

# Operating Instructions

## Radio Solar Presence Detector „eagle PM101“

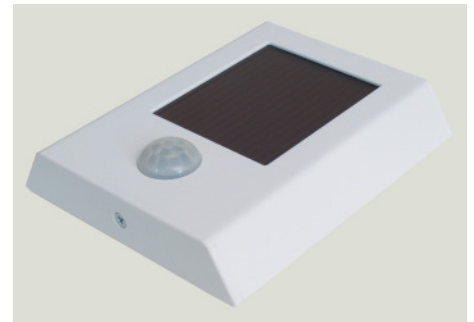


**Omnia AG, CH-8426 Lufingen**   
**Radio Bus System Ratio®**

Description	Color	Type	Order no.
Radio Solar Presence Detector	Pure white	PM101	2902 153

### General Information:

The Radio Solar Presence Detector PM101 with integrated brightness sensor is a device based on the EnOcean technology. It sends a radio data telegram to radio actuators and radio gateways of the Ratio radio bus systems to turn energy consumers on and off (e.g. lights, shutters, motor-driven actuators). The Radio Solar Presence Detector PM101 features two modes of operation with a total of five channels (4 x type PTM and 1 x type STM). Channels 1 and 3 evaluate the presence relative to the currently measured brightness, channels 2 and 4 evaluate only the presence and channel 5 sends all information (states of channel 1 and 2, current and stored brightness value). Energy is supplied through the conversion of room light into electrical energy by means of a solar generator; the electrical energy is stored in capacitors.



### Fields of application:

- Small offices
- Open plan offices with cubicles
- Premises with rest areas
- Multi-purpose rooms
- Locker rooms
- Large store rooms

### Functions (SW-SPIR05):

#### Channel 1 automatic mode (brightness / presence):

Using one presence event each, the integrated light sensor measures the light intensity in the sensing range and compares it with the brightness threshold preset in the Presence Detector.

If the light intensity is lower than the stored brightness threshold and the Presence Detector detects presence in the sensing range, then an ON telegram (PTM-A1) is sent. If during the presence phase the stored brightness threshold is exceeded or no presence is detected any more over a certain time (typically 12.5 minutes), then an OFF telegram (PTM-A0) is sent. The brightness threshold is set using „Learning mode 2“ (see chapter „Setup/Test“).

#### Channel 2 automatic mode (presence):

If the Presence Detector detects any presence in the sensing range, it sends an ON telegram (PTM-B1). If no presence is detected any more for a certain time (typically 12.5 minutes), then an OFF telegram (PTM-B0) is sent.

#### Channel 3 semi-automatic mode (brightness / presence):

Using one presence event each, the integrated light sensor measures the light intensity in the sensing range and compares it with the brightness threshold preset in the Presence Detector.

If during the presence phase the stored brightness threshold is exceeded or if no presence is detected any more over a certain time (typically 12.5 minutes), then an OFF telegram (PTM-C0) is sent. No ON telegram is sent – the electrical consumers are turned on by wall-mounted or hand-held radio transmitters. The brightness threshold is set using „Learning mode 2“ (see chapter „Setup/Test“).

#### Channel 4 semi-automatic mode (presence):

If no presence is detected any more during the presence phase, then an OFF telegram (PTM-D0) is sent. No ON telegram is sent – the electrical consumers are turned on by wall-mounted or hand-held radio transmitters.

#### Channel 5 value (brightness, threshold, presence):

A so-called value telegram (type STM) is sent together with any event from channel 1 to channel 4. This telegram includes the currently measured light intensity, the brightness threshold and the states of channels 1 and 2. The Presence Detector includes a function which automatically determines the brightness threshold (see chapter „Setup/Test“ „Learning mode 2“).

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### 1 Sensing range:

The Radio Solar Presence Detector PM101 is designed for wall or ceiling mounting and has a sensing range of 360°.

#### Ceiling mounting:

In a height of 2.5 m the Radio Solar Presence Detector PM101 covers a floor area with a diameter of 5 m. Typically, it is positioned approx. 1 m away from a seat above a desk. The Radio Solar Presence Detector PM101 includes a specially designed optics that is ideally suited for the detection of persons. This allows light control and, at the same time, guarantees the best possible energy efficiency.

#### Wall mounting:

In a height of 1.5 m the Radio Solar Presence Detector PM101 detects persons up to a distance of 8 m.

