C102-F9R

Application board

User guide

Abstract

This document describes the structure and use of the C102-F9R and provides information for evaluating and testing u-blox F9 high precision sensor fusion positioning technology.

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Document information

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This document applies to the following products:

Product name	Type number	Firmware version	PCN reference
C102-F9R	C102-F9R-1	HPS 1.30 C100 v1.0 C100-MSG v1.0	N/A

Contents

1 Introduction

The C102-F9R application board can be used to evaluate and test the high-precision sensor fusion positioning technology of the ZED-F9R module. The built-in USB interface provides both power supply and a high-speed communications interface. The device is compact, and it provides a flexible and user-friendly interface between the GNSS module and test vehicles. Furthermore, it can be used with a notebook or PC running the GUI-driven u-center application, making it the perfect companion through all stages of evaluation and design-in phases of projects.

1.1 Highlights

- Multi-band multi-constellation GNSS
- Automotive Dead Reckoning (ADR)
- Real-time kinematic (RTK)
- NEO-D9S module for L-band corrections
- Configurable CAN interface
- Dedicated pins for wheel tick and direction inputs
- USB, UART, RS-232 connections
- A short-term battery-backed RAM (BBR)

1.2 Kit includes

- Application board with enclosure
- USB cable
- Active multi-band GNSS antenna with a 5 m cable
- 14-pin breakout cable
- PointPerfect promotion card

☞ An L-band antenna for the NEO-D9S is not included and must be purchased separately. u-blox recommends the INPAQ LBAND01D-S6-00 to be used with the NEO-D9S.

1.3 System requirements

- A PC with Windows operating system
- u-center GNSS evaluation software
- Odometer input from vehicle
- Internet connection for correction data

1.4 Evaluation steps

Experience the lane-accurate performance of the u-blox F9R module in four simple steps:

1. Set up
2. Calibrate
3. Test
4. Analyze

2 Device description

2.1 USB

A USB 2.0-compatible serial port is featured for data communication and power supply. USB drivers are installed automatically through Windows update.

2.2 UART

The unit includes an RS-232 port which can be dynamically connected to the UARTs of the ZED-F9R and NEO-D9S modules or the MCU. Selection of the UART connection is controlled by the NEO_UART_SEL and MCU_UART _SEL pins on the front connector.

NEO_UART_SEL	MCU_UART_SEL	Connected component
LOW	OPEN	NEO-D9S
OPEN	LOW	MCU
OPEN	OPEN	ZED-F9R
LOW	LOW	None

The selected UART interface is also available via the RxD and TxD pins on the front connector.

RxD and TxD pins on the front connector are at TTL voltage levels.

Flow control should **not** be used with the RS-232 port.

2.3 Antenna

There are two female SMA connectors on the unit. The one on the front side (RF_IN) is used by the ZED-F9R module, and the one on the back side is used by the NEO-D9S module.

The kit includes a u-blox ANN-MB L1/L2 active multi-band GNSS antenna with a 5-meter cable to be used by the ZED-F9R module. A suitable antenna for the NEO-D9S is sold separately.

2.4 14-pin front connector

The connector and its signals are described in the table below.

Pin no.	Pin name	I/O	Level	Description
14	VIN 5-24V	I	5 - 24 V	Power input – can be used in place of USB
13	GND			Common ground pin for case-work, power and serial interface connections
12	CAN_H	I		Connect to the vehicle CAN high wire (ISO 11898-2)
11	CAN_L	I		Connect to the vehicle CAN low wire (ISO 11898-2)
10	NEO_UART_SEL	I	-	Pull-down signal for enabling UART communication with the NEO-D9S
9	MCU_UART_SEL	I	-	Pull-down signal for enabling UART communication with the MCU
8	TIME_MARK	I		Time mark input
7	WHEELTICK	I	5 - 24 V	Wheel tick pulse input
6	DIRECTION	I	5 - 24 V	Direction of travel input
5	SDA			Reserved
4	SCL			Reserved
3	TxD	I/O	3.3 V	UART TxD
2	RxD	I/O	3.3 V	UART RxD
1	GND_A			Ground for wheel tick and direction signals

Leave the reserved pins open.

2.5 10-pin rear connector

This connector is used for updating the MCU firmware. See section 4.5 for more information.

2.6 Reset and safe boot buttons

The reset button on the front panel resets the unit.

The safe boot button is used to set the unit in safe boot mode. In this mode the receiver executes only the minimal functionality, such as updating new firmware into the SQI flash. **USB communication is disabled** while in safe boot mode.

To set the receiver in safe boot mode:

- Press and hold the BOOT button.
- Press the RST button.
- Release the RST button.
- Release the BOOT button.

To use UART in safe boot mode, a training sequence needs to be sent to the receiver. The training sequence is a transmission of two bytes (0x55 0x55) at the baud rate of 9600. Wait for at least 100 milliseconds before the interface is ready to accept commands.

2.7 I2C/SPI slide switch

⚠ The switch must be kept at the I2C position to ensure correct operation of the device!

⚠ Contact u-blox technical support for assistance if required.

2.8 LED

On the front panel of the unit, a single blue LED may be configured to follow the receiver time pulse signal. If there is no GNSS fix, the LED will be lit without flashing.

2.9 NEO-D9S module

The device includes a NEO-D9S module for providing L-band corrections to the ZED-F9R module. The modules are connected via each module's UART2 port. The NEO-D9S can be connected to in u-center through either USB of UART. When connecting through UART, the NEO_UART_SEL pin must be pulled down to enable communication with the module.

For more information on how to use the NEO-D9S, refer to the C101-D9S application board User guide [7].

3 Setting up

3.1 Preparation

ADR requires odometer sensor input from the vehicle reference point (VRP), that is, wheel ticks or speed, and direction. The following options are available:

1. WHEELTICK and DIRECTION pins
2. UBX-ESF-MEAS messages
3. CAN_H and CAN_L pins

See the ZED-F9R documentation ([1], [2]) for more information about options 1 and 2. For option 3, refer to chapter 4.

☞ By default, the CAN bus is terminated by the unit. See appendix A for how to change the termination.

⚠ Take care when connecting to the vehicle to avoid blocking the CAN bus traffic, potentially creating serious malfunction of the vehicle.

High-precision positioning uses RTK, which can be easily configured with the u-center NTRIP client. Refer to the ZED-F9R documentation ([1], [2]) and u-center User guide [3] for more information.

☞ The provided correction service provider credentials are valid only in certain regions. Check the validity of the license in your region from the correction service provider webpage.

3.2 Installation

Follow these steps to complete the installation.

3.2.1 Mounting the device and the antenna to the vehicle

Attach the device to the vehicle firmly to avoid any movement or vibration. For testing purposes, a good location is near the VRP, that is, the center of the rear axle.

⚠ Dead reckoning performance can be seriously impaired by changes in the orientation of the device.

Place the provided GNSS antenna in a location with an unobstructed view of the sky, for example, the roof of the vehicle. For best performance, ensure that the antenna has contact to a ground plane with a minimum of 100–150 mm diameter. If using L-band corrections, also place the L-band antenna in a similar location.

⚠ To achieve the best possible performance, the GNSS antenna should be positioned on the vehicle roof over the EVK. If the antenna is placed at a significant distance from the EVK, a position offset can be introduced which might affect the accuracy of the navigation solution. To compensate for the position offset, advanced configurations can be applied. Contact u-blox support for more information on advanced configurations.

3.2.2 Connecting the cables

1. Connect the GNSS antenna(s) to the correct RF connector(s).
2. Connect the ADR signals to the related pins on the front connector:
    a. Analog wheel tick and direction signals to pins WHEELTICK and DIRECTION, <u>or</u>
    b. CAN high to CAN_H, CAN low to CAN_L.
3. Connect the device to a PC via USB for host interface and to power the device.

Alternatively, host interface can be established via UART pins on the front connector or the RS-232 connector. In this case, power must be provided via USB or the VIN and GND pins on the front connector.

☞ Use the provided 14-pin breakout cable to securely connect the front connector pins. The unused wires must be isolated.

3.3 Configuring the device

With u-center connected to the COM port assigned to the ZED-F9R module, verify that the host interface to the ZED-F9R is established. This can be verified with u-center "Messages" view by polling the UBX-MON-VER message. A valid response proves that the host interface is connected correctly.

3.3.1 ADR configuration

The receiver can be configured with UBX-CFG-VALSET messages. Consult the ZED-F9R documentation ([1], [2]) for more information about the configuration.

1. Enable automatic alignment of the IMU with key ID CFG-SFIMU-AUTO_MNTALG_ENA. Set the value to 1.
2. Configure the odometer sensor input depending on the used sensor:
    a. If the wheel tick and direction pins on the front connector are used, enable the use of the wheel tick pin by setting the value for key ID CFG-SFODO-USE_WT_PIN to 1.
    b. If using the CAN interface or the software interface, **the wheel tick pin must be disabled**. Set the value for key ID CFG-SFODO-USE_WT_PIN to 0. See chapter 4 for instructions on how to configure the CAN interface.

☞ It is highly recommended to verify that the configuration is correct and to perform system sanity checks.

4 Configurable CAN interface

The device has a configurable high-speed CAN (ISO 11898-2) interface. The on-board MCU converts the configured CAN messages into UBX-ESF-MEAS messages which are sent to the receiver via I2C.

4.1 Valid configurations

The CAN interface supports the following configurations:

- Single tick from VRP + direction
- Wheel ticks from both rear wheels + direction
- Speed from VRP + direction
- Speed from both rear wheels + direction

See appendix B for example configurations.

4.2 Configuring the interface

Communication with the MCU can be established via UART. Connect the front connector pin MCU_UART_SEL to ground to enable the MCU communication.

The MCU UART runs at baud rate 115200.

