Light Sensors for UVA SKU 420 and UVB SKU 430

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1. INTRODUCTION

Skye Instruments Limited family of specialist light sensors include sensors to measure different parts of the ultra violet, visible and infra-red spectrum for a wide range of applications.

All sensors use high quality photodiodes and spectral filters, and are individually calibrated to National Standards. Each is supplied with a traceable Calibration Certificate.

Both the SKU 420 UVA and SKU 430 UVB radiation sensors are ideal for monitoring UV levels in any application, indoor or outside and from any light source whether a UV lamp or full solar radiation. They are fully waterproof and guaranteed to 4m depth when submerged.

Skye's UV sensors can be used in many applications from the assessment of solar radiation damage on materials (weathering), solar radiation damage to human and animal skin (sunburn) to monitoring the output of UV lamps in curing or sterilisation processes.

As UV radiation levels, especially from natural solar radiation, tend to be very low, then these UV sensors contain a built in amplifier and are compatible with most datalogger, and controllers.

The sensors are cosine corrected, which means that they accept incoming light according to Lambert's Cosine Law. Essentially this means that light is measured from the hemisphere directly above the sensor.

2. CALIBRATION AND COSINE CORRECTION

2.1 Calibration

Each sensor is individually calibrated against a reference lamp. Reference lamps have been calibrated by the National Physical Laboratory, the UK's National Standards facility.

A calibration certificate traceable to National Standards is provided with each sensor.

We recommend sensors are recalibrated at a maximum interval of 2 years. Sensors can be returned to Skye for a recalibration service, or sent to your own local National Standards Laboratory.

2.2 Cosine Correction

Since the sensor is intended to measure light on a horizontal plane of unit area from a whole hemisphere, it has to collect light as would that plane. This is why the sensor is cosine corrected.

Light rays perpendicular to the sensor are fully measured, those at 90° to the perpendicular are not accepted (they would pass parallel to the surface of the plane and never intercept it). Rays at intermediate angles are treated according to the cosine of their angle to the perpendicular.

The cosine errors up to angles of 70° are minimal. Errors are less than 5% between 70-80°. At 90°, even the most insignificant acceptance of light represents an infinite error, and because of this, accurate error calculations beyond 85° are not practical. Errors from such low angle light in nature are generally not material in most studies.

The sensor has zero light acceptance at 90° and beyond.

3. USE AND CARE OF THE SENSOR

3.1 Sensor Positioning

For accurate positioning of the sensor during measurements, we recommend the use of a leveling unit (SKM 221). Great care should be given to the placing of the sensor, in order to achieve accurate and repeatable results. Avoid objects that will shade the sensor selectively, compared with the areas under study.

The sensor is fully waterproof - rated to IP65 - and entirely suitable for long term monitoring in all weathers and all environments.

Take care to secure the sensor cable to avoid chafing, trapping etc.

3.2 Sensor Maintenance

These sensors require very little maintenance apart from keeping the light collecting surface clean and dust free. This can be done using a soft cloth dampened with de-ionised water.

4. UV SENSOR RESPONSES

4.1 SKU 420 UV-A Sensor

The SKU 420 sensor measures UV-A radiation between 315-380 nm (FWHM or Full Width Half Maximum of its maximum response) according to DIN 5031 part 7.

The response curve for the UV-A sensor is shown in Figure 1. The standard calibrated units for this sensor are Watts per square metre (W/m^2). Skye offer alternative calibration in units of $mmol/(m^2/s)$ if required.

The standard output range for the SKU 420 is 0-1V = 0-100 W/m^2. Other outputs and ranges can also be supplied.

Please see the Calibration Certificate supplied with your sensor for its exact output range and calibrated units.

This sensor can be used to measure ultra-violet light from any light source, lamp or from natural solar radiation.

4.2 SKU 430 UV-B Sensor

The SKU 430 sensor measures UV-B radiation between 280-315 nm (FWHM or Full Width Half Maximum of its maximum response) according to DIN 5031 part 7.

The response curve for this sensor is shown in Figure 2. The standard calibrated units for this sensor are Watts per square metre (W/m^2). Skye offer alternative calibration in units of $mmol/(m^2/s)$ if required.

The standard output range for the SKU 430 is 0-1V = 0-10 W/m^2. Other outputs and ranges can also be supplied.

Please see the Calibration Certificate supplied with your sensor for its exact output range and calibrated units.

This sensor can be used to measure ultra-violet light from any light source, lamp or from natural solar radiation.

5. CONNECTION

5.1 Power Supply

All Skye UV sensors contain an in built amplifier which requires a power supply between 5 and 15 volts DC. The power supply voltage must be at least 2 volts higher than the maximum output of the sensor.

E.g.	**Sensor Output**	**Power Supply Required**
	0-1V, 0-2V, 0-3V	5-15V
	0-4V	6-15V
	0-5V	7-15V
	0-10V	12-15V

The current consumption of the sensors is very low, typically 1 mA, meaning that it can be powered from a logic high output of some computer cards and PLC's (check the specifications of the equipment first).

