

# DRV8428EVM GUI User's Guide

This document is provided with the DRV8428 evaluation module (EVM) as a supplement to DRV8428 Stepper Motor Driver datasheet. This user's guide details on how to use the DRV8428 EVM GUI application.

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## Trademarks

### 1 Overview

The DRV8428 EVM is a platform to support prototyping and evaluation for the DRV8428, a medium-voltage dual H-bridge driver for stepper driving applications. The DRV8428 drives a single bipolar stepper with microstep settings ranging from full-stepping to 1/256 resolution with internally-regulated microstep levels. It provides a variety of programmable decay settings.

The EVM uses an MSP430™ microcontroller and a USB interface chip to manage communication from the GUI software application installed on a PC computer with Windows®. The GUI sends serial commands to the MSP430 to control the device signals, monitor faults, read and write SPI registers, and drive a stepper motor by issuing the step commands at the desired rate. This document describes the software and tools used to evaluate DRV8428 device for stepper motor driving on the DRV8428 EVM.

### 2 Hardware and Software Setup

The hardware (HW) and software (SW) tools that follow are required for the evaluation of DRV8428:

- DRV8428 EVM
- Stepper motor
- Voltage supply from 4.2 to 33 V

This document only describes the installation and usage of the DRV8428 EVM GUI. For additional details on hardware connections refer to the [DRV8428xEVM User's Guide](#) .

## 3 GUI Application

### 3.1 Installation

Installation (For Desktop Version Only)

- Download the installable DRV8428\_x.x.x\_installer\_win.zip file (The file is inside the DRV8428xEVM\_software.zip file. x.x.x is the GUI revision number).
- Extract the zip.
- Double click on the installer to install the GUI Application. During first time installation, the installer prompts for installation of Cloud Agent. Please Install it. During the installation, customer company's firewall may block "download from website" option for the GUI composer runtime installation, please download GUI runtime v7.4.1 from this link: [https://software-dl.ti.com/ccs/non-esd/gui\\_composer/runtime/gcruntime-7.4.1-windows-installer.exe](https://software-dl.ti.com/ccs/non-esd/gui_composer/runtime/gcruntime-7.4.1-windows-installer.exe) and save it to your local harddrive. And then, use "Install from File" option to install the GUI composer runtime.

### 3.2 Getting Started with DRV8428 EVM GUI

The DRV8428 EVM GUI and DRV8428 EVM allows the user to configure various settings required for stepper motor driving. The DRV8428 EVM GUI lets the user adjust the motor speed, control the direction, control the step movement, configure various device settings, and monitor the device status.

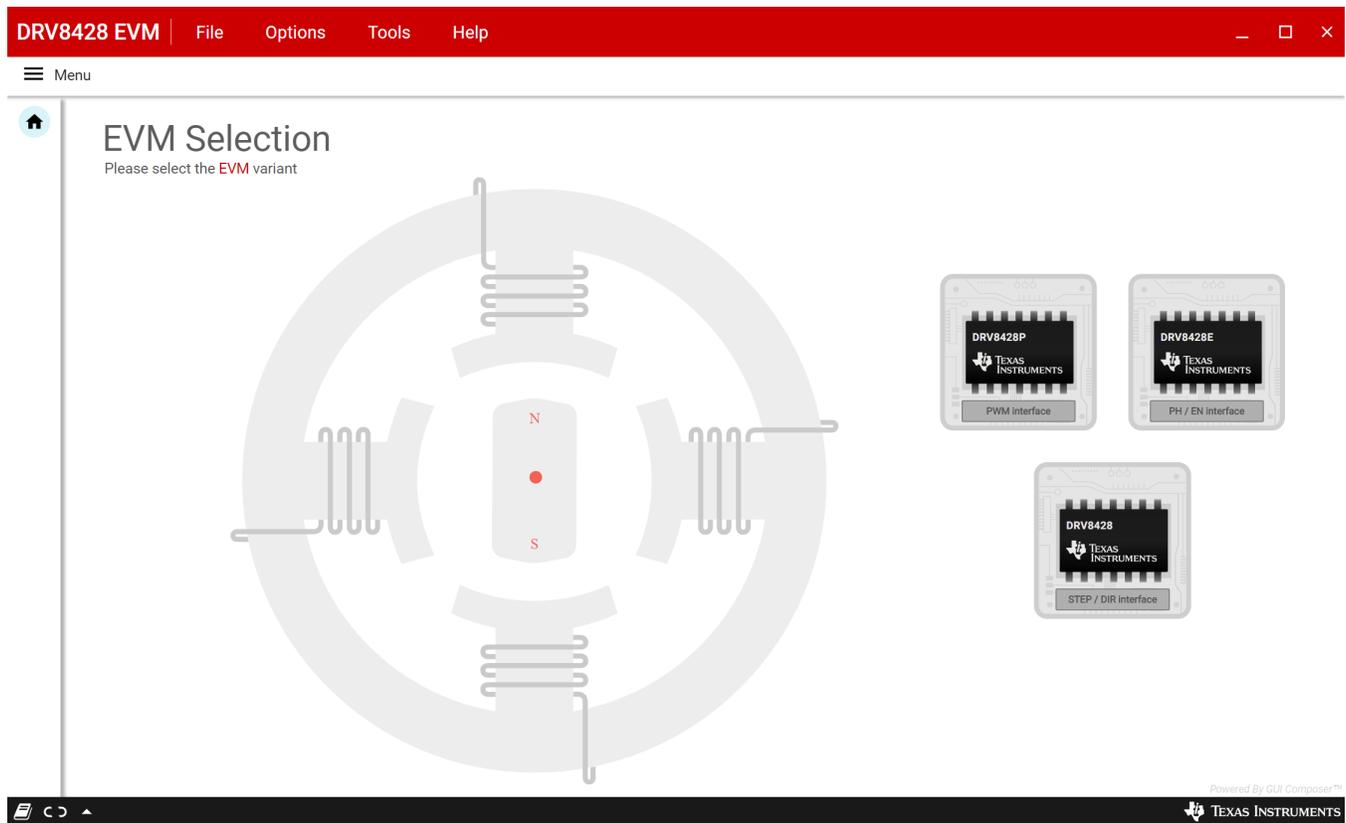
Perform the following steps to begin using the GUI:

- Connect the stepper motor to the EVM.
- Plug in the micro-USB cable to the PC.
- Enable the motor power supply. For additional details on hardware connections refer to the [DRV8428xEVM User's Guide](#)

Click on DRV8428 EVM GUI shortcut either on the desktop or from the start menu to run the GUI application.

### 3.3 Use the DRV8428 EVM GUI

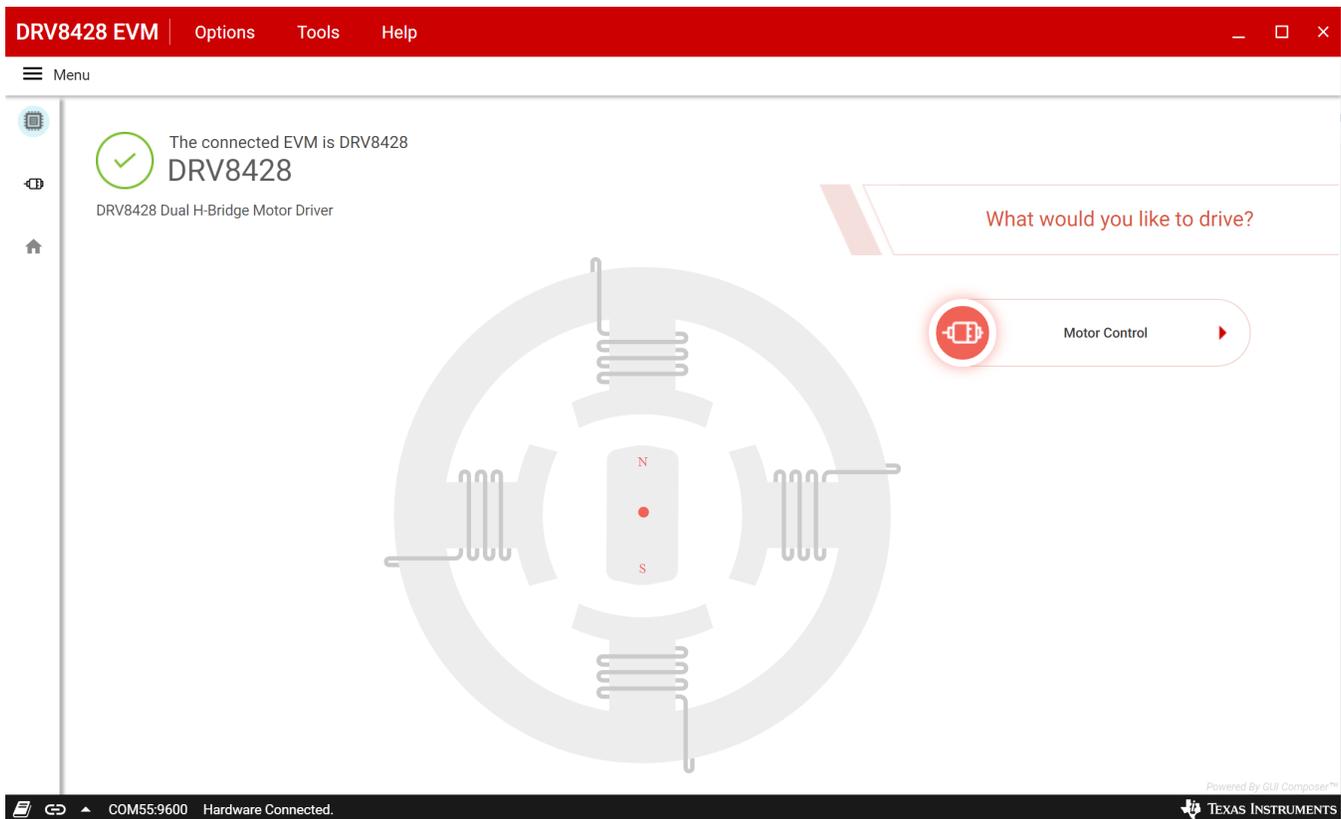
After open the DRV8428 GUI, the GUI landing page shown in [Figure 1](#)



