for use in both R&D and production environments. Using real-time referencing, while simultaneously acquiring output power from the tunable laser and the transmitted optical power through the DUT, the system provides high accuracy in WDL and PDL analysis using the Muller Matrix Method. Over-sampling and rescaling algorithms are used to maximize testing throughput while maintaining measurement integrity.
The santec MPM-210 power meter mainframe can be used in conjunction with the 4-channel current meter module, the MPM-213. The Swept Test System combined with the MPM-210 and MPM-213 is suitable for measuring the performance of fiber optics components using transceiver- like photodiodes (ROSA/Coherent receiver, etc.) or optical channel monitors.

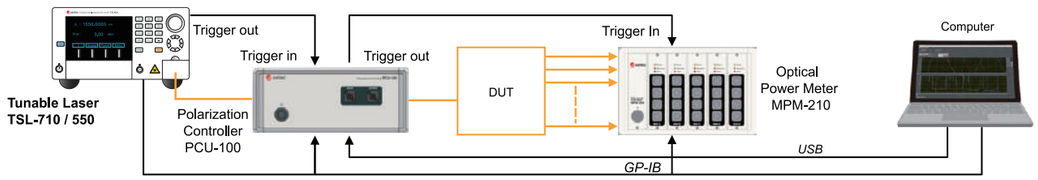


Features
- Real-time power referencing
- Rescaling algorithm
- Multi-channel measurement available
- Supporting LabVIEW control software

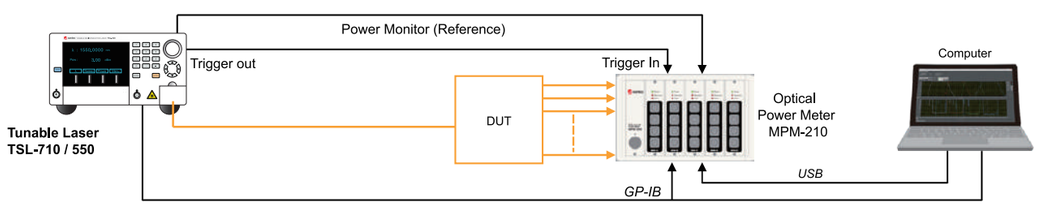
Applications
- Optical components characterization
  Interleavers, Fiber Bragg Gratings(FBGs), WSS, DWDM components, etc.
- Photonic material characterization
- Optical spectroscopye

Typical configuration

IL/PDL measurement setup with the polarization controller PCU-100 and the power meter MPM-210



IL measurement setup with the power meter MPM-210



SantecのSwept Test Systemは高速、高精度および高分解能で光コンポーネントやモジュールのWDL/PDL特性測定が可能で、生産ラインやR&Dなど幅広い分野でご利用いただけます。パワーモニタ出力を搭載したsantec TSLシリーズからの出力パワーモニタとDUTを透過した光パワーを同時に測定してリアルタイムにリファレンスを取得することで高精度にWDL/PDL特性を測定できます。Swept Test Systemはsantec波長可変光源 TSLシリーズ、パワーメータMPM-210、偏波コントローラPCU-100および専用ソフトウェアにて構築されます。PDLはMuller Matrix技術により測定しています。santecパワーメータのメインフレームMPM-210は電流モジュール(MPM-213)を搭載することが可能です。MPM-210とMPM-213を組み合わせたSwept Test SystemはROSA/コヒーレントレシーバーのようなフォトディテクタを内蔵したO/Eデバイス評価にも最適です。

Optical Power Meter

MPM-210 (Main frame)
MPM-211 (Power meter module 4 channel)
MPM-212 (Power meter module 2 channel and analog output)
MPM-213 (Current meter module 4 channel)



MPM-210



MPM-211/MPM-212/MPM-213

The MPM-210 is santec's new multi-port optical power meter capable of simultaneously measuring up to 20 ports (4 ports per MPM-211 module) with high speed and high resolution. GPIB, TCP/IP and RS-232C interfaces provide a convenient automated measurement solution.
The MPM-210 is ideal for IL and PDL measurements of multi -port optical components including Dense Wavelength Division Multiplexing (DWDM), AWG, Wavelength Selective Switches (WSS) and more. When combined with a santec TSL Series laser equipped with a power monitor output, the MPM-210 allows the user to complete high precision IL measurements while referencing in real-time.
The new MPM-210 multi-port optical power meter is also command compatible with the previous MPM-200 model, so switching to the new MPM-210 is as simple as swapping out your devices.

Features
- High speed measurement
  - ✓ Fast data transfer
  - ✓ Up to 1 million logging sampling points per port
  - ✓ 2 memory buffers per port
  - ✓ Fast measurement (100 kHz) with high resolution
- Wavelength Range 1250-1650 nm
- Dynamic power range -80 to +10 dBm (MPM-211/212)
- Dynamic power range -70 to + 10 dBmA (MPM-213)
- Up to 20 ports measurement
- High dynamic range (logging mode) 50 dB

Polarization Control Unit

PCU-100

- Wavelength range 1260-1360 nm/1500-1630 nm
- High SOP repeatability
- Power monitor function
- PDL measurement with Mueller Matrix method



Optical Switch Unit

OSU-100

- Wide wavelength range: 1260-1680 nm
- 1x4 optical switch
- Fast switching time
- Single mode fiber or polarization maintaining fiber



