

PTM 202

Toggle Switch Transmitter Module

The product is protected by the following granted patents:

US7710227, DE10315765B4

US9614553, EP1312171B1, CN100508406C

EP1389358B1, JP4225792B2

US7019241, EP1550202B1, DE50303733D1, CN1689218B

US7391135, EP1611663B1, DE10315764B4,

US8502470, JP5617103B2

EP2524572B1

And also by pending or not yet published patents and designs.

REVISION HISTORY

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

No	Major Changes
0.1	Initial version.
0.2	Update with new images and technical data
0.3	Text and links updated
1.0	Environmental Conditions and some images updated
1.1	EEP table enum values corrected
1.2	Product image and mechanical chapter updated

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Important!

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 devices, not for the described applications, processes and circuits.

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

The devices 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 devices 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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1 GENERAL DESCRIPTION

The toggle switch transmitter module PTM 202 enables the setup of intuitive and easy to use self-powered switches. PTM 202 module is powered by an electro-dynamic generator and therefore maintenance-free. It can be combined with existing PTM 215 switch designs (55 mm standard insert).

PTM 202 is designed to enable wireless switches, with focus on retrofit and smart buildings. Products based on PTM 202 can also be used in hermetically sealed systems or in remote (not easily accessible) locations. The module is designed for single rocker applications.



Figure 1 Toggle Switch Transmitter Module PTM 202

1.1 Product variants and ordering codes

The PTM 202 product family contains the following product variants:

Type	Frequency	Ordering Code	Product specifics
PTM 202	868.300 MHz	S3001-A202	Toggle switch (e.g. on/off)

Table 1 Product Variants

1.2 Basic Functionality

PTM 202 contains an electro-dynamic energy generator (ECO 200) which is actuated by pushing one of the two sides (O or I) to the end position of the module.

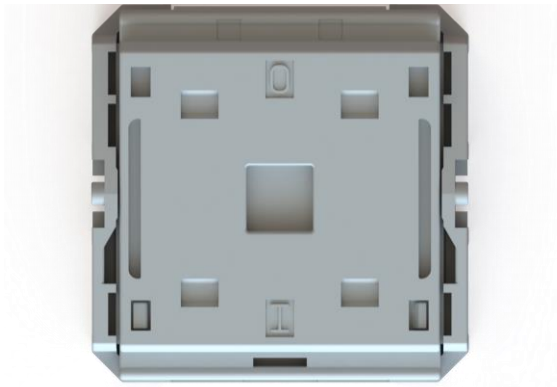


Figure 2 PTM 202 top view

The module has to be covered by an appropriate switch rocker or a similar construction mounted on top of the device. When the module is pushed on O or I side, electrical energy is harvested and a radio telegram with min. 2 sub telegrams is transmitted. The module provides the haptic of a classic switch, where the rocker keeps the position and represents the switch status. This means the module will toggle and keep the last position (O or I). There is no release telegram sent.



Figure 3 Position O & I

The radio telegram used by PTM 202 devices identifies the position (O or I) of the switch pressed. This enables easy implementation of switches with a specific haptic of the user interface e.g. for central power or toggle switch installations.

1.3 Technical Data

Power supply	Electro-dynamic power generator	
Antenna	PCB antenna	
Frequency	PTM 202: 868.300 MHz (ASK) ¹	
Data rate	125 kbps	
Max. radiated power	-1.9 dBm	
Channels	single channel two actions, B0/B1	
EnOcean Radio Standard	ERP1 based on ISO/IEC 14543-3-10:	PTM 202
EnOcean Equipment Profile supported	F6-02-xx (PTM 202 identification via 2 nd action)	
Security mode	no	
Transmission range	PTM 202: typ. 300 m free field, typ. 30 m indoor	
Device identifier	Individual 32 bit ID (factory programmed)	
Redundant sub-telegram count per radio transmission	min. 2	

1.4 Mechanical Interface

Device dimensions (inclusive rotation axis and energy bow)	40.0 x 40.0 x 11.2 mm	
Device weight	18 g ± 1 g	
Energy bow travel / operating force	typ. 3.2 mm / typ. 5 N At room temperature	
Number of operations at 25°C	typ. 50.000 actuations tested according to EN 60669 / VDE 0632	
Cover material	Hostaform (POM)	
Base plate	Polycarbonat	

1.5 Environmental Conditions

Operating temperature	0 °C up to +40 °C	
Storage temperature	-20 °C up to +50 °C	
Humidity	0% to 95% r.h.	

