



# OZ Optics

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## SMART PATCHCORDS™ AND WIRELESS FIBER™ FOR POWER AND WAVELENGTH MONITORING (PATENT: USA 7095931 AND 7295731)

### Features:

- Local or remote monitoring via RS232, USB, or wireless communication
- Inexpensive, miniature package
- Low insertion losses, return losses. High power handling
- Versions for wavelengths from 600 nm to 1700 nm available
- Polarization Maintaining (PM) and specialty fiber versions available

### Applications:

- Network and channel monitoring in FTTH networks
- Channel balancing for Wavelength Division Multiplexing (WDM) systems
- Dynamic optical amplifier gain monitoring
- Power monitoring
- Optical power control devices
- Polarization stabilization
- Polarization mode dispersion compensation
- Real time in-line test and measurement
- Fiber optic sensors

### Product Description:

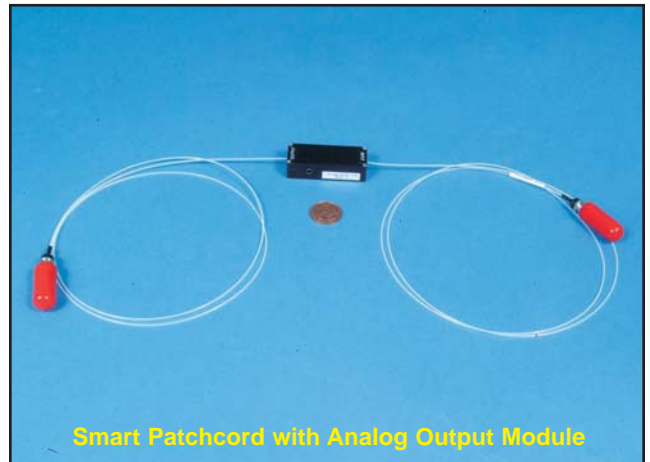
Smart patchcords utilize a new technology to monitor the properties of optical signals traveling through fibers. This includes power monitoring, wavelength sensing, and polarization measurement. The technology allows sensors to be integrated into networks and test equipment to provide real-time remote monitoring without interrupting the optical signal. Applications include channel monitoring in optical networks, polarization stabilization, and environmental sensing.

Using a novel technique to tap signals for measurements, the monitors are very compact, and resemble a patchcord in construction. Competing monitoring systems typically use fused couplers to tap a fixed amount of light into another fiber and on to a measuring module. This method is bulky and must be done using discrete components. In contrast, our technique directs a controlled amount of light from the fiber core to the surface where it can be directly monitored. This is all done without bending, shaping, or otherwise harming the fiber. As a result sensors can be directly incorporated into optical assemblies, without affecting functionality. The manufacturing process allows full automation, sharply reducing costs.

Sensors can be made into standard singlemode fiber, polarization maintaining (PM) fibers, or specialty fibers, for any design wavelength. The monitor electronics can be configured to give either an analog electrical output or a digital output via an RS-232 or USB port. Multiple sensor modules can be integrated into a single patchcord, allowing different properties to be measured simultaneously. The sensors are directional in nature, measuring light traveling in one direction through the fiber, but not in the reverse direction. This directionality is ideal for monitoring signals in one direction independently of signals traveling along the other direction. Bi-directional versions can be provided on request. We welcome custom applications and new ideas. Contact OZ Optics for additional information.

The latest member of the Smart Patchcord family is the Wireless Fiber™. This is a Smart Patchcord with a built-in miniature radio transceiver. This allows the Smart Patchcord to communicate with a host computer, which can be a laptop, PDA, or even a smart cell phone. This makes it possible in many instances for a technician to identify a problem fiber before he even enters a building, resulting in a tremendous reduction in troubleshooting time. Several versions of the wireless link are offered, with ranges from 10 meters to over 1 kilometer.

