

MEMS 3x3, 4x4, 5x5 Fiber Optical Switch

(Non-Blocking, Bidirectional, Passive, 65dB on/off, 850nm, 1260-1620nm)

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

MEMS Series Fiber Optical Switches are plug-and-play, all-in-one units that provide direct, non-blocking optical signal routing between any input ports to any output ports with millisecond switching speeds. These passive devices preserve signal integrity, supporting all data rates and waveforms. Engineered for long-term reliability, they are rated for continuous operation and backed by a five-year warranty. The standard version is optimized for lasers with linewidths greater than 1 GHz; optional specialized coatings are available to mitigate etalon effects for narrow-linewidth lasers. Each switch is housed in a rack-mounted enclosure, with height determined by the selected front panel connectors. A web-based GUI is included, compatible with standard network management protocols. For developers, a complete command set is provided, and code-writing services are available upon request. The GUI supports time-based step scripts, enabling pre-stored switching sequences to eliminate execution latency — particularly useful in automated test setups. To further minimize control delays caused by non-real-time systems, a dedicated computer running a real-time OS (e.g., Linux on a single-board computer) is recommended. A multicast version is also available for applications requiring simultaneous distribution from one input to multiple outputs.

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.



5-year manufacturer warranty

Features

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

Specifications ^[1]

Parameters	Min	Typical	Max	Unit
Operation Wavelength	750	1270~1630	2400	nm
Insertion Loss ^[1] (SM)		1.8	2.5	dB
Insertion Loss ^[1] (MM)		1.8	2.5	dB
Crosstalk, On/Off Ratio	45		65	dB
Extinction Ratio (PM Fiber)	18		23	dB
Switch Speed (Rise, Fall) ^[2]		5	20	ms
Durability	10 ⁹			cycle
Polarization Dependent Loss		0.04	0.2	dB
Wavelength Dependence Loss ^[3]		0.1	0.3	dB
Return Loss	50 ^[7]			dB
Repeatability		0.05	0.1	dB
Operating Temperature ^[4]	-5		65	°C
Transit Time Delay			0.2	ms
Port to Port Time Delay Difference			0.5	ns
Optical Power Handling (CW) ^[5]		300	500	mW
Storage Temperature	-40		85	°C
Electrical Power Consumption			50 ^[6]	W
Package Dimension	1RU/2RU/4RU			

Notes:

- [1]. Measured at 1550nm without connectors, each connector adds 0.2-0.3dB. Shorter or longer wavelength loss increases. Minimum loss version is available as special order
- [2]. This is intrinsic switch component performance. The remote control adds delay (Ethernet is the longest)
- [3]. Within 50nm bandwidth
- [4]. -25°C~75°C version is also available.
- [5]. High power version available
- [6]. For the non-latching version
- [7]. For SM fiber, MM fiber is 35dB

Applications

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



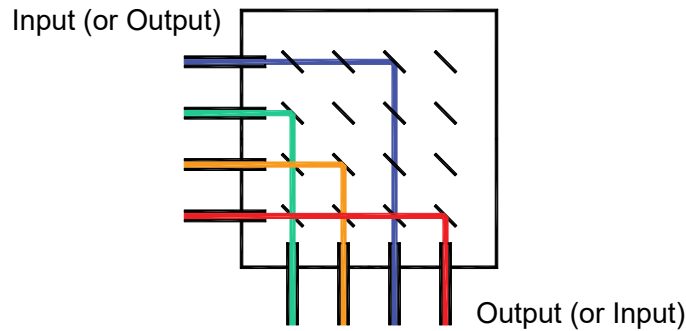
Note: The specifications provided are for general applications with a cost-effective approach. If you need to narrow or expand the tolerance, coverage, limit, or qualifications, please [click this link](#):

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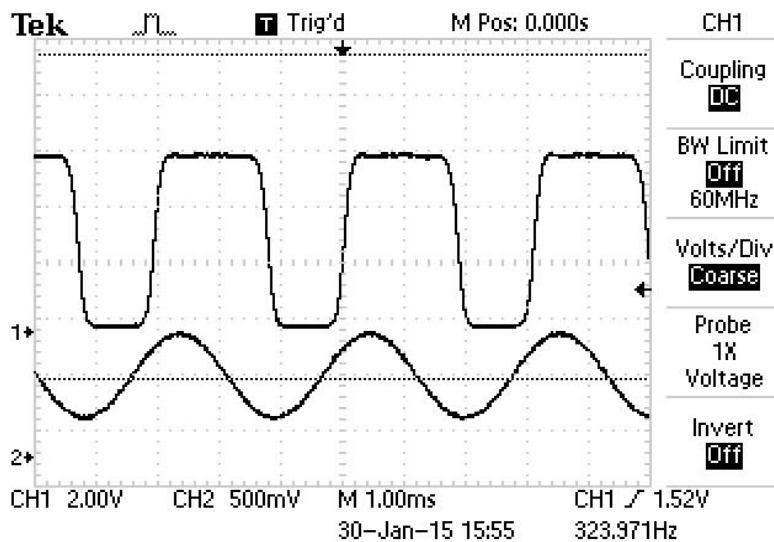
Optical Path