The following messages are supported:

- CONFIG GET – Reports the current CAN configuration.
  - Hex string: 0x43 0xa2 0x10 0x00 0x10 0x20
- CONFIG CLEAR – Deletes the current CAN configuration.
  - Hex string: 0x43 0xa2 0x12 0x00 0x12 0x24
- CONFIG SET – Sends a configuration for one data field.
  - Hex string: generate with the tool

Sending the commands to the MCU can be done through a terminal program. We recommend using RealTerm. For more information, see [4].

4.3 C100 MSG

C100 MSG is a browser-based tool for generating C100 MCU configuration messages for the configurable CAN feature. It can be run entirely locally, without an internet connection. Figure 1 shows a screenshot of the tool.

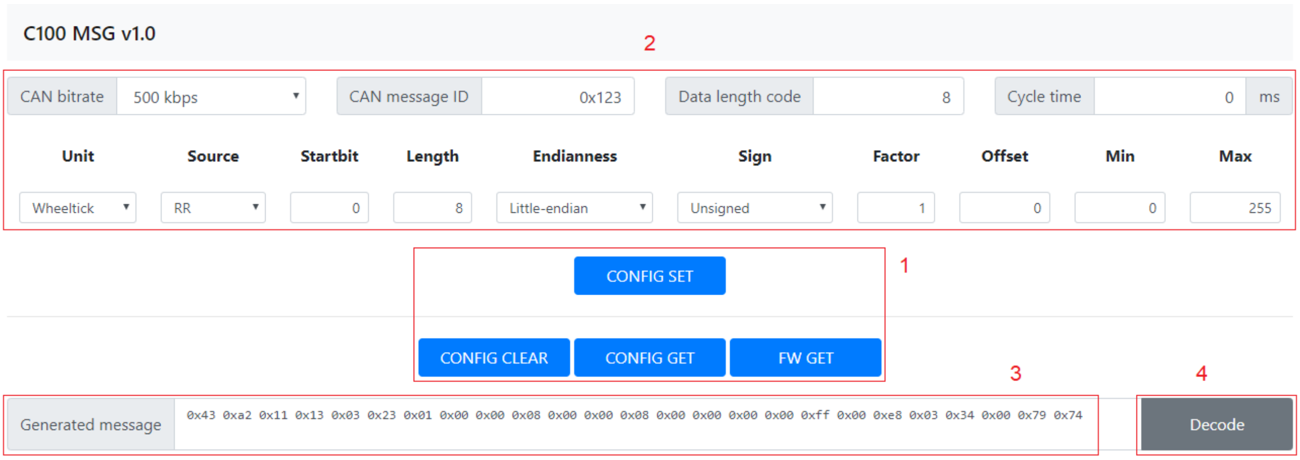


Figure 1: C100 MSG tool

The numbers in the list below refer to Figure 1:

- **1:** Select the blue buttons in the middle to generate messages.
- **2:** Fill these fields for CONFIG SET messages.
- **3:** The generated message is displayed in the text field at the bottom. It is automatically copied to the clipboard.
- **4:** Use the decode button to parse the contents of a message pasted in the text field (3).

☞ Ensure that the version number of the tool matches the MCU firmware version. Compatibility between versions is not guaranteed.

4.3.1 Configuration parameters

The following fields are required to generate a CONFIG SET message:

- **CAN bitrate**: bitrate of the CAN bus
- **CAN message ID**: ID of the message containing the wanted data
- **Data length code**: number of bytes in the CAN message
- **Cycle time**: time between consecutive messages
- **Unit**: the unit of measurement for the data
- **Source**: rear-left, rear-right wheel, etc.
- **Startbit**: index of the LSB of the value field within the CAN message
- **Length**: the bit-length of the value field
- **Endianness**: Big-endian (Motorola) or Little-endian (Intel)
- **Sign**: value is signed or unsigned
- **Factor**: scaling factor representing the value of one bit in the selected unit
- **Offset**: positive offset which shifts the zero point of the raw value
- Min/Forward:
    - Wheel tick and speed – sets the minimum value. Values smaller than this are discarded.
    - Direction – represents the value indicating forward movement
- Max/Backward:
    - Wheel tick and speed – sets the maximum value. Values greater than this are discarded.
    - Direction – represents the value indicating backward movement

4.4 Configuration process

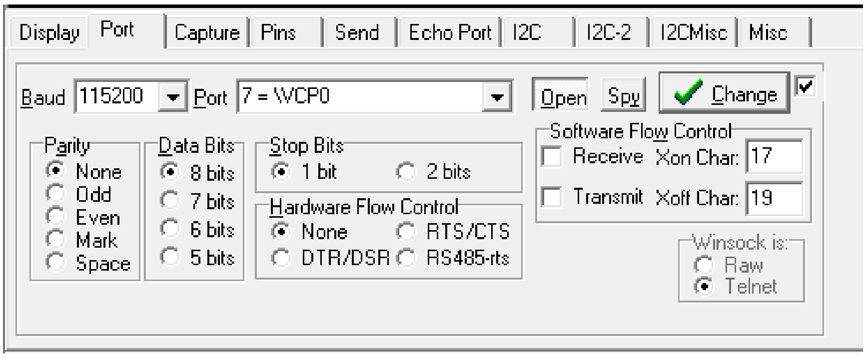
Follow these steps to configure the CAN interface:

4.4.1 Connections

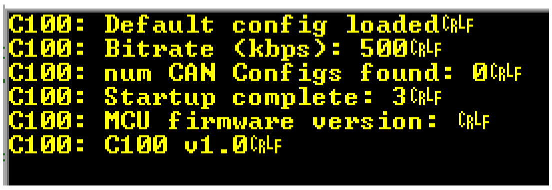
1. Connect the pin MCU_UART_SEL to the GND pin. Ensure that the pin NEO_UART_SEL is disconnected.
2. Connect a PC to the MCU via RS-232 cable or the front connector UART pins.

4.4.2 RealTerm

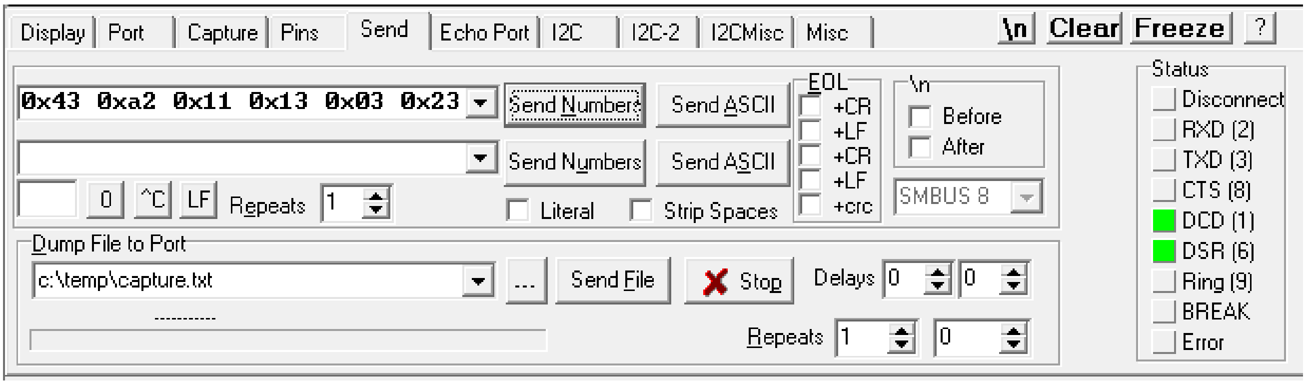
1. Select the port associated with the UART connection in the **Port** tab.
2. Set baud rate to 115200.
3. Apply changes by selecting the **Change** button. See the figure below.



Power on the device. The following startup message should be displayed in the terminal window:



4. Setting up the configurable CAN feature:
    4.1. Open the RealTerm **Send** tab.
    4.2. Generate CONFIG SET message(s) in the MSG tool.
    4.3. Copy and paste a CONFIG SET message into the text field.
    4.4. Send the message by selecting the **Send Numbers** button.



The following dialog should be displayed when a configuration has been accepted:

When all configuration messages have been sent:

    4.5. Generate a CONFIG GET message.
    4.6. Send the CONFIG GET message.
    4.7. A dialog similar to the one shown below should be displayed and can be used to validate the configurations.

```
C100: Get configuration:
C100: Bitrate (kbps): 500
C100: num CAN Configs found: 2
C100: Config 1
C100:       canMsgId 0x123
C100:       dlc 8
C100:       cycleTime 0
C100:       startBit 0
C100:       length 8
C100:       offset 0
C100:       factor 1000
C100:       minVal 0
C100:       maxVal 255
C100:       msgType 2
C100:       source 3
C100:       unit 1
C100:       sign 0
C100:       endian 0
C100: Config 2
C100:       canMsgId 0x123
C100:       dlc 8
C100:       cycleTime 0
C100:       startBit 8
C100:       length 8
C100:       offset 0
C100:       factor 1000
C100:       minVal 0
C100:       maxVal 255
C100:       msgType 2
C100:       source 2
C100:       unit 1
C100:       sign 0
C100:       endian 0
C100: OK 16
```

A configuration entry can be overwritten by sending a new CONFIG SET message with the same unit and source.

☞ All configuration entries can be deleted with the CONFIG CLEAR message.

4.5 Updating the MCU firmware

New MCU firmware and corresponding tool versions may be released e.g. to support new features or to increase the performance of the application. To update the firmware, the following equipment is required:

- Silicon Labs IDE or Flash Programming Utilities software [5], and
- USB debug adapter for 8-bit MCUs [6]

Follow these steps to flash the new firmware:

1. Power up the device.
2. Connect the debugger to the 10-pin rear connector.
3. If using the Silicon Labs IDE:
    a. Select **Debug > Connect** to connect the Debugger to the MCU.
    b. Select **Debug > Download** *object file* and input the correct file to the opened window.
    c. Select **Download** to start the flashing process.
4. If using Flash Programming Utilities, follow the instructions accompanying the software.
5. After the device is flashed, disconnect the debugger and reboot the device.
6. Confirm that the firmware version string matches by either checking what the MCU outputs during bootup, or by sending a FW GET command.

