User Guide: simpleRTK2B Pro

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Hardware overview

You can use simpleRTK2B Pro as a standalone board or as an arduino shield. The main component of simpleRTK2B Pro is u-blox ZED-F9, in it's different variants:

- ZED-F9P RTK GNSS module. If you are an advanced u-blox GPS user, you might want to have a look at the very extensive u-blox documentation.
- ZED-F9R RTK GNSS + sensor fusion module. This product is for advanced u-blox GPS users, you will find more documentation directly from the manufacturer: https://www.u-blox.com/en/product/zed-f9r-module

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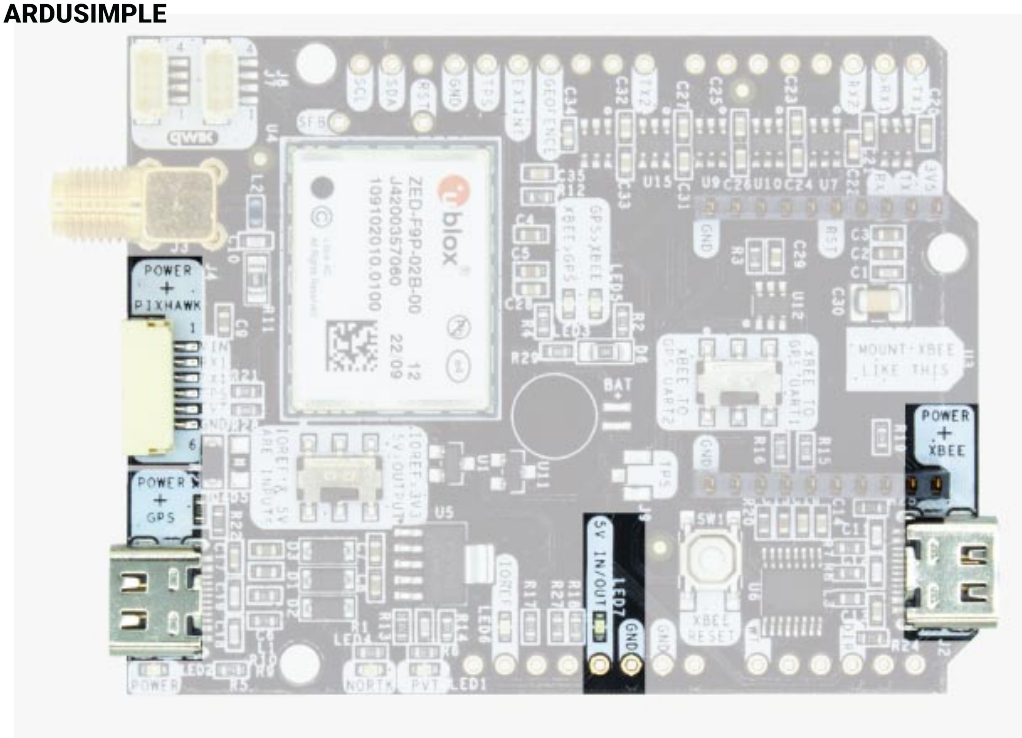

The simpleRTK2B Pro board can be powered from 4 different sources:

- GPS USB port
- XBEE USB port
- Pixhawk connector
- Arduino rail

Only 1 of them is needed to use the board, but you can also connect the 4 at the same time, there's no risk. With simpleRTK2B Pro we introduce the new High Power (HP) XBee socket. If you connect a device that requires high power to the XBee socket, you will have to make sure your power supply can provide this power.

- Use only high quality USB-C cables, not longer than 1 meter.
- If you connect simpleRTK2B Pro through a USB hub to your PC/Tablet or your PC has low power USB ports, you will have to connect the second USB port directly to a wall plug or high power USB port.

