GRINTECH

Gradient Index Optics

GRIN Needle Endomicroscopes

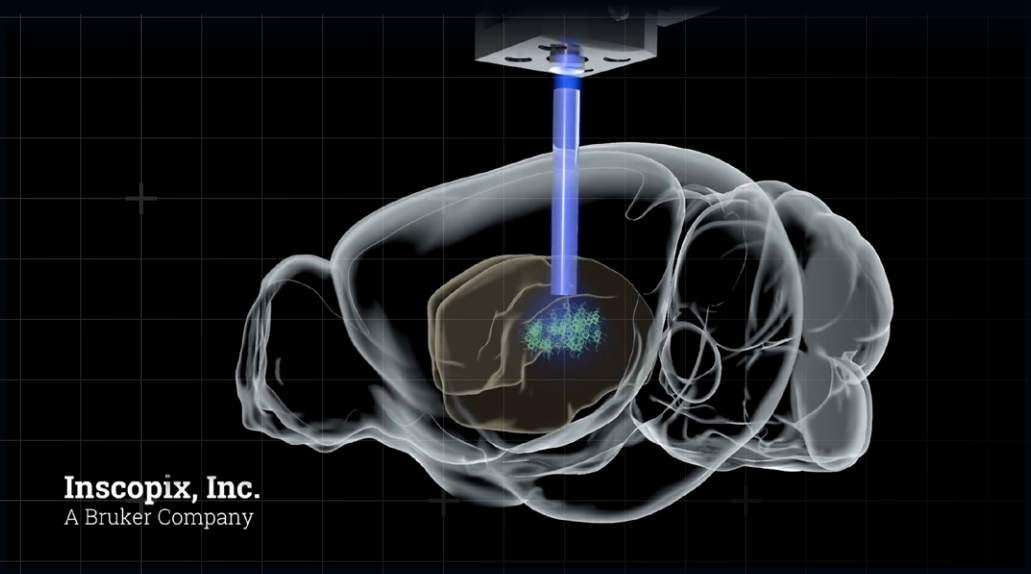
www.grintech.de

Precision Instruments for Cellular Tissue Research

GRIN needle endomicroscopes allow imaging access to deeper tissue areas.

- in active, living brains, especially for **neurobiological research**. The technology helps to understand the cause and the development of diseases at a cellular level of the tissue.
- **Cancer and rheumatism research** also uses GRIN needle optics to study, for example, metabolic processes, cell dynamics and communication in organs or organ interfaces.
- **Standard Diameters of 0.5 and 1.0 mm**
- GRIN **singlets** with **NA = 0.5** have lengths between **2.2 and 14 mm**
- Magnifying GRIN **doublets** with **NA = 0.5/0.2** have lengths between **4.0 and 20.5 mm**
- Typical modalities include Epi-fluorescence and 2-photon-fluorescence or SHG microscopy
- Please note also our GRIN lens gripper and handling tools, as well as our micro-positioning stage PosUnit 3x

Neuronal imaging is one of the most successful and unique applications of GRINTECH microoptics. In the field of non-human neuroscience, GRINTECH has an exclusive partnership with Inscopix Inc.



Customizable at the customer's request

On request, the following are possible:

- Working distances, design wavelengths and other parameters can be customized
- Optics are available in additional diameters to customer specifications, e.g. 350 µm, 600 µm, 850 µm, 1800 µm and 2000 µm
- Side-viewing optics with 90° microprisms are available on a customer-specific basis

Brain Imaging – one of the most enabling applications of GRINTECH micro optics

Endomicroscopy using GRINTECH lenses and assemblies allows an in-vivo imaging access to deep tissue regions in the brain, especially in non-humans. It helps to understand disease formation and progression on a cellular level of the tissue.

We are pleased to inform that GRINTECH GmbH has expanded its strategic partnership with Inscopix Inc. beyond one-photon imaging to include exclusively serving customers on behalf of GRINTECH in two-photon imaging and across all non-human neuroscience research applications.

Inscopix offers innovative products and scientific consulting services for advancing neuroscience research and we are excited to be able to partner with Inscopix to serve a broader research community. Inscopix commits to continuing to support legacy GRINTECH customers with their microendoscope imaging needs across all neuroscience preclinical imaging applications. Inscopix Field Scientific Consultants and Inscopix's Support team will now be available to all legacy GRINTECH customers and to any customer interested in leveraging microendoscope imaging for their brain research, irrespective of whether the user or lab is a customer of Inscopix instrumentation. The expanded partnership aims to benefit GRINTECH customers and the broader Neuroscience research community with a dedicated neuroscience partner, enhanced scientific support and customer service, and volume-based pricing discounts.

