NAVION i2

DEWESoft®

SOFTWARE USER MANUAL

NAVION i2 V23-4

1. Table of contents

2. About this document

This is the users manual for the NAVION i2 instrument.

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.

3. Foundation knowledge

This chapter is a learning reference that briefly covers knowledge essential to understanding the NAVION i2 product 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 the 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

Navion i2 uses the SAE standard 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 (red arrow), the Z axis pointing down through the base of the unit (blue arrow) and the Y axis pointing off to the right (green arrow), which can be also presented as Right hand rule → Illustration of hand with the same color coordinate system

Image 1: Navion i2 SAE coordinate frame

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 (red arrow)	
Pitch – is the angle around Y axis (green arrow)	
Heading – is the angle around Z axis (blue arrow) Heading is 0 or 360 degrees when X axis (red arrow) points to the North	

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 Illustration *3*, 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.

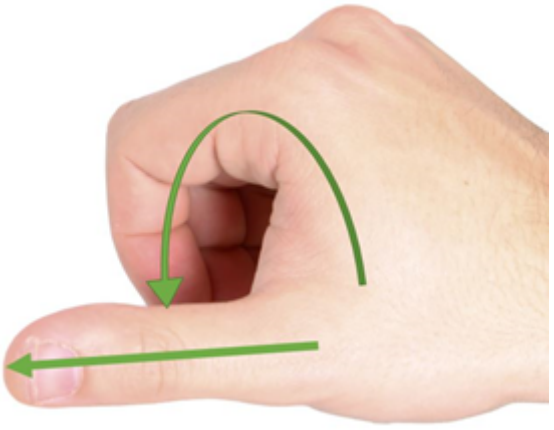


Image 3: Point a thumb in the positive direction of the axis in order to see the rotation direction

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.

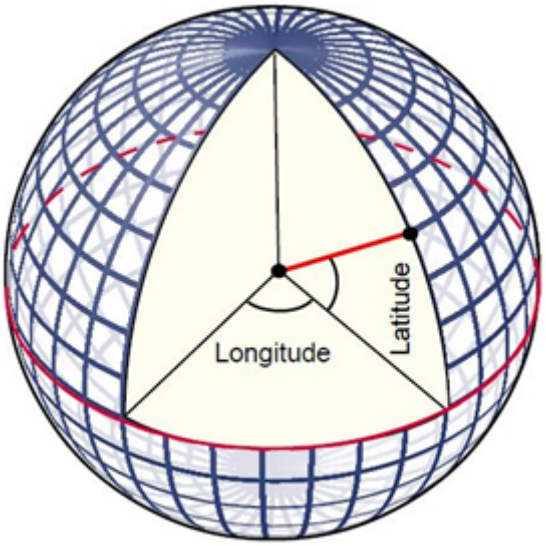


Image 4: Longitude and latitude positions presented *on the Earth*

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.

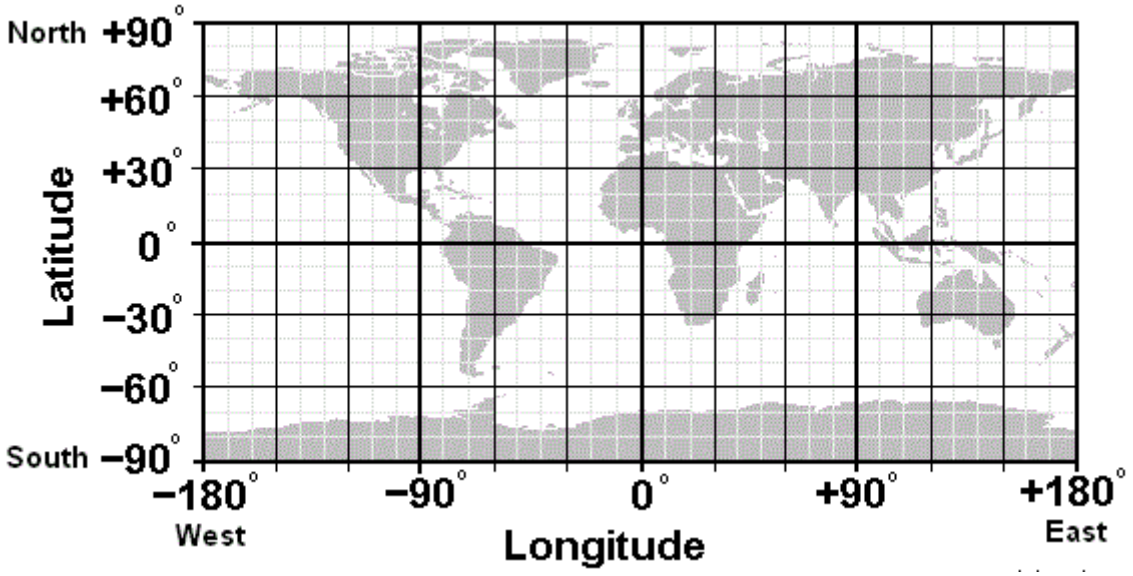


Image 5: Longitude and latitude values

Height means the height above the WGS84 reference ellipsoid. This ellipsoid is a model used to approximate sphere 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 but it is a HAE measurement (Height Above Ellipsoid).

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 Image 6 for a graphical representation of the NED coordinate frame at some position on the Earth.

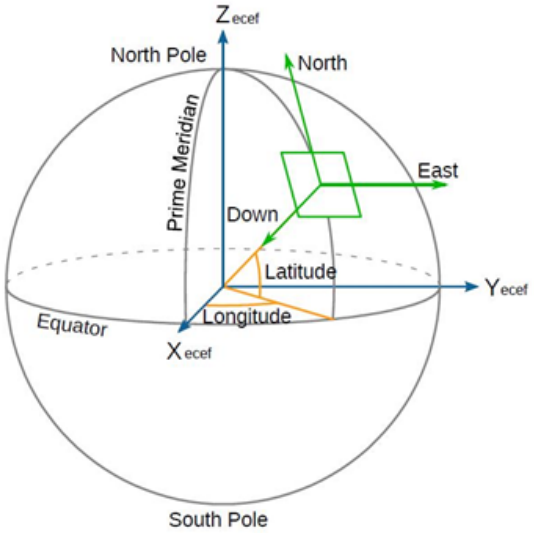


Image 6: NED coordinate frame

4. Quick start

- Position the NAVION i2 and the GNSS antenna with a clear view of the sky on the measured object.
- Connect the coaxial antenna cable to the NAVION i2.
- Connect the device with the NAVION i2 Connection-box.
- Provide the power supply via 2 Pin female Lemo to the NAVION i2 Connection-box.
- Connect the Rj45 ethernet cable into your computer.
- Set your ethernet port to the fixed IP 192.168.0.100 and subnet mask to 255.255.255.0 .
- Download the Navion plugin from Dewesoft Webpage and install it into the DewesoftX.
- Open DewesoftX, go to settings -> Devices, add device (+) -> Navion plugin.
- We use IP 192.168.0.5 to connect with the device.

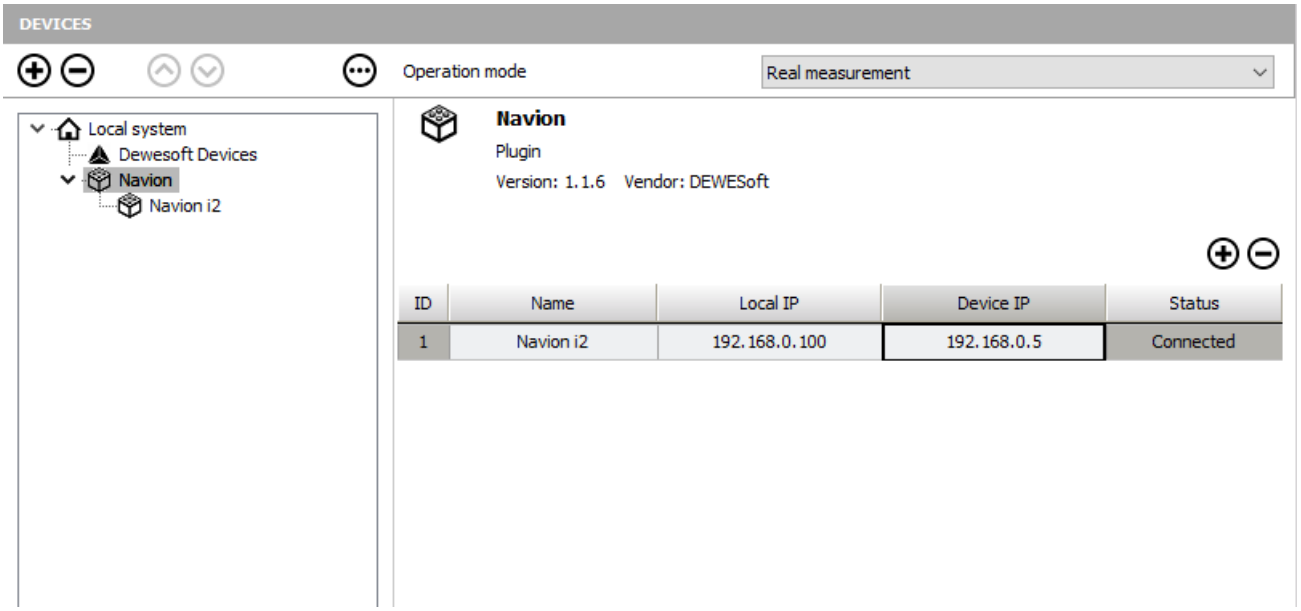


Image 7: NAVION i2 Device IP window in settings

4.1. Introduction

NAVION i2 is a GNSS-aided inertial navigation system with GNSS tracking, velocity reading, heading determinations, and recording parameters such as roll, pitch, slip angle, and more. It combines a built-in dual antenna GNSS receiver - which has support for all constellations and real-time kinematics - with an inertial sensor. This sensor has very low drift and helps determine position even when there is no GNSS signal.

4.1.1. Scope of supply

- NAVION i2 Instrument + Suction cups for mounting
- NAVION i2 Connection-Box
- Antenna with magnetic mounting + Suction cup for antenna mounting + Antenna cable
- 2x LEMO 8 pin connecting cables for connection box
- Y-cable with power in, sync and data out for basic use
- 2 pin Cigarette lighter plug power cable (L1B2f-CIG-2m)
- 2 pin Lemo power supply (60W)
- RJ45 data cable.

Image 8: NAVION i2 scope of supply

Hint

For standard use Y-cable provides you with an ethernet connection for data stream and the synchronization cable. Y-cable is assembled from two parts (cables with D-Sub 9 connector male/female should be plugged together). Also the Connection box can be used with just one connection cable (PRIM), providing you Eth, Sync and RTK in.

For using CAN output, NMEA output and Event input the second connection cable (SEC) must be used.

4.2. Connecting the device

To connect the device to the DewesoftX the RJ45 cable must be connected to the ethernet port of the computer you would like to connect the NAVION i2 to. Make sure that LEMO connecting cables between the NAVION i2 instrument and NAVION i2 connection box are connected. The other option of connectivity is with the Y-cable, which limits the device but is still good for simple use of the device. After that, some configuration of the ethernet port on your computer will be needed.

If you have more than one Navion i2 in a system, you have to change the IP of the device. This is done in the settings of selected Navion i2 (device must be connected).

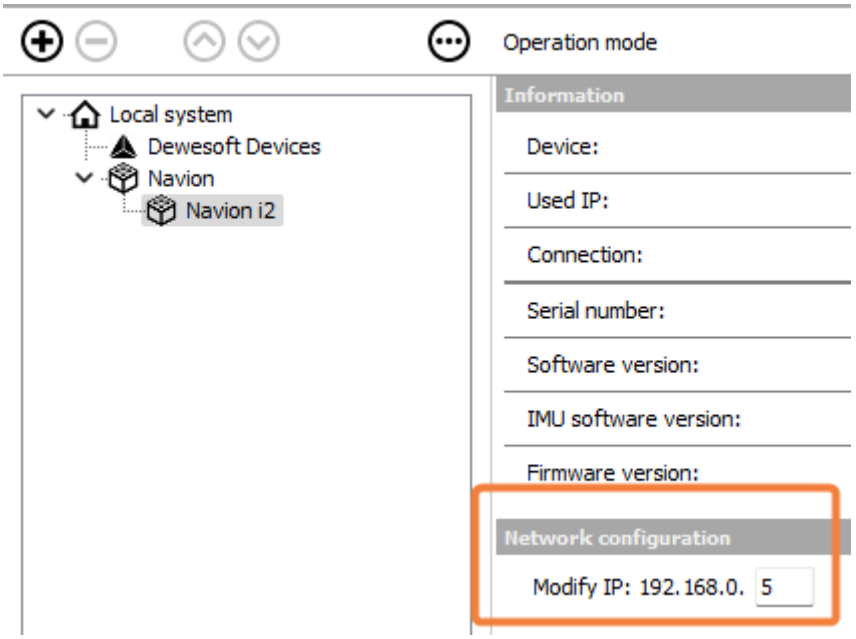


Image 9: Configuration of the IP

With the right mouse click on the ethernet icon, in the task bar, you open the Network & Internet settings.

