



**SCHOTT**  
glass made of ideas

SCHOTT is a leading international technology group in the areas of specialty glass and glass-ceramics. With more than 130 years of outstanding development, materials and technology expertise we offer a broad portfolio of high-quality products and intelligent solutions that contribute to our customers' success.

Light is a key element in stereo microscopy. Reliable illumination solutions are necessary to make hidden details visible and results reproducible. SCHOTT's Lighting and Imaging division offers a complete portfolio in fiber optic and direct LED illumination to provide the most suitable contrasting solution for a variety of industrial applications and life science.



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## Discover our EasyLED Series

The SCHOTT EasyLED portfolio for stereo microscopy delivers precise LED light for a wide variety of applications like laboratory and diagnostics, industrial applications, education or forensic science. The series offers robust design and easy handling in a compact device, with a range of accessories for your specific requirements.



### **Easy handling across the series**

The EasyLED series is designed for easy handling. Since the fully integrated and ergonomically designed control elements are placed right next to the focus control of the microscope, they make external controller boxes obsolete.



**Reliability through robust design**  
 SCHOTT's series of EasyLED products are tough, long-lasting and reliable. Their tough housings protect against mechanical influences and atmospheric conditions, while the long lifetime of LEDs make them maintenance-free.

## Benefits



### Maintenance-free

LED lifetime of 50,000 hours.



### Low power consumption

SCHOTT's experience in smart engineering leads to the optimization of energy use.



### Compatible with all common OEMs

A mounting adapter is available for all common microscope stands, making the EasyLED suitable for a wide range of systems.



### Ergonomic design

An integrated controller enables simple and intuitive switching between illumination modes.

## Product Variants

All products in the SCHOTT EasyLED collection are designed using robust metal housing and bright, efficient LEDs with a lifetime of 50,000 hours. In addition, the range of EasyLED Accessories offers a variety of diffusers, polarization filters and mounting brackets for standard and customized systems.



### Ring Lights

The EasyLED Ring Light delivers highly homogeneous and shadow-free illumination in a tough metal housing and well-designed heat sink. The EasyLED Ring Light Plus has the advantage of controllable segments to enable new contrasting methods, while the integrated 'jog dial' element provides simple and intuitive switching between illumination modes, as well as rotation of the segments in both directions.

#### Characteristics

- Powerful luminance (90/140 klux for EasyLED Ring Light and Ring Light Plus respectively)
- Integrated controller
- Mountable direct to the microscope objective
- EasyLED Ring Light Plus is segmentable with eight segments

#### Advantages

- Various contrasting methods thanks to different segment modes
- Easy to use thanks to integrated operational elements
- Robust design for operation in demanding environments

See SCHOTT's segmented ring lights in action and learn about typical areas of application.





## Back Lights

The EasyLED Back Light integrates high brightness LEDs with controller electronics into the head of the illuminator, offering easy and ergonomic operation. Made with a SCHOTT Opalika® glass surface, it's ideal for transparent specimens.

### Characteristics

- Powerful light density up to 12,000 cd/m<sup>2</sup>
- Continuous dimming from 0-100 %
- Integrated controller
- Scratch-resistant surface

### Advantages

- Made with SCHOTT Opalika® for perfect homogeneity
- Easy to use thanks to integrated operational elements
- Robust design for operation in demanding environments



## Spot Lights

EasyLED Spot Lights are available in two different versions: an individual spot light with a single light head (Spot Light Plus Single), and a double spot light with two light heads (Spot Light Plus Double). In addition, the two light heads of the Spot Light Plus Double can be used individually.

### Characteristics

- Powerful light flux of 130 lm for each spot
- Robust metal light head equipped with special cooling lamellae
- Integrated controller
- Mountable direct to the stand. Mounting brackets for all stands plus a standalone version are all available

### Advantages

- Ergonomic design – the dimming control is ergonomically placed near the focus control of the microscope
- Robust design for operation in demanding environments
- Double Spot Light Plus has a switching feature for alternating lighting options



## Accessories

SCHOTT offers a variety of mechanical and optical accessories to increase the flexibility of the EasyLED series. Accessories include polarization filters, mounting brackets and color filters for EasyLED Spot Lights, as well as diffusers for EasyLED Ring Lights.

### Characteristics

- Turnable polarization filter
- Halogen filter and color filters in red, blue, green and yellow available
- Diffuser with adapting thread (M110 x 1) to avoid LED reflection
- Mounting brackets for column Ø from 25-35 mm
- Borofloat® glass protection window for oily and dusty environments

### Advantages

- The unique tubular diffuser combines in an economic way the advantages of dome lights and conventional diffusers and enables perfect contrast for highly reflective objects
- Compatible with different OEM designs
- Polarization filters with perfect extinction ratio
- Color filters with high transmission unaffected by light-entrance angle

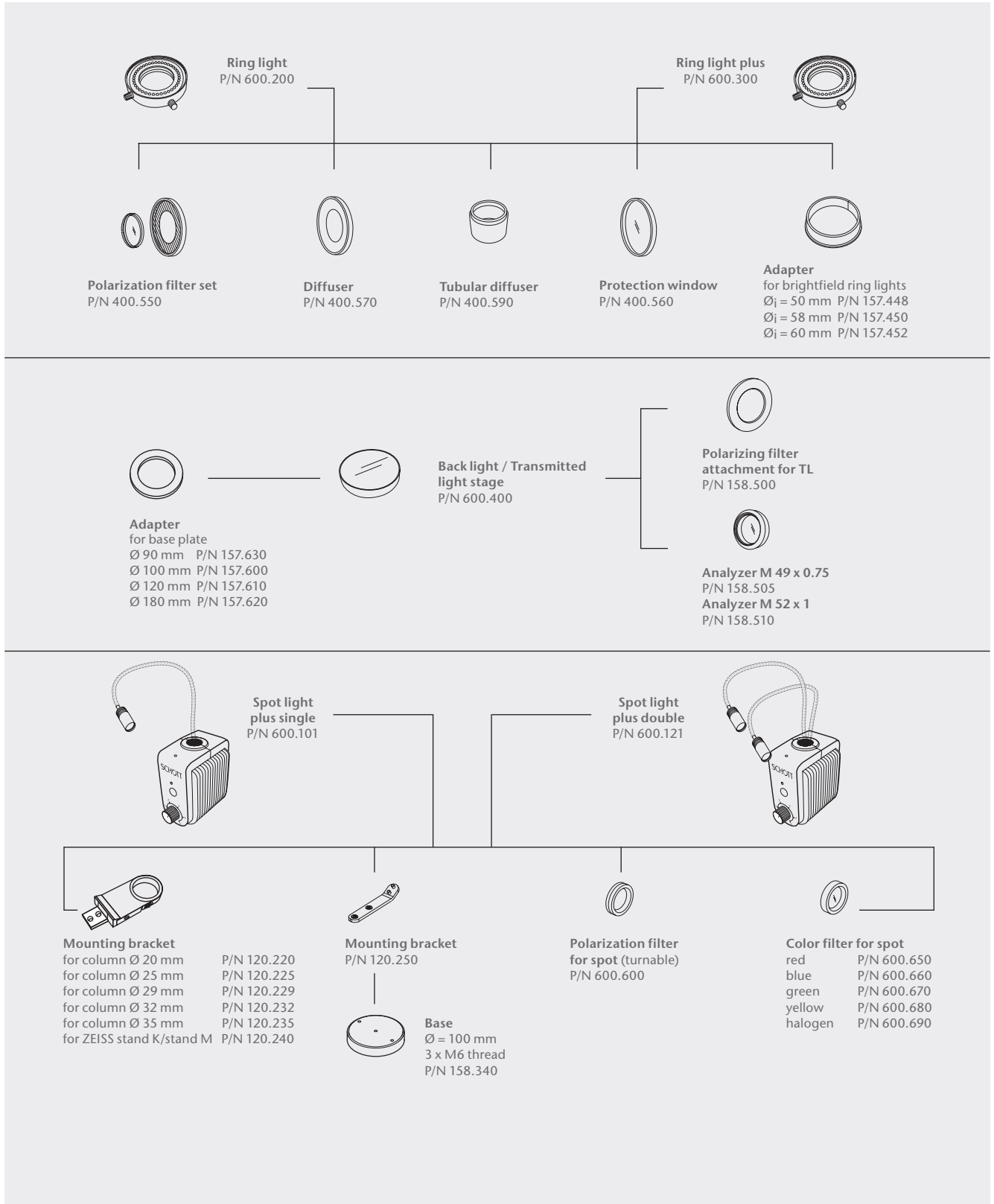


Watch the video about SCHOTT's tubular diffuser.





# System Diagram for EasyLED Series



# Lighting Solutions

For seats, cabins and monuments



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# Lighting solutions

## For seats, cabins and monuments

The design of an aircraft cabin interior plays an important role: It not only represents the airlines' brand, but even more importantly, it contributes to crew and passenger comfort and well being during a flight. SCHOTT has been delivering illumination solutions for aircraft seats for more than 20 years. Now new products such as the SCHOTT® Opal reading light series, the SCHOTT® HelioCurve as well as customized feature light design concepts combine esthetic appeal, visual performance, and easy integration.

Aircraft seats are key elements in differentiating airline brands, and for that reason, the design, comfort, and functionality of the seats are top priority. Seat lighting is particularly important because it plays both functional and emotional roles. As a lighting expert, SCHOTT offers a wide variety of lighting concepts based on both fiber optic and LED solutions and adapted to the state-of-the-art needs of our customers.

## Reading lights

### Elegant and intuitive

Combining strong visual performance with smart usability and an ultra-slim style, our personal illumination solutions is highly intuitive, adjusting to passenger needs.

### Modular and efficient

Easily integrated and low maintenance, our modular lighting system offers different shapes and finishes for highly individual lighting solutions.

### Established and proven

The classic semi-compact and flex-and-stay reading light designs have been proven over many years of service and feature a robust design that is customizable to the airlines' needs.

# SCHOTT® Opal series

style meets functionality | different shapes and finishes | ultra slim and elegant



Ray | \*Design by PearsonLloyd

The Opal series is a modular concept which offers an elegantly slimline and functional in-seat reading light design, which can be customized into different shapes, color schemes and finishes depending on individual airline or cabin requirements. Developed in cooperation with PriestmanGoode, our new Opal Cover variant now perfectly matches seat colors and leather, synthetic leather and fabric materials.

