

High Speed Driver Evaluation Board

MEMs Evaluation Driver Board
for critical timing requirements

Features

- Arbitrary waveform generation
- 4 Channels Analog Output
- 24 Channels of Digital Output
- 8100 Events Memory
- Simple USB UART interface
- Timing resolution from 3 μ s to 45 seconds with 10 ns resolution in between.
- One shot or periodic waveforms



Overview

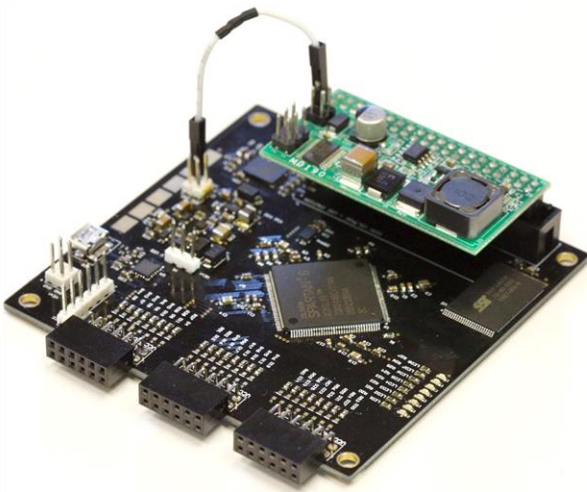
The wave drive evaluation board is designed to upgrade the functionality of the Raspberry Pi MEMs Evaluation platform. Software and simple interfaces have been developed to make it easy for users to communicate with the driver. The board is designed to accept Preciseley's MEMs driver evaluation board designed for the Raspberry Pi with zero additional circuitry required. Software and source code for controlling the driver is provided in C++ for higher performance applications. For even higher performance needs, an SPI interface and protocol are provided allows the end user to produce waveforms with much greater resolution.

1.0 Wiring and Communication

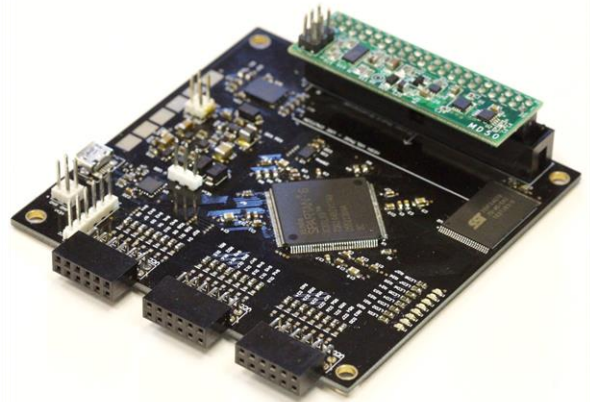
Insert the driver board into the driver board slot ensuring the correct orientation and seated firmly.

When using the 190V driver, connect the 12V power supply to the 190V board. To connect the **190V** board, connect the **Pin 12V on Port J2** on the main board to **Pin 4 on Port CN3** on the daughter board. Only one wire is required to connect the two boards. For additional details, see the 190V driver board manual.

For the 50V driver, there is no additional wire to connect to use the board.



190V Driver Installed



50V Driver Installed



High voltages used in the driver board.

Do not touch the driver when it is energized.

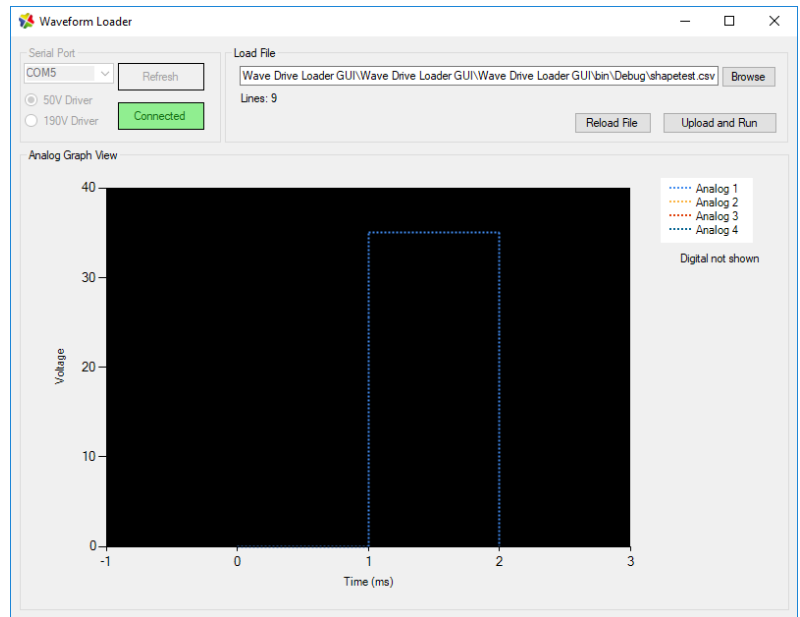
Unplug the board from power or USB when moving or changing wires.

