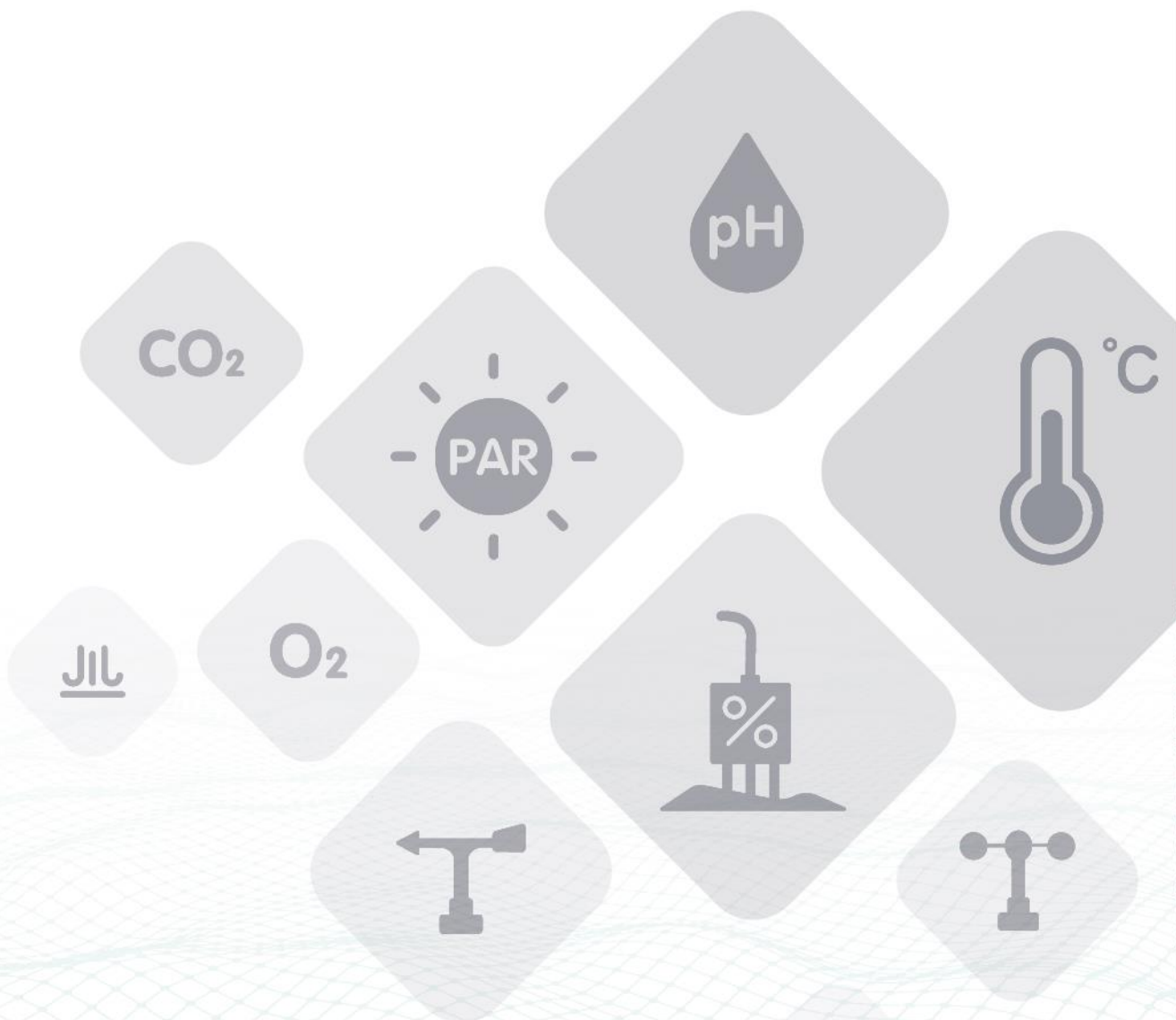




SENSECAP

Light Intensity Sensor User Guide

Version: V1.0



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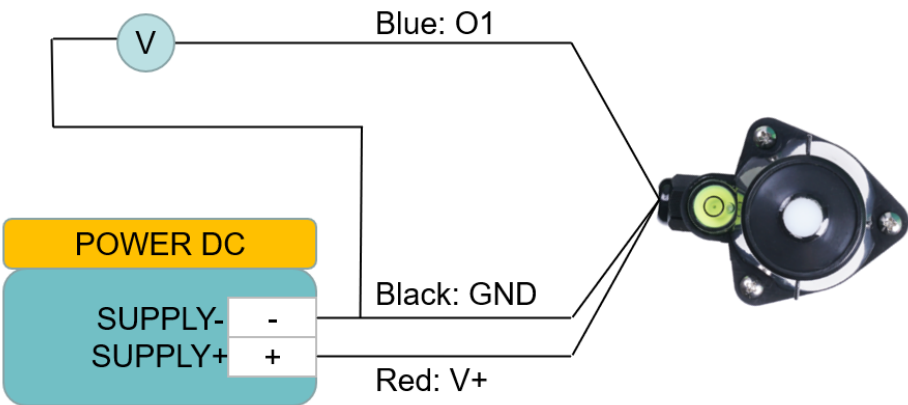
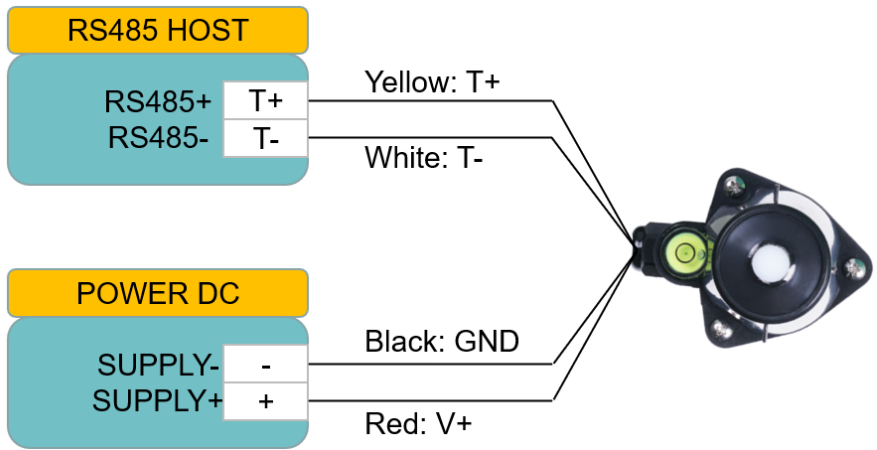
1 Product Introduction

S-Light-01 ambient light sensor, or illuminance sensor, measures the ambient illuminance. Each sensor is calibrated and offers excellent accuracy and consistency. The sensor is applicable for science research, solar power , greenhouse, weather station etc.

- Measurement range to 200000lux
- Output interface with RS485, Voltage
- Level indicator and spring loaded for installation
- Water proof to IP66 can be used outdoor directly
- High accuracy and consistency with excellent stability
- Reverse power protection and Built-in TVS/ESD protection

Specifications		
Output Interface	Analog Voltage 0-2V (Output resistance ~0ohm)	RS485 Modbus-RTU
Power Supply	3.9-30V/DC	3.9-30V/DC
Power Consumption	7mA@24V DC	7mA@24V DC
Illuminance Range	Range:0 ~ 2000 Lux, Accuracy: ±5% , Resolution:1lux Range:0 ~ 5000 Lux, Accuracy:±5% , Resolution:1lux Range:0 ~ 10000 Lux, Accuracy:±5% , Resolution:1lux Range:0 ~ 20000 Lux, Accuracy:±5% , Resolution:1lux Range:0 ~ 100000 Lux, Accuracy:±5% , Resolution:1lux Range:0 ~ 200000 Lux, Accuracy:±6% , Resolution:1lux	
Direction Error	30°±3%,60°±6%,80°±24% (Cosine Characteristics)	
IP Ratings	IP66	
Operating Temperature	-40~85°C	
Installation	Screw hole * 3	
Cable Length	2 meters	
Dimension	75*55*58mm	

