

This document is provided as a supplement to the DRV8811 datasheet. It details the hardware implementation of the DRV8811 customer evaluation module (EVM).

Contents

1	Introd	uction	. 3
	1.1	Block Diagram	. 3
	1.2	Power Connectors	. 3
	1.3	Test Stakes	. 3
	1.4	Jumpers	. 4
	1.5	Motor Outputs	. 4
2	Install	ing Drivers And Software	. 4
	2.1	Installing the FTDI USB Driver	. 4
	2.2	GUI Software Installation	. 4
	2.3	Running the Windows Application Software	15
3	Windo	ws Application	15
	3.1	Menu	17
	3.2	DRV8811 GPIO Control Signals	18
	3.3	Updating DAC Output for Current Control (VREF/DECAY)	19
	3.4	Updating DAC Output for Decay Control (DECAY)	19
	3.5	Operating the Stepper Motor	20

List of Figures

1	VREF SELECT Jumper	4
2	DECAY SELECT Jumper	4
3	Setup_DRV8811_EVM.exe	5
4	Installation Initialization	6
5	License Agreement	6
6	NI License Agreement	7
7	Installation Directory Screen	7
8	Component Selection	8
9	Configure Proxy	8
10	Ready to Install	9
11	Downloading RTE	9
12	LabVIEW RTE Self Extraction	10
13	LabVIEW RTE Installation Initialization	10
14	Installation of LabVIEW RTE in Progress	11
15	FTDI Installation Initialization	12
16	Driver Installation Wizard	12
17	License Agreement for FTDI Driver	13
18	Driver Installation Completion	14
19	Installation Complete	14
20	Readme Window	15
21	DRV8811EVM-001_R1p0.exe Main Screen	16



23 Debug Menu	17
24 Schematic	17
25 Help Menu	18
26 About Page	18
27 Signals Frame	19
28 Curent Control Frame	19
29 Current Control Frame	20
30 Step Rate	20
31 Speed Control Frame	21
32 Step Control Frame	21

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1 Introduction

The DRV8811EVM-001 customer EVM is the complete solution to evaluating the DRV8811 microstepping bipolar stepper driver. It houses a USB link to provide easy control from a PC computer, an MSP430 microcontroller that interprets serial commands from the PC and generates control signals to the driver device, and the DRV8811 device with access to all signals for a complete evaluation.

1.1 Block Diagram



1.2 Power Connectors

The DRV8811 customer EVM uses a combination of terminal blocks and test clips for the application/monitoring of power. The only power rail the user must supply is VM for the device's power stage. VDD for logic levels is internally generated from the USB connection.

The user must apply VM according to datasheet recommended parameters.

1.3 Test Stakes

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

3

Introduction



1.4 Jumpers

Three pin jumpers can be configured independently from the other two or three pin jumpers. However, two pin jumpers must either be closed or open. Two pin jumpers (JP2 to JP5) connect the diodes to the motor outputs and are used under asynchronous rectification (SR = LO).

1.4.1 VREF SELECT (JP1) Jumper



Figure 1. VREF SELECT Jumper

To configure the VREF SELECT jumper: Figure 1 (a) selects an analog voltage derived from VDD through a voltage divider implemented as a potentiometer R4. Figure 1 (b) selects an analog voltage derived from the MSP430's digital to analog converter channel 0 (DAC0).

1.4.2 DECAY SELECT (JP6) Jumper



Figure 2. DECAY SELECT Jumper

To configure the DECAY SELECT jumper: Figure 2 (a) selects an analog voltage derived from VDD through a voltage divider implemented as a potentiometer R6. Figure 2 (b) selects an analog voltage derived from the MSP430's digital to analog converter channel 1 (DAC1).

1.5 Motor Outputs

There are three ways of connecting the bipolar stepper motor into the DRV8811 EVM: four pin header (J2), four position terminal block (J3) or test clips. Each connection style offers identical connectivity to the device's output terminals. It is recommended, however, to use the header or terminal block, as the test stakes traces are of low current handling capability.

2 Installing Drivers And Software

2.1 Installing the FTDI USB Driver

Instructions on how to install the FTDI USB driver on a Windows based computer are detailed in the "USB_Drivers_Install_Readme.pdf" file supplied with the CD inside the USB_Driver folder.

2.2 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.

2.2.1 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

2.2.2 Installation Procedure

The following procedure helps you install the DRV8811 GUI

1. Double click on the Setup_DRV8811_EVM.exe as shown in Figure 3.

	s > Documents >	▼ 4 1	Search Documents	
Organize 🔻 Share w	ith 🔻 New folder) III • III •
Favorites	Documents library Includes: 2 locations		Arra	nge by: Folder 🔻
Downloads Recent Places	Name	Date modified 05-08-2015 19:17	Type Application	Size 13,698 KB
Documents				
🐺 Computer				

Figure 3. Setup_DRV8811_EVM.exe

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

🔂 DRV8811 EVM GUI Setup		
TEXAS INSTRUMENTS	Setup - DRV8811 EVM GUI - v 0.9.0.0	
	Welcome to the DRV8811 EVM Setup Wiza	rd.
	< Back Next >	Cancel

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**.

