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**Motion Link User Manual
Version 2.0**

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1 Revision History

Revision Date	Revision	Description
10/05/2016	1.0	Motion Link Version 1.0 release
11/01/2016	1.1	Motion Link Version 1.1 release
01/20/2017	1.2	Motion Link Version 1.2 release
04/20/2017	2.0	Motion Link Version 2.0 release

2 References

Please check the Register Map, STM32 MCU Nucleo board/Carrier board documentation, and product specification documentation for the relevant board.

<http://www.invensense.com/mems/gyro/catalog.html>

3 Overview

This document serves the purpose of a guide for installing the Motion Link data logger executable and also that of a guide to show how to use the Motion Link tool in combination with STM32 MCU Nucleo and Carrier boards.

4 Requirements

- (1) PC with Windows OS. (Tested on Windows 7 32-bit OS and Windows 7 64-bit OS, Windows 8 64-bit OS).
- (2) STM32 MCU Nucleo board.
- (3) Nucleo Carrier board.
- (4) Two mini USB cables.
- (5) Application software.
- (6) Internet connection if the .net framework and STM32/FTDI drivers/tools are not previously installed on the target PC.

5 Hardware Configuration

- (1) Jumper settings
 - On the STM32 Nucleo board,
 - i. JP6 must be open.
 - On the Carrier board,
 - i. JP10, 1-3 must be closed and 2-4 must be closed.
 - ii. JP9 must be closed.

- iii. JP8 must be set to "Nucleo".
- iv. JP7 must be set to "AUXnCS".
- v. JP2 must be set to "3V3".
- vi. JP1 must be set to "VDD".

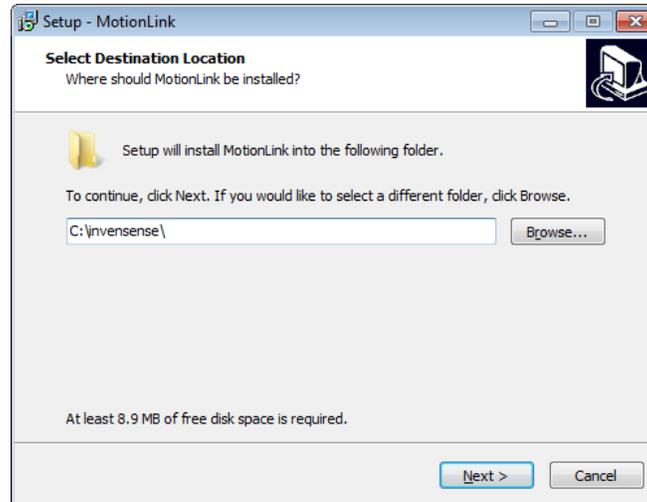
6 Motion Link Supported Devices

Motion Link supports the following InvenSense Motion devices:

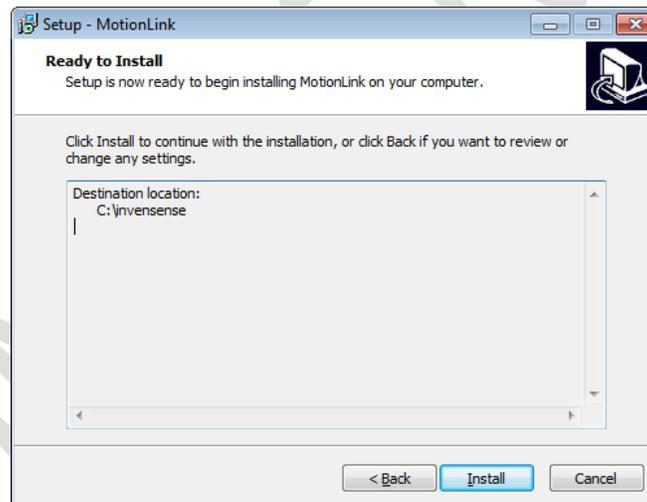
- MPU-6000
- ICM-10320
- ICM-20600
- ICM-20601
- ICM-20602
- ICM-20603
- ICM-20607
- ICM-20608
- ICM-20630
- ICM-20632
- ICM-20645
- ICM-20648
- ICM-20649
- ICM-20690
- ICM-20789
- ICM-20948
- IAM-20380
- IAM-20680
- ICG-20330
- ICG-20660
- ICC-51200
- ICP-10100
- INVN-9911

7 Installation

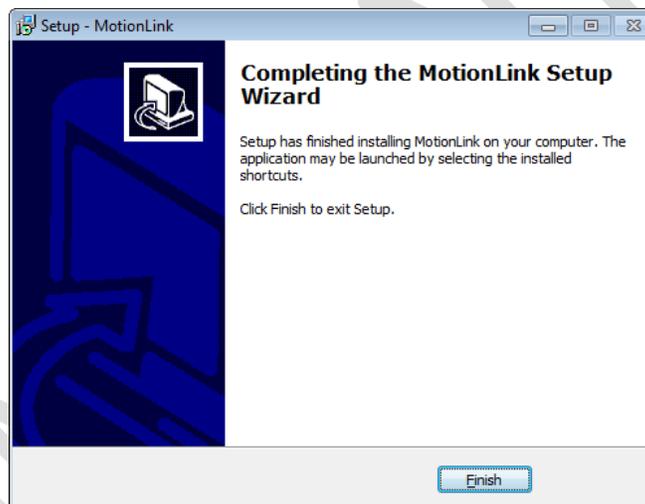
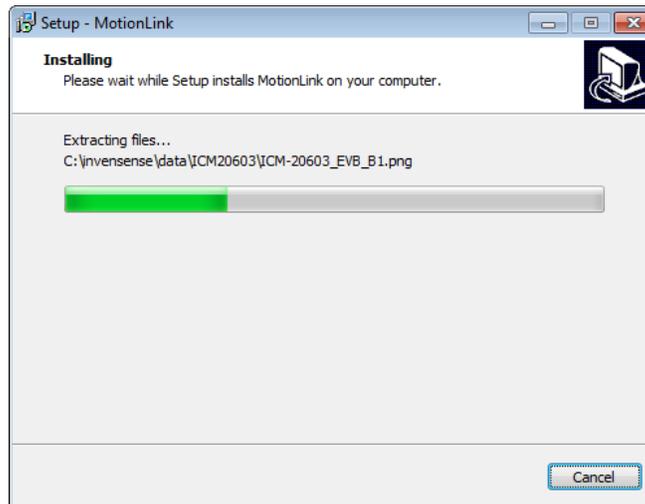
- (1) Run the installer, MotionLinkGUISetup.exe. It will prompt for the installation directory. Once the desired installation directory is selected, navigate to the next step by clicking “Next”.



- (2) Verify the destination folder and start the installation by clicking “Install”.

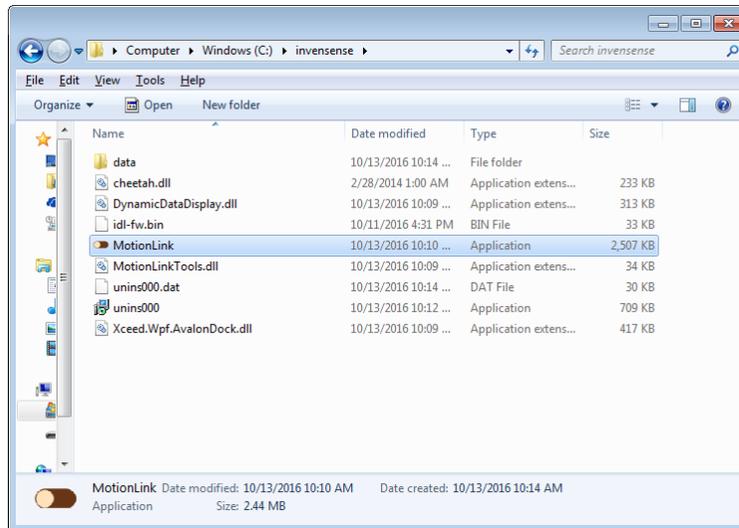


(3) Wait for the installation to complete and once done, click “Finish”.



