Inertial Labs IMU GUI

User Manual

Supported Devices:

IMU-P	KERNEL-100	TAA-304	TAG-200
IMU-P-M	KERNEL-102	TAA-308	TAG-207
IMU-P10	KERNEL-108	TAA-315	TAG-300
IMU-NAV-100	KERNEL-110		TAG-301
IMU-NAV-200	KERNEL-110M		TAG-307
IMU-H100	KERNEL-111		TAG-340
	KERNEL-120		TAG-512
	KERNEL-201		
	KERNEL-210		
	KERNEL-220		

Revision 2.35

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CONTACT INFORMATION

Contact Information	
Contact Information	info@inertiallabs.com https://inertiallabs.com Phone: +1 (703) 880-4222 39959 Catoctin Ridge St, Paeonian Springs, VA 20129, USA
Customer Support	Inertial Labs, Inc. offers extensive technical support. Visit the Inertial Labs Technical Support page if you have any questions. Also, you can contact the support team directly via the email address support@inertiallabs.com
Sales Contacts	To communicate with the sales department, use email address sales@inertiallabs.com
Social Networks	

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1. Introduction

This manual describes the GUI and provides information on the usage, care, and maintenance of the following Inertial Labs IMU products: IMU-NAV, IMU-P, TAG, KERNEL IMU, IMU-P10, TAA, and IMU-H100 (see Fig. 1.1).

Read this User Manual along with the provided Interface Control Document (ICD) to ensure proper usage.

Fig. 1.1. Inertial Labs products that are compatible with the IMU GUI

1.1. System Requirements

Operating System Requirements

The IMU GUI software is fully compatible with Microsoft Windows XP, Vista, 7, 8.1, and 10 (32bit); additionally, the IMU GUI works with 32bit and 64bit Linux.

Usage Requirements

The “Inertial Labs IMU GUI” is a Win32 application. A keyboard and mouse are required to operate the software. Since it runs on standard Windows OS, users should be familiar with general PC and Windows operations.

Understanding the Software

The directory structure for storing data must be created by the user. All required configuration and calibration coefficients are stored in the IMU's nonvolatile memory and automatically loaded into the device's microprocessor. These calibration coefficients are pre-set by the IMU developer and should only be modified under their guidance.

When the "Inertial Labs IMU GUI" software is closed, it generates a parameter file (*.prm) that stores the most recent microprocessor and shell configuration values. During operation, the system can automatically generate files with the extensions *.prm, *.dat, and *.bin when saving text or graphical data. Additionally, the user can create files in *.txt and *.rtf formats.

System Requirements

The software requires 30 MB of RAM for proper operation and approximately 25 MB of hard drive space for the GUI software files. Additional space should be allocated for files saved during operation. The recommended minimum screen resolution is 1280 x 1024 pixels. The IMU is connected to the PC via either a USB port when using the RS422-to-USB or RS-232 converter.

1.2. Getting Started

The "Inertial Labs IMU GUI" software does not require any installation. Just copy the software folder to the working directory and launch the application.

When connecting the IMU to a USB port through RS422-to-USB or RS232 converter for the first time, drivers for the RS-422-to-USB cables may need to be installed. If your connected device does not appear as shown in Fig. 1.2 see Section 6 for help.

Open "Device Manager" window to view and make note of the COM port number assigned to the respective unit (Control Panel -> System and Security -> System -> Device Manager). Fig. 1.2 shows the location of the cable and the assigned port number as "USB Serial Port (COM<N>)". Number '<N>' is the port number assigned by the operating system.

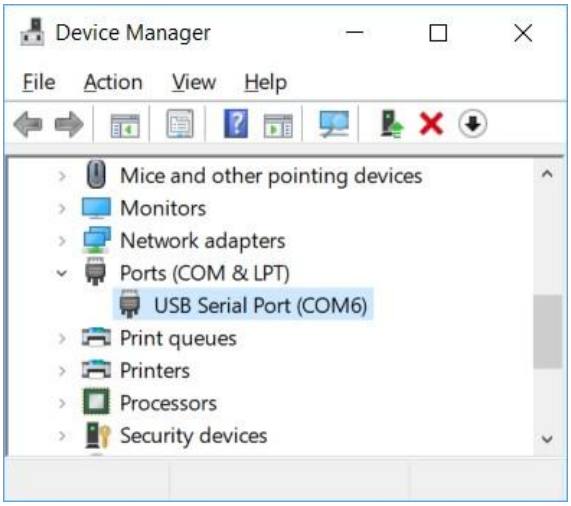

Fig. 1.2. Location of the Inertial Labs connected product under Device Manager

To minimize latency and improve performance, adjust some of the COM port properties for the COM-to-USB converter. Begin by right-clicking on “USB Serial Port (COM<N>)” and select “Properties” as shown in Fig. 1.3.

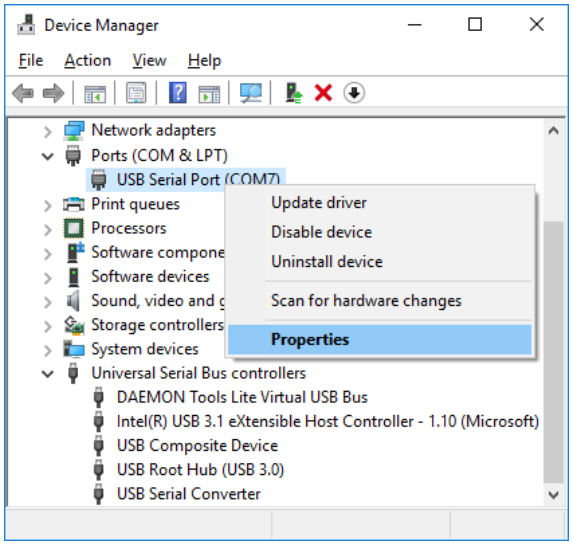

Fig. 1.3

From there, in the newly opened window, navigate to the “Port Settings” tab and click the “Advanced” button (see Fig. 1.4).

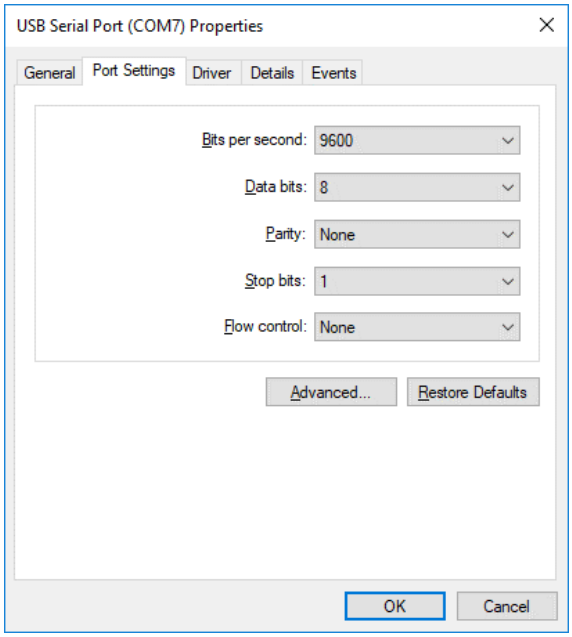

Fig. 1.4

In the opened window set the following parameters:

- Latency Time (msec) to 4.
- Minimum Read Timeout (msec) to 0.
- Minimum Write Timeout (msec) to 0.

After making changes (shown in Fig. 1.5), click “OK”. A restart of your host computer may be required to apply the changes.

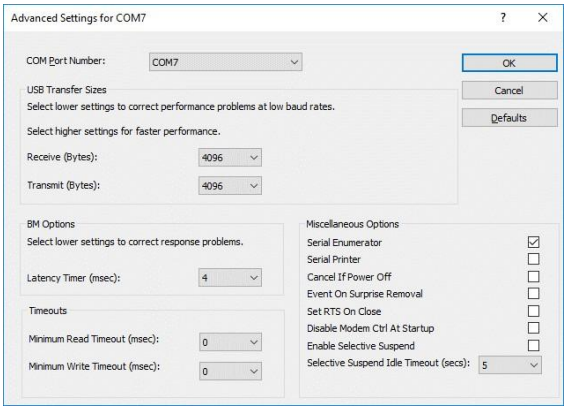

Fig. 1.5

2. Summary of the Main Menu

After opening the Inertial Labs IMU GUI executable software from the main folder, you will see a main menu containing the items shown in Fig. 2.1.

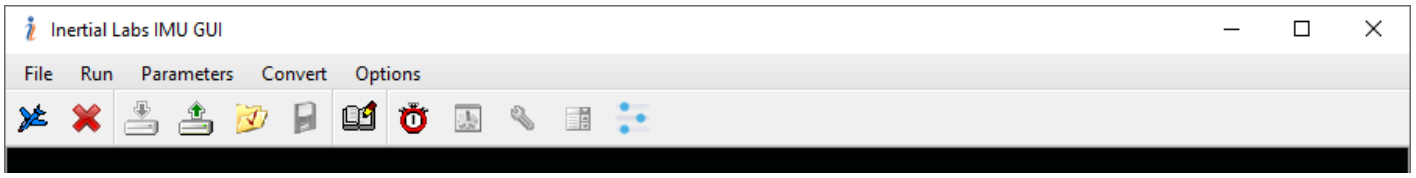

Fig. 2.1. The Main Menu of the Inertial Labs IMU GUI

Below is a brief description of the main menu items:

- File – standard Windows file management commands. See Section 4.1 for details.
- Run – IMU control commands. See Section 4.2 for more details.
- Parameters – operations with the IMU parameters. See Section 4.3 for details.
- Convert – options for converting recorded binary data to text format. See Section 4.4 for details.
- Options – the IMU configuration commands. See Section 4.5 for details.

Additionally, there is a toolbar below the main menu that contains functions for commonly used commands:

a) b) c) d) e) f) g) h) i) j) k) l)

Fig. 2.2. The Toolbar icons in the Main Menu of the Inertial Labs IMU GUI.

Where:

a) IMU Visualization (Shortcut key F4). See Section 4.2.1.
b) Stop IMU. See Section 4.2.2.
c) Write Parameters. See Section 4.3.1.
d) Read Parameters. See Section 4.3.2.
e) Open Parameters. See Section 4.3.3.
f) Save Parameters. See Section 4.3.4.
g) Report of Experiment (Shortcut key F8). See Section 4.4.1.
h) Test Options. See Section 4.5.1.
i) Devices Options. See Section 4.5.2.
j) Correction Options. See Section 4.5.3.
k) Sensors Options. See Section 4.5.4.
l) User Defined Data. See Section 4.5.5.

3. Device Workflows for GUI

The IMU GUI supports different Inertial Labs products:

- The Navigation Grade Inertial Measurement Unit (IMU-NAV);
- The Professional Inertial Measurement Unit (IMU-P, IMU-P-M);
- Two and Three Axis Gyroscopes (TAG-200, TAG-300, TAG-301, TAG-512 and TAG-304);
- The KERNEL Inertial Measurement Unit (KERNEL-100, KERNEL-102, KERNEL-108, KERNEL-110, KERNEL-111, KERNEL-120, KERNEL-201, KERNEL-210, KERNEL-220, KERNEL-110M);
- Miniature Inertial Measurement Unit (IMU-P10);
- Three Axis Accelerometers (TAA-308, TAA-315, and TAA-340);
- The Tactical Grade Inertial Measurement Unit (IMU-H100).

Important: *Utilize the workflow related to your specific unit.*

3.1. Workflow for the IMU-NAV

Important: *After changing any device settings/parameters within the IMU GUI, write them into device memory. To do so, use the "Write parameters" option in the Parameters menu (see Fig. 4.14). Otherwise, the changes will not be applied.*

1. Connect the unit to the host computer using the supplied cables. After providing power and connecting through the RS-422 (or RS-232) to USB adapter, launch the IMU GUI and open the "Test Options" menu.
2. Select the "Serial port" assigned to your unit (see Section 1.2 for help identifying it). Then select the "Baud rate" of your unit by clicking the button labeled "Auto". At this time, your unit should be successfully connected to your host computer.

   Note: *Ensure that "Flash writing extended timeout" is enabled to maintain stable communication between the IMU and the GUI.*

3. Choose the appropriate output data format for your application in the "Test Options" menu. Supported formats are listed in Section 5.1.

   Note: *Refer to the IMU-NAV ICD for details about each data format and its structure.*

4. (Optional)
   (a) Set the "Record time" if you want the GUI to record data for a specific duration.
   (b) Configure "Number data for average" to smooth data viewed in the GUI (this does not affect data written to file). See Section 4.5.1.

(c) Enable the Extended start checkbox to apply initial parameters for the onboard calculation algorithm (see Section 4.5.1.1).

