USER MANUAL V1.0

Green.Smart.Wireless.
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Scavenger Transmitter Module
STM 430J / 431J

April 30, 2013

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,
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Subject to modifications
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REVISION HISTORY

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

No	Major Changes
1.0	Initial version

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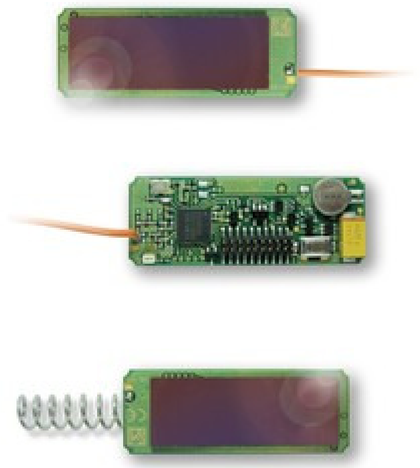
Important!

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.

TABLE OF CONTENT

1 GENERAL DESCRIPTION

1.1 Basic functionality



The extremely power saving RF transmitter module STM 430J / 431J of EnOcean is optimized for realization of wireless and maintenance free temperature sensors, or room operating panels including set point dial and occupancy button. It requires only a minimum number of external components and provides an integrated and calibrated temperature sensor.

Power supply is provided by a small solar cell, an external energy harvester or an external 3 V backup battery. An energy storage element is installed in order to bridge periods with no supply from the energy harvester. The module provides a user configurable cyclic wake up.
After wake up, the internal microcontroller reads the status of the temperature sensor and optional set point dial. A radio telegram will be transmitted in case of a significant change of measured temperature or set point values or if the external occupancy button is pressed.
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.
In addition to the cyclic wake-up, a wake up can be triggered externally using the input for the occupancy button or the internal LRN button.

The firmware can be configured to use different EEPs according to the availability set point dial and occupancy button.

Features with built-in firmware

- Pre-installed solar cell
- On-board energy storage and charging circuit
- On-board LRN button
- On-board TX indicator LED
- Calibrated internal temperature sensor
- Input for external occupancy button and set point dial
- Configurable wake-up and transmission cycle
- Wake-up via Wake pins or LRN button
- Support for humidity sensor module HSM 100

Features accessible via API

Using the Dolphin API library it is possible to write custom firmware for the module.
The API provides:

- Integrated 16.385MHz 8051 CPU with 64 kB FLASH and 4 kB SRAM
- Integrated temperature sensor
- Various power down and sleep modes down to typ. 0.1 µA current consumption
- Up to 13 configurable I/Os
- 10 bit ADC, 8 bit DAC