¹ According the international standard for energy harvesting wireless radio protocol for self-powered applications: ISO/IEC 14543-3-10

1.6 Typical Applications

PTM 202 module is commonly used for building installation. Key products include wall-mounted switches and handheld remote controls for switching between two states.

The image below shows an examples of an PTM 202 module assembled into a white housing. A wide range of custom designs with different shapes, materials and colours can be used together with PTM modules as long they respect the standardized mechanical interface. This allows customizable designs with well tested and promoted PTM modules.



Figure 4 Example of an assembled PTM Module

The image below shows the modular components of the final wall switch from the frame via the PTM 202 module to the single rocker. All components can be easily exchanged and a clicked into position.

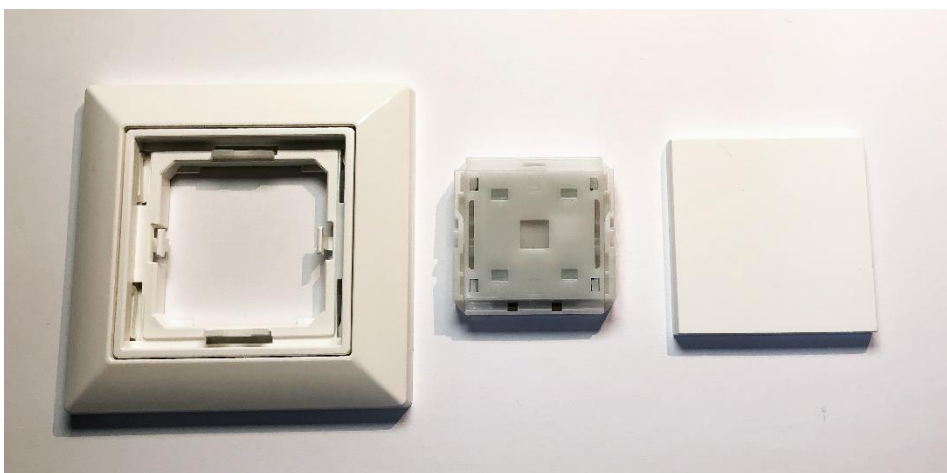


Figure 5 Example frame with PTM 202 and single rocker

2 FUNCTIONAL DESCRIPTION

2.1 Block Diagram

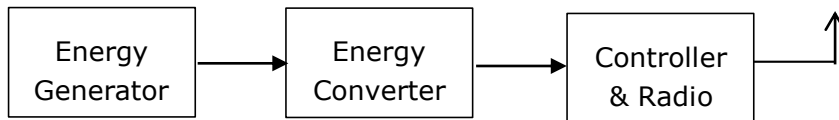


Figure 6 Block diagram of PTM 202

Energy Generator

Converts the motion of the energy bow into electrical energy. This is the main energy source for the operation of PTM Modules.

Energy Converter

Converts the energy of the energy generator into a stable DC supply voltage for the device electronics.

Energy Management

Secures energy supply of the module for the required period. The generator provides an burst of energy which needs to be conserved for the much longer period than the burst lasts.

Microcontroller

Determines the status of the contact nipples and the energy bow, encodes this status into a EnOcean Data telegram, if required it encrypts this data and computes the authentication signature, generates the proper radio telegram structure and sends it to the radio transmitter.