The smart approach also saves time and effort for qualification processes, and elements are easily installed into all types of surface. Opal lights can be switched on or off by a soft touch on the faceplate, and their wide rotation angle allows the light cone to be adjusted to the passenger's personal preference.

## SCHOTT® Opal



Standard



Plaza



Square

## SCHOTT® Opal Cover



Leather



Fabric



Synthetic leather

### Key benefits

- modular concept
- elegant and slim
- easy to install
- passenger-friendly usability
- customizable light colors
- installation depth 0.5 inch

### Technical Specifications

Wide input voltage range	12 V to 28 V DC fixed voltage or power PWM
Total current @ full on	Max. 60 mA
Power consumption / max power dissipation @ full on	Max. 1 W
Weight	Max. 100 g
Orientation light 1-dot design	Yes or no
Color temperature of main LED / orientation light	5000 K $\pm$ 10% , 3500 K $\pm$ 10%
Rotation	$\pm$ 40°
Tilt mechanism	25° - 45° seamless
Surface finish aluminium anodized	clear, champagne gold, rose gold, black
Connector type	TE connectivity, Amphenol SJS
Qualification status	Qualified for all major aircraft

# Classic reading light series

proven over many years of service | customizable |  
robust and elegant



The semi-compact and flex-and-stay reading lights are based on a modular design that combines standard features and customizable qualities with wall-mounted adjustable LED lights, adding value to the seat design. The series is also certified for all major aircraft platforms and can retrofit easily into just about any project.



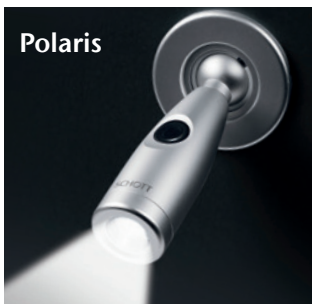
Phoenix

- elegant design
- two movable adjustments
- illuminated switch
- customizable finishes



Horizon

- slim and elegant
- high freedom in movement of light output position due to flex-and-stay
- illuminated switch
- customizable finishes



Polaris

- robust design
- rotatable movement
- illuminated switch
- compact wall-mounted light
- customizable finishes

(straight/angled)



Zenith

Technical Specifications	SCHOTT® Phoenix	SCHOTT® Polaris	SCHOTT® Horizon	SCHOTT® Zenith
Power supply	5 to 28 V DC	5 to 28 V DC		5 to 28 V DC
Standard switching sequence	Off / 30% / 60% / 100%	30 % / 60 % / Full On / Off		30 % / 60 % / Full On / Off
Power consumption @ full power	Max. 1 W	Max. 1 W		Max. 1 W
Weight (typical, for 410 mm total length)	Max. 200 g	Max. 200 g		430 g   460 g
Minimum bending radius of the flex & stay material				75 mm
Color temperature	5500 K ± 10 %	5500 K ± 10 %		5500 K ± 10 %
Standard connector type	Amphenol SJS	Amphenol SJS		Amphenol SJS
Qualification status	Qualified for all major aircraft	Qualified for all major aircraft		Qualified for all major aircraft

# Reading lights



SCHOTT® Opal



SCHOTT® Phoenix

	SCHOTT® Opal	SCHOTT® Phoenix
Power supply	12 V to 28 V DC fixed voltage or power PWM	5 to 28 V DC
Standard switching sequence		Off 30 % / 60 % / 100%
Power consumption @ full power	Max. 1 W	Max. 1 W
Weight	Max. 100 g	Max. 200 g
Minimum bending radius of the flex & stay material limited to	N/A	N/A
Color temperature	5500 K $\pm$ 10 % , 3500 K $\pm$ 10%	5500 K $\pm$ 10 %
Standard connector type	TE connectivity, Amphenol SJS	Amphenol SJS
Qualification status	Qualified for all major aircraft	Qualified for all major aircraft

# at a glance



SCHOTT® Polaris  
(straight/angled)



SCHOTT® Horizon



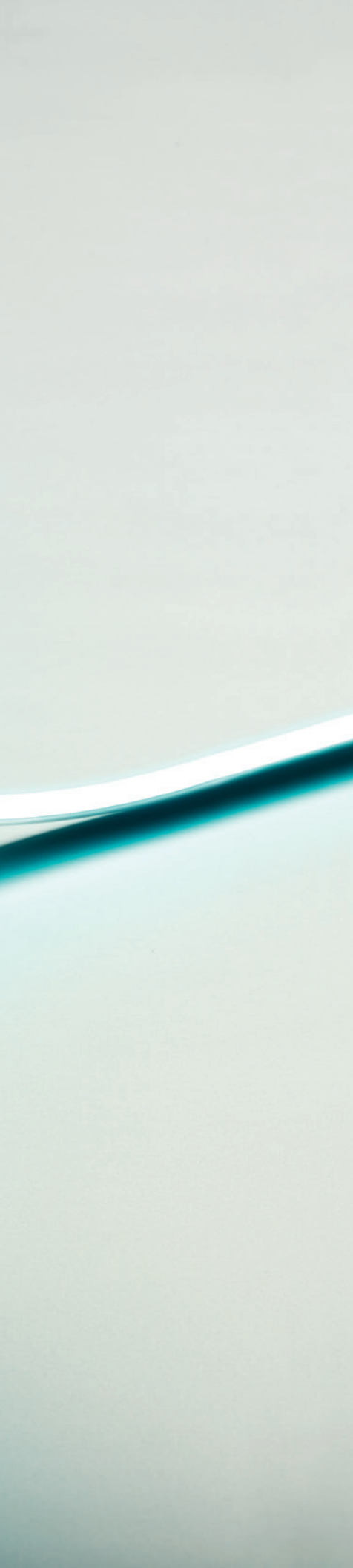
SCHOTT® Zenith

SCHOTT® Polaris	SCHOTT® Horizon	SCHOTT® Zenith
5 to 28 V DC	5 to 28 V DC	5 to 28 V DC
30 % / 60 % / full on / off		30 % / 60 % / full on / off
Max. 1 W	Max. 1 W	Max. 1 W
Max. 200 g	Max. 430 g (for 410 mm length)	Max. 460 g (for 410 mm length)
N/A	75 mm	75 mm
5500 K ± 10 %	5500 K ± 10 %	5500 K ± 10 %
Amphenol SJS	Amphenol SJS	Amphenol SJS
Qualified for all major aircraft	Qualified for all major aircraft	Qualified for all major aircraft



# Mood lights

flexible LED strips | homogeneous | bright

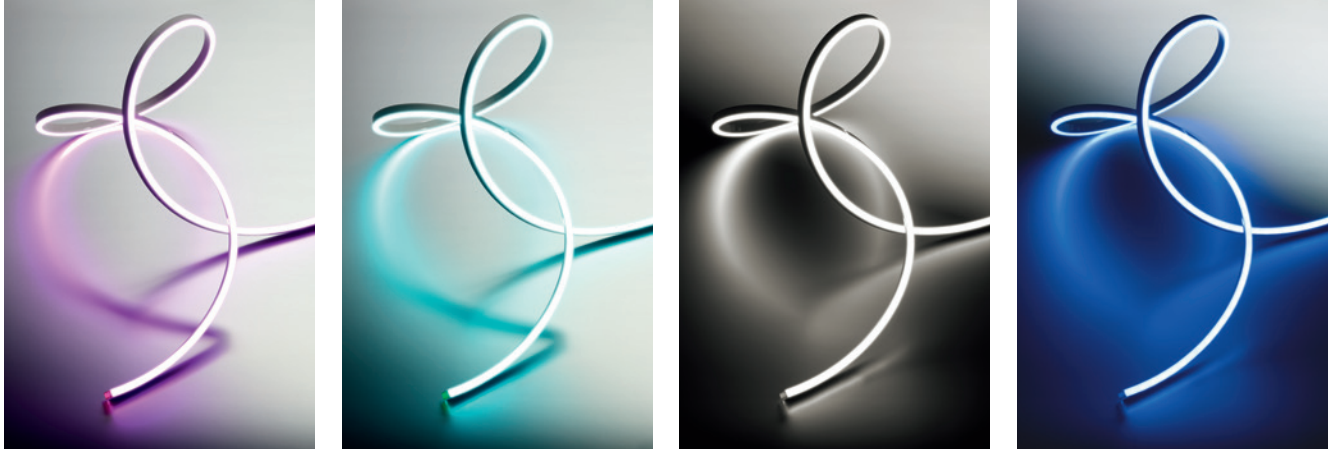


When flying, light and colors can have a significant effect on the passenger experience. On long-haul flights in particular, good quality rest and relaxing surroundings can make a big difference. SCHOTT's integrated approach to interior lighting optimizes the positive effects on passengers while in the air.

SCHOTT's mood lights offer high and homogeneous light emission with excellent color characteristics for perfect wash and contour lights. We work closely with airlines and aircraft designers to create bespoke lighting solutions including lighting scenarios. We also offer holistic approaches for illumination in all areas of the cabin – from the aisles to the restrooms.

A wide product portfolio, from pure LED solutions to a combination with fiber optics, serves every customer's needs.

