LASER COMPONENTS CATALOG

High Quality Laser Accessories

CASTECH®

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GWU-Lasertechnik

GWU

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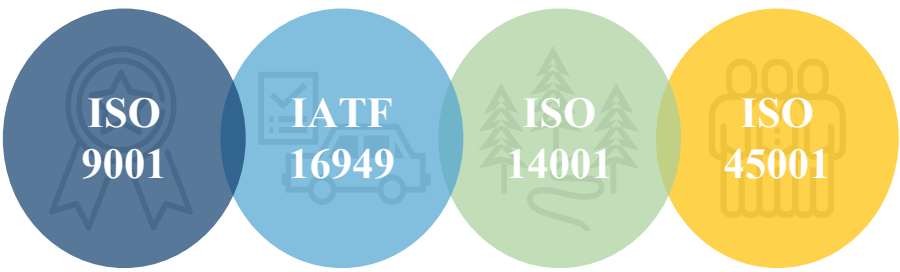
CASTECH,INC.

Nonlinear Optical Crystals · Laser Crystals · Precision Optics · Laser Components

ABOUT US

After 30 years' rapid growth, CASTECH now is a global leader in nonlinear optical crystals, laser crystals, precision optics and laser components in laser and optical communications industries. By integrating our leading capabilities of proprietary crystal growth, polishing, coating, assembly and designing technologies vertically, CASTECH has developed a broad range of magneto-optics devises, acousto-optics devises, electro-optics devises, fiber-optics devises, beam expanders, photoelastic modulators and other laser components for most demanding applications, to assist with our customers from prototype to mass production.



- Founded in 1990 by FIRSM (Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences).
- A public company (2008, Shenzhen, China, Stock Code: 002222).
- Sales revenue over US$80 millions.
- Over 1,000 employees.
- 40,000 m^2 facility.
- The ratio of domestic and international markets stands at 5:5

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CAPACITY

Crystal Growth

A variety of growth methods to provide a wide selection of high-quality crystals

Ultrasonic Cleaning

Superior cleaning effects

IBF

High surface quality without sub-damage layer

IBS Coators

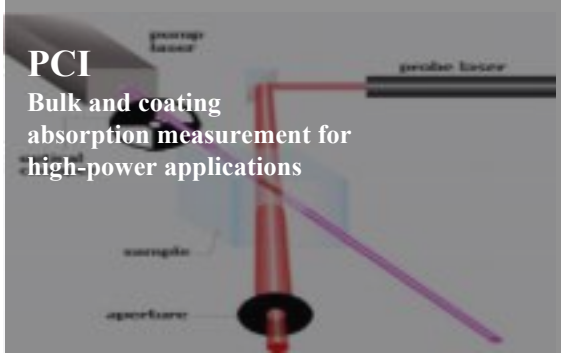
Ideal for high laser damage threshold optics

LDT Testing

Continuous guarantee &improvement of laser damage threshold level

4D Interferometer

High accurate measurement for flatness



PCI

Bulk and coating absorption measurement for high-power applications

Microscopes

Ensure high surface quality of each component

CASTECH®
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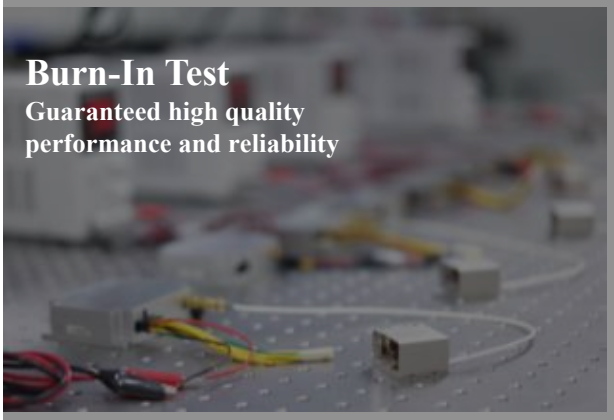
CAPACITY

M^2 Meter

Vigorous laser beam quality measurement

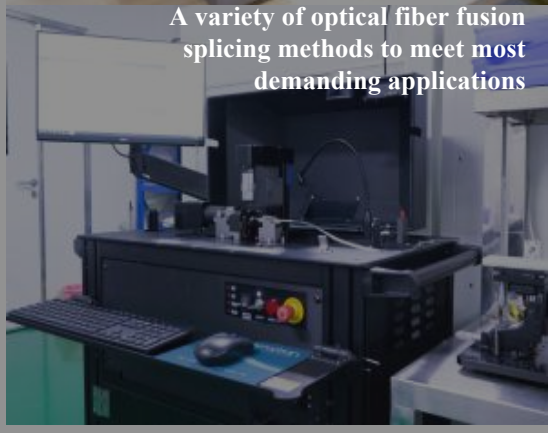
Fiber Optic Splicing

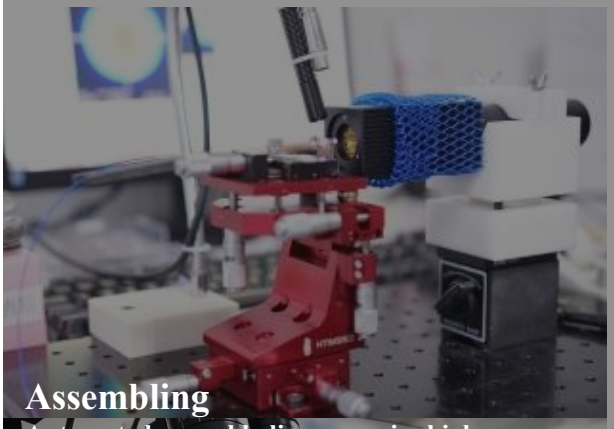
A variety of optical fiber fusion splicing methods to meet most demanding applications



Burn-In Test

Guaranteed high quality performance and reliability



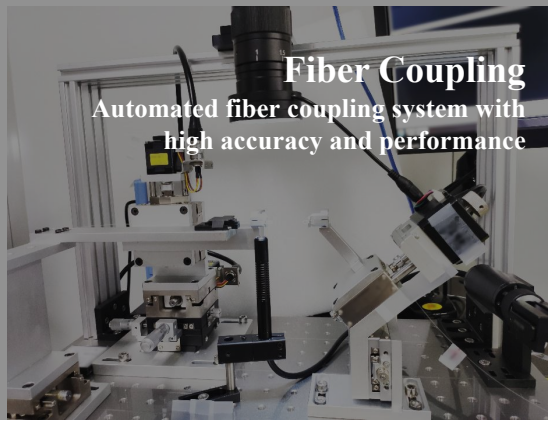


Assembling

Automated assembly lines promise high accuracy and efficiency

Production Workshops

Clean workshops ensure product quality



Fiber Coupling

Automated fiber coupling system with high accuracy and performance

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CATEGORY

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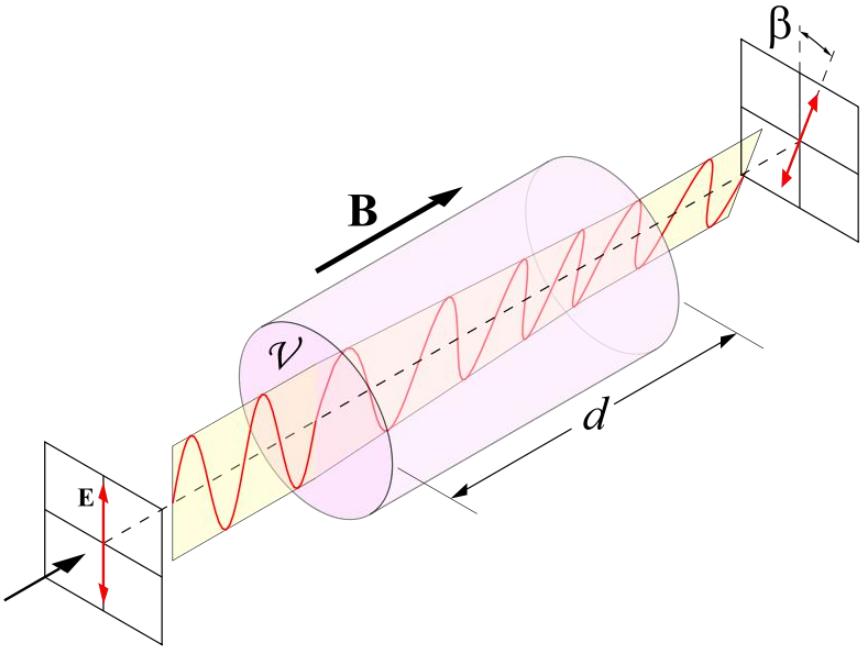
CATEGORY

Magneto-Optic Devices

In physics, the Faraday effect (also called Faraday rotation, magneto-optical rotation) is a type of magneto-optical effect, which is the interaction between light waves and magnetic fields in a medium.The Faraday effect causes a rotation of the plane of polarization, which is linearly proportional to the component of the magnetic field toward the direction of light wave propagation.

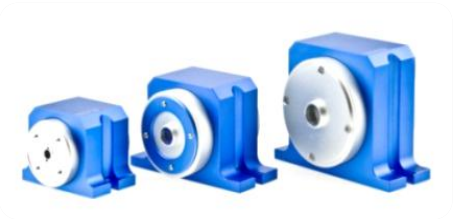
According to the working principle and applications, CASTECH's magneto-optic devices can be divided into the following five categories: Faraday rotators, free space isolators (polarization dependent type and polarization independent type), fiber-free space isolators (expanded beam type and non-expanded beam type), in-line isolators (non-polarization-maintaining, polarization-maintaining, and TAP in-line isolators) and optical circulators (non-polarization-maintaining type and polarization-maintaining type).



Schematic diagram of Faraday effect

Faraday rotator provides non-reciprocal rotation while maintaining linear polarization. The plane of polarization will be rotated 45°when light transmits through the Faraday rotator in the forward direction and rotated additional 45°in the same relative direction with respect to magnetic field when light travels backwards from the reverse direction. It will effectively reject the light traveling backward.

CASTECH is dedicated to grow magneto-optical crystals with high Verdet constant and low absorption coefficient to ensure higher level reliability and less degradation. Combined with our unique high LIDT process technology, we are able to supply customized Faraday rotators for high power applications, up to 500W average power. The working wavelength of our Faraday rotator family ranges from 355nm to 4500nm, and the aperture is up to 45mm.

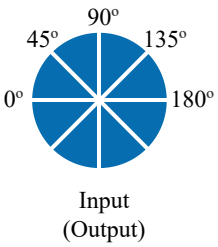


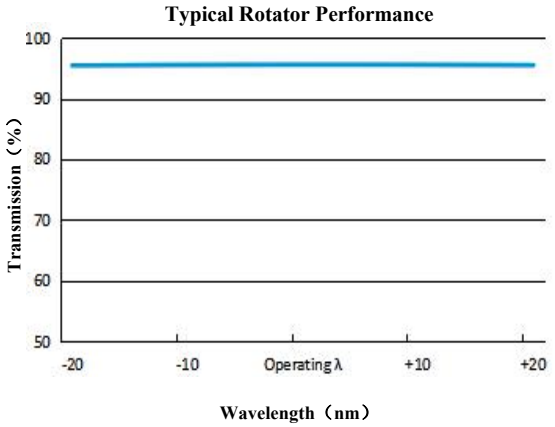
Applications

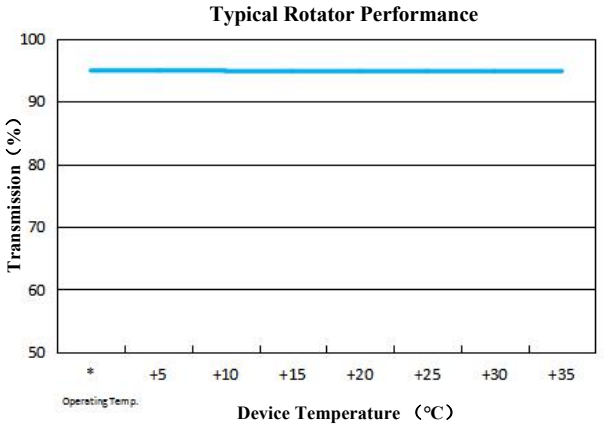
- **Laser sensing system**
- **Ultrafast laser system**
- **OCT system**
- **Laser detection**

Polarization Reference:

- All Faraday rotators non-reciprocally rotates the plane of polarized light in 45º.
- Extra half-wave plate for modifying output polarization is available on request.







Faraday Rotators Model Number：HPRO-t-p-a-λ-w-h					
Type(t)	Power(p)	Aperture(a)	Wavelength(λ)	Waveplate(w)	Housing(h)
FS (Common)	1 W 10 W 30 W 50 W 100 W 500 W* ...	2 mm 3 mm 4 mm 5 mm 8 mm 10 mm 12 mm 15 mm 25 mm 45 mm ...	355 nm 405 nm 532 nm 633 nm 780 nm 850 nm 980 nm 1030 nm 1064 nm 1319 nm 1550 nm 2000 nm 4500 nm ...	C (Contained) N (Not Contained)	A01 A02 A03 A12 A15 ...

***500W is only suitable for the wavelength of 1030/1064nm**

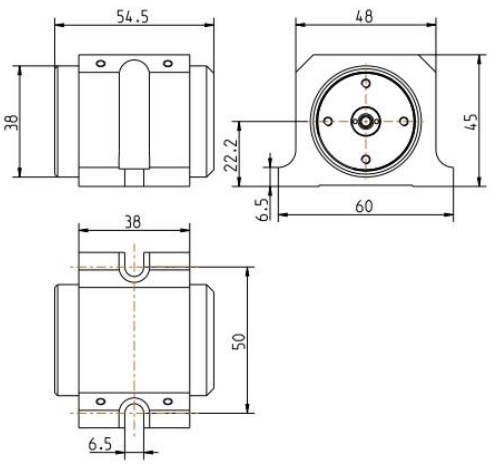
Typical Specifications				
Aperture	Damage Threshold	Rotation angle	Withstand power*	Transmission
2~15 mm	3J/cm² at 10ns @(532~980)nm 10J/cm² at 10ns @1030/1064nm	45°±0.5°	50 W	>98%
2~10 mm	10J/cm² at 10ns @(1319~2000)nm	45°±0.5°	50 W	>98%
15~25 mm	10J/cm² at 10ns @1030/1064nm	45°±1°	500 W	>98%

Operating temperature range: 10℃-30℃.

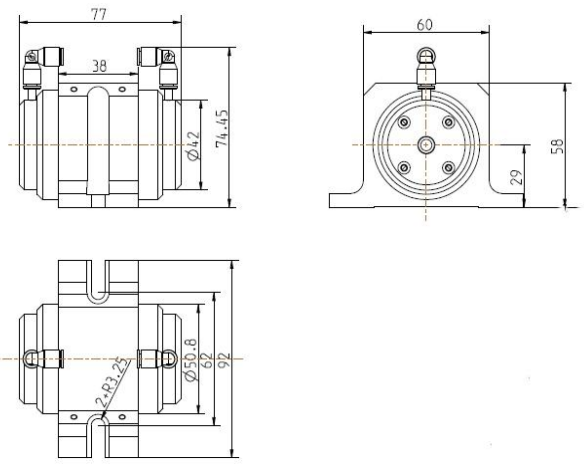
***Indicates the maximum average power products can handle.**

Housing dimensions(mm)：

A01 (Aperture ≤5 mm)



A15 (Aperture ≤12 mm, Water-cool)



Free Space Isolators

Free space isolators are divided into two categories: polarization dependent isolator and polarization independent isolator.

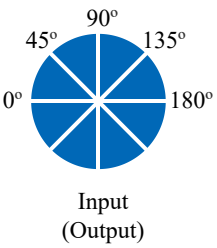
The polarization dependent isolator, or Faraday isolator consists of three major parts which are input polarizer (polarized vertically),Faraday Rotator, and output polarizer (aligned at 45° relative to the input polarizer).

The polarization independent isolator consists of three main components, which are birefringent beam displacer (polarizer), Faraday Rotator, half-wave plate. It's usually used for maintaining the stability of optical system effectively in fiber laser system.

CASTECH adopts high quality megneto-optic crystals with low absorption and high extinction ratios, and polarizers with low transmission losses to achieve outstanding performance. Customized free space isolators are available with peak isolation up to 45dB, maximum transmission above 95%, and aperture up to 45mm.

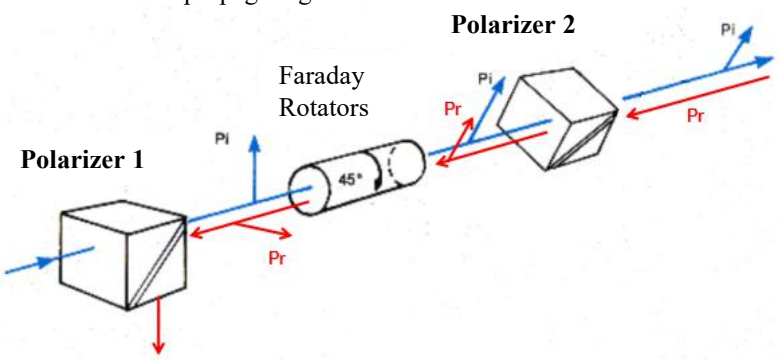
Polarization Reference:

- All Free Space Isolators non-reciprocally rotates the plane of polarized light in 45°;
- Extra half-wave plate for modifying output polarization is available on request.



Beam selection of polarization-dependent isolators:

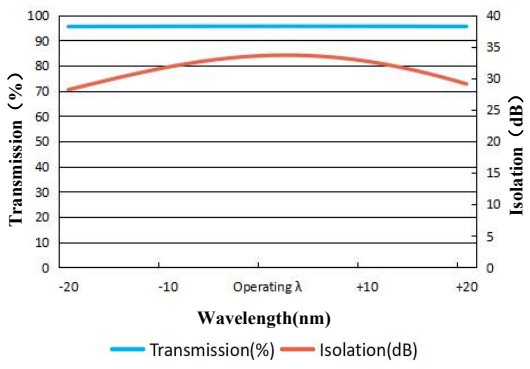
- Forward propagating beam Pi
- Reverse propagating beam Pr



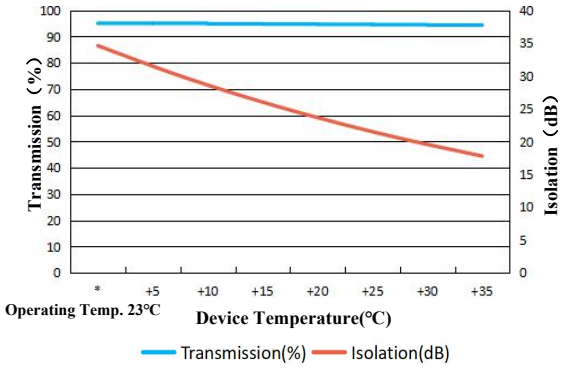
Applications

- Laser precision machining
- Laser sensing
- Ultrafast laser system
- OCT system
- Laser detection

Typical Isolator Performance



Typical Isolator Performance



Polarization-Dependent Type Model Number：HPISO-t-p-a-λ-w-h

Type(t)	Power(p)	Aperture(a)	Wavelength(λ)	Waveplate(w)	Housing(h)
FS (Free Space) DS (Dual Stage) AB (Adjustable bandwidth)	1 W 5 W 30 W 50 W 100 W 500 W** ...	2 mm 3 mm 4 mm 5 mm 8 mm 10 mm 12 mm 15 mm 25 mm 45 mm ...	550-880nm* 355 nm 405 nm 532 nm 633 nm 780 nm 850 nm 980 nm 1030 nm 1064 nm 1319 nm 1550 nm 2000 nm 4500 nm ...	C (Contained) N (Not Contained)	A03* A04 A06 A08 A23 A31 ...

***Only applicable to types with adjustable bandwidth**

****500W is only suitable for the wavelength of 1030/1064nm**

Typical Specifications

Aperture	Damage Threshold	Withstand Power	Transmission	Peak Isolation
2~15 mm	3J/cm² at 10ns @(532~980)nm	50 W	＞93%*, ＞90%**	>33 dB*, >45 dB**
2~10 mm	10J/cm² at 10ns @(1319~2000)nm	50 W	＞93%	>33 dB
15~25 mm	10J/cm² at 10ns @1030/1064nm	500W	＞93%	>33 dB

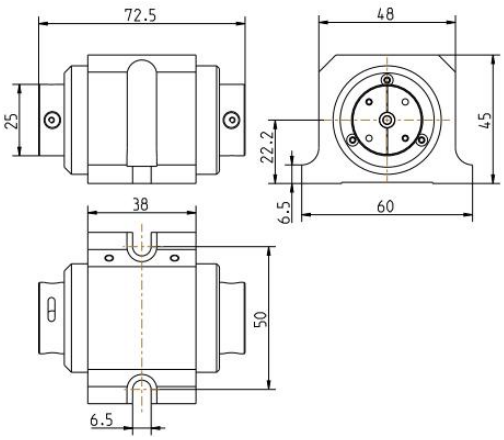
Operating temperature range: 10°C-30°C.

*** Only applicable to conventional isolator**

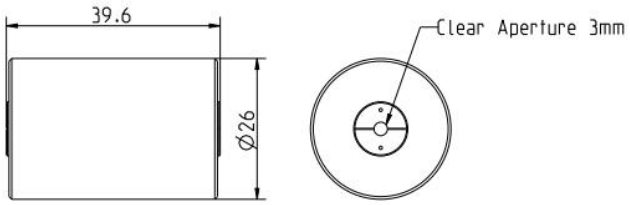
****Only applicable to dual-stage isolator**

Housing dimensions(mm)：

A04 (Aperture ≤5 mm)



A46 (Compact, 1064 nm)



Polarization-Independent Type Model Number：HPISO-t-p-a-λ-w-h

Type(t)	Power(p)	Aperture(a)	Wavelength(λ)	Wave Plate(w)	Housing(h)
PI (polarization-independent)	50 W 100 W 500 W 1000 W ...	1.5 mm 5 mm 8 mm ...	980 nm 1030 nm 1064 nm ...	C (Contained) N (Not Contained)	A16 A29 A38 A41 ...

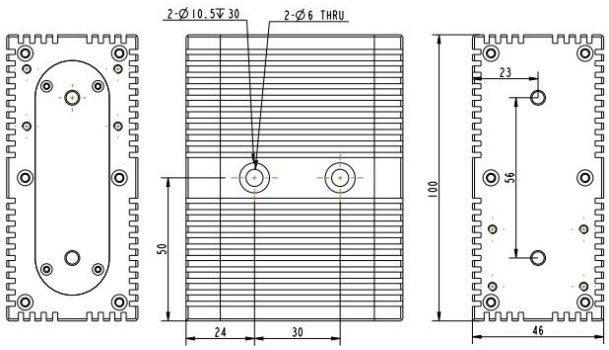
Typical Specifications

Aperture	Damage Threshold	Withstand Power	Transmission	Peak Isolation
1.5 mm	10J/cm² at 10ns @(980~1064)nm	50 W	＞93%	>33 dB
5 mm	10J/cm² at 10ns @(980~1064)nm	100 W	＞93%	>33 dB
8 mm	10J/cm² at 10ns @(980~1064)nm	1000 W	＞93%	>33 dB

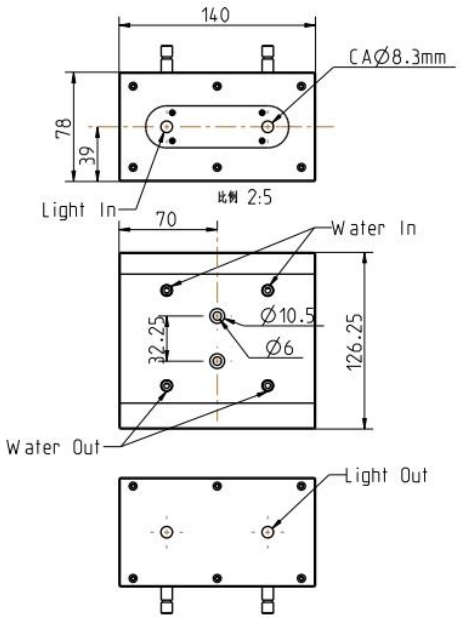
Operating temperature range: 10℃-30℃.

Housing dimensions(mm)：

A16 (Aperture ≤ 5 mm)



A41 (Aperture ≤ 8 mm, Water-cool)

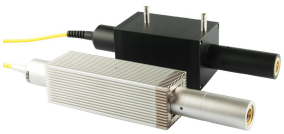


Fiber-Free Space Isolators can be divided into two categories according to its output mode: non-expanded-beam isolator and expanded-beam isolator.

Non-expanded-beam isolator consists of birefringent crystal, Faraday rotator, half-wave plate or polarizer and collimator.It's usually used in the fiber laser system to maintain the stability of optical system effectively.

Expanded-beam isolator consists of collimator, birefringent crystal, Faraday rotator, half wave plate or polarizer and beam expander. The output beam is characterized by good beam quality and small divergence angle.

