

Transmitter Module

PTM 33x / PTM 330C / PTM 332C / PTM 330U

July 2, 2014



Observe precautions! Electrostatic sensitive devices!

Patent protected:

WO98/36395, DE 100 25 561, DE 101 50 128,
WO 2004/051591, DE 103 01 678 A1, DE 10309334,
WO 04/109236, WO 05/096482, WO 02/095707,
US 6,747,573, US 7,019,241

REVISION HISTORY

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

No	Major Changes
0.81	CFG Pin: For test purposes only
0.85	Antenna length 868 MHz changed to 86 mm; upper limit of operating temperature reduced to 65 °C
0.90	Equivalent energy pulse definition added
1.00	Max. supply voltage for programming interface added in 2.4. Digital input parameters added in 2.3. FCC / IC grants added in 4.2 and 4.3.
1.01	TX power increased to 3 dBm at antenna input; Chapter Related Documents added; misleading table removed in 3.3
1.02	Figure corrected in 3.4
1.03	3.4 modified
1.1	Meander structures increased; PTM 330U added
1.2	PTM 335 added

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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 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.

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1 RELATED DOCUMENTS

In addition to this document additional information is available on our [web site](#):

- Proposal for mechanical integration with ECO 200 in 2D and 3D format
- Footprint with positions of pads available in Protel and Gerber format
- AN102: Antenna Basics – Basic antenna design considerations for EnOcean based products

2 GENERAL DESCRIPTION

2.1 Basic Functionality

The radio transmitter module PTM 330 from EnOcean enables the implementation of wireless sensors and switches without batteries.

Key applications are handheld remote controls or industrial switches.

Functional Principle

When an energy pulse is supplied (e.g. by ECO 200 from EnOcean) an RF telegram is transmitted including a unique 32-bit module ID, the polarity of the energy pulse, and the operating status of 4 digital inputs. The RPS telegram content can be configured if other content is needed.

PTM 330 can be connected to ECO 200 via a contact spring. There are two meander structures on the PCB which allow usage of a rubber pad to set the level of two digital inputs.

Alternatively PTM 330 can be mounted as an SMD component onto a host PCB. In this case energy supply pins and digital input pins are accessible via contact pads.

PTM 335 can additionally protect its outgoing communication with enhanced security features.

Product variants

- PTM 330: 868 MHz variant, pre-installed whip antenna, delivery in card board box
- PTM 332: 868 MHz variant, no pre-installed antenna, delivery as tape & reel
- PTM 335: 868 MHz variant, pre-installed whip antenna, delivery in card board box, supports enhanced security
- PTM 330C: 315 MHz variant, pre-installed whip antenna, delivery in card board box
- PTM 332C: 315 MHz variant, no pre-installed antenna, delivery as tape & reel
- PTM 330U: 902 MHz variant, pre-installed whip antenna, delivery in card board box



Figure 1 PTM 330 (C/U)

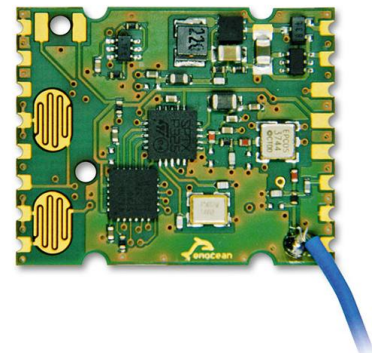


Figure 2 PTM 335

PTM 33x / PTM 330C / PTM 332C / PTM 330U

2.2 Technical Data

Power supply	ECO 200 or equivalent energy pulse
Antenna	pre-installed whip antenna PTM 330/ 335/330C/330U external 50 Ohm or whip antenna PTM 332/332C
Frequency	868.3 MHz (PTM 33x) / 315.0 MHz (PTM 33xC) / 902.875 MHz (PTM 330U)
Transmission power	3 dBm (PTM 33x, PTM 33xC) 1dBm (PTM 33xU) at antenna base
Data rate / Modulation type	125 kbps / ASK(315MHz, 868MHz), FSK(902MHz)
Telegram type	RPS of type 2 (allows interpretation of operating two buttons simultaneously)
Digital inputs	4
Mode switch (standard and enhanced security)	3 pins PTM 335 only
Transmission range	up to 200 m free field, up to 30 m indoor