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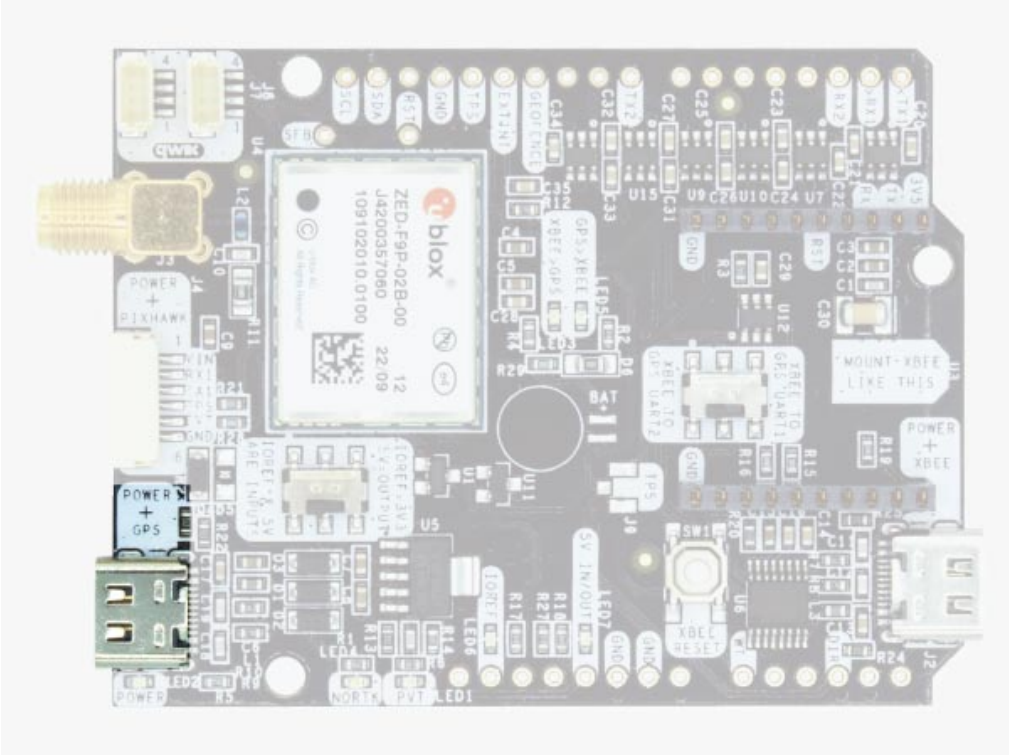
Communication ports:

simpleRTK2B Pro board has a few interfaces that we will now explain in detail

USB GPS



This USB-C connector gives you access to the native USB from the ZED-F9P module. You can receive NMEA with the position, or have full access to the ZED-F9P using the u-center tool: https://www.u-blox.com/en/product/u-center

You can connect this interface to your preferred mobile phone, tablet, or PC and start receiving NMEA data.

If you use Windows10, no drivers need to be downloaded so ignore the next paragraph ?

If you experience problems with above drivers in Windows 7/8 devices, try with the alternative driver that you can download from this link: https://www.ardusimple.com/wp-content/uploads/2020/06/zed-ubloxusb.zip

You can also connect this USB to your mobile phone using our OTG cable.

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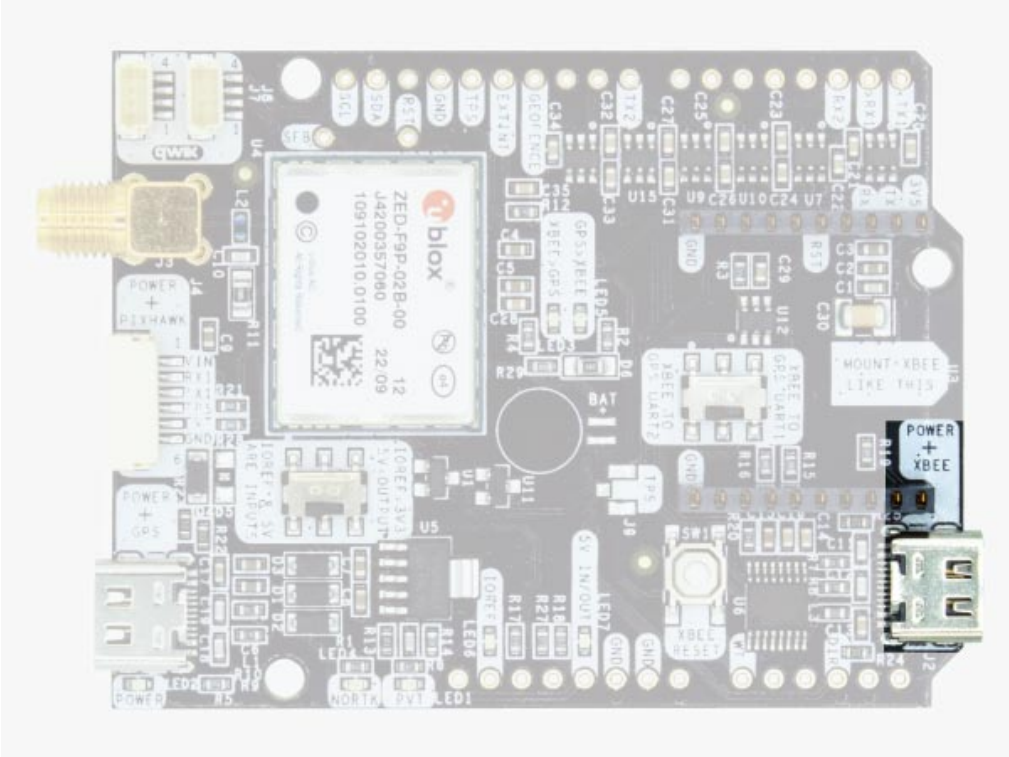
USB XBee



This USB-C connector gives you access to the UART of the XBEE radio (if you mount one), via an FTDI USB-to-UART converter.
We find very practical to use this connector to power the board, so you can then connect and disconnect the GPS USB as your wish, without removing the power to the board.
You can use any USB wall plug adapter you find at home.