MPM-210はマルチポート光デバイスの光特性評価のために最適な新しいマルチポート光パワーメータです。MPM-210は1台で最大20ポートまで同時に高速、高分解能にて測定可能です。GPIB/Ethernetインタフェースを搭載しており、プログラムによる自動化、遠隔操作が可能です。
PCU-100は4偏波を設定できる偏波コントローラです。Swept Test Systemに組み込むことでMuller MatrixによりPDL測定が可能になります。
OSU-100は、光スイッチユニットです。satenc 波長可変光源TSLシリーズと組み合わせることで、1260-1680 nmの超広帯域光源としてご利用いただけます。

Top-Flat Tunable Filter

Programmable type

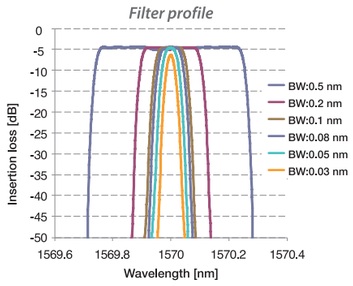
OTF-980 RoHS Compliant



The OTF-980 is a versatile programmable optical tunable filter that provides simultaneous and independent tuning of center wavelength and bandwidth over C & L bands. The OTF-980 is built with novel free-space optics combined with an ultra-fine tuning mechanism to ensure precise filter control and a flat-top passband shape. The fully programmable OTF-980 has automatic adjustment of the filter center wavelength and bandwidth. An integrated power meter monitors power at the output and features an automatic peak search function

Features

- Center wavelength & bandwidth can be tuned independently
- Flat-top filter shape with steep filter slope:
  - Ultrafine-Plus: 0.05-3 nm, 1000 dB/nm
  - Ultrafine: 0.08-4 nm, 500 dB/nm
  - Standard: 0.1-15 nm, 200 dB/nm
- Wavelength tuning range: 85 nm in C&L-band
- Peak search function
- Touchscreen and GPIB/Ethernet/USB interfaces



Manual type

OTF-350 RoHS Compliant



- Center wavelength & bandwidth can be tuned independently
- Wavelength range: 1530-1610 nm (C&L Band) O-band is available
- Bandwidth: 0.2-10.0 nm (Normal type)
- Bandwidth: 0.1-15.0 nm (Wide type)
- Flat-top filter shape

Gaussian Tunable Filter

Programmable type

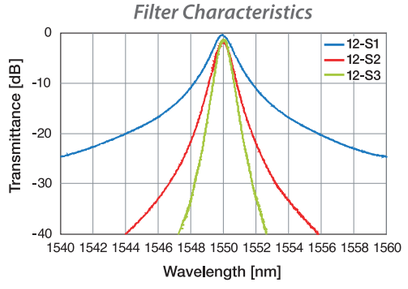
OTF-930 RoHS Compliant



The OTF-930 bench-top tunable filter features a full 80 nm wavelength tuning range, and improved tuning mechanics to ensure low insertion loss. The patented linear 'sliding tuning' method achieves excellent optical properties, including very low PDL and PMD. The versatile configuration of the device allows you to select both the filter profile and the number of cascaded filters (S1, S2, or S3), offering a wide variety of filter profile options to suit most fiber optic applications.

Features

- 80 nm tuning range, 0.01 nm resolution
- Filter selections: -3 dB Bandwidth 0.25 – 5.5 nm
- Low PDL (<0.1 dB) "linear sliding" filter
- Power monitoring and peak search functions
- Full GPIB support with LabView driver



Manual type

OTF-320 RoHS Compliant



The OTF-320 is a manually tunable optical filter that features a wavelength indicator.

OTF-980は波長と透過帯域幅をそれぞれ独立して変えることができるベンチトップ型の可変光フィルタです。回折格子をベースとしたユニークな高精度可変メカニズムにより、フラットトップな透過フィルタスペクトルと優れた光学特性を実現しております。波長と透過帯域幅の設定はタッチスクリーンもしくはGPIB/Ethernet/USBインタフェースより行うことができ、プログラムによる自動化、遠隔操作が可能です。OTF-350は波長と透過帯域幅をそれぞれ独立して変えることができる手動型可変光フィルタです。OTF-930は用途に合わせた様々な光フィルタの搭載や、1~3枚の光フィルタのカスケードマウント（Filter structure S1、S2、S3）による透過特性の選択が可能な波長可変フィルタです。リニアスライディング方式による80 nm連続波長可変と低損失、PDL <0.1 dB 、PMD <0.1 psの特長を持っています。

Polarization Extinction Ratio Meter

NEW PEM-340 RoHS Compliant



The PEM-340 polarization extinction ratio (PER) meter enables rapid and accurate polarization axis alignment of optical components to a PMF (Polarization Maintaining Fiber). The PEM-340 incorporates a powerful GPIB interface enabling full system integration and production line automation. In addition, to facilitate automatic alignment of diode lasers to optical fibers, an analog power monitor with 1 kHz response time is available. With this addition, both translational and rotational fiber alignment can be controlled automatically.

Features

- Full band 1260-1630 nm
- Simultaneous display of extinction ratio, optical power, and polarization angle
- 50 dB dynamic range for PER with high resolution 0.01 dB
- Wide dynamic input power range (-40 to +10 dBm/Normal power), (-25 to +20 dBm/High power)
- Interchangeable connectors: FC, SC or LC

Polarized Light Source

PLS-100 RoHS Compliant



The PLS-100 is a light source with well defined polarization. It features stable high output power while maintaining a high polarization extinction ratio of 45 dB (typ.). Combining PLS-100 and PEM-340 provides an optimized system for PER measurement of polarization maintaining (PM) fiber optic devices in both R&D and production environments.

