

Rev.: 1.01 Date: 02.03.2024 Page: 1 von 32	Quick Installation Guide for the Devices of iNAT and iTraceRT-MVT Product Series	
Document No.: Reference:	DOC240202513 IEP-I000151	

Quick Installation Guide for the Devices of iNAT, ISULONA, iCOMBANA, iPRENA and iTraceRT-MVT Product Series

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Commercial-in-Confidence



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APPLICABLE DOCUMENTS

Table 1: Applicable Documents

Ref.	Document Name	Description	Document No.
[1]	iXCOM-CMD User Manual	Operational Software / GUI	DOC151112010
[2]	ICD for iNAT-Rx/-Fx/-Hx/-MSx/-M-x, for iTraceRT-MVT-5x/-6x and for iPRENA / iCOMBANA	Detailed description	DOC210906044
[3]	ICD for iNAT-M300, iTraceRT-MVT- 300, iSULONA, iATTHEMO	Detailed description	DOC220831094
[4]	ICD for iNAT-U200 iSULONA/RLx-U, iATTHEMO-RLx-U	Detailed description	DOC210121069
[5]	User Manual for iNAT System Family	Detailed description	DOC151228001

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1 SCOPE

This *Quick Installation Guide* shall help to setup iMAR's INS-based iNAT architecture quickly and to perform the first measurements. Therefore, we explain **only the most significant settings**. For a more detailed explanation and configuration, please refer to the iXCOM-CMD [1] manual. In addition, please check out the corresponding ICDs of your inertial measurement system – namely [2], [3], and [4], respectively. For general information on the iNAT and iTraceRT-MVT family, see [5].

This installation guide is valid for all systems based on the iNAT architecture. This document covers the following types of systems:

iNAT-RQT	iNAT-M200	iSULONA
iNAT-RQH	iNAT-CFM	iRailLoc
iNAT-FSLH	iNAT-CB	iANARO
iNAT-FSSG	iTraceRT-MVT	iCORUS
iNAT-MSLG	iATTHEMO	iPST-FMS
iNAT-M300	iPRENA	...
iNAT-U200	iCOMBANA	

In chapter 5, we prepare the device for a measurement. In contrast – just for getting to know your device – we prepare the device for a quick test on the desk in chapter 7.

For many items and questions we have dedicated Application Notes available – ask our support for details.

2 BASICS

Unless stated otherwise (inside of the system's manual), customers can mount iMAR inertial measurement systems or inertial navigation systems (INS) virtually in any direction and attitude. In addition, any location is possible. Of course, you must mount your INS at a location free from strong vibrations or eigen frequencies. By default, the estimated navigation solution – e. g. values like position, velocity and altitude – refer to the so-called *accelerometer intersection point*. The latter is located within the inertial sensor of the INS. However, the INS can transfer the solution to any point of interest and orientation. For this purpose (and for configuring the INS), we will explain two of the most important terms in this chapter.

It is mandatory to know the coordinate system used by the INS. You can read off this parameter directly from the label on top the INS. Alternatively, you may inspect the INS configuration with the iXCOM-CMD: Here, in the "System Info" tab, the field "IMU Output Frame" yields this information.

Please install the latest iXCOM-CMD. The iMAR Support-Team can provide you with a link for downloading the software. For verifying your demand, we will require the project number (Proj.No.), Part Number (P/N), and Serial Number (S/N) as well as revision identifier of your device. You can find this information on the type plate on every INS. An example of this type plate and contact details of the iMAR Support, you find at chapter 9.

2.1 Power

On the type plate, you also find the required voltage to power the device and required expected power consumption. Typical values are 10-35 V DC, 16-35 V DC or 9-34 V DC, depending on the iNAT type and version. Please ensure that your power supply stays within the required range all the time and can provide the required power.

2.2 Angular Offsets

For determining angular offsets, follow the following rules:

- The rotation order is Z, Y, X!
- Using the “right-hand rule”: The thumb of the right hand is showing along the axis around, which shall be rotated. The other fingers will point out the positive direction of the angle.
- Rotating the vehicle coordinate system into the INS system



Figure 1: Right hand rule for rotations

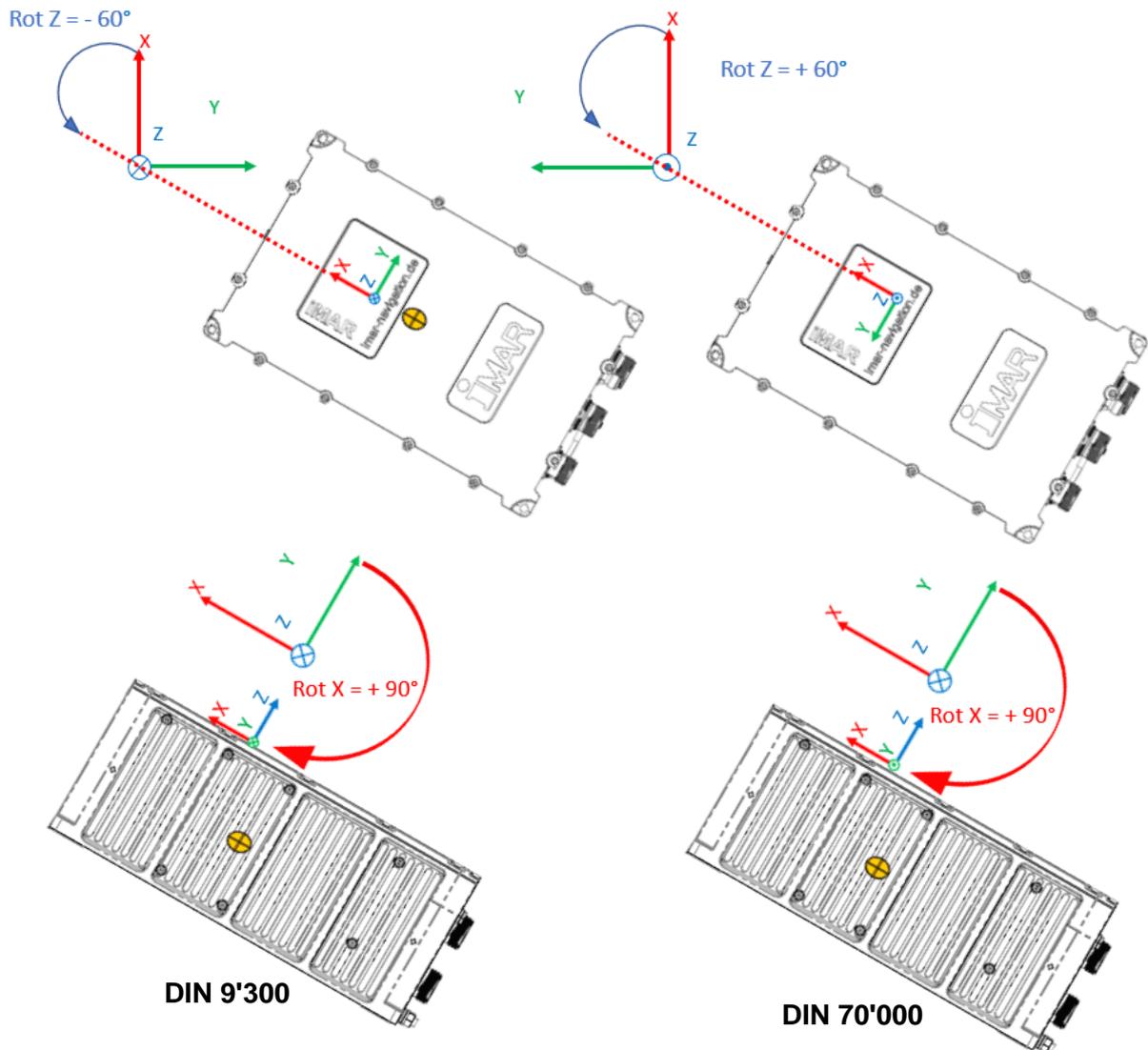


Figure 2: Two consecutive rotations around Z- and X-axis

2.3 Lever Arm

The lever arm is the offset from the INS's reference point to another point within the coordinate system of the INS. The reference point is in the center of the screw hole on the opposite side of the connectors. When you look at them it is the left hole, on height of bottom face of the base plate. Please note that this reference point is located at the same position for nearly all INS systems of the iNAT and iTraceRT-MVT family.