# SCHOTT® HelioCurve



Colors of SCHOTT® HelioCurve

Technical specifications	Single color (white) LED strip	Full color (RGBW) LED strip
Power supply	21 to 31 VDC	21 to 31 VDC
Current per segment (60 mm)	20 mA	20 mA
Power consumption	13.5 W per meter	13.5 W per meter
No. of LEDs per segment (60 mm)	5 (3000 K)	5 per color (RGBW)
Brightness at distance of 420 mm	150 lux	R:46 lux, G:200 lux, B:45 lux, W:150 lux
Dimensions	7 mm x 14 mm	7 mm x 14 mm
Min. / max. length	60 mm / 2100 mm (multiples of 60 mm) + 28 mm header + 175 mm pigtail and connector	60 mm / 2100 mm (multiples of 60 mm) + 28 mm header + 175 mm pigtail and connector
Min. bending radius	80 mm	80 mm
Weight	130 g/m	130 g/m
Aging and temperature compensation	No	Yes, but only in combination with Multi Light Controller
Color temperature of white LED	3000 K +/- 200 K	2700 K +/- 200 K
Color rendering index	CRI: > 90 (typ.: 93) @ 3100 K	CRI: > 90 (typ.: 93) @ 2700 K
Communication protocol	PWM (1 channel)	PWM (4 channels)
Connector type	TE connectivity, Amphenol SJS	TE connectivity, Amphenol SJS
Qualification status	Qualified for all major aircraft	Qualified for all major aircraft

## Key benefits

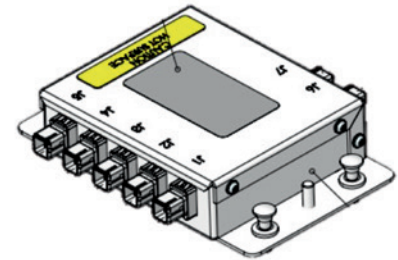
- RGBW or single color white
- no distance to the illuminated surfaces required
- no additional covers or diffusers needed

# Multi Light Controller

The SCHOTT® Multi Light Controller works in combination with the HelioCurve LED strip and provides status management, reporting of P/N and S/N, and power leveling by receiving information from the LED strip protection memory header. The Multi Light Controller has to be addressed with an RS485 communication protocol. Combining SCHOTT® HelioCurve LED strip (RGBW) with the Multi Light Controller enables independent temperature and aging compensation for each connected LED strip.

## Technical specifications

Power supply	21 to 31 VDC
Dimensions	108 mm (84 mm w/o connectors) x 140 mm x 30 mm
Weight	270 g
Communication protocol	RS485
Connector type	<ul style="list-style-type: none"> <li>• 5 output channels for HelioCurve RGBW: TE connectivity</li> <li>• 1 extra output channel: permanent DC output w/o any regulation</li> <li>• 1 input channel: TE connectivity</li> </ul>
MLC intelligence	<ul style="list-style-type: none"> <li>• Color control via CIE 1931 2° Yxy</li> <li>• Status management (LED current, LED temperature, input voltage monitoring)</li> <li>• Aging &amp; temperature compensation in combination with HelioCurve (RGBW)</li> <li>• Power leveling</li> </ul>
Qualification status	Qualified for all major aircraft



## Key benefits

- status management
- color control
- power leveling
- aging & temperature compensation
- memory interface with HelioCurve LED strips (RGBW)



Multi Light Controller

# LED light sources and fiber optic products

side-emitting optical fibers | end-emitting optical fibers | excellent flexibility

SCHOTT LED and fiber optic lighting products have pioneered markets such as the in-seat aviation reading light market. SCHOTT offers the aviation and transportation industry innovative and high-quality designs, quick turnaround sampling, and cutting-edge solutions to illuminate special environments such as aircraft interiors.

By technically separating light guides from LED light sources, you can realize almost any design, even if space is limited. The system has very high flexibility for creating mood lighting or functional lighting. With one LED light source you can cover several applications on the seat. The visible part of the light spot can easily be customized to match the overall seat and cabin design. Furthermore, this system significantly reduces maintenance costs as the light is built in modules that can be replaced individually, without ever having to replace the complete light.





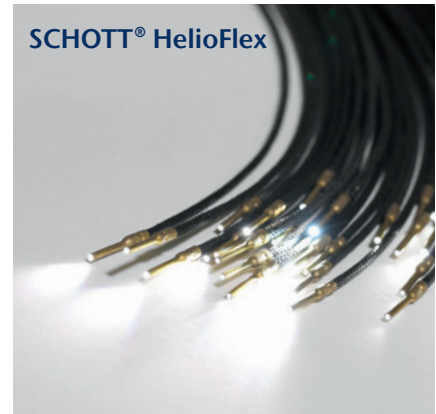
SCHOTT® HeliLine



SCHOTT® HeliIntense



SCHOTT® HeliFlex



- high flexibility
- creates mood lighting or functional illumination
- one LED light source can cover several applications in the cabin
- compliant with FAR 25-853 and ABD0031 standards regarding flammability, smoke and toxicity

- controlled in a number of different ways – illuminated functional lighting realized as spot or line lights
- compact design
- passive cooling

- no electrical interference with on-board wireless applications
- small bending radii
- compliant with FAR 25-853 and ABD0031 standards regarding flammability, smoke and toxicity

## SCHOTT® HelioLine | side-emitting optical fibers

Technical Specifications		
Cable diameter	3.85 ± 0.15 mm	4.85 ± 0.2 mm
Bending radius	> 10 mm	> 15 mm
Weight cable	42 g/m	55 g/m
Cable material	Silicon	Silicon
Cable color	White translucent	White translucent
Mounting and cleaning	No tensile stress or high pressure allowed	No tensile stress or high pressure allowed
Qualification status	Qualified for all major aircraft	Qualified for all major aircraft

## SCHOTT® HelioFlex | end-emitting optical fibers

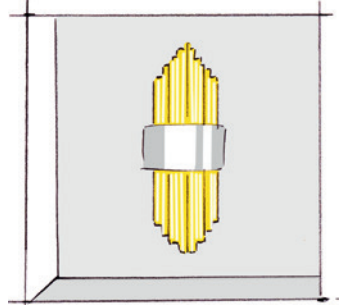
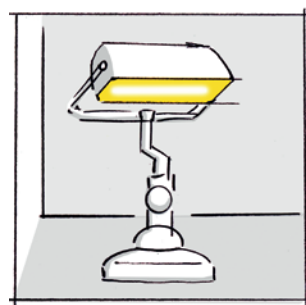
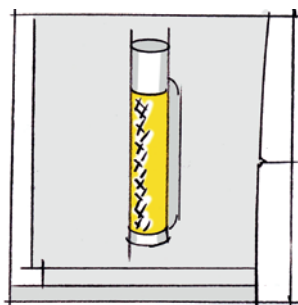
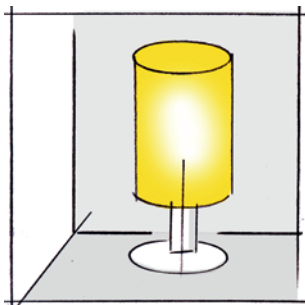
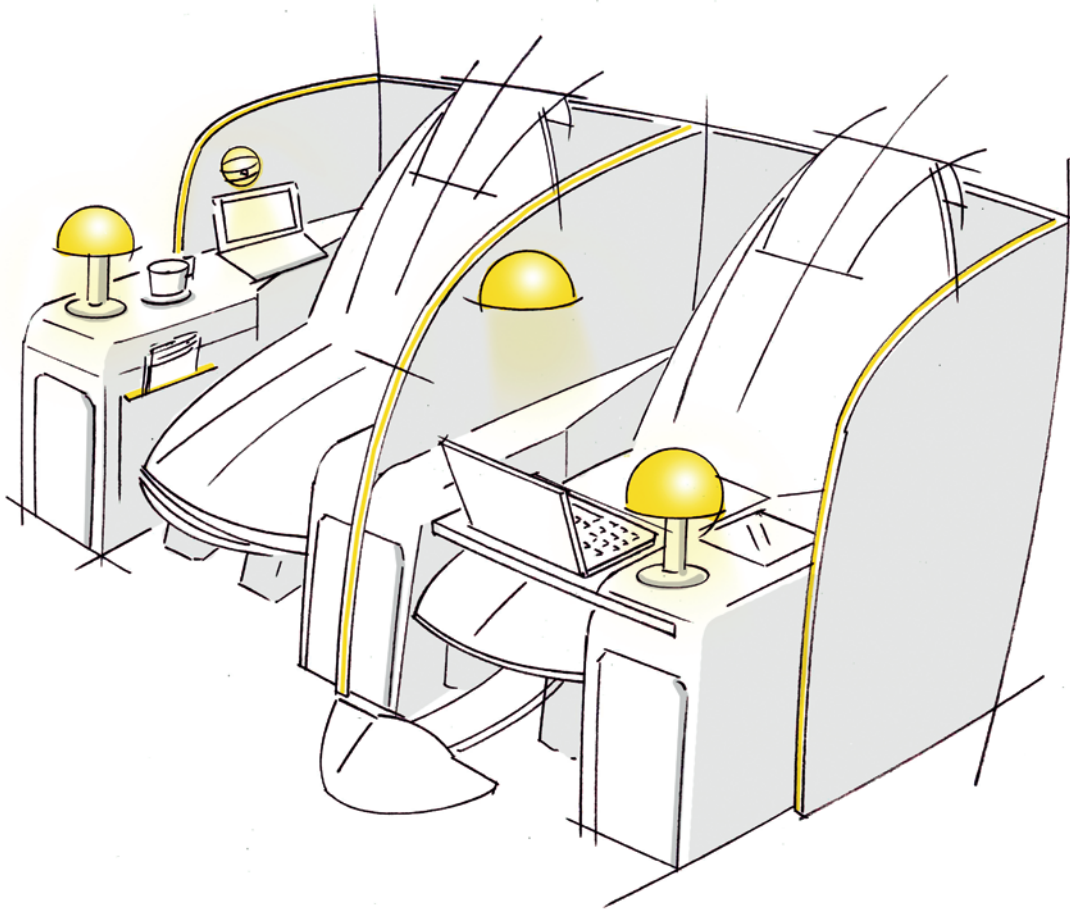
Technical Specifications		
Cable diameter	2.0 ± 0.2 mm	4.5 ± 0.2 mm
Bending radius	4 mm	15 mm
Weight cable	30.5 g/m	65 g/m
Cable material	Glass braid with silicon coating	Silicon
Qualification status	Qualified for all major aircraft	Qualified for all major aircraft

## SCHOTT® HelioIntense | strong and efficient LED light source

Technical Specifications	
Power input	12 – 28 VDC, 28 VDC direct aircraft power
Power consumption	Max. 4.5 W
Control	External switch   RS485   PWM
Control features	On / Off / Dimming
Color	White (other single colors possible)
Available color temperatures	2700 K (± 600 K)   3000 K (± 600 K)   4000 K (± 600 K) further and other colors on demand
Address selection	Daisy chain concept
Max. weight	200 g
Qualification status	Qualified for all major aircraft

# Feature lights

Feature lights are decorative seat lamps that are highly customized and individualized to every customer. SCHOTT provides feature lights upon request. We work closely with the airlines, designers and seat manufacturers to create the perfect feature light for our customers.



