

SOFTWARE USER MANUAL

DS-IMU/GYRO V26-1



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2. About this document

2.1. Legend

The following symbols and formats will be used throughout the document.



Important

It gives you important information about the subject.
Please read carefully!



Hint

It gives you a hint or provides additional information about a subject.



Example

Gives you an example of a specific subject.

2.2. Online versions

DewesoftX® homepage

<http://www.dewesoft.com>

you can download DewesoftX® plugins when you go to: Downloads – Plugins

3. Foundation knowledge

This chapter is a learning reference that briefly covers knowledge essential to understanding DS-IMU/GYRO products and the following chapters. It explains the concepts in simple terms so that people unfamiliar with the technology may understand it.

3.1. GNSS

GNSS stands for global navigation satellite system. A GNSS consists of a number of satellites in space that broadcast navigation signals. These navigation signals can be picked up by a GNSS receiver on the earth to determine the receiver's position and velocity. For a long time the only operational GNSS was the United States GPS. However the Russian GLONASS is now fully operational with similar performance to GPS. The Chinese BeiDou is in the process of becoming operational and the European GALILEO should be operational within ten years.

GNSS is excellent for navigational purposes and provides a fairly accurate position (2.5 meters) and velocity (0.03 m/s). The main drawback of GNSS is that the receiver must have a clear signal from at least 4 satellites. GNSS satellite signals are very weak and struggle to penetrate through buildings and other objects obstructing view of the sky. GNSS can also occasionally drop out due to disturbances in the upper atmosphere.

3.2. INS

INS stands for inertial navigation system. An inertial navigation system can provide position and velocity similar to GNSS but with some big differences. The principle of inertial navigation is the measurement of acceleration, which is then integrated into velocity and then with second integration into position. Due to noise in the measurement and the compounding of that noise through the integration, inertial navigation has an error that increases exponentially over time. But on the other hand such systems have a very low relative error over short time periods, which can dramatically increase over a long period of time.

3.3. GNSS/INS

By combining GNSS and INS together in a mathematical algorithm, it is possible to take advantage of GNSS long-term accuracy/stability and INS short-term accuracy. This provides an overall enhanced position and velocity solution that can withstand short GNSS drop outs.

3.4. AHRS

AHRS stands for attitude and heading reference system. An AHRS uses accelerometers, gyroscopes and magnetometers combined in a mathematical algorithm to provide orientation, which consists of three body angles: roll, pitch and heading.

3.5. The sensor Coordinate frame

Inertial sensors have 3 different axes: X, Y and Z which determine the directions of angles and accelerations. It is very important to align the axes correctly in installation otherwise the system won't work correctly. These axes are marked on the top of the device as shown in Illustration below with the X axis pointing in the direction of the connectors (green arrow), the Z axis pointing down through the base of the unit (red arrow) and the Y axis pointing off to the right (blue arrow), which can be also presented as Right hand rule → Illustration of hand with the same color coordinate system



Image 1: Sensors coordinate frame can be presented as a right hand rule

When installed in an application the X axis should be aligned such that it points forwards and the Z axis aligned so that it points down when level.

3.6. Roll, Pitch and Heading

Orientation can be described by the three angles: Roll, Pitch and Heading, which are known as the Euler angles. They are best described with the image below.

Roll - is the angle around X axis (green arrows)	
Pitch – is the angle around Y axis (blue arrows)	
Heading – is the angle around Z axis (0 degrees is when X axis points to the North → red arrows)	

Image 2: Roll, pitch and heading

To remember in which way the orientation is positive, it's best to use the second right hand rule, which is shown by the Illustration7, where we point a thumb in the positive direction of that axis and then the direction that your fingers curl over is the positive rotation on that axis.

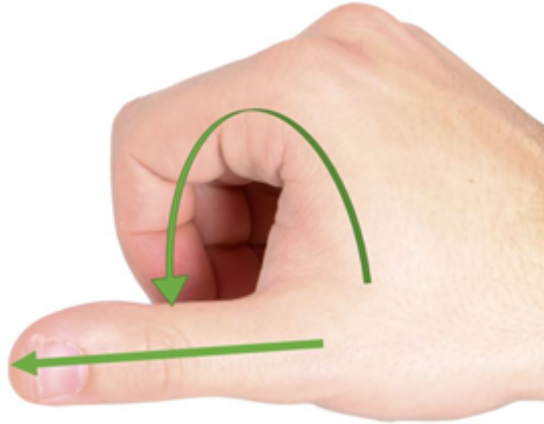


Image 3: Point a thumb in the positive direction of the axis in order to see the rotation direction

3.7. Geodetic coordinate system

The geodetic coordinate system is the most popular way of describing an absolute position on the Earth. It's made up of the angles of latitude and longitude combined with a height relative to the ellipsoid. Latitude is the angle that specifies the north to south position of a point on the Earth's surface. Longitude is the angle that specifies the east to west position of a point on the Earth's surface. The line of zero latitude is the equator and the line of zero longitude is the prime meridian. Image 4 shows how latitude and longitude angles are used to describe a position on the surface of the Earth.

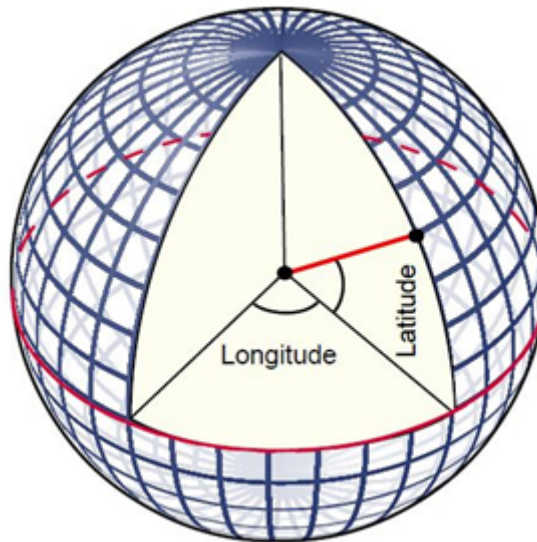


Image 4: Longitude and latitude positions presented on the Earth

On the map above we have latitude and longitude which gives the 2D point on the surface of the Earth. They are combined with height to give the 3D position on the Earth.

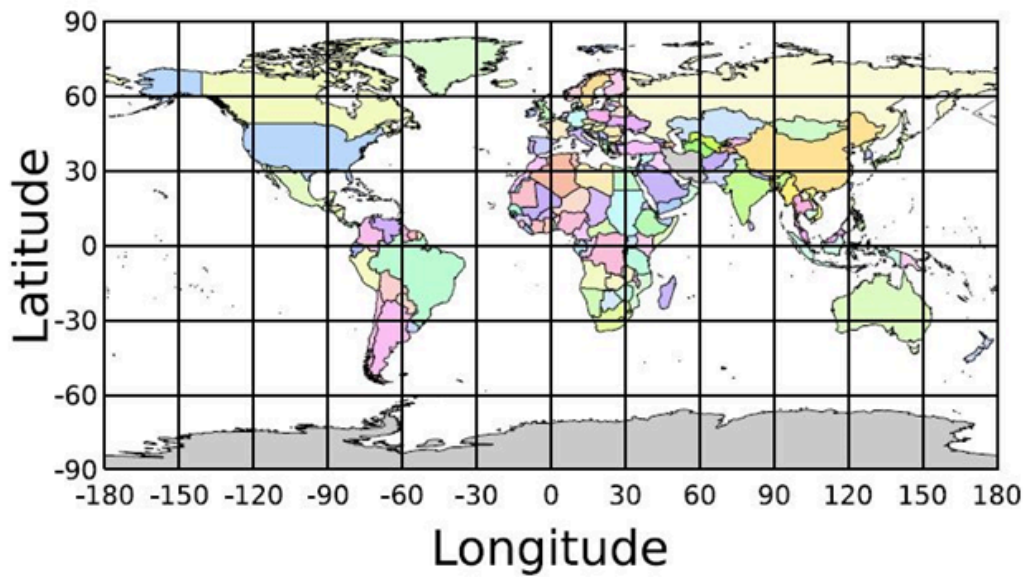


Image 5: Longitude and latitude values

Height means the height above the WGS84 reference ellipsoid. This ellipsoid is a model used to approximate sea level across the Earth, therefore the height should be considered approximately relative to sea level. Due to the approximate nature of the WGS84 model, this height will not be the same as the actual sea level --> it can vary up to 20 m.