Hint
If you are not sure about the IP address of your Navion i2, try to use the Wireshark software tool to check the correct IP address.

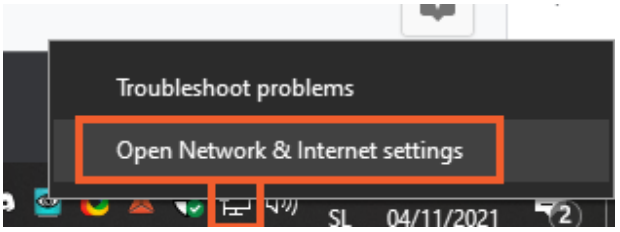


Image 10: network and internet settings

Hit the Change the adapter options and enter the properties of the Ethernet adapter on which you will connect the RJ45 data cable from the NAVION i2 connection box.

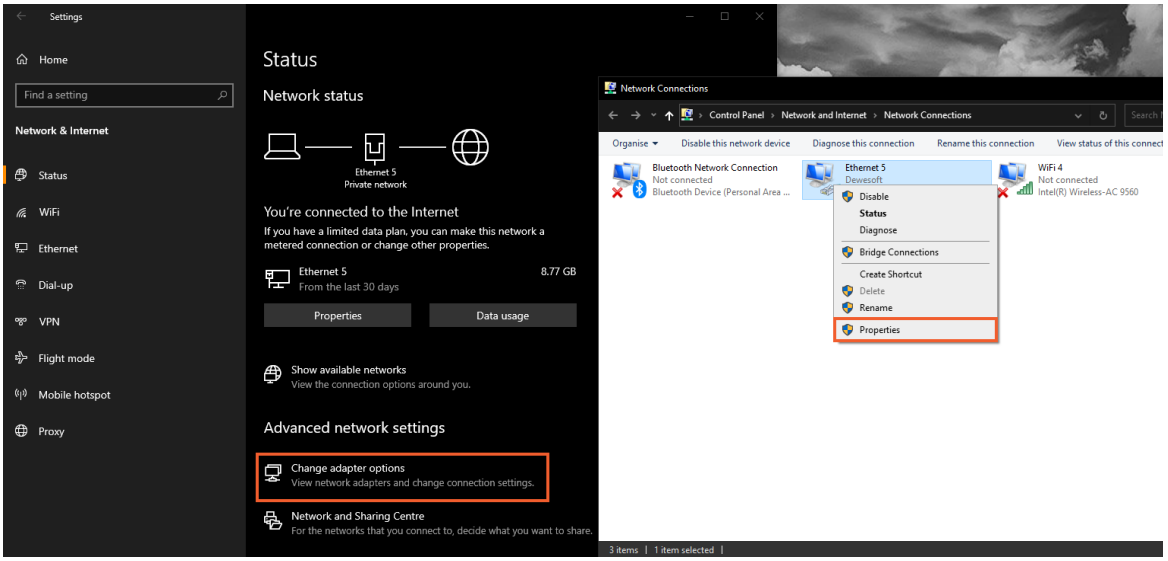


Image 11: Network adapter settings

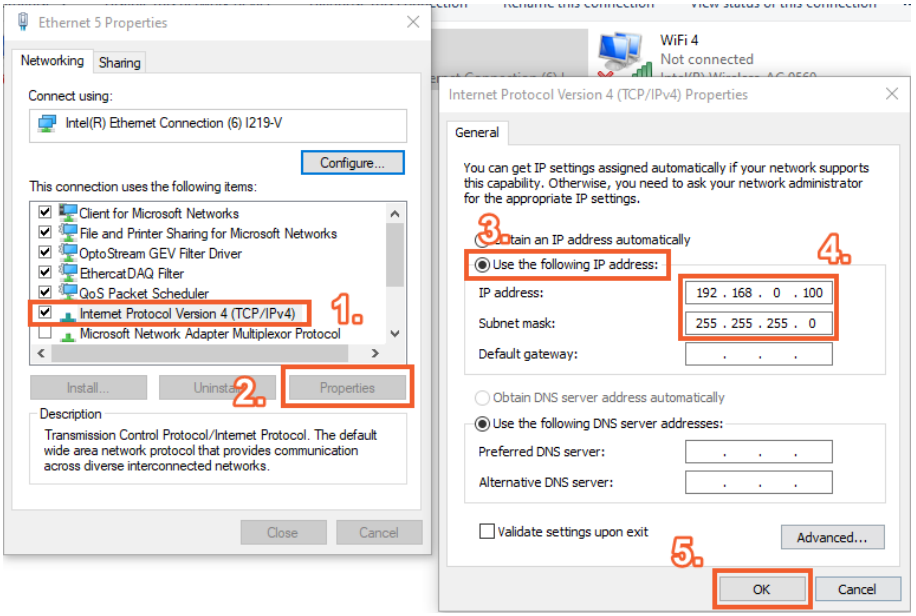


Image 12: Setting the static IP

4.2.1. Connecting NAVION-I2-WIFI-POE cable

To connect Navion i2 via DS-WIFI4, just connect PRIMARY 8-pin LEMO Female to NAVION-I2-WIFI-POE cable. Device and Wifi module are powered from 2 pin LEMO connector and data is streamed via RJ45 cable connected directly to DS-WIFI4.

4.3. Dewesoft licensing

The Dewesoft software license can be written to the NAVION device like we're used to from many other Dewesoft devices.
The license will then be active and available to use everytime when the NAVION is connected to the computer on which the DewesoftX is running.

5. Technical specs

5.1. Device performance

NAVIGATION	
Standalone (horizontal positioning)	1.2 m
Standalone (vertical position)	1.9 m
SBAS (horizontal positioning)	0.6 m
SBAS (vertical position)	0.6 m
RTK (horizontal positioning)	0.01 m
RTK (vertical positioning)	0.025 m
Velocity accuracy	0.015 m/s
Roll & Pitch accuracy (dynamic)	0.03°
Heading accuracy (dynamic with GNSS)	0.08°
Slip angle accuracy	0.08°
Range (Gyro/ACC)	± 490 deg/s / ±16 g
Hot start time	< 20 s
Output data rate	100 Hz
GNSS	
Supported navigation systems	GPS L1, L2, L5; GLONASS L1, L2, L3; BeiDou B1, B2; Galileo E1, AltBOC, E5a, E5b; NavIC (IRNSS) L5
Supported SBAS systems	SBAS L1, L5 QZSS L1, L2, L5
FEATURES SUPPORTED BY DEFAULT	
PPS output	✓
Dual antenna heading	✓
RTK positioning	✓
AUXILIARY DEVICES	
Odometer	Optional

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

5.1.1. Dual antenna performance - GNSS outages with no aiding

RMS ERROR	3 Seconds	10 Seconds	30 Seconds
Horizontal (meter)	0.12	0.3	2.5
Vertical (meter)	0.060	0.2	0.75
Heading (degree)	0.10	0.125	0.15
Horizontal Velocity (meters/s)	0.030	0.08	0.16
Vertical Velocity (meters/s)	0.02	0.04	0.06

Results in the table do not include use of any aiding. However, the unit is capable of accepting numerous aiding types (including odometer and velocity aiding).

5.2. Hardware specification

HARDWARE	
Interface	Ethernet (10/100), CAN, RS232 (RTK, NMEA)
Operating voltage	9 to 36 V
Power consumption	3.5 Watts
Operational temperature	-40°C to +71°C (0.8 °C/min Max)
Shock limit	40 g for 11 msec (MIL-STD-810G)
Dimensions	102 mm x 81 mm x 48 mm
Weight	310 g
Environmental protection	IEC 60529 IP68
Communication Ports	Ethernet (10/100), RS-232
SENSORS	
Accelerometer	✓
Gyroscope	✓

5.2.1. Sensor Specifications

PARAMETERS	GYROSCOPES	ACCELEROMETERS
Range	+/- 490 deg/s in all axes	+/- 16g in all axes
Bias repeatability	90 °/h (1σ)	2 mg (1σ)
Bias in-run stability	5 °/hr (1σ)	0.03 mg (1σ)
Random walk	0.25 °/√hr	0.03 m/s/√hr
Bandwidth	200Hz at 90° phase, 400Hz at -3dB (Output frequency dependent)	200Hz at 90° phase, 400Hz at -3dB (Output frequency dependent)
Scale Factor Repeatability	1400 ppm (1σ)	500[1] ppm (1σ)