To use this connector only as a power source, you don't need any driver. You can use your PC, or connect to your usb wall adapter.

To use this connector to configure an XBee radio, you will need the VCP driver from FTDI: https://ftdichip.com/drivers/vcp-drivers/

Pixhawk connector

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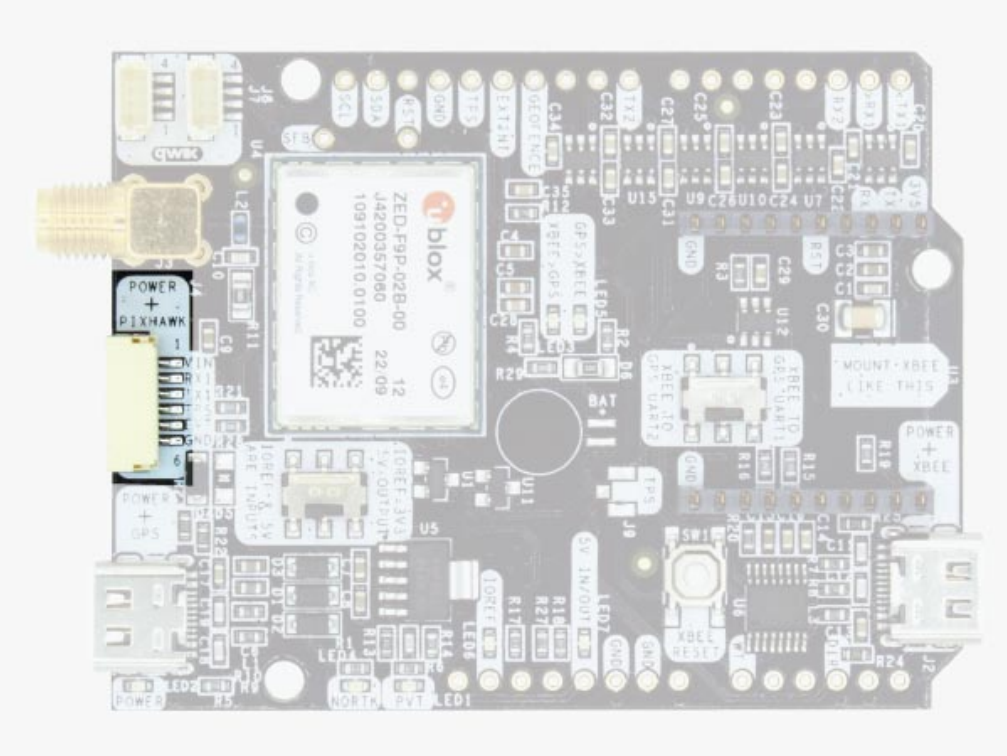

This connector is a standard JST GH that can be used to connect the simpleRTK2B V3 to a Pixhawk autopilot.
You can also use this connector to power the board.

The Pixhawk JST-GH connector is following the Pixhawk standard:

- 1: 5V_IN
- 2: ZED-F9P UART1 RX (3.3V level)
- 3: ZED-F9P UART1 TX (3.3V level)
- 4: Timepulse output (3.3V level)
- 5: EXTINT input (3.3V level)
- 6: GND

In case you want to build your own cable to connect to this connector, the mating aerial connector is JST GHR-06V.

Please note that the board only includes GPS and doesn't include magnetometer.

