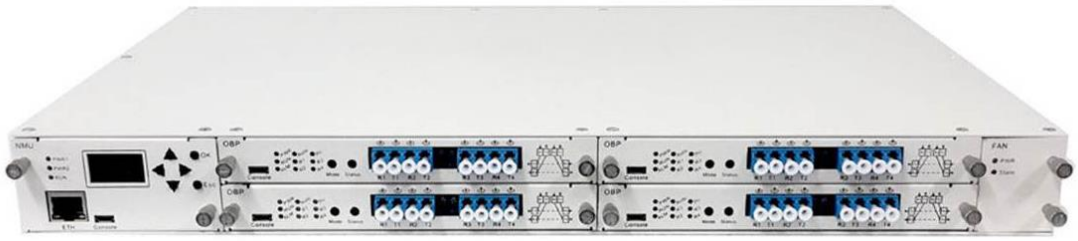
MEMS 1xN Fiber Optical Switch

(N Up to 196 Ports, Non-Blocking, Bidirectional, Passive)

The MEMS FIBER Optical switches establish optical signal paths passively in milliseconds supporting all data rates, ideally suited to manage and monitor large optical networks intelligently and remotely. The MEMS switches are reliable with longevity suited for continuous operation. The control is net-based GUI that is compatible with standard network management protocols. The box height is depended on connector choice and fiber port count. The 1U box front panel can house approximately 40 LC connectors (1x36).



Features

- Low Cost
- High Reliability
- Low Insertion Loss
- Broad Band
- Compact Design
- Low Voltage

Applications

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

Specifications [1]

Parameters	Min	Typical	Max	Unit
Operation Wavelength	850	1270~1630		nm
Insertion Loss [1] (SM)	0.4	0.8	2.6	dB
Insertion Loss [1] (MM)	0.5	1	4.3	dB
Dynamic Cross Talk	50			dB
Static Cross Talk	60			dB
Switch Speed (Rise, Fall)		5	20	ms
Durability	109			cycle
Polarization Dependent Loss		0.04	0.2	dB
Wavelength Dependence Loss [2]		0.1	0.3	dB
Return Loss	50 [6]			dB
Repeatability		0.3	0.5	dB
Operating Temperature [3]	-5		65	℃
Transit Time Delay			0.2	ms
Port to Port Time Delay Difference			0.5	ns
Optical Power Handling (CW) [4]		300	500	mW
Storage Temperature	-40		85	℃
Electrical Power Consumption			50 [5]	W
Switch type	Non-Latching			
Package Dimension	1RU / 2RU / 4RU			

[1]. Measured without connectors for SM only, each connector adds 0.2-0.3dB
[2]. Within 50nm bandwidth
[3]. -25 oC~75oC version is also available.
[4]. High power version available
[5]. For the non-latching version
[6]. For SM fiber, MM fiber is 35dB

Rev 08/02/23

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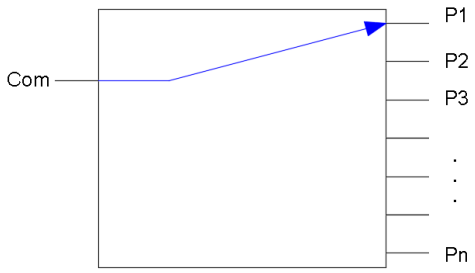
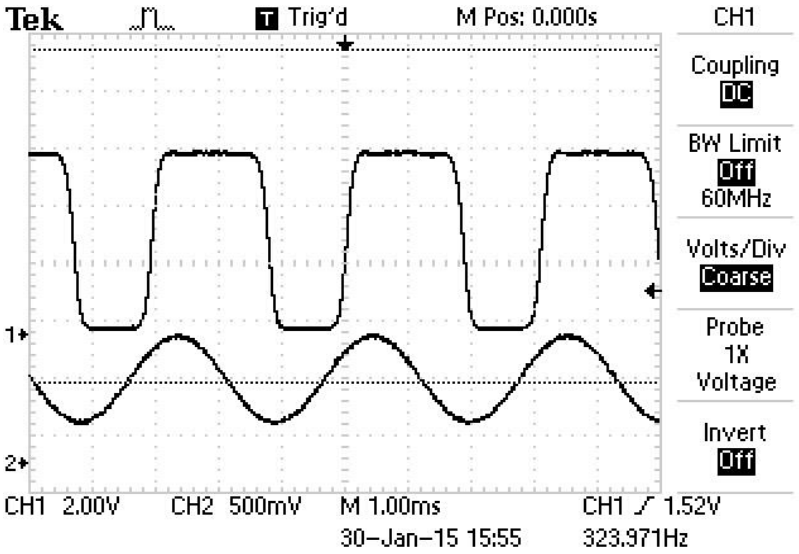
Optical Path Illustration



