

## Pushbutton Transmitter Device PTM 210 / 210C

October 18, 2011



Patent protected:  
US 6,747,573  
US 7,019,241  
Further patents pending

## REVISION HISTORY

The following major modifications and improvements have been made to the first version of this document:

No	Major Changes
0.95	New EEP naming included (EEP 2.1)

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This information describes the type of component and shall not be considered as assured characteristics. No responsibility is assumed for possible omissions or inaccuracies. Circuitry and specifications are subject to change without notice. For the latest product specifications, refer to the EnOcean website: <http://www.enocean.com>.

As far as patents or other rights of third parties are concerned, liability is only assumed for modules, not for the described applications, processes and circuits.

EnOcean does not assume responsibility for use of modules described and limits its liability to the replacement of modules determined to be defective due to workmanship. Devices or systems containing RF components must meet the essential requirements of the local legal authorities.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Components of the modules are considered and should be disposed of as hazardous waste. Local government regulations are to be observed.

Packing: Please use the recycling operators known to you. By agreement we will take packing material back if it is sorted. You must bear the costs of transport. For packing material that is returned to us unsorted or that we are not obliged to accept, we shall have to invoice you for any costs incurred.



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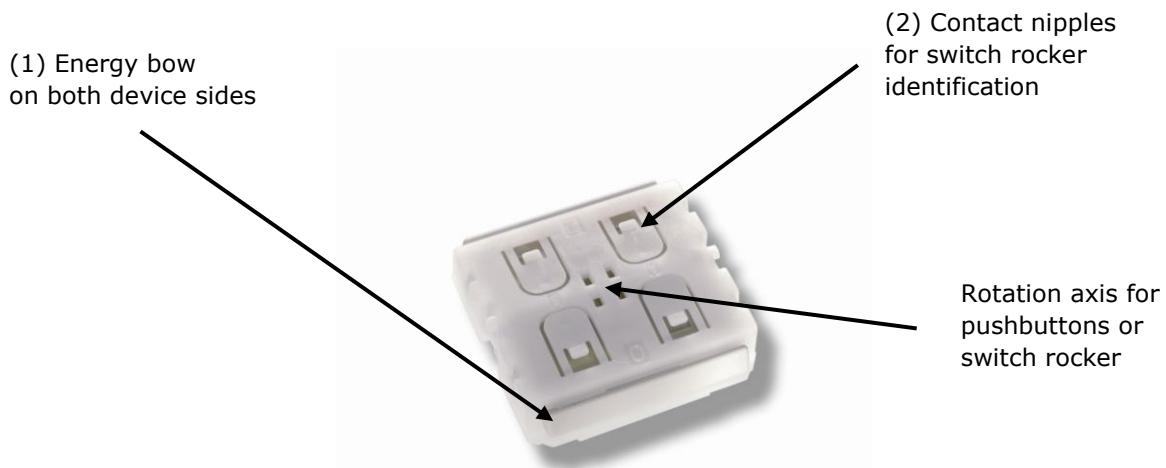
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## 1 GENERAL DESCRIPTION

The radio transmitter device PTM 210 / PTM 210C from EnOcean enables the implementation of wireless remote controls without batteries. Power is provided by a built-in electro-dynamic power generator. The PTM 210 / PTM 210C device serves the 868 MHz / 315 MHz air interface protocol of EnOcean.



### Electro-dynamic powered radio transmitter device PTM 210

#### 1.1 Basic Functionality

A common electro-dynamic energy transducer is actuated by a bow (1), which can be pushed from outside the device by an appropriate push button or switch rocker. When the energy bow is pushed down, electrical energy is created and an RF telegram is transmitted including a 32-bit device ID. Releasing the energy bow generates different telegram data, so every PTM telegram contains the information that the bow was pressed or released.

“Long” or “Short” push button operation (the time between pushing and releasing the pushbutton) can be easily detected by the receiver. By doing that, applications such as dimming control or blinds control including slat action are simple to implement.

In addition, the PTM telegram transmits the operating status of the contact nipples (2) when pressing the bow. This enables the identification of up to 2 appropriate switch rockers or up to 4 pushbuttons.

## 1.2 Typical Applications

- Building installation
- Industrial automation
- Consumer electronics

Key applications are wall-mounted flat rocker switches with 1 or 2 rockers, as well as hand-held remote controls with up to 4 single pushbuttons. Because the RF transmitters are self-powered (no batteries), maintenance-free RF systems are possible.

