Products & Supplies

Catalog 2012

DAHENG OPTICS CATALOG

2012 V.9

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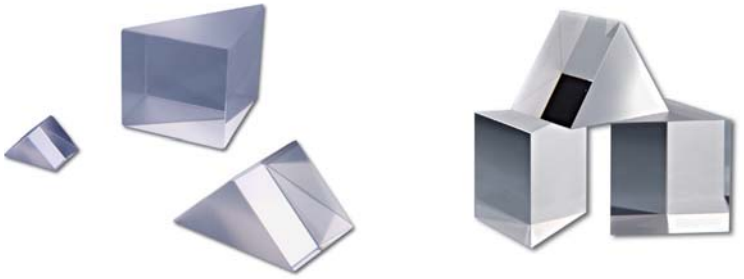

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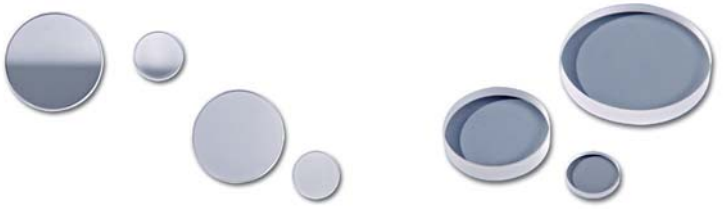

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All dimensions are in mm unless otherwise specified.

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All dimensions are in mm unless otherwise specified.

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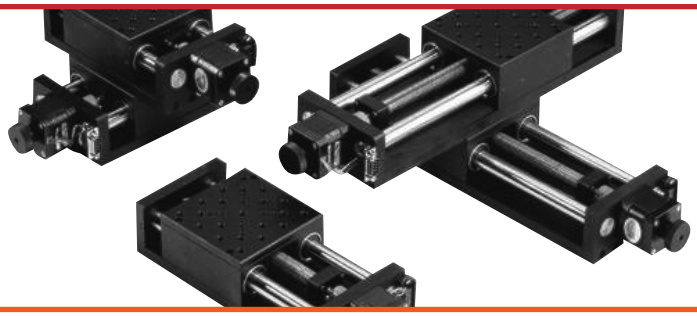

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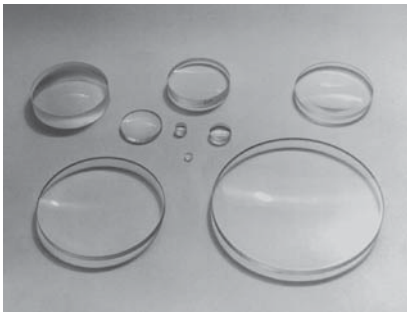
All dimensions are in mm unless otherwise specified.

Lenses

GCL-01 Lenses

LENSES



General

Lens is an optical device with perfect or approximate axial symmetry which transmits and refracts light, converging or diverging light. There are many forms of a lens or a lens system. A simple lens consists of a single optical element. A compound lens or a lens system has a series of simple lenses (elements) with a common axis in order to correct optical aberrations to improve performances or image quality, of which a simple single lens cannot offer.

Classifications

Single lenses are classified by the curvatures of its two optical surfaces. A lens that has its both surfaces convex, is called biconvex (or double convex). When the radii of curvature of the surfaces are the same, the lens is equi-convex. If one of the surfaces is flat, i.e. the radius of curvature is infinitive, the lens is plano-convex. Similarly, there are lenses that are biconcave, equi-concave and plano-concave if the lens surface is concave. A lens with one convex and concave side is convex-concave, or often called a meniscus lens.

A lens that converges light from infinitive and focuses a real spot has a positive focal length, and is called a positive lens; whereas a negative lens diverges light from infinitive with a virtual focus and has a negative focal length.

A doublet lens that often has a positive and negative lens cemented together with a common surface is for chromatic aberration correction and called achromatic doublet. There are positive and negative doublets with positive and negative focal length, respectively.

Name	Legend
Plano-Convex Lens	
Bi-Convex lens	
Plano-Concave Lens	
Bi-Concave Lens	

Name	Legend
Meniscus Lens	
Positive Achromatic Doublet	
Negative Achromatic Doublet	

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

Materials

Most glass manufacturers can supply the same characteristics of materials under different trade names. They modify their material processes to achieve lead- and arsenic-free. Daheng Optics utilizes many glass materials from main international manufacturers in our products. We source mainly in China with CDGM glasses which was founded in 1956 and is the largest production base of optical materials in China with its highest glass output in the world in recent years. With the constant efforts on development for new products and pursuing quality perfection, more than 200 types of optical glasses and optoelectronic glasses are in CDGM standard catalogue. Comparable glass materials and properties between CDGM and Schott are listed below.

CDGM	SCHOTT	Index of Refraction (Nd)	Abbe Number (Vd)
H-K9L	Bk7	1.51680	64.20
H-K50	K5	1.52249	59.48
H-BaK6	NSK11	1.56388	60.76
H-BaK7	BaK4	1.56883	56.04
H-F4	F2	1.62005	36.35
H-LaK10	LaKN22	1.65113	55.89
H-ZBaF16	BaF11	1.66672	48.42
H-ZBaF52	BaF10	1.67003	47.20
H-ZF2	SF5	1.67270	32.17
H-ZF10	SF8	1.68893	31.16
H-ZF4	FD10	1.72825	28.32
H-ZF12	N-SF14	1.76182	26.61
H-ZF7LA	N-SF6	1.80518	25.46
ZF52	SF57	1.84666	27.76

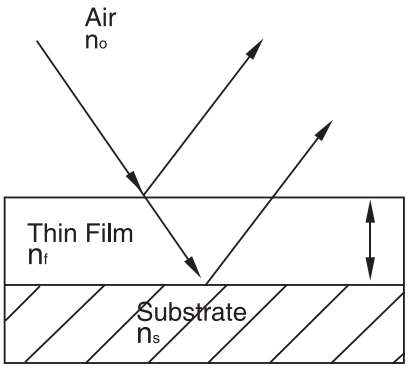
Antireflection Coating

Antireflection (AR) coating improves vastly the transmission of a lens system. The most common type is 1/4 wave MgF_2 coating. Normally, most of lenses in our catalogue are coated by this type of AR coating, of which the wavelength is centered at 550nm with 0° angle of incidence. We also offer specialized AR coatings such as 1/4 wave MgF_2 for visible range at different incidence angle, and broadband AR coatings for visible and near infrared ranges. The following table lists our capability on AR coatings.

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

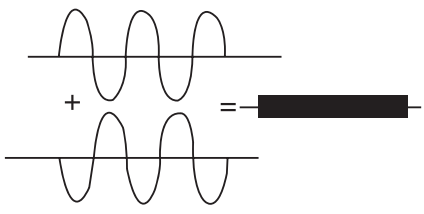
AR coatings	
Coating Description	Specifications
Blackened Edges	Eliminate stray light and improve signal-to-noise
1/4 wave MgF2 at 550nm	Rave≤1.75% 400-700nm (BK7)
VIS 0° at 425-675nm	Rave≤0.4%
VIS 45° at 425-675nm	Rave≤0.75%
NIR I at 800-1100nm	Rav≤0.5%
NIR II at 1200-1600nm	Rabs≤0.25% at 1295-1325nm Rabs≤0.25% at 1535-1565nm Rave≤0.25% at 1200-1600nm



Principle of Anti-reflection Coating

The transmission properties of an optical coating are dependent upon the wavelength of light being used, index of refraction of the substrate, index of refraction of the coating, the thickness of the coating, and the angle of the incident light. AR coating is designed to reduce back reflection at, say, air and glass interface caused by the difference of refractive index of the two media.

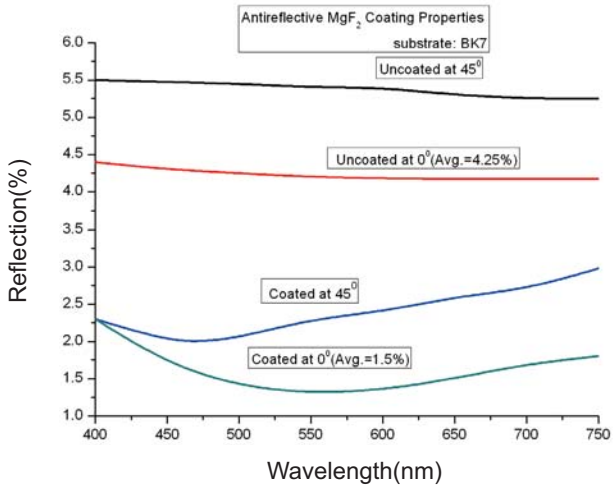
The AR coating design is such that the relative phase shift between the beam reflected at the upper and lower boundary of the thin film is 180. Destructive interference between the two reflected beams occurs, canceling both beams before they exit the surface. The optical thickness of the coating must be an odd number of quarter wavelengths.



$$n_f = (n_o \times n_s)^{1/2}$$

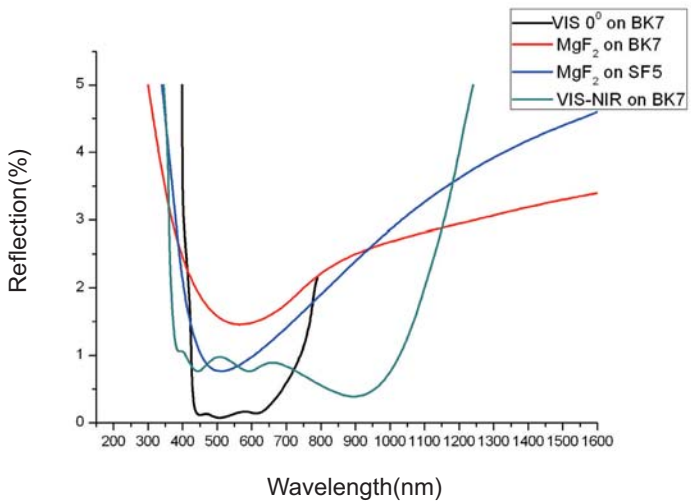
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses



1/4 Wave MgF2 Coating

The coatings of VIS 0° for 0° angle of incidence and VIS 45° for 45° angle of incidence provide optimized transmission for wavelength 425-675nm, achieving average reflection to 0.4% and 0.75%, respectively.



Multiple Layers of AR Coating

In order to increase transmission further, comparing with a single layer of AR coating, a triple-layer design is generally used with coating materials of MgF_2, Ta_2O_5 and Al_2O_3.

Accessory:

GCM-04 Self-Centering Lens Holders
GCM-05 Adjustable Self-Centering Lens Holders
GCM-0801 Lens/Mirror Mounts
GCM-0802 Small Lens/Mirror Holders
GCM-0803 Standard Lens/Mirror Holders
GCM-0805 Medium Lens/Mirror Holders
GCM-0814 Lens/Mirror Holder with Base
GCM-0823 Kinematic Corner Lens/Mirror Holders
GCM-0831M Kinematic Off-center Lens/Mirror Holders
GCM-0808 Kinematic Lens/Mirror Lockable Holders
GCM-0818 Kinematic Corner Lens/Mirror Lockable Holders GCM-0828 3D Kinematic Lens/Mirror Lockable Holders
GCM-0838 3D Kinematic Corner Lens/Mirror Lockable Holders
GCM-0809 Vertical Drive Kinematic Lens/Mirror Holders
GCM-0819 Gimbal Lens/Mirror Holders
GCM-0829 Compact Gimbal Lens/Mirror Holders
GCM-2501 4D Lens/Mirror Holders with Pedestal
GCM-2511 4D Lens/Mirror Holders

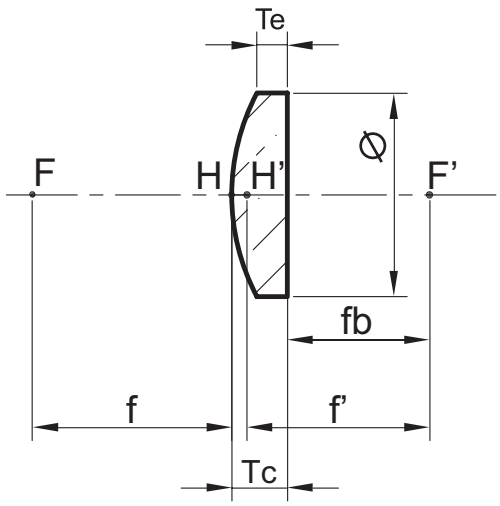
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0101

GCL-0101 BK7 Plano-Convex Lenses

Plano-convex lenses are mostly used for focusing parallel rays of light to a spot. The asymmetry of these lenses between the front and back surface minimizes spherical aberration effectively, particularly in the situations where the object and image are not at equal distance from the lens. The optimum case is where the object is placed at infinity (regarded as parallel rays entering lens) and the image is on the focus, which has infinite conjugate ratio, i.e. object distance/image distance. The curved surface of the lens should face the object direction.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
⌀: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0101

- Material: BK7 grade A, fine annealed
- Focal Length (f'): ±2% at 587.6nm
- Diameter(⌀) Tolerance: +0.0/-0.20
- Center Thickness (Tc): ±0.1
- Centration: 3'
- Form Error: 1~5 fringes
- Irregularity of Fringes: 0.2~0.5 fringes
- Surface Quality: 60-40 scratch-dig
- Coating: GCL-0101xx 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence
  GCL-0101xxB NIR I Multiple AR Layer from 800nm-1100nm, Rave<0.5%
- Clear Aperture: 90% diameter

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0101 BK7 Plano-Convex Lenses

Part No.	Ø	f'	fb	Tc	Te
GCL-010101	6.0	9.8	8.5	2.0	1.0
GCL-010102	6.0	19.0	17.7	2.0	1.5
GCL-010103	6.0	38.1	36.8	2.0	1.8
GCL-010131	10.0	10	6.8	4.8	1.1
GCL-010132	10.0	15.0	13.1	2.9	1.1
GCL-010133	10.0	20.0	18.4	2.4	1.1
GCL-010134	10.0	30.0	28.8	1.9	1.1
GCL-010104	12.7	12.7	8.7	6.0	1.1
GCL-010105	12.7	25.4	22.8	4.0	2.4
GCL-010106	12.7	38.1	36.1	3.0	2.0
GCL-010107	12.7	50.8	48.8	3.0	2.2
GCL-010135	20.0	30.0	26.2	5.7	2.0
GCL-010136	20.0	40.0	37.0	4.6	2.0
GCL-010137	20.0	50.0	47.4	4.0	2.0
GCL-010138	20.0	60.0	57.6	3.7	2.0
GCL-010139	20.0	80.0	77.9	3.2	2.0
GCL-010140	20.0	100.0	98.0	3.0	2.0
GCL-010108	25.4	38.1	33.5	7.0	2.4
GCL-010109	25.4	50.8	46.8	6.0	2.7
GCL-010110	25.4	75.0	71.7	5.0	2.9
GCL-010111	25.4	100.0	96.7	5.0	3.4
GCL-010112	25.4	150.0	147.4	4.0	3.0
GCL-010113	25.4	175.0	172.4	4.0	3.1
GCL-010141	30.0	60.0	55.8	6.4	2.5
GCL-010142	30.0	100.0	96.9	4.7	2.5
GCL-010143	30.0	120.0	117.1	4.3	2.5
GCL-010144	30.0	150.0	147.4	4.0	2.5
GCL-010114	38.1	75.0	69.7	8.0	3.0
GCL-010115	38.1	125.0	121.0	6.0	3.1
GCL-010116	38.1	200.0	196.7	5.0	3.2
GCL-010117	38.1	300.0	296.7	5.0	3.8
GCL-010145	40.0	80.0	74.3	8.7	3.5
GCL-010146	40.0	150.0	146.0	6.1	3.5
GCL-010147	40.0	200.0	196.4	5.5	3.5
GCL-010148	40.0	350.0	347.0	4.6	3.5
GCL-010118	50.8	100.0	92.7	11.0	4.3
GCL-010119	50.8	150.0	144.1	9.0	4.7
GCL-010120	50.8	250.0	245.4	7.0	4.5
GCL-010121	50.8	400.0	396.0	6.0	4.4
GCL-010149	60.0	200.0	194.5	8.4	4.0
GCL-010150	60.0	300.0	295.4	6.9	4.0
GCL-010151	60.0	500.0	495.6	6.7	5.0
GCL-010152	60.0	600.0	595.8	6.4	5.0

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0101 BK7 Plano-Convex Lenses

Part No.	Ø	f'	fb	Tc	Te
GCL-010153	60.0	800.0	796.0	6.1	5.0
GCL-010122	76.2	165.8	14.0	5.6	115
GCL-010123	76.2	293.4	10.0	5.2	90
GCL-010124	76.2	494.7	8.0	5.2	76
GCL-010125	76.2	695.4	7.0	5.0	70
GCL-010126	76.2	995.4	7.0	5.6	73
GCL-010127	100.0	493.5	9.9	5.0	79
GCL-010128	100.0	794.7	8.0	5.0	129
GCL-010129	100.0	995.1	7.4	5.0	124
GCL-010130	6	6	4.6	2.5	1.42
GCL-010168	10	40	38.02	3	2.39
GCL-010169	10	75	73.02	3	2.68
GCL-010170	10	100	98.02	3	2.76
GCL-010171	20	25	21.04	6	1.26
GCL-010158	25.4	30	24.66	8.1	1.49
GCL-010159	25.4	35	30.39	7	1.79
GCL-010160	25.4	40	36.31	5.6	1.24
GCL-010161	25.4	45	41.57	5.2	1.43
GCL-010162	25.4	60	56.9	4.7	1.98
GCL-010163	25.4	85	82.17	4.3	2.42
GCL-010164	25.4	125	122.69	3.5	2.24
GCL-010165	25.4	225	222.69	3.5	2.8
GCL-010166	25.4	250	247.69	3.5	2.87
GCL-010167	25.4	400	397.69	3.5	3.11
GCL-010172	50.8	50.8	44.08	12	2.86
GCL-010173	50.8	75	67.42	11.5	2.02
GCL-010174	50.8	125	120.06	7.5	2.3
GCL-010175	50.8	175	171.04	6	2.36
GCL-010176	50.8	200	196.57	5.2	2.03
GCL-010177	50.8	300	296.7	5	2.91
GCL-010178	50.8	500	496.7	5	3.75
GCL-010179	50.8	600	596.7	5	3.96
GCL-010180	50.8	800	796.7	5	4.22
GCL-010108B	25.4	38.1	33.5	7.0	2.4
GCL-010109B	25.4	50.8	46.8	6.0	2.7
GCL-010110B	25.4	75.0	71.7	5.0	2.9
GCL-010111B	25.4	100.0	96.7	5.0	3.4
GCL-010112B	25.4	150.0	147.4	4.0	3.0
GCL-010113B	25.4	175.0	172.4	4.0	3.1
GCL-010158B	25.4	30	24.66	8.1	1.49
GCL-010159B	25.4	35	30.39	7	1.79
GCL-010160B	25.4	40	36.31	5.6	1.24
GCL-010161B	25.4	45	41.57	5.2	1.43

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0101 BK7 Plano-Convex Lenses

Part No.	∅	f'	fb	Tc	Te
GCL-010162B	25.4	60	56.9	4.7	1.98
GCL-010163B	25.4	85	82.17	4.3	2.42
GCL-010164B	25.4	125	122.69	3.5	2.24
GCL-010165B	25.4	225	222.69	3.5	2.8
GCL-010166B	25.4	250	247.69	3.5	2.87
GCL-010167B	25.4	400	397.69	3.5	3.11
GCL-010154B	25.4	200	197.7	3.5	2.72
GCL-010155B	25.4	300	297.7	3.5	2.98
GCL-010156B	25.4	500	497.7	3.5	3.19
GCL-010157B	25.4	1000	997.7	3.5	3.34

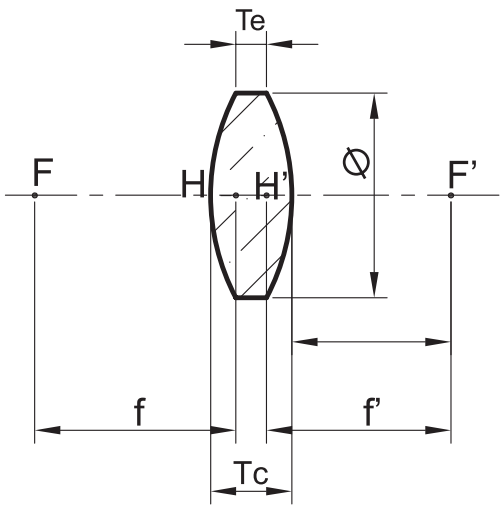
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0102 BK7 Bi-Convex Lenses

GCL-0102

Similar to plano-convex lenses, a bi-convex lens has a positive focal length and focuses parallel rays of light to a spot. Because the front and back surface of the lens are spherically convex and have the same radius of curvature, in situations where the object and image are at equal of near equal distances from the lens, it particularly minimizes spherical aberration, at the same time, aberration coma and distortion are also identically canceled. As a guideline, bi-convex lenses offer minimum aberrations at the conjugate ratio between 5:1 and 1:5.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
∅: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0102

- Material: BK7 grade A, fine annealed
- Focal Length (f'): ±2% at 587.6nm
- Diameter(∅) Tolerance: +0.0/-0.20
- Center Thickness (Tc): ±0.1
- Centration: 3'
- Form Error: 1~5 fringes
- Irregularity of Fringes: 0.2~0.5 fringes
- Surface Quality: 60-40 scratch-dig
- Coating: 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence
- Clear Aperture: 90% diameter

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0102 BK7 Bi-Convex Lenses

Part No.	Ø	f'	fb	Tc	Te
GCL-010201	6.0	19.0	18.1	3.0	2.5
GCL-010215	10.0	15.0	13.7	4.2	2.5
GCL-010216	10.0	30.0	28.7	3.9	3.0
GCL-010202	12.7	25.4	23.7	5.0	3.4
GCL-010203	12.7	38.1	36.7	4.0	3.0
GCL-010217	20.0	30.0	28.0	5.9	2.5
GCL-010218	20.0	40.0	37.9	5.0	2.5
GCL-010219	20.0	60.0	59.0	4.7	3.0
GCL-010220	20.0	75.0	73.7	4.4	3.0
GCL-010204	25.4	50.8	49.1	6.0	2.8
GCL-010205	25.4	100.0	98.5	5.0	3.4
GCL-010206	25.4	150.0	148.6	5.0	4.0
GCL-010207	25.4	175.0	172.7	5.0	4.1
GCL-010221	30.0	60.0	57.6	7.0	3.3
GCL-010222	30.0	120.0	118.7	5.0	3.2
GCL-010223	30.0	180.0	178.5	5.0	3.8
GCL-010224	30.0	250.0	248.0	5.0	4.1
GCL-010225	30.0	300.0	298.1	5.0	4.3
GCL-010208	38.1	75.0	72.9	8.0	3.2
GCL-010209	38.1	125.0	123.4	6.0	3.2
GCL-010210	38.1	200.0	197.8	5.0	3.2
GCL-010211	38.1	300.0	298.1	5.0	3.8
GCL-010226	40.0	100.0	97.0	8.0	4.0
GCL-010227	40.0	150.0	148.5	6.0	4.0
GCL-010228	40.0	250.0	247.9	5.6	4.0
GCL-010212	50.8	150.0	148.1	8.0	3.8
GCL-010213	50.8	250.0	248.8	6.0	3.5
GCL-010214	50.8	400.0	398.2	6.0	4.4

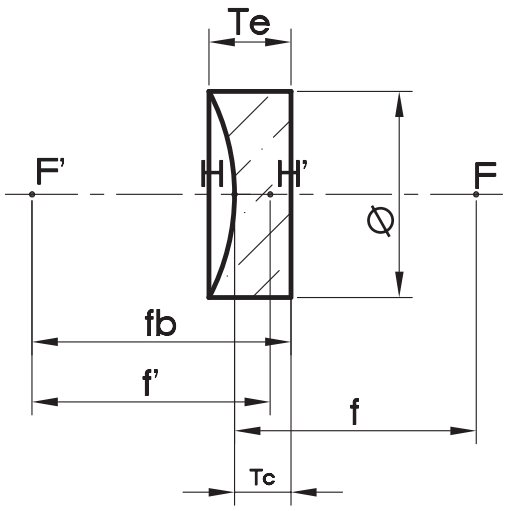
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0103 BK7 Plano-Concave Lenses

GCL-0103

A plano-concave lens diverges parallel input rays. It has a negative focal length. While the output rays do not actually meet to form a point, they do appear to be diverging from a virtual image located on the object side of the lens. At absolute conjugate ratio greater than 5:1 and less than 1:5, plano-concave lenses are nearly the best form lens to reduce spherical aberration, coma, and distortion. The curved surface of the lens should face the object in distance or infinite conjugate, except in a high energy laser system, this should be reversed to eliminate the possibility of a virtual focus.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
∅: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0103

- Material: BK7 grade A, fine annealed
- Focal Length (f'): ±2% at 587.6nm
- Diameter(∅) Tolerance: +0.0/-0.20
- Center Thickness (Tc): ±0.1
- Centration: 3'
- Form Error: 1~5 fringes
- Irregularity of Fringes: 0.2~0.5 fringes
- Surface Quality: 60-40 scratch-dig
- Coating: 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence
- Clear Aperture: 90% diameter

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0103 BK7 Plano-Concave Lenses

Part No.	Ø	f'	fb	Tc	Te
GCL-010301	6.0	-9.8	-10.5	1.0	1.98
GCL-010327	10.0	-15.0	-16.0	1.5	3.3
GCL-010326	10.0	-20.0	-21.2	1.5	2.8
GCL-010325	10.0	-30.0	-31.0	1.5	2.3
GCL-010302	12.7	-19.0	-20.3	2.0	4.3
GCL-010303	12.7	-25.4	-26.7	2.0	3.6
GCL-010304	12.7	-38.1	-39.4	2.0	3.1
GCL-010324	20.0	-30.0	-31.6	2.5	6.2
GCL-010323	20.0	-50.0	-51.6	2.5	4.5
GCL-010322	20.0	-60.0	-61.6	2.5	4.2
GCL-010321	20.0	-80.0	-81.6	2.5	3.7
GCL-010305	25.4	-50.8	-52.8	3.0	6.3
GCL-010306	25.4	-75.0	-77.0	3.0	5.1
GCL-010307	25.4	-100.0	-102.0	3.0	4.6
GCL-010308	25.4	-150.0	-152.0	3.0	4.1
GCL-010320	30.0	-60.0	-62.0	3.0	6.9
GCL-010319	30.0	-120.0	-121.9	3.0	4.8
GCL-010318	30.0	-150.0	-152.1	3.0	4.5
GCL-010309	38.1	-125.0	-127.0	3.0	5.9
GCL-010310	38.1	-200.0	-202.1	3.0	4.8
GCL-010311	38.1	-300.0	-301.9	3.0	4.2
GCL-010317	40.0	-100.0	-102.3	3.5	7.5
GCL-010316	40.0	-200.0	-202.2	3.5	5.5
GCL-010315	40.0	-400.0	-402.4	3.5	4.5
GCL-010312	50.8	-250.0	-252.6	4.0	6.5
GCL-010313	50.8	-400.0	-402.6	4.0	5.6
GCL-010314	50.8	-500.0	-502.5	4.0	5.3
GCL-010328	25.4	-30.0	-31.98	3.0	9.61
GCL-010329	25.4	-40.0	-41.98	3.0	7.36
GCL-010330	25.4	-200.0	-201.98	3.0	3.78

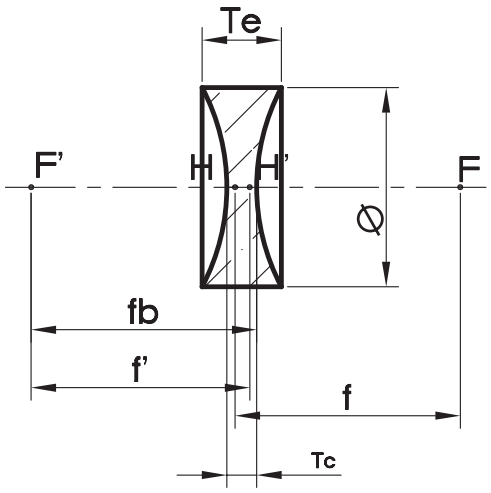
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0104 BK7 Bi-Concave Lenses

GCL-0104

Similar to plano-concave lenses, a bi-concave lens diverges parallel input rays and has a negative focal length. It has a virtual focus at the object side of the lens. Bi-concave lenses are usually suitable for absolute conjugate ratios closer to 1:1,



GCL-0104

f: focal length (object side)
f': focal length (image side)
fb: back focal length
⌀: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

- Material: BK7 grade A, fine annealed
- Focal Length (f'): ±2% at 587.6nm
- Diameter(⌀) Tolerance: +0.0/-0.20
- Center Thickness (Tc): ±0.1
- Centration: 3'
- Form Error: 1~5 fringes
- Irregularity of Fringes: 0.2~0.5 fringes
- Surface Quality: 60-40 scratch-dig
- Coating: 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence
- Clear Aperture: 90% diameter

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0104 BK7 Bi-Concave Lenses

Part No.	∅	f'	fb	Tc	Te
GCL-010401	6.0	-9.8	-10.4	2.0	2.9
GCL-010424	10.0	-15.1	-15.8	2.0	3.6
GCL-010423	10.0	-30.0	-30.7	2.0	2.8
GCL-010402	12.7	-19.0	-19.7	2.0	4.2
GCL-010403	12.7	-25.4	-26.0	2.0	3.6
GCL-010404	12.7	-38.1	-38.8	2.0	3.0
GCL-010422	20.0	-30.0	-30.8	2.7	6.0
GCL-010421	20.0	-40.0	-40.9	2.7	5.1
GCL-010420	20.0	-60.0	-61.2	2.7	4.3
GCL-010405	25.4	-50.8	-51.8	3.0	6.2
GCL-010406	25.4	-75.0	-76.3	3.0	5.1
GCL-010407	25.4	-100.0	-101.7	3.0	4.6
GCL-010408	25.4	-150.0	-150.9	3.0	4.1
GCL-010419	30.0	-60.0	-61.3	3.5	7.1
GCL-010418	30.0	-180.0	-181.1	3.5	4.7
GCL-010417	30.0	-250.0	-251.3	3.5	4.4
GCL-010409	38.1	-125.0	-126.5	4.0	6.8
GCL-010410	38.1	-200.0	-201.6	4.0	5.8
GCL-010411	38.1	-300.0	-301.5	4.0	5.2
GCL-010416	40.0	-100.0	-101.4	4.0	7.9
GCL-010415	40.0	-150.0	-151.4	4.0	6.6
GCL-010412	50.8	-250.0	-251.5	5.0	7.5
GCL-010413	50.8	-400.0	-401.6	5.0	6.6
GCL-010414	50.8	-500.0	-501.7	5.0	6.3

All dimensions are in mm unless otherwise specified.

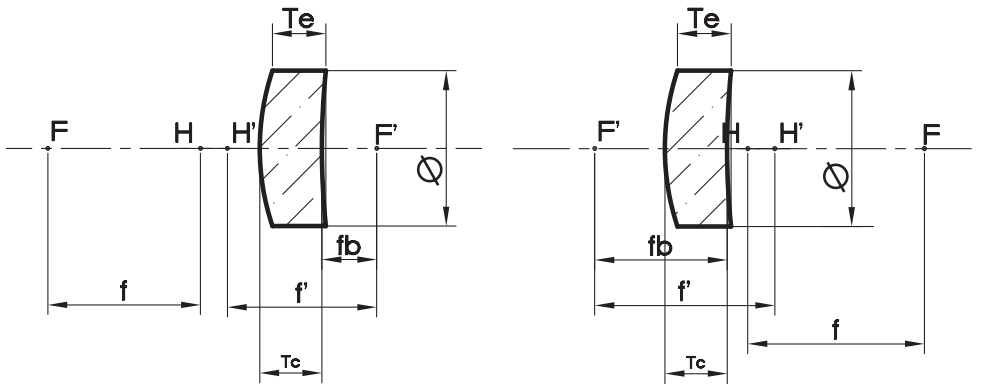
GCL-01 Lenses

GCL-0105 BK7 Meniscus Lenses

GCL-0105

Meniscus lenses can be either positive or negative, depending on the relative curvatures of the two surfaces. A negative meniscus lens is thinner at the centre than periphery. Conversely, a positive meniscus lens is thicker at the centre than periphery.

A thin lens with two surfaces of equal curvature has zero optical power, which means it does neither converge nor diverge light. All real lenses have thickness, because of its curvature, it affects the optical power. To achieve zero optical power, a meniscus lens must have slightly unequal curvatures to account for the effect of the lens thickness.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
∅: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0105

- Material: BK7 grade A, fine annealed
- Focal Length (f'): ±2% at 587.6nm
- Diameter(∅) Tolerance: +0.0/-0.20
- Center Thickness (Tc): ±0.1
- Centration: 3'
- Form Error: 1~5 fringes
- Irregularity of Fringes: 0.2~0.5 fringes
- Surface Quality: 60-40 scratch-dig
- Coating: 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence
- Clear Aperture: 90% diameter

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0105 BK7 Meniscus Lenses

Part No.	∅	f'	fb	Tc	Te
GCL-010501	25.4	50.0	44.6	5.0	1.3
GCL-010502	25.4	100.0	94.9	4.0	2.4
GCL-010503	25.4	150.0	144.8	4.0	2.9
GCL-010504	25.4	200.0	195.1	3.5	2.7
GCL-010505	25.4	-50.0	-53.3	5.0	9.4
GCL-010506	25.4	-100.0	-104.1	3.0	4.7
GCL-010507	25.4	-150.0	-153.9	3.0	4.1
GCL-010508	25.4	-200.0	-203.6	3.0	3.8

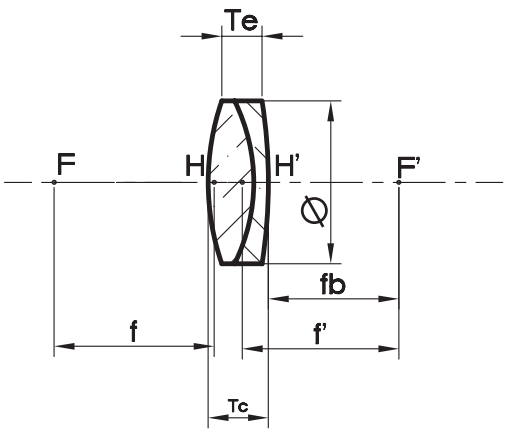
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0106 Positive Achromatic Doublets

GCL-0106

An achromatic-doublet consists of a positive low-index (crown glass) cemented with a negative high-index (flint glass) lens. These lenses are computer-optimized for infinite conjugate ratio. They also exhibit excellent paraxial performance, with minimal spherical aberration, coma and chromatic aberration. When used for focusing or collimating, the convex part of the lens or the lens surface with smaller radius should face the collimated light. When used for imaging, the convex lens should face the object or the image that is furthest away.



GCL-0106

f: focal length (object side)
f': focal length (image side)
fb: back focal length
⌀: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

• Material:	Optical glass (crown and flint)
• Focal Length (f'):	±2% at 587.6nm
• Diameter(⌀) Tolerance:	+0.0/-0.20
• Center Thickness (Tc):	±0.1
• Centration:	3'
• Form Error:	1~5 fringes
• Irregularity of Fringes:	0.2~0.5 fringes
• Coating:	1/4 wave MgF_2 coating at 550nm for 0° angle of incidence
• Clear Aperture:	90% diameter

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0106 Positive Achromatic Doublets

Part No.	Ø	f'	fb	Tc	Te
GCL-010661	6.0	10.0	7.8	4.2	3.0
GCL-010662	6.0	20.0	18.6	3.1	2.5
GCL-010601	6.0	30.0	28.8	2.8	2.4
GCL-010612	10.0	20.0	17.0	5.0	3.4
GCL-010613	10.0	30.0	28.2	3.7	2.7
GCL-010602	12.7	50.0	48.1	4.3	3.3
GCL-010603	12.7	75.0	73.3	3.8	3.1
GCL-010620	20.0	40.0	35.5	8.5	5.4
GCL-010621	20.0	50.0	46.4	7.4	4.9
GCL-010622	20.0	60.0	56.8	6.7	4.6
GCL-010604	25.4	100.0	96.4	7.7	5.7
GCL-010605	25.4	150.0	147.1	6.5	5.2
GCL-010606	25.4	200.0	197.3	6.1	5.1
GCL-010630	30.0	50.0	42.3	13.5	7.7
GCL-010631	30.0	75.0	69.7	9.9	6.2
GCL-010632	30.0	90.0	85.7	8.8	5.8
GCL-010607	38.1	150.0	145.2	10.3	7.4
GCL-010608	38.1	200.0	195.8	9.0	6.8
GCL-010609	38.1	300.0	296.3	8.0	6.5
GCL-010640	40.0	120.0	114.2	12.1	8.1
GCL-010641	40.0	250.0	246.1	8.6	6.7
GCL-010610	50.8	400.0	395.5	9.7	7.8
GCL-010611	50.8	500.0	495.9	9.0	7.5
GCL-010618	12.7	15.0	10.43	8.5	5.74
GCL-010619	12.7	25.0	21.83	5.8	4.4
GCL-010650	25.4	30.0	21.94	14.8	9.88
GCL-010651	25.4	40.0	33.26	12.0	8.42
GCL-010652	25.4	50.0	43.57	11.5	8.7
GCL-010653	25.4	60.0	52.56	11.4	8.86
GCL-010654	25.4	75.0	70.41	9.5	6.89
GCL-010655	25.4	125.0	120.96	8.4	6.85
GCL-010656	25.4	175.0	170.81	9.0	7.89
GCL-010614	50.8	75.0	61.29	24.5	16.89
GCL-010615	50.8	100.0	90.15	18.0	12.44
GCL-010616	50.8	150.0	143.44	13.5	8.94
GCL-010617	50.8	200.0	193.8	12.5	8.99

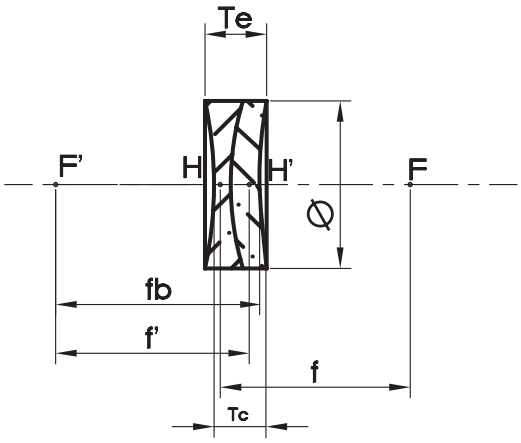
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0107 Negative Achromatic Doublets

GCL-0107

An achromatic-doublet consists of a negative low-index (crown glass) cemented with a positive high-index (flint glass) lens. These lenses are computer-optimized for infinite conjugate ratio. While the output rays do not actually meet to form a real point, they appear to be diverging from a virtual point located on the object side of the lens.



GCL-0107

f: focal length (object side)
f': focal length (image side)
fb: back focal length
∅: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

• Material:	Optical glass (crown and flint)
• Focal Length (f'):	±2% at 587.6nm
• Diameter(∅) Tolerance:	+0.0/-0.10
• Center Thickness (Tc):	±0.1
• Centration:	3'
• Form Error:	1~5 fringes
• Irregularity of Fringes:	0.2~0.5 fringes
• Surface Quality:	60-40 scratch-dig
• Coating:	1/4 wave MgF2 coating at 550nm for 0° angle of incidence
• Clear Aperture:	90% diameter

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0107 Negative Achromatic Doublets

Part No.	∅	f'	fb	Tc	Te
GCL-010711	25.4	-30	-36.15	12.0	16.71
GCL-010712	25.4	-40	-44.4	8.5	11.97
GCL-010713	25.4	-50	-53.37	6.6	9.32
GCL-010714	25.4	-75	-77.65	6.6	9.13
GCL-010715	25.4	-100	-102.37	4.6	5.95
GCL-010716	25.4	-150	-152.6	6.6	7.87

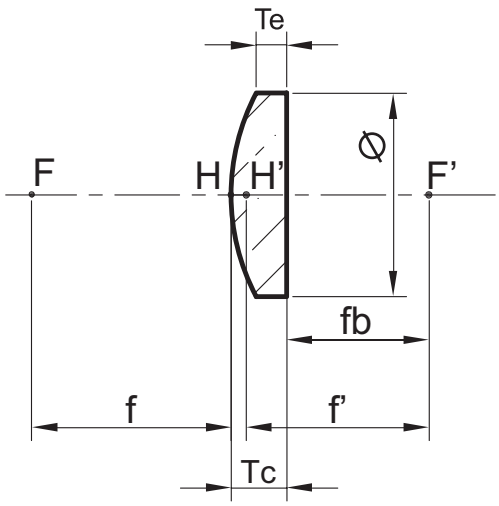
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0108 Fused Silica Plano-Convex Lenses

GCL-0108

Fused Silica is the material used in UV region and imaging applications. It has high transmission from 200nm to 2.5μm. In addition, it also can be used in higher operating temperatures. Fused silica positive lenses are most commonly used for focusing parallel rays of light to a spot.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
⌀: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0108

• Material:	UV grade fused silica
• Focal Length (f'):	±2% at 587.6nm
• Diameter(⌀) Tolerance:	+0.0/-0.20
• Center Thickness(Tc):	±0.1
• Centration:	3'
• Form Error:	1~5 fringes
• Irregularity of Fringes:	0.2~0.5 fringes
• Surface Quality:	60-40 scratch-dig
• Clear Aperture:	90% diameter
• Coating:	Uncoated

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0108 Fused Silica Plano-Convex Lenses

Part No.	∅	f'	fb	Tc	Te
GCL-010801	10.0	15.0	12.9	3.3	1.2
GCL-010802	10.0	30.0	28.5	2.3	1.4
GCL-010803	10.0	40.0	38.7	2.3	1.6
GCL-010804	12.7	25.4	22.5	4.0	2.1
GCL-010805	12.7	38.1	36.0	3.0	1.8
GCL-010806	12.7	50.8	48.3	3.0	2.1
GCL-010807	20.0	40.0	36.7	5.0	2.1
GCL-010808	20.0	60.0	56.6	5.0	3.1
GCL-010809	20.0	80.0	76.7	4.5	3.1
GCL-010810	25.4	38.1	33.3	7.0	1.5
GCL-010811	25.4	50.8	46.3	6.0	2.2
GCL-010812	25.4	75.0	71.6	5.0	2.6
GCL-010813	25.4	250.0	246.6	5.0	4.3
GCL-010814	25.4	100.0	97.3	4.0	2.2
GCL-010815	25.4	150.0	147.3	4.0	2.8
GCL-010816	25.4	175.0	172.3	4.0	3.0
GCL-010817	25.4	200.0	197.3	4.0	3.1
GCL-010819	25.4	30.0	23.14	10	1.53
GCL-010820	25.4	40.0	35.48	6.6	1.49
GCL-010821	25.4	60.0	56.85	4.6	1.49
GCL-010822	25.4	125.0	122.94	3	1.58

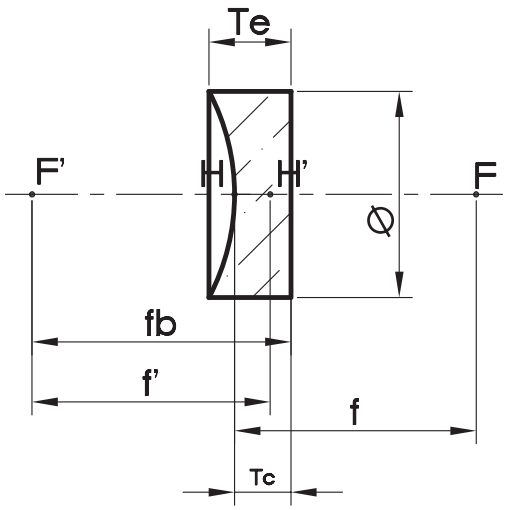
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0109 Fused Silica Plano-Concave Lenses

GCL-0109

Fused Silica is the material used in UV region and imaging applications. It has high transmission from 200nm to 2.5μm. In addition, it also can be used in higher operating temperatures. A plano-concave lens diverges parallel input rays and has a negative focal length. The output rays do not actually meet to form a real focus and appear to be diverging from a virtual spot located on the object side of the lens.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
∅: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0109

• Material:	UV grade fused silica
• Focal Length (f'):	±2% at 587.6nm
• Diameter(∅) Tolerance:	+0.0/-0.20
• Center Thickness(Tc):	±0.1
• Centration:	3'
• Form Error:	1~5 fringes
• Irregularity of Fringes:	0.2~0.5 fringes
• Surface Quality:	60-40 scratch-dig
• Clear Aperture:	90% diameter
• Coating:	Uncoated

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0109 Fused Silica Plano-Concave Lenses

Part No.	∅	f'	fb	Tc	Te
GCL-010901	10.0	-15.0	-16.9	2.3	4.5
GCL-010902	10.0	-30.0	-31.6	2.3	3.2
GCL-010903	10.0	-40.0	-41.8	2.3	3.0
GCL-010904	12.7	-25.4	-27.2	3.0	4.9
GCL-010905	12.7	-38.1	-40.1	3.0	4.2
GCL-010906	12.7	-50.8	-52.4	3.0	3.9
GCL-010907	20.0	-40.0	-42.3	3.2	6.1
GCL-010908	20.0	-60.0	-61.9	3.2	5.1
GCL-010909	20.0	-80.0	-81.9	3.2	4.6
GCL-010910	25.4	-38.1	-40.5	3.5	9.0
GCL-010911	25.4	-50.8	-52.8	3.5	7.3
GCL-010912	25.4	-75.0	-77.4	3.5	5.9

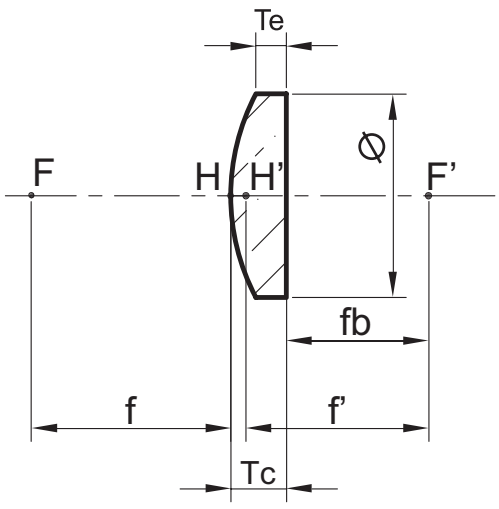
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0111 Calcium Fluoride Plano-Convex Lenses

GCL-0111

Calcium Fluoride has good thermal property due to its high transmission from 250nm to 7μm. It is commonly used in cooled thermal imaging systems or laser focusing. Plano-convex lenses are mostly used for focusing parallel rays of light to a spot.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
Ø: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0111

- Focal Length (f'): ±2% at 5μm
- Diameter(Ø)Tolerance: +0.0/-0.20
- Center Thickness(Tc): ±0.1
- Centration: 3'
- Form Error: 3 fringes
- Irregularity of Fringes: 0.5
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% diameter
- Uncoated:

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0111 Calcium Fluoride Plano-Convex Lenses

Part No.	∅	f'	fb	Tc	Te
GCL-011101	25.4	50	45.43	6.4	1.83
GCL-011102	25.4	75	71.57	4.8	1.97
GCL-011103	25.4	100	97.07	4.1	2.02
GCL-011104	25.4	150	147.57	3.4	2.04
GCL-011105	25.4	200	197.86	3	1.98

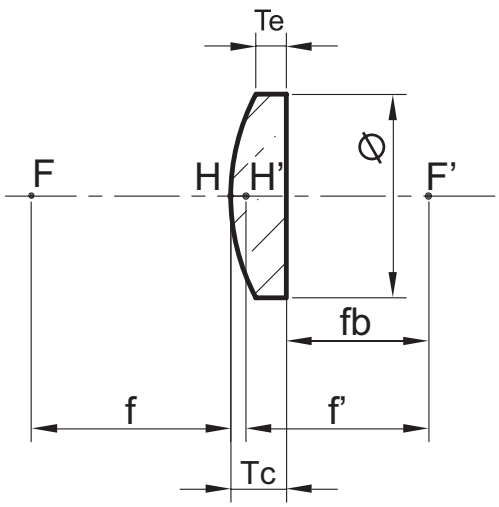
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0121 Zinc Selenide Plano-Convex Lenses

GCL-0121

Zinc Selenide has good thermal property due to its high transmission from 600nm to 16μm. It is commonly used in cooled thermal imaging systems or laser focusing. Plano-convex lenses are mostly used for focusing parallel rays of light to a real spot. As it is a relatively soft material, it is not recommended for use in harsh environments; handling, mounting and cleaning this lenses are with particular care.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
Ø: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0121

• Focal Length (f'):	±2% at 10.6μm
• Diameter(Ø)Tolerance:	+0.0/-0.20
• Center Thickness(Tc):	±0.1
• Centration:	3'
• Form Error:	3 fringes
• Irregularity of Fringes:	0.5
• Surface Quality:	60-40 scratch-dig
• Clear Aperture:	90% diameter
• Uncoated:	

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0121 Zinc Selenide Plano-Convex Lenses

Part No.	∅	f'	fb	Tc	Te
GCL-012101	25.4	50.8	49.51	3.1	1.96
GCL-012102	25.4	75	73.84	2.8	2.03
GCL-012103	25.4	100	98.92	2.6	2.02
GCL-012104	25.4	150	149	2.4	2.02
GCL-012105	25.4	200	199.04	2.3	2.01

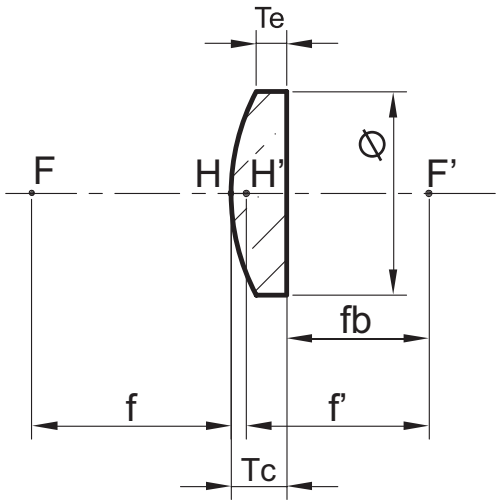
All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0131 Germanium Plano-Convex Lenses

GCL-0131

Germanium is ideal for mid-infrared applications. It stands up well to harsh environments. It is subject to thermal runaway, which means that the transmission decreases as temperature increases. Plano-convex lenses are mostly used for focusing parallel rays of light to a real spot.



f: focal length (object side)
f': focal length (image side)
fb: back focal length
Ø: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-0131

- Focal Length (f'): ±2% at 10.6μm
- Diameter(Ø)Tolerance: +0.0/-0.20
- Center Thickness(Tc): ±0.1
- Centration: 3'
- Form Error: 3 fringes
- Irregularity of Fringes: 0.5
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% diameter
- Uncoated:

All dimensions are in mm unless otherwise specified.

GCL-01 Lenses

GCL-0131 Germanium Plano-Convex Lenses

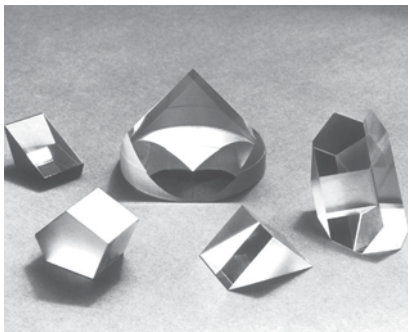
Part No.	∅	f'	fb	Tc	Te
GCL-013101	25.4	50.8	50.18	3.1	1.97
GCL-013102	25.4	75	74.4	2.8	2.04
GCL-013103	25.4	100	99.43	2.6	2.03
GCL-013104	25.4	150	149.45	2.4	2.02
GCL-013105	25.4	200	199.45	2.3	2.07

All dimensions are in mm unless otherwise specified.

Prisms

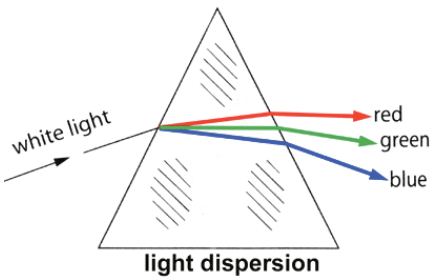
GCL-03 Prisms

PRISMS



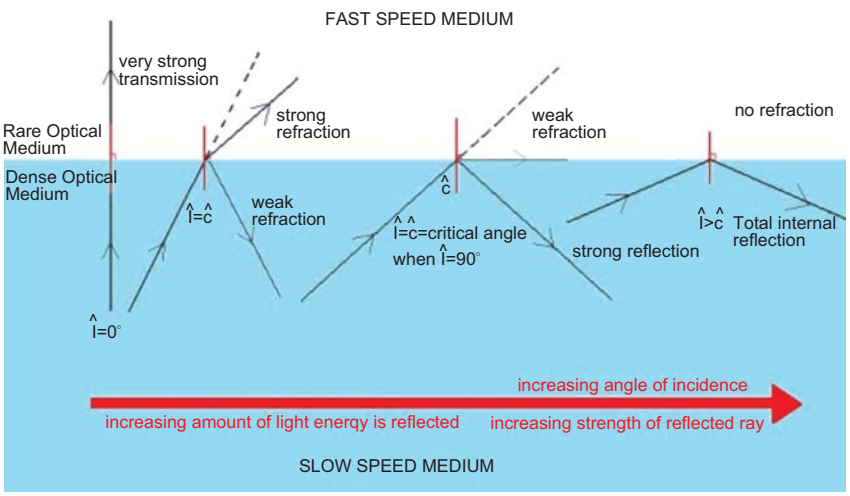
General

Prisms are used in an optical system when the exit beam may be reflected or deviated from the entrance direction. The images produced by prisms can be made reversed, inverted or rotated. Prisms are typically made of glass materials, and can be made from any material that is transparent to the wavelengths.



Dispersion

Light changes its speed as it moves from one medium to another, for example, from air into glass and from water to air. This causes the light to be refracted at the boundary and to enter the new medium at a different speed with a different angle (Huygens principle). The bending angle of the light path depends on the angle that the incident beam strikes at the interface and the ratio between the refractive indices of the two media (Snell's law). The refractive index of many materials such as glass varies with the wavelength or color of light, a phenomenon known as dispersion. This means that light of different colors is refracted differently and leaves the medium such as a prism at different angles, creating an effect similar to a rainbow. With this principle, a prism is used to separate a beam of white light into its constituent spectrum of colors, and so does a diffraction grating. However, prisms generally disperse light over a much larger frequency bandwidth than diffraction gratings, making them useful for broad-spectrum spectroscopy.



Total Internal Reflection (TIR) Prism

Prisms are sometimes used for the internal reflection at the surfaces rather than for dispersion. If light inside the prism hits one of the surfaces at a sufficiently steep angle, total internal reflection (TIR) occurs and all of the light is reflected. This makes a prism a useful substitute for a mirror in some situations. TIR Prism can be used to reflect light, or to split light into components with different polarizations.

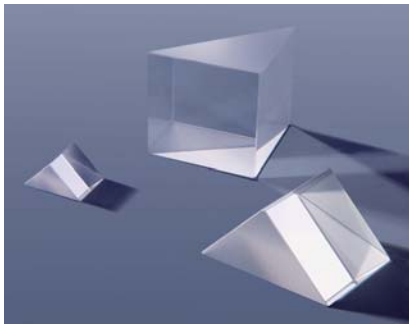
Accessory:

GCM-0601 Prism Tables
GCM-0602 V-groove Mounts
GCM-0603 V-grooved Lens Chucks

All dimensions are in mm unless otherwise specified.

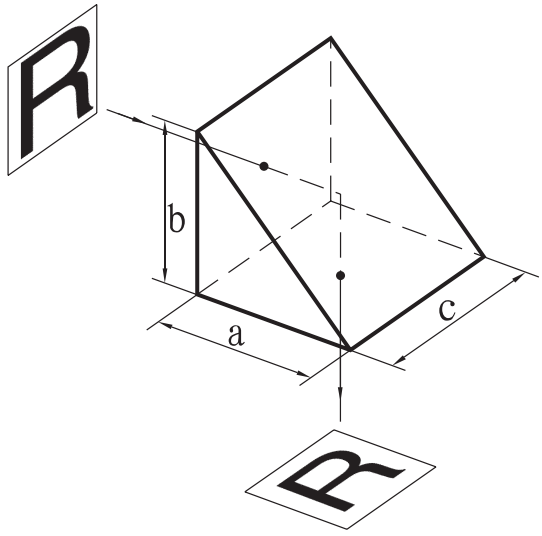
GCL-03 Prisms

GCL-03010 BK7 Right Angle Prisms



GCL-03010

Right angle prisms are ideal for beam bending and retro reflection applications. They are often used, instead of mirrors, in applications where deformation of the reflective surface may cause a problem. The fine balance between performance and cost has been optimized making these prisms ideal for OEM applications in the visible and near infrared wavelength range.



GCL-03010

- Angles: 45°, 90° ±3' or 30"
- Material: BK7, grade A, fine annealed
- Flatness: λ/4
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% surface area
- Uncoated

All dimensions are in mm unless otherwise specified.

GCL-03 Prisms

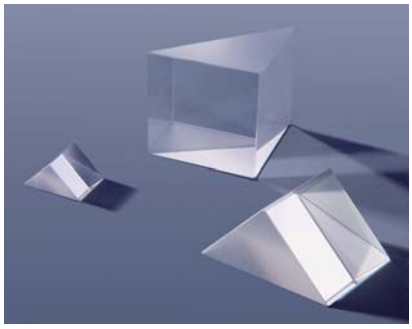
GCL-03010 BK7 Right Angle Prisms

Dimension	Part No.	
a=b=c	±3'	±30"
5.0	GCL-030104	GCL-030104A
10.0	GCL-030105	GCL-030105A
12.7	GCL-030101	GCL-030101A
20.0	GCL-030106	GCL-030106A
25.4	GCL-030102	GCL-030102A
30.0	GCL-030107	GCL-030107A
40.0	GCL-030108	GCL-030108A
50.8	GCL-030103	GCL-030103A

All dimensions are in mm unless otherwise specified.

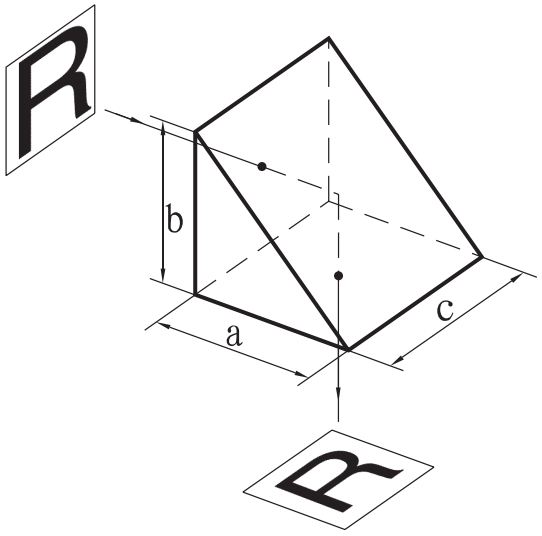
GCL-03 Prisms

GCL-03012 Fused Silica Right Angle Prisms



GCL-03012

Fused Silica is regarded as very good material to be used in UV laser and imaging applications. It has high transmission from 200nm to 2.5um. In addition, it also can be used in higher operating temperatures. Right angle prisms are ideal for beam bending and retro reflection applications. They are often used, instead of mirrors, in applications where deformation of the reflective surface may cause a problem.



GCL-03012

- Angles: 45°, 90° ±3'
- Material: UV grade fused silica
- Flatness: λ/4
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% surface area
- Uncoated

GCL-03012 Fused Silica Right Angle Prisms

Part No.	Dimension (a=b=c)
GCL-030121	10
GCL-030122	25.4

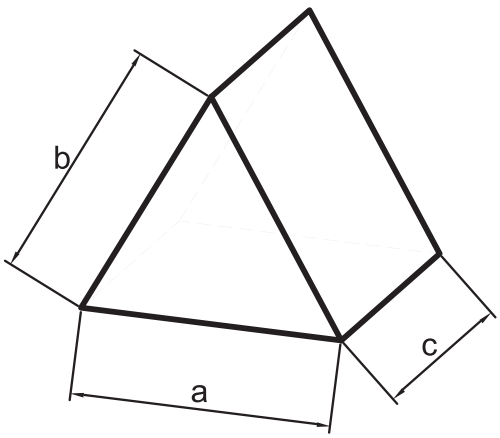
All dimensions are in mm unless otherwise specified.

GCL-03 Prisms

GCL-03013 Equilateral prisms

GCL-03013

An equilateral dispersing prism has an equilateral triangle in the cross-section with the three sides of equal length. They are used for wavelength separation. A light ray is refracted twice, passing through the prism with total deviation denoted by qd top angle. Deviation is a function of refractive index, and hence wavelength. Angular dispersion is the difference in deviation for light rays having different wavelengths and varies with prism orientation.



GCL-03013

- Angles: 60° ±2'
- Material: SF11
- Flatness: λ/4
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% surface area
- Coatings: 1/4 wave MgF_2 coating at 550nm for all 3 surfaces

GCL-03013 Equilateral prisms

Part No.	Dimension (a=b=c)
GCL-030131	10
GCL-030132	25.4
GCL-030133	40

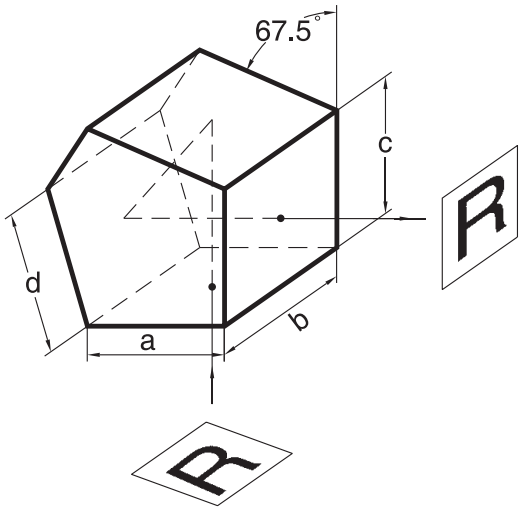
All dimensions are in mm unless otherwise specified.

GCL-03 Prisms

GCL-0302 Penta Prisms

GCL-0302

A Penta prism is a five-side prism, featuring two important properties. Firstly, the image is neither inverted nor reversed while it is deviated by 90 degree. Secondly, it is a constant deflection device, i.e., all the transmitted rays are exactly deflected by 90 degree. Slight movement of the prisms does not affect the right deflected angle. This feature makes the prism useful in rangefinder. It is also used in viewfinders of single reflex cameras. The reflecting surfaces are enhanced aluminum-coated with black paint overcoat for protection.



GCL-0302

- Beam Deviation: 90°±3'or 90°±30'' see table below
- Material: BK7, fine annealed
- Dimension Tolerance: ±0.1
- Flatness: λ/4 at reflection surface
  λ/2 at transmission surface
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90%
- Coatings: Reflecting surfaces are aluminized with black paint.
  Entrance and exit surfaces are 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence.

All dimensions are in mm unless otherwise specified.

GCL-03 Prisms

GCL-0302 Penta Prisms

Part No.	(a=b=c)	d	Total Deviation
GCL-030201	20.0	21.6	90° ±3'
GCL-030202	30.0	32.5	90° ±3'
GCL-030203	40.0	43.3	90° ±3'
GCL-030204	40.0	43.3	90° ±30"

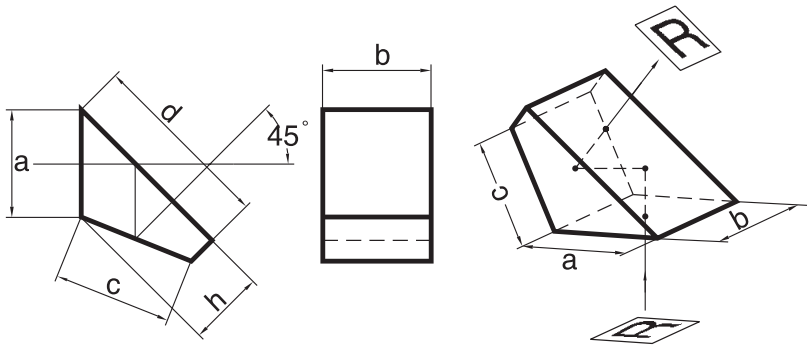
All dimensions are in mm unless otherwise specified.

GCL-03 Prisms

GCL-0303 45° Reflection Prisms

aluminum coated with black paint for protection.

GCL-0303



GCL-0303

- Beam Deviation: 45°±5'
- Material: BK7, fine annealed
- Dimension Tolerance: ±0.1
- Flatness: λ/4 at reflection surface
  λ/2 at transmission surface
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90%
- Coatings: Reflecting surfaces are aluminized with black paint.
  Entrance and Exit surfaces are 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence.

GCL-0303 45° Reflection Prisms

Part No.	(a=b)	c	d	h
GCL-030301	20.0	21.6	34.2	14.2
GCL-030302	30.0	32.4	51.3	21.3

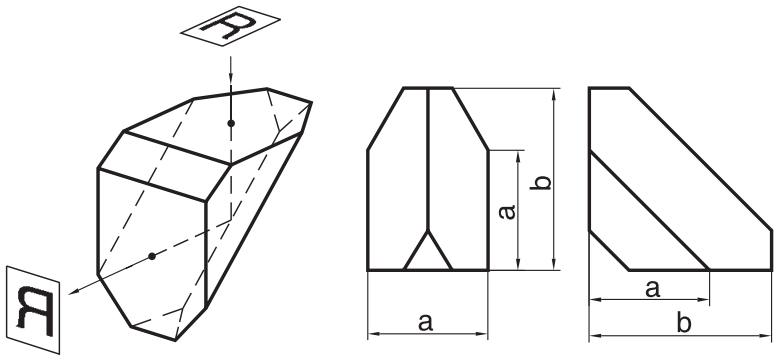
All dimensions are in mm unless otherwise specified.

GCL-03 Prisms

GCL-0304

GCL-0304 Right Angle Roof Prisms

This type of prism consists of a roof edge produced upon the long reflecting face of a right-angle prism and is also called Amici roof prism. Like a right-angle prism, it reflects an image by 90°, but inverts the image simultaneously. It is commonly used as an erecting system in telescopes.



GCL-0304

- Beam Deviation: 90°±5'
- Material: BK7, fine annealed
- Dimension Tolerance: ±0.15
- Flatness: λ/4 at reflection surface
  λ/2 at transmission surface
- Roof Angle Tolerance: ±5", ±15"
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% surface area
- Coatings: Entrance and exit surfaces are 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence.
  Roof surfaces are uncoated.

GCL-0304 Right Angle Roof Prisms

Part No.	a	b	Roof Angle
GCL-030401	18.0	24.5	90 ±5"
GCL-030401B	18.0	24.5	90 ±15"
GCL-030403	32.0	41.0	90 ±5"
GCL-030403B	32.0	41.0	90 ±15"

All dimensions are in mm unless otherwise specified.

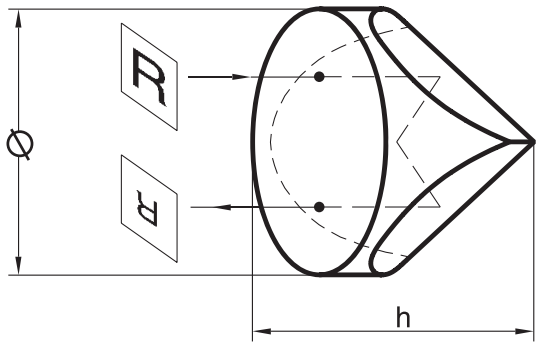
GCL-03 Prisms

GCL-0305 Corner Cube Prisms

GCL-0305

This prism has three mutually perpendicular intersected surfaces and a hypotenuse face. The three intersected surfaces are coated for high internal reflection. When light enters through the hypotenuse, it is reflected by each of the three surfaces in turn and emerges through the hypotenuse face parallel to the entering beam with a shift. The prism thus retro-reflects the beam to the source, regardless the orientation of the prism. It has a wider field of view. They are ideal in applications where orientation is difficult or impossible to control.

There is also an alternative form of the retro-reflector which consists of three perpendicular intersected mirrors in a holder. This is much lighter than the prism form but demands accurate assembly.



GCL-0305

- Beam Deflection: 180°±5"
- Material: BK7, optical glass fine annealed
- Dimension Tolerance: 0.15
- Wavefront Distortion: λ/4
- Surface Quality: 80-50 scratch-dig
- Clear Aperture: 90% surface area
- Coatings: Reflecting surfaces are aluminized with black paint.
  Entrance surfaces is 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence

All dimensions are in mm unless otherwise specified.

GCL-03 Prisms

GCL-0305 Corner Cube Prisms

Part No.	∅	h	Beam Deviation
GCL-030502	12.7	9.5	180° ±5"
GCL-030503	25.4	19.1	180° ±5"
GCL-030504	15.0	11.7	180° ±5"

All dimensions are in mm unless otherwise specified.

