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# ***SmartFusion2 Six-Axis Motor Control Development Kit***

***Demo Guide***

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March 2014



## Revision History

Date	Revision	Change
11 March 2014	1.0	First release

## Confidentiality Status

This is a non-confidential document.

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# Preface

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## About this document

This demo is for Microsemi<sup>®</sup> SmartFusion<sup>®</sup>2 system-on-chip (SoC) field programmable gate array (FPGA) six-axis motor control development kit. It provides instructions on how to use the corresponding reference design.

## Intended Audience

SmartFusion2 six-axis motor control development kits are used by:

- FPGA designers
- Embedded designers
- System-level designers

## References

### Microsemi Publications

- [Sensorless FOC of PMSM using SmartFusion2 Devices Reference Guide](#)

See the following web page for a complete and up-to-date listing of motor control documentation:  
<http://www.microsemi.com/applications/motor-control#resources>

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# SmartFusion2 Six-Axis Motor Control Development Kit

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## Introduction

The SmartFusion2 six-axis motor control Development Kit gives designers a great starting point for evaluating time-saving, proven motor-control reference designs. The kit is supplied with hardware and software IP blocks and a fully integrated solution along with a powerful, easy to use GUI that enables designers to quickly prototype the design. The kit helps designers in customizing and developing six-axis motor control solution on the SmartFusion2 device for a specific application and reduces the time-to-market. This document provides details about the hardware setup and connections for running the demo design.

## Software Requirements

- Microsemi Motor Control GUI 2.4
- USB drivers for GUI
- Flash programming software (v11.2)
- STAPL file
- SmartFusion2 Motor Control GUI 2.4 Installer

## System Requirements

- Any Windows 7 operating system

## Hardware Requirements

- SmartFusion2 Development Kit, Rev D
- FlashPro4 programmer
- Interposer board
- Three brushless DC (BLDC) driver boards
- Three BLDC motors
- Three stepper driver boards
- Three stepper motors
- USB A to micro USB cable
- 12 V power adapter
- 24 V power adapter

## Demo Design

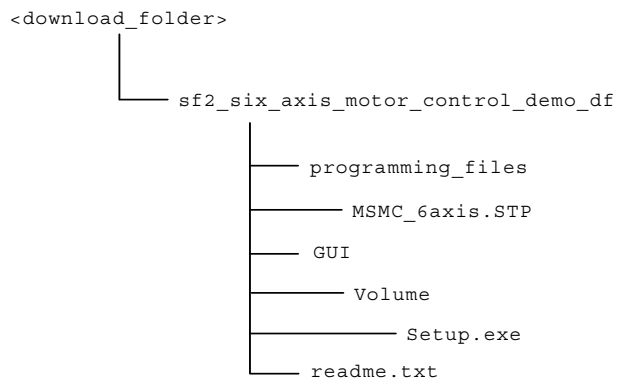
### Introduction

The demo design files are available for downloading from the following path in the Microsemi website:  
[http://soc.microsemi.com/download/rsc/?f=SF2\\_SIX\\_AXIS\\_MC\\_DEMO\\_DF](http://soc.microsemi.com/download/rsc/?f=SF2_SIX_AXIS_MC_DEMO_DF)

The demo design files include:

- GUI installer
- STAPL programming file
- readme.txt

Figure 1 shows the top-level structure of the design files. For further details, refer to the `readme.txt` file.



**Figure 1 • Demo Design Files Top-Level Structure**

Figure 2 shows running multiple motors by connecting multiple driver cards to the hardware platform where a single controller controls up to six motors.

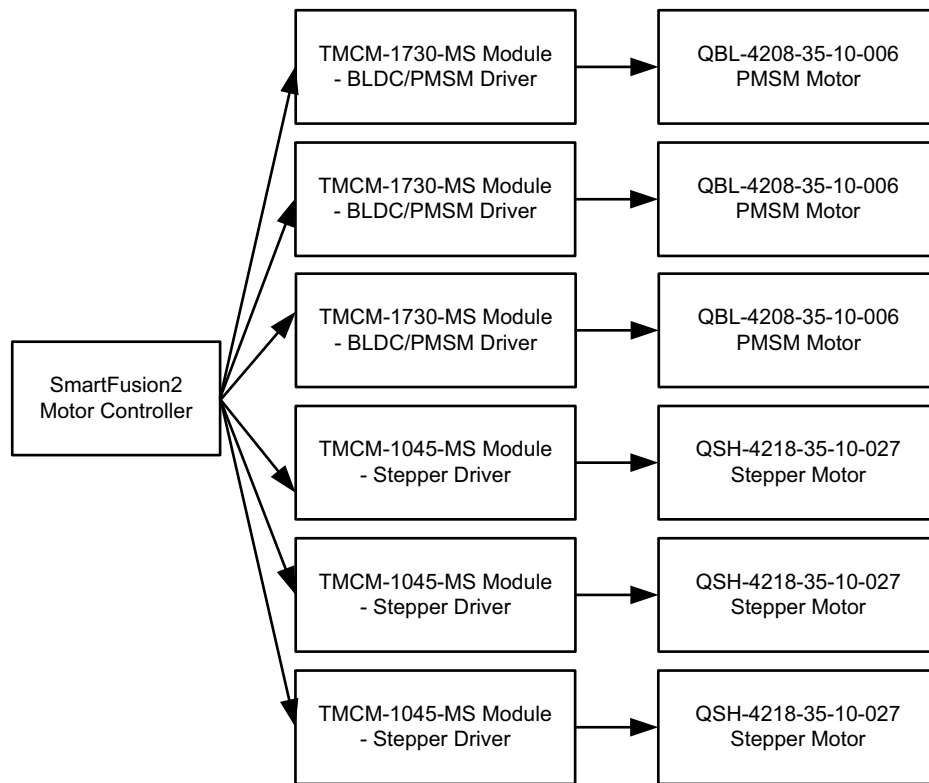


Figure 2 • Top-Level Demo Diagram

## Demo Design Features

The demo design runs:

- Three permanent-magnet synchronous motors (PMSMs) using sensorless field oriented control (FOC) algorithm
- Three stepper motors using a step direction interface

The GUI provided with the demo can be used to configure and control the motors. The GUI can also plot certain debug variables, and the motor speed values.

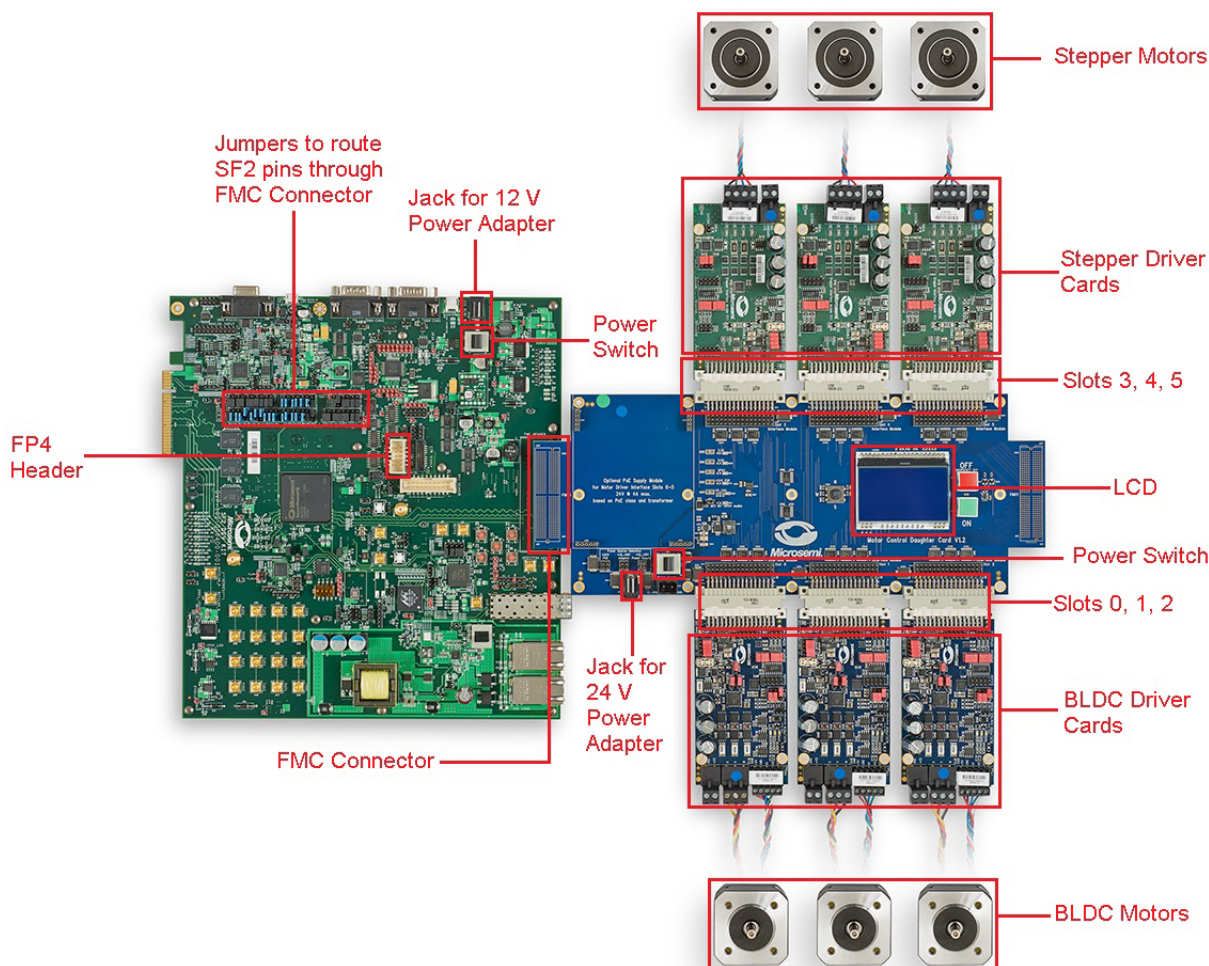
## Setting Up the Demo Design

The following subsections describe:

1. [Setting Up the Hardware](#)
2. [Motor Control GUI Installation](#)
3. [GUI Driver Installation](#)

## Setting Up the Hardware

Figure 3 shows the hardware setup for running three axes BLDC FOC motor control and three axes stepper motor control demo:



**Figure 3 • Three-Axis BLDC Sensorless FOC and Three-Axis Stepper Demo Hardware Setup**

### Connecting the Board

1. Connect the SmartFusion2 Development Kit Board with the interposer card using the FMC 0 connector.  
The interposer card FMC connector must fit into the SmartFusion2 Development Kit board connector. Refer to [Figure 3](#).
2. Connect the BLDC driver cards into 0, 1, and 2 slots of the interposer card, and stepper driver cards in 3, 4, and 5 slots of the interposer card.



