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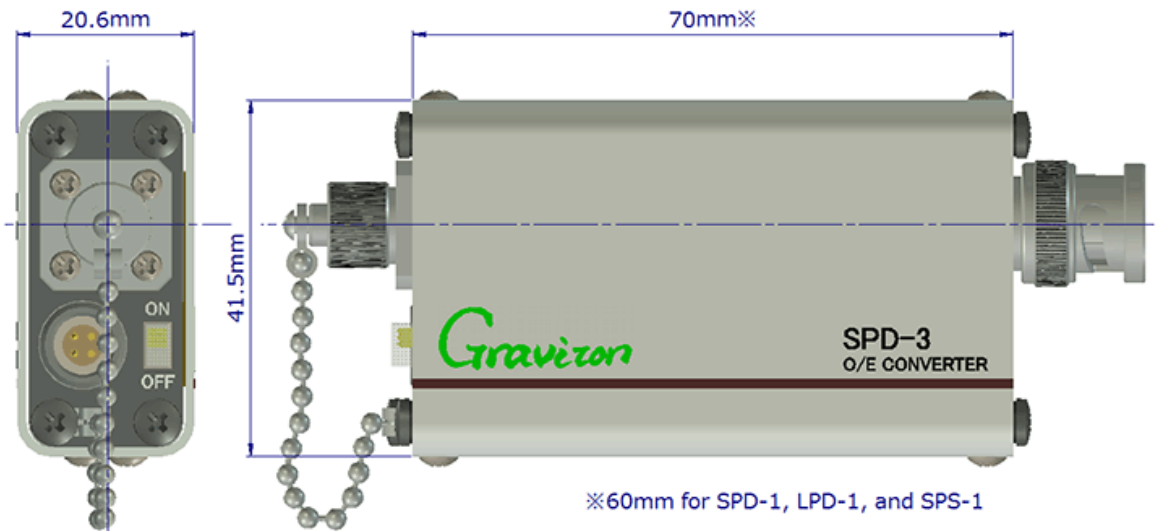
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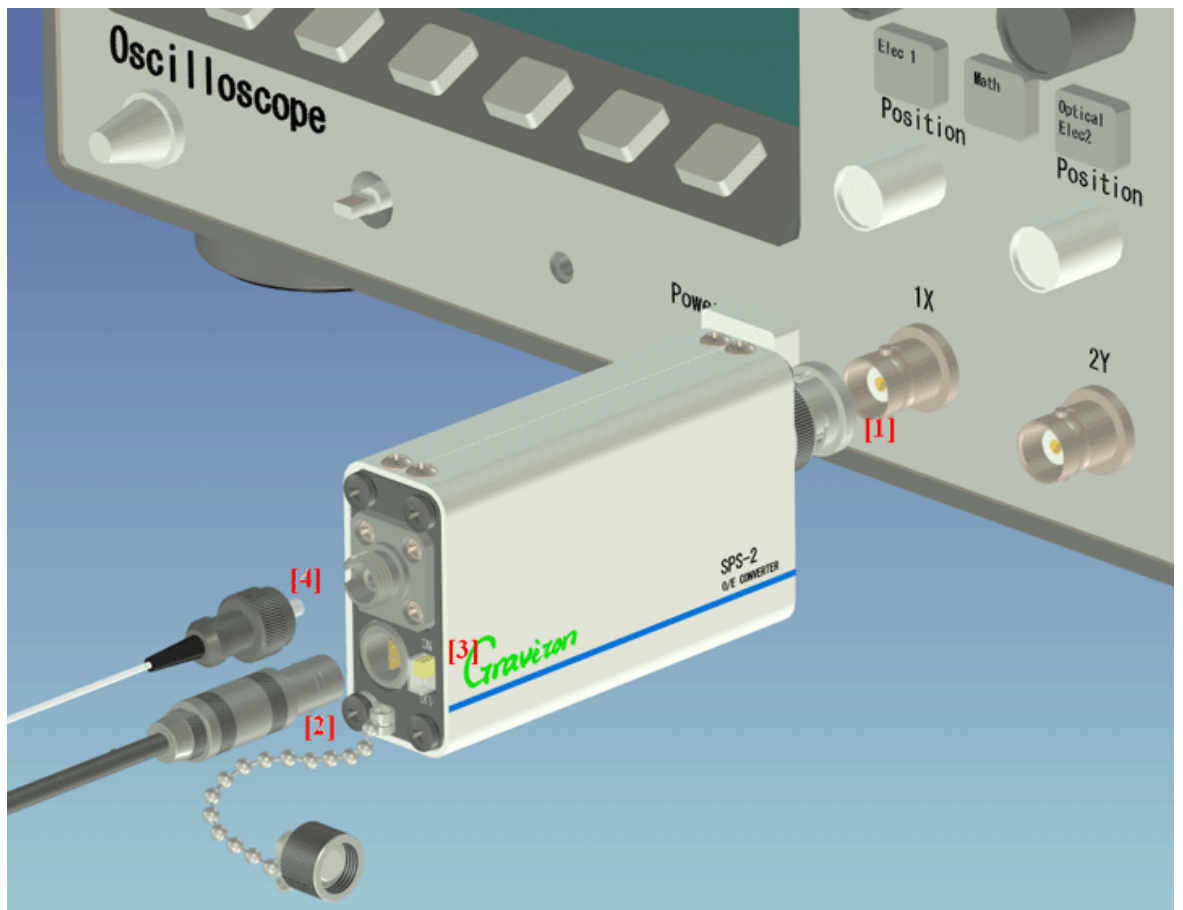
Gravizon's O to E converter makes easy optoelectronic instrumentation in cost effective way. Just attach the converter onto the input terminal of your electronic instrument then you can observe optical power waveforms.

*** Small Size, Light Weight**



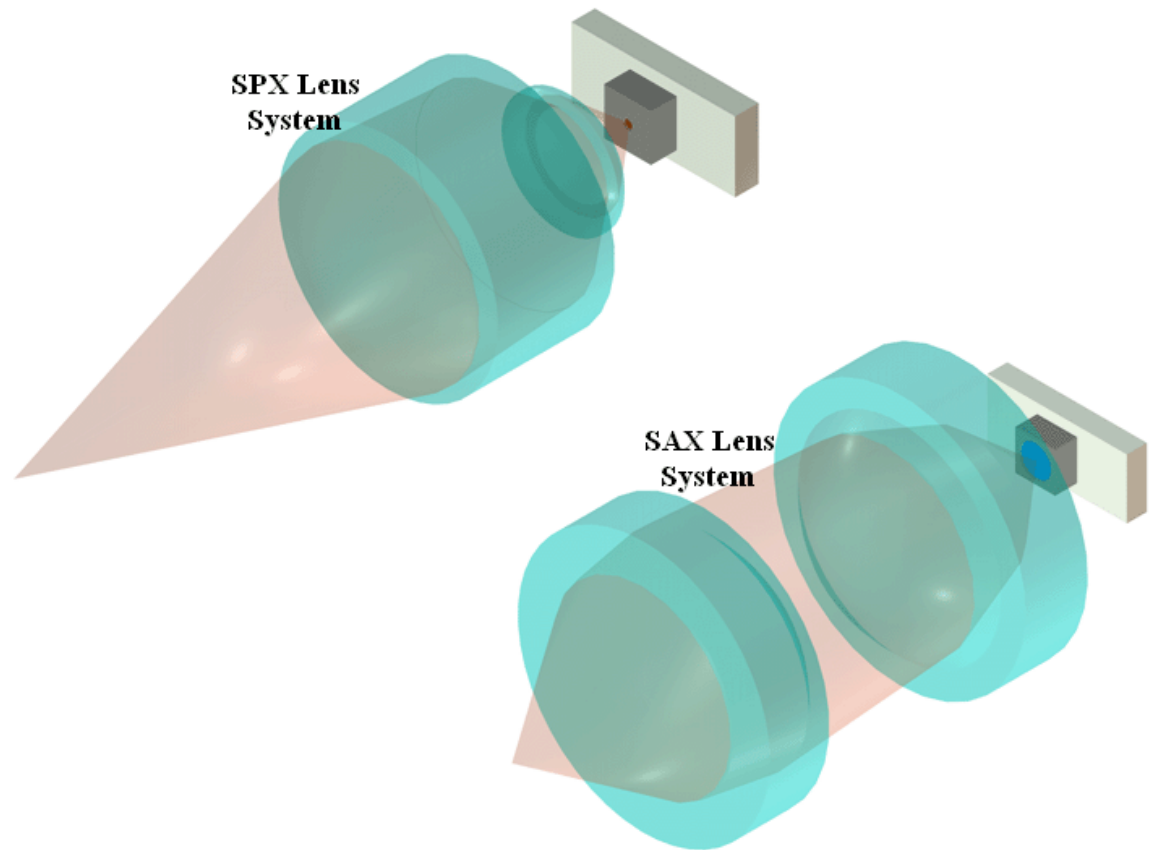
Gravizon's O to E converters are very small and light. No damage of the input terminals of your electronic equipments.

*** Easy to attach, Easy to connect**



[1] Just attach the O to E converter onto your electronic instrument, [2] Supply the DC power to the converter, [3] Turn on the DC power switch of the converter, [4] Connect the optical signal you want observe. Then adjust the voltage range, time range, or frequency range of the electronic instrument.

* Outstanding Detection Area



Graviton's O to E converter has Graviton's original lens system incarnates outstanding detection area. Maximum detection diameter is up to 1mm, and Maximum NA range is up to 0.5. (SPD-1, LPD-1, and SPS-1 is configured by a photodetector with a ball lens.)

* Wide bandwidth conversion from DC up to GHz

Transimpedance amplifire inside Graviton's converter is configured by discrete transistor devices. The TIA circuitry is effective to get wide band O to E conversion from DC up to GHz, and high sensitivity. Also the offset voltage is very low since the DC servo circuit system.

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Selection Guide of O to E Converters

Graviron offers a variety of O/E converter models, by the requested features of; Wavelength range, Reference wavelength, Acceptable core diameter, Input NA, and Conversion frequency bandwidth.

[* O to E Converters for Visible Light \(Max NA = 0.2, 0.25\)](#)

Model Name	Wavelength Range	Ref. Wavelength	Sensitivity	Max Core	Max NA	Bandwidth	tr/tf
SPD-1_650nm	320 to 1000nm	658nm	500V/W	0.8mm	0.2	DC to 1.2GHz	290ps
SPD-1_850nm	320 to 1000nm	850nm	500V/W	0.8mm	0.2	DC to 1.2GHz	290ps
SPD-2_650nm	380 to 1000nm	658nm	1000V/W	1.0mm	0.25	DC to 1.2GHz	290ps
SPD-2_850nm	380 to 1000nm	850nm	1000V/W	1.0mm	0.25	DC to 1.2GHz	290ps
SPD-3	380 to 950nm	850nm	500V/W	0.5mm	0.25	DC to 2.0GHz	190ps
SPD-4	380 to 1000nm	850nm	300V/W	0.5mm	0.25	DC to 3.0GHz	150ps

[* O to E Converters for Visible Light \(Max NA = 0.5\)](#)

Model Name	Wavelength Range	Ref. Wavelength	Sensitivity	Max Core	Max NA	Bandwidth	tr/tf
SPA-2_650nm	400 to 1000nm	658nm	1000V/W	1.0mm	0.5	DC to 1.0GHz	370ps
SPA-3	380 to 950nm	850nm	500V/W	0.25mm	0.5	DC to 2.0GHz	190ps
SPA-4	380 to 950nm	850nm	300V/W	0.25mm	0.5	DC to 3.0GHz	150ps

[* O to E Converters for Visible Light \(High Sensitivity Models\)](#)

Model Name	Wavelength Range	Ref. Wavelength	Sensitivity	Max Core	Max NA	Bandwidth	tr/tf
SPS-1_10KV/W	320 to 1000nm	850nm	10KV/W	0.8mm	0.2	DC to 100MHz	3.6ns
SPS-1_100KV/W	320 to 1000nm	850nm	100KV/W	0.8mm	0.2	DC to 15MHz	28ns
SPS-2_10KV/W	400 to 1000nm	850nm	10KV/W	1.0mm	0.5	DC to 100MHz	3.6ns
SPS-2_100KV/W	400 to 1000nm	850nm	100KV/W	1.0mm	0.5	DC to 15MHz	28ns

[* O to E Converters for NIR Light \(Using InGaAs PIN PD\)](#)

Model Name	Wavelength Range	Ref. Wavelength	Sensitivity	Max Core	Max NA	Bandwidth	tr/tf
LPD-1	900 to 1650nm	1310nm	500V/W	0.08mm	0.2	DC to 1.5GHz	250ps
LPD-2	950 to 1650nm	1310nm	1000V/W	0.5mm	0.25	DC to 1.5GHz	250ps

LPS-1_20KV/W	900 to 1650nm	1310nm	20KV/W	0.08mm	0.2	DC to 100MHz	3.5ns
LPS-2_20KV/W	950 to 1650nm	1310nm	20KV/W	0.5mm	0.25	DC to 100MHz	3.5ns

**** For 650nm standard model and 850nm standard model ****

Photodetector, which is currently build in **SPD-1**, **SPD-2**, and **SPA-2**, has [the wavelength dependency of a frequency characteristic](#), and the frequency characteristic of photodetector changes in the range of, approximately, 1MHz to 100MHz.

Therefore, a frequency characteristic of **SPD-1_650nm**, **SPD-2_650nm**, and **SPA-2_650nm**, is designed and tuned to be flat at 650 nm. Also, the frequency characteristic of **SPD-1_850nm** and for **SPD-2_850nm** is designed to be flat at 850 nm.

For customers who need several wavelengths measurements, it is recommend the use of **SPD-3**, **SPD-4**, **SPA-3**, **SPA-4** with PD which has less frequency characteristic dependence on the wavelength.

**** About the minimum fiber diameter ****

The core diameter of the fiber, to be connected to the **SPA-2_650nm**, is 100um diameter or more. When a fiber with a thin fiber core diameter is used, the optical spot at the photodetector becomes so small, that the frequency characteristics of the product is not maintained.

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SPD-1_650nm & SPD-1_850nm

(Max Core = 0.8mm, Max NA = 0.2, 500V/W@658nm or 850nm, DC to 1.2GHz)



Features

- * High Sensitivity, 500V/W
- * Wide Bandwidth, from DC up to 1.2GHz
- * Small Offset Voltage, 0.5mV or less
- * 93mm x 44mm x 21mm, 110 grams
- * JPY 230,000 for direct sales
(Excluded tax and shipping cost)

SPD-1 is a low cost O to E converter configured by a silicon PIN photodetector with a ball lens, and Graviton's original TIA circuitry. **SPD-1_650nm** is tuned for the wavelength of 658nm, and **SPD-1_850nm** is for 850nm. [Caution that the frequency characteristics compensation of photodetector is different between SPD-1_650nm and SPD-1_850nm.](#)

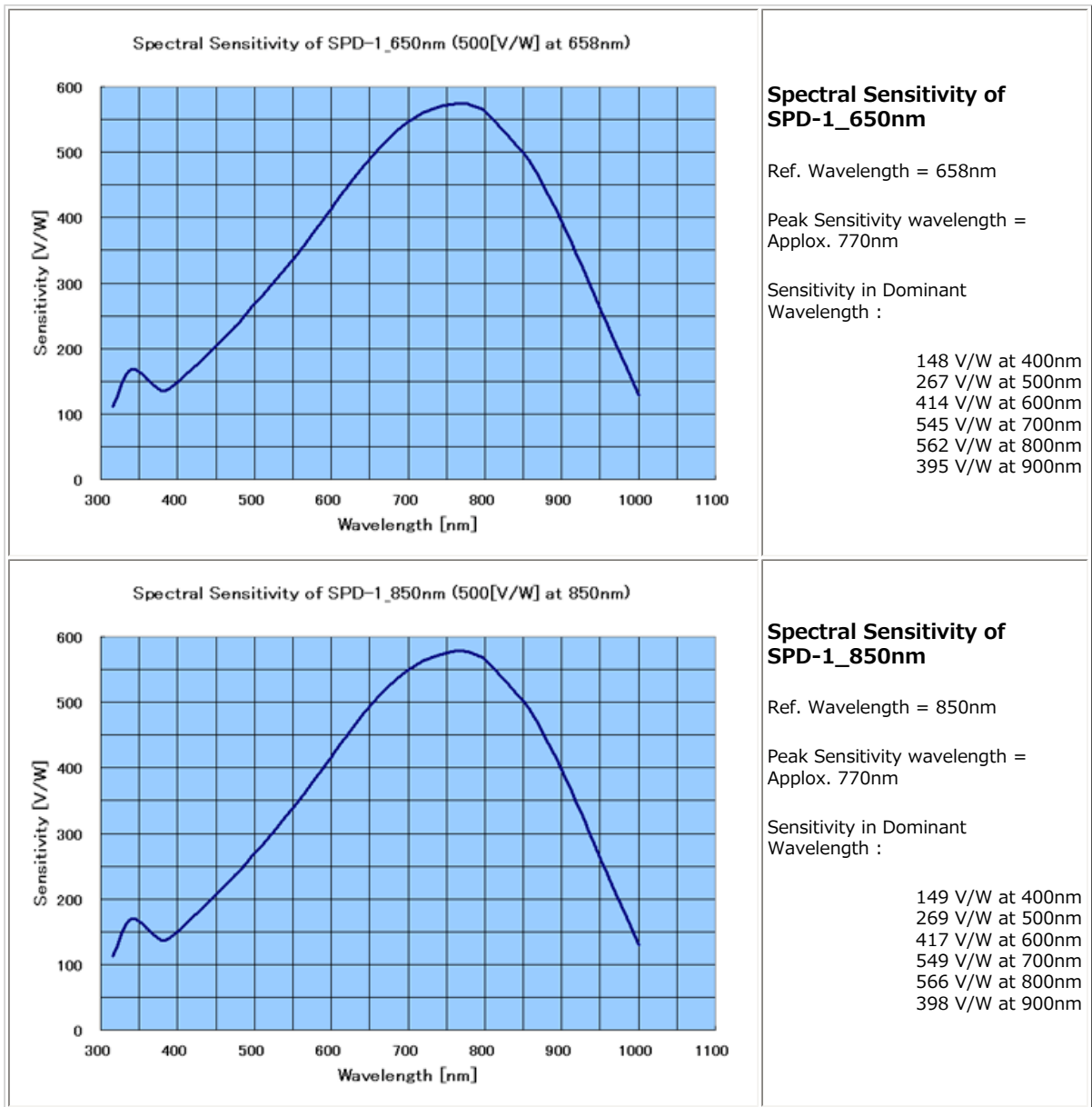
* Specifications of SPD-1_650nm & SPD-1_850nm