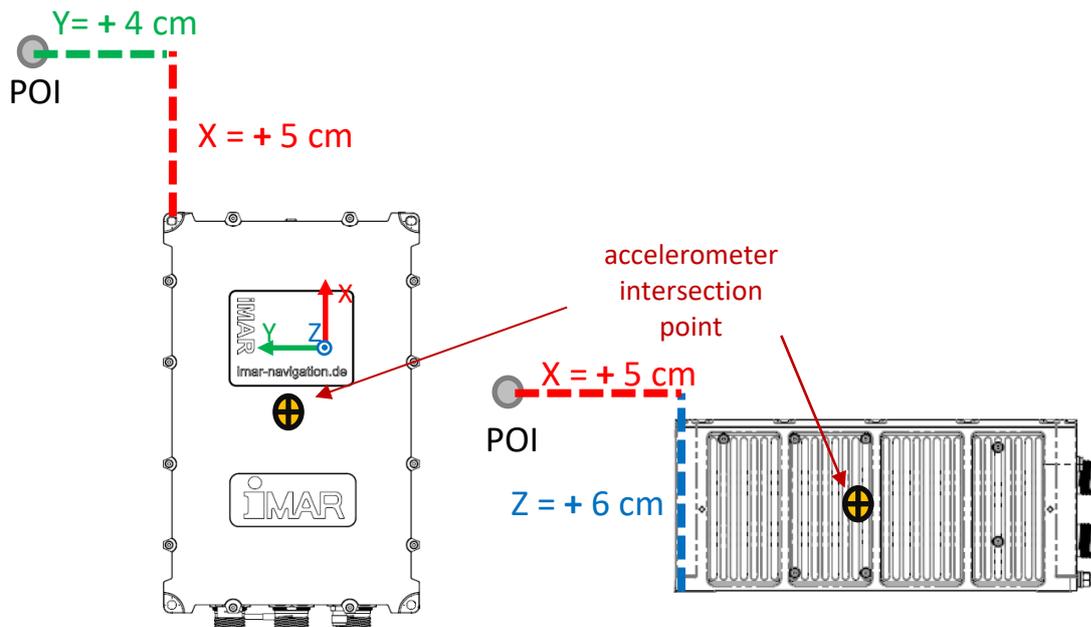


Figure 3: Lever arm (DIN 70'000)

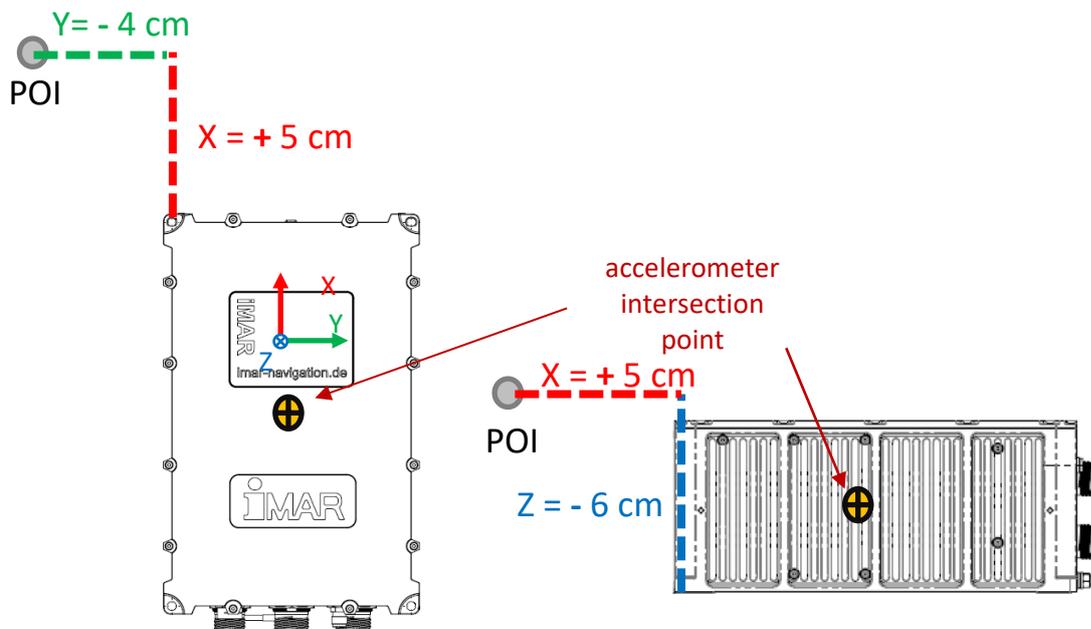


Figure 4: Lever arm (DIN 9'300)

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3 IXCOM-CMD BASICS

3.1 Connect

We recommend to connect to the INS via Ethernet (or USB if available). For this purpose, the IP range (subnet) of your computer must match with the IP range configured on your INS. In Appendix **Fehler! Verweisquelle konnte nicht gefunden werden.** we briefly explain how to change the IP address of the your computer accordingly.

By default, the INS comes with the following settings (unless you ordered a special configuration):

- IP address: 192.168.1.30
- Subnet mask: 255.255.255.0 or 255.255.248.0

In this case, you can use the “Search INS” function of iXCOM-CMD. This will broadcast a UDP search and the INS will answer with its name and IP address. Now, you can select the desired device via the dropdown menu. Alternatively, you may enter the IP address of the device manually.

If available, the connection via USB will work like the connection via Ethernet, but with the following default settings:

- IP address: 192.168.47.11
- Subnet mask: 255.255.255.0

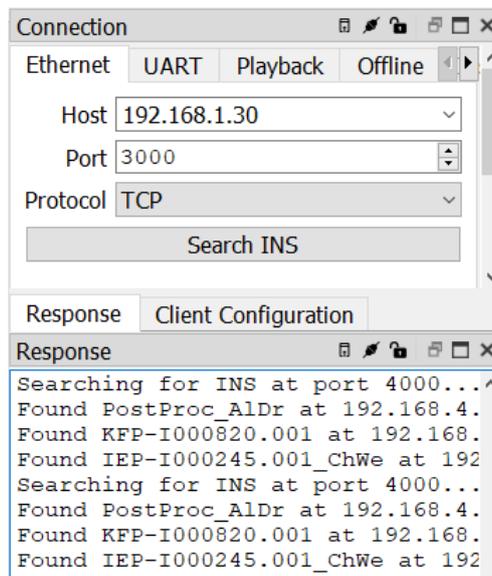


Figure 5: Ethernet/USB connection

You can also configure a UART connection to the INS. For this purpose, you require a serial port at your computer. For adding such a port to your PC or laptop, fir instance, a simple Serial-to-USB-adapter suffices. If the serial connector of the INS is a ...