3. Connect the BLDC motors (QBL4208-41-04-006) to the driver cards. Refer to [Figure 3](#).
    - Yellow wire indicates U-Phase of the motor
    - Red wire indicates V-Phase of the motor
    - Black wire indicates W-Phase of the motor
  4. Connect the Stepper motors (QSH4218-35-10-027) to the driver cards. Refer to [Figure 3](#).
    - Black wire indicates A1 of the motor
    - Green wire indicates A2 of the motor
    - Red wire indicates B1 of the motor
    - Blue wire indicates B2 of the motor
  5. Set all the required jumpers on the SmartFusion2 Development Kit board. For information on the jumper settings, refer to [Table 1 on page 31](#).
  6. Place a jumper on J804 on the interposer board.
  7. Set all the jumpers on the driver boards. For information, refer to [Table 3 on page 34](#) and [Table 4 on page 34](#).
  8. Connect the 12 V power adapter supplied to the SmartFusion2 Development Kit board.
  9. Connect the 24 V power adapter supplied to the interposer card.
  10. Switch **ON** the SW7 power supply switch on the SmartFusion2 Development Kit.
  11. Connect the FlashPro JTAG to the SmartFusion2 Development Kit FP4 header.
  12. Open FlashPro and program the STAPL file supplied.
  13. Switch **OFF** the SW7 power supply switch on the SmartFusion2 Development Kit.
  14. Switch **ON** the SW801 power supply switch on the interposer card.
- Note:** Once the switch is ON, power supply LEDs on driver cards and the LCD backlight must glow.
15. Switch **ON** the SW7 power supply switch on the SmartFusion2 Development Kit.
- Note:** Once the switch is ON, the Microsemi logo must appear on the LCD. It indicates that the hardware setup is now ready to use.

## Motor Control GUI Installation

For the first time, run the **Motor Control GUI Installer** before using the Six-Axis Motor Control GUI. Perform the following steps to install the motor control GUI:

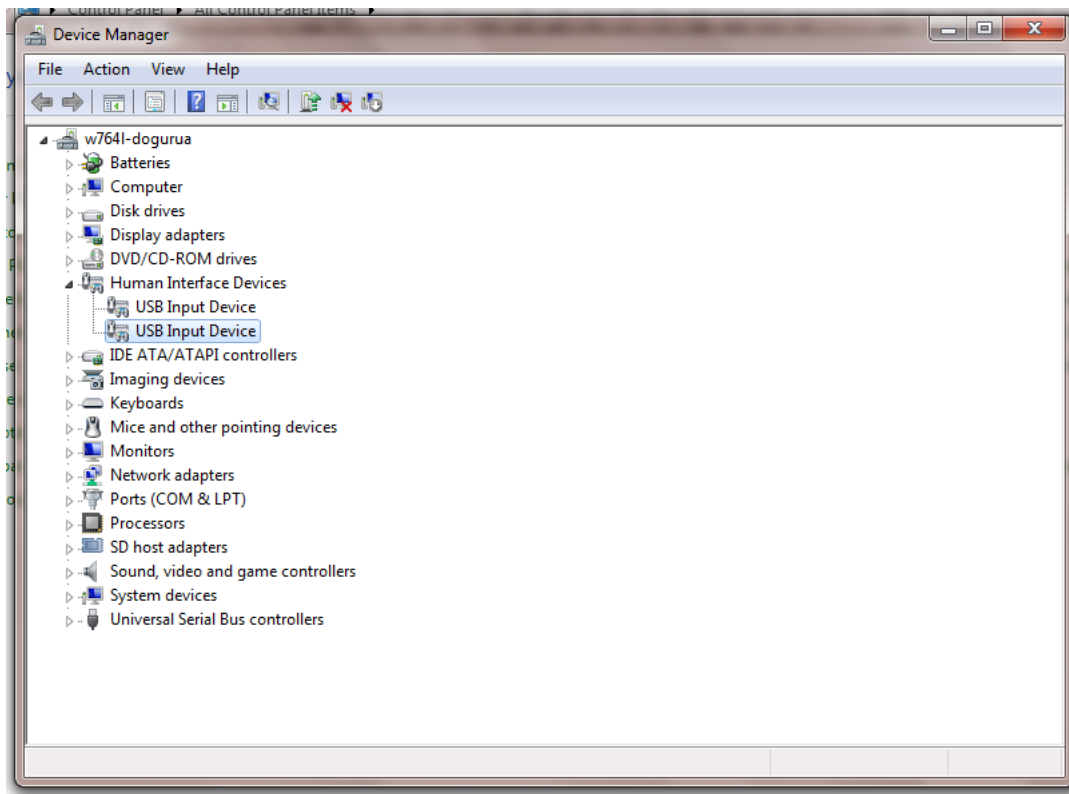
1. Download the design files from:  
[http://soc.microsemi.com/download/rsc/?f=SF2\\_SIX\\_AXIS\\_MC\\_DEMO\\_DF](http://soc.microsemi.com/download/rsc/?f=SF2_SIX_AXIS_MC_DEMO_DF)
2. Open GUI folder and click **Setup.exe**.
3. Click **Yes** for any message from User Account Control.  
Setup window is displayed with the default locations.
4. Click **Next**. Follow the steps provided in the installation wizard to install the GUI.  
A progress bar appears which shows the progress of the installation. On successful installation, a message is displayed as 'Installation Complete'.
5. Click **Finish** to exit the installation wizard.
6. Restart the Host PC before using the newly installed GUI.

## GUI Driver Installation

Perform the following steps to install the GUI drive:

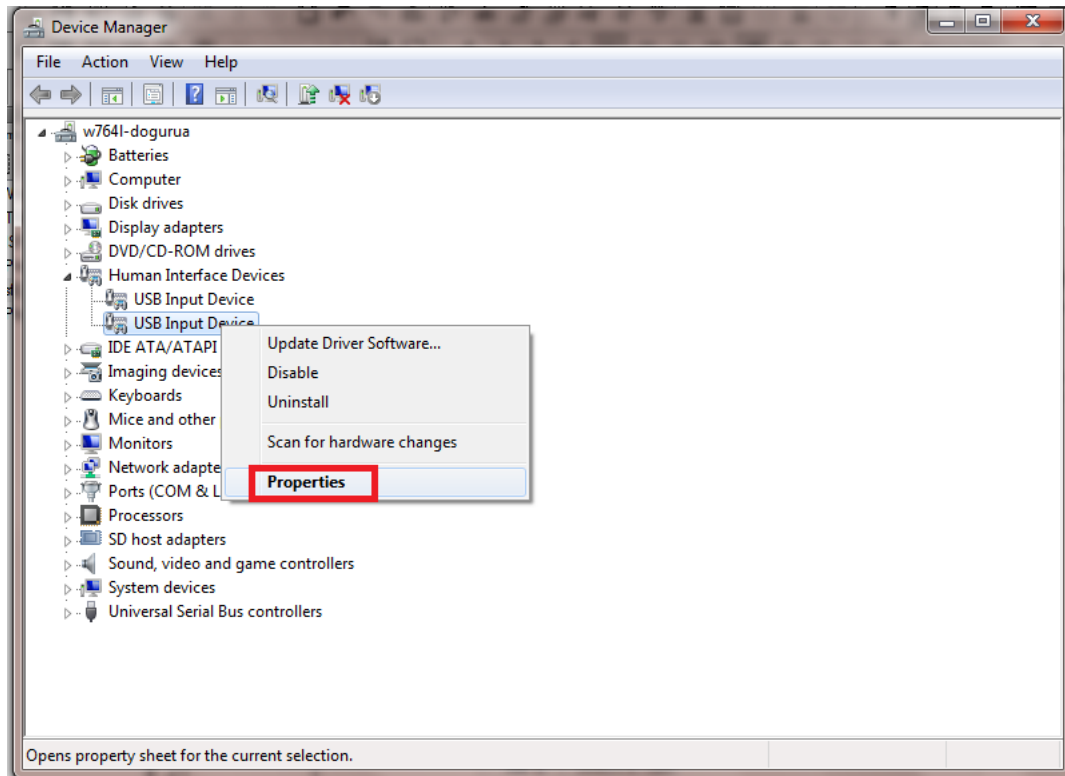
1. On the SmartFusion2 Development Kit Board, close the **J133 (2-3)** and **J129 (1-2)** jumpers.
2. Connect the SmartFusion2 Development Kit board to the interposer board and motor driver board.
3. Switch **ON** the SW7 power supply switch.
4. Connect USB cable from the Host PC to the SmartFusion2 Development Kit board.

5. Open Device Manager of the host PC, select **USB Input Device** under Human Interface Devices as shown in Figure 4.



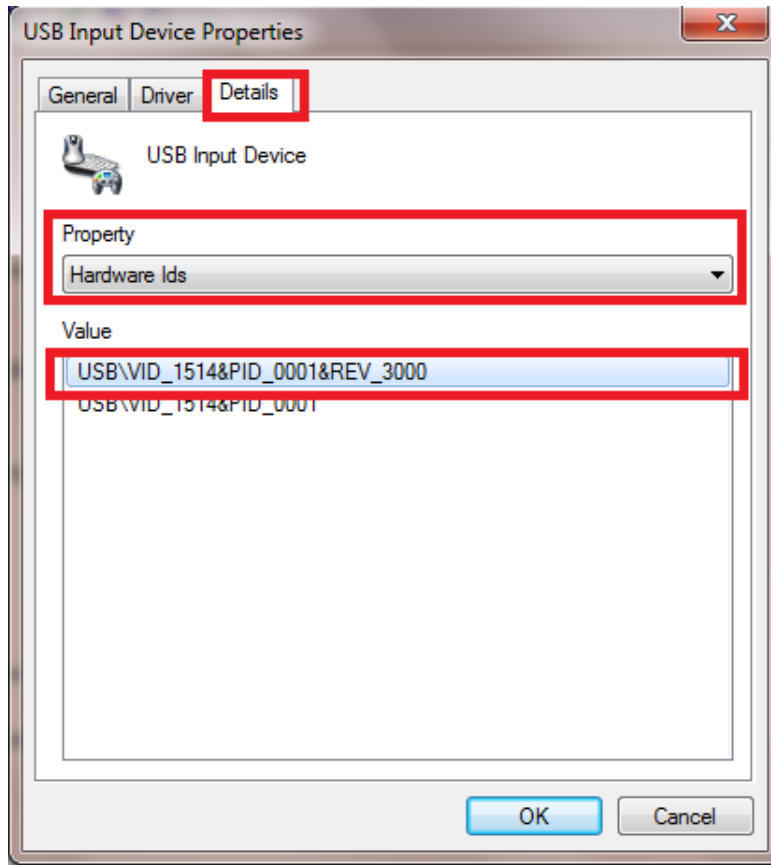
**Figure 4 • Installing the GUI Driver - Identifying the Human Interface Device**

6. Right-click on the **USB Input Device** and select **Properties**.



**Figure 5 • Installing the USB Driver - Opening the Properties Window**

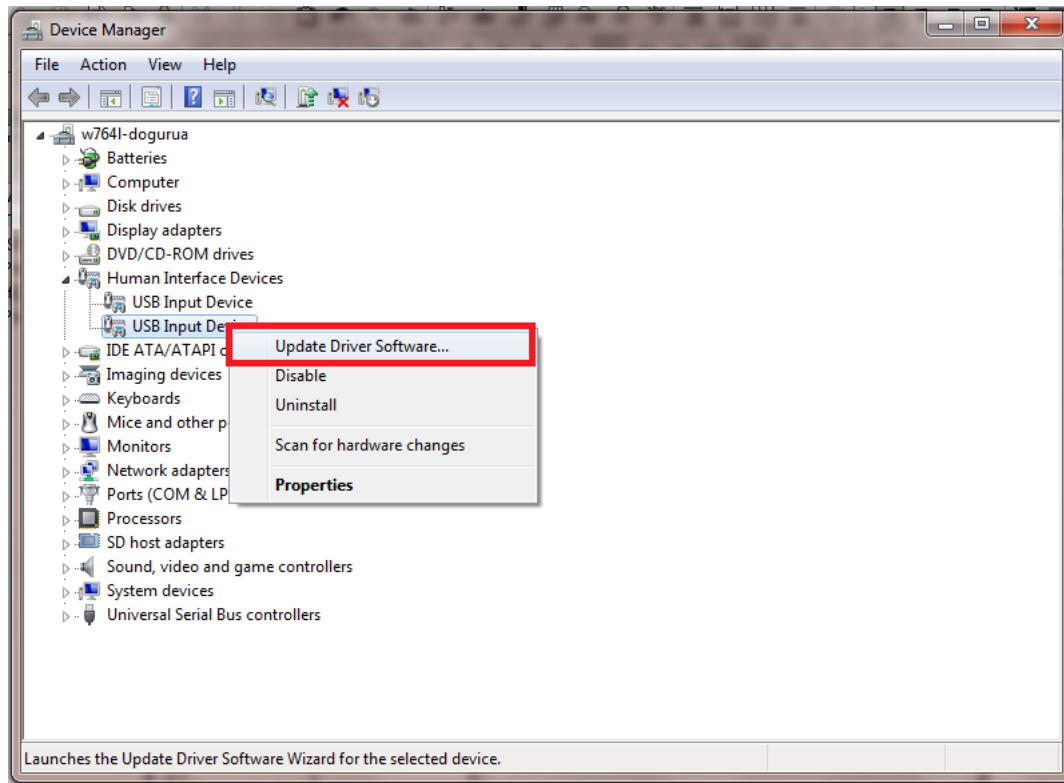
Figure 6 shows the USB Input Device Properties window.