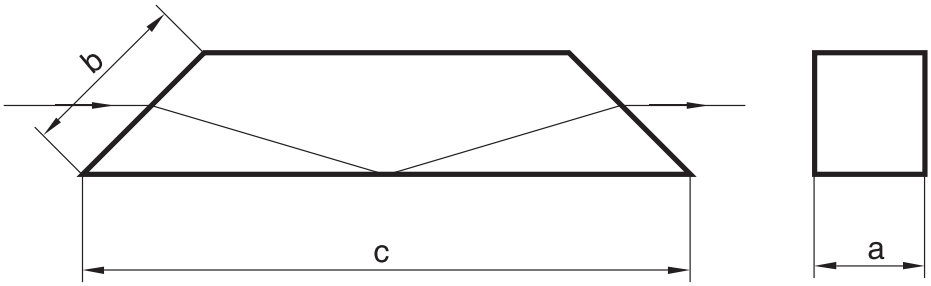
GCL-03 Prisms

GCL-0306 Dove Prisms

GCL-0306

This type of prism is a half of a common right-angle prism with the right angle corner truncated parallel to the hypotenuse face. Light, parallel to the hypotenuse face, enters one of slope faces, has total internal reflection(TIR) on that face, and emerges from the other slope face parallel to its incident direction. Because of one reflection on the hypotenuse face, the image is flipped and inverted, but not laterally transposed. The emerging light is continued in the incident direction.

The most interested property of the Dove prism is that, if the prism is rotated about the incident axis through an angle, the image rotates twice of that angle. This makes it as a beam rotator which is widely used in optical instruments. A Dove prism must be used in parallel light or a collimated beam.



GCL-0306

- Angle Tolerance: ±3'
- Material: BK7,fine annealed
- Dimension Tolerance: ±0.15
- Flatness: λ/4
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% surface area
- Uncoated:

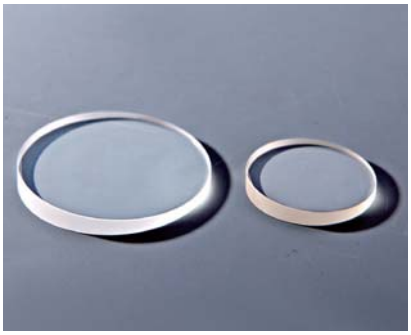
GCL-0306 Dove Prisms

Part No.	a	b	c
GCL-030601	10.0	14.14	42.28
GCL-030602	20.0	28.18	84.56

All dimensions are in mm unless otherwise specified.

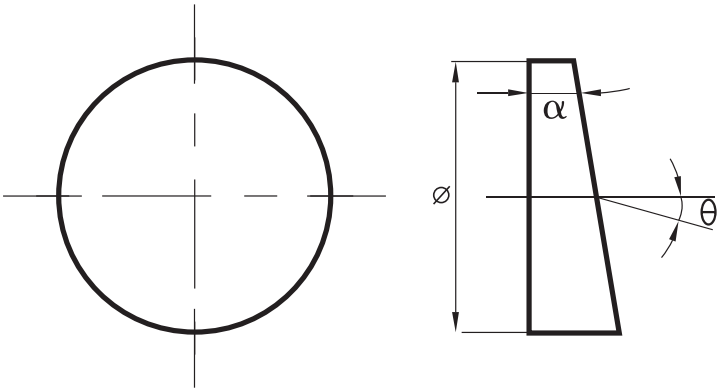
GCL-03 Prisms

GCL-04 Wedge Prisms



GCL-04

An optical element has plane-inclined surface. Wedge prisms are used as small beam steering elements in optical systems. By combining two wedges of equal power (equal wedge angle) in near contact and independently rotating them, a ray passing through the combination can be steered in anydirection, within a narrow cone.



GCL-04

- Material: BK7, fine annealed
- Diameter(∅) Tolerance: +0.0/-0.15
- Flatness: λ/4~λ
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90%surface area
- Coatings: 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence
- Beam Deviation(e°): ≈(n*-1)·α°

n*: Index of the material

GCL-04 Wedge Prisms

Part No.	∅	Wedge Angle(α°)
GCL-040101	25.4	2.0
GCL-040102	25.4	4.0
GCL-040201	38.1	2.0
GCL-040202	38.1	4.0

All dimensions are in mm unless otherwise specified.

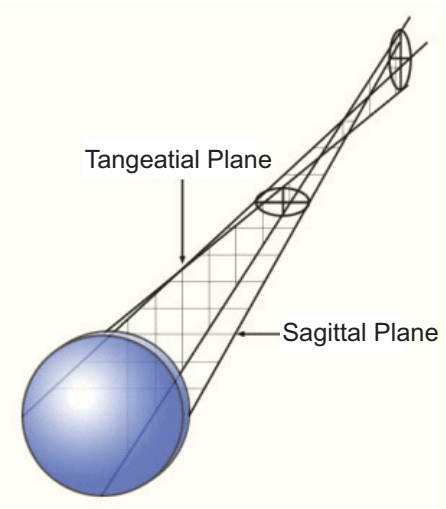
Cylindrical Lenses

GCL-11 Cylindrical Lenses

CYLINDRICAL LENSES

Cylindrical Lenses

Cylindrical lenses focus or expand light in one axis only. They can be used to focus light into a thin line in optical metrology, laser scanning, spectroscopy, laser diode, acousto-optic, and optical processor applications. They can also be used to expand the output of a laser diode into a symmetrical beam.



Astigmatism

An optical system with astigmatism is one where rays that propagate in two perpendicular planes have different foci. If an optical system with astigmatism is used to form an image of a cross, the vertical and horizontal lines will be in sharp focus at two different distances.

There are two distinct forms of astigmatism. The first is a third-order aberration, which occurs for objects (or parts of objects) away from the optical axis. This form of aberration occurs even when the optical system is perfectly symmetrical. This is often referred to as a "monochromatic aberration", because it occurs even for light of a single wavelength. This terminology may be misleading, however, as the amount of aberration can vary strongly with wavelength in an optical system.

The second form of astigmatism occurs when the optical system is not symmetric about the optical axis. This may be by design (as in the case of a cylindrical lens), or due to manufacturing error in the surfaces of the components or misalignment of the components. In this case, astigmatism is observed even for rays from on-axis object points. This form of astigmatism is extremely important in vision science and eye care, since the human eye often exhibits this aberration due to imperfections in the shape of the cornea or the lens.

Applications

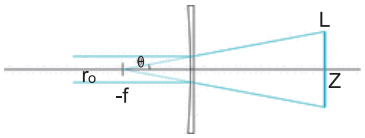


Figure A

A. Generating a Line of Light from a Collimated Laser

A common application of cylindrical lenses is shown in Figure A. A collimated laser beam of radius r_o is incident upon a cylindrical plano-concave lens of focal length, f. In this figure, the radius of the laser beam is exaggerated for clarity. The laser beam will expand with a half-angle θ of r_o/f. The laser beam will appear to be expanding from a virtual source placed a distance f behind the lens. At a distance z after the lens, there will be a line with thickness $2r_o$ (ignoring expansion of the Gaussian beam) and length

$L = 2 (r_o/f)(z+f)$

All dimensions are in mm unless otherwise specified.

GCL-11 Cylindrical Lenses

CYLINDRICAL LENSES

If z is large compared to f, then we have an expansion ratio that is very close to z/f. This is not an imaging problem; we are projecting the laser beam into a line at a particular distance. The length of the line is simply proportional to z.

If the thinnest possible line is required, a second lens, this one a cylindrical plano-convex lens of focal length ~ z, can be inserted into the system just before or after the plano-concave lens. When oriented on the orthogonal axis, it will focus the laser at the screen onto which the line is projected.

Circularizing the Beam from a Laser Diode

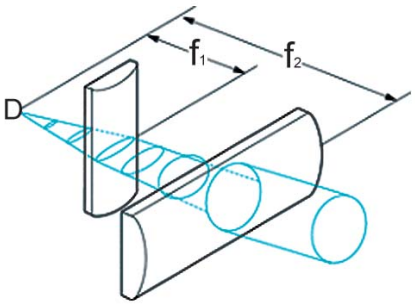


Figure B

The output of a laser diode diverges in an asymmetrical pattern, making collimating the beam a challenge. Cylindrical lenses can be used to circularize the beam. Consider a laser diode with beam divergence of θ1 & θ2 = 10° & 40°. Any attempt to collimate this beam with spherical optics would result in collimation in one direction only, with a diverging or converging beam in the other direction. With cylindrical optics the problem can be approached as two one-dimensional problems. The simplest solution would be to collimate the beam in one dimension with a single cylindrical lens, then collimate the orthogonal dimension with a second cylindrical lens (see Figure B).

A few observations will guide the selection and placement of the lenses:1) To achieve a symmetrical beam shape, the ratio of the focal length of the two lenses should be approximately equivalent to the ratio of the beam divergences: $\theta_1/\theta_2 = 10°/40° = f_1/f_2$.

2) First, to order, the laser diode is approximated by a point source, so the lenses should be placed at a distance equal to their respective focal lengths from the source to create a collimated output.

3) The principal planes of the two lenses should be spaced at a distance apart equal to the difference of their focal lengths $f_2 - f_1$. The actual spacing between plano surfaces of the lenses is $BFL_2 - BFL_1$. As with spherical lenses the convex surfaces should face the collimated rays to minimize aberrations.

4) Because of the rapid divergence of the laser diode beam, care must be taken to make sure the beam width at each lens does not exceed the lens clear aperture. Since each lens is placed one focal distance from the laser diode, the maximum beam width at each lens (d_1 and d_2) can be determined from the following equations: $d_1 = 2f_1(\tan(\theta_2/2))$, and $d_2 = 2f_2(\tan(\theta_1/2))$

All dimensions are in mm unless otherwise specified.

GCL-11 Cylindrical Lenses

CYLINDRICAL LENSES

Accessories

GCM-04 Self-Centering Lens Holders
GCM-05 Adjustable Self-Centering Lens Holders
GCM-0801 Lens/Mirror Mounts
GCM-0802 Small Lens/Mirror Holders
GCM-0803 Standard Lens/Mirror Holders
GCM-0805 Medium Lens/Mirror Holders
GCM-0814 Lens/Mirror Holder with Base
GCM-0823 Kinematic Corner Lens/Mirror Holders
GCM-0831M Kinematic Off-center Lens/Mirror Holders
GCM-0808 Kinematic Lens/Mirror Lockable Holders
GCM-0818 Kinematic Corner Lens/Mirror Lockable Holders
GCM-0828 3D Kinematic Lens/Mirror Lockable Holders
GCM-0838 3D Kinematic Corner Lens/Mirror Lockable Holders
GCM-0809 Vertical Drive Kinematic Lens/Mirror Holders
GCM-0819 Gimbal Lens/Mirror Holders
GCM-0829 Compact Gimbal Lens/Mirror Holders
GCM-2501 4D Lens/Mirror Holders with Pedestal
GCM-2511 4D Lens/Mirror Holders
GCM-10 Kinematic Cylindrical Lens Holders

All dimensions are in mm unless otherwise specified.

GCL-11 Cylindrical Lenses

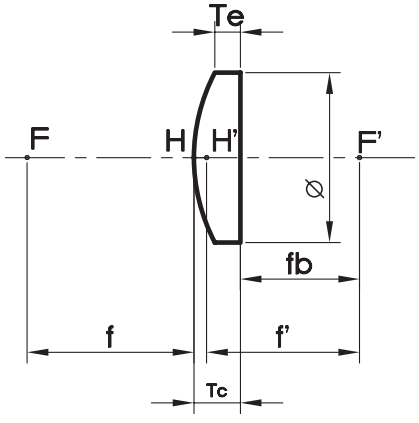
GCL-1101 Cylinder Plano-Convex Lenses

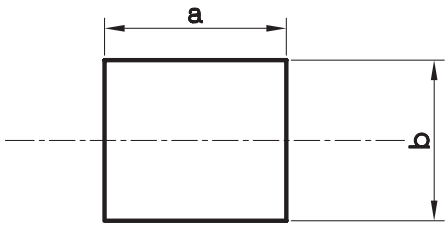
Similar to a Plano-Convex lens in profile, but only as a cylinder instead of a sphere, this cylindrical lens focuses light only in one dimension. It can also transform a point image into a line image or changing the height of an image without affecting its width. There are two circumference shapes, rectangular and circular.

GCL-11010 Rectangular Cylinder Plano-Convex Lenses

GCL-11010

- Material: BK7,fine annealed
- Effective Focal Length(f): ±2% at 587.6nm
- Dimension Tolerance: +0.0/-0.2
- Center Thickness Tolerance: ±0.2
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% surface area
- Centration: 3'
- Coatings: 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence





f: focal length (object side)
f': focal length (image side)
fb: back focal length
⌀: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-11010

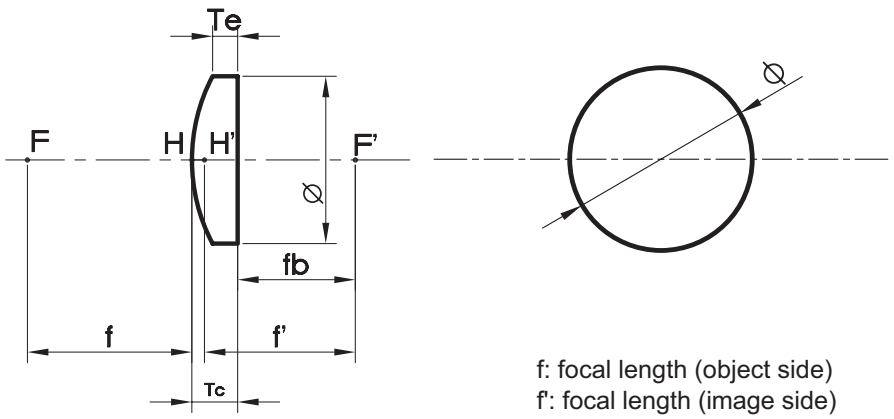
GCL-11010 Rectangular Cylinder Plano-Convex Lenses

Part No.	a*b	Tc	f'
GCL-110101	15.0x15.0	5.0	40.0
GCL-110102	25.4x25.4	5.0	200.0
GCL-110103	40.0x40.0	5.0	400.0

All dimensions are in mm unless otherwise specified.

GCL-11 Cylindrical Lenses

GCL-11011 Circular Cylinder Plano-Convex Lenses



GCL-11011

f: focal length (object side)
f': focal length (image side)
fb: back focal length
Ø: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-11011 Circular Cylinder Plano-Convex Lenses

Part No.	Ø	f'	fb	Tc
GCL-110114	25.4	25	17.09	12
GCL-110115	25.4	50	47.03	4.5
GCL-110116	25.4	75	72.89	3.2
GCL-110117	25.4	100	97.89	3.2
GCL-110118	25.4	150	147.89	3.2

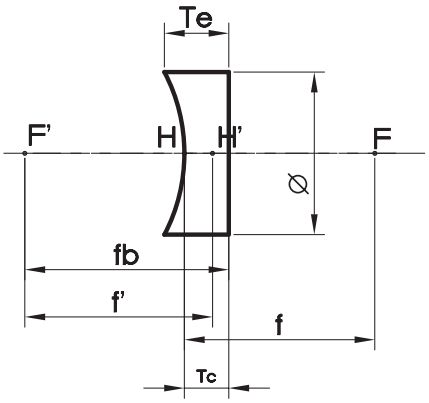
All dimensions are in mm unless otherwise specified.

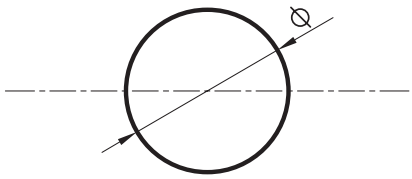
GCL-11 Cylindrical Lenses

GCL-1103 Cylinder Plano-Concave Lenses

GCL-1103

Similar to a Plano-Concave lens in profile, but only as a cylinder instead of a sphere, this cylindrical lens focuses light only in one dimension. It can be used with cylindrical plano-convex lens together in beam expander applications.





f: focal length (object side)
f': focal length (image side)
fb: back focal length
Ø: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCL-1103

- Material: BK7, fine annealed
- Effective Focal Length(f'): ±2% at 587.6nm
- Dimension Tolerance: +0.0/-0.2
- Center Thickness Tolerance: ±0.2
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% surface area
- Centration: 3'
- Coatings: 1/4 wave MgF_2 coating at 550nm for 0° angle of incidence

GCL-1103 Cylinder Plano-Concave Lenses

Part No.	Ø	f'	fb	Tc
GCL-110311	25.4	-25	-26.98	3
GCL-110312	25.4	-50	-51.98	3
GCL-110313	25.4	-75	-77.31	3.5
GCL-110314	25.4	-100	-102.31	3.5

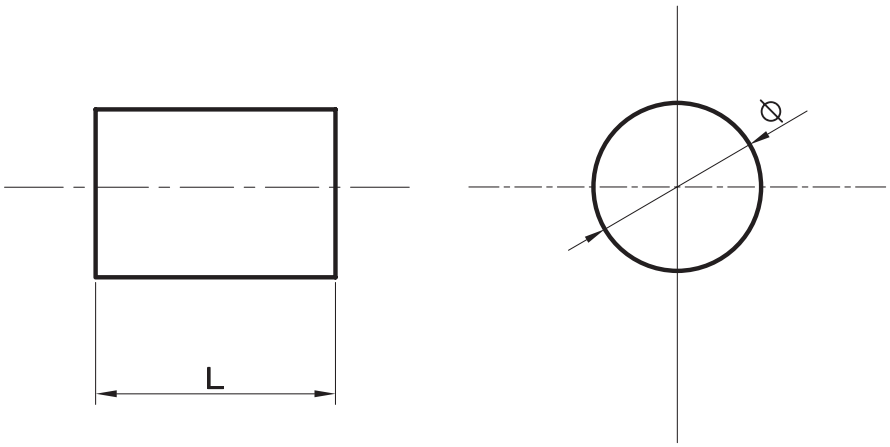
All dimensions are in mm unless otherwise specified.

GCL-11 Cylindrical Lenses

GCL-1105 Rod Lenses

Rod Lenses are polished on the circumference and ground on both ends. It is similar to a Plano-Convex cylinder lens. Collimated light passing through the diameter of the rod will be focused into a line.

GCL-1105



GCL-1105

- Material: BK7, fine annealed
- Dimension Tolerance: +0/-0.2
- Surface Quality: 60-40 scratch-dig
- Length: +0/-0.1
- Uncoated

GCL-1105 Rod Lenses

Part No.	Ø	L
GCL-110501	5	20
GCL-110502	10	20

All dimensions are in mm unless otherwise specified.

Windows

GCL-1201 Sapphire Windows

GCL-1202 Fused Silica Windows

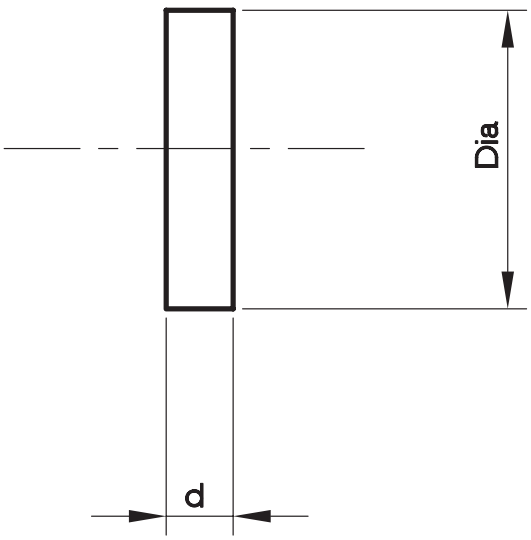
GCL-1203 Calcium Fluoride Windows

GCL-12 Windows

GCL-1201 Sapphire Windows

GCL-1201

Sapphire is transparent from 170nm to 5.3μm. Possessing high strength, hardness and chemical stability, it is an exellent material for severe environments. Being five times stronger than glass and heat resistant up to 2000°C, sapphire is often employed as pressure windows.



GCL-1201

- Diameter Tolerance: +0.0/- 0.1
- Wedge Angle: 3'
- Surface Quality: 80-50 scratch-dig
- flatness: Without demand
- Uncoated

GCL-1201 Sapphire Windows

Part No.	Dia	d
GCL-120101	12.7	1.0
GCL-120102	25.4	1.0

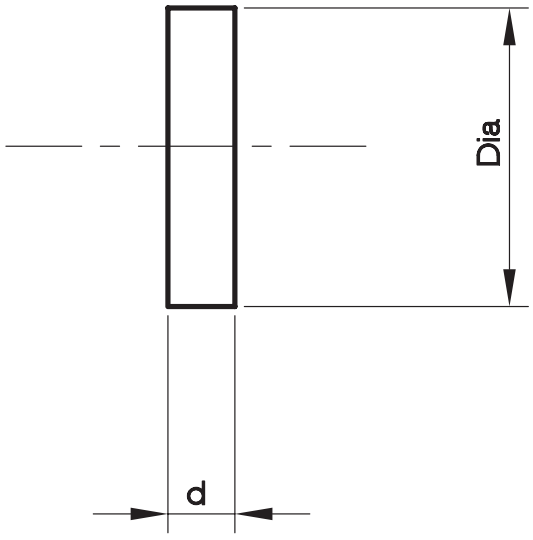
All dimensions are in mm unless otherwise specified.

GCL-12 Windows

GCL-1202 Fused Silica Windows

GCL-1202

Fused silica is an ideal material for UV applications and is transparent from 220nm to 4.0μm. It is characterized by excellent chemical and radiation resistance, low coefficient of thermal expansion, low fluorescence, and resistance to scratch.



GCL-1202

- Diameter Tolerance: +0.0/-0.1
- Wedge Angle: 3'
- Flatness: λ/10 at 633nm
  λ/10 per inch diameter
- Surface Quality: 40-20 scratch-dig
- Uncoated

GCL-1202 Fused Silica Windows

Part No.	Dia	d
GCL-120201	12.7	2.0
GCL-120202	25.4	5.0
GCL-120203	38.1	5.0
GCL-120204	40	2.0
GCL-120205	50	3.0

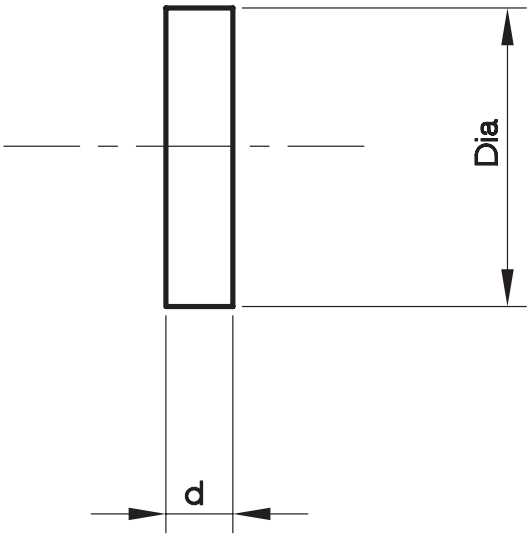
All dimensions are in mm unless otherwise specified.

GCL-12 Windows

GCL-1203

GCL-1203 Calcium Fluoride Windows

Calcium Fluoride is extremely transparent over a wide spectrum from deep UV (135nm) to far IR (9.4μm), which makes it idealfor windows in very short wavelength excimer lasers. The crystal has very low refractive index (about 1.40) , which eliminatesthe need of antireflection coatings. It is slightly soluble in water.



GCL-1203

- Diameter Tolerance: +0.0/- 0.1
- Wedge Angle: 3'
- Flatness: λ/2 at 633nm
- Surface Quality: 80-50 scratch-dig
- Uncoated

GCL-1202 Fused Silica Windows

Part No.	Dia	d
GCL-120301	12.7	3.0
GCL-120302	25.4	3.0
GCL-120303	38.1	4.0

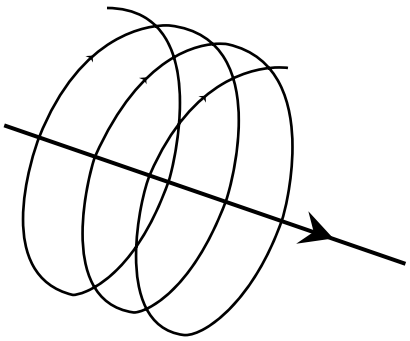
All dimensions are in mm unless otherwise specified.

Crystal components 063~073

GCL-06/07 Crystal components

Crystal Components

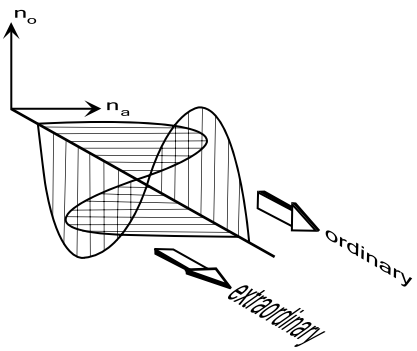
Polarized light



Polarized light has the optical radiation with its electric field vibrating in a specific regular mode. Any generally polarized electric field can be resolved into two orthogonally polarized components. If the light is plane polarized, the electric field vibrates in a single plane - the plane of polarization, and the two components are in phase. If it is elliptically polarized, the two components have a constant phase difference, and the tip of the electric field vector follows a three dimensional ellipse as the beam propagates.

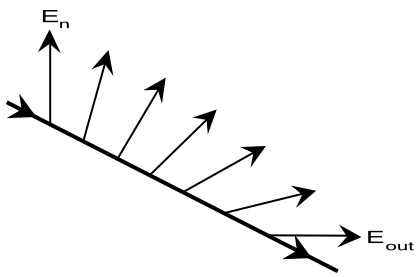
Circularly polarized light is a special case of elliptically polarized light in which the two components have a 90 degree phase difference and the electric field vector describes a circular cross section spiral. When viewed looking towards the source, a right circularly polarized beam had a light vector that describes a clockwise circle, while left circularly polarized light describes an anticlockwise circle.

Linear Birefringence



Linearly birefringent uniaxial crystalline materials are characterized by having a unique axis of symmetry, called the optic axis, which imposes constraints upon the propagation of light beams within the crystal. Two modes are permitted, either as an ordinary beam polarized in a plane normal to the optic axis, or as an extraordinary beam polarized in a plane containing the optic axis. Each of the beams has an associated refractive index, such that both the electric field (wave normal) velocities and the beam (ray) angles of the refraction are different. It is this latter property that enables suitably cut and oriented prisms of birefringent materials to act as polarizers and polarizing beam splitters.

Circular Birefringence



If a plane polarized beam propagates down the optic axis of a material exhibiting circular birefringence (see crystal quartz), it is resolved into two collinear circularly polarized beams, each propagating with a slightly different velocity. When these two components emerge from the material, they recombine into a plane polarized beam whose plane of polarization is rotated from that of the incident beam. This effect of producing a progressive rotation of the plane of polarization with path length is called optical activity.

All dimensions are in mm unless otherwise specified.

GCL-06/07 Crystal components

Crystal Components

Birefringent Materials

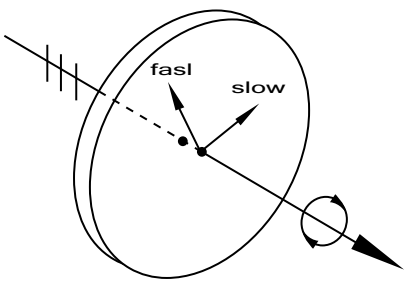
We use two principal materials out of a fairly wide range of birefringent crystals for the production of our polarizing components, calcite and crystal quartz.

Calcite is a widely preferred choice of material owing to its very high birefringence, wide spectral transmission and the availability of reasonably sized rhombs. It has the advantage of being non-hygroscopic, so that protection from the atmosphere is not necessary, though it is a fairly soft crystal and is easily scratched.

Quartz is another extremely useful birefringent material and is available as either natural crystals or as synthetic boules. Natural crystals occur as rough lumps that require orientation to determine the optic axis before processing, while synthetic crystals have reference surfaces aligned to crystallographic axes. When deciding which sort of quartz should be used for a component, two parameters that differ significantly between the two types should be considered: size and spectral transmission.

In general, components from synthetic quartz are limited to a maximum size in the direction of the optic axis of around 50mm, while natural quartz boules are available large enough to yield working apertures up to 100mm. The other significant discrimination between natural and synthetic quartz is the low wavelength cut-off. Natural quartz has a useful transmission (80%) from 220nm, while synthetic transmits similarly from 180nm. Both transmit to wavelength of about 1-6 microns.

Quartz is very hard (Moh's scale 7) and very strong. It thus lends itself to the fabrication of very thin low order retardation plate. Unlike calcite, quartz exhibits circular birefringence, and there is no unique direction (optic axis) down which ordinary and extraordinary beams propagate under one refractive index with the same velocity, instead, the optic axis is the direction for which the two indices are closest. This produces progressive optical rotation of an incident plane polarized beam, which is used as rotator.



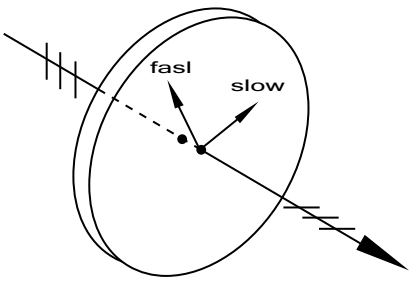
Retardation Plates

Retardation plates are optical elements that introduce a fractional wavelength phase difference between the ordinary and extraordinary polarization components of an input beam. The plate, made from a birefringent material, commonly crystal quartz, is oriented with its optic axis lying in the surface at 45 degree to the input polarization. The beam is then resolved into two equal amplitude components propagating with different velocities (fast and slow)

All dimensions are in mm unless otherwise specified.

GCL-06/07 Crystal components

Crystal Components



under the two refractive indices.

On exiting the plate, the two components recombine with a different phase relationship to the input beam, dependent on the plate thickness. The most useful retardations are a quarter and half wavelength for polarization analysis and separation purposes.

A quarter waveplate introduces a 90 degree phase shift between the two components, producing circularly polarized light. The sign of the phase shift determines whether the beam is left or right circularly polarized.

A half wave plate introduces a 180 degree phase shift, which has the effect of rotating the input plane of polarization through 90 degree.
Notations in the diagrams in this section

Accessory

GCM-09 Polarizer/Waveplate Holders
GCM-092 Linear Polarization Attenuator

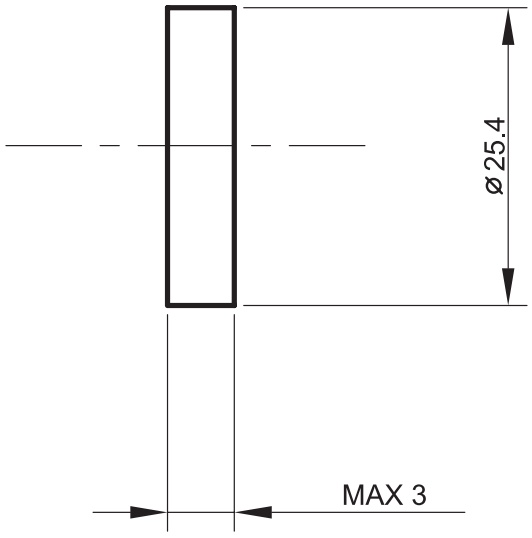
All dimensions are in mm unless otherwise specified.

GCL-06/07 Crystal components

GCL-0604 Quartz Zero-Order Waveplates

GCL-0604

Crystalline quartz is frequently used for the stringest quality retardation applications. Zero-order waveplate is made by cementing two quartz plates with their fast axes orthogonal to each other. The difference in thickness is equal to either λ/4 or λ/2 for a specified wavelength. Compared with multiple-order quartz retarders, they are much more insensitive to wavelength, temperature and angle of incidence. Waveplates of other wavelength and sizes are avalible for custom made.



GCL-0604

- Material: Crystalline quartz
- Diameter: ∅25.4+0.0/-0.15
- Thickness: 0.5~3±0.1
- Retardation Accuracy: λ/300
- Uncoated

GCL-0604 Quartz Zero-Order Waveplates

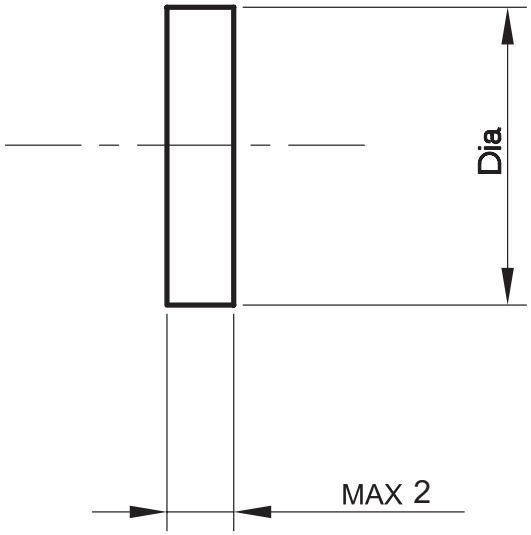
Part No.λ/4 plate	Part No.λ/2 plate	Wavelength (nm)
GCL-060401	GCL-060411	532
GCL-060402	GCL-060412	632.8
GCL-060403	GCL-060413	488
GCL-060404	GCL-060414	473
GCL-060405	GCL-060415	663
GCL-060406	GCL-060416	514.5

All dimensions are in mm unless otherwise specified.

GCL-06/07 Crystal components

GCL-0606 Quartz Multi-Order Waveplates

GCL-0606



GCL-0606

GCL-0606 Quartz Multi-Order Waveplates

Part No.	Dia	Retardation	Wavelength (nm)
GCL-060601	12.7	1/4	488
GCL-060602	12.7	1/4	514.5
GCL-060603	12.7	1/4	532
GCL-060604	12.7	1/4	632.8
GCL-060605	12.7	1/4	780
GCL-060606	12.7	1/4	1064
GCL-060611	12.7	1/2	488
GCL-060612	12.7	1/2	514.5
GCL-060613	12.7	1/2	532
GCL-060614	12.7	1/2	632.8
GCL-060615	12.7	1/2	780
GCL-060616	12.7	1/2	1064
GCL-060621	25.4	1/4	488
GCL-060622	25.4	1/4	514.5
GCL-060623	25.4	1/4	532
GCL-060624	25.4	1/4	632.8
GCL-060625	25.4	1/4	780
GCL-060626	25.4	1/4	1064
GCL-060631	25.4	1/2	488
GCL-060632	25.4	1/2	514.5
GCL-060633	25.4	1/2	532
GCL-060634	25.4	1/2	632.8
GCL-060635	25.4	1/2	780
GCL-060636	25.4	1/2	1064

All dimensions are in mm unless otherwise specified.

GCL-06/07 Crystal components

GCL-0606 Quartz Multi-Order Waveplates

Part No.	Dia	Retardation	Wavelength (nm)
GCL-060637	25.4	1/2	800
GCL-060641	25.4	1/4	441.6
GCL-060642	25.4	1/4	650
GCL-060643	25.4	1/4	670
GCL-060644	25.4	1/4	808
GCL-060645	25.4	1/4	830
GCL-060646	25.4	1/4	1310
GCL-060647	25.4	1/4	1550
GCL-060651	25.4	1/2	441.6
GCL-060652	25.4	1/2	650
GCL-060653	25.4	1/2	670
GCL-060654	25.4	1/2	808
GCL-060655	25.4	1/2	830
GCL-060656	25.4	1/2	1310
GCL-060657	25.4	1/2	1550

All dimensions are in mm unless otherwise specified.

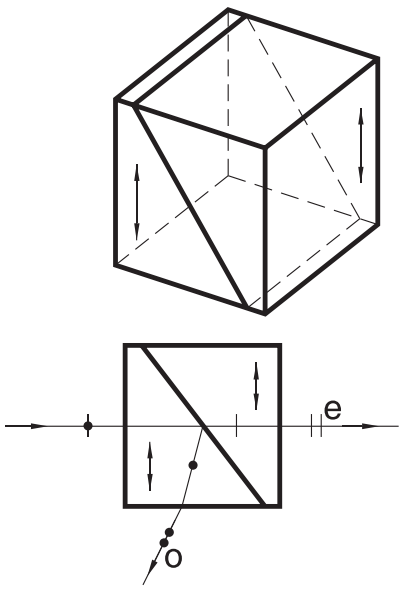
GCL-06/07 Crystal components

GCL-0702

GCL-0702 Glan-Taylor Prisms

A Glan–Taylor prism is an air-spaced prism, which is used as a polarizer or polarizing beam splitter. It is one of the most common types of modern polarizing prism. It was first described by Archard and Taylor in 1948.

The prism is made of two right-angled prisms of calcite (or sometimes other birefringent materials) which are separated on their long faces with an air gap. The optical axes of the calcite crystals are aligned parallel to the plane of reflection. Total internal reflection of s-polarized light at the air-gap ensures that only p-polarized light is transmitted by the device. Because the angle of incidence at the gap can be reasonably close to Brewster's angle, unwanted reflection of p-polarized light is reduced. Noted that the transmitted beam is 100% polarized, but the reflected beam is not. The sides of the crystal can be polished to allow the reflected beam to exit, or can be blackened to absorb it. The latter reduces unwanted Fresnel reflection of the rejected beam. However, the Glan-Taylor type prisms have a smaller field angle, which is not symmetric about the longitudinal axis of the prism. The total filed angle is 8 degrees, but the symmetric field angle is only 5.5 degrees



GCL-0702

- Wavelength Range: 220nm~2500nm
- Transmission: >85%, λ_0=632.8nm
- Optical Damage Threshold: CW:100W/cm^2
- Pulsed: 200W/cm^2
- Extinction Ratio: >1x10^5:1
- Wavefront Distortion: λ/8
- Deviation Angle: 3′

All dimensions are in mm unless otherwise specified.

GCL-06/07 Crystal components

GCL-0702 Glan-Taylor Prisms

Part No.	C.A.(∅)	Dimension (approx)
GCL-070210	5	7x7x9
GCL-070211	8	10x10x11
GCL-070212	10	12x12x13
GCL-070213	12	14x14x15
GCL-070214	15	17x17x18
GCL-070215	18	20x20x20

All dimensions are in mm unless otherwise specified.

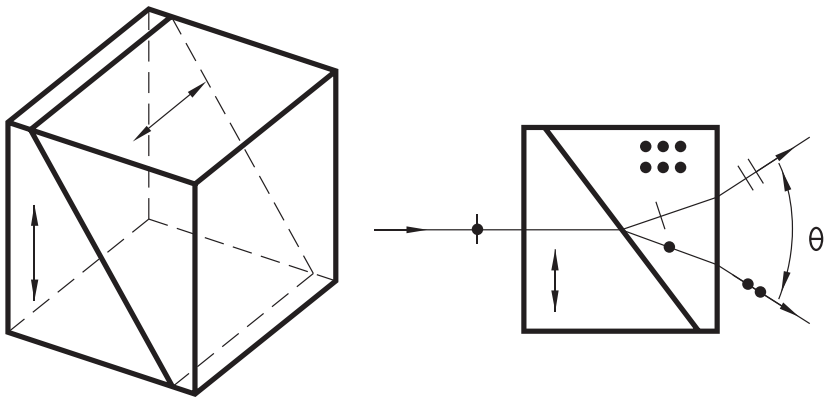
GCL-06/07 Crystal components

GCL-0711

GCL-0711 Wollaston Prisms

A Wollaston prism, invented by William Hyde Wollaston, is an optical device that manipulates polarized light. It separates randomly polarized or non-polarized light into two orthogonal linearly polarized outgoing beams.

The Wollaston prism consists of two orthogonal calcite prisms, cemented together on their base to form two right triangle prisms with perpendicular optic axes. The Wollaston prism is commonly used as a polarizing beamsplitter. The deviations of the two transmitted beams are nearly symmetric about the incident beam direction. The polarizations of the output beams are parallel and perpendicular to the plane where the entrance and exit beam lie. The beam splitting angle varies with the wavelength, therefore the data in the table below are approximate.



GCL-0711

- Wavelength Range: 300nm~2500nm
- Transmission: >85%, λ_0=632.8nm
- Optical Damage Threshold: CW:50W/cm^2
- Pulsed: 100W/cm^2
- Extinction Ratio: >1x10^5:1
- Beamsplitting Angle(θ): 5°, 10°, 15°

All dimensions are in mm unless otherwise specified.

GCL-06/07 Crystal components

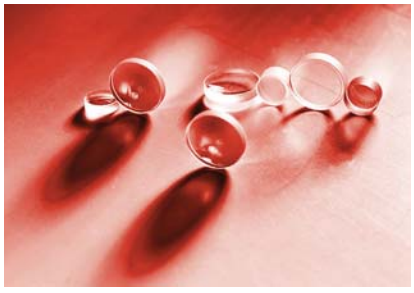
GCL-0711 Wollaston Prisms

Part No.	C.A	Housing Dimensions		
		5°	10°	15°
GCL-071110	10x10	10x10x7	10x10x9	10x10x10
GCL-071111	12x12	12x12x9	12x12x11	12x12x12
GCL-071112	14x14	14x14x10	14x14x13	14x14x14
GCL-071113	16x16	16x16x11	16x16x15	16x16x16
GCL-071114	18x18	18x18x14	18x18x16	18x18x18
GCL-071115	20x20	20x20x16	20x20x18	20x20x20

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors 074~100

Mirrors and Reflectors



General

High reflectivity (HR) coating is generally required for mirrors and reflectors, though some are partial reflection or wavelength dependent. They work the opposite way to antireflection coatings. For high reflectivity, there are two main types of optical coating: metallic and dielectric coating. Aluminum, silver and gold are used for metallic coated mirrors. The performance of the coatings varies with reflectivity and wavelength range specified. An example of hybrid coating with metallic and dielectric materials is the protected or enhanced metallic coatings because most of metallic-only coatings often suffer oxidization or poor adhesiveness to substrates which affect their durability. Daheng Optics offers a wide range of HR coating products off-the-shelf, those are coated on substrates with variety and commonly used shapes and dimensions.

Metallic Mirror Coating

This is the simplest and most common mirror coating. A layer of aluminum or silver makes an excellent reflector for the visible spectrum. Aluminum reflects about 90 percent of the light across the visible spectrum, while silver reflects about 95%. The figure below shows the reflectivity of aluminum and silver against wavelength. The reflectance of a metal mirror can be calculated from the index of refraction n and the extinction coefficient K of the metal.

The reflectance of a metal surface in air is given by:

$$R(\%) = \frac{(n+1)^2 + K^2}{(n+1)^2 + K^2} \times 100$$

n AND K FOR SELECTED METALS

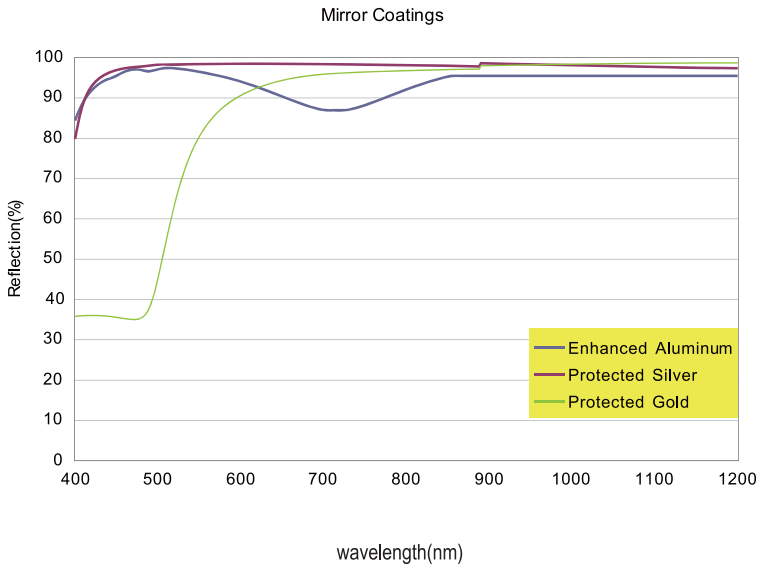
Wavelength(μm)		0.2	0.3	0.4	0.5	0.6	0.7	1.0	2.0	4.0
Aluminum*	n:	0.12	0.28	0.49	0.77	1.20	1.83	1.35	2.15	6.43
	K:	2.30	3.61	4.86	6.08	7.26	8.31	9.58	20.7	39.8
Silver	n:	1.07	1.51	0.17	0.13	0.12	0.14	0.21	0.65	2.30
	K:	1.24	0.96	1.95	2.92	3.73	4.52	6.76	12.2	24.3
Gold	n:	1.43	1.80	1.66	0.85	0.22	0.16	0.26	0.85	2.60
	K:	1.22	1.92	1.96	1.90	2.97	3.95	6.82	12.6	24.6

Aluminum has a reflectance dip at 0.8μm: for λ=0.8μm, n=2.80 and K=8.45

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

Across the visible spectrum, silver is the most reflective. The reflectivity of aluminum dips below 90% in the region from 0.8 to 1.0μm. In an optical system with several mirrors, this can be detrimental to performance. For example, a system with five mirrors that each has the reflectance of 85% would have a throughput of only 44%. Gold is useful only in the red and IR spectral regions. Aluminum is fairly stable as a mirror but silver tarnishes quickly unless kept in a dry and contamination-free environment. In addition, an unprotected aluminum or gold mirror cannot withstand cleaning with anything but the most gentle cotton ball or camel hair brush. To solve this problem, normally, a dielectric material such as silicon monoxide SiO for visible mirrors is coated over the mirror to strengthen the metal surface.



Dielectric Coatings

This type of optical coating is deposited onto a substrate and constructed from multiple thin layers of transparent dielectric materials with high and low refractive index alternated. It is also called interference coating. The multiple layers of the dielectric materials modify the reflective properties of the surface by exploiting the interference of the reflection from multiple optical interfaces. By careful choice of the exact composition, thickness, and number of these layers, it is possible to tailor the reflectivity and transmissivity of the coating to produce almost any desired characteristic. The reflectivity can be increased to greater than 99.99%.

The periodic dielectric mirror coating significantly enhances the reflectivity of the surface but is limited only in the certain wavelength range. The band width is determined by the ratio of the two used indices only for quarter-

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

wave coating systems, which the thicknesses of the layers are generally quarter-wave. Comparing to the non-quarter-wave systems, the quarter-wave systems offer the broadest high reflection band, tens of nanometers in the visible spectrum range.

High reflective coatings are affected by the incidence angle of the light. When used away from normal incidence, the reflective range shifts to shorter wavelengths, and becomes polarization dependent. This effect can be exploited to produce coatings that polarize a light beam.

By manipulating the exact thickness and composition of the layers in the reflective stack, the reflection characteristics can be tuned to a particular application. The coating can be designed as a long- or short-pass filter, a bandpass filter, or a mirror with a specific reflectivity, which is useful in lasers.

Selection

To select a suitable mirror for your application requires considering many aspects, including reflectivity, laser damage threshold, coating durability, and thermal expansion of the substrate. Mirrors with reflective coatings cover the UV, visible, near infrared, and infrared regions. Metallic coatings are more broadband, while dielectric coatings give better reflectivity.

All dimensions are in mm unless otherwise specified.

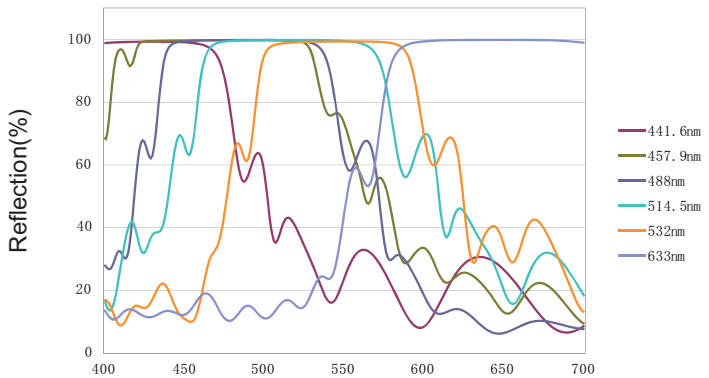
Mirrors and Reflectors

GCC-1010 Laser Line Dielectric HR Mirrors

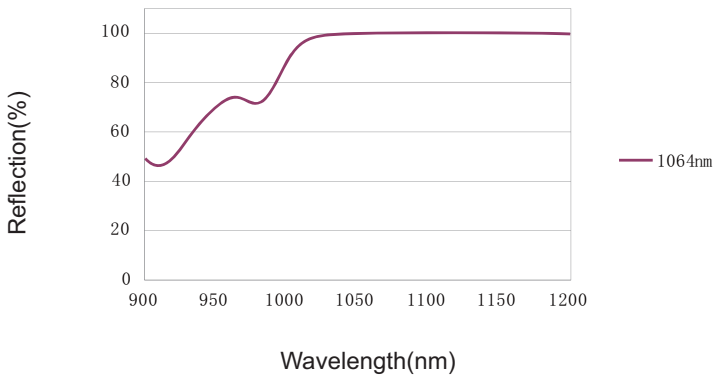
GCC-1010

These laser line mirrors are designed for high reflectance with high laser damage threshold at specific laser wavelengths, suitable for laser cavities or other laser applications. Dielectric multilayer coatings are deposited on the laser grade substrates using physical vapour deposition (PVD) technologies. These coatings are extremely durable, making them resistant also to damage from repeated cleaning.

GCC-1010 Laser Line Dielectric HR Mirrors



GCC-10106x Laser Line Dielectric HR Mirrors



All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

- Material: BK7, fine annealed.
- Diameter Tolerance: +0.0/-0.1
- Thickness: 4±0.1
- Parallelism: <3'
- Flatness: λ/8 at 633nm
- Surface Quality: 20-10 scratch-dig
- Back Surface: commercial polish
- Clear Aperture: 90% diameter
- Average Reflectance: R_{ave}>99.5% for 45° angle of incidence

GCC-1010 Laser Line Dielectric HR Mirrors

Part No.	Wavelength (nm)	Dia
GCC-101001	441.6	20
GCC-101002	441.6	25.4
GCC-101004	441.6	40
GCC-101011	457.9	20
GCC-101012	457.9	25.4
GCC-101014	457.9	40
GCC-101021	488	20
GCC-101022	488	25.4
GCC-101024	488	40
GCC-101031	514.5	20
GCC-101032	514.5	25.4
GCC-101034	514.5	40
GCC-101041	532	20
GCC-101042	532	25.4
GCC-101044	532	40
GCC-101051	633	20
GCC-101052	633	25.4
GCC-101054	633	40
GCC-101061	1064	20
GCC-101062	1064	25.4
GCC-101064	1064	40
GCC-101071	1310	20

All dimensions are in mm unless otherwise specified.

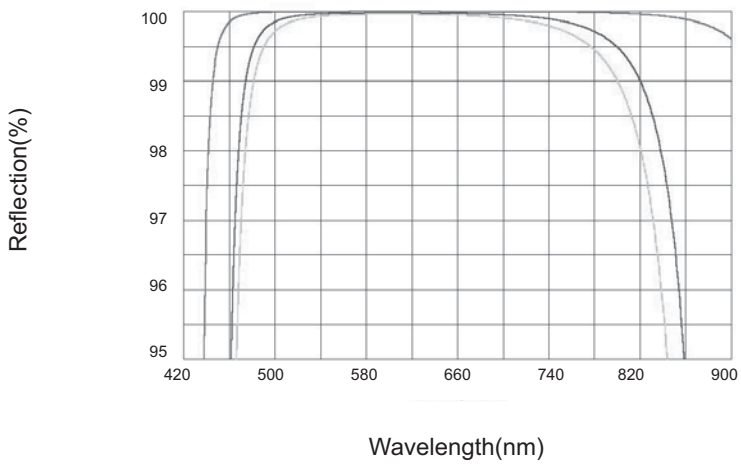
Mirrors and Reflectors

GCC-1011 Broadband Dielectric HR Mirrors

GCC-1011

These mirrors provide high reflectance over a broad bandwidth, and are ideal for tunable laser and white light applications. They are intended for use at 45incidence. Normal incidence is available on special request.

GCC-1011 Broadband Dielectric HR Mirrors



- Material: BK7, fine annealed.
- Diameter Tolerance: +0.0/-0.1
- Thickness: 4±0.1
- Parallelism: <3'
- Flatness: λ/8 at 633nm
- Surface Quality: 20-10 scratch-dig
- Back Surface: commercial polish
- Clear Aperture: 90% diameter
- Average Reflectance: R_{ave}>99.5% for 45° angle of incidence

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-1011 Broadband Dielectric HR Mirrors

Part No.	Wavelength (nm)	Dia
GCC-101101	450-700	20
GCC-101102	450-700	25.4
GCC-101104	450-700	40
GCC-101111	650-1000	20
GCC-101112	650-1000	25.4
GCC-101114	650-1000	40
GCC-101121	1000-1400	20
GCC-101122	1000-1400	25.4
GCC-101124	1000-1400	40

All dimensions are in mm unless otherwise specified.

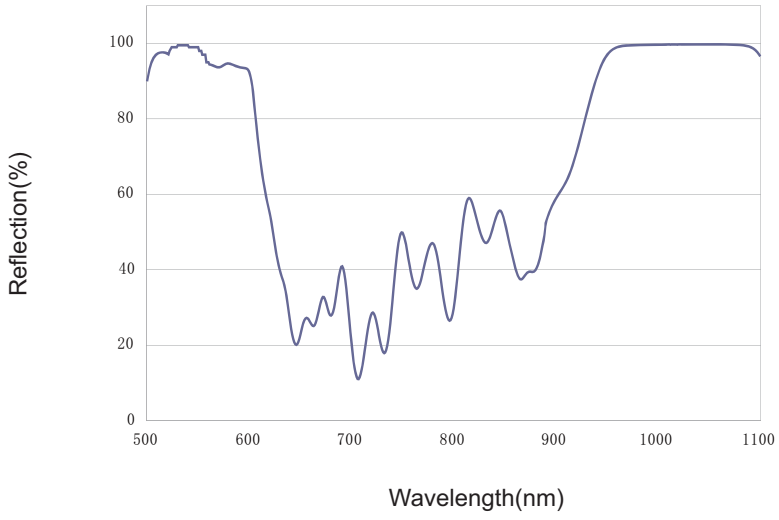
Mirrors and Reflectors

GCC-1012

GCC-1012 Dual Wavelength Dielectric HR Mirrors

These Nd: YAG/YLF laser mirrors are designed for high reflectance at the appropriate dual wavelengths. They are intended for use at either 45° or normal incidence. We also offer dual wavelength mirrors for use at the fundamental and second harmonic wavelengths.

GCC-1012 Dual Wavelength Dielectric HR Mirrors



- Material: BK7, fine annealed.
- Diameter Tolerance: +0.0/-0.1
- Thickness: 4±0.1
- Parallelism: <3'
- Flatness: λ/8 at 633nm
- Surface Quality: 20-10 scratch-dig
- Back Surface: commercial polish
- Clear Aperture: 90% diameter
- Average Reflectance: R_{ave}>99.5% for 45angle of incidence

GCC-1012 Dual Wavelength Dielectric HR Mirrors

Part No.	Wavelength (nm)	Dia
GCC-101201	532 & 1064	12.7
GCC-101202	532 & 1064	20
GCC-101203	532 & 1064	25.4

All dimensions are in mm unless otherwise specified.

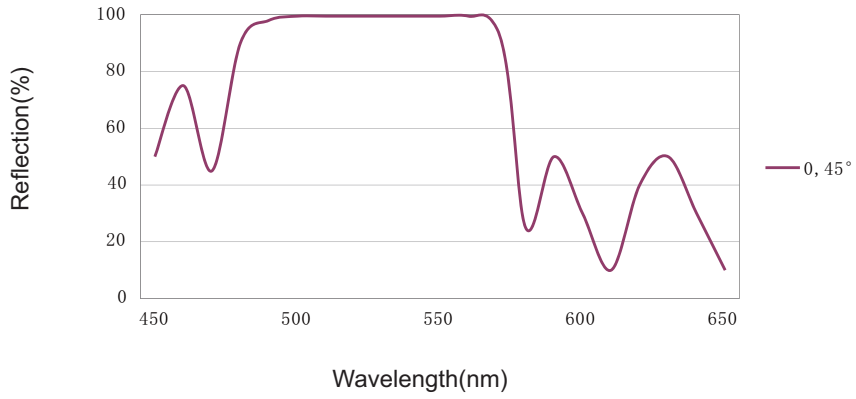
Mirrors and Reflectors

GCCH-1010 High Power Laser Line Dielectric HR Mirrors

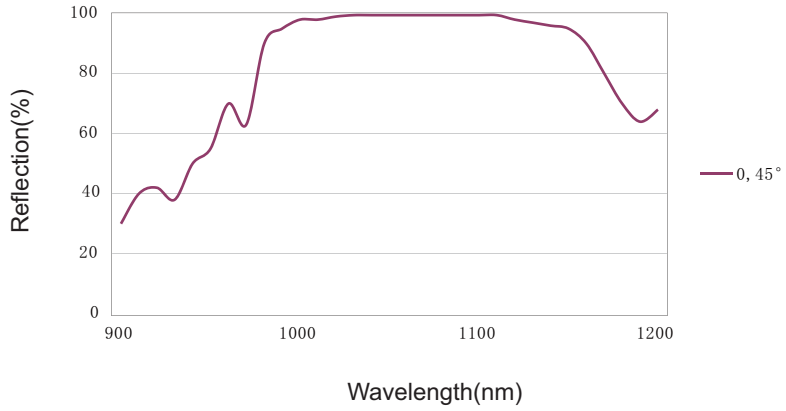
GCCH-1010

- Material: UV grade Fused Silica
- Diameter Tolerance: +0/-0.2
- Thickness: 6±0.2
- Parallelism: <3'
- Flatness: λ/10 at 633nm
- Surface Quality: 20-10 scratch-dig
- Clear Aperture: 90% Diameter

GCCH-1010 High Power Laser Line Dielectric HR Mirrors (532nm)



GCCH-1010 High Power Laser Line Dielectric HR Mirrors (1064nm)



All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCCH-1010 High Power Laser Line Dielectric HR Mirrors

Part No.	Wavelength (nm)	Reflection (%)	Incident Angle	Damage Threshold	Dia
GCCH-101042	532	>99.5%	45°	10J/cm^2 10ns	25
GCCH-101046	532	>99.5%	0°	10J/cm^2 10ns	25
GCCH-101062	1064	>99.5%	45°	10J/cm^2 10ns	25
GCCH-101066	1064	>99.5%	0°	10J/cm^2 10ns	25

All dimensions are in mm unless otherwise specified.

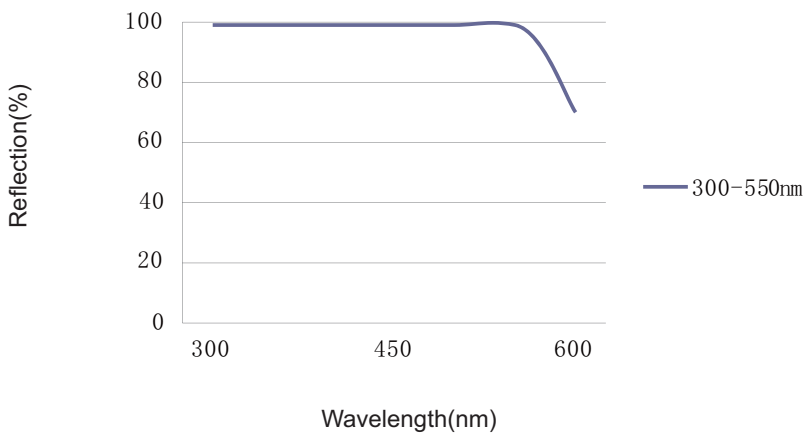
Mirrors and Reflectors

GCCH-1011 High Power Broadband Reflection Mirrors

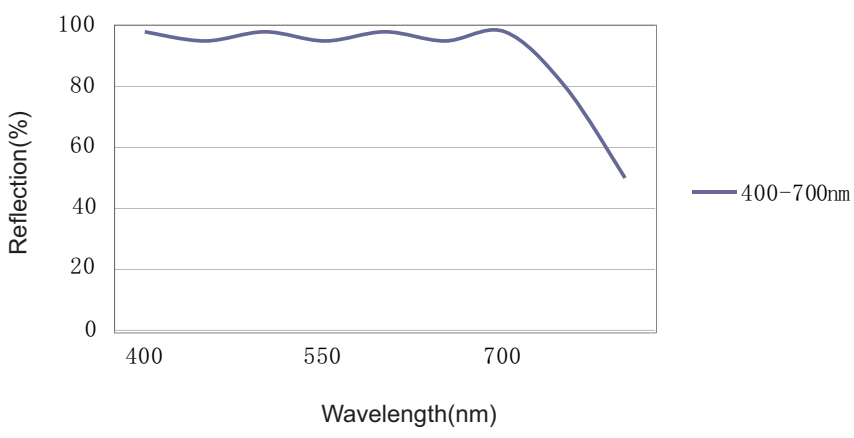
GCCH-1011

- Material: Borofloat
- Diameter Tolerance: +0/-0.2
- Thickness: 8±0.2
- Incident Angle: 0°~45°
- Parallelism: <3'
- Flatness: λ/10 at 633nm
- Surface Quality: 20-10 scratch-dig
- Clear Aperture: 80% Diameter

GCCH-101132 High Power Broadband Reflection Mirrors



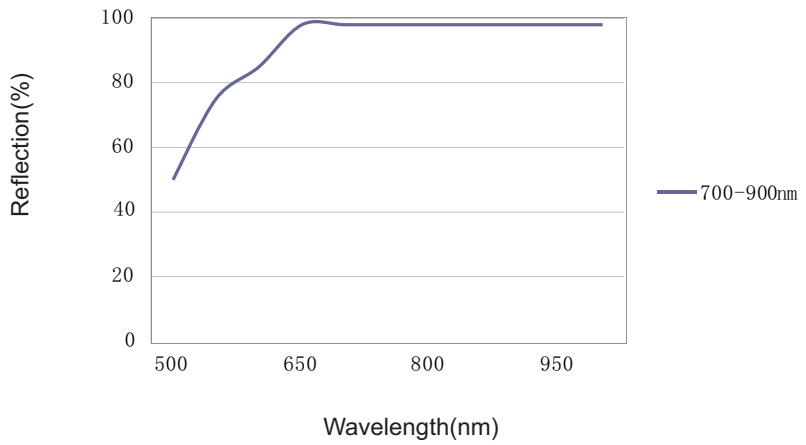
GCCH-101102 High Power Broadband Reflection Mirrors



All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCCH-101112 High Power Broadband Reflection Mirrors



GCCH-1011 High Power Broadband Reflection Mirrors

Part No.	Reflection Wavelength band	Reflection (%)	Damage Threshold	Dia
GCCH-101132	UV	99.5%@300-550nm	500kw/cm^2 CW 10J/cm2 10ns	25.4
GCCH-101102	VIS	99.5%@400-700nm	500kw/cm^2 CW 10J/cm2 10ns	25.4
GCCH-101112	NIR	99.5%@700-900nm	500kw/cm^2 CW 10J/cm2 10ns	25.4

All dimensions are in mm unless otherwise specified.

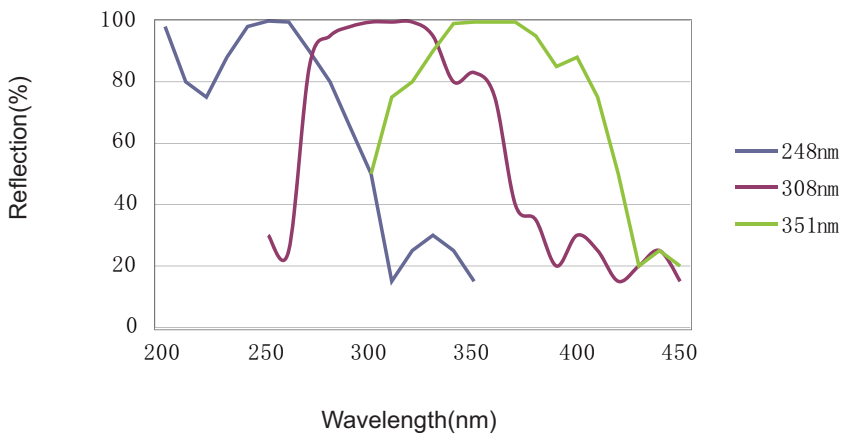
Mirrors and Reflectors

GCCH-10130 UV Dielectric HR Mirrors

GCCH-10130

- Material: UV grade Fused Silica
- Diameter Tolerance: +0/-0.2
- Thickness: 6±0.2
- Incident Angle: 45°
- Parallelism: <3'
- Flatness: λ/10 at 633nm
- Surface Quality: 20-10 scratch-dig
- Clear Aperture: 90% Diameter

GCCH-10130 UV Dielectric HR Mirrors



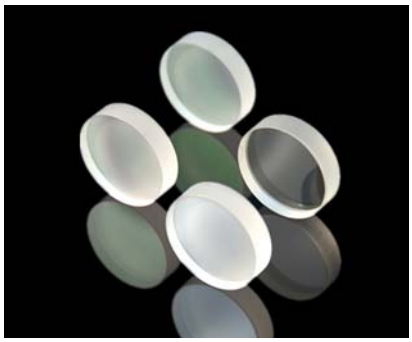
GCCH-10130 UV Dielectric HR Mirrors

Part No.	Wavelength (nm)	Reflection (%)	Damage Threshold	Dia
GCCH-101302	248	>99%	1.5J/cm^2 10ns	25.4
GCCH-101322	308	>99.5%	5J/cm^2 10ns	25.4
GCCH-101332	351	>99.5%	5J/cm^2 10ns	25.4

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

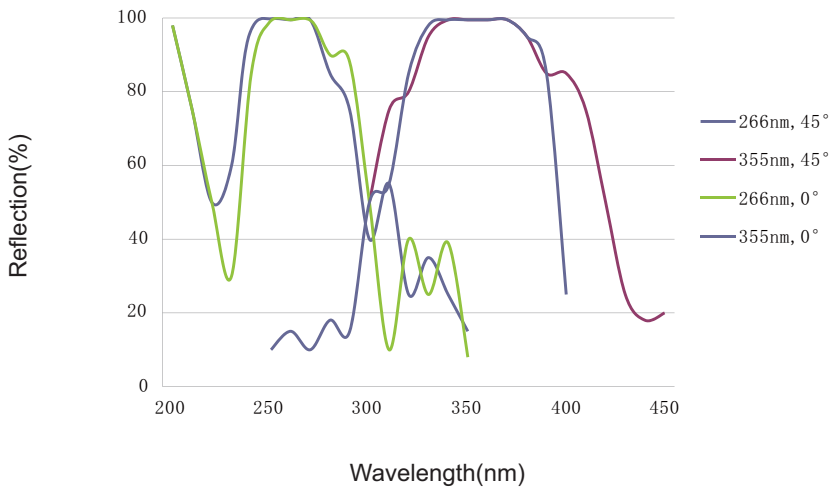
GCCH-10131 ND:YAG Laser Line UV Dielectric HR Mirrors



GCCH-10131

- materiecl: UV grade Fused Silica
- Diameter Tolerance: +0/-0.2
- Thickness: 6±0.2
- Incident Angle: 45°
- Parallelism: <3'
- Flatness: λ/10 at 633nm
- Surface Quality: 20-10 scratch-dig
- Clear Aperture: 90% Diameter

GCCH-10131 ND:YAG Laser Line UV Dielectric HR Mirrors



GCCH-10131 ND:YAG Laser Line UV Dielectric HR Mirrors

Part No.	Center Wavelength R>99.8% (nm)	Waveband R>98% (nm)	Damage Threshold	Incident Angle	Dia
GCCH-101312	266	255-275	>3J/cm^2 (10ns)	45°	25
GCCH-101342	355	340-370	>5J/cm^2 (10ns)	45°	25
GCCH-101314	266	255-275	>3J/cm^2 (10ns)	0°	25
GCCH-101344	355	340-370	>5J/cm^2 (10ns)	0°	25

All dimensions are in mm unless otherwise specified.

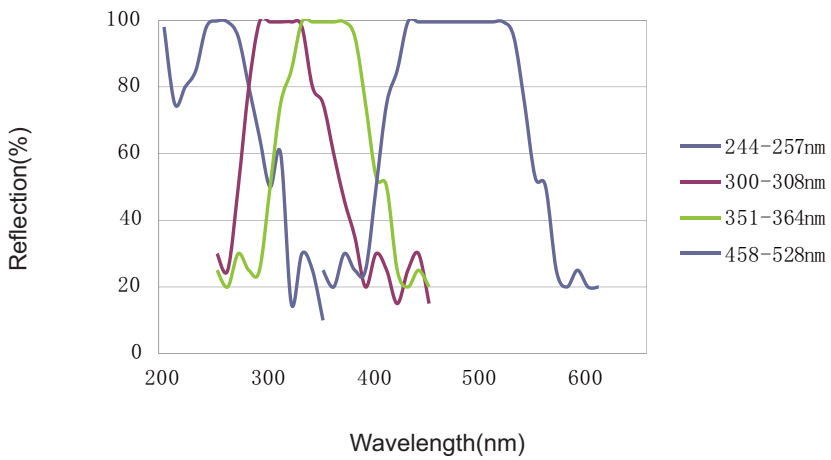
Mirrors and Reflectors

GCCH-1014 High Power Argon-Ion Laser Mirrors

GCCH-1014

- Material: UV grade Fused Silica
- Diameter Tolerance: +0/-0.2
- Thickness: 6±0.2
- Incident Angle: 45°
- Parallelism: <3'
- Flatness: λ/10 at 633nm
- Surface Quality: 20-10 scratch-dig
- Clear Aperture: 90% Diameter

GCCH-1014 High Power Argon-Ion Laser Mirrors



GCCH-1014 High Power Argon-Ion Laser Mirrors

Part No.	Wavelength (nm)	Reflection (%)	Damage Threshold	Dia
GCCH-101432	244-257	>98%	1kw/cm^2 CW	25
GCCH-101402	300-308	>98%	1kw/cm^2 CW	25
GCCH-101412	351-364	>98%	1kw/cm^2 CW	25
GCCH-101422	458-528	>98%	1kw/cm^2 CW	25

All dimensions are in mm unless otherwise specified.

