Optical Line Protection Switch

(switching-speed: 10ms, 100μs, 100ns, 50ns, 10ns, data-rate: 200Gb)

The optical Line Protection Switching System (OLP) uses a redundant optical fiber route as a backup path. We uniquely offer a high data rate of up to 200 gigabit and fast optical switching to reduce data loss with three choices of optical switching speed: ms to a few ns. By real-time monitoring the power status of both transmission and receiving in the working fiber, it can automatically switch to the backup fiber when the power value is lower than a user-defined threshold. This design allows the switch to operate independently without communicating, reducing reaction time. Moreover, our system has a built-in laser and detector to monitor the spare fiber line ensuring its integrity at all times and sensing an alarm when a problem occurs. Our net-ready OLPs offer various reliable protection schemes against fiber cuts and network failures. Our OLP is also compatible with 1310/1550 transmission in the opposite direction in the same fiber. They are used for protecting the backbone and important business lines. Management of the OPS is performed using a Web GUI, reachable through the local Ethernet ports on the OPS system control card.

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.

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.

Due to inherent computer delays under Windows, response speed can be improved by using a Linux-based controller or executing stored switching sequences directly on the board. In this mode, the host computer simply issues start, pause, and repeat commands.

Features

- Reduce interruption time
- Increase reliability
- Improve service quality
- Fault tolerance
- Automatic switching
- 1310nm/1550nm WDM

Applications

- Fiber Line Protection
- FTTx Networks

Specifications [1]

Parameters		Min	Typical	Max	Unit
Operating Wavelength			1310/1550 ± 50		nm
Insertion Loss [1], [2]	1 : 1 Tx		1.2	1.3	dB
	1 : 1 Rx		1.2	1.3	
	1 + 1 Tx		3.5	3.8	
	1 + 1 Rx		1.2	1.3	
Monitoring Power Range			-50	23	dBm
Return Loss			45		dB
Cross Talk On/Off Ratio			55		dB
PDL				0.05	dB
Optical Switching Time [4]		100 ns	10 ms		
Repeatability				± 0.05	dB
Noise Figure				30	dB
Signal Detection Range		-40		30	dBm
Durability [5]		10^7		10^{13}	Cycle
Operating Temperature		0		70	°C
Storage Temperature		-40		85	°C
Monitor Port/Interface [6]		RJ45, Console, SFP, CLI, SSH, Telnet, SNMP			
Power Supply		DC: 12~48V; 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

RoHS COMPLIANT

Rev 08/13/26

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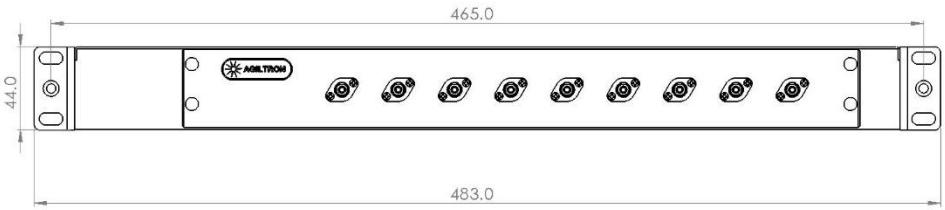
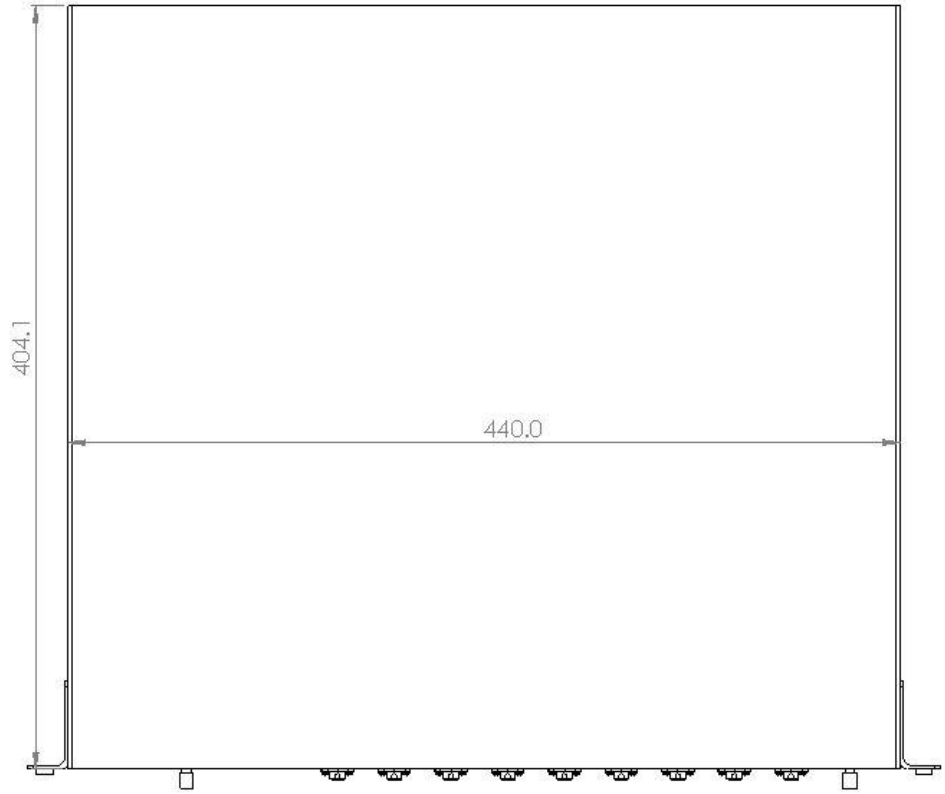
Mechanical Dimensions (mm)

