DRV8811EVM

User's Guide

Literature Number: SLVA344A
July 2009–Revised September 2009

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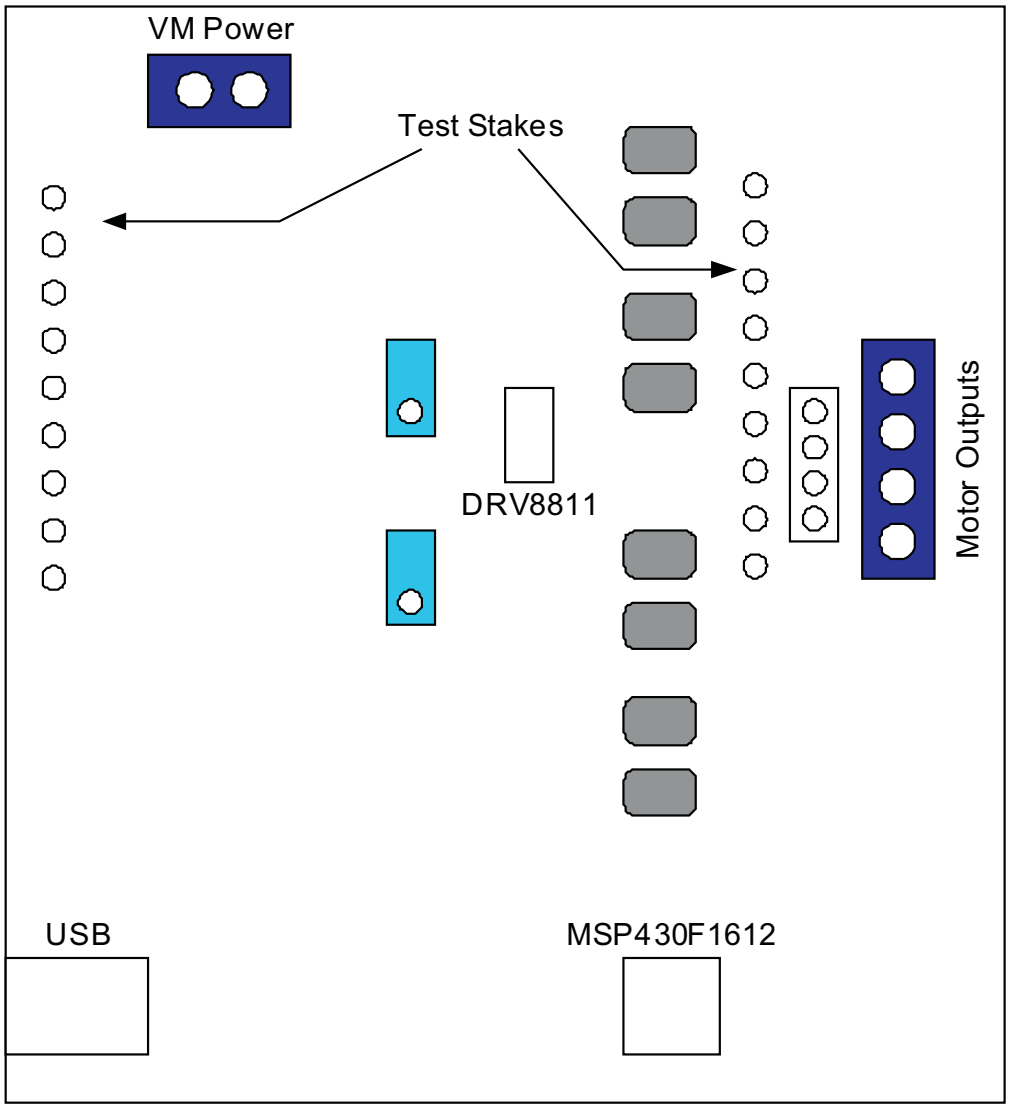
Laser and Motor Drives

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

1 Introduction

The DRV8811_RD 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.

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

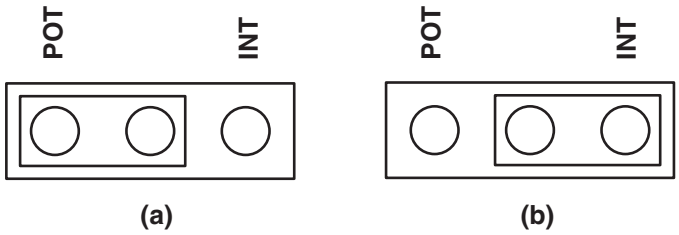


Figure 1. VREF SELECT Jumper

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

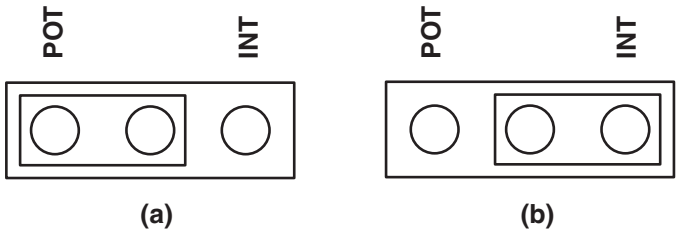


Figure 2. DECAY SELECT Jumper

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 Installing the DRV8811 Evaluation Board Windows Application Software

The included CD contains a folder titled “Windows Application”. It is recommended for the contents of this folder to be copied to any desired folder on the computer. The reason for this is the Settings.ini file will be written upon software exit. This action can not take place if the application is run within the CD environment.