Appendix

A CAN termination

The CAN bus is terminated by including the jumper circled in Figure 2. The jumper is included by default. If the termination needs to be removed, open the enclosure and remove the jumper.

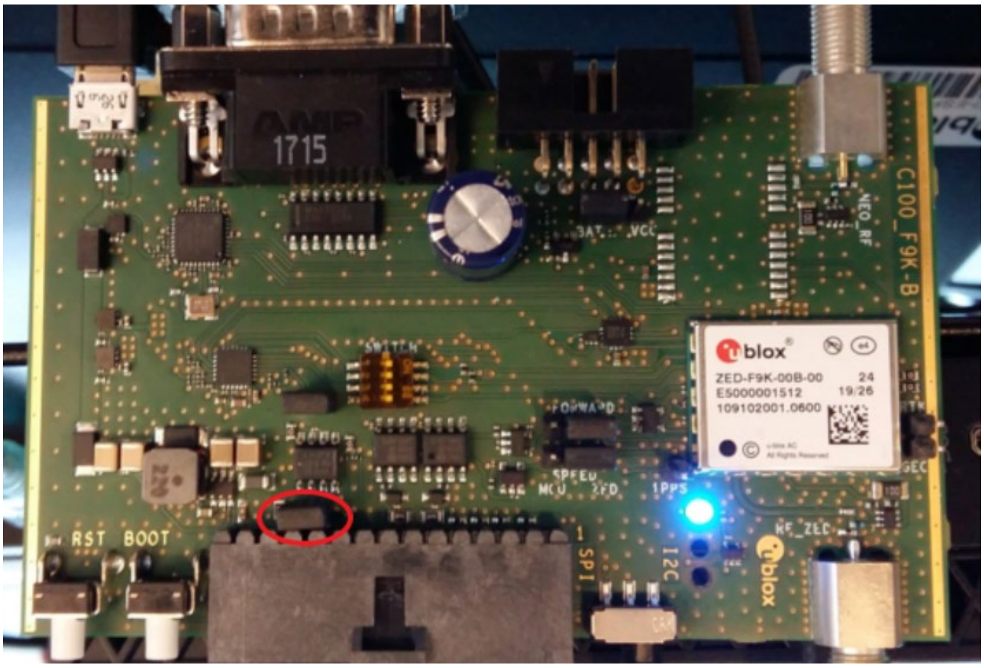


Figure 2: Jumper (circled)

B CAN configuration examples

This appendix contains example CAN configurations. Each example uses the following settings for the CAN bus:

- CAN bitrate: 500 kbps
- CAN message ID: 0x123
- DLC: 8
- Cycle time: 0 ms

The example messages are compatible with firmware C100 v1.0.

B.1 Wheel tick configurations

B.1.1 Two rear-wheel ticks and direction

This configuration uses wheel ticks from two rear wheels and a separate direction signal. The configuration entries are described in the tables below.

Startbit	Length	Byte order	Value type	Factor	Offset	Min	Max	Unit	Source
40	16	big-endian	unsigned	1	0	0	65535	tick	RR
56	16	big-endian	unsigned	1	0	0	65535	tick	RL
8	2	big-endian	unsigned	1	0	0	3	direction	direction

byte/bit	7	6	5	4	3	2	1	0
0								
1							msb	lsb
2								
3								
4	msb							
5								lsb
6	msb							
7								lsb

The following CONFIG SET messages are generated for this configuration:

- **RR**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x28 0x10 0x00 0x00 0x00 0x00 0xff 0xff 0xe8 0x03 0x34 0x01 0xa9 0xa8
- **RL**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x38 0x10 0x00 0x00 0x00 0x00 0xff 0xff 0xe8 0x03 0x24 0x01 0xa9 0x48
- **dir**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x08 0x02 0x00 0x00 0x00 0x00 0x03 0x00 0xe8 0x03 0x5f 0x01 0xab 0x01

B.1.2 Single tick and direction

This configuration uses single-tick data and a separate direction signal. The configuration entries are described in the tables below.

Startbit	Length	Byte order	Value type	Factor	Offset	Min	Max	Unit	Source
32	16	big-endian	unsigned	1	0	0	65535	tick	combined
8	2	big-endian	unsigned	1	0	0	3	direction	direction

byte/bit	7	6	5	4	3	2	1	0
0								
1							msb	lsb
2								
3	msb							
4								lsb
5								
6								
7								

The following CONFIG SET messages are generated for this configuration:

- **tick**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x20 0x10 0x00 0x00 0x00 0x00 0xff 0xff 0xe8 0x03 0x44 0x01 0xb1 0x68
- **dir**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x08 0x02 0x00 0x00 0x00 0x00 0x03 0x00 0xe8 0x03 0x5f 0x01 0xab 0x01

B.2 Speed configurations

B.2.1 Two rear wheels and direction

This configuration uses speed from two rear wheels and a separate direction signal. The configuration entries are described in the tables below.

Startbit	Length	Byte order	Value type	Factor	Offset	Min	Max	Unit	Source
52	12	big-endian	unsigned	0.1	0	0	409.6	km/h	RR
56	12	big-endian	unsigned	0.1	0	0	409.6	km/h	RL
8	2	big-endian	unsigned	1	0	0	3	direction	direction

byte/bit	7	6	5	4	3	2	1	0
0								
1							msb	lsb
2								
3								
4								
5	msb							
6				lsb	msb			
7								lsb

The following CONFIG SET messages are generated for this configuration:

- **RR**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x34 0x0c 0x00 0x00 0x00 0x00 0x00 0x10 0x64 0x00 0x39 0x01 0x41 0x58
- **RL**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x38 0x0c 0x00 0x00 0x00 0x00 0x00 0x10 0x64 0x00 0x29 0x01 0x35 0x68
- **dir**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x08 0x02 0x00 0x00 0x00 0x00 0x03 0x00 0xe8 0x03 0x5f 0x01 0xab 0x01

B.2.2 Single speed

This configuration uses a single-speed signal and a separate direction signal. The configuration entries are described in the tables below.

Startbit	Length	Byte order	Value type	Factor	Offset	Min	Max	Unit	Source
24	8	little-endian	unsigned	1	0	0	255	mph	combined
8	2	little-endian	unsigned	1	0	0	3	direction	direction

byte/bit	7	6	5	4	3	2	1	0
0								
1							msb	lsb
2								
3	msb							lsb
4								
5								
6								
7								

The following CONFIG SET messages are generated for this configuration:

- **speed**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x18 0x08 0x00 0x00 0x00 0x00 0xff 0x00 0xe8 0x03 0x4a 0x00 0xa7 0xc0
- **dir**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x08 0x02 0x00 0x00 0x00 0x00 0x03 0x00 0xe8 0x03 0x5f 0x00 0xaa 0x00

B.2.3 Signed speed

This configuration uses a signed speed signal from both rear wheels. The configuration entries are described in the tables below.

Startbit	Length	Byte order	Value type	Factor	Offset	Min	Max	Unit	Source
36	16	big-endian	signed	0.01	0	-327.68	327.67	km/h	RR
52	16	big-endian	signed	0.01	0	-327.68	327.67	km/h	RL

byte/bit	7	6	5	4	3	2	1	0
0								
1								
2					msb			
3								
4				lsb	msb			
5								
6				lsb				
7								

The following CONFIG SET messages are generated for this configuration:

- **RR**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x24 0x10 0x00 0x00 0x00 0x80 0xff 0x7f 0x0a 0x00 0x39 0x03 0xcb 0x03
- **RL**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x34 0x10 0x00 0x00 0x00 0x80 0xff 0x7f 0x0a 0x00 0x29 0x03 0xcb 0xa3

B.2.4 Offset speed

This configuration uses an offset speed signal from both rear wheels. The configuration entries are described in the tables below.

Startbit	Length	Byte order	Value type	Factor	Offset	Min	Max	Unit	Source
16	16	little-endian	unsigned	0.01	50	-50	605.35	mph	RR
32	16	little-endian	unsigned	0.01	50	-50	605.35	mph	RL

byte/bit	7	6	5	4	3	2	1	0
0								
1								
2								lsb
3	msb							
4								lsb
5	msb							
6								
7								

The following CONFIG SET messages are generated for this configuration:

- **RR**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x10 0x10 0x88 0x13 0x78 0xec 0x77 0xec 0x0a 0x00 0x3a 0x00 0x19 0xb2
- **RL**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x20 0x10 0x88 0x13 0x78 0xec 0x77 0xec 0x0a 0x00 0x2a 0x00 0x19 0x52

C Step-by-step example

This step-by-step guide will use the example from section B.1.1.

