# DRV8821/DRV8823 User's Guide

This document is provided as a supplement to the DRV8821/DRV8823 datasheet. It details the hardware implementation of the CPG003 DRV8821-23EVM-001 Customer Evaluation Module (EVM).

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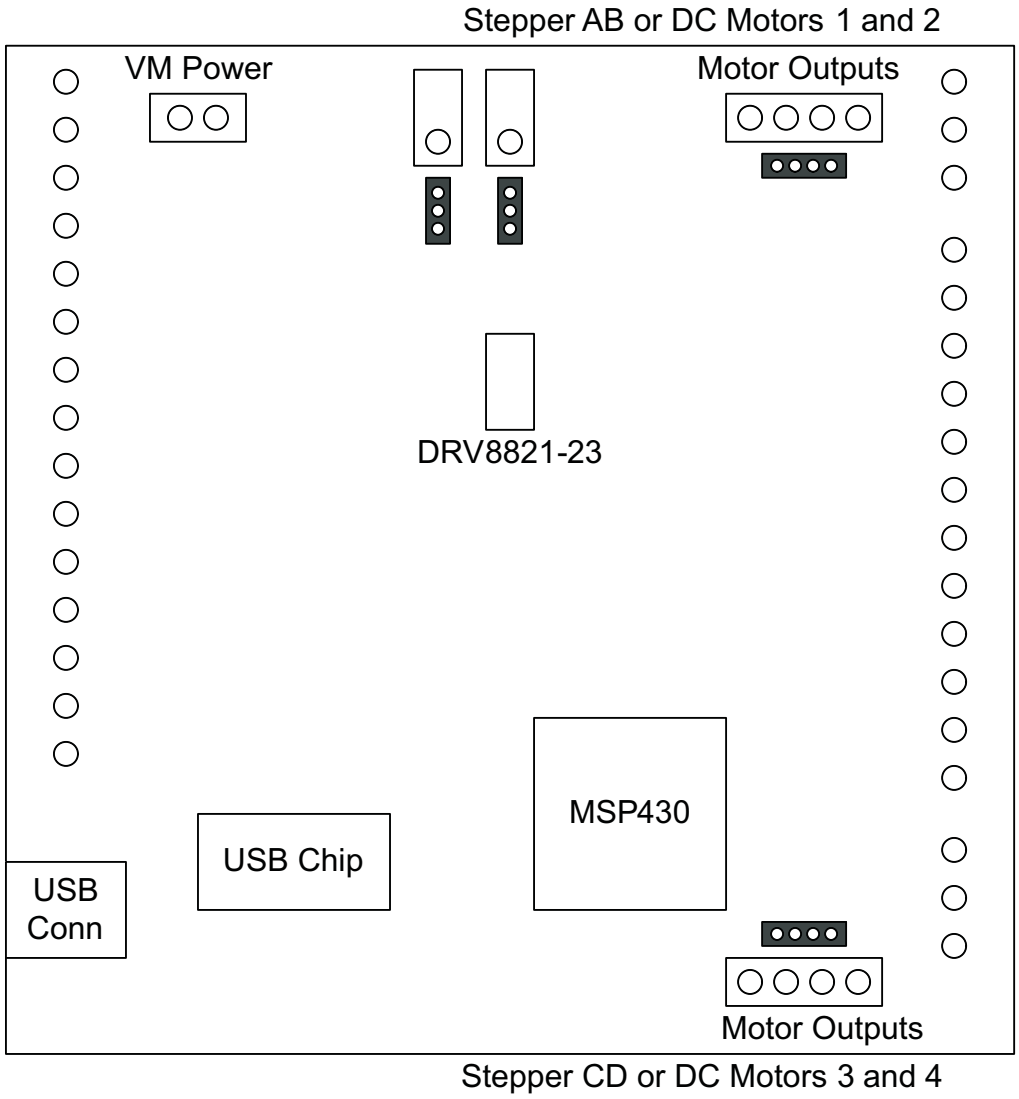
## Trademarks

All trademarks are the property of their respective owners.

# 1 Block Diagram




## 1.1 Power Connectors

The DRV8821/DRV8823 Customer EVM offers access to VM (Motor Voltage) power rail via a terminal block (J1). A set of test clips in parallel with the terminal block allows for the monitoring of the input power rail.

User must apply VM according to datasheet recommended parameters.

**NOTE:** VDD for logic and microcontroller is derived from USB interface.

## 1.2 Test Stakes

Every pin on the DRV8821/DRV8823 device has been brought out to a test stake. A label on the silkscreen identifies each signal.

For those pins that change functionality depending on device flavor, a table is provided with corresponding function name on its particular column.

## 1.3 Jumpers

There are two styles of jumpers on the DRV8821-23EVM: two pin jumpers (JP3 and JP4) and three pin jumpers (JP1 and JP2).

Two pin jumpers are used to set AB DECAY or CD DECAY HI or LO.

Three pin jumpers are used to select the VREF from a pot or from the microcontroller's DAC outputs.

### 1.3.1 VREF Select Jumpers (JP1 and JP2)

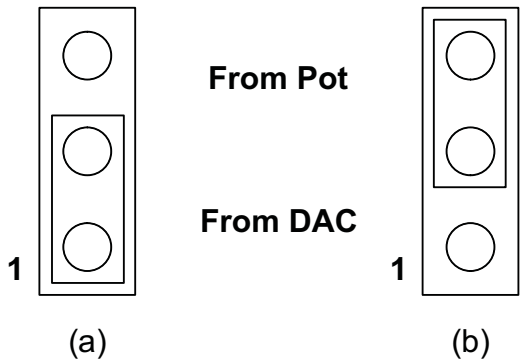



**Figure 1. VREF Select Jumpers (JP1 and JP2)**

To configure the VREF select (either AB or CD) jumper, (a) Use position JPx-1:2 to select the MSP430 DAC output (default). (b) Use position JPx-2:3 to select the respective variable resistance potentiometer. These jumpers should not be left open as a lack of a reference voltage on the device will minimize current sourcing into the respective H Bridge, resulting in very poor motion or no motion at all.

### 1.3.2 DECAY Select Jumpers (JP3 and JP4)

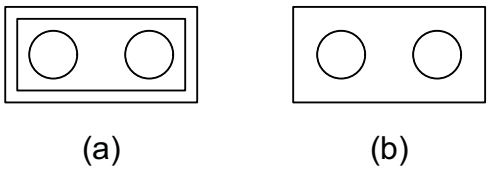



**Figure 2. DECAY Select Jumpers (JP3 and JP4)**

To configure the DECAY select jumper: (a) place a jumper to set the respective DECAY signal HI. (b) remove the jumper to use internal pull down resistor and set the DECAY signal to LO.

## 1.4 Motor Outputs

There are three ways of connecting the bipolar stepper motor (for DRV8821) or the dual DC motors (for DRV8823) into the CPG003_DRV882123EVM-001 evaluation module: four pin header (J4 and J5), four position terminal block (J2 and J3) and test clips. We do not recommend the connection of a stepper motor into the test clips as these are Kelvin connections and not rated for high current output.

# 2 GUI Software Installation

The following section explains the location of files and the procedure for installing the software correctly.

**NOTE:** Ensure that no USB connections are made to the EVM until the installation is completed. The installer will also install LabVIEW RTE 2014 and FTDI Driver, along with the GUI.

