



# Graphical Control Panel User Manual

## DS-MPE-GPIO

### PCIe Minicard 36-bit Digital I/O Module

For Universal Driver Version 7.0.0 and later

Revision A.0

May 2015

Revision	Date	Comment
A.0	5/13/2015	Initial release

**FOR TECHNICAL SUPPORT  
PLEASE CONTACT:**

[support@diamondsystems.com](mailto:support@diamondsystems.com)

© Copyright 2015  
Diamond Systems Corporation  
555 Ellis Street  
Mountain View, CA 94043 USA  
Tel 1-650-810-2500  
Fax 1-650-810-2525  
[www.diamondsystems.com](http://www.diamondsystems.com)

# CONTENTS

<b>1. Introduction.....</b>	<b>3</b>
1.1 I/O Connector Pinout.....	4
<b>2. Digital I/O .....</b>	<b>6</b>
2.1 Set DIO pins to output mode .....	6
2.2 Set DIO pins as high .....	7
2.3 Set DIO pins as low.....	8
2.4 Set DIO pins to input mode .....	9
<b>3. PWM .....</b>	<b>10</b>
3.1 Start PWM .....	11
3.2 Stop PWM .....	12
3.3 Reset PWM .....	12
3.4 Change polarity of PWM signal .....	13
3.5 Change duty cycle at run time.....	14
<b>4. Interrupt.....</b>	<b>15</b>
4.1 Start Interrupt .....	15
4.2 Stop Interrupt.....	15
4.3 Reset Interrupt.....	16
<b>5. Counters .....</b>	<b>17</b>
5.1 Counter up mode.....	17
5.2 Counter down mode .....	18
5.3 Reset Counter .....	19

## 1. INTRODUCTION

This document provides information relevant to the operation and demonstration of the DS-MPE-GPIO board's capabilities and verification of the board's operation using the Universal Driver 7.0 GUI Program.

- Diamond Systems' Universal Driver 7.0 must be installed before executing the GUI program. For more details read the installation instructions provided with the Universal Driver package.
- To start the control panel in Windows double click the following executable file:  
DS-MPEGPIO\_Control\_Panel.exe
- To start the GUI in Linux, run the following executable file with root user permission:  
\$ ./DS-MPEGPIO\_Control\_Panel
- The main window of the control panel software for DS-MPE-GPIO is shown below in Figure 1.

