

multimode • fiber • switches

optojena®

FSM 1x3 to 1x9
fiber core diameter up 50µm to 200µm

- fast switching time
- low insertion loss
- high optical isolation
- compact design
- no additional wavelength dependence



applications:

- optical measurement systems
- spectroscopy
- optical engineering
- telecommunications

fig.: FSM 1x9

The fiber switches are ideally suited to combine different sensor points with just one spectrometer. Therefore, the end-user derives a cost benefit and is able to directly compare different optical channels using only one spectrometer/detector system.

Technical data:

| fiber switch part.no.: | unit | FSM 1x3 | | FSM 1x4 | | FSM 1x6 | | FSM 1x9 | |
|-------------------------|--------|-------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|
| | | F-103-05 | F-103-03 | F-104-05 | F-104-03 | F-106-05 | F-106-03* | F-109-05 | F-109-03 |
| number of input fibers | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| number of output fibers | | 3 | 3 | 4 | 4 | 6 | 6 | 9 | 9 |
| fiber core | µm | Ø50; 62.5;100 | Ø200 | Ø50; 62.5;100 | Ø200 | Ø50; 62.5;100 | Ø200 | Ø50; 62.5;100 | Ø200 |
| insertion loss typ. | dB | 0.9 | 0.9 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| cross talk typ. | dB | -60 | -60 | -60 | -60 | -60 | -60 | -60 | -60 |
| repeatability typ. | dB | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| switching time typ | ms | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| lifetime typ. | cycles | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ |
| operating temperature | °C | 0...+60 | | | | | | | |
| humidity | %RH | 55 | | | | | | | |
| operating voltage | V | 5VDC | | | | | | | |
| control signal* | - | binary code (BCD) | | | | | | | |
| current | mA | 100 | | | | | | | |
| fiber length | m | 1 | | | | | | | |
| housing l/w/h | mm | 175x105 x44 | 225x105 x44 | 175x105 x44 | 225x105 x44 | 175x105 x44 | 225x105 x44 | 175x105 x44 | 225x105 x44 |
| housing l/w/h** | mm | 175x135 x45 | 225x135 x45 | 175x135 x45 | 225x135 x45 | 175x135 x45 | 225x135 x45 | 175x135 x45 | 225x135 x45 |

*RS232 version upon request part no.:Z-950-95

** screw slot version

All casings available in a screw slot version upon request. When ordering please use the suffix 95, 93, instead of -05, -03 respectively.

All fiber switches are available with anti-reflection option. Please ask for more details and the special order numbers.