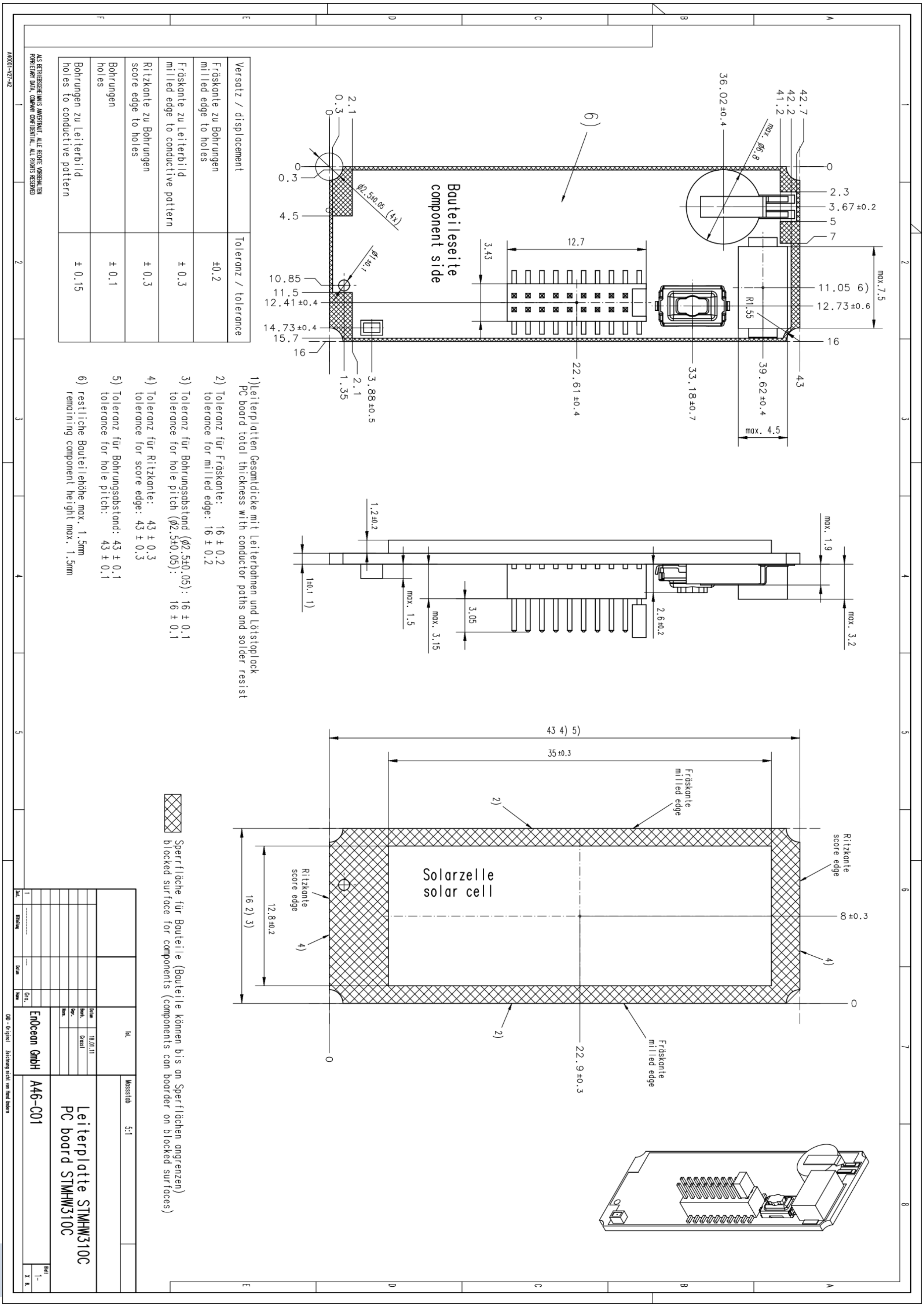
1.2 Technical data

Antenna	whip antenna (STM 430J) helix antenna (STM 431J)
Frequency	928.35MHz
Data rate/Modulation type	125 kbps/FSK
Radiated Output Power	Typ. 0dBm
Power Supply @ VDD	Pre-installed solar cell Illumination 50-100000 lux 2.1 V–5.0 V, 2.6 V needed for start-up
Initial operation time in darkness @ 25°C	typ. 4 days, min. 60 hours if energy storage fully charged, wake-up every 100 s, transmission of telegram every 1000 s on average[1]
Operation start up time with empty energy store	typ. 2.5 min @ 400 lux / 25 °C incandescent or fluorescent light
Input Channels	Internal: temperature sensor, LRN button External: occupancy button, set point dial, HSM 100
Temperature sensor	Measurement range 0-40 °C, resolution 0.16 K Accuracy typ. ±0.5 K between 17 °C and 27 °C typ. ±1 K between 0 °C and 40 °C
EnOcean Equipment Profiles	configurable EEPs: A5-02-05 (default), A5-10-05, A5-10-03 and with HSM 100: A5-04-01, A5-10-10, A5-10-12
Connector	20 pins, grid 1.27 mm, ☐ 0.4 mm
Radio Regulations	ARIB STD-T108

1.3 Physical dimensions

PCB dimensions	43±0.2 x 16±0.3 x 1±0.1 mm
Module height	8 mm
Weight	4.5 g

[1] Full performance of the PAS614L energy storage is achieved after several days of operation (up to two weeks) at good illumination level. Performance degrades over life time, especially if energy storage is exposed to higher temperatures. Each 10 K drop in temperature doubles the expected life span.


Bauteileseite
component side
Versatz / displacement
Toleranz / tolerance
Fräskante zu Bohrungen
milled edge to holes
±0.2
Fräskante zu Leiterbild
milled edge to conductive pattern
± 0.3
Ritzkante zu Bohrungen
score edge to holes
± 0.3
Bohrungen
holes
± 0.1
Bohrungen zu Leiterbild
holes to conductive pattern
± 0.15
1) Leiterplatten Gesamtdicke mit Leiterbahnen und Lötstoplack
PC board total thickness with conductor paths and solder resist
2) Toleranz für Fräskante: 16 ± 0.2
tolerance for milled edge: 16 ± 0.2
3) Toleranz für Bohrungsabstand (Ø2.5±0.05): 16 ± 0.1
tolerance for hole pitch (Ø2.5±0.05): 16 ± 0.1
4) Toleranz für Ritzkante: 43 ± 0.3
tolerance for score edge: 43 ± 0.3
5) Toleranz für Bohrungsabstand: 43 ± 0.1
tolerance for hole pitch: 43 ± 0.1
6) restliche Bauteilehöhe max. 1.5mm
remaining component height max. 1.5mm
Solarzelle
solar cell
Fräskante
milled edge
Ritzkante
score edge
Sperrfläche für Bauteile (Bauteile können bis an Sperrflächen angrenzen)
blocked surface for components (components can boarder on blocked surfaces)
EnOcean GmbH
A46-C01
Leiterplatte STMHW310C
PC board STMHW310C
Massstab 5:1

1.4 Environmental conditions

Operating temperature	-20 °C … +60 °C
Storage temperature	-20 °C … +60 °C, recommended[2]: +10 °C…+30 °C, <60%r.h.
Shelf life (in absolute darkness)	36 months after delivery[3]
Humidity	0% … 93% r.h., non-condensing

⚠ The module shall not be placed on conductive materials, to prevent discharge of the internal energy storages[3]. Even materials such as conductive foam (ESD protection) may have negative impact.

1.5 Ordering Information

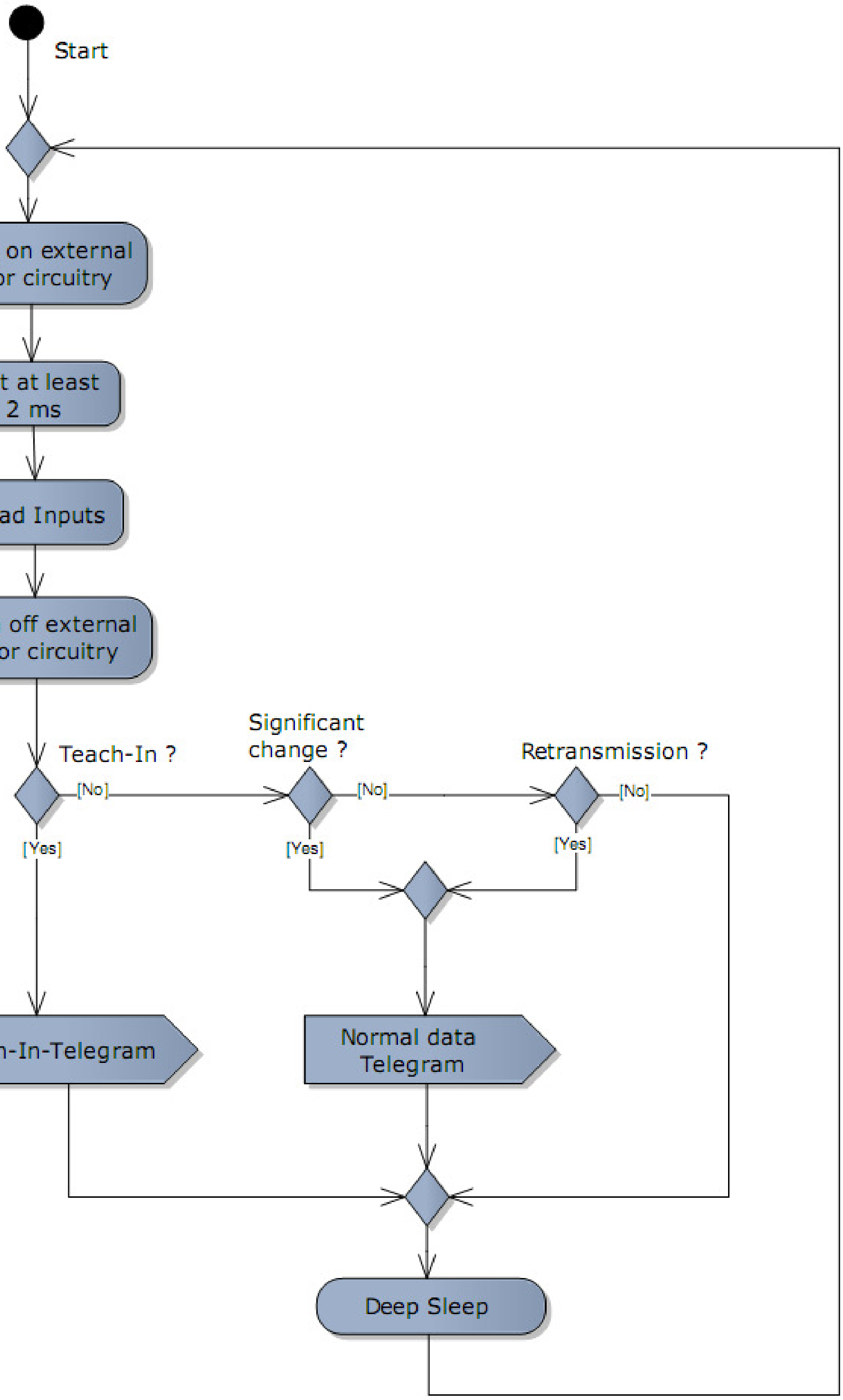
Type	Ordering Code
STM 430J	**S3061-D430**
STM 431J	**S3061-D431**

