TDK InvenSense
Smart Motion Development Kit
DK-46230/DK-46234
User Guide

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TABLE OF CONTENTS

1 OVERVIEW

The **TDK DK-46230/DK-46234 Host Board** is a comprehensive development system for TDK InvenSense Motion Sensor devices. The platform designed around the Microchip SAM V71 MCU can be used for rapid evaluation and development of InvenSense sensor-based solutions. The platform integrates an on-board Embedded Debugger so external tools are not required to program or debug with the SAM V71 MCU. Each InvenSense motion sensor has its own unique development kit (DK).

The **TDK DK-46230/DK-46234 Host Board** comes with the necessary software, including an InvenSense Motion Link, a GUI-based development tool, and embedded Motion Drivers (eMD) for InvenSense motion sensors.

Embedded Motion Drivers (eMD) consists of a set of APIs to configure various aspects of the platform including motion sensor parameters such as full-scale range (FSR), output data rate (ODR), and sensor interface to host (UART, SPI).

Motion Link is a GUI-based development tool included with the platform. It can be used to capture and visualize the sensor data from the motion sensor.

The platform supports Atmel Studio and is compatible with Microchip Xplained Pro Extension boards. The Xplained Pro extension series evaluation kits offer additional peripherals to extend the features of the board and ease the development of customer designs.

2 INTRODUCTION

2.1 FEATURES OVERVIEW

- Microchip SAM V71 microcontroller with 2 MB Embedded Flash
- On-board Embedded debugger (EDBG) for programming and debugging
- Built in FTDI USB to UART interface for fast motion sensor data transfer
- USB connectors for host interface to software debug and data logging
- Board power supply through USB

2.2 PLATFORM OVERVIEW

The **TDK DK-46230/DK-46234 Host Board** is a hardware unit for TDK sensor product evaluation and algorithm software development. The platform offers flexible solutions for many different application developments.

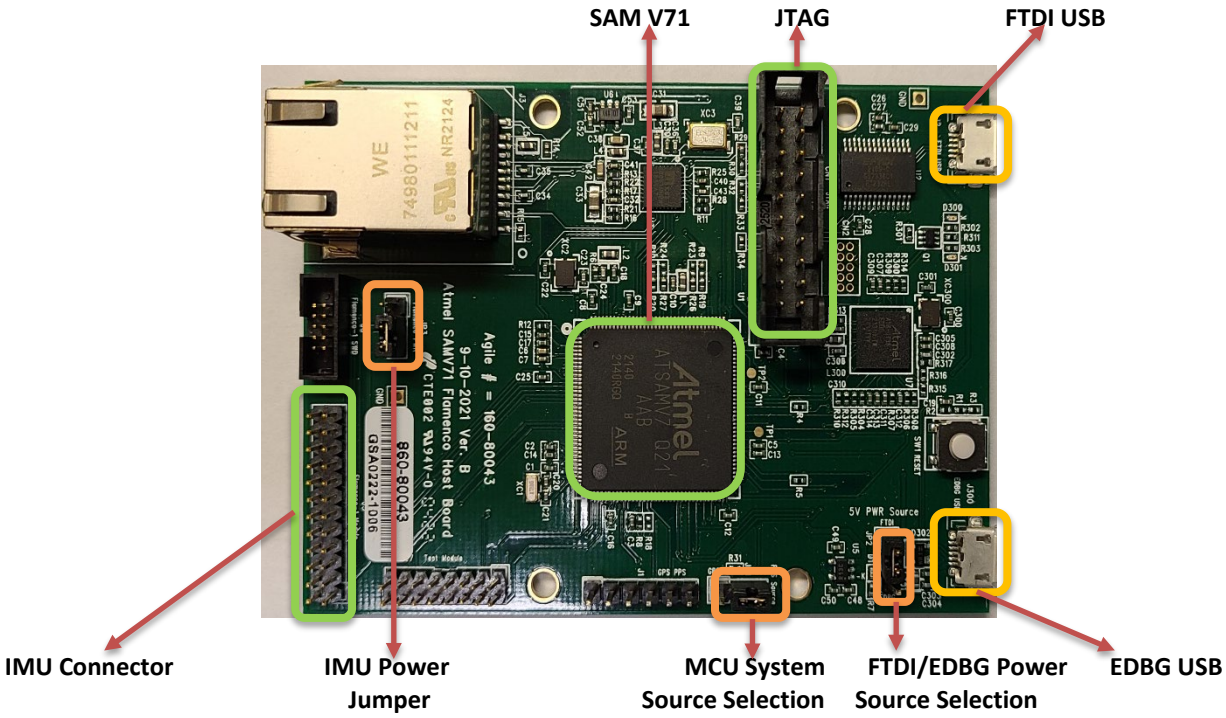


Figure 1. DK-46230/DK-46234 Host Board

2.2.1 Connectors

Table 1 details the connector and header reference names and descriptions.

Connector Names	Connector Ref#	Connector Function Descriptions
TDK Breakout Board Connector	J5	External Breakout Board Connector
JTAG Connector for SAM V71	CN1	JTAG Connector for SAM V71 debugging
FTDI USB	J2	USB connector for FTDI USB to serial UART interface
EDBG USB	J300	USB connector for flashing firmware
EDBG LED's	D300/D301	EDBG LEDs. D300 is green and D301 is yellow.
Power LED	D1	Red Light turns ON when supplied with power.
Reset Button	SW1	RESET Button: Hardware Reset for the Target MCU and EDBG MCU

Table 1. Connectors

2.2.2 Jumper Settings

Jumper	Description
JP1	JP1 is for system source selection. Only one jumper shunt is allowed. Jumper shunt on Pin 1/2: MCU
JP2	JP2 is for board power source selection. Only one jumper shunt is allowed. Jumper shunt on Pin 1/2: board power is from EDBG USB on J300 Jumper shunt on Pin 2/3: board power is from FTDI USB on J2
JP3	JP3 is for Power

Table 2. Jumpers

2.2.2.1 Configuration of Different Jumpers

To set the board to the MCU position, use jumper 1. To switch between FTDI and EDBG, use Jumper 2. Power comes from Jumper 3.

3 QUICK SETUP

3.1 USING EMD DEVELOPMENT ENVIRONMENT

This section explains how to start using the DK-46230 / DK-46234, update the firmware and install eMD drivers for the **DK-46230/DK-46234 Host Board** using Atmel Studio 7. This section also contains the simple installation instructions for Tera Term and the Industrial eMD Drivers.

For creating and debugging any AVR and SAM microcontroller applications, Atmel Studio 7 serves as the integrated development platform (IDP). To write, build, and debug your apps written in C/C++ or assembly code, you can use the Atmel Studio 7 IDP. Additionally, it effortlessly links to the development tools, programmers, and debuggers that support AVR and SAM devices. The interaction between Studio 7 and Atmel START for development has been improved. Re-configure and merge functionality in Studio 7 assist iterative development of START-based projects.

3.1.1 Getting Started

DK-46230 and DK-46234 come pre-programmed with eMD development environment, so the user can start discovering the features of the device immediately.

Steps to start exploring DK-46230/DK-46234:

1. Download FTDI driver from Drivers - FTDI (ftdichip.com).
2. Download Tera Term from https://ttssh2.osdn.jp/index.html.en.
3. Make sure that you connect the device to FTDI USB side, and your JP2 connection matches what is shown in Figure 4.
4. Follow the instructions on the next section to start exploring the platform.

3.1.2 Tera Term

1. Connect the Hardware module in DK-46230/DK-46234 Hardware Configuration – eMD
2. Start Tera Term and select USB Serial Port, then click OK.

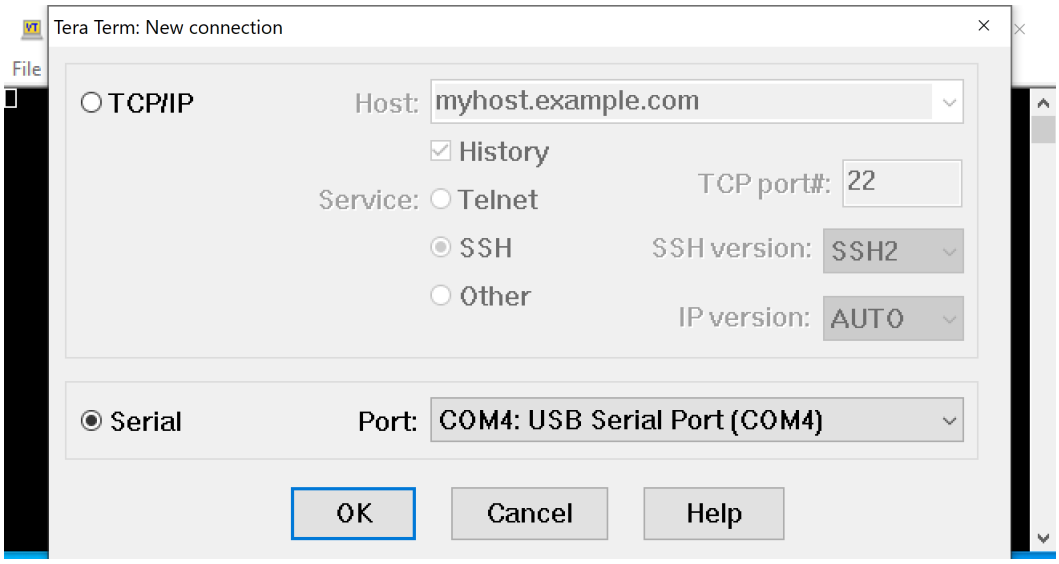


Figure 2. New Connection Setting

3. Go to Setup -> Serial Port…, and the serial port configuration window will pop-up.

4. Select the Port that USB Serial is connected to and Type “3000000” in the “Speed” section.

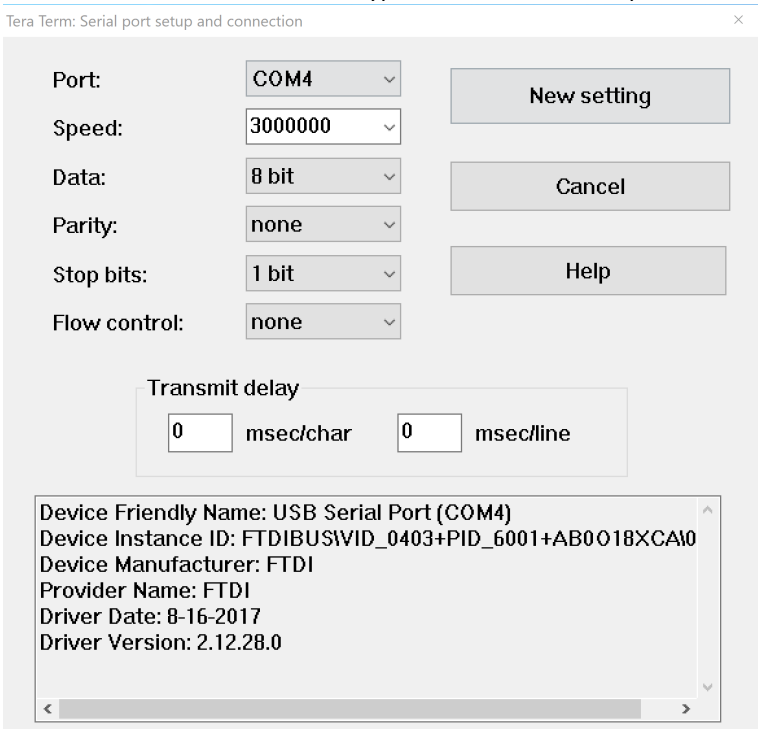


Figure 3. Serial Port Setup and connection

5. Then click on “New setting” to apply the configuration.
6. Press the software reset button on the board to see the command menu as shown in Figure 5.

