FSP201 with USB

Quick Start Guide
1000-4939

Rev. 1.0

December 2023

Documentation Control

History Table

Version	Date	Description
01.0	December 6, 2023	Inital Release

Disclaimer and Proprietary Information Notice

The information contained in this document does not represent a commitment on any part by CEVA®, Inc., or its subsidiaries (collectively, "CEVA"). CEVA makes no warranty of any kind with regard to this material, including, but not limited to implied warranties of merchantability and fitness for a particular purpose whether arising out of law, custom, conduct, or otherwise.

Additionally, CEVA assumes no responsibility for any errors or omissions contained herein, and assumes no liability for special, direct, indirect, or consequential damage, losses, costs, charges, claims, demands, fees, or expenses, of any nature or kind, which are incurred in connection with the furnishing, performance, or use of this material.

Support

CEVA® makes great efforts to provide a user-friendly software and hardware development environment. Along with this, CEVA provides comprehensive documentation, enabling users to learn and develop applications on their own. Due to the complexities involved in the development of DSP applications that might be beyond the scope of the documentation, an online Technical Support Service has been established. This service includes useful tips and provides fast and efficient help, assisting users to quickly resolve development problems.

How to Get Technical Support:

- **FAQs**: Visit our website http://www.ceva-dsp.com or your company's protected page on the CEVA website for the latest answers to frequently asked questions.
- **Application Notes**: Visit our website http://www.ceva-dsp.com or your company's protected page on the CEVA website for the latest application notes.
- **Email**: Use the CEVA central support email address ceva-support@ceva-dsp.com. Your email will be forwarded automatically to the relevant support engineers and tools developers who will provide you with the most professional support to help you resolve any problem.
- **License Keys**: Refer any license key requests or problems to sdtkeys@ceva-dsp.com. For SDT license keys installation information, see the *SDT Installation and Licensing Scheme Guide*.

Email: ceva-support@ceva-dsp.com

Visit us at: www.ceva-dsp.com

Table of Contents

List of Figures

List of Tables

1. Introduction

1.1 Scope

This document describes the features and operation of the FSP201 with USB device.

1.2 Audience

This document is intended for anyone who wants to evaluate the FSP201.

1.3 Related Documents

The following documents are related to the information in this document:

1. *1000-4819 FSP201 Datasheet, CEVA, Inc.*
2. *1000-3625 SH-2 Reference Manual, CEVA, Inc.*
3. *1000-4906 FSP201 Simple Calibration User Guide, CEVA, Inc.*
4. *1000-3535 Sensor Hub Transport Protocol*
5. *1000-5034 Schematic, Module USB Adapter*
6. *1000-4868 Schematic, FSP201 Module*

1.4 Overview

The FSP201 is a 6-axis IMU processor, integrating CEVA's high-performance sensor hub software stack, to provide heading and orientation outputs. When connected to one of several supported sensors, it performs all the accelerometer and gyroscope sensor fusion processing necessary to produce stable and accurate heading and orientation outputs. This document is intended to provide information about the FSP201 Module with USB board with software provided by CEVA to facilitate customer evaluation.

2. Hardware

2.1 Introduction

The FSP201 Module with USB board includes the FSP201 Module with Bosch BMI088 6 axis sensor and a USB to serial interface which is designed for quick and easy evaluation and prototyping.

Figure 2-1: FSP201 Module with USB board

2.2 Connections

The FSP201 communicates with the host system over a UART interface, either in UART-RVC mode or in UART-SHTP mode.

In UART-SHTP mode, the FSP201 uses the Sensor Hub Transport Protocol (SHTP) to communicate with a system or application processor. The SHTP protocol is documented in the Sensor Hub Transport Protocol [4], allowing a customer to potentially develop their own host software if they choose to do so.

In UART-RVC mode, the FSP201 transmits heading and sensor information at 100Hz.

The mode selection is made with S1 switch on board. The default configuration is UART-SHTP mode.

3. PC Demo Application

3.1 Requirement

Running Freespace™ MotionStudio 2 with FSP201 Module with USB board requires the following items.