For your safety, avoid exposure to high voltage!

2.0 Evaluation Software Usage

A program loader is included with the SDK. The program is easy to use.

1. Connect the board to the computer using a Micro USB cable.
2. The board should install automatically as it utilizes a FTDI virtual com port chip which Windows will recognize.
3. Launch the program *WaveformLoader.exe*
4. Choose the correct serial port from the drop down menu. If more than one port is connected, you may need to try multiple ports. This is usually not the case. If you didn't connect the board, click the *Refresh* button once the board is connected. Once connected, the program will remember your choice.
5. Click the *Open* button. If the connect is successful, the button will turn green.
6. Open the waveform file by click the *Browse* button. An Open File dialog will appear. Several examples are included for you to try. One example will blink the LEDs on the driver board.
7. Click *Upload and Run*.
8. If you make changes to the waveform file, click *Reload File* to import the changes, then click *Upload and Run* to upload your changes.



3.0 Waveform File Format with the Evaluation Program

The evaluation program accepts a csv file as a parameter. The format of the file is simple, but critical, and must be followed. Each line has three parameters, the channel, the timing, and the output value. The channels are listed in Table 4.1. The timing parameter is in nanoseconds. And the output value is a floating point number in the range from 0.0 to 190.0V if using the 190V driver and 0 to 50V if using the 50V driver. Each channel MUST be an integer. To put the device into loop mode for periodic signals a special row must be used at the end if the file.

Waveform File Format

- The file should have three columns
 - Column 1 is either 1, 2, 3, 4, 201, or 202
 - Column 2 is the output voltage. May contain a decimal. (1000000 = 1 second)
 - Column 3 is time in nanoseconds with no decimal. Time must be *greater than 3000 ns* to ensure functionality. For example, 200 ns, 10 ns, and 45 ns is not guaranteed to function. 3010 ns, 9430 ns, and 1000000 ns will work. You may use the exact same time as the previous row. Additional examples are shown below.
 - Each row has three columns, no letters, and no symbols

- The file extension should be .csv or .txt
- If the waveform should run as a periodic looping waveform, put 254,0,0, as the last line
 - If the pattern needs to repeat half the pattern, the jump to command can be used to indicated which position to reset to.
 - 254, <row number – 1>, <time to reset> (Example 254, 4, 10000 will cause the loop to jump to the 5 line at time 10000.
- The file must be sorted by the time column *except for the 254,0,0,* row at the end of the file.
- Please check the documentation for the maximum voltage for the mirror being used.
 - Damage to the target device is possible if the voltage rating is exceeded.
 - Please consult the device specifications for maximum voltage of the target device.

When creating a waveform file, the file must be sorted by the microsecond's column so that each row is greater than or equal to the time of the previous row. Channel order does not matter.

(Channel)	(Output Voltage)	(Nano Seconds)
1,	50.0,	1000,
2,	32.1,	50000000,
1,	37.2,	60000060,
2,	10.0,	75000070,
254,	0,	0,

The file format of the csv must have commas (,) at the end of each line.

For digital IO, use channels 200 and 201. Below is a table of bits and their corresponding ports.

Bit	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Channel 200	PortD<4:1>				PortC<4:1>				PortB<4:1>				PortA<4:1>			
Channel 201	PortF<4:1>				PortE<4:1>				LEDs<8:1>							

4.0 Example Waveform

Several example files are included with the example program in the SDK Zip File.