[2] Recommended for maximum life of energy storage capacitor

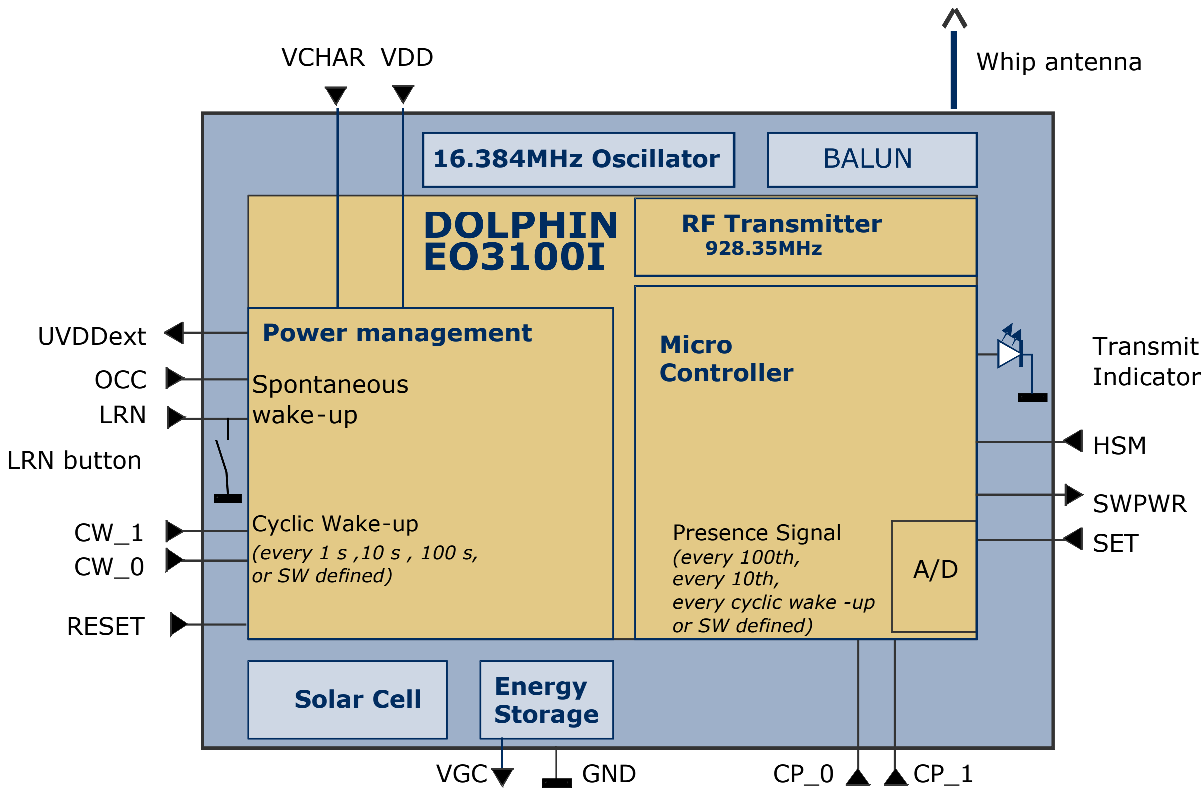
[3] Deep discharge of the PAS614L energy storage leads to degradation of performance. Therefore products have to be taken into operation after 36 months. At least the PAS614L needs to be recharged to 2.1 V.

2 FUNCTIONAL DESCRIPTION

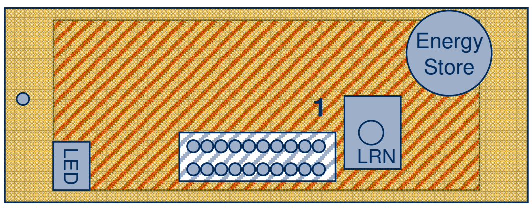
2.1 Simplified firmware flow chart and block diagram



2.2 Pin out



UVDDext	1	2	WAKE0
WAKE1	3	4	VGC
GND	5	6	VCHAR
PROG_EN	7	8	SWPWR
ADIO0	9	10	ADIO3
ADIO1	11	12	ADIO4
ADIO2	13	14	ADIO6
RESET	15	16	ADIO7
RSDADIO3	17	18	SCLKDIO1
WSDADIO2	19	20	SCSEDIO0



The figure above shows the pin out of the STM 430J / 431J hardware. The pins are named according to the naming of the EO3100I chip to simplify usage of the DOLPHIN API. The table in section 2.3 shows the translation of hardware pins to a naming that fits the functionality of the built-in firmware.

