

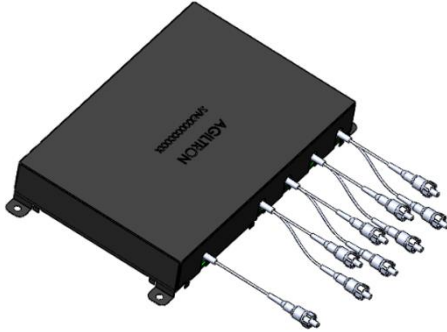
# Fiber-Fiber™ 1x8 Fiber Optical Switch

(SM, PM, MM, Bidirectional)



DATASHEET

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## Applications

- Protection
- Instrumentation

## Features

- Low Optical Distortions
- High Isolation
- High Reliability
- Fail-Safe Latching
- Epoxy-Free Optical Path
- Low Cost

The FF Series fiber optic switch connects optical channels by a micro-mechanical fiber to a fiber auto-alignment platform and is activated via an electrical relay. The advanced design significantly increases the performance, offering unprecedented low optical loss, broad wavelength operation with no coatings, high power handling, as well as an unmatched low cost. The latching operation preserves the selected optical path after the driver signal has been removed. The switch is bidirectional and conveniently controllable by 5V TTL.

Using no lens, the FF Series switch can accommodate all types of fibers, including SM. MM, PM, double cladding, bendable, large core, small core.

Lightpath in the device is bidirectional.

This switch uses a specially formulated index-matching liquid that does not generate fluorescent. The liquid fills a gap of less than 5  $\mu\text{m}$ .

Switches with PM fibers transmit both polarizations the same way as the fiber.

## Specifications

Parameter	Min	Typical	Max	Unit
Wavelength	500		2000	nm
Insertion Loss <sup>[1]</sup>		1	1.2	dB
Wavelength Dependent Loss		0.05	0.1	dB
Polarization Dependent Loss			0.1	dB
Polarization Extinction Ratio <sup>[2]</sup>	22	25	30	dB
Return Loss		55		dB
		35 <sup>[3]</sup>		
Cross Talk On/Off Ratio		50		dB
Switching Time		15	20	ms
Repeatability			$\pm 0.02$	dB
Durability	$10^7$			cycles
Repetition Rate			5	Hz
Operating Optical Power <sup>[2]</sup>			0.5	W
Operating Voltage	4	5	7	VDC
Operating Current (Latching/Non-Latching)		30	70	mA
Switching Type	Latching / Non-Latching			
Operating Temperature		-20 ~ 80		°C
Storage Temperature		-40 ~ 85		°C