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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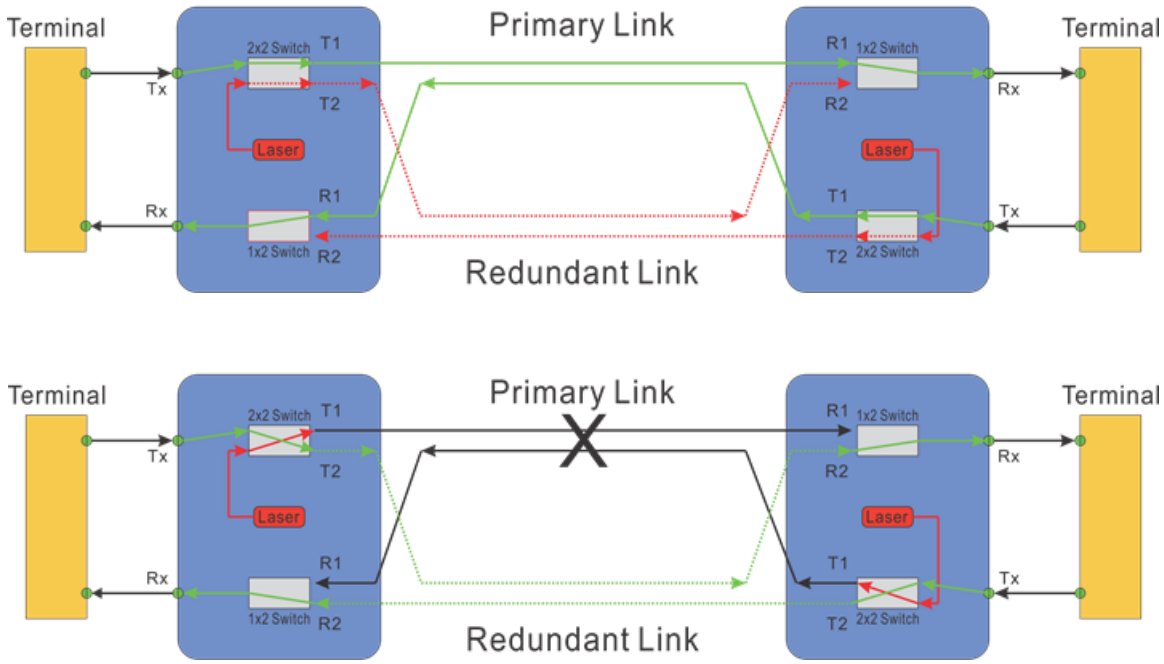
OLP 1:1 Configuration