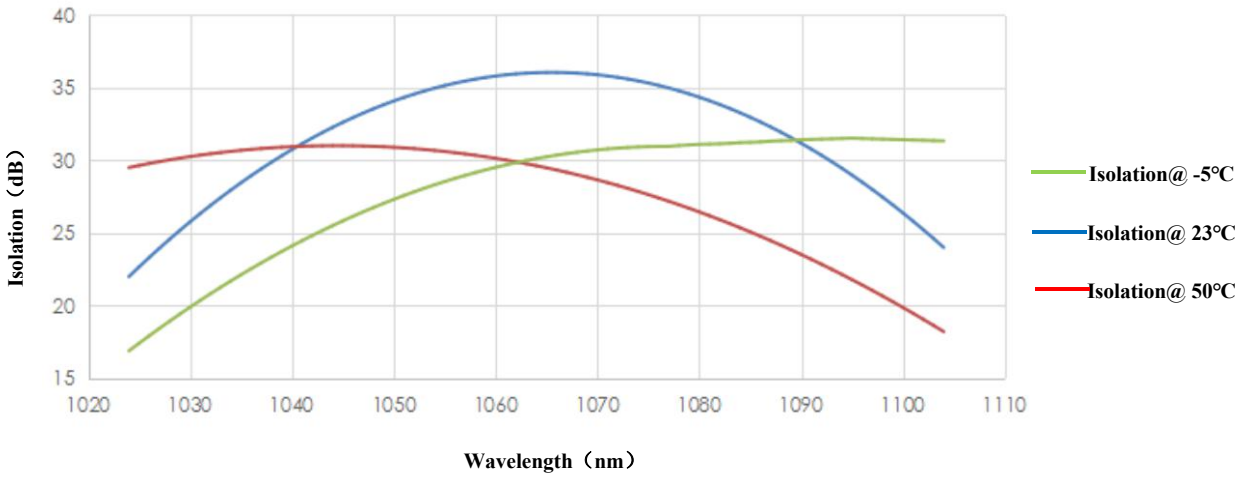
CASTECH utilizes the high-quality crystals and optical components to fabricate Fiber-Free Space Isolators with great performance. The power ranges from 300mW to 200W. The products are featured with high isolation(33dB for single-stage series and 50dB for dual-stage series), low insertion loss, excellent environmental stability and low thermal lens effect.The beam expander helps customers adjust systems magnification with high-quality beam quality output.



Applications

●Fabrication of fiber laser ●Optical fiber sensor ●Laser gauge

Typical Isolator Performance



Non-Expanded-Beam Type Model Number：HPISO-t-p-f-λ-e-b-s-d-h

Type(t)	Power(p)	Fiber Type(f)	Wavelength (λ)	Pigtail Diameter(e)	Beam Diameter(b)	Stage(s)	Spot Shape(d)	Housing(h)
FF (NonExpanded Beam)	1 W 5 W 30 W 50 W 70 W 100 W 200 W 500 W ...	1 (10/125SCF) 2 (20/130DCF) 3 (12/250SCF) 4 (20/250DCF) 5 (30/250DCF) 6 (PM 980) …	980 nm 1030 nm 1064 nm 1080 nm 2000 nm ..	C (6mm Armored Cable) E (8 mm Armored Cable) H (10 mm Armored Cable) L (900 μm Loose Tube) N (Bare fiber)	0.3 mm 0.5 mm 0.7 mm 1.0 mm 2.0 mm …	S (Single) D (Dual)	G (Gauss) F (Flat-top)	A08 A09 ...

Typical Specifications

Withstand Power	Damage Threshold (10 ns, 10 Hz)	Transmission	Peak Isolation
50 W	10 J/cm² @1064 nm	＞93 %*, ＞90 %**	>33 dB*, >50 dB**
100 W	10 J/cm² @1064 nm	＞93 %*, ＞90 %**	>33 dB*, >50 dB**
500 W*	10 J/cm² @1064 nm	＞93 %	>33 dB

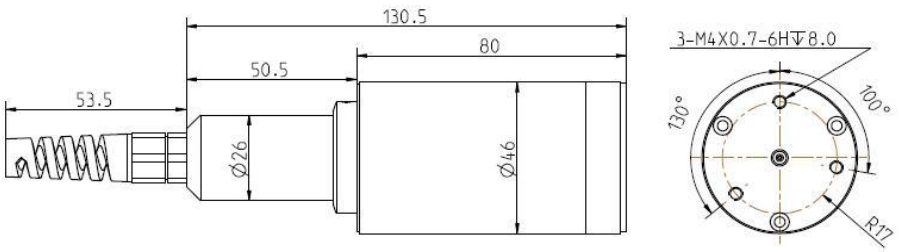
Operating temperature range: 10℃-30℃.

*** Only applicable to single-stage isolator**

****Only applicable to dual-stage isolator**

Housing dimensions(mm)：

A08



Expanded-Beam Type Model Number：HPISO-t-p-f-λ-e-b-s-d-h

Type(t)	Power (p)	Fiber Type(f)	Wavelen gth(λ)	Pigtail Diameter(e)	Beam Diameter(b)	Stage(s)	Spot Shape(d)	Housing(h)
EB (Expanded Beam) WLP* (With Laser Pointer)	1 W 5 W 30 W 50 W 70 W 100 W 200 W ...	1 (10/125SCF) 2 (20/130DCF) 3 (12/250SCF) 4 (20/250DCF) 5 (30/250DCF) 6 (PM 980) …	980 nm 1030 nm 1064 nm 1080 nm 2000 nm ..	C (6 mm Armored Cable) E (8 mm Armored Cable) H (10 mm Armored Cable) L (900 μm Loose Tube) N (Bare fiber)	5 mm 6 mm 7 mm 8 mm 9 mm 10 mm 11 mm …	S (Single) D (Dual)	G (Gauss) F (Flat-top)	A02 A05 A28 A36 A40 ...

***The red light indicator type is only applicable to single-stage isolators**

Typical Specifications

Withstand Power	Damage Threshold (10 ns, 10 Hz)	Transmission	M^2 Deterioration Rate	Peak Isolation
50 W	10 J/cm² @1064 nm	＞92 %*, ＞90 %**	≤10%	>33 dB*, >50 dB**
100 W	10 J/cm² @1064 nm	＞92 %*, ＞90 %**	≤10%	>33 dB*, >50 dB**
500 W	10 J/cm² @1064 nm	＞92 %	≤10%	>33 dB

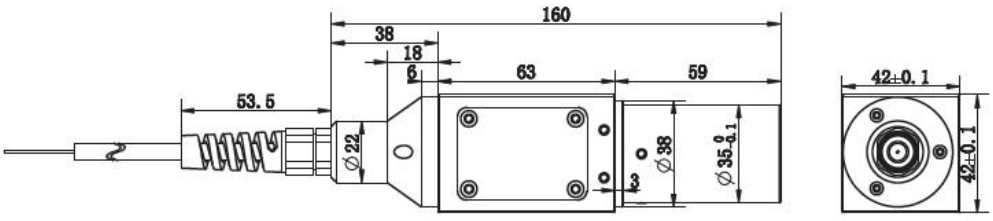
Operating temperature range: 10℃-30℃.

*** Only applicable to single-stage isolator**

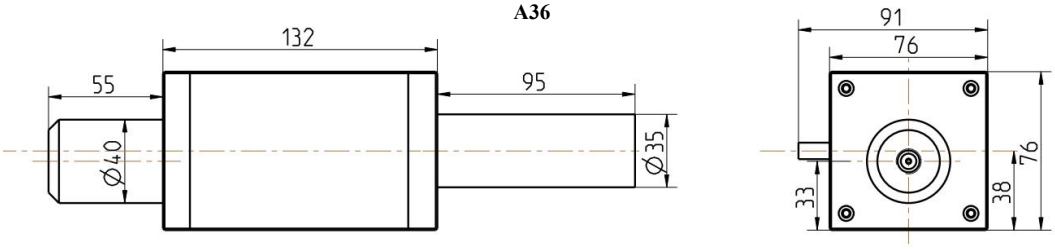
****Only applicable to dual-stage isolator**

Housing dimensions(mm):

A28



A36



In-Line Isolators

In-line isolators can be divided into two categories according to the fiber types: non-polarization-maintaining and polarization-maintaining in-line isolators.

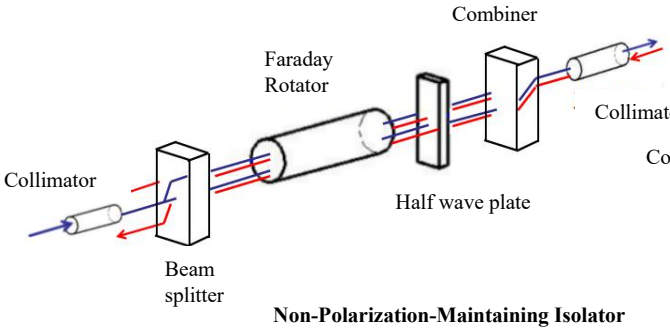
The non-polarization-maintaining type consists of birefringent crystals, Faraday rotator, half-wave plate or polarizer, and collimators. It is usually used in the fiber laser system to maintain the stability of optical system effectively.

The polarization-maintaining type can achieve the steady transmittance of linear polarized light and remain the polarization state unchanged. It consists of input polarizer, Faraday rotator, half-wave plate or polarizer, output polarizer, and collimators. In applications, this type of isolator is used to maintain the stability of the system's polarization state.

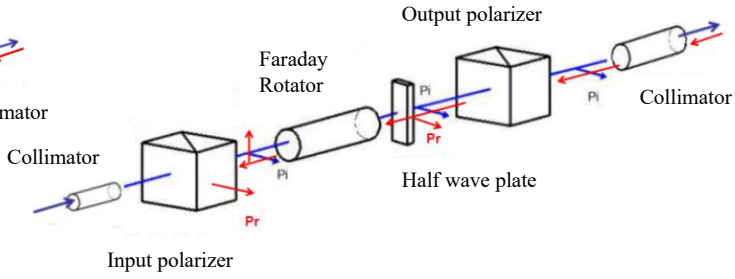
CASTECH produces in-line isolators with high isolation, high power handling, high return loss, low insertion loss, excellent environmental stability and high reliability, operating in the wavelength range of 850~2000nm and power range of 0.3~500W.The connection types of the fiber tail can be bare fiber or FC/APC.

Applications

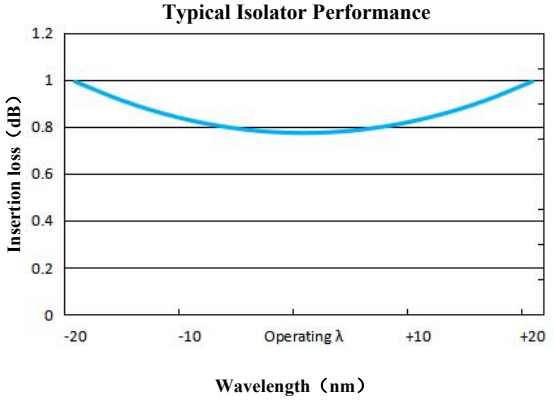
- **EDFA**
- **DWDM Systems**
- **Optical coherence detection**
- **Laser sensing**
- **Fiber communication**

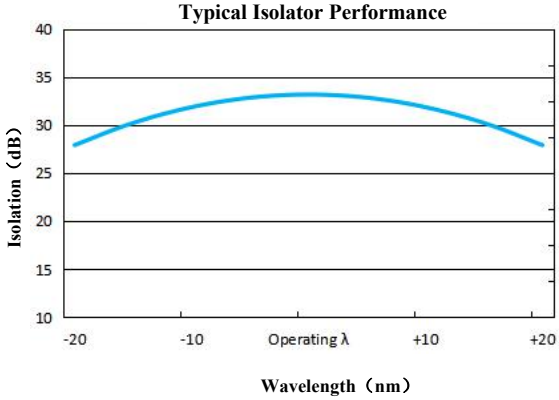


Non-Polarization-Maintaining Isolator



Polarization-Maintaining Isolator





Non-Polarization-Maintaining Type Model Number：HPISO-t-p-f-λ-e-l-b-h

Type(t)	Power(p)	Fiber Type(f)	Wavelength (λ)	Pigtail Diameter(e)	Fiber Length(l)	Filter(b)	Housing(h)
IL (Common) ID (Dual Stage)	0.3 W 5 W 30 W 50 W 100 W 200 W 500 W ...	1 (HI1060) 2 (10/125SCF) 3 (20/130DCF) 4 (12/250DCF) 5 (20/250DCF) 6 (30/250DCF) …	980 nm 1030 nm 1064 nm 1940 nm ...	L (900 μm Loose Tube) B (3 mm Loose Tube)	1 (1 m) 2 (1.5 m) …	C (Contained) N (Not contained)	A03 A08 A17 A31 ...

Typical Specifications

Withstand Power	Insertion Loss	Peak Isolation
5 W	＜0.8 dB*, ＜1.0 dB**	>33 dB*, >50 dB**
30 W	＜0.8 dB*, ＜1.0 dB**	>33 dB*, >50 dB**
100 W	＜0.8 dB	>33 dB
500 W	＜0.8 dB	>33 dB

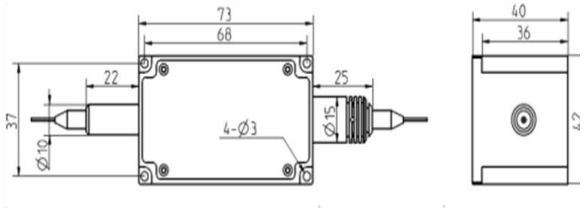
Operating temperature range: 10℃-30℃.

*** Only applicable to single-stage isolator**

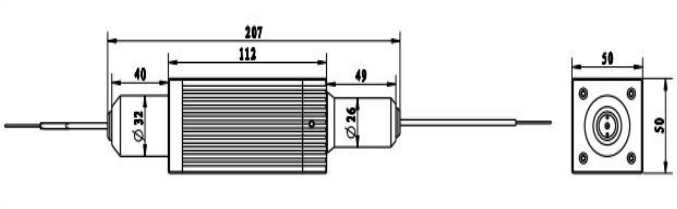
****Only applicable to dual-stage isolator**

Housing dimensions(mm)：

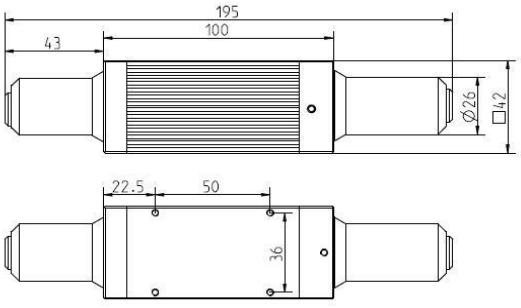
A03



A17



A08



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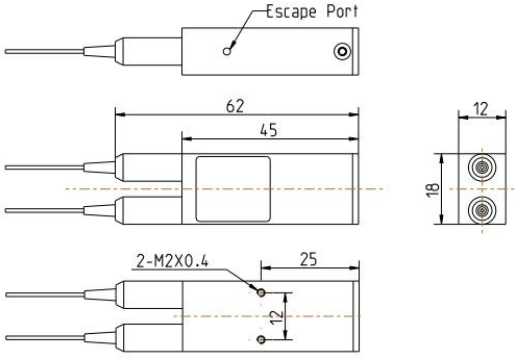


Polarization-Maintaining Type Model Number：HPISO-t-p-f-λ-e-l-b-h

Type(t)	Power(p)	Fiber Type(f)	Wavelength (λ)	Pigtail Diameter(e)	Fiber Length(l)	Filter(b)	Housing (h)
IL (Common) ID (Dual Stage)	0.3 W 5 W 30 W 50 W 120 W 200 W 500 W ...	7 (PM 980) 8 (PM10/125SCF) 9 (PM20/130DCF) …	980 nm 1030 nm 1064 nm 1940 nm ...	L (900 μm Loose Tube) B (3 mm Loose Tube)	1 (1 m) 2 (1.5 m) …	C (Contained) N (Not contained)	A01 A25 ...

Typical Specifications

Withstand Power	Extinction Ratio	Insertion Loss	Peak Isolation
0.3 W	＞20 dB	＜1.0 dB	>33 dB
10 W	＞20 dB	＜1.0 dB*, ＜1.2 dB**	>33 dB*, >50 dB**
20 W	＞20 dB	＜1.0 dB*, ＜1.2 dB**	>33 dB*, >50 dB**
50 W	＞20 dB	＜1.0 dB	>33 dB

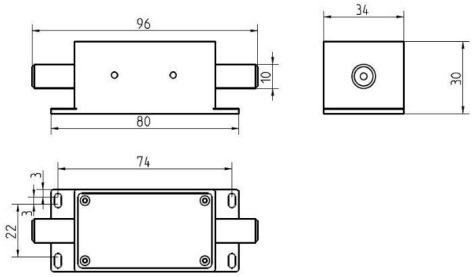
Operating temperature range: 10℃-30℃.

*** Only applicable to single-stage isolator**

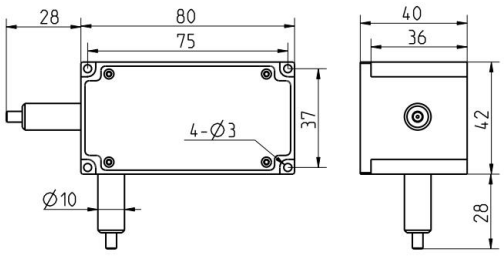
****Only applicable to dual-stage isolator**

Housing dimensions(mm)：

A01



A25



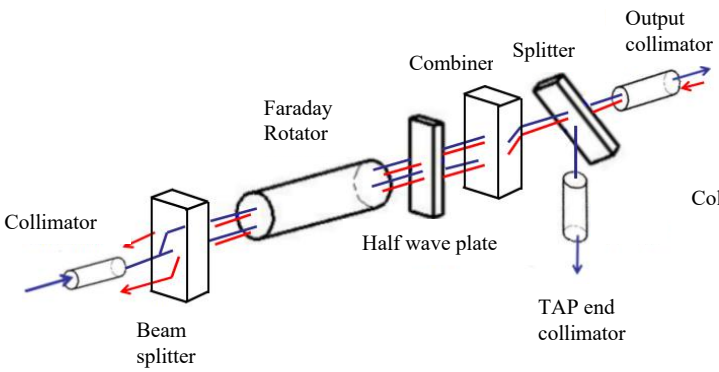
TAP In-Line Isolators

CASTECH supplies **TAP isolators** which have a power monitoring port, exporting light in constant proportion of the output power for easier detection. It supports various output ratios like 0.1± 0.05%, 1± 0.5%, 2± 0.8%, 5± 1.0% and 10± 2.0%, of course, the ratio can be customized as well.

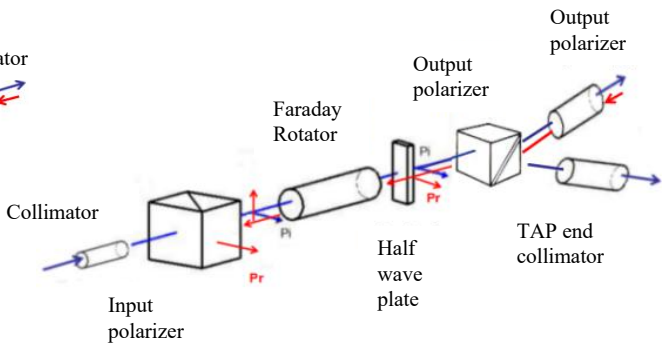
CASTECH produces TAP in-line isolators with high isolation, high power handling, high return loss, low insertion loss, excellent environmental stability and high reliability, The connection types of the fiber tail can be bare fiber or FC/APC.

Applications

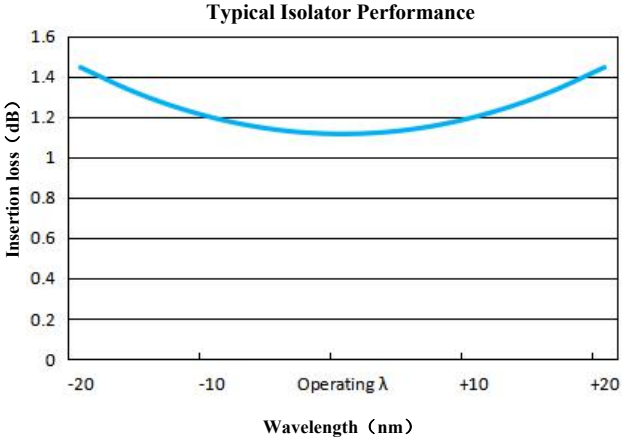
- **EDFA**
- **DWDM Systems**
- **Optical coherence detection**
- **Laser sensing**
- **Fiber communication**

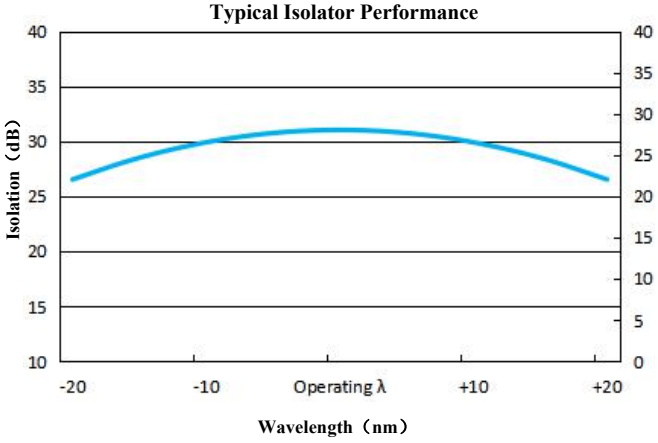


Non-Polarization-Maintaining TAP in-line Isolator



Polarization maintaining TAP in-line isolator





Non-Polarization-Maintaining Type Model Number：HPISO-t-p-f-λ-e-l-b-h

Type(t)	Power(p)	Fiber Type(f)	Wavelength (λ)	Pigtail Diameter(e)	Fiber Length(l)	Filter(b)	Housing(h)
TAP (With monitoring port)	0.3 W 5 W 30 W 50 W ...	1 (HI1060) 2 (10/125SCF) 3 (20/130DCF) 4 (12/250DCF) 5 (20/250DCF) 6 (30/250DCF) …	980 nm 1030 nm 1064 nm 1940 nm ...	L (900 μm Loose Tube) B (3 mm Loose Tube)	1 (1 m) 2 (1.5 m) …	C (Contained) N (Not contained)	A23 ...

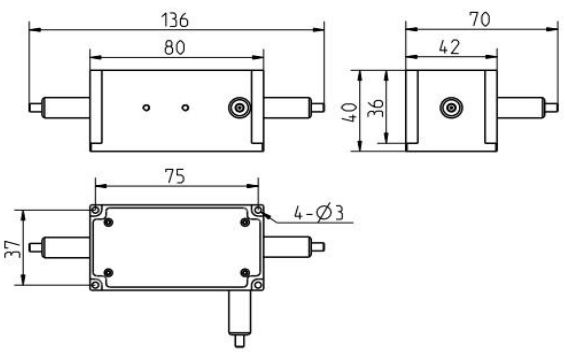
Typical Specifications

Withstand Power	Insertion Loss	Peak Isolation
10 W	≤1.2 dB	>30 dB
50 W	≤1.2 dB	>30 dB

Operating temperature range: 10℃-30℃.

Housing dimensions(mm)：

A23



Polarization-Maintaining Type Model Number：HPISO-t-p-f-λ-e-l-b-h

Type(t)	Power(p)	Fiber Type(f)	Wavelength (λ)	Pigtail Diameter(e)	Fiber Length(l)	Filter(b)	Housing(h)
TAP (With monitoring port)	0.3 W 5 W 30 W 50 W ...	7 (PM 980) 8 (PM10/125SCF) 9 (PM20/130DCF) …	980 nm 1030 nm 1064 nm 1940 nm ...	L (900 μm Loose Tube) B (3 mm Loose Tube)	1 (1 m) 2 (1.5 m) …	C (Contained) N (Not contained)	A15 ...

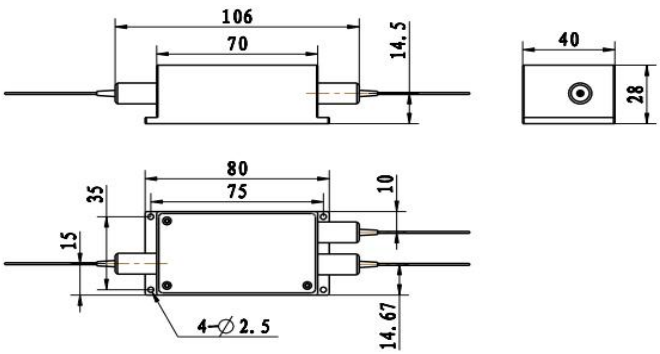
Typical Specifications

Withstand Power	Extinction Ratio	Insertion Loss	Peak Isolation
10 W	＜20 dB	≤1.5 dB	>30 dB
50 W	＜20 dB	≤1.5 dB	>30 dB

Operating temperature range: 10℃-30℃.

Housing dimensions(mm)：

A15



The circulator is an irreversible one-way three-port component that allows light propagate in a specific direction. Circulators can be divided into nonpolarization-maintaining circulator and polarization maintaining circulator.

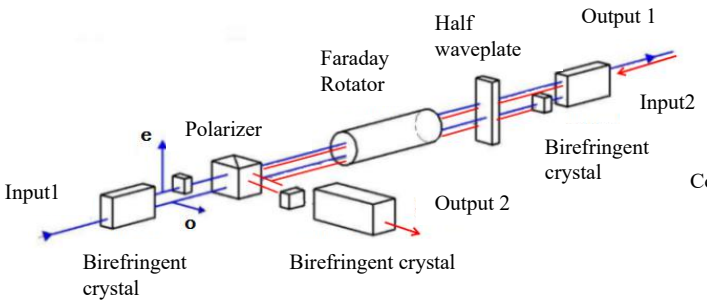
Non-polarization-maintaining circulator consists of birefringent beam displacer, polarization element, Faraday rotator, half-waveplate and collimator.