**Figure 1. DRV8428 EVM GUI (Landing Page)**

After click the DRV8428P device from the GUI landing page, the DRV8428P GUI home page shown in [Figure 2](#)

The application will try to establish communication with the device connected. A message showing 'Connected to Cloud Agent. Connecting to target...' will be displayed in the hardware connection status pane at the bottom of the screen. If the connection is successful, 'COMxx:9600 Connected to Target' message appears as shown in [Figure 3](#) below



**Figure 2. DRV8428 EVM GUI (Home Page)**



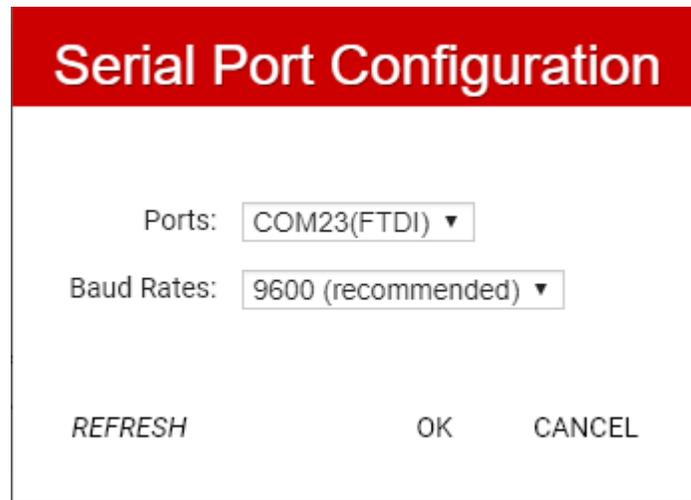
**Figure 3. DRV8428 EVM GUI (Device Connection Pane)**

If the GUI fails to connect to the EVM, the hardware connection status pane will show the message 'Hardware Not Connected'.

If the GUI is opened without connecting the EVM, the hardware connection status pane will show 'Error: no serial ports found'.

If there are more than one DRV8428 EVM boards connected, the first matching device will be connected automatically. In order to switch to another EVM:

1. Click Options -> Serial Port. A serial port configuration popup is displayed as shown below in [Figure 4](#).
2. Choose the appropriate port and baud rate.
3. Click OK



**Figure 4. Serial Port Configuration**

Once the correct device is connected, the home page will show a message 'Device Connected' with a green check mark as shown in [Figure 2](#)

Click on the 'Stepper Motor' button to open the stepper control page.

### 3.3.1 Stepper Control Page

This page (shown in [Figure 5](#)) includes various controls to sleep/wake the driver, ocp latched settings and control the stepper motor by configuring various parameters such as full scale current, step mode, direction and so forth. Hovering over the (?) icon to the right of a control displays a brief description about the control.