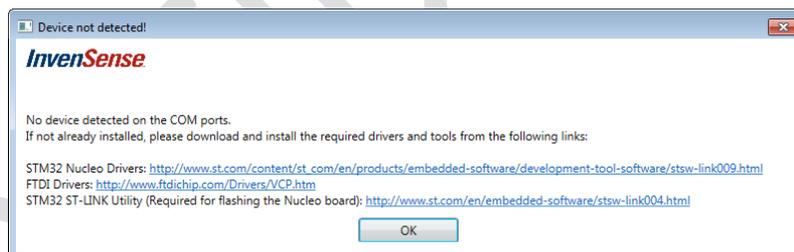
8 Starting the Motion Link Application

- (1) Navigate to the installation directory and run the executable, MotionLink.exe.



9 Connecting Sensor Boards

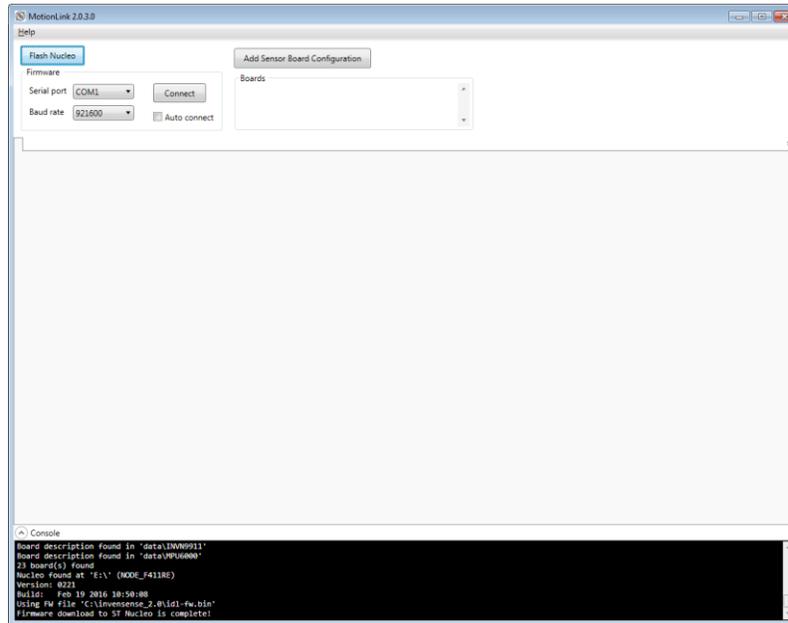
- (1) If no sensor boards are connected to the USB/COM ports or if the STM32 (or) FTDI drivers are not installed, the “Device not detected!” pop up will come up along with the links for downloading the drivers from the corresponding websites.



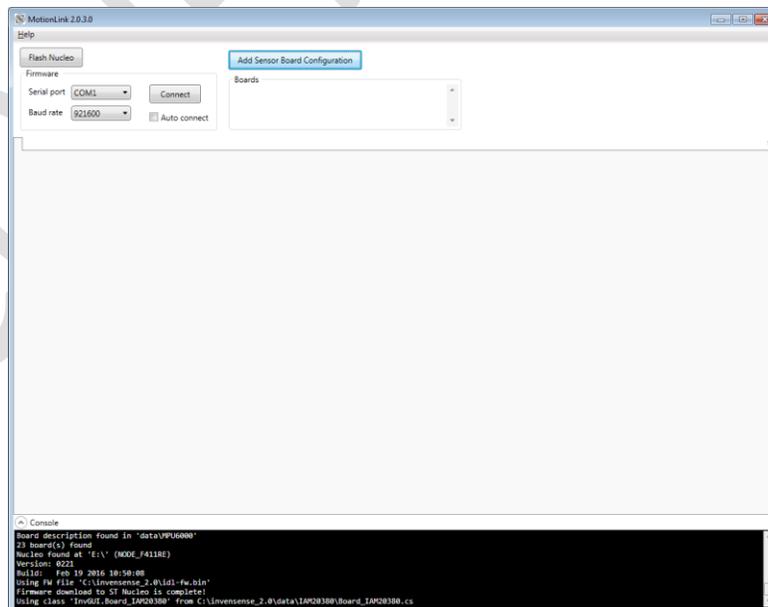
Connect the STM32 Nucleo sensor boards to the USB ports (Note: Both, the STM32 Nucleo board and the daughter board, needs to be connected to the USB interface). Install the following drivers and tools:

- STM32 Nucleo board: http://www.st.com/content/st_com/en/products/embedded-software/development-tool-software/stsw-link009.html
- FTDI drivers: <http://www.ftdichip.com/Drivers/VCP.htm>
- STM32 ST-LINK utility: <http://www.st.com/en/embedded-software/stsw-link004.html>

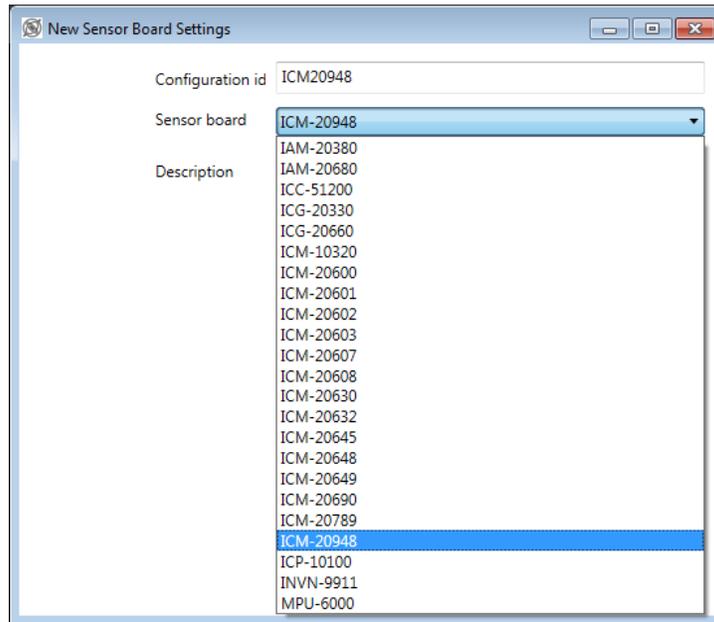
- (2) Once a sensor board is connected through a COM port, it shows up under “Serial port”. If the board needs to be initialized with a firmware, click “Flash Nucleo”; Otherwise, skip this and go to the next step.