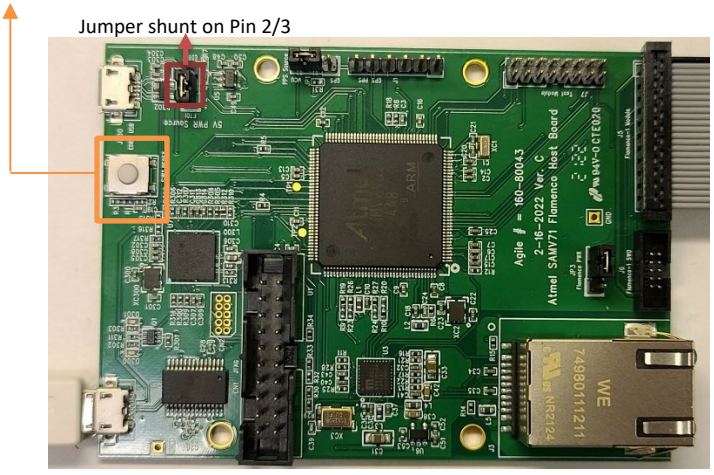


Figure 4. Software Reset Button

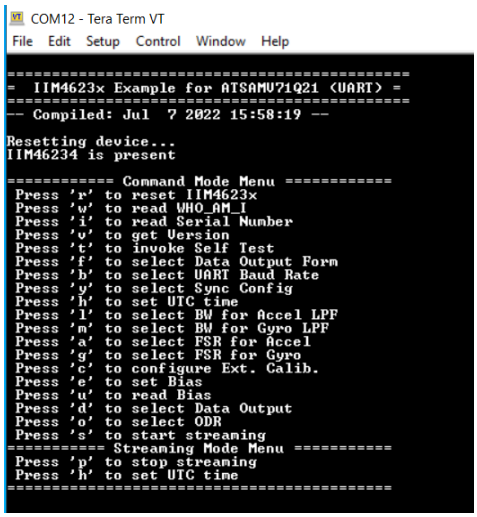


Figure 5. Teraterm Instructions to capture Data

7. Press the “s” key to start data capturing, and press “p” to stop.

3.1.3 Atmel Studio Requirements and Installation

1) Supported Operating Systems

- Windows 7 Service Pack 1 or higher
- Windows Server 2008 R2 Service Pack 1 or higher
- Windows 8/8.1
- Windows Server 2012 and Windows Server 2012 R2
- Windows 10

2) Supported Architectures

- 32-bit (x86)
- 64-bit (x64)

3) Hardware Requirements

- A computer that has a 1.6 GHz or faster processor
- RAM
    - 1 GB RAM for x86
    - 2 GB RAM for x64
    - An additional 512 MB RAM if running in a Virtual Machine
- 6 GB available hard disk space

4) Downloading and Installing

- Download the latest Atmel Studio installer: Atmel Studio 7
    - The web installer is a small file (<10 MB) and will download specified components as needed.
- Verify the hardware and software requirements from the "System Requirements" section
- Make sure you have local administrator privileges

- Save all your work before starting. The installation might prompt you to restart if required.
- Disconnect all Atmel USB/Serial hardware devices
- Double-click the installer executable file and follow the installation wizard
- Once finished, the installer displays an option to **Start Atmel Studio after completion**. If you choose to open, then note that Atmel Studio will launch with administrative privileges, since the installer was either launched as administrator or with the elevated privileges.
- In Atmel Studio you may see an update notification (flag symbol) next to the Quick Launch field in the title bar. Here you may select and install updated components or device support.

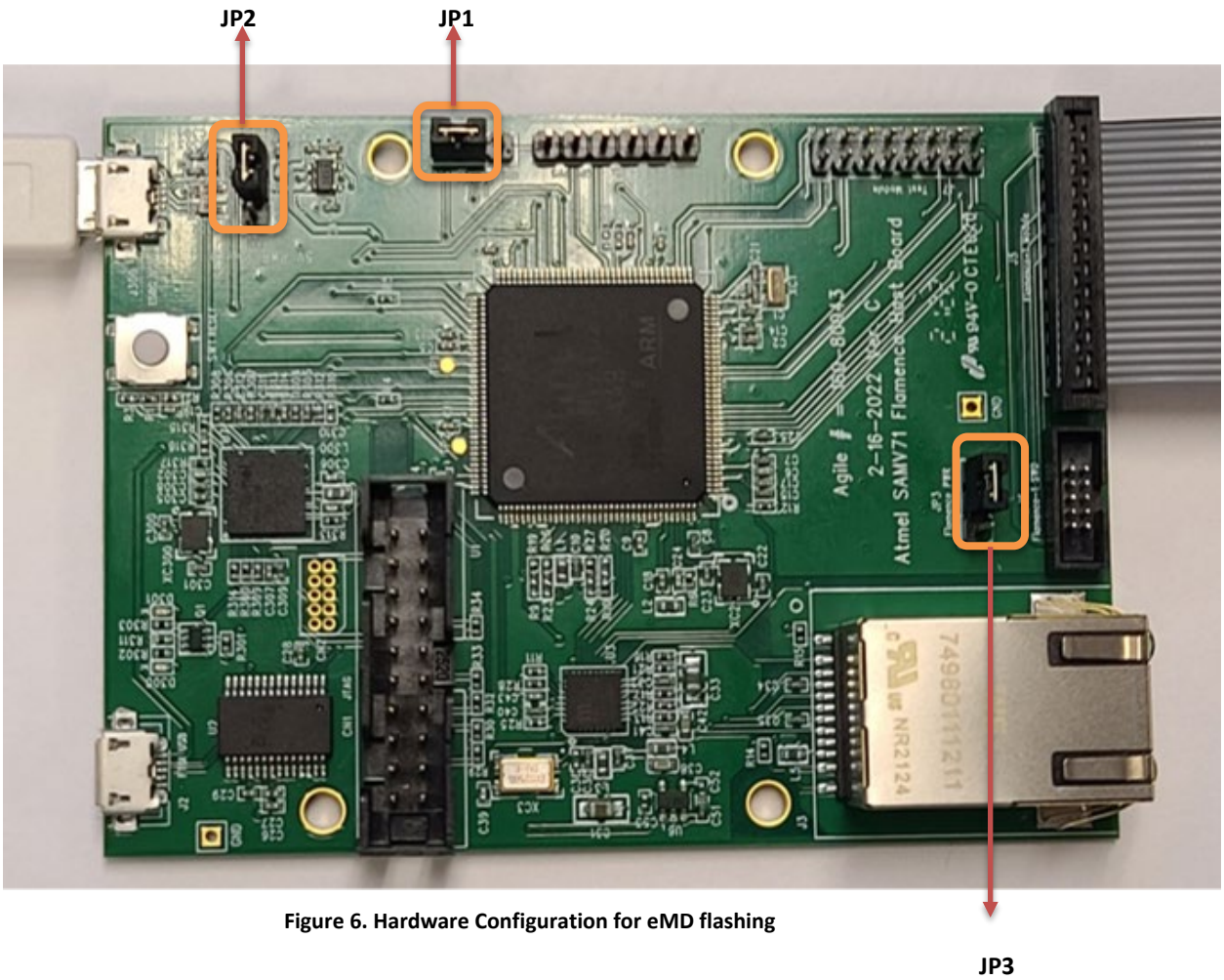


Figure 6. Hardware Configuration for eMD flashing

3.1.4 Industrial eMD

The **TDK DK-46230/DK-46234** is compatible with Microchip Studio for updating and flashing the firmware. Connect the EDBG (Atmel Embedded Debugger) USB port with USB cable to PC.

1. Connect the host board to PC using USB micro type-B cable. Check if 'EDBG Virtual COM Port' exists at the Device Manager of PC.
2. Start Atmel Studio 7.0, and select the project file IIM-4623X by File -> Open -> Project/Solution "Location of the project file"
3. Check if 'EDBG' is selected at the Tool section of 'Atmel Studio -> Project -> Properties' menu.
4. Select the menu Debug -> Start Without Debugging. Then Atmel Studio starts building and downloading. After finishes downloading, the example application starts running. After that, you can close Atmel Studio.