5. In the “Test options” window, set or verify, that the data output mode labeled “Operating Mode” is correctly set. Select “Continuous” to record a continuous data set for any duration of time, or “On request” to manually trigger data output via the GUI. See Section 4.5.1 for more details.
6. Use the “Read parameters” in the Parameters menu (see Fig. 4.14) to read current device settings. After this step, all GUI settings become active, allowing users to view and modify settings for the connected device.
7. Open the “Devices Options” window, set or verify the desired “Data rate (Hz)” for output packets (applicable when in “Continuous” mode). See Section 4.5.2 for details.
8. Set or verify the “Initial Alignment: time (s)”. When starting operation in a static environment, set this value to a non-zero. After initialization (which begins automatically after power-up if the unit is in Auto-Start mode, or manually via the GUI), the device estimates gyro biases and uses them to reduce errors in data output. However, if the device starts in a dynamic environment, this value should be set to zero. See Section 4.5.2 for details.
9. Set or verify the “Alignment Angles (deg)” in “Devices Options” to account for alignment offsets between the IMU and the carrier object. See Section 4.5.2 for details.
10. (Optional) To have the device start automatically after power-up (without GUI interaction), enable “Auto Start” in “Devices Options” (see Section 4.5.2).
11. (Optional, not recommended) Advanced users can modify algorithm parameters in the “Correction Options” menu. See Section 4.5.3 for details.
12. (Optional) Adjust output variants and apply settings for Bandwidth in the “Sensors Options” window. See Section 4.5.4 for details.
13. To apply settings/parameters, load them into the device memory. To do so, use the “Write parameters” item under the Parameters menu (see Fig. 4.14).
14. If you are using the GUI to record or view data, go to the “IMU Visualization” tab on the toolbar (See Section 4.2.1 for details). When you are ready, start the unit. Do not move the device until the initial alignment is over if its time is set to any nonzero value. After the unit starts, you can choose to view data in real-time, record data, or output data at select instances of time.
15. When you are done using the device to record or view data with the GUI, click “Stop IMU”. See Section 4.2.2 for details.
16. Create a report on your experiment using “Convert Report of Experiment” to view and analyze data further. See Section 4.4.1 for more details.

3.2. Workflow for the IMU-P

Important: *After changing any device settings/parameters within the IMU GUI, write them into device memory. To do so, use the "Write parameters" option in the Parameters menu (see Fig. 4.14). Otherwise, the changes will not be applied.*

1. Connect the unit to the host computer using the supplied cables. After providing power and connecting through the RS-422 (or RS-232) to USB adapter, launch the IMU GUI and open the "Test Options" menu.
2. Select the "Serial port" assigned to your unit (see Section 1.2 for help identifying it). Then select the "Baud rate" of your unit by clicking the button labeled "Auto". At this time, your unit should be successfully connected to your host computer.
3. Choose the appropriate output data format for your application in the "Test Options" menu. Supported formats are listed in Section 5.1.

   Note: *Details about supported data formats and their structure are provided in the IMU-P ICD.*

4. (Optional)
   (a) Set the "Record time" if you want the GUI to record data for a specific duration.
   (b) Configure "Number data for average" to smooth data viewed in the GUI (this does not affect data written to file). See Section 4.5.1.
5. In the "Test options" window, set or verify, that the data output mode labeled "Operating Mode" is correctly set. Select "Continuous" to record a continuous data set for any duration of time, or "On request" to manually trigger data output via the GUI. See Section 4.5.1 for more details.
6. Use the "Read parameters" in the Parameters menu (see Fig. 4.14) to read current device settings. After this step, all GUI settings become active, allowing users to view and modify settings for the connected device.
7. Open the "Devices Options" window, set or verify the desired "Data rate (Hz)" for output packets (applicable when in "Continuous" mode). See Section 4.5.2 for details.
8. Set or verify the "Initial Alignment: time (s)". When starting operation in a static environment, set this value to a non-zero. After initialization (which begins automatically after power-up if the unit is in Auto-Start mode, or manually via the GUI), the device estimates gyro biases and uses them to reduce errors in data output. However, if the device starts in a dynamic environment, this value should be set to zero. See Section 4.5.2 for details.
9. Set or verify the "Alignment Angles (deg)" in "Devices Options" to account for alignment offsets between the IMU and the carrier object. See Section 4.5.2 for details.
10. (Optional) To have the device start automatically after power-up (without GUI interaction), enable "Auto Start" in "Devices Options" (see Section 4.5.2).
11. (Optional, not recommended) Advanced users can modify algorithm parameters in the "Correction Options" menu. See Section 4.5.3 for details.

12. (Optional) Adjust output variants and apply settings for Bandwidth in the “Sensors Options” window. See Section 4.5.4 for details.
13. To apply settings/parameters, load them into the device memory. To do so, use the “Write parameters” item under the Parameters menu (see Fig. 4.14).
14. If you are using the GUI to record or view data, go to the “IMU Visualization” tab on the toolbar (See Section 4.2.1 for details). When you are ready, start the unit. Do not move the device until the initial alignment is over if its time is set to any nonzero value. After the unit starts, you can choose to view data in real-time, record data, or output data at select instances of time.
15. When you are done using the device to record or view data with the GUI, click “Stop IMU”. See Section 4.2.2 for details.
16. Create a report on your experiment using “Convert Report of Experiment” to view and analyze data further. See Section 4.4.1 for more details.

3.3. Workflow for the TAG-512

Important: *After changing any device settings/parameters within the IMU GUI, write them into device memory. To do so, use the "Write parameters" option in the Parameters menu (see Fig. 4.14). Otherwise, the changes will not be applied.*

1. Connect the unit to your host computer using the supplied cables. After providing power and connecting through the RS-422 to USB adapter, launch the IMU GUI and open the "Test Options" menu.
2. Select the "Serial port" assigned to your unit (see Section 1.2 for help on identifying it). Then select the "Baud rate" of your unit by clicking the button labeled "Auto". At this time, your unit should be successfully connected to your host computer.
3. In the "Test Options" menu, make sure that "Flash writing extended timeout" is selected as shown in Fig. 3.1 below.

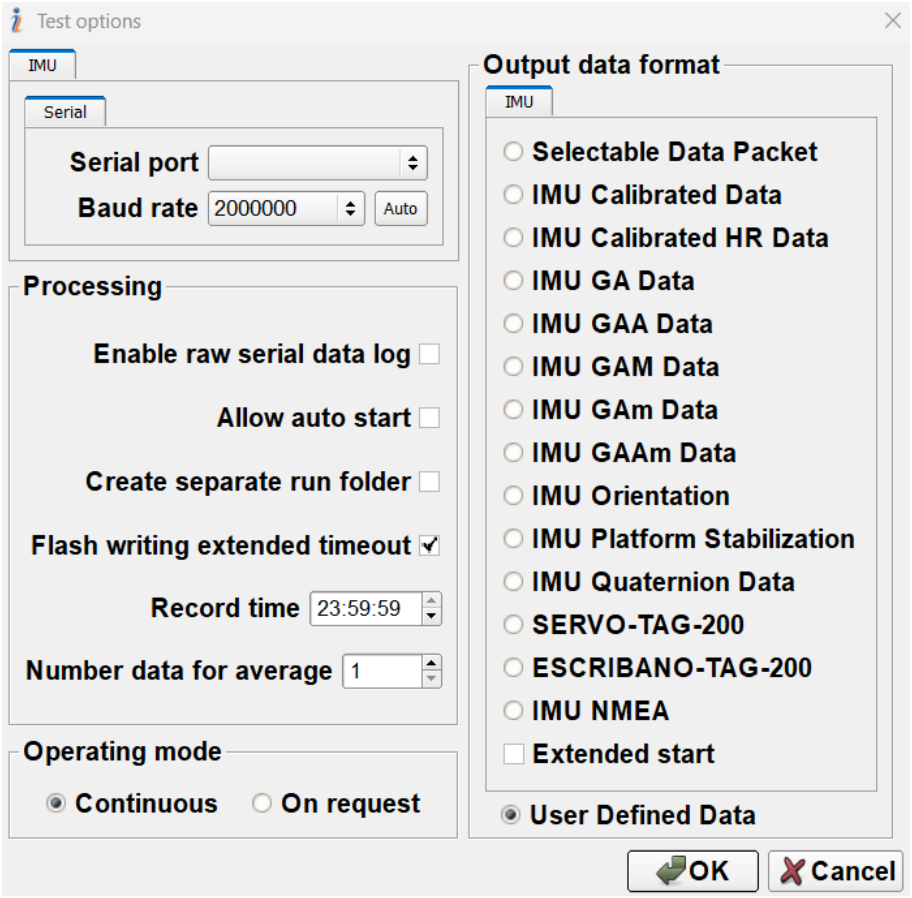

Fig. 3.1. Test Options Menu with Flash writing extended timeout selected.

4. Choose the appropriate output data format for your application in the "Test Options" menu. Supported formats are listed in Section 5.1.
5. If "User Defined Data" (UDD) is selected in the "Test Options" menu, select the "User Defined Data" icon in the taskbar on the top of the screen, as marked in red in Fig. 3.2 below.

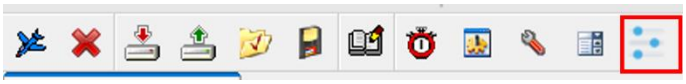

Fig. 3.2. UDD Icon Location

Note: *Details about supported data formats and their structure are provided in the TAG ICD.*

6. Once "User Defined Data" is selected, select the time data, orientation data, sensors data, and service data. For TAG-512, the only relevant fields are "Gyro data" and Gyro data HR" in the "Sensors data" field. Additionally, any data type in the "Service Data" field can be selected. The recommended selections are shown in Fig. 3.3 below.

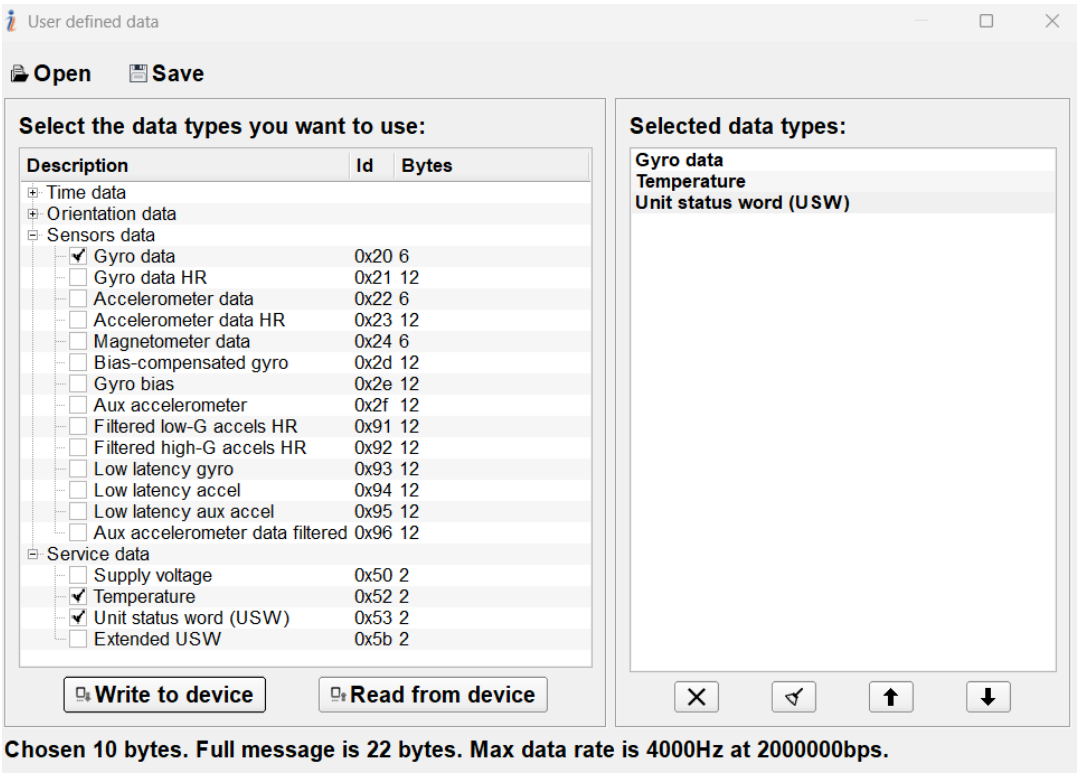

Fig. 3.3. Recommended User Defined Data

Note: *Details about user defined data are provided in section 4.5.5.*

7. (Optional)
   (a) Set the "Record time" if you want the GUI to record data for a specific duration.
   (b) Configure "Number data for average" to smooth data viewed in the GUI (this does not affect data written to file). See Section 4.5.1.
8. In the "Test options" window, set or verify, that the data output mode labeled "Operating Mode" is correctly set. Select "Continuous" to record a continuous data

set for any duration of time, or “On request” to manually trigger data output via the GUI. See Section 4.5.1 for more details.