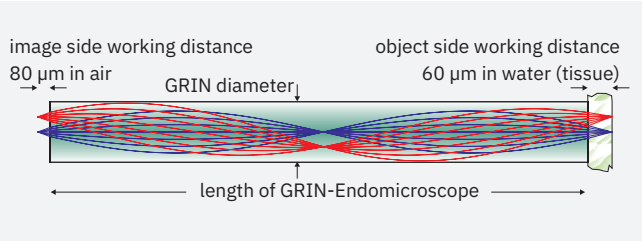
Going forward, Inscopix will be your primary contact for ordering GRIN lenses for non-human Neuroscience research applications. If you have a one-time, custom GRIN lens order, Inscopix will work with GRINTECH to ensure that if Inscopix is unable to fulfill the order, GRINTECH will do so.

If you wish to order GRIN lenses of this brochure, please visit www.inscopix.com or contact order.inscopix@bruker.com.

GRIN Needle Endomicroscopes for Fluorescence Microscopy

GRIN Needle Endomicroscopes are used for deep tissue imaging. They relay the micron-scale resolved image of the tissue over a longer length to a plane outside of the tissue at the other end of the needlescope. They are used with epi-fluorescence imaging (Design Wavelength 520 nm). The Endomicroscopes are fabricated as GRIN-singlets with NA = 0.50 on both sides or as GRIN-doublets with an object NA of 0.5 and an image NA of 0.19. Working distances on object side are specified in water or tissue, on image side in air. They are offered in different lengths resulting from adding 0.5 GRIN-pitches (periods) to the GRIN. Optionally, they can be offered as side viewing needlescope by adding a 90° prism on object side.

Singlets

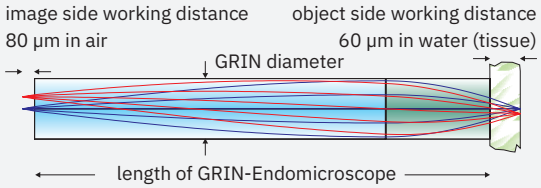


- Object side working distance in water: 60 µm
- Image side working distance in air: 0 µm / 80 µm
- Design wavelength: 520 nm
- NA Object / image side: 0.50 / 0.50
- Magnification: 1:1 / 1:-1 (depending on pitch length)

Available lengths

Diameter (mm)	Product Code	Image side working distance (µm)	Length (mm)
0.50	NEM-050-06-00-520-S-0.5p	0	2.22
	NEM-050-06-08-520-S-0.5p	80	2.08
	NEM-050-06-08-520-S-1.0p	80	4.38
	NEM-050-06-08-520-S-1.5p	80	6.67
	NEM-050-06-08-520-S-2.0p	80	8.96
1.00	NEM-100-06-00-520-S-0.5p	0	4.67
	NEM-100-06-08-520-S-0.5p	80	4.54
	NEM-100-06-08-520-S-1.0p	80	9.28
	NEM-100-06-08-520-S-1.5p	80	14.02

Doublets

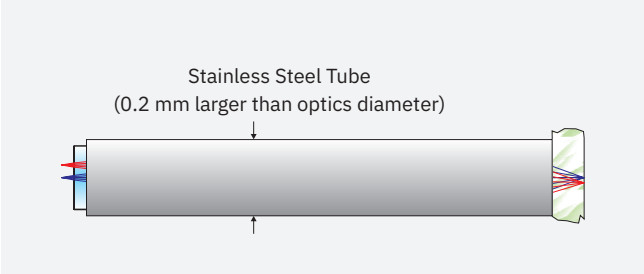


- Object side working distance in water: 60 µm
- Image side working distance in air: 80 µm
- Design wavelength: 520 nm
- NA Object / image side: 0.50 / 0.19
- Magnification: 1:2.6 / 1:-2.6 (depending on pitch length)