Polarization-maintaining optical circulator consists of input polarizer, Faraday rotator, half-waveplate, output polarizer and collimator.

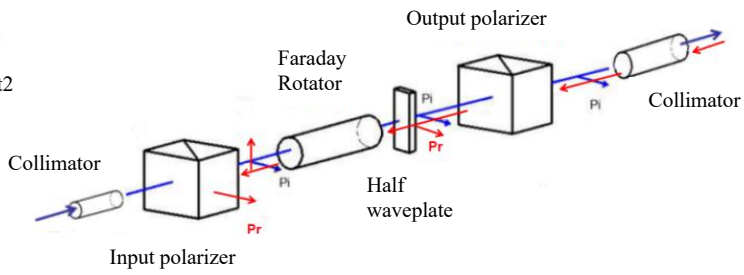
CASTECH produces circulators with low insertion loss, high isolation, low polarization dependent loss and excellent temperature stability. Operating wavelength range is 450~2000nm, and connection of fiber tail can be bare fiber or FC/APC.

Applications

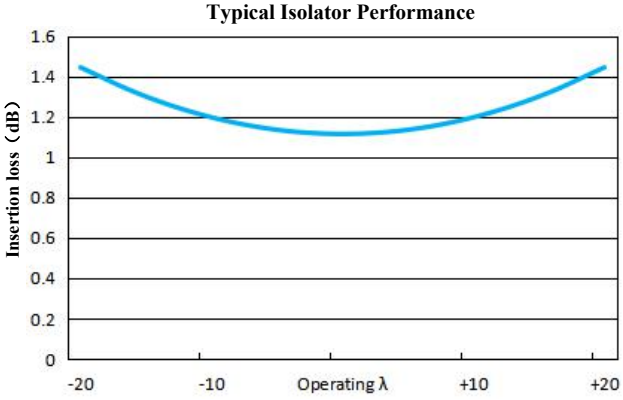
- **Fiber optical sensor system**
- **Bidirectional signal transmission system**
- **Dispersion compensation**

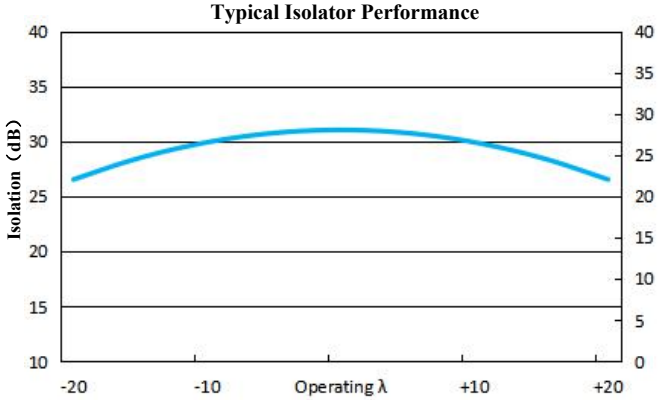


Non-polarization maintaining optical circulator



Polarization maintaining optical circulator





Non-Polarization-Maintaining Type Model Number：HPCIR-t-p-f-λ-e-l-b-h

Type(t)	Power(p)	Fiber Type(f)	Wavelength (λ)	Pigtail Diameter(e)	Fiber Length(l)	Filter(b)	Housing(h)
TRI (Three ports) CIR (Optical Circulator)	0.3W 5 W 30 W 50 W 100 W ...	1 (HI1060) 2 (10/125SCF) 3 (20/130DCF) 4 (12/250DCF) 5 (20/250DCF) 6 (30/250DCF) …	980 nm 1030 nm 1064 nm ...	L (900 μm Loose Tube) B (3 mm Loose Tube)	1 (1 m) 2 (1.5 m) …	C (contained) N (Not contained)	A01 A06 ...

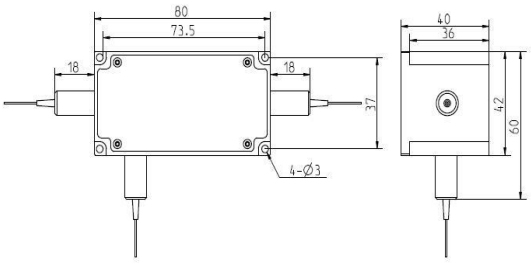
Typical Specifications

Withstand Power	Insertion Loss	Minimum Crosstalk	Peak Isolation
20 W	≤1.2 dB	≥45 dB	＞30 dB
100 W	≤1.2 dB	≥45 dB	＞30 dB

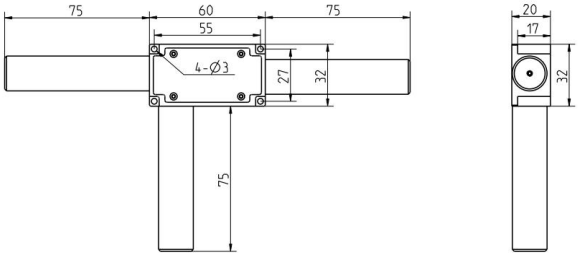
Operating temperature range: 10℃-30℃.

Housing dimensions(mm)：

A01



A06



Polarization-Maintaining Type Model Number：HPCIR-t-p-f-λ-e-l-b-h

Type(t)	Power(p)	Fiber Type(f)	Wavelength (λ)	Pigtail Diameter(e)	Fiber Length(l)	Filter(b)	Housing(h)
TRI (Three ports) CIR (Optical Circulator)	0.3 W 5 W 30 W 50 W ...	7 (PM 980) 8 (PM10/125SCF) 9 (PM20/130DCF) …	980 nm 1030 nm 1064 nm ...	L (900 μm Loose Tube) B (3 mm Loose Tube)	1 (1 m) 2 (1.5 m) …	C (Contained) N (Not contained)	A02 ...

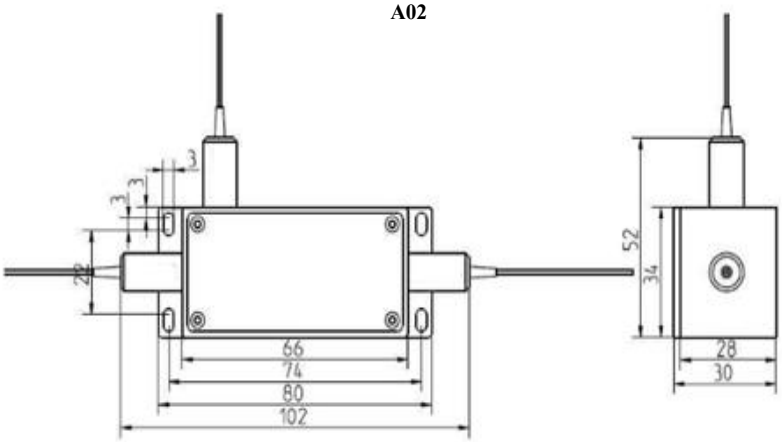
Typical Specifications

Withstand Power	Extinction Ratio	Insertion Loss	Minimum Crosstalk	Peak Isolation
1 W	＜20 dB	≤1.5 dB	≥45 dB	＞30 dB
50 W	＜20 dB	≤1.5 dB	≥45 dB	＞30 dB

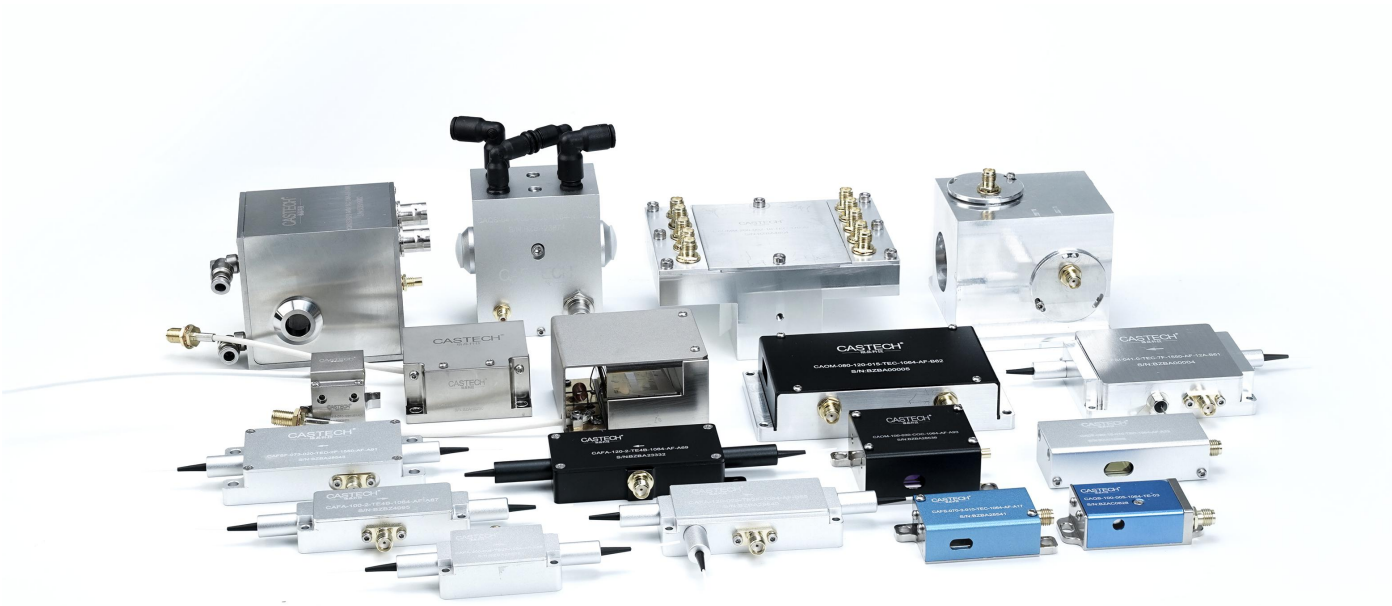
Operating temperature range: 10℃-30℃.

Housing dimensions(mm)：

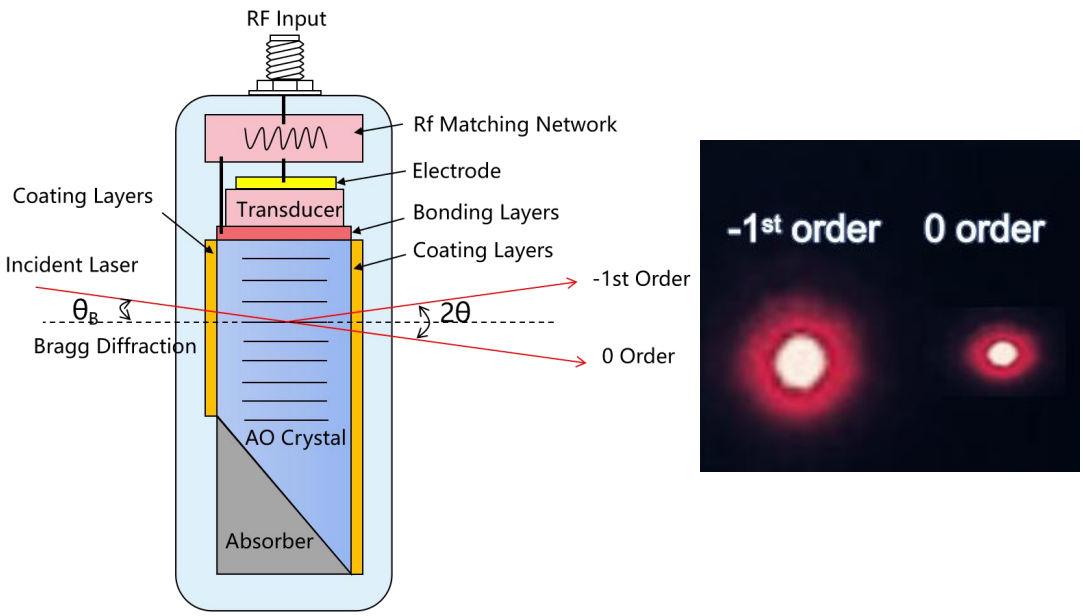
A02



Acousto-Optic Devices



Acousto-optic (AO) devices are composed of acousto-optic medium and piezo-electric transducers. The beam is controlled by the interaction of ultrasonic waves and light waves propagating in the medium. Acousto-optic devices mainly include acousto-optic Q-switch, acousto-optic modulator, acousto-optic deflector, acousto-optic frequency shifter and acousto-optic tunable filter. They are widely used in laser Q-switching, laser imaging, laser display, laser medicine, optical fiber communication, instruments and scientific research.



Schematic diagram of Acousto-optic principle

Acousto-optic devices are a kind of complex optical functional element, involving many subjects such as electricity, sound and light. With years of research and accumulation, CASTECH has the ability to design, develop and fabricate acousto-optic devices. With mature product design capability, high-quality pressure welding and high damage threshold coating process, CASTECH supplies acousto-optic devices with both superior performance and excellent consistency in mass production. Now CASTECH can provide a full range of acousto-optic devices and has the ability to customize special acousto-optic devices.

In order to meet the low VOC(volatile organic compounds) requirements of some high-performance lasers, CASTECH has developed LL-serie acousto-optic devices. Compared with conventional acousto-optic devices, this serie of products greatly reduce the volatile organic source, and are suitable for high-power ultraviolet laser systems.

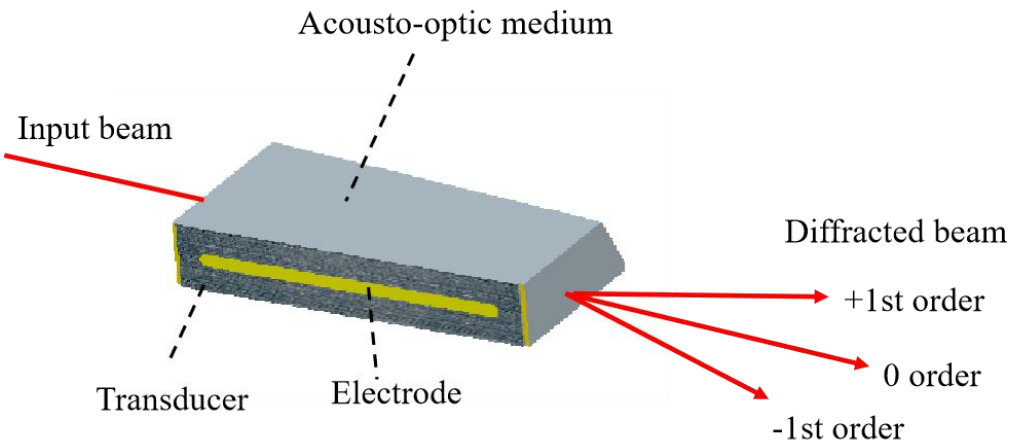
Acousto-optic Q-switch (AOQS) is a modulator designed for laser Q-switching applications. When applying the RF signal, the losses of cavity increases and the oscillation is hindered. When the RF signal is switched off, the losses of cavity decrease rapidly and then high-energy pulsed laser light is generated.

CASTECH provides a variety of A-O Q-switches work at wavelength range of 310 nm-3000 nm. Our products have the advantages of high transmission (up to 99.6%), high switching speed, strong switching off ability, high damage threshold and excellent pulse stability.

To obtain higher diffraction efficiency, it requires larger aperture acousto-optic Q-switch and higher RF power, therefore water cooling is needed to ensure the heat dissipation.

Applications

●Laser marking ●Lithography ●Medical surgery ●Material processsing



Schematic diagram of acousto-optic Q-switch

Q-Switches Model Number：CAQS-f-a-mt-w-c-h

RF Frequency (f)	Aperture (a)	Material (m)	Mode (t)	Wavelength (w)	RF Connector (c)	Housing (h)
024 (24 MHz) 027 (27.12 MHz) 041 (40.68 MHz) 068 (68 MHz) 080 (80 MHz) ...	005 (0.5 mm) 010 (1 mm) 020 (2 mm) 030 (3 mm) 040 (4 mm) 050 (5 mm) 060 (6 mm) ...	FS (Fused Silica) CQ (Crystalline Quartz)	C (Compressional)	310 nm 1030 nm 1064 nm 1342 nm 1550 nm 3000 nm …	AF (SMA-F) AM (SMA-M) NF (BNC-F) NM (BNC-M) MF (MMCX-F) MM (MMCX-M) …	LXX （Low volatile series） AXX （Conventional packaging series） ...

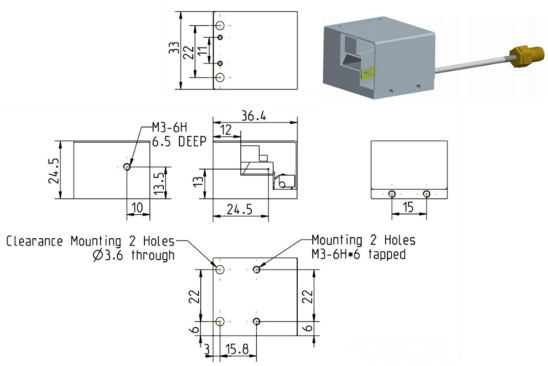
Typical Specifications*

Frequency	Active Aperture	Wavelength	Transmission	Modulation Losses
27.12 MHz	1~6 mm	1064 nm	≥ 99.6%	≥ 80%
40.68 MHz	0.5~2 mm	1064 nm	≥ 99.6%	≥ 85%
68 MHz	0.5~3 mm	1064 nm	≥ 99.6%	≥ 85%
80 MHz	0.5~3 mm	1342 nm	≥ 99%	≥ 85%

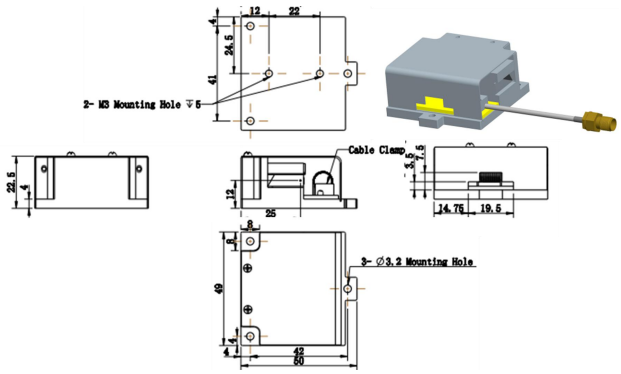
***Damage Threshold: 1GW/cm² @ 1064 nm, 10 ns，10Hz**

Housing dimensions(mm)：

A01



A05

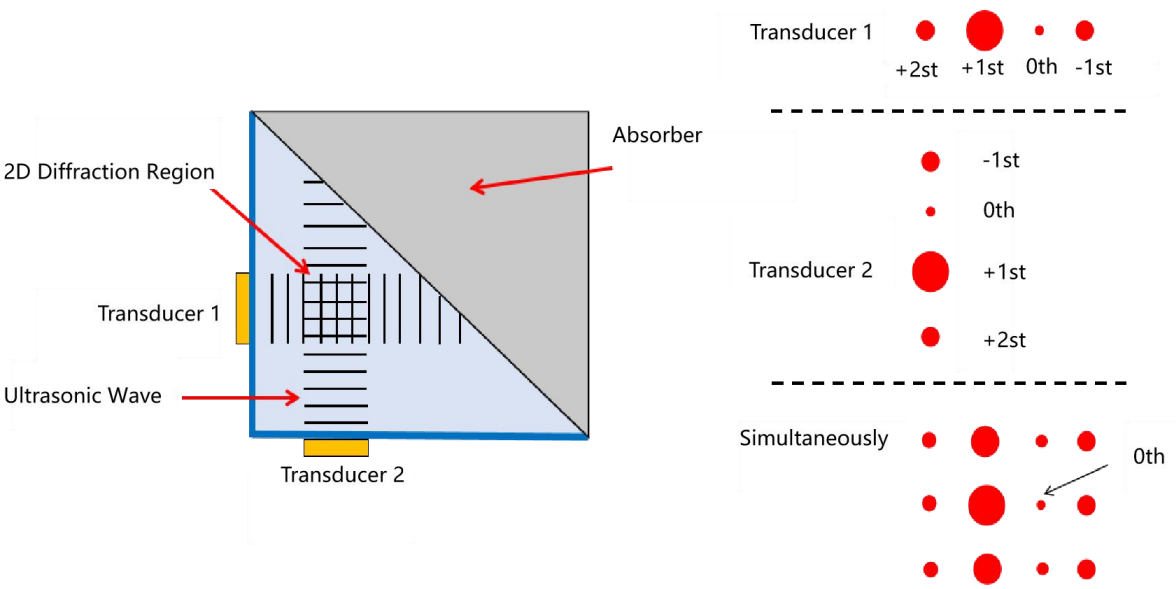


Two dimensional acousto-optic Q-switch (2D-AOQS) is based on one-dimensional acousto-optic Q-switch. Transducers are made on both two mutually orthogonal surfaces of the same acousto-optic medium. The RF signal is transmitted to the surface electrodes of the two transducers at the same time. The two transducers convert the absorbed RF signal into ultrasonic wave and transmit it to the acousto-optic medium at the same time, forming mutually orthogonal diffraction gratings in the medium. The incident light interacts with the orthogonal diffraction grating simultaneously to produce two-dimensional diffracted light, so as to improve the diffraction efficiency. 2D-AOQS aims to improve the diffraction efficiency of a single device and serve as an replacement of using two acousto-optic Q-switches in high-power system.

In order to obtain higher diffraction efficiency, 2D-AOQS requires higher RF power, therefore water cooling is needed to ensure the heat dissipation of the device.

Applications

●Laser marking ●Lithography ●Medical surgery ●Material processsing



Schematic diagram of two-dimensional acousto-optic Q-switch

2D-Q-Switches Model Number：CAQSD-f-a-mt-w-c-h

RF Frequency (f)	Aperture (a)	Material (m)	Mode (t)	Wavelength (w)	RF Connector (c)	Housing (h)
024 (24 MHz) 027 (27.12 MHz) 041 (40.68 MHz) 068 (68 MHz) 080 (80 MHz) ...	005 (0.5 mm) 010 (1 mm) 020 (2 mm) 030 (3 mm) 040 (4 mm) ...	FS (Fused Silica) CQ (Crystalline Quartz)	C (Compressional)	1030 nm 1064 nm …	AF (SMA-F) AM (SMA-M) NF (BNC-F) NM (BNC-M) MF (MMCX-F) MM (MMCX-M) …	A80 ...

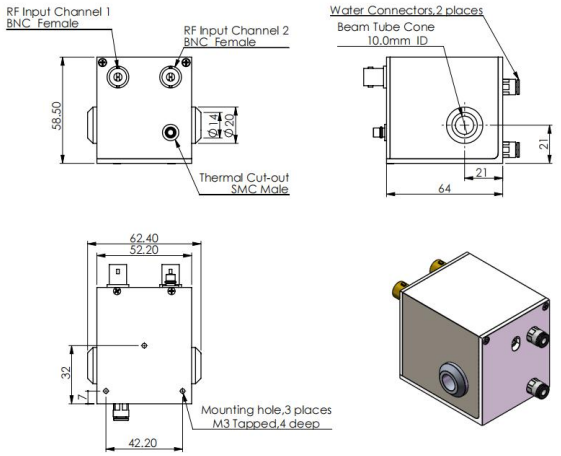
Typical Specifications*

Frequency	Active Aperture	Wavelength	Transmission	Modulation Losses
24 MHz	2~6 mm	1064 nm	≥ 99.6%	≥ 90%
27.12 MHz	2~6 mm	1064 nm	≥ 99.6%	≥ 90%
40.68 MHz	2~6 mm	1064 nm	≥ 99.6%	≥ 90%

***Damage Threshold: 1GW/cm² @ 1064 nm, 10 ns, 10Hz**

Housing dimensions(mm):

A80

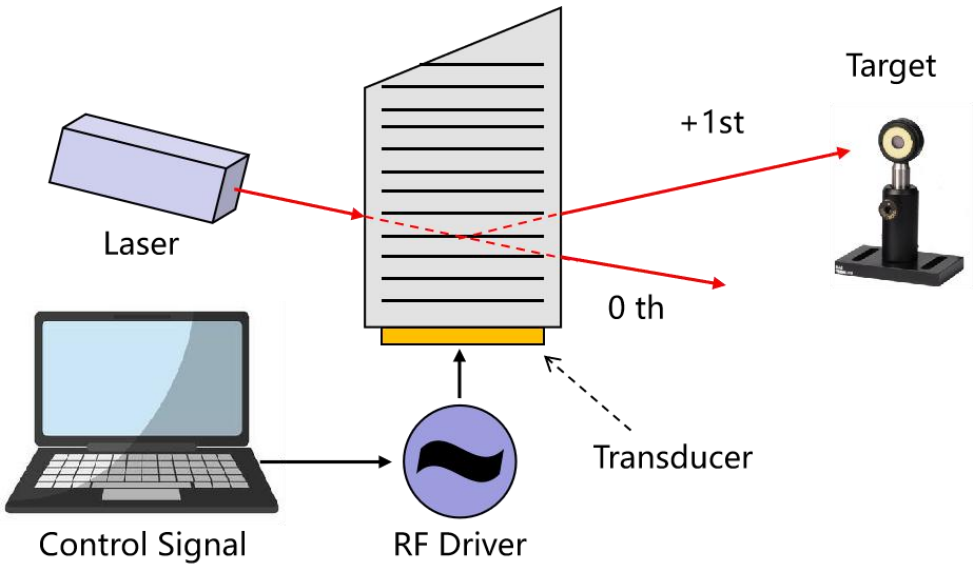


Acousto-optic modulation is an external modulation technology, which can control the intensity of laser beam, and its speed is much faster than that of mechanical shutter. **Acousto-optic modulator (AOM)** can be used in laser modulation, laser graphic processing, laser digital communication and other fields. It has the characteristics of fast modulation speed, compact size, high modulation efficiency, high extinction ratio, easy coding and convenient to use.