## 2.1 System Requirements

- Supported OS – Windows 7 (32 Bit,64 Bit). The window text size should be Smaller-100% (Default)
- Recommended RAM - 4 GB or higher
- Recommended CPU Operating Speed – 3.3 GHz or higher

## 2.2 Installation Procedure

The following procedure helps you install the DRV8821/DRV8823 GUI

1. Double click on the **Setup_DRV8821/DRV8823_EVM.exe** as shown in Figure 3.

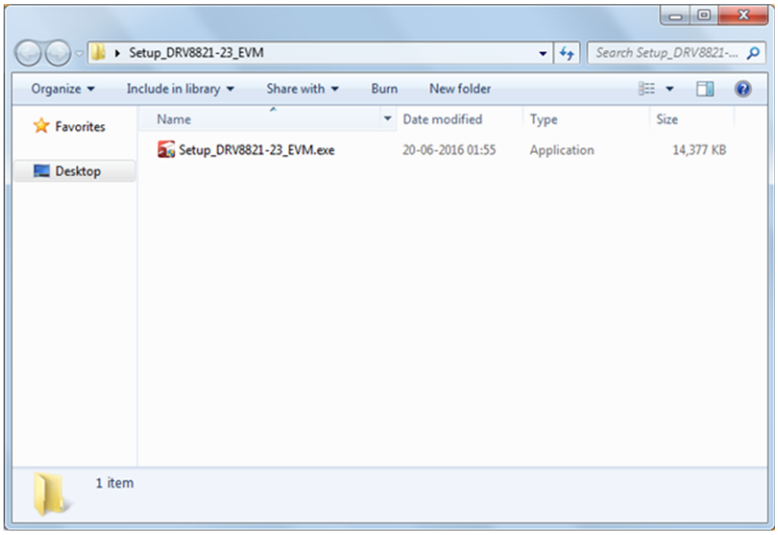



**Figure 3. Setup_DRV8821/DRV8823_EVM.exe**

2. The screen shown in Figure 4 appears, indicating installer initialization. Click the **Next** button.

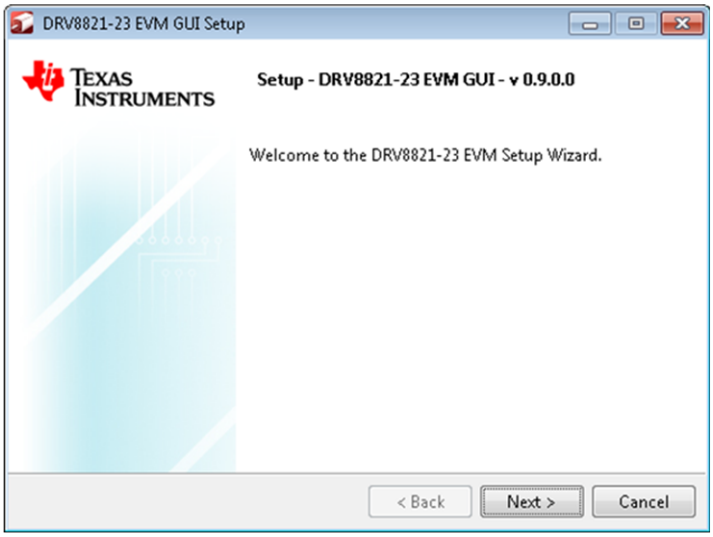



**Figure 4. Installation Initialization**

3. In the newly open installation pop-up window, click **Next**. The license agreement will be displayed. Please, read through it carefully and enable the "I Accept the Agreement" radio button and press **Next**.

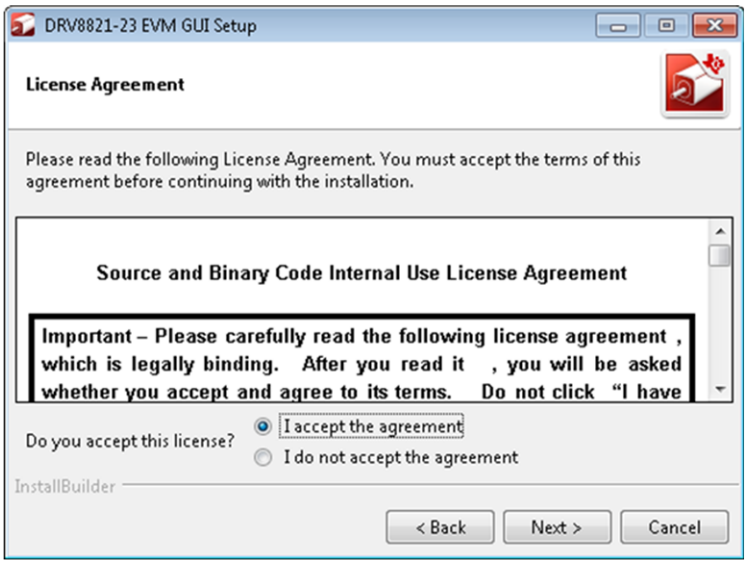



**Figure 5. License Agreement**

4. A screen as shown in Figure 6 appears, displaying the license agreement of National Instruments. Please read through the agreement carefully and enable the "I Accept the License Agreement" radio button and press the **Next** button.

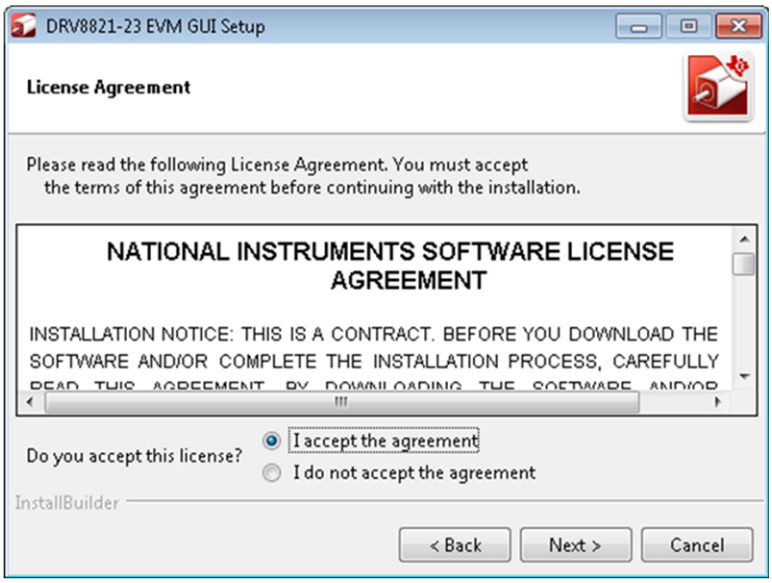



**Figure 6. NI License Agreement**

5. Set the default directory for the GUI Installation and click **Next**.

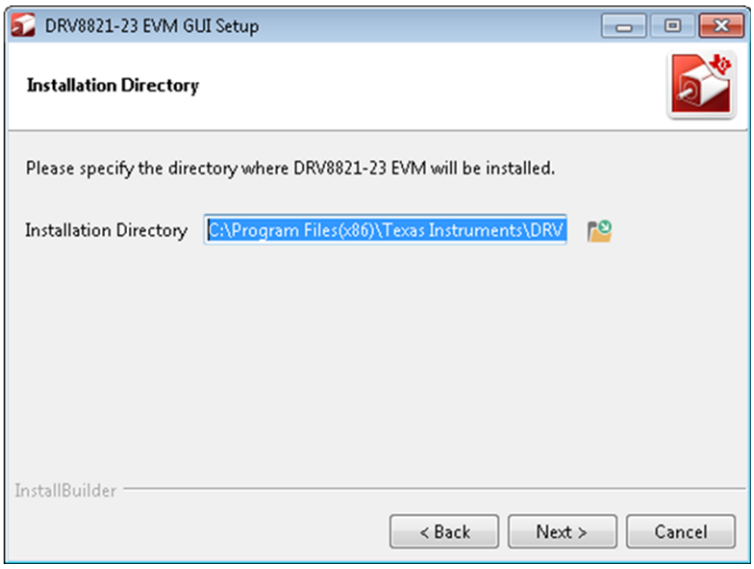



**Figure 7. Installation Directory Screen**

**NOTE:** It is highly recommended to keep the default values as provided in the installer.

6. A screen as shown in Figure 8 appears. This screen is to select the components to install. Select the Components to Install and Click **Next** to continue installation. The LabVIEW RTE component checks out if the LabVIEW RTE 2014 is already installed on the PC.

