RAK1920 Quick Start Guide

Prerequisite

What Do You Need?

Before going through each and every step on using the RAK1920 WisBlock module, make sure to prepare the necessary items listed below:

Hardware

- RAK1920
- Your choice of WisBlock Base
- Your choice of WisBlock Core
- USB Cable
- Li-ion/LiPo battery (optional)
- Solar charger (optional)
- Grove PIR Motion Sensor (AS312)

Software

- Download and install Arduino IDE.
- To add the RAKwireless Core boards on your Arduino board, install the RAKwireless Arduino BSP. Follow the steps in the Github repo.

Product Configuration

Hardware Setup

RAK1920 is a WisBlock Interface module, which extends the WisBlock system with an adapter board to connect Click Boards (MikroElektronika), QWICC (Sparkfun) based, and Grove (Seeed) based sensors to WisBlock.

For more information about the RAK1920, refer to the Datasheet.

RAK1920 module is part of the WisBlock Interface category, which connects to the base board through the IO slot. Also, always secure the connection of the WisBlock module by using the compatible screws.
Assembling and Disassembling of WisBlock Modules

Assembling

As shown in Figure 2, the location for IO slot is properly marked by silkscreen. Follow carefully the procedure defined in RAK5005-O module assembly/disassembly instructions to attach a WisBlock module. Once attached, carefully fix the module with one or more pieces of M1.2 x 3 mm screws depending on the module.

Disassembling

The procedure in disassembling any type of WisBlock modules is the same.

1. First, remove the screws.
2. Once the screws are removed, check the silkscreen of the module to find the correct location where force can be applied.

![Figure 3: Removing screws from the WisBlock module](image)

3. Apply force to the module at the position of the connector, as shown in **Figure 5**, to detach the module from the baseboard.

![Figure 4: Detaching silkscreen on the WisBlock module](image)

![Figure 5: Applying even forces on the proper location of a WisBlock module](image)

**NOTE**

If you will connect other modules to remaining WisBlock Base slots, check on the WisBlock Pin Mapper tool for possible conflicts. RAK1920 uses UART and I2C communication lines, and it can cause possible conflict especially on other WisBlock Modules connected to Slot A to D of the WisBlock Base.

After all this setup, you can now connect the battery (optional) and USB cable to start programming your WisBlock Core.
WARNING

- Batteries can cause harm if not handled properly.
- Only 3.7-4.2 V Rechargeable LiPo batteries are supported. It is highly recommended not to use other types of batteries with the system unless you know what you are doing.
- If a non-rechargeable battery is used, it has to be unplugged first before connecting the USB cable to the USB port of the board to configure the device. Not doing so might damage the battery or cause a fire.
- Only 5 V solar panels are supported. Do not use 12 V solar panels. It will destroy the charging unit and eventually other electronic parts.
- Make sure the battery wires are matching the polarity on the WisBlock Base board. Not all batteries have the same wiring.

Software Configuration and Example

The RAK1920 module is a sensor extension module, it supports several defacto-standard interfaces in the IoT market and allows customers to integrate sensors manufactured by Mikroe, SparkFun, SeeedStudio, and others. For example, the RAK1920 supports the Click Boards™ series of modules provided by Mikroe, Qwiic Connect™ sensor interface designed by SparkFun, and it supports all kinds of I2C module digital I/O, UART and ADC sensors with a Grove™ interface.

Initial Test of the RAK1920 WisBlock Module

If you already installed the RAKwireless Arduino BSP, the WisBlock Core and example code should now be available on the Arduino IDE.

1. You need to select first the WisBlock Core you have, as shown in Figure 6, Figure 7 and Figure 8.
Using RAK4631 WisBlock Core

Figure 7: Selecting RAK4631 as WisBlock Core

Using RAK11200 WisBlock Core

Figure 8: Selecting RAK11200 as WisBlock Core

Using RAK11300 WisBlock Core
2. The Basic Sample Code for RAK1920 in Github will work on all WisBlock Core. You can open the example codes depending on your WisBlock Core, as shown in Figure 9, Figure 10 and Figure 11. For this guide we will be using Grove PIR AS312.