5.3. Mechanical drawings

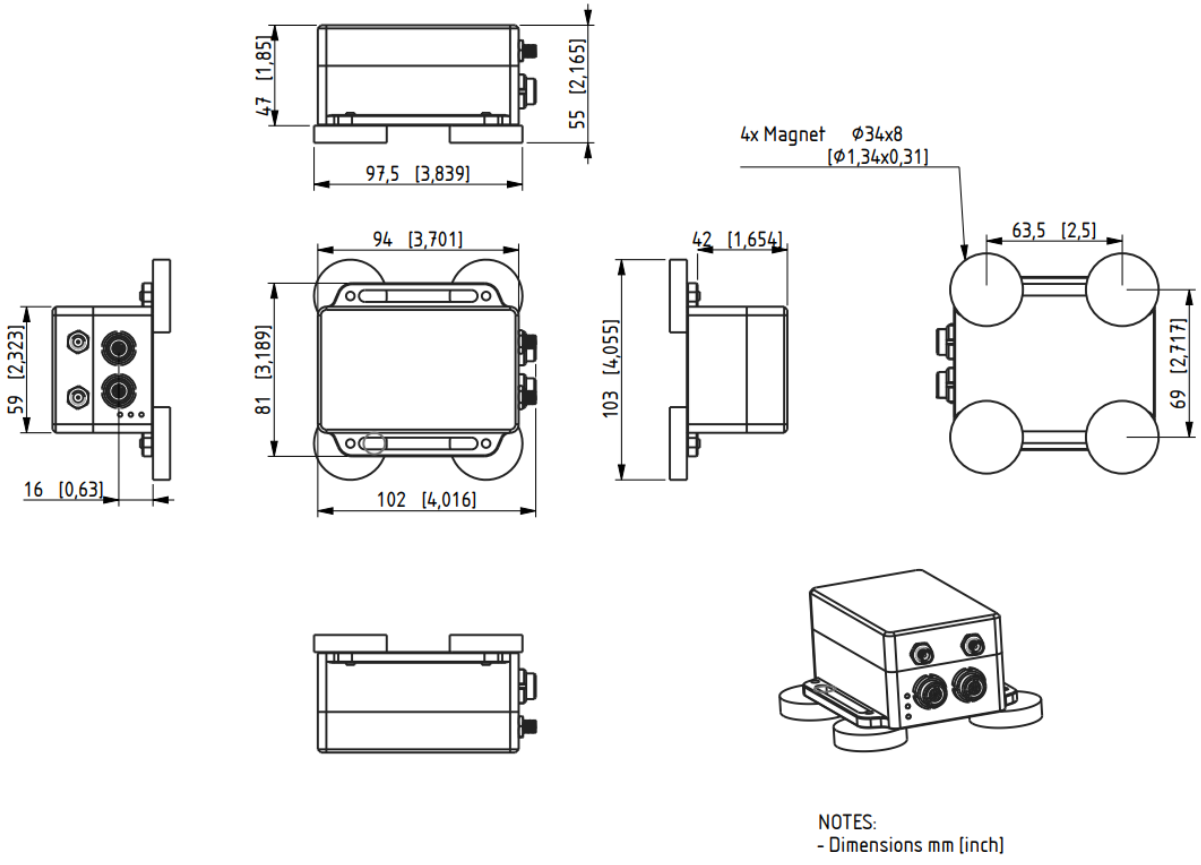


Image 13: Drawing of NAVION i2 v2 instrument magnet mounting

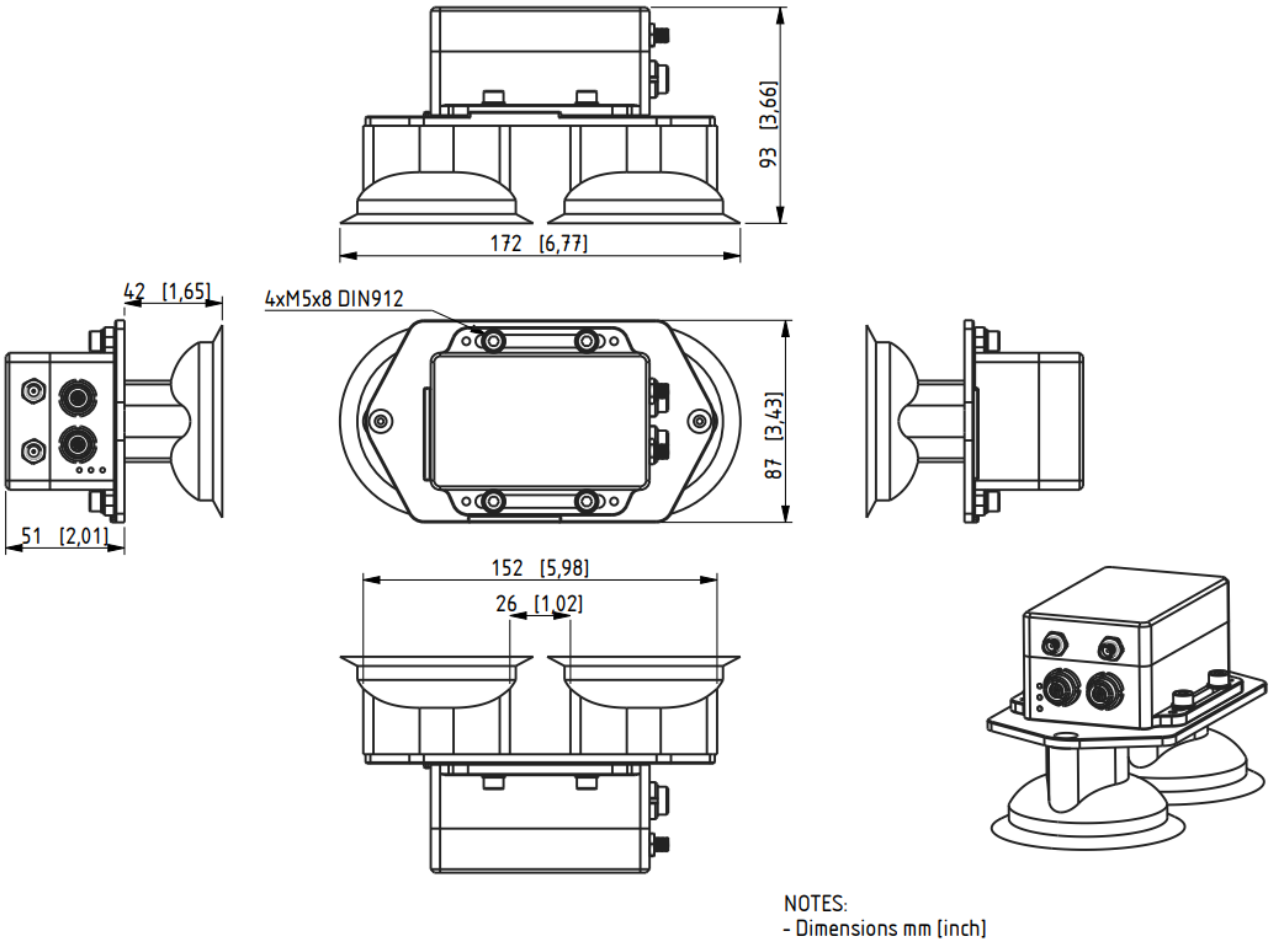


Image 14: Drawing of NAVION i2 instrument suction cups mounting

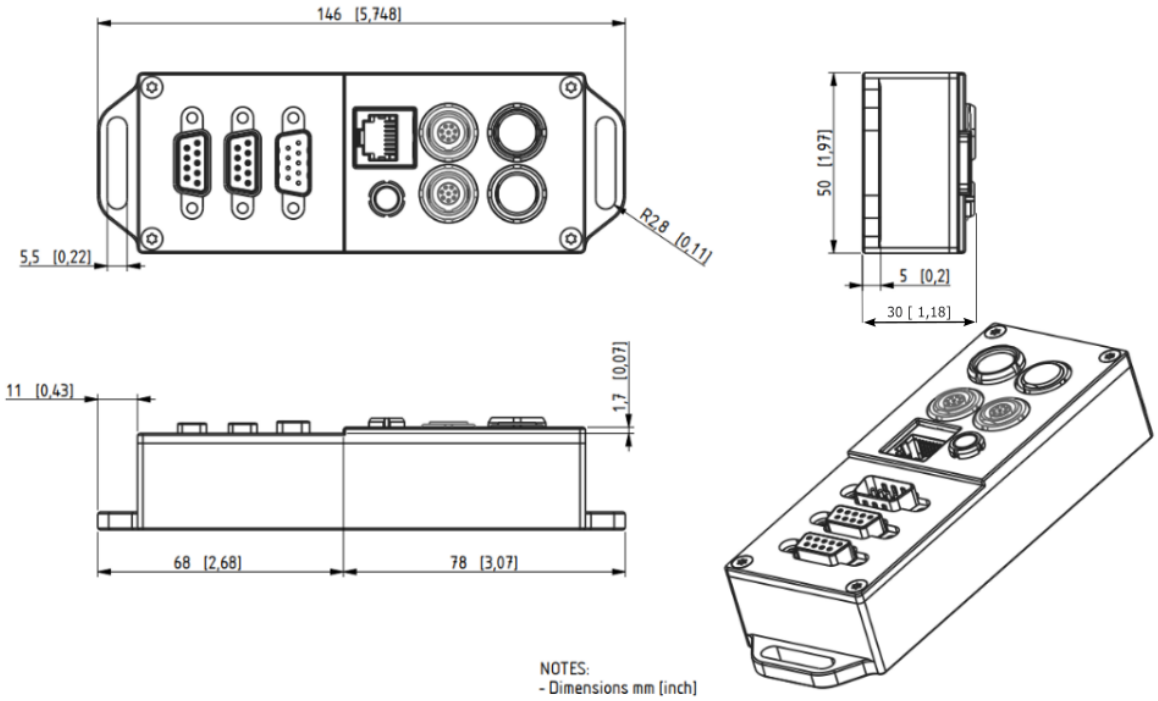


Image 15: Drawing of NAVION i2 Connection box

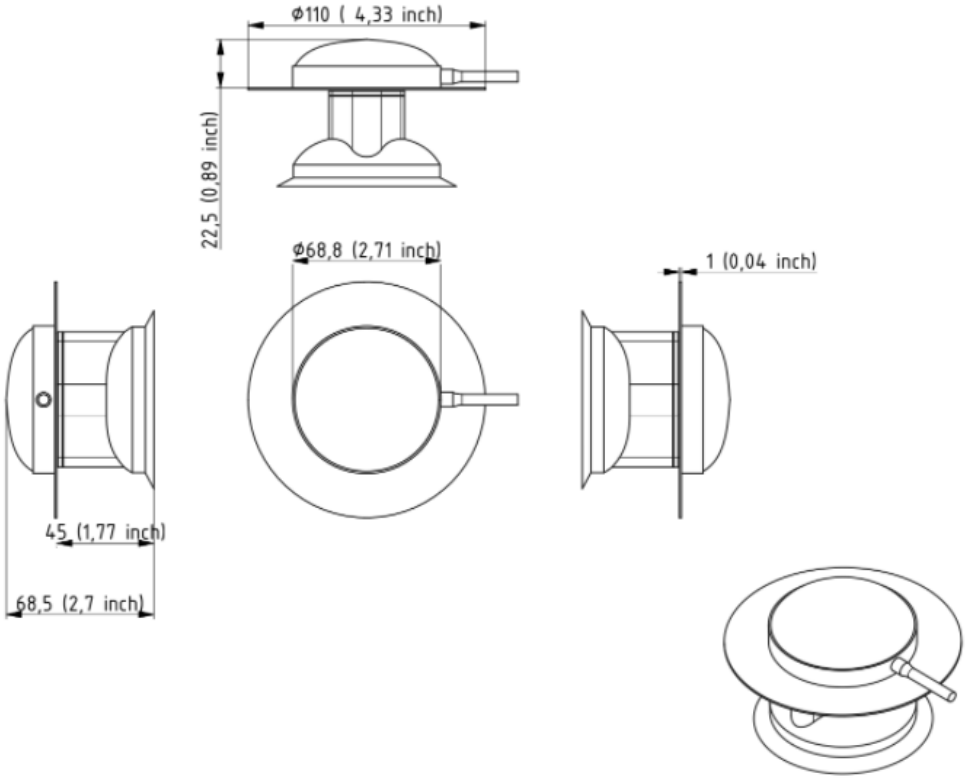


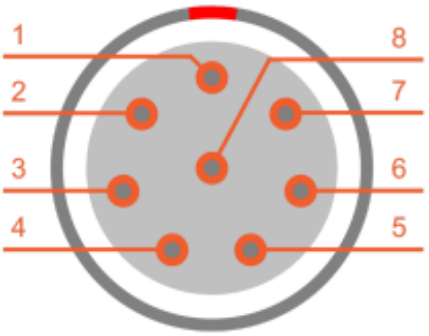
Image 16: Drawing of Gnss antenna with suction cup mounting

6. Connectors pinout

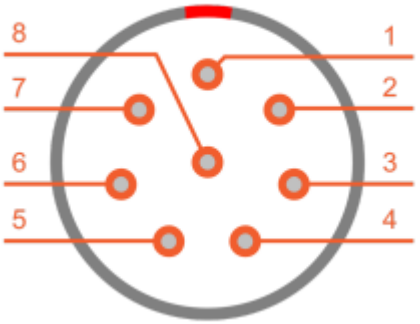
6.1. Break-Out box

Image 17: NAVION i2 Break-Out box

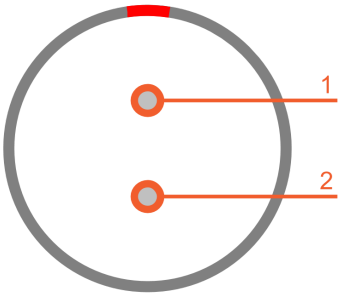
Primary connector	Lemo 1T8f
Pin	**Function**
1	ETH_Tx_p
2	ETH_Tx_n
3	ETH_Rx_p
4	ETH_Rx_n
5	Power 9V 36 V DC
6	GND
7	Sync
8	RTK correction input



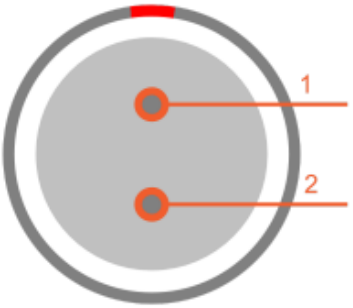
Secondary connector	Lemo 1T8m
Pin	**Function**
1	RES
2	COM4 Tx
3	CAN High
4	CAN Low
5	COM3 Rx CMOS
6	COM3 Tx CMOS
7	Event In
8	GND



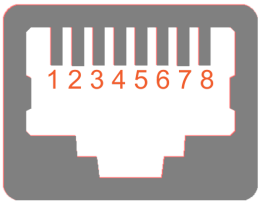
Power	Lemo 1B2m
Pin	**Function**
1	Vin +9V to +36V DC
2	GND



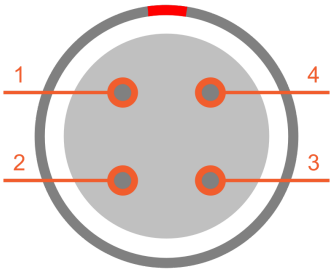
Power	Lemo 1B2m
Pin	**Function**
1	Vout = Vin
2	GND



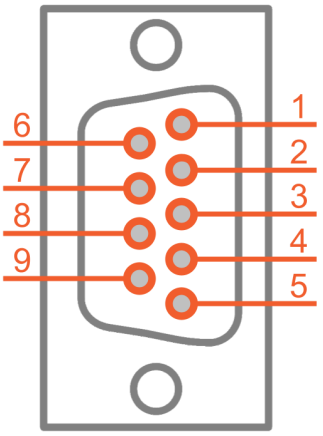
Ethernet	RJ45
Pin	**Function**
1	Tx_p
2	Tx_n
3	Rx_p
4	GND
5	GND
6	Rx_n
7	V+
8	V+



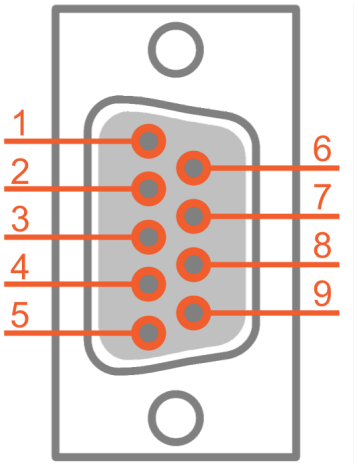
Sync	Lemo 00B4f
Pin	**Function**
1	
2	
3	PPS out
4	GND



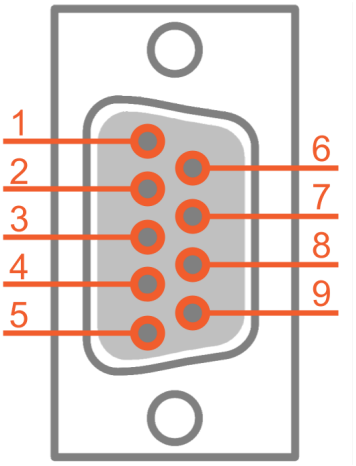
CAN	D-SUB9m
Pin	**Function**
1	
2	CAN low
3	
4	
5	
6	GND
7	CAN high
8	
9	



