GR-8018, u-blox M9 NEO-M9V-Based GNSS Smart Antenna w/ 50Hz Update Rate Support

RoHS Compliant



Overview

Based on u-blox NEO-M9V, GR-8018 supports concurrent reception of four GNSS. The high number of visible satellites allows it to select the best signals. This maximizes the position **accuracy**, in particular under challenging conditions such as deep urban canyons.

In addition, it supports **UDR** (Untethered Dead Reckoning) with built-in accelerometer and gyroscope sensors.

After it is calibrated, DR (Dead Reckoning) allows navigation to start as soon as power is applied before GNSS fix is available. DR is particularly useful under poor signal conditions, where it brings continuous positioning in environments even during complete signal loss such as basement, parking garages, and tunnels.

GR-8018 can combine GNSS and DR measurements and compute a position solution at update rates of up to **50 Hz**. It is especially useful for timing-critical applications such as high speed racing. The typical GNSS only output is also available.

The all-in-one compact design allows **plug-n-play**. It is an easy to use, ultra-high performance, low power, industrial grade GNSS smart antenna. USB or TTL/RS232 communication interfaces are available.

Applications

- Vehicle navigation
- Fleet management
- High speed racing

Features

- Based on u-blox NEO-M9V, supporting UDR only
- 50Hz fused (GNSS+DR) update rate support (by priority messages only)
- Concurrent multi-navigation systems support
  - GPS/Galileo/QZSS/SBAS/GLONASS/BeiDou
- SBAS (WAAS, EGNOS, MSAS, GAGAN) support
- QZSS L1S SLAS (Sub-meter Level Augmentation Service) support
- Sensitivity w/ GPS+GLONASS+Galileo+BeiDou
  - Acquisition: -147dBm
  - Tracking & navigation: -159Bm
- Assisted GNSS support, AssistNow Online
- RF interference and jamming detection and reporting
- Spoofing detection and reporting

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- Electrical interface support: USB, RS232, TTL
- Connector: PS2, Microfit, RJ45, DB9, USB etc.
- Cable length: 0.1m ~ 15m.
- Power supply options: 3.3 ~ 5.5 VDC
- Backup battery support for faster position fix
- SOS (Save-on-Shutdown) function support for saving and restoring DR calibration data via NaviViewerM9V
- LED for position fix indication
- IPX7 Waterproof
- Built-in magnet
- Windows location sensor support
- Linux/Android support
- Fully EMI shielded
- Industrial operating temperature range: -40 ~ 85℃

Technical Specifications

Receiver Performance Data+

Receiver Type	92-channel u-blox M9 engine GPS L1 C/A, SBAS L1 C/A, QZSS L1 C/A/S Galileo E1 B/C L1, E1: 1575.42MHz, GLONASS: L1OF:1598.0625~1605.375MHz BeiDou BI1: 1561.098 MHz
SBAS Support	WAAS, EGNOS, MSAS, GAGAN
Position Accuracy (CEP, 50%)	1.5m Horizontal 3m Vertical (Open sky with SBAS and QZSS enabled, -130dBm, >6 SVs)
Velocity Accuracy	0.08 m/s (speed) (68%@30m/s)
Dynamic Attitude Accuracy	0.3° Heading 0.4° Pitch 0.6° Roll (68%@30m/s)
Position Error w/o GNSS, 3Km travel	10% distance travelled w/ UDR
Time Pulse Signal Accuracy	RMS 30 ns 99% 60ns
Time Pulse Frequency	0.25 Hz ~ 10 MHz
Time To First Fix (TTFF) Hot start Cold start	Autonomous, GPS + GLONASS + Galileo + BeiDou 2 sec 24 sec (50% -130dBm)

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Sensitivity (Autonomous)	GPS+GLONASS+Galileo+BeiDou -147dBm (acquisition) -159dBm (tracking & navigation)
Max. Navigation. Update Rate	50Hz For 50Hz mode, default NMEA sentence ● RMC, GGA
Max. Altitude	80,000 m
Max. Velocity	< 500m/sec or 1,800 km/hr
Max. Dynamics	≦ 4 g
Protocol Support	NMEA 4.11 (default), 4.10, 4.0, 2.3, and 2.1. UART N,8,1; 4800~921600 bps, default: 115200 bps Priority NMEA up to 50Hz: RMC, VTG, GNS, GGA, GLL Non-priority NMEA up to 20Hz: GSA, GSV, GST, ZDA

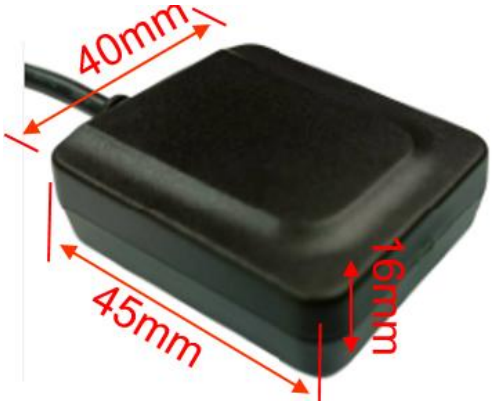
+: according to GNSS IC spec

Electrical Data

Power Supply	3.3 ~ 5.5 VDC
Power Consumption	52mA/average tracking (USB)
Protocols	NMEA, u-blox Binary

Environmental Data

Operating temperature	-40 ~ 85℃ except battery: -20~60℃
Storage temperature	-40 ~ 85℃ except battery: -20~60℃
Operating humidity	5% ~ 95% non-condensing
Waterproof	IPX7