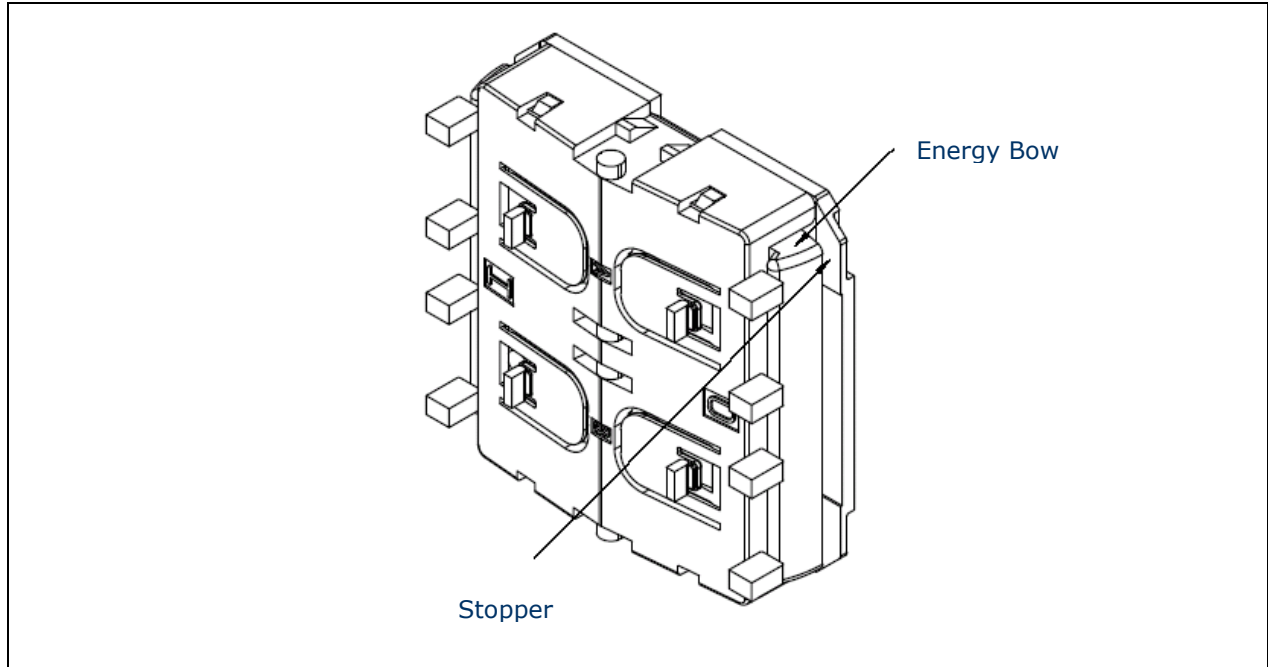
## 1.3 Technical Data

<b>Power supply</b>	power generation by rocker operating (Electrodynamic Power Generator)
<b>Antenna PTM 210C</b>	external whip antenna 26.8 cm, $\varnothing 1.3^{\pm 0.1}$ mm
<b>Antenna PTM 210</b>	internal PCB antenna
<b>Frequency</b>	315.0 MHz (PTM 210C) / 868.3 MHz (PTM 210)
<b>Data rate / Modulation type</b>	125 kbps / ASK
<b>Channels</b>	2 with 4 action states each (upper/lower pushbutton is pressed/released)
<b>EnOcean Equipment Profile supported</b>	EEP F6-02-xx, F6-03-xx, F6-04-xx
<b>Transmission range</b>	typ. 300 m free field, typ. 30 m indoor
<b>Telegram packet length (sub telegram)</b>	0.7 ms +/- 5%
<b>Number of channels</b>	2 channels with action states each (upper/lower contact nipple is pressed/released)
<b>Device-identifier</b>	individual 32-bit ID (factory programmed)
<b>No. of (redundant) packets</b>	PTM 210: 3 / PTM 210C: 3-5 (depending on residual energy)