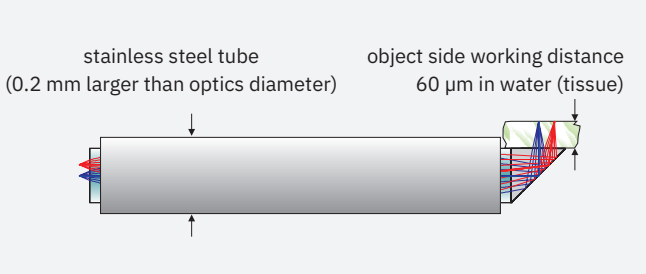
Available lengths

Diameter (mm)	Product Code	Length (mm)
0.50	NEM-050-06-08-520-DS	3.98
	NEM-050-06-08-520-DM	10.08
	NEM-050-06-08-520-DL	16.19
1.00	NEM-100-06-08-520-DS	8.28
	NEM-100-06-08-520-DM	20.50

Other diameters (0.35 mm, 0.60 mm, 0.85 mm, 1.80 mm or 2.00 mm), other working distances or design wavelength are available on request.



GRIN needle endomicroscope with optional stainless steel tube



GRIN needle endomicroscope with optional 90° prism and stainless steel tube

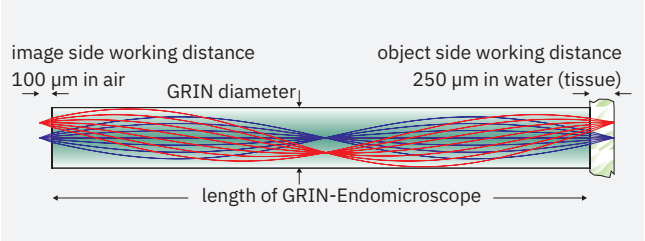
Notes:

- Diameters are sole GRIN-optics diameters
- Optionally the Endomicroscopes can be delivered in medical-grade stainless steel tubes (1.4301), with outer diameters of 0.70 mm for 0.5 mm optics and 1.2 mm for 1.0 mm optics. The tubes are mounted flush on the object side (tissue, high NA) for the side viewing version the prism is not protected by the tube
- On the image side, the optics sticks out of the tube by 50 – 500 µm. Please add –ST to the product code if desired.
- The lengths can have a tolerance of +/-5%.
- The lenses are non-coated. For customized projects, the lenses can be AR-coated.
- A side-viewing scope using microprisms may be also possible on a customized basis.
- Please ask for combination with imaging fiber bundles (Fujikura) as customized solution.
- For tolerances, handling and storage see the end of this brochure.

GRIN Needle Endomicroscopes for 2-Photon Microscopy

GRIN Needle Endomicroscopes are used for deep tissue imaging. They relay the micron-scale resolved image of the tissue over a longer length to a plane outside of the tissue at the other end of the needlescope. They are used with multi-photon fluorescence imaging (Design Wavelength 860 nm). The Endomicroscopes are fabricated as GRIN-singlets with NA = 0.50 on both sides or as GRIN-doublets with an object NA of 0.5 and an image NA of 0.19. Working distances on object side are specified in water or tissue, on image side in air. They are offered in different lengths resulting from adding 0.5 GRIN-pitches (periods) to the GRIN. Optionally, they can be offered as side viewing needlescope by adding a 90° prism on object side.

Singlets



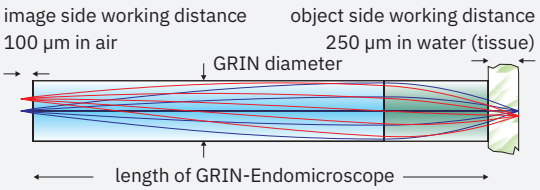
- Object side working distance in water: 250 µm
- Image side working distance in air: 100 µm
- Design wavelength: 860 nm
- NA object / image side: 0.50 / 0.50
- Magnification: 1:1 / 1:-1 (depending on pitch length)

Available lengths

Diameter (mm)	**Product Code**	**Length** (mm)
0.50	NEM-050-25-10-860-S-0.5p	1.87
	NEM-050-25-10-860-S-1.0p	4.20
	NEM-050-25-10-860-S-1.5p	6.52
	NEM-050-25-10-860-S-2.0p	8.85
1.00	NEM-100-25-10-860-S-0.5p	4.38
	NEM-100-25-10-860-S-1.0p	9.22
	NEM-100-25-10-860-S-1.5p	14.07

Other diameters (0.35 mm, 0.60 mm, 0.85 mm, 1.80 mm or 2.00 mm), other working distances or other design wavelength are available on request.