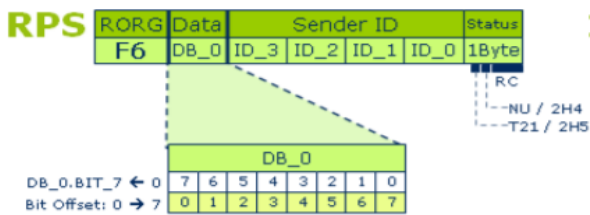
RF Transmitter

Transmits the data as a series of short EnOcean radio telegrams.

2.2 Radio Telegram and EnOcean Equipment Profiles

The PTM 202 module transmits radio telegrams based on the EnOcean Alliance Radio standard. The module uses "EnOcean Radio Protocol 1" – ERP 1 based on ISO/IEC 14543-3-10.

The (EnOcean Equipment Profile) EEP profile defines how the data inside the EnOcean telegram is encoded. In terms of PTM 202 a so called RPS profile is used and this defines which position has been pressed. It is up to the receiver to decide how the data will be interpreted. PTM 202 EEP supports application styles based on EnOcean Alliance RPS F6-02-xx telegrams:

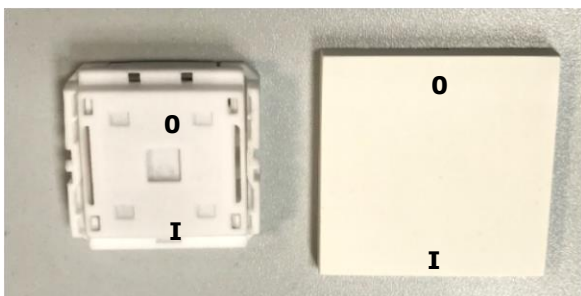


Status field:

T21 = 1: PTM switch module of type 2
 NU = 1: N-message (N = normal)

Data field:

- Application style depends on use case, receiver interpretation (EEP F6-02-01/-2/-03/-04)
- Single rocker operation only (Button B0 or B1)
- Energy bow pressed only, no release telegram
- Example installation with 0 up (see image below)



- PTM 202 identification via type identifier in 2nd action data field (see table below)

Data field implementation according EnOcean Alliance EEP F6-02-xx:

Offset	Size	Bit Range	Data according EEP	Enum Value (binary)
0	3	DB0.7 – DB0.5	Rocker 1st Action	0: Reserved
				1: Reserved
				2: Side I
				3: Side 0
				4-7: Reserved
3	1	DB0.4	Energy Bow	0: Reserved
				1: Pressed (1)
4	3	DB0.3 – DB0.1	Type Identifier	0-2: Reserved
				3: Toggle Switch
				4-7: Reserved
7	1	DB0.0	Reserved	0: Reserved

PTM 202 telegram implementation interpreted by DolphinView:

Offset 0123 4567

Bit Range 7654 3210 same order for EEP enum to binary conversion

BI Data: 0b0101 0110 0x56 (DolphinView hex value)

B0 Data: 0b0111 0110 0x76 (DolphinView hex value)

Status: 0b0011 0000 0x30 (DolphinView hex value, no repeater count)

3 APPLICATIONS INFORMATION

3.1 Product Label

The label provides additional information about the product including product name, order code, EnOcean ID and frequency, an example is printed below.

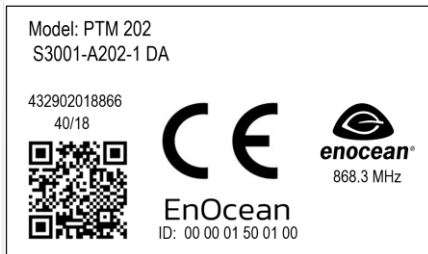


Figure 7 PTM 202



Field	Meaning	Examples
Model	Product name	PTM 202
Order code	EnOcean Order code	S3001-A202
Step code	Product version	DA (example)
Production date	Week / Year	40 / 20 (example)
	Certification marking of the EnOcean Alliance with frequency specification.	Frequencies: 868.3 MHz
EnOcean ID: 0000 0150 0100	Company name and Unique EnOcean ID in hexadecimal 48 bit format.	ID: 0x0000 0150 0100
	Production tracking in QR Code	See below

Table 2 QR Code containers

Reading the QR code will return a text string formatted according the EnOcean Alliance Labelling standard. Details about the labelling standard can be found here:

<https://www.enocean-alliance.org/productid/>.