🔂 DRV8811 EVM GUI Setup		- • •
License Agreement		
Please read the following Lic agreement before continuin	ense Agreement. You must ac g with the installation.	cept the terms of this
Source and Bina Important – Please ca which is legally bind whether you accent a	ary Code Internal Use Lic refully read the followin ing. After you read it and agree to its terms	ense Agreement g license agreement , , you will be asked Do not click "I have
Do you accept this license?	 I accept the agreement I do not accept the agree 	ment
	< Back	Next > Cancel

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.



DRV8811 EVM GUI Setup		
License Agreement		
Please read the following Lic the terms of this agreemen	ense Agreement. You must accept nt before continuing with the installatio	on.
NATIONAL IN	NSTRUMENTS SOFTWARE AGREEMENT	
INSTALLATION NOTICE: T SOFTWARE AND/OR CON DEAD THIS ACREEMEN	HIS IS A CONTRACT. BEFORE YOU MPLETE THE INSTALLATION PROC T BY DOWNING THE SOL	
Do you accept this license? InstallBuilder	 I accept the agreement I do not accept the agreement 	
	< Back N	lext > Cancel

Figure 6. NI License Agreement

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

🔂 DRV8811 EVM GUI Setup	
Installation Directory	
Please specify the directory where DRV8811 EVM will be installed.	
Installation Directory C:\Program Files(x86)\Texas Instruments\DRV	2
InstallBuilder	
< Back Next	> Cancel

Figure 7. Installation Directory Screen

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

 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.



DRV8811 EVM GUI Setup
Select Components
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.
Image: Click Next when you are ready to continue.
Image: Click on a component to get a detailed description
InstallBuilder
(< Back Next > Cancel

Figure 8. Component Selection

 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.

🔂 DRV8811 EVM GUI Setup	- • •
Configure Proxy(As Required)	*
Address	
Port	
InstallBuilder	
	Back Next > Cancel

Figure 9. Configure Proxy

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



🔂 DRV8811 EVM GUI Setup	- • •
Ready to Install	5 *
Setup is now ready to begin installing DRV8811 EVM on your comput	er.
InstallBuilder Kack Ne	xt > Cancel

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.

DRV88	11 EVM GUI Setup				3
Installing	3				Ŷ
Please wa	ait while Setup installs DR	₹V8811 EVM on your	computer.		
6	Downloading RTE	-			
	5000 KB downloade	Downloading ed. Speed: 850 KB/s.	Remaining ti	me: 5m 16s	
vetallBuile	der			_	
Iscalibulio	ACI.				

Figure 11. Downloading RTE

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



DRV8811 EVM GUI Setup		
Installing		
Please wait while Setup installs DRV8	3811 EVM on your comput	ter.
	Installing	
Extracting compressed[]roo	ducts\LabVIEW_Runtime_F	Engine_2014\lvrte.cab
and a life. Takes		
istalibuider		

Figure 12. LabVIEW RTE Self Extraction

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

nl.com/labview
peed. ement(s). or of Microsoft Silverlight.

Figure 13. LabVIEW RTE Installation Initialization

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



🐨 NI LabVIEW Run-Time Engine 2014 f2	Engine 2014 f2	
	NATIONAL INSTRUMENTS	
Overall Progress: 2% Complete		
Publishing product information		
	< Back Next >> Cancel	

Figure 14. Installation of LabVIEW RTE in Progress

- 13. Once the LabVIEW RTE 2014 is installed, DRV 8811 EVM GUI component installs.
- 14. After DRV8811 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.

Device Driver Installation Wizar	rd
	Welcome to the Device Driver Installation Wizard! This wizard helps you install the software drivers that some computers devices need in order to work.
	< <u>B</u> ack <u>Next</u> Cancel

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.**

Device Driver In	nstallation Wizard	
License Ag	greement	
Ŵ	To continue, accept the following license agreement. To read the entire agreement, use the scroll bar or press the Page Down key. IMPORTANT NOTICE: PLEASE READ CAREFULLY BEFORE INSTALLING THE RELEVANT SOFTWARE: This licence agreement (Licence) is a legal agreement between you (Licensee or you) and Future Technology Devices International Limited of 2 Seaward Place, Centurion Business Park, Glasgow G41 1HH, Scotland (UK Company Number SC136640) (Licensor or we) for use of driver software provided by the Licensor(Software). BY INSTALLING OB LISING THIS SOFTWARE YOU AGBEE TO THE	▲
	○ I accept this agreement Save As Print ○ I don't accept this agreement < Back Next >	ancel

Figure 17. License Agreement for FTDI Driver

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



Device Driver Installation Wizar	d	
	Completing the De Installation Wizard	vice Driver 1
	The drivers were successfully in	stalled on this computer.
	You can now connect your devi came with instructions, please re	ice to this computer. If your device ead them first.
	Driver Name	Status
	✓ FTDI CDM Driver Packa	Ready to use
	✓ FTDI CDM Driver Packa	Ready to use
	< <u>B</u> ack	Finish Cancel

