Release notes

Topic **u-blox M9 ADR 5.10 firmware for ADR products**

UBX-21051121

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Contents

1 General information

1.1 Scope

This release notes describes the firmware image 1.00 ADR 5.10, designed to run on the following hardware products:

- Modules: NEO-M9L-01A, NEO-M9L-20A
- Chipset: UBX_ M9140-KA-DR

This release can be used with prototypes and ES samples of the above-described products.

1.2 Software releases

1.2.1 External firmware image

Released firmware image for u-blox M9 products	
File	UBX_M9_100_ADR510.e09ddfaf83c72f72f734b45e80f58330.bin
Firmware version	EXT CORE 1.00 (501c661), FWVER=ADR 5.10
Protocol version	PROTVER=35.10
ROM base support	ROM 1.02 - ROM BASE 0x118B2060

1.2.2 u-center

The u-center version 21.12 (or later) should be used together with this released product.

1.2.3 Firmware update tool

u-blox recommends using firmware update tool software version 19.03 (or later) with the released product.

1.3 USB Identification

USB identification of u-blox M9 products	
Vendor ID	0x1546
Vendor string	u-blox AG - www.u-blox.com
Product ID	0x01A9
Driver string	u-blox GNSS receiver

1.4 Related documentation

[1] u-blox M9-ADR-5.10 Interface description – Public, doc. no. UBX- 20048972
[2] u-blox NEO-M9L Integration manual - Public, doc. no. UBX- 20048485
[3] Firmware Update Tool v19.03 Public release notes, doc. no. UBX-19008902

2 New Features

2.1 Secondary output

In addition to sensor fused position solution, a second output delivers an independent GNSS-only based positioning solution. Secondary output is disabled by default. It can be enabled using the configuration item CFG-NAV2-OUT_ENABLED. When enabled, the primary filter is configured for sensor fusion, and the secondary filter as GNSS-only.

2.2 Wake on Motion

Wake on Motion feature allows a customer to wake up the module using the integrated IMU following a motion event, it can also be used to wake up the host via an interrupt through an external pin. Please refer to the integration manual for more information regarding this feature.

2.3 Advanced Calibration Handling

Advanced calibration handling feature allows a customer to regularly save and later apply sensor fusion initialization and calibration parameters in order to quickly achieve a sensor fusion fix following a device restart/reset. UBX-MGA-SF message group has been implemented to enable polling and pushing of this data from the receiver. Please refer to the integration manual for more information regarding how to use the feature.

2.4 Calibrated sensor output

A new message UBX-ESF-CAL has been implemented along with support to output calibrated raw sensor measurements at 100 Hz, this has been done to fulfil the requirements of Android Auto. The implementation outputs calibrated measurements in IMU frame and does not check for invalid calibration. A rotation into the vehicle frame would be necessary to put this feature into use for Android Auto use case.

2.5 E-scooter dynamic model

A new kick e-scooter dynamic model has been introduced in this release. This can be configured by setting CFG-NAVSPG-DYNMODEL to 12.

2.6 ADR without directional input

This release introduces the ability to use wheel tick data without the directional input to reach a sensor fusion fix. The use of the WT directional input can be configured with CFG-SFODO-DIS_DIR_INFO configuration item. It is expected that the sensor fusion perfomance without directional input is better than UDR where no WT data is supplied. It will be however worse than ADR where WT and directional information are available.

2.7 Better navigation output debugging with UBX-NAV-PVAT

A new message UBX-NAV-PVAT has been implemented to improve debugging and unify navigation solution output. The new message which has a similar structure to UBX-NAV-PVT includes information about attitude solution.

2.8 NMEA support for secondary filter output

This release adds support for NMEA messages output from the secondary filter. Tags have been used to distinguish between the primary NMEA messages and the secondary messages coming from the second filter.

2.9 Improved UDR

When the wheel sensor information is not available via the software interface, the firmware switches automatically to UDR fallback mode and supports continuous dead reckoning operation without interruptions. Improvements on the UDR performance in corner case scenarios are included in this release.