Assumptions:

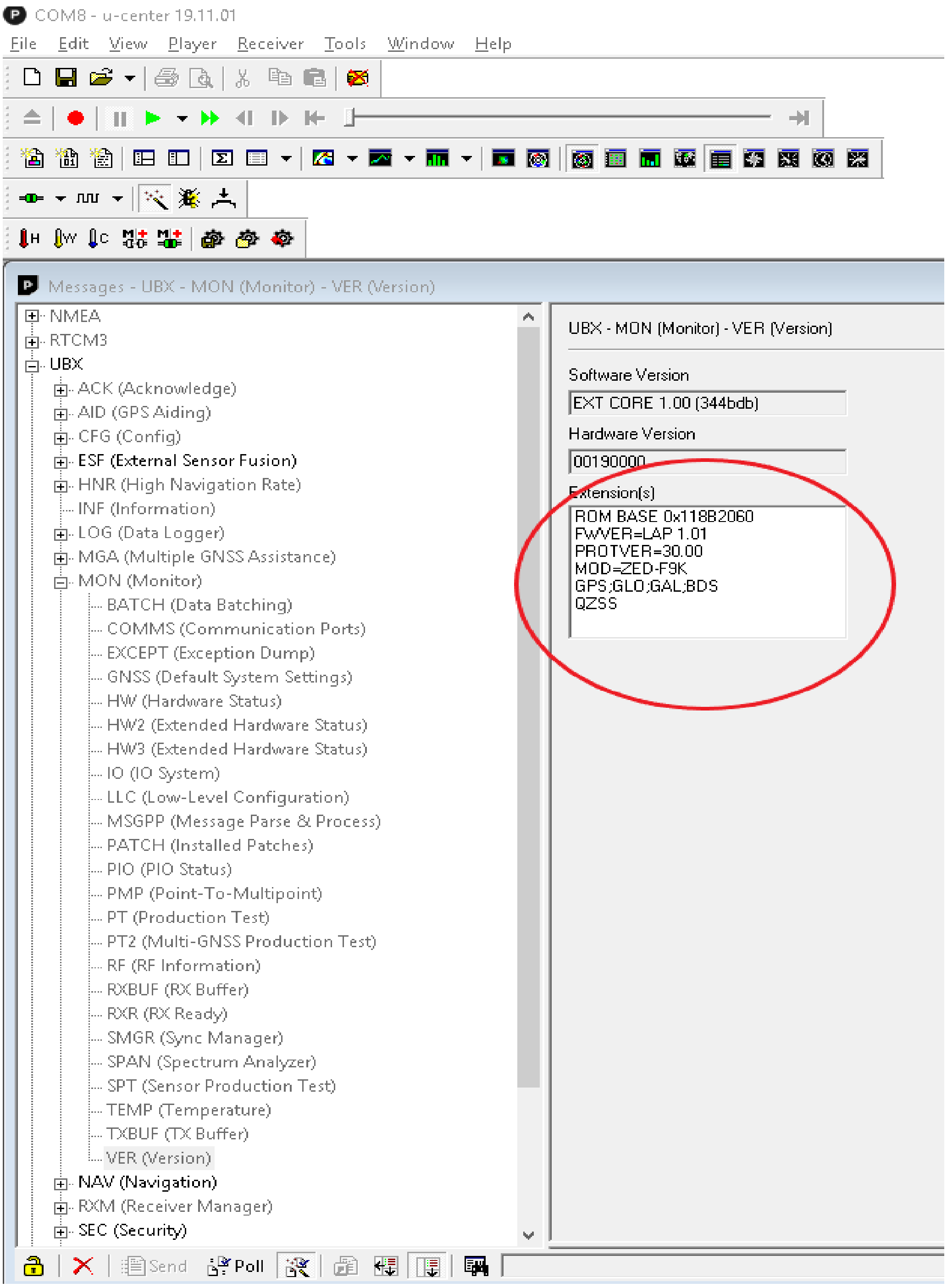
- User is familiar with u-center.
- USB will be used for powering the device and for the u-center interface.
- Odometer sensor measurements will be provided from the vehicle CAN bus via CAN_H and CAN_L pins on the front connector.
- UART RS-232 connector will be used for the configurable CAN.
- RealTerm is used as the PC terminal application for the configurable CAN.
- u-center NTRIP client is used for supplying RTK corrections.

Connecting the device:

1. Connect a cable between MCU_UART_SEL and ground. This will select the MCU UART.
2. Connect UART cable to PC.
3. Connect USB cable to PC. Check that the blue light on the front panel is active.

Checking u-center:

4. Open u-center.
5. Connect to the ZED-F9R:
   - **Receiver > Connection > COMxx**
6. Verify that the connection is established. Poll UBX-MON-VER, and check that the FWVER is correct as shown in the figure below.



7. Update ZED-F9R if necessary (**Tools** > **Firmware Update**).

Configuring ZED-F9R

ZED-F9R configuration can be set with UBX-CFG-VALSET message and the appropriate configuration keys.

8. Disable output messages on I2C (MCU is connected to I2C):
   - CFG-I2COUTPROT-UBX = false
   - CFG-I2COUTPROT-NMEA = false
9. Enable automatic alignment:
   - CFG-SFIMU-AUTO_MNTALG_ENA = true

10. (Optional) Enable priority navigation mode (10 Hz):
    - CFG-RATE-NAV_PRIO = 10
    - CFG-UART1-BAUDRATE = 115200

- You need to increase UART1 baud rate if you are using the priority navigation mode.

Enabling logging/debug messages

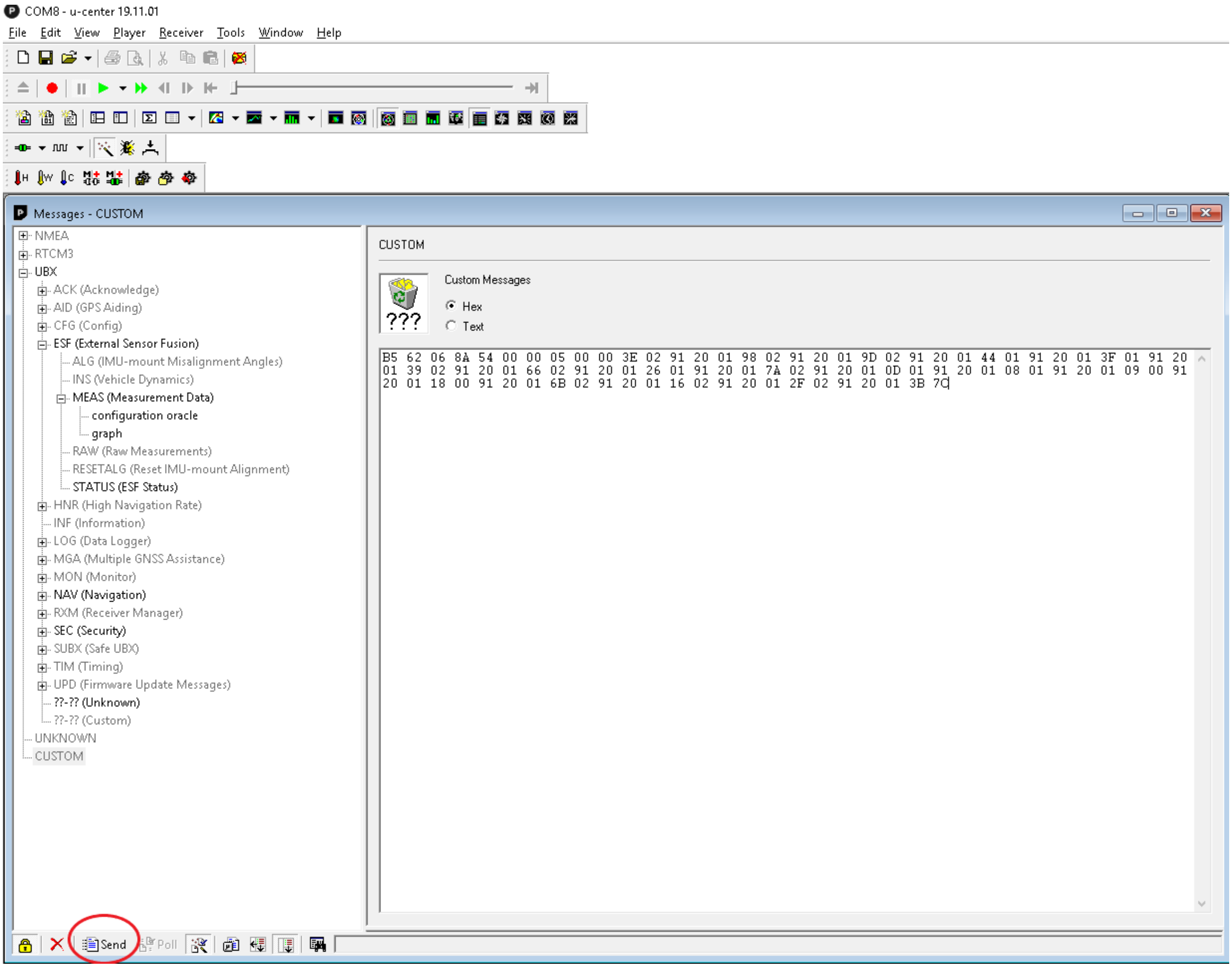
Messages can be enabled with UBX-CFG-VALSET with CFG-MSGOUT-xx configuration keys.

The following hex string contains the recommended minimum set of debug messages required by u-blox for any issues which may need investigation.