3.8. NED coordinate frame

The NED (North, East, Down) coordinate frame is used to express velocities and relative positions. The origin of the coordinate frame can be considered the current position. From that origin, the north axis points true north and parallel to the line of latitude at that point. The east axis points perpendicular to the north axis and parallel to the line of longitude at that point. The down axis points directly down towards the center of the Earth. See the Illustration 6 for a graphical representation of the NED coordinate frame at some position on the Earth.

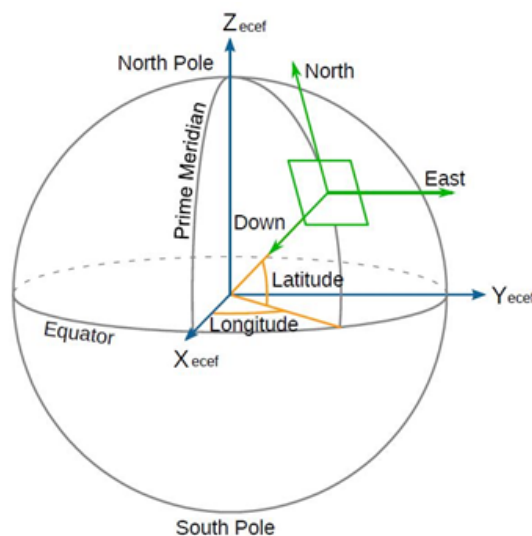


Image 6: NED coordinate frame

4. Introduction

DS-IMU-N1, DS-IMU2 and DS-IMU1 are miniature GNSS/INS & AHRS systems that provide accurate position, velocity, acceleration and orientation under the most demanding conditions.

DS-GYRO1 is a miniature orientation sensor and AHRS that provides accurate orientation under very difficult conditions.

All of them are a combination of temperature calibrated accelerometers, gyroscopes and magnetometers in a sophisticated fusion algorithm to deliver accurate and reliable orientation.

All 3 instruments can provide amazing results but they need to be set up properly and operated with an awareness of its limitations. Please read through this manual carefully to ensure success within your application.

The software is downloadable from our webpage:

www.dewesoft.com

4.1. Options

There are 4 Dewesoft inertial navigation instruments available:

- DS-IMU-N1
- DS-IMU2
- DS-IMU1
- DS-GYRO1

4.2. DS-IMU-N1

- DS-IMU-N1 is a ruggedized and reliable single antenna GNSS aided navigation system
- Combines inertial sensors together with single antenna GNSS receiver coupled in a sophisticated fusion algorithm to deliver accurate and reliable navigation and orientation
- GNSS receiver supports GPS, GLONASS, BeiDou, GALILEO, WAAS, EGNOS, MSAS, GAGAN, QZSS and Real-time kinematic --> RTK
- IP67 & MIL-STD-810G environmental protection
- Up to 100 Hz output data rate
- Connected over USB
- Fast and Easy to install

4.2.1. Scope of supply

DS-IMU-N1 is supplied in a kit that contains everything required to get started operating the system right away. It's supplied in a transport case to protect the equipment during the shipment.



Image 8: Complete DS-IMU-N1 supply package

4.2.1.1. Kit contents

- DS-IMU-N1
- 1x GPS/GLONASS/BeiDou/Galileo L1/L5 GNSS antenna with integrated 5m cable and magnetic mount
- Interface cable harness (with USB, auxiliary data port (RS232) and Sync connector)

Optional:

- Interface cable harness with additional PWR cable for powering the RF RTK module
- RF modem with RF cable + antenna
- 3G network RTK modem

4.2.1.2. Quick start

- Position the GNSS antenna in a level orientation with a clear view of the sky.
- Connect the coaxial antenna cable to the DS-IMU-N1.
- Plug the interface cable into DS-IMU-N1.
- Download DewesoftX® software and the plugin from www.dewesoft.com.
- Install the driver for RS232 converter [Link](#).
- Run DewesoftX® software --> go to Settings --> Devices --> Click on the plus button and under Plugins you will find the DS-IMU option.

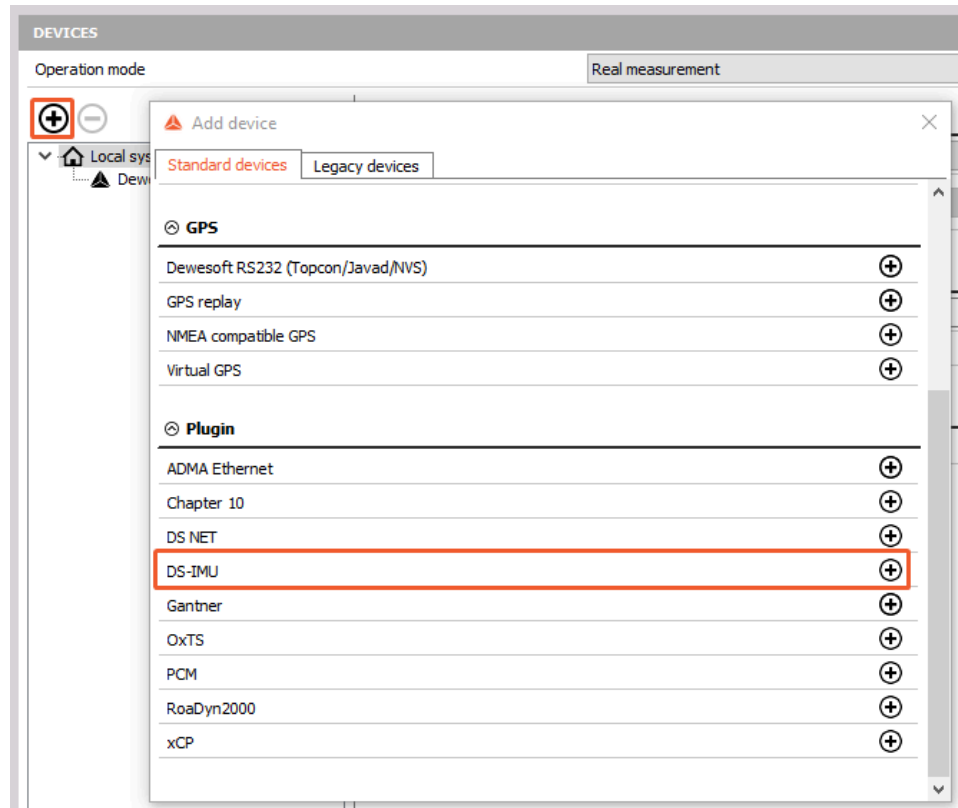


Image 9: Add DS-IMU as a device

- The device should be automatically recognized, if not press the Rescan device.

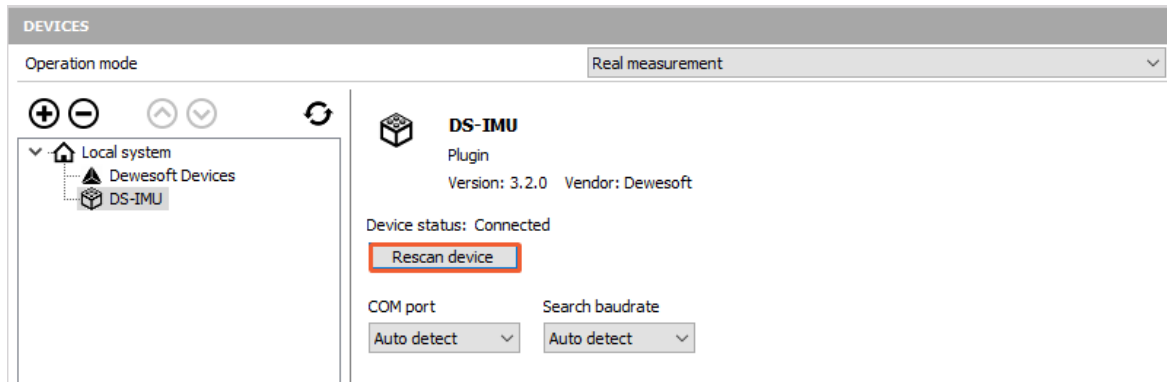


Image 10: If the device is not automatically recognized, press the Rescan device button

- After recognizing the device press OK.
- In Ch. setup define the GNSS antenna offset from the Inertial unit and upload the configuration to the device.
- Initialization of the Kalman based algorithm is done with driving in a straight line for a few seconds with a velocity over 1.15 m/s.
- The device will send the data all the time, so you can watch them already in the Channel setup.

DewesoftX 2026.1 - Trial Version

Measure Analyze Setup files Ch. setup Measure

Store Save Save as Storing Analog in CAN DS-IMU Math Polygon TestBed More... Remove

Device setup equals this setup.