... 9-pin-connector (RS232 level), you can use a common adapter. Depending on the adapter specifics, the setup may require a null-modem adapter.

... 15-pin-connector (RS422 level), you must use an adapter delivered by iMAR.

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Next, select the “Channel” of the INS and the “Port” of your computer that connects to the INS. By default, the “Baud Rate” is 115200 bits/s. For determining the baud rate automatically, please use the button “Detect Baud Rate”.

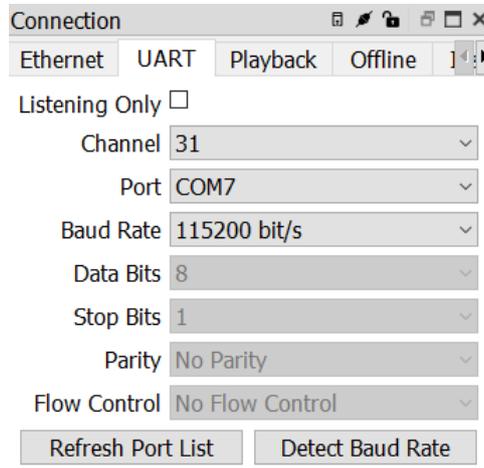


Figure 6: UART connection

3.2 Apply and save changes

When modifying any setting in iXCOM-CMD, the buttons “Apply” and “Refresh” will pop up in the lower part of the window.



Figure 7: “Apply”, “Refresh” and “Save Config” button

Pressing “Refresh” reverts these changes and retrieves the saved configuration from the INS.

In contrast, for transmitting these changes to the INS, press “Apply”. Clicking on the “Save Config” button in the upper taskbar will make these changes persistent over a power cycle.

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4 CONFIGURATION

The iXCOM-CMD offers powerful Wizards for assisting users to configure the device properly. The wizard “Vehicle Standard Configuration” covers most settings from sensors up to data recording.

You can find the available Wizards by clicking on the Wizard button in the upper icon bar- Afterward, press “Next”.



Figure 8: Wizard button

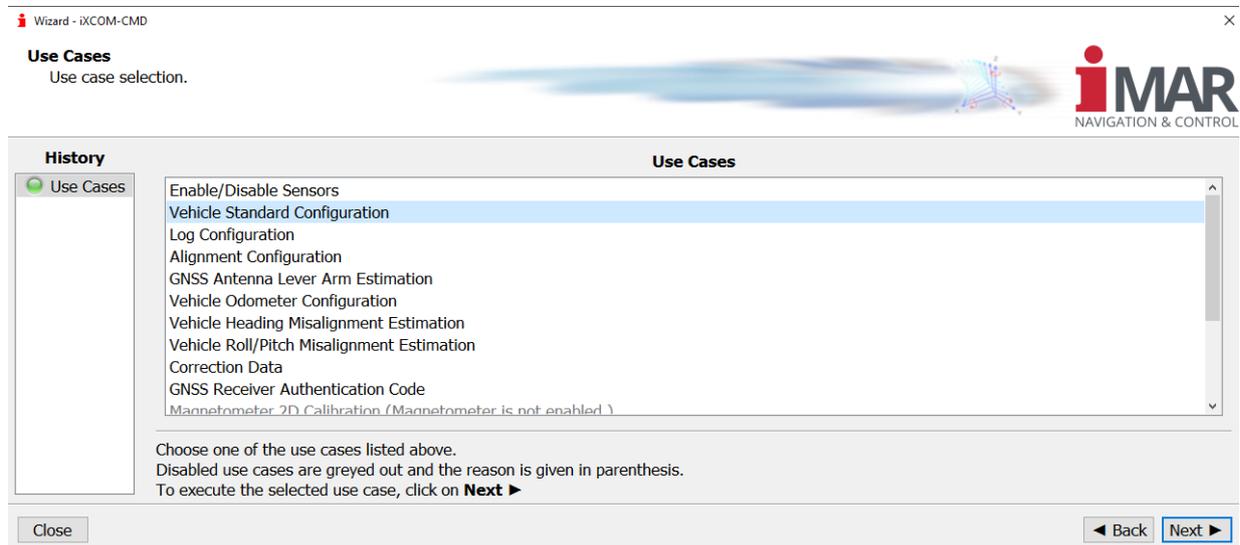


Figure 9: Available iXCOM-CMD Wizard use cases

5 PREPARATION FOR MEASUREMENT

This section will guide you through the preparation of the INS for your measurements. The titles and subtitles will correspond to the tabs and subtabs of the iXCOM-CMD. Depending on your setup and application, not all subsections are of interest to you.

5.1 Interfaces INS

Configure communication interfaces to the INS.

5.1.1 Ethernet

Depending on your Ethernet setup, you may select between a “Static” IP address and “DHCP”. It is important to note that we strictly discourage you from change the “Port”! In addition, for modifying the Ethernet interface settings, we recommend to connect via USB or serial.

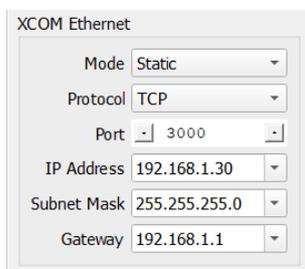


Figure 10: Ethernet interface

5.1.2 UART

For communicating with iXCOM-CMD, transmitting logs or providing GNSS correction data to the internal GNSS receiver, you have to configure the UART ports with the required “Baud Rate” and “Level”. The most commonly used “Mode” are as follows:

- “*XCOM*”: Sending and receiving XCOM commands and logs. Required to communicate with the iXCOM-CMD.
- “*XCOM Autostart*”: Automatically send logs. How to select the logs which shall be send on the here defined “Channel”, will be explained in detail in chapter 5.5 later.
- “*GNSS Correction*”: Required to provide GNSS correction data to the receiver. Please define input format (RTCMv3, RTCM, CMR...) and the GGA period.
- „*External Sensor*“: This will allow the INS to communicate with an external sensor like a DVL or magnetometer.

XCOM UART Ports					
Port	Baud Rate	Mode	Level	Additional Configuration	
COM3	115200 bit/s	XCOM	RS422		
COM4	115200 bit/s	XCOM Autostart	RS232	Channel 5	
COM5	115200 bit/s	GNSS Correction	RS422	RTCMv3	Period GGA: 1 s

Figure 11: UART interface

5.2 Sensors

5.2.1 GNSS

One of the most important sensors is the GNSS antenna. Connect the GNSS antenna cable to the connector. It is important to note that the lever arm between the GNSS antennas and the INS must not change during operation!

For configuring this parameter, you must state its coordinates (and its uncertainty) at the iXCOM-CMD tab labelled "Sensors → GNSS". For measuring the lever arm coordinates, please consider section 2.3 above.