3 Dropped or reduced features

3.1 Differential wheel tick & partial sensor (chip solution only)

For chip designs dead reckoning based on differential distance information (DWT) from each wheel is not supported any more. In addition, the firmware supports only 6-axis IMU sensors including 3-axis for gyroscope and 3-axis for accelerometer. Support for sensors with less than 6-axis is not given any more. Note: Both feature removals are only valid for chip designs but not for modules as modules include 6-axis sensors by default.

3.2 Data logging on Flash

Position, velocity and time data logging on the Flash device is not supported in this release.

3.3 AssistNow

AssistNow offline and autonomous and are not supported in this release, only AssistNow online is supported.

3.4 Legacy sensor drivers

The following sensor drivers have been removed:

- LSM6DS0
- LSM6DS3
- LSM6DSL

3.5 Low power configurations

The power save mode configurations are removed in this release, since the use case of these products is primarily the automotive market where the device is operated in full power mode.

4 Message interface

4.1 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.

4.2 UBX

This firmware supports the UBX Protocol Version 35.10.

4.3 New and modified messages

The following modifications have been made compared to firmware 1.00 ADR 5.10:

4.3.1 New messages

Message / Configuration item	Audience	Description / Comment
NMEA-NAV2-GGA NMEA-NAV2-GLL NMEA-NAV2-GNS NMEA-NAV2-GSA NMEA-NAV2-RMC NMEA-NAV2-VTG NMEA-NAV2-ZDA	PUB	Support for NMEA messages on the secondary output. Message output rate configurable with configuration items in the format of CFG-MSGOUT-NMEA_NAV2_ID_XXX_* where XXX denotes the NMEA message type e.g. GGA, ZDA etc
UBX-ESF-CAL	PUB	Support for a new message UBX-ESF-CAL which outputs RAW IMU sensor measurements that are calibrated at 100 Hz rate. Message output rate configurable with new CFG-MSGOUT-UBX_ESF_CAL_* configuration items
UBX-MGA-SF	PUB	Support for aiding messages for sensor fusion calibration and temperature compensation
UBX-MGA-INI-ATT	PUB	Support for a new message to supply attitude aiding (input only)
UBX-MON-SYS	PUB	Support for a new message UBX-MON-SYS which outputs system performance information. Message output rate configurable with new CFG-MSGOUT-UBX_MON_SYS_* configuration items
UBX-NAV-PVAT	PUB	Support for a new message UBX-NAV-PVAT which outputs position, velocity and time information along with heading and altitude information. Message output rate configurable with new CFG-MSGOUT-UBX_NAV_PVAT_* configuration items
UBX-NAV-SLAS	PUB	Support for a new message UBX-NAV-PVAT which outputs status information about SLAS corrections. Message output rate configurable with new CFG-MSGOUT-UBX_NAV_SLAS_* configuration items
UBX-NAV-TIMEQZSS UBX-NAV2-TIMEQZSS	PUB	Support for new messages which output information about QZSS time in primary and secondary output respectively. Message output rate configurable with CFG-MSGOUT-UBX_NAV_TIMEQZSS_* and CFG-MSGOUT-UBX_NAV2_TIMEQZSS_* configuration items respectively
UBX-SEC-SIG	PUB	Support for a new message to output state of signal security measures like jamming and spoofing detection. Message output rate is configuration with a new CFG-MSGOUT-UBX_SEC_SIG_* configuration items
UBX-SEC-SIGLOG	PUB	Support for new message to output a log of detected jamming/spoofing events. Message output rate is configuration with a new CFG-MSGOUT-UBX_SEC_SIGLOG_* configuration items
UBX-NAV2-CLOCK UBX-NAV2-COV UBX-NAV2-DOP UBX-NAV2-EELL UBX-NAV2-EOE	PUB	Support for new UBX messages to output navigation information for secondary output. Each message output rate is configurable with a new configuration item in the form of UBX-MSGOUT_UBX_NAV2_CLOCK_* for example