2.3 Running the Windows Application Software

To run the application, double click the DRV8811_RD_EVM_R1p0.exe application icon found in the same folder the application was extracted into.

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.

Figure 3 shows the DRV8811_RD_EVM_R1p0.exe 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.

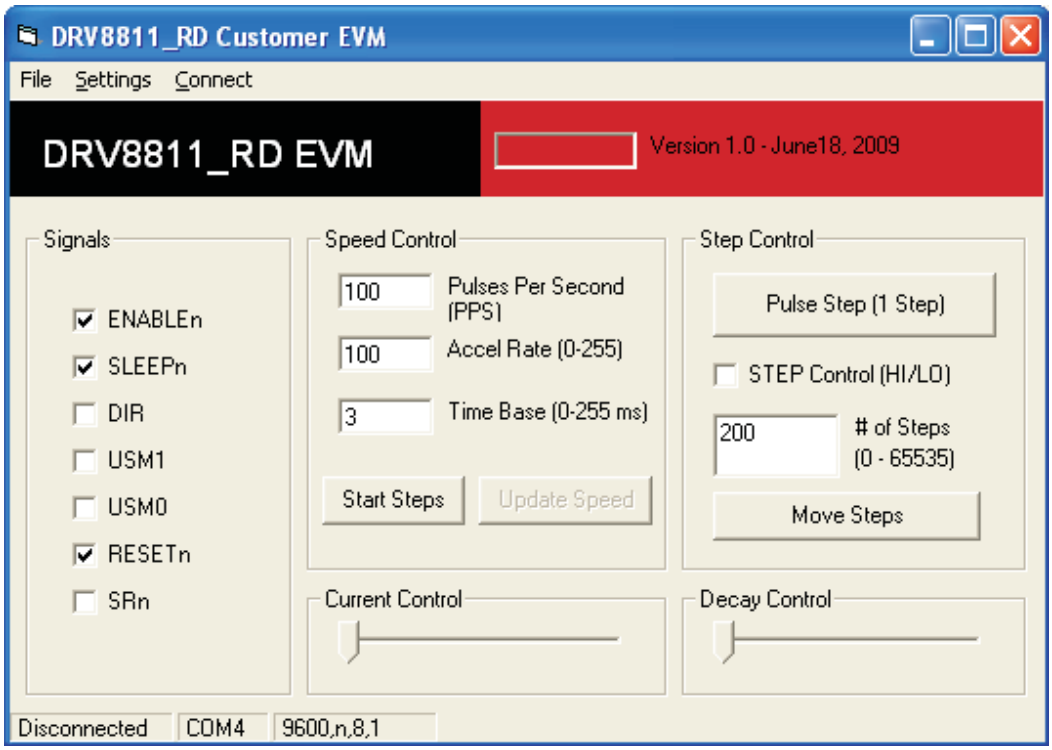


Figure 3. DRV8811_RD_EVM_R1p0.exe Main Screen

3.1 Menu

The menu at the top of the application offers a series of quick options for how the COM port is to behave.

1. **File** → Exit - Terminates the application
2. **Settings** → Port - Selects from COM1 to COM4. Default is COM4.
   The serial port's actual port number defaults to what we have specified on "USB_Drivers_Install_Readme.pdf". However, any port between COM 1 and COM 4 are equally usable.
3. **Connect:** Opens the serial port. When this menu item is pressed, its caption changes to "Disconnect".
4. **Disconnect:** Closes the serial port. When this menu item is pressed, its caption changes to "Connect".

After opening the application, the order of events should be:

1. Go to Settings → Port and choose the COM port where the USB virtual COM port device has been configured to work. If the COM port is 4, then this step can be skipped as application defaults to COM4.
2. Press Connect. If the port is available, the menu changes the "Connect" caption to "Disconnect". Press Disconnect to disable the serial communications.

<1><4><0> should return on the text box as an acknowledgement. The text box also changes from red to green, as shown in Figure 4.

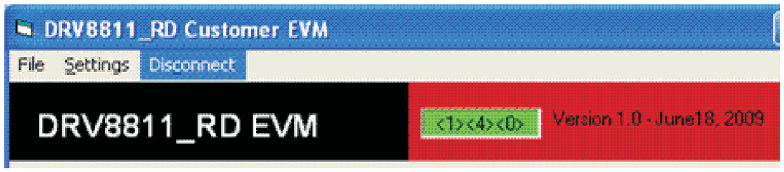


Figure 4. Acknowledgement Text Box

The application is ready for use.

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 5. 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.

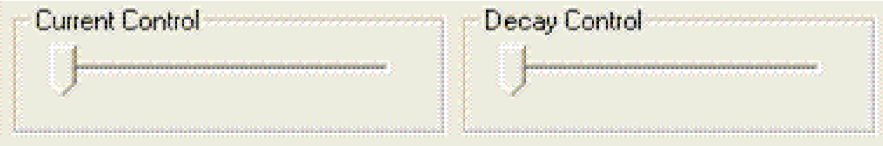


Figure 6. Curent Control Frame

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.