B5 62 06 8A 54 00 00 05 00 00 3E 02 91 20 01 98 02 91 20 01 9D 02 91 20 01 44 01 91 20 01 3F 01 91 20 01 39 02 91 20 01 66 02 91 20 01 26 01 91 20 01 7A 02 91 20 01 0D 01 91 20 01 08 01 91 20 01 09 00 91 20 01 18 00 91 20 01 6B 02 91 20 01 16 02 91 20 01 2F 02 91 20 01 3B 7C

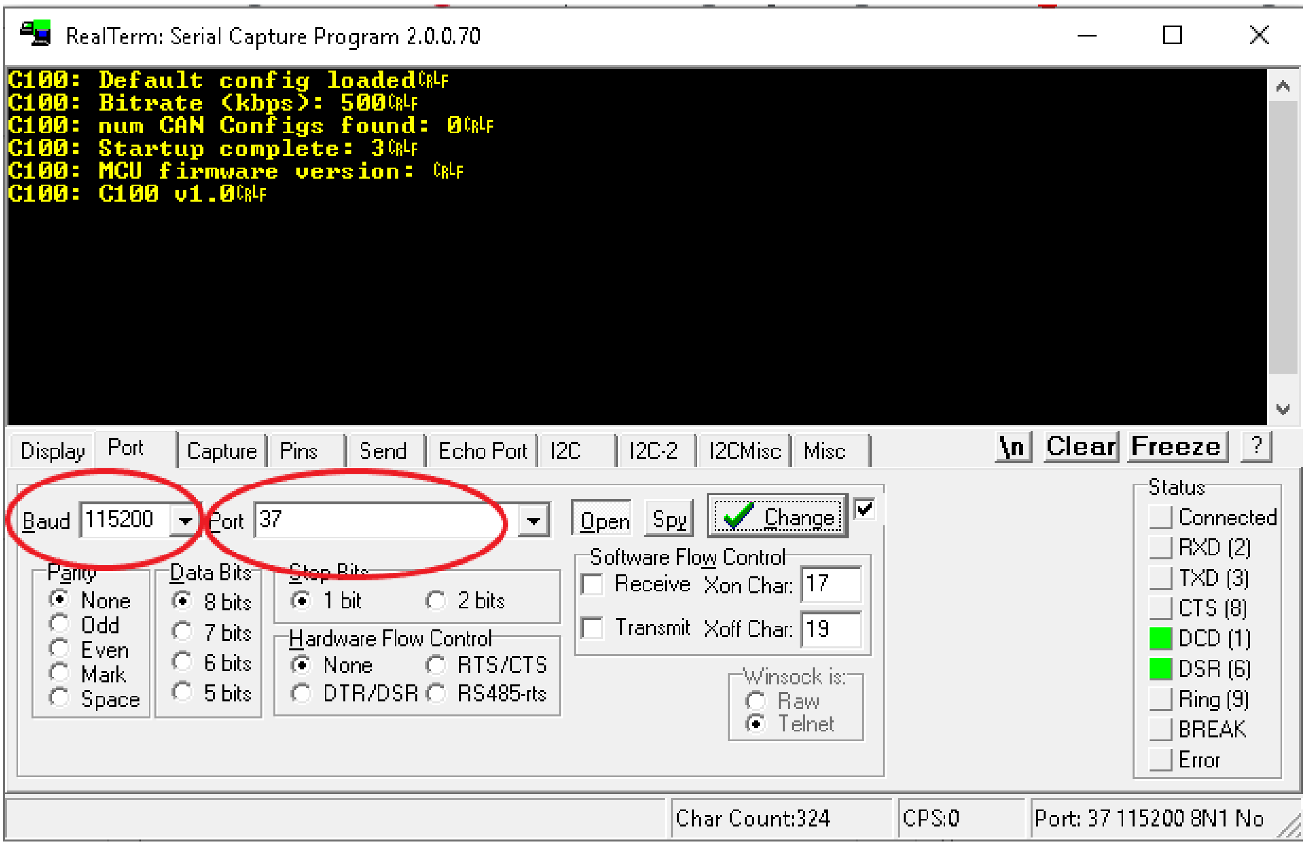
☞ The debug messages are supplied here as a hex string because it contains some proprietary messages.

11. Copy and paste the hex string into the **Custom Messages** field in u-center Messages view, and select the **Send** button (circled in the figure below).



Configuring the CAN interface in RealTerm

1. Open RealTerm.
2. Select the **Port** tab.
3. Select the PC port corresponding to the MCU UART.
4. Set baud rate to 115200.
5. Restart the C100.
6. MCU startup dialog should appear in the terminal.



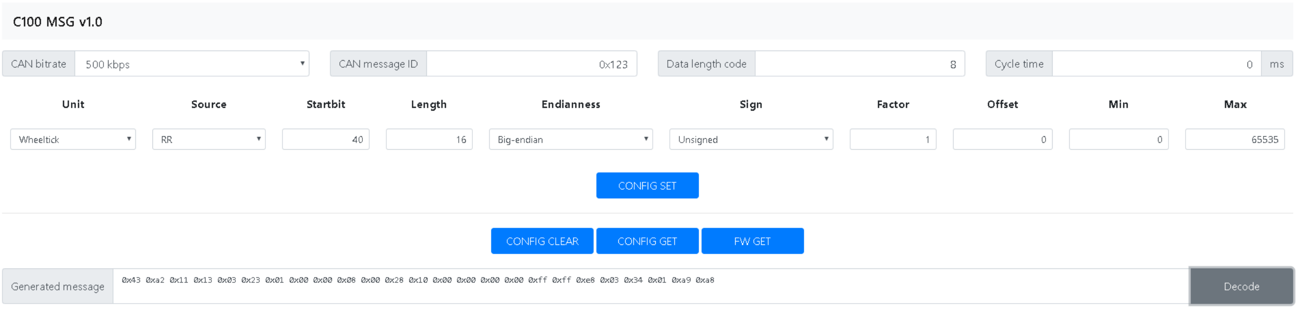
Generating the CONFIG SET strings with the MSG tool

From B.1.1:

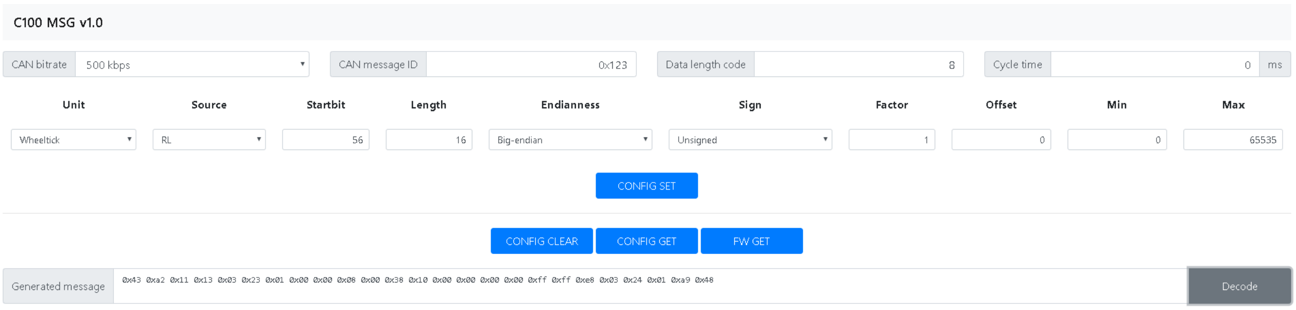
Startbit	Length	Byte order	Value type	Factor	Offset	Min	Max	Unit	Source
40	16	big-endian	unsigned	1	0	0	65535	tick	RR
56	16	big-endian	unsigned	1	0	0	65535	tick	RL
8	2	big-endian	unsigned	1	0	0	3	direction	direction

7. Use the MSG tool to generate the CONFIG SET messages.

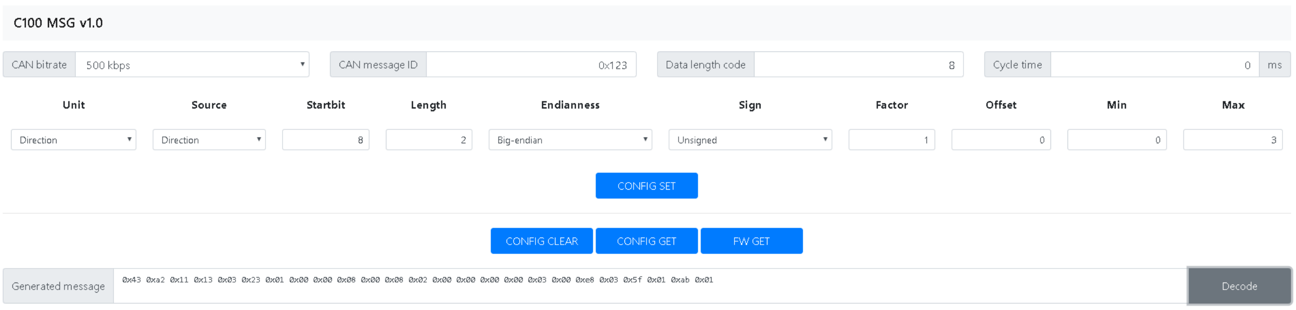
Rear-right wheel tick:



Rear-left wheel tick:



Direction:



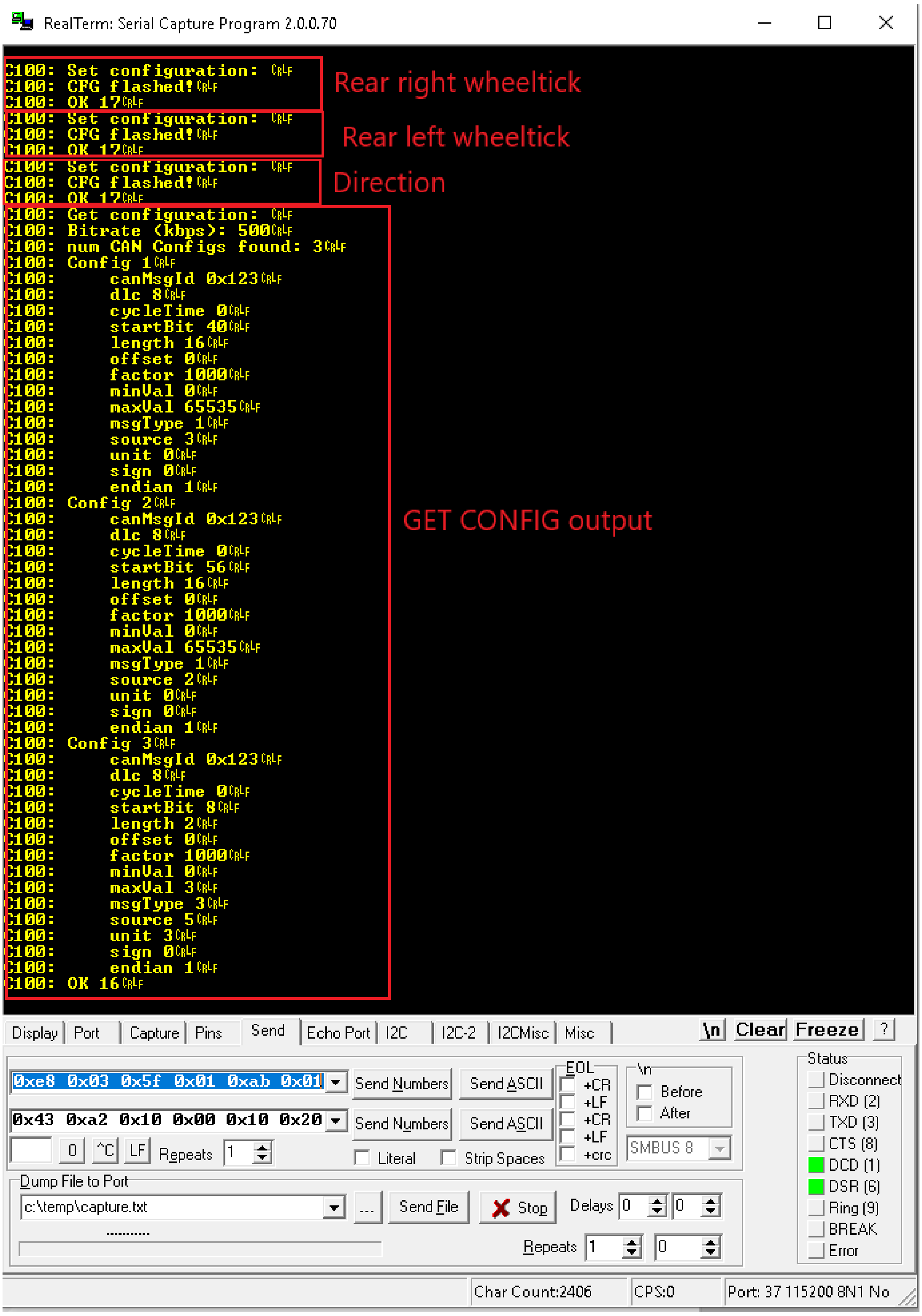
The following CONFIG SET messages are generated for this configuration:

- **RR**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x28 0x10 0x00 0x00 0x00 0x00 0xff 0xff 0xe8 0x03 0x34 0x01 0xa9 0xa8
- **RL**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x38 0x10 0x00 0x00 0x00 0x00 0xff 0xff 0xe8 0x03 0x24 0x01 0xa9 0x48
- **dir**: 0x43 0xa2 0x11 0x13 0x03 0x23 0x01 0x00 0x00 0x08 0x00 0x08 0x02 0x00 0x00 0x00 0x00 0x03 0x00 0xe8 0x03 0x5f 0x01 0xab 0x01

Sending CONFIG SET strings to MCU:

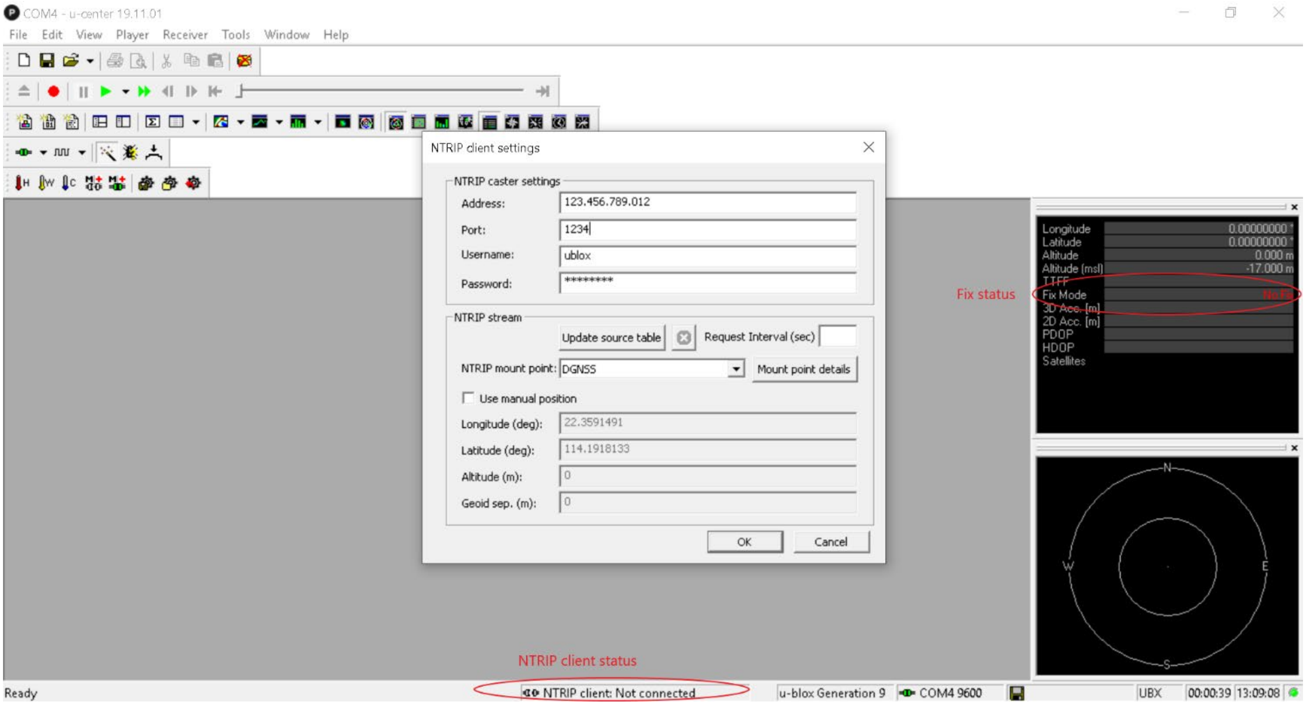
8. Open RealTerm.
9. Select the **Send** tab.
10. Copy and paste the rear-right wheel tick CONFIG SET string to the RealTerm text box.
11. Select the **Send Numbers** button.

Verify configurations with CONFIG GET string, 0x43 0xa2 0x10 0x00 0x10 0x20.



