

multimode • fiber • switches

optोजना®

FSM 1x2

- 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 1x2

The fiber switches are ideally suited to combine up to 2 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 1x2						
		F-102-04	F-112-04/8° ****	F-102-05	F-142-05	F-142-03	F-162-05*	F-162-13
number of input fibers		1	1	1	1	1	1	1
number of output fibers		2	2	2	2	2	2	2
fiber core	µm	Ø50; 62.5;100	Ø50; 62.5	Ø200	Ø400	Ø400	Ø600	Ø600
insertion loss typ.	dB	0.7	0.7	0.7	0.8	1.4	0.8	1.5
cross talk typ.	dB	-60	-60	-60	-55	-55	-50	-50
repeatability typ.	dB	0.02	0.02	0.02	0.02	0.02	0.02	0.02
switching time typ	ms	2	2	2	5	5	7	7
lifetime typ.	cycles	10 ⁹	10 ⁹	10 ⁹	10 ⁹	10 ⁹	10 ⁹	10 ⁹
operating temperature	°C	0...+60	0...+60	0...+60	0...+60	0...+60	0...+60	0...+60
humidity	%RH	55	55	55	55	55	55	55
operating voltage	V	7-12VDC or 7-9VAC						
control signal***	-	5V TTL						
current	mA	100						
fiber length	m	1	1	1	1	-	1	-
bulkhead connector		-	-	-	-	SMA	-	SMA
housing l/w/h	mm	85x105x44		175x105x44		225x105x44	175x105x44	225x165x44
housing l/w/h**	mm	85x135x45		175x135x45		225x135x45	175x135x45	225x195x45

* input and output fibers mounted on opposite sides

** screw slot version

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

****anti-reflection option

All casings available in a screw slot version upon request. When ordering please use the suffix 94, 95, 93 or 913 instead of -04, -04/8°, -05, -03, -13 respectively.

