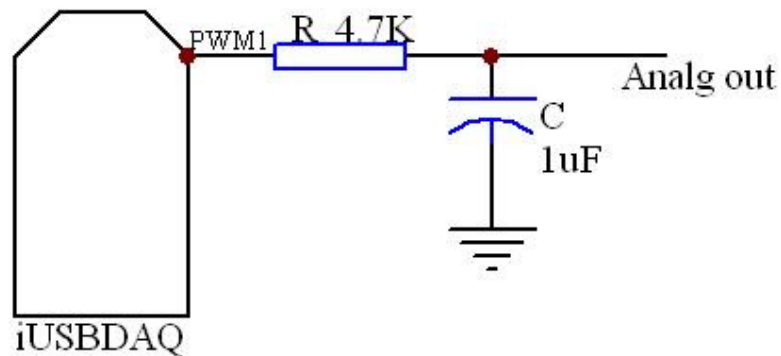




HYTEK Automation, Inc.  
www.hytekautomation.ca

## iUSBDAQ - Convert PWM Outputs To Analog Outputs

Some customers may want analog outputs instead of PWM outputs from iUSBDAQ, it is easy to convert PWM to analog outputs by just adjusting few components. All we need to do is using the below circuit. Picture 001.



Picture 001

Inside the iUSBDAQ – U120816, there is a  $470\Omega$  resistor in serial and a  $1M\Omega$  grounding resistor for each PWM outputs. The positions are:

PWM1: R37 -  $470\Omega$ , R36 -  $1M\Omega$ .

PWM2: R35 -  $470\Omega$ , R34 -  $1M\Omega$ .

If we change the  $470\Omega$  to  $4.7K\Omega$  and replace the  $1M\Omega$  to  $1\mu F$  capacitor, then we will get picture 001 circuit above. And now the PWM will become analog output.

Using the formula:  $RC=1/(2 \cdot \pi \cdot f)$

with  $R=4.7k\Omega$ ,  $C = 1\mu F$

We will get a low pass filter with 33HZ bandwidth.

**Note: If you buy the iUSBDAQ – U1208AO module, it has been modified based on picture 001 for the PWM ports out of factory.**

In iDAQTest&Log software, click on PWM output tab as showed at below picture 002



Picture 002

Select the PWM channel **Channel (1-2)** , and select the highest PWM frequency in order to minimize the noise, here in this case we select period of 3 **Period (3-333 micro second)**  micro second. By changing the duty **DutyCycle (0-100%)**  cycle, we can adjust the analog output value from 0 – 5V(nominal). For example, if we set duty cycle to be 80%, the analog output will be  $5V \times 80\% = 4V$ (nominal). Since the PWM is 10bit, so the resolution of analog outputs will be  $5V/1024 = 4.9mV$ . Now if we feed this analog output back into AI0, in order to measure the value with iUSBDQAQ's analog input channel, you will see as showed in picture 003.

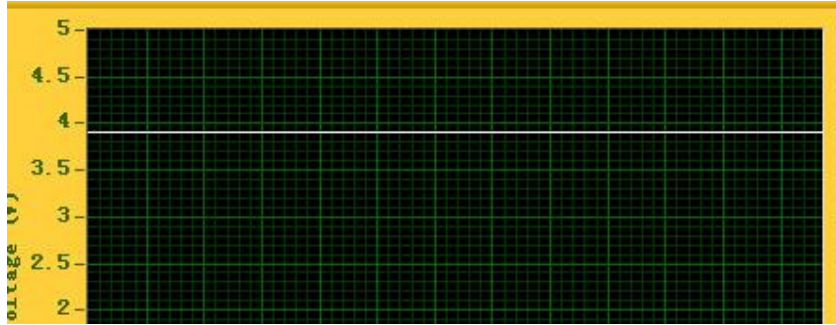


图 003

**Please note: if you didn't buy the iUSBDAQ – U1208AO, so you have to make the modification based on this document by yourself with iUSBDAQ – U120816, you may lose your warranty. Please do it with your own risk.**

**About the isolation with buffering amplifier at the output.**

In some cases, you may want to have low output impedance in order to drive external devices, you may need a buffering amplifier after the circuit in Picture 001, as showed in picture 004.

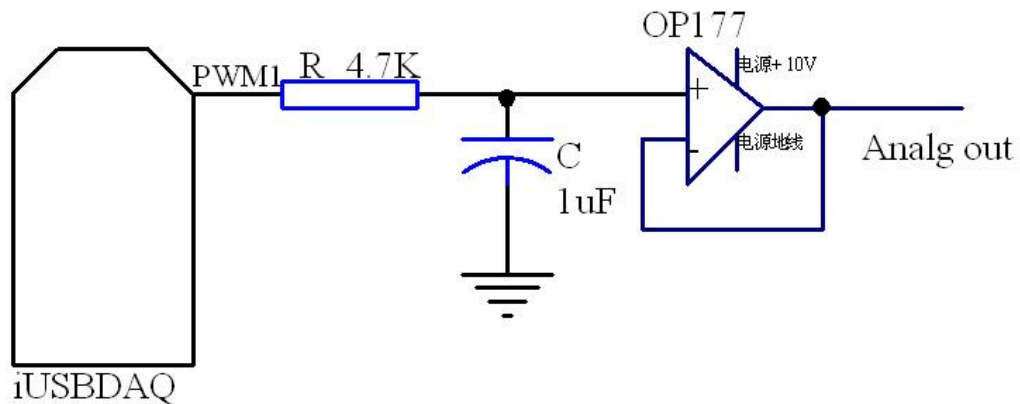


图 004

**Note: If you buy the iUSBDAQ – U1208AO module, it has been modified based on picture 001 for the PWM ports out of factory, but without buffering amplifier. You can add one right at the output port at Pin 25 for output1 and Pin 26 for output 2.**