2.3 Pin description and operational characteristics

STM 43x Hardware Symbol	STM 43x Firmware Symbol	Function	Characteristics
GND	GND	Ground connection	
VDD	VDD	Supply voltage	2.1 V – 5.0 V; Start-up voltage: 2.6 V Maximum ripple: see 2.6 Not available at pin header.
		Supply for programming I/F	Recommended supply voltage for programming 3V
VCHAR	VCHAR	Charging input	Input for an external energy harvester or a battery. See 2.10.
		Supply for programming I/F if VDD cannot be used.[4]	Recommended supply voltage for programming 3.3V – 3.6 V
VGC	VGC	Voltage Gold Cap	Connection of additional external energy storage possible. See 2.10.
SWPWR (= switched DVDD of EO3100I)	SWPWR	DVDD supply voltage regulator output switched via transistor controlled by EO3100I ADIO5 pin.	1.8 V. Output current: max. 5 mA. Supply for external circuitry, available while not in deep sleep mode. SWPWR is switched on 0.25 ms before sampling of inputs and is switched off afterwards.
UVDDext (=UVDD of EO3100I with 1.8MΩ in series)	UVDDext	Ultra low power supply voltage regulator output	Not for supply of external circuitry! For use with WAKE pins only, see section 3.1. Limited to max. 1 µA output current by internal 1.8 MΩ resistor!
IOVDD (not available at pin connector)	IOVDD	GPIO supply voltage	Internal connection to EO3100I DVDD (typ. 1.8 V) See 2.3.1
RESET	RESET	Reset input Programming I/F	Active high reset (1.8 V) Fixed internal 10 kΩ pull-down.
PROG_EN	PROG_EN	Programming I/F	HIGH: programming mode active LOW: operating mode Digital input, fixed internal 10 kΩ pull-down.
ADIO0	SET	Analog input	For connection of an external set point dial. See 3.3
ADIO1		Not used	Internal pull-up; do not connect
ADIO2		Not used	Internal pull-up; do not connect

[4] E.g. if module shall be programmed or configured via pin connector.
If a bed of nails fixture for programming is available VDD should be used instead of VCHAR.

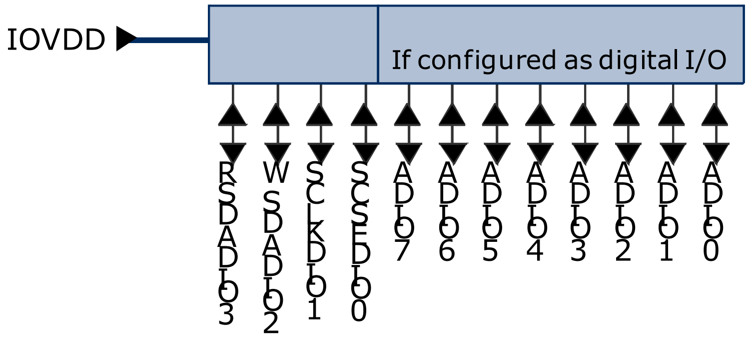
ADIO3	HSM	Input for HSM 100	Internal pull-up; leave open or connect HSM 100
ADIO4		Not used	Internal pull-up; do not connect
ADIO6		Not used	Internal pull-up; do not connect
ADIO7		Programming I/F	Leave open
SCSEDIO0	CW_1	Encoding input for wake-up cycle	Configuration interface. Leave open or connect to GND. See 2.7.1. Internal pull-up
		Programming I/F	
SCLKDIO1	CW_0	Encoding input for wake-up cycle	Configuration interface. Leave open or connect to GND. See 2.7.1. Internal pull-up
		Programming I/F	
WSDADIO2	CP_1	Encoding input for retransmission	Configuration interface. Leave open or connect to GND. See 2.7.1. Internal pull-up
		Programming I/F	
RSDADIO3	CP_0	Encoding input for retransmission	Configuration interface. Leave open or connect to GND. See 2.7.1. Internal pull-up
		Programming I/F	
WAKE0	OCC	Wake input	Input for external occupancy button. Change of logic state leads to wake-up and transmission of a telegram if correct EEP selected. See 2.7.2. Must be connected to UVDDext or GND! At time of delivery WAKE0 is connected to UVDDext via a jumper at the connector. See also 3.1.
WAKE1	LRN	LRN input	Change of logic state to LOW leads to wake-up and transmission of teach-in telegram. Internal pull-up to UVDD. See also 2.8.2 and 3.1.

2.3.1 GPIO supply voltage

The IOVDD pin of EO3100I is internally connected to DVDD. For digital communication with other circuitry therefore a voltage of 1.8 V has to be used. While the module is in deep sleep mode the microcontroller with all its peripherals is switched off and DVDD, IOVDD, and SWPWR are not supplied.

⚠ If DVDD=0 V and IOVDD is not supplied (e.g. while in sleep mode), do not apply voltage to ADIO0 to ADIO7 and the pins of the serial interface (SCSEDIO0, SCLKDIO1, WSDADIO2, RSDADIO3). This may lead to unpredictable malfunction of the device.

For I/O pins configured as analog pins the IOVDD voltage level is not relevant! See also 2.3.2.



2.3.2 Analog and digital inputs – *Preliminary and subject to full qualification*

Parameter	Conditions / Notes	Min	Typ	Max	Units
Analog Input Mode					
Measurement range	Single ended Internal reference RVDD/2	0		RVDD	V
	Interpreted as[5]	0x00		0xFF	
Input coupling			DC		
Input impedance	Single ended against GND @ 1 kHz	10			MΩ
Input capacitance	Single ended against GND @ 1 kHz			10	pF

Parameter	Conditions / Notes	Min	Typ	Max	Units
Digital Input Mode					
Input HIGH voltage		2/3 IOVDD			V
Input LOW voltage				1/3 IOVDD	V
Pull up resistor	@IOVDD=1.7 … 1.9 V	90	132	200	kΩ

2.3.3 Temperature sensor – *Preliminary and subject to full qualification*

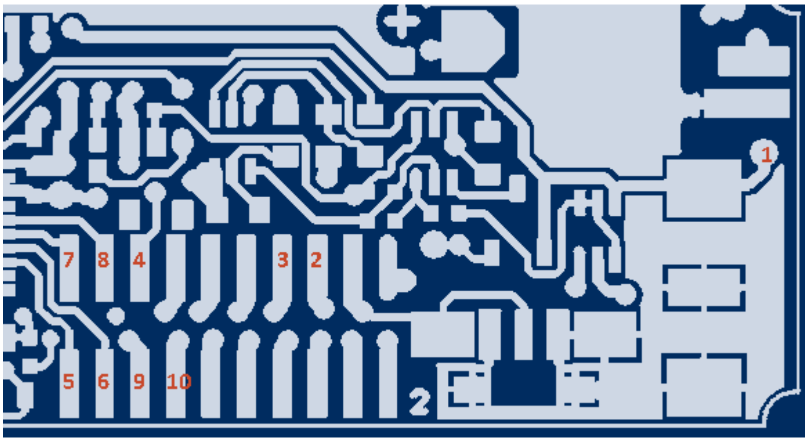
Parameter	Conditions / Notes	Min	Typ	Max	Units
Measurement range		0		40	°C
Accuracy	17 - 27 °C 0 - 40		0.5 1		K K

[5] For measurement of set point with external set point dial

2.3.4 Programming Interface

The positions of the pads needed for programming are shown in the layout below.