Model Name	SPD-1_650nm	SPD-1_850nm
Reference Wavelength	658nm	850nm
Wavelength Range	320 to 1000nm	320 to 1000nm
Acceptable Maximum Core Diameter	φ0.8mm	φ0.8mm
Acceptable NA Range	0.2 or less	0.2 or less
Optical Input Connector	FC receptacle	FC receptacle
Photodetector Type	Si PIN PD	Si PIN PD
Active diameter of Photodetector	φ0.4mm	φ0.4mm
Conversion Gain (at reference wavelength)	500V/W	500V/W
Output Saturation Optical Input Power (Ref. wavelength)	-1dBm	-1dBm
Conversion Bandwidth	DC to 1.2GHz	DC to 1.2GHz
Output Noise Level	1.3mVrms or less	1.3mVrms or less
Noise Equivalent Optical Power (at reference wavelength)	-26.0dBm or less	-26.0dBm or less
Electrical Output Connector	BNC plug	BNC plug
Output Impedance	50 ohms	50 ohms
Output Offset Voltage	0.5mV or less	0.5mV or less
DC Power Connector	LEMO 0S-4P	LEMO 0S-4P
Supply Voltage	DC±15V	DC±15V
Supply Current	+150mA/-50mA	+150mA/-50mA
Dimensions	93 x 44 x 21mm	93 x 44 x 21mm
Weight	Applox. 110g	Applox. 110g

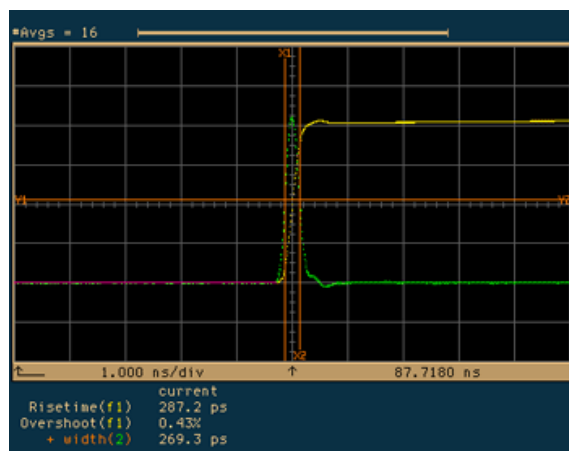
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

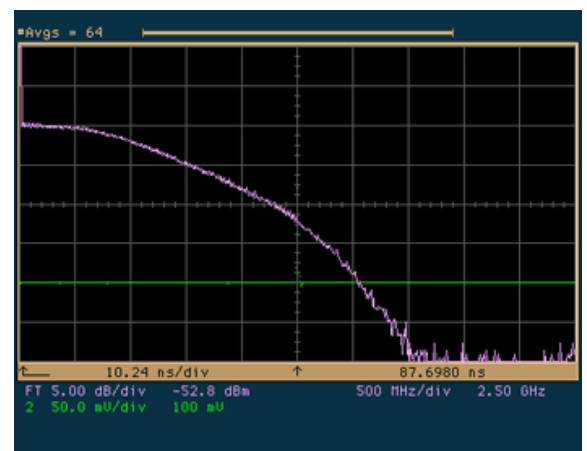
*** Spectral Sensitivity (by Calculation)**



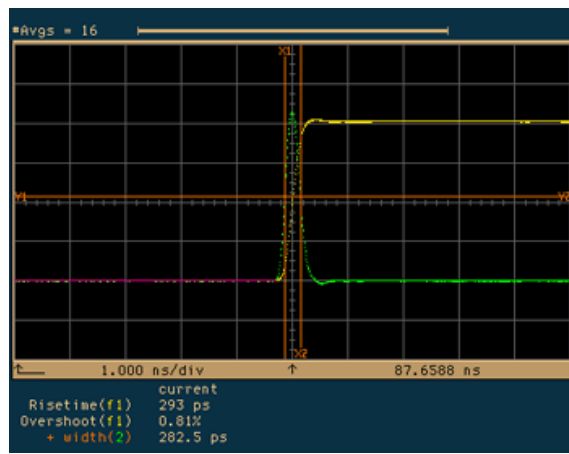
*** Step Response & Frequency Characteristics (Examples)**



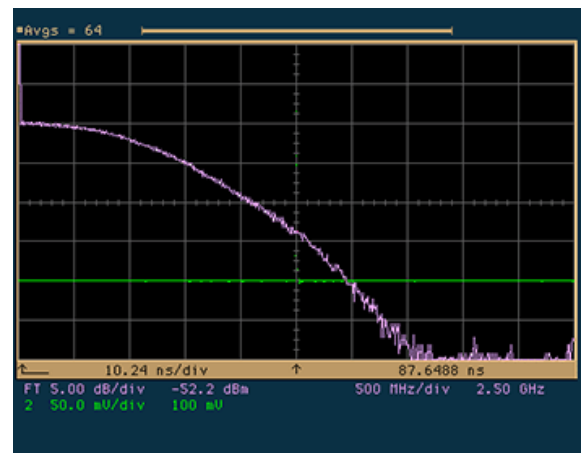
Step Response of **SPD-1_650nm**
Risetime = 287.2ps, Overshoot = 0.43%



Frequency Characteristics of **SPD-1_650nm**
-3dB (Electrical) Frequency = Applx. 1.2GHz



Step Response of **SPD-1_850nm**
 Risetime = 293ps, Overshoot = 0.81%



Frequency Characteristics of **SPD-1_850nm**
 -3dB (Electrical) Frequency = Approx. 1.2GHz

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SPD-2_650nm & SPD-2_850nm

(Max Core = 1mm, Max NA = 0.25, 1,000V/W@658nm or 850nm, DC to 1.2GHz)



Features

- * For High Speed POF,
Max core = 1mm, Max NA = 0.5
- * High Sensitivity, 1000V/W
- * Wide Bandwidth, from DC up to 1.2GHz
- * 103mm x 44mm x 21mm, 130 grams
- * JPY 290,000 for direct sales
(Excluded tax and shipping cost)

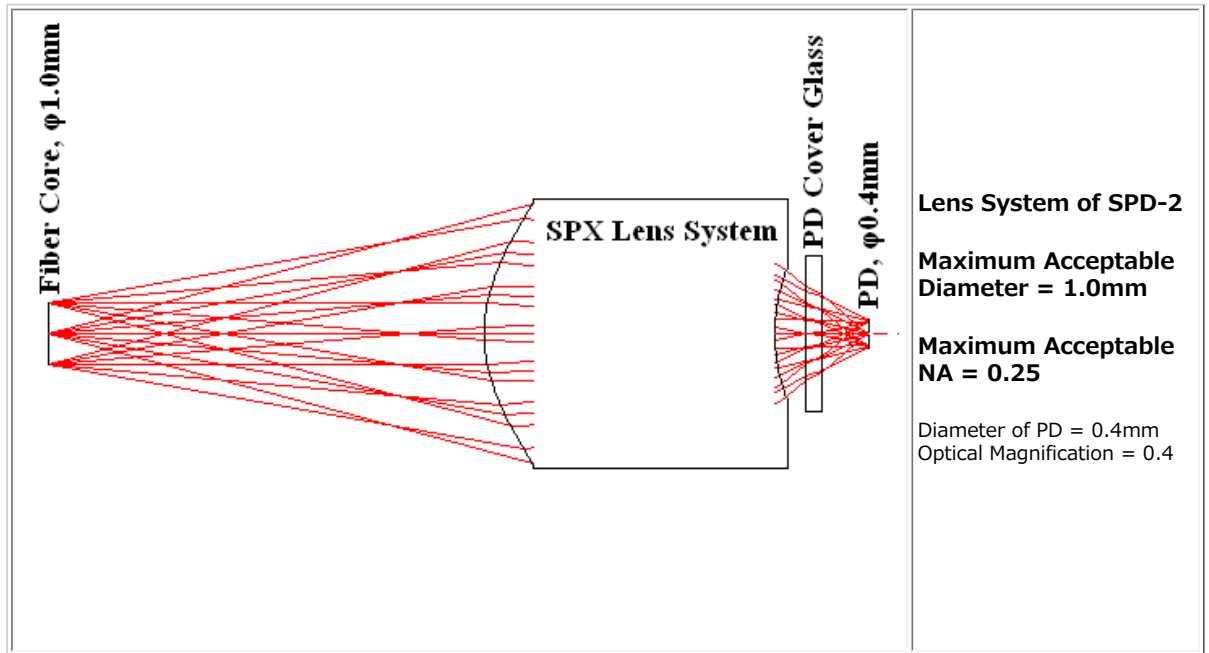
SPD-2 is a O to E converter configured by a silicon PIN photodetector, Gravizon's original lens system, and TIA circuitry. The lens system incarnates large detection diameter of 1.0mm. SPD-2 is suitable for instrumentation of fiber communication systems using a large core POF. SPD-2_650nm is tuned for the wavelength of 658nm, and SPD-2_850nm is for 850nm. [Caution that the frequency characteristics compensation of photodetector is different between SPD-2_650nm and SPD-2_850nm.](#)

* Specifications of SPD-2_650nm & SPD-2_850nm

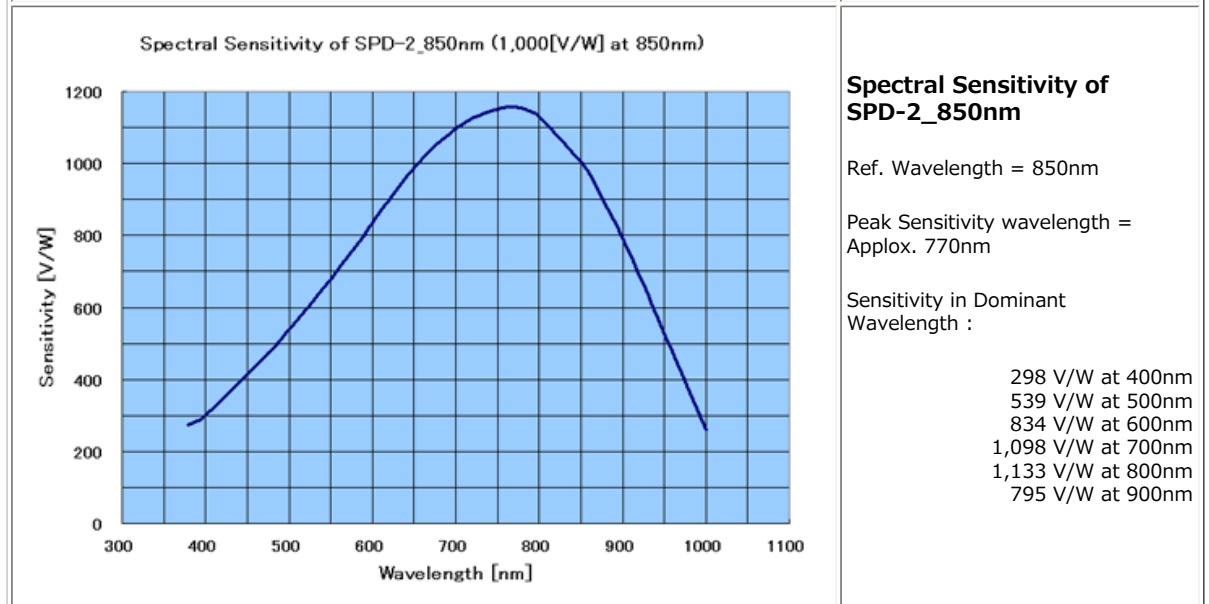
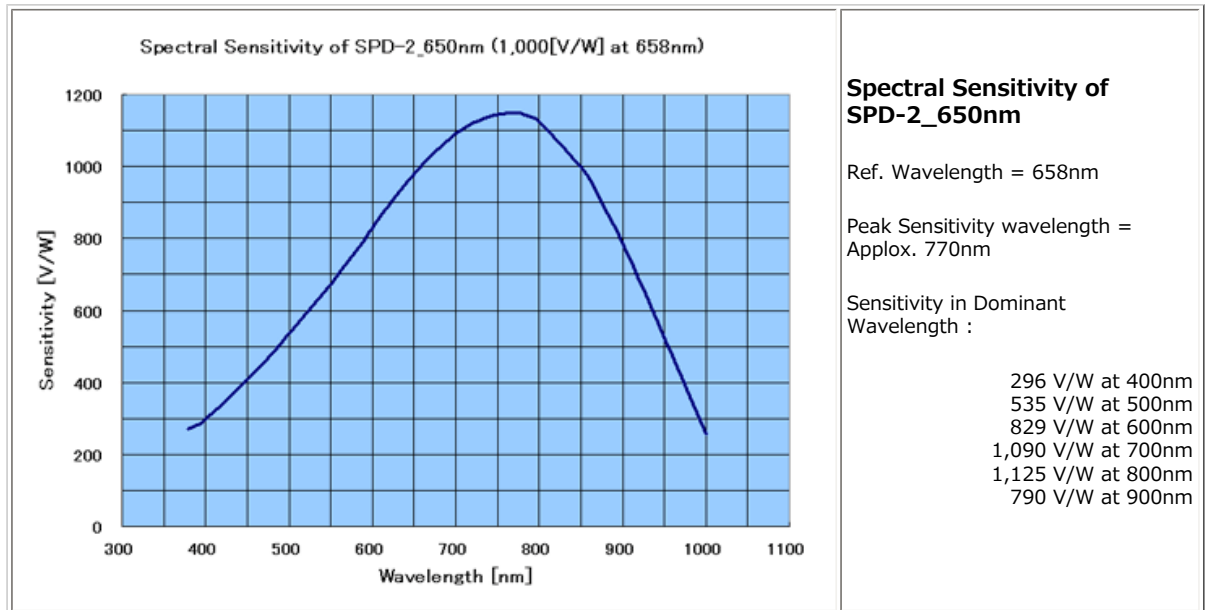
Model Name	SPD-2_650nm	SPD-2_850nm
Reference Wavelength	658nm	850nm
Wavelength Range	380 to 1000nm	380 to 1000nm
Acceptable Maximum Core Diameter	φ1.0mm	φ1.0mm
Acceptable NA Range	0.25 or less	0.25 or less
Optical Input Connector	FC receptacle	FC receptacle
Photodetector Type	Si PIN PD	Si PIN PD
Active diameter of Photodetector	φ0.4mm	φ0.4mm
Conversion Gain (at reference wavelength)	1,000V/W	1,000V/W
Output Saturation Optical Input Power (Ref. wavelength)	-4dBm	-4dBm
Conversion Bandwidth	DC to 1.2GHz	DC to 1.2GHz
Output Noise Level	1.9mVrms or less	1.9mVrms or less
Noise Equivalent Optical Power (at reference wavelength)	-27.3dBm or less	-27.3dBm or less
Electrical Output Connector	BNC plug	BNC plug
Output Impedance	50 ohms	50 ohms
Output Offset Voltage	0.5mV or less	0.5mV or less
DC Power Connector	LEMO 0S-4P	LEMO 0S-4P
Supply Voltage	DC±15V	DC±15V
Supply Current	+150mA/-50mA	+150mA/-50mA
Dimensions	103 x 44 x 21mm	103 x 44 x 21mm
Weight	Applox. 130g	Applox. 130g

** Optical input connector, electrical output connector is that of the standard model.
 ** Other types of connectors are available as a customer's option.