The Radio Solar Presence Detector PM101 is designed for mounting in a standard height of 1.5 m and it is typically positioned approx. 1 m away from a seat above a desk. It includes a specially designed optics that is ideally suited for the detection of persons. This allows light control and, at the same time, guarantees the best possible energy efficiency.

#### Caution!

Do not install the Radio Solar Presence Detector PM101 at locations where it will be exposed to direct sunlight or currents of air from air conditioning systems, heating system, etc. To ensure optimum transmission of the radio signals to the receiver, the Radio Solar Presence Detector PM101 must not be installed in areas with metal covers which may shield the signal from the transmitter to the receiver. See section „Information on Radio Transmission“.

### 2 Installation / Assembly:

- a) The best day light measurement is obtained if the Radio Solar Presence Detector PM101 is positioned such that the light sensor faces the source of light.
- b) For safe and energy self-sufficient operation, the Radio Solar Presence Detector PM101 has to be installed in a location where at least 200 lux will be guaranteed over 5 hours a day. If this is not the case, the Radio Presence Detector has to be operated by batteries.
- c) The boreholes in the bottom of the case can be used for installation of the Radio Solar Presence Detector PM101 on ceilings or walls.
- d) Do not install the Radio Solar Presence Detector PM101 on a metal plate as this would significantly weaken the radio signal.
- e) The case consists of the case bottom and the case cover. The case bottom can be separated from the case cover by opening the screws on the side using a Phillips screwdriver size 1. The case bottom includes slits for screws which can be used for installation of the case bottom on the wall or ceiling. Make sure that the case bottom does not get warped when tightening the screws.
- f) After successful commissioning, attach the case cover to the case bottom using the Phillips screws.

#### Operation and maintenance:

Make sure that the lens and the solar cell are clean and dry. The lens and the solar cell can be cleaned using a slightly moistened cloth.

### 3 Commissioning:

Before taking the Radio Solar Presence Detector PM101 into service, it has to be exposed to a source of light of > 1000 lux for 1 hour. The internal energy store is charged to maximum capacity.

### 4 Setup/Test:

The Radio Solar Presence Detector PM101 includes three buttons to learn the radio data telegrams and to set the brightness threshold.

#### Normal operation mode:

If an event occurs (absent / present), the Presence Detector immediately sends a corresponding telegram (channel 1 to channel 4) and approx. 200 ms later a value telegram (channel 5) with the current brightness value.

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„Learning mode 1 automatic“ for channel 1 and channel 2

Push the **RST** and **BT1** buttons at the same time and then release only the **RST** button to enable the „Learning mode Automatic“. Then release the **BT1** button **immediately**. In this learning mode the PIR sensor is inactive. Push the **BT1** button to send a defined ON telegram for channel 1, and push the **BT2** button to send a defined ON telegram for channel 2. Note: You have to set the actuators to the „Learning mode“ to enable the radio receivers to understand these radio data telegrams. See the operating instructions of the respective radio receiver. If you push the **RST** button, the device switches to the normal operation mode.

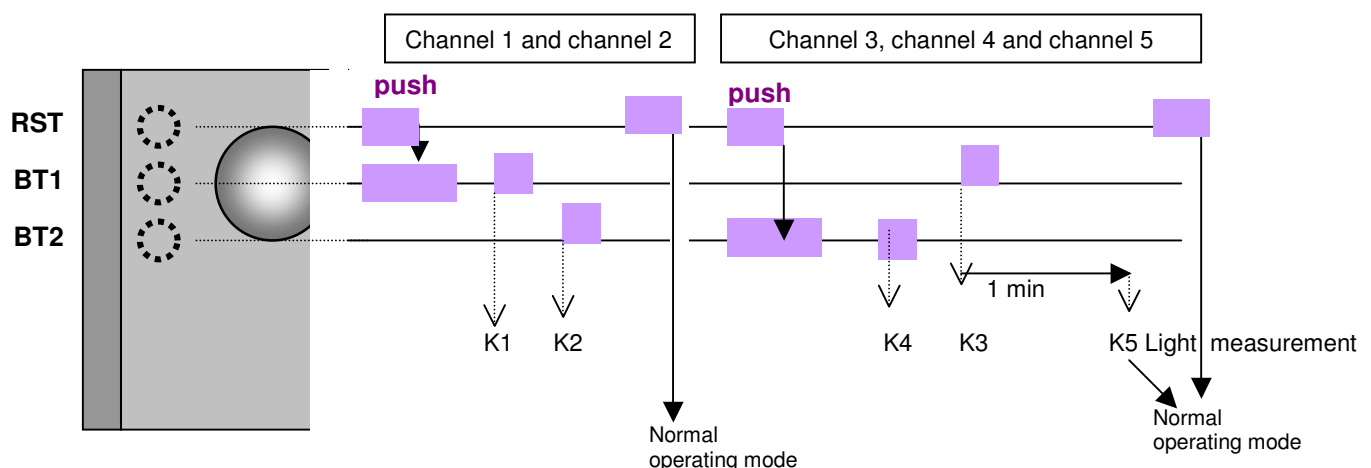
„Learning mode 2 semi-automatic“ for channels 3 and 4 and for channel 5 (setting the brightness threshold)

