



## ABSTRACT

This document is provided with the DRV84x2\_DRV82x2\_DRV89x2-EVM User customer evaluation module (EVM) as a supplement to the DRV8462, DRV8962, and DRV8262 data sheets. This user's guide details the hardware implementation of the EVM and how to install the software packages.

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### Note

If you ordered a DRV8452EVM use hardware files for DRV8462EVM.  
At the moment the silk screen has the following errata.

- The Silk screen says OUT3, it should say OUT4
  - The Silk screen says OUT4, it should say OUT3
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## Trademarks

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## 1 Introduction

### 1.1 Overview

The DRV84x2, DRV89x2, and DRV82x2 family of devices are a wide voltage, high power drivers ideal for a large range of industrial applications.

#### **DRV84x2: DRV8452 and DRV8462, Stepper Motor Driver with Autotorque, Silent Step Decay Mode, and Automatic Microstepping**

The auto-torque feature boosts system efficiency by adjusting the coil current according to the load torque. The standstill power saving mode automatically reduces power loss during motor hold condition. The silent step decay mode enables noiseless operation.

The internal current sense architecture eliminates the need for external sense resistors, therefore saving PCB area and system cost. The built-in indexer of the DRV8462 supports up to 1/256 microstepping, and the automatic microstepping mode interpolates the input STEP signal to reduce overhead on the controller MCU.

Sensor-less stall detection eliminates end stops from the system. The device supports protection and diagnostic features for robust and reliable operation.

#### **DRV89x2: DRV8952 and DRV8962, Four-channel Half-Bridge Driver with Current Sense Outputs**

The output stage of the device consists of N-channel power MOSFETs configured as four independent half-bridges, charge pump regulator, current sensing and regulation circuits, current proportional outputs and protection circuitry.

Integrated current sensing across the high-side MOSFETs allows the device to regulate the load current when the load is connected from output to ground. A regulation current limit can be set with an adjustable external voltage reference (VREF). Additionally, the device provides four proportional current output pins, one for each half-bridge high-side FET.

A low-power sleep mode is provided to achieve ultralow quiescent current. Internal protection features are provided for supply under-voltage lockout (UVLO), charge pump under-voltage (CPUV), output over current (OCP), and device over-temperature (OTSD).

#### **DRV82x2: DRV8252 and DRV8262, Single or Dual H-Bridge Motor Drivers with Current Sense Output**

The device integrates two H-bridges. The two H-bridges can be paralleled together. Reference the data sheet for more information.

Similar to the DRV 89x2, integrated current sensing across the high-side MOSFETs allows the driver to regulate the motor current during start-up and high load events. A current limit can be set with an adjustable external voltage reference. Additionally, the device provides output current proportional to the motor current for each H-bridge. The integrated sensing uses a current mirror architecture, removing the need for large shunt resistors, saving board area and reducing system cost.

A low-power sleep mode is provided to achieve ultra-low quiescent current. Internal protection features are provided for supply under-voltage lockout (UVLO), charge pump under-voltage (CPUV), output over current (OCP), and device over-temperature (OTSD).

### 1.2 Purpose and Scope

This document is designed to be used as a start-up guide and to supplement the DRV84x2\_DRV82x2\_DRV89x2-EVM. The scope of this document is to provide the user with a guide to evaluate the DRV84x2\_DRV89x2\_DRV82x2 family of devices using a Graphical User Interface (GUI). The GUI application is required to control the EVM. This document covers the required EVM connections, configuration, and steps to use the GUI application for evaluation.

## 2 Jumpers Table and Setup

The jumpers J16-18 and J20 in the board are populated differently depending on which version of the board was ordered. This has been done for simplicity's sake as you must simply populate all jumpers with jumper shunts.

Make sure to use jumper shunts to completely populate J4 and J8. J10 must be populated for there to be communication with the EZFET. Use the following [Figure 2-1](#) to populate the following jumpers for all variants:

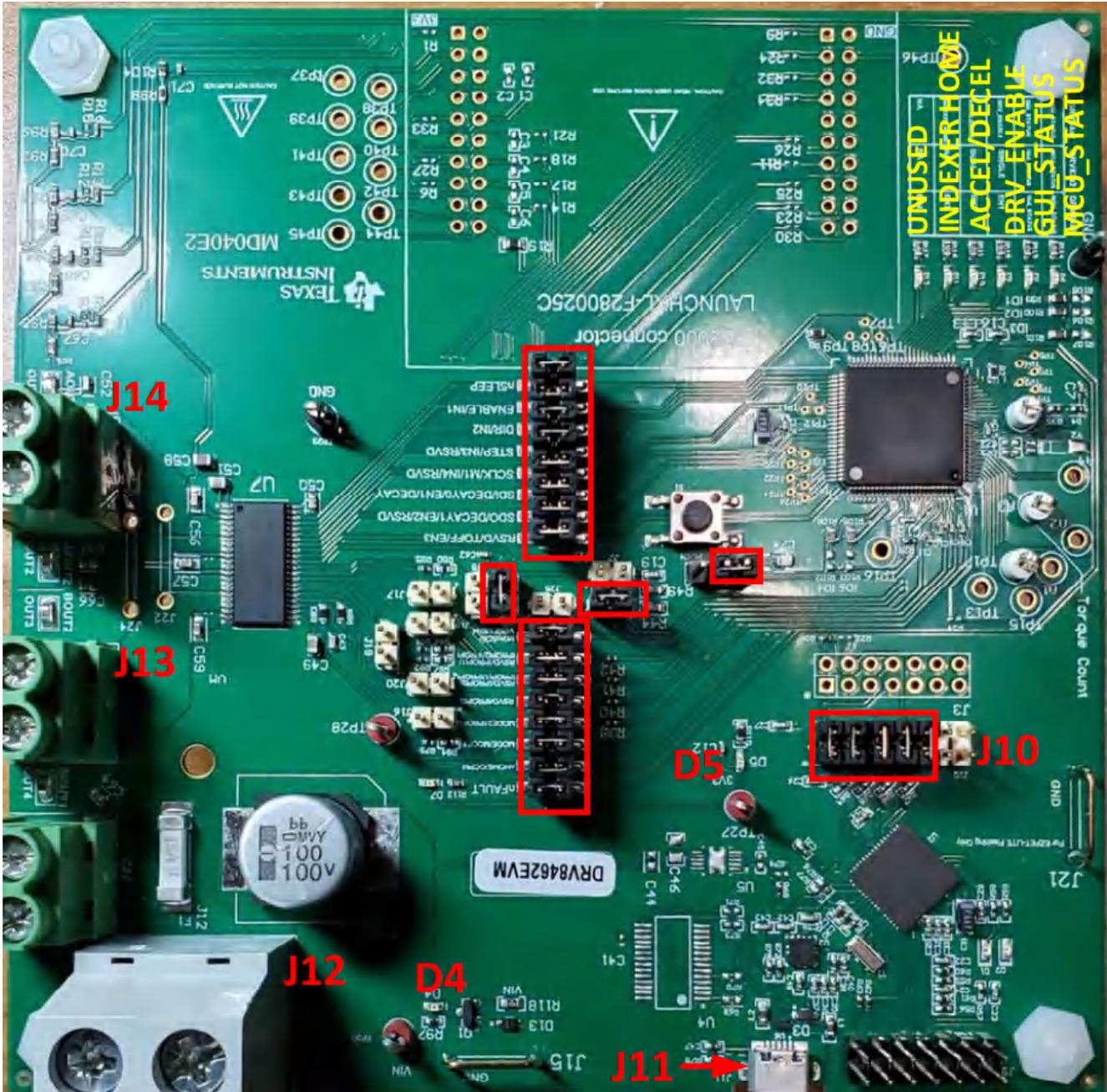


Figure 2-1. Jumper Population Guideline

Table 2-1. Jumper Identification Table

Description of jumper function and action if populated for different variants.

Jumpers	DRV84X2	DRV89X2	DRV82X2
J5	VREF with C2K	VREF with C2K	VREF with C2K
J6	VREF with MSP430	VREF with MSP430	VREF with MSP430

**Table 2-1. Jumper Identification Table (continued)**

Description of jumper function and action if populated for different variants.

Jumpers	DRV84X2	DRV89X2	DRV82X2
J7	VREF manually	VREF manually	VREF manually
J4/J8	MCU Communication Jumpers	MCU Communication Jumpers	MCU Communication Jumpers
J10	EZFET Communication Jumper	EZFET Communication Jumper	EZFET Communication Jumper
J11	Micro USB Connection	Micro USB Connection	Micro USB Connection
J13	BOUT1/BOUT2	OUT3/OUT4	OUT3/OUT4
J14	AOUT1/AOUT2	OUT1/OUT2	OUT1/OUT2
J25	DNP	DNP	Disconnect for dual H Bridge Mode. Connect for single H Bridge mode, connects VREFs (Pin 33 and Pin 34 together).
J26	DNP	DNP	Disconnect for single H-Bridge Mode, Disconnects CREF2 from MSP430 in single H Bridge mode. Leave connected for dual H Bridge mode.
J19	DNP	DNP	Not working properly at the moment. Do not populate. Instead connect the driver side of J18 and J17 with a jumper cable to connect IPROPIs together

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**Note**

Jumpers J16-J20 placement will vary depending on the different variants. Make sure to follow the following schematics to ensure functioning of each variant.

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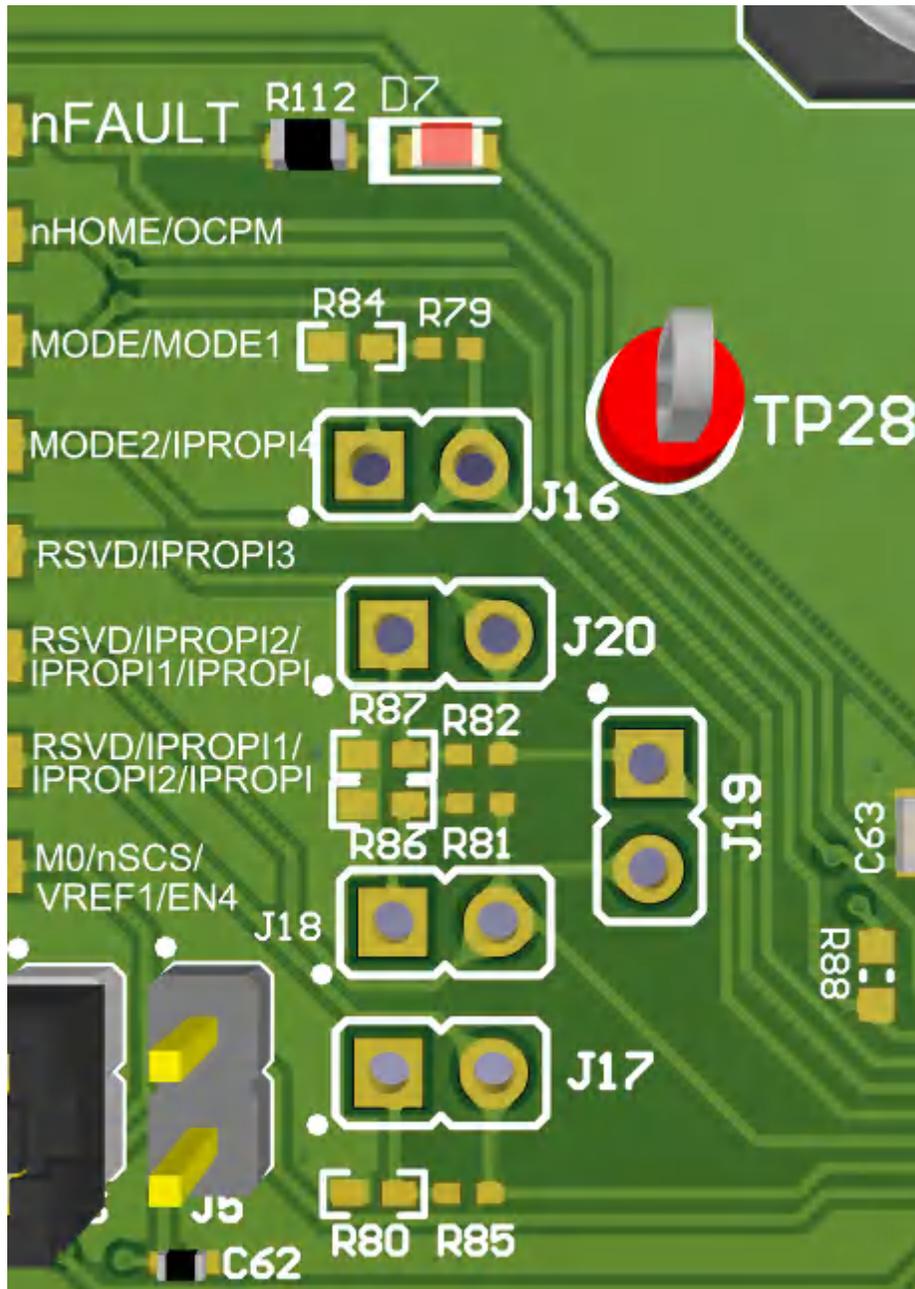


Figure 2-2. DRV84X2EVM Current Regulation Jumpers 3D View

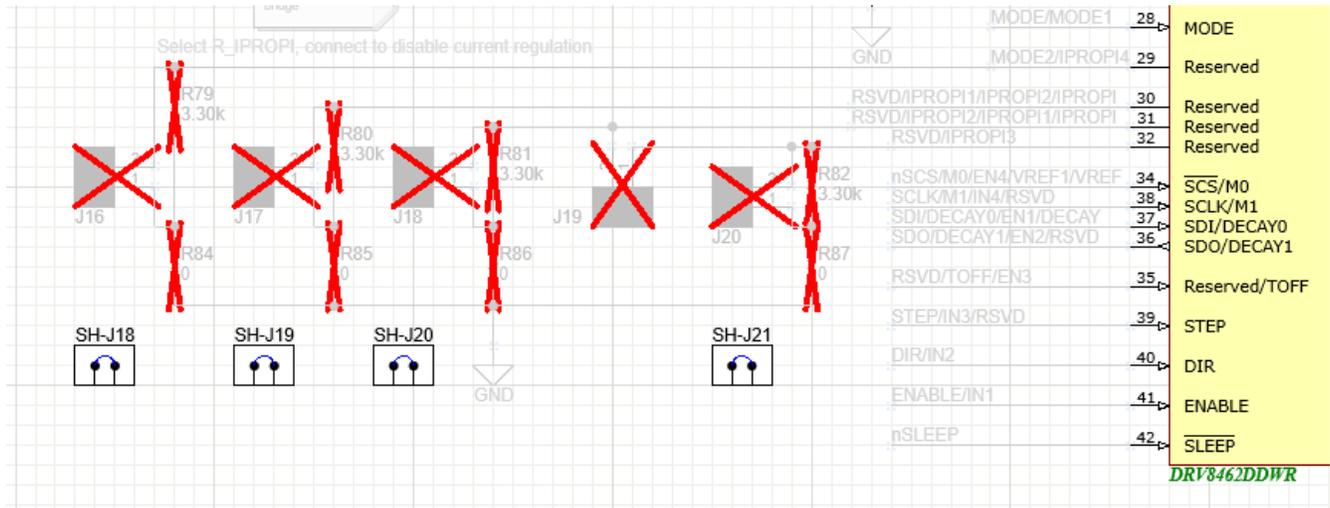


Figure 2-3. DRV84X2EVM Current Regulation Jumpers Schematic

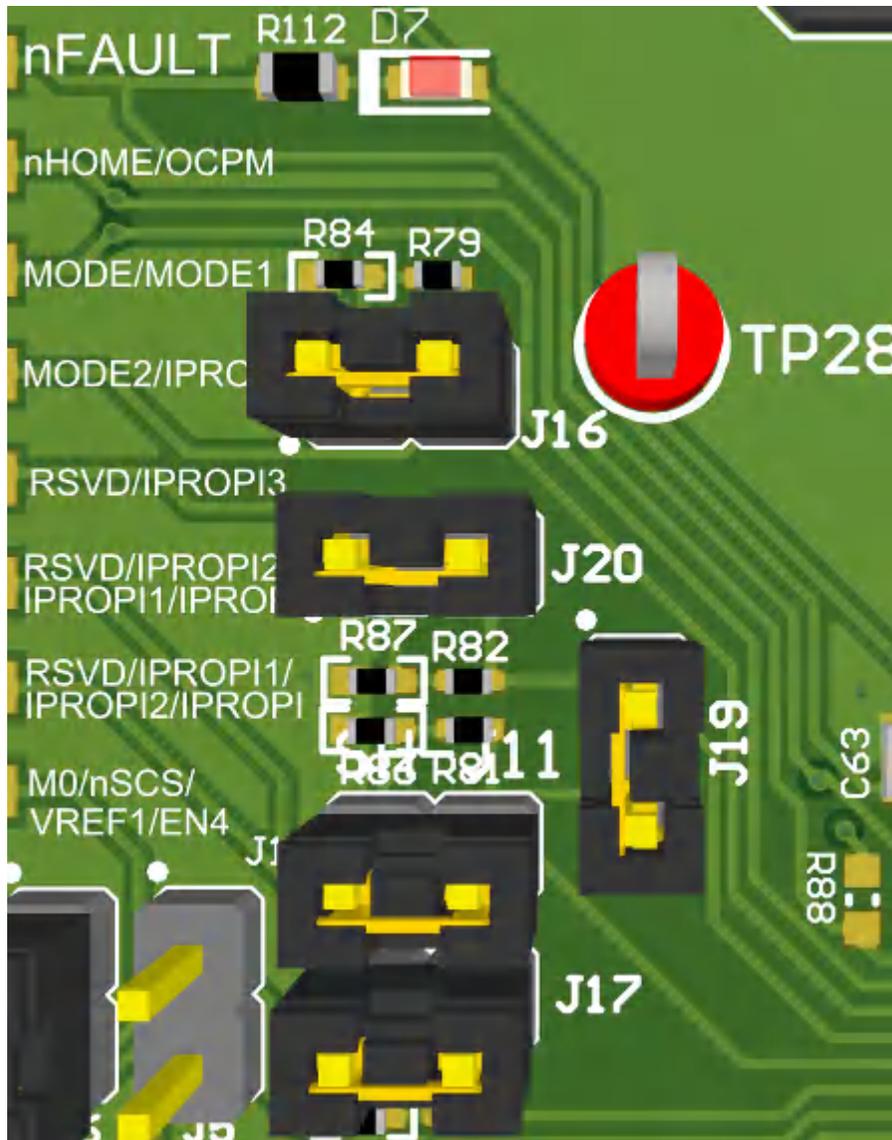


Figure 2-4. DRV89x2EVM Current Regulation Jumpers 3D View

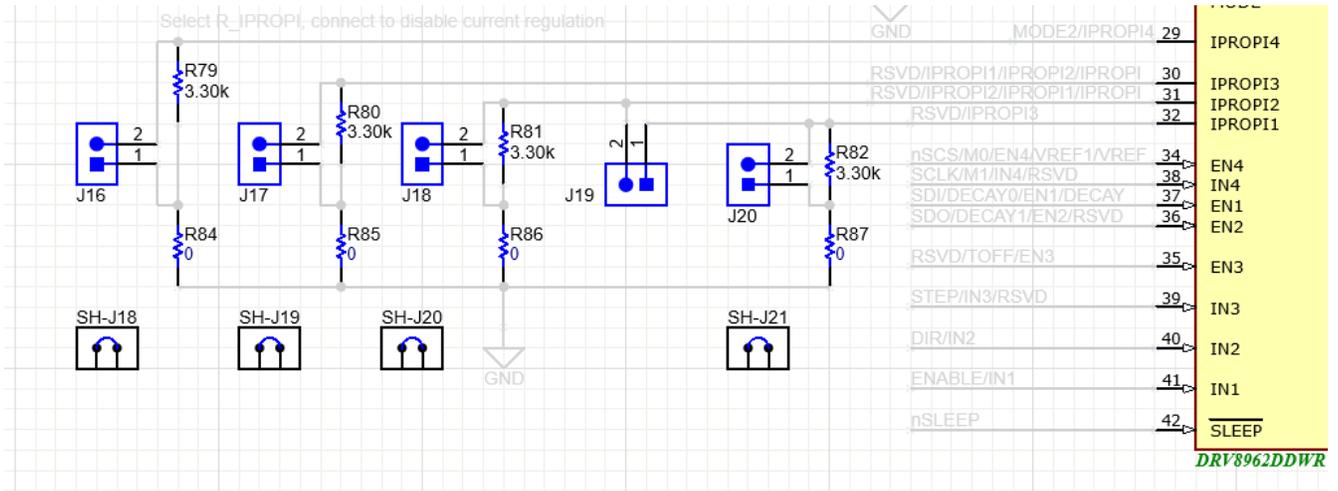


Figure 2-5. DRV89x2EVM Current Regulation Jumpers Schematic

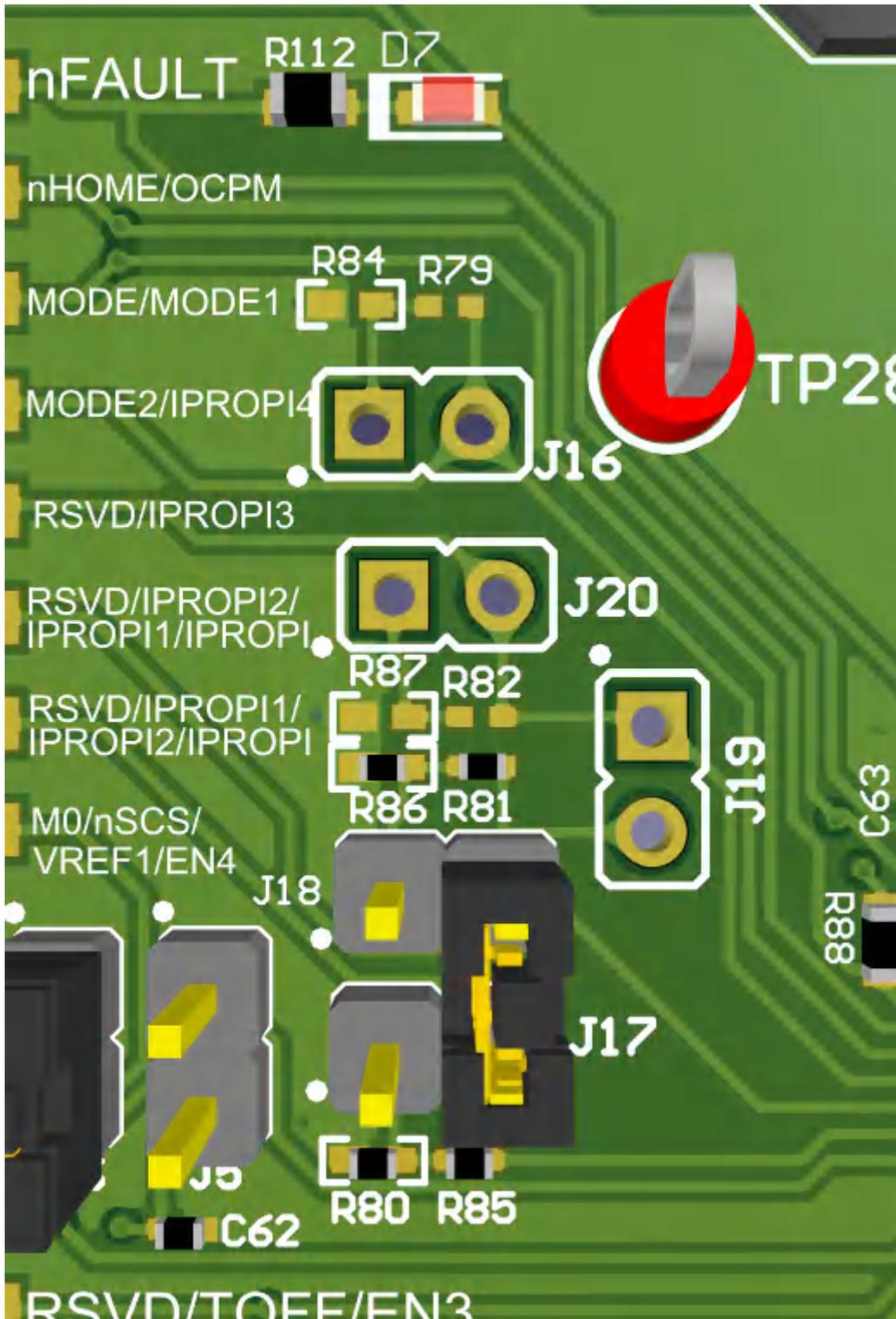
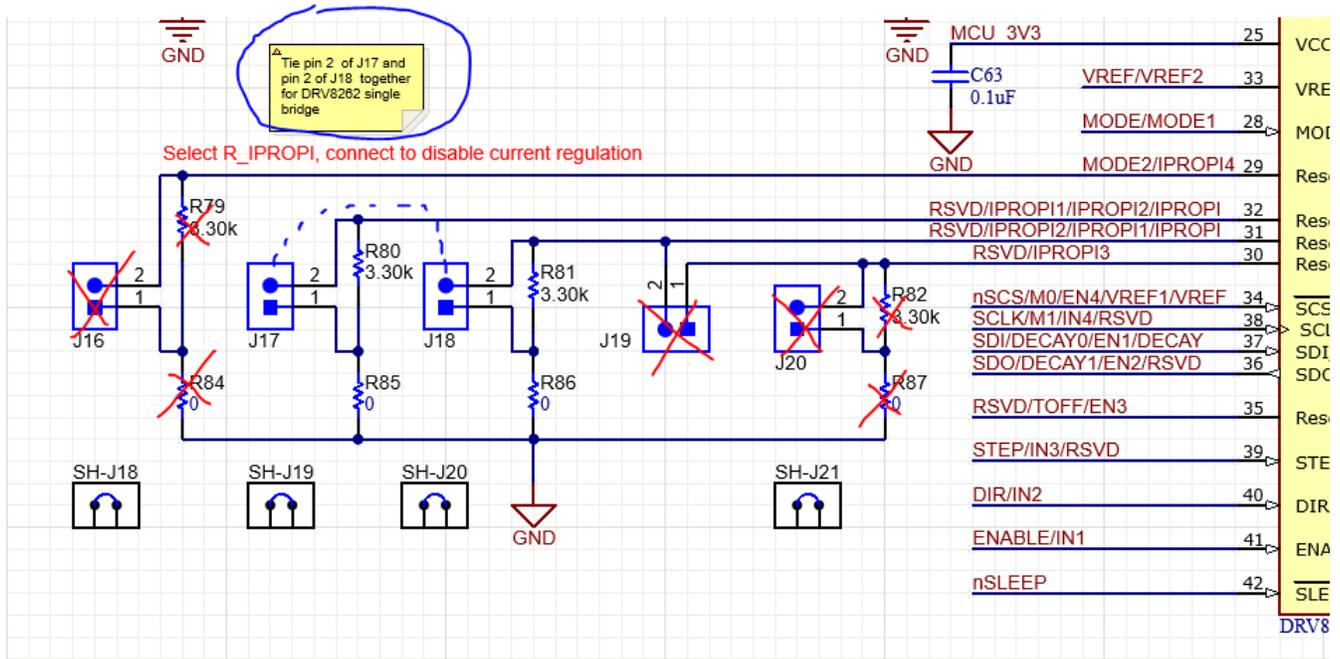


Figure 2-6. DRV82x2EVM Current Regulation Jumpers 3D View



**Figure 2-7. DRV82x2EVM Current Regulation Jumpers Schematic**

For more detailed information be sure to download the hardware files and schematics. Once you have verified that all shunts and jumpers are in the correct location you can move on to hardware setup.