### Notes:

[1]. SM 28 fiber, Excluding Connectors. For MM fiber with laser CPR<14

[2]. For PM fiber only

[3]. For MM fiber with laser CPR<14

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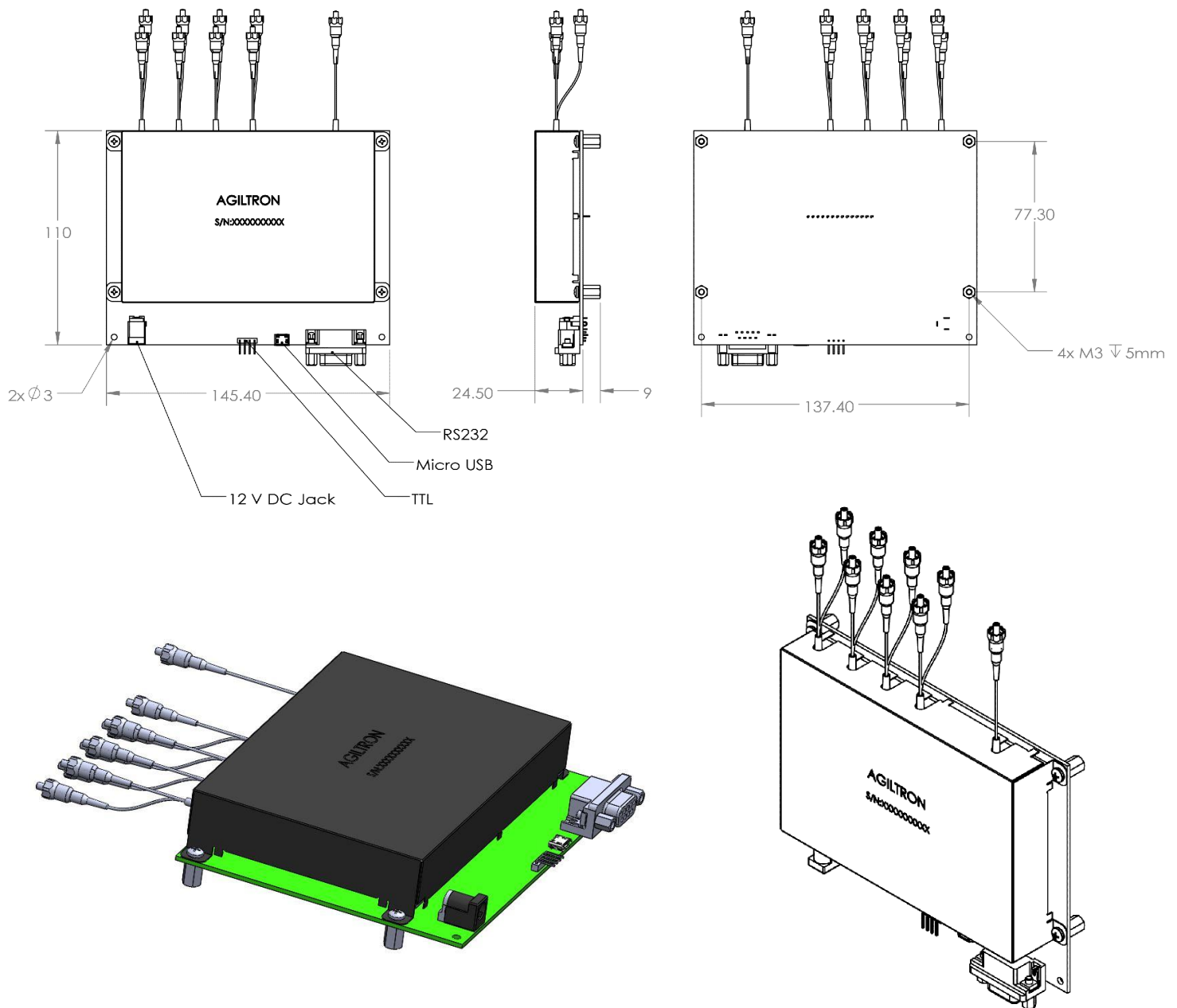
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### Mechanical Dimensions (mm)



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### Electrical Connector Configurations

The load is a resistive coil which is activated by applying 4.5V (draw ~ 40mA). Applying a constant driving voltage increases stability. The switches can also be driven by a pulse mode using Agiltron recommended circuit for energy saving.

Agiltron offers a computer control kit with TTL and USB interfaces and Windows™ GUI. We also offer RS232 interface as an option – please contact Agiltron sales.

#### Latching Type

Optical Path	Switch 1		Switch 2		Switch 3		Switch 4		Switch 5		Switch 6		Switch 7	
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
Port 1 → Port 2	L	H	L	H			L	H						
Port 1 → Port 3	L	H	L	H			H	L						
Port 1 → Port 4	L	H	H	L					L	H				
Port 1 → Port 5	L	H	H	L					H	L				
Port 1 → Port 6	H	L			L	H					L	H		
Port 1 → Port 7	H	L			L	H					H	L		
Port 1 → Port 8	H	L			H	L							L	H
Port 1 → Port 9	H	L			H	L							H	L

#### Notes:

H – 4.5V

L – 0V

Empty – Don't care H or L

#### Non-Latching Type

Optical Path	Switch 1		Switch 2		Switch 3		Switch 4		Switch 5		Switch 6		Switch 7	
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
Port 1 → Port 2	L	L	L	L			L	L						
Port 1 → Port 3	L	L	L	L			H	L						
Port 1 → Port 4	L	L	H	L					L	L				
Port 1 → Port 5	L	L	H	L					H	L				
Port 1 → Port 6	H	L			L	L					L	L		
Port 1 → Port 7	H	L			L	L					H	L		
Port 1 → Port 8	H	L			H	L							L	L
Port 1 → Port 9	H	L			H	L							H	L

#### Notes:

H – 4.5V

L – 0V

Empty – Don't care H or L

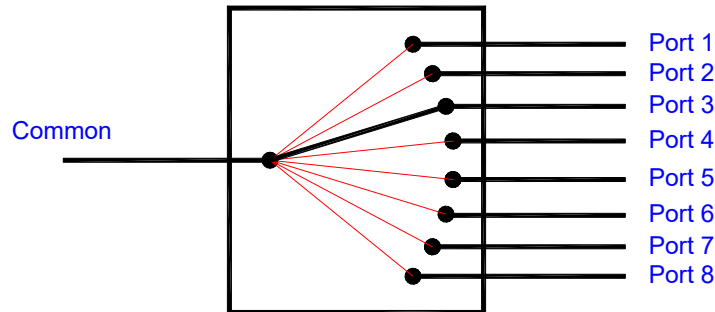
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### Functional Diagram