9. Use the “Read parameters” in the Parameters menu (see Fig. 4.14) to read current device settings. After this step, all GUI settings become active, allowing users to view and modify settings for the connected device.
10. Open the “Devices Options” window, set or verify the desired “Data rate (Hz)” for output packets (applicable when in “Continuous” mode). See Section 4.5.2 for details.
11. Set or verify the “Initial Alignment: time (s)”. When starting operation in a static environment, set this value to a non-zero. After initialization (which begins automatically after power-up if the unit is in Auto-Start mode, or manually via the GUI), the device estimates gyro biases and uses them to reduce errors in data output. However, if the device starts in a dynamic environment, this value should be set to zero. See Section 4.5.2 for details.
12. Set or verify the “Alignment Angles (deg)” in “Devices Options” to account for alignment offsets between the IMU and the carrier object. See Section 4.5.2 for details.
13. (Optional) To have the device start automatically after power-up (without GUI interaction), enable “Auto Start” in “Devices Options” (see Section 4.5.2).
14. (Optional, not recommended) Advanced users can modify algorithm parameters in the “Correction Options” menu. See Section 4.5.3 for details. Adjusting settings pertaining to accelerometers will have no effect on data output as the TAG product line contains gyroscopes only.
15. (Optional) Adjust output variants and apply settings for Bandwidth in the “Sensors Options” window. See Section 4.5.4 for details. For the TAG product line, these settings will only affect gyroscope data output since the TAG product line does not contain accelerometers.
16. To apply settings/parameters, load them into the device memory. To do so, use the “Write parameters” item under the Parameters menu (see Fig. 4.14).
17. If you are using the GUI to record or view data, go to the “IMU Visualization” tab on the toolbar (See Section 4.2.1 for details). When you are ready, start the unit. Do not move the device until the initial alignment is over if its time is set to any nonzero value. After the unit starts, you can choose to view data in real-time, record data, or output data at select instances of time.
18. When you are done using the device to record or view data with the GUI, click “Stop IMU”. See Section 4.2.2 for details.
19. Create a report on your experiment using “Convert Report of Experiment” to view and analyze data further. See Section 4.4.1 for more details.

3.4. Workflow for the TAG

Important: *After changing any device settings/parameters within the IMU GUI, write them into device memory. To do so, use the "Write parameters" option in the Parameters menu (see Fig. 4.14). Otherwise, the changes will not be applied.*

1. Connect the unit to your host computer using the supplied cables. After providing power and connecting through the RS-422 to USB adapter, launch the IMU GUI and open the "Test Options" menu.
2. Select the "Serial port" assigned to your unit (see Section 1.2 for help on identifying it). Then select the "Baud rate" of your unit by clicking the button labeled "Auto". At this time, your unit should be successfully connected to your host computer.
3. Choose the appropriate output data format for your application in the "Test Options" menu. Supported formats are listed in Section 5.1. Variants of the Selectable Data Packet are shown below in Fig. 3.4.

   Note: *Details about supported data formats and their structure are provided in the TAG ICD.*

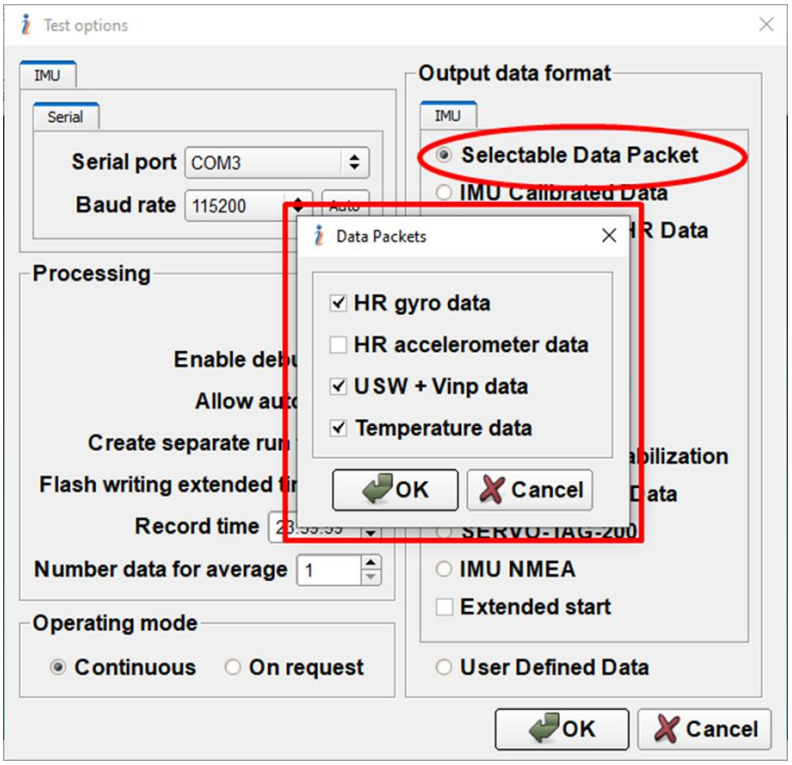

Fig. 3.4. Variants of Selectable Data Packet

4. (Optional)
   (a) Set the "Record time" if you want the GUI to record data for a specific duration.
   (b) Configure "Number data for average" to smooth data viewed in the GUI (this does not affect data written to file). See Section 4.5.1.

5. In the “Test options” window, set or verify, that the data output mode labeled “Operating Mode” is correctly set. Select “Continuous” to record a continuous data set for any duration of time, or “On request” to manually trigger data output via the GUI. See Section 4.5.1 for more details.
6. Use the “Read parameters” in the Parameters menu (see Fig. 4.14) to read current device settings. After this step, all GUI settings become active, allowing users to view and modify settings for the connected device.
7. Open the “Devices Options” window, set or verify the desired “Data rate (Hz)” for output packets (applicable when in “Continuous” mode). See Section 4.5.2 for details.
8. Set or verify the “Initial Alignment: time (s)”. When starting operation in a static environment, set this value to a non-zero. After initialization (which begins automatically after power-up if the unit is in Auto-Start mode, or manually via the GUI), the device estimates gyro biases and uses them to reduce errors in data output. However, if the device starts in a dynamic environment, this value should be set to zero. See Section 4.5.2 for details.
9. Set or verify the “Alignment Angles (deg)” in “Devices Options” to account for alignment offsets between the IMU and the carrier object. See Section 4.5.2 for details.
10. (Optional) To have the device start automatically after power-up (without GUI interaction), enable “Auto Start” in “Devices Options” (see Section 4.5.2).
11. (Optional, not recommended) Advanced users can modify algorithm parameters in the “Correction Options” menu. See Section 4.5.3 for details. Adjusting settings pertaining to accelerometers will have no affect on data output as the TAG product line contains gyroscopes only.
12. (Optional) Adjust output variants and apply settings for Bandwidth in the “Sensors Options” window. See Section 4.5.4 for details. For the TAG product line, these settings will only affect gyroscope data output since the TAG product line does not contain accelerometers.
13. To apply settings/parameters, load them into the device memory. To do so, use the “Write parameters” item under the Parameters menu (see Fig. 4.14).
14. If you are using the GUI to record or view data, go to the “IMU Visualization” tab on the toolbar (See Section 4.2.1 for details). When you are ready, start the unit. Do not move the device until the initial alignment is over if its time is set to any nonzero value. After the unit starts, you can choose to view data in real-time, record data, or output data at select instances of time.
15. When you are done using the device to record or view data with the GUI, click “Stop IMU”. See Section 4.2.2 for details.
16. Create a report on your experiment using “Convert Report of Experiment” to view and analyze data further. See Section 4.4.1 for more details.

3.5. Workflow for the KERNEL IMU

Important: *After changing any device settings/parameters within the IMU GUI, write them into device memory. To do so, use the "Write parameters" option in the Parameters menu (see Fig. 4.14). Otherwise, the changes will not be applied.*

1. Connect the unit to your host computer using the supplied cables. After providing power and connecting through the RS-422 to USB adapter, launch the IMU GUI and open the "Test Options" menu.
2. Select the "Serial port" assigned to your unit (see Section 1.2 for help on identifying it). Then select the "Baud rate" of your unit by clicking the button labeled "Auto". At this time, your unit should be successfully connected to your host computer.
3. Choose the appropriate output data format for your application in the "Test Options" menu. Supported formats are listed in Section 5.1.

   Note: *Details about supported data formats and their structure are provided in the KERNEL IMU ICD.*

4. (Optional)
   (a) Set the "Record time" if you want the GUI to record data for a specific duration.
   (b) Configure "Number data for average" to smooth data viewed in the GUI (this does not affect data written to file). See Section 4.5.1.
5. In the "Test options" window, set or verify, that the data output mode labeled "Operating Mode" is correctly set. Select "Continuous" to record a continuous data set for any duration of time, or "On request" to manually trigger data output via the GUI. See Section 4.5.1 for more details.
6. Use the "Read parameters" in the Parameters menu (see Fig. 4.14) to read current device settings. After this step, all GUI settings become active, allowing users to view and modify settings for the connected device.
7. Open the "Devices Options" window, set or verify the desired "Data rate (Hz)" for output packets (applicable when in "Continuous" mode). See Section 4.5.2 for details.
8. Set or verify the "Initial Alignment: time (s)". When starting operation in a static environment, set this value to a non-zero. After initialization (which begins automatically after power-up if the unit is in Auto-Start mode, or manually via the GUI), the device estimates gyro biases and uses them to reduce errors in data output. However, if the device starts in a dynamic environment, this value should be set to zero. See Section 4.5.2 for details.
9. Set or verify the "Alignment Angles (deg)" in "Devices Options" to account for alignment offsets between the IMU and the carrier object. See Section 4.5.2 for details.
10. (Optional) To have the device start automatically after power-up (without GUI interaction), enable "Auto Start" in "Devices Options" (see Section 4.5.2).
11. (Optional, not recommended) Advanced users can modify algorithm parameters in the "Correction Options" menu. See Section 4.5.3 for details.

12. (Optional) Adjust output variants and apply settings for Bandwidth in the “Sensors Options” window. See Section 4.5.4 for details.
13. To apply settings/parameters, load them into the device memory. To do so, use the “Write parameters” item under the Parameters menu (see Fig. 4.14).
14. If you are using the GUI to record or view data, go to the “IMU Visualization” tab on the toolbar (See Section 4.2.1 for details). When you are ready, start the unit. Do not move the device until the initial alignment is over if its time is set to any nonzero value. After the unit starts, you can choose to view data in real-time, record data, or output data at select instances of time.
15. When you are done using the device to record or view data with the GUI, click “Stop IMU”. See Section 4.2.2 for details.
16. Create a report on your experiment using “Convert Report of Experiment” to view and analyze data further. See Section 4.4.1 for more details.

3.6. Workflow for the IMU-P10

Important: *After changing any device settings/parameters within the IMU GUI, write them into device memory. To do so, use the "Write parameters" option in the Parameters menu (see Fig. 4.14). Otherwise, the changes will not be applied.*

1. Connect the unit to your host computer using the supplied cables. After powering, data is automatically being output. After providing power and connecting through the RS-422 to USB adapter, launch the IMU GUI and open the "Test Options" menu.
2. Select the "Serial port" assigned to your unit (see Section 1.2 for help on identifying it). Then select the "Baud rate" of the IMU-P10, which is by default 20000000. At this time, your unit should be successfully connected to your host computer.
3. Choose the appropriate output data format for your application in the "Test Options" menu. Supported formats are listed in Section 5.1. Also, click the checkbox labeled "Allow auto start". This is necessary to view data in the GUI for the IMU-P10.

   Note: *Details about supported data formats and their structure are provided in the IMU-P10 ICD.*

4. (Optional)
   (a) Set the "Record time" if you want the GUI to record data for a specific duration.
   (b) Configure "Number data for average" to smooth data viewed in the GUI (this does not affect data written to file). See Section 4.5.1.
5. Ensure the "Operating mode" is set to "Continuous", as this is the only supported operating mode for the IMU-P10. Now click "OK" to configure the "Test Options" you have finished adjusting. The discussed options in this workflow are the only available settings for the IMU-P10. Changing other options will have no effect on performance or data output.
6. When using the GUI to record or view data, exit out of the GUI, and re-open it. Since the user configured the GUI to "Allow auto start", the newly opened GUI will by default go to the "IMU Visualization" where you will see the IMU GAm data being plotted in real time. The user will have the option at this time to either "Stop" or "Write" data to a file. See Section 4.2.1 for details on the "Stop" and "Write" icons.
7. When you are done using the device to record or view data with the GUI, click "Stop IMU". See Section 4.2.2 for details.
8. Create a report on your experiment using "Convert Report of Experiment" to view and analyze data further. See Section 4.4.1 for more details.

3.7. Workflow for the TAA

Important: *After changing any device settings/parameters within the IMU GUI, write them into device memory. To do so, use the "Write parameters" option in the Parameters menu (see Fig. 4.14). Otherwise, the changes will not be applied.*

1. Connect the unit to your host computer using the supplied cables. After providing power and connecting through the RS-422 to USB adapter, launch the IMU GUI and open the "Test Options" menu.
2. Select the "Serial port" assigned to your unit (see Section 1.2 for help on identifying it). Then select the "Baud rate" of your unit by clicking the button labeled "Auto". At this time, your unit should be successfully connected to your host computer.
3. Choose the appropriate output data format for your application in the "Test Options" menu. Supported formats are listed in Section 5.1.