- Windows PC
- FTDI driver (Windows PC may not find the right driver) available in https://ftdichip.com/drivers/vcp-drivers/
- USB Type A to Micro-B cable
- Freespace™ MotionStudio 2 application available in https://www.ceva-dsp.com/resource/freespace-motionstudio-2-2-0-1/
- Setup USB Serial Port

Connect USB Type A to Micro-B cable to FSP201 with USB board and your PC. The USB Serial COM port should appear in your Device Manager after the driver is installed properly.

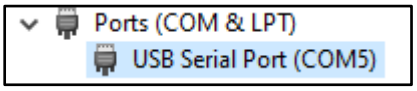

Figure 3-1: Device Manager for USB Serial Port

Please note the configurations of the FTDI COM Port driver should be updated to optimize latency and to improve overall performance.

Right click on the device entry and select Properties to bring up the properties windows.

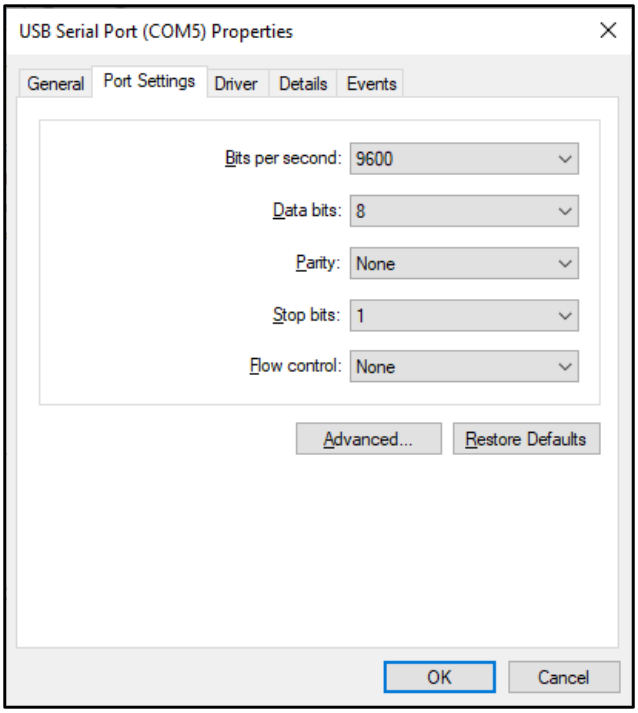

Figure 3-2: USB Serial Port Properties Window in the Device Manager

In the Properties windows, select the Port Settings tab and click the Advanced button to bring up the Advanced Settings window.

In the Advanced Settings window, change the default Latency Timer from 16msec to 1msec.

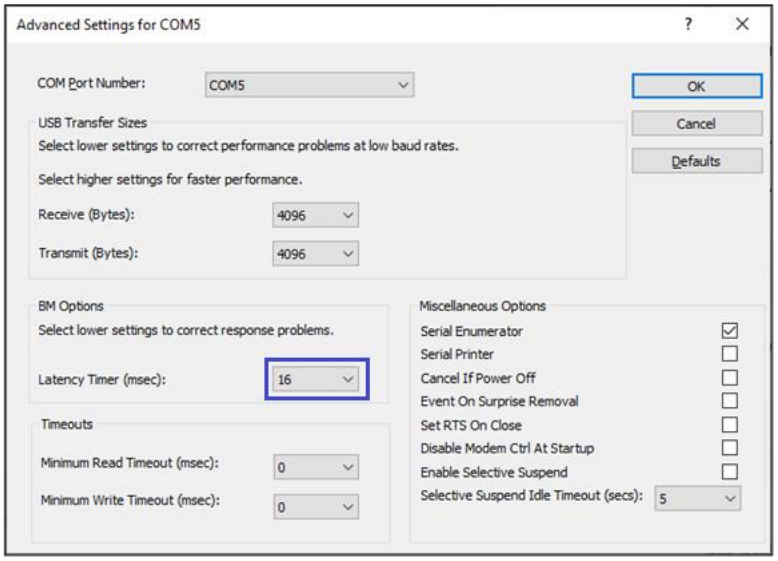

Figure 3-3: Advanced Setting for COM Port

3.2 Running Freespace™ MotionStudio 2

3.2.1 Start Freespace™ MotionStudio 2

After you unzip the PC Application package, launch MotionStudio2.exe under the MotionStudio2 folder. This will open MotionStudio2 window.