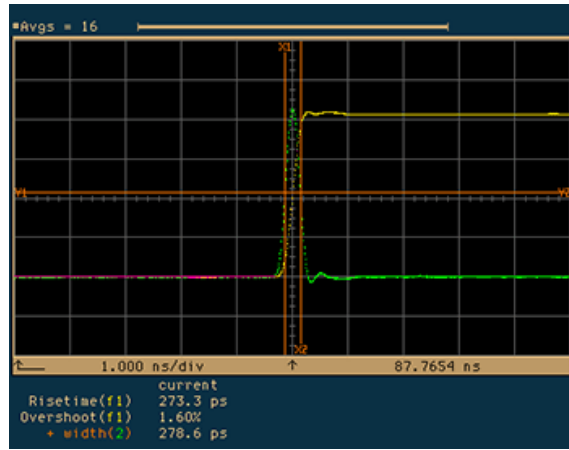
*** Lens System**



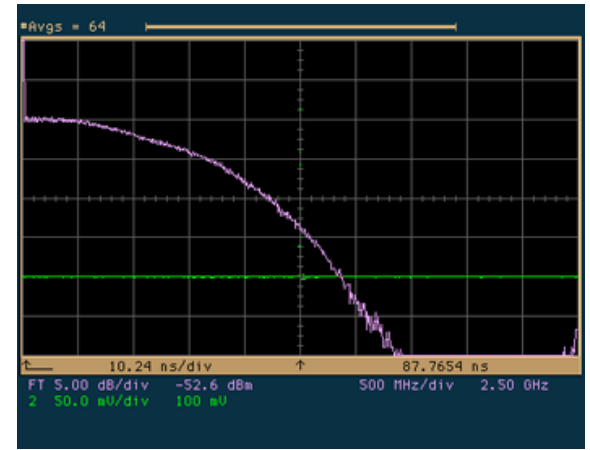
*** Spectral Sensitivity (by Calculation)**



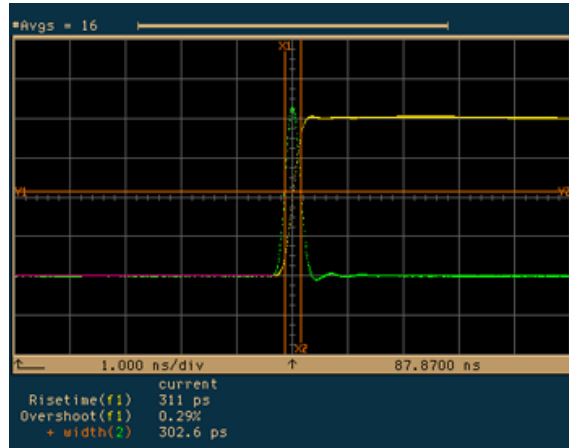
* Step Response & Frequency Characteristics (Examples)



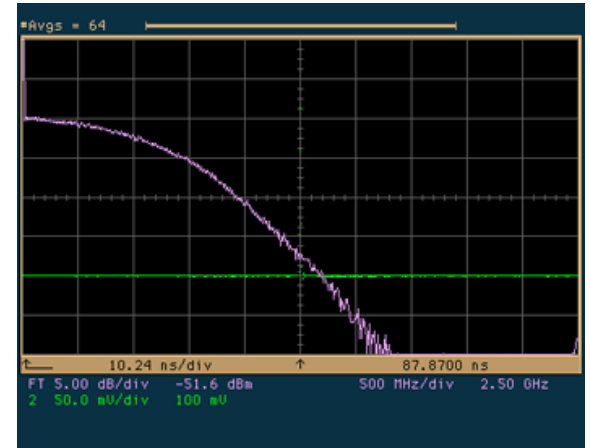
Step Response of **SPD-2_650nm**
 Risetime = 273.3ps, Overshoot = 1.60%



Frequency Characteristics of **SPD-2_650nm**
 -3dB (Electrical) Frequency = Approx. 1.2GHz



Step Response of **SPD-2_850nm**
 Risetime = 311ps, Overshoot = 0.29%



Frequency Characteristics of **SPD-2_850nm**
 -3dB (Electrical) Frequency = Approx. 1.2GHz

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SPD-3

(Max Core = 0.5mm, Max NA = 0.25, 500V/W@850nm, DC to 2GHz)



Features

- * For multi-wavelength instrumentation. Using a photodetector which does not have frequency characteristics dependency on the wavelength.
- * High Sensitivity, 500V/W
- * Wide Bandwidth, from DC up to 2.0GHz
- * 103mm x 44mm x 21mm, 130 grams
- * JPY 310,000 for direct sales (Excluded tax and shipping cost)

SPD-3 is a wide bandwidth O to E converter configured by a silicon PIN photodetector which does not have "frequency characteristics dependency on the wavelength", Graviton's original lens system, and a TIA circuitry. The lens system incarnates large acceptable diameter up to 0.5mm. SPD-3 is suitable for instrumentation of multi-wavelength optical pick up.

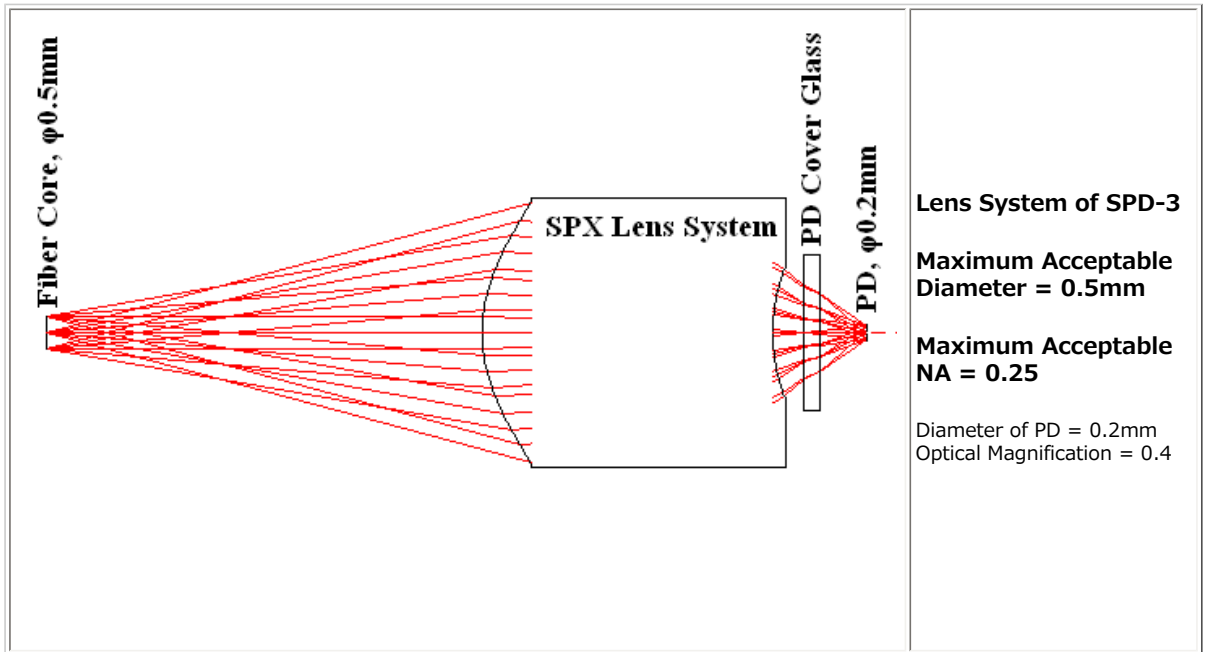
* Specifications of SPD-3

Model Name	SPD-3
Reference Wavelength	850nm
Wavelength Range	380 to 950nm
Acceptable Maximum Core Diameter	φ0.5mm
Acceptable NA Range	0.25 or less
Optical Input Connector	FC receptacle
Photodetector Type	Si PIN PD
Active diameter of Photodetector	φ0.2mm
Conversion Gain (850nm)	500V/W
Output Saturation Optical Input Power (850nm)	-1dBm
Conversion Bandwidth	DC to 2GHz
Output Noise Level	1.5mVrms or less
Noise Equivalent Optical Power (850nm)	-25.2dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC±15V
Supply Current	+150mA/-50mA
Dimensions	103 x 44 x 21mm
Weight	Appl. 130g

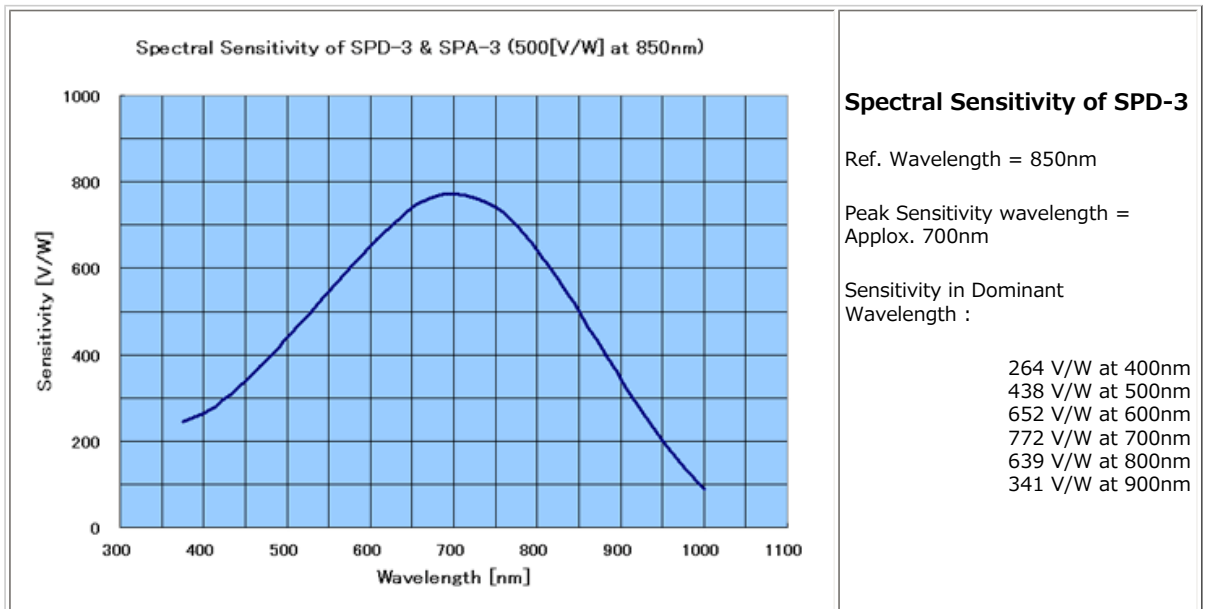
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

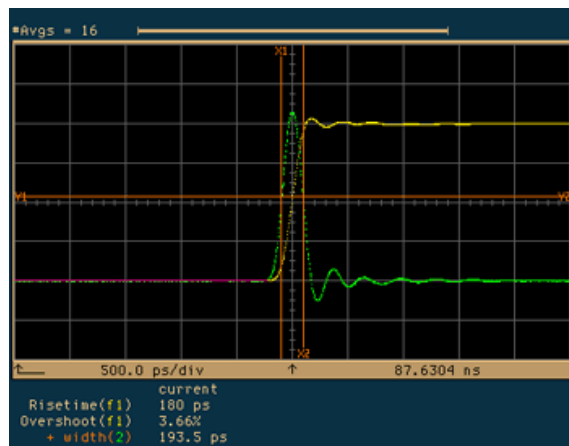
* Lens System



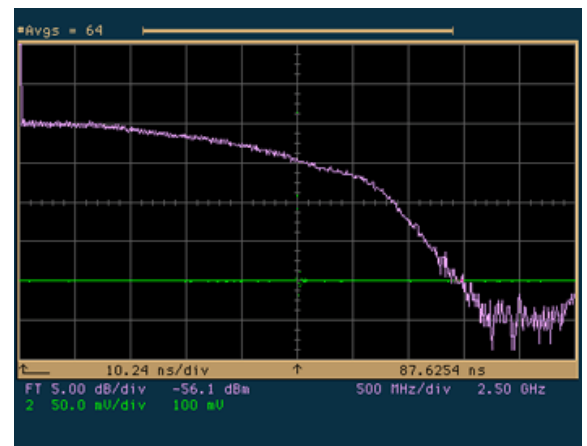
* Spectral Sensitivity (by Calculation)



* Step Response & Frequency Characteristics (Examples)



Step Response of **SPD-3**
Risetime = 180ps, Overshoot = 3.66%



Frequency Characteristics of **SPD-3**
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SPD-4

(Max Core = 0.5mm, Max NA = 0.25, 300V/W@850nm, DC to 3GHz)



Features

- * For multi-wavelength instrumentation. Using a photodetector which does not have frequency characteristics dependency on the wavelength.
- * For High Speed GI-POF, Max NA = 0.25, Max Core = 0.5mm
- * Wide Bandwidth, from DC up to 3.0GHz
- * 103mm x 44mm x 21mm, 130 grams
- * JPY 370,000 for direct sales (Excluded tax and shipping cost)

SPD-4 is wide bandwidth O to E converter configured by a silicon PIN photodetector which does not have "frequency characteristics dependency on the wavelength", Graviton's original lens system, and a wideband TIA circuitry. The lens system incarnates large acceptable core diameter up to 0.5mm. SPD-4 is suitable for instrumentation of multi-wavelength optical pick up and HFCS waveforms can be observed since wide bandwidth.

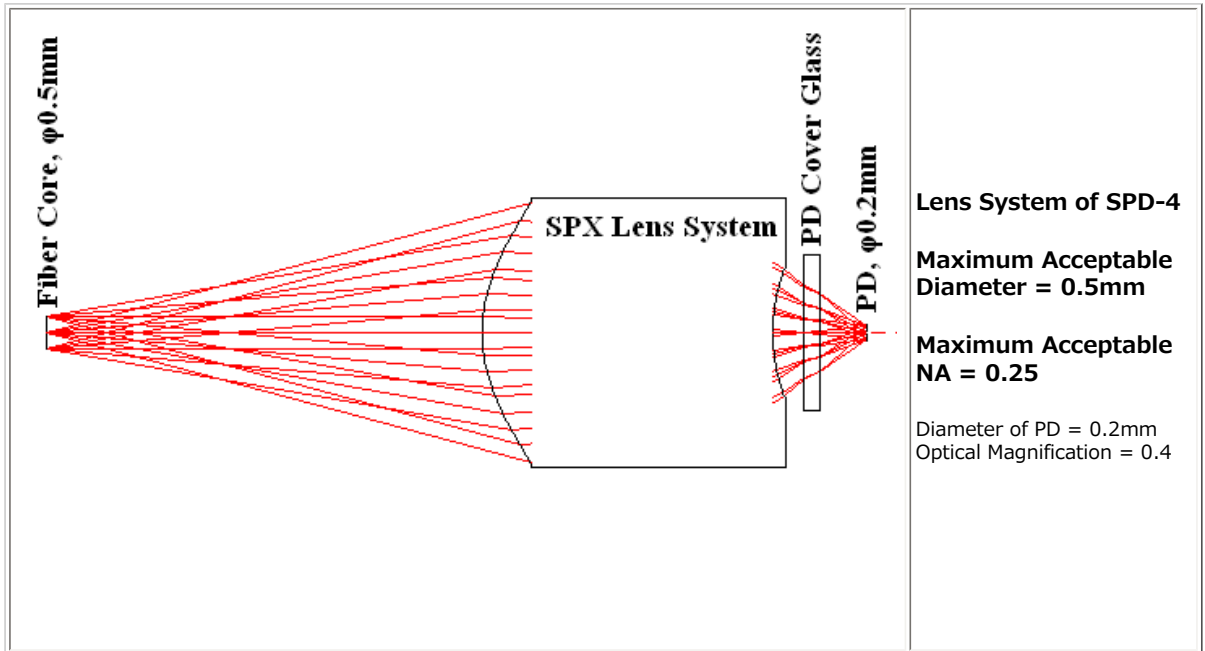
* Specifications of SPD-4

Model Name	SPD-4
Reference Wavelength	850nm
Wavelength Range	380 to 950nm
Acceptable Maximum Core Diameter	φ0.5mm
Acceptable NA Range	0.25 or less
Optical Input Connector	FC receptacle
Photodetector Type	Si PIN PD
Active diameter of Photodetector	φ0.2mm
Conversion Gain (850nm)	300V/W
Output Saturation Optical Input Power (850nm)	+1dBm
Conversion Bandwidth	DC to 3GHz
Output Noise Level	1.8mVrms or less
Noise Equivalent Optical Power (850nm)	-22.4dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC±15V
Supply Current	+150mA/-50mA
Dimensions	103 x 44 x 21mm
Weight	Applx. 130g

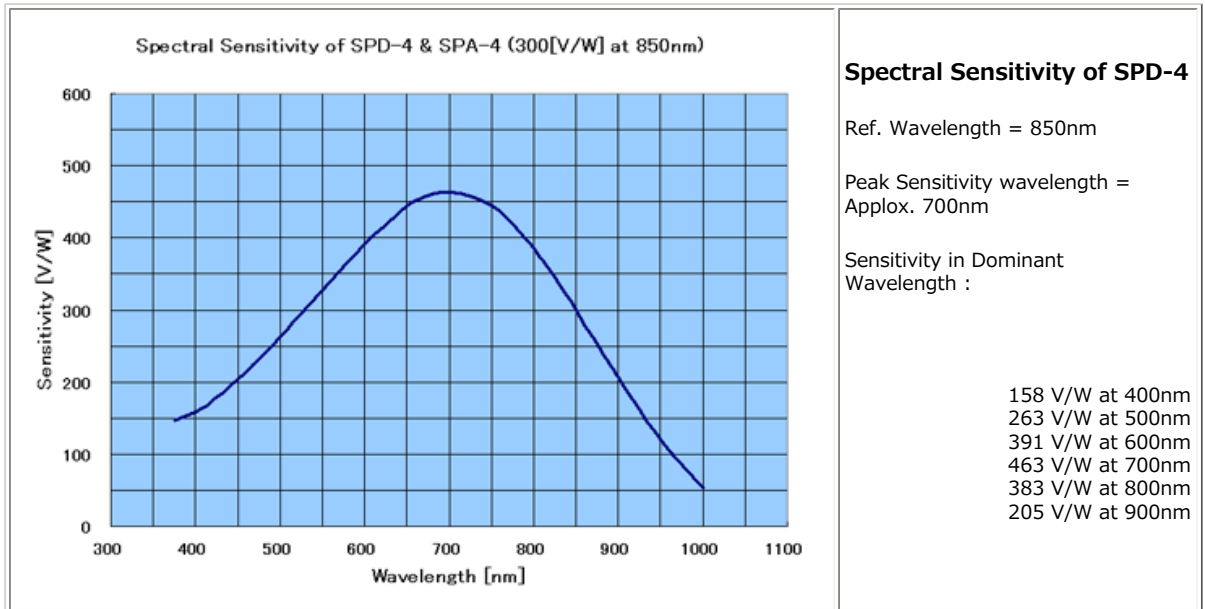
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

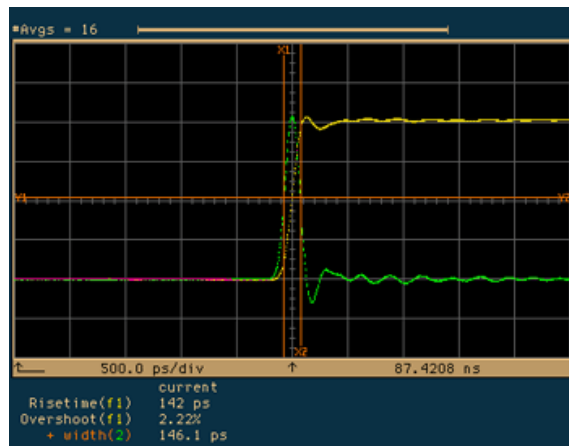
* Lens System



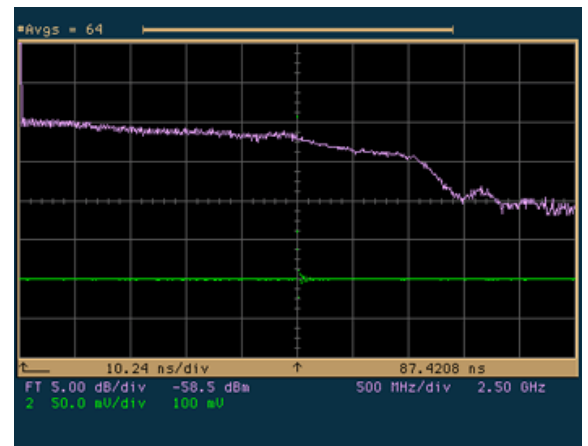
* Spectral Sensitivity (by Calculation)



* Step Response & Frequency Characteristics (Examples)



Step Response of **SPD-4**
Risetime = 142ps, Overshoot = 2.22%



Frequency Characteristics of **SPD-4**
-3dB (Electrical) Frequency = Approx. 3.0GHz

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SPA-2_650nm

(Max Core = 1mm, Max NA = 0.5, 1,000V/W@658nm, DC to 1GHz)



Features

- * Outstanding Detection Area. Catch the optical power from POF of NA = 0.5, core diameter = 1.0mm
- * High Sensitivity, 1,000V/W
- * Wideband, from DC up to 1.0GHz
- * 103mm x 44mm x 21mm, 130 grams
- * Single DC powered from +12V to +18V
- * JPY 290,000 for direct sales (Excluded tax and shipping cost)

SPA-2_650nm has outstanding optical detection area (Max Core = 1.0mm, Max NA = 0.5), and 1.0GHz of conversion bandwidth. SPA-2_650nm is suitable for instrumentation of typical POF optical communication system as well as MOST systems and IDB-1394 systems.