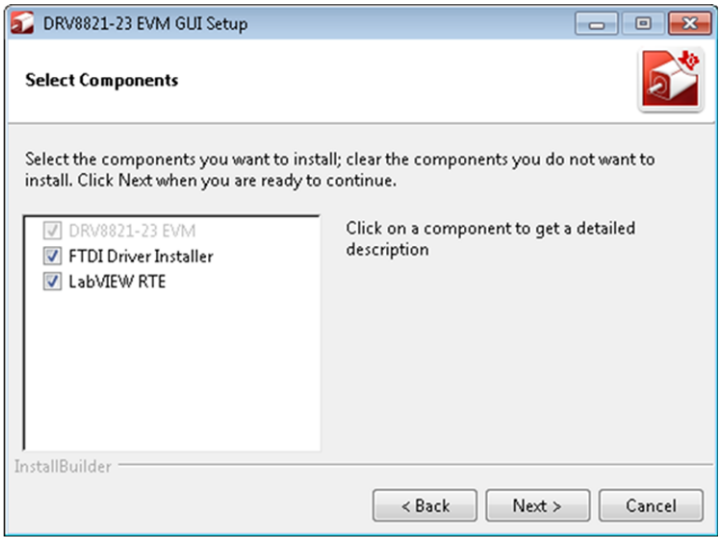



**Figure 8. Component Selection**

7. If LabVIEW RTE is selected as a component to install, a screen appears as shown in Figure 9. Configure the proxy settings as required. This screen is to download the LabVIEW RTE 2014 from ni.com, Click **Next** to continue the installation.

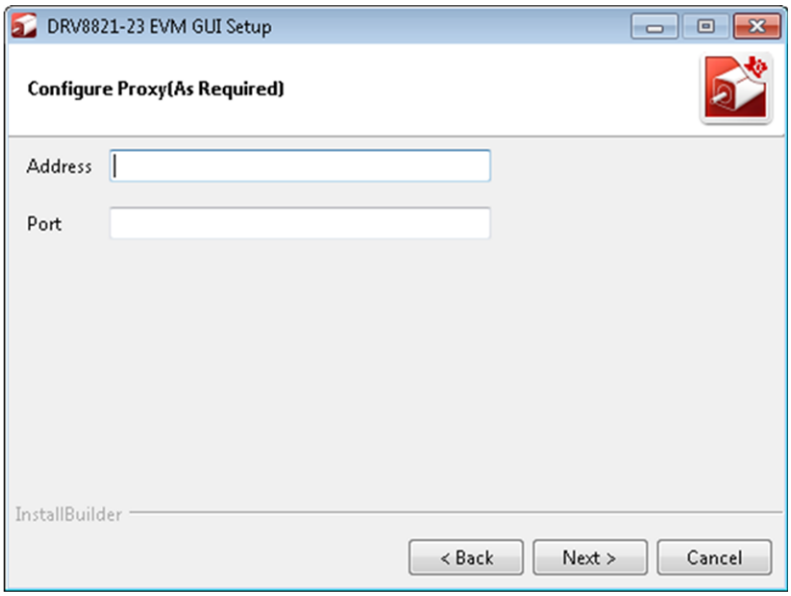



**Figure 9. Configure Proxy**

8. A screen as shown in Figure 10 appears. Click **Next** to begin the installation.

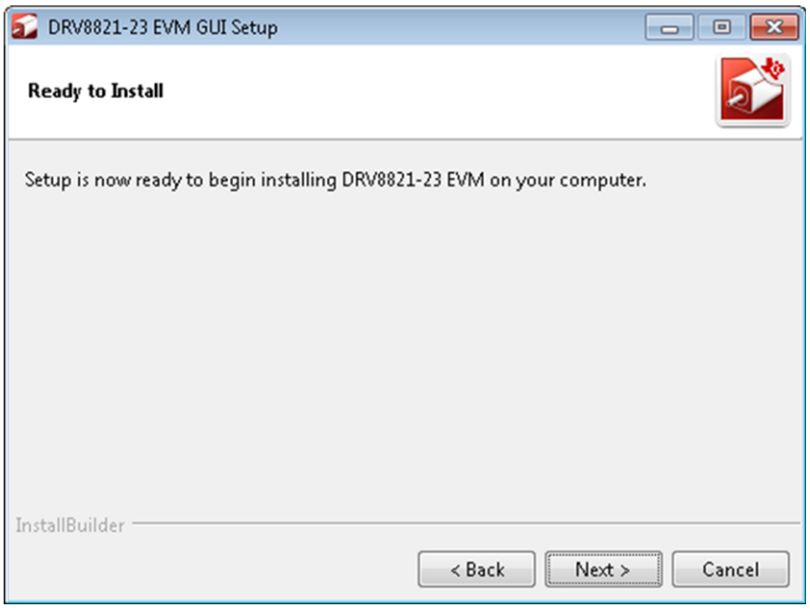



**Figure 10. Ready to Install**

9. If the LabVIEW RTE 2014 is selected as a component to install, LabVIEW RTE downloads and performs a silent mode installation.

