GR-905, GNSS RTK / CLAS

Helical Smart Antenna

Supporting DroneCAN or UART

✓ ArduPilot / PX4
✓ DroneCAN

Overview

Thanks to the lightweight of helical antennas, they are widely used in weight-sensitive devices, such as drones.

Integrating L1/L2/L6 helical antenna, RTK/CLAS-capable GNSS engines, backup battery, IP67 housing, and all necessary circuits, GR-905 is a plug-and-play GNSS smart antenna supporting cm-level positioning accuracy.

Moving baseline provides accurate attitude (heading/pitch/roll) data even without external RTCM calibration data. It could be easily implemented by two GR-905 devices acting as moving base and rover.

Acting as a rover, it provides cm-level accurate positioning when calibrated by RTK base or the Japanese free QZSS CLAS (centimeter-level augmentation service) satellite service. Acting as an RTK base, it provides RTCM calibration data.

GR-9050/9055 are DroneCAN-compatible. It provides reliable CAN-bus communication. No long wiring to the flight control, just connect GR-9050/9055 to the nearest CAN connector to talk to the flight control. Simple wiring makes the application more robust and reliable. Shorter cable also means less weight. An optional CAN terminating resistance could be customized when ordering.

For devices requesting UART interface, GR-9051/GR-9056 are the perfect alternatives for RTK/CLAS support.

Compass is also available as an option

In addition to IP67, the internal circuits are protected from water to work in high sky low-temperature environment.

There are 4 screw holes at the bottom. Fix it directly to the target or via a converting plate. That is to say, fix a converting plate to the 4 bottom screw holes first and then fix the converting plate to the target, e.g. a drone.

A cable running from the bottom or lateral, could be customized to meet different cable length and connector demands. The default is a 1m cable with a JWPF waterproof connector.

Applications

- Drones
- Radar systems
- Autonomous vehicles
- Heavy machine navigation
- Industrial navigation and tracking
- Construction engineering
- Precise farming: planting, irritation, fertilization, harvesting etc.

Features

- *Lightweight all-in-one GNSS helical smart antenna*
- *Communication options*
  - *CAN bus, DroneCAN-compliant*
  - *UART*
- *ArduPilot-compliant centimeter positioning*
  - *RTK base or rover*

- *CLAS rover*

- *Moving baseline support*
- *Powered by high-performance components*
  - *u-blox ZED-F9P dual-band GNSS receiver*
  - *u-blox NEO-D9C QZSS correction service receiver (CLAS variants only)*
  - *STM32L471RGT (DroneCAN variants only)*
- *Supported GNSS Constellations*
  - *GPS: L1C/A, L2C*
  - *GLONASS: L1OF, L2OF*
  - *Galileo: E1-B/C, E5b*
  - *BeiDou: B1I, B2I*
- Supported Augmentation Systems
  - QZSS: *L1 C/A, L1S, L2C, L6*
  - SBAS (WAAS, EGNOS, MSAS, GAGAN)
- High sensitivity[+]:
  - F9P: -167dBm tracking/-148dBm acquisition
  - D9C: Hot start: -154 dBm/Cold start: -137 dBm
- Up to 7Hz update rate for quad-GNSS constellation
- RTK convergence in 10 sec for multi-GNSS.
- Spoofing detection / monitoring
  - Multiple constellations should be enabled.
- Jamming / interference indicator
  - For continuous wave (narrow-band) jammers/interference only
- Satellite navigation data sub-frame broadcast message available
- Optional CAN bus terminating resistor
- Low speed (250kbps) CAN option available
- Optional compass (±8 Gauss, 3-axis)
  - Communicate via CAN bus for CAN model
  - Communicate via I2C for non-CAN model
- IP67 waterproof
- Water-protected circuit board
- Mounting by 4 screw holes in the bottom, vibration-resistant.
- Cable running from bottom or lateral w/ customized length and connector.

Technical Specifications

Receiver Performance Data[+] -

u-blox ZED-F9P

Supported GNSS Constellations	GPS/SBAS/QZSS: (MHz) L1 C/A (1575.42), L2C (1227.60) GLONASS: L1OF (1602+k*0.5625, k= -7,…,5,6), L2OF (1246+k*0.4375, k= -7,…,5,6), Galileo: E1-B/C (1575.42), E5b (1207.140) BeiDou: B1I (1561.098) B2I (1207.140)
Position Accuracy (24 hours static)	Horizontal: CLAS: 4 cm CEP SBAS: 1 m CEP PVT: 1.5 m CEP Vertical: CLAS: 8 cm R50
Velocity Accuracy	<0.05 m/s (speed) GPS+GLONASS/BDS <0.4° (heading) GPS+GLONASS/BDS (50% @ 30 m/s for dynamic operation)
Time Pulse Signal	0.25Hz...10MHz RMS: 30ns, 99%: 60ns
Time To First Fix (TTFF) Hot start Aided start Cold start	Autonomous (All at -130dBm) 2sec (GPS+Glonass+Galileo+BeiDou) 2sec (GPS+Glonass+Galileo+BeiDou) 25sec (GPS+Glonass+Galileo+BeiDou)
Sensitivity	GPS+Glonass+Galileo+BeiDou