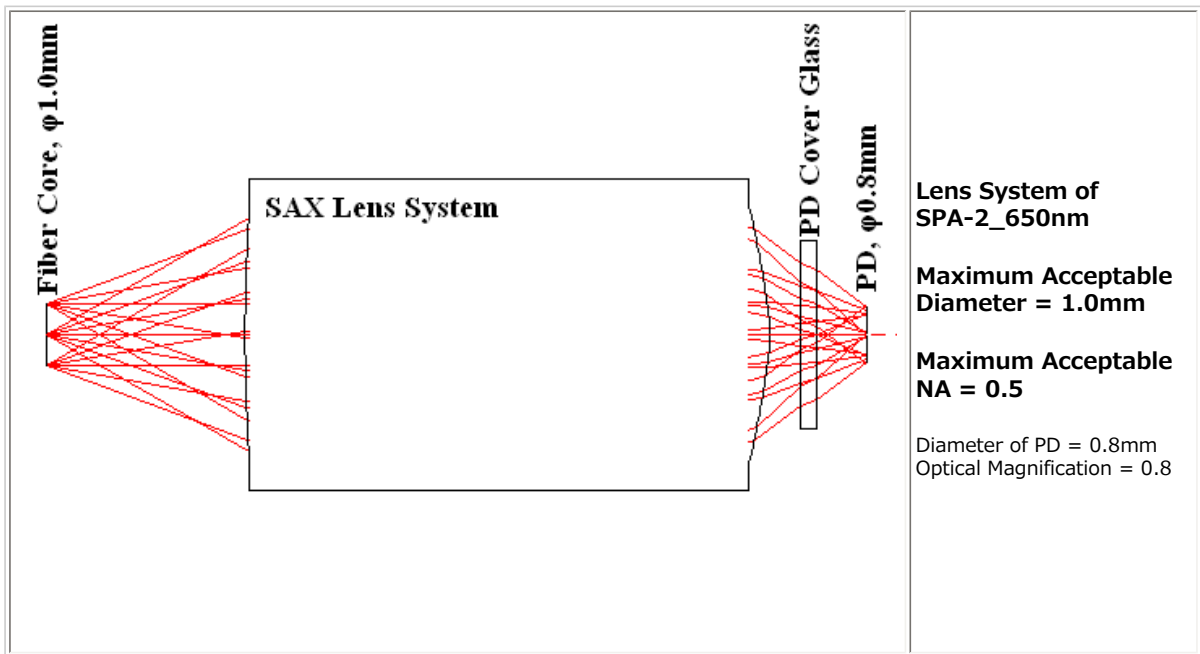
* Specifications of SPA-2_650nm

Model Name	SPA-2_650nm
Reference Wavelength	658nm
Wavelength Range	380 to 1,000nm
Acceptable Maximum Core Diameter	φ1.0mm
Acceptable NA Range	0.5 or less
Optical Input Connector	FC receptacle
Photodetector Type	Si PIN PD
Active diameter of Photodetector	φ0.8mm
Conversion Gain (658nm)	1,000V/W
Output Saturation Optical Input Power (658nm)	-1dBm
Conversion Bandwidth	DC to 1GHz
Output Noise Level	1.9mVrms or less
Noise Equivalent Optical Power (658nm)	-27.3dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC+15V
Supply Current	+150mA
Dimensions	103 x 44 x 21mm
Weight	Appl. 130g

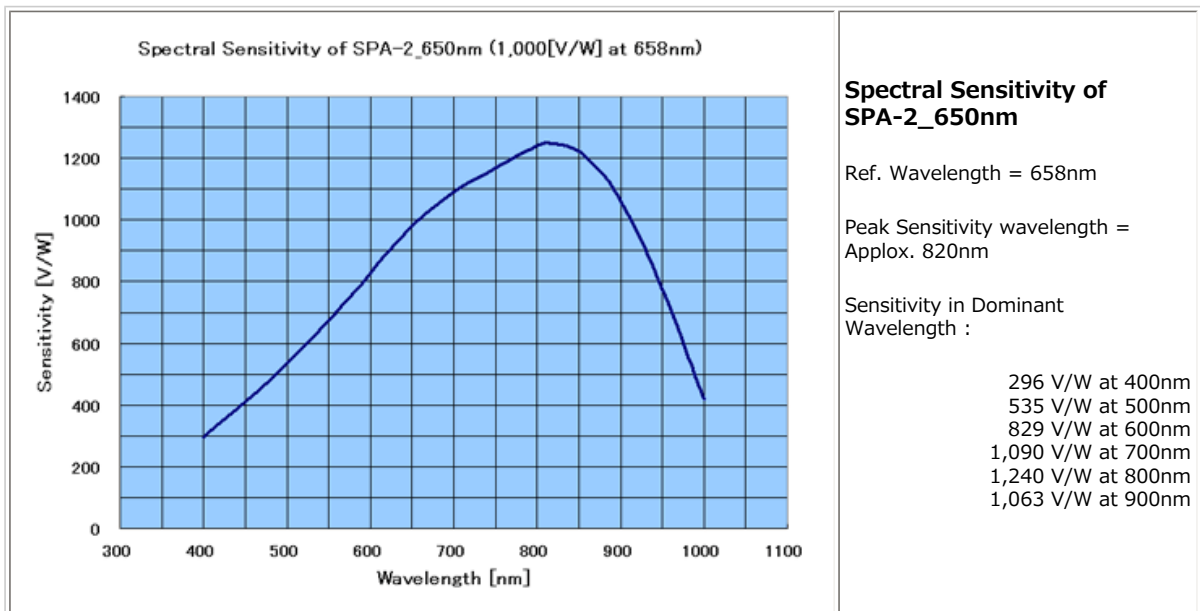
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

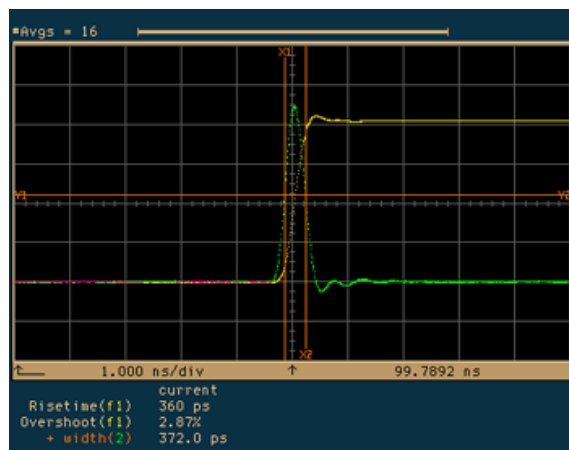
* Lens System



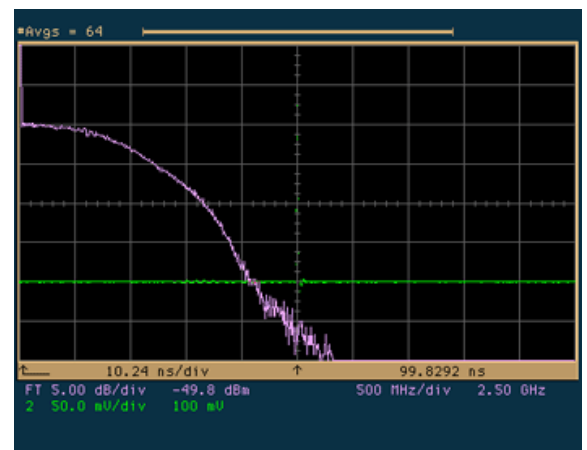
*** Spectral Sensitivity (by Calculation)**



*** Step Response & Frequency Characteristics (Examples)**



Step Response of SPA-2_650nm
Risetime = 360ps, Overshoot = 2.87%



Frequency Characteristics of SPA-2_650nm
-3dB (Electrical) Frequency = Approx. 1.0GHz

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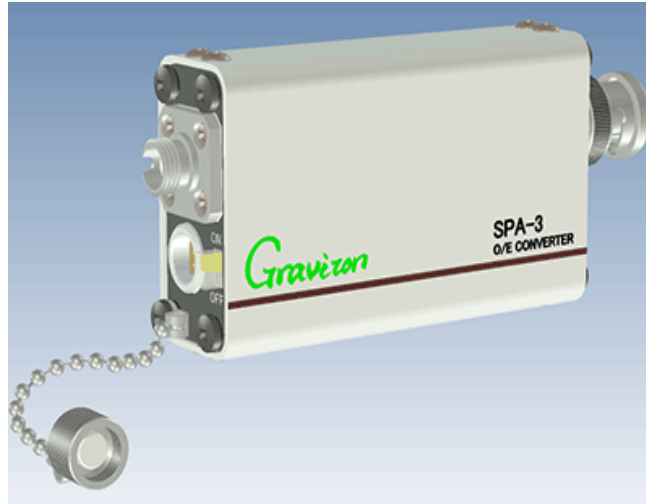
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SPA-3

(Max Core = 0.25mm, Max NA = 0.5, 500V/W@850nm, DC to 2GHz)



Features

- * For multi-wavelength instrumentation. Using a photodetector which does not have frequency characteristics dependency on the wavelength.
- * For large NA Fiber. Max NA = 0.5
- * High Sensitivity, 500V/W
- * Wide Bandwidth, from DC up to 2.0GHz
- * 103mm x 44mm x 21mm, 130 grams
- * JPY 350,000 for direct sales (Excluded tax and shipping cost)

SPA-3 is a wide bandwidth O to E converter configured by a silicon PIN photodetector which does not have "frequency characteristics dependency on the wavelength", Graviton's original lens system, and a TIA circuitry. The lens system incarnates large acceptable NA range up to 0.5. SPA-3 is suitable for instrumentation of fiber communication systems using high speed HPCF (Hard Polymer Clad Fiber).

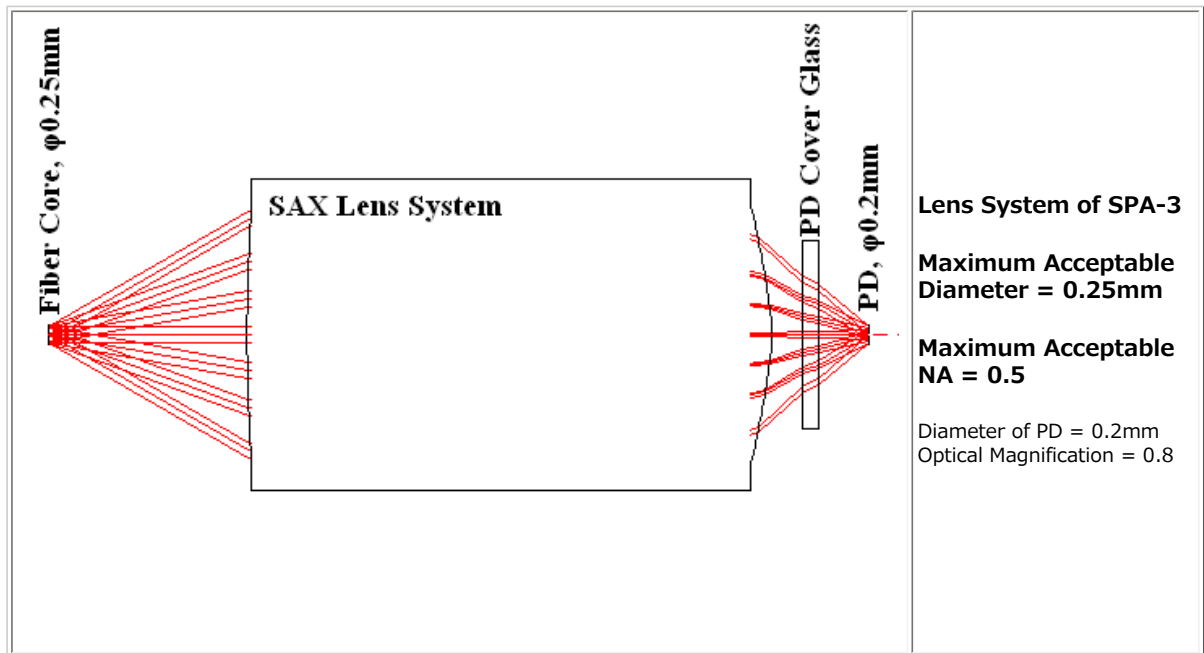
* Specifications of SPA-3

Model Name	SPA-3
Reference Wavelength	850nm
Wavelength Range	380 to 950nm
Acceptable Maximum Core Diameter	φ0.25mm
Acceptable NA Range	0.5 or less
Optical Input Connector	FC receptacle
Photodetector Type	Si PIN PD
Active diameter of Photodetector	φ0.2mm
Conversion Gain (850nm)	500V/W
Output Saturation Optical Input Power (850nm)	-1dBm
Conversion Bandwidth	DC to 2GHz
Output Noise Level	1.5mVrms or less
Noise Equivalent Optical Power (850nm)	-25.2dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC±15V
Supply Current	+150mA/-50mA
Dimensions	103 x 44 x 21mm
Weight	Applx. 130g

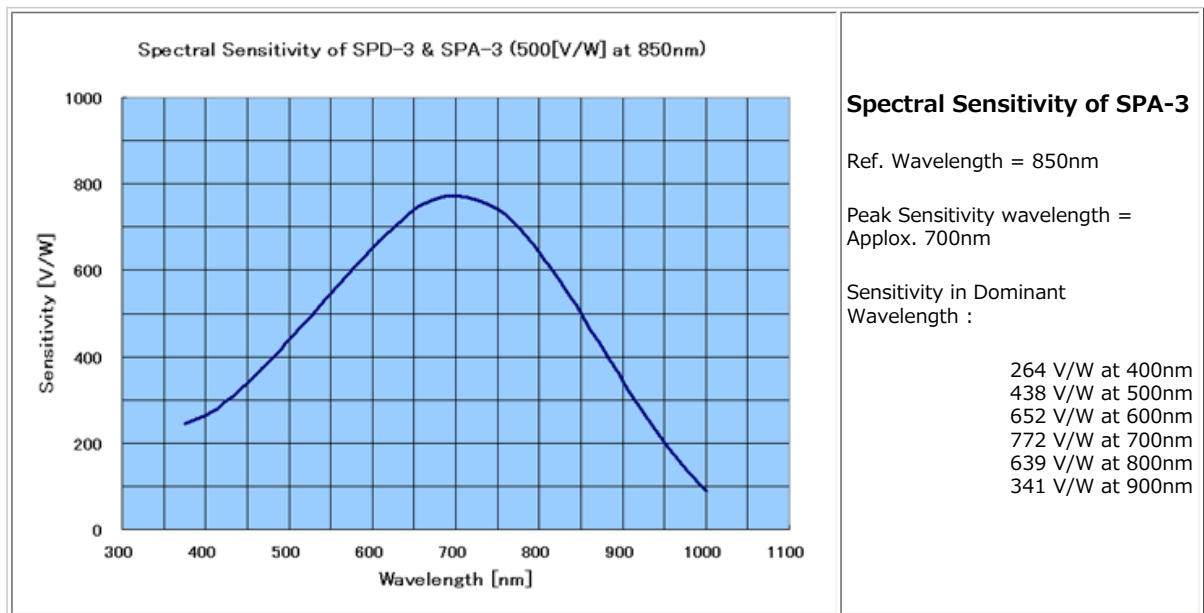
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

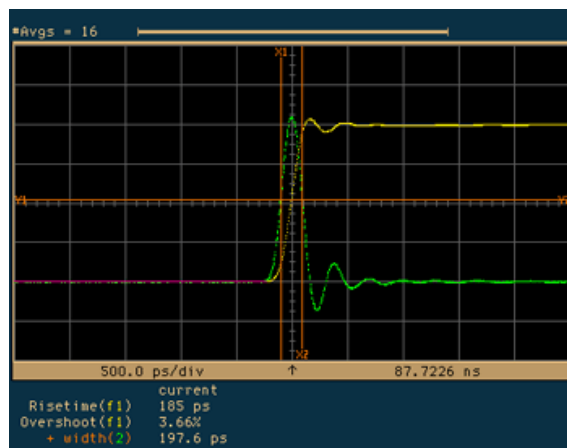
*** Lens System**



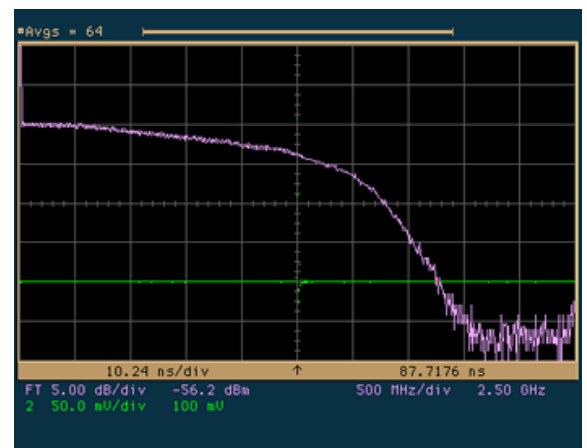
*** Spectral Sensitivity (by Calculation)**



*** Step Response & Frequency Characteristics (Examples)**



Step Response of **SPA-3**
Risetime = 185ps, Overshoot = 3.66%



Frequency Characteristics of **SPA-3**
-3dB (Electrical) Frequency = Approx. 2.0GHz

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SPA-4

(Max Core = 0.25mm, Max NA = 0.5, 300V/W@850nm, DC to 3GHz)



Features

- * For multi-wavelength instrumentation. Using a photodetector which does not have frequency characteristics dependency on the wavelength.
- * For large NA HPCF. Max NA = 0.5
- * Wide Bandwidth, from DC up to 3.0GHz
- * 103mm x 44mm x 21mm, 130 grams
- * JPY 410,000 for direct sales (Excluded tax and shipping cost)

SPA-4 is a wide bandwidth O to E converter configured by a silicon PIN photodetector which does not have "frequency characteristics dependency on the wavelength", Gravizon's original lens system, and a TIA circuitry. The lens system incarnates large acceptable NA range up to 0.5. SPA-4 is suitable for instrumentation of multi-wavelength optical pick up as well as fiber communication systems using high speed, large core HPCF (Hard Polymer Clad Fiber).