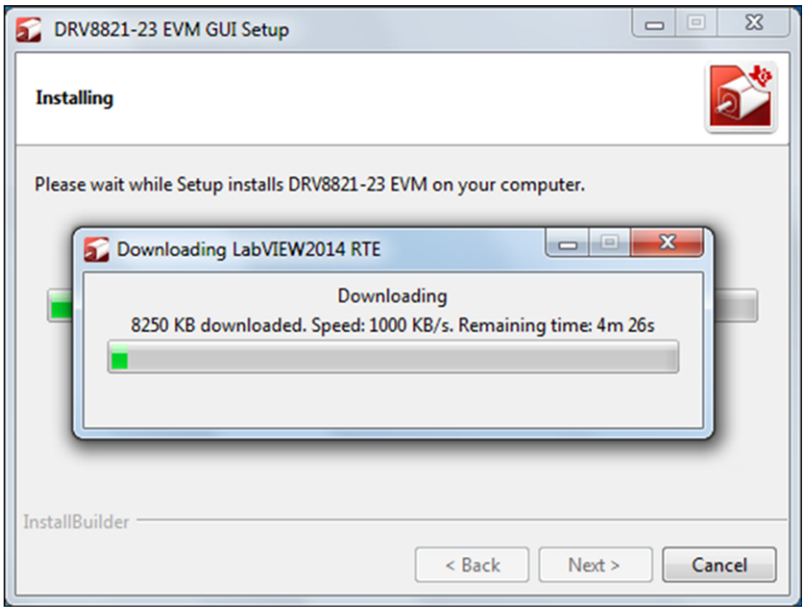



**Figure 11. Downloading RTE**

10. Once the Download completes, LabVIEW begins with the self-extraction as shown in Figure 12.

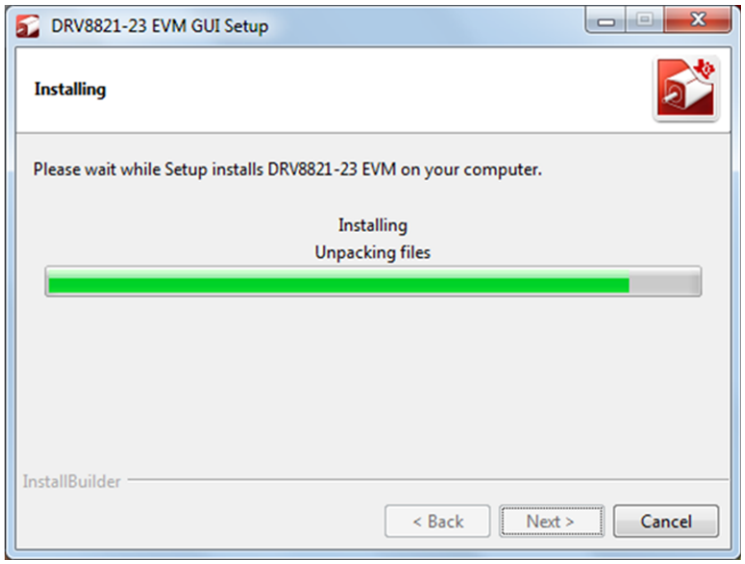



**Figure 12. LabVIEW RTE Self Extraction**

11. A screen appears as shown in Figure 13. It initializes the LabVIEW RTE Installation.


**Figure 13. LabVIEW RTE Installation Initialization**

12. A display as shown in Figure 14 appears which indicates the progress of LabVIEW RTE installation.

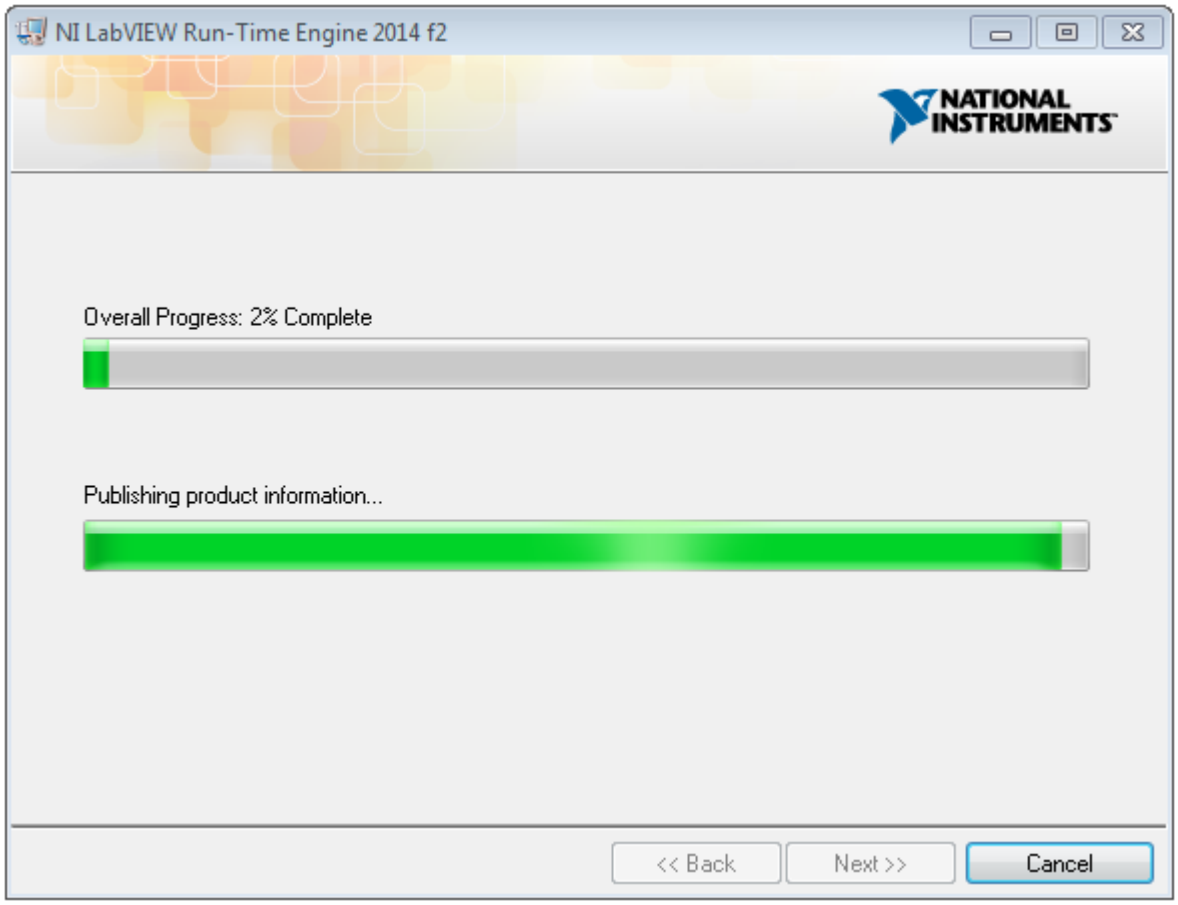



**Figure 14. Installation of LabVIEW RTE in Progress**

13. Once the LabVIEW RTE 2014 is installed, DRV 8821/DRV8823 EVM GUI component installs.
14. After DRV8821/DRV8823 Installation, FTDI Installation begins. A screen as shown in Figure 15 appears, click **Extract** to proceed.

