u-blox NEO-M9L migration guide

Migrating from u-blox NEO-M8L to NEO-M9L automotive grade module

Application note

Abstract

This document provides an overview of the most important software and hardware changes from the u-blox NEO-M8L module to the u-blox NEO-M9L automotive grade module.

Document information

Title	**u-blox NEO-M9L migration guide**	
Subtitle	Migrating from u-blox NEO-M8L to NEO-M9L automotive grade module	
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This document applies to the following products:

Product name	Type number	Firmware version
NEO-M9L	NEO-M9L-20A-00	ADR 5.10
NEO-M8L	NEO-M8L-04A-00	ADR 4.21

This document also applies to the following professional grade products (being used for first-mount Automotive applications):

Product name	Type number	Firmware version
NEO-M8L	NEO-M8L-06B-00	ADR 4.50
NEO-M8L	NEO-M8L-05B-00	ADR 4.31
NEO-M8L	NEO-M8L-04B-00	ADR 4.21
NEO-M8L	NEO-M8L-0-12	ADR 4.11

Contents

1 Overview

This document provides an overview of the software and hardware changes introduced in the u-blox M9 module product NEO-M9L, to support migration from the existing module design based on the u-blox M8 Automotive Dead Reckoning (ADR) module including 3D inertial sensors.

The NEO-M9L-20A automotive grade GNSS receiver features the u-blox M9 standard precision GNSS platform with 3D automotive dead reckoning (ADR), and provides exceptional sensitivity and acquisition times for all L1 GNSS systems. u-blox M9 receivers are available in different variants to serve automotive applications, such as navigation and telematics.

The u-blox M9 standard precision GNSS platform with ADR, which delivers meter-level accuracy, succeeds the well-known u-blox M8 product range.

u-blox M9 receivers support concurrent reception of four GNSS. The high number of visible satellites allows the receiver to select the best signals. This maximizes the position accuracy under challenging conditions such as deep urban canyons.

NEO-M9L is available in automotive grade.

1.1 Documentation

- Datasheet [1] focuses on essential parameters and performance figures of NEO-M9L.
- Firmware release note [2] gives information on the firmware features and configuration and message interfaces.
- Integration manual [3] provides detailed information on receiver configuration and hardware integration.
- Interface description [4] covers the supported protocols (UBX, NMEA) with a detailed description of the messages.
- Datasheet [5] focuses on essential parameters and performance figures of NEO-M8L automotive grade.
- Datasheet [6] focuses on essential parameters and performance figures of NEO-M8L professional grade.

2 Software changes

This section summarizes the main software changes in NEO-M9L compared to u-blox NEO-M8L.

The new features include wake on motion, advanced calibration handling, secondary navigation output (GNSS-only). In addition, when the wheel sensor information is not available, the firmware switches automatically to UDR fallback mode and supports continuous dead reckoning operation without interruptions. Improvements on the ADR performance in corner case scenarios are included in this release.

u-blox M9 receivers detect jamming and spoofing events and report them to the host, which allows the system to react to such events. Advanced filtering algorithms mitigate the impact of RF interference and jamming, thus enabling the product to operate as intended.

In addition to sensor-fused position solution, a second output delivers an independent GNSS-only positioning solution.

The receiver also provides a higher navigation rate and improved security features compared to previous u-blox GNSS generations.

This release adds support for NMEA message output from the secondary filter and introduces the ability to use wheel tick (WT) data without the directional input to reach a sensor fusion fix.

A new message, UBX-ESF-CAL, has been implemented along with support to output calibrated raw sensor measurements at 100 Hz. Another new message, UBX-NAV-PVAT, has been implemented to improve debugging and to unify the navigation solution output.

For detailed information on the software, refer to the u-blox M9 ADR-5.10 Interface description [4], the u-blox M9 ADR-5.10 firmware Release note [2], and the Integration manual [3].

2.1 Summary of software changes

Feature	Change	Action needed
Configuration	New configuration interface using UBX-CFG-VALSET, UBX-CFG-VALGET and UBX-CFG-VALDEL messages. Use of old configurations is prohibited.	Code change
Firmware	NEO-M9L can execute firmware from the receiver RAM. An external firmware image can be downloaded from an SPI flash memory and executed from the RAM. External firmware is no longer executed from flash memory.	-
Boot screen	Product identifier in boot screen and polling UBX-MON-VER: EXT CORE 1.00 (501c661), FWVER= ADR 5.10, PROTVER=35.10.	Code change (optional)
Default baud rate	Default baud rate at UART 38400 baud.	Code change
Default GNSS	GPS L1 C/A, Galileo E1-B/C, BeiDou B1I, GLONASS L1OF, QZSS L1 C/A, and SBAS L1 C/A.	Code change (optional)
Navigation update rate	Navigation update rate up to 50 Hz in the priority navigation mode. This is called as HNR in M8.	Code change (optional)
QZSS L1S	Supported.	Code change
IMES	Not supported.	Code change (optional)
Assisted GNSS	AssistNow Online supported	-
AssistNow Offline and AssistNow Autonomous	Not supported.	Code change
NMEA	There are four NMEA standards supported. The default NMEA version is 4.11. Alternatively, versions 4.10, 4.0, 2.3, and 2.1 can be enabled.	Code change (optional)