Features

- Polarization extinction ratio, up to 45 dB
- High output power and power stability
- Wavelength range : 1310±20 nm or 1550±20 nm

Wavelength Selectable Laser

WSL-100 (Single or two ports) RoHS Compliant



The WSL-100 is a compact and cost effective tunable laser source for use in WDM systems and optical measurement applications. This laser can be tuned to any wavelength with high, 1 MHz resolution in both C-band or L-band, covering a 38 nm tuning range. An internal wavelength locker provides high wavelength accuracy and stability.

Features

- C-band or L-band tuning with high resolution
- Fine tuning available with 1MHz resolution
- Narrow linewidth <100 kHz
- High output power >+15 dBm
- Integrated wavelength locker

Applications

- Fiber optic transmission testing
- DWDM component testing
- Local Oscillator for Coherent detection

PEM-340は、偏光子を高速回転させ、検出される光量の変化から消光比を求める偏光消光比モニタです。ノーマルパワー仕様は+10～-40 dBm、ハイパワー仕様は+20～-20 dBmの光入力に対して測定が可能です。測定光波長は1260 nm～1630 nmのフルバンドをカバー。偏光消光比・偏光角度・入力光強度を同時に測定し、結果をディジタル信号とアナログ電圧信号で得ることができます。偏波面保存ファイバの偏光軸アライメントに便利です。 PLS-100は、偏光光源です。45 dBの消光比を維持しながら高出力および高出力安定度を実現しています。PEM-340とPLS-100を組合せたシステムにより、PMF部品のPER測定が可能となります。
WSL-100はWDMシステムや測定アプリケーションに使用可能な小型で価格メリットがある波長可変光源です。C-bandもしくはL-band(38 nm波長可変範囲)を1 MHzの高分解能で任意の波長へ波長設定できます。内部の波長ロッカーにより高波長精度と高波長安定度を実現しています。

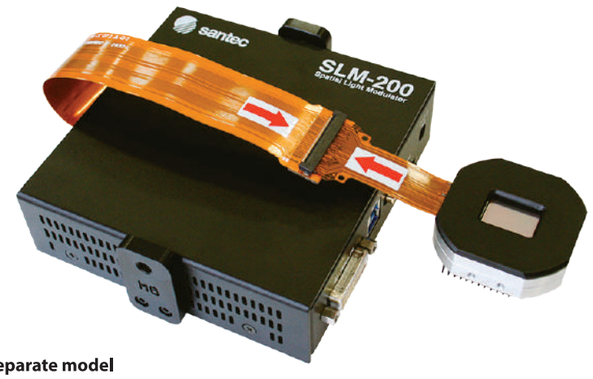
Liquid Crystal Based Spatial Light Modulator

SLM-200

Santec spatial light modulator (SLM) is based on reflective liquid crystal on silicon (LCOS) microdisplay technology. The SLMs enable optical phase modulation freely and generate arbitrary 2D phase patterns on a LCOS pixel-by-pixel basis.
SLM-200 series are our latest Full-HD LCOS model. The SLMs are suitable for various scientific and industrial applications, including beam shaping, wavefront correction and optical manipulations.



All-in-one model



Separate model

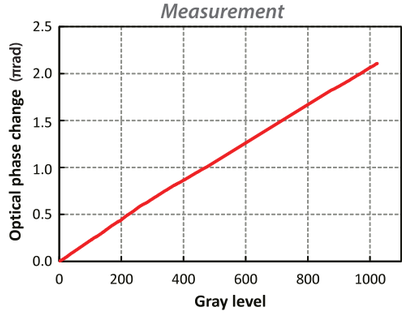
Features

- WUXGA (1920 x 1200) and Full-HD (1920 x 1080) available
- Frame rate, x2 (120 Hz)
- Memory function
- Triggers-input & output

Applications

- Beam steering
- Pulse/Beam shaping
- Optical manipulation
- Wavefront correction
- Diffractive optics
- Programmable phase pattern

Measurement



Specifications

Item	min	max	Units	Notes
Operating Wavelength range	450	1600	nm	(Refer to appended table about AR coating option)
Panel size	(H)15.36 x (V)9.60		mm	Active area
Pixel resolution	(H)1920 x (V)1200		pixel	
Pixel size / pitch	7.8 / 8.0		μm	
Panel reflectivity	Typ. >80		%	Depending on specified wavelength range
Aperture ratio	95		%	
Gray level	10 (1024)		bit	
Frame rate	60 or 120		Hz	
LCOS drive frequency	1200		Hz	
Phase depth	2π	-	rad.	
Relative phase fluctuation	Typ. <0.001π		rad.	
Response time	Typ. 300		ms	
Signal format	DVI / USB3.0		-	
Operating temperature range	15	35	degC	10-bit using RGB 8-bit, 3 colors
Storage temperature	0	40	degC	
Optical power handling	Typ. 10 1)		W/cm^2	@1550 nm, CW, 2.0 mm beam diameter
Dimensions	117.6 x 117.6 x 33.7		mm	
Control software	GUI software for Windows		-	

1) The value is not guaranteed. Please refer santec SLM technical sheet in one instance for judgement of useable light power.