Figure 3-4: Freespace™ MotionStudio 2 Startup Window

3.2.2 Establish Connection to the FSP201 USB Board

From the menu panel on the left, select Device Connection. This panel allows users to select device type, transport protocol and more.

- "Product" set to FSP201
- "Device Type" set to USB Adapter
- "Virtual COM Port" set to the corresponding COM port
- Target Device "Transport Protocol" set to SHTP over UART

Use Connect Button to Establish the Connection

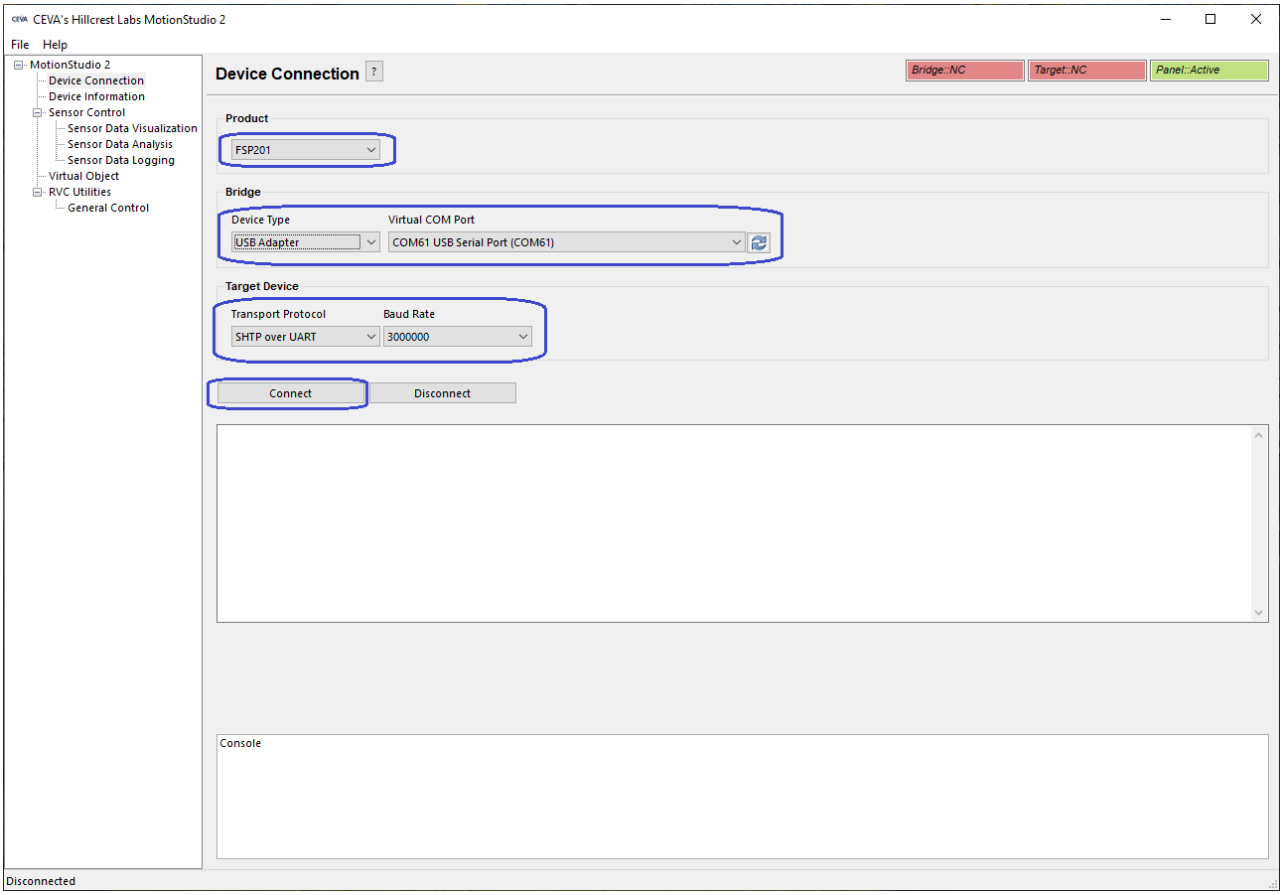

Figure 3-5: Device Connection Panel in MS2

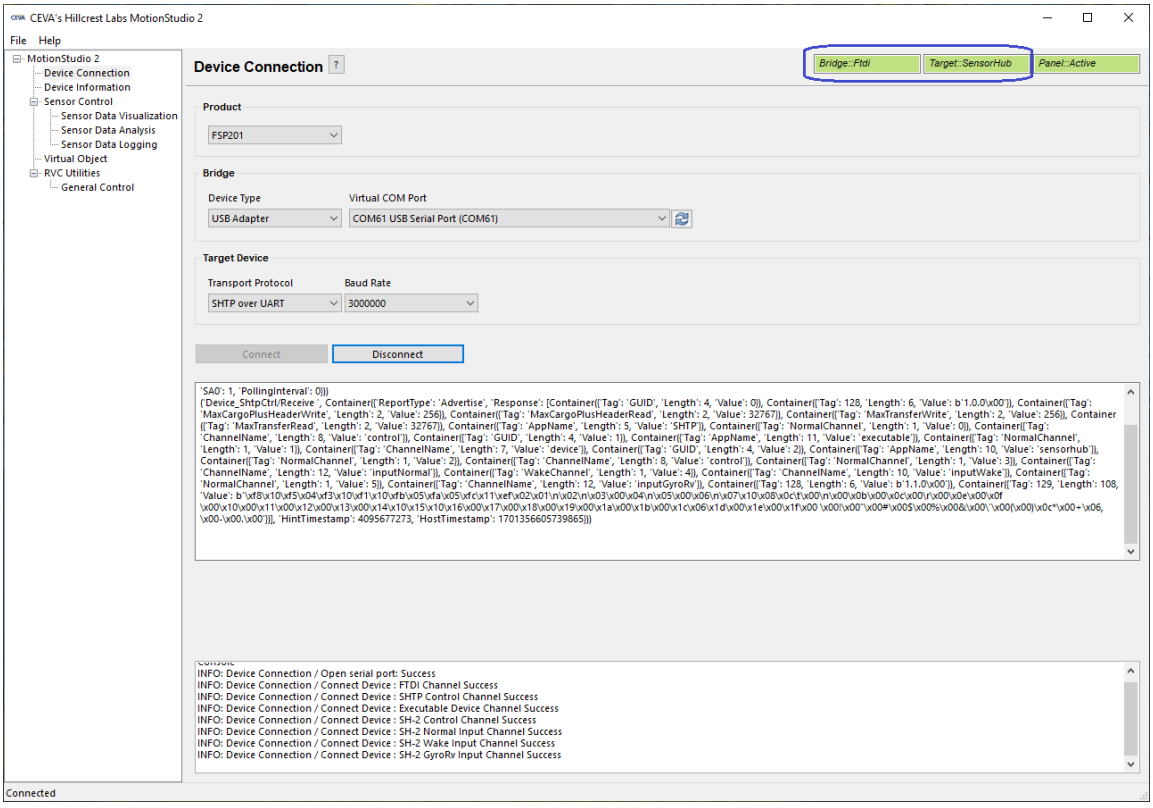

Figure 3-6: Device Connection Window after Connection

When connection process is completed, the three status indicator text boxes on the upper right corner of the panel and the console window on the bottom provide the result of connection process. The three status indicators show the status of the connected system and the status of the associated panel. If the specific panel supports the protocol used by the connected device, the panel becomes active and shows in green color.

3.2.3 Sensor Control

The Sensor Control panel allows the user to enable and disable the various sensors individually. There are two ways to control sensors:

- To enable an individual sensor at a default operation rate, use the check box on the right end of the row for each sensor.
- To enable sensors at specific rates, input the requested operating period, in microseconds, in the 'Requested Period (us)" fields. Then click the "Set Sensor Periods" button on the top of the panel. All sensors will be updated with the specified operating period. The "Requested Period (us)" fields which are left blank or have invalid values are assumed to be "zero".