**Figure 6 • Selecting the Right VID Number in the Properties Window**

7. Go to **Details** tab and select hardware ids from the **Hardware Ids** drop-down list under Property.
8. Select the VID number under **Value** and click **OK**. The VID number must match with the number (1514) shown in [Figure 6](#).

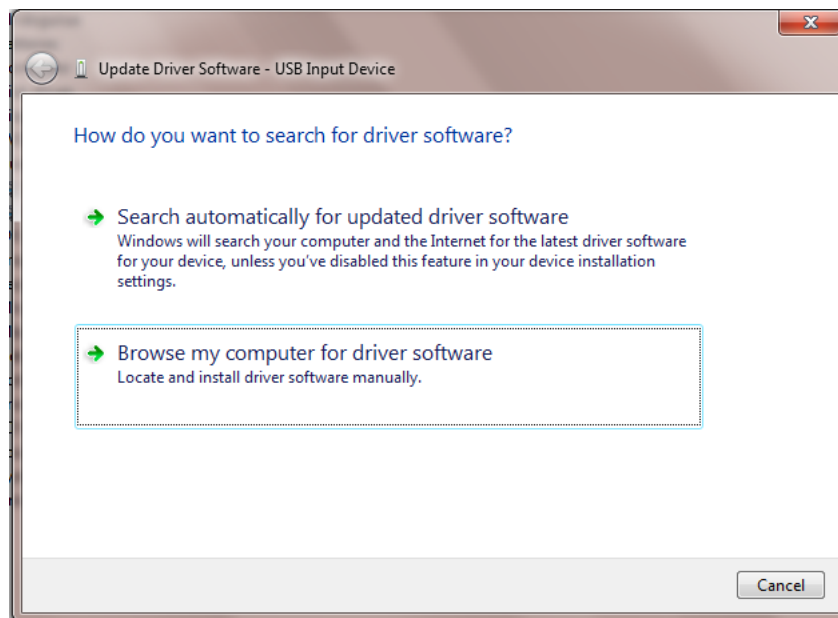
9. In the Device Manager window, right-click on the **USB Input Device** with the specified VID number and select **Update Driver Software**. Refer to [Figure 7](#).



**Figure 7 • Updating Driver Software**

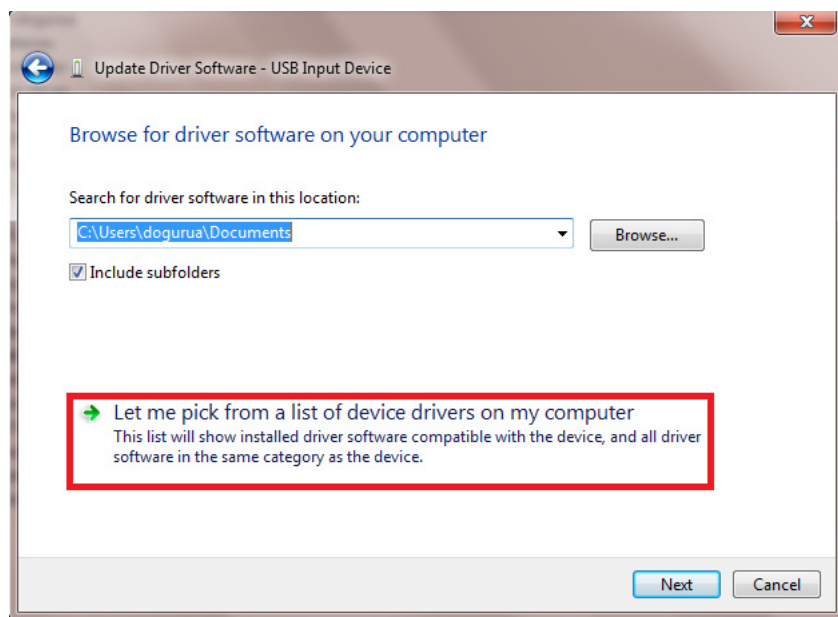
Figure 8 shows the **Update Driver Software - USB Input Device** window.

10. Select **Browse my computer for driver software** as shown in Figure 8.



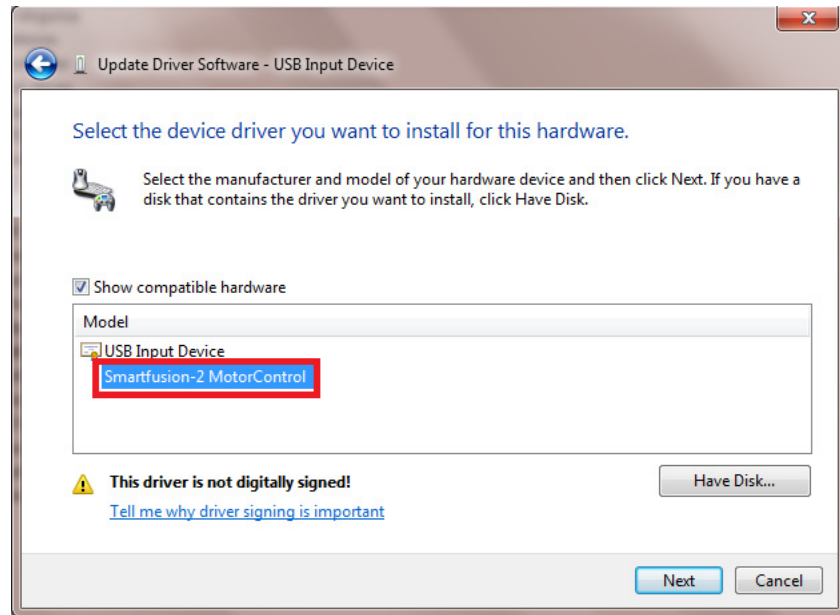
**Figure 8 • Updating Driver Software - Browsing for the Driver**

10. Click **Let me pick from a list of device drivers on my computer** and click **Next** as shown in Figure 9.



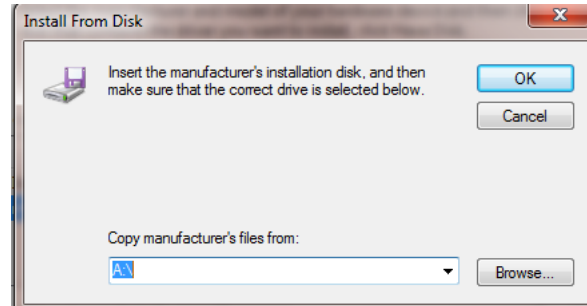
**Figure 9 • Updating Driver Software - Selecting the Driver Location**

11. Click **SmartFusion-2 MotorControl** and click **Have Disk** as shown in Figure 10.



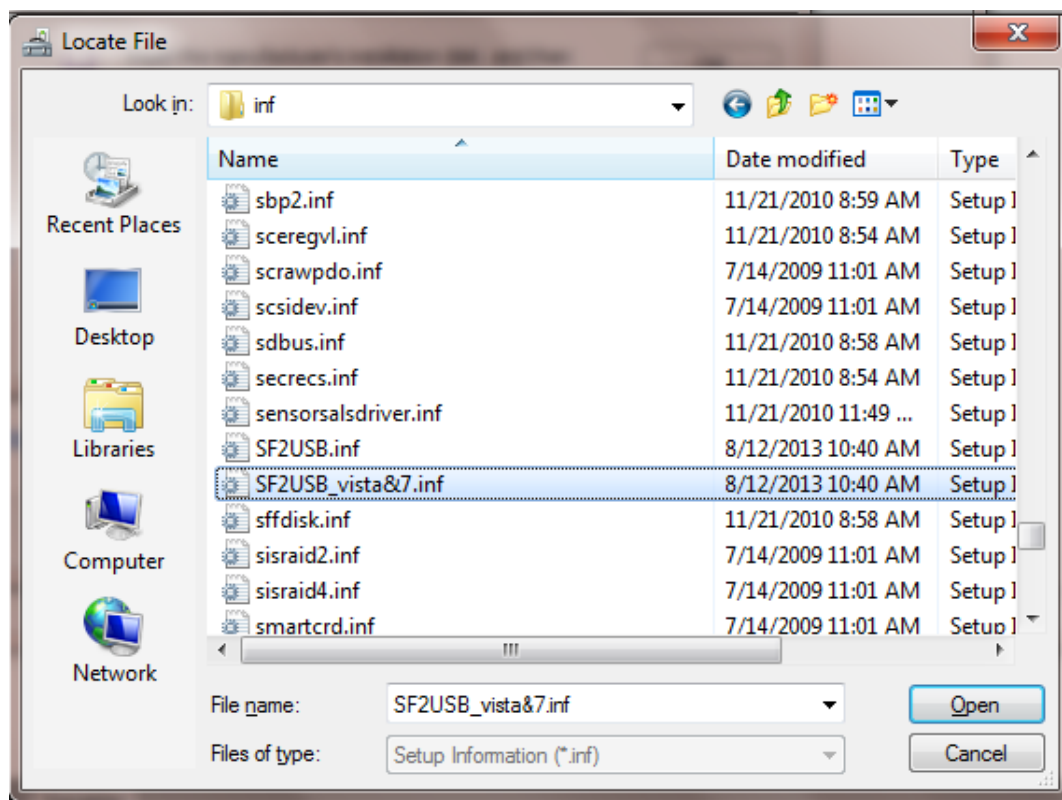
**Figure 10 • Selecting the Device Driver**

12. Click **Browse** and go to **C:\WINDOWS\inf**.



**Figure 11 • Browsing for the Device Driver**

13. Select **SF2USB\_vista&7.inf** for Window7/Vista system or **SF2USB.inf** for Windows XP system and click **Open** as shown in Figure 17.

