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Release Notes

Topic :	GNSS Firmware 3.01 for u-blox 8/M8 Standard Precision Products - Public
	UBX-16000319 – R05
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1 General Information

Firmware version 3.01 is the standard precision GNSS firmware release for UBX-G8020 chips, UBX-M8030 chips, and u-blox M8 modules that support or contain Flash memory. This release note covers the changes of the u-blox M8 firmware 3.01 compared to u-blox M8 firmware 2.01.

⚠️ **FW 3.01 is only for u-blox Standard Precision GNSS (SPG) products. It should not be used for Timing, Dead Reckoning or High Precision GNSS products.**

1.1 Released firmware images

ROM image for u-blox M8

HW ID String: HW UBX-M8030
FW ID String: ROM CORE 3.01 (107888)
FWVER string: SPG 3.01
Supported product variants: UBX-M8030-KT/KA/CT

ROM image for u-blox 8

HW ID String: HW UBX-G8020
FW ID String: ROM CORE 3.01 (107888)
FWVER string: SPG 3.01
Supported product variants: UBX-G8020-KT

Flash image for u-blox M8

File: UBX_M8_301_SPG.911f2b77b649eb90f4be14ce56717b49.bin
FW ID String: EXT CORE 3.01 (107900)
FWVER string: SPG 3.01
Supported product variants: UBX-M8030-KT/KA/CT, NEO-M8N, EVA-M8M (External Flash required)

Supports ROM base: 0.22, 2.01 and 3.01

1.2   Released documentation

- This release note: **UBX-16000319**
- u-blox 8 / u-blox M8 Receiver Description / Protocol Specification:

Content	Audience	File
u-blox M8, u-blox 8 : UBX v18	Public	UBX-13003221
u-blox M8, u-blox 8 : UBX v18	Confidential (NDA required)	UBX-13002887

1.3   Released software tools

1.3.1   u-center

Supported by u-center versions from 8.20

File: u-center_v8.20.exe

NOTE: the new version of u-center is mandatory for firmware update of FW3.01

1.3.2   Firmware update tool

The firmware update utility tool v2.01 supports this product.

NOTE: the new version, v2.01, of the firmware update tool is mandatory for FW3.01

1.3.3   USB driver

Drivers are supported for Windows Vista and on-wards:

Windows CDC-ACM: version 1.2.0.8

Windows Sensor Driver: version 2.21

1.3.4   USB identification u-blox M8 and u-blox 8

Vendor ID: 0x1546

Product ID: 0x01A8

Driver String: u-blox GNSS receiver

2 New Features

This firmware supports parallel operation of any two of the supported GNSS systems. It also supports Galileo for the first time.

The default configuration is for GPS, SBAS, QZSS & GLONASS

- Augmentation systems can only be used in conjunction with GPS
- Any GNSS can be used on its own or in combination with others (see Table 1 and Table 2)

GPS	Galileo	GLONASS	BeiDou
•	•	–	–
•	•	•	–
•	•	–	•
•	–	•	–
•	–	–	•
–	•	•	–
–	•	–	•
–	–	•	•

Table 1: Permissible GNSS combinations (• = enabled)

	GPS, SBAS, QZSS & GLONASS	GPS, Galileo & GLONASS	GPS, SBAS, QZSS & BeiDou	BeiDou & GLONASS	GPS	GLONASS	BeiDou
Time pulse	Supported						
PSM	Supported						
AssistNow Online	Supported for GPS, BeiDou, GLONASS, Galileo and QZSS						
AssistNow Offline	Supported for GPS and GLONASS [1]						
AssistNow Autonomous	Supported for GPS and GLONASS [1]						
Weak signal tracking	Supported						
RTCM					Supported		
Interference suppression	Supported						
Logging	Supported						

Table 2: Supported feature set for GNSS combinations

(1) See sections 2.5 for more details about AssistNow

2.1 Concurrent GNSS configuration

The message UBX-CFG-GNSS allows for switching on and off the supported GNSS. In order to configure system specific parameters, use UBX-CFG-SBAS.

The default configuration for FW3.01 is GPS+GLO+SBAS+QZSS, backward compatible with FW2.01.

2.2 Subframe data

FW3.01 provides the subframe data decoded for all the satellites systems with the message UBX-RXM-SFRBX.