In many cases, the sensors do not operate at the exact rate as requested. The actual operating period is shown in the "Reported Period (us)" field. Users can also use the "Get Sensor Periods" button on top of the panel to refresh the actual operating period for all sensors.

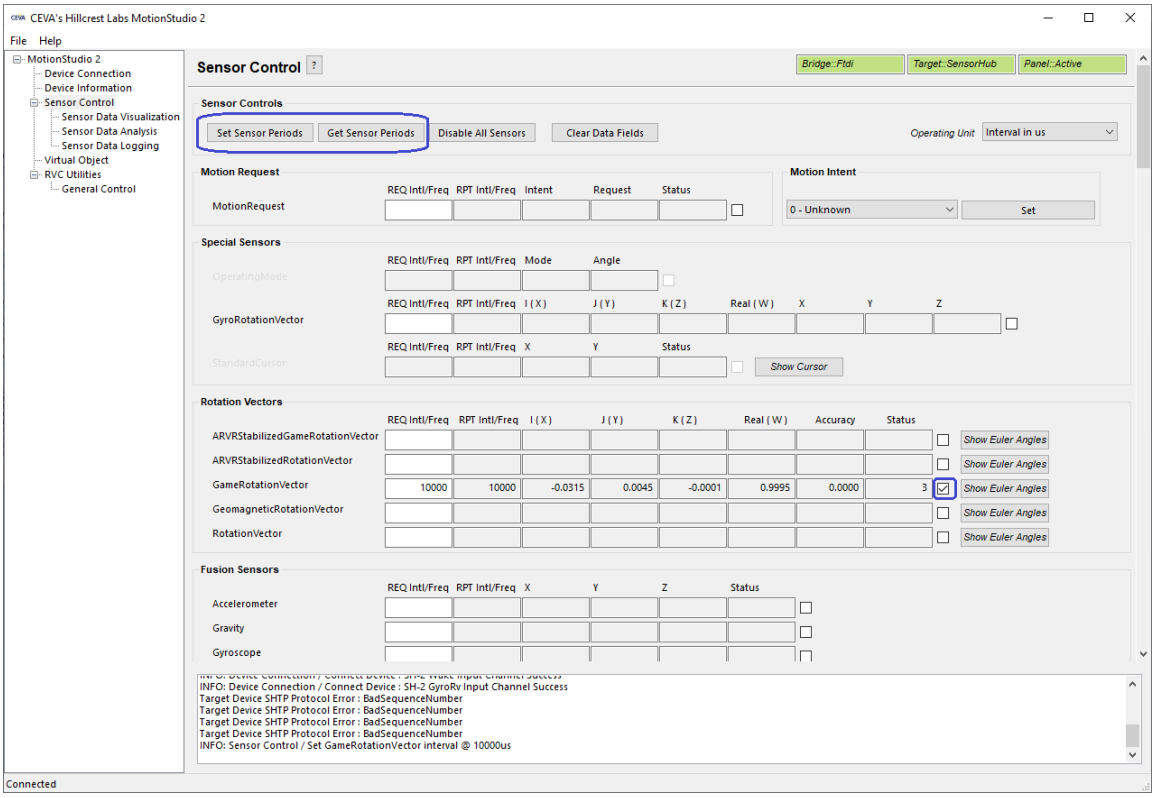

Figure 3-7: Sensor Control Panel in MS2

3.2.4 Virtual Object

Virtual Object panel shows the orientation of the device. Please note that you need to enable sensors in Sensor Control panel, then select the sensor from the drop-down menu in Virtual Object panel. The sword in the Virtual Object will move according to the device orientation.

To adjust the camera position, move the cursor to the Virtual Object Panel, then press the LEFT mouse button. Hold the button down and move the mouse to change the view position. To reset the camera position, use the "Reset Camera Position" button.

To display the Game Rotation Vectors, select the GameRotationVector from the drop-down menu, the data fields should start updating with the received sensor data. The virtual object will move according to the orientation of the hardware. The Virtual Control panel does not control the sensor but displays the output data.