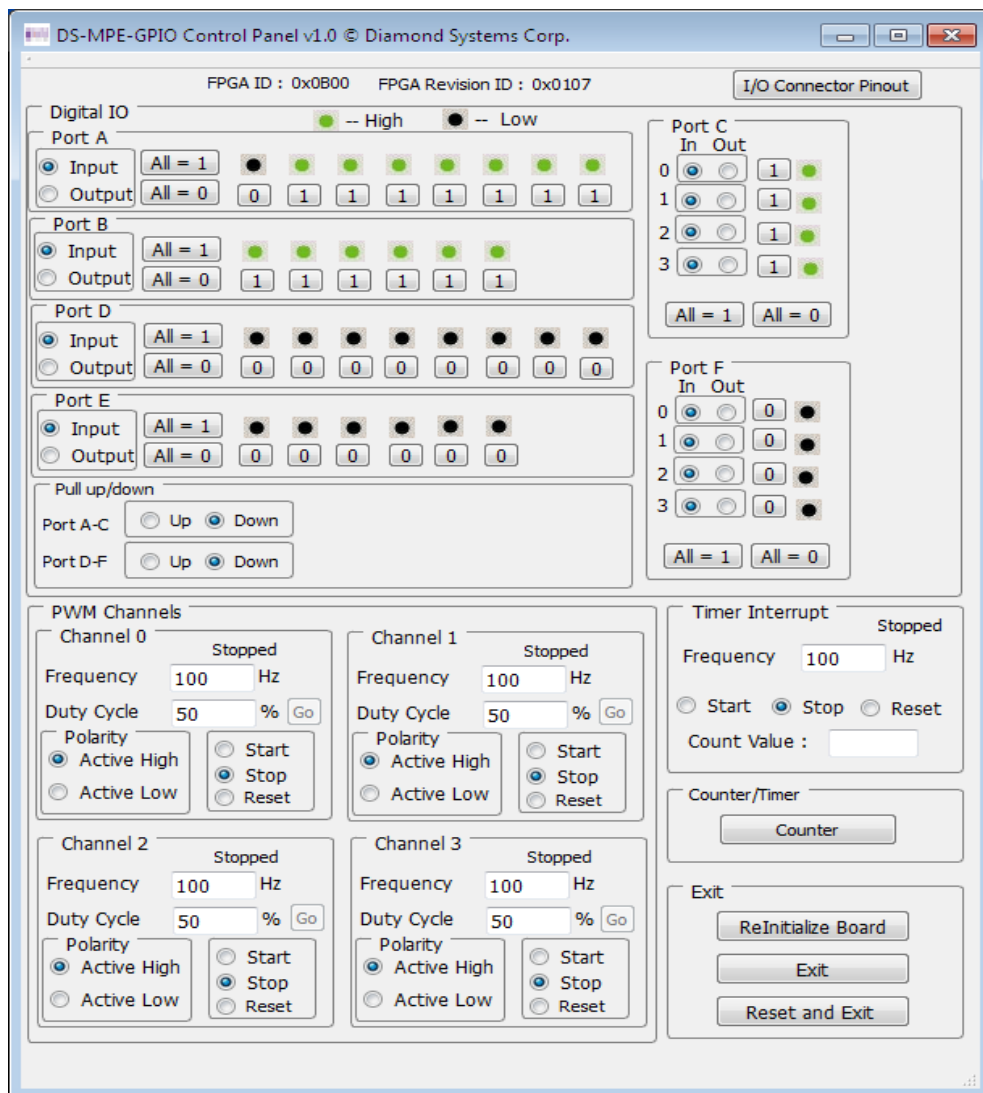


Figure 1: DS-MPE-GPIO Control Panel Main Window

## 1.1 I/O Connector Pinout

- To view the I/O connector pin out, click the “I/O Connector Pinout” button in the upper right hand corner of the main window, the location of which is shown below. A window opens with the board’s pinout.

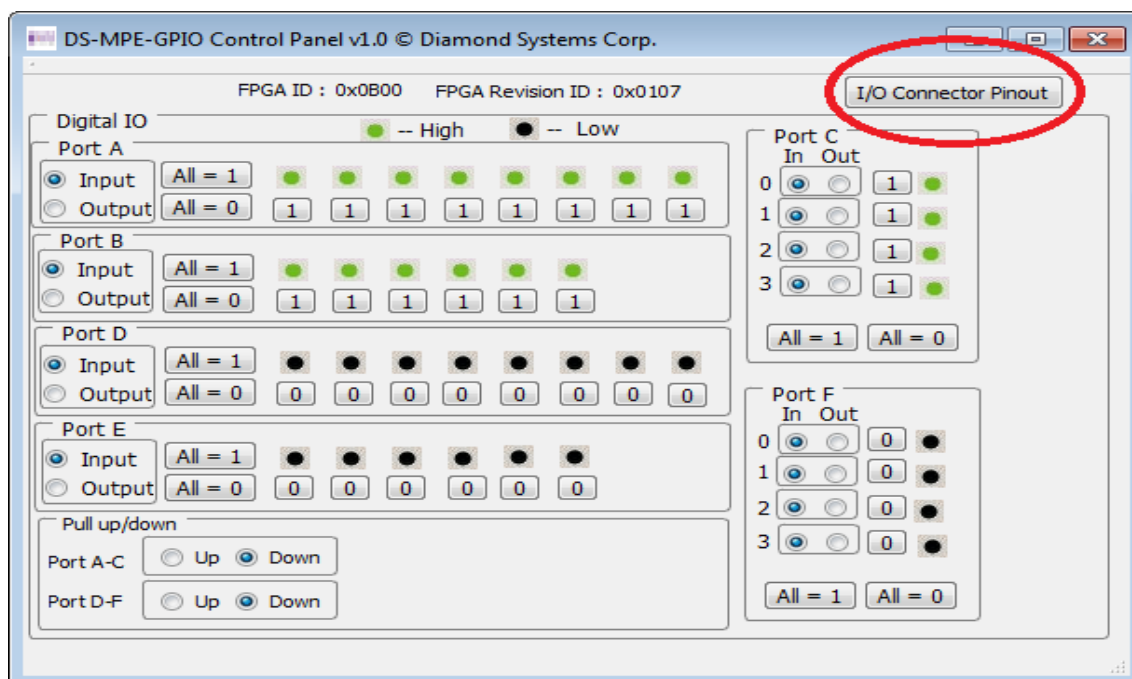
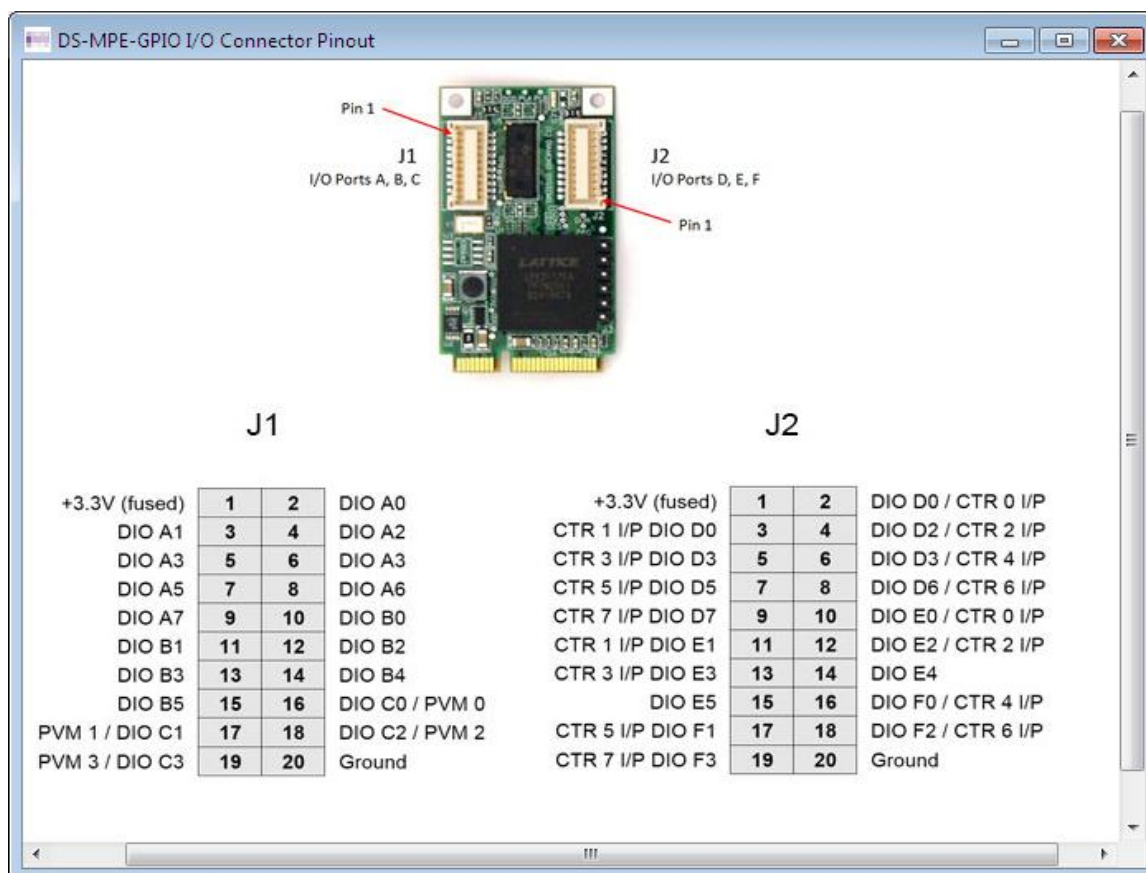