### 3 Hardware Setup

1. Connect the USB cable to J11 of the EVM and a computer.
2. If utilizing the Stepper Motor Driver, connect the stepper motor to screw terminal connectors J13 and J14. A-phase can be connected to J14 and B-phase to J13. If using the dual half bridge driver, or the half bridge driver use terminals J13 and J14 as indicated to connect in the desired setup.

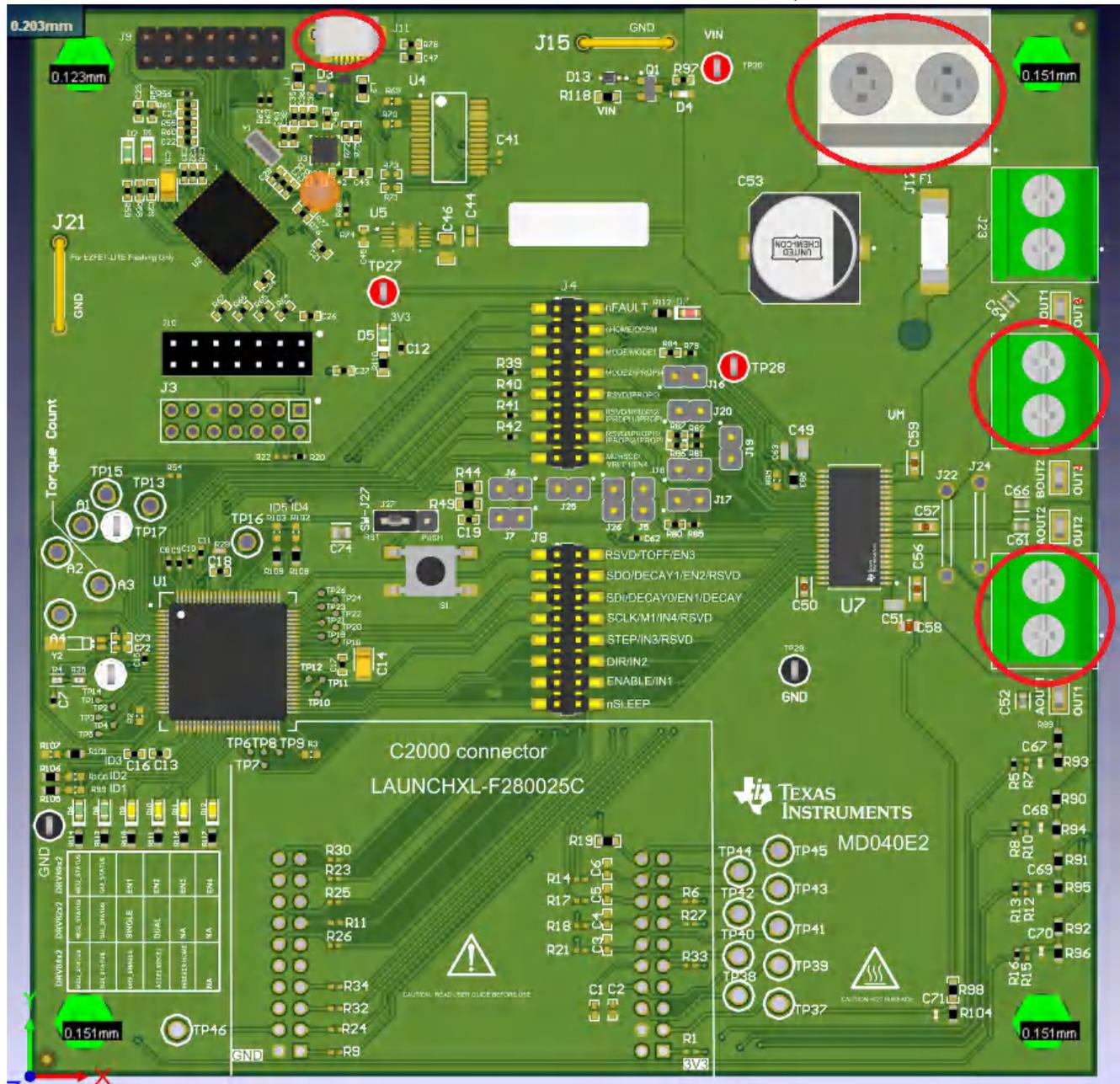


Figure 3-1. External Connections

Jumper	Explanation
J11	Micro-USB Connection
J12	Fuse protected power supply input and GND
J23	Power supply connection high side and low side connection terminals
J13	BOUT1/OUT3, BOUT2/OUT4 connection point. Top Right.
J14	AOUT2/OUT2, AOUT1/OUT1 connection point. Middle Right.

**WARNING**

At the moment the silk screen has the following errata:

- The Silk screen says OUT3, it should say OUT4
- The Silk screen says OUT4, it should say OUT3

4. Observing correct polarity connect the lab power supply to the large screw terminal block J12. CAUTION:

**CAUTION**

A reverse polarity connection can permanently damage the EVM hardware and can cause a fire hazard and / or personal injury.

VM in the left, GND on the right. VM is connected to the fuse.

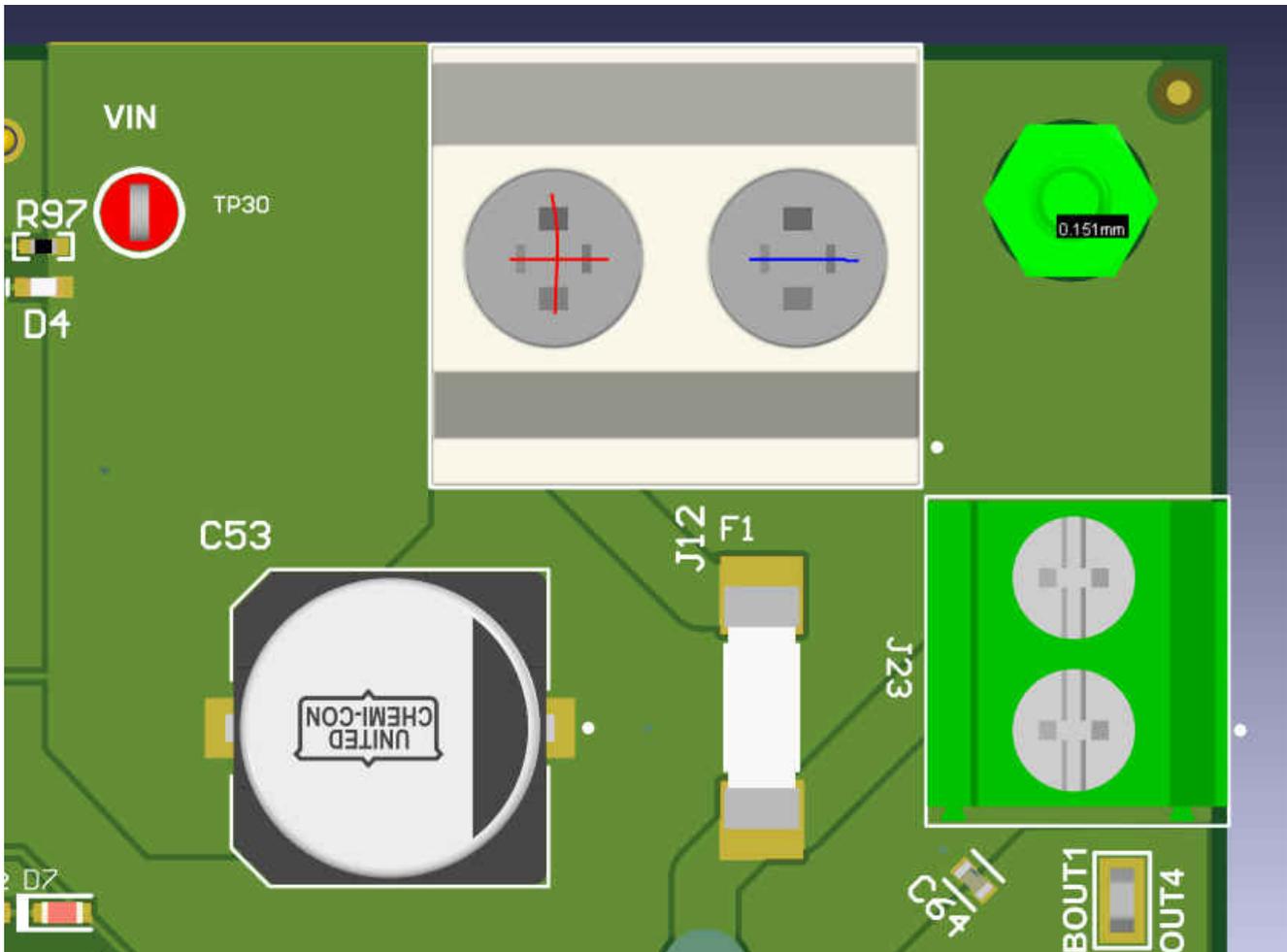


Figure 3-2. Polarity of J12

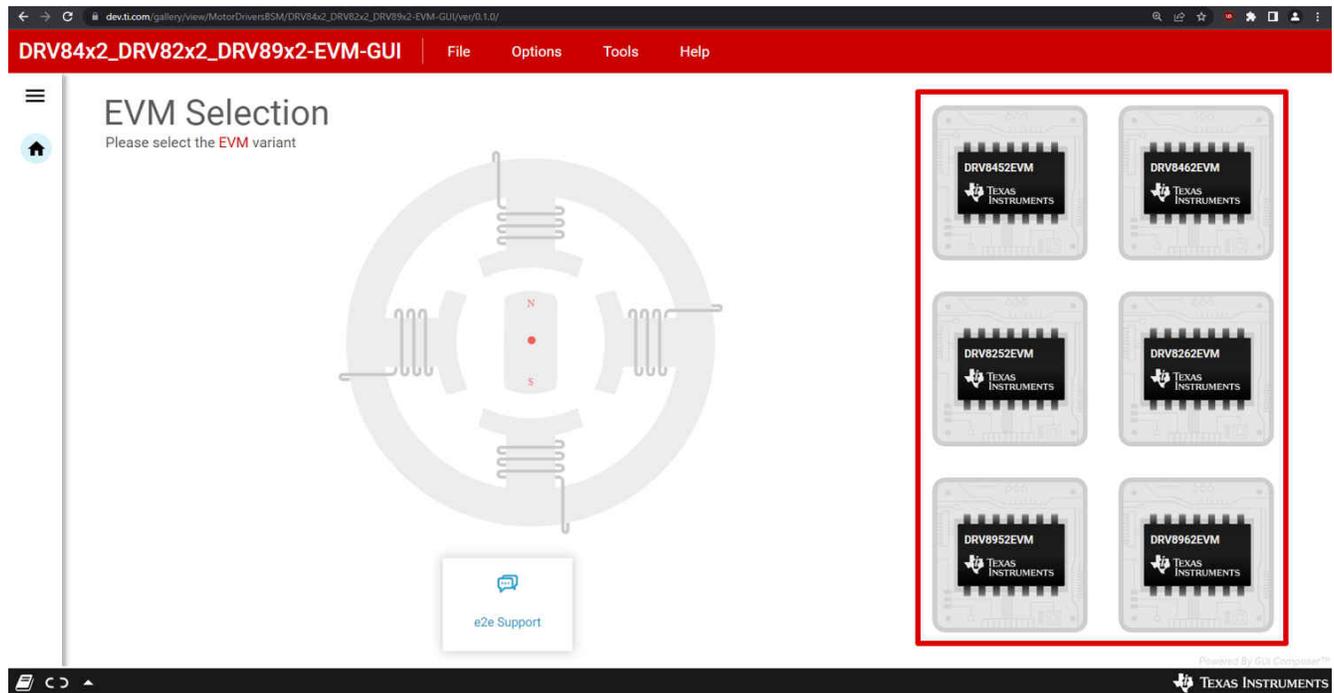
5. Set the lab supply for 12 V and enable output on lab supply. If the unit displays current consumption, there should be approximately 20 mA drawn from the lab supply at this state.
6. Verify the 3V3 LED D5 and VM LED D4 are illuminated. The nFAULT LED D7 may flash momentarily when VM power is switched on.
7. Verify MCU\_STATUS LED D6 is blinking at approximately 1 Hz. If the STATUS LED is not blinking perform a firmware reset using the push button S1 with jumper J27 in 1-2 RST position. The MCU\_STATUS LED D6 will blink now if the EVM hardware is functioning normally
8. The EVM is ready to be used with the GUI application ([Launching the DRV84x2\\_DRV82x2\\_DRV89x2-EVM GUI Application](#)). In certain situations, such as while disconnecting and reconnecting VM power before the power supply capacitors are fully discharged a proper firmware reset can fail to happen. A proper reset is indicated by the STATUS LED D6 blinking at a rate of approximately 1 Hz. If the Status LED is not blinking as expected, press the reset push button once with jumper J27 installed in the RST position.
9. Do not unplug the USB cable while the VM power is active. If you do, switch off the VM power, wait until the VM power is fully discharged and proceed to step 2. The latest version of the GUI application is bundled with the latest version of the EVM firmware.
10. A firmware update is suggested before selecting and connecting to an EVM variant using the GUI application. The firmware update procedure is described in the [updating firmware](#) section of this User's Guide.

## 4 Launching the DRV84x2\_DRV82x2\_DRV89x2-EVM GUI Application

Whether using the desktop or web version of the GUI, the user experience and steps covered below will be the same. It is assumed the hardware setup steps in the previous section have already been completed.

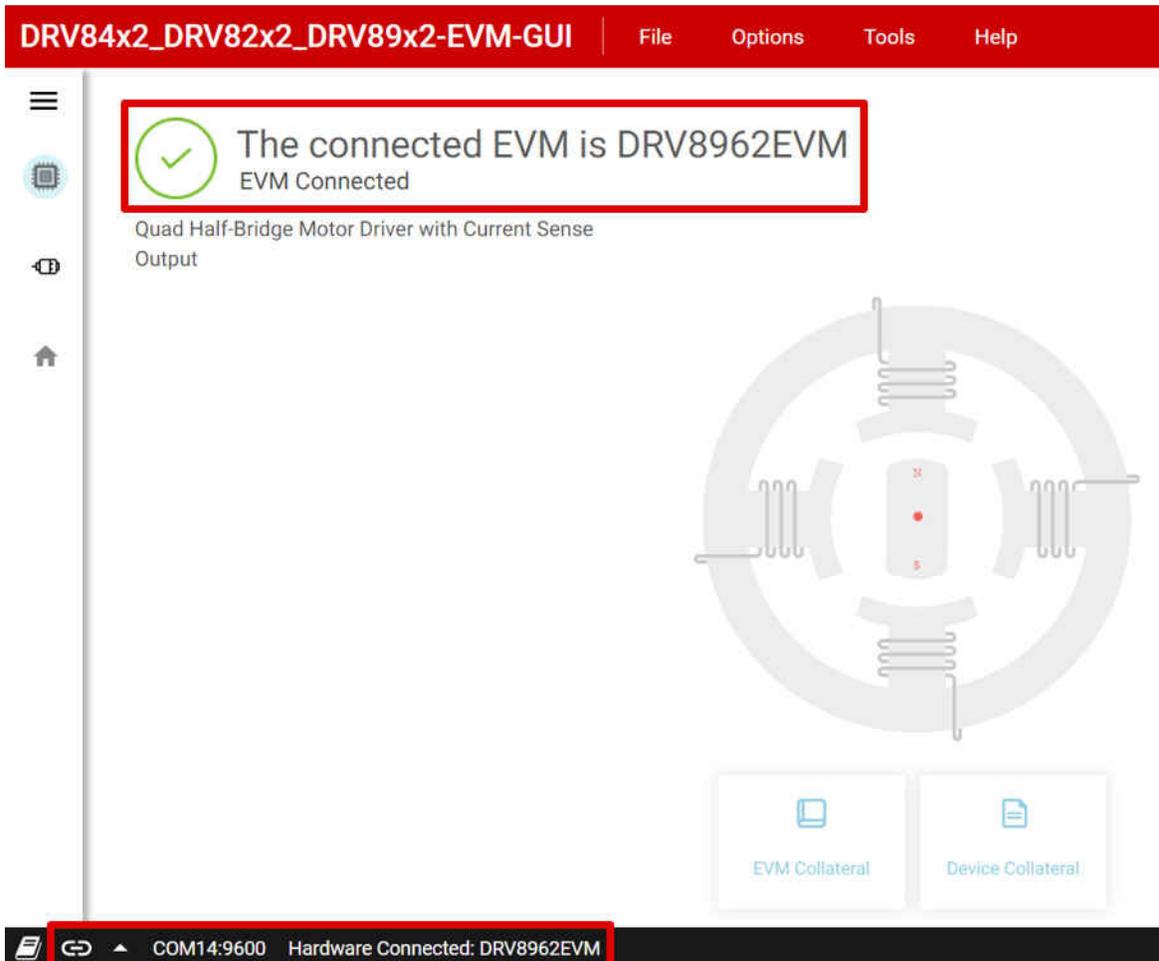
1. Launch the GUI application using Chrome web browser or from your local desktop installation. Note you'll have to log-in to [the TI Dev Gallery](#) using your myTI log-in credentials prior to launching the app while running from a web browser.
  - a. Hyperlink for running app in Chrome: [Web GUI](#)
2. From the screen referenced in [Figure 4-1](#)

Device selection screen within GUI



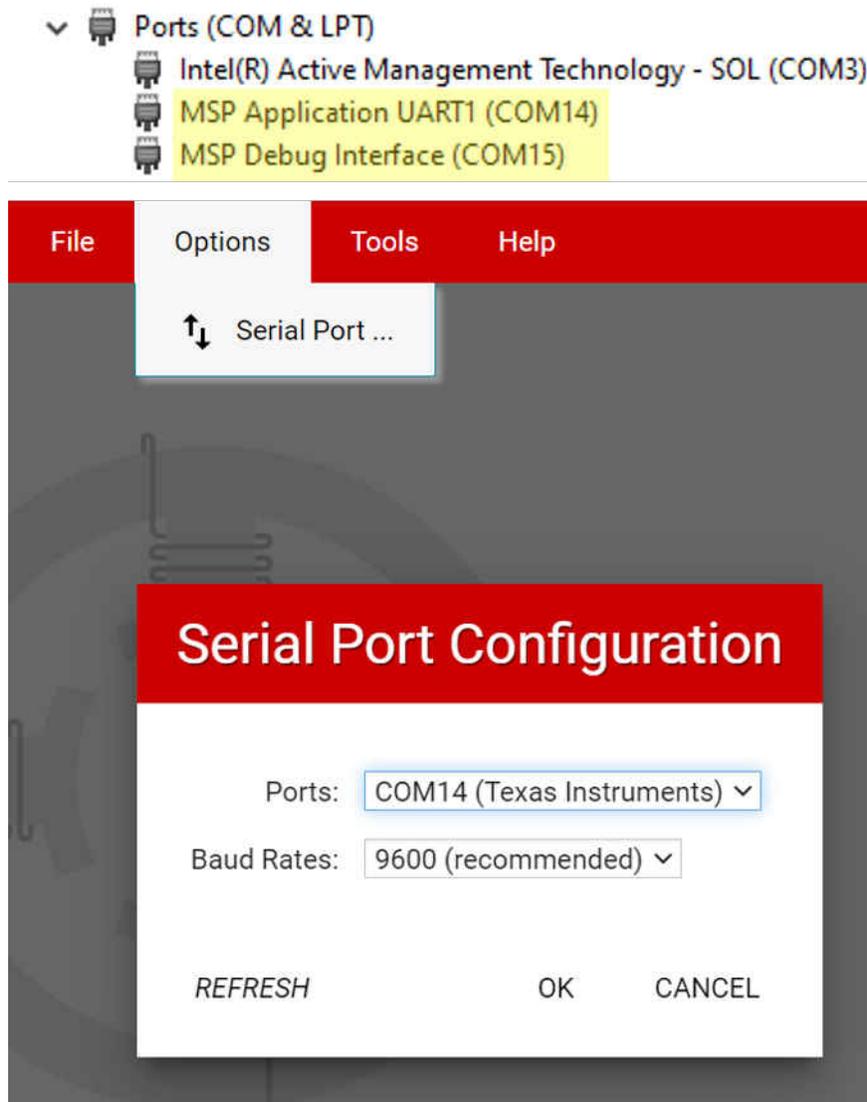
**Figure 4-1. DRV84x2\_DRV82x2\_DRV89x2-EVM GUI Home Screen**

3. After clicking the correct EVM type, the GUI application will initiate communications with the EVM. Connection confirmation will be displayed as shown below in [Figure 4-2](#):



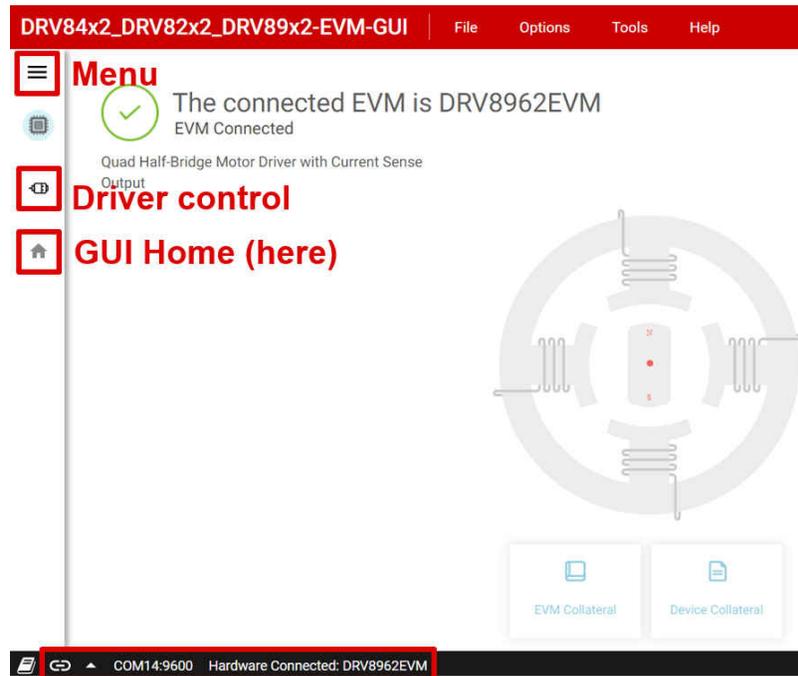
**Figure 4-2. Successful EVM Connection**

4. If the GUI app connection with the EVM is repeatedly not successful, follow the below listed steps to debug the issue.
  - a. Check if the serial communications parameters were properly configured. In the GUI, click on the “Options” menu, and select “Serial Port”. Verify if the port selected matches the MSP Application UART1 enumerated in the Device Manager, Windows system Control Panel. The baud rate must be set to 9600 (recommended). If no MSP COMxx ports were enumerated and displayed in the Windows Device Manager, ensure proper power sequencing was followed. If necessary do a power off and on cycle. If the following Windows Device Manager information is still not visible after the power cycle it points to a hardware connection issue.



**Figure 4-3. Serial Port Configuration**

- b. It is possible that the EVM has a much older version of the firmware. Perform a firmware update using the procedure described in [Updating Firmware](#)
  - c. Check if the MCU\_STATUS LED D6 is blinking at approximately 1 Hz. If the STATUS LED is not blinking, perform a firmware reset using the push button S1 with jumper J23 in 1-2 RST position. Attempt to connect the GUI app with the EVM again.
5. At this point, the user may set-up the EVM for device evaluation:
  - Driver Control page with configuration and diagnostic options.
  - GUI Home page to re-select the EVM if necessary.

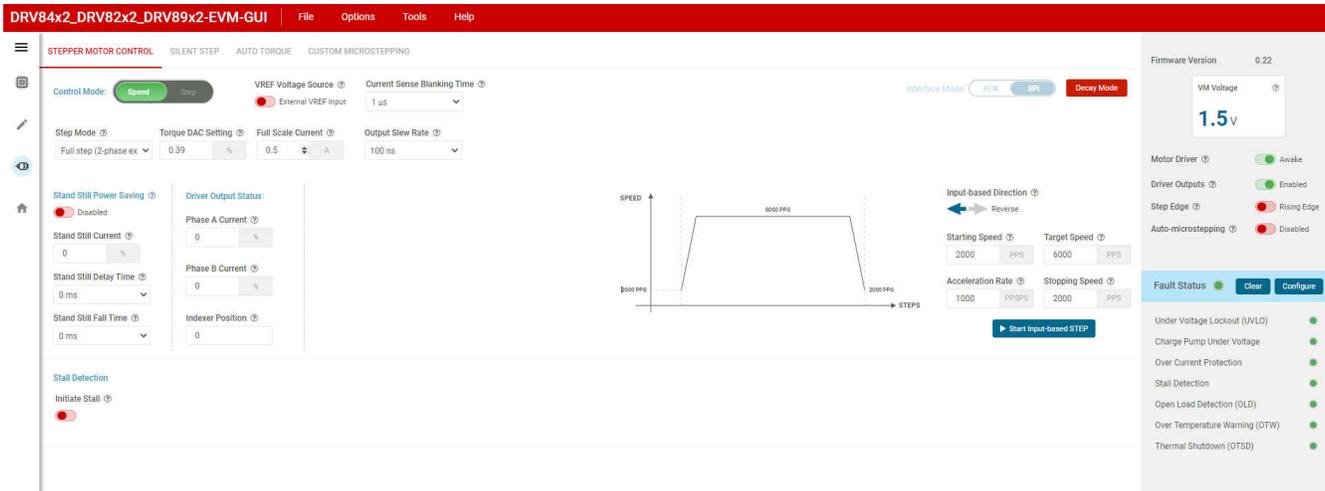


**Figure 4-4. DRV84x2\_DRV82x2\_DRV89x2-EVM GUI Navigation**

6. The "Driver Control" tab will display the firmware version in the top right corner. When you click on "Help > About" it should display the GUI version, Device Rev ID, and the EVM firmware version.
7. Using the DRV8462 as an example, go to the "STEPPER MOTOR CONTROL" tab in the "Driver Control" page. Set the "Motor Driver" to "Awake" and "Driver Outputs" to "Enabled". With default settings click on the "Start Input-based STEP" button. The motor should spin in one direction. Change the direction using the "Input-based Direction" control. The motor should spin in the opposite direction.

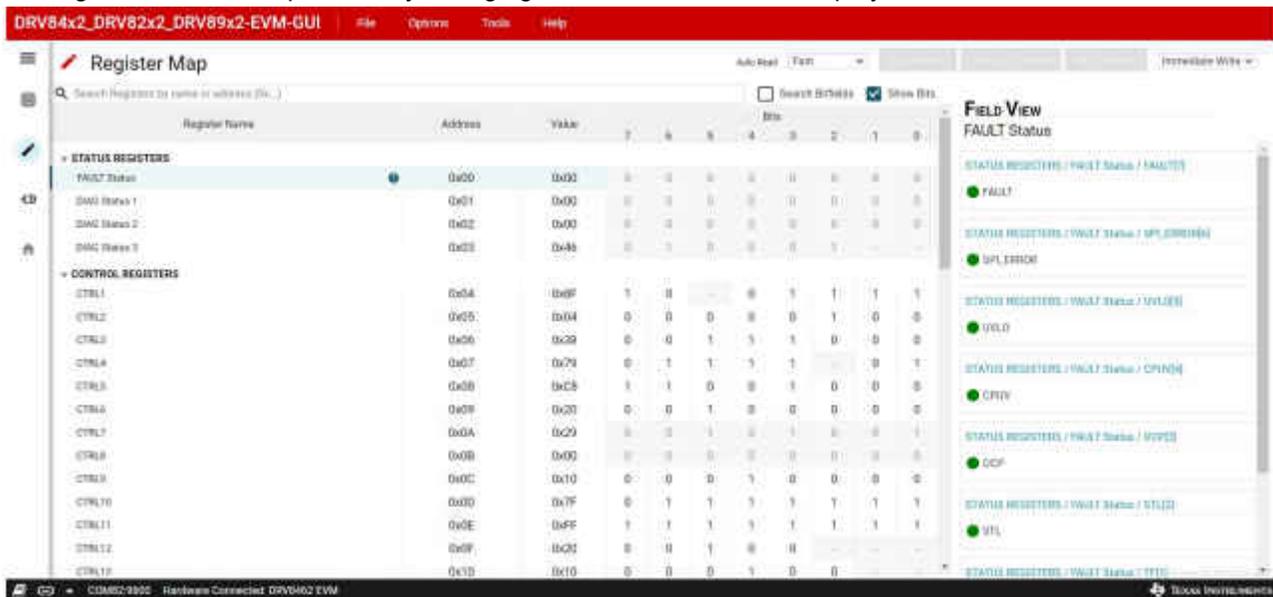
## 5 GUI Operations DRV8462

- Go to the “STEPPER MOTOR CONTROL” tab in the “Driver Control” page. Set the “Motor Driver” to “Awake” and “Driver Outputs” to “Enabled”. With default settings click on the “Start Input-based STEP” button. The motor should spin in one direction. Change the direction using the “Input-based Direction” control. The motor should spin in the opposite direction.



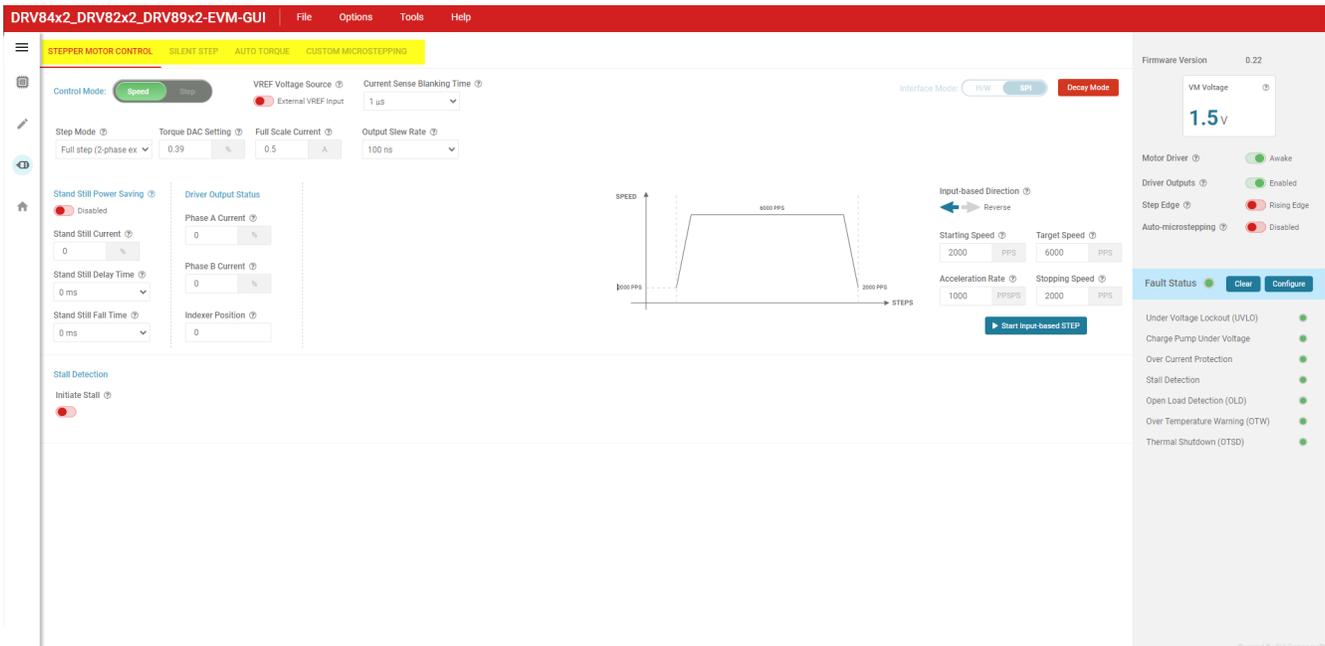
**Figure 5-1. Stepper Motor Control**

- The “Register Map” menu will display all the device Registers. Register values can be modified directly either using the “Field View” panel or by changing the hexadecimal data displayed in the “Value” column.



**Figure 5-2. Register Map**

- All Registers settings can be saved as a 'regs.json' file using the “File” menu “Save Registers” option. The saved values can be loaded back to the Registers from the saved 'regs.json' file using the “File” menu “Load Registers” option.
- The device features can be evaluated using the tabs in the "Driver Control"



**Figure 5-3. Driver Control Menu**

5. Refer to the DRV8462 “ADVANCE INFORMATION” data sheet to understand the integrated features of the stepper motor driver device. Only the key features are described below. The GUI provides access to all the features in the device.
  - a. Stand Still Power Saving: This feature defines the hold current level while the motor is in stand still. Typically hold current required can be significantly lower than run current. This feature will save power as well as avoid unnecessary heating of the motor. The default setting for the “Stand Still Current” is 50 % of the run current defined by “Torque DAC Setting” and “Full Scale Current”. The minimum value that can be input is 1 %. Enable this feature and set the desired hold current value as well as required delay times designed for your application.

### Stand Still Power Saving ?

Disabled

### Stand Still Current ?

100 %

### Stand Still Delay Time ?

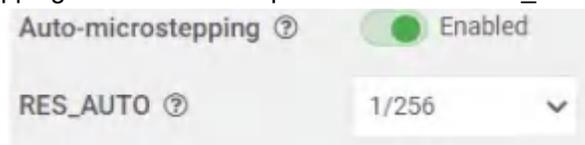
64 ms

### Stand Still Fall Time ?

64 ms

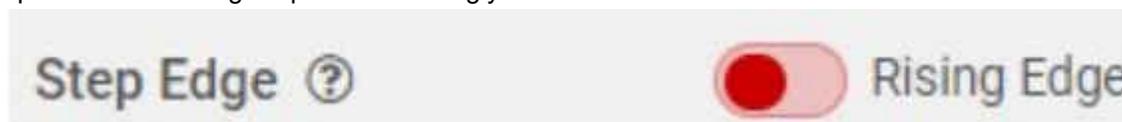
**Figure 5-4. Stand Still Power Saving**

- b. Auto-microstepping: When enabled this feature automatically interpolates the step input pulses to the selected auto microstepping modes in the drop down menu of RES\_AUTO.



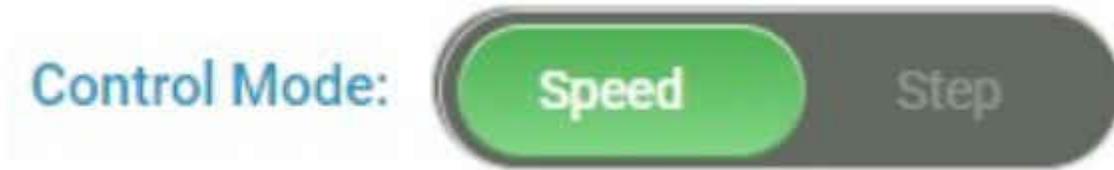
**Figure 5-5. Auto Microstepping & RES\_AUTO**

- c. Step Edge: This setting selects step input response to either rising edge or both edges. The default setting is rising edge. When “Both Edges” option is selected, the motor will step with double the target speed. Set the “Target Speed” accordingly to avoid a motor stall.



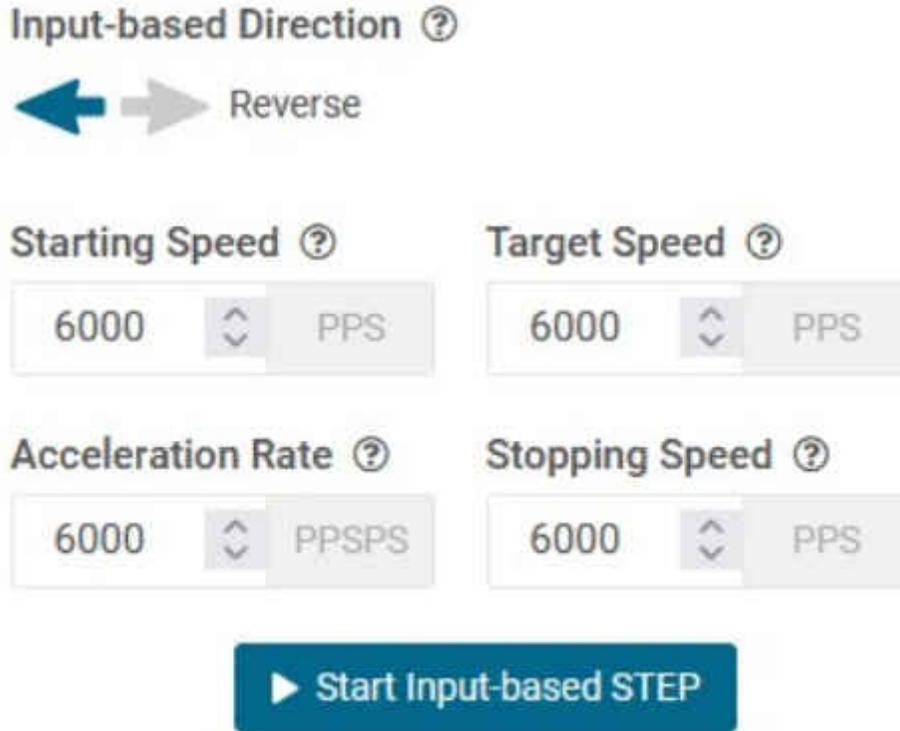
**Figure 5-6. Step Edge**

- d. Control Mode: This is a GUI app feature which allows selection between “Speed” mode and “Step” mode. In speed mode the motor will run at the set target speed using the defined acceleration and deceleration rate motion profile. In “Step” mode the motor can be stepped to the desired position by setting the required number of steps at the set target speed. When target speed is set to 1 PPS (pulse per second) set



**Figure 5-7. Control Mode**

Setting the starting, stopping, acceleration rate and target speed to the same value will start motor directly at the target speed.



**Figure 5-8. Input Based STEP Control Panel**

- e. Stall Detection: This feature can be enabled by using the “Initiate Stall” slide switch. While enabled, all stall detection settings and features are revealed by the GUI. Stall detection can be used in either learn mode which automatically learns the stall threshold value using a learn procedure or manual stall threshold value entry mode by disabling the “Learn Mode”.



**Figure 5-9. Stall Detection**

Stall detection requires the drive to operate in Smart Tune Ripple Control Decay mode which is the default setting of the device. The Decay mode can be modified using the “Decay Mode” GUI push button in the STEPPER MOTOR CONTROL tab. Test point A3 on the EVM outputs an analog voltage equivalent to the Torque Count updated once every 8 ms. Torque Count = (Output Voltage x 4095) / 3.3.



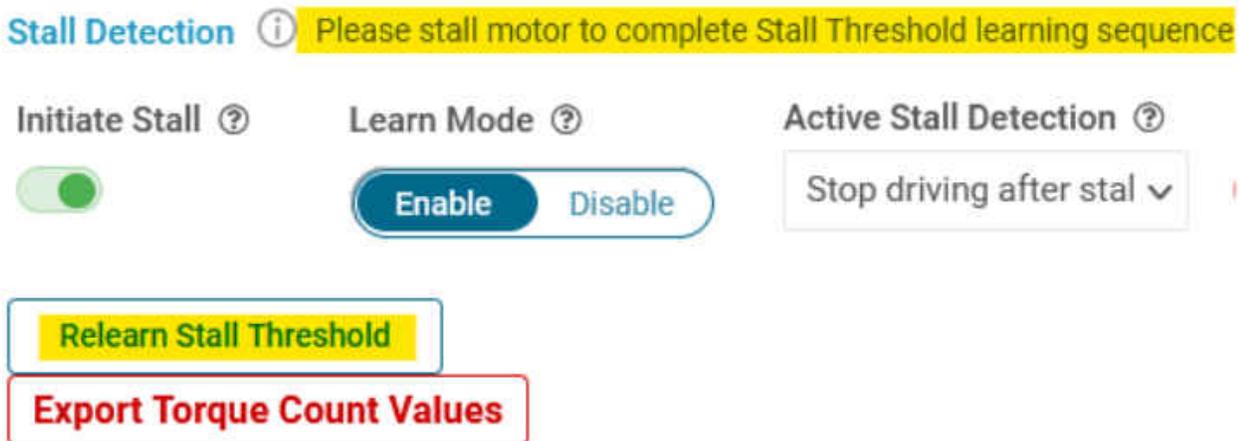
**Figure 5-10. Decay Mode**

The GUI app has a feature to disable stall detection during acceleration. The default setting for this is “Disabled”. Wait for the acceleration to complete which is indicated by the LED D10 off, before performing a stall threshold learn.

