Release Notes

Topic :	**Firmware 7.03 for u-blox 6**
	GPS.G6-SW-11013-6
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Date :	2/08/2011

1 General information

1.1 Released firmware images

Flash image for chipset TCXO

File: `EXT_G60_CHIPSET.ee9f5c6df0781c7288ab7b4774c5c2c3.bin`

ID String: `EXT CORE 7.03 (45970) Mar 17 2011 16:26:24`

Premium features: none.

Flash image for chipset XTAL

File: `EXT_G60_CHIPSET_XTAL.26e23fdb438d7d55104b8174d84deda2.bin`

ID String: `EXT CORE 7.03 (45970) Mar 17 2011 16:26:24`

Premium features: none.

Flash image for LEA-6H

File: `EXT_G60_LEA-6H.fd1146bafac24b1347701312d42bb698.bin`

ID String: `EXT CORE 7.03 (45970) Mar 17 2011 16:26:24`
`MOD LEA-6H-0`

Premium features: none.

Flash image for LEA-6P

File: `EXT_G60_LEA-6P.ccdbd64f4eb4e77bc5aa934011c5b6d0.bin`

ID String: `EXT CORE 7.03 (45970) Mar 17 2011 16:26:24`
`MOD LEA-6P-0`

Premium features: none.

Flash image for LEA-6T-1

File: `EXT_G60_LEA-6T.bffb9b168ba6f2ade1f39acf36e4e9fe.bin`

ID String: `EXT CORE 7.03 (45970) Mar 17 2011 16:26:24`
`MOD LEA-6T-0`

Premium features: Timing, Raw data.

Flash image for chipset TCXO (DWT, GWT only)

File: `EXT_G60_SFDR_CHIPSET_ADR.8a89c67d0e98c1972be86daf64b1bc67.bin`

ID String: `EXT CORE 7.03 (45970) Mar 17 2011 16:26:29`
`ADR`

Premium features: SFDR.

Flash image for chipset XTAL (DWT, GWT only)

File: `EXT_G60_SFDR_CHIPSET_ADR_XTAL.2c5ec07df07c123a04da518c6518f67d.bin`

ID String: `EXT CORE 7.03 (45970) Mar 17 2011 16:26:29`
`ADR`

Premium features: SFDR.

1.2 Released documentation

u-blox 6 Receiver Description including Protocol Specification

File	Audience	Content
GPS.G6-SW-10018-A.pdf	Public	u-blox 6 Receiver Description including Protocol Specification (GPS modules)
GPS.G6-SW-10019-A.pdf	Confidential/ NDA required	u-blox 6 Receiver Description including Protocol Specification (GPS chips)

1.3 Released software tools

1.3.1 u-center

A new u-center version will be released end of April 2011 and will be available for download from the u-blox website.

1.3.2 Firmware update utility

Same procedure as for u-center.

1.3.3 USB driver

The USB driver package has not changed. The driver released with FW 6.02 remains valid.

1.4 Identification

1.4.1 USB identification

Product ID: "01A6"

Version Nr: "07.03"

Driver String (ROM): `"u-blox 6 - GPS Receiver"`

1.5 References

[1] u-blox 6 Receiver Description incl. Protocol Specification FW 7 for Modules GPS.G6-SW-10018

[2] u-blox 6 Receiver Description incl. Protocol Specification FW 7 for Chips GPS.G6-SW-10019

2 New features

This chapter describes the new features in firmware 7.03.