CASTECH offers customized services that optimize the modulation scheme according to the demanding speed, wavelength, power, beam diameter and extinction ratio for our customers.

Applications

●Laser marking ●Lithography ●Material processsing ●Medical surgery ●Micromachining



Schematic diagram of free-space acousto-optic modulator

Free-Space AOM Model Number：CAOM-f-a-mt-w-c-h

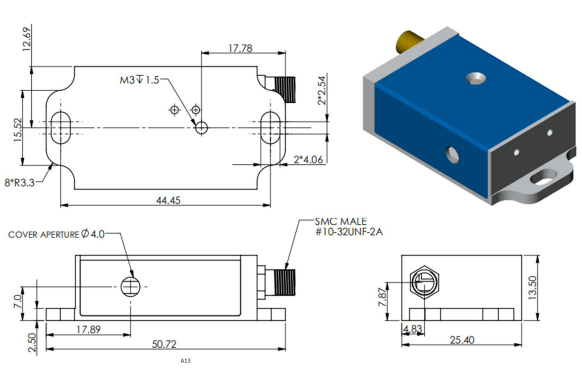
RF Frequency (f)	Aperture (a)	Material (m)	Mode (t)	Wavelength(w)	RF Connector (c)	Housing (h)
68 MHz 80 MHz 100 MHz 120 MHz 150 MHz 200 MHz 250 MHz ...	005 (0.5 mm) 010 (1 mm) 015 (1.5 mm) 020 (2 mm) 025 (2.5 mm) 030 (3 mm)	CQ (Crystalline Quartz) TE (TeO_2)	C (Compressional) S (Shear)	355 nm 532 nm 780 nm 850 nm 1030 nm 1064 nm 3000 nm ...	AF (SMA-F) AM (SMA-M) CF (SMC-F) CM (SMC-M) …	A03 A04 A05 A13 A29 A62 B09 B12 ...

Typical Specifications

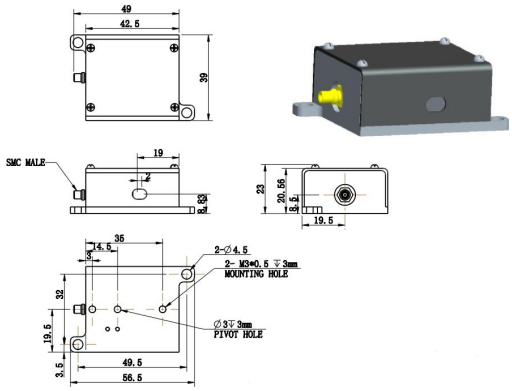
Frequency	Active Aperture	Wavelength	Transmission	Diffraction Efficiency	Separation angle
100 MHz	0.5~1 mm	355 nm	≥ 99.0%	≥ 85%	6.2 mrad
100 MHz	0.5~4 mm	1064 nm	≥ 99.0%	≥ 85%	25.3 mrad
120 MHz	0.5~1 mm	1064 nm	≥ 99.0%	≥ 85%	30.4 mrad
200 MHz	0.15~0.5 mm	1064 nm	≥ 99.0%	≥ 70%	50.7 mrad
250 MHz	0.15~0.5 mm	1064 nm	≥ 99.0%	≥ 70%	63.3 mrad

Housing dimensions(mm)：

A13



B09

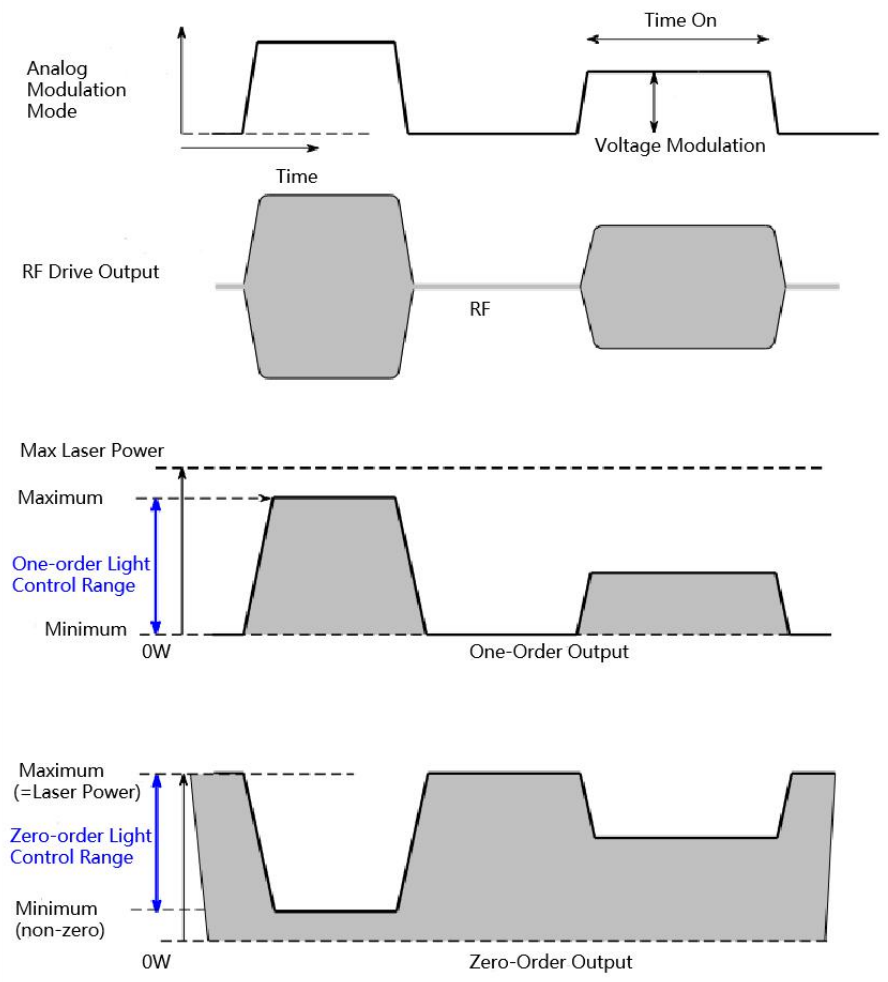


Fiber-coupled acousto-optic modulator (FCAOM) is based on the principle of body wave acousto-optic interaction and has the ability of optical pulse amplitude modulation and optical frequency shift. The rise time of the optical pulse output of the modulator represents the modulation speed which determines the response speed and available bandwidth of the system. Compared with free-space acousto-optic devices, FCAOM has the advantages of convenient to use, easy integration and high reliability with optical fiber coupling. It is widely used in fiber sensing system, fiber laser and other fields.

CASTECH can customize FCAOM with corresponding parameter according to customer requirements. The optical fiber terminal of FCAOM could be configured with FC / APC or other connectors as required.

Applications

●Laser marking ●Lithography ●Material processing ●Medical surgery ●Micromachining



Schematic diagram of acousto-optic modulation

Fiber-Coupled AOM Model Number：CAFA-f-r-p-mat-w-c-h

RF Frequency (f)	RF Range (r)	RF Power (p)	Material (m)	Fiber Type (a)	Fiber Termina l(t)	Wavelength (w)	RF Connector (c)	Housing (h)
80 MHz 100 MHz 120 MHz 200 MHz 250 MHz ...	0 (0 MHz） 1 (±1 MHz) 15 (±15 MHz) 50 (±50 MHz) ...	020 (≤2 W) 025 (≤2.5 W) 030 (≤3 W) ...	CQ (Crystalline Quartz) TE (TeO_2)	1 (HI1060) 2 (PM980) 3 (PM 10/125) 4 (10/125) 5 (20/125) 6 (10/125GDF) 7 (PM1550XP) 8 (PM1060L) 9 (SM28e) 10 (PMS350) 11 (PM1950) ...	B (Bare Fiber) F (FC/APC)	1030 nm 1064 nm 1550 nm ...	AF (SMA-F) AM (SMA-M) …	A50 A87 A88 B03 ...

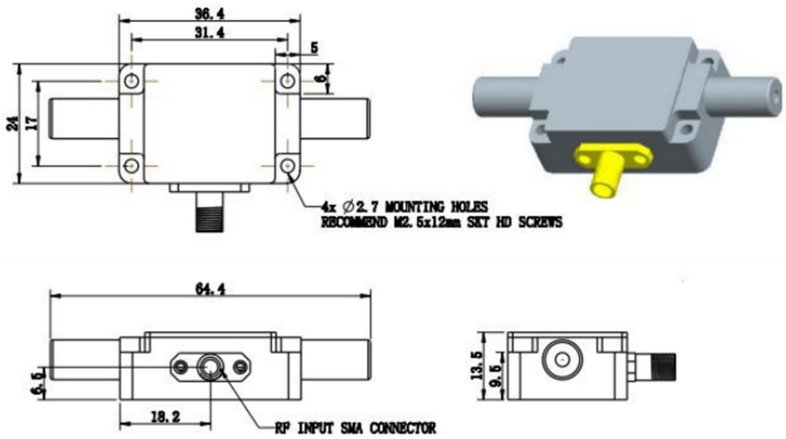
Typical Specifications

Frequency	Wavelength	Insertion Loss	Extinction Ratio	Rise/Fall Time	Polarization Extinction Ratio*
120 MHz	1064 nm	≤ 1.2 dB	≥ 45 dB	≤ 40 ns	≥ 18 dB
200/250 MHz	1064/1030 nm	≤ 2.5 dB	≥ 50 dB	＜ 10 ns	≥ 18 dB
200 MHz	1550 nm	≤ 4.0 dB	≥ 50 dB	＜ 10 ns	≥ 18 dB

***Only applicable to polarization maintaining devices (Polarization extinction ratio refers to the proportional relationship between two orthogonal polarization components decomposed along the main polarization state direction)**

Housing dimensions(mm):

B03



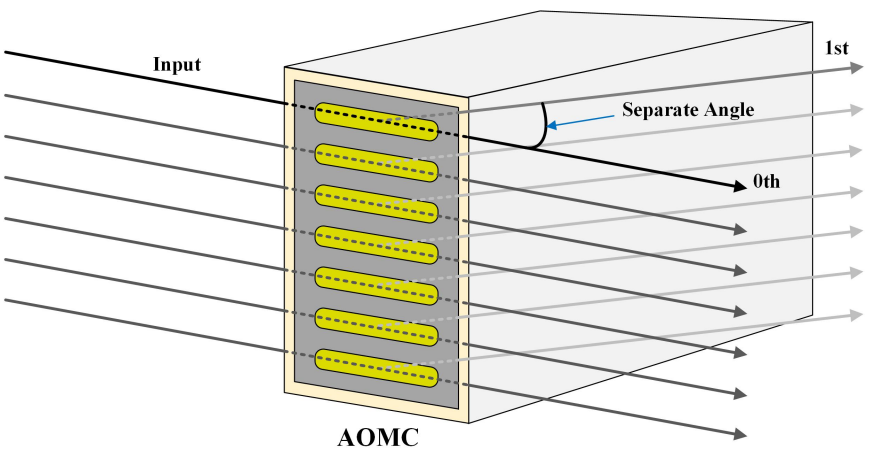
Acousto-optic multi-channel modulators(AOMM) integrate the transducer array with a single acousto-optic crystal to modulate or deflect multiple beams separately.

CASTECH manages to minimize the crosstalk through advanced optical and circuitry design, allowing the product to modulate up to 10 channels simultaneously.

By using high internal quality, low scattering crystalline quartz, CASTECH's multi-channel acousto-optic modulators are featured with low insertion and high LIDT to promise good performance.

Applications

●Lithography ● Laser marking ●Material processing ●Micromachining



Schematic diagram of multichannel acousto-optic diffraction

Multi-Channel AOM Model Number：CAOMM-f-a-n-mt-w-c-h

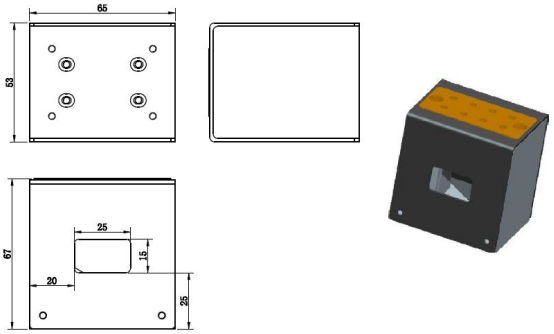
RF (f)	Aperture (a)	Number of Channels (n)	Material (m)	Mode (t)	Wavelength(w)	Rf Connector (c)	Housing (h)
100 MHz 120 MHz 220 MHz ...	002 (0.2 mm) 003 (0.3 mm) ...	5 8 10	FS (Fused Silica) CQ (Crystalline Quartz) TE (TeO_2)	C (Compressional)	355 nm 370 nm ...	AF (SMA-F) AM (SMA-M) CF (SMC-F) CM (SMC-M) ...	B23 B33 B35 B36 ...

Typical Specifications

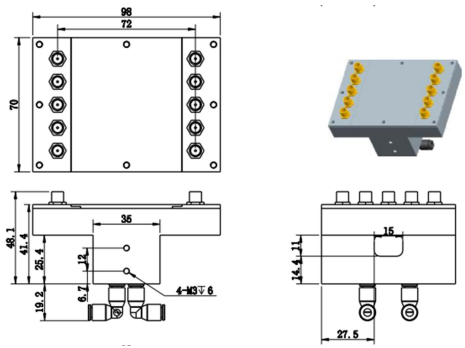
Operating Frequency	Active Aperture	Wavelength	Number of Channels	Channel Crosstalk	Diffraction Efficiency	VSWR
100 MHz	0.2~1 mm	370 nm	5	＞20 dB	≥70%	＜2.1:1
200 MHz	0.2~1 mm	355 nm	10	＞20 dB	≥70%	＜2.1:1

Housing dimensions(mm)：

B23



B36



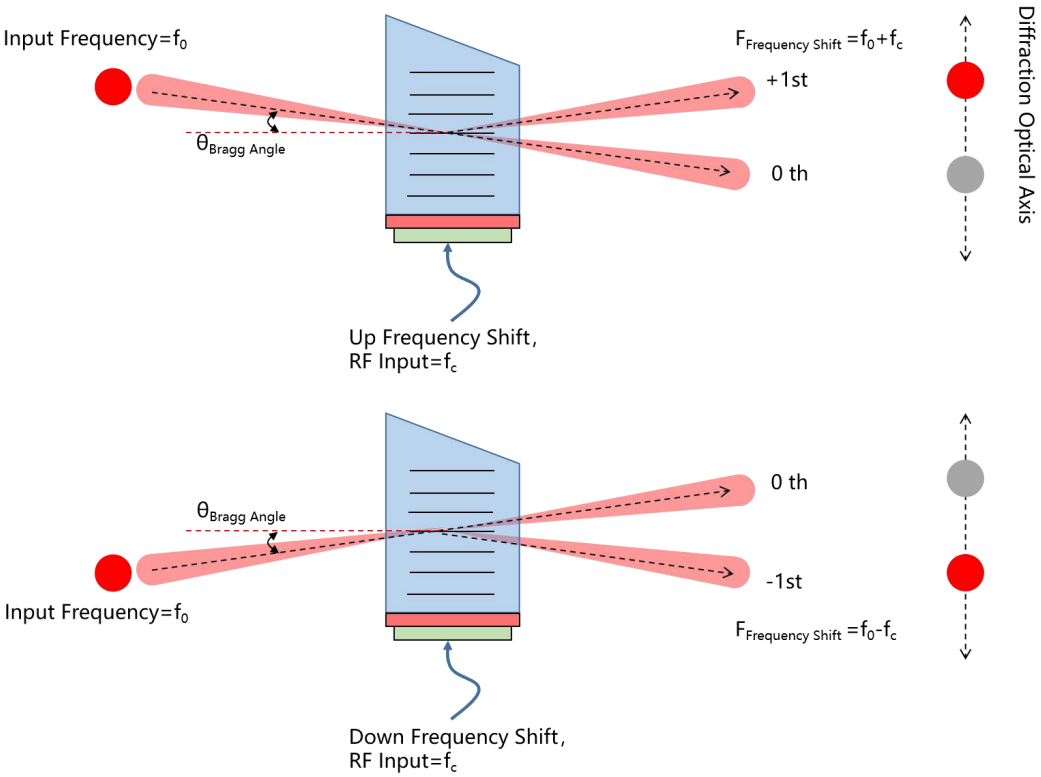
The acousto-optic frequency shifter(AOFS) with RF driver is used to modify the frequency of the optical beam. Due to the Doppler shift, the frequency shift of 1st order diffracted light (variation quantity of wavelength) equals to the frequency of RF signal (wavelength). If the incident direction of acoustic wave and optic wave are the same, the shifted laser frequency value will be positive, on the other hand, if the incident direction of acoustic wave and optic wave are opposite, the shifted laser frequency value will be negative.

Applications such as interference-based optical techniques require a high extinction ratio between the diffracted and undiffracted beam.

CASTECH provides customized specs including center frequency and the shifted frequency value.

Applications

- **Interferometry**
- **Laser cooling**
- **Laser doppler velocimetry**
- **Optical heterodyne detection**



Schematic diagram of frequency shifter

Free-Space Frequency Shifters Model Number：CAFS-f-r-a-mt-w-c-h

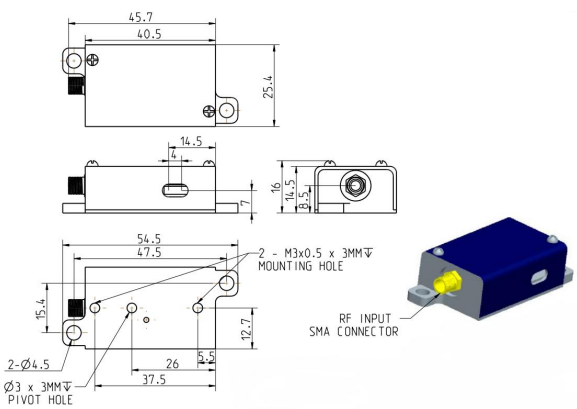
Center Frequency (f)	RF Range (r)	Aperture (a)	Material (m)	Mode (t)	Wavelength (w)	RF Connector (c)	Housing (h)
41 MHz 70 MHz 73 MHz 80 MHz 83 MHz 100 MHz ...	3 (±3 MHz) 10 (±10 MHz) ...	010 (1 mm) 020 (2 mm) 030 (3 mm) 040 (4 mm) 050 (5 mm) 060 (6 mm) ...	TE (TeO_2)	C (Compressional) S (Shear)	583 nm 770 nm 1030 nm 1064 nm ...	AF (SMA-F) AM (SMA-M) ...	A17 A33 B07 B17 ...

Typical Specifications

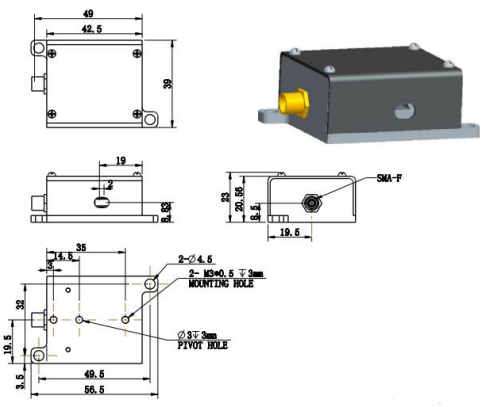
Center Frequency	Active Aperture	Wavelength	Transmission	Frequency Shift Range	Diffraction Efficiency
70 MHz	0.5~2 mm	1064 nm	≥ 99.0%	± 3 MHz	≥ 85%
80 MHz	0.5~2 mm	1064 nm	≥ 99.0%	± 10 MHz	≥ 80%
80 MHz	0.5~2 mm	1550 nm	≥ 99.0%	± 15 MHz	≥ 70%

Housing dimensions(mm)：

A17



B07



Fiber-Coupled Frequency Shifters Model Number：CAFSF-f-p-mqat-w-c-h

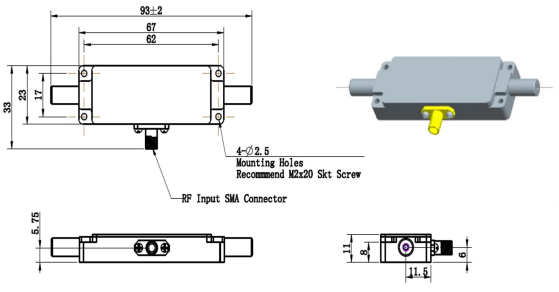
RF Frequency (f)	RF Power (p)	Material (m)	Crystal Quantity (q)	Fiber Type (a)	Fiber Terminal (t)	Wavelength (w)	RF Connector (c)	Housing (h)
41 MHz 73 MHz 80 MHz 100 MHz 120 MHz 150 MHz 200 MHz ...	020 (≤2 W) 025 (≤2.5 W) ...	TE (TeO_2)	S D	1 (HI1060) 2 (PM980) 3 (PM 10/125) 4 (10/125) 5 (20/125) 6 (10/125GDF) 7 (PM1550XP) 8 (PM1060L) 9 (SM28e) ...	B (Bare Fiber) F (FC/APC)	1030 nm 1064 nm 1550 nm ...	AF (SMA-F) AM (SMA-M) ...	A61 A91 B03 ...

Typical Specifications

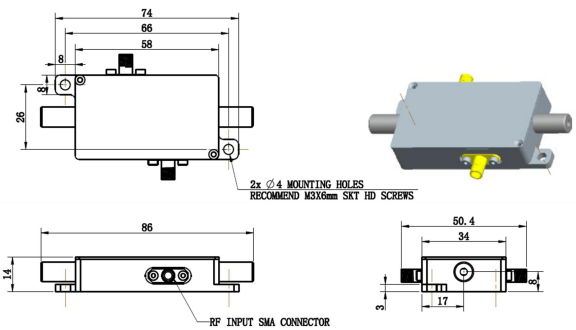
Center Frequency	Wavelength	Insertion Loss	Extinction Ratio	Frequency Shift Range
80 MHz	1550 nm	≤ 2.5 dB	≥ 45 dB	± 3 MHz

Housing dimensions(mm)：

A61



A91

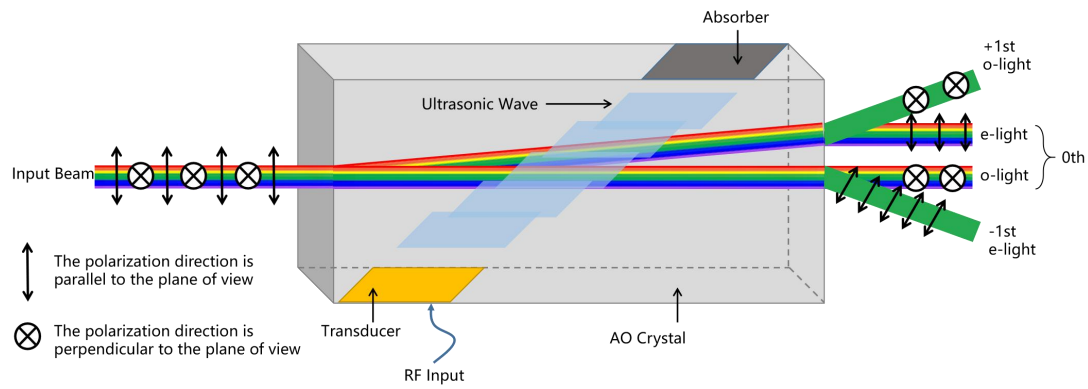


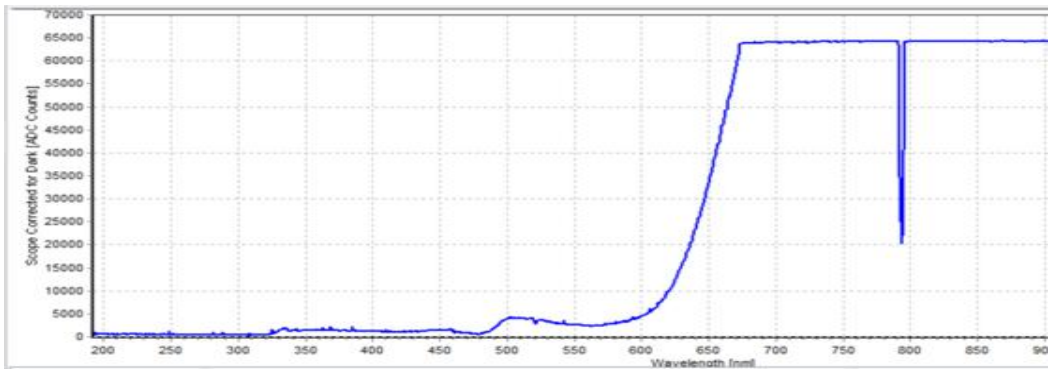
Acousto-optic tunable filters(AOTF) are used to pick and transmit a specific wavelength from a broadband or a multiline laser source efficiently. The transmitted wavelength of the narrow passband changes as the RF driver frequency changes. Compared with other types of filters, the primary advantage of acousto-optic tunable filters is its fast tuning speed. Wavelength tuning can be accomplished in tens of microseconds.

CATECH's acousto-optic tunable filters are fabricated using high quality TeO_2 crystals grown in-house. The products are suitable for a wide variety of wavelengths.