Arduino rails

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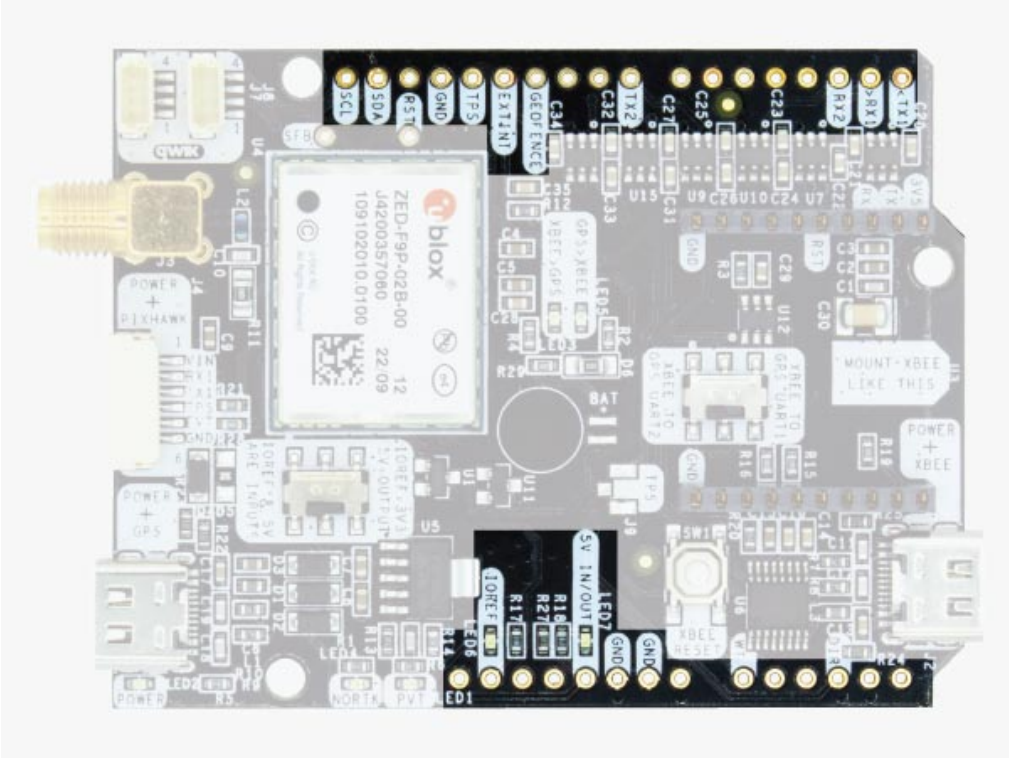

simpleRTK2B has optional rails to connect to other arduino UNO compatible devices.

- **GND:** ground is available in the standard arduino pins. You should always connect this line to your other board.
- **5V IN/OUT:**
  - When the LED next to this pin is OFF, can power simpleRTK2B V3 from this pin.
    For example, just plug it on top of an Arduino UNO board, and simpleRTK2B V3 will turn ON.
  - Alternatively, you can now use simpleRTK2B V3 to power shield board.
    Just turn ON the switch “5V=OUTPUT” and simpleRTK2B board will output 5V at this pin.
- **IOREF.** This pins affect the functionality of TX1,RX1,TX2,RX2,SDA and SCL pins.
  - When plugging simpleRTK2B V3 board on top of Arduino UNO or Raspberry Pi, this pin is used to automatically defined the voltage level of the communication pins (TX1,RX1,TX2,RX2,SDA,SCL).
  - When wiring your own cables to board, this is an input that will define the voltage levels of the pins.
    If you input 1.8V, the next pins will be 1.8V level. It supports from 1.2V to 5.5V.
  - If you want to connect wires to the listed pins and 3.3V is OK for you, you just need to enable the switch “IOREF=3.3V”
- **TX1,RX1,TX2,RX2,SDA,SCL:** These pins work with the voltage level defined by IOREF.
  - TX1: ZED-F9P UART1 TX
  - RX1: ZED-F9P UART1 RX