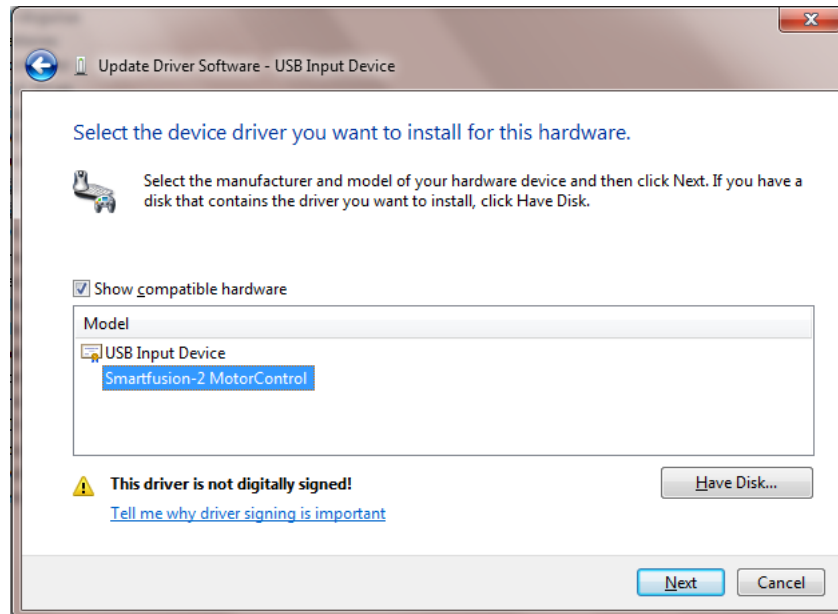


**Figure 12 • Selecting the Installation File**

14. Click **OK**.

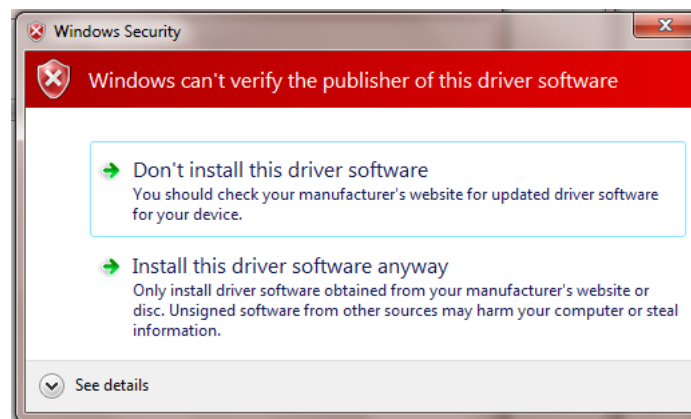


15. In Update Driver Software - USB Input Device window, select **Smartfusion-2 MotorControl** and click **Next**.



**Figure 13 • Completing Installation of the Driver Software**

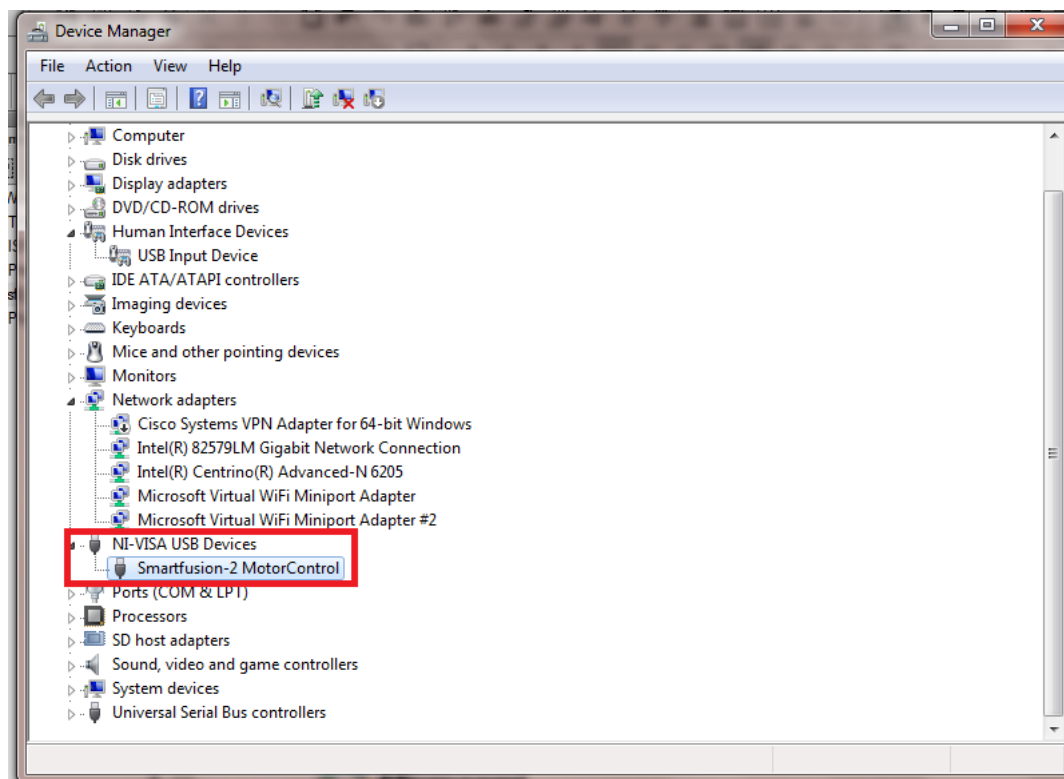
16. A Windows Security message is displayed as shown in Figure 14. Click **Install this driver software anyway**.



**Figure 14 • Windows Security Message**

On successful installation of the drivers, a message is displayed.

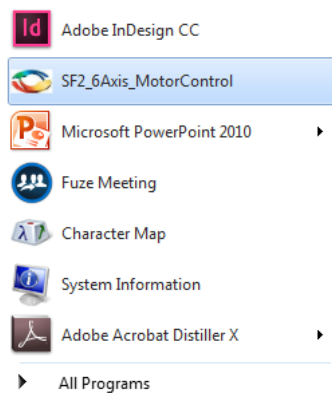
17. Check for **NI-VISA-USB Devices** in the Device Manager window to ensure that the driver is installed successfully.



**Figure 15 • Verifying the Installed Device**

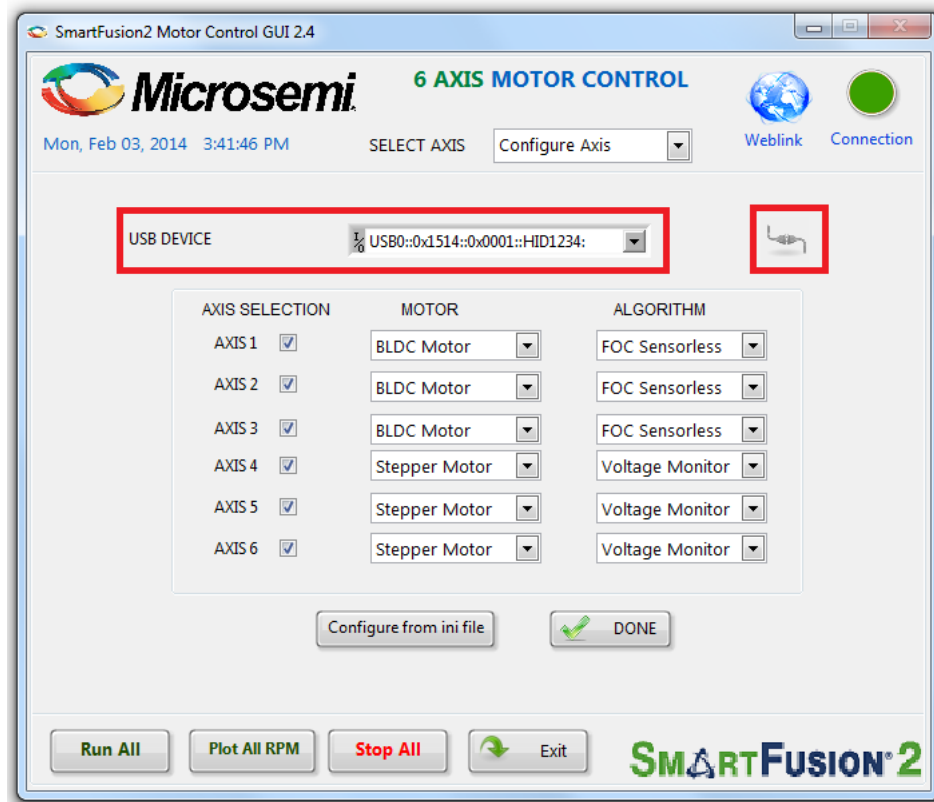
## Running the Demo Design

1. After installing the single-axis motor control GUI, go to **Start** and select **SF2\_6\_Axis\_MotorControl** to open the GUI as shown in [Figure 16](#).



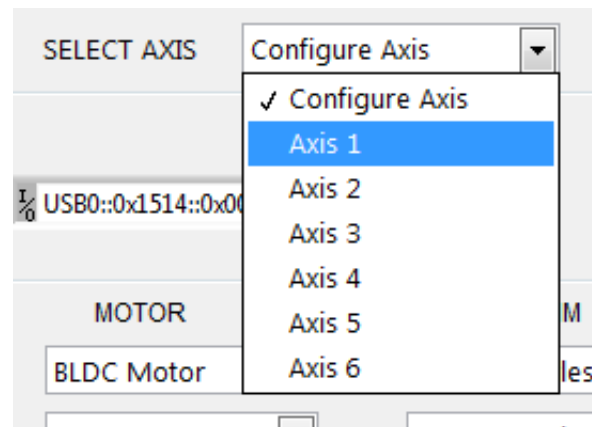
**Figure 16 • Launching the SmartFusion2 Single-Axis Motor Control GUI**

- In the SmartFusion2 Motor Control GUI, select a USB device from the **USB DEVICE** drop-down list.



**Figure 17 • SmartFusion2 Motor Control GUI - Main Screen**

- Click **Connect** as shown in Figure 19.  
On successful connection, the **Connection** LED on the right-side of the window displays in green.
- Select an Axis check-box to indicate the connection of a motor to that axis.
- Click **Done** to confirm that the right motor type is selected for each axis.
- Select a BLDC motor axis from the **SELECT AXIS** drop-down list as shown in Figure 18.