OLP configuration 1:1, as shown in the diagram below, consists of the main fiber route and a standby fiber route between the two sites and associated fiber optical switches. In normal operation, the data are transmitted and received through the main route. Inside the OLP pair, detectors are incorporated at Rx ports to detect the decreasing of the optical power. When a fault is detected on the main route, the system will switch both the transmitting and receiving from the main route to the standby route. This is accomplished by first turn off the built-in test laser so that both ends detect fault. **The advantages of a 1:1 OLP system are low optical insertion loss with direct signal passthrough, and the optical fiber for the backup path can also be used for other businesses. The disadvantage is conventional systems require CPU processing the information at both ends, resulting in typically delays of about 80ms in response.**



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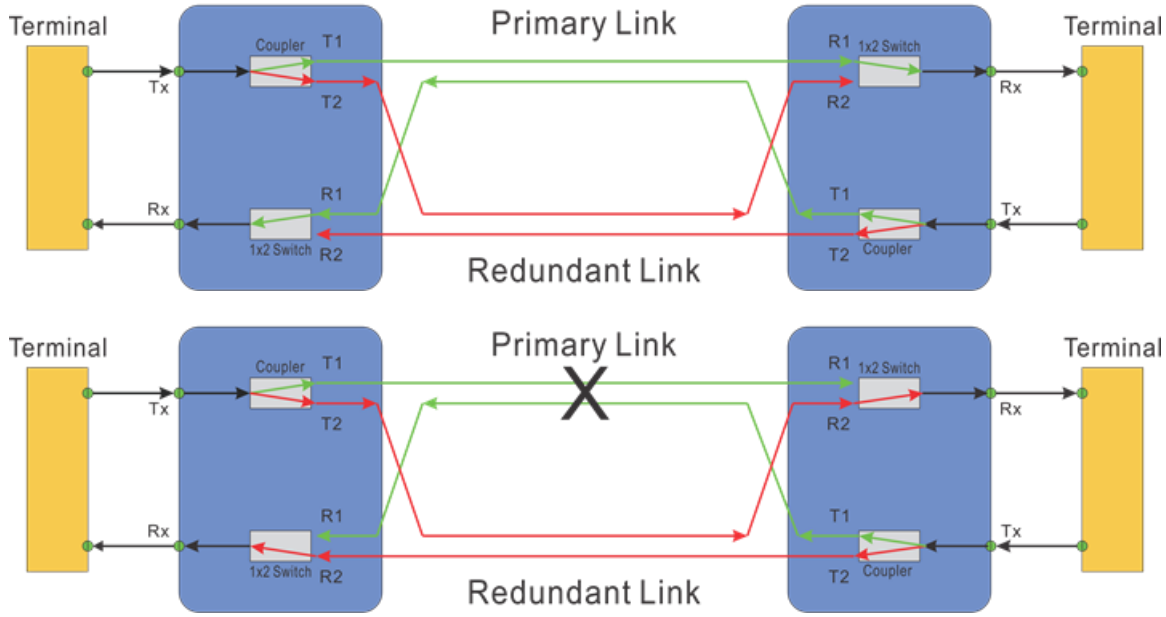
OLP 1+1 Configuration

OLP 1+1 configuration is shown in the following diagram, in which the optical signals are split into two with a ratio of 50:50 and transmitted through both main and standby routes at the same time. While for Rx, the optical signal with better quality will be selected when a fault is detected. **The advantage of the OLP 1+1 system is faster recovering optical switching. We offer a 100ns recovery option in this configuration. However, there will be a larger insertion loss compared with the OLP 1:1 system.**



Ordering Information (Part Number)

	☐	☐☐	☐	☐	☐	☐	☐	☐	☐
Prefix	**Type**	**Channel**	**Wavelength**	**Package [1]**	**Fiber Type**	**Switch Type**	**Power Supply**	**Connector [2][5]**	**Interface Code [3]**
OLP-	1:1 = 1 1+1 = 2	1 = 01 2 = 02 ... 99 = 99 Special = 00	1240-1640nm = 1 1310 = 3 1550 = 5 1310/1550 [4] = 9 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 = 2 100 ns = 3 50 ns = 5 10 ns = 9	48V DC = 2 110~220V AC = 3 Special = 0	None = 1 FC/PC = 2 FC/APC = 3 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC/PC = 7 Duple LC/PC = 8 LC/UPC = U MPO = Y Special = 0	Non = N Python = P LabVIEW = L

[1]. Rack Mount Depth ~ 430mm.

