



GMP

General Microtechnology & Photonics
Systems for Industry, Research, Telecom & Medicine



Optics and
optomechanics
from stock



www.gmp.ch

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GMP SA

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Things you need to know...

How to order



	UK/Europe/Rest of world	North America
By phone	+44 (0)1223 866120	1 866 40 COMAR (26627)
By fax	+44 (0)1223 866125	1 306 781 6006
By email	mail@comarinstruments.com	solutions@comaroptics.com
By post	Address as bottom of page	Address as bottom of page

Dispatch



	UK/Europe/Rest of world	North America
Dispatch policy	All items stocked in Cambridge, UK, for immediate dispatch	All items stocked in Regina, SK, for immediate dispatch
Standard delivery service	First class/airmail post (except heavy items indicated in Price List)	FedEx Priority or equivalent service – next day delivery
Standard delivery price	UK: £3.50 per order (except heavy items indicated in Price List) Europe: \$4.00 per order up to 500g Rest of world: \$9.00 per order up to 300g	Canada: CAD \$20.00 for Canada USA: USD \$30.00 for USA Heavy items indicated in Price List shipped at cost
Faster options	UK: Special Delivery mail by 9am £14.00 or by 1pm £7.00 UK: Business Post or equivalent next day service £8.00 Europe/Rest of world: FedEx Priority from £13.00	Fedex First early delivery service available to most locations – please enquire
Order cut off time for dispatch	4.00pm GMT/BST. For urgent items after this time, please enquire.	3.30pm Mountain Time (summer) 3.30pm CST (winter)



How to pay

	UK/Europe/Rest of world	North America
Payment methods	Thirty day account (subject to status), credit card (see below), cheque with order, bank transfer	Thirty day account (subject to status), credit card (see below), cheque with order, bank transfer
Cards accepted	Mastercard, Visa, Mastercard Debit, Visa Debit, Maestro, Solo	Visa, Mastercard
Sales tax	UK: VAT at current rate on invoice total. EU: Tax not chargeable if VAT/tax number given. Rest of world: terms ex works.	GST (Canada only)



Terms of business

	UK/Europe/Rest of world	North America
	See Price List. Copy on request.	See Price List. Copy on request.

Contact details

By phone	+44 (0)1223 866120	1 866 40 COMAR (26627)
By fax	+44 (0)1223 866125	1 306 781 6006
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Above details correct as of 1.1.09. See current price list for rate updates.

Contents

OPTICS - introduction [p.2](#)

Simple convex lenses

- Quality [pp.4,5](#) • Laser [p.6](#) • Meniscus [p.6](#) • UV-silica, Ball [p.7](#) • Commercial [p.8](#) • Large condenser, Fire polished, Plastic [p.9](#)

Concave and cylindrical lenses

- Concave [pp.10,11](#) (for negative doublets see [p.17](#)) • Cylindrical [pp.12-14](#) (for cylindrical Fresnels see [p.16](#)) Rod [p.13](#)

Aspherics and doublets

- Aspherics [pp.14,15](#) • Fresnels [p.16](#) • Doublets [pp.16,17](#)

Mounted lenses and lens systems

- Condenser [pp.18,19](#) • Relay [p.18](#) • Focusing, Projector [p.19](#) • Objectives [p.20](#) • Eyepieces [p.21](#)
- Microscopes, Telescopes, Collimators [p.22](#) • Beam expanders [p.23](#)

Mirrors and beamsplitters

- Plane mirrors [pp.24-26](#) • Optical flats [p.25](#) • Concave mirrors [p.27](#) • Beamsplitters [pp.27,28](#) (for dichroic beamsplitters see [p.39](#); for polarising beamsplitters see [p.42](#))

Prisms, windows and cells

- Prisms [pp.29-31](#) • Windows [pp.31,32](#) • Cells [p.33](#)

Filters and diffusers

- Diffusers and screens [p.33](#) • Neutral filters [pp.34,35](#) • Colour filters [pp.36,37](#) • Heat control [p.38](#) • Dichroics [pp.38,39](#)
- Interference filters [pp.39-41](#)

Polarisers and retarders

- Polarisers [pp.42-44](#) – Retarders [pp.44,45](#)

Gratings, graticules and apertures

- Bar and Diffraction gratings, Resolution charts [p.46](#) • Graticules, Iris diaphragms [p.47](#) • Pinholes and slits [p.48](#)

Light sources and fibre optics

- Fibre optics [p.49](#) • Lamps [p.50](#) • Lampholders, Tungsten lamphouses [p.51](#) • LED lamphouses, Condensers [p.52](#)

OPTOMECHANICS - introduction [p.53](#)

TubeMount system

- Cells and tubes [pp.54-56](#) • Spacers [p.54](#) • Adaptors [p.56-58](#) • Focusing and rotating cells [p.57](#) • Irises, End plugs [p.58](#)
- Cube connectors, Clevis mounts [p.59](#)

Breadboards and bases

- Breadboards [p.60](#) • Platforms [p.61](#) • Direct-mounting screws and bases [p.61](#) • Postholders, Magnetic bases [p.62](#)

Stages and rod system

- Translation [pp.63-65](#) • Rack and pinion [pp.65](#) • Elevation [p.66](#) • Rotation [pp.67,68](#) • Goniometer [p.68](#) • Tilt [p.69](#)
- Mounting rod system [p.70](#) • Micrometer heads and adjusting screws [p.71](#)

Rails and carriers

- 19mm Rail system [p.72](#) • 75mm Rail System [p.73](#)

Component holders

- Posts etc. [p.74](#) • Stock optics holders [pp.75-77](#) • Focusing, Centring [p.76](#) • Rotating [pp.77, 88](#) • Adjustable [pp.78,79](#)
- Filter holders [pp.79,80](#) • Mounted lens & laser holders [pp.81,82](#) • Mirror holders [pp.82,83](#) • Prism tables, lenses and Iris diaphragms [pp.84](#)

Adhesives and cleaning

- Adhesives and dispensers, cleaning supplies [p.85](#)

Why use Comar?



Solutions for optical problems

Need faster optics?

In the 1970's, obtaining optics in a hurry was often impossible. That's why, in 1978, we started Comar Instruments, a family business, in Cambridge, UK, offering a wide range of off-the-shelf optics for immediate despatch.

Now, over thirty years later, our range has expanded hugely, but we are still a family business and still retain the same aims of offering a fast, friendly, flexible service supplying the needs of European researchers and instrument manufacturers.

In 2004 we opened a branch in North America, thus offering the same service on both sides of the Atlantic.

If it won't fit...

The problem with catalogues of standard items is that, very often, your need is for something bespoke – a different size, shape or type. And bespoke means expensive and slow – or does it? Try our Customise service... and be pleasantly surprised!

As you will see from the page opposite, we can modify thousands of stock items to your particular requirements, and do it to meet your deadline! For out-and-out specials that can't be fabricated by adaptation of stock, we would be pleased to quote to your specific needs.

We aim to provide a 'one stop shop' service providing solutions to all your optical needs.

Getting technical

Having offered optics for three decades, we've come across most technical queries that customers can throw at us. We have a lot of experience in specifying optics to suit customers' requirements and provide a free technical advisory service. If your needs are complex we can recommend a consultant who will work for very reasonable rates.

Quality – optics that are what they claim to be!

All too often, catalogue optics are faulty or incorrect – they don't meet the description under which they are sold. You have a right to get optics that are what they claim to be.

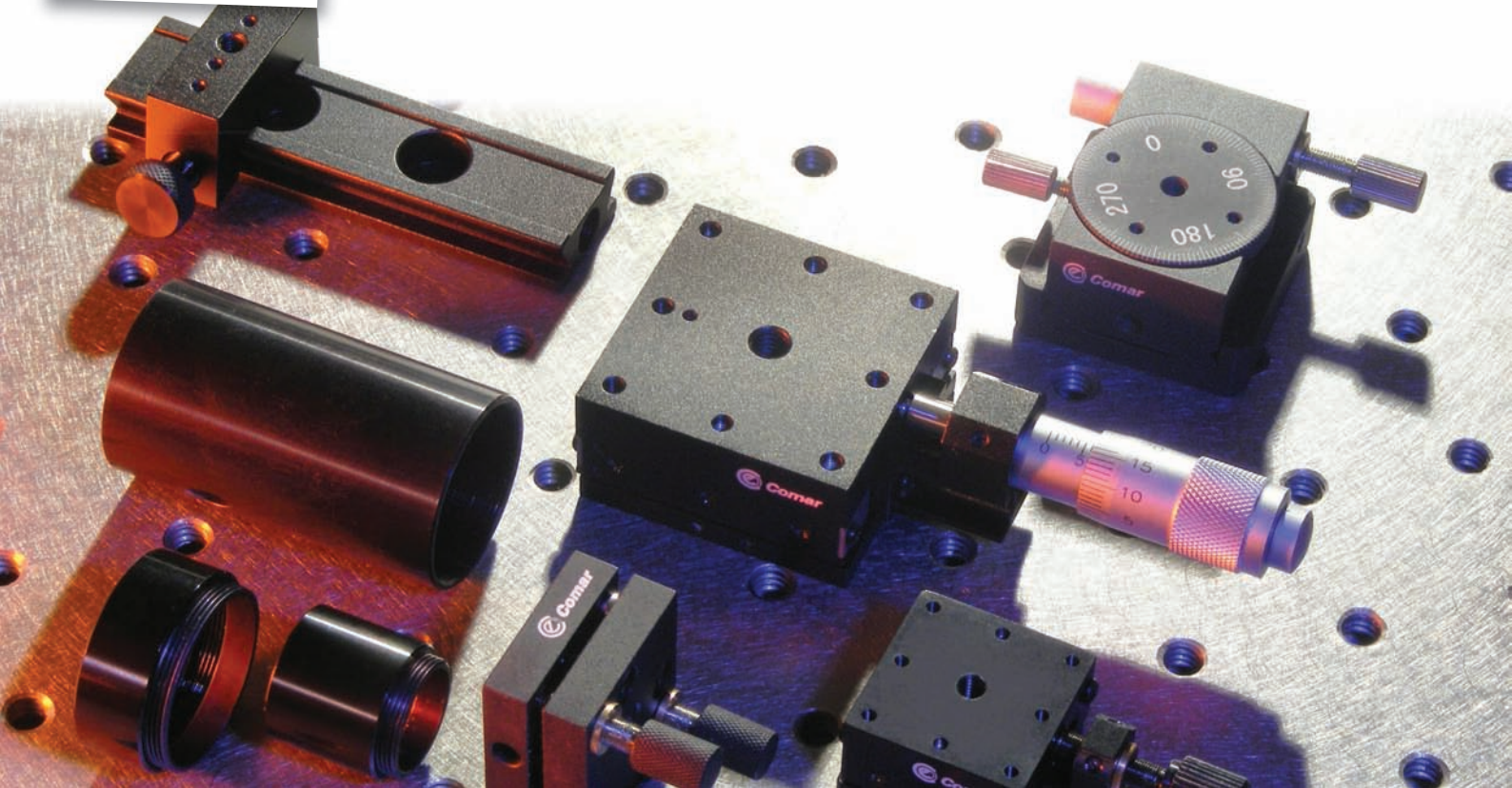
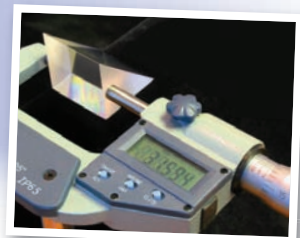
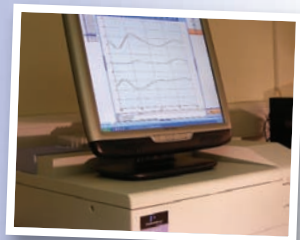
We have long recognised the importance of rigorous quality control, and all our 'own brand' items are both carefully toleranced and go through a detailed, documented test procedure.

To ensure consistent quality we have a well-equipped laboratory. Our latest test regime includes in-house interferometric Zygo testing and spectrophotometric scanning as appropriate. In addition 100% of items sold undergo manual cosmetic inspection to ensure consistent high quality.

We look forward to continuing to serve you...

Peter Marsh
Cambridge, UK

Richard Marsh
Regina, Canada



Introducing...

The **≡Customise** service

"I can't find what I want!"

Customise is a complete programme for supplying you with the components that you really need. So if a standard item won't do then...

We'll make it fit...

There's no need to compromise. We can modify both optical and mechanical catalogue items to your exact requirements, rapidly – even on a one-off basis – in our well-equipped, in-house workshops.

or we'll make it specially...

We have many years' experience manufacturing or sourcing custom optical and optomechanical components and assemblies.

"How long will it take?"

We aim to ship the modified goods within a week of your order although generally it will be quicker than this. Often we are able to offer an even faster service – please enquire.

"I bet it's expensive!"

No! We think the service is very reasonable, but then we would, wouldn't we! One-off mods start from just £20. Try it for yourself—it shouldn't do much damage to your budget...

"Can you modify my own optics?"

Yes! If you are looking for someone to adapt your optics, we are able to apply all the processes listed, albeit at your risk. All enquiries are welcome.

"So what mods can be done?"

You will find the following symbols throughout the catalogue. These mean as follows...



Stock optics reduced in size as needed.

For glass items this means diamond sawing, scoring and cracking, edging, grinding, etc.; for plastic items – sawing, milling, punching, guillotining, etc.



Larger sizes available from stock sheets.

Where you see this symbol we hold the materials in stock in large sheets and can cut custom shapes and sizes larger than those listed in the catalogue.



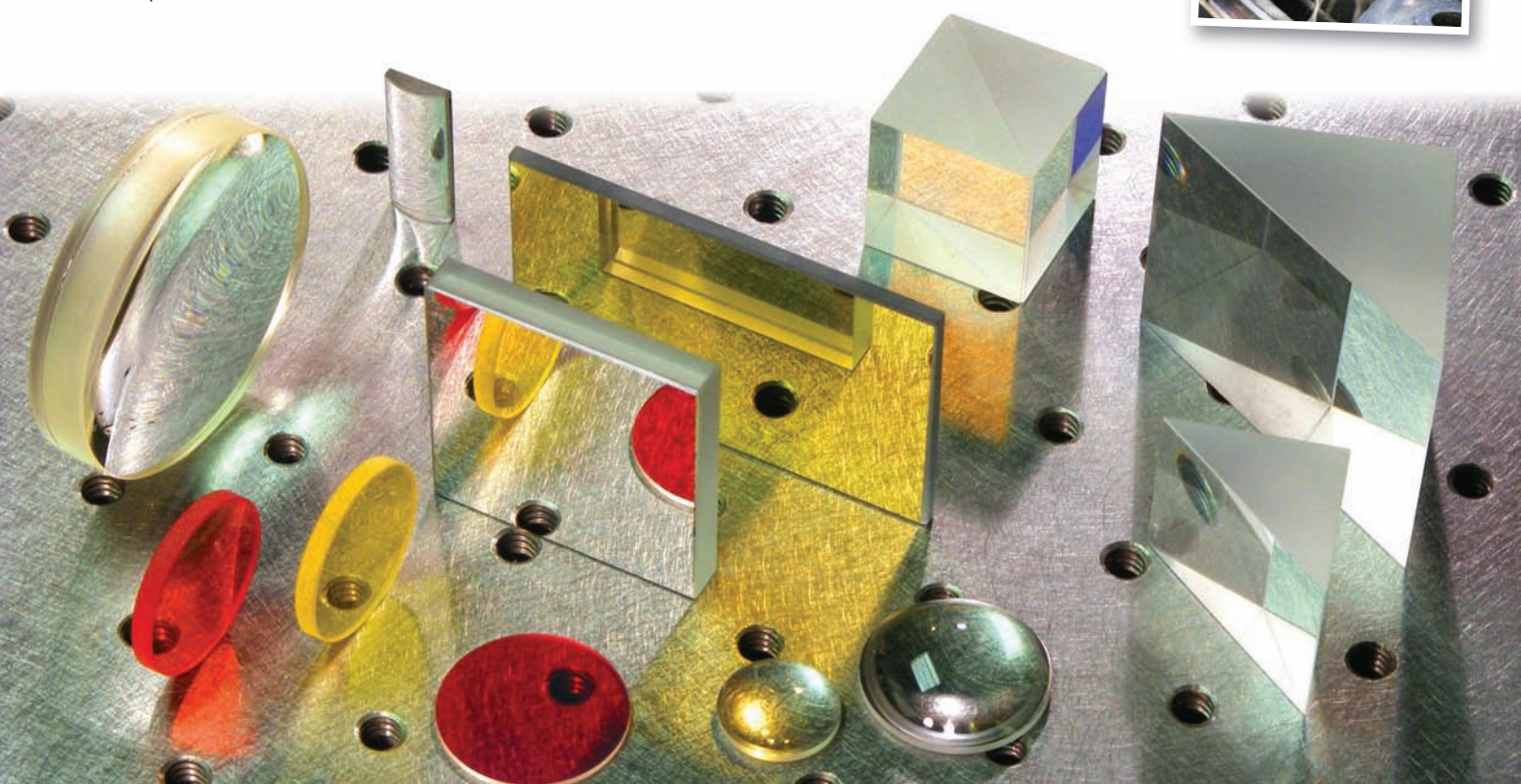
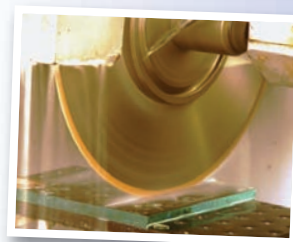
Metal parts machined as required.

You will find this symbol in our optomechanical range: it indicates customisation by drilling, tapping, reaming, milling, turning, etc.

"You don't even list what I want!"

A large part of our business is sourcing and supplying 'out-and-out' special optics and optomechanics for ongoing OEM requirements or even one-off items for repair or prototyping. We will do our best to produce that special item you're looking for. We have many years of expertise in the following areas.

- Lenses – singlets, doublets and compound
- Prisms – all types
- Mirrors, windows and flat work
- Filters – colour, neutral, dichroic, etc.
- Coatings of all types
- Laminating and cementing of items
- Optomechanical assemblies and devices



Specifications and quality

Most optics are listed in several grades, from precision optics of high accuracy to economical items for less critical applications. Whatever the grade, we take great care to ensure that the specification is met, and we are well known among our suppliers for our exacting attention to details. All incoming goods are quarantined until inspection, which includes both measurement of dimensions etc. and 100% visual check for cosmetic defects. Records are kept for future reference.

Our main ranges of optics are made to specifications set by ourselves, which we

are equipped to verify in-house. We also list some proprietary ranges from specialist manufacturers (e.g. eye pieces, polarisers, lamps); specifications given for these are generally as stated by the manufacturer.

Flatness and figure specifications

- Stated in wavelengths (λ): $1\lambda = 633\text{nm}$
- Often given for a specific test field, e.g. 1λ over $\varnothing 25\text{mm}$, meaning 1λ over any test field 25mm dia. within the optical aperture.
- For small areas the error often varies as the square of the test field size, so 1λ over 20mm is roughly equivalent to $\lambda/4$ over 10mm.

Scratch-dig specifications

The two numbers give respectively the largest scratch and largest dig (circular defect) permitted. Digs are simply measured by diameter in $10\mu\text{m}$ units. Scratches are assessed by visual comparison with a standard. Since the scratch specimens referred to in MIL-0-13830A are not generally available, we offer an equivalent standard to help our customers:-

01 QS 00 Reference standard containing scratches 10, 20, 40, 60, 80, 120, 160 and digs 5, 10, 20, 40, 50, 70, 100.

Optical materials

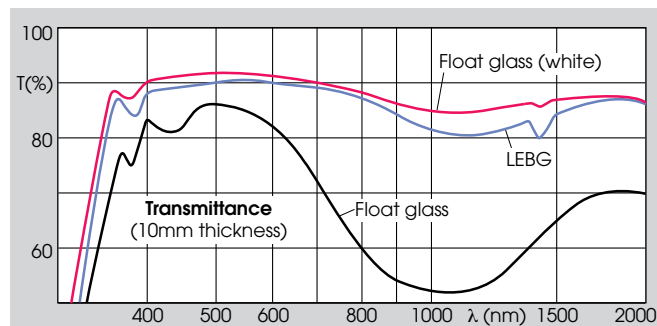
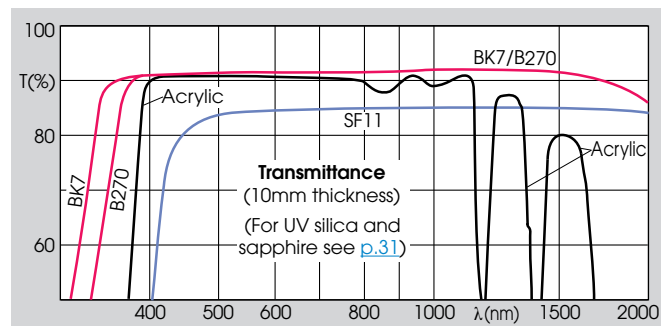
Key data for the principal materials are shown here for easy comparison.

Most precision optics for the visible are in BK7 or B270 crown glasses, which for almost all purposes are interchangeable.

Sheet materials made by the float process have many uses. 'Float glass' in this catalogue means common soda-lime glass as used for glazing, which has a slight green tint. 'White' float is similar but with reduced iron content and improved transmittance (see graph). LEBG float ('Borofloat') is made in low-expansion borosilicate glass for better heat resistance.

Material	Refr. index nd	Abbe value Vd	Transmission range (nm)	Surface refl. (%)	Max. temp. (°C)	Expans. coeff. ($10^{-6}/\text{K}$)	Density (g/cm^3)	Other names and notes
BK7	1.517	64.2	300-2700	4.2	350*	7.1	2.51	Include other mfrs.' equivalents
B270	1.523	58.6	320-2600	4.3	320*	8.2	2.55	
SF11	1.785	25.8	390-2300	7.9	300*	6.1	4.74	
UV silica	1.458	67.7	170-2500	3.5	1050	0.5	2.20	e.g. 'Spectrosil'
Sapphire	1.765†	72.2	170-5300	7.7	2000	5.3	3.98	Al_2O_3
LEBG‡	1.472	65.7	310-2700	3.6	500	3.2	2.20	e.g. 'Pyrex'
Float glass	1.517	59	340-2300	4.2	300*	9	2.5	see text
Acrylic	1.491	58	350-1600	3.9	80	67	1.19	e.g. 'Perspex'

*Attainable only by uniform slow heating; in practice thermal shock limits high-temperature use †Birefringent; $n_o = 1.768$, $n_e = 1.760$ ‡Low-expansion borosilicate glass



Spherical aberration calculation

To calculate the spherical aberration of a system and evaluate its effect proceed as follows.

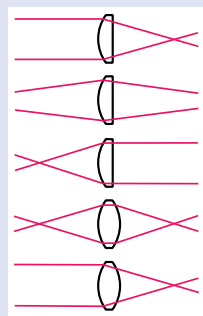
1. Calculate element contributions

For each lens element work out the wavefront aberration A:

$$A = ky^4/f^3$$

where y is the semi-aperture, or maximum ray height at the element (from an on-axis object); f is the element focal length, and the coefficient k depends on material, shape and conjugates and is given in the relevant section of this catalogue.

For BK7 or B270 lenses:



$$k = 0.0685$$

$$k = 0.135$$

$$k = 0.269$$

$$k = 0.0673$$

$$k = 0.101$$

For SF11 lenses: see [Section 1.2](#).

2. Sum contributions

Simply add the contributions algebraically to give the total wavefront aberration ΣA (deviation from the best-fit sphere).

3. Evaluate effect

If ΣA is less than $\lambda/4$ the system is diffraction-limited and aberration can usually be neglected. For larger aberration, the geometrical spot diameter D is given by:

$$D = 8 \Sigma A/v$$

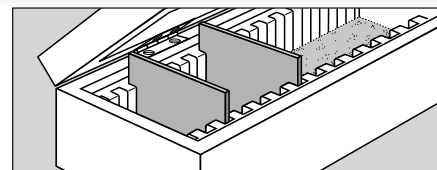
where y is as above, for the last element, and v is the distance from this element to the image.

For further detail request our Technical Note 'Spherical aberration'.

Storage boxes

These attractive wooden boxes are convenient to hold filters and other optics when not in use, allowing immediate access when required. They are listed in three sizes to hold the commonest sizes of filter.

Catalogue No.	Size held (mm)	No. of spaces
01 QB 12	Ø12.5	24
01 QB 25	Ø25	14
01 QB 50	50 x 50 / Ø50	14



Coating options

Calculation data

The reflectance (R_0) of an uncoated surface at normal incidence depends on the refractive index (n) according to:

$$R_0 = (n - 1)^2 / (n + 1)^2$$

With SLAR coating (MgF_2 , index 1.38) the reflectance is a minimum (R_{min}) at the design wavelength λ_0 , given by:

$$R_{min} = (1.38^2 - n)^2 / (1.38^2 + n)^2$$

The reflectance at any other wavelength λ is

$$R = R_{min} + (R_0 - R_{min}) \cos^2 \left[\frac{\pi \lambda_0}{2\lambda} \right]$$

AR coatings

Antireflection (AR) coating improves efficiency and reduces stray light and ghost images. We list many optics ready-coated, but special coatings greatly extend the range available. The wide variety of possible substrates and coatings makes it impossible to quote standard prices; quotations are available on request.

The simplest AR coating is a single layer of MgF_2 (SLAR), with a minimum reflectance of about 1.3% on crown glass (see graph and box). Unlike more complex coatings, the SLAR has a reflectance at all wavelengths of less than the uncoated substrate, so it is useful for optics which may be used outside the wavelength range primarily intended.

The V-AR coating is designed to minimise reflectance at one wavelength, usually specified as 0.25% max. but often in

practice much better, see typical curve.

A wide variety of **broadband** AR coatings are available; some examples are shown (see also p.4). Generally coatings for wider wavelength ranges have higher reflectances. Costs for the simpler types are similar to the V-AR.

Mirror coatings

These are used on prisms for internal reflection beyond the critical angle, or in wet or dirty conditions; on flat substrates (pp.25, 32) to form plane mirrors; and on lenses to form concave or convex mirrors.

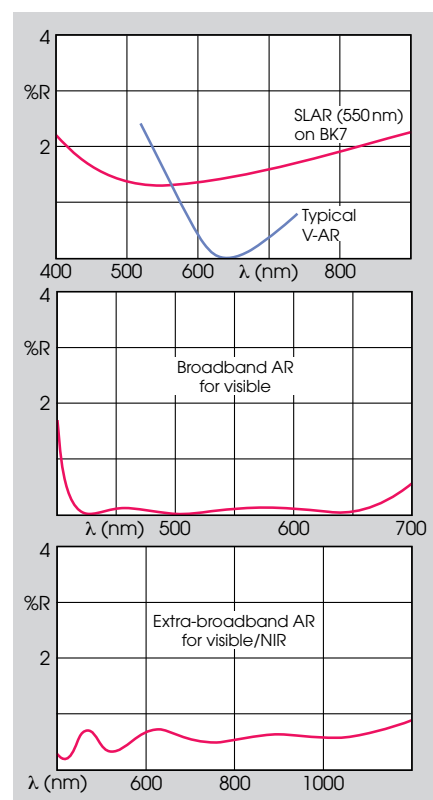
Protected aluminium (Al/SiO_x) gives a reflectance of 85-90% (external) in the visible and is the most economical coating for small batches. Other metal coatings include Al/MgF_2 for UV, gold for the IR, enhanced aluminium for higher visible reflectance and silver for internal use on prisms etc. Curves for some of these are shown on p.24.

For very high reflectances (over 99%) and high powers, dielectric coatings are available, either for single wavelengths or broadband; these are considerably more expensive than metal coatings. However, we have an extensive stock range of dielectric mirrors (pp.24-26) and can often cut special sizes from stock sheet materials at short notice.

Other coatings

These include broadband beamsplitter coatings (as on p.28), similar in cost to

broadband AR coatings, and dichroic coatings (as pp.38, 39) which are much more expensive, similar to dielectric mirrors. Many other possibilities exist – please enquire.



Mounting options

Customise

Most of our lenses and other circular components can be supplied from stock in standard mounts. This greatly simplifies the construction of optical systems by protecting components from damage in handling and providing mechanical interfaces to other components. Full details of our range of mounts and holders are given in Sections 11 and 15.

Components available ready-mounted are noted in the relevant sections, and the following types of mount are available.

Type MB – basic cylindrical cell, see p.54.

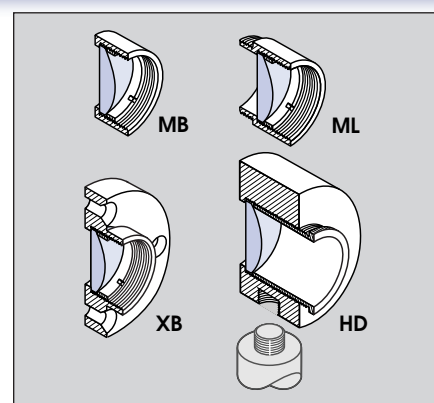
Type ML – cell with threaded spigot to attach to another cell or other TubeMount

element, see p.54.

Type XB – cell with flange to mount on flat surface (perpendicular to optical axis), see p.55.

Type HD – holder (see p.75) with M6 female thread in base to attach a mounting post (p.74) or direct mount to a breadboard or similar surface (parallel to the axis).

To order ready-mounted components simply add the suffix MB, etc. to the catalogue number, e.g. 25 PQ 16/MB would be a lens 25 PQ 16 in an MB type cell (specifically a cell 10 MB 16, as listed on p.54).

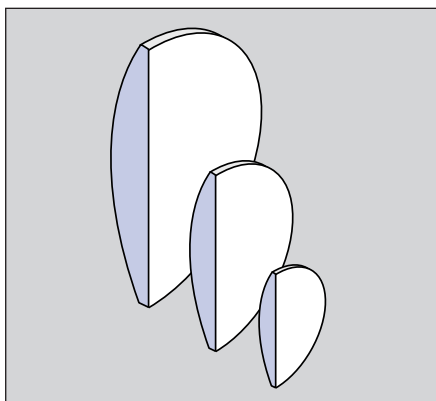


1.1 Quality convex lenses

Customise 

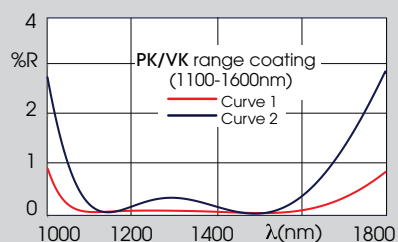
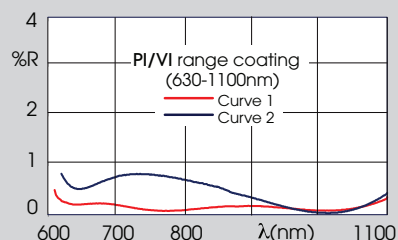
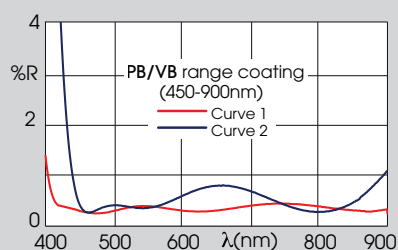
1

Convex lenses in crown glass are suitable for almost all singlet lens applications. Planoconvex lenses are normally specified for use with collimated light, but the biconvex form is better when the conjugates are roughly equal. Most lenses are also stocked in three different AR coatings covering from the visible out to telecoms IR wavelengths. Note special care is taken with the 630-1100nm coating to ensure good performance at 1064nm.



Coating specification

Two typical curves are shown for each coating. Curve 2 applies only to convex surfaces of short radius ($R < 1.33 \times \text{dia.}$) and Curve 1 to all other surfaces.



Catalogue No. Uncoated	Catalogue No. AR coated 450-900nm	Catalogue No. AR coated 630-1100nm	Catalogue No. AR coated 1100-1600nm	Focal length (mm)	Dia. (mm)	Back FL (mm)	Centre thick. (mm)	Glass type
Planoconvex								
2.5mm diameter								
025 PT 025	025 PX 025*	—	—	2.5	2.5	1.8	1.2	SF11
04 PT 025	04 PX 025*	—	—	4	2.5	3.4	1.0	SF11
4mm diameter								
04 PT 04	04 PX 04*	—	—	4	4	3.0	1.7	SF11
05 PQ 04	05 PB 04	—	—	5	4	3.7	1.9	BK7
06 PQ 04	06 PB 04	—	—	6.3	4	5.2	1.7	BK7†
10 PQ 04	10 PB 04	—	—	10	4	9.1	1.4	BK7†
6.3mm diameter								
06 PT 06	06 PX 06*	—	—	6.3	6.3	4.8	2.6	SF11
08 PQ 06	08 PB 06	08 PI 06	08 PK 06	8	6.3	6.1	3.0	BK7
10 PQ 06	10 PB 06	10 PI 06	10 PK 06	10	6.3	8.3	2.6	B270
12 PQ 06	12 PB 06	12 PI 06	12 PK 06	12.5	6.3	11.0	2.3	BK7
16 PQ 06	16 PB 06	16 PI 06	16 PK 06	16	6.3	14.6	2.1	BK7
20 PQ 06	20 PB 06	20 PI 06	20 PK 06	20	6.3	18.7	2.0	BK7
25 PQ 06	25 PB 06	25 PI 06	25 PK 06	25	6.3	23.7	1.9	B270
40 PQ 06	40 PB 06	40 PI 06	40 PK 06	40	6.3	38.9	1.7	BK7
63 PQ 06	63 PB 06	63 PI 06	63 PK 06	63	6.3	61.9	1.7	B270
10mm diameter								
12 PQ 10	12 PB 10	12 PI 10	12 PK 10	12.5	10	9.9	3.9	BK7
16 PQ 10	16 PB 10	16 PI 10	16 PK 10	16	10	13.9	3.2	BK7
20 PQ 10	20 PB 10	20 PI 10	20 PK 10	20	10	18.2	2.8	BK7
25 PQ 10	25 PB 10	25 PI 10	25 PK 10	25	10	23.4	2.5	BK7
32 PQ 10	32 PB 10	32 PI 10	32 PK 10	31.5	10	30.0	2.3	BK7
40 PQ 10	40 PB 10	40 PI 10	40 PK 10	40	10	38.6	2.1	BK7
50 PQ 10	50 PB 10	50 PI 10	50 PK 10	50	10	48.7	2.0	BK7†
63 PQ 10	63 PB 10	63 PI 10	63 PK 10	63	10	61.7	1.9	BK7
100 PQ 10	100 PB 10	100 PI 10	100 PK 10	100	10	98.9	1.7	BK7
16mm diameter								
20 PQ 16	20 PB 16	20 PI 16	20 PK 16	20	16	16.5	5.3	BK7
25 PQ 16	25 PB 16	25 PI 16	25 PK 16	25	16	22.2	4.3	BK7
32 PQ 16	32 PB 16	32 PI 16	32 PK 16	31.5	16	29.1	3.6	BK7
40 PQ 16	40 PB 16	40 PI 16	40 PK 16	40	16	38.0	3.1	BK7
50 PQ 16	50 PB 16	50 PI 16	50 PK 16	50	16	48.2	2.8	BK7
63 PQ 16	63 PB 16	63 PI 16	63 PK 16	63	16	61.4	2.5	BK7†
80 PQ 16	80 PB 16	80 PI 16	80 PK 16	80	16	78.5	2.3	BK7
100 PQ 16	100 PB 16	100 PI 16	100 PK 16	100	16	98.6	2.1	BK7†
160 PQ 16	160 PB 16	160 PI 16	160 PK 16	160	16	158.7	1.9	BK7
25mm diameter								
25 PT 25	25 PX 25*	—	—	25	25	21.6	6.0	SF11
32 PQ 25	32 PB 25	32 PI 25	32 PK 25	31.5	25	26.6	7.4	BK7
40 PQ 25	40 PB 25	40 PI 25	40 PK 25	40	25	36.2	5.7	BK7
50 PQ 25	50 PB 25	50 PI 25	50 PK 25	50	25	46.9	4.7	BK7
63 PQ 25	63 PB 25	63 PI 25	63 PK 25	63	25	60.4	4.0	BK7
80 PQ 25	80 PB 25	80 PI 25	80 PK 25	80	25	77.8	3.4	BK7
100 PQ 25	100 PB 25	100 PI 25	100 PK 25	100	25	98.0	3.0	BK7
125 PQ 25	125 PB 25	125 PI 25	125 PK 25	125	25	123.2	2.7	BK7
160 PQ 25	160 PB 25	160 PI 25	160 PK 25	160	25	158.4	2.5	BK7
200 PQ 25	200 PB 25	200 PI 25	200 PK 25	200	25	198.5	2.3	BK7
250 PQ 25	250 PB 25	250 PI 25	250 PK 25	250	25	248.6	2.1	BK7
315 PQ 25	315 PB 25	315 PI 25	315 PK 25	315	25	313.7	2.0	BK7
400 PQ 25	400 PB 25	400 PI 25	400 PK 25	400	25	398.8	1.9	BK7
500 PQ 25	500 PB 25	500 PI 25	500 PK 25	500	25	498.8	1.8	BK7
630 PQ 25	630 PB 25	630 PI 25	630 PK 25	630	25	628.9	1.7	BK7
800 PQ 25	800 PB 25	800 PI 25	800 PK 25	800	25	798.9	1.7	BK7
1000 PQ 25	1000 PB 25	1000 PI 25	1000 PK 25	1000	25	998.9	1.7	BK7
1600 PQ 25	1600 PB 25	1600 PI 25	1600 PK 25	1600	25	1598.9	1.6	BK7
2500 PQ 25	2500 PB 25	2500 PI 25	2500 PK 25	2500	25	2498.9	1.6	BK7

*SLAR coated for visible, very efficient for this material, see graph p.6 † Coated lenses B270

1.1 Quality convex lenses (continued)

Customise 

Specification

Diameter	+0, -0.1mm (≤ 63 mm) +0, -0.15mm (> 63 mm)
Focal length (at 587nm)	± 0.2 mm (< 10 mm) $\pm 2\%$ (10–1000mm) $\pm 5\%$ (> 1000 mm)
Scratch-dig	40-20 (see p.2)
Centration	0.1mm (FL ≤ 40 mm) 2.5mrad (FL > 40 mm)
Centre thickness	± 0.35 mm
Edge thickness	
Lens dia. 2.5mm	0.75mm
Lens dia. 4mm	1.0mm
Lens dia. ≥ 6.3 mm	1.5mm
Material data	see p.2

Sets at special price

Uncoated planoconvex lenses:

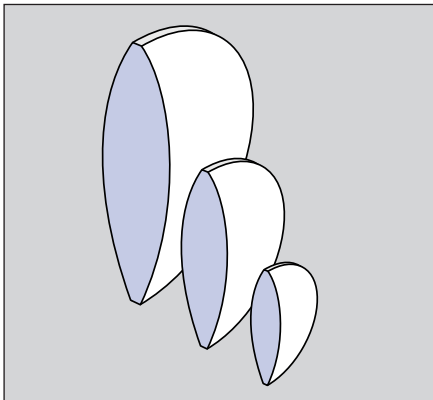
04 PQ 01	10mm set (9 lenses)
05 PQ 01	16mm set (9 lenses)
06 PQ 01	25mm set (19 lenses)
07 PQ 01	40mm set (9 lenses)

AR-coated planoconvex lenses (450-900nm):

01 PB 01	10mm set (9 lenses)
02 PB 01	16mm set (9 lenses)
03 PB 01	25mm set (19 lenses)
04 PB 01	40mm set (9 lenses)

Uncoated biconvex lenses:

01 VQ 00	10mm set (5 lenses)
02 VQ 00	16mm set (5 lenses)
03 VQ 00	25mm set (7 lenses)
04 VQ 00	40mm set (4 lenses)



Options available (see p.3)

- Mounting (lenses up to 50mm dia.)
- Special AR coating
- Edging to smaller diameters

See also:

Higher quality singlets	pp.6,14
Larger sizes	pp.9,16
UV lenses	p.7
Shorter FL and larger relative aperture	pp.7,14-16
Lower-cost lenses	pp.8,9
Aberration calculation	p.2

Catalogue No. Uncoated	Catalogue No. AR coated 450-900nm	Catalogue No. AR coated 630-1100nm	Catalogue No. AR coated 1100-1600nm	Focal length (mm)	Dia. (mm)	Back FL (mm)	Centre thick. (mm)	Glass type
Planoconvex (continued)								
<i>40mm diameter</i>								
50 PQ 40	50 PB 40	–	–	50	40	42.7	11.0	BK7
63 PQ 40	63 PB 40	–	–	63	40	57.5	8.4	BK7
80 PQ 40	80 PB 40	–	–	80	40	75.6	6.7	BK7
100 PQ 40	100 PB 40	–	–	100	40	96.4	5.5	BK7†
125 PQ 40	125 PB 40	–	–	125	40	121.9	4.7	BK7
160 PQ 40	160 PB 40	–	–	160	40	157.4	4.0	BK7†
200 PQ 40	200 PB 40	–	–	200	40	197.7	3.5	BK7
250 PQ 40	250 PB 40	–	–	250	40	248.0	3.1	BK7
500 PQ 40	500 PB 40	–	–	500	40	498.5	2.3	BK7
<i>50mm diameter</i>								
63 PQ 50	63 PB 50	–	–	63	50	54.4	13.0	BK7
80 PQ 50	80 PB 50	–	–	80	50	73.5	9.9	BK7
100 PQ 50	100 PB 50	–	–	100	50	94.8	7.9	BK7
160 PQ 50	160 PB 50	–	–	160	50	154.4	5.4	B270
250 PQ 50	250 PB 50	–	–	250	50	247.4	3.9	B270
500 PQ 50	500 PB 50	–	–	500	50	498.2	2.7	B270
<i>63mm diameter</i>								
100 PQ 63	–	–	–	100	63	92.0	12.2	BK7
125 PQ 63	–	–	–	125	63	118.6	9.7	BK7
160 PQ 63	–	–	–	160	63	154.9	7.7	BK7
250 PQ 63	–	–	–	250	63	246.4	5.4	BK7
500 PQ 63	–	–	–	500	63	497.8	3.4	B270
1000 PQ 63	–	–	–	1000	63	998.4	2.5	BK7
<i>100mm diameter</i>								
160 PQ 100	–	–	–	160	100	147.9	18.3	BK7
250 PQ 100	–	–	–	250	100	242.4	11.6	BK7
500 PQ 100	–	–	–	500	100	495.8	6.4	BK7
Biconvex								
<i>6.3mm diameter</i>								
06 VQ 06	06 VB 06	06 VI 06	06 VK 06	6.3	6.3	5.1	3.3	BK7
08 VQ 06	08 VB 06	08 VI 06	08 VK 06	8	6.3	7.0	2.8	BK7
10 VQ 06	10 VB 06	10 VI 06	10 VK 06	10	6.3	9.1	2.5	BK7
<i>10mm diameter</i>								
10 VQ 10	10 VB 10	10 VI 10	10 VK 10	10	10	8.5	4.3	BK7
12 VQ 10	12 VB 10	12 VI 10	12 VK 10	12.5	10	11.2	3.6	BK7
16 VQ 10	16 VB 10	16 VI 10	16 VK 10	16	10	14.9	3.1	BK7
20 VQ 10	20 VB 10	20 VI 10	20 VK 10	20	10	19.1	2.8	BK7
25 VQ 10	25 VB 10	25 VI 10	25 VK 10	25	10	24.2	2.5	BK7
<i>16mm diameter</i>								
16 VQ 16	16 VB 16	16 VI 16	16 VK 16	16	16	13.9	6.0	BK7
20 VQ 16	20 VB 16	20 VI 16	20 VK 16	20	16	18.3	4.9	BK7
25 VQ 16	25 VB 16	25 VI 16	25 VK 16	25	16	23.6	4.1	BK7
32 VQ 16	32 VB 16	32 VI 16	32 VK 16	31.5	16	30.3	3.5	BK7
40 VQ 16	40 VB 16	40 VI 16	40 VK 16	40	16	38.1	3.1	BK7
<i>25mm diameter</i>								
25 VQ 25	25 VB 25	25 VI 25	25 VK 25	25	25	22.1	8.4	BK7
32 VQ 25	32 VB 25	32 VI 25	32 VK 25	31.5	25	29.2	6.7	BK7
40 VQ 25	40 VB 25	40 VI 25	40 VK 25	40	25	38.1	5.5	BK7
50 VQ 25	50 VB 25	50 VI 25	50 VK 25	50	25	48.5	4.6	BK7
63 VQ 25	63 VB 25	63 VI 25	63 VK 25	63	25	61.7	3.9	BK7
80 VQ 25	80 VB 25	80 VI 25	80 VK 25	80	25	78.9	3.4	BK7
100 VQ 25	100 VB 25	100 VI 25	100 VK 25	100	25	99	3.0	BK7
<i>40mm diameter</i>								
40 VQ 40	40 VB 40	40 VI 40	40 VK 40	40	40	35.6	12.5	BK7
50 VQ 40	50 VB 40	50 VI 40	50 VK 40	50	40	46.6	9.9	BK7
63 VQ 40	63 VB 40	63 VI 40	63 VK 40	63	40	60.3	7.9	BK7
100 VQ 40	100 VB 40	100 VI 40	100 VK 40	100	40	98.1	5.4	BK7

1.2 High-index planoconvex laser lenses

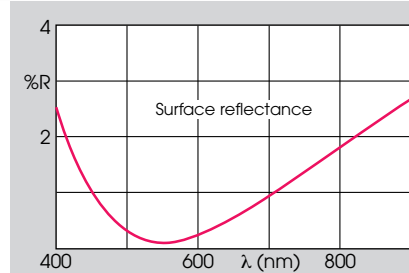
Customise 

1

Lenses in high-index glass ($n = 1.785$) have only 55% of the spherical aberration of equivalent BK7 lenses, and can be very efficiently AR coated with a single-layer coating. Beam expanders etc. can therefore be made with near diffraction-limited performance and very high transmittance, and suitable for high powers, having no cemented interfaces.

Specification

Diameter	+0, -0.1mm
Focal length (at 587nm)	$\pm 0.2\text{mm}$ ($\leq 10\text{mm}$) $\pm 2\%$ ($> 10\text{mm}$)
Figure (sphericity)	$\lambda/4$ (typical)
Scratch-dig	40-20 (see p.2)
Centration	0.05mm (FL $\leq 25\text{mm}$) 1.5mrad (FL $> 25\text{mm}$)
Material	SF11 (see p.2)



Catalogue No. AR coated	Focal length (mm)	Dia. (mm)	Back FL (mm)	Centre thick. (mm)	Edge thick. (mm)	Diffraction- limited aperture (mm)
025 PX 025	2.5	2.5	1.8	1.2	0.75	1.01
04 PX 025	4	2.5	3.4	1.0	0.75	1.44
04 PX 04	4	4	3.0	1.7	1	1.44
06 PX 04	6.3	4	5.5	1.4	1	2.03
06 PX 06	6.3	6.3	4.8	2.6	1.5	2.03
10 PX 04	10	4	9.3	1.3	1	2.87
16 PX 06	16	6.3	14.9	1.9	1.5	4.08
25 PX 06	25	6.3	24.0	1.8	1.5	5.71
25 PX 25	25	25	21.6	6.0	1.5	5.71
40 PX 10	40	10	38.9	1.9	1.5	8.11
63 PX 16	63	16	61.7	2.2	1.5	11.4
100 PX 16	100	16	98.9	1.9	1.5	16.1*
160 PX 25	160	25	158.2	2.1	1.5	23.0

Options available (see [p.3](#))

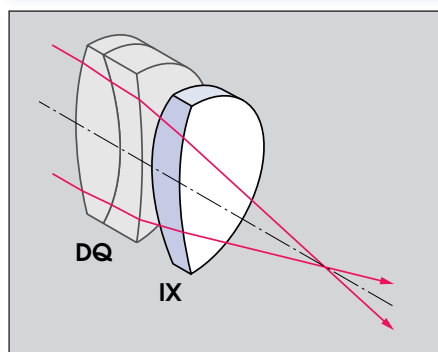
- Mounting (all items)
- Edging to smaller diameters

Aberration calculation (see [p.2](#))

The maximum aperture at which the lens is diffraction-limited at 633nm is given in the table.

* Diffraction-limited at full aperture

1.3 Meniscus laser lenses

Customise 

A high-index meniscus lens can be added to a focusing lens to increase its power and relative aperture with very little extra spherical aberration or coma. Those listed here are designed to be used with another lens of the same focal length (with collimated input), such as the PX series above or the doublets on [p.17](#). The power and numerical aperture of the lens are then doubled. Such combinations are listed ready-mounted on [pp.19, 20](#).

The lenses are available with and without AR coating; for coating performance see graph in Section 1.2.

Specification

Diameter	+0, -0.1mm
Focal length (at 587nm)	$\pm 2\%$
Figure (sphericity)	$\lambda/4$ (typical)
Scratch-dig	40-20 (see p.2)
Centration	0.05mm (FL $\leq 25\text{mm}$) 1.5mrad (FL $> 25\text{mm}$)
Material	SF11 (see p.2)

Options available (see [p.3](#))

- Mounting (all items)
- Special AR coating
- Edging to smaller diameters

Aberration calculation (see [p.2](#))

See also:

Combinations including these lenses [p.19, 20](#)
Crown-glass meniscus lenses [p.8](#)

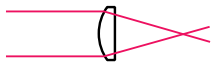
Catalogue No. Uncoated	Catalogue No. AR coated	Focal length (mm)	Dia. (mm)	Back FL (mm)	Centre thick. (mm)	Edge thick. (mm)	Radii (mm)
10 IT 04	10 IX 04	10	4	8.3	1.2	0.8	3.16/4.40
16 IT 06	16 IX 06	16	6.3	13.3	1.9	1.3	5.05/7.04
25 IT 10	25 IX 10	25	10	22.2	2.1	1.2	8.25/12.63
40 IT 16	40 IX 16	40	16	36.6	2.6	1.2	13.60/21.97

1.4 UV-silica convex lenses

Customise 

Synthetic fused silica is normally specified for UV use (down to 170nm) but also has very low fluorescence, excellent thermal properties and high resistance to radiation and to chemical attack. Lenses are available uncoated or with multilayer AR coating for 248-400nm.

Aberration calculation (see p.2)



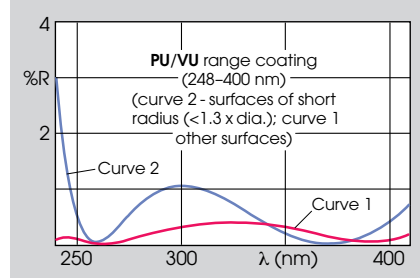
$$k = 0.0865$$

Specification

Diameter	+0, -0.1mm
Focal length (at 587nm)	±2%
Scratch-dig	40-20 (see p.2)
Edge thickness	1.5mm ± 0.35mm
Material	UV silica (see p.2 and graph p.11)

Sets at special price

01 PS 00	Uncoated set (31 lenses)
01 PU 00	AR-coated set (31 lenses)



Options available (see p.3)

- Mounting (all items)
- Special AR coating
- Edging to smaller diameters

Catalogue No. Uncoated	Catalogue No. AR coated 248-400nm	Focal length (mm)	Diameter (mm)	Back FL (mm)	Form
10 PS 06	10 PU 06	10	6.3	8.1	planovex
10 VS 10	10 VU 10	10	10	8.2	bivex
16 PS 10	16 PU 10	16	10	13.6	planovex
25 PS 10	25 PU 10	25	10	23.2	planovex
16 VS 16	16 VU 16	16	16	13.5	bivex
25 PS 16	25 PU 16	25	16	21.7	planovex
40 PS 16	40 PU 16	40	16	37.7	planovex
63 PS 16	63 PU 16	63	16	61.2	planovex
25 VS 25	25 VU 25	25	25	21.5	bivex
32 PS 25	32 PU 25	31.5	25	25.5	planovex
40 PS 25	40 PU 25	40	25	35.6	planovex
50 PS 25	50 PU 25	50	25	46.4	planovex
63 PS 25	63 PU 25	63	25	60.0	planovex
80 PS 25	80 PU 25	80	25	77.5	planovex
100 PS 25	100 PU 25	100	25	97.8	planovex
125 PS 25	125 PU 25	125	25	123.0	planovex

Catalogue No. Uncoated	Catalogue No. AR coated 248-400nm	Focal length (mm)	Diameter (mm)	Back FL (mm)	Form
160 PS 25	160 PU 25	160	25	158.2	planovex
200 PS 25	200 PU 25	200	25	198.4	planovex
250 PS 25	250 PU 25	250	25	248.5	planovex
500 PS 25	500 PU 25	500	25	498.7	planovex
1000 PS 25	1000 PU 25	1000	25	998.9	planovex
40 VS 40	40 VU 40	40	40	34.7	bivex
63 PS 40	63 PU 40	63	40	56.5	planovex
100 PS 40	100 PU 40	100	40	95.8	planovex
160 PS 40	160 PU 40	160	40	157.1	planovex
63 PS 50	63 PU 50	63	50	52.1	planovex
100 PS 50	100 PU 50	100	50	93.9	planovex
160 PS 50	160 PU 50	160	50	156.0	planovex
250 PS 50	250 PU 50	250	50	247.1	planovex
500 PS 50	500 PU 50	500	50	498.0	planovex
1000 PS 50	1000 PU 50	1000	50	998.5	planovex

1.5 Sapphire and glass ball lenses

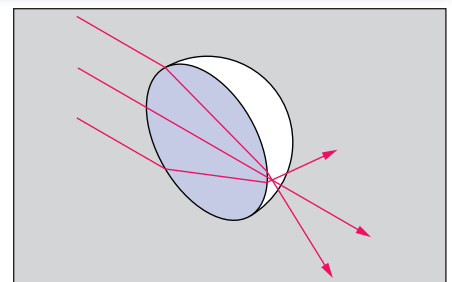
Customise 

Ball lenses have very low spherical aberration and so focus and collimate light very accurately; a sapphire ball has only 23% of the aberration of an equivalent BK7 planovex lens over the same aperture (see boxes p.2 and below). They are available economically at very high precision and are simple to mount. Sapphire can be used from 200nm to 5.3μm and has exceptional hardness, strength and temperature resistance (see p.2 and graph p.31).

Specification

Diameter*	±2.5μm
Figure (sphericity)*	1λ (typical)
Scratch-dig	40-20 (see p.2)
Material data	see p.2

*Manufacturer's data



Aberration calculation (see p.2)



$$k = 0.0156 \text{ (sapphire)}$$

$$k = 0.0366 \text{ (BK7)}$$

Sapphire ball lenses

Catalogue No.	Focal length (mm)	Dia. (mm)	Back FL (mm)
003 VA 006	0.345	0.6	0.045
006 VA 01	0.576	1	0.076
009 VA 016	0.921	1.6	0.121
014 VA 025	1.44	2.5	0.19
023 VA 04	2.30	4	0.30
035 VA 06	3.45	6	0.45
06 VA 10	5.76	10	0.76

BK7 ball lenses

Catalogue No.	Focal length (mm)	Dia. (mm)	Back FL (mm)
007 VQ 01	0.734	1	0.234
011 VQ 015	1.10	1.5	0.35
018 VQ 025	1.83	2.5	0.58
03 VQ 04	2.93	4	0.93
04 VQ 06	4.40	6	1.40
07 VQ 10	7.34	10	2.34

1.6 Crown-glass meniscus lenses

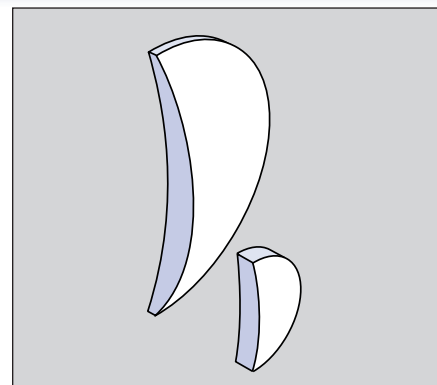
Customise 

1

Ophthalmic meniscus lenses offer a wide range of powers at low cost, especially in longer focal lengths. The 60/65mm lenses may have moulded edges whilst the 25mm are edged and centred.

Specification

Diameter	+0, -0.25mm (25mm) ±1mm (60/65mm)
Back vertex power (= 1/back FL)	± 0.06D (≤ 4D) ± 0.12D (> 4D)
Scratch-dig	60-40 (see p.2)
Material	B270 (see p.2)



Sets at special price

01 IO 00	25mm set (13 lenses)
02 IO 00	60/65mm set (15 lenses)

Options available (see [p.3](#))

- Mounting (25mm dia. only)
- AR coating
- Edging to smaller diameters

See also:

High-index meniscus lenses	p.6
Negative meniscus lenses	p.11
Cylindrical meniscus lenses	p.13

Catalogue No. 65mm dia.	Catalogue No. 25mm dia.	Focal length (mm)	Back FL (mm)	Back vertex power (diopter)
100 IO 60*	—	106	100	10
125 IO 60*	—	132	125	8
160 IO 60*	160 IO 25	165	160	6.25
200 IO 65	200 IO 25	207	200	5
250 IO 65	250 IO 25	257	250	4
333 IO 65	333 IO 25	340	333	3
400 IO 65	400 IO 25	407	400	2.5
500 IO 65	500 IO 25	508	500	2
570 IO 65	570 IO 25	580	570	1.75
667 IO 65	667 IO 25	674	667	1.5
800 IO 65	800 IO 25	809	800	1.25
1000 IO 65	1000 IO 25	1010	1000	1
1333 IO 65	1333 IO 25	1346	1333	0.75
2000 IO 65	2000 IO 25	2019	2000	0.5
4000 IO 65	4000 IO 25	4034	4000	0.25

*60mm diameter

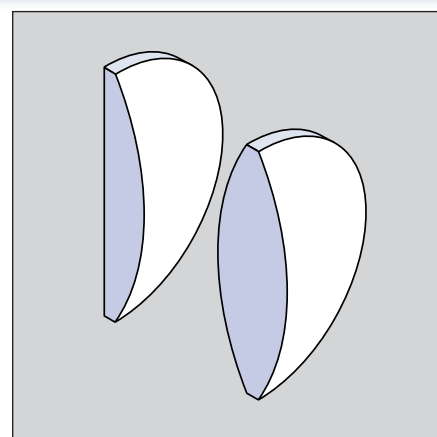
1.7 Commercial convex lenses

Customise 

Commercial-grade lenses are suitable for teaching and experimental work, and as condensers, magnifiers etc. where high quality is not needed.

Specification

Dimensions	Nominal
Material	Float glass or B270 (see p.2)



Planoconvex lenses

Catalogue No.	Focal length (mm)	Dia. (mm)
16 PC 06	16	6.3
25 PC 06	25	6.3
40 PC 16	40	16
50 PC 25	50	25
70 PC 25	70	25
100 PC 25	100	25
50 PC 38	50	38
100 PC 38	100	38
150 PC 38	150	38
200 PC 38	200	38
500 PC 38	500	38
100 PC 50	100	50
143 PC 50	143	50
200 PC 50	200	50
400 PC 50	400	50
150 PC 100	150	100

Biconvex lenses

Catalogue No.	Focal length (mm)	Dia. (mm)
50 VC 25	50	25
100 VC 25	100	25
150 VC 25	150	25
50 VC 38	50	38
100 VC 38	100	38
150 VC 38	150	38
250 VC 38	250	38
500 VC 38	500	38
1000 VC 38	1000	38
50 VC 50	50	50
100 VC 50	100	50
150 VC 50	150	50
250 VC 50	250	50
500 VC 50	500	50
1000 VC 50	1000	50

Sets at special price

03 PC 00	Planoconvex set (16 lenses)
03 VC 00	Biconvex set (15 lenses)

Options available (see [p.3](#))

- Mounting (lenses up to 50mm dia.)
- AR coating
- Edging to smaller diameters

1.8 Large condenser lenses

Customise 

These planoconvex condenser lenses are optically polished with moulded edges. Except for **568 PQ 254** they are in low-expansion borosilicate glass (Suprax) and have excellent thermal shock resistance. This material contains some striae and bubbles, but these are not normally significant for condenser applications.