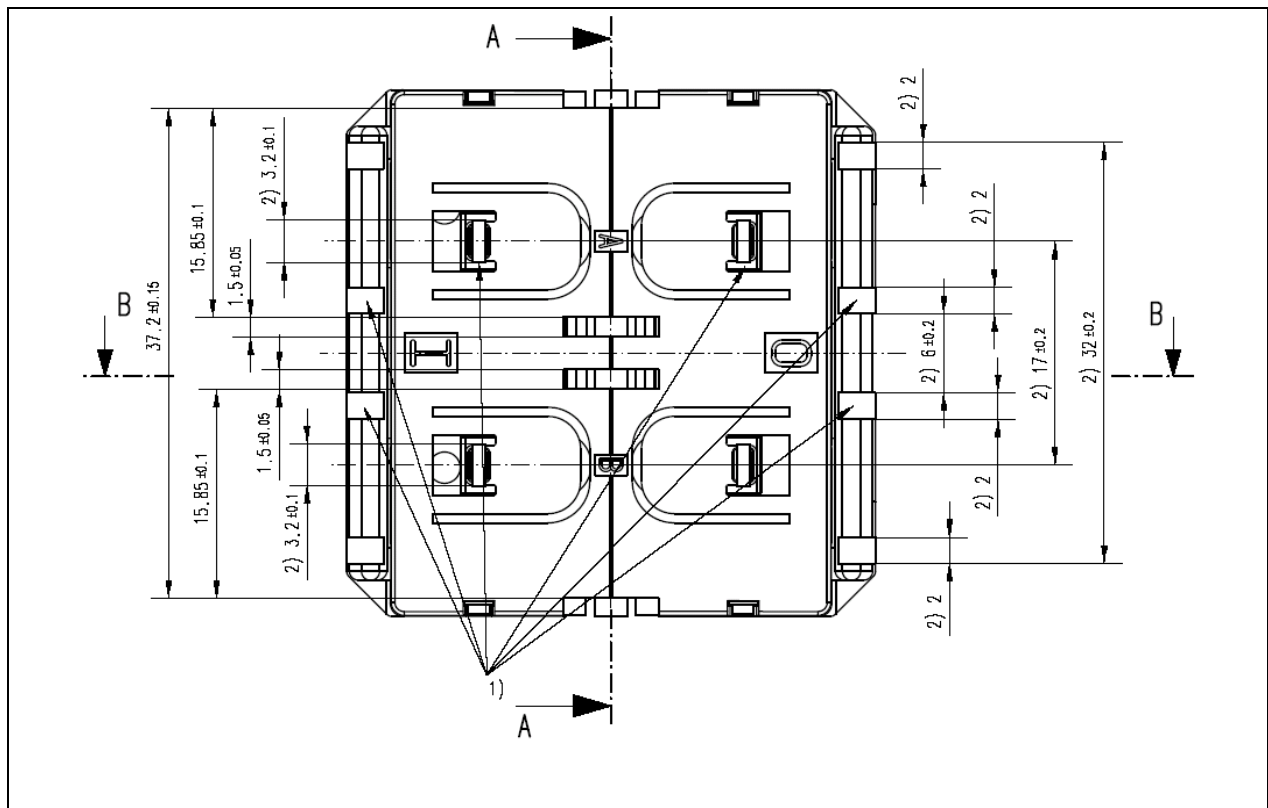
## 1.4 Mechanical Interface

<b>Module dimensions (inclusive rotation axis and energy bow)</b>	40.0 x 40.0 x 11.2 mm
<b>Device weight</b>	20 g $\pm$ 1 g
<b>Energy bow travel / operating force</b>	1.8 mm / approx. 7 N *)
*) at room temperature, only one energy bow may be actuated at the same time!	
<b>Restoring force at energy bow</b>	0.5 N to 4 N
For the correct function of the application, the specified minimal restoring force of 0.5 N must be considered!	
<b>Number of operations</b>	typ. 50.000 actuations tested according to VDE 0632 / EN 60669
<b>Cover material</b>	Hostaform (POM)
<b>Energy bow material</b>	PBT (50% GV)

PTM 210 / 210C STEP EA



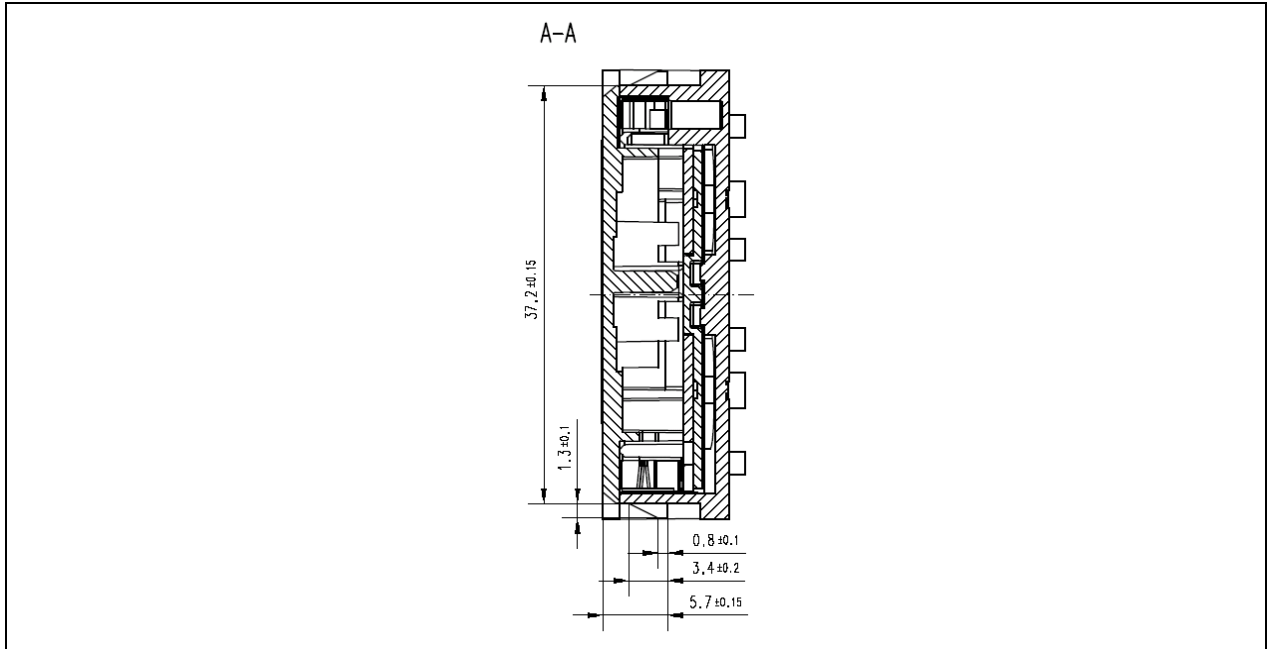
**PTM 210 without antenna, tilted view (including rocker catwalks)**



