

# Bidirectional Optical Protection Switch

(switching-speed: 10ms, 100µs, 10µs, DWDM, data-rate: 200Gb)

The Bidirectional Optical Line Protection Switching System (BOLP) provides automatic restoration of DWDM traffic by utilizing a redundant optical fiber as a backup path. Designed for both cascaded and hub-and-spoke network topologies, the system ensures recovery from a single fiber cut in a ring configuration within less than 10 ms. The system continuously monitors optical power in both forward and reverse transmission paths. When the power level drops below a user-defined threshold, the switch automatically reroutes traffic to the backup fiber. Once normal fiber continuity is restored, the system automatically reverts to its primary operating mode. To prevent false switching events caused by Fresnel reflections—resulting from abrupt refractive index changes during a fiber break—the switching threshold is software-adjustable during system installation. This enables users to fine-tune system sensitivity for stable and reliable operation. The design incorporates two independent line protection switching modules for bidirectional communication. In the event of DC power loss, the switch maintains traffic through the working port only. Additionally, the system includes a built-in laser and detector to continuously monitor the integrity of the spare fiber line and generate alarms if faults are detected. This architecture eliminates the need for inter-module communication, reducing response time and improving overall reliability. The BOLP system supports high DWDM data rates of up to 200 Gbps and offers fast optical switching with selectable speeds ranging from milliseconds down to a few microseconds, minimizing data loss during switching events. Real-time monitoring of both transmit and receive power levels further enhances system performance and fault detection.



## Features

- Bidirectional protection
- Reduce interruption time
- Increase reliability
- Improve service quality
- Fault tolerance
- Automatic switching
- DWDM

## Applications

- Fiber Line Protection
- Ring Networks

## Specifications <sup>[1]</sup>

Parameters	Min	Typical	Max	Unit
Operating Wavelength		1260-1650		nm
Insertion Loss <sup>[1], [2]</sup>		1.5	1.8	dB
Monitoring Power Range		-50	23	dBm
Return Loss		45		dB
Cross Talk On/Off Ratio		55		dB
PDL			0.05	dB
Optical Switching Time <sup>[4]</sup>	0.1	10	30	ms
Repeatability			± 0.05	dB
Noise Figure			30	dB
Signal Detection Range	-40		30	dBm
Durability <sup>[5]</sup>	10 <sup>8</sup>		10 <sup>13</sup>	Cycle
Operating Temperature	-5		60	°C
Storage Temperature	-40		85	°C
Monitor Port/Interface <sup>[6]</sup>	RJ45, Console, SFP, CLI, SSH, Telnet, SNMP			
Power Supply	DC: -48~70V; AC: 110~220V (50/60 Hz), 50W, Dual and Hot Swappable			
Alarms	Signal Degradation, Switching Event, Fan Failure, CPU at high work load			
Fiber Type	SMF-28 or equivalent			
Chassis Type	19" Rack, 1U Supports 4 Channels with Dimension 44.5x482.6x300mm			
Internal Cooling Fan	Included			
Relative Humidity	5-95%			

**Notes:**  
 [1]. Excluding connectors  
 [2]. Multimode IL measure @ Light Source CPR<14 dB  
 [3]. Dual band, and Dual 1x2, Full 2x2, Dual Full 2x2  
 [4]. Optical switch speed, there are electrical signal delay in the system  
 [5]. Higher reliability switches are available  
 [6]. A basic SNMP interface is included for customers to write their application-specific code. We provide code writing with NRE



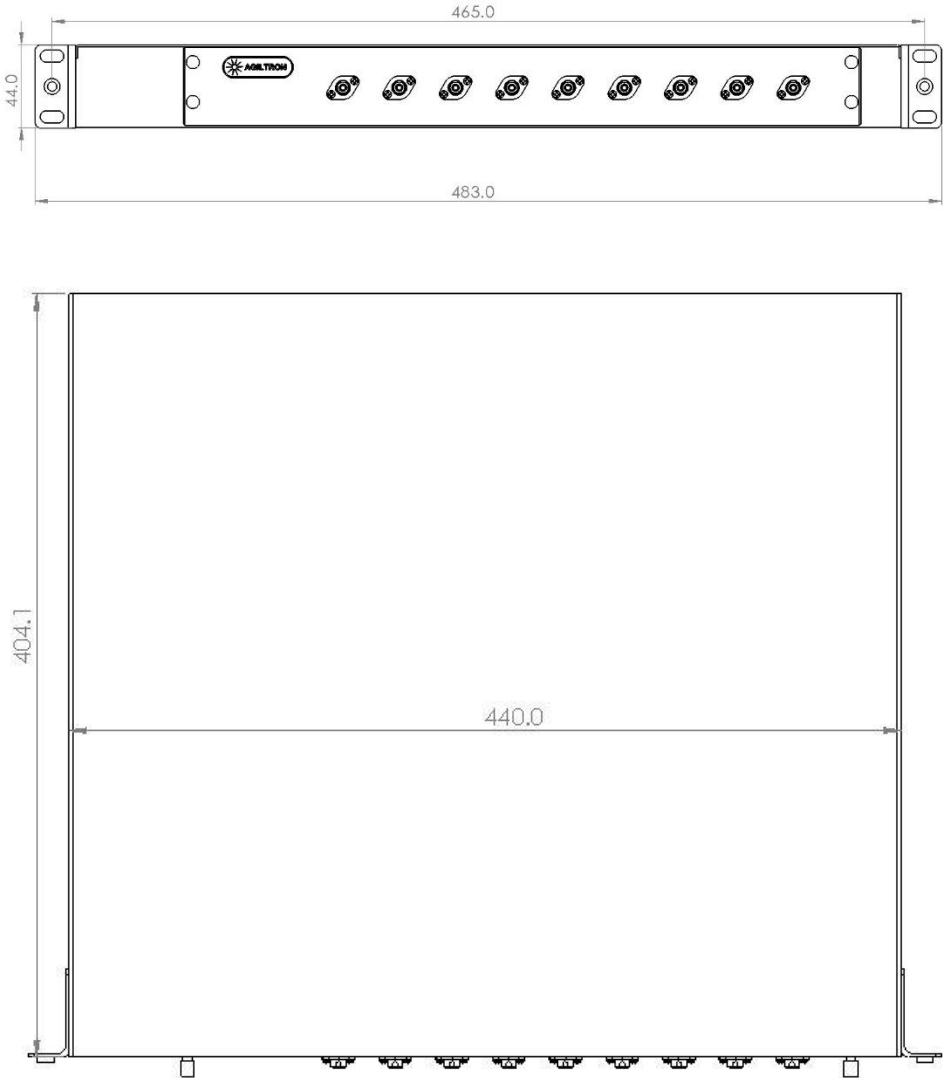
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## Mechanical Dimensions (mm)