Figure 2: DS-MPE-GPIO I/O Connector Pinout



**Figure 3: DS-MPE-GPIO I/O Connector Pinout**

## 2. DIGITAL I/O

### 2.1 Set DIO pins to output mode

- Click on the “Output” radio button in the group box inside the respective ports on the main screen of the control panel GUI.
- Port C and F pins direction can be individually set, but port A,B,D,E pins direction can only be set as a whole group.

#### Example: Setting Port A in output mode

- Click on the “Output” radio button.

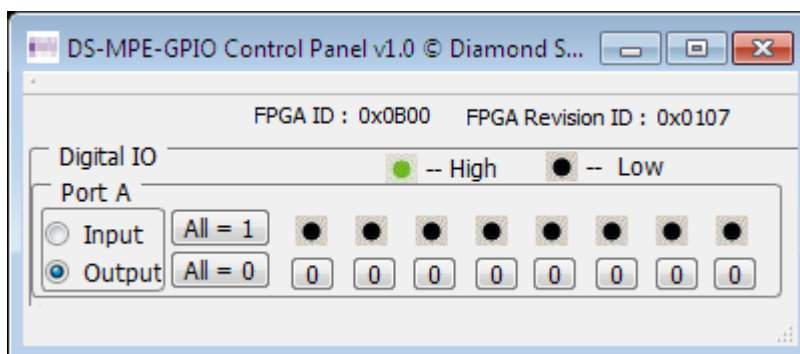


Figure 4: DIO pins as Output

#### Example: Setting 0<sup>th</sup> and 1<sup>st</sup> PIN of PORT C in output mode

- Click the 0<sup>th</sup> and 1<sup>st</sup> output radio button next to 0<sup>th</sup> and 1<sup>st</sup> pin of PORT C.