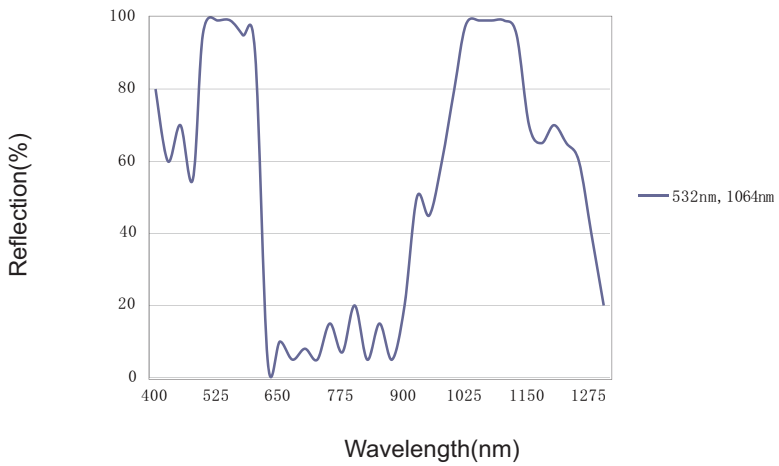
Mirrors and Reflectors

GCCH-101203 Dual Wavelength ND:YAG Laser HR Mirrors

GCCH-101203

- Material: UV grade Fused Silica
- Diameter Tolerance: +0/-0.2
- Thickness: 6±0.2
- Incident Angle: 45°
- Parallelism: <3'
- Flatness: λ/10 at 633nm
- Surface Quality: 20-10 scratch-dig
- Clear Aperture: 90% Diameter

GCCH-101203 Dual Wavelength ND:YAG Laser HR Mirrors



GCCH-101203 Dual Wavelength ND:YAG Laser HR Mirrors

Part No.	Wavelength (nm)	Reflection (%)	Damage Threshold	Dia
GCCH-101203	532nm&1064nm	>99.5%	10J/cm^2 20ns	25

All dimensions are in mm unless otherwise specified.

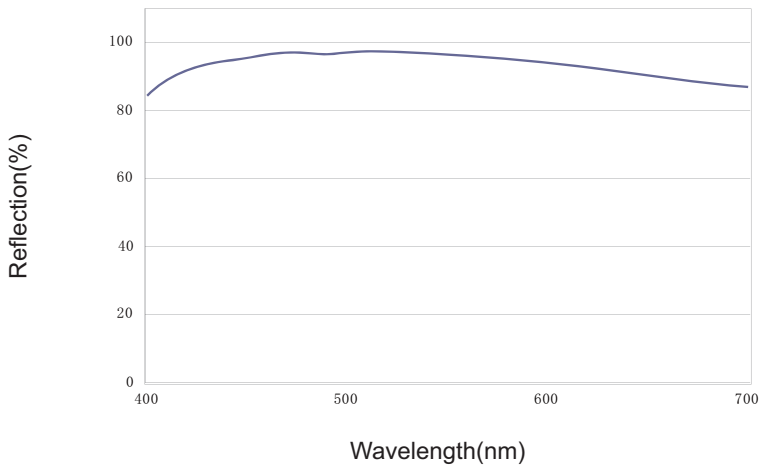
Mirrors and Reflectors

GCC-1021 Enhanced Aluminum Mirrors

GCC-1021

This design provides better performance than the protected aluminum coating with an average of about 92% reflection in the visible spectrum. The coating incorporates the use of a dielectric stack on the aluminum, which provides better resistance to abrasion than the raw metal.

GCC-1021 Enhanced Aluminum Mirrors



- Material: BK7, fine annealed.
- Dimension Tolerance: +0.0/-0.15
- Thickness Tolerance: ±0.1
- Parallelism: <3'
- S1 Flatness: λ/4 at 633nm
- Surface Quality: 60-40 scratch-dig
- Back Surface: fine ground
- Clear Aperture: 90% dimension
- Average Reflectance: R_{ave}>92% throughont VIS

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-1021 Enhanced Aluminum Mirrors

Part No.	Dimension	Thickness
GCC-102101	∅ 20	4
GCC-102102	∅ 25.4	4
GCC-102104	∅ 40	4
GCC-102105	∅ 50.8	4
GCC-102111	40x60	6
GCC-102112	70x100	10
GCC-102113	100x 150	15

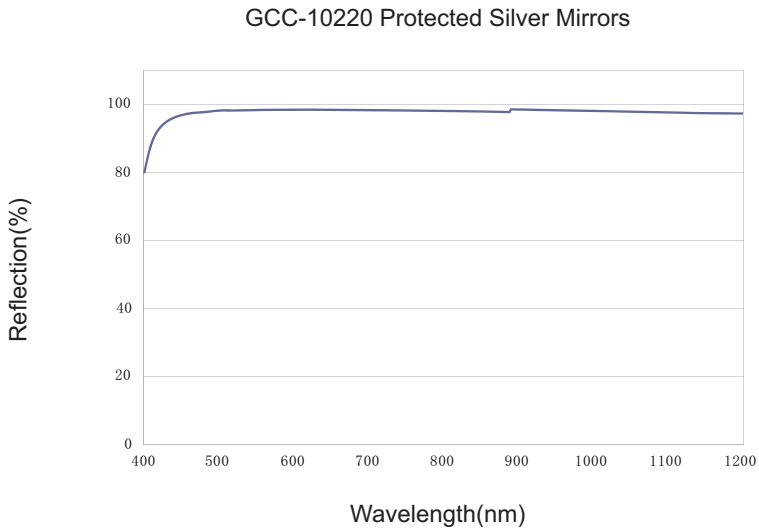
All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-10220 Protected Silver Mirrors

GCC-10220

Protected silver coating offers a higher surface reflectivity than the enhanced aluminum coating. It provides an average reflection of approximately 95% in the visible wavelength range. This coating is a hybrid design optimized to provide better environmental stability and maximum shelf life. The silver layer is protected both underneath and above with dielectric layers which minimizes tarnishing and allows cleaning by normal laboratory methods. These mirrors have very high reflectivity from 0.45 m through to the infrared spectrum.



- Material: BK7, fine annealed
- Dimension Tolerance: +0.0/-0.15
- Thickness: 4±0.1
- Parallelism: <3'
- S1 Flatness: λ/4 at 633nm
- Surface Quality: 60-40 scratch-dig
- Back Surface: fine ground
- Clear Aperture: 90% diameter
- Average Reflectance: R_{ave}>95% throughout VIS

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-10220 Protected Silver Mirrors

Part No.	Dimension	Center thickness
GCC-102201	20	4
GCC-102202	25.4	4
GCC-102204	40	4
GCC-102205	50.8	4

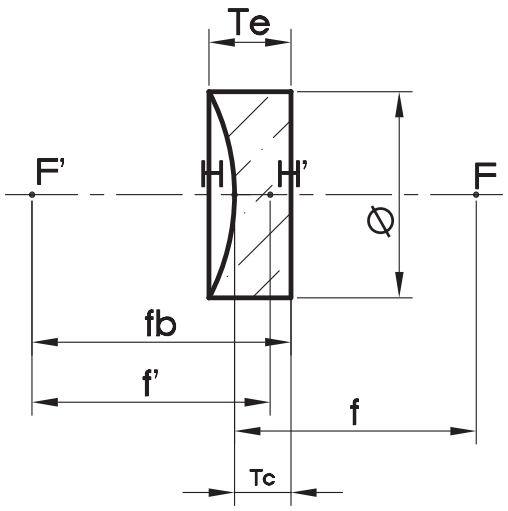
All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-10222 Protected Silver Plano-Concave Mirrors

GCC-10222

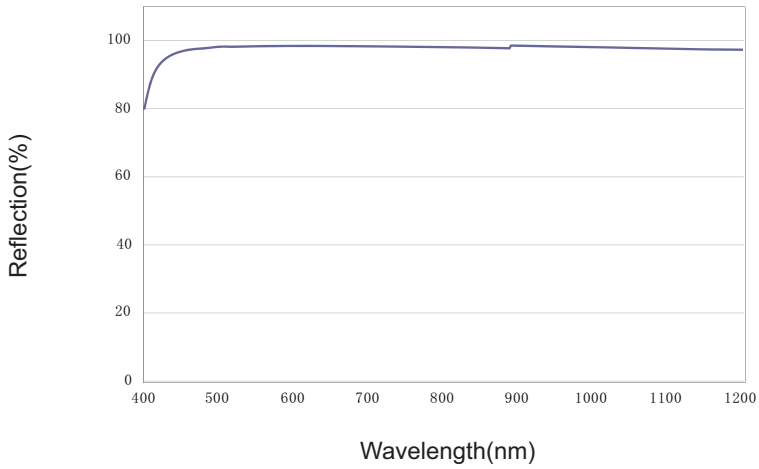
- Material: BK7, fine annealed
- Focal length (f'): ±2%
- Diameter Tolerance: +0/-0.2
- Thickness Tolerance: ±0.1
- Flatness: 1λ at 633nm
- Surface Quality: 40-20 scratch-dig
- Clear Aperture: 90% Diameter



f: focal length (object side)
f': focal length (image side)
fb: back focal length
⌀: lens diameter
Tc: center thickness
Te: edge thickness
F,F': focal points
H,H': principal points

GCC-10222

GCC-10222 Protected Silver Plano-Concave Mirrors



All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-10222 Protected Silver Plano-Concave Mirrors

Part No.	Dia	Focal Length	Edge Thickness
GCC-102221	25.4	25.4	6.35
GCC-102222	25.4	50.8	6.35
GCC-102223	25.4	76.2	6.35
GCC-102224	25.4	101.6	6.35
GCC-102225	25.4	152.4	6.35

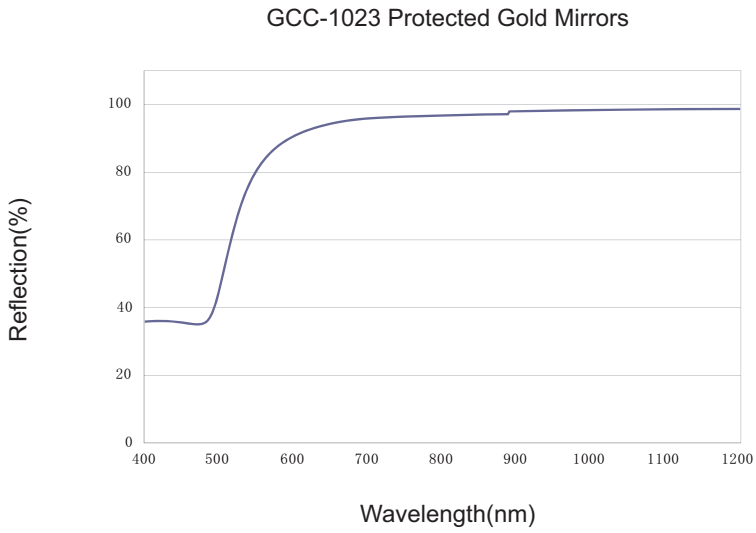
All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-1023 Protected Gold Mirrors

GCC-1023

These are precision flat mirrors with a metallic gold coating. The gold layer is protected both underneath and above with dielectric layers which ensures good adhesion to the substrate and allows cleaning by normal laboratory methods. These mirrors have very high reflectivity from 0.65 microns through to the infrared spectrum.



- Material: BK7, fine annealed.
- Dimension Tolerance: +0.0/-0.15
- Thickness: 4±0.1
- Parallelism: <3'
- S1 Flatness: λ /4 at 633nm
- Surface Quality: 60-40 scratch-dig
- Back Surface: fine ground
- Clear Aperture: 90% diameter
- Average Reflectance: R_{ave}>95% 0.65-2 microns

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-1023 Protected Gold Mirrors

Part No.	Dimension	Center thickness
GCC-102301	20	4
GCC-102302	25.4	4
GCC-102304	40	4

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-1030 Laser Line Dielectric Partial Reflectors

GCC-1030

The laser line partial reflector is made of thin plate optical glass. The first face is coated with a dielectric narrow band All dimensions are in mm unless otherwise specified. non-polarizing film stack which has a partial reflectivity at 45 incidence. It has low absorption and can be employed for high energy laser systems. Only the reflected beam is used.

- Material: BK7, fine annealed.
- Diameter: ∅ 25.4+0.0/-0.2
- Thickness: 4 ± 0.2
- Parallelism: <3'
- Flatness: λ/8@633nm
- Surface Quality: 20-10 scratch-dig
- Back Surface: fine ground
- Clear Aperture: 90% diameter
- R: (Rs+Rp)/2
- Incident Angle: 45°
- Coatings: Single wavelength partial reflectance coating@632.8nm. Other wavelengths and dimensions available on request

GCC-1030 Laser Line Dielectric Partial Reflectors

Part No.	Reflection (%)
GCC-103001	10 ± 5
GCC-103002	20 ± 5
GCC-103003	30 ± 5
GCC-103004	40 ± 5
GCC-103005	50 ± 5
GCC-103006	60 ± 5
GCC-103007	70 ± 5
GCC-103008	80 ± 5
GCC-103009	90 ± 2
GCC-103010	95 ± 1
GCC-103011	99 ± 0.5

All dimensions are in mm unless otherwise specified.

Mirrors and Reflectors

GCC-1031 Broadband Dielectric Partial Reflectors

GCC-1031

- Material: BK7, fine annealed.
- Diameter: ∅ 25.4 +0.0/-0.2
- Thickness: 4±0.2
- Parallelism: <3'
- Flatness: λ/8@633nm
- Surface Quality: 40-20 scratch-dig
- Back Surface: fine ground
- Clear Aperture: 90% diameter
- R: (Rs+Rp)/2
- Incidaent Angle: 45°
- Coatings: Broadband partial reflectance coating @450~650nm. Other wavebands and dimensions available on request.

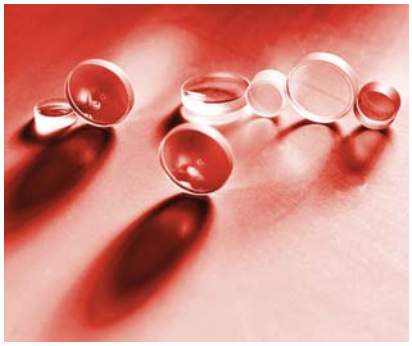
GCC-1031 Broadband Dielectric Partial Reflectors

Part No.	Reflection (%)
GCC-103101	10 ± 2
GCC-103102	20 ± 2
GCC-103103	30 ± 2
GCC-103104	40 ± 5
GCC-103105	50 ± 5
GCC-103106	60 ± 5
GCC-103107	70 ± 5

All dimensions are in mm unless otherwise specified.

Filters

Filters



General

Optical filters transmit a certain portion of light spectrum and block the rest. They generally belong to two main categories, absorptive filters and interference or dichroic filters. They are commonly used in photography, in many optical instruments, and to colour stage lighting. Daheng Optics supplies standard and custom filter products for research and instrumentation. They are designed to offer a rapid solution with high performance at an economic price. The off-the-shelf products are dichroic filters, long- and short-pass filters, and neutral density filters. Optical filters are used in many optical applications such as fluorescence microscopy.

Absorptive Filters

Absorptive filters are the simplest filters. They are usually made of absorptive materials of various inorganic or organic compounds doped into glass. The filters reply on the compounds that absorb some wavelengths of light while transmitting others. Absorptive filters are not sensitive to angle of incident. They generally maintain their performances for a wide angle of incident. The absorptive compounds can also be added to plastic to produce lighter and cheaper filters.

Dichroic Filters

Dichroic filters are interference filters coated with dielectric thin film on a glass substrate. They usually reflect the unwanted portion of the light and transmit the remainder, which are also called ‘reflective’ filters. As a type of dielectric optical coating, the dichroic filters use the principle of interference causing constructive and destructive interference of the light to achieve the required performance. Dichroic filters are very angle sensitive. By controlling the thickness and sequence of the coatings, dichroic filters can be designed to provide a specific wavelength range, the transmission level and the range of the incident angle. They are usually more expensive and delicate than absorption filters.

All dimensions are in mm unless otherwise specified.

Filters

Neutral Density Filters

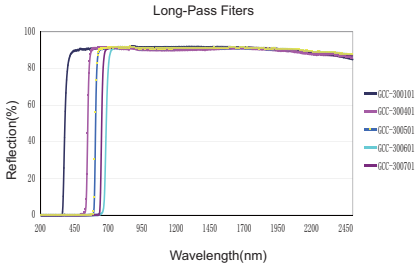
Neutral density (ND) filters attenuate uniformly the intensity of light over a broad spectrum range. They can be absorptive or reflective type, or the combination of the two with thin metallic coating.

The level of the attenuation is specified by Optical Density (OD) of the filter. OD is defined as the negative of the common logarithm of the transmission coefficient, as

$$OD = -\log_{10}(\frac{T}{100})$$

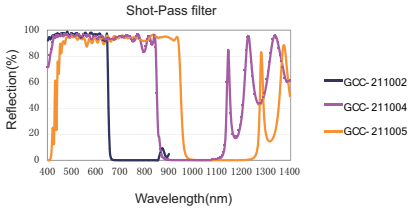
where T is the transmission in percentage. For example, a filter with 1% transmission has an OD of 2.

Long-pass Filters



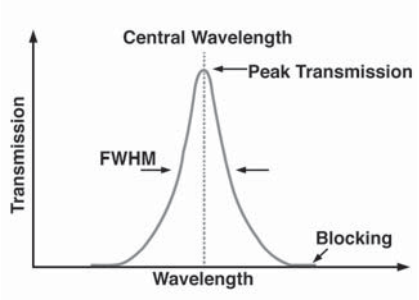
A long-pass (LP) filter blocks the wavelength range that is shorter than a specific cut-on wavelength and allows transmission of the longer wavelength range over the active spectrum. The cut-on wavelength is the wavelength at which its transmission increases to 50% of peak transmission. Long-pass filters can have a sharp slope over transmission-wavelength chart and are also referred to as edge filters.

Short-pass Filters



Similar to a long-pass filter but in reverse, a short-pass (SP) filter blocks longer wavelengths from the cut-off wavelength and transmits shorter wavelengths over the active spectrum. The cut-off wavelength is the wavelength at which its transmission decreases to 50% of peak transmission. Short-pass filters are also as edge filters.

Band-pass Filters



A band-pass filters only transmits a certain wavelength band or portion of the spectrum and blocks all other wavelengths. The band width of such a filter is, in wavelength, expressed as full width at half maximum (FWHM), as shown in the figure below. The FWHM can be from a few Ångströms to a few hundred nanometers. The narrower the band width is, the more complex the coating's design is.

All dimensions are in mm unless otherwise specified.

Filters

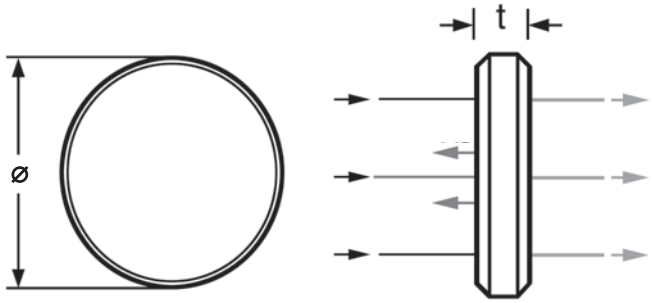
GCC-2010 UV Interference Filters

GCC-2010

Interference filters are fabricated by a series of thin layers of various dielectric materials sandwiched by glass substrates. When multi-wavelength light passes through the filter interference occurs due to the differences in refractive index, resulting in a very high transmittance for certain wavelengths, while other wavelengths are either reflected or absorbed. For a given wavelength a very narrow bandwidth (3nm-10nm) can be obtained. Optical interference filters are angle-sensitive and should be used with normal or near normal incident light. If the incident angle exceeds 20, it is essential to specify s-polarization, or p-polarization or random (the average of s and p polarization) when ordering. Filters for the major laser wavelengths are available from stock.

Those for other wavelengths and dimensions may be custom designed. The interference filters are extremely durable and withstand repeated cleaning.

Every filter comes in an anodized aluminum housing for protection against humidity and handling. The highly reflective side of the filter should generally face the source to minimize the thermal load on the absorptive glass and epoxies.

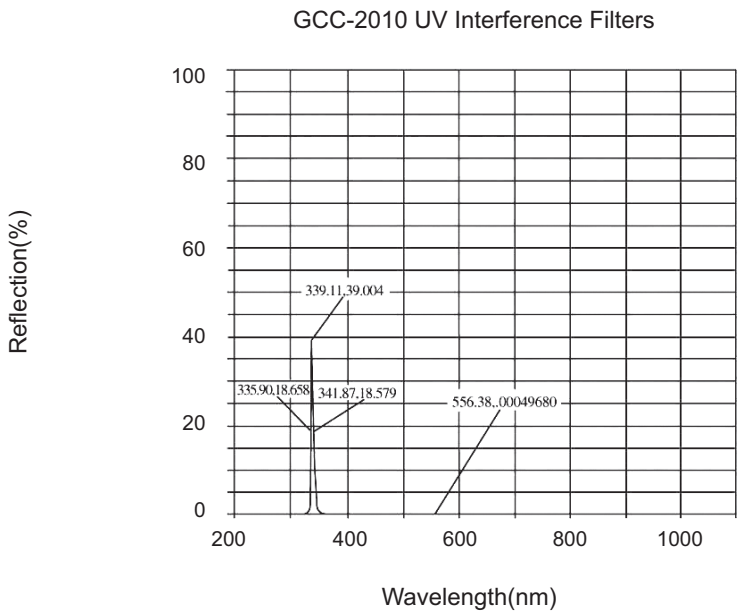


GCC-2010

- Center Wavelengh Tolerance: ±2nm
- Transmission Spectrum width (FWHM): 10nm±2nm
- Out-of-Band Blocking: < 0.1% (X-ray to 700nm)
- Housing Diameter: 25.4±0.15
- Thickness: 6 max.
- Clear Aperture: > 80% diameter

All dimensions are in mm unless otherwise specified.

Filters



GCC-2010 UV Interference Filters

Part No.	Center Wavelength (nm)	Peak Transmittance (%)
GCC-201001	254.0	≥ 8
GCC-201002	280.0	≥ 25
GCC-201003	340.0	≥ 30
GCC-201004	365.0	≥ 30

All dimensions are in mm unless otherwise specified.

Filters

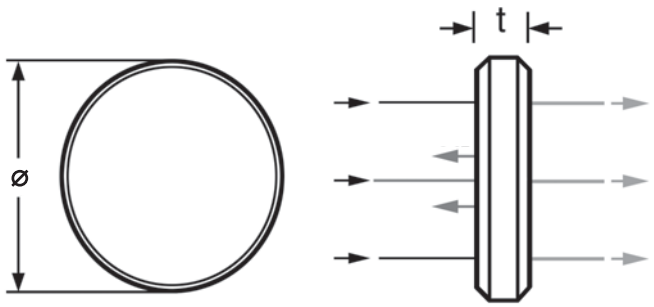
GCC-2020 VIS & IR Laser Interference Filters

GCC-2020

Interference filters are fabricated by a series of thin layers of various dielectric materials sandwiched by glass substrates. When multi-wavelength light passes through the filter interference occurs due to the differences in refractive index, resulting in a very high transmittance for certain wavelengths, while other wavelengths are either reflected or absorbed. For a given wavelength a very narrow bandwidth (3nm-10nm) can be obtained. Optical interference filters are angle-sensitive and should be used with normal or near normal incident light. If the incident angle exceeds 20, it is essential to specify s-polarization, or p-polarization or random (the average of s and p polarization) when ordering. Filters for the major laser wavelengths are available from stock.

Those for other wavelengths and dimensions may be custom designed. The interference filters are extremely durable and withstand repeated cleaning.

Every filter comes in an anodized aluminum housing for protection against humidity and handling. The highly reflective side of the filter should generally face the source to minimize the thermal load on the absorptive glass and epoxies.

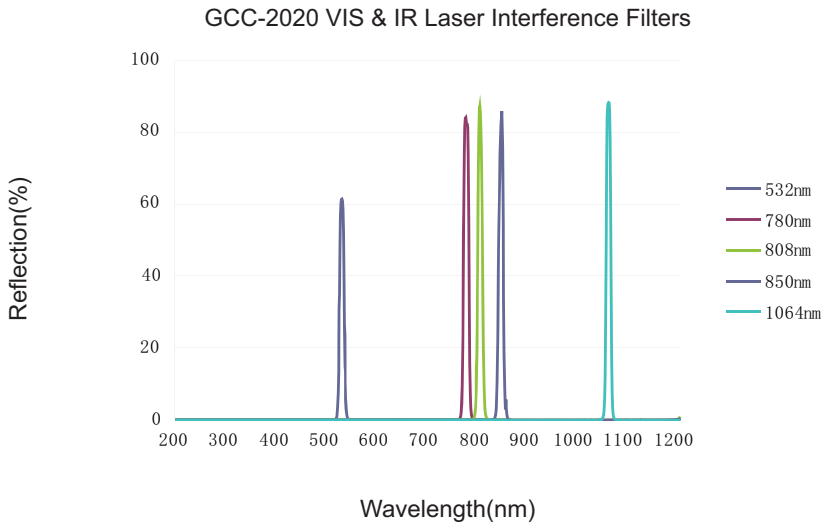


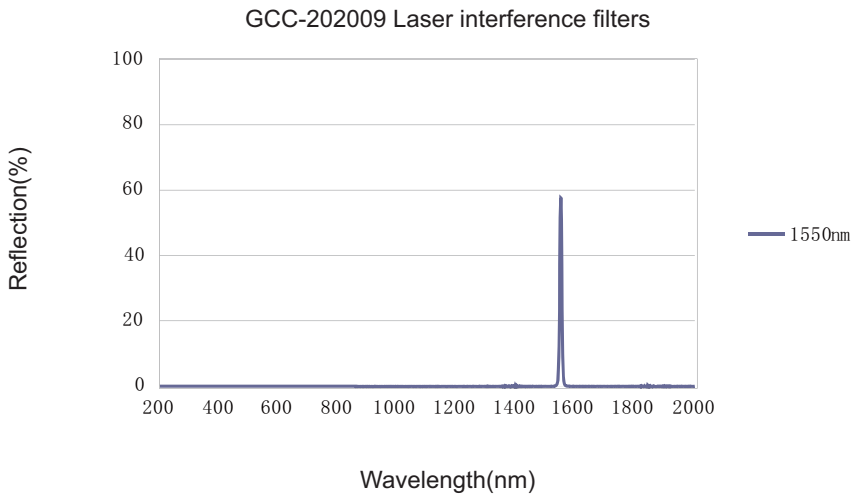
GCC-2020

- Center Wavelength(CWL): ±2nm
- Transmission Spectrum Width (FWHM): 10nm±2nm
- Minimum Peak Transmission: 410 to 515nm≥50%; 520 to 1550nm≥55%
- Out-of-Band Blocking: < 0.01%(X-ray to far IR)
- Temperature Range: -50°C to +80°C
- Center Wavelength Shifts: < 0.02nm/°C(linearly with temperature)
- Housing Diameter: 25.4 +0.0/-0.15
- Thickness: 6 max.
- Clear Aperture: > 80% diameter

All dimensions are in mm unless otherwise specified.

Filters





GCC-2020 VIS & IR Laser Interference Filters

Part No.	Center Wavelength (nm)	Peak Transmittance Min
GCC-202001	441.6	50%
GCC-202002	488	50%
GCC-202003	532	55%
GCC-202004	632.8	55%
GCC-202005	670	55%
GCC-202006	830	55%
GCC-202007	980	55%
GCC-202008	1064	55%
GCC-202009	1550	55%
GCC-202010	514.5	55%
GCC-202011	650	55%
GCC-202012	780	55%
GCC-202013	808	55%
GCC-202014	850	55%

All dimensions are in mm unless otherwise specified.

Filters

GCC-2021

GCC-2021 High Performance Interference Filters

- Center Wavelength Tolerance: ±2nm
- Transmission Spectrum Width (FWHM): 10nm±2nm
- Minimum Peak Transmission: >85%
- Out-of-Band Blocking: 0.01% (200-1100nm) from 442nm to 850nm
  0.01% (200-1500nm) from 905nm to 1064nm
  0.01% (200-1800nm) from 1310nm to 1550nm
- Center Wavelength Shifts: <0.02nm/°C
- Diameter Tolerance: 25.4+0/-0.2
- Thickness Tolerance: 5±0.1
- Flatness: 5 Fringes
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 85% Diameter

GCC-2021 High Performance Interference Filters

Part No.	Wavelength (nm)	FWHM (nm)
GCC-202101	442	10
GCC-202102	470	10
GCC-202103	488	10
GCC-202104	515	10
GCC-202105	532	10
GCC-202106	542	10
GCC-202107	570	10
GCC-202108	633	10
GCC-202109	650	10
GCC-202110	670	10
GCC-202111	730	10
GCC-202112	766	10
GCC-202113	780	10
GCC-202114	808	10
GCC-202115	830	10
GCC-202116	850	10
GCC-202117	905	10
GCC-202118	940	10
GCC-202119	980	10
GCC-202120	1064	10
GCC-202121	1310	10
GCC-202122	1550	10

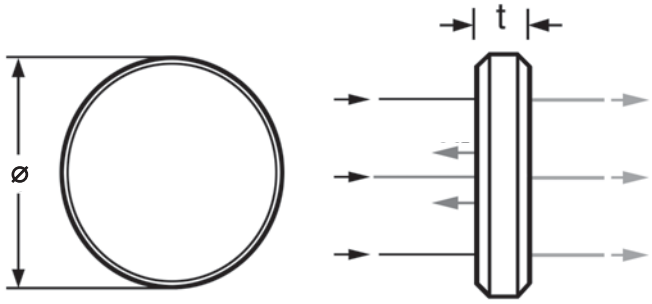
All dimensions are in mm unless otherwise specified.

Filters

GCC-2030 Broadband Interference Filters

GCC-2030

- Center Wavelength Tolerance: ±2nm
- Transmission Spectrum Width (FWHM): 80nm±2nm
- Minimum Peak Transmission: >85%
- Out-of-Band Blocking: 0.01% (200-1800nm)
- Center Wavelength Shifts: <0.02nm/°C
- Diameter Tolerance: 25.4+0/-0.2
- Thickness Tolerance: 5+/-0.1
- Flatness: 5 Fringes
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 85% Diameter



GCC-2030

GCC-2030 Broadband Interference Filters

Part No.	Wavelength (nm)	FWHM (nm)
GCC-203001	450	80
GCC-203002	500	80
GCC-203003	550	80
GCC-203004	600	80
GCC-203005	650	80
GCC-203006	700	80
GCC-203007	880	80
GCC-203008	950	80

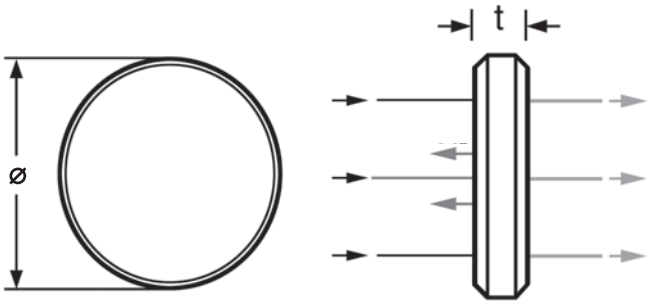
All dimensions are in mm unless otherwise specified.

Filters

GCC-211 Short-Pass Filters

GCC-211

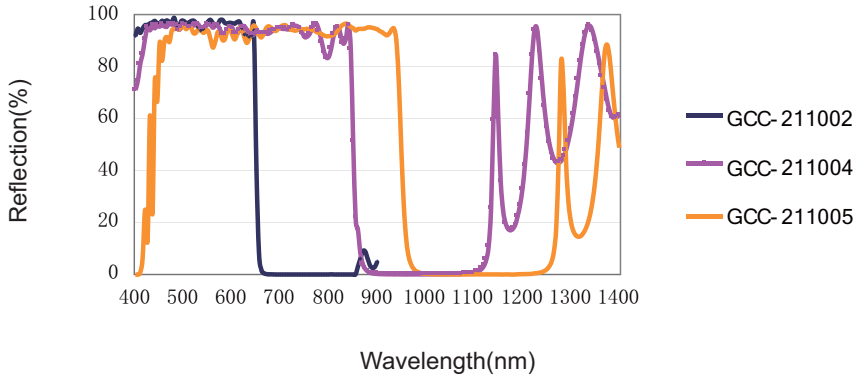
Optical Short-pass Filters are coated on a substrate of fused silica, which allows the transmission of any wavelength shorter than the cut-off wavelength and block any wavelength longer than the cut-off.



GCC-211

- Substrate: Fused silica
- Dimension Tolerance: +0/-0.2
- Thickness: 4±0.2
- Parallelism: < 3'
- Flatness: λ/4
- Surface Quality: 40-20 scratch-dig
- Clear Aperture: 90% Diameter
- Transmission: T≥85%
- Blocking: T≤1%

GCC-211 Shot-Pass filter



All dimensions are in mm unless otherwise specified.

Filters

GCC-211 Short-Pass Filters

Part No.	Transmission Band	Blocking Band	Cut-off Wavelength	λ80-λ10	Diameter
GCC-211002	400-630 nm	675-850 nm	650 nm	9 nm	∅ 25.4
GCC-211004	400-820 nm	910-1110 nm	850 nm	17 nm	∅ 25.4
GCC-211005	450-910 nm	1025-1235 nm	950 nm	20 nm	∅ 25.4

All dimensions are in mm unless otherwise specified.

Filters

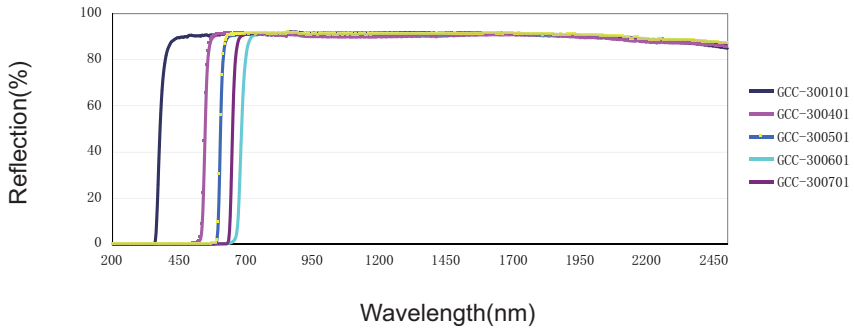
GCC-300 Long-Pass Filters

GCC-300

The substrate materials of the color filters inherently have different absorption and transmission properties across the spectrum. They are often used as long-pass and band-pass filters. It should be noted that the boundaries between passing and blocking wavelengths are less sharp than most coated filters, although peak transmission is often considerably higher.

• Material	Color glass
• Dimension Tolerance	+0/-0.2 mm
• Thickness	2±0.2 mm
• Parallelism	<3'
• Flatness	5 Fringes
• Surface Quality	60-40 scratch-dig
• Clear Aperture	90% diameter
• Transmission	T>85%
• Blocking	T<1%
• Uniformity	95%

GCC-300 Long-Pass Fiters



GCC-300 Long-Pass Filters

Part No.	Transmission Band	Blocking Band	Cut-off Wavelength	λ_1-λ_2 ($T\lambda_1$=80%,$T\lambda_2$=10%)	Diameter
GCC-300101	500-2500 nm	200-360 nm	380 nm	33 nm	Ø 25.4
GCC-300201	560-2500nm	200-430nm	450nm	22 nm	Ø 25.4
GCC-300301	600-2500nm	200-490nm	510nm	22 nm	Ø 25.4
GCC-300401	650-2500 nm	200-530 nm	550 nm	22 nm	Ø 25.4
GCC-300501	680-2500 nm	200-580 nm	600 nm	22 nm	Ø 25.4
GCC-300601	720-2500 nm	200-630 nm	650 nm	22 nm	Ø 25.4
GCC-300701	800-2500 nm	200-665 nm	685 nm	30 nm	Ø 25.4

All dimensions are in mm unless otherwise specified.

Filters

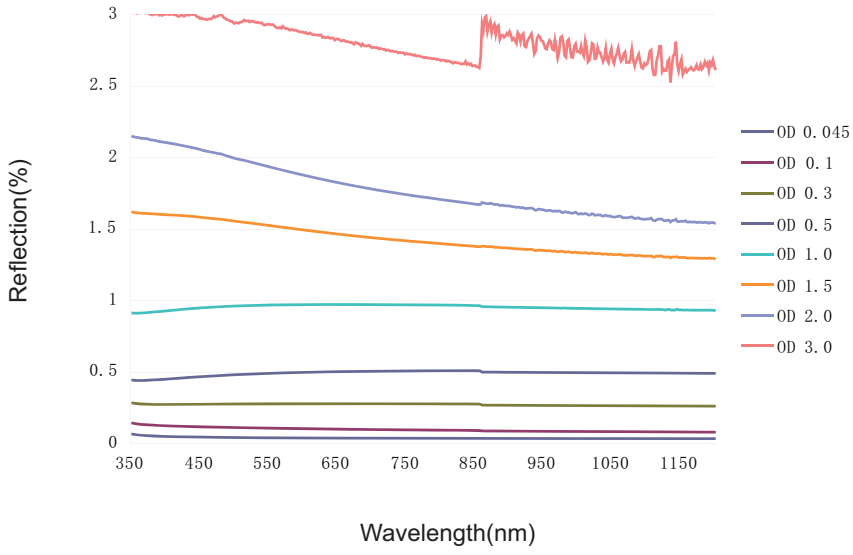
GCC-3010 Neutral Density Filters

GCC-3010

The metallic coatings on one side of the filter provide a nearly constant amount of transmitted energy over a wide visible and near infrared waveband. CDHC's neutral density filters are spectrally neutral from about 400nm to 1200nm. On BK7 or quartz substrates, we produce a variety of standard neutral density films with optical densities (OD) including 0.1, 0.3, 0.5, 1.0, 2.0, and 3.0 etc. The coating can be specially designed to fit most transmission requirements. We do not recommend this type of coating to be used with high power lasers due to the absorptive properties of the metallic materials.

- Material: BK7, optical glass.
- Dimension Tolerance: +0.0/-0.2
- Thickness: 2±0.1
- Wedge: <3'
- Flatness: 1λ/ ∅ 25.4 1λ per inch Dia.
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: 90% dimension

GCC-3010 Neutral Density Filters



All dimensions are in mm unless otherwise specified.

Filters

GCC-3010 Neutral Density Filters

Part No.	Optical Density(550nm)	Transmittance	Dimension
GCC-301001	0.045	90%	∅ 25.4
GCC-301002	0.045	90%	50x50
GCC-301011	0.1	79%	∅ 25.4
GCC-301012	0.1	79%	50x50
GCC-301021	0.3	50%	∅ 25.4
GCC-301022	0.3	50%	50x50
GCC-301031	0.5	32%	∅ 25.4
GCC-301032	0.5	32%	50x50
GCC-301041	1.0	10%	∅ 25.4
GCC-301042	1.0	10%	50x50
GCC-301051	1.5	3.2%	∅ 25.4
GCC-301052	1.5	3.2%	50x50
GCC-301061	2.0	1.0%	∅ 25.4
GCC-301062	2.0	1.0%	50x50
GCC-301071	3.0	0.1%	∅ 25.4
GCC-301072	3.0	0.1%	50x50
GCC-301081	0.2	6 3%	∅ 25.4

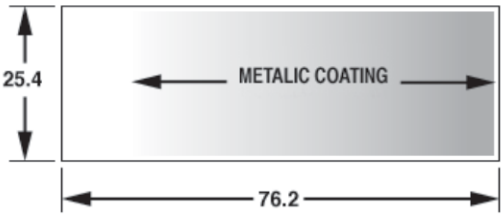
All dimensions are in mm unless otherwise specified.

Filters

GCC-3020 Metallic Linearly Variable Neutral Density Filters

GCC-3020

This ND filters provides linearly varying attenuation or beamsplitting in the visible and near infrared region. The optical density varies linearly across the length. Attenuation is achieved by a thin film of Ni-Cr-Fe protected with an overcoat of SiO. The rear surface is broadband AR coated for the visible region.



GCC-3020

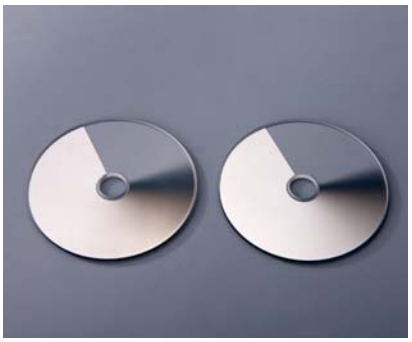
- Material: BK7 fine annealed or UV grade fused silica.
- Dimension Tolerance: +0.0/-0.2
- Clear Aperture: 90% of length and 80% of width
- Optical Density (OD): 0.08-2.0±5%@632.8nm
- Linearity of Optical Density: ±5%
- Coatings: S1: Ni-Cr-Fe
  S2: Broadband AR coated, R_{ave}<0.5% for 430-700nm at 0-15°incidence.

GCC-3020 Metallic Linearly Variable Neutral Density Filters

Part No.	Length	Width	Thickness
GCC-302001	76.2	25.4	2.0

All dimensions are in mm unless otherwise specified.

Filters

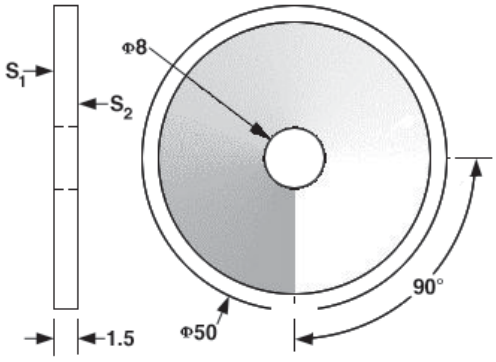


GCC-3030

GCC-3030 Metallic Circularly Variable Neutral Density Filters

Circularly variable neutral density filters are designed to simplify attenuation and beamsplitting from VIS to near IR. The optical density gradually varies around a 270circle for convenient attenuation adjustment by simply rotating the filter. Attenuation is achieved by a thin Ni-Cr-Fe film, allowing these attenuators to withstand moderate laser energy as well as to act as variable beamsplitters.

Circularly variable ND filters are available with BK7 substrates for general laboratory use, or with UV fused silica substrates for maximum thermal stability. Although the coatings are optimized for 450~700nm, they will operate from 400-1100nm with only minor losses.



GCC-3030

- Material: BK7 fine annealed or UV grade fused silica.
- Outside Diameter: ∅ 50±0.25
- Center hole Diameter: 8±0.25
- Thickness: 1.5±0.2
- Clear Aperture: >80% diameter
- Linearity of Optical Density: ±5% at 632.8nm
- Coatings: S1: Ni-Cr-Fe
  S2: Broadband AR coated, R_{ave}<0.5% for 430-700nm at 0-15° incidence.

GCC-3030 Metallic Circularly Variable Neutral DensityFilter Filters

Part No.	Relative Density Range
GCC-303001	0.0-1.0
GCC-303002	0.0-1.5
GCC-303003	0.0-2.0
GCC-303004	0.0-3.0

All dimensions are in mm unless otherwise specified.

Beamsplitters 117~137

Beamsplitters

General

A beamsplitter is an optical device that divides or splits an incident beam in two or more output beams. There are different types of beamsplitters and used for different purposes. The optical power of the total output beams may or may not be added up to the input power due to the possible optical loss on the beam splitting coatings, which vary significantly between different types of devices. The splitting ratio of the output power is related to wavelength and polarization state of the input beam. In general, the reflectivity of a dielectric coated surface depends on the polarization state of the input beam. A beam with a certain polarization can be totally reflected while the beam with different polarization is largely transmitted. It is also possible to have non-polarization beamsplitters.

Daheng Optics offers a variety of optical beamsplitters, off-the-shelf from its inventory, in the shapes of plate and cube, in terms of polarization and non-polarization, for different applications.

Plate Beamsplitters

Being partial-reflective coated mirrors, but often used with the incident of angle at 45°, plate beamsplitters consist of a thin plate of optical glass with a different type of coatings. The thin film coating determines, typically, to reflect half of the light incidence and to transmit the rest. The thin film coating can be half-metallic coating or dielectric coating. With dielectric coating, a wide range of power splitting ratio can be designed. Depending on how they are used in applications, the splitting coating can be deposited on either surface of the glass plate and the other surface is coated with anti-reflective coating.

The dielectric coated beamsplitters can have a strongly wavelength-dependent reflectivity. They are often called dichroic beam splitters which separate the different spectral components of the beam, depending on the difference in wavelength or polarization. Frequency doubler is an example of such a beam splitter to separate the harmonic beam from the residual pump light.

Cube Beamsplitters

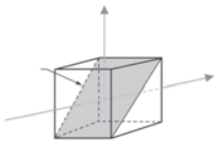
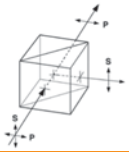
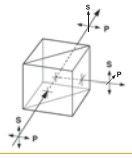
This is the most common form of beamsplitters, which is made from two triangular glass prisms glued together at their base, one base is coated optically for beam splitting. They have several advantages over plate beamsplitters. They are easy to mount. The coating is resistant to degradation with time because it is sealed within the body of the cube. However, it cannot be used in high damage threshold laser systems because of the weakness of the cementing on sustaining optical power.

All dimensions are in mm unless otherwise specified.

Beamsplitters

Polarizing and Non-Polarizing Beamsplitters

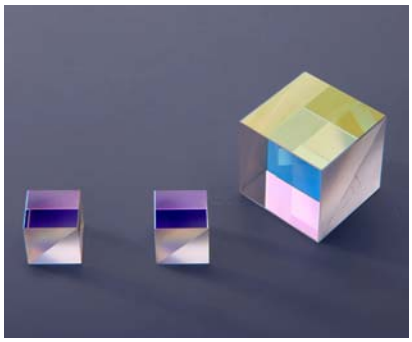
Daheng Optics provides three kinds of beamsplitters, all with strictly guaranteed splitting ratio but are distinguished by the polarization of the input and output beams. For conventional beamsplitter, partially polarized outgoing beams are obtained for randomly polarized incoming light. For polarizing beamsplitters, both s-polarized beam (reflecting) and p-polarized beam (transmitting) are the outputs from randomly polarized incoming light. For non-polarizing beamsplitter, the polarization of the outgoing beams remains the same when the incoming beam is varied polarized light.

	T=|Ts+Tp| R=|Rs+Rp| T+R=100%
	Tp/Ts>500:1
	|Ts-Tp|<5% |Rs-Rp|<5%

All dimensions are in mm unless otherwise specified.

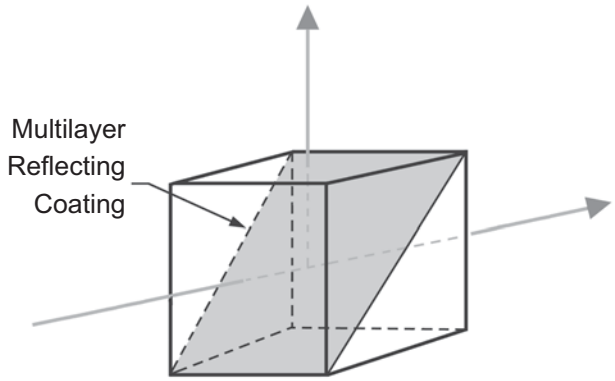
Beamsplitters

GCC-4010 Laser Line Beamsplitter Cubes



GCC-4010

This is a conventional beamsplitter independent of polarization. The incoming light should be one of the following: 45 linearly polarized, circularly polarized or natural light, i.e. the s-polarized and p-polarized components should be equal to within 5% of each other. The outgoing beams are two partially polarized beams of about equal intensities. It is advised not to use in polarization optical system.

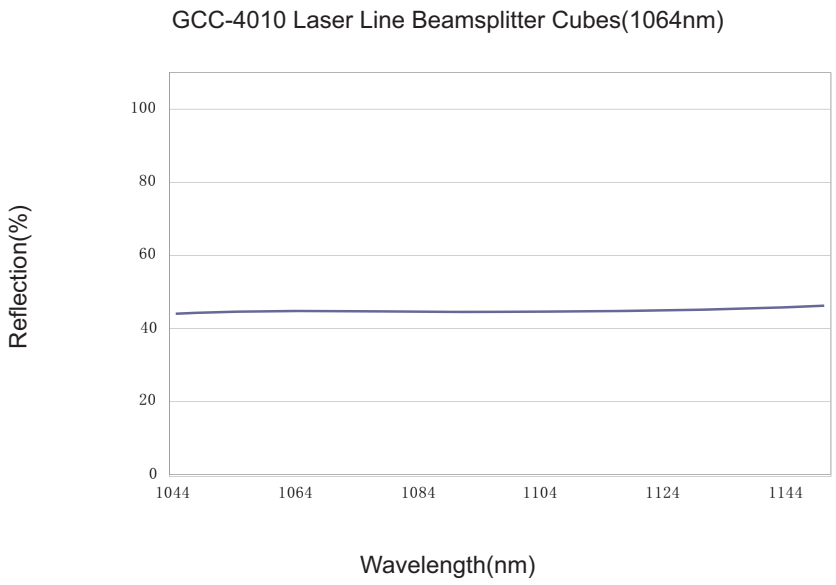


GCC-4010

- Material: BK7 fine annealed optical glass.
- Dimension Tolerance: ±0.15
- Flatness: λ/4 at 632.8nm
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: >90% dimension
- R/T ratio: 50/50±3% T=(Ts+Tp)/2, R=(Rs+Rp)/2
- Beam Deviation: 0°±3′(T), 90°±5′(R)
- Angle of Incidence: 0°±3′
- Coatings: Single wavelength partial reflectance on hypotenuse face.
  AR V-coatings on all input and output surface, R<0.15%

All dimensions are in mm unless otherwise specified.

Beamsplitters



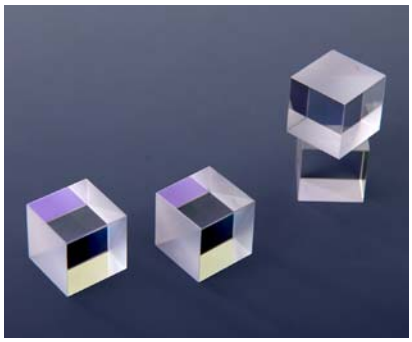
GCC-4010 Laser Line Beamsplitter Cubes

Part No.	Wavelength (nm)	a=b=c (mm)
GCC-401001	488	12.7
GCC-401002	488	25.4
GCC-401011	532	12.7
GCC-401012	532	25.4
GCC-401021	632.8	12.7
GCC-401022	632.8	25.4
GCC-401031	670	12.7
GCC-401032	670	25.4
GCC-401041	780	12.7
GCC-401042	780	25.4
GCC-401051	1064	12.7
GCC-401052	1064	25.4
GCC-401061	1310	12.7
GCC-401062	1310	25.4

All dimensions are in mm unless otherwise specified.

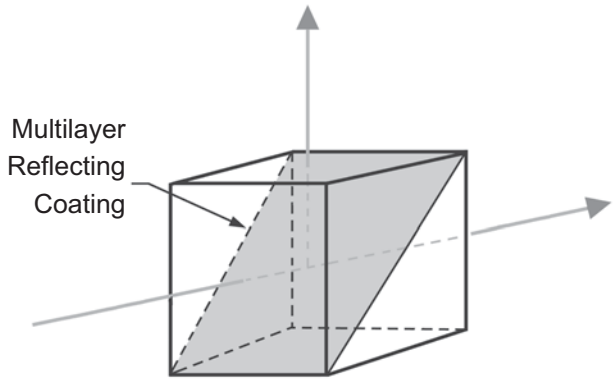
Beamsplitters

GCC-4011 Broadband Beamsplitter Cubes



GCC-4011

This is a conventional beamsplitter independent of polarization. The incoming light should be one of the following: 45 linearly polarized, circularly polarized or natural light, i.e. the s-polarized and p-polarized components should be equal to within 5% of each other. The outgoing beams are two partially polarized beams of about equal intensities. It is advised not to use in polarization optical system.

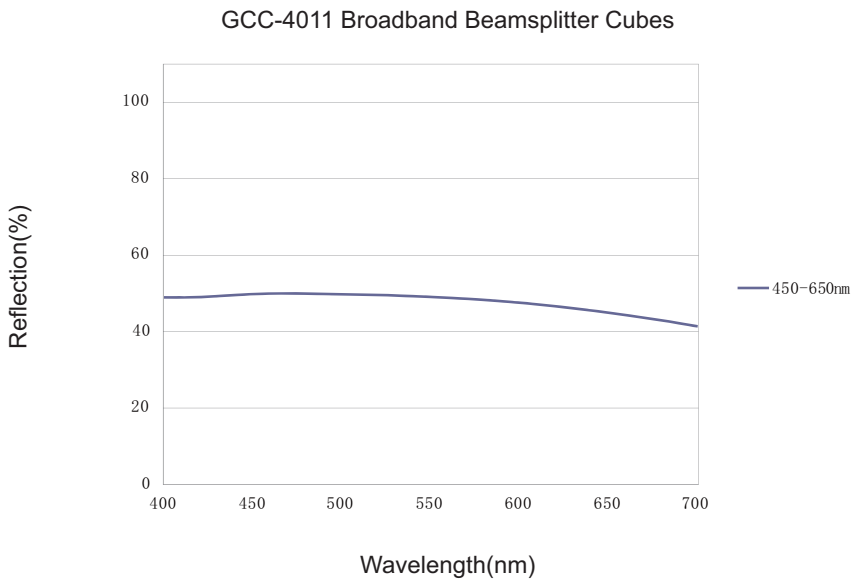


GCC-4011

- Material: BK7 fine annealed optical glass.
- Dimension Tolerance: ±0.15
- Flatness: λ/4 at 632.8nm
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: >90% dimension
- R/T ratio: 50/50 ±5% T=(Ts+Tp)/2, R=(Rs+Rp)/2
- Beam Devation: 0°±3′(T), 90°±5′(R)
- Angle of Incidence: 0°±3′
- Coatings: Single wavelength partial reflectance on hypotenuse face.
  Broadband AR V-coatings on all input and output faces, R_{ave}<0.5%.

All dimensions are in mm unless otherwise specified.

Beamsplitters

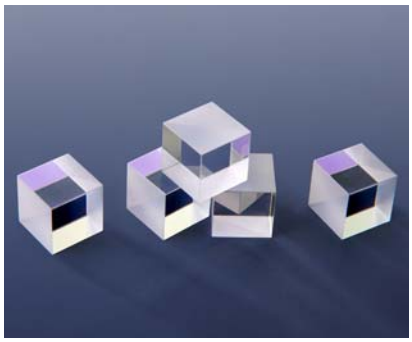


GCC-4011 Broadband Beamsplitter Cubes

Part No.	Wavelength (nm)	a=b=c (mm)
GCC-401101	450-650	12.7
GCC-401102	450-650	25.4
GCC-401111	650-900	12.7
GCC-401112	650-900	25.4
GCC-401131	900-1200	12.7
GCC-401132	900-1200	25.4
GCC-401141	1200-1600	12.7
GCC-401142	1200-1600	25.4

All dimensions are in mm unless otherwise specified.

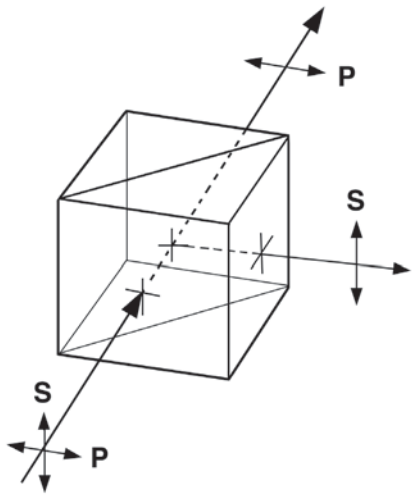
Beamsplitters



GCC-4020

GCC-4020 Laser Line Polarization Beamsplitter Cubes

A polarizing cube beamsplitter consists of a pair of right angle prisms cemented together. The hypotenuse face of one prism is coated with a special multilayer dielectric coating. When nonpolarized light is normally incident upon the entrance face, it is separated into two polarized beams, emerging through two adjacent faces in perpendicular directions and polarized orthogonally to each other. The transmitted beam is p-polarized while the reflected beam is s-polarized. When the linearly polarized light is incident, it is similarly divided into two beams in a ratio depending upon the orientation of the electric field vector of the incident light beam. These polarizing beamsplitters are available for many common laser wavelengths and broadband ranges.



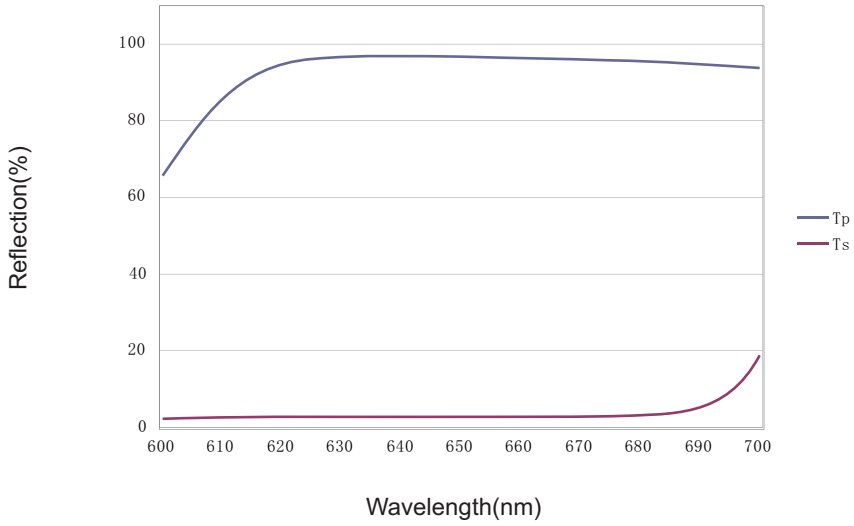
GCC-4020

- Material: BK7 fine annealed optical glass.
- Dimension Tolerance: ±0.15
- Flatness: λ/4 at 632.8nm
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: >90% dimension
- Extinction Ratio: Tp/Ts > 500:1
- Beam Deviation: 0°±3′(Tp), 90°±5′(Rs)
- Angle of Incidence: 0°~2°
- Coatings: Single wavelength polarization partial reflectance on hypotenuse face. Coatings of outside surfaces:multilayer AR V-coating, R < 0.15%.
- Temperature Range: -30℃ to +70℃

All dimensions are in mm unless otherwise specified.

Beamsplitters

GCC-4020 Laser Line Polarization Beamsplitter Cubes (633nm)

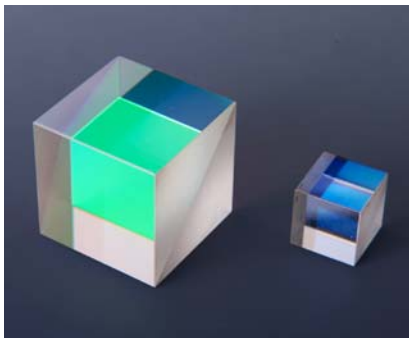


GCC-4020 Laser Line Polarization Beamsplitter Cubes

Part No.	Wavelength (nm)	Tp	Rs	a=b=c
GCC-402002	441.6	96%	99.9%	12.7
GCC-402003	441.6	96%	99.9%	25.4
GCC-402012	488.0	96%	99.9%	12.7
GCC-402013	488.0	96%	99.9%	25.4
GCC-402022	532.0	96%	99.9%	12.7
GCC-402023	532.0	96%	99.9%	25.4
GCC-402032	633	96%	99.9%	12.7
GCC-402033	633	96%	99.9%	25.4
GCC-402042	830	96%	99.9%	12.7
GCC-402043	830	96%	99.9%	25.4
GCC-402052	1064	96%	99.9%	12.7
GCC-402053	1064	96%	99.9%	25.4
GCC-402061	1310	96%	99.9%	5.0

All dimensions are in mm unless otherwise specified.

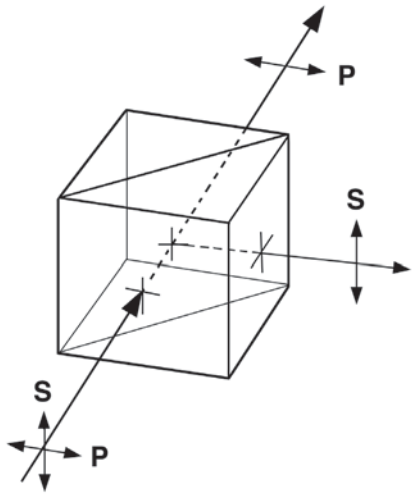
Beamsplitters



GCC-4021

GCC-4021 Broadband Polarization Beamsplitter Cubes

A polarizing cube beamsplitter consists of a pair of right angle prisms cemented together. The hypotenuse face of one prism is coated with a special multilayer dielectric coating. When nonpolarized light is normally incident upon the entrance face, it is separated into two polarized beams, emerging through two adjacent faces in perpendicular directions and polarized orthogonally to each other. The transmitted beam is p-polarized while the reflected beam is s-polarized. When the linearly polarized light is incident, it is similarly divided into two beams in a ratio depending upon the orientation of the electric field vector of the incident light beam. These polarizing beamsplitters are available for many common laser wavelengths and broadband ranges.



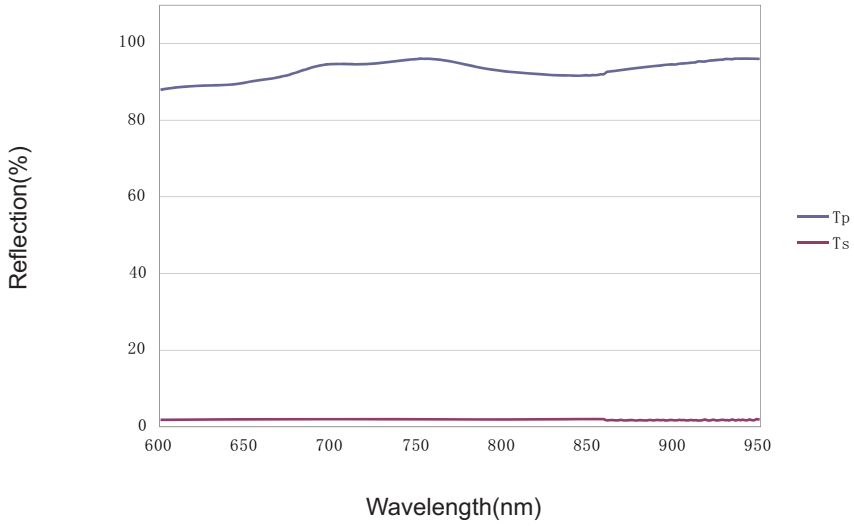
GCC-4021

- Material: SF2
- Dimension Tolerance: ±0.15
- Flatness: λ/4@632.8nm
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: >90% dimension
- Extinction Ratio: Tp/Ts >500:1
- Beam Deviation: 0°±3′(T), 90°±5′((R)
- Angle of Incidence: 0°±2°
- Coatings: Single wavelength polarization partial reflectance on hypotenuse face. Coatings of outside surfaces: broadband multilayer AR V-coating, R_{ave}<0.5%.
- Temperature Range: -30℃ to +70℃

All dimensions are in mm unless otherwise specified.

Beamsplitters

GCC-4021 Broadband Polarization Beamsplitter Cubes (650-900nm)



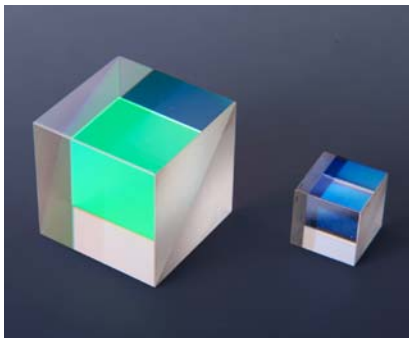
GCC-4021 Broadband Polarization Beamsplitter Cubes

Part No.	Wavelength (nm)	Tp	Rs	a=b=c
GCC-402102	450-650	95%	99.8%	12.7
GCC-402103	450-650	95%	99.8%	25.4
GCC-402104	450-650	95%	99.8%	50.8
GCC-402111	650-900	95%	99.8%	12.7
GCC-402112	650-900	95%	99.8%	25.4
GCC-402121	900-1200	95%	99.8%	12.7
GCC-402122	900-1200	95%	99.8%	25.4
GCC-402131	1200-1600	95%	99.8%	12.7
GCC-402132	1200-1600	95%	99.8%	25.4

All dimensions are in mm unless otherwise specified.

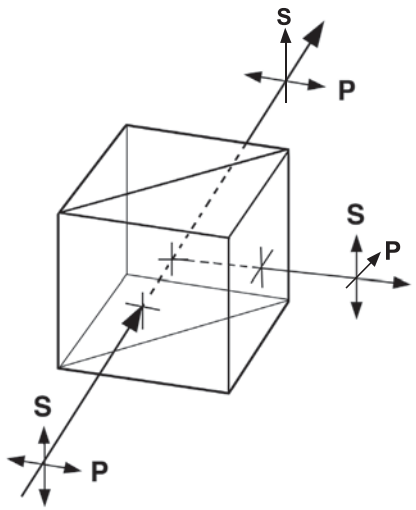
Beamsplitters

GCC-4030 Narrowband Non-polarizing Beamsplitter Cubes



GCC-4030

These beamsplitters have moderate absorption but minimal polarization sensitivity. The broad spectral flatness makes them ideal for use with multiple lasers or tunable lasers. Hybrid beamsplitters are less sensitive to changes in angle of incidence. Due to the metallic nature of the hybrid coating, these beamsplitters are not intended for use with high power lasers.



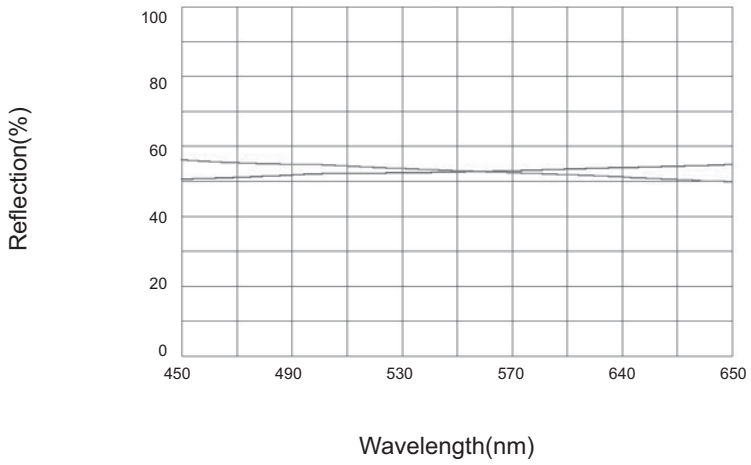
GCC-4030

- Material: BK7 fine annealed optical glass.
- Dimension Tolerance: ±0.15
- Flatness: λ/4 at 632.8nm
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: >90% dimension
- R/T: 48/48±5% independent of polarization
  |Ts-Tp|≤5%, |Rs - Rp|≤5%
- Beam Deviation: 0°±3′(T_p), 90°±5′(R_s)
- Angle of Incidence: 0°±2°
- Coatings: Single wavelength non-polarization partial reflectance on hypotenuse face. Coatings of outside surfaces:multilayer AR V-coatings, R<0.15%.
- Temperature Range: -30℃ to +70℃

All dimensions are in mm unless otherwise specified.

Beamsplitters

GCC-4030 Narrowband Non-polarizing Beamsplitter Cubes



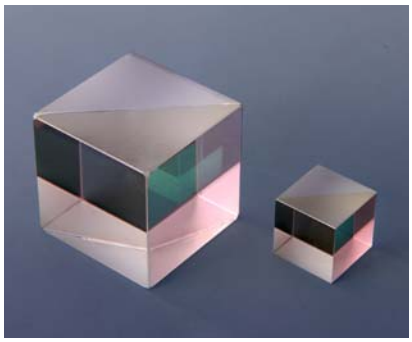
GCC-4030 Narrowband Non-polarizing Beamsplitter Cubes

Part No.	Wavelength (nm)	a=b=c (mm)
GCC-403001	488	12.7
GCC-403002	488	25.4
GCC-403011	532	12.7
GCC-403012	532	25.4
GCC-403021	632.8	12.7
GCC-403022	632.8	25.4
GCC-403031	670	12.7
GCC-403032	670	25.4
GCC-403041	780	12.7
GCC-403042	780	25.4
GCC-403051	1064	12.7
GCC-403052	1064	25.4

All dimensions are in mm unless otherwise specified.

