



OZ Optics

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OPTICAL POWER METER WITH SMART DETECTOR HEAD

Features

- High-speed response (over 1000 readouts/s)
- Wavelengths: 440 to 900 nm for visible (VIS) and 800 to 1700 nm for infrared (IR)
- Built-in attenuator for 20 or 30 dB attenuation; automatically detects whether the attenuator is active
- Built-in RS-232 and I²C interface
- Selectable sampling rate (from 7Hz to 1800Hz)
- Selectable RS-232 baud rate (from 9600 to 115, 200 bps)
- POM-110 hand-held display unit for controlling one or two detector heads
- Analog voltage output (optional)
- Interchangeable optical receptacles
- Mounting holes on sides and bottom
- Low power consumption (<60 mA at 5 V)
- Windows software drivers (Active-X Controls) for Visual Basic¹ and LabVIEW²

Applications

- Automatic fiber optical alignment and collimation systems
- Multi-channel optical power measurements
- General optical power measurements such as IL measurement
- Multi-channel test set
- Network installation and maintenance

Product Description

The Smart Detector Head (SDH) optical power meter from OZ Optics is unlike conventional optical power meters. The Smart Detector Head contains an optical detector, microprocessor, built-in attenuator switch, and a calibration table that form an intelligent optical power head. These features place the Smart Detector Head in the optical power meter market as a powerful and unique product. The built-in attenuator can be switched manually on or off in response to the detected optical power level. The Smart Detect Head detects whether the attenuator is active or not, eliminating the need for user intervention.

The Smart Detector Head retains all settings in the internal, non-volatile memory. The settings include the current wavelength, reference power, and the reporting unit (dB, dBm, W, or relative). The Smart Detector Head can report the calibration date and serial number of the unit while the unit is active. This information can be used to identify an individual unit.

A single hand-held display unit, such as the POM-110³, can drive two Smart Detector Heads to form a dual-channel optical power meter. The POM-110 can be controlled with a built-in keypad to display the measured data, or remotely controlled by a host computer through an RS-232 serial interface. The SDH can be interchanged without shutting down the meter. The SDH can also communicate with a personal computer directly through an RS-232 interface or through the POM-110. An optional Inter-IC (I²C)⁴ interface is also available. The serial communications channel allows the user to take multi-channel optical power measurements that can be used in fiber optic manufacturing and telecommunications systems applications.

With the advanced features of fast response, high dynamic range, and optional analog voltage signal output, the SDH provides an accurate, easy-to-use solution for automatic fiber optical alignment and collimating systems.

The SDH has a user-specified optical receptacle and can include an optional built-in analog output connector.

¹ Windows, ActiveX Control, and Visual Basic are registered trademarks of Microsoft Corporation.

² LabVIEW is a registered trademark of National Instruments Corporation.

³ POM-110 is a trademark of OZ Optics Limited.

⁴ I²C is a copyright of Koninklijke Philips N.V.



Smart Detector Head Optical Power Meter and Interchangeable Receptacles



Smart Detector Head Driven by Hand-Held Unit



Smart Detector Head Driven by PC



Multi Channel Power Meter



RS-232 to GPIB converter

Ordering Information for Standard Parts:

Bar Code	Part Number	Description
12492	SDH-IR-ND=20	Smart Detector Head Optical Power Meter for infrared wavelength 800 to 1700nm, -75 to 10dBm measurement range without attenuator. Standard built-in 20dB attenuator switch for up to 23dBm measurement. Receptacle not included.
13601	SDH-IR-A-ND=20	Smart Detector Head Optical Power Meter with analog output for infrared wavelength 800 to 1700 nm, -75 to 10dBm measurement range without attenuator. Standard built-in 20dB attenuator switch for up to 23dBm measurement. Receptacle not included.
13408	SDH-IR-ND=30	Smart Detector Head Optical Power Meter for infrared wavelength 800 to 1700nm, -75 to 10dBm measurement range without attenuator. Standard built-in 30dB attenuator switch for high power measurement. Receptacle not included.
13602	SDH-IR-A-ND=30	Smart Detector Head Optical Power Meter with analog output for infrared wavelength 800 to 1700nm, -75 to 10dBm measurement range without attenuator. Standard built-in 30dB attenuator switch for high power measurement. Receptacle not included.
12493	SDH-VIS-ND=20	Smart Detector Head Optical Power Meter for visible wavelength 440 to 900nm, -65 to 10dBm measurement range without attenuator. Standard built-in 20dB attenuator switch for up to 23dBm measurement. Receptacle not included.
13603	SDH-VIS-A-ND=20	Smart Detector Head Optical Power Meter with analog output for visible wavelength 440 to 900nm, -65 to 10dBm measurement range without attenuator. Standard built-in 20dB attenuator switch for up to 23dBm measurement. Receptacle not included.
13604	SDH-VIS-ND=30	Smart Detector Head Optical Power Meter for visible wavelength 440 to 900nm, -65 to 10dBm measurement range without attenuator. Standard built-in 30dB attenuator switch for high power measurement. Receptacle not included.
13605	SDH-VIS-A-ND=30	Smart Detector Head Optical Power Meter with analog output for visible wavelength 440 to 900nm, -65 to 10dBm measurement range without attenuator. Standard built-in 30dB attenuator switch for high power measurement. Receptacle not included.
12680	SDHR-2.5U	Universal receptacle for 2.5 mm ferrules for Smart Detector Head.
12675	SDHR-3	Standard flat, super, or ultra NTT-FC/PC receptacle for Smart Detector Head.
12676	SDHR-3A	Angled NTT-FC/PC receptacle for Smart Detector Head.
12679	SDHR-8	AT&T-ST receptacle for Smart Detector Head.
12677	SDHR-SC	SC receptacle for Smart Detector Head.
12678	SDHR-SCA	Angled SC receptacle for Smart Detector Head.
12723	SDHR-Q	Quick-connect receptacle adaptor.
8705	ER-23-IR	Quick-connect FC/PC receptacle for 850 – 1650nm with lens.
7525	ER-23A-IR	Quick-connect FC/APC receptacle for 850 – 1650nm with lens.
7526	ER-28-IR	Quick-connect ST receptacle for 850 – 1650nm with lens.
8874	ER-2LC-IR	Quick-connect LC receptacle for 850 – 1650nm with lens.
7528	ER-2SC-IR	Quick-connect SC receptacle for 850 – 1650nm with lens.
8393	ER-2SCA-IR	Quick-connect SC/APC receptacle for 850 – 1650nm with lens.
9068	ER-22.5U-IR	Quick-connect universal receptacle for 2.5mm diameter ferrules for 850 – 1650nm with lens.
11458	SDHA-CAB	Standard serial interface cable, connects the Smart Detector Head to the display unit, or PC with the optional DB-9 adaptor.
12580	SDHA-DB9	DB-9 adaptor connects the serial interface cable, a DB-9 COM port on a PC, and has a power jack for the AC/DC power adaptor.
13168	SDHA-POW	AC/DC adaptor for North American use, with power cord, connects to DB-9 adaptor to power the SDH.
13606	SDHA-CAX	Coaxial interface cable connects to the analog socket on the SDH, with a male BNC connector on the other end of the cable for analog output.
12886	SDHA-CDR	Smart Detector Head software package (one CD-ROM included with Smart Detector Head).
12681	POM-110	Optical Power Meter hand-held display unit. AC powered only.
13607	POM-110-B	Optical Power Meter hand-held display unit with rechargeable battery pack.
4571	GPIO-CABLE-2	GPIO cable, 2m long
4572	GPIO-RS232	RS232 to GPIO converter
13397	CASE-03	Ruggedized watertight carrying case for POM-110 or POM-110-B
8403	AC-9VDC-EU	Power supply for SDH for use in Europe
8404	AC-9VDC-UK	Power supply for SDH for use in the United Kingdom

Standard Product Specifications:

Parameter		Specification	
Measurement range ¹		Without Attenuator	With Standard 20 dB Attenuator
IR		-75 to +10 dBm	Up to 23 dBm at 1480 nm
VIS		-65 to +10 dBm	
Wavelength range		440 to 900 nm with VIS detector 800 to 1700 nm with IR detector	
Calibrated wavelengths with and without attenuator		IR	1620, 1550, 1480, 1310, 1064, 980, and 850 nm
		VIS	850, 780, and 630 nm
Resolution		0.01 dB	
Accuracy, at 23 °C ²		±5%	
Linearity ³		0.01 dB (0 to -60 dBm)	
Measurement units		Watts, dBm, dB, relative (P/P _{REF})	
Available optical connector receptacles		- Universal receptacle for 2.5 mm diameter ferrules - Standard receptacles: standard flat, super, or ultra NTT-FC/PC; angled NTT-FC/PC; AT&T-ST; SC; or angled SC - Quick connector receptacles (Quick connector adaptor required): standard flat, super, or ultra NTT-FC/PC; angled NTT-FC/PC; AT&T-ST; SC; angled SC; LC; MU; 2.5 mm ID universal.	
Sampling rate		7, 14, 28, 56, 113, 255, 450, 900, or 1800 Hz (user selectable)	
Maximum data read-out speed		1040 read-outs/s at 115 kbps, using RS-232	
Dimensions (H x D)		40.64 x 39.52 mm (1.55 x 1.53 in), without optical receptacle	
Weight		70 g (0.15 lb.) without optical receptacle 90 g (0.20 lb.) with standard flat, super, or ultra NTT FC/PC receptacle	
Communications interface		RS-232 serial port and I ² C	
Baud rate (using RS-232)		9600, 19200, 38400, 56700, or 115200 bps	
Maximum I ² C bit rate		400 kbps	
Analog output ⁴	Rail	0 to 5 V	
	Offset voltage	500 µV (maximum), 60 µV (typical)	
	Load resistance	1 MOhms (minimum)	
	Maximum dynamic range	-45 to +10 dBm	
Power supply		+4.8 to +12 VDC for SDH; Universal 110/220V AC to 12V DC adaptor for POM-110, or optional rechargeable battery pack.	
Current requirements: Normal operation: Sleep mode:		<60 mA at 5V <25mA	
Temperature range	Operating	-10 to +50 °C (14 to 122 °F); humidity: <70% RH	
	Storage	-40 to +60 °C (-40 to 140 °F); humidity: <95% RH	

Note:

- Maximum measurement range is dependent on wavelength, which is related to the responsiveness of the detector and neutral density filter. Please consult OZ Optics for high power measurement.
- At calibrated wavelengths, without attenuator, at 7 samples/s, with single mode fiber and FC/PC receptacle without lens.
- Measured at 23 °C with 1550 nm wavelength, using FC/PC receptacle without lens and singlemode fiber.
- Tested at 23 °C with 1550 nm wavelength, V_{IN} = 6 V.

Ordering Examples for Standard Parts:

1. A customer requires a hand-held meter to measure IR optical power with an FC/PC receptacle without lens. Power measurement is in the range of -75 to +20 dBm. The hand-held unit must have the ability to be controlled with a PC through an RS-232 interface.

Bar Code	Part Number	Description
12492	SDH-IR-ND=20	Smart Detector Head Optical Power Meter for IR wavelength, with standard build-in 20 dB attenuator switch.
12675	SDHR-3	Standard flat, super, or ultra NTT-FC/PC receptacle without lens for Smart Detector Head.
11458	SDHA-CAB	Standard interface cable connects the Smart Detector Head to the display unit, or to the PC with the optional DB-9 adaptor.
12681	POM-110	Optical Power Meter hand-held display unit.

2. A customer requires a hand-held meter to measure IR optical power with an FC/PC receptacle. Power measurement is in the range of -75 to +30 dBm. The hand-held unit must have the ability to be controlled with a PC through an RS-232 interface.

