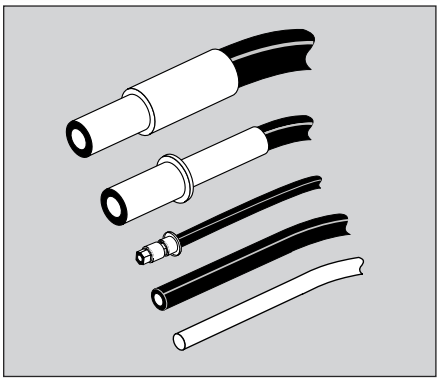
10.1 Optical fibres and light guides

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

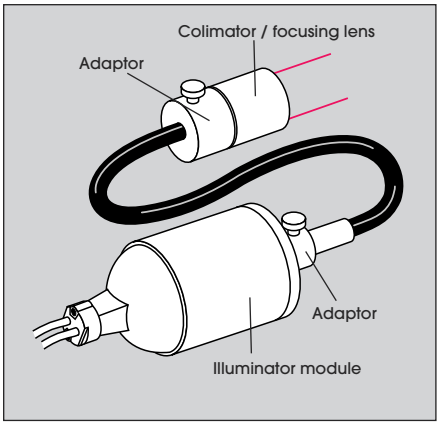
Customise

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

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

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 modificaton

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10.3 Tungsten-halogen lamps

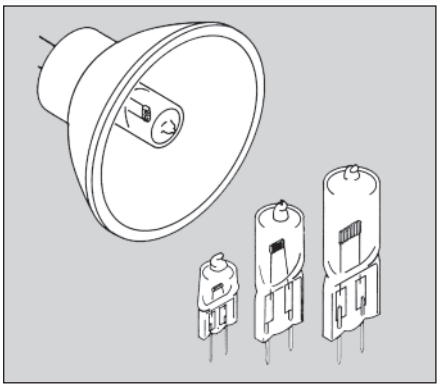
Our **capsule** lamps (without reflectors) have compact straight coil filaments positioned accurately with respect to the base – essential features for optical applications. Note that lamps offered elsewhere, nominally equivalent to these, are not necessarily made with the same accuracy. Some types include 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 $\propto V^{-12}$
Wattage $\propto V^{1.5}$
Output $\propto V^{3.5}$



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

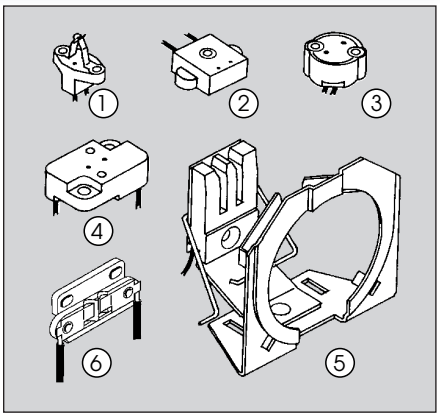
10.4 Lampholders

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.



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

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

10.5 Tungsten-halogen lamphouses

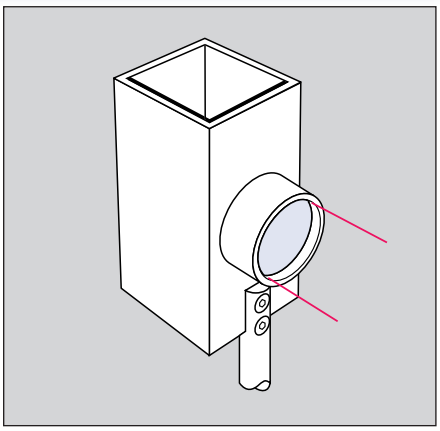
≡Customise

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.

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10.6 LED lamphouses

≡Customise

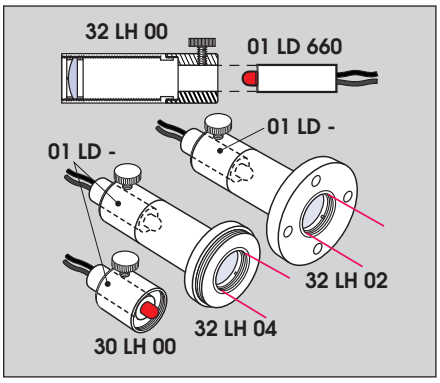
LEDs are now intense enough to be useful for many illumination tasks. A great variety of LED lamphouses can be made up using our interchangeable bodies and lamp inserts listed.

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 $2\theta_{\frac{1}{2}}$	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

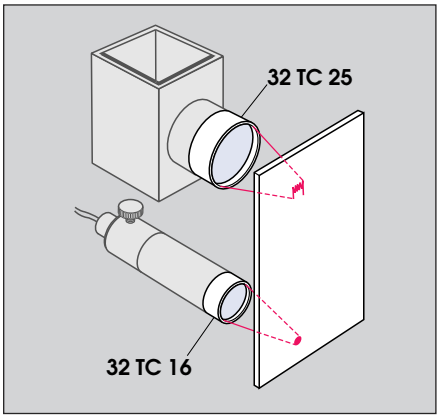
≡Customise

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