



FiberSplit®  
Light Distribution for Optical Systems

LEONI 1x8-802 105  
LEONI 1x8-802 107

The Quality Connection

**LEONI**

# Our product family

## FiberSplit®



### Applications

LEONI's multimode splitters are based on a planar waveguide technology that offers maximum performance and exceptional long-term stability. Our standard splitters are mainly used in passive optical distribution networks in the subscriber loop of the telecommunication networks (FTTH). Other applications of LEONI splitters are measuring systems and laser systems. LEONI also offers special PLCs with optical functions such as couplers, interferometers or pitch converter systems for measurement, sensor technology systems or optical signal processing.

### Optical technologies at LEONI

The Business Unit Fiber Optics of the LEONI Group is one of the leading suppliers of high quality fused silica, preforms and optical fibers for special industrial and optical applications, sensor technology and optical analysis, scientific purposes, the telecommunication sector and laser medicine. LEONI offers a unique product portfolio at every stage in the value chain: from fused silica to preforms and drawn fibers, to fiber-optic cables and entire optical fiber systems fitted with in-house-design components developed by LEONI.

The LEONI group, which is market-listed in the German MDAX index, employs more than 62,000 people in 33 countries and with 88 subsidiaries generated consolidated sales of € 3.9 billion in 2013.

### Product portfolio

Our splitter products are based on planar waveguide technology that offers maximum performance and exceptional long-term stability – ion-exchange in glass. The standard products are low-loss and broadband singlemode splitters for the entire telecommunication wavelength range manufactured on 6-inch wafers with splitting ratios of 1×2 to 1×64, including splitters such as 1×5 or 1×12.

Our planar integrated multimode splitters are produced by means of ion exchange in glass, too. Thus, they are very compact, robust and long-term stable. Whether in sensor technologies or in optical power transfer – there is a wide range of applications. Planar waveguide components for the near infrared wavelength range (NIR: 780 nm–1060 nm) are also available.

Special products can be developed customer-specific according to your requirements, also for the visible wavelength range (VIS).

### The splitters are above all characterised by

- Very low insertion loss
- High uniformity
- High extinction rate
- Lowest PDL
- Widest bandwidth  
(780 nm – 1060 nm or 1260 nm – 1650 nm)
- Small, rugged metal housing
- Any fiber assembly
- Own connectors
- Exceptional long-term stability – tested according to Telcordia GR 1209 and 1221



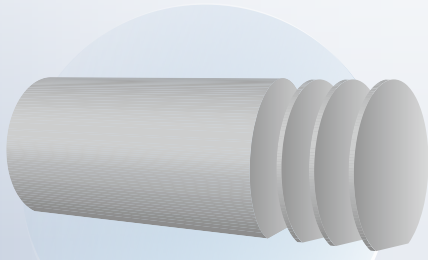
*Planar optical waveguide chip with fiber arrays*

## Process

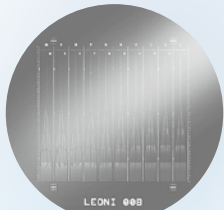
# Planar light waveguides by ion exchange in glass

Process steps starting with the preparation of the glass to completely manufactured components

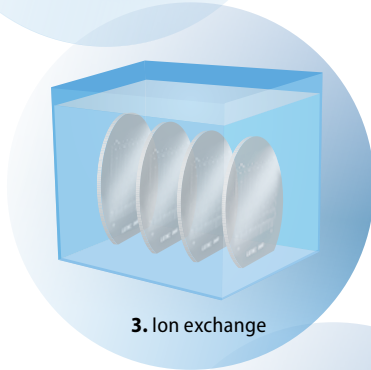
The high mobility of monovalent cations in a solid glass matrix at elevated temperatures makes it possible to produce planar waveguides by ion exchange in glass. At LEONI we utilize the exchange process of sodium ions with silver ions. The increasing concentration of silver ions results in an increase of the refractive index of the glass.



