

# EVK-F10N

## Evaluation kit

### User guide



### Abstract

This document describes the structure and use of the EVK-F10N evaluation kit and provides information for evaluating u-blox F10 dual-band positioning technology.

**Note!** GPS L5 signals are pre-operational and not used by default. Refer to the Overview section for more information.

## Document information

|                               |                        |             |  |
|-------------------------------|------------------------|-------------|--|
| <b>Title</b>                  | <b>EVK-F10N</b>        |             |  |
| <b>Subtitle</b>               | Evaluation kit         |             |  |
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This document applies to the following products:

| <b>Product name</b> | <b>Type number</b> | <b>FW version</b> | <b>IN/PCN reference</b> |
|---------------------|--------------------|-------------------|-------------------------|
| EVK-F10N            | EVK-F10N-00-00     | SPG 6.00          | N/A                     |

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# Contents

|   |           |
|---|-----------|
| <b>1 Product description.....</b>                       | <b>5</b>  |
| 1.1 Overview.....                                       | 5         |
| 1.2 Kit contents.....                                   | 5         |
| 1.3 System requirements.....                            | 5         |
| <b>2 Specifications.....</b>                            | <b>6</b>  |
| 2.1 Safety precautions.....                             | 6         |
| <b>3 Getting started.....</b>                           | <b>7</b>  |
| 3.1 Installing u-center 2 software.....                 | 7         |
| 3.2 Installing hardware.....                            | 7         |
| 3.3 Default interface configuration.....                | 7         |
| <b>4 Device description.....</b>                        | <b>8</b>  |
| 4.1 Interface connection.....                           | 8         |
| 4.1.1 MODE switch.....                                  | 8         |
| 4.1.2 14-pin connector.....                             | 9         |
| 4.1.3 USB.....  | 10        |
| 4.1.4 UART.....   | 10        |
| 4.2 GNSS input signal.....                              | 11        |
| 4.3 Antenna connector.....                              | 11        |
| 4.4 Time pulse.....                                     | 11        |
| 4.5 Reset button.....                                   | 11        |
| 4.6 Safe boot button.....                               | 11        |
| 4.7 LED.....  | 12        |
| 4.8 Super capacitor.....                                | 12        |
| 4.9 External interrupt.....                             | 12        |
| <b>5 Measuring current.....</b>                         | <b>13</b> |
| 5.1 Measuring GNSS current on the 14-pin connector..... | 13        |
| 5.2 Measuring current with u-center 2.....              | 13        |
| 5.3 Measuring backup current.....                       | 14        |
| <b>6 Block diagram.....</b>                             | <b>15</b> |
| <b>7 Board layout.....</b>                              | <b>16</b> |
| <b>8 Updating firmware.....</b>                         | <b>17</b> |
| <b>9 Configuring the device.....</b>                    | <b>20</b> |
| 9.1 Connecting the EVK with a PC.....                   | 20        |
| 9.1.1 Configuring UART baud rate.....                   | 21        |
| 9.2 Configuring GNSS constellations.....                | 22        |
| 9.3 Using GPS L5 signals for evaluation.....            | 23        |
| 9.4 Configuring navigation update rate.....             | 25        |
| 9.5 Configuring power modes.....                        | 25        |
| 9.5.1 Configuring backup modes.....                     | 25        |
| <b>10 Approvals.....</b>                                | <b>27</b> |

|   |           |
|---|-----------|
| <b>11 Troubleshooting.....</b>            | <b>28</b> |
| <b>12 Common evaluation pitfalls.....</b> | <b>30</b> |
| <b>Related documents.....</b>             | <b>31</b> |
| <b>Revision history.....</b>              | <b>32</b> |

# 1 Product description

## 1.1 Overview

The EVK-F10N evaluation kit makes it simple to evaluate the high performance and low-power u-blox F10 L1/L5 dual-band GNSS technology.

 At the time of writing, the GPS L5 signals remain pre-operational and are set as unhealthy until sufficient monitoring capability is established. This is an operational issue concerning the satellites / space segment and not a limitation of u-blox products.

 Due to the pre-operational status, the GPS L5 signals are not used for the navigation solution by default. However, it is possible to evaluate the GPS L5 signals before they become fully operational by changing the receiver configuration to override the GPS L5 health status. Refer to the section [Using GPS L5 signals for evaluation](#) for details.

The built-in USB interface provides both power supply and USB-to-Serial communication to the receiver, keeping the possibility to also connect through a 14-pin connector or a dedicated RS-232 port. The versatile interfaces and measurement points enable advanced evaluation needs.

u-blox evaluation kits are compact, and their user-friendly interface and power supply make them ideally suited for use in laboratories or vehicles. Furthermore, they can be used with a desktop PC or a laptop, making them the perfect companion through all stages of design-in projects.

| Evaluation kit | Description                         | Related products    |
|----------------|-------------------------------------|---------------------|
| EVK-F10N       | u-blox F10 evaluation kit with TCXO | NEO-F10N module [2] |

Table 1: EVK-F10N supported products

## 1.2 Kit contents

The delivery package contains:

- Compact 105 x 64 x 26 mm EVK-F10N unit
- Active dual-band GNSS antenna with 3 m cable. <sup>1</sup>
- USB 2.0 cable (Type-C)
- EVK Welcome card
- GPS L5 information card

## 1.3 System requirements

- PC with USB 2.0 or RS-232 interface
- Operating system: Microsoft Windows 10 onwards (x86 and x64 versions)
- Internet connection for the first-time use to download the required Windows drivers. See section [Installing u-center 2 software](#) for details.

<sup>1</sup> L1/L5 dual-band antenna that supports GPS, Galileo, BeiDou, and NavIC

## 2 Specifications

| Parameter                    | Specification   |
|------------------------------|---|
| Serial interfaces            | 1 USB 2.0 Type-C<br>1 UART, max baud rate 921600 baud (using 14-pin connector)<br>RS-232 +/- 5.0 V level<br>14 pin, 3.3 V logic |
| Timing interfaces            | 1 time pulse output   |
| Dimensions                   | 105 x 64 x 26 mm  |
| Power supply                 | 5.0 V via USB or powered via external power supply pin 14 (5V_IN) and pin 1 (GND)   |
| Normal operating temperature | -40 °C to +65 °C  |

**Table 2: EVK-F10N specifications**

### 2.1 Safety precautions

EVK-F10N must be supplied by a PS1 class limited power source. See section 6.2.2.4 of IEC 62368-1:2018 [5] for more information on the PS1 class.

In addition to a limited power source, only ES1 class circuits are to be connected to the EVK-F10N, including interfaces and antennas. See section 5.2.1.1 of IEC 62368-1:2018 [5] for more information on the ES1 class.

## 3 Getting started

### 3.1 Installing u-center 2 software

u-center 2, the u-blox interactive evaluation software is required for configuration, testing, visualization and data analysis of u-blox GNSS receivers as well as EVKs. The EVK user guide together with the u-center 2 evaluation tool provide useful assistance during all phases of a system integration project. To install the u-center 2 evaluation software tool, follow the steps available on [www.u-blox.com/product/u-center](http://www.u-blox.com/product/u-center). For more information on how to use the u-center 2 evaluation software tool, refer to the u-center 2 User guide [1].

The required Windows drivers for the FTDI FT4232H USB-to-UART converter that is used in the EVK are available from the Microsoft Windows Update service. To ensure that the latest FTDI drivers are installed automatically from Windows Update, check and uninstall the previously installed FTDI drivers. The Windows system driver search mechanism will download and install the FTDI drivers automatically from the Microsoft Windows Update service. If the automatic installation fails, contact u-blox support to get the FTDI drivers and install manually.

### 3.2 Installing hardware

- Before connecting the interface cable to the EVK, slide the MODE switch to 0 or 1 to bypass or enable the external LNA (LNA2) in the front of the NEO-F10N module:
  - 0: LNA2 disabled**
  - 1: LNA2 enabled**



**CAUTION** Risk of device damage. Changing the MODE switch position while the EVK is powered on may damage the GNSS receiver chip. Power off the EVK before changing the MODE switch position.

Refer to section [Device description](#) for more information on the MODE switch. Select the EVK interface cable from the available options:

- USB:** Connect via USB port.
  - UART:** Connect via RS-232 or through the 14-pin connector.
- Power the device on, either via USB on the back or through the 5V\_IN input on the front of the EVK.
  - Connect the provided GNSS antenna to the evaluation unit and place the antenna in a location with clear sky view.
  - Start the u-center 2 evaluation tool and select corresponding COM port and baud rate as shown in [Connecting the EVK with a PC](#) and also in the u-center 2 User guide [1].