COM I/O RTK	D-SUB9f
Pin	**Function**
1	
2	Tx GPS
3	Rx GPS
4	PPS
5	GND
6	
7	
8	Event in
9	Power Out



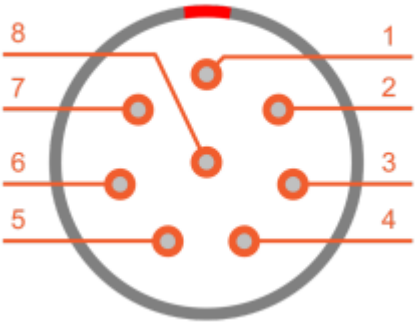
COM I/O NMEA	D-SUB9f
Pin	**Function**
1	+5V
2	Tx NMEA
3	Rx NMEA
4	PPS
5	GND
6	
7	
8	Event in
9	



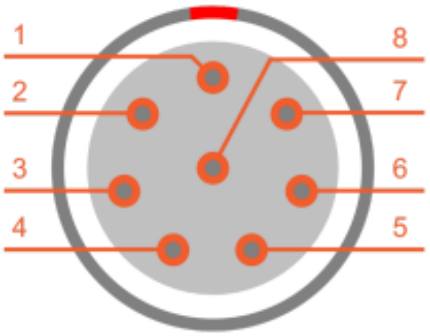
6.2. NAVION i2 Instrument

Image 18: NAVION i2 Instrument

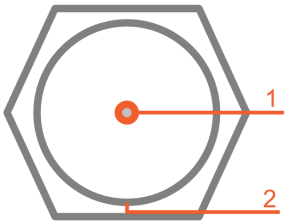
Primary connector	Lemo 1T8m
Pin	**Function**
1	ETH_Tx_p
2	ETH_Tx_n
3	ETH_Rx_p
4	ETH_Rx_n
5	Power 9V 36 V DC
6	GND
7	Sync
8	RTK correction input



Secondary connector	Lemo 1T8f
Pin	**Function**
1	RES
2	COM4 Tx
3	CAN High
4	CAN Low
5	COM3 Rx CMOS
6	COM3 Tx CMOS
7	Event In
8	GND



Antenna	SMA Female
Pin	**Function**
1	Antenna
2	GND



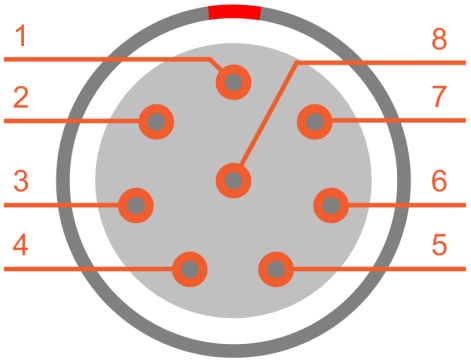
6.2.1. LED lights meanings

LED	Description	LED OFF	LED blinking	LED ON
P	Power	No Power applied	-	Power applied
G	GNSS	No GNSS	Standalone, SBAS or RTK float solution	RTK Fixed
I	Inertial navigation	Standby awaiting heading	Aided navigation & zero motion detected	Aided navigation

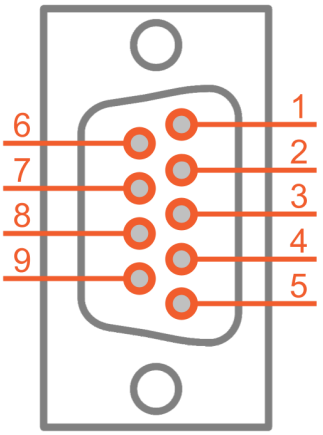
6.3. Y-Cable

6.3.1. PRIMARY 8-pin LEMO Female

Primary connector	Cat7 cbl	Lemo 1T8m
Pin	**Color**	**Function**
1	Worange	ETH_Tx_p
2	Orange	ETH_Tx_n
3	Wgreen	ETH_Rx_p
4	Green	ETH_Rx_n
5	blue	Power 9V 36 V DC
6	Wblue	GND
7	brown	PPS+
8	Wbrown	Res

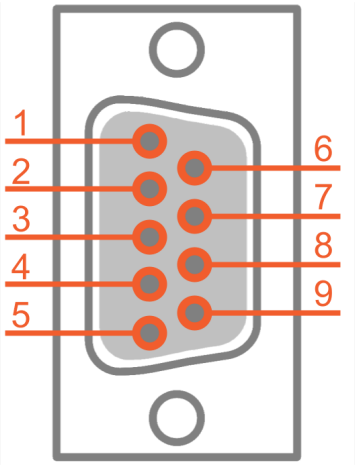


Prim DSUB9	Cat7 cbl	D-SUB9m
Pin	**Color**	**Function**
1	blue	Power 9V 36 V DC
2		RES Blue pair to Vin+
3		RES Brown pair to Vin-
4	Wblue	GND
5	brown	PPS+
6	Worange	ETH_Tx_p
7	Orange	ETH_Tx_n
8	Wgreen	ETH_Rx_p
9	Green	ETH_Rx_n

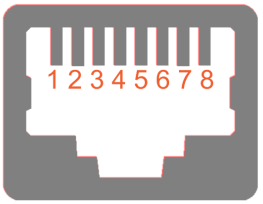


6.3.2. WIFI POE CBL

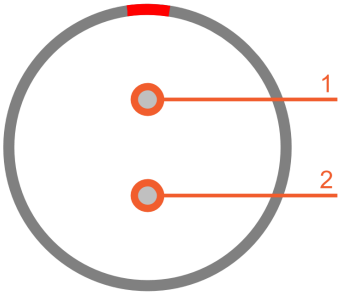
	RJ45+2-pin	D-SUB9f
Pin	**Color**	**Function**
1	Brown (2pin)	Vin+
2	Blue + WBlue + bridge to Pin1	Blue
3	Brown + WBrown + bridge to PIN4	Brown
4	Blue (2pin)	Vin- (GND)
5		RES
6	Worange	ETH_Tx_p
7	Orange	ETH_Tx_n
8	Wgreen	ETH_Rx_p
9	Green	ETH_Rx_n



Ethernet	RJ45	RJ45
Pin	**Color**	**Function**
1	Worange	Tx_p
2	Orange	Tx_n
3	Wgreen	Rx_p
4	Blue	V+
5	Wblue	V+
6	Green	Rx_n
7	Wbrown	GND
8	Brown	GND

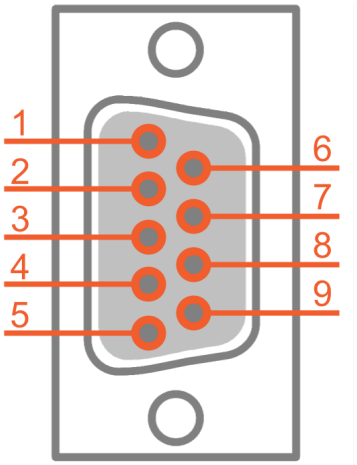


Power	2-pin	Lemo 1B2m
Pin	**Color**	**Function**
1	Brown	Vout +9V to +36V DC
2	Blue	GND

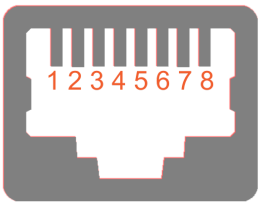


6.3.3. SECONDARY

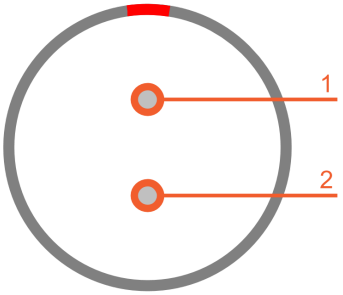
COM I/O RTK		D-SUB9f
Pin	**Color**	**Function**
1	Brown	Vin+
2		RES
3		RES
4	Blue,yellow (sync)	Vin- (GND)
5	Green (sync)	PPS+
6	Worange	ETH_Tx_p
7	Orange	ETH_Tx_n
8	Wgreen	ETH_Rx_p
9	Green	ETH_Rx_n



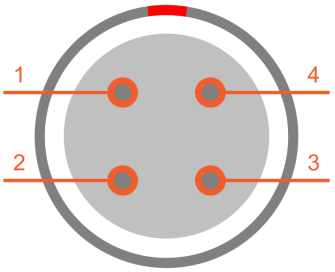
Ethernet		RJ45
Pin	**Color**	**Function**
1	Worange	Tx_p
2	Orange	Tx_n
3	Wgreen	Rx_p
4	Blue	/
5	Wblue	/
6	Green	Rx_n
7	Wbrown	/
8	Brown	/



Power		Lemo 1B2m
Pin	**Color**	**Function**
1	Brown	Vout +9V to +36V DC
2	Blue	GND



Sync		Lemo 00B4f
Pin	**Color**	**Function**
1		
2		
3	Green	PPS out
4	Yellow	GND



7. Installation and setup

7.1. Mounting

For mounting the device package includes magnetic and suction cups solutions. Magnetic mountings are rubberized and are handy when NAVION i2 is mounted on ferromagnetic metal surfaces.
Suction cups the other mounting option, please make sure that the mounting surface and suction cups are clean before use.

Image 19: Mounting with suction cups

7.2. Mounting and device setup configuration

With software package DewesoftX Release 2023.5 or Navion plugin version 1.2.0 the orientations of the antenna offsets are presented in 3D view.

Mounting setup tab is offering few different setup groups:

- 1 Orientation alignment explained in 7.2.1.
- 2 Antenna setup explained in 7.2.2.
- 3 Static initialisation explained in 7.2.3.

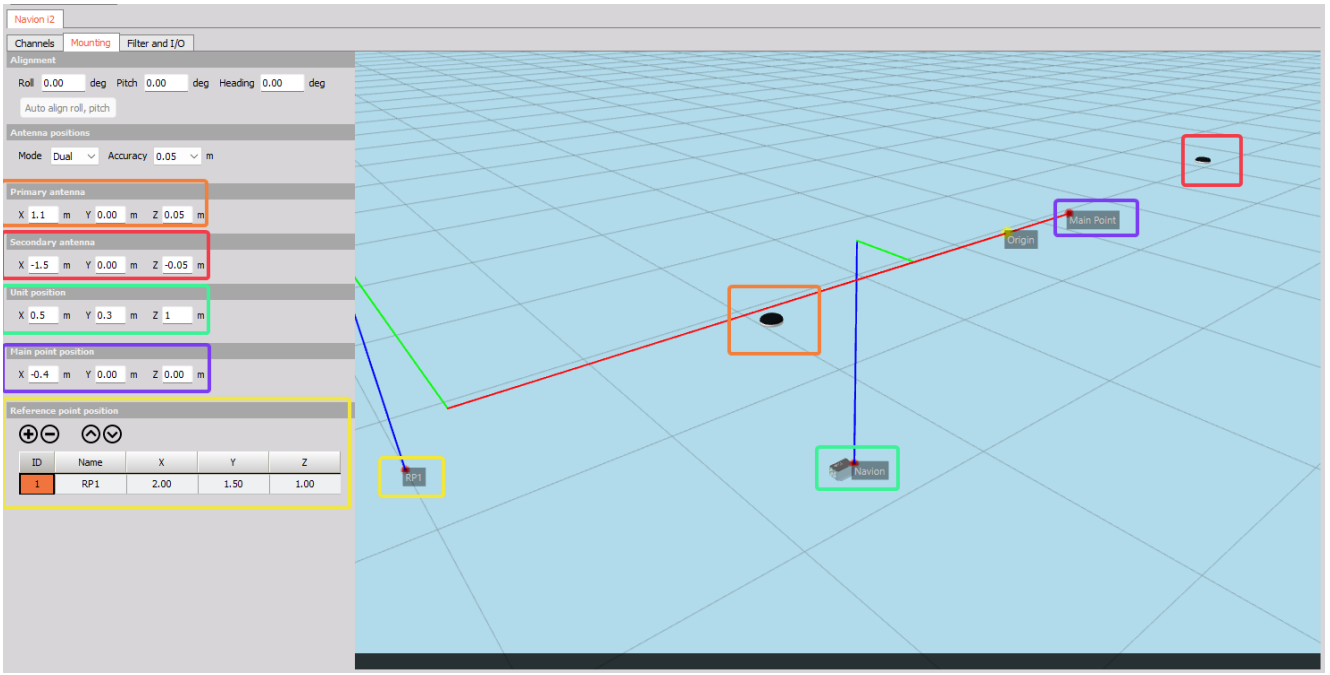


Image 20: Mounting configuration inside DewesoftX

In the Navion i2 plugin you have a tab named ''Mounting''. Since manufacturers usually have vehicle frame defined in one point (Origin), the configuration of the Navion is made from that point, that means every point in setup is measured from only one point.. The calculations are made in the Main point but you can add Reference points. If you leave Main point 0,0,0 the measured values will be in the zero point of the unit. On the next page, different examples are added.