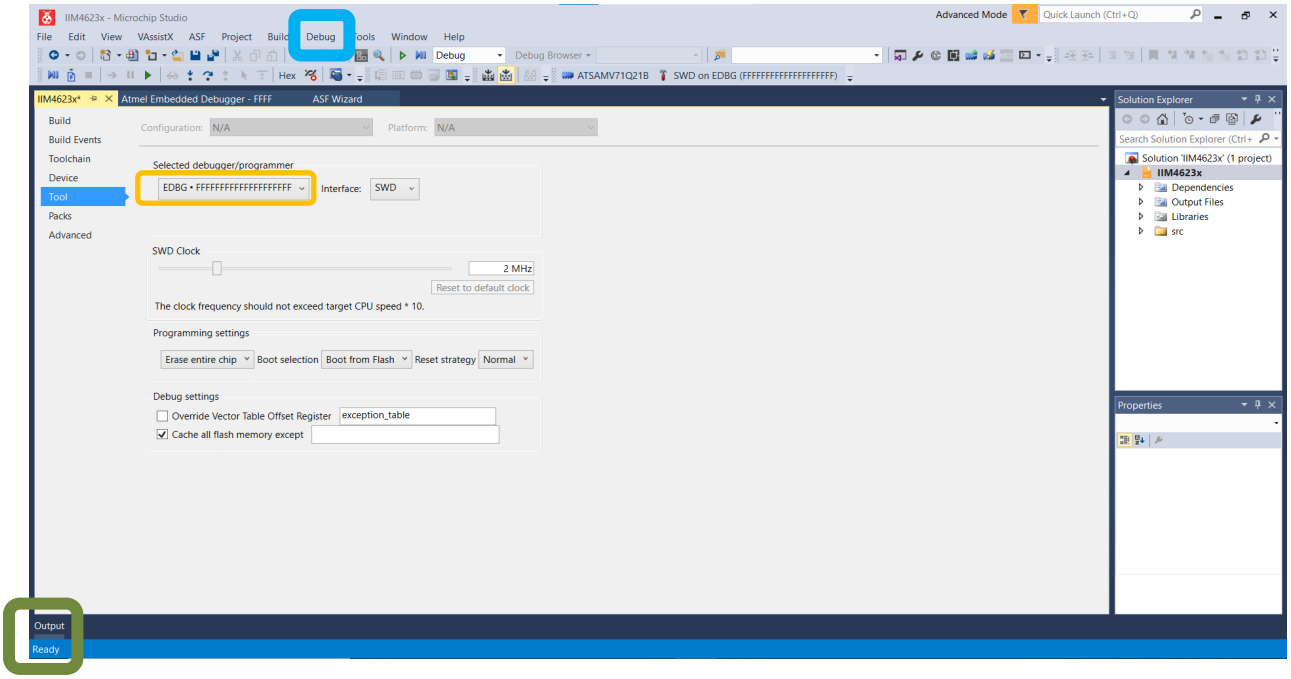


Figure 7. Updating Firmware using Microchip Studio

5. For the serial communication between PC and the host board, a terminal program on PC (such as Tera Term) is required. Follow Tera Term installation in section 3.1.2 to see how to capture data.

4 ADVANCED INFORMATION

4.1 USING INDUSTRIALMOTIONLINK EVALUATION SOFTWARE

This section is an installation guide for the IndustrialMotionLink Tool 1.0.0 data logger executable and shows how to use the IndustrialMotionLink tool in combination with **Atmel SAM V71 MCU boards**.

(1) Connect the FTDI USB (J2) to PC and open IndustrialMotionLink for quick testing, as shown in the block diagram in Figure 8.

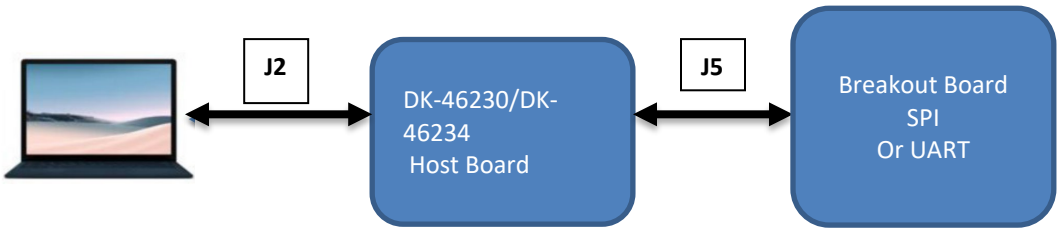


Figure 8. Block Diagram

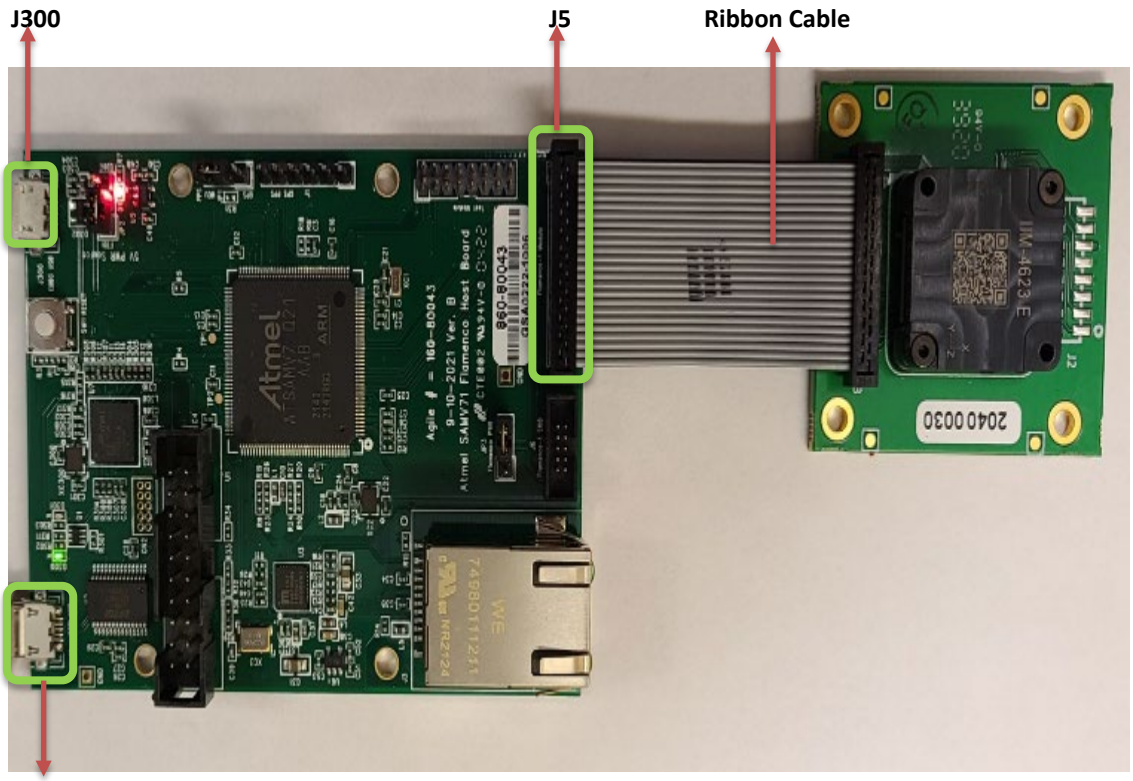


Figure 9. DK-4623X Host Board connected to Breakout board

4.1.1 Supported Devices

IndustrialMotionLink 1.0.0 supports the following InvenSense Motion devices on the Atmel MCU platform:

- **IIM-46230**
- **IIM-46234**

4.1.2 Installation

(1) Run the installer, IndSmartMotion_1.0.0_Installer.exe. Click on “More info.”

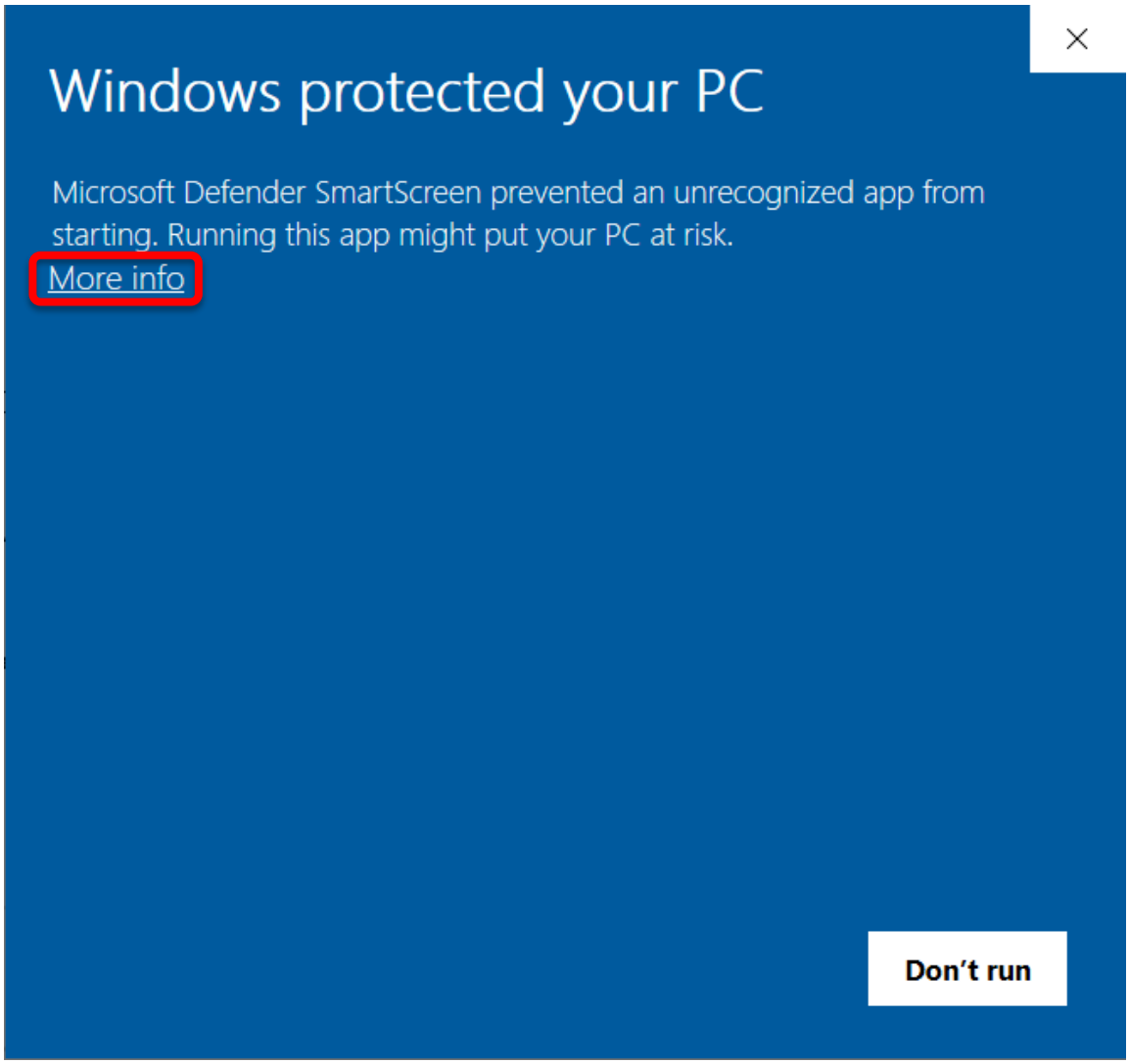


Figure 10. Installation Prompt

(2) Choose “Run anyway.”