### 3.3 Default interface configuration

| Parameter    | Description                         | Remark                                      |
|--------------|-------------------------------------|---|
| UART, Input  | UBX and NMEA protocol at 38400 baud |   |
| UART, Output | UBX and NMEA protocol at 38400 baud | Only NMEA messages are activated by default |

**Table 3: Default configuration**



The UART interface on the 14-pin connector is available for debugging and design-in purposes.

## 4 Device description

EVK-F10N evaluation kit contains a NEO-F10N L1/L5 dual-band GNSS module, along with a built-in USB interface which provides both power supply and high-speed data transfer. This eliminates the need for an external power supply.

The EVK offers the flexibility to enable or disable an external LNA (LNA2), to evaluate performance with and without external RF gain. In addition, the EVK includes an I2C current sensor for current measurement through the on-board FTDI USB-to-I2C interface as shown in [Figure 6](#).

### 4.1 Interface connection

The EVK-F10N supports a UART communication interface. To connect the EVK to a PC, use a standard SUBD-9 cable or the included USB cable. The EVK includes an on-board USB-to-Serial converter for USB-to-UART communication with the receiver. For current measurements and to evaluate the available digital interfaces, additional measurement equipment and devices can be connected to the 14-pin connector on the front side of the EVK unit. The EVK design allows the front side pins to be used simultaneously with the other ports.

 Do not drive any of the IO pins when the EVK is not connected to a power supply.

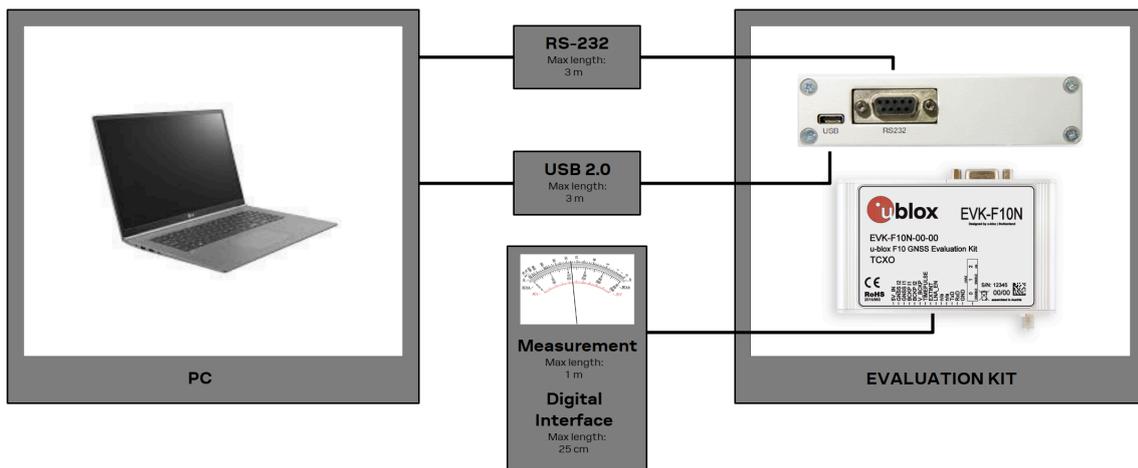


Figure 1: Connecting the EVK-F10N unit for power supply and communication

Figure 2 shows the front and back of the EVK-F10N evaluation unit.



Figure 2: The front and back of EVK-F10N

#### 4.1.1 MODE switch

The EVK integrates an external LNA (LNA2) in the front of the NEO-F10N module. Use the MODE switch to enable or disable additional signal amplification. The switch allows three modes:

1. **Mode 0: LNA2 disabled.** The external LNA (LNA2) is disabled and the RF signal goes directly to the RF input pin of the NEO-F10N.

2. **Mode 1: LNA2 enabled.** The external LNA (LNA2) is enabled and the RF signal is amplified before reaching the NEO-F10N RF input pin.
3. **Mode 2: n/a.** Not applicable for this product.

To evaluate the best performance of the F10 platform with a GNSS simulator, enable the external LNA (LNA2).

-  Two RF switches are used internally to enable/disable the external LNA (LNA2). These switches have an insertion loss of 0.2-0.3 dB each and they increase the system noise figure by ~0.6 dB.
-  The maximum external gain is limited to ~5-10 dB when the external LNA (LNA2) is enabled. Large external gain on the RF path may exceed the receiver's dynamic range resulting in degraded performance.

The MODE switch is shown in the [Figure 2](#) and in the [Figure 6](#).

### 4.1.2 14-pin connector

The EVK-F10N front side has a 14-pin connector that provides programmable input/output signals, communication interfaces and supply options. All these pins are ESD protected. The 14-pin connector can be used for communicating with the receiver through the UART interface. In addition, the 14-pin connector provides flexibility for evaluating other advanced scenarios.

| Pin no. | Pin name  | I/O | Level         | Description  |
|---------|-----------|-----|---------------|--|
| 14      | 5V_IN     | I   | 4.75 - 5.25 V | Power input. This can be used instead of USB.  |
| 13      | GNSS I2   | O   | 3.3 V         | Supply current measurement (total current) node 2. See pin 12 description.   |
| 12      | GNSS I1   | O   | 3.3 V         | Supply current measurement (total current) node 1. Current measured from a voltage drop over a 1 $\Omega$ 1% resistor between pins 12 (GNSS I1) and 13 (GNSS I2). Pin 12 (GNSS I1) is at higher potential.                                 |
| 11      | BCKP I1   | O   | 3.3 V         | Backup supply current measurement node 1. Connected to backup supply (super capacitor). Current measured from voltage over a 100 $\Omega$ 1% resistor between pins 11 (BCKP I1) and 10 (BCKP I2). Pin 11 (BCKP I1) is at higher potential. |
| 10      | BCKP I2   | O   | 3.3 V         | Backup supply current measurement node 2. See pin 11 description.  |
| 9       | VBCKP     | I   | 3.3 V         | Backup power supply input. Optional input for testing backup operation.  |
| 8       | TIMEPULSE | O   | 3.3 V         | Time pulse signal (50 $\Omega$ output). Can also be used as generic input/output (PIO4).   |
| 7       | EXTINT    | I   | 3.3 V         | External interrupt signal. It can be used for time mark feature and time aiding.   |
| 6       | LNA_EN    | O   | 3.3 V         | LNA enable signal that controls an optional external LNA (LNA2). This signal is independent of the MODE switch in the front panel.   |
| 5       | n/a       | -   | -             | -  |
| 4       | n/a       | -   | -             | -  |
| 3       | TXD       | O   | 3.3 V         | Serial port transmit.  |
| 2       | RXD       | I   | 3.3 V         | Serial port receive.   |
| 1       | GND       | I   | -             | Recommended common ground pin.   |

**Table 4: EVK-F10N 14-pin connector pin description**



**Figure 3: EVK-F10N 5.0 V DC power supply example**

Use a maximum 25 cm cable when using the 3.3 V digital interfaces with your application (e.g. UART).

### 4.1.3 USB

The USB connector in the evaluation kit can be used for both power supply and communication. The easiest way to evaluate the EVK-F10N operation is to connect the EVK to a PC with the USB cable and use the u-center 2 tool to configure and monitor the GNSS functions. The USB connector is internally connected to a USB-to-Serial converter that connects to the UART interface of the NEO-F10N module on the EVK. This allows the USB connector to be used for UART communication as well.

When the EVK is connected to the PC, Windows creates a virtual COM port to the PC. This newly created virtual COM port needs to be selected in the u-center 2 evaluation tool for communicating with the receiver. EVK-F10N supports USB-to-UART communication speeds up to 921600 baud.

### 4.1.4 UART

The EVK unit includes two options for the UART connection, via the RS-232 serial port or the 14-pin connector. By default, the UART communication speed is set to 38400 baud and EVK-F10N supports speeds up to 921600 baud (through the 14-pin connector).

#### 4.1.4.1 RS-232

The EVK can be connected to a PC using a maximum 3 m straight RS-232 serial cable with male and female connectors. If a USB-to-RS-232 adapter cable is used, it can be connected directly to the RS-232 port of the evaluation kit. The maximum operating baud rate is 230400 baud.

The RS-232 port also provides a TIMEPULSE output signal and supports evaluation of EXTINT functions such as time mark and time aiding .

The 9-pin RS-232 female connector is assigned as listed below:

| Pin no. | Assignment  |
|---------|---|
| 1 & 6   | Time pulse  |
| 2       | TXD (GNSS Transmit Data , serial data to external device )  |
| 3       | RXD (GNSS Receive Data , serial data from external device ) |

| Pin no.  | Assignment    |
|----------|---------------|
| 4        | EXTINT        |
| 5        | GND           |
| 7, 8 & 9 | not connected |

**Table 5: EVK-F10N RS-232 connector pin description**

#### 4.1.4.2 UART through 14-pin connector

The EVK also provides UART communication through the 14-pin connector on pins TxD and RxD. The maximum operating baud rate is 921600 baud. See section [14-pin connector](#) for more information.