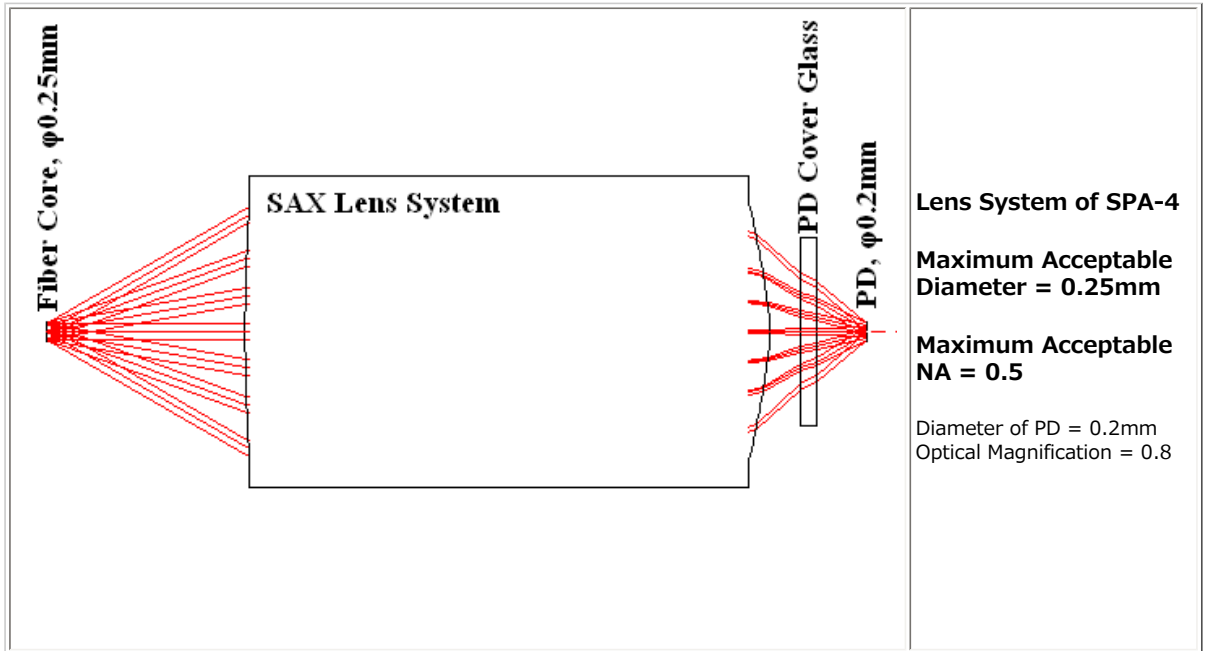
* Specifications of SPA-4

Model Name	SPA-4
Reference Wavelength	850nm
Wavelength Range	380 to 950nm
Acceptable Maximum Core Diameter	φ0.25mm
Acceptable NA Range	0.5 or less
Optical Input Connector	FC receptacle
Photodetector Type	Si PIN PD
Active diameter of Photodetector	φ0.2mm
Conversion Gain (850nm)	300V/W
Output Saturation Optical Input Power (850nm)	+1dBm
Conversion Bandwidth	DC to 3GHz
Output Noise Level	1.8mVrms or less
Noise Equivalent Optical Power (850nm)	-22.4dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC±15V
Supply Current	+150mA/-50mA
Dimensions	103 x 44 x 21mm
Weight	Applx. 130g

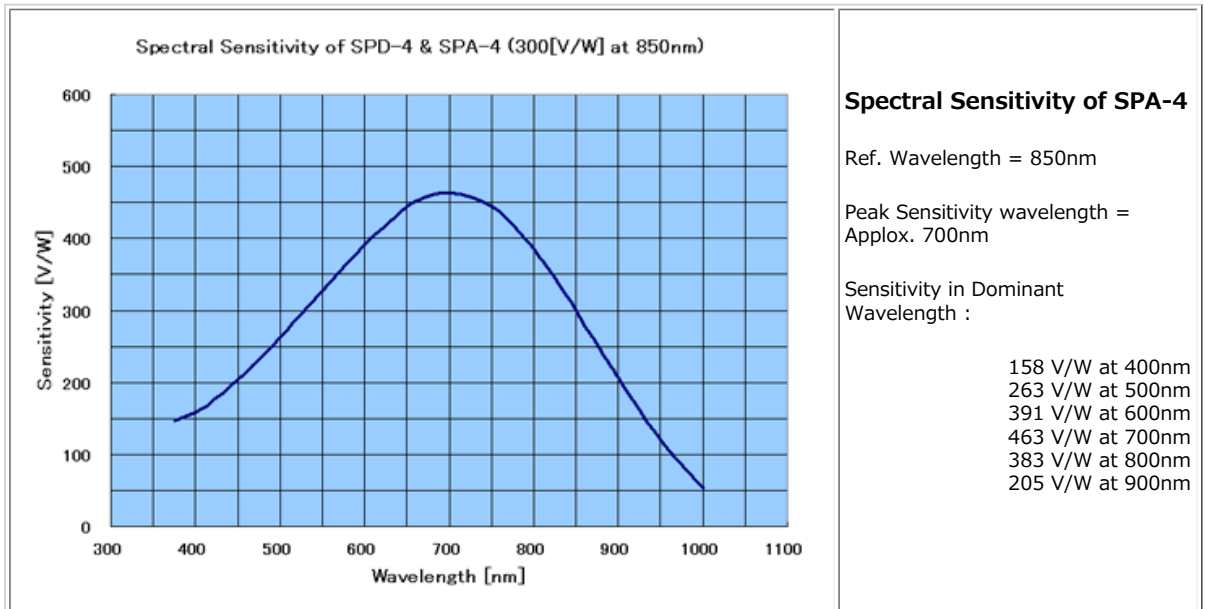
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

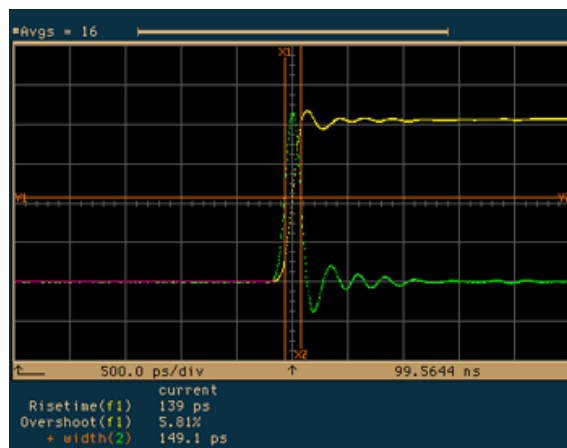
* Lens System



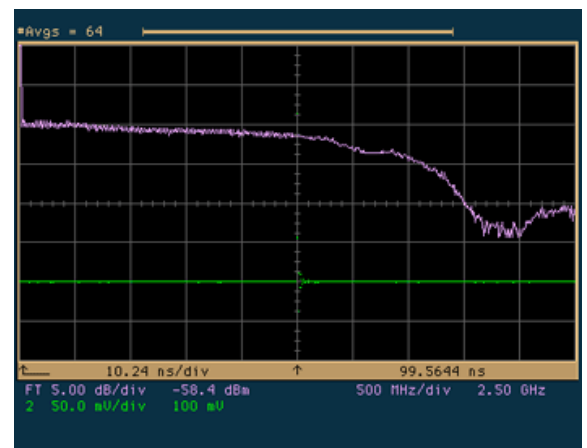
* Spectral Sensitivity (by Calculation)



* Step Response & Frequency Characteristics (Examples)



Step Response of **SPA-4**
Risetime = 139ps, Overshoot = 5.81%



Frequency Characteristics of **SPA-4**
-3dB (Electrical) Frequency = Approx. 3.0GHz

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SPS-1_10KV/W & SPS-1_100KV/W

(Max Core = 0.8mm, Max NA = 0.2, 10KV/W or 100KV/W, DC to 100MHz or 15MHz)



Features

- * Very High Sensitivity, 10KV/W, 100KV/W, or Higher
- * DC to 100MHz or 15MHz
- * Small Offset Voltage, 0.5mV or less
- * 93mm x 44mm x 21mm, 110 grams
- * JPY 230,000 for direct sales (Excluded tax and shipping cost)

SPS-1_10KV/W and SPS-1_100KV/W are very high sensitivity O to E converters configured by a silicon PIN photodetector with a ball lens, and a TIA circuitry. Gravizon's original transimpedance amplifire of FET input type is effective to make it very high sensitivity over 10 times more than SPD series. SPS-1 is suitable for many types of fiber sensors. We can also make higher sensitivity products (in this case, bandwidth is reduced). Please contact us.

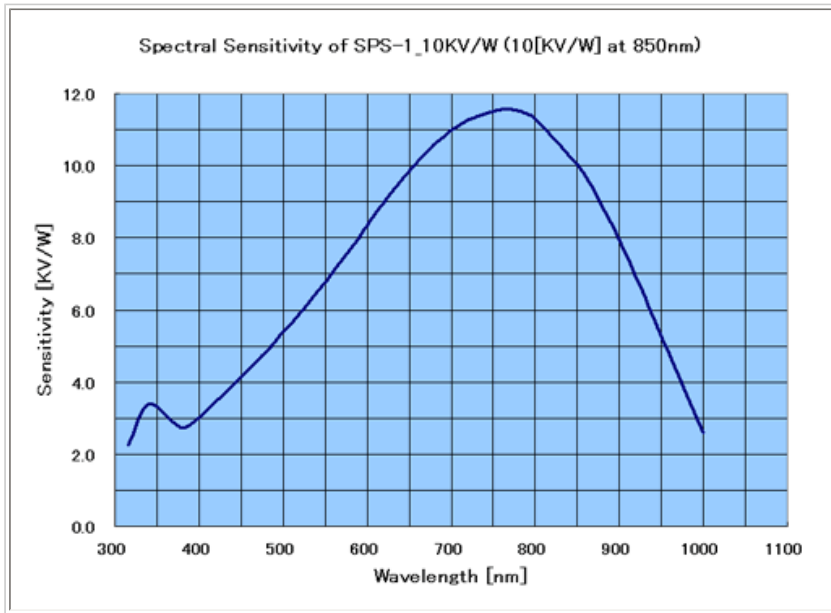
* Specifications of SPS-1

Model Name	SPS-1_10KV/W	SPS-1_100KV/W
Reference Wavelength	850nm	850nm
Wavelength Range	320 to 1000nm	320 to 1000nm
Acceptable Maximum Core Diameter	φ0.8mm	φ0.8mm
Acceptable NA Range	0.2 or less	0.2 or less
Optical Input Connector	FC receptacle	FC receptacle
Photodetector Type	Si PIN PD	Si PIN PD
Active diameter of Photodetector	φ0.4mm	φ0.4mm
Conversion Gain (850nm)	10,000V/W	100,000V/W
Output Saturation Optical Input Power (850nm)	-8.2dBm	-18.2dBm
Conversion Bandwidth	DC to 100MHz	DC to 15MHz
Output Noise Level	1.0mVrms or less	1.0mVrms or less
Noise Equivalent Optical Power (850nm)	-40dBm or less	-50dBm or less
Electrical Output Connector	BNC plug	BNC plug
Output Impedance	50 ohms	50 ohms
Output Offset Voltage	0.5mV or less	0.5mV or less
DC Power Connector	LEMO 0S-4P	LEMO 0S-4P
Supply Voltage	DC±15V	DC±15V
Supply Current	+80mA/-50mA	+80mA/-50mA
Dimensions	93 x 44 x 21mm	93 x 44 x 21mm
Weight	Approx. 110g	Approx. 110g

** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

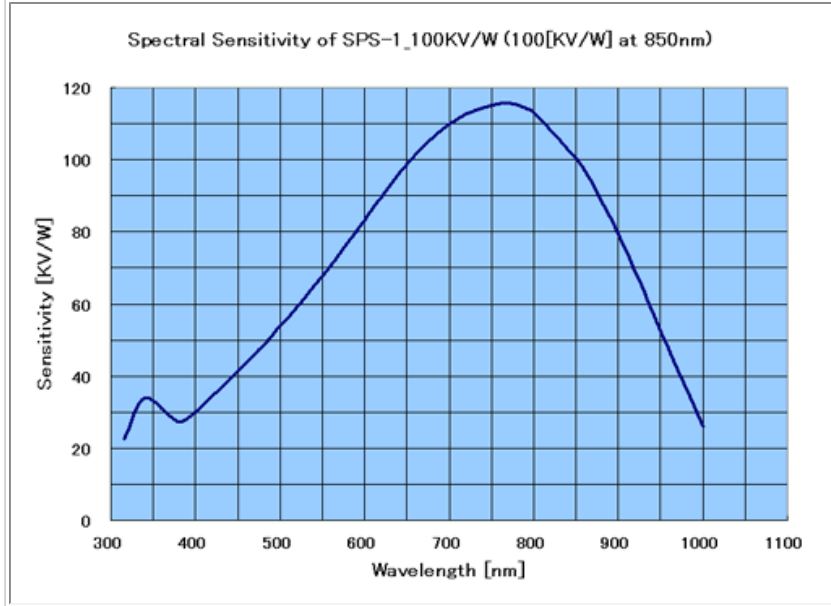
*** Spectral Sensitivity (by Calculation)**



Spectral Sensitivity of SPS-1_10KV/W

Ref. Wavelength = 850nm
 Peak Sensitivity wavelength =
 Applox. 770nm
 Sensitivity in Dominant
 Wavelength :

- 3,000 V/W at 400nm
- 5,400 V/W at 500nm
- 8,300 V/W at 600nm
- 11,000 V/W at 700nm
- 11,300 V/W at 800nm
- 8,000 V/W at 900nm

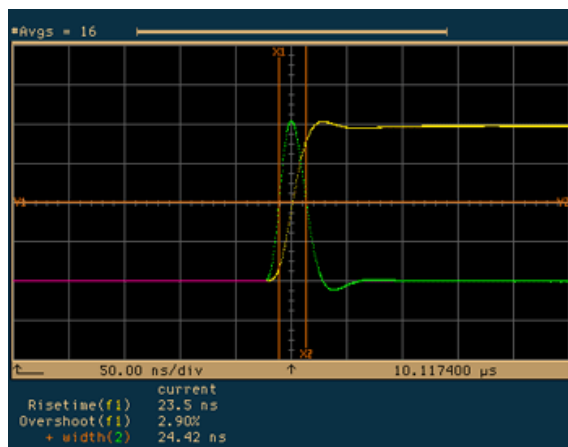


Spectral Sensitivity of SPS-1_100KV/W

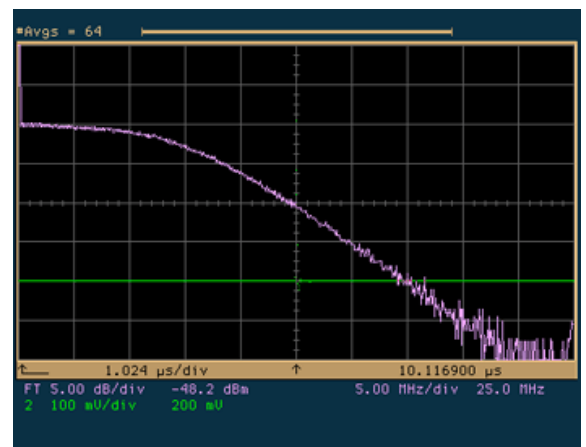
Ref. Wavelength = 850nm
 Peak Sensitivity wavelength =
 Applox. 770nm
 Sensitivity in Dominant
 Wavelength :

- 29,800 V/W at 400nm
- 53,900 V/W at 500nm
- 83,400 V/W at 600nm
- 109,800 V/W at 700nm
- 113,300 V/W at 800nm
- 79,500 V/W at 900nm

*** Step Response & Frequency Characteristics (Examples)**



Step Response of **SPS-1_100KV/W**
 Risetime = 23.5ns, Overshoot = 2.90%



Frequency Characteristics of **SPS-1_100KV/W**
 -3dB (Electrical) Frequency = Applox. 15MHz

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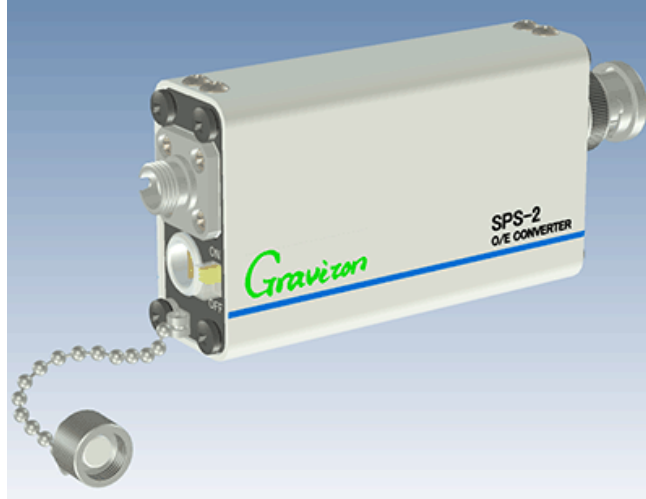
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SPS-2_10KV/Wnm & SPS-2_100KV/W