Number	Symbol
1	VDD
2	GND
3	PROG_EN
4	RESET
5	SCSEDIO0
6	SCLKDIO1
7	WSDADIO2
8	RSDADIO3
9	ADIO7
10	ADIO6 Only if in addition to programming I/F a serial interface is needed



Top layer

If VDD is not accessible, e.g. because the module shall be programmed via the pin connector, please use VCHAR instead of VDD (see 2.3).

2.4 Absolute maximum ratings (non operating)

Symbol	Parameter	Min	Max	Units
VDD	Supply voltage at VDD	-0.5	5.5	V
VGC	Voltage gold cap	1.5	3.3	V
VCHAR	Supply voltage from external energy harvester	0	6	V
ICHAR	Supply current from external energy harvester		45	mA
GND	Ground connection	0	0	V
VINA	Voltage at every analog input pin	-0.5	2	V
VIND	Voltage at RESET, WAKE0/1, and every digital input	-0.5	3.6	V

2.5 Maximum ratings (operating)

Symbol	Parameter	Min	Max	Units
VDD	Supply voltage at VDD and VDDLIM	2.1	5.0	V
VGC	Voltage gold cap	1.5	3.3	V
VCHAR	Supply voltage from external energy harvester	0	6	V
ICHAR	Supply current from external energy harvester VCHAR<4 V 4 V<VCHAR<6 V		Limited internally 45	mA
GND	Ground connection	0	0	V
VINA	Voltage at every analog input pin	0	2.0	V
VIND	Voltage at RESET, WAKE0/1, and every digital input	0	3.6	V

2.6 Power management and voltage regulators

Symbol	Parameter	Conditions / Notes	Min	Typ	Max	Units
Voltage Regulators						
VDDR	Ripple on VDD, where Min(VDD) > VON				50	mV_{pp}
UVDD	Ultra Low Power supply			1.8		V
RVDD	RF supply	Internal signal only	1.7	1.8	1.9	V
DVDD	Digital supply	Internal signal only	1.7	1.8	1.9	V
Threshold Detector						
VON	Turn on threshold		2.3	2.45	2.6	V
VOFF	Turn off threshold	Automatic shutdown if VDD drops below VOFF	1.85	1.9	2.1	V

Threshold detector
STM 430J / 431J provides an internal ultra low power ON/OFF threshold detector. If VDD > VON, it turns on the ultra low power regulator (UVDD), the watchdog timer and the WAKE# pins circuitry. If VDD ≤ VOFF it initiates the automatic shut down of STM 430J / 431J. For details of this mechanism please refer to the Dolphin Core Description documentation.

2.7 Configuration

2.7.1 Configuration via pins

The encoding input pins have to be left open or connected to GND in correspondence with the following connection schemes. These settings are checked at every wake-up.

Wake-up cycle time

CW_0	CW_1	Wake-up cycle time
NC	GND	1 s ±20%
GND	NC	10 s ±20%
NC	NC	100 s ±20%
GND	GND	No cyclic wake-up

Redundant retransmission

Via CP_0 and CP_1 an internal counter is set which is decreased at every wake-up signal. Once the counter reaches zero the redundant retransmission signal is sent.

CP_0	CP_1	Number of wake-ups that trigger a redundant retransmission
GND	NC	Every timer wake-up signal
NC	NC	Every 7^{th} - 14^{th} timer wake-up signal, affected at random
NC	GND	Every 70^{th} - 140^{th} timer wake-up signal, affected at random
GND	GND	No redundant retransmission

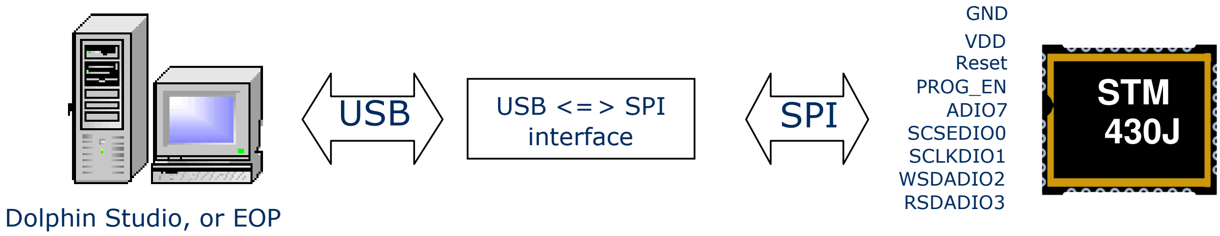
⚠ A radio telegram is always transmitted after wake-up via WAKE pins!
After transmission the counter is reset to a random value within the specified interval.

2.7.2 Configuration via serial interface

Via the programming interface the configuration area can be modified. This provides a lot more configuration options. Values set via serial interface override hardware settings! These settings are read after RESET or power-on reset only and not at every wake-up of the module!

Parameter	Configuration via pins	Configuration via serial interface
Wake up cycle	See section 2.7.1	Value can be set from 1 s to 65534 s
Redundant Retransmission cycle	See section 2.7.1	Min…Max values for random interval If Min=Max -> random switched off
Threshold values for inputs (transmission of telegram if threshold value exceeded)	No	The default values are: Temperature measurement: ±0.5 K Set point measurement: ±10 digits
Edge of wake pin change causing a telegram transmission	No	Every change of a wake pin triggers a wake-up. For both wake pins it can be configured individually if a telegram shall be sent on rising, falling or both edges.
Manufacturer ID and EEP (EnOcean Equipment Profile)	No	Information about manufacturer and type of device. This feature is needed for "automatic" interoperability of sensors and actuators or bus systems. Unique manufacturer IDs are distributed by the EnOcean Alliance.

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 or EDK 350 developers kit.

2.8 Radio telegram

2.8.1 Normal operation

In normal operation STM 430J / 431J transmits telegram data according to the selected EEP (EnOcean Equipment Profile).
For details please refer to the EnOcean Equipment Profiles 2.5 specification.

2.8.2 Teach-in telegram

In case of a wake-up via WAKE1 pin (LRN input) the module transmits a teach-in telegram.

- If the manufacturer code is not set, the module transmits a normal telegram according to 2.8.1 with the difference that DI_3=0.
- If a manufacturer code is set, this teach-in telegram contains special information as described below.