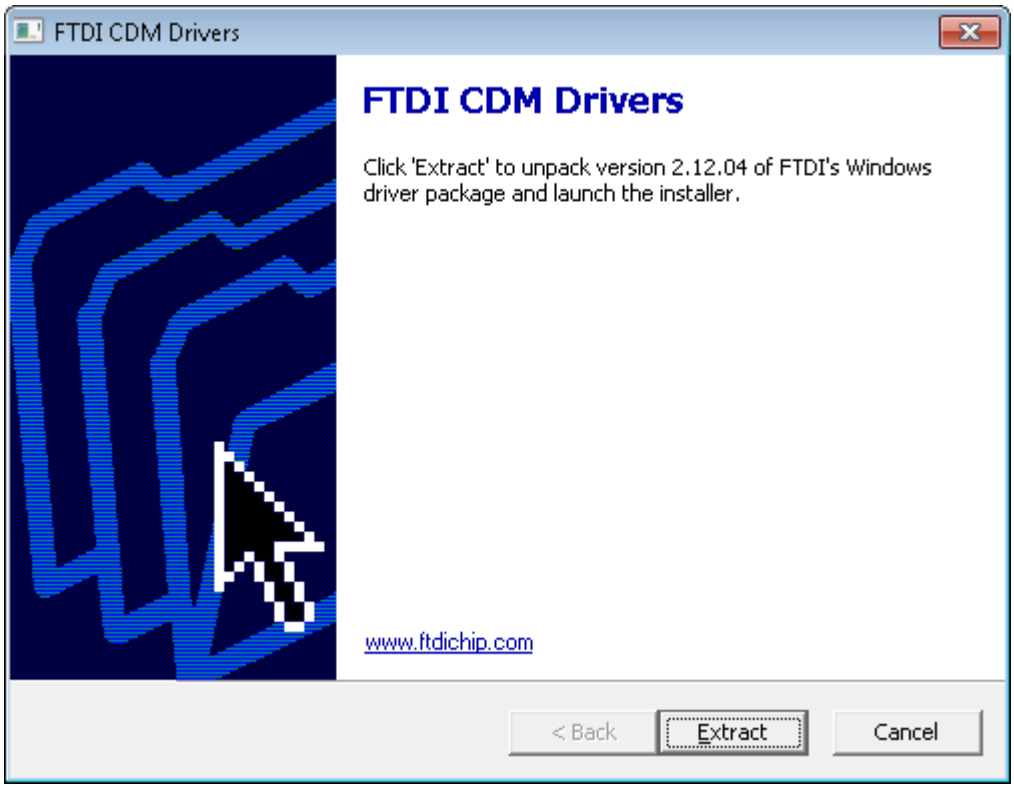



**Figure 15. FTDI Installation Initialization**

15. A screen as shown in Figure 16 appears, click **Next** to proceed.

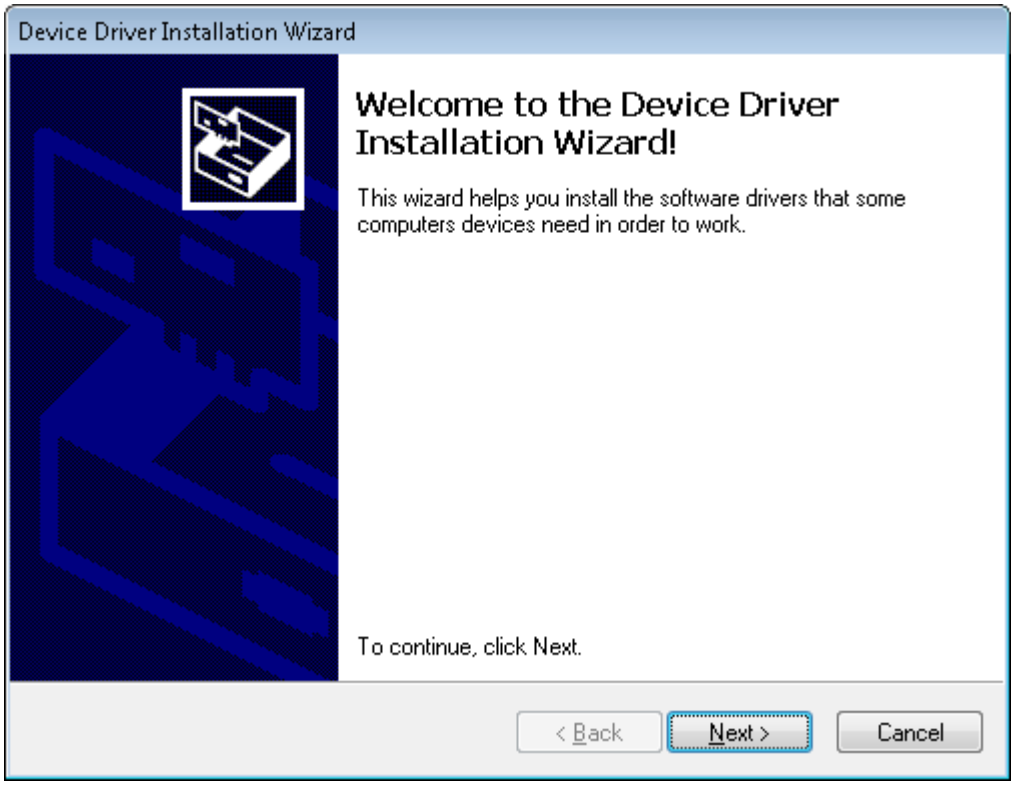



**Figure 16. Driver Installation Wizard**

16. The License Agreement appears on screen as shown in Figure 17.
17. Read through the License Agreement carefully and enable the “I Accept this Agreement” radio button and Click on **Next.**