2 Wiring

Type	Wiring diagram
Analog Voltage Output	<p>Red (V+): Power Supply + Black (G): Power Supply - Blue (O1): Analog Output</p> 
RS485 Modbus	<p>Red (V+): Power Supply + Black (G): Power Supply - Yellow (T+): RS485+/A/T+ White (T-): RS485-/B/T-</p>  <p>ALL RS485 communication parameters (Modbus Slave Address, baud rate, parity, data bits, stopbits) are set in internal register and can be saved when power down, the factory setting is ADDRESS=1, BAUDRATE=9600bps,PARITY=NONE, DATABITS=8bits, STOPBITS=1bit;</p> <p>Sometimes you may FORGET the communication settings, In this case, you can open the shield module and press the SET button for more than 3 seconds, then all the communication parameters are reset to factory setting, then communicating with the sensor using the factory setting to set your desired settings. Please re-power up the sensor to make the settings effective.</p>

3 Dimension



Seed

4 Safety, Care and Installation

4.1 Care and Safety

Keep the white optical lens on the top of the sensor clean and wiping lens by soft rag. Always checking the horizontal bubble to keep the sensor horizontally placed.

4.2 Installation

Adjusting the screw and checking the horizontal bubble to make the sensor horizontally installed.

5 Output Signal Conversion

Output Interface	Parameters Range	Conversion Formula
Analog Voltage Output 0-2V	ILLU: 0-2000 lux ILLU: 0-5000 lux ILLU: 0-10000 lux ILLU: 0-20000 lux ILLU: 0-100000 lux ILLU: 0-200000 lux	$ILLU = RANGE * VLOTAGE / 2.00$.When RANGE=2000 lux and VOLTEGE=1.0V,then $ILLU = 2000 * 1.00 / 2.00 = 1000$ lux
RS485 Modbus-RTU	ILLU: 0-2000 lux ILLU: 0-5000 lux ILLU: 0-10000 lux ILLU: 0-20000 lux ILLU: 0-100000 lux ILLU: 0-200000 lux	$ILLU = (32\text{-Bits REGISTER VALUE})$.When REGISTER VALUE=1000,then $ILLU = 1000$ lux

6 RS485 Modbus Protocol

6.1 Modbus Protocol

Modbus Protocol is widely used to establish master-slave communication between intelligent devices or sensors. A MODBUS message sent from a master to a slave contains the address of the slave, the function code (e.g. 'read register' or 'write register'), the data, and a check sum (LRC or CRC).

The sensor is RS485 interface with Modbus protocol. The default serial communication settings is slave address 1, Modbus RTU, 9600bps, 8 data bits and 1 stop bit. All communication settings can be changed with Modbus command, and take effective after re-power up the sensor.

Following Modbus function code are supported by sensor.

Modbus Function Code 0x03 : used for reading holding register.

Modbus Function Code 0x04 : used for reading input register.

Modbus Function Code 0x06 : used for writing single holding register.

Modbus Function Code 0x10: used for writing multiple holding register.

6.2 Modbus Register

Parameters	Register Addr. (HEX/DEC)	Data Type	Modbus Function Code(DEC)	Range and Comments	Default Value
ILLUMINANCE HIGH 16 Bits	0x0000 /0	UINT16 RO	3/4	0-200000 for 0- 200000lux	N/A
ILLUMINANCE LOW 16 Bits	0x0001 /1	UINT16 RO	3/4		
STATUS	0x0002 /2	UINT16 RO	3/4	BIT15-BIT2: Reserved BIT1: Sensor Error BIT0: Over Range	N/A
RESERVED	0x0003 /3	UINT16 RO	3/4	0	0
RESERVED	0x0004 /4	UINT16 RO	3/4	0	0
RESERVED	0x0004 /5	UINT16 RO	3/4	0	0
SLAVEADDRESS	0x0200 /512	UINT16 R/W	3/6/16	0-255	1
BAUDRATE	0x0201 /513	UINT16 R/W	3/6/16	0-6 0:1200bps 1:2400bps 2:4800bps 3:9600bps 4:19200bps 5:38400bps	3:9600bps
PROTOCOL	0x0202 /514	UINT16 R/W	3/6/16	0 0:Modbus RTU	0:Modbus RTU
PARITY	0x0203 /515	UINT16 R/W	3/6/16	0-2 0:None 1:Even 2:Odd	0:None Parity
DATABITS	0x0204 /516	UINT16 R/W	3/6/16	1 1:8 databits	1:8 databits
STOPBITS	0x0205 /517	UINT16 R/W	3/6/16	0-1 0:1 stopbit	0:1 stopbit