**Note**

The torque count is 4095 when the stall detection is disabled during acceleration. After the acceleration is completed, stall detection is automatically enabled and the actual torque count is displayed.

In the learn mode, run the stepper motor at the desired target speed with no load. Wait for the “Stall Detection” message “Please stall motor to complete Stall Threshold learning sequence” and “Relearn Stall Threshold” push button to appear. Then manually stall the motor by safely using a pair of pliers with soft jaws or if you are using a linear system with mechanical travel end hard stop positions, allow the motor to hit the physical stop.



**Figure 5-11. Stall Threshold Learning**

A successful stall threshold learning will be indicated by a check mark icon and text “Stall threshold learning sequence complete”. A relearn can be done at any time by pressing the “Relearn Stall Threshold” button. If the “Active Stall Detection” is set to “Stop driving after stall” and “Reverse direction on stall fault” to off, which happen to be the default setting, the motor will stop immediately after a learning is completed and the “Stall Detection” indicator in the GUI status panel will turn red. The motor can be run again after pressing the “Clear” button to the right of the Fault Status indicator in the GUI. If you want to keep driving after stall you can enable it below.

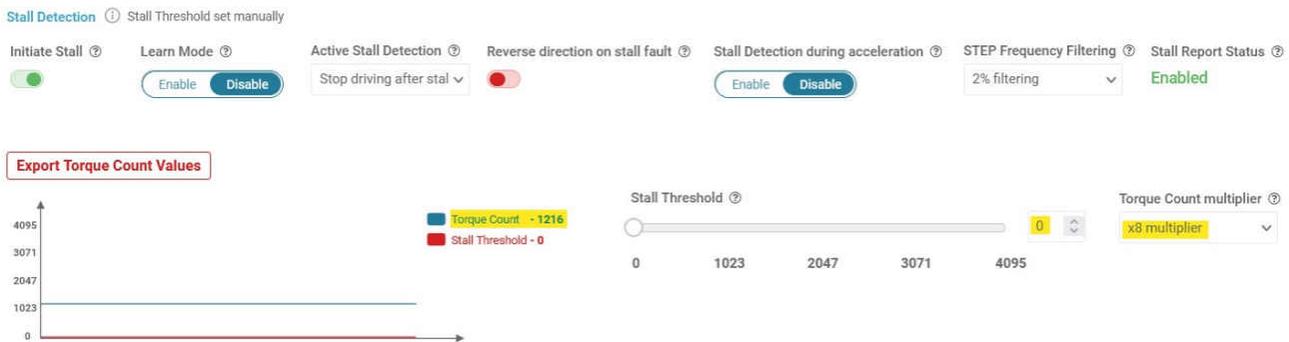


**Figure 5-12. Keep Driving After Stall Option**

In manual stall threshold entry mode run the motor with “Stall Threshold” slider set to zero. The torque count it displayed as well as plotted in the graph vs. time. Use the x8 multiplier if the torque count is low while using high DCR stepper motors.

**Note**

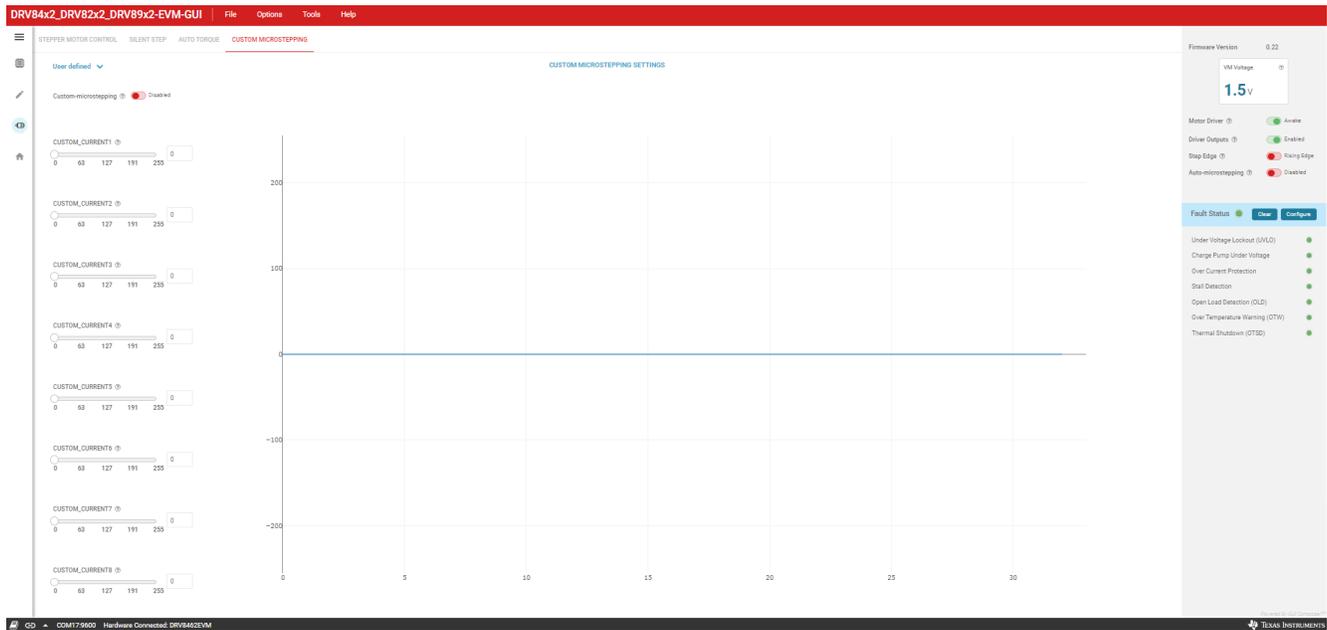
The torque count and set the threshold to 50 % of the torque count value or lower. Follow the same procedure as in the learn mode operation to detect a motor stall. Pressing the “Export Torque Count Values” exports 512 values of the historical torque count to an Excel file.



**Figure 5-13. Torque Count and Export Torque**

- f. Custom microstepping: To setup and enable this feature CUSTOM MICROSTEPPING tab should be used. Custom microstepping allows the user to define a custom current waveform other than the sine wave defined by the integrated microstepping indexer. When custom microstepping is enabled the integrated microstepping settings are ignored by the driver regardless of its setting.

A drop down menu allows the user to choose between “User defined” (default) or three other preset options available in the GUI. This is a GUI feature provided for ease of use. Click on the desired option, for example “Triangular” to automatically populate the Registers CUSTOM\_CURRENT1 to CUSTOM\_CURRENT8. Registers CUSTOM\_CURRENT1 to CUSTOM\_CURRENT8 define the first quadrant of the electrical cycle of the phase currents. Rest of the quadrants are automatically populated by the device including the zero values of the full electrical cycle. If the “User defined” option is selected, enter the values for a desired waveform. Enable the “Custom-microstepping” slide switch after the Registers are populated with the required values.



**Figure 5-14. Custom Microstepping**

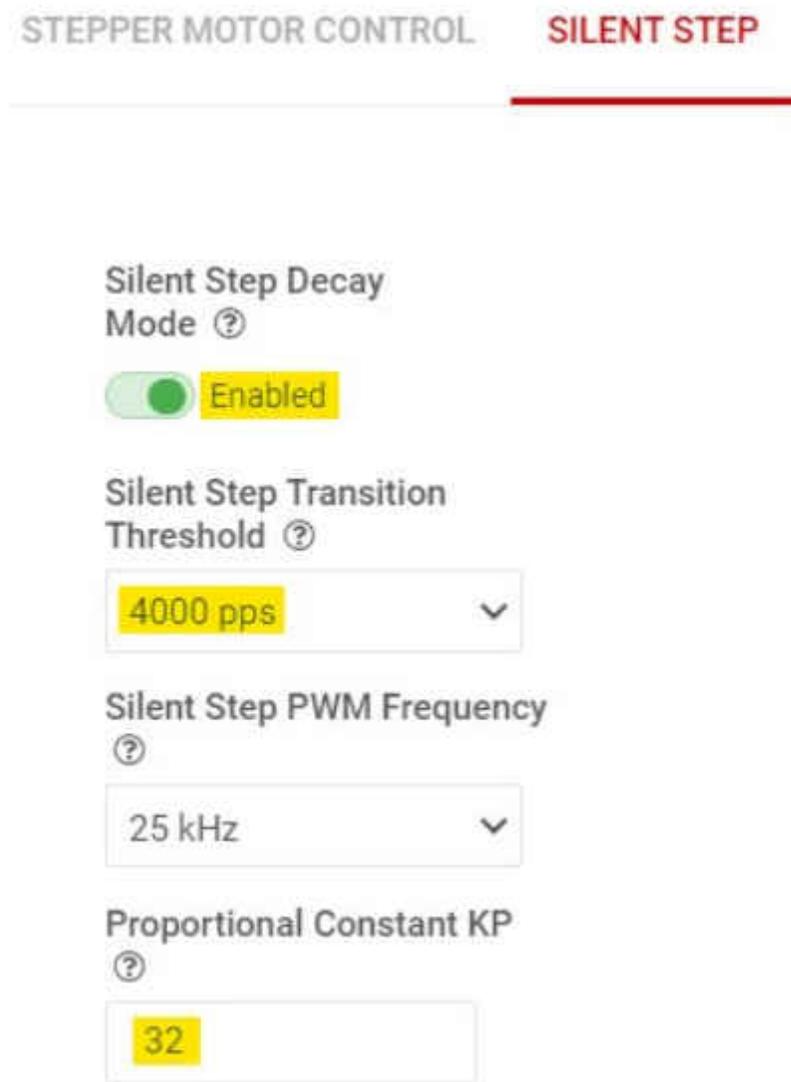
- g. Silent step Decay mode: To setup and enable this feature SILENT STEP tab should be used.

**Note**

Stall Detection will work only in Smart Tune Ripple Control Decay mode. Disable stall detection while Silent Step Decay Mode is used.

Set the “Silent Step Decay Mode” slide switch to “Enabled”. Select the desired silent step transition threshold step rate for your application. Start with a KP value of 32 and fine tune KP and KI to suit your application. Silent step decay mode benefits low stepping rate operation of the motor especially with low microstepping settings such as 1/4, 1/2, and Full step.

Use the following procedure to demonstrate this feature. Start with the default settings of the GUI in “Speed” Control Mode. Reduce the “Target Speed” to 2000 PPS and change “Step Mode” to 1/4 Step. Run the stepper motor. While running with these settings the motor usually generates an audible noise. Switch to the SILENT STEP tab. Set the “Silent Step Decay Mode” slide switch to “Enabled”. Select the “Silent Step Transition Threshold” to 4000 PPS. Set a KP value of 32. The motor will run quietly.



**Figure 5-15. Silent Step Control Panel**

- h. Auto Torque: To setup and enable this feature AUTO TORQUE tab should be used. The following example describes setting up Auto Torque with a J-4218HB2401 NEMA17 bipolar Stepper motor rated 1.7 A, commonly used in 3D printers. A 24 V power supply with > 3 A current rating is used for powering the EVM.
  - i. Start with the default settings of the EVM. Performing an EVM firmware reset using push button S1 will ensure all the default settings of the EVM are loaded. Click on the DRV8462EVM icon from the GUI home page to establish connection between the GUI app and the EVM.
  - ii. Go to the “Motor Control” menu in the left-hand side menu bar. Set “Motor Driver” to “Awake”. Increase the Full-Scale Current setting to 2 A in the STEPPER MOTOR CONTROL tab. Set “Driver Outputs” to “Enable”. Start the motor using the “Start Input based STEP” push button.
  - iii. Switch to the AUTO TORQUE tab of the GUI. Enable Auto Torque mode using the slide switch.
  - iv. Next, while the motor is running unloaded and with the default settings of the “Learn” parameters, initiate a learn by pressing the “Auto Torque Learn” push button. A green check mark with text “Learn Completed” will appear as soon as the learning is completed. Relearning can be done at any time with the motor running unloaded at any time by pressing the “Auto Torque Learn” push button.
  - v. Configure the minimum and maximum current limit values in “Loop Regulation” section. These are 8-bit integer values, 0 to 255 in decimal. Set the minimum current limit value to 48 which will be equal to  $(48/256) * 2 \text{ A}$  or 375 mA. With 375 mA drive current, this stepper motor will have sufficient

torque to run with a light load without losing steps or stalling. This is the criteria for choosing the minimum current limit value in an application. Set the maximum current limit value to 192 which will be equal to  $(192/256) * 2A$  or 1.5A. A higher maximum value can be chosen if needed by the application. Auto torque will allow over driving the motor for short periods of time during transient higher load torque.