With this special teach-in telegram it is possible to identify the manufacturer of a device and the function and type of a device. The following EnOcean Equipment Profiles are supported by STM 430J / 431J. They have to be selected according to the availability of external occupancy button and set point control by the method described in 2.7.2:

- A5-02-05 Temperature sensor 0-40 °C (default)
- A5-10-03 Temperature sensor 0-40 °C, set point control
- A5-10-05 Temperature sensor 0-40 °C, set point, and occupancy control

If a HSM 100 module is plugged onto the connector in addition the following EEPs are supported:

- A5-04-01 Temperature and humidity sensor 0-40 °C and 0-100% r.h.
- A5-10-10 Temperature and humidity sensor 0-40 °C and 0-100% r.h., set point control, and occupancy control
- A5-10-12 Temperature and humidity sensor 0-40 °C and 0-100% r.h., set point control

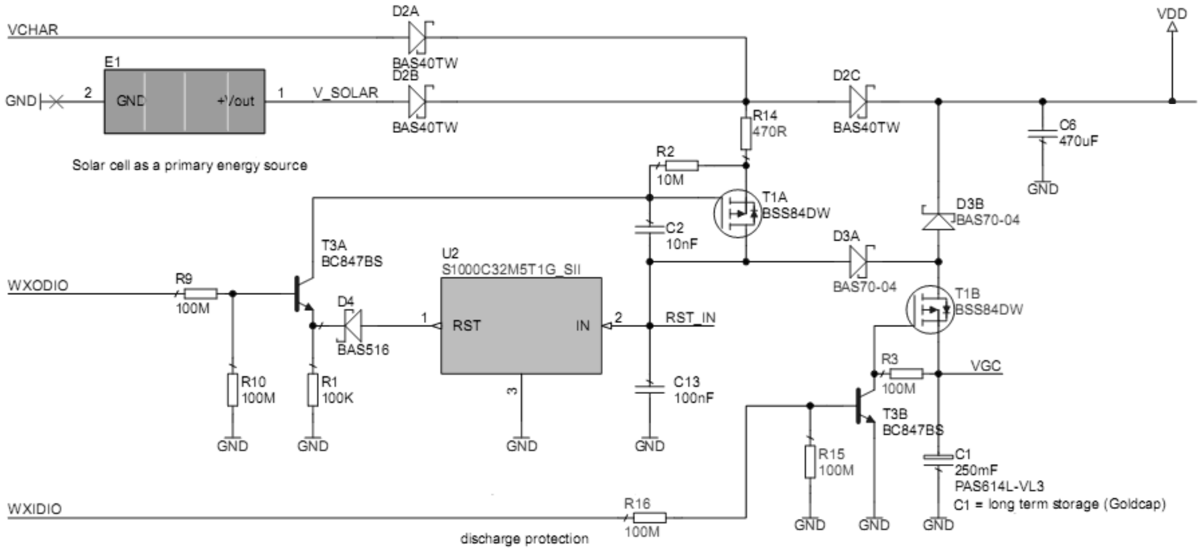
For details please refer to the EnOcean Equipment Profiles 2.5 specification.

2.9 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 1.2 ms. The delay between the three transmission bursts is affected at random.

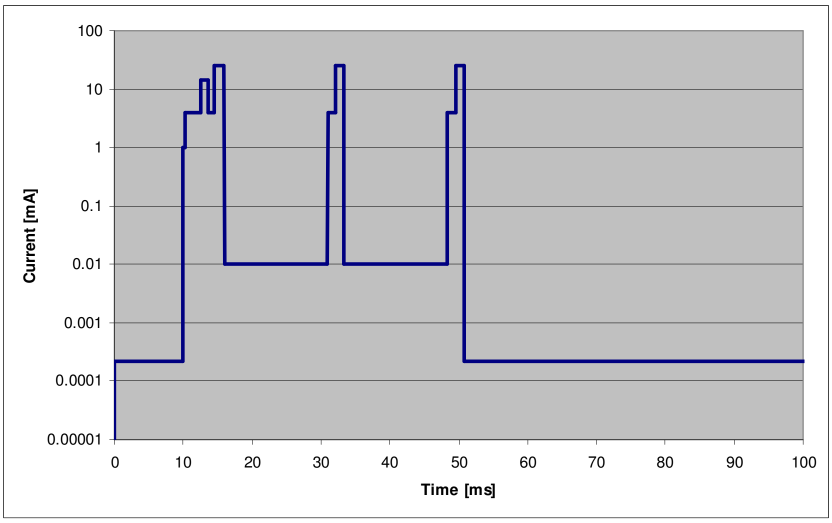
2.10 Charging circuitry

The figure below shows the internal charging circuit. It is controlled via the WXODIO pin of EO3100I which switches according to the status of the internal threshold detector. For details please refer to our Dolphin Core Description documentation. The WXIDIO pin is used to disconnect the goldcap at voltages below VOFF to avoid deep discharge.



An external 3 V backup battery can be connected at VCHAR.

2.11 Energy consumption



Current Consumption of STM 430J / 431J

Charge needed for one measurement and transmit cycle: ~130 µC
Charge needed for one measurement cycle without transmit: ~30 µC
(current for external sensor circuits not included)

Calculations are performed on the basis of electric charges because of the internal linear voltage regulator of the module. Energy consumption varies with voltage of the energy storage while consumption of electric charge is constant.

From these values the following typical performance parameters at room temperature have been calculated:

Wake cycle [s]	Transmit interval	Operation Time in darkness [h] when storage fully charged	Required reload time [h] at 200 lux within 24 h for continuous operation	24 h operation after 6 h illumination at x lux	Illumination level in lux for continuous operation	Current in µA required for continuous operation
1	1	0.5	storage too small	storage too small	5220	130.5
1	10	1.7	storage too small	storage too small	1620	40.5
1	100	2.1	storage too small	storage too small	1250	31.3
10	1	5.1	storage too small	storage too small	540	13.5
10	10	16	21	storage too small	175	4.4
10	100	20	16.8	storage too small	140	3.5
100	1	43	7.8	260	65	1.6
100	10	98	3.6	120	30	0.8
100	100	112	3	100	25	0.6

Assumptions:

- Internal storage PAS614L-VL3 (after several days of operation at good illumination level) with 0.25 F, Umax=3.2 V, Umin=2.2 V, T=25 °C
- Consumption: Transmit cycle 100 µC, measurement cycle 30 µC
- Pre-installed solar cell ECS 300, operating values 3 V and 5 µA @ 200 lux fluorescent light
- Current proportional to illumination level (not true at very low levels!)