**Figure 18 • SmartFusion2 Motor Control GUI - Axis Selection**

## Running the BLDC Motors

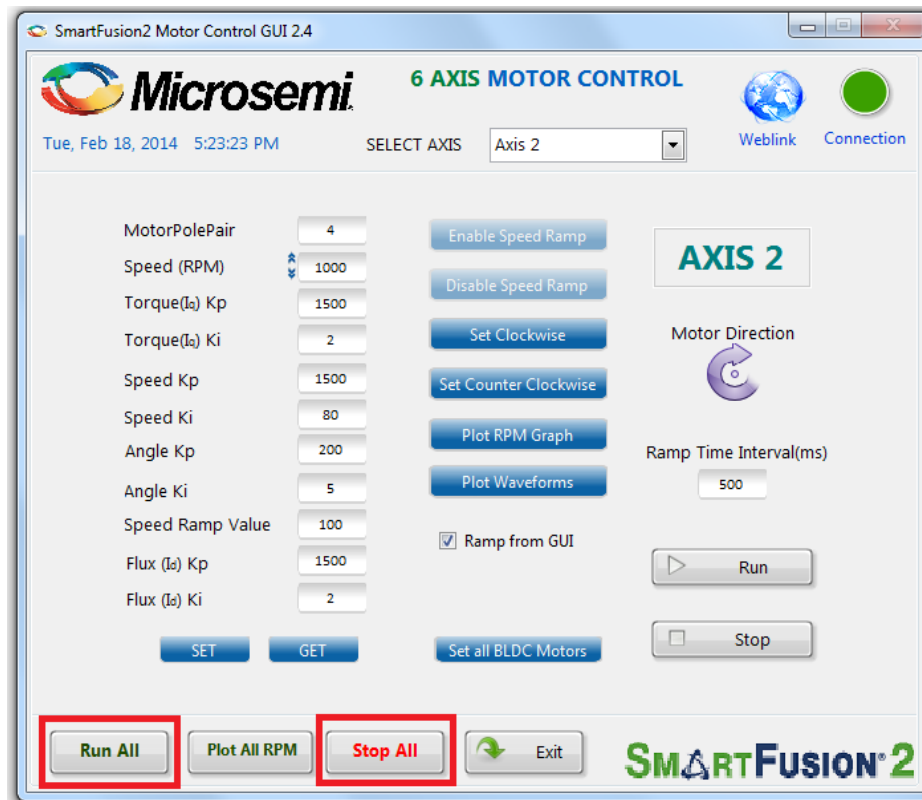
**SET** and **GET** buttons shown in Figure 19 are used to modify or verify the MotorPolePair, motor speed, torque, flux and speed loop PI controller parameters, and angle correction PI parameters.



**Figure 19 • SmartFusion2 Motor Control GUI - BLDC Motor Screen**

- To modify a parameter, change the required field and click **SET**.
- To check the data in the hardware corresponding to each parameter, click **GET**.
- To run the motor, click **RUN** and to stop the motor, click **STOP**.

- Click **Run All** to run all the motors and click **Stop All** to stop all the running motors



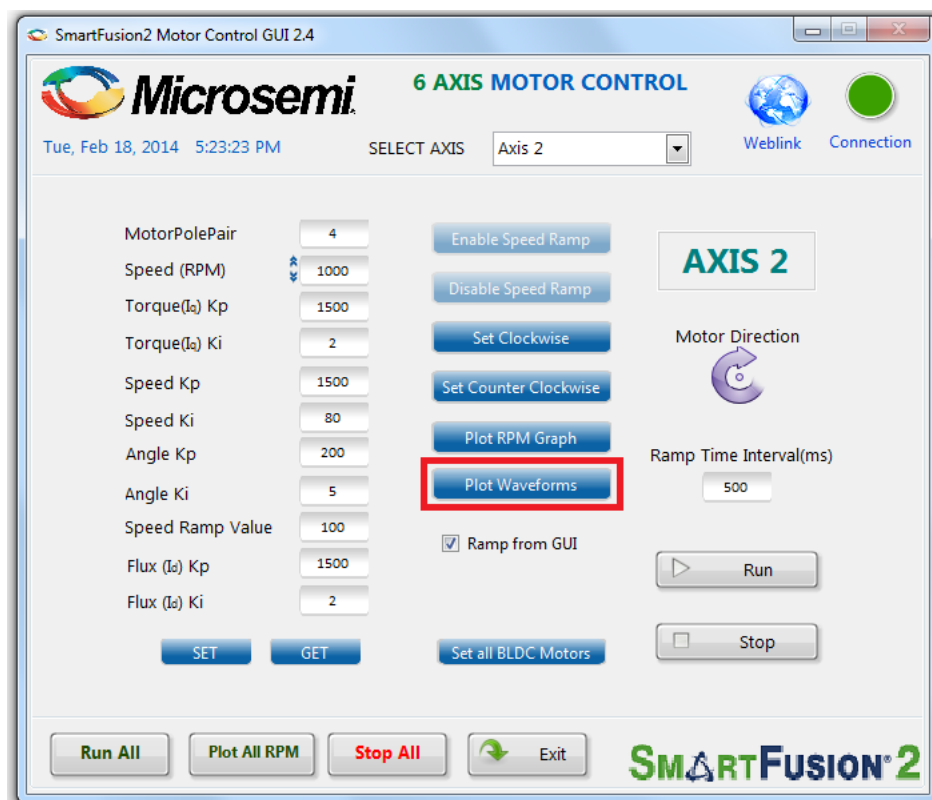
**Figure 20 • SmartFusion2 Motor Control GUI - Run or Stop All Motors**

- To use the speed ramp in the GUI, ensure that the **Ramp from GUI** check-box is selected. When this is selected, the **Speed Ramp Value** is used as the speed increment, and the time duration between increments is specified by the Ramp Time Interval. The speed ramp rate can be specified by changing either of these values.
- To use the hardware speed ramp, deselect the **Ramp from GUI** check-box. For enabling or disabling the hardware ramp, use the **Enable Speed Ramp** and **Disable Speed Ramp** on the GUI.

**Note:** The hardware speed ramp is not available in the demo design v1.1.

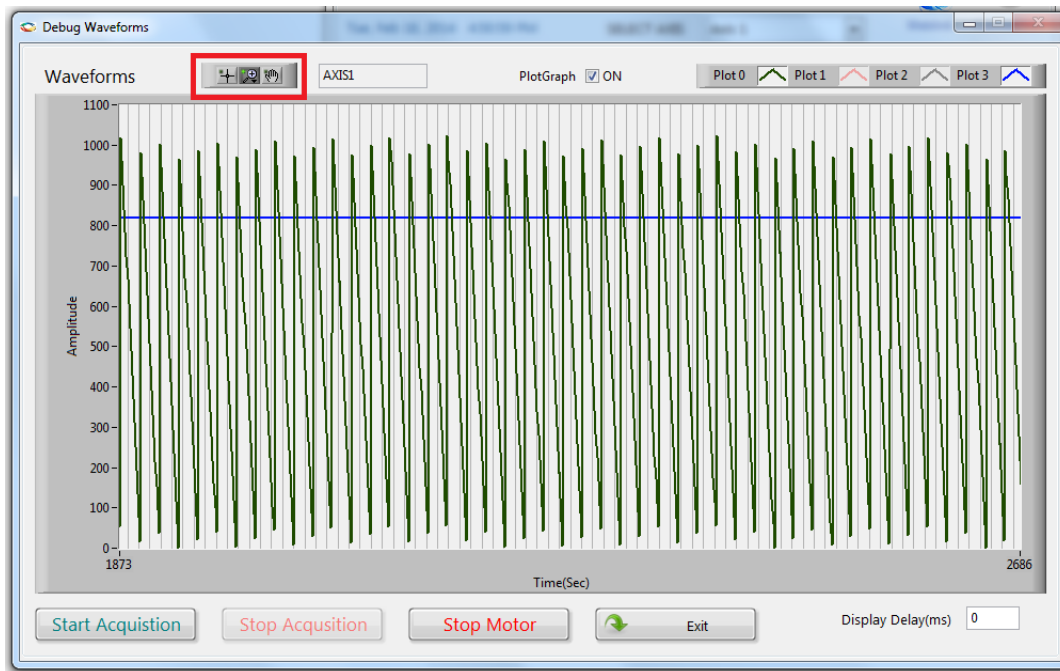
- Click **Set Clockwise** or **Set Counter Clockwise** to set the motor direction, respectively. The motor direction indicator indicates the current direction of the motor.

7. For plotting and analyzing the internal parameters of the system as waveforms, click **Plot Waveform** as shown in Figure 21.



**Figure 21 • SmartFusion2 Motor Control GUI - Selecting Plot Waveforms**

Figure 22 shows the plot wave form displayed in a separate window.



**Figure 22 • Debug Waveforms Window**

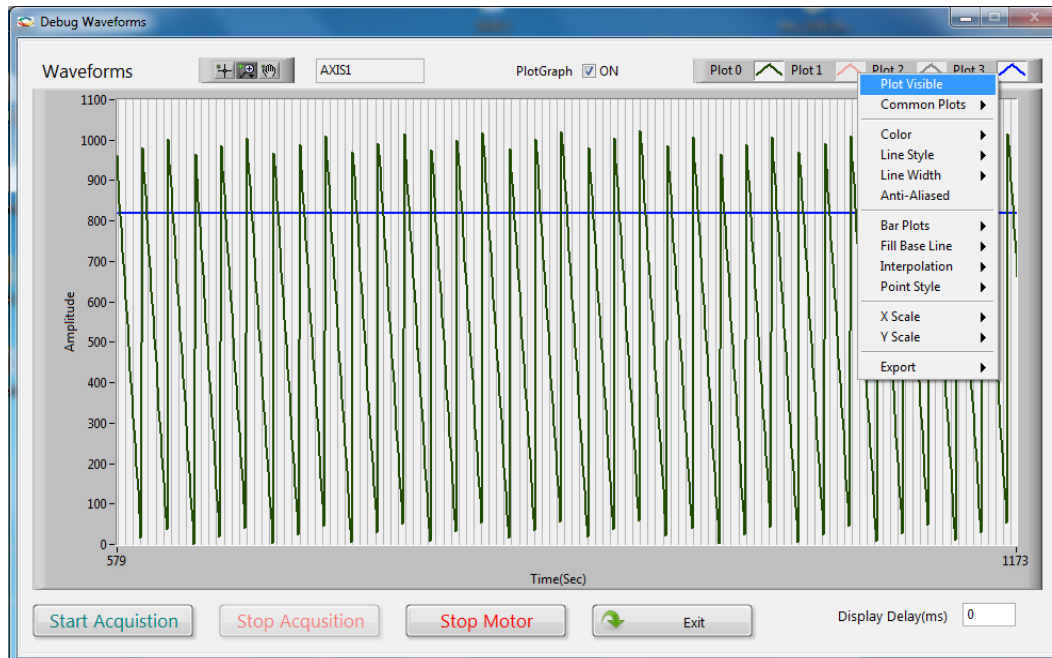
Use the Graph Palette to expand and analyze the acquired waveforms.

- Click **Start Acquisition** to start acquiring up to four parameter waveforms and simultaneously plot it.

**Note:** Click **Start Acquisition** to start the motor even if the motor is not running already.

- Click **Stop Acquisition** to stop acquisition.
- Click **Stop Motor** to stop the motor.

d. Click  $\wedge$  symbol next to a plot to make use of the available options.



**Figure 23 • Debug Waveforms Window with Options**

In Figure 23, Plot 0 corresponds to the rotor angle, while Plot 3 corresponds to the motor speed. Plots 1 and 2 are invisible and represent the estimated  $V_{\alpha}$  and  $V_{\beta}$  values.

e. Use the graph palette highlighted in Figure 22 to move cursors, zoom, or pan the display. The graph palette appears with the following options, in order from left to right:

- Cursor Movement Tool: Moves the cursor on the display.
- Zoom: Zooms in and out of the display.
- Panning Tool: Picks up the plot and moves it around the display.