Primary Antenna		
	Offset	Standard Deviation
X	0.050 m	0.100 m
Y	0.040 m	0.100 m
Z	0.060 m	0.100 m
Secondary Antenna		
	Offset	Standard Deviation
X	1.050 m	0.100 m
Y	0.040 m	0.100 m
Z	0.060 m	0.100 m

Figure 12: GNSS lever arm

If applicable, you must configure the lever arm of the secondary antenna, too. In the case of a dual-antenna device, we recommend a minimal distance of one meter between both antennas. It is important to note that you must connect the primary antenna to the connector with the lower number (e. g. X5). In contrast, the secondary antenna must connect to the connector with the higher number (e. g. X6).

The INS can estimate the lever arms if RTK- or PPP-based GNSS solutions are available. For this purpose, we recommend using the "GNSS lever arm estimation" Wizard.

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5.2.2 Odometer

For ground vehicle-based measurement campaigns with long periods of GNSS outages or degraded GNSS reception, utilizing an odometer typically yields a huge benefit.

Please use the connector labeled “ODO” of your INS. The Wizard “Vehicle Odometer Configuration” will assist in configuring the corresponding settings.

For manually configuring the odometer, you must calculate the scale factor according to the following formula:

$$Scale\ Factor = \frac{2 * \pi * radius\ wheel}{ticks\ per\ revolution\ odometer}$$

Equation 1: Odometer scale factor

Also, you must determine the lever arm, see 2.3, to the center of the contact surface of the wheel that carries the odometer sensor.

The INS can estimate the lever arm and the scale factor. Please use the Wizard mentioned above.

In addition, you must enter the mounting direction vector of the odometer. For instance, a value of 1.0 on X-axis and 0.0 on Y- and Z-axes means that the odometer measuring direction is pointing in parallel to the INS body X-axis.

However, internally the INS device requires normalized direction vectors; i. e. the squared sum of all three values must be 1.0. However, since the device will normalize this setting automatically, you can enter the component in any convenient way.

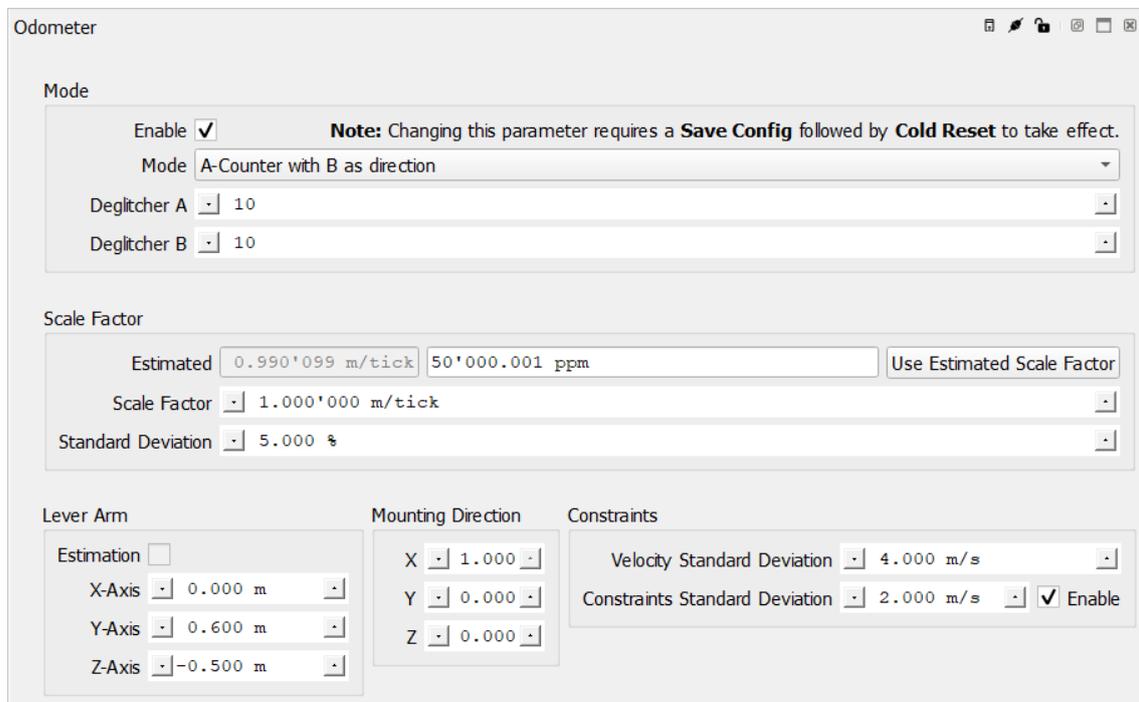


Figure 13: Odometer settings with odometer running in the INS X-axis direction.

5.2.3 IMU

As mentioned in the introduction, the device will work at any mounting position. However, it is not always possible to mount your INS in parallel to the vehicle axes. In this case, you may want to compensate the existing angular misalignment between vehicle and INS. In addition, please consider section 2.2 about **“Fehler! Verweisquelle konnte nicht gefunden werden.”** above.