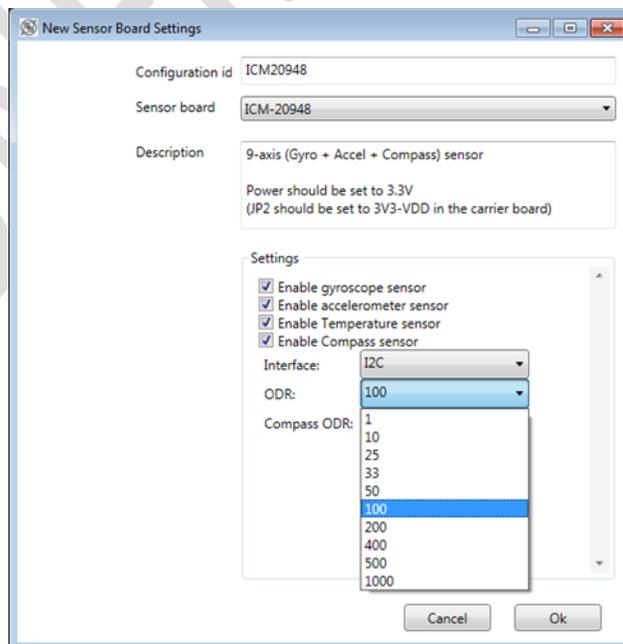
- (3) Add the configuration to match the board that is connected by clicking, “Add Sensor Board Configuration”. In this example, ICM-20690 is connected to the COM ports, so the appropriate configuration is selected.



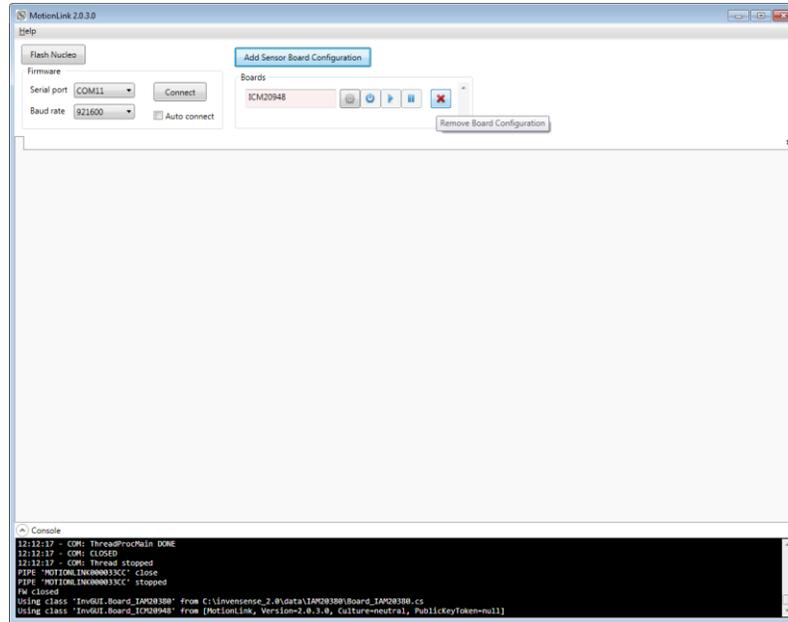
Select the sensor board configuration that matches the connected sensor board as shown below. Enable appropriate “Settings” and click “Ok”.



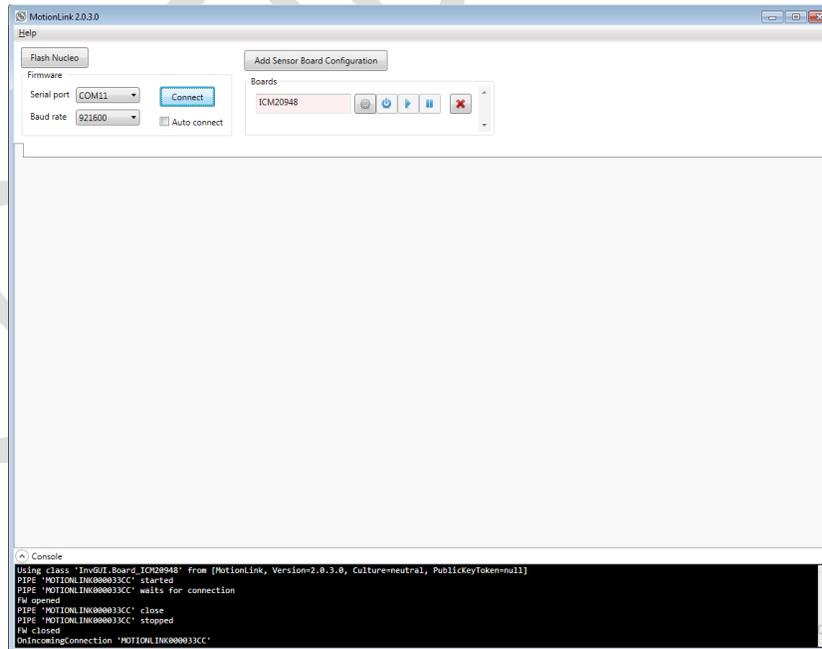
- (4) Select ODR settings for Gyro and Accel. (Note: Compass sensors have a different ODR settings. And, the I2C interface ODR for Gyro/Accel is limited by the Pressure sensor’s ODR for ICM-20789).



(5) To remove a sensor board configuration from the data logger, click  button.

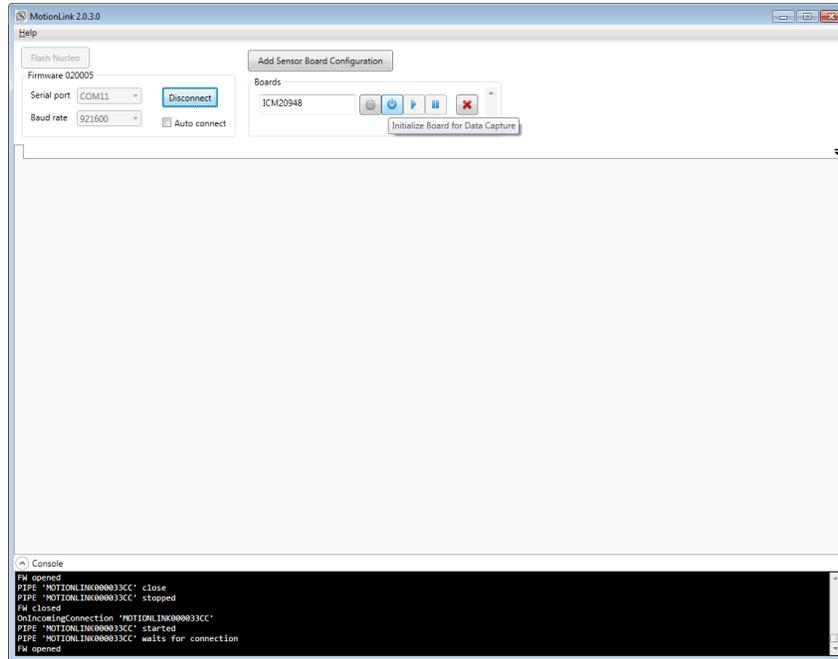


(6) After adding the board configuration, click on “Connect” to connect to the Sensor Board.