< AR coating option >

Item	Parameter						Units
Ordering code number	-01	-02	-03	-04	-12	-14	-
AR coating range	450-550	750-850	1000-1100	1500-1600	400-800	450-550 / 1500-1600	nm
AR coating reflectance 2)	< 0.5				< 1.5	< 0.6	%

2) Angle of incidence = 0 degree

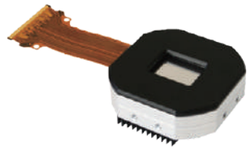
SLM-200は弊社第2世代となる空間光変調器です。第1世代より有する他社比4倍優れた10-bit 1024階調度と10倍以上優れた位相安定度はそのままに、当社従来比1.5倍の230万画素（解像度1920×1200）の高精細パネルを採用しております。
* 光学素子マウント（φ2インチ）適合、Separate modelのみ

Liquid Crystal Based Spatial Light Modulator

SLM-250

Santec introduces an Ultra Violet (UV) durable spatial light modulator (SLM-250). This product is a world's first for two-dimensional SLM, extending their use into the UV band. The UV hardened SLM-250 has 42 times UV durability when compared to standard SLM devices. A power density up to 10 mW/cm^2 is sustainable using a novel liquid crystal and dielectric mirror design. The SLM-250 follows the popular first generation, HD-LCOS, SLM-150 from Santec model. The SLM-150 is suitable for various scientific and industrial applications, including beam shaping, wavefront correction and optical manipulations.





Easy handling LCOS



Easy mounting LCOS*

Features

- Wavelength range: 365-550 nm
- Optical power handling: 10 mW/cm^2
- Easy mount LCOS head
- Low stress design for SLM
- Full HD available
- No separate control box is required
- Plug and play

Applications

- 3D-printing
- IC trimming
- Laser processing
- Biology sensing

Specifications

Parameter	min	max	Unit	Notes
Wavelength range	365	550	nm	
AR coat range	365	550	nm	
AR coat reflectance	-	0.7	%	Angle of incidence = 0degree
Panel size	(H)15.36 x (V)9.60		mm	Active area
Pixel resolution	(H)1920 x (V)1200		pixel	
Pixel size / pitch	7.8 / 8.0		μm	
Panel reflectivity	Typ. >70		%	Depending on specified wavelength range
Aperture ratio	95		%	
Gray level	10 (1024)		bit	
DVI video frame rate	60 or 120		Hz	
LCOS drive frequency	1200		Hz	
Phase depth	2π	-	rad.	
Phase fluctuation	Typ. <0.003π		rad.	
Response time	Typ. 50		ms	
Signal format	DVI / USB3.0		-	10-bit using RGB 8-bit, 3 colors
Operating temperature range	15	35	degC	
Storage temperature	0	40	degC	
Optical power handling *	Typ. 40		MW/cm^2	Peak power@355 nm, pulse laser, pulse width 260 psec, reception rate 100 Hz
	-	10.0	mW/cm^2	@365 nm, 24H/day continuous operation
Dimensions	122 x 122 x 38.3		mm	
Control software	GUI software for Windows		-	

* The value is not guaranteed. Please refer santec SLM technical sheet in one instance for judgement of useable light power.

SLM-250は「液晶は紫外線に弱い」と認識されていた常識を覆す画期的な紫外線耐性を有する空間光変調器です。当社対応する波長範囲が紫外域に拡張されたことによってバイオセンシング、3Dプリンティング、ICトリミングなどのアプリケーションにも適用できるようになりました。
* 光学素子マウント（φ2インチ）適合

Liquid Crystal Based Spatial Light Modulator

NEW SLM-300

Santec introduces a High power LCOS model of spatial light modulator series (SLM-300). SLM-300 is for use with High-Power Lasers up to 200 W. This product is suitable for Laser processing application.

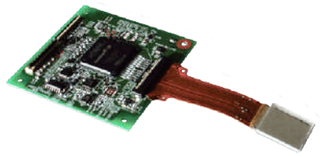


Features
- High-power LCOS SLM
- Water-Cooling Jacket Option available
- High Phase Resolution 10-bit (1024) Gray Level
- Ultra Low Phase Noise ~0.002π rad

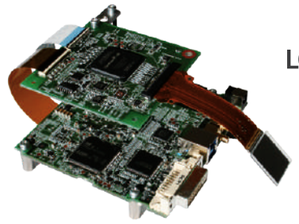
Applications
- Laser Processing
- 3D-Printing
- IC Trimming

SLM-20

Santec introduces an OEM model of the LCOS based spatial light modulator (SLM-20). The SLM-20 consists of a compact LCOS head module and driver board, enabling easy integration into systems requiring accurate wavefront control, especially laser processing and microscopic applications.

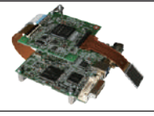


LCOS driver model



Multifunctional model

Features
- Compact design for built-in SLM : 70 x 70 mm
- Full-HD high resolution : 1920 x 1200 pixel
- LVDS/DVI-D video signal format : 546 MHz
- Double frame rate available : 60 or 120 Hz
- Low consumption power : 8.4 W

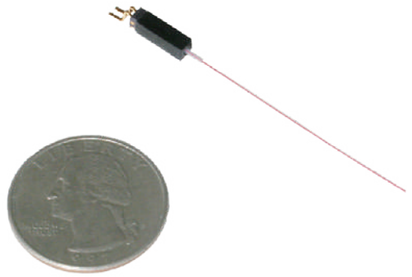
Item	Model		Note
	LCOS driver	Multifunctional	
Appearance			
Image storing		✓	Max. 128 images
Gamma correction		✓	
Phase adjusting		✓	Adjust to 2π radian at arbitral
Trigger input/output		✓	LCOS drawing trigger
Error output	✓	✓	
Temperature monitor	✓	✓	

SLM-300はレーザー加工に最適なハイパワー耐性を有する空間光変調器です。SLM-20は産業機器組み込み用の空間光変調器です。全ての機能を有するマルチファンクションモデルと基本駆動特性に特化したLCOSドライバモデルよりお選び頂けます。さまざまな機器組み込み用カスタムに対応いたします。

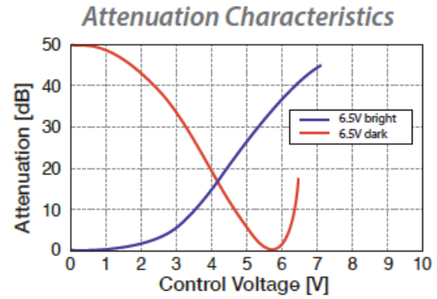
MEMS Attenuator

COVA-1

Santec's COVA-1 is the world's smallest optical variable attenuator based on electrostatic MEMS technology. Compared to the current SANTEC MOVA-1, COVA-1 has achieved an 82% reduction in volume ratio. SANTEC's variable attenuator series is excellent for high density integration in next generation small form factor packages.