   Note: *Details about supported data formats with their structure are provided in the TAA ICD.*

4. (Optional)
   (a) Set the "Record time" if you want the GUI to record data for a specific duration.
   (b) Configure "Number data for average" to smooth data viewed in the GUI (this does not affect data written to file). See Section 4.5.1.
5. In the "Test option" window, verify that the data output mode is set as "Continuous".
6. Use the "Read parameters" in the Parameters menu (see Fig. 4.14) to read current device settings. After this step, all GUI settings become active, allowing users to view and modify settings for the connected device.
7. Open the "Devices Options" window, set or verify the desired "Data rate (Hz)" for output packets (applicable when in "Continuous" mode). See Section 4.5.2 for details.
8. Set or verify the "Alignment Angles (deg)" in "Devices Options" to account for alignment offsets between the IMU and the carrier object. See Section 4.5.2 for details.
9. (Optional) To have the device start automatically after power-up (without GUI interaction), enable "Auto Start" in "Devices Options" (see Section 4.5.2).
10. (Optional, not recommended) Advanced users can modify algorithm parameters in the "Correction Options" menu. See Section 4.5.3 for details. Adjusting settings pertaining to gyroscopes will have no effect on data output as the TAA product line contains accelerometers only.
11. (Optional) Adjust output variants and apply settings for Bandwidth in the "Sensors Options" window. See Section 4.5.4 for details. For the TAA product line, these settings will only affect accelerometer data output since the TAA product line does not contain gyroscopes.
12. To apply settings/parameters, load them into the device memory. To do so, use the "Write parameters" item under the Parameters menu (see Fig. 4.14).

13. If you are using the GUI to record or view data, go to the “IMU Visualization” tab on the toolbar (See Section 4.2.1 for details). When you are ready, start the unit. Do not move the device until the initial alignment is over if its time is set to any nonzero value. After the unit starts, you can choose to view data in real-time, record data, or output data at select instances of time.
14. When you are done using the device to record or view data with the GUI, click “Stop IMU”. See Section 4.2.2 for details.
15. Create a report on your experiment using “Convert Report of Experiment” to view and analyze data further. See Section 4.4.1 for more details.

3.8. Workflow for the IMU-H100

Important: *After changing any device settings/parameters within the IMU GUI, write them into device memory. To do so, use the "Write parameters" option in the Parameters menu (see Fig. 4.14). Otherwise, the changes will not be applied.*

1. Connect the unit to your host computer using the supplied cables. After providing power and connecting through the RS-422 to USB adapter, launch the IMU GUI and open the "Test Options" menu.
2. Select the "Serial port" assigned to your unit (see Section 1.2 for help on identifying it). Then select the "Baud rate" of your unit by clicking the button labeled "Auto". At this time, your unit should be successfully connected to your host computer.
3. Choose the appropriate output data format for your application in the "Test Options" menu. Supported formats are listed in Section 5.1.

   Note: *Details about supported data formats and their structure are provided in the IMU-H100 ICD.*

4. (Optional)
   (c) Set the "Record time" if you want the GUI to record data for a specific duration.
   (d) Configure "Number data for average" to smooth data viewed in the GUI (this does not affect data written to file). See Section 4.5.1.
5. In the "Test options" window, set or verify, that the data output mode labeled "Operating Mode" is correctly set. Select "Continuous" to record a continuous data set for any duration of time, or "On request" to manually trigger data output via the GUI. See Section 4.5.1 for more details.
6. Use the "Read parameters" in the Parameters menu (see Fig. 4.14) to read current device settings. After this step, all GUI settings become active, allowing users to view and modify settings for the connected device.
7. Open the "Devices Options" window, set or verify the desired "Data rate (Hz)" for output packets (applicable when in "Continuous" mode). See Section 4.5.2 for details.
8. Set or verify the "Initial Alignment: time (s)". When starting operation in a static environment, set this value to a non-zero. After initialization (which begins automatically after power-up if the unit is in Auto-Start mode, or manually via the GUI), the device estimates gyro biases and uses them to reduce errors in data output. However, if the device starts in a dynamic environment, this value should be set to zero. See Section 4.5.2 for details.
9. Set or verify the "Alignment Angles (deg)" in "Devices Options" to account for alignment offsets between the IMU and the carrier object. See Section 4.5.2 for details.
10. (Optional) To have the device start automatically after power-up (without GUI interaction), enable "Auto Start" in "Devices Options" (see Section 4.5.2).
11. (Optional, not recommended) Advanced users can modify algorithm parameters in the "Correction Options" menu. See Section 4.5.3 for details.

12. (Optional) Adjust output variants and apply settings for Bandwidth in the “Sensors Options” window. See Section 4.5.4 for details.
13. To apply settings/parameters, load them into the device memory. To do so, use the “Write parameters” item under the Parameters menu (see Fig. 4.14).
14. If you are using the GUI to record or view data, go to the “IMU Visualization” tab on the toolbar (See Section 4.2.1 for details). When you are ready, start the unit. Do not move the device until the initial alignment is over if its time is set to any nonzero value. After the unit starts, you can choose to view data in real-time, record data, or output data at select instances of time.
15. When you are done using the device to record or view data with the GUI, click “Stop IMU”. See Section 4.2.2 for details.
16. Create a report on your experiment using “Convert Report of Experiment” to view and analyze data further. See Section 4.4.1 for more details.

4. Descriptions of the User Interface

4.1. File

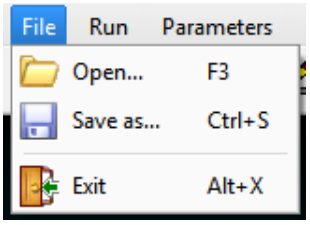

Fig. 4.1. Drop-down options associated with the "File" menu item, located in the main menu

4.1.1. Open

You can emulate data files from previous runs by opening the correspondingly saved *.bin file. Begin by clicking the "**Open**" option (see Fig. 4.1) or press F3. In the "**Open**..." window, navigate to the desired *.bin file from a previously saved trial. After selecting the file, data is read from it and a new tab labeled "**Data viewer**" as shown in Fig. 4.2 will open. It is possible to configure which data is shown in the plot area by right-clicking on the plot and toggling the available options on/off as seen in Fig. 4.3.

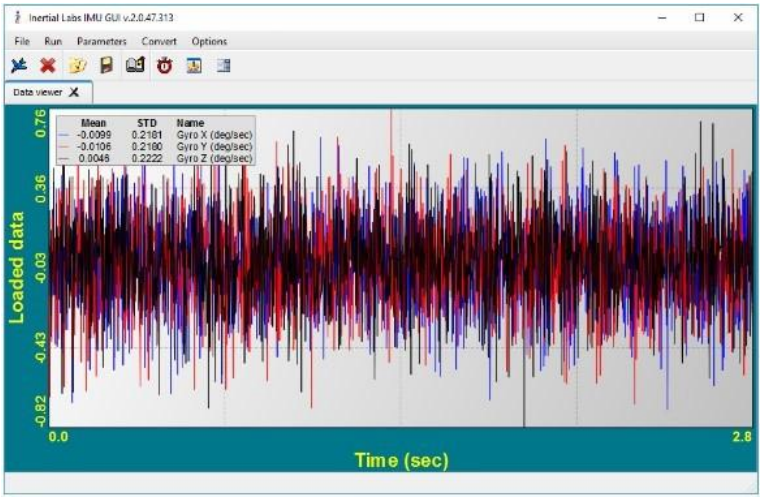

Fig. 4.2. Opening previously acquired data files opens the data viewer: a window that displays data recorded from previous trials

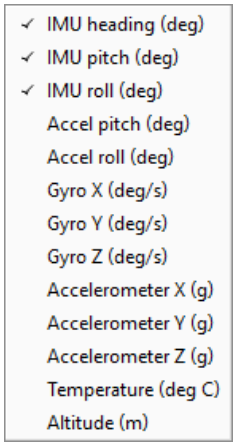

Fig. 4.3. Options of available data than can be plotted within the data viewer

Additionally, the user can manipulate the viewing region of plotted graphs. To zoom-in on a region of the plot, click-and-drag the to create a view region of the plot. Once you release the cursor, the plot region will zoom-in on the desired region. To go back to the original view, simply click once anywhere on the plot.

The plot legend is located at the upper left-hand corner of the plot region. This legend shows the mean value, STD (standard deviation) and name of the displayed data.

To close the graph, click on the 'X' icon for the respective tab underneath the toolbar.

4.1.2. Save As

Optionally, the user can pre-define a recorded data file by selecting "**Save As...**" shown in Fig. 4.1 and entering in the desired name of the file. The available shortcut feature for this option is the standard Windows 'Ctrl+S' command.

4.1.3. Exit

To close the IMU GUI, select the "Exit" option under the File menu (Fig. 4.1). A warning window, as illustrated in Fig. 4.4, will appear if any device parameters were modified within the GUI shell but were not written to the device or saved on a PC.

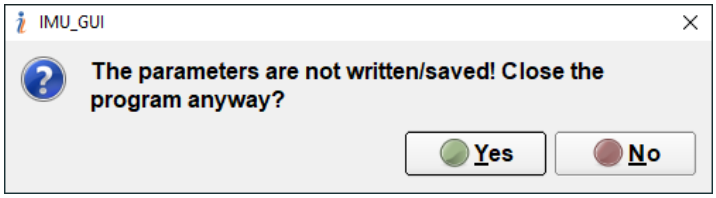

Fig. 4.4. Warning window when exiting IMU GUI

4.2. Run

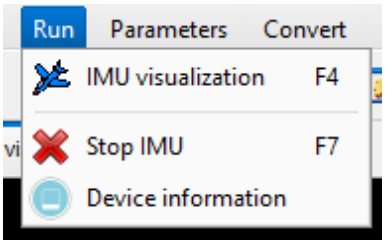

Fig. 4.5. The Run drop-down menu in the IMU GUI

4.2.1. IMU Visualization

The "**IMU Visualization**" option is accessible from the Toolbar (see Fig. 2.2), the **"Run"** drop-down menu and by shortcut key 'F4'. Once opened, the user will see a screen similar to the one shown in Fig. 4.6.

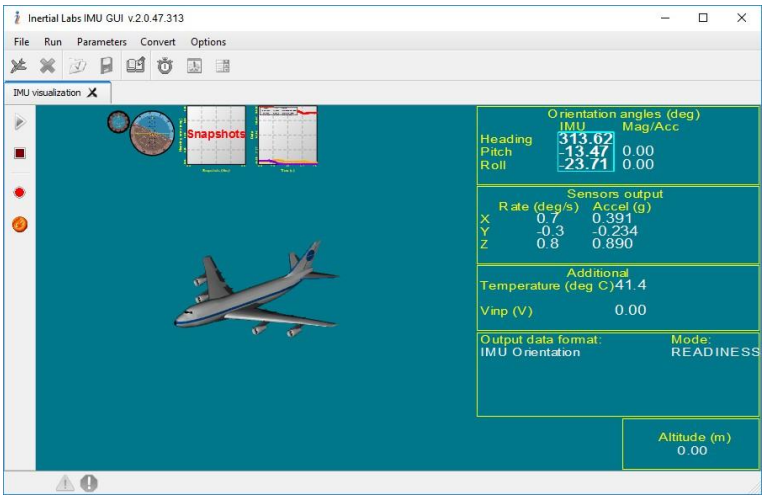

Fig. 4.6. The IMU Visualization window of the IMU GUI

The "**IMU Visualization**" window is divided into two sections. The left side of the window shows visual representations of data outputs, either as plots, or virtual representations of data output. The right side of the window displays data output values that are dependent on the output data format that is selected in the "Test Options" window (see Section 4.5.1 for details).

On the left side of the "**IMU Visualization**" window, the user will notice interactive icons that start and stop the unit, as well as record and take snapshots of data. The different interactive icons used in the "**IMU Visualization**" window are seen in Fig. 4.7.

a) b) c) d)

Fig. 4.7. Icons shown in the IMU Visualization window of the IMU GUI

a) Start – This button is used to initialize the device. Press when you are ready to start the unit.

Note: *If any device parameters were modified within the GUI shell but were not written to the device, a warning window, as illustrated in Fig. 4.8, will appear.*

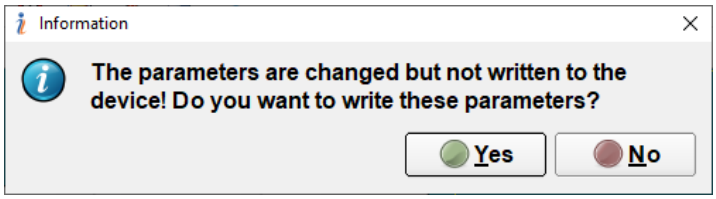

Fig. 4.8. Warning window when starting the device

b) Stop – Once started, this button is used to stop the device. Press when you would like to stop the unit.

c) Write – Once started, this button is used to write data from the device to your computer. Press this button when you would like to start recording data.

d) Snapshot – Once started, this button is used to check the accuracy of the device during ordinary operation. Simply point the device in a known orientation to check the accuracy of the device's solution.

Depending on the unit that is being used with the IMU GUI and the output data format that was selected, the user will have the ability to view data with the following options:

- **IMU 3D** – visualization style shown in Fig. 4.9 (ee below for details).
- **Cockpit Style View** – visualization style shown in Fig. 4.10 (see below for details).
- **Snapshots** – visualization style shown in Fig. 4.11 (see below for details).
- **Real Time Data Graphs** – visualization style shown in Fig. 4.12 (see below for details).

