

# n-Core<sup>®</sup>

## *n-Core<sup>®</sup> Sirius Quantum 2.0 User Manual*

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## 1. Introduction

The all-new **Sirius Quantum 2.0** device is a radio-frequency device that offers a complete solution for deploying **wireless sensor networks and real-time locating systems** based on the IEEE 802.15.4/ZigBee™ international standard in a simple and fast way.



Its tiny design provides an extraordinary versatility to suit a wide range of applications, especially those where **mobility and miniaturization** are key factors. It includes **IP65 case** to protect the device against dust and water, a **tri-axial accelerometer** to detect lack of movement or falls, **Qi inductive** charge, as well as a **buzzer** to alert the user.

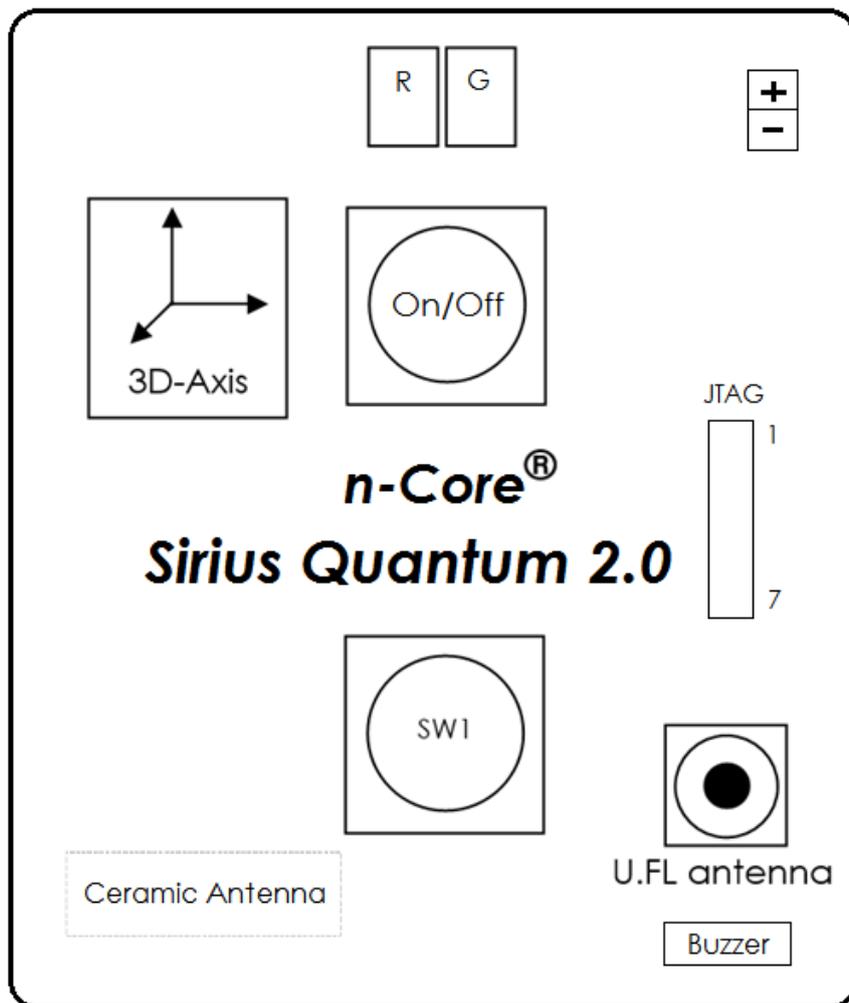
**The new Sirius Quantum 2.0 device is part of the n-Core platform**, developed by Nebusens. The n-Core platform offers a complete set of hardware and software tools to fit all your necessities when developing and deploying wireless networks based on the international standard IEEE 802.15.4/ZigBee™.

For more information about n-Core, please visit [www.nebusens.com](http://www.nebusens.com)

## 2. General Characteristics

| Electrical features                      |  |
|--|--|
| Batteries Power Supply                   | 3.7V   |
| External Power Supply                    | 3.2V - 5V  |
| Power Switch                             | On/Off Button  |
| Physical characteristics                 |  |
| Dimensions (mm) without enclosure        | 38 x 33 x 8  |
| Dimensions (mm) with enclosure           | 47.5 x 37.4 x 15.0   |
| Micro-controller                         |  |
| Model                                    | ATMEGA256RFR2  |
| Frequency                                | 16MHz  |
| Flash                                    | 256KBytes  |
| RAM                                      | 32KBytes   |
| EEPROM                                   | 8KBytes  |
| Radio                                    |  |
| Transceiver                              | ATMEGA256RFR2  |
| Frequency Band                           | 2405 to 2480MHz  |
| Number of Channels                       | 16   |
| Channel Spacing                          | 5MHz   |
| Power Transmission (Software-controlled) | +11 to +22dBm  |
| Sensitivity                              | -100dBm  |
| Data Transmission Rate                   | 250Kbps  |
| Connectivity                             |  |
| On Board Connectivity                    | <ul style="list-style-type: none"> <li>• JTAG</li> <li>• Power Supply</li> </ul>                     |
| Programming Port                         | <ul style="list-style-type: none"> <li>• JTAG</li> <li>• OTA (Over the air)</li> </ul>               |
| Buttons (x2)                             | <ul style="list-style-type: none"> <li>• Button connected to IRQ</li> <li>• On/Off Button</li> </ul> |
| LEDs (x2)                                | <ul style="list-style-type: none"> <li>• Red</li> <li>• Green</li> </ul>                             |