Connected Healthy Upload to device Download from device Restart device Disconnect

Data Mounting Configuration

Rate 100 Hz Velocity unit km/h ☐ Reset distance on start ☐ Detect standstill

☐ Store raw data log Acc. unit g



+	Used	C	Channel name	Units	Min	Values	Max	Scale	Offset	Zero
--- Satellite channel ---										
	Used		Number of satellites	-	0,00	AVG 26,000 (-)	100,00	1,00	0,00	Zero
--- Navigation channel ---										
	Used		Navigation	-	0,00	46°10,313' N 15°03,309' E	0,00	1,00	0,00	Zero
--- System state channels ---										
	Used		Time	-	-INF	09.02.2026 13:53:01	INF	1,00	0,00	Zero
	Used		System status	-	-INF	AVG 10,000 (-)	INF	1,00	0,00	Zero
	Used		GNSS status	-	-INF	AVG 2,000 (-)	INF	1,00	0,00	Zero
	Used		Latitude	'	-540...	46°10,313' N	5400...	1,00	0,00	Zero
	Used		Longitude	'	-108...	15°03,309' E	1080...	1,00	0,00	Zero
	Used		Altitude	m	0,00	AVG 355,828 (m)	1000...	1,00	0,00	Zero
	Used		Height	m	0,00	AVG 402,887 (m)	1000...	1,00	0,00	Zero
	Used		Velocity North	km/h	0,00	AVG -0,011 (km/h)	1800...	1,00	0,00	Zero
	Used		Velocity East	km/h	0,00	AVG 0,037 (km/h)	1800...	1,00	0,00	Zero
	Used		Velocity Down	km/h	0,00	AVG -0,059 (km/h)	1800...	1,00	0,00	Zero
	Used		Velocity Total	km/h	0,00	AVG 0,071 (km/h)	1800...	1,00	0,00	Zero
	Used		Software distance	m	0,00	AVG 0,757 (m)	1000...	1,00	0,00	Zero
	Used		Velocity X	km/h	0,00	AVG -0,038 (km/h)	1800...	1,00	0,00	Zero
	Used		Velocity Y	km/h	0,00	AVG -0,011 (km/h)	1800...	1,00	0,00	Zero
	Used		Velocity Z	km/h	0,00	AVG -0,059 (km/h)	1800...	1,00	0,00	Zero
	Used		Body acceleration X	g	-16,32	AVG 0,001 (g)	16,32	1,00	0,00	Zero
	Used		Body acceleration Y	g	-16,32	AVG 0,000 (g)	16,32	1,00	0,00	Zero
	Used		Body acceleration Z	g	-16,32	AVG 0,000 (g)	16,32	1,00	0,00	Zero
	Used		G force	g	0,00	AVG 1,000 (g)	16,00	1,00	0,00	Zero
	Used		Roll	deg	-90,00	AVG 0,431 (deg)	90,00	1,00	0,00	Zero

Image 11: You can preview the device data inside Channel setup

4.2.2. Specifications

4.2.2.1. Mechanical drawings

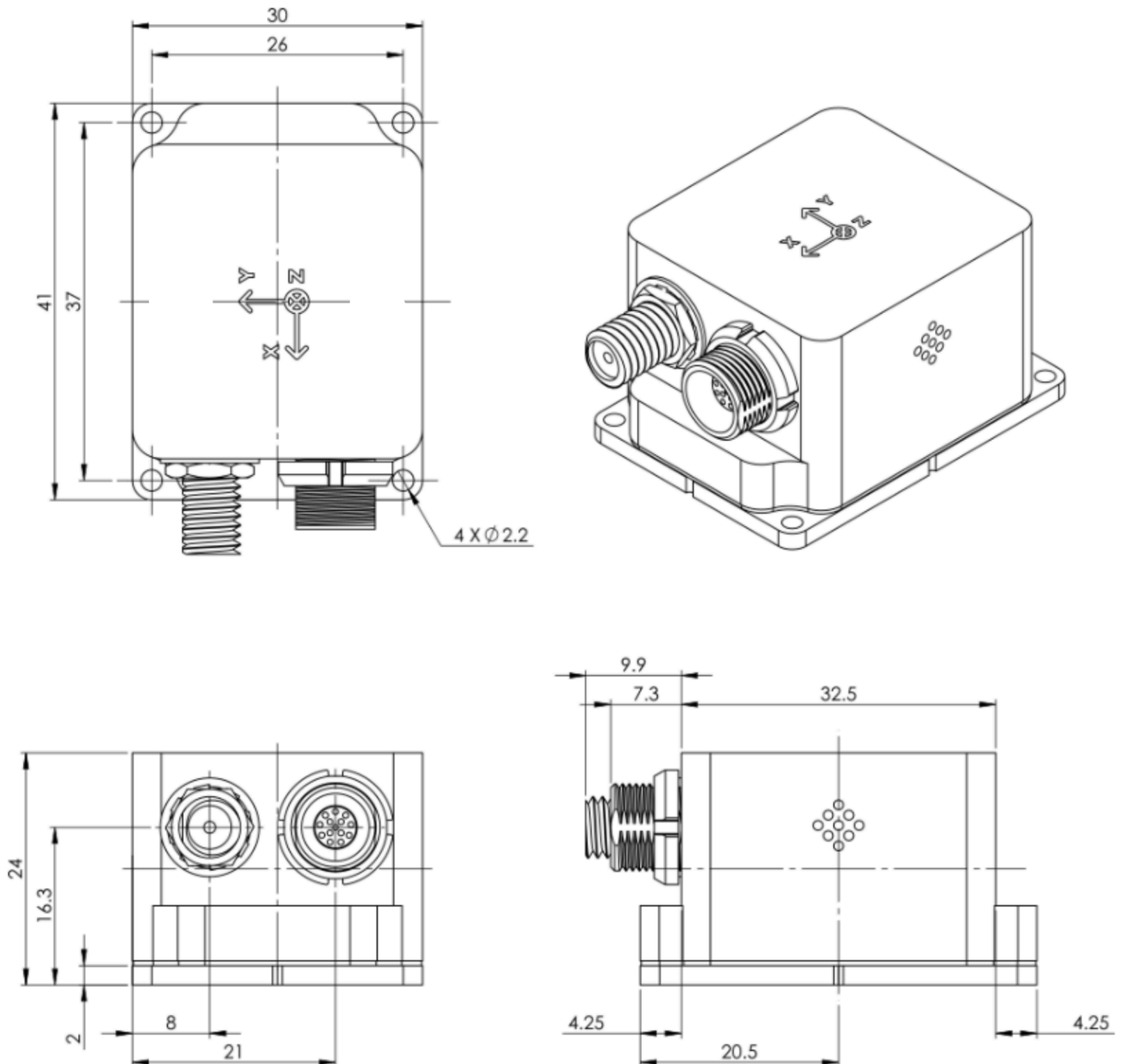


Image 12: Drawing from front view

4.2.2.2. Navigation specifications

Parameter	Value
Horizontal position accuracy	1.5 m
Vertical position accuracy	2.0 m
Horizontal position accuracy (SBAS)	0.7 m
Horizontal position accuracy (SBAS)	0.8 m
Horizontal position accuracy (RTK) *1	0.02 m
Vertical position accuracy (RTK) *1	0.03 m
Velocity accuracy	0.05 m/s
Roll & Pitch accuracy (static)	0.1 °
Heading accuracy (dynamic with GNSS)	0.2 °
Heading accuracy (dynamic with only magnetometer)	0.8 °
Slip angle accuracy	0.2 °
Orientation range	Unlimited
Hot start time	< 5 s
Internal filter rate	400 Hz
Output data rate	Up to 100 Hz

*1 with base station and optional RF modem

*All navigation specifications are valid in open sky conditions

4.2.2.3. Sensor specifications

Parameter	Accelerometers	Gyroscopes	Magnetometers	Pressure
Range (dynamic)	2 g 4 g 16 g	250 °/s 500 °/s 2000 °/s	8 G	30 to 125 kPa
Noise density	100 µg/√Hz	0.004 °/s/√Hz	210 µg/√Hz	0.56 Pa/√Hz
Non-linearity	< 0.05 %	< 0.05 %	< 0.08 %	-
Bias stability	< 20 µg	< 0.2 °/s	< 0.09 %	< 100 Pa
Scale factor stability	< 0.06 %	< 0.05 %	< 0.05 %	-
Cross-axis alignment error	< 0.05 °	< 0.05 °	< 0.05 °	-
Bandwidth	400 Hz	400 Hz	110 Hz	50 Hz