fig.:F-109-93

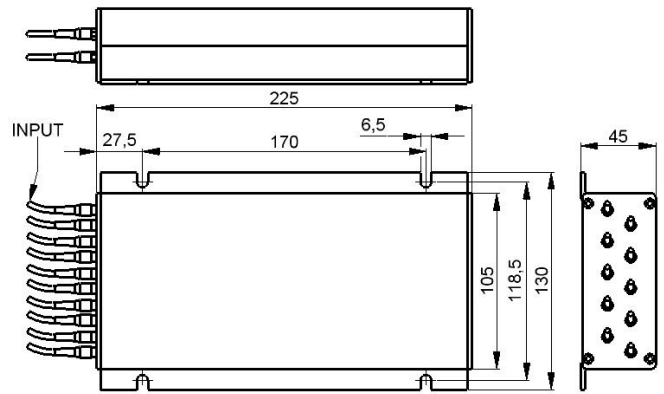


fig.: F-109-03

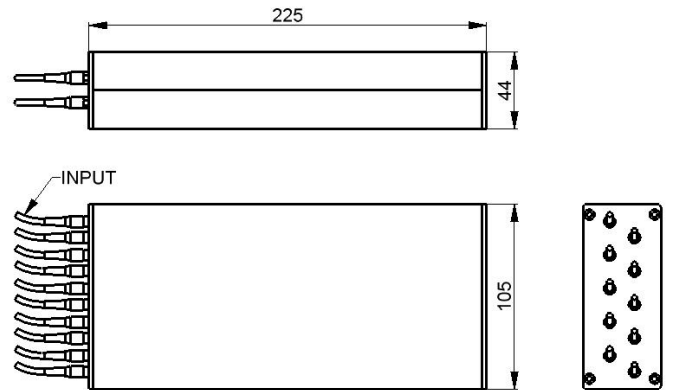
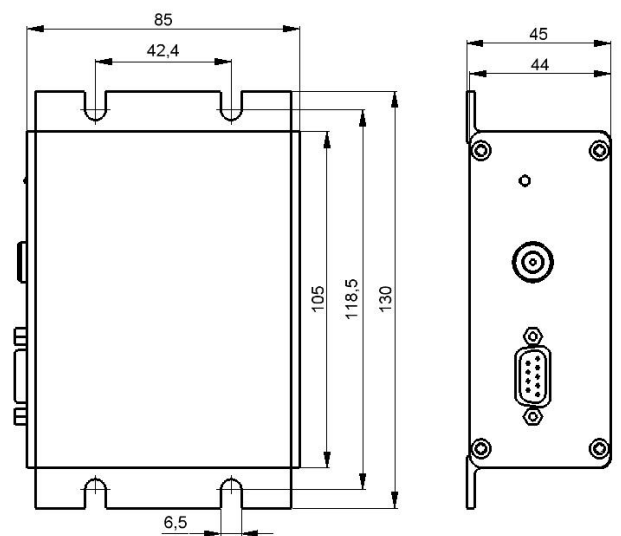
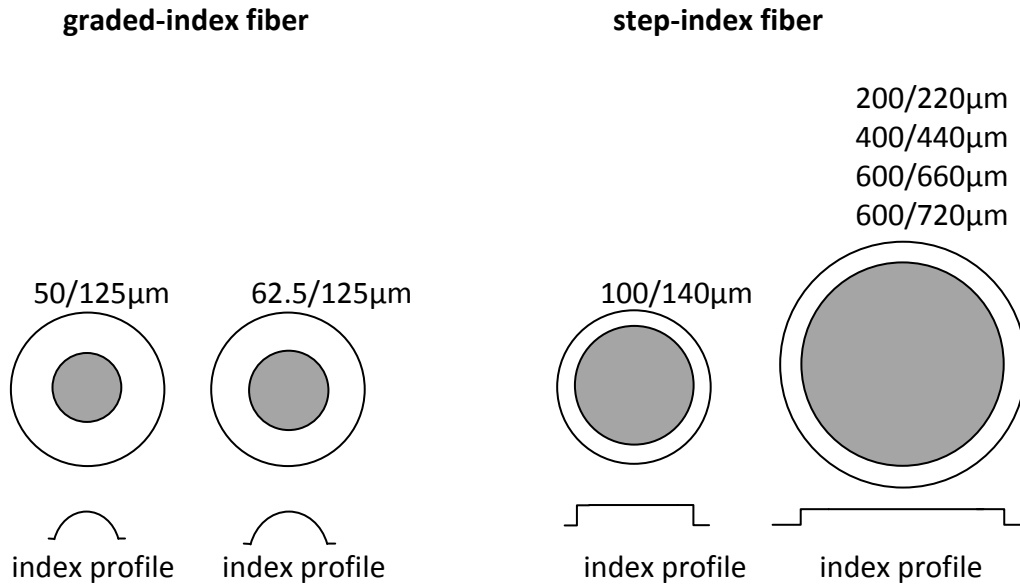


fig.: Z-950-95 RS232 BOX



Types of optical fibers:

Optical fibers are mainly classified with respect to the lateral dimensions of the light-guiding region, the so-called fiber core. The core diameter together with the refractive index distribution of the core-cladding assembly determines the number of modes the fiber carries. The following figure and table give a rough overview on the different fiber types.



| fiber diameter µm | index-profile | wavelength range nm | spectrum | NA* | connector typ | part no.for fiber (without optical connector) |
|----------------------|---------------|---------------------------|----------|------|----------------------------------|---|
| 50/125 | graded-index | 850-1300 | - | 0,20 | SMA, ST, FC/PC, FC/APC, E2000 | C-319-** |
| 62.5/125 | graded-index | 850-1300 | - | 0,28 | SMA, ST, FC/PC, FC/APC, E2000 | C-329-** |
| 100/140 | graded-index | 850-1300 | - | 0,29 | SMA, ST, FC/PC, FC/APC | C-339-** |
| 100/110 | step-index | 180-1100 | UV, VIS | 0,22 | SMA, ST, FC/PC | C-230-** |
| 100/140 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC, FC/APC | C-130-** |
| 105/125 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC | C-120-** |
| 200/220 | step-index | 180-1100 | UV, VIS | 0,22 | SMA, ST, FC/PC | C-240-** |
| 200/220 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC | C-140-** |
| 400/440 | step-index | 180-1100 | UV, VIS | 0,22 | SMA | C-260-** |
| 400/440 | step-index | 600-2600 | IR | 0,22 | SMA | C-160-** |
| 600/660 | step-index | 180-1100 | UV, VIS | 0,22 | SMA | C-280-** |
| 600/720 | step-index | 600-2600 | IR | 0,22 | SMA | C-185-** |