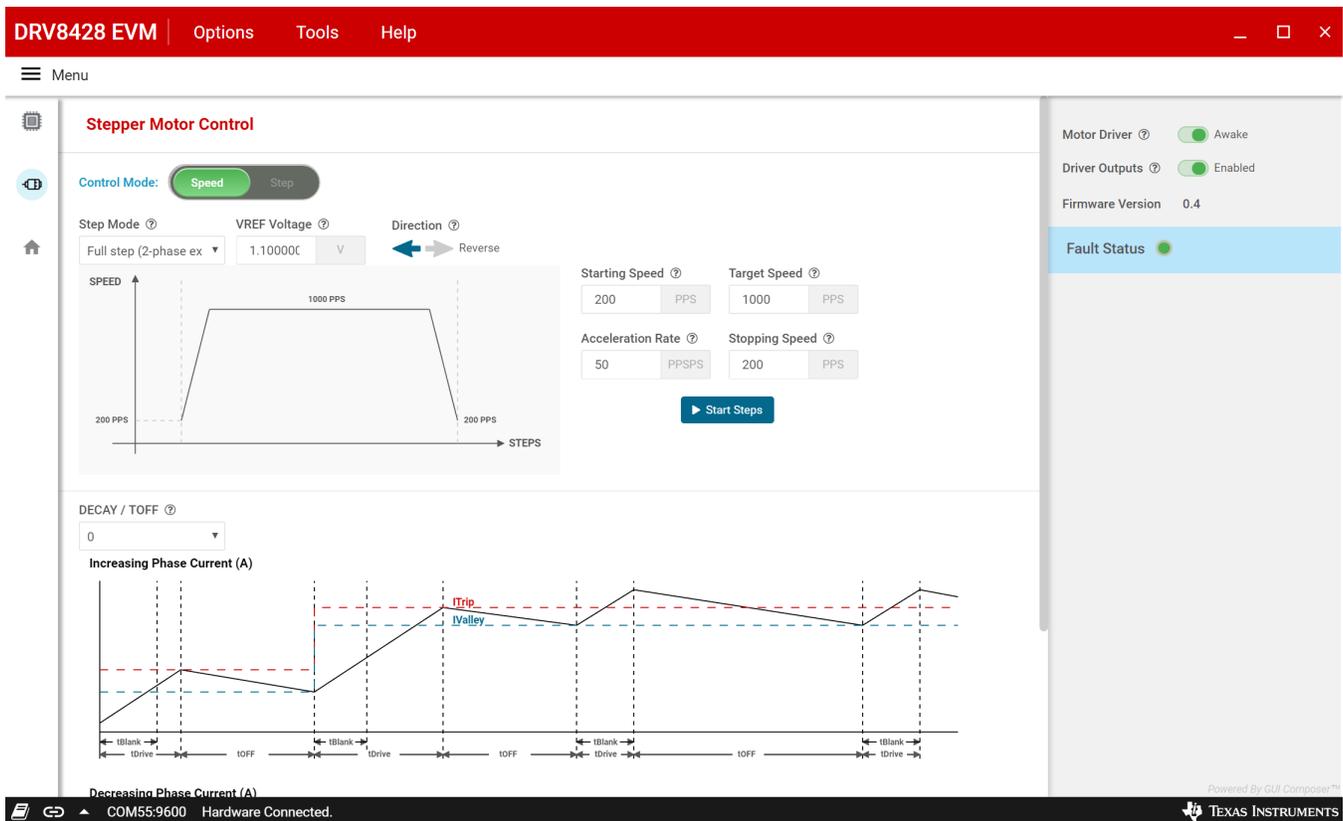


Figure 5. DRV8428 EVM GUI (Stepper Motor Control Page)

### 3.3.1.1 Stepper Control Modes

The GUI allows the user to control the stepper motion profile in two modes – Speed Mode and Step Mode. To toggle between the modes, use the toggle button at the top of the screen.

#### 3.3.1.1.1 Speed Mode

Speed Mode allows the user to spin the stepper motor continuously at a desired speed. The user configures the starting speed, stopping speed, acceleration rate, and target speed. Stepper controls are enabled only when 'Motor Driver' control is enabled. 'Start Steps' button is enabled only when 'Driver Outputs' control is enabled for example, EN/nFault pin is set to high. When the 'Start Steps' button is clicked, the motor begins spinning at the starting speed and accelerates to the target speed according to the configured acceleration rate. The acceleration profile in the microcontroller firmware accepts the starting-speed PPS signal and target-speed PPS signal as a clock cycle number.

When the 'Start steps' button is clicked, the PWM timer generates steps at a rate specified by the 'Starting Speed' PPS parameter. When 'Stop Steps' is clicked, the motor starts decelerating at the 'Acceleration Rate' configured to reach the stopping speed and eventually stop. The configuration is visualized by the embedded graph shown on the GUI screen.