4.2.1.1. IMU 3D

Fig. 4.9. The IMU 3D icon in the IMU Visualization window of the IMU GUI

This method of visualization (if such view option is available) allows the user to view the changes in orientation of the unit in real time as if it were mounted to an airplane. To use this visualization option, click on the icon that is shown in Fig. 4.9.

4.2.1.2. Cockpit Style View

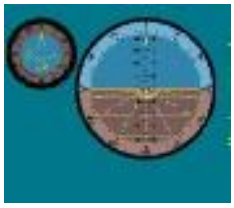

Fig. 4.10. The Cockpit Style View icon in the IMU Visualization window of the IMU GUI

After starting the unit, this method of visualization (if such view option is available) allows the user to view the changes in orientation of the unit in real time as if it were mounted to an airplane. To use this visualization option, click on the icon that is shown in Fig. 4.9.

4.2.1.3. Snapshots

Fig. 4.11. The Snapshots icon in the IMU Visualization window of the IMU GUI

After starting the unit, this feature is used (if such option is available) to check the accuracy of the solution from the device. Simply orient the unit in a known orientation and press the "**Snapshot**" button shown in Fig. 4.7. To use this visualization option, click on the icon that is shown in Fig. 4.11.

4.2.1.4. Real Time Data Graphs

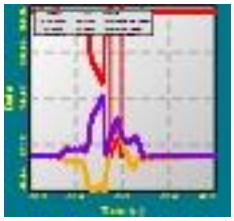

Fig. 4.12. The Real Time Data Graphs icon in the IMU Visualization window of the IMU GUI

The Real Time Data Graphs style of visualization is the most used method of visualization. It can be used for all output data formats supported in the IMU GUI. After starting the unit, this feature is used by right-clicking in the plot area and selecting which data should be shown in the plot area. Available data shown in graphs is limited and dependent on the output data format that is being used. To use this visualization option, click on the icon that is shown in Fig. 4.12. See Section 5 for details on output data formats.

4.2.2. Stop IMU

When you have finished using your device, the user may choose to select the "**Stop IMU**" option, as shown in Fig. 4.5. Optionally the user can choose to stop the device by using the shortcut key 'F7' or the red 'X' on the toolbar, shown in Fig. 2.2.

4.2.3. Device Information

The last item in the Run menu, shown in Fig. 4.5, is the "**Device Information**" option. When selected, a new tab opens inside the IMU GUI window where detailed information pertaining to the unit is displayed such as device serial number, firmware version, parameters, maximum data and more. Fig. 4.13 shows an example if this window.

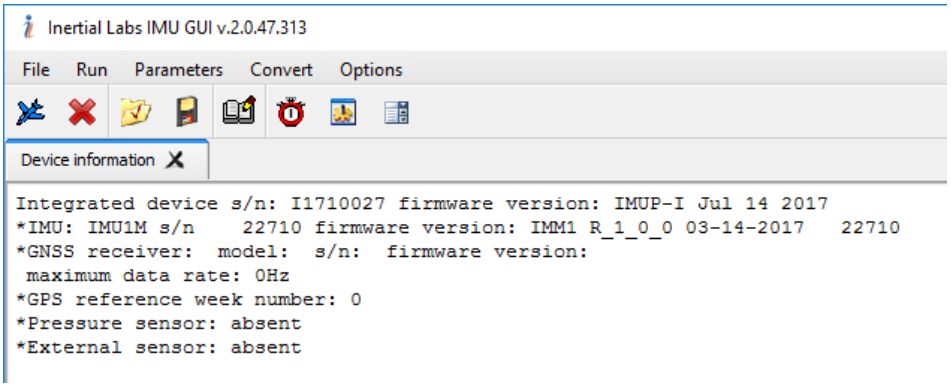

Fig. 4.13. An example of the Device Information window, which can be accessed from the Run menu

4.3. Parameters

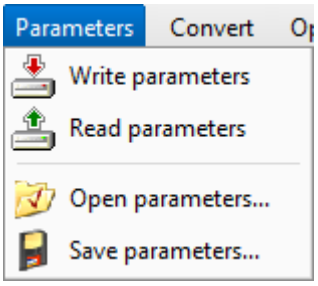

Fig. 4.14. The Parameters drop-down menu

The "**Parameters**" menu (see Fig. 4.14) enables the user to work with the device's internal parameters. This menu contains the following items:

- Write Parameters. (discussed in Section 4.3.1)
- Read Parameters. (discussed in Section 4.3.2)
- Open Parameters (discussed in Section 4.3.3)
- Save Parameters (discussed in Section 4.3.4).

4.3.1. Write Parameters

This item becomes active when parameters are read from the device or when a previously saved *.prm file is opened. By clicking, the IMU GUI writes the parameters to the connected device memory.

4.3.2. Read Parameters

By clicking, the IMU GUI reads the parameters from the connected device memory. Subsequently, all GUI menus become active, allowing users to view and modify settings for the connected device.

4.3.3. Open Parameters

This item is used to load parameters to the IMU GUI shell. By clicking, a standard Open dialog box appears where the user can select a previously saved parameter file (denoted with *.prm file type). Subsequently, all GUI menus become active, allowing users to view and modify the settings of the opened file. After modification, the parameters can be saved into a new file or written to the connected device.

4.3.4. Save Parameters

If you wish to retain a specific set of parameters, you can create a corresponding parameters file. This enables you to reference it later if necessary. Simply click on the "**Save parameters**" option to prompt a standard "Save file" dialog box. In this window, save the parameters file (indicated with the *.prm file type) to your desired folder path.

4.4. Convert

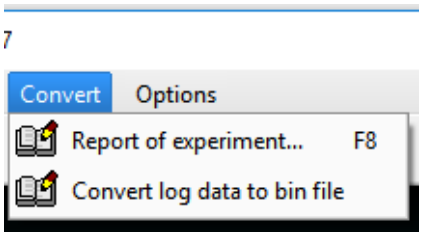

Fig. 4.15. The Convert main menu drop-down list in the IMU GUI

The "Convert" menu item contains two items, the "**Report of Experiment**" option, and "**Convert Log Data to Bin File**", as shown above in Fig. 4.15.

4.4.1. Report of Experiment

The "Report of Experiment" option is used to convert saved binary data (*.bin) to a text file. When the "**Report of Experiment**" item is selected, the toolbar icon (shown in Fig. 2.2) is clicked, or shortcut key 'F8' is pressed, a standard Windows "Open" window is opened. In this window, the operator should select one of the recorded data files (with *.bin extension). Consequently, a report file (with the same name as the *.bin file that was loaded) with a *.txt extension is created.

This "**Report of Experiment**" (saved as a text file with *.txt extension) is generated according to the output data format used to create the original binary data file (with *.bin extension). The user can then go on to use this generated report in other analysis scripts and programs as they see fit.

4.4.2. Convert Log Data to Bin File

The "**Convert Log Data to Bin File**" option is useful if the data saved was output as a log file directly from the IMU COM port (without any modifications to the data file). This is the case when the user is not logging data within the GUI. The saved log file contains data, a header, check sum and other service data according to the units data format. Combining the log data and the parameter file for the device will result in the ability for the GUI to convert these two files into a binary file. After selecting "**Convert Log Data to Bin File**", a standard Windows Open window appears. In this window, select the parameter file (indicated by the extension *.prm) used for the respective log file you wish to convert. Then, in the newly opened window, select the corresponding log file you would like to convert. After doing this, a binary file (indicated by extension *.bin) will appear in same root folder as the log file, with a name ending in 'Converted'.

4.5. Options

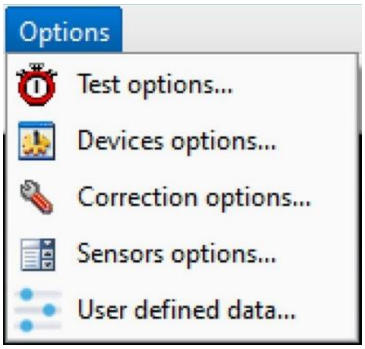

Fig. 4.16. The Options drop-down main menu list in the IMU GUI

The "**Options**" main menu drop-down contains list of configurable options pertaining to the GUI and the device. Below is list with a short description of the available "**Options**" items.

- **Test Options** – used for configuring settings related to the GUI. See Section 4.5.1 for details.
- **Devices Options** – settings for adjusting the Inertial Labs sensor in use. See Section
- 4.5.2 for details.
- **Correction Options** – recommended for experienced users only and can be used to adjust detailed settings pertaining to how the device's algorithm operates. See Section 4.5.3 for details.
- **Sensors Options** – setting for adjusting how sensor data is output. See Section 4.5.4 for details.

4.5.1. Test Options

The "**Test Options**" menu is used for main testing settings in the GUI. Fig. 4.17 shows the "**Test Options**" menu window.

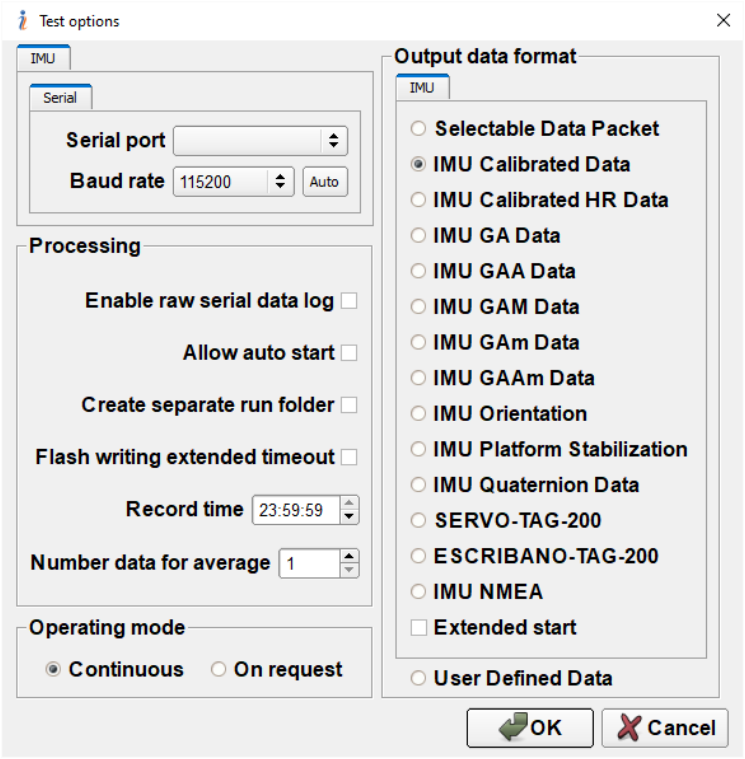

Fig. 4.17. The Test Options window in the IMU GUI

When connecting to the device in use, the "**Test Options**" window is the first place the user will navigate to. Here, the user will connect to the unit by selecting the "**Serial port**" that the host computer has assigned to the device. For help determining the correct serial port, visit Section 1.2 for more information.

Next, the user should select the correct "**Baud rate**" for the device. For ease, the "**Auto**" button was added such that the user could quickly connect to the device and the computer would automatically detect the baud rate of the unit. Optionally, the user could manually select the baud rate from the respective drop-down menu.

The following section of the "**Test Options**" window contains settings for data processing. The list below defines the functions of each of the processing settings.

- **Enable raw serial data log** – allows recording of the log file of the device run. This log contains all data received from the device after its start until its stop independently on the data writing option that the user can choose during the device run (see Section 4.2.1, description of the Write button). Log data is saved to a binary file with a *.rsd extension.

- **Allow auto start** – allows the GUI to communicate with a device that has been set into Auto Start mode and is running prior to being started using the GUI. See Section 4.5.2 for details on configuring the device to operate in auto start mode.
- **Create separate run folder** – allows for the automatic creation of a separate data folder for each run.
- **Flash writing extended timeout** – when checked, configures the GUI to wait for up to 20 seconds for a response from the device after the initial command is sent to the unit to load a set of parameters. Typically, this is a developer only tool and it should not be used unless you are directed to by an Inertial Labs engineer.
- **Record time** – allows the user to define the duration of time that they would like to record data for inside the GUI. This value is configurable and is in the time format of: 'hours:minutes:seconds' (max record time is 24:59:59). Once the user begins writing data (see Section 4.2.1 for information on writing data) the GUI begins counting down and will automatically terminate data acquisition when the time allotted for this setting has been reached.
- **Number data for average** – gives the user the ability to smooth data plots in the GUI. The value picked in this setting will be the number of values that will be averaged together when displaying measurements in the "IMU Visualization" window (information in Section 4.2.1). This setting does not affect data that is written to any file but is purely for smoothing plots shown in real time in the GUI.

Another key setting inside the "**Test Options**" window is the "**Operating mode**" option. The two available modes are "**Continuous**" and "**On request**" and are defined as:

- **Continuous** – used when the user intends to view data in the GUI as a continuous stream of data, seeing changes in real time for measured values and plotting them in the IMU Visualization window (discussed in Section 4.2.1). This is the recommended operating mode for any device.
- **On request** – the unit waits for commands from the GUI, or host-computer to output data packets. Once the command is received to output data the device then returns the respective data packet that was requested.