1RU 19" mount rack typically. The input and output connectors and the control interface are on the front panel, while and power inputs are on the rear panel.

### 1U Rack Mount



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

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## Ordering Information (Part Number)

Prefix	Type	Channel	Wavelength	Package <sup>[1]</sup>	Fiber Type	Switch Type	Power Supply	Connector <sup>[2]</sup>
<b>BOLP-</b>	1:1 = 1	1 = 01 2 = 02 ... 99 = 99 Special = 00	1260-1650nm = 1  Special = 0	1RU = 1 2RU = 2 3RU = 3 4RU = 4 Special = 0	SMF28e = 1 MM50/125 = 5 MM62.5/125 = 6 Special = 0	10 ms = 1 100 µs = 2 10 µs = 3	-48~70VDC = 2 110~220V AC = 3 Special = 0	FC/APC = 1 FC/PC = 2 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC/PC = 7 Duple LC/PC = 8 LC/UPC = U MPO = Y Special = 0

[1]. Rack Mount Depth ~ 430mm.

[2]. 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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## An Example of TRAPS

SNMP TRAP	Description	Object Identifier/SNMP trap receiver display
OLP channel change	In the last 1.3.9 of the OID, 1 indicates the slot, 3 indicates the OLP board, 9 indicates the working channel, value=100 indicates that the current channel is the main channel, and value=200 indicates that the current channel is the backup channel	1.3.6.1.2.1.1.3.0 1.3.6.1.6.3.1.1.4.1.0 1.3.6.1.4.1.40989.10.16.1.3.9
OLP R1 alarm state	In the last 1.3.26 of the OID, 1 indicates the slot, 3 indicates the OLP board, 26 indicates the R1 alarm status, value=1 indicates that the current R1 power has changed from being less than the switching threshold state to being greater than the switching threshold state, and value=0 indicates the current R1 power From the state greater than the switching threshold to the state less than the switching threshold	1.3.6.1.2.1.1.3.0 1.3.6.1.6.3.1.1.4.1.0 1.3.6.1.4.1.40989.10.16.1.3.26
OLP R2 alarm state	In the last 1.3.27 of the OID, 1 indicates the slot, 3 indicates the OLP board, 27 indicates the R2 alarm status, value=1 indicates that the current power of R2 has changed from being less than the switching threshold state to being greater than the switching threshold state, and value=0 indicates the current power of R2 From the state greater than the switching threshold to the state less than the switching threshold	1.3.6.1.2.1.1.3.0 1.3.6.1.6.3.1.1.4.1.0 1.3.6.1.4.1.40989.10.16.1.3.27
OLP TX alarm state	In the last 1.3.28 of the OID, 1 indicates the slot, 3 indicates the OLP board, 28 indicates the TX alarm status, value=1 indicates that the current power of the TX has changed from being less than the switching threshold state to being greater than the switching threshold state, and value=0 indicates the current power of the TX From the state greater than the switching threshold to the state less than the switching threshold	1.3.6.1.2.1.1.3.0 1.3.6.1.6.3.1.1.4.1.0 1.3.6.1.4.1.40989.10.16.1.3.28

## 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 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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## 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")

#####
```



# Bidirectional Optical Protection Switch

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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 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

**Q:** What OLP configuration affects the response characters?

**A:** The switch choice affects the most, however, the switch with fast rise/fall is more expensive. 1+1 only involves one switching, thus the performance is better than 1:1, but at the expense of half the signal lost.

**Q:** What OLP configuration affects the detection accuracy for low signal traffic?

**A:** OLP uses tap monitors to automatically detect fault. The tap ratio can be increased to provide more accurate detection for low signal levels, but this is at the expense of more signal losses.

## 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.