4.2.2.4. GNSS Specifications

Parameter	Value
Supported navigation systems	GPS L1C/A, L5; GLONASS L1OF; Galileo E1B/C, E5a; BeiDou B1I, B2a; NavIC L5 SPS
Supported SBAS systems	WAAS, EGNOS, MSAS, GAGAN, QZSS
Update rate	Up to 25 Hz
Hot start first fix	3 s
Cold start first fix	27 - 37 s
Horizontal position accuracy	1.5 m
Horizontal position accuracy (SBAS)	1.0 m
Horizontal position accuracy (RTK) *1	0.02 m
Velocity accuracy	0.05 m/s
Timing accuracy	30 ns
Acceleration limit	4 g
Velocity Limit	500 m/s
Altitude Limit	80,000 m

*1 with base station and optional RF modem

4.2.2.5. Hardware specifications

Parameter	Value
Operating voltage	5 to 36 V
Input protection	- 40 to 60 V
Power consumption	0.7 Watts -> 140 mA @ 5 V
Hot start battery endurance	> 10 years
Operating temperature	- 40 °C to 85 °C
Environmental sealing	IEC 60529 IP67
Shock limit	150 g for 6 msec (MIL-STD-810H 516.8)
Dimensions	30 x 41 x 24 mm
Weight	43 grams
Interface	USB

Peripheral interface	1x GPIO and 1x NMEA/RTK
GPIO Level	5V or RS232

4.2.2.6. Electrical specifications

Parameter	Minimum	Typical	Maximum
Power supply			
Input supply voltage	5 V		36 V
Input protection range	- 40V		60 V
RS 232			
Tx voltage low		-5.4 V	-5 V
Tx voltage high	5 V	5.4 V	
Tx short circuit current		±30 mA	
Rx voltage low	0.6 V	1.2 V	
Rx voltage high		1.5 V	2.0 V
GPIO			
Output voltage low	0 V		0.5 V
Output voltage high	3.8 V		5 V
Input voltage	-15 V		20 V
Input threshold low			1.5 V
Input threshold high	3.5 V		
Output current	-15 mA		15 mA
GNSS Antenna			
Active antenna supply voltage		3.2 V	3.3 V
Antenna supply current			100 mA

4.2.2.7. Power consumption

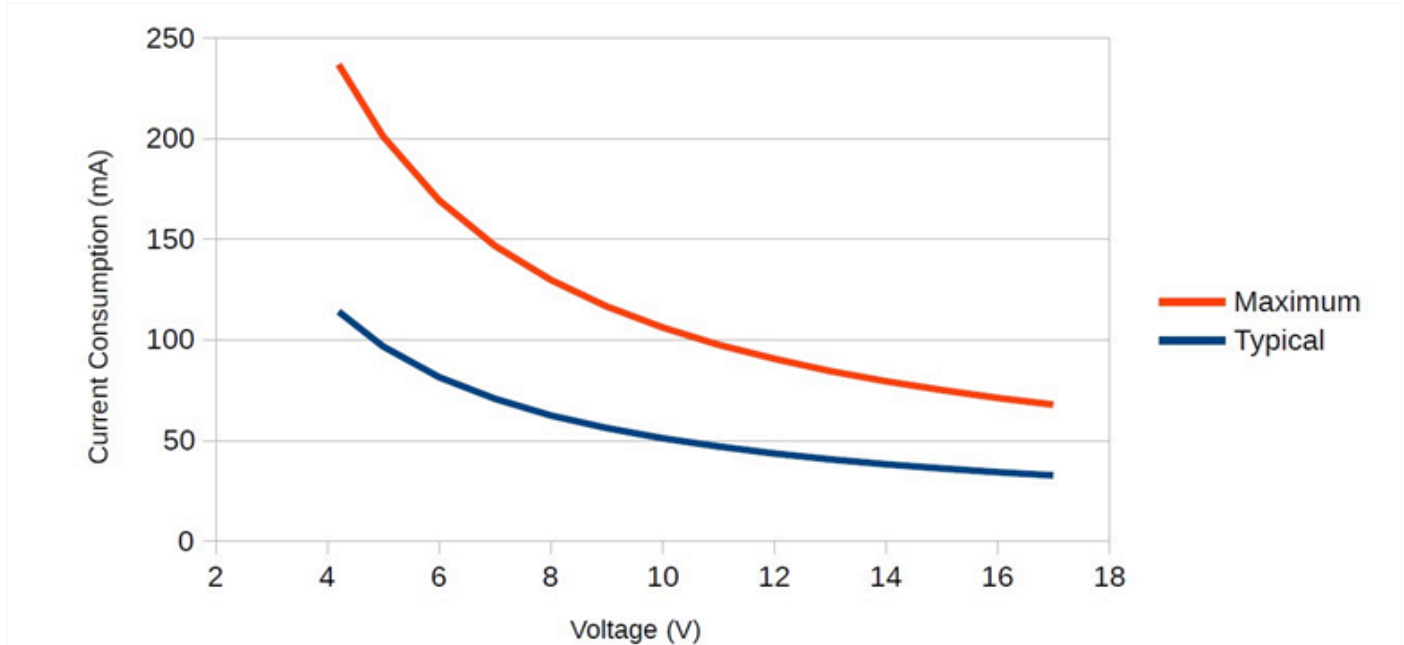


Image 13: Maximal and typical power consumption diagram

4.3. DS-IMU2

- DS-IMU2 is a ruggedized and reliable GPS aided navigation system
- Combines inertial sensors together with dual antenna GNSS receiver coupled in a sophisticated fusion algorithm to deliver accurate and reliable navigation and orientation
- GNSS receiver supports GPS, GLONASS, BeiDou, GALILEO, WASS, EGNOS, Gagan and Real-time kinematic --> RTK
- IP67 & MIL-STD-810G environmental protection
- Up to 500 Hz output data rate
- Connected over USB
- Fast and Easy-to-install



Image 7: DS-IMU2

4.3.1. Scope of supply

DS-IMU2 is supplied in a kit that contains everything required to get started operating the system right away. It's supplied in a rugged transport case to protect the equipment during the shipment.



Image 8: Complete DS-IMU2 supply package

4.3.1.1. Kit contents

- DS-IMU2

- 2x GPS/GLONASS/BeiDou/Galileo L1/L2/L5 GNSS antenna with 5/8-11 surver mounts
- 2x 5m GNSS antenna cable
- 2x Magnetic holder with antenna mounting
- Interface cable harness (with USB, Power and Sync connector)
- Optional: RF modem with RF cable + antenna

4.3.1.2. Quick start

- Position the two GNSS antennas in a level orientation with a clear view of the sky. The primary antenna should be positioned directly forwards of the secondary antenna with separation of at least 0.5 meters.
- Connect the coaxial cables between the antennas and DS-IMU2.
- Plug the interface cable into DS-IMU2.
- Plug the USB cable into your computer and 2 pin LEMO connector to power
- Download DewesoftX® software and the plugin from www.dewesoft.com.
- Install the driver for RS232 converter
- Run DewesoftX® software --> go to Settings --> Devices --> Click on the plus button and under Plugins you will find the DS-IMU option.

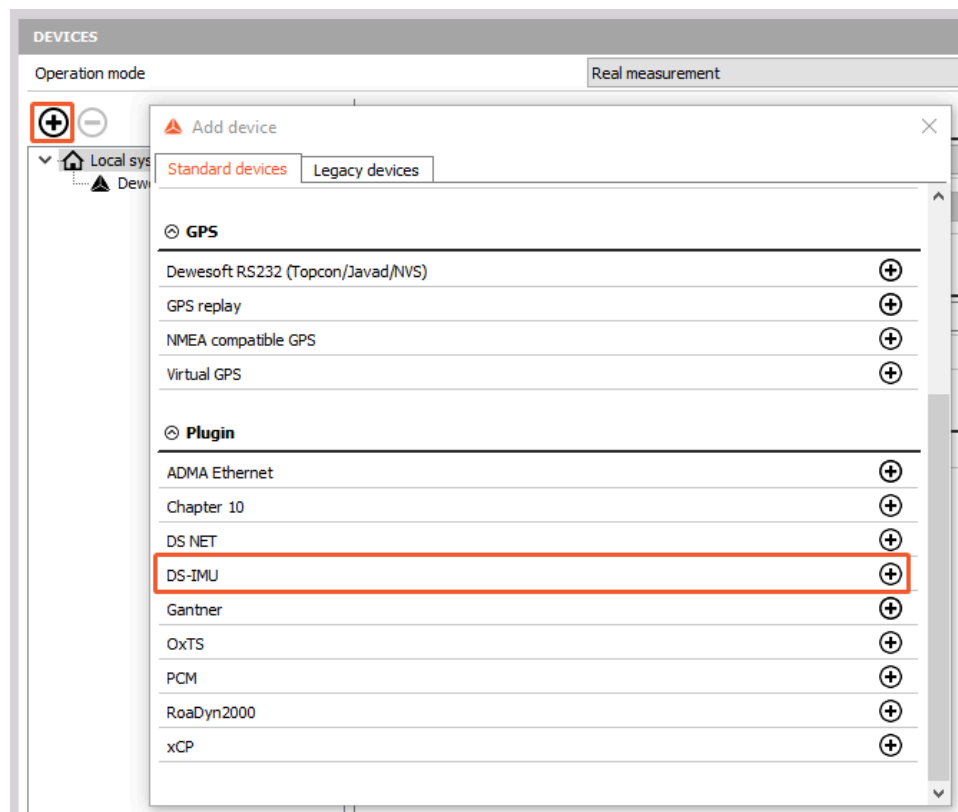


Image 9: Add DS-IMU as a device

- The device should be automatically recognized, if not press the Rescan device.