(Max Core = 1mm, Max NA = 0.5, 10KV/W or 100KV/W, DC to 100MHz or 15MHz)



Features

- * Very High Sensitivity, 10KV/W, 100KV/W, or Higher
- * Outstanding Detection Area, Max Core = 1.0mm, Max NA = 0.5
- * DC to 100MHz or 15MHz
- * 103mm x 44mm x 21mm, 130 grams
- * JPY 290,000 for direct sales (Excluded tax and shipping cost)

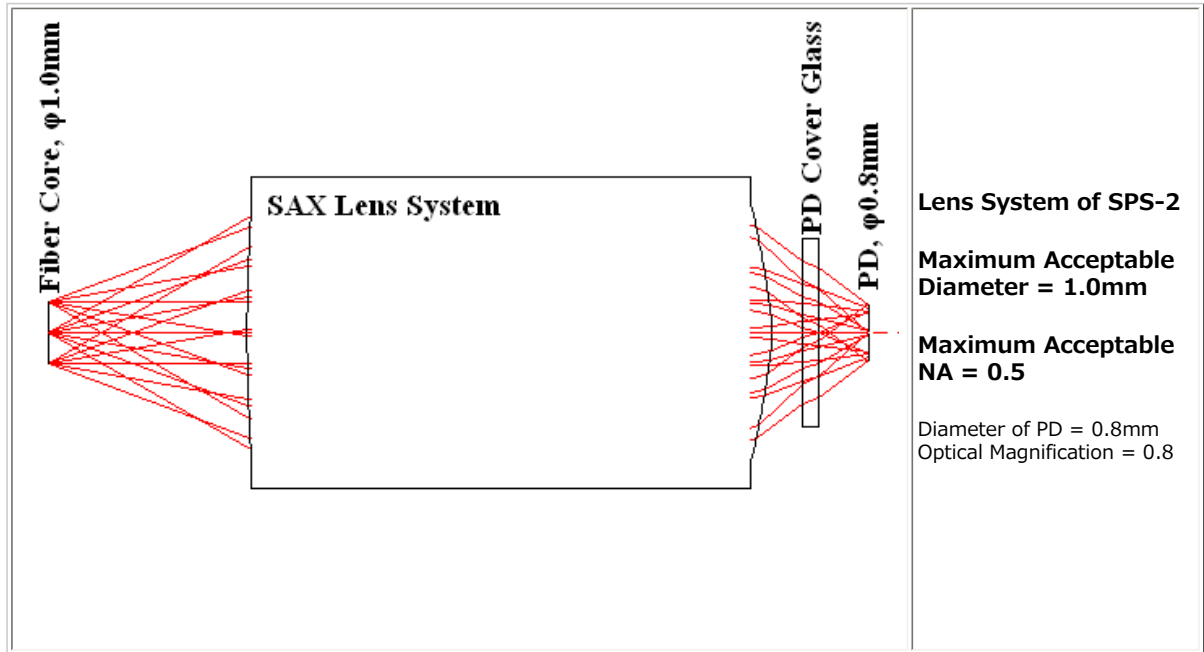
SPS-2_10KV/W and SPS-2_100KV/W are very high sensitivity O to E converters configured by a silicon PIN photodetector, Graviton's original lens system, and high sensitivity transimpedance amplifire circuitry. The lens system incarnates outstanding detection area which acceptable maximum core diameter is 1.0mm, acceptable maximum fiber NA is 0.5. The TIA circuitry of FET input type is effective to make the product very high sensitivity over 10 times more than SPD series. SPS-2 is suitable for many types of fiber sensors. We can also make higher sensitivity products (in this case, bandwidth is reduced). Please contact us.

* Specifications of SPS-2

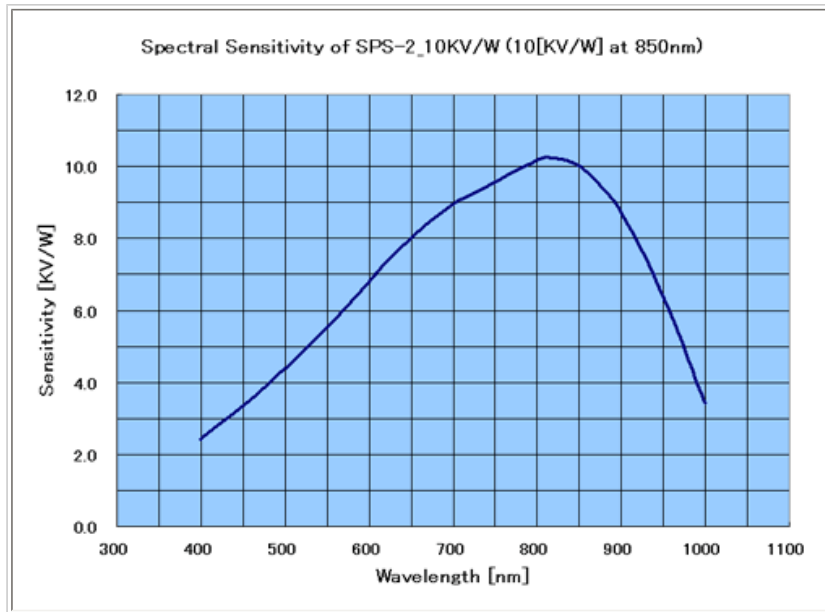
Model Name	SPS-2_10KV/W	SPS-2_100KV/W
Reference Wavelength	850nm	850nm
Wavelength Range	380 to 1000nm	380 to 1000nm
Acceptable Maximum Core Diameter	φ1.0mm	φ1.0mm
Acceptable NA Range	0.5 or less	0.5 or less
Optical Input Connector	FC receptacle	FC receptacle
Photodetector Type	Si PIN PD	Si PIN PD
Active diameter of Photodetector	φ0.8mm	φ0.8mm
Conversion Gain (850nm)	10,000V/W	100,000V/W
Output Saturation Optical Input Power (850nm)	-8.2dBm	-18.2dBm
Conversion Bandwidth	DC to 100MHz	DC to 15MHz
Output Noise Level	1.0mVrms or less	1.0mVrms or less
Noise Equivalent Optical Power (850nm)	-40dBm or less	-50dBm or less
Electrical Output Connector	BNC plug	BNC plug
Output Impedance	50 ohms	50 ohms
Output Offset Voltage	0.5mV or less	0.5mV or less
DC Power Connector	LEMO 0S-4P	LEMO 0S-4P
Supply Voltage	DC±15V	DC±15V
Supply Current	+80mA/-50mA	+80mA/-50mA
Dimensions	103 x 44 x 21mm	103 x 44 x 21mm
Weight	Applox. 130g	Applox. 130g

** Optical input connector, electrical output connector is that of the standard model.
 ** Other types of connectors are available as a customer's option.

*** Lens System**



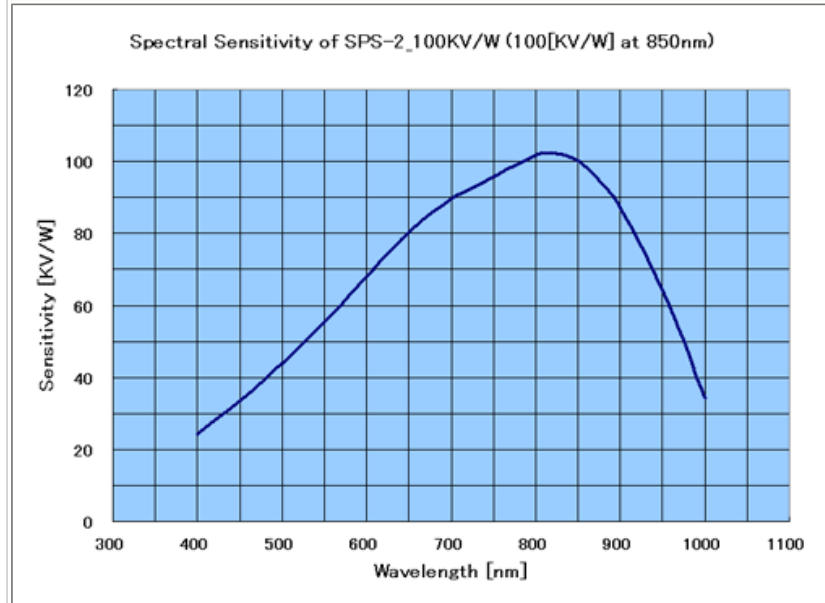
*** Spectral Sensitivity (by Calculation)**



Spectral Sensitivity of SPS-2_10KV/W

Ref. Wavelength = 850nm
 Peak Sensitivity wavelength =
 Applx. 770nm
 Sensitivity in Dominant
 Wavelength :

- 2,400 V/W at 400nm
- 4,400 V/W at 500nm
- 6,800 V/W at 600nm
- 9,000 V/W at 700nm
- 10,200 V/W at 800nm
- 8,700 V/W at 900nm

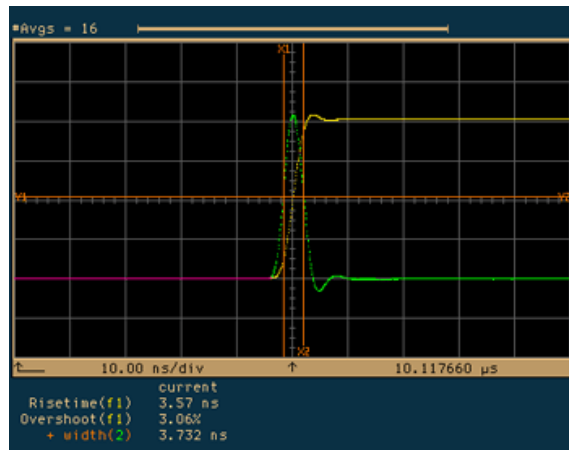


Spectral Sensitivity of SPS-2_100KV/W

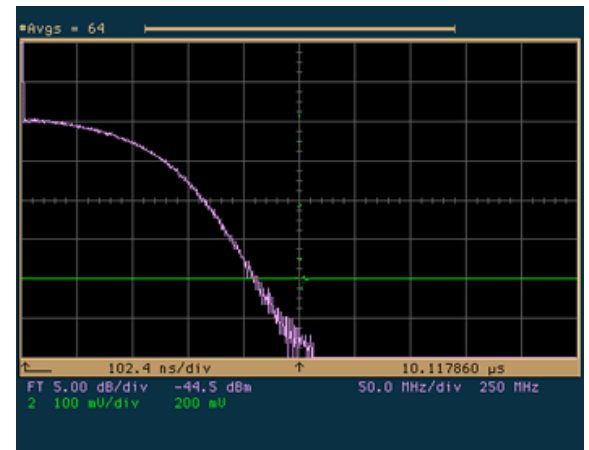
Ref. Wavelength = 850nm
 Peak Sensitivity wavelength =
 Applx. 770nm
 Sensitivity in Dominant
 Wavelength :

- 24,300 V/W at 400nm
- 43,900 V/W at 500nm
- 68,000 V/W at 600nm
- 89,500 V/W at 700nm
- 101,800 V/W at 800nm
- 87,300 V/W at 900nm

* Step Response & Frequency Characteristics (Examples)



Step Response of **SPS-2_10KV/W**
Risetime = 3.57ns, Overshoot = 3.06%



Frequency Characteristics of **SPS-2_10KV/W**
-3dB (Electrical) Frequency = Approx. 100MHz

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LPD-1

(Max Core = 0.08mm, Max NA = 0.2, 500V/W@1310nm, DC to 1.5GHz)



Features

- * Low cost O to E for NIR wavelength using a InGaAs PIN Photodetector.
- * High Sensitivity, 500V/W
- * Wideband, from DC up to 1.5GHz
- * 93mm x 44mm x 21mm, 110 grams
- * JPY 260,000 for direct sales (Excluded tax and shipping cost)

LPD-1 is a low cost NIR O to E converter configured by an InGaAs PIN photodetector (ball lens type) and Graviton's original TIA circuitry. LPD-1 is suitable for instrumentation of 1310nm or 1550nm lightwave communication systems using a single mode fiber as well as a HPCF (Hard Polymer Clad Fiber) which core diameter is up to 62.5 micro meter.

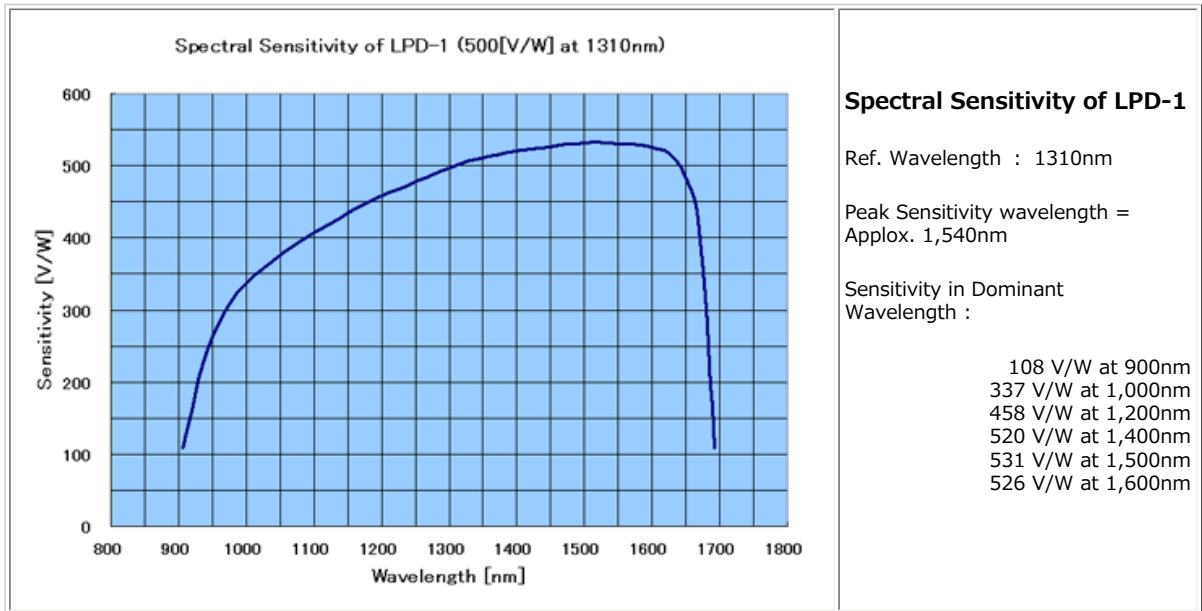
* Specifications of LPD-1

Model Name	LPD-1
Reference Wavelength	1310nm
Wavelength Range	900 to 1650nm
Acceptable Maximum Core Diameter	φ0.08mm
Acceptable NA Range	0.2 or less
Optical Input Connector	FC receptacle
Photodetector Type	InGaAs PIN PD
Active diameter of Photodetector	φ0.08mm
Conversion Gain (1310nm)	500V/W
Output Saturation Optical Input Power (1310nm)	-1dBm
Conversion Bandwidth	DC to 1.5GHz
Output Noise Level	0.8mVrms or less
Noise Equivalent Optical Power (1310nm)	-27.9dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC±15V
Supply Current	+150mA/-50mA
Dimensions	93 x 44 x 21mm
Weight	Appl. 110g

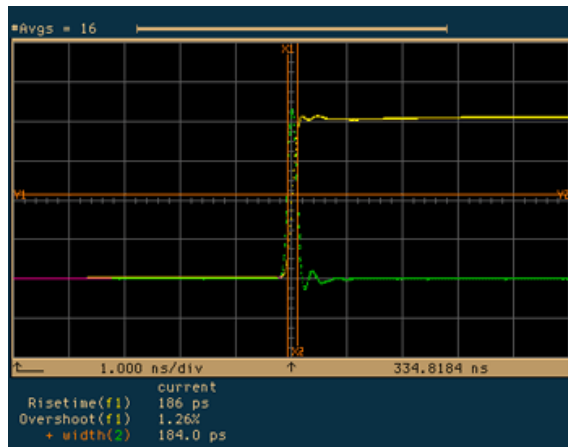
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

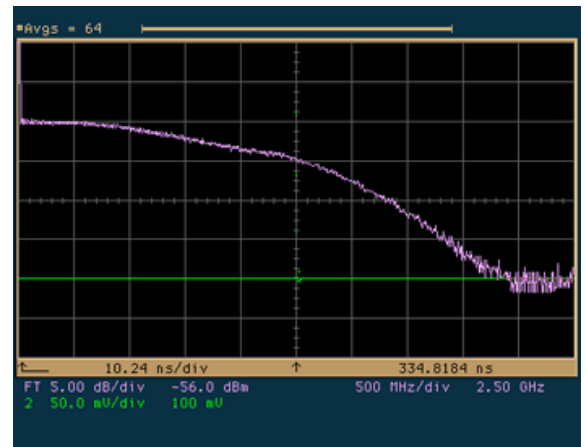
*** Spectral Sensitivity (by Calculation)**



*** Step Response & Frequency Characteristics (Examples)**



Step Response of **LPD-1**
Risetime = 186ps, Overshoot = 1.26%



Frequency Characteristics of **LPD-1**
-3dB (Electrical) Frequency = Approx. 1.8GHz

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LPD-2

(Max Core = 0.5mm, Max NA = 0.25, 1,000V/W@1310nm, DC to 1.5GHz)



Features

- * O to E for NIR wavelength using a InGaAs PIN Photodetector.
- * Large Detection Area
Max Core diameter = 0.5mm
- * High Sensitivity, 1000V/W
- * Wideband, from DC up to 1.5GHz
- * 103mm x 44mm x 21mm, 130 grams
- * JPY 320,000 for direct sales
(Excluded tax and shipping cost)

LPD-2 is a NIR O to E converter configured by Graviton's original lens system, InGaAs PIN photodetector, and TIA circuitry. Large detection Area enables instrumentation of communication system using a large core diameter fiber.

