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. Manar Qamhieh.	Experiment #: 9
Academic Year: 2023/2024	Experiment Name: Stepper motor
Semester: 1 (A)	

Students	
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Report's Outcomes

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

Evaluation Criterion	Grade	Points
Abstract answers to 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 considering 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:

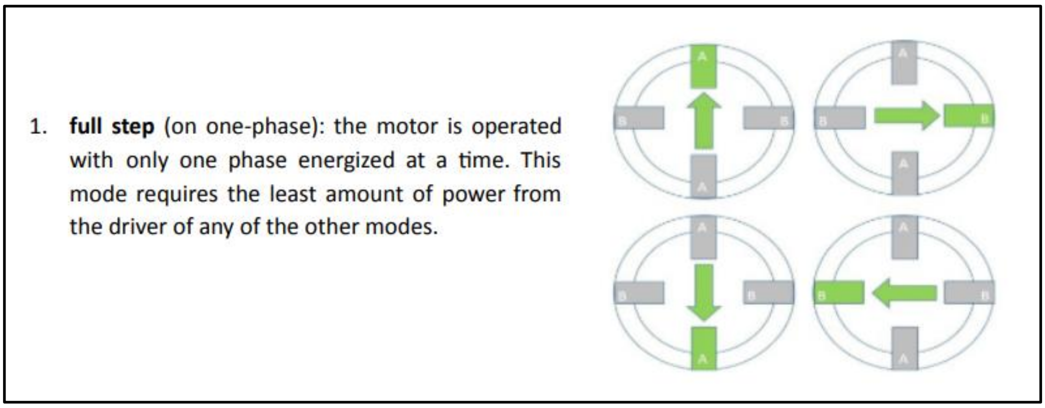
In this experiment, we have multiple goals to achieve:

- Understand the basic principle of stepper motor control.
- Master the programming method of stepper motor rotation (Rotating to the right, left, or at a specific angle).

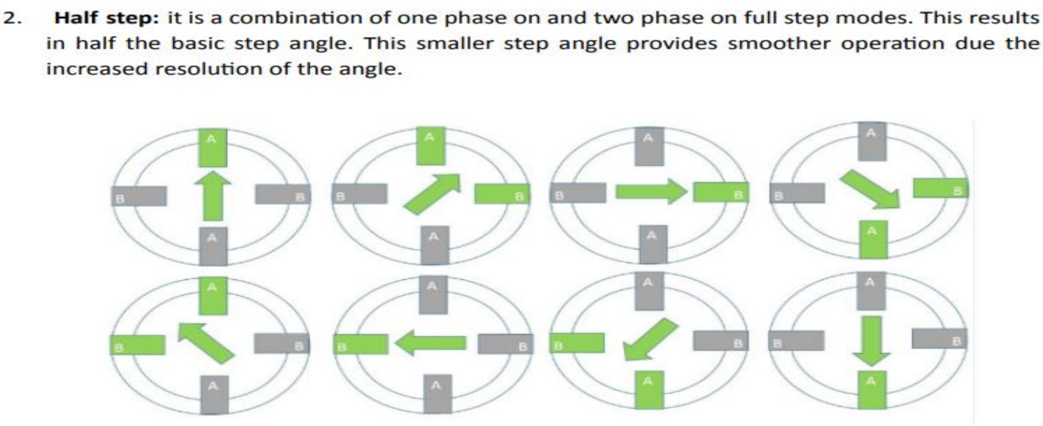
➢ Introduction:

In this experiment will be using the 8255 IC to control the stepper motor on the kit. We will be using the IC to rotate the motor continuously until we reset the program. Then we will be using the 8255IC to read the push buttons to decide whether to rotate the button clockwise or counterclockwise. Finally, we will rotate the stepper more a single rotation (90°) or (180°), clockwise or counterclockwise depending on the button pressed.

❖ Operating Modes:



1. **full step** (on one-phase): the motor is operated with only one phase energized at a time. This mode requires the least amount of power from the driver of any of the other modes.



2. **Half step:** it is a combination of one phase on and two phase on full step modes. This results in half the basic step angle. This smaller step angle provides smoother operation due the increased resolution of the angle.

❖ Tools:

- MML8086K3 Trainer Kit.
- MML8086K3 Software: 86PCI Debug Software.
- 8255 (Programmable Peripheral Interface adapter).