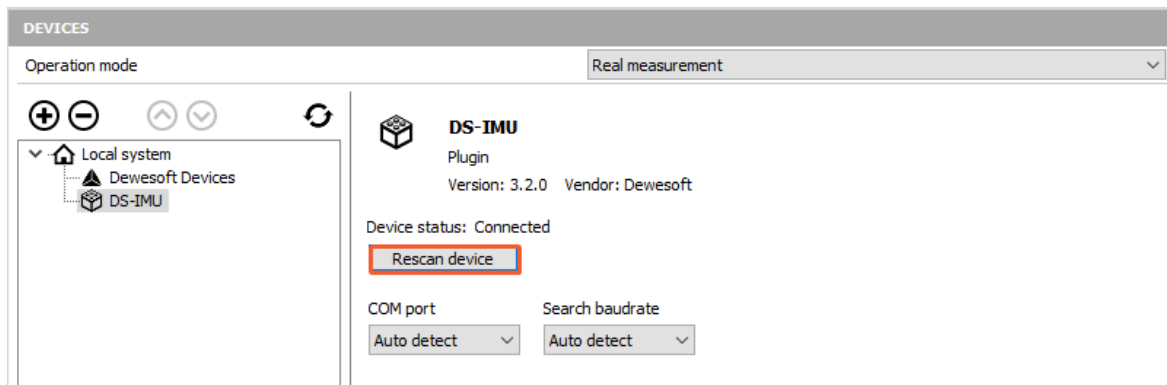


Image 10: If the device is not automatically recognized, press the Rescan device button

- After recognizing the device press OK.
- The dual antenna heading will take a short time to initialize. The progress can be seen in the top of the DS-IMU plugin window
- Device will send the data all the time, so you can watch them already in the Channel setup.

	+	Used	C	Channel name	Units	Min	Values	Max	Scale	Offset	Zero
--- Satellite channel ---											
Unused				Number_of_satellites	-	0.00	3.000 (-)	100.00	1.00	0.00	Zero
--- Navigation channel ---											
Unused				Navigation	-	0.00	46°32.256' N 14°59.132' E	0.00	1.00	0.00	Zero
--- System state channels ---											
Unused				Time	-	-INF	5.8.20 07:37:40	INF	1.00	0.00	Zero
Unused				System_status	-	-INF	8.000 (-)	INF	1.00	0.00	Zero
Unused				GNSS_status	-	-INF	0.000 (-)	INF	1.00	0.00	Zero
Unused				Latitude	'	-540...	46°32.256' N	5400...	1.00	0.00	Zero
Unused				Longitude	'	-108...	14°59.132' E	1080...	1.00	0.00	Zero
Unused				Altitude	m	0.00	476.251 (m)	1000...	1.00	0.00	Zero
Unused				Height	m	0.00	476.251 (m)	1000...	1.00	0.00	Zero
Unused				Velocity_North	m/s	0.00	0.000 (m/s)	500.00	1.00	0.00	Zero
Unused				Velocity_East	m/s	0.00	0.000 (m/s)	500.00	1.00	0.00	Zero
Unused				Velocity_Down	m/s	0.00	0.000 (m/s)	500.00	1.00	0.00	Zero
Unused				Velocity_Total	m/s	0.00	0.000 (m/s)	500.00	1.00	0.00	Zero
Unused				Software_distance	m	0.00	0.000 (m)	1000...	1.00	0.00	Zero
Unused				Velocity_X	m/s	0.00	0.000 (m/s)	500.00	1.00	0.00	Zero
Unused				Velocity_Y	m/s	0.00	0.000 (m/s)	500.00	1.00	0.00	Zero
Unused				Velocity_Z	m/s	0.00	0.000 (m/s)	500.00	1.00	0.00	Zero
Unused				Body_acceleration_X	m/s²	-160.00	0.000 (m/s²)	160.00	1.00	0.00	Zero
Unused				Body_acceleration_Y	m/s²	-160.00	0.000 (m/s²)	160.00	1.00	0.00	Zero
Unused				Body_acceleration_Z	m/s²	-160.00	0.000 (m/s²)	160.00	1.00	0.00	Zero
Unused				G_force	g	0.00	0.000 (g)	16.00	1.00	0.00	Zero
Unused				Roll	deg	-90.00	-0.628 (deg)	90.00	1.00	0.00	Zero
Unused				Pitch	deg	-90.00	-0.388 (deg)	90.00	1.00	0.00	Zero
Unused				Heading	deg	0.00	219.531 (deg)	360.00	1.00	0.00	Zero

Image 11: You can preview the device data inside Channel setup



Important recommendation

We do **not** recommend using a magnetometer on a metal car with a SINGLE antenna option on IMU2! When using a dual antenna the magnetometer is automatically enabled and magnetic calibration is executed automatically!

4.3.2. Specifications

4.3.2.1. Mechanical drawings

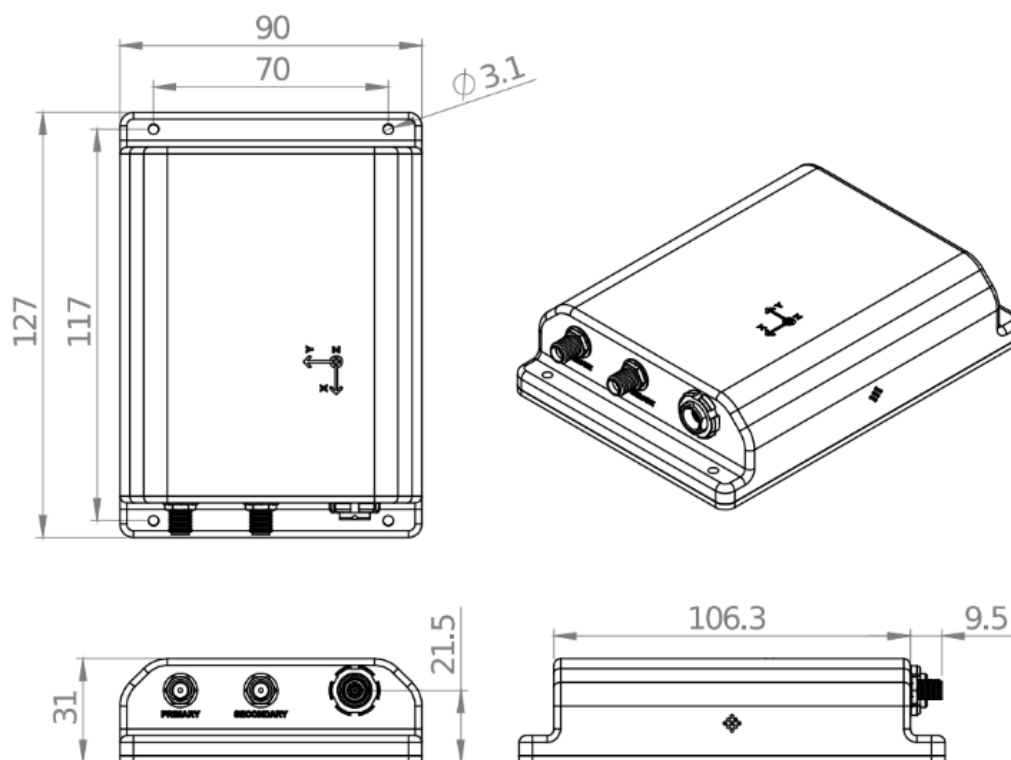


Image 12: Drawing from front view

4.3.2.2. Navigation specifications

Parameter	Value
Horizontal position accuracy	1.2 m
Vertical position accuracy	2.0 m
Horizontal position accuracy (SBAS)	0.5 m
Horizontal position accuracy (SBAS)	0.8 m
Horizontal position accuracy (Omnistar) *1	0.1 m
Vertical position accuracy (Omnistar) *1	0.2 m
Horizontal position accuracy (RTK) *2	0.008 m
Vertical position accuracy (RTK) *2	0.015 m
Velocity accuracy	0.01 m/s
Roll & Pitch accuracy (static)	0.1 °
Heading accuracy (static)	0.1 °
Roll & Pitch accuracy (dynamic)	0.15 °
Heading accuracy (dynamic)	0.1 °
Slip accuracy	0.1 °
Orientation range	Unlimited
Hot start time	500 ms
Internal filter rate	1000 Hz
Output data rate	Up to 500 Hz