Although this example is similar to the previous one, there are a couple of differences in terms of the required parts that should be ordered. For high power applications, a quick-connect receptacle with a lens must be used. (See the section on frequently asked questions). This requires a Quick-connect receptacle adaptor. Also, in order to cover the desired power range, a Smart Detector Head with a 30 dB attenuator is necessary. A complete list of parts to order is shown below:

Bar code	Part Number	Description
13408	SDH-IR-ND=30	Smart Detector Head Optical Power Meter for infrared wavelengths from 800 to 1700 nm, -75 to 10 dbm measurement range without attenuator. Standard built-in 30 dB attenuator switch for high power measurement. Receptacle not included.
12723	SDHR-Q	Quick-connect receptacle adaptor
8705	ER-23-IR	Quick-connect FC/PC receptacle for 850 – 1650nm with lens.
11458	SDHA-CAB	Standard serial interface cable connects the Smart Detector Head to the display unit, or PC with the optional DB-9 adaptor.
12580	SDHA-DB9	DB9 adaptor connects the serial interface cable, a DB-9 COM port on a PC, and has a power jack for the AC/DC power adaptor.
13168	SDHA-POW	AC/DC adaptor (for North American use), with power cord, connects to DB-9 adaptor to power the SDH when it is connected to a PC.

Questionnaire:

1. What is your application?
2. What is the wavelength range?
3. What is the optical power level?
4. What type of optical connector is required?
5. How many channels (optical power measurement) do you need?
6. Do you want a handheld display unit or just PC control and display?
7. Do you want a battery pack for the handheld unit?
8. Is this power meter part of your auto control /test system?
9. Is analog output useful for you?

Ordering Information for Custom Parts:

Smart Detector Head:

W = Wavelength: IR = 800 to 1700 nm
VIS = 440 to 900 nm

SDH-W-Z

Z = Other options: -ND=20 = Standard version with 20 dB attenuator
-ND=30 = High power version with 30 dB attenuator
-A-ND=20 = Standard version with 20 dB attenuator and analog voltage output
-A-ND=30 = High power version with 30 dB attenuator and analog voltage output

When the high-power version (-ND=30) is configured, the beam is expanded to avoid damage to the neutral density filter. When this version is ordered, the quick-connect receptacle and quick-connect adaptor must also be ordered. Please consult OZ Optics before placing an order for the high power version.

Optical connector receptacle:

X = Receptacle code:
2.5U = Universal receptacle for 2.5 mm diameter ferrules
3 = Standard flat, super, or ultra NTT-FC/PC
3A = Angled NTT-FC/PC
8 = AT&T-ST
SC = SC
SCA = Angled SC
Q = Quick-connect adaptor with lens (required for high power version)

SDHR-X

Quick-connect adaptor:

X = Connector adaptor code:
3 = Standard flat, super, or ultra NTT-FC/PC
3A = Angled NTT-FC/PC
8 = AT&T-ST
SC = SC
SCA = Angled SC
LC = LC
MU = MU
2.5U = Universal adaptor for 2.5 mm diameter ferrules

ER-2X-W

W = Wavelength: IR = 800 to 1700 nm
VIS = 450 to 900 nm

Frequently Asked Questions (FAQs)

Q: Is the hand-held display unit POM-110 necessary for operating the Smart Detector Heads?

A: No. The Smart Detector Heads can be driven by a PC.

Q: What software comes with the Smart Detector Head?

A: Windows: interface software Active-X Control for Visual Basic and LabVIEW driver.

Q: Is analog output a standard feature?

A: No. It is an option.

Q: I have a POM-100 optical power meter from OZ Optics and a personal digital assistant (PDA). Can I use either of these devices as the hand-held display unit for the Smart Detector Head?

A: No. The optional POM-110 or POM-110-B is the hand-held display interface.

Q: I need to format the measurement data into a report. How can I do this?

A: Remote control of the Smart Detector Head via a computer allows direct output of the readings to a text file. The data can then be imported into a spreadsheet program to draft the report.

Q: Why are there so many adaptors? You have ordinary and quick connect adaptors.

A: Different style receptacles are offered, because of the different requirements of low and high power applications. The standard receptacles are intended for low power (<50mW) applications, and provide the best accuracy. At higher power levels the output from the fiber must be spread out over the entire detector, to prevent damage. The quick connectors have a built in lens to do this. However, the lens does reduce the measurement accuracy, so the standard connectors are preferred for most common applications.

