



Combined swept-wavelength tunable laser (CSTL) system with ultra-wide tuning range at near infrared region

Features

- Record-breaking tuning range of up to 190 nm
- Models for 770 – 880 nm, 805 – 995 nm, and 1010 – 1185 nm ranges
- High tuning speed of up to 10000 nm/s
- Linear $k(t)$ sweeping
- User-selectable sweep direction
- Mechanical-free laser design
- Perfect wavelength stability and repeatability – no k -clocking is required
- Optical power boosting up to 7 mW (optional)
- Stable output laser polarization
- User-friendly interface for computer control
- Compact design for OEM applications



Applications

- OCT applications, including Full-Field OCT
- Spectrum analysis, interferometry
- Optics testing (couplers, FBG, photodiodes, etc.)
- Sensor interrogation



1. Introduction

The CSTL system has been designed for applications that require wavelength scanning over a wide spectral range unachievable by a single conventional tunable laser. A typical example is the measurement of basic operating parameters (transmission, loss, etc.) of sophisticated optical elements – fiber-optic splitters, isolators, fiber Bragg gratings, optical multiplexers and others. Another example is UHR full-field SS OCT, where the wavelength tuning determines the depth resolution provided by the method. Obtaining the desired spectral range may require a combination of several tunable lasers, each covering a portion of the total spectral range. In addition to wide tuning range requirement, the tuning speed must be fast enough to provide the required data acquisition speed and the optical power must be rather high to have a high signal-to-noise ratio.

The CSTL system is the answer to all these challenges. This system utilizes two synchronized swept-wavelength tunable lasers (TRCL series) operating in adjacent or partly overlapping tuning ranges. The lasers are connected through a broadband optical coupler to a single PM fiber.

The CSTL series features a compact package suitable for OEM applications, high wavelength tuning speed, high output optical power, narrow spectral line of laser emission, high and stable PER (polarization extinction ratio), and computer control of all operating modes. The CSTL systems are ready to use, and require no special skills to operate.

All elements of the system are carefully selected and tested at every stage of the assembly process to ensure high reliability and durability.

Laser synchronization modes, selectable by the user via a user-friendly computer interface, include:

1. **Single Triggering Mode:** In this mode, the computer starts tuning the first laser. At the end of its tuning range, the first laser starts tuning the second one by sending a synch pulse via the cable. Then the process continuously repeats until stopped by the computer. In this mode, the first and second lasers are directly synchronized via the cable.

This mode allows you to adjust the sweep repetition rate, but not the interval between the sweeps of the first and the second laser.



Laser system control program.

2. **Dual Triggering Mode:** The computer triggers both the first and the second laser with defined time intervals. The lasers are not connected to each other. In this mode, only software synchronization is performed by the computer.

This mode allows you to adjust both the sweep repetition rate and the interval between the sweeps of the first and the second laser.

3. **Cyclic Triggering Mode:** In this mode, the lasers are connected in a ring via the synch inputs and outputs. The computer is needed only to start and to stop operation of the devices, not to trigger them. This mode of operation ensures minimum switching delay between the lasers. However, neither the sweep repetition rate, nor the interval between the sweeps of the first and the second laser can be adjusted.

The user can adjust the sweep direction (increasing or decreasing k in time) of each laser in the combination. The sweep range of each laser can be adjusted downwards only (by default, the sweep range is set to the maximum value).

Three models are currently available for ordering:

- 1) **CSTL825.110-1** is a combination of TRCL790.55-3 and TRCL.840.75-3 that covers a spectral range of 770 – 880 nm.
- 2) **CSTL900.190-1** is a combination of TRCL840.75-3 and TRCL.930.115-3 that covers a spectral range of 805 – 995 nm.
- 3) **CSTL1095.175-1** is a combination of TRCL1060.100-3 and TRCL1145.80-3 that covers a spectral range of 1010 – 1185 nm.

Output optical power of the CSTL system is 1 mW. To increase the laser power (to 7 mW max.), the CSTL can optionally be equipped with optical boosters (not applicable to the CSTL1095.175-1 model).

Each of these systems can be customized to meet your specific requirements. For more details, please contact us at enquiries@sldsources.com.