The last option that is left for the user to determine when preparing for any test is selecting the proper "**Output data format**" that will be needed for their application. Supported data formats for each device are shown in Section 5.

Note: *Details about supported data formats with their structure are provided in the appropriate device ICD.*

4.5.1.1. Extended Start

The IMU-NAV supports the Extended start feature. So, the user can set some initial conditions for the calculating algorithm at the unit start. To achieve that, select the Extended

start checkbox and in the appeared window choose and set up desired values (see Fig. 4.18).

- **Init type** – this parameter is not used in the algorithm at the moment.
- **Start time (s)** – initial alignment time. If this parameter is not set, then the initial alignment time saved in the parameters will be used.
- **Heading (deg)** – initial heading.
- **Tilt** – initial Pitch and Roll angles.
- **Gyro bias** – initial gyro bias values.

Note: *This feature should be used with the Inertial Labs guidance to achieve the most acceptable result in the upcoming operation.*

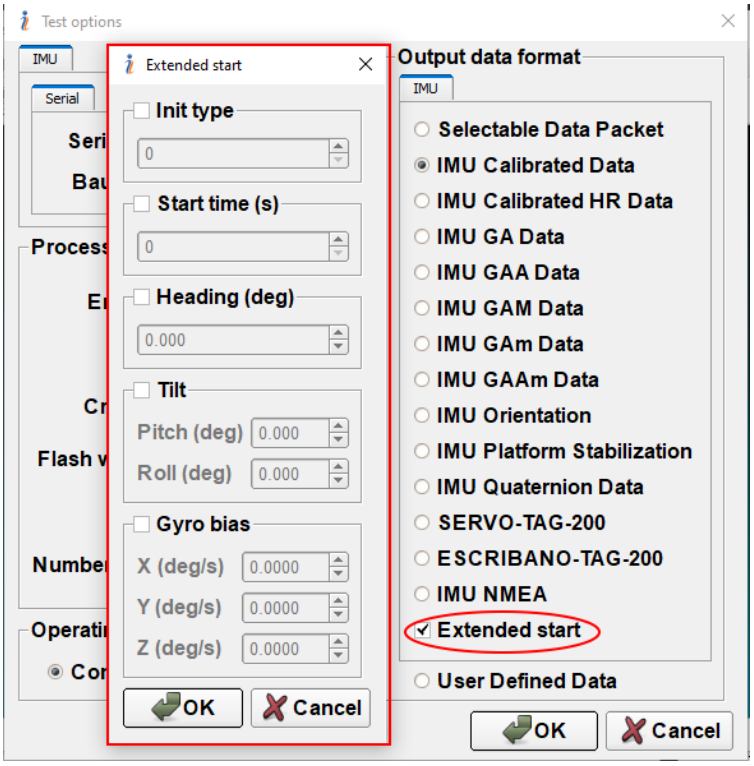

Fig. 4.18. Extended start settings supported by the Inertial Labs IMU-NAV

4.5.2. Devices Options

Inside the "**Devices Options**" window, the user will have the ability to configure settings that relate directly to the device in use.

Notes:

1. *This menu is available when parameters are read from the device or when a previously saved *.prm file is opened. See section 4.3.*
2. *After changing any settings/parameters in the menu, by clicking on the "OK" button, it is possible to see information about which parameter was changed and its initial and final value for checking. After that, you must write them into the device memory so they make an effect (or save them in a file). Otherwise, the changes will not be applied. To do so, use the "Write parameters" item under the Parameters menu (see Fig. 4.14).*

4.5.2.1. IMU

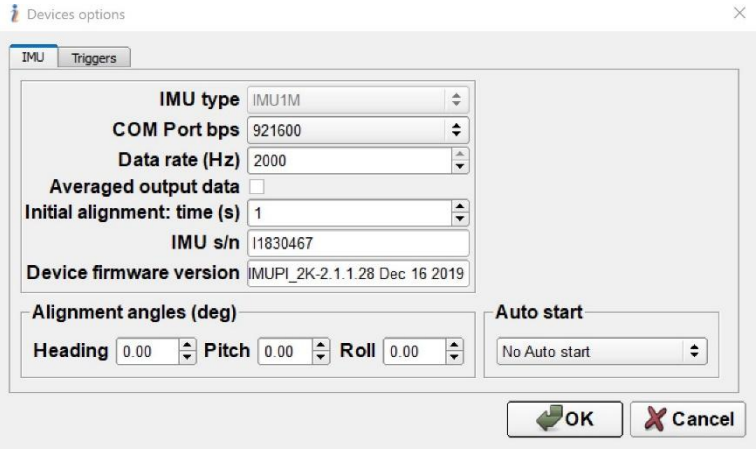

Fig. 4.19. The IMU tab, located in the Devices Options window in the IMU GUI

The "**IMU**" tab, inside the "**Devices Options**" window (shown in Fig. 4.19) displays the following settings:

- **IMU type** – this parameter cannot be changed (for Inertial Labs Support if needed).
- **COM Port bps** – sets the baud rate of the device COM port in use. The COM port baud rate within "**Test Options**" (reference Section 4.5.1) will be changed automatically to the chosen value in order to keep communication between the IMU GUI software and the device in use.

  Important:

  1. *The 1843200, 3686400, and 4000000 baud rate values were designed for specific purposes only, and a particular adaptor for data/commands transmission is required. Do not apply such values to the IMU without the Inertial Labs agreement.*

2. *If the default baud rate for the IMU COM port is changing, then the same baud rate must also be set for the COM port of the host computer to keep data/commands transmission.*
3. *The list of supported baud rates may vary from one device to another device. The supported ones depend on the user's needs. In case of any questions related to the baud rate change, contact the Inertial Labs support team.*

- **Data rate (Hz)** - Sets the output data rate in Hertz. The maximum data rate of the device can be set by the user, ranging from 1 to 2000 Hz; it can be changed using the arrows by increments of 10 or by manually entering the desired value from a keyboard. The default value is set as the maximum allowable data rate for the respective device.

  Note: *The maximum data rate is limited by the chosen baud rate of the COM port in use by the unit and the output data format selected. See the ICD document for the device under use for information regarding limitations of data rates of respective output data formats for corresponding baud rate settings.*

- **Averaged output data** – is used if the output data rate is set to a value less than the maximum value (2000 Hz). If this checkbox is checked then the device will output averaged data, otherwise instant data values are outputted.
- **Initial alignment: time (s)** – sets the initial alignment time in seconds. If a nonzero initial alignment time is set, then the device will use this selected time period to estimate gyro biases and apply this estimation to data output upon power up during next operation. If using a nonzero initial alignment time, don't move the device during the initial alignment process. If you choose to disregard this, there will be errors in data output. The minimum value of this parameter is 0 and it can be changed by ±1 with the arrows or by entering the necessary value from a keyboard. The default value is set to 1.
- **IMU s/n** – specifies the serial number for the device in use. This parameter cannot be changed.
- **Device firmware version** – the firmware version of the device in use. Its identification code consists of the firmware type, firmware version, and the date of firmware release. This parameter cannot be changed.
- **Alignment angles (deg)** – the values entered in this field pertain to angular offsets between the device and the carrier object that the device is mounted to. The default values for fields in this section are 0 degrees.

  The three alignment angles are defined in the following order (heading, pitch and roll):

  - The first alignment angle (heading) is determined by device rotation around its Z-axis. Clockwise rotation is denoted as positive. The range for this alignment angle is -180° to +180°.

  In other words, this angle sets the misalignment between the longitudinal axes of the device and the carrier object in the horizon plane.

- The second alignment angle (pitch) is determined by device rotation around its X-axis. Counterclockwise rotation is denoted as positive. The range for this alignment angle is -90° to +90°.

In other words, this angle sets the inclination of the longitudinal axis of the device relative to the carrier object horizon plane.

- The third alignment angle (roll) is determined by device rotation around its Y-axis. Counterclockwise rotation is denoted as positive. The range for this alignment angle is -180° to +180°.

Fig. 4.20 shows an example of different alignment angle values.

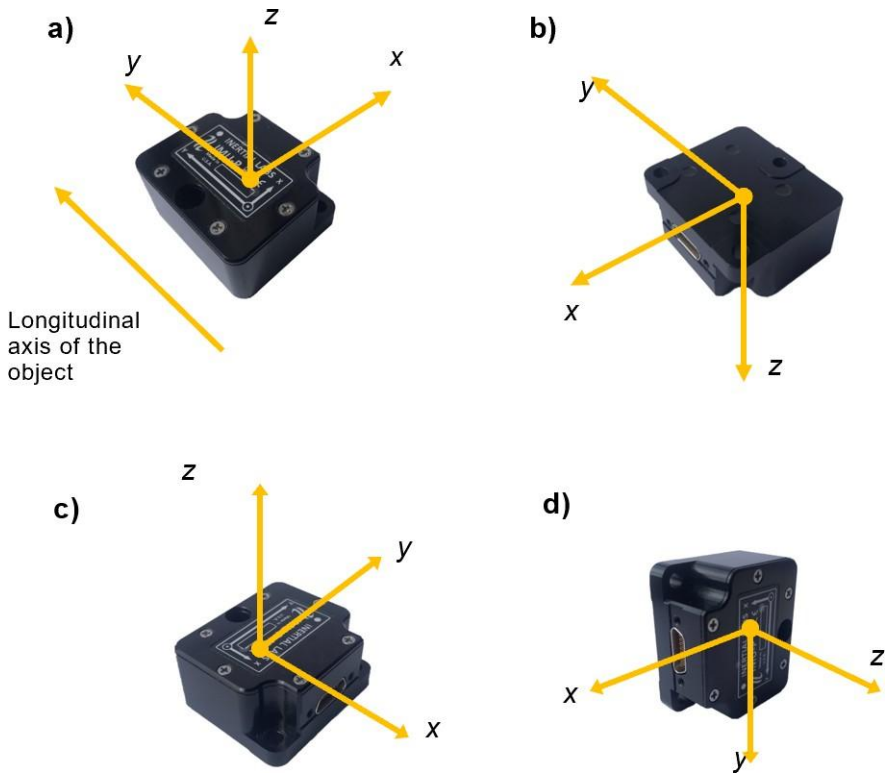

Fig. 4.20. Examples of the device mounting on the carrier object

For the alignment angles shown in Fig. 4.20 each example can be defined for its respective alignment angles in the following way:

a – alignment angles are	0	0	0	(degrees);
b – alignment angles are	0	0	180	(degrees);
c – alignment angles are	90	0	0	(degrees);
d – alignment angles are	180	-90	0	(degrees).

- **Auto start** – enables or disables the automatic start of the device with a specified data output immediately upon power up (and initial alignment). For help selecting an appropriate output data format see Section 5.

Note: *If a connected device to the IMU GUI software operates with the RS485 interface, then the setting of the Auto Start option is unavailable.*

4.5.2.2. Triggers

The "**Triggers**" tab (shown in Fig. 4.21) can be used to configure the following settings:

- **Trigger control** - This checkbox allows the user to enable or disable the Trigger functionality, to output special data packets after receiving an external trigger on the units defined pin.
    - **Polarity** - This drop-down menu allows you to specify the pulse polarity as positive, or negative. The default pulse polarity is negative, which means that the data will be generated at the falling edge of the trigger signal.
    - **Hold-off time (ms)** - This configurable time field allows the user to set the trigger hold-off time in milliseconds. To change this parameter enter the required value using a keyboard. The default value is 2 (ms).

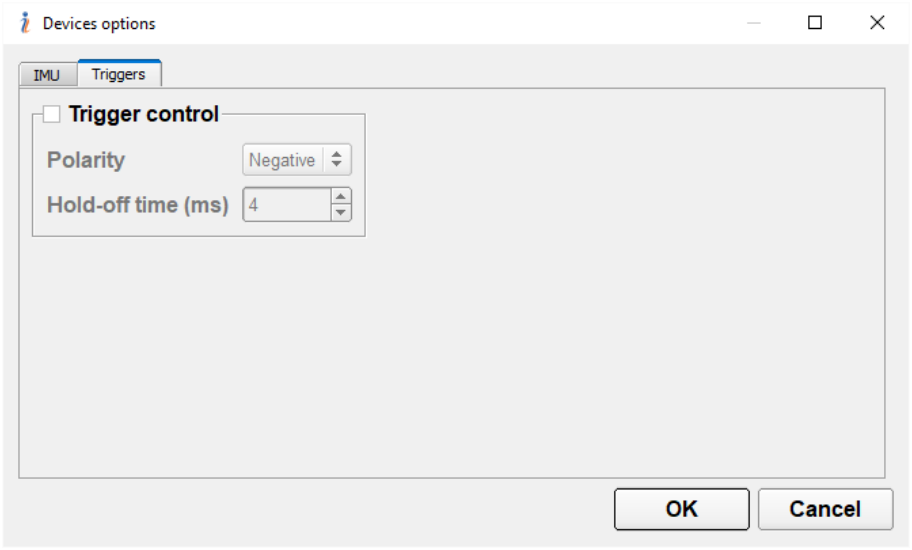

Fig. 4.21. The Triggers tab, located in the Devices Options window in the IMU GUI

4.5.3. Correction Options

Inside the "**Correction Options**" window, the user will have the ability to configure settings that relate directly to the device's algorithm and filters.