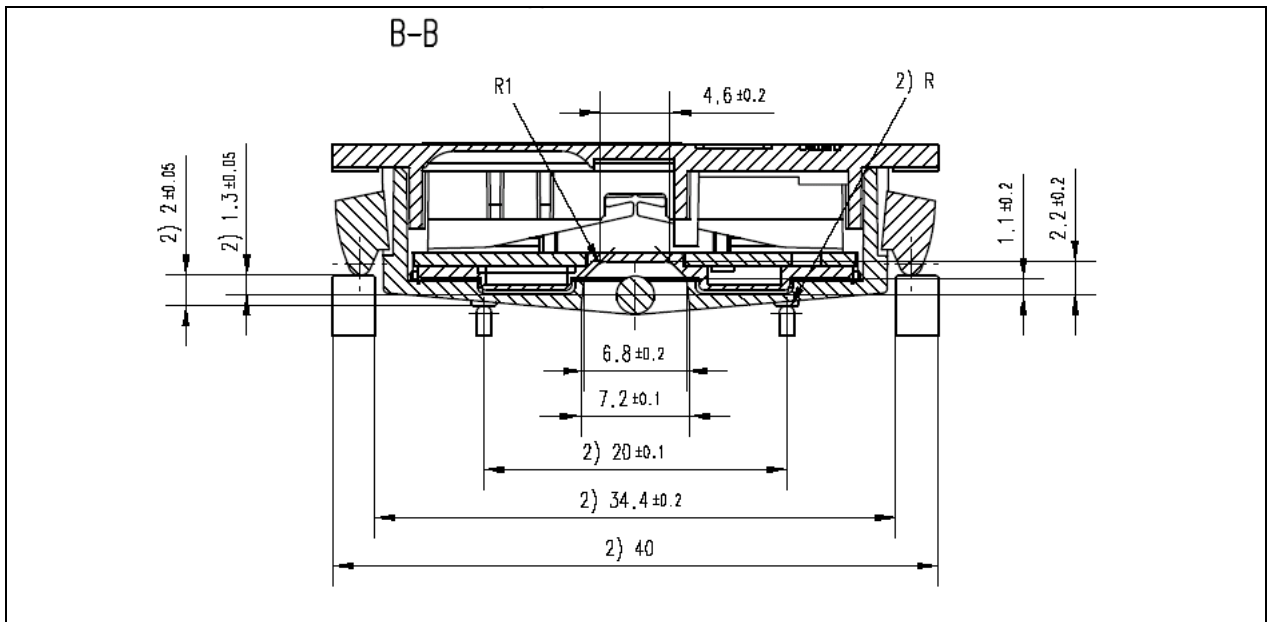
1) this catwalks are not needed when using one single rocker only    2) dimensions of rocker part