PTM 33x / PTM 330C / PTM 332C / PTM 330U

2.3 Physical Dimensions

PCB dimensions

26.2 x 21.15 x 3.5 mm

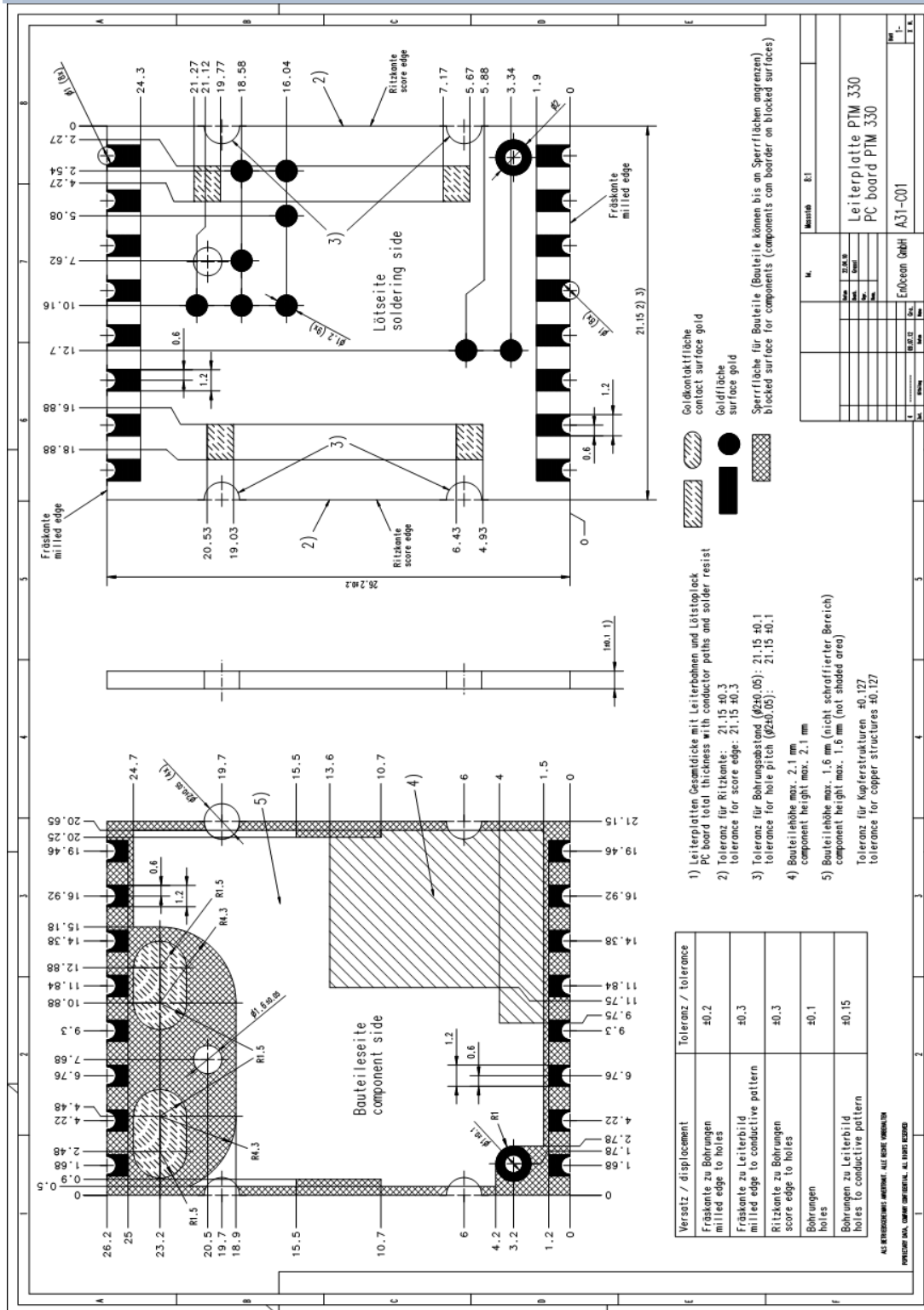


Figure 3 PTM 330 / 332 / 330C / 332C / 330U drawing

PTM 33x / PTM 330C / PTM 332C / PTM 330U

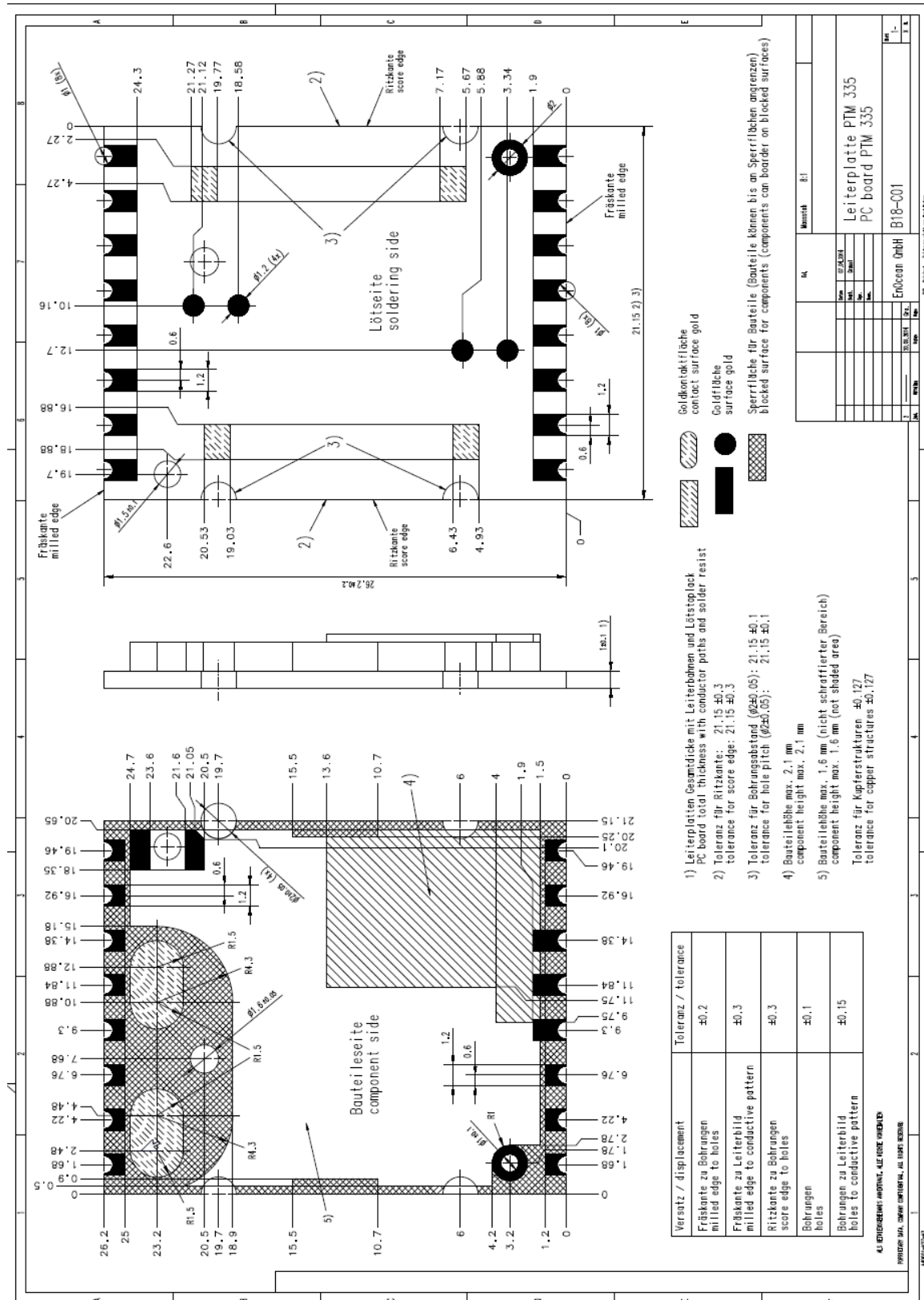


Figure 4 PTM 335 Drawing

PTM 33x / PTM 330C / PTM 332C / PTM 330U

2.4 Environmental Conditions

Operating temperature	-25 °C ... +65 °C
Storage temperature	-40 °C ... +85 °C
Storage temperature in Tape&Reel	-20 °C ... +50 °C
Humidity	0% ... 93% r.h., non-condensing

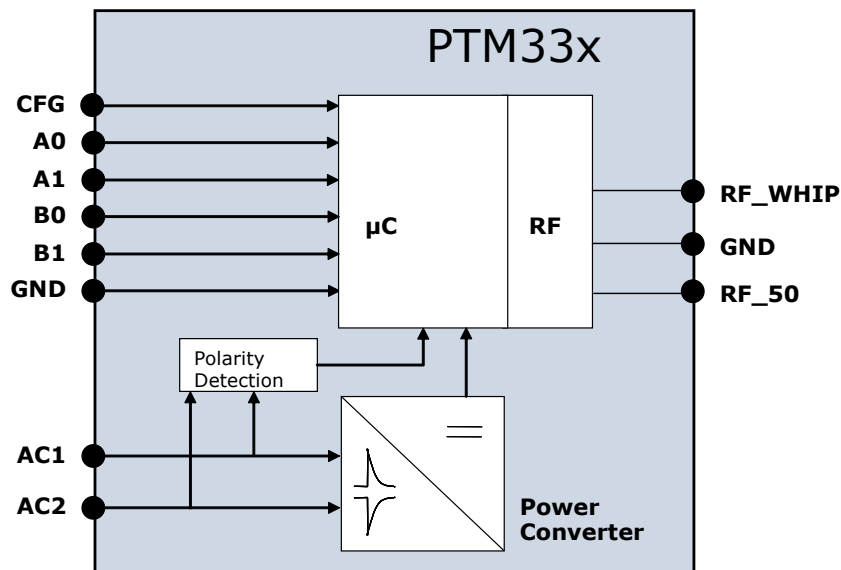
2.5 Ordering Information

Type	Ordering Code	Frequency	Note
PTM 330	S3001-A330	868.3 MHz	Whip antenna mounted Card board box
PTM 335	S3001-A335	868.3 MHz	Whip antenna mounted Card board box, Supports Enhanced security
PTM 332	S3001-A332	868.3 MHz	No antenna mounted Tape & Reel
PTM 330C	S3031-A330	315.0 MHz	Whip antenna mounted Card board box
PTM 332C	S3031-A332	315.0 MHz	No antenna mounted Tape & Reel
PTM 330U	S3051-A330	902.875 MHz	Whip antenna mounted Card board box

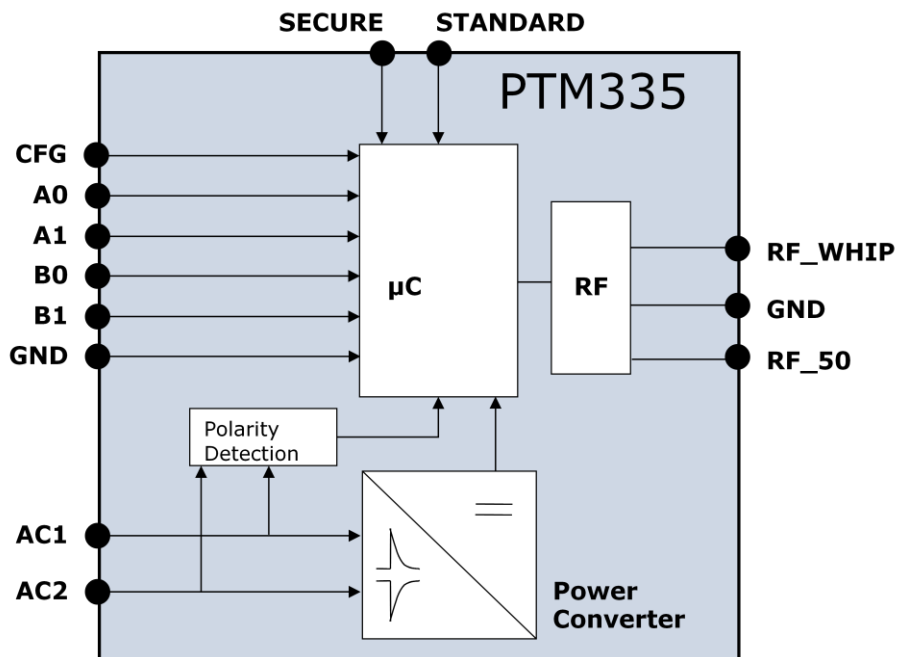
3 FUNCTIONAL DESCRIPTION

3.1 Block diagram

At power-up by an energy pulse at AC1, AC2 a DC voltage is provided to the internal micro controller. The microcontroller reads the polarity of the supply voltage pulse and the status of the digital inputs A0, A1, B0, B1. After that 3 identical radio telegrams calculated from the status of these inputs are transmitted.



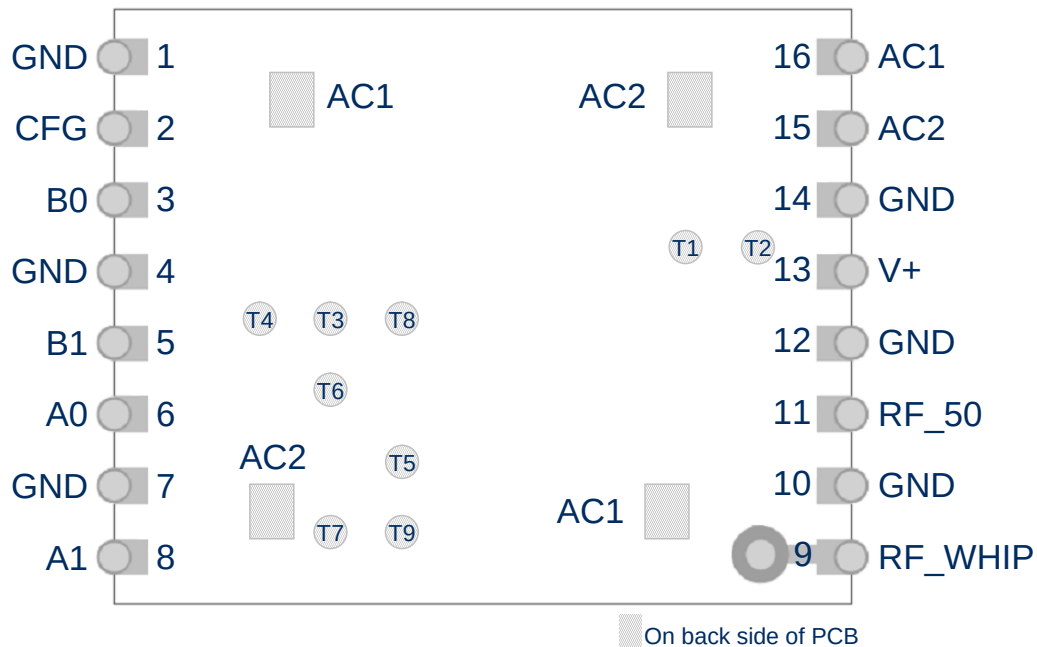
The PTM 335 has additionally SECURE and STANDARD input pins, which enable to switch between enhanced security communication and standard communication.