When accelerating or decelerating, the PPS signal is adjusted every 32 ms based on the integer value of  $PPSPS / 32 \text{ ms}$ . Acceleration rates must be between 1 and 65,535 PPSPS. The step rate increases by the calculated value until the target speed is reached.

The starting speed must be less than or equal to the target speed. If the starting speed and target speed are equal, the EVM firmware will not perform an acceleration routine. The stopping speed must also be less than or equal to the target speed. The target speed is limited to a range between 200 and 65,535 PPS.

The 'Start Steps' command computes how frequently automatic speed updates are issued and a second timer is used to change the speed according to the programmed acceleration rate profile. Once clicked, the motor will begin spinning according to the parameters set in the GUI.

When the target speed PPS value is reached, the acceleration profile ends and the motor continues running until the 'Stop Steps' button is clicked. When the stepper is commanded to stop, the controller performs the same actions as it did while accelerating, but in reverse order to decelerate until the stop speed PPS value is reached, in which case the motor fully stops.

Figure 6 shows the acceleration profile and the role each parameter plays during speed computation.

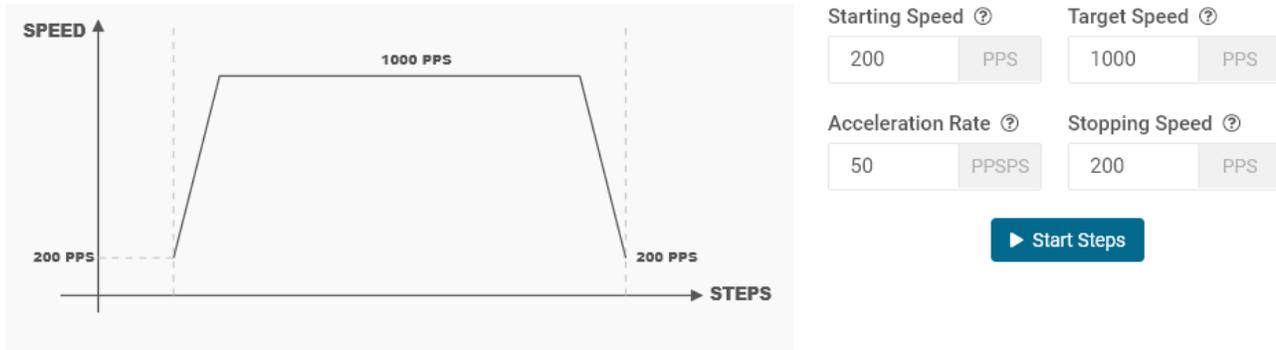


Figure 6. Controls Available for Speed Mode

### 3.3.1.1.2 Step Mode

Step Mode allows the user to move the stepper motor a configured number of steps. Stepper controls are enabled only when 'Motor Driver' control is enabled. 'Start Steps' button is enabled only when 'Driver Outputs' control is enabled for example, EN/nFault pin is set to high. When the 'Start Steps' button is clicked, the motor starts spinning at the starting speed and accelerates at the rate configured to reach until the number of steps is reached after which it stops.

The acceleration and deceleration profiles work similarly as before, except when the deceleration routine starts and when the motor stops are a function of the 'Steps to Stop' and deceleration rate parameters.

The configuration can be visualized in the graph embedded in the GUI. If the "Reciprocate" button is enabled, the stepper will travel the set number of steps, then reverse direction. It will do this continuously until 'Stop Steps' is clicked. Figure 7 shows the controls available in Step Mode.