**PTM 210 without antenna, top view (note cut A, B and C marking)**

PTM 210 / 210C STEP EA



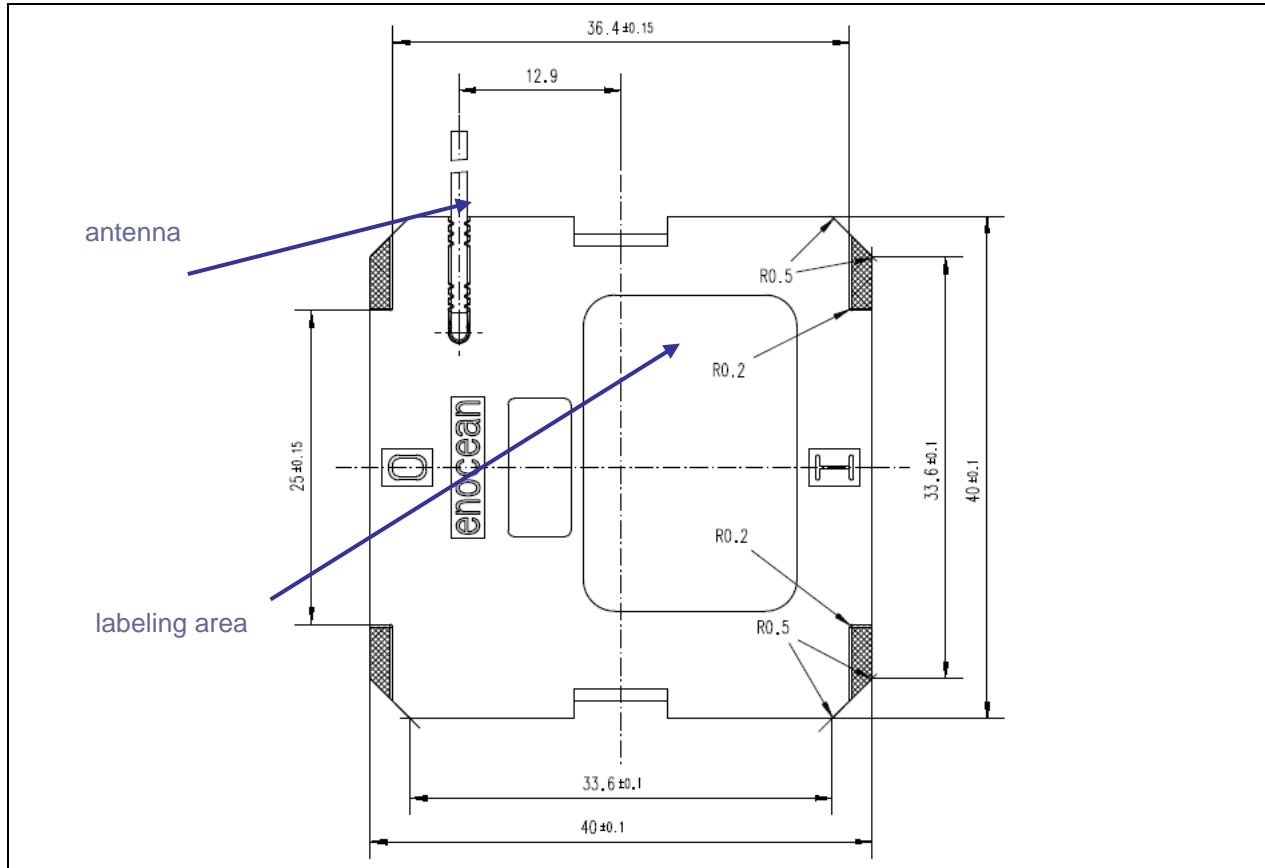
PTM 210 without antenna, cut A



2) dimensions of rocker part

PTM 210 without antenna, cut B and C

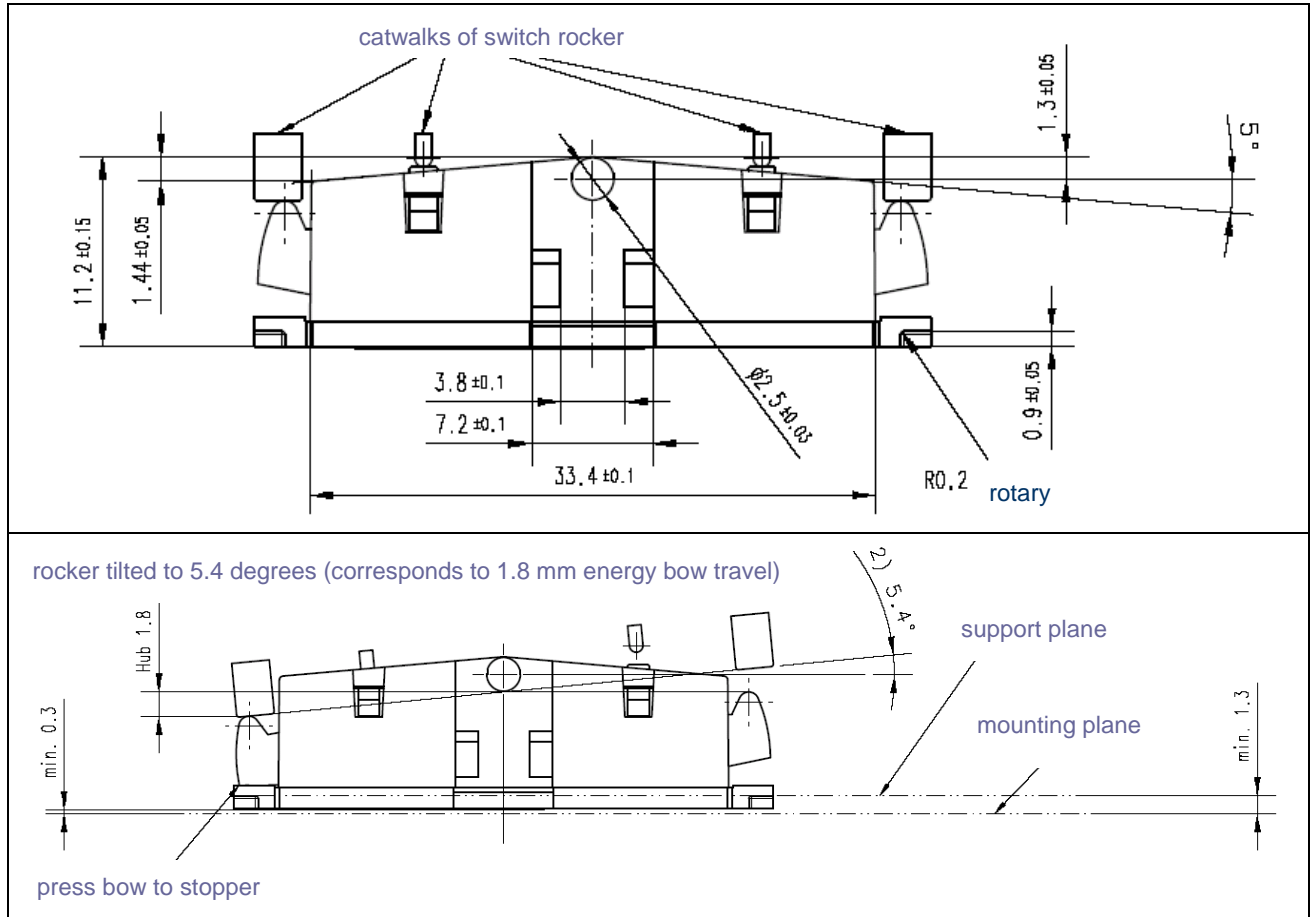
PTM 210 / 210C STEP EA



Hatched areas: support planes

**PTM 210C with antenna (PTM 210 provides internal antenna), rear view**





2) dimensions of rocker part

**PTM 210 without antenna, side view**



If the rocker is not mounted on the rotation axis of PTM 210 several tolerances have to be considered!  
The measure from support plane to top of the energy bow is 7.70 mm +/- 0.3 mm!



The movement of the energy bow must not be limited by mounted rockers!



Catwalks of switch rocker must not exert continuous forces on contact nipples!

