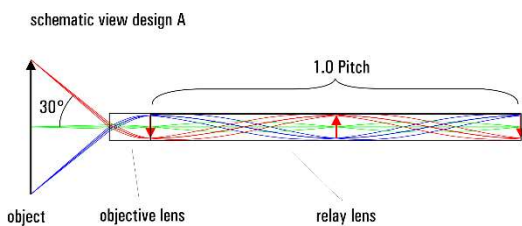


## GRIN Endoscopic Rod Lens Systems

**GRIN endoscopic systems**, which combine a GRIN objective lens, a GRIN relay lens and a GRIN eyepiece. Combining the system with a prism enables the change of the direction of view. Standard diameters are 0.35, 0.5, 1.0 and 2.0 mm. We offer the systems in two different principle design options:

### Design A:

The objective lens creates a reduced intermediate image at the exit surface of the objective lens, which will be imaged by the relay lens 1:1 (if the lens length of the relay lens is a multiple of the period) or - 1:1 (if the lens length of the relay lens is an odd multiple of the half period) to the exit surface of the relay lens.



possible working distances (please specify):

0.35 mm diameter: 5 mm,

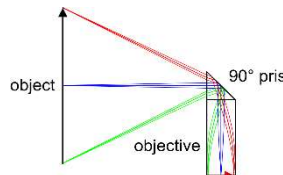
0.5 to 2.0 mm diameter: 5 mm, 10 mm and infinity

other working distances on request

possible pitch lengths:

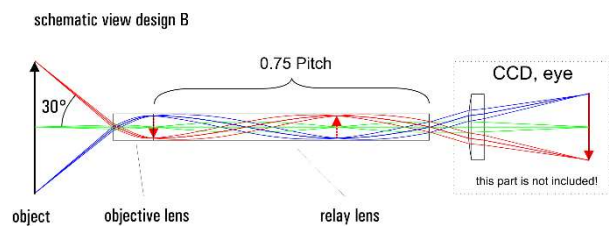
diameter	Relay pitch	System length [mm]	Image orientation
0.35	0.5	approx. 8.2	inverted to like design A
	1.0	approx. 15.7	like design A
	1.5	approx. 23.1	inverted to like design A
0.50	0.5	approx. 16.3	inverted to like design A
	1.0	approx. 31.4	like design A
	1.5	approx. 46.5	inverted to like design A
1.00	0.5	approx. 24.7	inverted to like design A
	1.0	approx. 47.0	like design A
	1.5	approx. 69.4	inverted to like design A
2.00	0.5	approx. 55.5	inverted to like design A
	1.0	approx. 105.8	like design A
	1.5	approx. 156.0	inverted to like design A

Both versions are available with a 90° change of view by attaching a prism to the objective.



### Design B:

The objective lens creates a reduced intermediate image at the exit surface of the objective lens, which will be imaged by the relay lens at infinity. Such a lens system is a complete endoscopic imaging system. It allows the direct observation with the human eye or the use of a conventional camera system (including camera lens): camera and camera lens are not included!



possible working distances (please specify):

0.35 mm diameter: 5 mm,

0.5 to 2.0 mm diameter: 5 mm, 10 mm and infinity

other working distances on request

possible pitch lengths:

diameter	Relay pitch	System length [mm]	Image orientation
0.35	0.75	approx. 12.0	like design B
	1.25	approx. 19.4	inverted to like design B
	1.75	approx. 26.9	like design B
0.5	0.75	approx. 23.8	like design B
	1.25	approx. 38.9	inverted to like design B
	1.75	approx. 54.0	like design B
1.00	0.75	approx. 35.9	like design B
	1.25	approx. 58.2	inverted to like design B
	1.75	approx. 80.6	like design B
2.00	0.75	approx. 80.7	like design B
	1.25	approx. 130.9	inverted to like design

Order example:

GT – ERLS – d – wd – p	
GT	GRINTECH
ERLS	Endoscopic Rod Lens System
d	Diameter: 0.35, 0.50, 1.00 or 2.00 mm
wd	Working distance: 5, 10 mm or infinity
p	Relay pitch: 0.50, 0.75, 1.00, 1.25, 1.50 or 1.75

For tolerances, handling and storage see page 28

We are happy to advise you. Please contact us.

## Tolerances / Handling Instructions

### Tolerances:

For of our single lenses we have the following fabrication tolerances and quality criteria:

#### Tolerances:

lens length  $z_L$ :  $\pm 5\%$  due to variations of the gradient constant  
 working distance  $s$ :  $\pm 0.02$  mm (only LFRL- and CFRL lens series)  
 diameter  $d$ :  $+ 0 / -0.01$  mm  
 - tighter diameter tolerances on request

#### Surface quality:

5 / 3 x 0.025; L 3 x 0.005; E 0  
 (defined by DIN ISO 10110-7:2000-02).  
 The surface quality is defined within 90 % of the lens diameter.  
 Outside of this area defects are allowed.

### Storage and Handling of Lenses

#### Storage

GRIN lenses and lens systems should be stored in a dry environment. For short term storage, the plastic box or foam packing in which the lenses are shipped will provide adequate storage.

Recommended storage temperature:  $-20^{\circ}\text{C} - 80^{\circ}\text{C}$ .

**Storage boxes should ensure that the lenses do not touch each other to prevent chipping and scratches. Best is to use the original box.**

#### Handling

Lenses should be carefully handled with plastic tweezers, preferably those with a tapered end. Lenses should be picked up out of their individual compartments by firmly holding each on its side cylinder surface (not the polished ends). Especially small sized lenses may stick to the lens box material and can be lost during removal.

#### Cleaning

If it is necessary to clean the lens surfaces due some dust or other contaminant which may impair the optical performance. GRINTECH generally recommends the use of ethyl alcohol as a cleaning solvent, maybe combined with some smooth lintfree lens cleaning tissue.

Acetone may also be used, but it should be pure enough, otherwise it might leave some residue on the lens surface.