2.1 AssistNow Autonomous

The "AssistNow Autonomous" feature provides functionality similar to A-GPS (AssistNow Online, AssistNow Offline) without the need of a host and data connection. Based on a broadcast ephemeris downloaded from the satellite (or obtained by A-GPS) the receiver can autonomously (i.e. without any host interaction or online connection) generate an accurate satellite orbit model that is usable for navigation much longer than the underlying ephemeris was intended for. This satellite orbit model is stored as AssistNow Autonomous in the receiver's Battery Backup RAM (BBR) and can be used for subsequent first fixes (e.g. for the next day). The use of AssistNow Autonomous makes obtaining live satellite ephemeris unnecessary for the first fix after start-up and hence reduces the time to first fix (TTFF). As an alternative to storing the AssistNow Autonomous data in BBR, it can be stored either to external flash memory or host processor, see [1] for further details. The feature can be enabled using the UBX-CFG-NAVX5 message (it is disabled by default). The UBX-NAV-AOPSTATUS message provides information on the status of the subsystem and the availability of data per satellite. The UBX-AID-AOP message provides a host interface for data, and the UBX-NAV-SVINFO indicates the use of AssistNow Autonomous orbits, see [1] for further details.

2.2 Map matching input

Map matching input is only available with u-blox Automotive Dead Reckoning (ADR) functionality.

The map matching input feature allows feeding a map matched position solution back to the receiver in order to aid its next navigation solution. Map matching data contributes to improved positioning performance. However, the result using map matching depends directly on the quality of the map data used, i.e. bad or outdated data will corrupt or downgrade performance. Data can be supplied using the UBX-AID-MAPM input message. See u-blox 6 Receiver Description including Protocol Specification [2] for more details.

2.3 Save Almanac and AssistNow Autonomous data to NVS

The message UBX-CFG-NVS allow storing AssistNow Autonomous data to external flash memories, see [1] for details. Note, dumped data from a receiver shall not be transferred to other receivers as it contains device specific data, e.g. oscillator offset.

2.4 TX ready signal

The TX ready signal indicates that the receiver has data to transmit. A listener can wait on the TX ready signal instead of polling the DDC or SPI interfaces. The UBX-CFG-PRT message allows configuration of the polarity and the number of bytes in the buffer before the ready signal goes active. The TX ready signal can be mapped to any GPIO. TIMEPULSE is not a GPIO and cannot be used as a TX ready pin! The TX ready pin is disabled by default. See [1] for details.

2.5 RTCM 2.3

The RTCM implementation supports the following RTCM 2.3 messages:

Message Type	Description
1	Differential GPS Corrections
2	Delta Differential GPS Corrections
3	GPS Reference Station Parameters
9	GPS Partial Correction Set

DGPS requires no configuration to work properly. When an RTCM stream is input on any of the communication interfaces, the data will be parsed and applied if possible, putting the receiver into DGPS mode. RTCM protocol must be enabled on the interface being used with CFG-PRT. The only configurable parameter of the DGPS mode is the DGPS timeout that can be specified using CFG-NAV5. This value defines the time before old RTCM data will be discarded.

To guarantee best positioning accuracy with RTCM, the receiver behaves as follows:

- The DGPS solution only includes measurements from satellites for which DGPS corrections were provided. This is because the navigation algorithms cannot mix corrected with uncorrected measurements.
- SBAS corrections will not be applied when using RTCM correction data
- RTCM correction data cannot be applied when using AssistNow Offline or AssistNow Autonomous

RTCM support is implemented according to RTCM 10402.3: "RECOMMENDED STANDARDS FOR DIFFERENTIAL GNSS".

2.6 Jamming/Interference Monitor

The Jamming/Interference Monitor indicates if the receiver suspects the presence of in-band broadband or CW jamming. This is well suited for security and automotive customers as an indication of intentional external jamming.

The indicator has four states:

- Unknown - jammer detection not enabled, uninitialized, or antenna disconnected
- OK - no interference detected
- Warning - position ok but interference is visible (above the thresholds)
- Critical - no position and interference is visible (above the thresholds), probably reason there is no fix

The indicator is part of the UBX message MON-HW. Normally, with no interference detected, it will report 'OK'.

The indicator is disabled by default and is enabled by sending an appropriate CFG-ITFM UBX message. This message also specifies the thresholds at which broadband and CW jamming are reported and whether the receiver has an Active or Passive antenna connected.