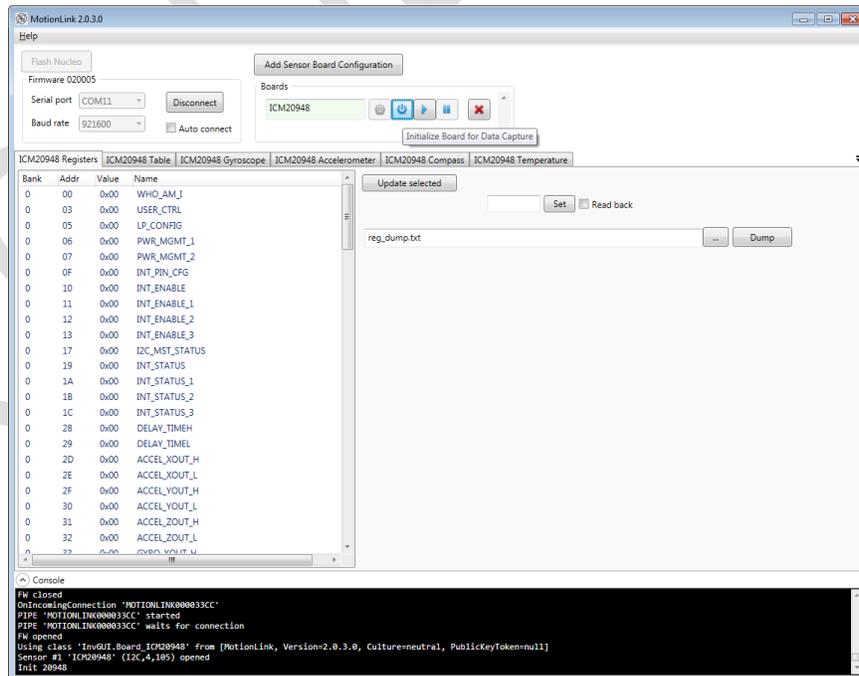


10 Starting the Data Capture

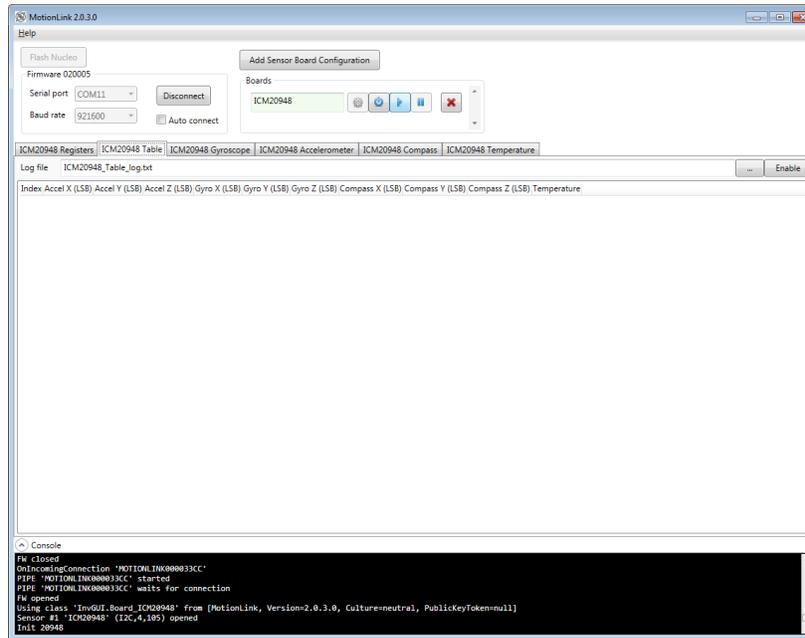
- (1) Once the configuration is added, click on the  button to initialize the board.



After initialization, a set of tabs opens up in the main window as shown below.



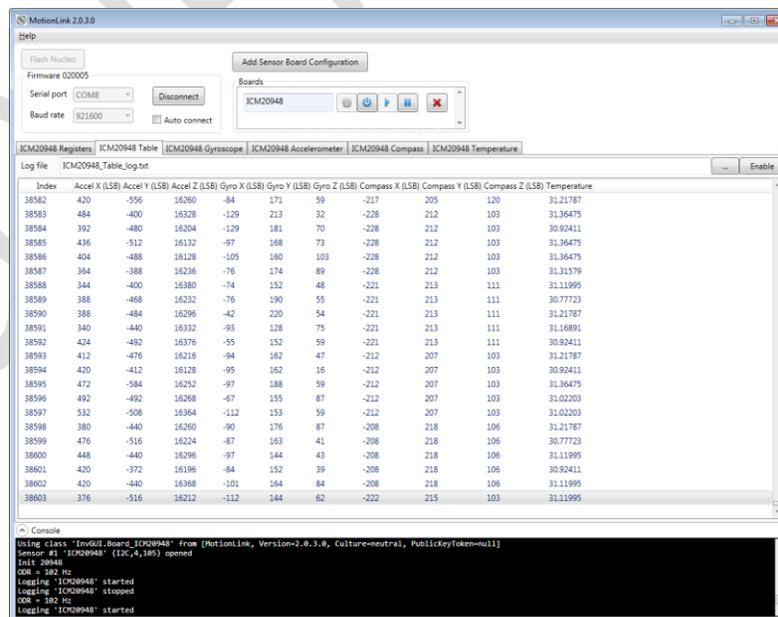
(2) Click the button to start the data logging.



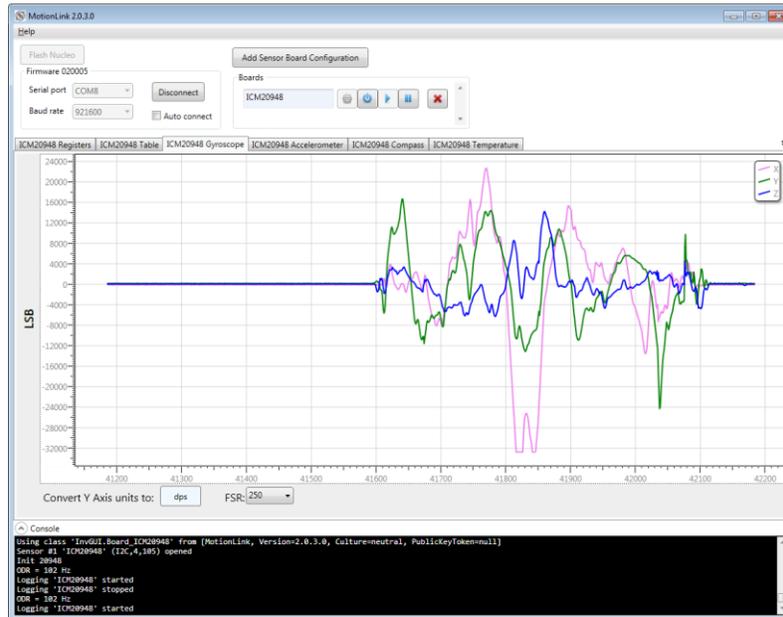
11 Viewing the Data

Once the data logging has started, click on the tabs above to view the data.

(1) The "... Table" tab shows the live Gyroscope (X, Y, Z) and Accelerometer (X, Y, Z) values. User can choose to log the captured data to a text file.



