

# Calibrated Integrating Sphere Sensors



Newport NIST traceable, calibrated integrating sphere detectors consist of the 819C and 819D series spheres, configured to measure diverging or collimated light sources, respectively. A Si, UV-enhanced Si or an InGaAs sensor are used. The available sphere sizes are between 2" and 5.3" sphere sizes.

CAL2 models feature a built-in temperature sensor and OD1 attenuator sensor. When connected to power meter models 1830-R, 1919-R, 844-PE-USB, 1938-R, or 2938-R, they will automatically recognize the attenuator On/Off position and the detector head temperature.

The spheres with a silicon photodiode are suitable for measurements ranging from 400 – 1100 nm, while the models with an InGaAs detector are suitable for approximately 800 – 1650 nm range. The UV version is optimized for wavelengths between approximately 200 - 400 nm, even though it is calibrated up to 1100 nm. All the spheres come with an SMA fiber optic connector on the North pole as a standard feature, allowing a small amount of light pickoff for wavelength measurement or any further analysis without affecting the overall system calibration.

Note that the system calibration is no longer valid if any component is changed from the original calibrated configuration. For a very high power level, elevated temperature of the integrating sphere system can affect the measurement accuracy, so the sphere must be properly cooled. Check with Newport for the complete list of integrating sphere detectors.



## Features and Benefits

- Calibrated and traceable to NIST standards
- Smallest calibration uncertainty specification in market
- Maximum power measurement up to 10 watts and higher
- Wavelengths covered 200 - 1650 nm

## Specifications

All the spheres come with an SMA fiber optic connector on the North pole as a standard feature, allowing a small amount of light pickoff for wavelength measurement or any further analysis without affecting the overall system calibration.

### Sphere-Based Fiber Optic Detectors

| No. | Model      | Spectral Range | Sphere Size | Power Range   | Maximum Measurable Power | Input Port Size | Linearity with Power | Detector Type      | Calibration Uncertainty Filter Out | Calibration Uncertainty Filter In |
|-----|------------|----------------|-------------|---------------|--------------------------|-----------------|----------------------|--------------------|------------------------------------|-----------------------------------|
| 1   | 918D-IS-1  | 400-1650 nm    | 1 inch      | 10nW to 0.35W | 350mW                    | 3mm/0.118 Inch  | ±1 %                 | InGaAs and Silicon | 400 to 430nm 1.65%                 | N/A                               |
|     |            |                |             |               |                          |                 |                      |                    | 430 to 700nm 1.1%                  |                                   |
|     |            |                |             |               |                          |                 |                      |                    | 700 to 1430nm 2.4%                 |                                   |
|     |            |                |             |               |                          |                 |                      |                    | 1430 to 1600nm 2.6%                |                                   |
| 2   | 918D-IS-IG | 800-1650 nm    | 1 inch      | 10nW to 0.1W  | 100mW                    | 3mm/0.118 Inch  | ±1 %                 | InGaAs             | 900 to 1430nm 2.4%                 | N/A                               |
|     |            |                |             |               |                          |                 |                      |                    | 1430 to 1600nm 2.6%                |                                   |
| 3   | 918D-IS-SL | 400-1100 nm    | 1 inch      | 10nW to 0.3W  | 300mW                    | 3mm/0.118 Inch  | ±1 %                 | Silicon            | 400 to 430nm 1.65%                 | N/A                               |
|     |            |                |             |               |                          |                 |                      |                    | 430 to 1000nm 1.1%                 |                                   |
|     |            |                |             |               |                          |                 |                      |                    | 1035 to 1065nm 4.3%                |                                   |