Applications

- **Laser wavelength tuning**
- **Wavelength selection**
- **Laser-microscope**
- **Laser imaging**
- **Spectroscopy**





Schematic diagram of AOTF

Acousto-Optic Tunable Filters Model Number：CATF-w-r-a-ms-f-c-h

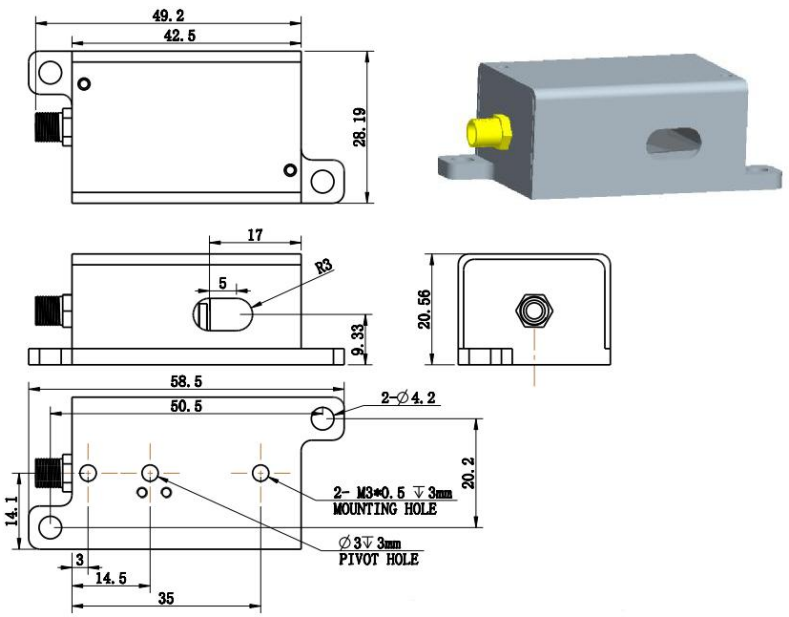
Wavelength (w)	Aperture (a)	Material (m)	Mode (t)	Resolution Bandwidth (f)	RF Connector (c)	Housing (h)
450~650 nm 640~1100 nm	015 (1.5 mm) 020 (2 mm) 025 (2.5 mm)	TE (TeO_2)	S (Shear)	10 nm	AF (SMA-F) AM (SMA-M) ...	B70 ...

Typical Specifications

Frequency	Wavelength	Transmission	Diffraction Efficiency	Bandwidth	VSWR
95 ~ 180 MHz	450 ~ 650 nm	≥ 97%	≥ 70%	≤ 12 nm	＜ 3.5:1
48 ~ 86 MHz	640 ~ 1100 nm	≥ 97%	≥ 70%	≤ 12 nm	＜ 3.5:1

Housing dimensions(mm):

B70

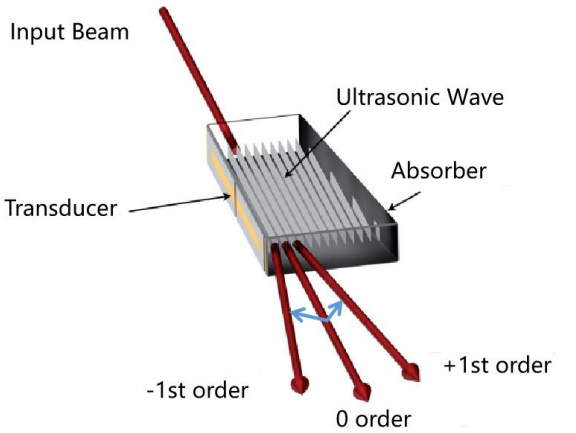


Acousto-optic deflectors (AODF) can provide precise spatial control of an optical beam by frequency tuning of RF driver.The response time within a hundred nanoseconds. It is designed based on the deflection of light when it travels through an diffraction grating created by acoustic wave optical propagating within the medium.

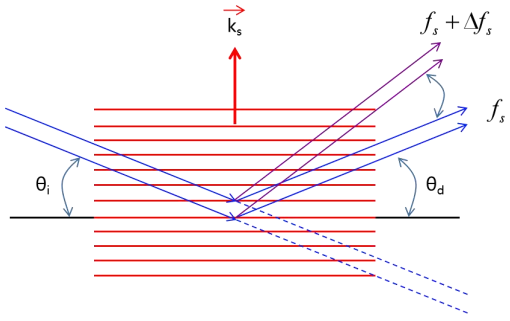
CASTECH's AODF adopts TeO_2 crystal as the acousto-optic medium. Benefited from our well known expertise in crystal growing and process technology. CASTECH promise the high performance of deflectors characterized with low insertion loss, high laser damage threshold, high consistency of power and diffraction efficiency across the full scan angle.

Applications

- **Laser display**
- **Micromachining**
- **Heterodyne interferometer**
- **Laser tweezers**
- **Optical inspection**



Scanning Angle: $\Delta\alpha_s = \frac{\lambda_0}{\lambda_s}\Delta f_s$



Schematic diagram of deflector

1D-Deflectors Model Number：CADF-f-r-a-mt-w-c-h

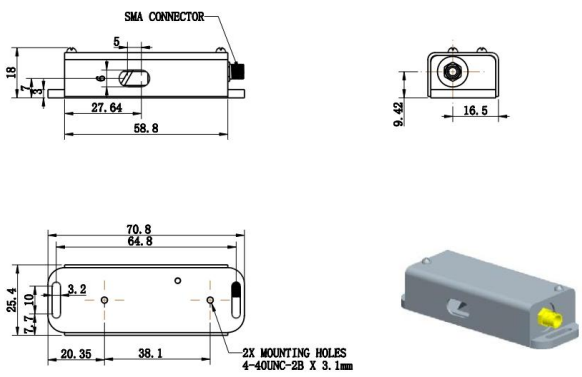
Center Frequency (f)	RF Range (r)	Aperture (a)	Material (m)	Mode (t)	Wavelength (w)	RF Connector (c)	Housing (h)
80 MHz 100 MHz 120 MHz 200 MHz ...	10 (±10 MHz) 15 (±15 MHz) 20 (±20 MHz) ...	005 (0.5 mm) 010 (1 mm) 020 (2 mm) 030 (3 mm)	TE (TeO_2)	C (Compressional) S (Shear)	1030~1064 nm 1066~1100 nm	AF (SMA-F) ...	A33 B18

Typical Specifications

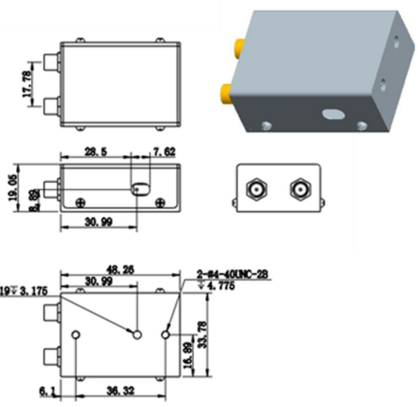
Operating Frequency	Active Aperture	Wavelength	Frequency Shift Bandwidth	Scanning Angle	Diffraction Efficiency	VSWR
80 MHz	0.5~2 mm	1064 nm	34 MHz	59.0 mrad	≥ 80%	< 3.5:1
90 MHz	0.5~3 mm	532 nm	10 MHz	8.7 mrad	≥ 80%	< 3.5:1
120 MHz	0.5~2 mm	1030 nm	30 MHz	50.4 mrad	≥ 80%	< 3.5:1
200 MHz	0.5~2 mm	1064 nm	30 MHz	52.1 mrad	≥ 70%	< 3.5:1

Housing dimensions(mm):

A33



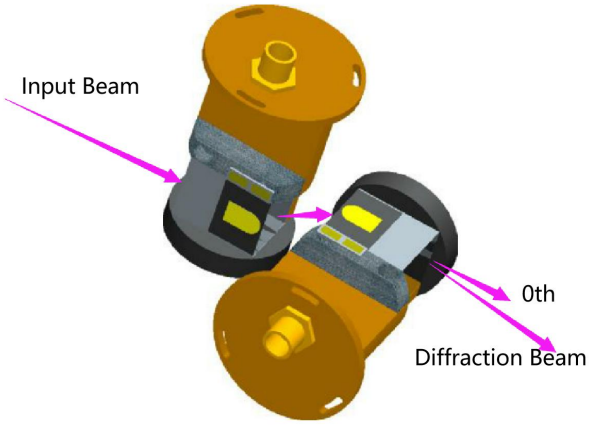
B18



Two-Dimensional Acousto-optic deflectors (2D-AODF) can extend the scanning range to two dimensions through a pair of orthogonal acousto-optic deflectors and implements light spot random leaping scan. It is widely used in multiphoton excitation scanning measurement and imaging, femtosecond laser storage and laser micromachining.

Applications

- Laser display
- Micromachining
- Heterodyne interferometer
- Laser tweezers



Schematic diagram of 2D-deflector

2D- Deflectors Model Number：CADFD-f-r-a-mt-w-c-h

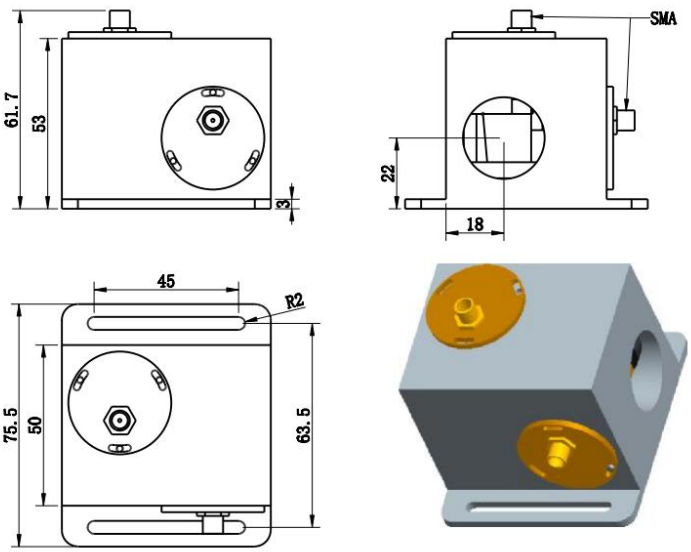
Center Frequency (f)	RF Range (r)	Aperture (a)	Material (m)	Mode (t)	Wavelength (w)	RF Connector (c)	Housing (h)
80 MHz 100 MHz ...	10 (±10 MHz) 15 (±15 MHz) 20 (±20 MHz) ...	005 (0.5 mm) 010 (1 mm) 020 (2 mm) 030 (3 mm)	TE (TeO_2)	C (Compressional) S (Shear)	1030~1064 nm 1066~1100 nm	AF (SMA-F) ...	B28

Typical Specifications

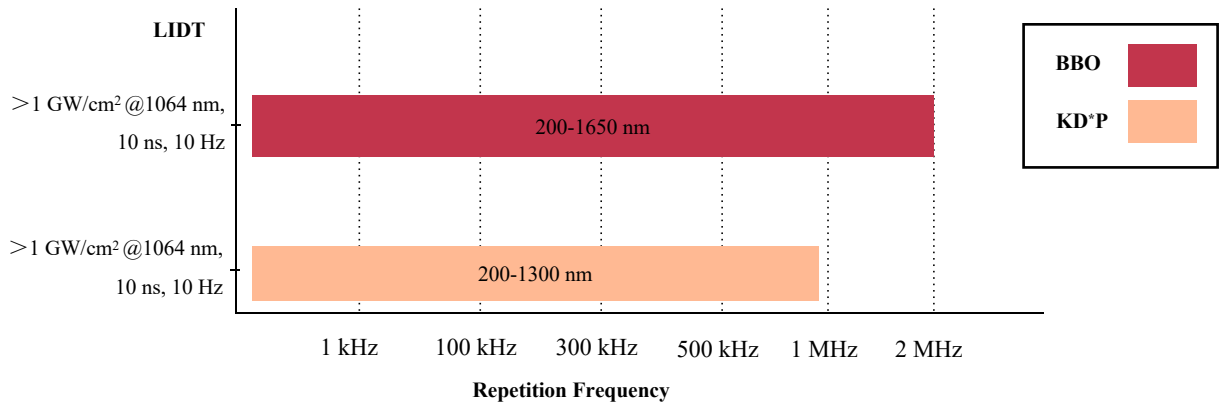
Operating Frequency	Active Aperture	Wavelength	Frequency Shift Bandwidth	Scanning Angle	Diffraction Efficiency	VSWR
100 MHz	5 * 5 mm	532nm	30 MHz	26.0 mrad	≥ 40%	＜ 3.5:1

Housing dimensions(mm):

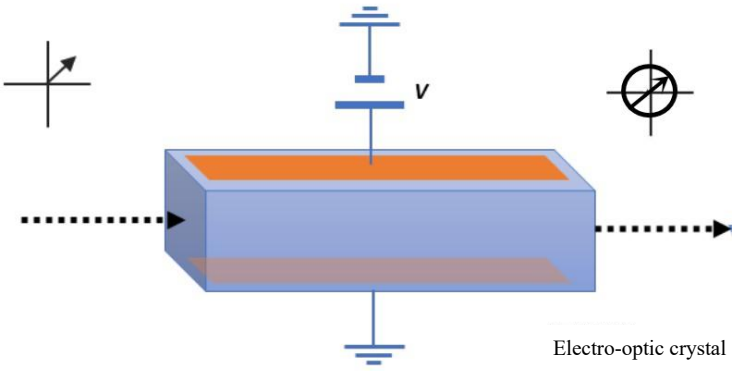
B28



Electro-Optic Devices



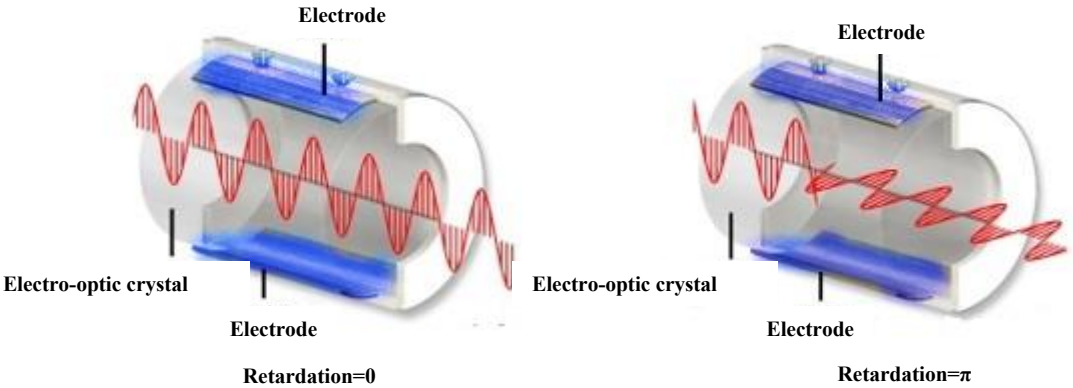
Electro-optical devices are made based on electro-optical effect, which generally refers to the Pockels effect, which means that the refractive index of a transparent medium (such as an electro-optical crystal) changes with the intensity of the electric field under the action of a constant or alternating electric field. The change of its refractive index is proportional to the magnitude of the applied electric field. It was first discovered by German physicist Friedrich Pockels in 1893 that when a driver applies a voltage to an electro-optic crystal, the optical axis of the crystal rotates directionally, and the refractive index changes immediately. Due to the different propagation velocities of light in the O and E directions inside the crystal, there is a certain phase difference between the two when they reach the same position. Therefore, the electro-optic crystal is equivalent to an optical wave plate with a variable phase retardation at this time, which can phase-modulate the polarized light incident inside it.



Schematic diagram of electro-optical device

In summary, we know that the electro-optic effect makes the electro-optic crystal an optical wave plate with variable phase retardation which can be continuously changed in theory, and some of the retardations have unique properties, such as 0, π/2, and π.

CASTECH can provide high-performance electro-optic Q switches based on BBO, KD*P and other materials. The product could achieve high-speed modulation up to frequency of 2MHz, meanwhile, withstand high laser power,which is widely used in high-power Q-switching, pulse picking, regenerative amplification and other systems.



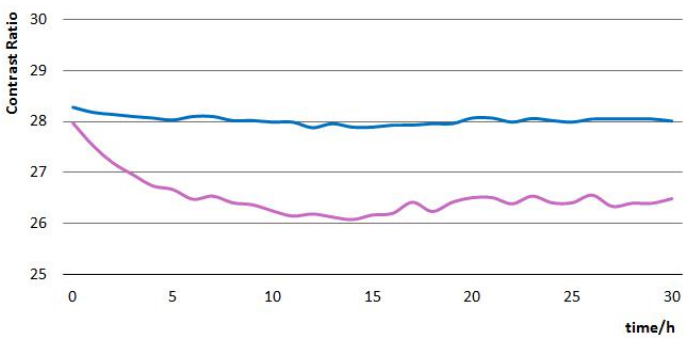
BBO Pockels cell is a laser device based on electro-optic effect. When a voltage is applied to the electro-optic crystal,the refractive index of the crystal will change and the phase difference caused by the birefringence of the polarized light transmitted along the optical axis will cause the change of polarization state after exiting. The working principle of the BBO Pockels cell is based on the transverse electro-optic effect, so the working voltage can be effectively reduced by changing the size of the BBO crystal.

CASTECH provides BBO Pockels cells in a range of configurations to adapt to different use conditions even unique and demanding applications. Due to its low ringing effect, repetition frequency of CASTECH's Pockels cell can go as high as 2 MHz, while by working with CASTECH' driver, its repetition frequency can reach up to 1 MHz.

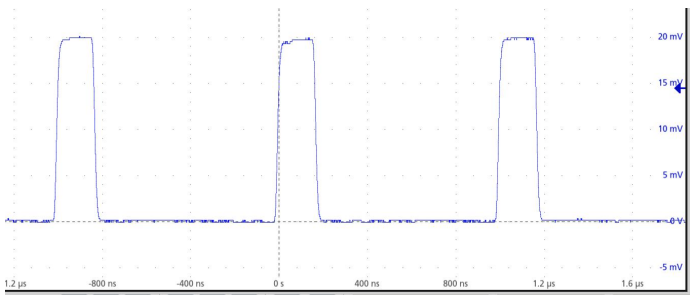
CASTECH also provides BBO Pockels cells with polarizers, wave plates and ceramic plates as requested.

Applications

- ●Q-switching
- ●Regenerative amplifier
- ●Pulse picker
- ●Cavity dumping
- ●High speed optical switch
- ●Beam chopper
- ● Optical power stabilizer



CASTECH products (blue)Contrast Ratio @1 MHz



Typical waveform @1 MHz

Pockels Cells Model Number：BPt-alq-b-w

Type(t)	Effective Clear Aperture(a)	Crystal Length(l)	Cascade type(q)	Optional Accessories(b)	Wavelength(w)
A (Square) C (Round) S (Special aperture)	3 (2.6 mm) 4 (3.6 mm) 5 (4.6 mm) 6 (5.6 mm) 7 (6.6 mm) 8 (7.6 mm) 10 (9.6 nm) 12 (11.6 nm) 114 (1*14 mm)* 214 (2*14 mm)* ...	A (20 mm) B (25 mm) C (16 mm) D (14 mm) ...	S (Single) D (Double) T (Triple) ...	C (Ceramic) L (Water Cooling) W (Wave plate) B (Brewster window) A (Brewster window & Wave plate) N (Nothing) ...	355 nm 532 nm 800 nm 1030 nm 1064 nm 1550 nm ...

***Only applicable to S (special aperture) type products**

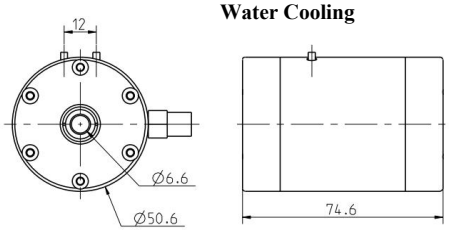
Typical Specifications*

Clear Aperture	Voltage Contrast Ratio（VCR） @1064 nm	Rise/Fall Time	Cascade Type	Cooling Method	Transmission @1064nm
3~6 mm	≥1200:1	＜10 ns	Single	Conduction Cooling	≥99%
3~6 mm	≥1000:1	＜10 ns	Double	Conduction Cooling	≥98.5%
7mm	≥500:1	＜20 ns	Double	Water Cooling	≥98.5%
8 mm	≥500:1	＜20 ns	Double	Water Cooling	≥98.5%
12 mm	≥400:1	＜20 ns	Double	Water Cooling	≥98.5%

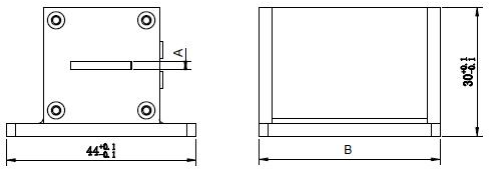
***Damage threshold:1GW/cm² @ 1064 nm, 10 ns & 50GW/cm² @ 1064 nm, 1 ps, & 200GW/cm² @ 1064 nm, 100 fs**

Housing dimensions(mm)：

Water Cooling

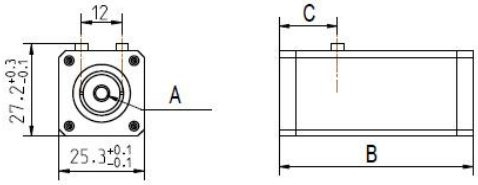


BPS

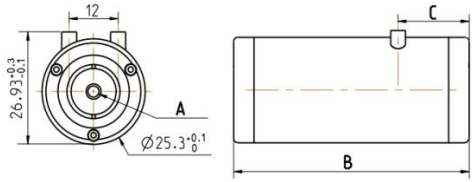


	3AS	3BS	4AS	4BS	3AD	4AD	6AD
A	2.6	2.6	3.6	3.6	2.6	3.6	5.6
B	35	40	35	40	57.7	57.7	57.7
C	17.5	20	17.5	20	17.4	17.4	17.4
λ/4 voltage @ 1064 nm	3.5kV	2.8kV	4.9kV	3.9kV	1.8kV	2.5kV	3.7kV

BPA



BPC



The KD*P Pockels cell is a laser modulation component based on the electro-optic effect of the DKDP crystal.The products can be divided into transverse electro-optical effect series and longitudinal electro-optical effect series.

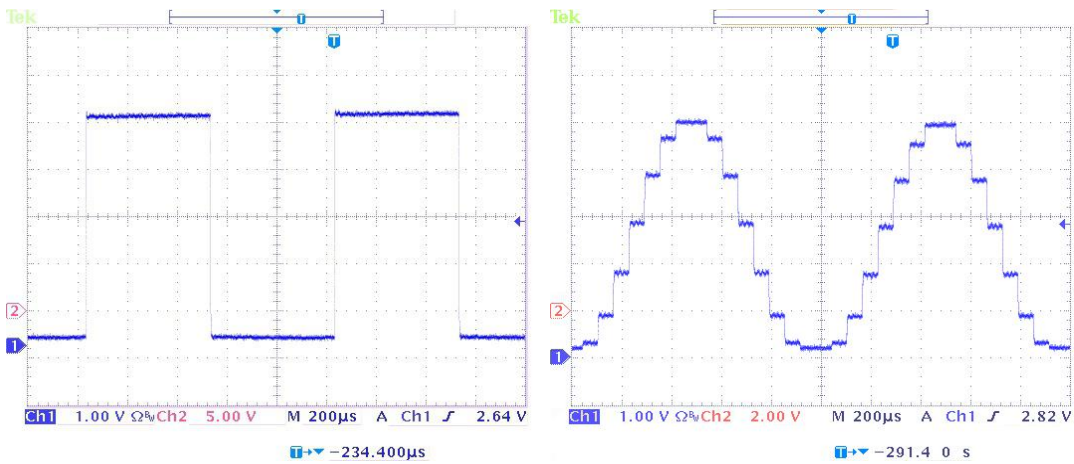
The products of the transverse electro-optical effect series utilize the transverse electro-optical effect of DKDP crystals when the light propagation direction is perpendicular to the electric field. By controlling the number and size of the crystals, the working voltage is effectively reduced to hundreds volt level, and the repetition frequency can reach up to 1 MHz.

The longitudinal electro-optical effect series products utilize the longitudinal electro-optical effect of the DKDP crystal when the propagation direction of light is parallel to the electric field. CASTECH's longitudinal KD*P Pockels cell has excellent optical uniformity, high extinction ratio, and high transmittance.

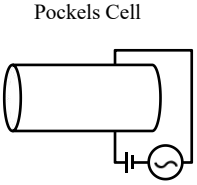
CASTECH can provide a series of products with BNC connectors, as well as accessories such as polarizers, wave plates and ceramic plates, to facilitate impedance matching.

Applications

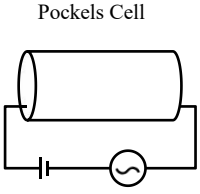
●Q-switching ●Regenerative amplifier ●Pulse picker ●Cavity dumping ●Beam chopper ●High speed optical switch ●Optical power stabilizer



Typical modulation waveform of transverse electrode configuration



Schematic diagram of transverse electrode configuration



Schematic diagram of longitudinal electrode configuration

Longitudinal Electro-Optical Type Model Number：DPC-taq-c-b-w

Type(t)	Clear Aperture(a)	Type(q)	Cascade Type(c)	Optional Accessories(b)	Wavelength(w)
L (Longitudinal Electrode Configuration)	6(6 mm) 7(7 mm) 8(8 mm) 10(10 mm) 12(12 mm) 15(15 mm) ...	S (Single) D (Double) ...	P (Pin) W (Wire) ...	C (Ceramic) W (Wave plate) B (Brewster window) A (Brewster window) & Wave plate) N (None) ...	355 nm 532 nm 1030 nm 1064 nm ...