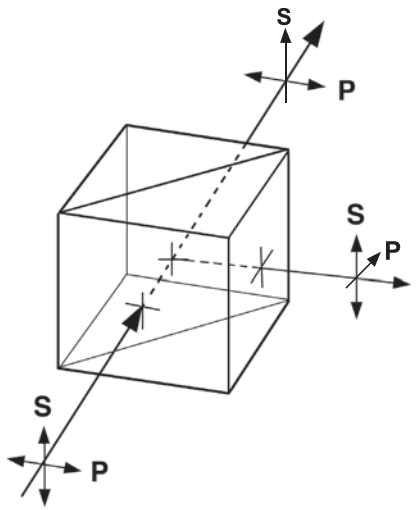
Beamsplitters

GCC-4031 Broadband Non-polarizing Beamsplitter Cubes



GCC-4031

Broadband non-polarizing hybrid cube beamsplitters have moderate absorption but minimal polarization sensitivity. The broad spectral flatness of these beamsplitters make them ideal for use with multiple lasers or tunable lasers. Hybrid beamsplitters are less sensitive to changes in angle of incidence. Due to the metallic nature of the hybrid coating, these beamsplitters are not intended for use with high power lasers.



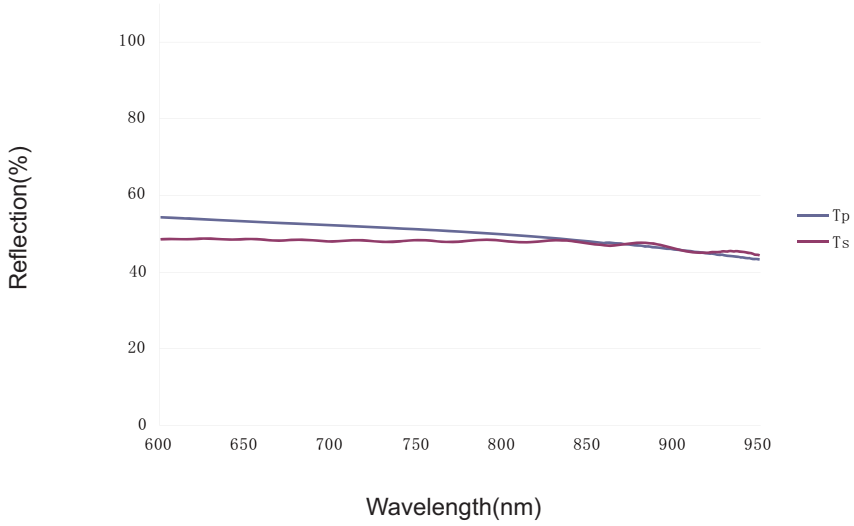
GCC-4031

- Material: BK7 fine annealed optical glass.
- Dimension Tolerance: ±0.15
- Flatness: λ/4 at 632.8nm
- Surface Quality: 60-40 scratch-dig
- Clear Aperture: >90% dimension
- R/T: 48/48±5% independent of polarization
  |Ts-Tp|5%, |Rs - Rp|5%
- Beam Deviation: 0°±3′(T), 90°±5′((R)
- Angle of Incidence: 0°±2°
- Coatings: Broadband non-polarization partial reflectance on hypotenuse face. Coatings of outside surfaces: multilayer AR V-coatings, R_{ave}<0.5%
- Temperature Range: -30℃ to +70℃

All dimensions are in mm unless otherwise specified.

Beamsplitters

GCC-4031 Broadband Non-polarizing Beamsplitter Cubes (650-900nm)



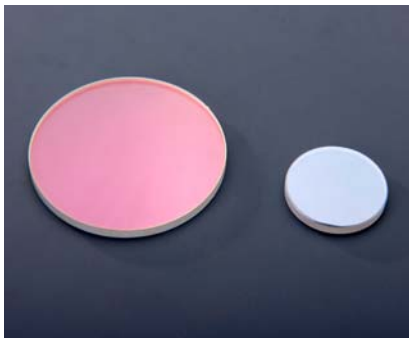
GCC-4031 Broadband Non-polarizing Beamsplitter Cubes

Part No.	Wavelength (nm)	a=b=c (mm)
GCC-403101	450-650	12.7
GCC-403102	450-650	25.4
GCC-403111	650-900	12.7
GCC-403112	650-900	25.4
GCC-403121	900-1200	12.7
GCC-403122	900-1200	25.4
GCC-403131	1200-1600	12.7
GCC-403132	1200-1600	25.4

All dimensions are in mm unless otherwise specified.

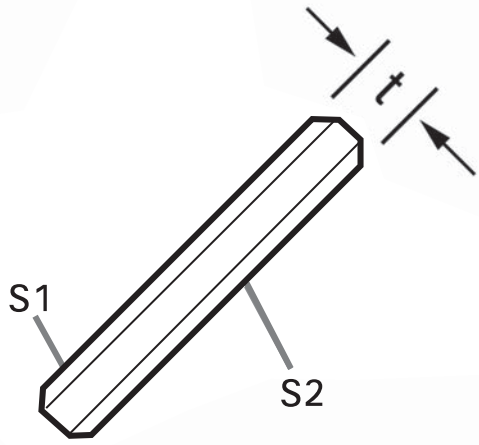
Beamsplitters

GCC-4110 Laser Line Conventional Beamsplitter Plates



GCC-4110

The beamsplitter plate is a thin optical glass plate. The first face is coated with an all-dielectric thin film having partial reflection properties. The second surface is multilayer AR coated for 45or some other specified incident angle. This beamsplitter has low absorption and high damage threshold, suitable for high energy laser applications where cemented cubes may fail. CDHC provides three kinds of plates, all with strictly guaranteed splitting ratio but are distinguished by the polarization of the incoming and outgoing beams. For BS plates, we obtain partially polarized outgoing beams for randomly polarized incoming light. For PBS plates, we obtain both s-polarized and p-polarized beams from randomly polarized incoming light. For NPBS plates, the polarization of the outgoing beams remains the same when the incoming beam is 45linearly polarized or circularly polarized.



GCC-4110

- Material: BK7 fine annealed optical glass.
- Dimension Tolerance: +0.0/-0.15
- Thickness: 3±0.15
- Parallelism: ≤1'
- Flatness: λ/8 at 632.8nm
- Surface Quality: 40-20 scratch-dig
- Clear Aperture: >90% diameter
- R/T: 50/50±5% for specified wavelength
  R=(Rs+Rp)/2, T=(Ts+Tp)/2
- Incident angle: 45°
- Coatings: S1: Single wavelength beamsplitter coatings
  S2: AR V-Coatings, R<0.15%

All dimensions are in mm unless otherwise specified.

Beamsplitters

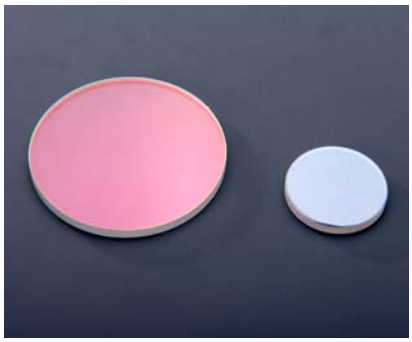
GCC-4110 Laser Line Conventional Beamsplitter Plates

Part No.	Wavelength (nm)	Dia
GCC-411001	488	12.7
GCC-411002	488	25.4
GCC-411011	532	12.7
GCC-411012	532	25.4
GCC-411021	632.8	12.7
GCC-411022	632.8	25.4
GCC-411031	670	12.7
GCC-411032	670	25.4
GCC-411041	780	12.7
GCC-411042	780	25.4
GCC-411051	1064	12.7
GCC-411052	1064	25.4
GCC-411061	1310	12.7
GCC-411062	1310	25.4
GCC-411071	1550	12.7
GCC-411072	1550	25.4

All dimensions are in mm unless otherwise specified.

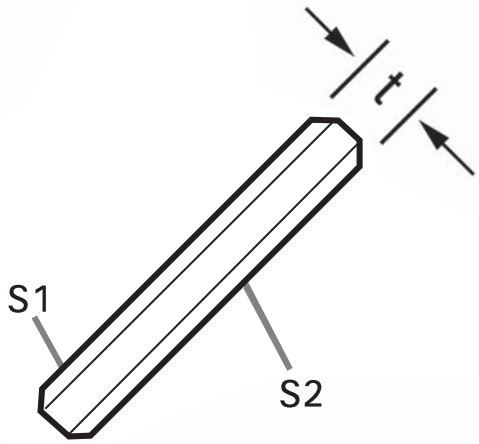
Beamsplitters

GCC-4111 Broadband Conventional Beamsplitter Plates



GCC-4111

This is a conventional beamsplitter independent of polarization. The incoming light should be one of the following: 45 linearly polarized, circularly polarized or natural light, i.e. the s-polarized and p-polarized components should be equal to within 5% of each other. The outgoing beams are two partially polarized beams of about equal intensities.

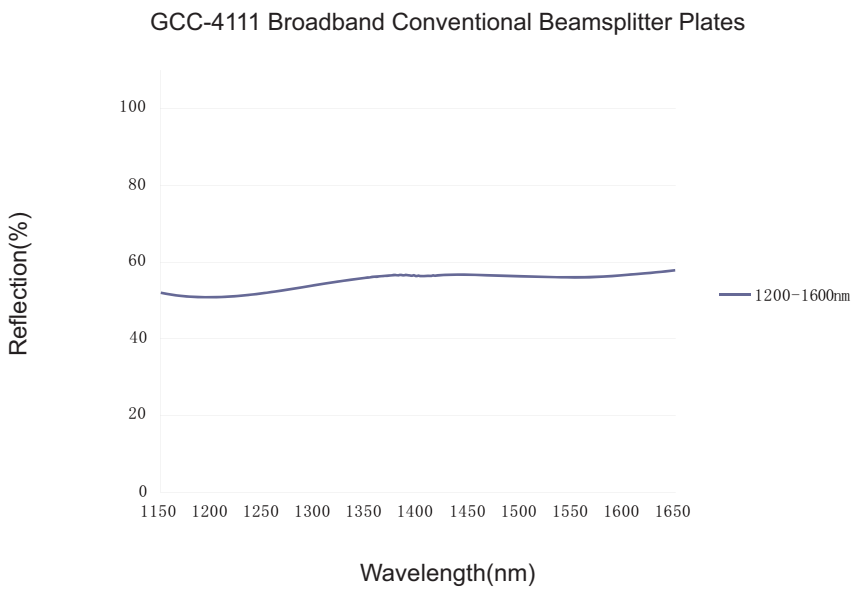


GCC-4111

• Material:	BK7 fine annealed optical glass
• Dimension Tolerance:	+0.0/-0.15mm
• Thickness:	3±0.15mm
• Parallelism:	≤1’
• Flatness:	λ/8 at 632.8nm
• Surface Quality:	40-20 scratch-dig
• Clear Aperture:	>90% diameter
• R/T:	50/50±5% for random polarization T=(Ts+Tp)/2, R=(Rs+Rp)/2
• Incidence angle:	45°
• Coatings:	S1: broadband beamsplitter coatings. S2: broadband AR coatings, R_{ave}<0.5%.

All dimensions are in mm unless otherwise specified.

Beamsplitters



GCC-4111 Broadband Conventional Beamsplitter Plates

Part No.	Wavelength (nm)	Dia
GCC-411101	450-650	12.7
GCC-411102	450-650	25.4
GCC-411103	450-650	50
GCC-411111	650-900	12.7
GCC-411112	650-900	25.4
GCC-411113	650-900	50
GCC-411121	900-1200	12.7
GCC-411122	900-1200	25.4
GCC-411123	900-1200	50
GCC-411131	1200-1600	12.7
GCC-411132	1200-1600	25.4
GCC-411133	1200-1600	50

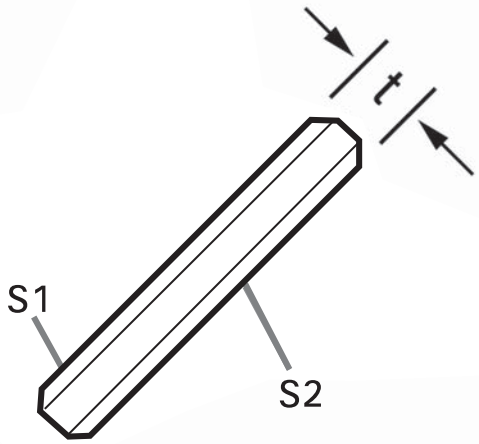
All dimensions are in mm unless otherwise specified.

Beamsplitters

GCC-414 Dichroic Beamsplitter Plates

GCC-414

Dichroic Beamsplitter Plates allow NIR light to pass through and reflect visible light at 45°incident angle. They have a very steep transition between the region of transmission and reflection. They have a hard and dielectric coating using interference ranther than absorption to isolate the spectral bands. Unlike colored glass filters the cut-off wavelength will shift to shorter wavelengths with an increase in angle of incidence.



GCC-414

- Material: BK7 fine annealed
- Diameter Tolerance: 25.4+0/-0.2
- Thickness Tolerance: 3.5+/-0.1
- Incident Angle: 45°
- Flatness: 5 Fringes
- Surface Quality: 60-40 scratch-dig

All dimensions are in mm unless otherwise specified.

Beamsplitters

GCC-414 Dichroic Beamsplitter Plates

Part No.	specification	Cut-off Wavelength
GCC-414001	R>98%@350-450nm,T>90%@465-750nm	458nm
GCC-414002	R>98%@350-488nm,T>90%@500-750nm	495nm
GCC-414003	R>98%@350-500nm,T>90%@513-750nm	506nm
GCC-414004	R>98%@350-512nm,T>90%@528-750nm	520nm
GCC-414005	R>98%@350-554nm,T>90%@570-750nm	562nm
GCC-414006	R>98%@350-585nm,T>90%@600-850nm	593nm
GCC-414007	R>98%@350-651nm,T>90%@669-850nm	660nm
GCC-414008	R>98%@350-676nm,T>90%@695-850nm	685nm

All dimensions are in mm unless otherwise specified.

Laser Lenses

Laser Lenses

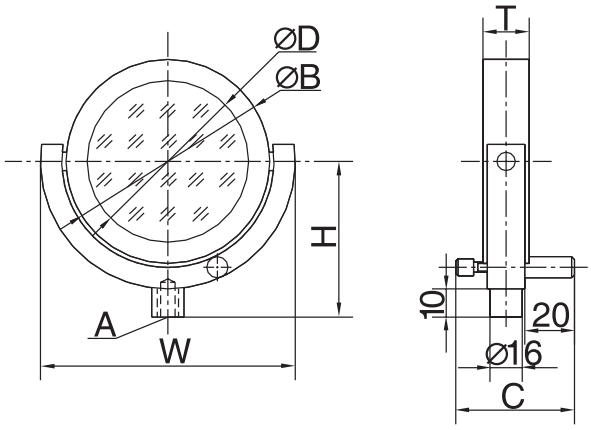
GCO-02 Achromatic Fourier Transform Lenses

These air-spaced or cemented doublets are designed for application in coherent or incoherent optical systems for information processing. Spherical, coma,astigmatic and achromatic aberrations are corrected. The components can be applied as achromatic collimators.

One-Tilt Achromatic Fourier Transform Lenses

It can be tilted about the Y axis by a thumbscrew. The components can bemounted on the post of Daheng product.

GCO-02



GCO-0201～03M

One-Tilt Achromatic Fourier Transform Lenses

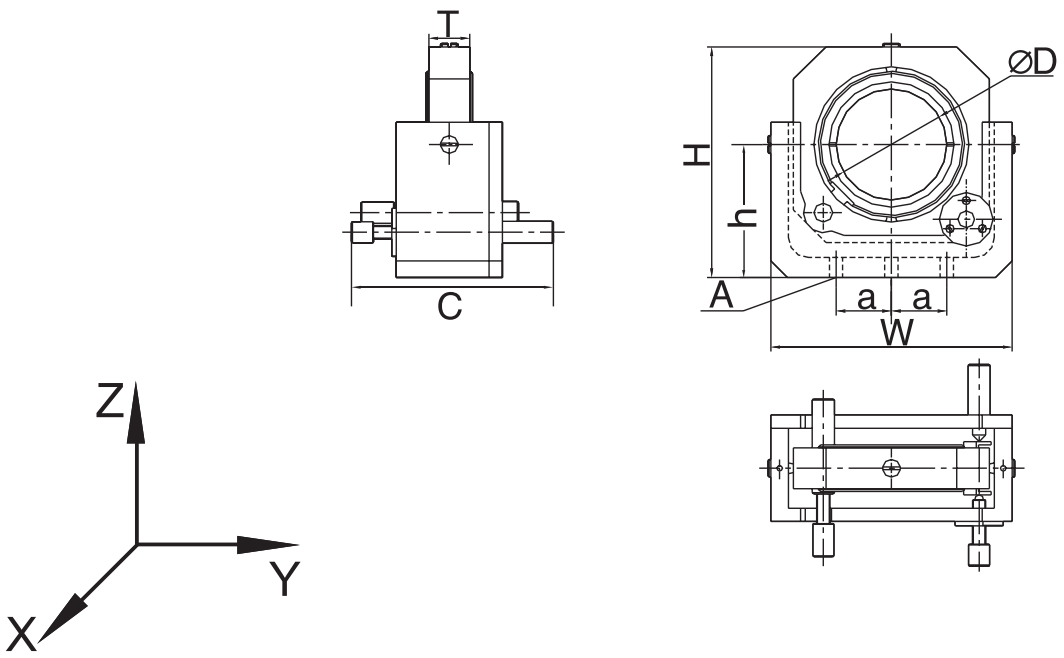
Part No.	A	Ø D	W	T	Ø B	C	H	f
GCO-0201M	M6	50	86	19	66	46	56	300
GCO-0202M	M6	75	120	26	96	55	74	300
GCO-0203M	M6	100	152	30.5	124	63.5	90	400

All dimensions are in mm unless otherwise specified.

Laser Lenses

Two-Tilt Achromatic Fourier Transform Lenses

It can be tilted about the Y and Z axes by two thumbscrews. The components can be mounted on post (GCM-01M and GCM-03M).



GCO-0211～16M

Two-Tilt Achromatic Fourier Transform Lenses

Part No.	a	A	Ø D	W	T	C	H	h
GCO-0211M	25	M6	50	109	18.5	91	104	60
GCO-0212M	50	M6	75	143	22	98	139	79
GCO-0213M	62.5	M6	100	188	24	103	179	100
GCO-0214M	25	M6	145	238	30	112	217	117
GCO-0215M	50	M6	194	306	32	131	288	158
GCO-0216M	50	M6	240	366	45	151	384	188

All dimensions are in mm unless otherwise specified.

Laser Lenses

GCO-14

GCO-14 Beam Expanders

A beam expander is an optical system for changing the beams diameter. The product of the diameter and divergence for a laser beam remains constant between input and output. This means that, if the beam diameter increases, the divergence of the output will decrease. Beam expanders use this inverse-proportional relationship between the diameter and divergence to expand a laser beam, or to reduce the beam divergence. Low divergence allows for a smaller focus spot of a Gaussian beam.
In summary, beam expanders are used for fine focusing, reducing beam divergence and minimizing diffraction effect. Daheng Beam Expanders (GCO-14) are professionally designed for complicated systems and ideally used in combination with Daheng F-Theta lenses (GCO-31).

TECHNICAL NOTES

- Type of beam expander

Beam expanders are generally afocal system; in which two groups of lenses have their focal points coincided. The front and the rear lens group are input and output lens, respectively. There are two types of beam expanders, Galilean and Keplerian, based on the input lens.

Galilean beam expander is the most common type of beam expander, which is derived from Galilean telescope. It usually has one negative lens and one positive lens. The front focal point of the negative lens and the front focal point of the positive lens are coincided in front of the input lens. For lens expansion ratios <20x, the Galilean beam expander is most often used because of its simplicity, small package size and low cost. However, the Galilean beam expander is unable to accommodate spatial filters and limited to low expansion ratios.

In cases where larger expansion ratio or spatial filtering is required, the Keplerian beam expanders are employed. The Keplerian beam expander has two positive lenses, which the rear focal point of the first lens is positioned at the front focal point of the second lens. In addition, spatial filtering can be instituted by placing a pinhole at the coincided focus point.

- Expansion ratio, M

The expansion ratio M is the ratio of the output beam diameter Øout to the input beam diameter Øin. It can be calculated using the focal length of the input lens f 'in and the output lens f 'out as follows:

As mentioned above, increasing the beam diameter means decreasing the divergence of the beam by inverse proportion. So,

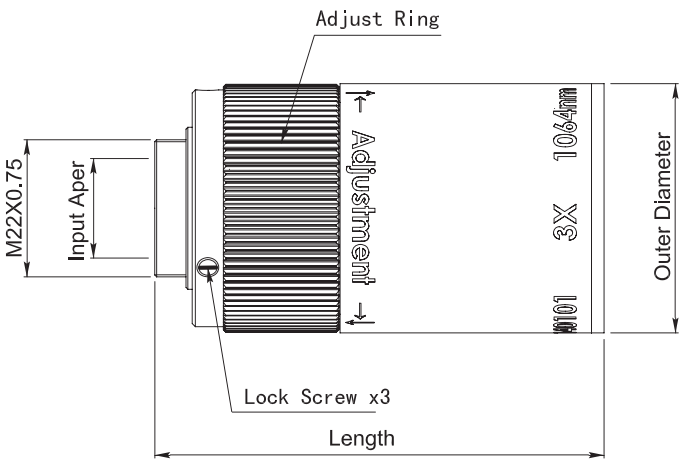
$$M = \frac{\varnothing_{out}}{\varnothing_{in}} = -\frac{f'_{out}}{f'_{in}}$$

All dimensions are in mm unless otherwise specified.

Laser Lenses

whereis the divergence of the input beam and θout is the divergence of the output beam.

$$M = -\frac{\tan(\theta_{in})}{\tan(\theta_{out})}$$



GCO-14

GCO-14 Beam Expanders

Part No.	Expansion Ratio	Wavelength	Max. Input Beam Diameter(1/e²)	Input Aperture	Outer Diameter	Length	Transmitted Wavefront	Transmission	Damage Threshold
GCO-140101	3X	355nm	6	8	40	75	< λ/4 (RMS)	> 98.5%	
GCO-140102	5X	355nm	4	5.5	40	95	< λ/4 (RMS)	> 98.5%	
GCO-140103	8X	355nm	3	5	40	115	< λ/4 (RMS)	> 98.5%	10J/cm2
GCO-140111	3x	532nm	8	10.5	40	75	< λ/4 (RMS)	> 98.5%	@10ns
GCO-140112	5X	532nm	6	8	48	95	< λ/4 (RMS)	> 98.5%	10Hz
GCO-140113	8X	532nm	4	8	48	105	< λ/4 (RMS)	> 98.5%	1064nm
GCO-140121	3x	1064nm	8	10.5	40	75	< λ/4 (RMS)	> 98.5%	
GCO-140122	5x	1064nm	6	8	48	95	< λ/4 (RMS)	> 98.5%	
GCO-140123	8x	1064nm	4	5.5	48	105	< λ/4 (RMS)	> 98.5%	

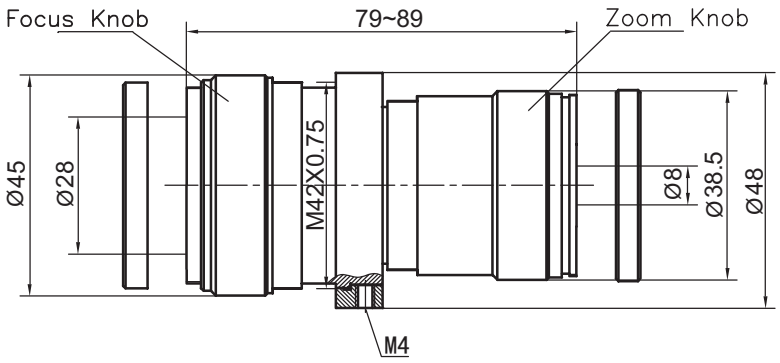
All dimensions are in mm unless otherwise specified.

Laser Lenses

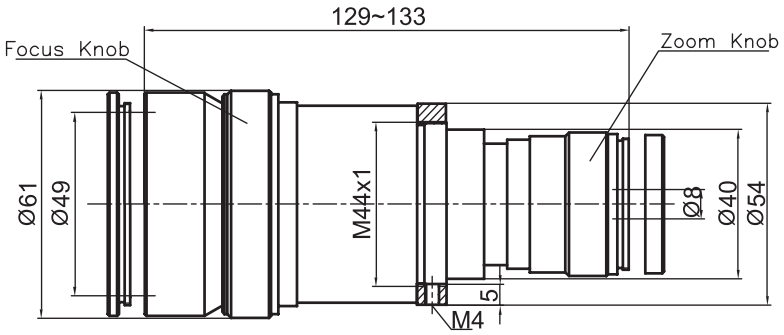
GCO-25 Zoom Beam Expanders

GCO-25 Series Zoom Beam Expanders are designed for changing a collimated laser beam, there are two zoom ranges available: 2x~6x and 5x~10x. Adjusting the knob at the input and achieves expanding variation and restoration of collimation. With the design of using air-spaced lenses only, this series is suitable for high energy laser.

GCO-25



GCO-2501/2



GCO-2503/4

GCO-25 Zoom Beam Expanders

Part No.	Waveband	Expansion Ratio	Input Aperture max.	Output Aperture max.	Diamter	Length	Wavefront Distortion
GCO-2501	450~680 nm	2x~6x	Ø 4	Ø 24	Ø 48	89	1/5 λ
GCO-2502	900~1100 nm	2x~6x	Ø 4	Ø 24	Ø 48	89	1/5 λ
GCO-2503	450~680 nm	5x~10x	Ø 4	Ø 40	Ø 60	134	1/2 λ
GCO-2504	900~1100 nm	5x~10x	Ø 4	Ø 40	Ø 60	134	1/2 λ

All dimensions are in mm unless otherwise specified.

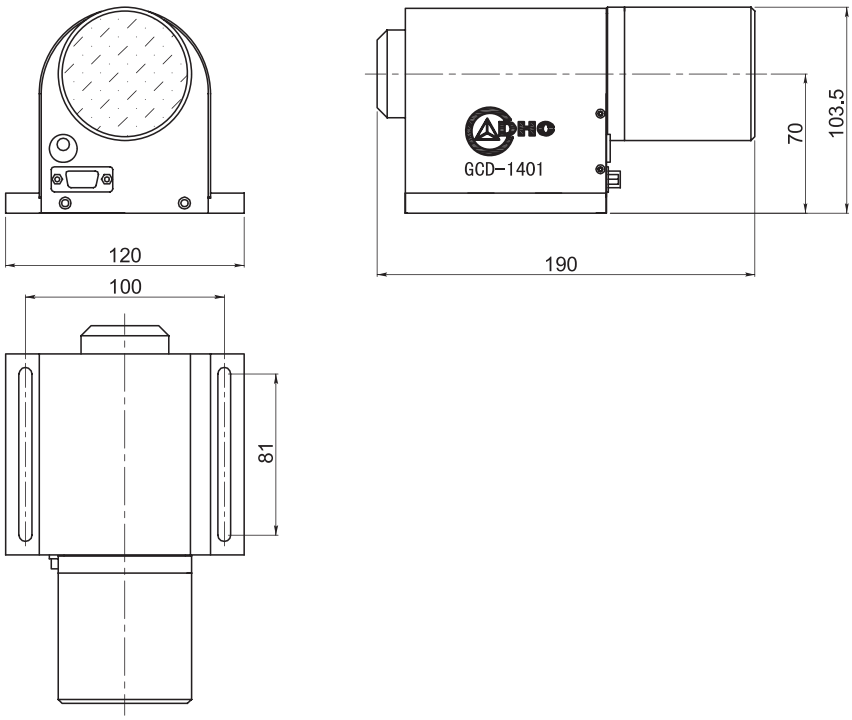
Laser Lenses

GCD-14 Motorized Zoom Beam Expanders

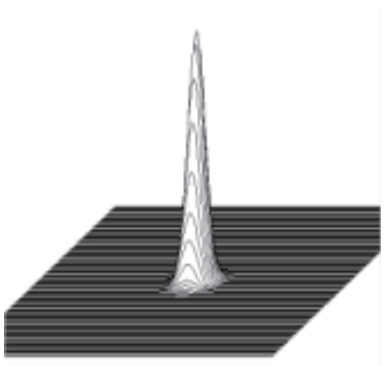
GCD-14

For automated applications, Daheng Optics developed motorized zoom beam expanders --GCD-14 series. GCD-14 series employ the 4 lens-element optical designs and the build-in adjustment motors for controlling lens groups. With the motorized systems, both magnification and focus can be controlled independently.

With Daheng Optics motorized zoom beam expanders, variable expansion ratio can automatically be set ranging from 1.5X~6X. This variability helps to reduce machine set up times and provides flexibility to equipment for a wide range of jobs.



GCD-14



All dimensions are in mm unless otherwise specified.

Laser Lenses

Features

- Continuous variable expansion ratio
- Wavelength: 450~650nm or 780~1080nm or 10.6μm
- Default expansion setting pre-programmed
- User-defined magnification settings
- Use-controlled focus adjustment
- Communication with PC or joystick with a USB

GCD-14 Motorized Zoom Beam Expanders

Part No.	Expansion Ratio	Waveband	Max. entrance beamØ at $1/e^2$ Gaussian beam (mm)	Output Aperture	Damage Threshold	Transmission
GCD-1401	1.5x ~ 6x	450nm~650nm	Ø4	Ø40	200MW/cm2	> 96%
GCD-1402	1.5x ~ 6x	780nm~1080nm	Ø4	Ø40	200MW/cm2	> 96%
GCD-1403	1.5x ~ 6x	10.6μm	Ø4	Ø40	200MW/cm2	> 96%

All dimensions are in mm unless otherwise specified.

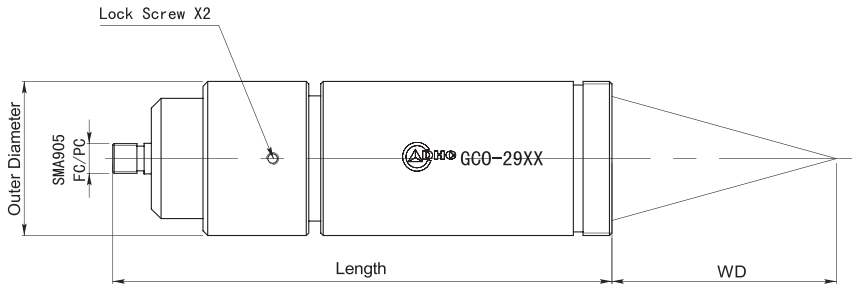
Laser Lenses

GCO-29

GCO-29 Fiber Focusing Lenses

Fiber focusing lenses are designed to use for the laser output of a fiber with common standard fiber connection attachment. They are widely used in laser machining systems for welding, cutting, drilling and structuring applications. They are also used in the end-pump DPSS laser systems to focus the pump radiation output into the laser crystal.

Daheng fiber focusing lens (GCO-29) employs an optimized design with multi-elements system. The focus spot has a fix magnification with the fiber core diameter. The lenses also characterized with designated working distance ideal for the laser machining applications. A range of magnifications for spot sizes are available off-the-shelf.



GCO-29

GCO-29 Fiber Focusing Lenses

Part No.	Magnification	Transmission	WD	Outer diameter	length	core Diameter	N.A.	The maximum power(W)
GCO-2901	1:1	>92%	46.6	32	104	0.4	0.22	100
GCO-2902	1:0.8	>95%	49.2	37.5	98.4	0.4	0.22	100
GCO-2904	1:0.5	>95%	30	44	126.5	0.4	0.22	100
GCO-2911	1:1.5	>95%	78.6	35	103.8	1.2	0.22	100
GCO-2912	1:2	>95%	75	32	98	0.4	0.22	100
GCO-2914	1:4	>95%	300	44	108	0.8	0.22	100

All dimensions are in mm unless otherwise specified.

Laser Lenses

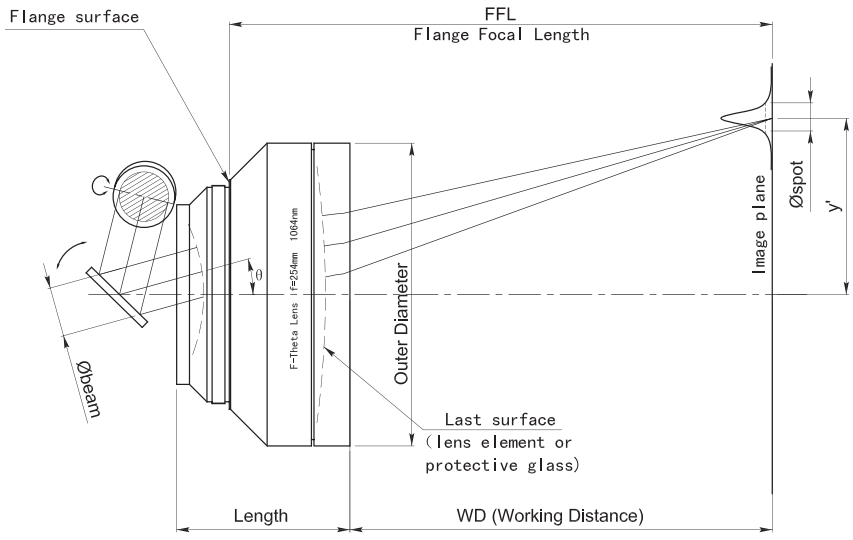
GCO-31

GCO-31 F-theta Lenses

F-theta Lenses are plane field objectives, which are commonly used in combination with XY galvanometer scanner. Contrary to a normal lens which focuses a input collimated beam on a spherical image plane, a F-theta lens focuses on a flat image surface. At the same time, it maintains almost constant spot size over the entire field when the input beam scans with input angle θ. The position of the spot on the image plane is directly proportional to the scan angle, i.e. F-theta condition:

$$y' = f' \cdot \theta$$

Daheng F-theta lens series (GCO-31) fulfils the F-theta condition better than 0.1%.



APPLICATION

For laser material processing, F-theta lenses guarantee the best processing result over the entire scan field. These lenses contribute to production lines, especially for sophisticated applications. The wide range of applications includes:

- Drilling and fine cutting of metals and ceramics
- Plastic welding
- Marking
- Cleaning for treatment or restoration

All dimensions are in mm unless otherwise specified.

Laser Lenses

Key parameters

- The overall scan angle,θ_{max}, refers to the maximum diagonal scan angle.
- The entrance beam diameter, $Ø_{beam}(1/e^2)$, is the beam diameter where the optical intensity is 13.5% of the peak intensity of the laser beam.
- Factor of apodisation (FAP)is the ratio of the beam diameter, $Ø_{beam}$, and the entrance pupil,$Ø_{aper}$, of the F-theta lens. FAP is used for calculation of the minimal possible focus spot size.

$Ø_{aper}/Ø_{beam}$	FAP
2	1.27
1.5	1.41
1.25	1.56
1	1.83
0.9	1.99
0.75	2.32
0.5	2.44

- Diffraction value M^2 refers to the ability of focusing laser light, defined by ISO11146 standards. It is the ratio of the divergence angle of a laser beam to the divergence angle of an ideal Gaussian beam. A Gaussian beam would provide the smallest possible focus spot size, which M^2 value is 1. This value is also used for calculation of the minimal possible focus spot size.
- Spot size $Ø_{spot}$ $(1/e^2)$ is the minimal possible focused spot size calculated as the wavelength of the laser multiplied with the focal length of F-theta lens, the FAP and the diffraction value M^2, divided by the beam diameter $Ø_{beam}$.

$$Ø_{spot} = \lambda \cdot f' \cdot FAP \cdot M^2 / Ø_{beam}$$

GCO-31 F-theta Lenses

Part No.	EFL	Wavelength	Scan Angle θ	Scan Area (mm*mm)	Max. Input Beam Diameter $Ø_{beam}$ (mm)	EFL (mm)	WD (mm)	Spot Size $Ø_{spot}$(μm)	Outer Diameter	Length (mm)	Screw
GCO-310101	100	355nm	±25°	61.5*61.5	6	127.1	115.7	11	90	51	M85X1
GCO-310102	160	355nm	±25°	98.7*98.7	6	205	186.3	18	90	51	M85X1
GCO-310103	254	355nm	±25°	156.7*156.7	10	346.4	298.8	17	120	65.9	M85X1
GCO-310201	100	532nm	±25°	61.5*61.5	12	109	100.4	8	90	51.1	M85X1
GCO-310202	160	532nm	±25°	98.7*98.7	12	189.7	181.1	13	90	49.3	M85X1
GCO-310203	254	532nm	±25°	156.7*156.7	20	345.3	296.6	13	120	69.2	M85X1
GCO-310301	100	1064nm	±25°	61.5*61.5	12	110.5	101.9	16	90	51.1	M85X1
GCO-310302	160	1064nm	±25°	98.7*98.7	12	188.5	179.9	26	90	49.3	M85X1
GCO-310303	254	1064nm	±25°	156.7*156.7	20	342.9	294.2	25	120	69.2	M85X1

All dimensions are in mm unless otherwise specified.

Laser Lenses

GCO-15

GCO-15 Laser Focusing Lenses

Air-spaced focusing lenses are designed to focus the high-power radiation emitted by lasers. The lenses are optimized for high precision applications such as used in laser machining systems for welding, cutting, drilling and strutting. They can also be used for collimating the laser beam delivered by fiber.

The Daheng's air-spaced focusing lens product utilizes high quality triple lens elements which are optimized to obtain a diffraction-limited focus spot. With the design-specific optical coating, the lens system achieves transmission throughout at a designed wavelength up to 98%.

Spot size $Ø_{spot}$ ($1/e^2$)

The minimal possible focus spot size from an air-spaced focusing lens is calculated by the wavelength of the laser multiplied with the focal length of the lens, f', the FAP factor and the diffraction value M^2 of the laser beam, and divided by the beam diameter $Ø_{beam}(1/e^2)$.

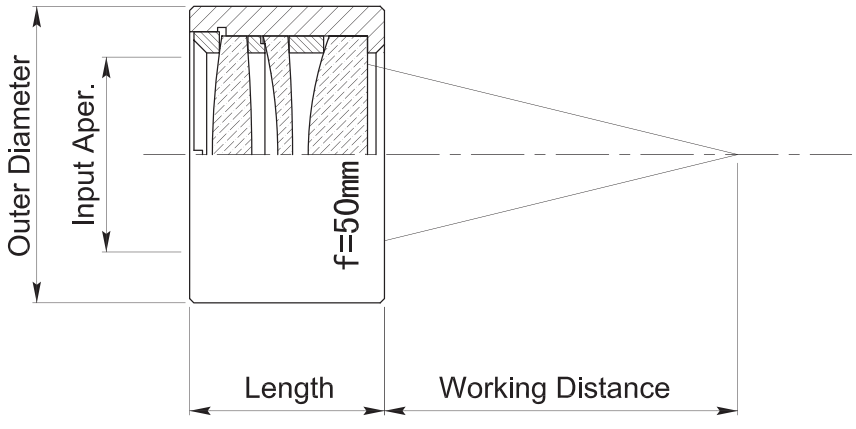
$$Ø_{spot} = \lambda \cdot f' \cdot FAP \cdot M^2 / Ø_{beam}$$

Depth of focus

The depth of focus of an air-spaced focusing lens is defined by a doubled Rayleigh length. The Rayleigh length describes as a distance, along the optical axis, between the positions where the beam area is doubled in front of or behind the focal position.

The Rayleigh length ZR is calculated by the beam area in the focal plane multiplied with a factor (depending on the FAP-factor) divided by the wavelength and the diffraction value M2 of the laser.

$$Z_R = \pi \cdot (d_0/2)^2 \cdot (FAP/1.27)^2 / (\lambda \cdot M^2)$$



GCO-15

All dimensions are in mm unless otherwise specified.

Laser Lenses

GCO-15 Laser Focusing Lenses

Part No.	EFL	Wavelength	Outer Diameter	Input Aperture	Length	Working Distance	Transmission	Damage Threshold
GCO-150101	25	355nm	25	12	17	17.2	> 98.5%	
GCO-150102	48	355nm	30	23	20	40	> 98.5%	
GCO-150103	60	355nm	40	34	27.6	47.5	> 98.5%	10J/cm2
GCO-150111	25	532nm	25	12.5	13.5	19.7	> 98.5%	@10ns
GCO-150112	50	532nm	35	23.5	23	42.2	> 98.5%	10Hz
GCO-150113	77	532nm	41	35	24	66.6	> 98.5%	1064nm
GCO-150121	25	1064nm	25	12.5	13.5	20.1	> 98.5%	
GCO-150122	50	1064nm	35	23.5	20	41.7	> 98.5%	
GCO-150123	77	1064nm	41	35	24	67	> 98.5%	

All dimensions are in mm unless otherwise specified.

Image Lenses

GCO-23 Bi-Telecentic lenses (Match, Iris fixed)

GCO-232 Bi-Telecentic lenses (Intigrate, Iris adjustment)

GCO-26 Object-Telecentic Micro-vision Lenses

Image Lenses

Telecentric Lenses

For most lenses, an object closer to the lens produces a larger image. Consequently, the image of the object or parts of the object which does not lie in a plane parallel to the image plane will exhibit perspective distortions. In many measurement applications, however, perspective distortions are undesirable. It is required that an imaging system performs parallel projection that eliminates the perspective distortions and removes occlusions of objects occurred. Such imaging system is the telecentric lens. They are frequently used in the machine vision industry for measurement and alignment applications.

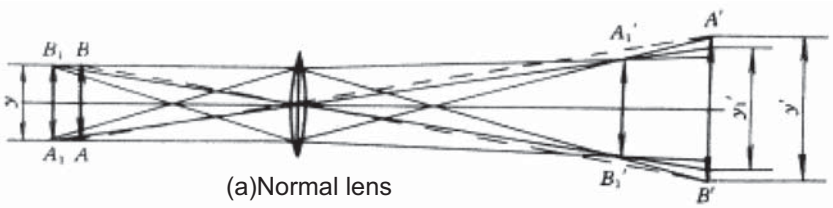
Principle

Telecentric lenses in which the chief rays are parallel to the optical axis, providing a constant magnification regardless of the object distance, the system pupil is at infinity and this results in minimum perspective errors when changing the object position. Therefore the size of the viewed object appears to be the same when changing the distance of the object (within the range of depth of field). These lenses are ideal for precision measurements application.

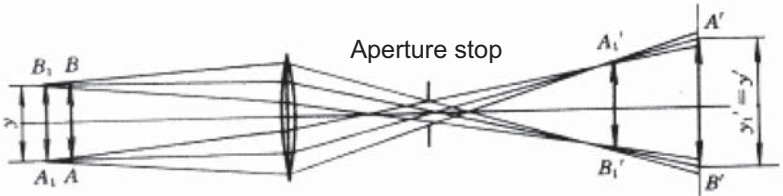
There are three classifications of telecentric lens depending upon the optical spaces in which the chief rays exhibit this behavior.

Object-Space Telecentric Lenses

The aperture stop is on the back focal plane of objective lens, and the entrance pupil located at infinity. A shift in the object plane does not affect image magnification. The incident chief rays are always parallel to the axis, and the emergent chief rays will not change, so the intersection of rays on the image plane will also not change. Object-space telecentric lenses are often used in machine vision because they produce images with simple, constant perspective, like the flattened perspective that one see through binoculars or a telescope.



(a)Normal lens



(b)Object-space Telecentric Lens

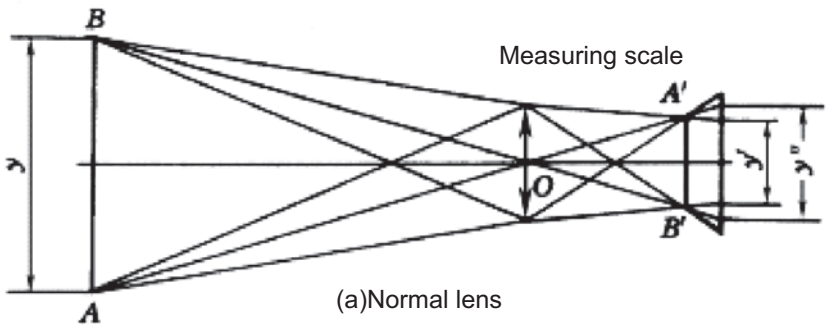
All dimensions are in mm unless otherwise specified.

Image Lenses

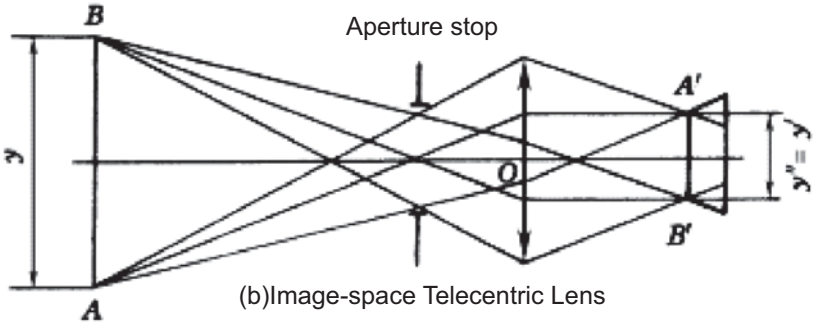
Image-Space Telecentric Lenses

The aperture stop is on the front focal plane of objective lens, and the exit pupil located at infinity. A shift in the image plane does not affect image magnification. The chief ray of the emergent rays will be always parallel to the axis, and the intersection of it on the image plane will also not change.

Image-space telecentric lenses are in demand for digital cameras which make the light rays hit the sensor straight-on. The rays from a conventional lens are straight-on only in the center; at the edge, however, they hit the sensor obliquely, causing color fringing.



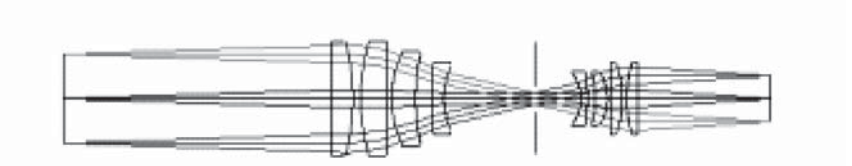
(a)Normal lens



(b)Image-space Telecentric Lens

Bilateral Telecentric Lenses

An image-spaced and an object-spaced telecentric lens are combined together with the common focal plane. The aperture stop is on the common focal plane, resulting in both the entrance and exit pupils being located at infinity. Shifting either the image or object planes does not affect magnification given that double telecentric systems are afocal.



Object-space Aperture stop Image-space

All dimensions are in mm unless otherwise specified.

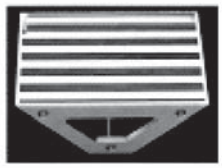
Image Lenses

Telecentricity

No Perspective Error. Telecentricity describes the angular deviation of the chief ray from a ray parallel to the optical axis. A lower angular value means a lens will reproduce an image more accurately.

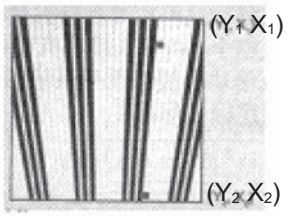
Our telecentric target allows keystoning in an image to be visualized and accurately measured. The amount of keystoning is related to the telecentricity of the lens that is imaging the target. The target is placed at a 45°angle to the optical axis so that the bottom of the target is further away from the lens than the top of the target. When imaging the target through a non-telecentric lens, the distance between the vertical lines will appear to decrease at the bottom of the image; this effect is known as keystoning. A perfectly telecentric lens will have no keystoning and the telecentricity will be 0°.

$$\alpha = arctg\frac{\Delta X}{\Delta Y} = arctg\frac{|X_1 - X_2|}{|Y_1 - Y_2|}$$



Target

How to test?



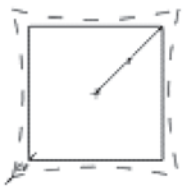
How to calculate?

Distortion

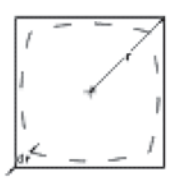
It is a deviation from a theoretical perfect point. It is a function of image height. Distortion is simply defined as the percentage difference between the distance of an image point from the image center and the same distance as it would be measured in a distortion-free image. There are a few typical distortion shapes commonly seen in imaging lenses, such as pincushion and barrel, shown below.

Common machine vision lenses typically exhibit more than 1-2% distortion. This could severely limit accuracy in a dimensional measurement application, e.g. a 50mm object could look 51mm on the image plane. For instance, if a point of an image is 198 pixels distant from the center, while a distance of 200 pixels would be expected in absence of distortion, the radial distortion, at that point, would be distortion = (198-200)/200 = -2/200 = -1%.

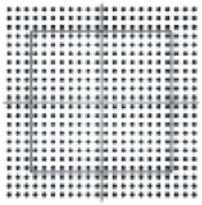
Daheng Optics' telecentric lenses exhibit radial distortion less than 0.2%, e.g. a 50mm object will look no larger than 50.1 mm in the image plane, 10 times less distortion than the requirement for common machine vision applications.



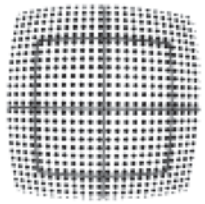
"pincushion"type distortion



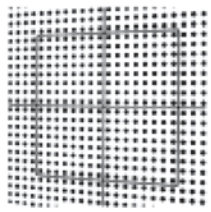
"barrel"type distrotion



distrotion with telecentric lens



radial distortion



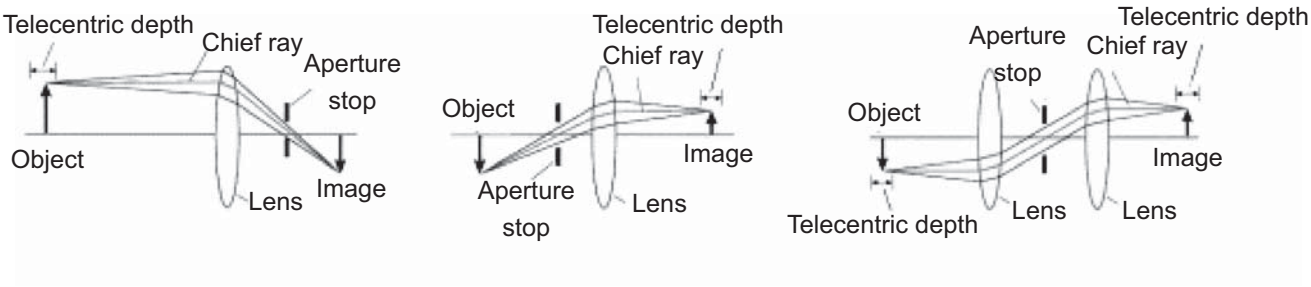
trapezoidal distortion

All dimensions are in mm unless otherwise specified.

Image Lenses

Telecentric Depth

Telecentric Depth or telecentric range is the total distance in the front of and behind an object that remains in focus and with constant magnification. Objects can be placed within the telecentric range for measurement without introducing perspective error. Generally, larger apertures (lower F#) reduce field depth. Also, although smaller apertures (higher F#) increase field depth, they reduce resolution and require much brighter illumination.



(a)Object-space telecentric lens (b)Image-space telecentric lens (c)Bilateral telecentric lens

Magnification

It is the ratio of the size of the image to the size of the object. A magnification specification of 0.5× means that the lens reduces the object by a factor of 2 when it projects the image onto a camera's sensor.

Object size

Object size or field of view gives the maximum object size that the lens can image. Due to the way a telecentric lens works, the field of view cannot exceed the diameter of the lens' front surface.

Image size

Image size or sensor format specifies the maximum image size a lens can form.

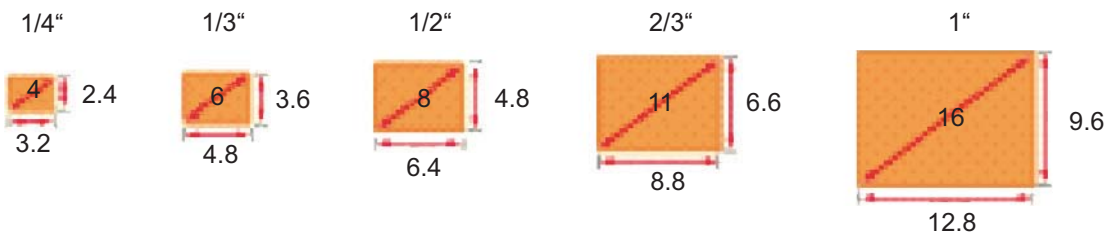


Image Sensor Size(unit in mm)

All dimensions are in mm unless otherwise specified.

Image Lenses

Working Distance

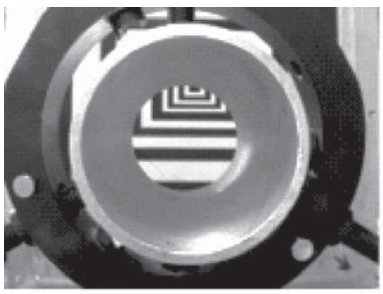
It specifies the distance from the object to the front of the lens housing. A telecentric lens operates properly at only one working distance.

Applications

Example 1:

Measurement of Mechanical Parts

When standard optics are used to image 3D objects, closer objects appear relatively larger than those further away. As a consequence, when an object such as a cylindrical cavity is imaged, the top and bottom circular edges appear to be concentric and the inner walls are imaged, as well (left). However, by using telecentric optics, the bottom edge disappears and the inner walls are not imaged (right).



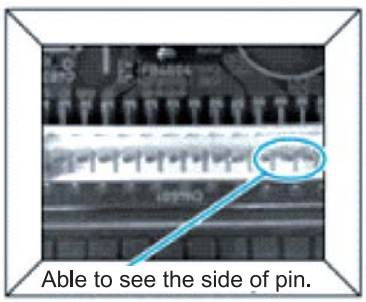
Non-telecentric Lens

Telecrtric Lens

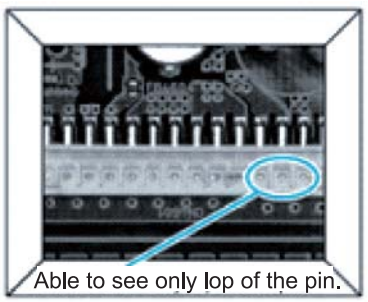
Example 2:

PCB Inspection

You can see the side of connector pins on the image of non-telecentric lens, whereas telecentric image has only top view of connector pins.



Non-telecentric Lens



Telecentric Lens

All dimensions are in mm unless otherwise specified.

Image Lenses

Other applications:

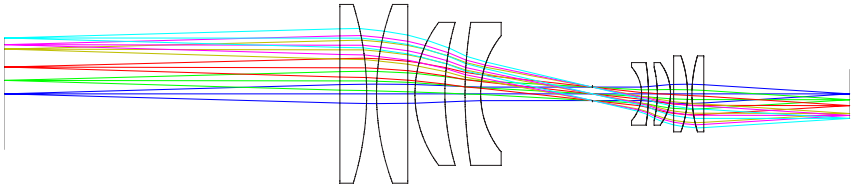
Plastic part measurement: to measure rubber seals, o-rings and plastic caps which definitely need non-contact optical measurement techniques as they are difficult to handle without changing their shape thus altering the inspected dimensions.
Electronics component measurement,
Glass and pharmaceutical part measurement,Surface defect inspection, and etc.

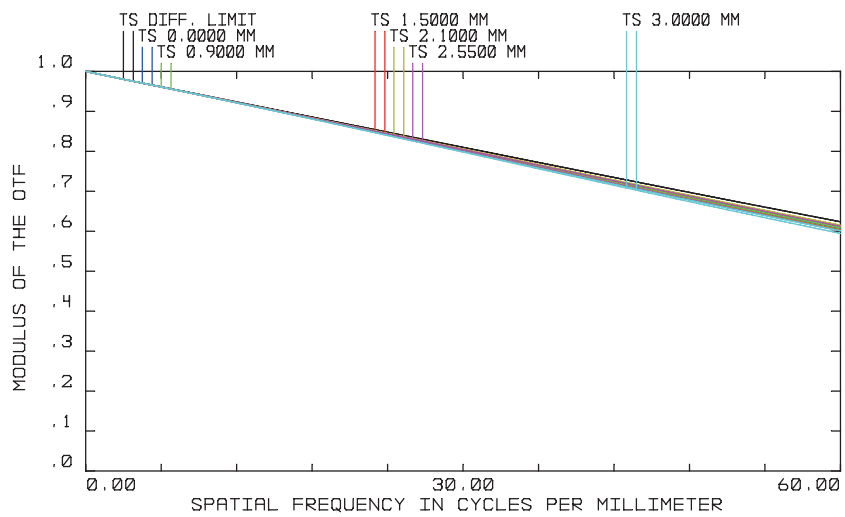
Image Lenses

GCO-23 Bi-Telecentic lenses (Match, Iris fixed)

The series of telecentric system is developed by using a pair of base lenses to achieve telecentricity required on object and image plane. The combined telecentric lens systems is afocal lens system with an aperture stop located at the common focus of the front and back lens, resulting in the chief ray being parallel to the optical axis in both object and image space. Both the entrance and exit pupil are at infinity. A constant perspective or viewing angle and a constant magnification can therefore be achieved in the cases when the object and image surface are tilted with respect to the optical axis or the lens is defocused on either object surface or image surface. Another feature is the large depth of focus, up to several millimeters, which is extremely useful in inspection applications. C/T-mount adapters (GCO-230101~231206) are offered for coupling to CCD cameras.

GCO-23 Telecentric Lens





All dimensions are in mm unless otherwise specified.

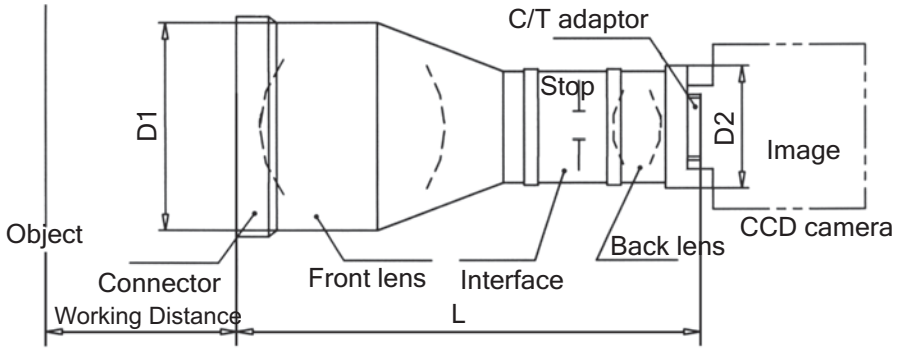
Image Lenses

GCO-23 Telecentric Lenses
(The combinations of the base lenses)

Any two of the base lenses can be combined via an interface (GCO-230101~231206) to build a telecentric lens system, for specific magnifications. Every base lens can act as either the front lens or the back lens, according to the object size or image size.

Interfaces and CCD adapters

The interface settings between the base lenses are listed in the table below. A stop is built in the interface and aligned to achieve the telecentric effect. The CCD adapters are provided along with the interfaces. Custom CCD adapters are also available on special request.



GCO-23 Telecentric Lens

All dimensions are in mm unless otherwise specified.

Image Lenses

Product Part No.	Interface Part No.	Magnification	Field of View	Sensor Format	Mount	Working Distance	Telecen-tricity	Distortion	Dimension ØxL
GCO-2312+GCO-2303	GCO-231203	0.16×	80×60	1”	C	495	<0.2°	<0.2%	Ø117x278
GCO-2312+GCO-2304	GCO-231204	0.11×	80×60	2/3”	C	495	<0.2°	<0.2%	Ø117x251
GCO-2312+GCO-2305	GCO-231205	0.08×	80×60	1/2”	C	495	<0.2°	<0.2%	Ø117x233
GCO-2312+GCO-2306	GCO-231206	0.06×	80×60	1/3”	C	495	<0.2°	<0.2%	Ø117x222
GCO-2301+GCO-2301	GCO-230101	1×	40×30			146	<0.2°	<0.2%	Ø72x233
GCO-2301+GCO-2302	GCO-230102	0.5×	40×30			146	<0.2°	<0.2%	Ø72x176
GCO-2301+GCO-2303	GCO-230103	0.32×	40×30	1”	T	146	<0.2°	<0.2%	Ø72x190
GCO-2301+GCO-2304	GCO-230104	0.22×	40×30	2/3”	C	146	<0.2°	<0.2%	Ø72x157
GCO-2301+GCO-2305	GCO-230105	0.16×	40×30	1/2”	C	146	<0.2°	<0.2%	Ø72x146
GCO-2301+GCO-2306	GCO-230106	0.12×	40×30	1/3”	C	146	<0.2°	<0.2%	Ø72x135
GCO-2302+GCO-2302	GCO-230202	1×	20×15			75	<0.2°	<0.2%	Ø45x118
GCO-2302+GCO-2303	GCO-230203	0.64×	20×15	1”	T	72	<0.2°	<0.2%	Ø45x134
GCO-2302+GCO-2304	GCO-230204	0.44×	20×15	2/3”	C	72	<0.2°	<0.2%	Ø45x103
GCO-2302+GCO-2305	GCO-230205	0.32×	20×15	1/2”	C	72	<0.2°	<0.2%	Ø45x101
GCO-2302+GCO-2306	GCO-230206	0.24×	20×15	1/3”	C	72	<0.2°	<0.2%	Ø45x77
GCO-2303+GCO-2303	GCO-230303	1×	12.8×9.6	1”	T	46	<0.2°	<0.2%	Ø42x111
GCO-2303+GCO-2304	GCO-230304	0.69×	12.8×9.6	2/3”	C	46	<0.2°	<0.2%	Ø31x74
GCO-2303+GCO-2305	GCO-230305	0.5×	12.8×9.6	1/2”	C	46	<0.2°	<0.2%	Ø33x67
GCO-2303+GCO-2306	GCO-230306	0.375×	12.8×9.6	1/3”	C	46	<0.2°	<0.2%	Ø37x56
GCO-2304+GCO-2304	GCO-230404	1×	8.8×6.6	2/3”	C	31	<0.2°	<0.2%	Ø33x72
GCO-2304+GCO-2305	GCO-230405	0.73×	8.8×6.6	1/2”	C	31	<0.2°	<0.2%	Ø30x56
GCO-2304+GCO-2306	GCO-230406	0.55×	8.8×6.6	1/3”	C	31	<0.2°	<0.2%	Ø29x45
GCO-2305+GCO-2305	GCO-230505	1×	6.4×4.8	1/2”	C	23	<0.2°	<0.2%	Ø35x38
GCO-2305+GCO-2306	GCO-230506	0.75×	6.4×4.8	1/3”	C	23	<0.2°	<0.2%	Ø33x38
GCO-2306+GCO-2306	GCO-230606	1×	4.8×3.6	1/3”	C	16	<0.2°	<0.2%	Ø 33x33

Example

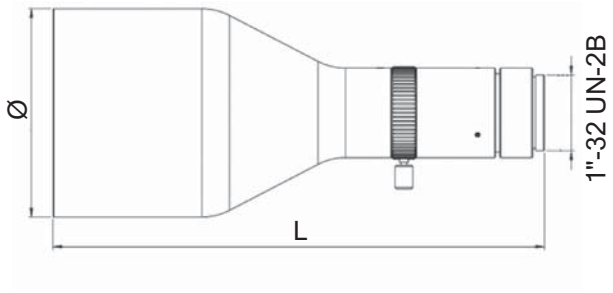
A 1/2 inch CCD camera is used to inspest a circular object of 45mm in diameter. One can choose a combination as follows. For the object of 45mm, the base lens GCO-2301 can be used, which offers 50mm object size. For 1/2 inch CCD camera, the base lens GCO-2305 can be chosen for 1/2 inch CCD camera to give an image size of 8mm (or 6.4x4.8mm). The combined system gives the magnification of 0.16. The total length of the combined system is 146mm. The conjugate distance from object to image is 304.7mm. A CCD adaptor is included.

Front Lens GCO-2301 (Object size 50)	+	Interface GCO-230105	+	Back Lens GCO-2305 (Image size Ø8)	+	1/2 inch CCD

All dimensions are in mm unless otherwise specified.

Image Lenses

GCO-232 Bi-Telecentic lenses(Intigrate, Iris adjustment)



GCO-232xxx

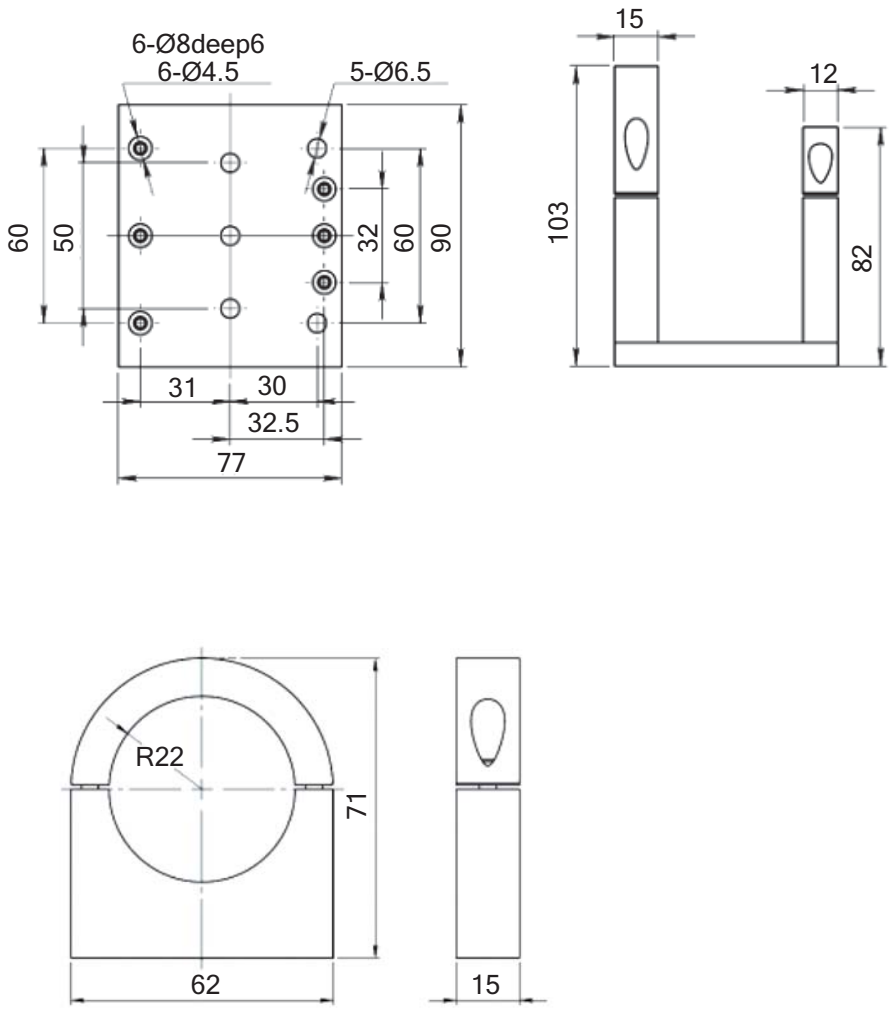
GCO-232 Bi-Telecentic lenses(Intigrate, Iris adjustment)

Product Part No.	Magnification	Field of View	Sensor Format	Mount	Working Distance	Telecen -tricity	Distortion	Aperture (f/#)	Filter Thread	Dimension ØxL
GCO-232005	0.08×	80×60	1/2”	C	450	<0.2°	<0.2%	F4-F16	M105×1	Ø116x233
GCO-232006	0.06×	80×60	1/3”	C	450	<0.2°	<0.2%	F4-F16	M105×1	Ø116x223
GCO-232103	0.32×	40×30	1”	C	150	<0.2°	<0.2%	F4-F16	M67×0.75	Ø70x191
GCO-232104	0.22×	40×30	2/3”	C	150	<0.2°	<0.2%	F4-F16	M67×0.75	Ø70x165
GCO-232105	0.16×	40×30	1/2”	C	150	<0.2°	<0.2%	F4-F16	M67×0.75	Ø70x149
GCO-232106	0.12×	40×30	1/3”	C	150	<0.2°	<0.2%	F4-F16	M67×0.75	Ø70x138
GCO-232203	0.64×	20×15	1”	C	75	<0.2°	<0.2%	F4-F16	M46×0.75	Ø44x140
GCO-232204	0.44×	20×15	2/3”	C	75	<0.2°	<0.2%	F4-F16	M46×0.75	Ø44x114
GCO-232205	0.32×	20×15	1/2”	C	75	<0.2°	<0.2%	F4-F16	M46×0.75	Ø44x98
GCO-232206	0.24×	20×15	1/3”	C	75	<0.2°	<0.2%	F4-F16	M46×0.75	Ø44x87

All dimensions are in mm unless otherwise specified.

