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STM 3xy wireless sensor transmitter module family

Seven years ago EnOcean presented the first generation of solar powered sensor modules – the STM 100. Since then a lot of effort has been put into the miniaturization of this circuit. Based on the new EnOcean Dolphin chip – which incorporates most of the previously discrete circuitry – EnOcean has developed a new product family of solar powered wireless sensor transmitters.

Dr. Wolfgang Heller, Product Line Manager, EnOcean GmbH

Overview and key features

The figure below shows a comparison between the first generation STM 100 and the latest generation STM 310.

STM 100   STM 310   STM 100   STM 100   STM 310
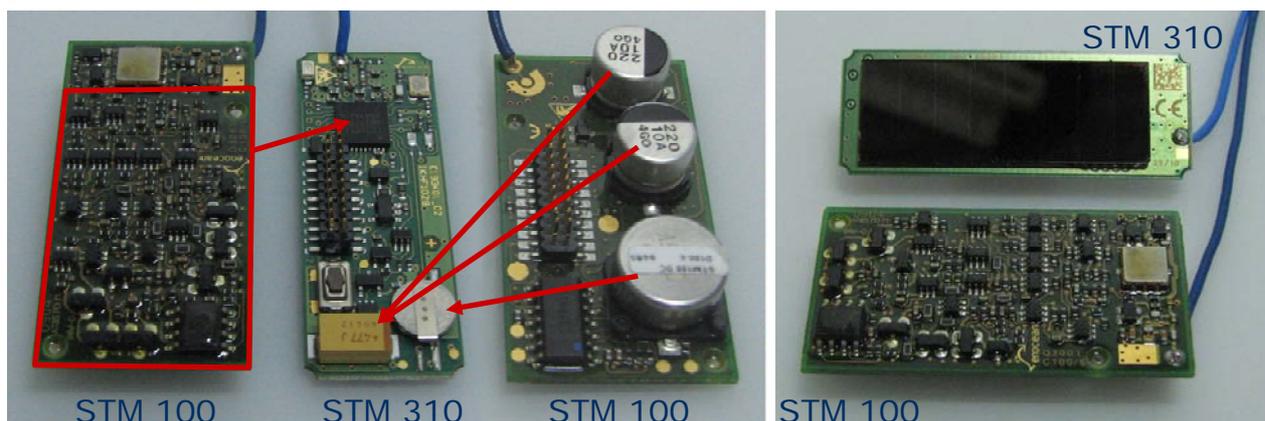
Due to the much higher level of integration the back side of the module could be emptied completely making room for a solar cell directly mounted onto the module.

The STM 3xy product family consists of several variants. The STM 31x variants can be used as general purpose modules for a variety of applications such as STM 100 and STM 110. In addition there are dedicated variants for the applications magnet contact (STM 320) and temperature sensor (STM 330).

All modules include a radio transmitter with antenna, an integrated charging circuit with energy storage, internal sensors or a connector for external sensor circuits, a LRN button , and a transmission indicator LED. All variants except STM 312 are equipped with a pre-installed solar cell. STM 312 can be supplied by an external solar cell, by temperature differences using the ECT310 module or by other energy harvesters.

The internal energy storage is designed to supply the module in periods where no light is available. In typical scenarios where a radio telegram is sent every 15 minutes this energy storage can bridge periods of about 4 days. The magnet contact even survives for 6 days in total darkness.

All products are available as 868 MHz variant with approval according to R&TTE for Europe

and as 315 MHz variant with FCC / IC approval for North America. The table below gives an overview of the variants and features.

|	STM 310 STM 310C	STM 311 STM 311C	STM 312 STM 312C	STM 320 STM 320C	STM 330 STM 330C
Application	General purpose			Magnet contact	Temperature sensor
Firmware Features	Monitors 3 analog and 3 digital inputs, configurable wake-up and transmit cycle			Monitors internal reed contact, wake-up and transmit cycle every 20-30min	Monitors internal temperature sensor (0-40° C), external set-point dial and occupancy button. Configurable wake-up and transmit cycle
Programmable Configurable	Yes			No	Yes
Antenna	Whip	Helical	Whip	Helical	Whip
LRN button	Vertical			Side	Vertical
Solar cell	Yes	Yes	No	Yes	Yes
Connector	20 pin			No	20 pin
Transmit indicator	Yes				
Operating Temperature	-20 … +60° C				
Frequency variants	STM 31x: 868 MHz STM 31xC: 315 MHz			STM 320: 868 MHz STM 320C: 315MHz	STM 31x: 868 MHz STM 31xC: 315 MHz
PCB size	43x16x9mm			43x16x7mm	43x16x9mm