See also:

Smaller planovex lenses [pp.4.8](#)
Aspheric condensers [p.15](#)
Fresnel lenses [p.16](#)

Specification

Diameter	nominal
Focal length	±5%
Refractive index (n_d):	
Suprax	1.483
B270	1.523
Expansion coefficient ($10^{-6}/K$):	
Suprax	4.3
B270	8.2

Catalogue No.	Focal length (mm)	Dia. (mm)	Material FL (mm)
237 PH 152	237	152	Suprax
329 PH 152	329	152	Suprax
427 PH 152	427	152	Suprax
329 PH 203	329	203	Suprax
427 PH 203	427	203	Suprax
534 PH 203	534	203	Suprax
568 PQ 254	568	254	B270

1.9 Fire-polished biconvex lenses

Customise 

These inexpensive moulded glass lenses of large aperture are commonly used to concentrate light onto detectors and for similar non-critical uses.

Options available (see p.3)

- Edging to smaller diameters

Sets at special price

01 VF 00 Complete set (4 lenses)

See also:

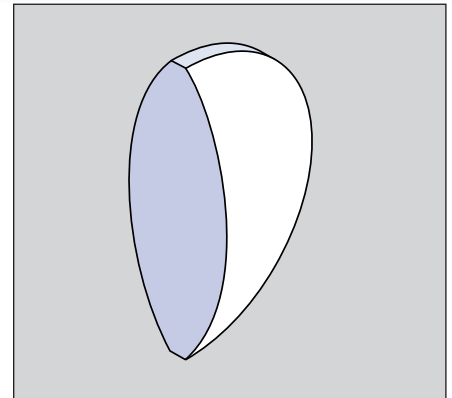
Aspheric condensers [p.15](#)

Specification

Diameter	+0, -0.5mm
Focal length	±10%
Material	B270 (see p.2)

Catalogue No.	Focal length (mm)	Dia. (mm)	Edge thick. (mm)
07 VF 07	7	7.39	2.0
12 VF 14	12	13.97	2.4
23 VF 26	23	26.2	2.0
50 VF 42	50	51.0*	3.9

*Flanged lens, 42mm aperture



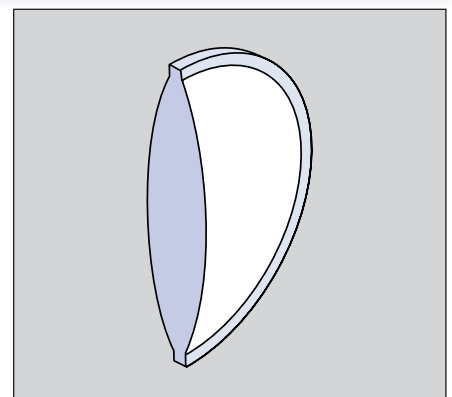
1.10 Plastic lenses

Customise 

Plastic lenses are generally used for their low price, particularly in bulk, but are also lightweight, shatterproof and machinable.

Specification

Diameter	+0, -0.25mm
Focal length	±5%
Material data:	
Acrylic (see p.2)	$n = 1.49$, $v = 58$
Polystyrene	$n = 1.59$, $v = 31$



Sets at special price

01 PP 00 Complete set (12 lenses)

See also:

Plastic aspherics [pp.14,15](#)
Fresnel lenses [p.16](#)

Catalogue No.	Focal length (mm)	Overall dia. (mm)	Lens aper. (mm)	Back FL (mm)	Material	Form
05 VP 04	5.4	7.8	4.1	4.0	acrylic	bivex
07 VP 06	6.8	6.4	6.0	5.8	acrylic	bivex
10 VP 09	10.3	10.0	8.8	9.1	acrylic	bivex
20 VP 14	20.0	16.0	14.0	19.0	polystyrene	bivex
26 VP 08	26.0	9.8	7.8	25.3	acrylic	bivex
33 PP 09	32.7	9.0	9.0	30.6	acrylic	planovex
41 PP 13	40.8	12.9	12.8	39.3	acrylic	planovex
53 VP 18	52.9	17.9	17.9	52.2	polystyrene	bivex
62 VP 25	61.8	25.5	25.5	60.6	acrylic	bivex
100 VP 25	100.4	25.4	25.4	99.6	acrylic	bivex
159 PP 34	159.2	33.6	33.6	157.1	acrylic	planovex
499 PP 38	499.0	38.1	38.1	497.8	acrylic	planovex

2.1 Quality concave lenses

Customise 

Negative lenses form a reduced virtual image of a real object (as in door viewers). However, if inserted in a system such as a microscope upstream from an image plane, the image will be magnified and projected further. Such a lens is known in microscopy as a tube-length correction lens and in astronomy as a Barlow lens.

Options available (see p.3)

- Mounting (all items) • Special AR coatings
- Edging to smaller diameters

Sets at special price

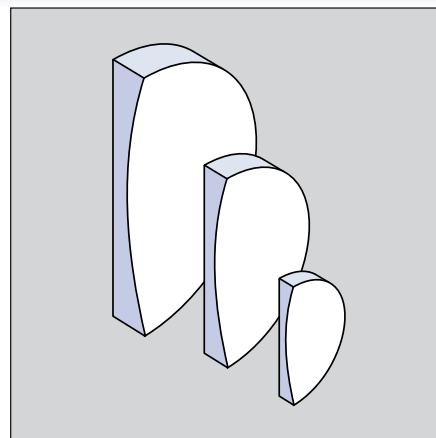
03 NQ 00 Uncoated set (18 lenses)
03 NB 00 AR-coated set (18 lenses)

Specification

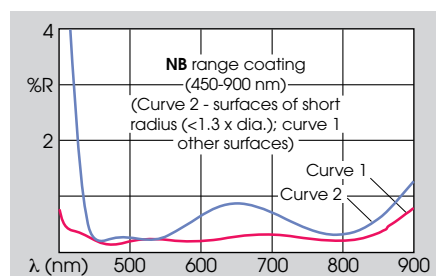
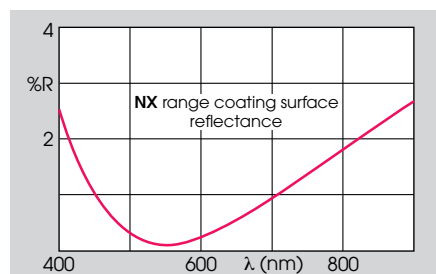
Form	planoconcave
Diameter	+0, -0.1mm
Focal length	±0.2mm (≤10mm) ±2% (>10mm)
Scratch-dig	40-20 (see p.2)
Centration	0.1mm (FL ≤ 40mm) 2.5mrad (FL > 40mm)
Material data	see p.2
AR coating	multilayer for 450-900nm (except SF11 – SLAR).

See also:

Negative doublets [p.17](#)



Catalogue No. Uncoated	Catalogue No. AR coated 450-900nm	Focal length (mm)	Dia. (mm)	Back FL (mm)	Centre thick. (mm)	Edge thick. (mm)	Radius (mm)	Glass type
04 NT 025	04 NX 025	4	2.5	4.4	0.75	1.0	3.14	SF11
06 NT 04	06 NX 04	6.3	4	6.9	1.0	1.4	4.95	SF11
10 NT 06	10 NX 06	10	6.3	10.8	1.5	2.2	7.85	SF11
16 NQ 10	16 NB 10	16	10	17.0	1.5	3.2	8.27	BK7
25 NQ 10	25 NB 10	25	10	26.0	1.5	2.5	12.9	BK7
40 NQ 10	40 NB 10	40	10	41.0	1.5	2.1	20.9	BK7
25 NQ 16	25 NB 16	25	16	26.0	1.5	4.2	12.9	BK7
40 NQ 16	40 NB 16	40	16	41.0	1.5	3.1	20.9	BK7
63 NQ 16	63 NB 16	63	16	64.0	1.5	2.5	32.6	BK7
100 NQ 16	100 NB 16	100	16	101.0	1.5	2.1	51.7	BK7
25 NT 25	25 NX 25	25	25	25.8	1.5	6.0	19.6	SF11
32 NQ 25	32 NB 25	31.5	25	32.5	1.5	7.4	16.3	BK7
40 NQ 25	40 NB 25	40	25	41.0	1.5	5.6	20.7	BK7
50 NQ 25	50 NB 25	50	25	51.0	1.5	4.7	25.8	BK7
63 NQ 25	63 NB 25	63	25	64.0	1.5	4.0	32.6	BK7
100 NQ 25	100 NB 25	100	25	101.0	1.5	3.0	51.7	BK7
160 NQ 25	160 NB 25	160	25	161.0	1.5	2.4	82.7	BK7
250 NQ 25	250 NB 25	250	25	251.0	1.5	2.1	129	BK7

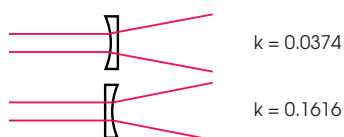


2.2 High-index planoconcave laser lenses

Customise 

These AR-coated negative lenses complement the positive lenses in [Section 1.2](#), with which they may be combined to form Galilean beam-expanders (see [p.23](#)). The high index reduces spherical aberration and allows use of an efficient and economical single-layer AR coating.

Aberration calculation (see p.2)



Note: Aberration is negative and tends to cancel aberration of any positive elements in the system. Reversed orientation (as lower picture) therefore often reduces total system aberration.

Specification

Diameter	+0, -0.1mm
Focal length	±0.2mm (≤10mm) ±2% (>10mm)
Figure (sphericity)	λ/4 (typical)
Scratch-dig	40-20 (see p.2)
Centration	0.05mm
Material	SF11 (see p.2)
AR coating	see curve p.6

Options available (see p.3)

- Mounting (all items)
- Edging to smaller diameters

See also:

SF11 convex lenses [p.6](#)
Beam expanders [p.23](#)

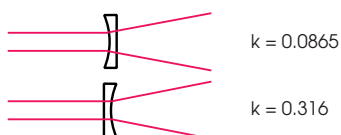
Catalogue No.	Focal length (mm)	Dia. (mm)	Back FL (mm)	Centre thick. (mm)	Edge thick. (mm)	Radius (mm)
04 NX 025	4	2.5	4.4	0.75	1.0	3.14
06 NX 04	6.3	4	6.9	1.0	1.4	4.95
10 NX 06	10	6.3	10.8	1.5	2.2	7.85
16 NX 10	16	10	16.8	1.5	2.5	12.6
25 NX 16	25	16	25.8	1.5	3.2	19.6

2.3 UV-silica concave lenses

Customise

This range provides negative lenses for use down to 170nm in the UV, or for hostile environments requiring greater thermal, chemical or radiation resistance than ordinary glasses. AR-coated lenses are also offered for improved UV transmittance (248-400nm, see curve).

Aberration calculation (see p.2)



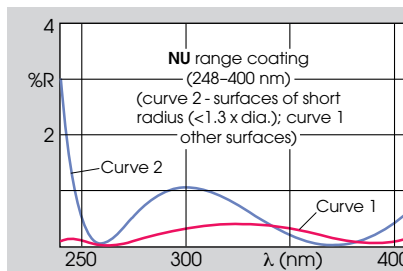
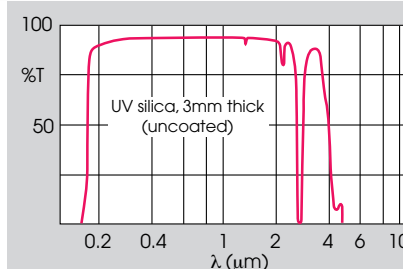
Note that aberration is negative.

Specification

Form	planoconcave
Diameter	+0, -0.1mm
Focal length	±2%
Scratch-dig	40-20 (see p.2)
Centration	0.1mm (FL ≤ 40mm) 2.5mm (FL > 40mm)
Material	UV silica (see p.2)

Options available (see p.3)

- Mounting (all items)
- Special AR coating
- Edging to smaller diameters



Sets at special price

01 NS 00	Uncoated set (6 lenses)
01 NU 00	AR-coated set (6 lenses)

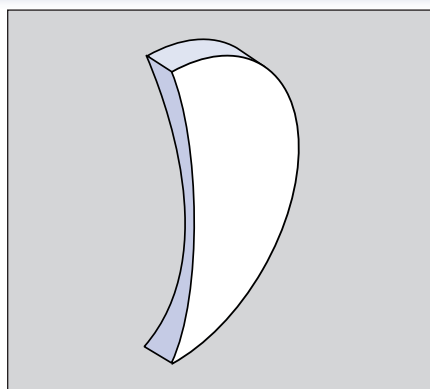
2.4 Meniscus negative lenses

Customise

Ophthalmic meniscus lenses offer a wide range of powers at very low cost, and are particularly useful as supplementary lenses to reduce the power of another lens. The 60/65mm lenses may have moulded edges whilst the 25mm are edged and centred.

Specification

Back vertex power (=1/back FL)	±0.06D (≤4D) ±0.12D (>4D)
Diameter	+0, -0.25mm (25mm) ±1mm (60/65mm)
Scratch-dig	60-40 (see p.2)
Material	B270 (see p.2)



Sets at special price

01 JO 00	25mm set (14 lenses)
02 JO 00	60/65mm set (16 lenses)

Options available (see p.3)

- Mounting (25mm only)
- AR coating
- Edging to smaller diameters

See also:

Positive meniscus lenses	pp.6, 8
Cylindrical meniscus lenses	p.13

Catalogue No. 65mm dia.	Catalogue No. 25mm dia.	Focal length (mm)	Back FL (mm)	Back vertex power (diopter)
80 JO 60*	—	80	80	12.5
100 JO 60*	—	100	100	10
125 JO 60*	125 JO 25	125	125	8
160 JO 60*	160 JO 25	160	160	6.25
200 JO 65	200 JO 25	201	200	5
250 JO 65	250 JO 25	251	250	4
333 JO 65	333 JO 25	335	333	3
400 JO 65	400 JO 25	402	400	2.5
500 JO 65	500 JO 25	502	500	2
570 JO 65	570 JO 25	574	570	1.75
667 JO 65	667 JO 25	670	667	1.5
800 JO 65	800 JO 25	804	800	1.25
1000 JO 65	1000 JO 25	1005	1000	1
1333 JO 65	1333 JO 25	1342	1333	0.75
2000 JO 65	2000 JO 25	2013	2000	0.5
4000 JO 65	4000 JO 25	4028	4000	0.25

*60mm diameter

2.5 Quality cylindrical lenses (visible/UV)

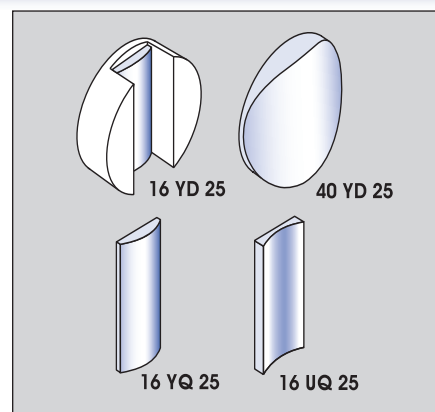
Customise 

Cylindrical lenses focus or diverge light in one plane only. Our circular lenses are particularly convenient for mounting; the longer-focus lenses are simply cut to a circular shape, whilst the stronger lenses are mounted in a recess on a black anodised aluminium disc.

B270 optical crown lenses are offered for the visible and near IR, and fused silica for the UV; both are also available multilayer AR coated to improve transmittance.

Specification

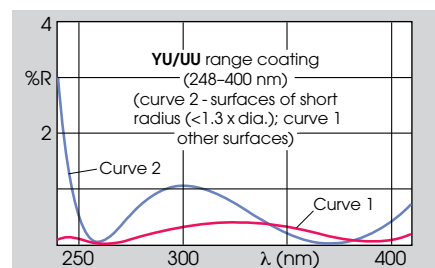
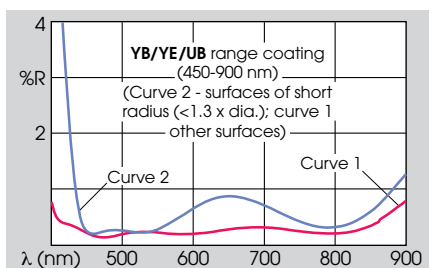
Length, width	+0, -0.25mm
Diameter	+0, -0.15mm
Focal length (at 587nm)	±2.5%
Thickness	1.5mm (thinnest point)
Scratch-dig	60-40 (see p.2)
Centration	0.25mm (FL < 50mm) 5mrad (FL > 50mm)
Wedge	4mrad (along axis)
Material data	see p.2
AR coating:	multilayer
B270 lenses	450-900nm
UV-silica lenses	248-400nm (see p.7)



Sets at special price

Rectangular convex lenses (B270):
01 YQ 00 Uncoated set (12 lenses)
01 YB 00 AR-coated set (12 lenses)

Circular convex lenses (B270):
01 YD 00 Uncoated set (7 lenses)
01 YE 00 AR-coated set (7 lenses)



Options available (see p.3)

- Mounting (circular lenses only)
- Special AR coating
- Cutting to special sizes

Aberration calculation (see p.2)

Use coefficients given for spherical lenses, pp.2, 7, 10, 11

See also:

Fresnel cylindrical lenses [p.16](#)
(Section 3.4, at ends of tables)

Circular planoconvex lenses (B270 crown)

Catalogue No. Uncoated	Catalogue No. AR coated 450-900nm	Focal length (mm)	Aperture (mm)	Overall dia. (mm)	Back FL (mm)
Lenses mounted on 25mm disc					
10 YD 25	10 YE 25	10	19 x 6.3	25	8.3
16 YD 25	16 YE 25	16	19 x 10	25	13.9
25 YD 25	25 YE 25	25	19 x 16	25	22.2
Unmounted lenses					
40 YD 25	40 YE 25	40	—	25	36.3
63 YD 25	63 YE 25	63	—	25	60.5
100 YD 25	100 YE 25	100	—	25	98.0
160 YD 25	160 YE 25	160	—	25	158.4

Rectangular planoconcave lenses (B270 crown)

Catalogue No. Uncoated	Catalogue No. AR coated 450-900nm	Focal length (mm)	Length x width (mm)	Back FL (mm)	Edge thick. (mm)
10 UQ 16	10 UB 16	10	16 x 6.3	11.0	2.6
16 UQ 25	16 UB 25	16	25 x 10	17.0	3.2
25 UQ 25	25 UB 25	25	25 x 16	26.0	4.3
40 UQ 40	40 UB 40	40	40 x 25	41.0	5.7
63 UQ 40	63 UB 40	63	40 x 25	64.0	4.0

Rectangular planoconvex lenses (B270 crown)

Catalogue No. Uncoated	Catalogue No. AR coated 450-900nm	Focal length (mm)	Length x width (mm)	Back FL (mm)	Centre thick. (mm)
10 YQ 16	10 YB 16	10	16 x 6.3	8.3	2.6
16 YQ 25	16 YB 25	16	25 x 10	13.9	3.2
16 YQ 40	16 YB 40	16	40 x 10	13.9	3.2
25 YQ 25	25 YB 25	25	25 x 16	22.2	4.3
25 YQ 40	25 YB 40	25	40 x 16	22.2	4.3
40 YQ 40	40 YB 40	40	40 x 25	36.3	5.7
40 YQ 63	40 YB 63	40	63 x 25	36.3	5.7
63 YQ 40	63 YB 40	63	40 x 25	60.5	4.0
100 YQ 40	100 YB 40	100	40 x 25	98.0	3.0
100 YQ 63	100 YB 63	100	63 x 40	96.4	5.5
160 YQ 63	160 YB 63	160	63 x 40	157.4	4.0
250 YQ 63	250 YB 63	250	63 x 40	248.0	3.1

Rectangular UV-silica lenses

Catalogue No. Uncoated	Catalogue No. AR coated 248-400nm	Focal length (mm)	Length x width (mm)	Back FL (mm)	Centre thick. (mm)
Planoconvex					
10 YS 16	10 YU 16	10	16 x 6.3	8.1	2.8
16 YS 25	16 YU 25	16	25 x 10	13.6	3.5
25 YS 25	25 YU 25	25	25 x 16	21.7	4.8
40 YS 40	40 YU 40	40	40 x 25	35.6	6.4
63 YS 40	63 YU 40	63	40 x 25	60.0	4.3
100 YS 40	100 YU 40	100	40 x 25	97.8	3.2
Planoconcave					
16 US 25	16 UU 25	16	25 x 10	17.0	1.5
25 US 25	25 UU 25	25	25 x 16	26.0	1.5
40 US 40	40 UU 40	40	40 x 25	41.0	1.5
63 US 40	63 UU 40	63	40 x 25	64.0	1.5

2.6 Rod lenses

Customise

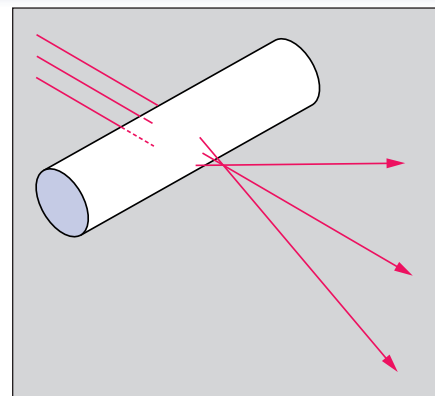
These cylindrical lenses have very short focal lengths and large apertures, and are simple to mount. They are generally used to expand a laser beam into a fan of rays, so defining a plane and projecting a line on to any surface. For this purpose we also offer these mounted. The mount has a standard TubeMount 25mm thread (see p.53) and attaches directly to our beam expanders and, via adaptors (p.58), to laser heads etc. It can be rotated and locked in the correct orientation.

Specification

Material	LEBG (see p.2)
Mount body	As 16 XE 25 (see p.56)
Diameter	±10%

See also:

Holder for rod lenses [p.77,78](#)



Focal length calculation

The focal length f required to give a desired line length L from a beam of diameter D is given by:

$$f = xD/L$$

where x is the distance to the target.
For $f > 8\text{mm}$ use lenses on [p.12](#).

Catalogue No. Unmounted rod	Catalogue No. Rod in mount	Focal length (mm)	Rod dia. (mm)	Rod length (mm)	Spread angle from 1mm beam
016 YR 16	016 YM 01	1.6	2	16	41°
02 YR 16	02 YM 01	2.3	3	16	26°
03 YR 16	03 YM 01	3.1	4	16	19°
05 YR 16	05 YM 01	4.7	6	16	12°
08 YR 16	08 YM 01	7.8	10	16	7.4°

2.7 Meniscus cylindrical lenses

Customise

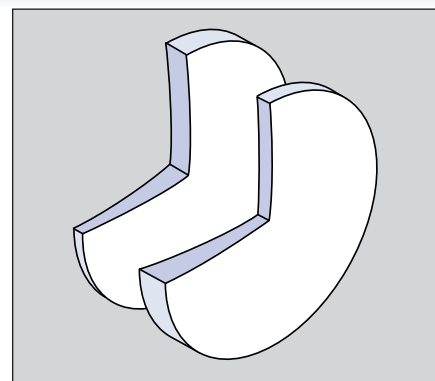
These ophthalmic meniscus lenses provide a wide range of longer focal lengths at low cost. The 60mm lenses have moulded edges whilst the 25mm are edged and centred. Each lens has one spherical and one toroidal surface, giving zero power in one cross-section and positive or negative power in the orthogonal section. The overall effect is that of a conventional cylindrical lens.

Specification

Back vertex power (=1/back FL)	±0.06D (≤4D) ±0.12D (>4D)
Diameter	+0, -0.25mm (25mm) ±1mm (60mm)
Scratch-dig	60-40 (see p.2)
Material	B270 (see p.2)

Options available (see p.3)

- Mounting (25mm only)
- Edging to smaller diameter
- AR coating



Sets at special price

- 02 YO 00 60mm set (20 lenses)
- 03 YO 00 25mm set (18 lenses)

Positive lenses

Catalogue No. 60mm dia.	Catalogue No. 25mm dia.	Focal length (mm)	Back FL (mm)	Back vertex power (D)
160 YO 60	—	166	160	6.25
200 YO 60	200 YO 25	209	200	5
250 YO 60	250 YO 25	258	250	4
400 YO 60	400 YO 25	407	400	2.5
500 YO 60	500 YO 25	508	500	2
667 YO 60	667 YO 25	675	667	1.5
1000 YO 60	1000 YO 25	1010	1000	1
1333 YO 60	1333 YO 25	1346	1333	0.75
2000 YO 60	2000 YO 25	2018	2000	0.5
4000 YO 60	4000 YO 25	4030	4000	0.25

Negative lenses

Catalogue No. 60mm dia.	Catalogue No. 25mm dia.	Focal length (mm)	Back FL (mm)	Back vertex power (D)
160 UO 60	—	161	160	6.25
200 UO 60	200 UO 25	201	200	5
250 UO 60	250 UO 25	252	250	4
400 UO 60	400 UO 25	403	400	2.5
500 UO 60	500 UO 25	503	500	2
667 UO 60	667 UO 25	671	667	1.5
1000 UO 60	1000 UO 25	1007	1000	1
1333 UO 60	1333 UO 25	1342	1333	0.75
2000 UO 60	2000 UO 25	2013	2000	0.5
4000 UO 60	4000 UO 25	4026	4000	0.25

2.8 Commercial cylindrical lenses

Customise 

These inexpensive cylindrical lenses are useful for educational demonstrations of basic lens optics and other less demanding applications.

Specification

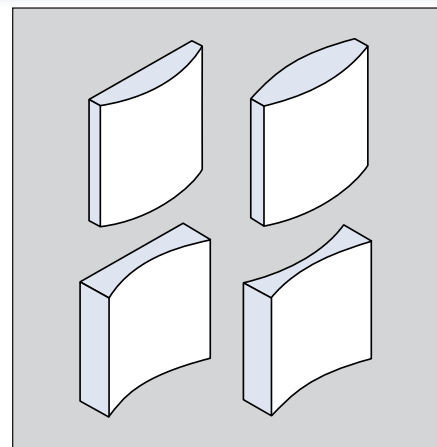
Dimensions	Nominal
Material	Float glass (see p.2)

Sets at special price

02 YC 00 Complete set (8 lenses)

Options available (see [p.3](#))

- AR coating
- Edging or cutting to smaller size



See also:

Higher quality cylindricals
Fresnel cylindricals

[p.12](#)
[p.16](#)

Catalogue No.	Focal length (mm)	Length (mm)	Width (mm)	Form
Positive				
60 YC 50	60	50	50	planovex
80 YC 50	80	50	45	bivex
100 YC 50	100	50	50	planovex
143 YC 50	143	50	50	planovex
Negative				
60 UC 50	60	50	50	planocave
80 UC 50	80	50	45	bicave
155 UC 45	155	45	40	bicave
310 UC 22	310	22	40	planocave

3.1 Precision aspheric lenses

Aspheric surfaces allow single elements to achieve near-diffraction-limited performance even at large apertures, avoiding the complexity, bulk and reflection losses of multiple-element designs such as microscope objectives. However, until recently it has not been possible to produce them economically with good figure.

Precision moulding technology, and bulk demand for laser-diode collimators, allow us to offer this range at a very reasonable cost. They are also ideal for laser focusing and beam expanders and for fibre input and output.

Although designed for specific laser wavelengths, their performance will be practically as good over most of the visible and NIR range.

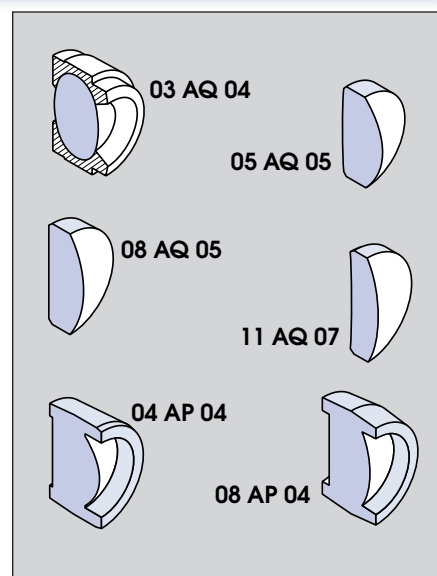
The glass lenses have a single-layer AR coating on high-index flint glass giving over 97% transmittance at the design wavelength. To calculate variation with wavelength see box on [p.3](#). The plastic lenses offer high precision at a very low cost. Some items (see diagrams) have integral mounting rings to simplify handling and mounting.

Material specification

FDS-9	$n_d = 1.847$ $v_d = 23.8$
TaC-4	$n_d = 1.734$ $v_d = 51.1$
Acrylic	see p.2

Literature available

Data Sheet giving equations of aspheric curves



Catalogue No.	Focal length (mm)	Overall diameter (mm)	Back FL (mm)	Design aperture (mm)	NA	Centre thick (mm)	Wavefront distortion (waves RMS)*	Design wavelength (nm)	Material
Glass lenses, AR coated									
03 AQ 04	3.3	7.37	2.03	3.52	0.47	3.95	< 0.2	670	FDS-9
05 AQ 05	4.6	6.0	2.89	4.89	0.53	3.1	< 0.1	655	TaC-4
08 AQ 05	7.5	6.51	5.9	4.5	0.3	2.75	< 0.15	810	TaC-4
11 AQ 07	11.0	7.2	9.64	6.59	0.3	2.2	< 0.1	670	TaC-4
Plastic lenses, uncoated									
04 AP 04	4.25	5.6	2.29	3.8	0.5	3.0	< 0.07	670	acrylic
08 AP 04	7.71	5.6	6.17	3.8	0.25	2.5	< 0.06	670	acrylic

*Manufacturer's data. Measured with 0.25-0.3mm coverglass. Plastic lens data is double pass. See Data Sheet.

3.2 Plastic aspheric lenses

Customise 

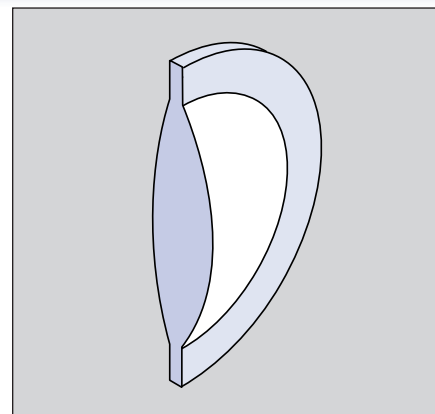
These lenses are excellent as simple magnifiers, with a much larger distortion-free field than spherical lenses. They are designed for collimating a point source and are very suitable for low-power sources such as LEDs; for tungsten lamp condensers use the glass lenses in the next section. The plastic is light-weight, shatterproof and machinable; some items have flanges to simplify mounting.

Specification

Focal length	±5%
Overall dia.	+0, -0.2mm
Material	Acrylic (see p.2)

Sets at special price

02 AP 00 Complete set (11 lenses)



See also:

Higher-quality plastic aspherics [p.14](#)
Fresnel lenses [p.16](#)

Catalogue No.	Focal length (mm)	Overall diameter (mm)	Lens aperture (mm)	Back FL (mm)	Centre thickness (mm)
05 AP 04	4.63	7.8	4.5	3.2	2.7
09 AP 09	8.8	19.7	9.0	6.9	3.7
18 AP 18	17.5	19.7	18.3	14.6	6.7
18 AP 26	18.2	30.9	26.0	13.1	13.0
28 AP 34	27.5	36.1	34.0	22.7	13.0
31 AP 29	31.0	29.4	29.4	27.2	7.9
41 AP 36	41.3	38.2	35.5	35.4	11.3
42 AP 29	41.6	29.4	29.4	38.1	6.4
57 AP 50	56.6	49.7	49.7	49.6	13.5
68 AP 50	68.4	49.9	49.9	63.3	11.1
86 AP 64	85.6	64.1	64.1	79.0	14.3

3.3 Glass aspheric condensers

Customise 

These lenses are thermally toughened to withstand high temperatures (except as noted) and are usually used to collimate light from a lamp or similar source. Their large apertures allow efficient collection. The steeply-curved aspheric surface is moulded and fire-polished; the second surface, facing the source, is ground and polished (except as noted).

Literature available

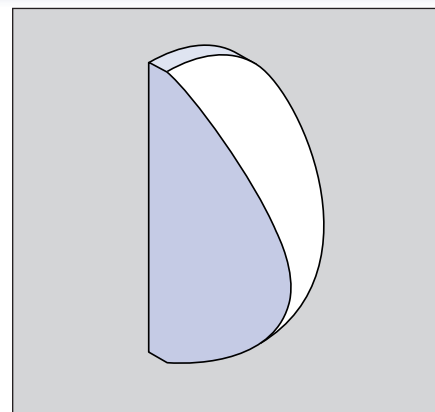
Technical note 'Design of illumination systems'.

Specification

Diameter	nominal
Focal length	nominal
Material	B270 (see p.2)

Options available (see [p.3](#))

- Mounting (some lenses only)
- AR coating (single-layer only)
- Edging to smaller diameters



See also:

Combinations including these lenses [p.18](#)
UV condenser lens [p.19](#)
Lamphouses [pp.51,52](#)

Catalogue No.	Focal length (mm)	Diameter (mm)	Back FL (mm)	Centre thick. (mm)	Form
06 AF 07	5.9	6.8	4.0	2.8	planovex
08 AF 10	8.3	9.9	5.6	4.1	planovex
10 AF 12	10.5	12.0	7.6	5.2	bivex
14 AF 13*	14.0	12.9	10.2	5.7	planovex
15 AF 16	15.0	16.0	11.1	6.0	planovex
16 AF 25	16.5	24.8	10.5	9.2	planovex
18 AF 27	18.5	27.4	9.2	14.2	planovex
22 AF 21*†	21.8	21.3	17.5	8.2	bivex
29 AF 40	28.6	39.9	18.7	15.4	planovex
39 AF 50	39.0	50.0	26.2	19.5	planovex
55 AF 73	55.0	73.0	34.3	31.5	planovex

*Not toughened † Fire-polished both sides

3.4 Fresnel lenses

Customise 

These lightweight large-aperture plastic lenses are widely used as collimators and collectors, e.g. in sensor or communication systems. Alongside our low-cost standard range, we offer a precision range of different manufacture, with very close tolerances and better surface finish, and so suitable for more demanding applications such as projection systems and simulators.

Some 'cylindrical' lenses focusing light in one direction only are included.

Specification

Focal length:	
Standard range*	±5%
Precision range*	±1%
Design condition	Parallel light on grooved side
Material	Acrylic (see p.2)

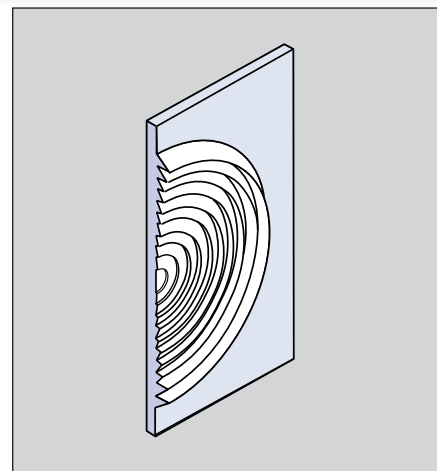
*Manufacturer's data

Options available

- Cutting to size
- Many other types available at short notice

See also:

Fresnel prisms and beam dividers [p.30](#)



Standard range

Catalogue No.	Focal length (mm)	Effective dia. (mm)	Overall size (mm)	Facet width (mm)	Thickness (mm)
10 FQ 13	10	13	26 x 26	0.1	1.5
15 FQ 25	15	25	39 x 39	0.13	1.5
22 FQ 33	22	33	51 x 51	0.1	1.5
25 FQ 25	25	25	38 x 38	0.25	1.5
32 FQ 50	32	50	58 x 58	0.2	1.5
38 FQ 50	38	50	58 x 58	0.2	1.5
50 FQ 50	50	50	64 x 64	0.25	1.5
61 FQ 63	61	63	76 x 76	0.2	1.5
70 FQ 102	70	102	127 x 127	0.25	1.5
76 FQ 152	76	152	170 x 170	0.25	1.5
100 FQ 63	100	63	76 x 76	0.2	1.5
127 FQ 102	127	102	127 x 127	0.2	1.5
152 FQ 152	152	152	170 x 170	0.2	1.5
254 FQ 152	254	152	170 x 170	1.0	1.5
Cylindrical-type lens					
152 FY 76	152	76 x 76	76 x 76	0.37	1.5

Precision range

Catalogue No.	Focal length (mm)	Effective aperture (mm)	Overall size (mm)	Facet width (mm)	Thickness (mm)
22 FQ 44	22.2	Ø44.4	50	0.64	2
25 FQ 61	25.4	Ø61.5	80	0.51	2
40 FQ 100	40	Ø100	110 x 110	0.5	2
100 FQ 200	100	Ø200	210 x 210	0.5	2
102 FQ 137	101.6	Ø137.2	150	0.51	2
150 FQ 300	150	Ø300	310 x 310	0.5	2
152 FQ 203	152.4	Ø203.2	220	0.25	2
200 FQ 400	200	Ø400	410 x 410	0.5	2
254 FQ 254	254	Ø254	315	0.25	2
279 FQ 406	279.4	Ø406.4	425	0.51	2
305 FQ 310	304.8	Ø310	315	0.51	2
400 FQ 387	400	Ø387	410	0.51	2
400 FQ 500	400	500 x 450	510 x 460	0.5	2
500 FQ 500	500	Ø500	510 x 510	0.5	2
600 FQ 600	600	Ø600	610 x 610	0.5	2
610 FQ 464	609.6	Ø463.6	465	0.51	2
Cylindrical-type lenses					
38 FY 203	38.1	203 x 38	250 x 50	0.25	2
150 FY 300	150	310 x 100	310 x 110	0.3	2

3.5 Commercial achromatic doublets

Customise 

These are manufacturer's surplus items offered whilst stocks last at an economical price. Some items may have minor cosmetic defects.

For designs intended for production we would recommend the doublets on [p.17](#), which are our own designs with full technical specification and are ongoing stock items.

Catalogue No.	Focal length (mm)	Dia. (mm)
24 DC 08	24	8.4
28 DC 17	28	17.5
29 DC 09	29	8.6
40 DC 18	40	17.7
47 DC 08	47	7.9
50 DC 18	50	17.8
53 DC 22	53	21.7
59 DC 25	59	25.2
69 DC 08	69	8.3

Catalogue No.	Focal length (mm)	Dia. (mm)
72 DC 15	72	14.9
99 DC 26	99	26.0
103 DC 29	103	28.5
170 DC 22	170	22.1

3.6 Achromatic doublets

Customise 

These doublets easily outperform equivalent singlets even in monochromatic light, being corrected for spherical aberration and coma, as well as for chromatic aberration. Their performance and uses depend on the relative aperture. All but the largest apertures are essentially diffraction-limited on axis and give excellent imaging over a small field (say 5°) as required for microscopes, telescopes etc.

The performance of the largest-aperture lenses (marked *) is inevitably affected by higher-order aberrations, and they are typically used for laser or fibre collimation or focusing onto detectors, etc. For better imaging at these apertures in monochromatic light see doublet/meniscus combinations (p.19); for white light, see microscope objectives (p.20, section 4.6). All positive doublets are designed for an infinite conjugate (parallel light) on the more steeply curved side.

Negative doublets are commonly inserted between an objective and its image to increase the tube length (as in microscopy) or magnification (as in astronomy – a Barlow lens). They are therefore optimised for these conditions with a magnification of 2x. The conjugates can of course be adjusted to vary the magnification.

Specification

Diameter	+0, -0.1mm
Focal length	±0.1mm (≤10mm) ±1% (>10mm)
Scratch-dig	40-20 (see p.2)
Centration	0.1mm (FL≤40mm) 2.5mrad (FL>40mm)
AR coating	SLAR (see graph)

Options available (see p.3)

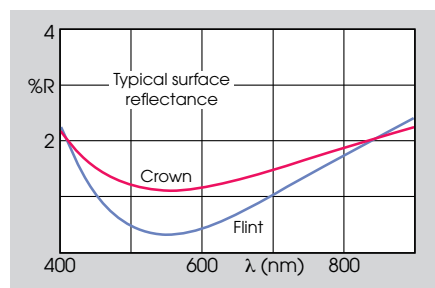
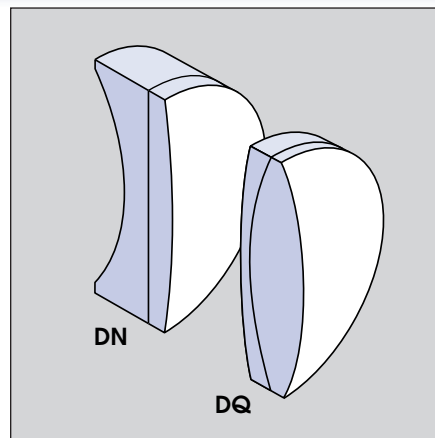
- Mounting (all items)
- Edging to smaller diameters

Technical data

Full prescriptions are available for computing purposes – please enquire

See also:

Doublet objectives (OD series) [p.20](#)
Doublet pairs for finite conjugates [p.18](#)



Catalogue No.	Focal length (mm)	Dia. (mm)	Back FL (mm)	Design aperture (mm)	Centre thick. (mm)	Edge thick. (mm)
Positive doublets						
04 DQ 03*	4	3.15	2.5	2.65	2.9	2.1
05 DQ 04*	5	4	3.1	3.3	3.6	2.7
06 DQ 04	6.3	4	4.8	3.15	3.6	2.8
08 DQ 06*	8	6.3	5.0	5.3	5.8	4.3
10 DQ 06	10	6.3	7.6	4.8	5.7	4.4
12 DQ 06	12.5	6.3	10.5	5.0	4.4	3.5
16 DQ 06	16	6.3	14.2	5.3	4.0	3.3
25 DQ 06	25	6.3	23.4	5.3	3.6	3.2
40 DQ 06	40	6.3	38.5	5.3	3.3	3.0
16 DQ 08	16	8	13.8	6.4	5.1	3.9
16 DQ 10*	16	10	12.7	9.0	6.1	4.3
20 DQ 10	20	10	17.2	8.0	6.4	4.9
25 DQ 10	25	10	22.9	9.0	4.5	3.4
40 DQ 10	40	10	38.0	9.0	4.3	3.5
63 DQ 10	63	10	61.2	9.0	4.0	3.6
32 DQ 12	31.5	12.5	28.9	11.3	5.7	4.3
25 DQ 16*	25	16	19.8	14.2	9.5	6.7
32 DQ 16*	31.5	16	27.8	14.4	7.7	5.3
40 DQ 16	40	16	36.7	14.4	7.3	5.4
50 DQ 16	50	16	47.4	14.5	5.6	4.1
63 DQ 16	63	16	60.5	14.5	5.3	4.0
100 DQ 16	100	16	97.6	14.5	5.3	4.6
63 DQ 20	63	20	59.7	18.3	7.0	5.2
80 DQ 20	80	20	77.4	18.4	5.6	4.1
40 DQ 25*	40	25	34.0	24.3	10.5	6.1
50 DQ 25*	50	25	45.1	23.5	10.3	6.6

Catalogue No.	Focal length (mm)	Dia. (mm)	Back FL (mm)	Design aperture (mm)	Centre thick. (mm)	Edge thick. (mm)
63 DQ 25*	63	25	58.6	23.5	9.2	6.3
80 DQ 25	80	25	76.3	23.2	7.7	5.4
100 DQ 25	100	25	96.8	23.0	7.0	5.2
125 DQ 25	125	25	122.3	23.7	5.7	4.3
160 DQ 25	160	25	157.7	24.0	4.9	3.7
200 DQ 25	200	25	197.4	24.0	5.7	4.7
250 DQ 25	250	25	248.0	24.0	4.2	3.5
315 DQ 25	315	25	312.7	24.0	5.0	4.4
400 DQ 25	400	25	397.7	24.0	4.8	4.3
500 DQ 25	500	25	497.6	24.0	4.6	4.3
160 DQ 32	160	31.5	156.5	30.4	7.3	5.6
200 DQ 32	200	31.5	197.1	30.0	6.1	4.6
63 DQ 40*	63	40	53.6	38.2	16.5	9.6
100 DQ 40*	100	40	94.2	38.0	11.8	7.2
160 DQ 40	160	40	155.5	38.0	9.2	6.4
250 DQ 40	250	40	246.4	37.5	7.6	5.7
400 DQ 40	400	40	397.2	38.8	5.9	4.7
100 DQ 50*	100	50	91.9	48.2	15.9	8.6
160 DQ 50*	160	50	153.8	48.2	12.4	7.9
250 DQ 50	250	50	245.2	48.2	9.6	6.7
400 DQ 50	400	50	395.6	48.5	8.6	6.7
630 DQ 50	630	50	627.1	48.5	6.3	5.1
Negative doublets						
40 DN 16	40	16	43.8	14.4	3.8	5.5
63 DN 25	63	25	69.0	24.0	6.0	8.7
100 DN 25	100	25	107.7	24.0	6.9	8.2
160 DN 25	160	25	169.8	24.0	8.7	9.6

*Apertures too large to be diffraction-limited (see text)

4.1 Condenser lens assemblies

≡Customise 

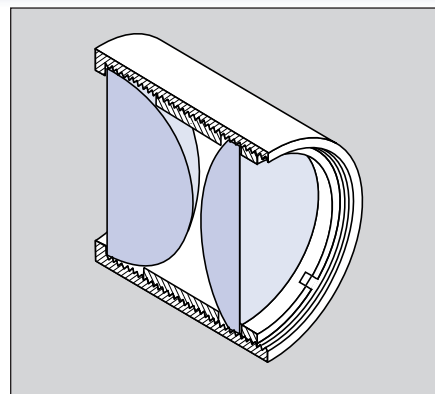
These systems comprise an aspheric condenser (see [p.15](#)) and either a second aspheric or a planoconvex lens, all mounted in a black anodised aluminium cell from our TubeMount range ([p.53](#)). Usually the aspheric will be used to collect light from a source and the second lens to form an image of the source on the required target area. The object-to-lens distance is shown for each lens as 'WD' (working distance) and the lens-to-image distance as 'Throw'. Measurements are to the metal mount rather than the glass surface.

Technical data available

Request our note 'Design of illumination systems' for further information on system design

See also:

For details of mounts used (MB type) [p.54](#)



Options available

Only a small selection of the possible 2-lens systems can be listed. Almost any two catalogue lenses (max. 50mm dia.) can be supplied in a similar mount. To order use code **TA** followed by the lens catalogue numbers, e.g.:

TA/20 PQ 16/50 PQ 16

Please enquire for pricing.

Catalogue No.	Length x dia. (mm)	WD (mm)	Throw (mm)	Mag.	Accept. angle	Lenses included (see pp.4-5, 15)
01 TA 16	20 x 19	9.5	7.3	1.0	59°	15 AF 16/15 AF 16
02 TA 16	16 x 19	9.5	25	2.1	59°	15 AF 16/32 PQ 16
04 TA 16	16 x 19	9.5	57	4.2	59°	15 AF 16/63 PQ 16
01 TA 25	25 x 28	8.9	7.7	1.0	90°	16 AF 25/16 AF 25
02 TA 25	25 x 28	8.9	24	1.9	90°	16 AF 25/32 PQ 25
04 TA 25	20 x 28	8.9	56	3.8	90°	16 AF 25/63 PQ 25
01 TA 40	50 x 43	17.1	12	1.0	91°	29 AF 40/29 AF 40
02 TA 40	40 x 43	17.1	48	2.2	91°	29 AF 40/63 PQ 40
04 TA 40	40 x 43	17.1	112	4.4	91°	29 AF 40/125 PQ 40
01 TA 50	50 x 53	24.6	23	1.0	82°	39 AF 50/39 AF 50
02 TA 50	40 x 53	24.6	65	2.0	82°	39 AF 50/80 PQ 50
04 TA 50	40 x 53	24.6	147	4.1	82°	39 AF 50/160 PQ 50

4.2 Achromatic relay lenses

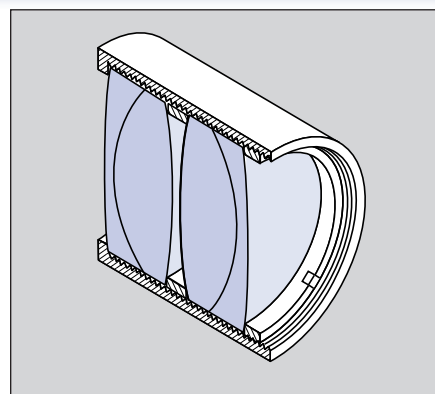
≡Customise 

A pair of doublet lenses forms a well-corrected system for imaging at finite conjugates. This range comprises lenses from our achromatic doublet range ([p.17](#)) in a black anodised aluminium cell.

The object-to-lens distance is shown for each lens as 'WD' (working distance) and the lens-to-image distance as 'Throw'. Measurements are to the metal mount rather than the glass surface.

Options available (see [p.3](#))

To order special types see box in Section 4.1 above but use code **TT** followed by doublet catalogue numbers required from [p.17](#).



Catalogue No.	Length x dia. (mm)	WD (mm)	Throw (mm)	Mag.	FL (mm)	Clear aper. (mm)	Lenses included (see p.17)
01 TT 25	25 x 28	58	53	1.0	32.4	23.2	63 DQ 25/63 DQ 25
02 TT 25	20 x 28	96	92	1.0	50.7	23.2	100 DQ 25/100 DQ 25
03 TT 25	16 x 28	156	153	1.0	80.5	23.2	160 DQ 25/160 DQ 25
04 TT 25	20 x 28	58	95	1.59	39.6	23.2	63 DQ 25/100 DQ 25
05 TT 25	20 x 28	58	153	2.54	45.7	23.2	63 DQ 25/160 DQ 25
06 TT 25	20 x 28	58	243	3.97	50.8	23.2	63 DQ 25/250 DQ 25
01 TT 40	25 x 43	94	94	1.0	51.0	38.2	100 DQ 40/100 DQ 40
02 TT 40	25 x 43	155	150	1.0	80.8	38.2	160 DQ 40/160 DQ 40
03 TT 40	20 x 43	245	243	1.0	125.7	38.2	250 DQ 40/250 DQ 40
04 TT 40	25 x 43	94	153	1.6	62.7	38.2	100 DQ 40/160 DQ 40
05 TT 40	25 x 43	94	243	2.5	72.5	38.2	100 DQ 40/250 DQ 40
06 TT 40	20 x 43	94	396	4.0	80.5	38.2	100 DQ 40/400 DQ 40

See also:

For lens details [p.17](#)
For mount details (MB) [p.53](#)

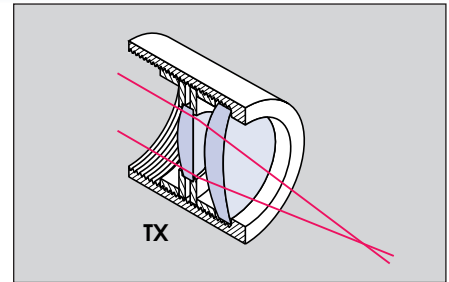
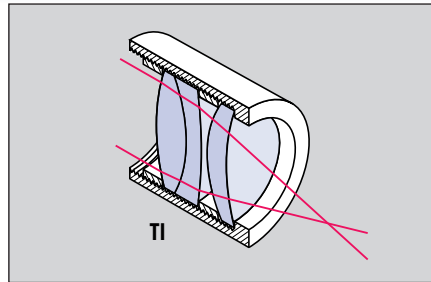
4.3 Focusing/collimating lens combinations

Customise

These lens systems, incorporating high-index meniscus supplementary lenses (see p.6), are ideal for laser focusing and collimation, offering good correction at large apertures. They are supplied ready-mounted in black anodised TubeMount cells (p.53).

The TI series comprise a doublet and a meniscus lens and are diffraction-limited over almost the entire aperture.

The TX series comprise two high-index singlets (planoconvex and meniscus). They are suitable for high powers (having no cemented interfaces), have higher transmittance and lower cost, but of course are not quite so well corrected.



Catalogue No.	Length x dia. (mm)	FL (mm)	WD (mm)	Aperture (mm)	NA	Lenses included (see pp.6, 17)
Doublet + meniscus						
05 TI 04	16 x 19	5.4	0.6	4.3	0.40	10 DQ 06/10 IX 04
08 TI 06	16 x 19	8.2	2.6	6.4	0.39	16 DQ 08/16 IX 06
12 TI 09	16 x 19	12.7	6.6	8.8	0.35	25 DQ 10/25 IX 10
20 TI 14	16 x 19	20.4	13.4	14.2	0.35	40 DQ 16/40 IX 16
Planovex + meniscus						
05 TX 03	10 x 19	5.0	0.9	3.3	0.33	10 PX 04/10 IX 04
08 TX 05	10 x 19	8.0	2.8	5.3	0.33	16 PX 06/16 IX 06
12 TX 05	10 x 19	12.5	6.8	5.3	0.21	25 PX 06/25 IX 10
20 TX 09	10 x 19	20.0	13.8	8.8	0.22	40 PX 10/40 IX 16

See also:

Similar combinations in objective mounts p.20

4.4 UV condenser lens

Customise

This 3-element f/1 lens offers excellent spherical-aberration correction, with a spot diameter of around 0.2mm. Being entirely in UV silica (see p.2) it can be used down to 170nm.

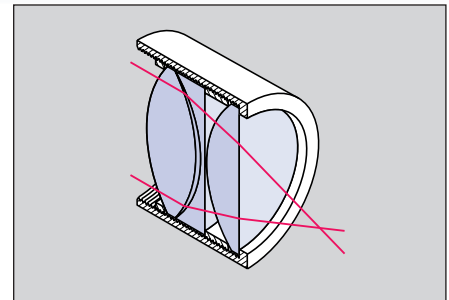
Catalogue No.	Length x dia. (mm)	FL (mm)	Clear aper. (mm)
10 TS 25	25 x 28	25	23.2

Specification

Working distance	13.9mm
Collection angle	53°
Numerical aperture	0.45
Note: Data given for 400nm	

Options available (see p.3)

- AR coating
- Special mounting



4.5 Projector lenses

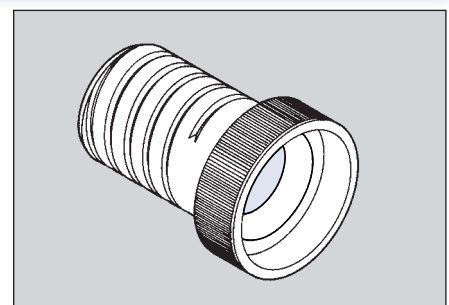
These 35mm projector lenses are useful in any optical system requiring good definition of a projected image over a large angle.

The 85mm FL lens is particularly low-cost, owing to mass production, and is useful in illumination systems where the area to be illuminated must be precisely defined.

Specification

Object size	43mm diagonal
Barrel dia.	42.5mm

Catalogue No.	Focal length (mm)	F/No.
60 TQ 21	60	2.8
85 TQ 30	85	2.8
180 TQ 51	180	3.5

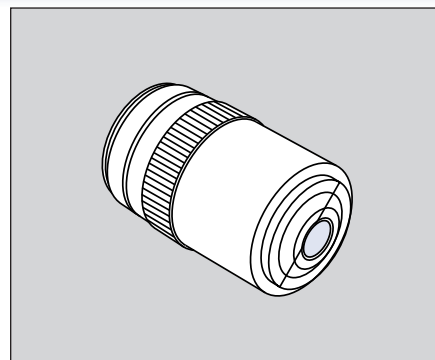


4.6 Microscope objectives

We offer a standard range of high-quality achromats; long-working-distance achromats for viewing objects with restricted access; metallurgical achromats for surface inspection and

planachromats for flatter field.

Microscope objectives are widely used for laser focusing in spatial filters etc. but those listed in Section 4.7 below will often be better for this purpose.



Specification

Optical tube length (shoulder to image)	150mm
Cover glass correction (not critical on low powers)	0.17mm
Parfocal distance	45mm

Accessories available

05 Q0 06	Immersion oil, 6-7ml
10 Q0 00	Tap for thread
Adaptors	see p.58
Holders	see p.81

Catalogue No.	Mag.	NA	WD (mm)	FL (mm)	Length (mm)	Parfocal	Type
04 OA 10	4	0.1	18.5	30.7	26.5	yes	achromat
06 OA 10	6	0.1	18.5	22.6	26.5	yes	achromat
10 OA 25	10	0.25	6.5	16.9	38.5	yes	achromat
20 OA 40	20	0.4	1.7	9.01	43.3	yes	achromat, sprung
40 OA 65	40	0.65	0.6	4.51	44.3	yes	achromat, sprung
60 OA 85	60	0.85	0.3	2.91	44.7	yes	achromat, sprung
100 OA 125	100	1.25	0.15	1.69	44.85	yes	achromat, sprung, oil
01 OL 04	1	0.04	125	73	23.5	no	long-WD achromat
02 OL 05	2	0.05	68	53	23.5	no	long-WD achromat
03 OL 07	3	0.07	26	38	23.5	no	long-WD achromat
10 OL 18	10	0.18	15	17	30	yes	long-WD achromat
20 OL 30	20	0.3	5.8	8.19	39.2	yes	long-WD achromat
04 OS 10	4	0.1	20	31	25	yes	planachromat
10 OS 25	10	0.25	7.3	15.9	37.7	yes	planachromat
40 OS 65	40	0.65	0.7	4.5	44.3	yes	planachromat
05 OM 10	5	0.1	18.0	26.98	26.9	yes	met. achromat
10 OM 25	10	0.25	5.5	16.56	38.6	yes	met. achromat
20 OM 40	20	0.40	1.8	7.84	43.3	yes	met. ach. sprung
40 OM 65	40	0.65	0.6	4.52	44.7	yes	met. ach. sprung
100 OM 125	100	1.25	0.15	1.69	44.7	yes	met. ach. sprung, oil

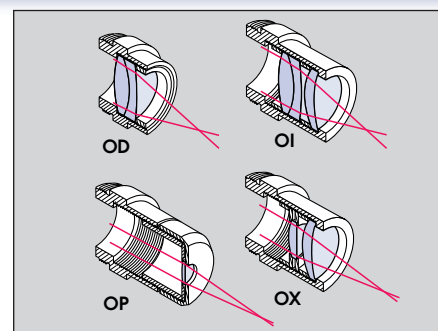
4.7 Laser objectives

≡Customise

Conventional microscope objectives are not ideal for laser focusing, being designed for finite conjugates and usually having more elements and higher reflection losses than necessary for this application. We therefore offer here several ranges of laser lenses in standard objective mounts, parfocal at 45mm where possible, to fit directly into spatial filters etc.

The doublets (OD series) give diffraction-limited performance and being achromatic can also be used for microscopy. See [p.17](#) for more details. The

OI series have larger aperture with similar performance (not achromatic) by adding a supplementary meniscus lens (see TI series, [p.19](#)). The singlets (OP series) are suitable for high powers, having no cemented interfaces, and have very high transmittance. Owing to the high-index glass used they still have a useful diffraction-limited aperture; see [p.6](#) for further details. The OX series are also cement-free and comprise a singlet focusing lens with supplementary meniscus for greater NA (as TX combinations, [p.19](#)).