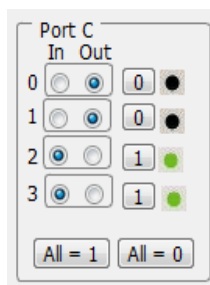


Figure 5: Setting the pins in output mode individually

## 2.2 Set DIO pins as high

- Click on the **All = 1** button of port A,B,C,D,E,F to set all pins of port A,B,C,D,E,F as high.
- Click on the **1** button next to the desired pins of port C and F to set as high.

### Example: To set all the pins of PORT A to high

- Click on the **All = 1** push button to set all the pins as high.

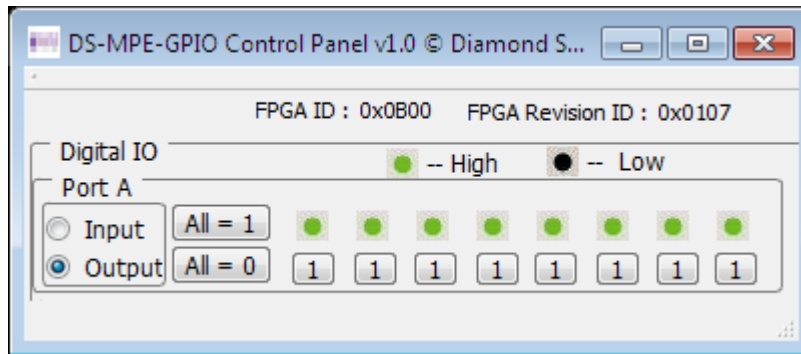


Figure 6: DIO output pins as high

- Now all the PORT A pins are set high. The user can measure and confirm this with a multimeter.

### Example: Set PORT C 0<sup>th</sup> pin as high

- Click on the **1** push button of 0<sup>th</sup> pin to set as high.
- 0<sup>th</sup> pin indicator light turns green, then the user can measure the voltage on the corresponding DIO pin and it will be high (3.3V or 5V).

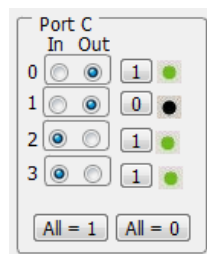


Figure 7: Setting the Output Pins as high Individually

## 2.3 Set DIO pins as low

- Click on the **All = 0** button of port A,B,C,D,E,F to set all pins of port A,B,C,D,E,F to low.
- Click on the **0** button adjacent to the desired pins of port C and F to set low.

### Example: set all PORT A pins to low

- Click on the **All = 0** push button to set all the PORTA pins to low.
- All indicator lights turn black indicating 0V is fed to all the pins. The user can measure and confirm the voltages using a multimeter.

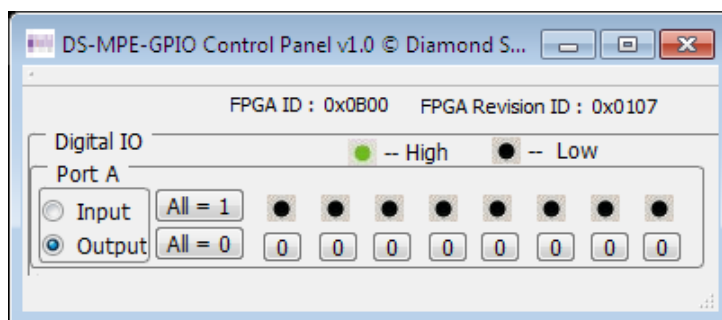


Figure 8: DIO Pins as Low

### Example: Set 1st pin of PORT C as low

- Click on the **0** push button of 1<sup>st</sup> pin to set as low.
- 1<sup>st</sup> pin indicator light turns black indicating 0V is fed to the specified pin.

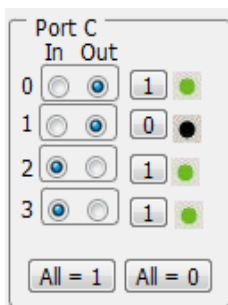


Figure 9: Setting the output pins low individually



## 2.4 Set DIO pins to input mode

- Click on the “Input” radio button in the group box inside the respective ports.
- Port C, F pins can be individually set in Input mode and port A,B,D,E pins can be wholly set in Input mode.

### Example: Setting Port A in Input mode

- Click on the “Input” radio button.