## 4.2 GNSS input signal

To evaluate the GNSS reception, a GNSS signal must be supplied to the antenna input SMA connector of the evaluation kit. EVK-F10N evaluation kit includes a dual band L1/L5 antenna for GPS, Galileo, BeiDou constellations with a 3.0 m cable. It is possible to connect various active and passive GNSS antennas with SMA connectors or provide a signal from a recorded or simulated GNSS RF source to the antenna input.

For evaluation with active antennas, disable the external LNA (LNA2) in the [MODE switch](#) on the front panel.

-  The maximum external gain is limited to ~5-10 dB when the external LNA (LNA2) is enabled. Large external gain on the RF path may exceed the receiver's dynamic range resulting in degraded performance.

## 4.3 Antenna connector

For an antenna connection, the EVK has an SMA female connector available on the front side of the unit (see [Figure 2](#)). The EVK provides 3.3 V bias supply for the external antenna and the recommended maximum antenna supply current for active antennas is 30 mA. This pin is also ESD protected.

-  EVK-F10N has no antenna supervisor or short circuit detection feature. The short circuit protection is limited to 70mA.

## 4.4 Time pulse

u-blox receivers include a time pulse function that provides pulses with a configurable pulse period, pulse length and polarity (rising or falling edge). The u-center 2 evaluation tool can be used to configure the time pulse parameters. The time pulse signal is available at the 14-pin and RS-232 connectors. In addition, the time pulse signal is inverted and connected to the LED on the front side of the EVK.

-  The time pulse signal from the 14-pin connector has 50 ohms output and thus, no fast slope output signal is possible.

## 4.5 Reset button

The RST button on the front side resets the u-blox F10 receiver. This includes any data or configuration stored in the RAM and BBR layers.

## 4.6 Safe boot button

This button is used to set the receiver into safeboot mode. In this mode, the receiver executes only the minimal functionality.

## 4.7 LED

| LED               | Description  |
|-------------------|--|
| Solid blue LED    | Time pulse signal, no GNSS fix, power on               |
| Flashing blue LED | The LED flashes one pulse per second during a GNSS fix |

**Table 6: EVK-F10N timepulse LED state**

## 4.8 Super capacitor

The evaluation kit board includes a 1.0 F super capacitor to supply the backup power domain of the EVK-F10N and is charged whenever there is a power supply available, either via USB or through the 14-pin connector. The super capacitor provides backup power directly to the EVK-F10N V\_BCKP power input of the GNSS receiver in case no other V\_BCKP power supply is provided. The super capacitor allows more than 12 hours of backup power, when it is fully charged to 3.3 V.

-  The super capacitor requires about 200 seconds to charge to 2.0 V and about 1000 seconds to charge fully to 3.3 V. Due to this, avoid doing a hot start for a few minutes after connecting the power supply (from USB or from the 14-pin connector).

The V\_BCKP power supply can provide power for an extended time while evaluating very long backup periods.

## 4.9 External interrupt

On the EVK-F10N, the external interrupt (EXTINT) signal is available on the 14-pin connector. The EXTINT signal can be used for time mark and time aiding features of the receiver, as well as for waking up the receiver from power save modes. See section [14-pin connector](#) for more information.

-  EXTINT signal is not transmitted when connecting the EVK using an RS-232 cable. Disconnect the RS-232 cable and use the EXTINT signal from the front side of the EVK.

## 5 Measuring current

### 5.1 Measuring GNSS current on the 14-pin connector

The receiver starts up in the acquisition state to search for available satellites and download GNSS orbital data, i.e. ephemeris and almanac. After downloading the data, the receiver switches to the tracking mode and typically stays in it during continuous operation, reducing the current consumption. The time required to enter tracking mode can be reduced by downloading aiding data from the AssistNow™ Online service.

On EVK-F10N, the main supply voltage for the u-blox F10 GNSS receiver is 3.3 V. To measure the total GNSS supply current with EVK-F10N, follow these steps:

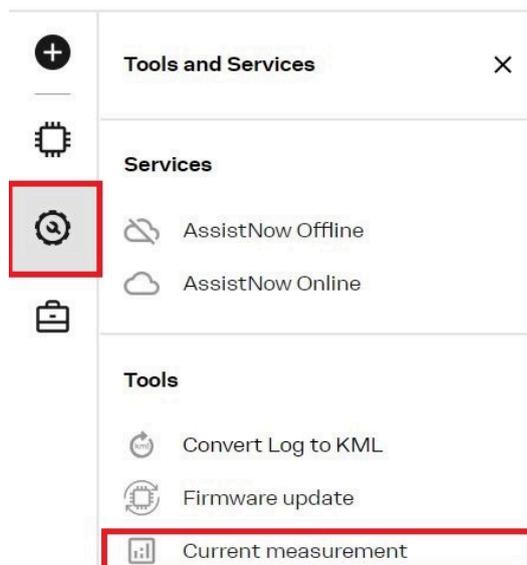
1. Before starting the test, make sure you have good signals and clear sky view to ensure that the receiver can acquire the satellite signals.
2. Power up EVK-F10N.
3. Connect a true RMS voltmeter across GNSS I1 (pin 12) and GNSS I2 (pin 13) of the [14-pin connector](#).
4. Read the voltage (and average if necessary) on the voltmeter and convert it to current (1 mV equals 1 mA).

### 5.2 Measuring current with u-center 2

 The current measurement feature is available in EVK-F10N-00-00, and later.

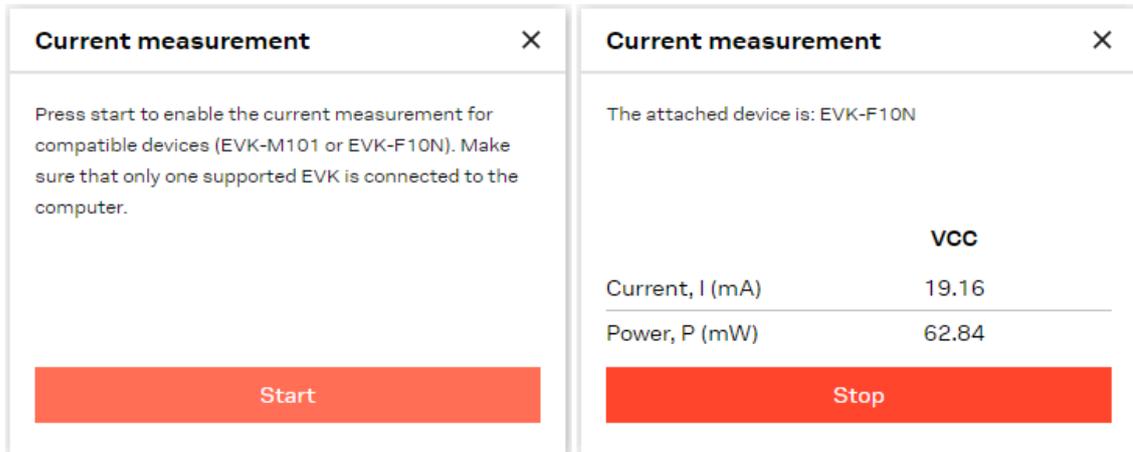
The total GNSS current ( $I_{VCC}$ ) can be measured from the current measurement tool in u-center 2. To do so, follow these steps:

1. Connect EVK-F10N to a PC with the USB cable and configure the correct communication port with u-center 2, as shown in [Connecting the EVK with a PC](#).
2. Once the device has been successfully added, go to **Tools and Service > Tools > Current measurement >** as shown below:



**Figure 4: u-center 2 current measurement option in Tools and Services section**

3. To start the current measurement, press the **Start** button as depicted on the left-hand side of [Figure 5](#). The **Current measurement** window continuously updates the VCC current value. To finish the continuous current measurement, press the **Stop** button.



**Figure 5: u-center 2 current measurement window**

u-center 2 measures the VCC current at 3.3 V.

To manually measure current contribution, connect a true RMS voltmeter to the test points available on the EVK board. The test point are connected to the I2C current sensors on the EVK board.

## 5.3 Measuring backup current

To measure the backup current ( $I_{BCKP}$ ) with EVK-F10N, follow these steps:

1. Connect a true RMS voltmeter across BCKP I1 (pin 11) and BCKP I2 (pin 10) of the [14-pin connector](#).
2. Remove the power supply by disconnecting the USB cable from the PC or other external power supply from the 14-pin connector.
3. Read the voltage (and average if necessary) on the voltmeter and convert it to current (1 mV equals 10  $\mu$ A).