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

10^9 Switching Cycle Test

We have tested MEMS 1x2 switch at the resonant frequency ~300Hz for more than 40 days, as shown in the attachment, which corresponds over 10^9 switching cycles. The measurements show little changes in Insertion loss, Cross Talk, Return loss, etc, all parameters are within our specs.



Control & Electric Interface

The switch default control is Ethernet with a GUI.

- Physical Layer: 10/100Base-T
- Data Link Layer: Ethernet Protocol per IEEE 802.3
- Network Layer: IPv4
- Transport Layer: UDP
- Application Protocol: SNMP
- Connector Type: RJ-45
- Dual 48V/110-220V Power Input

We provide a command list for customers to write their control code, such as Python

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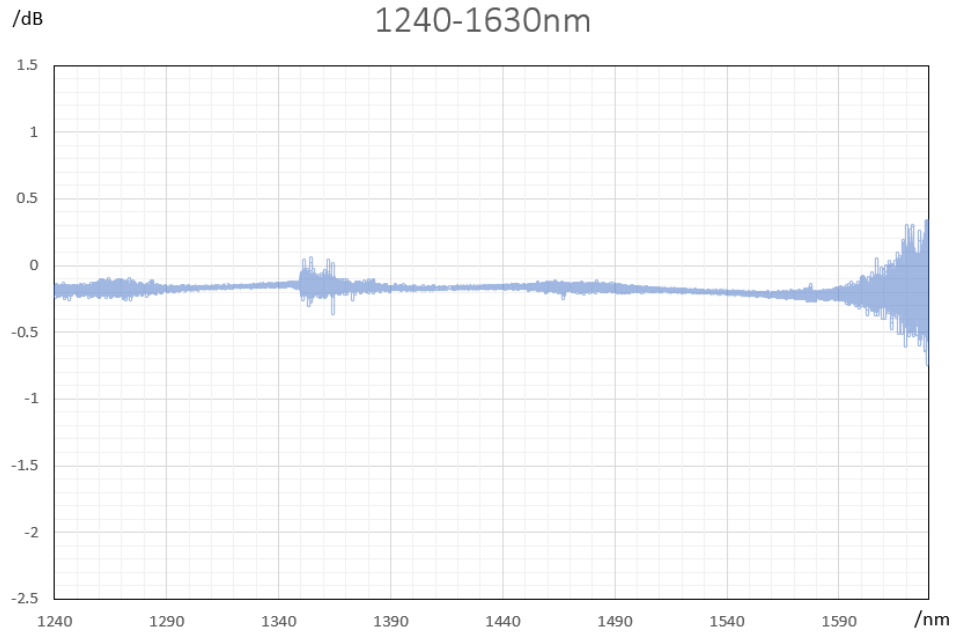
Typical Insertion Loss vs Wavelength (1240-1630nm)



Ordering Information

	□□□	□	□	□	□	□	□
Prefix	Type	Wavelength [1]	Control Interface	Package	Fiber Type	Power Supply	Connector
MEMS-	1x8 = AA8 1x12 = A12 1x16 = A16 1x32 = A32 1x64 = A64 1x96 = A96 1x128 = 128 Special = 000	1240-1640nm = 1 1310 = 3 1410 = 4 1550 = 5 1310/1550 = 2 1060 = 6 850 = 8 Special = 0	Ethernet = 2 RS232 = 3 Special = 0	1RU = 1 1.5U = 5 2RU = 2 4RU = 4 Special = 0	SMF-28 = 1 MM 50/125 = 2 Hi1060 = 3 Panda = 5 [2] 780HP = 8 Special = 0	110-220V = 4 48V = 5	FC/PC = 2 FC/APC = 3 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC = 7 Duplex LC = 8 Special = 0

[1]. Measured wavelength. The device has a wider wavelength coverage. Customer can request to measure at several wavelengths.
[2]. For PM fiber version, please call us to get more information.

