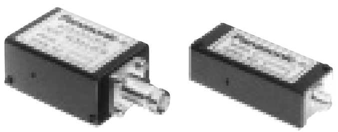
Acousto-Optic Devices

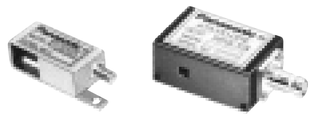
A piezoelectric element is bonded to an acousto-optic medium consisting of single crystal such as tellurium dioxide (TeO_2) and lead molybdate ($PbMoO_4$) or glass, and when an electrical signal is applied to this piezoelectric element to generate acoustic waves, which are propagated in the medium, a laser beam passing through the medium is diffracted (Acousto-Optic effect). This diffraction includes Bragg diffraction and anisotropic Bragg diffraction. Using the former is an acousto-optic light modulator, and using the latter is an acousto-optic light deflector and acousto-optic tunable filter.

The acousto-optic light modulator can modulate laser beam intensity by means of amplitude modulation at a fixed frequency.
The acousto-optic light deflector is capable of angle modulation (position modulation) and intensity modulation for laser beam by means of frequency modulation and amplitude modulation.
The acousto-optic tunable filter can select incident light wavelength by means of frequency modulation and amplitude modulation, i.e. irradiate only the light with an optical wavelength in a given direction and at an optical intensity.

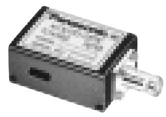
Acousto-Optic Devices



Acousto-Optic Light Modulators



Acousto-Optic Light Deflectors



Acousto-Optic Tunable Filters

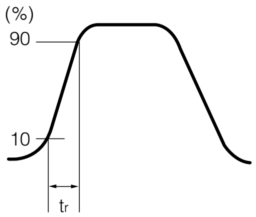
⚠ Safety Precautions
(Common precautions for Acousto-Optic Devices)

- When using our products, no matter what sort of equipment they might be used for, be sure to make a written agreement on the specifications with us in advance.
- Do not use the products beyond the specifications described in this catalog.

1. Falling Shock
   As single crystal or glass is used as medium for acousto-optic devices, care shall be taken not to give a falling shock to prevent breakage of the devices.
2. Electrical Input (Driving Power)
   The electrical input power shall not exceed the specified maximum driving power to prevent breakage of the crystal.
3. Laser Input Beam
   Polarized light conditions of laser input beam differ in accordance with the input equipment types.
   Operate at the specified polarized light.
   Exercise caution as the light input of 1 W/mm^2 or more can not be applied in some cases.
4. Dewing
   Dewing on optical surfaces of the medium causes stain, thus deteriorating the light transmittance.
5. Installation
   Use fixing screws and bragg adjusting rotating axis with the allowable depth of the fixing taps or the rotating center hole specified in the product diagram or more.
6. Environmental Conditions
   The AODs shall not be operated and/or stored under following environmental conditions:
   a) To be exposed directly to water or salt water
   b) Under conditions of dew formation
   c) Under conditions of corrosive atmosphere such as hydrogen sulfied, sulfurous acid, chroline and ammonia.
7. Long Term Storage
   The AODs shall not be stored under severe conditions of high temperatures and high humidities. Store them indoors under 40 °C max. and 75 %RH max. with no dew formation.

<Package markings>
Package markings include the product number, quantity, and country of origin.
In principle, the country of origin should be indicated in English.

Definition of Terms

Terms	Definition
Center Frequency: f_o	Driving frequency at light modulator and the center frequency of deflection bandwidth at light deflector.
Modulation Bandwidth: Δf_i	This is calculated via following equation using response (t_r) $\Delta f_i=0.35/t_r$
Diffraction Efficiency	Ratio of the primary diffracted light intensity (I_1) and the 0th diffraction intensity with no driving power (Transmitting light intensity) (I_{00}) I_1/I_{00} (%)
Pulse Response: t_r	Rise time at pulse modulation (10 to 90 %) With the pulse response of electric system (t_e) included, the total response time (t_s) is $t_s=\sqrt{t_e^2+t_r^2}$ 
Extinction Ratio	Ratio of the maximum primary diffracted light intensity and the optical intensity in the same direction with no driving power.
Number of Resolvable Spots: N	Ratio of the deflection angle $\Delta\theta=\lambda\,\Delta f/\upsilon$ and the extending angle of optical beam $\Delta\theta_b=\lambda/D$ $N=\frac{1}{\gamma}\cdot\frac{\Delta\theta}{\Delta\theta_b}=\frac{1}{\gamma}\cdot\Delta f\cdot\frac{D}{\upsilon}=\frac{1}{\gamma}\cdot\Delta f\cdot\tau$ λ : Optical Wavelength Δf : Deflection Bandwidth υ : Acoustic Velocity of medium D : Diameter of input laser beam γ : Coefficie nt in accordance with optical beam shape τ : Access Time
Access Time: τ	Time for acoustic wave to pass optical beam $\tau=D/\upsilon$
Deflection Bandwidth: Δf	Driving frequency range where diffracted light intensity is half of the maximum value (–3 dB).
Deflection Angle: $\Delta\theta$	Diffraction angle in accordance with deflection bandwidth $\Delta\theta=\lambda\,\Delta f/\upsilon$
Resolution	Extention of filter light wavelength with the constant driving frequency at acousto-optic tunable filter.
Dispersion of Deflection Angle	Dispersion of diffracting direction in the range of optical wavelength at acousto-optic tunable filter.