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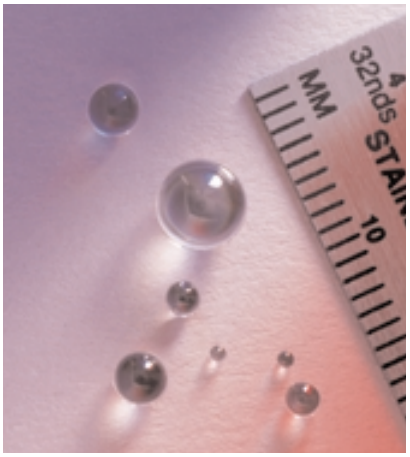
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Fiber Coupling Optics



Spherical Ball Micro Lenses

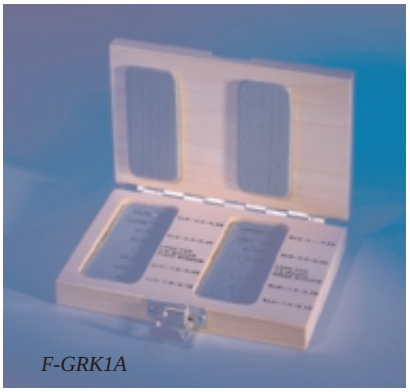
Spherical Ball Micro Lenses are commonly used for: laser collimating and focusing; laser-to-fiber coupling; fiber-to-fiber coupling; and fiber-to-detector coupling. Four diameters are available—1, 2, 3, and 5 mm. Larger spheres are easier to handle and ease the sensitivity of translational alignment. However, smaller spheres fit into smaller packages. The addition of a broadband MgF_2 antireflection coating centered at 830, 1300 or 1550 nm results in a highly efficient lens due to the high refractive index of the glass. Coupling efficiency is generally >90% due to the simplicity of these lenses.



Gradient Index Micro Lenses

Gradient Index Micro Lenses have a radially varying index of refraction that causes an optical ray to follow a sinusoidal propagation path through the lens. They combine refraction at the end surfaces along with continuous refraction within the lens.

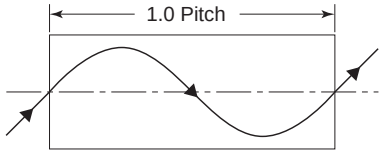
A lens is said to have a pitch of 1.0 if its length is such that a ray completes one sinusoidal period in traveling through the lens.


F-GRK1A

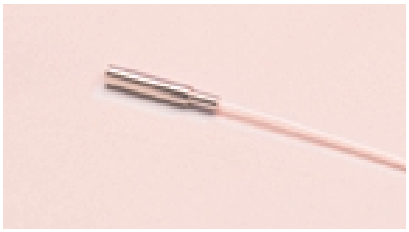
Newport's **F-GRK1A** set features a comprehensive selection of six different kinds of gradient index lenses and an informative, applications-oriented instruction manual of interest to the beginner as well as the expert.

The F-GRK1A includes lenses of three different pitches. The 0.25-pitch lenses collimate a point source or focus a collimated beam. Two 0.25-pitch lenses in series are commonly used for fiber-to-fiber coupling. The 0.29-pitch lenses take a diverging beam from a source or fiber and convert it to a converging beam that may be imaged on a fiber or detector. The 0.15-pitch lenses collimate the diverging beam from a packaged laser diode source allowing a 1 mm working distance to accommodate the diode package constraints.

Ray Path in Gradient Index Micro Lenses



Fiber Pigtailed Collimators *see page 267.*



Specifications

F-GRK1A

Quantity	Pitch	Applications	NA	Diameter (mm)	Focal Length (mm) @ λ (nm)
2	0.29	Laser–Fiber and Fiber–Detector Coupling	0.46	1.8	1.95 @ 830
2	0.29	Laser–Fiber and Fiber–Detector Coupling	0.46	1.8	1.98 @ 1300
4	0.25	Fiber–Fiber Coupling	0.46	2.0	2.10 @ 830
4	0.25	Fiber–Fiber Coupling	0.46	2.0	2.13 @ 1300
1	0.15	Laser Diode Collimating	0.60	1.8	1.78 @ 830
1	0.15	Laser Diode Collimating	0.60	1.8	1.81 @ 1300

Antireflection Coating: Multilayer, R≤ 0.25% per surface, λ ±15 nm

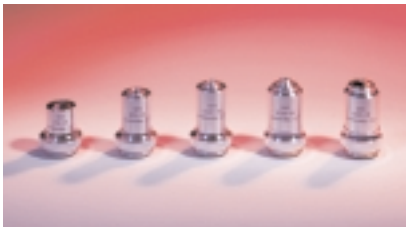
Ordering Information

Model	Description
F-GRK1A	Gradient Index Lens Set

Please see the Optics Section for specifications and ordering information of our large selection of individual Gradient Index Micro Lenses optimized for operation at 630, 830, 1300 and 1560 nm wavelengths.

Key Features

- *Ideal for collimating or focusing*
- *Diffraction limited performance*
- *AR coated for high transmission*
- *Excellent wavefront quality*
- *Corrected for laser diode cover glass*
- *Microscope objective-type housing*



Please see the Optical Systems Chapter for our complete line of microscope objectives and infinity corrected objectives, compatible with our Single-Mode and Multimode Fiber Couplers.

Laser Diode Objective Lenses



These objective lenses have been specially designed for collimating and focusing laser diodes as well as fiber coupling. Since laser diodes have very large beam divergence, we offer various high numerical aperture lenses. Multiple focal lengths are available so you can optimize your collimated beam diameter. These lenses have all been corrected for the standard laser diode cover glass. We offer both multi-element and aspheric lenses.

Our multi-element lenses are precision optics with diffraction limited performance. They offer the best solution for more critical applications. Each is antireflection coated to maximize transmission. The F-L40B has a triple V-coating for peak transmission at 800, 1300, and 1550 nm.

The F-L20B has a large clear aperture for collimated beams up to 9 mm.

Our aspheric lenses are diffraction-limited molded glass lenses with typical wavefront quality better than λ/20 rms. Each is antireflection coated with MgF_2 centered at 780 nm for maximum transmission. These lenses offer an economical solution without sacrificing performance.

Ordering Information

Model	Wavelength (nm)	Numerical Aperture (NA)	Focal Length (mm)	Clear Aperture (mm)	Working Distance (mm)	Cover Glass Thickness Correction (mm)	Transmission			
							800 nm	1060 nm	1300 nm	1550 nm
Multi-element Lenses										
F-L20B	760–880	0.55	8.18	9.0	1.9	ALL/n = 1.5	93%	90%	80%	72%
F-L40B	750–850	0.47	4.50	4.5	2.3*	0.3/n = 1.5	>97%	94%	>97%	>97%
F-L10B	850–1550	0.25	12.00	5.0	6.0	ALL/n = 1.5	94%	94%	94%	94%
Aspheric Lenses										
F-LA15	460–1550	0.50	2.00	2.0	0.7*	0.25/BK 7	94%	94%	92%	88%
F-LA11	510–1550	0.40	6.24	5.0	3.0*	0.275/BK 7	93%	93%	91%	87%
F-LA17	430–1550	0.30	6.16	3.7	4.4*	0.275/BK 7	94%	94%	92%	88%
F-LA22	350–1550	0.25	11.00	5.5	7.5*	0.25/BK 7	93%	93%	91%	87%

* Working distance includes the cover glass thickness.

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