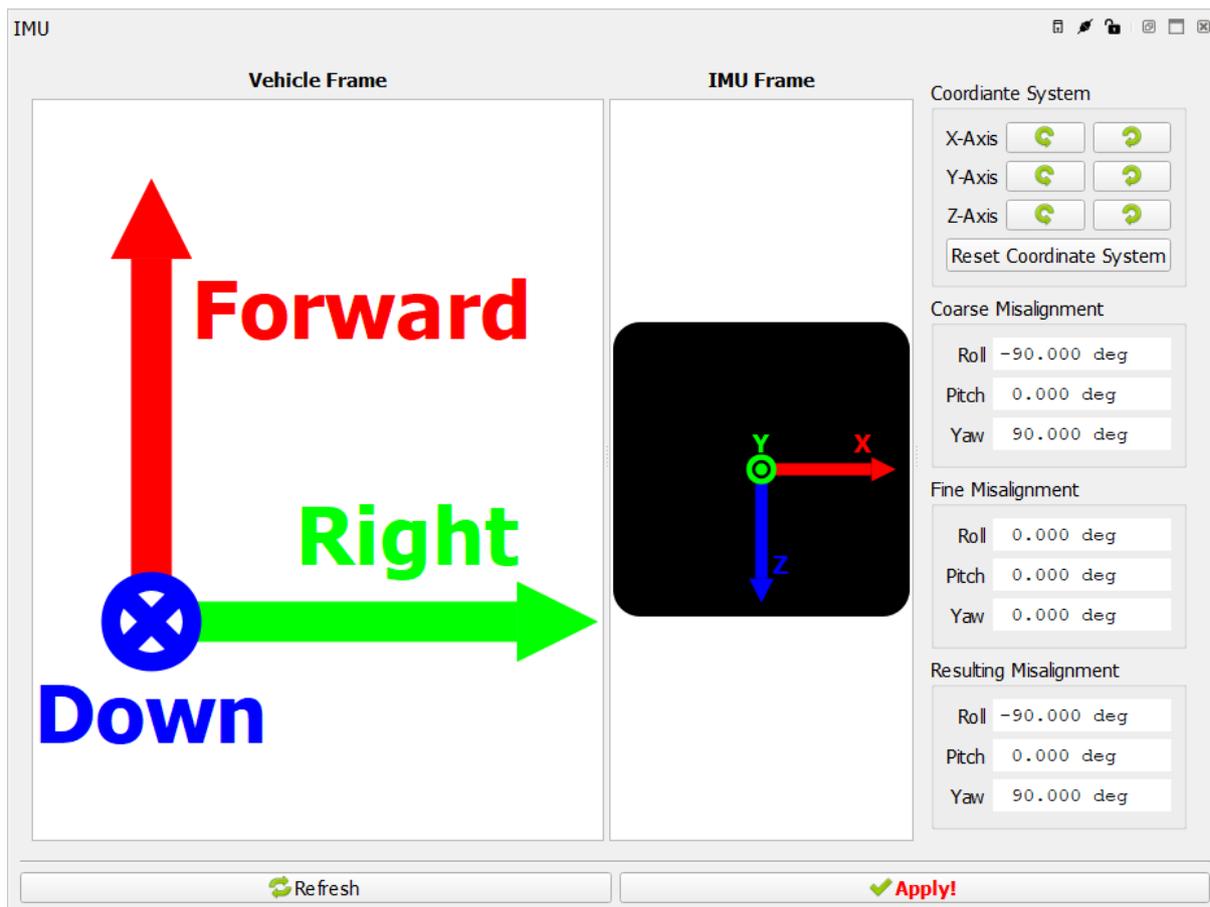


Figure 14: IMU Misalignment

Please note that this configuration will not have any effect on the algorithmic procedure and the solution accuracy. Only the output of the solution is rotated.

If this offset is not known, you can use the Wizards “Vehicle Heading Misalignment Estimation” and “Vehicle Roll/Pitch Misalignment Estimation” for estimating the angular misalignments.

When entering the values manually, first set the “Coarse Misalignment”. If you see in your measurements, that the rotated solution does not match the desired vehicle axis, you can simply use the “Fine Misalignment” for fine-tuning the rotation. This setting is a second rotation around the already rotated coordinate system with the values from the “Coarse Misalignment”. The GUI will calculate for you the “Resulting Misalignment” and send it to the INS. Since the INS has only one parameter for the misalignment, the values from the “Resulting Misalignment” will show up in the “Coarse Misalignment” fields now. You may continue fine-tuning the misalignment if desired.

5.2.4 Magnetometer

Depending on your used INS, connect the magnetometer to the connector labeled with COM1, COM3 or COM5. In the UART configuration tab (see 5.1.2), please set “Mode” to “External Sensor”.

Follow the same rotation rules as described in section 2.1 “Angular offsets” for compensating the rotatory offset between the INS and the magnetometer coordinate system. For this purpose, you must check “Enable iMAG” and configure “Port”, “Baud Rate” and “Type” of the used magnetometer.

The Wizards “Magnetometer 2D Calibration” and “Magnetometer 3D Calibration” can help the user to calibrate the magnetometer.

Misalignment

X-Axis

Y-Axis

Z-Axis

Configuration

Enable iMAG **Note:** Changing this parameter requires a **Save Config** followed by **Cold Reset** to take effect.

Port

Baud Rate

Type

Calibration

Enabled

	CC00	CC10	CC20	B0
CC00	<input type="text" value="1.000"/>	<input type="text" value="0.000"/>	<input type="text" value="0.000"/>	<input type="text" value="0.000"/>
CC01	<input type="text" value="0.000"/>	<input type="text" value="1.000"/>	<input type="text" value="0.000"/>	<input type="text" value="0.000"/>
CC02	<input type="text" value="0.000"/>	<input type="text" value="0.000"/>	<input type="text" value="1.000"/>	<input type="text" value="0.000"/>

Figure 15: Magnetometer settings

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5.3 Alignment

For estimating the attitude, sensor errors, and initial position, the device perform the alignment procedure. This is required for initializing the data fusion properly.

The Wizard “Alignment Configuration” will assist the user.

5.3.1 Startup

Select the source of the “Initial Position”. In most cases, we recommend “GNSS”. For the “Initial Heading”, the following options suit most use cases:

- Default: The system will estimate the heading during movement. High grade INS system will even estimate this at stand still.
- Dual Antenna: System using two GNSS antennas can estimate the heading at standstill.
- Magnetometer: Using a magnetometer will deliver also an initial heading at standstill.

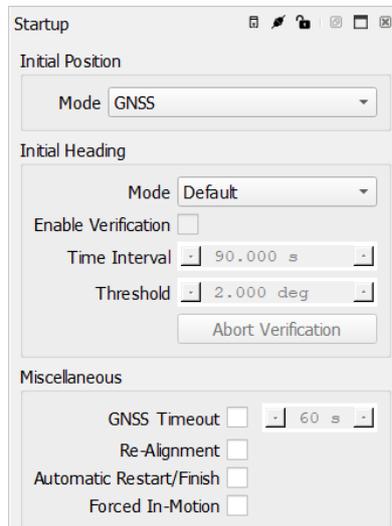


Figure 16: Startup of alignment

When the “Motion Detector” has been configured (will be explained in **Fehler! Verweisquelle konnte nicht gefunden werden.**), you may activate the “Automatic Restart/Finish” checkbox. The INS can now abort a running “Stationary Alignment” and may switch to a “Dynamic Alignment” – if the device detects motion. We will explain the difference between these two alignment modes in the following subchapter.

5.3.2 Alignment

The “Method” called “Stationary alignment” requires a complete standstill of the INS during the entire period of the “Levelling Duration” and “Stationary Duration”. Note that the “Stationary Duration” differs from systems with different inertial sensors. By default, the configured values fit to the recommendation.

In contrast, a “Dynamic alignment” requires constant GNSS reception and some decent dynamics. High grade INS system can also do this alignment at standstill.

Attention: With the option “Initial Position: GNSS” the alignment will instantly start after the GNSS solution is considered as valid, even if the system is moving. If you configure your device to use the “Stationary alignment” method, such movements will lead to a broken initialization.

Therefore, we recommend to choose one of the following start-up procedures:

- Power the INS under open sky or trigger the „Stationary Alignment“ at a specific moment, so the standstill condition is fulfilled during the required time.

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- Select “Dynamic alignment”.
- Select “Stationary Alignment” and “Automatic Restart/Finish” while the “Motion Detector” is configured.

It is important to note that the checkbox “Gyro Averaging” shall be activated only for MEMS units.

Alignment

Method Dynamic alignment

Levelling Duration 5.000 s

Stationary Duration 30.000 s

Gyro Averaging

Track Align

Enable

Threshold 14.400 km/h

Direction X 0.000

Direction Y -1.000

Direction Z 0.000

Thresholds

Heading 0.050 deg

Position Medium 1.000 m

Position High 0.500 m

ZUPT

Standard Deviation 0.010 m/s

Figure 17: Alignment

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5.4 Aiding

The algorithms of the INS data fusion and GNSS engine can utilize additional information for aiding.

5.4.1 GNSS Aiding

For improving the GNSS solution, the INS' integrated GNSS receiver can utilize GNSS correction data provided by base stations or external providers. The "Correction data" Wizard allows for integrating such sources easily. Alternatively, you can use the iXCOM-CMD tab "Aiding" for this purpose. Please remember, that the correction data provided by a modem over the serial connection, must be configured as described in 5.1.2.

5.4.1.1 INS NTRIP Client

When an Internet connection is provided to the INS, it can acquire correction data on its own. For this purpose, the INS device requires the "Server" address, and the "Port". For login, please enter "User" name and "Password". In addition, you must enter name of the mount point at the field "Stream".