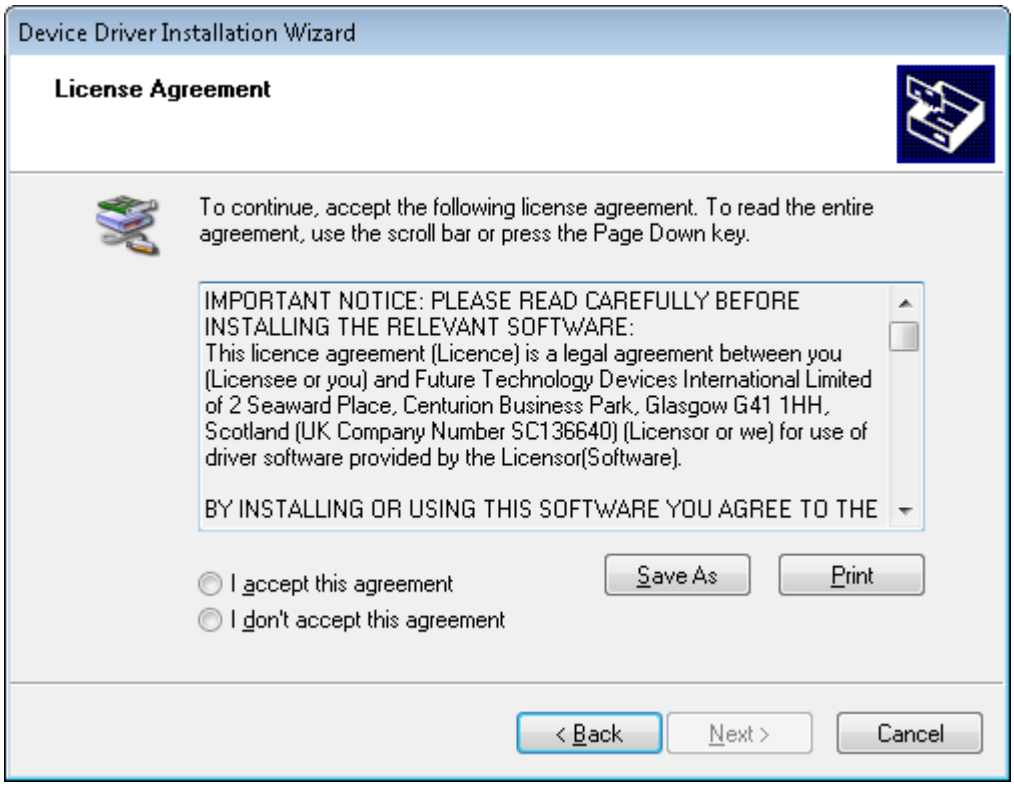



**Figure 17. License Agreement for FTDI Driver**

18. Click **Finish** to complete the Driver Installation.

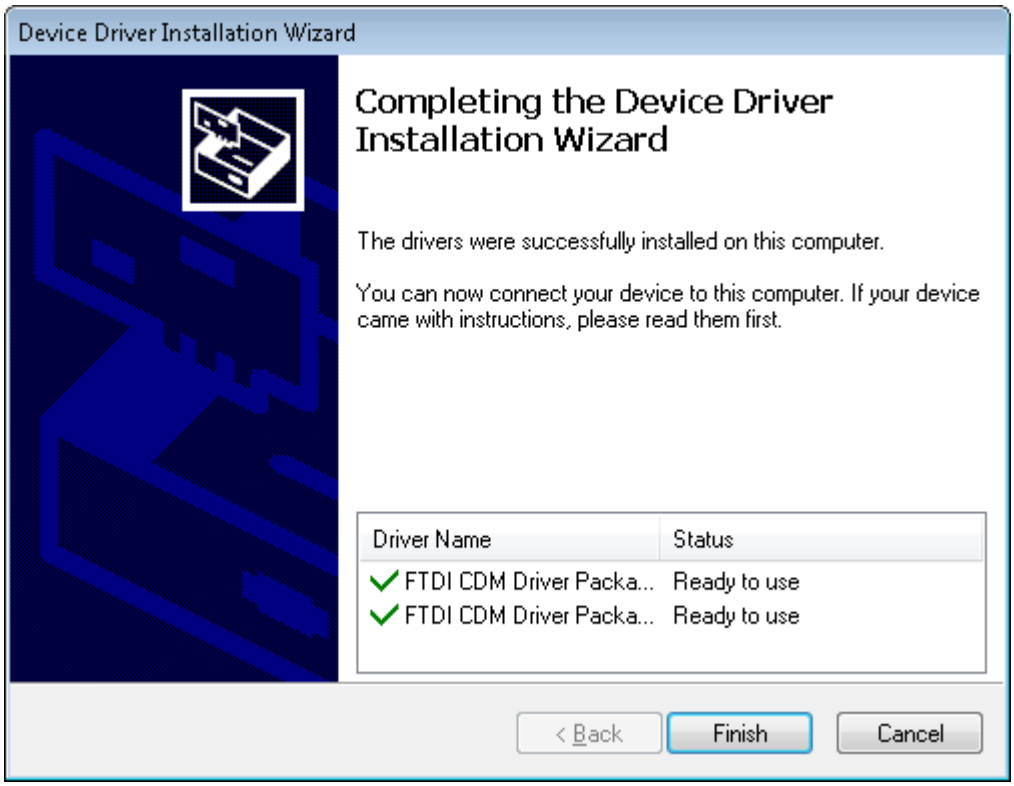



**Figure 18. Driver Installation Completion**

19. Figure 19 appears denoting the completion of DRV8821/DRV8823 EVM GUI Installation. Click **Finish**.

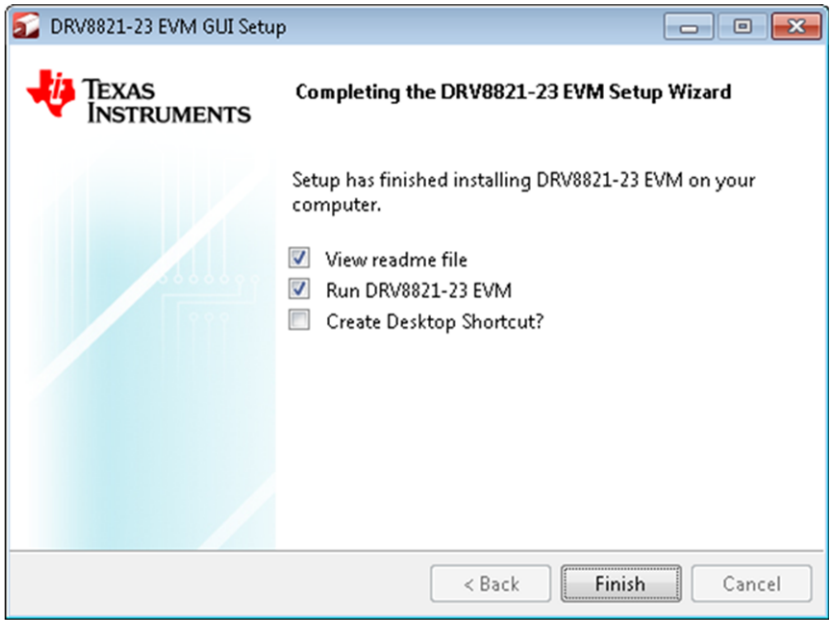



**Figure 19. Installation Complete**

20. A Readme window as shown in Figure 20 appears displaying the link for LV 2014 RTE.

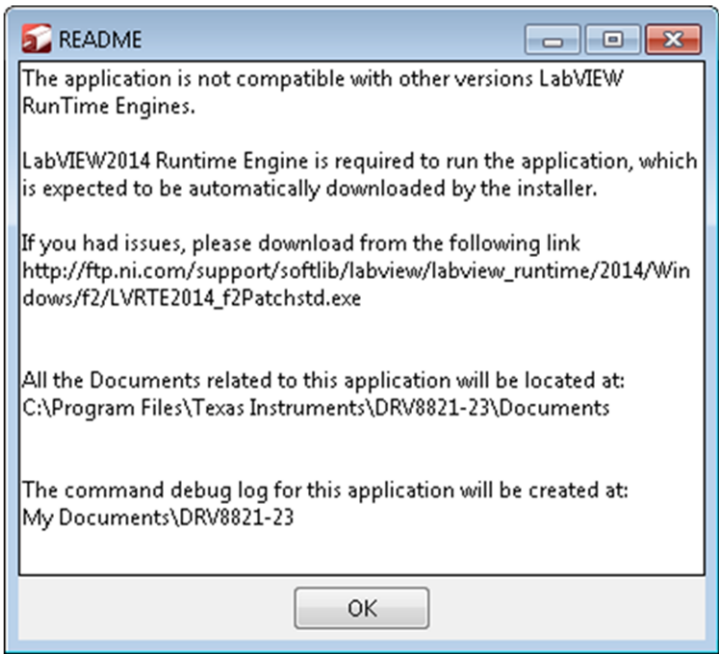



**Figure 20. Readme Window**

## WARNING

**The DRV8821/DRV8823 EVM GUI requires the LabVIEW Run-Time Engine 2014 to be installed before the GUI executes. Please note the application is not compatible with other versions of LabVIEW Runtime Engine.**

You can download National Instruments LabVIEW Run-Time Engine 2014 from the below link:

LabVIEW Run-Time Engine 2014

**NOTE:** DRV8821/DRV8823 EVM GGUI executable has been built in LabVIEW 2014 (32-bit) version, and it expects the LabVIEW Run-Time Engine version to be LabVIEW Run-Time Engine (32-bit version).

# 3 The Windows Application

The CPG003_DRV8821-23EVM Windows application is the software counterpart for the CPG003_DRV8821-23EVM-001 EVM. It allows the PC computer to connect to the MSP430F1612 microcontroller though an USB interface chip. Once connection is established and commands are sent, microcontroller takes care of configuring control signals and administering certain levels of automation, such as STEP generation (for DRV8821) or SPI communications (for DRV8823).

The graphical user interface (GUI) has been designed to allow for all of the DRV8821/DRV8823 device's functionality to be tested without having to intervene with the hardware, except for the proper configuration of jumpers, when needed.

Figure 21 and Figure 22 show the CPG003_DRV8821-23EVM-001_R1p0.exe main screen. The application is divided into two tabs: One for the DRV8821 and one for the DRV8823. The menu contains items to configure and enable/disable the serial port.

The DRV8821 tab contains frames with GPIO control for DRV8821's control signals, speed, acceleration and number of steps control for both stepper motors AB and CD, and current control through the microcontroller's DACs.