Features
- World's smallest size
- Bright / Dark types available
- Low power consumption
- Telcordia GR-1221 qualified
- Shock and vibration tolerance design
- Minimum fiber bending radius of 5mm is available
- Shutter function



MOVA-1

For DWDM application, Santec's MOVA is an optical variable attenuator based on electrostatic MEMS technology. Our tilting mirror design coupled with laser welded packaging ensure a reliable, stiction-free device. Silicon MEMS devices are robust, which withstands repeated switching, wide temperature range and mechanical shock without failure. Operational stability and long-term reliability are ensured with Telcordia compliant packagings.



MOVAシリーズは、PDLや波長依存性が小さく波長多重通信で必要とされる各種仕様について優れた特性を持つ可変アッテネータです。多くのシミュレーションと実験により完成された内部ミラー設計やレーザー溶接によるパッケージングが採用されており、Telcordia要求仕様を満たす信頼性の優れた製品です。シリコンMEMSデバイスは、電圧変動の繰り返しや、大きな環境温度変化、機械的な衝撃に対して耐久性の高いデバイスです。信頼性に優れた光学系パッケージングとの組み合わせにより長期に渡って安定した動作が得られます。

Non-contact, Non-destructive and Non-invasive real time imaging

Swept Source - Optical Coherence Tomography system for research, feasibility studies and product development

IVS-1000(1060 nm), -2000(1310 nm)

Santec has been an innovator in SS-OCT since the launch of our first swept source in 2004. We bring a wealth of expertise backed up with a wide selection of hardware and software to address most all applications of SS-OCT, in medical, industrial and scientific fields. A SS-OCT system from Santec can accelerate your product development, help you image those hard to see features all with customized performance to meet your needs. Santec is the most flexible supplier of complete SS-OCT systems in the world, with a wider range of lasers, software modifications and probe hardware than any other manufacturer.

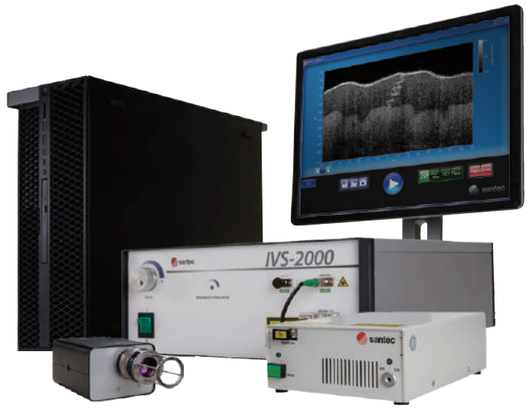
Recent additions to our SS-OCT system line-up includes a long coherence length systems for high speed remote surface profiling. We continue to widen our scope of SS-OCT solutions from the latest applications medical diagnostics through to in-situ industrial non-destructive testing.

Features

- Custom order possible
- Wavelength band : 1060 nm, 1310 nm
- Axial resolution : 6 µm typ. (High resolution type)
- High speed measurement : max 400,000 line/sec
- Deep imaging depth : 150 mm (IVS-1000-VCSEL)
- SDK available for LabVIEW, C# and C++

Applications

- Industrial non-destructive inspection
  - Defect inspection (resin, molded plastic, etc.)
  - Figuration (semiconductor, etc.)
- Thickness monitor
- Height, Depth measurement
- 3D surface profiler
- Spectroscopy
- Biology & Medical microscope



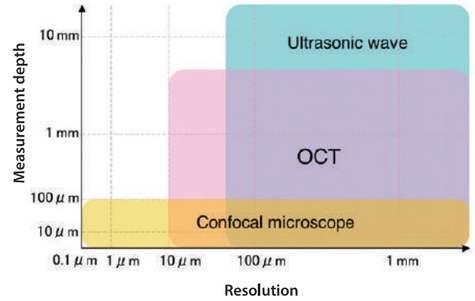
OCT System Line up						
Model name and Option		Center wavelength(nm)	Typ. Axial resolution (µm)	Max. Imaging depth (mm)	Image acquisition speed (lines/sec)	Scanning Laser Type
IVS-2000	Standard (ST)	1310	<16	>6	20,000	Polygon scanner
	High Resolution (HR)		<6	>4	20,000	
	Long Imaging depth (LC)		<16	>20	50,000	MEMS
	High Speed (HS)		<16	>10	100,000	
IVS-1000	Ultra long Imaging depth (VCSEL)	1060	<16	20 to 150	10,000 to 400,000	Tunable VCSEL

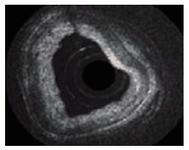
OCT(Optical Coherence Tomography : 光コヒーレンストモグラフィ)システムは、X線CT、MRI、超音波、共焦点顕微鏡に続く最先端断層測定器で、近赤外線の後方散乱光の干渉を利用して内部構造を可視化することができます。Inner Visionは、当社のHSLシリーズ高速スキャニングレーザーを使い、高解像度で鮮明な干渉分析画像をリアルタイムに得ることができます。電子顕微鏡や実体顕微鏡とは異なり、可視光では得られない内部の組織や構造を、生体や試料を採取、破壊することなく分析することができます。また、3次元撮影も可能です。