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

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

[4]. **1310nm** and **1550nm** transmit in the opposite direction inside the same fiber

[5]. The default connector configuration uses fiber with 0.9 mm buffer protection. The connector cannot be installed directly onto bare fiber because the bare fiber 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 may remove this protective tube after testing. The optical power handling of a standard connector is less than 0.5 W for SMF-28 fiber and decreases further for 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")

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


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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.

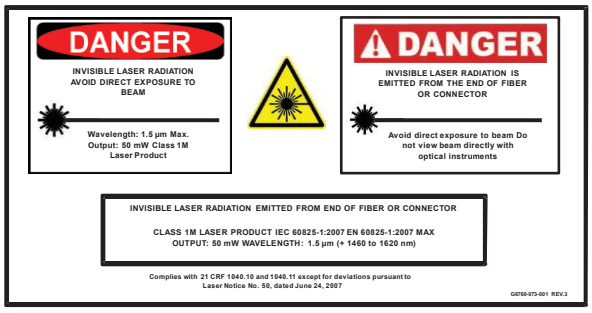
Q: What OLP configuration affects the detection accuracy for low signal traffic?
A: OLP uses tap monitors to automatically detect fault. The tap ratio can be increased to provide more accurate detection for low signal levels, but this is at the expense of more signal losses.

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.

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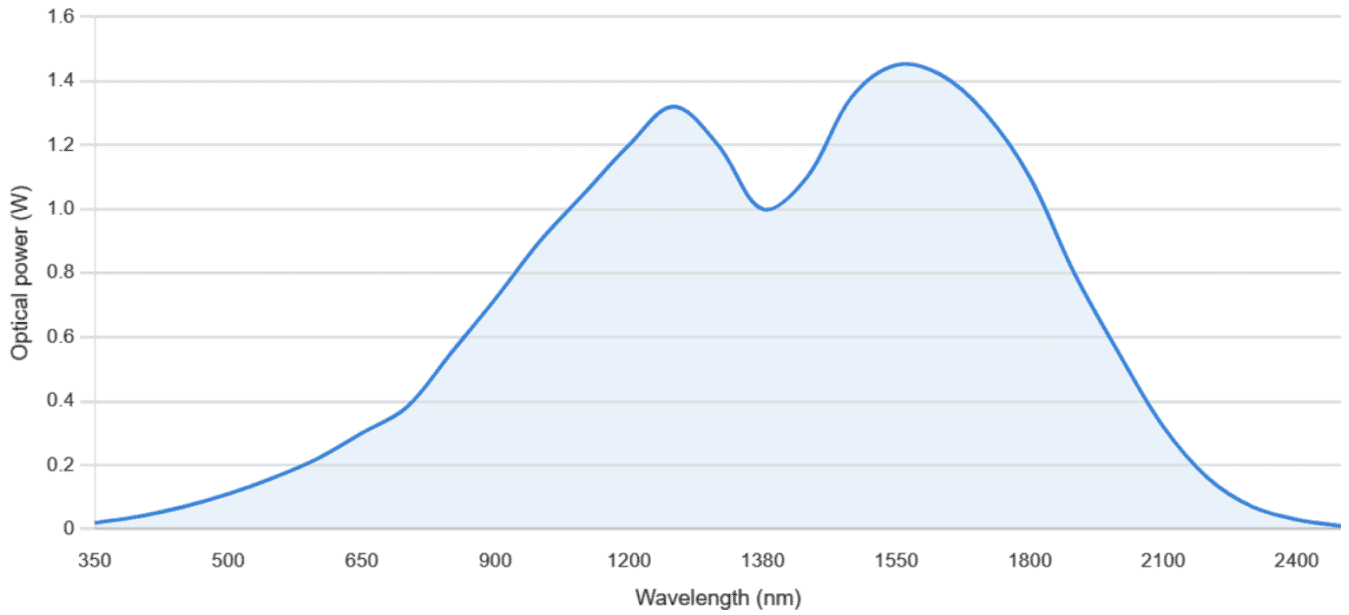
Regular Single Mode / Polarization Maintaining Fiber Optical Power Handing vs Wavelength



Single mode fiber optical power is limited by nonlinear effects in addition to absorption that increase loss and generate heat. The curve shows the approximate safe CW power envelope for standard single-mode fiber. Actual limits depend on fiber design, core size, length, and laser characteristics. Specialty fibers can significantly increase the power limit.

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