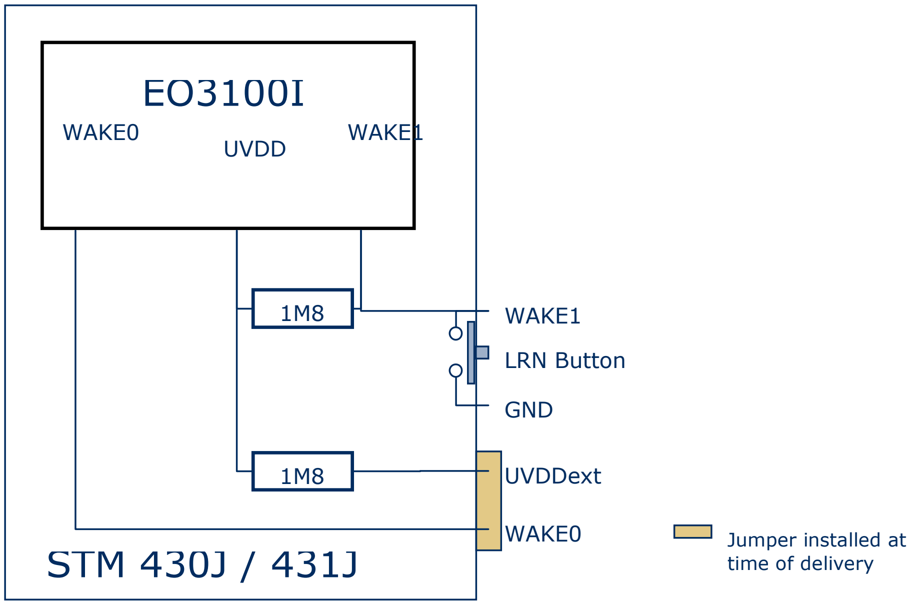
These values are calculated, the accuracy is about +/-20%! The performance varies over temperature and may be strongly reduced at extreme temperatures or short transmit intervals.

3 APPLICATIONS INFORMATION

3.1 Using the WAKE pins

The logic input circuits of the WAKE0 and WAKE1 pins are supplied by UVDD and therefore also usable in "Deep Sleep Mode". Due to current minimization there is no internal pull-up or pull-down at the WAKE pins. When STM 430J / 431J is in "Deep Sleep Mode" and the logic levels of WAKE0 and / or WAKE1 is changed, STM 430J / 431J starts up.

As the there is no internal pull-up or pull-down at the WAKE0 pin, it has to be ensured by external circuitry, that the WAKE0 pin is at a defined logic level at any time. At time of delivery a jumper is connected between WAKE0 and UVDDext. WAKE1 provides an internal 1.8 MΩ pull-up. See figure below.



When the LRN button is pressed WAKE1 is pulled to GND and a teach-in telegram is transmitted. As long as the button is pressed a small current of approximately 1 µA is flowing. It is possible to connect an additional external button in parallel between WAKE1 and GND if a different position of the button in the device is required.

WAKE0 is connected to UVDDext via a jumper at time of delivery. If the module is mounted onto a host PCB the jumper has to be removed. The circuitry on the host PCB then has to ensure that WAKE0 is always in a defined position. There are two ways to use WAKE0:

- Connect WAKE0 to UVDDext and connect an external button between WAKE0 and GND. As long as the button is pressed a current of 1 µA will flow.
- Connect a 3 terminal switch and switch WAKE0 to either GND or UVDDext. In this case there is no continuous flow of current in either position of the switch.

3.2 Temperature sensor

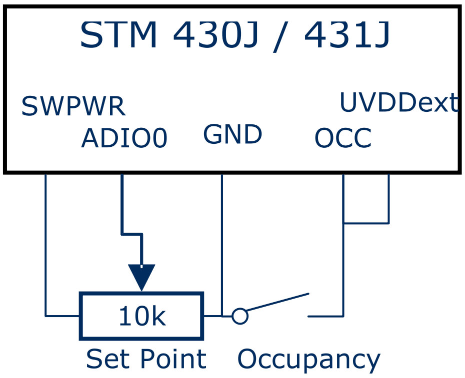
STM 430J / 431J provides an internal temperature sensor. The sensor is part of the EO3100I IC and measures the chip temperature. Therefore it is important to provide a good thermal connection of the IC to the environment by ensuring sufficient ventilation of air inside the housing. Only then the measurement will represent the ambient temperature. Depending on the design of the housing a delay between ambient temperature changes and measured temperature value will be seen.

Heating of the chip due to its current consumption is negligible as the chip only consumes 100 nA while in sleep mode.

Temperature measurement every second is not recommended as in this case effects of heating of the chip might become visible and accuracy is reduced.

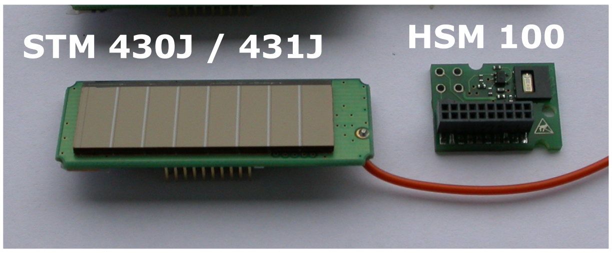
3.3 Set point control and occupancy button

In order to control the set point, an external potentiometer has to be connected as shown below. In addition this figure shows how to connect the occupancy button.



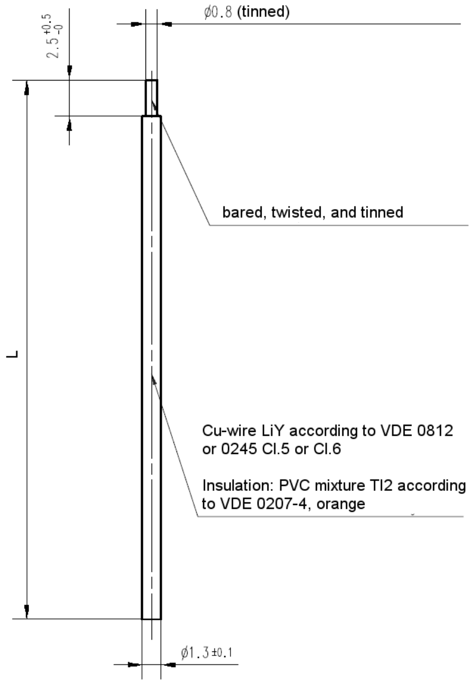
3.4 Combination with humidity sensor module HSM 100

The humidity sensor module HSM 100 extends the functionality of STM 430J / 431J temperature sensor modules. HSM 100 contains an internal calibrated humidity sensor. It can be plugged onto STM 430J / 431J modules via the 20 pin connector. For details please refer to the data sheet of HSM 100.