Notes:

1. *This menu is available when parameters are read from the device or when a previously saved *.prm file is opened. See section 4.3.*
2. *After changing any settings/parameters in the menu, by clicking on the "OK" button, it is possible to see information about which parameter was changed and its initial and final value for checking. After that, you must write them into the device memory so they make an effect (or save them in a file). Otherwise, the changes will not be applied. To do so, use the "Write parameters" item under the Parameters menu (see Fig. 4.14).*

4.5.3.1. IMU Tilt Algorithm

The parameters placed under the "**IMU Tilt Algorithm**" tab (shown in Fig. 4.22) shouldn't be adjusted unless you are an experienced user. It can be used to change specific settings used for correcting sensor data in the device's Kalman Filter.

For questions on this tab item, contact the Inertial Labs Support Team.

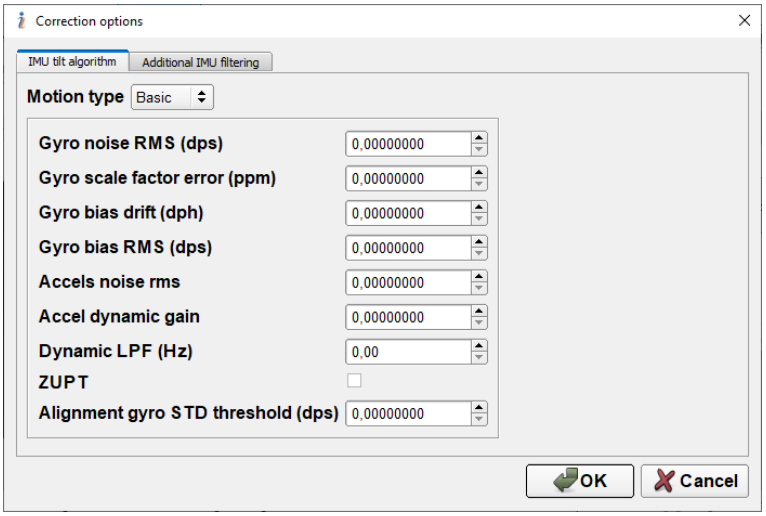

Fig. 4.22. The IMU tilt algorithm tab

Note: *This tab is located in the Correction Options window in the IMU GUI.*

4.5.3.2. Additional IMU Filtering

The parameters placed under the "**Additional IMU Filtering**" tab (shown in Fig. 4.23) are available for the KERNEL IMU only.

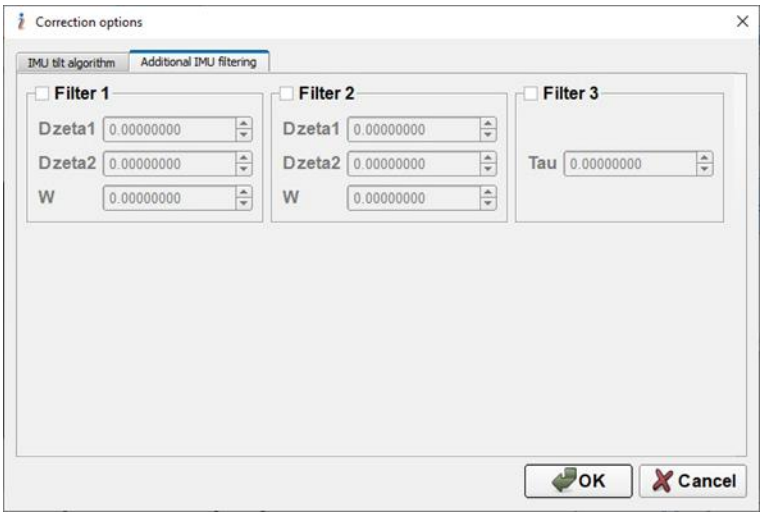

Fig. 4.23. The Additional IMU filtering tab

These parameters are intended for a cascade filter to process the transmitted signals from accelerometers and gyroscopes. The cascade filter includes a combination of first and second-order IIR filters, and its structure is illustrated in Fig. 4.24.

Fig. 4.24. IMU output filter cascade

Filter1 and Filter2 are the second-order filters with transfer function:

$$Filter_1(s) = \frac{s^2 + 2\zeta_{11}\omega_1 s + \omega_1^2}{s^2 + 2\zeta_{21}\omega_1 s + \omega_1^2} \qquad Filter_2(s) = \frac{s^2 + 2\zeta_{12}\omega_2 s + \omega_2^2}{s^2 + 2\zeta_{22}\omega_2 s + \omega_2^2}$$

Filter3 is the first-order filter with transfer function:

$$Filter_3(s) = \frac{1}{\tau s + 1}$$

The user can activate or deactivate each filter in a chain and configure its parameters to meet experiment requirements.

Important:

1. *This cascade filter was designed for specific operations only and for experienced users. For questions on this filter, contact the Inertial Labs Support Team.*
2. *The result of signal filtering can be seen outputting the following data through UDD (see Section 4.5.5):*
   - *"Filtered low-G accels HR" (id 0x91),*
   - *"Filtered high-G accels HR" (id 0x92),*
   - *"Bias-compensated gyro" (id 0x2D).*

   Note the filter customization does not affect the IMU algorithm.

4.5.4. Sensors Options

The "**Sensor Options**" window (shown in Fig. 4.25) is used to adjust the settings of the individual sensors located within the device that is in use. If your device does not contain accelerometers or gyroscopes, only the contained sensors will be affected by the respective variant that is selected.

Notes:

1. *This menu is available when parameters are read from the device or when a previously saved *.prm file is opened. See section 4.3.*
2. *After changing any settings/parameters in the menu, by clicking on the "OK" button, it is possible to see information about which parameter was changed and its initial and final value for checking. After that, you must write them into the device memory so they make an effect (or save them in a file). Otherwise, the changes will not be applied. To do so, use the "Write parameters" item under the Parameters menu (see Fig. 4.14).*

4.5.4.1. Settings

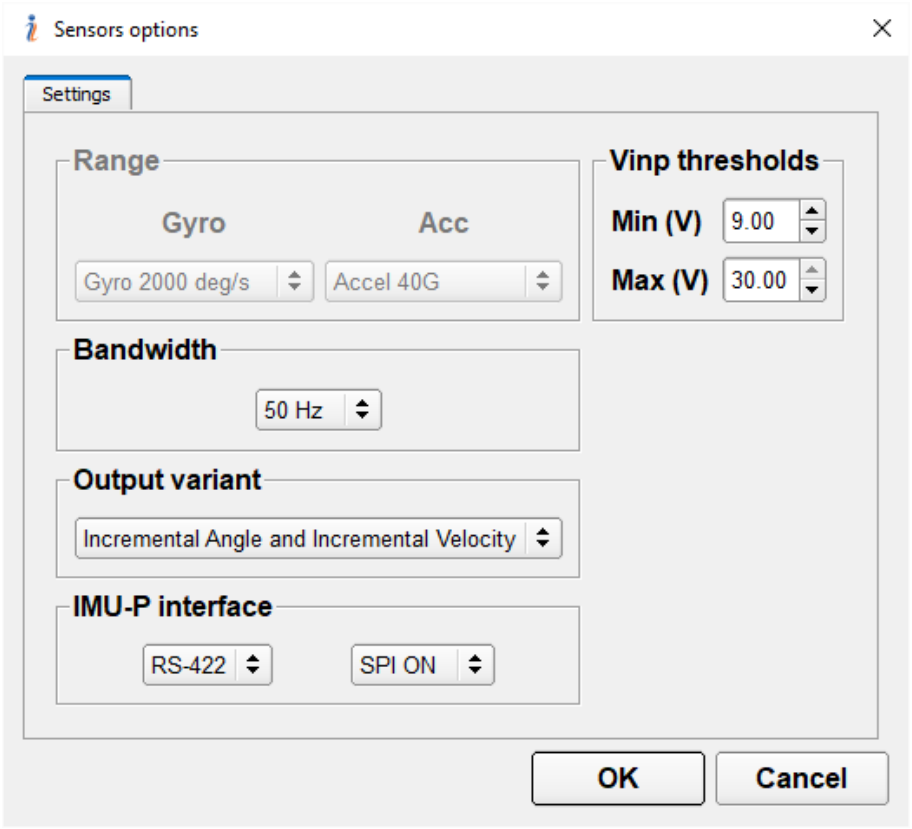

Fig. 4.25. The Sensors Options window in the IMU GUI

The "**Settings**" tab, inside the "**Sensors Options**" window (shown in Fig. 4.25) consists of the following settings:

- **Range**
  - Gyro – shows the measurement range of gyros. This parameter cannot be changed.
  - Acc – shows the measurement range of accelerometers. This parameter cannot be changed.
- **Output Variant**
  - Instant angular rate and acceleration – the data of the device is sampled at the same rate as the specified data rate in “Devices Options” window in the “IMU” tab (See Section 4.5.2.1).
  - Average angular rate and acceleration – the data of the device is sampled at 2000Hz and then averaged according to the chosen data rate in “Devices Options” window in the “IMU” tab (See Section 4.5.2.1).
  - Incremental Angle and Incremental Velocity – The incremental angle is the change in angle per sample for example: (100 deg/s)/(250 samples/s)=0.4 deg; similarly for incremental velocity: (100 deg/s/s)/(250 samples/s)=0.4 deg/s.
- **IMU-P interface**
  - RS422/RS485 – switches the IMU external interface between full-duplex RS422 and half-duplex RS485. Reserved for future use.
  - SPI ON/OFF – enables an additional SPI interface (SDLC) for the IMU-H100.
- **LPF bandwidth** – specifies the bandwidth of the low-pass filter (LPF), which is applied to the sensor output data.
- **Vinp thresholds** – the minimal and maximal thresholds for the input voltage. The minimal available threshold is 4V, the maximal is 30V.

  These parameters may be adjusted if the user wants to inspect input voltage during operation with the special USW massages (see USW description and structure in the device ICD).

  Note: *GUI software controls the correctness of the entered value, and if it exceeds the allowed range (4-30V), the value will be corrected automatically.*

4.5.5. User Defined Data

The "**User Defined Data**" option is available for the IMU-P, KERNEL IMU, IMU-NAV, TAG-301, TAG-304, TAG-512 and TAA. This window will appear as shown in Fig. 4.26. This setting gives the user the ability to generate a custom output data format based on their application needs pertaining to IMU data resolution, data rate, baud rate, and data types.

Note: *IMU GUI software allows configuring UDD data types for different IL products, but the supported structure of UDD data types may vary for each product. For information about the data types that can be transmitted through UDD, refer to the product ICD.*

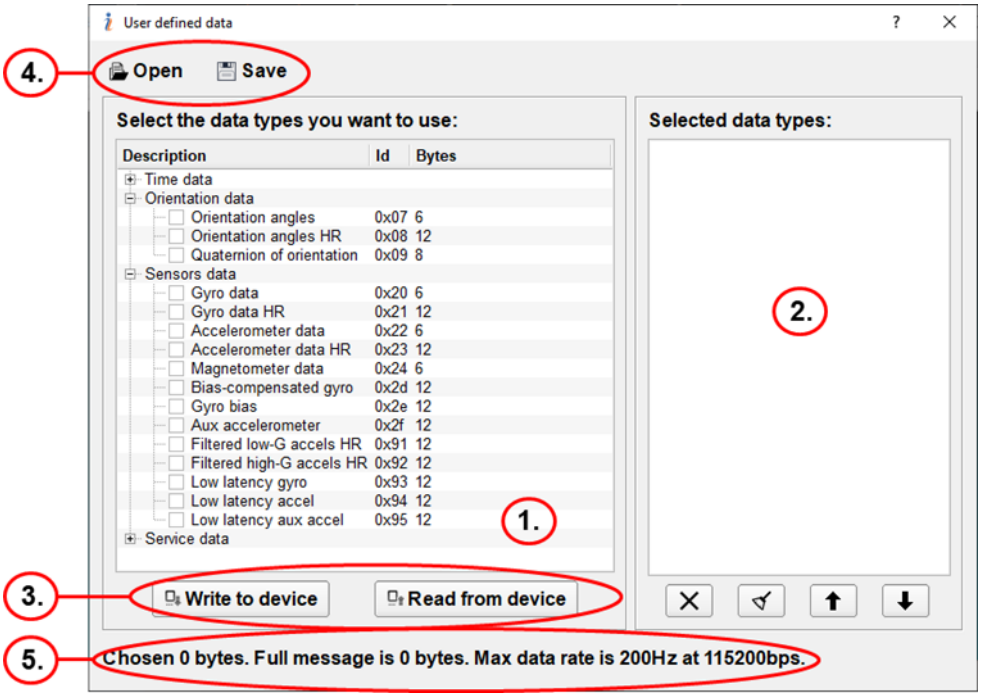

Fig. 4.26. The User Defined Data window in the IMU GUI

In the User Defined Data options window, the user will notice the following things, numbered in the image above.