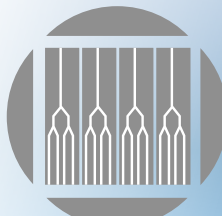
1. Cutting and polishing of wafers



2. Photolithography



3. Ion exchange



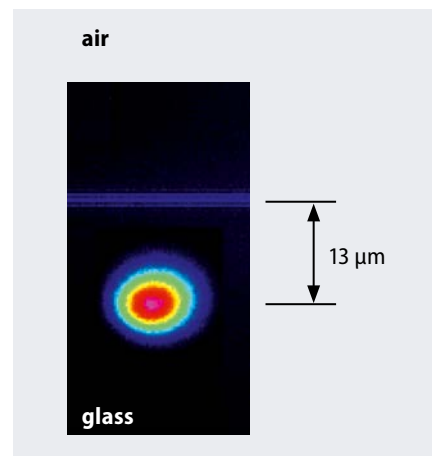
4. Cutting and polishing of chips



5. Fiber-chip-coupling



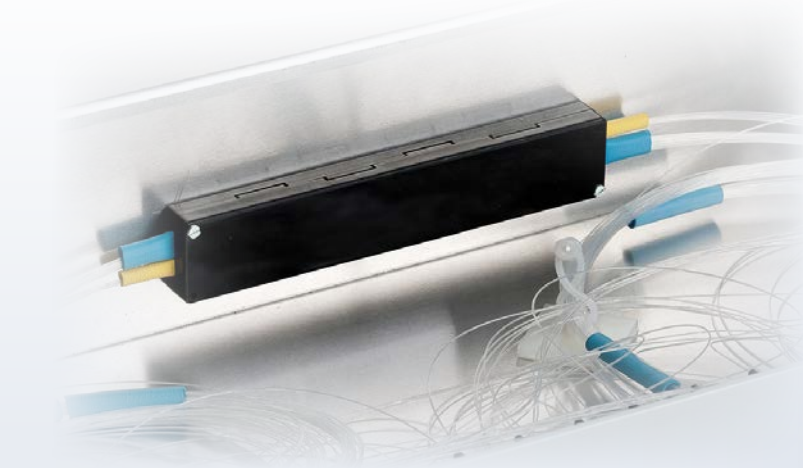
6. Housing



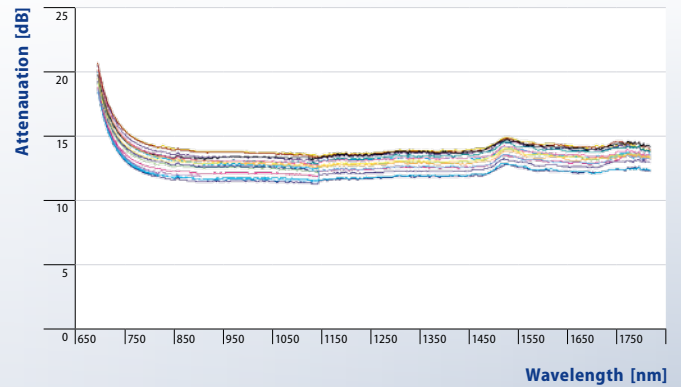
buried singlemode waveguide adapted to the fiber's modal field created in a two-stage ion exchange process

# FiberSplit® Splitter series

for multimode applications



Broadband PLC Splitter 1x16 Premium

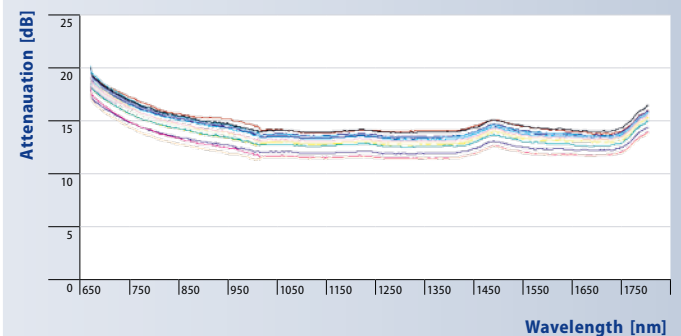


## Description

The new multimode splitter series is based on planar integrated waveguides which are produced by means of ion exchange in glass. The splitters are monolithically integrated on glass chips using lithographic structuring techniques. Thereby they are compact, robust and long-term stable and offer an extremely broad-banded uniform distribution.