Application Notes

The Smart Detector Head provides optical power measurements with high resolution, high speed, and wide dynamic range. The SDH features high optical power measurement, programmable sampling rate, optional analog voltage output, and low power consumption. Several units can be used simultaneously to create a multi-channel measurement system.

A PC can be used as a virtual instrument, with the Visual Basic and LabVIEW drivers, to make the SDH a reliable, flexible, and effective device for automatic fiber optical alignment and collimation, fiber optic assembling and testing, quality control and measurement, network installation, component and system troubleshooting, and general optical power measurement applications.

Automatic fiber optical alignment

In the manufacture of fiber optic components, it is often necessary to attach an optical fiber to a semiconductor device such as a laser diode, a semiconductor optical amplifier, an optical switch, or any of the other numerous types of opto-electronic devices. Coupling the light into the optical fiber is a very real problem in these applications. When the alignment tolerances are very tight, typically in the sub μm regime, auto alignment systems are required to achieve maximum coupling efficiency, and a power meter is needed to measure the optical power level.

OZ Optics' Smart Detector Head can communicate with a computer control system through an RS-232 or I²C interface. The high-speed sampling rate, of up to 1800 Hz, high resolution of 0.01 dB, high dynamic range of 85 dB, and analog voltage signal output make the SDH a good choice for rapid and accurate alignment.

High-power measurement

Except for preamplifiers, which are designed to generate a few mW at most, all optical amplifiers generate power levels that exceed the measurement range of conventional power meters. Today, the highest powers from EDFA exceed 1 W. When the output power is a key parameter, the question is: How can such large power levels be measured with good accuracy and good reliability?

The SDH provides two solutions: Increase the spot size on the photodetector and use an attenuator. Generation of the maximum spot diameter allowable by the SDH active area can decrease the optical power density (irradiance) and prevent local overshooting, which reduces the measurement accuracy (saturation at high power levels) and can damage the photodetector. Attenuation between the fiber end and the photodetector can reduce the measured power level to within the specified measurement range of the power meter.

The SDH attenuator provides an easy-to-use solution for high-power measurement. The built-in attenuator switch allows manual selection of no attenuation or attenuation of 20 dB (standard) or 30 dB (high power). The SDH detects whether the attenuator is active or not, and corrects the readout accordingly.

Always estimate the optical power level before applying power to the SDH. To guarantee that the measured power level does not exceed the measurement range of the power meter, always engage the attenuator before connecting the power meter.

When high power levels must be measured, the signals must be attenuated so that the optical detector is not saturated. Within the high power version of the SDH, a high loss attenuator is used for this purpose, but high power attenuators have several intrinsic problems that limit their accuracy:

- 1) Their attenuation tends to change with wavelength.
- 2) They tend to degrade over time when exposed to high optical power levels.
- 3) Any time that additional optics are included in the light path, there will always be unwanted reflections that may affect the stability of the readings.
- 4) As with most components, changes in temperature may limit the accuracy that can be achieved.

OZ Optics has strived to minimize the influence of these factors by proper mechanical design and by selecting high quality components. The calibration process takes into account the variation of attenuation with wavelength. Nonetheless, the laws of physics set constraints on the overall accuracy that can be achieved, for practical applications.

Using PC as a virtual instrument

OZ Optics' Smart Detector Head can be used with or without a display unit. In the latter case, it can communicate with a personal computer directly through an optional RS-232 interface and power supply adaptor. Windows application software and driver (Active-X Control) for Visual Basic, as well as a LabVIEW driver, allow the PC to function as a virtual instrument.

Multi-channel optical power measurement

The Smart Detector Head can be connected directly to an RS-232 serial port of a computer. Any number of detector heads can be controlled by a PC, limited only by the number of available serial ports, which can be increased by using a USB to RS-232 converter, assuming the PC has a USB port.

The SDH can be used with customer-designed I²C interface control. A Smart Detector Head, or multiple devices, can be connected to the I²C interface control device. Depending on requirements and applications, the interface control can be developed with up to 127 SDH units.

Since the Smart Detector Heads are interchangeable, it is possible to mix visible and infrared heads in the same system. When two heads are used with a POM-110, they may be of different types, covering different wavelengths and power ranges.

Contact OZ Optics for complete details.