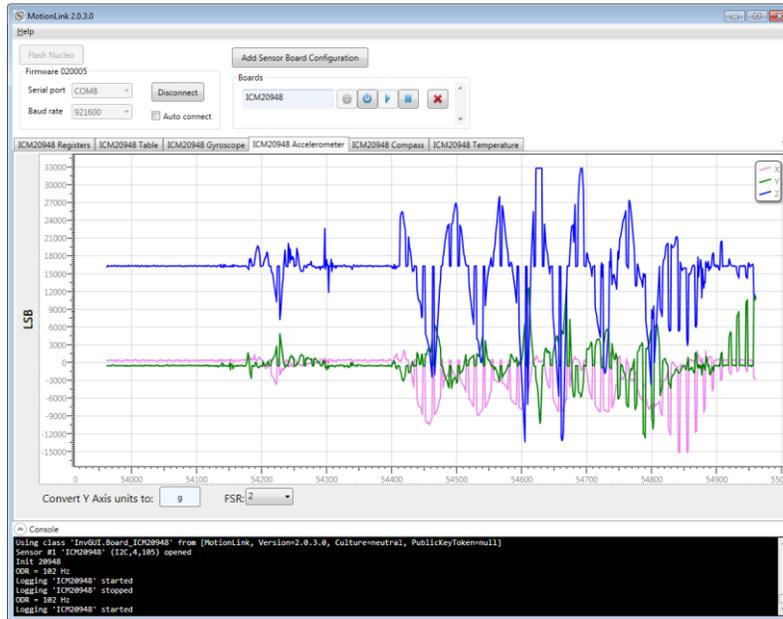
- (2) The "... Gyroscope" tab shows the Gyroscope (X, Y, Z) data in graphical representation. When the "DPS" button is selected, the Y-axis units get converted from raw data (LSB) to "DPS" (Degrees Per Second).



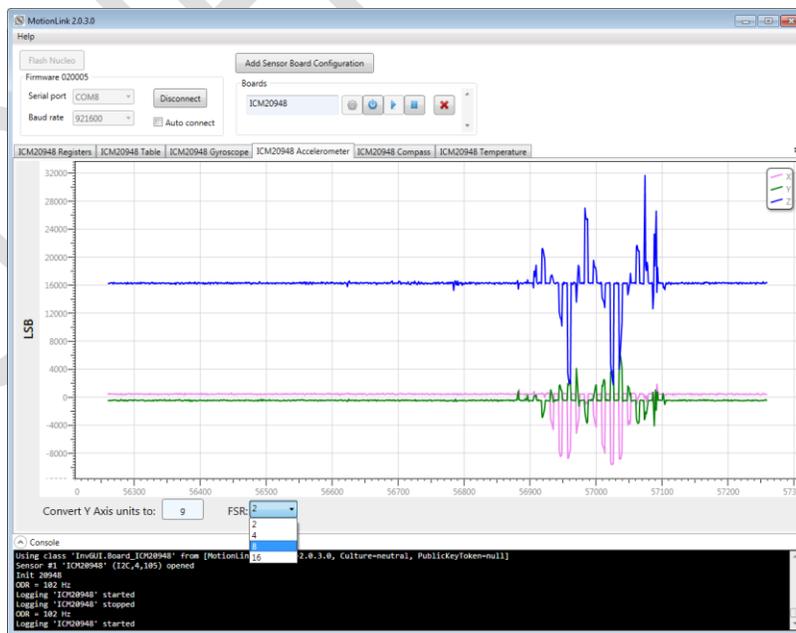
To select a different FSR value for the gyroscope readings, click on the drop-down menu "FSR:" and select a suitable option.



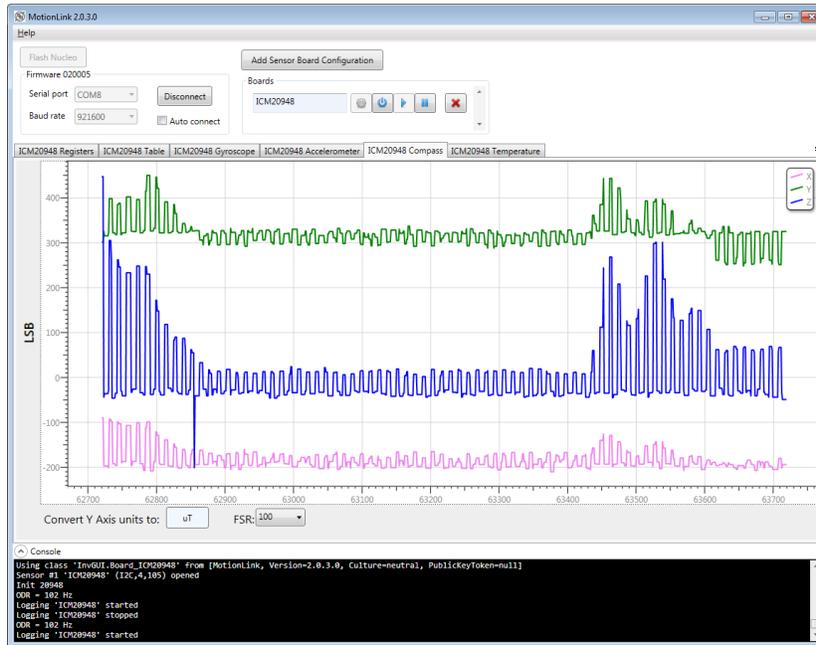
- (3) The "... Accelerometer" tab shows the Accelerometer (X, Y, Z) data in graphical representation. When the "g" button is selected, the Y-axis units get converted from raw data (LSB) to "g" (unit of acceleration).



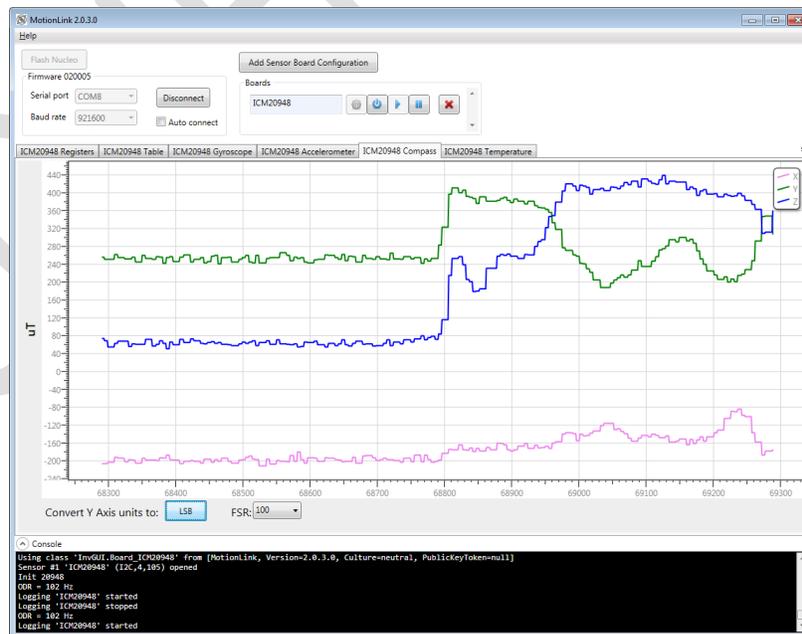
To select a different FSR value for the accelerometer readings, click on the drop-down menu "FSR:" and select a suitable option.