### Sphere-Based Fiber Optic Detectors (continuation #1)

| No. | Model      | Max. Power (W) vs Wavelength (nm) Responsivity (Ma/w) with Attenuator 1938/2938 | Max. Power (W) vs Wavelength (nm) Responsivity (Ma/w) with Attenuator 1936/2936 | Max. Power (W) vs Wavelength (nm) Responsivity (Ma/w) with Attenuator 1919-R/843-R/844-PE-USB | Max. Power (W) vs Wavelength (nm) Responsivity (Ma/w) with Attenuator 845-PE-RS | Max. Power (W) vs Wavelength (nm) Responsivity (Ma/w) without Attenuator 1938/2938 | Max. Power (W) vs Wavelength (nm) Responsivity (Ma/w) without Attenuator 1936/2936 | Max. Power (W) vs Wavelength (nm) Responsivity (Ma/w) without Attenuator 1919-R/843-R/844-PE-USB | Max. Power (W) vs Wavelength (nm) Responsivity (Ma/w) without Attenuator 845-PE-RS |
|-----|------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 1   | 918D-IS-1  | NA                                                                              | NA                                                                              | NA                                                                                            | NA                                                                              | 400-849 300mW                                                                      | 400-849 300mW                                                                      | 400-850 100mW                                                                                    | 400-849 300mW                                                                      |
|     |            |                                                                                 |                                                                                 |                                                                                               |                                                                                 | 850-1399 350mW                                                                     | 850-1399 350mW                                                                     | 851-1400 150mW                                                                                   | 850-1399 350mW                                                                     |
|     |            |                                                                                 |                                                                                 |                                                                                               |                                                                                 | 1400-1650 300mW                                                                    | 1400-1650 300mW                                                                    | 1401-1650 100mW                                                                                  | 1400-1650 300mW                                                                    |
| 2   | 918D-IS-IG | NA                                                                              | NA                                                                              | NA                                                                                            | NA                                                                              | 900-1650 30mW                                                                      | 900-1650 30mW                                                                      | 900-1650 30mW                                                                                    | 900-1650 30mW                                                                      |
| 3   | 918D-IS-SL | NA                                                                              | NA                                                                              | NA                                                                                            | NA                                                                              | 400-900 0.15W                                                                      | 400-900 0.15W                                                                      | 400-900 0.13W                                                                                    | 400-900 0.15W                                                                      |
|     |            |                                                                                 |                                                                                 |                                                                                               |                                                                                 | 901-1100 0.3W                                                                      | 901-1100 0.3W                                                                      | 901-1100 0.25W                                                                                   | 901-1100 0.3W                                                                      |

### Sphere-Based Fiber Optic Detectors (continuation#2)

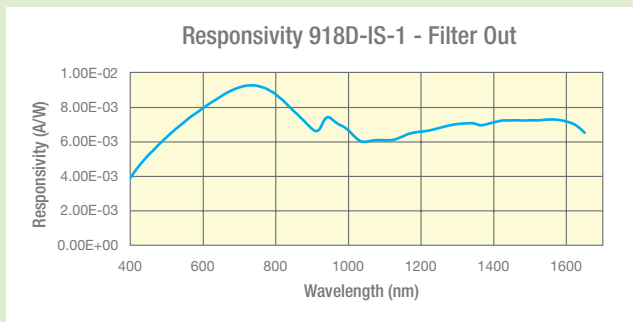
| No. | Model      | Power Range 1938/2938 | Power Range 1936/2936 | Power Range 1919-R/843-R/844-PE-USB | Power Range 845-PE-RS | Max. Beam Divergence deg° | Sensitivity to Beam Divergence ±% | Power Noise Level 1938/2938 | Power Noise Level 1936/2936 | Max. Pulse Energy | Accuracy vs Wavelength | Compliance           |
|-----|------------|-----------------------|-----------------------|-------------------------------------|-----------------------|---------------------------|-----------------------------------|-----------------------------|-----------------------------|-------------------|------------------------|----------------------|
| 1   | 918D-IS-1  | 10nW - 0.35W          | 10nW - 0.35W          | 10nW - 0.15W                        | 10nW - 0.35W          | NA                        | NA                                | 0.5nW                       | 0.5nW                       | 100μJ             | 400-1650 ±5%           | CE, UKCA, China RoHS |
| 2   | 918D-IS-IG | 10nW - 0.1W           | 10nW - 0.1W           | 10nW to 0.1W                        | 10nW - 0.1W           | NA                        | NA                                | 0.5nW                       | 0.5nW                       | 100μJ             | 900-1650 ±5%           | CE, UKCA, China RoHS |
| 3   | 918D-IS-SL | 10nW - 0.3W           | 10nW-0.3W             | 10nW to 0.3W                        | 10nW-0.25W            | NA                        | NA                                | 0.5nW                       | 0.5nW                       | 100μJ             | 400 - 1000 ±5%         | CE, UKCA, China RoHS |
|     |            |                       |                       |                                     |                       |                           |                                   |                             |                             |                   | 1001 - 1100 ±7%        |                      |