➢ Procedure:

❖ The first part: make a full step.

```
CODE SEGMENT

ASSUME CS:CODE

ORG 2000H

START:

MOV DX, 0FF2BH  ;Moving the data to register with port number 0FF2Bh.

MOV AL ,80H ;Making port A & port B output.

OUT DX, AL  ;Put 80h on port number 0FF2Bh (Control word register).

MOV BL,0EEH ; Load BL with the initial value for port A

MAIN:

MOV DX, 0FF28H  ;The address of port A.

MOV AL,BL

OUT DX,AL ; Output the content of AL (the control pattern) to the port addressed by DX (port A).

PUSH CX  ;Save the current value of CX register onto the stack.

MOV CX ,0FFFH ;set the time of delay.

DEL: NOP  ;make a delay to let the stepper motor work.

LOOP DEL

POP CX

ROL BL,1 ;Rotate the bits in BL left by 1 bit. This changes are to rotate the stepper motor by one step.

JMP MAIN ;Jump back to the MAIN label to continuously rotate the stepper motor.

END START

CODE ENDS
```

- ❖ The second part: we make a half step.

```
CODE SEGMENT
ASSUME CS:CODE
ORG 2000H
START:
MOV DX, 0FF2BH ;Moving the data to register with port number 0FF2Bh.
MOV AL ,80H ;Making port A & port B output.
OUT DX, AL ;Put 80h on port number 0FF2Bh (Control word register).
L:
MOV SI,OFFSET ARRAY ; Loads the offset address of the ARRAY into SI.
MOV CX, 8 ;represent the number of steps in a half step sequence.
MAIN:
MOV DX, 0FF28H ;The address of port A.
MOV AL,[SI]
OUT DX,AL ; Sends the step value to the motor control port, to move the stepper motor.
PUSH CX
MOV CX ,0FFFH ;Set up a delay counter.
DEL: NOP ;no operation loop to make delay
LOOP DEL
POP CX
INC SI  ;Increments SI to point to the next step value in the ARRAY.
LOOP MAIN
JMP L
ARRAY DB 0EH, 0CH, 0DH, 09H, 0BH, 03H, 07H, 06H ; An array for the half sequence for the stepper motor.
END START
CODE ENDS
```

- The third part: Use two push buttons (connected to PORTB0 and PORTB1) to control the rotation of the stepper motor. When btn1 is pressed, the motor rotates in a clockwise direction (360°), and btn2 rotates the motor in a counterclockwise direction (90°).

```
CODE SEGMENT

ASSUME CS:CODE

ORG 1000H

START: MOV DX,0FF2BH

MOV AL,82H ;Configure 8255: Port A = output, Port B = input, Port C = not used.

OUT DX,AL ;Send configuration to 8255 control register.

MOV BL,0EEH ;load Initial pattern.

LP1: MOV DX,0FF29H ;Load address of Port B (input port) into DX.

IN AL,DX ;Read the state of Port B into AL.

AND AL,00000110B ;Mask for keeping only bits corresponding to buttons.

CMP AL,02H ;Check if btn1 is pressed (expecting 00000010B).

JE ST ;If btn1 is pressed, jump to code block for 360° clockwise rotation.

CMP AL,04H ;Check if btn2 is pressed (expecting 00000100B).

JE ST1 ;If btn2 is pressed, jump to code block for 90° clockwise rotation.

JMP LP1 ; ;If nothing is pressed, loop back and check again.

ST: MOV CX,2048  ; 360˚ → 2048 step.

LPP: ROR BL,1  ;Rotate in BL to the right, for clockwise movement.

MOV AL,BL ;Move BL into AL for output.

MOV DX,0FF28H ;Load address of Port A (output port) into DX.

OUT DX,AL

PUSH CX

MOV CX,0FFFH ;Short delay loop count.

DELL: NOP ;Delay loop No Operation.

LOOP DELL
```

```
POP CX
LOOP LPP ;Repeat rotation steps until full rotation is achieved.
JMP LP1 ;Return to check the buttons again.
ST1: MOV CX,512 ;360° ➔ 2048 step so 90° ➔ 512 step.
LPP1: ROL BL,1  ;Rotate in BL to the left, for counterclockwise movement.
MOV AL,BL ;Move BL into AL for output.
MOV DX,0FF28H ;Load address of Port A (output port) into DX.
OUT DX,AL
PUSH CX
MOV CX,0FFFH  ;Short delay loop count.
DELL2: NOP ;Delay loop No Operation.
LOOP DELL2
POP CX
LOOP LPP1 ;Repeat rotation steps until 90° rotation is achieved.
JMP LP1 ;Return to check the buttons again.
MOTH DB 0EH, 0CH, 0DH, 09H, 0BH, 03H, 07H, 06H ; for half step
MOTF DB 0EH,  0DH, 0BH, 07H ; for full step
END START
CODE ENDS
```

➢ Conclusion:

In this experiment, we learned about the basics of stepper motor, also we learned control direction of rotation. We were able to rotate it using full and half cycle, we were also able to control the degree of rotation by the number of steps.