An-Najah National University
Faculty of Engineering and IT

جامعة النجاح الوطنية
كلية الهندسة وتكنولوجيا المعلومات

Computer Engineering Department
Course Name: Microprocessor Lab Number: 10636392
Lab Report Grading Sheet

Instructor: Dr. Aladdin Masri	Experiment #: 2
Academic Year: 2019/2020	Experiment: 8253 Timer / Counter
Semester: Summer Semester	

Students	
1- Mohammad Badawi	2- Taher Anaya
3-	4-
Performed on: 16th of August	Submitted on: 18th of August

Report's Outcomes

ILO __ =( ) %	ILO __ =( ) %	ILO __ =( ) %	ILO __ =( ) %	ILO __ =( ) %

Evaluation Criterion	Grade	Points
Abstract answers of the questions: "What did you do? How did you do it? What did you find?"	0.5	
Introduction and Theory Sufficient, clear and complete statement of objectives. In addition to Presents sufficiently the theoretical basis.	1.5	
Apparatus/ Procedure Apparatus sufficiently described to enable another experimenter to identify the equipment needed to conduct the experiment. Procedure sufficiently described.	2	
Experimental Results and Discussion (In-Lab Worksheet) Crisp explanation of experimental results. Comparison of theoretical predictions to experimental results, including discussion of accuracy and error analysis in some cases.	4	
Conclusions and Recommendations Conclusions summarize the major findings from the experimental results with adequate specificity. Recommendations appropriate in light of conclusions. Correct grammar.	1	
Appearance Title page is complete, page numbers applied, content is well organized, correct spelling, fonts are consistent, good visual appeal.	1	
Total	10	

Abstract:

In this experiment, we are going to use the 8253 provided by the MML8086K3 training board to make a frequency generator in two different modes.

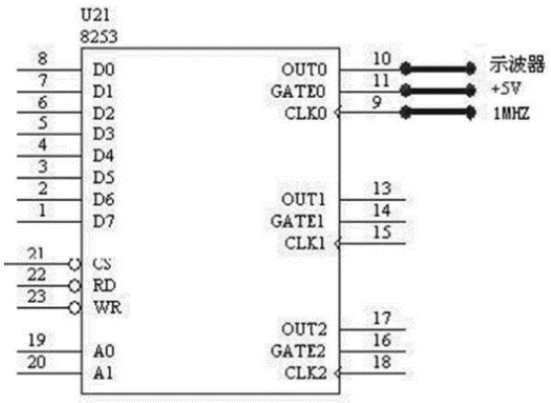
Objectives:

- To be familiar with the 8253 timer/counter.
- Implementing a function generator using the 8.

Procedure:

The 8253 is a programmable logic device that is used to generate pulses after a certain period. The device contains 3 16-bit counters and a control word register that is used to program the counters. The device works at a frequency between 0 and 2 MHz.

The 8253 is connected to microprocessor on the kit where each register has a certain address for communication.



Selects	Address
Counter 0	0040H
Counter 1	0041H
Counter 2	0042H
Control word register	0043H

Procedure: *(cont.)*

In the first part, we will be using the first counter (counter 0) as a square wave function generator at frequency 10 khz. To do this, first we need to configure the 8253 using the internal control word. We will need to send an 8-bit instruction to the control word "XXXXXXXX" at address 0043H. The following diagram contains all the commands for the configuration.

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
SC1	SC0	RL1	RL0	M2	M1	M0	BCD

Definition of Control:

SC-Select Counter:

SC1	SC0	
0	0	Select counter 0
0	1	Select counter 1
1	0	Select counter 2
1	1	Illegal

M-Mode

0	0	0	Mode 0
0	0	1	Mode 1
X	1	0	Mode 2
X	1	1	Mode 3
1	0	0	Mode 4
1	0	1	Mode 5

RL-Read/Load:

RL1	RL0	
0	0	Counter latching operation (see read/write procedure section)
1	0	Read/Load most significant byte only
0	1	Read/Load Least significant byte only
1	1	Read/Load Least significant byte first, then most significant byte

BCD:

0	Binary counter 16-bits
1	Binary coded decimal (BCD) counter (4 decades)

Our device will be working on 1Mhz frequency.

- First, we will be selecting the counter 0, so our instruction is "00XXXXXX".
- The next step we will be selection the Read/Load mode. In our case, we will be using the 3rd mode "Read/Load Least significant byte only", this mode will allow us to load the frequency division number. Since we need 10 khz frequency, we will send the number $n = 100$ to the counter 0 according to the following formula:

$$n = \frac{f_{in}}{f_{out}} = \frac{1\ Mhz}{10\ khz} = 100$$

  8 bits are enough to represent the number 100, so our instruction is "0001XXXX".

- The next step will be selecting the counter mode. In our case it will be mode 3, which is square wave mode. "0001011X".
- The last step will be to select the counting format. We will be using binary, so our instruction will be "00010110" – "16H".