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# ColdVision Series

Fiber optic illumination for machine vision and stereo microscopy

Pioneering. Responsibly. Together. These attributes have characterized SCHOTT, global manufacturer of specialty glass, glass-ceramics and other innovative materials, for over 130 years. As #glasslovers and inventor of specialty glass, we are reliable partners for high-tech industries to enable new market launches and applications. Our goal is to become climate neutral by 2030.

SCHOTT's Lighting and Imaging offers solutions for machine vision and microscopy applications for many decades. With easy-to-integrate solutions in light transfer, we enable highly accurate measurements for industrial processes in challenging environments.



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# Discover our ColdVision Series

SCHOTT ColdVision Fiber Optic illumination for machine vision and stereo microscopy brings together LED light sources, fiber optic light guides and accessories in a single, versatile service where the products are specially designed to work together.



## Designed for demanding situations

ColdVision light sources come with a robust metal housing while the light guides offer strong protection against pressure and other mechanical challenges for improved fiber longevity – despite their light weight. Those properties make the series the ideal choice for harsh environments in industrial applications.



### **Measurements with high precision and speed**

By using glass optical fibers with high incoupling efficiency in combination with powerful light sources, the SCHOTT ColdVision Series offers a homogeneous and at the same time high light output. As a result, measurements can be done with highest precision and speed.

# ColdVision Fiber Optic Light Sources

SCHOTT ColdVision Light Sources provide flexible and versatile illumination. The robust metal housing, high quality components and long lifetime of the light sources make them the ideal choice for harsh environments in industrial applications.



## Advanced control options

SCHOTT ColdVision Light Sources have been developed for efficiency, reliability and functionality, with a range of hardware interfaces to provide seamless integration with existing and new illumination systems. Industrial Ethernet, USB and RS232 ports, and a remote control option, offer highly versatile connectivity and control.

## Features

An at-a-glance guide to the features of SCHOTT's range of ColdVision Light Sources.

Feature	CV-LS	MC-LS
Lamp type	LED	LED
Lightflux (lm)	1350	850
Max. active light guide Ø (mm)	13	13
Wide range power supply	●	●
Continuous dimming	●	●
Filter compatible (attached to Light Guide)	●	●
Fan cooling	●	●
Connectivity	USB RS-232 Dual Ethernet Multiport (Analog)	USB RS-232 Analog

## Benefits



### Homogeneous lighting

Light sources are perfectly harmonized with SCHOTT ColdVision Light Guides.



### Low power consumption

Smart engineering leads to high energy efficiency.



### Retro fitting

Existing SCHOTT and Fostec light sources can be seamlessly upgraded to new LED models.



### Remote control

Options with industrial Ethernet, RS232 und USB connectivity for remote control available.

# Light Source Variants



## CV-LS

The CV-LS light source is the flagship of the SCHOTT ColdVision series, offering high efficiency output in a compact footprint with versatile connectivity. This connectivity makes it ideal for machine vision applications, while the high brightness LED light engine greatly increases light output – far beyond 150 W EKE halogen lamp levels for the cool white model.

### Characteristics

- Internal light feedback stabilization
- Fast triggered strobe (25 $\mu$ s rise time, 1 $\mu$ s precision)
- Analog and digital remote control: USB (Virtual RS232), RS232, Dual Ethernet, Mutliport-Wide range power supply according to international standards
- Cool White, Warm White, and RGBW models are available

### Advantages

- All connectors with retention mechanisms
- High resistance to vibration and shock
- ESD Immunity
- Maintenance-free LED engine with 50,000 operating hours





## MC-LS

As the standard LED fiber optic light source in the SCHOTT ColdVision range, the MC-LS delivers exceptional light output from its high-brightness LED engine. Developed for stereo microscopy, the design of the light source makes it highly suitable for desktop usage, where its USB port can easily connect to application software systems.

### Characteristics

- Can be controlled by digital remote control via USB port (virtual RS232) or built-in 9-pin connector (analog)
- Wide range of power supplies, all compliant with international standards
- Continuous dimming from 0-100%
- Temperature monitoring for protection of the LED light engine



### Advantages

- Robust industrial design with a small footprint and ultra-quiet operation
- High resistance to vibration and shock
- Long-life, high-efficiency, maintenance-free LED light engine
- Low power consumption
- Over 10% higher output than EKE halogen light sources\*
- Stable light output with minimal variation in color temperature
- ETL approved, RoHS compliant
- Compatible with ColdVision light guides

\*Light sources compared at the output of a SCHOTT ColdVision fiber optic light guide, Ø13mm active, length 1m (A08051.40 bundle), 23°C ambient, typical output

# ColdVision Fiber Optic Light Guides

SCHOTT ColdVision Fiber Optic Light Guides deliver modular fiber optic illumination for machine vision and stereo microscopy. As the light is guided from the source by our light guides, heat at the object is kept to a minimum.



## Broad product portfolio

The large range of products in our ColdVision Light Guides portfolio offers the ability to create all common illumination techniques. As well as the standard range, we also manufacture a variety of specialty light guides, such as back lights, ring lights, goosenecks, and flexible bundles.





### Top quality optical fibers

The technical properties of SCHOTT Light Guides and their range of light sources and accessories enable the precise camera systems in machine vision equipment to achieve optimum performance. Since consistency is key for decision-making, our light guides have built-in accuracy and reliability.

### Benefits



#### Mechanical stability

Light guide designs include protection against pressure and other mechanical challenges for improved fiber longevity.



#### Homogeneous lighting

Perfectly harmonized system with SCHOTT ColdVision Light Sources.



#### Specialized design

60 years of experience provides SCHOTT with highly advanced light guide design capability.



#### High compatibility

A broad portfolio of adapters offers high compatibility with almost all product designs.

# Light Guides Variants



## Gooseneck Light Guides

Gooseneck light guides deliver incident illumination that remains in place after positioning. Generally used to highlight structures through shadows in space-constrained applications, these trusted light guides offer both flexibility and mechanical stability.

### Characteristics

- Flex and stay light guides
- Available with 1 or 2 branches
- Available as chrome plated semi-obedient metal or black dekabon versions
- Available as 2-branch Gooseneck plus flexible bundle (Combination Light Guide)
- Available as dual focusing gooseneck with permanently attached spot lenses
- Focusing optics and filter accessories available

### Advantages

- Mechanical stability enables long-term usability
- Flexibility enables precise positioning for complete control of light placement
- The Combination Light Guide can be stationary, fixed at the microscope post
- Dual models illuminate a workspace with a single light source
- Gooseneck legs placed in opposing positions create shadow-free illumination



## Flexible Bundles

As the name suggests, SCHOTT ColdVision Flexible Bundles are highly bendable and generally used to highlight structures through shadows. In contrast to gooseneck light guides, they offer a higher flexibility and need to be held.

### Characteristics

- Variety of standard sizes with tight bending radius for easy routing
- Available with 1, 2, or 4 branches
- Available as randomized versions to improve spot uniformity
- Focusing optics, filters and mechanical accessories available

### Advantages

- High flexibility for different light requirements, as well as remote illumination
- Randomized bundles with multiple outputs can be calibrated to deliver a matching output within ~5 % bundle-to-bundle
- Compatible with ColdVision light guides





## Ring Lights

SCHOTT ColdVision Ring lights offer absolute shadow-free illumination. Using a range of diameters and mechanical adapters, the ring lights can be configured to fit many different objective sizes.

### Characteristics

- The “Universal Ring Light” fits microscope and camera objectives from 33 to 81 mm with appropriate clamps
- 4” Ring Light is available with randomized fiber bundle for optimum uniformity
- With housing made of rugged, black anodized aluminum, and the fiber bundle protected with flexible metal PVC sheathing, SCHOTT Ring Lights are tough, dependable and long-lasting

### Advantages

- Annular Ring Lights offer absolute shadow-free illumination
- Vertical exit bundle option increases work space and prevents the bundle from interfering with surrounding objects
- ESD (Electro Static Discharge) option is available





## Line Lights

Suitable for narrow and elongated illumination in microscopy and machine vision inspection, SCHOTT ColdVision Line Lights offer high uniformity thanks to randomization. With a range of accessories and customized options, we can develop a bespoke line light solution for your application.

### Characteristics

- Line Lights offers intense calibrated homogeneous illumination
- Available as randomized line light for maximized uniformity and redundancy
- Different slit slices available
- Rugged aluminum body and light source ferrule with black anodized finish
- PVC covered metal tubing protects the fiber bundle
- Perfect illumination for line scan cameras

### Advantages

- Our line light accessory range includes cylindrical, apertured lenses and mechanical holders
- Accurately positioned fiber line within the body on all three planes assures that the fiber axis will be parallel with the mounting surface of the body
- Custom lengths, bundle exits, multiple combinations (dual, quad, etc.) and line widths can be designed for your unique requirements
- The 1", 2", & 3" size of line light offer a narrow, elongated body design





## Back Lights

SCHOTT ColdVision Back Lights can be used to create a crisp edge definition or soft, diffuse incident light for a range of applications with limited space. Those applications include glass inspection, edge detection, photography and instrumentation display.

### Characteristics

- All units come with a protective IR filter
- The back light housing is made of rugged, black anodized aluminum
- The fiber bundle is protected with flexible PVC covered metal tubing
- Dual and quad backlights increase lighting versatility

### Advantages

- Compact, low profile housing fits in small spaces
- The white acrylic diffuser plate and calibration process provides the optimum combination of uniformity and intensity



# Accessories



SCHOTT ColdVision series comes with a range of accessories, which offers even more options for contrast enhancement. Our optical accessories include focusing lenses, cylindrical lenses for line lights, and a wide variety of filters, while mechanical accessories include an articulated arm and base, as well as holders for different size light guides, focusing lenses and adapters for ring lights.

## Characteristics

All ColdVision accessories are designed for stability, easy handling and optimum performance. While focusing lenses can increase light intensity at the spot center, additional contrast can be achieved with a range of optical filters. Adapters are also available for different lens sizes.

## Advantages

- Polarization filters have a perfect extinction ratio.
- Color filters demonstrate high transmission and remain unaffected by light-entrance angle.
- Mechanical accessories offer precise positioning of light guides.
- Ease of replacement of competitor light sources.