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

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.

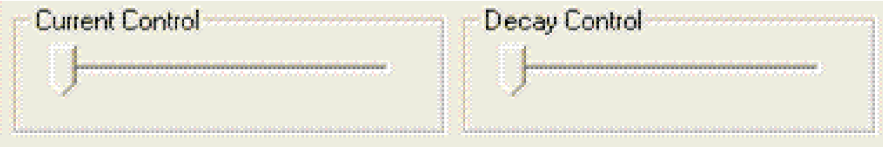


Figure 7. Current Control Frame

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.

$$DECAY = DAC_VALUE \bullet \frac{2.5\ V}{4095} \tag{2}$$

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

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 DRV8811_RD 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.

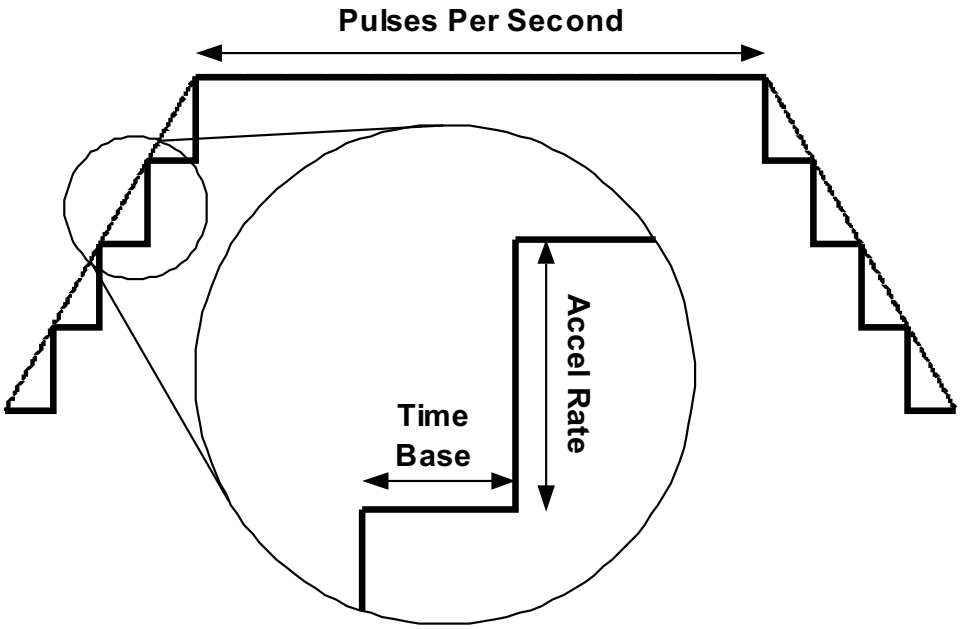


Figure 8. Step Rate

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 9.

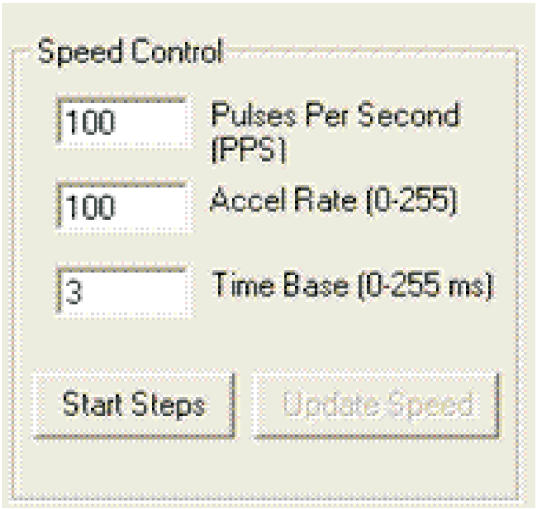


Figure 9. Speed Control Frame

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.

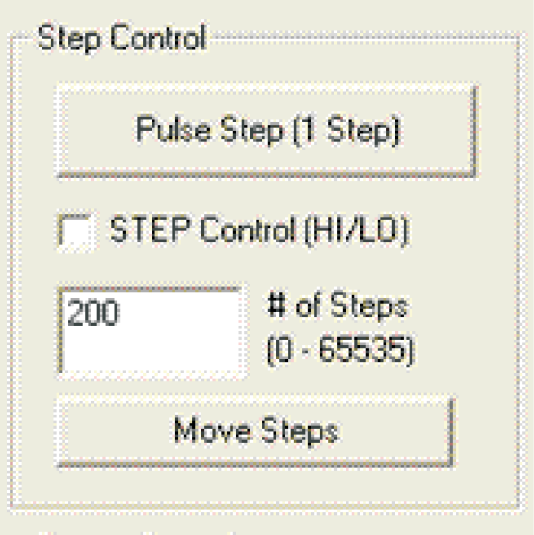


Figure 10. Step Control Frame

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.

4 Schematic

The schematic can be found on the provided CD under the EVM Related folder.

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