### Manual Operation Instruction



Rise

Fall

### Command List

Baudrate 115200-8-N-1

Command List:

1. Version Check/ Connection Check - 4 bytes

CMD: 0x01 0x02 0x00 0x00

RTN: 0x01 0x02 0x41 0x30

2. Set Channel - 4 bytes

CMD: 0x01 0x12 0x00 <CH> 1-8

RTN: 0x01 0x12 0x00 <CH>

3. Read Channel - 4 bytes

CMD: 0x01 0x11 0x00 0x00

RTN: 0x01 0x11 0x00 <CH>

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### Ordering Information

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Prefix	Type		Tested Wavelength <sup>[1]</sup>	Fiber type	Fiber Cover	Fiber Length	Connector <sup>[2]</sup>	Driver	Benchtop <sup>[3]</sup>
FFSW-	1x8 = 18	Latching = A	488 = 4	Pick from below table	Bare fiber = 1	0.25m = 1	None = 1	Non = 1	Non = 1
	Dual 1x8 = D8	Non-Latching = B	532 = 5		900um tube = 3	0.5m = 2	FC/PC = 2	USB = 2	Yes = 2
	Special = 00		630 = 6		Special = 0	1.0m = 3	FC/APC = 3	RS232 = 3	
			780 = 7			Special = 0	SC/PC = 4	TTL = 4	
			850 = 8				SC/APC = 5		
			980 = 9				ST/PC = 6		
			1060 = 1				LC/PC = 7		
			1310 = 3				Duplex LC/PC = 8		
			1550 = C				MTP = 9		
			2000 = 2				LC/APC = A		
		2.3-4.1 μm = F			LC/UPC = U				
		3.2-5.5 μm = G			Special=0				

[1]. The device is ultra-broadband limited by the fiber transmission. However, we only test at one selected wavelength to save cost. If customer needs to test at several wavelengths, the selection is **Special=0** with added cost.

[2]. Regular fiber connector has PER ~22dB. Connector with PER >27 dB is available using special process

[3]. The benchtop integrates the modulator, driver, and power supply. Front Panel: SMA 0-5V electrical control input port for precise modulation. Fiber input and output ports with standard FC/APC connectors. Back Panel: 100-240 VAC power input for global compatibility and a Power switch for easy on/off control. This all-in-one design simplifies setup and operation

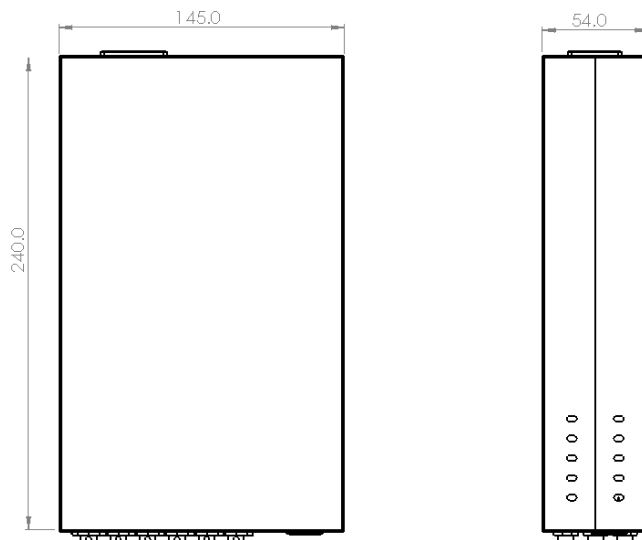
#### Note:

- PM1550 fiber works well for 1310nm

### Fiber Type Selection Table:

01	SMF-28	34	PM1550	71	GIF 50/125 μm
02	SMF-28e	35	PM1950	72	GIF 62.5 μm
03	Corning XB	36	PM1310	73	105/125 μm
04	SM450	37	PM400	74	FG105LCA
05	SM1950	38	PM480	75	FG50LGA
06	SM600	39	PM630	76	STP 50/125
07	Hi780	40	PM850	77	IRZS23
08	SM800	41	PM980	78	IRZS32
09	Hi980	42	PM780	79	
10	Hi1060	43	PM350	80	
11	Draka BBE	44		81	UV180nm
12		45		82	LMA-PM-10
13		46			