				1:2 stopbits	
RESPONSEDELAY	0x0206 /518	UINT16 R/W	3/6/16	0-255 for 0-2550 milliseconds	0
ACTIVEOUTPUTINTER VAL	0x0207 /519	UINT16 R/W	3/6/16	0-255 for 0-255 seconds.	0

NOTE: UINT16:16 bit unsigned integer, INT16:16bit signed integer

NOTE: RO: Register is Read Only, R/W: Register is Read/Write

NOTE: HEX is Hexadecimal (data with 0x/OX prefix), DEC is Decimal

6.3 Modbus Register Detail Description

ILLUMINANCE - HIGH 16 Bits		
ILLUMINANCE - LOW 16 Bits		
Data Range	0-200000 for 0-200000 lux	Default: N/A
Power Down Save	N/A	

Note: Illuminance value

Example: When REGISTER(HIGH 16 Bits) = 0x0003 (HEX format) and REGISTER(LOW 16 Bits) = 0x0D40 (HEX format), then VALUE=(0x0003 *65536+0x0D40) = 200000lux

STATUS		
Data Range	BIT15-BIT2: Reserved, always 0 BIT1: Bit set when sensor error BIT0: Bit set when overrange	Default: N/A
Power Down Save	N/A	

Note: Sensor status

SLAVEADDRESS --- Modbus Slave Address		
Data Range	0-255	Default: 1
Power Down Save	YES	

Note: Please re-power on the sensor to take effective after set.

BAUDRATE --- Serial Comm Baudrate		
Data Range	0-5 0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps	Default: 3
Power Down Save	YES	

Note: Please re-power on the sensor to take effective after set.

PROTOCOL --- Serial Comm Protocol		
Data Range	0 0:Modbus RTU	Default: 0
Power Down Save	YES	

Note: Please re-power on the sensor to take effective after set.

PARITY --- Serial Comm Parity		
Data Range	0-2 0:NONE 1:EVEN 2:ODD	Default: 0
Power Down Save	YES	

Note: Please re-power on the sensor to take effective after set.

DATABITS --- Serial Comm Databits		
Data Range	1 1:8 databits	Default: 1
Power Down Save	YES	

Note: Please re-power on the sensor to take effective after set.

STOPBITS --- Serial Comm Stopbits		
Data Range	0-1 0:1 stopbit 1:2 stopbits	Default: 0
Power Down Save	YES	

Note: Please re-power on the sensor to take effective after set.

RESPONSEDELAY --- Serial Comm Response Delay		
Data Range	0-255 for 0-2550 milliseconds, 0 for disabled	Default: 0
Power Down Save	YES	

Note: Please re-power on the sensor to take effective after set.

Note: Sensor will delay a period before response to master request command.

Example: When set to 5 and receive a request from master device, then sensor will delay $5 \times 10\text{ms} = 50\text{ms}$, then response to master.

ACTIVEOUTPUTINTERVAL --- Serial Comm Active Output Interval time		
Data Range	0-255 for 0-255 seconds, 0 for disabled	Default: 0
Power Down Save	YES	

Note: Please re-power on the sensor to take effective after set.

Note: Sensor will output the data actively without any master request command.

Note: Only ONE sensor should be on RS485 network, or there will be data collision and corrupt the data on line.

