2 – Channel Light Sensor

SKR 1840

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Products include light sensors & systems, weather monitoring sensors, automatic weather stations, plant research systems, soil and water research systems.

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If you have any queries, please do not hesitate to contact our technical team by any of the methods above.

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1. INTRODUCTION

The SKR 1840 is a two channel sensor, with the ability to simultaneously detect and measure two separate bands of light that are chosen at the time of ordering by the purchaser. The wavelengths can be between 400 and 1050nm with bandwidths of set widths. The exact wavebands will be shown on the Calibration Certificate of each sensor for each of the four channels in each sensor.

The sensor is available with a cosine-corrected diffuser or with a narrow angle 25° filed of view. Sensors that are supplied in pairs will have normally have one sensor fitted with a cosine-corrected diffuser and one with a narrow angle filed of view. The sensor fitted with the cosine-corrected diffuser is usually mounted with the diffuser facing upwards for measuring the incident light. These sensors will have the suffix D after the part number. The sensor supplied without the narrow angle field of view is normally mounted with the light collecting apertures facing downwards, for the measurement of reflected light. These sensors have the suffix ND after the part number.

The sensor may be used with a data logger (e.g. Skye DataHog2) or other readout devices (e.g. Skye SpectroSense 2+), or alternatively with a third party display meter or logger.

The sensor output is a small current (nA) direct from the internal photodiode. No power supply is required.

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2 OPERATION

The sensor is machined from black Delrin acrylic material – 527UV, specially chosen for its resistance to UV degradation.

The optics and electronics are fully sealed and weatherproof. It is suitable for use in any orientation. The sensor may be cleaned with moist soft tissues. Avoid the use of solvents.

The upward looking sensor (SKR 1840D) is cosine-corrected and the downward looking sensor (SKR 1840ND) has a 25° field of view.

Please see Appendix 1 for the narrow angle response and area of measurement for these sensors.

The sensor may be mounted to any flat surface using the M6 threaded hole in its base. It may be hand-held in many applications.

2.1 Sensor Maintenance

SKR 1840 sensors require very little maintenance apart from cleaning. It is important keeping the light collecting surface clean and dust free.

Simply wipe clean the white diffuser disc or clear glass window with a soft cloth dampened with de-ionised water. Take care not to scratch this surface as this may affect the sensor calibration.

For all sensors, ensure the cable is not bent or curled up near the point where it exits the base of the sensor. The cable should not be tightly coiled at any point. These tips will help to increase the cable's lifetime. Skye Instruments light sensors and meters are recommended to be calibrated every 2 years. Please return to Skye for recalibration against the reference lamp and for a new calibration certificate to be issued.

3 OUTPUTS

The output from each channel is in the form of a current that is directly proportional to the amount of light falling on the sensor within the waveband of the filter for that channel. The output is linear over many decades of light level, extending well beyond natural ranges. In complete darkness the current will always be zero.

The calibration certificate will show the calibration values relevant to the model ordered.

If the outputs of the sensors channels are to be related in an attempt to gain knowledge of spectral distribution then the bandwidth of each channel should be taken into account.

The bandwidth shown on the calibration certificate is the range of wavelengths (around the centre wavelength) over which the sensitivity of the channel is greater than 50% of its peak. This is know as 'full width at half maximum' (FWHM) and is a common way of defining optical bands, and since the sensitivity of the SKR 1840 channels falls off very sharply beyond these 50% points this band definition includes most of the light detected. It is a consistent way of relating the widths of the channels.

Thus the irradiance or radiance detected by any channel, if divided by its bandwidth will then give a figure of or proportional to the light intensity per nm.

Clearly this will be a mean of light detected in the waveband of the channel.

If a voltage output is needed to drive a logger or similar, then a resistor may be employed as a current to voltage converter. Appendix 2 shows how this may be accomplished.

The maximum value of resistor that should be used in this connection is 5 to 10 kΩ. In general however the minimum value that can be used to give the desired mV output should be used. This will minimise the pickup of electrical interference. The output will be as follows :-

mV per light unit = mA per light unit x resistor (kΩ)

4 CONNECTIONS

The sensor houses two large area photodiodes which are connected back to back using a common ground connection. Thus there are three wires from each unit. These are shown below. The photodiodes are electrically fragile and no external sources of voltage or current should be applied to them.

4.1 SKR 1840 (D and ND), SKR 1840 (D and ND)/SS2, SKR 1840 (D and ND)/I Current Output Sensor with standard cable

The green wire should be connected to the common ground of the logger or readout unit. If the sensor has been supplied with a Skye meter or logger then a connector shown below will have been fitted using the same wiring colours as shown below.

Wire Colour	*Function*	*Skye Connector*
-	no connection	Pin 1
-	no connection	Pin 2
Red	Channel 2 negative current output	Pin 3
Blue	Channel 1 negative current output	Pin 4
Green	Ground	Pin 5
Grey	Cable Screen	Pin 5

4.2 SKR 1840 (D and ND) /X Current Output Sensor with Extension cable EXT/1

If your sensor requires an extension cable and it is to be plugged into a SpectroSense or DataHog then it will be fitted with an EXT/1 extension cable. The sensor cable and the extension cable will already be connected when supplied. The connector at the other end of the extension cable will be fitted as shown below.

Function	*Skye Connector*
no connection	Pin 1
no connection	Pin 2
Channel 2 negative current output	Pin 3
Channel 1 negative current output	Pin 4
Ground	Pin 5
Cable Screen	Pin 5

4.3 SKR 1840 (D and ND) /X Current Output Sensor with Extension cable EXT/3

If your sensor requires an extension cable and is supplied wire ended then it will be fitted with an EXT/3 extension cable. The sensor cable and the extension cable will already be connected when supplied. The connection details are shown below.