*1 can be purchased at Omnistar

*2 with base station and optional RF modem

*All navigation specifications are valid in open sky conditions and with 2m baseline for dual antenna

4.3.2.3. Heading accuracy

Antenna separation	Accuracy
1 m	0.1 °
2 m	0.07 °

4.3.2.4. Sensor specifications

Parameter	Accelerometers	Gyroscopes	Magnetometers	Pressure
Range (dynamic)	2 g 4 g 16 g	250 °/s 500 °/s 2000 °/s	2 G 4 G 8 G	10 to 120 kPa
Noise density	150 µg/√Hz	0.009 °/s/√Hz	210 µg/√Hz	0.56 Pa/√Hz
Non-linearity	< 0.05 %	< 0.05 %	< 0.05 %	-
Bias stability	20 µg	4 °/hr	-	100 Pa/yr
Scale factor stability	< 0.05 %	< 0.05 %	< 0.05 %	-
Cross-axis alignment error	< 0.05 °	< 0.05 °	< 0.05 °	-
Bandwidth	400 Hz	400 Hz	110 Hz	50 Hz

4.3.2.5. GNSS Specifications

Parameter	Value
Supported navigation systems	GPS L1, L2, L5 GLONASS L1, L2 GALILEO E1, E5 *1 BeiDou B1, B5 *2
Supported SBAS systems	WAAS, EGNOS, MSAS, GAGAN, QZSS Omnistar HP/XP/G2 *3
Update rate	20 Hz
Hot start first fix	3 s
Cold start first fix	30 s
Horizontal position accuracy	1.2 m
Horizontal position accuracy (SBAS)	0.5 m
Horizontal position accuracy (RTK) *4	0.008 m
Velocity accuracy	0.01 m/s
Timing accuracy	20 ns
Acceleration limit	11 g

*1 additional license to purchase

*2 additional license to purchase

*3 can be purchased at Omnistar

*4 with base station and optional RF modem

4.3.2.6. Hardware specifications

Parameter	Value
Operating voltage	9 to 36 V
Input protection	- 40 to 100 V
Power consumption	220 mA @ 12 V (typical)
Hot start battery capacity	> 24 hours
Hot start battery capacity	30 mins
Hot start battery endurance	> 10 years
Operating temperature	- 40 °C to 85 °C
Environmental sealing	IP 67 MIL-STD-810G
Shock limit	2000 g
Dimensions	90 x 127 x 31 mm
Weight	285 grams
Interface	USB
Peripheral interface	1x GPIO and 1x NMEA/RTK
GPIO Level	5V or RS232

4.3.2.7. Electrical specifications

Parameter	Minimum	Typical	Maximum
Power supply			
Input supply voltage	9 V		36 V
Input protection range	- 40V		100 V
RS 232			
Tx voltage low		-5.4 V	-5 V
Tx voltage high	5 V	5.4 V	
Tx short circuit current			±60 mA
Rx voltage low	0.8 V	1.3 V	
Rx voltage high		1.7 V	2.5 V
GPIO			
Output voltage low	0 V		0.3 V
Output voltage high	4.8 V		5 V
Input voltage	-20 V		20 V
Input threshold low			1.5 V
Input threshold high	3.5 V		
Output current			5 mA
GNSS Antenna			
Active antenna supply voltage	4.8 V		5 V
Antenna supply current			100 mA

4.3.2.8. Power consumption

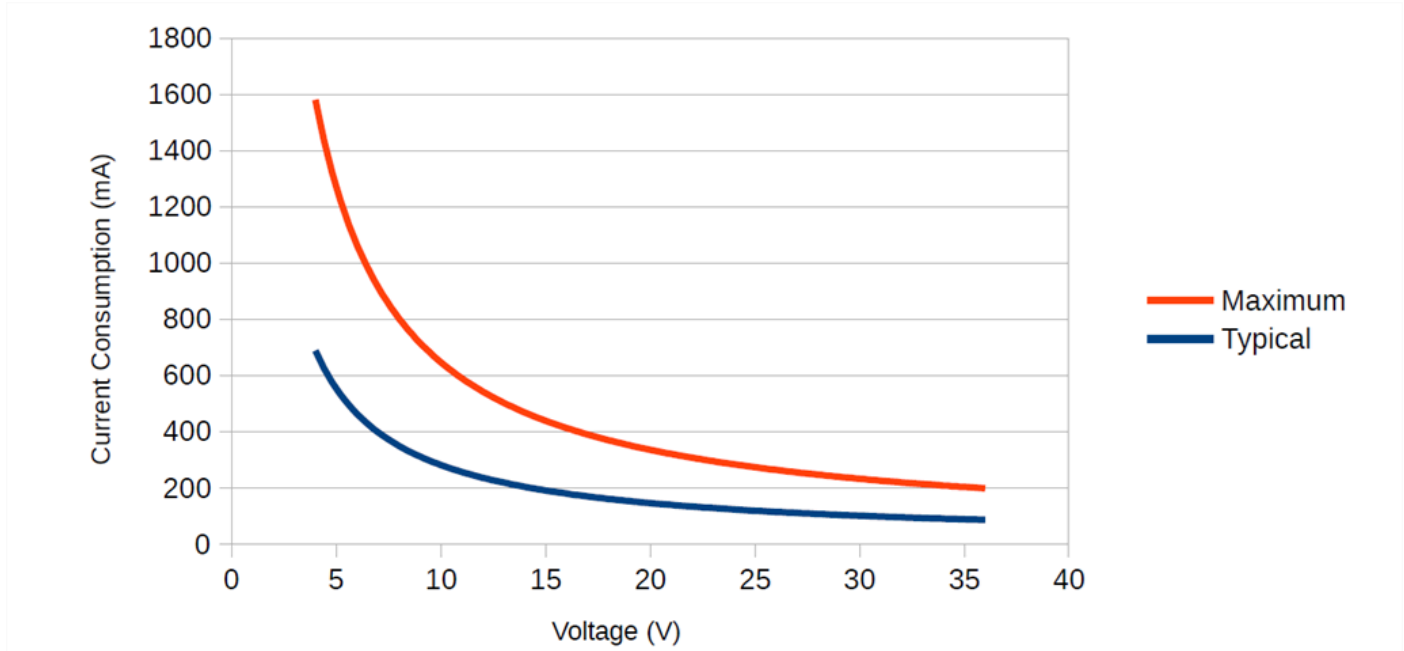


Image 13: Maximal and typical power consumption diagram

4.3. DS-IMU1

- DS-IMU1 is a miniature, ruggedized and reliable GPS aided navigation system
- Combines inertial sensors together with GNSS receiver coupled in a sophisticated fusion algorithm to deliver accurate and reliable navigation and orientation
- GNSS receiver supports GPS, GLONASS, BeiDou, GALILEO, WAAS, EGNOS and GAGAN (HW version 6.1 or earlier supports SBAS, HW v7.0 and newer supports DGNSS)
- IP67 & MIL-STD-810G environmental protection
- Up to 100 Hz output data rate
- Connected over USB
- Fast and Easy-to-install



Image 14: DS-IMU1

4.4.1. Scope of supply

DS-IMU1 is supplied in a kit that contains everything required to get started operating the system right away. It's supplied in a carry case to protect the equipment during the shipment.



Image 15: DS-IMU1 supply kit

4.4.1.1. Kit contents

- DS-IMU1
- GPS/GLONASS/BeiDou/Galileo L1/L2/L5 GNSS antenna with 5/8-11 survey mounts
- 5m GNSS antenna cable
- Interface cable harness (with USB, Power and Sync connector)
- Suction cup for sensor is available as accessory

4.4.1.2. Quick start

- Position the GNSS antenna in a level orientation with a clear view of the sky.
- Connect the coaxial cables between the antennas and DS-IMU1.
- Plug the interface cable into DS-IMU1.
- Plug the USB cable into your computer
- Download DewesoftX® software and the plugin from www.dewesoft.com.
- Install the driver for RS232 converter
- Run DewesoftX® software --> go to Settings --> Devices --> Click on the plus button and under Plugins you will find the DS-IMU option.