### 1.5 Environmental Conditions

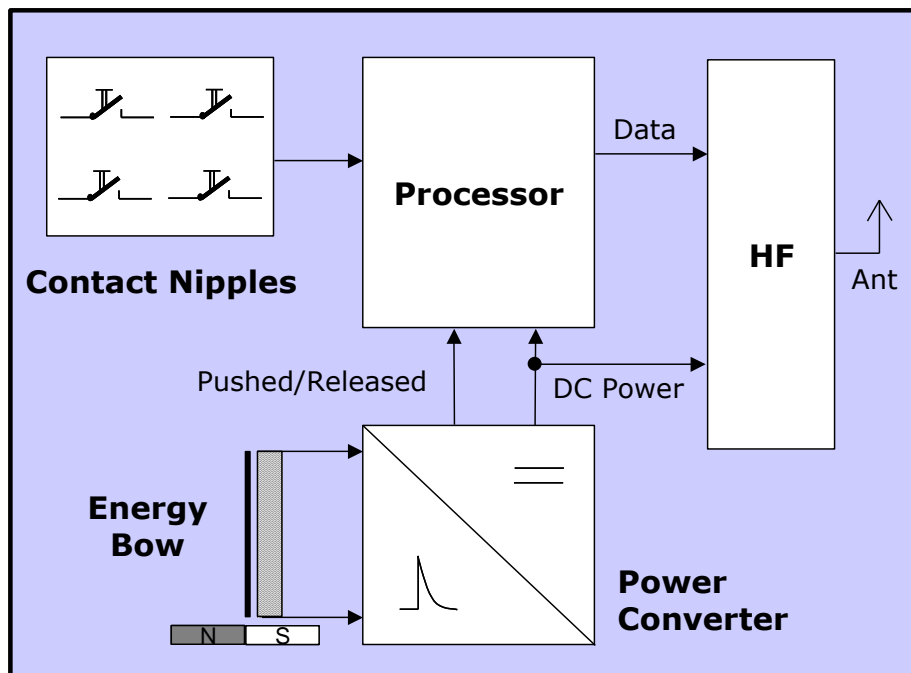
<b>Operating temperature</b>	-25 °C up to +65 °C
<b>Storage temperature</b>	-25 °C up to +65 °C
<b>Humidity</b>	0% to 95% r.h.

### 1.6 Ordering Information

Type	Ordering Code
<b>PTM 210</b>	<b>S3001-A210</b>
<b>PTM 210C</b>	<b>S3031-A211</b>

## 2 FUNCTIONAL DESCRIPTION

### 2.1 Block Diagram



Block diagram of PTM 210

#### Energy Bow / Power Generator

Converts pressure on the energy bow into electrical energy.

#### Power Converter

Electronic converter unit for generating the device DC power supply

### Processor

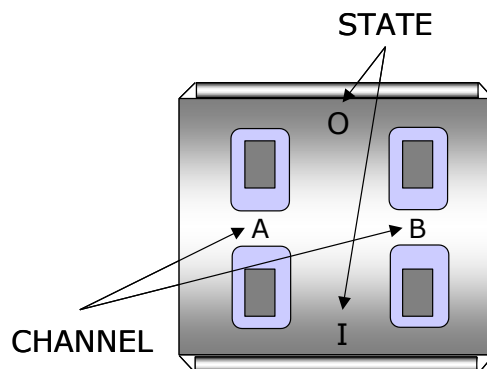
Converts the contact nipples' status and pushed/released data from the power generator into a reliable and energy-efficient serial telegram structure.