Catalogue No.	FL (mm)	Aper. (mm)	WD* (mm)	Mag.†	NA*	Similar to lens type
Doublets (see p.17)						
04 OD 026	4	2.6	2.1	47	0.32	04 DQ 03
05 OD 03	5	3.3	2.8	37	0.33	05 DQ 04
06 OD 03	6.3	3.15	4.0	29	0.25	06 DQ 04
10 OD 05	10	5.3	7.0	17	0.26	10 DQ 06
16 OD 06	16	6.4	13.0	10	0.20	16 DQ 08
25 OD 09	25	8.8	22.2	5.7	0.18	25 DQ 10
40 OD 14	40	14.2	32.9	2.7	0.18	40 DQ 16
63 OD 14‡	63	14.2	55.1	1.42	0.11	63 DQ 16
100 OD 14‡	100	14.2	92.5	0.52	0.07	100 DQ 16
Doublet/meniscus combinations (see p.19)						
05 OI 04	5.4	4.3	1.7	33	0.40	05 TI 04
08 OI 06	8.2	6.4	3.7	21	0.39	08 TI 06
12 OI 09	12.7	8.8	7.7	13	0.35	12 TI 09
20 OI 14	20.4	14.2	12.0	7.2	0.35	20 TI 14

Catalogue No.	FL (mm)	Aper. (mm)	WD* (mm)	Mag.†	NA*	Similar to lens type
High-index planovex singlets (see p.6)						
025 OP 02	2.5	2.0	1.3	76	0.43	025 PX 025
04 OP 02	4	2.0	2.9	47	0.26	04 PX 025
06 OP 03	6.3	3.3	4.5	29	0.27	06 PX 04
10 OP 03	10	3.3	8.3	17	0.17	10 PX 04
16 OP 05	16	5.3	13.9	10	0.17	16 PX 06
25 OP 05	25	5.5	23.0	5.8	0.11	25 PX 06
40 OP 09	40	8.8	33.1	2.9	0.11	40 PX 10
63 OP 14‡	63	14.2	57.1	1.4	0.11	63 PX 16
100 OP 14‡	100	14.2	94.2	0.52	0.07	100 PX 16
Planovex/meniscus singlet combinations (see p.19)						
05 OX 03	5	3.3	2.0	37	0.33	05 TX 03
08 OX 05	8	5.3	3.8	22	0.33	08 TX 05
12 OX 05	12.5	5.3	7.8	13	0.21	12 TX 05
20 OX 09	20	8.8	12.2	7.6	0.22	20 TX 09

*For infinite conjugate † For 150mm optical tube length ‡ Not parfocal

4.8 Microscope eyepieces

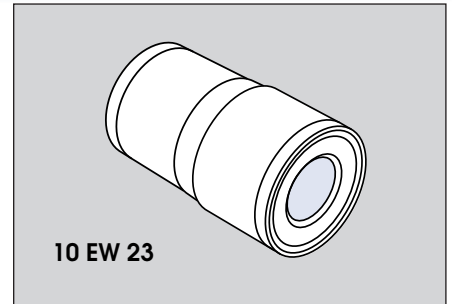
These eyepieces fit most standard microscopes (23.2mm fitting) and can be incorporated in other optical systems, especially where a graticule is required for measurement or alignment. The **12 EW 23** is a low-cost type without provision for a graticule. For incorporation in instruments the astronomical eyepieces listed below should also be considered.

For regular use with a graticule we recommend the focusing eyepiece **10 EF 23** which allows adjustment for individual users' sight.

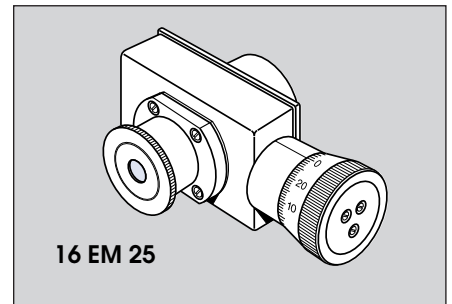
The filar micrometer eyepiece **16 EM 25** allows very accurate measurements of position, having a crosshair driven by an external micrometer head and reading to 10 microns. This unit clamps on the outside of an eyepiece tube (25mm dia.).

- Focusing eyepiece for comfortable viewing
- Zoom for variable magnification
- Filar micrometer for precise measurements

Catalogue No.	Mag.	Field dia. (mm)	Graticule dia. (mm)	Type
10 EW 23	10	18	19	widefield
12 EW 23	12	16	–	widefield
15 EW 23	15	11	19	widefield
20 EW 23	20	8	19	widefield
10 EF 23	10	18	19	widefield, focusing
16 EM 25	16	11	–	filar micrometer
20 EZ 23	10-20	7.5-10	–	widefield, zoom



10 EW 23



16 EM 25

See also:

Graticules

[p.47](#)

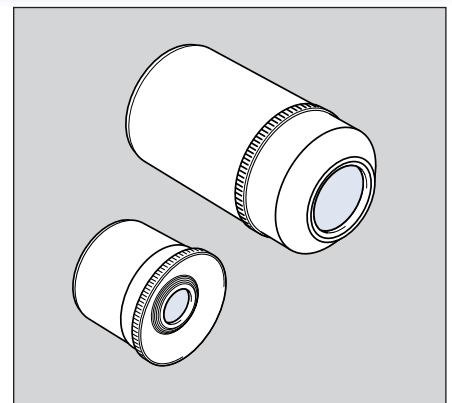
4.9 Telescope/instrument eyepieces

These eyepieces, primarily intended for astronomical telescopes, are very suitable for incorporation into other optical instruments for viewing or projecting an image. They are of high optical quality and available in a wide range of powers. The image plane is external to the optics and can be accessed by unscrewing the fitting tube, for use with an independently-mounted graticule etc.

The Kellner (**EK**) series is roughly equivalent to microscope widefield eyepieces, at a very competitive price. The orthoscopic (**EO**) series has similar field size but better correction and a flatter field, while the Erfle (**EE**) offers a much wider field.

Catalogue No. 24.5mm dia.	Catalogue No. 31.7mm dia.	Focal length (mm)	Field dia. (mm)	Field angle	Equiv. mag.	Eye relief (mm)	No. of elements	Type
06 EK 24	–	6	4.2	42°	42	4.8	3	Kellner
09 EK 24	–	9	7.1	44°	28	7.2	3	Kellner
12 EK 24	–	12	8.5	40°	21	9.6	3	Kellner
18 EK 24	–	18	15.0	45°	14	15.0	3	Kellner
25 EK 24	–	25	17.8	42°	10	19.5	3	Kellner
04 EO 24	–	4	2.8	41°	63	3.5	4	orthoscopic
06 EO 24	06 EO 32	6	4.2	43°	42	4.8	4	orthoscopic
09 EO 24	09 EO 32	9	7.2	42°	28	7.2	4	orthoscopic
12 EO 24	12 EO 32	12.5	8.5	44°	20	10.0	4	orthoscopic
18 EO 24	18 EO 32	18	13.1	44°	14	14.4	4	orthoscopic
25 EO 24	25 EO 32	25	17.0*	45°*	10	20.0	4	orthoscopic
–	20 EE 32	20	20.0	62°	12.5	11.0	6	Erfle

*25 EO 32 has field dia. 17.5mm, angle 47°



Magnification calculation

For convenience we list the equivalent magnification of each eyepiece, given by 250mm/FL; this is the magnification when used as a simple magnifier or in a microscope. The magnification of a telescope is given by the ratio of the focal lengths of the objective and eyepiece.

4.10 Microscope tubes

Customise

These visual and camera microscopes are convenient for building a wide range of industrial vision and inspection systems. We list both empty tubes accepting standard microscope optics ([pp.20, 21](#)) and ready-made systems. All tubes are 28mm diameter.

The **visual** systems use 10x widefield eyepieces, which accept 19mm dia. graticules ([p.47](#)). Those with focusing eyepiece allow the focus on the graticule to be adjusted to suit individual users' sight and are recommended if a graticule is to be frequently used. For accurate measurements, scale graticules should be calibrated using a stage graticule, since the magnifications quoted are approximate only.

The **camera** systems have the standard 1"-32 thread to screw directly into any C-mount or CS-mount camera.

These units do not, of course, include adjustments for focusing on the object, which should be placed at the approximate working distance shown and adjusted for best focus.

Options available

Many different configurations can be made up from our TubeMount system – see [pp.53-59](#) or contact us to discuss your application

See also:

Objectives to fit

Eyepieces to fit

Graticules and stage graticules

Rack and pinion focusing units

Holders for tubes

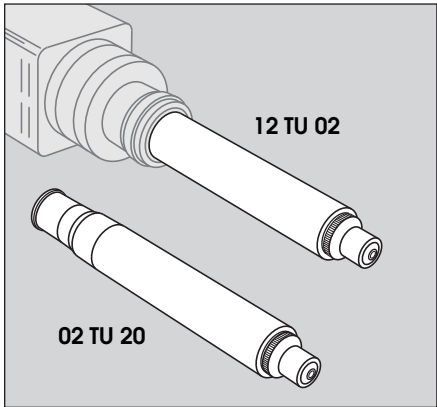
[p.20](#) (all items)

[p.21](#) (Section 4.8 only)

[p.47](#)

[p.65](#)

[pp.81,82](#)



Visual microscopes						
Catalogue No. with focusing eyepiece	Catalogue No. with non-focusing eyepiece	Mag.	Field of view (mm)	Overall length (mm)	Working distance (mm)	NA
02 TU 10	04 TU 10	10	18	212	125	0.04
02 TU 20	04 TU 20	20	9	212	68	0.05
02 TU 30	04 TU 30	30	6	212	26	0.07
02 TU 40	04 TU 40	40	4.5	215	18.5	0.1
02 TU 100	04 TU 100	100	1.8	227	6.5	0.25
Tube without eyepiece or objective						
02 TU 00	–	–	–	160	–	–

Camera microscopes					
Catalogue No.	Mag.	Field of view (1/2" camera)* (mm)	Overall length (mm)	Working distance (mm)	F/No. (image side)
12 TU 01	1	6.4 x 4.8	154	125	13
12 TU 02	2	3.2 x 2.4	154	68	20
12 TU 03	3	2.1 x 1.6	154	26	22
12 TU 04	4	1.6 x 1.2	157	18.5	20
12 TU 10	10	0.64 x 0.48	169	6.5	20
Tube without optics					
12 TU 00	–	–	130	–	–

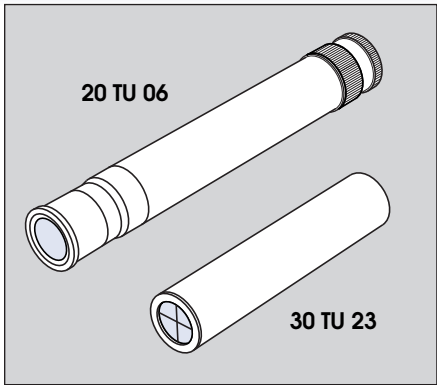
*For 1/3" multiply by 0.75; for 2/3" by 1.375 and for 1" by 2

4.11 Telescopes and collimators

Customise

Simple telescopes are widely used for alignment, remote scale reading etc. Our standard unit has a 160mm f.l. 23mm aperture doublet objective with screw movement focusing from 2m to infinity. It is offered complete with eyepiece and crosshair graticule giving 6.4x magnification, or alternatively as a tube accepting any standard microscope

eyepiece (with graticule if required). Many other systems can readily be constructed from our TubeMount system ([pp.53-59](#)) – we shall be very happy to advise on your specific application. Collimators comprise a crosshair mounted at the focus of an achromatic objective and are useful for various measurement and alignment applications.



Catalogue No.	Overall length (mm)	Tube diameter (mm)	Objective lens (see p.17)	Description
20 TU 06	216	28	160 DQ 25	Telescope 6.4x
20 TU 00	188	28	160 DQ 25	Telescope without eyepiece
30 TU 23	170	28	160 DQ 25	Collimator 23mm aperture
30 TU 38	170	43	160 DQ 40	Collimator 38mm aperture

See also:

Eyepieces to fit (Section 4.8 only)

Graticules

Holders for tubes

[p.21](#)

[p.47](#)

[pp.81,82](#)

4.12 Laser beam expanders

Customise 

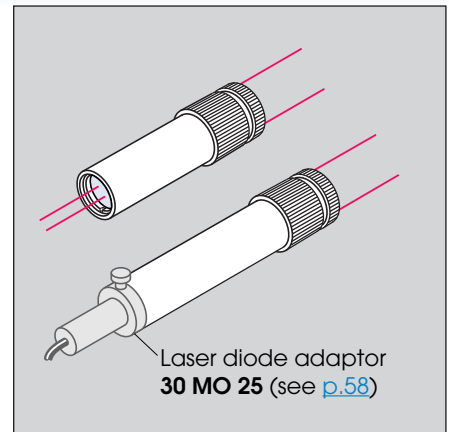
Expansion of a laser beam reduces the divergence in the same ratio, and so is desirable for use over long distances. These expanders have a focusing movement of 16mm on the output lens and so can be used to produce a converging beam.

Our **Standard** range have very high transmittance and aberration correction within the diffraction limit. For the smaller apertures we use high-index singlet lenses

(see [pp.6,10](#)) allowing these expanders to handle high laser powers. To maintain correction for larger output apertures we use cemented-doublet output lenses.

The **UV silica** range can be used from 170nm to 2500nm, and is suitable for high powers.

The **Achromatic** range uses doublet lenses (see [p.17](#)) for both input and output and is useful for multi-line lasers.



Options available

Many other configurations possible – please enquire

See also:

Adaptors to connect to lasers [p.58](#)
Mounting rings [p.81](#)

Standard range

Catalogue No.	Mag.	Input aperture (mm)	Length x dia. (mm)
Singlet optics			
01 TE 016	1.6	9.1	71 x 28
01 TE 025	2.5	5.7	71 x 28
01 TE 04	4	3.6	95 x 28
01 TE 06	6.4	3.6	156 x 28
01 TE 10	10	2.3	156 x 28
01 TE 16	16	1.45	171 x 28
Doublet/singlet optics			
11 TE 10	10	3.8	192 x 43
11 TE 16	16	2.4	192 x 43
11 TE 25	25	1.9	192 x 53

UV silica range

Catalogue No.	Mag.	Input aperture (mm)	Length x dia. (mm)
02 TE 016	1.6	14.5	71 x 28
02 TE 025	2.5	9.1	111 x 28
02 TE 04	4	5.8	132 x 28
02 TE 06	6.4	3.6	157 x 28
02 TE 10	10	2.3	157 x 28
02 TE 16	16	1.45	172 x 28

Achromatic range

Catalogue No.	Mag.	Input aperture (mm)	Length x dia. (mm)
03 TE 016	1.6	9	86 x 28
03 TE 025	2.5	7.2	111 x 28
03 TE 04	4	5.8	146 x 28
03 TE 06	6.3	3.7	132 x 28
03 TE 10	10	2.3	131 x 28
03 TE 16	16	1.45	191 x 28
13 TE 10	10	3.8	194 x 43
13 TE 16	16	2.4	207 x 43
13 TE 25	25	1.9	219 x 53

4.13 Zoom beam expanders

Customise 

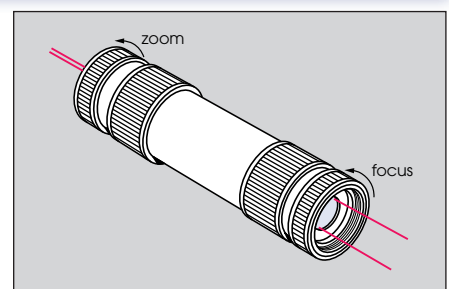
The expansion ratio of these beam expanders can be varied over a range of approximately 2:1 by a simple rotation of the input lens. A similar motion of the output lens provides for focusing.

Two ranges are offered. The **01 TZ** series

are most suitable for high power, having no cemented components. The **11 TZ** range achieve better correction (normally diffraction-limited) and larger apertures by use of a cemented-doublet output lens.

Technical data sheet

Available on request



Expanders with singlet output lens

Catalogue No.	Mag.	Input aper. at max. mag. (mm)	Length (mm)	Body dia. (mm)
01 TZ 02	1-2	2.65	128	28
01 TZ 03	1.6-3.2	1.7	140	28
01 TZ 05	2.5-5	1.76	114	28
01 TZ 08	4-8	1.83	141	28
01 TZ 12	6.3-12.5	1.15	141	28
01 TZ 20	10-20	1.16	216	28

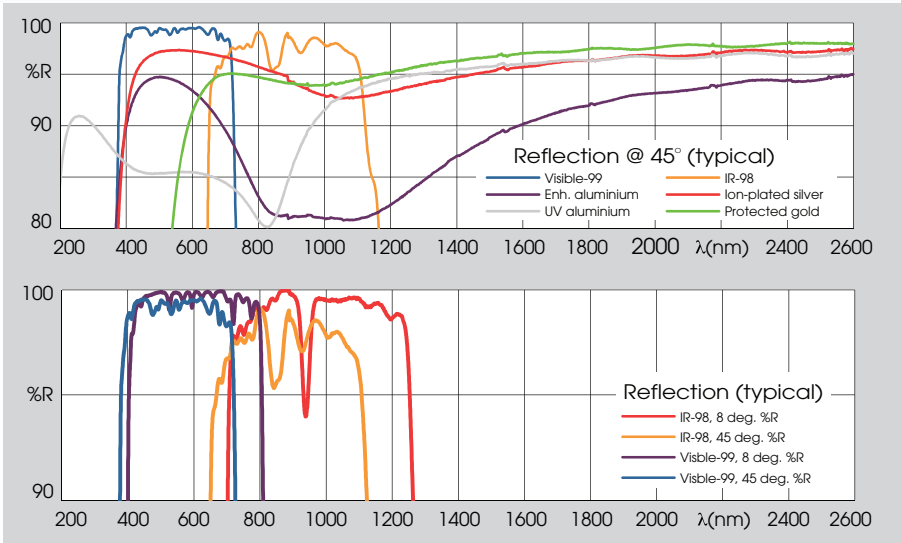
Expanders with doublet output lens

Catalogue No.	Mag.	Input aper. at max. mag. (mm)	Length (mm)	Body dia. (mm)
11 TZ 03	1.6-3.2	2.8	140	28
11 TZ 05	2.5-5	2.9	122	28
11 TZ 08	4-8	2.9	141	28
11 TZ 12	6.3-12.5	1.9	141	28
11 TZ 20	10-20	1.9	232	43
11 TZ 32	16-32	1.2	296	43

5.1 Mirror coatings

Dielectric coatings
Dielectric mirror coatings are very hard and durable and, having negligible absorption, are suitable for high powers. Our coatings, being broad-band, are much more versatile than ordinary laser-mirror coatings; **Visible-99** has about 99% reflectance over 450-700nm, 0° to 45°. **IR-98** covers 700-1064nm with average reflectance of about 98.5% at 0° (97% at 45°); in particular, the reflectance at 1064nm is designed to be high for normal incidence.

Metal coatings
Metal coatings cover wider ranges than dielectrics and are lower in cost.
Ion-plated silver surpasses both aluminium and gold for reflectance over the range 420-1000nm, and is useful throughout the IR. The usual drawbacks of silver (softness and tarnishing) have been overcome by a hard dielectric coating applied by new technology, giving excellent chemical and mechanical protection.
Enhanced aluminium is a good general-purpose coating for the visible. The reflectance is considerably increased by



the dielectric overcoat and peaks at about 94%. **Protected aluminium** (Al + SiOx), used on our elliptical and concave mirrors, is a versatile coating with 85-90% reflectance in the visible and also useful in the IR and UV.

UV aluminium is used for the UV (down to below 180nm) and **Protected gold** for the IR. Both these coatings are very delicate; to clean use an air-duster (p.85) or, if necessary, cotton-wool with acetone or other solvent.

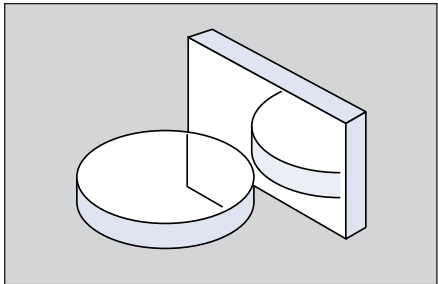
5.2 Precision plane mirrors

Customise

These mirrors of guaranteed flatness are suitable for interferometry and other demanding applications.
Low-expansion glass (LEBG, see p.2) is used for the λ/10 series to reduce thermal distortions.

- Options available (see p.3)**
- Cutting or edging to special sizes

Specification	
Flatness:	
λ/4	over test area 90% of mirror dimension
λ/10	over entire area
Diameter	+0, -0.2mm
Length, width	±0.1mm
Thickness	+0.1, -0.3mm
Scratch-dig	40-20 (see p.2)



Circular mirrors (λ/10)			
Catalogue No. Enhanced Al	Catalogue No. Visible-99	Dia. (mm)	Th. (mm)
25 MF 01	25 MF 02	25	6
40 MF 01	40 MF 02	40	9
63 MF 01	—	63	12
100 MF 01	—	100	15

Square mirrors (λ/4)		
Catalogue No. Enhanced Al	Length x width (mm)	Thickness (mm)
10 MX 10	10 x 10	3
16 MX 16	16 x 16	4
25 MX 25	25 x 25	6
40 MX 40	40 x 40	6
50 MX 50	50 x 50	8

Rectangular mirrors (λ/4)		
Catalogue No. Enhanced Al	Length x width (mm)	Thickness (mm)
16 MX 10	16 x 10	3
25 MX 16	25 x 16	4
40 MX 25	40 x 25	6
63 MX 40	63 x 40	8

Circular mirrors (λ/4)							
Catalogue No. Visible-99	Catalogue No. IR-98	Catalogue No. Enhanced Al	Catalogue No. Ion-plated silver	Catalogue No. UV aluminium	Catalogue No. Protected gold	Diameter (mm)	Thickness (mm)
—	—	10 MX 01	—	—	—	10	3
16 MX 02	16 MX 05	16 MX 01	16 MX 06	16 MX 04	16 MX 03	16	3
25 MX 02	25 MX 05	25 MX 01	25 MX 06	25 MX 04	25 MX 03	25	6
40 MX 02	40 MX 05	40 MX 01	40 MX 06	40 MX 04	40 MX 03	40	6
50 MX 02	50 MX 05	50 MX 01	50 MX 06	50 MX 04	50 MX 03	50	9
—	—	63 MX 01	—	—	—	63	9
—	—	100 MX 01	—	—	—	100	15

5.3 Optical flats

Customise 

These uncoated flats are used for checking the flatness of other surfaces from the interference fringes (Newton's rings) seen when the surfaces are in contact, in monochromatic light. They are also useful as substrates for special mirrors.

Options available (see p.3)

- Special mirror and other coatings
- Cutting or edging to special sizes

See also:

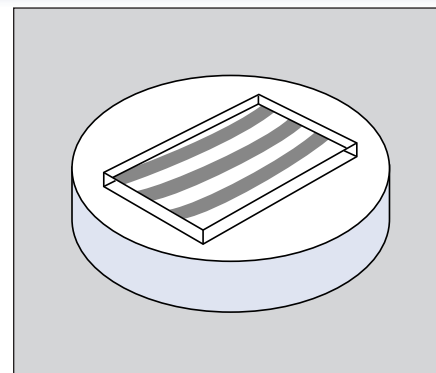
Double-sided substrates

[p.32](#)

Specification

Flatness	$\lambda/10$ (front face) 1λ (rear face)
Diameter	+0, -0.2mm
Thickness	± 0.1 mm
Material	LEBG (see p.2)
Scratch-dig	40-20 (see p.2)

Catalogue No.	Diameter (mm)	Thickness (mm)
25 MF 00	25	6
40 MF 00	40	9
63 MF 00	63	12
100 MF 00	100	15



5.4 Elliptical mirrors

Customise 

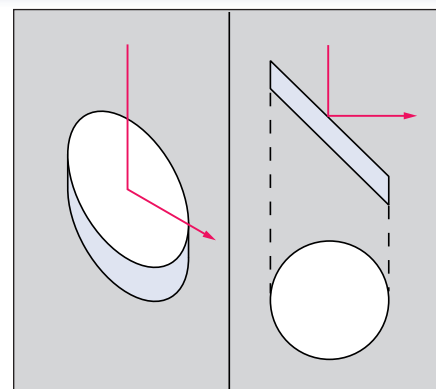
When used at 45°, these mirrors present a circular cross-section, with no obscuration from the edges beyond the mirror aperture.

They are used as secondary mirrors in Newtonian telescopes. Another possible use is for mounting in a tube, where the maximum possible aperture is required.

Catalogue No.	Diameter (minor axis) (mm)	Major axis (mm)	Thickness (mm)
25 MD 00	25	35	6
40 MD 00	40	57	10
50 MD 00	50	71	10

Specification

Flatness	$\lambda/4$
Diameter (minor axis)	+0, -0.25mm
Thickness	± 0.15 mm
Coating (see p.24)	Protected aluminium
Material	Float glass (see p.2)
Scratch-dig	40-20 (see p.2)



5.5 Plane mirrors (1λ over 25mm)

Customise  

These mirrors of guaranteed flatness are available in a wide range of sizes at very reasonable prices, made possible by bulk preparation of the material.

Specification

Flatness	1λ over any 25mm dia.
Diameter	+0, -0.2mm
Length, width	± 0.2 mm
Thickness	± 0.25 mm (3mm) +0, -0.5mm (6mm)
Scratch-dig	60-40 (see p.2)

See also:

Coating data [p.24](#)
More sizes [p.26](#)

Options available (see p.3)

- Cutting or edging to special sizes
- Larger sizes available from stock sheets

Circular mirrors

Catalogue No.	Diameter (mm)	Thickness (mm)
Visible-99		
25 MJ 00	25	3
Enhanced aluminium		
10 MQ 00	10	3
16 MQ 00	16	3
25 ME 00	25	6
40 ME 00	40	6
50 ME 00	50	6
63 ME 00	63	6
100 ME 00	100	6

Square mirrors

Catalogue No.	Length x width (mm)	Thickness (mm)
Visible-99		
16 MJ 16	16 x 16	3
25 MJ 25	25 x 25	3
Enhanced aluminium		
10 MQ 10	10 x 10	3
16 MQ 16	16 x 16	3
25 ME 25	25 x 25	6
40 ME 40	40 x 40	6
50 ME 50	50 x 50	6
63 ME 63	63 x 63	6

Rectangular mirrors

Catalogue No.	Length x width (mm)	Thickness (mm)
Visible-99		
16 MJ 10	16 x 10	3
25 MJ 16	25 x 16	3
40 MJ 25	40 x 25	3
Enhanced aluminium		
16 MQ 10	16 x 10	3
25 MQ 16	25 x 16	3
40 ME 25	40 x 25	6
63 ME 40	63 x 40	6
100 ME 63	100 x 63	6

5.6 General-purpose plane mirrors

Customise  

These mirrors, generally on float glass substrates, have a wide range of uses. 1.1mm thick mirrors are useful for their low inertia in scanning systems. 3mm and 6mm mirrors have better flatness and are useful for camera, microscope or projector systems, illumination, sensing etc. Special sizes of all materials are readily available.

Specification

Flatness (typical):

1.1mm thick 1λ over Ø10mm
3mm/6mm thick 2λ over Ø25mm

Diameter

+0, -0.25mm

Length, width

±0.3mm (≤80mm)
±0.5mm (>80mm)

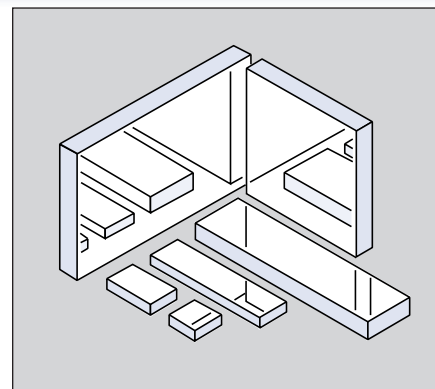
Thickness

±0.25mm (≤3mm)
+0, -0.5mm (6mm)

Coating data

see [p.24](#)

Scratch-dig

60-40 (see [p.2](#))Options available (see [p.3](#))

- Cutting or edging to special sizes
- Larger sizes available from stock sheets

5

Catalogue No. Visible-99	Catalogue No. IR-98	Catalogue No. Enhanced Al	Catalogue No. Ion-plated silver	Catalogue No. UV aluminium	Catalogue No. Protected gold	Dimensions (mm)
Circular mirrors						
06 MH 00	—	06 MV 00	06 MP 00	—	—	Ø6.3 x 1.1
10 MH 00	10 MI 00	10 MV 00	10 MP 00	—	—	Ø10 x 1.1
25 MH 00	—	25 MV 00	—	—	—	Ø25 x 1.1
10 MG 00	—	10 MT 00	—	—	—	Ø10 x 3
16 MG 00	16 MI 00	16 MT 00	16 MP 00	—	—	Ø16 x 3
25 MG 00	25 MI 00	25 MT 00	25 MP 00	25 MK 00	25 MN 00	Ø25 x 3
40 MG 00	—	40 MT 00	40 MP 00	40 MK 00	40 MN 00	Ø40 x 3
50 MG 00	50 MI 00	50 MT 00	50 MP 00	—	—	Ø50 x 3
—	—	50 MC 00	—	—	—	Ø50 x 6
—	—	100 MC 00	—	—	—	Ø100 x 6
Square mirrors						
06 MH 06	—	06 MV 06	—	—	—	6.3 x 6.3 x 1.1
10 MH 10	10 MI 10	10 MV 10	10 MP 10	—	—	10 x 10 x 1.1
16 MH 16	—	16 MV 16	—	—	—	16 x 16 x 1.1
25 MH 25	—	25 MV 25	—	—	—	25 x 25 x 1.1
—	—	40 MV 40	—	—	—	40 x 40 x 1.1
10 MG 10	—	10 MT 10	—	10 MK 10	10 MN 10	10 x 10 x 3
16 MG 16	16 MI 16	16 MT 16	16 MP 16	16 MK 16	16 MN 16	16 x 16 x 3
25 MG 25	25 MI 25	25 MT 25	25 MP 25	25 MK 25	25 MN 25	25 x 25 x 3
40 MG 40	—	40 MT 40	40 MP 40	—	—	40 x 40 x 3
50 MG 50	—	50 MT 50	50 MP 50	50 MK 50	50 MN 50	50 x 50 x 3
63 MG 63	—	63 MT 63	63 MP 63	—	—	63 x 63 x 3
—	—	50 MC 50	—	—	—	50 x 50 x 6
—	—	63 MC 63	—	—	—	63 x 63 x 6
—	—	80 MC 80	—	—	—	80 x 80 x 6
—	—	100 MC 100	—	—	—	100 x 100 x 6
—	—	160 MC 160	—	—	—	160 x 160 x 6
—	—	250 MC 250	—	—	—	250 x 250 x 6
Rectangular mirrors						
10 MH 06	10 MI 06	10 MV 06	—	—	—	10 x 6.3 x 1.1
16 MH 10	—	16 MV 10	—	—	—	16 x 10 x 1.1
25 MH 16	—	25 MV 16	—	—	—	25 x 16 x 1.1
16 MG 10	16 MI 10	16 MT 10	—	16 MK 10	16 MN 10	16 x 10 x 3
25 MG 16	25 MI 16	25 MT 16	25 MP 16	25 MK 16	25 MN 16	25 x 16 x 3
40 MG 25	—	40 MT 25	40 MP 25	40 MK 25	40 MN 25	40 x 25 x 3
63 MG 40	—	63 MT 40	63 MP 40	63 MK 40	63 MN 40	63 x 40 x 3
—	—	40 MC 25	—	—	—	40 x 25 x 6
—	—	63 MC 40	—	—	—	63 x 40 x 6
—	—	100 MC 63	—	—	—	100 x 63 x 6
—	—	160 MC 100	—	—	—	160 x 100 x 6
—	—	250 MC 160	—	—	—	250 x 160 x 6

5.7 Quality concave mirrors

≡Customise 

Compared to lenses, spherical mirrors have the advantages of perfect achromatism, considerably lower spherical aberration (see box) and wide wavelength coverage.

Catalogue No.	FL (mm)	Dia. (mm)	Radius (mm)
16 SQ 25	16	25	32
25 SQ 25	25	25	50
40 SQ 25	40	25	80
63 SQ 25	63	25	126
100 SQ 25	100	25	200
160 SQ 25	160	25	320
25 SQ 40	25	40	50
40 SQ 40	40	40	80
63 SQ 40	63	40	126
100 SQ 40	100	40	200
160 SQ 40	160	40	320

Specification

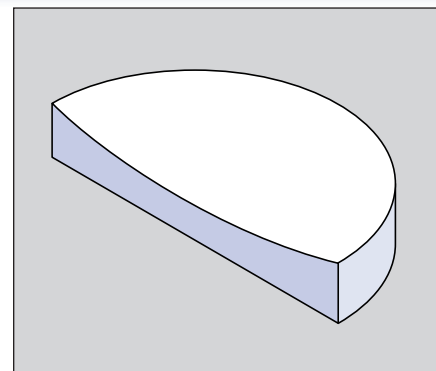
Focal length	±2%
Diameter	+0, -0.2mm
Coating	Al/SiO _x (visible reflectance 85-90%)
Scratch-dig	40-20 (see p.2)

Alternative items available

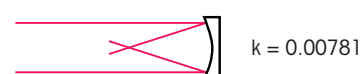
Mirror coatings (see p.3) can easily be applied to lenses (pp.4, 10 etc.) to form convex or concave mirrors

Options available (see p.3)

- Cutting or edging to special sizes



Aberration calculation (see p.2)



5

5.8 Concave lamp reflectors

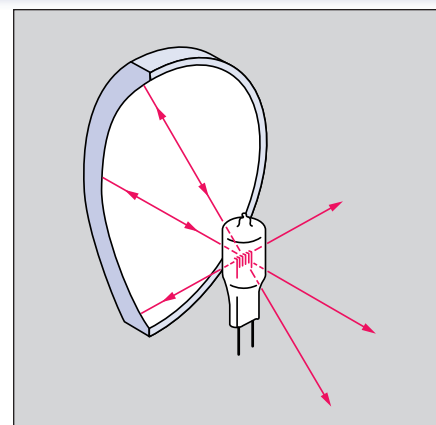
≡Customise 

These spherical front-surface reflectors of very wide aperture are mainly intended as back reflectors for lamphouses. They are positioned with the lamp at the centre of curvature and form a same-size image which can be superimposed on the source or positioned just beside it.

Catalogue No.	Focal length (mm)	Diameter (mm)	Radius of curvature (mm)	Source to rim plane clearance (mm)
08 SR 25	8	25	16	11.1
10 SR 33	10	32.5	20	13.8
14 SR 40	14	40.0	28	20.6
14 SR 50	14	50	28	14.4

Specification

Focal length	±1mm
Diameter	±0.25mm
Coating	Protected Al



5.9 Cube beamsplitters

≡Customise 

Cube beamsplitters, although more expensive than plates, have the advantages of stability, ease of mounting, equality of optical paths and absence of a second-surface ghost image. This range has hybrid coatings with considerably smaller polarising effect than the common all-dielectric types.

Catalogue No.	Dimensions (mm)
06 JQ 01	6.3 x 6.3 x 6.3
10 JQ 01	10 x 10 x 10
16 JQ 01	16 x 16 x 16
25 JQ 01	25 x 25 x 25
40 JQ 01	40 x 40 x 40
50 JQ 01	50 x 50 x 50

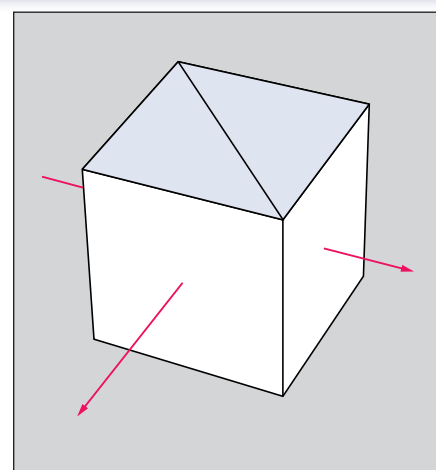
Specification

Wavelength range	450-700nm
Reflectance*	45 ±5%
Transmittance*	45 ±5%
Polarisation ratio	R _s /R _p = 1.25 approx.
Outer face coatings	Multilayer AR
Material	BK7 (see p.2)

* Average over wavelength range

See also:

Polarising cube beamsplitters	p.42
Cube connectors	p.59
Clevis mounts	p.59



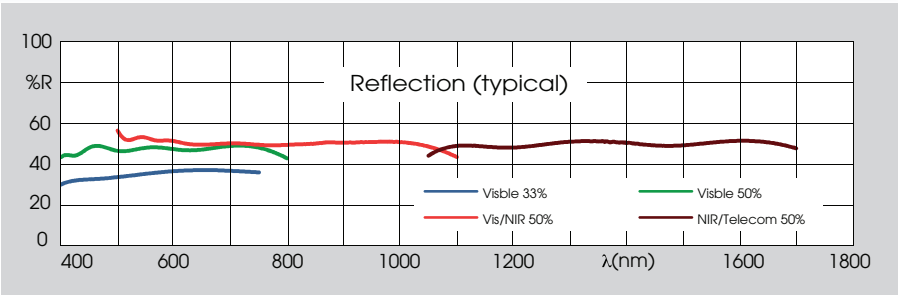
5.10 Plate beamsplitters

Customise

Plate beamsplitters are considerably lighter and cheaper than the traditional cubes, and avoid the problem of stray light back-reflected from the entry and exit faces. Our **Precision** and **Standard** ranges both have dielectric multilayer coatings giving excellent durability and neutrality and much less affected by temperature changes than ordinary evaporated coatings. The spurious reflection from the back surface is almost eliminated by multilayer AR coating.

The Precision range has optically polished BK7 substrates flat to $\lambda/4$. The Standard range is prepared as large sheets, allowing us to offer a wide range of satisfactory quality for most purposes at a very reasonable cost. We can also cut special sizes at short notice. The **Economy** range has a single-layer dielectric (TiO_2) beam splitting coating, without AR, and offers very large sizes at low cost.

- Highly efficient, hard, all-dielectric coatings
- All (except Economy range) multi AR coated on the back surface



See also:

- Metallic neutral filters (can be used as beamsplitters) [p.35](#)
- Dichroic beamsplitters [p.39](#)
- Fresnel beam dividers [p.30](#)
- Cube connectors [p.59](#)

Options available (see p.3)

- Mounting in camera filter rings (see [p.80](#))
- Cutting or edging to special sizes
- Larger sizes available from stock sheets

Coating specification

- Angle** 45°
- Visible 50%:**
- Reflectance $50 \pm 5\%$
 - Wavelength 450-700nm
 - AR coating $R < 1.2\%$ average
- Visible 33%:**
- Reflectance $33 \pm 5\%$
 - Wavelength 450-700nm
 - AR coating $R < 0.6\%$ average
- VIS/NIR 50%**
- Reflectance $50 \pm 6\%$
 - Wavelength 530-1070nm
 - AR coating $R < 0.9\%$ average
- NIR/Telecom 50%**
- Reflectance $50 \pm 5\%$
 - Wavelength 1070-1650nm
 - AR coating $R < 0.6\%$ Average
- Economy:**
- Reflectance 40% nom. (visible)
- Polarisation ratio** $R_s/R_p = 2$ (approx. for all types)

Precision range

Catalogue No. Visible 50%	Catalogue No. VIS/NIR 50%	Catalogue No. NIR/Telecom 50%	Size (mm)	Thickness (mm)
Circular				
25 BQ 00	25 BI 00	25 BX 00	Ø25	4
50 BQ 00	50 BI 00	50 BX 00	Ø50	6
Rectangular				
16 BQ 10	16 BI 10	16 BX 10	16 x 10	3
25 BQ 16	25 BI 16	25 BX 16	25 x 16	4
40 BQ 25	40 BI 25	40 BX 25	40 x 25	6
63 BQ 40	63 BI 40	63 BX 40	63 x 40	8

Standard range

Catalogue No. Visible 50%	Catalogue No. Visible 33%	Catalogue No. VIS/NIR 50%	Catalogue No. NIR/Telecom 50%	Size (mm)	Thickness (mm)
Circular					
25 BV 00	—	25 BJ 00	25 BW 00	Ø25	1.1
25 BA 00	25 BD 00	25 BN 00	25 BL 00	Ø25	3
40 BA 00	—	—	—	Ø40	3
50 BA 00	—	—	—	Ø50	3
Rectangular					
10 BV 06	—	10 BJ 06	10 BW 06	10 x 6.3	1.1
16 BV 10	—	16 BJ 10	16 BW 10	16 x 10	1.1
25 BV 16	—	25 BJ 16	25 BW 16	25 x 16	1.1
40 BV 25	—	40 BJ 25	40 BW 25	40 x 25	1.1
63 BV 40	—	—	—	63 x 40	1.1
100 BV 63	—	—	—	100 x 63	1.1
10 BA 06	10 BD 06	10 BN 06	10 BL 06	10 x 6.3	3
16 BA 10	16 BD 10	16 BN 10	16 BL 10	16 x 10	3
25 BA 16	25 BD 16	25 BN 16	25 BL 16	25 x 16	3
40 BA 25	40 BD 25	40 BN 25	40 BL 25	40 x 25	3
63 BA 40	63 BD 40	63 BN 40	63 BL 40	63 x 40	3
100 BA 63	100 BD 63	100 BN 63	100 BL 63	100 x 63	3
160 BA 100	—	—	—	160 x 100	3

Substrate specification

- Precision range:**
- Flatness (both sides) $\lambda/4$ over 90% of aperture size
 - Diameter $+0, -0.1\text{mm}$
 - Length, width $\pm 0.1\text{mm}$
 - Thickness $\pm 0.1\text{mm}$
 - Scratch-dig 60-40 (see [p.2](#))
 - Material BK7 (see [p.2](#))
- Standard and Economy ranges:**
- Flatness (typical):
- 1mm thick $0.5-1.5\lambda$ over Ø10mm
 - 3mm thick $1-2\lambda$ over Ø25mm
 - Diameter $+0, -0.2\text{mm}$
 - Length, width $\pm 0.3\text{mm}$ ($\leq 100\text{mm}$)
 - $\pm 0.5\text{mm}$ ($> 100\text{mm}$)
 - Thickness $\pm 0.2\text{mm}$
 - Scratch-dig 60-40 (see [p.2](#))
 - Material B270 (NIR range) (see [p.2](#))
 - Float glass (others)

Economy range

Catalogue No.	Size (mm)	Thickness (mm)
100 BT 63	100 x 63	3
160 BT 100	160 x 100	3
250 BT 160	250 x 160	3

6.1 Right-angle prisms

≡Customise 

For 90° turning of a beam, these prisms are easier to mount and to clean than mirrors. Uncoated prisms give total internal reflection (100%), if kept clean, up to the critical angle, corresponding to 5.7° externally for BK7 and 2.5° for silica (at 587nm).

The **AR-coated** range achieves 99% overall efficiency with multilayer coatings for 450-900nm on the entry/exit faces.

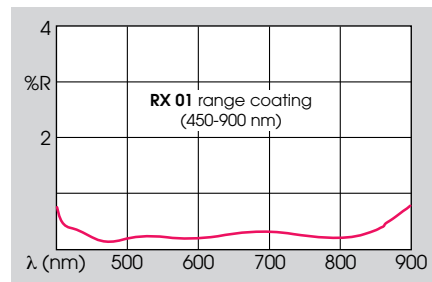
The **Protected** range have the hypotenuse aluminised and black painted (R = 85% approx.) for use at larger incident angles

- Crown prisms for visible and IR use (RQ, RX)
- UV silica prisms for UV/high temperature use (RS)
- Coating options: internal aluminium, external aluminium, multi AR

or in wet or dirty conditions.

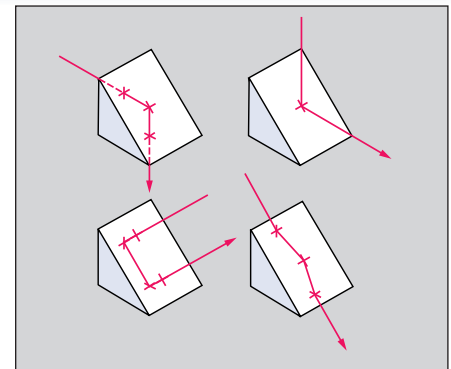
The **External reflection** range have protected aluminium on the hypotenuse for use as mirrors.

BK7 prisms are offered in two grades for general use, and UV silica prisms for wavelengths down to 170nm and for use at high temperatures etc.



BK7 prisms

Catalogue No. Uncoated	Catalogue No. AR coated 450-900nm	Catalogue No. Protected	Catalogue No. External reflection	Entry face size (mm)
Precision grade				
06 RX 00	06 RX 01	06 RX 02	06 RX 03	6.3 x 6.3
10 RX 00	10 RX 01	10 RX 02	10 RX 03	10 x 10
16 RX 00	16 RX 01	16 RX 02	16 RX 03	16 x 16
25 RX 00	25 RX 01	25 RX 02	25 RX 03	25 x 25
40 RX 00	40 RX 01	40 RX 02	40 RX 03	40 x 40
Standard grade				
025 RQ 00	—	—	—	2.5 x 2.5
04 RQ 00	04 RQ 01	04 RQ 02	—	4 x 4
06 RQ 00	06 RQ 01	06 RQ 02	06 RQ 03	6.3 x 6.3
10 RQ 00	10 RQ 01	10 RQ 02	10 RQ 03	10 x 10
12 RQ 00	12 RQ 01	12 RQ 02	12 RQ 03	12.5 x 12.5
16 RQ 00	16 RQ 01	16 RQ 02	16 RQ 03	16 x 16
20 RQ 00	20 RQ 01	20 RQ 02	20 RQ 03	20 x 20
25 RQ 00	25 RQ 01	25 RQ 02	25 RQ 03	25 x 25
32 RQ 00	—	—	—	31.5 x 31.5
40 RQ 00	40 RQ 01	40 RQ 02	—	40 x 40
50 RQ 00	—	—	—	50 x 50
63 RQ 00	—	—	—	63 x 63



See also:

Porro prism
Cleviss mounts

[p.31](#)
[p.59](#)

UV-silica prisms (Precision grade)

Catalogue No. Uncoated	Catalogue No. Protected	Entry face size (mm)
06 RS 00	06 RS 02	6.3 x 6.3
10 RS 00	10 RS 02	10 x 10
16 RS 00	16 RS 02	16 x 16
25 RS 00	25 RS 02	25 x 25
40 RS 00	40 RS 02	40 x 40

Specification

Angles (between polished faces)

Precision ±1min.
Standard ±5min.

Flatness (over inscribed ellipse)

Precision $\lambda/4$
Standard 1λ

Dimensions:

Precision ±0.1mm
Standard ±0.1mm (≤4mm)
±0.2mm (>4mm)

Scratch-dig 40-20 (see [p.2](#))
Material data see [p.2](#)

6.2 Dove prisms

≡Customise 

The output of a dove prism emerges coaxial with the input after one reflection. If the prism is rotated, the output beam turns through twice the angle, allowing an image to be set at any desired orientation.

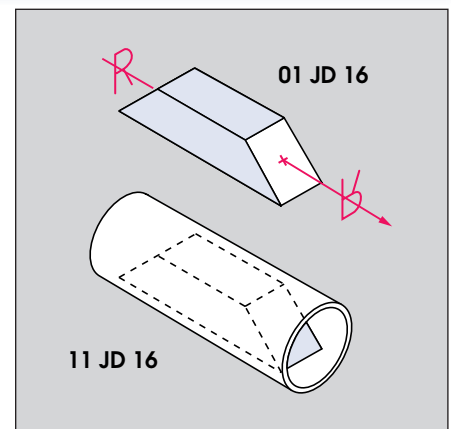
Small achromatic angular deviations, difficult to achieve by other means, can be produced by tilting the prism.

We also stock these prisms mounted in tubes, which can be conveniently held in the holders on [p.81,82](#) or connected by their threads to TubeMount assemblies ([pp.53-59](#)).

Specification

Angles 45° ±5'
Prism dimensions ±0.25mm
Material BK7 (see [p.2](#))

Catalogue No. Unmounted	Catalogue No. Mounted in tube	Aperture (mm)	Prism length (mm)	Mount length x dia. (mm)
01 JD 10	11 JD 10	10 x 10	43	50 x 28
01 JD 16	11 JD 16	16 x 16	68.5	80 x 28



6.3 Wedge prisms

≡Customise 

The deviation produced by a wedge is given approximately by $(n - 1) W$ (where W is the wedge angle) and of course varies slightly with wavelength.

Sets at special price

01 JW 00 Complete set (4 prisms)

See also:

For larger deviations: Equilateral prisms [p.31](#)

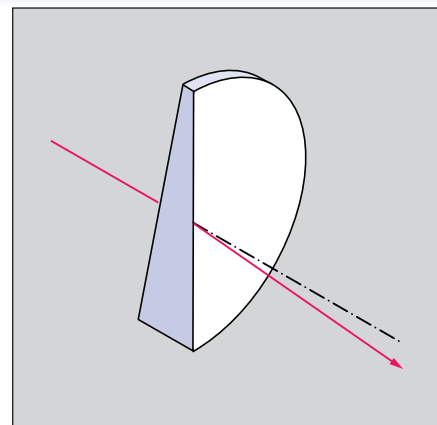
Options available (see [p.5](#))

- Mounting (all items)
- AR coating
- Edging and cutting to special sizes

Specification

Diameter	25mm (+0, -0.2mm)
Deviation tolerance	±3min. (at 633nm)
Material	BK7 (see p.2)

Catalogue No.	Deviation angle	Wedge angle
01 JW 25	1°	1.94°
02 JW 25	2°	3.88°
05 JW 25	5°	9.65°
10 JW 25	10°	18.97°



6.4 Fresnel prisms and beam dividers

≡Customise 

6

A Fresnel prism replaces the sloping surface of a wedge by a series of facets moulded in acrylic, with a great saving of weight and cost. Fresnel prisms are so called as analogous to Fresnel lenses ([p.16](#)) and are not to be confused with Fresnel rhombs ([p.44](#)) or Fresnel biprisms.

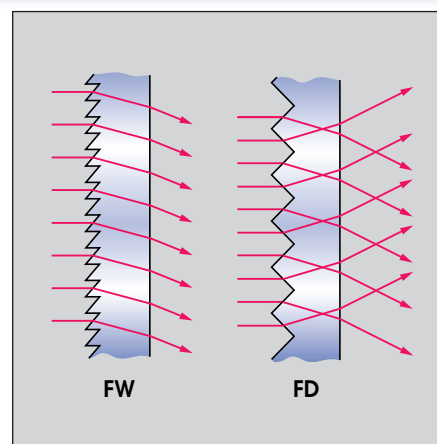
In the Fresnel beam divider alternate facets are reversed, so dividing the light into two beams deviated in opposite directions.

See also:

Beamsplitters [pp.27,28](#)

Catalogue No.	Deviation angle	Prism angle	Aperture length (along grooves) (mm)	Aperture width (mm)	Overall L x W (mm)	Facet width (mm)
Prisms						
16 FW 240	16°	30°	240	240	250 x 250	0.15
16 FW 450	16°	30°	450	360	470 x 390	0.33
23 FW 133	23°	41°	133	133	170 x 170	0.13
Beam dividers						
16 FD 165	±16°	30°	165	165	180 x 180	1.01*
25 FD 330	±25.5°	45°	330	250	355 x 285	0.15*

*Pitch (groove width) = 2 x facet width



Options available

Cutting to special sizes

6.5 Corner-cube and constant-deviation prisms

≡Customise 

The corner-cube retroreflector returns all rays in the incoming direction after three reflections, independent of its own orientation.

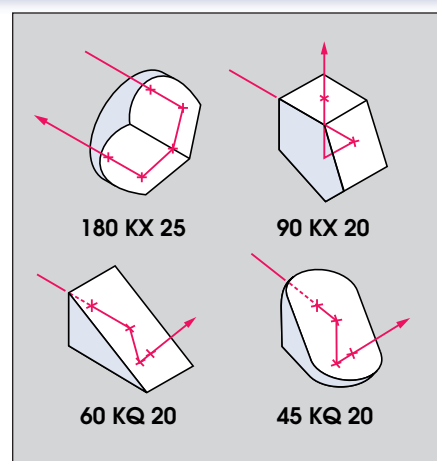
The other prisms shown employ two reflections and have similar invariance of deviation angle to tilt in one direction only. They have the advantage of not causing image inversion and so are widely used in microscope systems etc. For a two-reflection 180° retroreflector see the Porro prism in the next section.

The pentaprisms have very close deviation angle tolerance (10") and have metrological uses, e.g. for setting up axes accurately at right angles.

See also:

Clevis mounts [p.59](#)

Catalogue No.	Deviation angle	Aperture (mm)
Corner-cube prisms		
180 KX 25	180° ± 5sec.	Ø25
180 KQ 25	180° ± 1min.	Ø25
Pentaprisms		
90 KX 10	90° ± 10sec.	10 x 10
90 KX 20	90° ± 10sec.	20 x 20
Other prisms		
60 KQ 20	60° ± 5min.	20 x 20
45 KQ 20	45° ± 5min.	Ø20

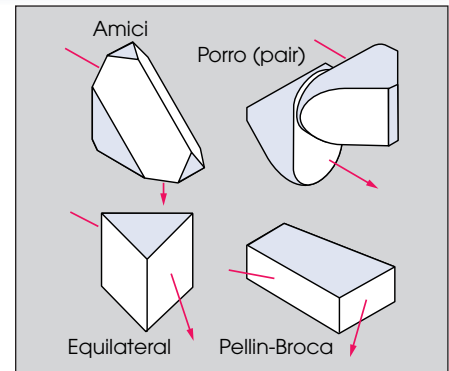


6.6 Inverting and dispersing prisms

Customise 

Both the Amici and Porro prisms invert the image and are commonly used in telescopes and binoculars. The equilateral and Pellin-Broca prisms both disperse the spectrum, the equilateral producing a fan of rays of different

wavelengths, while for the Pellin-Broca 'constant deviation' prism the output is always taken at 90° to the input with the wavelength varying as the prism is rotated: very convenient for monochromator use.



Options available (see p.3)

- AR coating
- Mirror coating

Catalogue No.	Aperture (mm)	Prism type	Material	n_d	V_d
Inverting prisms					
01 JM 23	Ø23	Amici	BK7	1.517	64.2
02 JM 20	Ø20	Porro	BaK4	1.569	56.1
Dispersing prisms					
01 JE 16	16 x 16*	equilateral	UV silica	1.458	67.7
03 JE 16	16 x 16*	equilateral	SF11	1.785	25.8
04 JE 25	25 x 25*	equilateral	F2	1.620	36.4
04 JE 40	40 x 40*	equilateral	F2	1.620	36.4
11 JE 15	27 x 15*	Pellin-Broca	UV silica	1.458	67.7

*Width x height of exit face as drawn above

6.7 Sapphire and UV-silica windows

Customise 

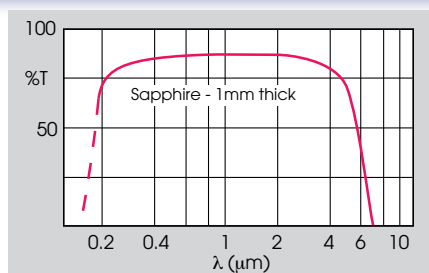
Sapphire is an outstanding material for windows with extraordinary mechanical properties and transparency range, together with usability to 2000°C. The UV silica windows, usable to 1050°C, and down to 170nm wavelength, have very low fluorescence and excellent chemical and radiation resistance.

Specification

Diameter	+0, -0.2mm
Thickness	±0.1mm
Flatness	Sapphire, 2-5λ UVFS, 1λ (over 90%)
Material data	see p.2

Sapphire windows

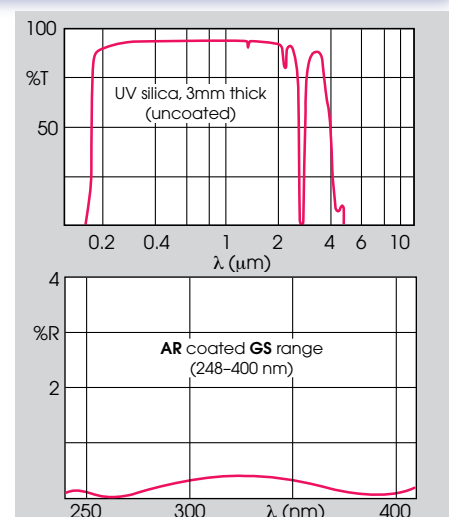
Catalogue No.	Diameter (mm)	Thickness (mm)
10 GA 00	10	1
16 GA 00	16	1
25 GA 00	25	1
40 GA 00	40	2



UV fused silica windows*

Catalogue No. Uncoated	Catalogue No. AR-coated 248-400nm	Dia. (mm)	Thick (mm)
10 GS 00	10 GS 01	10	2
16 GS 00	16 GS 01	16	3
25 GS 00	25 GS 01	25	3
40 GS 00	40 GS 01	40	3
50 GS 00	50 GS 01	50	4
63 GS 00	—	63	6

*Also available in UV silica: 003 SN 25 (25 dia. x 2) and 003 SN 50 (50 x 50 x 2); see p.35



Options available (see p.3)

- Mounting (items up to 50mm dia.)
- AR coating
- Mounting in camera filter rings (see p.80)

6.8 Borosilicate windows

Customise 

Low-expansion borosilicate glass (LEBG, see p.2) is very suitable for windows, on account of its excellent chemical and thermal-shock resistance. We offer both 1.1mm windows made by the float process and thicker optically-polished windows.

Options available (see p.3)

- Mounting (circles up to 50mm dia.)
- AR and other coatings
- Mounting in camera filter rings (see p.80)
- Edging and cutting to special sizes

Specification

Diameter	+0, -0.2mm
Thickness	±0.2mm (float) ±0.1mm (polished)
Flatness:	
Float	typ. 1λ over Ø10mm
Polished	1λ over 90% of aperture dimensions
Scratch-dig	60-40 (see p.2)
Parallelism	1min.
Material	LEBG, see p.2

Catalogue No.	Dimensions (mm)
Float	
25 GH 01	Ø25 x 1.1
50 GH 50	50 x 50 x 1.1
Polished	
10 GH 02	Ø10 x 2
16 GH 03	Ø16 x 3
25 GH 03	Ø25 x 3
40 GH 03	Ø40 x 3
50 GH 04	Ø50 x 4
63 GH 06	Ø63 x 6

6.9 Precision glass windows

Customise 

These optically-polished plates are useful not only as windows but as substrates for special beamsplitters etc. Our AR coated ranges cover the visible/NIR (450-900nm), the NIR (630-1100nm) and the telecoms wavelengths (1100-1600nm) See curves in section 6.10 (below).