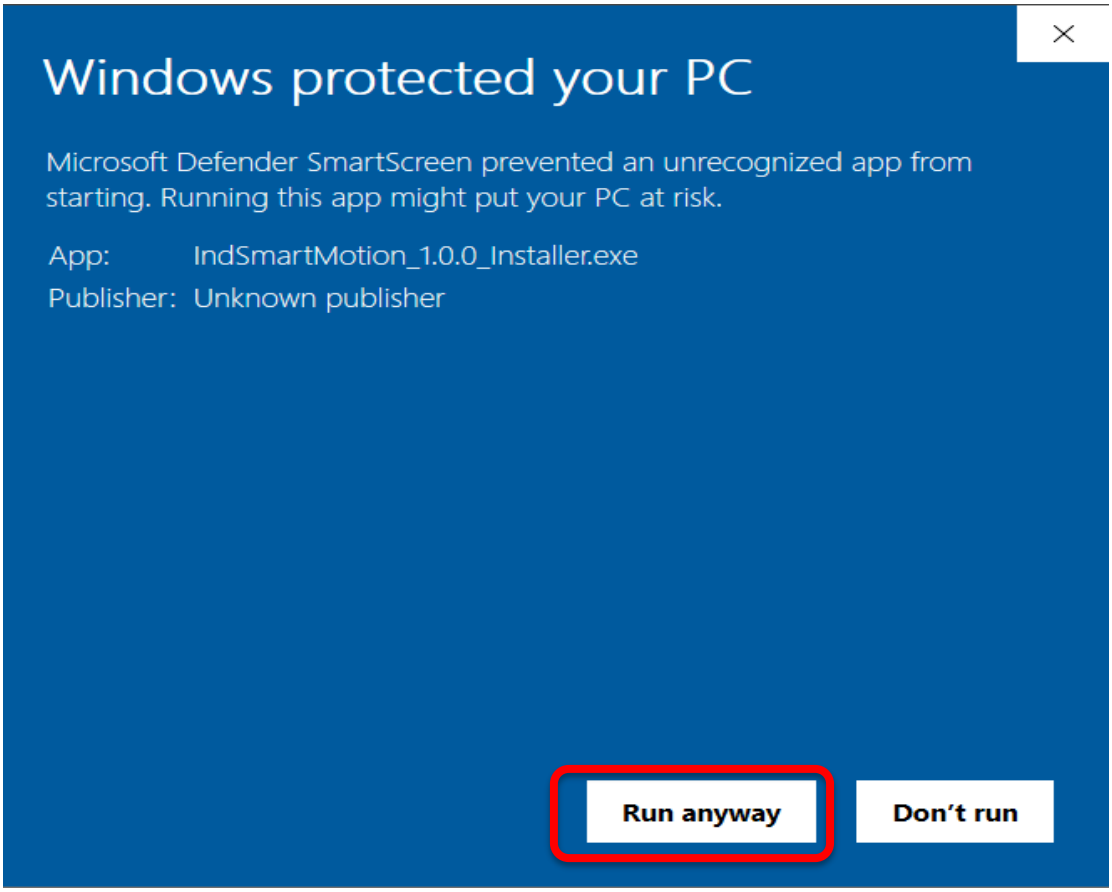


Figure 11. Installation Prompt

(3) It will prompt for the installation directory. Once the desired installation directory is selected, navigate to the next step by clicking “Next.”

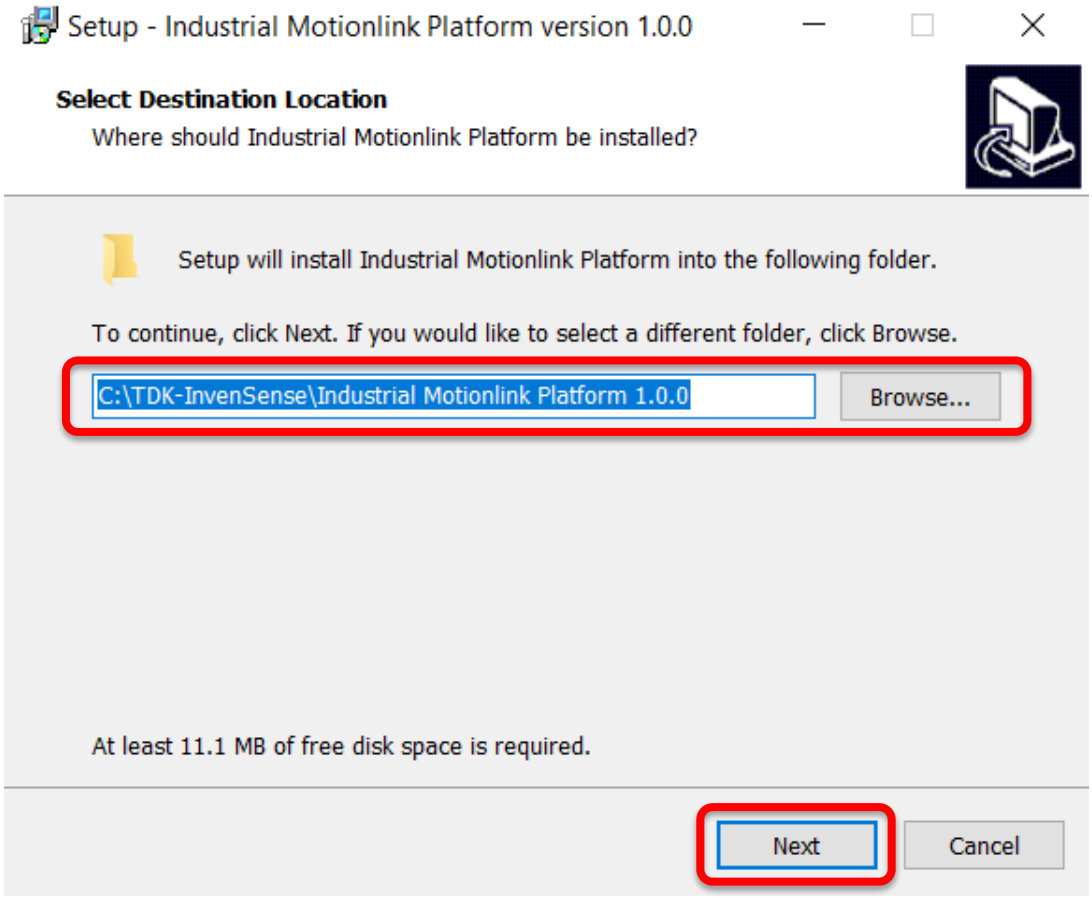


Figure 12. Destination Location

(4) Confirm that FTDI drivers are enabled. Click “Next.”