Transverse Electro-Optical Type Model Number：DPt-alq-b-w

Type(t)	Clear Aperture(a)	Crystal Length(l)	Cascade Type(q)	Optional Accessories(b)	Wavelength(w)
T (Low Repetition Frequency) H (High Repetition Frequency)	3(3 mm) 4(4 mm) 5(5 mm) 6(6 mm) 7(7 mm) 8(8 mm) 10(10 mm) ...	A (20 mm) B (25 mm) C (40 mm) ...	D (Double) Q (Four) ...	W (Wave plate) B (Polarizer) A (Brewster window) & Wave plate) N (None) ...	355 nm 405 nm 532 nm 1030 nm 1064 nm ...

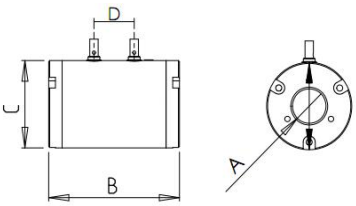
Typical Specifications*

Type	Clear Aperture	Voltage Contrast Ratio @1064 nm	Rise/Fall Time	Cascade Type	Transmission @1064 nm
Longitudinal	6~15 mm	≥1000:1	＜20 ns	Single	≥98.5%
Transverse	3~10 mm	≥500:1	＜20 ns	Double	≥98%

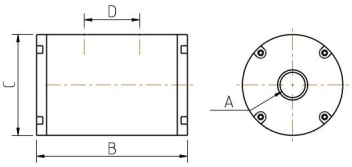
***Damage threshold: 10 J/cm² @ 1064 nm, 10 ns**

Housing dimensions(mm)：

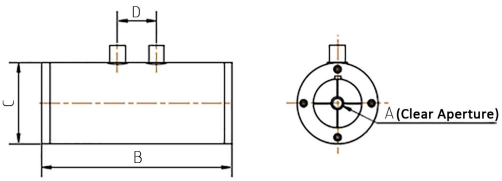
Type L



Type T

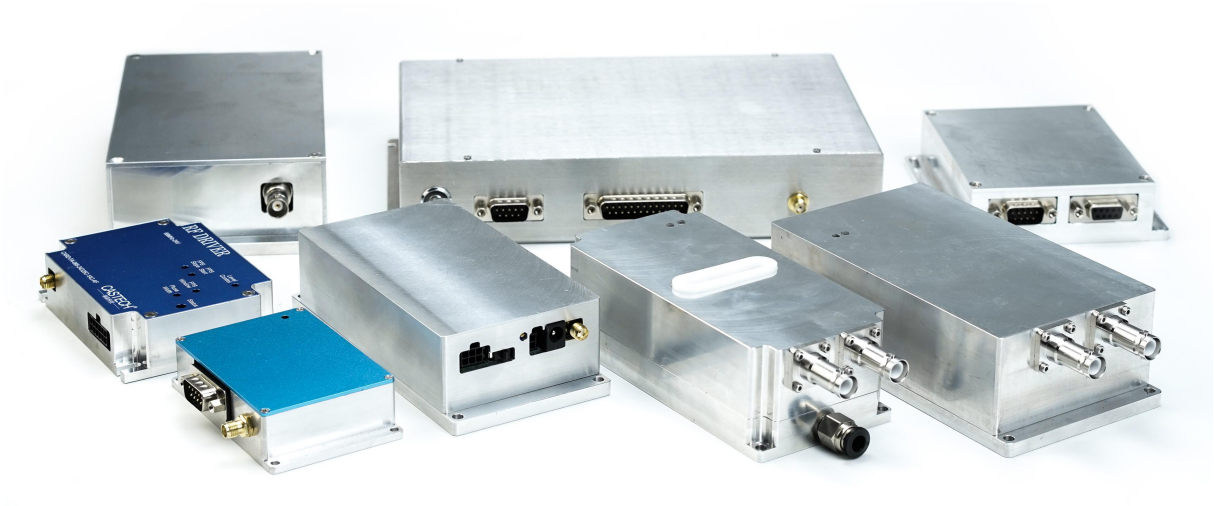


Type H

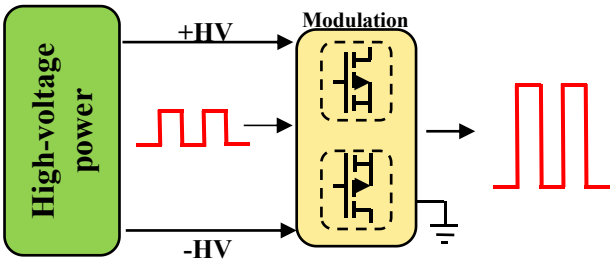


	L8S	L10S	L12S	L15S	3BD(H)	5BD(H)	10AD(T)
A	8	10	12	15	3	5	10
B	28	39	44	44	70	66	60
C	19	25.4	25.4	30	40	50	40
D	10	12	15	15	22	24	22
λ/4 voltage @ 1064 nm	3.5kV	3.5kV	3.5kV	3.5kV	0.6kV	1.0kV	2.1kV

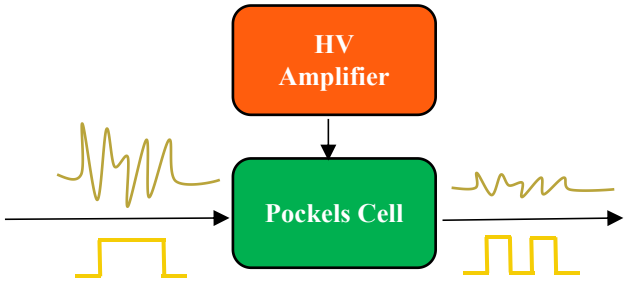
Drivers



Pockels cell driver is composed of a high-voltage power source and a modulation circuit. Through external control signals, the high-voltage tube array is triggered to generate high-voltage pulses. The voltage difference applied to the Pockels cell causes electro-optical effect. The rise/fall time of high voltage pulses are less than 10ns, which is applicable to Q-switching, pulse selection systems and etc. Optical switch, optical power attenuation, and optical power stabilization can also be achieved by changing the voltage (output power).

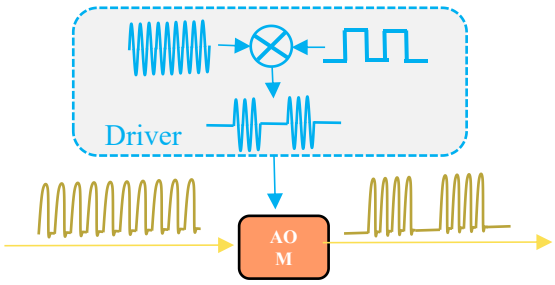


Schematic diagram of Pockels cell driver

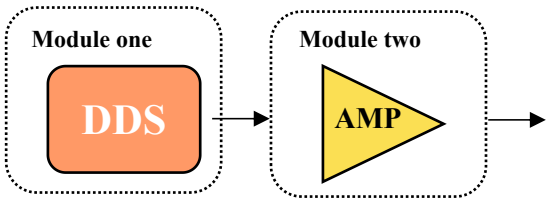


Schematic diagram of electro-optical noise reduction/optical switch

RF driver consists of RF source, RF switch and RF amplifier, it is mainly applied to drive the acousto-optic device. Users can change the control mode of the RF switch according to actual needs to achieve different RF output effects. Control methods include digital control, analog control and first pulse suppression, etc. RF driver can be applied to different application scenarios, according to different control modes. RF driver produced by CASTECH is optimized to match with our acosto-optic device products to achieve its best performance.

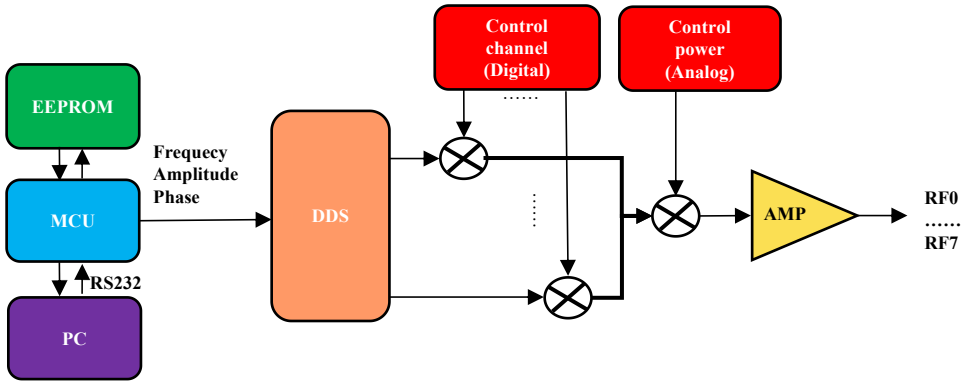


Schematic diagram of RF driver



Schematic diagram of RF source amplifier

CASTECH can provide variable-frequency RF drivers, which adapt to acousto-optic frequency shifters, deflectors, filters according to different applications. Users can control various functions through the host computer software according to their needs. CASTECH can also customize high-precision, high-stability radio frequency source DDS and amplifier modules to support our customers.



Schematic diagram of varable-frequency RF driver

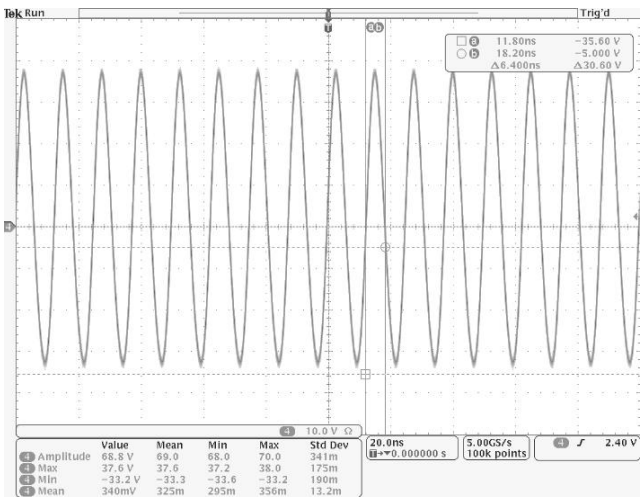
RF Drivers

RF drivers can generate RF signals at fixed or variable-frequencies. Specified waveforms could be produced by different modulated signals to meet the requirements of different acousto-optic components and determine how much an optical beam is modulated, deflected, or tuned. CASTECH's RF drivers are able to generate RF signal at 27.12MHz, 40.68MHz, 68MHz, 80MHz, 100MHz, 120MHz, 200MHz, 250MHz, 300MHz and even higher, with RF power up to 120W. A variety of operating modes are available including FPS, PPK, R05 and A05 (Analog).

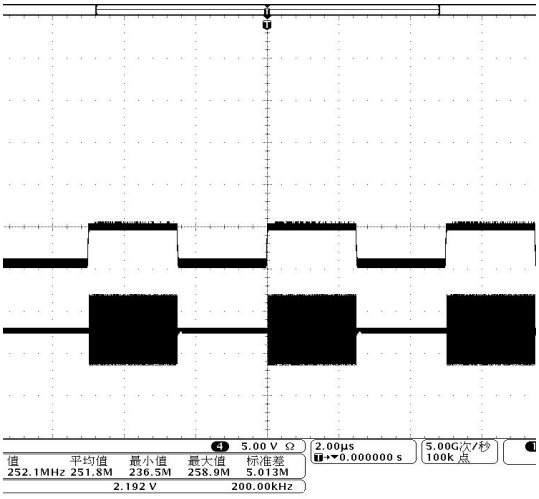
Acousto-optic variable-frequency series drive of frequency shifter, deflector and filter, can output RF signal with high precision and broad frequency range, and support digital control, analog control, *etc.* PC softwares are equipped, with which users can set the frequency and power at will. The frequency sweeping and other functions can also be set (TA series). For high-speed frequency conversion applications, it is capable of fast frequency switching(TB series).

Applications

- **Matching acousto-optic components**



RF Output Waveform



Modulation Waveform

Fixed-Frequency Series Model Number：CARD-as-f-vpt-bme-c

Series(as)	RF(f)	Supply Voltage(v)	Output Power(p)	Cooling(t)	Channel(b)	Mode(m)	Function(e)	RF Connector(c)
FA (Fixed-frequency series A)	40.68 MHz 68 MHz 80 MHz	15D (15 VDC) 24D (24 VDC)	20 W 25 W	C (Conduction-Cooled)	1	F (FPS) P (PPK) A (A05) R (R05) M (M05)	C (Common) H (TTL_HIGH = RF on) L (TTL_HIGH = RF off)	AF (SMA-F)
FD (Fixed-frequency series D)	40.68 MHz 68 MHz 80 MHz 100 MHz 110 MHz 120 MHz ...	12D (12 VDC) 15D (15 VDC) 24D (24 VDC)	5W 20W 40W	C (Conduction-Cooled) A (Air-Cooled) W (Water-Cooled)	1	F (FPS) A (A05) D (Digital)		
FB (Fixed-frequency series B)	27.12 MHz 40.68 MHz 68 MHz 80 MHz	24D (24 VDC) 28D (28 VDC)	50W 100W	C (Conduction-Cooled) A (Air-Cooled) W (Water-Cooled)	1, 2	F (FPS) A (A05) D (Digital)		NF (BNC-F)
FE (Fixed-frequency series E)	200 MHz 250 MHz 300 MHz ...	24D (24 VDC)	2.5 W	C (Conduction-Cooled)	1	D (Digital) A (A05)* DA (Digital+Analog)		AF (SMA-F)

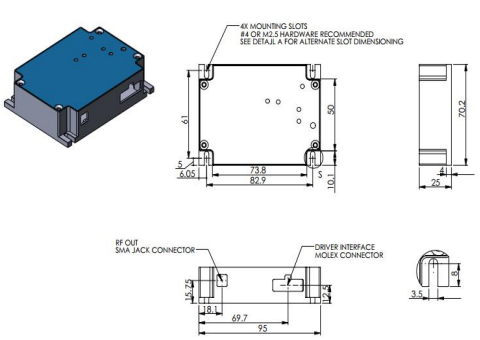
***Analog control voltage can be requested：A5：0-5 V，A1：0-1 V**

Typical Specifications

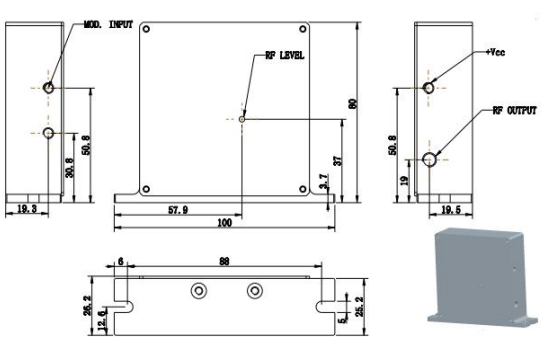
Working Frequency	Maximum RF Power	Rise/Fall time
27.12 MHz	100 W	<150 ns
40.68/68/80 MHz	15/20/25 W	<35 ns
200/250 MHz	2.5 W	<6 ns

Housing dimensions(mm)：

FA Series



FE Series



Variable-Frequency Series Model Number：CARD-as-f-vpt-bme-c

Series(as)	RF(f)	Supply Power(v)	Output Power(p)	Cooling(t)	Channel(b)	Mode(m)	Function(e)	RF Connector(c)
TA (Variable-frequency series A)	60~120 MHz ...	24D (24 VDC)	0.5~4 W	C (Conduction-Cooled)	1	Programmable frequency	C (Common) ...	AF (SMA-F) AM (SMA-M)
TB （Variable-frequency series B）	70~120 MHz ...	24D (24 VDC)	0.5~4 W	C (Conduction-Cooled)	1	A (A05)* D (Digital)	Px (channel)	AF (SMA-F)
TE (Variable-frequency series E)	70~120 MHz	24D (24 VDC)	0.5~4 W	C (Conduction-Cooled)	1	Voltage control 0~10V D (Digital)	C (Common) ...	AF (SMA-F) CF (SMC-F)

***Analog control voltage can be requested：A10：0-10 V，A5：0-5 V，A1：0-1 V**

Typical Specifications

Working Frequency	RF Power*	Working Mode***	Switching Speed
60~120 MHz	4 W	Programmable frequency**	~us
70~120 MHz	4 W	Voltage control 0~10 V, Digital**	~50ns

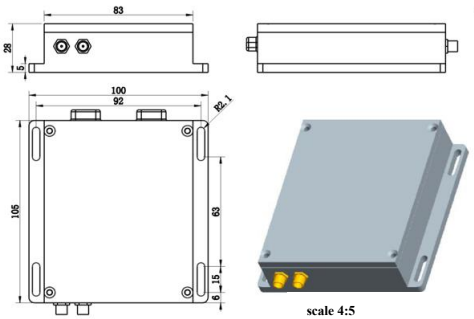
***The output power of the product is matched according to the load**

**** Supporting related host computer software and control instruction set**

*****Special control methods can be customized**

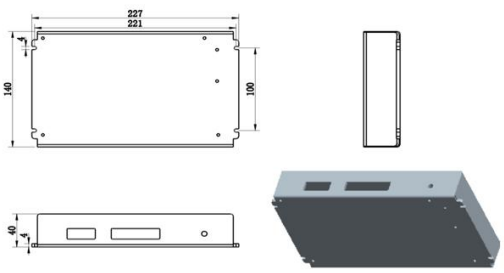
Housing dimensions(mm)：

TA Series



scale 4:5

TB Series

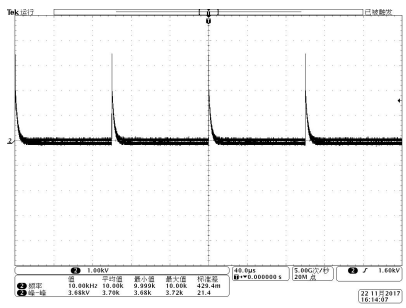


scale 2:5

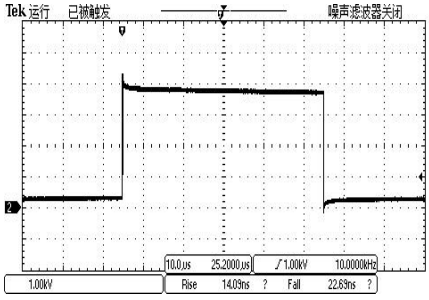
CASTECH provides drivers to complement our Pockels cell series. When receiving a certain frequency trigger signal, **Pockels cell driver** will generate a high voltage with same frequency. By working with a signal generator, the driver is suitable for industrial integration, and can also be controlled by computer (USB to RS-232), which is convenient for scientific research institutes and industrial users to operate intelligently. CASTECH's Pockels cells driver is compatible with the KD*P Pockels cells at low repetition frequency and the BBO Pockels cells at high repetition frequency(~1MHz),the minimum pulse width can reach ~20 ns (PCDH series). The waveform can be positive, negative, and square. CASTECH provides customized services.

Applications

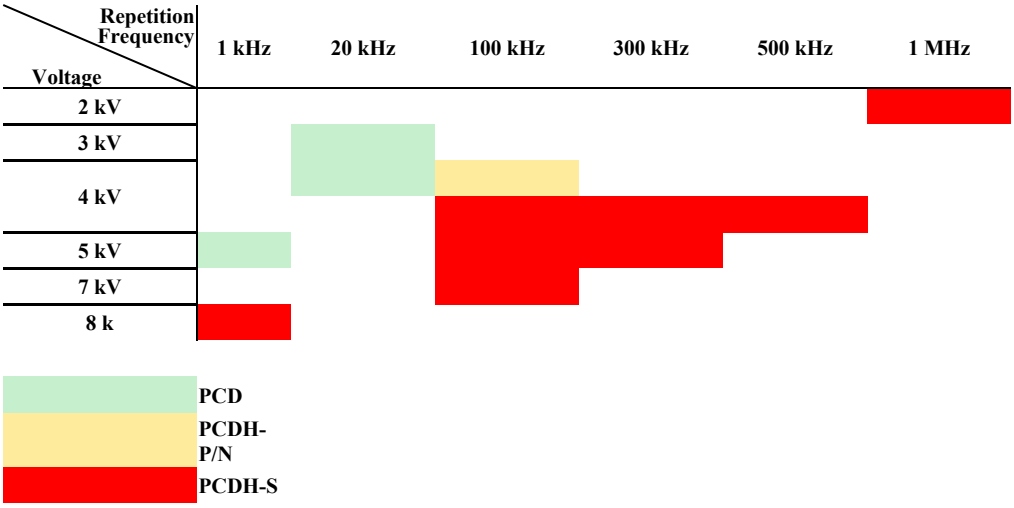
●BBO Pockels cell ●KD*P Pockels cell ●Pulse picker



Typical positive waveform



Typical square waveform



Correspondence diagram of maximum voltage and maximum repetition frequency

Integrated Driver Model Number：PCD-m-f-t-h

Working Mode(m)	Maximum Voltage(v)	Maximum Repetition Frequency(f)	Trigger Mode(t)	Control Mode(c)
S (Square)	5 (5 kV)	1 (1 kHz)	E (External)	N (None) R (USB to RS-232)
	4 (4 kV)	20 (20 kHz)		

Split Driver Model Number：PCDH-mv-f-t-h

Working Mode(m)	Maximum Voltage(v)	Maximum Frequency(f)	Trigger Mode(t)	Control Mode(c)
P (Positive) N (Negative) S (Square)	2 (2 kV)	1000 (1000 kHz)	E (External)	N (None)
	4 (4 kV)	100 (100 kHz)* 500 (500 kHz)		
	7 (7 kV)	100 (100 kHz)		
	8 (8 kV)	1 (1 kHz)		

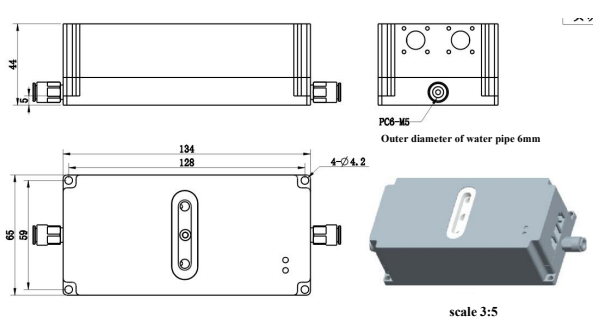
*** Only applicable to positiver/negative mode**

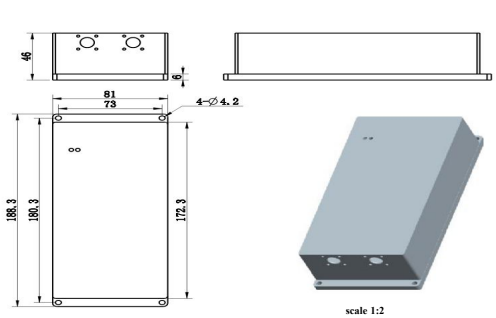
Typical Specifications

Working Mode	Pulse Amplitude	Maximum Frequency	Pulse Width	High Voltage Source	Rise Time	Fall Time
Square		20 kHz	200 ns~DC	Build-in	**≤10 ns**	**≤10 ns**
Positive	4 kV	100 kHz	-	External	**≤10 ns**	-
Negative	4 kV	100 kHz	-	External	-	**≤10 ns**
Square	4 kV	500 kHz	25 ns~10 μs	External	**≤10 ns**	**≤10 ns**
Square	5 kV	300 kHz	25 ns~10 μs	External	**≤10 ns**	**≤10 ns**
Square	8 kV	1 kHz	35 ns~10 μs	External	**≤20 ns**	**≤20 ns**

Housing dimensions(mm):

PCDH series





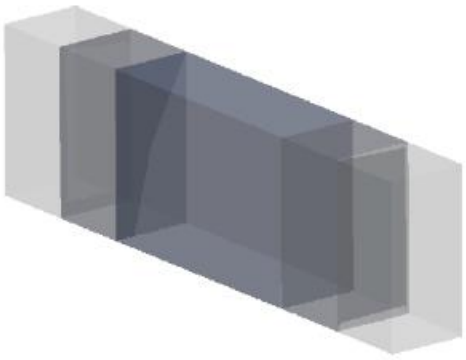
Photoelastic modulators

55 ● Photoelastic modulators

Photoelastic modulator (PEM) is a modulation device based on the birefringence effect and the photoelastic effect, which can change the polarization state of the transmitted light beam.

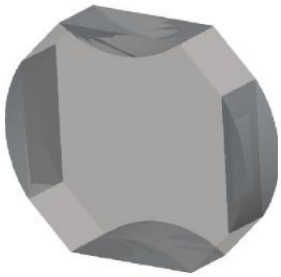
Photoelastic effect refers to the change of optical properties (refractive index) of the medium happens when elastic stress or strain exists in the medium, thus affecting the propagation characteristics of light. Photoelastic modulators are usually composed of piezoelectric elements and optical elements. The inverse piezoelectric effect of the piezoelectric material is applied to generate the periodic sinusoidal driving voltage that causes the vibration of piezoelectric element. The ultrasonic wave generated by the crystal transmits through the optical medium, which causes the vibration of the optical element, periodically changes the refractive index of the optical element, and makes its retardation change periodically. The photoelastic modulator in the working state has the same effect as a dynamic wave plate, and its representative maximum retardation is λ/4 and λ/2.