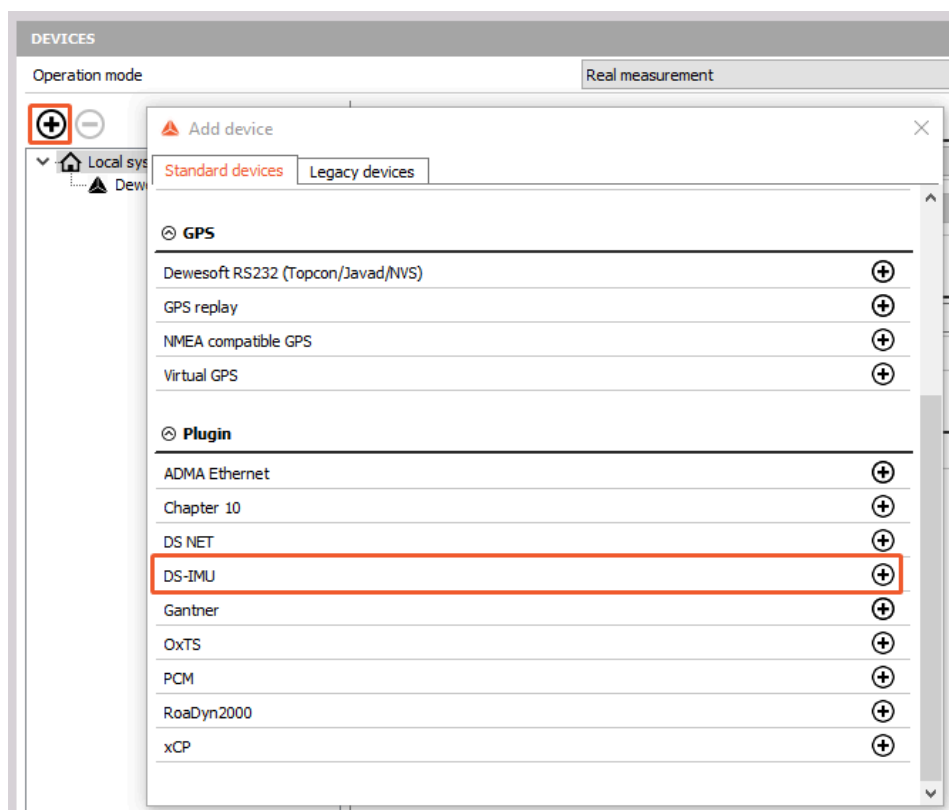


Image 16: Add DS-IMU device inside settings

- The device should be automatically recognized, if not press the Rescan device.

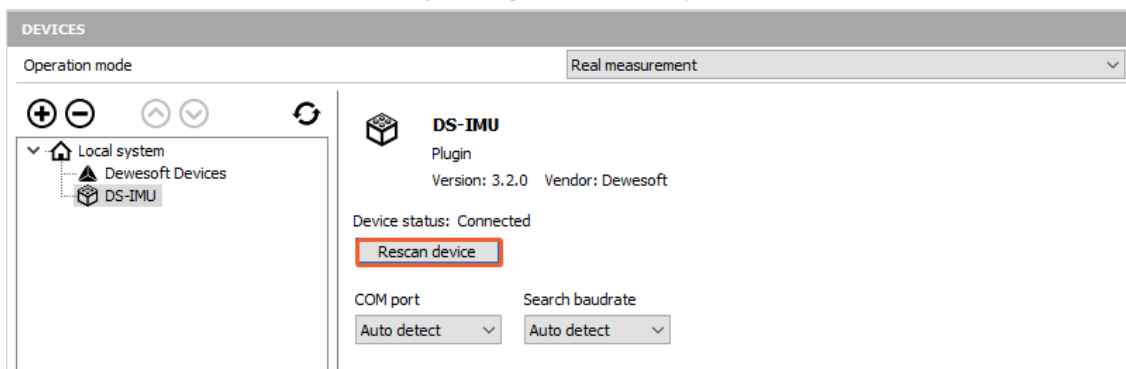


Image 17: Click on Rescan device button if the device is not automatically recognized

- After recognizing the device press OK.
- Device will send the data all the time, so you can watch them already in the Channel setup.
- Device will initialize, when the system travels at a speed of over 1.15 m/s for over 5 seconds in the straight line.

+	Used	C	Channel name	Units	Min	Values	Max	Scale	Offset	Zero
--- Satellite channel ---										
	Unused		Number_of_satellites	-	0.00	9.000 (-)	100.00	1.00	0.00	Zero
--- Navigation channel ---										
	Unused		Navigation	-	0.00	46°10.299' N 15°03.329' E	0.00	1.00	0.00	Zero
--- System state channels ---										
	Unused		Time	-	-INF	5.8.20 09:37:50	INF	1.00	0.00	Zero
	Unused		System_status	-	-INF	10.000 (-)	INF	1.00	0.00	Zero
	Unused		GNSS_status	-	-INF	1.000 (-)	INF	1.00	0.00	Zero
	Unused		Latitude	'	-540...	46°10.299' N	5400...	1.00	0.00	Zero
	Unused		Longitude	'	-108...	15°03.329' E	1080...	1.00	0.00	Zero
	Unused		Altitude	m	0.00	343.197 (m)	1000...	1.00	0.00	Zero
	Unused		Height	m	0.00	390.255 (m)	1000...	1.00	0.00	Zero
	Unused		Velocity_North	m/s	0.00	0.105 (m/s)	500.00	1.00	0.00	Zero
	Unused		Velocity_East	m/s	0.00	0.133 (m/s)	500.00	1.00	0.00	Zero
	Unused		Velocity_Down	m/s	0.00	0.008 (m/s)	500.00	1.00	0.00	Zero
	Unused		Velocity_Total	m/s	0.00	0.170 (m/s)	500.00	1.00	0.00	Zero
	Unused		Software_distance	m	0.00	3.180 (m)	1000...	1.00	0.00	Zero
	Unused		Velocity_X	m/s	0.00	0.117 (m/s)	500.00	1.00	0.00	Zero
	Unused		Velocity_Y	m/s	0.00	-0.123 (m/s)	500.00	1.00	0.00	Zero
	Unused		Velocity_Z	m/s	0.00	0.006 (m/s)	500.00	1.00	0.00	Zero
	Unused		Body_acceleration_X	m/s²	-160.00	0.028 (m/s²)	160.00	1.00	0.00	Zero
	Unused		Body_acceleration_Y	m/s²	-160.00	-0.010 (m/s²)	160.00	1.00	0.00	Zero
	Unused		Body_acceleration_Z	m/s²	-160.00	0.017 (m/s²)	160.00	1.00	0.00	Zero
	Unused		G_force	g	0.00	0.998 (g)	16.00	1.00	0.00	Zero
	Unused		Roll	deg	-90.00	-0.684 (deg)	90.00	1.00	0.00	Zero
	Unused		Pitch	deg	-90.00	-0.250 (deg)	90.00	1.00	0.00	Zero
	Unused		Heading	deg	0.00	98.121 (deg)	360.00	1.00	0.00	Zero

Image 18: DS-IMU tab preview in channel setup



4.4.2. Important recommendation

We do **not** recommend using IMU1 on a metal CAR with magnetometer enabled!