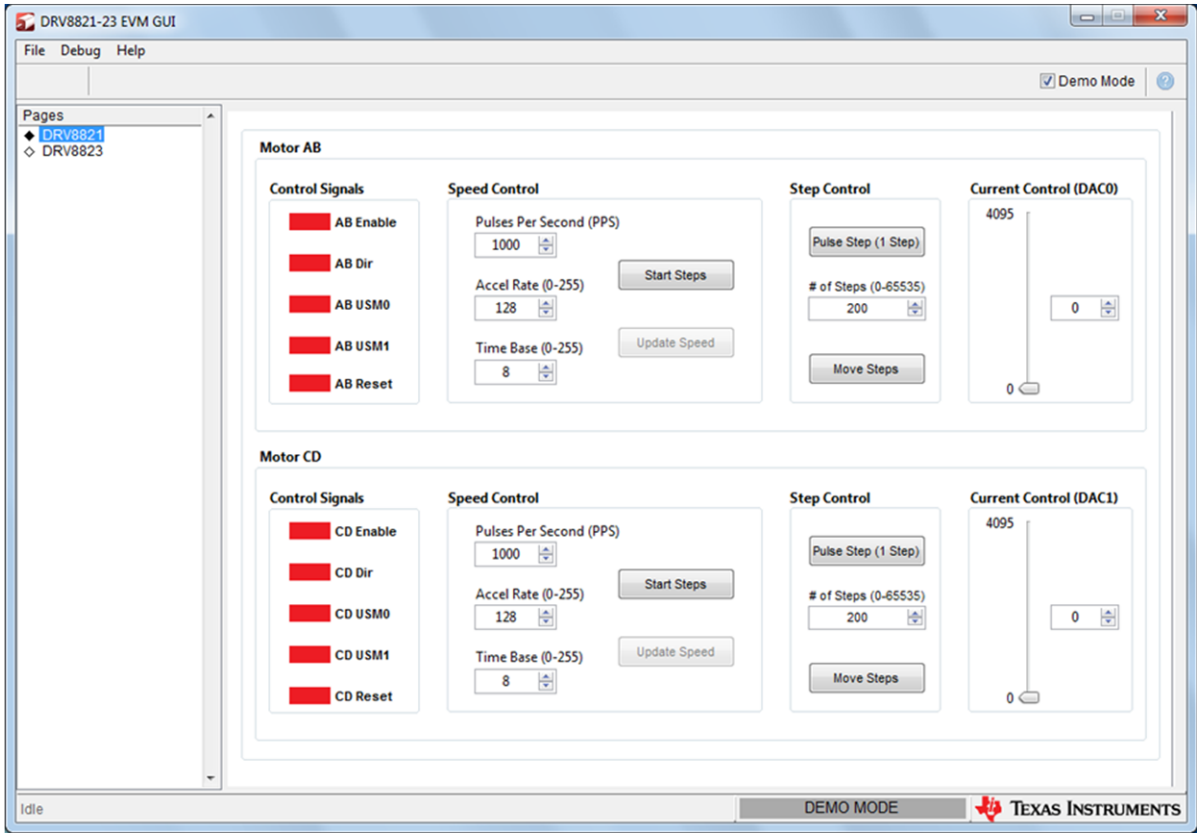



**Figure 21. CPG003_DRV8821-23EVM-001_R1p0.exe Main Screen (DRV8821)**

The DRV8823 tab contains two frames with the bits that make up the 16-bit serial registers which contain the control signals to properly articulate each motor. Also GPIO signals such as Reset and SLEEPn are made accessible through check boxes. Finally, two sliders adjust the reference voltage through the microcontroller's DAC outputs.

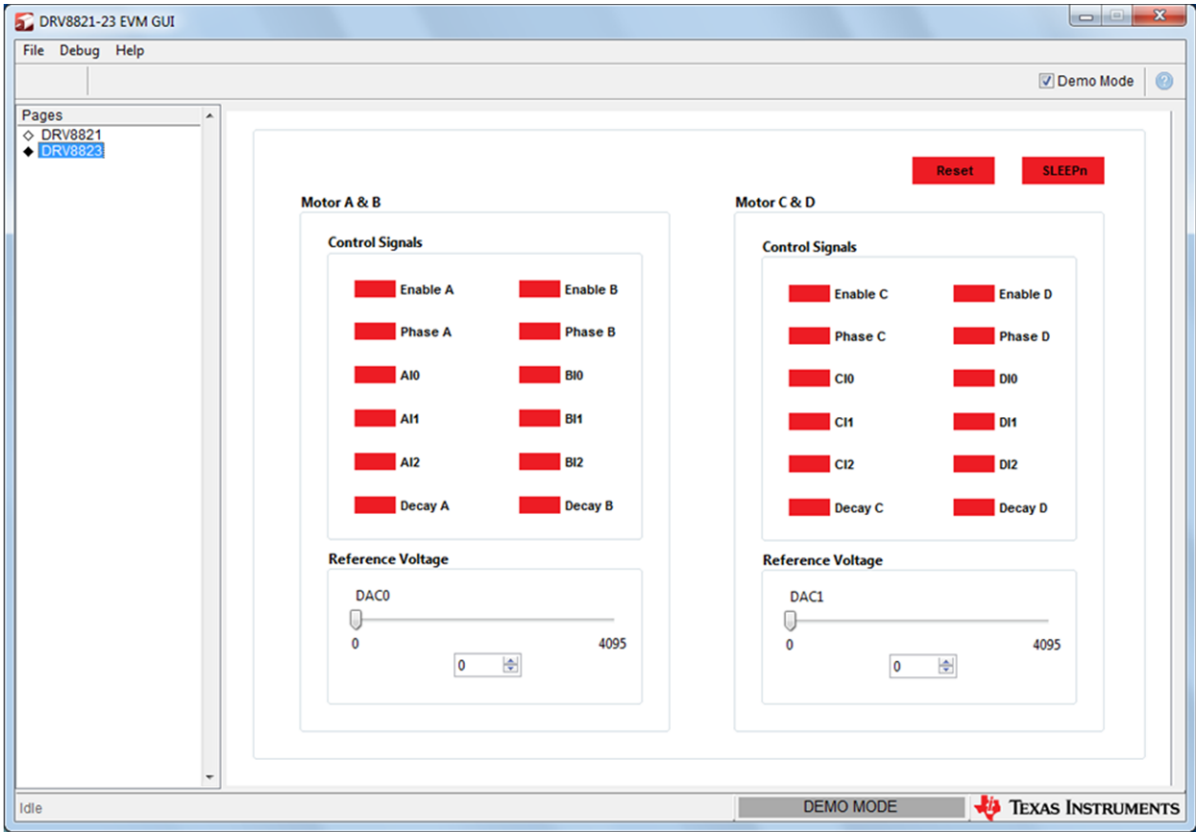



**Figure 22. CPG003_DRV8821-23EVM-001_R1p0.exe Main Screen (DRV8823)**

## 3.1 DRV8821 GPIO Control Signals

Once the application is communicating with the interface board, the control signals can be actuated by checking or un-checking check boxes on the Control Signals frame.

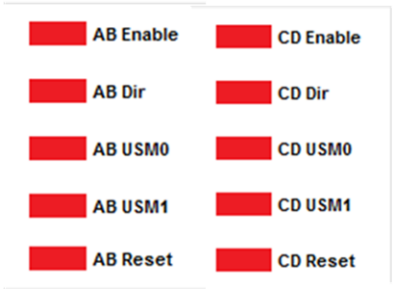



**Figure 23. Control Signals Frame**

A checked checkbox translates to a HI level on the respective control signal. Un-checked checkboxes translate to a LO level on the respective control signals.

## 3.2 Updating DAC Output for Current Control (VREF)

If the DRV8821 has been configured to accept VREF analog voltages through the microcontroller DAC outputs (refer to Jumpers section), then the slider bar on the Current Control frame can be used to set the VREF voltage.

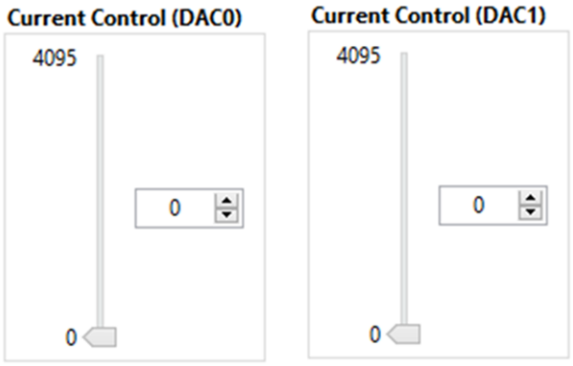



**Figure 24. Current Control Frame**

The 12-bit DAC channels, 0/1, are connected to the DRV8821/DRV8823 VREF analog inputs ABVREF and CDVREF. Changing the DAC digital value from 0 to 4095 changes the analog voltage at the respective VREF pin from 0 V to 2.5 V respectively, following Equation 1.

$$VREF = DAC\_VALUE \bullet \frac{2.5\ V}{4095} \tag{1}$$

Where:

1. VREF is the output voltage.
2. DAC_VALUE is a number from 0 to 4095.

## 3.3 Operating the Stepper Motor (DRV8821)

### 3.3.1 Turning the Stepper Motor

The Windows application, in conjunction with the MSP430F1612 microcontroller, utilizes a series of timers to coordinate the rate of steps sent to the device. Once all the control signals are configured accordingly, (ENABLEn = LO, SLEEPn = HI, RESETn = HI; DIR, USM0 and USM1 can be HI or LO depending on preferred mode of operation; SRn must be L, if external diodes are not populated), the motor is ready to be turned.

The DRV8821-23EVM-001 customer EVM allows for the possibility of coordinating step rates such that accelerating and decelerating profiles are achieved. Both acceleration and deceleration are controlled by the same parameters, acceleration rate and time base.

When the motor starts, it always starts at the slowed PPS speed (62 pulses per second). The controller will accelerate the motor in order to reach the PPS speed. Acceleration rate is an 8-bit number (0 to 255) that gets added to the current PPS speed and time base is an 8-bit number (0 to 255) that specifies how many milliseconds will elapse from one speed increase to the next. Once the specified PPS has been achieved, the acceleration stops.