*NA – numerical aperture

**when ordering please use the suffix: ST: -10; SMA: -20, FC/PC: -30, FC/APC: -50, E2000: -60

All fibers can be provided with anti –reflection option after request. The anti-reflection option is recommended for spectroscopy application.

multimode • fiber • switches

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FSM 1x3 to 1x9
fiber core diameter 400µm up to 600µm

- fast switching time
- low insertion loss
- high optical isolation
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- no additional wavelength dependence



fig.: FSM 1x9

applications:

- optical measurement systems
- spectroscopy
- optical engineering

The fiber switches are ideally suited to combine different sensor points with just one spectrometer. Therefore, the end-user derives a cost benefit and is able to directly compare different optical channels using only one spectrometer/detector system.

Technical data:

| fiber switch part.no.: | unit | FSM 1x3 | | FSM 1x4 | | FSM 1x6 | | FSM 1x9 | |
|-------------------------|--------|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | F-143-10 | F-163-10 | F-144-10 | F-164-10* | F-146-10 | F-166-10 | F-149-10 | F-169-10 |
| number of input fibers | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| number of output fibers | | 3 | 3 | 4 | 4 | 6 | 6 | 9 | 9 |
| fiber core | µm | Ø400 | Ø600 | Ø400 | Ø600 | Ø400 | Ø600 | Ø400 | Ø600 |
| insertion loss typ. | dB | 1.5 | 2.5 | 2.5 | 2.5 | 1.5 | 2.5 | 3.0 | 3.0 |
| cross talk typ. | dB | -60 | -60 | -60 | -60 | -60 | -60 | -60 | -60 |
| repeatability typ. | dB | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| switching time typ | ms | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| lifetime typ. | cycles | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ | 10 ⁹ |
| operating temperature | °C | 0...+60 | | | | | | | |
| humidity | %RH | 55 | | | | | | | |
| operating voltage | V | 100...240 VAC | | | | | | | |
| control signal* | - | BCD code, RS232, USB | | | | | | | |
| bulkhead connector | type | SMA | | | | | | | |
| fiber length | m | 1 | | | | | | | |
| housing l/w/h | mm | 448 x 375.5 x 88.9 (17.6378 x 14.7835 x 3.5 inches) | | | | | | | |

*Option: ETHERNET interface (part no. Z-950-100) substitute the USB interface

accessories

| description | connector style | length | part no. |
|---------------------------------------|-----------------|--------|-------------|
| adapter fiber 400/440µm; IR; NA; 0.22 | plug to plug | 1m | C-160-20/20 |
| adapter fiber 400/440µm; UV; NA; 0.22 | plug to plug | 1m | C-260-20/20 |
| adapter fiber 600/720µm; IR; NA; 0.22 | plug to plug | 1m | C-185-20/20 |
| adapter fiber 600/660µm; UV; NA; 0.22 | plug to plug | 1m | C-280-20/20 |



fig.:F-164-10



fig.: F-169-10



fig.: F-16X-10 (backside view)