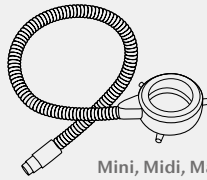
- 1 | Polarizer and Analyzer
- 2 | Spot lens
- 3 | Articulated arm
- 4 | Color filter

# System diagram

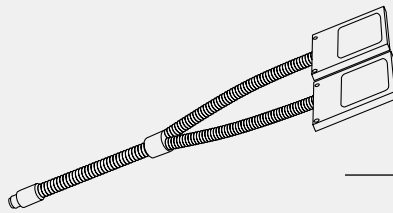
CV-LS | MC-LS



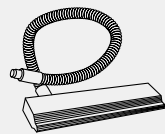
CV-LS



Mini, Midi, Maxi Ring Light  
Ring Light 66 mm  
Universal Ring Light  
Darkfield Ring Light



Single Back Light  
Dual Back Lights



1" - 16" Line Lights  
Custom Line Lights



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glass made of ideas

# Glass optical fibers

## Options and variants

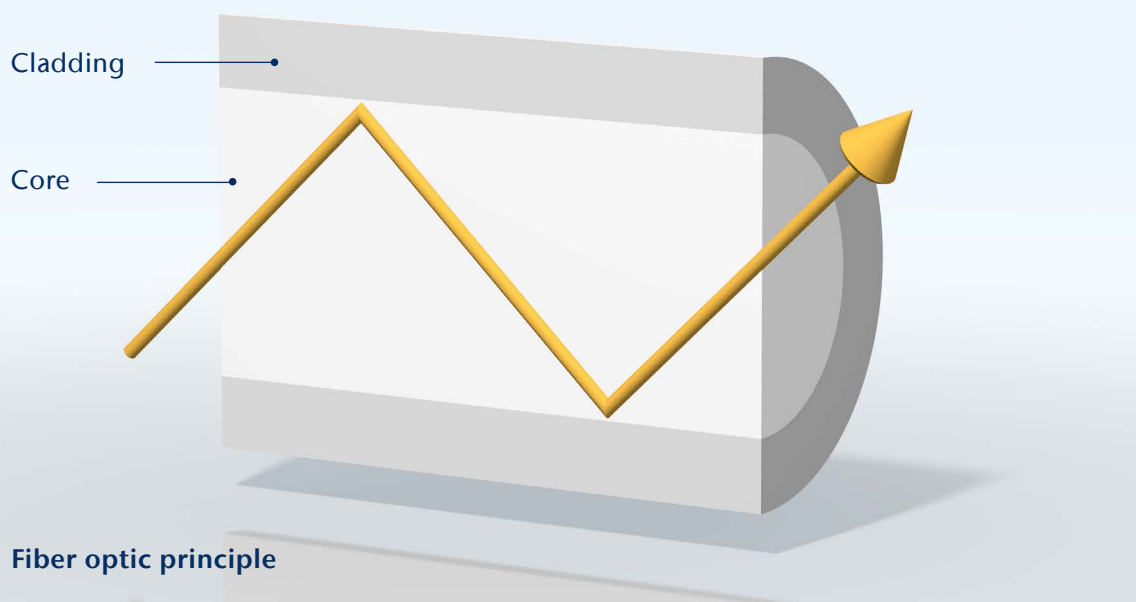
Pioneering the impossible since 1884. When others say no, we say yes. Because at SCHOTT we believe that shared responsibility can release the energy to achieve the impossible. As a global material technology group, we are constantly exploring unique and innovative ways to make a difference for businesses and people. Being a foundation company, SCHOTT has anchored a responsibility for scientific research, society and the environment deeply in its DNA. Represented in over 30 countries by 17,100 employees, we are a highly skilled partner for many high-tech industries: Healthcare, Home Appliances & Living, Consumer Electronics, Semiconductors, Optics, Astronomy, Energy, and Aerospace. Whatever challenges the future might hold, we can't wait to come up with innovative solutions and turn visions into reality.

SCHOTT Lighting and Imaging has been a leading designer and manufacturer of fiber optics and LED solutions for 60 years. We apply our advanced glass technology capabilities to create leading-edge flexible and rigid glass fiber optic guides that transfer images and light with precision, and to produce high-quality LED light sources. Our proficiency in lighting and imaging is improving lives by advancing applications in medical, industrial, aviation, automotive, and defense areas. We provide a full range of services that range from assisting with early-stage product development all the way to serial production.



## Content

- 4 Fiber optic technology
- 6 Components
- 16 Light guide
- 16 Options
- 22 Subassemblies
- 24 Image guide
- 24 Options
- 30 Why SCHOTT?



# Fiber optic technology

## What are optical glass fibers?

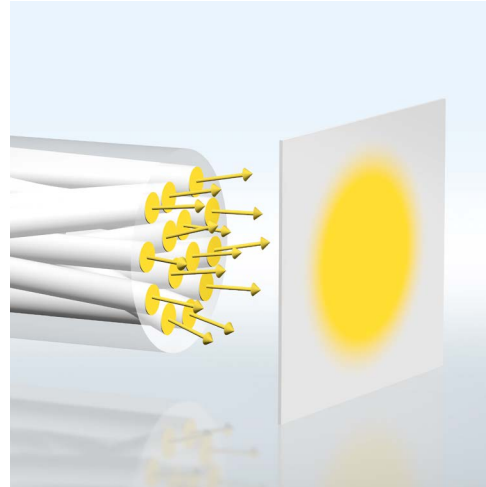
At the heart of all fiber optic technology is the glass fiber. This thin, flexible, and transparent optical component has a diameter about the size of a human hair. Light travels through the core of optical fibers, emitting light or forming images at the fiber bundle's end.

This transmission is possible thanks to two materials with different refractive indices. Glass fibers are composed of a high refractive index core and a low refractive index cladding. The principle of total internal reflection dictates that when light hits the boundary between the core and the cladding below the limiting angle, it's reflected and carried further along the fiber to the end.

# Glass optical fibers enable light and image transmission

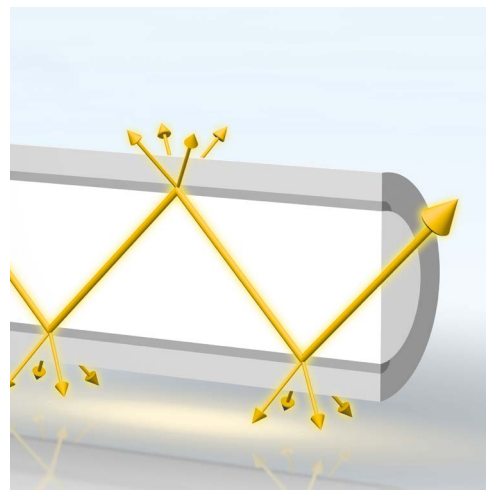
## Light transmission for sensors and control applications

Light guides carry light from one end to the other. The arrangement of SCHOTT's fibers can be randomized to create very homogenous illumination.



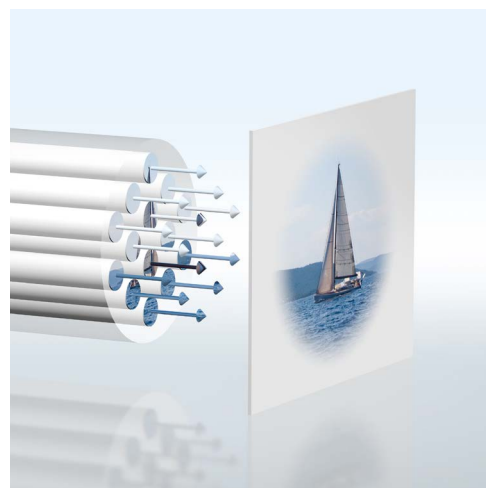
## Side-light transmission for industrial lighting and sensor applications

Side-emitting light guides are designed to emit light to the side or to work as a sensor.

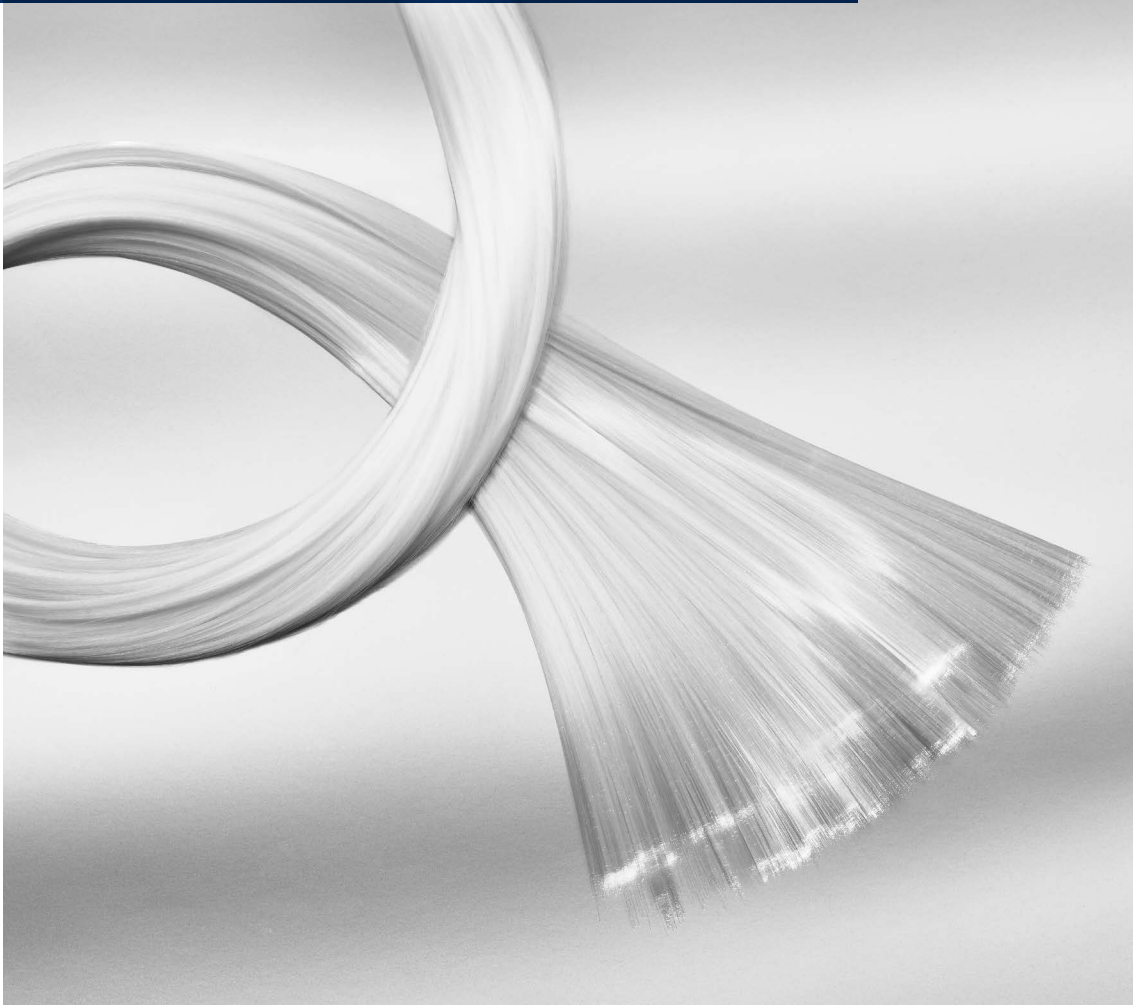


## Image transmission for imaging applications

Image guides can transport an image over a long distance and magnify, reduce, or invert it. Each fiber in the image guide acts like a single image pixel, making end-to-end fiber alignment critical.