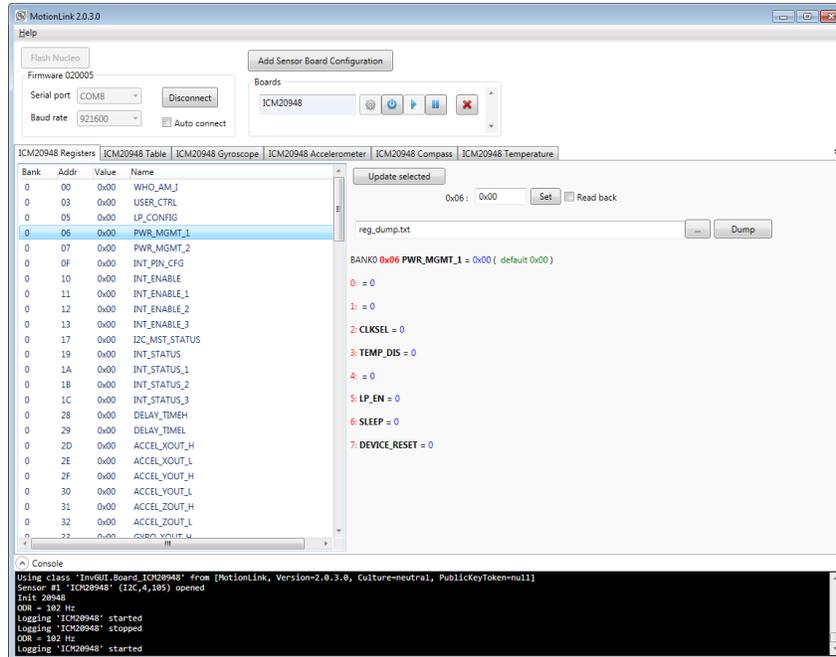
(4) The "... Compass" tab shows the Compass (X, Y, Z) data in graphical representation.



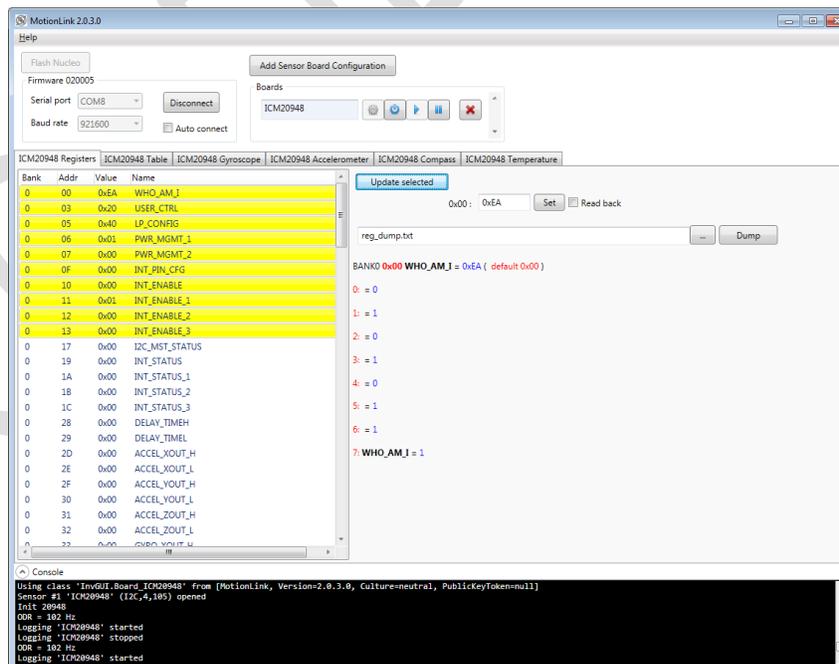
When the "uT" button is selected, the Y-axis units get converted from raw data (LSB) to "uT" (unit of magnetometer).



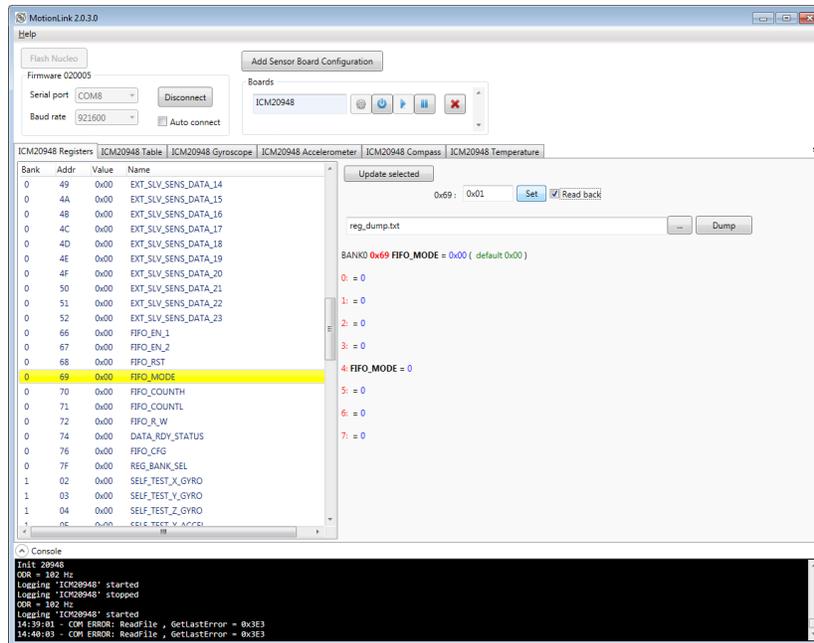
- (5) The “... Registers” tab shows the list of sensor data registers that contain the latest gyroscope measurement, accelerometer measurement, temperature measurement and other data. Please refer to the register map corresponding to the sensor you are using.



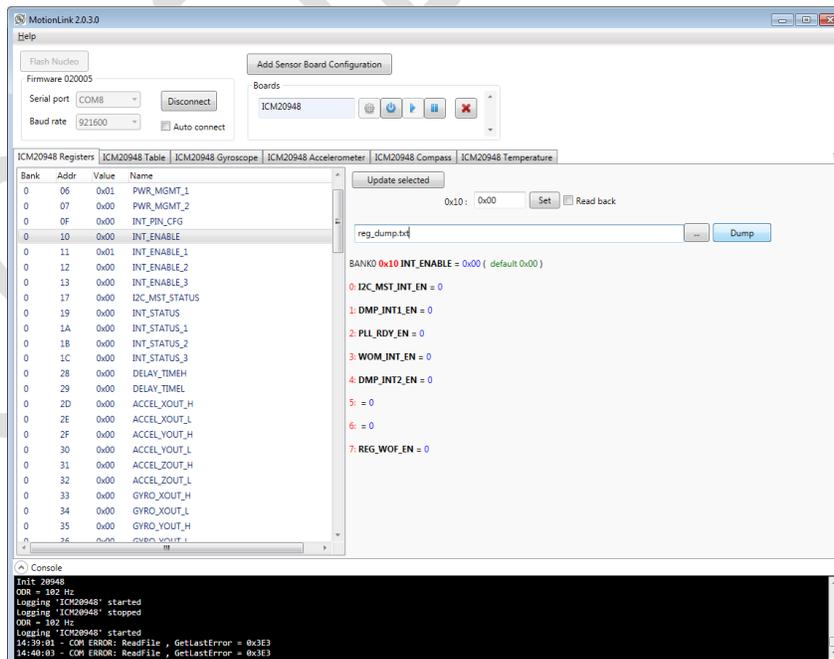
To read one or more registers, select the registers on the left side table and click “Update selected”.



For writing to one of the registers, select the register on the left side table, enter the write value for that register in the “CONFIG:” text area and click “Set”. Optionally, the user can check the option “Read back” if they want to read that register back after a right.



Additionally, the user can choose to dump all the register values to a text file by selecting a filename/path and clicking, “Dump”.