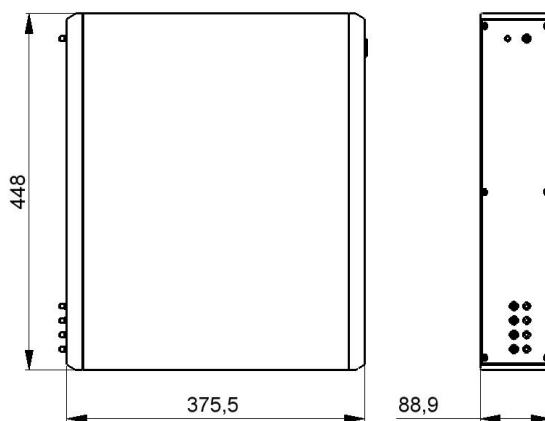
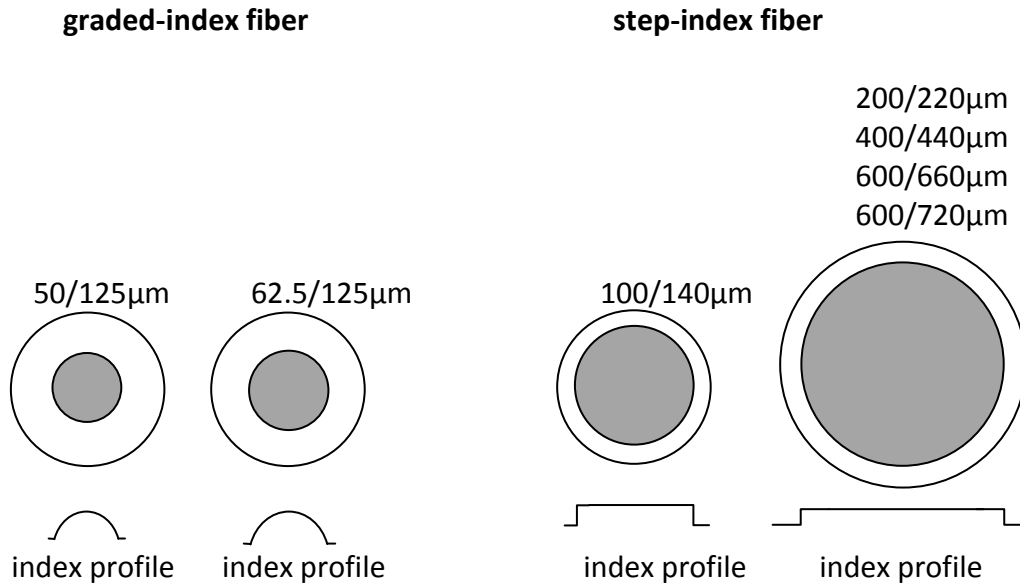


fig.: casing size

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| fiber diameter µm | index-profile | wavelength range nm | spectrum | NA* | connector typ | part no.for fiber (without optical connector) |
|----------------------|---------------|---------------------------|----------|------|----------------------------------|---|
| 50/125 | graded-index | 850-1300 | - | 0,20 | SMA, ST, FC/PC, FC/APC, E2000 | C-319-** |
| 62.5/125 | graded-index | 850-1300 | - | 0,28 | SMA, ST, FC/PC, FC/APC, E2000 | C-329-** |
| 100/140 | graded-index | 850-1300 | - | 0,29 | SMA, ST, FC/PC, FC/APC | C-339-** |
| 100/110 | step-index | 180-1100 | UV, VIS | 0,22 | SMA, ST, FC/PC | C-230-** |
| 100/140 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC, FC/APC | C-130-** |
| 105/125 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC | C-120-** |
| 200/220 | step-index | 180-1100 | UV, VIS | 0,22 | SMA, ST, FC/PC | C-240-** |
| 200/220 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC | C-140-** |
| 400/440 | step-index | 180-1100 | UV, VIS | 0,22 | SMA | C-260-** |
| 400/440 | step-index | 600-2600 | IR | 0,22 | SMA | C-160-** |
| 600/660 | step-index | 180-1100 | UV, VIS | 0,22 | SMA | C-280-** |
| 600/720 | step-index | 600-2600 | IR | 0,22 | SMA | C-185-** |

*NA – numerical aperture

**when ordering please use the suffix: ST: -10; SMA: -20, FC/PC: -30, FC/APC: -50, E2000: -60

All fibers can be provided with anti –reflection option after request. The anti-reflection option is recommended for spectroscopy application.