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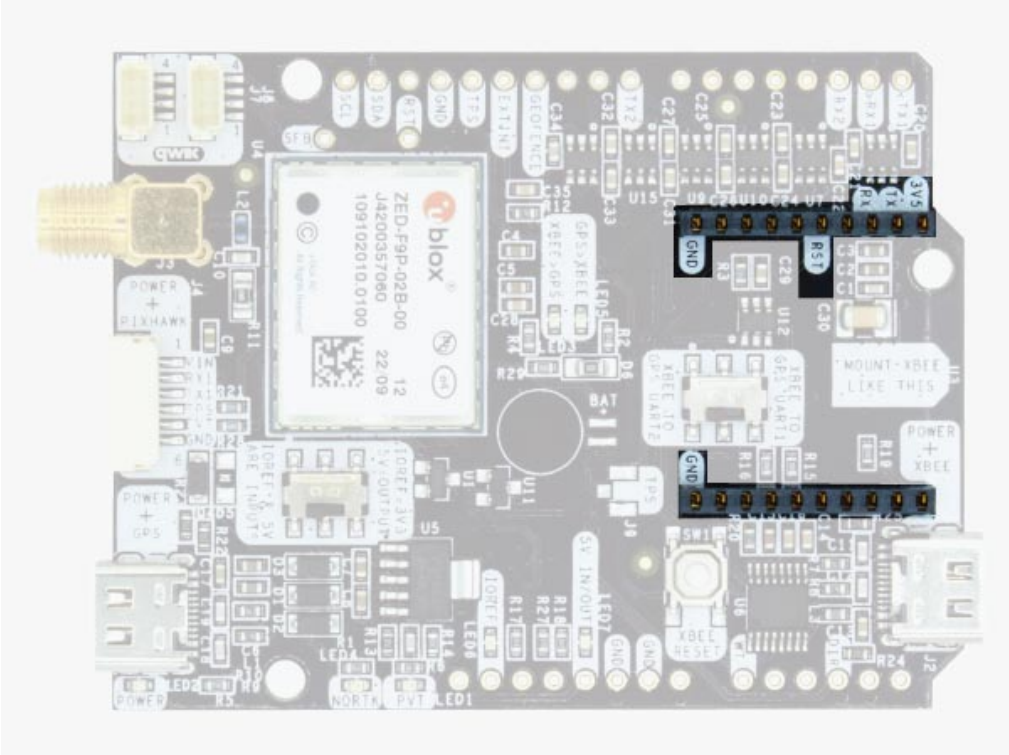
- RX2: ZED-F9P UART2 RX (this pin is also connected to XBee UART TX).
- TX2: ZED-F9P UART2 TX (this pin is also connected to XBee UART RX).
- SDA: ZED-F9P i2C SDA
- SCL: ZED-F9P I2C SCL

High Power (HP) XBee socket



With simpleRTK2B V3 we introduce the new High Power (HP) XBee socket.
You can use this socket to connect an XBee compatible radio. The following pins are available:

- VCC, which is a 3.3V output with maximum current 1A constant and peak 1.5A.
- XBee UART RX, at 3.3V level
- XBee UART TX, at 3.3V level
- GND

This interface is connected to ZED-F9P UART2 or UART1.
You can choose to which one you want to connect with the switch XBEE TO GPS UART X.

qwiic connectors

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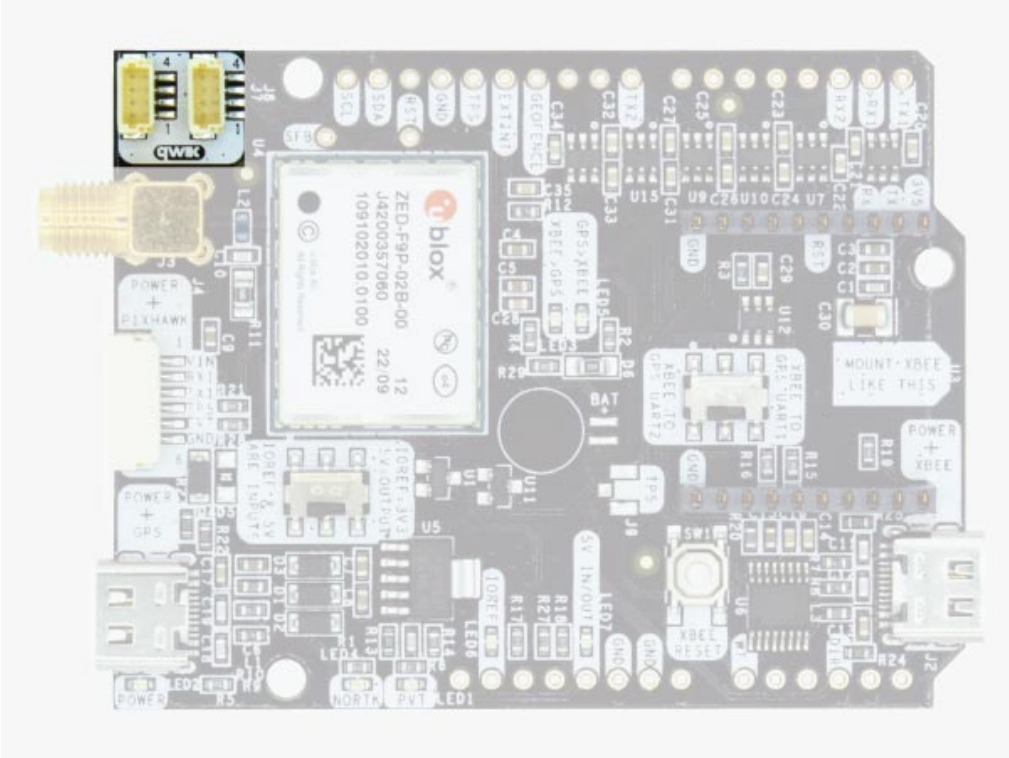

If you already own a Sparkfun qwiic accessory, you now can also use it together with simpleRTK2B V3!
There's only one difference: as simpleRTK2B V3 in some configurations has very high power requirements, it is not possible to power the board from the qwiic connector.