MEMS 4x4 Switch



10⁹ Switching Cycle Test (This was performed on 1x2 component, not the switch system)

We have tested MEMS 1x2 switch at the resonant frequency ~300Hz for more than 40 days, as shown in the attachment, which corresponds over 10⁹ 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

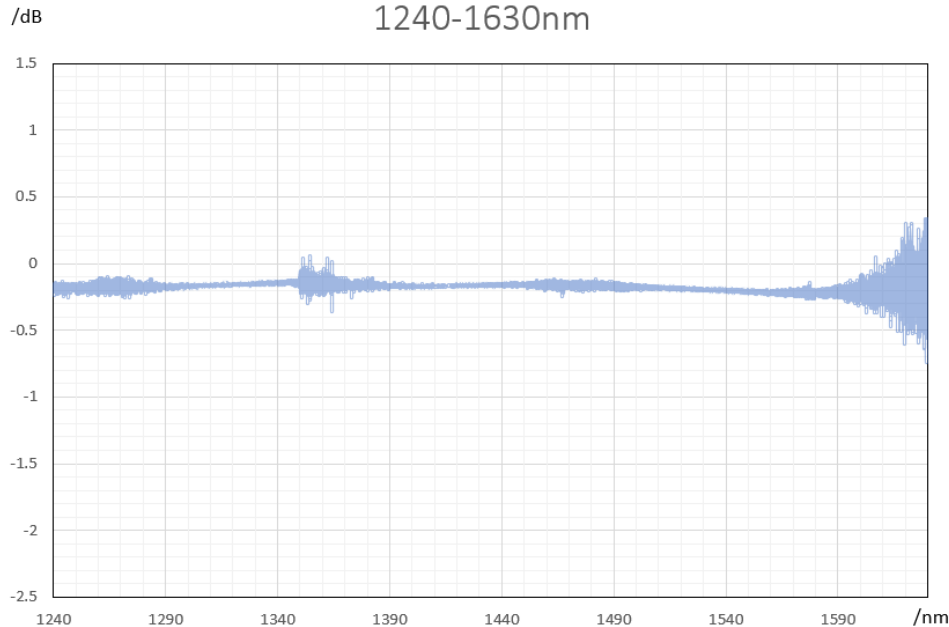
We provide a command list for customers to write their control code, such as Python



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Typical Insertion Loss vs Wavelength (1240-1630nm)



Ordering Information (Part Number)

Prefix	Configuration	Channel	Wavelength ^[1]	Control Interface	Package ^[2]	Fiber Type	Power Supply	Connector ^{[3][5]}	On/Off	PER	Monitor	Interface Code ^[4]
MEMS-	3x3 = 0303 4x4 = 0404 5x5 = 0505 Special = 0000	Single = 1 Duplex = 2	1240-1640nm = 1 1060nm = 6 1310nm = 3 1410nm = 4 1550nm = 5 1310/1550nm = 2 2000nm = A 850nm = 8 750nm = 7 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 PM1550 = 5 62.5/125 = 6 105/125 = E Hi1060 = 3 780HP = 8 PM980 = 9 SM800 = A PM850 = B PM780 = C SM1950 = L PM1950 = M Special = 0	110-220V = 4 48V = 5	None = 1 FC/APC = 2 FC/APC = 3 SC/APC = 4 SC/APC = 5 LC/APC = 7 Duplex LC/APC = 8 LC/APC = A LC/UPC = U E2000/APC = E MPO = Y Special = 0	Regular = 1 SM65dB = 2 MM50dB = 3 PM65dB = 5	Non = N >18 = 1 23 = 2 29 = 3	Non = 1 Output = 2 Input Output = 3 Input = 4	Non = N Python = P LabVIEW = L

[1]. Measured wavelength. The device has a wider wavelength coverage. Customer can request to measure at several wavelengths.

[2]. Rack Mount Depth ~ 430mm.