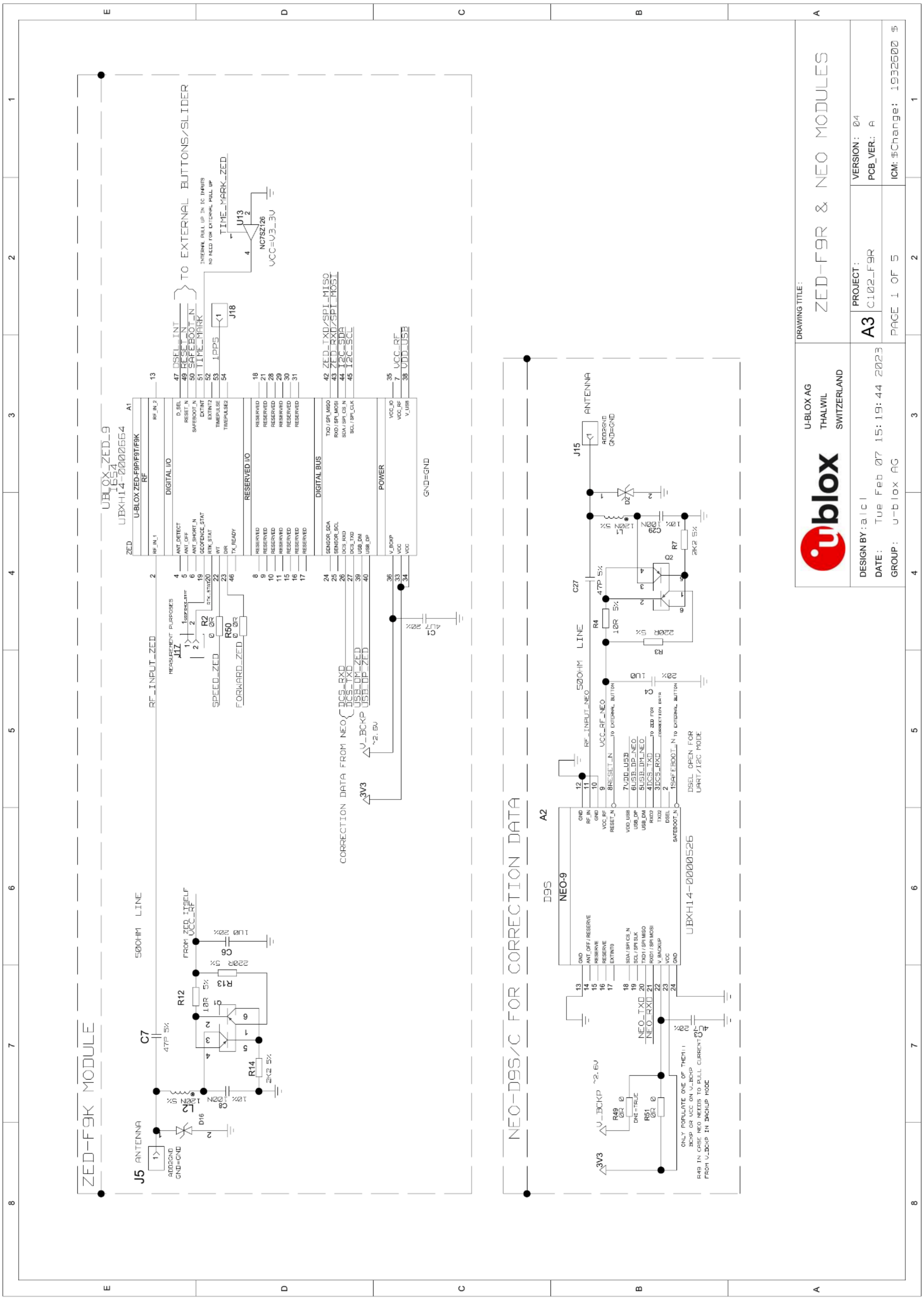
Configuring u-center NTRIP client

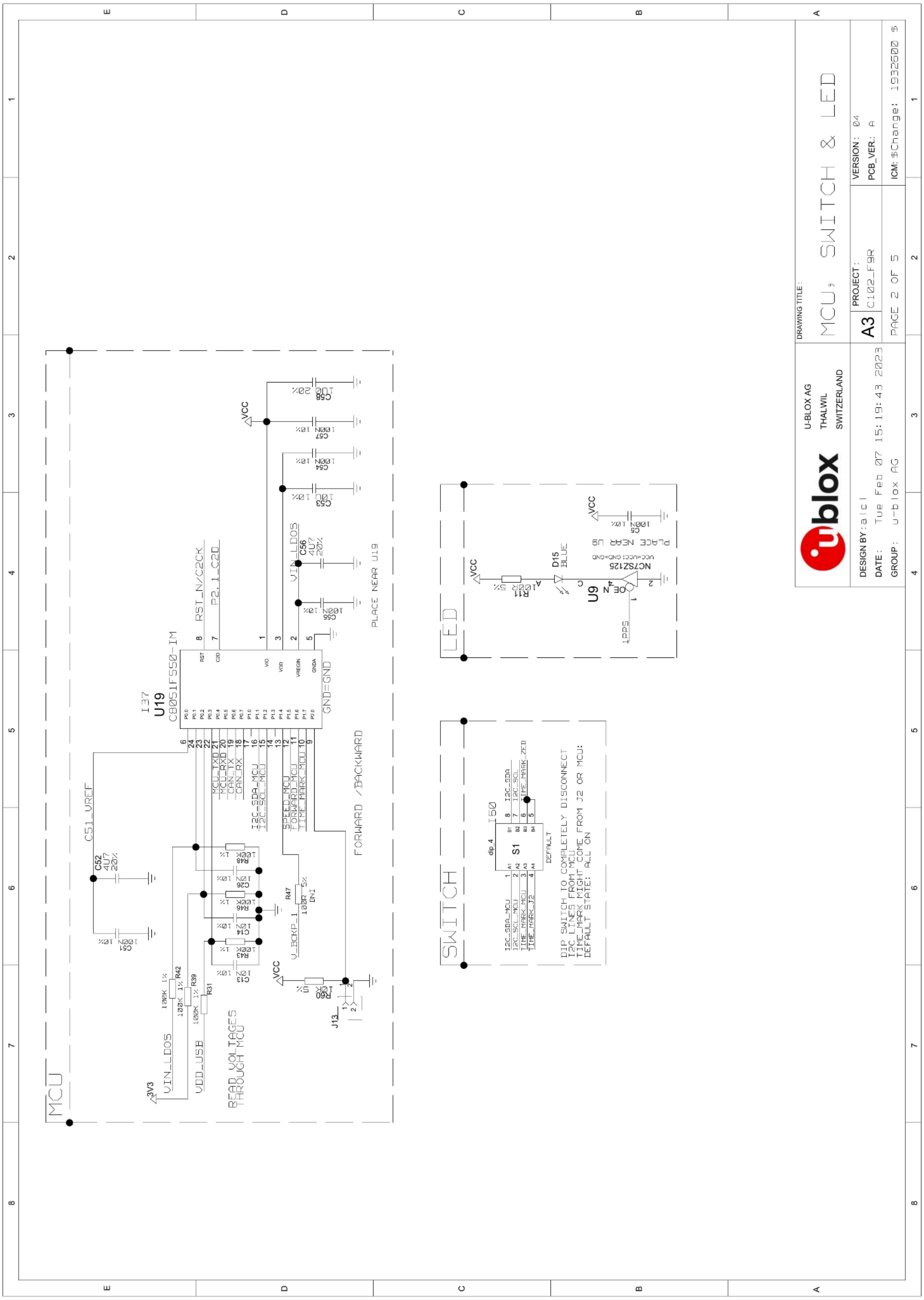
12. Connect receiver to u-center.
13. Open NTRIP client: **Receiver** > **NTRIP client**.
14. Input correction service provider credentials.
15. Select **OK**.
16. NTRIP client status can be monitored in the lower part of the u-center frame, see the circle in the figure below.
17. Fix status can be monitored with the docking windows > data view.