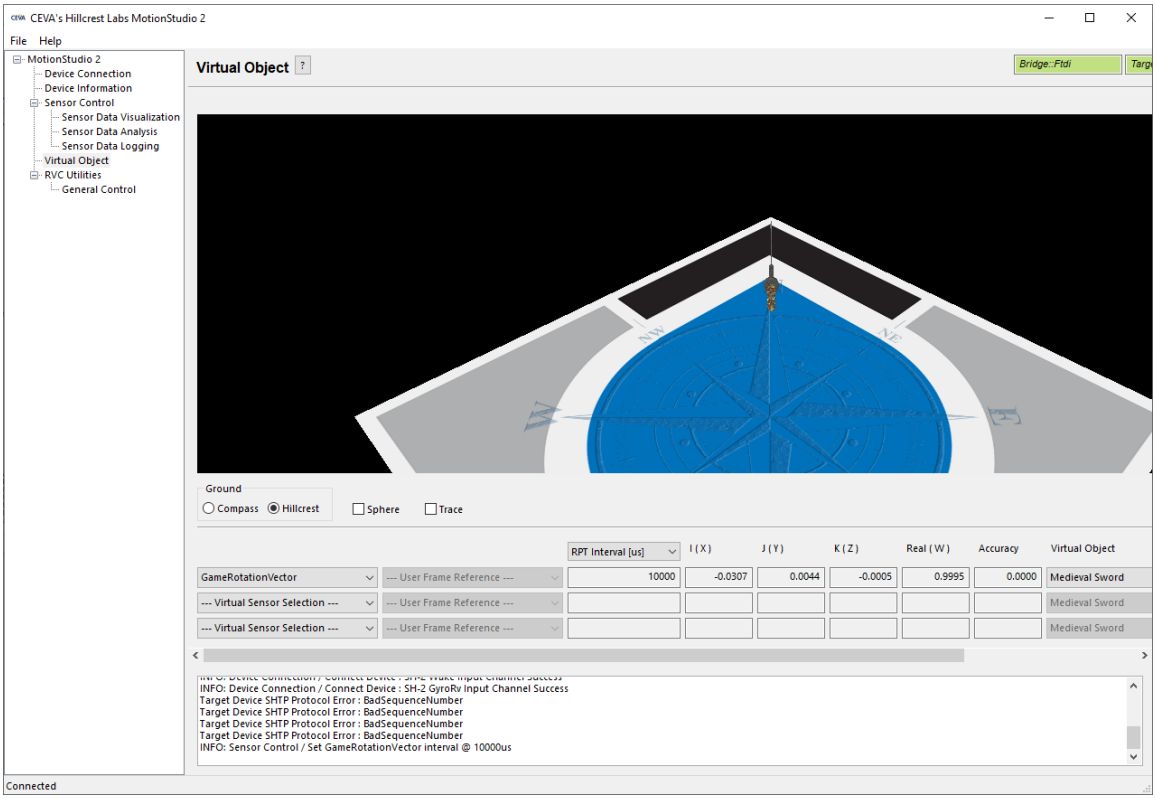

Figure 3-8: Virtual Object Panel in MS2

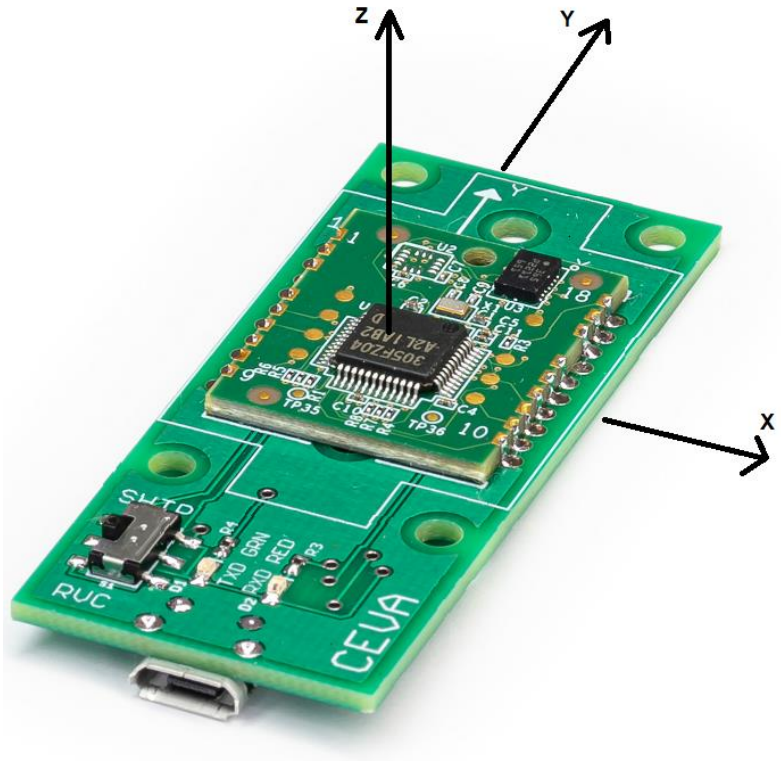

Figure 3-9: FSP201 with USB board Orientation

Please follow the instructions below to align your device.

- Enable Game Rotation Vector in “Sensor Control” panel.
- Switch to Virtual Object panel and move the background so the black corner of the logo on the ground plane points to your forward direction (heading).
- Hold the FSP201 with USB board Y+ axis points to your forward direction.
- Select “GameRotationVector” in drop-down menu and click “Tare Z”. Now, the sword will point to the edge of the logo and is aligned with your device Y+.