### Benchtop Box Mechanical Dimension



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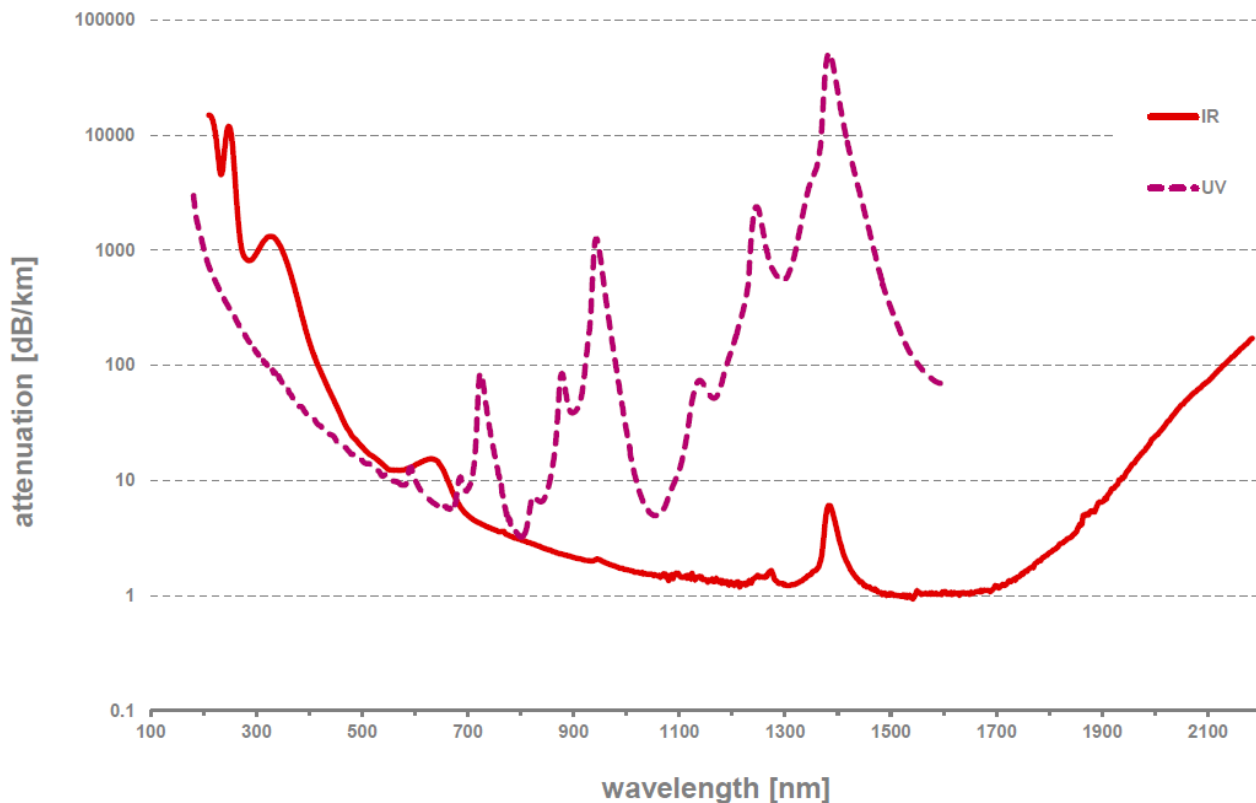
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### Typical Fiber Transmissions



### Application Notes

#### Fiber Core Alignment

Note that the minimum attenuation for these devices depends on excellent core-to-core alignment when the connectors are mated. This is crucial for shorter wavelengths with smaller fiber core diameters that can increase the loss of many decibels above the specification if they are not perfectly aligned. Different vendors' connectors may not mate well with each other, especially for angled APC.

#### Fiber Cleanliness

Fibers with smaller core diameters (<5  $\mu\text{m}$ ) must be kept extremely clean, contamination at fiber-fiber interfaces, combined with the high optical power density, can lead to significant optical damage. This type of damage usually requires re-polishing or replacement of the connector.

#### Maximum Optical Input Power

Due to their small fiber core diameters for short wavelength and high photon energies, the damage thresholds for device is substantially reduced than the common 1550nm fiber. To avoid damage to the exposed fiber end faces and internal components, the optical input power should never exceed 20 mW for wavelengths shorter 650nm. We produce a special version to increase the how handling by expanding the core side at the fiber ends.

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## Driver Reference Design