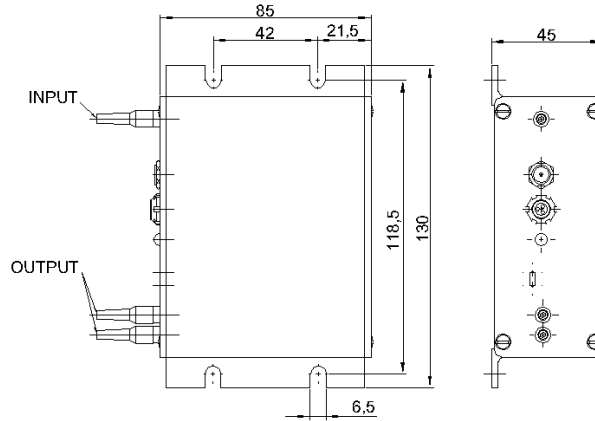


fig.: F-102-94

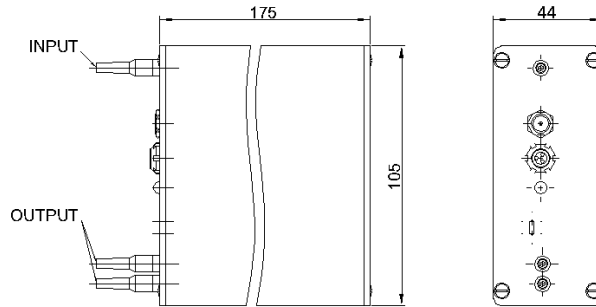


fig.:F-102-05

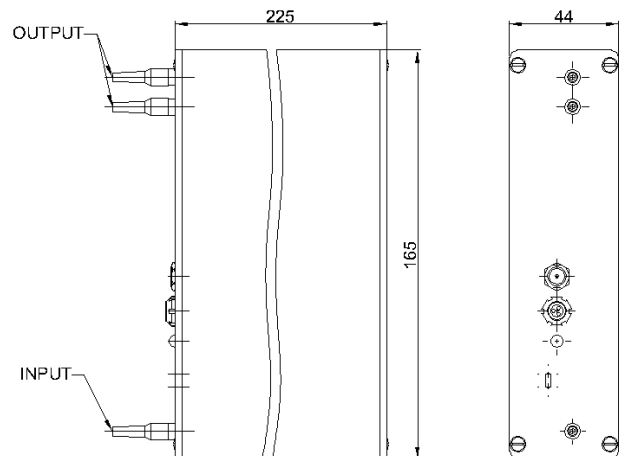
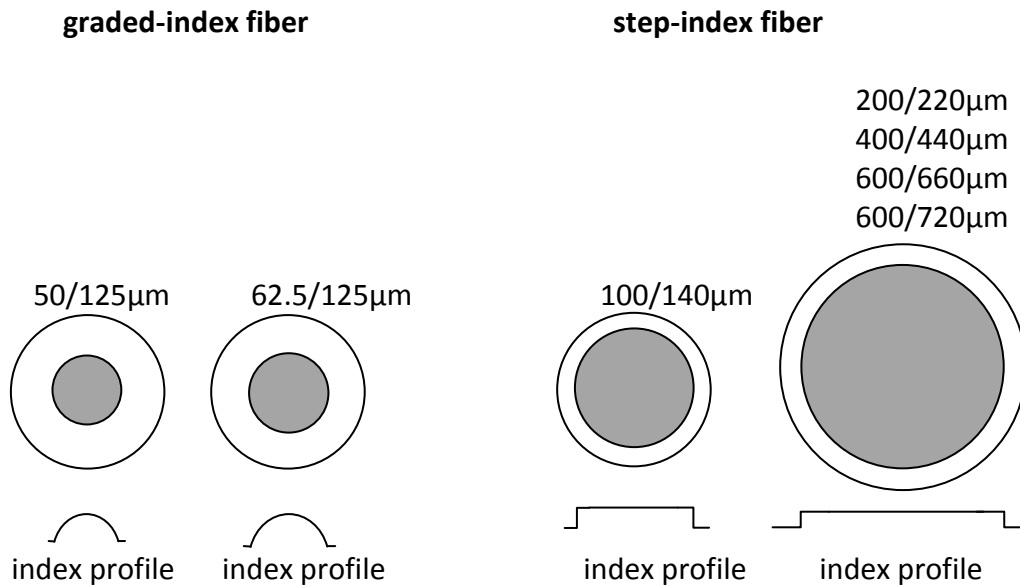


fig.: F-162-13

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.

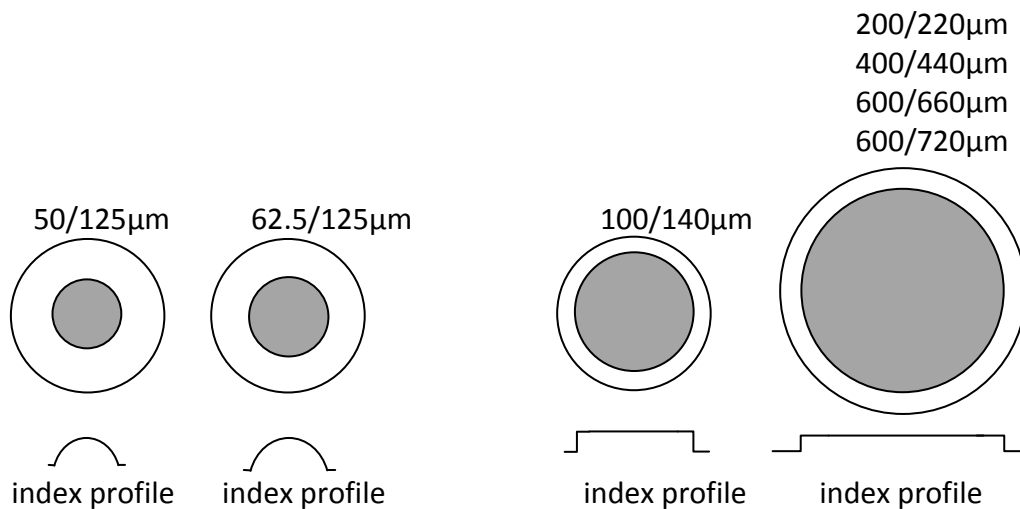
FSM – optical fibers and connectors

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.