2. Specifications

Parameter	Units	CSL825.110-1 (w/o boosters)	CSL900.190-1 (w/o boosters)	CSL1095.175-1 (w/o boosters)
		CSL825.110-1-B (with boosters)	CSL900.190-1-B (with boosters)	
Center wavelength	nm	825	900	1095
Entire tuning range	nm	770 – 880	805 – 995	1010 – 1185
Linewidth (FWHM)	nm	≤ 0.05		≤ 0.08
Output power	mW	1 7 ¹		1
Peak-to-ASE excess, any wavelength within the entire tuning range	dB	> 50 > 30 ¹		> 50
Signal-to-ASE ratio (integral), any wavelength within the entire tuning range	dB	$> 99:1$ $> 9:1$ ¹		$> 99:1$
Fiber type		PANDA PM 850		PANDA PM 980
Weight	kg	5 7 ²		5
Number of lasers ³		2		
Minimum tuning range ⁴	nm	10		
Power change over tuning range	%	± 10		
Laser switching delay (min.)	μ s	200		
Tuning speed (changeable)	nm/s	1-10000		
Output PER ⁵	dB	> 15		
Optical connector		FC/APC (narrow key)		
Working fiber axis		Slow ⁶		
Interface		USB		
Operating voltage	VDC	+12		
Operating current	A	3		
Operating temperature range	$^{\circ}$ C	+15 to +35		
Storage temperature range	$^{\circ}$ C	0 to +40		
Relative humidity, non-condensing	%	< 90		
Dimensions (W $\times$ H $\times$ D)	mm	laser: 110 $\times$ 75 $\times$ 230; booster: 110 $\times$ 31 $\times$ 190		

¹ At the output of an optical booster (optional). If the optical boosters are required, the suffix “-B” must be added to the end of the P/N, i.e., CSL825.110-1-B, CSL900.190-1-B. The optical boosters are not available for the CSL1095.175-1 model.

² 7 kg with the optical power boosters (optional).

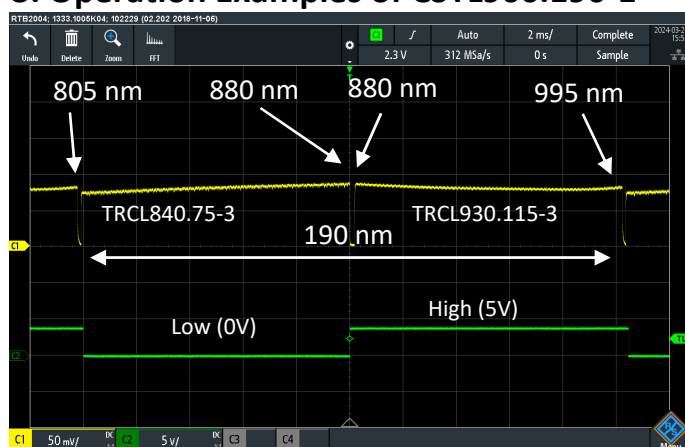
³ Both are ring-cavity lasers (TRCL series).

⁴ The tuning range of each laser in the combination can be adjusted by the user (downwards only). By default, the tuning range is set to the maximum value. The minimum value of the tuning range for each laser is 5 nm.

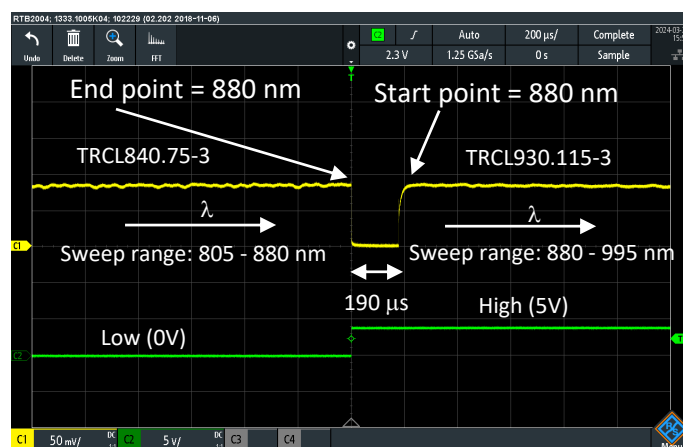
⁵ Measured at the output of the supplied optical cable.

⁶ Aligned to the connector key.

3. Operation Examples of CSL900.190-1



Both lasers are swept consistently in the same direction (yellow trace – laser power, green trace – synch pulses)



Minimum switching time between laser sweeps is 190 μ s (yellow trace – laser power, green trace – synch pulses)