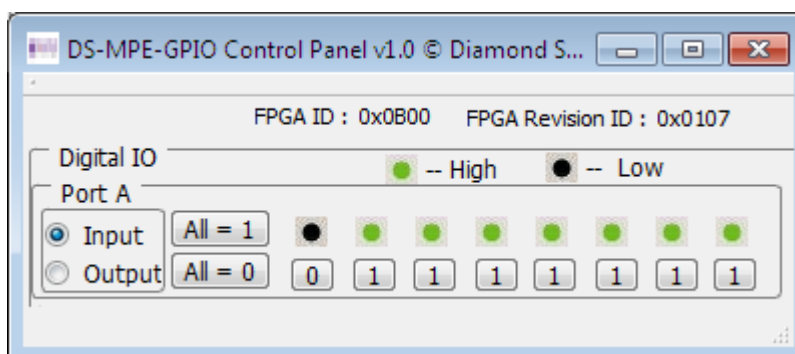


Figure 10: DIO pins as input

### Example: Setting 0<sup>th</sup> and 2<sup>nd</sup> pin of Port C in Input mode

- Click on the 0<sup>th</sup> and 2<sup>nd</sup> Input radio button.

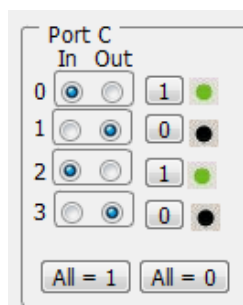
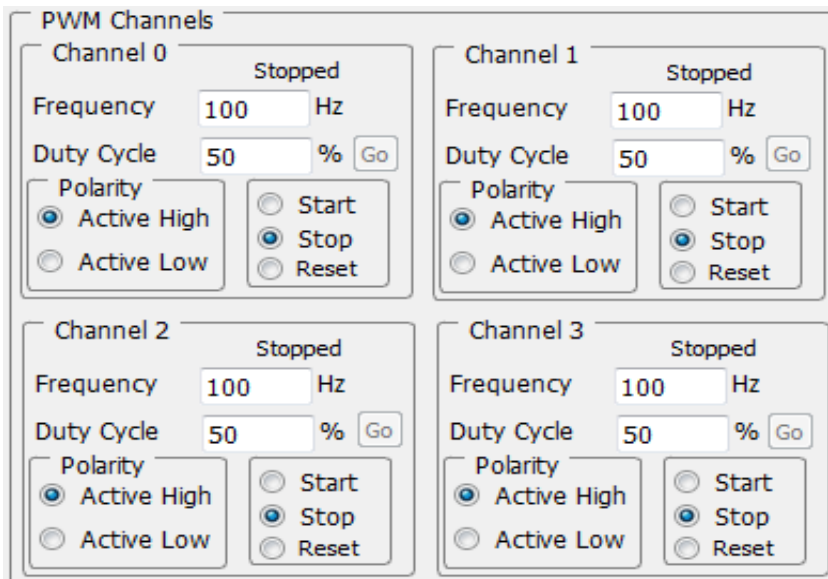


Figure 11: Setting the input pins as input/output individually

### 3. PWM

Pulse width modulators can be controlled and changed from the controls provided on the main screen of the control panel as shown in Figure 10.



The screenshot displays the 'PWM Channels' control panel, which is organized into four distinct sections for Channel 0, Channel 1, Channel 2, and Channel 3. Each channel section contains the following controls:

- Status:** A label indicating the channel's current state, which is 'Stopped' for all channels.
- Frequency:** A numeric input field set to '100' followed by a 'Hz' unit label.
- Duty Cycle:** A numeric input field set to '50' followed by a '%' unit label and a 'Go' button.
- Polarity:** Two radio button options: 'Active High' (which is selected) and 'Active Low'.
- Control Buttons:** Three radio button options: 'Start', 'Stop' (which is selected), and 'Reset'.

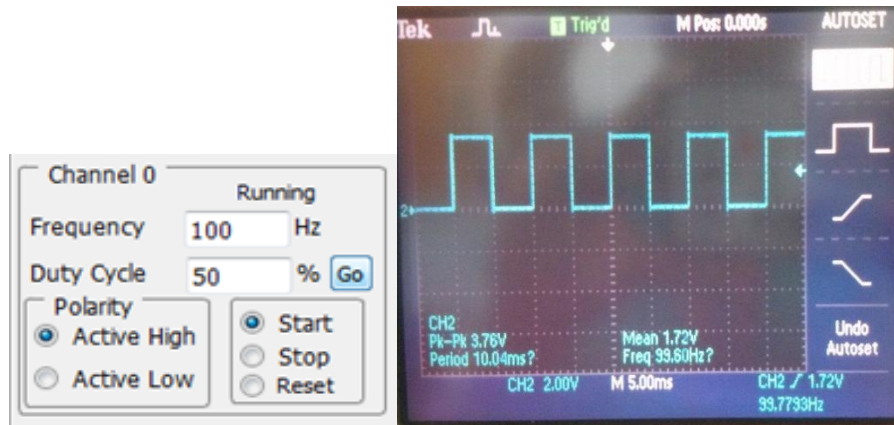
**Figure 12: PWM Controls**

### 3.1 Start PWM

- Enter the desired frequency value in the frequency input text box.
- Enter the desired duty cycle in the duty cycle input text box.
- Select the polarity as Active High or Low as required.
- Click on the “Start” radio button to start PWM.