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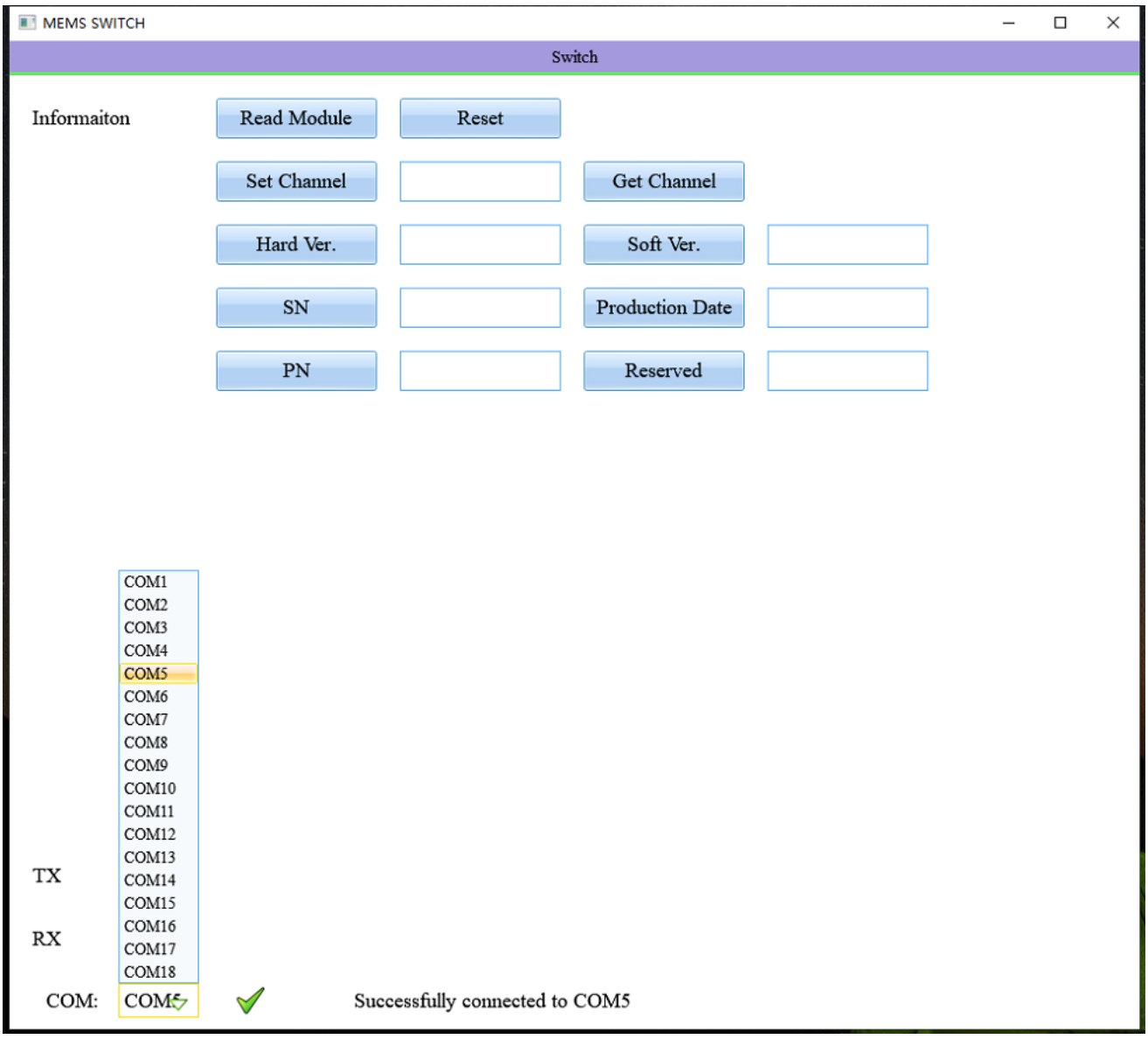
Example of RS232 Remote Control GUI



RS232 Command List (1x196 example) (start)

```
##### COM SET #####
UART Control Setting
Baud Rate: 115200
Start Bits: 1
Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: None
```

