Light intenzity sensor with Modbus RTU communication

P21M

P20M

- Modbus RTU communication over RS485 line
- Wide range of power supply

The P21M sensors are intended for general-purpose application in control and regulation systems for the light intensity measurement in interior (P20M) or in outside (P21M) - for example for automatic switching lighting. The values from the sensor, which is incorporated in the side wall of the plastic head are evaluated by the processor that transmits the measured data to the superior system.
By standard, the sensors P21M are supplied in pass-through design with two glands. Only sensors ordered as end pieces (type P21M/K) are equipped with a single gland.

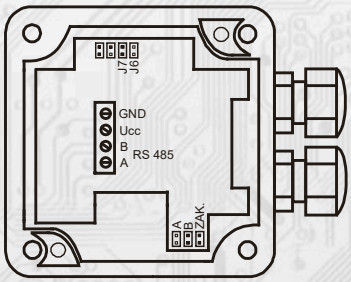
Technical parameters

Power supply	12 až 30 VDC	Communication	RS485, protocol ModBus RTU, 8bitů, 1 stop bit, without parity
Current consumption	max. 20 mA		
Fotosensor	BPW21	Baud rate	1200 ÷ 19200 Bd
Spectral sensitivity	350 až 820 nm	Configuration software	REGMET MBSet; freeware; www.regmet.cz
Measuring range	0 lx ÷ ≈20000 lx = 0 ÷ ≈60000	RS485 galvanic isolation	no
Max. Measuring range	0 ÷ ≈ 65535*	Protection type	IP65
Ambient temperature	-30 to 50°C	Terminal board	COB (wires max. 1,5 mm^2)
Storage temperature range	-30 to 70°C	Cable gland	PG9 / 8 mm

* Max. 65535 can never be reached as it is reduced by a calibration value at 0 lx.

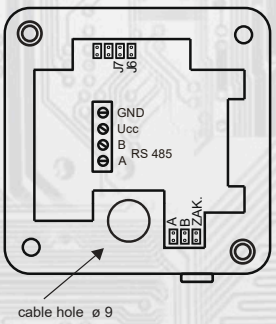
Arrangement of jumpers and connectors:

P21M



Terminal Ucc.....power supply
Terminal GND.....common terminal
Terminals A, B RS485
A.....definition of idle status (conductor A)
B.....definition of idle status (conductor B)
ZAK....termination resistor 120R
J6.....jumper "service" - enabling writing the configuration value
J7.....jumper "service" (setting a fixed address 255 and setup communication speed of 19200 baud)

P20M



Properties of the communication protocol

Protocol Modbus RTU with adjustable Baud rate 1200 - 57600 Bd, 8 bits, no parity, 1 stop bit, line RS485, half-duplex operation

Description of data registers:
To read these registers use **command no. 03** "register reading" (0x03 Read Holding Registers).

The light intensity values from the BPW21 photodiode evaluate electronics that send the data over the RS485 line to the control system:

Registr 0x0005 ** (light intenzity)
Range is 2 bytes, The number format is unsigned integer

Registr 0x0005 ** (light intenzity in %) 0x0000 to 0x03E8 (1000dek)
Range is 2 bytes, The number format is unsigned integer multiplied by a constant 10.

0x0001 = 0,1%, 0x03E8 = 100% (resolution 0,1%)

Note: It depends on the set ZD_NPR and ZD_SPR values (see Description of configuration registers).

** During the transfer the addresses of registers are indexed from zero, i.e. register 0x0005 is physically sent through the bus bar as 0x0004... (zero based addressing).