The inverse of the above described will command the motor to stop.

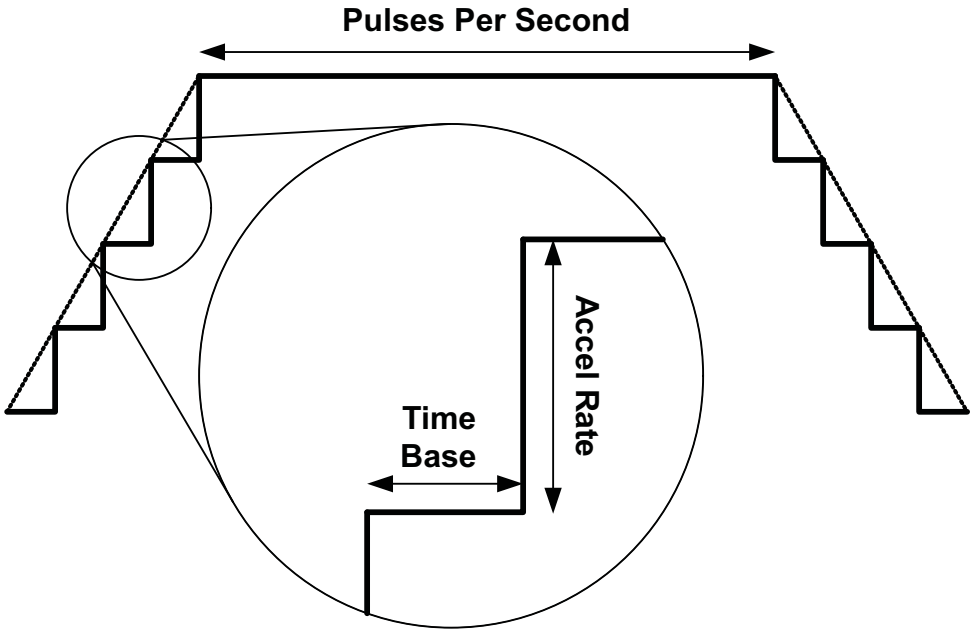



**Figure 25. Turning the Stepper Motor**

The Windows application frame to control speed, acceleration and deceleration, as well as motor start and stop is shown in Figure 26.

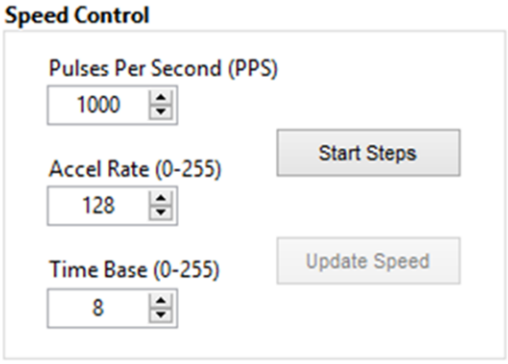



**Figure 26. Speed cnotrol Frame**

Pressing the “Start Steps” button, will start the timer and pulses will be generated at the rate specified by the decimal number at the PPS text box. Once the “Start Steps” button is pressed it becomes the “Stepping” button. Press the “Stepping” button to stop the stepper motion.

When the motor is stepping, the “Update Speed” button becomes enabled. Speed can be updated by modifying the PPS text box and then pressing the “Update Speed” button. The “Speed" button is disabled every time the motor is not turning because the stepping has been halted by pressing the “Stepping” button.

### 3.3.2 Step by Step control

The Step Control frame has a series of tools to control the stepping of the motor on a predetermined number of steps fashion.

The “Pulse Step” button allows for a single step to be issued. Remember that a STEP takes place when STEP goes from LO to HI.


**Figure 27. Step Control Frame**

To move the motor a number of steps and then stop, fill the "# of Steps" text box with a decimal number from 0 to 65535 and the motor will move that number of steps at the speed specified on the PPS text box. No acceleration or deceleration takes place under this function.

### 3.4 Operating the Motors (DRV8823)

The Windows application gives access to both serial registers on the DRV8823 bit by bit, very similar to the GPIO section on the DRV8821 tab. If the “Auto Update” checkbox is checked, checking any of the checkboxes on the respective frame, will update the serial register. If the “Auto Update” checkbox is unchecked, the button “Write Motor x” must be pressed for these bit states to be transmitted to the device.

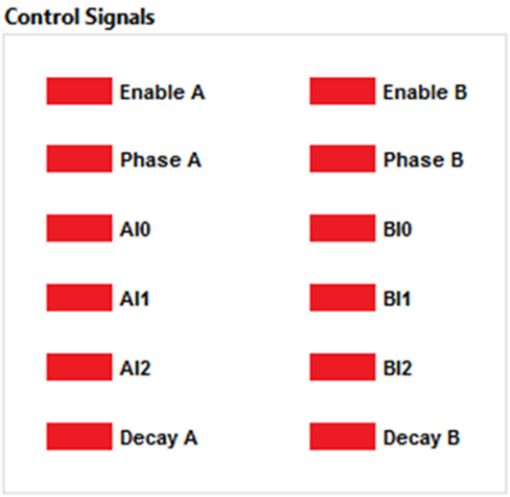



**Figure 28. Motor A and B Frame**

A checked checkbox translates to a 1 on the respective serial register bit. Un-checked checkboxes translates to a 0 on the respective serial register bits.

### 3.5 Updating DAC Output for Reference Voltage

If the DRV8823 has been configured to accept VREF analog voltages through the microcontroller's DAC outputs (refer to Jumpers section), then the slider bar on the Reference Voltage frame can be used to set the VREF voltage.


**Figure 29. Reference Voltage Frame**

The 12-bit DAC channels, 0/1, are connected to the DRV883 VREF analog inputs ABVREF and CDVREF. Changing the DAC digital value from 0 to 4095 changes the analog voltage at the respective VREF pin from 0 V to 2.5 V respectively, following Equation 2.

$$VREF = DAC\_VALUE \bullet \frac{2.5\ V}{4095} \quad (2)$$

Where:

1. VREF is the output voltage.
2. DAC_VALUE is a number from 0 to 4095.

## 4 Menu Options

- File - The File menu contains the option Exit as shown in Figure 30 below.

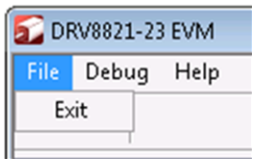



**Figure 30. File Menu**

- Debug - The Debug option can be used for the following operations.

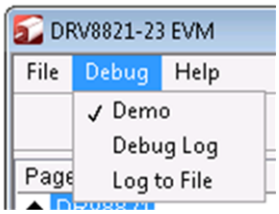



**Figure 31. Debug Menu**

-
  - Demo - By selecting the Demo in the submenu, the GUI runs in simulation mode, and by unselecting it, the GUI runs in connected mode.
  - Log to File - The log to file submenu is used to log the GUI activities to a log file that is specified.
  - Debug log - The Debug log option enables to log all the activities of the user. If that is not selected, only the high-level operations log.
- Help
  - Clicking the About in the Help Menu

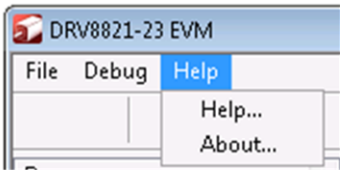



**Figure 32. Help Menu**

– The About Page provides the details like the Name of the GUI, GUI version, Supported OS and Copyright Information.


**Figure 33. About Page**

## STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   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.

**WARNING**

**Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.**

**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 DEGREDATION 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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。
上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社
東京都新宿区西新宿 6 丁目 2 4 番 1 号
西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page
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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

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:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

## IMPORTANT NOTICE AND DISCLAIMER

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