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RS232 Command List (1x196 example) (ending)

```
##### 1, Command Format #####
1.1 Command
FLAG            LEN             RES             CMD             DATA            SUM
2 Byte          1 Byte          1 Byte          1 Byte          0-N Byte        1 Byte

FLAG: 0xEFEF or 0xAAAA
LEN: Total number of bytes from RES to SUM
RES: 0xFF
SUM: Checksum, SUM=FLAG+LEN+RES+CMD+DATA

1.2 Response
FLAG            LEN             RES             RESP            DATA            SUM
2 Byte          1 Byte          1 Byte          1 Byte          0-N Byte        1 Byte

FLAG: 0xEDFA
LEN: Total number of bytes from RES to SUM
RES: 0xFF
SUM: Checksum, SUM=FLAG+LEN+RES+ RESP+DATA


##### 2, Command List #####
2.1 Set Channel
Command
     FLAG1      LEN             RES             CMD             DATA            SUM
     0xEFEF     0x04            0xFF            0x04            1 byte          SUM
     DATA = Channel
Response
     FLAG2      LEN             RES             RESP            DATA            SUM
     0xEDFA     0x04            0xFF            0x04            1 byte          SUM
     DATA = Result
Result = 0xEE  Success
Result = 0xEF  Fail

Example (Set Channel=180):
Command
     EF EF 04 FF 04 B4 99
Response
     ED FA 04 FF 04 EE DC

2.2 Get Channel
Command
     FLAG1      LEN             RES             CMD             DATA            SUM
     0xEFEF     0x03            0xFF            0x02            1 byte          SUM
Response
     FLAG2      LEN             RES             RESP            DATA            SUM
     0xEDFA     0x04            0xFF            0x02            1 byte          SUM
     DATA = Channel

Example (Get Channel=0):
Command
     EF EF 03 FF 02 E2
Response
     ED FA 04 FF 02 00 EC
```

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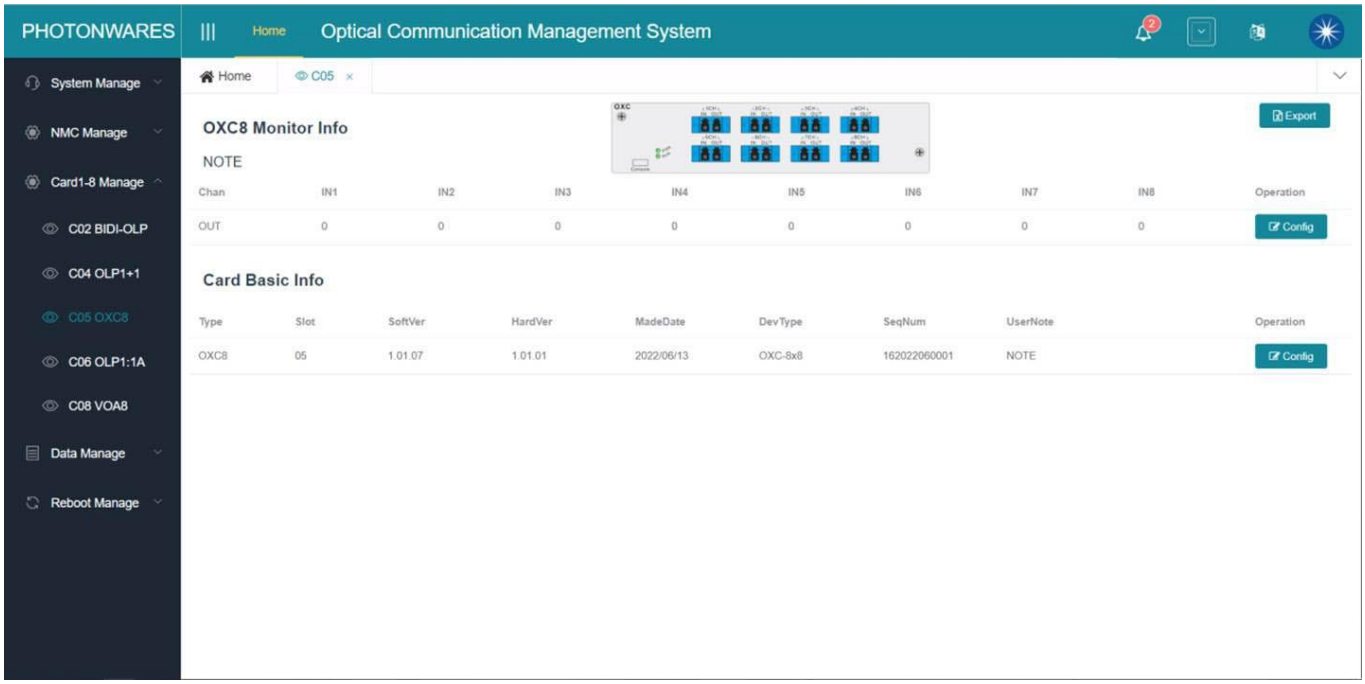
Example of Ethernet Remote Control GUI