graded-index fiber

step-index fiber



fiber diameter µm	index-profile	wavelength range nm	spectrum	NA*	connector typ	part no. for fiber (without optical connector)
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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.

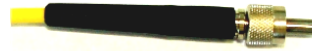
Fiber optic connectors types



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.

optical fiber switch nm-resolution cross coupling cascade switching speed
fiber alignment multiplexer back reflection high dynamic beam msec laser source
core diameter precision insertion loss flexible data storage
multimode spectroscopy

Optical Fiber Switches

piezosystemjena
incredibly precise

volume 2



optojena®



1	introduction	3
	<i>Piezo electrically driven optical switches</i>	3
2	technology	4
	<i>Important parameters to characterize an optical fiber switch</i>	4
	<i>Multimode switches – the switching principle by direct fiber movement</i>	5
3	types of optical fibers & interfaces	6
	<i>Types of optical fibers</i>	6
	<i>Fiber optic connector types</i>	7
	<i>Control interfaces</i>	7
4	fiber switches	8
	<i>Multimode fiber switch FSM 1x2</i>	8
	<i>Multimode fiber switch FSM 1x3 to 1x9 – fiber core diameter 50 up to 200 μm</i>	10
	<i>Multimode fiber switch FSM 1x3 to 1x9 – fiber core diameter 400 and 600 μm</i>	12
5	customized fiber switches	14
	<i>Multimode fiber switch 2times FSM 1x9 with 200 μm fiber</i>	14
	<i>Multimode fiber switch 2times FSM 1x6 for 600 μm fiber</i>	14
	<i>Multimode fiber switch FSM 1x11 for 600 μm fiber</i>	14
	<i>Multimode fiber switch FSM 1x12 for 62.5 μm fiber</i>	15
	<i>Multimode fiber switch FSM 1x16 for 200 μm fiber</i>	15
	<i>Multimode fiber switch FSM 4 by 5 with 100 μm fiber</i>	15
6	contact	16

introduction 1

In 1999 **piezosystem jena** was introduced as one of the first companies in the world to provide fiberoptic switches for multiplexing of optical signals. **piezosystem jena** developed an unique principal of fiber surface coupling. The major advantage of this principal is the wavelength independence of the switch due to the fact that no optical components inside the switch are necessary. Furthermore the switching procedure is done by piezoelectric elements which are well known for a high speed movement in combination with high accuracy in positioning. Since then **piezosystem jena** has expanded its line to a variety of fiber switches for different types of fibers and different numbers of channels.

Standard configurations switches cover the range from 1 by 1 up to 1 by 9 channel.

The standard fiber diameter is 50 micron up to 600 micron. A wide range of connectors can be offered.

Built on years of experience in designing optical switches and using piezoelectric elements, **piezosystem jena** possesses unique know how and technology. This makes piezosystem jena suitable as the first choice for a trusted partner in the design and development of your optical switch solution.

Technology

Fiber switches with optical components, like lenses or prisms, will always result in a wavelength-dependent limitation. The **piezosystem jena** concept of fiber surface cross-coupling guarantees a wavelength independency.

By utilizing piezoelectric technology, **piezosystem jena** can guarantee a very high accuracy in positioning of optical fibers. The high accuracy of fiber coupling is the key for excellent optical parameters. The precise positioning of the piezoelectric actuators guarantees a light transmission of >80 % with a typical switching time of < 3 ms.

piezosystem jena fiber switches can be equipped with all kind of standard connectors at the fiber end and also with bulk-head connectors at the switch side.