Primary, Secondary antenna - Positions of the antennas regarding origin

Unit position - Position of the Navion i2 regarding origin

Main point - Calculation point regarding origin

Origin - Vehicle frame 0,0,0 point

In this example, the Main point and Origin collide and the calculations are done in the Origin. Unit position is different from Origin.

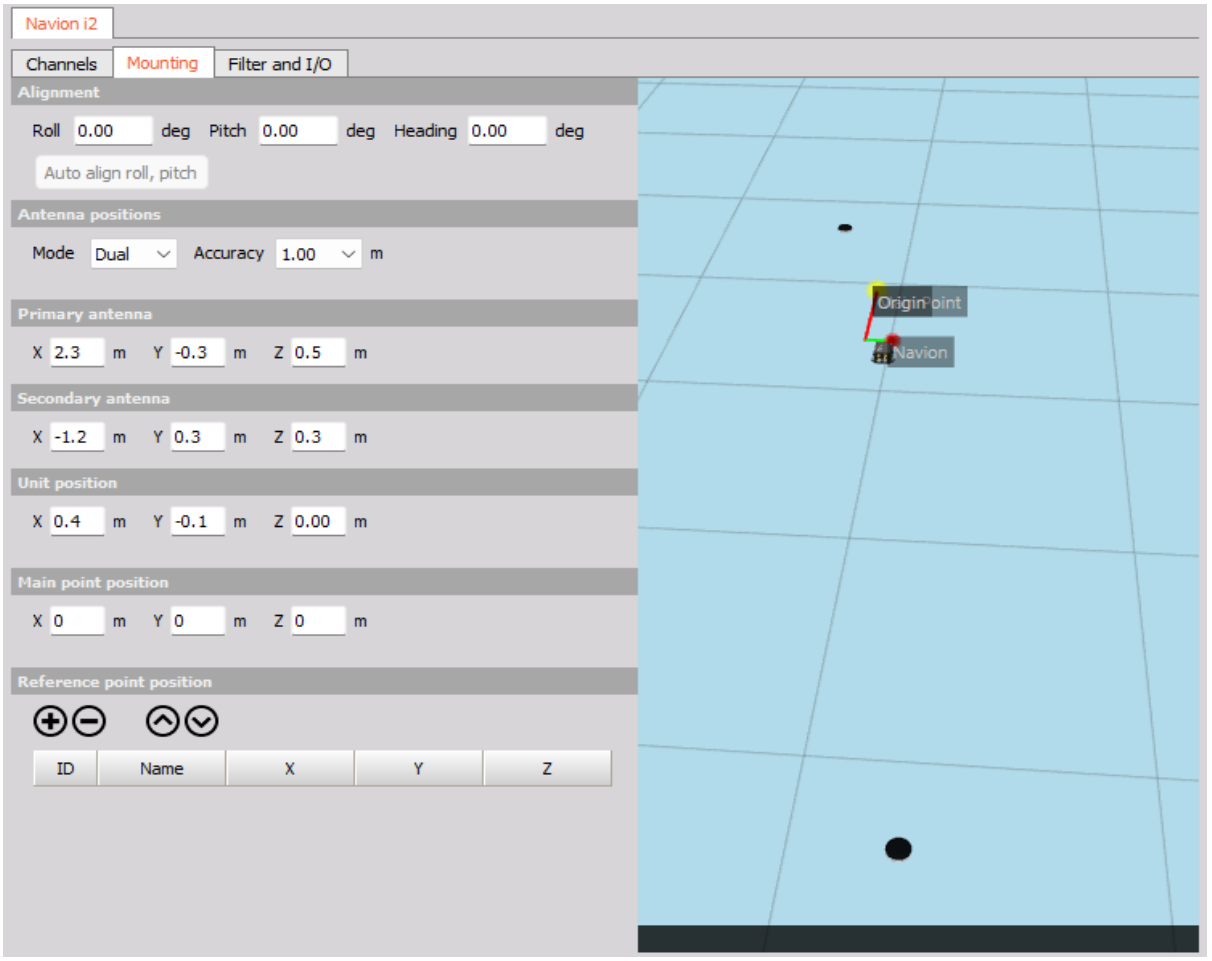
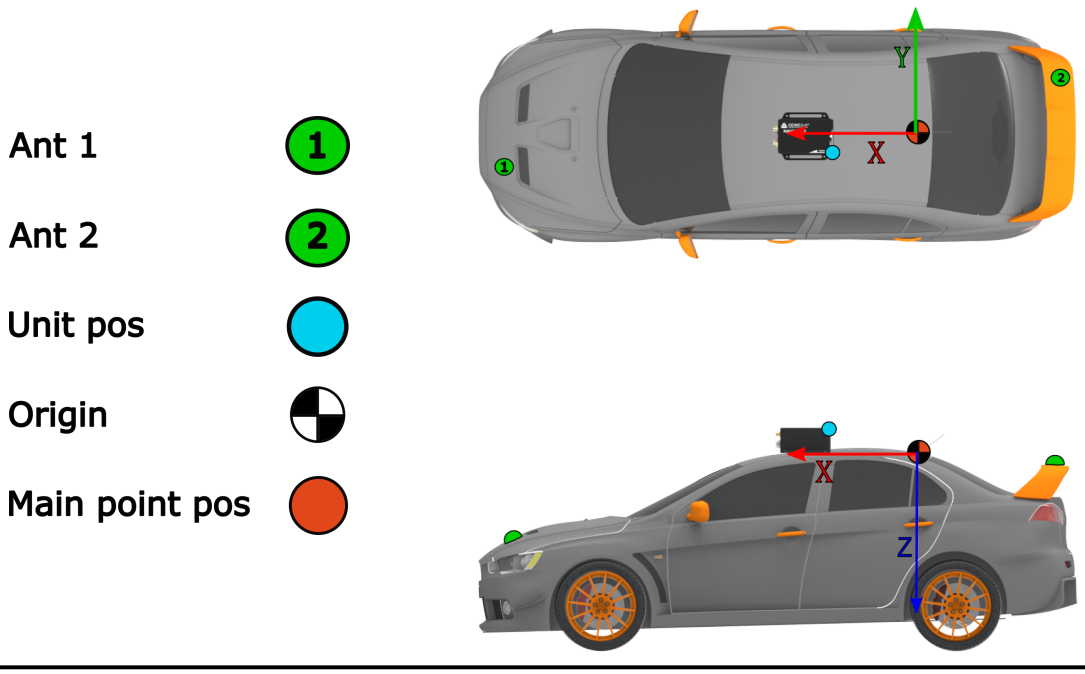


Image 21: Mounting configuration



In this example, the Main point and Origin are not in the same point, so the calculation is done on the front left wheel. Unit position is different from Origin.

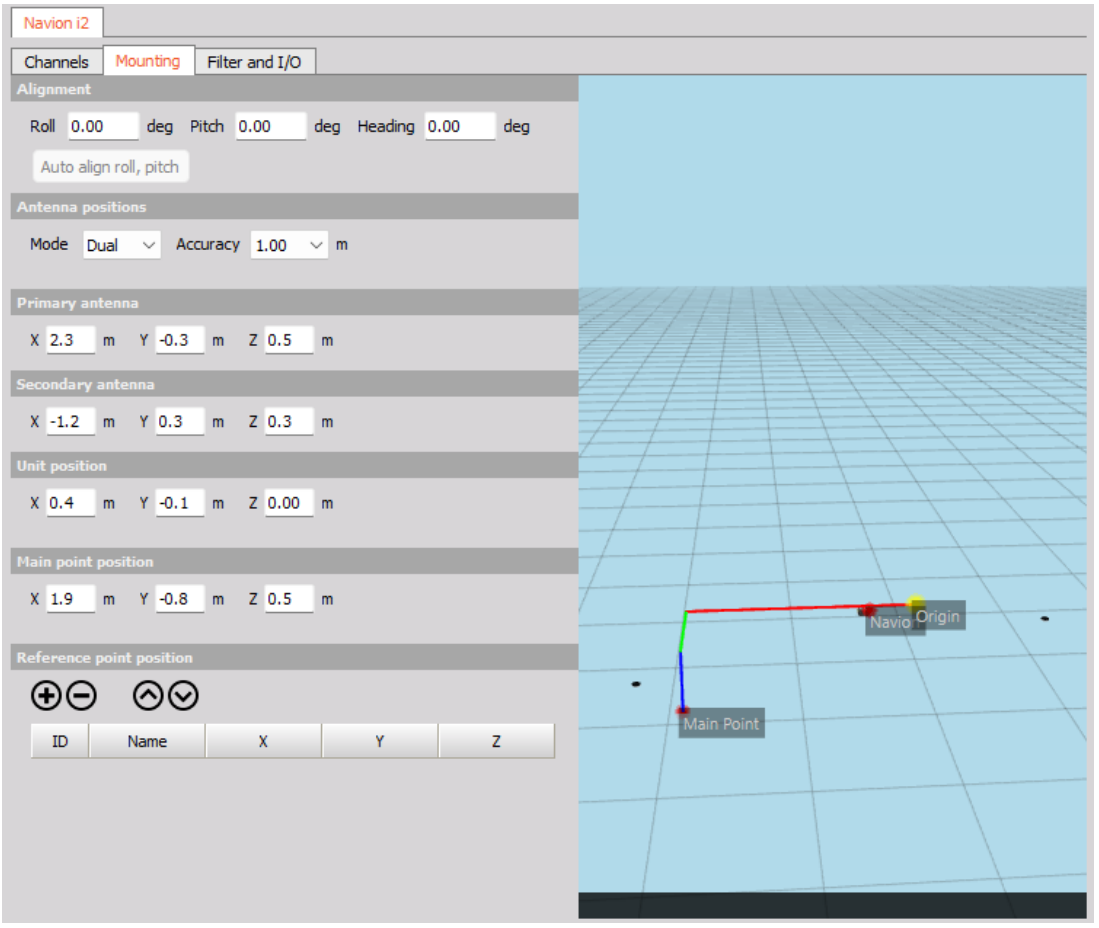
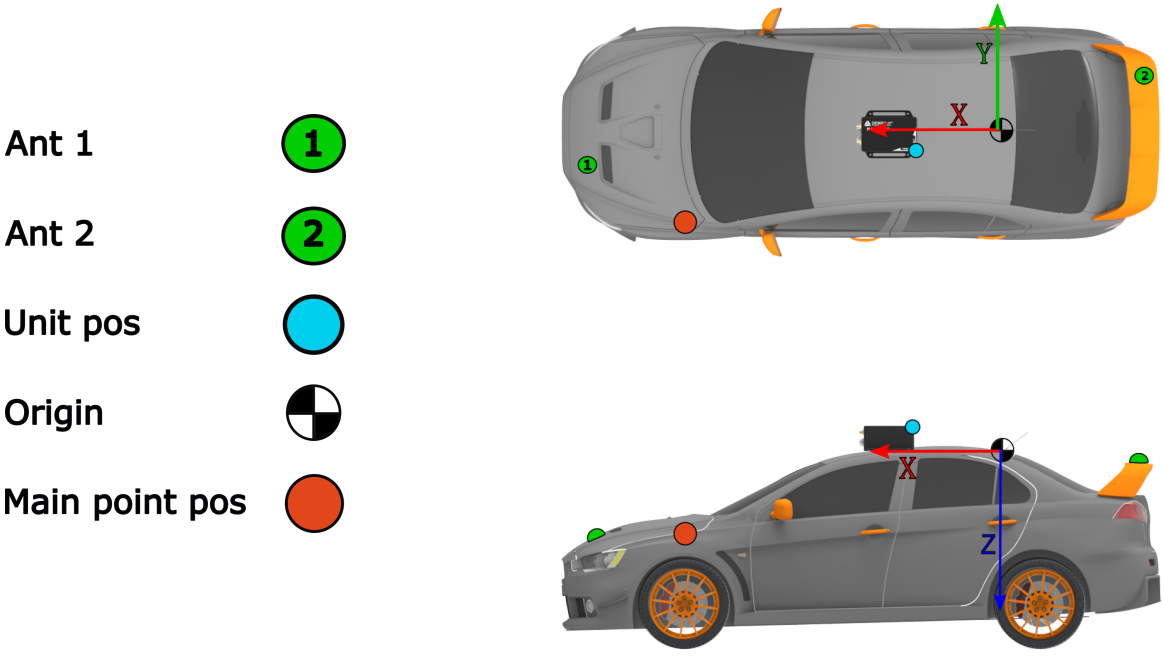
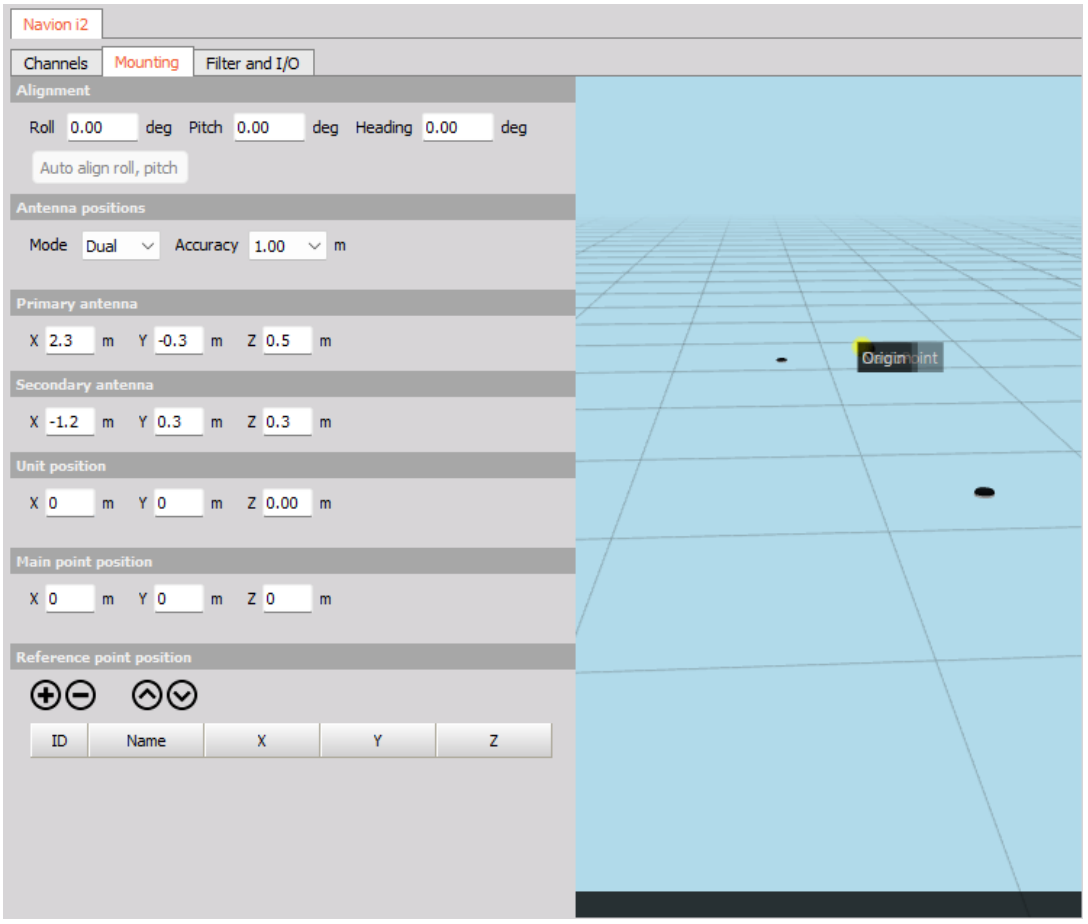