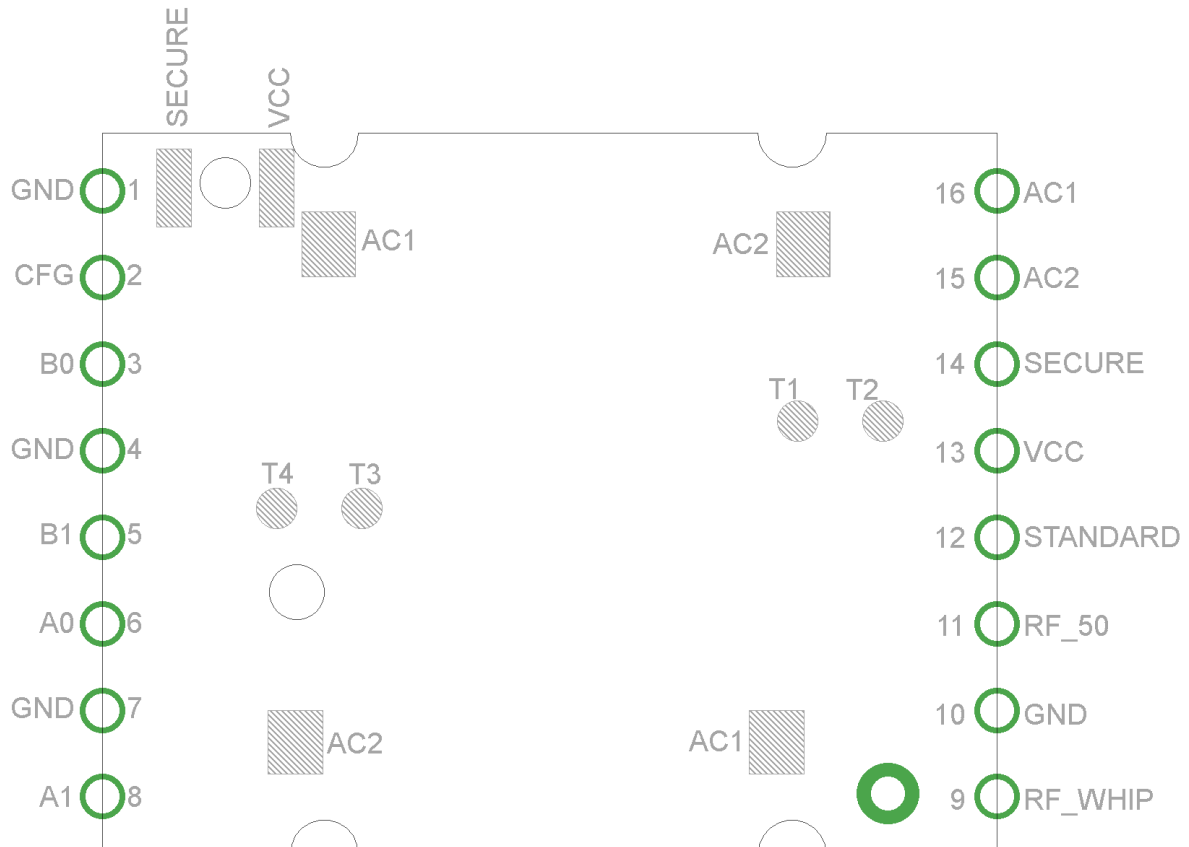
PTM 33x / PTM 330C / PTM 332C / PTM 330U

3.2 Pin out

Pin Out of PTM 330 /332/330U/330C/332C



Pin Out of PTM 335 bottom:



PTM 33x / PTM 330C / PTM 332C / PTM 330U

3.3 Pin Description and operational characteristics

PTM 330 /332/330U/330C/332C

Symbol	Function	Characteristics
GND	Ground connection	Must be connected to GND
V+	For test purposes only	Do not connect
B0	O-Button Rocker B	Digital input, leave open or connect to GND Internal pull-up
B1	I-Button Rocker B	Digital input, leave open or connect to GND Internal pull-up
A0	O-Button Rocker A	Digital input, leave open or connect to GND Internal pull-up
A1	I-Button Rocker A	Digital input, leave open or connect to GND Internal pull-up
CFG	For test purposes only	Internal pull-up
AC1	Input for ECO 200	ECO 200 or equivalent energy pulse
AC2	Input for ECO 200	ECO 200 or equivalent energy pulse
RF_WHIP	RF output	Output for whip antenna
RF_50	RF output	50 Ohm output for external antenna (not available for PTM 330U)
T1-9	Configuration Interface	See 3.4

PTM 335 Only

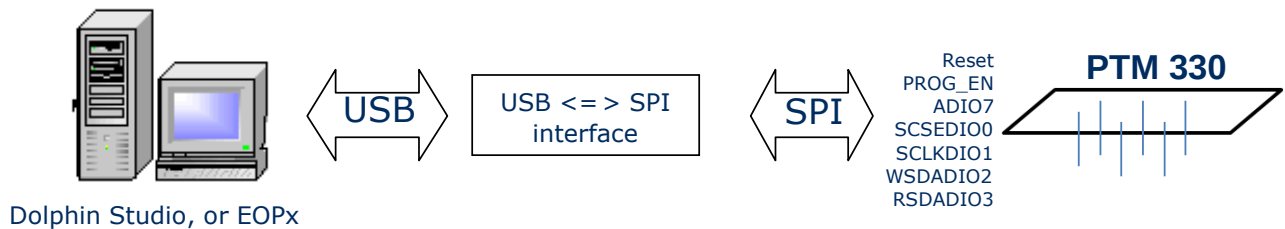
Symbol	Function	Characteristics
GND	Ground connection	Must be connected to GND
VCC	Operating voltage	Connect to SECURE or STANDARD to change modes
SECURE	Mode change pin	Connect to VCC to and press ECO to change mode - secure. Then disconnect.
STANDARD	Mode change pin	Connect to VCC to and press ECO to change mode - standard. Then disconnect.
B0	O-Button Rocker B	Digital input, leave open or connect to GND Internal pull-up
B1	I-Button Rocker B	Digital input, leave open or connect to GND Internal pull-up
A0	O-Button Rocker A	Digital input, leave open or connect to GND Internal pull-up
A1	I-Button Rocker A	Digital input, leave open or connect to GND Internal pull-up
AC1	Input for ECO 200	ECO 200 or equivalent energy pulse
AC2	Input for ECO 200	ECO 200 or equivalent energy pulse
RF_WHIP	RF output	Output for whip antenna
RF_50	RF output	50 Ohm output for external antenna (not available for PTM 330U)
T1-4	Configuration Interface	See 3.4

PTM 33x / PTM 330C / PTM 332C / PTM 330U

3.4 Configuration Interface

3.4.1 PTM 330 /332/330U/330C/332C

Via the programming interface the telegram content can be modified.
The interface is shown in the figure below:



EnOcean provides EOPx (EnOcean Programmer, a command line program) and Dolphin Studio (Windows application for chip configuration, programming, and testing) and the USB/SPI programmer device as part of the EDK 300 / 350 developer's kits. In order to contact PTM 330 programming and testing points a needle bed adapter is needed.