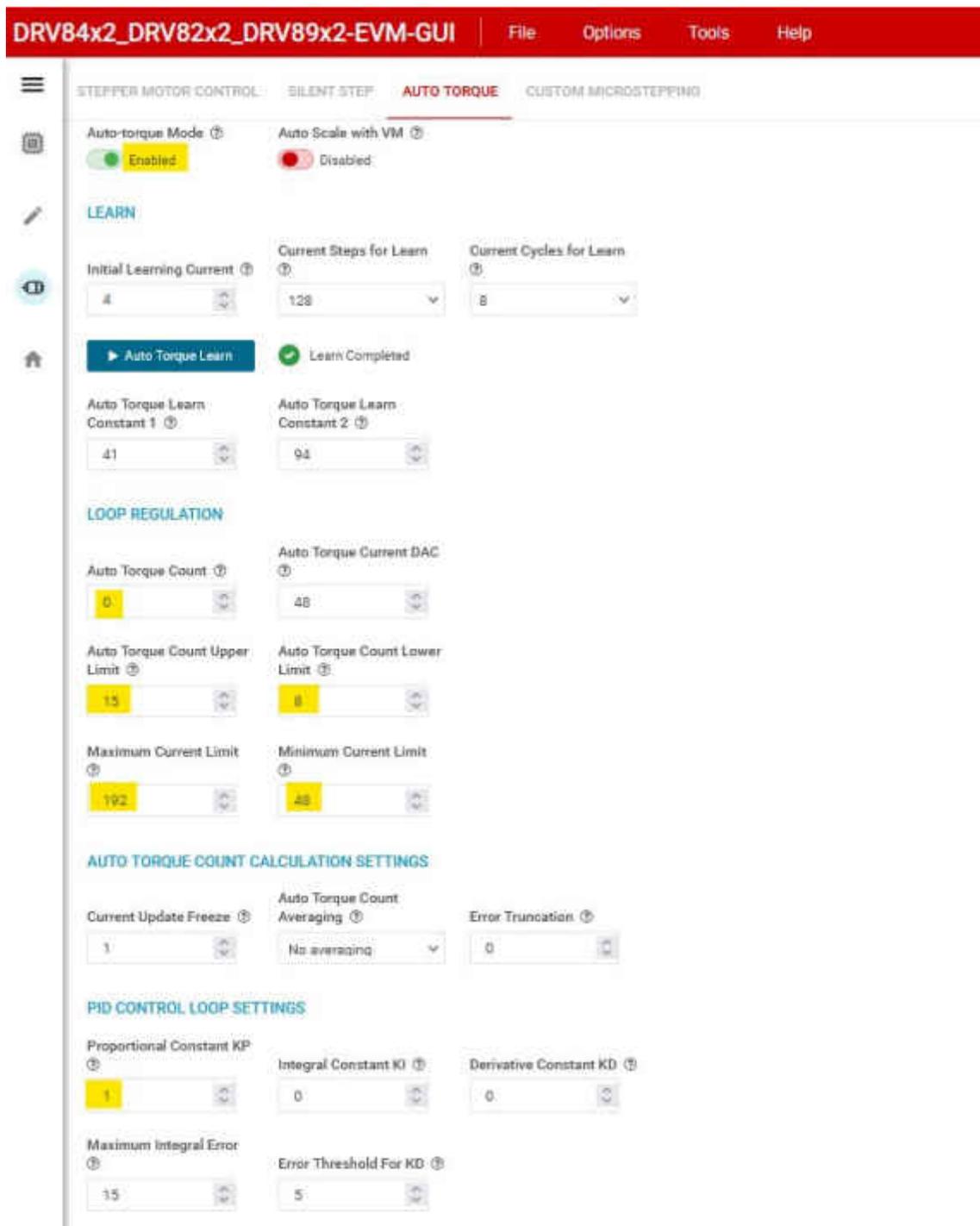


Figure 5-16. Auto Torque Control Panel

- vi. Now, observe the “Auto Torque Count” values with no load. Use the range of values observed to set the Auto Torque Count upper and lower limits. The auto-torque algorithm maintains the ATQ\_CNT value within the hysteric band defined by ATQ\_UL and ATQ\_LL, by modulating the full-scale current between 375 mA and 1.5 A.

- vii. Please refer to the DRV8462 “ADVANCE INFORMATION” data sheet for detailed description of the Auto Torque feature including details on how to setup and tune its operation to suit your application
6. In addition to the SPI interface-based Register controlled operation, the DRV8462 device also supports GPIO controlled operation described in the device data sheet. The GUI also allows operating the device in this mode. The GUI comes up with “SPI” controlled operation by default. To operate the device with GPIO control select “H/W” in the “Interface Mode” selector in the STEPPER MOTOR CONTROL tab. The selector can be changed only while the “Motor Driver” slide switch is in “Asleep” position.

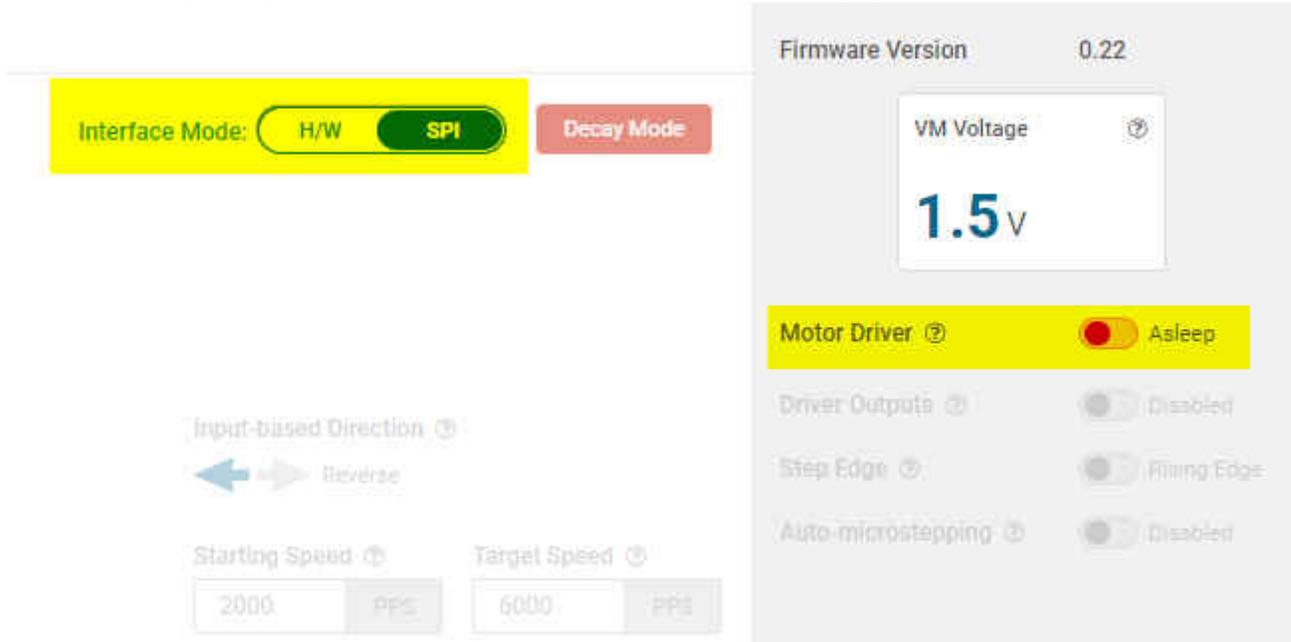
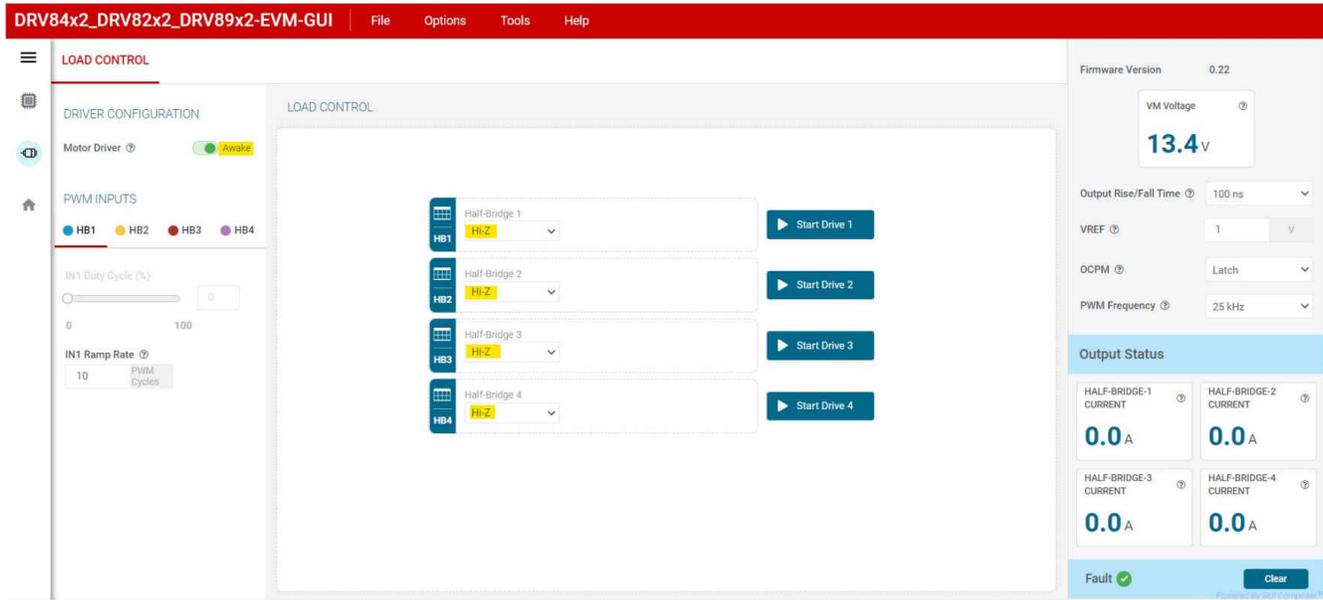


Figure 5-17. Interface Mode Control Panel

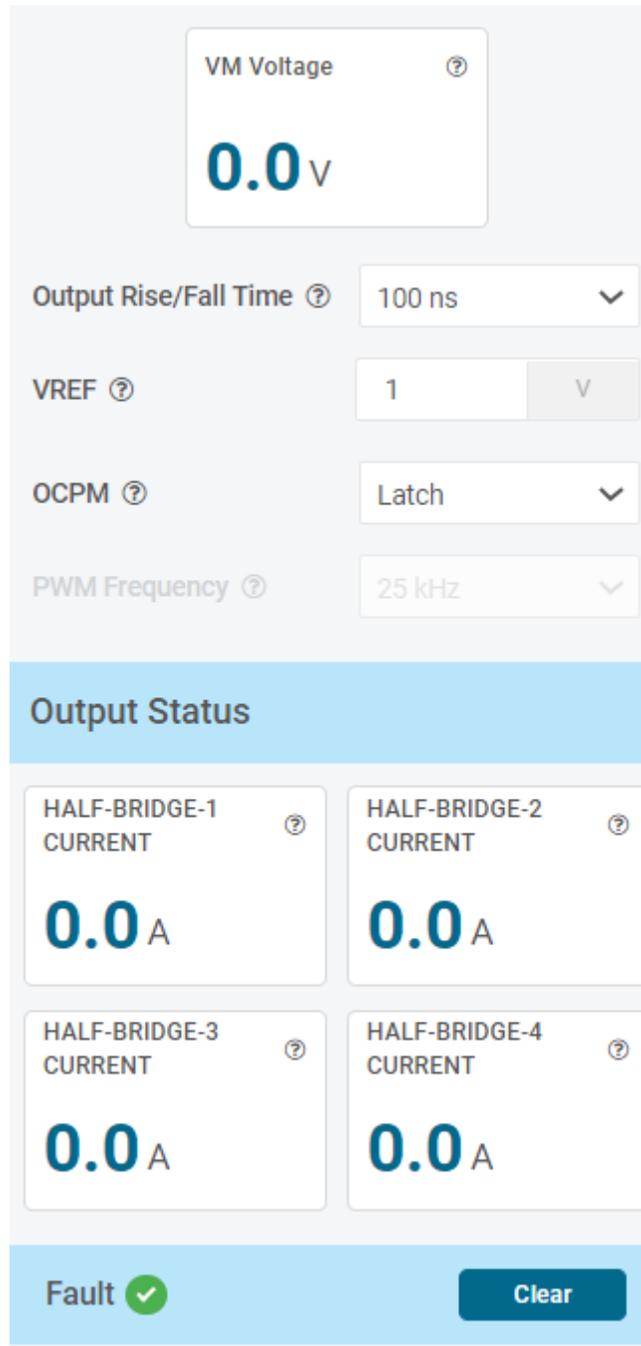
## 6 GUI Operations DRV8962

1. If not done so already turn off the power supply and connect your motors to the EVM in the desired configuration. Both high side and low side load driving is possible and is open to the user to configure. Use Jumpers J13 and J14 to connect the motors to the half bridges and J23 for VM and GND
2. Go to the “LOAD CONTROL” tab in the “Driver Control” page. The VM Voltage widget will read out the input voltage to J12. Set the “Motor Driver” to “Awake”. Using the drop-down menu displaying “Hi-Z” choose “Low Side Load” for HB1, HB2, HB3 and HB4.



**Figure 6-1. DRV8962 GUI**

3. Press all the four “Start Drive 1,2,3 and 4” buttons. The HB1, HB2, HB3 and HB4 PWM INPUTS sliders will turn active now. First set IN1 Duty Cycle to 50%. Motor-1 will start spinning and the motor current will be displayed in the HALF-BRIDGE-1 display window. Next set IN2 Duty Cycle to 100% from the HB2 tab. Motor-1 will slow down to zero speed and reverse direction. Now the motor current will be displayed in the HALF-BRIDGE-2 display window. Repeat these steps for HB3 with 50% duty cycle and HB4 with 100% duty cycle. This will spin Motor-2 and the currents will be displayed in HALF-BRIDGE-3 and HALF-BRIDGE-4 display windows similar to Motor-1. Switch the “Motor Driver” widget to “Asleep”. The motors will spin down to a stop.
4. The section on the right will allow you to monitor the Output Status of each half bridge, clear faults, set the PWM frequency, set the OCPM mode, output rise/fall time, and VREF for current regulation. Make sure to only make this changes when the outputs are disabled. Changes might not be reflected if changed mid drive.