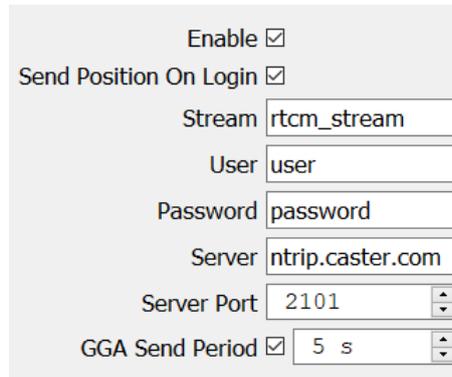


Figure 18: INS NTRIP Client

5.4.2 Motion Detector

Knowing when the INS is at a complete standstill is a valuable information for the INS – especially during GNSS outages. For this purpose, you can use the "ZUPT"-button in the upper taskbar. It is important to note that, by using this button, the INS will assume it is at a complete standstill, even under movement! An improper use will lead to a degradation of the solution.

However, the system can determine zero-velocity periods automatically if certain measurement values drop below given "Thresholds".

5.4.2.1 Thresholds

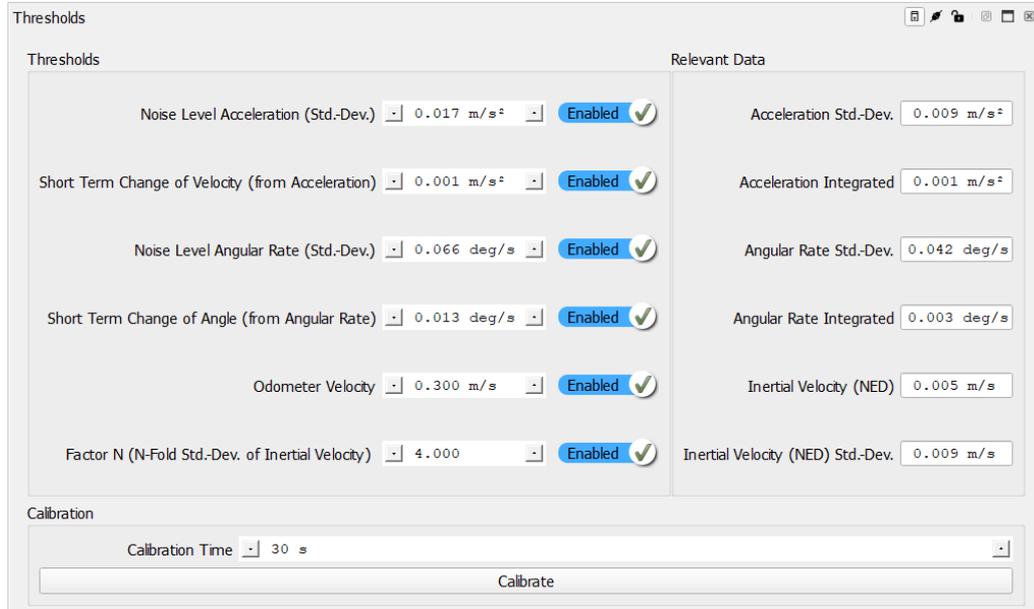


Figure 19: Motion detector thresholds

For determining acceleration- and angular rate-dependent values, the INS must have undergone an alignment and some decent movement. Afterward, you can “Calibrate” the required “Thresholds” at standstill.

For the “Velocity” variant, the device will require an odometer. By default, the value of 0,1 m/s suits most cases.

5.4.3 Zero velocity aiding

Please ensure to enable the “Automatic ZUPT”. It is important to note that the parameter “Zero Angular Rate Aiding” must be active for MEMS units only!

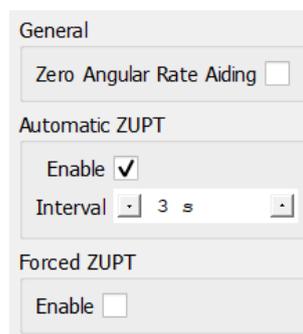


Figure 20: ZUPT aiding

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5.5 Log Configuration

The Wizard “Log Configuration” can assist the user by selecting the interface and required logs.

5.5.1 iXCOM

Data will be transmitted in the iMAR’s proprietary binary data format. A “Log Channel” must be selected and one of the following “Usages”:

- “UART Autostart”: All configured logs will be transmitted via the selected “Port”. The baud rate of this port can be configured under “Interfaces INS UART”, see 5.1.2. Please select there „XCOM Autostart“, too.
- “UDP Autostart”: All configured logs will be sent via Ethernet to the “IP Address” and “Port” of the host/target computer. It is also possible to enable the “ABD Interface” for ABD steering robots here.
- “System Recorder”. The device will store the configured logs on the INS’s internal memory. Three options are available here:
 - “Manual”: Starting the recording must be done manually by clicking the “REC INS button”. Only the configured logs are recorded.
 - “Auto-Start”: The recording will start automatically after power up. Only the configured logs are recorded.
 - “Store only Post-Processing Logs with Auto-Start”: The recording will start automatically after power up. A default log list is used, each log at a specific rate. Since we can easily utilize such data for post-processing purposes and later analyses, we recommend this option for data logging.
- “Host Computer”: All configured logs will be stored in the selected “Directory” of the used computer. A “Prefix” can be added to all subfolders and a “Format” can be selected.

For the configuring the “Log List”, select the “Frequency” of the desired “Log” and its “Trigger”. Setting “Trigger” type to “Sync” suits most use cases.

Finally, press “Add” for adding the log to the “Log List”.

Please note that you can configure either iXCOM messages or NMEA0183 messages on a given channel.

Channel

Log Channel ▶ 1: recording (System Recorder) ▼ Deactivate

Usage

Usage System Recorder ▼ ✔ Apply!

Mode Store only Post-Processing Logs with Auto-Start ▼

Supplement

Log List

Action	Trigger	Frequency	Activity	Log
Add	Sync ▼	1 Hz ↕	<input type="radio"/>	NTRIP Status
Add	Sync ▼	1 Hz ↕	<input type="radio"/>	Load Factor
Add	Sync ▼	1 Hz ↕	<input type="radio"/>	Angular Acceleratio...
Add	Event ▼	1 Hz ↕	<input type="radio"/>	Satellite Info
Remove	Sync ▼	500 Hz ↕	<input checked="" type="radio"/>	Post Processing
Add	Sync ▼	1 Hz ↕	<input type="radio"/>	ABD

Estimated Transfer Rate 1'039.104 kbit/s

Note: Changes to the log list are applied immediately without the need for any confirmation.

Figure 21: Log Configuration, iXCOM with enabled System Recorder.

5.5.2 Data

You can modify the content of the log “INS Solution” (INSSOL). The IMS settings may be

- “Raw Data”: Calibrated INS data (i. e. including gravity and earth rate)
- “Corrected”: Calibrated IMS data, additionally corrected for estimated bias and scale factor (sensor errors), obtained by the data fusion.
- “Compensated”: Similar to “Corrected”, but additionally compensated for gravity and earth rotation rate.
- “Corrected Filtered”: The very same as “Corrected”, but after a “Band-stop Filter”.
- “Compensated Filtered”: The very same as “Compensated”, but after a “Band-stop Filter”.