Specification

Diameter	+0, -0.15mm
Length, width	±0.1mm
Thickness	±0.1mm
Flatness	$\lambda/4$ over 90% of aperture dimensions
Scratch-dig	40-20 (see p.2)
Parallelism	1min.
Material	BK7 (see p.2)

Catalogue No. Uncoated	Catalogue No. AR coated 450-900nm	Catalogue No. AR coated 630-1100nm	Catalogue No. AR coated 1100-1600nm	Dimensions (mm)
10 GQ 00	10 GQ 01	10 GQ 02	10 GQ 03	Ø10 x 3
16 GQ 00	16 GQ 01	16 GQ 02	16 GQ 03	Ø16 x 3
25 GQ 00	25 GQ 01	25 GQ 02	25 GQ 03	Ø25 x 4
40 GQ 00	40 GQ 01	40 GQ 02	40 GQ 03	Ø40 x 6
50 GQ 00	50 GQ 01	50 GQ 02	50 GQ 03	Ø50 x 6
63 GQ 00	63 GQ 01	63 GQ 02	63 GQ 03	Ø63 x 8
10 GQ 10	—	—	—	10 x 10 x 3
16 GQ 16	—	—	—	16 x 16 x 4
25 GQ 25	—	—	—	25 x 25 x 6
40 GQ 40	—	—	—	40 x 40 x 6
50 GQ 50	—	—	—	50 x 50 x 8
16 GQ 10	—	—	—	16 x 10 x 3
25 GQ 16	—	—	—	25 x 16 x 4
40 GQ 25	—	—	—	40 x 25 x 6
63 GQ 40	—	—	—	63 x 40 x 8

6

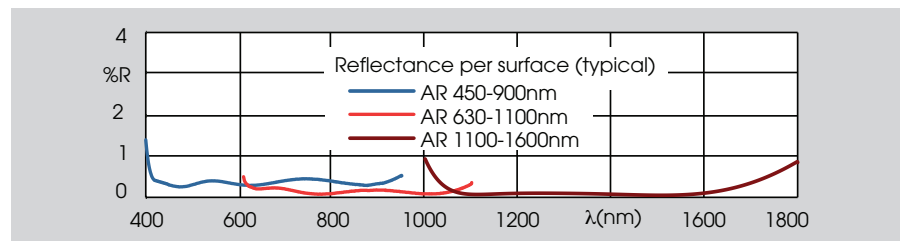
6.10 Standard glass windows

Customise  

We list a comprehensive range of windows in two materials: crown glass, and 'white' float glass (much better transmission than the common 'green' float). These are available uncoated or with a choice of broadband AR coatings.

Single-sided coated glass is useful for laminating.

The ITO (indium tin oxide) material has a conductive coating and is often used in displays, electrically heated, or EMI shielded windows.



ITO coated

Catalogue No. ITO coated one side	Dimensions (mm)
25 GI 01	Ø25 x 1.0-1.2*
50 GI 50	50 x 50 x 1.0-1.2*
25 GI 16	25 x 16 x 1.0-1.2*

Options available (see p.3)

- Mounting (circles up to 50mm)
- Special sizes and coatings
- Mounting in camera filter rings (see p.80)

Specification

Diameter	+0, -0.2mm
Length, width	±0.25mm
Thickness	
Type GE & GJ	1.0mm nominal
Type GU, GC, GL, GM, GP, GV & GI	1.1mm nominal
Type GO & GW	1.2mm nominal
Flatness (typical)	0.5λ over Ø10mm (1.1mm thick) 1-2λ over Ø25mm (3mm/6mm thick)
Material	
ITO, type GI	Float glass
Uncoated GC type	Float glass
Uncoated GU type	Crown glass
MLAR vis, 450-900nm	Float glass
630-1100, 1100-1600nm	Crown glass
ITO coating	Square resistance <20 ohms

Uncoated and AR coated

Uncoated		MLAR vis.		AR 450-900nm		AR 630-1100nm		AR 1100-1600nm		Dimensions (mm)
Float glass	Crown glass	Float glass		Float glass		Crown glass		Crown glass		
		One side	Both sides	One side	Both sides	One side	Both sides	One side	Both sides	
16 GC 01	16 GU 01	16 GO 01	16 GW 01	16 GE 01	16 GJ 01	16 GL 01	16 GM 01	16 GP 01	16 GV 01	Ø16 x 1.0-1.2*
25 GC 01	25 GU 01	25 GO 01	25 GW 01	25 GE 01	25 GJ 01	25 GL 01	25 GM 01	25 GP 01	25 GV 01	Ø25 x 1.0-1.2*
25 GC 03	25 GU 03	—	25 GW 03	25 GE 03	25 GJ 03	25 GL 03	25 GM 03	25 GP 03	25 GV 03	Ø25 x 3
40 GC 03	40 GU 03	40 GO 03	40 GW 03	40 GE 03	40 GJ 03	40 GL 03	40 GM 03	40 GP 03	40 GV 03	Ø40 x 3
50 GC 03	50 GU 03	50 GO 03	50 GW 03	50 GE 03	50 GJ 03	50 GL 03	50 GM 03	50 GP 03	50 GV 03	Ø50 x 3
63 GC 03	63 GU 03	—	63 GW 03	—	—	—	—	—	—	Ø63 x 3
100 GC 06	—	—	—	—	—	—	—	—	—	Ø100 x 6
50 GC 50	50 GU 50	50 GO 50	50 GW 50	50 GE 50	50 GJ 50	50 GL 50	50 GM 50	50 GP 50	50 GV 50	50 x 50 x 1.0-1.2*
100 GC 100	100 GU 100	100 GO 100	100 GW 100	—	—	—	—	—	—	100 x 100 x 3
25 GC 16	25 GU 16	25 GO 16	25 GW 16	25 GE 16	25 GJ 16	25 GL 16	25 GM 16	25 GP 16	25 GV 16	25 x 16 x 1.0-1.2*
40 GC 25	40 GU 25	40 GO 25	40 GW 25	40 GE 25	40 GJ 25	40 GL 25	40 GM 25	40 GP 25	40 GV 25	40 x 25 x 3

*For actual thickness see specification

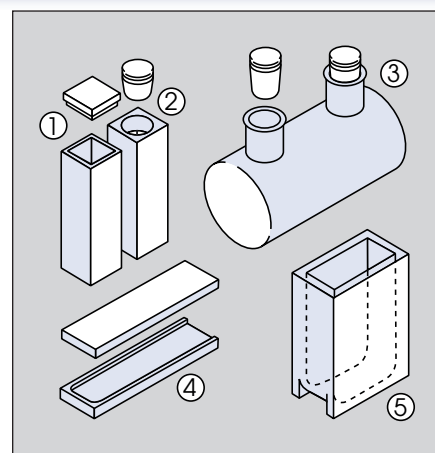
6.11 Cells

These cells are of fully-fused construction, containing no adhesive, and are stocked both in crown glass (for 330-2500nm) and in UV silica (for 190-2700nm). Fluorimeter cells have all five faces polished; all other cells have one pair of faces polished.

Specification

Path length:	
Crown glass	±0.02mm (<10mm)* ±0.1mm (10mm)* ±0.2mm (>10mm)*
UV silica	±0.01mm*
Window thickness	1.25mm
Flatness	2λ over Ø10mm
Parallelism	3min.
Scratch-dig	20-10 (see p.2)

*Manufacturer's data



Options available (see p.3)

A full range of cells and accessories, including flow cells, micro and semi-micro cells, other sizes, materials and path lengths etc. available to order, often at very short notice.

Catalogue No. Crown glass	Catalogue No. UV silica	Path length (mm)	Ext. size (mm)	Fig.	Description
01 GT 01	21 GT 01	1	45 x 12.5	—	standard cell with lid
01 GT 10	21 GT 10	10	45 x 12.5	1	standard cell with lid
02 GT 10	22 GT 10	10	48 x 12.5	2	cell with stopper
03 GT 10	23 GT 10	10	45 x 12.5	1	fluorimeter cell
04 GT 10*	—	10	40 x 28	5	absorptiometer cell
05 GT 01	25 GT 01	1	45 x 12.5	4	demountable cell
06 GT 50	26 GT 50	50	Ø22	3	} cylindrical cells with two stoppers
06 GT 100	26 GT 100	100	Ø22	3	
07 GT 50†	27 GT 50	50	Ø50	—	

*Windows 3mm thick †Low-expansion borosilicate glass

7.1 Diffusers and screens

≡Customise

Anti-Newton glass gives the weakest diffusion effect. This lightly-etched glass is used to support film in enlargers etc. without interference fringes (Newton's rings) appearing.

Ground glass gives a diffusion angle of about ±10° and is useful for focusing screens and for weak diffusion in illuminating systems. We list both LEBG and UV silica (see p.2 for material data).

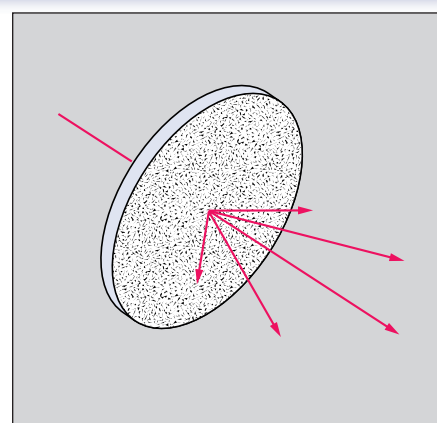
Our plastic materials have much greater diffusion, allowing an image to be back-projected on a large screen without 'hot spot', and have a grey tint to minimise reflection of ambient and scattered light. The 0.3mm PVC material, with a gain of

2.3, is normally stretched over a rigid frame, whereas the 3mm acrylic (with gain of 3) is self-supporting.

Flashed opal glass has a nearly Lambertian characteristic (luminance independent of viewing angle) and is used in light boxes and illumination systems where strong diffusion is needed.

Specification

Diameter	+0, -0.25mm (≤63mm) +0, -0.5mm (>80mm)
Length, width	±0.25mm (glass) ±1mm (plastic)



Options available (see p.3)

- Mounting (circles up to 50mm dia.)
- Special sizes at short notice
- Edging and cutting to smaller sizes
- Larger sizes available from stock sheet

Glass diffusers (3mm thick)

Catalogue No. Anti-Newton glass	Catalogue No. Ground LEBG	Catalogue No. Ground UV silica	Catalogue No. Flashed opal glass	Dimensions (mm)
—	16 DH 00	16 DS 00	—	Ø16
25 DA 00	25 DH 00	25 DS 00	25 DO 00	Ø25
—	40 DH 00	40 DS 00	40 DO 00	Ø40
50 DA 00	50 DH 00	50 DS 00†	50 DO 00	Ø50
—	63 DH 00‡	—	63 DO 00	Ø63
—	—	—	100 DO 00	Ø100
—	—	—	160 DO 00	Ø160
50 DA 50	50 DH 50	50 DS 50*	50 DO 50	50 x 50
100 DA 100	100 DH 100	—	100 DO 100	100 x 100

*2mm thick †4mm thick ‡6mm thick

Plastic screens

Catalogue No. 0.3mm PVC	Catalogue No. 3mm acrylic	Size (mm)
100 DF 100	100 DR 100	100 x 100
160 DF 160	160 DR 160	160 x 160
250 DF 250	250 DR 250	250 x 250
400 DF 400	400 DR 400	400 x 400
600 DF 600	600 DR 600	600 x 600

7.2 Glass neutral filters

Customise 

As the absorption takes place in the bulk of the glass, these filters are less prone to surface damage than metal-coated filters, and are also capable of handling higher powers.

The optical density is reasonably constant in the visible (400-600nm) but may be either higher or lower in the NIR depending on glass type. Transmittance figures for several IR wavelengths are given in the table; for fuller detail request our Technical Data Sheet.

Density calculation

Optical density (D) is related to percentage transmittance (T) by:

$$D = -\log_{10} (T/100)$$

If several filters are used in series their densities can simply be added. Attenuation measured in dB is equal to 10 x density, e.g. density of 2 = 20dB.

Specification

Optical density	±12.5% (at 546nm)
Diameter	+0, -0.2mm
Length, width	±0.2mm
Thickness	±0.1mm

Options available (see p.3)

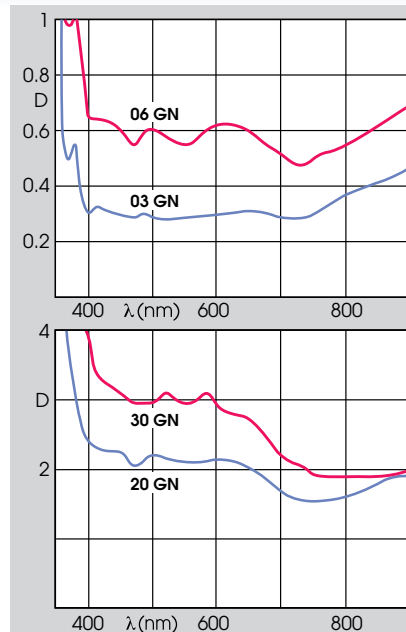
- Mounting (circles only)
- AR coating
- Edging and cutting to special sizes
- Mounting in camera filter rings (see p.80)

Sets including storage box

04 GN 00	12.5mm set (13 filters)
02 GN 00	25mm set (13 filters)
03 GN 00	50 x 50mm set (12 filters)

See also:

Light trap	p.59
Filter wheels	p.80
Storage boxes	p.3



7

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50 x 50mm	Density 546nm	546nm	700nm	Transmittance (%)				1060nm	1500nm	Thickness (mm)	Glass type
01 GN 12	01 GN 25	–	0.1	79	80	78	75	69	77			0.6	NG11
02 GN 12	02 GN 25	02 GN 50	0.2	63	64	60	54	43	59			1.4	NG11
03 GN 12	03 GN 25	03 GN 50	0.3	50	52	46	39	27	44			2.3	NG11
04 GN 12	04 GN 25	04 GN 50	0.4	40	42	35	28	17	34			3.2	NG11
05 GN 12	05 GN 25	05 GN 50	0.5	32	33	27	20	11	26			4.1	NG11
06 GN 12	06 GN 25	06 GN 50	0.6	25	31	30	24	15	32			2.3	NG5
08 GN 12	08 GN 25	08 GN 50	0.8	16	21	20	15	8.2	22			3.1	NG5
10 GN 12	10 GN 25	10 GN 50	1.0	10	14	13	9.4	4.3	15			3.9	NG5
15 GN 12	15 GN 25	15 GN 50	1.5	3.2	5.3	6.7	4.6	2.7	11			2.9	NG4
20 GN 12	20 GN 25	20 GN 50	2	1	2.0	2.7	1.6	0.79	5.5			3.8	NG4
25 GN 12	25 GN 25	25 GN 50	2.5	0.32	1.4	2.5	2.5	1.2	9.8			2.4	NG3
30 GN 12	30 GN 25	30 GN 50	3	0.1	0.60	1.2	1.2	0.51	6.2			2.9	NG3
40 GN 12	40 GN 25	40 GN 50	4	0.01	0.11	0.29	0.29	0.087	2.5			3.9	NG3

7.3 Gelatin and polyester neutral filters

Customise 

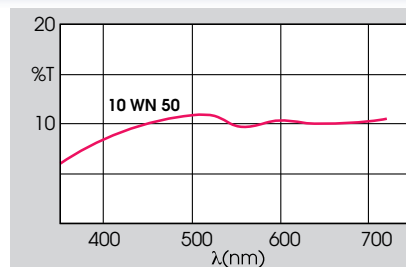
These filters offer accurate achromatic attenuation and are sufficiently thin (0.1mm) not to alter appreciably the state of focus of a system. The gelatin filters, although lacquered for protection, are of course easily damaged by moisture or heat and care is needed in handling.

Much more robust and easy to clean are the Wratten 2 polyester filters manufactured to the same standard as the gelatin filters.

Specification

Dimensions	
WN	50 x 50 x 0.1mm
WS	75 x 75mm
Density	
	±5%
(measured in diffuse light to ANSI PH2.19-1959)	

Catalogue No. gelatine	Catalogue No. polyester	Dens.	Trans. (%)
01 WN 50	01 WS 75	0.1	79
02 WN 50	02 WS 75	0.2	63
03 WN 50	03 WS 75	0.3	50
04 WN 50	04 WS 75	0.4	40
05 WN 50	05 WS 75	0.5	32
06 WN 50	06 WS 75	0.6	25
07 WN 50	07 WS 75	0.7	20
08 WN 50	08 WS 75	0.8	16
09 WN 50	09 WS 75	0.9	13
10 WN 50	10 WS 75	1.0	10
15 WN 50	–	1.5	3.2
20 WN 50	20 WS 75	2.0	1.0
30 WN 50	30 WS 75	3.0	0.1
40 WN 50	40 WS 75	4.0	0.01



- Inexpensive and accurate
- Low scatter
- Neutral 450-720nm
- Easily cut to size

Sets at special price

01 WN 00	Complete set (14 filters)
01 WS 00	Complete set (13 filters)

7.4 Metallic neutral filters

Customise 

These filters consist of a thin layer of nickel-chromium alloy vacuum-deposited on a glass substrate. This gives excellent neutrality and very accurate attenuation. About half the rejected light is absorbed and the remainder reflected, so these filters can also be used as beamsplitters.

Our Visible/IR range have low-expansion borosilicate glass substrates and cover the range 350-2500nm.

Our UV range are on synthetic fused silica and extend the useful range down to about 170nm. Note that the density of all filters is specified at 550nm, but in the UV it can be up to 40% higher – see curves.

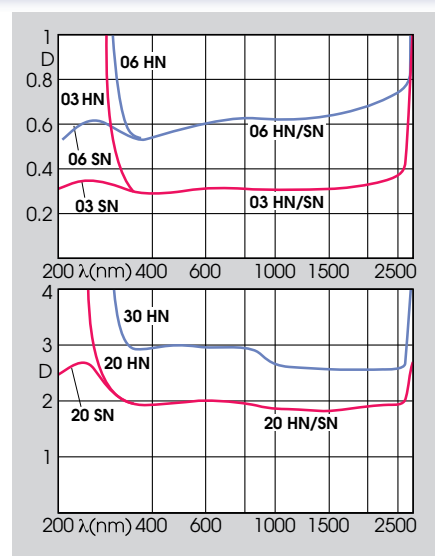
All filters are supplied with a copy transmittance scan taken on a filter from the same production run.

Sets including storage box

01 HN 00	Visible/IR 25mm dia. set (13 filters)
02 HN 00	Visible/IR 50 x 50mm set (13 filters)
01 SN 00	UV 25mm dia. set (11 filters)
02 SN 00	UV 50 x 50mm set (11 filters)

Catalogue No. Visible/IR Ø25 x 2mm	Catalogue No. Visible/IR 50 x 50 x 2mm	Catalogue No. UV Ø25 x 2mm	Catalogue No. UV 50 x 50 x 2mm	Density (550nm)	Transmittance (550nm) (%)
003 HN 25	003 HN 50	003 SN 25	003 SN 50	0.03*	93
01 HN 25	01 HN 50	01 SN 25	01 SN 50	0.1 ± 0.015	79
02 HN 25	02 HN 50	02 SN 25	02 SN 50	0.2 ± 0.015	63
03 HN 25	03 HN 50	03 SN 25	03 SN 50	0.3 ± 0.015	50
04 HN 25	04 HN 50	04 SN 25	04 SN 50	0.4 ± 0.015	40
05 HN 25	05 HN 50	05 SN 25	05 SN 50	0.5 ± 0.015	32
06 HN 25	06 HN 50	06 SN 25	06 SN 50	0.6 ± 0.015	25
08 HN 25	08 HN 50	08 SN 25	08 SN 50	0.8 ± 0.015	16
10 HN 25	10 HN 50	10 SN 25	10 SN 50	1.0 ± 0.015	10
15 HN 25	15 HN 50	15 SN 25	15 SN 50	1.5 ± 0.02	3.2
20 HN 25	20 HN 50	20 SN 25	20 SN 50	2.0 ± 0.03	1.0
30 HN 25	30 HN 50	–	–	3.0 ± 0.06	0.1
40 HN 25	40 HN 50	–	–	4.0 ± 0.12	0.01

* Uncoated substrate



Options available (see p.3)

- Mounting (25mm dia. only)
- All filters can be cut down or edged to special sizes
- Mounting in camera filter rings (see p.80)

Technical data available

Set of transmittance curves for all filter types

7.5 Variable neutral filters

Customise 

These filters have a precisely-graduated Ni-Cr-Fe coating and can be used as variable attenuators or as variable beamsplitters. A combination of two filters with opposite orientation gives uniform density over larger apertures.

The circular filters have density varying with angle, allowing adjustment by simple rotation. Both surfaces have multilayer AR coatings. We offer both unmounted discs

and complete assemblies with scale graduated in degrees and M6 thread to take standard posts (p.74).

An economical alternative is the rectangular linear filter with density increasing along the length. This has a multilayer-AR coated rear face and a small wedge (15°) across the width to reduce multiple reflections.

Catalogue No. Unmounted	Catalogue No. Complete assembly	Maximum density
Circular filters		
10 HV 00	10 HV 01	1
15 HV 00	15 HV 01	1.5
20 HV 00	20 HV 01	2
30 HV 00	30 HV 01	3
Linear filter		
20 HV 10	–	2

Dimensions (mm)

Unmounted circular filters:

Diameter	50 ± 0.25
Thickness	1.5 ± 0.2
Hole dia.	8 ± 0.25
Coated area	Ø46 x 300°

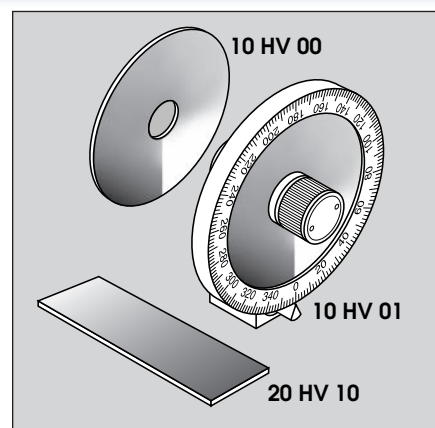
Circular filter assemblies:

Overall dia.	52
Aperture	Ø12 - Ø42

Linear filter:

Dimensions	76.2 x 25.4 x 2
Coated length*	~56

*First 20mm (approx.) of length uncoated



Specification

Density (633nm):

Circular*	±5% of max. value
Linear*	±8% of max. value

Material

BK7 (see p.2)

*Manufacturer's data

7.6 Glass colour filters



Solid glass filters, mostly from Schott materials, are listed in two sizes. These boast excellent blocking characteristics - especially the long-pass types.

Most types are additionally stocked in polished plates about 165mm square permitting large 'specials' to be cut at

short notice via our *Customise* service.

Our **540 GB** photopic filters are a laminated construction and are designed to adapt the spectral response of silicon detectors or cameras to approximate that of the human eye.

Technical Data Sheets

Available for each filter; please specify type

Options available (see p.3)

- Mounting (circles)
- Edging and cutting special sizes
- Mounting in camera filter rings (see p.80)
- AR coating

Specification

Material Schott glass

Diameter +0, -0.2mm

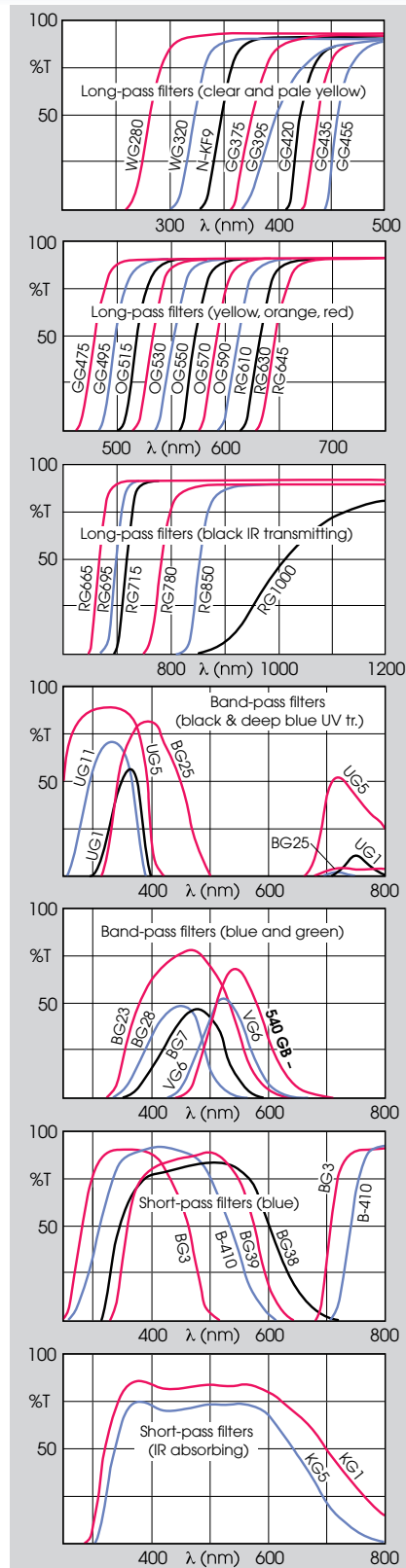
Length/width ±0.2mm

Thickness ±0.2mm

Note: Wavelength listed in table is transition wavelength ($T = T_{max}/2$) for long-pass and short-pass filters, and peak for band-pass filters

Catalogue No. 25mm dia.	Catalogue No. 50 x 50mm	Glass type	Thick. (mm)	Wave- length (nm)	Description
Long-pass filters					
280 GY 25	280 GY 50	WG280	2	280	} colourless filters transmitting visible and some UV
315 GY 25	315 GY 50	WG320	2	315	
340 GY 25*	341 GY 50	N-KF9	3	341	
375 GY 25	375 GY 50	GG375	3	375	} colourless UV-absorbing
395 GY 25	395 GY 50	GG395	3	395	
420 GY 25	420 GY 50	GG420	3	420	} very pale yellow
435 GY 25	435 GY 50	GG435	3	435	
455 GY 25	455 GY 50	GG455	3	455	} UV-absorbing
475 GY 25	475 GY 50	GG475	3	475	
495 GY 25	495 GY 50	GG495	3	495	pale yellow
515 GY 25	515 GY 50	OG515	3	515	yellow
530 GY 25	530 GY 50	OG530	3	530	yellow
550 GY 25	550 GY 50	OG550	3	550	deep yellow
570 GY 25	570 GY 50	OG570	3	570	yellow-orange
590 GY 25	590 GY 50	OG590	3	590	orange
610 GY 25	610 GY 50	RG610	3	610	orange-red
630 GY 25	630 GY 50	RG630	3	630	bright red
645 GY 25	645 GY 50	RG645	3	645	red
665 GY 25	665 GY 50	RG665	3	665	deep red
695 GY 25	695 GY 50	RG695	3	695	very deep red
715 GY 25	715 GY 50	RG715	3	715	} extreme red/IR transmitting
780 GY 25	780 GY 50	RG780	3	780	
850 GY 25	850 GY 50	RG850	3	850	} black filters passing IR from the stated wavelength to 2.7µm
1000 GY 25	1000 GY 50	RG1000	3	1000	
Band-pass filters					
320 GB 25	320 GB 50	UG5	3	320	} black UV-transmitting
330 GB 25	330 GB 50	UG11	3	330	
360 GB 25	360 GB 50	UG1	3	360	
390 GB 25	390 GB 50	BG25	3	390	deep blue
445 GB 25	445 GB 50	BG28	3	445	blue
465 GB 25	465 GB 50	BG23	3	465	bright blue
475 GB 25	475 GB 50	BG7	3	475	blue
520 GB 25	520 GB 50	VG6	3	520	green
540 GB 25	540 GB 50	—	5	540	photopic (eye response)
Short-pass filters					
465 GK 25	465 GK 50	BG3	1	465	deep blue, UV-transmitting
538 GK 25	538 GK 50	B-410‡	2.5	538	bright blue, UV-transmitting
575 GK 25	575 GK 50	BG39	3	575	pale blue, strongly absorbs red/NIR
610 GK 25	610 GK 50	BG38	3	610	pale blue, absorbs red/NIR
668 GK 25	668 GK 50	KG5	3	668	IR-absorbing
716 GK 25	716 GK 50	KG1	3	716	IR-absorbing, toughened \$

* 25mm dia. is in similar Hoya type UV-34, 340nm cut-off, 2.5mm thick. ‡ Hoya \$ See p.38 for full range of heat filters



See also:

Neutral glass filters
More heat filters
Storage boxes

p.34
p.38
p.3

7.7 Gelatin and polyester colour filters

≡Customise 

The well-known Wratten gelatin filters, an industry standard for many years, are now being replaced by 'Wratten 2' filters. These are manufactured in polyester and are much more robust, but are still made to the same spectral standard.

We are introducing them as they become available, distinguishing them from the original catalogue number by changing the letter pairs from **WY** and **WB** to **KY** and **KB** respectively.

We also offer a low-cost range of polyester filters which are rough equivalents of the Wratten range.

Specification

Dimensions 75 x 75 x 0.1mm

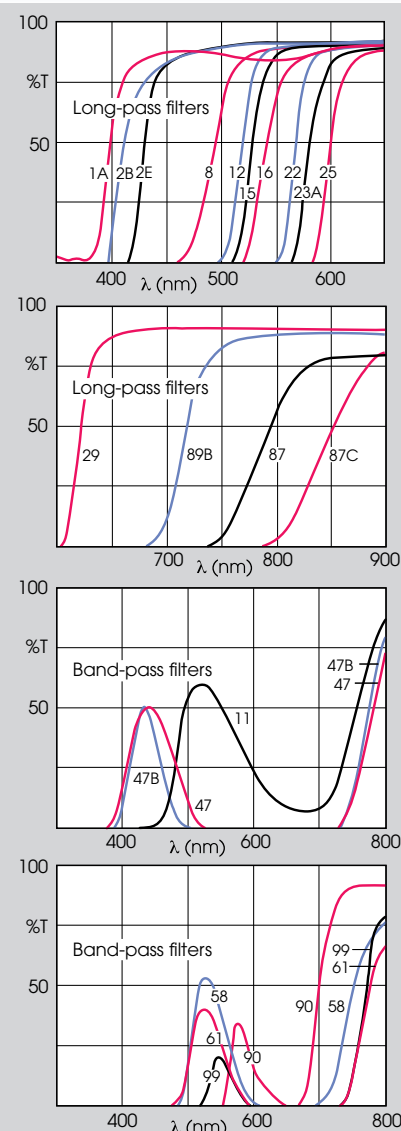
Transmittance See curves

Note: Wavelength listed is transition wavelength ($T = 50\%$) for long-pass and peak for band-pass types. Data and curves are based on Wratten data; for exact curves for polyester see Technical Data Sheets.

Technical Data Sheets

Available for each filter; please specify type

Catalogue No. 'Wratten' gelatin	Catalogue No. Polyester	Wratten No.	Wavelength (nm)	Description
Long-pass filters				
—	395 CY 75	1A	395	pale pink UV-absorbing (skylight)
411 WY 75	411 CY 75	2B	411	pale yellow UV-absorbing
430 WY 75	—	2E	430	pale yellow UV-absorbing
494 WY 75	494 CY 75	8	494	yellow
519 WY 75	519 CY 75	12	519	deep yellow (minus blue)
528 WY 75	528 CY 75	15	528	deep yellow
540 WY 75	540 CY 75	16	540	yellow-orange
568 WY 75	—	22	568	deep orange
—	581 CY 75	23A	581	orange-red
600 WY 75	600 CY 75	25	600	tricolour red
622 WY 75	—	29	622	narrow-cut tricolour red
717 WY 75	—	89B	717	} black filters passing IR from the stated wavelength to 2.7µm
794 WY 75	794 CY 75	87	794	
852 WY 75	—	87C	852	
Band-pass filters				
432 WB 75	432 CB 75	47B	432	narrow-cut tricolour blue
440 WB 75	—	47	440	tricolour blue
516 WB 75	516 CB 75	11	516	yellowish green
525 WB 75	—	61	525	narrow-cut tricolour green
527 WB 75	527 CB 75	58	527	tricolour green
547 WB 75	—	99	547	dark green
575 WB 75	—	90	575	dark amber monochromat



7.8 Acrylic filters

≡Customise 

These robust and inexpensive long-pass filters are available in large sheets. The UV blocking type is often used for protection from photochemical damage. The IR black filters are used to cover IR transmitters or receivers to hide them from view and block unwanted ambient light.

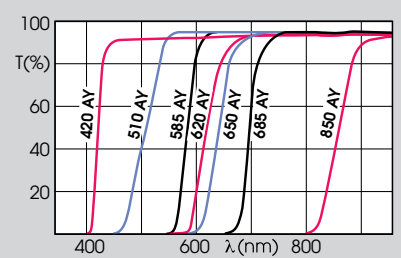
Specification

Diameter +0, -0.2mm

Length, width ±0.5mm (50mm)
±1mm (400mm)

Thickness ±0.2mm

Catalogue No. 25mm dia.	Catalogue No. 50 x 50 mm	Catalogue No. 400 x 400 mm	TWL ($T = 50\%$) (nm)	Thick. (mm)	Description
420 AY 25	420 AY 50	420 AY 400	420	1	clear UV blocking
510 AY 25	510 AY 50	510 AY 400	510	1	yellow
585 AY 25	585 AY 50	585 AY 400	585	1	light red
620 AY 25	620 AY 50	620 AY 400	620	1	red
650 AY 25	650 AY 50	650 AY 400	650	1	dark red
685 AY 25	685 AY 50	685 AY 400	685	1	black IR trans.
850 AY 25	850 AY 50	850 AY 400	850	1	black IR trans.



Options available (see p.3)

- Mounting in camera filter rings (see p.80)
- Edging and cutting special sizes

7.9 Heat-control optics

Customise  

Heat filters absorb unwanted IR. Hot and cold mirrors, at some extra cost, divide much more sharply between IR and visible and can handle more power. Hot mirrors reflect IR and transmit visible, whilst cold mirrors reflect visible and transmit IR.

For further specification detail request a Technical Data Sheet.

Specification

Diameter	+0, -0.2mm
Length, width	±0.2mm
Thickness	±0.25mm
Heat filters:	
Material	Schott KG1, toughened
Hot mirrors:	
Transmittance (0°)*	>88% (425-675nm) typical 94%
Reflectance (0°)*	>95% (760-1150nm)
Substrate	LEBG float (see p.2)
Cold mirrors:	
Reflectance (45°)*	>90% (425-650nm)
Transmittance (45°)*	>90% (800-1200nm)
Substrate	LEBG float (see p.2)

*Average over wavelength regions stated

Catalogue No. Dimensions (mm)

Heat filters

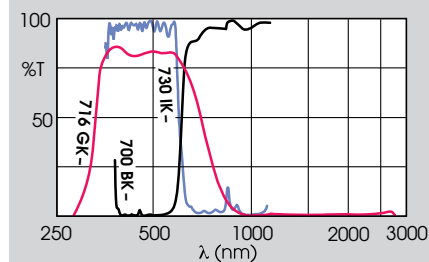
716 GK 25	Ø25 x 3
716 GK 105	Ø40 x 3
716 GK 106	Ø50 x 3
716 GK 40	40 x 40 x 3
716 GK 50	50 x 50 x 3
716 GK 63	63 x 63 x 3

Hot mirrors (0°)

730 IK 25	Ø25 x 3
730 IK 105	Ø40 x 3
730 IK 106	Ø50 x 3
730 IK 40	40 x 40 x 3
730 IK 50	50 x 50 x 3
730 IK 63	63 x 63 x 3
730 IK 80	80 x 80 x 3

Cold mirrors (45°)

700 BK 16	25 x 16 x 3
700 BK 25	40 x 25 x 3
700 BK 40	63 x 40 x 3
700 BK 63	100 x 63 x 3
700 BK 100	160 x 100 x 3



Options available (see p.3)

- Mounting (circular items)
- Edging and cutting special sizes
- Special sizes
- Mounting in camera filter rings (see p.80)
- Larger sizes available from stock sheets

See also:

Other short-pass filters

p.36

7.10 Dichroic filters (0°)

Customise  

These filters consist of thin-film dielectric coatings on glass with sharp transitions between the transmitted and reflected bands. Having negligible absorption they are suitable for high powers and do not show the strong fluorescence of certain glass filters.

Where strong blocking is needed, however, glass filters (p.36) or bandpass interference filters (pp.39-41) are recommended.

Data are given for normal incidence; if used at 45° the shift towards shorter wavelengths is about 35-50nm.

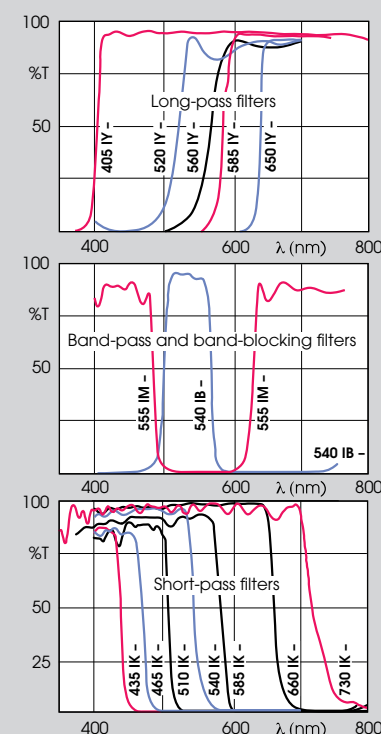
New range now available

Comprehensive new range of dichroic filters now stocked including greatly increased choice of long-pass, short-pass, band pass and band block types.

[Click here for full information.](#)

Catalogue No. 25mm dia.	Catalogue No. 50 x 50mm	TWL* (T=50%) (nm)	Passband (nm)	Block band (nm)	Thick. (mm)	Description
Long-pass filters						
405 IY 25	405 IY 50	405	420-760	300-380	1	UV block.
520 IY 25	520 IY 50	520	545-760	400-480	1	yellow
560 IY 25	560 IY 50	560	585-760	425-525	1	orange
585 IY 25	585 IY 50	590	615-760	400-540	1	red
650 IY 25	650 IY 50	650	680-760	400-595	1	deep red
Band-pass filters						
540 IB 25	540 IB 50	{505 575}	530-550	{380-460 600-730}	1	green
Short-pass filters						
435 IK 25	435 IK 50	435	390-415	475-710	1	violet
465 IK 25	465 IK 50	465	400-440	500-740	1	deep blue
510 IK 25	510 IK 50	510	400-490	550-700	1	blue
540 IK 25	540 IK 50	540	400-510	580-700	1	light blue
585 IK 25	585 IK 50	585	420-565	630-760	1	cyan
660 IK 25	660 IK 50	660	400-640	690-1000	1	IR block.
730 IK 25	730 IK 50	730	425-675	750-1150	3	hot mirror †
Band-blocking filters						
555 IM 25	555 IM 50	{485 630}	{400-460 650-730}	530-560	1	magenta

* Transition wavelength † For full range of hot mirrors see 7.9 above



Specification

Diameter	+0, -0.2mm
Length, width	±0.25mm
Thickness	±0.2mm
Transmittance	Request data sheet

7.11 Dichroic beamsplitters (45°)

Customise 

These are similar to the dichroic filters above but are used at 45°, so separating two spectral regions to be used or detected simultaneously. Applications include separation of laser wavelengths, fluorescence microscopy and tricolour separation. The UV mirrors allow UV to be isolated without expensive transmitting materials.

Options available (see p.3)

- Edging and cutting special sizes
- Mounting in camera filter rings (see p.80)
- Larger sizes available from stock sheets

Specification

Dimensions ±0.25mm
For full specification request a Technical Data Sheet.

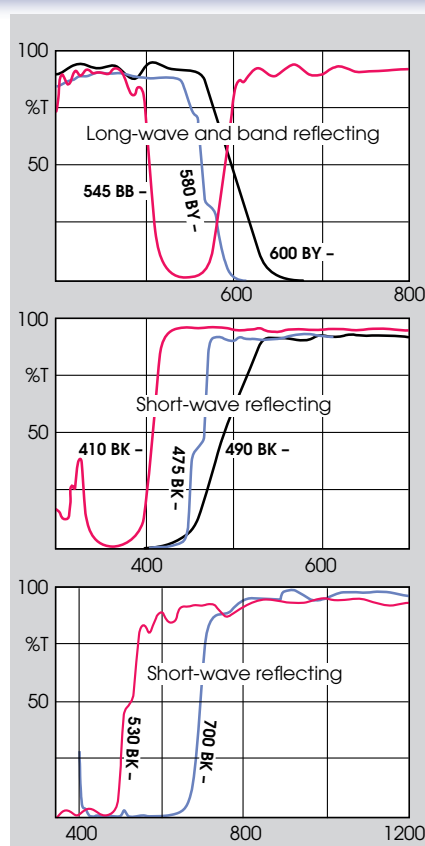
New range now available

Comprehensive new range of dichroic filters now stocked including greatly increased choice of long-pass, short-pass, band pass and band block types.

[Click here](#) for full information.

Catalogue No. 25 x 16mm	Catalogue No. 40 x 25mm	TWL* (T=50%) (nm)	Trans. band (nm)	Refl. band (nm)	Thick. (mm)	Description (Reflected light)
Long-wave reflecting						
580 BY 16	580 BY 25	580	400-550	610-725	1	red
600 BY 16	600 BY 25	600	400-560	640-760	1	red
Band reflecting						
545 BB 16	545 BB 25	{500 590}	{400-480 620-760}	520-560	1	green
Short-wave reflecting						
410 BK 16	410 BK 25	410	440-700	340-390	1	UV
475 BK 16	475 BK 25	475	525-800	380-450	1	blue
490 BK 16	490 BK 25	490	520-760	400-450	1	blue
530 BK 16	530 BK 25	530	600-1200	325-475	3	UV/blue
700 BK 16	700 BK 25	700	800-1200	425-650	3	visible†

* Transition wavelength † For full range of cold mirrors see p.38



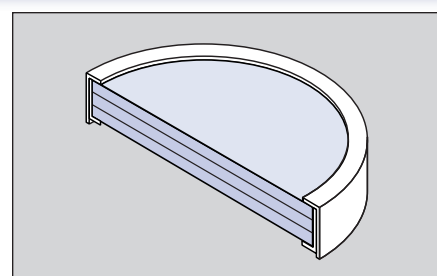
7.12 Interference filters

Customise 

These filters consist of an all-dielectric Fabry-Perot coating, prepared – along with other coatings for additional blocking – on large sheets of glass, which are then cemented to form a solid stack. Individual filters are then cut and mounted in nested rings, providing a labyrinth epoxy edge seal which greatly extends their life. Filter life, however, is not indefinite and filters should be stored with desiccant to prevent damage to the hydrophilic coatings. Each filter is marked with catalogue number and batch code and supplied with a copy scan from its production batch.

Uses include laser signal discrimination, line selection, colorimetry and fluorimetry. Although not originally designed for imaging, they are often so used, but please note that the various reflective surfaces in each filter are not precisely parallel and multiple reflections of bright objects in the field of view may be troublesome.

Filters used with high flux must have the more reflective side towards the incoming light.



See also:

Storage boxes

[p.3](#)

Dimensions

Diameter	+0, -0.3mm
Thickness	5-6mm
Clear aperture:	
12.5mm dia.	8.6mm
25mm dia.	19mm
50mm dia.	44mm

Options available (see p.3)

- Mounting in camera filter rings (see p.80)

Specification

Range	IN	IL (<1100nm)	IL (≥1100nm)	IH	IU	IW
CWL Tolerance (nm)	+0.8,-0.5	±2.5	±3.5	±2.5	±6	±8
HBW tolerance (nm)	±0.8	±2.5	±3.5	±2.5	±6	±9
Bandwidth ratios*:						
10%BW/HBW	1.74	1.35	1.74	1.35	1.13	1.05
1%BW/HBW	3.21	1.99	3.21	1.99	1.30	1.18
0.1%BW/HBW	6.09	2.92	6.09	2.92	1.60	1.36
0.01%BW/HBW	12.68	4.41	12.68	4.41	2.04	1.69
Blocking type and specification						
	Induced transmittance filter 10 ⁻⁴ absolute, 200-3500nm+			Dielectric stacks: 10 ⁻⁴ ave., 10 ⁻³ abs., x-ray to 1150nm		
No of cavities (min)	2	3	2	3	5	7

* Manufacturers data. A few items may have more cavities than standard, hence lower ratios.

† Some filters have 5 cavities, see extra - broadband range on p.41. Filters with 5 cavities will have the same bandwidth ratios as the broadband range.

7.12 Interference filters (continued)

Customise 

Interference filter glossary

Bandwidth (HBW, FWHM): Width of the pass-band; specifically, the difference between the two wavelengths at which the transmittance is half the peak value. Similarly, 10% bandwidth (10%BW) is measured between points where $T = 10\%$ of the peak, etc.

Blocking: Rejection of energy outside the pass-band. Absolute blocking is the transmittance level not exceeded at any point in the specified wavelength range. Average blocking is a value averaged over the range.

Cavity: The basic element from which a filter is constructed, consisting of two reflective coating stacks with a spacer layer between. Our standard range are based on a series of three cavities, all deposited as a single stack of layers. Wider-band filters have more cavities and therefore a squarer shape of passband.

Centre wavelength (CWL): The wavelength midway between the half-power points which define bandwidth (see above).

Transmittance (T): The guaranteed minimum value of the peak transmittance of the filter (not necessarily occurring at the centre wavelength)

Technical notes

- To estimate the transmittance near the passband, use the bandwidth ratios given on p.39: e.g. **340 IL 12** has HBW = 10; for IL range 1%BW/HBW = 1.99, so 1%BW = 19.9; i.e. transmittance will be 1% of peak (about 0.3% absolute) at $340 \pm (19.9/2)$, i.e. about 330nm and 350nm.
- For light incident at an angle the centre wavelength λ_0 will shift to:

$$\lambda(\theta) = \lambda_0 (1 - k \sin^2\theta)$$

where k is approximately 0.24 for **IW** filters and 0.11 for all others.

- The CWL shifts towards longer wavelengths with increasing temperature, at about 0.01nm/K

Specification

See p.39

Boxed filter sets

Sets are supplied complete with a wooden storage box, at a discount on the individual filter prices. Items included in sets are marked in the tables.

01 IL 12 12.5mm } 10nm bandwidth UV/
01 IL 25 25mm } visible sets (10 filters)
01 IL 50 50mm }

02 IL 12 12.5mm } 10-18nm bandwidth
02 IL 25 25mm } IR sets (10 filters)

01 IU 12 12.5mm } 40nm bandwidth
01 IU 25 25mm } sets (10 filters)
01 IU 50 50mm }

01 IW 12 12.5mm } 65-75nm bandwidth
01 IW 25 25mm } sets (10 filters)

Custom sets: Order 10 or more different interference filters in the same size and we will supply a wooden storage box (see p.3) free of charge.

Narrowband range (3nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
488 IN 12	488 IN 25	488	3	35
515 IN 12	515 IN 25	514.5	3	35
532 IN 12	532 IN 25	532	3	35
546 IN 12	546 IN 25	546.1	3	40
568 IN 12	568 IN 25	568.2	3	40
578 IN 12	578 IN 25	577.7	3	40
589 IN 12	589 IN 25	589.6	3	40
633 IN 12	633 IN 25	632.8	3	40
670 IN 12	670 IN 25	670	3	40

Standard range (10nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
340 IL 12*	340 IL 25*	340 IL 50*	340	10	30
365 IL 12	365 IL 25	365 IL 50	365	10	30
380 IL 12	380 IL 25	380 IL 50	380	10	30
390 IL 12	390 IL 25	—	390	10	33
400 IL 12*	400 IL 25*	400 IL 50*	400	10	33
405 IL 12	405 IL 25	—	405	10	35
410 IL 12	410 IL 25	410 IL 50	410	10	43
420 IL 12	420 IL 25	420 IL 50	420	10	45
430 IL 12	430 IL 25	430 IL 50	430	10	45
436 IL 12	436 IL 25	436 IL 50	435.8	10	45
440 IL 12	400 IL 25	440 IL 50	440	10	45
450 IL 12*	450 IL 25*	450 IL 50*	450	10	45
458 IL 12	458 IL 25	458 IL 50	457.9	10	45
460 IL 12	460 IL 25	—	460	10	45
470 IL 12	470 IL 25	470 IL 50	470	10	45
480 IL 12	480 IL 25	480 IL 50	480	10	45
488 IL 12	488 IL 25	—	488	10	45
488 IH 12	488 IH 25	488 IH 50	488	10	70
490 IL 12	490 IL 25	490 IL 50	490	10	45
500 IL 12*	500 IL 25*	500 IL 50*	500	10	50
510 IL 12	510 IL 25	510 IL 50	510	10	50
515 IL 12	515 IL 25	—	514.5	10	50
515 IH 12	515 IH 25	515 IH 50	514.5	10	70

Standard range (10nm bandwidth) continued

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
520 IL 12*	520 IL 25*	520 IL 50*	520	10	50
530 IL 12	530 IL 25	530 IL 50	530	10	50
532 IL 12	532 IL 25	—	532	10	50
532 IH 12	532 IH 25	532 IH 50	532	10	75
540 IL 12	540 IL 25	540 IL 50	540	10	50
543 IL 12	543 IL 25	—	543	10	50
546 IL 12	546 IL 25	546 IL 50	546.1	10	50
550 IL 12*	550 IL 25*	550 IL 50*	550	10	50
560 IL 12	560 IL 25	560 IL 50	560	10	50
570 IL 12*	570 IL 25*	570 IL 50*	570	10	50
578 IL 12	578 IL 25	—	577.7	10	50
580 IL 12	580 IL 25	—	580	10	50
589 IL 12	589 IL 25	—	589.6	10	50
590 IL 12	590 IL 25	590 IL 50	590	10	50
600 IL 12*	600 IL 25*	600 IL 50*	600	10	50
610 IL 12	610 IL 25	610 IL 50	610	10	50
620 IL 12	620 IL 25	620 IL 50	620	10	50
630 IL 12	630 IL 25	630 IL 50	630	10	50
633 IL 12	633 IL 25	—	632.8	10	50
633 IH 12	633 IH 25	633 IH 50	632.8	10	75
636 IL 12	636 IL 25	—	636	10	50
640 IL 12	640 IL 25	640 IL 50	640	10	50
645 IL 12	645 IL 25	—	645	10	50
650 IL 12*	650 IL 25*	650 IL 50*	650	10	50
656 IL 12	656 IL 25	656 IL 50	656.3	10	50
660 IL 12	660 IL 25	660 IL 50	660	10	50
670 IL 12	670 IL 25	—	670	10	50
670 IH 12	670 IH 25	670 IH 50	670	10	75
675 IH 12	675 IH 25	—	675	10	75
680 IL 12	680 IL 25	680 IL 50	680	10	50
685 IH 12	685 IH 25	685 IH 50	685	10	75
690 IL 12	690 IL 25	690 IL 50	690	10	50
694 IL 12	694 IL 25	—	694.3	10	50
700 IL 12*	700 IL 25*	700 IL 50*	700	10	50
710 IL 12	710 IL 25	—	710	10	50

*Included in set (see box above)

7.12 Interference filters (continued)

Customise 

Standard IR range (10-18nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
720 IL 12	720 IL 25	720	10	50
730 IL 12	730 IL 25	730	10	50
740 IL 12	740 IL 25	740	10	50
750 IL 12*	750 IL 25*	750	10	50
760 IL 12	760 IL 25	760	10	50
770 IL 12	770 IL 25	770	10	50
775 IH 12	775 IH 25	775	10	75
780 IL 12*	780 IL 25*	780	10	50
780 IH 12	780 IH 25	780	10	75
785 IH 12	785 IH 25	785	10	75
790 IL 12	790 IL 25	790	10	50
800 IL 12*	800 IL 25*	800	10	50
810 IL 12	810 IL 25	810	10	45
820 IL 12	820 IL 25	820	10	45
820 IH 12	820 IH 25	820	10	75
825 IH 12	825 IH 25	825	10	75
830 IL 12	830 IL 25	830	10	45
830 IH 12	830 IH 25	830	10	75
835 IH 12	835 IH 25	835	10	75
840 IL 12	840 IL 25	840	10	45
850 IL 12*	850 IL 25*	850	10	45
860 IL 12	860 IL 25	860	10	45
870 IL 12	870 IL 25	870	10	45
880 IL 12	880 IL 25	880	10	45
885 IH 12	885 IH 25	885	10	75
890 IL 12	890 IL 25	890	10	45
900 IL 12*	900 IL 25*	900	10	45
900 IH 12	900 IH 25	900	10	75
905 IL 12	905 IL 25	905	10	50
905 IH 12	905 IH 25	905	10	75
910 IL 12	910 IL 25	910	10	50
910 IH 12	910 IH 25	910	10	75
920 IL 12	920 IL 25	920	10	50
930 IL 12	930 IL 25	930	10	50
940 IL 12	940 IL 25	940	10	50
950 IL 12*	950 IL 25*	950	10	50
960 IL 12	960 IL 25	960	10	50
970 IL 12	970 IL 25	970	10	50
980 IL 12	980 IL 25	980	10	45
990 IL 12	990 IL 25	990	10	50
1000 IL 12*	1000 IL 25*	1000	15/14 [†]	50
1020 IL 12	1020 IL 25	1020	15/14 [†]	50
1040 IL 12	1040 IL 25	1040	15	50
1050 IL 12	1050 IL 25	1050	15/14 [†]	47
1064 IL 12*	1064 IL 25*	1064	16	50
1064 IH 12 [†]	1064 IH 25 [†]	1064	10	75
1080 IL 12	1080 IL 25	1080	15/14 [†]	45
1100 IL 12*	1100 IL 25*	1100	16.5/14 [†]	45
1120 IL 12	1120 IL 25	1120	17.5	45
1140 IL 12	1140 IL 25	1140	17.5/14 [†]	45
1160 IL 12	1160 IL 25	1160	18/11 [†]	45
1180 IL 12	1180 IL 25	1180	11	45
1200 IL 12*	1200 IL 25*	1200	11	45
1220 IL 12	1220 IL 25	1220	11	45
1240 IL 12	1240 IL 25	1240	11.5/11 [†]	45
1260 IL 12	1260 IL 25	1260	12/11 [†]	45
1280 IL 12	1280 IL 25	1280	12/11 [†]	45
1300 IL 12	1300 IL 25	1300	12	45
1320 IL 12	1320 IL 25	1320	12.5/12 [†]	45
1340 IL 12	1340 IL 25	1340	13/12 [†]	45
1360 IL 12	1360 IL 25	1360	13/12 [†]	45
1380 IL 12	1380 IL 25	1380	13.5/12 [†]	45

Standard IR range (10-18nm bandwidth) continued

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
1400 IL 12	1400 IL 25	1400	14/12 [†]	40
1420 IL 12	1420 IL 25	1420	14/12 [†]	40
1440 IL 12	1440 IL 25	1440	14/12 [†]	40
1460 IL 12	1460 IL 25	1460	14/12 [†]	40
1480 IL 12	1480 IL 25	1480	15/12 [†]	40
1500 IL 12	1500 IL 25	1500	15/14 [†]	40
1520 IL 12	1520 IL 25	1520	15/13 [†]	40
1540 IL 12	1540 IL 25	1540	15/13 [†]	40
1560 IL 12	1560 IL 25	1560	15/13 [†]	40
1580 IL 12	1580 IL 25	1580	16/13 [†]	40
1600 IL 12	1600 IL 25	1600	16/13 [†]	40
1620 IL 12	1620 IL 25	1620	16/13 [†]	40
1640 IL 12	1640 IL 25	1640	16/13 [†]	40
1660 IL 12	1660 IL 25	1660	14/13 [†]	40
1680 IL 12	1680 IL 25	1680	14	40
1700 IL 12	1700 IL 25	1700	15	40
1800 IL 12	1800 IL 25	1800	17/15 [†]	40
1900 IL 12	1900 IL 25	1900	16	35
2000 IL 12	2000 IL 25	2000	17	35

Broadband range (22-40nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
400 IU 12*	400 IU 25*	400 IU 50*	400	40	45
450 IU 12*	450 IU 25*	450 IU 50*	450	40	60
500 IU 12*	500 IU 25*	500 IU 50*	500	40	70
550 IU 12*	550 IU 25*	550 IU 50*	550	40	75
570 IU 12	570 IU 25	—	570	40	75
600 IU 12*	600 IU 25*	600 IU 50*	600	40	75
633 IU 12	633 IU 25	633 IU 50	632.8	40	75
650 IU 12*	650 IU 25*	650 IU 50*	650	40	75
660 IU 12	660 IU 25	—	660	40	75
670 IU 12*	670 IU 25*	670 IU 50*	670	40	75
678 IH 12 [†]	678 IH 25 [†]	678 IH 50 [†]	678	22	75
700 IU 12*	700 IU 25*	700 IU 50*	700	40	75
730 IU 12	730 IU 25	730 IU 50	730	30	75
750 IU 12*	750 IU 25*	750 IU 50*	750	40	75
780 IU 12	780 IU 25	780 IU 50	780	30	75
830 IU 12	830 IU 25	830 IU 50	830	40	75
850 IU 12*	850 IU 25*	850 IU 50*	850	40	75
905 IU 12	905 IU 25	—	905	40	75

*Included in set (see box p.40)

†Special design; bandwidth ratios do not apply

Extra-broadband range (65-75nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
500 IW 12*	500 IW 25*	500 IW 50	500	70	70
550 IW 12*	550 IW 25*	550 IW 50	550	70	75
600 IW 12*	600 IW 25*	600 IW 50	600	65	75
650 IW 12*	650 IW 25*	650 IW 50	650	75	75
670 IW 12	670 IW 25	670 IW 50	670	75	75
700 IW 12*	700 IW 25*	—	700	70	75
750 IW 12* [†]	750 IW 25* [†]	—	750	60	75
800 IW 12* [†]	800 IW 25* [†]	800 IW 50	800	65	75
820 IW 12	820 IW 25	—	820	75	75
850 IW 12* [†]	850 IW 25* [†]	850 IW 50	850	70	75
880 IW 12 [†]	880 IW 25 [†]	—	880	70	75
900 IW 12* [†]	900 IW 25* [†]	—	900	60	75
940 IW 12	940 IW 25	—	940	60	75
950 IW 12*	950 IW 25*	—	950	65	75

*Included in set (see box p.40) †Blocked to 1250nm

†Undergoing redesign with narrower bandwidth. If exact bandwidth critical please enquire for specification of current stock

8.1 Cube polarisers

Customise

Polarising beamsplitter cubes conveniently divide any beam into two polarised components. They also make excellent variable beamsplitters, particularly for sources such as lasers with polarised output, used with a half-wave plate (pp.44,45) to vary the incident polarisation state. This arrangement allows continuous variation of the split ratio over a wide range with negligible losses.

We offer cubes for both the visible and near IR ranges, both with multilayer AR coatings for maximum efficiency. Note that the polarisation purity of the transmitted beam is considerably better than the reflected beam. For even better performance see the crystal polarisers below.

Cubes are also listed **mounted** in a flanged clevis mount (see p.59) to fit directly into our rotating holders (p.77,78), TubeMount cells (p.54) and similar mounts, whilst still allowing access to the reflected beam.

Specification

Wavelength range:

Visible450-700nm

NIR700-1064nm

T_p

Typ. 97%, see graph

T_s

0.2% max.*

R_p

Typ. 3% (1 - T_p)

R_s

> 99%

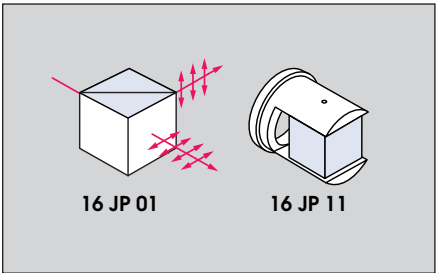
Material

SF15 (699301)

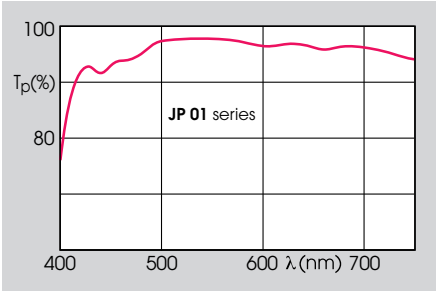
Dimensions

±0.25mm

*At centre of aperture. May be up to 0.5% around periphery. For NIR range, T_s for 700-725nm <1%.