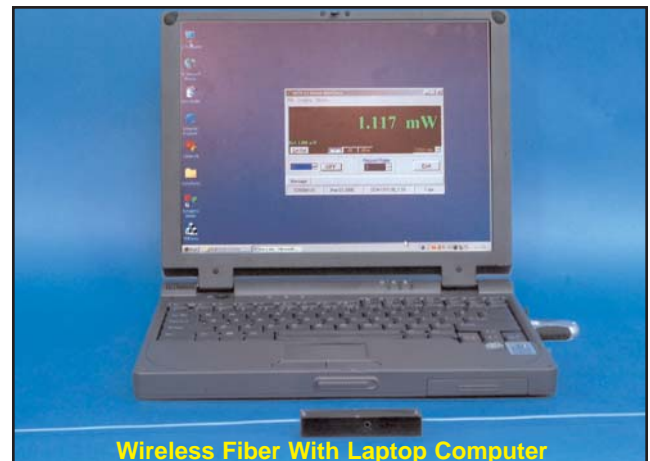
When a smart cell phone is used, measurements can be instantly sent to a central location for logging, or for comparison with previous measurements to monitor degradation of a link. By allowing easy monitoring of optical signal power levels without disrupting the signal, unnecessary maintenance and down time can be virtually eliminated.



Smart Patchcord with Analog Output Module



Wireless Fiber With Smart Phone



Wireless Fiber With Laptop Computer

## Advantages of Smart Patchcords:

Smart Patchcords possess several key advantages over the standard technique of using a fused coupler with a measurement module. These include:

- **Size:** Fused splitters are typically at least 30 mm long, plus you need tens of centimeters of fiber on the arms of the splitters for attaching the splitter to your device and to the measurement system. In contrast, smart patchcords can be made with a package less than a centimeter in length on the fiber.
- **Consolidation:** Smart patchcords combine the functions of a fused splitter and a optical analyzer into one package.
- **Automation:** Smart patchcords can be made in a single automated process. In contrast adding fused splitters with optical test modules requires several discrete processes, with some manual operations necessary.
- **Flexibility:** Smart Patchcords can be made with tap ratios as small as 0.1%, allowing one to manufacture modules for very high power applications
- **Multichannel Friendly:** Smart patchcords are manufactured in a small, friendly, easy to use package. In contrast assembling multichannel monitors with fused splitters makes a cumbersome package with many fibers to arrange.

## Standard Product Specifications:

### Optical Properties of Smart Patchcords <sup>1</sup>

Operating Wavelength	1450-1650 nm, or 1280-1440 nm standard.
Tap Ratio	2% ± 0.5% standard <sup>2</sup>
Tap Efficiency <sup>3</sup>	>60%
Insertion Loss	<0.2 dB <sup>4</sup>
Return Loss	>70 dB (excluding connectors)
Directionality	Better than -35 dB <sup>5</sup>
Polarization Dependent Loss	<0.1 dB (over the specified wavelength range)
Polarization Dependent Response <sup>5</sup>	<0.2 dB (over the specified wavelength range)
Wavelength Dependent Response <sup>5</sup>	±0.25 dB (over the specified wavelength range)
Polarization Extinction Ratio <sup>6</sup>	>20 dB (>30 dB extinction ratios available on request)
Power Handling	> 1 Watt <sup>7</sup>

<sup>1</sup> As measured using Corning SMF-28 fiber or 1550 nm PANDA style polarization maintaining fiber. Other fiber types available on request.

<sup>2</sup> Other tap ratios, from 0.5% to over 4% are available on request.

<sup>3</sup> Defined as (Power received at the module)/(Power attenuated by the tap)\*100%

<sup>4</sup> For 2% taps or lower.

<sup>5</sup> As measured from a 2% tap mated with a 0.5 mm active area InGaAs detector, with index matching epoxy.

<sup>6</sup> PM fiber versions only.

<sup>7</sup> While not yet tested at powers higher than 1 watt, the units are expected to handle in excess of 5 watts of power.

### Electrical Specifications for Smart Patchcords

Communications Interface	Smart Patchcords: RS232, USB Wireless Fiber™ : Radio link (Wi-Fi, Bluetooth, Zigbee) Other types are possible. Contact OZ Optics for details
Data Transfer Rate	Smart Patchcord: RS232 and USB: >8 readings per second. Wireless Fiber™: Radio link: >25 nodes per second. Higher rates are possible. Contact OZ Optics for details.
Power Requirements	Smart Patchcord: RS232 and USB units can be powered by the communications link. Smart Patchcord or Wireless Fiber™: External DC power supply: 5 to 24 volts. Battery operation is possible. Contact OZ Optics for details.

