# Fiber-Fiber™
# MxN Fiber Optic Switch Module

## (all fiber type, ultra-broadband, bidirectional, latching, M/N up to 300, 70dB on/off)

(Protected by U.S. patents 7224860, 6757101, 6577430 and pending patents)

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The Fiber-Fiber Series of optical fiber switch is based on a patent-pending self-groove alignment mechanism without needing AR coating and lenses. It offers unparalleled advantages of very low loss of about 1dB for any array size, low cost, amicable to any fiber core size, and broad wavelength operation from 300nm~2300nm. The latching operation preserves the selected optical path after removing the drive signal. Multimode fiber core size is from 50 to 1000 µm. The switch is bidirectional and can accommodate up to 300 fiber ports. The Fiber-Fiber multimode switches are designed with very short paths between fibers, so signals propagate in practically the same distribution as through uninterrupted multimode fiber, uniquely achieving high modal fidelity. It is available in single and dual channels. The dual channel acts at the same time, design for testing applications.

The switch is controlled by RS232 or USB computer interface with graphic Software. The Labview version is also available.

Lightpath in the device is bidirectional.

The order table includes a list of standard control interfaces. Additionally, we provide a list of commands to assist customer engineers in coding. For those who require it, we offer a code-writing service for customer interfaces at an additional charge.

This switch uses a specially formulated index-matching liquid that does not generate fluorescent. The liquid fills a gap of less than 5 µm.

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

Each switch driver includes a GUI for programming and a command set (API) so customers can develop their own control software. Python and LabVIEW interface libraries; integration support is available for a fee.

## Features

- High Reliability
- Ultra Low Insertion Loss
- Broad Band
- Latching
- All Fiber Types

## Applications

- Optical Signal Routing
- Network Protection
- Wavelength Management
- Signal Monitoring
- Instrumentation

RoHS COMPLIANT

## Specifications

| Parameter | Min | Typical | Max | Unit |
|---|---|---|---|---|
| Operation Wavelength | 400 | 1260~1650 | 1800 | nm |
| Insertion Loss [1] | | 1 | 2.0 | dB |
| Crosstalk, On/Off Ratio | 55 | 60 | 70 | dB |
| Extinction Ratio (PM Fiber) | 22 | | 30 | dB |
| Switch Speed (Rise, Fall) | | | 1000 | ms |
| Durability | $10^7$ | | | cycle |
| Polarization Dependent Loss | | 0.04 | 0.2 | dB |
| Wavelength Dependence Loss [2] | | 0.1 | 0.3 | dB |
| Return Loss | 45 | | | dB |
| Repeatability | | 0.05 | 0.1 | dB |
| Operation Voltage [3] | | | 12 | V |
| Power Consumption [4] | 0.7 | 3.6 | 5 | W |
| Operating Temperature [5] | -5 | | 65 | °C |
| Optical Power Handling [6] | | 300 | 500 [6] | mW |
| Storage Temperature | -40 | | 85 | °C |
| Switch type | Non-Latching/Latching | | | |
| Fiber Type | SMF-28 or 50/125µm or 62.5/125µm | | | |
| Package Dimension | Connector dependent W/LC=2RU/96 Ports | | | |

**Notes**:

[1]. Measured without connectors for 1xN. For multimode fiber, use a laser source with CPR<15

[2]. Within 50nm bandwidth

[3]. Other voltage options also available

[4]. Consume minimum power during sleep time, latching switch type only

[5]. -25°C~75°C version is also available.

[6]. High power version available



Rev 02/07/26

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## Module Mechanical Dimensions

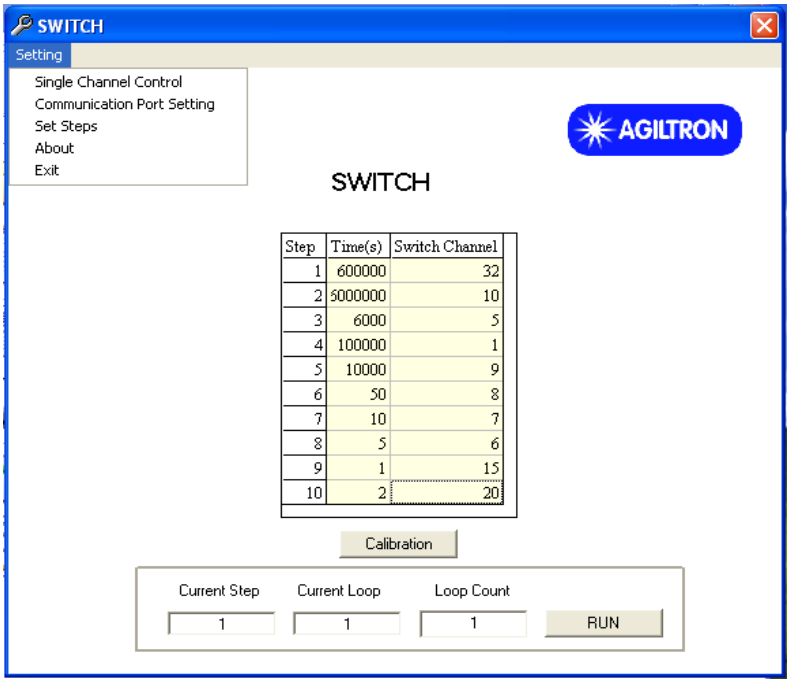
2RU 19” mount rack typically. The input and output connectors are on the front panel, while the control interface and power supplier are on the rear panel.