When connecting to the qwiic connectors:

- Power simpleRTK2B V3 from one of the 4 power sources: USB GPS, USB XBEE, 5VIN or Pixhawk.
- Leave the switch is in the side "IOREF & 5V ARE INPUTS". Your qwiic system will power the IOREF system.

In case you want to build your own cable to connect to this connector, the mating aerial connector is JST SHR-04V.

Special function pins

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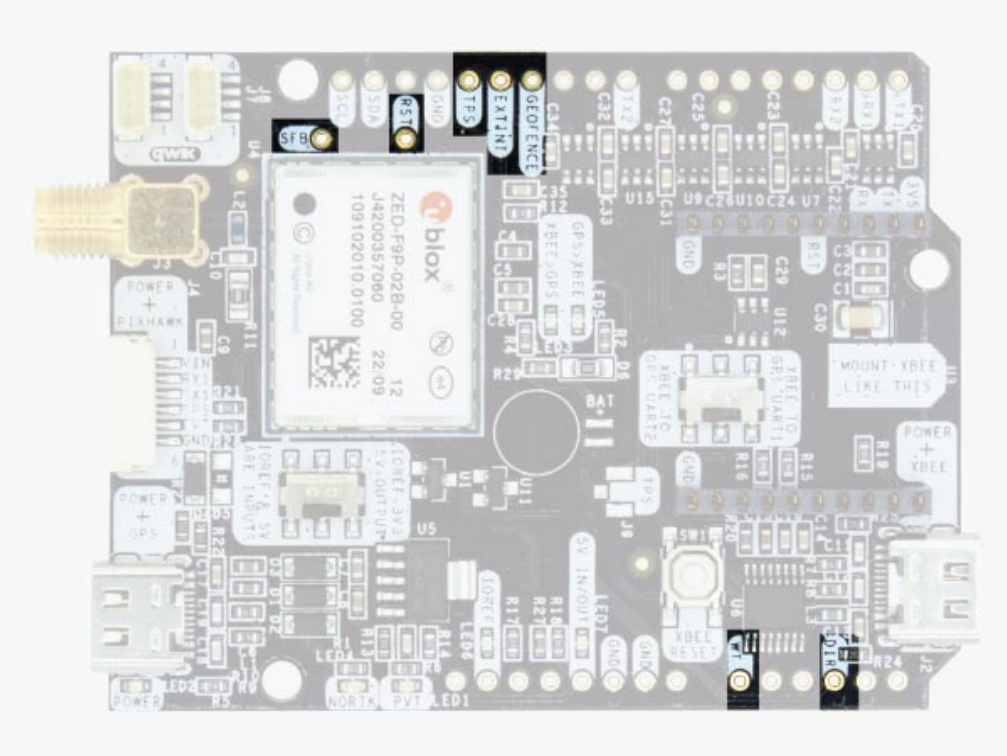

In addition to above, there's also a few additional pins available for the most advanced users.
If you are going to use simpleRTK2B V3 connected on top of an Arduino or Raspberry Pi and you don't use any of these pins, it's recommended to not connect the pins: you can cut the header in this pins to avoid the connection, and prevent unexpected behaviors.

- Timepulse (TPS): 3.3V configuration time pulse output.
- Extint (EXTINT): time synchronization input, maximum voltage 3.6V.
  This input is filtered to avoid glitches.
- Geofence (GEOFENCE): geofence input/output pin from ZED-F9P.
- Safeboot (SF)
- Reset_N (RST)
- Wheeltick (WT): only available in F9R variant.
- Direction (DIR): only available in F9R variant.

To learn more about this pins, we recommend you to read ZED-F9P documentation, available here: https://www.u-blox.com/en/product/zed-f9p-module