### Environmental

Operating Temperature	0 to 60°C
Storage Temperature	-40 to 85°C
Relative Humidity	< 85% RH noncondensing at 50°C
Dimensions	Depends on configuration. Contact OZ Optics for details.
Weight	Depends on configuration. Contact OZ Optics for details.

## Ordering Information For Custom Parts:

OZ Optics welcomes the opportunity to provide custom designed products to meet your application needs. As with most manufacturers, customized products do take additional effort so please expect some differences in the pricing compared to our standard parts list. In particular, we will need additional time to prepare a comprehensive quotation, and lead times will be longer than normal. In most cases non-recurring engineering (NRE) charges, lot charges, and a 25 piece minimum order will be necessary. These points will be carefully explained in your quotation, so your decision will be as well-informed as possible. We strongly recommend buying our standard products.

## Questionnaire For Custom Parts:

1. What is your operating wavelength range?
2. Are you using standard singlemode, polarization maintaining, or a speciality fiber? What type?
3. What is the expected optical power through the fiber?
4. Do you need a single channel, or multiple channel device?
5. Do you need to measure optical power, spectral intensity, or polarization?
6. What sort of measurement resolution or accuracy do you need?
7. What dynamic range do you need?
8. Do you need the ends of the fiber connectorized? What type of connector do you need?
9. How long should each end of the fiber be?
10. Do you need the fiber cabled? What cable size do you need?
11. What kind of communication link do you need?
12. If you need a wireless link, what communication range do you need?

## Description

### Smart Patchcord

## Part Number

**OCM-1N-W-a/b-F-XY-JD-L-M-E**

**N** = Number of fibers (1 channel is standard)

**W** = Wavelength in nm:

1550 for 1450 to 1650 nm operating range  
1300 for 1280 to 1440 nm operating range  
(For single channel monitoring, specify the exact wavelength)  
Contact OZ Optics for other wavelengths

**a/b** = Fiber core/cladding sizes, in microns:

9/125 for 1300 or 1550 nm SMF  
7/125 for 1300 nm PMF  
8/125 for 1550 nm PMF.  
See Tables 1 to 5 of the OZ Optics Standard Tables for other fiber sizes

**F** = Fiber type: S = Singlemode

P = Polarization maintaining

**E** = Electrical Output

A = analog output  
RS232 = digital output  
U = USB  
W = wireless (radio)

**M** = Measurement module

D = Optical Power (Detector)  
P = Polarization  
C = Single Channel Monitor

**L** = Fiber length, in meters, on each side of the device.

**JD** = Fiber jacket type:

0.25 = 250 micron acrylate coating  
1 = 900 micron OD hytrel jacket  
3 = 3 mm OD Kevlar reinforced PVC cable

**XY** = Input and output connector codes

3S = Super NTT-FC/PC  
3U = Ultra NTT-FC/PC  
3A = Angled NTT-FC/PC  
SCU = Ultra SC  
SCA = Angled SC  
LC = LC  
E = E2000/PC  
EA = Angled E2000/APC  
X = No Connector (See table 6 of the Standard Tables for other connector types)

## Ordering Examples For Custom Parts:

A network station needs to actively monitor the signal strength of the 1545 nm channel in a coarse optical WDM network. The monitoring unit will be spliced into the network, and an analog current proportional to the optical signal strength is sufficient to keep track of the signal.

Part Number	Description
OCM-11-1545-9/125-S-XX-1-1-C-A	Single channel smart patchcord for monitoring 1545 nm wavelength signals only in an optical system. The fiber on either side of the monitor is 1 meter long, 1 mm jacketed, with no connectors on either end. The module generates an analog signal proportional to the intensity of the 1545 nm light.

