L3HARRIS®
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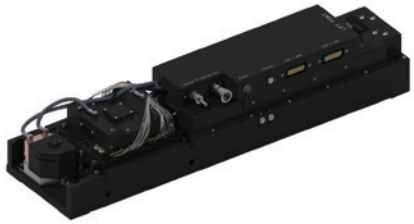
MULTI-CHANNEL ACOUSTO-OPTIC MODULATOR (AOM) ILLUMINATION MODULE

Precision control of optical beams for quantum state manipulation

L3Harris is building upon more than 40 years' experience in developing AOM devices and technologies to design illumination modules that control the quantum states of trapped ions with extreme precision. With their low-noise, low-drift and low-cross-talk capabilities, these subsystems are now enabling the multi-channel optical beam control operations needed for quantum computing, quantum state manipulation for applications such as atomic clocks and advanced quantum sensing, and enhanced micromachining. The robust multi-channel AOM illumination module requires a single ultraviolet (UV) (355 nanometer typical) beam input and provides the capability for performing independent modulation of the amplitude and phase of 32 individual beams simultaneously. It enables multi-qubit state transitions and entangling operations needed for ion-trap- based quantum state manipulation.

PERFORMANCE PARAMETERS

PARAMETER	SPECIFICATION
Number of channels	32
Nominal radio frequency (RF) input impedance	50 ohms
Center frequency	200 MHz
Nominal channel spacing	450 µm c-c
Rise time	<25 ns
Diffraction efficiency	>50%
Optical channel beam waist in AOM	Approximately 150 µm (1/e2 dia.)
Maximum RF drive power	0.60 W/channel
Optical wavelength	355/532 nm standard, other wavelengths available
Optical material	UV-grade fused silica/Te02
Overall dimensions	L: 69 cm x W: 19 cm x H: 14 cm



APPLICATIONS

- Micromachining
- Metrology
- Quantum computing

COMPONENTS

- 355 or 532 nanometer (nm) diffractive optical element (D.O.E., other wavelengths available)
- Transform telescope for a telecentric input of 32 beams into the module with 32 modulated polarized beams output
- Stable base mount assembly with a precision optomechanical alignment system and input adjustment
- Purge cover and purge feeds to prevent dust and particle contamination at on the high-power UV optics
- Documentation for setup procedure

Multi-Channel Acoustic-Optic Modulator (AOM) Illumination Module

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PARAMETER	SPECIFICATION
Module input beam diameter	1.0 (+/-) 0.1 mm
Distortion (spacing variation)	ABS < 2.7 µm
Telecentricity	< 35 µRad
Beam height delta*	< +/- 6 µm
AOM throughput timing	130 ns < T < 170 ns
Differential timing*	+/- 1 ns (between any two channels)
Scan first order delta	< 23%
Diffraction efficiency minimum	> 50%
Cross-talk all but 1 off maximum	ABS < 0.2% (typical 0.1%)
1st order polarized maximum	< 0.5%
Maximum discrete scatter	< 1% (0.02% typical)
Dynamic overshoot	ABS <1%**

* Measured with regard to transducer surface

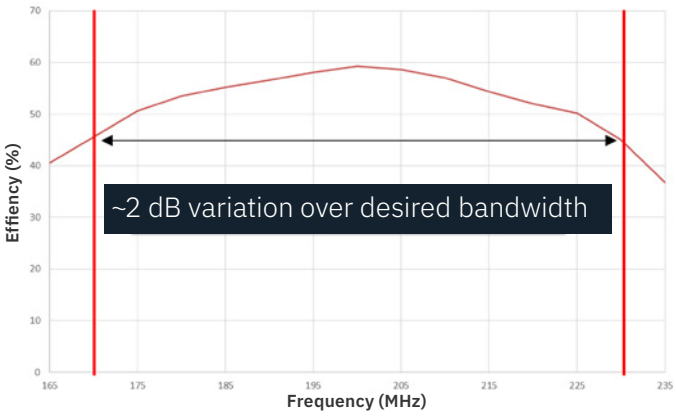
** Of channel first order beam intensity

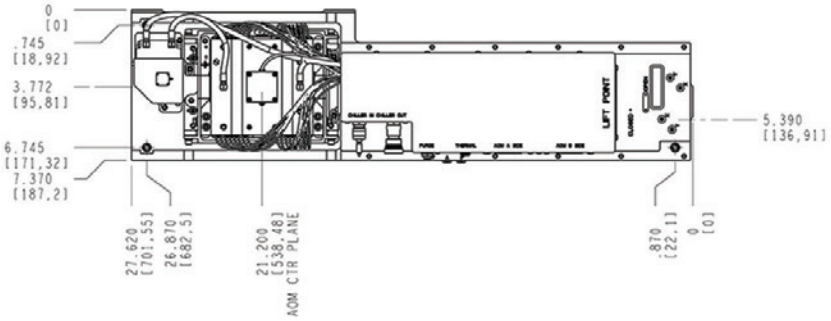
KEY FEATURES

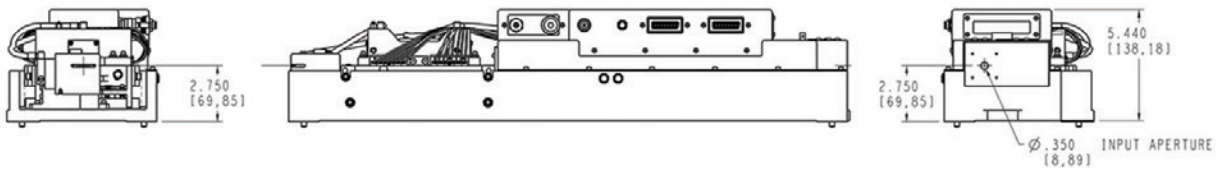
- Stable mechanical enclosure assembly with precision optomechanical alignment and adjustment for single standard 1 millimeter beam input
- Thermally balanced system to minimize thermal beam drift with on-off modulation of channels (chiller required, purchased separately)
- Base wavelength of 355 nm, but wavelength options from 355 nm to 532 nm (D.O.E., customization required for some wavelengths)
- Polarization cleanup and DC stop provide highly polarized output of 32 modulated beams with no extraneous beams
- A purge cover and purge feeds to prevent contamination of UV optics
- *Available with internal alignment tool for precision alignment
- Compact RF connector interface (2X 16-channel snap-on RF connectors)
- Flexible RF driver option with direct digital synthesizer for lab testing or pass-through amplifiers to support external AWG

REPRESENTATIVE PERFORMANCE CURVES

32-Channel AOM 004







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