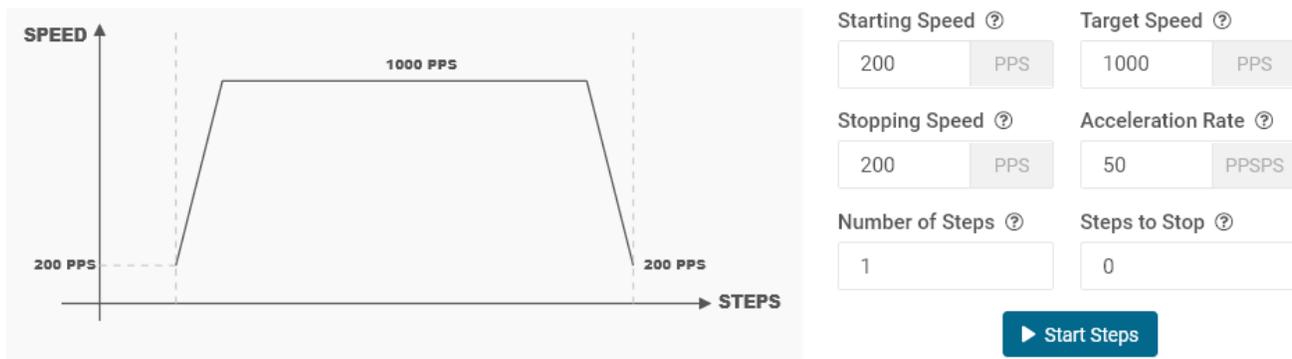


Figure 7. Controls Available for Step Mode

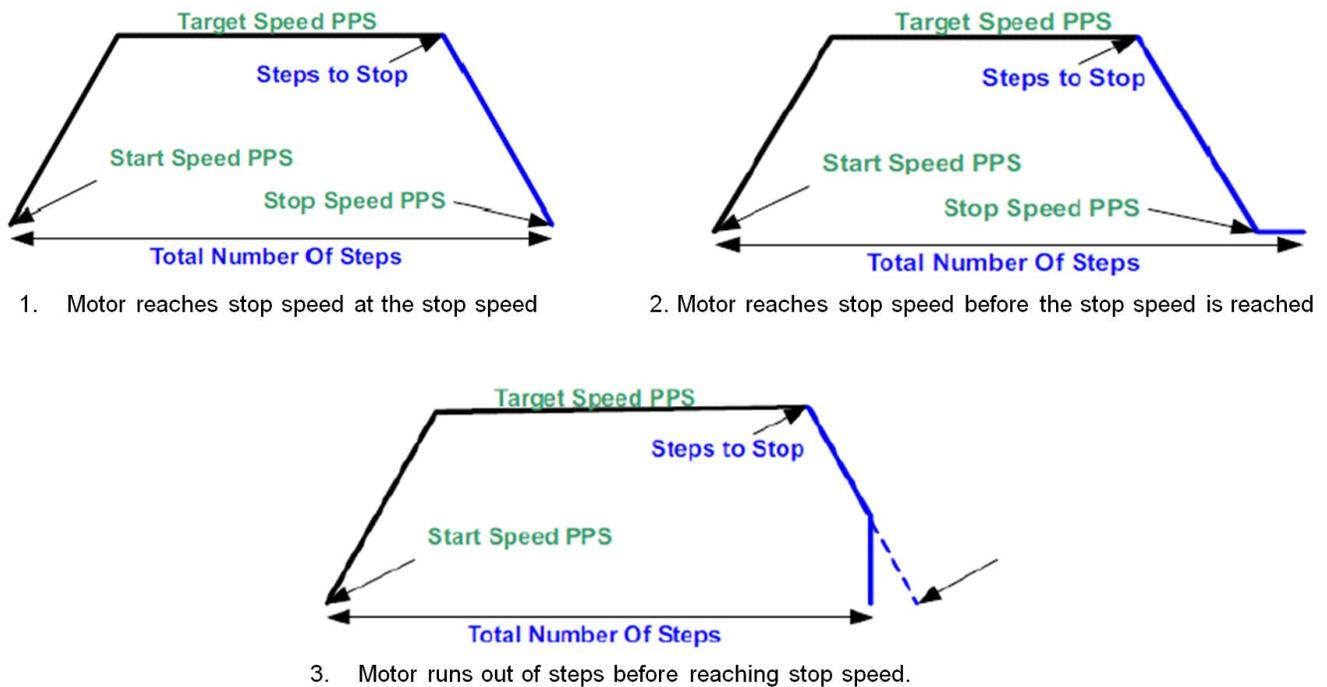
The parameters from 'Speed Mode' are reused as well, and they operate the same as described in [Section 3.3.1.1.1](#). Two new parameters have been added to properly control the limited number of steps actuation. These parameters are described as follows:

**Number of Steps**— This parameter is the number of steps that the controller will issue.

**Steps to Stop**— The controller is continuously monitoring the step being issued and when the current step is equal to the 'Steps to Stop' parameter, a deceleration profile is issued. If the value of the 'Steps to Stop' parameter is larger than the number of steps, then the motor stops abruptly and without undergoing a deceleration profile.

When a deceleration profile is issued, the controller decreases the speed until reaching the value of the 'Stopping Speed' parameter. If the 'Number of Steps' parameter is met before the deceleration profile is complete, then the motor stops at the current speed. If the stopping speed is met before all the number of steps is issued, then the motor rotates at the stop speed value until all the steps are executed.

Ideally, the system should resemble the case in which the controller executes all the commanded steps at a speed as close as possible to the stop speed. In the event this is not possible because of the particular parameters that were selected, stopping the motor at a speed very close to the 'Stopping Speed' parameter is often good enough to ensure good motion quality and application performance.