### HF transmitter

Sends the data in the form of a series of short radio signals.

## 2.2 Contact Nipples Designation

With 4 contact nipples, the PTM 210 offers 2 channels with 4 action states each (upper/lower nipple is pressed/released when activating the energy bow). The nipples' designation is as follows:



**Contact nipple designation**

Radio signals of the PTM 210 device are event-controlled (energy bow is pressed/released) with contact nipple code (channel/state) and unique device identification (fixed 32-bit ID). When operating more than one nipple at the same time, note that PTM 210 sends multiple-button code combinations:

- N-message: One or two contact nipples have been pressed when activating the energy generator → Message with nipple code and pressed/released event status of the energy bow is sent.
- U-message: No contact nipple was pressed when activating the energy generator, or 3 or 4 nipples have been pressed → Message with pressed/released event status of the energy bow is sent and the information if either none or more than two nipples have been pressed. Note that it can't be differentiated if 3 or if 4 nipples have been pressed.



Due to the mechanical hysteresis of the energy bow, in most rocker switch device implementations, pressing the rocker sends an N-message and releasing the rocker sends a U-message!

## 2.3 Transmission timing

The transmission timing of the radio device PTM 210C has been developed to avoid possible collisions with data packages of other EnOcean transmitters as well as disturbances from the environment.

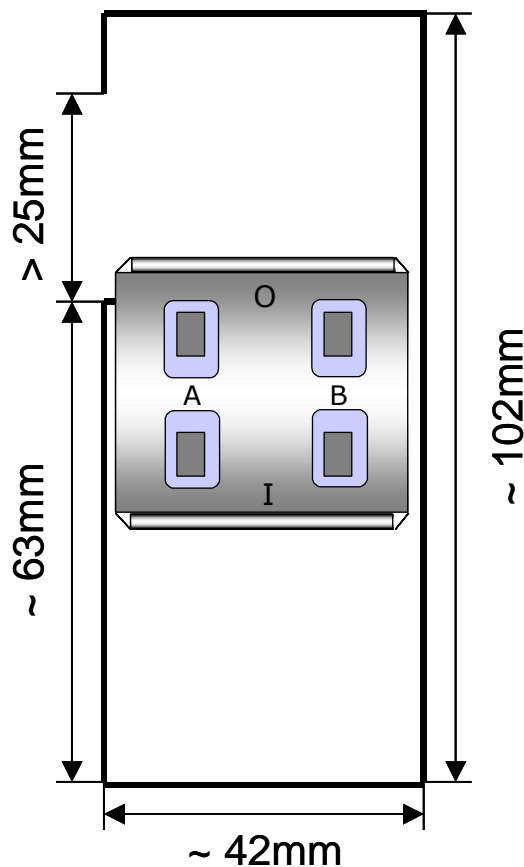
With each transmission cycle, at least three identical subtelegrams are transmitted. The transmission of a subtelegram lasts approximately 0.7 ms. To optimize data security, each telegram is repeated twice within about 40 ms, whereas the delay between the second and the third transmission burst is effected at random.

If some residual energy is available after transmission of three subtelegrams, up to 2 further subtelegrams are sent (PTM 210C only).

### 3 APPLICATIONS INFORMATION

#### 3.1 Laying the antenna (PTM 210C only)

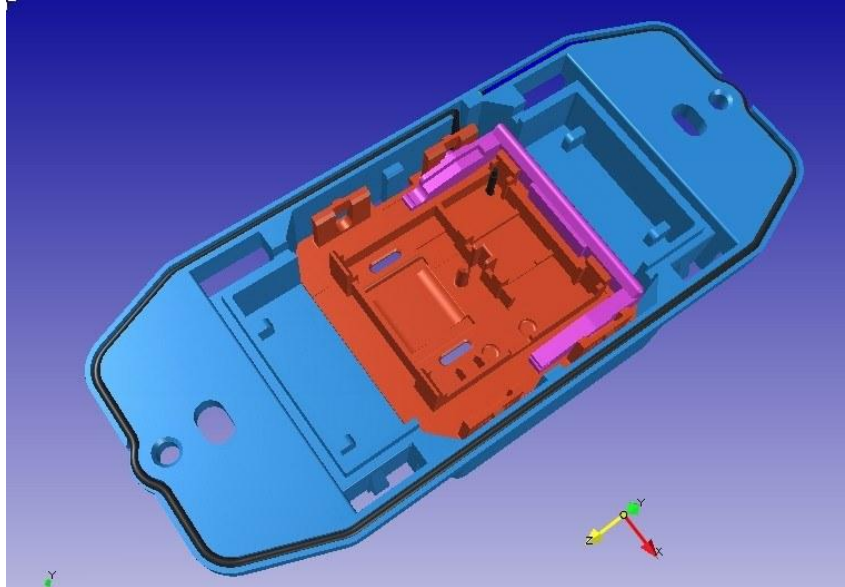
For best performance the antenna cable should be laid as shown in the figure below.