Push the **RST** and **BT2** buttons at the same time and then release only the **RST** button to enable the „Learning mode semi-automatic“. Then release the **BT2** button **immediately**. In this learning mode the PIR sensor is inactive. Push the **BT2** button to send a defined OFF telegram for channel 4. Note: You have to set the actuators to the „Learning mode“ to enable the radio receivers to understand these radio data telegrams. See the operating instructions of the respective radio receiver. If you push the **RST** button, the device switches to the normal operation mode.

Push the **BT1** button to send a defined OFF telegram for channel 3 and to prepare the Presence Detector for the automatic measurement of the brightness threshold. Now you have one minute to place the Radio Solar Presence Detector PM101 at the appropriate assembly location. Once this minute is over, the automatic brightness measurement is started for 10 seconds and then the device automatically switches to the normal operation mode.

Note: Before measuring the brightness threshold, the room should be lit up as desired. Now, if the current brightness value is higher than this measured brightness threshold, the light system in channel 1 is turned off.

Sequence of operation diagram of the learning modes:



Information on operation modes:

Semi-automatic mode:

In this operation mode the light is turned on and off by a person by means of radio transmitters. All the Presence Detector has to do is turn off the light after a certain time nobody is present any more. This function can be implemented by teaching in channels 3 or 4 into radio actuators.

Automatic mode:

In this operation mode the light is turned on and off by the Presence Detector. This function can be implemented by teaching in channels 1 or 2 into radio actuators.

### 5 Information on wireless HF-transmission:

The Radio Solar Presence Detector PM101 includes an integrated HF transmitter type TCM120 (EnOcean). The HF signal has a frequency of 868 MHz and the transmitting power is less than 10 mW. This guarantees an HF environment reduced to one hundredth, as compared to conventional, wired systems. The repeat rate of the HF signals is 10 – 12.5 minutes if presence is detected. If no presence is detected, no HF signals will be sent.

HF transmission range:

A HF signal consists of electromagnetic oscillations/waves (of a certain field strength) which are attenuated on their way to the receiver. The field strength of the HF signal decreases proportionally to the square of the distance between transmitter and receiver.

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This natural decrease in field strength as a function of the distance, however, is not the only factor that affects the range. Metal parts, e.g. reinforced walls and ceiling elements, metal foils in damp-proof membranes or UV/color filters, reflect, disturb or attenuate the HF signal on its way to the receiver.

The following list shows the approximate HF penetration rate with typical construction materials:

Penetration strength of HF signals:

<i>Material</i>	<i>Permeability</i>
Wood, plaster and glass without foil coating	90...100%
Brickwork, MDF and chipboards	65...95%
Reinforced concrete	10...80%
Metal, aluminum plates, etc.	0...10%

In practice, this means that the materials used in buildings have a major influence on the range between transmitter and receiver. The following ranges may be taken as reference values.

HF range/Penetration:

*Viewing distance between transmitter and receiver:*

Typically 30 m in hallways, up to 100 m in large, open rooms, e.g. sports halls.

*Plaster/Wooden walls:*

Typically 30 m range through max. 5 walls.

*Brick/Porous concrete walls:*

Typically 20 m range through max. 3 walls.

*Steel-reinforced walls/Ceilings (bottom structures):*

Typically 10 m range through max. 1 wall/ceiling.

The angle of incidence of the HF signal onto the wall affects the field strength. Ideal is the right angle. See Fig. 9b.

Fire prevention walls, elevator shaft and stairs have to be regarded as areas that cannot be penetrated by HF signals.

If in doubt, check the range in the building prior to installation.

Other sources of interference for wireless HF signal transmission:

Devices that also use HF signals, e.g. computers, audio/video systems, mobile/cordless phones, electronic transformers, wireless connection units, frequency converters and other HF transmitters/receivers are also considered sources of interference for the wireless HF signal. We recommend to keep a minimum distance of 0.5 m from this kind of devices.