Note: Refer to SET button to exit the Active Output Mode.

Example: When set to 5 then sensor will output the data every 5 seconds without any master request command.

6.4 Modbus Function Code

For description below, data started with 0X/0x means that it's in HEX format.

6.4.1 Function Code 3 Protocol Example

Master Request: AA 03 RRRR NNNN CCCC

AA	1 byte	Slave Address,0-255
0x03	1 byte	Function Code 3
RRRR	2 byte	Starting Register Addr
NNNN	2 byte	Quantity of Register to read
CCCC	2 byte	CRC CHECKSUM

Slave Response: AA 03 MM VV0 VV1 VV2 VV3... CCCC

AA	1 byte	Slave Address,0-255
0x03	1 byte	Function Code 3
MM	1 byte	Register Data Byte Count
VV0,VV1	2 byte	Register Value (High8bits first)
VV2,VV3	2 byte	Register Value (High8bits first)
...	...	Register Value (High8bits first)
CCCC	2 byte	CRC CHECKSUM

Example: Read register 0x0200-0x0201,that is slave address and baud rate.

Master Request:01 03 0200 0002 C5B3

Slave Addr.	1 byte	0x01
Function Code	1 byte	0x03
Starting Register Addr.	2 byte	0x0200
Quantity of Register to read	2 byte	0x0002
Checksum	2 byte	0xC5B3

Slave Response:01 03 04 00 01 00 03 EB F2

Slave Addr.	1 byte	0x01
Function Code	1 byte	0x03
Register Data Byte Count	1 byte	0x04
Register Value:	2 byte	0x00(HIGH 8 Bits)
Address		0x01(LOW8 Bits)
Register Value:	2 byte	0x00(HIGH 8 Bits)
Baudrate		0x03(LOW8 Bits)
Checksum	2 byte	0xEBF2

6.4.2 Function Code 4 Protocol Example

Master Request: AA 04 RRRR NNNN CCCC

AA	1 byte	Slave Address,0-255
0x04	1 byte	Function Code 4
RRRR	2 byte	Starting Register Addr
NNNN	2 byte	Quantity of Register to read
CCCC	2 byte	CRC CHECKSUM

Slave Response: AA 04 MM VV0 VV1 VV2 VV3... CCCC

AA	1 byte	Slave Address,0-255
0x04	1 byte	Function Code 4
MM	1 byte	Register Data Byte Count
VV0,VV1	2 byte	Register Value (High8bits first)
VV2,VV3	2 byte	Register Value (High8bits first)
...	...	Register Value (High8bits first)
CCCC	2 byte	CRC CHECKSUM

Example: Read register 0x0000-0001,that is illuminance value:

Master Request: 01 04 00 00 00 02 71 CB

Slave Addr.	1 byte	0x01
Function Code	1 byte	0x04
Starting Register	2 byte	0x0000

Addr.		
Quantity of Register to read	2 byte	0x0002
Checksum	2 byte	0x71CB

Slave Response: 01 04 04 0000 004D 3BB1

Slave Addr.	1 byte	0x01
Function Code	1 byte	0x04
Register Data Byte Count	1 byte	0x04
Register Value: Illuminance high 16 bits	2 byte	0x00(HIGH 8 Bits)
		0x00(LOW8 Bits)
Register Value: Illuminance low 16 bits	2 byte	0x00(HIGH 8 Bits)
		0x4D(LOW8 Bits)
Checksum	2 byte	0x3BB1

ILLUMINANCE=0x0000*65536+0x004D=77lux

6.4.3 Function Code 6 Protocol Example

Master Request: AA 06 RRRR VVVV CCCC

AA	1 byte	Slave Address,0-255
0x06	1 byte	Function Code 6
RRRR	2 byte	Register Addr (High8bits first)
VVVV	2 byte	Register Value (High8bits first)
CCCC	2 byte	CRC CHECKSUM

Slave Response: AA 06 RRRR VVVV CCCC

AA	1 byte	Slave Address,0-255
0x06	1 byte	Function Code 6
RRRR	2 byte	Register Addr (High8bits first)
VVVV	2 byte	Register Value (High8bits first)
CCCC	2 byte	CRC CHECKSUM

Example: Write Register 0x0200, that is change Modbus slave address to 2.