The small size of the switching box and the easy control via USB, Ethernet or RS232 interface make these fiberoptic switches ideally suited for use as components of spectrometers or other metrology devices. Switches with more than 100 output channels can be easily achieved by cascading of the switching modules.

Multiplexers from **piezosystem jena** are distributed under the brand name "optojena®".



2 technology

Piezo electrically driven optical switches

Piezoelectric actuators are well suited to move optical fibers. This application is not only for adjusting these components in the laboratory; it can also be used to create special products in the fields of optical communication, optical data storage, spectroscopy, and metrology.

Typical designs are:

- 1 x N switches for multimode fibers for optical measurements (especially spectroscopy) and multi-point sensor systems
- Custom made solutions (for example 2 by 2 or 2 by 9 configurations)

Optical fiber switches using direct piezo electrical movement of fiber ends have several advantages over alternative approaches with intermediate optics

- High switching speed – down to the sub-millisecond region
- Compactness and stability, low power consumption
- No influence of aberrations of intermediate optics
- Various standard connectors and fibers
- No additional wavelength dependent loss introduced by the switch

High repeatability for cases where there is a combination with stopping configurations.

The latter point is of particular interest for **spectroscopic and sensing applications**.

This type of switch can even be used in operation wavelength range 180 to 2600 nm.

The anti-reflection option can be used for spectroscopy.

Important parameters to characterize an optical fiber switch

For all applications of optical fibers, switching plays an important role. In optical communication, spectroscopy or data storage, the signals coming from one transceiver have to be directed to one of a number of receivers [Fig. 1]. In optical spectroscopy the information from different probes must be given to the spectrometer head in a time multiplexed way. Finally a switchable high power beam delivery system can switch the light tool between a number of working stations and thus increase system flexibility and decrease cost.

There are several key parameters for fiber optic switches that are relevant for all the applications mentioned above.

The typical parameters for different applications are given in the following table

Insertion loss:	0,7 dB
Crosstalk:	-70 dB
Back reflection:	-60 dB
Switching time:	< 1 ms

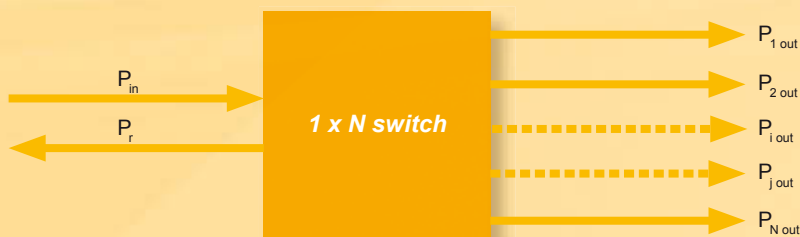


Fig. 1

Insertion loss [dB]: $L_i = 10 \cdot \log (P_{in} / P_{i out})$

Crosstalk [dB]: $C_j = 10 \cdot \log (P_{j out} / P_{i out})$; for signal switched to output channel i

Back reflection [dB]: $R = 10 \cdot \log (P_r / P_{in})$

Switching time – τ : time difference of the 10–90 % output power transition in the switched channel.

In general, there are also several application driven special requirements for the switches:

- Optical power: up to tens of Watts for laser material processing
- Switching regime: from fast switching with high repetition rates down to slow and periodic switching actions.
- Stable switch positions requiring no electrical power (latching)
- Repeatability and stability of the parameters given above

Multimode switches – the switching principle by direct fiber movement

The best way for switching optical fibers is the direct movement of the optical fiber ends with respect to each other. Piezoelectric actuators are ideal candidates for this purpose due to their typical movement ranges and actuation speed. In order to exclude the influences of hysteresis and creep on the accuracy of such a switch, the actuator end positions can be fixed by special stopping configurations. In the case of multimode fibers, the required accuracy (10 microns or less depending on the fiber core diameter) can be achieved by different approaches of precision engineering. Each switch consists of 1x2 and 1x3 basic switching module. [Fig. 2]