HF transmitter repeat rate:

The PIR 360° sensor transmits an HF code as a function of an event-controlled process, but also in a fixed, time-controlled process.

Principle of measurement and code output:

a) An event-controlled process can be enabled by pushing the **RST** button. This starts the internal microprocessor, the status (enabled or disabled) of the PIR 360° sensor is registered, and an HF code is immediately sent to the receiver.

b) Sequence of a time-controlled process. If a presence has been detected for the first time, the detection interval is 10 minutes; after presence has been detected again, the detection interval is reduced to 2.5 minutes. If a presence is detected again or once the 2.5 minutes are over, a corresponding HF code is sent.

If no presence is detected, no HF code will be sent.

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### Description of the HF telegram of channels 1, 2, 3 and 4 (SW-SPIR05):

Description							Telegram structure (without header bytes)										
Function	ON	OFF	Presence	Light	Auto- matic	Semi- auto- matic	Type	Org	D3	D2	D1	D0	ID3	ID2	ID1	ID0	Stat
Turn on channel 1	AI	-	Yes	Yes	Yes	No	0B	05	10	00	00	00	Module-ID			10	
Turn off channel 1	-	AO	Yes	Yes	Yes	No	0B	05	30	00	00	00	Module-ID			10	
Turn on channel 2	BI	-	Yes	No	Yes	No	0B	05	50	00	00	00	Module-ID			10	
Turn off channel 2	-	BO	Yes	No	Yes	No	0B	05	70	00	00	00	Module-ID			10	
Turn off channel 3	-	CO	Yes	Yes	No	Yes	0B	05	B0	00	00	00	Module-ID			10	
Turn off channel 4 <sup>o</sup>	-	DO	Yes	No	No	Yes	0B	05	F0	00	00	00	Module-ID			10	
PTM Release Tg							0B	05	00	00	00	00	Module-ID			00	

<sup>o</sup>: Telegram without following PTM release Tg

### Description of the HF telegram of channel 5:

Description		Telegram structure (without header bytes)										
Function		Type	Org	D3	D2	D1	D0	ID3	ID2	ID1	ID0	Stat
Channel 5 AA-Tg (profile 0b111111)	Initialization at start of normal mode	0B	07	AA	LTH	xRC	0x	Module-ID+1			00	
Channel 5 BB-Tg (profile 0b111111)	Regular telegram in normal mode	0B	07	BB	LW	LTH	0x	Module-ID+1			00	
Channel 5 EE-Tg (profile 0b111111)	Message telegram at the end of the light measurement	0B	07	EE	LTH	wRC	0x	Module-ID+1			00	

### Bit resolution of the STM-BB TG data byte D0:

STM BB-Tg	B7	B6	B5	B4	B3	B2	B1	B0
Data byte 0	-	-	-	-	Learn 0 = Learn	-	Channel 2 1 = ON 0 = OFF	Channel 1 1 = ON 0 = OFF

LTH = current measurement value of light sensor  
 LW = current light value 0..255 Bit corresponding to 0 – 1000 lux  
 wRC = return value from EEPROM memory write command  
 xRC = return value from EEPROM memory read command  
 x = variable value

Module ID: The ID can be viewed on the board. To do this, separate the case bottom from the case cover. The ID can also be read out using a terminal program

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### 7. Application Examples

#### 7.1 Classroom / Office (Lights)

Problem:

In classrooms and offices the ceiling light is often turned on all the time, even though there is sufficient light in the room. In the morning the lights are turned on and in the evening they are, normally, turned off again. A lot of energy will be wasted.

Solution:

The ceiling lights can be turned on and off by persons by means of wall-mounted radio transmitters. The Radio Solar Presence Detector PM101 turns the lights off only when

- the room is bright enough or
- nobody is in the room any more.

Channel 3 of the Presence Detector is learned into the radio actuators that switch the light on or off. The Presence Detector works in the operation mode „semi-automatic“.

#### 7.2 Classroom / Office extended (Lights)

Problem:

In addition to the description in 7.1, quite often the ceiling lights should be turned off if there is enough light in the room, but not the floor lamp next to the office desk. This floor lamp should be turned off only if nobody is in the room any more.

Solution:

Channel 4 of the Presence Detector is learned into the radio actuator that switches the floor lamp. The Presence Detector works in the operation mode „semi-automatic“.