	Acquisition: -148 dBm Reacquisition: -160 dBm Tracking & navigation: -167 dBm
Max. Update Rate	a. GPS+Glonass+Galileo+BeiDou b. GPS+BeiDou c. GPS CLAS: 5Hz@a&b, 8Hz@c PVT: 9Hz@a, 16Hz@b, 25Hz@c RAW: 15Hz@a, 25Hz@b, 25Hz@c
Convergence Time	CLAS: < 70 s Depends on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility and geometry
Max. Altitude	80,000 m
Max. Velocity	500 m/s
Protocol Support Default Settings	NMEA 0183 up to v 4.11, ASCII GGA, GLL, GSA, GSV, RMC, VTG, TXT UBX: u-blox proprietary, binary RTCM 3.3: binary UART1 & 2: 38400bps, N-8-1 UART1: NMEA, UBX, RTCM 3.3 enabled Only NMEA output UART2: UBX
Augmentation System Support	QZSS: Support L1S SLAS Correction data broadcasted on L1 SBAS: WAAS, EGNOS, MSAS, GAGAN DGNSS: RTCM 10403.3 ● RTK rover mode messages: (RTCM) 1001~1007, 1009~1012, 1033, 1074, 1075, 1077, 1084, 1085, 1087, 1094, 1095, 1097, 1124, 1125, 1127, 1230, 4072.0 ● RTK base mode messages: (RTCM) 1005, 1074, 1077, 1084, 1087, 1094, 1097, 1124, 1127, 1230, 4072.0, 4072.1
	● SPARTN 2.0.1 rover messages SM 0-0, 0-1, 0-2, 1-0, 1-1, 1-2, 2-0
Dynamics	< 4g

u-blox NEO-D9C (CLAS variants only)

Receiver Type	u-blox D9 engine QZSS L2C and L6 receiver: L2C (1227.60 ± 5) (MHz) L6 (1278.75 ± 5) (MHz)
Time to First Frame	Hot start 3 s, Cold start 18 s
Decoding Sensitivity	90% frame rate at -136 dBm
Acquisition Sensitivity	Hot start: -154 dBm, Cold start: -137 dBm
Specification Compliance	PS-QZSS-001
Number of Concurrent L6 Reception Channels	2
Vehicle Dynamics	Dynamics ≤ 4 g Velocity 500 m/s

+ Note. According to IC Spec

Compass MMC5983MA

Full Range (Each Axis)	Total applied field: ±8 Gauss
Heading Accuracy	±1.0 degrees (using MEMSIC's proprietary software or algorithm)
Sensitivity Accuracy	16384 counts/Gauss With 18 bits operation

CAN

CAN 2.0	1 Mbps (default) or 250kbps

Environmental Data

Operating temperature	-40 ~ 85℃ (GNSS backup battery: -10~60℃)
Storage temperature	-40 ~ 85℃

Mechanical Data:

- 56.3x74x67 (mm)

- Fixing screws: 4

Interfaces:

4-Pin Connector for DroneCAN (default)

Pin	Name	Function	I/O
1	GND	Ground	Input
2	CAN_L	CAN bus -	I/O
3	CAN_H	CAN bus +	I/O
4	VCC	Power supply of 5V	Input

4-Pin Connector for UART w/o Compass

Pin	Name	Function	I/O
1	GND	Ground	Input
2	VCC	Power supply of 5V	Input
3	TXD	TTL serial data output (from GNSS)	Output
4	RXD	TTL serial data input (to GNSS)	Input

6-Pin Connector for UART w/ Compass

Pin	Name	Function	I/O
1	GND	Ground	Input
2	VCC	Power supply of 5V	Input
3	TXD	TTL serial data output (from GNSS)	Output
4	RXD	TTL serial data input (to GNSS)	Input
5	I2C_SCL	I2C clock of compass	Input
6	I2C_SDA	I2C data of compass	I/O

! Connector and cable customization available

Applications

- Heading receivers (Moving Baseline)
  - DroneCAN (MB: Moving Base, R: Rover)
    - RTK: GR-9050(MB)+GR-9050(R)
    - CLAS: GR-9055(MB)+GR-9050(R)
  - UART
    - RTK: GR-9051(MB)+GR-9051(R)
    - CLAS: GR-9056(MB)+GR-9051(R)
  - In addition to heading, installed at different locations, these attitude receivers could also be used for roll and/or pitch sensing.
- Accurate navigation
  - For RTK models, RTCM calibration data needs to be input for accurate positioning.
  - For CLAS models working in Japan, calibration data are received from QZSS satellites in the sky.

Ordering Information

GR-905XY:

X=\	RTK	CLAS
CAN	0	5
UART	1	6

GR-9050 RTK Helical Smart Antenna w/ CAN Bus

GR-9051 RTK Helical Smart Antenna w/ UART

GR-9055 CLAS Helical Smart Antenna w/ CAN Bus

GR-9056 CLAS Helical Smart Antenna w/ UART

Y options	N
Compass	-
CAN Resistor	-
Low Speed CAN	-
Lateral Wiring	-

For Y option other than N, and cable options, please specify when ordering.

*This document is subject to change without notice.