### 3. Pinout



| JTAG |                          |
|------|--------------------------|
| 1    | GND                      |
| 2    | TCK                      |
| 3    | TDO                      |
| 4    | 3.3 V Output (Permanent) |
| 5    | TMS                      |
| 6    | TDI                      |
| 7    | RESET                    |

## 4. Power supply

Using the 2-pin power connectors, the *Sirius Quantum 2.0* device has the following power supply alternatives:

- Internal Li-Po battery 3.7V 320mAh
- External power supply

### 4.1. Battery

By default, *Sirius Quantum 2.0* device is powered by an internal 320mAh Li-Po battery 3.7V which can be recharged through a Qi inductive charger. The battery has an internal controller that protects its performance and therefore the device can be powered continuously.

### 4.2. External power supply

As an alternative, if there is no battery connected to the 2-pin connector, the *Sirius Quantum 2.0* can be powered by an external power supply:

- Input Voltage -> 3.2V - 5V
- Input Current -> < 200 mA

## 5. Input and output interfaces

Sirius Quantum 2.0 device has the following interfaces:

- 1x On/Off Button
- 1x button connected to a microcontroller interrupt (IRQ Button)
- 2x LED (Red and Green)
- 1x 3D-Axis accelerometer with 2 interrupts connected to the microcontroller
- 1x Buzzer connected to the microcontroller
- 1x Analog-to-Digital Converter (ADC) as battery monitor
- JTAG
- OTAU (Over The Air Update)

### 5.1. On/Off Button

Sirius Quantum 2.0 has an On/Off Button that allows eliminating the power supply of the device.

This button can be enabled/disabled by software in order to allow or not allow the user to power off the device:

- If On/Off button is enabled -> User will be able to power On/Off the device.
- If On/Off button is disabled -> User will not be able to power Off the device, so the device will be always On.

The On/Off button can be enabled/disabled by software modifying the value of an internal GPIO of the device:

- Microcontroller -> Port B6
- n-Core API:
  - Port type -> GPO
  - Port Address -> 0x31 (HEX)
- GPIO value:
  - 0x00 -> On/Off Button enabled
  - 0x01 -> On/Off Button disabled

On/Off Button is enabled by default.

### 5.2. IRQ Button

Sirius Quantum 2.0 has a button connected to a microcontroller IRQ that could be used by users as a panic/alert button:

- Microcontroller -> IRQ2
- n-Core API:
  - Port type -> IRQ
  - Port Address -> 0x02

### 5.3. LED

Sirius Quantum 2.0 has 2 LEDs:

- Red LED: connected to the Port B5 of the microcontroller.
- Green LED: connected to the Port B7 of the microcontroller.

By default, LEDs are configured as detailed below:

- Red LED fast blinking: the device is looking for a ZigBee™ network to join.
- When the device is connected to the ZigBee™ network all LED are turned off and they will behave the next way:
  - Green LED on: the device starts to send data over the air.
  - Green LED off: the device has sent the data correctly over the air.
  - Red LED on: the device has received data over the air.
  - Red LED off: the received data has been analyzed.

## 5.4. Accelerometer

Sirius Quantum 2.0 device has a 3D-Axis accelerometer based on the Freescale MMA8451Q<sup>1</sup>. The accelerometer is directly connected to the microcontroller using the I<sup>2</sup>C interface.

The MMA8451Q has two external programmable interrupts for detecting motion events:

- Accelerometer Interruption 1:
  - Microcontroller -> IRQ4
  - n-Core API:
    - Port type -> IRQ
    - Port Address -> 0x04
- Accelerometer Interruption 2:
  - Microcontroller -> IRQ5
  - n-Core API:
    - Port type -> IRQ
    - Port Address -> 0x05

## 5.5. Buzzer

Sirius Quantum 2.0 has an internal buzzer that can be enabled/disabled by software modifying the value of an internal GPIO of the microcontroller:

- Microcontroller port -> Port B4
- n-Core API:
  - Port type -> GPO
  - Port Address -> 0x33 (HEX)
- GPIO value:
  - 0x00 -> Buzzer disabled
  - 0x01 -> Buzzer enabled

Buzzer could be enabled by an external app to alert/notify the user. Buzzer is disabled by default.