8. Click **EXIT** to close the waveforms window.

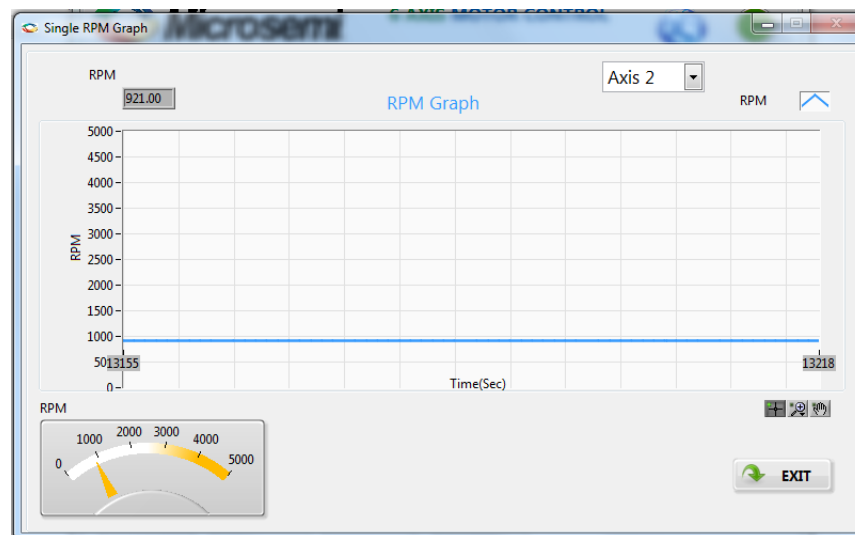


9. For plotting the RPM graph of the motor, click **Plot RPM Graph** as shown in Figure 24.



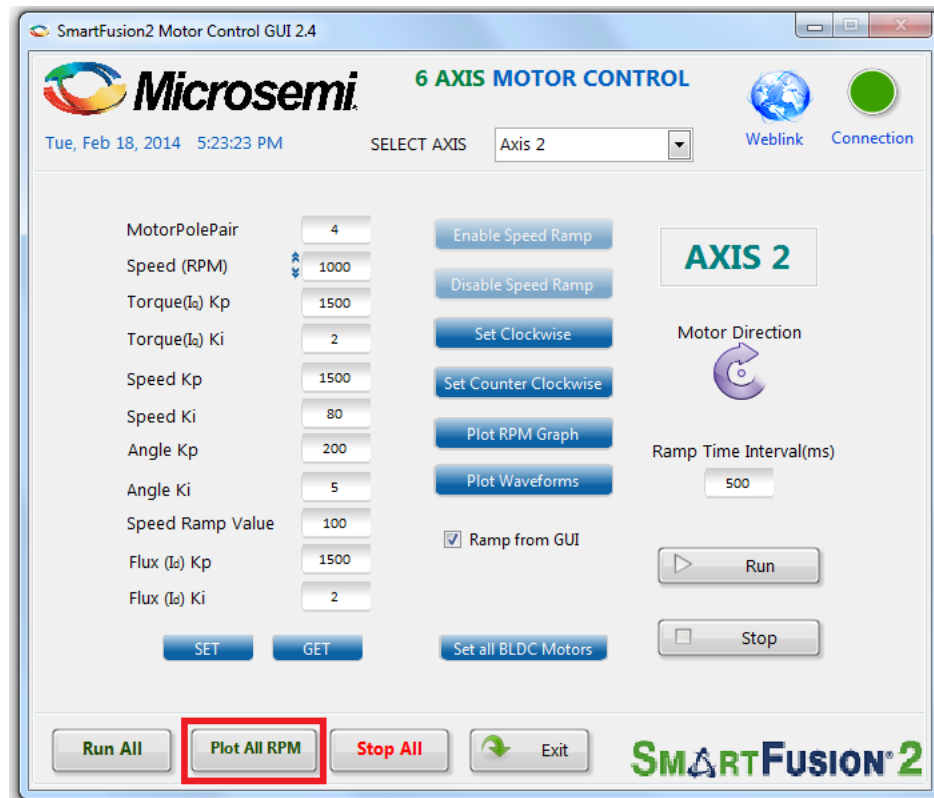
**Figure 24 • SmartFusion2 Motor Control GUI - Plotting RPM Graph**

10. Single RPM Graph window is displayed with the plot RPM graph. Figure 25 shows the Single RPM Graph window with RPM Graph and RPM indicator.



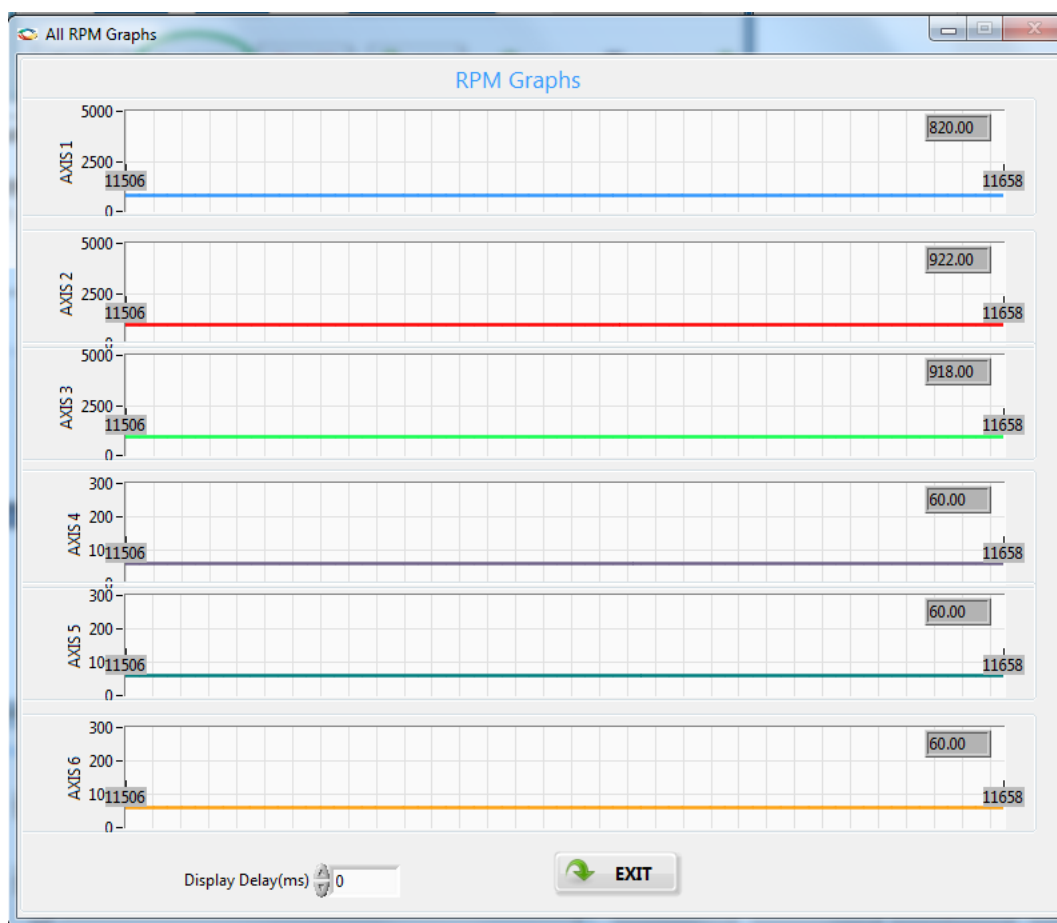
**Figure 25 • SmartFusion2 Motor Control GUI - Plotting RPM Data from One Motor**

To plot the RPM graphs of all axes, click **Plot All RPM** shown in Figure 26.



**Figure 26 • SmartFusion2 Motor Control GUI - Plotting RPM Data from all Motors**

Figure 27 shows the All RPM Graphs window with the generated RPM graphs for all the axes.



**Figure 27 • SmartFusion2 Motor Control GUI - All RPM Graphs window**

11. Click **EXIT** to close the plot RPM window.

## Running Stepper Motors

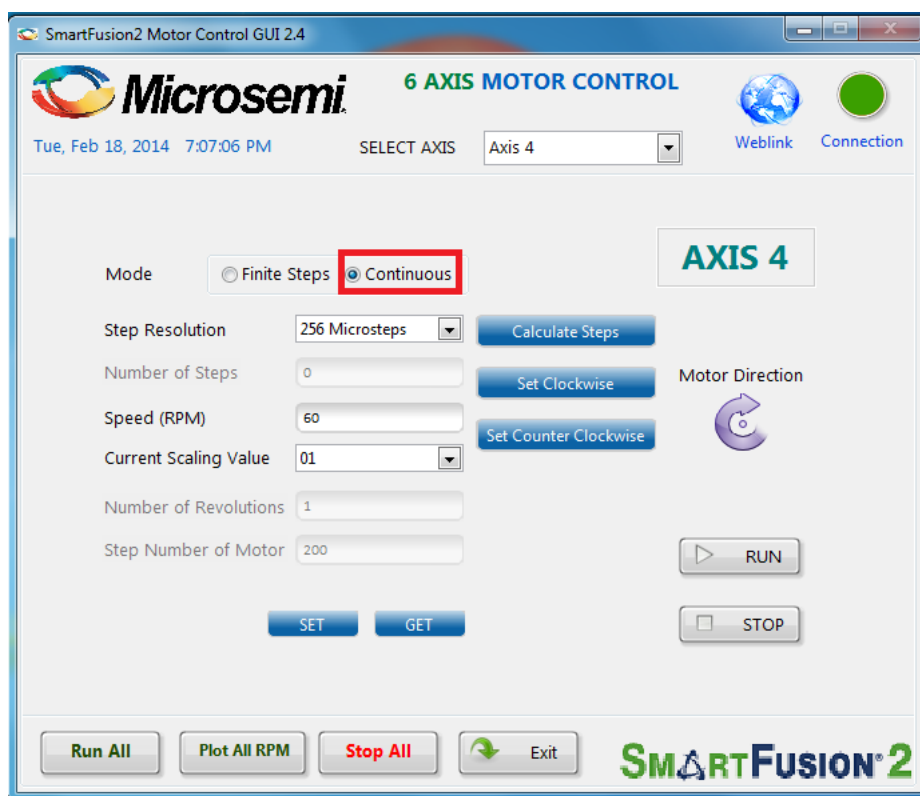
This design runs stepper motors in:

- Continuous Mode
- Finite Steps Mode

The Continuous Mode is selected by default.

### Continuous Mode

1. Select a stepper axis from the **SELECT AXIS** drop-down list, refer to Figure 18.
2. Ensure that the **Continuous** mode option is selected. Figure 28 shows the SmartFusion2 Motor Control GUI - Stepper motor window.



**Figure 28 • SmartFusion2 Motor Control GUI - Stepper Motor Screen**

3. Click **GET** to see the default parameters.
4. Click **RUN** to run the motor with the default parameters.
5. Select step resolution value from the **Step Resolution** drop-down list.
6. Enter a speed value between 1 and 255 RPM in **Speed (RPM)** and click **Set**. Each time the motor is stopped, the entered value will be overwritten with a default value of 60 RPM.

#### Notes:

- It is not necessary to stop the motor to change motor speed or the step resolution.
  - To change the direction of the motor, click **Set Clockwise** or **Set Counter Clockwise**.
7. To increase motor torque:
    - a. Stop the motor
    - b. Increase the current scaling value by selecting a bigger value compare to the existing value from the **Current Scaling Value** drop-down list.