4.4.3. Specifications

4.4.3.1. Mechanical drawings

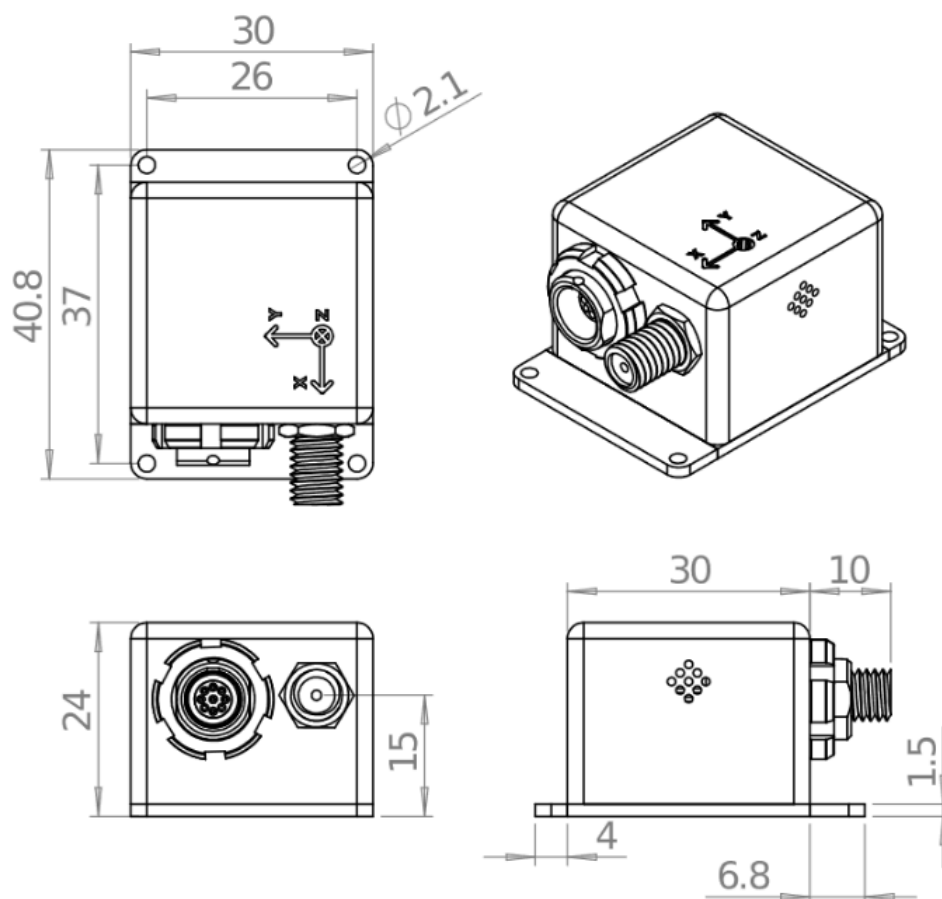


Image 19: Mechanical drawing of DS-IMU1

4.4.3.2. Navigation specifications

Parameter	Value
Horizontal position accuracy	2.0 m
Vertical position accuracy	3.0 m
Velocity accuracy	0.05 m/s
Roll & Pitch accuracy (static)	0.1 °
Heading accuracy (static)	0.5 °
Roll & Pitch accuracy (dynamic)	0.2 °
Heading accuracy (dynamic with GNSS)	0.2 °
Heading accuracy (dynamic with only magnetometer)	0.8 °

Slip accuracy	0.5 °
Orientation range	Unlimited
Hot start time	500 ms
Internal filter rate	1000 Hz
Output data rate	Up to 100 Hz

*All navigation specifications are valid in open sky conditions and with 2m baseline for dual antenna

4.4.3.3. Sensor specifications

Parameter	Accelerometers	Gyroscopes	Magnetometers	Pressure
Range (dynamic)	2 g 4 g 16 g	250 °/s 500 °/s 2000 °/s	2 G 4 G 8 G	10 to 120 kPa
Noise density	150 µg/√Hz	0.008 °/s/√Hz	210 µg/√Hz	0.56 Pa/√Hz
Non-linearity	< 0.05 %	< 0.05 %	< 0.05 %	-
Bias stability	5 mg	3 °/hr	-	100 Pa/yr
Scale factor stability	< 0.05 %	< 0.05 %	< 0.05 %	-
Cross-axis alignment error	< 0.05 °	< 0.05 °	< 0.05 °	-
Bandwidth	400 Hz	400 Hz	110 Hz	50 Hz

4.4.3.4. GNSS Specifications

Parameter	Value
Supported navigation systems	GPS L1 GLONASS L1 GALILEO E1 BeiDou B1
Update rate	10 Hz
Cold start sensitivity	-148 dBm
Tracking sensitivity	-167 dBm
Hot start first fix	1 s
Cold start first fix	26 s
Horizontal position accuracy	2.5
Velocity accuracy	0.05 m/s
Timing accuracy	30 ns

Acceleration limit	4 g
--------------------	-----

4.4.3.5. Hardware specifications

Parameter	Value
Operating voltage	5 to 36 V
Input protection	± 40 V
Power consumption	100 mA @ 5 V (typical)
Hot start battery capacity	> 24 hours
Hot start battery charge time	30 mins
Hot start battery endurance	> 10 years
Operating temperature	- 40 °C to 85 °C
Environmental sealing	IP 67 MIL-STD-810G
Shock limit	c
Dimensions	30 x 40.6 x 24 mm
Weight	37 grams
Interface	USB
Peripheral interface	1x GPIO and 1x NMEA Output
GPIO Level	5V or RS232

4.4.3.6. Electrical specifications

Parameter	Minimum	Typical	Maximum
Power supply			
Input supply voltage	5 V		36 V
Input supply voltage	- 40V		40 V
RS 232			
Tx voltage low		-5.7 V	-5 V
Tx voltage high	5 V	6.2 V	
Tx short circuit current		±35 mA	±70 mA
Rx voltage low	0.8 V	1.3 V	
Rx voltage high		1.7 V	2.5 V
GPIO			

Output voltage low	0 V	0.3 V	
Output voltage high	4.8 V	5 V	
Output voltage high	-20 V	20 V	
Input threshold low		1.5 V	
Input threshold low	3.5 V		
Output current		5 mA	
GNSS Antenna			
Active antenna supply voltage	2.9 V	3 V	3.1 V
Antenna supply current			75 mA

4.3.2.7. Power consumption

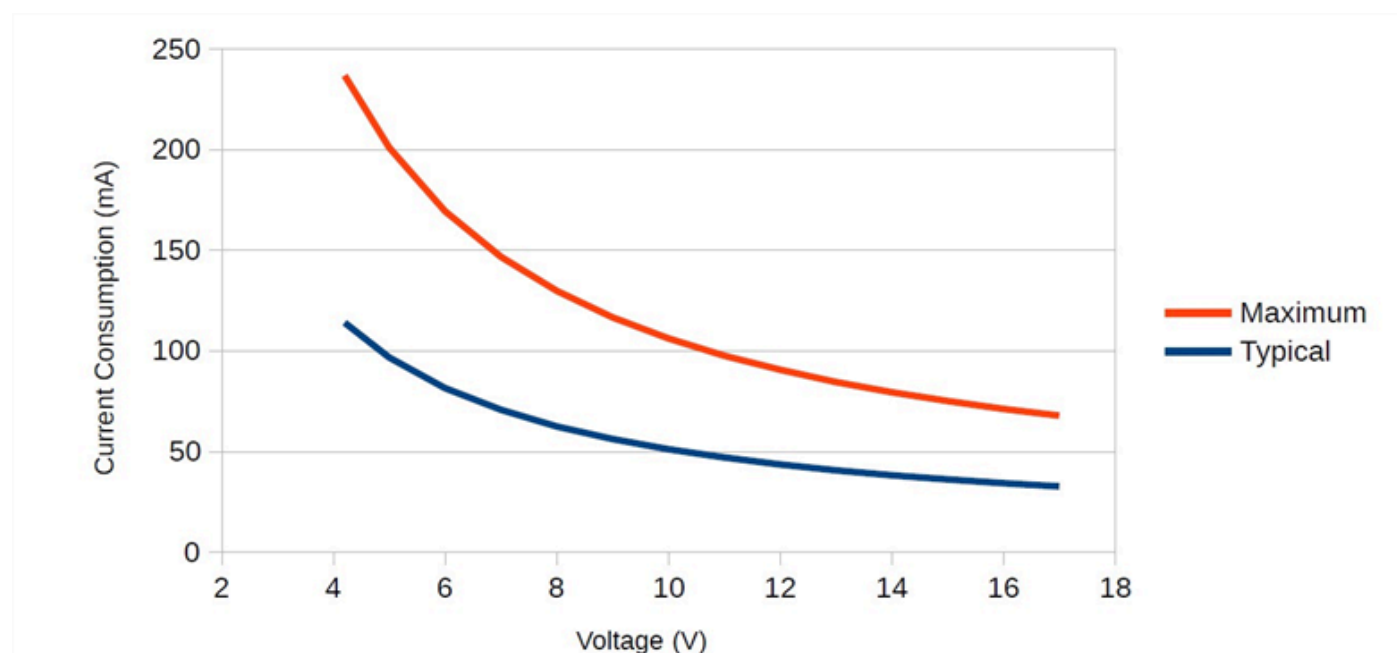


Image 20: Maximal and typical power consumption

4.5. DS-GYRO1

- DS-GYRO1 is a miniature, ruggedized and reliable inertial navigation unit
- Combines inertial sensors in a sophisticated fusion algorithm to deliver accurate and reliable orientation
- IP67 & MIL-STD-810G environmental protection
- Up to 500 Hz output data rate
- Connected over USB
- Fast and Easy-to-install