1. A drop-down list of all the available data types that can be selected in any sequence the user chooses. The drop-down lists make sure to provide information on the description of the data type, the ID code, and the number of bytes associated with the data packet.
2. As the user selects data types to apply to the unit, they will become visible here. Using the buttons at the bottom of this section, the user can remove a selected data packet (clicking 'X'), completely restart the selection process (clicking the brush), or move a data packet up or down in relation to when it is output in the compiled data set, items at the top will be output before items at the bottom of the list.

3. Use the “Write to device” option to write the compiled data set to the device. Alternatively, use the “Read from device” to see the structure of the presently loaded User Defined Data format on the device.
4. The user also has the option to open externally saved User Defined Data format configurations from the host computer or save the current configuration on the host computer.
5. For user convenience, the User Defined Data window automatically calculates useful information for the user pertaining to interface limitations of the configured data set. This message will indicate to the user the total number of bytes for the data format constructed in the “Selected Data Types” section (shown above as ”2.”), and the max data rate of this constructed data format at the baud rate the device is currently configured to operate at. If a higher data rate is needed for a configured data set, the user must increase the baud rate of the device. See Section 4.5.2.1 for details.

5. Available Output Data Formats

The IMU GUI currently supports interfacing with different Inertial Labs sensors. This section shows which data formats are supported by each sensor. Note that details about supported data formats and their structure are provided in the appropriate device ICD.

5.1. Limitations of Output Data Formats

	IMU-P IMU-P-M	IMU-NAV	IMU-P10	IMU-H100	KERNEL-100, 102, 108, 110, 110M, 111, 120, 201, 210, 220	TAG-200 TAG-300	TAG-301 TAG-304	TAG-512	TAA-308 TAA-315 TAA-340
Data Format	**Device Compatibility**								
Selectable Data Packet						✓	✓		
Calibrated Data	✓	✓							
Calibrated HR Data					✓				
GA Data	✓	✓		✓	✓		✓	✓	✓
GAA Data	✓				✓				
GAM Data	✓ (IMU-P-M only)								
GAm Data			✓		✓				
GAAm Data	✓				✓				
Orientation	✓	✓			✓				
Platform Stabilization	✓	✓							
Quaternion Data	✓	✓			✓				
SERVO-TAG-200						✓			
ESCRIBANO-TAG-200						✓			
NMEA	✓	✓		✓					
User Defined Data	✓	✓		✓	✓		✓	✓	✓

Important: *The KERNEL-201 only supports the following data types: GA, GAm, GAA, GAAm, and UDD.*

6. Troubleshooting

6.1. How to Repair Device Parameters

The device parameters may occasionally need to be repaired when the user incorrectly modifies and uploads the parameter file to the IMU memory.

You can use the original parameter file (with a *.prm extension) located on the USB drive shipped with the Inertial Labs device. Alternatively, you can create your own parameter file by using the **"Save parameters"** command.

To restore device parameters, follow these steps:

1. Connect the device to the PC and power it on.
2. Start the IMU GUI software. The main menu will appear (see Fig. 2.1).
3. Select "Test options..." from the "Options" menu (or click the button), and Fig. 4.17 will open.
4. Select the correct COM port number and its rate. Click "OK".

   Note: *To identify the serial port number that the device is connected to, see Section 1.2.*

5. Select "Open parameters" in the "Parameters" menu (see Fig. 4.14) or click the button. A standard Windows "Open" window will open. Select a file with extension *.prm containing the factory settings (or desired settings) to load into the GUI shell and click "OK".
6. Select "Write parameters" in the "Parameters" menu (see Fig. 4.14) or click the button. The selected parameters will be loaded into the device's memory.

6.2. Diagnosing Strange Behavior

If you start to notice the device behaving strangely, begin by checking if the correct parameters were loaded onto the unit. To check which parameters are loaded onto the connected device, select **"Read parameters"** from the **"Parameters"** menu (or click button), then go to the **"Devices options..."** from the **"Options"** menu (or click button) and the "Device options" window (Fig. 4.19) will open.

In the field labeled **"IMU name"** you will see the serial number of the device. To mitigate risk of potential issues, ensure that the device name corresponds with the device serial number located on the unit's label.

In the case that the correct parameters are not on the device, go through the parameters repairing procedure that is described in section 6.1.

Additionally, Inertial Labs recommends checking if the correct cables are being used for the unit and if the baud rate is set correctly for the unit. If issues persist, reach out to the Inertial Labs Technical Support team by visiting the Inertial Labs website.

6.3. Error Message Definitions

When using the Inertial Labs IMU GUI Software, most operations are started with reading data from the unit's nonvolatile memory to correctly control the device status. The device should be powered on and connected to the USB-port using RS422-to-USB (or RS-232) adapter.

When you see one of the messages shown in Fig. 6.1, check the following items:

- The IMU is connected to the USB port using the RS422-to-USB or RS-232-to-USB adapter.
- The COM-port number and baud rate are set correctly in the **"Serial port"** under the **"Test options..."** located in the **"Options"** menu, as Fig. 4.17 shows.
- Ensure that if the unit is in Auto Start mode, it has been correctly stopped before connecting to it.

Once you have ensured that you have correctly addressed the above potential issues, click the **"OK"** button and repeat your operation. If issues persist, contact the Inertial Labs Technical Support team by visiting the Inertial Labs website.

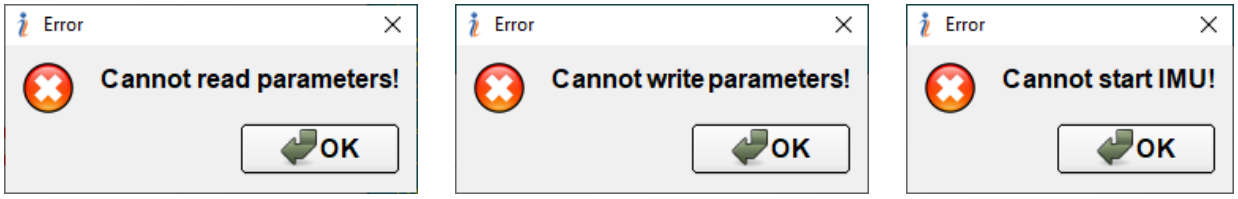

Fig. 6.1. Possible error messages associated with the IMU GUI

6.4. Proper Installation of COM-to-USB Drivers

In some cases, the host computer may not recognize the connected device and will appear in "**Device Manager**" as shown in Fig. 6.2.

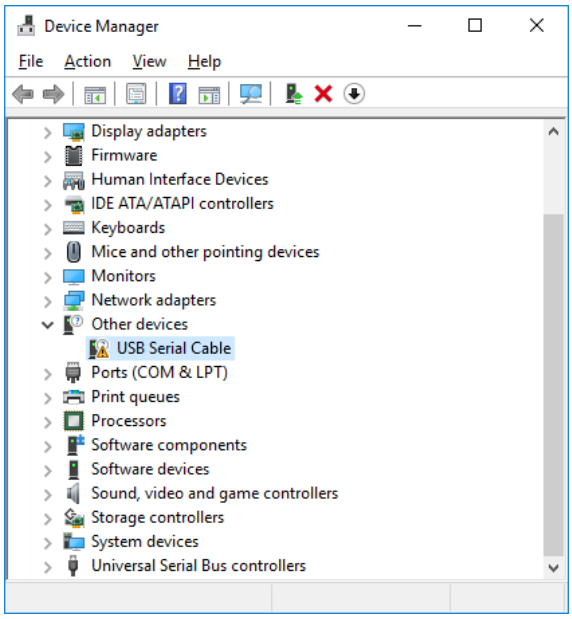

Fig. 6.2

If this is the case, download the appropriate driver package for the converter (https://ftdichip.com/drivers/vcp-drivers/). Then, in Device Manager, right-click on the unrecognized device (in this case "**USB Serial Cable**") and select the option labeled "**Update Driver**" as shown in Fig. 6.3.

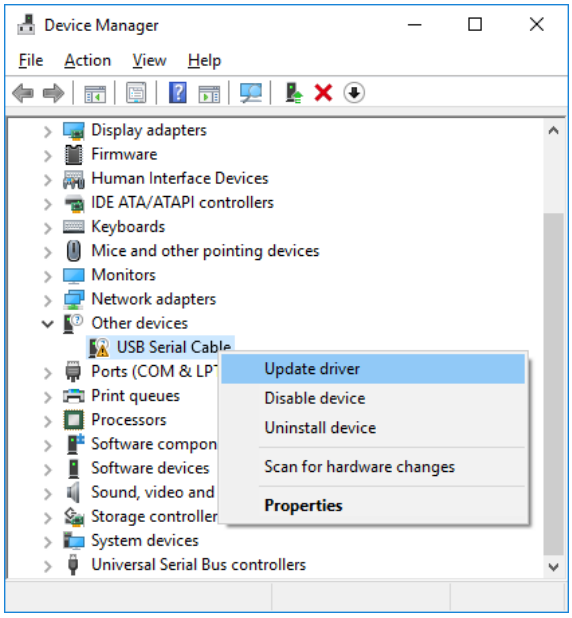

Fig. 6.3

From there, select the option that says "**Browse my computer for driver software**" and locate the folder where the downloaded drivers were saved (will be similar to Fig. 6.4).

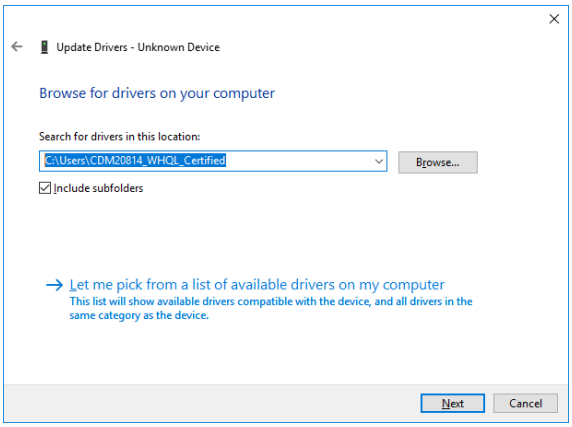

Fig. 6.4

Next, select "**Next**" and wait for the completion screen to appear as shown in Fig. 6.5.

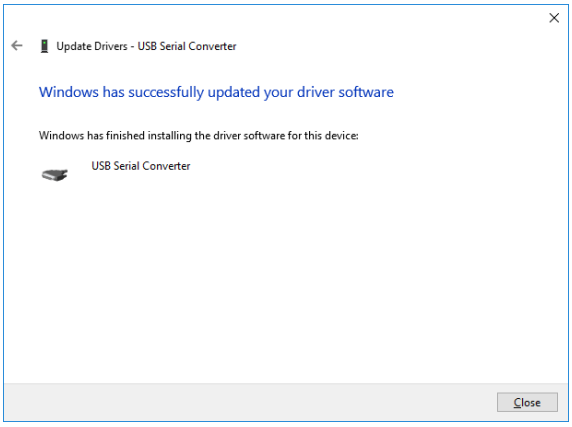

Fig. 6.5

If configured properly, there will be a new item listed under "**Universal Serial Bus Controllers**" in Device Manager, as shown in Fig. 6.6.

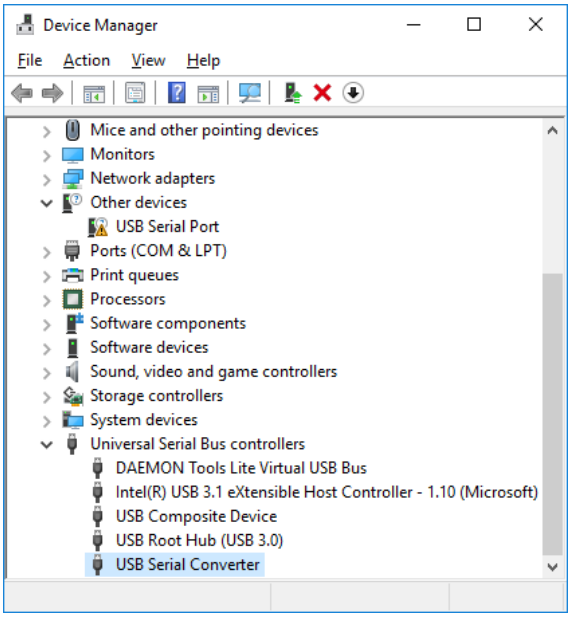

Fig. 6.6

From here, right-click the newly appeared item (in this case the item labeled "**USB Serial Converter**"), and in a similar fashion as before, select "**Update Driver**", then "**Browse my computer for driver software**". The location of this folder is the same that was used in the previous step.

Once completed, Device Manager will now recognize the converter and it will appear in "**Ports (COM and LPT)**". The last step is to ensure the parameters of the COM port are set up properly for minimal latency as described in Section 1.2.

REVISION HISTORY

Revision	Date	Affected Paragraphs	Remarks
2.35	May 20, 2025	5.1	1. Updated the note to specify that the KERNEL-201 supports the following output data formats: GA, GAm, GAA, GAAm, and UDD.
Previous revisions are available upon request.