



### Acousto-Optic Frequency-Shifter

An AO Frequency Shifter (AOFS) is a device that modifies the frequency of the optical beam. This is a consequence of the Doppler effect; the travelling acoustic wave causing the frequency of the optical beam to be either increased or decreased by an amount equal to the RF carrier frequency. Since the RF frequency is typically of the order of tens or hundreds of Megahertz, and the optical frequency is typically of the order of 10<sup>14</sup>Hz, the frequency shift is relatively small and would not normally be perceivable, for example as a visible change in colour.

Utilising a wide range of materials including Crystal Quartz, Fused Silica, Tellurium Dioxide, Lead Molybdate, Chalcogenide Glass, Gallium Phosphate, Silicon and Germanium allows us to offer devices operating in the wavelength range 244 to 15000nm and RF frequencies ranging from <20MHz to >1GHz. We also manufacture a range of RF drivers including; single frequency, tunable frequency (VCO or DFS) and dual frequency master / slave.

Typical applications include Interferometry, vibrometry & atom cooling.



	FS040-2C-AR1	FS040-2E-AR1	FS040-2E-ME1	FS110-8M-DS3
Frequency Shift	40MHz	40MHz	40MHz	110MHz
Frequency Drift / °C			< ±10ppm	
Wavelength	532nm	630-690nm	630-690nm	1900-2100nm
Interaction Material	Tellurium Dioxide	Tellurium Dioxide	Tellurium Dioxide	Chalcogenide Glass
Acoustic Mode	Anisotropic, slow shear	Anisotropic, slow shear	Anisotropic, slow shear	
AR Coating Reflectivity	< 0.2% per surface	< 0.3% per surface	< 0.2% per surface	≤ 0.4% per surface
Transmission	> 95% @ 532nm	> 95% @ 532nm	> 95%	≥ 95%
Clear Aperture	4x2.0mm (horizontal and vertical)	4x2.0mm (horizontal and vertical)	4x2mm (horizontal and vertical)	
Active Aperture	1.5mm (vertical)	1.5mm (vertical)	1.5mm (vertical)	2.0mm
Polarisation (input)	Linear and horizontal with respect housing	Linear; horizontal with respect housing	Linear & horizontal in respect to housing	Any
Polarisation (output 1st order)	Linear and orthogonal to input	Linear and orthogonal to input	Linear & orthogonal to input	
0/1st Order Polarisation Extinction Ratio	>100:1	>100:1	>100:1	
Zero and 1st Order Beam Symmetry	Symmetrical to the left and right of the straight through direction ±0.5°	Symmetrical to the left and right of the straight through	Symmetrical to the left and right of the straight through	

		direction $\pm 0.5^\circ$	direction $\pm 0.5^\circ$	
Angle between 0/1st Order Beams			2.4° @655nm	
Vertical Angle of Deflection	<2mrad with respect to straight through	<2mrad with respect to straight through	<2mrad with respect to straight through	
Angle between Input Beam and Housing	90° $\pm 1^\circ$	90° $\pm 1^\circ$	90° $\pm 1^\circ$	
Maximum Diffraction Efficiency	>90% @532nm	>90% @635nm	>90%	
Supply Voltage	+5Vdc ( $\pm 10\%$ )	+5Vdc ( $\pm 10\%$ )	15VDC ( $\pm 10\%$ )	
Power Consumption	<1.5W	<1.5W	<1.5W	<2W
Power Supply Connection	Lead-through filter	Lead-through filter		
RF Input Connector	SMB bulkhead jack	SMB bulkhead jack		SMA Female
RF Input	40MHz sine-wave voltage of 0.5 to 1V p-p	40MHz sine-wave; 0.5 to 1V p-p		
RF Input Impedance				50 $\Omega$
Reference RF Output			10MHz sine-wave voltage of 0.5 to 1V peak to peak as a reference signal (drive frequency $\div 4$ )	
Diffraction Efficiency				$\geq 85\%$
Harmonic Distortion			< 40dB @ 40MHz	

### AOFS for Fibre Sensors M040-8J-F2S

- Polarisation insensitive
- Choice of wavelengths, 1450 to 1650nm
- Choice of operating frequencies, 35 to 45MHz

A compact fibre-coupled acousto-optic frequency shifter ideal for use in interferometric fibre sensor systems such as Mach-Zehnder and laser Doppler configurations.

Available in frequencies from 35 to 45MHz and either up-shift or down-shift. This device operates over a broad wavelength range making it the first choice frequency shifter for distributed sensor networks.

### Specification

Interaction Material	Chalcogenide Glass
Wavelength	1520 to 1610nm
Polarisation Dependant Loss	None
Polarisation Mode Dispersion	None
Insertion Loss	<3.0dB

Extinction Ratio (1st order on/off)	>50dB
Rise-Time / Fall-Time	110ns
Frequency	40MHz
VSWR	<1.2:1 (50 $\Omega$ input impedance)
RF Power	0.2W typical
Frequency Shift	-40MHz, down shift
Fibre Type	Single mode, 2m
Fibre Connectors	FC/PC, Seiko-Geiken

### Options

Frequency: 35 to 45MHz  
Frequency Shift: Up shift  
Wavelength Range: Centred on 1500 to 1580nm  
Fibre Type: Polarisation maintaining, multimode  
Fibre Connectors: Pig-tails for splicing, FC / APC

### Driver Selection

Digital Modulation: A118  
Analogue Modulation: A025