**Example: Starting PWM Channel 0 with 100Hz frequency , 50% duty cycle and active high polarity**

- Perform following settings and probe the PWM signal with oscilloscope.
- Click on the “Start” button to start the PWM on channel 0.
- A PWM signal of 100Hz, 50% duty cycle with high polarity will be generated.
- The screen shot of the oscilloscope would be as shown in Figure 11.



**Figure 13: Starting the PWM**

## 3.2 Stop PWM

- Click on the “Stop” button.

### Example: Stopping Channel 0 PWM

PWM 0 is running.

- Click on the “Stop” radio button to stop the channel 0 PWM.
- PWM signal of 100Hz, 80% duty cycle with high polarity is stopped.
- The screen shot of the oscilloscope is as shown in Figure 12.

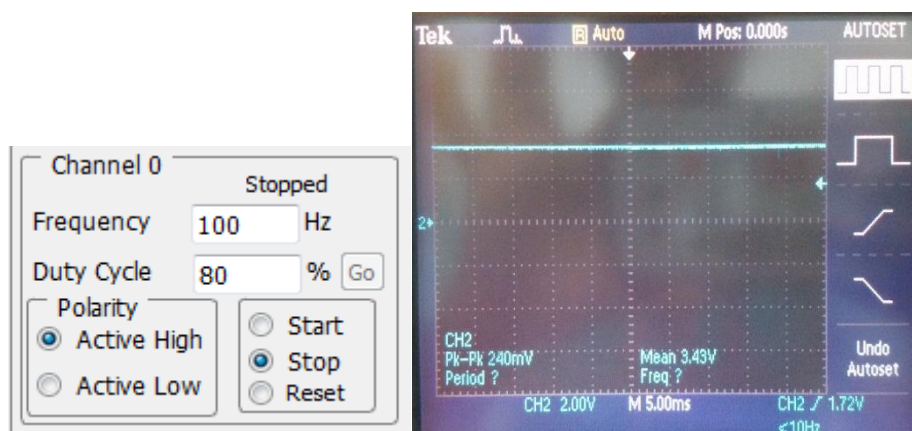


Figure 14: Stopping the PWM

## 3.3 Reset PWM

The reset option releases the corresponding DIO pin for normal DIO operation.

- Click on the “Reset” button.

### Example: Resetting the PWM channel 0

PWM channel 0 is running.

- Click on the “Reset” button to reset PWM channel 0.
- Resetting the channel releases the I/O pins for normal DIO operation.

### 3.4 Change polarity of PWM signal

PWM 0 is running with 100Hz frequency, 80% duty cycle with active high polarity.

- Click on the “Active” high button to change the polarity to high.
- The screen shot of the oscilloscope would be as shown in Figure 13.

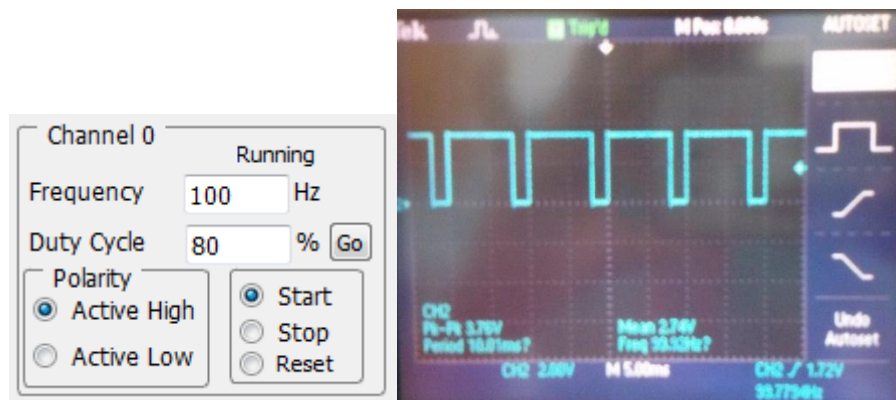


Figure 15: PWM as active high

PWM 0 is running with 100Hz frequency, 80% duty cycle with active low polarity.

