This document provides a brief introduction to the *RoKiX Sensor Node*, a key component in the *RoKiX IoT Platform*. *RoKiX Sensor Node* is a small device based on the Nordic Semiconductor nRF52840 advanced multiprotocol system-on-chip (SoC).

Key features

- External connectivity with USB, BLE 4.1, 4.2, 5.0.
- BLE 5.0 with an integrated crystal antenna and a connector for an external antenna.
- Integrates multiple sensors from Kionix and ROHM. These default sensors enable the measurement of 3D-acceleration, 3D-magnetism, 3D-rotation, atmospheric pressure, and temperature.
- Two system connectors for extended connectivity of additional sensors and functions
- Can be powered by a rechargeable Li-Polymer battery, replaceable coin cell batteries, or via Micro USB.
- Low power consumption and long battery life
- The RoKiX Sensor Node comes in a compact (42 x 67 x 22 mm) housing and has a programmable RGY LED, expansion capability with extended I/O connectors, and 8 Mb of flash memory.
- The RoKiX Sensor Node comes with a mounting accessory that can be used to attach the device to surfaces with screws - or to mount the device onto a wristband to make the device wearable.

Software support

- *RoKiX Firmware* preinstalled
- The sensor node can be used with the Nordic Semiconductor's nRF5 SDK, that enables secure over-the-air device firmware updates (OTA-DFU).
- Supporting software packages include a *RoKiX Windows GUI* with visualization and data logging capability, a Python-based Command Line Interface (*RoKiX Python CLI*), and an Android Data Logger App.

Electronic specifications

Electronics is assembled on the 0.8 mm PCB (Printed Circuit Board) board. The main electronic blocks are: Power management, main controller (SoC), peripherals and interfaces.

Power management

- Functions for "power-on-logic", power sources and charger
- Power ON/OFF switch to start/shutdown the SoC
- SoC's power will be set ON if a powered USB cable is inserted to the USB connector
- SoC's power will be kept ON if USB cable is removed from the USB connector and a valid VBAT level is available.
- Enables/disables VDD voltage level for SoC, peripherals, and internal interfaces
- Main voltage supply and logic reference for the SoC: VDD = 2.5 V ±1% (25°C)

- Max. current for VDD is 300 mA for all the internal and external devices
- LiPo battery (VBAT)
  - Voltage range: 3.0 V – 4.3 V
  - Nominal cell voltage: 3.7 V
  - Battery capacity: 250 mAh
  - Battery size: 20.0 x 25.0 x 6.5 mm
- LiPo battery charger
  - Battery is charged when a powered USB cable is attached to the USB connector
  - The middle LED indicator is red when charging is ongoing
  - When the battery is fully charged, the LED goes off
  - Maximum charging current is 220 mA
  - Charging time is about 90 minutes from empty to fully charged battery
- USB (VUSB)
  - Voltage range: 4.75 – 5.5 V (USB 2.0 standard)
  - Supplied via a µUSB connector
  - Protections on the board circuit: Over current (1A) fuse, EMC/ESD filters, wrong polarity.

Main controller

- The main controller block consists of SoC, interfaces from the SoC, peripherals, and a number of indicators.
- Main SoC: Nordic Semiconductor nRF52840 (Cortex M4F)
- Communication interfaces:
  - TWI0/SPI0 – internal sensors
  - TWI1/SPI1 – external sensor boards
  - UART – external device boards
  - SPI2 – SPI-flash memory on board
  - NFC – external NFC antenna
  - USB – external USB connection
  - BLE – internal wireless connection
  - Pxx – SoC's I/O GPIO lines

Peripherals

- The peripherals block consists of (internal) onboard sensors and a memory device which is directly controlled by the SoC. In addition, a pull-up configuration for busses and signals belongs to this block.
- Memory: External flash memory of 8 Mbits is connected to the dedicated SPI bus (speed: up to 8 MHz).
- Five (5) onboard sensor positions for TWI0/SPI0
- Onboard sensors can be configured to use either I2C or SPI bus. Every sensor position has dedicated Interrupt/Data Ready outputs.

Interfaces

- Onboard sensors have bus (TWI0/SPI0) lines and two types of digital bus interfaces available:
  - I2C (TWI0/SPI0) with 100 kHz and 400 kHz speed modes
  - SPI up to 8 MHz (TWI0/SPI0 and SPI2)
- For the external sensors, there are dedicated bus lines (TWI1/SPI1) and two combined digital bus interfaces (I2C and SPI) available. In addition, a dedicated UART bus can be used (UARTE).
- Loading the firmware and flashing can be done using either wired or wireless interface.
- *RoKiX Sensor Node* offers both the wired (USB 2.0, UARTE) and wireless (BLE, NFC) independent communication interfaces.

On-board sensors

The following sensors are included on the main board:

SENSOR TYPE	PART NUMBER
Tri-Axis Accelerometer	KX122
Combination Tri-Axis Accelerometer + Tri-Axis Magnetometer	KMX62
Combination Tri-Axis Accelerometer + Tri-Axis Gyroscope	KXG08
Barometer	BM1383AGLV
Magnetometer	BM1422AGMV

Battery lifetimes

The following battery lifetime estimates are for the MAX variant of the *RoKiX Sensor Node* with a fully charged battery (250 mAh):

- Stand-by, only power management running: up to 6 months
- SoC in active power mode, BLE active and sending data to gateway: up to 16 h
- SoC in active power mode, BLE active and sending advertisements: up to 35 h
- SoC in low-power mode, active time 0.5 seconds / 1 minute: up to 10 days
- SoC in low-power mode, waiting external trigger: up to 12 days

Current consumption depends heavily on the FWs on SoC and Power-On-Logic. Above values are obtained with Power-On-Logic software: PoL FW v. #45b7c279 and SoC software: SoC FW v. #efc64721.

Dimensions and mechanics outline

- PCB board only dimensions: 39.0 x 33.0 x 0.8 mm
- PCB dimensions of the fully assembled board: 40.0 x 33.0 x 4.7 mm (MAX variant)

- Cover mechanics with a bracket: 67.5 x 42.8 x 23.0 mm, weight: 30 g
- Cover mechanics without a bracket: 46.6 x 41.0 x 22.4 mm, weight: 22 g, IP44 rating

The main parts of the mechanic include a top and bottom cover, and an optional bracket for fixed position use or wristband use. The power ON/OFF button and the USB connector outlet are located at the longer sides of the node. PCB, battery, three indicator light guides and the Power ON/OFF switch are placed on the cover mechanics.

Identification of the RoKiX Sensor Node

The main SoC has a unique MAC number which identifies the assembled board and is readable from the SoC. Additionally, every sensor node has a unique serial number to identify the HW variant and manufacturing batch. The MAC and serial numbers are shown on the bottom cover of the node.