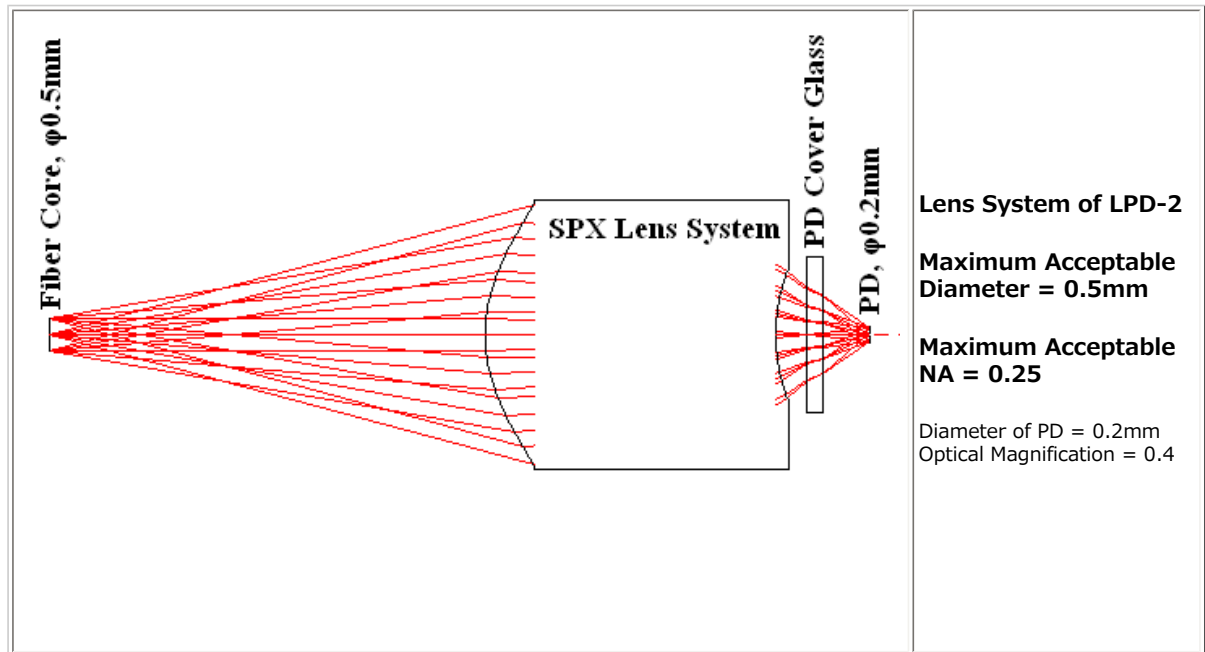
* Specifications of LPD-2

Model Name	LPD-2
Reference Wavelength	1310nm
Wavelength Range	950 to 1650nm
Acceptable Maximum Core Diameter	φ0.5mm
Acceptable NA Range	0.25 or less
Optical Input Connector	FC receptacle
Photodetector Type	InGaAs PIN PD
Active diameter of Photodetector	φ0.2mm
Conversion Gain (1310nm)	1,000V/W
Output Saturation Optical Input Power (1310nm)	-4dBm
Conversion Bandwidth	DC to 1.5GHz
Output Noise Level	1.8mVrms or less
Noise Equivalent Optical Power (1310nm)	-29.2dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC±15V
Supply Current	+150mA/-50mA
Dimensions	103 x 44 x 21mm
Weight	Applx. 130g

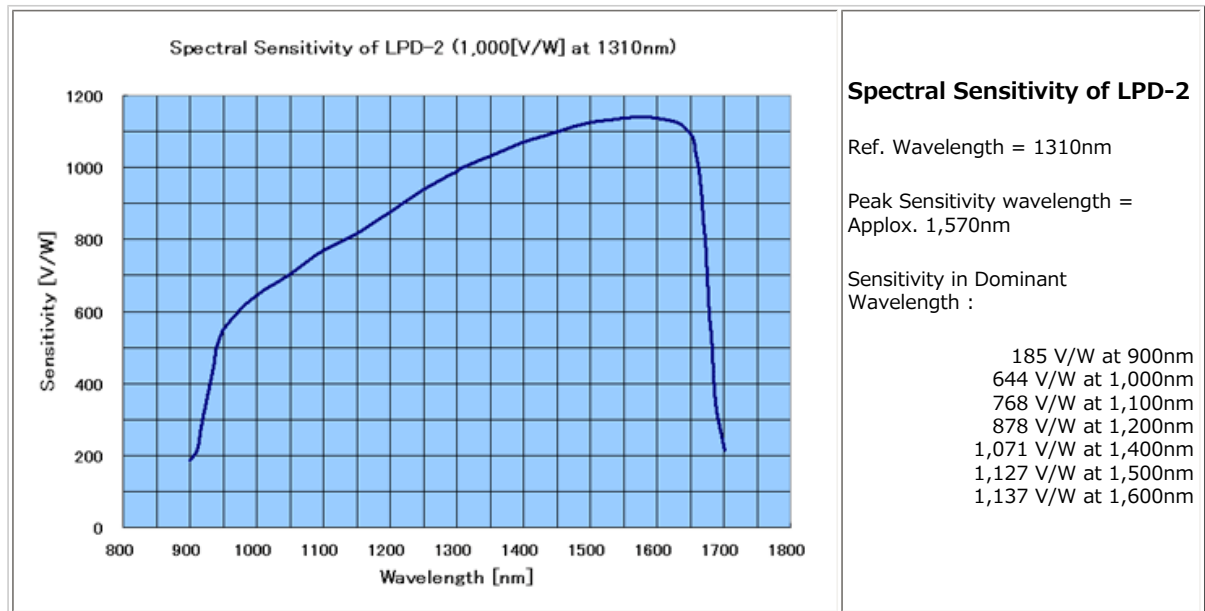
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

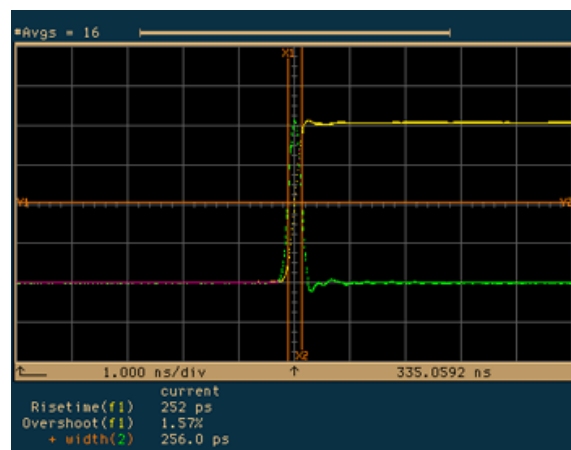
* Lens System



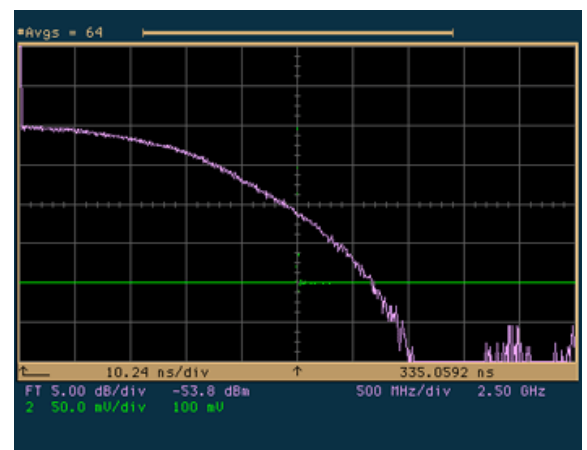
* Spectral Sensitivity (by Calculation)



* Step Response & Frequency Characteristics (Examples)



Step Response of **LPD-2**
Risetime = 252ps, Overshoot = 1.57%



Frequency Characteristics of **LPD-2**
-3dB (Electrical) Frequency = Approx. 1.5GHz

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LPS-1_20KV/W

(Max Core = 0.08mm, Max NA = 0.2, 20KV/W@1310nm, DC to 100MHz)



Features

- * High Sensitivity O to E for NIR wavelength using InGaAs PIN PD
- * Very High Sensitivity, 20,000V/W
- * DC to 100MHz of conversion bandwidth
- * 93mm x 44mm x 21mm, 110 grams
- * JPY 260,000 for direct sales (Excluded tax and shipping cost)

LPS-1_20KV/W is a high sensitivity O to E converter configured by a InGaAs photodetector (ball lens type) and TIA circuitry. Graviton's original transimpedance amplifire of FET input type is effective to make it very high sensitivity over 10 times more than LPD series. LPS-1_20KV/W is suitable for many types of fiber sensors. We can also make higher sensitivity products (in this case, bandwidth is reduced). Please contact us.

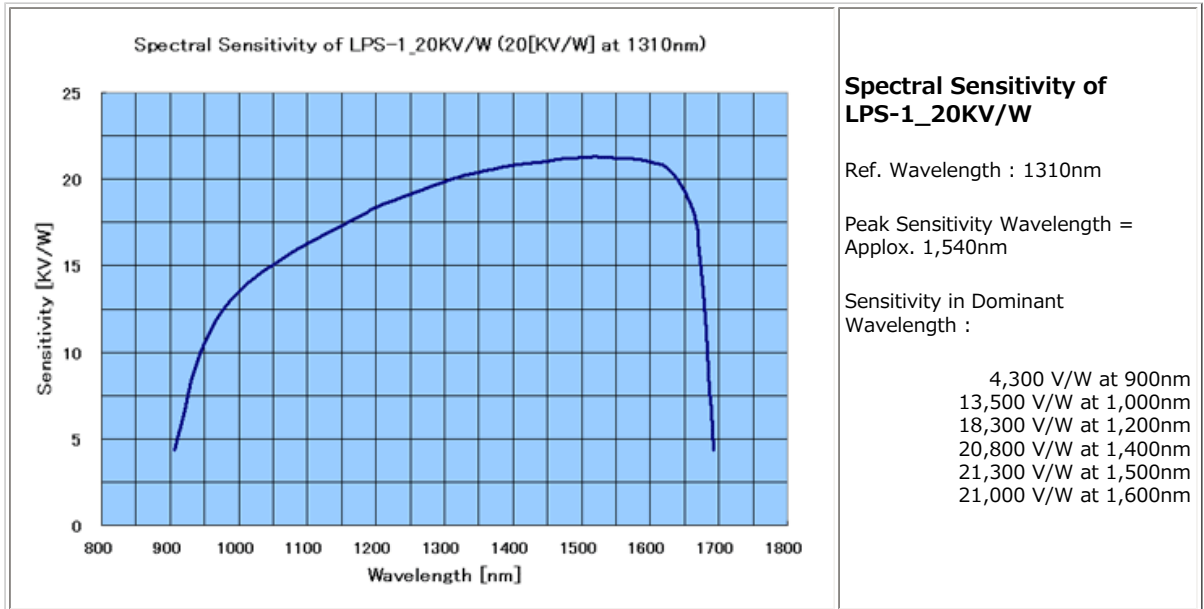
* Specifications of LPS-1_20KV/W

Model Name	LPS-1_20KV/W
Reference Wavelength	1310nm
Wavelength Range	900 to 1650nm
Acceptable Maximum Core Diameter	φ0.08mm
Acceptable NA Range	0.2 or less
Optical Input Connector	FC receptacle
Photodetector Type	InGaAs PIN PD
Active diameter of Photodetector	φ0.08mm
Conversion Gain (1310nm)	20,000V/W
Output Saturation Optical Input Power (1310nm)	-11.2dBm
Conversion Bandwidth	DC to 100MHz
Output Noise Level	1.0mVrms or less
Noise Equivalent Optical Power (1310nm)	-43dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC±15V
Supply Current	+80mA/-50mA
Dimensions	93 x 44 x 21mm
Weight	Applox. 110g

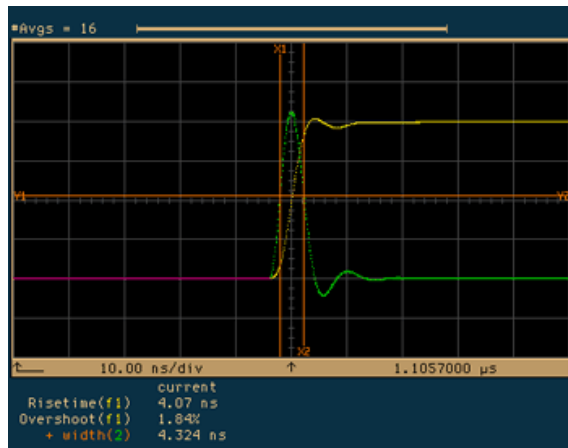
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

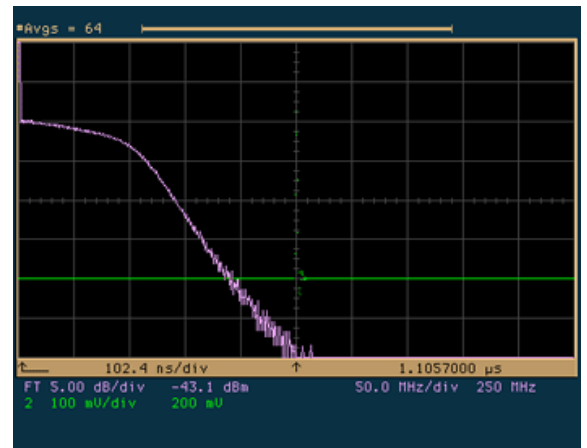
*** Spectral Sensitivity (by Calculation)**



*** Step Response & Frequency Characteristics (Examples)**



Step Response of **LPS-1_20KV/W**
Risetime = 4.07ns, Overshoot = 1.84%



Frequency Characteristics of **LPS-1_20KV/W**
-3dB (Electrical) Frequency = Applx. 100MHz

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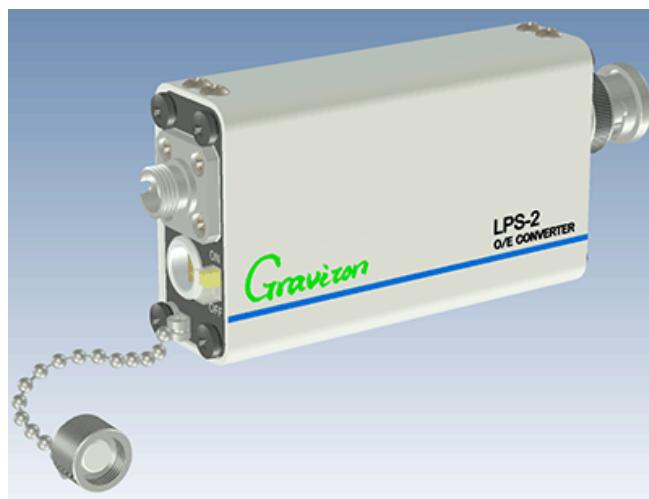
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LPS-2_20KV/W

(Max Core = 0.5mm, Max NA = 0.25, 20KV/W@1310nm, DC to 100MHz)



Features

- * High Sensitivity O to E for NIR wavelength using InGaAs PIN PD
- * Large Detection Area, Maximum Fiber Core = 0.5mm
- * Very High Sensitivity, 20,000V/W
- * DC to 100MHz of conversion bandwidth
- * 103mm x 44mm x 21mm, 130 grams
- * JPY 320,000 for direct sales (Excluded tax and shipping cost)

LPS-2_20KV/W is a high sensitivity O to E converter for NIR wavelength configured by a InGaAs photodetector, Graviton's original lens system, and TIA circuitry. The lens system and the transimpedance amplifire of FET input type are effective to make it high sensitivity and large optical detection area. LPS-2_20KV/W is suitable for many types of fiber sensors. We can also make higher sensitivity model (in this case, bandwidth is reduced). Please contact us.

