PIKSI® MULTI FIRMWARE 1.2 RELEASE

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Updates to Swift Navigation's Multi-Band, Multi-Constellation Centimeter-Accurate RTK GNSS Receiver

Overview

Swift Navigation is proud to release the second major firmware upgrade to Piksi® Multi. Firmware Version 1.2 provides users with a new satellite constellation (GLONASS) for use with Piksi Multi, which is unlocked via firmware upgrade offered at no additional cost. It also provides users with increased functionality and improved performance as defined below.

Firmware Version 1.2 (Build 1.2.14) for the Piksi Multi GNSS Receiver follows Swift's previous release, Firmware Version 1.1 from May of 2017. Refer to Section 7 of the Getting Started Guide entitled Piksi Multi - Upgrading Firmware for detailed instructions on how to upgrade your device. Firmware release binaries, incremental technical release notes and product support documents are available at support.swiftnav.com.

New Features

GLONASS Support - Swift has added GLONASS support to Piksi Multi. The new firmware provides dual-frequency (L1/L2) GLONASS raw measurements for use cases such as Post-Processed Kinematic (PPK) and custom navigation engines. Additionally, initial GLONASS navigation output expands the receiver capability for both Single Point (SPP) and Real Time Kinematic (RTK) positioning. In the position solution, GLONASS measurement integer ambiguities are not resolved and these measurements operate in RTK "float" mode at all times. Improved navigation performance due to the addition of GLONASS are targeted for future releases.

Piksi Multi's new constellation support improves solution robustness and precision performance in more challenging environments. From a system perspective, GLONASS RTK correction input is supported over Swift Binary Protocol (SBP) as well as RTCM v3. With Version 1.2, GLONASS raw observations can also be converted to RINEX using the sbp2rinex utility tool. In some open sky use cases, GLONASS operation can actually delay time to first RTK fixed position. It is recommended that users in open sky use cases who are sensitive to the time required for the first RTK fixed position disable GLONASS acquisition through the settings interface.

Fundamentally Improved RTK Float Solution - Piksi Multi's float RTK output has been tuned to optimize the solution for autonomous machines and precision navigation. There is a step-change improvement of positioning performance in float mode. Swift also suggests that users utilize the estimated accuracy fields in navigation outputs for an indication of solution quality rather than using the transition to RTK "fixed" mode as an indicator of solution quality, as the new and improved float solution performance can often fulfill precision navigation requirements.

Fundamentally Improved SPP Solution - In all prior firmware releases, Swift used what is known as a "single epoch" SPP that was sometimes less smooth and performant than users expected. Version 1.2 firmware has a Kalman filter-derived SPP solution that brings Swift's estimation and filtering expertise to bear on the SPP output when there are no RTK corrections.

Improved I/O Capabilities - This release continues to improve upon input/output capabilities in the receiver. Two fully configurable TCP/IP clients have been added, which, when coupled with the TCP/IP server features from prior releases, allow users to send and receive SBP information including RTK corrections across any LAN through settings changes only. The release also allows modification of the numerical TCP/IP server ports for compatibility with legacy systems. This release also has improved stability of the micro-USB serial interface through a key bug fix to this interface. The addition of a linux serial console over the micro-USB interface allows advanced receiver command and control for developers.

RTK Robustness - Swift has added a Measurement Integrity Assurance (MIA) feature that ensures only top quality pseudorange and carrier phase range measurements are used for navigation. This will improve navigation performance in the face of poor measurement conditions from multipath, pitch and roll of the antenna on dynamic vehicles and temporary obstructions.

Changes from Firmware 1.1

Addition of TCP/IP client - A TCP/IP client has been added which expands receiver communication options.

Raw measurement improvements - In addition to a new constellation, this release continues to update raw measurement quality and capabilities when compared with version 1.1. Users should expect faster measurement availability after RF outage or occlusion in addition to generally higher quality

measurements, improved carrier phase lock detection and improved sensitivity profile switching when satellites are transitioning in and out of view or the vehicle is accelerating.

Observation packing change - The "msg_obs_max_size" setting default value was changed from 104 to 255 to reduce bandwidth required for SBP observation output. The new default value could impact some system designs that rely on a smaller observation message size such as SBP corrections over mavlink in UAV integrations.

SBP tracking status message redefinition - The SBP tracking status messages was changed and now has an SBP message id of 65 (0x41) to support GLONASS. The observation message remains unchanged. Please refer to the documentation for version 2.2.15 documentation of Swift Binary Protocol.

Support for multiple external events - Swift has added software support for multiple external events which can unlock sensor timing applications and allow users to precisely time tag digital signals from multiple sources. The names of legacy external event settings have changed to support the 3 external events. The new settings names may require users to update configuration on deployed devices.

Fixes - Swift has implemented important fixes worth noting in the version 1.2 firmware. The release:

- Prevents the momentary loss of differential solutions which coincided with the message "Error calculating base station position"
- Improves USB serial interface to fix a bug where the micro USB interface sometimes did not work with the Swift Console until the cable was unplugged or the device was restarted
- Fixes issues with the sd card on the Piksi Multi Evaluation Board so that the sdcard is now an experimental option for the standalone data logging feature
- Eliminates gaps in standalone logging feature at high data rates
- Solves an issue where the device took an unexpectedly long time to converge to RTK "fixed mode" after a radio or correction outage in open sky
- Suppresses Pulse Per Second output before first solution and 60 seconds after solution is lost

UART1 default SBP messages - Rather than allow every single SBP message produced by Piksi Multi on the UART1 interface by default as in prior firmware release, the port by default sends out only the SBP messages in use by the Swift Console. The primary change is that position, velocity and baseline messages in Earth Centered Earth Fixed (ECEF) coordinate format are suppressed.

Known Issues

Tracking elevation mask - There is a historical setting in the firmware with group "track" and name "elevation_mask" which has no effect on the release firmware. The "elevation_mask" setting in the "solution" group should be used to set an elevation mask.

Solution rate settings - There is no protection around the solution rate setting and it is possible to configure solution rates that are unsupported by the device which results in undefined behavior. The device supports up to 10Hz solution rate during low latency RTK operation, up to 20Hz solution rate during raw GNSS measurement output without RTK and up to 5Hz solution frequency with time-matched RTK or heading operation. For information about the combination of solution rates and navigation modes supported by the device refer to support.swiftnav.com.

Risk of saturating default UART baudrate - With the addition of raw GLONASS observations in the receiver, it is more likely for users to incorrectly configure the device such that the bandwidth of UART interfaces in SBP communication mode is saturated. This would manifest itself as incomplete SBP messages and "crc mismatch" messages in the Swift Console over the interface. Users should pay special attention to the solution rate and raw observation rate configured in the receiver if using 115200 or lower Baud rates. It is recommended to use a higher Baud rate, or to decimate or suppress raw observation messages if they are not required.

LED state with low solution rates - If the solution frequency setting (soln_freq) is set to a value below 1 Hz, the LED behavior on the receiver is inconsistent. In this state, the POS LED blinks even if a nav solution is present and the MODE LED is off between two epochs.