Catalogue No. Visible	Catalogue No. NIR	Side (mm)
Unmounted		
06 JP 01	06 JP 02	6.3
10 JP 01	10 JP 02	10
16 JP 01	16 JP 02	16
25 JP 01	25 JP 02	25
In mount 25mm dia.		
10 JP 11	10 JP 12	10
16 JP 11	16 JP 12	16



See also:

Non-polarising cubes

Rotating holders

p.27

p.77,78

8.2 Crystal polarisers

Customise

The basic Glan-Taylor polarising prism gives both excellent extinction and high transmittance over a wide wavelength range. The form with side faces polished is useful as a polarising beamsplitter or for high powers.

For modest extra cost, Glan Taylors can be supplied with a single layer anti-reflection coating for any desired wavelength. Please enquire for details.

The Wollaston polarising beamsplitter, a cemented type, deviates the two polarisation components of a beam at angles ±10° from the input direction, with a small chromatic dispersion.

Most types are also offered **mounted** in flanged clevis mounts (as illustrated in 8.1

above, and see p.59); these fit directly, for instance, into our rotating holders (p.77,78) and TubeMount system (pp.53-59), whilst still allowing access to the side exit beam.

Specification

Material

Calcite (CaCO₃)

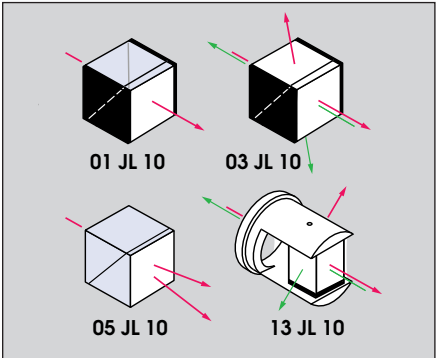
Wavelength range

350-2800nm

Face flatness*

λ/8

*Manufacturer's data



Options available

• Rochon, Glan-Thompson and other designs

• Quartz, MgF₂ and other materials

• Special sizes, mounts etc.

• AR coating (by special quotation)

See also:

Graduated rotating holders

p.77,78

Catalogue No. Unmounted	Catalogue No. In mount 25mm dia.	Nominal aperture (mm)	Acceptance angle	Peak trans.* (%)	Extinction ratio*	Max. power* (continuous) (W/cm ²)	Max. power* (pulsed) (MW/cm ²)	Type
01 JL 07	—	7 x 7	±3°	~88	10 ⁵	10	20	Glan-Taylor
01 JL 10	11 JL 10	10 x 10	±3°	~88	10 ⁵	10	20	Glan-Taylor
03 JL 10	13 JL 10	10 x 10	±3°	~88	10 ⁵	300	300	Glan-Taylor with side windows
05 JL 10	15 JL 10	10 x 10	±20°	~90	10 ⁴	1	—	Wollaston, beamsplitting

*Manufacturer's data

8.3 Sheet polarisers (visible)

Customise 

The materials offered are from the former Polaroid/3M range. All are obsolescent and are being replaced by alternatives. If your application is for ongoing production, please contact us for the current situation.

However, we hold substantial stocks of many of the types. In addition to the standard grades we also offer HN38S and HN42HE, which combine very good extinction with high transmittance, at some extra cost, and HN22 which has the widest wavelength range (400-800nm): for wavelengths outside this range see [p.44](#).

- Glass lamination for durability
- Acrylic for rigid sheets
- CAB for economy and hand cutting

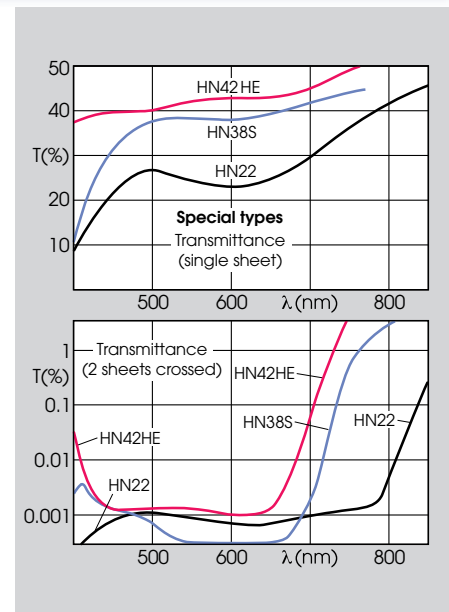
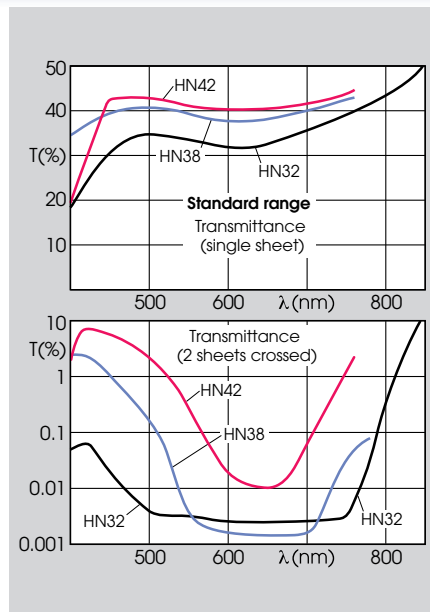
Options available

We offer a unique range of special services.

- Special sizes and shapes
- Precision alignment of polarising axis ($\pm 20'$ regularly achieved)
- Mounting (see [p.3](#)) (circles)
- Special glass laminating
- Special AR coatings
- Larger sizes available from stock sheets

Technical Data Sheet

Available on request



Specification

Diameter	+0, -0.25mm
Length, width	±0.5mm (<100mm) ±1mm (100-400mm) nominal (> 400mm)
AR coating	Multilayer for visible
Axis direction	typ. $\pm 2^\circ$
Note: Rectangular sheets have axis parallel to short edge	

Transmittance data* (%) (uncoated)

Grade	Single	2 sheets	2 sheets at 90°	
			(nom.)	(max.)
HN42	42	34	0.5	0.9
HN38	38	29	0.05	0.1
HN32	32	20	0.005	0.01
HN22	22	10	0.0005	0.001
HN38S	38	29	0.0004	-
HN42HE	42	34	0.002	-

*Manufacturer's data

Catalogue No. Standard range			Catalogue No. Special types			Size (mm)	Thickness (mm)	Lamination material
HN42	HN38	HN32	HN22	HN38S	HN42HE			
Glass-laminated polarisers, AR coated								
42 CA 25	38 CA 25	32 CA 25	22 CA 25	05 CA 25	04 CA 25	Ø25	3 ± 0.25	B270 glass
Plastic laminates, AR coated								
42 VE 25	38 VE 25	32 VE 25	22 VE 25	05 VE 25	—	Ø25	0.28 ± 0.1	} CAB
42 VE 106	38 VE 106	32 VE 106	22 VE 106	05 VE 106	—	Ø50	0.28 ± 0.1	
Plastic laminates, uncoated								
42 CL 25	38 CL 25	32 CL 25	22 CL 25	—	—	Ø25	3.4 ± 0.75	} Acrylic
42 CL 106	38 CL 106	32 CL 106	22 CL 106	—	—	Ø50	3.4 ± 0.75	
42 CL 50	38 CL 50	32 CL 50	22 CL 50	—	—	50 x 50	3.4 ± 0.75	
42 CL 100	38 CL 100	32 CL 100	22 CL 100	—	—	100 x 100	3.4 ± 0.75	
42 WL 25	38 WL 25	32 WL 25	22 WL 25	05 WL 25	—	Ø25	0.75 ± 0.1	} CAB (cellulose acetate butyrate) lacquered for protection
42 WL 106	38 WL 106	32 WL 106	22 WL 106	05 WL 106	—	Ø50	0.75 ± 0.1	
42 WL 50	38 WL 50	32 WL 50	22 WL 50	05 WL 50	—	50 x 50	0.75 ± 0.1	
42 WL 100	38 WL 100	32 WL 100	22 WL 100	05 WL 100	—	100 x 100	0.75 ± 0.1	
42 WL 160	38 WL 160	—	22 WL 160	05 WL 160	—	160 x 160	0.75 ± 0.1	
42 VL 25	38 VL 25	32 VL 25	22 VL 25	05 VL 25	04 VL 25	Ø25	0.28 ± 0.1	} CAB not lacquered
—	—	—	—	—	04 VL 106	Ø50	0.28 ± 0.1	
42 VL 50	38 VL 50	32 VL 50	22 VL 50	05 VL 50	04 VL 50	50 x 50	0.28 ± 0.1	
42 VL 100	38 VL 100	32 VL 100	22 VL 100	05 VL 100	—	100 x 100	0.28 ± 0.1	
42 VL 160	38 VL 160	32 VL 160	—	—	—	160 x 160	0.28 ± 0.1	

†635 x 432mm

8.4 UV and IR sheet polarisers

Customise

We now offer very good alternatives to the obsolescent Polaroid UV and IR materials (HNP'B and HR). All offer excellent contrast ratio and high transmission.

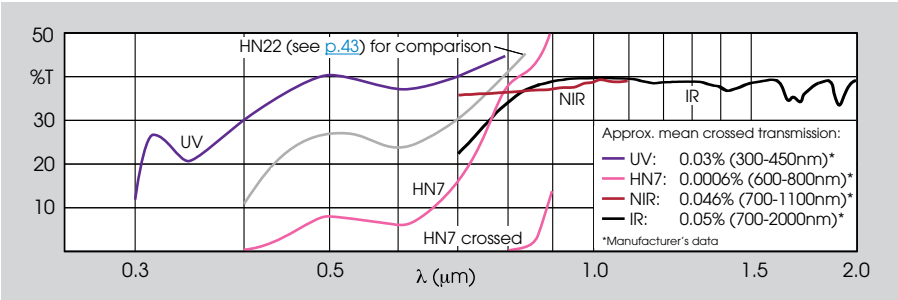
UV material for use down to 280nm.

The IR material (equivalent to the old Polaroid HR) covers 700-2000nm.

The NIR polariser has a narrower bandwidth, 700-1100nm, but is much more economical than the IR.

Finally we still have stocks of the old Polaroid HN7 which is cheap, but range-limited (600-800nm).

Catalogue No.	Material	Wavelength range (nm)	Size (mm)	Thickness (mm)
01 WL 25	UV	280-450+	25 x 25	0.15
01 WL 104	UV	280-450+	Ø25	0.15
01 WL 50	UV	280-450+	50 x 50	0.15
02 WL 25	HN7	800-860	Ø25	0.38
02 WL 50	HN7	800-860	50 x 50	0.38
02 WL 100	HN7	800-860	100 x 100	0.38
06 WL 25	IR	800-2000	25 x 25	0.38
06 WL 104	IR	800-2000	Ø25	0.38
06 WL 50	IR	800-2000	50 x 50	0.38
07 WL 25	NIR	700-1100	25 x 25	0.13
07 WL 104	NIR	700-1100	Ø25	0.13
07 WL 50	NIR	700-1100	50 x 50	0.13



Options available

- Special sizes
- Mounting (circles)
- Glass laminating

Technical Data Sheet

Available on request

8

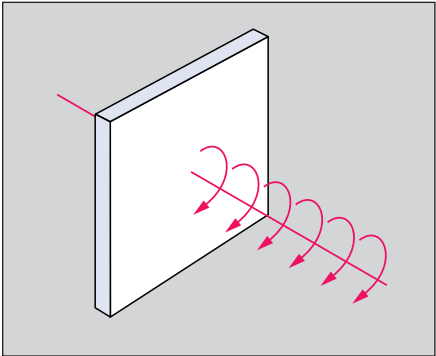
8.5 Circular polarisers

Polaroid circular polariser HNC37 consists of a linear polariser laminated to a quarter-wave plate. Its commonest use is to block specular reflections from displays. The matt non-glare finish helps to suppress reflections from the polariser itself, but can

only be used where the polariser is very close to the display.

The original HNC37 is no longer manufactured, but is being replaced by equivalent material from other sources.

Catalogue No. 50 x 50mm	Catalogue No. 100 x 100mm	Catalogue No. 160 x 160mm	Thickness (mm)	Lamination	Finish
10 W0 50	10 W0 100	10 W0 160	0.8	CAB	clear
11 W0 50	11 W0 100	11 W0 160	0.8	CAB	non-glare
10 C0 50	10 C0 100	10 C0 160	3.4	acrylic	clear
11 C0 50	11 C0 100	11 C0 160	3.4	acrylic	non-glare



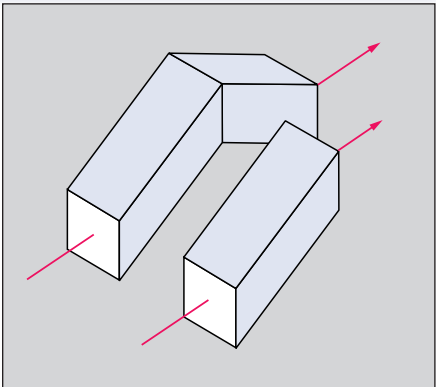
8.6 Achromatic retarders

Customise

The Fresnel rhomb is unique among retarders in giving a fractional-wave retardation nearly independent of wavelength, the variation due to change of index with wavelength being less than ±1% through the visible (450-700nm) and within ±4% throughout the range of transparency (350-2500nm). The variation with angle is also small (less than ±6% over ±5°) and spurious stress birefringence is reduced by use of a fine-annealed grade of glass. The single (quarter-wave) rhomb gives an output parallel to the input but laterally displaced. The double (half-wave) rhomb has input and output coaxial.

Specification		
Aperture	16 x 16mm	
Lateral offset (single rhomb)	21.6mm	
Angles	55°20' ± 5'	
Material	BK7 (see p.2)	

Catalogue No.	Type	Length (mm)
01 JR 16	single (λ/4)	31.3
02 JR 16	double (λ/2)	62.6



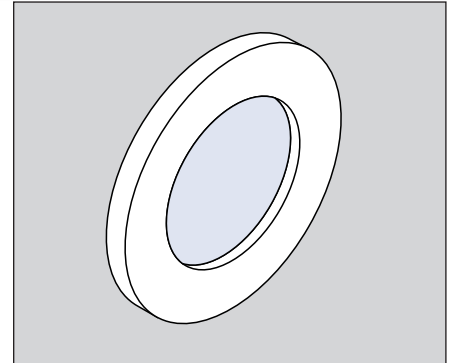
8.7 Quartz retarders

These V-AR coated quarter-wave and half-wave plates are suitable for high powers, having negligible absorption and very high transmittance. The low-order single-plate design minimises angle and wavelength dependence whilst avoiding the very high cost of double-plate zero-order retarders.

Specification

Retardance	$\pm 0.005\lambda$
Transmittance	$>99.5\%$
Aperture	13mm
Mount dia.	25mm
Quartz thickness	0.2-0.3mm
Orders of retardance	2-4

Catalogue No. $\lambda/4$ plate	Catalogue No. $\lambda/2$ plate	Wavelength (nm)
129 GR 04	257 GR 02	514.5
133 GR 04	266 GR 02	532
158 GR 04	316 GR 02	632.8
266 GR 04	532 GR 02	1064



8.8 Mica retarders

Customise

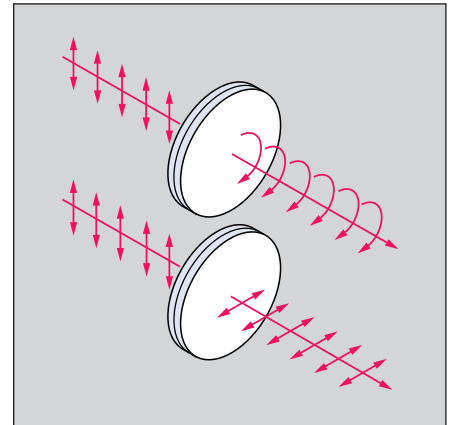
The natural cleavage of mica allows accurate zero-order retarders to be made at much lower cost than in quartz. The mica is laminated between glass plates for ease of handling.

The quarter-wave plate converts linear to circular polarisation and is often used with a linear polariser to form an isolator, blocking light reflected from surfaces beyond. The half-wave plate changes the

direction of linear polarisation; with a polarising beamsplitter cube or prism (see p.42) it forms a useful variable-ratio beamsplitter. Mica retarders, being zero-order, can be used over a fairly broad wavelength range; e.g. a 5% change of wavelength results in only 0.6% transmittance of light of incorrect polarisation – see box for calculation.

Specification

Retardation tolerance:	
Quarter-wave	$\pm 0.01\lambda$
Half-wave	$\pm 0.02\lambda$
Diameter	25mm +0, -0.2mm
Thickness	3mm ± 0.25 mm
AR coating	All laminating plates are AR coated for the relevant wavelength



Options available

- Special wavelengths (usually at no extra cost)
- Special sizes and thickness
- Full-wave and other retardations
- Unlaminated mica
- Mounting (all items, see p.3)
- Edging to special sizes

Technical notes

- The spurious transmittance of a quarter-wave plate in double passage as an isolator, or of a half-wave plate as a 90° rotator, is given by:

$$\sin^2 \left(\frac{\pi \Delta\lambda}{2\lambda} \right)$$

where $\Delta\lambda$ is the difference between the actual wavelength λ and that for which the retardance is a true half or quarter wave.

- The path-difference (retardance expressed in nm) of mica is nearly constant with

wavelength, so that e.g. a quarter-wave plate for 1064nm has 266nm path-difference and is also a half-wave plate at 532nm.

- The birefringence of mica is about 0.0054, so an unlaminated quarter-wave plate for 532nm is about 25µm thick.
- Tilt of a plate can be used to tune retardance either upwards or downwards, according as the rotation is about the fast or slow axis. The effect is approximately quadratic with angle, a 10° tilt causing about 9% change in retardance.

Catalogue No. $\lambda/4$ plate	Catalogue No. $\lambda/2$ plate	Wavelength (nm)
110 CM 25	221 CM 25	442
122 CM 25	244 CM 25	488
129 CM 25	257 CM 25	515
133 CM 25	267 CM 25	532
136 CM 25	272 CM 25	543
147 CM 25	295 CM 25	589
158 CM 25	316 CM 25	633
167 CM 25	335 CM 25	670
195 CM 25	390 CM 25	780
208 CM 25	415 CM 25	830
266 CM 25	532 CM 25	1064
378 CM 25	755 CM 25	1510

8.9 Plastic retarders

Customise

Plastic retarders are an inexpensive alternative to mica or quartz and are available in large sizes. Quarter wave retarder (140 WR) is 0.4mm thick, and half wave retarder (280 WR) is 0.8mm thick.

Catalogue No. 50 x 50mm	Catalogue No. 100 x 100mm	Catalogue No. 150 x 150mm	Catalogue No. 305 x 305mm	Retardance (nm)	Description
140 WR 50	140 WR 100	140 WR 150	140 WR 305	140 \pm 20	visible $\lambda/4$
280 WR 50	280 WR 100	280 WR 150	280 WR 305	280 \pm 40	visible $\lambda/2$

9.1 Diffraction gratings

Customise

Our **research** range of high-quality replica reflection gratings includes both ruled and holographic types. Generally ruled gratings have higher efficiency, while holographics have lower stray-light levels and are available in closer rulings. For the UV, however, blazed holographics are available with a similar profile and efficiency to ruled types. Efficiency curves are available on request.

The **commercial** range are inexpensive transmission replicas mounted between glass plates and are suitable for simple demonstrations etc.

Options available

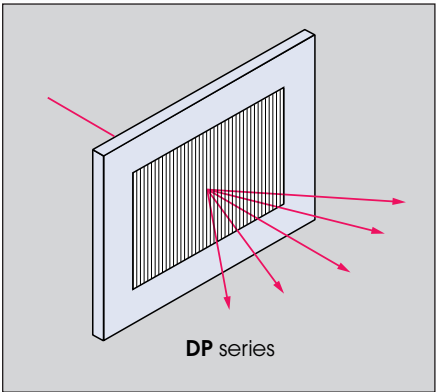
Research range: Other wavelengths, sizes and coatings, transmission types etc. available to order.

Data for calculation

Light of wavelength λ incident at an angle i will be diffracted at angles i' given by:

$$\sin i' = G n \lambda - \sin i$$

where G = groove density (lines/mm) and n is the order of diffraction (any integer). Blazed gratings have facets inclined at an angle b to the surface to concentrate light into the first order ($n = +1$). When the grating is used in the Littrow condition (retroreflection, $i = i'$) peak efficiency will be near the blaze wavelength shown ($= (2/G) \sin b$).



Research range – ruled				Research range – holographic				Commercial range			
Catalogue No.	Lines/mm	Blaze (nm)	Size (mm)	Catalogue No.	Lines/mm	Blaze (nm)	Size (mm)	Catalogue No.	Lines/mm	Eff. size (mm)	Size (mm)
600 DG 300	600	300	25 x 25 x 9.5	Optimised for visible				100 DP 00	100	45 x 30	65 x 50
600 DG 500	600	500	25 x 25 x 9.5	1200 DI 00	1200	–	25 x 25 x 9.5	200 DP 00	200	45 x 30	65 x 50
600 DG 1000	600	1000	25 x 25 x 9.5	2400 DI 00	2400	–	25 x 25 x 9.5	300 DP 00	300	45 x 30	65 x 50
600 DG 1600	600	1600	25 x 25 x 9.5	Blazed for UV				600 DP 00	600	45 x 30	65 x 50
1200 DG 250	1200	250	25 x 25 x 9.5	1200 DI 240	1200	240	25 x 25 x 9.5				
1200 DG 500	1200	500	25 x 25 x 9.5	2400 DI 240	2400	240	25 x 25 x 9.5				
1200 DG 750	1200	750	25 x 25 x 9.5								

9.2 Bar gratings and resolution charts

Customise

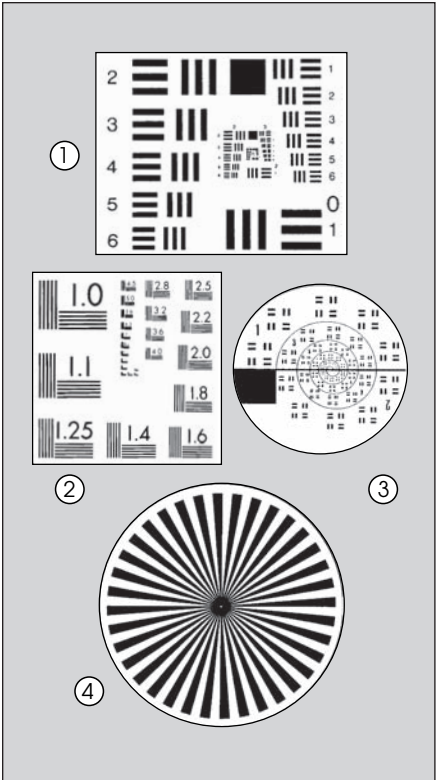
Bar gratings consist of a pattern of equal bars and spaces formed in chromium on a glass substrate, commonly used for moiré, Ronchi and other metrological techniques.

Resolution charts provide a range of spatial frequencies for optical testing, and similarly consist of precision metallic patterns deposited on a transparent glass substrate.

See also:

Scratch-dig standard [p.2](#)

Catalogue No.	Lines/mm	Overall size (mm)	Fig.	Pattern
Bar gratings				
02 RD 50	2	50 x 50	—	} Bar gratings with equal bars and spaces
08 RD 50	8	50 x 50	—	
20 RD 50	20	50 x 50	—	
40 RD 50	40	50 x 50	—	
50 RD 50	50	50 x 50	—	
100 RD 50	100	50 x 50	—	
125 RD 50	125	50 x 50	—	
Resolution charts				
02 RU 50	1-228	50 x 50	1	USAF 1951, groups 0-7
04 RU 75	1-18	75 x 75	2	NBS 1963A (BS 4657)
06 RU 75	1-10	75 x 75	3	Cobb chart (BS 1613)
08 RU 50	0.46-57	50 x 50	4	36-sector star 25mm dia.



9.3 Eyepiece and stage graticules

[Customise](#) 

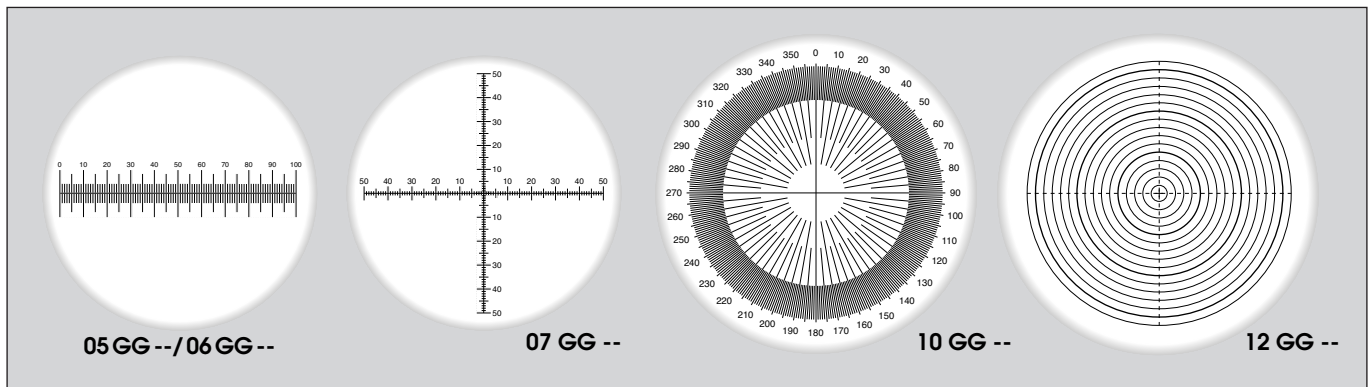
Eyepiece graticules include scales for measuring linear dimensions, circles for estimating diameters and radii, and a protractor for angles. Scales can be calibrated by comparison with a stage graticule, supplied in convenient microscope slide format.

See also:

Eyepieces
Microscope tubes

[p.21](#)
[p.22](#)

Catalogue No. Eyepiece graticules		Catalogue No. Stage graticules 76 x 25mm	Line width (μm)	Pattern
19mm dia.	21mm dia.			
00 GG 19	00 GG 21	–	10	cross lines
02 GG 19	02 GG 21	–	20	cross lines
–	–	11 GG 76	1	scale 1mm in 0.01mm divisions
05 GG 19	05 GG 21	05 GG 76	10	scale 5mm in 0.05mm divisions
06 GG 19	06 GG 21	06 GG 76	10	scale 10mm in 0.1mm divisions
07 GG 19	07 GG 21	–	10	crossed scales 10mm/0.1mm div.
08 GG 19	08 GG 21	–	10	grid 10 x 10mm of 0.1mm squares
10 GG 19	10 GG 21	–	10	protractor 10mm dia.
12 GG 19	12 GG 21	–	5/10	circles 1-16mm dia.

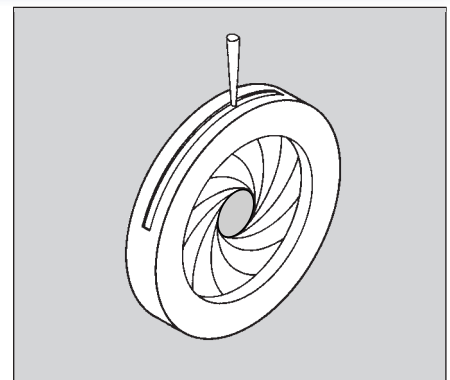


9.4 Iris diaphragms

Iris diaphragms are commonly used in optical systems to control light-throughput or f/number. The diaphragms in our range have blackened brass bodies and blackened steel leaves. The **IZ** fully closing

types have two sets of leaves that overlap on closing thus completely blocking the beam. As the sets of leaves are longitudinally separated, these are best used with well-collimated light.

Catalogue No.	Maximum aperture (mm)	Minimum aperture (mm)	Outside diameter (mm)	Thickness (mm)	Pin length (mm)	Number of leaves
05 IC 10	5	0.7	10	4.5	10	6
08 IC 15	8	0.7	14.8	4.5	10	8
12 IC 20	12	0.8	19.8	5.0	11	10
15 IC 24	15	0.8	24	5.0	10	12
18 IC 28	18	0.8	28	5.0	12	12
20 IC 30	20	0.8	30	5.5	12	12
22 IC 33	22	0.8	33	5.5	12	14
25 IC 37	25	0.8	37	5.5	12	14
28 IC 40	28	1.2	40	5.5	12	16
34 IC 49	34	1.0	49	6.5	12	14
37 IC 53	37	1.2	53	6.0	12	16
42 IC 58	42	1.2	58	6.5	12	18
50 IC 70	50	2	70	7.5	12	16
58 IC 80	58	3	80	8.0	12	18
75 IC 100	75	4	100	9.0	15	20
120 IC 165	120	6	165	15	30	18
225 IC 300	225	12	300	18	30	18
Fully closing iris diaphragms						
12 IZ 21	12	0	21	6	11	10
25 IZ 38	25	0	38	6	13	14
37 IZ 54	37	0	54	7.5	13	16



See also:

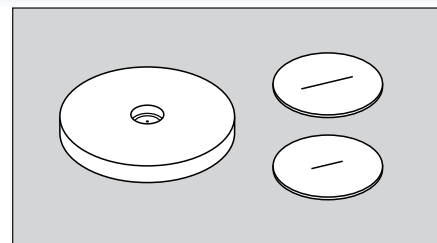
TubeMount iris diaphragms
Iris diaphragms in holders
(post-mounted)

[p.58](#)
[p.84](#)

9.5 Precision apertures

Our precision apertures are prepared in copper foil by an electroforming process, which allows very precise control of size and shape, and thins the substrate around the aperture leaving a sharp well-defined edge.

The foil is blacked one side to reduce reflections. Pinholes are supplied in mounts 16mm dia. 1.5mm thick; slits are unmounted foils 10mm dia.



Pinholes (in 16mm mount)

Catalogue No.	Aperture dia. (μm)	Foil thickness (μm)
025 HP 16	2.5 ± 0.5	9
04 HP 16	4 ± 0.5	8
06 HP 16	6 ± 0.5	7
10 HP 16	10 ± 0.5	8
16 HP 16	16 ± 1	15
25 HP 16	25 ± 1	11
40 HP 16	40 ± 1.5	16
63 HP 16	63 ± 1.5	7
100 HP 16	100 ± 2	14

Slits (unmounted 10mm foils)

Catalogue No.	Width (μm)	Length (mm)	Foil thick. (μm)
05 HS 10	5 ± 0.5	3	16
10 HS 10	10 ± 0.5	3	13
25 HS 10	25 ± 1	5	17
50 HS 10	50 ± 1.5	5	17
100 HS 10	100 ± 2	7.5	22
200 HS 10	200 ± 2.5	7.5	22
500 HS 10	500 ± 3	7.5	22

Specification

Circularity/straightness:*

<25μm	0.5μm
25-63μm	1μm
100μm	1.5μm
>100μm	2μm

Centration:*

To foil edge	20μm
To mount	100μm

*Manufacturer's data

9.6 Standard and high-power apertures

≡Customise

These apertures are laser-drilled in discs 9.53mm dia. and are available unmounted or in two mount sizes.

The **standard** range are in 302 stainless steel 12.5μm thick, except the 1μm and 2μm which are in a 2.5-5μm patch on an 0.1mm backing.

High power apertures are in copper, gold plated on one side, flat poly black (98% emissivity) on the other, and typically

withstand 100-200MW/cm² for a 10ns pulse (700nm). Thickness is 0.15mm, thinned to 25μm around the aperture.

Options available

- Special sizes and mounts
- Black one or both sides
- Closer tolerance or calibration
- Thicker substrate (0.15mm)

Specification

Centration:*

To foil edge	50μm
To mount	150μm

Pinhole roundness:*

1-15μm	0.5μm
20-50μm	1μm
≥75μm	2μm

Slit straightness*

2μm

*Manufacturer's data

Standard series pinholes

Catalogue No. Foil 9.53mm dia.	Catalogue No. Mounted 16mm dia.	Catalogue No. Mounted 25mm dia.	Aperture dia. (μm)
01 HL 10	01 HL 16	01 HL 25	1 +0.5, -0
02 HL 10	02 HL 16	02 HL 25	2 ± 0.5
03 HL 10	03 HL 16	03 HL 25	3 ± 0.5
05 HL 10	05 HL 16	05 HL 25	5 ± 1
10 HL 10	10 HL 16	10 HL 25	10 ± 1
15 HL 10	15 HL 16	15 HL 25	15 ± 1.5
20 HL 10	20 HL 16	20 HL 25	20 ± 2
25 HL 10	25 HL 16	25 HL 25	25 ± 2
35 HL 10	35 HL 16	35 HL 25	35 ± 2
50 HL 10	50 HL 16	50 HL 25	50 ± 3
75 HL 10	75 HL 16	75 HL 25	75 ± 3
100 HL 10	100 HL 16	100 HL 25	100 ± 4
150 HL 10	150 HL 16	150 HL 25	150 ± 6
200 HL 10	200 HL 16	200 HL 25	200 ± 6
300 HL 10	300 HL 16	300 HL 25	300 ± 8
400 HL 10	400 HL 16	400 HL 25	400 ± 10
600 HL 10	600 HL 16	600 HL 25	600 ± 10
800 HL 10	800 HL 16	800 HL 25	800 ± 10
1000 HL 10	1000 HL 16	1000 HL 25	1000 ± 10

Standard series slits

Catalogue No. Foil 9.53mm dia.	Catalogue No. Mounted 16mm dia.	Catalogue No. Mounted 25mm dia.	Slit length (mm)	Slit width (μm)
025 HM 10	025 HM 16	025 HM 25	1	2.5 +1, -0.5
05 HM 10	05 HM 16	05 HM 25	3	5 ± 1
10 HM 10	10 HM 16	10 HM 25	3	10 ± 1
25 HM 10	25 HM 16	25 HM 25	3	25 ± 2
50 HM 10	50 HM 16	50 HM 25	3	50 ± 2
100 HM 10	100 HM 16	100 HM 25	3	100 ± 4

High power pinholes

Catalogue No. Foil 9.53mm dia.	Catalogue No. Mounted 16mm dia.	Catalogue No. Mounted 25mm dia.	Aperture dia. (μm)
05 HG 10	05 HG 16	05 HG 25	5 ± 1
10 HG 10	10 HG 16	10 HG 25	10 ± 1
25 HG 10	25 HG 16	25 HG 25	25 ± 2
50 HG 10	50 HG 16	50 HG 25	50 ± 3
100 HG 10	100 HG 16	100 HG 25	100 ± 4

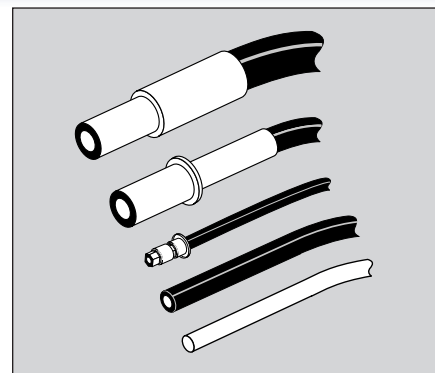
10.1 Optical fibres and light guides

Acrylic fibres are very economical and versatile in use as no special end preparation is required. We list four sizes of bare fibre and also a sheathed type with considerably lower attenuation.

Glass bundle light guides, consisting of 50µm fibre with black plastic sheath, will handle higher powers and are available in larger sizes. The ends are epoxied and polished with brass or nickel-silver ferrules. Adaptors for these are listed below and on [p.58](#). Note, however, that 1mm and 1.5mm bundles are not suitable for direct use with our illuminators or halogen lamphouses, owing to temperature limitations.

Specification

Acceptance angle:	
Acrylic	56°
Glass	66°
Numerical aperture:	
Acrylic	0.47
Glass	0.54



Acrylic fibres

Catalogue No. 5m length	Catalogue No. 20m length	Fibre dia. (mm)	Overall dia. (mm)	Attenuation (dB/m)
Bare fibres				
005 FP 05	005 FP 20	0.5	0.5	0.85
01 FP 05	01 FP 20	1	1	0.5
02 FP 05	02 FP 20	2	2	0.5
03 FP 05	03 FP 20	3	3	0.25
Fibre in PVC sheath				
01 FS 05	01 FS 20	1	2.2	0.15

Glass bundle light guides

Catalogue No. 1m length	Catalogue No. 2.5m length	Bundle dia. (mm)	Ferrule dia. (mm)
01 FB 01	01 FB 025	1	3
015 FB 01	015 FB 025	1.5	3.5
03 FB 01	03 FB 025	3	8
06 FB 01	06 FB 025	6	8

10.2 Fibre optic illuminators and output optics

Customise

Our self-contained semi-enclosed **illuminator module** provides a simple means of filling a light guide with 'cold' light. It is supplied complete with an 8V 50W dichroic reflector lamp ([08 LE 50](#), [p.50](#)) and a lampholder with leads to connect to a suitable supply.

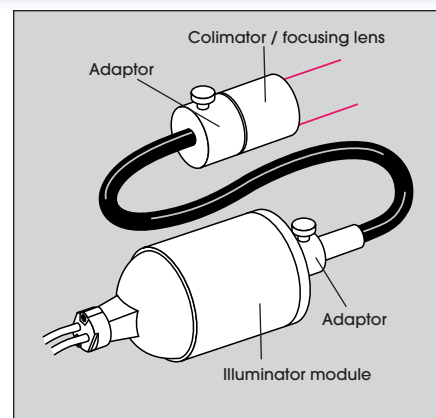
Alternatively our lamphouses ([pp.51, 52](#)) can be used for fibre illumination, with the special fibre condensers listed in [Section 10.7](#).

Light from a fibre can be directed using either a **collimator** or a **focusing lens** at

the output end. Collimators give an approximately parallel beam, while focusing lenses give an image of the fibre end at the given magnification and distance (throw) from the lens.

All items require an **adaptor** from the table to accept the fibre fitting required. Adaptors are listed both for our light guides (Section 10.1) and for SMA connectors.

Note that illuminators cannot be used with our 1mm and 1.5mm glass bundles owing to temperature limitations.



Illuminator and output optics

Catalogue No. Basic body	Catalogue No. Mounted on post	Length x dia.(mm)	Description
Illuminator (fibre input)			
01 FL 00	01 FL --*	73 x 53	self-contained module, 8V 50W
Fibre output optics			
02 FC 00	02 FC --*	25 x 28	collimator, 16mm f.l. 23mm aperture
04 FC 00	04 FC --*	50 x 53	collimator, 39mm f.l. 48mm aperture
10 FC 00	10 FC --*	40 x 28	focusing lens, 1x, 8mm throw
12 FC 00	12 FC --*	40 x 28	focusing lens, 2x, 25mm throw
14 FC 00	14 FC --*	40 x 28	focusing lens, 4x, 58mm throw

Adaptors

Catalogue No. Basic body	Fitting accepted
02 FA 03	Ferrule 3mm dia.
02 FA 035	Ferrule 3.5mm dia.
02 FA 08	Ferrule 8mm dia.
02 FA 50	SMA connector
02 FA 00	Blank for customer modification

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

10.3 Tungsten-halogen lamps

Our **capsule** lamps (without reflectors) have compact straight coil filaments positioned accurately with respect to the base – essential features for optical applications. Note that lamps offered elsewhere, nominally equivalent to these, are not necessarily made with the same accuracy. Some types include UV-blocking material in the bulb. For technical uses where the UV output is needed we offer alternatives without the blocking; these are made in much smaller quantities and so are more expensive.

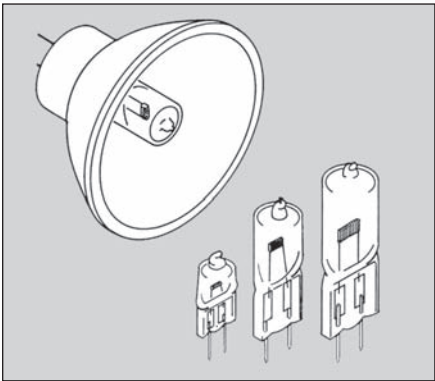
Lamps with integral dichroic reflectors efficiently collect and direct only the visible output of the bulb, reducing system heat load. The **spotlamps** give a narrow beam, whilst the **focusing** lamps form an

intense spot of light at the focal distance stated. Note that the first three focusing lamps listed have smooth reflectors, which give much more accurate and intense illumination than the faceted reflectors used on the other types.

Over- and under-running

Long-life lamps have lower luminance and efficiency than short-life types. The balance can be adjusted by running lamps at higher or lower than the rated voltage. The effect of this should be verified by trials but can be estimated by the following useful rules of thumb.

Life ∝ V⁻¹²
Wattage ∝ V^{1.5}
Output ∝ V^{3.5}



Technical note available

'Design of Illumination Systems'

Capsule lamps (without reflectors)

Catalogue No.	UV blocked?	LIF type	Voltage (V)	Wattage (W)	Output (lm)	Luminance* (cd/mm²)	Life (hr)	Length x dia. (mm)	LCL† (mm)	Filament dimensions (mm)	Base type
Short-life series											
06 LK 10	no	M/29	6	10	200	18	100	31 x 9	19.5	1.7 x Ø0.65	G4
06 LK 20	no	M/30	6	20	475	24	100	30 x 9	19.5	2.0 x Ø1.0	G4
12 LK 20	no	M/35	12	20	420	18	200	30 x 9	19.5	2.9 x Ø0.8	G4
12 LK 50	no	A1/220	12	50	1500	37	50	44 x 11.5	30	3.3 x 1.6 x 0.6	G6.35
12 LK 100	no	A1/215	12	100	3400	45	50	44 x 11.5	30	4.2 x 2.3 x 1.0	GY6.35
15 LK 150	no	A1/234	15	150	5000	46	50	44 x 11.5	30	4.8 x 3.0 x 1.1	G6.35
24 LK 150	no	A1/216	24	150	6000	47	50	50 x 13.5	30	5.8 x 2.9 x 1.0	G6.35
24 LK 250	no	A1/223	24	250	10000	54	50	55 x 13.5	33	7.0 x 3.5 x 1.3	G6.35
Long-life series											
06 LU 10	no	M/42	6	10	150	10	2000	30 x 9	19.5	3.0 x Ø0.5	G4
06 LL 20	yes	M/34	6	20	350	15	2000	30 x 10	19.5	2.6 x Ø0.9	G4
06 LU 20	no	M/34	6	20	350	12	2000	30 x 9	19.5	2.9 x Ø1.0	G4
12 LL 20	yes	M/47	12	20	350	13	2000	30 x 10	19.5	3.3 x Ø0.8	G4
12 LU 20	no	M/47	12	20	350	12	2000	30 x 9	19.5	3.3 x Ø0.9	G4
12 LL 50	yes	M/32	12	50	850	10	3000	44 x 12	30	5.2 x Ø1.6	GY6.35
12 LU 50	no	M/32	12	50	900	11	2000	44 x 11	30	4.2 x 2.5 x 0.8	GY6.35
12 LU 100	no	M/28	12	100	2550	23	2000	44 x 11.5	30	4.8 x 3.0 x 1.1	GY6.35
24 LU 250	no	M/36	24	250	5750	17	2000	58 x 16	37	9.1 x 4.9 x 1.6	GY6.35

*Average over filament area; approximate figure inferred from manufacturer's data
†Light centre length: distance from end of pins to centre of filament

Spotlamps

Catalogue No.	LIF/ ANSI	Voltage (V) type	Wattage (W)	Central intensity (cd)	Full beam angle
35mm diameter, GZ4 base, 2000hr life					
12 LP 12	M/64	12	12	6400	7°
12 LP 20	M/52	12	20	5500	10°
12 LP 35	M/65	12	35	9000	8°
51mm diameter, GX5.3 base, 3000hr life					
12 LP 50	M/49	12	50	12000	10°
12 LP 75	EYF	12	75	11200	14°

Focusing lamps

Catalogue No.	LIF/ ANSI	Voltage (V) type	Wattage (W)	Focal distance (mm)
50mm diameter, GZ6.35 base, 50hr life				
08 LE 50	A1/229	8	50	32
12 LE 100	A1/231	12	100	32
15 LE 150	A1/232	15	150	32
51mm diameter, GX5.3 base, 3000hr life				
12 LE 50	ENL	12	50	40

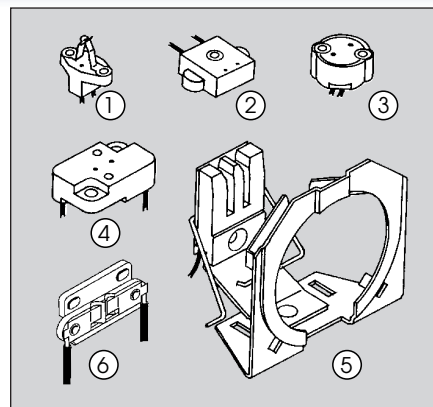
10.4 Lampholders

These ceramic holders are suitable for the lamps on [p.50](#), and others of the listed base types up to the ratings shown. They have leads with high-temperature insulation and offer a range of mounting configurations, including some which allow a condenser lens to be placed very close to the lamp.

Many other varieties are available, please enquire.

Literature available

Detailed drawings and specifications of all items.



Key to features

- A: spring clips act as heat sinks to lamp pinch
- B: allow condenser lens close to lamp
- C: supports lamp and reflector
- D: side mounting

Catalogue No.	Suitable for lamp base types	Dimensions L x W x D (mm)	Rated voltage (V)	Rated current (A)	Fig. No.	Features (see box)
01 LM 01	G4	18 x 9 x 10	24	4	1	A
01 LM 02	G4, GZ4*	26 x 16 x 8	50	10	2	B
01 LM 03	G4, GZ4*	17 x 17 x 10	250	10	3	—
02 LM 03	G6.35, GY6.35, GZ6.35*	17 x 17 x 10	250	12.5	3	—
02 LM 04	G6.35, GY6.35, GZ6.35*	28 x 17 x 9	250	12.5	4	—
02 LM 05	GZ6.35	60 x 57 x 49	250	10	5	C
02 LM 06	G6.35	38 x 7 x 16	24	10	6	BD
02 LM 07	GY6.35	38 x 7 x 16	24	10	6	BD
03 LM 03	G3.9*, G5.3, GX5.3*	17 x 17 x 10	250	12.5	3	—
03 LM 05	GX5.3	60 x 57 x 53	250	10	5	C

* Reflector should be supported separately

10.5 Tungsten-halogen lamphouses

≡Customise

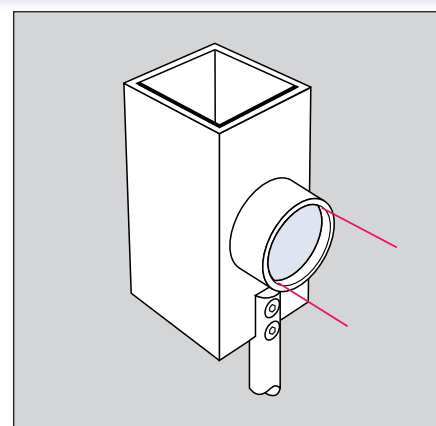
These tungsten-halogen lamphouses, available in two sizes, have efficient aspheric condensers to collimate the output, and optional back reflectors to further improve light collection. Heat is dissipated efficiently by the vertical chimney design and ceramic lampholders with high-temperature flying leads are provided. Lamps should be ordered separately (see [p.50](#)).

The lens tube has a standard TubeMount thread (25mm for small, 50mm for large)

lamphouse) to which condenser lenses ([p.52](#)) to project a filament image can be attached. Any other lens, filter etc. mounted on an ML mount (see [p.3](#) and [p.54](#)) can also be screwed in.

Lamphouses are available as basic bodies or with mounting posts for use on optical tables etc. The ventilation holes at top and bottom must not be obstructed.

Special optics, such as fused silica for UV, can readily be provided.



Catalogue No. Basic	Catalogue No. Post-mounted	Body H x W x D (mm)	Lamp watts (max.)	Lamp base types	Lens dia. (mm)	Lens FL (mm)	Description
10 LH 00	10 LH --*	75 x 45 x 45	20	G4	25	16	small, without mirror
12 LH 00	12 LH --*	75 x 45 x 45	20	G4	25	16	small, with mirror
20 LH 00	20 LH --*	105 x 64 x 64	100	G6.35/GY6.35	50	39	large, without mirror
22 LH 00	22 LH --*	105 x 64 x 64	100	G6.35/GY6.35	50	39	large, with mirror

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm.

10.6 LED lamphouses

Customise

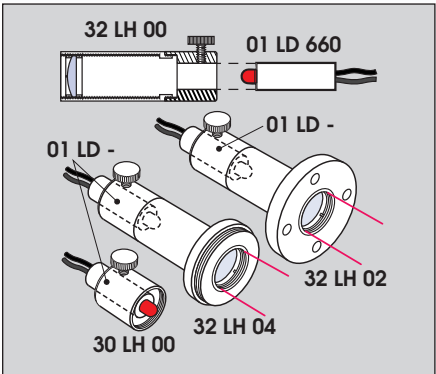
LEDs are now intense enough to be useful for many illumination tasks. A great variety of LED lamphouses can be made up using our interchangeable bodies and lamp inserts listed.

Bodies are listed with or without collimating lenses; these project a well-defined circular patch of light at any distance from 100mm upwards. (For closer focusing add a condenser, see 10.7 below.) All bodies have a 16mm female TubeMount thread (see p.53) for attaching further optics. As well as the very compact basic bodies we list flanged bodies for bolting to a flat surface and a 25mm threaded version for joining to 25mm tubes (see p.55) etc.

The **lamp insert**, carrying the LED, slides in and out of the body for focusing. Inserts come complete with high-intensity LEDs, series resistors and flying leads for connection to a 6V DC supply. We also list empty inserts (without resistor or leads) to take customers' own LEDs.

Illuminated area

This is normally an image of the LED body, which on our standard modules is 5mm dia. The magnification of the image is given by $(v - f)/f$ where v is the projection distance from the lens and f is the lens focal length (31.5mm as standard).



See also:

Clamp ring 250 BR – for mounting of bodies

p.81

Lamphouse bodies (19mm dia.)		
Catalogue No.	Length (mm)	Description
With collimating lens (31.5mm FL)		
32 LH 00	60	Basic body
32 LH 02	60	With flange 35mm dia.*
32 LH 04	60	With 25mm male thread†
Without lens		
30 LH 00	20	Basic body
30 LH 02	20	With flange 35mm dia.*
30 LH 04	20	With 25mm male thread†

Lamp inserts (40mm long, 10mm dia.)					
Catalogue No.	Intensity (typical) (cd)	Wavelength (nm)	LED dia. (mm)	Emission angle 2θ _{1/2}	Colour
Inserts with LEDs (6V, 20mA)					
01 LD 470	2.0	470	5	15	blue
01 LD 525	6.0	525	5	15	green
01 LD 660	2.75	660	5	30	red
01 LD 555	3.0	–	5	20	white
Empty inserts					
01 LD 03	–	–	3	–	–
01 LD 05	–	–	5	–	–

* See p.55 for fixing screws and flange details
† See p.53 for thread details

10

10.7 Lamphouse condenser lenses

Customise

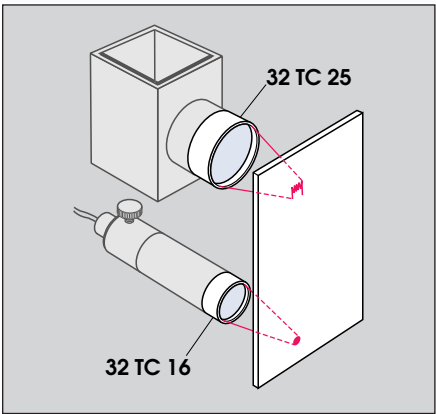
Condensers are listed for both our LED and tungsten-halogen lamphouses, and project an image of the LED or filament at the given distance (throw) from the lens. The size of the illuminated area can be calculated from the magnification shown.

The **fibre** condensers are useful for illuminating various types of light guide; they require an appropriate adaptor from p.49 to complete the assembly.

Options available

Many other focal lengths available at short notice – please enquire

Catalogue No.	Throw (mm)	Mag.	Lens FL (mm)	Lens dia. (mm)	Body length x dia. (mm)	To fit lamphouse type
Basic condensers (for free-space illumination)						
15 TC 16	9	0.5	15	16	10 x 19	30 LH 00* (LED)
32 TC 16	27	1	31.5	16	10 x 19	30 LH 00* (LED)
16 TC 25	9	1	16	25	16 x 28	10/12 LH 00 (p.51)
32 TC 25	25	1.9	31.5	25	10 x 28	10/12 LH 00 (p.51)
39 TC 50	25	1	39	50	25 x 53	20/22 LH 00 (p.51)
80 TC 50	72	2	80	50	16 x 53	20/22 LH 00 (p.51)
Fibre condensers						
01 TC 16	–	0.5	15	16	14.8 x 28	30 LH 00* (LED)
01 TC 25	–	1	16	25	25 x 28	10/12 LH 00 (p.51)
01 TC 50	–	1	39	50	50 x 53	20/22 LH 00 (p.51)



* With any lamp insert – see 10.6 above

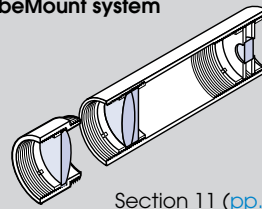
Optomechanics - introduction

There are basically two ways of mounting an optical system – enclosed or open.

Enclosed systems, such as an ordinary microscope, are light- and dust-tight, rigid, robust and compact, but generally very difficult to prototype and to modify. Our **TubeMount system** ([Section 11](#)) overcomes these limitations, being a modular set of stock parts capable of forming a very wide variety of systems, and suitable both for prototypes and production.

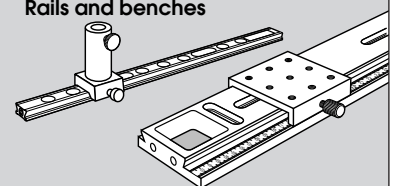
Open mounting, as on a breadboard, where each component is supported individually, is even more flexible and allows better access to optics and to light paths. **Breadboards** are listed in [Section 12](#), along with **bases** for use on these or on other flat surfaces; alongside the traditional post-mounting bases we offer a new direct-mounting system (see [p.61](#)) giving much more compact and rigid assemblies. **Stages and rod systems** ([Section 13](#)) allow precise calibrated motions to be incorporated in any system. **Rails and carriers** ([Section 14](#)) are convenient for aligning components on a common axis, allowing focusing movements without loss of alignment. Finally [Section 15](#) lists **component holders** for use in any open-mounting system.

TubeMount system



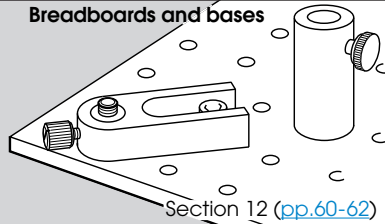
Section 11 ([pp.53-59](#))

Rails and benches



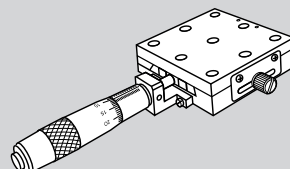
Section 14 ([pp.72-73](#))

Breadboards and bases



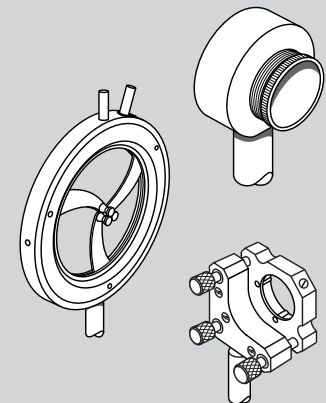
Section 12 ([pp.60-62](#))

Stages and rod system



Section 13 ([pp.63-70](#))

Component holders



Section 15 ([pp.74-84](#))

11.1 The TubeMount system – introduction

Customise

This modular system uses stock parts to accommodate anything from a simple lens to a complex optical system. Not only does it allow prototypes to be built entirely from stock parts, but the same design can be carried forward into production, since it is very compact and robust and fully encloses the optical paths.

Optics are held gently and firmly by threaded retaining rings and can be placed at any point along the tube bores, allowing great flexibility in layout.

Four standard ranges are listed, to suit optics of (up to) 16mm, 25mm, 40mm and 50mm diameter, with adaptors for other sizes and for mounted lenses etc. All items can be connected together, giving an endless variety of possible systems.

Special items are readily available, often at short notice and at little extra cost. For production we can supply assemblies complete with optics in quantity.

Most items are in aluminium alloy with black anodised finish. Adhesives are used in assembly of some items; please check with us before using at high temperatures.

Standard dimensions (mm)

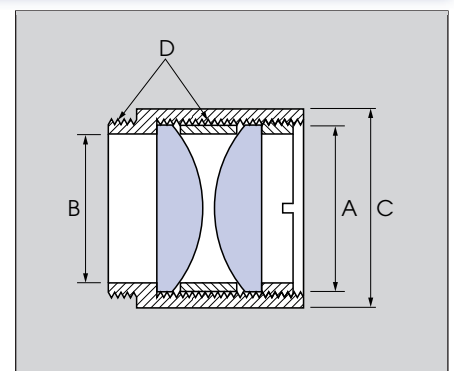
The following dimensions are common to most TubeMount elements – see drawing.

Lens dia. A	16	25	40	50
Clear aper. B	14.25	23.25	38.25	48.25
Outside dia. C	19	28	43	53

Thread D:

Major dia.	16.9	25.9	40.9	50.9
Minor dia.	16.14	25.14	40.14	50.14

Note: The threads are metric form, pitch 0.7mm. Threads and system elements in general are named according to the lens diameter they fit, 16mm, 25mm etc.



Mounts for 1" optics

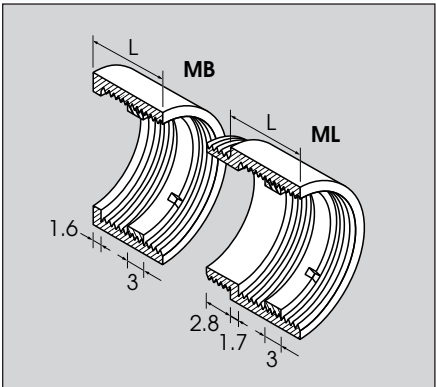
Please enquire

11.2 Lens cells

Customise

Each TubeMount cell is supplied with a slotted retaining ring, which normally holds the lens against the shoulder at the back of the cell. Any circular component up to the maximum thickness listed can be mounted. To vary the lens position, or hold several lenses in one cell, see 11.3 below.

We list two types of cell. The **MB**, the most compact, can be held in a clamp ring (p.74, 81) or any plain bore. The **ML** cells have a threaded spigot which screws into any other TubeMount element of the same size, and are useful as extension tubes or to add to an existing system. Further types for other support methods are listed on pp.55-56.