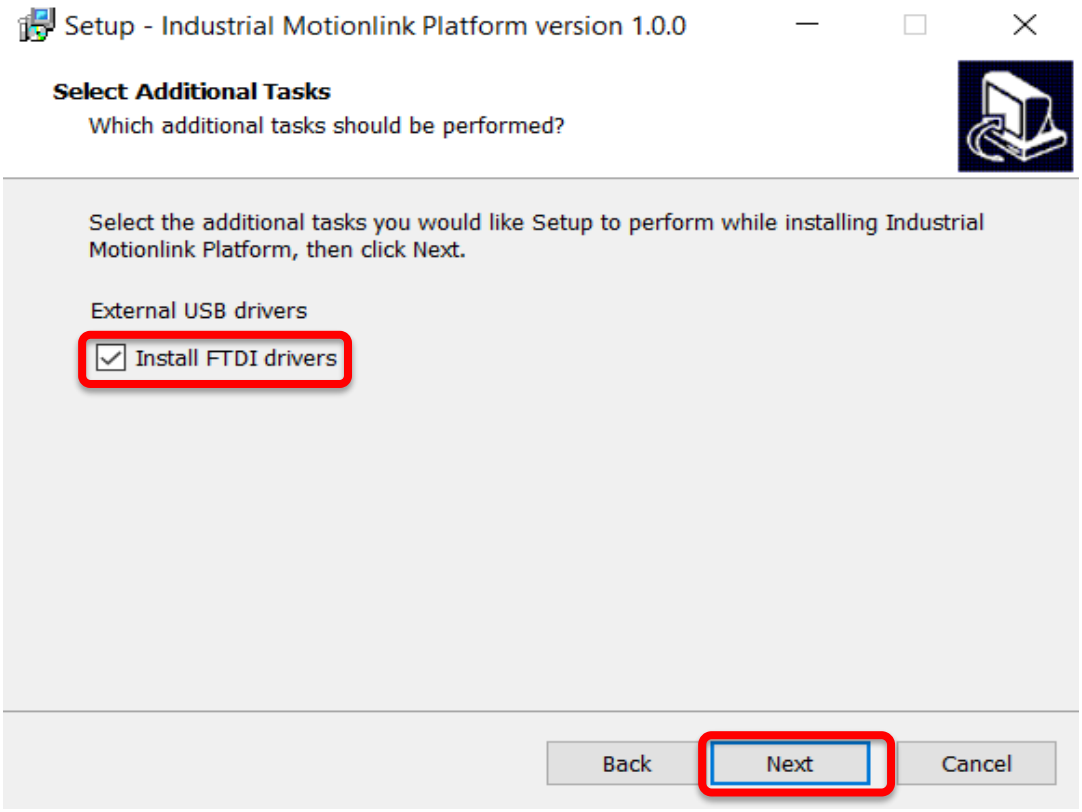


Figure 13. Additional Drivers

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

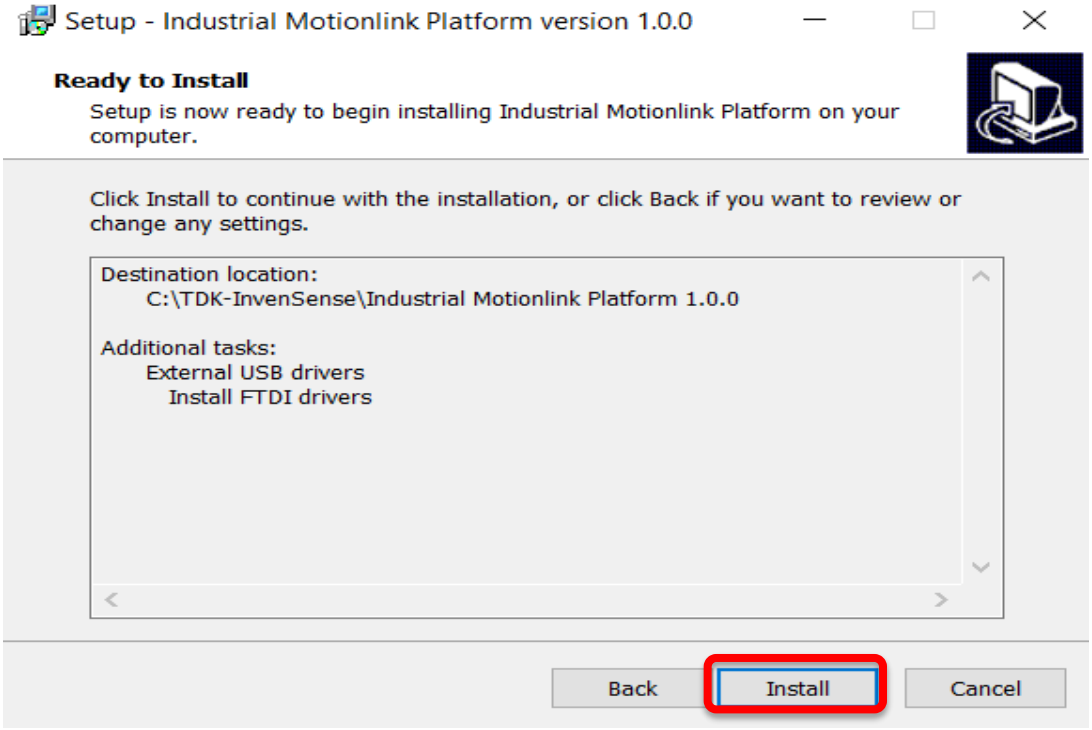


Figure 14. Verify Destination and Drivers

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

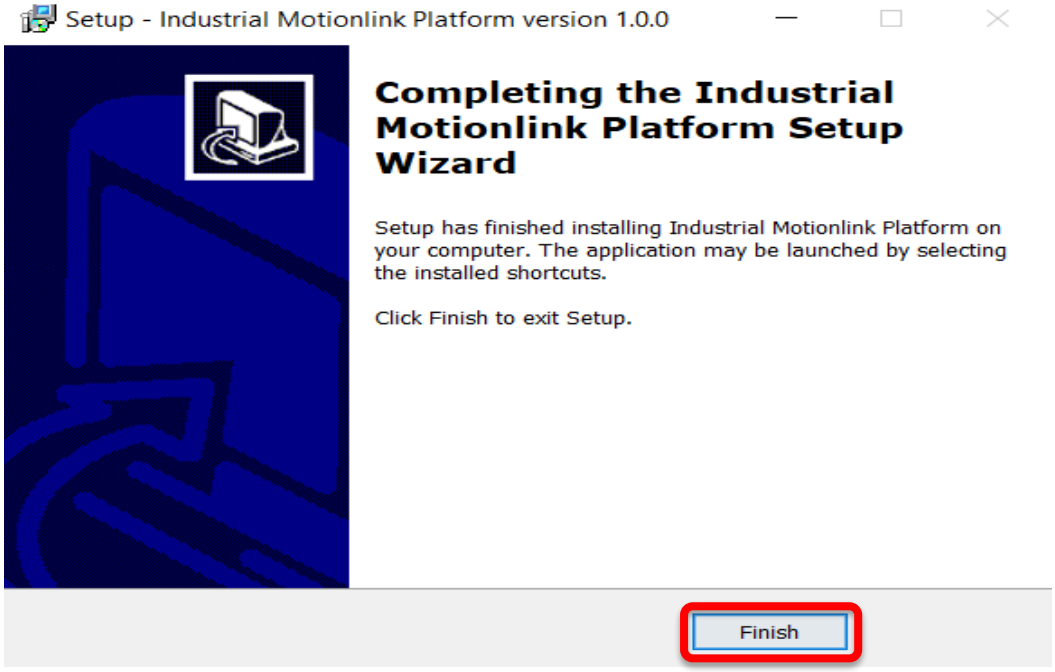


Figure 15. Successful Completion

4.1.3 Starting the IndustrialMotionLink 1.0.0 Application

(1) Navigate to the IndustrialMotionLink shortcut on the desktop and run the executable, IndustrialMotionLink.exe.

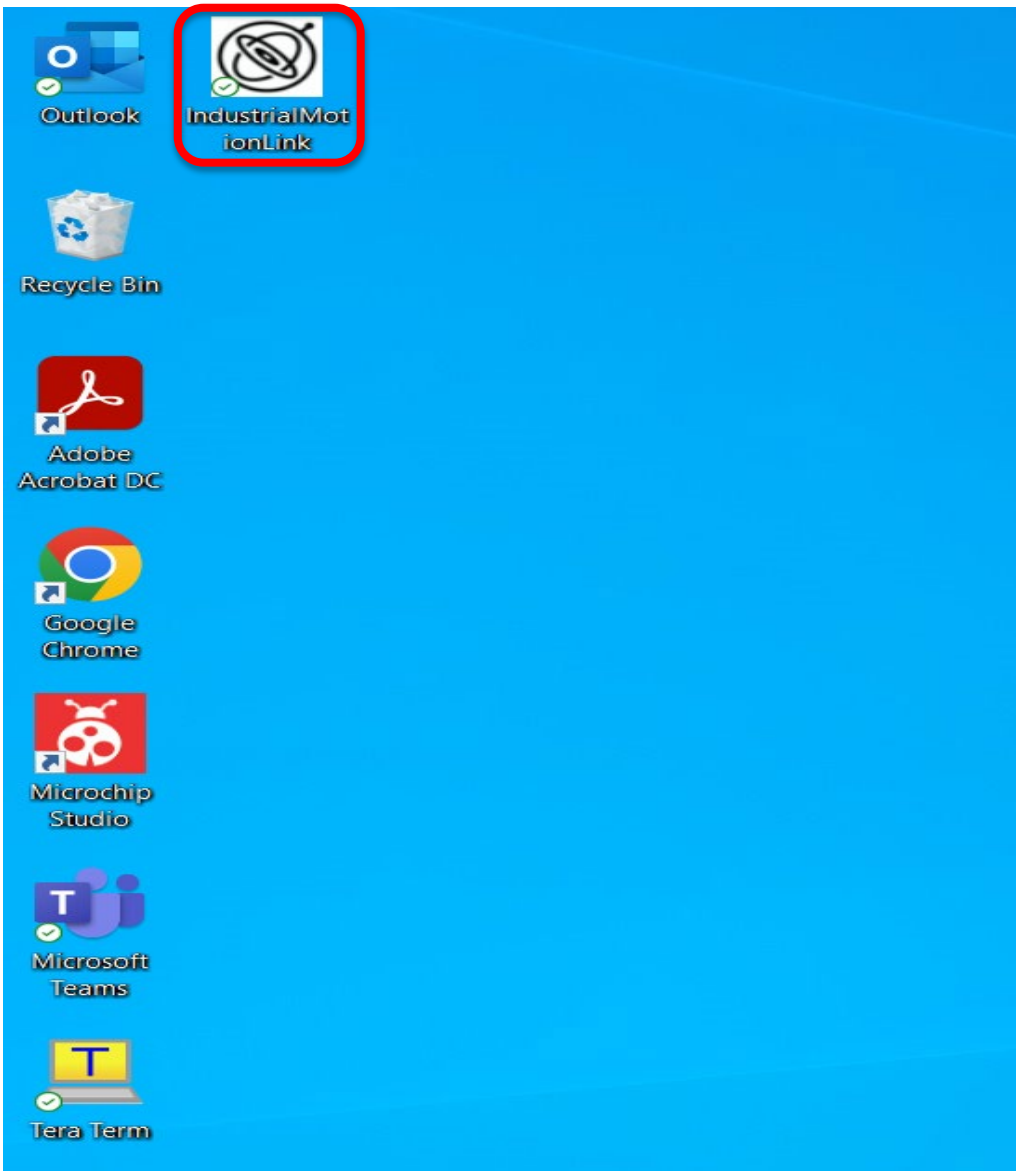


Figure 16. Starting IndustrialMotionLink

4.1.4 Connecting Sensor Boards

(1) Start IndustrialMotionLink from the Platform.

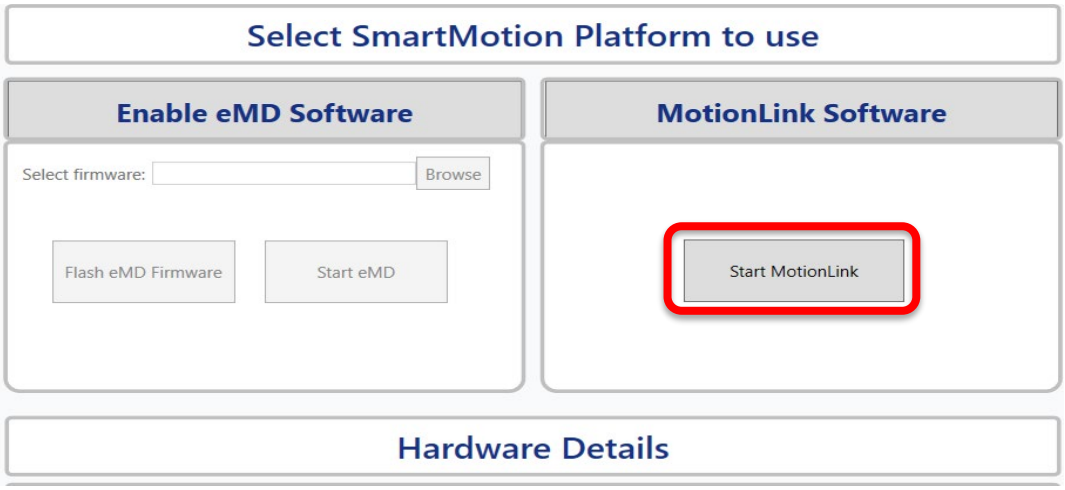


Figure 17. Start Window of IndustrialMotionLink

(2) Once **IIM-46230/IIM-46234 Breakout Board** is connected through J5 COM port, it shows up under "Serial port."

a. If the board needs to be initialized with a firmware, click "Flash MCU Firmware." Otherwise, skip this and go to the next step.