## 5.6. Battery monitor

Sirius Quantum 2.0 device has an ADC that monitors its internal battery voltage:

- Microcontroller -> ADC Channel 0
- n-Core API:
  - Port type -> BAT

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<sup>1</sup> [http://www.freescale.com/files/sensors/doc/data\\_sheet/MMA8451Q.pdf](http://www.freescale.com/files/sensors/doc/data_sheet/MMA8451Q.pdf)

- Approximate Read Battery Values (mV):
  - Maximum value (100%) -> 4136
  - Minimum value (0%) -> 3500

When the *Sirius Quantum 2.0* is coupled to a Qi inductive charger, it can be monitored through an internal GPI of the microcontroller to control if the battery is charging correctly or not:

- Microcontroller port -> Port E7
- n-Core API:
  - Port type -> GPI
  - Port Address -> 0x32 (HEX)
- GPI read values:
  - 0x00 -> *Sirius Quantum 2.0* battery is charging correctly.
  - 0x01 -> *Sirius Quantum 2.0* battery is full charged or *Sirius Quantum 2.0* is not correctly coupled to the Qi inductive charger.

## 5.7. JTAG

*Sirius Quantum 2.0* can be programming through a JTAG device using the JTAG connectors describes into the Section 3 of this manual.

## 5.8. OTAU (Over The Air Update)

*Sirius Quantum 2.0* implements OTAU (Over the air update), in such a way its internal firmware can be updated remotely over the air (OTA) without connecting anything to the device.

For further information, see Section 7 of this manual.

## 6. Radio

Sirius Quantum 2.0 devices have a transceiver that implements the IEEE 802.15.4/ZigBee™ standard. The transmission power can be configured by software through the n-Core API.

Types of antenna:

- Integrated ceramic antenna.
- U.FL antenna.

Transceiver:

- ATMEGA256RFR2 + amplifier (up to +22dBm).

## 7. Firmware updates

Sirius Quantum 2.0 device has 2 possibilities to be updated:

- Over the Air (OTA)
- Using a JTAG device

Users should perform firmware update by means of OTA because using a JTAG device involves open the IP65 case.

In order to update the device's firmware in a safe way, please, download the n-Core update package and follow instructions of use carefully. The update package can be downloaded from the support section on the [www.n-core.info](http://www.n-core.info) Web page.

**IMPORTANT NOTE:** During the firmware update, it is necessary to ensure the power supply in order to prevent any damage or data loss. See section 4 of this manual.

## 8. Recommendations of use and security

Please, follow the next indications in order to obtain the maximum performance and to use *Sirius Quantum 2.0* device in a safe way:

- Avoid placing metallic objects near the device as far as possible.
- Architectonic elements, such as metallic walls, doors, railings, pipes, concrete walls, among many others, can affect signal quality and, therefore, the maximum distance of communication between devices.
- Avoid wetting the device unnecessarily (IP65 protection is provided).
- Do not store or make use of the device in atmospheres with a high humidity rate (70% as maximum).
- Do not expose the device to heat sources or directly to the sun.
- Avoid short-circuiting connections.
- Pay special attention to relay output connections, because it could cause a short circuit in the device to be controlled.
- Do not apply to the device voltages and currents out of maximum and minimum rates recommended in this manual (both in power supply and input/output ports, as well as communication buses).
- Use an appropriate external power supply. The product must only work with the type of power supply indicated in this manual. If you are not sure about the type of the required power supply, please consult the manufacturer.
- Avoid manipulating any element of the device not described in this manual, because the warranty could be invalidated and the equipment could be damaged permanently.
- Do not use this product in gas stations, fuel tanks, chemical plants or places where demolition operations are being carried out or near potentially explosive atmospheres, such as re-fuelling areas, fuel tanks, under boat decks, chemical plants, facilities of transference or storage of fuel or chemical agents and areas where the air contains chemistries or particles, such as grain, metallic dust or dust. Please, consult the pertinent preventive measures before using this device in these kinds of zones.
- The use of accessories unapproved by the manufacturer could damage the equipment, break local laws and invalidate the warranty.
- This product works in approved bands for the use in presence of medical, industrial and scientific equipment (ISM band), however, in case of doubt avoid the use of the device until being completely sure of the absence of risk derived from its use in the presence of this type of equipment.
- Use only the antenna that is delivered with the device. The use of modified or unauthorized antennas can reduce the quality of the communication and damage the equipment, besides break local regulations of your country.

## 9. Further information

### Disclaimer

Nebusens believes that all information is correct and accurate at the time of issue. Nebusens reserves the right to make changes to this product without prior notice. Please visit the Nebusens website ([www.nebusens.com](http://www.nebusens.com)) for the latest available version.

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We provide you with a support forum ([support.nebusens.com](http://support.nebusens.com)) for any question related to the n-Core® platform.

### Waste and recycling

When the device reaches the end of its life cycle, it will have to be deposited in a point of recycling for electronic equipment. The equipment will not have to be deposited in the points of urban garbage collection. Please, go to a specialized point. Your distributor will indicate the most appropriate way to proceed with the recycle of the device.





[www.n-core.info](http://www.n-core.info)