12 Storing the Data

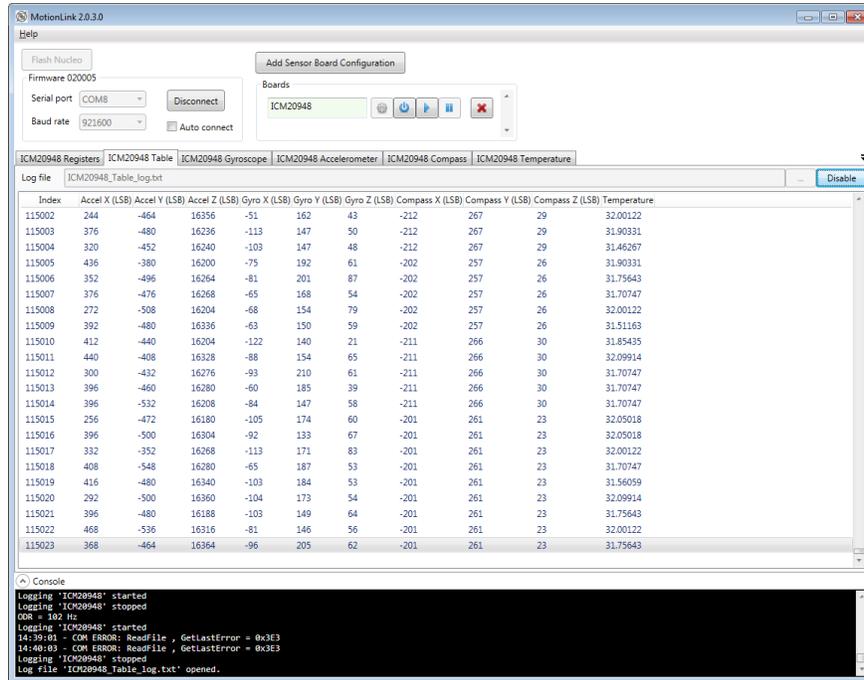
- (1) Additionally, the user can choose to save the data by selecting a path/filename and clicking "Enable" to log the data to a file.

The screenshot shows the MotionLink 2.0.3.0 software interface. The 'Log file' field is set to 'ICM20948_Table_log.txt'. The 'Enable' button is highlighted in blue, indicating that logging is active. The main data table is visible, showing sensor readings for Accelerometer, Gyroscope, and Compass.

Index	Accel X (LSB)	Accel Y (LSB)	Accel Z (LSB)	Gyro X (LSB)	Gyro Y (LSB)	Gyro Z (LSB)	Compass X (LSB)	Compass Y (LSB)	Compass Z (LSB)	Temperature
115002	244	-464	16356	-51	162	43	-212	267	29	32.00122
115003	376	-480	16236	-113	147	50	-212	267	29	31.90331
115004	320	-452	16240	-103	147	48	-212	267	29	31.46267
115005	436	-380	16200	-75	192	61	-202	257	26	31.90331
115006	352	-496	16264	-81	201	87	-202	257	26	31.75643
115007	376	-476	16268	-65	168	54	-202	257	26	31.70747
115008	272	-508	16204	-68	154	79	-202	257	26	32.00122
115009	392	-480	16336	-63	150	59	-202	257	26	31.51163
115010	412	-440	16204	-122	140	21	-211	266	30	31.85435
115011	440	-408	16328	-88	154	65	-211	266	30	32.09914
115012	300	-432	16276	-93	210	61	-211	266	30	31.70747
115013	396	-460	16280	-60	185	39	-211	266	30	31.70747
115014	396	-532	16208	-84	147	58	-211	266	30	31.70747
115015	256	-472	16180	-105	174	60	-201	261	23	32.05018
115016	396	-500	16304	-92	133	67	-201	261	23	32.05018
115017	332	-352	16268	-113	171	83	-201	261	23	32.00122
115018	408	-548	16280	-65	187	53	-201	261	23	31.70747
115019	416	-480	16340	-103	184	53	-201	261	23	31.56059
115020	292	-500	16360	-104	173	54	-201	261	23	32.09914
115021	396	-480	16188	-103	149	64	-201	261	23	31.75643
115022	468	-536	16316	-81	146	56	-201	261	23	32.00122
115023	368	-464	16364	-96	205	62	-201	261	23	31.75643

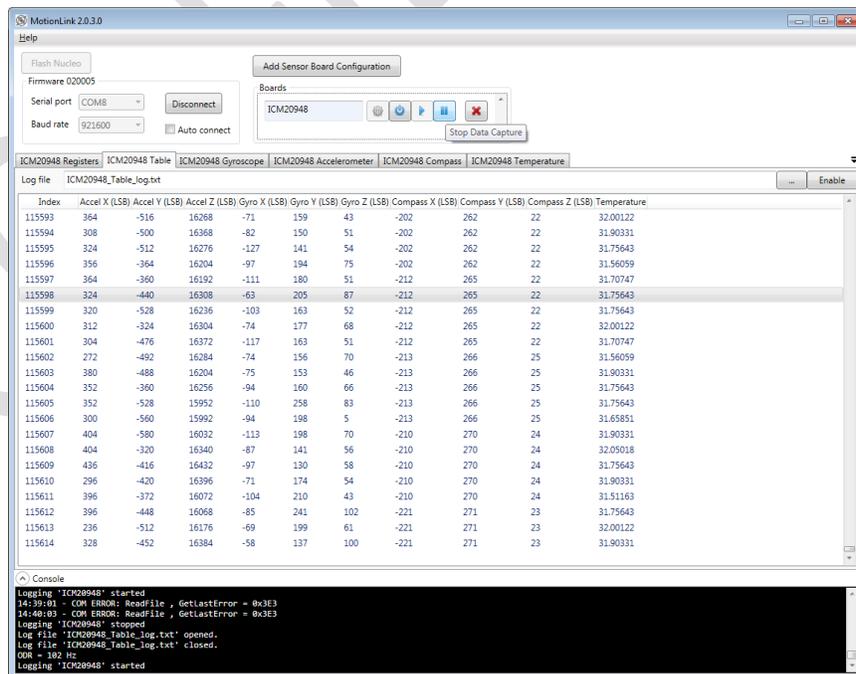
This screenshot is identical to the one above, showing the MotionLink 2.0.3.0 software interface with the 'Enable' button highlighted. The data table and console output are the same.

(2) To stop saving the data to a file, press the “Disable” button.



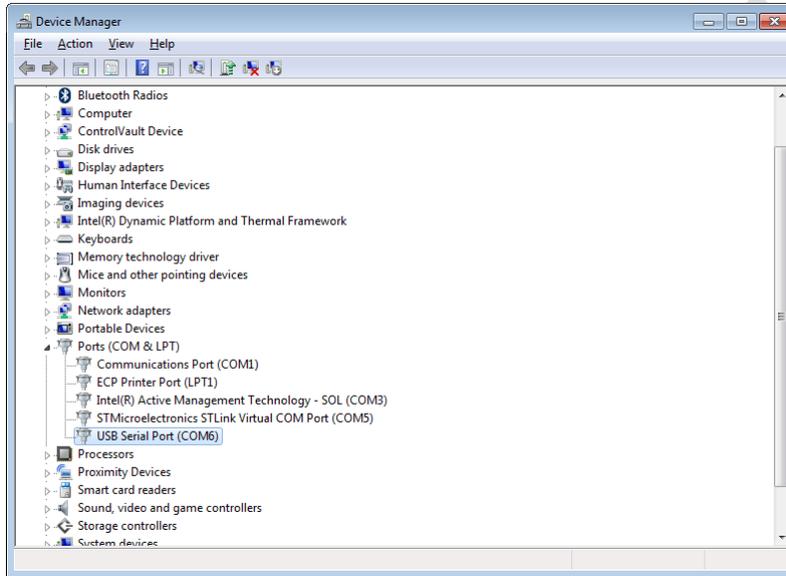
13 Stopping the Data Capture

(1) To stop the data logging, press  button in the main (“Connect”) tab.