Doublets

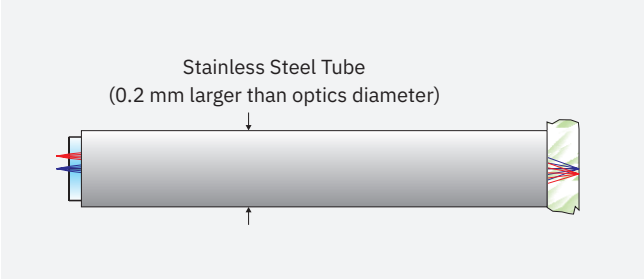


- Object side working distance in water: 250 µm
- Image side working distance in air: 100 µm
- Design wavelength: 860 nm
- NA object / image side: 0.50 / 0.19
- Magnification: 1:2.6 / 1:-2.6 (depending on pitch length)

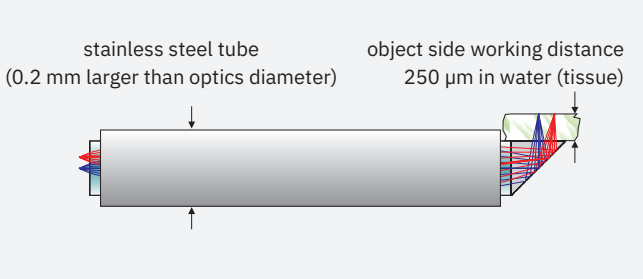
Available lengths

Diameter (mm)	**Product Code**	**Length** (mm)
0.50	NEM-050-25-10-860-DS	3.79
	NEM-050-25-10-860-DM	9.89
	NEM-050-25-10-860-DL	16.00
1.00	NEM-100-25-10-860-DS	8.09
	NEM-100-25-10-860-DM	20.09

Other diameters (0.35 mm, 1.80 mm), other working distances or other design wavelength are available on request.



GRIN needle endomicroscope with optional stainless steel tube



GRIN needle endomicroscope with optional 90° prism and stainless steel tube

Notes:

- Diameters are sole GRIN-optics diameters
- Optionally the Endomicroscopes can be delivered in medical-grade stainless steel tubes (1.4301), with outer diameters of 0.70 mm for 0.5 mm optics and 1.2 mm for 1.0 mm optics. The tubes are mounted flush on the object side (tissue, high NA) for the side viewing version the prism is not protected by the tube.
- On the image side, the optics sticks out of the tube by 50 – 500 µm. Please add -ST to the product code if desired.
- The lengths can have a tolerance of +/- 5%.
- The lenses are non-coated. For customized projects, the lenses can be AR-coated.
- A side-viewing scope using microprisms may be also possible on a customized basis (see left).
- Please ask for combination with imaging fiber bundles (Fujikura) as customized solution.
- For tolerances, handling and storage see below.

Tolerances and Handling Instructions

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

Tolerances

- Lens length z_l: ± 5% due to variations of the gradient constant
- Diameter d: +0 / -0.01 mm
- Tighter diameter tolerances on request

Surface quality

- 5 / 3 × 0.025; L 3 × 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

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 °C – 80 °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.

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Contact Address

GRINTECH GmbH
Otto-Eppenstein-Straße 7
07745 Jena
Germany

Phone: +49 (3641) 55417-0
Fax: +49 (3641) 55417-101

E-Mail: info@grintech.de

Our Distributors:

Japan

Luminex Trading, Inc.
Avenue-Otowa Bldg 2-2-2 Otowa Bunkyo-ku
Tokyo 112-0013 Japan

Phone: +81-3-5395-2722
Fax: +81-3-5395-2721

E-Mail: sales@luminex.co.jp
Web: www.luminex.co.jp

China

Hangzhou SPL Photonics Co., Ltd.
Room D301, Huaxing Industrial Park, NO.18
Tangmiao Road, Xihu district, Hangzhou,
China. 310007

Phone: +86 571 8807 6956
Fax: +86 571 8807 7926

E-Mail: info@spl-tech.cn
Web: www.spl-tech.cn

Korea

Seongkyeong Photonics
Jijok-dong, World Plaza 401-ho, 355,
Jijok-ro, Yuseong-gu

Daejeon 34071 Republic of Korea

Phone: +82 42 867-2227
Fax: +82 42 867-2228

E-Mail: support@skphotonics.com
Web: www.skphotonics.com