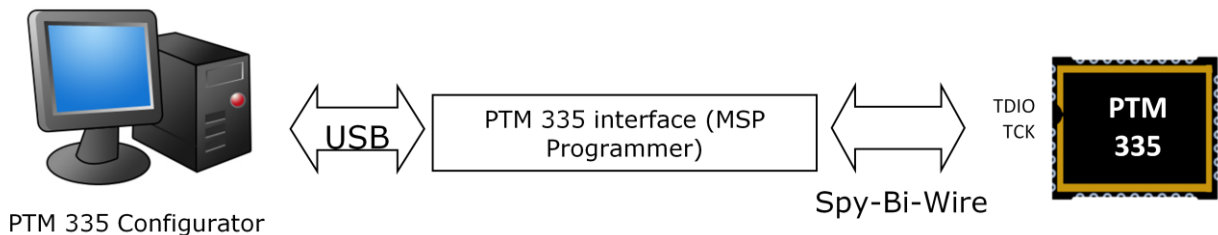
Pad	Symbol	Function	Characteristics
T1	VDD	Supply voltage	Interface to programmer; Max. 3.3 V
T2	GND	Ground connection	Interface to programmer
T3	SCSEDIO0	SPI chip select	Interface to programmer
T4	SCLKDIO1	SPI serial clock	Interface to programmer
T5	WSDADIO2	SPI input	Interface to programmer
T6	RSDADIO3	SPI output	Interface to programmer
T7	RESET	Reset	Interface to programmer, internal pull down
T8	ADIO7	Sync output	
T9	PROG_EN	Enable programming mode	Interface to programmer HIGH: programming mode active LOW: operating mode Internal pull-down

PTM 33x / PTM 330C / PTM 332C / PTM 330U

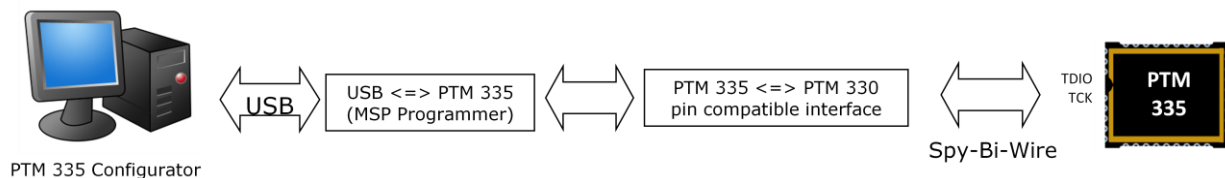
3.4.2 PTM 335 Only

To configure PTM 335 the PTM 335 Configuration suite must be used. Please see here for latest version - <http://www.enocean.com/en/download/>

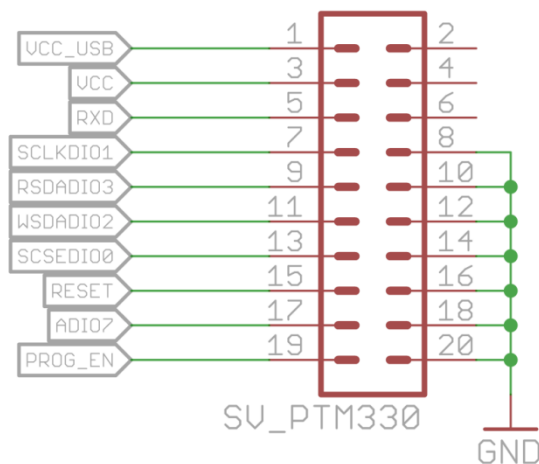
Additional Programmer for MSP 430 is required (e.g. MSP-FET430UIF - <http://www.ti.com/tool/msp-fet430uif>).



Pin adapter which were used to program PTM 330 can be reused to program PTM 335 too.



To reuse the PTM 330 a convertor is required please see here the layout of such convertor PTM 330 Interface.

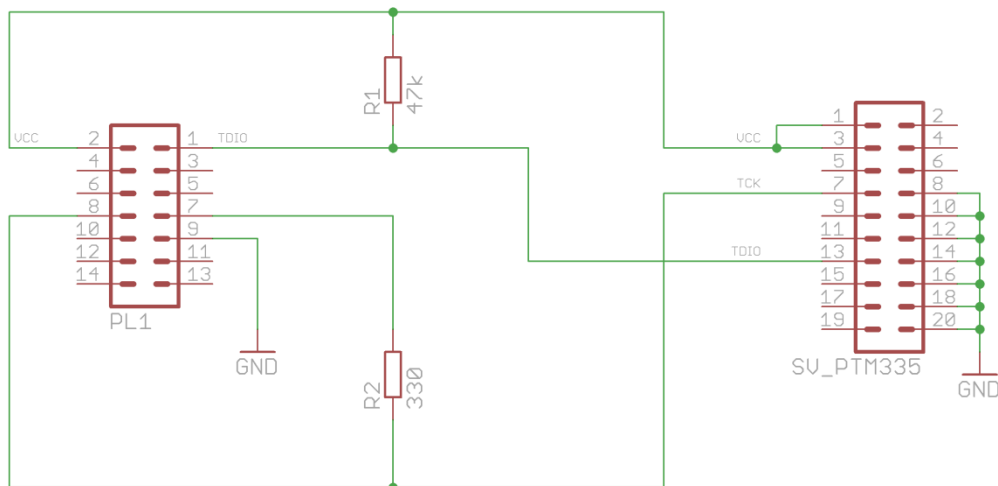


PTM 335 Interface – PL1 is corresponding to the interface of MSP-FET430UIF programmer.

PTM 33x / PTM 330C / PTM 332C / PTM 330U

JTAG interface

PTM 335 interface

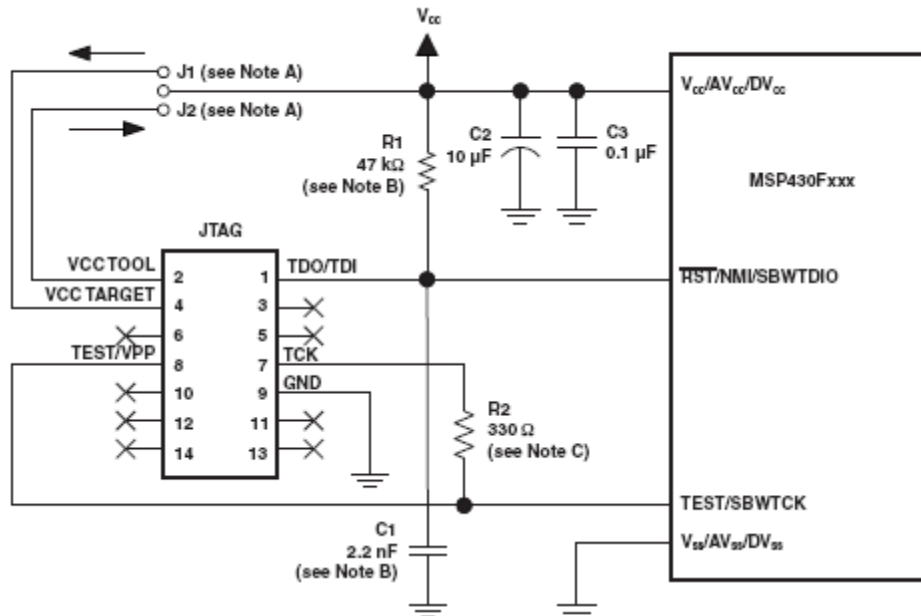


There are less pins required. Please refer to the table below to see an overview which PINs are still required.

Pad	Symbol PTM 330	Symbol PTM 335	Characteristics
T1	VDD	VCC	Programming interface. Spy-Bi-Wire
T2	GND	GND	Programming interface. Spy-Bi-Wire
T3	SCSEDIO0	TDIO	Programming interface. Spy-Bi-Wire
T4	SCLKDIO1	TCK	Programming interface. Spy-Bi-Wire

The configuration of PTM 335 is executed via „2-wire Spy-Bi-Wire“.
 The programming interface consists of the PINS: TCK, TDIO, GND and VCC.
 Following is the „2-wire Spy-Bi-Wire“-interface of MSP430FRxxxx.

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- A Make either connection J1 (if a local target power supply is used) or connection J2 (if powering the from the debug/programming adapter).
- B Note that the device RST/NMI/SBWTIO pin is used in 2-wire Spy-Bi-Wire mode for bi-directional debug communication with the device and that any capacitance attached to this signal may affect the ability to establish a connection with the device. The upper limit for C1 is 2.2 nF when using current TI FET interface modules (USB FET).
- C R2 is used to protect the JTAG debug interface TCK signal against the JTAG security fuse blow voltage that is supplied by the TEST/VPP pin during the fuse blow process. In the case that fuse blow functionality is not needed, R2 is not required (becomes 0 Ω) and the connection TEST/VPP must not be made.

Figure 3-2. Signal Connections for 2-Wire Spy-Bi-Wire Communication

Picture Source - <http://www.ti.com/tool/msp-fet430uif> (20.6.2014)

The Parts R1, C2 und C3 must be included in the programming adapter / converter from MSP 430 interface to PTM 330. R1 is already included in the layout above.

Configuring Values in PTM 335 Configurator

PTM 335 Configurator provides additional configuration option than Dolphin Studio does. Additionally the secure telegrams content relevant parameters can be configured.

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Parameter	Configuration via programming interface
No. of secure subtelegrams.	When ECO 200 is connected in secure mode only 2 telegrams can be transmitted. In case of sufficient power source is secured you can change this parameter to 3. Default value: 2
Secure teach-in starts when	To operate in secure mode the PTM 335 sends a secure teach-in telegram. This event can be triggered by connecting SECURE with VCC and either: • pressing the energy bow only • releasing the energy bow only • pressing or releasing the energy bow Default value: •pressing or releasing the energy bow
PTM 335 secure telegrams content	The content of the 32 possible data telegrams with enhanced security can be configured. Please see PTM 335 Configurator for details.
PTM 335 standard telegram content	The content of the 32 possible data telegrams can be configured. Please see PTM 335 Configurator for details.