*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

## Control Interface and Power Supply

- RS 232
- Ethernet 10/100 with definable IP address
- USB
- GUI
- 110-220V (0.6 A) Power Input

## Typical Graphic User Interface

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## Ordering Information

| | ☐☐☐☐ | ☐ | 1 | ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|---|---|---|---|
| **Prefix** | **Type** | **Wavelength** | **Switch Type** | **Package** | **Fiber Type** | **Power Monitor** | **Connector** | **Interface Code [1]** |
| **SANM-** | 16x16 = 1616<br>24x24 = 2424<br>32x32 = 3232<br>48x48 = 4848<br>64x64 = 6464<br>80x80 = 8080<br>96x96 = 9696<br>128x128 = 1282<br>144x144 = 1442<br>192x192 = 1922<br>250x250 = 2502<br>Special = 0000 | 1240-1640 = A<br>1060 = 1<br>1310 = 3<br>1410 = 4<br>1550 = 5<br>1310/1550 = 2<br>650 = 6<br>780 = 7<br>850 = 8<br>Special = 0 | Latching = 1<br>Non-latching = 0 | Standard = 1<br>Special = 0 | 50/NA.22 = 5<br>62.5/NA.22 = 6<br>105/NA.15 = E<br>200/NA.22 = F<br>300/NA.22 = G<br>400/NA.22 = H<br>600/NA.22 = J<br>800/NA.22 = K<br>UV180nm = U<br>Special = 0 | Input = 1<br>Output = 3<br>Input/Output = 2<br>No = 0 | None = 1<br>FC/PC = 2<br>FC/APC = 3<br>SC/PC = 4<br>SC/APC = 5<br>ST/PC = 6<br>LC/PC = 7<br>Duplex LC/PC = 8<br>Quad LC/PC = 9<br>LC/APC = A<br>LC/UPC = U<br>MPO = Y<br>Special = 0 | Non = N<br>Python = P<br>LabVIEW = L |

[1]. GUI and a command set (API) are included. Python $**560**. LabVIEW interface libraries $**750**

RED is Special Order

**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 μm) 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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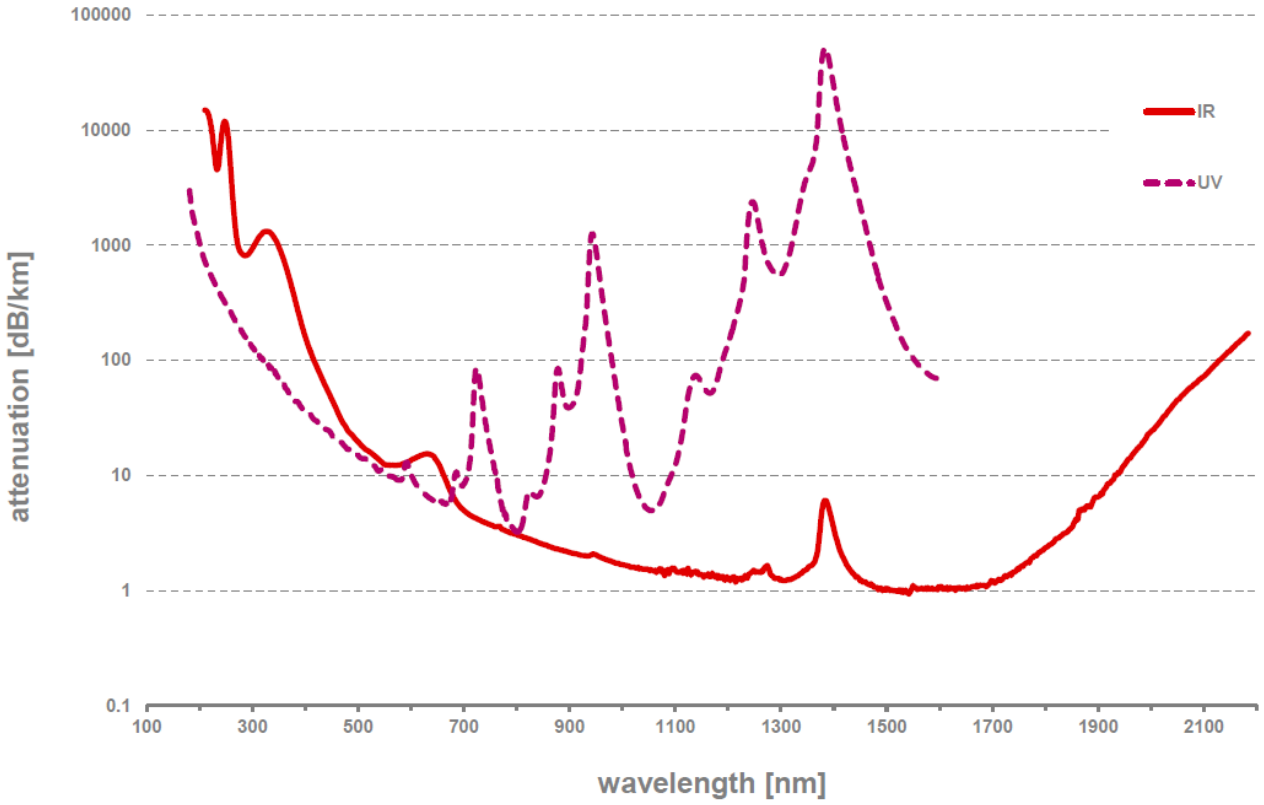
## Typical Fiber Transmissions