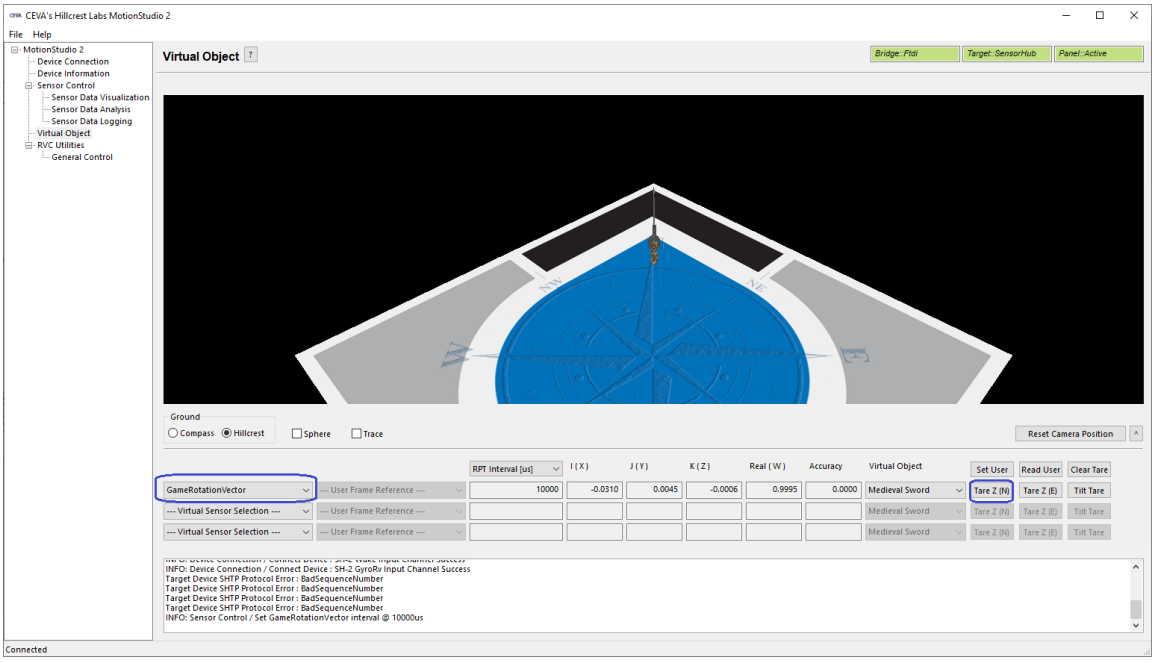

Figure 3-10: Sensor Orientation in Virtual Object Panel in MS2

4. Example Software

4.1 UART-SHTP Mode

CEVA provides software for the FSP201 Module with USB board. The example application source code is available in public github.

https://github.com/ceva-dsp/sh2-logger

Clone this repository using the --recursive flag with git. Alternatively, you can download a ZIP file from the link. An example git clone command is shown below.

git clone --recursive https://github.com/ceva-dsp/sh2-logger

Follow the instructions on the github to build either in Windows or Linux.