Figure 18. Driver Installation Completion

19. Figure 19 appears denoting the completion of DRV8811 EVM GUI Installation. Click Finish.





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



EADME	
The application is not compatible with other version Engines.	ons LabVIEW RunTim
LabVIEW2014 Runtime Engine is required to run th expected to be automatically downloaded by the i	e application, which nstaller.
If you had issues, please download from the follow http://ftp.ni.com/support/softlib/labview/labview s/f2/LVRTE2014_f2Patchstd.exe	ving link _runtime/2014/Wind
All the Documents related to this application will b C:\Program Files\Texas Instruments\DRV8811\Doc	e located at: uments
The command debug log for this application will b My Documents\DRV8811	oe created at:
ОК	

Figure 20. Readme Window

WARNING

The DRV8811 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: DRV8811 EVM GUI 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).

2.3 Running the Windows Application Software

To run the application, search for the desktop shortcut of the application or search for the DRV8811EVM GUI in your Programs or its installation directory.

3 Windows Application

The DRV8811 Windows Application is the software counterpart for the DRV8811 EVM. It is in charge of connecting to the MSP430 microcontroller via a USB connection which in turn selects the proper logic state for the DRV8811 control signals.

The graphical user interface (GUI) has been designed to allow for all of the DRV8811 device's functionality to be tested without having to intervene with the hardware, except for the proper configuration of jumpers when needed.



Windows Application

www.ti.com

Figure 21 shows the GUI main screen. It contains menu items to configure and enable/disable the serial port, frames with GPIO control for the DRV8811 control signals, stepper motor control for start/stop and speed, and current/decay control through the MSP430 DACs.



Figure 21. DRV8811EVM-001_R1p0.exe Main Screen



3.1 Menu

• File - The File menu contains the option Exit as shown in Figure 22 below.



Figure 22. File Menu

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

2 DRV8811 EVM		
File View	Debug	Help
	√ Dem Debi	o 1g Log
Pages	Logt	to File

Figure 23. 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.
- · View Select View-> Schematics->DRV8811 to view the GUIs schematics



Figure 24. Schematic



- Help
 - Clicking the About in the Help Menu

🖸 DRV8811 EVM				
File	View	Debug	Help	
			He	lp
			Ab	out

Figure 25. Help Menu

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



Figure 26. About Page

3.2 DRV8811 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 Signals frame.





Figure 27. Signals Frame

A checked checkbox translates to a HI level on the respective control signal. A un-checked checkbox translates to a LO level on the respective control signal.

3.3 Updating DAC Output for Current Control (VREF/DECAY)

If the DRV8811 EVM has been configured to accept VREF analog voltages through the MSP430 microcontroller interface (JP1 is set to INT), then the slider bar on the Current Control frame can be used to set the VREF voltage.

Decay Control	Current Control
Vref = 0.35 V	Vref = 0 V
0 4	095 0 4095

Figure 28. Curent Control Frame

The MSP430F1612 12-bit DAC channel 0 is connected to the DRV8811 VREF analog input. Changing the DAC digital value from 0 to 4095, changes the analog voltage at the VREF/DECAY pin from 0 V to 2.5 V respectively. See Equation 1.

 $VREF = DAC_VALUE \bullet \frac{2.5 V}{4095}$

(1)

Where VREF is the output voltage and DAC_VALUE is a number from 0 to 4095.

3.4 Updating DAC Output for Decay Control (DECAY)

If the DRV8811 EVM has been configured to accept DECAY analog voltages through the MSP430 microcontroller interface (JP6 is set to INT), then the slider bar on the Current Control frame can be used to set the DECAY voltage.





Figure 29. Current Control Frame

The MSP430F1612 12 bit DAC channel 1 is connected to the DRV8811 DECAY analog input. Changing the DAC digital value from 0 to 4095, changes the analog voltage at the DECAY pin from 0 V to 2.5 V respectively. See Equation 2.

$$DECAY = DAC_VALUE \bullet \frac{2.5 V}{4095}$$

Where DECAY is the output voltage and DAC_VALUE is a number from 0 to 4095.

(2)

3.5 Operating the Stepper Motor

3.5.1 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 DRV8811EVM-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 pulses per second (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 speed has been achieved, the acceleration stops.



Figure 30. Step Rate



When the motor is commanded to stop, the inverse of the description above occurs.

The Windows Application frame to control speed, acceleration and deceleration, as well as motor start and stop, looks as portrayed in Figure 31.

200	32000
200 🛃 Pulses Per S	Second(PPS)(200-32000)
50 🚖 Acceleration	n Rate (0-255)
1 🔄 Time Base (1	0-255 ms)

Figure 31. Speed Control 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 Update Speed button is disabled every time the motor is not turning because the stepping has been halted by pressing the Stepping button.

3.5.2 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. At the same time, the STEP Control check box allows the control of the STEP signal in the same fashion that other GPIO signals on the Signals frame could be set and cleared. Checked stands for HI and unchecked for LO. Remember that a STEP takes place when STEP goes from LO to HI.

Pulse Step (1 Step)		
# of 9	Steps (1	1-65536
	love St	ens

Figure 32. 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.

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