Photoelastic modulators can be divided into two categories: one-dimensional and two-dimensional. The photoelastic effect of one-dimensional photoelastic modulators only occurs in a certain linear direction:



Vibration diagram of one-dimensional photoelastic modulator

Two-dimensional photoelastic modulator has two vibration directions perpendicular to each other,thus can obtain larger phase retardation than one-dimensional type.



Vibration diagram of two-dimensional photoelastic modulator

Photoelastic modulator is applied for changing the polarization state of light, and make the transmitted light have a dynamic phase retardation. The light-passing part of the device is made of isotropic material, which periodically vibrates at an inherent resonant frequency. The refractive index of the optical material will change periodically due to the photoelastic effect, which changes the phase retardation of the incident light. CASTECH's photoelastic modulator has the advantages of wide receiving angle, large clear aperture, wide wavelength range, high modulation frequency and high precision.

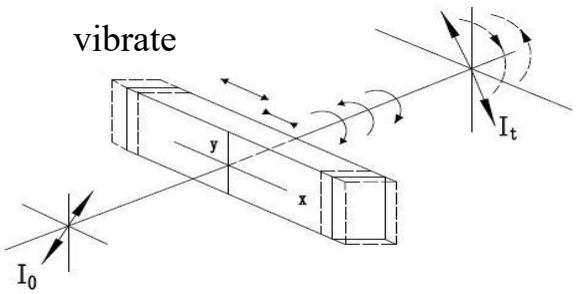
According to the working mode, photoelastic modulators can be divided into two categories: one-dimensional and two-dimensional.

The one-dimensional photoelastic modulator has only one vibration dimension and is applicable for ultraviolet, visible and near-infrared wavebands.

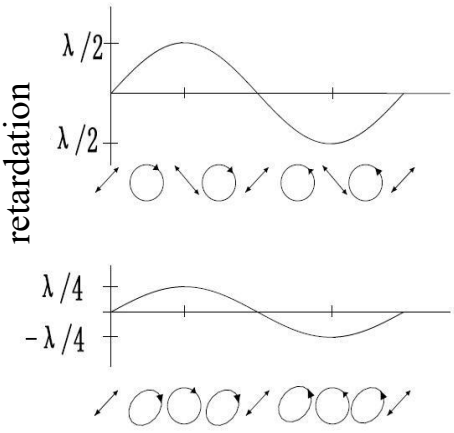
The two-dimensional photoelastic modulator has two vibration dimensions, can achieve a larger range of phase modulation, and is mainly used in visible and infrared wavebands.

Applications

- **Polarization measurement**
- **Quantum sensing**
- **Spectrometer**
- **Astronomical observation**
- **Magnetometer**



Photoelastic principle



Phase retardation

Model Number：CPEM-f-a-m-t-h

Frequency (f)	Clear aperture (a)	Material (m)	Type (t)	Housing (h)
50(50kHz) 60(60kHz) 84(84kHz) ...	13(13mm) 14(14mm) 16(16mm) 22(22mm) ...	FS (fused silica) CF (calcium fluoride) ZS (zinc selenide) ...	1 (One-dimensional) 2 (Two-dimensional)	A01 A02 A03 A04 ...

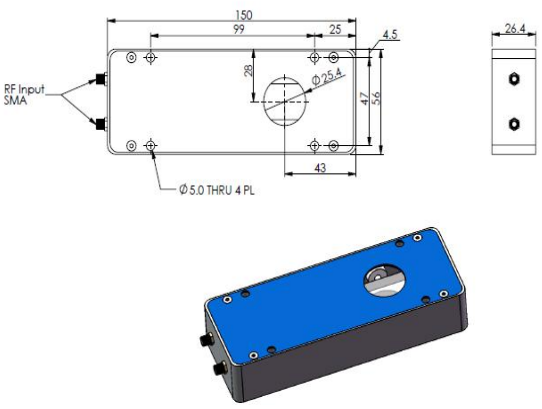
Typical Specifications*

Frequency	Type	Maximum Clear Aperture	Transmission	Acceptance Angle
50kHz	One-dimensional	16mm	≥98%	20°
60kHz	One-dimensional	13mm	≥98%	20°
50kHz	Two-dimensional	22mm	≥98%	20°
60kHz	Two-dimensional	13mm	≥98%	20°

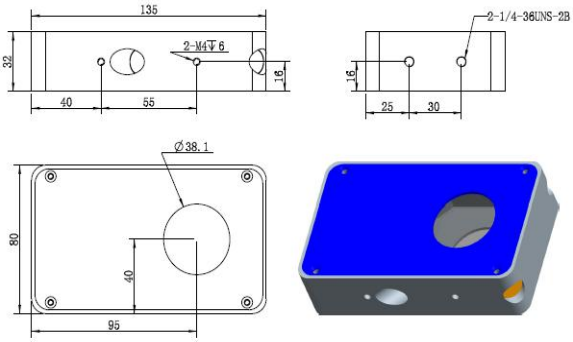
***Wavelengths range 532-1100nm**

Housing dimensions(mm)：

A01



A02



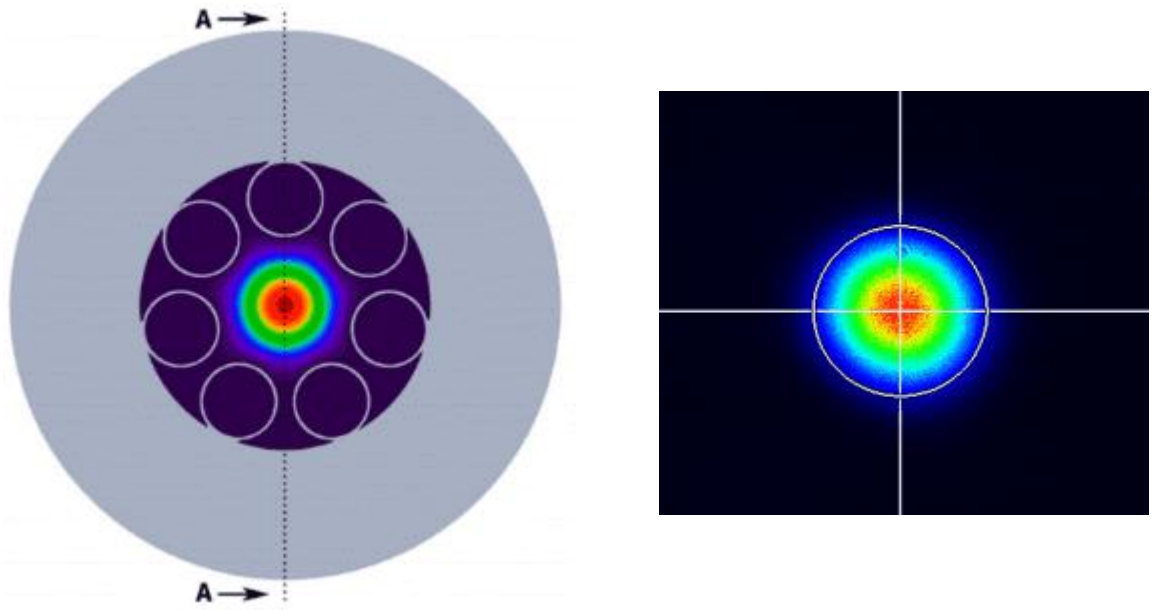
Optical Fiber Transmission Devices

Hollow-core photonic crystal fibers can guide light through air rather than through glass, so they have advantages over traditional optical fibers and may eventually take the place of traditional optical fibers. Hollow core photonic crystal fiber has high damage threshold, low loss, supports broadband transmission, and can effectively modulate fiber dispersion and nonlinear effects by changing the inflatable body of the fiber core or adjusting the air pressure. It shows outstanding advantages in research fields such as strong field physics, super laser technology, etc.

The packaging process developed by CASTECH can provide hollow core photonic crystal fiber optic cables with high-reliability. Tailor-made design and processing according to the customers' requirements are also available.

Applications

- **Industrial processing**
- **Medical surgery**
- **Scientific research**
- **Bioimaging**



Hollow core photonic fiber structure and output beam profile

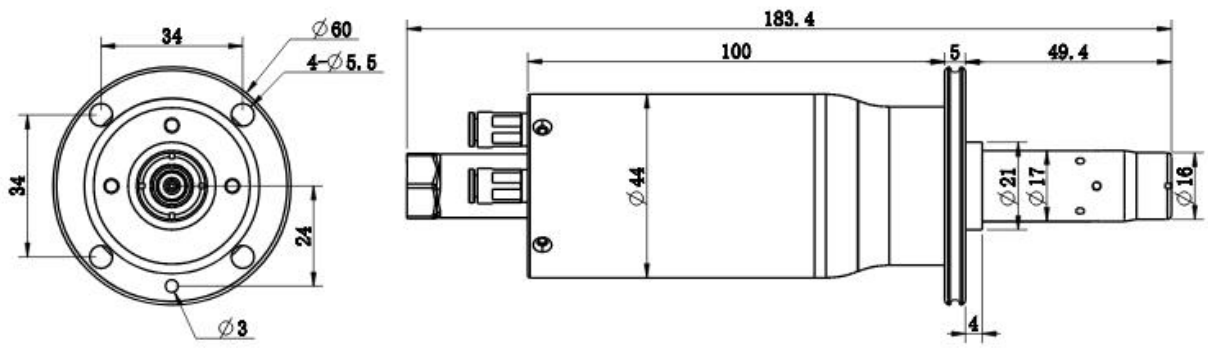
Ultra-Fast Optical Fiber Transmission Cable Model Number：LLC-t-w-l-a

Type(t)	Wavelength(w)	Fiber Length（l）	Fiber Type(a)
N （Without fiber break monitoring） M （With fiber break monitoring）	980 nm 1030 nm 1064 nm ...	2 m 3 m 5 m ...	HC30-250 HC45-250 ...

Typical Specifications

Wavelength	Fiber Length	Max. Pulse Energy	Max. Power	Transfer Efficiency	Max. air Pressure
1030 nm	2~5 m	500 μj	500 W	90%	5 bar

Housing dimensions(mm)：



The fiber collimator is an important component of laser devices such as isolators and circulators. It is formed by precisely aligned the optical fiber and the focusing lens. It can not only collimate the beam output from the optical fiber but also couple the collimated beam into the optical fiber.

According to the output mode, the collimator can be categorised into two types: non-expanded beam collimator and expanded beam collimator.

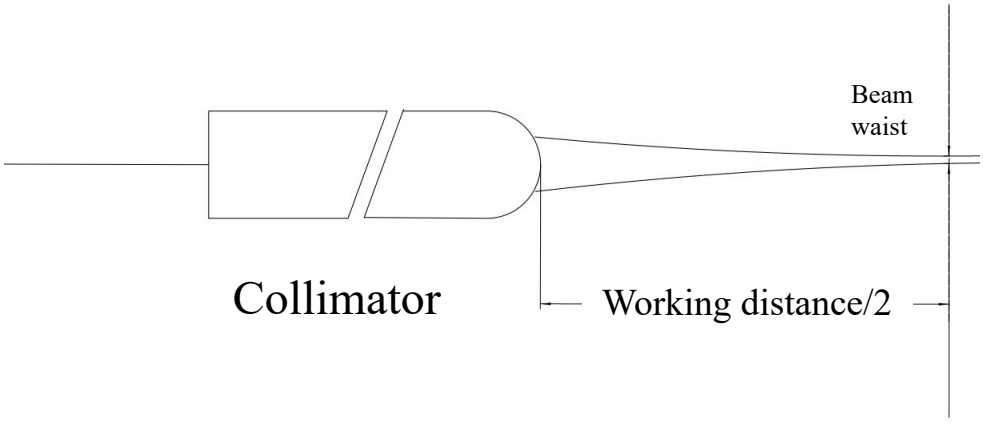
The non-expanded beam collimator, composed of an optical fiber and a focusing lens, is usually used for beam collimation or coupling in fiber laser systems, has the advantages of simple structure and light weight. Non-expanded beam collimators can be divided into conventional type and direct fusion type. The direct fusion type directly fuses the optical fiber and lens (made of fused silica). Compared with the conventional collimator, it has higher reliability and can withstand higher power laser.

The expanded beam collimator is composed of an optical fiber, a focusing lens and a beam expander. The output beam has a small divergence angle and is usually used in a large spot output system.

The collimator provided by CASTECH can choose active fiber, passive fiber, polarization-maintaining fiber, and non-polarization-maintaining fiber. The wavelength range is 980~2000 nm. It adopts high-quality optical components and a simple and reliable mechanical structure, and has small divergence angle, long working distance, high damage, *etc.* Various specifications of QCS connectors, special parameter requirements can also be customized according to customers' needs.

Applications

- **Optics coupling**
- **Light source-fiber coupling output**



Shematic diagram of non-expanded beam collimator structure

Collimator Model Number：HPCOL-t-p-f-λ-e-b-h

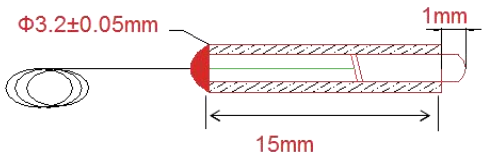
Type(t)	Power(p)	Fiber Type (f)		Wave Length (λ)	Pigtail Diameter (e)	Output Spot (b)	Housing (h)
N (None-expanded) E (expanded)	30 (≤30 W) 50 (≤50 W) 100 (≤100 W) 200 (≤200 W) 300 (≤300 W) 500 (≤500 W)	Non-polarity-maintaining	1 (10/125SCF) 2 (20/130DCF) 3 (20/250DCF) 4 (30/250DCF) 5 (20/120SCF) ...	980 nm 1030 nm 1064 nm ...	L (900 μm Loose tube) C (6 mm Armored tube) E (8 mm Armored tube)	04 (0.4 mm) 05 (0.5 mm) 1 (1 mm) 2 (2 mm) 5 (5 mm) 6 (6 mm) ...	A01 A02 ...
		polarity-maintaining	P1 (PM 980) P2 (PM10/125SCF) P3 (PM20/130DCF) P4 (PM30/250DCF) P5 (PM 1550) ...				

Typical Specifications

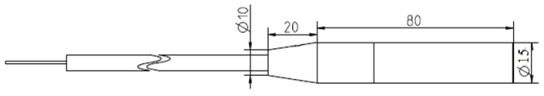
Withstand Power	Wavelength	Diameter of Output Beam	Divergence Angle	Return Loss
20 W	1064 nm	0.3~0.4 mm	3.5 mrad	≥50 dB
50 W	1064 nm	1 mm	3.5 mrad	≥50 dB
100 W	1080 nm	3.5 mm	3.5 mrad	≥50 dB

Housing dimensions(mm)：

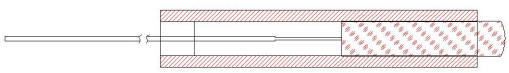
Non-expanded, power≤30 W



Expanded, power≤200 W



Direct fusion collimator, power ≤100 W

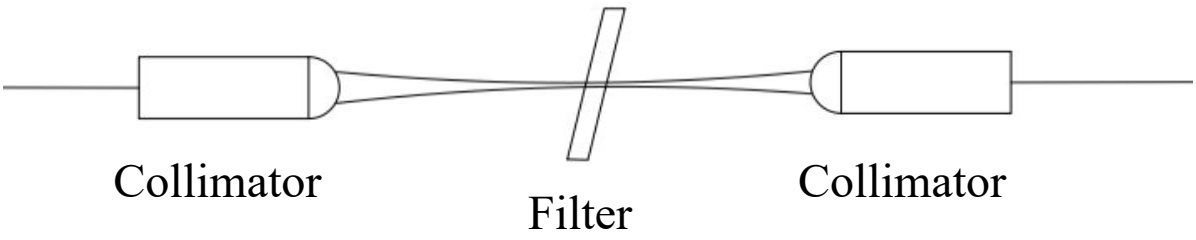


Band-pass filter is a passive device that passes the wavelength within a certain range and attenuates wavelengths outside the range.

The band-pass filters produced by CASTECH are divided into polarization-maintaining type and non-polarization-maintaining type. There is an extremely flat passband without amplification or attenuation, and the waves outside the passband are attenuated within a certain range. Based on the thin film filter technology, the band-pass filters have the characteristics of high isolation and low insertion loss.

Applications

- **Fiber laser**
- **Fiber optic sensing**
- **ASE spectrum control**
- **Fiber grating application**



Schematic diagram of bandpass filter

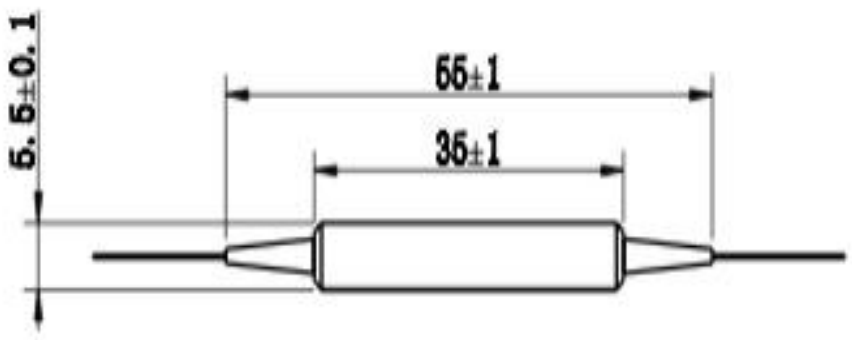
Filter Model Number：CBPF-w-f-b-l-h

Wave Length(w)	Passband Bandwidth(f)	Fiber Type(b)		Pigtail Length(l)	Housing(h)
980 nm 1030 nm 1064 nm 1550 nm ...	2 nm 5 nm 9 nm ...	Non-Polarization-Maintaining	1 (Hi1060) 2 (SMF-28e) 3 (10/125) ...	80 (800 mm) 100 (1 m) 150 (1.5 m) …	A01 A02 A03 …
		Polarization-Maintaining	P1 (PM980) P2 (PM1550) ...		

Typical Specifications

Center Wavelength	Passband Bandwidth(0.5 dB)	Cut-off Bandwidth (25 dB)	Insertion Loss	Withstand Power
1064 nm	2nm，8nm，25nm	12nm，22nm，50nm	1.2 dB	300 mW
1550 nm	2nm，8nm，25nm	12nm，22nm，50nm	0.8 dB	300 mW

Housing dimensions(mm)：



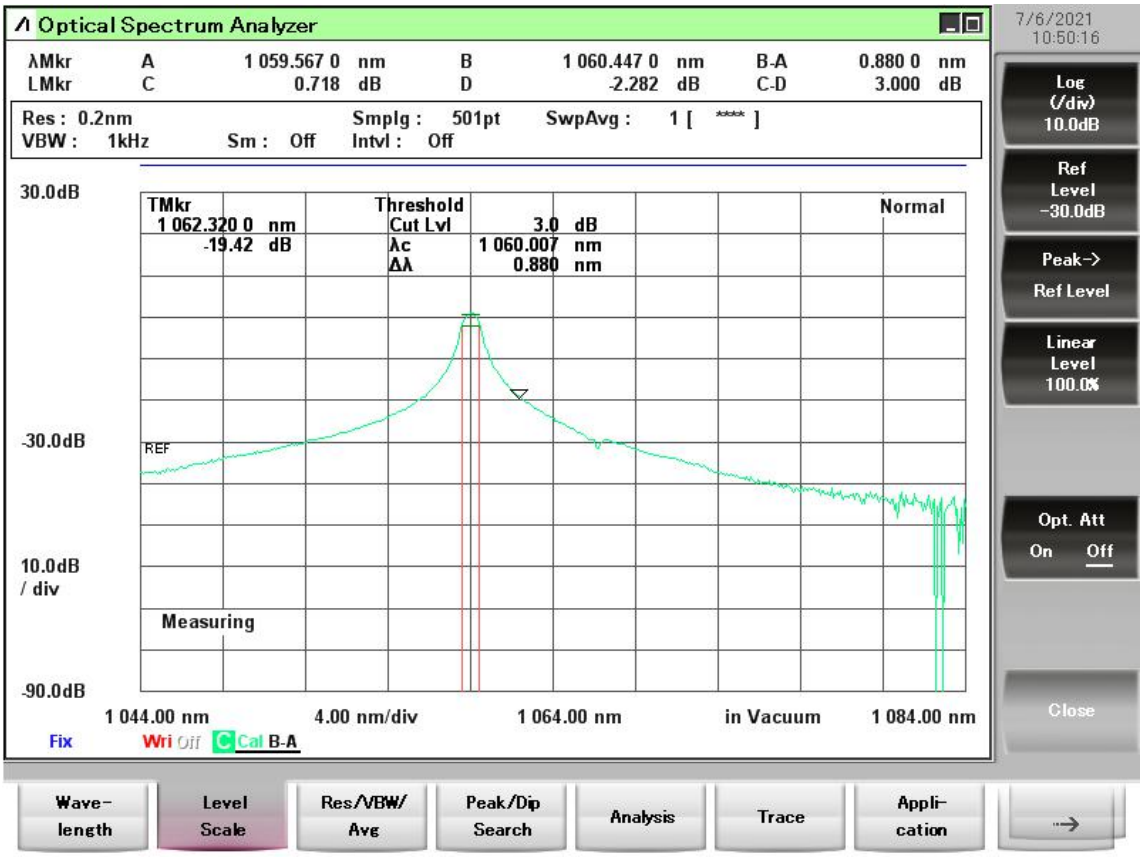
Fixed bandpass filter

Tunable filter is a wavelength selection device which has a wide range of applications in the field of optical fiber communication and optical fiber sensing. It can be used in semiconductor laser, fiber laser reflector, multiplexing devices, optical amplifier, wavelength selectors, wavelength converters, dispersion compensators and so on.

The tunable filters produced by CASTECH has the characteristics of wide tuning range, narrow bandwidth, small insertion loss and high stability. In order to meet various special applications, CASTECH provides customized products according to requirements.

Applications

- **Fiber Laser**
- **Fiber optic sensing**
- **ASE spectrum control**
- **Fiber grating application**



Measured line width

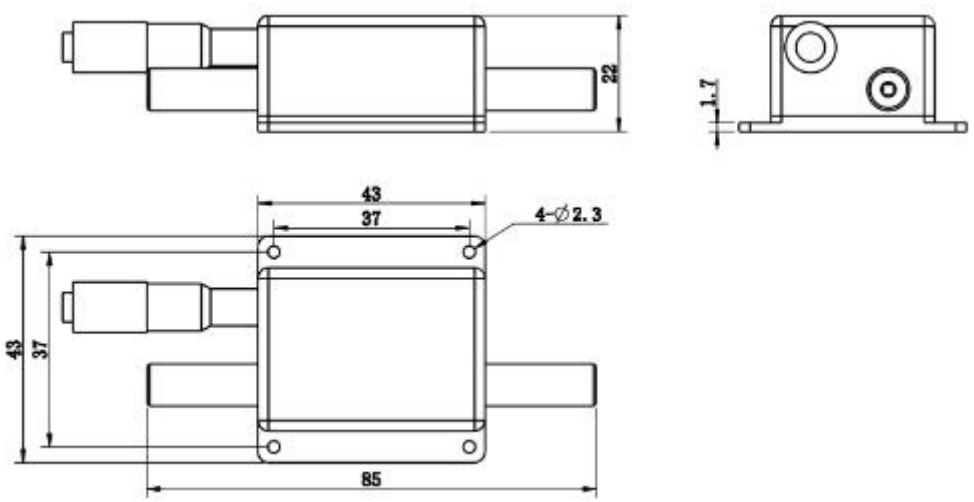
Tunable Filter Model Number: CTF-t-w-f-b-l-h

Type(t)	Wavelength(w)	Tuning Bandwidth(f)	Fiber Type(b)		Pigtail Length(l)	Housing(h)
A (Automatic) M （Manual）	980 nm 1030 nm 1064 nm 1550 nm ...	40 nm 50 nm 60 nm ...	Non-polarity-maintaining	1 (Hi1060) 2 (SMF-28e) 3 (10/125) ...	80 (0.8 m) 100 (1 m) 150 (1.5 m) ...	A01 A02 A03 ...
			polarity-maintaining	P1 (PM980) P2 (PM1550) ...		