The same standard is also used to specify the NDEF String content.

The QR content example might look like this:

30S000001500100+13Z12345678123456781234567812345678+1P000B00000057+30PS3061-A215+2PDC22+S01123456789012

The string holds different information containers joined by "+". At the beginning of every container is an identifier e.g. "30S". The example string above consists of the following containers.

Identifier	Length of data	Value
30S	15 characters (12 data)	Static Source Address (hex), 0000 + EnOcean ID
+	1 character	Field Separator
1P	14 characters (12 data)	Alliance Product ID: (000B0000005B)
+	1 character	Field Separator
30P	13 characters (10 data)	Ordering Code (S3001-A202)
+	1 character	Field Separator
2P	6 characters (4 data)	Step Code - Revision (DA01)
+	1 character	Field Separator
S	15 characters (2 + 12 data)	Manufacturer recognition „08“ + 12 characters DMC/Serial Number

3.2 Packaging information

Packaging Unit	100 units
Packaging Method	tray / box / pallet



3.3 Construction of application specific switch rockers

EnOcean provides 2D drawings and 3D construction data (IGS/STEP format) of the mechanical interface of PTM 202 modules for the design of customer specific housing (e.g. ground plate, frame and rocker). This data is available for download at following link:

https://www.enocean.com/produkte/enocean_module/ptm-202

Polycarbonate is recommended as rocker material since it is buckling resistant and wear-proof. It is also recommended to apply Teflon varnish in the areas of actuation.



It is recommended using non-conductive material for the rockers to ensure best radio transmission range. Avoid if possible metallic materials or plastics with conducting ingredients such as graphite.

PTM is powered by the electromagnetic generator ECO 200. For proper function magnets or ferromagnetic materials are not permitted within a keep-out zone of 60mm around the centre of the PTM.

If the rocker is not mounted on the rotation axis of PTM 202 several tolerances have to be considered. Please check with our support team.

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

3.4 Transmission Range

The main factors that influence the system transmission range are:

- Type and location of the antennas of receiver and transmitter.
- Type of terrain and degree of obstruction of the link path.
- Sources of interference affecting the receiver.
- "Dead spots" caused by signal reflections from nearby conductive objects.

Since the expected transmission range strongly depends on this system conditions, range tests should always be performed to determine the reliably achievable range under the given conditions.

The following figures for expected transmission range are considered by using a PTM, an STM or a TCM radio transmitter device together with a TCM radio receiver device with preinstalled whip antenna.

These figures should be treated as a rough guide only:

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

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 include:

- Switch mounting 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 more detailed application note on how to determine the transmission range within buildings is available from: <https://www.enocean.com/support/application-notes/>

4 AGENCY APPROVALS

4.1 PTM 202: Radio Approval for the European Market

The module is developed and tested according to the Radio Equipment Directive (RED) of the European Union (EU). The product 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.

The following provisos apply:

- EnOcean switch modules must not be modified or used outside specification limits.
- EnOcean switch modules may only be used to transfer digital sensor data
- The final product including EnOcean switch module must meet all necessary application specific requirement for CE conformity (e.g. product labelling, manual and conformity to all application specific directives and standards).

If transmitters are used according to the regulations of the 868.300 MHz SRD 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 202 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 sub-telegrams. Also a tolerance of 5% in the telegram length is included.

5 References

- [1] 2D drawing and 3Dmodel for PTM 202 and example rocker
https://www.enocean.com/products/enocean_modules/ptm-202/
- [2] EnOcean Alliance Standards (e.g. EnOcean Equipment Profile)
<https://www.enocean-alliance.org/specifications/>
- [3] EnOcean Radio Protocol
<https://www.enocean.com/en/support/knowledge-base/>