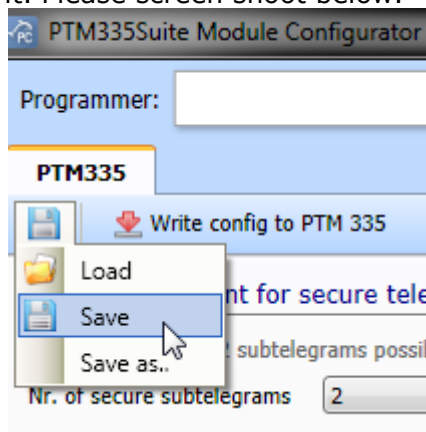
Configuring PTM 335 in production with command line tool

During PTM 335 Configuration a command line programmer tool is installed – MSP 430 Flasher:

http://processors.wiki.ti.com/index.php/MSP430_Flasher_-_Command_Line_Programmer

This command line tool can be also used without PTM 335 Configuration – similar to EOPX. The command line tool is most valuable during production, where no GUI is needed for configuration and the configuration must be performed without user involvement.

For this purpose first create the required configuration in PTM 335 Configurator and save it. Please screen shoot below.



The stored file can be then used to configure a PTM 335. This command must be used:

```
MSP430Flasher.exe -i COM59 -n MSP430FR5730 -w ptm335_config.txt -u -e ERASE_SEGMENT -s -z [VCC]
```


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The COMXX must be specified according your COM Port representing the MSP 430 Programming interface.



Be sure not programming previously read-out configuration files or other files into the PTM 335. By programming other than the specified cells the module configuration will become corrupted and the PTM 335 fails to operate according to specification.

3.5 Absolute maximum ratings (non operating)

Symbol	Parameter	Min	Max	Units
AC1 AC2	Supply voltage	0	6.4	V
GND	Ground connection	0	0	V
A0 A1 B0 B1	Voltage digital input pins	0	0	V

3.6 Maximum Ratings (operating)

Symbol	Parameter	Min	Max	Units
AC1 AC2	Supply voltage	0	6.0	V
GND	Ground connection	0	0	V
A0 A1 B0 B1	Voltage digital input pins	0	0	V

3.7 Radio telegram

3.7.1 Normal operation

In default configuration PTM 33x transmits the same telegrams as a PTM 210 radio switch:

- Telegram type RPS: There are two message types depending on how many buttons (A0, A1, B0, B1) have been pressed (connected to GND)
 - N-message: Only one or two buttons have been pressed.
 - U-message: No pushbutton was pressed when activating the energy generator, or more than two pushbuttons have been pressed.
- Unique factory programmed 32 bit ID
- DATA_BYTE2, DATA_BYTE1, DATA_BYTE0=0
- DATA_BYTE3 and STATUS as follows:

N-message:

DATA_BYTE3:

7						0
RID	UD	PR	SRID	SUD	SA	
RID	(2 bit)					Rocker ID, A=0, B=1
UD	(1 bit)					UD=1 → O-button, UD=0 → I-button
PO	(1 bit)					Polarity, see table below
SRID	(2 bit)					Second Rocker ID
SUD	(1 bit)					(Second) SUD=1 → O-button, SUD=0 → I-button
SA	(1 bit)					SA=1 → Second action (2 buttons pressed simultaneously), SA=0 → No second action

STATUS:

7				0
Reserved	T21	NU	RP_COUNTER	
Reserved	(2 bit)			For future use
T21	(1 bit)			1
NU	(1 bit)			NU=1 → N-message.
RP_COUNTER	(4 bit)			Repeater level: 0 is original message (not repeated)

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U-message:

DATA_BYTE3:

7	0
BUTTONS	PR Reserved

BUTTONS (3 bit) Number of simultaneously pressed buttons, as following:

- 0 = 0 Button
- 1 = not possible
- 2 = not possible
- 3 = 3 or 4 buttons
- 4 = not possible
- 5 = not possible
- 6 = not possible
- 7 = not possible

PO (1 bit) Polarity, see table below
Reserved (4 bit)

STATUS:

7	0
Reserved	T21 NU RP_COUNTER

Reserved (2 bit) For future use
T21 (1 bit) 1
NU (1 bit) NU=0 → U-message.
RP_COUNTER (4 bit) Repeater level: 0 is original message (not repeated)

The polarity PO is defined as follows:

AC1	AC2	PO
-	+	1
+	-	0

3.7.2 Secured Radio Message – PTM 335 only

While operating in secure mode, PTM 335 sends secure telegrams in accordance to EEP D2-03-00 as specified in EnOcean Equipment Profiles For more details refer to <http://www.enocean-alliance.org/eeep/>.

These secure telegrams include a rolling code based on an incrementing counter which guarantees that identical message content will be encrypted differently for each telegram thus preventing replay attacks.

The initial counter value is transmitted from PTM 335 to the receiver as part of the teach-in telegram when entering secure mode. Subsequent secure telegrams do not specify this counter value, therefore sender and receiver have to automatically increment their respective counters for each secure telegram to keep them synchronized.

When telegrams are not received by the receiver this may lead to a de-synchronization of transmitter and receiver counters, i.e. the transmitter counter will have a greater value than the receiver counter.

In order to prevent failure, the receiver will usually test the received rolling code against a defined window of future expected rolling codes and – if successful - resynchronize its counter automatically. The size of this rolling code window is defined on the receiver side. It is important that the amount of consecutive, non-received telegrams does not exceed the side of this window.

For more details please refer to <http://www.enocean.com/en/security-specification/>.



The rolling code is not transmitted with every telegram. It is only transmitted during teach-in. Afterwards the receiver has to increase the counter autonomously for each received message.



It is strongly recommended to use PTM 335 in secure mode only in fixed installations with safe radio distance to avoid de-synchronization of sender and receiver. De-synchronization will occur if PTM 335 is operated outside the range of the receiver consecutively more often than the size of the rolling code window defined on the receiver.

The same may apply if consecutive telegrams are lost on the receiver side due to power interruptions.

In these cases it is necessary to set the receiver in LRN mode and teach-in the device again.

3.7.3 Switching between modes (PTM 335 only)

PTM 335 can be switched from normal mode to secure mode by connecting SECURE with VCC (see chapter 3 for details), and triggering the ECO 200. Then disconnect the pins. Repeating this process will trigger the secure teach-in telegram to be sent again.

Upon entry into secure mode, a teach-in telegram is sent by PTM 335. The type of the teach-in telegram (`Teach_In_Info : Type`) is: 1-PTM. To completely transmit the teach-in telegram the ECO 200 must be triggered two times in total.

The complete secure teach-in message consists of two subsequent telegrams. Therefore to transmit a complete message the ECO generator has to be triggered twice. The two contacts must not remain connected during the sequence of transmitting the teach-in telegram. The connection is only required to trigger the process.

For more information on the structure of the teach-in telegram please refer to chapter 4.2 of <http://www.enocean.com/en/security-specification/>.

PTM 335 can be switched from secure mode to normal mode by connecting STANDARD with VCC, and triggering the ECO 200. Then disconnect the pins.



Before changing the operating mode please make sure to clear the device from all receivers which have been taught to work with this device before. Otherwise the receiver will ignore the telegrams and the application will not work.

3.7.4 User defined operation

Via the configuration interface it is possible to define different content of DATA_BYTE3 and define if a N-message or U-message shall be sent. This allows for example to transmit other RORG=F6 telegrams, e.g. "Mechanical handle", as described in the EnOcean Equipment Profiles defined by EnOcean Alliance.

For details please refer to the EnOcean Equipment Profiles specification-

http://www.enocean-alliance.org/en/enocean_standard/.

3.8 Transmit timing

The setup of the transmission timing allows avoiding possible collisions with data packages of other EnOcean transmitters as well as disturbances from the environment. With each transmission cycle, 3 identical subtelegrams are transmitted within 40 ms. The transmission of a subtelegram lasts approximately 0.7 ms. The delay between the three transmission bursts is affected at random.

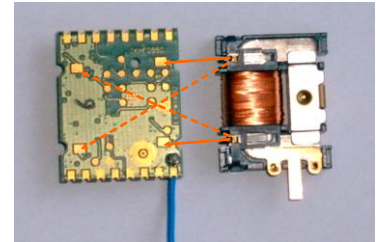
PTM 335 transmits in secured mode 2 identical subtelegrams with length of ~ 1.3 ms

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4 APPLICATIONS INFORMATION

4.1 How to connect an energy harvester

PTM 33x can be connected to ECO 200 without soldering. ECO 200 provides contact springs which can directly be connected to contact pads of PTM 33x. The contact pads on the bottom of the PCB are shown below (left). A second orientation where PTM 33x is rotated 180° with respect to ECO 200 is also possible as shown with dashed lines.

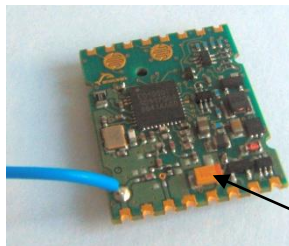


4.2 How to generate an equivalent energy pulse

PTM33x can also be operated from an external equivalent energy pulse.

As the source impedance is not known a procedure is defined how to find the needed duration of the pulse.