The indicator algorithm relies on comparing the current measured spectrum with one for which a good fix was obtained. Therefore the indicator will only function once the receiver has had at least one successful first fix, and reports 'Unknown' before this time.

2.7 Time aiding error message

A UBX message UBX-TIM-VRFY has been implemented which outputs the error of the time aiding as done with the UBX-AID-INI message. See [1] for details.

3 Improvements and changes

This chapter describes the improvements and changes in firmware 7.03 compared to earlier versions.

3.1 Power Save Mode (PSM)

3.1.1 Power Save Mode configuration

The configuration message CFG-PM remains unchanged from FW6.02. When using CFG-PM with FW7.03, the new algorithms built into FW7.03 are selected and configured to provide best performance while at the same

time providing a maximum of backwards compatibility with FW6.02. It 's recommended to use the new CFG-PM2 message in all new designs (see 3.1.1.1).

3.1.1.1 New CFG-PM2 configuration message

CFG-PM2 allows configuring new settings of FW7.03:

- Select operation mode: on/off operation or cyclic tracking operation.
  The selection of the operation mode influences the possible position update period that can be configured:
  - on/off operation allows update periods larger than 5000 ms
  - cyclic operation allows update periods between 1000 ms to 10000 ms.
- The user can influence the behavior of the receiver in case it can't get a position fix while in PSM: If the flag "doNotEnterOff" (in u-center the flag is called "Do not enter inactive for search state when no fix") is set, the receiver does not enter inactive for search state but keeps trying to acquire a position fix.

3.1.2 Behavior while USB host connected

As long as the receiver is connected to a USB host, it will not enter backup state. Instead, CPU-only state is entered. This ensures that the USB specification is not violated; however the power consumption is higher.

Wake-up by pin/UART/USB is possible, even if the receiver is in CPU-only state.

3.1.3 UBX-RXM-PMREQ message applicable during PSM

With message UBX-RXM-PMREQ it is possible to overrule PSM and force the receiver to enter backup state.

3.2 Performance

3.2.1 Tracking sensitivity

The tracking sensitivity has been increased up to 2dB compared to FW6.02.

3.2.2 Improved Anti-Jamming by better CW / narrow band interferer mitigation

A new narrow band and comb interferer mitigation algorithm has been added, which results in even better jamming mitigation.

3.2.3 Acquisition and re-acquisition improvements

Hot start and re-acquisition sensitivity and acquisition time has been improved particularly in low dynamic scenarios.

3.2.4 Improved velocity accuracy

Various measures have been taken to improve the accuracy of the velocity output, especially for receivers with crystal oscillator and in high dynamic scenarios.

3.2.5 Bad 2D fixes at startup

In previous firmware revisions, bad 2D solutions became unmasked after some observation time. With FW 7.03, 2D fixes calculated with an inaccurate altitude will stay masked over time.

3.2.6 New time mode for u-blox Timing receivers

- A new CFG-TMODE2 message has been defined to allow for larger position uncertainty and for supplying the position in Lat/Lon/Alt format.
- T-RAIM has been significantly improved for 1-3 SVs

- The accuracy estimation for the survey-in position has been improved to better reflect field situations in order to avoid problems in degraded signal scenarios. Customers currently using survey-in need to review their accuracy limit setting with CFG-TMODE or CFG-TMODE2.

3.3 Interfaces

3.3.1 NMEA PUBX,04 message with GPS-UTC time offset

A previously reserved field of NMEA PUBX,04 has been changed to contain the time difference (leap seconds) between UTC and GPS time. See [1] for details.

3.4 AID message acknowledge

AID message acknowledge payload has been fixed.

3.5 QZSS cross correlation mitigation

Additional checks have been introduced for improved cross correlation mitigation for QZSS satellites.

Known limitations

3.6 Standard datums removed

Due to ROM size limitations the built in standard datums list has been removed. The user can still set all these datums by entering the values in the UBX-CFG-DAT message. The values are available in the appendix of [1].