The development and in-house manufacturing of planar multimode components is customer-specific. Waveguide-diameters from 50  $\mu\text{m}$  up to 200  $\mu\text{m}$  and NA from 0.2 up to 0.4 are possible. The number of input and output channels is currently limited to 32.

Broadband PLC Splitter 1x16 Standard



## Application

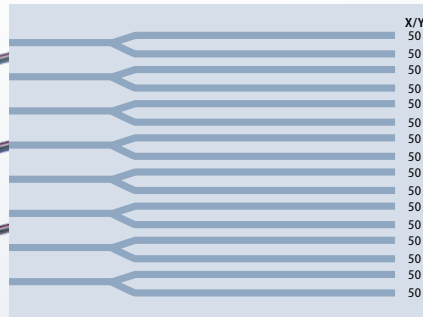
- Laser applications
- Measuring techniques
- Sensor technology
- High-power beam combiners and high-power beam splitters

<b>Composition</b>										
<b>Fiber length</b>	$\geq 1$ m									
<b>Housing dimension</b>	e.g. 160 mm $\times$ 40 mm $\times$ 12 mm (other shapes on request)									
<b>Temperature range</b>	Operating temperature					-20 °C to +70 °C				
	Storage temperature					-20 °C to +70 °C				
<b>Splitter type</b>	1x2	1x4	1x8	1x16	1x32	2x2	2x4	2x8	2x16	
<b>Max. insertion loss [dB]*</b>	4	8	11	15	18,5	4	8	11,5	16	
<b>Max. uniformity [dB]</b>	0,8	1,2	1,5	2,5	2,5	1	1,8	2	2,5	
<b>Central wavelength [nm]</b>	550 - 1700, depending on fiber type									

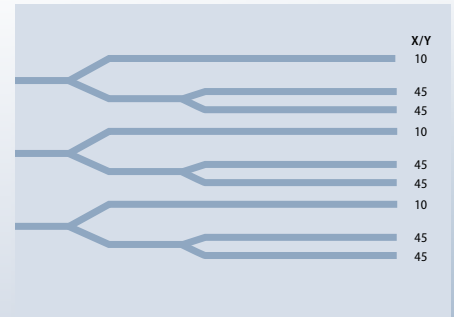
In the table the specifications of multimode splitters with core diameter 200  $\mu\text{m}$  and numerical aperture 0.36 are listed, measured at room temperature. The components have been optimized for corresponding PCF fiber. Measured values for room temperature, without connector and under stable launching conditions with an LED. Our FiberSplit® products are generally suitable for the wavelength range from 450 nm to 2000 nm. The fiber may limit the wavelength range.

# FiberSplit® Multiple ultra-broadband splitter series

planar monolithic integrated multi-splitters



(Graph above:) 8-fold 1x2 splitter



(Graph above:) customer-specific 3-fold 1x2 splitter with additional monitor channel

## M-fold 1xN Ultra-broadband

### Description

An optimum balance of performance versus cost is achieved by the exchange of silver ions in a glass specially developed for this process.

Intelligent design and sophisticated in-house manufacturing methods give LEONI splitters exceptional quality and reliability and make them especially suitable for use under the harshest environmental conditions, both for singlemode and multimode splitters.

### Product range

Standard products → 1xN M-fold (with M=2 to 12)

Customer-specific designs (on request):

- All singlemode splitter types also available as multiple splitters
- Multiple splitters for low wavelengths
- Multiple multimode splitters

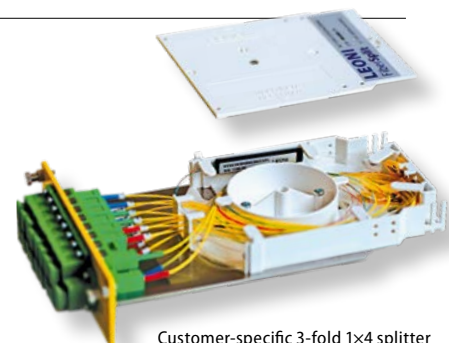
### Application

- For numerous applications within telecommunications and sensor technology
- For broadband splitting or combination of singlemode optical fibers

Composition		
Connectors	UPC or APC: SC, FC, LC, MU, E2000, ST, MPO, DIN	
Trays	"plug & play" for different connector types, e.g. LGX, Corning CCH	
Inserts	19"-inserts with connector panels 1, 2 or 3 HU (height units)	
Fiber type	G652D (9/125/250 μm) (other types on request)	
Fiber length	≥ 1 m	
Housing dimension	40 mm × 7 mm × 4 mm for 4-fold 1x4 splitters SM (other shapes on request)	
Temperature range	Operating temperature	-40 °C to +85 °C
	Storage temperature	-40 °C to +85 °C

Splitter type	8-fold 1x2	12-fold 1x2	4-fold 1x4
Max. insertion loss [dB]*	3.9	4.2	7.4
Max. uniformity [dB]	0.5	0.7	0.9
Return loss	≥ 55 dB		
Directivity	≥ 55 dB		
Polarization-dependent loss	≤ 0.15 dB		
Wavelength ranges	1260–1360 nm and 1480–1650 nm		

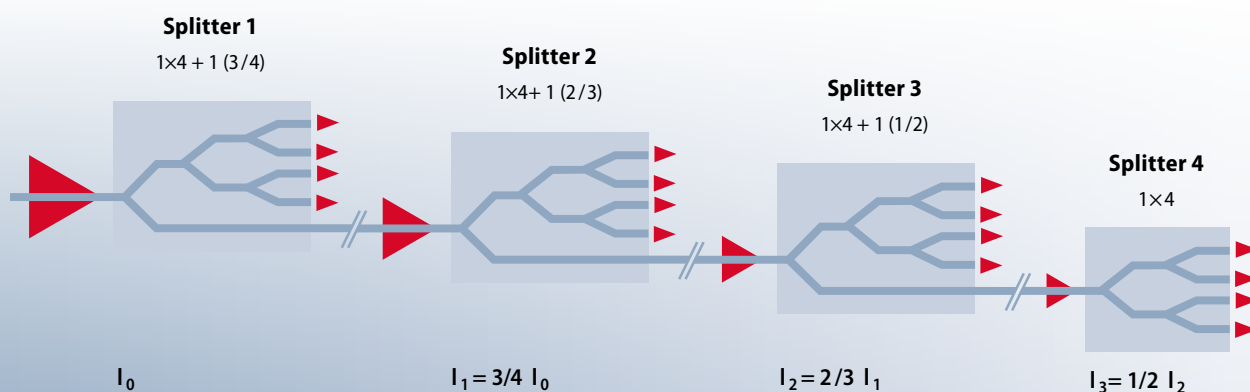
\* Applies across the entire wavelength and temperature range as well as for all polarization states. The value is up to 0.3 dB higher for the extended wavelength range from 1360–1480 nm.



Customer-specific 3-fold 1x4 splitter in vertical insert

# FiberSplit® Broadband splitters

asymmetric optical power split for singlemode applications



## 1×N Ultra-broadband cascaded splitter

### Description

Cascaded splitter composed of four single splitters equipped with four output channels each, i.e. 16 channels with the same optical power output and 3 bypass channels with an adequately reduced optical power (further cascade types with different splitting rates on request).

### Application

- For numerous applications within telecommunications and sensor technology
- For asymmetric splitting of singlemode optical fibers

Composition		
Fiber type**	Singlemode fiber (9 / 125 / 250) (n ITU G.652D or G. 657A or equ.)	
Fiber length	≥ 1 m	
Housing dimension	min. 40 mm × 4 mm × 4 mm (other shapes on request)	
Temperature range	Operating temperature	–40 °C to +85 °C
	Storage temperature	–40 °C to +85 °C

Optical specifications*	1×4 + 1 (3/4)	1×4 + 1 (3/4)	1×4 + 1 (3/4)	1×4
	Splitter level 1	Splitter level 2	Splitter level 3	Splitter level 4
Output channel IL (max.) [dB]	14.9	13.1	10.8	7.1
Output channel IL (min.) [dB]	12.9	11.6	9.7	6.5
Bypass channel IL (max.) [dB]	1.9	2.5	3.6	–
Bypass channel IL (min.) [dB]	1.3	1.9	3.0	–
Return loss RL	≥ 55 dB			
Directivity	≥ 55 dB			
Polarization-dependent loss PDL	≤ 0.15 dB			
Wavelength ranges	1260–1360 nm and 1480–1650 nm			

\* Applies across the entire wavelength and temperature range as well as for all polarization states

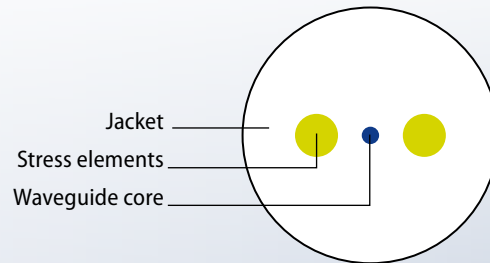
\*\* Other fiber / cable types and modified housings on request

# FiberSplit® Broadband splitter series

polarization-maintaining (PM) planar splitters for singlemode applications



Panda fiber



## 1×N Broadband PM

### Description

LEONI's planar PM splitters 1×N are developed for special applications that require high polarization retention.

The special ion exchange process for manufacturing the extremely stress-free waveguide structures on planar chips results in excellent and stable polarization properties even under extreme conditions.

### Application

- For numerous applications in optical measurement technology and sensor technology
- For broadband splitting or combination of polarization-maintaining optical fibers

Composition	
Connectors	UPC or APC: FC, others on request
Trays	"plug & play" for different connector types, e. g. LGX, Corning CCH
Inserts	19"-inserts with connector panels 1, 2 or 3 HU (height units)
Fiber type	polarization-maintaining fibers
Fiber length	1 m
Housing dimension	40 mm × 4 mm × 4 mm (other shapes on request)
Temperature range	Operating temperature     −20 °C to +60 °C Storage temperature       −40 °C to +85 °C

Splitter type	1×2	1×4	1×8
Max. insertion loss [dB]*	3.9	7.4	10.8
Max. uniformity [dB]	0.5	0.9	1.0
Return loss	≥ 55 dB		
Directivity	≥ 55 dB		
Polarization-dependent loss	≤ 0.15 dB		
Wavelength ranges	depending on fiber type		

\* Applies across the entire wavelength and temperature range as well as for all polarization states.  
The value is up to 0.3 dB higher for the extended wavelength range from 1360–1480 nm.

# FiberSplit® Ultra-broadband splitter series

for NIR (780 nm–1060 nm) / for singlemode applications

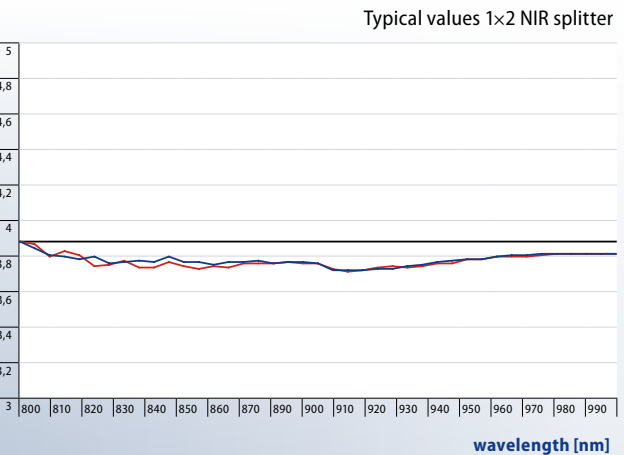


## M-fold 1×N Ultra-broadband

### Planar waveguide splitters

An optimum balance of performance versus price is achieved by the exchange of silver ions in a glass specially developed for this process.

Intelligent design and sophisticated manufacturing methods give these splitters exceptional quality and reliability and make them especially suitable for use under the harshest environmental conditions.



### Product range

Standard products → 1×2, 1×4, 1×8

Customer-specific designs (on request) e. g. 1×N with  $N \neq 2^n$ ,

- Asymmetric splits
- Splitters for lower wavelengths available on request

### Application

- For numerous applications in sensor technology
- For broadband splitting or combination of singlemode optical fibers

Composition	
Connectors	UPC or APC: SC, FC, LC, MU, E2000, ST, MPO, DIN
Trays	“plug & play” for different connector types, e. g. B. LGX, Corning CCH
Inserts	19"-inserts with connector panels, 1, 2 or 3 HU (height units)
Fiber type	G652D (9 / 125 / 250 μm), single fiber version (highest reliability and flexibility) or ribbon type
Fiber length	≥ 1 m
Housing dimension	40 mm × 4 mm × 4 mm for 1×8 splitters (other shapes on request)
Temperature range	Operating temperature    −40 °C to +85 °C Storage temperature       −40 °C to +85 °C

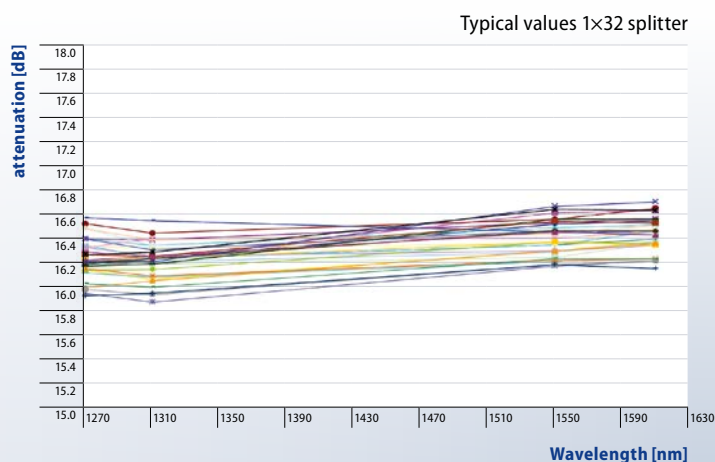
Splitter type	1×2	1×4	1×8
Max. insertion loss [dB]*	3.9	7.4	10.8
Max. uniformity [dB]	0.5	0.9	1.0
Return loss	≥ 55 dB		
Directivity	≥ 55 dB		
Polarization-dependent loss	≤ 0.15 dB		
Wavelength ranges	780–1060 nm		

\* Applies across the entire wavelength and temperature range as well as for all polarization states.



# FiberSplit® Ultra-broadband splitter series

planar waveguide splitters for singlemode applications



## 1xN Ultra-broadband

### Description

An optimum balance of performance versus cost is achieved based on the exchange of silver ions in a glass specially developed for this process.

Intelligent design and sophisticated in-house manufacturing methods give LEONI splitters exceptional quality and reliability and make them especially suitable for use under the harshest environmental conditions.

### Product range

Standard products → 1x2, 1x4, 1x8, 1x16, 1x32 and 1x64

Customer-specific designs (on request):

e. g. 1xN with  $N \neq 2^n$ , e. g. 1x6, 1x10, 1x48

- Asymmetric splits, e. g. 80 % to 20 %
- Splitters for lower wavelengths, e. g. 780 nm to 1060 nm

### Application

- For numerous applications within telecommunications and sensor technology
- For broadband splitting or combination of singlemode optical fibers

Composition		
Connectors	UPC or APC: SC, FC, LC, MU, E2000, ST, MPO, DIN	
Trays	"plug & play" for different connector types e. g. LGX, Corning CCH	
Inserts	19"-inserts with connector panels, 1, 2 or 3 HU (height units)	
Fiber type	G652D (9 / 125 / 250 μm), Single fiber version (highest reliability and flexibility) or ribbon type	
Fiber length	≥ 1 m	
Housing dimension	40 mm × 4 mm × 4 mm for 1x8 splitters (other shapes on request)	
Temperature range	Operating temperature	-40 °C to +85 °C
	Storage temperature	-40 °C to +85 °C

Splitter type	1x2	1x4	1x8	1x16	1x32	1x64
Max. insertion loss [dB]*	3.9	7.0	10.2	13.5	16.7	20.4
Max. uniformity [dB]	0.5	0.8	1.0	1.0	1.3	1.8
Return loss	≥ 55 dB					
Directivity	≥ 55 dB					
Polarization-dependent loss	≤ 0.15 dB					
Wavelength ranges	1260–1360 nm and 1480–1650 nm					

\* Applies across the entire wavelength and temperature range as well as for all polarization states.  
The value is up to 0.3 dB higher for the extended wavelength range from 1360–1480 nm.