# Components



## Guide types

Optical guides based on glass fibers are available in flexible or rigid formats. Flexible light or image guides are often longer than rigid guides and are typically used when the target lies around a corner or in a narrow space. When used in movable setups, the guide must be very flexible and able to withstand repeated bending.

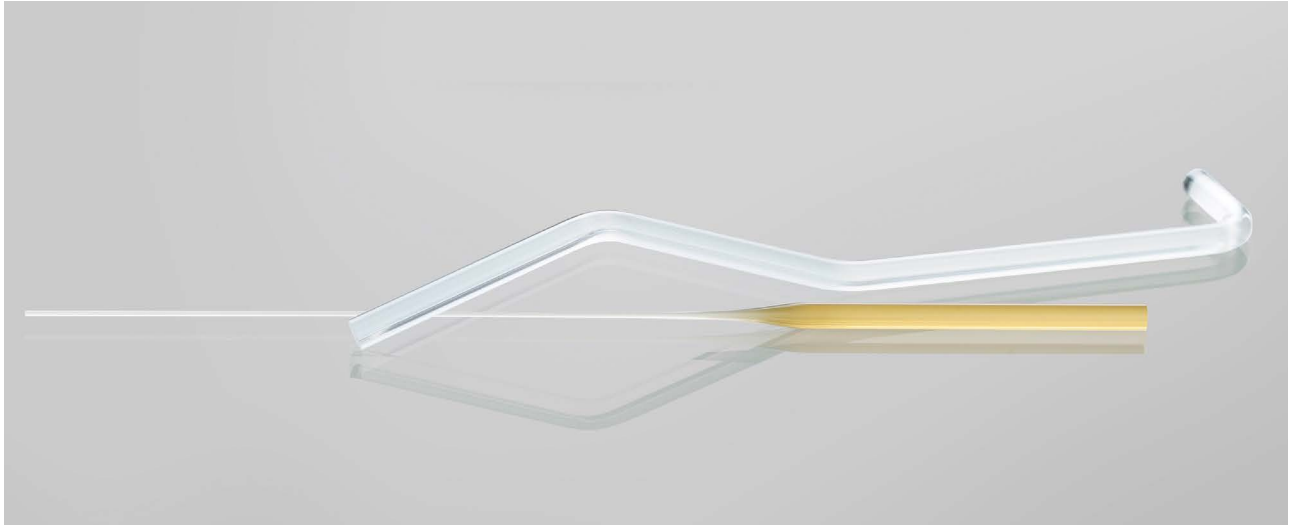


**Rigid fiber optic rods are solid fiber optic elements that can be used to transmit light, images, or signals over short distances when flexibility is not required. Versions that combine flexible and rigid properties are also available.**



## Lengths, diameters, and bending radii

Fiber optic light guides and images guides can be custom-tailored for individual applications. Working with our customers we develop optomechanical solutions for wavelengths ranging from ultraviolet to near infrared regions with nanometer tolerances. Fiber optic guides are available with various lengths, diameters, and bending radii.



# Sheathings

Sheathing is more than simply packaging for fiber bundles. It is an integral structural component that can be used to meet specific application needs. If, and for how long, a light or image guide operates reliably depends to a large extent on the protective sheathing used.

SCHOTT offers many different types of sheathings so that fiber bundles can be protected in various challenging mechanical, physical, and chemical environments.



## Example sheathings:

- Metal-PVC
- Stainless steel interlock
- Stainless steel interlock with silicone covering
- Thin wall silicone or FEP
- Extrusion options with PVC, TPU, FEP



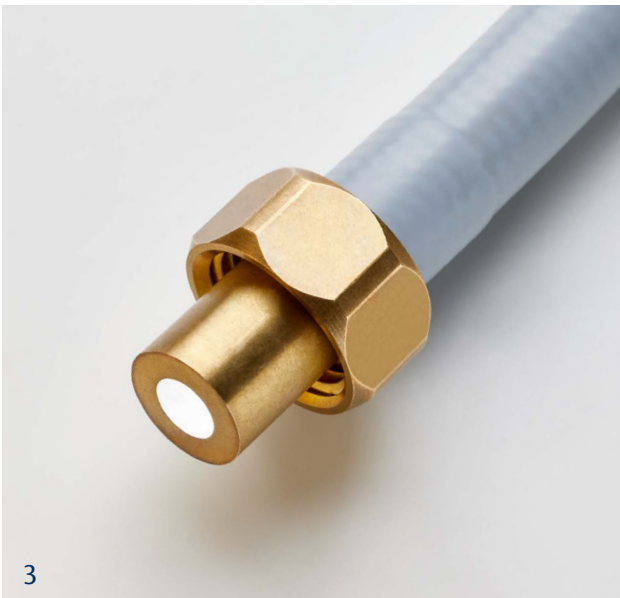


## Terminations and connectors

End ferrules for bonded/epoxied light guides are made of aluminum, brass, stainless steel, nickel silver, or other materials. For hot-fused components, the end ferrules are made from stainless steel.

### Ferrule material and connector examples

- German silver and brass
- Stainless steel (medical grade)
- Aluminum (in particular for milled housings)
- Anodizing options upon request
- Polymer housings milled or injection molded
- Standard industrial connectors: SMA, ST, FC
- Standard medical connectors: Storz, Olympus, ACMI



- 1 | C-Mount
- 2 | C-Mount adapter
- 3 | Customized thread
- 4 | LC
- 5 | ST





## **Glass tube fusion**

**The hot-fused ends of flexible light guides can be tapered. Compared to other solutions where a taper is added to the end of the light guide, this process reduces the number of**



**optical interfaces where light can be lost and hence, improves light output. In addition, the design allows the the guides to be used in high-temperature environments.**



# Light guide

## Options

### Cross section transformers/Spot-to-line assemblies

Light guides can be fabricated in a variety of complex geometries to meet the requirements of advanced sensing measurement devices.

Cross-section transformers can be used at the object end to change a specific type of fiber bundle into a form that matches the geometry of the detector. For example, this is useful for spot-to-line assemblies where a fiber bundle that is round at the object end is transformed into a line. Other transformations are also possible.



## Dual or multibranch options

Homogenized glass optical fibers can be divided into multiple branches. This can be used to create a light guide that splits a signal for detection by several photodiodes. By using different diodes, an even light measurement along the spectrum can be achieved.





Individual fiber arrangements and geometries are suitable for hazardous and hot environments.



## Extreme geometries

SCHOTT's special production processes facilitate extreme bending angles and tapering, which are highly valuable in applications where space is precious.

We also offer a wide range of geometries with small tolerances and consistent reproduction.





# Subassemblies



## Optical subassemblies

SCHOTT offers customized optical subassemblies for a range of industrial uses. Besides fiber optics, subassemblies can include a comprehensive suite of components such as lenses, filters, dichroic mirrors, and homogenizers, all customized to meet the unique requirements of each application.

## Mechanical subassemblies

To seamlessly integrate our light guides into your application, we offer tailored mechanical subassemblies such as high-temperature housings and protection using SCHOTT NEXTREMA® and Quarzal. Additional assemblies include couplings and feedthroughs for vacuum-tight applications. Hybrid solutions that combine optical and electrical links and harnesses are available.





# Image guide

## Options

### Fused imaging fiber optics

SCHOTT fused imaging fiber optics transmit a high quality image with minimal distortion and transmission loss. We can transform your vision into fused fiber optics with customized forms, shapes, lengths, and diameters.

Each custom solution is developed for specific applications and environments.



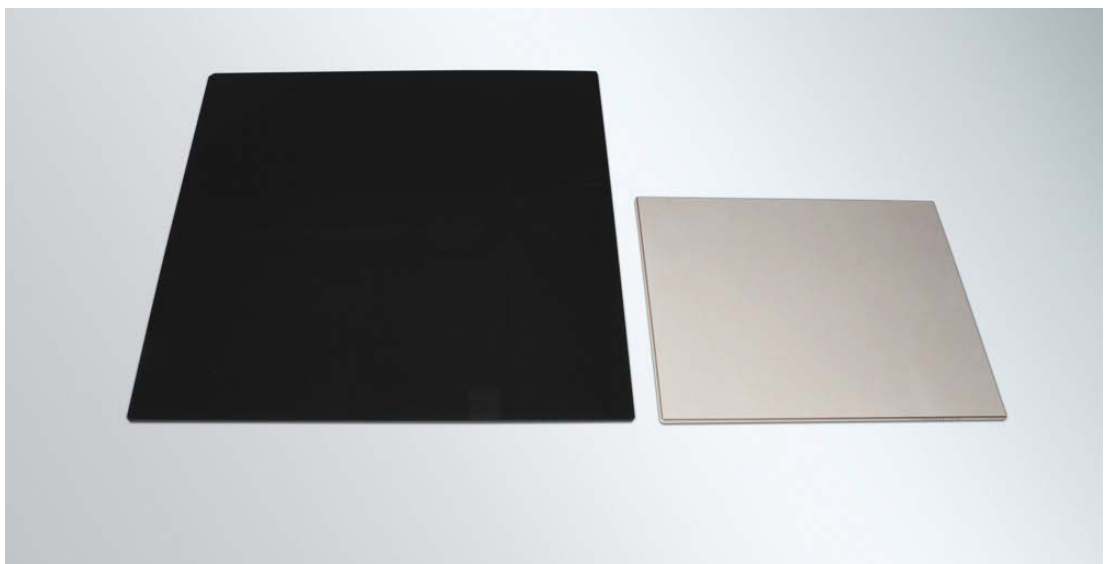
## Tapers

**A taper provides a reliable method of magnifying or reducing an image with minimum distortion in image transfer applications. Whether you require image coupling to CCD or CMOS devices or for intensified video or biological imaging, we can find a high-performance solution.**

# Faceplates

Widely used for high resolution 'zero thickness' image transfer applications, fiber optic faceplates can be coupled to CCD, CMOS, and OLED devices to enable image intensification, remote viewing, field flattening, and x-ray imaging.