Image Lenses

GCO-232 Lens Holder



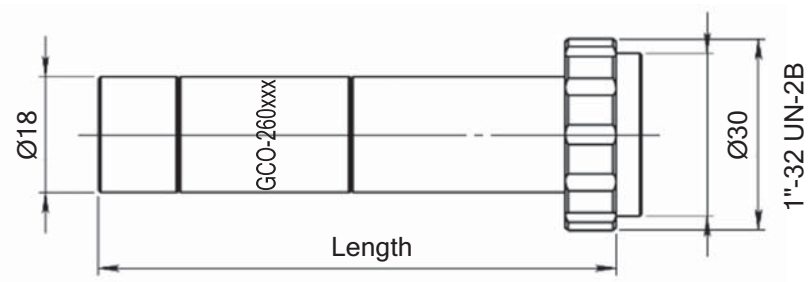
GCO-232 Lens Holder

Part NO	Application
GCO-2321-FJ	GCO-2321 Series
GCO-2322-FJ	GCO-2322 Series

All dimensions are in mm unless otherwise specified.

Image Lenses

GCO-26 Object-Telecentic Micro-vision Lenses



GCO-260xxx

GCO-26 Object-Telecentic Micro-vision Lenses

Product Part No.	Magnification	Field of View	Sensor Format	Mount	Working Distance	Telecentricity	Distortion	Aperture (f/#)	Length
GCO-260601	1×	8.8×6.6	2/3”	C	40	<0.2°	<0.2%	11	53.5
GCO-260602	2×	4.4×3.3	2/3”	C	40	<0.2°	<0.2%	14.3	37
GCO-260603	3×	2.9×2.2	2/3”	C	40	<0.2°	<0.2%	16	49
GCO-260604	4×	2.2×1.7	2/3”	C	40	<0.2°	<0.2%	20	46.5
GCO-260611	1×	8.8×6.6	2/3”	C	65	<0.2°	<0.2%	18.6	76.1
GCO-260612	2×	4.4×3.3	2/3”	C	65	<0.2°	<0.2%	17.3	76.5
GCO-260613	3×	2.9×2.2	2/3”	C	65	<0.2°	<0.2%	21.9	76.3
GCO-260614	4×	2.2×1.7	2/3”	C	65	<0.2°	<0.2%	27	81
GCO-260615	5×	1.8×1.3	2/3”	C	65	<0.2°	<0.2%	30	83
GCO-260621	0.5×	17.6×13.2	2/3”	C	110	<0.2°	<0.2%	9.3	166.6
GCO-260622	0.75×	11.7×8.8	2/3”	C	110	<0.2°	<0.2%	13.3	156.2
GCO-260623	1×	8.8×6.6	2/3”	C	110	<0.2°	<0.2%	20.9	106.6
GCO-260624	2×	4.4×3.3	2/3”	C	110	<0.2°	<0.2%	33	126.6

All dimensions are in mm unless otherwise specified.

Optic Holders

Optic Holders

Mechanical Mounts and Holders GCM series

Mounts and Holders for Optic Components

Daheng Optics supplies several series of optical holders to mount a wide range of optical components. The two types of mounting style, post or base, enable simple construction and easy alignment in optical systems.

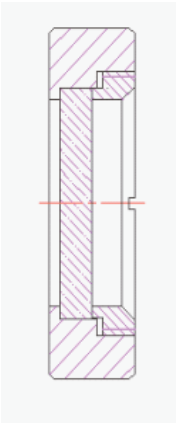
Optical Components	Part No.
Lens and Mirror (Circular)	GCM-04 Self-Centering Lens Holders
	GCM-05 Adjustable Self-Centering Lens Holders
	GCM-0801 Lens/Mirror Mounts
	GCM-0802 Small Lens/Mirror Holders
	GCM-0803 Standard Lens/Mirror Holders
	GCM-0805 Medium Lens/Mirror Holders
	GCM-0814 Lens/Mirror Holder with Base
	GCM-0823 Kinematic Corner Lens/Mirror Holders
	GCM-0831M Kinematic Off-center Lens/Mirror Holders
	GCM-0808 Kinematic Lens/Mirror Lockable Holders
	GCM-0818 Kinematic Corner Lens/Mirror Lockable Holders
	GCM-0828 3D Kinematic Lens/Mirror Lockable Holders
	GCM-0838 3D Kinematic Corner Lens/Mirror Lockable Holders
	GCM-0809 Vertical Drive Kinematic Lens/Mirror Holders
	GCM-0819 Gimbal Lens/Mirror Holders
	GCM-0829 Compact Gimbal Lens/Mirror Holders
	GCM-2501 4D Lens/Mirror Holders with Pedestal
	GCM-2511 4D Lens/Mirror Holders
	GCM-20 Large Lens Holders
Cylindrical Lens (Rectangular)	GCM-10 Kinematic Cylindrical Lens Holders
Prisms	GCM-0601 Prism Tables
	GCM-0602 V-groove Mounts
	GCM-0603 V-grooved Lens Chucks
Lasers	GCM-1802 D60 Laser Holder
	GCM-1811 D50 Laser Holder
	GCM-1821 Compact D50 Laser Holder
Polarizers	GCM-09 Polarizer/Wave Plate Holders
	GCM-092 Linear Polarization Attenuator
Filters	GCM-13 Plate Holders
	GCM-140 Double Wheel Filter Holder
	GCM-141 Five Slot Filter Holder
Fiber	GCM-21 Precision Fiber Alignment Mount

All dimensions are in mm unless otherwise specified.

Optic Holders

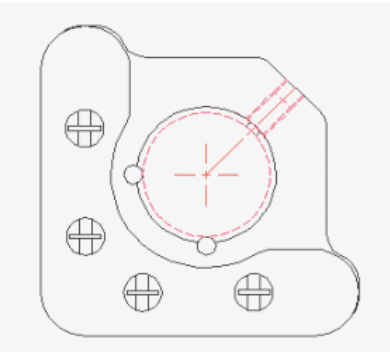
Mount Structures

Daheng Optics adopts different mechanical structures required by optical components for their positioning and alignment. Optical components have a variety of shapes and forms that needed to be held in position in optical systems; often alignment and fine adjustment of their positions are required. Many mechanism and mechanical structures are implemented into the optic mounts and holders' series, GCM series. The detailed descriptions of the structures are explained below.



Retaining Ring

This is the simplest and commonly-used mount structure for holding optical components. A retainer ring holds the optics in the mount, which can be quickly dismounted by using a spanner wrench. The diameter of the retainer should have a clearance to the diameter of the optics in order for the optics to be put in easily. This may make the optics eccentric.

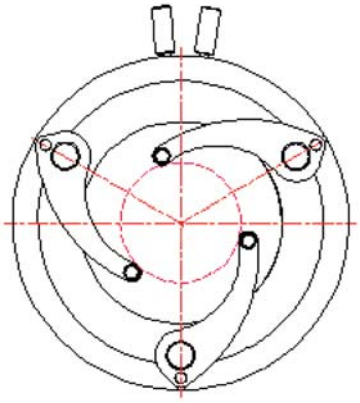


Three-Point Mounting

Instead of holding optical components in a ring with clearance in diameters, in this structure, the optics is held by three equally-spaced points in the circumference. One of the three contact points is a nylon tip, which can be loosed for easy replacement of the component.

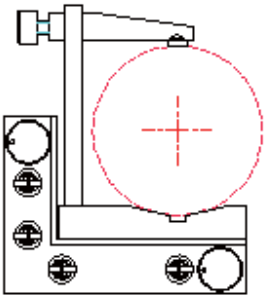
All dimensions are in mm unless otherwise specified.

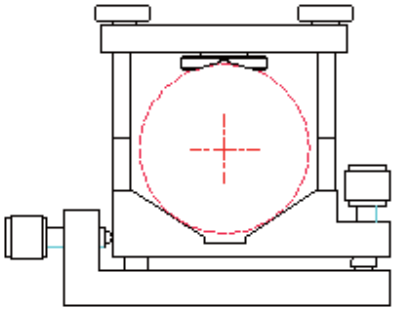
Optic Holders



Self-Centering

As its name indicates, this type of mount overcomes the eccentric problem in the retainer ring structure. The self-centering structure has three spring-loaded jaws that move along the same circular track to ensure its concentricity. This type of holders is ideal for holding optic components that are round and cylindrical in shape and requiring reliable axial positioning. Another advantage is that It can maintain the position of the optical axis even when lenses with different diameters are put in. It has a sufficient diameter space to load and unload lenses, particularly in the systems which lenses are changed frequently. However, the spring-loading strength of the jaws can be limited to hold a large and heavy optics.





Platform and Clamp

This type of structure is ideal for optical components such as prisms and laser. It has a flat base and a clamp on the top to press down on the top of the component. It is constructed from black-anodized aluminum with stainless steel guides. It sometimes combines V-grooves to hold an element. It has a certain diameter range to fit different optics.

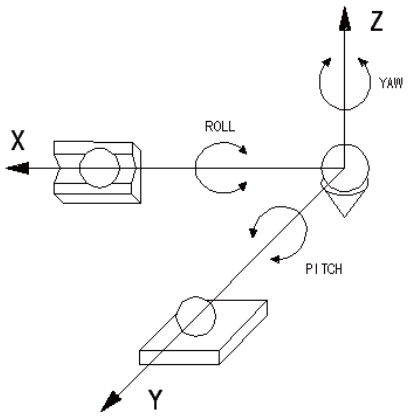
Adjustment Mounts

Movement in position, fundamentally, can be defined uniquely in terms of six independent coordinates: three translations and three rotations relative to the three axes of an arbitrary coordinate system. Adjustment mounts typically have two types, Kinematic, and Gimbal.

All dimensions are in mm unless otherwise specified.

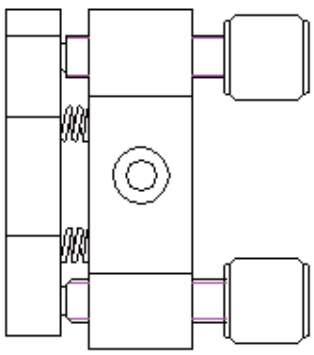
Optic Holders

Kinematic Mounts



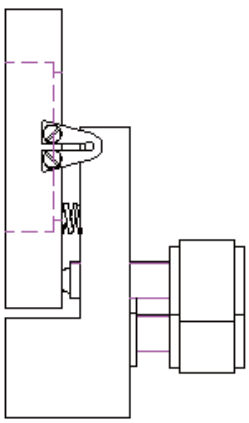
A mount is said to be kinematic when the number of degrees of freedom (axes of free motion) and the number physical constraints applied are six in total. This is equivalent to saying that any physical constraints applied are independent (non-redundant). A kinematic optical mount therefore has six independent constraints.

The most common type of kinematic mount is the “cone, groove and flat” mount schematically illustrated in the figure below. Considering the optic as being attached to the coordinate system of the three spheres and its corresponding mount having the cone, vee and flat. If the optic is first seated in the cone, three degrees of freedom (x,y and z translations) are eliminated without redundancy.



At this point, the optic can still rotate freely about all axes. Next, the second sphere is seated in the groove which is aligned towards the cone. This constrains or eliminates two more degrees of freedom, pitch and yaw, as shown in the figure. The alignment of the groove towards the cone is important in order not to over-constrain one or more of the translation degrees of freedom. Finally, there is only one degree of freedom left to constrain, roll about the x axis. This is accomplished by seating the third sphere on the flat. Six non-redundant constraints make this a kinematic mount.

Kinematic mounting is the most commonly used approach for providing two axis (θx, θy) rotational adjustments in optical mounts. In a kinematic mount, the center of rotation is located somewhat off the optic surface. As a result, any adjustment usually results in both angular movement and translation of the reflected/transmitted light. Furthermore, the adjustment axes are not completely independent in a kinematic mount.



Gimbal Mounts

Gimbal mounts imply the center of rotation is located at the geometrical center and on the front surface of the optical component. They allow for non-coupled rotation adjustment of the optics with any translation. They are typically used when even small changes in optical path length are critical.

All dimensions are in mm unless otherwise specified.

Optic Holders

Position Resolution

It is the smallest difference in movements that can be discriminated. Typically fingertips are sensitive enough to distinguish 0.5°~1°rotations of an adjustment screw, in some cases, is much less. Therefore, we define the position resolution as the angular change of an optics associated with a 1°turn of the screw.

Repeatability

It is the error within which a given position can be reproduced. Unidirectional repeatability is measured by approaching a position from a single direction, hides errors caused by backlash effects. Bidirectional repeatability is measured by approaching a position from opposing directions, includes these effects and provides a more meaningful specification.

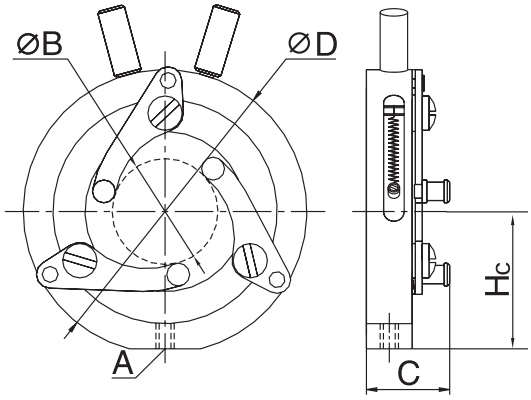
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-04 Self-Centering Lens Holders

The holders offer a reliable and self-centering mechanism for holding lenses or other round optical components. They are very useful when optics of variable diameters must be interchanged frequently and the height of the optical axis must be kept unchanged. They can be mounted on any post.

GCM-04



GCM-04

GCM-04 Self-Centering Lens Holders

Part No.	A	$ØB_{min}$	$ØB_{max}$	H_c	C	ØD	Weight (g)
GCM-0401M	M4	4	35	30	18	62	70
GCM-0402M	M4	7	64	52	23.5	106	190
GCM-0403M	M6	5	80	75	52	150	450

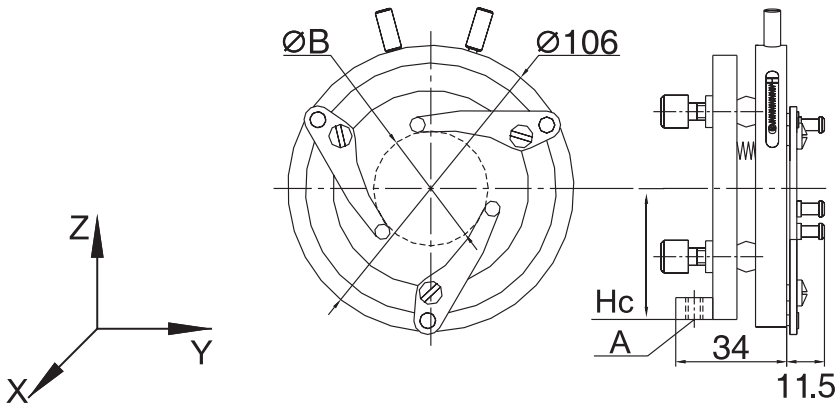
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-05 Adjustable Self-Centering Lens Holders

The holder not only has the self-centering capability, like the GCM-04 lens holders, but can also be tilted relative to the X and Z axes through ± 4°.

GCM-05



GCM-05

GCM-05 Adjustable Self-Centering Lens Holders

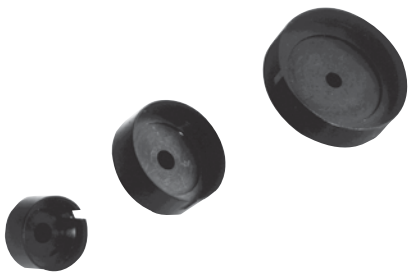
Part No.	A	$ØB_{min}$	$ØB_{max}$	H_c	Weight (g)
GCM-0501M	M6	7	64	45.5	285

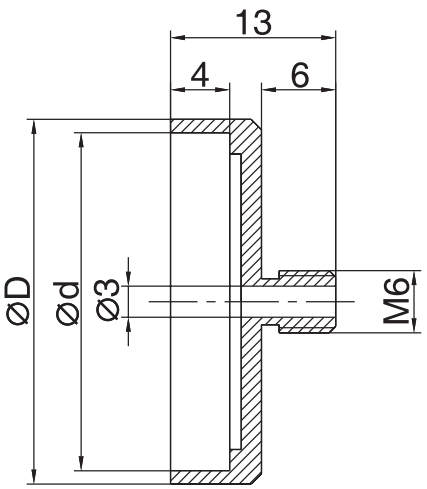
All dimensions are in mm unless otherwise specified.

Optic Holders

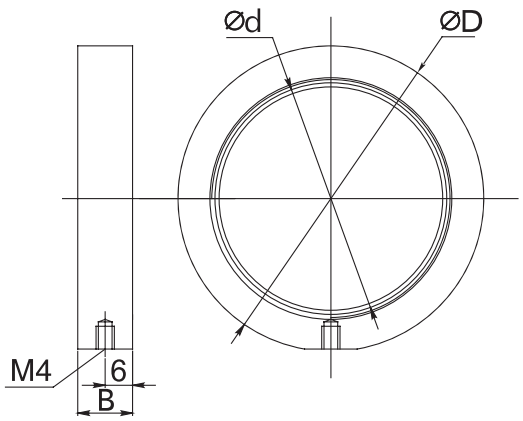
GCM-0801 Lens/Mirror Mounts

The GCM-0801 mounts with different diameters, can be used on the several kinds of small lens/mirror holds in the GCM-0802 series.





GCM-0801



GCM-0811

All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0801 Lens/Mirror Mounts

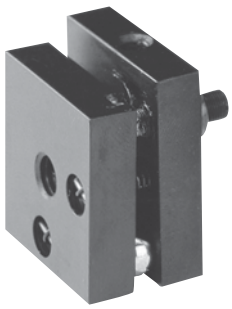
Part No.	Ød	ØD	Weight (g)	B	The optical aperture
GCM-0801127M	12.7	13.5	2.2		
GCM-080120M	20	20.8	2.8		
GCM-0801254M	25.4	26.2	5		
GCM-080130M	30	30.8	7		
GCM-081120M	20	36	16	8	18
GCM-081125M	25.4	41.5	20	8	23.5
GCM-081130M	30	46	23	8	28
GCM-081140M	40	56	27	8	38
GCM-081150M	50.8	67	30	12	49

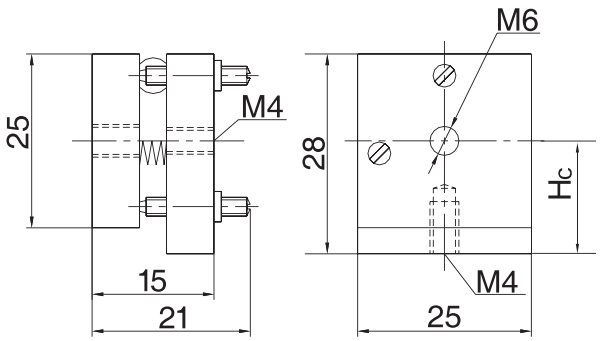
All dimensions are in mm unless otherwise specified.

Optic Holders

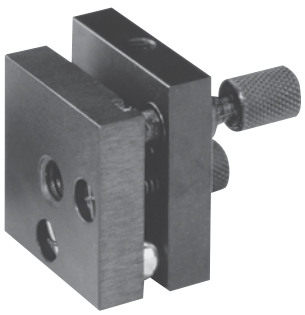
GCM-0802 Small Lens/Mirror Holders

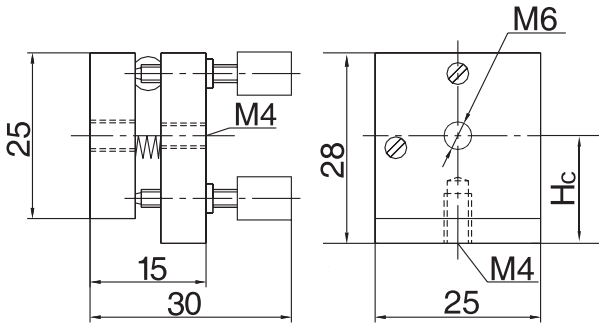
The GCM-0802 series of small lens/mirror holders can be tilted about Y and Z axes through ± 4°, and can be fixed on other holders by means of the tapped hole A.



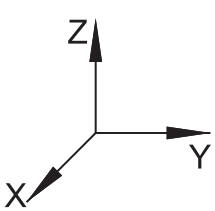


GCM-080201M



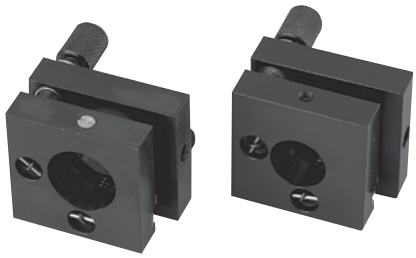


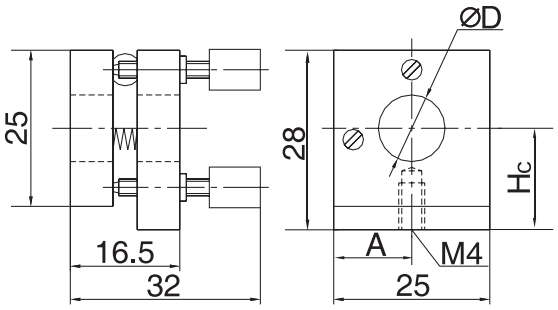
GCM-080202M



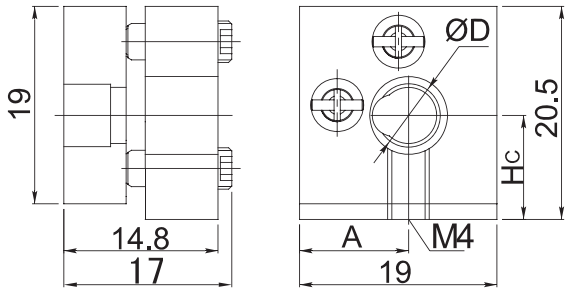
All dimensions are in mm unless otherwise specified.

Optic Holders





GCM-080203M/GCM-080204M



GCM-080205M

GCM-0802 Small Lens/Mirror Holders

Part No.	D	A	H_c	Weight (g)
GCM-080201M	---	---	15.5	27
GCM-080202M	---	---	15.5	29
GCM-080203M	10	12.5	15.5	25
GCM-080204M	12.7	14	14	25
GCM-080205M	6	10.5	10	27

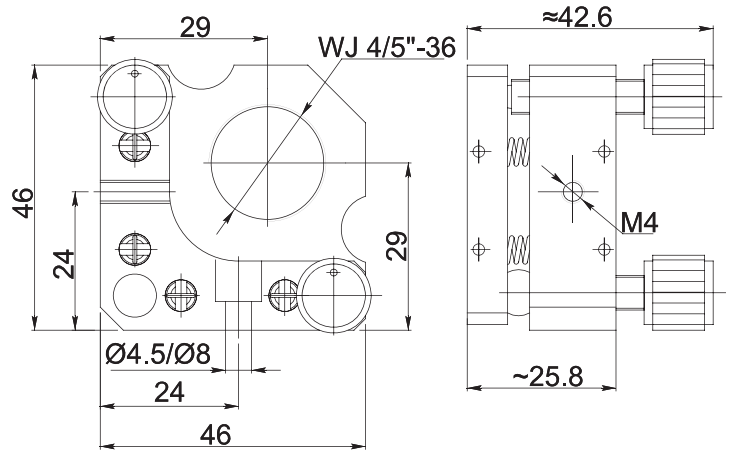
All dimensions are in mm unless otherwise specified.

Optic Holders

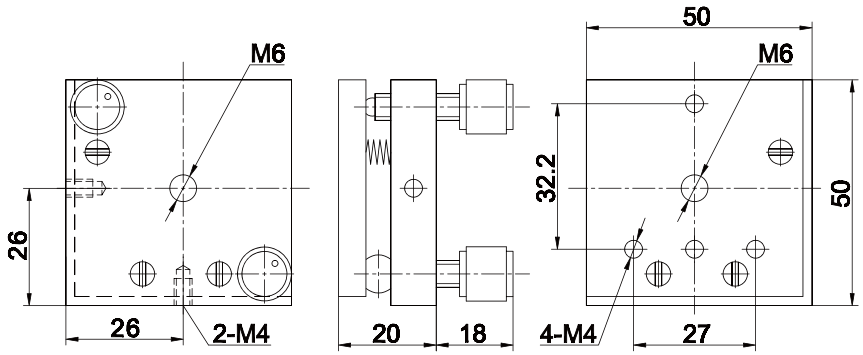
GCM-0803 Standard Lens/Mirror Holders

The GCM-0803 series of Standard Lens/Mirror Holders has many different sizes to meet different requirements. They may be tilted about the Y and Z axes through ± 4°, and can be fixed on other types of holders by means of the tapped hole M4. In addition, the Model GCM-080304 holder can be translated along the X direction, in addifion to tilts.

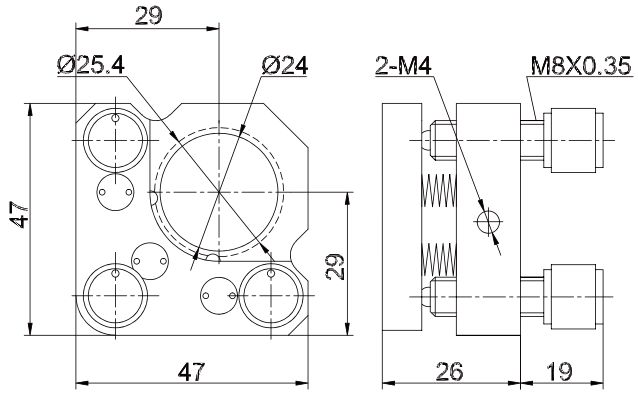
GCM-080301M



GCM-080303M

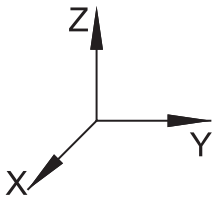


GCM-080304M



All dimensions are in mm unless otherwise specified.

Optic Holders



GCM-0803 Standard Lens/Mirror Holders

Part No.	Weight (g)
GCM-080301M	188
GCM-080303M	125
GCM-080304M	191

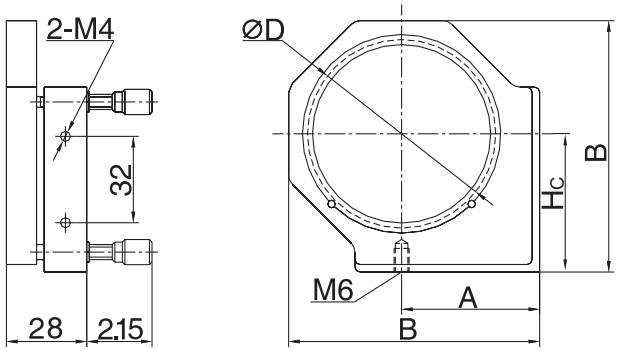
All dimensions are in mm unless otherwise specified.

Optic Holders

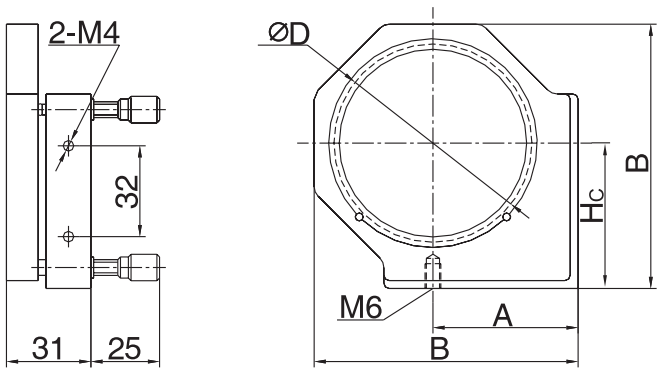
GCM-0805 Medium Lens/Mirror Holders

The GCM-0805 series of Medium Lens/Mirror Holders holds lenses or mirrors of diameter Ø75mm or diameter Ø100mm. They may be tilted about the Y and Z axes through ± 4°, and can be fixed on other types of holders by means of the tapped hole M6.

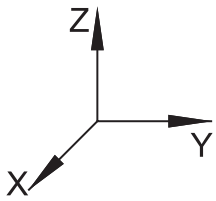
GCM-0805



GCM-080501M



GCM-080601M



GCM-0805 Medium Lens/Mirror Holders

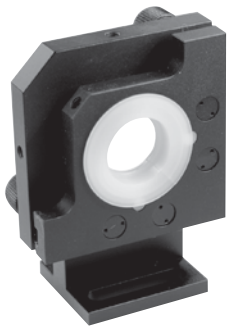
Part No.	A	BxB	ØD	H_c	Weight (g)
GCM-080501M	53	99x99	76.2	53	200
GCM-080601M	71	134x134	100	71	514

All dimensions are in mm unless otherwise specified.

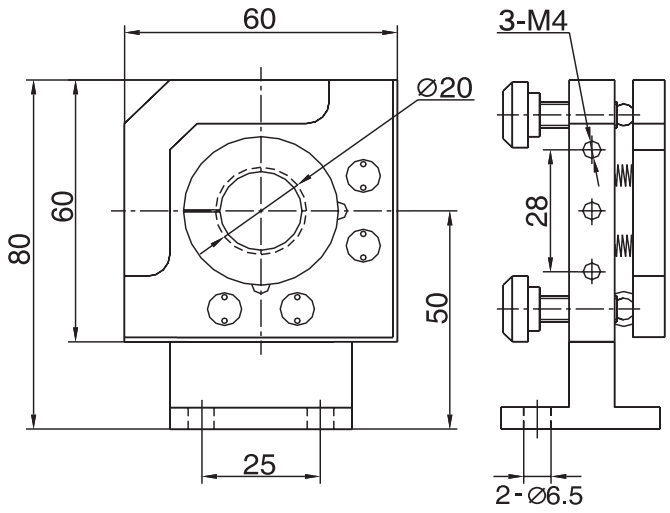
Optic Holders

GCM-0814 Lens/Mirror Holder with Base

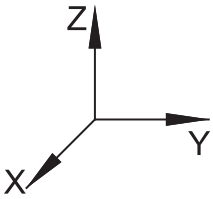
The GCM-0814 Lens/Mirror Holder with Base provides smooth and precision tilt in two directions for the mounted lens or mirror. The total angle adjustment in the directions is ± 4°. Screw M6 makes it compatible with post mounting.



GCM-0814



GCM-0814



GCM-0814 Lens/Mirror Holder with Base

Part No.	Weight (g)
GCM- 081401M	190

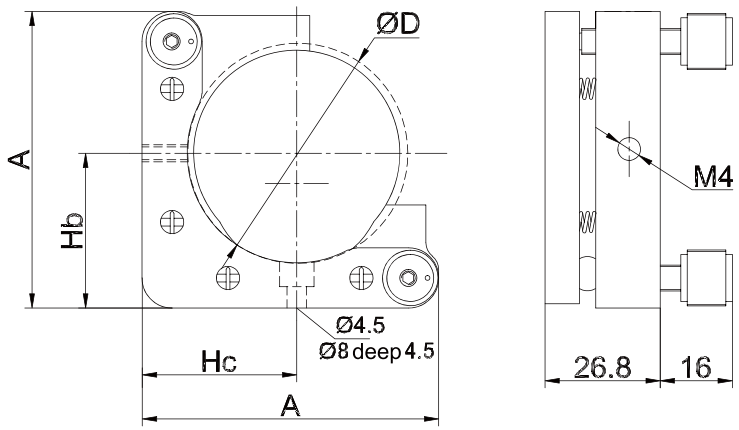
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0823 Kinematic Corner Lens/Mirror Holders

Several Kinematic Corner Lens/Mirror Holders are available for different applications. They provide smooth and precision tilt in two directions for adjustment. The total angle adjustment in any of the directions is ± 4°with a resolution of 10". Screw M4 makes it compatible with post mounting.

GCM-0823



GCM-0823

GCM-0823 Kinematic Corner Lens/Mirror Holders

Part No.	AxA	$H_C=H_B$	ØD	Weight (g)
GCM-082313M	50x50	26	20	60
GCM-082314M	50x50	26	25.4	80
GCM-082315M	52x52	28	30	85
GCM-082316M	62x62	32	38.1	93
GCM-082317M	62x62	32	40	95
GCM-082318M	69x69	36	50.8	150

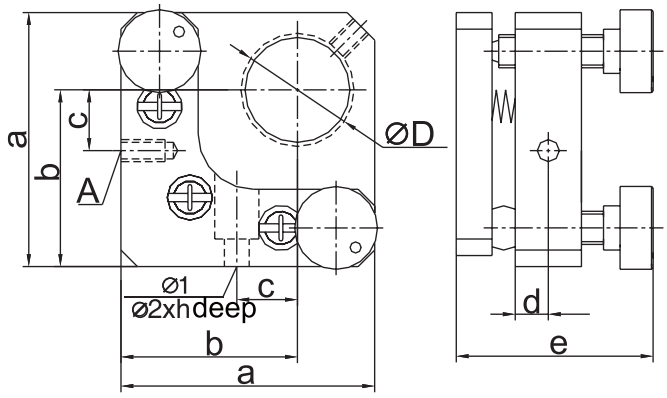
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0831M Kinematic Off-center Lens/Mirror Holders

Several kinematic off-center lens/mirror holders are available for different applications. They provide smooth and precision tilt in two directions for the mounted lens or mirror. The total angle adjustment in any of the directions is ± 4°. Screw A makes it compatible with post mounting.

GCM-0831M



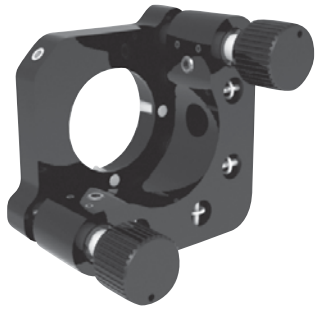
GCM-0831M

GCM-0831M Kinematic Off-center Lens/Mirror Holders

Part No.	A	ØD	a	b	c	d	e	Ø1	Ø2xh	Weight (g)
GCM-083103M	M4	20	46	32	11	6	36	4.5	8x4.5	80
GCM-083104M	M4	25.4	52	36	10.6	6	36	4.5	8x4.5	95
GCM-083105M	M4	30	60	41	11	6	36	4.5	8x4.5	120
GCM-083106M	M4	38.1	70	47	12	6	36	4.5	8x4.5	145
GCM-083107M	M4	40	70	47	12	6	36	4.5	8x4.5	145
GCM-083108M	M6	50.8	77	48	17	7.5	41	7	11x6	150

All dimensions are in mm unless otherwise specified.

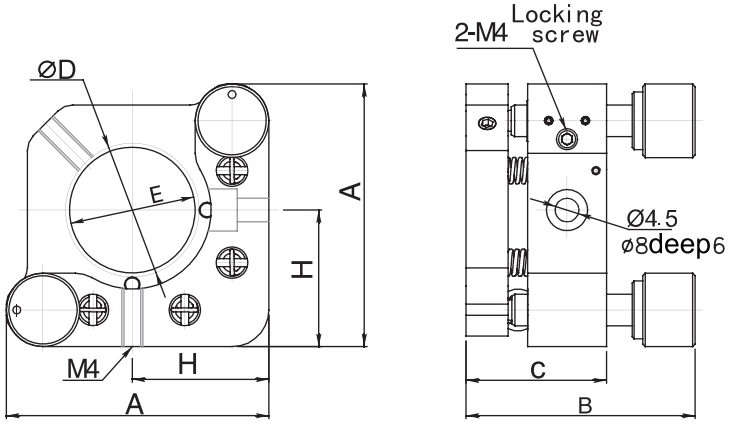
Optic Holders



GCM-0808

GCM-0808 Kinematic Lens/Mirror Lockable Holders

The series of Kinematic Lens/Mirror Lockable Holders, GCM-0808, is designed to mount a lens or mirror. The product offers two-axis tilt position adjustment. The tilting adjustment is achieved by precision fine screws and the tilting position can be locked by a small axial locking screw on each of the adjustment screws. The total tilting range in each axis is ±4°. The series contains a range of sizes to accommodate for different standard diameters of lenses or mirrors. There is a M4 tapped hole on the holder for connecting to a post mount or other products.



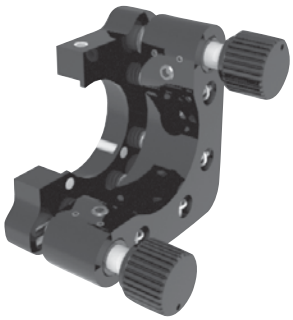
GCM-0808

GCM-0808 Kinematic Lens/Mirror Lockable Holders

Part No.	D	E	A	B	C	H
GCM-080803M	20	18.5	50	43.6	26.7	26
GCM-080804M	25.4	23.9	50	43.6	26.7	26
GCM-080805M	30	28.5	52	43.6	26.7	28
GCM-080806M	38.1	36.6	62	43.6	26.7	32
GCM-080807M	40	38.5	62	43.6	26.7	32
GCM-080808M	50.8	49.3	69	43.6	26.7	36

All dimensions are in mm unless otherwise specified.

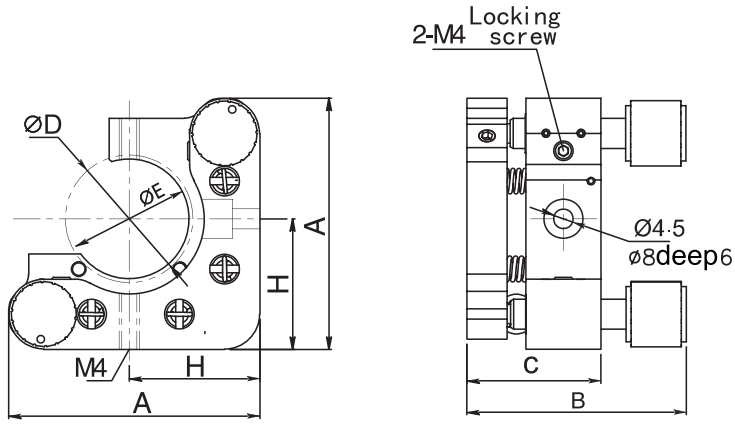
Optic Holders



GCM-0818

GCM-0818 Kinematic Corner Lens/Mirror Lockable Holders

The series of Kinematic Corner Lens/Mirror Lockable Holders, GCM-0818, is designed to mount a lens or mirror with the mounting edge opened (i.e. in a Corner holder). This feature allows light beams to pass through near the edge of the optics without blocked by the holder structure. The product offers two-axis tilt position adjustment. The tilting adjustment is achieved by precision fine screws and the tilting position can be locked by a small axial locking screw on each of the adjustment screws. The total tilting range in each axis is ±4°. The series contains a range of sizes to accommodate for different standard diameters of lenses or mirrors. There is a M4 tapped hole on the holder for connecting to a post mount or other products.



GCM-0818

GCM-0818 Kinematic Corner Lens/Mirror Lockable Holders

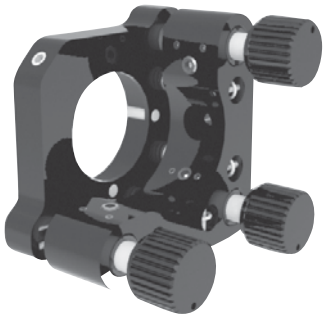
Part No.	D	E	A	B	C	H
GCM-081803M	20	18.5	50	43.6	26.7	26
GCM-081804M	25.4	23.9	50	43.6	26.7	26
GCM-081805M	30	28.5	52	43.6	26.7	28
GCM-081806M	38.1	36.6	62	43.6	26.7	32
GCM-081807M	40	38.5	62	43.6	26.7	32
GCM-081808M	50.8	49.3	69	43.6	26.7	36

All dimensions are in mm unless otherwise specified.

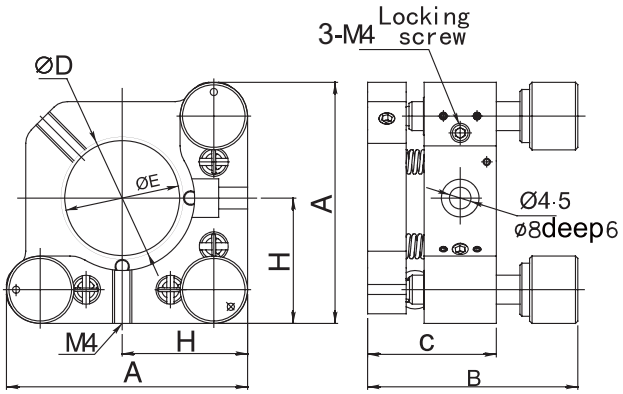
Optic Holders

GCM-0828 3D Kinematic Lens/Mirror Lockable Holders

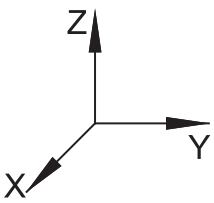
The series of 3D Kinematic Lens/Mirror Lockable Holders, GCM-0828, has many different sizes to meet different requirements. They provide three high precision screws for adjustment. They may be tilted about the Y and Z axes through ±4°,and can be fixed on other types of holders by means of the tapped hole M4.



GCM-0828



GCM-0828



GCM-0828 3D Kinematic Lens/Mirror Lockable Holders

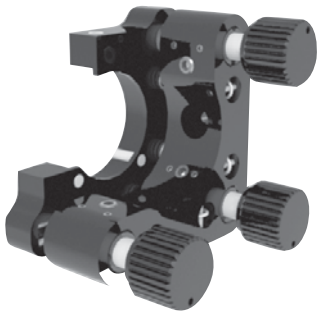
Part No.	D	E	A	B	C	H
GCM-082803M	20	18.5	50	43.6	26.7	26
GCM-082804M	25.4	23.9	50	43.6	26.7	26
GCM-082805M	30	28.5	52	43.6	26.7	28
GCM-082806M	38.1	36.6	62	43.6	26.7	32
GCM-082807M	40	38.5	62	43.6	26.7	32
GCM-082808M	50.8	49.3	69	43.6	26.7	36

All dimensions are in mm unless otherwise specified.

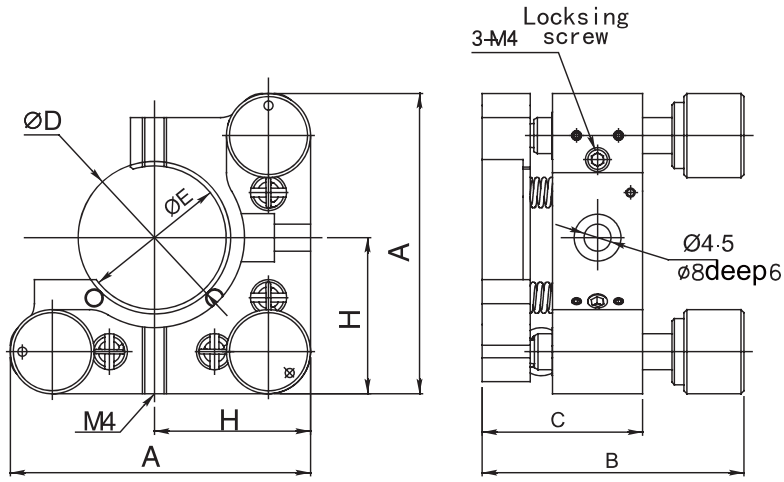
Optic Holders

GCM-0838 3D Kinematic Corner Lens/Mirror Lockable Holders

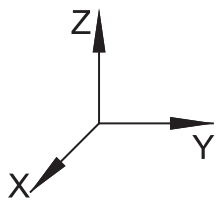
The GCM-0838 series of 3D Kinematic Corner Lens/Mirror Lockable Holders has many different sizes to meet different requirements. They provide three high precision screws for adjustment. They may be tilted about the Y and Z axes through ±4°,and can be fixed on other types of holders by means of the tapped hole M4.



GCM-0838



GCM-0838



GCM-0838 3D Kinematic Corner Lens/Mirror Lockable Holders

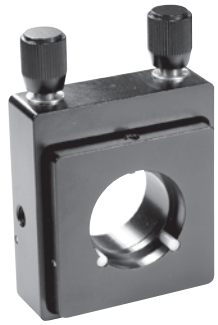
Part No.	D	E	A	B	C	H
GCM-083803M	20	18.5	50	43.6	26.7	26
GCM-083804M	25.4	23.9	50	43.6	26.7	26
GCM-083805M	30	28.5	52	43.6	26.7	28
GCM-083806M	38.1	36.6	62	43.6	26.7	32
GCM-083807M	40	38.5	62	43.6	26.7	32
GCM-083808M	50.8	49.3	69	43.6	26.7	36

All dimensions are in mm unless otherwise specified.

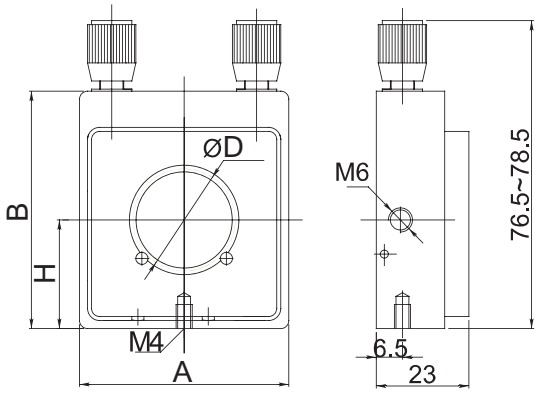
Optic Holders

GCM-0809 Vertical Drive Kinematic Lens/Mirror Holders

The series of Vertical Drive Kinematic Lens/Mirror Holders, GCM-0809, provides two-axis tilting adjustment by means of two high precision screws on the top of the holder. This facilitates to avoid obstructing the beam path during the adjustment. It also minimizes space usage particularly along the optical axis. Each tilting adjustment has a range of ±4º. There is also a tapped hole of M4 for fixing with other products.



GCM-0809



GCM-0809

GCM-0809 Vertical Drive Kinematic Lens/Mirror Holders

Part No.	A x B	ØD	H	Weight (g)
GCM-080904M	52x59	25.4	27	140

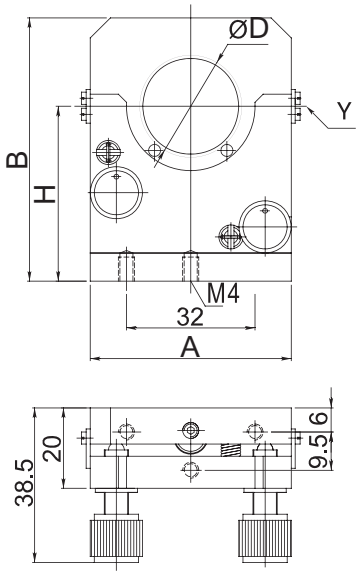
All dimensions are in mm unless otherwise specified.

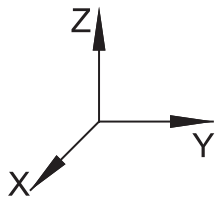
Optic Holders

GCM-0819 Gimbal Lens/Mirror Holders

The series of Gimbal Lens/Mirror Holders, GCM-0819, provides two high precision screws for orthogonal and coplanar adjustments. It can be tilted about the Y and Z axes through ±4° independently. Screw M4 makes it compatible with post mounting.

GCM-0819





GCM-0819

GCM-0819 Gimbal Lens/Mirror Holders

Part No.	A x B	ØD	H	Weight (g)
GCM-081904M	50x65.5	25.4	43.5	160

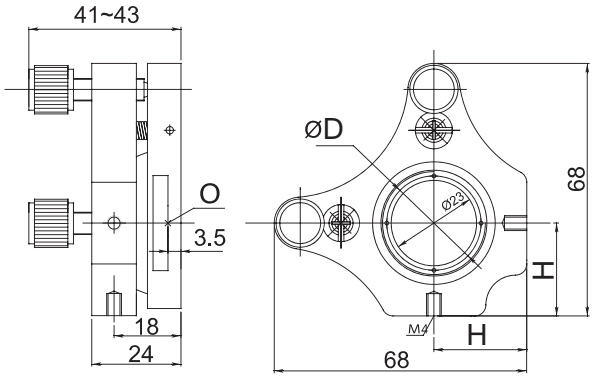
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0829 Compact Gimbal Lens/Mirror Holders

The Compact Gimbal Lens/Mirror Holders, GCM-0829, provides fine tilting adjustments in two separate axes without center translation. Each tilting range is ±4° by means of two high precision screws. The tapped M4 holes are compatible with post mounting.

GCM-0829



GCM-0829

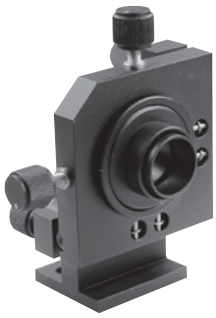
GCM-0829 Compact Gimbal Lens/Mirror Holders

Part No.	ØD	H	Weight (g)
GCM-082904M	25.4	25	165

All dimensions are in mm unless otherwise specified.

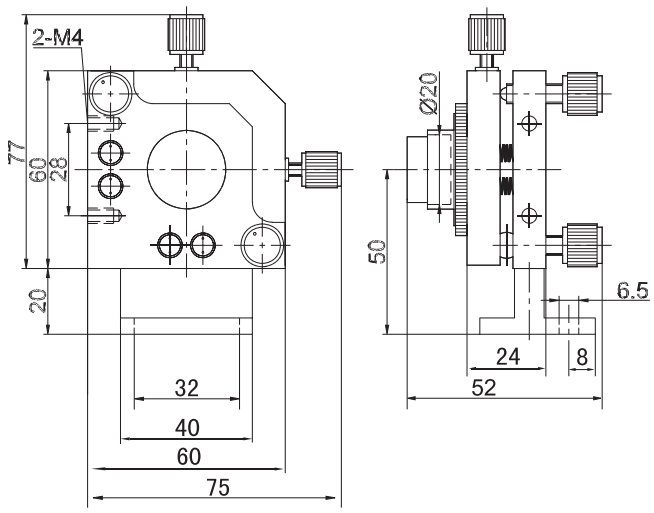
Optic Holders

GCM-2501 4D Lens/Mirror Holders with Pedestal

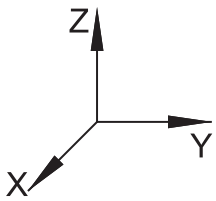


GCM-2501

This 4D Lens/Mirror Holders with Pedestal allow smooth and precision tilts and translations along the two axes perpendicular to the optical axis.i.e. Y and Z axes. All the adjustments are independent. The total tilting angle of each axis is ±4°; the total axial travel range is ±2mm with a resolution of 10μm.



GCM-2501

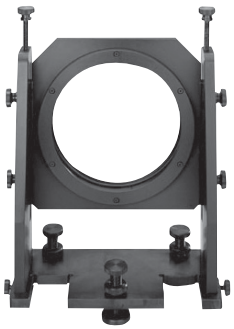


GCM-2501 4D Lens/Mirror Holders with Pedestal

Part No.	Weight (g)
GCM-250101	210

All dimensions are in mm unless otherwise specified.

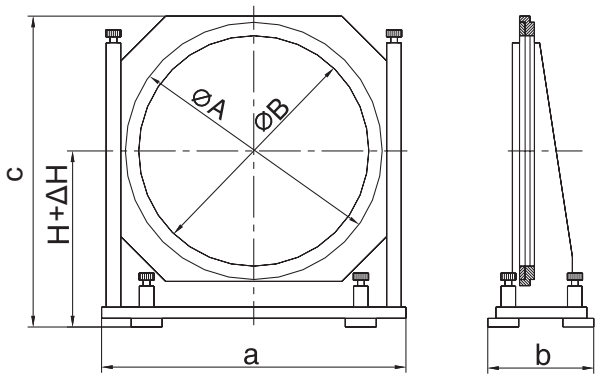
Optic Holders



GCM-20

GCM-20 Large Lens Holders

These Large Lens Holders are specially designed for large lenses and mirrors. The height of the optic center can be adjusted slightly. Custom orders are also accepted.



GCM-20

GCM-20 Large Lens Holders

Part No.	ØA	ØB	a x b x c	H	ΔH
GCM-2001M	150	140	280x130x330	160	15
GCM-2002M	200	190	320x135x350	180	20
GCM-2003M	250	240	350x150x370	210	20
GCM-2004M	300	290	425x180x423	243	25
GCM-2005M	400	390	504x197x540	320	25
GCM-2006M	500	486	641x234x650	370	30

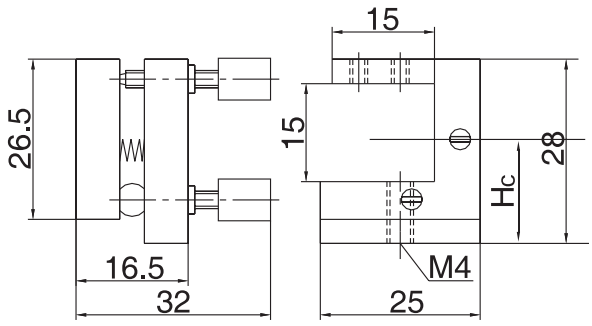
All dimensions are in mm unless otherwise specified.

Optic Holders

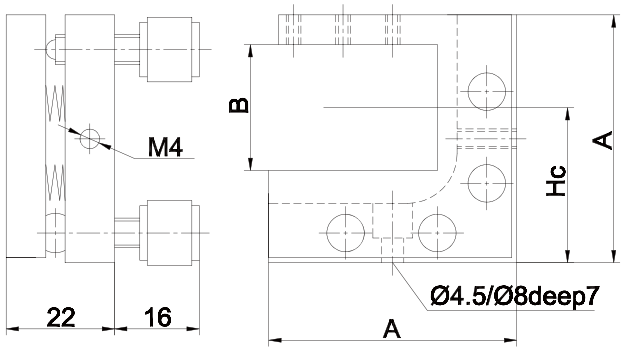
GCM-10 Kinematic Cylindrical Lens Holders

The GCM-10 Kinematic Cylindrical Lens Holder provides smooth and precision tilt in two directions for the mounted cylindrical lens. The total angle adjustment in any of the direction is ±4°. Screw M4 makes it compatible with postmounting.

GCM-10



GCM-100201M



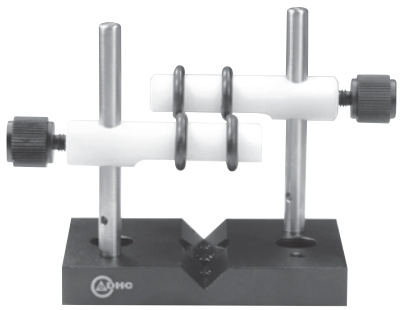
GCM-100202M GCM-100203M

GCM-10 Kinematic Cylindrical Lens Holders

Part No.	A x A	B	H_c	Weight (g)
GCM-100201M	picture	picture	16.5	20
GCM-100202M	50x50	25.4	30	85
GCM-100203M	60x60	40	34	100

All dimensions are in mm unless otherwise specified.

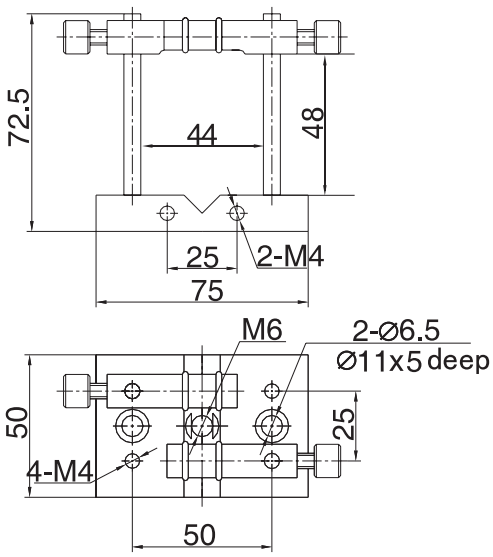
Optic Holders



GCM-0601

GCM-0601 Prism Tables

The GCM-0601 Prism Tables one or two optical elements of different size, shape and orientation. There is also a V-groove for positioning cylindrical or curved objects on the table.



GCM-0601

GCM-0601 Prism Tables

Part No.	Weight (g)	Maximum size clamping
GCM-0601M	135	32×50×50

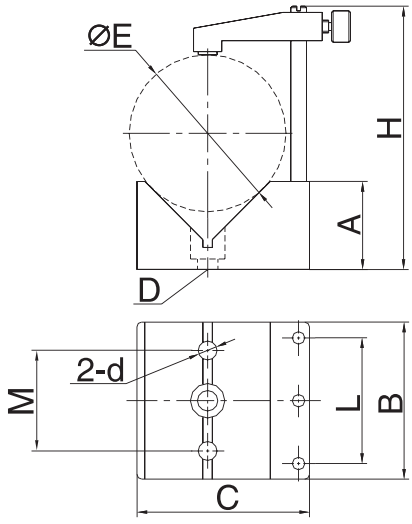
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0602 V-groove Mounts

The GCM-0602 Prism Tables one or two optical elements of different size, shape and orientation. There is also a V-groove for positioning cylindrical or curved objects on the table.

GCM-0602



GCM-0602

GCM-0602 V-groove Mounts

Part No.	A	B	C	H	L	D	d	ØE	M	Weight(g)
GCM-060201M	20	20	34	50.5	--	M4	--	0~25	--	36.5
GCM-060202M	28	50	55	88	32	M6	Ø3.2/ Ø6x3.5	12~50	40	170
GCM-060203M	45	80	105	153	50	M6x14	Ø7/ Ø12x8	50~100	64	750
GCM-060204M	35	65	78	115	50	M6x10	Ø6.5/ Ø12x7	25~75	50	370

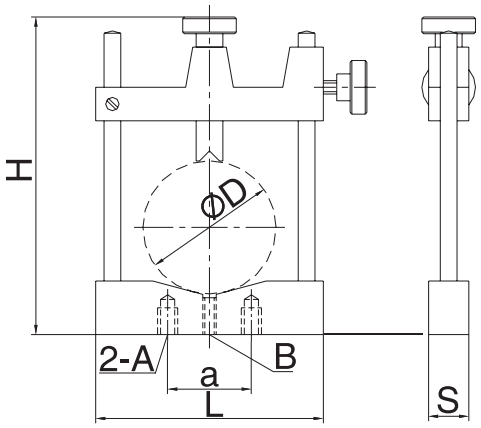
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0603 V-grooved Lens Chucks

The GCM-0603 Prism Tables one or two optical elements of different size, shape and orientation. There is also a V-groove for positioning cylindrical or curved objects on the table.

GCM-0603



GCM-0603

GCM-0603 V-grooved Lens Chucks

Part No.	H_{max}	L	S	A	a	B	$ØD_{max}$	Weight(g)
GCM-060301M	73	48	10	--	--	M4	30	49
GCM-060302M	110	68	12	2-Ø6.5(Ø11x15deep)	25	M4	50	90
GCM-060303M	140	95	14	M6	50	M6	75	150
GCM-060304M	175	128	14	M6	50	M6	100	225

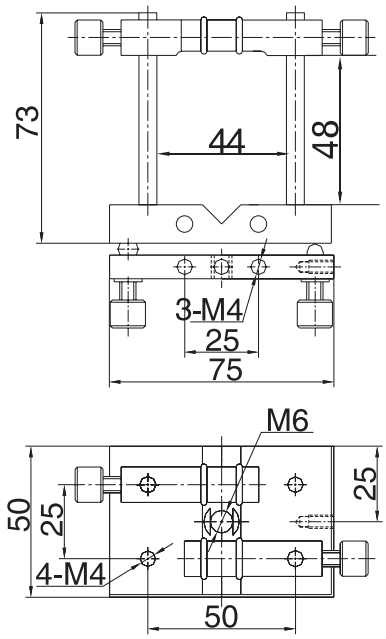
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0701 Adjustable Prism Tables

These adjustable prism tables not only feature the GCM-0601 Prism Table but also can be tilted about the X and Y axes within ±5°.

GCM-0701



GCM-0701

GCM-0701 Adjustable Prism Tables

Part No.	Weight (g)	Maximum size clamping
GCM-070101M	245	32×50×50

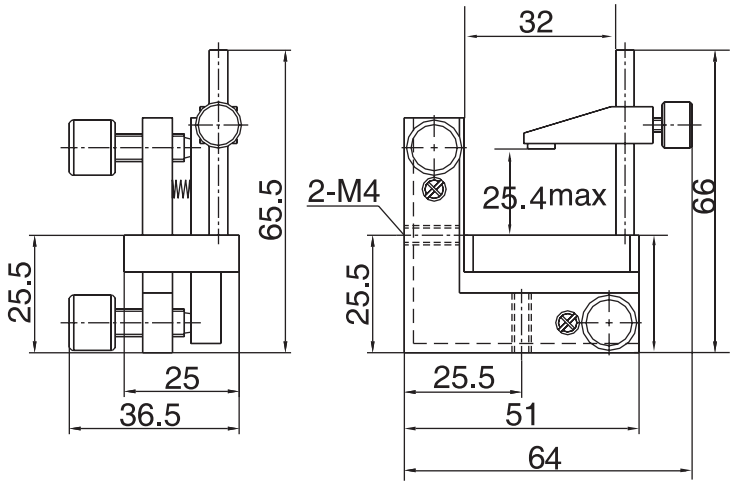
All dimensions are in mm unless otherwise specified.

Optic Holders

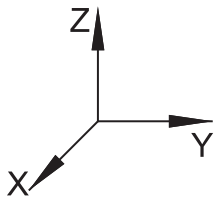
GCM-0702 Two-Tilt Platform

This platform allows a prism or an optical component to be tilted about the X and Z axes through ±4°. The clamp arms and the platform are practically convenient.

GCM-0702



GCM-0702



GCM-0702 Two-Tilt Platform

Part No.	Weight (g)	Maximum size clamping
GCM-0702M	100	30×30×30

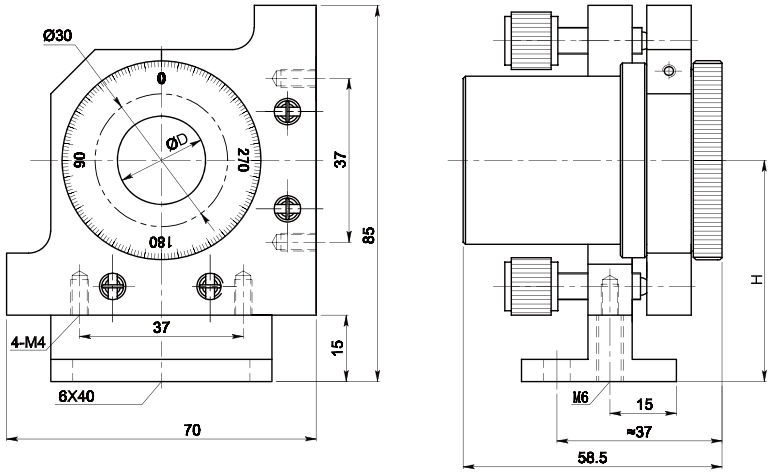
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0703M 3D Prism Polarizer holder

GCM-0703M

The product of 3D Prism Polarizer holder, GCM-0703M, is designed to mount GCL-07 prism polarizers and provides two-axis tilting adjustments in the plane orthogonal to the optical axis and one-axis rotation about the optical axis. Each of the two tilting adjustments is by a high precision screw with tilting range of ±4°. 6x40 mm slot makes it compatible with plate mounting.



GCM-0703M

GCM-0703M 3D Prism Polarizer holder

Part No.	ØD	H	Weight (g)
GCM-0703M	20	50	240

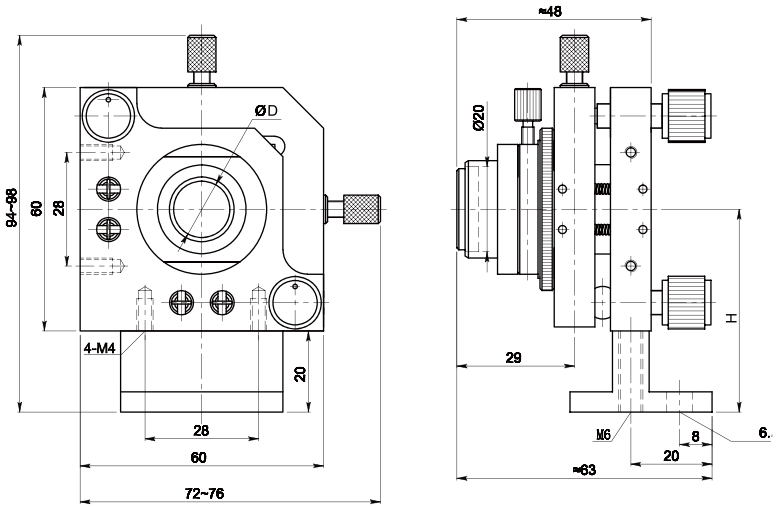
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-0704M 5D Prism Polarizer holder

The product of 5D Prism Polarizer Holder, GCM-0704M, is designed to mount GCL-07 prism polarizers and provides three-axial translation adjustments and two axis tilting adjustments. 6.5x25 mm slot makes it compatible with plate mounting.

GCM-0704M



GCM-0704M

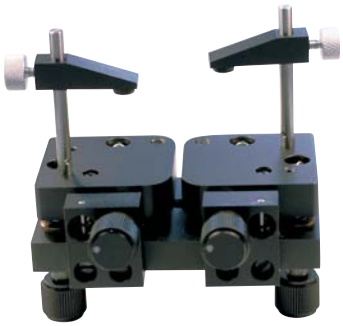
GCM-0704M 5D Prism Polarizer holder

Part No.	ØD	H	Weight (g)
GCM-0704M	14	50	250

All dimensions are in mm unless otherwise specified.

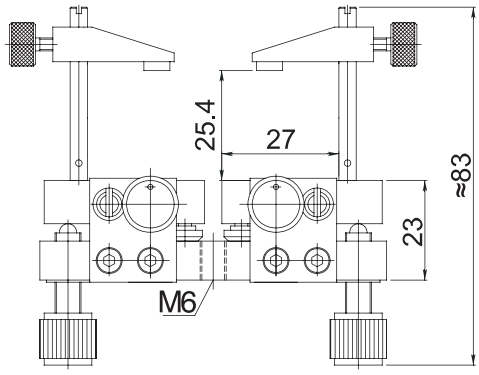
Optic Holders

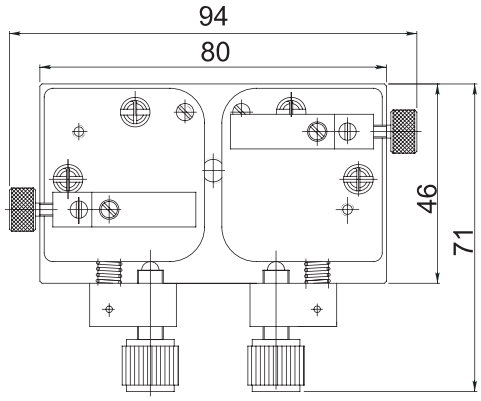
GCM-0705M 2 in 1 Prism Table



GCM-0705M

The product of 2 in 1 Prism Table, GCM-0705M, combines two independent tilting adjustment stage to allow two prisms or cubical optical components with fine tilting adjustments. Each of tilting adjustment has a range of ±4º. The platform-clamp design is practical and convenient to use.





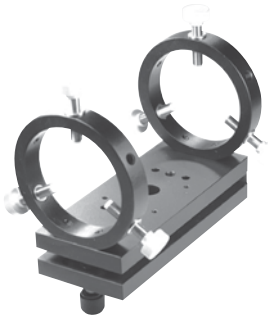
GCM-0705M

GCM-0705M 2 in 1 Prism Table

Part No.	Weight (g)	Maximum size clamping
GCM-0705M	255	25.4

All dimensions are in mm unless otherwise specified.

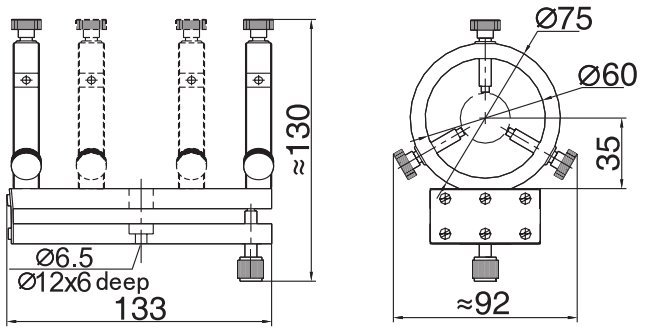
Optic Holders



GCM-180201M

GCM-1802 D60 Laser Holder

We offer fixed laser holders for supporting any cylindrical laser heads. The six nylon faced screws gently but firmly hold laser tubes so as to make a fine and precise alignment of the laser beam. The base can be tilted over ±3°.



GCM-180201M

GCM-1802 D60 Laser Holder

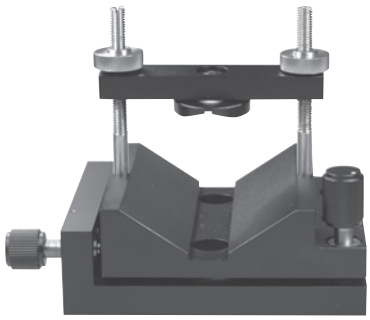
Part No.	Weight (g)
GCM-180201M	135

All dimensions are in mm unless otherwise specified.

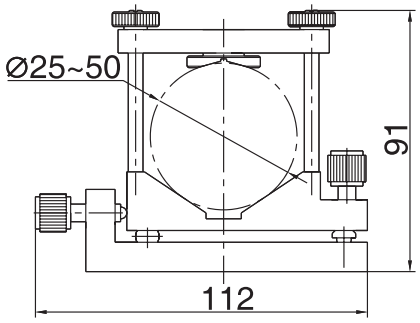
Optic Holders

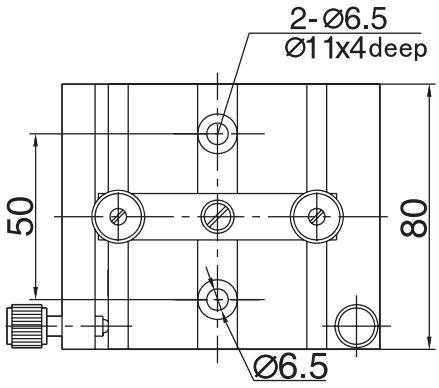
GCM-1811 D50 Laser Holder

GCM-181101M Laser Holdel can provide a convenient way to attach any 25 to 50mm diameter laser. It features V-groove kinematic pivots to assure reliable holding and repeatable angular orientation. The base can be titled over ±2º.



GCM-181101M





GCM-181101M

GCM-1811 D50 Laser Holder

Part No.	Weight (g)
GCM-181101M	555

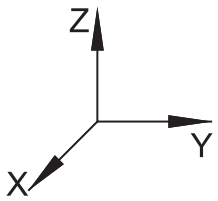
All dimensions are in mm unless otherwise specified.

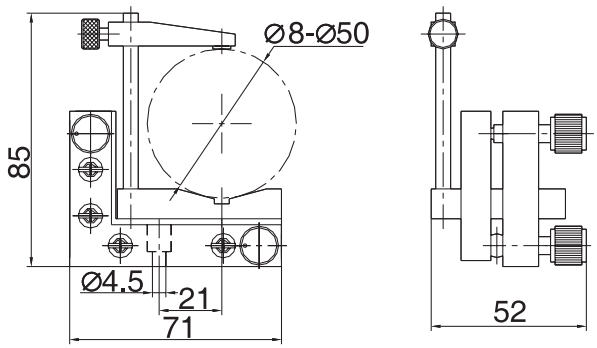
Optic Holders

GCM-1821 Compact D50 Laser Holder

The GCM-1821 Compact D50 Laser Holder can provide a convenient way to attach any 8 to 50mm diameter laser. It can provide an angular range of ±4°. Its high-resolution adjustment screws act on hardened carbide inserts for smooth adjustment, minimal crosscoupling and accurate beam placement.

GCM-182101M





GCM-182101M

GCM-1821
Compact D50 Laser Holder

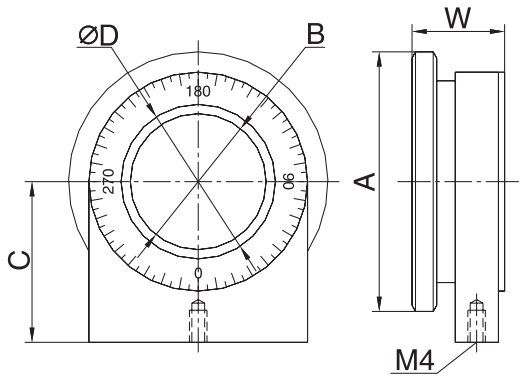
Part No.	Weight (g)
GCM-182101M	186

All dimensions are in mm unless otherwise specified.

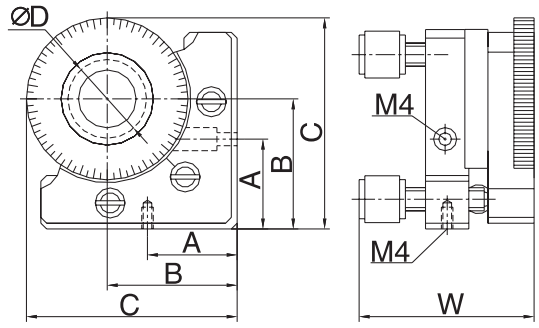
Optic Holders

GCM-09 Polarizer/Wave Plate Holders

The GCM-09 series of Polarizer/Waveplate Holders is used to hold circular optical components such as the GCL-06 waveplates and GCL-05 polarizers. One face is marked with a 360°scale for easy angular alignment. The series 3-dimensional Polarizer/Waveplate Holders may be tilted about the X and Z axes through ± 4°.



GCM-0901M 0902M 0903M 0905M



GCM-0911M 0912M

GCM-09 Polarizer/Wave Plate Holders

Part No.	A	B	C	ØD	W	Weight(g)
GCM-0901M	Ø30	Ø10	20	Ø12.7	12	15
GCM-0902M	Ø42	Ø22	26	Ø25.4	12.5	30
GCM-0903M	Ø43	Ø22	30	Ø30	12.5	
GCM-0905M	Ø70	Ø46	40	Ø50.8	16	145
GCM-0911M	14.5	22.5	37	Ø12.7	31	40
GCM-0912M	22	34.5	55.5	Ø25.4	41.6	75

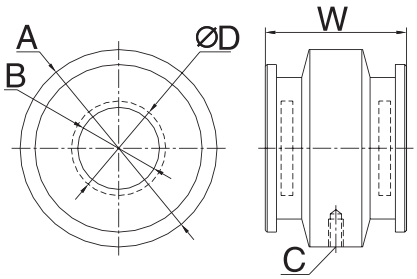
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-092 Linear Polarization Attenuator

The Linear Polarization Attenuator has two linear polarizers, centered on the same axis, which can be rotated relatively to achieve different attenuation levels. The rotating angle is marked. The mechanism of attenuation is based on the Malus Principle.

GCM-092



GCM-092

GCM-092 Linear Polarization Attenuator

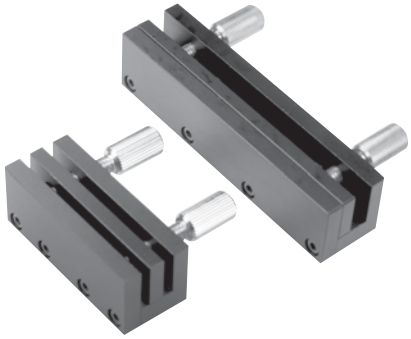
Part No.	A	B	C	ØD	W	Weight(g)
GCM-0922M	Ø39.5	Ø9	M4/M6	Ø12.7	24	75
GCM-0923M	Ø50	Ø22	M4	Ø25.4	24	130
GCM-0926M	Ø78	Ø47	M4/M6	Ø50.8	38	205

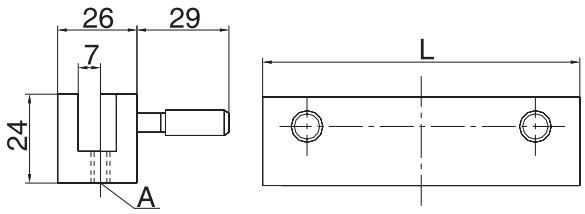
All dimensions are in mm unless otherwise specified.

Optic Holders

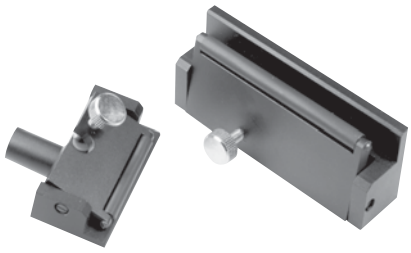
GCM-13 Plate Holders

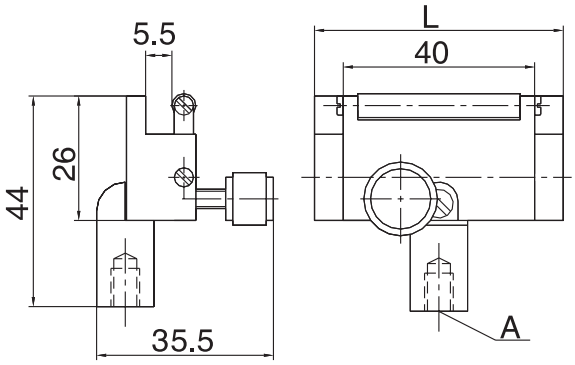
These holders are designed to hold flat plate optics that are less than 5mm thick and can be mounted on posts such as the GCM-01.





GCM-13M

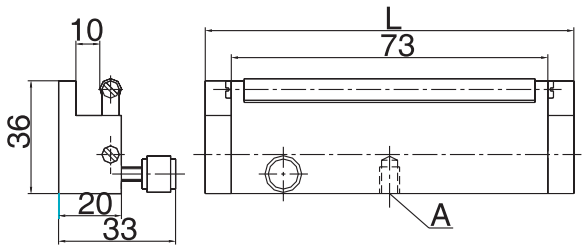




GCM-1311M

All dimensions are in mm unless otherwise specified.

Optic Holders



GCM-1312M

GCM-13 Plate Holders

Part No.	A	L	Weight (g)
GCM-1301M	M6	100	155
GCM-1302M	M6	60	105
GCM-1311M	M6	52	105
GCM-1312M	M4	85	55

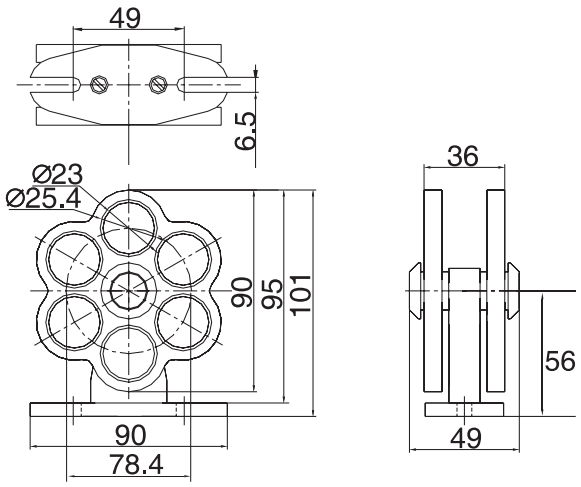
All dimensions are in mm unless otherwise specified.

Optic Holders

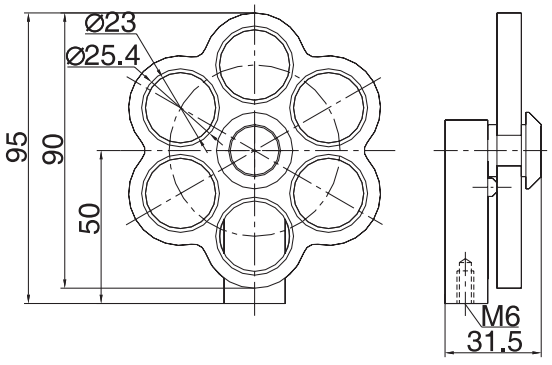
GCM-140 Double Wheel Filter Holder

This is a compact structure that can hold securely 12 neutral density filters or any optical components of 1-inch diameter (25.4mm). Different densities can be obtained by rotating the two wheels so as to combine different filter pairs.

GCM-140



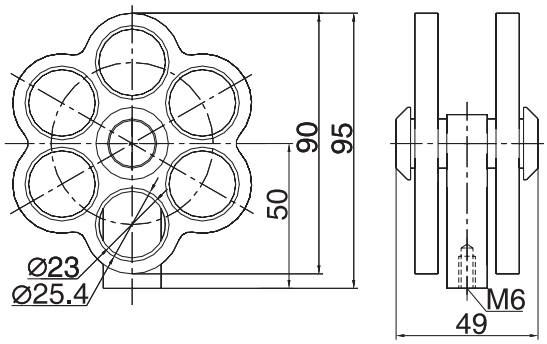
GCM-1401M



GCM-1402M

All dimensions are in mm unless otherwise specified.

Optic Holders



GCM-1403M

GCM-140
Double Wheel Filter Holder

Part No.	Weight (g)
GCM-1401M	220
GCM-1402M	110
GCM-1403M	170

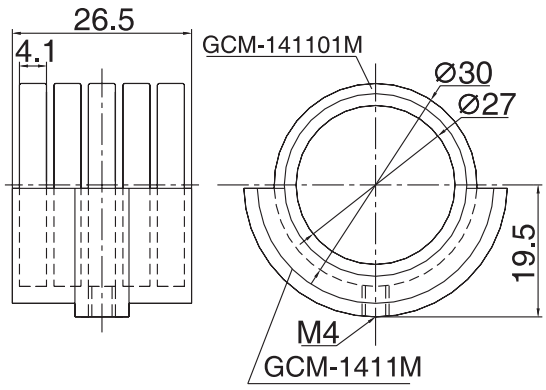
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-141 Five Slot Filter Holder

Up to five filters or other round optics of 1" or 25mm diameters can be mounted. Each mountcan be individually and accurately positioned to give different combination of the optics.Changing the optics is simple and easy.

GCM-141M



GCM-141M

GCM-141
Five Slot Filter Holder

Part No.	Weight (g)
GCM-1411M	23
GCM-141101M	2

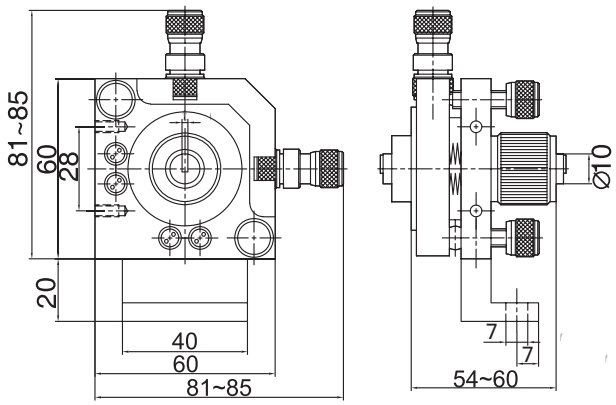
All dimensions are in mm unless otherwise specified.

Optic Holders

GCM-21 Precision Fiber Alignment Mount

This mount features precision fine turning for optical fiber alignment.

GCM-21



GCM-2111M

GCM-21Precision
Fiber Alignment Mount

Part No.	Weight (g)
GCM-2111M	435

All dimensions are in mm unless otherwise specified.

Translation Stages 211~243

Translation Stages

Product Range

Translation stages are for moving components linearly. An actuator pushes the platform relative to the base of the stage. A built-in guide in the stage maintains the translation movement. The form of the guide generally determines the characteristics of the translation stages. Daheng Optics offers a variety type of the translation stages off-the-shelf. There are of single axis or dual axis. The table below lists the product series for our customer to select according to their applications.

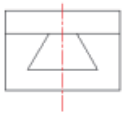
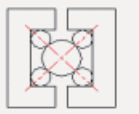
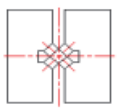
Translation Type	Part No.
Horizontal motion	GCM-120 Dovetail Translation Stages
	GCM-15 Rack and Pinion Translation Stages
	GCM-83 Digital Display Translation Stages
	GCM-160 Ball Bearing Mini Vertical Translation Stages
Vertical motion	GCM-161 Mini Threaded Vertical Translation Stages
	GCM-162 High Precision Vertical Translation Stages
	GCM-164 Side-Driven Vertical Stages
	GCM-17 Lab Jacks

Guide Form

The translation stage consists of a platform and a base, joined by some form of guide or linear bearing in such a way that the platform is restricted to linear motion with respect to the base. The performance of the translation stages is primarily determined by the type of the bearing used. Below is the comparison.

All dimensions are in mm unless otherwise specified.

Translation Stages

	Dovetail Bearing	Ball Bearing	Crossed Roller Bearing
			
Cost	low	moderate	high
Friction Coefficient	high (0.25~0.35)	low (0.002)	low(0.003)
Stiffness	high	low	high
Range of Motion	large	moderate	moderate
Shock Resistance	high	low	moderate
Load Capacity	high	low	high
Accuracy	high backlash	moderate	high
Lifetime	long	short	long
Immunity	high	moderate	low
Typical Application	GCM-1202 GCM-1203	GCM-1252 GCM-1253	GCM-1273 GCM-1275

Driving Actuators

In addition to the guide in a translation stage, a linear actuator pushes and controls the position of the moving platform relative to the fixed base. Daheng Optics provides a variety of different manual actuators.

Precision screws

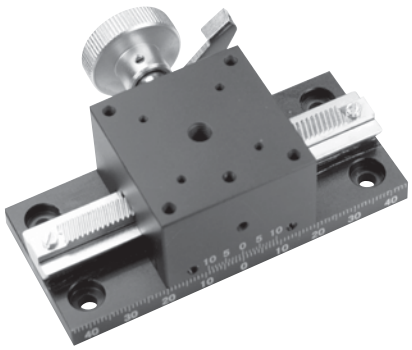
These products are supplied with a hardened steel ball tip and the brass bushing, which provide exceptionally smooth and repeatable movements. The pitch of the precision screws defines the adjustment resolution. Daheng Optics provides a wide range of high quality fine adjusters, including pitch of 0.35mm and 0.25mm.

All dimensions are in mm unless otherwise specified.

Translation Stages

Vernier micrometers heads

They can also be used as driving actuators for precise movement in demanding requirements. Daheng Optics offers vernier micrometer heads with travel range from 6.5mm to 25mm and fine scale reading from 0.01mm to 0.001mm.

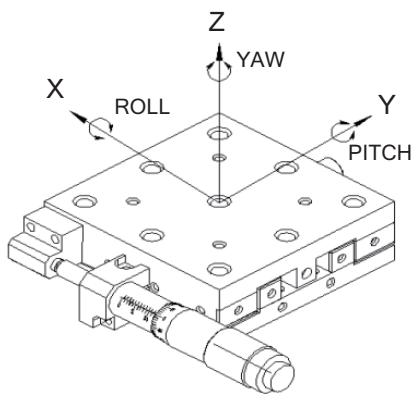


Rack and pinion

This structure comprises a pair of gears which converts rotational motion into linear motion.

Run-out error

It is the measure for how straight the line of movement is, which is the maximum distance off the ideal straight line in the perpendicular directions of the motion. For each axis travel, there are two associated orthogonal run-out measurements corresponding to the two remaining translational degrees of freedom. For instance, for an x-axis translation stage, there exists a y-axis run-out and a z-axis run-out. They are referred to as straightness of travel (in plane motion) and flatness of travel (out of plane motion, respectively). Run-out error is generally measured by a dial gauge.



Tilt and wobble

It is the angular error that refers to the offset between the ideal straight line motion and actual measured motion. It has three mutually perpendicular components reference to the x-, y- and z-axis, which generally is the roll, pitch and yaw. These three components are normally resulted from the geometrical shapes in the structure.

All dimensions are in mm unless otherwise specified.

Translation Stages

Straightness

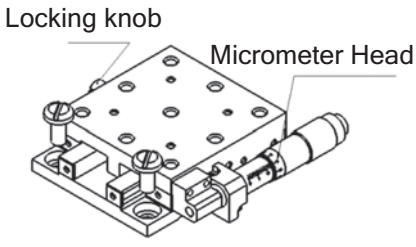
It is the ability of a machine to accurately travel in a straight line with respect to a known reference plane, and the specification refers to the maximum possible deviation from the desired straight line path.

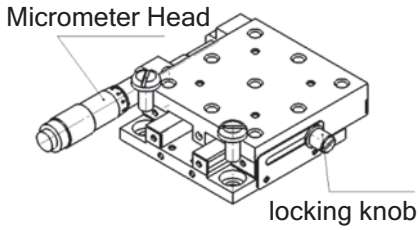
Mechanical Interface

Single- or dual-axis translation stages can be combined to produce compound motions with interface mechanical parts. The table below lists the standard interface parts according to the table dimension of the translation stage attached.

Table dimension (mm)	Interface
25x25	GCM-5313M
40x40	GCM-5314M
50x50	GCM-5315M
52x52	GCM-5313M/5314M/5315M
65x65	GCM-5316M
75x75	GCM-5317M/GCM-5315M

Installation





There are four counter-sank through hole on the fixing base of each translation stage. To access them, please follow the procedure below:

1. Rotate the micrometer head (or other built-in driving actuator) in one direction so that the table moves to the one end of its travel range. Make sure to release the locking knob before the operating. Two installment holes are then revealed for fixing.

2. Next, turn the micrometer head (or other built-in driving actuator) in the opposition direction until the table moves to the other end of its travel range. The other two installment holes are then revealed for fixing.

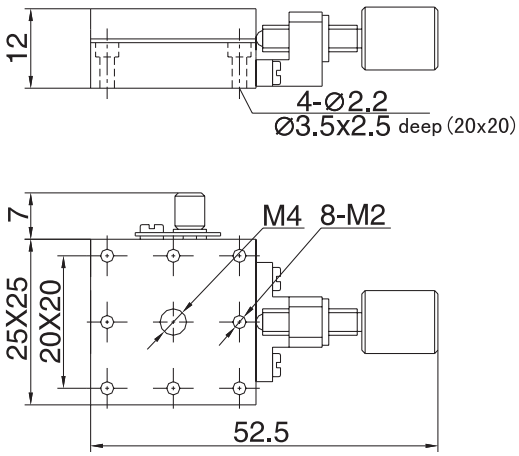
All dimensions are in mm unless otherwise specified.

Translation Stages

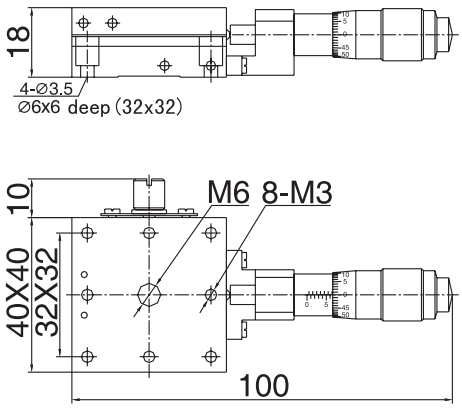
GCM-120 Dovetail Translation Stages

Precise and smooth linear translation with no backlash is achievable by dovetail guides and a spring-loaded micrometer or lead screw mechanism. The springs pre-load the moving plate, eliminating any backlash. In the tables below x stands for one-dimensional stage and x-y stands for a combination of two dimensions. A denotes micrometer drive;B denotes side-mounted drive. With product GCM-53 series, one can build a 3D translation stage.

GCM-120101AM

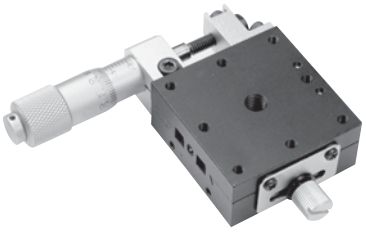


GCM-120201AM

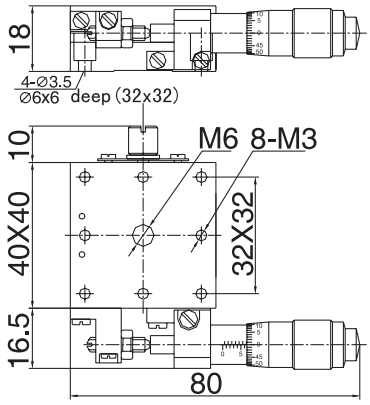


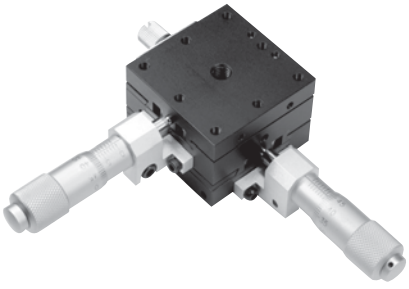
All dimensions are in mm unless otherwise specified.

Translation Stages

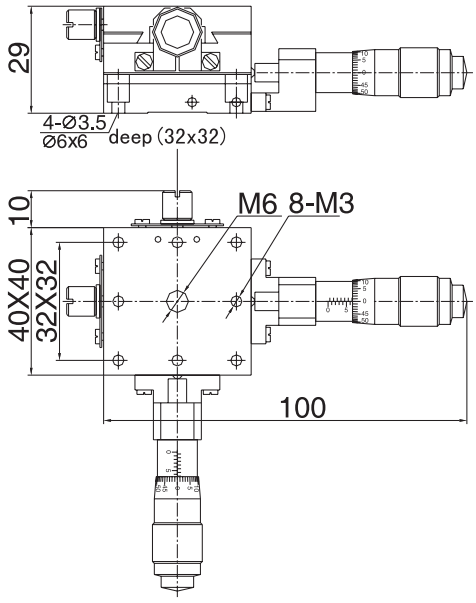


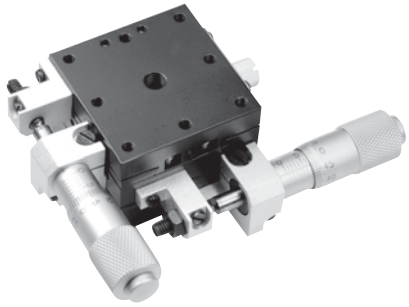
GCM-120201BM



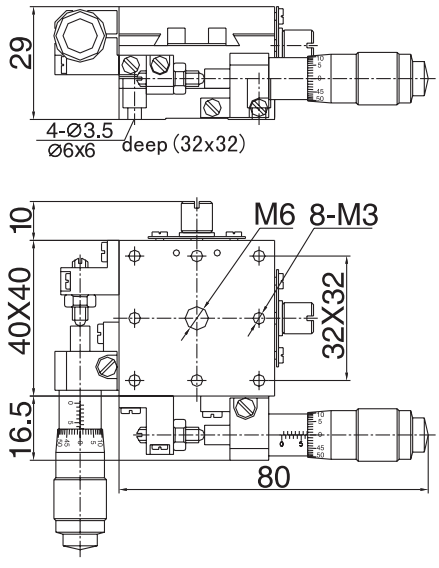


GCM-120202AM





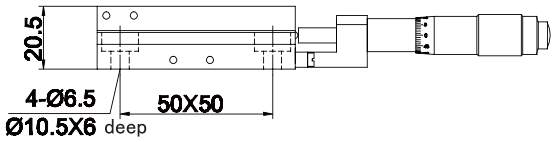
GCM-120202BM

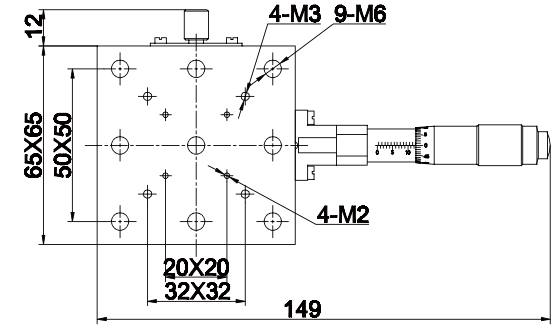


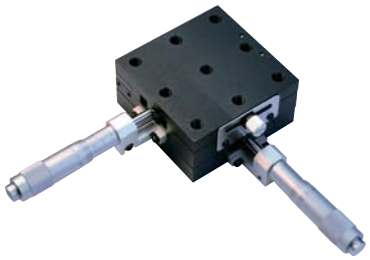
All dimensions are in mm unless otherwise specified.

Translation Stages

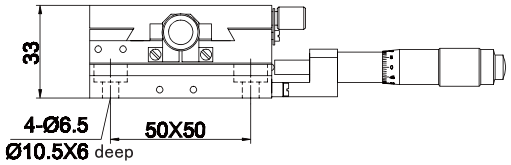
GCM-120301AM

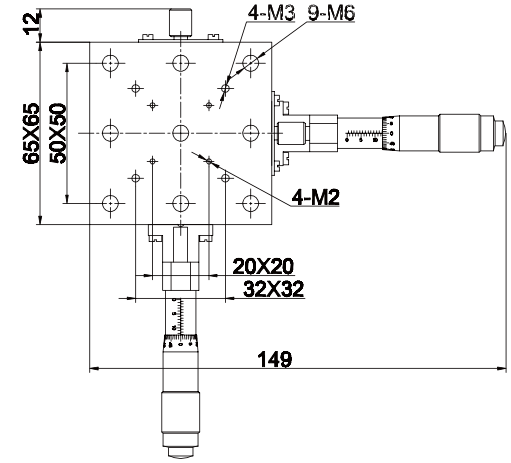


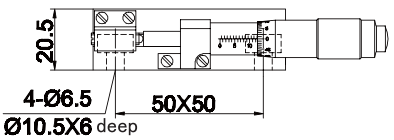


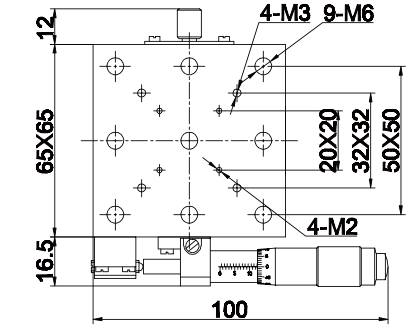


GCM-120302AM

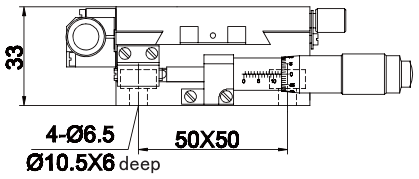


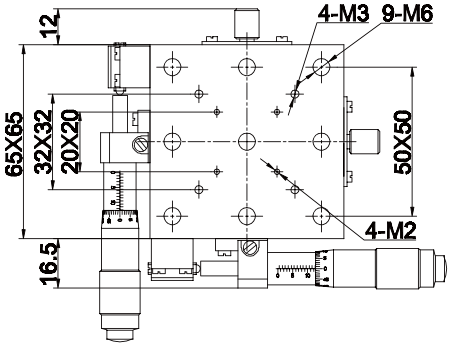






GCM-120301BM

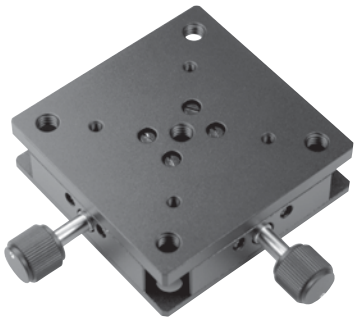


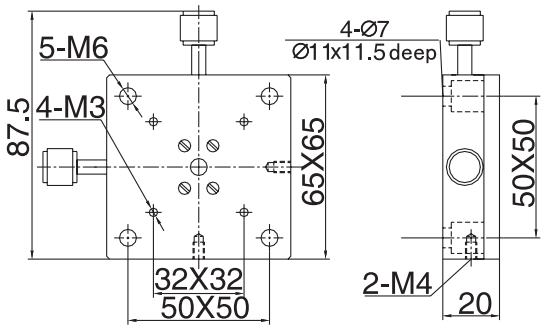


GCM-120302BM

All dimensions are in mm unless otherwise specified.

Translation Stages





GCM-122101M

GCM-120 Dovetail Translation Stages

Part No.	Dimension	Travel	Weight (g)
GCM-120101AM	x	±3.25	45
GCM-120201AM	x	±6.5	120
GCM-120201BM	x	±6.5	125
GCM-120202AM	x-y	±6.5	210
GCM-120202BM	x-y	±6.5	220
GCM-120301AM	x	±12.5	295
GCM-120301BM	x	±12.5	305
GCM-120302AM	x-y	±12.5	505
GCM-120302BM	x-y	±12.5	525
GCM-122101M	x-y	±3	225

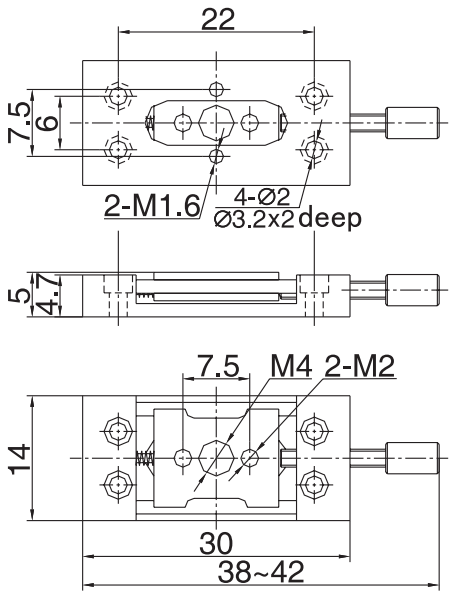
All dimensions are in mm unless otherwise specified.

Translation Stages

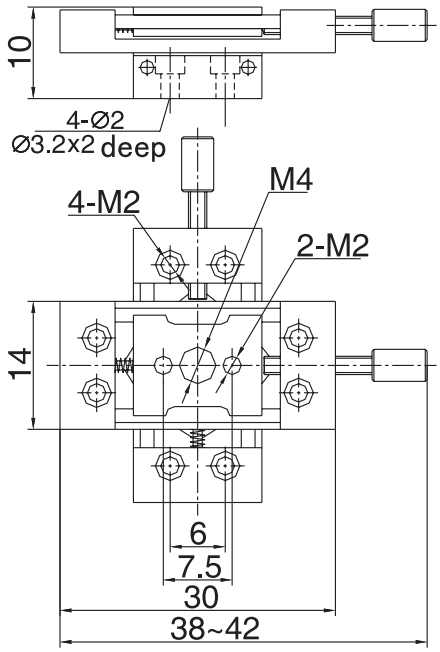
GCM-123 Bar-guided Micro Translation Stages

This type of the translation stages is commonly used in positioning optical components of small size. There are types of one dimension, two dimensions and three dimensions. The guide is a precision bar of Ø1.5mm with compact design. The stages are suitable in the situations of light weight and low accuracy.

GCM-123



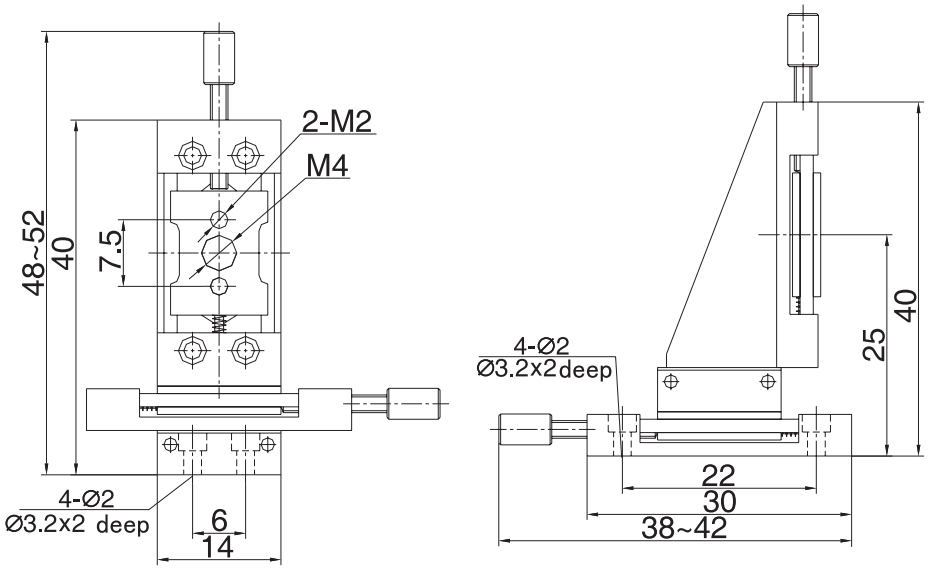
GCM-123101M



GCM-123102M

All dimensions are in mm unless otherwise specified.

Translation Stages



GCM-123103M

GCM-123 Bar-guided Micro Translation Stages

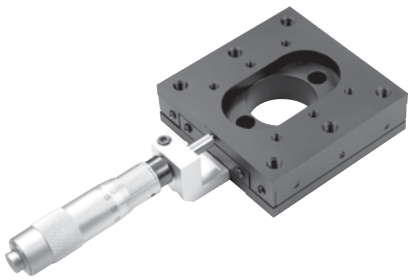
Part No.	Dimension	Travel	Weight (g)
GCM-123101M	x	±2	4.5
GCM-123102M	x,y	±2	9.2
GCM-123103M	x,y,z	±2	17

All dimensions are in mm unless otherwise specified.

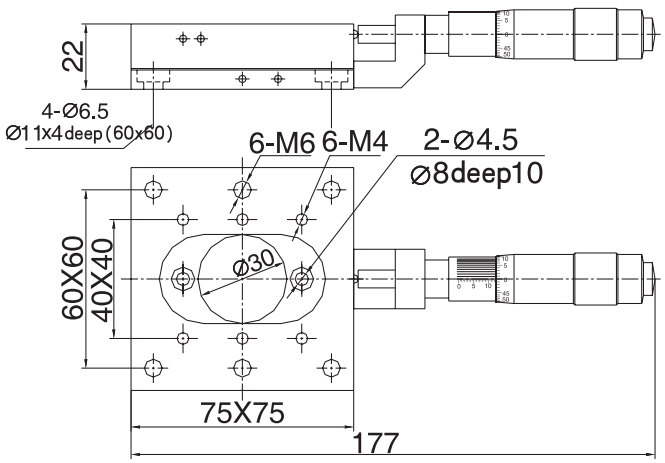
Translation Stages

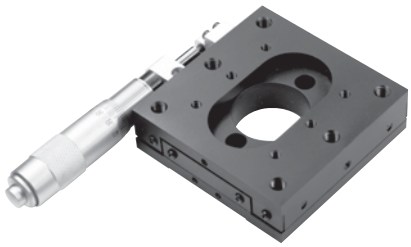
GCM-124/125 Precision Translation Stages

Ball and rod bearing combined with a micrometer (or precision lead screw) drive provide smooth and creep free linear translation with an accuracy of 0.001mm. If fitted with the precision GCM-4111 micrometer, an even higher accuracy can be accomplished. Use product GCM-53 series to build a 3D translation stage.

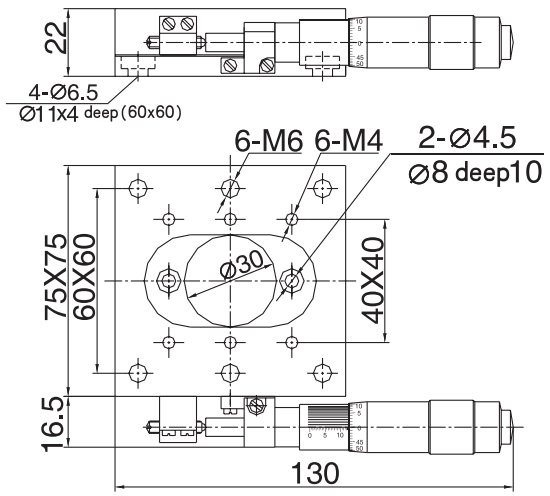


GCM-124501AM



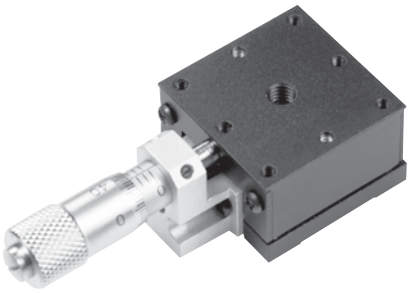


GCM-124501BM

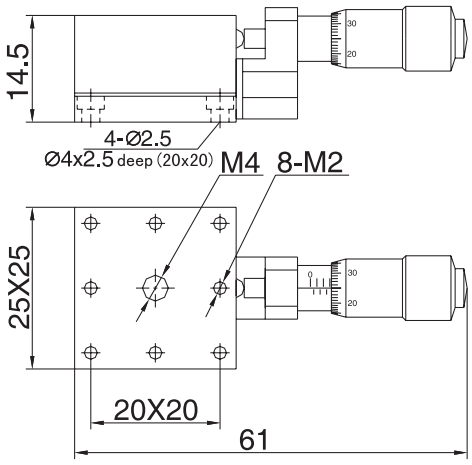


All dimensions are in mm unless otherwise specified.

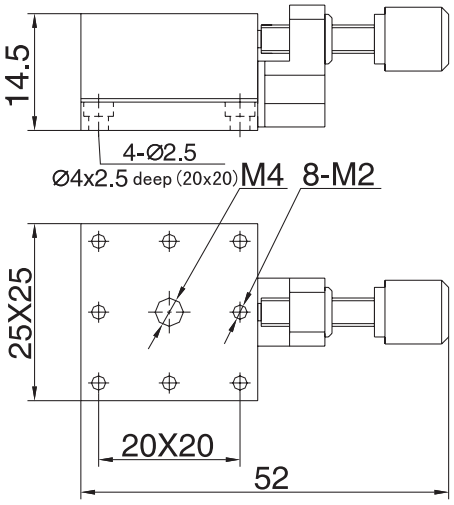
Translation Stages

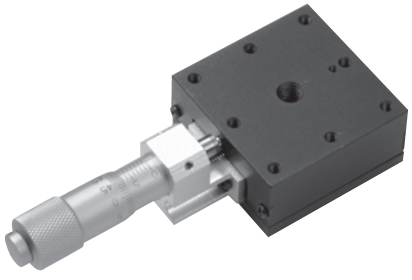


GCM-125001ASM

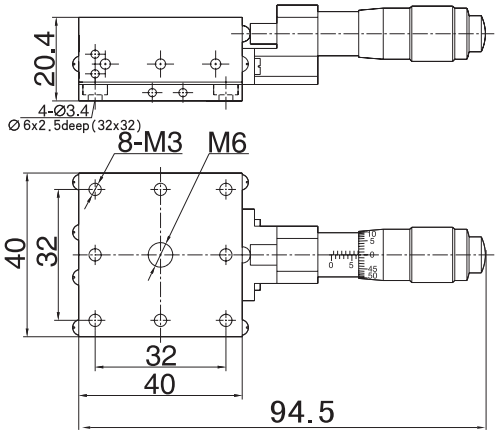


GCM-125001AM





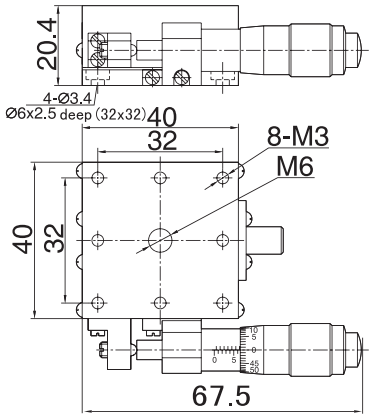
GCM-125101AM

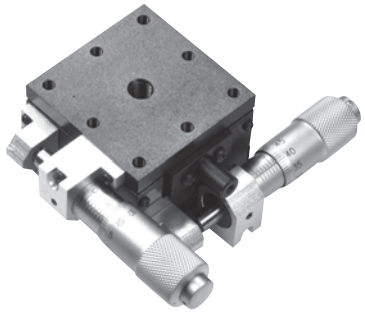


All dimensions are in mm unless otherwise specified.

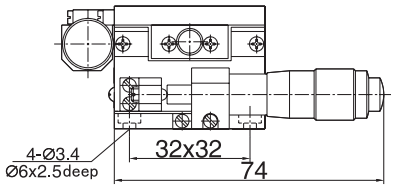
Translation Stages

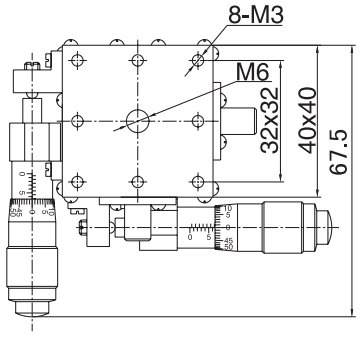
GCM-125101BM

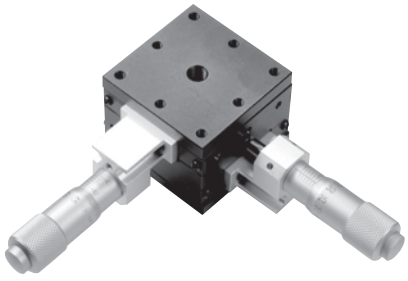




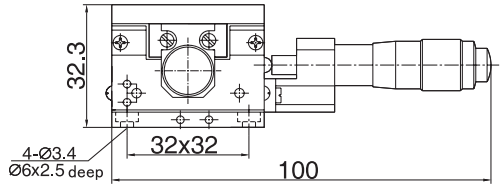
GCM-125102BM

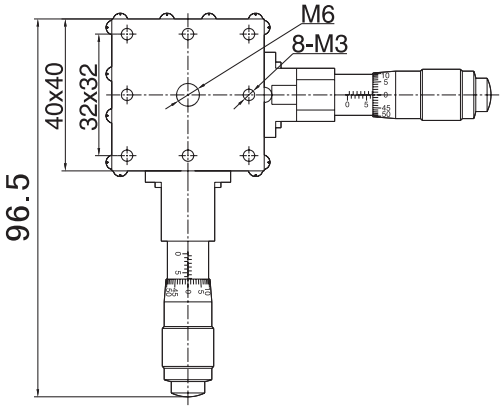






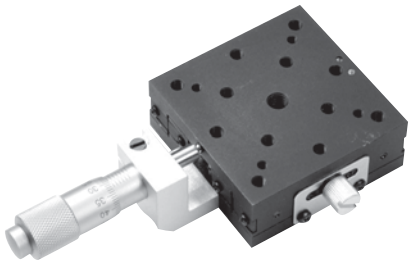
GCM-125102AM



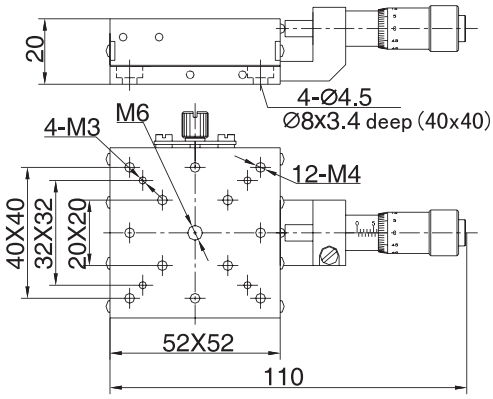


All dimensions are in mm unless otherwise specified.

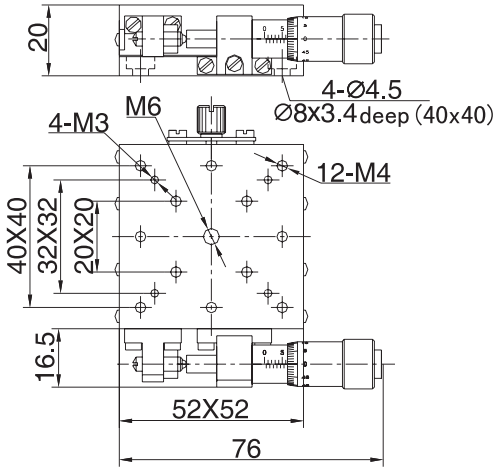
Translation Stages

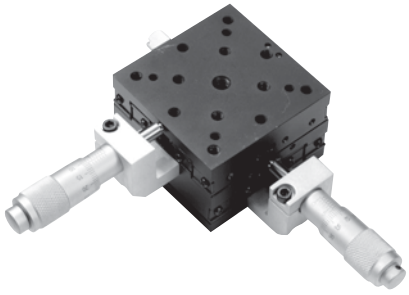


GCM-125201AM

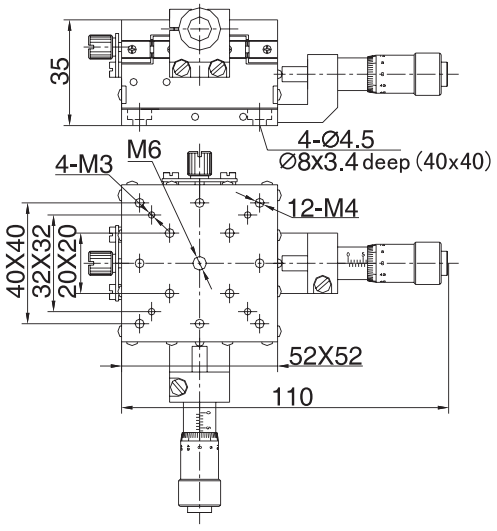


GCM-125201BM



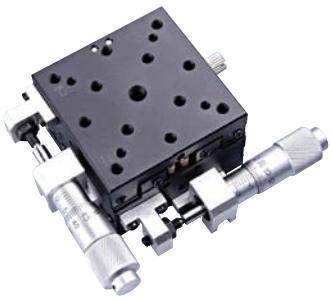


GCM-125202AM

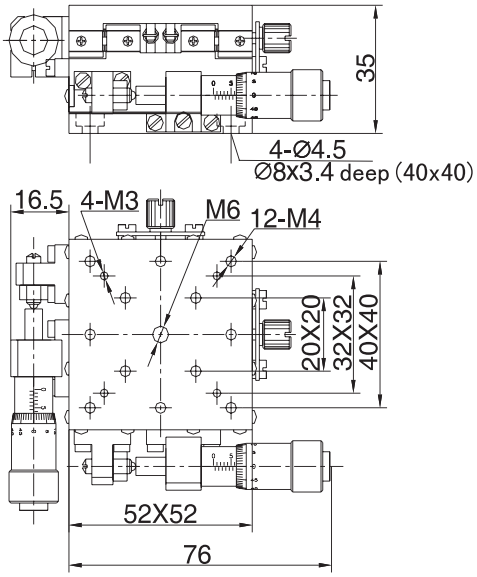


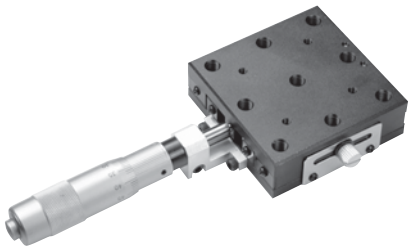
All dimensions are in mm unless otherwise specified.

Translation Stages

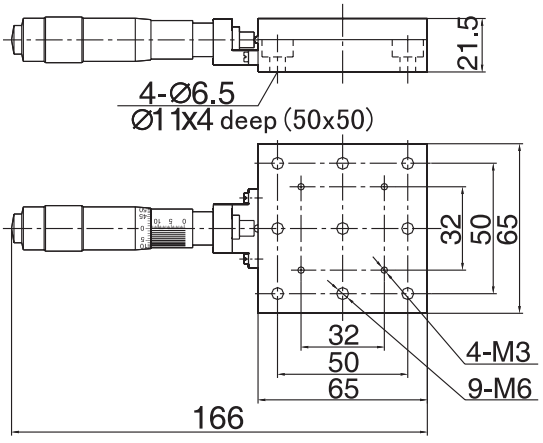


GCM-125202BM





GCM-125301AM



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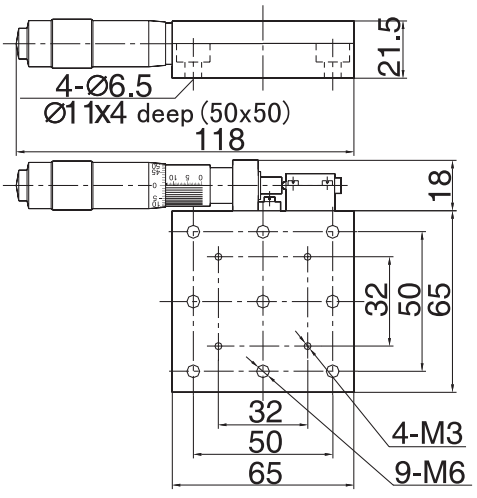
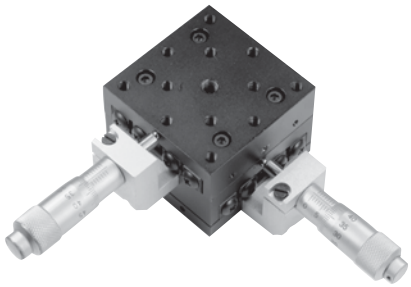
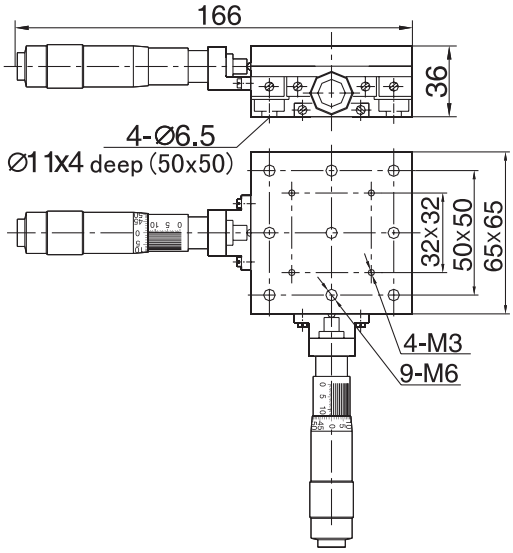


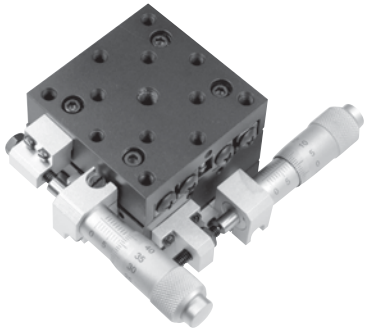
All dimensions are in mm unless otherwise specified.

Translation Stages



GCM-125302AM





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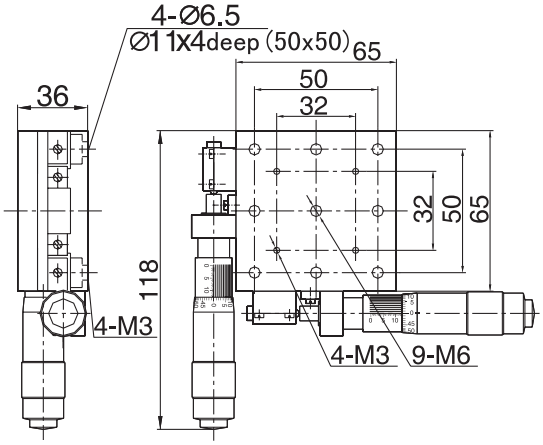
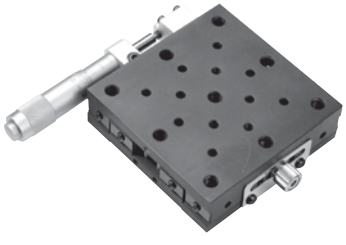
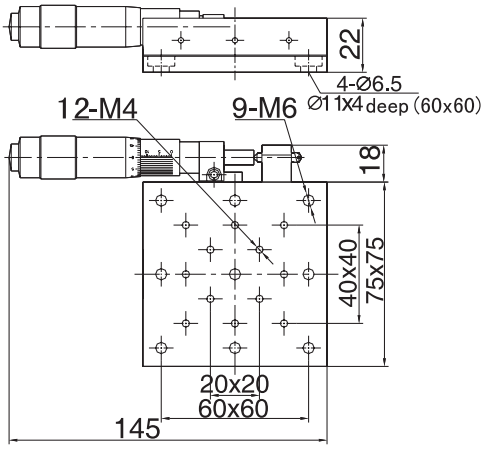




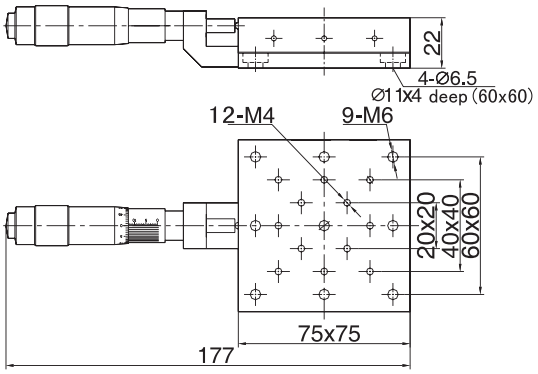
GCM-125401BM

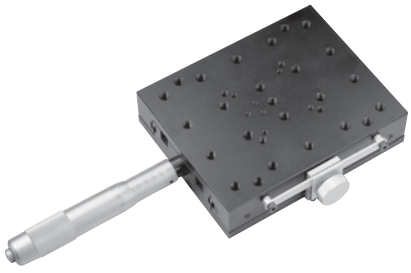


All dimensions are in mm unless otherwise specified.

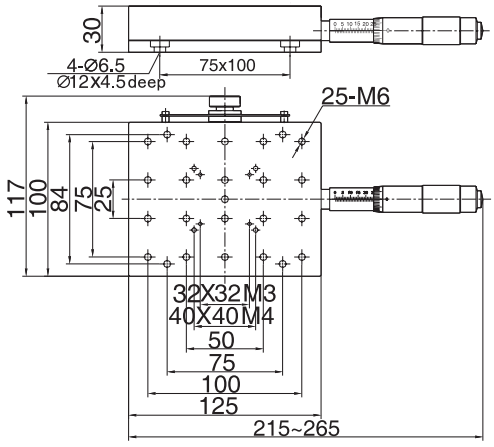
Translation Stages

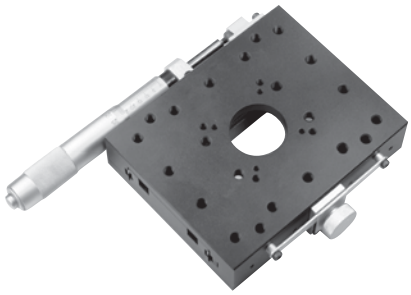
GCM-125401AM



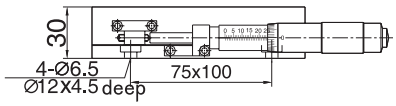


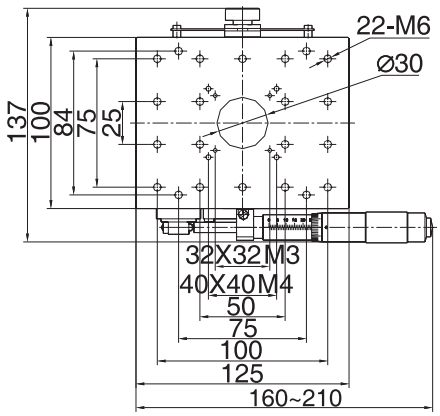
GCM-125501AM





GCM-125501BM





All dimensions are in mm unless otherwise specified.

Translation Stages

GCM-124/125 Precision Translation Stages

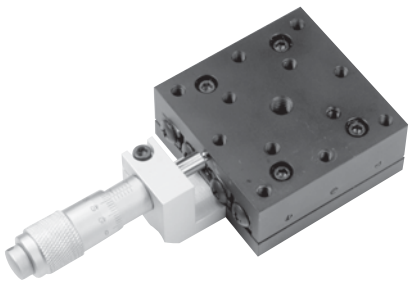
Part No.	Dimension	Travel	Weight (g)
GCM-124501AM	x	±12.5	380
GCM-124501BM	x	±12.5	375
GCM-125001AM	x	±3.25	30
GCM-125001ASM	x	±3.25	40
GCM-125101AM	x	±6.5	130
GCM-125101BM	x	±6.5	130
GCM-125102AM	x-y	±6.5	220
GCM-125102BM	x	±6.5	225
GCM-125201AM	x	±6.5	180
GCM-125201BM	x	±6.5	185
GCM-125202AM	x-y	±6.5	335
GCM-125202BM	x-y	±6.5	335
GCM-125301AM	x	±12.5	330
GCM-125301BM	x	±12.5	345
GCM-125302AM	x-y	±12.5	590
GCM-125302BM	x-y	±12.5	610
GCM-125401AM	x	±12.5	355
GCM-125401BM	x	±12.5	355
GCM-125501AM	x	±25	465
GCM-125501BM	x	±25	475

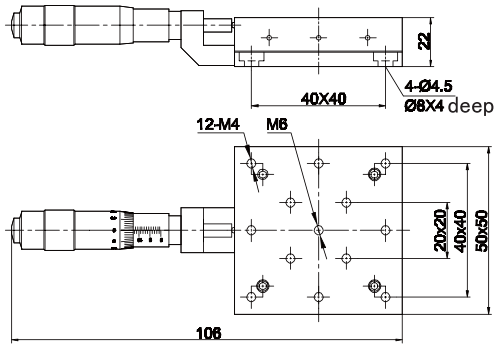
All dimensions are in mm unless otherwise specified.

Translation Stages

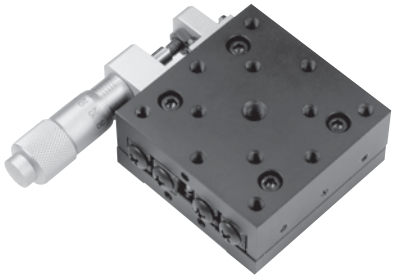
GCM-127 High Precision Translation Stages

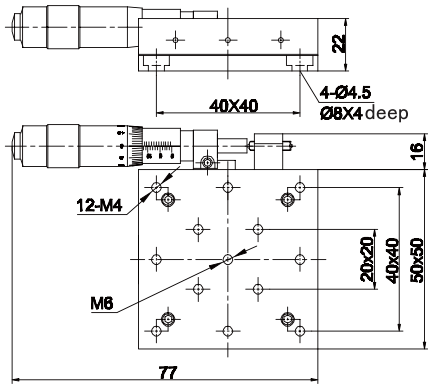
This structure is pre-loaded and characterized by linear-touch contact between the rollers and the grooves. Cylindrical rollers are set in two V-grooves, offering more accurate play-free linear translation. It withstand higher load from all directions. Resolution of 0.001mm is available. Combined with differential micrometers (GCM-4111) much higher resolution can be accomplished. In the table x means a 1-dimensional translation stage; x-y means a 2-dimensional translation stage assembly; A indicates the micrometer mounted at the end (center drive), while B indicates the micrometer at the side (side drive). Use product GCM-53 series to build a 3D translation stage.





GCM-127301AM

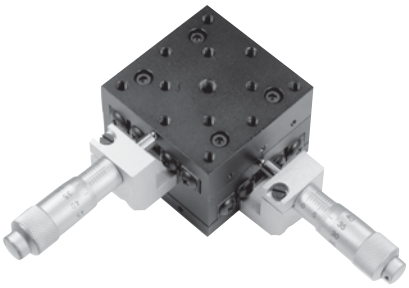




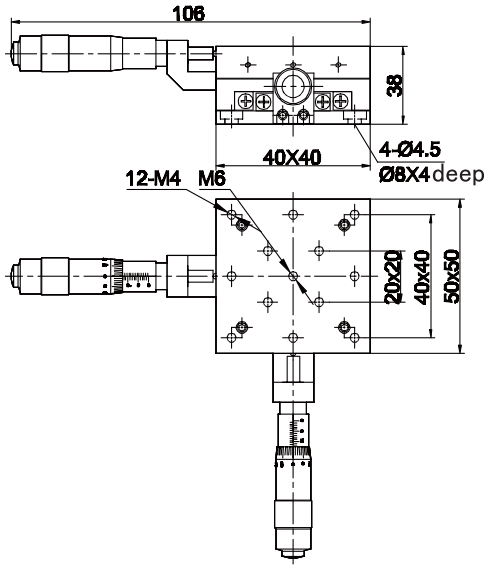
GCM-127301BM

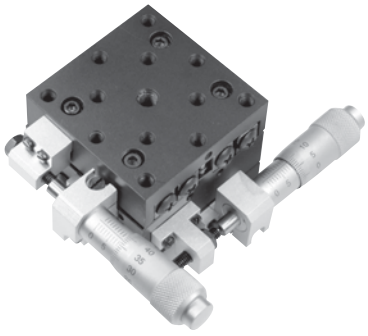
All dimensions are in mm unless otherwise specified.

Translation Stages

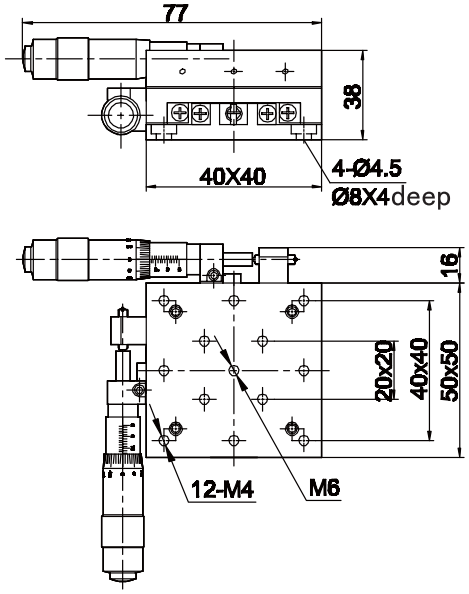


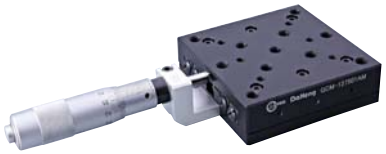
GCM-127302AM



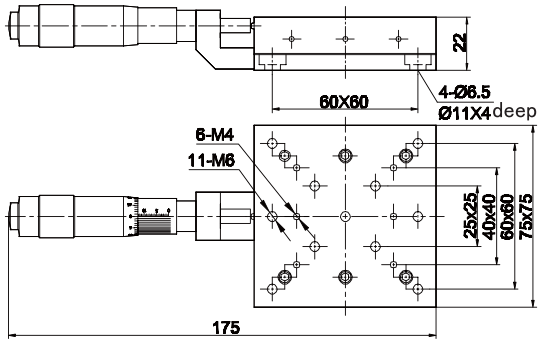


GCM-127302BM



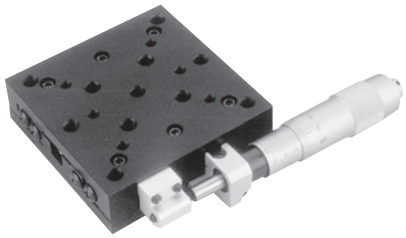


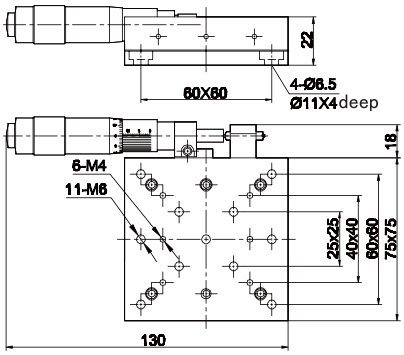
GCM-127501AM



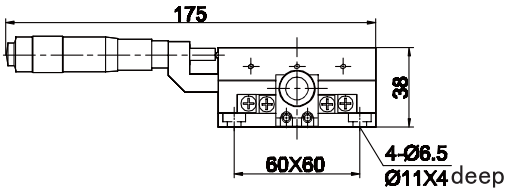
All dimensions are in mm unless otherwise specified.

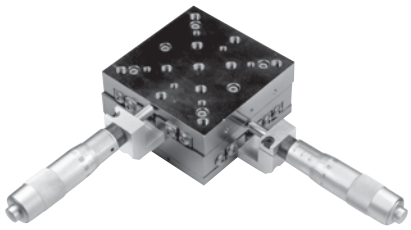
Translation Stages

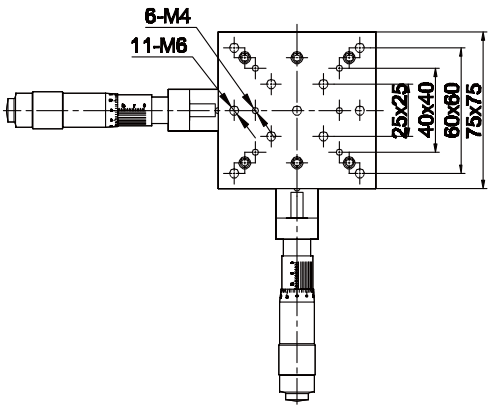




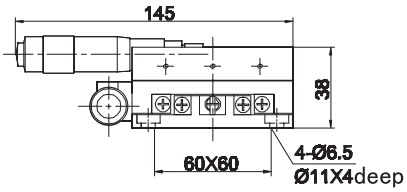
GCM-127501BM

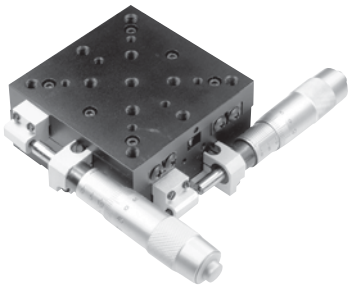


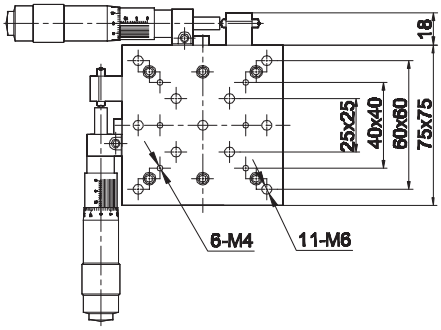




GCM-127502AM



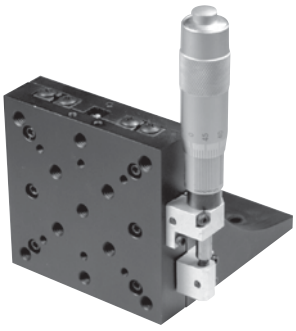




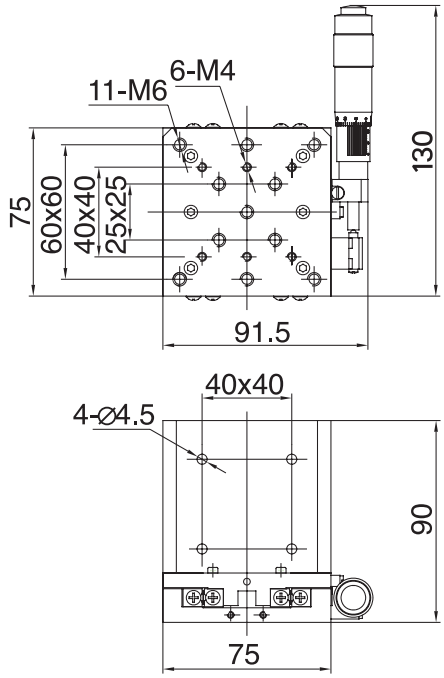
GCM-127502BM

All dimensions are in mm unless otherwise specified.

Translation Stages



GCM-127503BM



GCM-127 High Precision Translation Stages

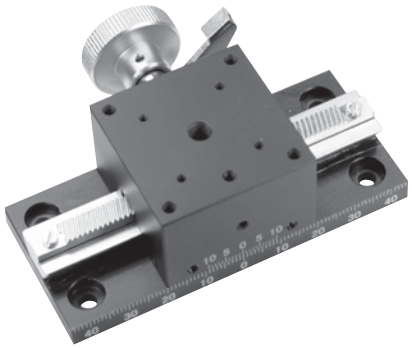
Part No.	Dimension	Travel	Weight (g)
GCM-127301AM	x	±6.5	240
GCM-127301BM	x	±6.5	245
GCM-127302AM	x-y	±6.5	460
GCM-127302BM	x-y	±6.5	460
GCM-127501AM	x	±12.5	515
GCM-127501BM	x	±12.5	510
GCM-127502AM	x-y	±12.5	935
GCM-127502BM	x-y	±12.5	930
GCM-127503BM	Z	±12.5	550

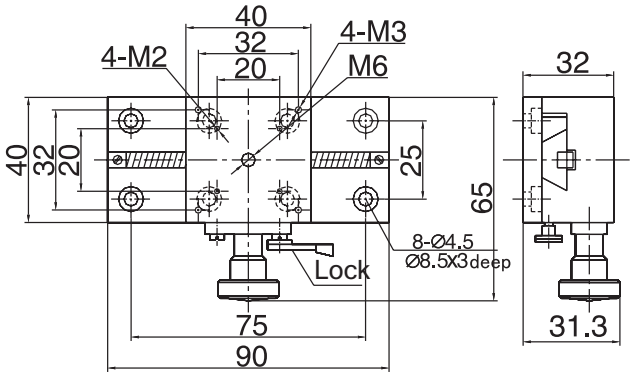
All dimensions are in mm unless otherwise specified.

Translation Stages

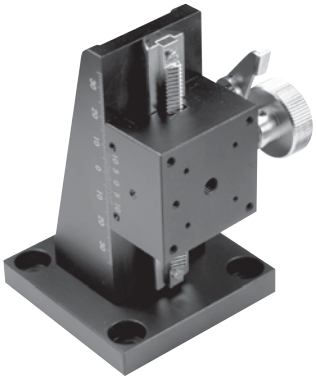
GCM-15 Rack and Pinion Translation Stages

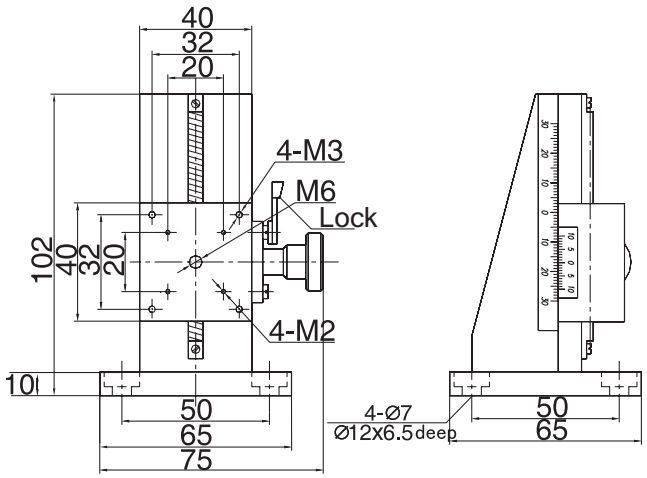
These stages provide the perfect solution for reliable long and fast travel by rack & pinion drive. One, two and three-dimensioned stages are available. A ruled scale and veriner permit a readout accuracy of 0.1mm. In the tables, "x" denotes 1-dimensioned stage in x direction, "z" denotes 1-dimensioned stage in z direction, "x-y" denotes 2-dimensioned stage , "x-z" denotes 2-dimensioned stage, "x-y-z" denotes 3-dimensioned stage.





GCM-150101M



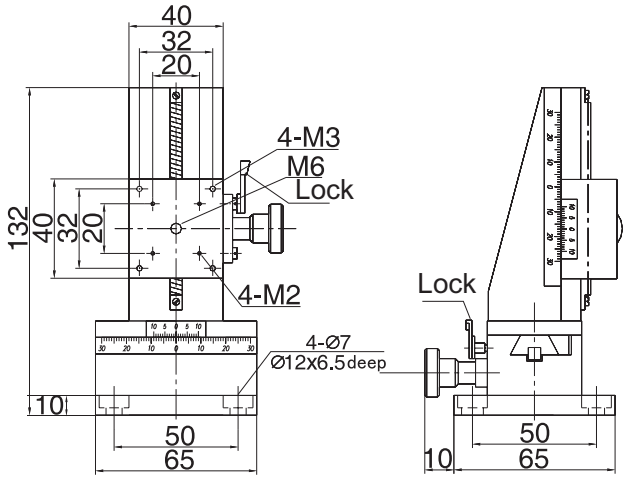


GCM-150102M

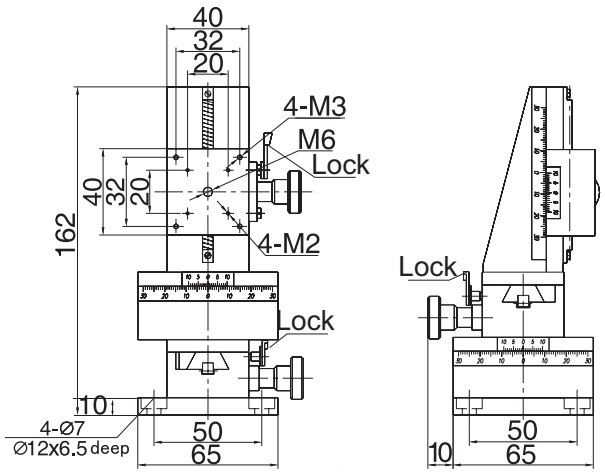
All dimensions are in mm unless otherwise specified.

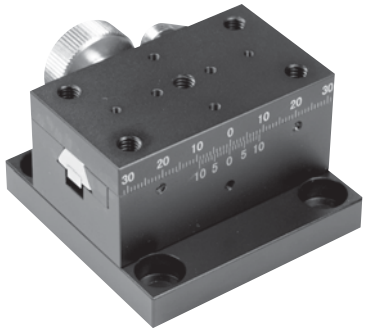
Translation Stages

GCM-150103M

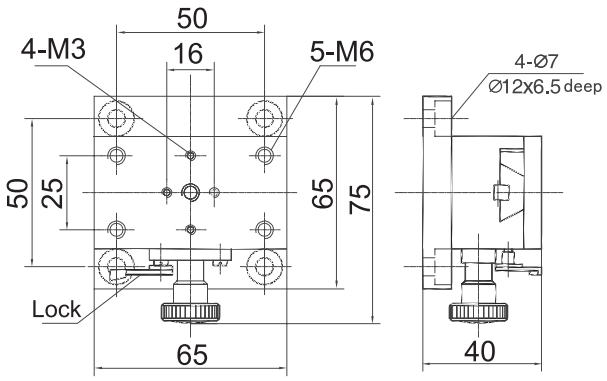


GCM-150104M



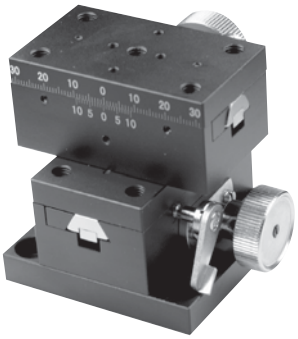


GCM-150201M

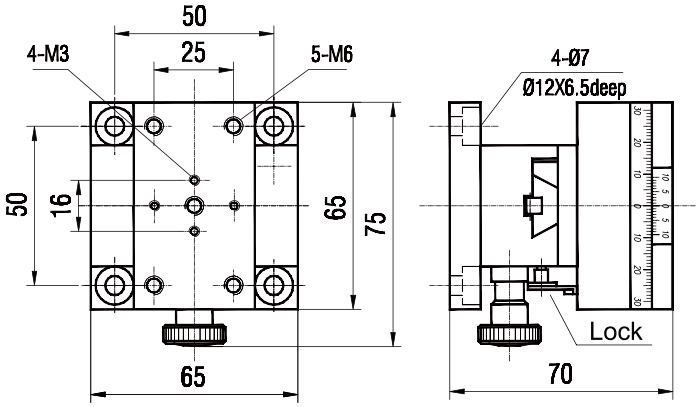


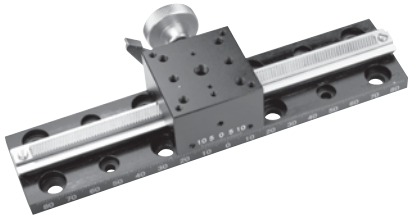
All dimensions are in mm unless otherwise specified.

Translation Stages

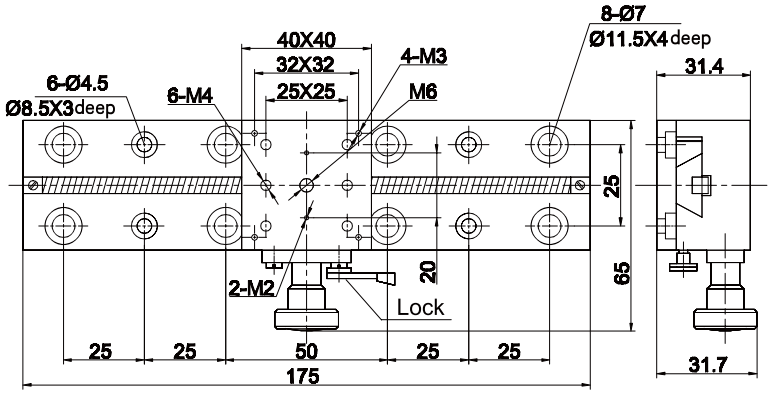


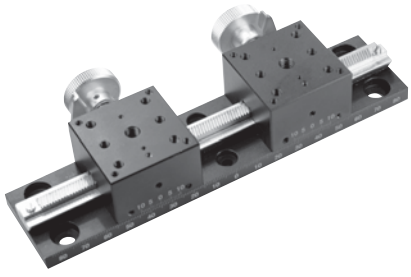
GCM-150202M



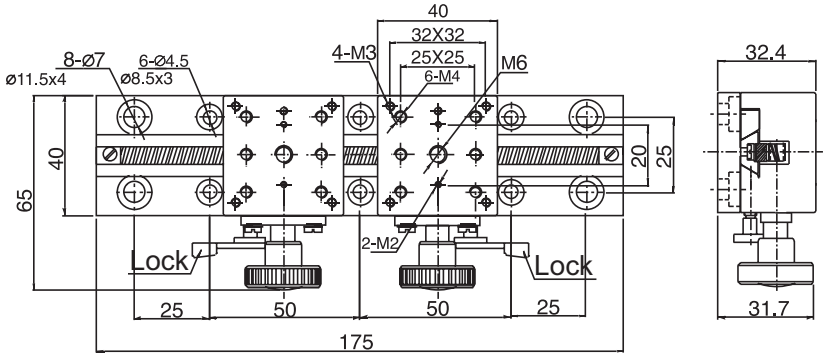


GCM-150301M





GCM-150401M



All dimensions are in mm unless otherwise specified.

Translation Stages

GCM-15 Rack and Pinion Translation Stages

Part No.	Dimension	Travel	Weight (g)
GCM-150101M	x	x:±35	275
GCM-150102M	z	z:±25	305
GCM-150103M	x-z	x,z:±25	575
GCM-150104M	x-y-z	x,y,z:±25	830
GCM-150201M	x	x:±25	360
GCM-150202M	x-y	x,y:±25	720
GCM-150301M	x	x:±77	315
GCM-150401M	x	x:90	355

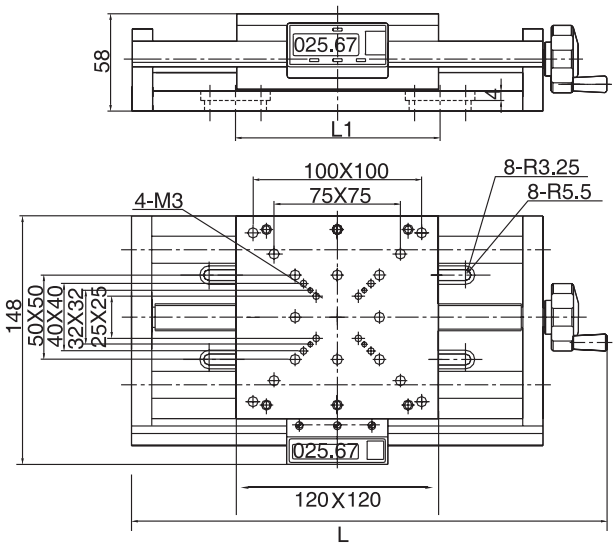
All dimensions are in mm unless otherwise specified.

Translation Stages

GCM-83 Digital Display Translation Stages

The GCM-83 series Digital Display Translation stages use bearing rails to accomplish a linear movement. They can provide a long distance smooth movement. The position can be digitally displayed by LED with a resolution of 0.01mm. These stages can be integrated to make a 2-dimensional or 3-dimensional stage upon the request.

GCM-83



GCM-83xxxx

GCM-83 Digital Display Translation Stages

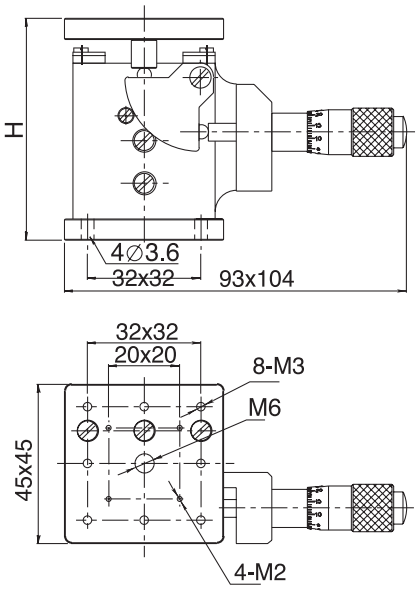
Part No.	Travel	L	L1	Weight (g)
GCM-830301M	50	50	50	3550
GCM-830302M	75	75	75	3850
GCM-830303M	100	100	100	4100
GCM-830304M	150	150	150	4540

All dimensions are in mm unless otherwise specified.

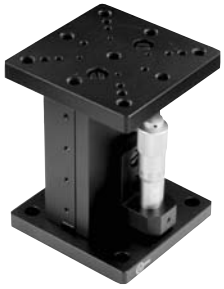
Translation Stages

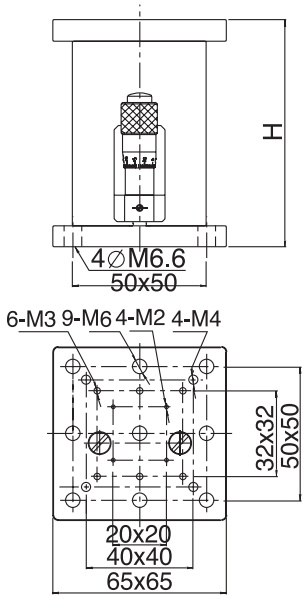
GCM-160 Ball Bearing Mini Vertical Translation Stages

Vertical translation is achieved through a precision ball and rod bearing. A micrometer and pre-leaded spring drive ensures smooth, accurate and backlash free movement.



GCM-1601M





GCM-1602M

GCM-160 Ball Bearing Mini Vertical Translation Stages

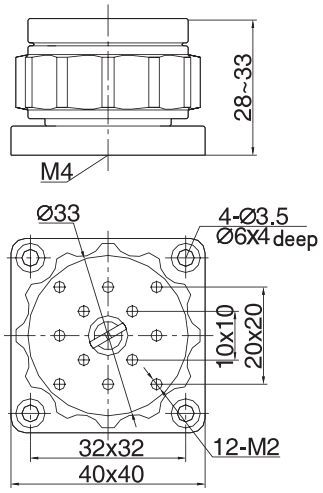
Part No.	H_{min}	H_{max}	Display Accuracy	Weight (g)
GCM-1601M	55	66	0.01mm	230
GCM-1602M	85	97.5	0.01mm	455

All dimensions are in mm unless otherwise specified.

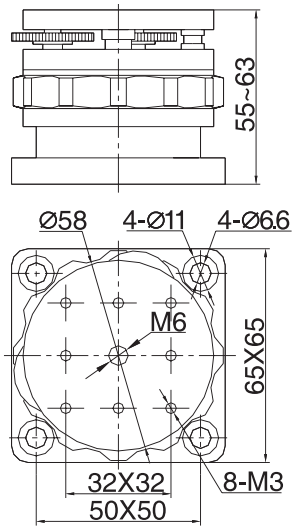
Translation Stages

GCM-161 Mini Threaded Vertical Translation Stages

Smooth, accurate and backlash free/Vertical translation is achieved by screws thread motion. The GCM-1612 model can also be tilted about the X and Y axes through 3, which makes leveling of the platform a simple operation.



GCM-1611M



GCM-1612M

GCM-162 High Precision Vertical Translation Stages

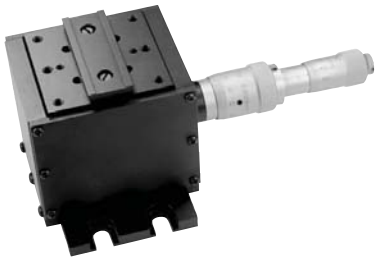
Part No.	Weight (g)
GCM-1611M	75
GCM-1612M	355

All dimensions are in mm unless otherwise specified.

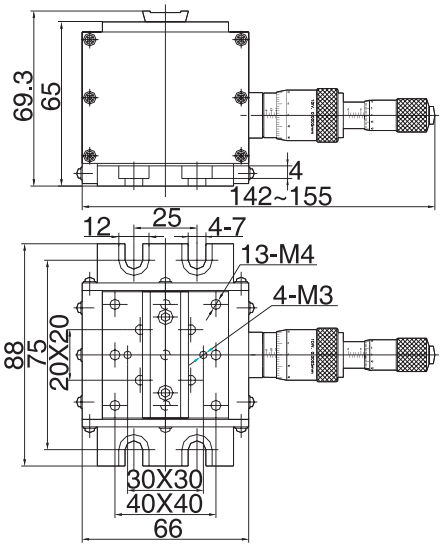
Translation Stages

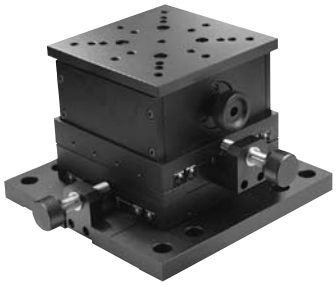
GCM-162 High Precision Vertical Translation Stages

This device provides smooth and play-free vertical motion driven by a precision micrometer. The dovetail guide enables it to withstand higher loads. A standard dovetail is set on the working surface to adapt any other components.

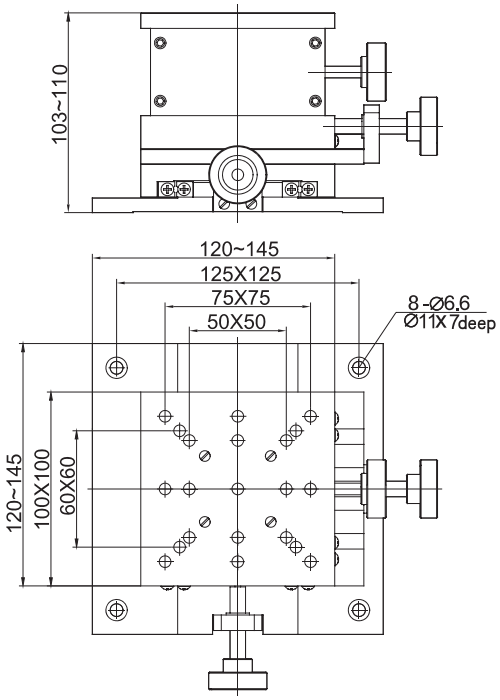


GCM-1622M





GCM-1623M



GCM-162 High Precision Vertical Translation Stages

Part No.	Resolution	Weight (g)
GCM-1622M	0.25μm	26.5
GCM-1623M	1μm	40

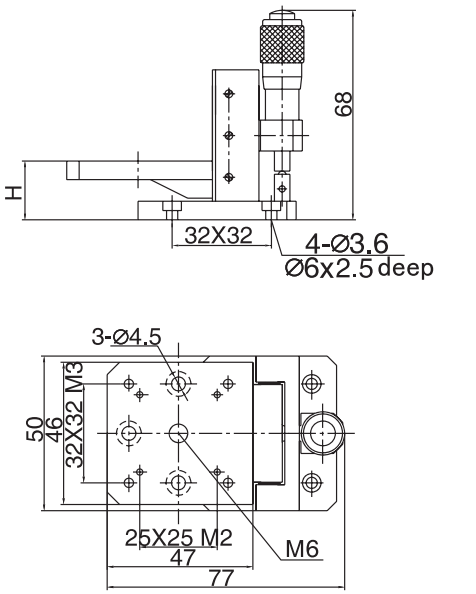
All dimensions are in mm unless otherwise specified.

Translation Stages

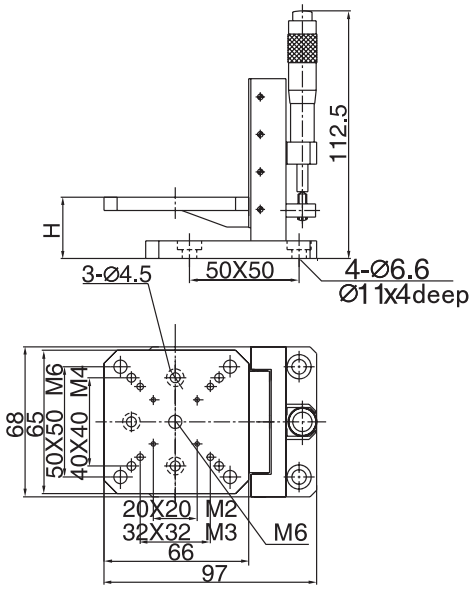
GCM-164 Side-Driven Vertical Stages

The Side-Driven Vertical Stage combines a linear translation stage with a L plate to provide the precision height adjustment. One of the advantages is that the carrier stage can be lowered to a relatively low level so as to improve the stability of a whole optical system.

GCM-1641M



GCM-1642M



GCM-164 Side-Driven Vertical Stages

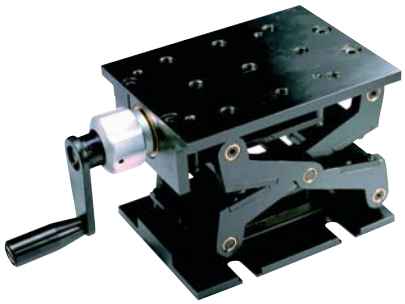
Part No.	H_{min}	H_{max}	Weight (g)
GCM-1641M	12.5	25	230
GCM-1642M	15	40	385

All dimensions are in mm unless otherwise specified.

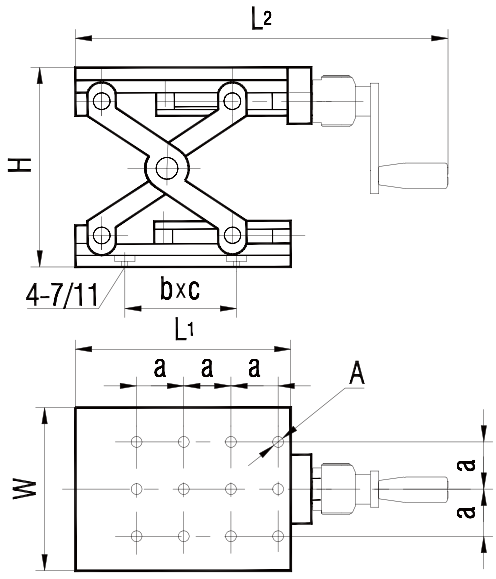
Translation Stages

GCM-17 Lab Jacks

Lab Jacks provide stable smooth height adjustment and high load capacity. Operation is very simple. The reliability of these jacks make them ideal for setting the height of various optical components, assemblies and lasers.



GCM-1701M/1702M/1703M



GCM-1701M/1702M/1703M

GCM-17 Lab Jacks

Part No.	L1	L2	W	a	b	c	H_{min}	H_{max}	Bearing	A	Weight (g)
GCM-1701M	100	164	75	25	50	50	75	109.5	15kg	9-M6	1465
GCM-1702M	130	194	100	25	50	75	92	130	30kg	15- M6	3455
GCM-1703M	230	294	150	25	125	75x2	128	222	50kg	41- M6	10125

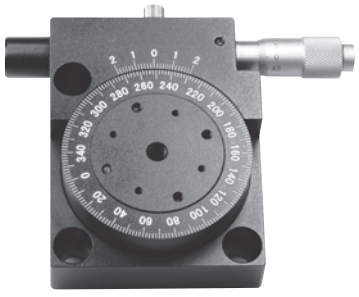
All dimensions are in mm unless otherwise specified.

Rotation Stages 244~252

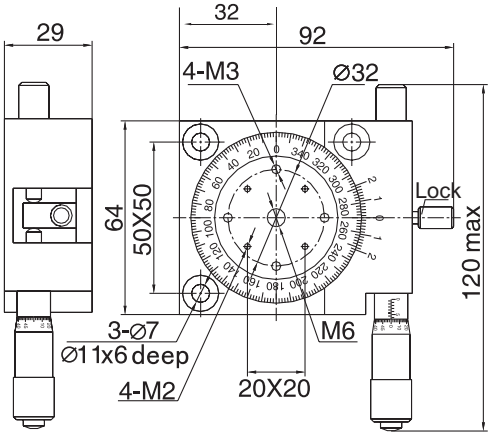
Rotation Stages

GCM-110 Rotation Stages

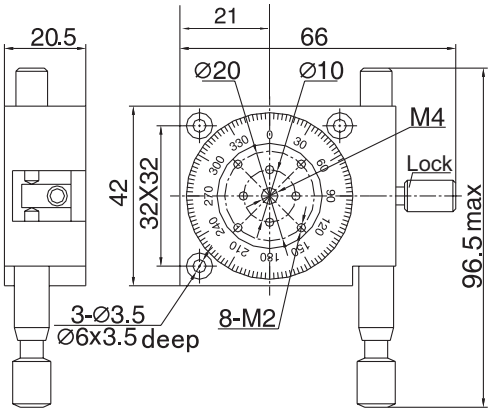
These stages allow manual rotation through 360° and fine angular adjustments achieved through a precision worm gear drive or micrometer movement. The GCM-1104M and GCM-1105M models have a central hole to allow the passage of light or can be fitted with an optional adapter (GCM-110401M or GCM-110501M, respectively) for conversion to a solid rotation stage. The GCM-11 series can be mounted on the GCM-12 series Translation Stages or other optical platforms.



GCM-1101M

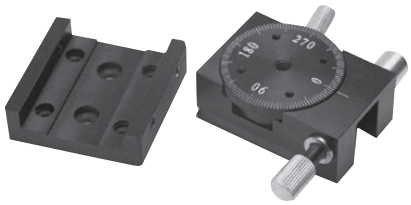


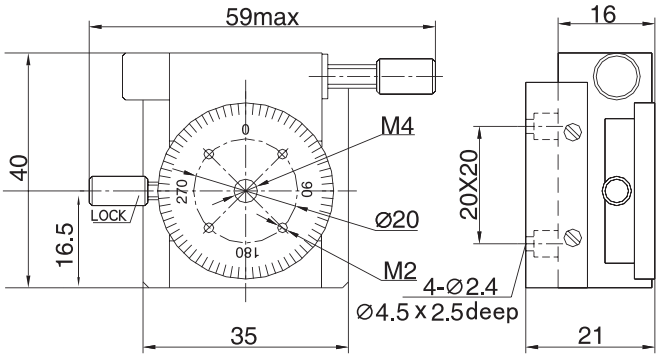
GCM-1102M



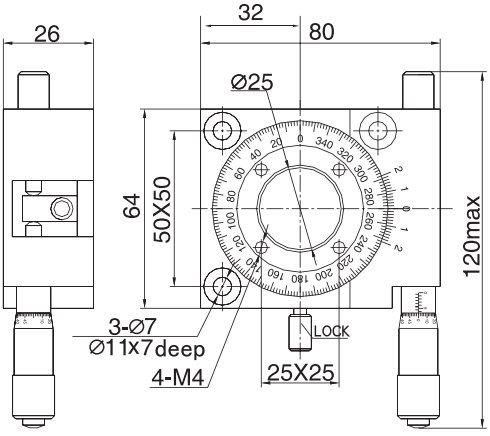
All dimensions are in mm unless otherwise specified.

Rotation Stages

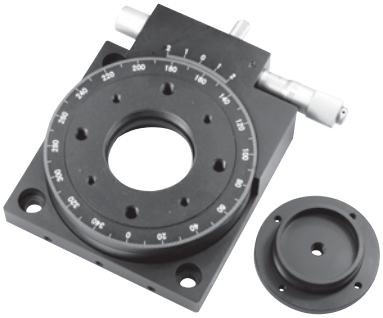


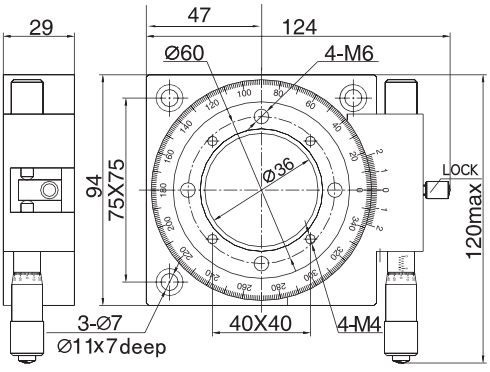


GCM-1103M



GCM-1104M

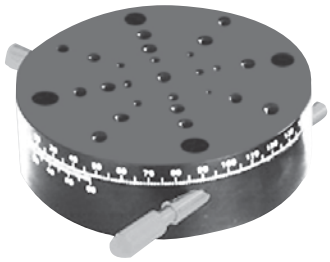




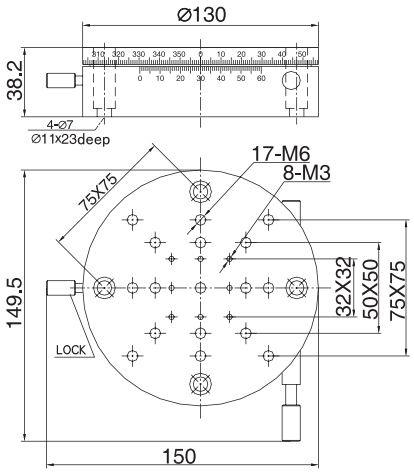
GCM-1105M

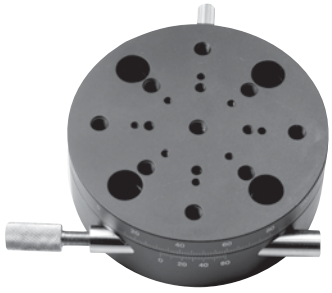
All dimensions are in mm unless otherwise specified.

Rotation Stages

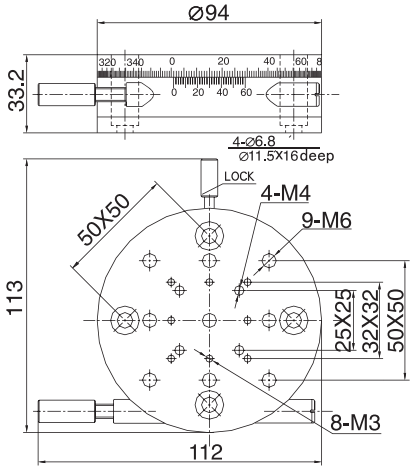


GCM-1106M

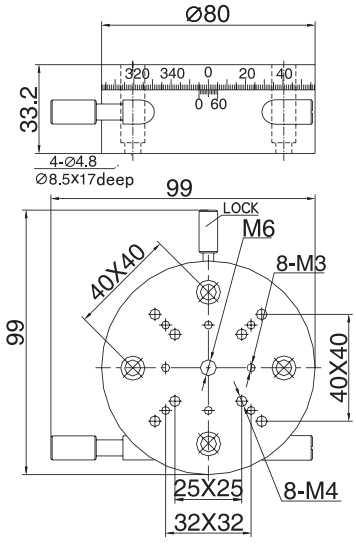




GCM-1107M



GCM-1108M



All dimensions are in mm unless otherwise specified.

Rotation Stages

GCM-110 Rotation Stages

Part No.	Fine Adjustment	Resolution	Weight (g)
GCM-1101M	±4°	±10'	305
GCM-1102M	±5°	±10'	110
GCM-1103M	±4°	±10'	65
GCM-1104M	±5°	±10'	285
GCM-1105M	±4°	±6'	565
GCM-1106M	±4°	±1'	1190
GCM-1107M	±5°	±2'	555
GCM-1108M	±3°	±5'	420

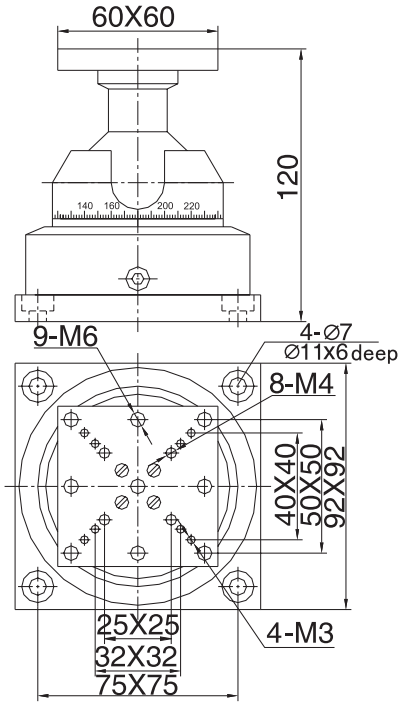
All dimensions are in mm unless otherwise specified.

Rotation Stages

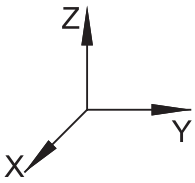
GCM-1112M Gimbal Base

GCM-1112M

The GCM-1112M base is a socket-mounted platform with a high precision ball that offers free spherical motion over a complete hemisphere. A single locking mechanism provides reliable and rapid angular positioning of any component mounted on the base.



GCM-1112M



GCM-1112M Gimbal Base

Part No.	Weight (g)
GCM-1112M	930

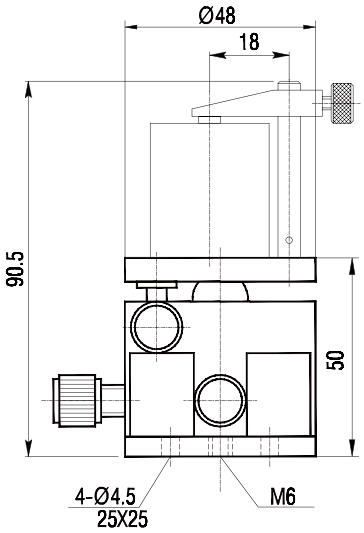
All dimensions are in mm unless otherwise specified.

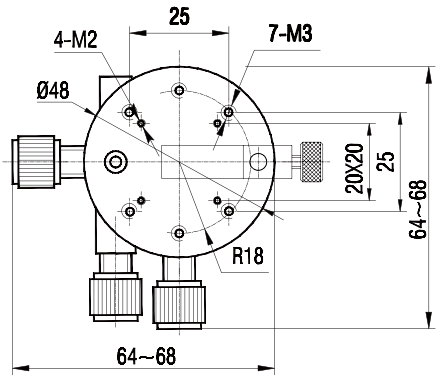
Rotation Stages

GCM-112 3-Axis Precision Rotation Stage

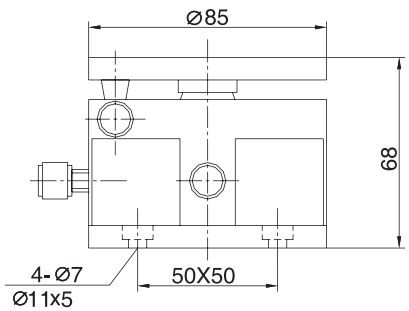
These stages allow precise angular alignment about the X,Y and Z axes through ±5°with an accuracy of 10'. A convenient clamp arm secures the optical element.

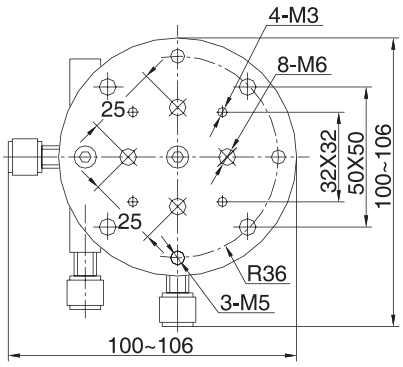
GCM-1121M





GCM-1122M

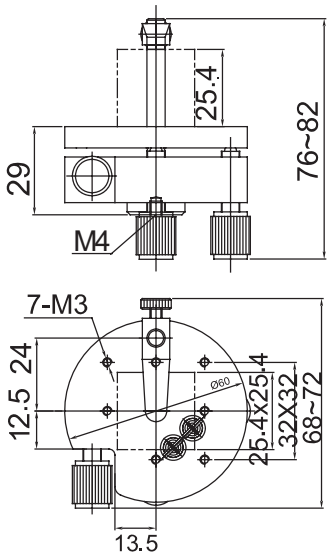




All dimensions are in mm unless otherwise specified.

Rotation Stages

GCM-1122M



GCM-112 3-Axis Precision Rotation Stage

Part No.	Adjustment	Resolution	Weight (g)
GCM-1121M	±5°	±10'	235
GCM-1122M	±5°	±10'	770
GCM-1123M	4°	2	210

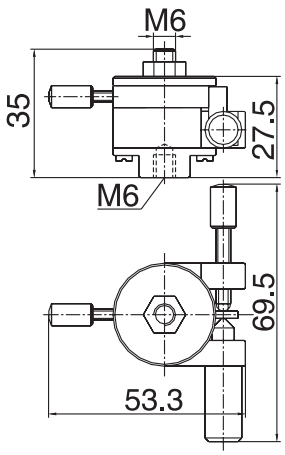
All dimensions are in mm unless otherwise specified.

Rotation Stages

GCM-113 Rotation Adapter

The Rotation adapter allows 360°rotation manually with ±5°fine angle adjustment. A thread of M6 adapts other components or modules.

GCM-1131M



GCM-1131M

GCM-113 Rotation Adapter

Part No.	Adjustment	Resolution	Weight (g)
GCM-1131M	±5°	±10'	105

All dimensions are in mm unless otherwise specified.

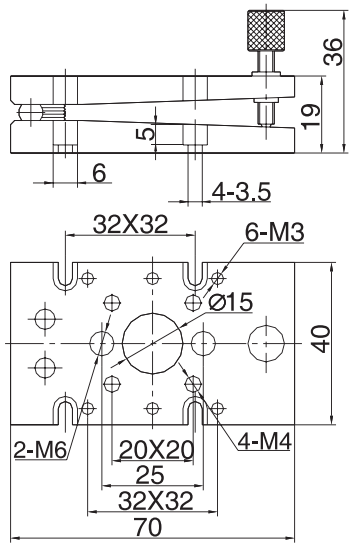
Tilt Platforms

Tilt Platforms

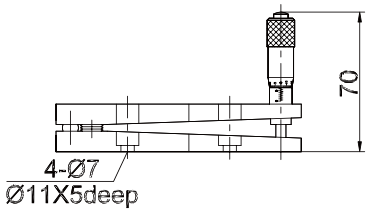
GCM-190 Single-Axis Tilt Platforms

Single-axis tilt platforms provide stable, high-resolution alignment and high load capacity. They offer precise and smooth adjustment with backlash-free motion.

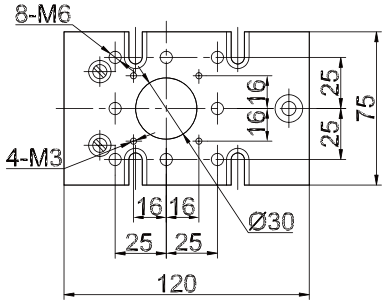
GCM-1901M



GCM-1901M



GCM-1902M



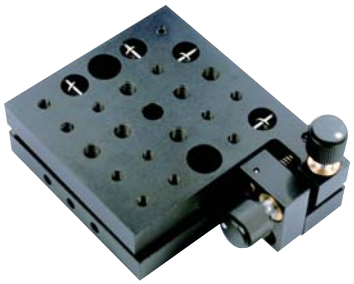
GCM-1902M

GCM-190 Single-Axis Tilt Platforms

Part No.	Display Accuracy	Weight (g)
GCM-1901M	±3.8°	100
GCM-1902M	±3.8°	490

All dimensions are in mm unless otherwise specified.

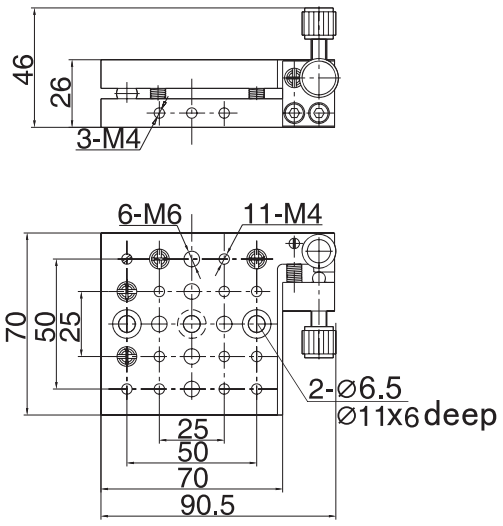
Tilt Platforms



GCM-1911M

GCM-191 Rotatable Tilt Platform

After from being able to be tilted, this platform can also be rotated through a small angle in the horizontal plane.



GCM-1911M

GCM-191 Rotatable Tilt Platform

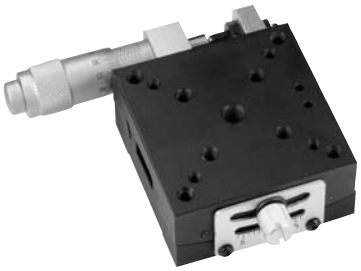
Part No.	Tilt Angle	Rotation Angle	Weight (g)
GCM-1911M	±1.8°	±1.8°	350

All dimensions are in mm unless otherwise specified.

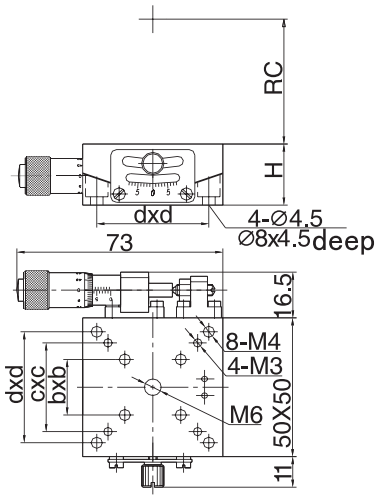
Tilt Platforms

GCM-73 Goniometers

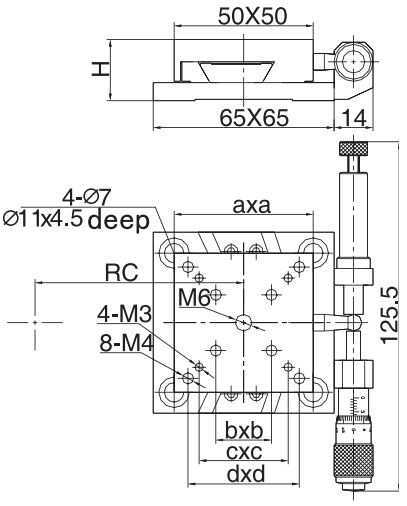
Goniometers are used to rotate an object or a sample around a point in space. The center of rotation is located over the center of the table.These goniometers can be used either alone or integrated together to accomplish a 2-dimensional tilt motion with common rotation center. A 3-dimensional tilt motion with two different rotation centers is also available.
The mechanism uses precision dovetail slides. A scale is marked on the edge of the goniometers to indicate the angle from horizontal.



GCM-730202M

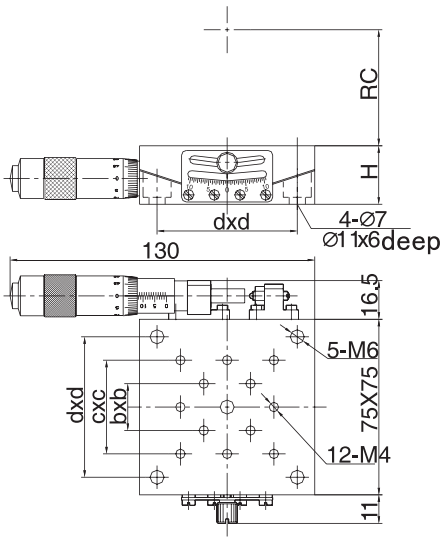


GCM-730201-02M

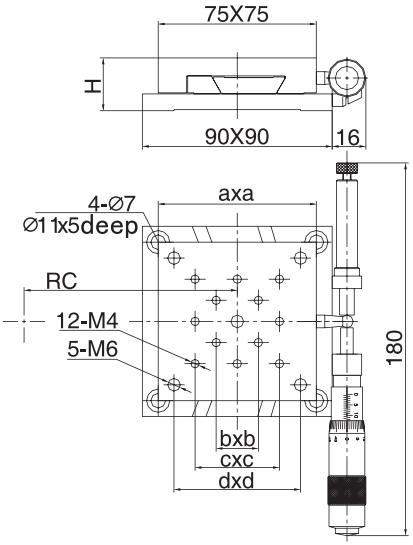


GCM-730206

GCM-730402M



GCM-730401-02M



GCM-730406M

All dimensions are in mm unless otherwise specified.

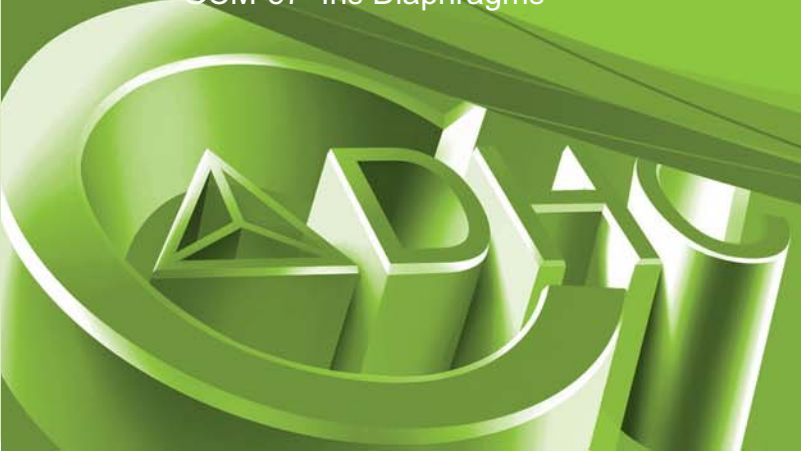
Tilt Platforms

GCM-73 Goniometers

Part No.	H	RC	a x a	b x b	c x c	d x d	Rotate Angle	Weight (g)
GCM-730201M	22	45	——	20x20	32x32	40x40	±5°	180
GCM-730202M	22	67	——	20x20	32x32	40x40	±5°	180
GCM-730206M	22	75	50x50	20x20	32x32	40x40	±3°	190
GCM-730401M	25	75	——	20x20	40x40	60x60	±7.5°	355
GCM-730402M	25	100	——	20x20	40x40	60x60	±7.5°	355
GCM-730406M	25	125	75x75	20x20	40x40	60x60	±4°	380

All dimensions are in mm unless otherwise specified.

Mechanical Accessory 258~301

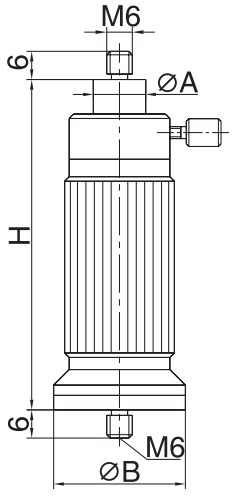


Mechanical Accessory

GCM-01 Threaded Adjustable Post

The height of the posts can be adjusted convenient, quickly and accurately. One complte turn produces 12mm height change. The post can be reliably locked in place by a thumbscrew. The posts can be easily mounted on magnetic bases (GCM-42), magnetic plates (GCM-43), breadboards (GCM-30) and post bases (GCM-53) , or directly mounted to an optical table.

GCM-01



GCM-01

GCM-01 Threaded Adjustable Post

Part No.	ØA	$ØB_{min}$	H_{min}	H_{max}	Weight (g)
GCM-0101M	12	32	50	65	109
GCM-0102M	12	32	60	85	129
GCM-0103M	12	32	75	115	160
GCM-0104M	12	32	110	180	237

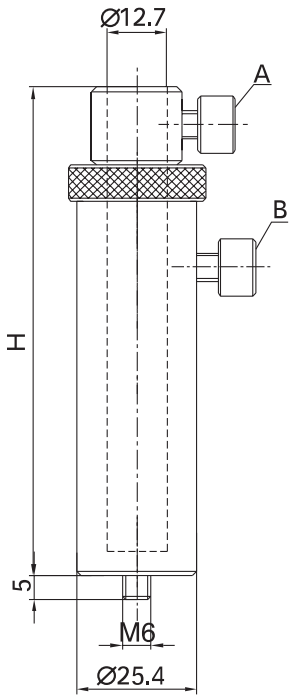
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-02 Coarse-Fine Adjustment Post Holders

GCM-02

GCM-02 Coarse-Fine Adjustment Post Holders provide both coarse and fine height adjustments for the GCM-0301 posts. By loosening screw A; the post can rotate 360° and its height can be coarsely adjusted. After tightening screw A, the height can be finely adjusted by turning the large thumbscrew. Screw B locks the post in place. The holders can be mounted on magnetic bases (GCM-42), magnetic plates (GCM-43), breadboards (GCM-30), and post bases (GCM-53), or directly mounted to an optical table.



GCM-02

GCM-02 Coarse-Fine Adjustment Post Holders

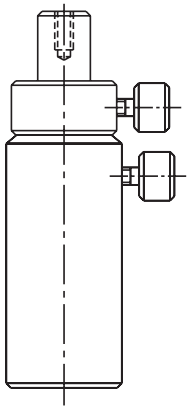
Part No.	H_{min}	H_{max}	Weight (g)
GCM-0201M	77	90	80
GCM-0202M	103	116	95

All dimensions are in mm unless otherwise specified.

Mechanical Accessory

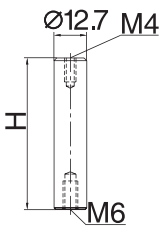
GCM-030 Ø12.7 Series Standard Posts and Holders

This series consists of posts (GCM-0301), clamps (GCM-0302) and holders (GCM-0303), providing a quick way to set the height and angular orientation of mounted components. The posts can be rotated 360° without changing their height. All the posts are of stainless steel. The holders can be mounted on magnetic bases (GCM-42), magnetic plates (GCM-43), breadboards (GCM-30), and post bases (GCM-53), or directly mounted to an optical table.

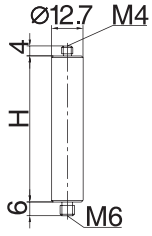


GCM-030

GCM-0301



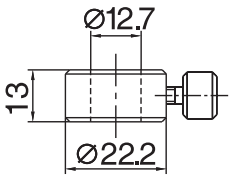
GCM-03010



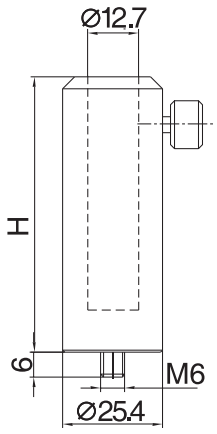
GCM-03011

All dimensions are in mm unless otherwise specified.

Mechanical Accessory



GCM-0302



GCM-0303

GCM-0301 Posts

Part No.	H	Weight (g)
GCM-030101M	51	50
GCM-030102M	76	75
GCM-030103M	102	100
GCM-030104M	152	150
GCM-030105M	203	195
GCM-030106M	305	295
GCM-030107M	25	25
GCM-030108M	37.5	38
GCM-030111M	51	50
GCM-030112M	76	75
GCM-030113M	102	100
GCM-030114M	152	150
GCM-030115M	203	195
GCM-030116M	305	295
GCM-030117M	25	25
GCM-030118M	37.5	38

All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-0302 Clamps

Part No.	Weight (g)
GCM-0302M	15

GCM-0303 Holders

Part No.	H	Weight (g)
GCM-030301M	51	50
GCM-030302M	76	80
GCM-030303M	102	105
GCM-030304M	152	150
GCM-030305M	25	26
GCM-030306M	37.5	38

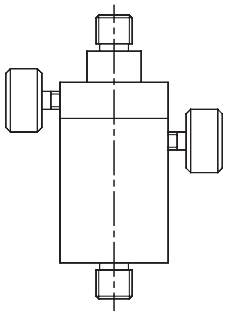
All dimensions are in mm unless otherwise specified.

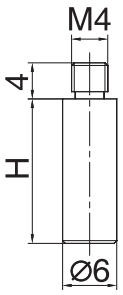
Mechanical Accessory

GCM-031 Ø6 Series Mini Posts and Holders

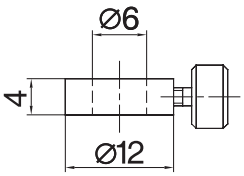
Where space is limited, the GCM-0311 Mini Posts, GCM-0312 Mini Clamps and GCM-0313 Mini Holders can be used. They can be quickly and conveniently assembled into a height and angle adjustable system. The posts can rotate 360° without changing height. The Mini Holders can be mounted on GCM-42 magnetic bases or onto an optical table.

GCM-0313

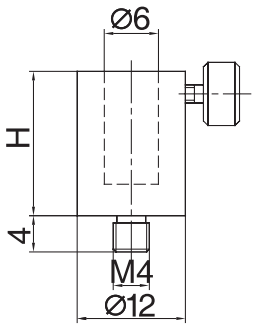




GCM-0311



GCM-0312



GCM-0313

All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-0311 Mini Posts

Part No.	H	Weight (g)
GCM-031101M	16	4
GCM-031102M	21	5
GCM-031103M	26	6
GCM-031104M	31	7

GCM-0312 Mini Clamp

Part No.	Weight (g)
GCM-0312M	2

GCM-0313 Mini Holders

Part No.	H	Weight (g)
GCM-031301M	16	4
GCM-031302M	21	6
GCM-031303M	26	7

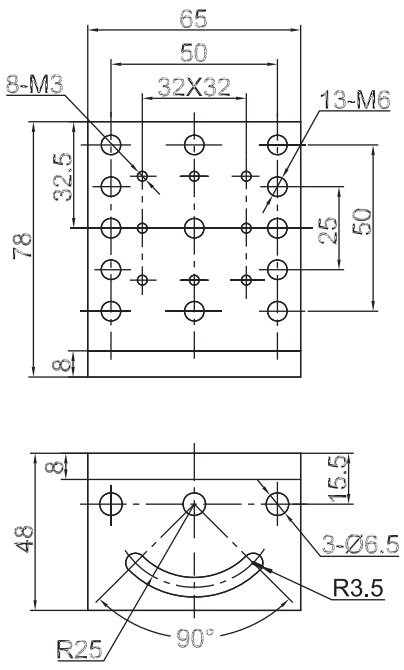
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-22 Ø38.1 Series Posts and Accessories

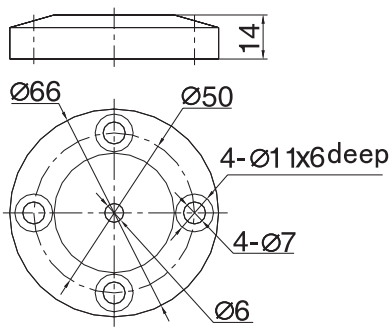
This series include a post, sliding clamp and accessories, providing fast vertical alignment of mounted components with high stability, rigidity and lead capacity. The accessories may be purchased separately or as a system.

GCM-220401M

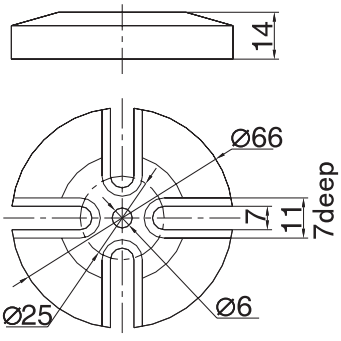


GCM-2204 Right Angle Bracket

Part No.	Weight (g)
GCM-220401M	155



GCM-220501M



GCM-220502M

GCM-2205 Post Bases

Part No.	Weight (g)
GCM-220501M	85
GCM-220502M	70

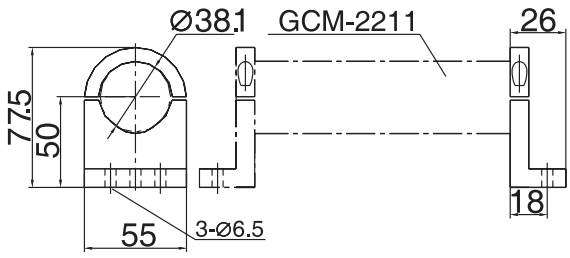
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-220503M

GCM-220503M Mount

The GCM-220503M mount is designed for horizontally holding a 38.1 mm diameter post.



GCM-220503M

GCM-220503M Mount

Part No.	Weight (g)
GCM-220503M	95

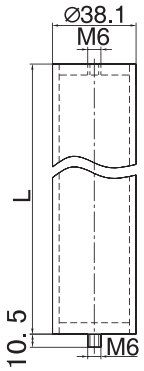
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-2211 Posts

The posts are made of stainless steel. Optical components mounted or a sliding platform attached to the post can be easily raised of lowered over a wide range.

GCM-2211



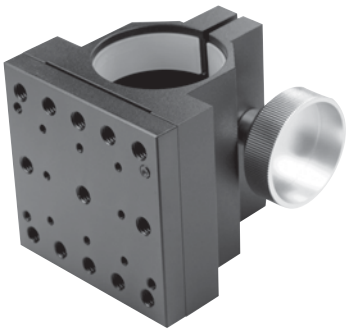
GCM-2211

GCM-2211 Posts

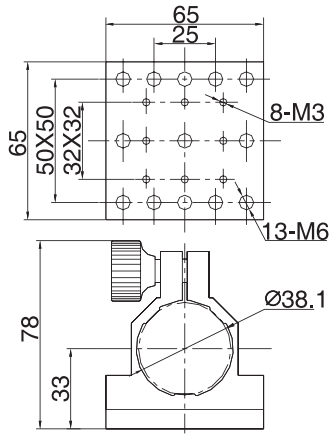
Part No.	L	Weight (g)
GCM-221101M	203	705
GCM-221102M	355	945

GCM-2212 Sliding Bracket Clamp

This clamp is used together with the GCM-2211 posts and other accessories for adjusting the height of optical components. A reliable locking mechanism is incorporated.



GCM-221201M



GCM-221201M

GCM-2212 Sliding Bracket Clamp

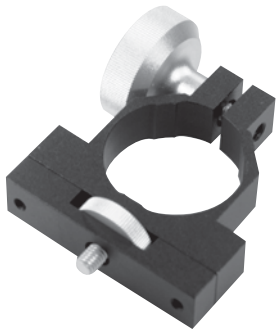
Part No.	Weight (g)
GCM-221201M	355

All dimensions are in mm unless otherwise specified.

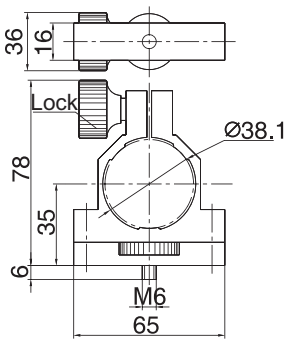
Mechanical Accessory

GCM-2213 Narrow Sliding Clamp

The GCM-2213 Narrow Sliding Clamp is designed for horizontally holding a 38.1 mm diameter post.



GCM-221301M



GCM-221301M

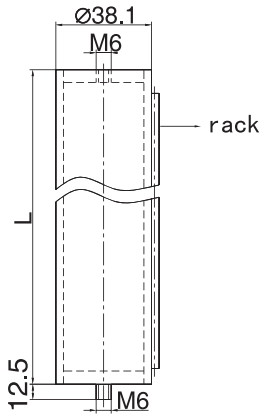
GCM-2213 Narrow Sliding Clamp

Part No.	Weight (g)
GCM-221301M	105

GCM-2221 Gear Rack Posts

These stainless steel posts are fitted with a gear rack and used with a pinion fitted clamp. Mounted optical components can be easily raised or lowered over a wide range.

GCM-2221



GCM-2221M

GCM-2221 Gear Rack Posts

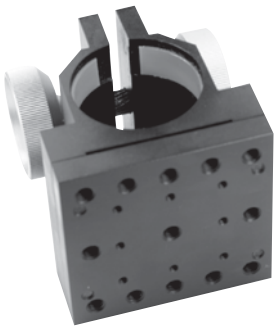
Part No.	L	Weight (g)
GCM-222101M	203	570
GCM-222102M	355	1335

All dimensions are in mm unless otherwise specified.

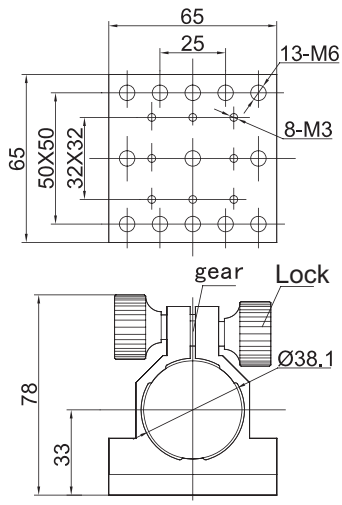
Mechanical Accessory

GCM-2222 Pinion Tilted Clamp

In connection with the GCM-2221 posts, this clamp is used for vertical adjustment of optical components through a reliable rack and pinion movement. The height may be locked in place.



GCM-2222



GCM-222201M

GCM-2222 Pinion Tilted Clamp

Part No.	Weight (g)
GCM-222201M	355

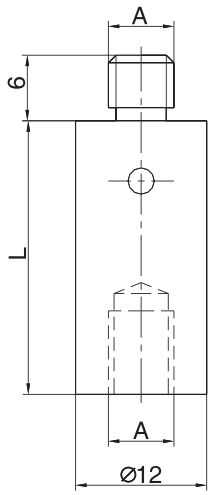
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-51 Extension Posts

GCM-51

The extension posts are supplied in a variety of lengths, ranging from 25mm to 75mm. Threaded at both ends, they can be connected to each other, or mounted on top of other posts such as GCM-01.



GCM-51

GCM-51 Extension Posts

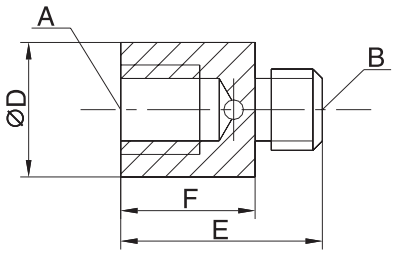
Part No.	A	L
GCM-510101M	M4	25
GCM-510102M	M4	38
GCM-510103M	M4	50
GCM-510104M	M4	63
GCM-510105M	M4	75
GCM-510201M	M6	25
GCM-510202M	M6	38
GCM-510203M	M6	50
GCM-510204M	M6	63
GCM-510205M	M6	75

All dimensions are in mm unless otherwise specified.

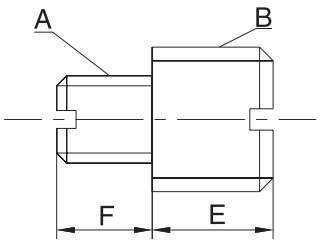
Mechanical Accessory

GCM-54 Screw Adapter Rods

Thread adaptors have threads at both ends. They offer a convenient way to connect components with different threads such as metric and imperial or different diameters.



GCM-540



GCM-541

GCM-54 Screw Adapter Rods

Part No.	A—B	ØD	F	E	Weight (g)
GCM-540101	8-32 to 1/4"-20	10	9	15	2
GCM-540102	8-32 to M4	10	9	14	2
GCM-540103	8-32 to M6	10	9	15	2
GCM-540201	1/4"-20 to 8-32	10	10	15	2

All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-540 Screw Adapter Rods

Part No.	A—B	ØD	F	E	Weight (g)
GCM-540202	1/4"-20 to M4	10	10	15	2
GCM-540203	1/4"-20 to M6	10	10	16	4
GCM-540301	M4 to 8-32	10	9	14	2
GCM-540302	M4 to 1/4"-20	10	9	15	2
GCM-540303	M4 to M6	10	9	15	2
GCM-540401	M6 to 8-32	10	10	15	2
GCM-540402	M6 to 1/4"-20	10	10	16	2
GCM-540403	M6 to M4	10	10	15	5
GCM-540501	M10x1 to 8-32	13	15	20	6
GCM-540502	M10x1 to M4	13	15	20	6
GCM-540503	M10x1 to 1/4"-20	13	15	21	6
GCM-540504	M10x1 to M6	13	15	21	7

GCM-541 Screw Adapters

Part No.	A—B	F	E	Weight (g)
GCM-541101	M4 to M4	5	5	0.2
GCM-541102	M4 to M6	5	6	0.8
GCM-541202	M6 to M6	6	6	1

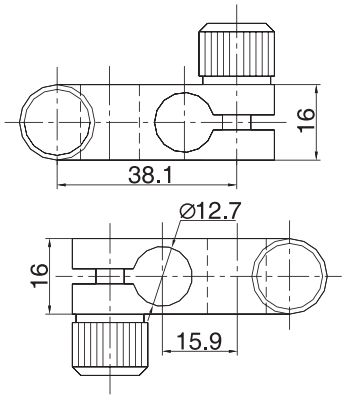
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

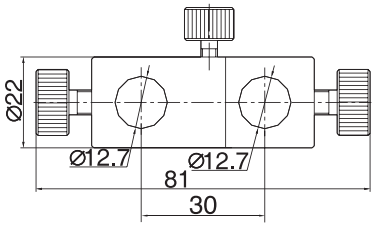
GCM-55 Rod Clamps

The GCM-5501 Series of Rod Clamps are used for securing two rods or lens/mirror holders at 45°, 90°or 360°angle to each other.

GCM-55



GCM-550101

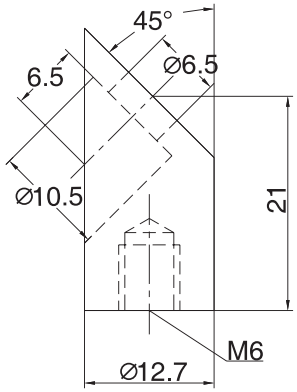


GCM-550102

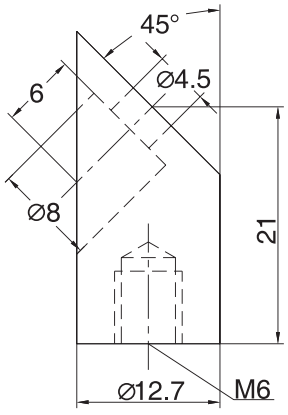
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-550103 GCM-550104



GCM-550103



GCM-550104

GCM-55 Rod Clamps

Part No.	Specification	Weight (g)
GCM-550101M	90°、 Ø12.7	65
GCM-550102M	360° 、Ø12.7	55
GCM-550103M	45° 、M6	5
GCM-550104M	45°、 M4	6

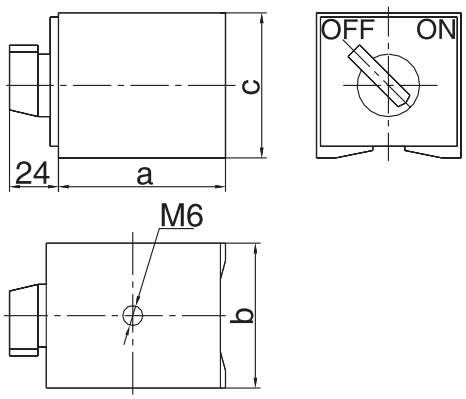
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

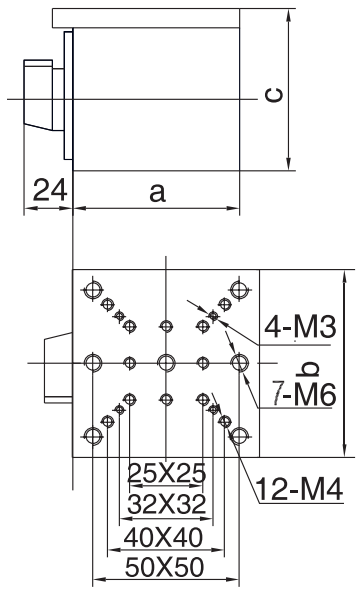
GCM-42 Magnetic Bases

Magnetic bases provide a solid, stable support for optical components. A tapped hole can accommodate various posts such as the GCM-01, GCM-02 and GCM-03.