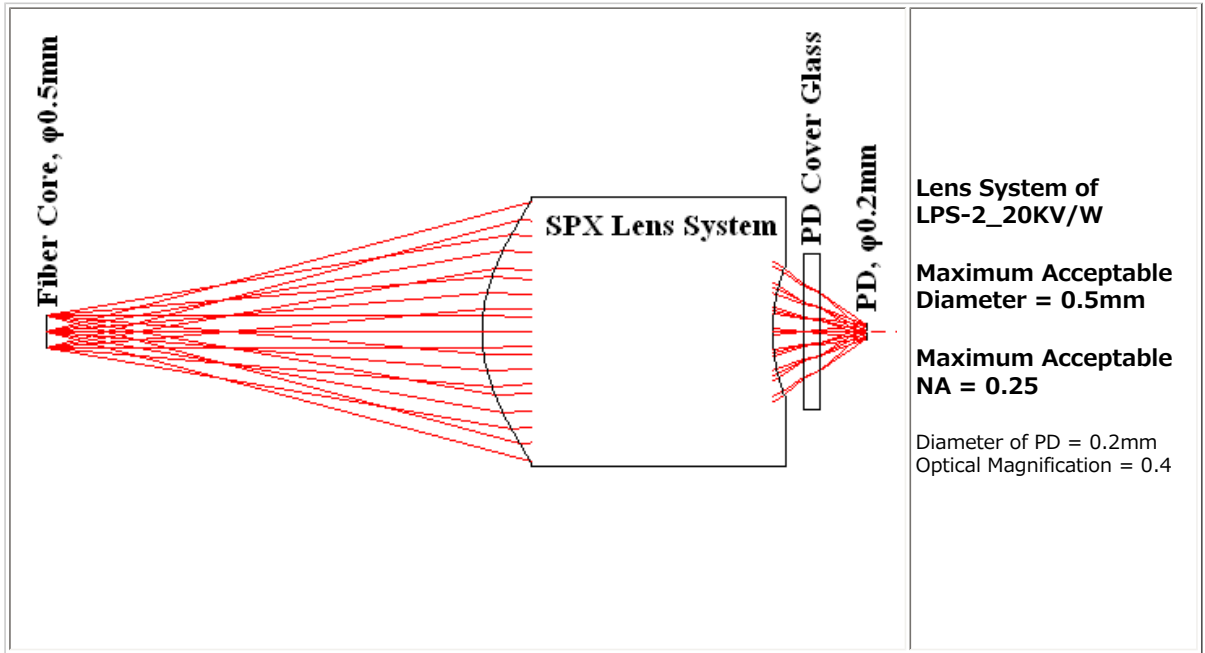
* Specifications of LPS-2_20KV/W

Model Name	LPS-2_20KV/W
Reference Wavelength	1310nm
Wavelength Range	950 to 1650nm
Acceptable Maximum Core Diameter	φ0.5mm
Acceptable NA Range	0.25 or less
Optical Input Connector	FC receptacle
Photodetector Type	InGaAs PIN PD
Active diameter of Photodetector	φ0.2mm
Conversion Gain (1310nm)	20,000V/W
Output Saturation Optical Input Power (1310nm)	-11.2dBm
Conversion Bandwidth	DC to 100MHz
Output Noise Level	1.0mVrms or less
Noise Equivalent Optical Power (1310nm)	-43dBm or less
Electrical Output Connector	BNC plug
Output Impedance	50 ohms
Output Offset Voltage	0.5mV or less
DC Power Connector	LEMO 0S-4P
Supply Voltage	DC±15V
Supply Current	+80mA/-50mA
Dimensions	103 x 44 x 21mm
Weight	Applx. 130g

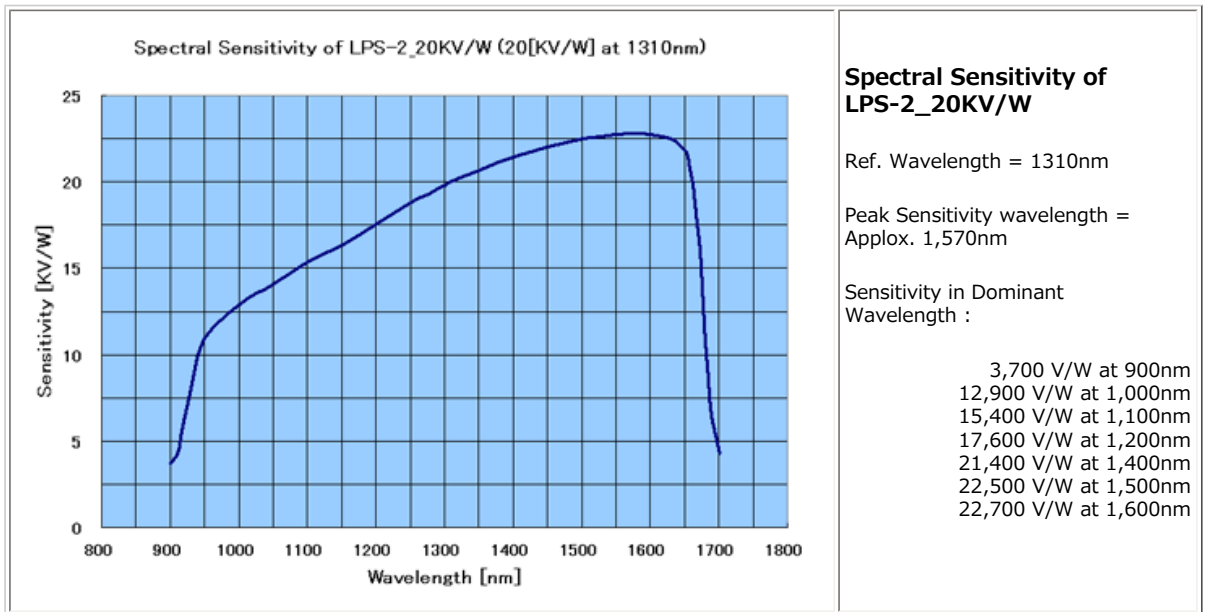
** Optical input connector, electrical output connector is that of the standard model.

** Other types of connectors are available as a customer's option.

*** Lens System**



*** Spectral Sensitivity (by Calculation)**





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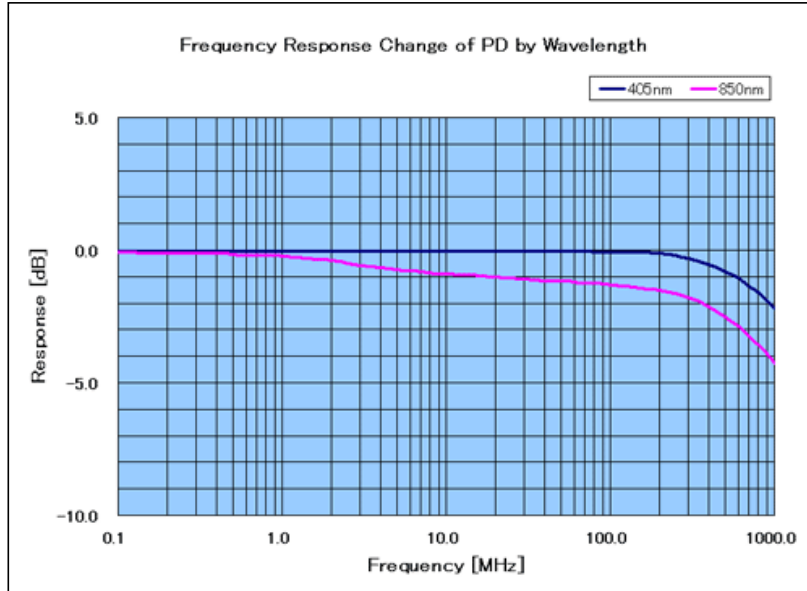
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The many of silicon photodetector has a frequency characteristics change, depending on the wavelength of incident light, in nature. Graph on the left is the frequency characteristic example of high-speed silicon PIN photodetector.

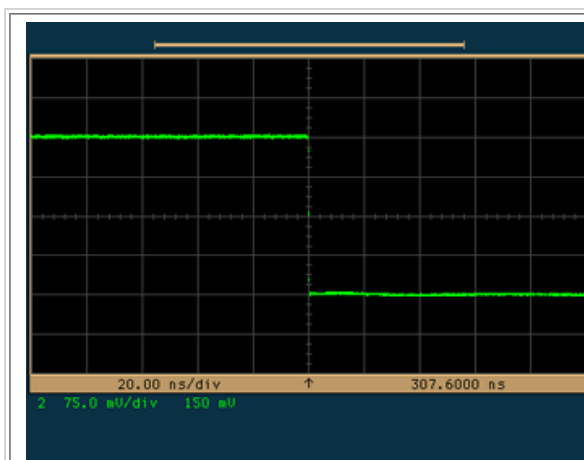
As shown in this example, it is observed that the element has a flat response up to 1GHz or more for the short wavelength, though, there is the response shelf-like decrease, starting from a relatively low frequency, for the long wavelength.

In the high-frequency range of the frequency characteristics, response is significantly reduced from where the wavelength of the beam is longer than the maximum sensitivity wavelength of the photo detector.

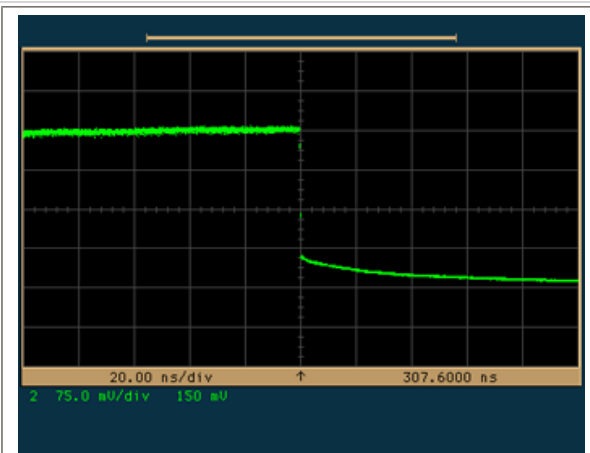
Also, the same character is seen on the photodetector currently used for **SPD-1**, **SPD-2**, and **SPA-2**. By changing the compensation constant of the circuit for each reference wavelength of the product, those models have earned a flat frequency characteristic as a whole.

Accordingly, when a light with different wavelength from the reference wavelength is inputted to **SPD-1**, **SPD-2**, **SPA-2**, the frequency characteristics of the product cannot be maintained flat, and may result in distorted. The following shows the output voltage waveform at a moment when the beam, inputted to O/E converter, is intercepted instantly.

* Example, using SPD-1_650nm



An output voltage waveform when the **658nm** beam is inputted to **SPD-1_650nm** and is intercepted rapidly.



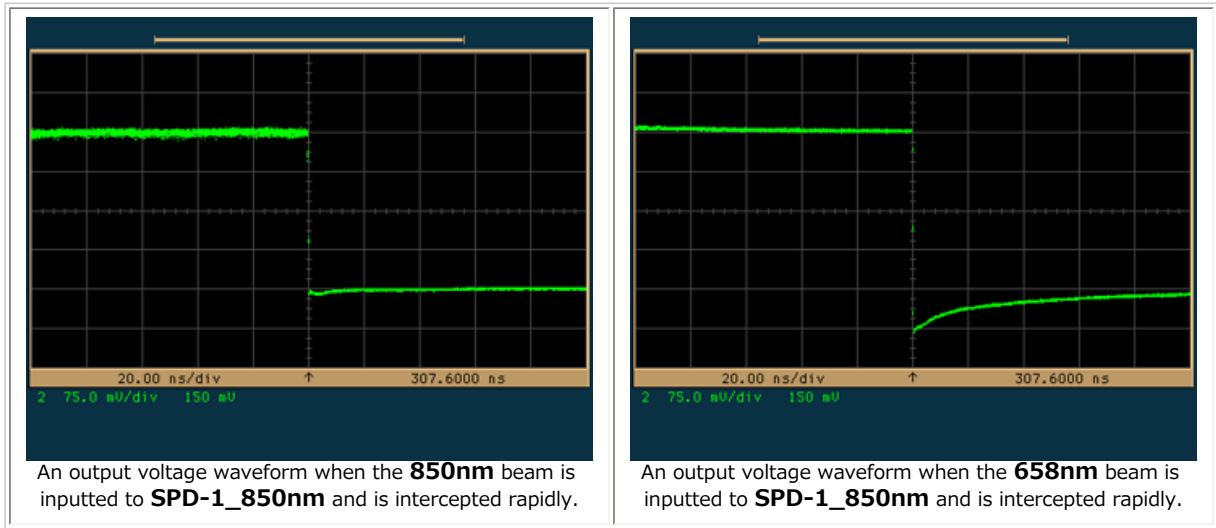
An output voltage waveform when the **850nm** beam is inputted to **SPD-1_650nm** and is intercepted rapidly.

Waveform, on the left, shows the one when the wavelength of the beam and the reference wavelength of the product are close. Output voltage, immediately after the interception of the beam, is settled down instantly to dark level, and thereafter, becomes a flat waveform.

Waveform on the right shows the one when a beam wavelength is longer than the reference wavelength of the product. It is seen that the frequency characteristic compensation of **SPD-1_650nm** with the built-in amplifier, is **insufficient** for a beam of **850nm**, and the response

of the frequency characteristic is decreasing in the high frequency range.

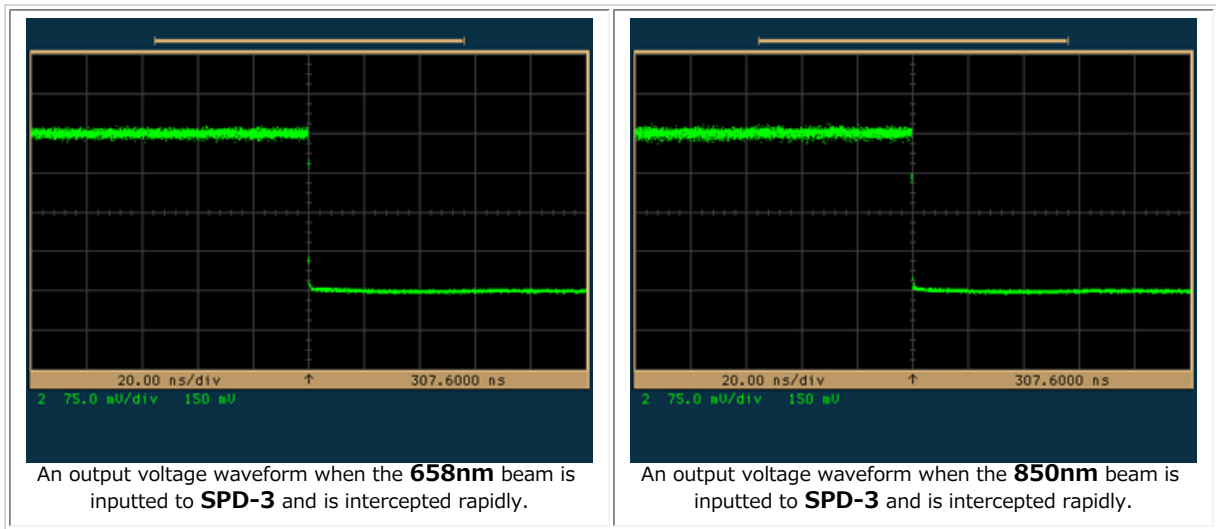
*** Example, using SPD-1_850nm**



Waveform, on the left, shows the one when the wavelength of the beam and the reference wavelength of the product are close. Output voltage, immediately after the interception of the beam, is settled down to dark level, and thereafter, becomes a roughly flat waveform.

Waveform on the right shows the one when a beam wavelength is shorter than the reference wavelength of the product. It is seen that the frequency characteristic compensation of **SPD-1_850nm** with the built-in amplifier, becomes **excessive** for the beam of **658nm**, and the response of the frequency characteristic is increasing in the high frequency range.

*** Example, using SPD-3**



Some device among the silicon photo-detectors, whose the frequency characteristic does not depend on the wavelength, also exists. Since the model of **SPD-3**, **SPA-3**, **SPD-4**, and **SPA-4** uses such type of a photodetector, there is no response change against the wavelength of the beam for those models.

When using one unit of an O/E converter to perform measurement of different wavelengths, **SPD-3**, **SPA-3**, **SPD-4**, or **SPA-4** is recommended.

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The standard model of Gravizon's O/E converter equips FC receptacle as the optical input connector, and BNC plug as an electrical signal output connector. The following lists the connector types which are offered as a customer's option.

In addition, DC power supply (by Cosel) and NA conversion adaptor (by Gravizon), which can be used together with the O/E converter, are available.

* Optical input connector option



Model with a FC receptacle (standard)

The standard model comes with **FC** type receptacle, as shown in the left figure, for the optical input connector to the O/E converter.

Also, upon the customer's request, a product, which equips with optical connectors of **SC**, **FSMA**, **F05**, or **G-OCN** type, can be offered. (Requires an extra charge) Please specify this option when ordering..

** The standard product with **FC-type** receptacle comes with a connector dust cap, however, the dust cap is not included in the product of other receptacle types.

** A **G-OCN** receptacle is connectable with any plug of **FC**, **SC**, **ST** and **F05**, whose ferrule diameter is 2.5 mm. However, **G-OCN** receptacle has a structure that holds the ferrule only, and is not suitable for use to keep connected for an extended period.

** Contact us for a product with **ST** receptacle connector.



Model with SC receptacle connector (option)



Model with FSMA receptacle connector (option)



**** Electrical signal output connector option**



Model with a BNC plug (standard)

The standard model comes with **BNC plug**, as shown in the left figure, as the electrical signal output connector of the O/E converter.

Also, upon the customer's request, a product, which equips with a **SMA jack** and a **SMA plug**, can be offered. (Requires an extra charge)
Please specify this option when ordering..

**** Contact us for the product with BNC jack.**



Model with SMA jack (option)



Model with SMA plug (option)

*** DC power supply**



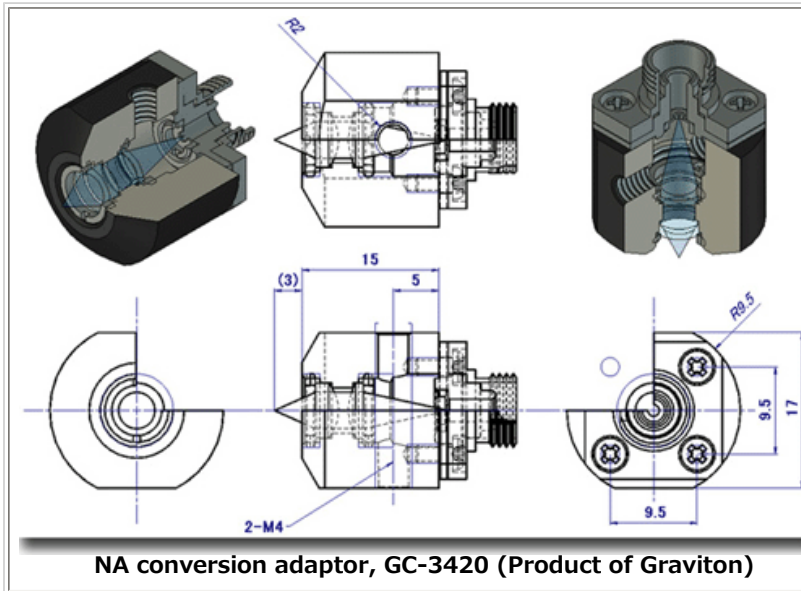
DC power supply, G1W-15 (by Cosel)

If the electronic measuring instrument to has $\pm 15V$ output terminal of LEMO 0S-4P type, DC power can be supplied to the O/E converter, using a dedicated power cable.

When there is no power supply output port on the electronic measuring instrument, another stabilized power supply have to be used in order to supply power to the O/E converter. In such cases, Cosel products of DC power supply - **G1W-15** is offered and Cosel's **G1W-15** is in stock.

**** This power supply is not included in the O/E converter product. Please separately purchase the power supply.**

* NA conversion adaptor, GC-3420



When the emitted light from a CD or a DVD pickup need to be transmitted to an O/E converter, and fiber with a large-diameter is placed over the objective lens directly, the emitted light NA is so large that sufficient quantity of light cannot be detected.

If NA conversion adaptor - **GC-3420** is used, a light in the range of up to $NA = 0.34$ out of the emitted light, can be efficiently guided to the optical fiber of $NA = 0.2$.

** **GC-3420** is not included in the O/E converter product. Please separately purchase the NA conversion adaptor.