In opto-electronic applications, coated faceplates are used as both input and output high resolution image transfer windows. In some applications, the x-ray absorption properties of the fiber optic plates protect the photodetectors from damage and prevent electronic noise affecting the images.



## Straight thrus and inverter



SCHOTT's fused imaging fiber optic straight thru transfer an image 1:1 from its input surface to its output surface with high resolution.



A fiber optic image inverter twists an image in a specific angle (for example 180 degrees) from its input surface to its output surface. An inverter provides the advantages of a compact, vacuum-tight, and lightweight image transfer package.

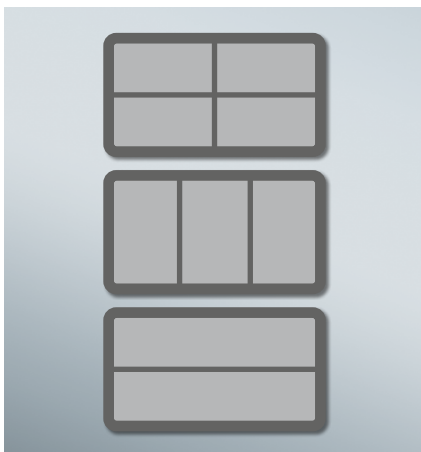


#### How it works:

Each bundle corresponds to a different segment in the image guide. The image above shows an assembler with four arms, different numbers of arms and different layouts are possible.

## Image assembler | multiple arms

Image assemblers combine multiple arms into a single output. A camera with software can then easily detect separated and isolated information from each segment.



Examples of different output layouts.

**SCHOTT**  
glass made of ideas

## KL Series

Fiber optic illumination  
for stereo microscopy

2800 K

0 100

1500 HAL

**SCHOTT**

SCHOTT is a leading international technology group in the areas of specialty glass and glass-ceramics. With more than 130 years of outstanding development, materials and technology expertise we offer a broad portfolio of high-quality products and intelligent solutions that contribute to our customers' success.

Light is a key element in stereo microscopy. Reliable illumination solutions are necessary to make hidden details visible and results reproducible. SCHOTT's Lighting and Imaging division offers a complete portfolio in fiber optic and direct LED illumination to provide the most suitable contrasting solution for a variety of industrial applications and life science.



## Contents

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| <b>4</b>  | Discover our KL Series       | <b>16</b> | Light Guide Variants |
| <b>6</b>  | KL Fiber Optic Light Sources | <b>20</b> | Accessories          |
| <b>8</b>  | Light Source Variants        | <b>21</b> | System Diagrams      |
| <b>14</b> | KL Fiber Optic Light Guides  |           |                      |

## Discover our KL Series

SCHOTT's KL series combines fiber optic light sources with a broad range of light guides that use PURAVIS® glass fibers to offer high levels of flexibility and light quality. Taken with specialist light guides such as line lights, the illumination portfolio provides solutions for all applications.



### **Intense light for high magnification**

Combining the high light output of SCHOTT's light sources with our light guides offers significantly higher intensities compared to direct LED light. Our KL models are favourable for intense lighting for magnifications over 30x.

**Uniform light quality**

The KL series demonstrates its full strength in situations where uniform light quality is crucial. Carefully matched components deliver homogeneous illumination, while consistent color temperature, controllable features and a variety of accessories enable our light sources to deliver accurate results every time.

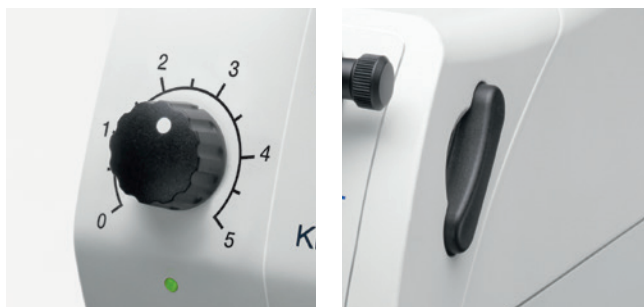
## KL Fiber Optic Light Sources

SCHOTT's KL Fiber Optic Light Sources with LED or halogen illumination are widely used in stereo microscopy for a broad range of applications. As cold light sources, they are ideal in heat-critical situations, and with a halogen light option, natural color reproduction is available across the full spectrum.



### Reduced heat influx

SCHOTT launched its first cold light source in 1970, and these sources were quickly established as a market standard. As the light is guided from the cold light source via light guides, heat at the specimen is reduced to a minimum.





### Smart design

SCHOTT KL Fiber Optic Light Sources are ergonomically designed for efficiency and performance. Their small footprint opens up more workspace, while the high quality materials and production offers near-silent operation for distraction-free working.

## Benefits



### Quiet operation

Fan-less or low-noise fan with air vent at the rear of the casing.



### Low power consumption

SCHOTT's experience in smart engineering leads to the optimization of energy use.



### Maintenance-free

LED lifetime of 50,000 hours.



### Remote control

Options for USB connectivity for remote control.

## Light Source Variants

Our light sources are available in a number of models, each with their own set of properties and features to give you the widest choice of intensity, options and accessories. Whether it's the compact KL 300 LED or the powerful KL 1500 HAL for color-critical applications, high performance comes as standard across the range.



### KL 2500 LED

The KL 2500 LED is the performance leader in advanced cold light sources with an LED light engine. With a highest light output and wide range of special features, it's ideal for customers with specialist requirements.

#### Characteristics

- Patented white light engine
- USB connectivity
- Electronic shutter function
- LCD display indicating brightness, operation mode or error code
- Intensity control with three sensitivities
- Two-position filter slider

#### Advantages

- Maximum light intensity of 1,100 lm
- Connection for foot switch
- PC-controllable via USB connection
- Continuous dimming from 0-100 %
- Extra-fine dimming option, down to 0.1 % steps
- Maintenance-free LED engine with 50,000 operating hours



## KL 1600 LED

A standard LED cold light source for fiber optics, the KL 1600 LED is an ideal option for all objects and applications. Its multiple-chip white LED light engine offers an attractive alternative to conventional halogen cold light sources.

### Characteristics

- Patented white light engine
- Easy to use fixture mechanism with clamping screw
- Two-position filter slider

### Advantages

- Maximum light intensity of 680 lm
- Continuous dimming from 0-100 %
- Maintenance-free LED engine with 50,000 operating hours



## KL 1500 HAL

The KL 1500 HAL is a color-neutral professional halogen light source for fiber optic illumination. With the full 150-Watt halogen spectrum of CRI 100, it's designed to deliver optimum performance for color-critical measurements.

### Characteristics

- High frequency illumination of 20 kHz
- Sensor interlock at the light guide socket
- LCD display to monitor color temperature and light intensity
- Swing-in optics for homogenization of light output
- Two-position filter slider

### Advantages

- Maximum light intensity of 600 lm
- Color rendering index of 100 for excellent performance
- Continuous dimming from 0-100 %





## KL 300 LED

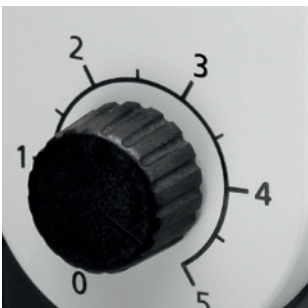
The KL 300 LED is a compact LED light source for fiber optics, offering simple operation combined with excellent value for money. These qualities make it ideally suited to routine inspections and education.

### Characteristics

- Compact design
- Directly mountable to stand or column
- Wide range power supply with international clip plug system

### Advantages

- Maximum light intensity of 80 lm
- Continuous dimming from 0-100 %
- Maintenance-free LED engine with 50,000 operating hours
- Fan-less convection cooling enables silent operation





## Features

An at-a-glance guide to the features of SCHOTT's range of KL Fiber Optic Light Sources.

Feature	KL 300 LED	KL 1600 LED	KL 2500 LED	KL 1500 HAL
Lamp type	LED	LED	LED	HAL
Lightflux (lm)	80	680	1100	600
Max. active light guide Ø (mm)	6	9	9	9
Wide range power supply	●	●	●	●
Continuous dimming	●	●	●	●
Extra fine dimming			●	
LCD display			●	●
Filter slider		●	●	●
Fan cooling		●	●	●
USB port			●	
Lamp replaceable by user				●

## KL Fiber Optic Light Guides

SCHOTT's KL Fiber Optic Light Guides offer modular fiber optic illumination for stereo microscopy and are the ideal match for our KL Light Sources. Made using high quality PURAVIS® glass fibers in a tough metal housing, they deliver strong performance, superior longevity and outstanding transmission of white light.



### **High white light transmission**

All SCHOTT microscopy light guides use PURAVIS® eco-friendly glass optical fibers to offer high light transmission and low color shift. And thanks to an improved numerical aperture, the light guides capture more light at their source, leading to a brighter, more intense output.



### Mechanical stability

Our light guide designs are light-weight yet offer strong protection against pressure and other mechanical challenges for improved fiber longevity. The bundles also have extremely small bending radii, as well as high flexural capabilities.

## Benefits



### Mechanical stability

Our light guides design includes protection against pressure and other mechanical challenges for improved longevity.



### Homogeneous lighting

Perfectly harmonized system with SCHOTT KL Fiber Optic Light Sources.



### Specialized design

60 years of experience gives SCHOTT the edge in light guide design.



### High compatibility

A broad portfolio of adapters ensures SCHOTT light guides fit almost all microscopes.

## Light Guide Variants

The optimal illumination of objects under examination is the most decisive factor for accurate results in stereo microscopy. The range of products and accessories in SCHOTT's Fiber Optic Light Guide series ensures that you receive the very best contrast for your application.



