



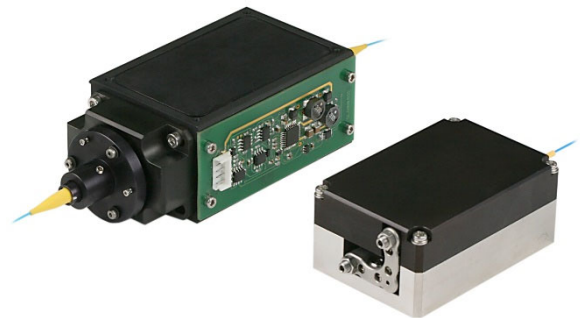
## Acousto-optic components and RF drivers

# Fiber-coupled acousto-optic tunable filters (AOTFs) for external cavity lasers

SLDsources.com designs, manufactures and assembles fiber-coupled acousto-optic (AO) components for use in external cavity lasers (ECL). This product line includes in-line (fiber-to-fiber) tunable filters, optical modulators, and RF drivers for them. This document describes the main performance characteristics of the Acousto-Optic Tunable Filters (AOTFs). Fiber-coupled modulators are available upon request only. If you require more information, or you have custom requirements, please contact us at [enquiries@sldsources.com](mailto:enquiries@sldsources.com).

### Features

- Very high resolution
- Fast switching speed
- Low RF drive power
- Stable performance
- No moving parts
- Thermally stabilized
- PM fiber coupling



### Applications

- Laser wavelength tuning
- Optical Coherence Tomography (OCT)
- Wavelength selection
- Incoherent light sources
- Various OEM applications



## 1. Introduction

Acousto-Optic Tunable Filter (AOTF) is a solid-state, electronically-tunable bandpass filter based on anisotropic Bragg diffraction in a birefringent crystal. Filters of this type can be used with Semiconductor Optical Amplifiers (SOA) in ECL configurations as wavelength-selective elements, as well as with broadband light sources to select and transmit a single or multiple wavelengths from the incoming light.

We offer AOTFs based on  $\text{TeO}_2$  with quasi-collinear slow-shear AO interaction. An AOTF is designed for a particular tuning range, as specified in Tables 1 and 2. All components are optimized so that the filter has the best performance in that tuning range. The filters feature narrow transmission bandwidth, high diffraction efficiency, and low RF drive power.

Our standard models include:

1. **In-line fiber-coupled AOTF:** It is a Peltier TEC cooled assembly including input and output PM fibers, an AOTF and an optical isolator. This model is intended for use in ring ECL configurations that require unidirectional light propagation.

2. **Bi-directional fiber-coupled AOTF:** It is a Peltier TEC cooled assembly consisting of a single fiber for input and output of the light, an AOTF and a broadband high-reflective dielectric mirror ( $R > 99\%$ ). This model does not have an isolator installed. It is intended for use in linear ECL configurations.

RF drivers compatible with our AOTFs are also available. They provide stationary operation at a single frequency and tuning operation at speeds of 1 – 10000 nm/s for internal and external trigger modes. AOTF temperature stabilization is also provided. The drivers are based on a direct digital synthesizer. They use non-volatile memory to store operating settings. All drivers are equipped with USB ports for remote control from a PC using the software supplied.