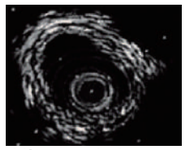
Features of OCT

OCT (Optical Coherence Tomography) is a non-invasive imaging technique that relies on analyzing the frequency components of backscattered light to reveal the internal structure of an object or tissue.
The advantages of OCT are:

- High resolution
- Real-time imaging
- Non-invasive
- Small size, cost

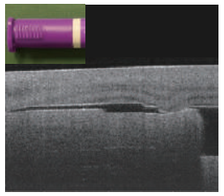


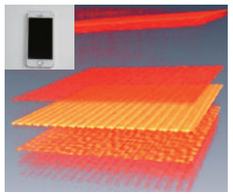

OCT image

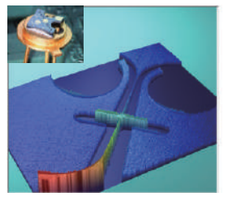

Ultrasonic image

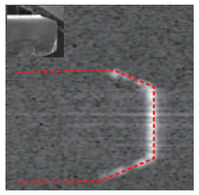
OCT image gallery

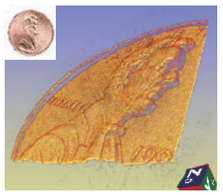
■Industrial Inspection


Plastic molded object (pen)

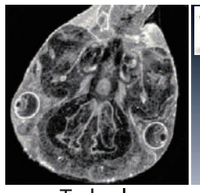

Liquid crystal display

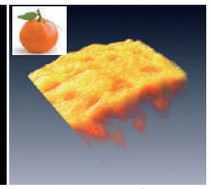

Silicon structure


Wafer edge profile

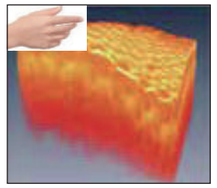

Surface profile

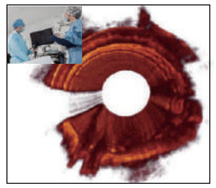
■Biology


Tadpole

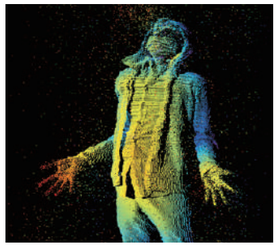

Orange skin

■Medical Imaging


Skin


Vascular

Wide field 3D-sensing with Tunable VCSEL



Tunable VCSEL having a intrinsically long coherence length combined with advanced signal processing can benefit attractive applications.
In analogous to SS-OCT, but not just for cross-section imaging, it provides high-sensitivity 3D profiling capability as well as velocity detection of moving objects in many different industries such as 3D depth sensing, robot machine vision and LIDAR.

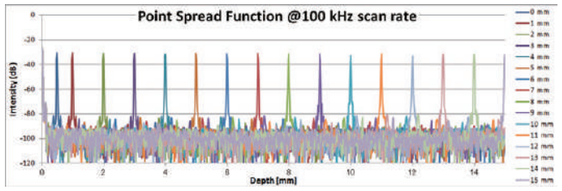
IVS-2000は、研究用途、製品化の為の基礎検討などさまざまな分野・応用でご利用いただけるように、光源やプローブをご希望にあわせてお選びいただけるカスタマイズ対応が可能なSS-OCTシステムです。オプションでLabViewを用いたコード開示も出来ますので、お客様ご自信でのカスタマイズも可能です。LabView, C#, C++用のSDKもオプションで提供しております。

Tunable VCSEL OEM Solution

HSL-1 RoHS

The HSL-1 is based on advanced electrically pumped VCSEL (Vertical Cavity Surface Emitting Laser) technology. An attractive laser for SS-OCT applications the HSL-1 takes advantage of a number of features intrinsic to VCSELs to deliver best-in-class performance, including long coherence length, variable scan speed and low signal noise. The HSL-1 has been designed with system integration in mind; a compact, efficient package the laser is also robust, reliable and suitable for mass production.





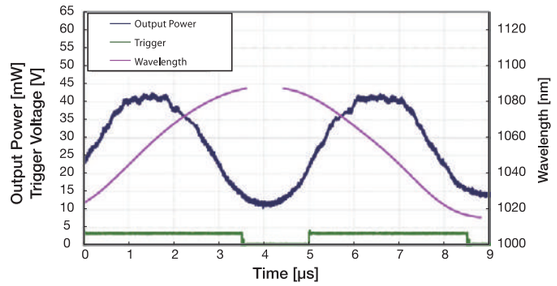
Features

- 1060 nm Wavelength Range
- Single Mode Lasing: Ultra Long Coherence Length >1 m
- Flexible Scanning Rate, Tuning Range, and Direction
  - Max. 400 kHz scan rate, Wideband tuning range
- Coherence Revival and Mode Competition Noise Free
- Compact and Designed for Reliability
- Integrated k-Trigger

Applications

- OEM source for OCT systems
- Spectroscopy and Optic Sensing
- FMCW LiDAR

HSL-1 Optical Characteristics @200 kHz scan rate



MEMS based HSL OEM Solution

HSL-10 (1060 nm wavelength band) RoHS

HSL-20 (1310 nm wavelength band) RoHS

The HSL-20 is Santec's MEMS based swept laser that combines high speed operation with long coherence length in a compact package for the ultimate in integrated sources for SS-OCT imaging. Scan rates up to 100 kHz are available from this robust laser that may be configured with start trigger and k-clock depending on system needs.