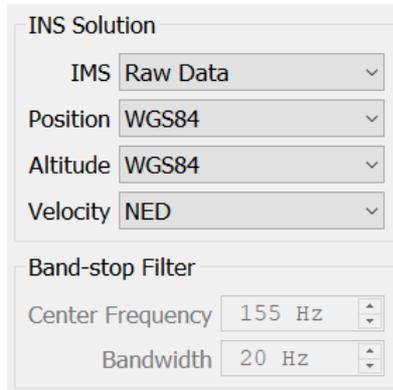


Figure 22: Log Configuration, Data

5.5.3 NMEA 0183

NMEA-0183-conforming strings can be transmitted via UART or UDP at a specific rate, like the iXCOM messages. Please check section 5.5.1 for configuring such output. Please note you cannot configure XCOM messages and NMEA 0183 sentences on the same channel.

Action	Trigger	Frequency	Activity	Log
Add	Event	1.000 Hz	●	Plugin Data
Add	Sync	1.000 Hz	●	ABD
Add	Sync	1.000 Hz	●	NMEA 0183 GGA
Add	Sync	1.000 Hz	●	NMEA 0183 GLL
Add	Sync	1.000 Hz	●	NMEA 0183 GSA
Add	Sync	1.000 Hz	●	NMEA 0183 HDT
Remove	Sync	1.000 Hz	▲	NMEA 0183 RMC
Remove	Sync	1.000 Hz	▲	NMEA 0183 VTG
Remove	Sync	10.000 Hz	▲	NMEA 0183 ZDA
Remove	Sync	10.000 Hz	▲	NMEA 0183 GST
Add	Sync	100.000 Hz	●	NMEA 0183 PIAHS
Add	Sync	1.000 Hz	●	NMEA 0183 PISTATUS1
Remove	Sync	100.000 Hz	▲	NMEA 0183 PAPBN

Estimated Transfer Rate: 65.520 kbit/s

Figure 23: NMEA 0183 logs

5.5.4 CAN

For activating the transmission of CAN messages, please set “Mode” to “Simple CAN”. In the tab “SimpleCAN” you can set the desired logs with the desired rate. All messages are transmitted at the configured “Frequency”. The ID of the messages start at the “Base Address” and it can be selected between masked IDs (“Format 29 bit”) and not masked IDs (“Format 11 bit”). In addition, you can select the “Source” of the data.

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Configuration **SimpleCAN**

CAN1

Mode **Simple CAN**

Baudrate **1000 kbit/s**

Enable Gateway

Enable Bus-Recovery

CAN2

Mode **None**

Baudrate **1000 kbit/s**

Enable Gateway

Enable Bus-Recovery

Figure 24: CAN configuration

Configuration **SimpleCAN**

Base Address **256**

Frequency **5.000 Hz**

Source **INS**

Extended Id

Estimated Transfer Rate **12.900 kbit/s**

[Export DBC](#)

Enable	ID	Name
<input checked="" type="checkbox"/>	0x00	Vehicle Angular Rate (Earth Rate Compensated)
<input checked="" type="checkbox"/>	0x01	Vehicle Acceleration (Gravity Compensated)
<input checked="" type="checkbox"/>	0x02	Vehicle Acceleration (Including Gravity)
<input checked="" type="checkbox"/>	0x03	Attitude (roll + pitch + yaw)
<input checked="" type="checkbox"/>	0x04	Velocity East
<input checked="" type="checkbox"/>	0x05	Velocity North
<input checked="" type="checkbox"/>	0x06	Velocity Up
<input checked="" type="checkbox"/>	0x07	Longitude
<input checked="" type="checkbox"/>	0x08	Latitude
<input checked="" type="checkbox"/>	0x09	Altitude
<input checked="" type="checkbox"/>	0x0a	Roll/Pitch/Yaw Standard Deviations
<input checked="" type="checkbox"/>	0x0b	Velocity Standard Deviations
<input checked="" type="checkbox"/>	0x0c	Position Standard Deviations
<input checked="" type="checkbox"/>	0x0d	Time Information
<input checked="" type="checkbox"/>	0x0f	System Status
<input checked="" type="checkbox"/>	0x11	Side Slip Angle
<input checked="" type="checkbox"/>	0x12	System Temperature

Figure 25: Simple CAN log list

5.5.5 ARINC 429

The values of each label on the ARINC 429 are defined as in the standard, but you may change them if desired.

Channel
 Selected 2

General

High Speed

RX

Loop-Back

Labels

Enable	Label ID	Data ID	Field Width	Offset	Frequency	Scale	Range
enabled ✓	104	UtcTime	0	0	5.000 Hz	1.000	0.000
enabled ✓	96	UtcFine	20	0	5.000 Hz	1.000	1.000
enabled ✓	176	UtcDate	0	0	5.000 Hz	1.000	0.000
enabled ✓	217	BodyAccelLongitudinal	12	0	5.000 Hz	0.001	4.000
enabled ✓	218	BodyAccelLateral	12	0	5.000 Hz	0.001	4.000
enabled ✓	219	BodyAccelNormal	12	0	5.000 Hz	0.001	4.000
enabled ✓	223	InertialRollRate	13	0	5.000 Hz	0.016	128.000
enabled ✓	222	InertialPitchRate	13	0	5.000 Hz	0.016	128.000
enabled ✓	224	InertialYawRate	13	0	5.000 Hz	0.016	128.000
enabled ✓	221	TrackAngleRate	11	0	5.000 Hz	0.016	32.000
enabled ✓	213	Roll	14	0	5.000 Hz	0.011	180.000
enabled ✓	212	Pitch	14	0	5.000 Hz	0.011	180.000

Figure 26: ARINC 429 configuration

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5.5.6 Virtual Measurement Point

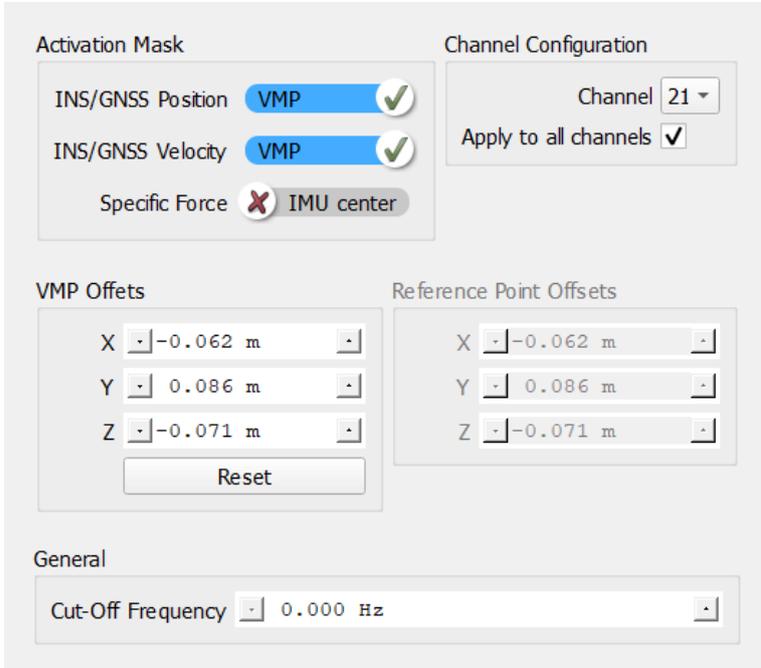
By default, all values are given out at the position of the accelerometer intersection point, which is located in the inertial sensor of the IMU. Please refer to the ICD of the used device to get its device depending position. But since this is not always the point of interest, this point can be transferred to another point.