## 6 Block diagram

EVK-F10N block diagram provides an overview on supply voltages, current measurement and communication interfaces as shown in [Figure 6](#).

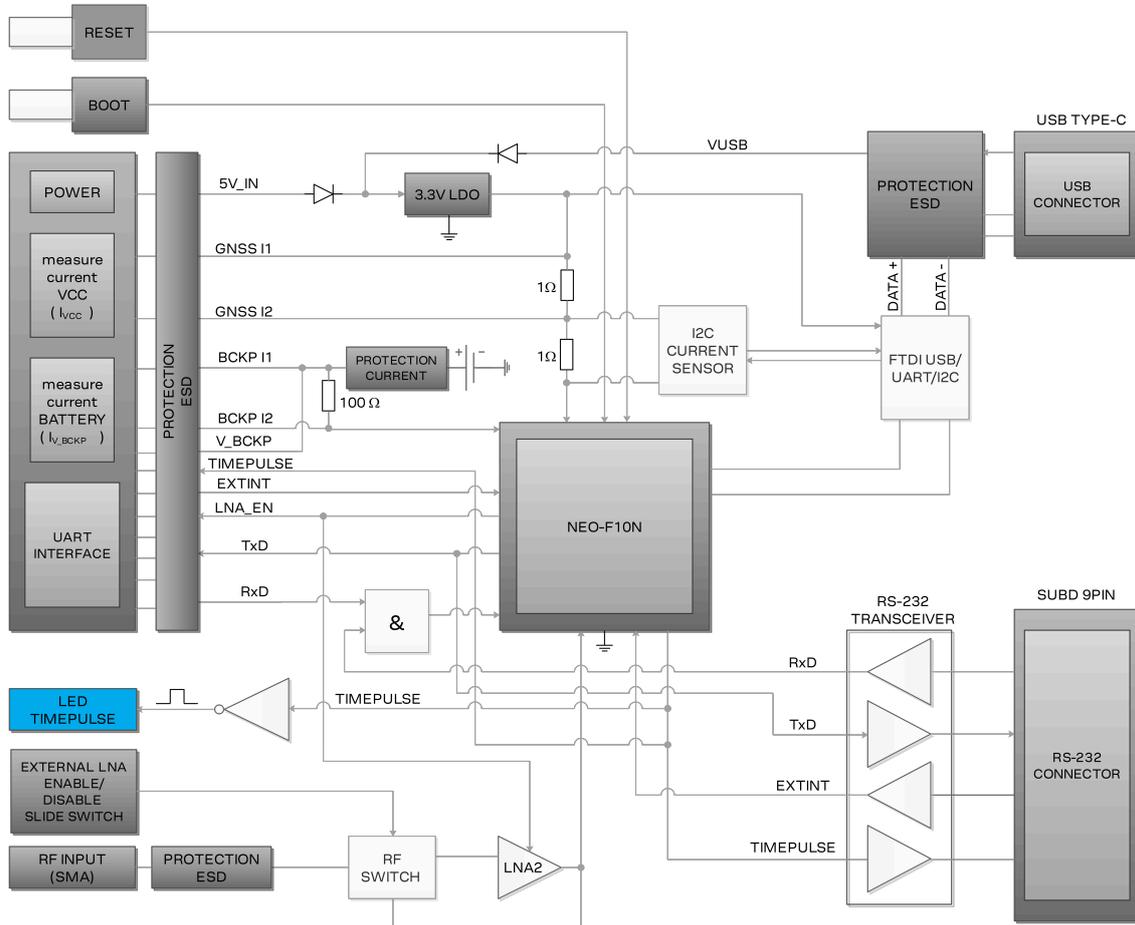


Figure 6: EVK-F10N block diagram

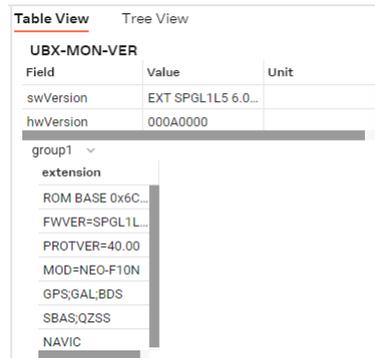


## 8 Updating firmware

EVK-F10N is delivered with the latest firmware version. However, as newer images may become available during the product life cycle, you may need to update the firmware. During start-up, EVK-F10N executes the firmware image that is loaded from the flash memory. This section shows how to upload the firmware image on the external flash memory.

To upload the new firmware with u-center 2, do as follows:

1. Connect the EVK to u-center 2 via USB. Check the installed firmware version by polling UBX-MON-VER, as shown in [Figure 9](#) or checking the **Device info** panel as shown in [Figure 12](#).



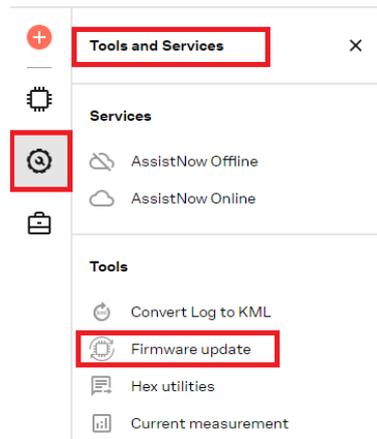
| UBX-MON-VER |                    |      |
|-------------|--------------------|------|
| Field       | Value              | Unit |
| swVersion   | EXT SPGL1L5 6.0... |      |
| hwVersion   | 000A0000           |      |

group1 ▾

- extension
- ROM BASE 0x6C...
- FWVER=SPGL1L...
- PROTVER=40.00
- MOD=NEO-F10N
- GPS;GAL;BDS
- SBAS;QZSS
- NAVIC

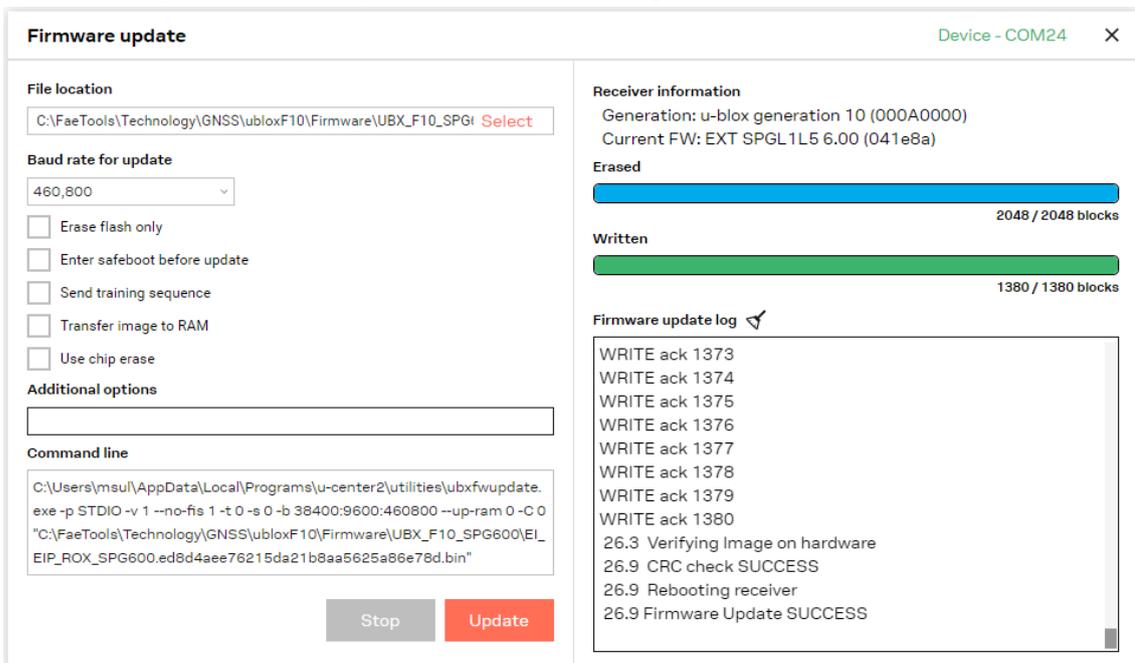
**Figure 9: Checking EVK-F10N firmware version from u-center 2**

- From the **Tools** section in the left ribbon, select **Tools and Services > Firmware update** as shown in [Figure 10](#).



**Figure 10: Tools and Services section in u-center 2**

The firmware update window appears, as shown in [Figure 11](#).