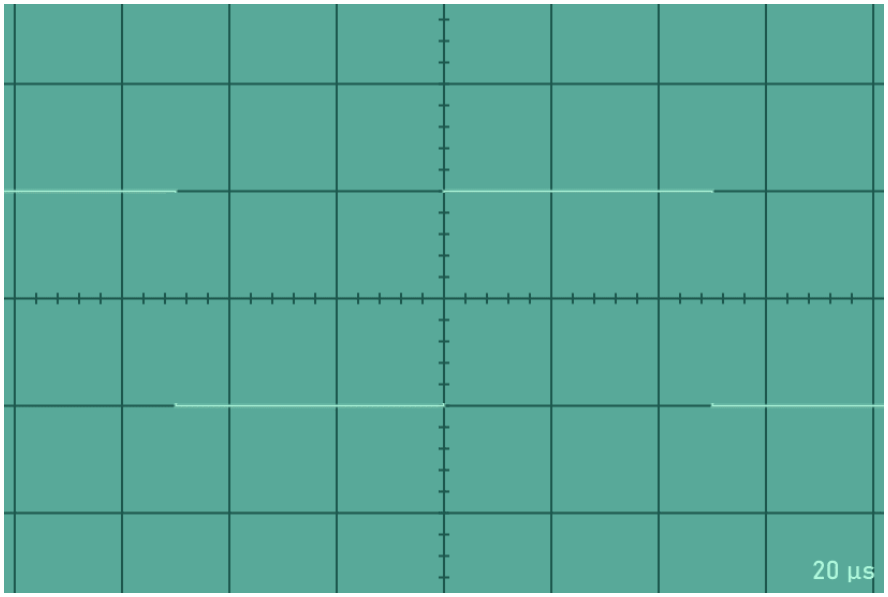
```
1  MOV AL, 16H
2  OUT 43H, AL
```

Procedure: *(cont.)*

After the configuration process, we will be sending the number $n = 100$ to the counter 0 so that the counter will start working:

```
3   MOV AL, 100
4   OUT 40H, AL
```

Now that the coding process is done, we need to install the code on the microprocessor. We need to ensure that GATE0 is connected to High (5V) as this is our enable signal. To validate our code, we need to see our output visually. To do so, we need to connect the output port OUT0 to the oscilloscope. The oscilloscope can visually demonstrate the output signal on its screen.



In the second part, we will be configuring the counter 0 as a rate generator with a period of 100 µs. The time period 100 µs is translated to 10 khz frequency. The configuration process will remain the same as the first part, except that we will be selecting mode 2 instead of mode 3. So the instruction byte will end up being “00010100” – “14H”.

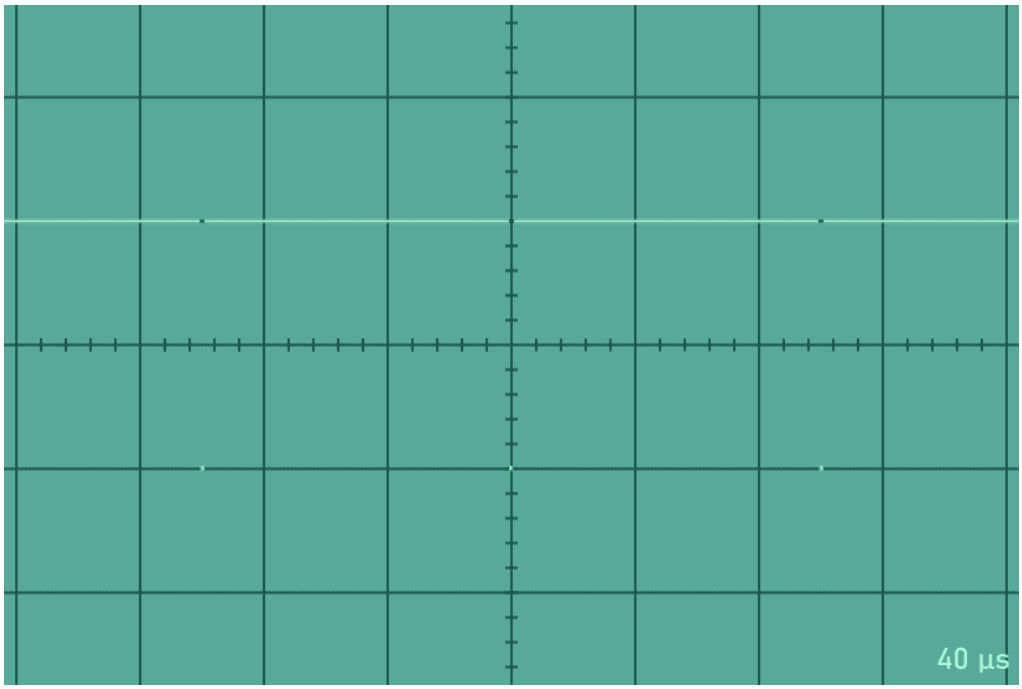
```
1   MOV AL, 14H
2   OUT 43H, AL
```

We will be also sending the number 100 to the counter:

```
3   MOV AL, 100
4   OUT 40H, AL
```

Procedure: *(cont.)*

To see the output of our code, we need to use the oscilloscope just like the first part and ensure that our GATE0 port is connected to High:



As we can see, the rate generator gives a very small pulse after the counter finishes counting, which appears as a very small dot on the oscilloscope.

Conclusion:

In the end, we learned how to use the 8253 device along with the microprocessor. We also learned the different aspects of this counter and how it can be used as a function generator.