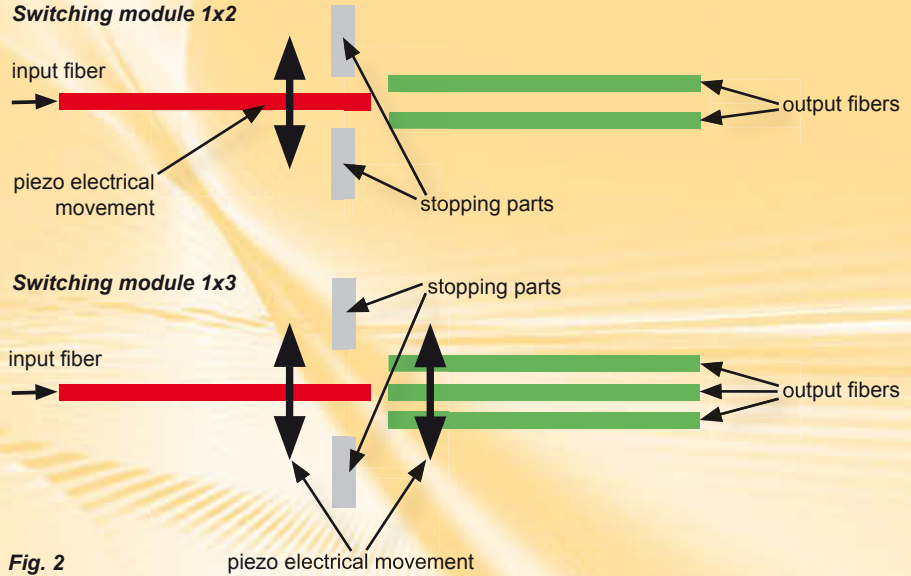


Fig. 2

Cascading different number of these basic modules makes it possible to realize different numbers of channels. [Fig. 3]

To realize a very flexible design concerning different optical fibers, different wavelengths and different number of channels a modular design of the fiber switch was developed.

Optical fiber switches using direct piezo electrical movement of fiber ends have several advantages over alternative approaches with intermediate optics:

- High switching speed.
- No influence of aberrations of intermediate optics
- High repeatability for cases where there is a combination with stopping configurations
- Robustness and reliability
- No additional wavelength dependent loss introduced by the switch.

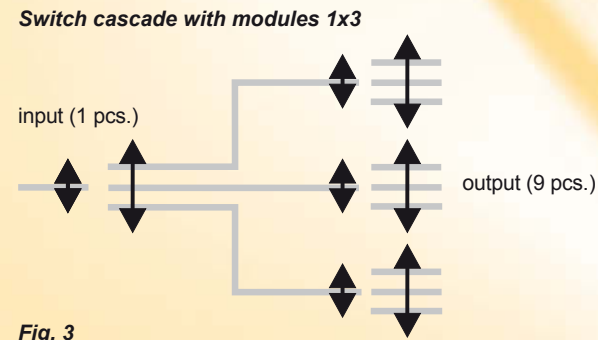


Fig. 3

The latter point is of particular interest for **spectroscopic and sensing** applications. This type of switch can even be used in operation wavelength range 180 to 2600 nm.

3 types of optical fibers & interfaces

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 [Fig. 4] and table give a rough overview on the different fiber types.