REGMET s.r.o. • Bynina 186, 757 01 Valašské Meziříčí • tel.: 571 612 622 • fax.: 571 615 392 • mobil: 602 773 550
http://www.regmet.cz • e-mail: obchod@regmet.cz

Description of conguration registers:

EXTENDED REGISTERS can only be modified if the J6 jumper (enabling writing the configuration values) and J7 jumper (setting the fixed sensor address to 255 and setting the baudrate to 19 200 Bd - these network variables are reserved for configuration only and, therefore, if the required sensor address of 255 is set, the sensor modifies to 254 automatically) are inserted. In case only the J7 jumper is inserted, it is possible to use a fixed address and baudrate without the risk of overwriting the configuration parameters.
The configuration is carried out by command 16 (multiple register preset 0x10). The changes are written and configuration is finished by extracting the J6 and J7 jumpers. No reset is necessary for proper function.
X Reg = 8 byte, ie 4 registry MODBUS

Mark	Content of X Reg								Address range X Reg **	
X Reg	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	[hex]	[dek]
X Reg 0	-	-	ZD_TEXT/0	ZD_TEXT/1	ZD_TEXT/2	ZD_TEXT/3	ZD_TEXT/4	ZD_TEXT/5	0x2001 ÷ 0x2004	8193 ÷ 8196
X Reg 1	ZD_TEXT/6	ZD_TEXT/7	ZD_TEXT/8	ZD_TEXT/9	ZD_NPR/Hi	ZD_NPR/Lo	ZD_SPR/Hi	ZD_SPR/Lo	0x2005 ÷ 0x2008	8197 ÷ 8200
X Reg 2	ZD_CIT	ZD_TOD	SK_ADR	SK_SPD	-	-	-	-	0x2009 ÷ 0x200C	8201 ÷ 8204

** During the transfer the addresses of registers are indexed from zero, i.e. register 0x2001 is physically sent through the bus bar as 0x2000... (zero based addressing).

Bytes variables:

ZD_TEXT The custom text field,range is 10 bytes. It is determined for the client´s identification of the device.

ZD_NPR A value corresponding to 0% of the customer's range of intensity. The value is related to the measured intensity value (register 0x0005). The range is 2 byte. The number format unsigned integer. Takes the value 0x0000 až 0xFFFF.

ZD-SPR A value corresponding to 100% of the customer's range of intensity. The value is related to the measured intensity value (register 0x0005). The range is 2 byte. The number format unsigned integer. Takes the value 0x0000 až 0xFFFF.

SK_CIT Sensor sensitivity. The range is 1 byte. Takes the value 0.x00=0 to 0x0a=10

Value 0x00 = 0	HW amplification 4x	-	18 bit conversion and quarter range
Value 0x01 = 1	HW amplification 2x	-	17 bit conversion and half range
Value 0x02 = 2	HW amplification 1x	-	16 bit conversion
Value 0x03 = 3	SW masking 1 lsb	-	15 bit conversion
Value 0x04 = 4	SW masking 2 lsb	-	14 bit conversion
Value 0x05 = 5	SW masking 3 lsb	-	13 bit conversion
Value 0x06 = 6	SW masking 4 lsb	-	12 bit conversion
Value 0x07 = 7	SW masking 5 lsb	-	11 bit conversion
Value 0x08 = 8	SW masking 6 lsb	-	10 bit conversion
Value 0x09 = 9	SW masking 7 lsb	-	9 bit conversion
Value 0x0A = 10	SW masking 8 lsb	-	8 bit conversion

SK_TOD The sensor's response time- indicates the time between two light intensity outputs. It is used to adjust the sensor's non-sensitivity for short-term shading. The range is 1 byte. The number format unsigned integer. The base time is 200ms multiplied by SK_TOD.
So the value 0x01 = 200ms, the value 0xFF= 51s

SK_ADR Network address. Range is 1 byte. It acquires the values 0 ÷ 255 dek, whereas the address 0 is reserved for the broadcast and the sensor does not respond to it, the address 255 is reserved for the controller configuration. Thus the range of available addresses is 1 ÷ 254. The number format is unsigned integer.

SK_SPD Communication speed. The range is 1 byte. The value is 0 ÷ 4. The number format is unsigned integer.