In this way it is possible for the customer to use the subframe information for specific usage, for example for the tsunami warning available in the QZSS L1-SAIF signals.

2.2.1 QZSS L1-SAIF Signal

L1-SAIF signal can be tracked and the unprocessed navigation data is reported via RXM-SFBRX. The receiver makes no use of L1-SAIF signals.

The QZSS signal provides L1-C/A navigation messages from which the following information is used:

- QZSS ephemeris
- QZSS almanac
- all GPS rebroadcast sub-frames (almanac, health, UTC parameters, ionosphere parameters)

2.3 Galileo

The E1B/C signals are used for navigation.

Use of Galileo signals is disabled by default and can be enabled using the UBX-CFG-GNSS message.

2.4 IMES

IMES signals can be tracked and decoded by the receiver. The signal will not be used for ranging, but only for data decoding. The data decoded will be available in the message UBX-RXM-SFRBX; in addition the receiver parses the data and provides the information in a slightly better structured form RXM-IMES

The IMES signal is disabled by default but can be enabled using the UBX-CFG-GNSS message.

2.5 AssistNow Autonomous

The AssistNow Autonomous feature adds support for BeiDou and Galileo satellites on circular and near-circular orbits. It will not consider satellites on orbits with an eccentricity of > 0.05 (e.g. E18). QZSS is not supported. Besides these limitations, AssistNow Autonomous will use any available SV and GNSS when enabled.

The performance of the predicted orbits for Galileo cannot be guaranteed due to the immature state of the Galileo deployment at firmware release.

2.6 NMEA

With FW3.01 there are four NMEA standards supported:

Version 2.1

Version 2.3

Versions 4.0

Versions 4.1

The default NMEA version is 4.0

2.6.1 NMEA talker identifiers

The details on the NMEA talker identifier can be found in the U-M8 Receiver Description / Protocol Specification.

2.7 New Protocol Messages

Message	Remark
UBX-CFG-DYNSEED	Dynamic key for signing messages
UBX-CFG-FIXSEED	Secret key and configuration for signing messages
UBX-CFG-GEOFENCE	Geofencing configuration
UBX-CFG-PMS	Power mode template
UBX-MGA-GAL	Extension of MGA to support Galileo (for online assistance, at least)

Message	Remark
UBX-NAV-EOE	End of epoch indication
UBX-NAV-GEOFENCE	Geofencing status
UBX-NAV-TIMEBDS	BeiDou time information
UBX-NAV-TIMEGAL	Galileo time information
UBX-NAV-TIMEGLO	GLONASS time information
UBX-NAV-TIMELS	Provides leap second information (current value and future events)
UBX-RXM-IMES	IMES beacon information (replacement for UBX-NAV-IMES)
UBX-RXM-PMREQ	New version to request a power management task with additional fields
UBX-RXM-RLM	Galileo SAR RLM messages (short and long)
UBX-SEC-SIGN	Message signature
UBX-SEC-UNIQID	Retrieving unique chip ID

2.8 Modified Protocol Messages

Message	Remark
UBX-CFG-GNSS	Added parameters to cover new features (e.g. Galileo)
UBX-CFG-NAV5	New dynamical model "wrist" added
UBX-CFG-PM2	Inactivity timeout on EXTINT pin if enabled
UBX-CFG-TP5	Updated to allow for Galileo
UBX-MGA-BDS	Extension of MGA to support BeiDou (for online assistance, at least) - was RD for GF2
UBX-MON-GNSS	Updated to allow for Galileo
UBX-NAV-STATUS-SPOOFSTATE	Added spoofing state to NAV status
UBX-RXM-RAWX	Feature restricted to products with a particular e-Fuse setting
UBX-RXM-SFRBX	Used to be restricted to certain products, now a standard feature

3 Multi GNSS Operation

3.1 Concurrent GNSS support

With FW3.01 on u-blox M8 it is possible to enable up to three major GNSS concurrently.

When GPS is enabled, then the augmentation systems QZSS, SBAS and IMES can also be enabled.

It is not possible to enable an augmentation system without having enabled a major GNSS system. IMES is an exception; it can be enabled alone for specific customer specific needs.

The recommended combinations of major GNSS are listed in

GPS	Galileo	GLONASS	BeiDou
•	•	–	–
•	•	•	–
•	•	–	•
•	–	•	–
•	–	–	•
–	•	•	–
–	•	–	•
–	–	•	•

Table 1, page 5.

3.2 GNSS Time

3.2.1 GNSS time systems

The GNSS are referenced to different time systems. Additionally the GNSS time systems are referenced to different realizations of UTC:

GNSS	Time system	UTC reference
GPS	GPS Time (GPST)	USNO
SBAS	SBAS Network Time (SNT)	System provider dependent
QZSS	QZSS System Time (QZSST)	NICT
GLONASS	GLONASS Time	SU
BeiDou	BeiDou Time (BDT)	NTSC
Galileo	Galileo System Time (GST)	TBD

FW3.01 chooses the reference time system for the navigation solution autonomously based on signal availability. For the legacy UBX messages that output GPS time references, the internal time is converted to GPS time as accurately as possibly.

New multi-GNSS messages use UTC as time reference. In some cases unknown parameters (leap seconds, inter-GNSS time offsets) may lead to a reduced accuracy of the output time. This inaccuracy can be as high as 20 s (unknown leap seconds), which overflows the accuracy fields of some messages, resulting in maximum accuracy figures (e.g., the UTC time accuracy in UBX-NAV-PVT is capped at 4294967295ns when deriving UTC from GPS time with unknown leap seconds).

By default the firmware uses a UTC standard that matches the selection of the active GNSS (UBX-CFG-GNSS):

If GPS is enabled: USNO
else
if GLO is enabled: SU
else
if BeiDou is enabled: NTSC
else
if Galileo is enabled: EU (TBD)

The UTC time accuracy figure always reflects the receiver's knowledge of all parameters relevant for converting GNSS time to the chosen UTC time. A specific UTC standard can be configured using UBX-CFG-NAV5.

3.2.2 Time Pulse

In FW3.01 the time pulse is aligned to UTC by default for u-blox M8 receivers, while u-blox 8 receivers default to outputting a GPS aligned time pulse. The time pulse is output only when the time system it's aligned to can be realized within the accuracy figures defined by the time accuracy mask (UBX-CFG-NAV5). For example, on a u-blox M8 receiver, the time pulse is only output once the leap seconds are known and UTC time can be calculated properly. Time jumps may occur when the receiver obtains new information on GNSS to UTC time offsets.

3.3 Coordinate frames

The different GNSS systems employ different coordinate frames to express their satellite positions. However, all output in NMEA and UBX is related to WGS84, regardless of the GNSS used.

4 Improvements and changes

This chapter describes the improvements and changes in GNSS firmware 3.01 compared to earlier u-blox firmware versions.

4.1 Changes in boot screen and in UBX-MON-VER

In order to generate consistent information across our positioning product line, the boot screen and the UBX-MON-VER message have been adapted.

The boot screen is as follows:

```
$GNTXT,01,01,02,u-blox AG - www.u-blox.com*4E
$GNTXT,01,01,02,HW UBX-M8030 00080000*60
$GNTXT,01,01,02,EXT CORE 3.01 (107900)*33
$GNTXT,01,01,02,ROM BASE 3.01 (107888)*25
$GNTXT,01,01,02,FWVER=SPG 3.01*46
$GNTXT,01,01,02,PROTVER=18.00*11
$GNTXT,01,01,02,FIS=0xBF2601 (100111)*5A
$GNTXT,01,01,02,GPS;GLO;GAL;BDS*77
$GNTXT,01,01,02,SBAS;IMES;QZSS*49
$GNTXT,01,01,02,GNSS OTP=GPS;GLO*37
$GNTXT,01,01,02,LLC=FFFFFFFF-FFFFFFFF-FFFFFFFF-FFFFFFFF-FFFFFFFF*2D
$GNTXT,01,01,02,ANTSUPERV=AC SD PDoS SR*3E
```

The major differences are:

1. Date and time of the compilation has been removed
2. A line for FWVER, which mentions the type of build: SPG stands for Standard Precision GNSS
3. GNSS supported system is now split into major GNSS (in that case GPS, GLO, GAL and BDS) and augmentation systems (here SBAS, IMES and QZSS)

UBX-MON-VER has been updated to provide the same information as the boot screen and in the same format.