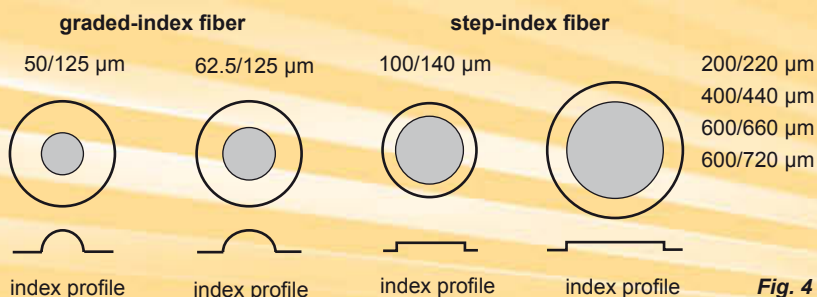


Fig. 4

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.

Fiber optic connector types



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/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



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 (> 140 μm) fibers.

suffix for ordering: –10



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



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 (>140 μm) fibers.

suffix for ordering: –30

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 by 3 up to 200 micron core size diameter).

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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™ control of the switch is also supplied on a CD-ROM when the switch is supplied.

4 fiber switches

Multimode fiber switch FSM 1x2

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

applications:

- optical measurement systems
- spectroscopy
- optical engineering
- telecommunications

The fiber switches are ideally suited to combine up to 2 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.

fiber switch part no.	unit	FSM 1x2						
		F-102-04	F-112-04/8 ^{o****}	F-102-05	F-142-05	F-142-03	F-162-05*	F-162-13
no. of input fibers		1	1	1	1	1	1	1
no. of output fibers		2	2	2	2	2	2	2
fiber core	µm	Ø50; 62.5; 100	Ø50; 62.5	Ø200	Ø400	Ø400	Ø600	Ø600
insertion loss typ.	dB	0.7	0.7	0.7	0.8	1.4	0.8	1.5
cross talk typ.	dB	-60	-60	-60	-55	-55	-50	-50
repeatability typ.	dB	0.02	0.02	0.02	0.02	0.02	0.02	0.02
switching time typ.	ms	2	2	2	5	5	7	7
lifetime typ.	cycles	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	7-12 VDC or 7-9 VAC						
control signal***	-	5 V TTL						
current	mA	100						
fiber length	m	1	1	1	1	-	1	-
bulkhead connector		-	-	-	-	SMA	-	SMA
housing l/w/h	mm	85x105x44		175x105x44		225x105x44	175x105x44	225x165x44
housing l/w/h**	mm	85x135x45		175x135x45		225x135x45	175x135x45	225x195x45

* input and output fibers mounted on opposite sides

** screw slot version

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

**** anti-reflection option

All casings available in a screw slot version upon request. When ordering please use the suffix 94, 95, 93 or 913, instead of -04, -04/8°, -05, -03, -13 respectively.

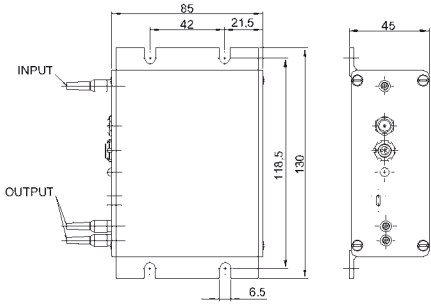


Fig.: F-102-94

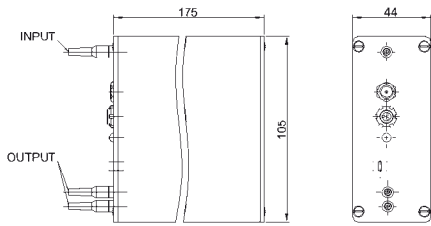


Fig.: F-102-05

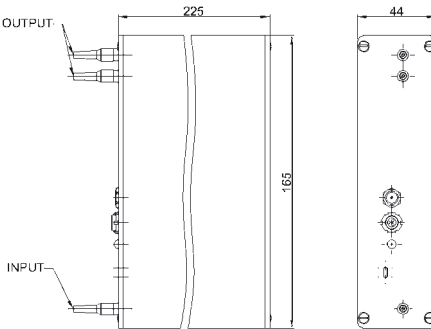


Fig.: F-162-13

4 fiber switches

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

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

applications:

- optical measurement systems
- spectroscopy
- optical engineering
- telecommunications

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
no. of input fibers		1	1	1	1	1	1	1	1
no. of output fibers		3	3	4	4	6	6	9	9
fiber core	μm	$\varnothing 50; 62.5;$ 100	$\varnothing 200$	$\varnothing 50; 62.5;$ 100	$\varnothing 200$	$\varnothing 50; 62.5;$ 100	$\varnothing 200$	$\varnothing 50; 62.5;$ 100	$\varnothing 200$
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	$^{\circ}\text{C}$	0...+60							
humidity	% RH	55							
operating voltage	V	5 VDC							
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.

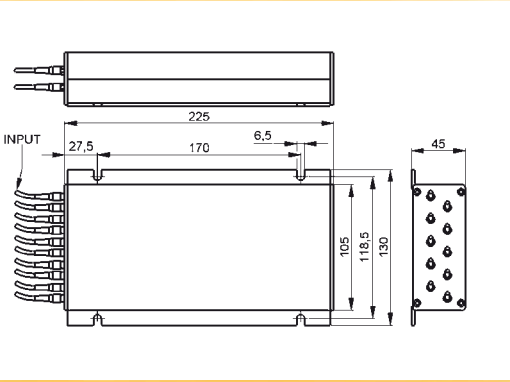


Fig.: F-109-93

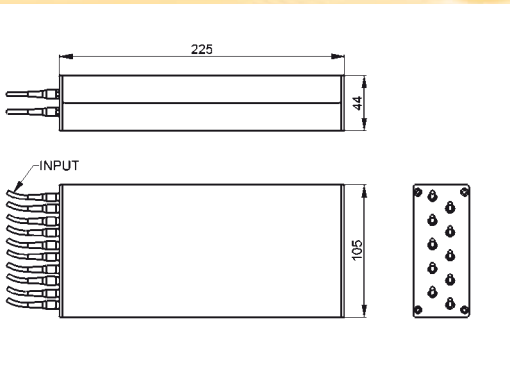


Fig.: F-109-03



Fig.: F-104-95

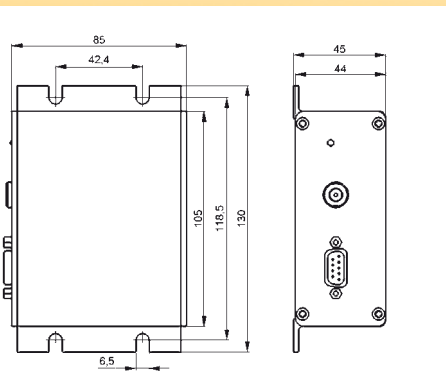


Fig.: Z-950-95 external RS232 BOX



4 fiber switches

Multimode fiber switch FSM 1x3 to FSM 1x9 fiber core diameter 400 and 600 µm

- fast switching time
 - low insertion loss
 - high optical isolation
 - compact design
 - no additional wave-length dependence
 - integrated anti-reflection option
- applications:**
- spectroscopy
 - optical measurement system
 - optical engineering

fiber switch part no.	unit	FSM 1x3		FSM 1x4		FSM 1x6		FSM1x9	
		F-143-10	F-163-10	F-144-10	F-164-10*	F-146-10	F-166-10	F-149-10	F-169-10
no. of input fibers		1	1	1	1	1	1	1	1
no. 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	m	SMA							
housing l/w/h	mm	448x375.5x88.9							

* Option: ETHERNET interface (part no. Z-950-100) instead of USB

accessories:

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

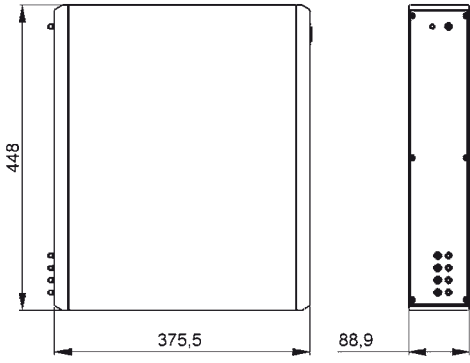


Fig.: F-164-10

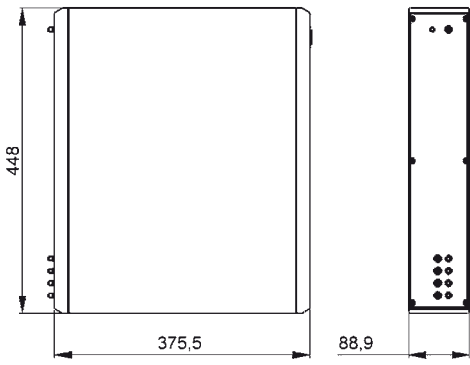


Fig.: F-169-10

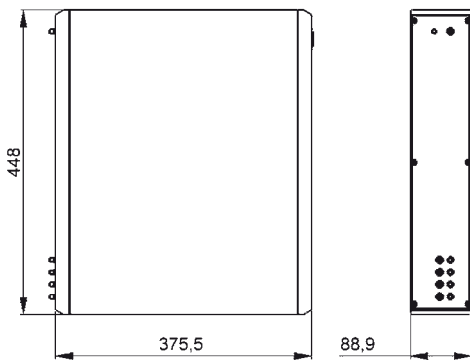


Fig.: F-16X-10

5 customized fiber switches

Multimode fiber switch 2times FSM 1x9 with 200 μm fiber

Technical data:

insertion loss: 1.5 dB
switching time: 2 ms
fiber: 200/280 μm
connector: E 2 108.6/K
operating voltage: 100–240 VAC
control signal: BCD code
housing (l/w/h): 429x320x126 mm³



Multimode fiber switch 2times FSM 1x6 for 600 μm fiber

Technical data:

insertion loss: 3.0 dB
switching time: 7 ms
fiber: 600/660 μm
connector: SMA bulkhead
operating voltage: 100–240 VAC
control signal: BCD, RS232, USB
control: synchronously
housing (l/w/h): 448x375x132 mm³



Multimode fiber switch FSM 1x11 for 600 μm fiber

Technical data:

insertion loss: 3.0 dB
switching time: 7 ms
fiber: 600/720 μm
connector: SMA bulkhead
operating voltage: 100–240 VAC
control signal: BCD, RS232, USB
housing (l/w/h): 448x375x132 mm³



Multimode fiber switch FSM 1x12 for 62.5 μm fiber



Technical data:

insertion loss: 2.5 dB
switching time: 3 ms
fiber: 62.5/125 μm
connector: FC/PC bulkhead
operating voltage: 7–12 VAC
control signal: BCD code
housing (l/w/h): 448x375x89 mm³

Multimode fiber switch FSM 1x16 for 200 μm fiber



Technical data:

insertion loss: 2.5 dB
switching time: 3 ms
fiber: 200/220 μm
connector: SMA bulkhead
operating voltage: 5V
control signal: BCD code
housing (l/w/h): 429x360x126 mm³

Multimode fiber switch FSM 4 by 5 with 100 μm fiber



Technical data:

insertion loss: 1.5 dB
switching time: 3 ms
fiber: 100/140 μm
connector: ST
fiber length: 1 m
operating voltage: 100–240 VAC
control signal: RS 232
housing (l/w/h): 448x375x89 mm³

piezosystem jena has expanded its line to a variety of fiber switches for different types of fibers, different types of connectors and different numbers of channels. Switches with more than 80 output channels can be easily achieved by cascading of the switching modules. **piezosystem jena** has specialized on fiber switches customization.

optical fiber switch nm-resolution cross coupling cascade switching speed
fiber alignment multiplexer back reflection laser source
core diameter precision beam msec
multimode insertion loss spectroscopy flexible data storage



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