Applications

The product family supports a variety of applications such as window contacts, temperature and humidity sensors, light sensors, pressure sensors or gas sensors.
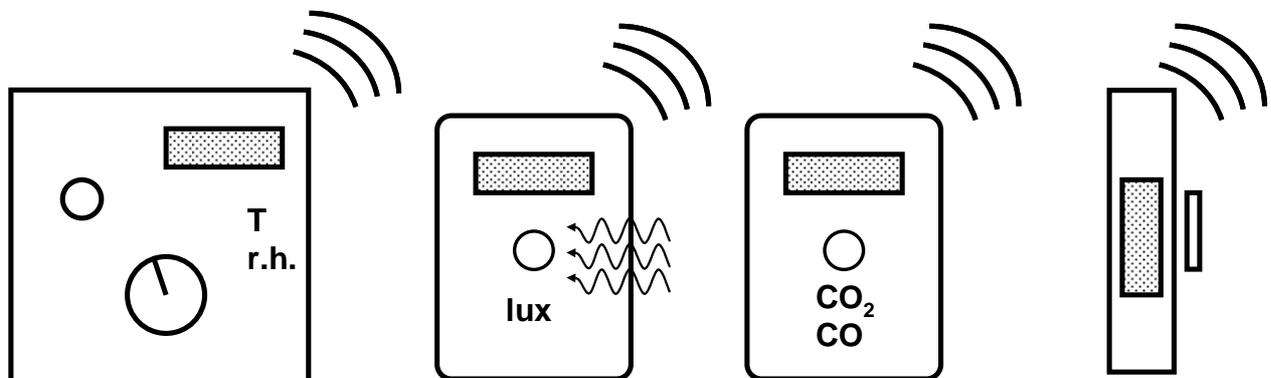
The STM 31x variants provide – as their predecessor STM 110 three analog and digital inputs (plus one digital input used by the LRN button). The module provides a user configurable cyclic wake up. After wake up the external sensors are supplied with energy and after a configurable delay (default 2 ms) the internal microcontroller reads the status of the connected sensors. A radio telegram will be transmitted in case of a change of any digital input value compared to the last sending or in case of a significant change of measured analogue values. In case of no relevant input change a redundant retransmission signal is sent after a user configurable number of wake-ups to announce all current values. With default settings the module wakes up every 100s and transmits a life signal every 15 min. In addition to the cyclic wake-up, a wake-up can be triggered externally using a wake input or the internal LRN button.

STM 330 provides a calibrated internal temperature sensor. It can work as a stand-alone wireless temperature sensor without the need for a host PCB. This allows a significant cost reduction compared to products based on STM 110. In addition an external occupancy button and a potentiometer for a set point dial can be connected via a very simple host PCB. There is no need for additional external components on that host PCB. The complete schematics for a temperature sensor with set point dial and occupancy button is shown below:
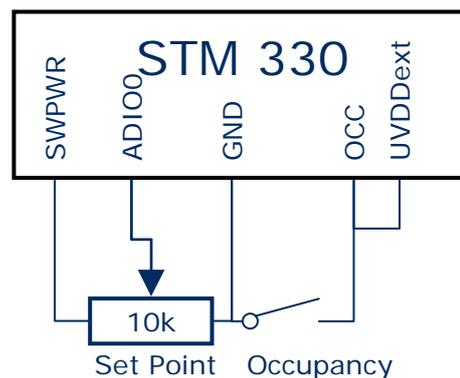
With default settings the module wakes up every 100s and transmits a life signal every 15 min. In addition, a wake up can be triggered externally using an external occupancy button or the internal LRN button.

STM 320 is equipped with a reed contact which detects the presence of an external magnet. Whenever the status of the reed contact changes or the LRN button is pressed the module wakes up and transmits the status. In addition a life signal is sent every 20-30 min, affected at random. The housing has to be designed by the OEM, it is possible to strongly reduce the size of a finished product compared to the current STM250 window contact.

Configuration and programming

STM 31x and STM 330 can be configured via a serial interface or via hardware pins. The wake-up cycle and transmit cycle can be set via configuration pins. The module can be configured to wake up every 1, 10, or 100 seconds. In addition it can be configured to transmit at every wake-up, or (on average) at every 10th, or 100th wake-up.

Using the serial interface a much higher degree of configuration is possible. Wake-up and transmit cylce can be defined almost freely, threshold levels for analog input values can be

set, EnOcean Equipment Profile and manufacturer ID can be selected, and a lot more.

If different software features are needed, it is also possible to write custom firmware in C-language for STM 31x and for STM 330 based on the powerful Dolphin API.

Combination with ECT 310

ECT 310 is a low-cost ultra-low-voltage DC/DC converter for powering battery-less EnOcean radio modules by thermal energy. Operation starts at typ. 20 mV relating to a 2 Kelvin temperature difference at a standard low-cost Peltier element.

ECT 310 can be soldered onto the back side of STM 312 as shown below. This allows to use thermal energy instead of solar energy to power the module.
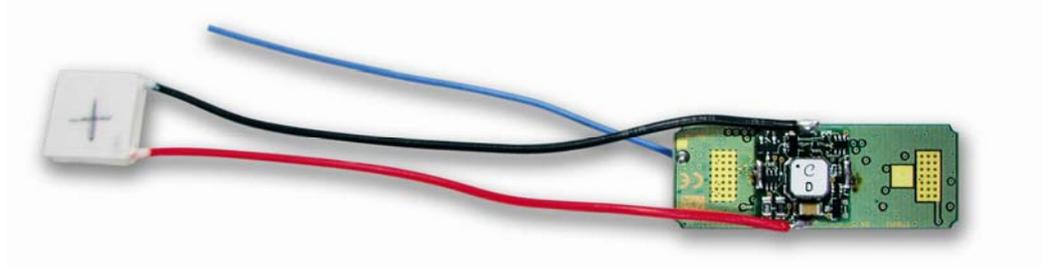
Summary

The new STM 3xy product familiy is a very versatile platform for development of self pow-ered radio sensors. With pre-installed solar cell and internal temperature sensor it allows significant reduction of production cost for temperature sensors and room operating panels compared to its predecessor modules. Due to the configuration options and programmabil-ity it is much easier to realize new products and to adopt them to ever changing customer requirements.