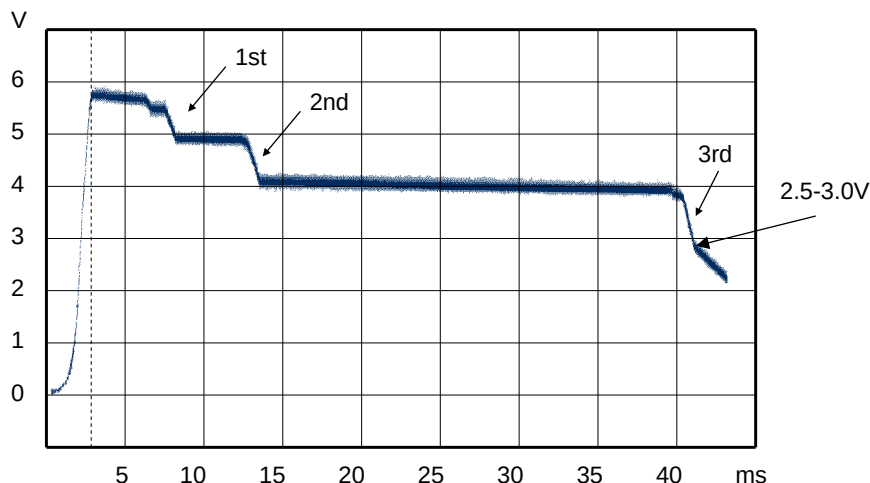
The pulse must provide a voltage between 5 V and 6 V for maximum 10 ms time.



storage capacitor

The length of this supply pulse needs to be defined by measuring the remaining voltage on the storage capacitor after the 3rd subtelegram, according to the following procedure:

- 1) Discharge the storage capacitor (see photo) completely
- 2) Apply a short pulse, voltage between 5 V to 6 V which charges the capacitor
- 3) Measure the voltage drop at the storage capacitor to ground (between pin 13 and pin 12) while the sub-telegrams are being transmitted with an oscilloscope
- 4) The remaining voltage shortly after the 3rd sub-telegram should be 2.5 to 3.0 V



4.3 How to solder additional teach-in button – PTM 335 only

On PTM 335 there is are not populated pads – SECURE and VCC. By mounting a push button on them the PTM 335 can have a teach-in button. By pressing the button and triggering the ECO the secure teach-in process is triggered and the module switches to secure mode.

By repeated pressing the button will retransmit the secure message. To switch to the standard mode the STANDARD and VCC pin must be connected. There is no push button option available for this step.

A drilling is positioned between the pads. This enables the possibility to mount also push buttons which have pressing point deeper then the PCB (better tactile handling) or are operated from the bottom.

Please see drawings of PTM 335 for detailed information and position of pads. (please see chapter 2.4 and 3.2)

Following push buttons have been evaluated as acceptable for the above defined use case:

- Ultra-small Tactile Switch (SMT) B3U – from Omron



1

4.4 Antenna

315 MHz

Option 1: 150 mm wire, connect to RF_WHIP

Option 2: A 50 Ω antenna can be connected to RF_50.

In this case the limited modular FCC/IC approval is not valid!

An FCC/IC approval is then needed for the end device!

868 MHz

Option 1: 86 mm wire, connect to RF_WHIP

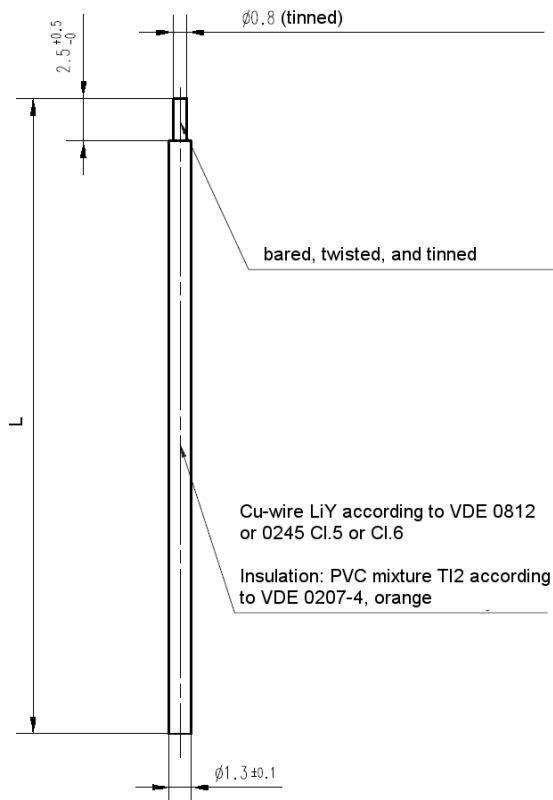
Option 2: A 50 Ω antenna can be connected to RF_50

902 MHz

64 mm wire, connect to RF_WHIP

¹ Picture Source: <http://www.omron.com/ecb/products/pdf/en-b3u.pdf> (20.6.2014)

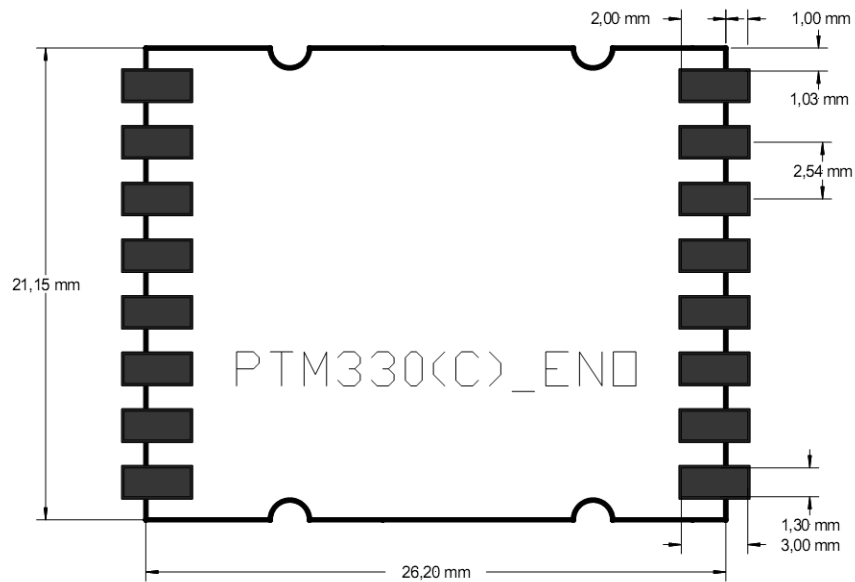
PTM 33x / PTM 330C / PTM 332C / PTM 330U



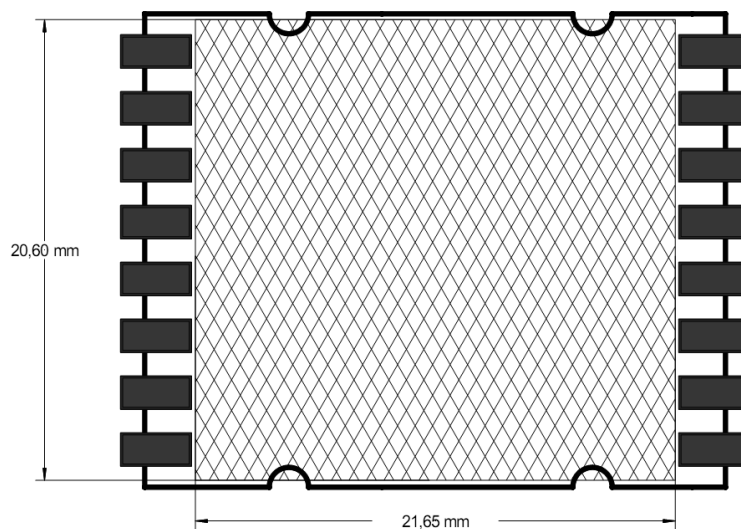
**Specification of the whip antenna; L=150 mm @ 315 MHz,
L=86 mm @ 868 MHz, L=64 mm @ 902 MHz**

PTM 33x / PTM 330C / PTM 332C / PTM 330U

4.5 Layout recommendations



Proposal for foot print on host PCB



Keep out area on host PCB. No copper surface area allowed!

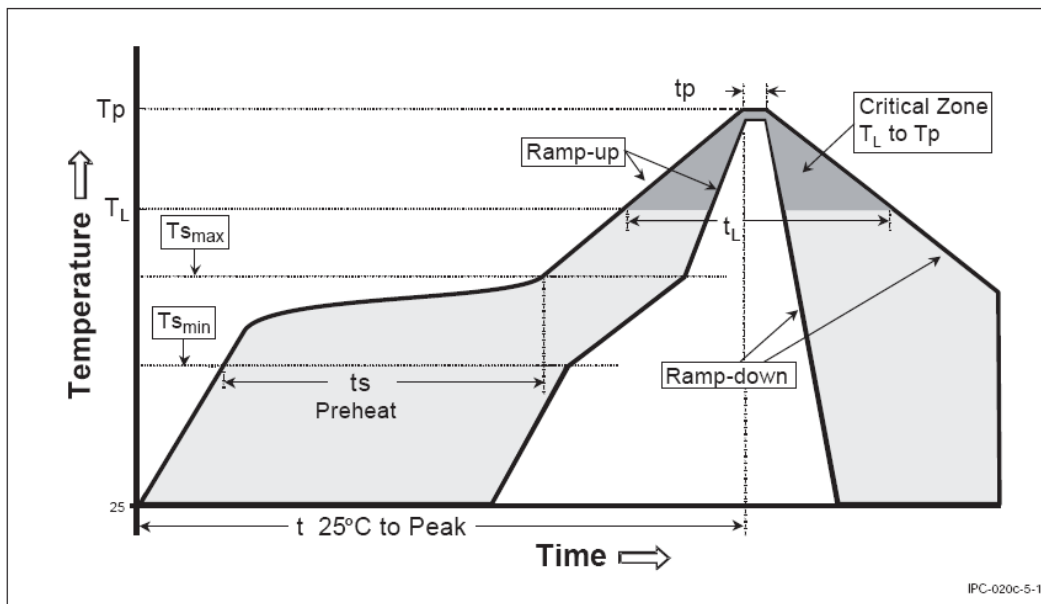
PTM 33x / PTM 330C / PTM 332C / PTM 330U

4.6 Soldering information PTM 332/332C

PTM 332 has to be soldered according to IPC/JEDEC J-STD-020C standard.