Catalogue No. Lens dia. 16mm	Catalogue No. Lens dia. 25mm	Catalogue No. Lens dia. 40mm	Catalogue No. Lens dia. 50mm	Body length L (mm)	Max. lens thickness (mm)
Plain-ended cells					
06 MB 16	06 MB 25	06 MB 40	06 MB 50	6.3	1.3
10 MB 16	10 MB 25	10 MB 40	10 MB 50	10	5
16 MB 16	16 MB 25	16 MB 40	16 MB 50	16	11
20 MB 16	20 MB 25	20 MB 40	20 MB 50	20	15
25 MB 16	25 MB 25	25 MB 40	25 MB 50	25	20
40 MB 16	40 MB 25	40 MB 40	40 MB 50	40	35
Spigoted cells					
06 ML 16	06 ML 25	06 ML 40	06 ML 50	6.3	1.3
10 ML 16	10 ML 25	10 ML 40	10 ML 50	10	5
16 ML 16	16 ML 25	16 ML 40	16 ML 50	16	11
20 ML 16	20 ML 25	20 ML 40	20 ML 50	20	15
25 ML 16	25 ML 25	25 ML 40	25 ML 50	25	20
40 ML 16	40 ML 25	40 ML 40	40 ML 50	40	35

Diameter and thread data

See box p.53

See also:

Adaptors for other lens diameters p.56
Lens holders (post-mounting etc.) pp.74-79

Cells for 1" optics

Please enquire

11.3 Spacers and retaining rings

Customise

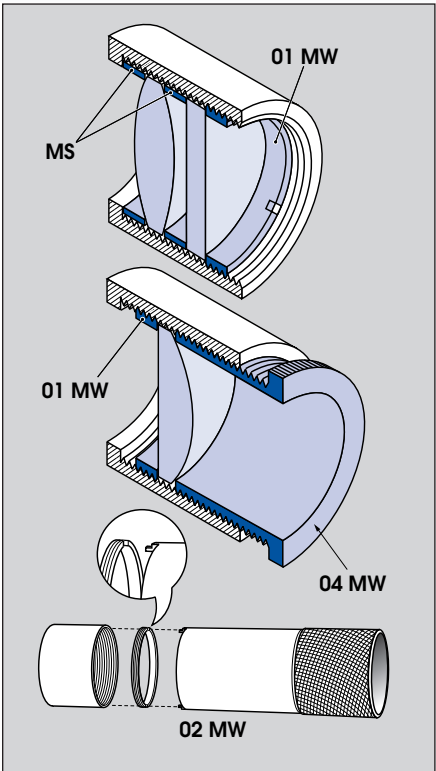
TubeMount spacers are plain unthreaded tubes which can be inserted between components or to pack a component forward from a shoulder. Alternatively, individual lenses etc. can be held between pairs of retaining rings. The standard slotted retaining ring is best tightened with the special tools listed. An alternative type, which can be tightened

by hand without a tool, is also listed; this has a knurled lip protruding from the end of the cell and can be used to clamp components at a depth of up to 13mm.

Clear aperture and thread data

See box p.53

Catalogue No. Lens dia. 16mm	Catalogue No. Lens dia. 25mm	Catalogue No. Lens dia. 40mm	Catalogue No. Lens dia. 50mm	Length (mm)
Spacers				
016 MS 16	016 MS 25	016 MS 40	016 MS 50	1.6
025 MS 16	025 MS 25	025 MS 40	025 MS 50	2.5
04 MS 16	04 MS 25	04 MS 40	04 MS 50	4
06 MS 16	06 MS 25	06 MS 40	06 MS 50	6.3
10 MS 16	10 MS 25	10 MS 40	10 MS 50	10
16 MS 16	16 MS 25	16 MS 40	16 MS 50	16
25 MS 16	25 MS 25	25 MS 40	25 MS 50	25
Slotted retaining rings				
01 MW 16	01 MW 25	01 MW 40	01 MW 50	3
Hand-tightened retaining ring				
04 MW 16	04 MW 25	04 MW 40	04 MW 50	16
Driving tools for slotted rings				
02 MW 16	02 MW 25	02 MW 40	02 MW 50	60



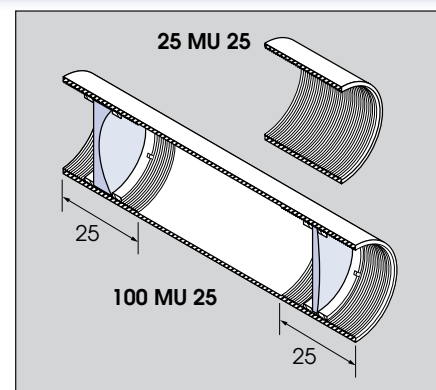
11.4 Tubes

≡Customise 

These are similar to the lens cells above but have no fixed shoulder, allowing components to be inserted from either end and mounted at any point along the length. Tubes of 63mm length or more are threaded only for a depth of 25mm from each end. Components can still be mounted in the plain centre portion if

they are held between spacers (p.54) by a retaining ring in the thread at each end. Normally, however, components are mounted at each end separately, for instance for telescopes or beam expanders.

Retaining rings are **not** included; order from p.54 as required.



Diameter and thread data

See box p.53

See also:

Microscope tubes

p.22

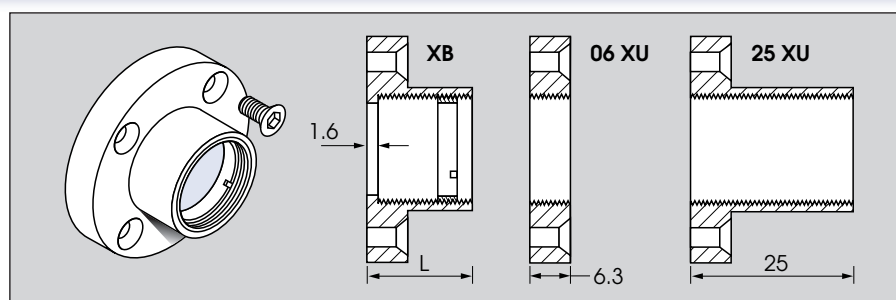
Catalogue No. Lens dia. 16mm	Catalogue No. Lens dia. 25mm	Catalogue No. Lens dia. 40mm	Catalogue No. Lens dia. 50mm	Length (mm)
06 MU 16	06 MU 25	06 MU 40	06 MU 50	6.3
10 MU 16	10 MU 25	10 MU 40	10 MU 50	10
16 MU 16	16 MU 25	16 MU 40	16 MU 50	16
20 MU 16	20 MU 25	20 MU 40	20 MU 50	20
25 MU 16	25 MU 25	25 MU 40	25 MU 50	25
40 MU 16	40 MU 25	40 MU 40	40 MU 50	40
–	50 MU 25	–	50 MU 50	50
–	63 MU 25	63 MU 40	63 MU 50	63
–	80 MU 25	–	–	80
–	100 MU 25	100 MU 40	100 MU 50	100
–	125 MU 25	–	–	125
–	160 MU 25	160 MU 40	160 MU 50	160

11.5 Flanged cells and tubes

≡Customise 

TubeMount flanged cells and tubes allow optics to be attached to any flat surface, using 4 M3 countersunk screws. For an alternative method see Section 11.6.

The XB series are like MB cells (p.54) with an internal shoulder and retaining ring. XU flanged tubes have no shoulder and are supplied without rings; see MU tubes in section above for details. The 06 XU series can be used to add a flange to any other mount with male thread.



Catalogue No. Lens dia. 16mm	Catalogue No. Lens dia. 25mm	Catalogue No. Lens dia. 40mm	Catalogue No. Lens dia. 50mm	Body length (mm)	Max. lens thickness (mm)
XB flanged cells					
06 XB 16	06 XB 25	06 XB 40	06 XB 50	6.3	1.3
10 XB 16	10 XB 25	10 XB 40	10 XB 50	10	5
16 XB 16	16 XB 25	16 XB 40	16 XB 50	16	11
20 XB 16	20 XB 25	20 XB 40	20 XB 50	20	15
25 XB 16	25 XB 25	25 XB 40	25 XB 50	25	20
XU flanged tubes					
06 XU 16	06 XU 25	06 XU 40	06 XU 50	6.3	–
10 XU 16	10 XU 25	10 XU 40	10 XU 50	10	–
16 XU 16	16 XU 25	16 XU 40	16 XU 50	16	–
20 XU 16	20 XU 25	20 XU 40	20 XU 50	20	–
25 XU 16	25 XU 25	25 XU 40	25 XU 50	25	–
40 XU 16	40 XU 25	40 XU 40	40 XU 50	40	–
–	50 XU 25	–	50 XU 50	50	–
–	63 XU 25	63 XU 40	63 XU 50	63	–
–	80 XU 25	–	–	80	–
–	100 XU 25	100 XU 40	100 XU 50	100	–
–	125 XU 25	–	–	125	–
–	160 XU 25	160 XU 40	160 XU 50	160	–

Fixing screws

10 MW 100 M3 x 12mm countersunk in A2 stainless steel, box of 100

Flange dimensions (mm)

Lens dia.	16	25	40	50
Flange dia.	35	43	59	69
Hole p.c.d.	27	36	51	61
Thickness	6.3	6.3	6.3	6.3

For other diameters and thread data see p.53.

11.6 Panel-mounting cells

Customise

These cells are mounted by putting the male-threaded end through a clearance hole in a panel, which is gripped by the knurled ring provided. The hole diameter should be 1mm greater than the lens diameter, and the panel may be up to 5mm thick. Longer spigots to clamp thicker panels are available if required.

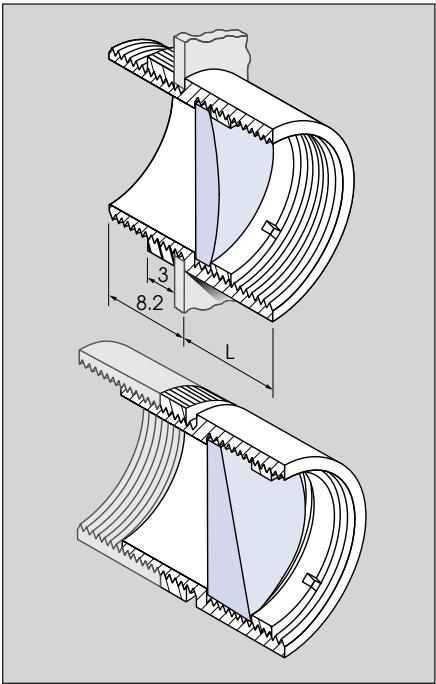
Alternatively the cell can be screwed into another TubeMount element, using the knurled ring as a locknut. This allows polarisers or wedges, for instance, to be

joined to a system whilst maintaining a specific angular alignment. It also allows an axial adjustment range of about 2.5mm. Freely-rotating cells and cells with longer focusing motions are both listed on [p.57](#).

Diameter and thread data

See box [p.53](#)

Catalogue No. Lens dia. 16mm	Catalogue No. Lens dia. 25mm	Catalogue No. Lens dia. 40mm	Catalogue No. Lens dia. 50mm	Body length L (mm)	Max. lens thickness (mm)
06 XE 16	06 XE 25	06 XE 40	06 XE 50	6.3	1.3
10 XE 16	10 XE 25	10 XE 40	10 XE 50	10	5
16 XE 16	16 XE 25	16 XE 40	16 XE 50	16	11
20 XE 16	20 XE 25	20 XE 40	20 XE 50	20	15
25 XE 16	25 XE 25	25 XE 40	25 XE 50	25	20
40 XE 16	40 XE 25	40 XE 40	40 XE 50	40	35
Spare knurled rings					
03 MW 16	03 MW 25	03 MW 40	03 MW 50	3	—



11.7 Lens-size adaptors

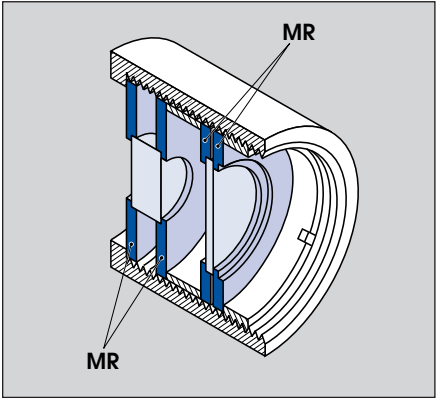
Customise

These simple stepped rings allow TubeMount elements to be used for components smaller than the nominal bore. This greatly extends the range of items that can be mounted, and is also very useful for systems including optics of different sizes, for which it is usually best to select a cell or tube appropriate to the largest size and use these adaptors for the smaller sizes.

They are usually used in pairs to clamp the item. For items between 0.5mm and 1mm thick one ring can be reversed, see diagram.

Components less than 0.5mm thick can be mounted in a single ring with adhesive (e.g. [02 QL 50](#), [p.85](#)).

They are also suitable as stops, e.g. to help eliminate stray light or reduce the aperture of a lens.



Adaptors for 16mm and 25mm lens mounts

Catalogue No. 16mm o.d.	Catalogue No. 25mm o.d.	Lens dia. (mm)	Clear aperture (mm)
025 MR 16	025 MR 25	2.5	2
03 MR 16	03 MR 25	3.15	2.5
04 MR 16	04 MR 25	4	3.3
05 MR 16	05 MR 25	5	4.3
06 MR 16	06 MR 25	6.3	5.3
08 MR 16	08 MR 25	8	6.4
10 MR 16	10 MR 25	10	8.8
12 MR 16	12 MR 25	12.5/12.7	11.0
15 MR 16	15 MR 25	15	13.5
—	16 MR 25	16	14.4
—	18 MR 25	18	16.5
—	19 MR 25	19	17.5
—	20 MR 25	20	18.3
—	22 MR 25	22.4	21

Adaptors for 40mm and 50mm lens mounts

Catalogue No. 40mm o.d.	Catalogue No. 50mm o.d.	Lens dia. (mm)	Clear aperture (mm)
04 MR 40	04 MR 50	4	3.3
06 MR 40	06 MR 50	6.3	5.3
10 MR 40	10 MR 50	10	8.8
16 MR 40	16 MR 50	16	14.4
25 MR 40	25 MR 50	25	23.5
26 MR 40	—	25.4	24
30 MR 40	—	30	28.5
32 MR 40	32 MR 50	31.5	30
38 MR 40	—	38.1	36.5
—	40 MR 50	40	38.5

11.8 Connectors and thread-size adaptors

≡Customise 

Connectors are used to join two tubes (etc.) of the same size. The **04 MA** connectors with rotational adjustment have an additional lock ring allowing one tube to be locked at any desired angular position relative to the other.

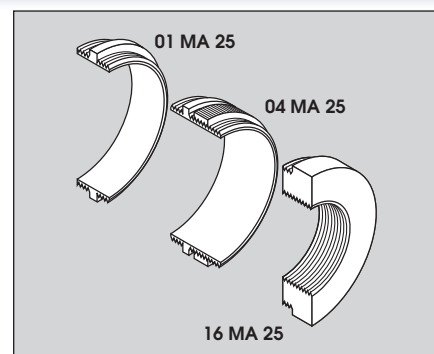
Thread-size adaptors connect TubeMount elements of different diameters. Note, however, that often the easiest way to construct systems of lenses of different size is to use a single tube of the largest size, with lens-size adaptors ([p.56](#)) for the smaller lenses.

Connectors

Catalogue No. Fixed	Catalogue No. With rotational adjustment	Lens dia. (mm)
01 MA 16	04 MA 16	16
01 MA 25	04 MA 25	25
01 MA 40	04 MA 40	40
01 MA 50	04 MA 50	50

Thread-size adaptors

Catalogue No.	Fits female thread size (mm)	Fits male thread size (mm)
16 MA 25	25	16
25 MA 40	40	25
25 MA 50	50	25
40 MA 50	50	40



See also:

Adaptors for non-Comar threads

[p.58](#)

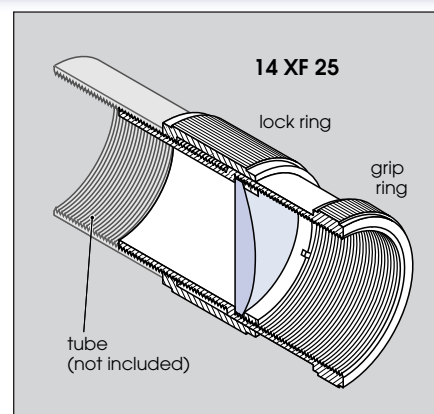
11.9 Focusing lens cells

≡Customise 

TubeMount focusing cells have a long threaded spigot which can be screwed to a variable depth into the end of any tube (not included – see [p.55](#)), thus focusing the lens in the cell over a range of 16mm. A knurled grip is provided and

the thread is concealed by a cover. The locking type has an extra knurled ring which acts as a locknut, allowing the focus to be fixed.

Catalogue No. Lens dia. 25mm	Catalogue No. Lens dia. 40mm	Focusing movement (mm)	Min. projection from tube end (mm)	Max. lens thickness (mm)	Type
02 XF 25	02 XF 40	16	13	5	non-locking
03 XF 25	03 XF 40	16	19	11	non-locking
04 XF 25	04 XF 40	16	28	20	non-locking
14 XF 25	14 XF 40	16	28.5	20	locking



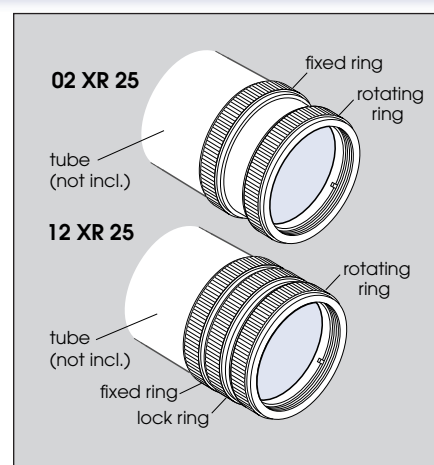
11.10 Rotating cells and connectors

≡Customise 

These elements attach to the end of a tube (etc.) and allow free rotation without axial motion. The **cells** hold optics (e.g. polarisers) directly; the **connectors** accept other male-threaded TubeMount elements such as **ML** cells ([p.54](#)) or adaptors ([p.58](#)).

Locking types allow the rotation to be locked at any desired position.

Catalogue No. Lens dia. 25mm	Catalogue No. Lens dia. 40mm	Body length (mm)	Max. lens thickness (mm)	Type
Cells				
02 XR 25	02 XR 40	17	5	non-locking
03 XR 25	03 XR 40	23	11	non-locking
04 XR 25	04 XR 40	32	16	non-locking
12 XR 25	12 XR 40	20	5	locking
13 XR 25	13 XR 40	26	11	locking
14 XR 25	14 XR 40	35	16	locking
Connectors				
00 XR 25	00 XR 40	13	–	non-locking
10 XR 25	10 XR 40	20	–	locking

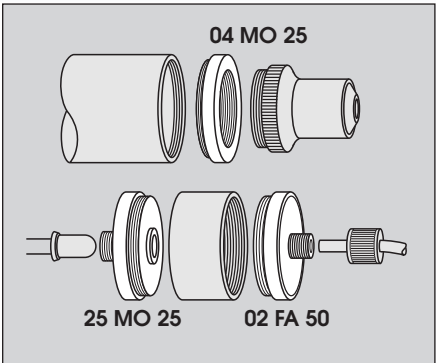


11.11 Microscope, C-mount, LED and other adaptors

Customise

These adaptors generally have 25mm TubeMount male threads and allow objectives, cameras etc. to be attached to the end of a 25mm tube (p.55) or similar. The **05 MO 16**, however, has a 16mm female thread and allows any lens in an **ML 16** mount (p.54) to be fitted to a microscope as a special objective.

Catalogue No.	Body length (mm)	TubeMount thread size accepted	Fitting accepted
Adaptors to fit mounted lenses			
02 MO 25	30.0	25mm female	Telescope/instrument eyepiece 24.5mm dia.
03 MO 25	31.2	25mm female	Microscope eyepiece 23.2mm dia.
04 MO 25	3.8	25mm female	Microscope objective (0.800-36BSMO male)
10 MO 25	6.0	25mm female	C-mount or CS-mount lens (1"-32UNS male)
Adaptors to fit microscope or camera bodies			
05 MO 16	5.0	16mm male	Microscope nosepiece (0.800-36BSMO female)
11 MO 25	1.3	25mm female	C-mount or CS-mount camera (1"-32UNS female thread)
Other adaptors			
23 MO 25	6.0	25mm female	3mm (T-1) LED
25 MO 25	6.0	25mm female	5mm (T-1½) LED
30 MO 25	13.6	25mm female	Diode laser module 15mm dia.
02 FA 03	13.6	25mm female	Light guide ferrule 3mm dia.
02 FA 035	13.6	25mm female	Light guide ferrule 3.5mm dia.
02 FA 08	13.6	25mm female	Light guide ferrule 8mm dia.
02 FA 50	11.0	25mm female	Fibre SMA connector
02 FA 00	13.6	25mm female	Blank adaptor for customer modification



See also:

- Adaptors between TubeMount threads [p.57](#)
- Microscope tubes [p.22](#)
- Objectives [p.20](#)
- Eyepieces [p.21](#)
- LED lamphouses [p.52](#)
- Fibre optics [p.49](#)

11.12 TubeMount iris diaphragms

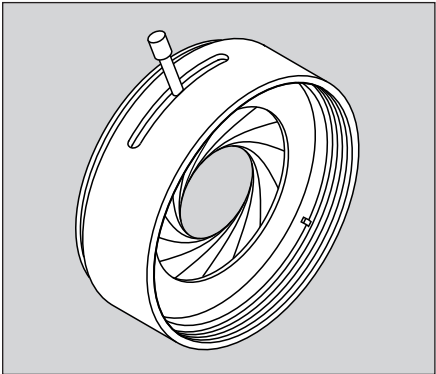
Customise

These iris diaphragms are offered ready-mounted in lens cells with standard male and female threads at the two ends to join to any other TubeMount element.

See also:

- Fixed stops (lens-size adaptors) [p.56](#)
- Unmounted iris diaphragms [p.47](#)
- Iris in holders [p.84](#)

Catalogue No.	Maximum aperture (mm)	Minimum aperture (mm)	Thread size (lens dia.) (mm)	Body length (mm)
20 TM 16	8	0.7	16	16
20 TM 25	15	0.8	25	16
20 TM 40	28	1.2	40	16
20 TM 50	34	1.0	50	16



11.13 Blank end plugs

Customise

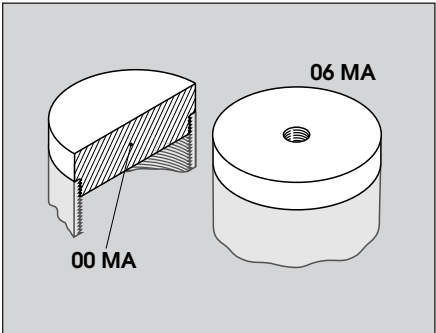
These solid black anodised plugs, 6.3mm thick, screw into TubeMount elements to close off the end. They can easily be modified to hold components such as small lamps and detectors.

They are particularly useful for closing off spare ports on our cross connectors (p.59). Plugs with M6 threaded holes accept standard mounting posts (p.74) for support where needed.

See also:

- Light trap plug [p.59](#)

Catalogue No. Undrilled	Catalogue No. With M6 hole	Mount size (lens dia.) (mm)
00 MA 16	06 MA 16	16
00 MA 25	06 MA 25	25
00 MA 40	06 MA 40	40
00 MA 50	06 MA 50	50



11.14 Cube connectors

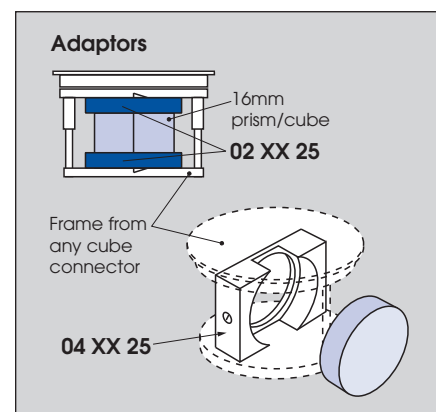
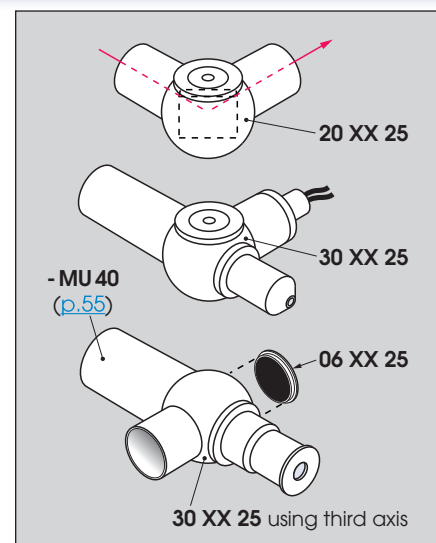
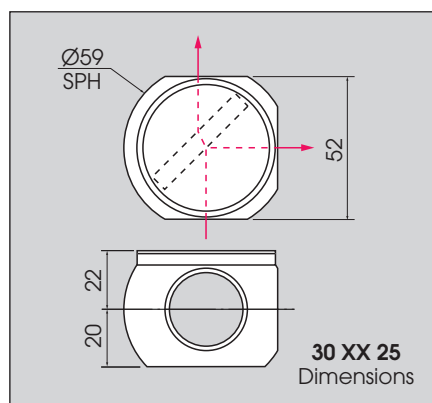
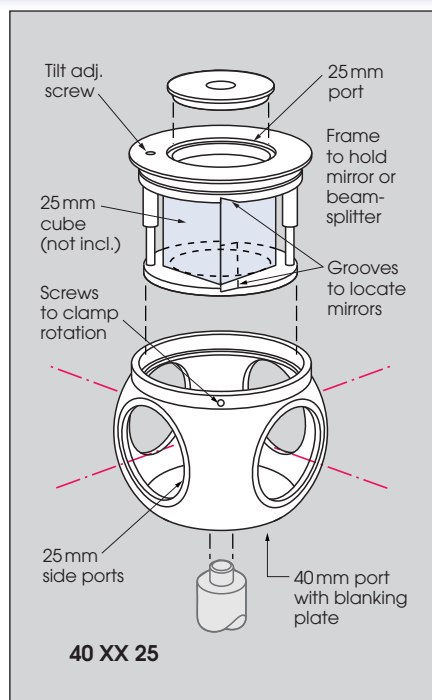
Customise

These connectors are used to construct TubeMount assemblies with intersecting axes. Each is supplied with a frame which clamps either a 25mm prism or cube beamsplitter, or a 40x25mm mirror or plate beamsplitter, with rotation and tilt adjustments. Adaptors are listed for 16mm cubes/prisms and for 25mm dia. optics.

The side ports around the circumference (2, 3 or 4 according to model) have 25mm TubeMount threads and accept, for instance, **ML 25** mounts ([p.54](#)); to attach tubes ([p.55](#)) use the connectors listed on [p.57](#).

All cube connectors also have a 40mm threaded port in the base and a 25mm port in the cap, forming a third axis, which is particularly useful for systems using 40mm tubes. Blanking plates to fill these two ports are included; these have M6 threaded holes for direct mounting ([p.62](#)) or post-mounting ([p.74](#)). Other ports may be closed with standard plugs ([p.58](#)) or with the light trap plug listed here, which has an AR-coated black glass face which practically eliminates spurious reflections in beamsplitter illumination systems etc.

These connectors are also useful in single-axis systems to hold bulky prisms etc. or optics needing rotation or tilt adjustments.



For optics to fit see:

Beamsplitter cubes
Cube polarisers
Right angle prisms

[p.27](#)
[p.42](#)
[p.29](#)

Catalogue No. Description

Cube connectors

- 20 XX 25** Elbow (two ports at 90°)
- 30 XX 25** Tee (three side ports)
- 40 XX 25** Cross (four side ports)

Accessories

- 02 XX 25** Pair of adaptors for 16mm cube/prism
- 04 XX 25** Adaptor for 25mm dia. mirror etc.
- 06 XX 25** Light trap plug

11.15 Clevis mounts

Customise

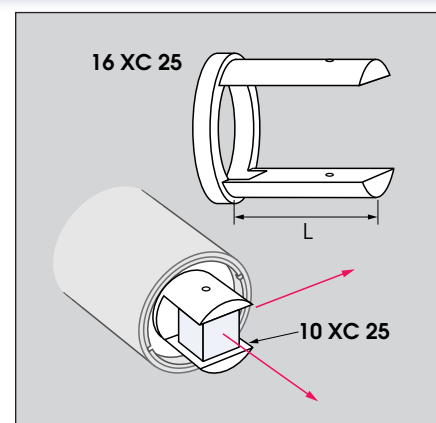
These mounts are particularly useful for holding prisms or other flat-sided components in TubeMount assemblies or in lens holders ([pp.75-79](#)). If necessary, the prism can overhang the end of the tube or holder to avoid blocking a reflected beam.

See also:

Adhesive

[p.85](#)

Catalogue No.	Gap width (mm)	Length L (mm)	Flange dia. (mm)
10 XC 25	10.3	16	25
12 XC 25	12.8	20	25
16 XC 25	16.3	25	25
25 XC 50	25.3	30	50

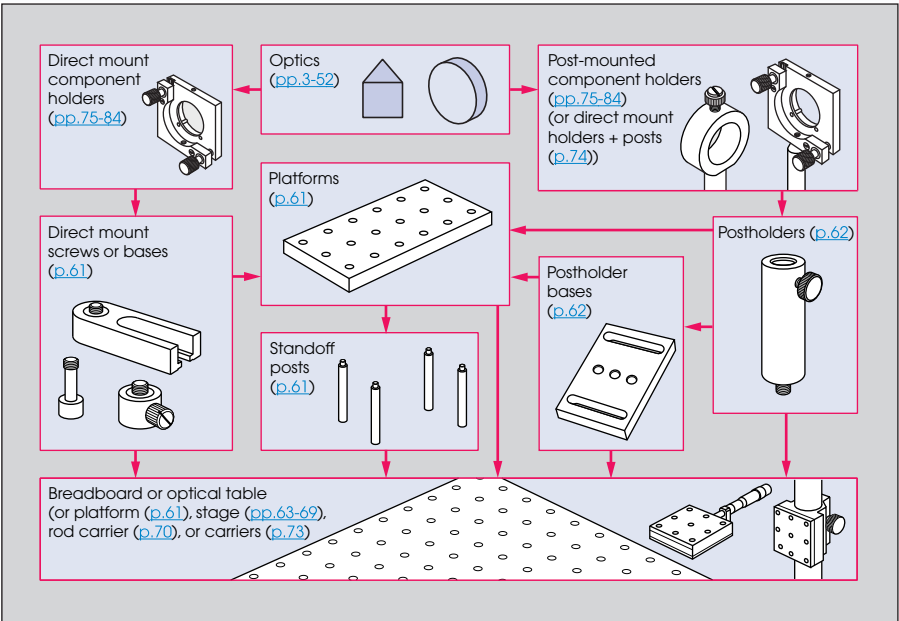


12.1 Breadboards and bases – Introduction

Breadboards provide a solid foundation for construction of an optical system. We offer two basic methods of mounting optics on breadboards, optical tables etc.

Postholders and bases (p.62) used with post-mounted holders allow great flexibility of layout and are useful for experimental work.

Direct-mounting screws and bases (p.61) give a much more stable and compact system, suitable for production as well as prototyping. Component holders are screwed either directly to the breadboard, or to a base on the breadboard. This is feasible because of our standardised axis heights – see box and diagram on p.74.

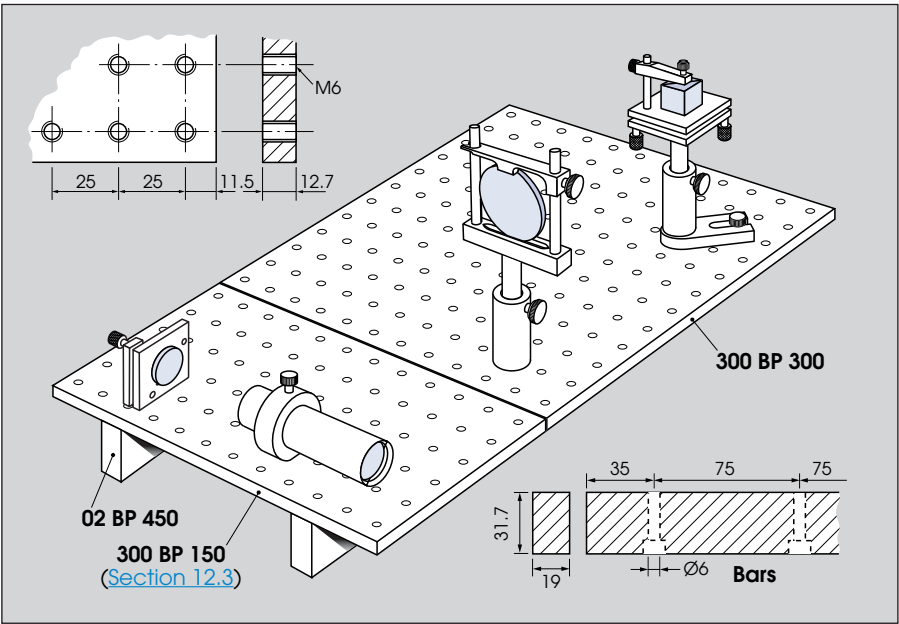


12.2 Breadboards ≡Customise

These solid aluminium plates have fine machined surfaces with satin black anodised finish and the standard 25mm grid of M6 through holes.

We also offer a novel system of subframe bars. These not only allow boards to be joined together to make a great variety of sizes and shapes, but also increase the rigidity of the boards. The system is very versatile, since the bars can be fixed using any of the M6 holes in the boards. Holes so used can still be used to fix bases on the top surfaces. Boards joined edge-to-edge provide a continuous 25mm grid of M6 holes.

Bars are supplied complete with fixing screws and levelling feet; for boards used without bars a set of feet should be ordered separately.



Breadboard specifications	
Material	Cast tooling plate
Finish	Machined and black anodised
Mass	33kg/m²
Length, width	±0.3mm
Thickness	±0.15mm

See also:

Smaller boards (platforms)	p.61
----------------------------	----------------------

Breadboards	
Catalogue No.	Dimensions (mm)
300 BP 300	298 x 298 x 12.7
600 BP 150	598 x 148 x 12.7
600 BP 300	598 x 298 x 12.7
600 BP 600	598 x 598 x 12.7
900 BP 600	898 x 598 x 12.7
Set of levelling feet (4)	
02 BP 00	–

Subframe bars	
Catalogue No.	Dimensions (mm)
02 BP 225	220 x 31.7 x 19
02 BP 450	445 x 31.7 x 19
02 BP 900	895 x 31.7 x 19
02 BP 1200	1195 x 31.7 x 19
Spare bar fixing screws (pack of 10)	
30 XW 06	M6 x 30

12.3 Platforms

Customise 

These small baseplates are particularly useful with direct-mounted components (see 12.4 below) to construct optical subassemblies in a compact form. They can be stood off above a breadboard, optical table etc. using the posts listed. Alternatively the captive screws **16 XW 16** (Section 12.4) can be used to mount them vertically on brackets **02 XT 65** (p.65) or **40 RM 00** (p.70), or direct to stages, optical tables, rods, rod carriers etc. They can also be joined to one another or to breadboards, using subframe bars (p.60).

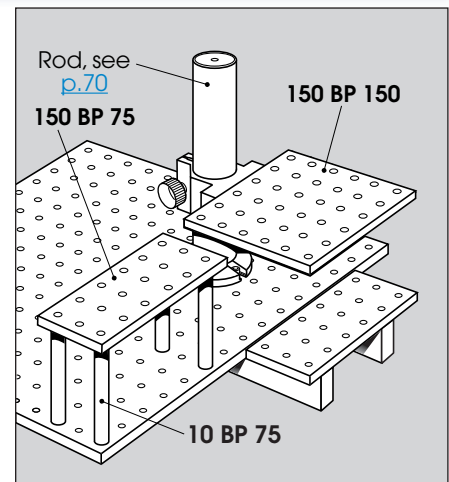
They are machined from aluminium with a black finish and have the standard 25mm grid of M6 holes. Standoff posts are stainless steel, 12.7mm dia. and supplied complete with a fixing screw.

Platforms

Catalogue No.	Dimensions (mm)
150 BP 75	148 x 73 x 12.7
150 BP 150	148 x 148 x 12.7
300 BP 75	298 x 73 x 12.7
300 BP 150	298 x 148 x 12.7

Standoff posts

Catalogue No.	Length (mm)
10 BP 50	50
10 BP 75	75
10 BP 100	100
10 BP 150	150



12.4 Direct-mounting screws and bases

Customise 

Direct mounting of component holders to breadboards or tables gives very compact and rigid assemblies, and is especially useful for our stock-size lens holders (pp.75-77) and other items with standardised axis heights, allowing different items to be mounted coaxially. For standard axis heights, and packers to make up differences, see p.74.

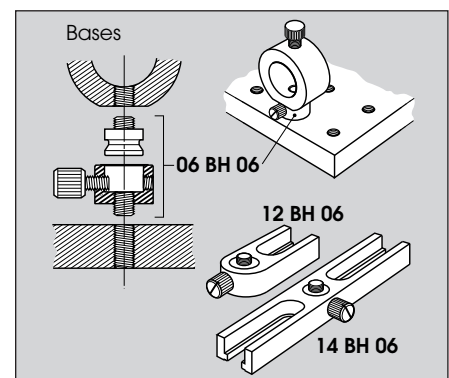
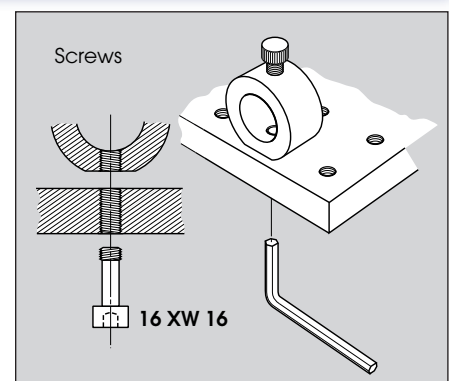
The simplest method of direct mounting is to use the special **screws** listed, which are inserted from the underside of a breadboard or platform. Part of the screw shank is unthreaded, allowing it to turn freely once inserted.

Direct-mounting **bases** are more versatile and convenient, not requiring access to the underside of the baseboard, and can be used on optical tables, stages, rod carriers etc. as well as breadboards. They

are in two parts, having a removable insert which screws into the component holder. The insert rotates freely in the lower part until clamped by a thumbscrew, which also holds the component positively down in position. Components can therefore be quickly removed and replaced in the same position.

The simple circular bases hold a component directly over a hole in the breadboard etc.; the slotted bases allow freedom of positioning, and are narrow enough to be placed in adjacent holes (25mm centres) if required.

The bases listed accommodate the common American Unified threads as well as the metric threads used in our own equipment.



Fixing screws for slotted bases

08 XW 06 M6 x 8mm (pack of 10)

Catalogue No. to fit component holder thread				To fit breadboard thread	Dimensions (mm)	Height added (mm)	Description
M4	M6	8-32	¼"-20				
Direct-mounting screws (sold singly)							
16 XW 14	16 XW 16	—	—	M6*	16 long	0	For breadboards 12.7mm thick
Direct-mounting bases							
04 BH 04	04 BH 06	04 BH 05	04 BH 07	M4	Ø16	10	Circular base to hold component directly over hole
06 BH 04	06 BH 06	06 BH 05	06 BH 07	M6	Ø16	10	
07 BH 04	07 BH 06	07 BH 05	07 BH 07	¼"-20	Ø16	10	
12 BH 04	12 BH 06	12 BH 05	12 BH 07	M6/¼"-20†	39 x 17.5	10	With single clamping slot
14 BH 04	14 BH 06	14 BH 05	14 BH 07	M6/¼"-20†	88 x 17.5	10	With 2 clamping slots

*16 XW 14 also fits boards with 1/4"-20 base threads † To use on boards with M4 threads add adaptor **01 RC 04** (p.72)

12.5 Postholders, bases and clamp arms

Customise

Postholders are stocked to fit all four commonly-used post diameters and in three fixed heights. We also list adjustable holders with a screw mechanism allowing fine adjustment of height over a range of 25mm, without rotation of the component mounted.

Postholders have M6 male threads to screw directly into breadboards, optical tables, stages, etc. For greater freedom of positioning, they can also be fitted to the slotted bases listed here, which bolt down to breadboards etc. using the screws **14 XW 06**.

Postholders		
Catalogue No.	Height (mm)	Diameter (mm)
Fixed height		
45 BH --*	45	22
75 BH --*	75	22
105 BH --*	105	22
Variable height		
01 BH --*	57.5-82.5	27

Clamp arms		
Catalogue No.	Clamp Capacity Min (mm) Max (mm)	
22 BH 00	0 ~7.5	
24 BH 00	3 ~13	
26 BH 00	0 ~13	

The basic type **12 BH 00**, whilst very compact, has a single slot allowing any arbitrary post position to be reached from a standard 25mm grid; the double-slotted types give greater stability of fixing.

Slots in bases are designed to accommodate 1/4"-20 screws and 1" hole spacings, as well as the metric equivalents.

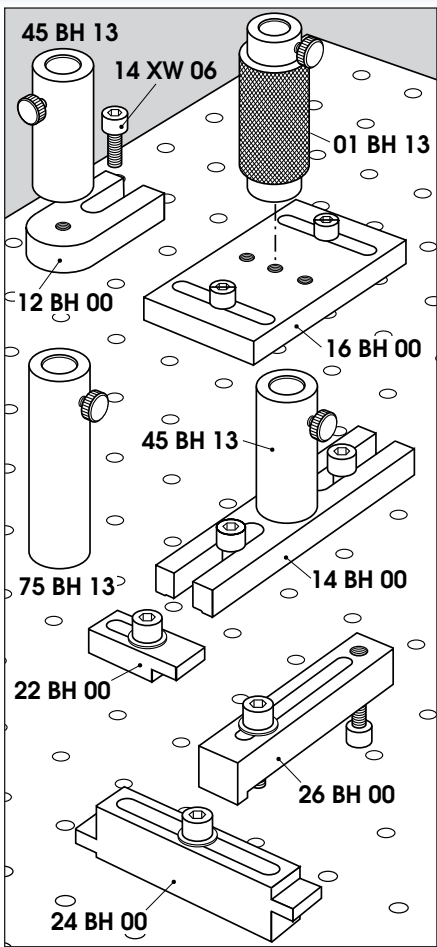
Clamp arms are very useful and versatile for general clamping of equipment onto optical tables, breadboards and platforms. Slotted clamping holes allow very accurate positioning of clamps.

See also:

Breadboards
Platforms
Fixing screw kit
Posts

[p.60](#)
[p.61](#)
[p.63](#)
[p.74](#)

Catalogue No.	Dimensions (mm)
12 BH 00	42 x 23 x 10
14 BH 00	90 x 23 x 10
16 BH 00	75 x 50 x 10
Screws for bolting down (pack of 10)	
14 XW 06	M6 x 14



*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

12.6 Magnetic bases

These bases allow complete freedom of positioning on a table. For steel tables magnetic bases are particularly convenient.

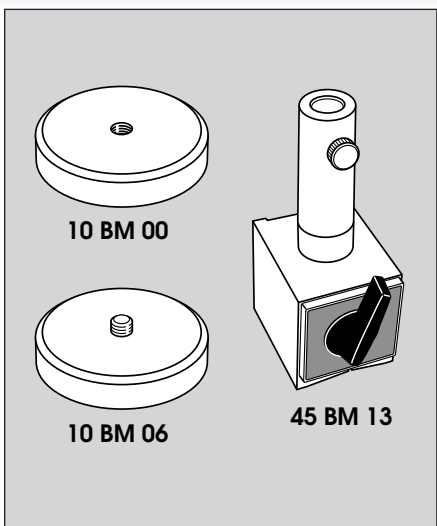
Our unswitched magnetic base is a very compact and inexpensive type, and is listed either in a direct-mount form with

M6 male thread to fit component holders directly, or with M6 female thread to accept the postholders in Section 12.5.

Switchable bases have a much greater holding-down force (780N) and are supplied complete with postholders (fixed or variable height).

Unswitched magnetic bases	
Catalogue No.	Dimensions (mm)
10 BM 00	Base 50 x 10 with M6 fem. thread to accept postholders
10 BM 06	Base as above with M6 male thread for direct mounting

Switchable magnetic bases		
Catalogue No.	Column height (mm)	Overall height (mm)
Fixed height		
45 BM --*	45	100
75 BM --*	75	130
105 BM --*	105	160
Variable height		
01 BM --*	62.5-87.5	117.5-142.5



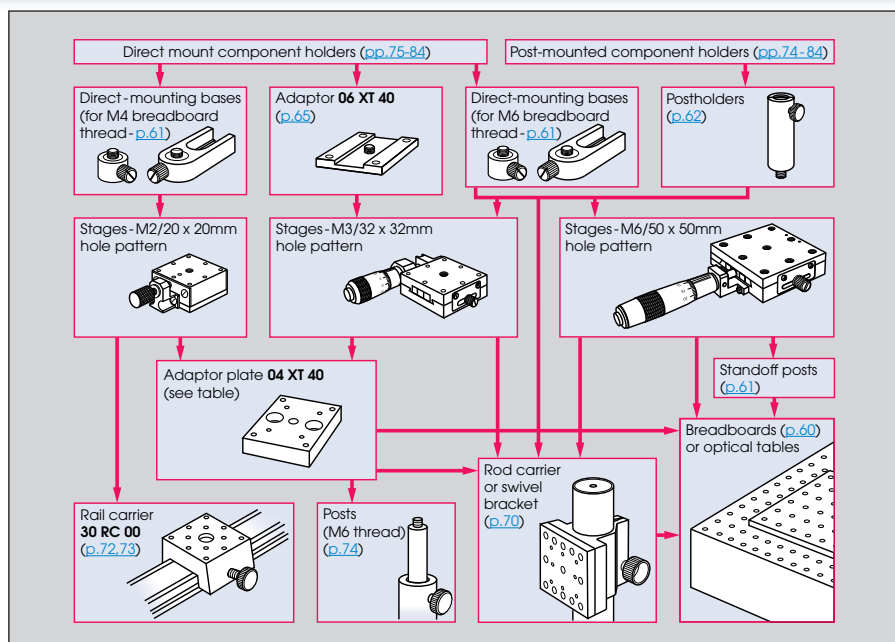
*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

13.1 Stages and rod system – introduction

Stages provide precise linear or angular movements and can be built into most optical systems using the fixing holes provided – see diagram.

Most stages have one of three standard patterns of tapped holes in the top plate (M6/50 x 50mm, M3/32 x 32mm, M2/20 x 20mm) and corresponding clearance holes in the base, allowing them to be stacked. Fixing screws are supplied with each stage; a complete assorted kit is listed below. Stages with M6/50 x 50mm holes bolt directly to breadboards etc.; for the other hole patterns use the adaptor **04 XT 40**. This adaptor also accepts a post (p.74) allowing stages to be post-mounted.

Catalogue No.	Dimensions (mm)
Fixing screw kit (300 total)	
02 XW 00	M2, M3, M4, M6
Adaptor plate	
04 XT 40	40 x 40 x 10



13.2 Translation stages (dovetail)

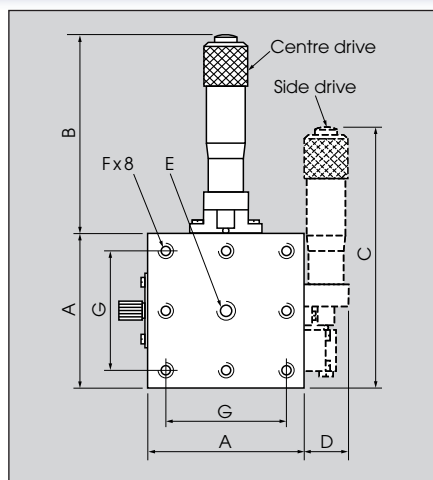
≡Customise

These robust and economical stages incorporate dovetail slides and are suitable for most applications. For higher-precision ball and roller stages see p.64.

The basic range includes both centre-drive and side-drive models, all with clamp screws to lock the motion at any desired position. The 2-axis stages are equivalent to two crossed single-axis units but take up less space.

Even more compact is the **25 XT 65**, which has the two motions combined within a space thinner than a basic single-axis stage.

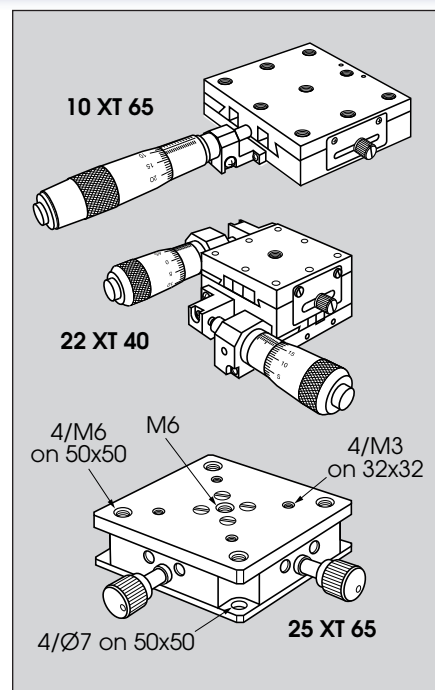
To add a third axis, mount a stage on an angle bracket (p.65) or use an elevation stage or jack (p.66).



Specification

Resolution	10µm
Sideplay (typ.)	<40µm

Catalogue No. Centre drive	Catalogue No. Side drive (mm)	Dimensions (excl. drives)	No. of axes	Travel (mm)	Drive type
Basic range					
15 XT 25	–	25 x 25 x 12	1	6.5	thumbscrew
10 XT 40	12 XT 40	40 x 40 x 18	1	13	micrometer
20 XT 40	22 XT 40	40 x 40 x 29	2	13	micrometer
10 XT 65	12 XT 65	65 x 65 x 20.5	1	25	micrometer
20 XT 65	22 XT 65	65 x 65 x 33	2	25	micrometer
Compact 2-axis stage					
25 XT 65	–	65 x 65 x 20	2	4	thumbscrew



Dimensions (mm) – basic range

Series	A	B	C	D	E	F	G
– XT 25	25	26	–	–	M4	M2	20
– XT 40	40	58	73	14	M6	M3	32
– XT 65	65	98	119	16	M6	M6	50

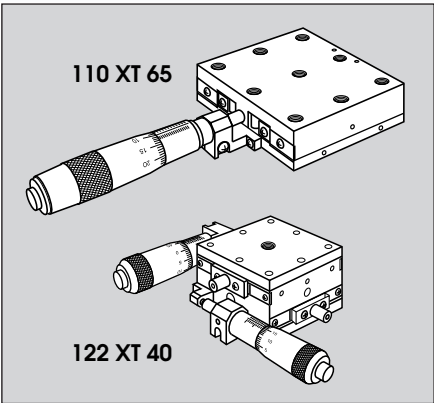
Note: Bottom plates have 4 counterbored clearance holes size F on centres G x G. Fixing screws are provided.

13.3 Translation stages (ball-slide)

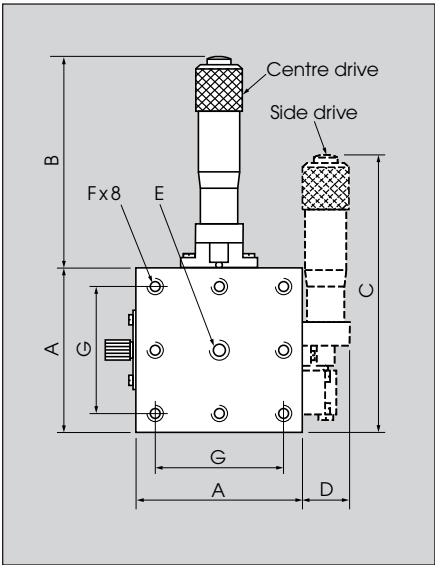
≡Customise

Preloaded precision ball slides have much less sideplay (typically less than 5µm) than the standard dovetail range. We offer single-axis and 2-axis stages in centre-drive and side-drive forms.

These stages are limited in their load capacity by the single-point contacts in the slides. For precise movement of very heavy loads the crossed-roller stages listed in the next section are recommended.



Specification	
Resolution	10µm
Sideplay (typ.)	<5µm



Catalogue No. Centre drive	Catalogue No. Side drive	Dimensions (excl. drives) (mm)	No. of axes	Travel (mm)	Drive type
114 XT 25	–	25 x 25 x 16.5	1	7	micrometer
115 XT 25	–	25 x 25 x 16.5	1	7	thumbscrew
110 XT 40	112 XT 40	40 x 40 x 23.5	1	13	micrometer
120 XT 40	122 XT 40	40 x 40 x 32.5	2	13	micrometer
110 XT 65	112 XT 65	65 x 65 x 22	1	25	micrometer
120 XT 65	122 XT 65	65 x 65 x 36	2	25	micrometer

Dimensions (mm)							
Series	A	B	C	D	E	F	G
114 XT 25	25	35	–	–	M4	M2	20
115 XT 25	25	27	–	–	M4	M2	20
– XT 40	40	58	73	14	M6	M3	32
– XT 65	65	98	119	16	M6	M6	50

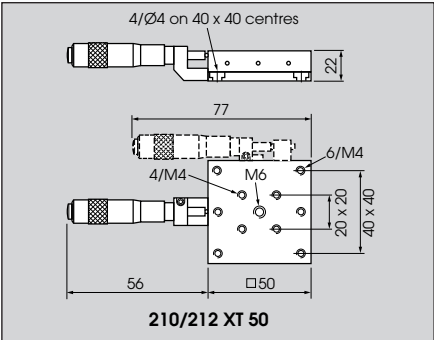
Note: Bottom plates have 4 counterbored clearance holes size F on centres G x G. Fixing screws are provided.

13.4 Translation stages (crossed-roller)

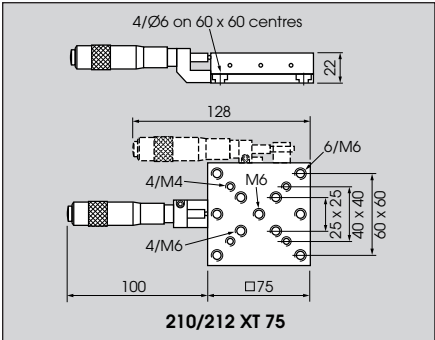
≡Customise

Crossed-roller slides combine the precision of a ball slide with the high load capacity of the dovetail design, and are thus suitable for the most demanding applications. The micrometers are of the vernier type, reading to 0.001mm.

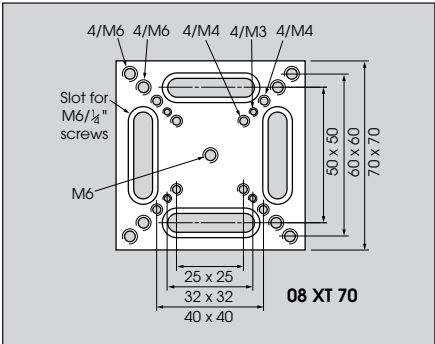
The adaptor plate **08 XT 70** enables these stages to be bolted down to a standard breadboard or table, or to be post-mounted.



Specification	
Resolution	1µm
Sideplay (typ.)	<1µm



Catalogue No. Centre drive	Catalogue No. Side drive	Dimensions (excl. drives) (mm)	No. of axes	Travel (mm)	Drive type
210 XT 50	212 XT 50	50 x 50 x 22	1	13	micrometer
220 XT 50	222 XT 50	50 x 50 x 38	2	13	micrometer
210 XT 75	212 XT 75	75 x 75 x 22	1	25	micrometer
220 XT 75	222 XT 75	75 x 75 x 38	2	25	micrometer



13.5 Brackets for vertical mounting of stages

Customise

These brackets allow stages to be connected at right angles to other stages with the same hole pattern. The **02 XT 65** will also screw directly to a breadboard or table. They are generally used for translation stages to make up combinations including vertical motions,

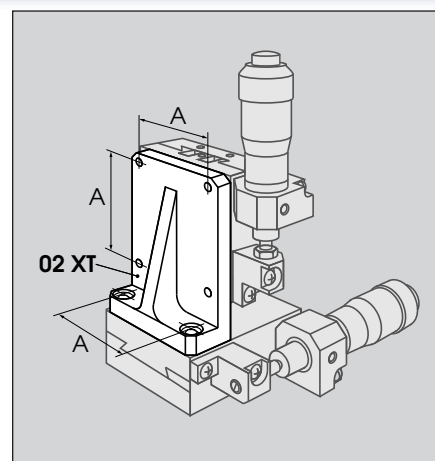
but other types of stage can also be used. Screws to bolt down the foot of the bracket are supplied.

See also:

Swivel bracket
Fixing screw kit

[p.70](#)
[p.63](#)

Catalogue No.	Overall size L x W x H (mm)	Hole size	Hole spacing A (mm)
02 XT 25	25 x 9.2 x 32.5	M2	20
02 XT 40	40 x 14.5 x 52	M3	32
02 XT 50	50 x 20 x 65	M4	40
02 XT 65	65 x 23 x 86	M6	50



13.6 Rack and pinion stages

Customise

These stages allow longer travel and much quicker movement than screw-driven types. They are provided with scales and verniers reading to 0.1 mm and clamps to lock the motion.

The adaptor plate **06 XT 40** allows any component holder with M6 thread to be mounted onto the carriage of these stages. A locating groove in the adaptor allows any holder of 16mm width to be locked with the axis parallel or perpendicular to the rack. This includes tube clamp rings ([p.81](#)) and stock-size lens holders ([pp.75-77](#)).

A variety of measuring microscope or cathetometer systems can be constructed using the microscopes and telescopes on [p.22](#) in conjunction with the scales on these units. The clamp ring/adaptor **07 XT 40** simplifies construction of these systems by mounting the tubes directly on the stage carriage (see picture to right).

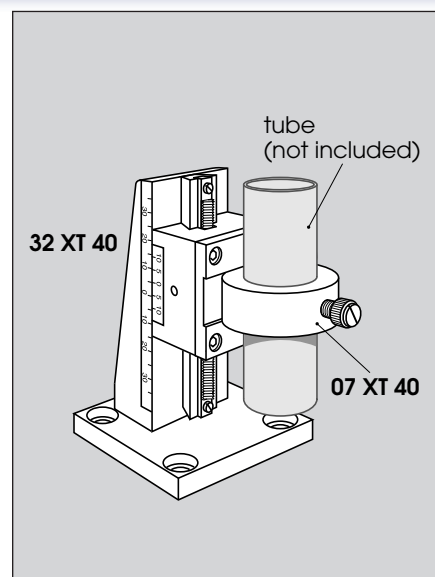
Catalogue No.	Horizontal travel (mm)	Vertical travel (mm)
---------------	------------------------	----------------------

Stages

30 XT 40	70	—
32 XT 40	—	50
34 XT 40	50	50

Adaptor plates

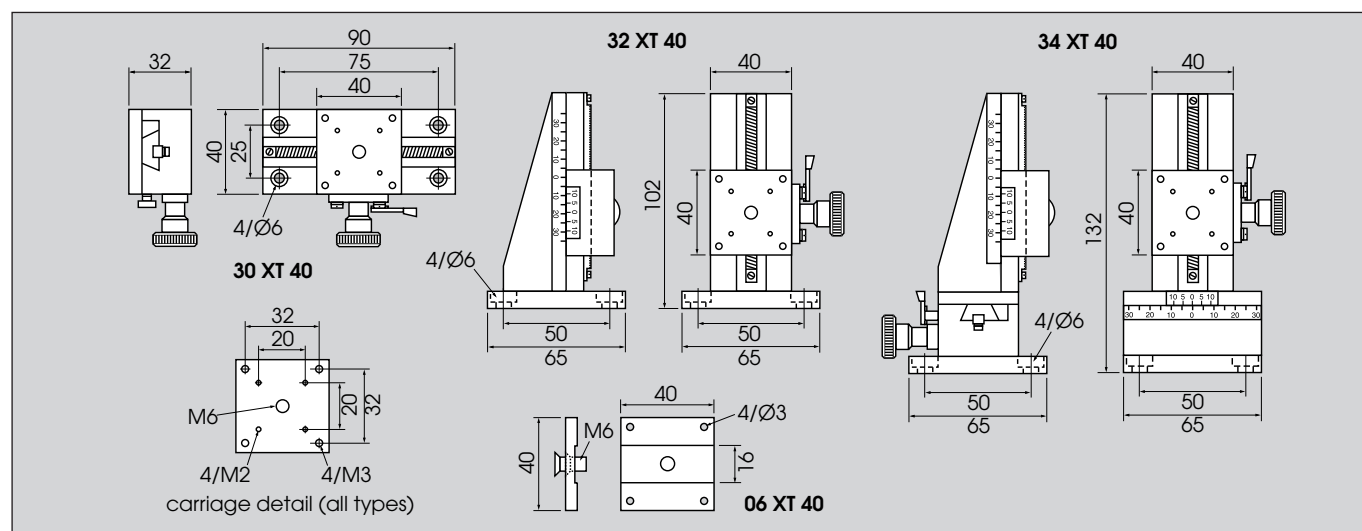
06 XT 40	Adaptor for holders with M6 thread
07 XT 40	Adaptor for TubeMount 25mm tubes etc. (28mm o.d.)