VM Voltage ?  
**0.0** V

Output Rise/Fall Time ? 100 ns ▼

VREF ? 1 V

OCPM ? Latch ▼

PWM Frequency ? 25 kHz ▼

### Output Status

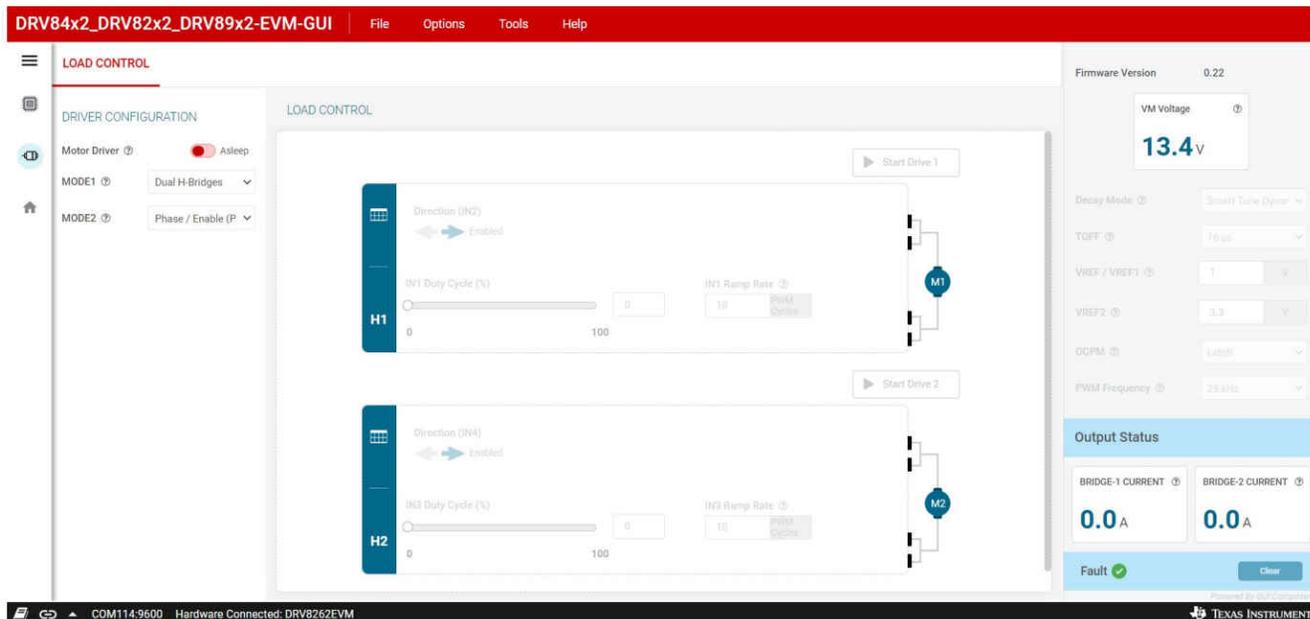
HALF-BRIDGE-1 CURRENT <span>?</span> <b>0.0</b> A	HALF-BRIDGE-2 CURRENT <span>?</span> <b>0.0</b> A
HALF-BRIDGE-3 CURRENT <span>?</span> <b>0.0</b> A	HALF-BRIDGE-4 CURRENT <span>?</span> <b>0.0</b> A

Fault ✓ Clear

Figure 6-2. DRV8962 Monitor Panel

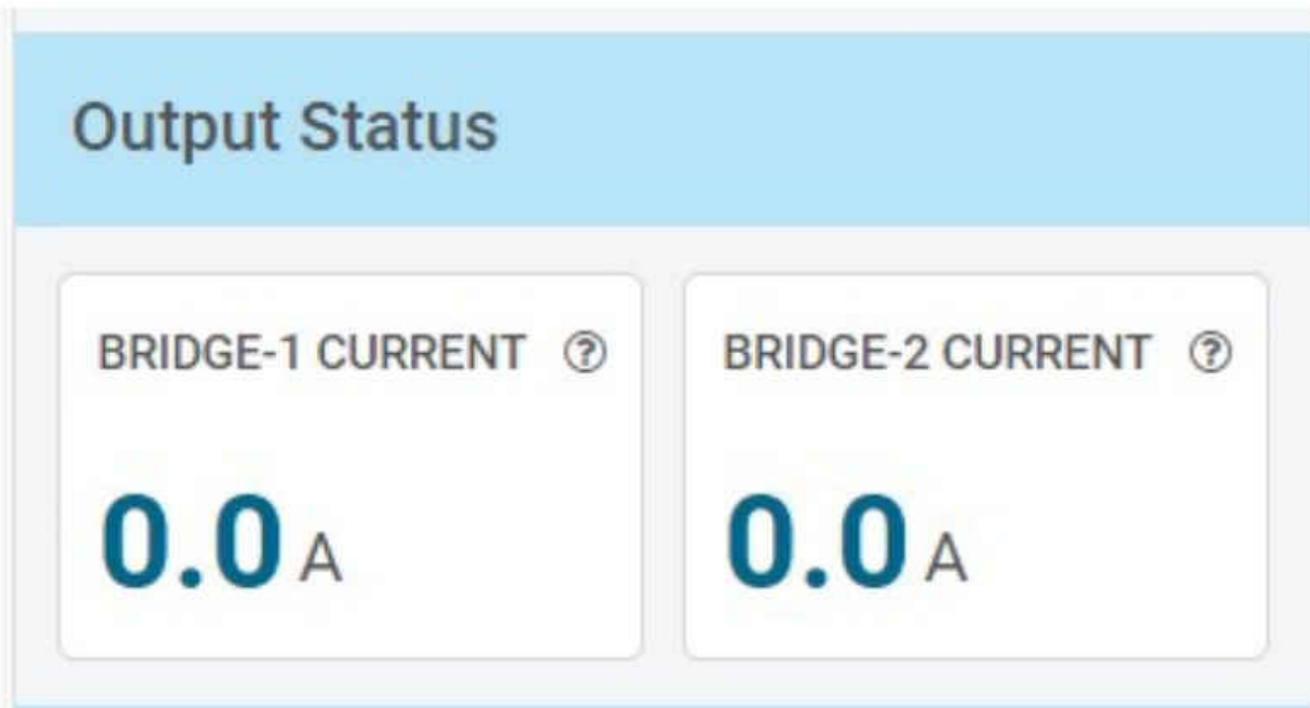
## 7 GUI Operations DRV8262

1. If not done so already turn off the power supply and connect the two brushed DC motors to the EVM screw terminal blocks J13 and J14. Alternatively in single H Bridge mode connect a single motor to terminal J14. First motor, Motor-1 pair of wires should be connected to J14 and the second motor, Motor-2 pair of wires should be connected to J13. Turn on the lab power supply. Be sure to switch off the lab power supply when swapping the motor connections. Note: If only one motor is available the tests can be conducted for one motor at a time, first for the motor connected to J14 and next for the motor connected to J13.
2. Go to the “LOAD CONTROL” tab in the “Driver Control” page. The VM Voltage widget will read out the input voltage to J12. Leave MODE1 and MODE2 settings in its default value. Set the “Motor Driver” to “Awake”.



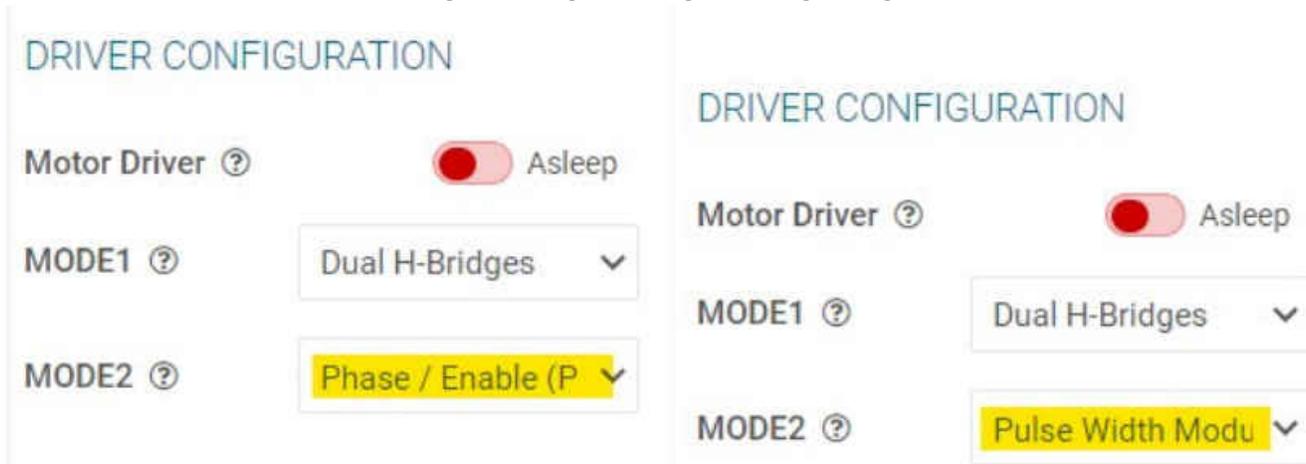
**Figure 7-1. Driver Control Page**

3. Press the two “Start Drive 1 and 2” buttons. Leave the “Direction” setting in its default position. Rest of the settings during these tests should be left with default positions and values. First set IN1 Duty Cycle to 50%. Motor 1 will start spinning in one direction and the motor current will be displayed in the BRIDGE-1 CURRENT display window. Change the “Direction” setting. The motor speed will ramp down to a standstill and then change direction and ramp up speed corresponding to 50% duty cycle. The motor current will be displayed in the BRIDGE-1 CURRENT display window. Press the “Stop Drive 1” button. The motor will ramp down and stop.
4. Next set IN3 Duty Cycle to 50%. Motor 2 will start spinning in one direction and the motor current will be displayed in the BRIDGE-2 CURRENT display window. Change the “Direction” setting. The motor speed will ramp down to a standstill and then change direction and ramp up speed corresponding to 50% duty cycle. The motor current will be displayed in the BRIDGE-2 CURRENT display window. Press the “Stop Drive 2” button. The motor will ramp down and stop. Switch the “Motor Driver” widget to “Asleep”.



**Figure 7-2. Output Status**

- Using the MODE2 drop down menu choose "Pulse Width Modulation (PWM)" setting. This is where you can also choose between Dual H Bridges vs Single H Bridge allowing for higher current.

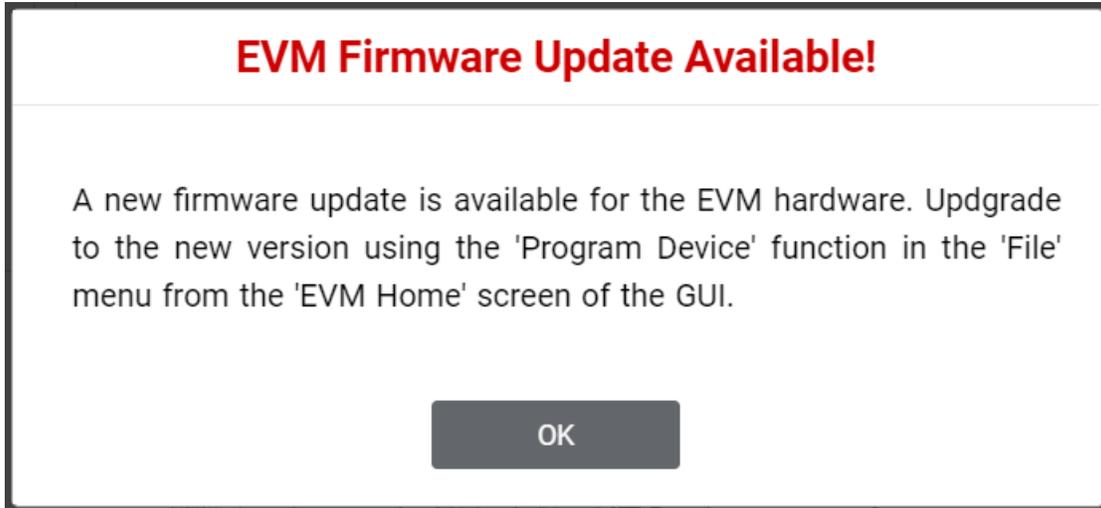


**Figure 7-3. Driver Configuration**

- The LOAD CONTROL window will change to PWM control mode with four PWM settings sliders

## 8 Updating Firmware

Your EVM includes the ability to update the MCU firmware controlling the DRV84x2\_DRV82x2\_DRV89x2EVM device without any additional hardware. There should be a pop-up every time the GUI Driver Control page is selected after an EVM connection is made and if a new update becomes available as can be seen in EVM Firmware Update Pop-Up.



**Figure 8-1. EVM Firmware Update Pop-up**

The user can update the EVM to the latest firmware by simply going to File -> Program Device from either the EVM Home Page or the Driver Control page as shown in [Figure 8-2](#).

Successful firmware update will bring up a message window stating "Flash Successful!".

**Figure 8-2. Update Firmware**



## 9 Evaluation Hardware Overview



### CAUTION

Hot surfaces on the EVM include the DRV824x-Q1 or DRV814x-Q1 device (U1) and the area surrounding it.

When operating the EVM at the maximum device specifications and a high ambient temperature, external cooling fans may be required to minimize potential fire hazard, personal injury, or both.

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  - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

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**User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.**

**NOTE:**

**EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.**

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#### 3.1 United States

##### 3.1.1 Notice applicable to EVMs not FCC-Approved:

**FCC NOTICE:** This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

##### 3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

#### **CAUTION**

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### **FCC Interference Statement for Class A EVM devices**

*NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

#### **FCC Interference Statement for Class B EVM devices**

*NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### 3.2 Canada

##### 3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

#### **Concerning EVMs Including Radio Transmitters:**

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

#### **Concernant les EVMs avec appareils radio:**

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

#### **Concerning EVMs Including Detachable Antennas:**

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

### Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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[http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page)

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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- 
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