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

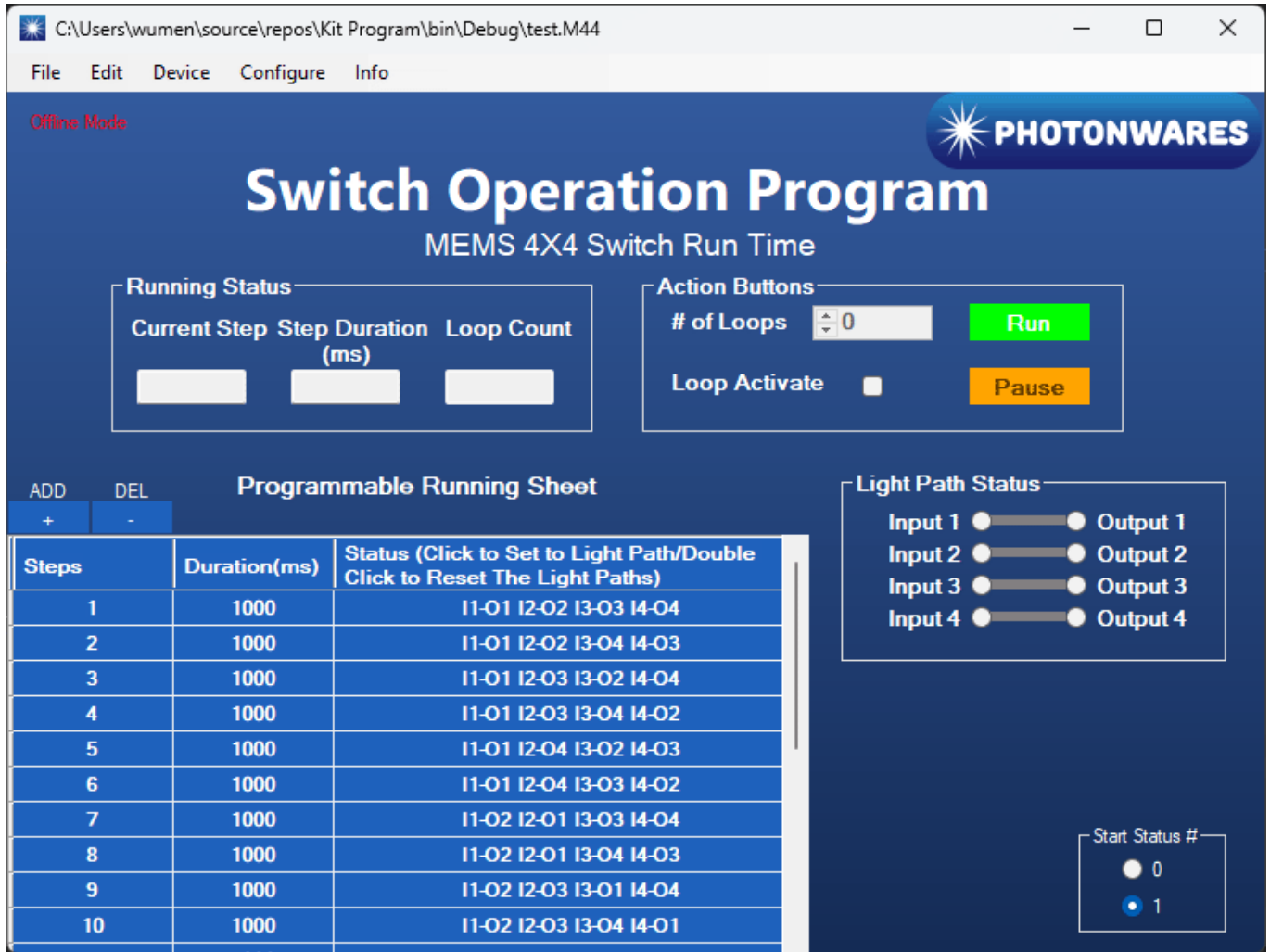
[4]. GUI and a command set (API) are included. Python **\$560**. LabVIEW interface libraries **\$750**

[5]. The connector cannot be installed directly onto bare fiber, as it is prone to damage during shipping. However, the connector can be assembled on bare fiber if a 3 cm protective loose tube is added for reinforcement. The customer can remove this protective tube after testing. The optical power handling of a standard connector is less than 0.5 W for SM28 fiber and decreases further with smaller core fibers.

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Example of RS232 Control GUI
(one can create a running receipt, pause, repeat loop)



The screenshot shows a software window titled "Switch Operation Program" for a MEMS 4X4 Switch. It includes a menu bar (File, Edit, Device, Configure, Info), a status bar (Offline Mode), and the PhotonWares logo. The main interface is divided into several sections:

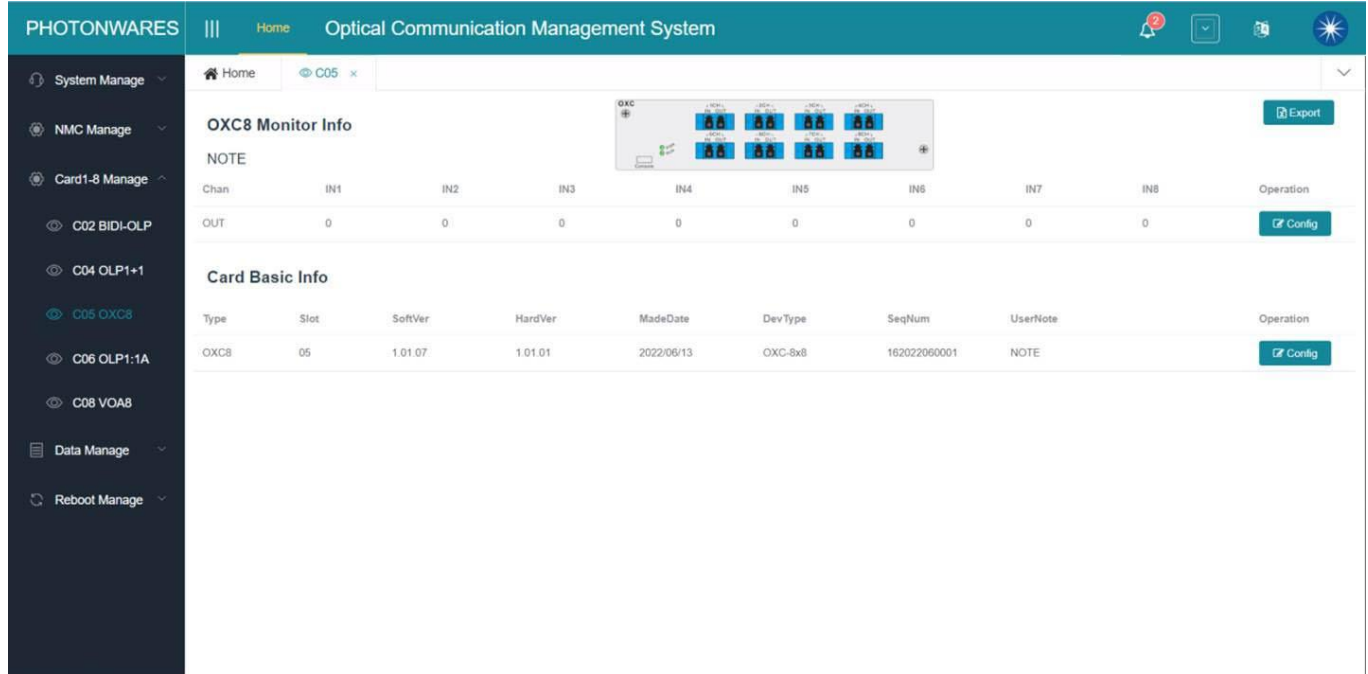
- Running Status:** A table with columns for Current Step, Step Duration (ms), and Loop Count, each with an empty input field.
- Action Buttons:** A "# of Loops" spinner set to 0, a green "Run" button, a "Loop Activate" checkbox, and an orange "Pause" button.
- Programmable Running Sheet:** A table with columns for Steps, Duration (ms), and Status. It contains 10 rows of data.
- Light Path Status:** Four rows of sliders, each labeled "Input X" and "Output X" (for X=1,2,3,4).
- Start Status #:** A small control with radio buttons for status 0 and 1, where status 1 is selected.

Steps	Duration(ms)	Status (Click to Set to Light Path/Double Click to Reset The Light Paths)
1	1000	I1-O1 I2-O2 I3-O3 I4-O4
2	1000	I1-O1 I2-O2 I3-O4 I4-O3
3	1000	I1-O1 I2-O3 I3-O2 I4-O4
4	1000	I1-O1 I2-O3 I3-O4 I4-O2
5	1000	I1-O1 I2-O4 I3-O2 I4-O3
6	1000	I1-O1 I2-O4 I3-O3 I4-O2
7	1000	I1-O2 I2-O1 I3-O3 I4-O4
8	1000	I1-O2 I2-O1 I3-O4 I4-O3
9	1000	I1-O2 I2-O3 I3-O1 I4-O4
10	1000	I1-O2 I2-O3 I3-O4 I4-O1

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Example of Ethernet Remote Control GUI



The screenshot displays the PhotonWares Optical Communication Management System interface. The left sidebar contains navigation options: System Manage, NMC Manage, Card1-8 Manage, C02 BIDI-OLP, C04 OLP1+1, C05 OXC8, C06 OLP1:1A, C08 VOA8, Data Manage, and Reboot Manage. The main content area shows the OXC8 Monitor Info section with a NOTE and a table of channel data. Below this is the Card Basic Info section with a table of card details.

Chan	IN1	IN2	IN3	IN4	IN5	IN6	IN7	IN8	Operation
OUT	0	0	0	0	0	0	0	0	Config

Type	Slot	SoftVer	HardVer	MadeDate	DevType	SeqNum	UserNote	Operation
OXC8	05	1.01.07	1.01.01	2022/06/13	OXC-8x8	162022060001	NOTE	Config



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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?

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