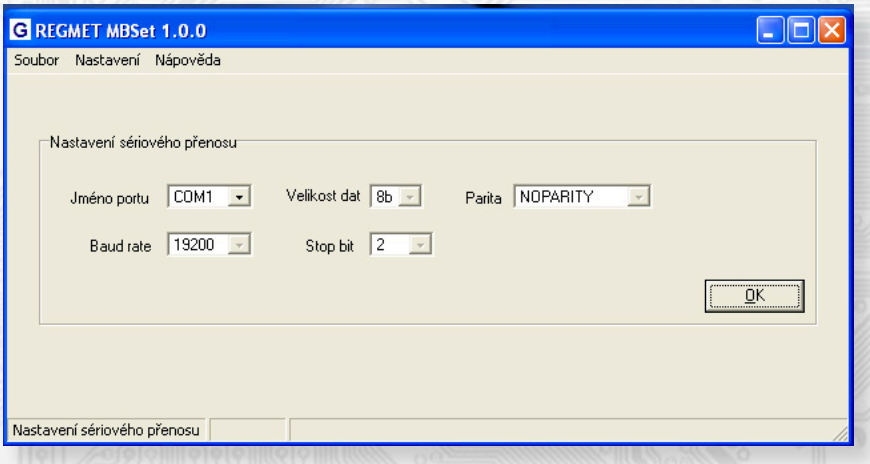
value SK_SPD [hex]	0x00	0x01	0x02	0x03	0x04
value SK_SPD [dek]	0	1	2	3	4
Baud rate [Bd]	1200	2400	4800	9600	19200

***Users text field* (ZD_TEXT)** - It is determined for the client´s identification of the device.
***Baud rate* (SK_SPD)** - ,Selection of baudrate in the range of 1200 ÷ 19200 Bd in case a converter is connected in the serial line.
***Network address* (SK-ADR)** - selection of network address (range 1 - 254) in case a converter is connected in the serial line.
SK_CIT Sensor sensitivity. Standard is HW gain of 1x; with greater gain (2x, 4x) it is necessary to ensure that there is no overflow, otherwise the DAC internal protection would reset the device regularly.
ZD_NPR A value corresponding to 0% of the customer's range of intensity. The value is related to the measured intensity value (register 0x0005).
ZD-SPR A value corresponding to 100% of the customer's range of intensity. The value is related to the measured intensity value (register 0x0005).
SK_TOD The sensor's response time- indicates the time between two light intensity outputs. It is used to adjust the sensor's non-sensitivity for short-term shading.

Načíst data (Load data) - loads currently set configuration from the converter's memory.
Uložit data (Save data) – saves the configuration set in the application to the converter's memory.
Soubor →Uložit konfiguraci (File →Save configuration) – saves the configuration set in the configuration window into an *.ini file.
Soubor →Načíst konfiguraci (Load configuration) – sets the values in the configuration window as per the selected file.

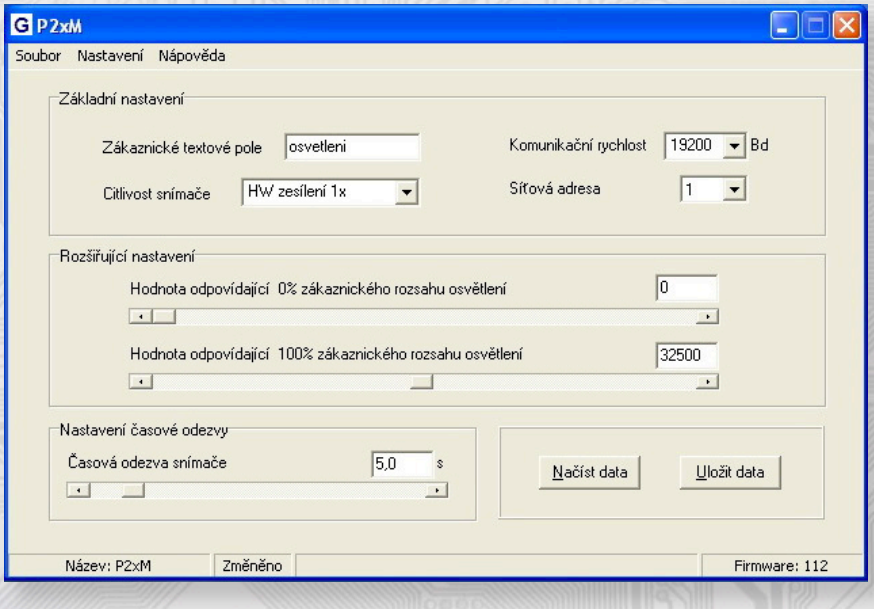
SW configuration of transmitter using the REGMET MBset program:

The conguration application REGMET MBSset is freely available at producer´s web pages. The transmitter can be configured only when the jumper J6 is inserted before the connection of supply voltage (reset) and J7 jumper (setting the fixed sensor address to 255 and setting the baudrate to 19 200 Bd - these network variables are reserved for configuration only and, therefore, if the required sensor address of 255 is set, the sensor modifies to 254 automatically) are inserted. In case only the J7 jumper is inserted, it is possible to use a fixed address and baudrate without the risk of overwriting the configuration parameters.
After the launching of REGMET MBSset program, the basic window is opened and the connected sensor is automatically connected with the hosting PC. After running the REGMET MBSet application, the basic window opens, which allows general setup of the application. First, in Nastavení
(Settings)→Sériový přenos (Serial tranfer), select the port to which the RS485 communication interface is connected



Other options in the settings:

Nastavení (Setting)→Automaticky rozpoznat komponentu při startu programu (Detect component automatically upon application startup) – if a functional converter with jumpers J6 and J7 (or at least J7) inserted is connected to the line prior to running the application, the converter's configuration window opens automatically.
Nastavení (Setting)→Načíst uloženou konfiguraci při spuštění (Load saved configuration upon startup – parameters selected in Nastavení (Settings)→Sériový přenos (Serial transfer) are set every time the application is started.
Nastavení (Setting)→Zobrazovat plovoucí nápovědu (Show floating help) – when pointing on a configuration value, a help is displayed for that option.
Nastavení (Setting)→Výběr komponenty (Component selection) – by selecting an RF component from the drop-down list, the converter's configuration window is opens.



Description of the configuration values (in the brackets, the name of byte of appropriate register is provided to allow setting of the converter using a software other than REGMET MBSet – see the X RAM map).

Examples of communication:

Command 03 (0x03): Read Holding Registers:

Master: 02 03 00 05 00 01 Crc Crc
- 02 Address of device (device with address 2)
- 03 Command (Read Holding Registers)
- 00 05 Address of initially read register (0x0006**)
- 00 01 Number of read registers (1 registers)

Slave: 02 03 02 01 F4 Crc Crc
- 02 Address of device (device with address 2)
- 03 Command (Read Holding Registers)
- 02 Number of bytes (2)
- 01 F4 Data from register (0x00FF)

The address of the read register is 0x0006 **, which is the address of the light intensity register in%.
Useful data are customer's range of light intensity. 0x01F4 = 500deck = 50%

Command 16 (0x10) Write Multiple Registers:
Master:
FF 10 20 09 00 01 02 09 04 Crc Crc
- FF Address of device (with inserted jumper "servs" J6 and J7 - address 255)
- 10 Command (Preset Multiple Registers)
- 20 09 Address of first registered register (0x200A**)
- 00 01 Number of registered registers (1)
- 02 Number of bytes (2)
- 09 04 Registered data (0x0904)

Slave:
FF 10 20 09 00 01 Crc Crc
- FF Address of device (with inserted jumper "servis" J6 and J7- address 255)
- 10 Command (Preset Multiple Registers)
- 20 09 Address of first registered register (0x200A**)
- 00 01 Number of registered registers (1)

With writing of the value 0x0904 in register 0x200A** the address 9 is set and the Baud rate 19 200 Bd is set.

** During the transfer the register addresses are indexed from zero, i.e. register 0x0005 is physically sent through the busbar as 0x0004... (zero based addressing)

Example of wiring the sensors in the system (fig.2)