### Gooseneck Light Guides

SCHOTT Goosenecks are flex-and-stay light guides that remain in place after positioning, providing flexible and obedient incident illumination for space-constrained applications.

#### Characteristics

- Available with one, two or three branches
- Available as two-branch Gooseneck with flexible input bundle (Combi Light Guide)
- Focusing optics and filter accessories available
- High white light transmission thanks to the use of SCHOTT PURAVIS® fibers

#### Advantages

- Perfect trade-off between flexibility and mechanical stability
- Mechanical stability enables long-term usability and precise positioning for complete control of light placement
- The Combi Light Guide can be fixed stationary at the microscope stand



## Flexible Light Guides

SCHOTT Flexible Light Guides are highly bendable. In contrast to goosenecks, they allow a higher flexibility and need to be held.

### Characteristics

- Flexible Light Guides are available in different lengths and diameters
- Available with one, two or three branches
- Focusing optics, filters and mechanical accessories are available
- High white light transmission thanks to the use of SCHOTT PURAVIS® fibers

### Advantages

- High flexibility for different lighting
- Extra long lengths available





## Ring Lights

SCHOTT Fiber Optic Ring Lights are available as six-point, annular or darkfield versions with specific advantages. For all ring lights we offer adaptors for a variety of objective series.

### Characteristics

- Mounts directly to the objective using a thumb screw
- Housing made of rugged, black, anodized aluminum
- Fiber bundle protected by flexible metal PVC sheathing
- High white light transmission thanks to the use of SCHOTT PURAVIS® fibers

### Advantages

- Annular ring lights offer absolute shadow-free illumination
- Six-point ring lights offer a cost-effective alternative to annular ring lights
- Darkfield ring lights offer low-angle illumination for shiny, reflective surfaces





## Line Lights

SCHOTT Line Lights are used to increase the visibility of fine surface structures on flat samples. When illuminated with line light, the sample is lit from the side at a flat angle, resulting in contrast being enhanced by grazing light and its shadow effects.

### Characteristics

- Line lights offer intense homogeneous slit illumination
- Adjustable cylindrical lens to reduce the illumination angle by up to three degrees
- Housing made of rugged, black, anodized aluminum
- Fiber bundle protected by flexible metal PVC sheathing

### Advantages

- Three different slit slices available according to sample size
- Line lights offer low-angle illumination for objectives with flat structures
- Mechanically stable configuration when combined with a separate articulated arm



See SCHOTT's line lights in action and learn about typical areas of application.



## Accessories

SCHOTT provides a wide range of mechanical and optical accessories to increase the flexibility of its KL Light Sources and Light Guides.

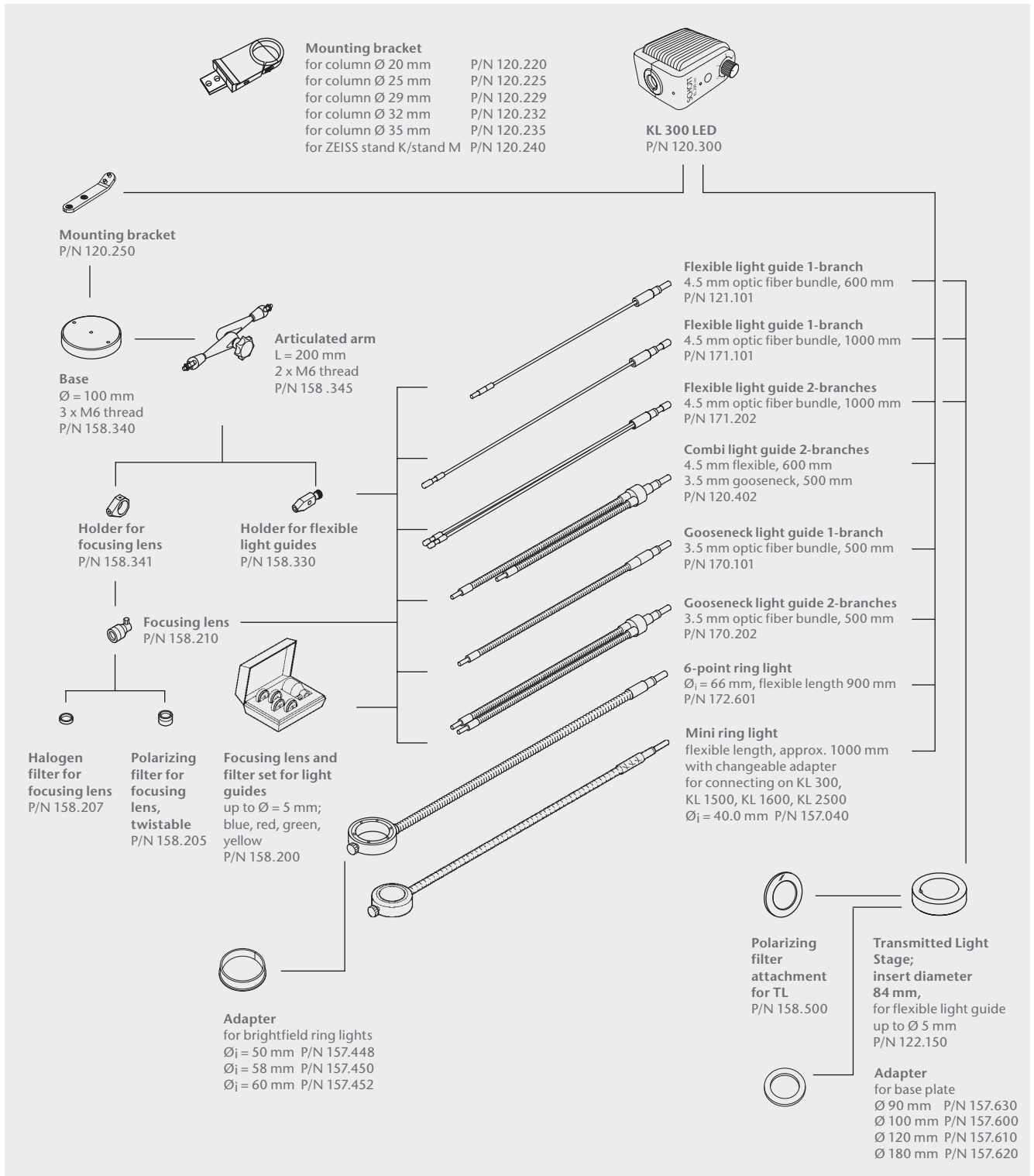
### Examples



- 1 | Color Filters
- 2 | Transmitted Light Stage
- 3 | Mounting Brackets for Column  
Ø from 25-35 mm
- 4 | Adapter for Combi Light Guide
- 5 | Focusing Lens and Filter Set
- 6 | Articulated Arm
- 7 | Base
- 8 | Holders

# System Diagrams for KL Series

## KL 300 LED



KL 1600 LED | KL 2500 LED | KL 1500 HAL

Power cord EU P/N 400.051  
 Power cord US P/N 400.052  
 Power cord UK P/N 400.053  
 Power cord CH P/N 400.054

Insert filter Ø 28 mm  
 blue P/N 258.302 green P/N 258.304  
 red P/N 258.303 yellow P/N 258.305

KL 1500 HAL  
 P/N 150.700

Light guide adapter  
 for Volpi and Photonic  
 P/N 158.320

Insert filter Ø 28 mm  
 daylight filter P/N 258.306

**A** Adapter for working  
 Distance (WD)  
 WD 30-50 mm P/N 157.569  
 WD 30-80 mm P/N 157.567  
 WD 30-110 mm P/N 157.562

Polarization filter  
 for annular ring light  
 Ø<sub>i</sub> = 66 mm P/N 158.430  
 for annular ring light  
 Ø<sub>i</sub> = 58 mm P/N 158.440

**A** Adapter  
 for brightfield ring lights  
 Ø<sub>i</sub> = 50 mm P/N 157.448  
 Ø<sub>i</sub> = 58 mm P/N 157.450  
 Ø<sub>i</sub> = 60 mm P/N 157.452

**B** Diffuse facelight  
 active area 78 x 30 mm  
 P/N 500.100  
 fitting light guides  
 P/N 155.103

Annular ring light  
 for incident darkfield  
 flexible length  
 approx. 1000 mm  
 P/N 157.406

Mini ring light  
 flexible length  
 approx. 1000 mm  
 with changeable adapter  
 for connecting on KL 300,  
 KL 1500, KL 1600, KL 2500  
 Ø<sub>i</sub> = 40.0 mm P/N 157.040

Annular ring light  
 flexible length  
 approx. 1000 mm  
 Ø<sub>i</sub> = 58 mm P/N 157.410  
 Ø<sub>i</sub> = 66 mm P/N 157.420

Annular ring light  
 flexible length  
 approx. 1000 mm  
 Ø<sub>i</sub> = 66 mm (slim) P/N 157.066  
 Ø<sub>i</sub> = 81 mm P/N 157.081  
 Ø<sub>i</sub> = 86 mm P/N 157.086

Line light with  
 adjustable front lens  
 flexible length  
 approx. 1000 mm  
 Slit 50 x 1.2 mm P/N 160.100  
 Slit 100 x 0,6 mm P/N 160.110  
 Slit 200 x 0,3 mm P/N 160.120

Gooseneck light  
 guide 1-branch  
 Ø = 4.5 mm/600 mm  
 P/N 154.101

Gooseneck light  
 guide 2-branch  
 Ø = 4.5 mm/600 mm  
 P/N 154.202

Gooseneck light  
 guide 3-branch  
 Ø = 4.5 mm/600 mm  
 P/N 154.302

Flexible light guide 1-branch  
 Ø = 5.0 mm/1000 mm P/N 155.100  
 Ø = 5.0 mm/1600 mm P/N 155.102  
 Ø = 8.0 mm/1000 mm P/N 155.103  
 Ø = 9.0 mm/1000 mm P/N 155.104

Flexible light  
 guide 2-branch  
 Ø = 4.5 mm/1000 mm  
 P/N 155.204  
 Ø = 4.5 mm/1600 mm  
 P/N 155.205

Flexible light  
 guide 3-branch  
 Ø = 4.5 mm/1000 mm  
 P/N 155.206

Double combi  
 light guide  
 Ø = 4.5 mm/500 mm  
 + 800 mm  
 flexible P/N 170.402