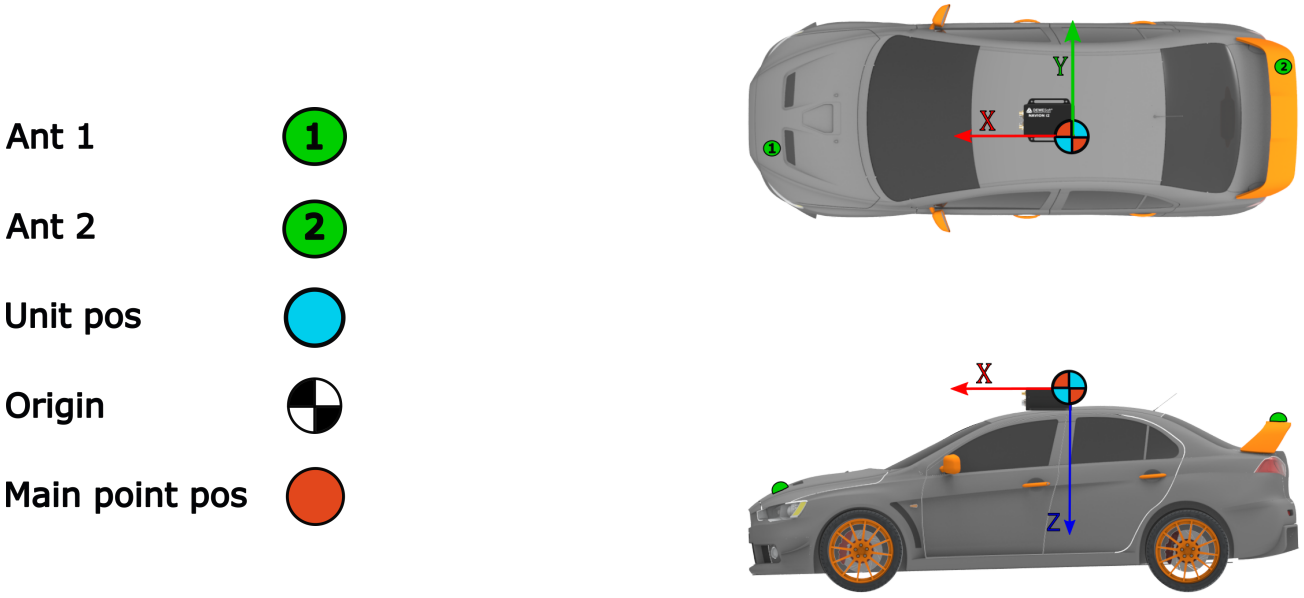
Image 22: Mounting configuration



7.2.2. In this example, the Main point, Origin and Unit position collide and the calculations are done in the Navion origin point.



7.2.3. Image 23: Mounting configuration



7.2.4. Orientation alignment

In this area it's possible to input angle offsets. This has to be done to compensate for the error of mounting and surface inclination. The most effective way of doing this is to drive on location, where you want to test (proving grounds, test circuit or just standing vehicle) and press the Auto align roll, pitch button. With doing this several outputs are compensated for Roll and Pitch offset.

Heading offset is the angle of vehicle heading vs the direction where the "Front" arrow on the NAVION i2 is pointing. For example if the device is mounted in the vehicle in a way that the connectors and the “Front” arrow are looking opposite of driving direction, the heading offset would be set to 180 by the user. Antenna offsets would be still defined within the Vehicle frame orientation so the “front” antenna usually offsetted in positive X direction will be in the front of the vehicle.

7.2.5. GNSS antenna offset (Antenna setup)

This parameter has to be measured and filled carefully, because error of velocity can increase significantly due to the different position of the NAVION i2 and GNSS antenna. Here you have to enter the distance between GNSS antennas and Origin. Offsets of both antennas are always measured in the coordinate system of the vehicle.
The precision of the offsets will get feedback to the Kalman-based algorithm for the precision of the calculations. With better precision of the antenna offset input you will achieve better precision of the algorithm calculations. If the RTK is used, then the precision should be 0.01 m if you want to have the maximum accuracy.

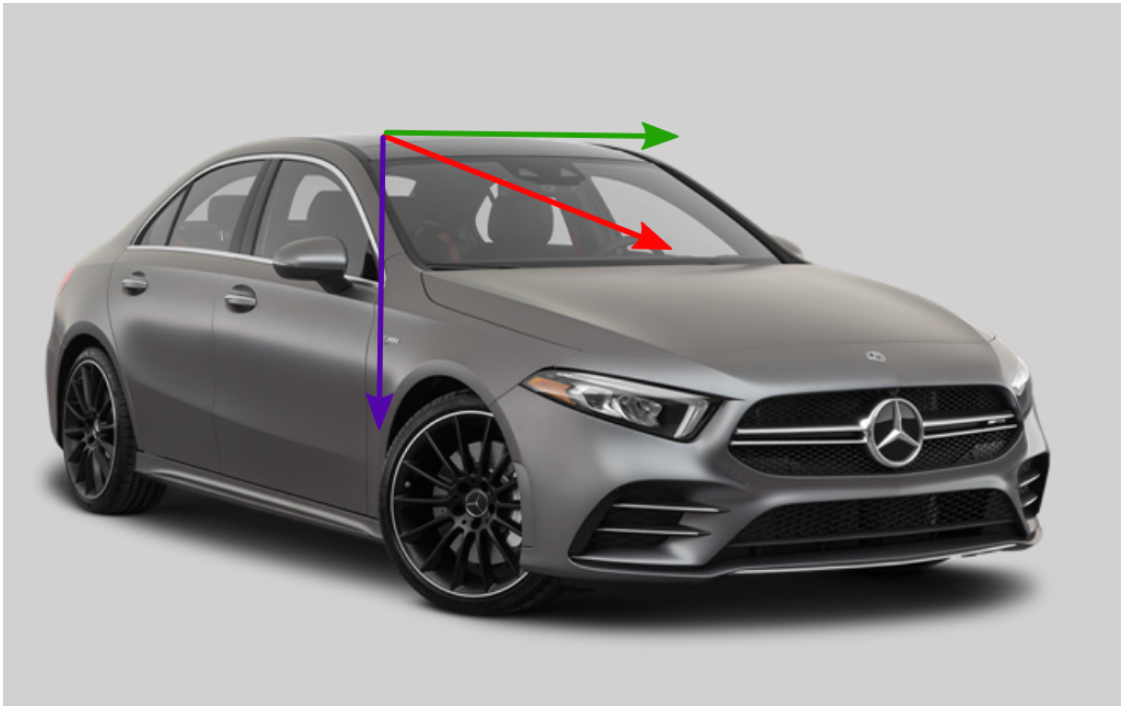


Image 24: Example of the vehicle frame

7.3. Initialization process

Automatic initialization is made when two antennas are mounted and have GPS fix. The antenna offsets must be set in the Navion plugin so that device can calculate the heading from the antennas position regarding the NAVION i2 instrument.

Important
When using two GNSS antennas the initialisation is made automatically while the object is static. Please make sure that antennas offsets are set correctly and precisely.

7.4. Synchronization configuration

You can use the NAVION as a GPS PPS synchronization source.

If NAVION is not the synchronization source, the plugin automatically goes into software synchronization mode (softsync)