**Figure 11: Firmware update window in u-center 2**

- Select the firmware image by clicking the **Select** button.
- The default baud rate is 460,800. To make the firmware update faster, select a higher baud rate from the **Baud rate for update** drop-down menu, e.g. 921,600.
- Click **Update**.

6. Poll UBX-MON-VER again to verify the updated firmware or check the **Device info** panel as shown in [Figure 12](#).

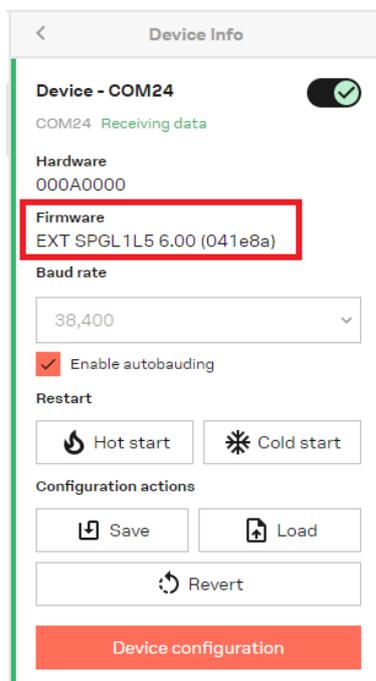
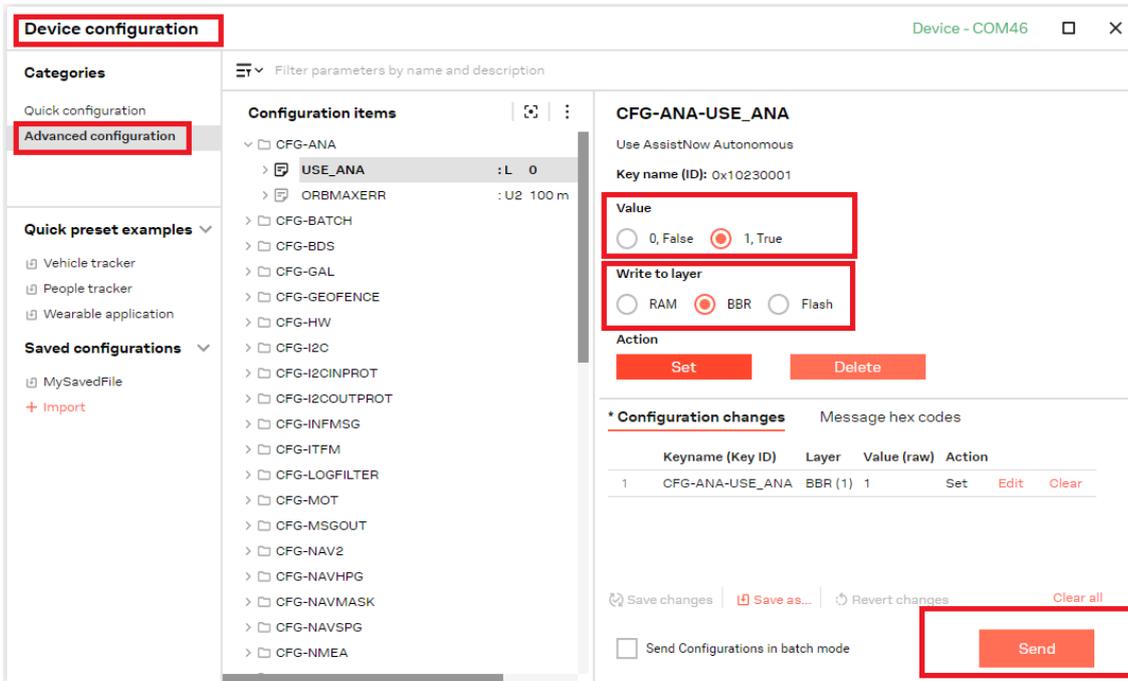


Figure 12: The firmware version displayed in the Device info panel in u-center 2

## 9 Configuring the device

This chapter shows how to configure and evaluate the EVK-F10N key features related to power modes, GNSS constellations, and navigation rate of the receiver. The receiver can be configured with the configuration keys using the u-center 2 evaluation tool in the Device configuration -> Advanced configuration view, as shown in [Figure 13](#).



**Figure 13: EVK-F10N receiver configuration view**

The receiver configuration can be saved to the receiver RAM, battery-backed RAM (BBR), or to the available SPI flash memory. The RAM content is cleared after the power supply is disconnected, in the software standby mode. Therefore, it is recommended to save the receiver configuration to RAM and BBR or permanently in the Flash memory. The BBR content is maintained as long as the backup battery supply is available. The content of the flash memory is preserved between power cycles and thus, it is the preferred option for long-term storage of the receiver configuration.

### 9.1 Connecting the EVK with a PC

The FTDI USB-to-UART converter generates four virtual communication (COM) ports as shown in [Figure 14](#). The third COM port based on the COM port ID is the correct port to use. For example, if the generated COM ports are COM1, COM2, COM3, and COM4, then the port to use is COM3.



If the RS-232 port is also connected to the same PC, there will be an additional COM port for the RS-232 serial connection.

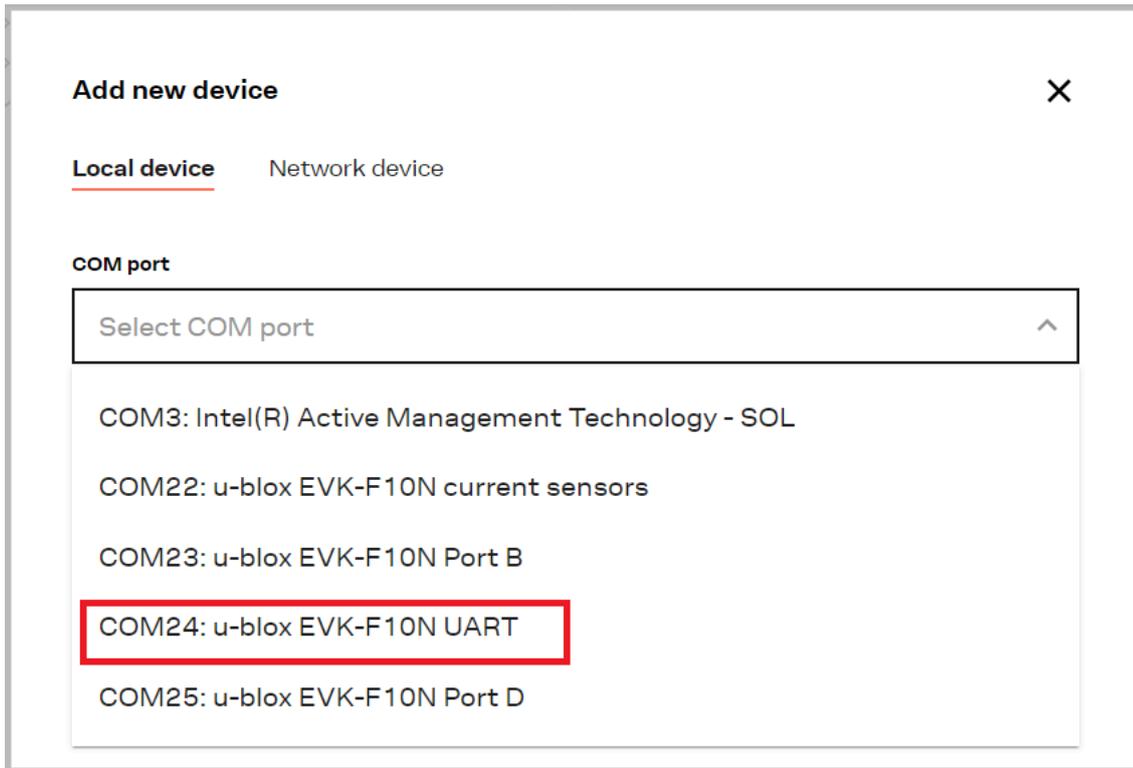


Figure 14: EVK-F10N communication ports identification on Windows

The identification of EVK-F10N on Windows machines has been improved to provide descriptive names to each virtual communication (COM) port as below.

- **u-blox EVK-F10N current sensors:** Do not use this COM port.
- **u-blox EVK-F10N Port B:** Do not use this COM port.
- **u-blox EVK-F10N UART:** Use this COM port for UART communication with the receiver via the FTDI USB-to-UART interface.
- **u-blox EVK-F10N Port D:** Do not use this COM port.

### 9.1.1 Configuring UART baud rate

The baud rate for the UART communication to the receiver can be configured in the **CFG-UART1-BAUDRATE** configuration key. The default baud rate is set to 38400 as shown in [Figure 15](#), and the maximum baud rate is 921600.