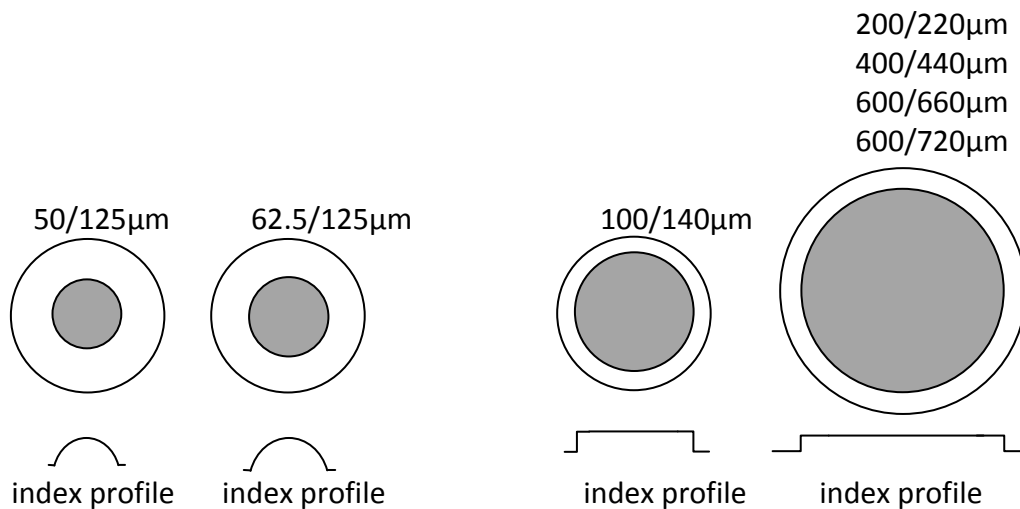
FSM – optical fibers and connectors

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graded-index fiber

step-index fiber



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| 100/140 | graded-index | 850-1300 | - | 0,29 | SMA, ST, FC/PC, FC/APC | C-339-** |
| 100/110 | step-index | 180-1100 | UV, VIS | 0,22 | SMA, ST, FC/PC | C-230-** |
| 100/140 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC, FC/APC | C-130-** |
| 105/125 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC | C-120-** |
| 200/220 | step-index | 180-1100 | UV, VIS | 0,22 | SMA, ST, FC/PC | C-240-** |
| 200/220 | step-index | 600-2600 | IR | 0,22 | SMA, ST, FC/PC | C-140-** |
| 400/440 | step-index | 180-1100 | UV, VIS | 0,22 | SMA | C-260-** |
| 400/440 | step-index | 600-2600 | IR | 0,22 | SMA | C-160-** |
| 600/660 | step-index | 180-1100 | UV, VIS | 0,22 | SMA | C-280-** |
| 600/720 | step-index | 600-2600 | IR | 0,22 | SMA | C-185-** |

*NA – numerical aperture

**when ordering please use the suffix: ST: -10; SMA: -20, FC/PC: -30, FC/APC: -50, E2000: -60

All fibers can be provided with anti –reflection option after request. The anti-reflection option is recommended for spectroscopy application.

Fiber optic connectors types



ST – The ST connector is high-precision, ceramic ferrule. The bayonet style keyed coupling mechanism featuring push and turn locking of the connector prevents overturning and damaging of the fiber end. The insertion loss of the ST connector is less than 0.3 dB.

Drilled-out, metallic ST connectors having insertion losses of > 1 dB are being used with large-core (> 140µm) fibers.

suffix for ordering: -10



SMA – Due to its stainless steel structure and low-precision, threaded fiber locking mechanism, this connector is used mainly in applications requiring the coupling of high-power laser beams into large-core, multimode fibers. The typical insertion loss of an SMA connector is greater than 1 dB.

suffix for ordering: -20



FC/PC –This high-precision, ceramic ferrule connector is equipped with an anti-rotation key, reducing fiber endface damage and rotational alignment sensitivity of the fiber. The typical insertion loss of the FC connector is around 0.3 dB.

Drilled-out, metallic FC/PC connectors having insertion losses of >1 dB are being used with large-core (>140µm) fibers.

suffix for ordering: -30



FC/APC –The Angle FC (APC) polish, adds an 8 degree angle to the connector endface; equipped with an anti-rotation key and axially spring-loaded. The typical insertion loss is less than 0.2 dB.

suffix for ordering: -50



E2000 – This fiber optic connector features secure transmission of high bit-rate protocols, zirconia ceramic ferrule fully protected by spring loaded shutter and push-pull locking mechanism for easy installation.

suffix for ordering: -60

Control interfaces

piezosystem jena offers different options for controlling of the fiber switch.

The fiber switches can be controlled easily via TTL signal (high and low) by BCD code. This is the most practical solution for switches which are built in the small size casing (FSM 1 by 2 or 1 by3 up to 200micron core size diameter).

RS232 interface is included into the fiber switches which are built in the

industrial rack size casing. For the small casing size we offer a separate control box (part. no. Z-950-95) where the interface board is located.

An USB interface is also standard for the switches built into the 19"-industrial rack. Now the line of switches is extended by the addition of an Ethernet interface (part. no. Z-950-100) for all switches that are assembled into a standard 19"-industrial rack. The customers benefit

from the easy installation into existing network systems. Selection of Ethernet interface substitutes the USB interface. In general, for every interface type, the required software comes with the switch. A demo program for Lab-View™ controlling of the switch is also supplied on a CD-Rom when the switch is supplied.