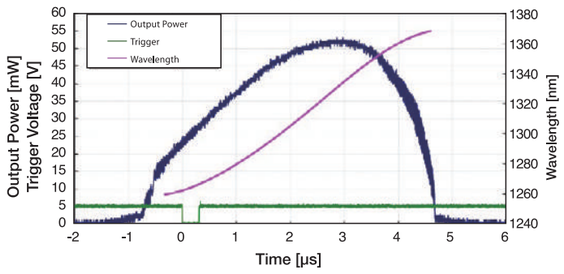
Features

- 1060 nm, 1310 nm wavelength band
- unidirectional sweep
- Wide scan range >100 nm
- Long coherence length >10 mm
- High output power >40 mW (at peak)
- k-Trigger integrated
- Compact size (150x226x67 mm)

Applications

- OEM source for OCT systems
- Spectroscopy and Optic Sensing

HSL-20 Optical Characteristics
**100 KHz standard type*



Santecの光源技術を駆使した高速波長掃引レーザーHSLシリーズ。狭線幅のレーザーが連続的に高速スキャンします。ターンキーひとつで起動し、トリガーも内蔵しているため、シンプルに測定系を構築する事が可能です。RIN（Relative Intensity Noise）が小さいため、OCTで利用した場合に高いS/Nを得ることが出来ます。OCTだけではなく、高速な分光分析用の光源としてもご利用いただけます。HSL-1は面発光レーザーの技術を応用し、シングルモード発信で高速に波長をスキャン。帯域やスキャンレートを可変できます。HSL-20はMEMSフィルタを用いた外部共振器型レーザーで、OEM光源として広く使われております。

Polygon scanner based HSL

HSL-2100 (1310 nm wavelength band) RoHS

The HSL-2100 is Santec's best selling tried and trusted scanning laser designed for OCT applications. The output wavelength is scanned continuously at high speed using a polygon based filter.
Scan rates of up to 50 kHz (high speed model) and tuning range of up to 170 nm(wideband model) are available, with linear scan that allows for imaging using rescaling technique without k-clock. Averaging of A-lines to increase image SNR is made possible by the high-stability of the laser scan.



HSL-200 (1310 nm wavelength band) RoHS OEM Solution

HSL-200 is the OEM swept source package based on the same technology used in the bench-top lasers, HSL-2100. The HSL-200 packs the same high performance of the bench-top unit into a smaller footprint and adds features such as RS-232C communication for integration into customer systems. Santec will customize HSL-200 laser performance to match imaging requirements.



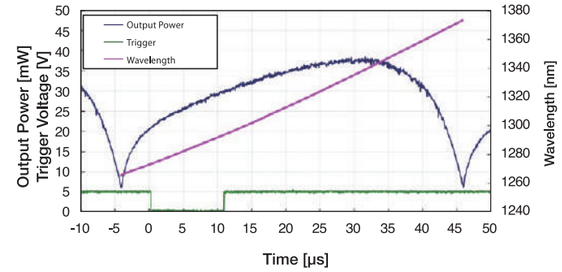
Features

- Max. 50 kHz scan rate, >170 nm tuning range
- Linear frequency scan. High-linearity option available

Applications

- Research in BioMedical Imaging
- Spectroscopy and Fiber-Optic Sensing
- OEM source for OCT systems(HSL-200)
  (Medical devices and in-line inspection systems)

HSL-200 / HSL-2100 Optical Characteristics
**20 KHz standard type*



Type	1060 nm Ophthalmology OCT	1310 nm Conventional OCT	1550 nm Spectroscopic OCT	3000 nm Spectroscopic OCT
Tunable VCSEL Flexible scan rate, Ultra long coherence length, No coherence revival.	fs: 4-400 kHz ⊿λ: 75 nm Lc: >1 m	-	fs: 10-400 kHz ⊿λ: 80 nm Lc: >1 m coming soon	fs: 10-200 kHz ⊿λ: 80 nm Linewidth: <10 MHz
MEMS High speed, Long coherence length	fs: 100 kHz ⊿λ: 100 nm Lc: 15 mm	fs: 50, 100 kHz ⊿λ: 100-130 nm Lc: 10-18 mm	-	-
Polygon scanner Simple rescaling, High accuracy		fs: 20-50 kHz ⊿λ: 100-170 nm Lc: 2-5 mm	-	-

*Lc：Coherence length

HSL-2100はポリゴンスキャナを用いた外部共振器型レーザーで、高繰り返し性、直線性を有しており、容易に波長校正が可能です。特に高精度の計測などで使われております。HSL-200はHSL-2100のOEM版で、コンパクトな設計、外部からのシリアル通信による制御が可能です。

Compact and High-performance SS-OCT Engine

OCT Engine

Santec's OCT Engine is based on the High Speed Scanning Laser (HSL) series, OCT-grade Balanced Photo Detector BPD-200, and the real-time resampling OCT DAQ card HAD-5200B-S. Santec is the pioneer for scanning lasers and Swept Source OCT technology with cutting-edge performance in our SS-OCT systems. Santec OCT is used for various applications in the medical and industrial fields. With our experienced OCT team, we can provide great solutions to any integration and customization needs with continuous support.