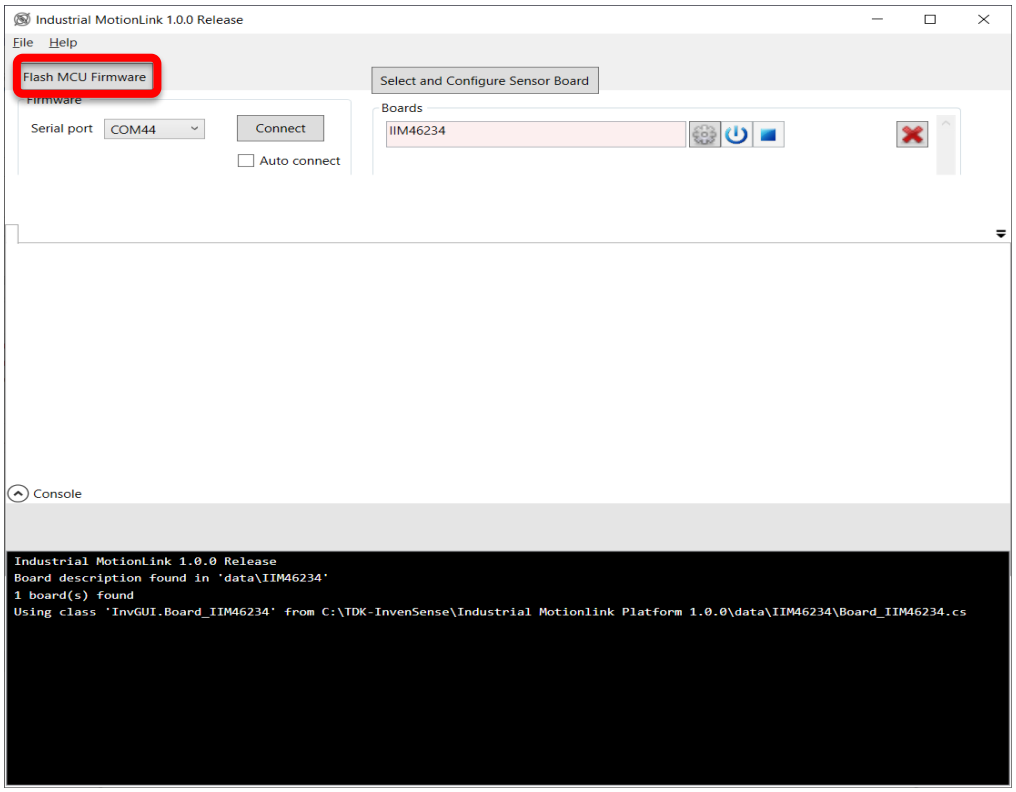


Figure 18. Flashing the MCU Firmware

(3) Add the configuration to match the board that is connected by clicking, “Select and Configure Sensor Board.” In this example, **IIM-46230/IIM-46234 Breakout Board** is connected to the host board, so the appropriate configuration is selected.

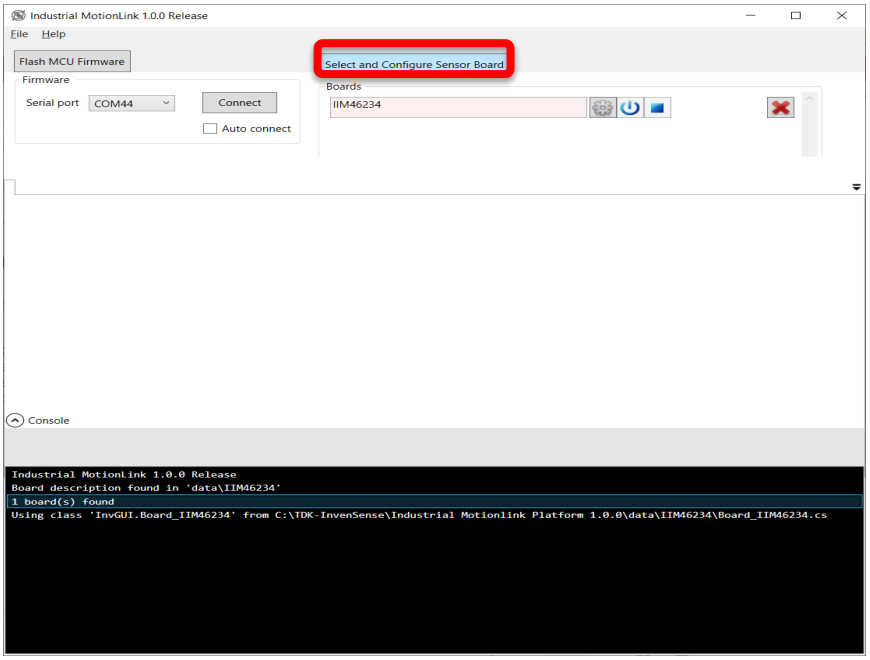


Figure 19. Selecting and Configuring Sensor Board

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

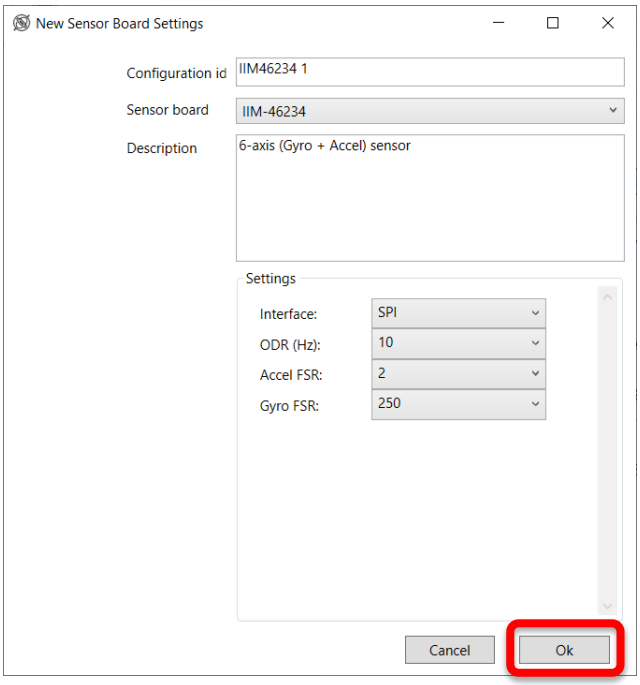


Figure 20. Configuration of Sensor Board

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

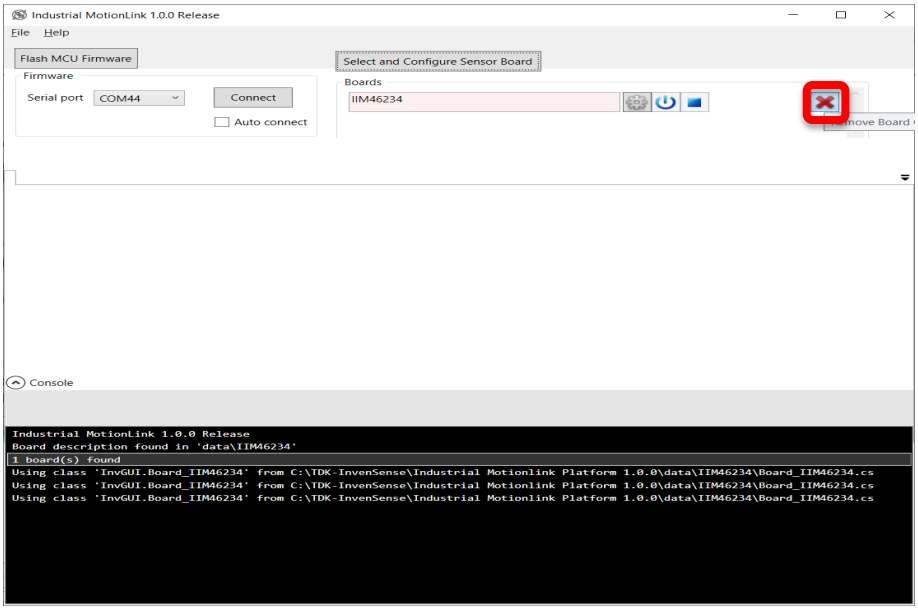


Figure 21. Configuration of Sensor Board

(6) Adding the board configuration, click on “Connect” to connect to the Sensor Board after selecting the proper COM port.

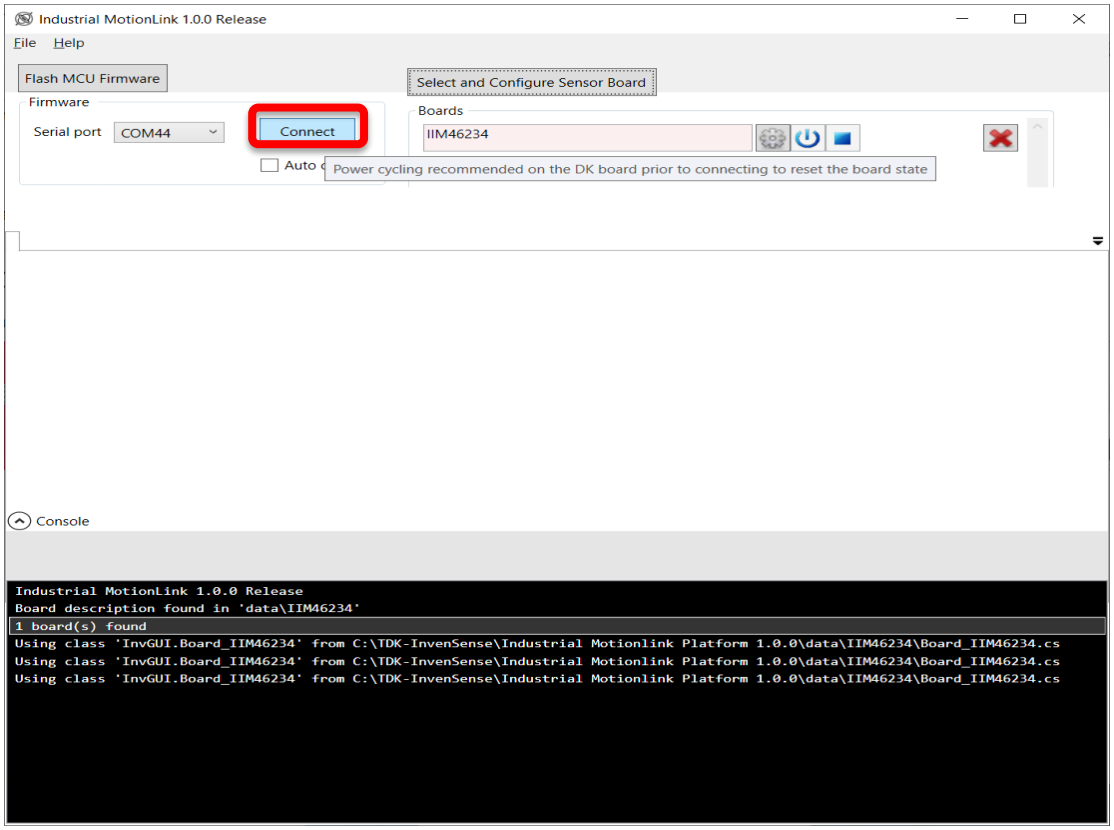


Figure 22. Connect to the Sensor Board

4.1.5 Starting the Data Capture

(1) After adding the configuration, click on the button to initialize the board. After initialization, a set of tabs opens in the main window as shown below.