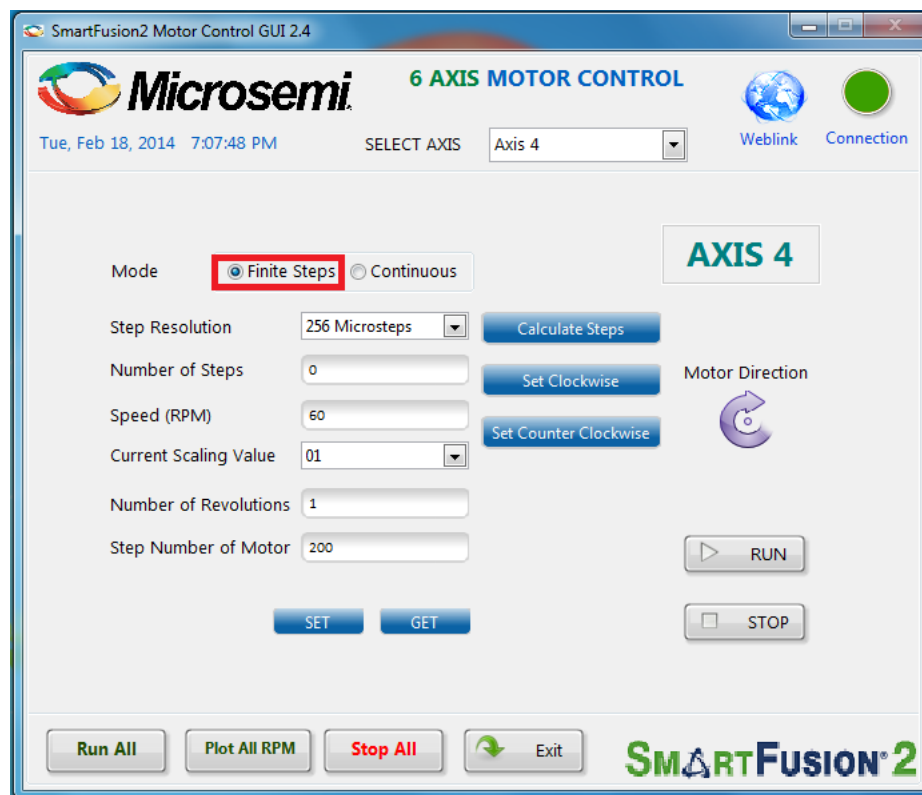
- c. Click **SET**.
- d. Click **RUN**.

**Note:** Increasing the current scaling value increases the motor current and the motor can get heated if it is run for a long time.

### Finite Steps Mode

1. Enter **Number of Steps** to fix the number of times that the motor needs to run.
  - a. To run the motor through 51200 steps, enter 51200 in **Number of Steps**
  - b. Click **SET**.
  - c. Click **RUN**. The motor runs through the specified number of steps.

In the finite steps mode, the motor will move through a fixed number of steps after which the motor will stop rotating, but will remain energized. Each time the motor is started, the Number of Steps is reset to zero.



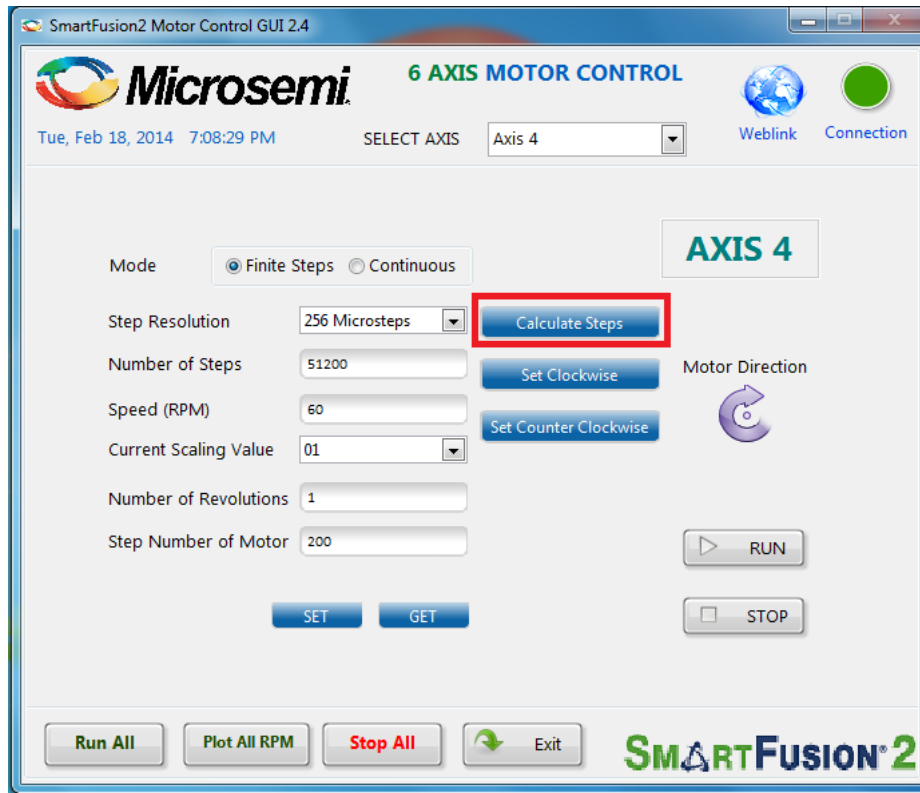
**Figure 29 • SmartFusion2 Motor Control GUI - Stepper Motor in Finite Step Mode**

**Note:** If the step number of a motor is known, the number of steps can be calculated from the step number and the number of revolutions required.

2. To calculate the steps in the GUI:
  - a. Verify the **Step Number of Motor**. The default value is 200.
  - b. Enter the **Number of Revolutions**.
  - c. Click **Calculate Steps**. The calculated number of steps will be displayed as the Number of Steps.
3. Click **SET**.

**Note:** Change the motor speed if required before clicking **SET**.

- Click **RUN**.



**Figure 30 • SmartFusion2 Motor Control GUI - Using the GUI to Calculate Steps**

The motor runs at the specified speed through the calculated number of steps.

- Click **STOP** to stop the motor.
- Click **EXIT** to exit the SmartFusion2 Motor Control GUI.

## Appendix 1: Jumper Settings

Table 1 lists all the jumpers that are required to set on the SmartFusion2 Development Kit board.

**Table 1 • Jumper Settings on the SmartFusion2 Development Kit Board**

Jumper	Function	Default Settings	Notes
<b>Power Supply</b>			
J23	Select the core voltage (VDD_REG) for 1.2 V	2-3 Closed	
J117	Connect 3P3V_LDO to PLLFDDRVDAA	1-2 Closed	
J123	Connect VDD_REG to PCIExVDD	1-2 Closed	
J142	Connect 3P3V_LDO to PLLPCIExVDDA	1-2 Closed	
J157	Connect 3P3V_LDO to VPPNVMsA0	1-2 Closed	
J160	Connect VDD_REG to PCIExVDDIOx	1-2 Closed	
J167	Connect 2P5V_LDO to PCIExVDDPLL	1-2 Closed	
J225	Connect 3P3V_LDO to PLLMDDRVDAA	1-2 Closed	
J226	Connect 3P3V_LDO to PLLXVDDA	1-2 Closed	
J227	Connect 3P3V_LDO to VPP	1-2 Closed	
<b>Programming and Debugging</b>			
J38	Select FLASH_GOLDEN_N for IAP mode.	Open	
J70	Device reset generation selection.	1-2 Closed	
J93	JTAG: Select between RVI header or FP4 header for debug: Select FlashPro	1-2 Closed	
J94	Select the JTAG reset	1-2 Closed	
<b>USB Communication</b>			
J163	On-The-Go(OTG) Mode	1-2 Closed	
J164	Jumper to provide the VBUS supply to USB when using in Host mode	1-2 Closed	
J139	Select between USB reset and FMC_P24.	1-2 Closed	
J129	Connects FMC_R29 to FMC connector.	1-2 Closed	
<b>FMC Connector Routing Header</b>			
J111	Select between CAN1 bus Rx and FMC_V24	2-3 Closed	
J114	Select between CAN1 bus Tx and FMC_AA28.	2-3 Closed	
J115	Select between CAN1 TXEBL and FMC_AA29.	2-3 Closed	
J131	Select between CAN2 TXEBL and FMC_T27.	2-3 Closed	
J134	Select between CAN2 bus Rx and FMC_T26.	2-3 Closed	
J232	Select between CAN2 bus Tx and FMC_U24.	2-3 Closed	
J110	Select between SPI flash SCK and FMC_V22.	2-3 Closed	
J118	Select between SPI flash SDO and FMC_W27.	2-3 Closed	
J119	Select between SPI flash SDI and FMC_Y30.	2-3 Closed	
J121	Select between SPI flash SS and FMC_W28.	2-3 Closed	

**Table 1 • Jumper Settings on the SmartFusion2 Development Kit Board (continued)**

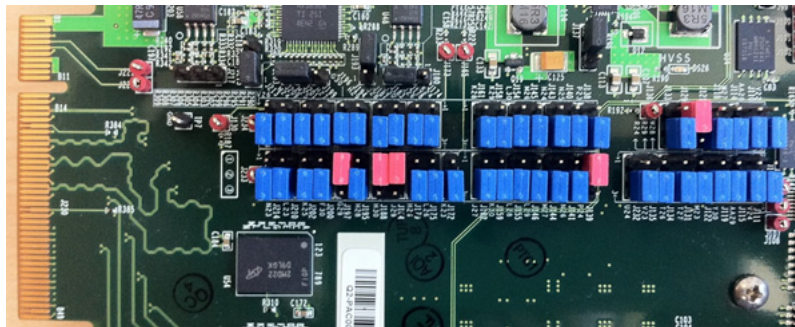
Jumper	Function	Default Settings	Notes
J122	Select between ADS8568_REFEN and FMC_M23.	2-3 Closed	
J138	Select between ADC CONVST_D and FMC_P23 from SmartFusion2 I/O P23 pin.	2-3 Closed	
J140	Select between ADC CONVST_C and FMC_N25 from SmartFusion2 I/O N25 pin.	2-3 Closed	
J141	Select between ADC CONVST_B and FMC_N26 from SmartFusion2 I/O N26 pin.	2-3 Closed	
J162	Select between ADC SEL_B and FMC_J27.	2-3 Closed	
J144	Select between ADC BUSY and FMC_M27 from SmartFusion2 I/O M27 pin.	2-3 Closed	
J146	Select between ADC DB7 and FMC_L29 from SmartFusion2 I/O L29 pin.	2-3 Closed	
J154	Select between ADC DB1 and FMC_L30 from SmartFusion2 I/O L30 pin.	2-3 Closed	
J155	Select between ADC DB2 and FMC_L28 from SmartFusion2 I/O L28 pin.	2-3 Closed	
J158	Select between ADC DB3 and FMC_K29 from SmartFusion2 I/O K29 pin.	2-3 Closed	
J159	Select between ADC DB4 and FMC_K30 from SmartFusion2 I/O K30 pin.	2-3 Closed	
J161	Select between ADC SEL_CD and FMC_K28 from SmartFusion2 I/O K28 pin.	2-3 Closed	
J175	Select between ADC DB8 and FMC_L26 from SmartFusion2 I/O L26 pin.	2-3 Closed	
J179	Select between ADC SDI and FMC_H26 from SmartFusion2 I/O H26 pin.	2-3 Closed	
J183	Select between ADC DB11 and FMC_J30 from SmartFusion2 I/O J30 pin.	2-3 Closed	
J184	Select between ADC DB0 and FMC_J29 from SmartFusion2 I/O J29 pin.	1-2 Closed	Unused
J187	Select between ADC SDO_A and FMC_J28 from SmartFusion2 I/O J28 pin.	2-3 Closed	
J196	Select between ADC SDO_C and FMC_G30 from SmartFusion2 I/O G30 pin.	2-3 Closed	
J200	Select between ADC SDO_D and FMC_F30 from SmartFusion2 I/O F30 pin.	2-3 Closed	
J201	Select between ADC CSN and FMC_M25 from SmartFusion2 I/O M25 pin.	2-3 Closed	
J202	Select between ADC RDN and FMC_K25 from SmartFusion2 I/O K25 pin.	2-3 Closed	
J214	Select between ADC RESET and FMC_N23 from SmartFusion2 I/O N23 pin.	2-3 Closed	



**Table 1 • Jumper Settings on the SmartFusion2 Development Kit Board (continued)**

Jumper	Function	Default Settings	Notes
J178	Select between RS485_RE and FMC_J26.	2-3 Closed	
J199	Select between RS485_TX and FMC_H27.	2-3 Closed	
J209	Select between RS485_TE and FMC_M29.	2-3 Closed	
J210	Select between RS485_RX and FMC_L23.	2-3 Closed	
J188	Select between RS232_DIN and FMC_H30.	1-2 Closed	
J195	Select between RS232_INVALIDn and FMC_H28.	2-3 Closed	
J197	Select between RS232_ROUT and FMC_G29.	1-2 Closed	
J172	Connect the I2C_0 SDA to pull-Up or FMC_K23.	2-3 Closed	
J174	Connect the I2C_0 SCL to pull-Up or FMC_K24.	2-3 Closed	
J135	Connect the I2C_1 SDA to pull-Up or FMC_V23.	2-3 Closed	
J133	Select between FT4232_DD1 and FMC_R24.	2-3 Closed	

*Note:* Figure 31 shows the jumper settings on the SmartFusion Development Kit.