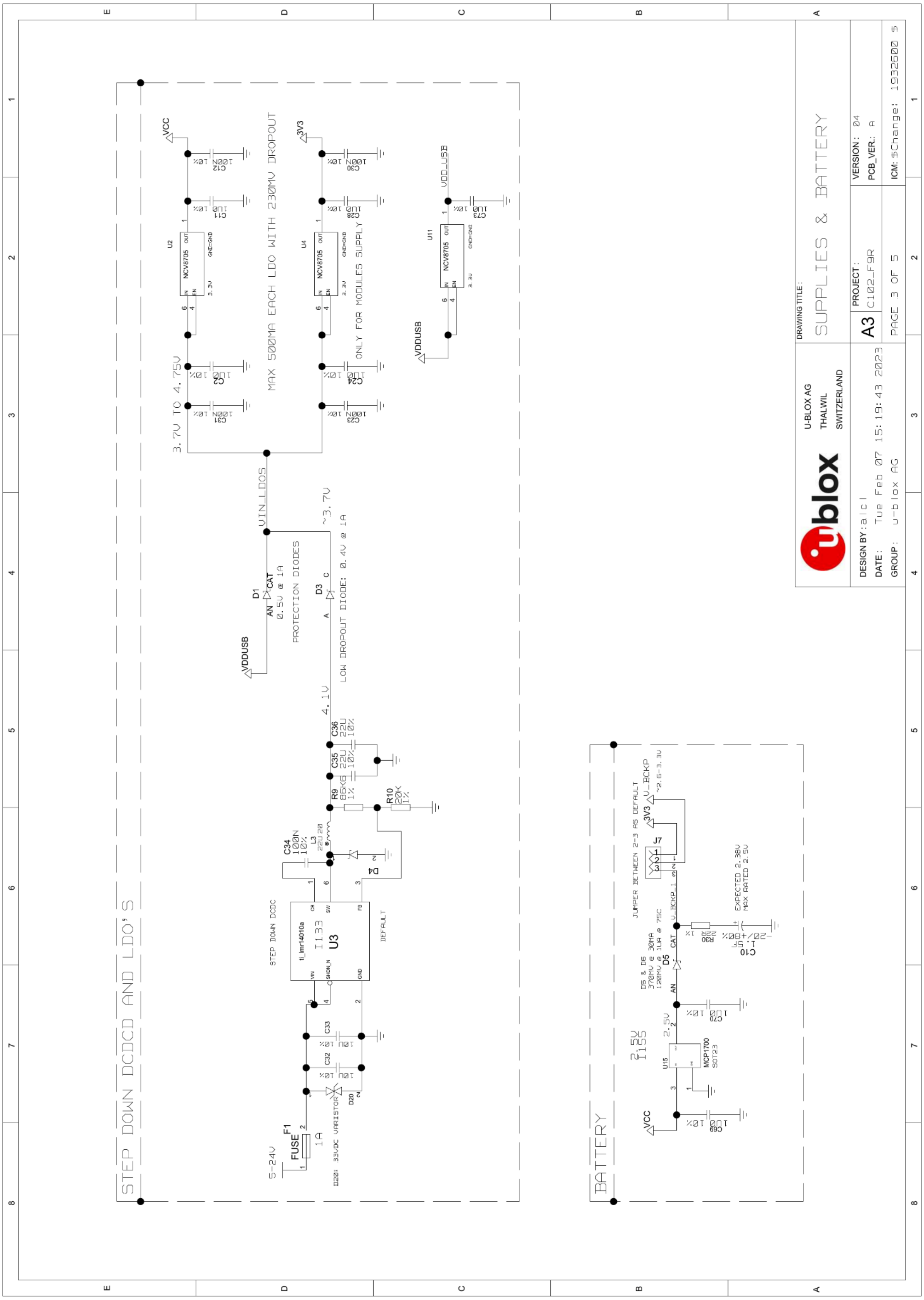


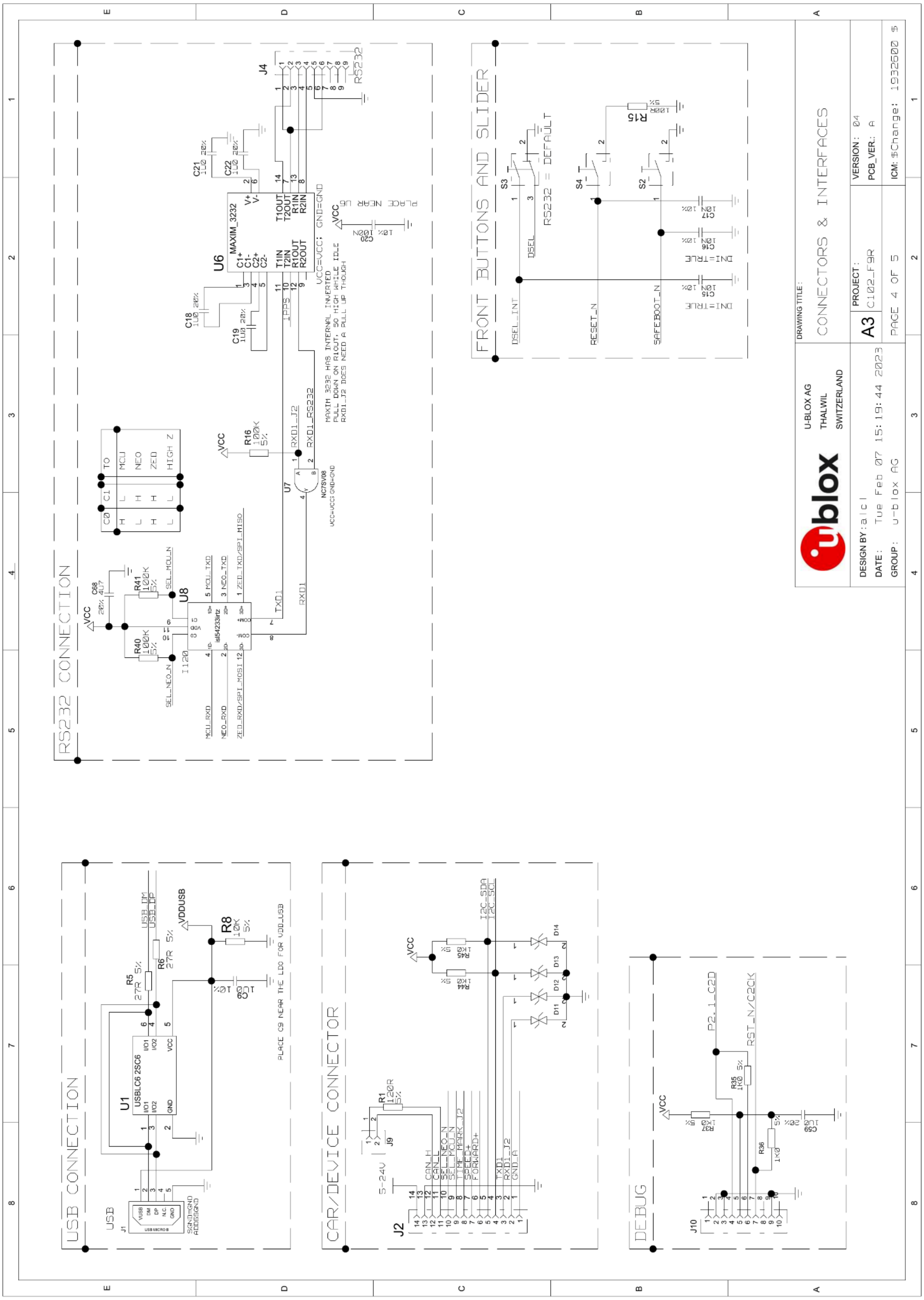
D Schematic

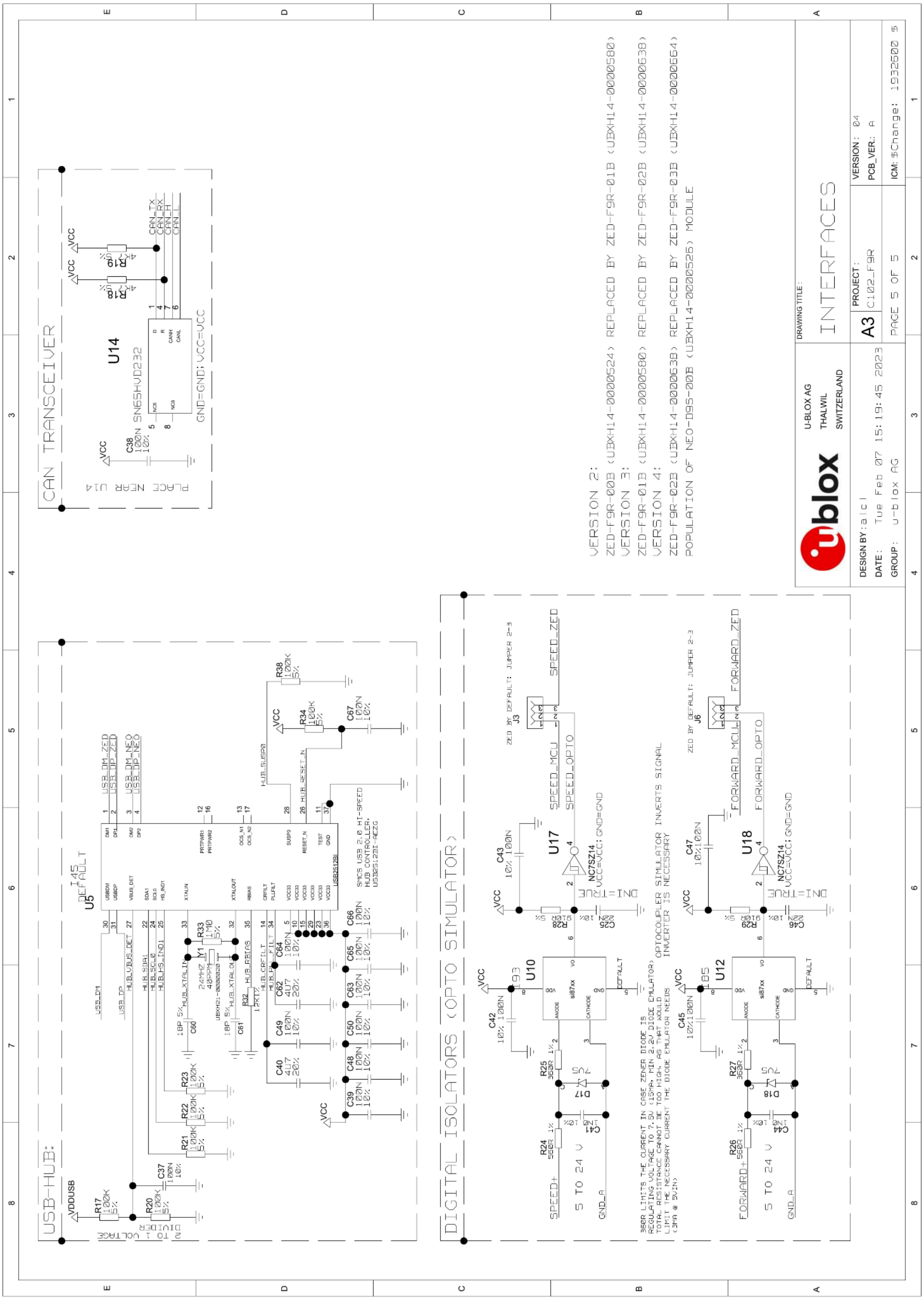
The following pages include the complete schematic for the C102-F9R board. Note that the GNSS module in the schematic is F9K, but otherwise the schematic is accurate.


ZED-F9K MODULE
NEO-D9S/C FOR CORRECTION DATA
U-BLOX AG
THALWIL
SWITZERLAND
ZED-F9R & NEO MODULES
A3
C102_F9R


MCU
LED
SWITCH
U-BLOX AG
THALWIL
SWITZERLAND
DRAWING TITLE :
MCU, SWITCH & LED
A3
PROJECT :
C102_F9R
VERSION : 04
PCB_VER.: A
DESIGN BY : alcl
DATE : Tue Feb 07 15:19:43 2023
GROUP : u-blox AG
PAGE 2 OF 5
ICM: $Change: 1932500 $


SUPPLIES & BATTERY
U-BLOX AG
THALWIL
SWITZERLAND
DRAWING TITLE:
PROJECT: C102_F9R
VERSION: 04
PCB_VER.: A
A3
PAGE 3 OF 5
DESIGN BY: alcl
DATE: Tue Feb 07 15:19:43 2023
GROUP: u-blox AG
STEP DOWN DCDCD AND LDO'S
BATTERY
MAX 500MA EACH LDO WITH 230MV DROPOUT
3.7V TO 4.75V
ONLY FOR MODULES SUPPLY
PROTECTION DIODES
LOW DROPOUT DIODE: 0.4V @ 1A
VIN_LDOS
VDDUSB
VDD_USB
VCC
3V3
5-24V
FUSE
STEP DOWN DCDC
JUMPER BETWEEN 2-3 AS DEFAULT
V_BCKP
EXPECTED 2.38V
MAX RATED 2.5V


RS232 CONNECTION
FRONT BUTTONS AND SLIDER
USB CONNECTION
CAR/DEVICE CONNECTOR
DEBUG
CONNECTORS & INTERFACES
U-BLOX AG
THALWIL
SWITZERLAND
PROJECT: C102_F9R
PAGE 4 OF 5
GROUP: u-blox AG
DATE: Tue Feb 07 15:19:44 2023
A3
VERSION: 04


CAN TRANSCEIVER
U14
SN65HVD232
GND=GND; VCC=VCC
PLACE NEAR U14
USB-HUB:
DIGITAL ISOLATORS (OPTO SIMULATOR)
VERSION 2:
ZED-F9R-00B (UBXH14-0000524) REPLACED BY ZED-F9R-01B (UBXH14-0000580)
VERSION 3:
ZED-F9R-01B (UBXH14-0000580) REPLACED BY ZED-F9R-02B (UBXH14-0000638)
VERSION 4:
ZED-F9R-02B (UBXH14-0000638) REPLACED BY ZED-F9R-03B (UBXH14-0000664)
POPULATION OF NEO-D9S-00B (UBXH14-0000526) MODULE
U-BLOX AG
THALWIL
SWITZERLAND
DRAWING TITLE:
INTERFACES
A3
PROJECT:
C102_F9R
PAGE 5 OF 5

Related documents

[1] ZED-F9R Integration manual, UBX-20039643
[2] u-blox F9 HPS 1.30 Interface description, UBX-22010984
[3] u-center user guide, UBX-13005250
[4] RealTerm Serial Terminal, https://realterm.sourceforge.io/
[5] Silicon Labs 8-bit Microcontroller Software, https://www.silabs.com/products/development-tools/software/8-bit-8051-microcontroller-software
[6] Silicon Labs 8-bit USB Debug Adapter, https://www.silabs.com/development-tools/mcu/8-bit/8-bit-usb-debug-adapter
[7] C101-D9S User guide, UBX-20031865

☞ For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Name	Status / Comments
R01	21-Jul-2020	jilm	Initial release
R02	02-Oct-2020	jilm	Corrected HPS FW number. Added chapter 4.5 for updating the MCU FW. Added mention about advanced DR config. application note in 3.2.1.
R03	29-Oct-2020	jilm	Updated related documents
R04	13-Jun-2023	jilm	Updated schematic for new hardware. Added NEO-D9S-related information.

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