3.7 Static Hold not effective in certain Power Save Modes

In Power Save Mode, when the receiver enters one of the Inactive states the static hold function doesn't work as one might expect. Static hold works if the receiver is either in Tracking state or in Power Optimized Tracking state, but not if the receiver enters one of the Inactive states. Hence static hold is not effective during ON/OFF operation, when the receiver repeatedly enters Inactive states.

3.8 AssistNow Autonomous performance limited on Flash Firmware

Due to the slower execution speed of FW running from a Flash, AssistNow Autonomous performance is not as good as with ROM-based receivers. u-blox strongly recommends using ROM-based receivers to experience the full benefit of AssistNow Autonomous.

3.9 Power Save Mode (PSM)

3.9.1 Masked position fixes in PSM for prolonged periods

If masked fixes occur (due to few SVs or low accuracy and/or DOP masks), the receiver will go into inactive state. If the fixes are still masked after a wake up, the receiver will go into inactive state again, even if it tracks 4 or more SVs with usable orbits. In the very worst case, this cycling between inactive state and acquisition state (with masked fixes) can last for up to 4 hours.

To avoid such a situation, implement one of the following recommendations:

- Set acquisition timeout to 30 seconds
- Use aiding data, e.g. AssistNow Online or Offline.
- Enable feature "Do not enter 'inactive for search' state when no fix".
- Allow fixes with lower accuracy/higher DOP (UBX-CFG-NAV5)
- Send cold- or warmstart command to the GPS receiver

3.9.2 Ephemeris update every 10 minutes in ON/OFF operation

When in ON/OFF operation, ephemeris update is done every 10 minutes instead of every 30 minutes. The receiver wakes up every 10 minutes for 27 seconds, irrespective of the configured position update period. FW6.02 (when in on/off operation) runs ephemeris tasks more often than every 30 minutes but not strictly every 10 minutes.

3.9.3 Interference monitor not available during PSM ON/OFF operation

The interference monitor is not available during PSM ON/OFF operation.

3.10 AID-DATA does not return all messages

When AID-DATA is used to poll the full set of aiding data, messages might be lost. The use of AID-DATA is not recommended and the message might be removed in future versions. Use the specific poll messages for the AID messages.

3.11 Automotive Dead Reckoning (ADR)

3.11.1 No initial sensor calibration during backwards driving

Initial sensor calibration (after a coldstart) is only possible when driving forwards. After a coldstart, the receiver always starts navigating in GPS-only mode and switches to sensor fusion mode navigation (GPS+sensors) after the initial calibration is done. However, if after a coldstart the vehicle is driving only backwards, no sensor calibration is done and sensor fusion navigation will not be possible until a new coldstart with initial sensor calibration is done. During sensor fusion navigation, there is a continuous sensor calibration performed, also when driving backwards.

3.11.2 No change from GPS-only to sensor fusion during backwards driving

The receiver will never change from GPS-only to Dead Reckoning when driving backwards. After a sensor measurement outage or after having been disabled temporarily (e.g. car on a ferry), the receiver will not switch to sensor fusion navigation and remains in GPS-only mode until the vehicle drives forwards. If the receiver has already switched to sensor fusion navigation before the sensor measurement outage, sensor fusion navigation is continued.

3.11.3 Fall back from GWT to DWT fails if combineTicks flag is set

The ADR firmware determines the solution (GPS only, DWT, GWT) to be performed depending on the number and type of measurements currently available. So, if both GWT and DWT are configured the firmware will perform

- GWT, if gyro and single tick measurement are available
- DWT, if no gyro but wheel tick measurements are available
- GPS only, if no or insufficient sensor measurements are available

If both GWT and DWT are configured AND the combineTicks flag is set by means of UBX-CFG-ESFGWT, the firmware won't switch from GWT to DWT at all since only the ticks of the left rear wheel are stored as single tick into the SFDR data base. All other ticks from the front wheels and the right rear wheel are ignored to save CPU load and RAM. This does not appear if the combineTicks flag is not set.