See also:

Rods with racks

[p.70](#)



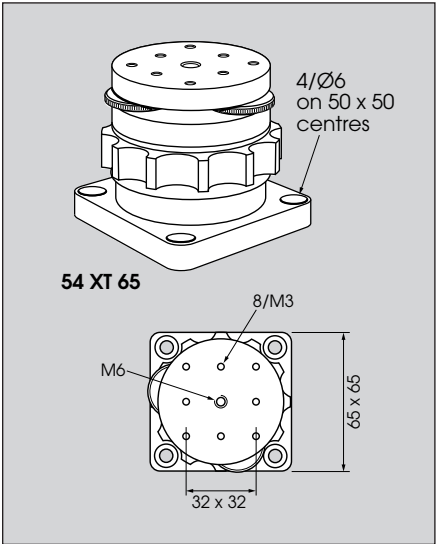
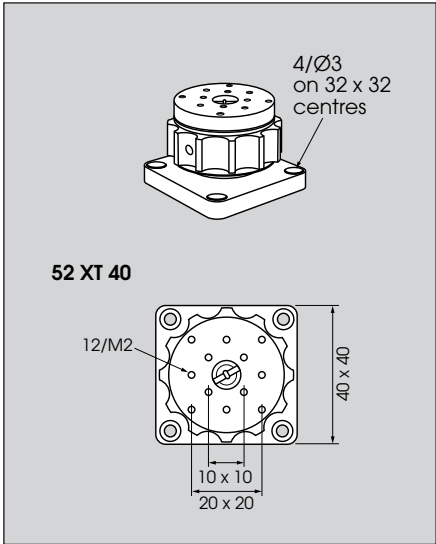
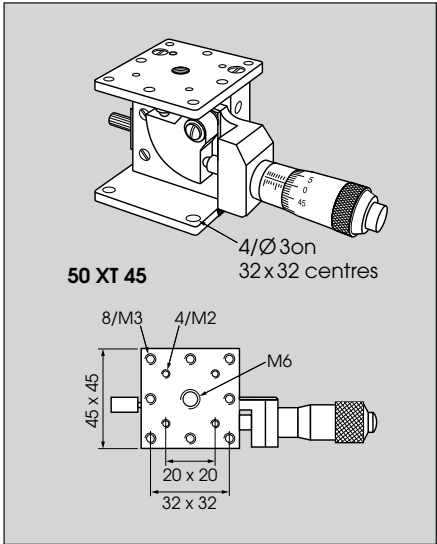
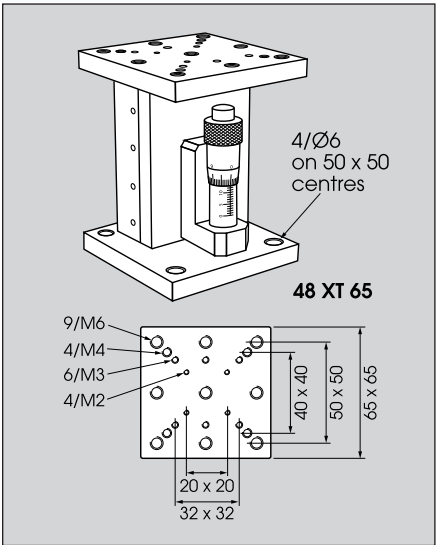
13.7 Elevation stages

Customise

These units provide a stable platform of variable height. The **48 XT 65** allows the most precise movement, being driven directly by a micrometer head operating in the direction of motion, and incorporating a precision preloaded ball slide. The **50 XT 45** has a dovetail slide and achieves greater compactness by mounting the micrometer horizontally and driving via a 'bellcrank'.

The screw-jack stages **52 XT 40** and **54 XT 65** are elevated by a large knurled nut driving a central screwed member, without rotating the platform. The much larger **54 XT 65** also permits tilting of the platform over $\pm 3^\circ$ in two directions, useful for accurate levelling. All have standard arrays of tapped holes in the platform to accept other optomechanics.

Catalogue No.	Platform dims. (mm)	Overall dims. (mm)	Height range (mm)	Description
48 XT 65	65 x 65	65 x 65	85-97	Vertical slide stage (precision)
50 XT 45	45 x 45	104 x 45	56-67	Bellcrank stage (dovetail)
52 XT 40	33 dia.	40 x 40	28-33	Screw-jack stage
54 XT 65	58 dia.	65 x 65	53-63	Screw-jack with tilt motions



13.8 Lab jacks

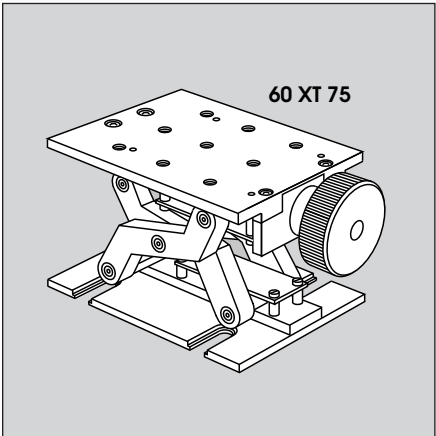
Customise

These lab jacks employ a screw-driven scissor mechanism. They are especially useful for their large top plates and wide range of movement.

The top plates have the standard breadboard grid of M6 holes on 25mm centres and the bases have fixing slots to suit the same grid.

See also:
Rack and pinion stages [p.65](#)

Catalogue No.	Top plate dimensions (mm)	Overall length (mm)	Height range (mm)
60 XT 75	100 x 75	130	60-97
60 XT 100	130 x 100	160	89-132



13.9 Rotation stages (standard)

Customise

These rotation stages with rectangular bases rotate freely by hand over 360° and can be locked at any angle. This engages a fine tangent screw drive which can then be used for accurate setting.

The smallest size, **70 XT 25**, is a very compact design in two parts, the body being removable from the support cradle to expose the base fixing screws.

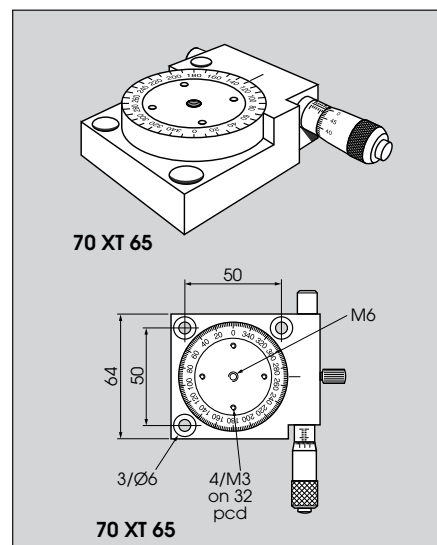
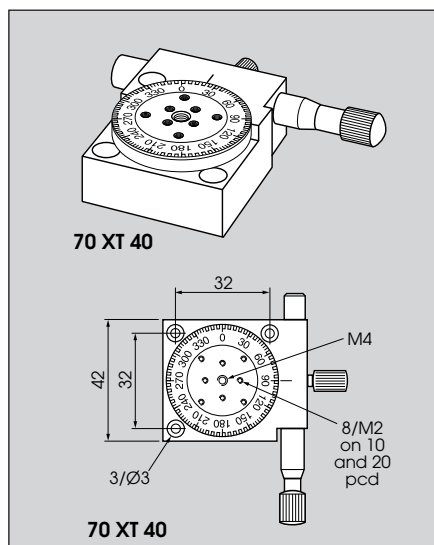
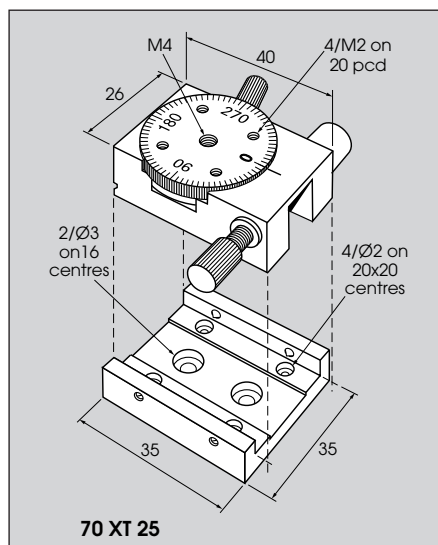
The **70 XT 65** has a micrometer drive which, although not calibrated in angular measure, allows accurate repeatable setting over the whole fine adjustment range of 14° with each division on the thimble representing about 1.1'.

For more accurate angular readout see the precision stages in [Section 13.11](#) and for a larger size see **74 XT 94** below.

Catalogue No.	Scale divisions	Fine adjustment range
70 XT 25	3°	17°
70 XT 40	3°	18°
70 XT 65	2°	14°

Mounting possibilities

See diagram on [p.63](#). When stacked with other stages, the rotating stage should be at the top, as the top plate hole pattern is not compatible with other stage bottom plates.



13.10 Rotation stages (hollow)

Customise

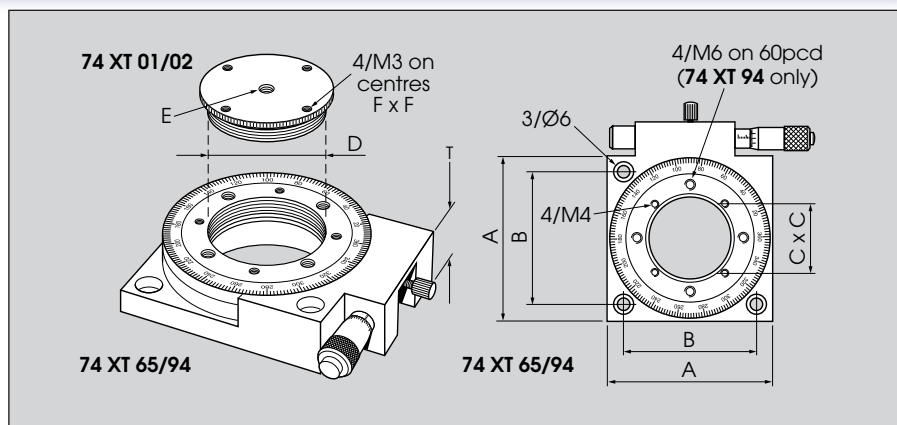
These are similar to **70 XT 65** above, having 360° manual rotation and a micrometer fine drive (range 12°), but have a central aperture through which light can pass along the rotation axis.

The blanking plates listed fill the aperture and convert the stage to the solid form. Even if the central aperture is being used, the plate may still be useful to mount components, and can easily be drilled to allow light to pass where needed.

Standoff posts ([p.61](#)) or packers ([p.74](#)) may be useful in mounting these stages to allow a clear space underneath.

See also:

Prism tables [p.84](#)
Graduated rotating holders [pp.77,78](#)



Stages

Blanking plates

Catalogue No.	Body dims. A x A (mm)	Overall dims. L x W x T (mm)	Aperture dia. (mm)	Hole centres B C (mm) (mm)
74 XT 65	64 x 64	112 x 80 x 26	25	50 25
74 XT 94	94 x 94	120 x 124 x 29	36	75 40

Catalogue No.	To fit stage	Diameter (mm)	Thread D	Hole E	Hole centres F x F (mm)
74 XT 01	74 XT 65	36	M28 x 0.75	M4	16 x 16
74 XT 02	74 XT 94	54	M39 x 0.75	M6	32 x 32

13.11 Rotation stages (precision)

Customise

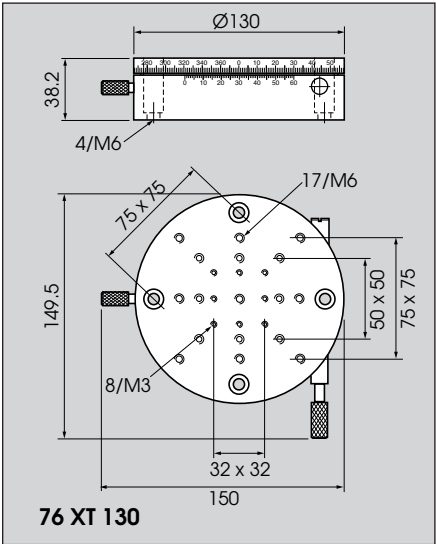
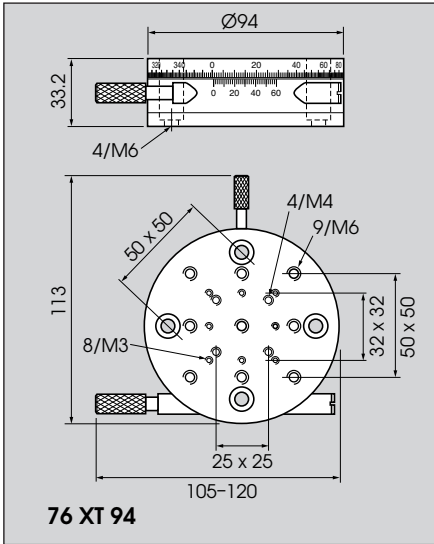
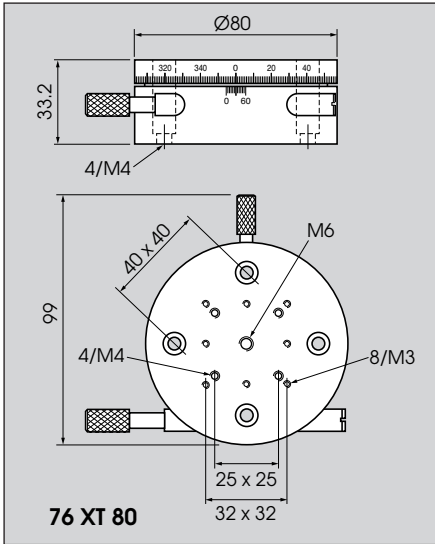
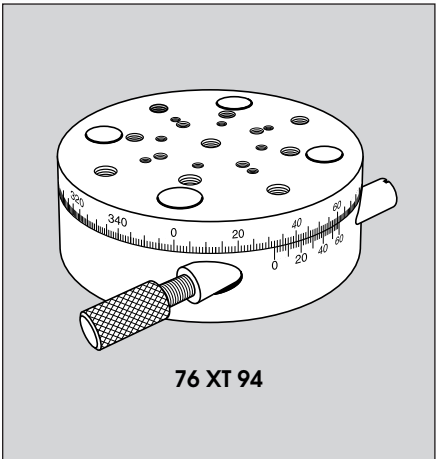
These stages are very compact, having circular bases of the same diameter as their tables. They have vernier scales reading directly in arc minutes (see table for resolution).

The table rotates freely through 360° and can be locked to a fine tangent-screw drive for accurate setting.

The two larger models bolt directly to standard breadboards or tables (M6 holes on 25mm centres); the **76 XT 80** requires adaptor **08 XT 70** (p.64).

See also:
Prism tables [p.84](#)

Catalogue No.	Diameter (mm)	Resolution (minutes)	Fixing holes in base (4 No.) Screw size (clearance)	Centres (mm)
76 XT 80	80	5	M4	40 x 40
76 XT 94	94	2	M6	50 x 50
76 XT 130	130	1	M6	75 x 75



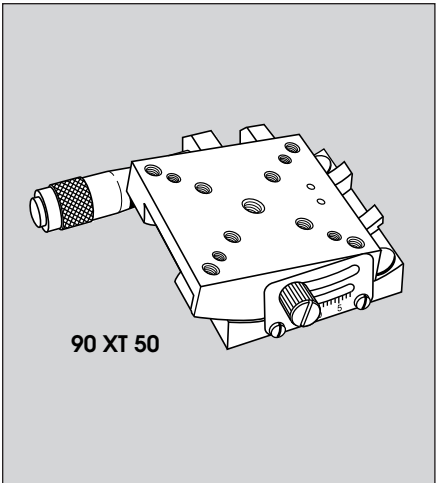
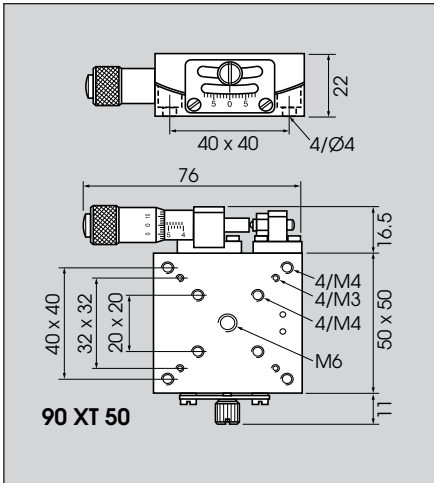
13.12 Goniometer stages

Customise

These compact stages provide a calibrated tilt about a horizontal axis well above the top surface, and are therefore useful for angling a component without translating it.

The two models are the same size but with different axis heights. By stacking the **90 XT 50** on top of the **92 XT 50**, rotations may be made on two perpendicular axes about a common centre 45mm above the top face of the upper stage.

Catalogue No.	Tilt range	Scale divisions	Axis height from top face (mm)
90 XT 50	±5°	1°	45
92 XT 50	±5°	1°	67

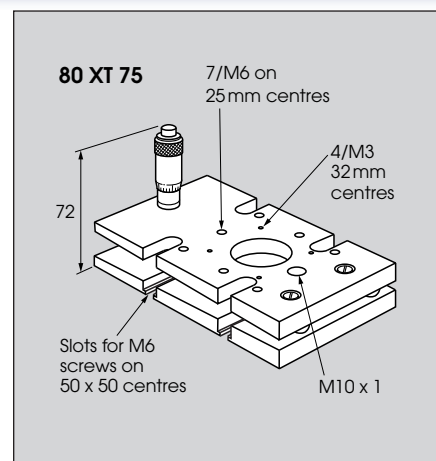
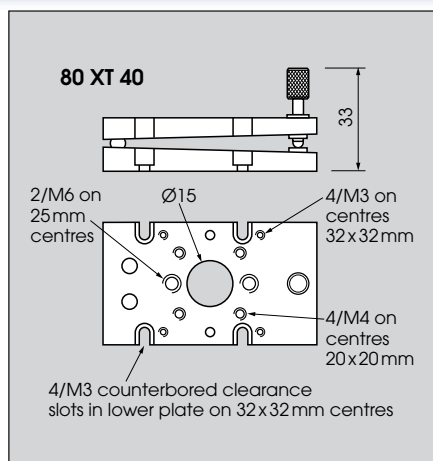


13.13 Tilt stages

Customise

These tilting platforms are of kinematic design, giving precise, smooth and backlash-free tilt about one axis of up to $\pm 3.8^\circ$. The larger stage has a micrometer drive and the smaller a fine-pitch screw. They have standard hole patterns and are stackable with translation and other stages: for other mounting possibilities see diagram on [p.63](#).

Catalogue No.	Length x width (mm)
80 XT 40	70 x 40
80 XT 75	120 x 75

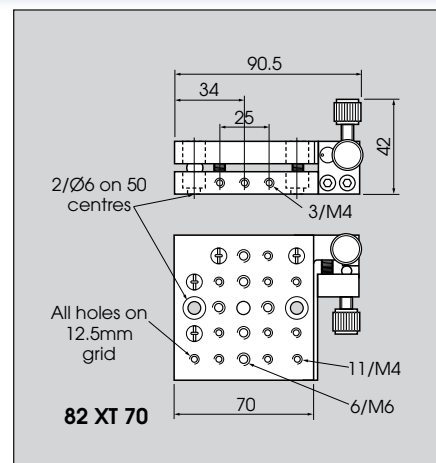
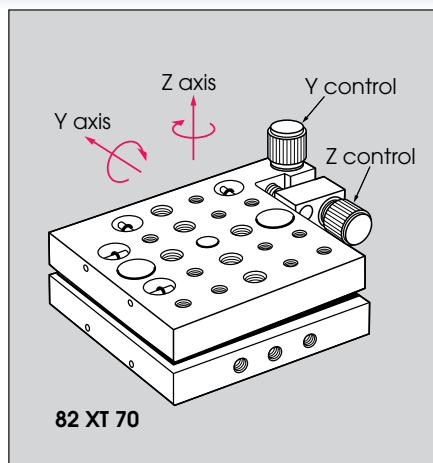


13.14 Tilt and rotation stage

Customise

This stage has both a tilt action and a rotation about an axis perpendicular to the platform, both driven by fine-pitch screws. These provide the two adjustments necessary for reflecting optics such as beamsplitter cubes. The base plate has tapped holes in the edge, allowing it to be post-mounted vertically like a mirror holder, if required, instead of being bolted to a flat surface.

Catalogue No.	Tilt range	Rotation range
82 XT 70	$\pm 1.8^\circ$	$\pm 1.8^\circ$



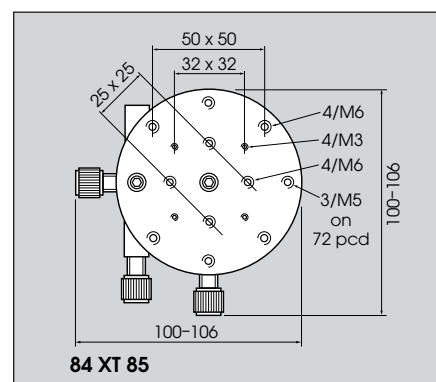
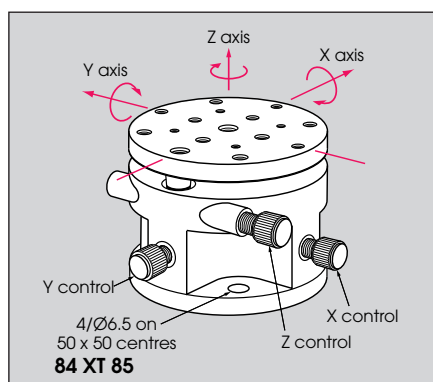
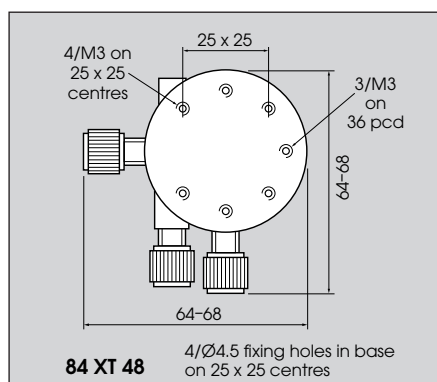
13.15 Double-tilt and rotation stages

Customise

These allow rotation of optics with a range of $\pm 5^\circ$ about three perpendicular axes. The fine-pitch thumbscrews allow very fine setting, adjustments as small as 30 arc seconds being possible.

Both models have clearance fixing holes in the baseplate as shown below. The 84 XT 48 also has a central tapped M6 hole in the base allowing post-mounting ([p.74](#)) or use of direct-mount screws or bases ([p.61](#)).

Catalogue No.	Diameter (mm)	Height (mm)
84 XT 48	48	56
84 XT 85	85	68



13.16 Mounting rod system

Customise

These 38.1mm diameter rods provide much more stable and rigid support than standard posts, and allow easy long-range height adjustments. Rods are made with ground finish in stainless steel tubing, with or without racks for use with pinion-drive carriers.

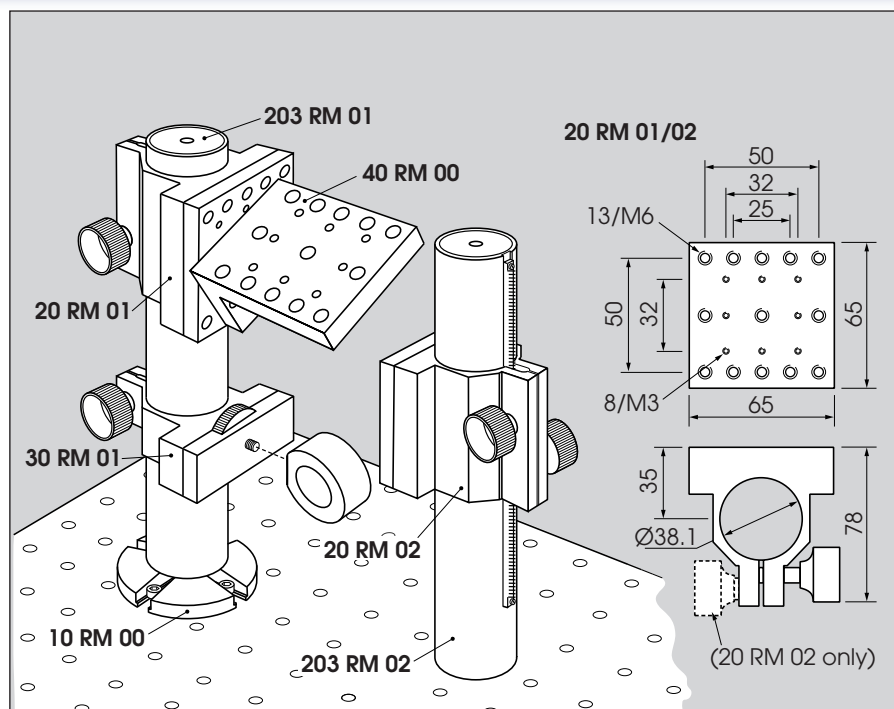
All rods have an M6 male base thread which can either be screwed directly into breadboards, stages etc. or used to attach the slotted base **10 RM 00**, for more flexibility in positioning. However, for rods with racks we recommend using the base, which allows the rack to be aligned in the required direction. An M6 female thread in the top of the rod allows rods to be stacked for greater heights. (Rods with racks should not be stacked together, since the racks will not align.)

Additionally, brackets **15 RM 00** can be used to mount any of the above rods parallel to the base so permitting a horizontal rod system as illustrated below. This arrangement can be useful for travelling microscopes and similar uses.

Standard carriers, available with or without pinion drive, provide a vertical mounting surface with tapped holes to fit stages etc. Direct mount bases (p.61), postholders (p.62) or adaptors **06/07 XT 40** (p.65) can be used to mount component holders.

The swivel bracket **40 RM 00** can be added to provide a similar mounting surface in a horizontal plane, or at any other angle desired. Brackets **02 XT 40/65** (p.65) are also suitable.

Direct mount carriers **30 RM 01** are very compact and can be closely spaced; they have a captive M6 screw with thumbwheel to allow most component holders to be clamped in any orientation.



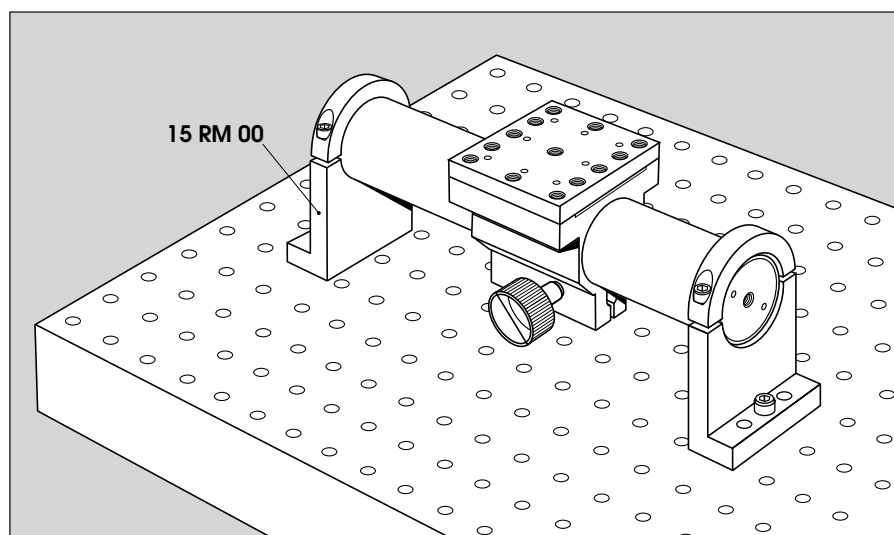
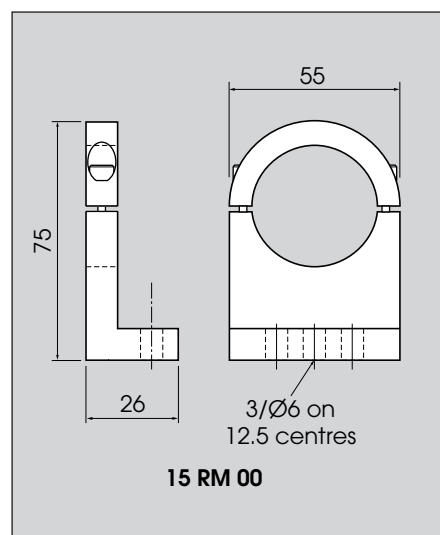
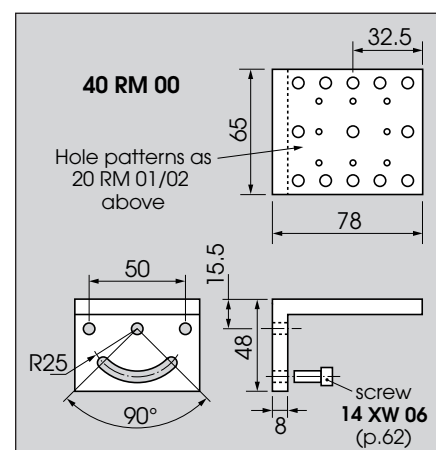
Catalogue No.	Description
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Rods (38.1mm dia.)

203 RM 01	rod 203mm long
355 RM 01	rod 355mm long
203 RM 02	rod with rack, 203mm
355 RM 02	rod with rack, 355mm
10 RM 00	slotted base for rod
15 RM 00	bracket for horiz. use

Carriers

20 RM 01	basic carrier
20 RM 02	basic carrier, pinion drive
30 RM 01	direct mount carrier
40 RM 00	swivel bracket



13.17 Micrometer heads

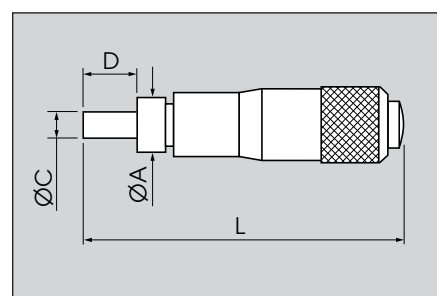
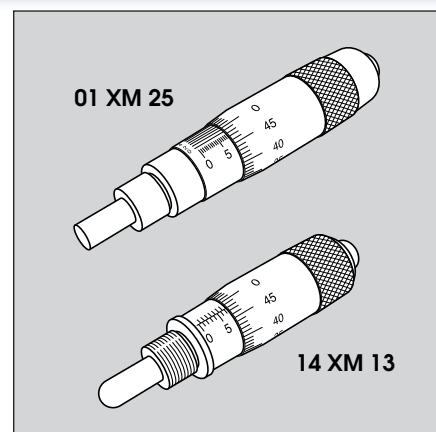
Micrometer heads are useful for special optomechanical assemblies, or any device requiring precise adjustments. Standard heads read to 0.01mm and vernier models to 0.001mm.

Mounting is either by clamping of a plain diameter or by a 10mm diameter thread,

and spindles are available with flat or hemispherical ends.

All have the standard 0.5mm pitch thread; for even more delicate adjustments, see the precision screws listed below.

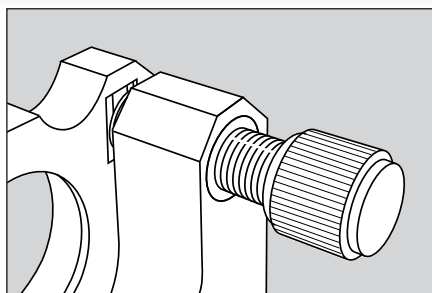
Catalogue No.	Range (mm)	Overall length L (mm)	Mounting diameter A (mm)	Spindle dia. C (mm)	Spindle projection D (mm)	Spindle end form
Vernier (resolution 0.001mm)						
01 XM 25	25	101.5	10	6	0-25	plane
04 XM 25	25	101.5	M10 x 0.75	6	0-25	plane
Standard (resolution 0.01mm)						
11 XM 06	6.5	34	6	3.5	0-6.5	plane
12 XM 06	6.5	38.6	6	3.5	5-11.5	sph.
11 XM 13	13	57	10	5	0-13	plane
12 XM 13	13	60	10	5	3-16	sph.
13 XM 13	13	57	M10 x 0.75	5	0-13	plane
14 XM 13	13	64.5	M10 x 0.75	5	7-20	sph.
11 XM 25	25	101.5	10	6	0-25	plane
12 XM 25	25	101.5	10	6.5	0-25	sph.
13 XM 25	25	82	M10 x 0.75	5	0-25	plane
14 XM 25	25	82	M10 x 0.75	5	0-25	sph.
11 XM 50	50	150	11	6	0-50	plane



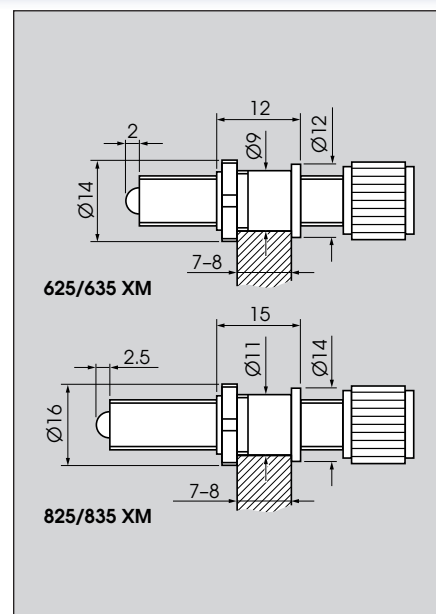
13.18 Precision adjusting screws

Customise

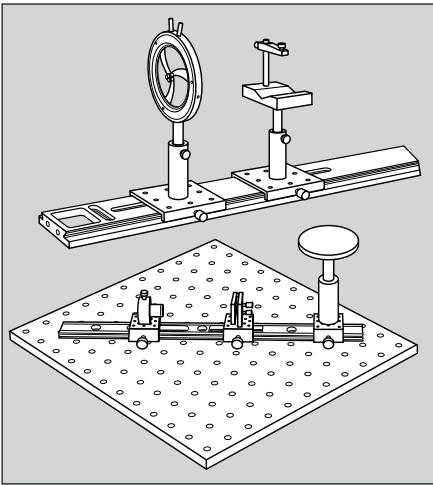
These very fine pitch screws, supplied ready-assembled in mounting bushes, greatly simplify the construction of precision equipment. The bush has an external thread with clamping nut and is a close fit into a simple reamed hole. They are of all-metal construction with attractive black knurled heads, steel shafts and an inset polished ball at the tip, useful in kinematic designs. The screw threads are a very close fit in their bushes and operate smoothly with no detectable backlash.



Catalogue No. 0.25mm pitch	Catalogue No. 0.35mm pitch	Thread dia. (mm)	Length (mm)	Adjustment range (mm)
625 XM 08	635 XM 08	6	20	8
625 XM 18	635 XM 18	6	30	18
625 XM 28	635 XM 28	6	40	28
825 XM 10	835 XM 10	8	25	10
825 XM 30	835 XM 30	8	45	30
825 XM 50	835 XM 50	8	65	50



14.1 Rails and carriers – Introduction



In optical experiments it is often necessary to translate components along an axis, e.g. when focusing a lens. The traditional solution is the optical bench consisting of a heavy cast-iron section (or similar) of immense rigidity, carrying heavy, cast saddles. Such systems are still relevant for special single-axis work, but are relatively useless for multiple axis assemblies, especially when these axes intersect. They are also useless when setting-up small scale optics which are characteristic of most electro-optic instruments, as bench systems do not permit close spacing of optics. Thus the optical bench has largely given way to smaller scale optical rails which can provide intersecting axes when mounted on optical tables or

breadboards and can permit close spacing of components. We offer a 19mm system allowing very compact assemblies and a 75mm system which is rigid enough to act as a stand-alone optical bench, but is usually used on an optical table. This rail system can carry any number of 19mm rails as 'piggy-backs' so giving greater versatility to combined systems. Narrow carriers of both systems enable close spacing of optics (10mm spacing for the 19mm system and 25mm spacing for the 75mm system). Finally, both systems allow for direct-mounting of TubeMount components or assemblies (see [section 12.4](#)) so making even more compact systems.

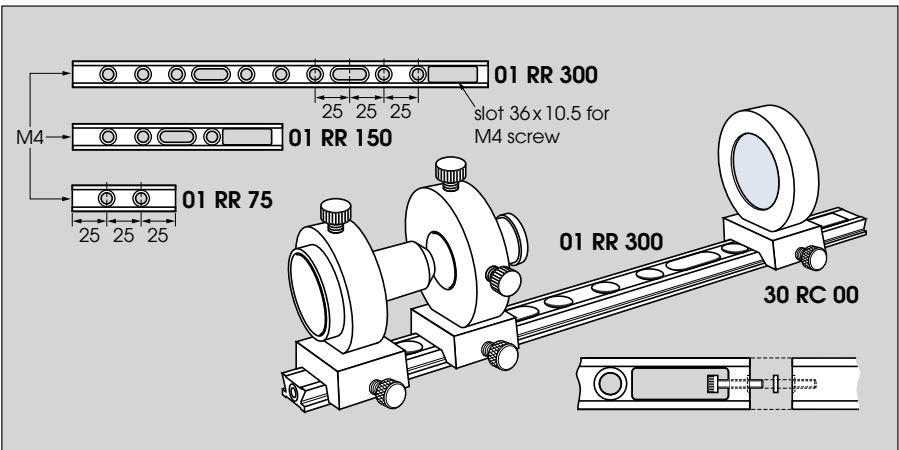
14.2 Rails and carriers (19mm) Customise

Our 19mm wide rails are precision-machined in aluminium for greater straightness and accuracy than extruded sections. They can be screwed down to breadboards, optical tables or any flat surface using M6 screws as listed. Fixing slots allow rails to be fixed at an angle to the rows of holes on breadboards etc. Each rail (except 75mm) has an M4 tapped hole in one end and a clearance hole and slot for an M4 screw (included) at the other, allowing rails to be joined together to make greater lengths. (75mm rails have tapped holes in both ends.) These holes can also be used to attach rails endwise to other surfaces for more complex arrangements.

Our **direct mount carrier** has a loose M6 screw for fixing component holders direct to the top surface, a very compact arrangement particularly useful for holders with standard axis heights (see [p.74](#)). An adaptor kit (screw and washer) is listed for holders with M4 thread. This carrier also has M2 holes to mount our 25 x 25mm translation stages ([pp.63, 64](#)).

Postholder carriers accept post-mounted component holders, allowing greater flexibility in component axis heights.

The **narrow carrier** can be butted against another carrier to mark its position, allowing it to be removed and replaced in exactly the same position. It accepts component holders via a direct-mount base such as **04 BH 06** ([p.61](#)).

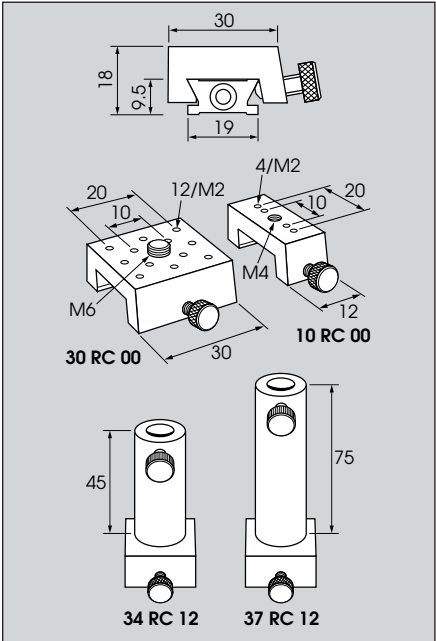


Rails	
Catalogue No.	Length (mm)
01 RR 75	75
01 RR 150	150
01 RR 300	300
01 RR 450	450 (300 + 150)*
01 RR 600	600 (300 + 300)*
Spare fixing screws (pack of 10)	
08 XW 06	M6 x 8mm

*Two rails supplied pre-assembled

Carriers	
Catalogue No.	Description
30 RC 00	Direct mount carrier
01 RC 04	Adaptor kit for above to M4
34 RC --*	With postholder 45mm high
37 RC --*	With postholder 75mm high
10 RC 00	Narrow carrier

*Select post diameter by inserting 10 for 10mm, 12 for 12mm, 13 for 12.7mm or 14 for 13.7mm

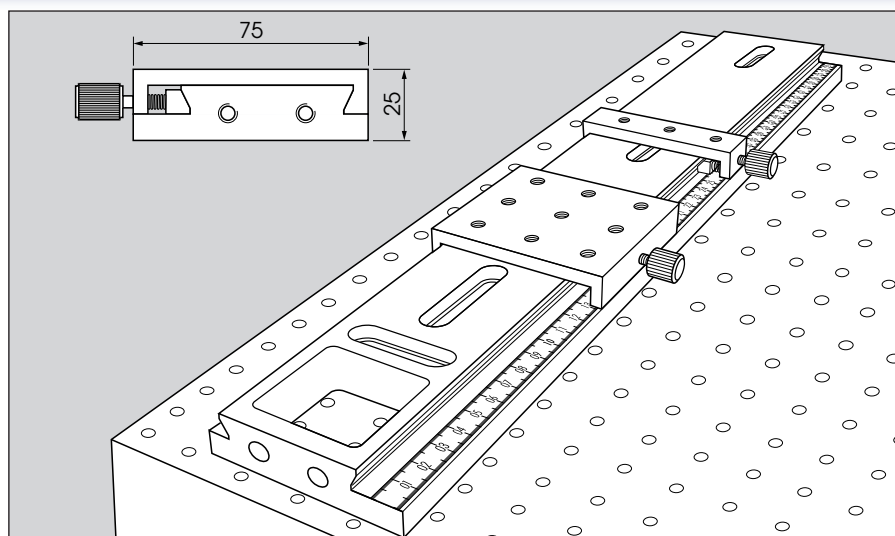


14.3 Rails and carriers (75mm)

Customise

The 75mm rail and saddle system is not only very robust, but also has a range of special features: rails can be joined together to make a wide variety of lengths and are easily aligned during joining so that saddles slide smoothly over the full length. Saddles load vertically on to the rail – they do not have to be slid on from one end. A spring in the saddle clamp keeps the saddle aligned but permits easy sliding before final clamping.

The rail scale permits accurate positioning of saddles. Cross rails can bolt on saddles to give transverse slides and **08 XT 70** adaptors (p.64) allow a wide range of stages etc. to be mounted on saddles.



- Robust 75mm design
- Rails can be joined together
- Saddles load vertically on to the rail; they do not have to be slid on from one end
- Scale permits accurate positioning

Rails

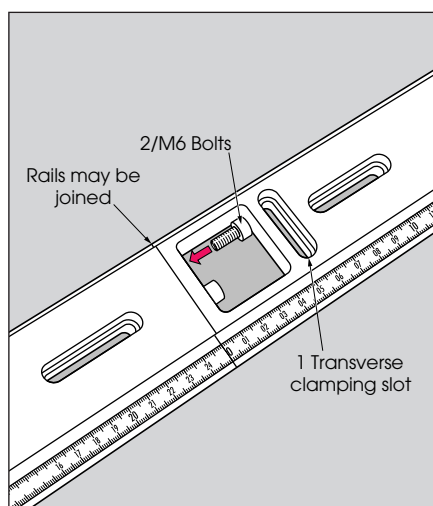
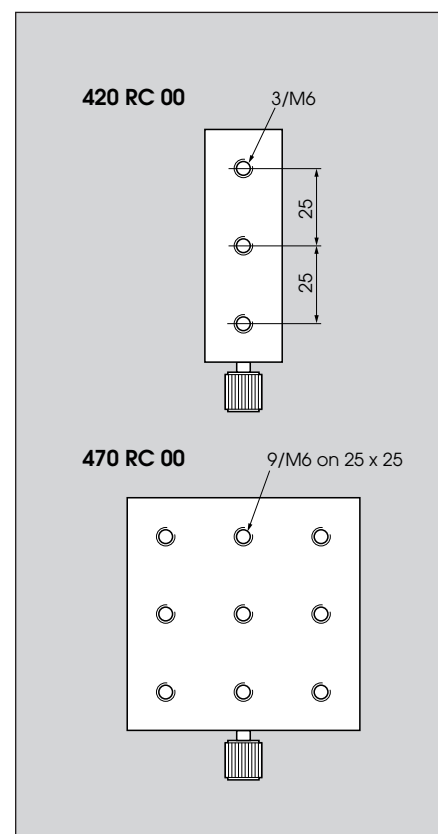
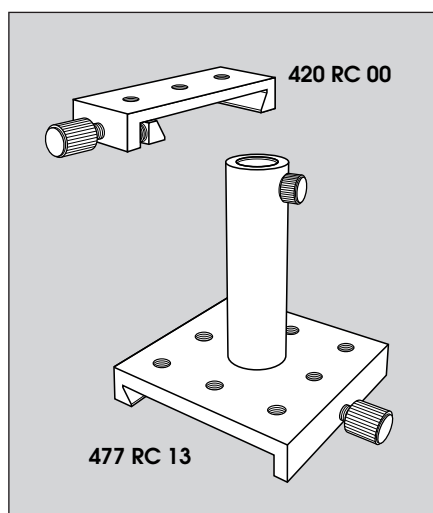
Catalogue No.	Length (mm)
04 RR 250	250
04 RR 500	500
04 RR 1000	1000

Plain carriers

Catalogue No.	Width (mm)
420 RC 00	25
470 RC 00	75

Carriers with postholders

Catalogue No.	Width (mm)	Height (mm)
Fixed height		
424 RC --*	25	45
427 RC --*	25	75
429 RC --*	25	105
474 RC --*	75	45
477 RC --*	75	75
479 RC --*	75	105
Variable height		
421 RC --*	25	62.5-87.5
471 RC --*	75	62.5-87.5



See also:

19mm Rails	p.72
Platforms	p.61
Direct mounting bases	p.61
Postholders, bases & Clamp arms	p.62
Elevation stages	p.66
08 XT 70 - Adaptor Plate	p.64

*Select post diameter by inserting 10 for 10mm, 12 for 12mm, 13 for 12.7mm or 14 for 13.7mm

15.1 Component holders – introduction

Our component holders are supplied either with an M6 (or M4) female thread (direct mount) or with a mounting post.

Post-mounted holders are available with four different post diameters (10mm, 12mm, 12.7mm, 13.7mm) to suit almost all makes of postholder. The required diameter is indicated by adding the appropriate suffix to the catalogue number – see footnotes to tables. Standard post lengths are listed in the tables, and are chosen to give a total length from the optical axis of approximately 140mm; if other lengths are required, specify direct-mount holders and order posts separately from the section below.

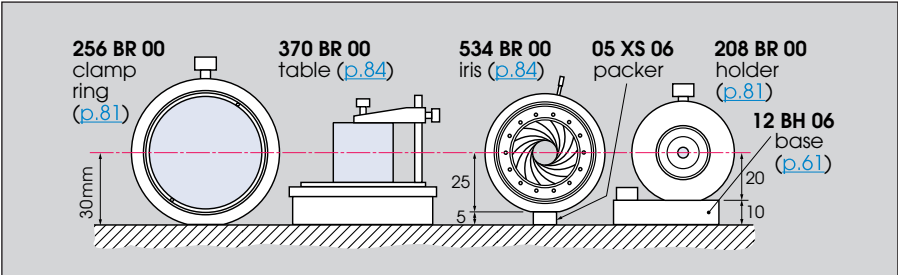
Direct mount holders can be fixed directly to a breadboard (p.60) or base (p.61) giving very compact assemblies. To facilitate this we have standardised the axis heights of most of our holders to allow optics of different types to be mounted coaxially – see box and diagram for examples. The differences between standard heights are multiples of 5mm

and can easily be made up by using the **packers** listed here, which simply screw into the component base.

For other methods of supporting components, such as flanged holders, see our TubeMount system, [Section 11](#).

Catalogue No. M4 thread	Catalogue No. M6 thread	Height (mm)
05 XS 04	05 XS 06	5
075 XS 04	075 XS 06	7.5
10 XS 04	10 XS 06	10
15 XS 04	15 XS 06	15

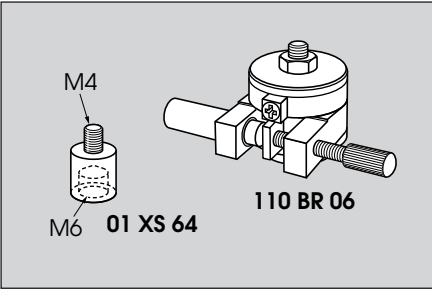
Standard axis heights
25mm lens holder (p.75)
Clamp ring (p.81) with 25mm TubeMount cell
Eye-piece holder (sliding type, p.81)
40mm lens holder (p.75)
Iris diaphragm 28mm aper. (p.84)
50mm lens holder (p.75)
Clamp ring (p.81) with 50mm TubeMount cell
Self-centring holder (p.78)
25mm prism on rotary table (p.84)



15.2 Posts and accessories

Customise

Stainless steel **posts** are listed in six lengths with M4 or M6 male threads to fit our component holders, and also with Unified threads for holders of other makes. All are available in four diameters to suit different postholders.



Stainless steel posts

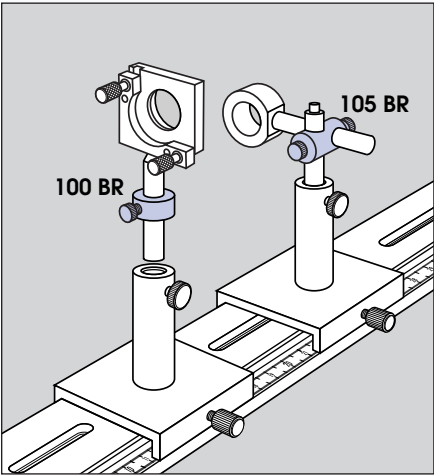
Catalogue No. M4 thread	Catalogue No. M6 thread	Catalogue No. 8-32 thread	Catalogue No. 1/4"-20 thread	Length excluding thread (mm)
04 BR --*	06 BR --*	—	—	25
14 BR --*	16 BR --*	—	—	50
24 BR --*	26 BR --*	25 BR --*	27 BR --*	75
34 BR --*	36 BR --*	—	—	100
44 BR --*	46 BR --*	—	—	115
54 BR --*	56 BR --*	55 BR --*	57 BR --*	125
64 BR --*	66 BR --*	—	—	150

Collars can be added to any post-mounted item to allow it to be rotated, or removed and replaced, at the same height. **Cross clamps** allow posts to be connected at right angles.

The **rotation adaptor** can be inserted below any component holder with M6 thread, allowing it to be freely rotated through 360°, then clamped and fine-adjusted through 30° range with a tangent screw. **Thread adaptors** allow parts with different threads to be connected together.

See also:

38.1mm dia. rod system [p.70](#)
Post with 0.25" camera tripod thread [p.80](#)



Accessories and adaptors

Catalogue No.	Height (mm)	Description
100 BR --*	12	Collar with clamp screw
105 BR --*	—	Cross clamp for 2 posts
110 BR 06	27.5	Rotation adaptor (M6)
Thread adaptors (to connect threads stated)		
01 XS 46	26	M4 male to M6 female
01 XS 64	9	M6 male to M4 female
01 XS 45	10	M4 male to 8-32 female
01 XS 54	10	8-32 male to M4 female
01 XS 67	14	M6 male to 1/4"-20 female
01 XS 76	10	1/4"-20 male to M6 female

*Select post diameter by inserting 10 for 10mm, 12 for 12mm, 13 for 12.7mm or 14 for 13.7mm

15.3 Holders for stock diameter optics

Customise

These holders provide a much more secure mounting than adjustable types and are also more compact. They grip the optical component gently but firmly all around its perimeter, without obscuring the useful aperture. The threaded retaining ring has a knurled lip which protrudes from the mount and can easily be turned by hand without a special tool. For alternative slotted rings see [p.54](#).

The ranges are based on four standard bodies, accepting the commonest lens diameters of 16mm, 25mm, 40mm and 50mm. Other holders listed comprise one of these bodies supplied with a pair of lens-size adaptors ([p.56](#)) to accept the diameter listed. Other adaptors can of course be supplied at relatively small cost, see [p.56](#), making the system much more versatile and economical than holders limited to one size only.

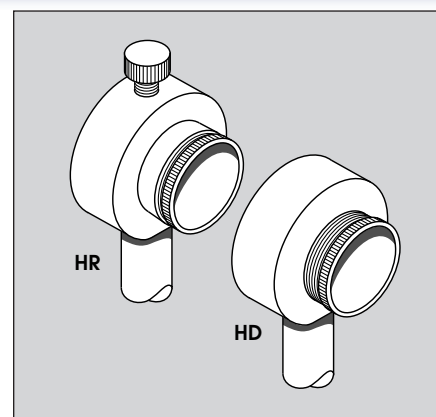
Two ranges are listed. The basic **HD** series have a fixed one-piece body and are the most economical. The ring-mounted **HR** series consist of a lens cell (similar to the **MB** series, [p.54](#)) clamped in an outer ring. The lens and cell can be released, rotated or translated axially (range about

10mm) and clamped in any position. For smoother continuous movements, see the following sections.

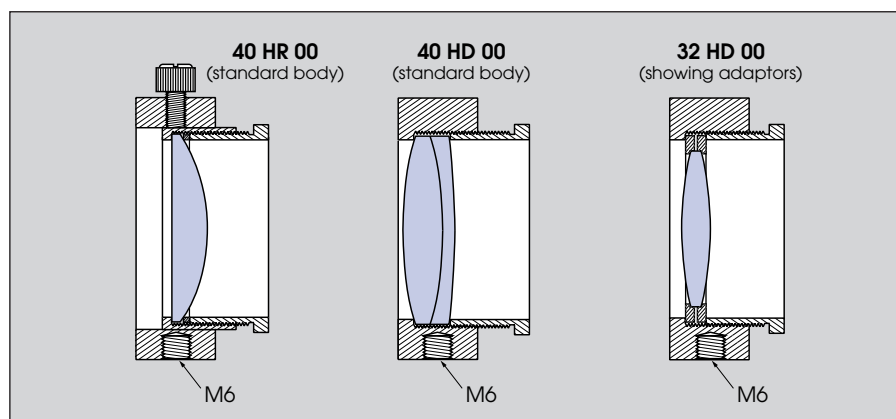
The threads used are those of the TubeMount system (see [p.53](#)) and can also be used to attach other TubeMount elements. Spacers or extra retaining rings ([p.54](#)) can be used to mount several components in one holder.

Alternative posts

Direct mount holders have M6 thread to accept posts listed on [p.74](#)



- Secure grip around lens edge
- Minimal obscuration of aperture
- No special tool required
- No stray light around lens edge
- Component edge thickness 0–9mm



Standard fixed holders

Direct mount holder (no post)		Post-mounted holder		Lens dia. (mm)	Clear aper. (mm)
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)		
025 HD 00	15	025 HD --*	125	2.5	2
04 HD 00	15	04 HD --*	125	4	3.3
05 HD 00	15	05 HD --*	125	5	4.3
06 HD 00	15	06 HD --*	125	6.3	5.3
08 HD 00	15	08 HD --*	125	8	6.4
10 HD 00	15	10 HD --*	125	10	8.8
12 HD 00	15	12 HD --*	125	12.7	11
15 HD 00	15	15 HD --*	125	15	13.5
16 HD 00	15	16 HD --*	125	16	14.2
18 HD 00	20	18 HD --*	125	18	16.5
19 HD 00	20	19 HD --*	125	19	17.5
20 HD 00	20	20 HD --*	125	20	18.3
22 HD 00	20	22 HD --*	125	22.4	21
25 HD 00	20	25 HD --*	125	25	23.2
26 HD 00	25	26 HD --*	115	25.4	24
30 HD 00	25	30 HD --*	115	30	28.5
32 HD 00	25	32 HD --*	115	31.5	30
38 HD 00	25	38 HD --*	115	38	36.5
40 HD 00	25	40 HD --*	115	40	38.2
50 HD 00	30	50 HD --*	115	50	48.2

Ring-mounted holders

Direct mount holder (no post)		Post-mounted holder		Lens dia. (mm)	Clear aper. (mm)
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)		
025 HR 00	15	025 HR --*	125	2.5	2
04 HR 00	15	04 HR --*	125	4	3.3
05 HR 00	15	05 HR --*	125	5	4.3
06 HR 00	15	06 HR --*	125	6.3	5.3
08 HR 00	15	08 HR --*	125	8	6.4
10 HR 00	15	10 HR --*	125	10	8.8
12 HR 00	15	12 HR --*	125	12.7	11
15 HR 00	15	15 HR --*	125	15	13.5
16 HR 00	15	16 HR --*	125	16	14.2
18 HR 00	20	18 HR --*	125	18	16.5
19 HR 00	20	19 HR --*	125	19	17.5
20 HR 00	20	20 HR --*	125	20	18.3
22 HR 00	20	22 HR --*	125	22.4	21
25 HR 00	20	25 HR --*	125	25	23.2
26 HR 00	25	26 HR --*	115	25.4	24
30 HR 00	25	30 HR --*	115	30	28.5
32 HR 00	25	32 HR --*	115	31.5	30
38 HR 00	25	38 HR --*	115	38	36.5
40 HR 00	25	40 HR --*	115	40	38.2
50 HR 00	30	50 HR --*	115	50	48.2

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

15.4 Focusing holders for stock optics

≡Customise

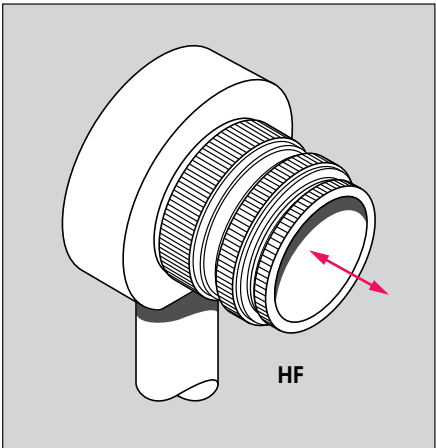
These have all the features of the standard fixed holders above, but also provide a 9mm focusing motion controlled by simple rotation of the moving cell. When correctly focused the movement can be locked by a knurled lock ring.