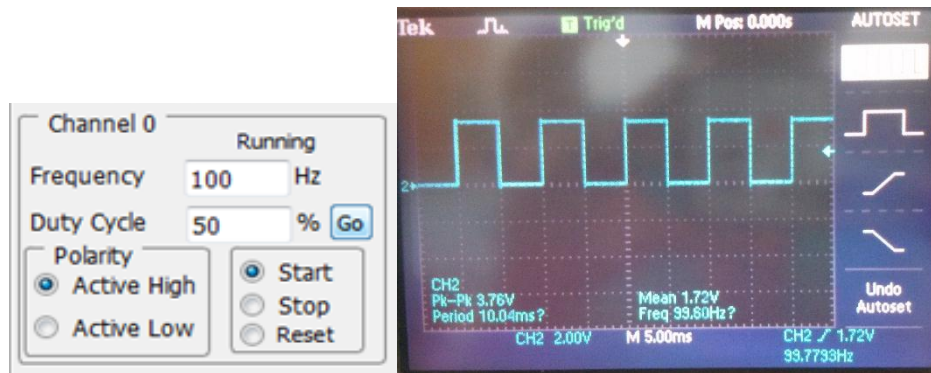
- Click on the “Active” low button to change the polarity to low.
- The screen shot of the oscilloscope would be as shown in Figure 14.



Figure 16: PWM as Active Low

### 3.5 Change duty cycle at run time

- The duty cycle can be changed while the PWM is running and by selecting a new duty cycle and pressing the Go button. The PWM signal will be updated to new duty cycle value.
- Here the PWM 0 is running with 50% duty cycle.



**Figure 17: PWM with 50% Duty Cycle**

- To change the duty cycle value from 50 to 80%, enter value 80 in duty cycle input text box and press the “Go” button.



**Figure 18: PWM with 80% Duty Cycle**

## 4. INTERRUPT

The counter/timer can be used for interrupt events. The counter gets a frequency as input and triggers the interrupt at the same rate. On each interrupt, the counter value is incremented by one, and the counter value is updated in GUI once each second.

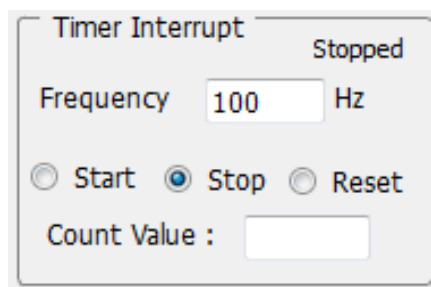


Figure 19: Interrupt Control

### 4.1 Start Interrupt

- Provide the frequency value in the frequency text box.
- Click on the “Start” radio button.

**Example: Starting the interrupt with 100Hz frequency, the count value will be incremented by 100 each second.**

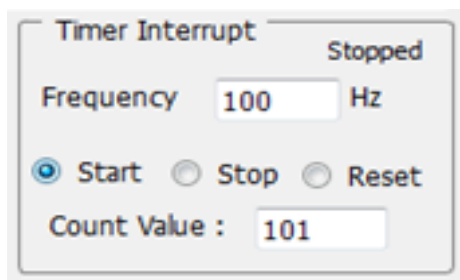


Figure 20: To start the interrupt

### 4.2 Stop Interrupt

- Click on the “Stop” radio button to stop the interrupt.
- Interrupt stops and count value is retained.

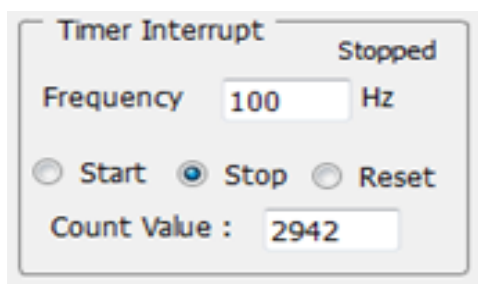


Figure 21: To stop the interrupt

### 4.3 Reset Interrupt

- The reset option sets the count value back to zero.
- Click on the “Reset” radio button.
- Interrupt resets and count value resets.

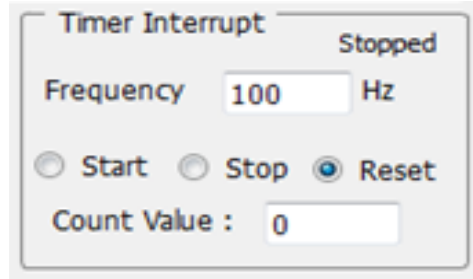


Figure 22: To reset interrupt



## 5. COUNTERS

- Counters can be configured in either up or down mode. Click on the “Counter” button from the main window located in the lower right hand corner as show in Figure 21.

