



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 10¹⁴Hz, 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 Ω |
| 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 Ω 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