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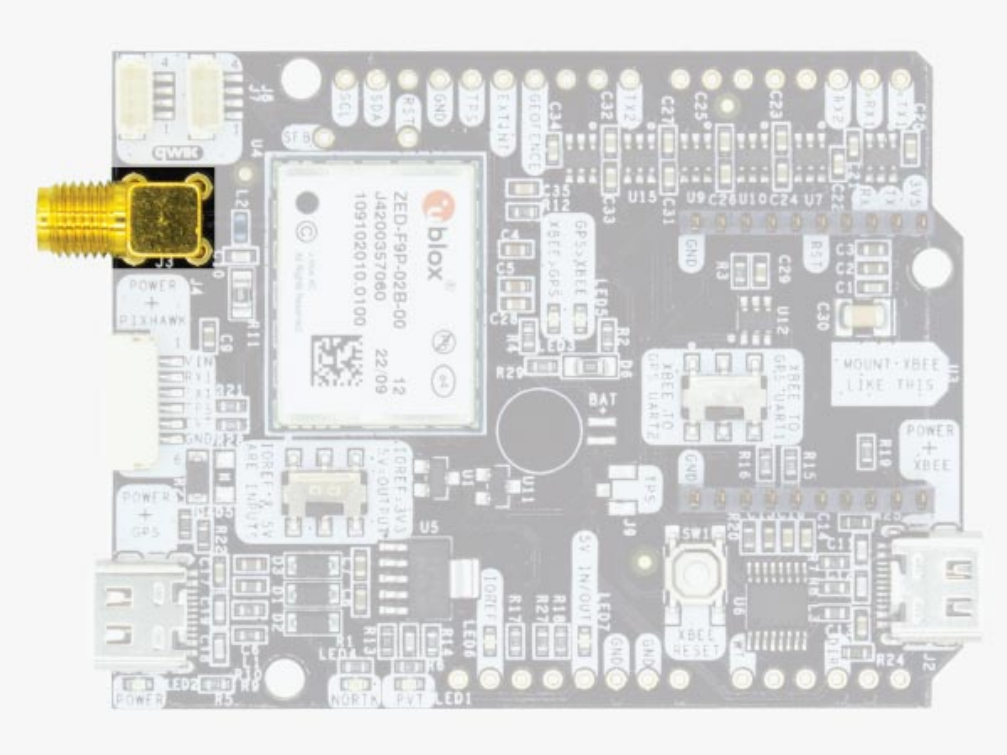
Antennas

GPS/GNSS Antenna



simpleRTK2B V3 requires a good quality GPS/GNSS dual band antenna.
The board is compatible with both active antennas supporting 3.3V supply and passive antennas.
The maximum output current is 75mA @ 3.3V.
If you use it with the traditional cheap GPS antennas widely available, you will not achieve the expected performance.
That being said, just connect the antenna to the SMA connector without using tools (the strength of your fingers is enough).
It is recommended to connect the antenna before powering the board.

The installation of the antenna is also a key point to achieve the best results.
The GPS/GNSS antenna should always be installed with the maximum possible view of the sky.
In addition, if possible, it should be installed with a metallic plane behind, e.g. rooftop of the car, on a metal plate bigger than 20cm, etc.

If you want to learn how installation impacts performance, please have a look at our GPS/GNSS antenna installation guide.

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XBee Antenna

If you own a simpleRTK2B LR Kit or XLR radios, you will also have an external antenna for the radio. Just screw the dipole antenna to the SMA connector using the strength of your fingers.

How to optimize the range:

- The antenna should be mounted vertical.
- It is recommended to install the antenna in a location where it always has line-of-sight with the other device.
- Increase the distance to the ground, by installing it in an elevated point.

If you want to learn more about how installation impacts performance, please have a look at our XBee antenna installation guide.

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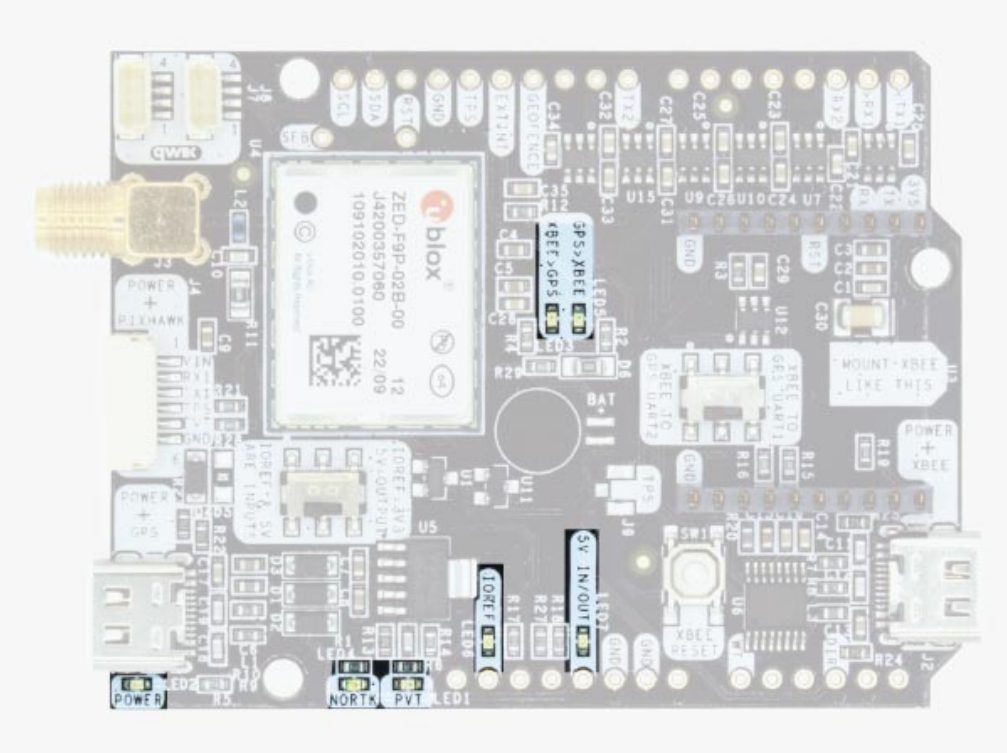
LEDs