## 2. Specifications

**Table 1. In-line fiber-coupled unidirectional AOTFs for ring ECLs**

Parameter	Units	AOTF-800-0.2-I	AOTF-850-0.2-I	AOTF-950-0.3-I	AOTF-1050-0.3-I
Interaction medium	-	TeO <sub>2</sub>	TeO <sub>2</sub>	TeO <sub>2</sub>	TeO <sub>2</sub>
AO interaction mode	-	Quasi-collinear slow-shear	Quasi-collinear slow-shear	Quasi-collinear slow-shear	Quasi-collinear slow-shear
Interaction length	mm	23	23	23	23
Diffraction efficiency	%	> 80	> 80	> 80	> 80
Center wavelength <sup>1</sup>	nm	800	850	950	1050
Wavelength tuning range	nm	750 – 850	800 – 900	900 – 1000	1000 – 1100
Frequency tuning range	MHz	95 – 115	90 – 110	80 – 90	70 – 80
Spectral resolution <sup>2</sup>	nm	0.2	0.2	0.3	0.3
Maximum tuning speed	nm/s	10000	10000	10000	10000
Nominal RF power	W	0.1	0.1	0.1	0.1
Transmission (input to output)	%	55 – 60	55 – 60	55 – 60	55 – 60
PER	dB	> 18 dB	> 18 dB	> 18 dB	> 18 dB
Fiber type	-	Panda PM 850	Panda PM 850	Panda PM 850	Panda PM 980
Slow axis alignment <sup>3</sup>	-	Aligned to connector key	Aligned to connector key	Aligned to connector key	Aligned to connector key
Operating axis	-	Slow, fast axis blocked	Slow, fast axis blocked	Slow, fast axis blocked	Slow, fast axis blocked
Optical connector type <sup>4</sup>	-	FC/APC, narrow key	FC/APC, narrow key	FC/APC, narrow key	FC/APC, narrow key
Filter stabilization temperature	°C	+36	+36	+36	+36
Operating conditions	-	Room, non-condensing	Room, non-condensing	Room, non-condensing	Room, non-condensing
TEC cooled assembly <sup>5</sup>	-	+	+	+	+
Supply voltage and current for AOTF temperature controller <sup>6</sup>	-	+5 VDC, 2 A	+5 VDC, 2 A	+5 VDC, 2 A	+5 VDC, 2 A
Storage temperature range	°C	+10 to +40	+10 to +40	+10 to +40	+10 to +40
Dimensions (W × H × D)	mm	59 × 50 × 183	59 × 50 × 183	59 × 50 × 183	59 × 50 × 183
Weight	g	792	792	792	792

<sup>1</sup>Custom wavelengths are available on request.

<sup>2</sup>Specified at the center wavelength.

<sup>3</sup>Fast axis alignment is available on request.

<sup>4</sup>Other fiber connectors are available on request.

<sup>5</sup>AOTF is mounted on a Peltier cooler in the assembly.

<sup>6</sup>RF driver and temperature controller are purchased separately. Power supply is not included.

**Table 2. Bi-directional fiber-coupled AOTFs with broadband HR mirrors for linear ECLs**

Parameter	Units	AOTF-800-0.2-M	AOTF-850-0.2-M	AOTF-950-0.3-M	AOTF-1050-0.3-M
Interaction medium	-	TeO <sub>2</sub>	TeO <sub>2</sub>	TeO <sub>2</sub>	TeO <sub>2</sub>
AO Interaction mode	-	Quasi-collinear slow-shear	Quasi-collinear slow-shear	Quasi-collinear slow-shear	Quasi-collinear slow-shear
Interaction length	mm	23	23	23	23
Diffraction efficiency	%	> 80	> 80	> 80	> 80
Center wavelength <sup>1</sup>	nm	800	850	950	1050
Wavelength tuning range	nm	750 – 850	800 – 900	900 – 1000	1000 – 1100
Frequency tuning range	MHz	95 – 115	90 – 110	80 – 90	70 – 80
Spectral resolution <sup>2</sup>	nm	0.2	0.2	0.3	0.3
Maximum tuning speed	nm/s	10000	10000	10000	10000
Nominal RF power	W	0.1	0.1	0.1	0.1
Transmission (input to output)	%	45 – 50	45 – 50	45 – 50	45 – 50
PER	dB	> 18 dB	> 18 dB	> 18 dB	> 18 dB
Fiber type	-	Panda PM 850	Panda PM 850	Panda PM 850	Panda PM 980
Slow axis alignment <sup>3</sup>	-	Aligned to connector key	Aligned to connector key	Aligned to connector key	Aligned to connector key
Operating axis	-	Slow, fast axis blocked	Slow, fast axis blocked	Slow, fast axis blocked	Slow, fast axis blocked
Optical connector type <sup>4</sup>	-	FC/APC, narrow key	FC/APC, narrow key	FC/APC, narrow key	FC/APC, narrow key
Filter stabilization temperature	°C	+36	+36	+36	+36
Operating conditions	-	Room, non-condensing	Room, non-condensing	Room, non-condensing	Room, non-condensing
TEC cooled assembly <sup>5</sup>	-	+	+	+	+
Supply voltage and current for AOTF temperature controller <sup>6</sup>	-	+5 VDC, 2 A	+5 VDC, 2 A	+5 VDC, 2 A	+5 VDC, 2 A
Storage temperature range	°C	+10 to +40	+10 to +40	+10 to +40	+10 to +40
Dimensions (W × H × D)	mm	51 × 33 × 106	51 × 33 × 106	51 × 33 × 106	51 × 33 × 106
Weight	g	390	390	390	390