UBX-NAV2-ODO UBX-NAV2-POSECEF UBX-NAV2-POSLLH UBX-NAV2-PVT UBX-NAV2-SAT UBX-NAV2-SBAS UBX-NAV2-SIG UBX-NAV2-SBAS UBX-NAV2-SLAS UBX-NAV2-STATUS UBX-NAV2-TIMEBDS UBX-NAV2-TIMEGAL UBX-NAV2-TIMEGLO UBX-NAV2-TIMEGPS UBX-NAV2-TIMELS UBX-NAV2-TIMEUTC UBX-NAV2-VELECEF UBX-NAV2-VELNED		
CFG-NAV2-OUT_ENABLED	PUB	Configuration to enable secondary navigation output
CFG-NAV2-SBAS_USE_INTEGRITY	PUB	Configuration to enable use of SBAS integrity flag in secondary navigation output
CFG-SIGNAL-QZSS_L1S_ENA	PUB	Configuration to enable QZSS L1S signal
CFG-QZSS-SLAS_MAX_BASELINE CFG-QZSS-USE_SLAS_DGNSS CFG-QZSS - USE_SLAS_RAIM_UNCORR CFG-QZSS-USE_SLAS_TESTMODE	PUB	Configurations for SLAS corrections: 1. Set maximum baseline distance to the closest ground monitoring station 2. Use SLAS differential corrections 3. RAIM measurements that are not corrected by SLAS corrections 4. Enable Use of SLAS messages which are in test mode
CFG-HW-SENS_WOM_MODE	PUB	Configuration to set the WoM mode of operation
CFG-HW-SENS_WOM_THLD	PUB	Configuration to set the acceleration threshold which when reached would wake up the IMU sensor
CFG-SFODO-DIS_DIR_INFO	PUB	Configuration to disable the use of WT directional information
CFG-TP-DRSTR_TP1	PUB	Configuration to set TP1 drive strength (default 4mA)
CFG-TP-DRSTR_TP2	PUB	Configuration to set TP2 drive strength (default 4mA)
CFG-SFIMU-IMU_EN	PUB	Enable the use of internal IMUs/ IMUs connected on I2C pins
NMEA-Standard-RLM	PUB	Return link message
UBX-CFG-VALDEL	PUB	Part of the new configuration interface
UBX-CFG-VALGET	PUB	Part of the new configuration interface
UBX-CFG-VALSET	PUB	Part of the new configuration interface
UBX-LOG-RETRIEVEBATCH	PUB	Data batching request for retrieval
UBX-MON-BATCH	PUB	Data batching state monitoring
UBX-MON-HW3	PUB	Replaces and extends part of UBX-MON-HW and UBX-MON-HW2 functionality
UBX-MON-RF	PUB	Replaces and extends part of UBX-MON-HW and UBX-MON-HW2 functionality
UBX-MON-SPAN	PUB	Crude spectrum analyzer functionality

UBX-NAV-SAT	PUB	Replaces UBX-NAV-SVINFO, contains satellite information but no signal-specific information
UBX-NAV-SIG	PUB	Replaces UBX-NAV-SVINFO, contains signal-specific information
UBX-SEC-SESSID	PUB	Session ID for message authentication when locking configuration

4.3.2 Modified messages

Message / Configuration item	Audience	Description / Comment
CFG-NAVSPG-DYNMODEL	PUB	Added a new dynamic model: e-scooter model (12).
CFG-NMEA-PROTVER	PUB	New default value: NMEA protocol version 4.11 configured by default Previous default value: NMEA protocol version 4.10
CFG-BDS-USE_GEO_PRN	PUB	Configuration item name changed from CFG-BDS-USE_PRN_1_TO_5 to CFG-BDSUSE_ GEO_PRN. Configuration item key ID remains the same.
CFG-SBAS-PRNSCANMASK	PUB	SBAS search mask changed from 0x0000000000072bc8 to 0x0000000000072b88
CFG-SFIMU-ACCEL_ACCURACY	PUB	Default accelerometer accuracy changed from 0 to 1000
CFG-SFIMU-AUTO_MNTALG_ENA	PUB	Automount alignment is enabled by default, used to be disabled by default
CFG-SFIMU-GYRO_ACCURACY	PUB	Default gyroscope accuracy changed from 0 to 100
CFG-TP-TP2_ENA	PUB	Enable timepulse 2 by default
NMEA-Standard-GAQ	PUB	It is now possible to poll a standard message if the current Talker ID is GA.
NMEA-Standard-DTM	PUB	The message now supports the display of PZ90 datum (as P90).
NMEA-Standard-GST	PUB	Support the output of the error ellipse as defined by its semi-major and semi-minor axis as well as its orientation.
NMEA-Standard-GSV	PUB	Various implementation errors fixed, e.g. null fields, range of azimuth angle [0..359], etc.
NMEA-Standard-GRS	PUB	Various implementation errors fixed, e.g. null fields, residual ordering.
NMEA-Standard-VLW	PUB	The fields that were only introduced in NMEA version 4.00 have been removed from this message for version 2.30.
UBX-TIM-TP	PUB	Added “qErrInvalid” flag to indicate when quantization error is not provided