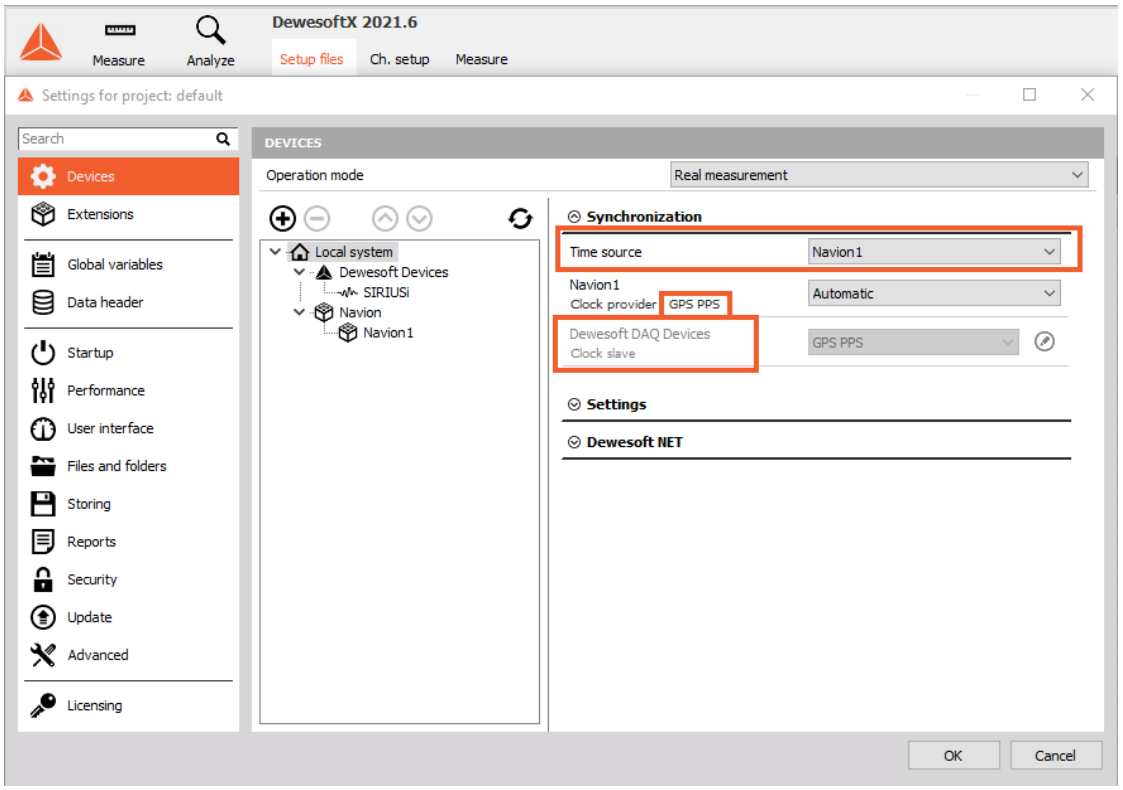


Image 25: NAVION i2 as Clock Provider

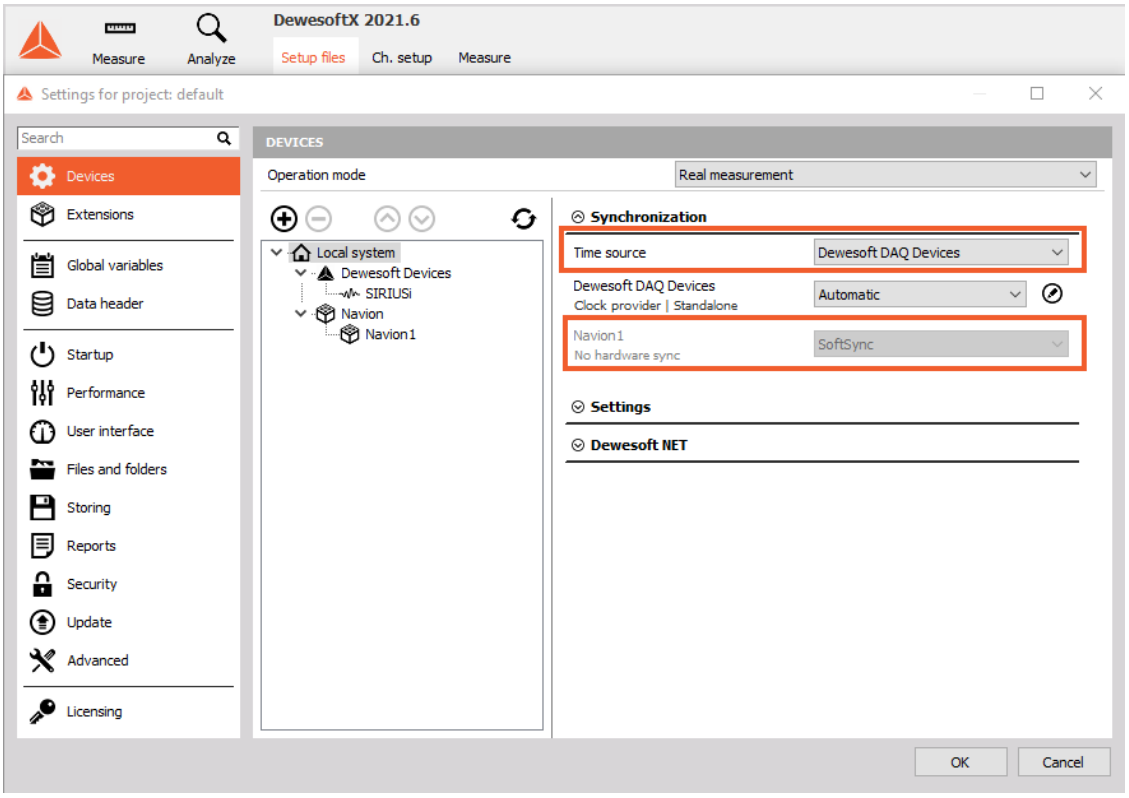


Image 26: NAVION i2 in SoftSync

7.5. RTK, CAN, Event In

Auxiliary inputs and outputs are located under the configuration tab in the Navion plugin.

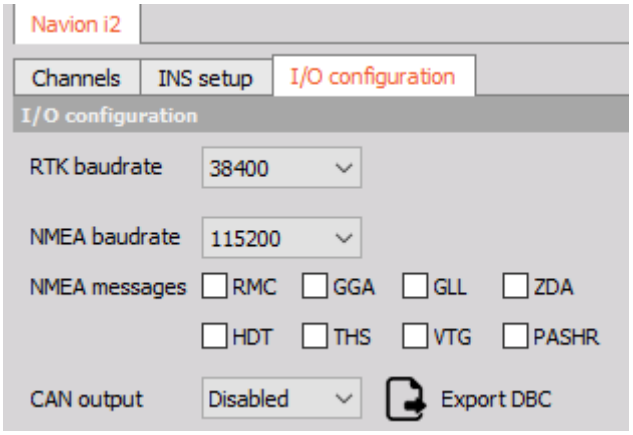


Image 27: I/O Configuration tab

7.5.1. RTK

RTK is enabled by default. On the RS232 connector we must provide RTK correction data in RMC or RTCM formats, format is automatically detected.
Baudrate of the correction data is set to 38400 by default.

7.5.2. CAN

CAN output must be enabled with the click on the Disabled button and then the drop down menu turns Default baud rate is set to 500kBaud.

CAN cable must be terminated on both sides with 120 Ohm resistor or with 60 Ohm on one side.

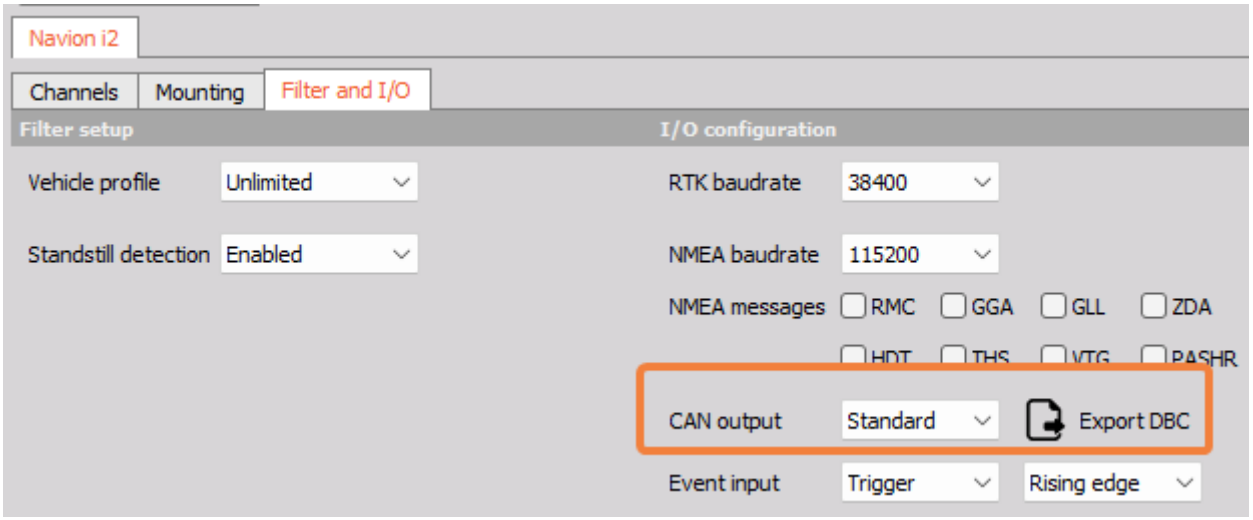


Image 28: CAN output and DBC Export

In the CAN module you can find the “scan” function which decodes the messages on the bus.

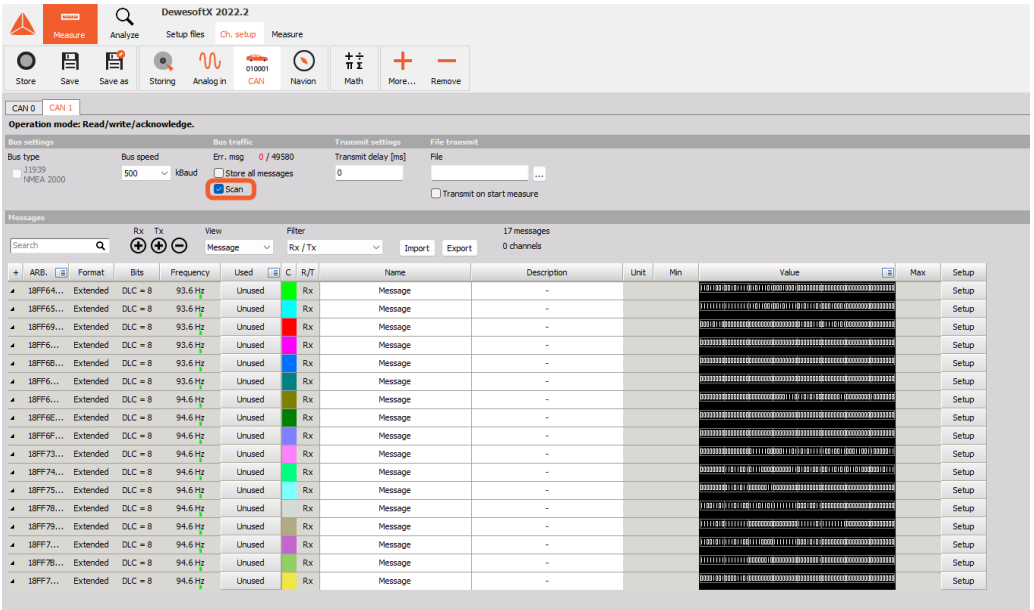


Image 29: CAN module setup window

Channel decoding can be achieved easily with importing the .dbc file which you can export from the plugin, while you have the device connected.

7.5.3. Event IN

Event IN must be enabled with a checkbox.

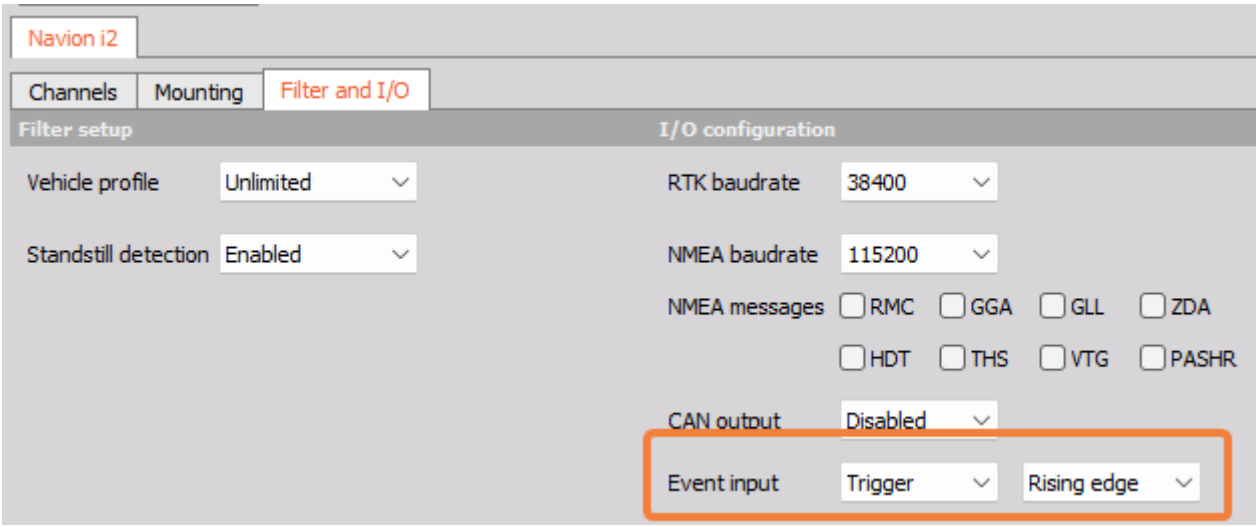


Image 30: Event input box

Both D9f connectors on the connection box have an event pin available.
For getting the trigger signal we need to use a switch between GND and Event pin. You can choose 'Rising edge', 'Falling edge' or 'Both edges'.