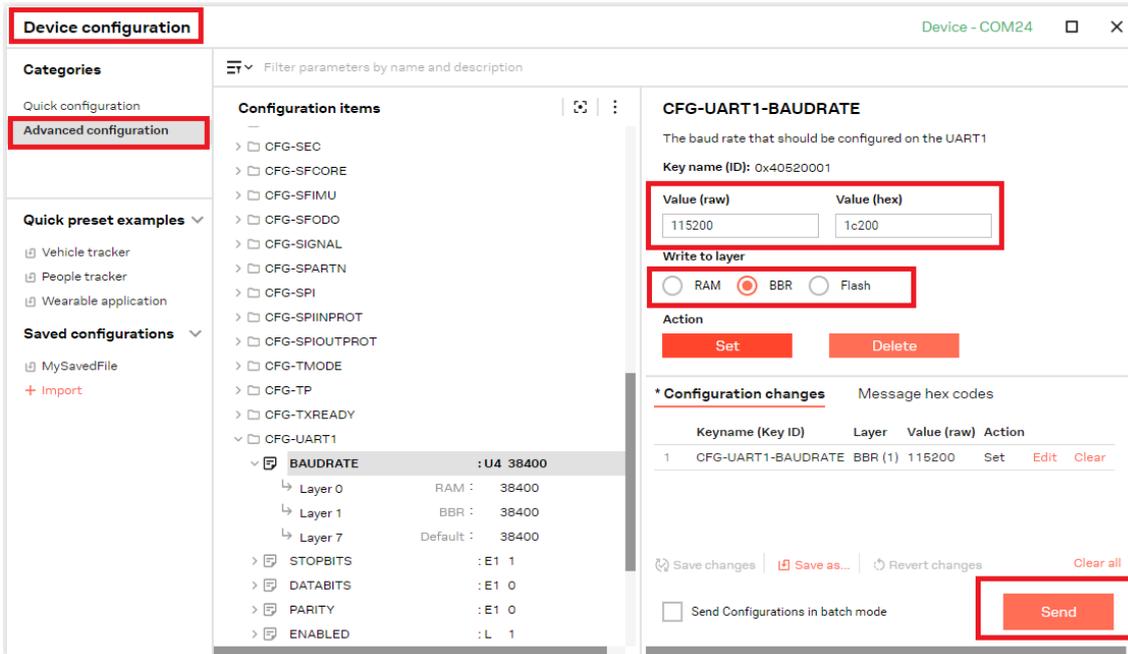


Figure 15: EVK-F10N UART baud rate configuration



Setting a different baud rate will interrupt communication. If other configuration keys were set after, these will not be applied. Therefore, the new baud rate needs to be selected manually in u-center 2 to resume communication with the host and apply the remaining configuration items.

## 9.2 Configuring GNSS constellations

The default GNSS constellations that are enabled on the receiver are GPS, Galileo, BeiDou SBAS, and QZSS. The receiver GNSS configuration can be updated by selecting the constellations in the Device configuration -> Quick configuration -> Constellation configuration view as shown in Figure 16.



u-blox receivers do not use GPS L5 signals by default. Refer to [Using GPS L5 signals for evaluation](#) to evaluate the GPS L5 signals.

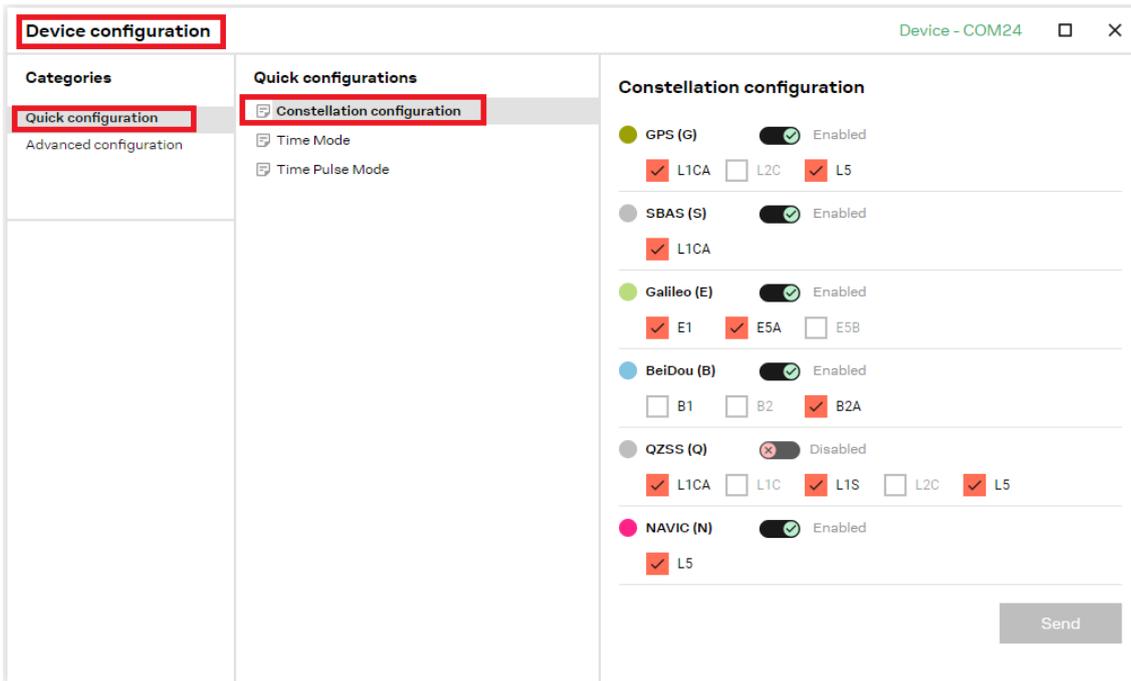


Figure 16: EVK-F10N receiver GNSS configuration

### 9.3 Using GPS L5 signals for evaluation

EVK-F10N supports both GPS L1 C/A and L5 signals. Broadcasting of Civil Navigation (CNAV) messages on the L5 signal began in April 2014. At the time of writing, GPS L5 signals remain [pre-operational](#). They are set as unhealthy until sufficient monitoring capability is established and as such are not used by u-blox receivers as a default.

To evaluate GPS L5 signals before they become fully operational, the receiver can be configured to ignore the GPS L5 health status by overriding it with the respective GPS L1 C/A signal status.

To ignore the GPS L5 signal health status and override it with the respective GPS L1 signal health status, send the configuration string given in [Table 7](#) by navigating to Tools and Services -> Hex utilities -> Send raw data as shown in [Figure 17](#).

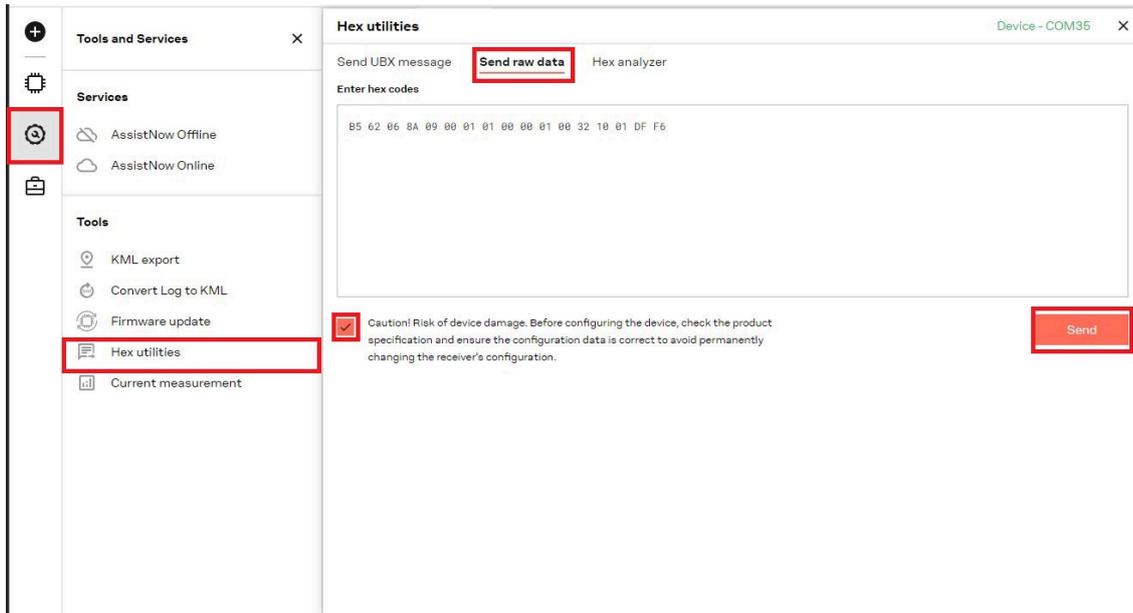


Figure 17: EVK-F10N GPS L5 health status configuration

The configuration can be stored in RAM, BBR and flash layers. If stored in the RAM layer, the device returns the UBX-ACK-ACK message if the configuration is sent successfully and it is applied immediately without a configuration reset. To apply the configuration stored in the BBR and flash layers, send the UBX-CFG-RST message with resetMode 0x01 as shown in Figure 18.