Laying the 315 MHz whip antenna



- The distance between antenna foot point and antenna end must be > 25 mm
- The antenna area should be maximized
- The antenna should be placed at the same height above the ground plane as the rotation axis for the switch rocker (see example below)



**Example of a well suited antenna**

### 3.2 Construction of application specific Switch Rockers

For CAD system development support, 3D construction data is available from EnOcean (IGS data). Using this data, the mechanical interface is fixed, and the shape and surface of the rocker(s) can be changed according to requirements. Recommendation for suitable rocker material is polycarbonate (buckling resistant and wear-proof material). It is recommended to apply teflon varnish in the areas of actuation.



Please note that the rockers should be of nonmetal for best transmission range!  
Please also avoid plastic materials with conducting ingredients like graphite!

### 3.3 Device Mounting

For mounting the PTM 210 device into an application specific case, the package outline drawings of the device are roughly dimensioned in chapter 1.4. If more detailed dimensioning data device case is necessary, 3D construction data is available from EnOcean (IGS data).



Mounting the module back side on metal surfaces directly or mounting the module into metal frames can lead to up to typical 30% loss of transmission range within a building.

### 3.4 Transmission Range

The main factors that influence the system transmission range are type and location of the antennas of the receiver and the transmitter, type of terrain and degree of obstruction of the link path, sources of interference affecting the receiver, and “dead” spots caused by signal reflections from nearby conductive objects. Since the expected transmission range strongly depends on this system conditions, range tests should categorically be performed before notification of a particular range that will be attainable by a certain application.

The following figures for expected transmission range are considered by using a PTM, a STM or a TCM radio transmitter device and the TCM radio receiver device with preinstalled whip antenna and may be used as a rough guide only:

Line-of-sight connections: Typically 30 m range in corridors, up to 100 m in halls  
Plasterboard walls / dry wood: Typically 30 m range, through max. 5 walls  
Line-of-sight connections: Typically 30 m range in corridors, up to 100 m in halls  
Ferro concrete walls / ceilings: Typically 10 m range, through max. 1 ceiling  
Fire-safety walls, elevator shafts, staircases and supply areas should be considered as screening.

The angle at which the transmitted signal hits the wall is very important. The effective wall thickness – and with it the signal attenuation – varies according to this angle. Signals should be transmitted as directly as possible through the wall. Wall niches should be avoided. Other factors restricting transmission range:

Switch mounted on metal surfaces (up to 30% loss of transmission range)  
Hollow lightweight walls filled with insulating wool on metal foil  
False ceilings with panels of metal or carbon fibre  
Lead glass or glass with metal coating, steel furniture

The distance between EnOcean receivers and other transmitting devices such as computers, audio and video equipment that also emit high-frequency signals should be at least 0.5 m

A summarized application note to determine the transmission range within buildings is available as download from [www.enocean.com](http://www.enocean.com).

## 4 AGENCY APPROVALS

### 4.1 CE Approval (PTM 210 only)

The devices bear the EC conformity marking CE and conform to the R&TTE EU-directive on radio equipment. The assembly conforms to the European and national requirements of electromagnetic compatibility. The conformity has been proven and the corresponding documentation has been deposited at EnOcean. The PTM devices can be operated without notification and free of charge in the area of the European Union, and in Switzerland. The following provisos apply:

- EnOcean RF devices must not be modified or used outside their specification limits.
- EnOcean RF devices may only be used to transfer digital or digitized data. Analog speech and/or music are not permitted.
- The final product incorporating EnOcean RF devices must itself meet the essential requirement of the R&TTE Directive and a CE marking must be affixed on the final product and on the sales packaging each. Operating instructions containing a Declaration of Conformity has to be attached.

If transmitters are used according to the regulations of the 868.3 MHz band, a so-called "Duty Cycle" of 1% per hour for each transmitter must not be exceeded. Permanent transmitters such as radio earphones are not allowed. For conventional applications, it must be ensured that the PTM 210 radio device is not operated more than 6000 times within one hour (one operation: energy bow is pressed and released). Within this calculation, the extraordinary short telegram length is considered including three subtelegrams. Also a tolerance of 5% in the telegram length is included.

### 4.2 FCC/IC Approval (PTM 210C only)

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada. If this device is operated in compliance with the following requirements it can be operated without notification and free of charge in the area of the United States of America and in Canada. Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Trade Name: PTM 210C  
Model No: PTM 210C

FCC ID: SZV-PTM211C  
IC: 5713A-PTM211C

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada. Operation is subject to the following two conditions. (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.





Changes or modifications made to this equipment not expressly approved by EnOcean may void the FCC authorization to operate this equipment.

### 4.3 Japanese Type Approval (PTM 210C only)

PTM 210C complies with the Japanese radio law. It carries the following marking on the back side label (MIC marking):

+++ in preparation +++

If the certification label cannot be recognized from outside (e.g. installation in a host) appropriate information must be referenced in the user manual.