**Application example:** Using Smart Patchcords to monitor a FTTH network.

These days fibers are being employed in fiber to the home (FTTH) networks. Such networks may use a single wavelength source, or multiplex several wavelengths, such as 1310 nm, 1480 nm and 1550 nm, to transmit data. Each network may have several dozen nodes on it. Often the optical signal strength through these networks must be measured at each node, to monitor signal quality and troubleshoot connection problems. However, problems may occur while the repair technician is checking the signals.

Typically to measure the optical strength at a node, the technician has to break the connection, shutting down the node. He then has to measure the relative signal strengths. If there are multiple wavelengths going through the same node, then he needs to use an optical spectrum analyzer (OSA) or wavemeter, which is costly. Finally, there is a risk of contaminating the fiber ends while disconnecting or reconnecting the node to the network. This can lead to problems later on, and possible costly repairs. Therefore these measurements can be quite costly.

In contrast, smart patchcords can be built onto the fiber of each node and installed at a convenient location, such as a patch panel. The smart patchcords tap about 1% of the light out and can be designed to receive light only for a specific wavelength. Thus three units could be used to measure the power levels at three separate wavelengths at each node, without interrupting transmission. Smart patchcords can be provided with optional electronics and RS232 or USB connections, allowing the technician to simply connect the unit to a laptop or PDA to record and log the measurements effortlessly. Alternatively the smart patchcords could transmit their measurements on a regular basis to a remote monitoring station. Depending on the options selected, smart patchcords could be installed on every node of a network for a few tens of dollars each.

If a Wireless Fiber™ is installed, then the technician does not even have to make an electrical connection. By using a laptop computer, PDA, or smart phone, along with an inexpensive radio module, he can immediately read the optical power level in any Wireless Fiber™ within the operating range, which can be over 1 kilometer. Data encoding is possible to prevent unauthorized reading of the power levels.

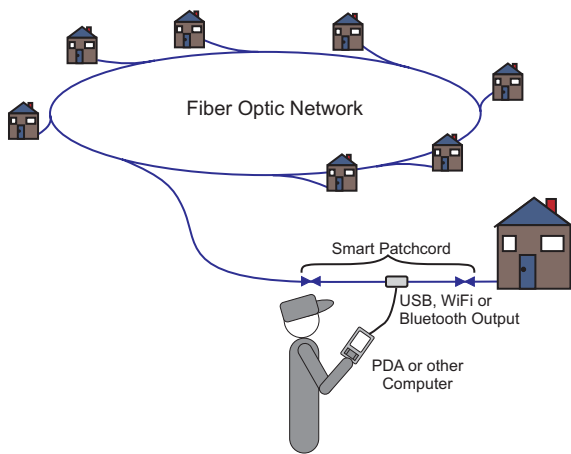


Figure 1: Testing Networks with Smart Patchcords Installed

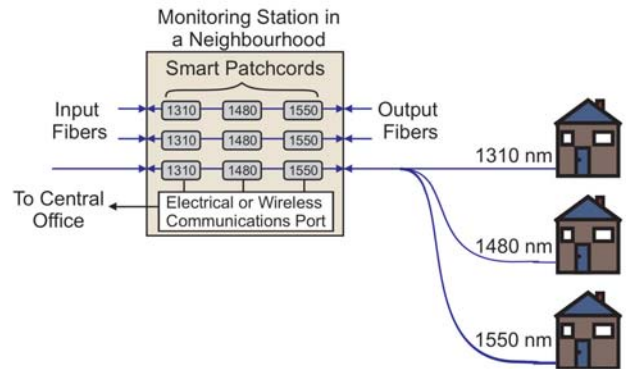


Figure 2: Remote Monitoring a WDM Network

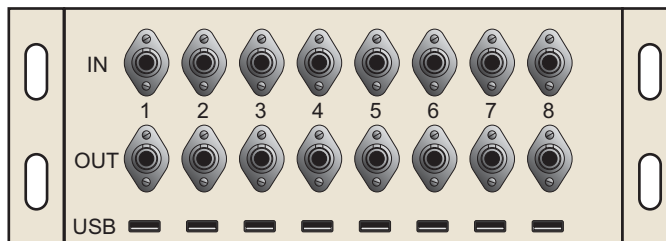


Figure 3: Smart Patchcord Patch Panel for Monitoring a Network