4.1.1 Running the Application on Windows PC

- Create a configuration file.

```
sh2_logger.exe template -o config.json


Generate a configuration file template "config.json".
```

- Edit the config.json file with any editor to configure setup.
  - Not all sensors are available in the FSP201. Please check with the datasheet for supported sensor reports.
  - Following example enables Game Rotation Vector at 100Hz, Accelerometer at 100Hz

```
    "sensorList": {
        "ARVR Stabilized GameRotation Vector": 0,
        "ARVR Stabilized Rotation Vector": 0,
        "Accelerometer": 100,
        "Ambient Light": 0,
        "Circle Detector": 0,
        "Dead Reckoning Pose": 0,
        "Flip Detector": 0,
        "Game Rotation Vector": 100,
```

- `Execute sh2_logger.exe`

- sh2_logger.exe log -i config.json -o test.dsf -d 0

```
sh2_logger.exe log -i config.json -o test.dsf -d 0


INFO: (json) Process the batch json file 'config.json'
...
INFO: (json) Calibration Enable : 8
INFO: (json) Clear DCD : Disable
INFO: (json) Clear OF Cal : Disable
INFO: (json) DCD Auto Save : Enable
INFO: (json) Orientation : NED
INFO: (json) Extract Sensor list ...
INFO: (json)      Sensor ID : 1 - Accelerometer @ 100Hz
(10000us) [ss=0]
INFO: (json)      Sensor ID : 8 - Game Rotation Vector @
100Hz (10000us) [ss=0]


INFO: Open a session with a SensorHub
FTDI device found on COM27
INFO: Get Product IDs


WARNING: SHTP error detected.
INFO: Set DCD Auto Save
INFO: Set Calibration Configuration
INFO: Get FRS Records


INFO: Enable Sensors


Press a key to exit . . .


Processing Sensor Reports . . .


WARNING: SHTP error detected.
Samples:         50 Duration: 0:00:00  Rate: 207.20
(50.00) Samples per second
```

```
Samples:        250 Duration: 0:00:01  Rate: 202.05
(200.00) Samples per second

Samples:        451 Duration: 0:00:02  Rate: 201.60
(201.00) Samples per second

Samples:        652 Duration: 0:00:03  Rate: 201.29
(201.00) Samples per second

Samples:        854 Duration: 0:00:04  Rate: 201.32
(202.00) Samples per second
```

- test.dsf is a sensor report log file in CEVA proprietary format.
  - Use any text editor to open the file.
  - The beginning of the log file includes the format of each channel followed by + (plus).

```
+1
TIME{s},SYSTEM_TIME{s},SAMPLE_ID[x]{samples},STATUS[x]{st
ate},LIN_ACC_GRAVITY[xyz]{m/s^2}
```

  - Corresponding data follows the channel number followed by . (period).

```
.1 0.759617000,0.759917000,226,2,0.390625,-
3.1875,9.16015625
```

  - In this example:

channel	○ Time	System Time	Sample ID	Status	Accelerometer		
					x	y	z
1	0.759617000	0.759617000	226	2	0.390625	3.1875	9.16015625

4.2 UART-RVC Mode

The FSP201 automatically sends data when UART-RVC mode is set by S1 on the board.

After the device power on, there are 93 bytes of message followed by UART RVC data. Please refer to the FSP201 datasheet [1] Section 3.3.1 for more information about the format.

Header	**Index**	**Yaw**		**Pitch**		**Roll**		**X-axis accel**		**Y-axis accel**		**Z-axis accel**		**Interactive Calibration**		**Rsvd**	**Csum**
0xAAAA		LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	MI	MR	0x00	csum

5. Glossary

Table 5-1 defines the acronyms used in this document.

Table 5-1: Acronyms

Term	Definition
SHTP	Sensor Hub Transport Protocol
MS2	MotionStudio 2
RVC	Robot Vacuum Cleaner

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

CEVA:

FSP201-USB-UART