When check marking a value under “Activation Mask” this value is transferred along the “Direction” starting at the INS reference point. For details, please consider section 2.3.

If all values of the “VMP Offsets” are zero and a check box of “Activation Mask” is marked, then the value is transferred to the reference point of the INS. If no value is check marked, then the values are not transferred away from the accelerometer intersection point, no matter of the configured “VMP Offsets”.

This VMP can be configured for every “Channel” separately or applied to all channels.

At factory settings the all vales are unchecked and the direction is the offset from the INS reference point to the accelerometer intersection point. This is only for information purposes.



The screenshot displays the VMP configuration interface with the following sections:

- Activation Mask:**
 - INS/GNSS Position: VMP
 - INS/GNSS Velocity: VMP
 - Specific Force: IMU center
- Channel Configuration:**
 - Channel: 21
 - Apply to all channels:
- VMP Offsets:**
 - X: -0.062 m
 - Y: 0.086 m
 - Z: -0.071 m
 - Reset button
- Reference Point Offsets:**
 - X: -0.062 m
 - Y: 0.086 m
 - Z: -0.071 m
- General:**
 - Cut-Off Frequency: 0.000 Hz

Figure 27: Virtual measurement point (VMP) configuration

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6 START MEASUREMENT

Please configure the device as follows (required only once):

Mandatory:

- Set lever arms for GNSS antenna/s, see 5.2.1 for configuration and 2.3 for definition
- Configure alignment that best suits your case, see 5.3
- Define desired data output, see 5.5

Optional:

- GNSS correction data, see 5.1.2 or 5.4.1
- Odometer configuration, see 5.2.2
- Magnetometer configuration, see 5.2.4
- Configure „Motion detector“ (e.g. for ZUPTs), see 5.4.2
- Set misalignment, see 5.2.3 for configuration and for 2.2 definition

Please check and do the following every time before starting the measurement:

- Make sure, that the GNSS antenna/s is/are connected
- Apply power the device, see 2.1
- Double check if data is recorded/transmitted
- Follow requirements for alignment procedure, see 5.3

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7 PREPARATION FOR QUICK LAB TEST SETUP

The following chapter describes how to configure an iNAT system for acquiring data in a lab environment (as a stand-alone unit). As many labs lack proper GNSS reception, this setup explains how to configure the iNAT for such an environment.

7.1 Alignment

Assuming that GNSS is unavailable, we must configure the device to align itself at a user-defined position. For devices not capable of gyro compassing (M200, FSSG...), we recommend setting the heading to a defined value with a given standard deviation, too.

7.1.1 Startup

Please set the “Initial Position” mode to “Forced”. If required, set the “Initial Heading” to the same “Mode”.

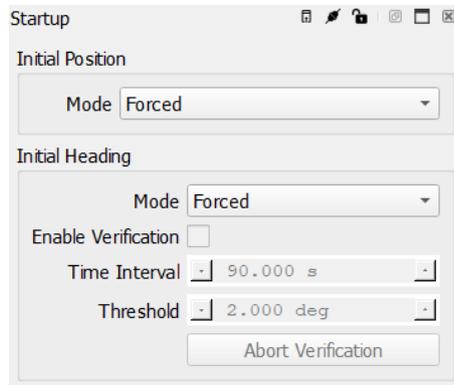


Figure 28: Lab test - Alignment startup

7.1.2 Alignment

Set the “Method” to “Stationary alignment”. Remember, that “Gyro Averaging” should be set for MENS units only.

Alignment

Method: Stationary alignment

Levelling Duration: 2.000 s

Stationary Duration: 120.000 s

Gyro Averaging:

Track Align

Enable:

Threshold: 4.000 m/s

Direction X: 1.000

Direction Y: 0.000

Direction Z: 0.000

Thresholds

Heading: 0.050 deg

Position Medium: 1.000 m

Position High: 0.500 m

ZUPT

Standard Deviation: 0.100 m/s

Figure 29: Lab test – Alignment

7.2 Aiding

7.2.1 Motion Detector

Please enable the “Factor N”. this will allow the device to perform ZUPTs.

Thresholds	Relevant Data
Noise Level Acceleration (Std.-Dev.) 0.010 m/s² <input checked="" type="checkbox"/> Disabled	Acceleration Std.-Dev. 0.011 m/s²
Short Term Change of Velocity (from Acceleration) 2.000 m/s² <input checked="" type="checkbox"/> Disabled	Acceleration Integrated 0.000 m/s²
Noise Level Angular Rate (Std.-Dev.) 0.010 deg/s <input checked="" type="checkbox"/> Disabled	Angular Rate Std.-Dev. 0.048 deg/s
Short Term Change of Angle (from Angular Rate) 1.000 deg/s <input checked="" type="checkbox"/> Disabled	Angular Rate Integrated 0.005 deg/s
Odometer Velocity 0.300 m/s <input checked="" type="checkbox"/> Disabled	Inertial Velocity (NED) 0.009 m/s
Factor N (N-Fold Std.-Dev. of Inertial Velocity) 4.000 <input checked="" type="checkbox"/> Enabled	Inertial Velocity (NED) Std.-Dev. 0.023 m/s

Figure 30: Lab test - Motion detector

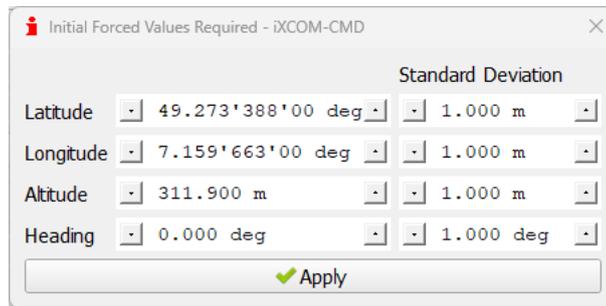
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7.2.2 ZUPT Aiding

Please ensure to enable “Automatic ZUPT” as described in section 5.4.3.

8 QUICK LAB TEST PROCEDURE

After configuring the device as described in chapter 7, you can hit the button “Static Alignment”. Please provide a position as close as possible to the real position with a reliable standard deviation. Please set the “Standard Deviation” of the “Heading” to a value less than 2 deg.



	Value	Standard Deviation
Latitude	49.273'388'00 deg	1.000 m
Longitude	7.159'663'00 deg	1.000 m
Altitude	311.900 m	1.000 m
Heading	0.000 deg	1.000 deg

✔ Apply

Figure 31: Alignment - Set initial position and heading

When the alignment has finished, the “In Motion” LED should be off and the “ZUPT” LED should be blinking. When starting to move the device, the “In Motion” LED becomes blue and the ZUPT LED stays off.

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9 CONTACT / SUPPORT

You can find general information about our products, used technologies and about inertial navigation and GNSS based navigation at www.imar-navigation.de.

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Germany

Type: iNAT-M200-MLI Proj.No.: KFP-I000718.001 P/N 00190-00003-0201 S/N: 00001 -- A B C D Power: 9-34 V DC / 10W MFD: 05.2017 Nato CageCode DN401	 
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For our support management system, we need to know the project number (Proj.No.) and part number (P/N) and serial number (S/N) as well as revision character of the system you are speaking about.

These numbers are for example provided on the type plate (example shown in the Fig. on the right side).

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10 ABBREVIATIONS AND ACRONYMS

Table 2: Abbreviations

Expression	Description
INS	Inertial navigation system
GNSS	Global navigation satellite system