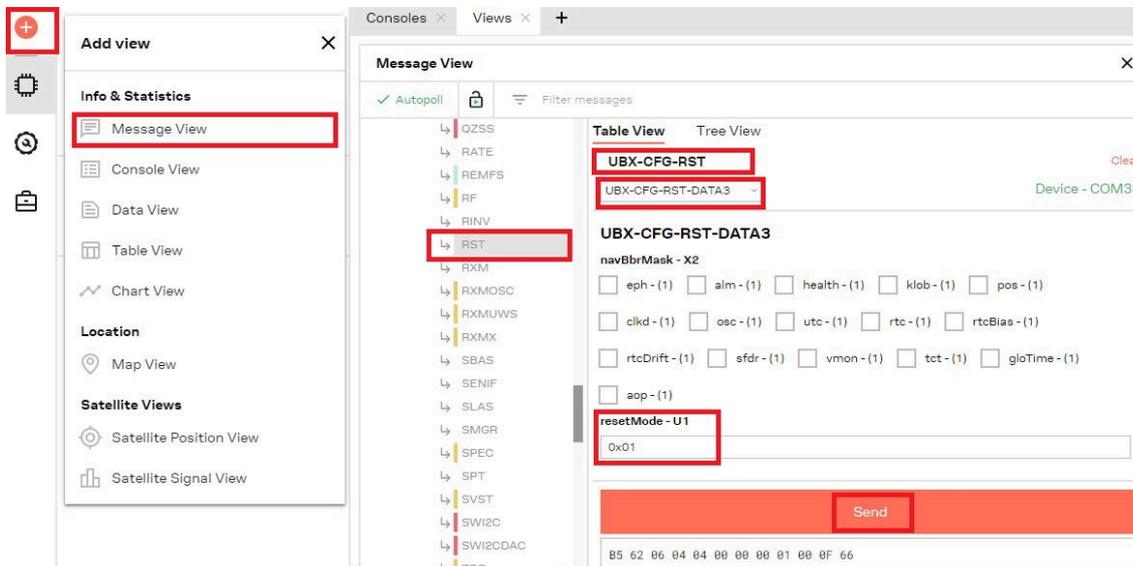


Figure 18: EVK-F10N UBX-CFG-RST message view with reset mode 0x01

To revert to the default configuration, send the configuration string given in Table 8 by navigating to Tools and Services -> Hex utilities -> Send raw data as shown in Figure 17.

The device returns the UBX-ACK-ACK message if the configuration is sent successfully and it is applied immediately without a reset in the RAM layer. To apply the configuration stored in the BBR and flash layers, send the UBX-CFG-RST message with resetMode 0x01 as shown in Figure 18.

| Configuration layer | Configuration string                               |
|---------------------|--|
| RAM                 | B5 62 06 8A 09 00 01 01 00 00 01 00 32 10 01 DF F6 |
| BBR                 | B5 62 06 8A 09 00 01 02 00 00 01 00 32 10 01 E0 FE |
| FLASH               | B5 62 06 8A 09 00 01 04 00 00 01 00 32 10 01 E2 0E |

**Table 7: UBX binary string to override GPS L5 signal health status with GPS L1 health status**

| Configuration layer | Configuration string                               |
|---------------------|--|
| RAM                 | B5 62 06 8A 09 00 01 01 00 00 01 00 32 10 00 DE F5 |
| BBR                 | B5 62 06 8A 09 00 01 02 00 00 01 00 32 10 00 DF FD |
| FLASH               | B5 62 06 8A 09 00 01 04 00 00 01 00 32 10 00 E1 0D |

**Table 8: UBX binary strings to revert the GPS L5 signal health status monitoring to default**

## 9.4 Configuring navigation update rate

The **CFG-RATE-MEAS** configuration key that is shown in [Figure 19](#) can be used to configure the navigation update rate. The navigation update rate value is defined in ms, where 100 ms corresponds to 10 Hz. The default update rate is 1000 ms which corresponds to 1 Hz. The default 1 Hz update rate is a good tradeoff between position accuracy and power consumption. Certain applications require faster update rates for high performance but this will increase the receiver power consumption.



When high navigation update rates are used, increase the communication baud rate and reduce the number of enabled messages. The maximum baud rate of 921600 or 460800 is sufficient for most use cases.

| * Configuration changes |         | Message hex codes |                |
|-------------------------|---------|-------------------|----------------|
| Keyname (Key ID)        | Layer   | Value (raw)       | Action         |
| 1 ✓ CFG-RATE-MEAS       | RAM (0) | 100               | Set Edit Clear |

**Figure 19: EVK-F10N receiver navigation update rate configuration**

## 9.5 Configuring power modes

EVK-F10N supports continuous power mode only. This is the full power mode and the default mode of the receiver.

### 9.5.1 Configuring backup modes

EVK-F10N supports two backup modes: hardware backup mode and software standby mode.

- **Hardware backup mode:** In this mode, only the the backup supply (V\_BCKP) is turned on. All other supplies are turned off. To turn on the hardware backup mode on EVK-F10N, remove the EVK main power supply either by disconnecting the USB cable from the PC or the 5.0 V supply from the 14-pin connector.
- **Software standby mode:** To turn on the software standby mode, provide the time duration as milliseconds in the duration field and select the UBX-RXM-PMREQ message backup flag, as shown in [Figure 20](#). The receiver wakes up after the provided duration or by selecting the supported wakeup sources in the message field. The available wakeup sources are EXTINT and UART RxD signals.



To keep the software standby mode on until a signal is detected from the configured wakeup source, set the duration to 0 in the UBX-RXM-PMREQ message.



The RAM memory is cleared in the software standby mode. Save the configuration to maintain it during the inactive state.

The screenshot shows the 'Message View' window with the following configuration:

- Message Type:** UBX-RXM-PMREQ
- Version (U1):** 0
- Duration (U4):** 10000
- Flags (X4):**
  - backup - (1)
  - force - (1)
- Wakeup Sources (X4):**
  - uartrx - (1)
  - extint0 - (1)
  - extint1 - (1)
  - spics - (1)

The hex data display at the bottom shows: B5 62 02 41 10 00 00 00 00 00 10 27 00 00 02 00 00 00 00 00 00 00 8C 98

**Figure 20: EVK-F10N receiver software standby mode configuration**

Refer to u-blox F10 interface description for more information on the advanced receiver configuration [4].

## 10 Approvals

EVK-F10N complies with the essential requirements and other relevant provisions of the Radio Equipment Directive (RED) 2014/53/EU.

EVK-F10N complies with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

The Declaration of Conformity (DoC) is available at [u-blox website](#).

# 11 Troubleshooting

## My application (e.g. u-center 2) does not receive all messages

If the baud rate is insufficient, the GNSS receivers based on u-blox F10 GNSS technology skip excessive messages. When using UART, check that the baud rate is high enough or reduce the number of enabled messages. The maximum baud rate of 921600 or 460800 is sufficient for most use cases. Some serial port cards/adapters (e.g. USB to RS-232 converter) frequently generate errors. If a communication error occurs while u-center 2 receives a message, the message is discarded.

## My application (e.g. u-center 2) loses the connection to the GNSS receiver

u-blox F10 positioning technology and u-center 2 have an autobauding feature. If frequent communication errors occur (e.g. due to problems with the serial port), the connection may be lost. This happens if the GNSS receiver has the autobauding enabled because both u-center 2 and the GNSS receiver try to autonomously adjust the baud rate. Select a suitable baud rate from the list available in u-center 2.

## Some COM ports are not shown in the port list of my application (e.g. u-center 2)

Only the COM ports that are available on your computer show up in the COM port drop down list. If a COM port is gray or u-center 2 is not able to connect to the selected COM port, check if another application running on the computer is using the same port.

## FTDI drivers are not automatically mapped in Linux environment

EVK-F10N does not officially support Linux. The following example shows how to map the available FTDI drivers to the connected EVK.

To map the FTDI drivers available in the Linux system to the EVK device, save the following configuration in a new rules file under the `/etc/udev/rules.d/` folder.