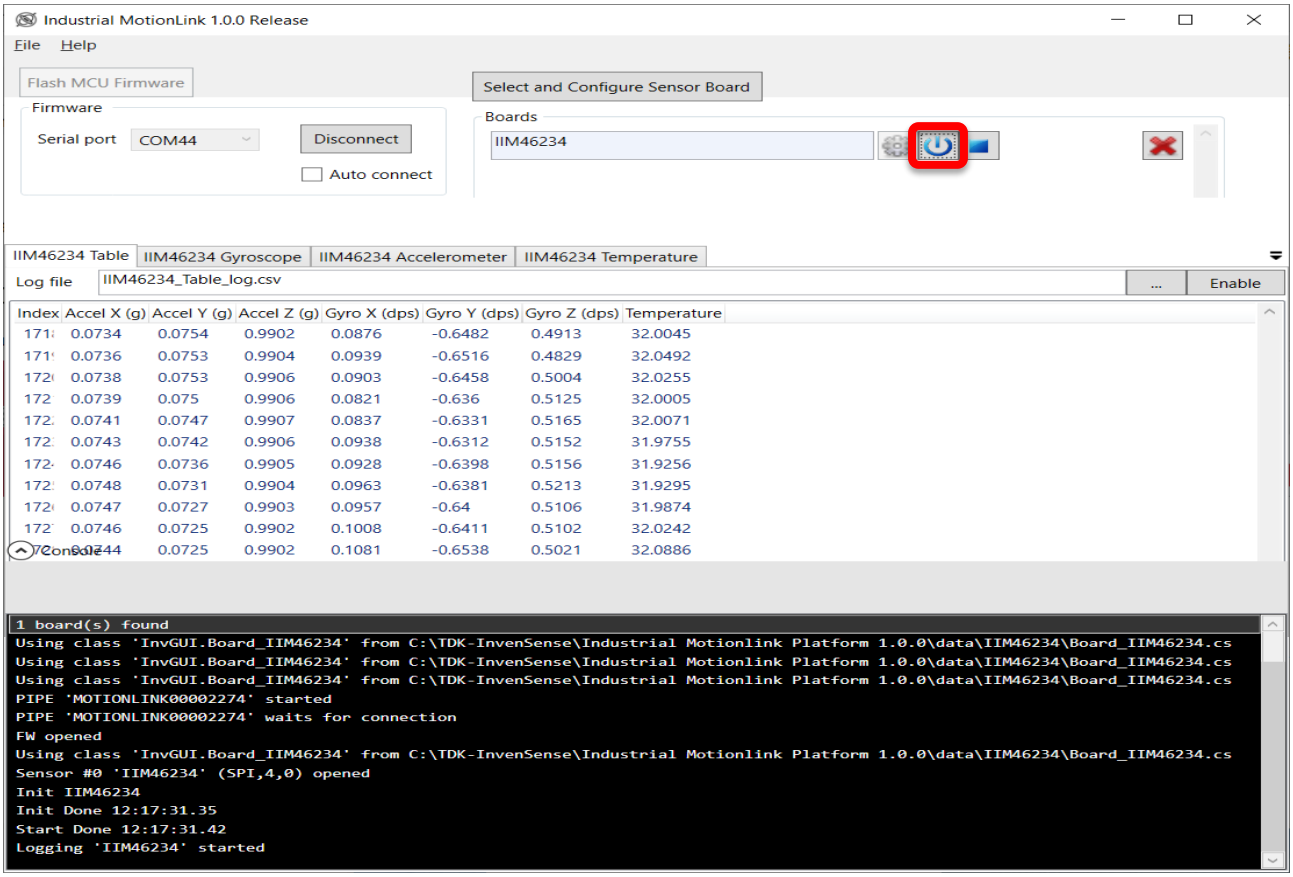


Figure 23. Capturing Data

4.1.6 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. You can choose to log the captured data to a text file.

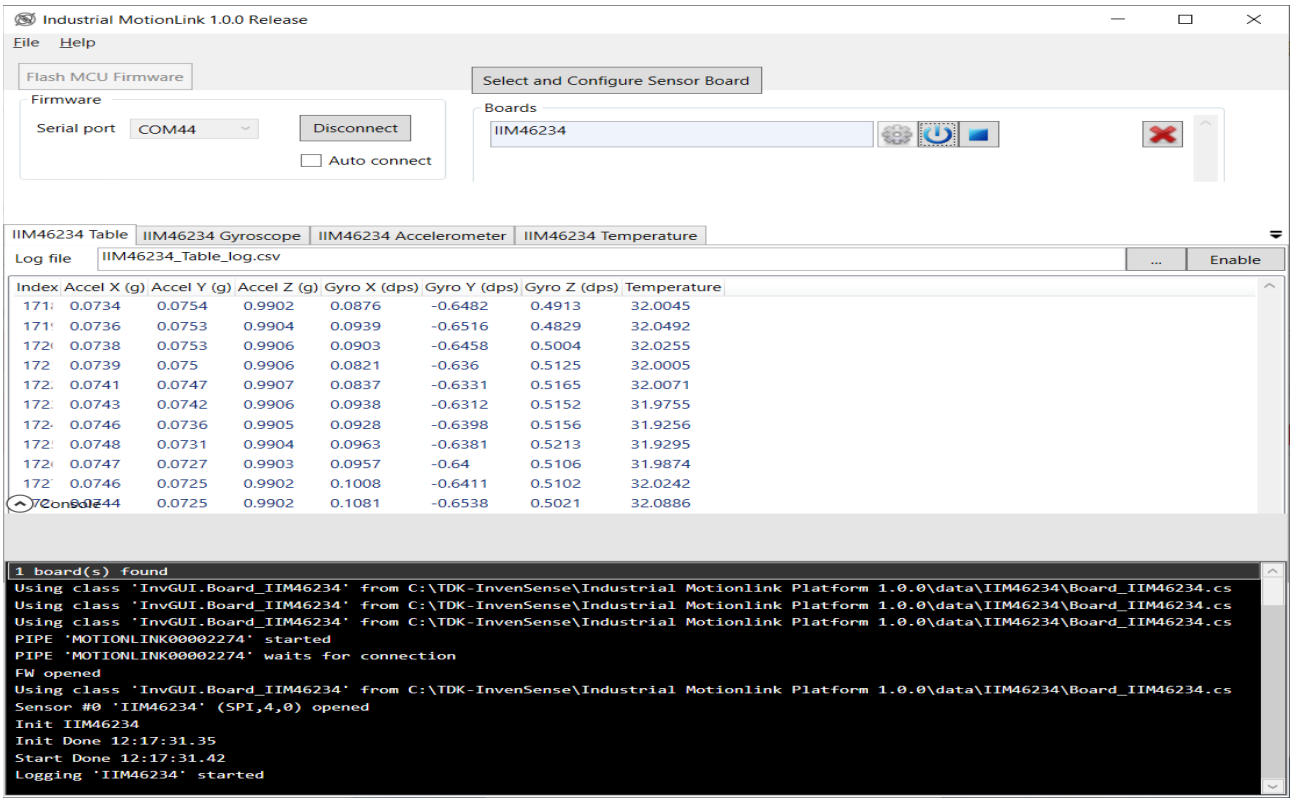


Figure 24. Combined tabular representation of Accel, Gyro, and Temperature data

(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).

Figure 25. Graphical representation of Gyroscope Values

(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).

Figure 26. Graphical representation of Accelerometer Values

4.1.7 Storing the Data

(1) Additionally, you can choose to save the data by selecting a path/filename and clicking “Enable” to log the data to a file.

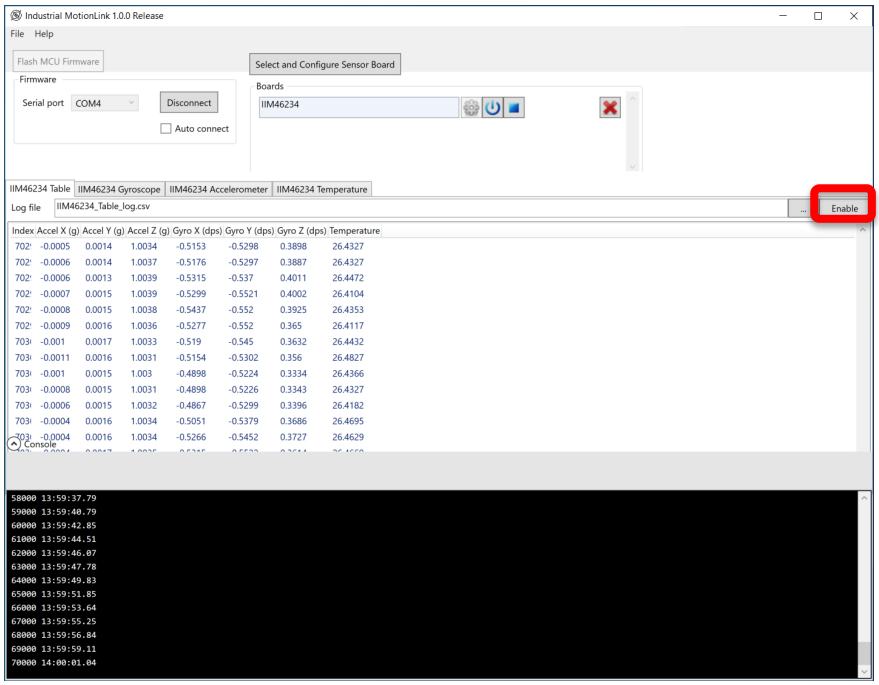


Figure 27. Enabling Data Storage

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

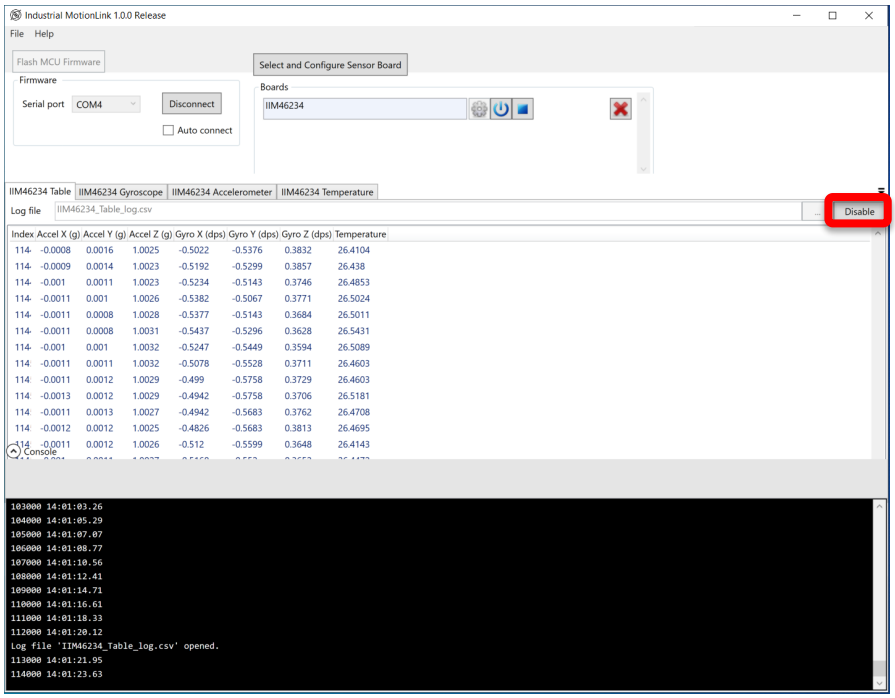
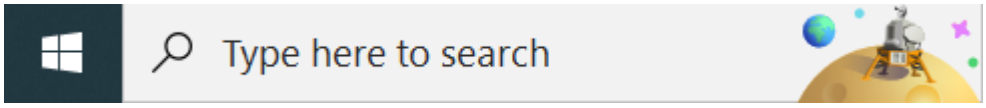


Figure 28. Disabling Data Storage

4.1.8 Notes / Known issues / Future updates

- For the "Flash Atmel" option, you must select the correct firmware version, and as of 1.0.0, IndustrialMotionLink does not issue a warning if the incorrect firmware version is used.
- Future releases will provide further device support.
- IndustrialMotionLink Software does not identify devices with COM port numbers of less than 10. To manually change the COM port number, follow these steps:

1) Search for Device Manager in Taskbar at the bottom of the Windows Screen.