**Figure 8. Stop Conditions**

### 3.3.2 Decay Mode and TOFF setting

Decay refers to how the driving currents recirculate in H-bridge FETs during the Toff time. The user configures the decay mode and TOFF using the GUI

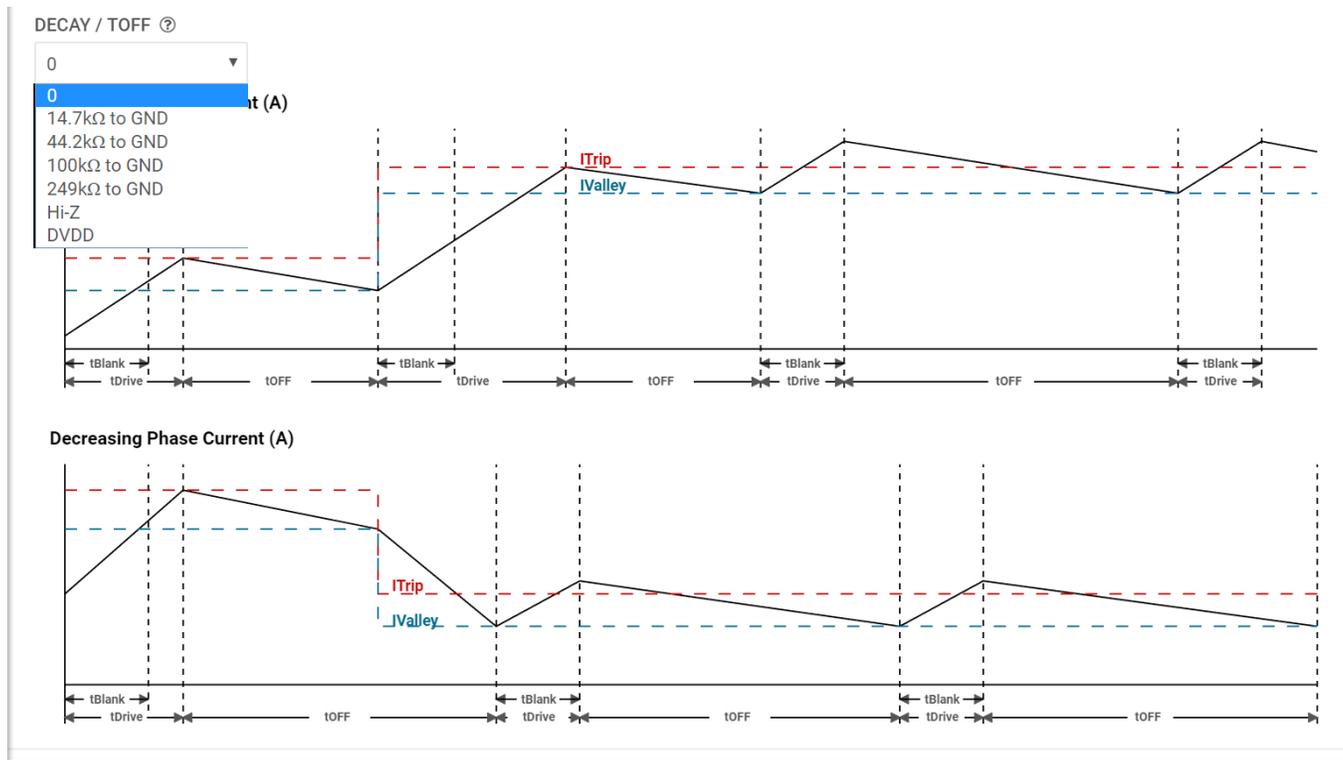


Figure 9. DRV8428 EVM GUI (Decay Mode and TOFF setting)

Decay mode and appropriate TOFF values can be configured in this section. The configurations can be visualized in the graph shown. For more information about the different decay modes and TOFF setting, refer to the DRV8428 Stepper Motor Driver datasheet.

### 3.3.3 Fault Monitoring

The fault monitor section at the right side of the screen allows the user to monitor the fault. The LED staying green indicates 'No Fault'. When the LED turns red, it indicates that a fault has occurred.

### 3.3.4 Use the Side-Bar Menu

Use the side-bar menu in the left pane to navigate to the different pages at any time. Click on the hamburger button in the top-left corner of the GUI to expand the side-bar menu. The following pages that are displayed in the side-bar menu:

- Home (landing page)
- Motor control (motor control page)
- Motor driver (DRV8428EVM GUI home page)

### 3.3.5 Menu Bar Options

The following menus are available in the menu bar displayed at the top of the GUI as shown in [Figure 10](#).