Features

- 1060 nm and 1310 nm wavelength range
- High sensitivity, Low noise and real-time imaging
- Easy integration, SDK for LabVIEW & C++/# available
- Optimized image by real-time resampling & dispersion compensation
- 2 ch analog output (±4 V, 16 bit) to control Galvano/MEMS scanner

Specifications

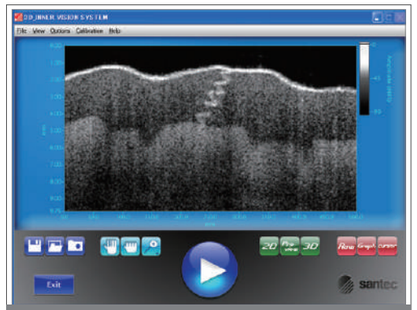
Parameter	Unit	Specifications			
		HSL-1	HSL-10	HSL-20-50	HSL-20-100
Center Wavelength	nm	1040-1080	1040-1080	1290-1330	1290-1330
Typ. axial resolution (in Air)	μm	<16	<14	<16	<16
Imaging depth range (in air)	mm	>70 mm (@10 kHz)	>10 mm	>20 mm	>10 mm
A-line rate	kHz	10-400 +/- 0.1	100 +/- 0.1	50 +/- 0.1	100 +/- 0.1
Peak output power	mW	>20			
Optical fiber type	-	SMF			
OS	-	Windows 10 (64 bit)			
System Bus	-	PCI Express2.0 (Gen2) 5.0 GT/s x8			

*Please note, these specifications are subject to change. Please contact to us for the details.

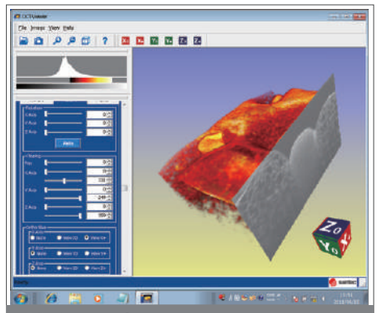
Features of IVS software

- Proprietary rescaling algorithm integrated FPGA DAQ board
- Real time imaging up to 30 fps
- 1D, 2D, 3D imaging mode
- Storage mode for time elapsed measurement
- Scan angle setting arbitrary angle scan
- OCT graph capture, Raw data import/export
- Custom settings Viewing area
- Thickness, distance analysis software for industrial application available
- SDK available for LabVIEW, C# and C++

Multi Slice Viewer



IVS Main software



3D viewer software

OCTEngineは、高速波長掃引レーザーHSLシリーズ、バランスドフォトディテクタBPD-200、及びリアルタイムサンプリングDAQカードHAD-5200を使用したSS-OCTを実現するための核となるパーツです。

OCT-grade Balanced Detector

OEM Solution

BPD-200 DC to 80 MHz (Suitable for <30 kHz A-Line rate)
BPD-200-HS DC to 200 MHz (Suitable for >30 kHz A-Line rate)
NEW **BPD-400** DC to 400 MHz (Suitable for >100 kHz A-Line rate)



BPD-200 is a balanced photo detector that outputs the difference of two detector signals. This can be used for reduction of common mode noise due to the laser power fluctuation. In heterodyne detection as in most of OCT applications, it provides a 3 dB sensitivity advantage when detecting the signal inverted in phase in between two input signals. Furthermore, special design significantly reduced the problem of the undesired image artifact which was a major problem in the other balanced detectors. BPD-200 is the best detector ever made specifically for SS-OCT applications.

Features

- Wide dynamic range (DC to 80 MHz, 200 MHz or 400 MHz)
- High reliability and high gain, high linearity
- Flat balanced level
- Specially designed for artifact-reduction
- Wavelength range (950-1600 nm)

Applications

- Swept Source – OCT
- Heterodyne measurement
- OFDR (Optical Frequency Domain Reflectometry)

Integrated Interferometer Module

OEM Solution

IFM-200

IFM-200 is an OEM module Mach-Zehnder type interferometer. A wide range of configurations can be realized based upon customer requirements including PS-OCT with added features such as targeting diode laser, and optical delay line. Thirty-five years of optical integration and packaging experience is applied to maintain high quality and high reliability as well as optimizing cost. Custom configuration including other interferometer types (ex. Michelson, Fizeau type) can be designed for OEM solutions.



Features

- Swept Source – OCT
- Heterodyne measurement
- OFDR (Optical Frequency Domain Reflectometry)

Applications

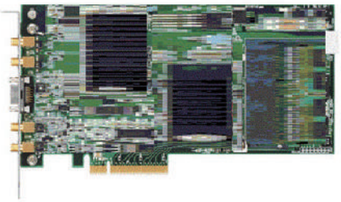
- Interferometer block for OCT systems
- K-clock module for SS-OCT systems
- Interferometer block for In-line inspection systems
- Interferometer block for heterodyne measurement

High Speed Imaging DAQ-Board for HSL

OEM Solution

HAD-5200B-S

Santec offers a high speed imaging Data Acquisition (DAQ) Board compatible with santec's high performance swept laser. Santec's patented rescaling algorithm is encoded into the FPGA for real time OCT processing.



Features

- High speed ADC (12 bit/1 GSps sampling)
- Customized FPGA for SS-OCT with HSL-Series
- High reliability and high gain, high linearity
- Includes analog output (2ch)

Applications

- Swept Source – OCT
- Heterodyne measurement
- OFDR (Optical Frequency Domain Reflectometry)

光源以外にもOCT用の様々なデバイスをご提供しております。BPD-200はSwept Source OCT (SS-OCT)で問題になるディテクタの波長依存性によるアーチファクトの問題を大幅に軽減しており、SS-OCTに最適なディテクタです。IFM-200はディレイラインや可視光などを内蔵した、マッハツェンダー型干渉計ユニットです。お客様のご要望に応じたカスタマイズも可能です。HSLシリーズに適したDAQボードもご提供しています。搭載されたFPGAにより、高速・リアルタイムイメージングを可能にします。

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