Ethernet Command List For Telnet/Python Control (start)

Login:
1, Use the Windows Command Prompt,
2, telnet 192.168.1.200 or the current IP address
3, Username: root
4, Password: fs19681086

Command List
1, Request Switch Status:
CARD -c xx B_?
xx is the slot number of card. For example, to show the status of the card in slot 2:
[FT@\h \W]# CARD -c 02 B_?

Show Card Info:
===== CARD Monitor Info =====

Chan	MaxRoute	CurrRoute
1	64	64

===== CARD Basic Info =====

Type	Slot	SoftVer	HardVer	MadeDate	DevType	SeqNum
OSW64	02	1.01.07	1.02.01	2021/10/22	MOSW64-DEV	333333333333

[FT@\h \W]#
2, Set Switch status:
CARD -c xx S01_y
xx is the slot number of the card.
01 is the input channel number of the switch, for 1xN products this is fixed.
y is the output channel number of the switch, for a 1x64 switch it's 1~64.
Return value: Success means operation succeed, Fail means operation failed.

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Ethernet Command List For Telnet/Python Control (ending)

```
For example,:
1> Set the input #1 to output #1:
   [FT@\h \W]# CARD -c 02 S01_1
   Send: S01_1
   Return: Operation Success
   [FT@\h \W]#

2> Set the input #1 to output #64
   [FT@\h \W]# CARD -c 02 S01_64
   Send: S01_64
   Return: Operation Success
   [FT@\h \W]#

3> Request the current status:
   [FT@\h \W]# CARD -c 02 B_?
   Show Card Info:
   ===== CARD Monitor Info =====
   Chan        MaxRoute       CurrRoute
   1           64             64
   ===== CARD Basic Info =====
   Type        Slot           SoftVer        HardVer        MadeDate       DevType        SeqNum
   OSW64       02             1.01.07        1.02.01        2021/10/22     MOSW64-DEV     333333333333
```


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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?
A: This depends, if one mirror fails, it only affects the light going through that mirror.

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 the power to the device were shut off, would the device continue to pass the fiber light as configured before failure?
A: This function is called latching. We uniquely offer MEMS latching switches 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

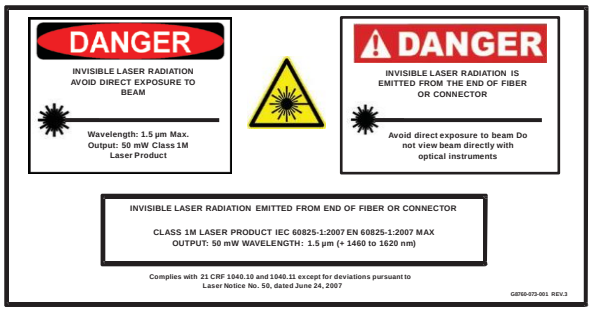
Q: With the Ethernet Control Option, does the user need to install any software on their computer other than a web browser?
A: No

Laser Safety

This product meets the appropriate standard in Title 21 of the Code of Federal Regulations (CFR). FDA/CDRH Class 1M laser product. This device has been classified with the FDA/CDRH under accession number 0220191. All versions of this laser are Class 1M laser products, tested according to IEC 60825-1:2007 / EN 60825-1:2007. An additional warning for Class 1M laser products. For diverging beams, this warning shall state that viewing the laser output with certain optical instruments (for example eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. For collimated beams, this warning shall state that viewing the laser output with certain instruments designed for use at a distance (for example telescopes and binoculars) may pose an eye hazard.

Wavelength = 1.3/1.5 µm.

Maximum power = 30 mW.



*Caution - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
*IEC is a registered trademark of the International Electrotechnical Commission.

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