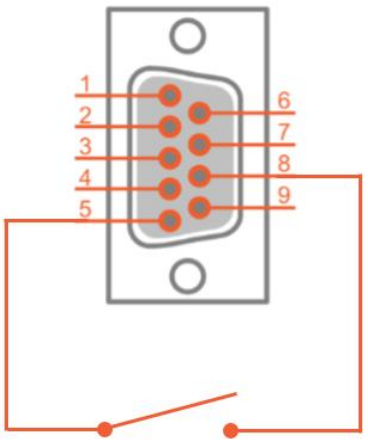
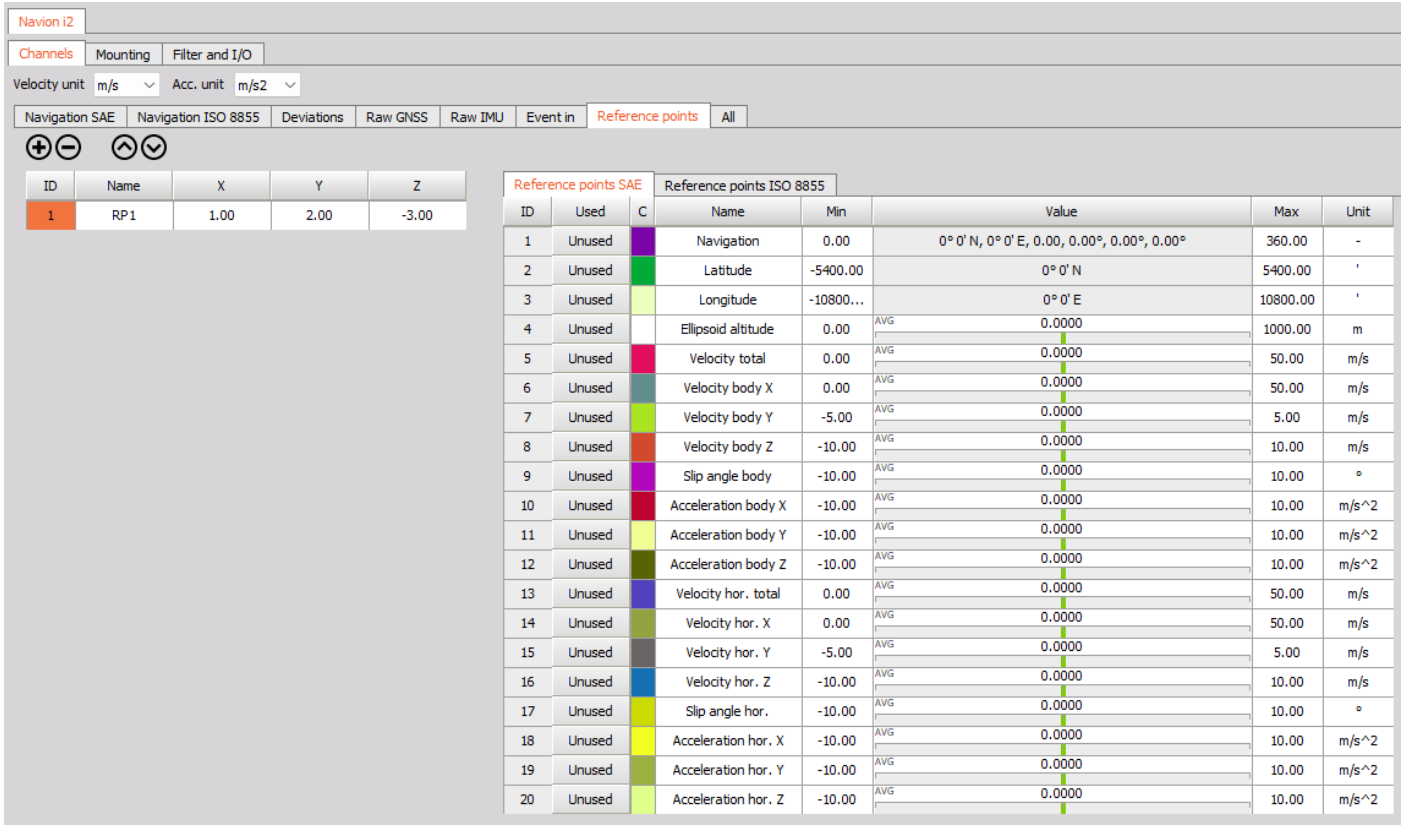


Image 31: Event input switch wiring

7.6. Virtual measurement points



ID	Name	X	Y	Z
1	RP1	1.00	2.00	-3.00

ID	Used	C	Name	Min	Value	Max	Unit
1	Unused		Navigation	0.00	0° 0' N, 0° 0' E, 0.00, 0.00°, 0.00°, 0.00°	360.00	-
2	Unused		Latitude	-5400.00	0° 0' N	5400.00	'
3	Unused		Longitude	-10800...	0° 0' E	10800.00	'
4	Unused		Ellipsoid altitude	0.00	AVG 0.0000	1000.00	m
5	Unused		Velocity total	0.00	AVG 0.0000	50.00	m/s
6	Unused		Velocity body X	0.00	AVG 0.0000	50.00	m/s
7	Unused		Velocity body Y	-5.00	AVG 0.0000	5.00	m/s
8	Unused		Velocity body Z	-10.00	AVG 0.0000	10.00	m/s
9	Unused		Slip angle body	-10.00	AVG 0.0000	10.00	°
10	Unused		Acceleration body X	-10.00	AVG 0.0000	10.00	m/s^2
11	Unused		Acceleration body Y	-10.00	AVG 0.0000	10.00	m/s^2
12	Unused		Acceleration body Z	-10.00	AVG 0.0000	10.00	m/s^2
13	Unused		Velocity hor. total	0.00	AVG 0.0000	50.00	m/s
14	Unused		Velocity hor. X	0.00	AVG 0.0000	50.00	m/s
15	Unused		Velocity hor. Y	-5.00	AVG 0.0000	5.00	m/s
16	Unused		Velocity hor. Z	-10.00	AVG 0.0000	10.00	m/s
17	Unused		Slip angle hor.	-10.00	AVG 0.0000	10.00	°
18	Unused		Acceleration hor. X	-10.00	AVG 0.0000	10.00	m/s^2
19	Unused		Acceleration hor. Y	-10.00	AVG 0.0000	10.00	m/s^2
20	Unused		Acceleration hor. Z	-10.00	AVG 0.0000	10.00	m/s^2

Image 32: Reference points

With this offset it's possible to shift position data to another point. So if you want to shift position data to CoG just enter offset from inertial platform to center of gravity. The coordinates of the reference points are referenced from the Origin. Reference points are measured in the vehicle coordinate system.

8. Output channels

8.1. Channel groups

NAVION i2 provides many output channels, outputs are defined by channel groups.

8.1.1. Status channels:

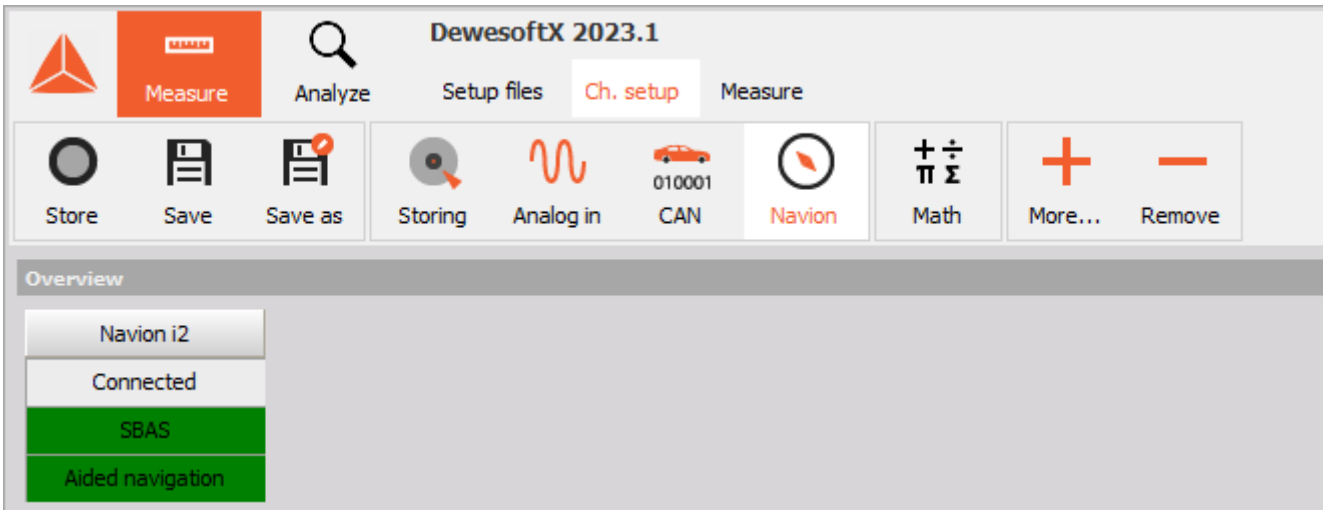


Image 33: NAVION i2 instrument status

Index	Channel name	Description	Channel rate
1	INS status	Status of internal filter and device	1 Hz
2	GNSS status	GNSS status (Standalone, DGPS, RTK mode,..)	100 Hz
3	Standstill status	Status of standstill (standstill or moving)	100 Hz
4	Satellite count	Number of satellites used by GNSS receiver	1 Hz
5	Time	GPS time (date + time in microseconds)	100 Hz

Device status:

- Disconnected
- No GPS fix
- Not initialized
- Ready

GNSS status:

- Standalone
- SBAS
- DGPS
- RTK Float

- RTK Fixed
- Invalid

IMU status:

- Standby
- Coarse Level
- Aided navigation

9. Warranty information

Notice
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Note:
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The copy of the specific warranty terms applicable to your Dewesoft product and replacement parts can be obtained from your local sales and service office. To find a local dealer for your country, please visit https://dewesoft.com/support/distributors.

9.1. Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

9.2. Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

Dewesoft d.o.o.
Gabrsko 11a
1420 Trbovlje Slovenia

Europe Tel.: +386 356 25 300
Web: http://www.dewesoft.com
Email: Support@dewesoft.com
The telephone hotline is available Monday to Friday from 07:00 to 16:00 CET (GMT +1:00)

9.3. Service/repair

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly on https://dewesoft.com/support/rma-service.

9.4. Restricted Rights

Use Slovenian law for duplication or disclosure. Dewesoft d.o.o. Gabrsko 11a, 1420 Trbovlje, Slovenia / Europe.

9.5. Printing History

Version 2.0.0, Revision 217 Released 2015 Last changed: 23. July 2018 at 16:54.

9.6. Copyright

9.7. Trademarks

We take pride in our products and we take care that all key products and technologies are registered as trademarks all over the world. The Dewesoft name is a registered trademark. Product families (KRYPTON, SIRIUS, DSI, DS-NET) and technologies (DualCoreADC, SuperCounter, GrandView) are registered trademarks as well. When used as the logo or as part of any graphic material, the registered trademark sign is used as a part of the logo. When used in text representing the company, product or technology name, the ® sign is not used. The Dewesoft triangle logo is a registered trademark but the ® sign is not used in the visual representation of the triangle logo.

10. Safety instructions

Your safety is our primary concern! Please be safe!

10.1. Safety symbols in the manual

Warning

Calls attention to a procedure, practice, or condition that could cause the body injury or death

Caution

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

10.2. General Safety Instructions

Warning

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Dewesoft d.o.o. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as an option and will not be shipped as standard parts.

10.2.1. Environmental Considerations

Information about the environmental impact of the product.

10.2.2. Product End-of-Life Handling

Observe the following guidelines when recycling a Dewesoft system:

10.2.3. System and Components Recycling

Production of these components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at its end of life! Please recycle this product in an appropriate way to avoid unnecessary pollution of the environment and to keep natural resources.

This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further information about recycling on the Dewesoft web site www.dewesoft.com

Restriction of Hazardous Substances
This product has been classified as Monitoring and Control equipment and is outside the scope of the 2002/95/EC RoHS Directive. However, we take care of our environment and the product is lead-free.

10.2.4. General safety and hazard warnings for all Dewesoft systems

Safety of the operator and the unit depend on following these rules.

- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- You may not connect higher voltages than rated to any connectors.
- The power cable and connector serve as Power-Breaker. The cable must not exceed 3 meters, the disconnect function must be possible without tools.
- Maintenance must be executed by qualified staff only.
- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advice for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), a non-interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.

- The inputs must not, unless otherwise noted (CATx identification), be connected to the main circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorized personnel only.
- Adverse environmental conditions are Moisture or high humidity Dust, flammable gases, fumes or dissolver Thunderstorm or thunderstorm conditions (except assembly PNA) Electrostatic fields, etc.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuiting, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until the safe operation can be verified by service-trained personnel. If necessary, return the product to Dewesoft sales and service office for service and repair to ensure that safety features are maintained.
- If you assume a more riskless use is not provided anymore, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more riskless operation is not possible anymore if the system is damaged obviously or causes strange noises. The system does not work anymore. The system has been exposed to long storage in adverse environments. The system has been exposed to heavy shipment strain.
- Warranty void if damages caused by disregarding this manual. For consequential damages, NO liability will be assumed!
- Warranty void if damage to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of high magnetic or electromagnetic fields, transmitting antennas or high-frequency generators, for exact values please refer to enclosed specifications.
- Use measurement leads or measurement accessories aligned with the specification of the system only. Fire hazard in case of overload!

- Lithium ion batteries are classified as not hazardous when used according to the recommendations of the manufacturer described in Battery Safety Data Sheet, which is available for download from this link.
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatize the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipment in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use in humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already- lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advice of the connected systems.
- This product has left the factory in safety-related flawlessness and in proper condition. In order to maintain this condition and guarantee safety use, the user has to consider the security advice and warnings in this manual.

EN 61326-3-1:2008
IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.

Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally well-tried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for the protection of buildings, are excluded from the scope of IEC 61326-3-1.

11. Documentation version history

Version	Date	Notes
V22-1	20.1.2022	NAVION i2 V1 user manual.
V22-2	30.8.2022	Added licensing, RTK and CAN settings.
V23-1	14.2.2023	Added images of Navion i2 v2 NMEA out definition
V23-2	7.4.2023	Updated coordinate frame explanation
V23-3	30.5.2023	Updated reference point and antenna offsets definition
V23-4	15.9.2023	New plugin with 3D mounting