## Maximum Power Calculation

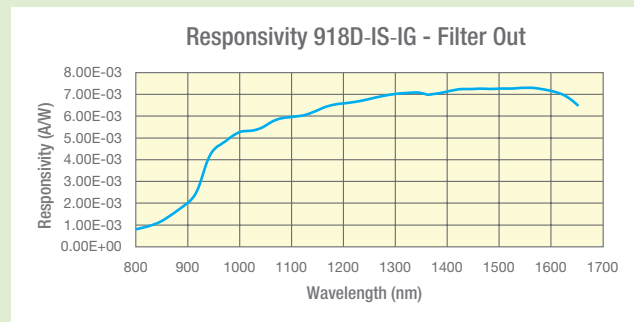
One key specification in calculating the maximum power handling capability is the detector saturation current. Typical values of a UV silicon, a Si, and a InGaAs photodiode are approximately 100  $\mu\text{A}$ , 2.5 mA, and 10 mA, respectively. Dividing the detector responsivity, R, by the saturation current density will result in the saturation power. Since the detector responsivity is

wavelength dependent, so is the saturation power level, as shown in the plot. When the responsivity is the maximum, the maximum power before saturation is the lowest. Also make sure to have a proper heat sink to the sphere for the most accurate measurement, when working with a high power light source.

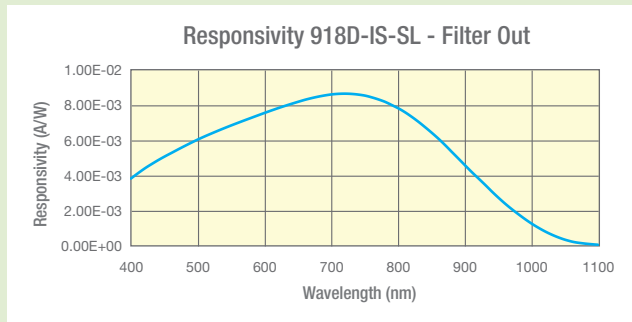
**918D-IS-1**



**918D-IS-IG**

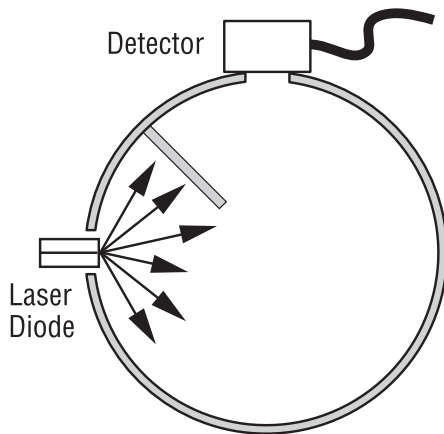


**918D-IS-SL**

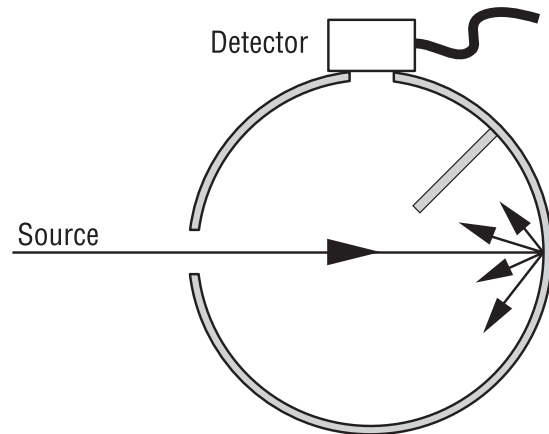


One of the major advantages of using an integrating sphere is to diffuse the input beam so that the detector readings are insensitive to errors caused by detector positioning or problems associated with overfilling, or saturation of the active area of the detector. The detector should see a completely diffused input field. Then,

a key technical consideration, when deciding which configuration one has to choose, is whether the input beam will directly hit the detector, influencing the optical power at the detector. For this purpose, each integrating sphere includes a baffle.



*819D integrating sphere configuration is ideal for divergent beam source such as an output beam from a laser diode.*



*819C integrating sphere configuration is ideal for a collimated beam source such as a collimated laser beam.*

## Ordering Information

### Sphere-Based Fiber Optic Detectors

| NO. | Model      | Description                                                  |
|-----|------------|--------------------------------------------------------------|
| 1   | 918D-IS-1  | Fiber Optic Detector, Universal, 400-1650 nm, DB15 Connector |
| 2   | 918D-IS-IG | Fiber Optic Detector, Universal, 800-1650 nm, DB15 Connector |
| 3   | 918D-IS-SL | Fiber Optic Detector, Universal, 400-1100 nm, DB15 Connector |