#### 7.3 Classroom / Office extended once more (Lights and heating)

Problem:

In addition to the description in 7.1 and 7.2, which include requirements concerning an efficiently switched lighting system, the heating should also work in the comfort mode only if persons are present in the room.

Solution:

Channel 4 of the Presence Detector is learned into the radio thermostat actuator that switches the control valve of the room heating. The Presence Detector triggers a target value switchover in the thermostat actuator and thus works in the operation mode „semi-automatic“. The comfort temperature in the room will be adjusted only if persons are present in the room.

#### 7.2 Hallway (Lights)

Problem:

The hallway lights are to be turned on automatically as soon as a person enters the hallway. If there is enough light in the hallway, the lights should not be turned on or should be turned off.

Solution:

Channel 1 of the Presence Detector is learned into the radio actuator that turns on the hallway lights. The Presence Detector works in the operation mode „Automatic“.

#### 7.2 Lobby (Lights)

Problem:

The lights in the lobby are to be turned on automatically as soon as a person enters the lobby. If there is no person at the reception desk, the lights should be turned off. In addition, the Presence Detector should control a gong to announce the visitor.

Solution:

Channel 1 of the Presence Detector is learned into the radio actuator that turns on the lights in the lobby. The Presence Detector works in the operation mode „Automatic“. Channel 2 of the Presence Detector is learned into the radio actuator that controls the gong and the radio actuator is parameterized for pulse operation.

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### Technical data:

Technical data	Solar Presence Detector PM101	Remark
Operating data	Energy generation through solar generator, battery free and maintenance free Buffering using SuperCap, functional capability, if fully charged, up to 36 hours in complete darkness. Optional battery operation possible	
Radio technology	Protocol EnOcean, type PTM100 for presence and STM100 for presence and brightness value, frequency 868.3 MHz, modulation ASK, transmitting power max. 10 mW	
Channels	Channel 1, PTM-Tlg, on and off depending on presence and one light threshold, Channel 2, PTM-Tlg, on and off depending on presence, Channel 3, PTM-Tlg, off depending on presence and one light threshold, Channel 4, PTM-Tlg, off depending on presence, Channel 5, STM-Tlg, message telegram with presence, brightness and channel 1 and 2.	
Radio transmission module	TCM120	
Motion sensor	PIR sensor, Sensing range - ceiling mounting: 2.4 m above floor, 5 m/360°, Sensing range - wall mounting: 1.5 m above floor, 8 m Aperture angle approx. 90°, preferred direction horizontal, 36 detection zones, detection speed 0.2 to 3 m/sec. Brightness sensor 10 .. 1000 lux	
Charge and discharge times of memory cells	Startup time for learning mode > 1 hour @ 1000 lux Startup time for 24 hour operation in darkness > 8 hours @ 250 lux Charge time from lower operation limit to full charge > 7 Std. @ 50 lux. Discharge time from full charge to lower operation limit > 48 hours	
Positioning	Wall or ceiling mounting, taking into account a daily basic light of at least 50 lux for 7 hours	
Data acquisition / Transmission interval	In case of an event and motion detection enabled approx. every 10 – 12.5 minutes.	
Range	Interior depending on building materials typically 20 to 100 m	
Dimensions	Case: LxWxH 120 mm x 100 mm x 20 mm	
Mechanical data	Case: Plastic ABS,	Weight: 180 g
Installation / Mounting	On-wall installation on a flat background	Glue or screws
Environmental conditions	Ambient temperature during operation 5°C ... +55°C Storage temperature -20°C ... +55°C Relative humidity (non-condensing) 0 ... 95%	
Protection type	IP20	
Approbations	CE certified and conforming to R&TTE Directive EU Directive on Radio Installations. In the USA and Canada, the 868 MHz radio technology is also licensable.	

### Legal requirements

The transmitters may not be used in connection with devices that are employed, directly or indirectly, for health- or life-saving purposes or if their operation may cause hazards to human beings, animals or property. Do not leave packaging material lying around carelessly. Plastic foils/bags, etc. may be hazardous toys for children. These operating instructions are part of the device and part of our warranty terms. They have to be handed over to the customer. The technical specifications of the device may be changed without prior notice. The products may be sold and operated without a license and free of charge in the countries of the European Union, in Switzerland, Croatia and Romania.

### Old appliances

Do not throw your old appliances into the domestic garbage can. The device contains electrical components that have to be disposed off as electronic waste. The case is made of reusable plastic material.

### General information

For additional questions, please contact our technical support:

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 Issued: March 2008  
 File: 2902\_Manual\_da.doc

Specifications subject to change!