To verify the board is connect and your waveform file is working, trying using the LEDs for indicators. Here's an example waveform which turns the LEDs on, then displays a looping pattern.

```

201, 85, 0,
201, 1, 1100000000,
201, 2, 1200000000,
201, 4, 1300000000,
201, 8, 1400000000,
201, 16, 1500000000,
201, 32, 1600000000,
201, 64, 1700000000,
201, 128, 1800000000,

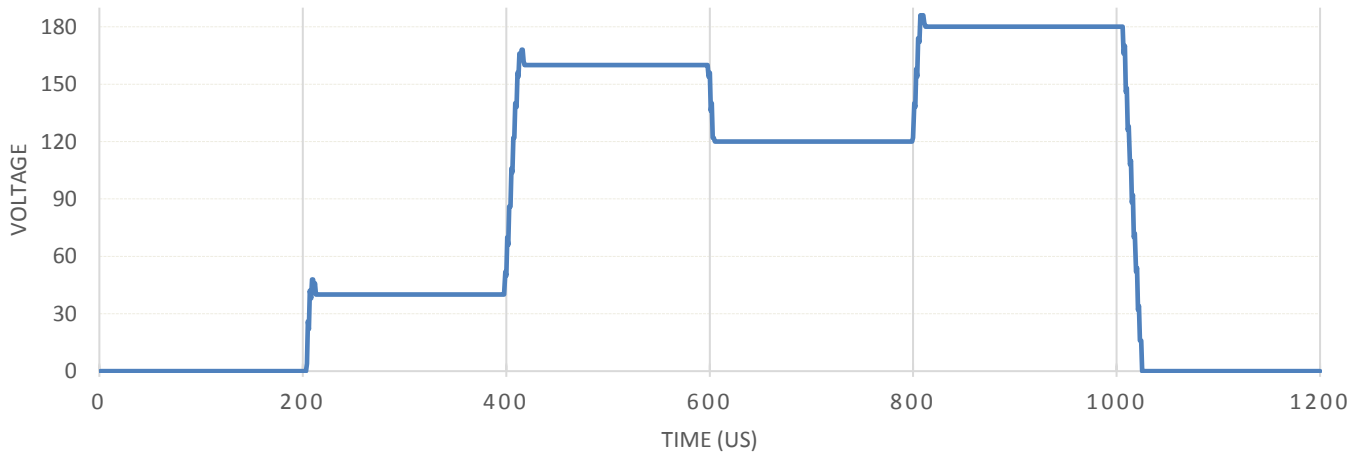
```

```
201, 64, 1900000000,
201, 32, 2000000000,
201, 16, 2100000000,
201, 8, 2200000000,
201, 4, 2300000000,
201, 2, 2400000000,
201, 1, 2500000000,
254, 2, 2600000000,
```

Here is an example file and its generated output. Note that the waveform loop restarts at time 1000. Be sure to include the start point and the end point of the wave you wish to define. In this example, we want to hold at 50V for 200us at the end. The start of the 50V starts at 800us and ends at 1000us. If we did not define 50V at 1000us, the waveform would not be generated predictably.

File Contents of example.csv

```
1, 0, 0,
1, 40, 200000,
1, 160, 400000,
1, 120, 600000,
1, 180, 800000,
1, 180, 1000000,
254, 0, 0,
```



*For a better estimate of performance, please refer to Section 1.0 Performance Characteristics.
Captured Output from 190V driver – Note the pattern restarts at 1000us
Results will vary based on load, filtering, and driver choice.*

5.0 Source Code and Compiling

You don't need to compile the program to use it. A compiled version is provided for you in the SDK Zip File. If you would like to develop additional functionality, we provide the source code for the example program which is included in the SDK Zip File.

For Advanced Users Who Are Interested in Adding Features

To re-compile our evaluation program follow the steps below.

The program is written in C# 4.6.1. Microsoft Visual Studio Community Edition is a free development environment and can be used to recompile the source code.

Once you have installed Microsoft Visual Studio, open the project file, and compile the program.