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## Ethernet Remote Control with Python

Several options: Telnet, HTTP/JSON API, or VISA Raw Socket mode (SCPI over TCP/IP)

```
############################################################
Telnet:

import telnetlib

HOST = "192.168.0.1"
PORT = 23

######################
username = "admin"
password="admin"
###################
tn=telnetlib.Telnet(HOST,PORT)

reply=tn.read_until(b"username:",timeout=10)
print(reply.decode("ascii"))#debug
tn.write(username.encode("ascii")+b"\r\n")

reply=tn.read_until(b"password:",timeout=10)
print(reply.decode("ascii"))#debug
tn.write(password.encode("ascii")+b"\r\n")

reply=tn.read_until(b"telnet>",timeout=10)
print(reply.decode("ascii"))#debug

tn.write(b"setswitch 31 32 0 0\r\n")
reply=tn.read_until(b"telnet>",timeout=10)
print(reply.decode("ascii"))#debug

tn.write(b"runswitch\r\n")
reply=tn.read_until(b"telnet>",timeout=10)
print(reply.decode("ascii"))#debug

tn.write(b"quit\r\n")

############################################################
```

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## Ethernet Remote Control with Python (ending)

Several options: Telnet, HTTP/JSON API, or VISA Raw Socket mode (SCPI over TCP/IP)

```
############################################################
API:
import requests

BASE_URL = "
TOKEN = "TOKEN"
def api_post(path, payload):
    r = requests.post(
        BASE_URL + path,
        json=payload,
        headers={"X-Auth-Token": TOKEN},
        timeout=3,
    )
    r.raise_for_status()
    return r.json()

def api_get(path):
    r = requests.get(
        BASE_URL + path,
        headers={"X-Auth-Token": TOKEN},
        timeout=3,
    )
    r.raise_for_status()
    return r.json()

# Set port 3
print(api_post("/api/set_permanent_port", {"port": 3}))
# Read status
print(api_get("/api/status"))

############################################################
pyVISA:
import pyvisa

HOST = "192.168.0.1"
TOKEN = "TOKEN"

rm = pyvisa.ResourceManager()

inst = rm.open_resource(f"TCPIP0::{HOST}::5025::SOCKET")
inst.read_termination = "\n"
inst.write_termination = "\n"
inst.timeout = 2000  # ms

print("IDN:", inst.query("*IDN?").strip())

# Set port
inst.write("SWITCH:PERMANENTPORT 3")
print("PORT?:", inst.query("SWITCH:PERMANENTPORT?").strip())

# Status
print("STATUS:", inst.query("SWITCH:STATUS?").strip())

############################################################
```

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## Questions and Answers

**Q:** If the device were to fail, would the switch continue to pass the fiber light through the switch as configured before failure? When power is restored, does the IN/OUT configuration before failure remain in place?
**A:** This depends, if one mirror fails, it only affects the light go through that mirror. Yes, when power back up it will go to the previous points

**Q:** When power is restored, does the IN/OUT configuration before failure remain in place?
**A:** Yes, when power back up it will go to the previous flightpath

**Q:** If power to the device were shutoff, would the device continue to pass the fiber light as configured before failure?
**A:** This function is call latching. We uniquely offer MEMS latching switch but cost more.

**Q:** With the Ethernet Control Option, does the switch support SNMPv3
**A:** Yes. This internet standard protocol allows user to write their own control code

**Q:** With the Ethernet Control Option, what type of encryption does the SNMPv3 use?
**A:** MD5/DES

**Q:** With the Ethernet Control Option, could this device be controlled by multiple users at different locations and all users will also see the configuration updates?
**A:** Yes

**Q:** With the Ethernet Control Option, could this switch be controlled by multiple users at different locations and all users will also see the configuration updates?
**A:** Yes

**Q:** With the Ethernet Control Option, does the user need to install any software on their computer other than a web browser?
**A:** No