3.5 Antenna layout

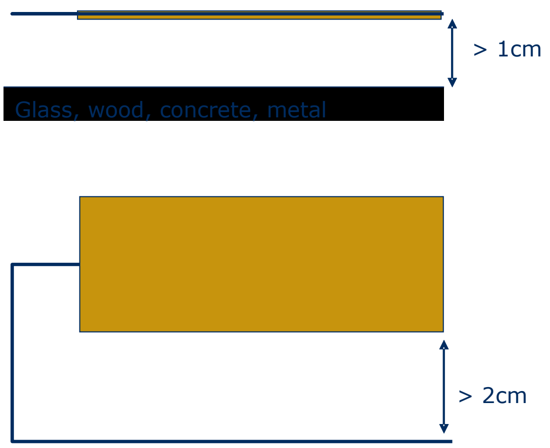
3.5.1 Whip antenna (STM 430J)



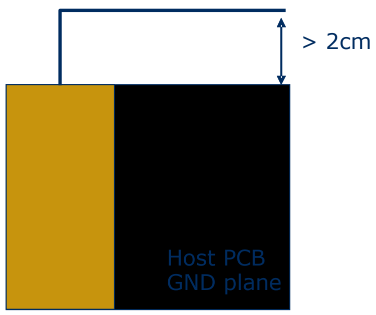
Specification of the whip antenna; L=86 mm

Antenna layout recommendation

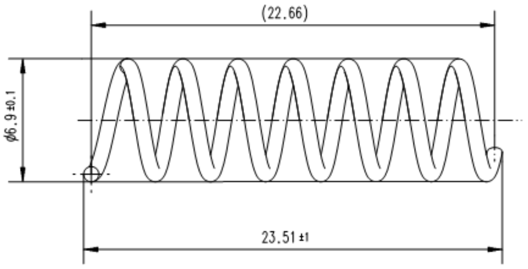
STM 430J without host PCB



STM 430J with host PCB

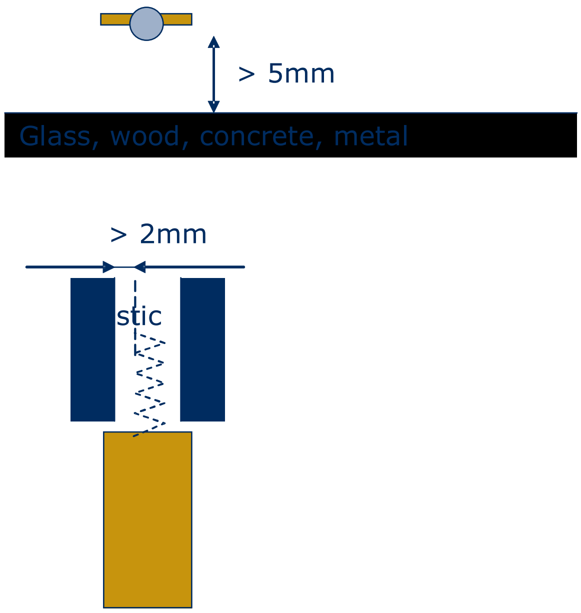


3.5.2 Helical antenna (STM 431J)

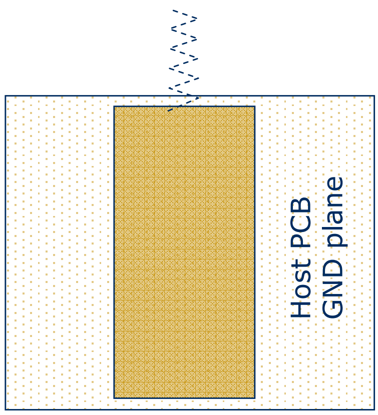


Antenna recommendation

STM 431J without host PCB

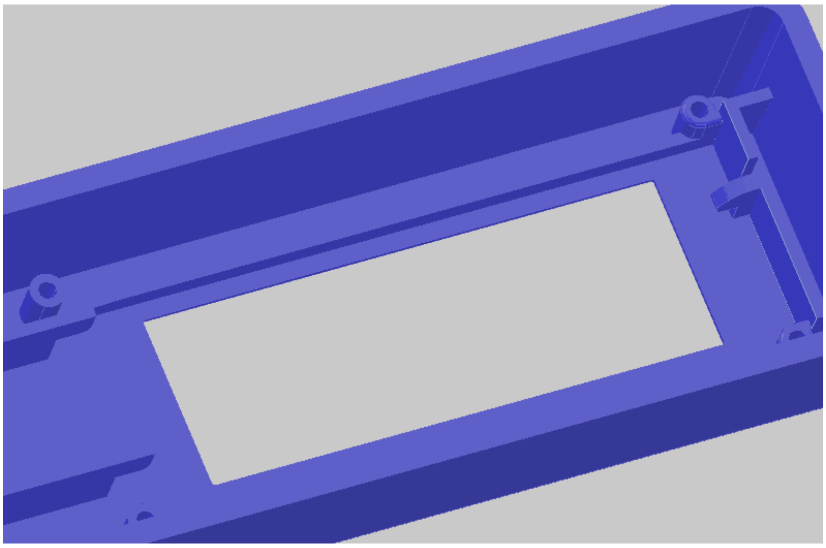


STM 431J with host PCB



3.6 Mounting STM 430J / 431J into a housing

The figure below shows an example of a housing in which the module can be mounted (with antenna pointing to the left).



⚠ Please make sure not to exert shear force (side force within the plane of the solar cell) onto the solar cell! The maximum vertical force onto the solar cell must not exceed 4 N and should be homogeneously distributed! Bending of the PCB must be avoided!

⚠ Please make sure that the housing covers 0.5 mm at the solar cell edges. Within 0.5 mm off the edge flaking is possible due to the cutting process.

3.7 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 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
- 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.

4 AGENCY CERTIFICATIONS

The modules have been tested to fulfil the approval requirements for ARIB STD-T108 based on the built-in firmware.

When developing customer specific firmware based on the API for this module, special care must be taken not to exceed the specified regulatory limits, e.g. the duty cycle limitations!

5 Label Information