The two basic bodies accept 25mm and 40mm lenses directly. Other sizes are provided with a pair of lens-size adaptors. For sizes not listed use suitable adaptors (p.56) in the 25mm or 40mm holder.

Specification	
Pitch of thread	0.7mm
Range of motion	9mm
Component edge thickness	0-9mm

Direct mount holder (no post)		Post-mounted holder		Lens dia. (mm)	Clear aper. (mm)
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)		
06 HF 00	20	06 HF --*	125	6.3	5.3
10 HF 00	20	10 HF --*	125	10	8.8
12 HF 00	20	12 HF --*	125	12.5/12.7	11
16 HF 00	20	16 HF --*	125	16	14.2
20 HF 00	20	20 HF --*	125	20	18.3
22 HF 00	20	22 HF --*	125	22.4	21
25 HF 00	20	25 HF --*	125	25	23.2
32 HF 00	25	32 HF --*	115	31.5	30
38 HF 00	25	38 HF --*	115	38	36.5
40 HF 00	25	40 HF --*	115	40	38.2

*Select post diameter by inserting 10 for 10mm, 12 for 12mm, 13 for 12.7mm or 14 for 13.7mm



Alternative posts

Direct mount holders have M6 thread to accept posts listed on p.74

15.5 Centring holders for stock optics

≡Customise

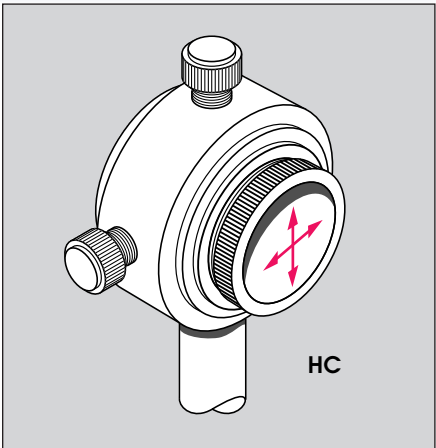
These are similar to standard fixed holders (p.75) but have vertical and horizontal adjusting screws allowing a component to be translated up to 1.5mm off axis in any direction.

The HX series also incorporates a focusing action (similar to those in the section above) of range 9mm. (Note that this rotates the component.)

The body of both types accepts 25mm components directly, but is also offered complete with lens-size adaptors for other sizes. For sizes not listed use the 25mm size and select appropriate adaptors from p.56.

Direct mount holder (no post)		Post-mounted holder		Lens dia. (mm)	Clear aper. (mm)
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)		
Centring holders					
04 HC 00	20	04 HC --*	125	4	3.3
06 HC 00	20	06 HC --*	125	6.3	5.3
10 HC 00	20	10 HC --*	125	10	8.8
12 HC 00	20	12 HC --*	125	12.5/12.7	11
16 HC 00	20	16 HC --*	125	16	14.4
20 HC 00	20	20 HC --*	125	20	18.3
25 HC 00	20	25 HC --*	125	25	23.2
Centring and focusing holders					
04 HX 00	20	04 HX --*	125	4	3.3
06 HX 00	20	06 HX --*	125	6.3	5.3
10 HX 00	20	10 HX --*	125	10	8.8
12 HX 00	20	12 HX --*	125	12.5/12.7	11
16 HX 00	20	16 HX --*	125	16	14.4
20 HX 00	20	20 HX --*	125	20	18.3
25 HX 00	20	25 HX --*	125	25	23.2

*Select post diameter by inserting 10 for 10mm, 12 for 12mm, 13 for 12.7mm or 14 for 13.7mm



- Allows precise alignment of optics
- X-Y or X-Y-Z motions
- Component thickness 0-9mm

Alternative posts

Direct mount holders have M6 thread to accept posts listed on p.74

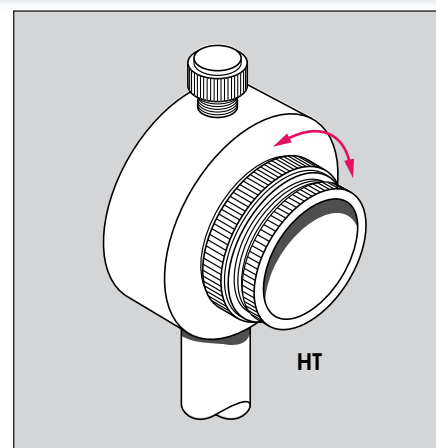
15.6 Rotating component holders

≡Customise 

These holders for optics of standard diameters allow smooth rotation of the component on its axis, without axial motion. The movement is controlled by a knurled ring and can be clamped at any desired position. For similar mounts with a scale for angular measurement see the following section.

The two basic bodies accept 25mm and 50mm optics directly. Other sizes are provided with a pair of lens-size adaptors. Sizes not listed can be accommodated by selecting the appropriate adaptors from [p.56](#) for the 25mm or 50mm body.

Our rod lenses ([p.13](#)) can be mounted in the special rotating holder listed.



Alternative posts

Direct mount holders have M6 thread to accept posts listed on [p.74](#)

Direct mount holder (no post)		Post-mounted holder		Lens dia. (mm)	Clear aper. (mm)
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)		
06 HT 00	20	06 HT --*	125	6.3	5.3
10 HT 00	20	10 HT --*	125	10	8.8
12 HT 00	20	12 HT --*	125	12.5/12.7	11
16 HT 00	20	16 HT --*	125	16	14.4
20 HT 00	20	20 HT --*	125	20	18.3
25 HT 00	20	25 HT --*	125	25	23.2
32 HT 00	30	32 HT --*	115	31.5	30
40 HT 00	30	40 HT --*	115	40	38.5
50 HT 00	30	50 HT --*	115	50	48.2
Rod lens holder (for rod 16mm long, 2-14mm dia.)					
170 BR 00	20	170 BR --*	125	—	—

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

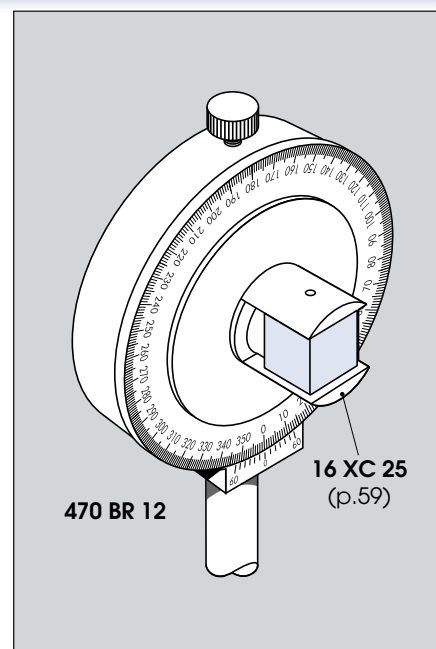
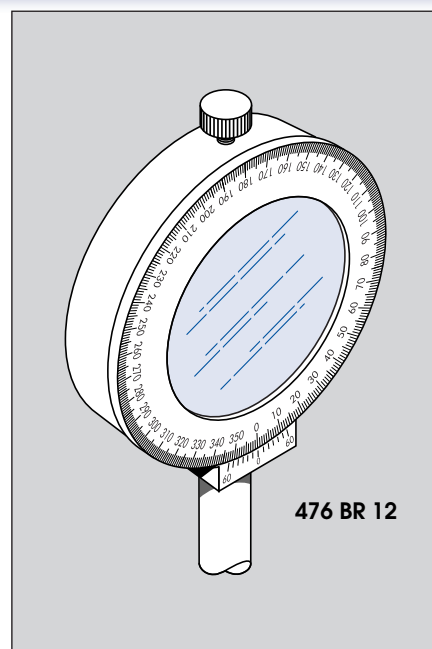
15.7 Graduated rotating holders (precision)

≡Customise 

These rotating holders with scales graduated in 10 divisions allow polarisers etc. to be rotated through accurately measured angles, aided by a vernier reading to 10 arc-minutes. They are available for both 25mm and 50mm diameter components; other sizes can be mounted using lens-size adaptors ([p.56](#)). The rotation can be locked at any desired angle with the clamp screw provided. To mount polarising cubes and similar prisms in these holders see clevis mounts, [p.59](#).

Alternative posts

Direct mount holders have M6 thread to accept posts listed on [p.74](#)



Direct mount holder		Post-mounted holder		Component dia. (mm)	Clear aper. (mm)
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)		
470 BR 00	40	470 BR --*	100	25	23.2
476 BR 00	40	476 BR --*	100	50	48.2

See also:

Polarisers [pp.42-44](#)
 Graduated holders (basic) [p.78](#)
 For rotation about vertical axis [p.84](#)

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

15.8 Graduated rotating holders (basic)

≡Customise

These holders are useful for polarisers, retarders, cylindrical lenses, etc. where an indication of angle is required. For accurate angle measurements the precision models in the previous section are recommended.

The basic holder **460 BR**, with 2° divisions, accepts components 25mm diameter and up to 9mm thick. Smaller sizes can be mounted using lens-size adaptors (p.56). The special variant **462 BR** accommodates

our rod lens range (p.13). Both types have clamp screws to lock the rotation, and knurled retaining rings for easy mounting and replacement of optics without special tools.

The tilting type **464 BR**, with 5° divisions, provides two kinematic tilt adjustments in addition to 360° rotation about the optical axis, and is useful for precise alignment of optics normal to a beam or for deliberate tilting of waveplates to adjust the retardance.

Alternative posts

Direct mount holders have M6 thread to accept posts listed on p.74

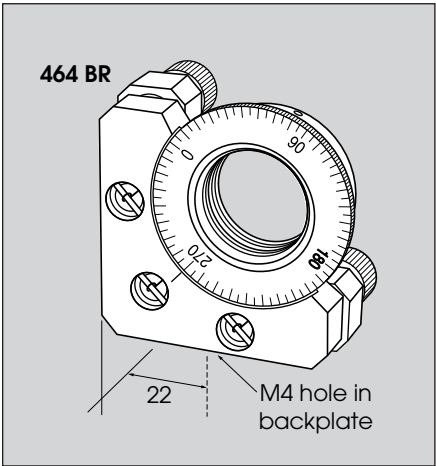
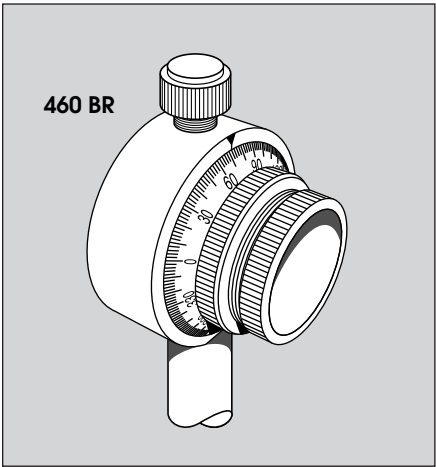
See also:

For greater precision
Goniometers
Polarisers
Retarders
Rod lenses
Cylindrical lenses (circular)

[p.77](#)
[p.68](#)
[pp.42-44](#)
[p.45](#)
[p.13](#)
[pp.12-14](#)

Direct mount holder (no post)			Post-mounted holder		Component held
Catalogue No.	Axis height (mm)	Mounting thread	Catalogue No.	Post length (mm)	
460 BR 00	20	M6	460 BR --*	125	disc 25mm dia. rod 16mm x Ø2-14mm disc 25mm/1" dia
462 BR 00	20	M6	462 BR --*	125	
464 BR 00	32.5	M4	464 BR --*	100	

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm



15.9 Self-centring holders

≡Customise

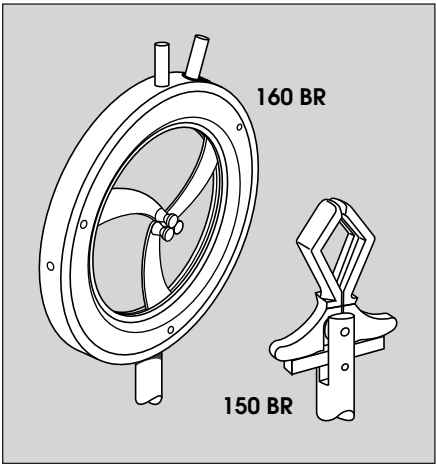
These holders are particularly useful for experimental work, as they accept any circular component within the diameter range stated, and insertion and removal is much quicker than holders with retaining rings.

The three-jaw type centres all components automatically on the same axis. We offer two sizes, covering a very wide range of diameters.

The traditional two-jaw holder, although less bulky and expensive, centres the component only in a horizontal direction and has a more restricted range of sizes.

Direct mount holder		Post-mounted holder		Component diameter (mm)	
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)	Max.	Min. (approx)
3-jaw holders					
158 BR 00	30	158 BR --*	115	36	8
160 BR 00	68	160 BR --*	75	75	10
2-jaw holder					
—	—	150 BR 14†	—	50	18

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm
†13.7mm post only



Alternative posts

Direct mount holders have M6 thread to accept posts listed on p.74

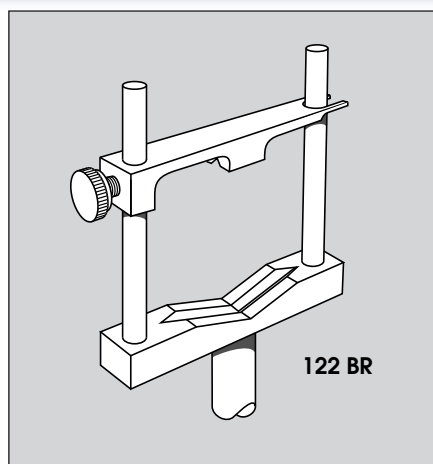
15.10 Sliding-arm lens holders

Customise 

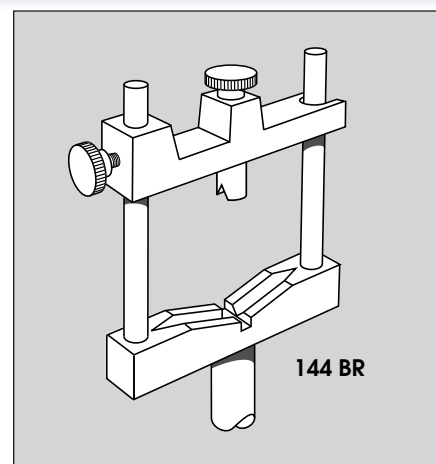
These simple and inexpensive holders grip and automatically centre any circular component in precisely-machined V-grooves and are a necessary item for any optical laboratory.

In the **basic range**, the lens is clamped by sliding the top bar.

Our **spring-loaded** holders have a sprung plastic plunger in the top bar which allows rapid removal and insertion of optics, even of slightly different sizes, without moving the top bar. The larger models have additional tapped mounting holes in the base (see diagram) useful for rigid direct mounting with direct mounting screws, **16 XW 16** - (p.61).



122 BR



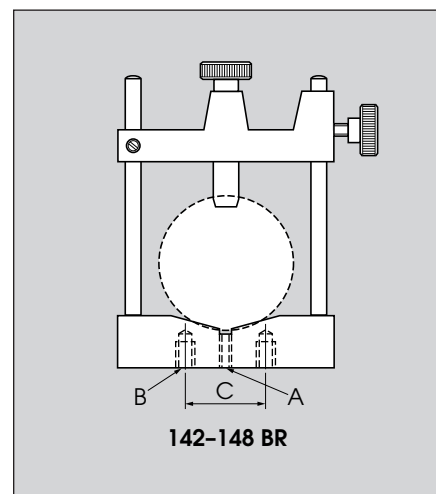
144 BR

Alternative posts

Direct mount holders have M6 thread to accept posts listed on p.74

Direct mount holder (without post)	Post-mounted holder		Max. lens dia. (mm)	Central hole thread A	Side hole thread B	Hole spacing C (mm)
Catalogue No.	Catalogue No.	Post length (mm)				
Basic range						
122 BR 00	122 BR --*	125	64	M6	—	—
124 BR 00	124 BR --*	100	100	M6	—	—
Spring-loaded range						
142 BR 00	142 BR --*	125	30	M4	—	—
144 BR 00	144 BR --*	115	50	M4	M6	25
146 BR 00	146 BR --*	100	75	M6	M6	50
148 BR 00	148 BR --*	100	100	M6	M6	50

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm



142-148 BR

15.11 Sliding-arm filter holders

Customise 

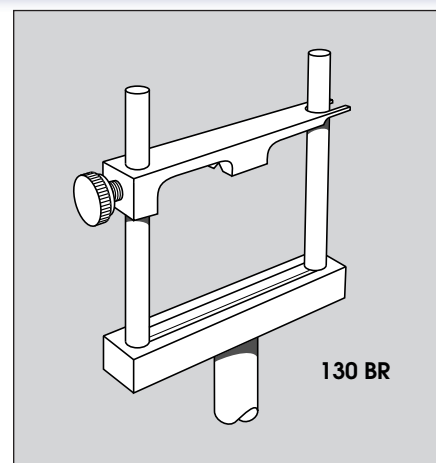
These are similar to the basic lens holders listed above, but have straight lower bars for holding square or rectangular optics up to 6mm thick, such as filters, beamsplitters or cylindrical lenses.

Alternative posts

Direct mount holders have M6 thread to accept posts listed on p.74

Direct mount holder (no post)	Post-mounted holder		Component size (mm)	
Catalogue No.	Catalogue No.	Post length (mm)	Max.	Min. (approx)
130 BR 00	130 BR --*	115	60 x 60	8 x 5
132 BR 00	132 BR --*	100	90 x 90	12 x 5

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm



130 BR

15.12 Edge clamps

Customise

These holders are suitable for screens, filters, Fresnel lenses and any flat straight-sided component up to 6mm thick. Components are held by nylon screws in a black anodised channel section, without marring the surfaces.

The smaller filter holder is particularly suitable for standard 50x50mm filters and has a cut-out to allow a central clear aperture of up to 48mm diameter. The

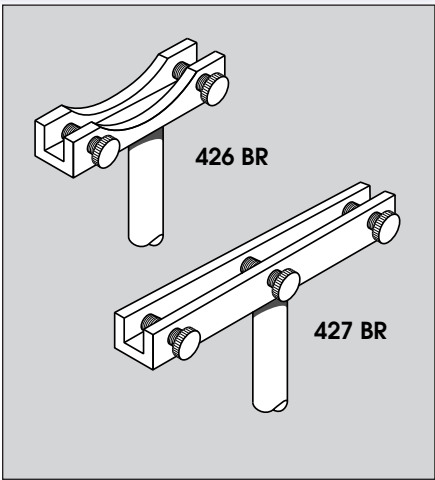
longer screen holder is intended for larger sizes and obscures a 7mm strip along the bottom edge of the component. However both are open-ended and can be used for any size.

Alternative posts

Direct mount holders have M6 thread to accept posts listed on [p.74](#)

Direct mount holder (no post)		Post-mounted holder		Length (mm)	No. of clamp screws	Description
Catalogue No.		Catalogue No.	Post length (mm)			
426 BR 00		426 BR --*	115	50	2	filter holder
427 BR 00		427 BR --*	100	80	3	screen holder

*Select post diameter by inserting 10 for 10mm, 12 for 12mm, 13 for 12.7mm or 14 for 13.7mm



15.13 Filter wheels

Customise

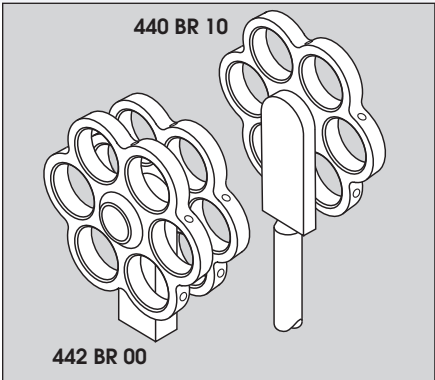
Each wheel holds six filters of either 25mm or 1" (25.4mm) diameter, held in place by nylon grub-screws. The detent mechanism allows very quick changing of filters.

The double wheel allows two filters to be independently selected and placed in

series in the optical path. This is useful, for instance, with neutral filters ([pp.34-35](#)); a suitable selection in each wheel gives up to 36 different possible combination density values.

Direct mount holder (no post)		Post-mounted holder		Type
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)	
440 BR 00	50	440 BR --*	100	single
442 BR 00	50	442 BR --*	100	double

*Select post diameter by inserting 10 for 10mm, 12 for 12mm, 13 for 12.7mm or 14 for 13.7mm



15.14 Holders for camera lenses and filters etc.

Customise

The mounting of camera lenses by their filter threads allows almost all lenses to be accommodated on simple mounts, irrespective of format, and avoids the high cost of special adaptors for bayonet fittings etc. Adaptors for other sizes of filter thread not listed are readily available, please enquire.

Empty camera filter holders, or filter rings,

facilitate easy mounting of filters and windows allowing them to be screwed directly to your camera lens. They are available in the fixed or rotating type, the rotating type being especially useful for mounting polarisers. Other thread sizes not listed are readily available: please enquire.

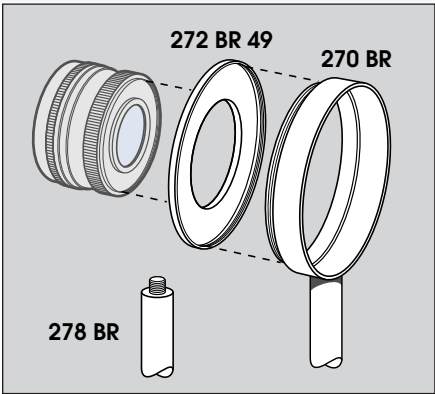
We also list holders for camera bodies, supported by the standard tripod fitting thread, and for C or CS mount lenses. For projector lens supports see Section 15.16 ([p.81](#)).

Holder for camera lenses etc

Catalogue No.	Description
270 BR 00	Holder for lens with 77mm filter thread
270 BR --*	As above with post (100mm long)
272 BR 49	Adaptor for above to accept 49mm thread
272 BR 52	As above, for 52mm thread
272 BR 58	As above, for 58mm thread
274 BR --*	Holder for C-mount or CS-mount lens (with post)
278 BR --*	Post to support camera by 0.25" tripod thread

Empty camera filter holders

Catalogue No.	Catalogue No.	Thread size (mm)
Fixed	Rotating	
40 RF 00	—	40.5
49 RF 00	49 RT 00	49
52 RF 00	52 RT 00	52
55 RF 00	55 RT 00	55
58 RF 00	58 RT 00	58
62 RF 00	62 RT 00	62
67 RF 00	67 RT 00	67



Options available

Other thread sizes not listed to order
Filters, windows etc. can be provided ready-mounted to order
C-mount adaptors

[p.58](#)

*Select post diameter by inserting 10 for 10mm, 12 for 12mm, 13 for 12.7mm or 14 for 13.7mm

15.15 Objective and eyepiece holders

Customise

Our basic microscope eyepiece holder is also listed complete with a Kellner eyepiece (**12 EW 23**, see [p.21](#)). The range also includes a sliding holder allowing the eyepiece to be adjusted over a focusing range of 10mm and clamped in any position. The focusing holder is similar but has a screw movement with 0.7mm pitch allowing fine adjustments of focus.

Microscope objectives have a wide range of uses such as laser focusing as well as the traditional imaging function. Our range of holders includes a sliding type (similar to the sliding eyepiece mount described above), a basic fixed type and a centring type with two orthogonal screw adjustments, allowing the objective axis to be accurately positioned within a 3mm diameter area.

Alternative posts

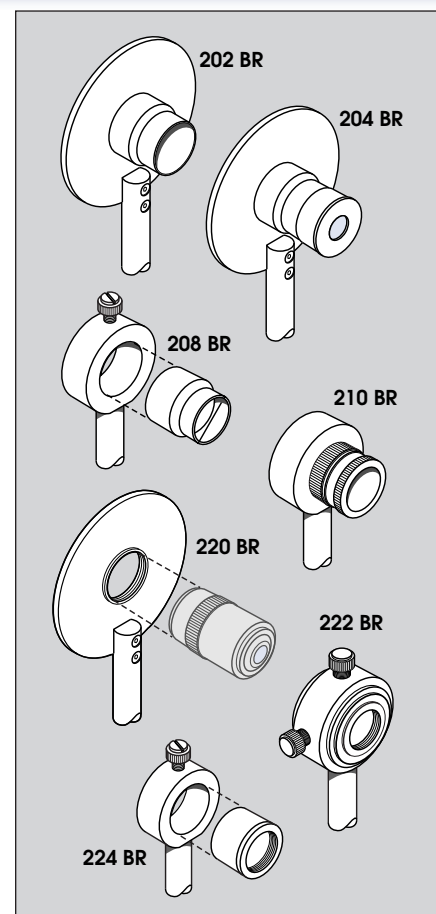
Direct mount holders have M6 thread to accept posts listed on [p.74](#)

See also:

Eyepieces [p.21](#)
Objectives [p.20](#)

Direct mount holder (no post)		Post-mounted holder		Description
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)	
Holders for microscope eyepieces (23.2mm dia.)				
—	—	202 BR --*	—	Basic fixed type
—	—	204 BR --*	—	As above, with 12x Kellner eyepiece (12 EW 23)
208 BR 00	20	208 BR --*	125	Sliding holder, 10mm range
210 BR 00	20	210 BR --*	125	Focusing holder, 9mm range
Holder for telescope/instrument eyepieces (24.5mm dia.)				
214 BR 00	20	214 BR --*	125	Sliding holder, 10mm range
Holders for microscope objectives				
—	—	220 BR --*	—	Basic fixed type
222 BR 00	20	222 BR --*	125	Centring holder
224 BR 00	20	224 BR --*	125	Sliding holder, 10mm range

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm



15.16 Holders for tubes

Customise

Simple fixed tube holders are listed here: if angular adjustments are required, see overleaf.

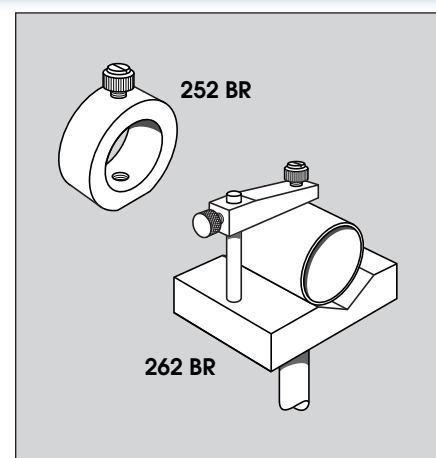
Clamp rings are listed to fit TubeMount elements ([pp.53-59](#)) in all sizes, as well as lens assemblies ([pp.18-19](#)) and standard projector lenses ([p.19](#)).

For other cylindrical devices we list a simple vee-block holder **262 BR**.

All clamp screws are nylon to avoid marring surfaces.

Direct mount holder (no post)		Post-mounted holder		Tube dia. held (mm)	To fit
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)		
Clamp rings					
250 BR 00	15	250 BR --*	125	19	16mm TubeMount cells etc.
252 BR 00	20	252 BR --*	125	28	25mm TubeMount cells etc.
254 BR 00	25	254 BR --*	115	43	40mm TubeMount cells etc.
256 BR 00	30	256 BR --*	115	53	50mm TubeMount cells etc.
Vee-block holder					
262 BR 00	—	262 BR --*	125	2-45	Any tube

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm



Alternative posts

Direct mount holders have M6 thread to accept posts listed on [p.74](#)

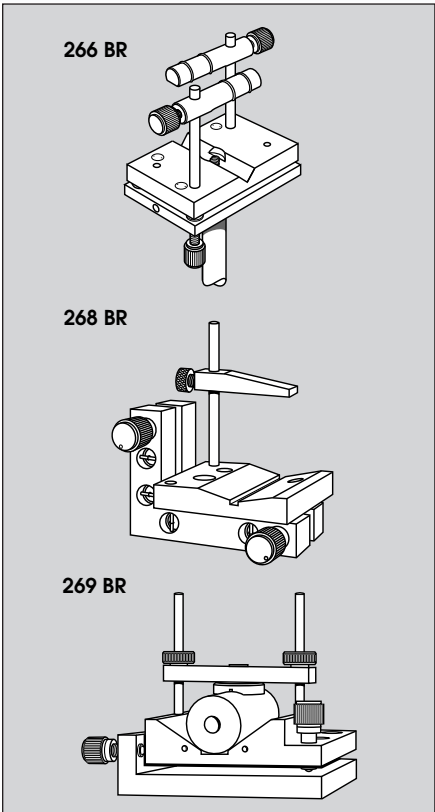
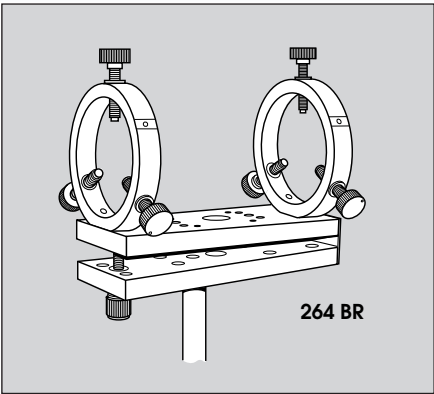
15.17 Laser holders

Customise

These holders support tubular items such as lasers, telescopes and beam expanders and allow for angular adjustments.

The 6-screw holder, **264 BR**, is very suitable for long tubes, as it grips them at two places well apart. The clamp ring positions can be altered to accept shorter tubes. A fine adjustment screw is provided for vertical tilt (pitch) and the clamp screws can be used for other adjustments.

The other models are basically vee-blocks with clamp bars, and each has two angular adjustments. The **266 BR** can be used for prisms etc. as well as tubes, having a horizontal mounting surface, and allows tilt about two horizontal axes (pitch and roll). The other types have the two adjustments needed to align an output beam: pitch for vertical movement and yaw for horizontal.



Catalogue No. Holder without post	Catalogue Post-mounted holder	Tube dia. accepted (mm)	Overall dimensions (mm)	Adjustment range		
				Pitch	Yaw	Roll
264 BR 00	264 BR --*	28-58	133 x 92 x 130	±3°	—	—
266 BR 00	266 BR --*	8-44	51 x 104 x 105	±5°	—	±3°
268 BR 00†	268 BR --*	8-50	52 x 71 x 85	±4°	±3°	—
269 BR 00	269 BR --*	25-50	80 x 112 x 91	±2°	±2°	—

*Post length 100mm. Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm
†Base hole M4 clearance, so needs special post, available on request.

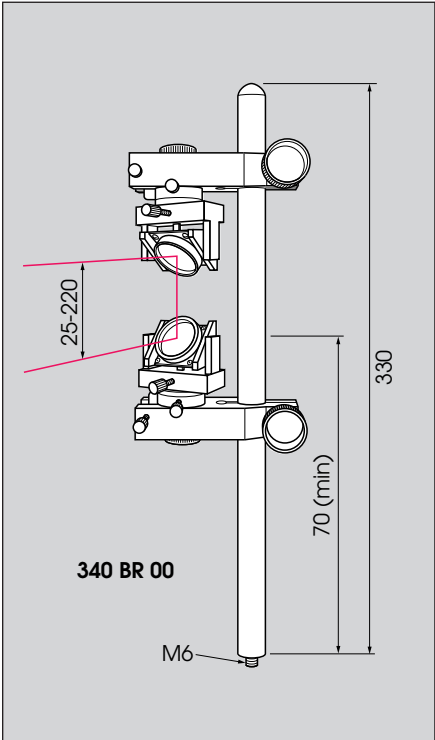
15.18 Beam-steering mirror holder

Customise

This beam-steering assembly is useful for setting both height and direction of a laser beam. It consists of a 16mm diameter rod carrying two mirror holders which can be clamped independently at the required heights. Mirrors are set at approximately 45° and are fully rotatable about a vertical axis. They have fine vertical and horizontal screw adjustments for aiming the beam. Thus an incoming horizontal beam can be redirected in any azimuth at a height up to 220mm above or below the input level, and angled at 15° or more above or below the horizontal.

The unit comes without mirrors, allowing users to select the most suitable mirrors from the wide range listed on [pp.24-26](#). 25mm or 1" diameter mirrors (up to 6.5mm thick) are recommended and can be mounted with the retaining rings supplied; smaller mirrors can be cemented in place. For convenience the mirrors most commonly used are listed below; for full details of coatings see [p.24](#).
The rod has an M6 male thread at the base and screws directly into standard postholder bases ([p.62](#)) as well as breadboards, stages, rail carriers etc.

Catalogue No.	Description
340 BR 00	Beam-steering assembly, without mirrors
Mirrors (25mm dia. flat to $\lambda/4$; for details see p.24)	
25 MX 01	Enhanced aluminium coating (R = 94% peak)
25 MX 02	Visible-99 coating (R = 99%, 450-700nm)
25 MX 05	IR-98 coating (R = 97% average, 700-1064nm)



15.19 Holders for circular mirrors and beamsplitters

Customise 

These mirror holders have 0.35mm-pitch adjustment screws giving smooth kinematic tilt movements about two axes. The type **302 BR** has an additional screw allowing translation of the mirror, for instance to compensate for the translation produced by the tilting screws.

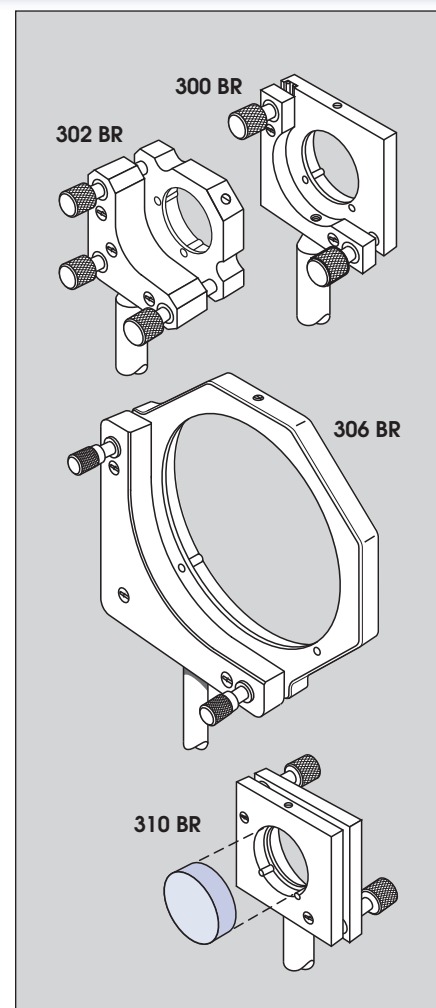
The mirror is held in a counterbored aperture by a nylon setscrew and two nylon inserts. The range accommodates most standard metric and inch sizes of mirror and allows easy mounting and removal. For non-standard or odd-shaped mirrors, and for more compact mounts, see the next section.

The holders have two types of fixed backplate; the L shape is ideal for beamsplitters as minimising the obscuration of the transmitted beam, whilst the square type better protects the mirror from accidental knocks.

- Easy mounting
- Smooth sensitive adjustment

Alternative posts

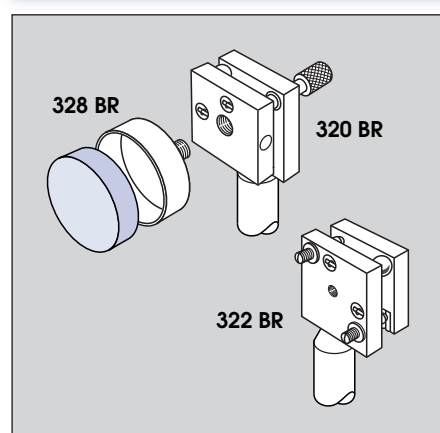
Direct mount holders have M6 thread to accept posts listed on [p.74](#)



Direct mount holder (no post)			Post-mounted holder		Mirror dia. (mm/ inch)	Height x width (mm)	No. of adj. screws
Catalogue No.	Axis height (mm)	Mounting thread	Catalogue No.	Post length (mm)			
'L' backplate							
300 BR 00	28	M4	300 BR --*	115	25/1"	50 x 50	2
302 BR 00	29	M4	302 BR --*	115	25/1"	47 x 47	3
304 BR 00	35	M4	304 BR --*	100	50/2"	69 x 69	2
306 BR 00	73	M6	306 BR --*	75	100	136 x 136	2
Square backplate							
310 BR 00	28	M4	310 BR --*	115	25/1"	50 x 50	2
314 BR 00	35	M4	314 BR --*	100	50/2"	69 x 69	2

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

15.20 Universal mirror holders

Customise 

These holders have a solid carrier onto which any size or shape of mirror may be mounted by cementing. The adhesive listed is a flexible type to minimise induced strain.

The miniature 25 x 25mm holder, invaluable for compactness in crowded layouts, has the option of slotted set-

screws instead of knob adjusters, discouraging unauthorised or inadvertent movements. It also takes a screw-in cell to hold 25mm diameter mirrors, allowing several mirrors to be interchanged on the same holder without re-cementing.

- Compact and versatile

Direct mount holder (no post)		Post-mounted holder		Mirror carrier dims. (mm)	Description
Catalogue No.	Mounting thread	Catalogue No.	Post length (mm)		
320 BR 00	M4	320 BR --*	125	25 x 25	Holder with knob adjusters
322 BR 00	M4	322 BR --*	125	25 x 25	Holder with slotted screws
324 BR 00	M4	324 BR --*	115	48 x 48	Holder with knob adjusters
Accessories					
328 BR 25	(M6 male)	—	—	Ø26	Cell for mirror 25mm dia.
02 QL 50	—	—	—	50ml	Adhesive, structural acrylic, 2-part kit

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

15.21 Prism tables

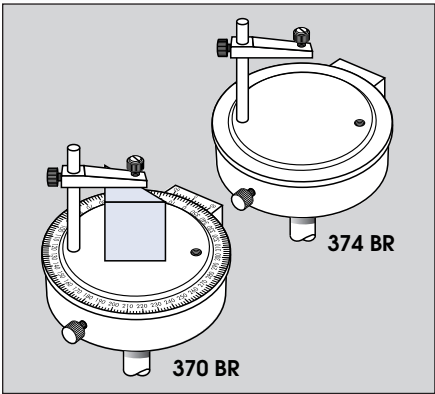
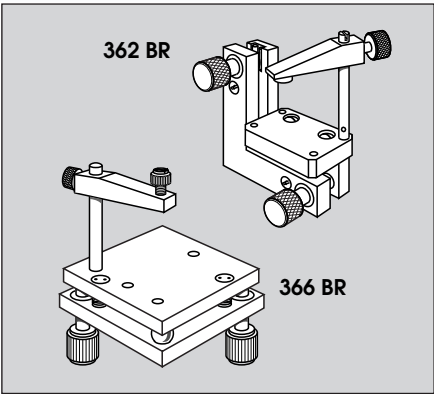
Customise

These tables with adjustable clamp arm are suitable for prisms, gratings, beamsplitters, rectangular mirrors, etc. and include both tilting and rotating types.

Tilting tables provide kinematic tilt adjustments about two axes. The **362 BR** accommodates prisms up to about 25mm and has rotations about the vertical and one horizontal axis. The **366 BR** has rotations about two horizontal axes and is suitable for larger items.

Rotating tables provide 360° of rotation about the vertical axis. The **370 BR** has an angular scale with 1° divisions and a vernier reading to 10'. **374 BR** is a simple rotating table without scale. Both have clamp screws to lock the motion. The thickness of 17.5mm brings a 25mm prism to the standard axis height of 30mm, matching other holders (see [p.74](#)).

The adjustable clamp arm, as included with these tables, is also available separately (**380 BR 00**).



Direct mount holder (no post)			Post-mounted holder		Platform size (mm)
Catalogue No.	Mounting thread	Platform height (mm)	Catalogue No.	Post length (mm)	
Tilting tables					
362 BR 00	M4	25.5	362 BR --*	100	38 x 25
366 BR 00	M6	20.5	366 BR --*	100	48 x 48
Rotating tables					
370 BR 00	M6	17.5	370 BR --*	115	Ø56
374 BR 00	M6	17.5	374 BR --*	115	Ø56
Clamp arm					
380 BR 00	(M4)	—	—	—	—

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

Alternative posts

Direct mount holders have M6 thread to accept posts listed on [p.74](#)

See also:

Tube/prism holder (266 BR) [p.82](#)
Rotation stages [p.p.67,68](#)
Tilt stages [p.69](#)

15.22 Iris diaphragms in holders

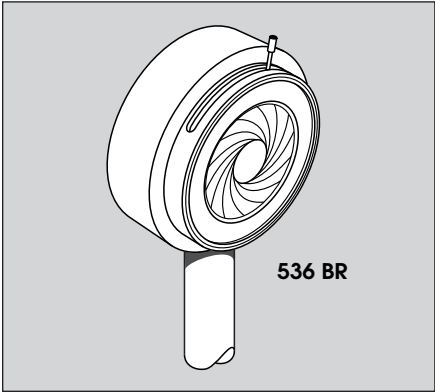
Customise

Iris diaphragms are offered here post-mounted for use on optical benches etc. or with M6 base thread for direct mounting.

See also:

Unmounted irises [p.47](#)
TubeMount irises [p.58](#)
Fixed apertures [p.48](#)

Direct mount holder (no post)		Post-mounted holder		Aperture size range (mm)
Catalogue No.	Axis height (mm)	Catalogue No.	Post length (mm)	
Iris diaphragms				
532 BR 00	20	532 BR --*	125	0.8-15
534 BR 00	25	534 BR --*	115	1.2-28
536 BR 00	30	536 BR --*	115	1-34



Alternative posts

Direct mount holders have M6 thread to accept posts listed on [p.74](#)

*Select post diameter by inserting **10** for 10mm, **12** for 12mm, **13** for 12.7mm or **14** for 13.7mm

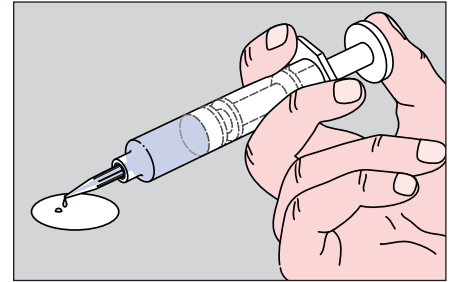
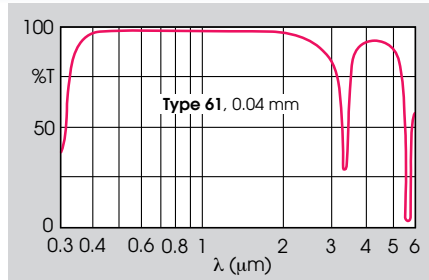
16.1 Adhesives and dispensers

The Norland range of optically clear **UV-curing** adhesives are very convenient in use, requiring no mixing or preparation. Unlimited time is available for alignment before curing with long-wave UV light. We list four types:

- 61** – for general optical use, to MIL-A3920
- 63** – for UV transmission down to 350nm
- 65** – very flexible to minimise induced strain
- 68** – especially for plastics

Our low-friction **dispenser** syringe is highly recommended from experience in our own workshops for economical application of all types of adhesive. Unlike a hypodermic syringe it allows very precise control of the deposit and requires very little effort. No cleaning is necessary as the barrel, tip etc. are disposable.

Our **structural acrylic** adhesive is a flexible type recommended for mounting of mirrors etc. where the joint does not need to transmit light, and also for mechanical assembly of optical mounts. The activator is applied to one part and the adhesive to the other. Order as **08 QL 50** 50ml adhesive + 18ml activator.



Norland UV-curing adhesives

Catalogue No. 28g bottle	Norland type	Adhesion* to			Viscosity at 25°C (mPa s)	Index (cured)	Modulus of elasticity (N/mm ²)
		Glass	Metals	Plastics			
61 QL 28	61	E	E	F	300	1.56	930
63 QL 28	63	G	G	F	2000	1.56	165
65 QL 28	65	G	G	F	1200	1.52	140
68 QL 28	68	E	G	G - E	5000	1.54	140

* F = Fair; G = Good; E = Excellent

Dispenser system

Catalogue No.	Description
01 QD 01	Dispenser kit, comprising reusable plunger, barrel with piston and cap, 2 fine and 2 coarse tips
02 QD 01	Replacement barrel with piston and cap
02 QD 10	Replacement barrel etc. as above, pack of 10
10 QD 10	Pack of 10 fine tips (0.4mm bore)
15 QD 10	Pack of 10 coarse tips (0.8mm bore)

16.2 Cleaning supplies

'First Contact' liquid replaces the 'Opticlean' liquid which is no longer available. The product is virtually identical and is equally effective. This remarkable liquid is painted or sprayed onto the surface and cures to a solid film. This is then stripped off carrying away any contaminants and leaving an extremely clean surface. Very delicate surfaces can be cleaned in situ, but a prior trial on a scrap sample is recommended. May damage some plastics. The product is offered either clear or red dyed, the latter making any residual film more apparent.

For conventional cleaning, our Comar Optics Cleaner used with our Microfibre Cloth gives excellent results, especially on coated surfaces. The 'Selvyt' is an alternative cloth of long-standing reputation and is often used with

moisture condensed from breath.

If disposable wipes are preferred, we offer the well-known 'Whatman' lens tissue.

The air duster is an invaluable tool for

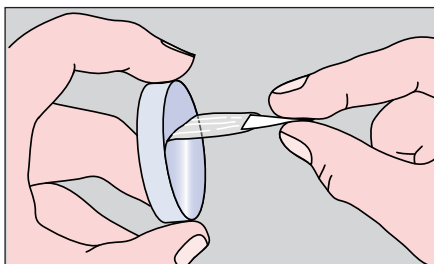
removing loose dust or grit without scratching surfaces.

'First Contact' polymer film cleaner

Catalogue No.	Total pack size	Colour	Description
82 QC 15	15ml	Clear	'First Contact' bottle with brush, and 12 peel tabs
82 QC 73	73ml	Clear	As above plus 2x29ml refill bottles, plus 48 extra peel tabs
82 QC 150	150ml	Clear	Pack of 10x15ml bottles with brush, and 120 peel tabs
83 QC 15	15ml	Red	'First Contact' bottles with brush and 12 peel tabs
83 QC 73	73ml	Red	As above plus 2x29ml refill bottles, plus extra 48 peel tabs
83 QC 150	150ml	Red	Pack of 10x15ml bottles with brush and 120 peel tabs
84 QC 29	29ml	Clear	'First Contact' in spray bottle with 16 peel tabs
85 QC 29	29ml	Red	'First Contact' in spray bottle with 16 peel tabs
86 QC 100	100 No	-	Pack of peel tabs
88 QC 174	174ml	-	Pack of 6x29ml bottles of 'First Contact' thinner

General cleaning materials

Catalogue No.	Pack size	Description
10 QC 254	1 No	Selvyt washable cotton polishing cloth 254 x 254mm
20 QC 178	1 No	Comar Microfibre Cloth, washable 178 x 178mm
60 QC 25	25 No	Whatman 105 lint-free lens tissue, 150 x 100mm
70 QC 100	100 No	Whatman 105 lint-free lens tissue, 300 x 200mm
90 QC 29	29ml	} Comar optics cleaner, water based Fluid in pump spray bottles
90 QC 236	236ml	
110 QC 400	400ml	Air duster (compressed gas in can)



- AR coating 3
- on glass sheets 32
- Aberration calculation 2
- Achromatic doublets 16, 17
- objectives 20
- relay lenses 18
- retarders 44
- Acrylic, data 2
- fibre 49
- filters 37
- lenses 9, 14-16
- screens 33
- Adaptors
- camera lens/body 58, 80
- eyepiece 58
- fibre optic 49, 58
- gender (connectors) 57
- LED; laser 58
- lens-size 56
- microscope 58
- objective (RMS) 58
- rotating (connectors) 57, 74
- stage 63-65
- thread-size 57, 74
- Adhesives 85
- dispensers for 85
- Air duster 85
- Anti-Newton glass 33
- Antireflection coating 3
- on glass sheets 32
- Apertures 48
- Aplanatic doublets 17
- Arm, clamp 84
- Aspherics 14-16
- Attenuators 34, 35
- Axis heights 74
- Ball lenses 7
- Bar gratings 46
- Bars, subframe 60
- Bases 61, 62
- direct-mounting 61
- lamp 51
- magnetic 62
- postholder 62
- rod 70
- Baseplates 60, 61
- Beam dividers 30
- Beam expanders 23
- lenses for 6, 10
- Beamsplitters
- cube 27
- dichroic 39
- Fresnel 30
- holders for 83
- plate 28, 35
- polarising 42
- Beam-steering holders 82
- Blank adaptor 58
- plugs 58
- Boxes, storage 3
- Brackets 65
- swivel 70
- Breadboards 60
- Bulbs 50
- Bundles, fibre 49
- C-mount/CS-mount
- adaptors 58
- camera/lens 22
- microscopes 22
- Cable, fibre optic 49
- Calcite 42
- Camera (lens)
- adaptors 58
- Empty filter holders 80
- Filter rings 80
- holders 80
- microscopes 22
- Capsule lamps 50
- Carriers
- rail 72-73
- rod system 70
- Cells
- lens 54-57
- mirror 83
- post-mounted, see Holders
- Cements 85
- Centring holders 76
- - objective 81
- Charts, resolution 46
- Clamp arm 84
- rings 81
- - for posts (collars) 74
- Clamps, cross 74
- edge 80
- Cleaning supplies 85
- Clevis mounts 59
- Cloths 85
- Coating options 3
- Coatings, AR 3
- conductive (ITO) 32
- mirror 24
- Collars 74
- Collimators 22
- fibre 49
- laser diode etc. 14
- lens combinations 19
- Comar Microfibre Cloth 85
- Optics Cleaner 85
- Component holders 74-84
- Condensers
- aspheric 15
- assemblies 18, 19
- fibre 52
- lamphouse 52
- large 9
- UV 19
- Connectors 57
- cross, tee etc. 59
- rotating 57
- see also Adaptors
- Corner cubes 30
- Cross connectors 59
- clamps 74
- Cube connectors 59
- Cubes, beamsplitter 27
- corner 30
- polarising 42
- Cuvettes (cells) 33
- Cylindrical lenses 12-14, 16
- Diaphragms, see Iris
- Dichroics 38, 39
- polarisers 43, 44
- reflector lamps 50
- Diffraction gratings 46
- Diffusers 33
- Diodes (LEDs) 52
- Direct mounting 61
- - carriers 72, 73
- Dispensers 85
- Doublets 16, 17
- Duster, air 85
- Edge clamps 80
- Elbow connector 59
- Elevation stages 66
- End plugs 58
- Eyepieces 21
- adaptors 58
- graticules 47
- holders 81
- post-mounted 81
- Expanders, beam 23
- Feet for, breadboard 60
- Fibre
- adaptors 58
- condensers 52
- Filters, acrylic 37
- band-pass 36, 41
- colour 36-38
- dichroic 38
- display 44
- eye-response 36
- gelatin 34, 37
- glass 34, 36, 38
- graduated 35
- heat 38
- holders for 79, 80
- interference 39-41
- laser-line 39-41
- long-pass 36-38
- metallic 35
- neutral 34, 35
- plastic 37
- polarising 43, 44
- short-pass 36, 38
- variable 35
- Flashed opal 33
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55
- Flatness specifications 2
- Flats 25
- Float glass, data 2
- - windows 32
- Fluid, cleaning 85
- Focusing holders 76, 81
- lamps 50
- lens cells 57
- lens combinations 19
- lenses (fibre) 49
- Fresnel beam dividers 30
- lenses 16
- prisms 30
- rhombs 44
- Fused silica - see Silica
- Glass data 2
- Goniometers 68
- Graticules 47
- Gratings 46
- Ground glass 33
- Guides, light 49
- Half-wave plates 45
- Heat-control optics 38
- Height adjustment, see Vertical adjustment
- Heights, axis 74
- Holders (see also Cells)
- beamsplitter 83
- camera (lens) 80
- centring 76, 81
- component 74-84
- eyepiece 81
- filter 79, 80
- focusing 76, 81
- lens 75-81
- mirror 82, 83
- prism 84
- ring-mounted 75
- rod-lens 77
- screen 80
- self-centring 78
- sliding-arm 79
- 3-jaw 78
- tube 81, 82
- IR-98 coating 24
- ITO coated windows 32
- Illuminator, fibre 49
- see also Lamphouses
- Immersion oil 20
- Iris diaphragms 47
- - in holders 84
- - post-mounted 84
- - TubeMount 58
- Jacks, lab 66
- LEBG, data 2
- lenses 9
- windows 31
- LED adaptors 58
- lamphouses 52
- Lab jacks 66
- Lamp inserts 52
- Lamps 50
- Lampholders 51
- Lamphouses, LED 52
- tungsten-halogen 51
- see also Illuminator
- Laser adaptors 58
- beam-expanders 23
- holders 82
- lenses 6, 10, 14, 20
- Lens holders and cells, see Holders and
- Cells/Lens-size adaptors 56
Lenses 4-21
- achromatic 16-18
- aplanatic 17
- aspheric 14-16
- ball 7
- borosilicate 9
- collimator 14, 19, 49
- commercial grade 8, 14
- wheel for 80
- Watten 37
- 'First Contact' cleaner 85
- Flanged cells and tubes 55

Part number Index

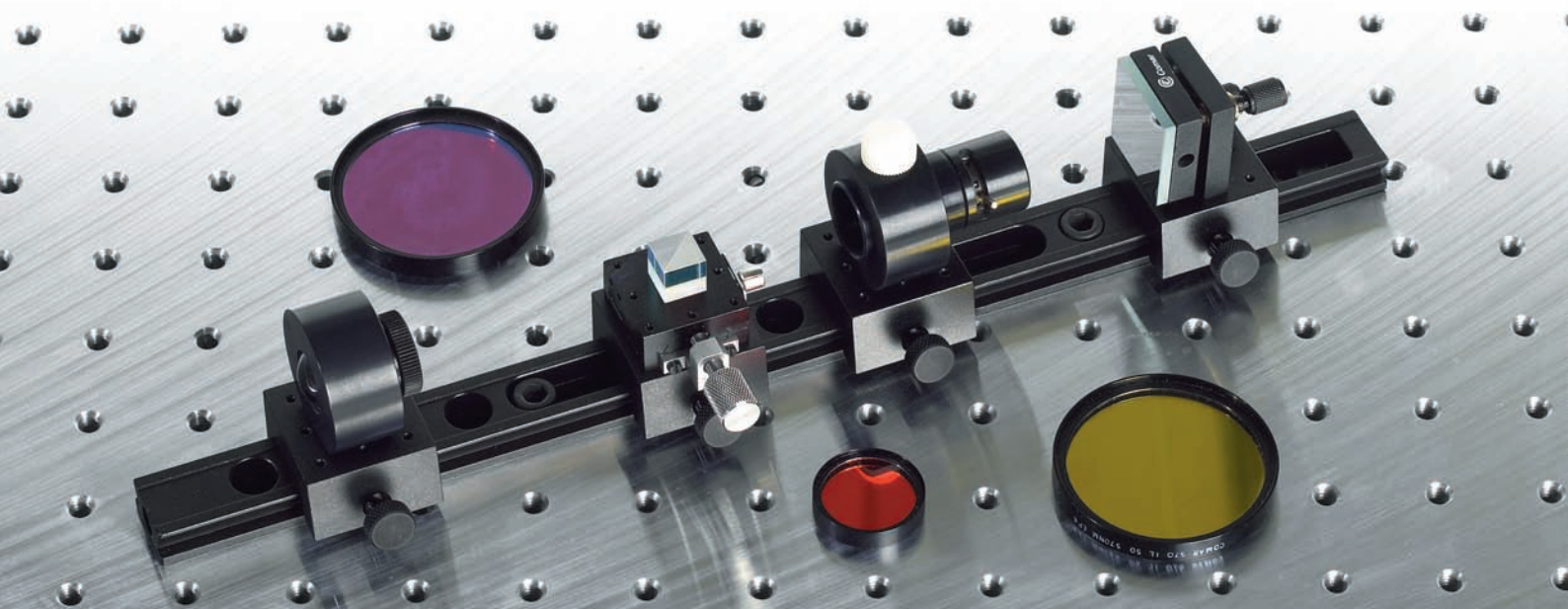
Part number index by letter pair. To search for a part number use the pair of letters in the middle of the part number (e.g. for 25 PQ 10, look under 'PQ').

AF	15	DP	46	GR	45	JL	42	MU	55	RD	46	VL	43
AP	14, 15	DQ	17	GS	31	JM	31	MV	26	RF	80	VP	9
AQ	14	DR	33	GT	33	JO	11	MW	54, 56	RM	70	VQ	5, 7
AY	37	DS	33	GU	32	JP	42	MX	24, 82	RQ	29	VS	7
BA	28	EE	21	GV	32	JQ	27	NB	10	RR	72, 73	VU	7
BB	39	EF	21	GW	32	JR	44	NQ	10	RS	29	WB	37
BD	28	EK	21	GY	36	JW	30	NS	11	RT	80	WL	43, 44
BH	61, 62	EM	21	HC	76	KQ	30	NT	10	RU	46	WN	34
BI	28	EO	21	HD	75	KX	30	NU	11	RX	29	WO	44
BJ	28	EW	21	HF	76	LD	52	NX	10	SN	35	WR	45
BK	38, 39	EZ	21	HG	48	LE	50	OA	20	SQ	27	WS	34
BL	28	FA	49, 58	HL	48	LH	51, 52	OD	20	SR	27	WY	37
BM	62	FB	49	HM	48	LK	50	OI	20	TA	18	XB	55
BN	28	FC	49	HN	35	LL	50	OL	20	TC	52	XC	59
BP	60, 61	FD	30	HP	48	LM	51	OM	20	TE	23	XE	56
BQ	28	FL	49	HR	75	LP	50	OP	20	TI	19	XF	57
BR	74, 77-84	FP	49	HS	48	LU	50	OS	20	TM	58	XM	71
BT	28	FQ	16	HT	77	MA	57, 58	OX	20	TQ	19	XR	57
BV	28	FS	49	HV	35	MB	54	PB	4, 5	TS	19	XS	74
BW	28	FW	30	HX	76	MC	26	PC	8	TT	18	XT	63-69
BX	28	FY	16	IB	38	MD	25	PH	9	TU	22	XU	55
BY	39	GA	31	IC	47	ME	25	PI	4	TX	19	XW	60-63, 72
CA	43	GB	36	IH	40	MF	24, 25	PK	4	TZ	23	XX	59
CB	37	GC	32	IK	38	MG	26	PP	9	UB	12	YB	12
CL	43	GE	32	IL	40	MH	26	PQ	4, 5, 9	UC	14	YC	14
CM	45	GG	47	IM	38	MI	26	PS	7	UO	13	YD	12
CO	44	GH	31	IN	40	MJ	25	PT	4	UQ	12	YE	12
CY	37	GI	32	IO	8	MK	26	PU	7	US	12	YM	13
DA	33	GJ	32	IT	6	ML	54	PX	4, 6	UU	12	YO	13
DC	16	GK	36, 38	IU	40, 41	MN	26	QB	3	VA	7	YQ	12
DF	33	GL	32	IW	40, 41	MO	58	QC	85	VB	5	YR	13
DG	46	GM	32	IX	6	MP	26	QD	85	VC	8	YS	12
DH	33	GN	34	IY	38	MQ	25	QL	83, 85	VE	43	YU	12
DI	46	GO	32	IZ	47	MR	56	QO	20	VF	9		
DN	17	GP	32	JD	29	MS	54	QS	2	VI	5		
DO	33	GQ	32	JE	31	MT	26	RC	72, 73	VK	5		

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