The board includes 7 status LEDs, which indicate that:

- POWER: the simpleRTK2B board has power.
- PVT: LED lights when it was possible to calculate a position from the available satellite visibility.
- NO RTK: u-blox default configuration for RTK_STAT pin is used: OFF when RTK fix, blinking when receiving RTCM data, ON when no corrections. This LED has special color RED.
- XBEE>GPS: The XBEE radio is receiving data over the air and sending it to the ZED-F9P.
- GPS>XBEE: The ZED-F9P is outputting data that the XBEE radio is receiving and sending over the air.
- 5V IN/OUT: Will indicate you if there is voltage on that pin.
- IOREF: Will indicate you if the IOREF pin is enabled.

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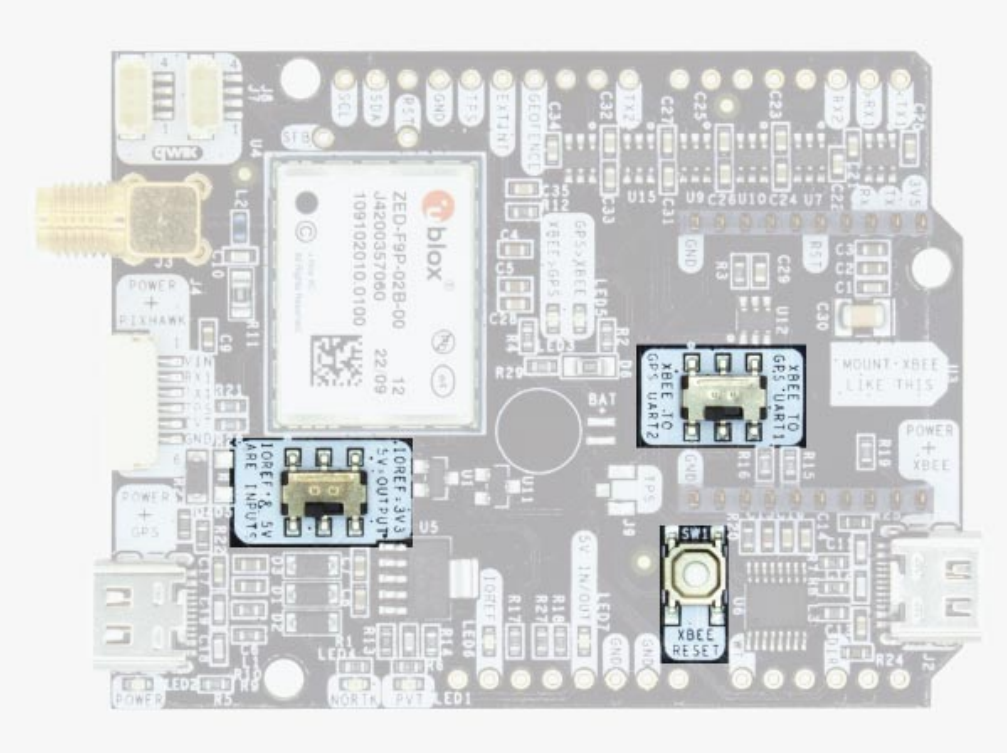
Buttons and switches



There’s only one button: XBee Reset, and the good news is that you probably will not have to use it.
This button is used to program the XBee radio if you want to update firmware, etc

You will find 2 switches:

- The switch under the XBee socket lets you choose which UART you want to connect to the XBee socket.
- The switch next to the “POWER” led let’s you enable IOREF with 3.3V and 5V arduino pin as output so the board can power accessories like Shield for Second XBee socket.

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