Typical Specifications

Center Wavelength	Resolution	Passband Bandwidth(0.5 dB)	Cut-off Bandwidth (25 dB)	Insertion Loss	Withstand Power	Tunable Bandwidth
1064 nm	0.1 nm	1 nm	10 nm	3.5 dB	500 mW	40 nm

Housing dimensions(mm):

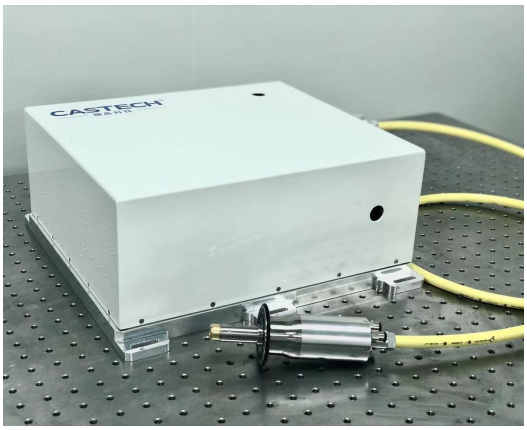


Optical System

Optical Fiber Transmission System

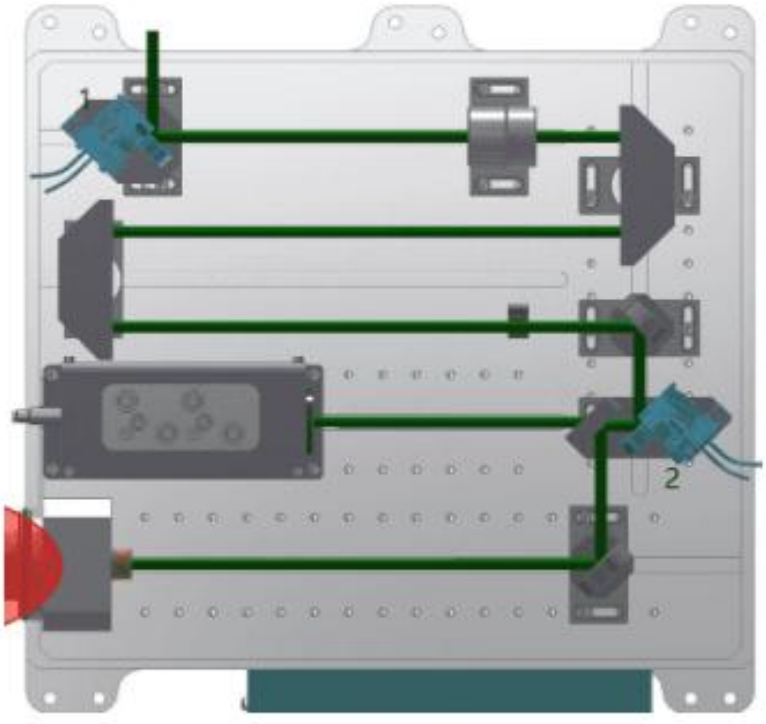
The ultra-fast laser transmission system developed by CASTECH is a high-power laser transmission system based on hollow core anti-resonance photonic crystal fiber. Picosecond or femtosecond pulses laser with high energy can be confined to the tiny hollow core structure of the fiber, transmitting with excellent beam quality. Compared with the commonly used space optical transmission, the system greatly simplifies the structure, which not only meets the flexible operation requirements of users, but also has the characteristics of high power endurance, low loss, low distortion, and near single-mode transmission.

For ultra-fast laser transmission, CASTECH provides automatic, manual pointing stable ultra-fast optical transmission system, or encapsulated optical cable with hollow-core photonic crystal fiber for customers choice.



Applications

- **Industrial processing**
- **Medical surgery**
- **Experiment**
- **Bio-imaging**



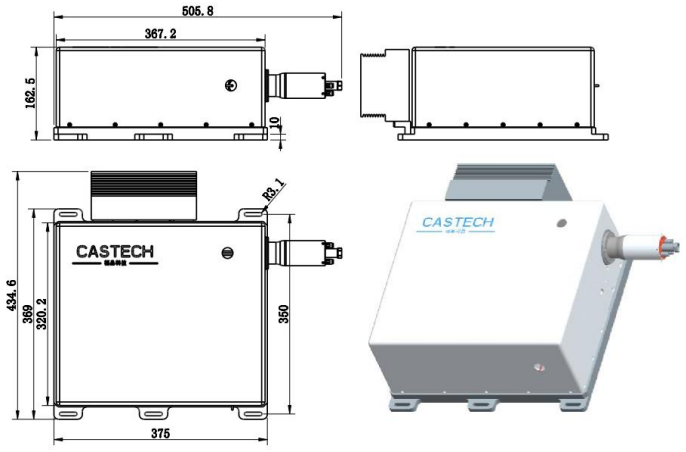
Transmission path of ultra-fast system

Optical Fiber Transmission System Model Number：FTS-t-w-a		
Type(t)	**Wavelength(w)**	**Fiber Type(a)**
A (Automatic pointing stable) M (Manual pointing stable)	980 nm 1030 nm 1064 nm ...	30/250 45/250 ...

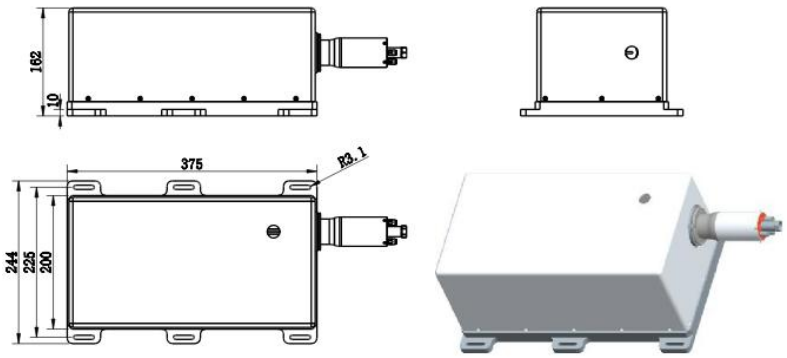
Typical Specifications

Type	Wavelength	Maximum Pulse Energy	Maximum Optical Power	Transmission Efficiency
Automatic	1030 nm	500 μJ	500 W	90%
Manual	1030 nm	500 μJ	500 W	90%

Housing dimensions(mm)：



Automatic pointing stable



Manual pointing stable

Optical Attenuators

Optical attenuator is an optical component that can change the output power of laser continuously. It is consisted of a half-wave plate (or an electro-optic crystal) and a polarizer. The polarization state of incident light is modulated by the half-wave plate (or electro-optic crystal) therefore to vary the degree of attenuation. The polarizer can divide the light further into two beams at a specific ratio. Optical attenuators are ideal for the applications in precision laser processing, laser detection, laser sensing etc., especially in ultra-fast and ultra-short pulse laser systems.

CASTECH provides two types of attenuators according to different modulating principles：mechanical and electro-optical type.

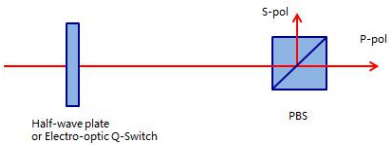
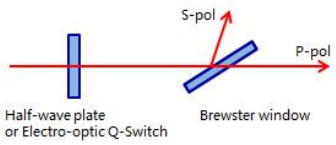
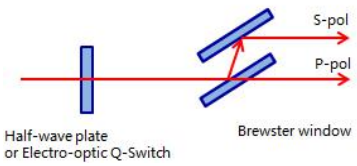
Mechanical attenuator modifies the polarization state of light by rotating the half-wave plate. It is characterized by compact structure and adaptability.

Electro-optical attenuator can be used as a high-speed optical switch which can accomplish a modulation in nanoseconds.

CASTECH's optical attenuator has two control schemes, electric and manual. Attenuator can be equipped with PBS, Brewster window, or removable optical trap as optional accessaries.

Applications

- **Laser industrial processing**
- **Laser sensing system**
- **Ultrafast laser system**

Diagram of Optical Path	Polarizer Type	Advantage	Disadvantage
	PBS	● High extinction ratio ● P-light and S-light are perpendicular to each other	● Limited aperture ● Relatively low laser damage threshold
	Single Brewster window	● Relatively high LIDT ● Large aperture	● P-light and S-light have a certain angle between ● Strict angle limit
	Double Brewster windows	● Relatively high LIDT ● Large aperture ● P-light and S-light are perpendicular to each other	● Strict angle limit

Mechanical Attenuators Model Number：COA-Oc-b-a-p-λ-h					
Control mode(c)	Polarizer(b)	Aperture(a)	Power(p)	Wavelength(λ)	Housing (h)
A (automatic) M (manual)	B (Brewster window) P (PBS)	5 mm 10 mm 12 mm 20 mm 40 mm ...	100 (≤100 W) 200 (≤200 W) 1000* (≤1000 W)	266 nm 355 nm 515 nm 532 nm 800 nm 1030 nm 1064 nm 1550 nm ...	P01 P02 ...

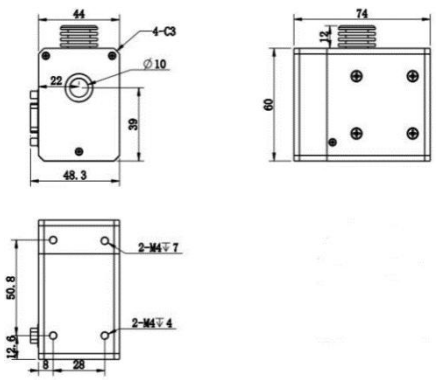
Electro-Optical Attenuators Model Number：COA-Ec-b-a-p-λ-h					
Control mode(c)	Polarizer(b)	Aperture(a)	Power(p)	Wavelength(λ)	Housing (h)
A (automatic)	B (Brewster window) P (PBS)	5 mm 10 mm 12 mm 20 mm ...	100 (≤100 W) 200 (≤200 W)	266 nm 355 nm 515 nm 532 nm 800 nm 1030 nm 1064 nm 1550 nm ...	P04 ...

***Only suitable for Brewster window polarizer type products**

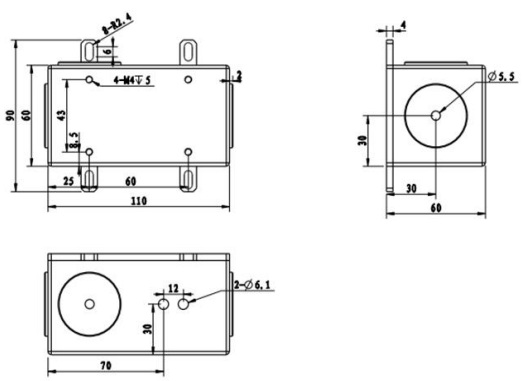
Typical Specifications				
Type	Aperture	LIDT	Wavelength	Response time
Mechanical	20 mm	10 J/cm² 10 ns,10 Hz	1064 nm	ms
Electro-optical	10 mm	3 J/cm² 10 ns,10 Hz	532 nm	ns

Housing dimensions(mm)：

P02



P04



The optical switch is a high-speed switch with an electro-optical crystal or a rotatable wave plate as the core element. It is an external cavity modulator which consists of a polarizing element and a polarizer. When a voltage is applied to the electro-optic crystal, the birefringence will be induced hence altering the polarization of light. The polarizer will split the light into two beams orthogonally as transmitted light and reflected light. Thus, the laser could be turned-on and turned-off quickly with response to the change of voltage.

CASTECH's optical switches can be divided into two types: mechanical optical switches and electro-optical optical switches.

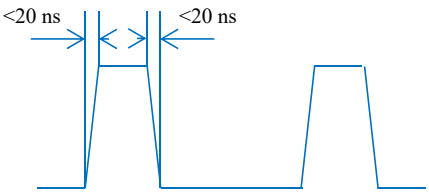
The mechanical optical switch changes the light on and off by controlling the rotation angle of the half-wave plate.

The electro-optical optical switch is a high-speed shutter based on the electro-optical effect, and the modulation speed can reach nanosecond level.

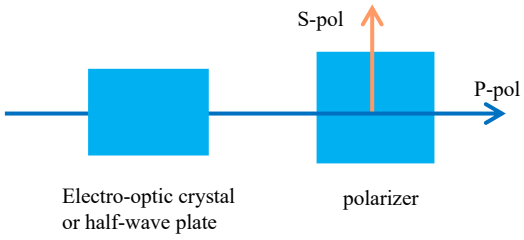
CASTECH provides drivers with nanoseconds rise/fall time to complement our optical switches. And optional accessories such as optical traps are also available.

Applications

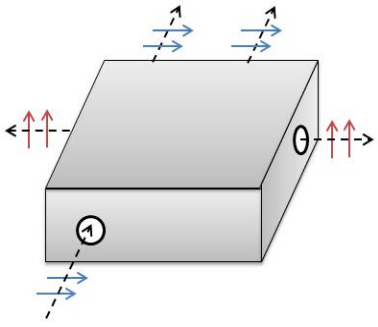
- **Laser industrial processing**
- **Beam splitting**
- **Frequency division**
- **Laser sensing system**
- **Ultrafast laser system**



High voltage waveform



Schematic diagram of optical switch



Multi-channel optical switch

Mechanical Optical Switches Model Number：COS-Oc-p-a-w-b-d

Control mode(c)	Power(p)	Aperture(a)	Wavelength(w)	Polarizer(b)	Channel(d)
A (automatic) M (manual)	100 (≤100 W) 200 (≤200 W) 1000 (≤1000 W)	5(5 mm) 10(10 mm) 12(12 mm) 14(14 mm) 20(20 mm) 30(30 mm) ...	343 nm 355 nm 800 nm 1030 nm 1064 nm 1550 nm ...	B (Brewster) P (PBS)	1 2 3 4 ...

Electro-optical optical switches Model Number：COS-Ec-p-a-w-b-d

Control mode(c)	Power(p)	Aperture(a)	Wavelength(w)	Polarizer(b)	Channel(d)
A (automatic)	50 (≤50 W) 100 (≤100 W) 200 (≤200 W)	5(5 mm) 10(10 mm) 12(12 mm) 14(14 mm) 20(20 mm) ...	343 nm 355 nm 800 nm 1030 nm 1064 nm 1550 nm ...	B (Brewster) P (PBS)	1 2 3 4 ...

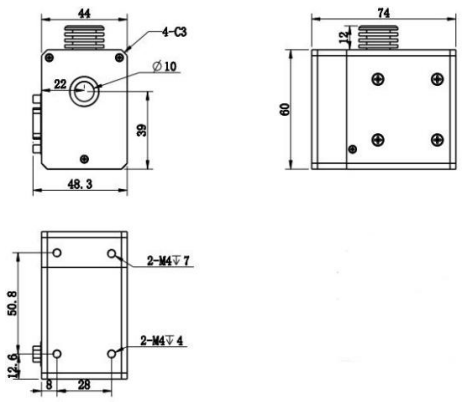
Typical Specifications

Type(t)	Power	LIDT	Wavelength	Aperture	Rise/fall time	Extinction Ration
Mechanical	<1000 W*	10 J/cm²10 ns,10 Hz	1064	10 mm	＜10 ns	>1000:1
Eletro-optical	<100 W	3 J/cm² 10 ns,10 Hz	532	10 mm	＜20 ns	>1000:1

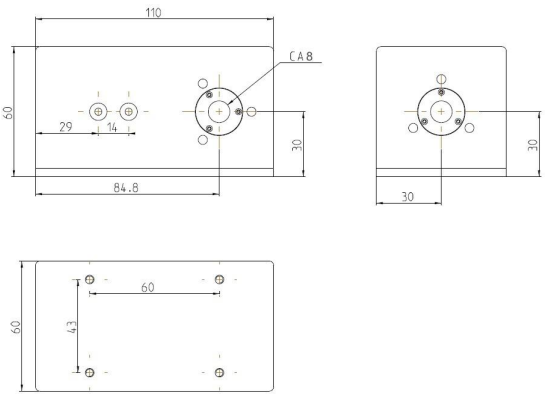
*** Polarizing element used is Brewster window**

Housing dimensions(mm)：

Mechanical



Electro-optical



Laser Material Processing Optics

Beam Expanders

Beam expander is an optical component built to enlarge the diameter of collimated input beam and reduce beam divergence. It is primarily applied in laser scanning, laser processing, interferometry and remote sensing. A typical Galilean type beam expander consists of one negative lens and one positive lens. CASTECH offers two types of beam expanders, fixed magnification and variable magnification. The fixed magnification beam expander is with compact design, while the magnification and divergence of variable type are adjustable. Our product covers diverse magnifications and output diameters to meet various application requirements. Advanced polishing and coating technology have been used to ensure high beam quality and low insertion loss.

Applications

- **Laser Scanning**
- **Short Pulsed Laser**
- **Ultra-Short Pulsed Laser**

	Fixed Magnification Beam Expander	Variable Magnification Beam Expander
Advantage	• Compact structure • Lower cost	• Variable magnification
Disadvantage	• Invariable magnification	• Complex structure • Higher cost

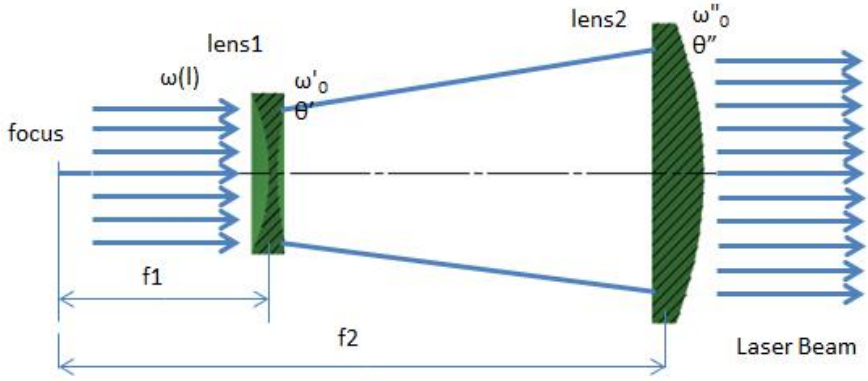


Figure: Common beam expander is derived from the Galilean telescopes which consists of a negative lens and a positive lens that are also separated by the sum of their focal lengths.

Beam Expander Model Number：tBE-a-b-c-d-h

Type(t)	Wavelength(a)	Expansion(b)	Thread(c)	Divergence Adjustable(d)	Package(h)
F (fixed magnification) V (variable magnification)	355 nm 532 nm 1064 nm ...	2 (2X) 3 (3X) 103 (1X-3X)* 104 (1X-4X)* 208 (2X-8X)* ...	22 (M22*0.75) 30 (M30*1) ...	A (Yes) B (No)	G01 G02 G03 G04 G05 G06 ...

***Only suitable for V (variable magnification beam expander) type products.**

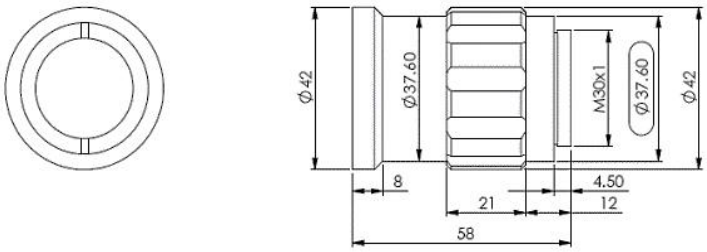
Typical Specifications

Expansion	Material	Input Aperture	Exit Aperture	Max Outside Diameter
2	UVFS	12 mm	26 mm	42 mm
10	UVFS	6 mm	31 mm	46 mm
2X~8X*	UVFS	3 mm	26 mm	48 mm

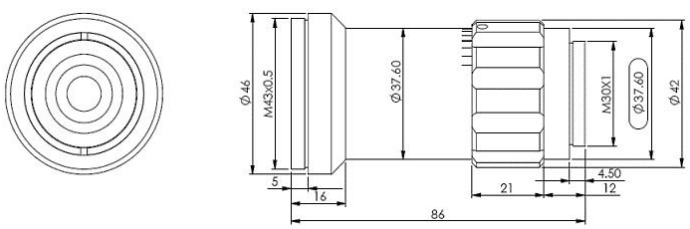
***Only suitable for V (variable magnification beam expander) type products.**

Housing dimensions(mm):

G01



G02



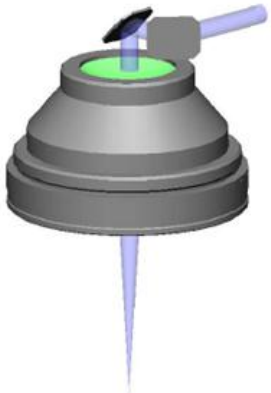
F-theta lenses are often used in laser marking, laser engraving and laser cutting systems where constant scan rate and linear displacement are required. F-theta lenses are designed with a barrel distortion, and resulting a displacement that is linear with scanning angle.

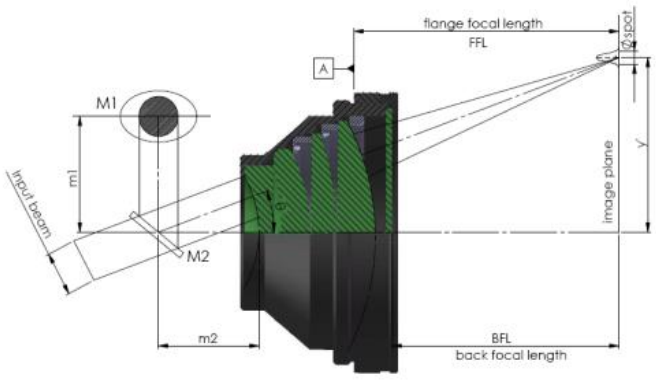
CASTECH provides **telecentric and non-telecentric F-theta lenses** with low distortion. We adopt quality materials, proprietary polishing and coating techniques, and standard interface thread to ensure high laser damage threshold and compatibility of our products.

Applications

- **Laser industrial processing**
- **Laser sensing system**
- **Ultrafast laser system**

	Telecentric F-Theta Lenses	Non-telecentric F-Theta Lenses
Advantage	• The shape of the central spot is consistent with that of the edge spot • Small distortion of the spot	• Lower cost
Disadvantage	• Larger size • High cost	• The magnification may varies with relative position •Large difference in spot size between center and edge





Schematic diagram of F-theta lens

F-Theta Lenses Model Number：FT-a-b-c

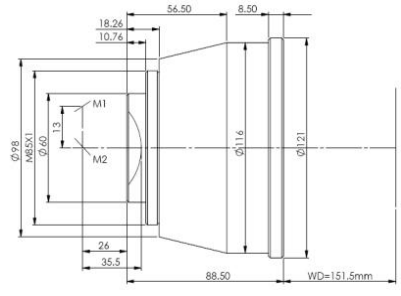
Wavelength (a)	Focal Distance (b)	Scan Field (c)
355 nm ...	109 (109.4 mm) 160 (160 mm) 174 (174.1 mm) 225 (255 mm) ...	63 (63×63 mm) 99 (99×99 mm) 107 (107×107 mm) 158 (158×158 mm) ...

Typical Specifications

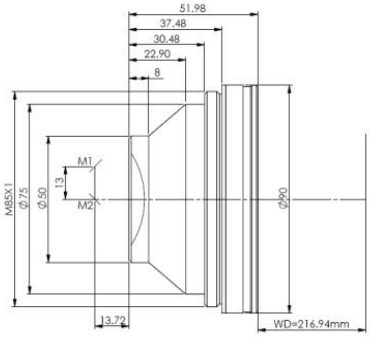
Material	Max Input Beam	Scan Field	Wd	M1/M2
UVFS	6 mm	63x63 mm^2	151.5 mm	13/35.5
UVFS	7 mm	99x99 mm^2	194.43 mm	13/23
UVFS	10 mm	158x158 mm^2	319.7 mm	13/28

Housing dimensions(mm)：

63



107

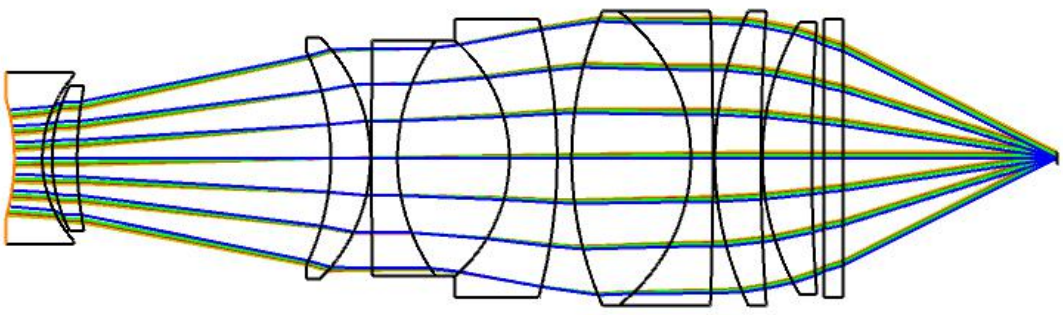


Objective Lenses

The achromatic objective lenses is an infinity corrected lens used for axial achromatic correction. It produces the same flat focus field for multiple imaging modes without introducing vignetting effect, so the observation image at the edge of the field of view can also be natural and clear. The objective lenses with focal length can also be compatible with other wavelengths, when femtosecond laser (such as 770~790nm) or near-infrared (such as 1064nm) laser aberration correction was applied. CASTECH's laser objective lenses have the characteristics of high NA, high LIDT, high transmission, and high flatness of field of view.

Applications

- **Coaxial Observation**
- **Laser Import**
- **Laser Processing**
- **Chromatic Aberration Correction**



Schematic diagram of the light path

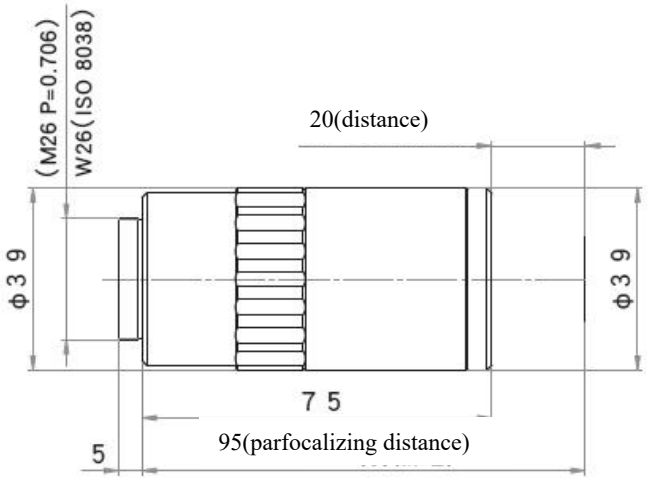
Objective Lenses Model Number：CAOL-w-e-l-n

Wavelength (w)	Expansion (e)	Distance (l)	NA (n)
1064 nm …	20X 50X …	20 mm 15.1 mm …	0.45 0.67 ...

Typical Specifications

Wavelength	Expansion	Distance	NA	Resolution	Transmission
1064 nm	20X	20 mm	0.45	0.61 μm	≥82%

Housing dimensions(mm)：



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