Master Request: 01 06 0200 0002 09B3

Slave Addr.	1 byte	0x01
Function Code	1 byte	0x06
Register Addr.	2 byte	0x0200
Register Value	2 byte	0x0002
Checksum	2 byte	0x09B3

Slave Response: 01 06 0200 0002 09B3

Slave Addr.	1 byte	0x01
Function Code	1 byte	0x06
Register Addr.	2 byte	0x0200
Register Value	2 byte	0x0002
Checksum	2 byte	0x09B3

6.4.4 Function Code 16 Protocol Example

Master Request: AA 10 RRRR NNNN MM VVVV1 VVVV2 ...CCCC

AA	1 byte	Slave Address,0-255
0x10	1 byte	Function Code 0x10
RRRR	2 byte	Starting Register Addr
NNNN	2 byte	Quantity of Register to write
MM	1 byte	Register Data Byte Count
VVVV1	2 byte	Register Value(High8bits first)
VVVV2	2 byte	Register Value(High8bits first)
...	...	Register Value(High8bits first)
CCCC	2 byte	CRC CHECKSUM

Slave Response: AA 10 RRRR NNNN CCCC

AA	1 byte	Slave Address,0-255
0x10	1 byte	Function Code 0x10
RRRR	2 byte	Starting Register Addr
NNNN	2 byte	Quantity of Register to write
CCCC	2 byte	CRC CHECKSUM

Example: Write Register 0x0200-0x0201, that is set slave address to 1, and baudrate to 19200bp.

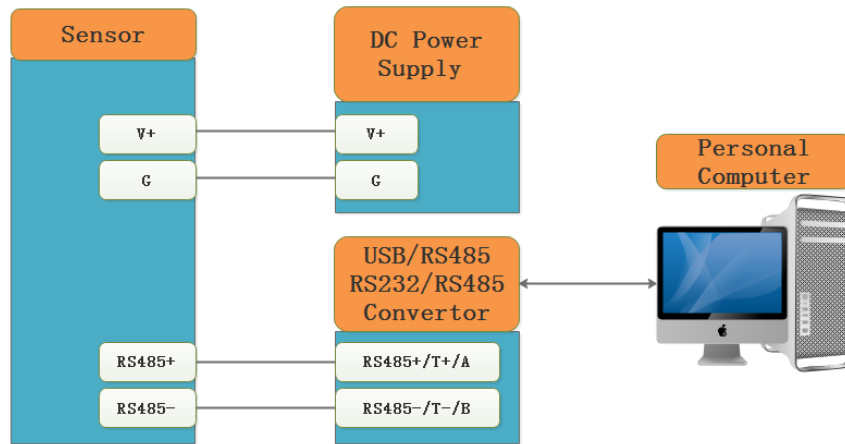
Master Request: 01 10 0200 0002 04 0001 0004 BACC

0x01	1 byte	Slave Addr.
0x10(HEX)	1 byte	Function Code 0x10
0x0200	2 byte	Starting Register Addr
0x0002	2 byte	Quantity of Register to write
0x04	1 byte	Register Data Byte Count
0x0001	2 byte	Register Value: Slave Address 1
0x0004	2 byte	Register Value: Baudrate 19200bps
0xBACC	2 byte	CRC CHECKSUM

Salve Response: 01 10 0200 0002 4070

0x01	1 byte	Slave Addr.
0x10(HEX)	1 byte	Function Code 0x10
0x0200	2 byte	Starting Register Addr(High8bits first)
0x0002	2 byte	Quantity of Register to write(High8bits first)
0x4070	2 byte	CRC CHECKSUM

7 Software Configuration Utility



You can use software listed below to try reading/writing the register of sensor,
<https://github.com/ed-chemnitz/qmodbus/releases>