Other Data

Cable Length (Default)	1.5m for GR-8018U 3m for GR-8018R 1m for GR-8018T
Dimension (mm)	40 x 45 x 18
Weight	103.4g GR-8018R (3m)
Fixing	Strong magnet in the bottom
LED	Amber

Interfaces

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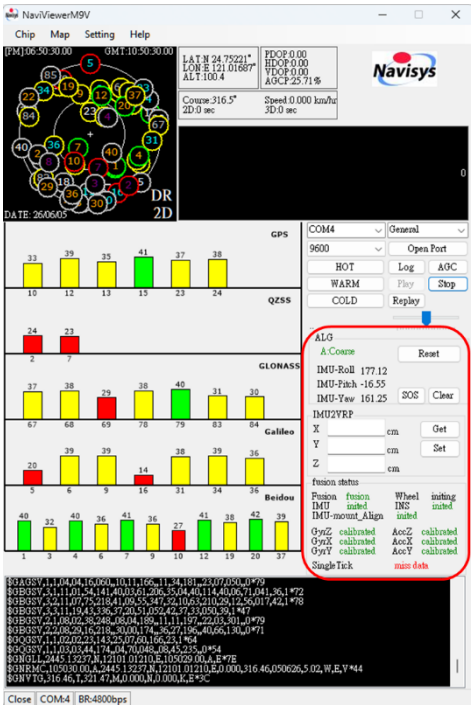
GR-8018R/T	GR-8018U
	
	
Mini-Din 6-pin PS/2, Male Plug	USB Type A, Male Plug

Application

The accuracy of the 50Hz position update is enhanced with the help of UDR. Before using it, UDR calibration is strongly suggested as described below.

1. Drive to an open area, such as a parking lot, with good GNSS signal conditions. Stay stationary until a reliable GNSS fix can be achieved for at least 3 minutes.
2. Drive a figure-of-eight pattern 3 times, or equivalently do a series of approximately 10 left and right turns (at least 90 degrees), at a minimum speed of 30 km/h.
3. Drive straight for at least 100 meters at a minimum speed of 40 km/h.

- If do the test with NaviViewerM9V,



The calibration data is displayed within the highlighted box in the image above.



ALG is abbreviated for alignment. Alignment defines the rotation from the installation-frame to the GR-8018 internal IMU-frame in angles for yaw, roll, and pitch. As the alignment is well-calibrated (from Coarse to Fine), the vehicle moving information could be best derived based

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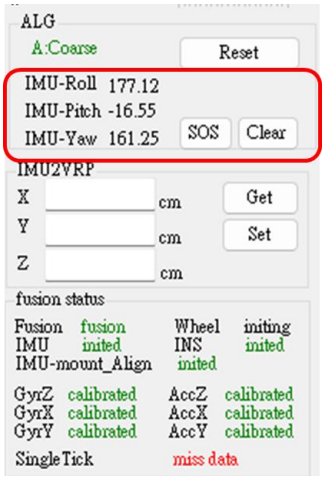
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on the data provided by IMU. Instead of manual setting, the default is to discover the alignment data automatically during calibration.

INS is abbreviated for Inertial Navigation System. It is initialized when the fusion of IMU and GNSS is completed and could be used for navigation.

GR-8018 does not implement the ADR function and thus there is no wheel tick data input. **Wheel** state would always be **initing** and **Single Tick** shows miss data.

SOS Function



The purpose of SOS is to save dead-reckoning (DR) calibration data. Click "SOS" to save the data, or click "Clear" to delete it.

- "SOS" would save calibration data as a file internally. On every power-on, if such a file exists, the saved calibration data will be restored. This is a good alternative to a backup battery for retaining calibration data, especially in cases of extended power-off periods where the backup battery may be drained.
- It is suggested to save calibration data on every power-off, so that correct calibration and position data will be used on the next power-on.

Road Test

Thanks to the 50Hz high update rate, the details of a turn curve is clearly presented as shown by picture below.



Indicative Indoor UDR Test

Drive into the indoor MingChih parking tower. Drive up to second floor along the outer rectangle and then drive down along the inner rectangle as shown by picture below. Length of indoor path is about 400m. The indoor log path roughly matches the real path with a few deviations because of error introduced by travelling.



Firmware Option:

Option	Update Rate	Settings
A	50Hz	Baud: 115200bps, 50Hz for GGA, RMC 1Hz for GLL, VTG, GSA, GSV
B	1Hz	Baud: 115200bps, 1Hz for GGA, RMC, GLL, VTG, GSA, GSV

Ordering Information

Pin	GR-8018R	GR-8018T	GR-8018U
1	GND	GND	VDD 5V
2	VCC	VCC	D-
3	TX-RS232	TXD-TTL	D+
4	RX-RS232	RXD-TTL	GND
5	1PPS-TTL	1PPS-TTL	-
6	-	-	-

Pin	Name	Function	I/O
1	GND VDD 5V	Ground USB 5V power supply	Input
2	VCC D-	Non-USB power supply USB D-	Input I/O
3	TXD-TTL TX-RS232/ D+	TTL level serial data out from GPS RS232 level serial data out from GPS USB D+	Output Output I/O
4	RXD-TTL RX-RS232	TTL level serial data into GPS RS232 level serial data into GPS	Input Input
5	1PPS-TTL	TTL level 1PPS signal	Output
6	-	-	-

* MOQ-based customizations are welcome.
* For non-standard demand (12V/24V power supply, connector, cable length, baud rate, update rate etc.), please specify them when ordering.
*This document is subject to change without notice.

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