2) Double click “USB Serial Port (COM**<X>**)”

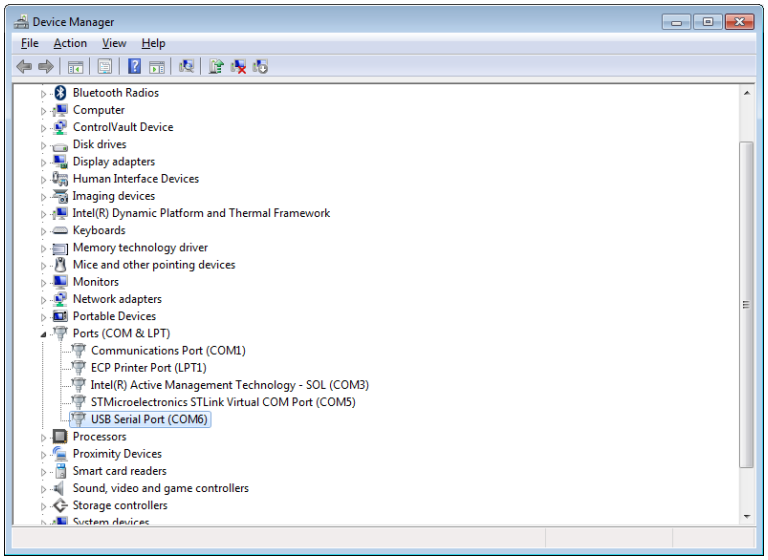


Figure 29. Device Manager

3) Go to “Port Settings” tab, and click “Advanced.”

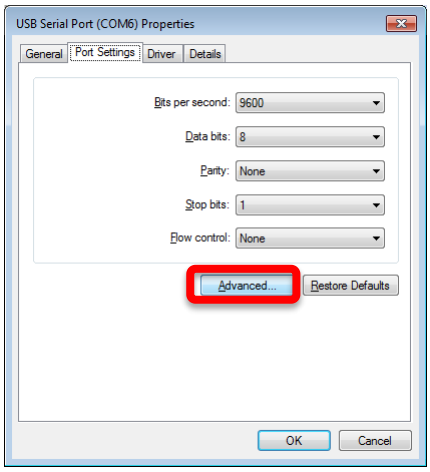


Figure 30. USB Port Settings

4) 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.

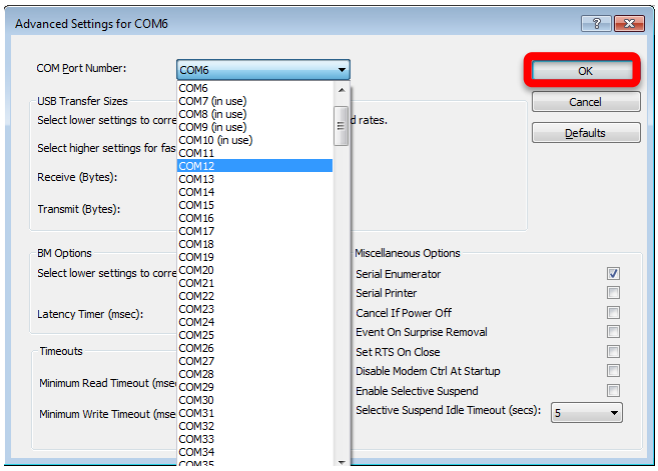


Figure 31. Advanced Settings

5) Click "OK" on all the screens after selection.

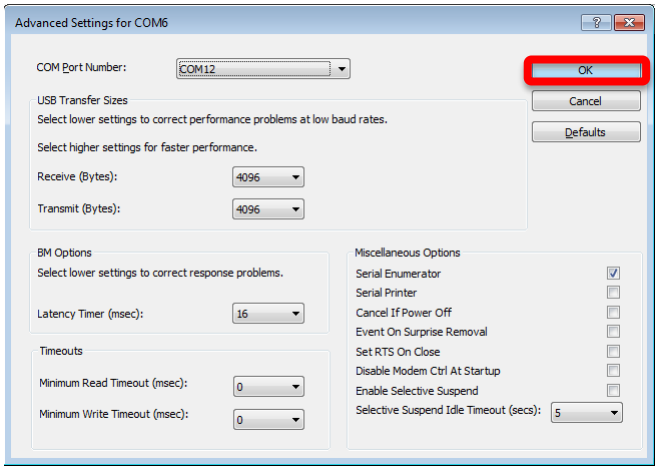


Figure 32. COM Port Number

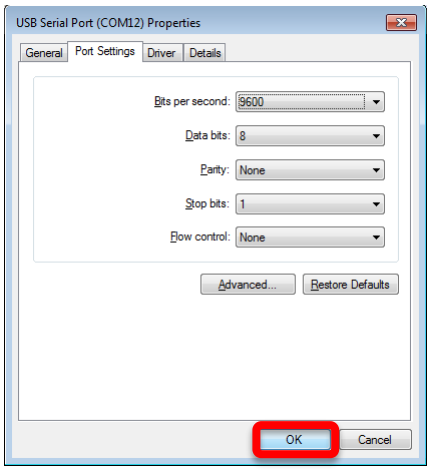


Figure 33. USB Serial Port Properties

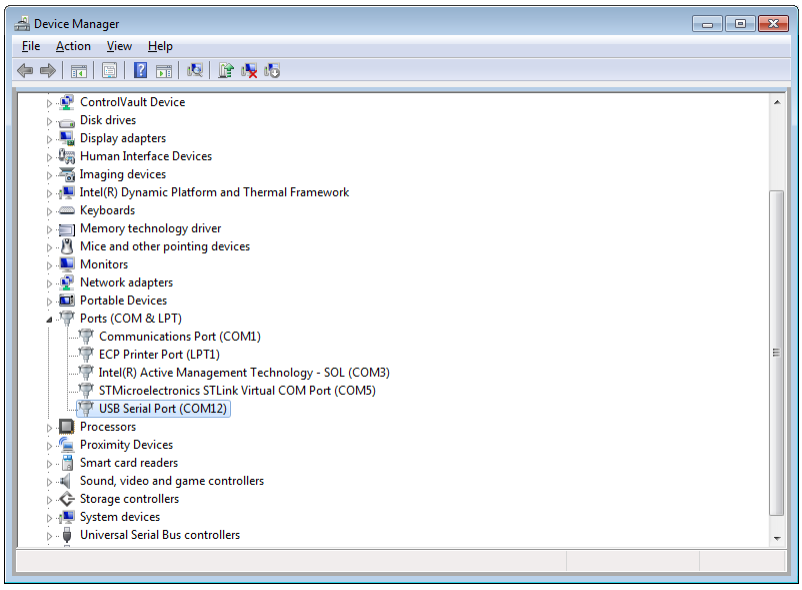


Figure 34. USB Serial Port Properties

6) Repeat the above steps to change the “EDBG Virtual COM Port” number to a value greater than 10.

7) Now, restart the “IndustrialMotionLink” software and the COM ports should be visible in the “Serial port” drop-down list.

5 SYSTEM ARCHITECTURE

5.1 HARDWARE BLOCK DIAGRAM

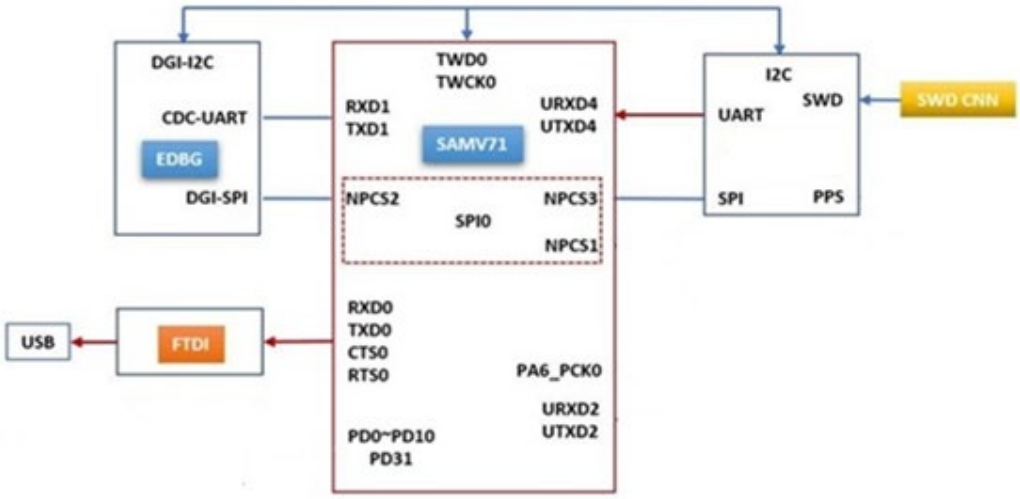


Figure 35. System Block Diagram

6 DECLARATION DISCLAIMER

InvenSense believes the environmental and other compliance information given in this document to be correct but cannot guarantee accuracy or completeness. Conformity documents substantiating the specifications and component characteristics are on file. InvenSense subcontracts manufacturing, and the information contained herein is based on data received from vendors and suppliers, which has not been validated by InvenSense.

7 REVISION HISTORY

DATE	REVISION	DESCRIPTION
11/01/2022	1.0	Initial Release