For example: `> nano /etc/udev/rules.d/10-evk.rules`

```
ACTION=="add",
ATTRS{idVendor}=="1546",
ATTRS{idProduct}=="0509",
ATTRS{bInterfaceNumber}=="00", SYMLINK+="ttyUSB-EVK-F10N-Current-sensors",
ATTRS{bInterfaceNumber}=="01", SYMLINK+="ttyUSB-EVK-F10N-PortB",
ATTRS{bInterfaceNumber}=="02", SYMLINK+="ttyUSB-EVK-F10N-UART",
ATTRS{bInterfaceNumber}=="03", SYMLINK+="ttyUSB-EVK-F10N-PortD",
RUN+="/sbin/modprobe ftdi_sio"
RUN+="/bin/sh -c 'echo 1546 0509 > /sys/bus/usb-serial/drivers/ftdi_sio/new_id'"
RUN+="/bin/stty -F /dev/ttyUSB-EVK-* -clocal raw ispeed 38400 ospeed 38400"
```

The configuration generates four ports as shown in the example in [Figure 21](#) and the third port (ttyUSB2 in the figure) can be used for UART communication with the receiver.

```
lrwxrwxrwx 1 root root      7 tammi 25 11:49 /dev/ttyUSB-EVK-F10N-Current-sensors -> ttyUSB0
lrwxrwxrwx 1 root root      7 tammi 25 11:49 /dev/ttyUSB-EVK-F10N-PortB -> ttyUSB1
lrwxrwxrwx 1 root root      7 tammi 25 11:49 /dev/ttyUSB-EVK-F10N-UART -> ttyUSB2
lrwxrwxrwx 1 root root      7 tammi 25 11:49 /dev/ttyUSB-EVK-F10N-PortD -> ttyUSB3
crw-rw---- 1 root dialout 188, 0 tammi 25 11:49 /dev/ttyUSB0
crw-rw---- 1 root dialout 188, 1 tammi 25 11:49 /dev/ttyUSB1
crw-rw---- 1 root dialout 188, 2 tammi 25 11:49 /dev/ttyUSB2
crw-rw---- 1 root dialout 188, 3 tammi 25 11:49 /dev/ttyUSB3
```

Figure 21: EVK-F10N communication ports in Linux environment

### EVK-F10N does not work properly when connected to a GNSS simulator

When using EVK-F10N together with a GNSS simulator, pay attention to proper handling of the EVK. A GNSS receiver is designed for real-life use (i.e. time is always moving forward). When using a GNSS simulator scenario, the scenario time can be in the past causing the receiver to jump backwards in time. This affects the receiver performance.

To avoid this, configure the GPS week rollover value to a week number preceding the date used in the GNSS simulator scenario. For example, setting the GPS week number to 1200 (corresponding to Jan 2003) allows running simulator scenarios taking place after this date. For more information on setting the GPS week number with the u-center 2 GNSS evaluation tool, see [Figure 22](#). In addition, issue a cold start command before every simulator test to avoid receiver confusion due to time jumps.

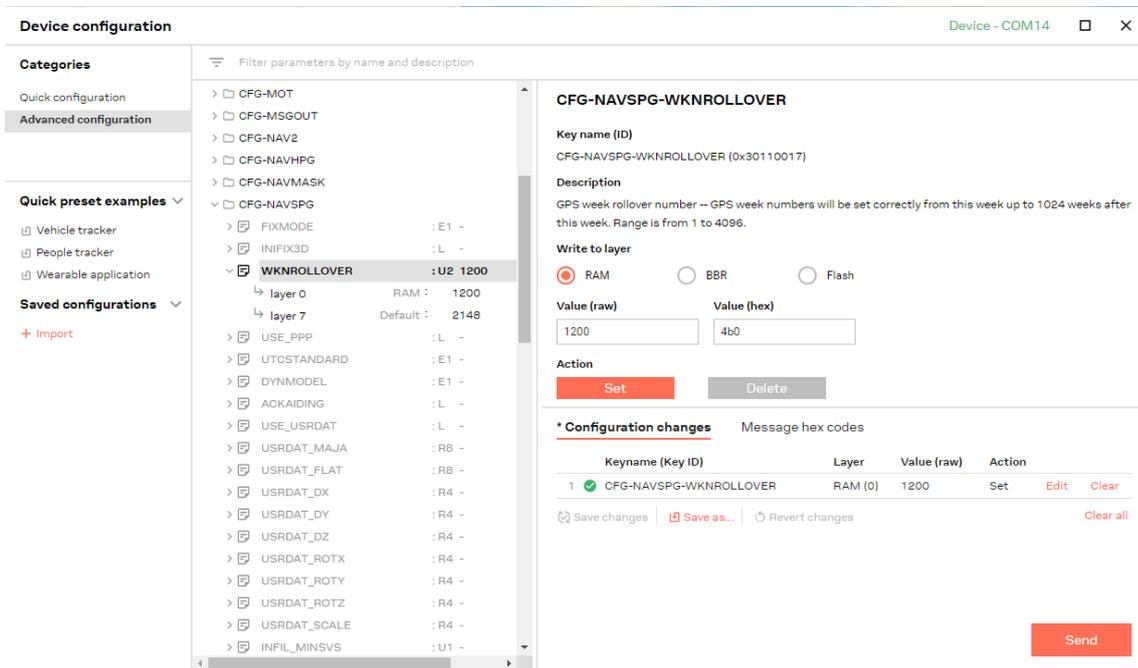


Figure 22: Setting the GPS week number with the u-center 2 GNSS evaluation tool

## 12 Common evaluation pitfalls

- **Parameters may have the same name but a different definition.** GNSS receivers may have a similar size, price and power consumption but different functionalities (e.g. no support for passive antennas, different temperature range). Also, the definitions of hot, warm, and cold start times may differ between suppliers.
- Verify design-critical parameters. Try to **use identical or at least similar settings when comparing** the GNSS performance of different receivers. Data which has not been recorded at the same time and the same place, should not be compared. The satellite constellation, the number of visible satellites and the sky view might have been different.
- **Do not compare momentary measurements.** GNSS is a non-deterministic system. The satellite constellation changes constantly. Atmospheric effects (i.e. dawn and dusk) have an impact on signal travel time. The position of the GNSS receiver is typically not the same between two tests. Therefore, conduct comparative tests in parallel by using one antenna and a signal splitter. Run statistical tests for 24 hours.
- **Monitor the carrier-to-noise-ratio (C/N0).** The average C/N0 of the high elevation satellites should be between 40 dBHz and about 50 dBHz. A low C/N0 will result in a prolonged TTFF and more position drift.
- Try to **feed the same signal to all receivers in parallel** (i.e. through a splitter) with identical cable length. Otherwise, the receivers do not have the same sky view. Even small differences can have an impact on the speed, accuracy, and power consumption. One additional satellite can lead to a lower dilution of precision (DOP), less position drift, and lower power consumption.
- **When doing reacquisition tests**, cover the antenna to block the sky view. **Do not unplug the antenna** since the u-blox F10 positioning technology continuously performs a noise calibration on idle channels.
- **Do not change the MODE switch position while the EVK is powered on.** This may damage the GNSS receiver chip. Power off the EVK before changing the MODE switch to enable/disable the external LNA (LNA2).
- **The measured GNSS performance does not match the performance data given in the NEO-F10N Data sheet.** When operating in MODE 0 (LNA2 disabled), the system noise figure is increased by ~0.6 dB. When operating in MODE 1 (LNA2 enabled), the maximum external gain is limited to ~5-10 dB.

## Related documents

- [1] u-center 2 User guide, [www.u-blox.com/en/info/u-center-2-user-guide](http://www.u-blox.com/en/info/u-center-2-user-guide)
- [2] NEO-F10N Data sheet, [UBX-23002117](#)
- [3] NEO-F10N Integration manual, [UBXDOC-963802114-12193](#)
- [4] u-blox F10 SPG 6.00 Interface description, [UBX-23002975](#)
- [5] Information technology equipment - [Safety Standard IEC 62368-1:2018](#)



For regular updates to u-blox documentation and to receive product change notifications please register on our homepage <https://www.u-blox.com>.

## Revision history

| Revision | Date        | Status / comments  |
|----------|-------------|--|
| R01      | 01-Nov-2023 | Initial release  |
| R02      | 28-Nov-2023 | Added chapter Firmware update using u-center 2<br>Added section Using GPS L5 signals for evaluation<br>Updated sections: <ul style="list-style-type: none"><li>• Overview with information related to GPS L5</li><li>• Measuring current with u-center 2</li></ul> |
| R03      | 07-Feb-2024 | Added chapter Approvals<br>Updated sections: <ul style="list-style-type: none"><li>• Troubleshooting</li><li>• Common evaluation pitfalls</li></ul>  |

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