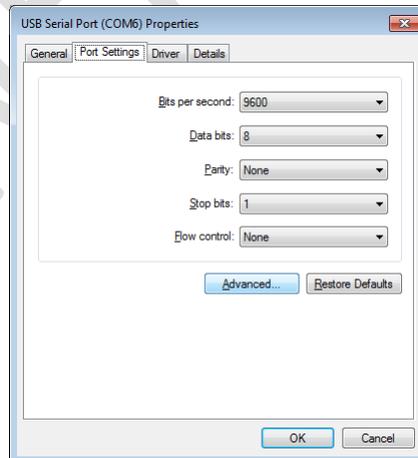


14 Notes / known issues / future updates

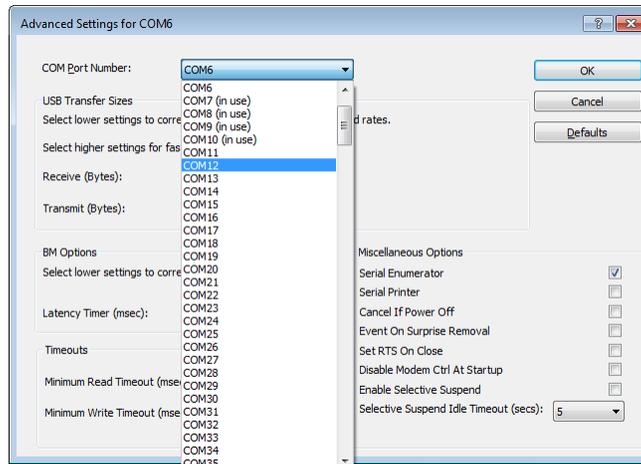
- The User needs to use the proper firmware version for “Flash Nucleo” option and, currently, Motion Link 1.0 does not throw any warning if wrong firmware version is used.
- More device support will be added for future releases.
- If the COM port numbers are less than 10, the devices are not recognized by the Motion Link Software. To manually change the COM port number, follow these steps:
 - Double click “USB Serial Port (COM<X>)”



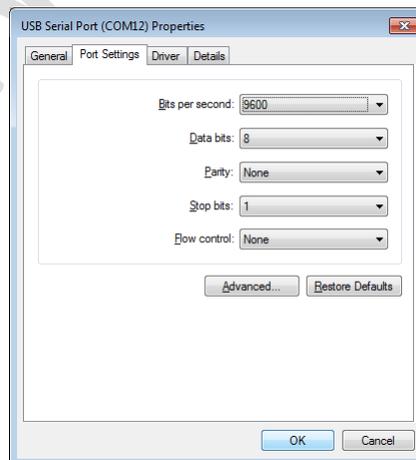
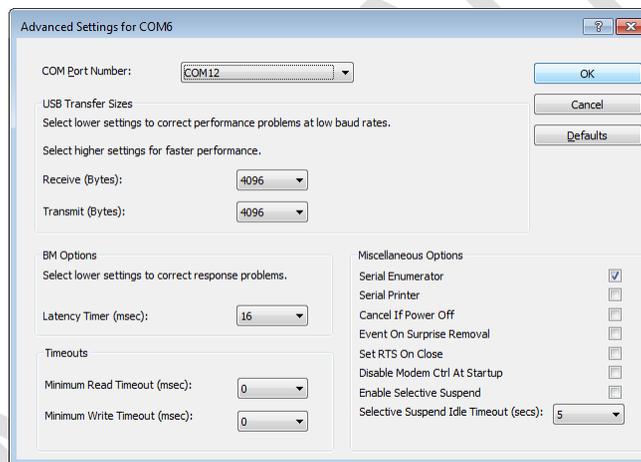
- Go to “Port Settings” tab and click “Advanced”.

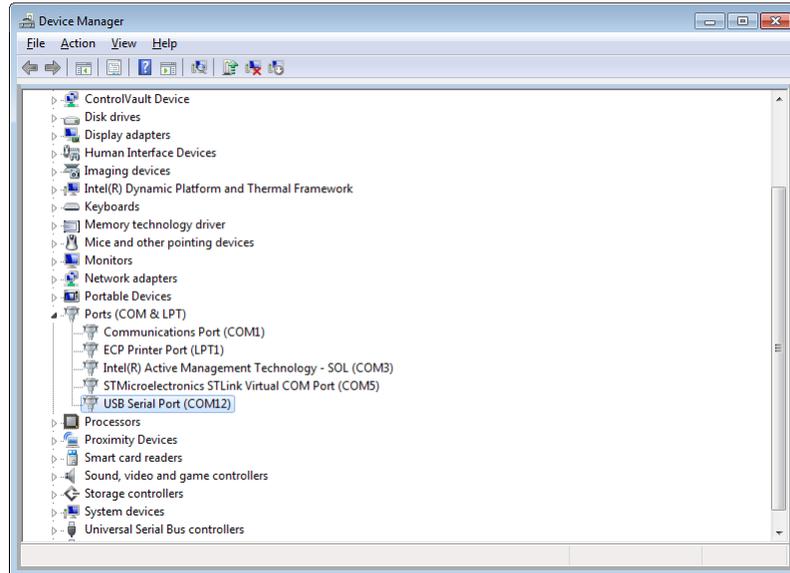


- In the “Advanced Settings for COM<X>” window, select “COM Port Number” drop-down options and pick an available COM port number that is greater than 10.

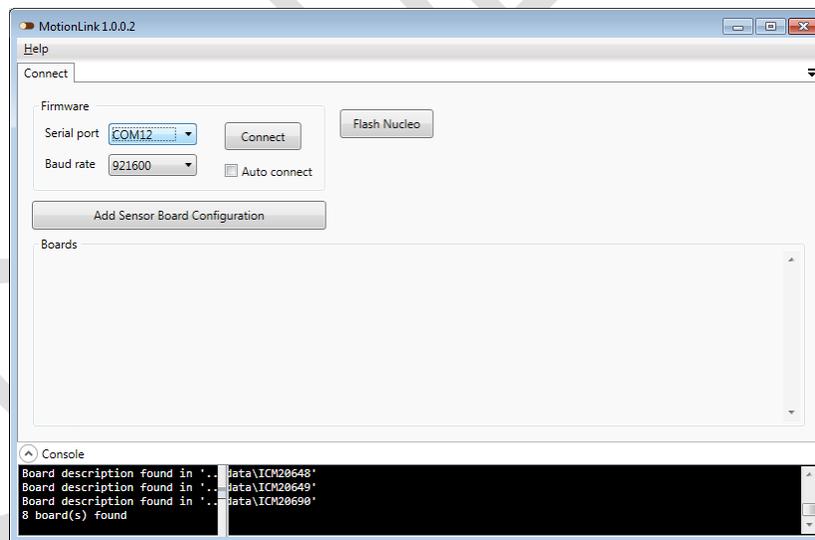


- Click “OK” on all the screens after selection.





- Repeat the above steps to change the “STMicroelectronics STLink Virtual COM Port” number to a value greater than 10.
- Now, restart the “Motion Link” software and the COM ports should be visible in the “Serial port” drop-down list.



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