## FiberSplit® Splitter modules, inserts and trays

for direct installation in sockets, racks and cabinets



multiple multimode splitter with PCF fibers and ST connectors in a 19" rack



### Description

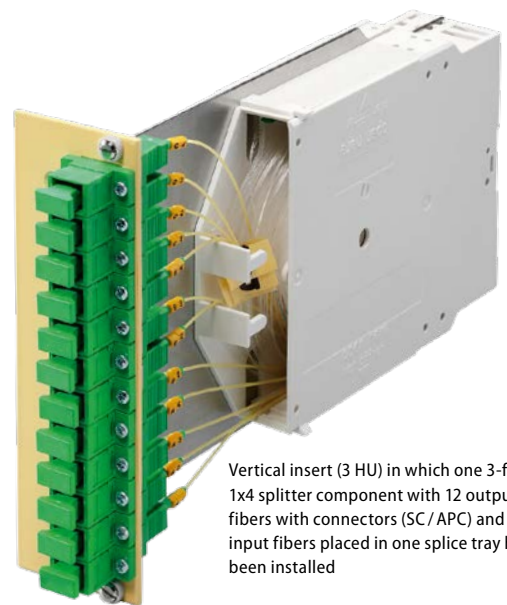
Based on the described splitter components, LEONI offers a wide range of further assemblies in modules, inserts and trays that are suitable for direct installation in sockets, racks or cabinets.

A range of housing shapes from the standard housing customary in the market to customer-specific housing solutions are available.

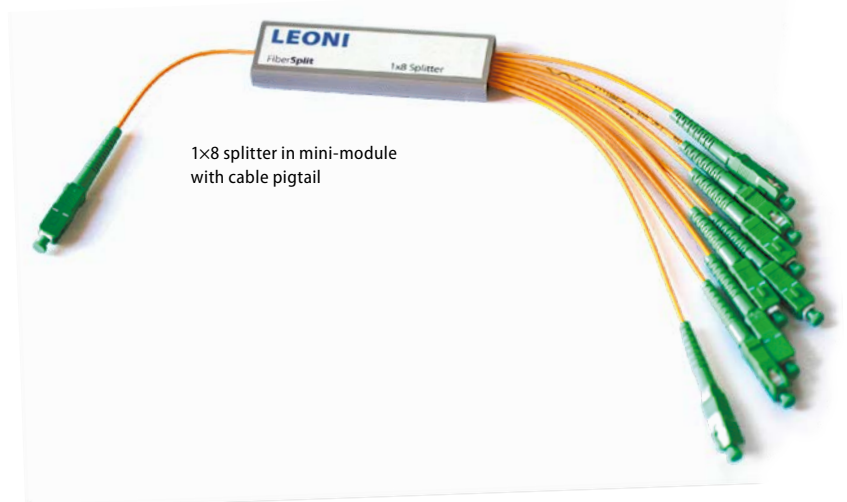
### Further information and solution suggestions on request

### Example

Vertical insert (3 HU) in which one 3-fold 1x4 splitter component with 12 output fibers with connectors (SC/APC) and three input fibers placed in one splice tray have been installed.



Vertical insert (3 HU) in which one 3-fold 1x4 splitter component with 12 output fibers with connectors (SC/APC) and three input fibers placed in one splice tray have been installed



1x8 splitter in mini-module with cable pigtail

## Learn more about our product families

Take advantage of our expertise in fiber optic systems for sensor technology and measurement applications:

### In-house production of optical fibers

- multimode and singlemode fibers
- step index and gradient index fibers
- various numerical apertures, claddings, coatings
- from deep UV range to MIR range
- fiber rods
- fiber tapers
- capillaries

### Optical modules and components

- fiber cables
- fiber bundles
- hybrid cables
- fiber optic probes
- fiber arrays
- cross section converter
- multi branch fiber bundles
- lensed fibers with fiber arrays
- vacuum feedthroughs
- fiber optical switches
- fiber optical splitters / planar waveguide technology

Contact: [fibersense@leoni.com](mailto:fibersense@leoni.com)



### Get to know our product families:

#### FiberConnect®

Light Guide Fiber & Cable Solutions

#### FiberTech®

Special Optical Fiber Technologies

#### FiberSwitch®

Light Switching for Optical Systems

#### FiberSplit®

Light Distribution for Optical Systems

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