GCM-420101M



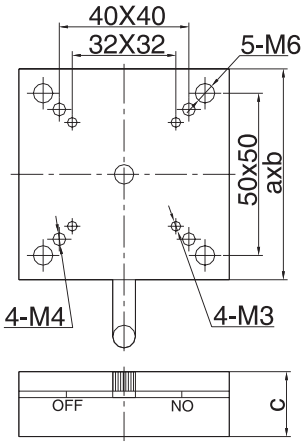
GCM-420102M

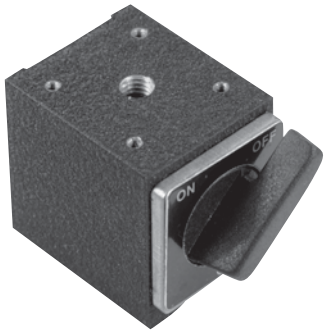


All dimensions are in mm unless otherwise specified.

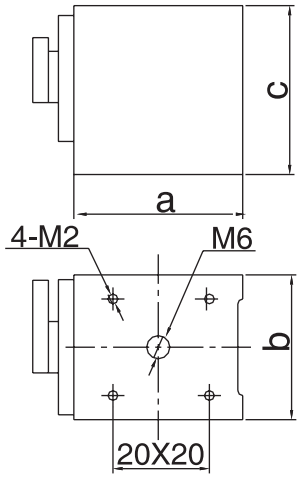
Mechanical Accessory

GCM-420302M





GCM-420401M



GCM-42 Magnetic Bases

Part No.	a	b	c	Attractive force (kg)	Weight (g)
GCM-420101M	61	51	55	145	450
GCM-420102M	61	51	63	45	450
GCM-420302M	65	65	20	30	550
GCM-420401M	35	30	35	10	250

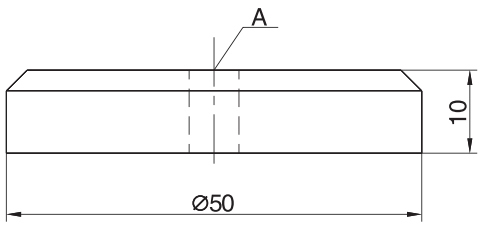
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-43 Magnetic Plates

These plates provide a stable and reliable base for optical components. They are small, stable and easy to re-position. A tapped hole accommodates the GCM-01,GCM-02,GCM-03 posts.

GCM-4301M



GCM-4301M

GCM-43 Magnetic Plates

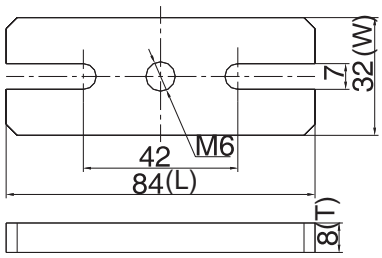
Part No.	A	Attractive force (kg)	Weight (g)
GCM-4301M	M6	> 6 kgs	120

All dimensions are in mm unless otherwise specified.

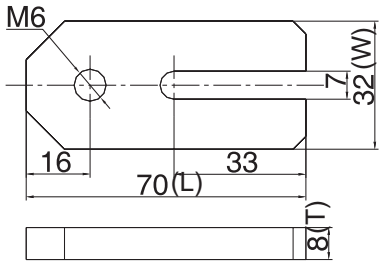
Mechanical Accessory

GCM-530 Post Bases

The post bases allow posts, translation stages and rotation stages to be mounted anywhere on an optical table or optical breadboard.



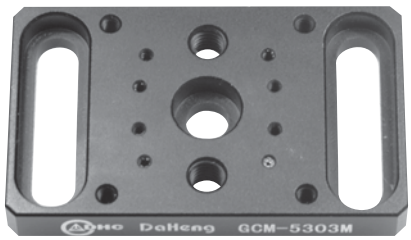
GCM-5301M



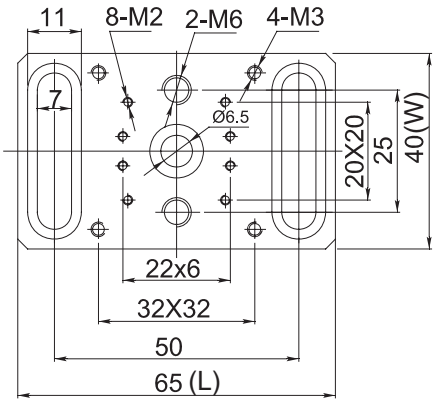
GCM-5302M

All dimensions are in mm unless otherwise specified.

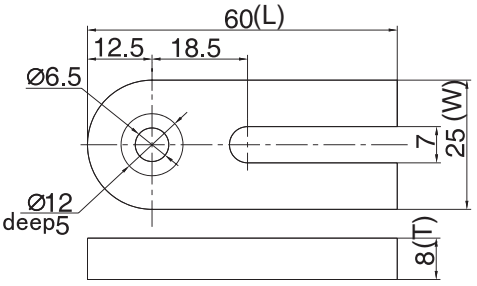
Mechanical Accessory

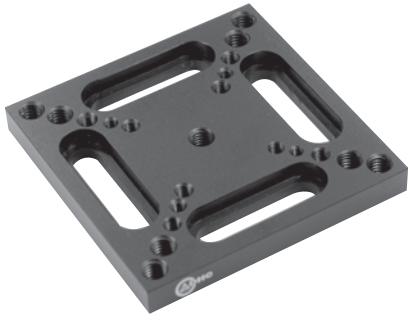


GCM-5303M

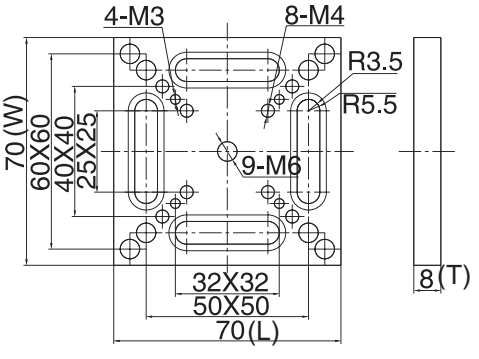


GCM-5304M





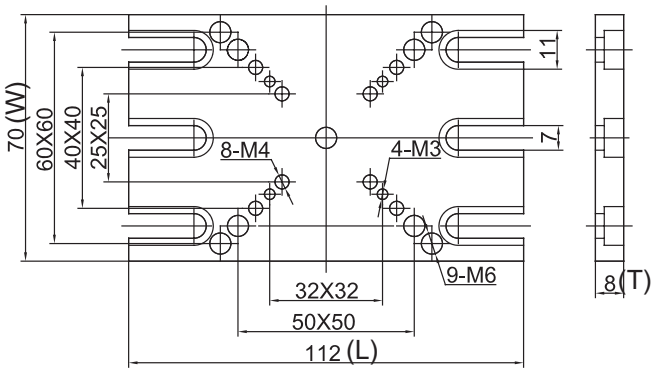
GCM-5305M



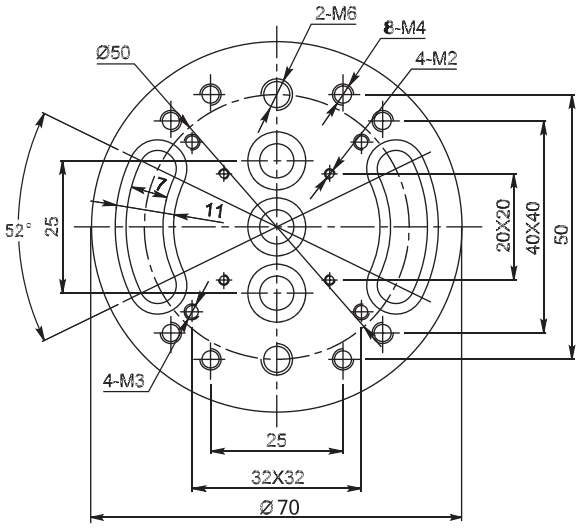
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-5306M



GCM-5308M



GCM-530 Post Bases

Part No.	T	L x W	Weight (g)
GCM-5301M	8	84x32	55
GCM-5302M	8	70x32	45
GCM-5303M	8	65x40	40
GCM-5304M	8	60x25	25
GCM-5305M	8	70x70	75
GCM-5306M	8	112x70	150
GCM-5308M	8	Ø70	65

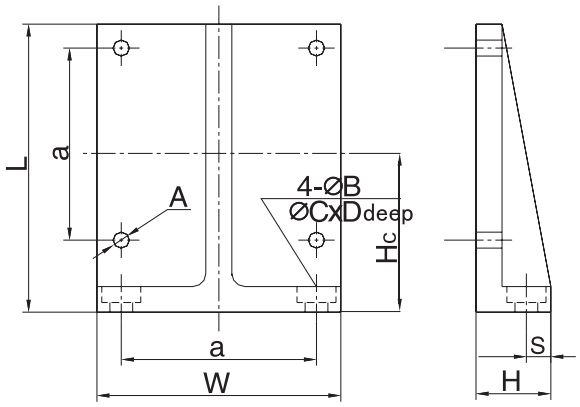
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-531 Right Angle Bases

The GCM-531 Right Angle Bases are used for mounting 3-dimentional translation stages, or holding two components at right angle.

GCM-531



GCM-5313~5317M

GCM-531 Right Angle Bases

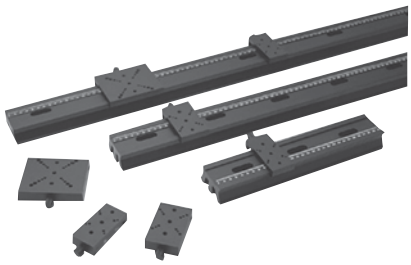
Part No.	A	a	ØB	ØC	D	L	W	S	H	Weight (g)	Hc
GCM-5313M	M2	20	2.2	4	1.5	30	25	3.5	9.5	10	17.5
GCM-5314M	M3	32	3.5	6	2.5	52	40	4	14.5	35	32
GCM-5315M	M4	40	4.5	8	3	65	50	6	20	70	40
GCM-5316M	M6	50	6.6	10.6	4	86	65	7	23	125	52.5
GCM-5317M	M6	60	7	10.6	4	90	75	7.5	23	165	52.5

All dimensions are in mm unless otherwise specified.

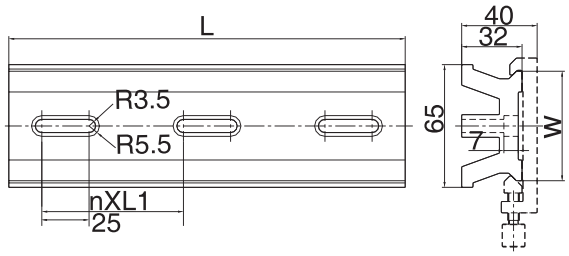
Mechanical Accessory

GCM-7201 58mm Width Rails and Carriers

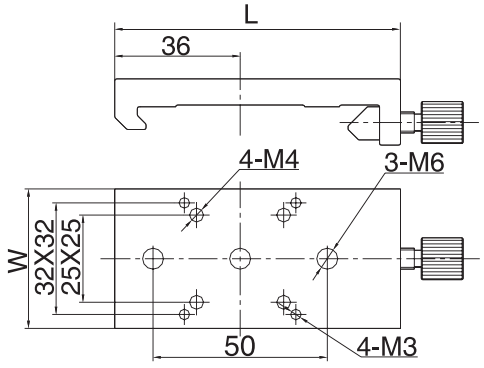
The post bases allow posts, translation stages and rotation stages to be mounted anywhere on an optical table or optical breadboard.



GCM-72



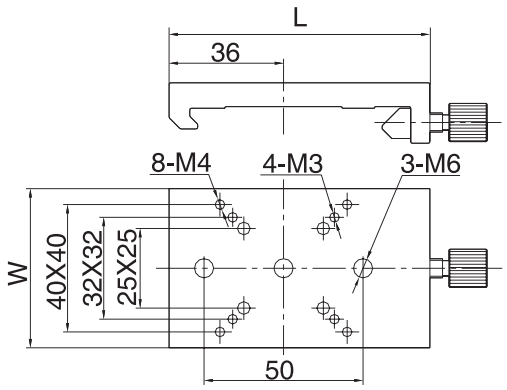
GCM-720101-05



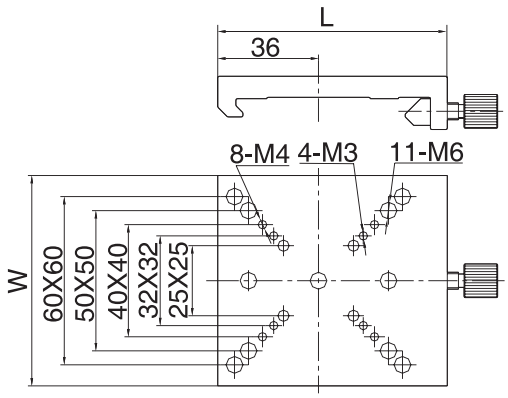
GCM-720111M

All dimensions are in mm unless otherwise specified.

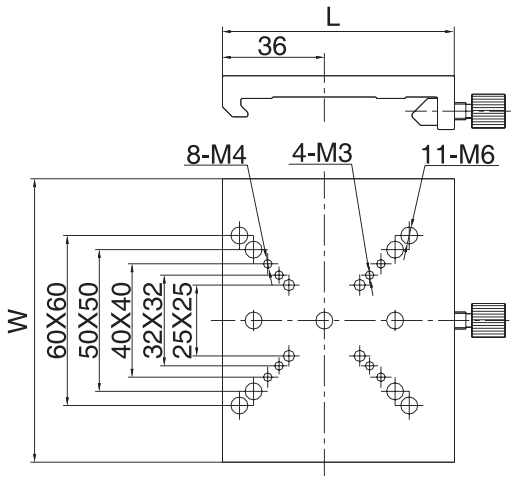
Mechanical Accessory



GCM-720112M



GCM-720113M



GCM-720114M

All dimensions are in mm unless otherwise specified.

Mechanical Accessory

58mm width Rail

Part No.	W x L	n x L1	Weight (g)
GCM-720101M	58x310	2x100	995
GCM-720102M	58x610	4x125	1950
GCM-720103M	58x910	4x200	2960
GCM-720104M	58x1210	5x200	3965
GCM-720105M	58x1510	5x250	4980

58mm width Carriers

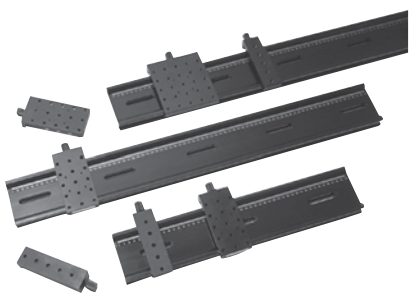
Part No.	L x W	Weight (g)
GCM-720111M	82x40	85
GCM-720112M	82x50	105
GCM-720113M	82x75	155
GCM-720114M	82x100	200

All dimensions are in mm unless otherwise specified.

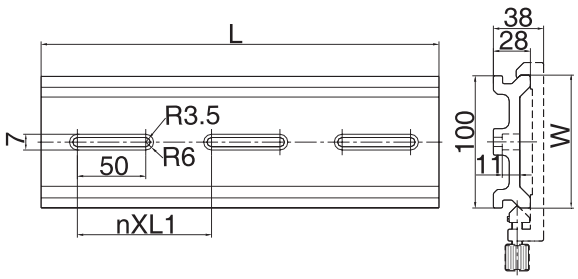
Mechanical Accessory

GCM-7202 100mm Width Rails and Carriers

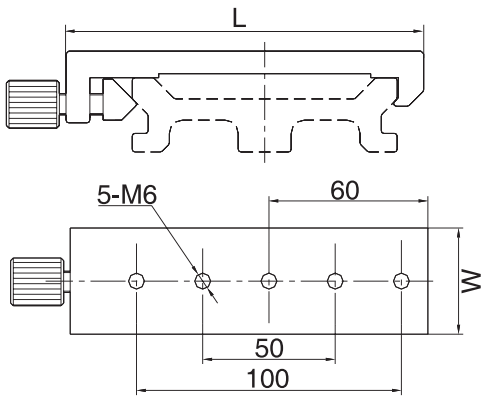
The post bases allow posts, translation stages and rotation stages to be mounted anywhere on an optical table or optical breadboard.



GCM-720201-07



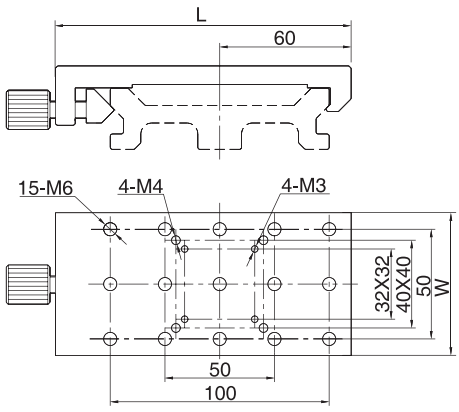
GCM-720201-07



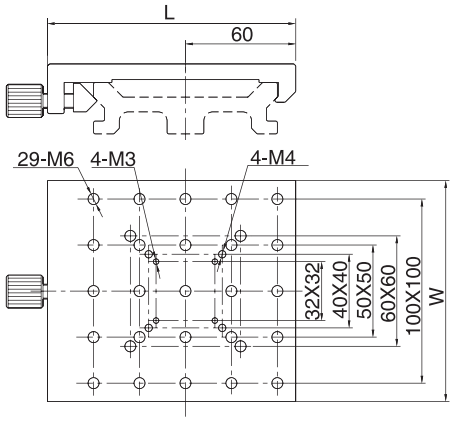
GCM-720211M

All dimensions are in mm unless otherwise specified.

Mechanical Accessory



GCM-720212M



GCM-720213M

100mm width Rail

Part No.	W x L	n x L1	Weight (g)
GCM-720201M	100x300	1x175	1125
GCM-720202M	100x500	2x175	1860
GCM-720203M	100x800	4x175	2925
GCM-720204M	100x1000	5x175	3795
GCM-720205M	100x1200	6x175	4015
GCM-720206M	100x1500	8x175	5215
GCM-720207M	100x2000	11x175	6935

100mm width Carriers

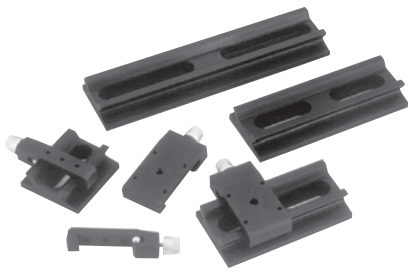
Part No.	L x W	Weight (g)
GCM-720211M	135x40	190
GCM-720212M	135x65	275
GCM-720213M	135x120	475

All dimensions are in mm unless otherwise specified.

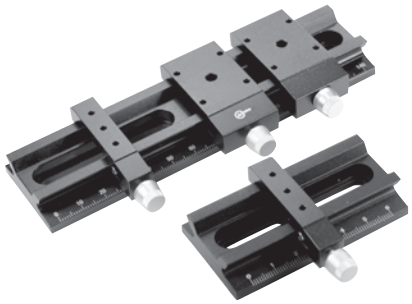
Mechanical Accessory

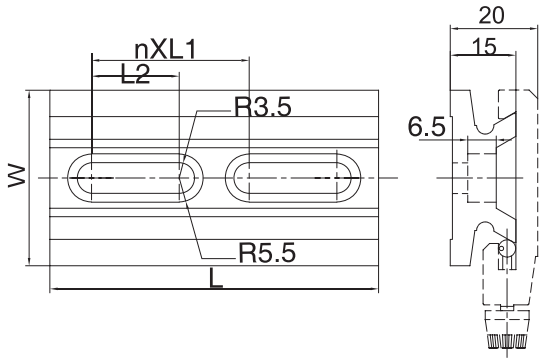
GCM-7203 40mm Width Rails and Carriers

The post bases allow posts, translation stages and rotation stages to be mounted anywhere on an optical table or optical breadboard.

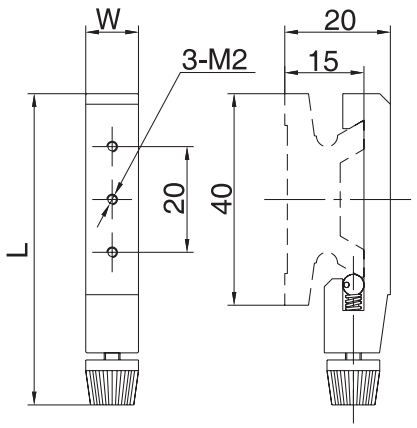


GCM-72





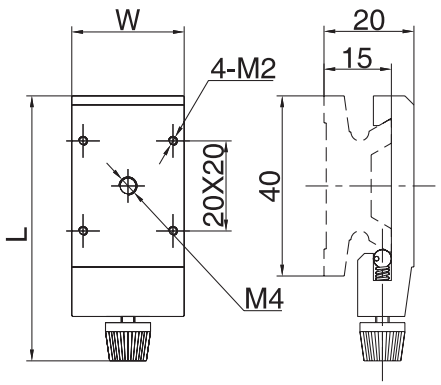
GCM-720301-04M



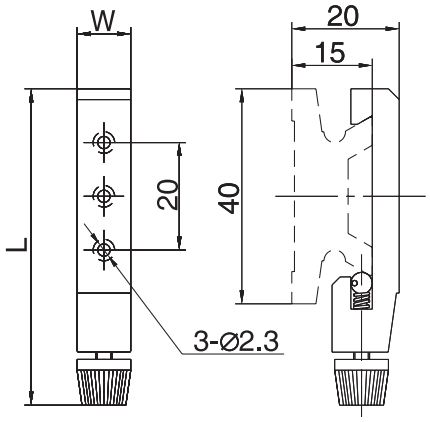
GCM-7203011M

All dimensions are in mm unless otherwise specified.

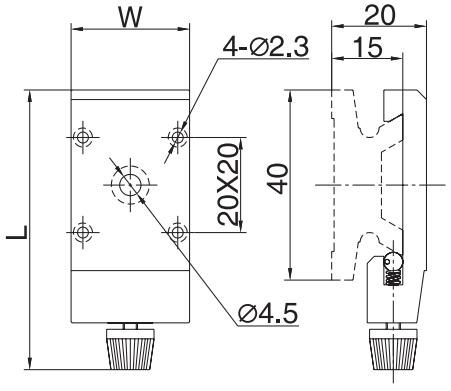
Mechanical Accessory



GCM-7203012M



GCM-720313M



GCM-720314M

All dimensions are in mm unless otherwise specified.

Mechanical Accessory

40mm width Rail

Part No.	W x L	n x L1	L2	Weight (g)
GCM-720301M	40x40	—	25	30
GCM-720302M	40x75	1x36	20	55
GCM-720303M	40x100	1x50	25	80
GCM-720304M	40x150	1x80	50	115

40mm width Carriers

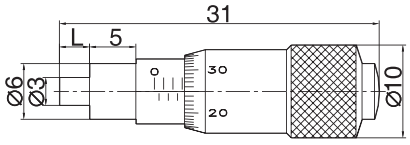
Part No.	W x L	Weight (g)
GCM-720311M	60x10	10
GCM-720312M	60x25	25
GCM-720313M	60x10	10
GCM-720314M	60x25	25

All dimensions are in mm unless otherwise specified.

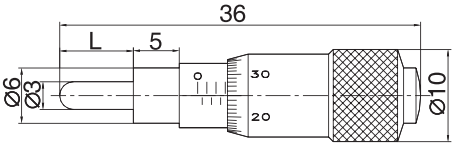
Mechanical Accessory

GCM-37 6.5mm Vernier Micrometers

GCM-37 Series Vernier Micrometers offer smooth movement for the most demanding requirements. The travel range is 6.5mm, with coarse scale reading is 0.5mm and fine scale reading is 0.01mm, with a resolution of 2μm. They can be used in conjunction with other parts.



GCM-3701M



GCM-3702M

GCM-37 6.5mm Vernier Micrometers

Part No.	L	End	Weight (g)
GCM-3701M	0~6.5	Plane	9.5
GCM-3702M	5~11.5	Sphere	10

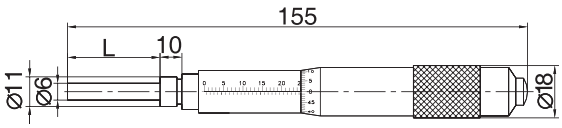
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-38 50mm Vernier Micrometers

GCM-38 Series Vernier Micrometers offer smooth movement for the most demanding requirements. The travel range is 50mm, with coarse scale reading is 0.5mm and fine scale reading is 0.01mm, with a resolution of 1μm. They can be used in conjunction with other parts.

GCM-38



GCM-38

GCM-38 50mm Vernier Micrometers

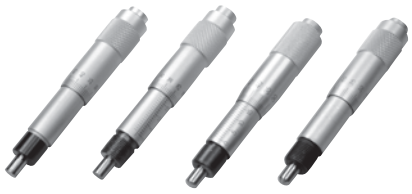
Part No.	L	End	Weight (g)
GCM-3801M	0~50	Plane	155

All dimensions are in mm unless otherwise specified.

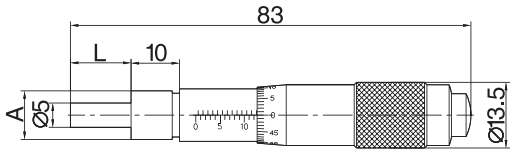
Mechanical Accessory

GCM-400 25mm Vernier Micrometers

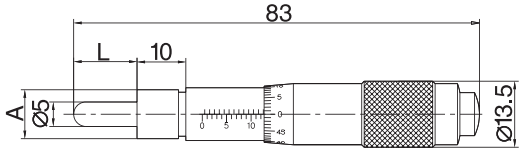
GCM-400 Series Vernier Micrometers offer smooth movement for the most demanding requirements. The travel range is 25mm, with coarse scale reading is 0.5mm and fine scale reading is 0.01mm, with a resolution of 1μm. They can be used in conjunction with other parts.



GCM-400



GCM-4001M



GCM-4002M

GCM-400 25mm Vernier Micrometers

Part No.	A	L	End	Weight (g)
GCM-4001M	Ø10	0~25	Plane	105
GCM-4001TM	M10x0.75	0~25	Plane	105
GCM-4002 M	Ø10	0~25	Sphere	100
GCM-4002TM	M10x0.75	0~25	Sphere	100

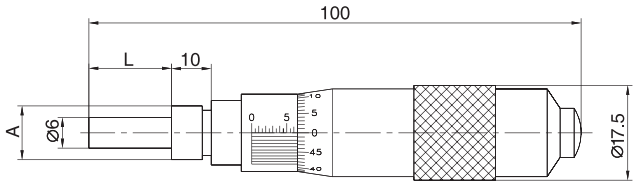
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-401 25mm Precision Vernier Micrometers

This precision vernier micrometers had has a travel range of 25mm, with coarse scale reading 0.5mm and fine scale reading 0.001mm and a resolution of 0.2μm. It can be used in conjunction with other parts.

GCM-401



GCM-401

GCM-401 25mm Precision Vernier Micrometers

Part No.	A	L	End	Weight (g)
GCM-4011M	Ø10	0~25	Plane	110
GCM-4011TM	M10x0.75	0~25	Plane	110

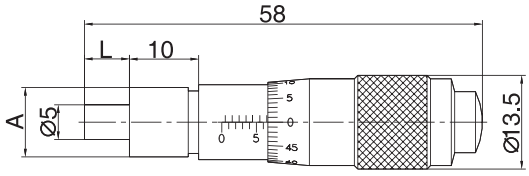
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

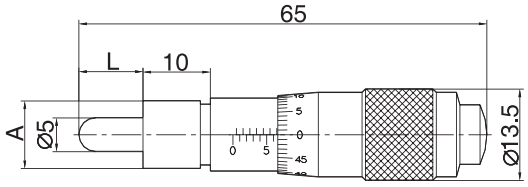
GCM-410

GCM-410 13mm Vernier Micrometers

These widely used vernier micrometers heads feature fine scale markings and smooth movement. The travel range is 13mm, with coarse scale reading 0.5mm and fine scale reading 0.01mm, with a resolution of 1μm. They can be used in conjunction with other parts.



GCM-4101



GCM-4102

GCM-410 13mm Vernier Micrometers

Part No.	A	L	End	Weight (g)
GCM-4101M	Ø10	0~13	Plane	55
GCM-4101TM	M10x0.75	0~13	Plane	55
GCM-4102M	10	7~20	Sphere	60
GCM-4102TM	M10x0.75	7~20	Sphere	60

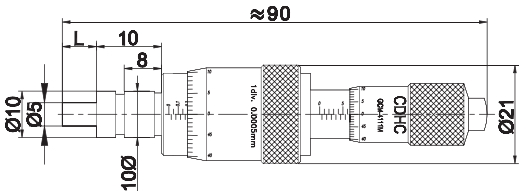
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

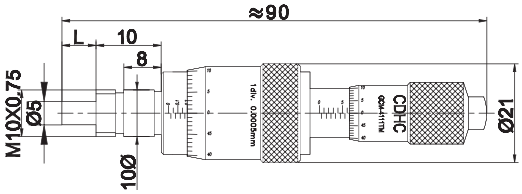
GCM-411 13mm Precision Vernier Micrometers

GCM-411

This precision vernier micrometers employs an elegantly designed differential movement. The travel range is 13mm, with coarse scale reading 0.5μm and fine scale reading 0.5μm. The resolution can be reached to 0.1μm. It can be used in conjunction with other parts.



GCM-4111M



GCM-4111TM

GCM-411 13mm Precision Vernier Micrometers

Part No.	A	L	End	Weight (g)
GCM-4111M	Ø10	0~13	Plane	120
GCM-4111TM	M10x0.75	0~13	Plane	120

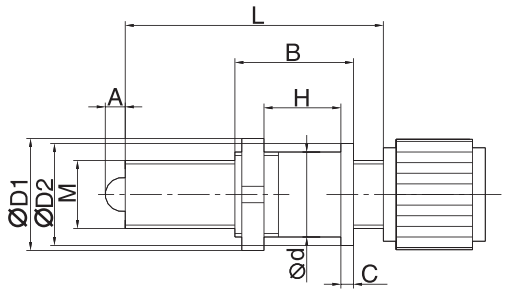
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-39 Precision Screws

These high precision screws have a threadpitch of 0.25~0.35mm, giving better accuracy than ordinary micrometers can achieve.They can be employed in various components.

GCM-39



GCM-39

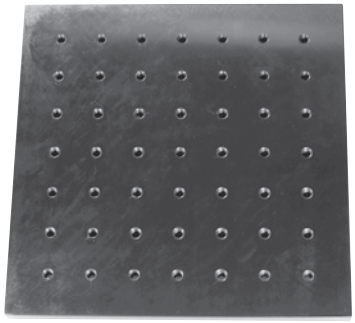
GCM-39 Precision Screws

Part No.	M	D1	D2	A	B	C	H	L	△L	Weight (g)
GCM-390101M	M6x0.25	14	12	2	12	1.5	6~8	20	8	20
GCM-390102M	M6x0.25	14	12	2	12	1.5	6~8	30	18	34
GCM-390103M	M6x0.25	14	12	2	12	1.5	6~8	40	28	41
GCM-390111M	M8x0.25	16	14	2.5	15	2	7~9.5	25	10	36
GCM-390112M	M8x0.25	16	14	2.5	15	2	7~9.5	45	30	48
GCM-390113M	M8x0.25	16	14	2.5	15	2	7~9.5	65	50	58
GCM-390201M	M4x0.35	-	8	1.25	8	1.5	6.5	13	5	10
GCM-390202M	M4x0.35	-	8	1.25	8	1.5	6.5	18	10	12
GCM-390203M	M4x0.35	-	8	1.25	8	1.5	6.5	23	15	15
GCM-390211M	M6x0.35	14	12	2	12	1.5	6~8	20	8	20
GCM-390212M	M6x0.35	14	12	2	12	1.5	6~8	30	18	34
GCM-390213M	M6x0.35	14	12	2	12	1.5	6~8	40	28	41
GCM-390221M	M8x0.35	16	14	2.5	15	2	7~9.5	25	10	36
GCM-390222M	M8x0.35	16	14	2.5	15	2	7~9.5	45	30	48
GCM-390223M	M8x0.35	16	14	2.5	15	2	7~9.5	65	50	58

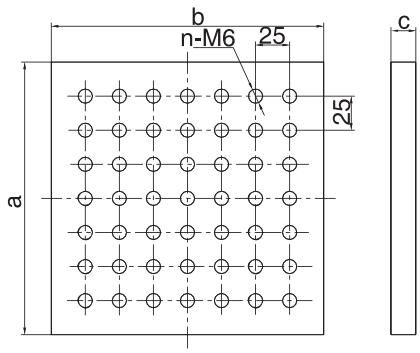
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-30 Breadboards



GCM-30



GCM-30

GCM-30 Breadboards

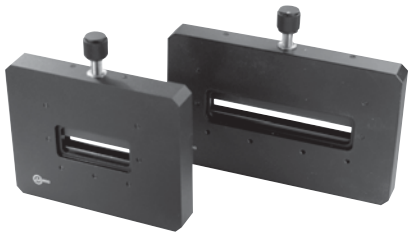
Part No.	a x b x c	Weight (g)
GCM-3001M	200x200x12.7	3725
GCM-3002M	200x250x12.7	4680
GCM-3003M	200x300x12.7	5270
GCM-3004M	250x300x12.7	6905
GCM-3005M	300x450x12.7	12555

All dimensions are in mm unless otherwise specified.

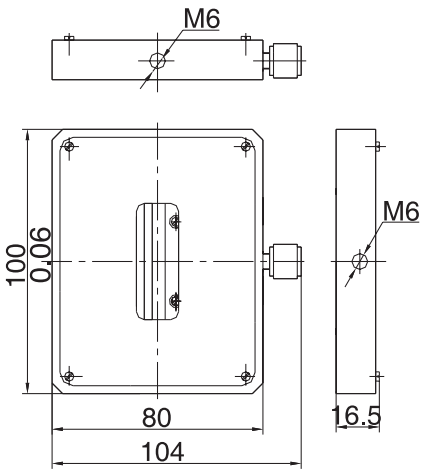
Mechanical Accessory

GCM-5601 Slits

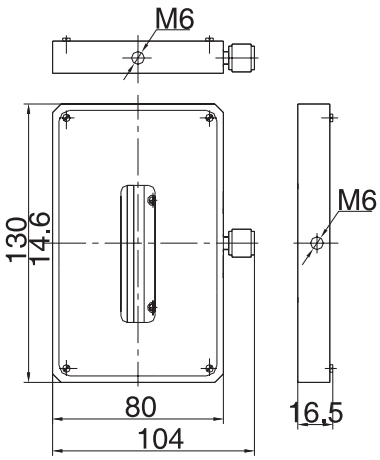
The GCM-5601 Slit series is adjustable. Two lengths of slit are available.



GCM-5601



GCM-560101M



GCM-560102M

GCM-5601 Slits

Part No.	Slit Aperture	Weight (g)
GCM-560101M	40x0~40x10	220
GCM-560102M	80x0~80x6	270

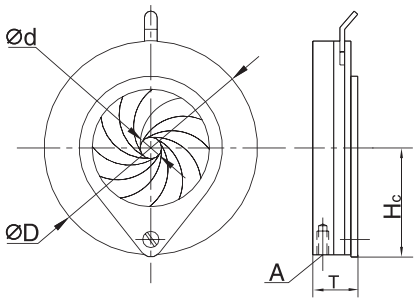
All dimensions are in mm unless otherwise specified.

Mechanical Accessory

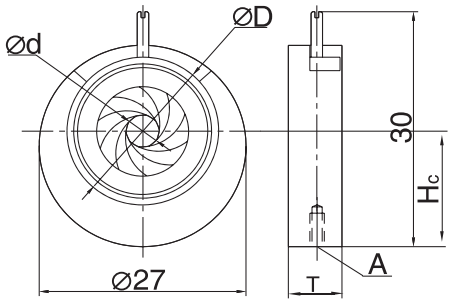
GCM-57 Iris Diaphragms

The iris diaphragm offers a continuously variable aperture for a variety of optical systems. Moving the shift lever changes the diameter of the iris diaphragm. The threaded hole A is used for mounting the diaphragm on a post.

GCM-57



GCM-5701M



GCM-5702M

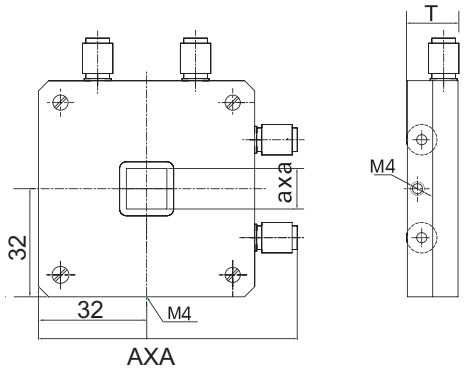
GCM-57 Slits

Part No.	A	ØD	$Ød_{min}$	$Ød_{max}$	T	H_c	Weight (g)
GCM-5701M	M4	50	2.0	28	18	27.5	40
GCM-5702M	M4	19	1.0	12	5	15.5	10

All dimensions are in mm unless otherwise specified.

Mechanical Accessory

GCM-5711



GCM-5711M

Part No.	AXA	axa_{min}	axa_{max}	T
GCM-5711M	77x77	0.1x0.1	12x12	15.5

All dimensions are in mm unless otherwise specified.

Motorized Stages 302~313

Motorized Stages

GCD-03M

Motorized Stage Controllers

A motorized stage controller is an electronic device to control and drive translation or rotational stages. The motorized stage controller product of Daheng Optics, GCD series, has a built-in USB/RS485 adapter and a special MCU,, which connect to PC. Specific developed software, 'Electric Stage Controller', offers direct and easy-to-use interface (GUI) for the general-purpose motion control.

The motorized stage controller has functions such as PC auto control, manual control, emergency stop, and limit position. It also has an advantage that the product can be used alone or in cluster, up to 15 axes of movement. Through the controller software, the operation parameters of each individual controller can be set, including Ratio, Ramp, Startup, Step, and TRV/Pulse etc. The controller can perform a single command or a list of commands that are edited by the user. The product can be easily integrated into the user's system. The communication protocols support many development environments such as VC, VB and LabView for secondary development.

Serial cable, power supply and USB/RS485 adapter are provided.

The Motorized Stage Controller, GCD-0301M, is suitable to control a variety of Daheng Optics' motorized stages, such as GCD-104, GCD-105, GCD-202 and GCD-203.

Main Features

• Operating Voltage:	Input: AC100V ~ 240V output: DC24V4A
• Max. Axes:	15
• Subdivision:	2/5/10/16/20/32/40/64
• Speed:	0 ~ 40mm/s, 0 ~ 25º/s
• Rate:	0 ~ 8mm/s, 0 ~ 5º/s
• Max. Frequency:	33KHz
• Interface:	USB/RS485
• Max. Distance:	1200m
• C/C++/LabVIEW	Compatible

All dimensions are in mm unless otherwise specified.

Motorized Stages

Minimum System Requirements

- Operation System: Windows® 2000/XP/Vista/7
- CPU: Intel Pentium® or AMD @ 1,5 Ghz
- RAM: 512MB
- Graphics Card: >64MB of RAM
- HD space: >2GB free space
- USB Compliant: USB2.0
- Monitor Resolution: >800×600

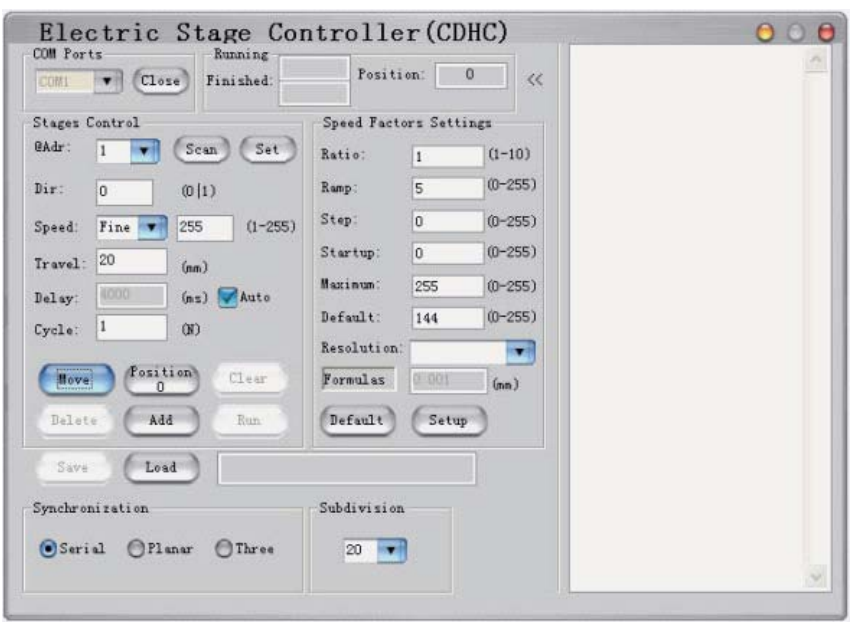
Motorized Stages Controller

Part No.	Power Supply	Subdivision	Dimensions(W×H×L)(mm)	Weight
GCD-0301M	DC24V 3A	2/5/10/16/20/32/40/64	68×80×209	920 g

Power Supply

Part No.	Input Voltage	Output Power	Dimensions(W×H×L)(mm)	Weight
Power Supply	AC100V ~ 240V	DC24V 3A	61×38×123	275 g

Graphic User Interface

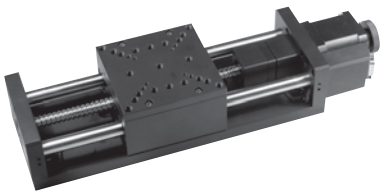


All dimensions are in mm unless otherwise specified.

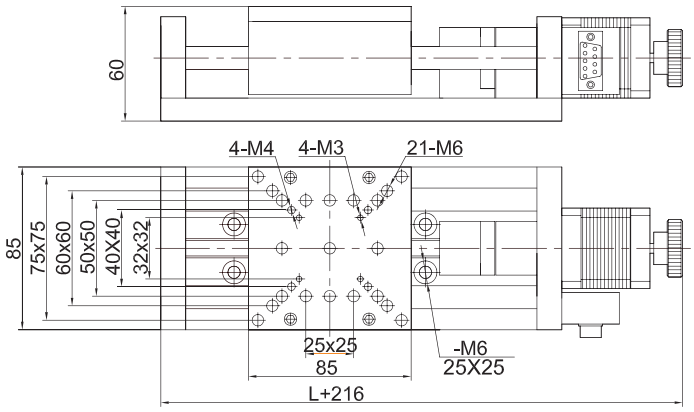
Motorized Stages

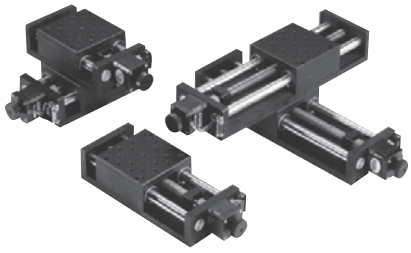
GCD-10 Conventional Motorized Translation Stages

The Motorized Translation Stage GCD-10 Series uses a linear motor for load carrying and linear guide, which features with low cost and dust-resistance, but low load capacity. This type of translation stages is not suitable for long travel and heavy load.

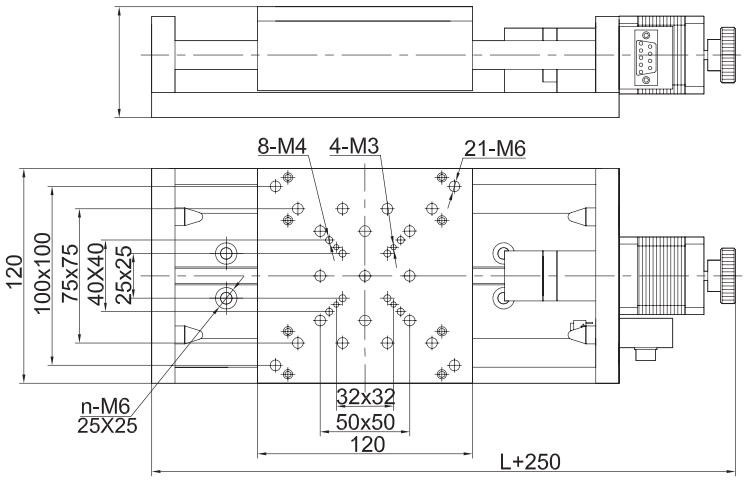


GCD-104M





GCD-105M



All dimensions are in mm unless otherwise specified.

Motorized Stages

GCD-10 Conventional Motorized Translation Stages

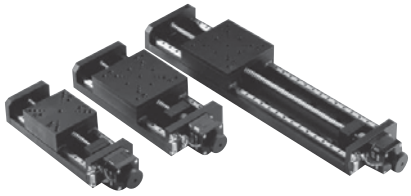
Part No.	Platform Size (mm)	Trave (mm)	Pitch (mm)	Resolution (μm)	Repeat ability (μm)	Max Speed (mm/s)	Load Capacity(kg)	
							Vertical	Horizontal
GCD-104050M	85X85	50	4	1	<5	40mm/s	5kg	3kg
GCD-104100M	85X85	100	4	1	<5	40mm/s	5kg	3kg
GCD-104150M	85X85	150	4	1	<5	40mm/s	5kg	3kg
GCD-105050M	120X120	50	4	1	<5	40mm/s	5kg	3kg
GCD-105100M	120X120	100	4	1	<5	40mm/s	5kg	3kg
GCD-105200M	120X120	200	4	1	<5	40mm/s	5kg	3kg
GCD-105300M	120X120	300	4	1	<5	40mm/s	5kg	3kg

All dimensions are in mm unless otherwise specified.

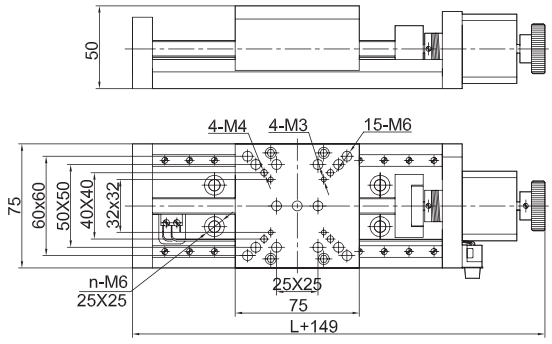
Motorized Stages

GCD-20 Linear Guideway Motorized Translation Stages

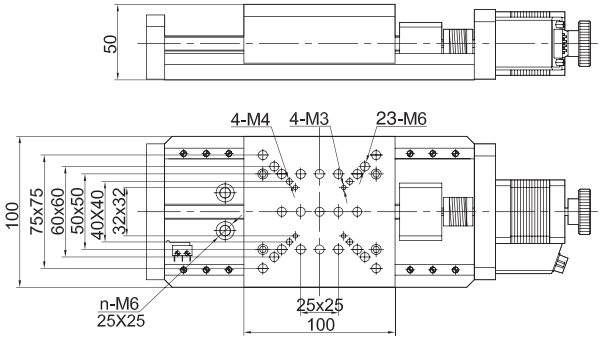
The Motorized Translation Stages GCD-20 series are implemented in the design with linear guides which in comparison with guide type of GCD-10 series, have high load capacity and suitable for long travel length and heavy loads.



GCD-20



GCD-202M



GCD-203M

All dimensions are in mm unless otherwise specified.

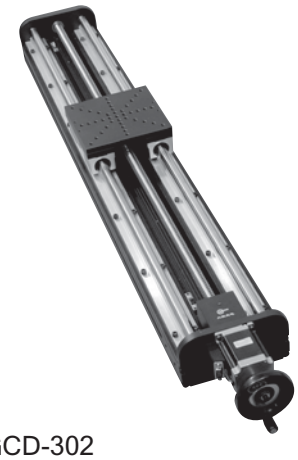
Motorized Stages

GCD-20 Linear Guideway Motorized Translation Stages

Part No.	Platform Size (mm)	Trave (mm)	Pitch (mm)	Resolution (μm)	Repeat ability (μm)	Max Speed (mm/s)	Load Capacity(kg)	
							Vertical	Horizontal
GCD-202050M	75X75	50	4	1	<5	40mm/s	20kg	5kg
GCD-202100M	75X75	100	4	1	<5	40mm/s	20kg	5kg
GCD-202150M	75X75	150	4	1	<5	40mm/s	20kg	5kg
GCD-203050M	100X100	50	4	1	<5	40mm/s	20kg	5kg
GCD-203100M	100X100	100	4	1	<5	40mm/s	20kg	5kg
GCD-203200M	100X100	200	4	1	<5	40mm/s	20kg	5kg
GCD-203300M	100X100	300	4	1	<5	40mm/s	20kg	5kg

All dimensions are in mm unless otherwise specified.

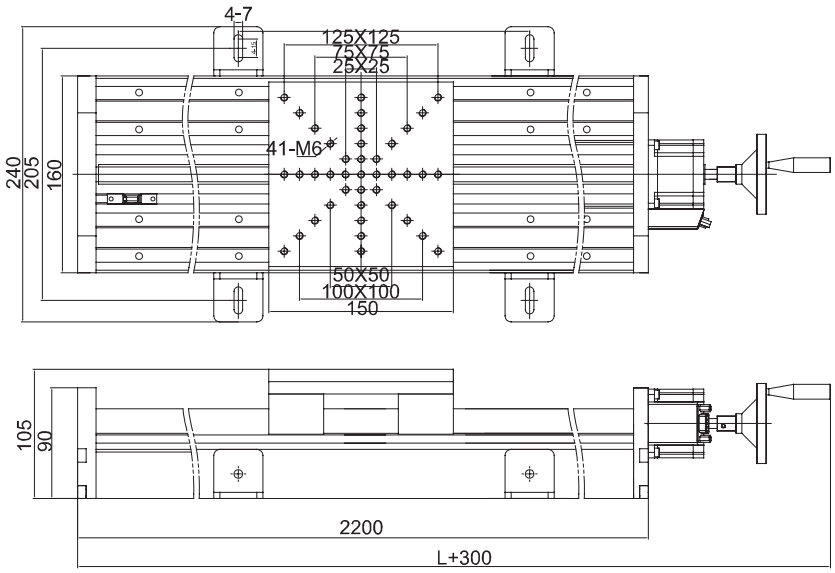
Motorized Stages



GCD-302

GCD-302 Long Range Motorized Translation Stages

The Motorized Translation Stages GCD-30 series are implemented in the design with rod linear guides which in comparison with guide type of GCD-20 and 40 series, have high load capacity and suitable for long travel length and heavy loads.



GCD-302XXXM

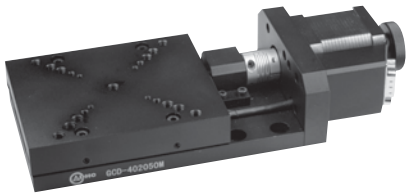
GCD-30 Long Range Motorized Translation Stages

Part No.	Platform Size (mm)	Trave (mm)	Pitch (mm)	Resolution (μm)	Repeat ability (μm)	Max Speed (mm/s)	Load Capacity(kg)	
							Vertical	Horizontal
GCD-302001M	150X150	400	5	1.25	<10	10mm/s	50kg	15kg
GCD-302002M	150X150	600	5	1.25	<10	10mm/s	50kg	15kg
GCD-302003M	150X150	800	5	1.25	<10	10mm/s	50kg	15kg
GCD-302004M	150X150	1000	5	1.25	<10	10mm/s	50kg	15kg
GCD-302005M	150X150	1500	5	1.25	<10	10mm/s	50kg	15kg
GCD-302006M	150X150	2000	5	1.25	<10	10mm/s	50kg	15kg

All dimensions are in mm unless otherwise specified.

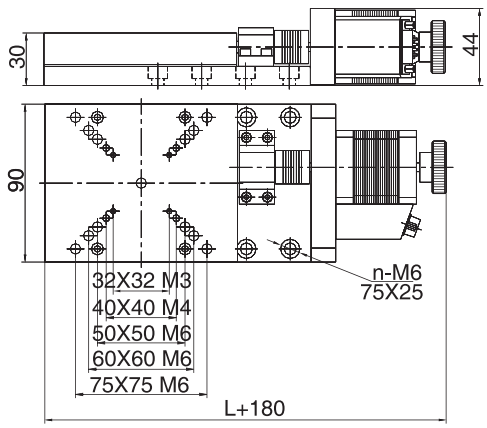
Motorized Stages

GCD-40 Crossed Roller Bearing Motorized Translation Stages



The Motorized Translation Stages GCD-40 series are implemented in the design with cross rollers guides which, in comparison with guide type of GCD-10 series, have high load capacity and suitable for long travel length and heavy loads.

GCD-40



GCD-40

GCD-40 Crossed Roller Bearing Motorized Translation Stages

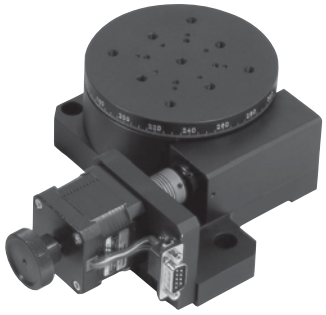
Part No.	Platform Size (mm)	Trave (mm)	Pitch (mm)	Resolution (μm)	Repeat ability (μm)	Max Speed (mm/s)	Load Capacity(kg)	
							Vertical	Horizontal
GCD-402030M	90X90	30	1	0.25	<5	10mm/s	5kg	1kg
GCD-402050M	90X110	50	1	0.25	<5	10mm/s	5kg	1kg

All dimensions are in mm unless otherwise specified.

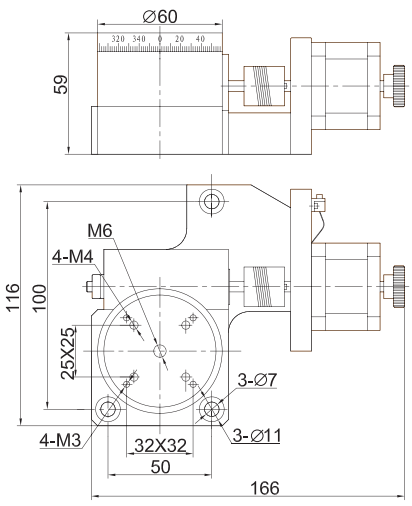
Motorized Stages

GCD-01 Motorized Rotational Stages

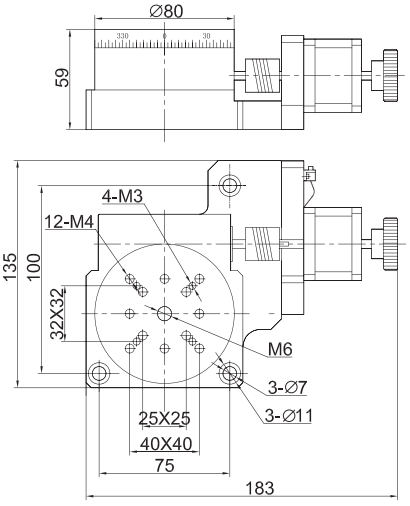
Motorized Rotational Stages GCD-01 provide 360°of rotation with high accuracy and stability. This is an excellent general purpose rotator. Coarse angular position is indicated on a 360°engraved scale on the rotating platform, graduated in 1° increments.



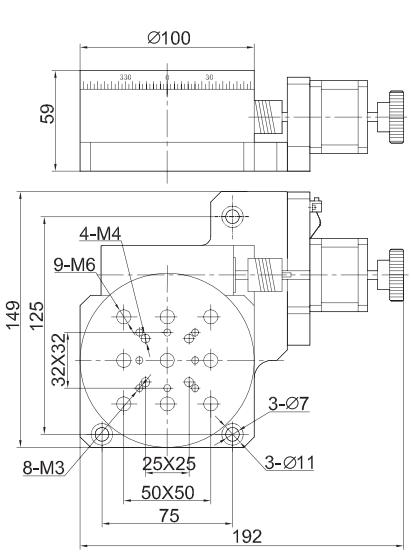
GCD-011



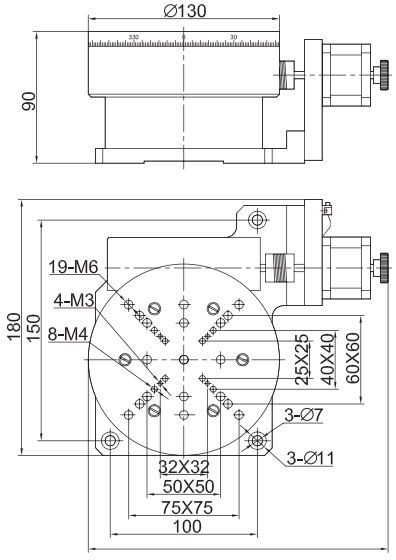
GCD-011060M



GCD-011080M



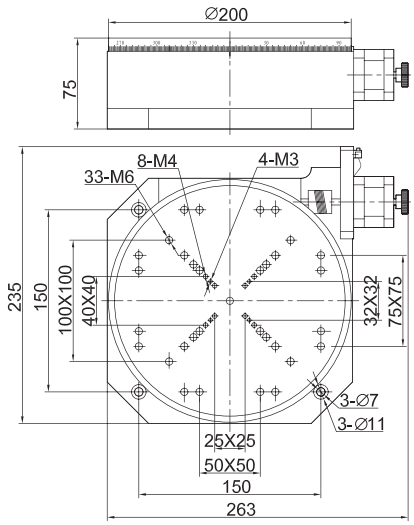
GCD-011100M



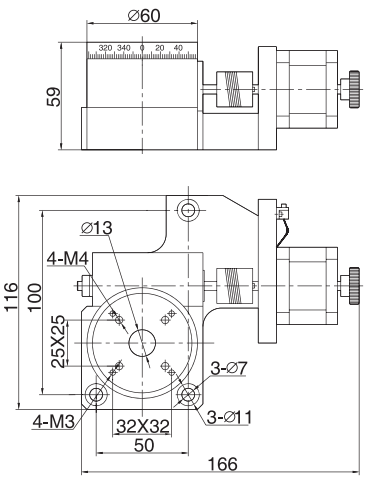
GCD-011130M

All dimensions are in mm unless otherwise specified.

Motorized Stages

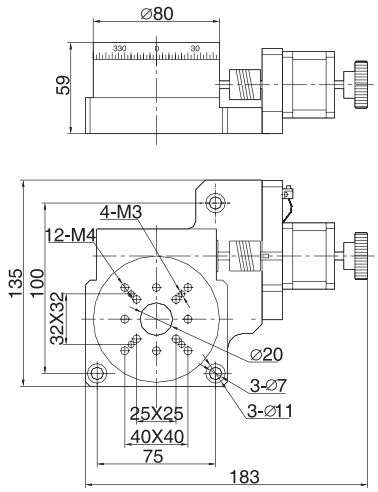


GCD-011200M

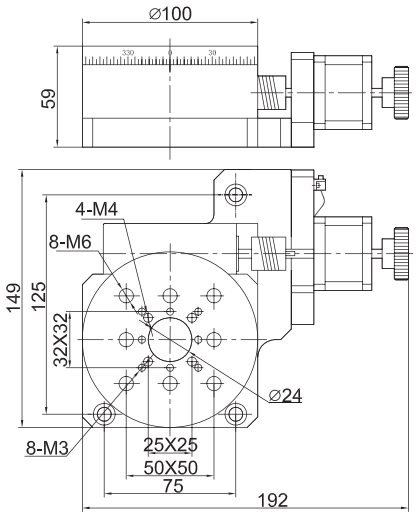


GCD-012060M

GCD-012



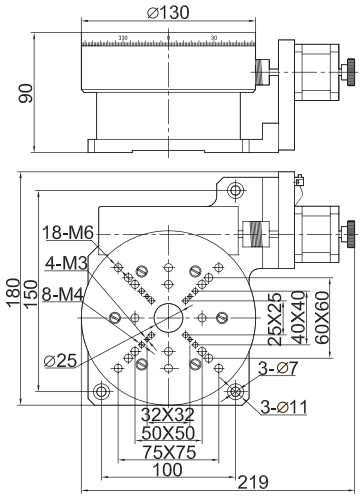
GCD-012080M



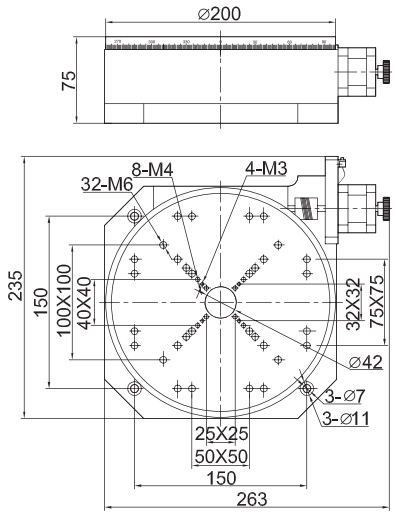
GCD-012100M

All dimensions are in mm unless otherwise specified.

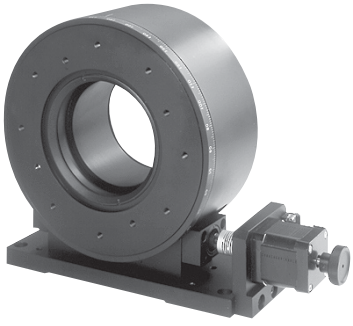
Motorized Stages



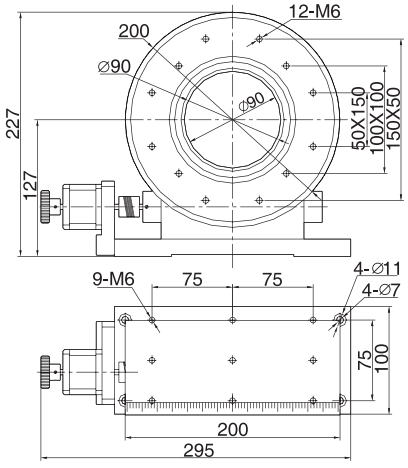
GCD-012130M



GCD-012200M



GCD-013



GCD-013200M

GCD-01 Motorized Rotational Stages

Part No.	Platform Size(mm)	Worm Gear Ratio	Resolution (second)	Repeatability (second)	Max Speed (r.p.m)	Max Torque (N·m)	Load Capacity
GCD-011060M	Ø60	100:1	3.24	9	3	0.45	20kg
GCD-011080M	Ø80	135:1	2.4	7.2	2	0.45	25kg
GCD-011100M	Ø100	180:1	1.8	5.4	1	0.45	30kg
GCD-011130M	Ø130	225:1	1.44	4.32	1	0.45	35kg
GCD-011200M	Ø200	300:1	1.08	3.6	1	0.45	45kg
GCD-012060M	Ø60	100:1	3.24	9	3	0.45	20kg
GCD-012080M	Ø80	135:1	2.4	7.2	2	0.45	25kg
GCD-012100M	Ø100	180:1	1.8	5.4	1	0.45	30kg
GCD-012130M	Ø130	225:1	1.44	4.32	1	0.45	35kg
GCD-012200M	Ø200	300:1	1.08	3.6	1	0.45	45kg
GCD-013200M	Ø200	300:1	1.08	3.6	1	0.45	45kg

All dimensions are in mm unless otherwise specified.

Photo Detector

Photo Detector

Photodetector Products
GCPD series

Photodetector Products
GCPD series

Photodiodes are one of semiconductor devices used for light detection, which convert light into current. PIN photodiodes are much faster and more sensitive than general P-N junction photodiodes, and hence are often used for optical communications and in lighting regulation. PIN photodiodes can be packaged with a window or optical fiber connection to allow light to reach the sensitive part of the device. Depending on the detector materials, a PIN photodiode is sensitive to certain spectral region with well defined linear response. For InGaAs PIN photodiodes, the response spectrum is 850nm~1700nm. And for Silicon PIN photodiodes, the response spectrum is 400nm~1100nm. The active area of a photodiode is finite. For InGaAs PIN photodiodes, the active area can be from Ø75μm to Ø1mm, and for Silicon PIN photodiodes, the active area can be from Ø0.5mm to Ø6mm. Customized photodetectors are available.

Notation Codes

GCPD-xPxx
- Active area
- Detector material

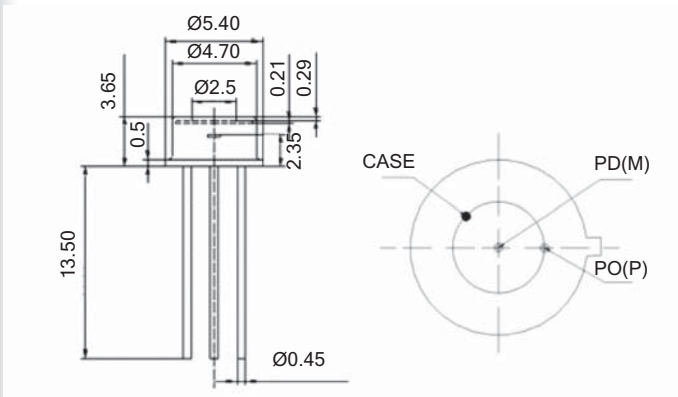
Detector material		Active area
Code	--	
1	InGaAs	xx ➡ mm
2	Silicon	e.g. 03 ➡ 0.3mm
		0075 ➡
		0.075mm ➡ 75μm
		1 ➡ 1mm

All dimensions are in mm unless otherwise specified.

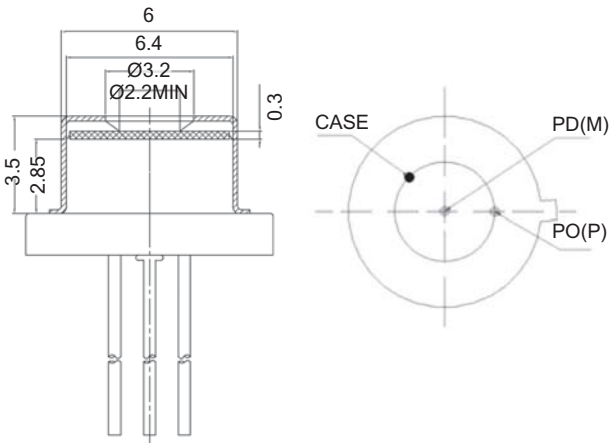
Photo Detector

Package Style

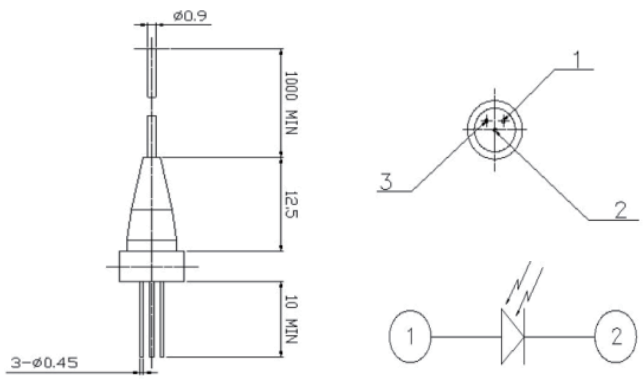
TO46 package



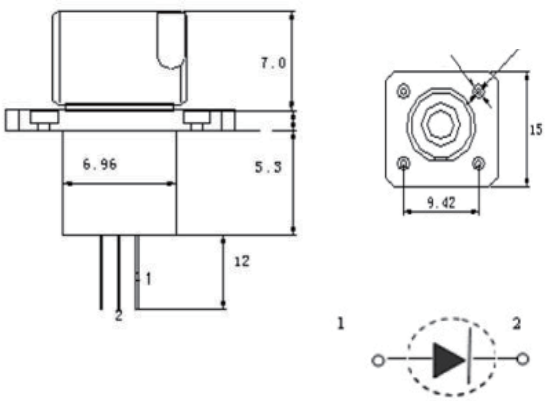
TO5 package



Coaxial pigtailed package



Receptacle package



All dimensions are in mm unless otherwise specified.

Photo Detector

GCPD Photodiodes

GCPD Photodiodes

Features:

- High sensitivity
- High reliability
- Standard TO package, fiber pigtailed co-axial packages or in connector style receptacle packages available

Applications:

- Optical measurement equipment, analytical equipment, etc.

Part No.	Specifications
GCPD-12P12-3	Cover 400~1700nm, InGaAs Ø1mm & Si Ø2mm PIN, TO5 package
GCPD-1P0075-1	InGaAs PIN, Ø75μm, TO46 package
GCPD-1P0075-2	InGaAs PIN, Ø75μm, Mini can package
GCPD-1P03-1	InGaAs PIN, Ø300μm, TO46 package /Balllens/Flat windows
GCPD-1P03-2	InGaAs PIN, Ø300μm, Mini can package
GCPD-1P05-1	InGaAs PIN, Ø50μm, TO46 TO5 package/Balllens/Flat windows
GCPD-1P1-3	InGaAs PIN, Ø1mm, TO5 package. Flat window
GCPD-1P2-3	InGaAs PIN, Ø2mm, TO5 package. Flat window
GCPD-2P05	Si PIN, Ø0.5mm
GCPD-2P1	Si PIN, Ø1mm
GCPD-2P2	Si PIN, Ø2mm
GCPD-2P4	Si PIN, Ø4mm
GCPD-2P6	Si PIN, Ø6mm
GCPD-2P10	Si PIN, Ø10mm

All dimensions are in mm unless otherwise specified.