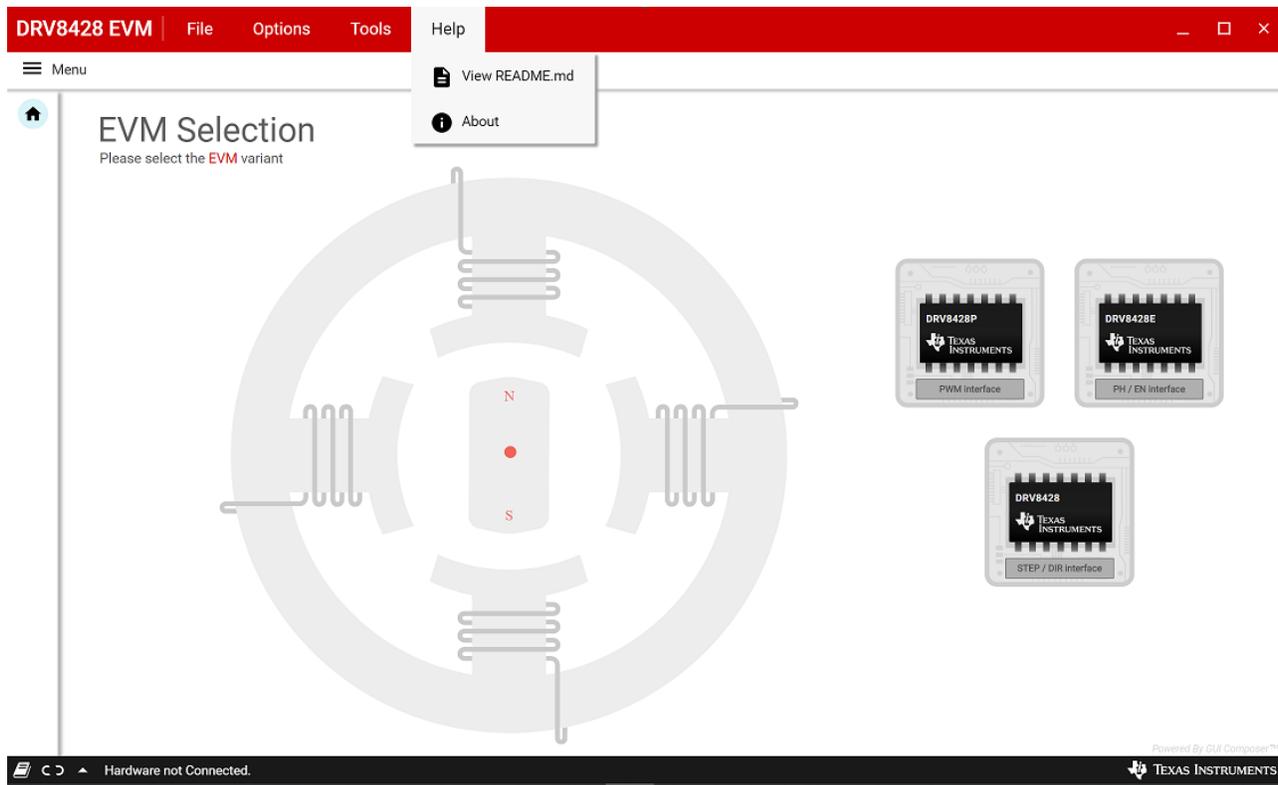


Figure 10. DRV8428 EVM GUI (Menu Bar – Help Option)

### 3.3.5.1 File Menu

The user can load the firmware (.out) file onto the onboard MSP430 by clicking file menu and selecting an appropriate motor driver device to match the EVM variant. For the firmware load to work, MSP430 FET needs to be plugged into the J2 connector on the EVM board.

### 3.3.5.2 Options Menu

This menu provides the option to configure the serial port communication settings.

### 3.3.5.3 Tools Menu

The "log pane" option in this menu is to open a log pane at the bottom of the GUI which shows the GUI actions.

### 3.3.5.4 Help Menu

The Help Menu contains options to view Readme File and About Section. The About Section displays the installed software information, including the application version.

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**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.**

### 3 Regulatory Notices:

#### 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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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):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
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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- 
- 4 *EVM Use Restrictions and Warnings:*
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    - 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
    - 4.3 *Safety-Related Warnings and Restrictions:*
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