**Figure 31 • Jumpers on SmartFusion2 Development Kit for Routing Essential Signals through the FMC Connector**

- Jumpers highlighted in red are 1-2 connections
- Jumpers highlighted in blue are 2-3 connections

Table 2 lists the jumpers that are required to set on the interposer card.

**Table 2 • Jumper Settings on the Interposer Card**

Jumper	Function	Default Settings
J804	SmartFusion2 Development Kit 12P0V enable	Closed
J805, J806	PoE source	Open
J807, J808	12 V - 48 V adapter source	Open
J809, J810	12 V - 48 V power source	Closed

*Note:* Do not connect jumpers for multiple power supply options simultaneously.

Table 3 lists all the jumpers that are required to set on the BLDC driver cards.

**Table 3 • Jumper Settings on the BLDC Driver Card**

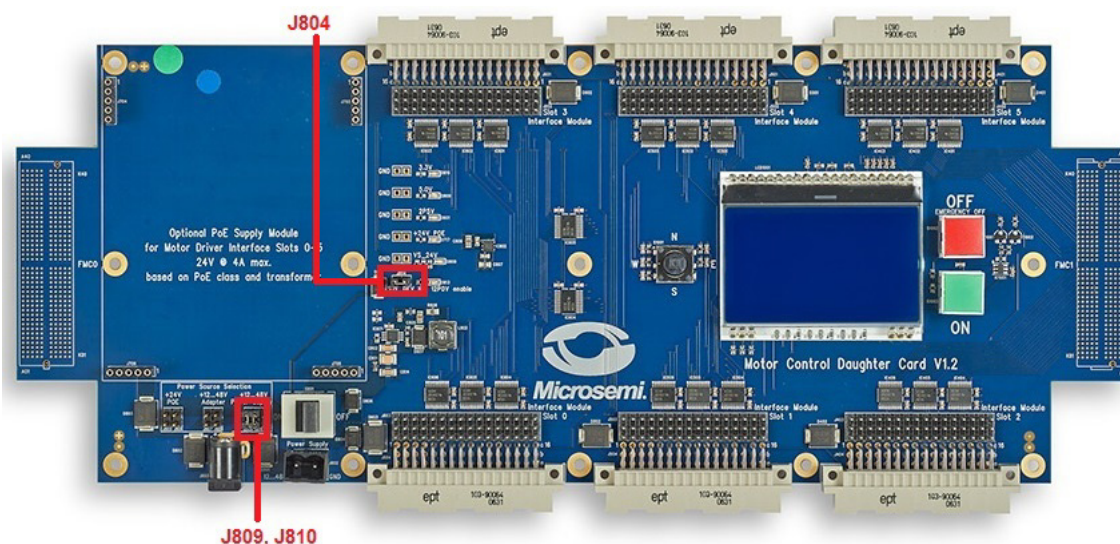
Jumper	Function	Default Settings
Supply Voltage	External or Onboard VS: Default should be VS Mainboard	VS Mainboard
SingleEnd	Single-ended/Differential signals: Default should be single-ended	Single-ended Closed
Sel0.2	ADC channel select 0/1 pins: Default should be set to High	SEL-H
	ADC channel select 2 pin: Default should be set to Low	SEL-L
Sense HI	Sense HI of TMC603A chip: Default should be set to Low	Low: 2-3 Closed
INV_BL	INV_BL of TMC603A chip: Default should be set to Low	Low: 2-3 Closed
X207	Connections to Error-Out and 603-Enable signals: Default - should be 2-3 connected.	2-3 Closed

Table 4 lists all the jumpers that are required to set on the Stepper driver cards.

**Table 4 • Jumper Settings on the Stepper Driver Card**

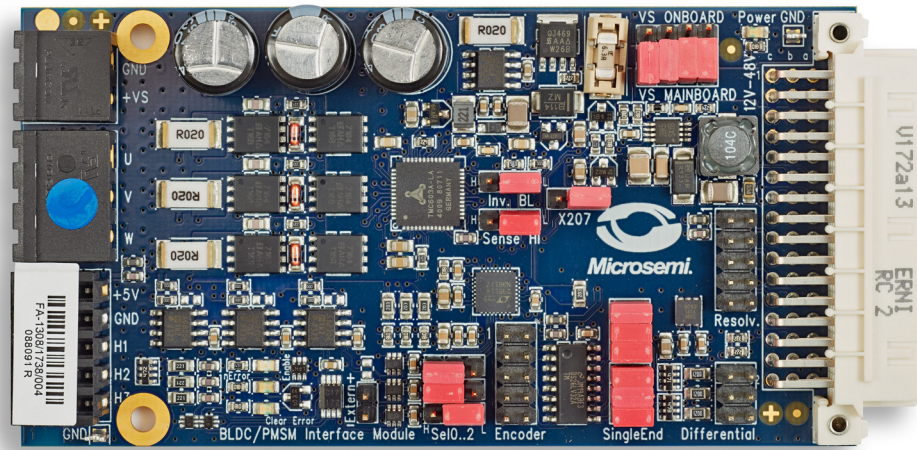
Jumper	Function	Default Settings
Supply Voltage	External or Onboard VS: Default should be VS Mainboard	VS Mainboard
SingleEnd	Single-ended/Differential signals: Default should be single-ended	Single-ended closed
Sel0.2	ADC channel select 0/1/2 pins: Default should be set to High	SEL-H 1-2 closed

Figure 32 shows the jumper settings on the interposer card to use with the power supply available with the kit.



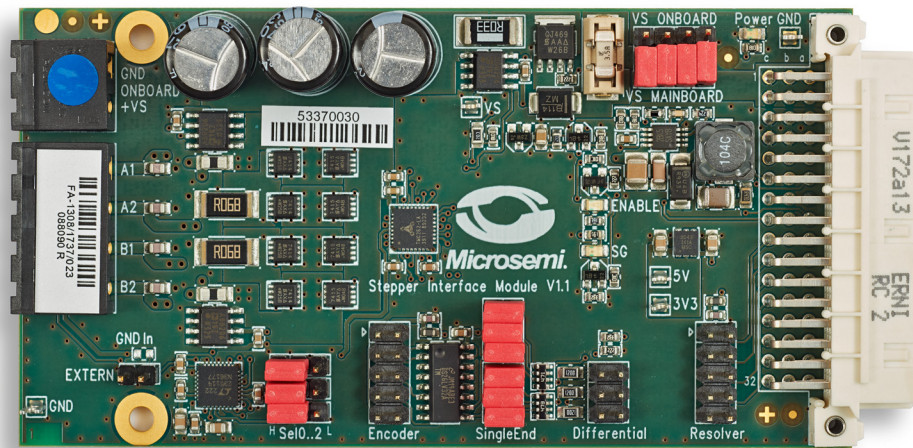
**Figure 32 • Jumpers on TCM-6930-MS (Interposer Card)**

Figure 33 show the BLDC Daughter Card.



**Figure 33 • Jumpers on TCM-1730-MS (BLDC Daughter card)**

Figure 34 shows the jumper settings on the Stepper Daughter cards.



**Figure 34 • Jumpers on TCM-1045-MS (Stepper Daughter card)**



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## Product Support

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Microsemi SoC Products Group backs its products with various support services, including Customer Service, Customer Technical Support Center, a website, electronic mail, and worldwide sales offices. This appendix contains information about contacting Microsemi SoC Products Group and using these support services.

### Customer Service

Contact Customer Service for non-technical product support, such as product pricing, product upgrades, update information, order status, and authorization.

From North America, call 800.262.1060

From the rest of the world, call 650.318.4460

Fax, from anywhere in the world, 408.643.6913

### Customer Technical Support Center

Microsemi SoC Products Group staffs its Customer Technical Support Center with highly skilled engineers who can help answer your hardware, software, and design questions about Microsemi SoC Products. The Customer Technical Support Center spends a great deal of time creating application notes, answers to common design cycle questions, documentation of known issues, and various FAQs. So, before you contact us, please visit our online resources. It is very likely we have already answered your questions.

### Technical Support

Visit the Customer Support website ([www.microsemi.com/soc/support/search/default.aspx](http://www.microsemi.com/soc/support/search/default.aspx)) for more information and support. Many answers available on the searchable web resource include diagrams, illustrations, and links to other resources on the website.

### Website

You can browse a variety of technical and non-technical information on the SoC home page, at [www.microsemi.com/soc](http://www.microsemi.com/soc).

### Contacting the Customer Technical Support Center

Highly skilled engineers staff the Technical Support Center. The Technical Support Center can be contacted by email or through the Microsemi SoC Products Group website.

#### Email

You can communicate your technical questions to our email address and receive answers back by email, fax, or phone. Also, if you have design problems, you can email your design files to receive assistance. We constantly monitor the email account throughout the day. When sending your request to us, please be sure to include your full name, company name, and your contact information for efficient processing of your request.

The technical support email address is [soc\\_tech@microsemi.com](mailto:soc_tech@microsemi.com).



## My Cases

Microsemi SoC Products Group customers may submit and track technical cases online by going to [My Cases](#).

## Outside the U.S.

Customers needing assistance outside the US time zones can either contact technical support via email ([soc\\_tech@microsemi.com](mailto:soc_tech@microsemi.com)) or contact a local sales office. [Sales office listings](#) can be found at [www.microsemi.com/soc/company/contact/default.aspx](http://www.microsemi.com/soc/company/contact/default.aspx).

## ITAR Technical Support

For technical support on RH and RT FPGAs that are regulated by International Traffic in Arms Regulations (ITAR), contact us via [soc\\_tech\\_itar@microsemi.com](mailto:soc_tech_itar@microsemi.com). Alternatively, within [My Cases](#), select **Yes** in the ITAR drop-down list. For a complete list of ITAR-regulated Microsemi FPGAs, visit the [ITAR](#) web page.



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