The blue wire should be connected to the common of the logger or readout unit.

Wire Colour	*Function*
Black	no connection
Red	no connection
Yellow	Channel 2 negative current output
Green	Channel 1 negative current output
Blue	Ground
White	Cable Screen

4.4 SKR 1840/LT Current Output Sensor with low temperature cable

These sensors are fitted with a grey cable that has the following temperature specifications;

Moving; -20°C to +80°C
Fixed; -40°C to +80°C

Wire colour	*Function*
Brown	Channel 1 negative current output
Yellow	Channel 2 negative current output
Green	Ground
Grey	Cable screen

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5. SPECIFICATIONS

Range	Two channels each between 400-1050 nm.
Construction	Dupont "Delrin" acrylic. 527UV Optical glass diffuser/window
Filters	Metal interference and/or glass depending on wavelengths & bandwidths chosen.
Detectors	Si, GaP or GaAsP photodiode depending on wavelengths and bandwidths chosen.
Cable	Screened. 7-4-C military specification. 3m. standard length.
Temperature Range	-25 to +75 °C (for a fixed PVC cable)
Humidity Range	0-100%
Dimensions	Height: 86mm Diameter: 49mm
Weight	295 grams. (with 3m cable)
Outputs	Current output (nA) varies with filters used, No voltage output as standard.
Power supply	Not required
Linearity	Better than 0.2% of scaled range
Cosine Error	Typically <5% to 60 degrees (cosine diffuser fitted)
Response Time	Typically less than 100 nanoseconds.
Absolute Calibration	Typically better than 5%. Note that this error is to some dependant on bandwidth - wide bandwidths will be less subject to error than very low bandwidth channels. Calibration traceable to the UK National Physical laboratory.

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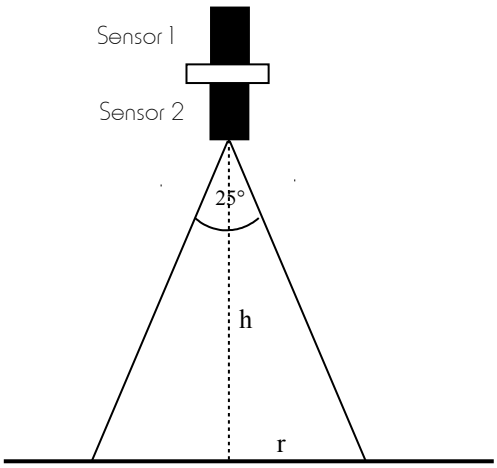
APPENDIX 1 – NARROW ANGLE LIGHT ACCEPTANCE

The SKR 1840 2- channel light sensors> The upward looking sensor is fully cosine corrected (accepts light in accordance with Lambert's Cosine Law).

For the measurement of reflected or up-welling light, the sensor has a smaller, defined field of view and can accurately measure from a defined ground area.
It has a 25° cone field of view (12.5° off perpendicular). The area of ground in view to the sensor is then defined by the height above the ground, as shown below:



Sensor 1 is cosine corrected and is measuring incident light.

Sensor 2 is narrow angle and is measuring reflected light.

Both incident and reflected light is measured simultaneously by two matching sensors, to eliminate fluctuations in solar radiation

EXAMPLES OF MEASUREMENT AREA

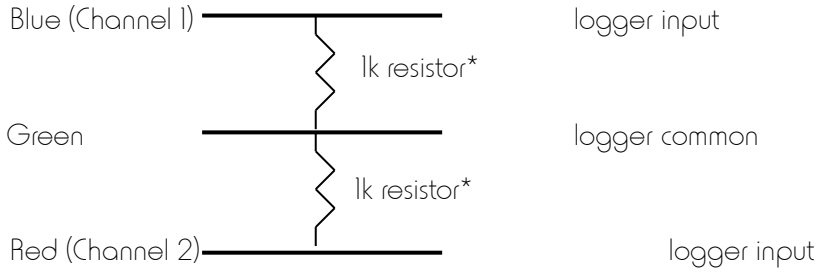
HEIGHT OF SENSOR (h)	RADIUS OF CIRCLE (r)	AREA OF MEASUREMENT
0.50m	0.11m	0.04m^2
0.75m	0.17m	0.09m^2
1.00m	0.22m	0.15m^2
1.25m	0.28m	0.24m^2
1.50m	0.33m	0.35m^2
1.75m	0.39m	0.47m^2
1.80m	0.40m	0.50m^2
2.00m	0.44m	0.62m^2

APPENDIX 2 – USING A RESISTOR FOR VOLTAGE OUTPUT

SKR 1840 2-channel light sensors are often supplied without display meters or amplifiers for connection direct to user's own data loggers. It is recommended, if possible, that a current input to the logger is used, the scaling factor is shown on the calibration certificate.

If this is not possible, then a voltage input may be used, by connecting a resistor across the input of the logger for each channel,

e.g. wiring diagram



If a precision resistor of 1K (0.1% ppm/deg.C.)* is used, then the output in mV of the sensor will be identical to the current output in µA. For example, if the calibration certificate says Channel 1 output is 30.25 µmol m^{-2} s^{-1} per µA, then when connected with a 1kΩ resistor, 30.25 µmol m^{-2} s^{-1} will give an output of 1mV.

Other values of resistance may be calculated as follows:-

Sensitivity	=	Sensitivity	/	Resistance
(µmol m^{-2} s^{-1} per mV)	=	(µmol m^{-2} s^{-1} per µA)	/	(kΩ)

Resistor values above 1 kΩ should be used with caution, as they may give rise to pickup noise. 10 kΩ is the maximum that should be used.

* as supplied by Skye Instruments.