UBX	This firmware supports the UBX Protocol Version 35.10.	Code change
RTCM2.3	Not supported	Code change
Configuration lock	New feature. Receiver configuration can be locked by command.	Code change (optional)
Advanced calibration handling	New feature. Calibration information can be stored with the host.	Code change
Wake on motion	New feature. Wakes up the receiver and the host while the receiver is in SW backup mode	Code change
Calibrated sensor output	A new message UBX-ESF-CAL has been implemented along with support to output calibrated raw sensor measurements at 100 Hz. Message output rate configurable with new CFG-MSGOUT-UBX_ESF_CAL_* configuration items.	Code change
RF spectrum view	New message. UBX-MON-SPAN shows in-band RF spectrum around the GNSS band. This can be used to identify potential in-band RF interference sources in the design.	Code change (optional)
Software	The u-center version 21.12 (or later) should be used together with this released product	-
Data logging on Flash	Position, velocity, and time data logging on the flash device is not supported in this release.	-
Data batching	Autonomous tracking up to 5 min.	Code change (optional)
Firmware update tool	u-blox recommends using firmware update tool software version 19.03 (or later) with the released product.	-

Table 1: Summary of software changes

2.2   Configuration concept

A new configuration concept is introduced. Many legacy UBX-CFG group messages have been deprecated and replaced by new configuration messages UBX-CFG-VALSET, UBX-CFG-VALGET, and UBX-CFG-VALDEL. Refer to the Interface description [4] for a description of this feature and the available settings. This allows direct access to individual configuration items (typically individual fields in the deprecated legacy UBX-CFG group messages). The configuration items can be applied independently on RAM, BBR, and flash memory layers.

3   Hardware changes

The pin layout and the function of the pins have changed. The following sections list the key differences between NEO-M9L and NEO-M8L modules. Refer to the product Data sheet [1] and Integration manual [3] for technical specifications and design support.

The wake-on-motion functionality that allows turning off the host and saving power until motion is detected by the IMU.

The NEO-M9L module is available in the NEO form factor, which is a 12.2 x 16.0 mm LCC package.

3.1   Summary of hardware changes

Feature	Change	Action needed
Module pin-out	New module pin-out, a 1:1 u-blox M8 module replacement may not be possible in old designs. New and changed pin specification.	PCB routing change
Power supplies	New V_BCKP supply voltage specification. The backup battery current rating changed.	Hardware change (optional) Check backup battery capacity
Wake on motion (WOM Pin)	NEO-M9L pin 17 (WOM) is available as the wake-on-motion output. By default, wake on motion is disabled.	Hardware change
Digital IO	New electrical specification for digital IO pins (incl. UART, I2C, SPI). External isolation required if hardware backup mode is used.	Hardware change
USB	Due to hardware implementation, it may not be possible to certify the USB interface.	-
UART	Neither handshaking signals nor hardware flow control signals are available. The UART interface protocol and baud rate can be configured but there is no support for setting different baud rates for reception and transmission.	Hardware change (optional)
RF input	New RF input specification. Change in receiver chain noise figure and external gain (at RF_IN) 30dB Max.	Hardware change (optional)

Table 2: Summary of hardware changes

3.2   Digital IO isolation

Driving digital pins is not allowed in the NEO-M9L module (all I/O including UART and other interfaces to float or connect to a high impedance) in HW backup mode (V_BCKP supplied when VCC is removed). This is to avoid cross-supplying the receiver via digital pins. External isolation may be required, e.g., on the communication lines to the host controller. An example of digital IO isolation is given in the Communication interfaces section of the Integration manual [3].

Related documentation

[1]   NEO-M9L-20A - Data sheet, UBX-21028129
[2]   u-blox M9 ADR 5.10 firmware Release note, UBX-21051121
[3]   NEO-M9L Integration manual, UBX-20048485
[4]   M9 ADR-5.10 Interface Description, UBX-20048972
[5]   NEO-M8L-04A_ADR421_DataSheet_(UBX-18059210)_CONFIDENTIAL
[6]   NEO-M8L-06B-ADR450_DataSheet, UBX-20058645

☞   For product change notifications and regular updates of u-blox documentation, register on our website, www.u-blox.com.

Revision history

Revision	Date	Name	Comments
R01	26-Apr-2022	kkir	Initial release

Contact

For complete contact information, visit us at www.u-blox.com.

u-blox Offices

North, Central and South America

u-blox America, Inc.

Phone: +1 703 483 3180
Email: info_us@u-blox.com

Regional Office West Coast:

Phone: +1 408 573 3640
Email: info_us@u-blox.com

Technical Support:

Phone: +1 703 483 3185
Email: support_us@u-blox.com

**Headquarters
Europe, Middle East, Africa**

u-blox AG

Phone: +41 44 722 74 44
Email: info@u-blox.com
Support: support@u-blox.com

Asia, Australia, Pacific

u-blox Singapore Pte. Ltd.

Phone: +65 6734 3811
Email: info_ap@u-blox.com
Support: support_ap@u-blox.com

Regional Office Australia:

Phone: +61 3 9566 7255
Email: info_anz@u-blox.com
Support: support_ap@u-blox.com

Regional Office China (Beijing):

Phone: +86 10 68 133 545
Email: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Chongqing):

Phone: +86 23 6815 1588
Email: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Shanghai):

Phone: +86 21 6090 4832
Email: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Shenzhen):

Phone: +86 755 8627 1083
Email: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office India:

Phone: +91 80 405 092 00
Email: info_in@u-blox.com
Support: support_in@u-blox.com

Regional Office Japan (Osaka):

Phone: +81 6 6941 3660
Email: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Japan (Tokyo):

Phone: +81 3 5775 3850
Email: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Korea:

Phone: +82 2 542 0861
Email: info_kr@u-blox.com
Support: support_kr@u-blox.com

Regional Office Taiwan:

Phone: +886 2 2657 1090
Email: info_tw@u-blox.com
Support: support_tw@u-blox.com