The output is linear with increasing light levels and will rise to a maximum value, usually well above the output levels specified on the Calibration Certificate. This is because the built-in amplifier will increase its output linearly with increasing light levels up to an output voltage about 2 volts less than its supply.

The precise scaling factor is given on the sensor's Calibration Certificate, either at the front of this manual or in a separate booklet if purchased with a Skye datalogger system. The zero or darkness output voltage should ideally be zero millivolts. In practice, this is rarely the case and there is often a small offset of around 0.1 millivolts, positive or negative*. Even with a 1 volt output sensor this represents an error of only 0.01% and can be reasonably ignored. With most systems it will be below the minimum resolution of measurement anyway and thus will not be resolved for measurement, it will appear as zero. If desired and possible, the offset can be measured and subtracted or added to all measurements, since it is a constant offset.

Great care should be taken not to apply power to the output lead. The output will drive loads with impedance from infinity to around 1K ohms. The output will not be damaged by momentary shorting to the common, but should never, even momentarily be shorted to the supply.

* for units with outputs of 5 volts this may be up to 1 millivolt

5.2 Wiring Details

SKU 420 and SKU 430

These sensors have been supplied wire ended for connection to the user's own equipment. The wire connections are as shown below:

Wire Colour	Function
Red	Positive Supply 5-15 volts*
not connected	
Green	Sensor signal ground
Yellow	Sensor signal positive output
Blue	Power supply ground
White	cable screen + sensor body

*5-15 volts DC for standard UV sensors

SKU 420/D/I and SKU 430/D/I

These sensors have been fitted with a 5 pin plug for a Skye DataHog2 logger connection and wired for a differential voltage or UV input socket, as shown below:

DataHog connector	Wire Colour	Function
Pin 1	Red	Positive Supply 5-15 volts*
Pin 2	not connected	-
Pin 3	Green	Sensor signal ground
Pin 4	Yellow	Sensor signal positive output
Pin 5	Blue + white	Power supply ground + cable screen + sensor body

*5-15 volts DC for standard UV sensors

SKU 420/SS2 and SKU 430/SS2 (and before 4/2011 SKU420/I and SKU 430/I)

These sensors have been fitted with a 5 pin plug for a Skye SpectroSense2 meter connection and wired for a voltage input socket of the meter, as shown below:

SpectroSense2 connector	Wire Colour	Function
Pin 1	Red	Positive Supply 5-15 volts*
Pin 2	not connected	-
Pin 3	Green	Sensor signal ground
Pin 4	Yellow	Sensor signal positive output
Pin 5	Blue + White	Power supply ground + cable screen + sensor body

*5-15 volts DC for standard UV sensors

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SKU 420/X and SKU 430/X

These sensors have been fitted with a 7pin in line socket for a light sensor extension cable (EXT/1 or EXT/3) connection, as shown below:

Extension cable connector	Wire Colour	Function
Pin 1	Red	Positive Supply 5-15 volts*
Pin 2	not connected	-
Pin 3	Green	Sensor signal ground
Pin 4	Yellow	Sensor signal positive output
Pin 5	Blue	Power supply ground
Pin 6	Grey	Sensor body + cable screen
Pin 7	not connected	-

*5-15 volts DC for standard UV sensors

Extension Cable Wiring Details

EXT/1

An EXT/1 light sensor extension cable can be used with an SKU 440/X sensor. It has a 7 pin plug at one end (to connect to the SKU 440/X) and a 5 pin plug at the other end (to plug into a Skye DataHog2 logger or a Skye SpectroSense2 meter).

5 pin plug	Wire Colour	Function
Pin 1	Black	Positive Supply 5-15 volts*
Pin 2	Red	-
Pin 3	Yellow	Sensor signal ground
Pin 4	Green	Sensor signal positive output
Pin 5	Blue, White	Power supply ground + cable screen + sensor body

*5-15 volts DC for standard UV sensors

EXT/3

An EXT/3 light sensor extension cable can be used with an SKU 440/X sensor. It has a 7 pin plug at one end (to connect to the SKU 440/X) and the other end is wire ended.

Wire Colour	Function
Black	Positive Supply 5-15 volts*
Red	-
Yellow	Sensor signal ground
Green	Sensor signal positive output
Blue	Power supply ground
White	Cable screen + sensor body