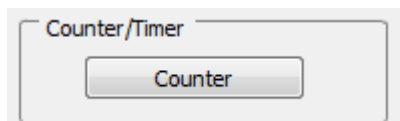


Figure 23: Counter/Timer control

### 5.1 Counter up mode

- If counter is configured in up mode, the count value will be incremented by one for each falling edge clock source provided at counter input pin.
- To test this up mode easily, configure any one DIO pin in output mode, then connect the DIO pin to a counter input pin; when the user toggles the DIO pin, on each falling edge the count value will be incremented by one.
- To see the counter input pins, click on “I/O Connector Pinout” button in the main window.

#### Example: Starting counter 0 in UP mode, using DIO A0 pin

- Before clicking on the “Start” button, the counter 0 input pin must be connected to DIO A0 pin, i.e DIO A0 pin acts as clock source for the counter 0.
- Click on the “Counter 0” start radio button.
- Toggle the DIO A0 pin in DIO section GUI and on each falling edge, the count value will be incremented by one.

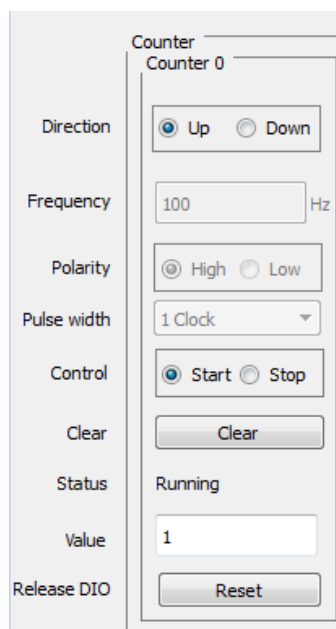


Figure 24: Incrementing the Counter

## 5.2 Counter down mode

- The counter can be configured in down mode. In this mode it uses the internal oscillator of 50MHz.
- The user can configure frequency, output pulse polarity, and output pulse width in the down mode.

### Example: Configure counter 0 with 100Hz frequency, low polarity and pulse with as 1 clock

- Click on the “Start” button and probe the counter output signal with an oscilloscope, which should appear as displayed on the next page.

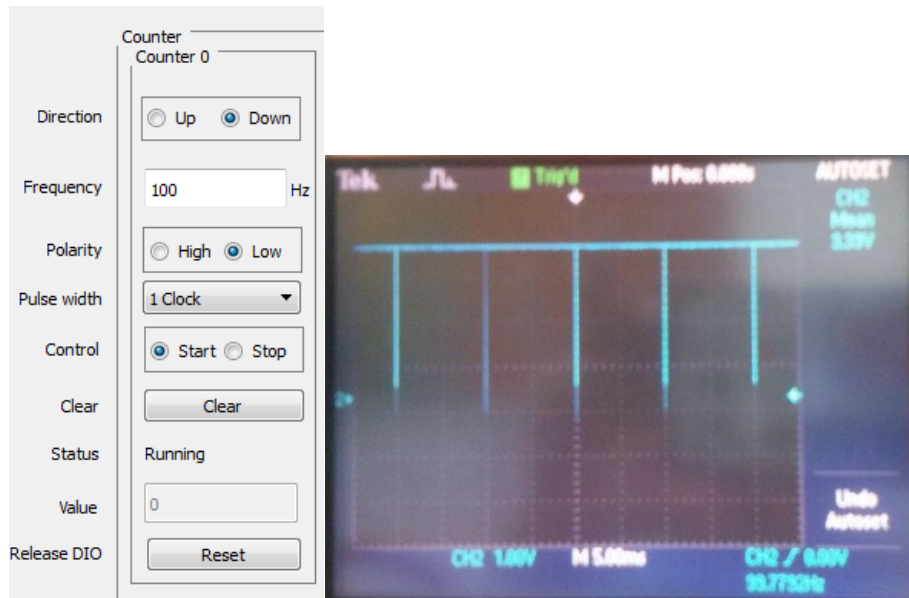


Figure 25: Decrementing the counter (low polarity)

### Example: Configure counter 0 with 100Hz frequency, high polarity and pulse with as 1 clock

- Click on the “Start” button to probe. The counter output signal can be seen by the user from the oscilloscope as displayed below. Longer clock durations are more visible when using slower counter rates.



**Figure 26: Decrementing the counter (high polarity)**

### 5.3 Reset Counter

- The "Stop" option in the GUI does not release the counter pin for normal DIO operation, hence to reset the counter and release the DIO pin for normal DIO operation, click on the "Reset" button.