4.2 Oscillator support

FW3.01 supports XTOs with a 7pF capacity (same as FW2.01). The calibration procedure has been changed; For this use, contact your local field application engineer.

FW3.01 supports 105°C extended temperature range for the Automotive Grade products. For this the FW now supports a TCXO with following characteristics: 3 ppm, Temp stability time 1200 s.

Oscillator	Features
XTO	15 ppm time to temp 3600 s (**Default**)
XTO 7pF	16.5 ppm time to temp 3600 s
TCXO	0.5 ppm, time to temp 1200 s
USTCXO	0.1 ppm, time to temp 1200 s (Ultra Stable TCXO)
TCXO 105°	3 ppm, time to temp 1200 s

Any TCXO can be configured to be supplied directly (1.9 or 3.0 V) or using the LDOX out as an enable signal for the TCXO.

4.3 Firmware Update

The mechanism for a firmware update has changed. The messages UBX-UPD-UPLOAD, UBX-UPD-DOWNL and UBX-UPD-EXEC have been replaced. Refer to section 1.3.2 or contact your local Field Application Engineer for more information.

4.4 Galileo SAR / RLM

FW3.01 provides a message to retrieve the Galileo SAR (Search And Rescue) RLM (Return Link Message) messages.

The customer can send the Distress signal (over 406 MHz band), then wait for confirmation through the Galileo data flow, in form of RLM message. The message contains the beacon ID to be paired with the request.

4.5 Week number rollover

The week number rollover is set to 1867 (October 2015). All transmitted week numbers are mapped to the ~19.5 year period between week 1867 and week 2990 (April 2035).

4.6 Signature for message integrity

FW3.01 provides a way to ensure integrity of the messages over IO interface (UART / I2C / SPI or USB).

The mechanism can be activated using the message UBX-CFG-FIXSEED

4.7 Geofencing

FW3.01 provides a feature that can set up to 4 circular geofences, and upon configuring UBX-CFG-GEOFENCE, a PIO can be toggled on entering or exiting a geofence. Polarity of the PIO can be configured as well.

The geofence status can be retrieved also polling the message UBX-NAV-GEOFENCE.

Geofence can be used in combination with the power save modes.

For further details, refer to u-blox 8 / u-blox M8 Receiver Description Including Protocol Specification.

4.8   Spoofing detection

Spoofing is the process whereby someone tries to forge a GNSS signal with the intention of fooling the receiver into calculating a different user position than the true one.

FW3.01 features a spoofing detection mechanism which monitors the GNSS signals for suspicious patterns indicating that the receiver is being spoofed. A flag in UBX-NAV-STATUS alerts the user to potential spoofing.

4.9   Power mode setups

In order to simplify the customer use of the power save modes of the receiver, the message UBX-CFG-PMS is a simplified interface which applies a setup, instead of dealing with several complex messages.

The following setups are available: Balanced (default), Full Power, Aggressive 1, 2 and 4 Hz, and Interval.

Interval setup allows setting two additional parameters for fine tuning the ON/OFF mode.

4.10   Wrist use case mitigation

In UBX-CFG-NAV5 a new dynamic model has been added, WRIST, that mitigates the effect of the wrist movement while walking or running, for the sport watch use case.

4.11   PSM improvements

All the GNSS supported by DO_GF3 are now supported also in PSMOO and PSMCT in all the combinations allowed by the hardware: GPS, QZSS, SBAS, GLO, BDS, GAL. The selection is done via UBX-CFG-GNSS in the usual way.

Also single GNSS operation is possible (except for QZSS and SBAS).

IMES is only supported in PSMOO (along with at least one other GNSS system), but not currently in PSMCT (IMES signals are not tracked in power optimized tracking state aka ITM state).

4.12   Navigation rate

The recommended maximum navigation rate supported is 5 Hz for standard multi-GNSS operation (GPS + SBAS + GLONASS + QZSS) and 10 Hz for single GNSS operation. When Galileo is enabled, then the maximum navigation rate when executed from flash is 3 Hz.

4.13   GNSS configuration changes

In FW3.01 a successful UBX-CFG-GNSS change will always reset the receiver. The firmware imposes tighter restrictions on valid combinations (and channel numbers).