*5-15 volts DC for standard UV sensors

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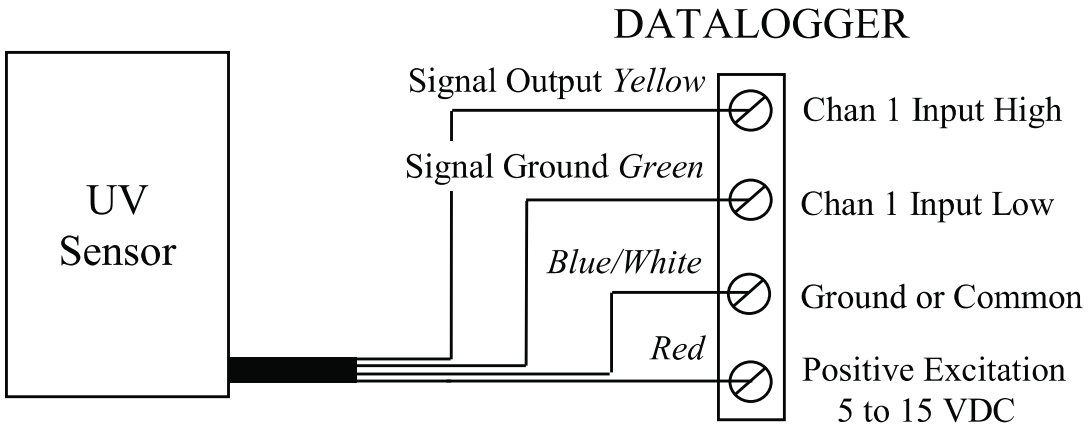
Example of Connection to a Datalogger



Typical connections to a datalogger with differential voltage inputs

FIGURE 1

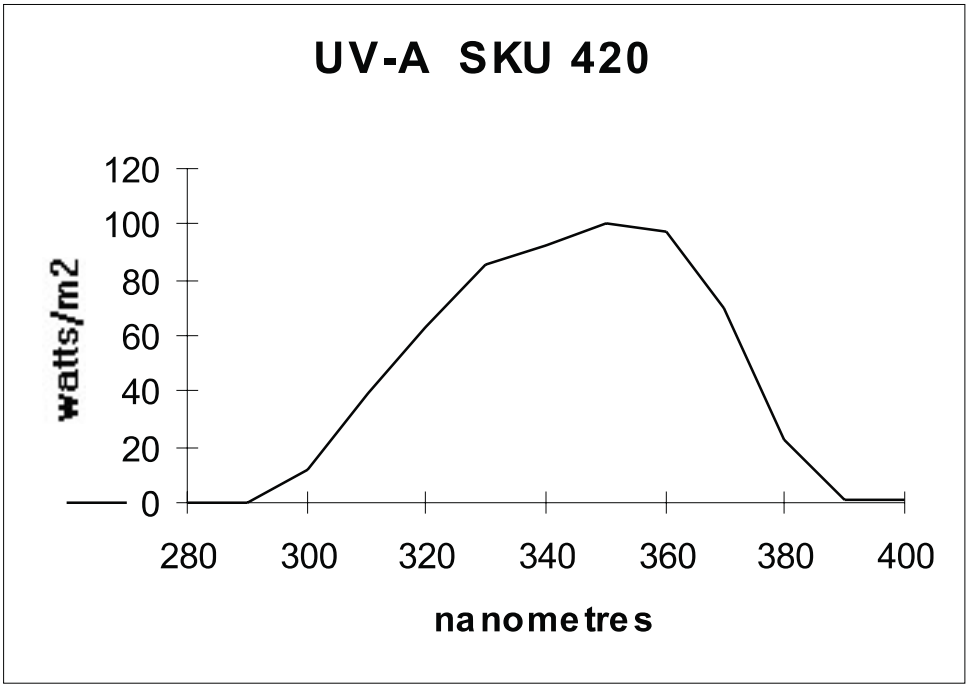


FIGURE 2

SENSOR SPECIFICATIONS

DIMENSIONS	34 mm diameter x 69 mm
WEIGHT	200 g with 3m cable
CONSTRUCTION	Material - anodised aluminium, Sealed to IP68, submersible to 4m Cosine Corrected head, specially formulated diffuser Screened cable, military specification, 7-1-4C. 3m as standard, longer to order
DETECTOR	SiC or GaAsP photocell depending on sensor
FILTERS	Optical glass and metal interference to military spec
BANDWIDTH	UVA - 315 - 380 nm, peak at 347 nm UVA - 280 -315 nm, peak at 297 nm
WORKING RANGE	UV-A 0-100 W/m^2, UV-B 0-5 W/m^2, other ranges available
OPERATING RANGE	0-100 % RH, -30 to +60°C
OUTPUT SIGNAL	Standard 0-1V(options up to 0-10V)
ZERO OFFSET RANGE	+/- 1 mV (Each sensor individually calibrated)
POWER SUPPLY	5-15 V DC @ 1 mA
LINEARITY	Better than 1% (0-1V with 9V power supply)
ABSOLUTE CALIBRATION ERROR	Typical <3%, max. 5%. Traceable to UK National Standards (NPL)
COSINE ERROR	3% (max 5% up to 80°)
THERMAL DRIFT OF OUTPUT	0.075 mV/°C (-20 to +50°C)
THERMAL DRIFT OF ZERO OFFSET	Typical 0.03 mV/°C (-20 to +50°C)
LONG TERM STABILITY	± 2%
RESPONSE TIME	Better than 10 ms
OUTPUT IMPEDANCE	500 W

Wiring details updated 9/2011

Manual version:UVA/B rev.2