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate ($T_{S_{max}}$ to T_p)	3° C/second max.
Preheat – Temperature Min ($T_{S_{min}}$) – Temperature Max ($T_{S_{max}}$) – Time ($t_{S_{min}}$ to $t_{S_{max}}$)	150 °C 200 °C 60-180 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)	217 °C 60-150 seconds
Peak/Classification Temperature (T_p)	260 °C
Time within 5 °C of actual Peak Temperature (t_p)	20-40 seconds
Ramp-Down Rate	6 °C/second max.
Time 25 °C to Peak Temperature	8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.



PTM 332 shall be handled according to Moisture Sensitivity Level MSL4 which means a floor time of 72 h. PTM 332 may be soldered only once, since one time is already consumed at production of the module itself.

Once the dry pack bag is opened, the desired quantity of units should be removed and the bag resealed within two hours. If the bag is left open longer than 30 minutes the desiccant should be replaced with dry desiccant. If devices have exceeded the specified floor life time of 72 h, they may be baked according IPC/JEDEC J-STD-033B.

Devices packaged in moisture-proof packaging should be stored in ambient conditions not exceeding temperatures of 40 °C or humidity levels of 90% r.h.

PTM 332 modules have to be soldered within 6 months after delivery!

4.7 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
- Ferroconcrete 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 fiber
- 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.

5 AGENCY CERTIFICATIONS

The modules have been tested to fulfil the approval requirements for CE (PTM 33x) and FCC/IC (PTM 33xC, PTM 330U) based on the built-in firmware.

5.1 CE approval

The modules 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 according documentation has been deposited at EnOcean. The modules 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 modules must not be modified or used outside their specification limits.
- EnOcean RF modules may only be used to transfer digital or digitized data. Analog speech and/or music are not permitted.
- The final product incorporating EnOcean RF modules 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 the transmitter is used according to the regulations of the 868.3 MHz band, a so-called "Duty Cycle" of 1% per hour must not be exceeded. Permanent transmitters such as radio earphones are not allowed.
- The module must be used with only the following approved antenna(s).

Type	Parameter	Value
Wire/Monopole at RF_WHIP	Maximum gain	1.0 dBi
External antenna at RF_50	Antenna type	Passive
	Impedance	~50 Ohm
	Maximum gain	≤ 0 dBd

5.2 FCC (United States) Certification

5.2.1 PTM 330C and PTM 332C LIMITED MODULAR APPROVAL

This is an RF module approved for Limited Modular use operating as an intentional transmitting device with respect to 47 CFR 15.231(a-c) and is limited to OEM installation. The module is optimized to operate using small amounts of energy, and may be powered by a battery. The module transmits short radio packets comprised of control signals, (in some cases the control signal may be accompanied with data) such as those used with alarm systems, door openers, remote switches, and the like. The module does not support continuous streaming of voice, video, or any other forms of streaming data; it sends only short packets containing control signals and possibly data. The module is designed to comply with, has been tested according to 15.231(a-c), and has been found to comply with each requirement. Thus, a finished device containing the PTM 330C/PTM 332C/PTM 330U radio module can be operated in the United States without additional Part 15 FCC approval (approval(s) for unintentional radiators may be required for the OEM's finished product), under EnOcean's FCC ID number. This greatly simplifies and shortens the design cycle and development costs for OEM integrators. The module can be triggered manually or automatically, which cases are described below.

Manual Activation

The radio module can be configured to transmit a short packetized control signal if triggered manually. The module can be triggered, by pressing a switch, for example. The packet contains one (or more) control signals that is(are) intended to control something at the receiving end. The packet may also contain data. Depending on how much energy is available from the energy source, subsequent manual triggers can initiate the transmission of additional control signals. This may be necessary if prior packet(s) was(were) lost to fading or interference. Subsequent triggers can also be initiated as a precaution if any doubt exists that the first packet didn't arrive at the receiver. Each packet that is transmitted, regardless of whether it was the first one or a subsequent one, will only be transmitted if enough energy is available from the energy source.

Automatic Activation

The radio module also can be configured to transmit a short packetized control signal if triggered automatically. Again, the packet contains a control signal that is intended to control something at the receiving end and may also contain data. As above, it is possible for the packet to get lost and never reach the receiver. However, if enough energy is available from the energy source, and the module has been configured to do so, then another packet or packets containing the control signal may be transmitted at a later time.

OEM Requirements

In order to use EnOcean's FCC ID number, the OEM must ensure that the following conditions are met:

- End users of products, which contain the module, must not have the ability to alter the firmware that governs the operation of the module. The agency grant is valid only when the module is incorporated into a final product by OEM integrators.
- The end-user must not be provided with instructions to remove, adjust or install the module.

PTM 33x / PTM 330C / PTM 332C / PTM 330U

- The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product. Attaching a label to a removable portion of the final product, such as a battery cover, is not permitted. The label must include the following text:

PTM330C/PTM332C

Contains FCC ID: SZV-PTM33XC

The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation.

When the device is so small or for such use that it is not practicable to place the statement above on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

The user manual for the end product must also contain the text given above.

- Changes or modifications not expressly approved by EnOcean could void the user's authority to operate the equipment.
- The module must be used with only the following approved antenna(s).

Part Number	Type	Gain
N.A.	Wire/Monopole	1.0 dBi

- The OEM must ensure that timing requirements according to 47 CFR 15.231(a-c) are met.
- The OEM must sign the OEM Limited Modular Approval Agreement with EnOcean

PTM 33x / PTM 330C / PTM 332C / PTM 330U

5.2.2 PTM 330C and PTM 332C FCC Grant**TCB****GRANT OF EQUIPMENT
AUTHORIZATION****TCB****Certification****Issued Under the Authority of the
Federal Communications Commission****By:**

PHOENIX TESTLAB GmbH
Koenigswinkel 10
D-32825 Blomberg,
Germany

Date of Grant: 07/22/2010

Application Dated: 07/22/2010

EnOcean GmbH
Kolpingring 18a
Oberhaching, 82041
Germany

Attention: Armin Anders , Director Product Marketing

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is
VALID ONLY for the equipment identified hereon for use under the Commission's
Rules and Regulations listed below.

FCC IDENTIFIER: SZV-PTM33XC
Name of Grantee: EnOcean GmbH
Equipment Class: Part 15 Security/Remote Control Transmitter
Notes: 315 MHz Transmitter
Modular Type: Limited Single Modular

Grant Notes

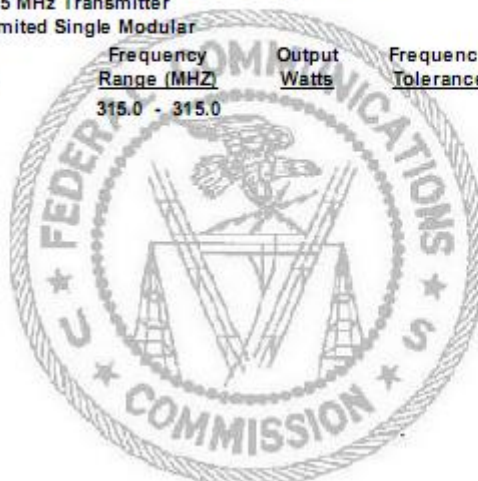
FCC Rule Parts
15.231

Frequency
Range (MHz)
315.0 - 315.0

Output
Watts

Frequency
Tolerance

Emission
Designator



PTM 33x / PTM 330C / PTM 332C / PTM 330U

5.2.3 PTM 330U FCC APPROVAL

This device complies with part 15 of the FCC rules. 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.

IMPORTANT! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product. Attaching a label to a removable portion of the final product, such as a battery cover, is not permitted. The label must include the following text:

PTM 330U

Contains FCC ID: SZV-PTM330U

The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation.

When the device is so small or for such use that it is not practicable to place the statement above on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

PTM 33x / PTM 330C / PTM 332C / PTM 330U

5.2.4 PTM 330U FCC Grant**TCB****GRANT OF EQUIPMENT
AUTHORIZATION**

Certification
Issued Under the Authority of the
Federal Communications Commission
By:

EMCCert Dr. Rasek GmbH
Stoernhofer Berg 15
D-91364 Unterleinleiter,
Germany

TCB

Date of Grant: 06/20/2013

Application Dated: 06/20/2013

EnOcean GmbH
Kolpingring 18a
Oberhaching, 82041
Germany

Attention: Armin Anders , Director Product Marketing

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID
ONLY for the equipment identified hereon for use under the Commission's Rules and
Regulations listed below.