<sup>1</sup>Custom wavelengths are available on request.

<sup>2</sup>Specified at the center wavelength.

<sup>3</sup>Fast axis alignment is available on request.

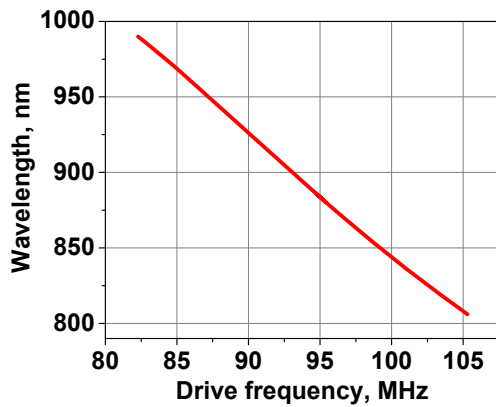
<sup>4</sup>Other fiber connectors are available on request.

<sup>5</sup>AOTF is mounted on a Peltier cooler in the assembly.

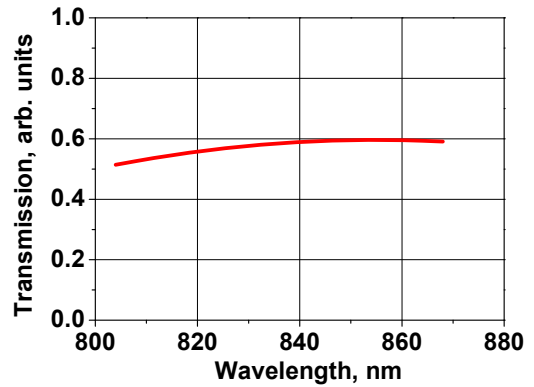
<sup>6</sup>RF driver and temperature controller are purchased separately. Power supply is not included.

### 3. Typical performance examples.

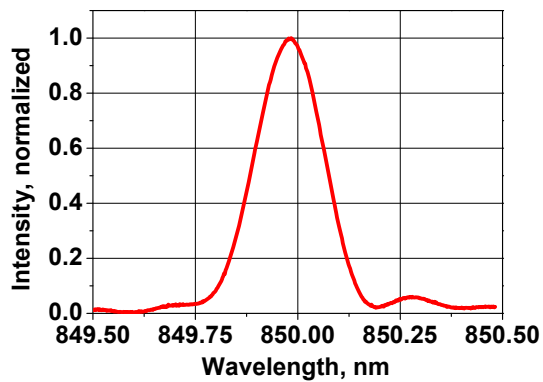
Tuning characteristic for the model AOTF-850-0.2-I



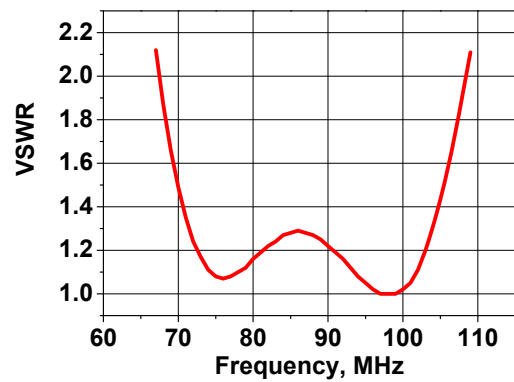
Transmission for the model AOTF-850-0.2-I



AOTF bandwidth for the model AOTF-850-0.2-I



VSWR for the model AOTF-850-0.2-I



### 4. Typical application examples.