4.3.3 Deprecated UBX messages

Message	Audience	Description / Comment
UBX-CFG-ANT	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-BATCH	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-CFG	PUB	Designate storage medium in UBX-CFG-VAL[SET|DEL|GET] instead.

[1] See Legacy UBX message field reference in the Interface description.

Message	Audience	Description / Comment
UBX-CFG-DAT	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-DGNSS	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-GEOFENCE	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-INF	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-ITFM	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-LOGFILTER	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-MSG	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-NAV5	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-NAVX5	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-NMEA	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-ODO	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-PM2	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-PMS	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-PRT	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-RATE	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-RINV	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-RXM	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-SBAS	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-TP5	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-CFG-USB	PUB	Use UBX-CFG-VAL[SET|DEL|GET] instead [1]
UBX-MON-HW	PUB	Use UBX-MON-HW3 and UBX-MON-RF as a replacement
UBX-MON-HW2	PUB	Use UBX-MON-HW3 and UBX-MON-RF as a replacement

4.3.4 Removed messages

Message / Configuration item	Audience	Description / Comment
UBX-LOG-INFO	PUB	Message to output status about data logging
UBX-AID-*	PUB	GPS assistance data; use UBX-MGA-* instead
UBX-NAV-SVINFO	PUB	Use UBX-NAV-SAT or UBX-NAV-SIG instead
UBX-NAV-SOL	PUB	Use UBX-NAV-PVT instead
UBX-HNR-PVT UBX-HNR-ATT UBX-HNR-INS	PUB	Use UBX-NAV-PVT instead
UBX-RXM-IMES	PUB	IMES is not supported in this firmware
UBX-RXM-SVSI	PUB	Use UBX-NAV-ORB instead
CFG-LOGFILTER-APPLY_ALL_FILTERS CFG-LOGFILTER-MIN_INTERVAL CFG-LOGFILTER-ONCE_PER_WAKE_UP_ENA CFG-LOGFILTER-POSITION_THRS	PUB	Configurations for data logging

CFG-LOGFILTER-RECORD_ENA
CFG-LOGFILTER-SPEED_THRS
CFG-LOGFILTER-TIME_THRS

4.4 Configuration interface

u-blox M9 introduces a new configuration mechanism compared to u-blox M8, based on UBX-CFG-VALSET, UBX-CFG-VALDEL and UBX-CFG-VALGET. Refer to the Interface description for a description of this feature and the available settings.

4.5 Supported sensor drivers

The following IMUs have been fully characterized and are therefore supported by this release.
Operating temperature -40 °C to +105 °C:

- STm ISM330DHCX
- TDK IIM42652

Operating temperature -40 °C to +85 °C:

- Bosch BMI 160
- STm LSM6DSR (reports the same 'Sensor Id' as the STm ISM330DHCX in sensor self-test)
- TDK ICM42605

Although not fully characterized and therefore not officially supported, the following sensor drivers are also included in this release:

- MPU6500
- MPU6515
- Bosch SMI130
- Bosch SMI230
- Bosch BMI320
- STm ISM330DLC
- TDK IAM20680, 20680HT, 20680HP and 20680M (for M9140-KA-DR chipset design only)

5 Known limitations

This firmware release is the first official release of the ADR firmware which delivers ADR functionalities and includes a lot of new features compared to its predecessor, the NEO-M8L. The next official release is planned for Q1/2023 with a few additional new features. Feature improvements will be supported by a maintenance release (if needed).

The following features are not included in this release:

- QZSS L1S
- AssistNow Offline and Autonomous

6 Revision history

Revision	Date	Name	Comments
R01	22-Dec-2021	ARAT	First official release of ADR5.10 release notes