Sample code for RAK4631

Sample code for RAK11200
Figure 11: Opening RAK1920 example code for RAK11200 WisBlock Core

Sample code for RAK11300

![Sample code for RAK11300](image)

Figure 12: Opening RAK1920 example code for RAK11300 WisBlock Core

3. Once the example code is open, you can now select the right serial port and upload the code, as shown in Figure 12 and Figure 13.
5. When you successfully uploaded the example sketch, open the Serial Monitor of the Arduino IDE to see the sensor's reading logs. If you see the logs, as shown in Figure 14, then your RAK1920 is properly communicating to the WisBlock core.
Sample code for other sensors

- Grove Color TCS3472
- MikroBUS Temperature TMP102
- QWIIC AirQuality SGP30
RAK1920 WisBlock Sensor Adapter Module Datasheet

Overview

Description

The RAK1920 module, a part of the WisBlock Interface series, is a sensor extension module, which extends the WisBlock system with an adapter board to connect Click Boards (MikroElektronika), QWICC (Sparkfun) based and Grove (Seeed) based sensors to WisBlock. This module was designed to be part of a production-ready IoT solution in a modular way and must be combined with a WisBlock Core and a Base module.

It supports several defacto-standard interfaces in the IoT market and allows you to integrate sensors manufactured by Mikroe, SparkFun, SeeedStudio, and others. For example, the RAK1920 supports the Click Boards™ series of modules provided by Mikroe, Qwiic Connect™ sensor interface designed by SparkFun. Also, it supports all kinds of I2C module digital I/O, UART, and ADC sensors with a Grove™ interface.

Features

- Interface to all Click Boards of Mikroe
- Interface to all Qwiic sensors of SparkFun
- Interface to all I2C and Digital I/O sensors of Grove
- Interface to UART and ADC sensors options of Grove
- Reserved I2C interface
- 3.3 V and 5 V sensors options

Specifications

Overview

The RAK1920 module supports Mikroe’s Click Boards, Sparkfun’s Qwiic Connect, and Seeed’s Grove sensors. Figure 1 shows the sensors’ connector available in the RAK1920.

Figure 1: RAK1920 sensor extension interface

Mounting

Figure 2 shows how the RAK1920 module is integrated with the RAK5005-O baseboard, and the mounting sketch is also shown.
Hardware

The hardware specification is categorized into four parts. It discusses the interfacing, its corresponding functions and the diagram of the module as well. It also covers the electrical and mechanical parameters that include the tabular data of the functionalities and standard values of the RAK1920 WisBlock Sensor Adapter Module.

Interfaces

Mikroe Click Boards Interfaces

The RAK1920 supports all the Click boards modules manufactured by Mikroe through the mikroBUS™ interface. Figure 3 shows the pin out diagram of the mikroBUS.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Label</th>
<th>Pin Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A0</td>
<td>Analog</td>
</tr>
<tr>
<td>2</td>
<td>RESET</td>
<td>Reset</td>
</tr>
<tr>
<td>3</td>
<td>SPI_CS</td>
<td>SPI Chip Select</td>
</tr>
<tr>
<td>4</td>
<td>SPI_CK</td>
<td>SPI Clock</td>
</tr>
<tr>
<td>5</td>
<td>SPI_MISO</td>
<td>SPI Master Input Slave Output</td>
</tr>
</tbody>
</table>
Grove Sensor Interfaces

The RAK1920 module supports the Grove I2C and digital I/O sensors. **Figure 4** shows the pin number and definition of the Grove sensor. By default, VCC is connected to the 3.3 V line of the IO connector.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Label</th>
<th>Pin Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>SPI_MOSI</td>
<td>SPI Master Output Slave Input</td>
</tr>
<tr>
<td>7</td>
<td>+3.3 V</td>
<td>VCC 3.3 V Power</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Reference Ground</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>Reference Ground</td>
</tr>
<tr>
<td>10</td>
<td>+5 V</td>
<td>VCC 5.5 V Power</td>
</tr>
<tr>
<td>11</td>
<td>I2C_SDA</td>
<td>I2C Data</td>
</tr>
<tr>
<td>12</td>
<td>I2C_SCL</td>
<td>I2C Clock</td>
</tr>
<tr>
<td>13</td>
<td>UART_TX</td>
<td>UART Transmit</td>
</tr>
<tr>
<td>14</td>
<td>UART_RX</td>
<td>UART Receive</td>
</tr>
<tr>
<td>15</td>
<td>INT</td>
<td>Hardware Interrupt</td>
</tr>
<tr>
<td>16</td>
<td>PWM</td>
<td>PWM Input</td>
</tr>
</tbody>
</table>

By default, the I2C is enabled in the RAK1920 module, but if it is required, the RAK1920 module can also support sensors with Grove UART interface and ADC sensors. To enable the UART interface, a resistance connection needs to be added by the customer. When using the Grove UART interface sensor module, replace R9 to R10 and R11 to R12. When using Grove ADC interface (not ADC to I2C module) sensor module, replace R13 to R14 and change R15 to R16.
Figure 6 shows Grove sensor cables:

![Grove Sensor cables](image)

Table below shows Grove cable color and function definition.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yellow</td>
<td>Digital IO1 /ADC CH1 /UART RX /I2C Cock</td>
</tr>
<tr>
<td>2</td>
<td>White</td>
<td>Digital IO2 /ADC CH2 /UART TX /I2C Data</td>
</tr>
<tr>
<td>3</td>
<td>Red</td>
<td>VCC</td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>GND</td>
</tr>
</tbody>
</table>

Qwiic Sensor Interface

The RAK1920 module supports sensors manufactured by SparkFun through the Qwiic Connect interface. Figure 7 shows the Qwiic Connect interface:

![Qwiic Connect interface](image)

Figure 8 shows a Qwiic Connect cable:
The table below shows the Qwiic Connect cable color and function definition:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yellow</td>
<td>I2C Clock</td>
</tr>
<tr>
<td>2</td>
<td>Blue</td>
<td>I2C Data</td>
</tr>
<tr>
<td>3</td>
<td>Red</td>
<td>3.3 V</td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>GND</td>
</tr>
</tbody>
</table>

**Reserved I2C Interface**

The RAK1920 module has a reserved I2C interface, and it can be used for generic I2C interface sensors.

**NOTE:**

The I2C interface only supports 3.3 V type of sensors. The reversed I2C interface is shown in Figure 9.

**Electrical Characteristics**

**Absolute Maximum Ratings**

Table below shows the absolute maximum ratings of the RAK1920 module:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBAT</td>
<td>Power supply for the module</td>
<td>-0.5</td>
<td>4.2</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>
Recommended Operating Conditions

Table below shows the recommended operating conditions of the RAK1920 module:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBAT</td>
<td>Power supply for the module</td>
<td>2.6</td>
<td>4.2</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>3V3</td>
<td>3.3 V power supply</td>
<td>3.3</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>5V</td>
<td>5.5 V power supply</td>
<td>5.0</td>
<td></td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

Mechanical Characteristics

Board Dimensions

WisConnector PCB Layout
The following sections will describe the schematic of the RAK1920 module:
Power Supply

The RAK1920 module supports the 5 V option. By default, the 3.3 V_S is used as the 3.3 V power source of sensors. The module integrates a boost converter from the VBAT to 5 V. The VBAT is the battery output voltage, usually between 3.7 V and 4.2 V. The EN pin enables the boost converter and is controlled by the WisBlock Core module of the overall solution.

⚠️ WARNING
The 3V3_S has to be enable via WB_IO2 GPIO. Otherwise, the module will not work.

![Power Supply Diagram](image)

**Figure 13:** Power supply

IO Connector

The RAK1920 module uses only a subset of all the pins available in the IO connector. These are shown in the table below:

![IO Connector Diagram](image)

**Figure 14:** IO Connector

The RAK1920 module uses only a subset of all the pins available in the IO connector. These are shown in the table below:
<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBAT</td>
<td>Battery output voltage</td>
<td>Maximum: 4.2 V</td>
</tr>
<tr>
<td>3V3</td>
<td>3.3 V</td>
<td>Default, sensor power supply</td>
</tr>
<tr>
<td>TXD1/RXD1</td>
<td>UART interface</td>
<td>Connected only to the Click Boards connector.</td>
</tr>
<tr>
<td>CS/SCK/MOSI/MISO</td>
<td>SPI interface</td>
<td>Connected only to the Click Boards.</td>
</tr>
<tr>
<td>SDA/SCL</td>
<td>I2C interface</td>
<td>All I2C sensors</td>
</tr>
<tr>
<td>AIN0/AIN1</td>
<td>ADC input interfaces</td>
<td>Grove or click Boards</td>
</tr>
<tr>
<td>INT</td>
<td>Hardware Interrupt</td>
<td>Connected only to the Click Boards connector.</td>
</tr>
<tr>
<td>RST</td>
<td>Reset</td>
<td>Connected only to the Click Boards connector.</td>
</tr>
<tr>
<td>PWM</td>
<td>PWM input</td>
<td>Connected only to the Click Boards connector.</td>
</tr>
<tr>
<td>EN</td>
<td>Boost Converter Enable</td>
<td>IO5</td>
</tr>
<tr>
<td>IO1/IO3</td>
<td>General purpose I/O</td>
<td>Connected to Grove digital I/O sensors' connectors.</td>
</tr>
</tbody>
</table>

**IO Connector Pin Order**

**Figure 15** shows the IO connector's pin order. The connector is located in the bottom layer of the RAK1920 module.

![IO Connector Pin Order](image)