Work-around: Don't set the combineTicks flag but send the left rear wheel tick measurement as a single tick instead which is used by GWT if combineTicks flag is not set.

3.12 Time aiding at the week rollover may result in wrong week number

Time aiding will fail if it is performed within a time window of approximately ±2s around the week rollover and the receiver not output a position until it decodes the correct week number from satellite data.

To avoid this issue, no AID-INI should be sent during a time window of approximately ±2s around the week rollover.

3.13 Writing to I2C EEPROM not always reliable

In rare cases, writing to I2C EEPROM may fail, resulting a configuration settings not stored into I^2C EEPROM memory. Reading from I^2C EEPROM never fails.

If zero error rate required, writing must be done when GPS is turned off and all MON messages are disabled on the IO ports. The GPS is turned off with this CFG-RST message: B5 62 06 04 04 00 00 00 08 00 16 74 Once the configuration is saved, as indicated by the ACK-SUCCESS message, the GPS can be turned back on with this CFG-RST message, and any required MON messages can be re-enabled: B5 62 06 04 04 00 00 00 09 00 17 76. Configuration settings should be polled at last for verification of storage.

3.14 DGPS flag may be set on dead reckoning fixes

It is possible that the DGPS flag is set on pure dead reckoning fixes (i.e. when no satellites are used). In that case the setting of that flag is unjustified of course, as it makes only sense when navigation satellites are involved in the position calculation.

3.15 Timing Survey-in Mode: Incorrect time accuracy estimation of Fixed Positions

When Timing Receivers are in Survey-in mode the time accuracy estimate (when a Position is fixed) is incorrect. The estimate is the square of what should normally be estimated. (e.g. 100 m instead of 10 m).

Although the time base and performance of the Timepulse signal is not affected, this limitation can affect migration from earlier timing product versions where timing applications rely on an estimation of the maximum timing accuracy. As the Timing accuracy estimate is worse than it is in reality, customers may see more outages during poor signal conditions than what would otherwise be expected (i.e. the estimated time accuracy exceeds the configured time accuracy mask).

To avoid this, the following workaround can be implemented:

- In Time Mode use Survey-in until the position is determined (when switching to Fixed Mode). Once in Fixed Mode read the fixed position using TMODE2, calculate the square root of the estimated accuracy and return this value to the Timing Receiver. The time accuracy estimate will then be correct on the following epochs and as long as stored/maintained in memory.

3.16 Flash firmware 6.02 not running on ROM 7.0x version

Previous Flash firmware version 6.02 cannot run on u-blox 6 ROM7-based product versions.

3.17 Feature combination matrix

Not all features can be used at the same time, either by functional or technical limitation. The tables below illustrate which u-blox 6 FW7.03 GPS features can be combined and which cannot.

Yes means combination is supported.

No means not supported.

3.17.1 Flash firmware for LEA-6H/P/T and Chipset TCXO/XTAL

	SBAS	PSM	RTCM	AssistNow Autonomous	AssistNow Offline
SBAS	-	No	No (1)	Yes (2)	Yes
PSM	-		No	Yes	Yes
RTCM	-			No	No
AssistNow Autonomous	-				Yes (3)
AssistNow Offline	-				

3.17.2 Flash firmware for chipset ADR (DWT/GWT) TCXO/XTAL

	SBAS	PSM	RTCM	ADR	AssistNow Autonomous	AssistNow Offline
SBAS	-	No	No (1)	Yes	Yes (2)	Yes
PSM	-		No	No	Yes	Yes
RTCM	-			No	No	No
ADR	-				No	Yes
AssistNow Autonomous	-					Yes (3)
AssistNow Offline	-					

(1) If RTCM data is sent to the receiver, SBAS will be disabled.
(2) The combination is possible, but SBAS performance is degraded, because SBAS orbit corrections cannot be used.
(3) If valid AssistNow Offline data is available it is used instead of AssistNow Autonomous