FCC IDENTIFIER: SZV-PTM330U

Name of Grantee: EnOcean GmbH

Equipment Class: Part 15 Security/Remote Control Transmitter

Notes: 902.875MHz transmitter

Grant NotesFCC Rule Parts

15.231

Frequency
Range (MHZ)

902.875 - 902.875

Output
WattsFrequency
ToleranceEmission
Designator

5.2.5 FCC Regulatory Statements

This device complies with part 15 of the FCC rules. 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. Any changes or modifications not expressly approved by manufacturer could void the user's authority to operate the equipment.

IMPORTANT! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/ TV technician for help.

5.3 IC (Industry Canada) Certification

In order to use EnOcean's IC number, the OEM must ensure that the following conditions are met:

- Labeling requirements for Industry Canada are similar to those required by the FCC. The Original Equipment Manufacturer (OEM) must ensure that IC labeling requirements are met. A clearly visible label on the outside of a non-removable part of the final product must include the following text:

PTM 330C / PTM 332C:

Contains IC: 5713A-PTM33XC

PTM 330U:

Contains IC: 5713A-PTM330U

- OEM wishing to use PTM 330C / 332C under limited modular approval conditions must sign the OEM Limited Modular Approval Agreement with EnOcean

Pour utiliser le numéro IC EnOcean, le OEM doit s'assurer que les conditions suivantes sont remplies:

- Les exigences d'étiquetage pour Industrie Canada sont similaires à ceux exigés par la FCC. Le fabricant d'équipement d'origine (OEM) doit s'assurer que les exigences en matière d'étiquetage IC sont réunies. Une étiquette clairement visible à l'extérieur d'une partie non amovible du produit final doit contenir le texte suivant:

PTM 330C / PTM 332C:

Contains IC: 5713A-PTM33XC

Contient le module d'émission IC: 5713A-PTM33XC

PTM 330U:

Contains IC: 5713A-PTM330U

Contient le module d'émission IC: 5713A-PTM330U

- L'OEM doit signer l'accord OEM limitée Approbation modulaire avec EnOcean pour utiliser PTM 330C / 332C.

PTM 33x / PTM 330C / PTM 332C / PTM 330U

5.3.1 PTM 330C and PTM 332C Industry Canada Technical Approval Certificate

 PHOENIX TESTLAB	
TECHNICAL APPROVAL CERTIFICATE based on the Agreement on Mutual Recognition between the European Community and Canada	CERTIFICAT D'APPROBATION TECHNIQUE en se basant l'accord de reconnaissance mutuelle entre la Communauté Européenne et le Canada
CERTIFICATE NUMBER <i>NUMÉRO DE CERTIFICAT</i>	10-111340
CERTIFICATION NUMBER <i>NUMÉRO DE CERTIFICATION</i>	IC: 5713A-PTM33XC
TYPE OF SERVICE <i>TYPE DE SERVICE</i>	New Family Certification / Limited Modular Approval
CERTIFICATE HOLDER <i>TITULAIRE DU CERTIFICAT</i>	EnOcean GmbH Kolpingring 18a 82041 Oberhaching Germany
TYPE OF EQUIPMENT <i>GENRE DE MATÉRIEL</i>	Transmitter Module
TRADE NAME AND MODEL NUMBER <i>MARQUE ET NUMÉRO DE MODÈLE</i>	EnOcean PTM330C / PTM332C
FREQUENCY RANGE <i>BANDE DE FRÉQUENCES</i>	315MHz
EMISSION DESIGNATION (TRC-43) <i>DÉSIGNATION D'ÉMISSION (CRT-43)</i>	315KA1D
R.F. POWER RATING (WATT) <i>PUISSANCE NOMINALE H.F. (WATT)</i>	/
ANTENNA INFORMATION <i>INFORMATION D'ANTENNE</i>	Wire Antenna 15cm
CONTACT INFORMATION OF TESTING LABORATORY <i>COORDONNÉES DU LABORATOIRE DESSAI</i>	Center for Quality Engineering SGS Germany GmbH Hoffmannstraße 50 81379 München Germany
CERTIFIED TO <i>CERTIFIÉ SELON LE</i>	SPECIFICATION / ISSUE <i>CAHIER DES CHARGES / ÉDITION</i>
	RSS-210 Issue 7, RSS-GEN Issue 2 RSS-102 Issue 4

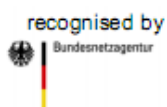
Certification of equipment means only that the equipment has met the requirements of the above noted specification. License applications, where applicable to use certified equipment, are acted on accordingly by the issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures issued by the Department.

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation. Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences aux procédures d'Industry Canada.

Labelling of Certified Radio Equipment: Equipment that has received certification but is not labelled with the applicant's name, model number and the certification number as outlined above is not considered certified.

Étiquetage du matériel radio homologué: Le matériel pour lequel une certification a été obtenue mais qui n'est pas étiqueté conformément aux exigences ci-dessus (nom du requérant, numéro de modèle et numéro de certification) n'est pas considéré comme certifié.

Certification Body Code: DE0003



Blomberg, 23 July 2010


 Signed by / Signataire Uwe Dollitz

Foreign Certification Body (FCB)

BNZ-A-CAB-04/22-53

 PHOENIX TESTLAB GmbH • Königswinkel 10 D-32825 Blomberg, Germany • Phone: +49 (0) 5235-9500-0 • Fax: +49 (0) 5235-9500-10
<http://www.phoenix-testlab.de>

PTM 33x / PTM 330C / PTM 332C / PTM 330U

5.3.2 PTM 330U Industry Canada Technical Approval Certificate



FCB under the Canada-EC MRA
 TCB under the USA-EC MRA
 RFCAB under the Japan-EC MRA
 Notified Body R&TTE Directive 99/5/EC
 Notified Body EMC Directive 2004/108/EC

No. ► CA001351D

TECHNICAL ACCEPTANCE CERTIFICATE CANADA

CERTIFICAT D'ACCEPTABILITÉ TECHNIQUE CANADA

CERTIFICATION No. ► 5713A-PTM330U
 No. DE CERTIFICATION
 ISSUED TO ► EnOcean GmbH
 DÉLIVRÉ À

Street Address
 Numéro et rue
 Province or State
 Province ou État

Kolpingring 18 a
 Germany

City
 Ville
 Postal Code
 Code postal

Oberhaching
 82041

TYPE OF EQUIPMENT
 GENRE DE MATÉRIEL
 FREQUENCY RANGE
 BANDE DE FRÉQUENCES
 R.F. POWER
 PUISSANCE H.F.
 SPECIFICATION
 SPÉCIFICATION

► Remote Control Device
 ► 902.88 - 902.88 MHz
 ► 50.86 dBuV/m @ 3m
 ► RSS-210

TRADE NAME & MODEL
 MARQUE ET MODÈLE
 EMISSION TYPE
 GENRE D'ÉMISSION
 ANTENNA
 ANTENNE
 ISSUE
 ÉDITION

► Transmitter Module PTM 330U
 ► 299K7F1DAN
 ► Integrated
 Incorporé
 8 11 December 2010

TEST LABORATORY
 LABORATOIRE D'ESSAI

Street Address
 Numéro et rue
 Province or State
 Province ou État
 Name
 Nom
 E-mail

► EMCCons DR. RAŠEK GmbH &
 Co. KG
 Moggast, Boelwiese 8
 Germany
 Karlheinz Kraft
 k.kraft@emcc.de

CN 3484C OATS 3481C-1
 City
 Ville
 Postal Code
 Code postal
 Tel 0049 9194 9016
 Fax 0049 9194 8125

Certification of equipment means only that the equipment has met the requirements of the above-noted specification. Licence applications, where applicable to use certified equipment, are acted on accordingly by the Industry Canada issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements and procedures issued by Industry Canada. The equipment for which this certificate is issued shall not be manufactured, imported, distributed, leased, offered for sale or sold unless the equipment complies with the applicable technical specifications and procedures issued by Industry Canada.

I hereby attest that the subject equipment was tested and found in compliance with the above-noted specification.

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance d'Industrie Canada et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation. Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'Industrie Canada. Le matériel à l'égard duquel le présent certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins d'être conforme aux procédures et aux spécifications techniques applicables publiées par Industrie Canada.

J'atteste par la présente que le matériel a fait l'objet d'essai et jugé conforme à la spécification ci-dessus.

DATE 21 June 2013


 Certification Officer

EMCCert DR. RAŠEK GmbH • Stoernhofer Berg 15, 91364 Unterleinleiter, Germany
 Tel.: +49 9194 72279-01 • Fax: +49 9194 72279-06 • E-mail: emc.cert@emcc.de • Web: www.emcc.de

PTM 33x / PTM 330C / PTM 332C / PTM 330U

5.3.3 Industry Canada Regulatory Statements

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IMPORTANT! Tous les changements ou modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner cet équipement.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada