8255 Programmable Peripheral Interface (PPI)

1. Silent features of PPI
2. Pin Description of PPI
3. Block Diagram of PPI
4. Control word Register (CWR)
4. Mode of operations
(a) I/O Mode :
    Mode 0
    Mode 1
    Mode 2
(b) BSR Mode :
5. Problem Solving

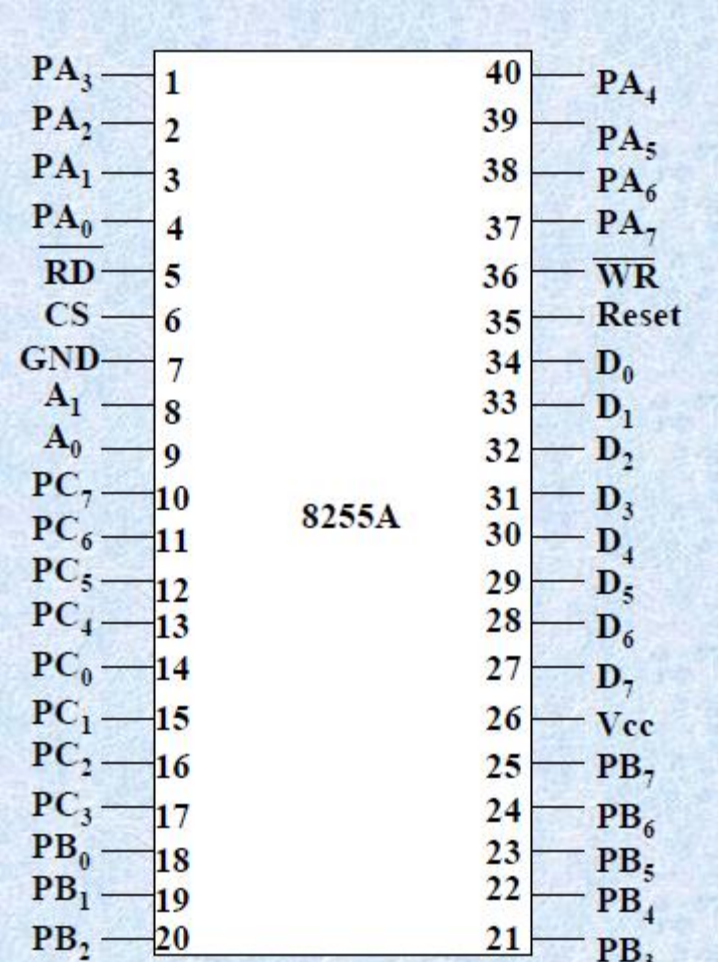
The Salient features of 8255 PPI

- The parallel input-output port chip 8255 is also called as programmable ***peripheral input-output port.***
- ***The Intel's*** 8255 is designed for use with Intel's 8-bit, 16-bit and higher capability microprocessors.
- It has 24 input/output lines which may be individually programmed in two groups of twelve lines each, or three groups of eight lines.
- The two groups of I/O pins are named as **Group A and Group B.**
- Each of these two groups contains a subgroup of eight I/O lines called as 8-bit port and another subgroup of four lines or a 4-bit port.
- Thus **Group A contains an 8-bit port A along with a 4-bit port. C upper.**

- The port A lines are identified by symbols PA0-PA7 while the port C upper lines are identified as PC4-PC7.
- Similarly, **Group B contains an 8-bit port B, containing lines PB0-PB7 and a 4-bit port C with lower bits PC0- PC3.**
- The port C upper and port C lower can be used in combination as an 8-bit port C.
- Both the port C are assigned the same address. Thus one may have either three 8-bit I/O ports or two 8-bit and two 4-bit ports from 8255.

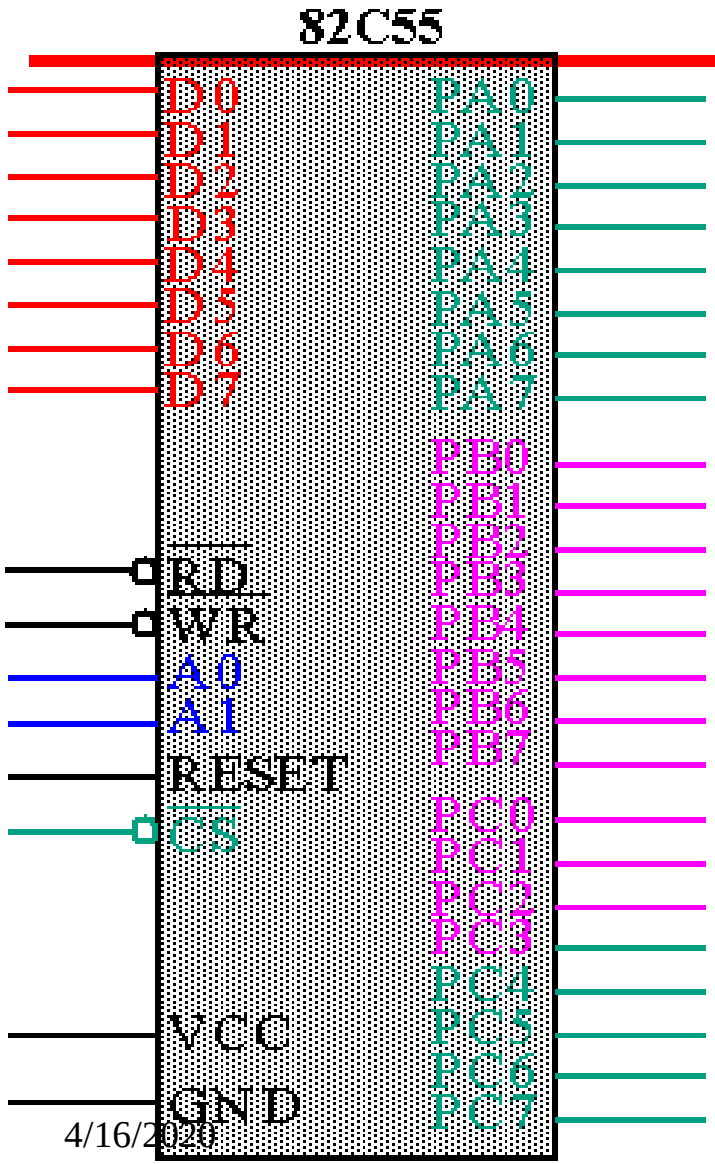
- All of these ports can function independently either as input or as output ports.
- This can be achieved by programming the bits of an internal register of 8255 called as control word register (CWR).
- The 8255 is a popular interfacing component, that can interface any TTL-compatible I/O device to a microprocessor.
- It is used to interface to the keyboard and a parallel printer port in PCs (usually as part of an integrated chipset).
- Used for parallel data transfer.

8255 PPI Pin Description:-



8255A Pin Configuration

8255 Programmable Peripheral Interface



Group A

Port A (PA7-PA0) and upper half of port C (PC7 - PC4)

Group B

Port B (PB7-PB0) and lower half of port C (PC3 - PC0)

I/O Port Assignments

A_1	A_0	Function
0	0	Port A
0	1	Port B
1	0	Port C
1	1	Command Register

Block Diagram of 8255 (Architecture)

- **It has a 40 pins of 4 groups.**

1. Data bus buffer
2. Read Write control logic
3. Group A and Group B controls
4. Port A, B and C

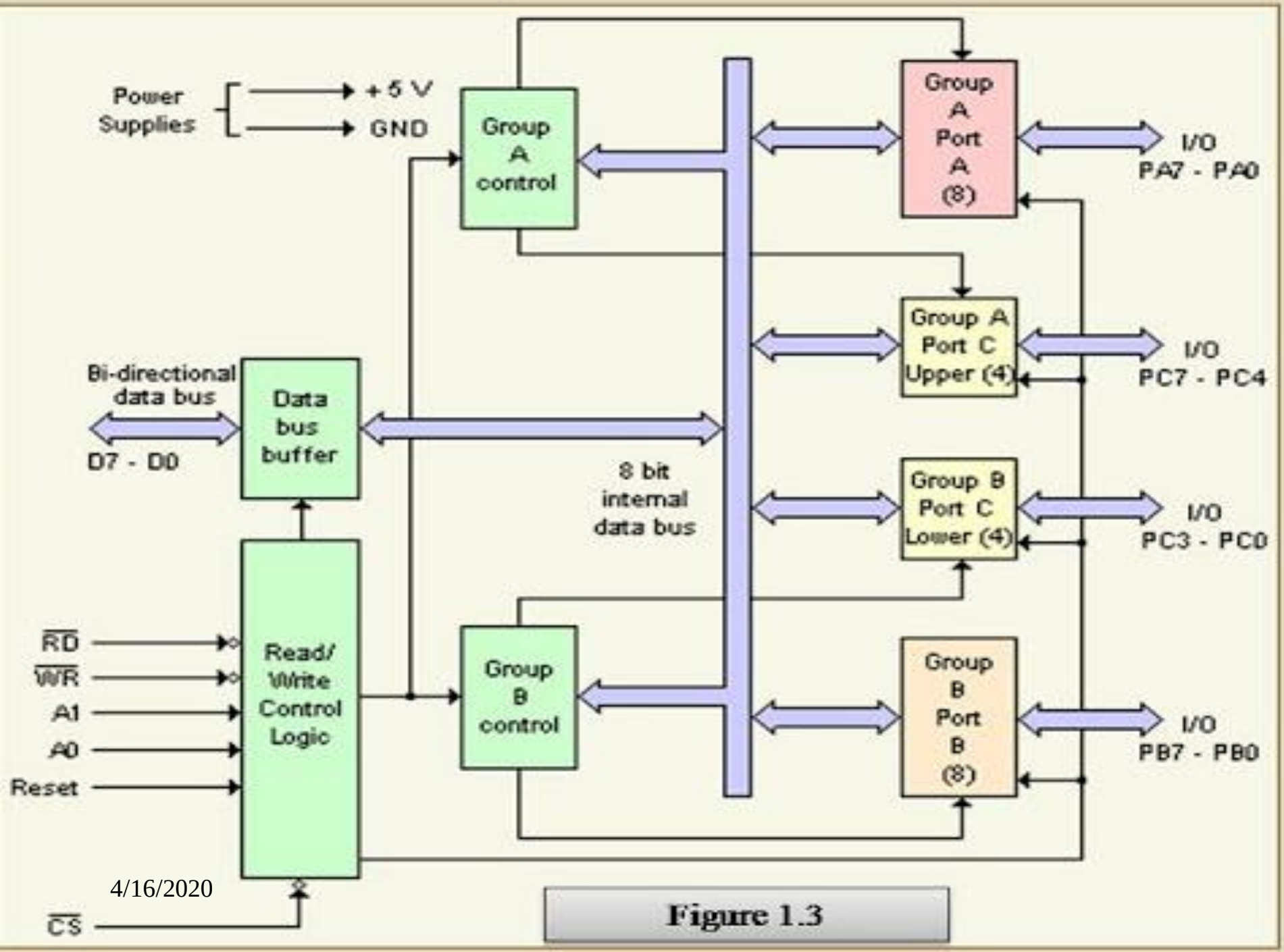
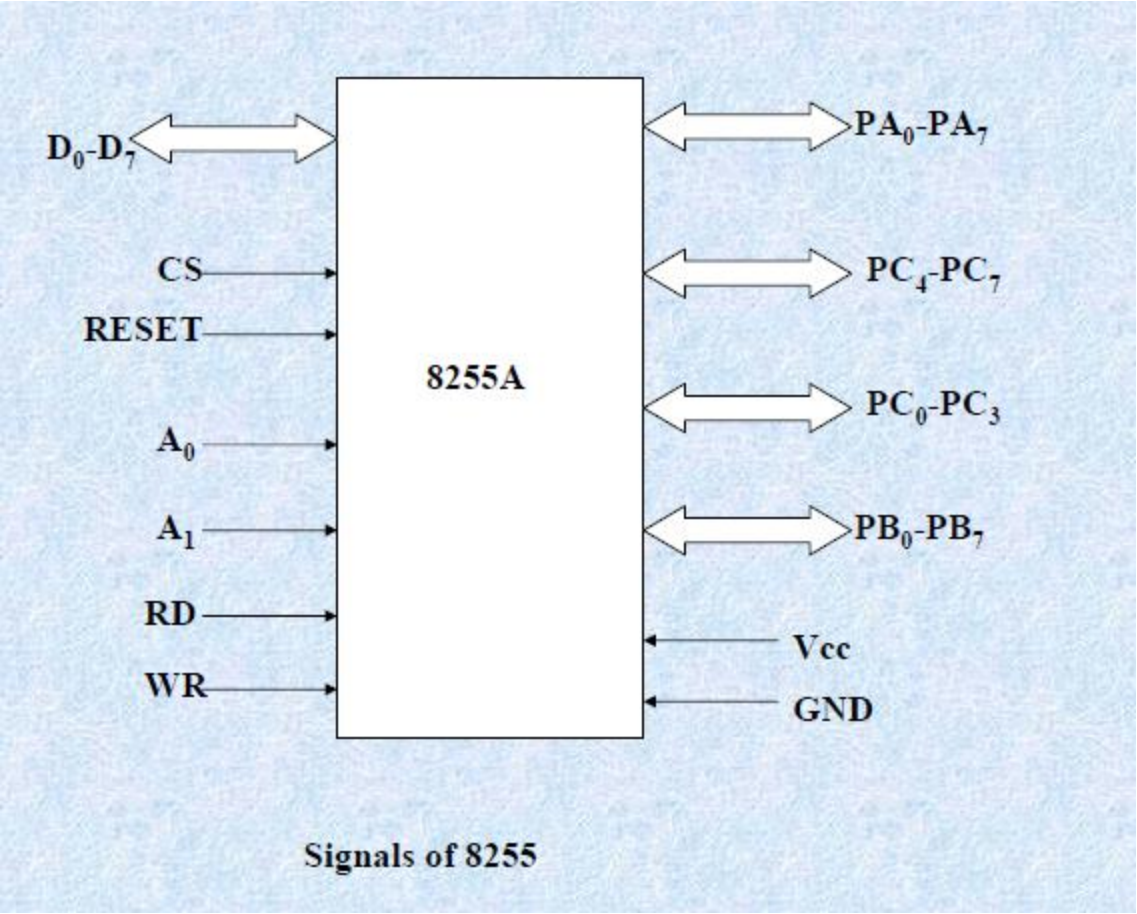

Power Supplies
+5 V
GND
Group A control
Group A Port A (8)
I/O PA7 - PA0
Group A Port C Upper (4)
I/O PC7 - PC4
Bi-directional data bus
D7 - D0
Data bus buffer
8 bit internal data bus
Group B Port C Lower (4)
I/O PC3 - PC0
RD
WR
A1
A0
Reset
Read/ Write Control Logic
Group B control
Group B Port B (8)
I/O PB7 - PB0
CS

Figure 1.3

Signals of 8255



Signals of 8255

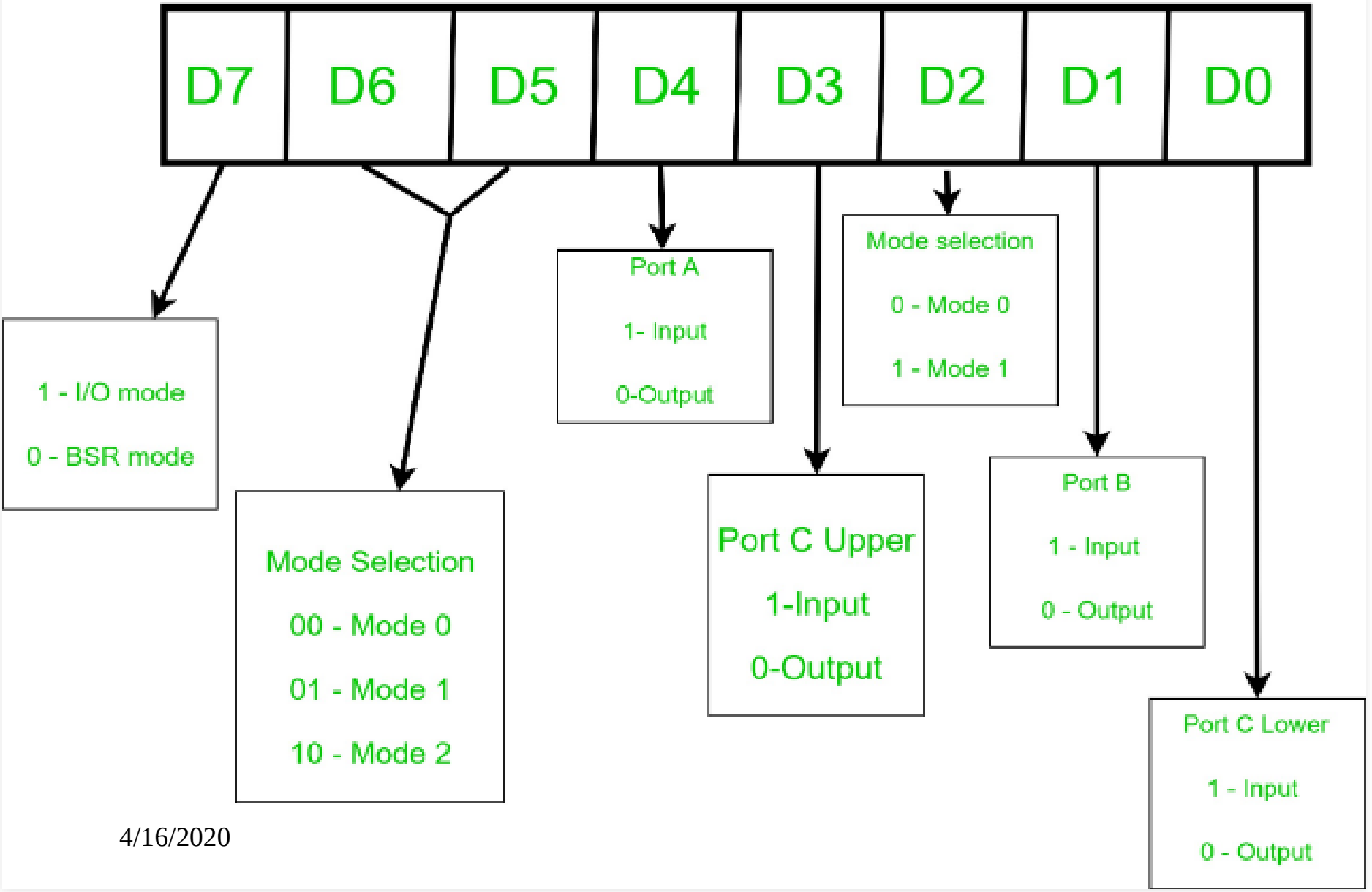
Input (Read) Cycle

RD′	WR′	CS′	A1	A2	Input Read Cycle
0	1	0	0	0	Port A to Data Bus
0	1	0	0	1	PORT B to Data Bus
0	1	0	1	0	PORT C to Data Bus
0	1	0	1	1	CWR to Data Bus

Output (Write) Cycle

RD′	WR′	CS′	A1	A2	Input Read Cycle
1	0	0	0	0	Data Bus To Port A
1	0	0	0	1	Data Bus To Port B
1	0	0	1	0	Data Bus To Port C
1	0	0	1	1	Data Bus to CWR

Control Word Format



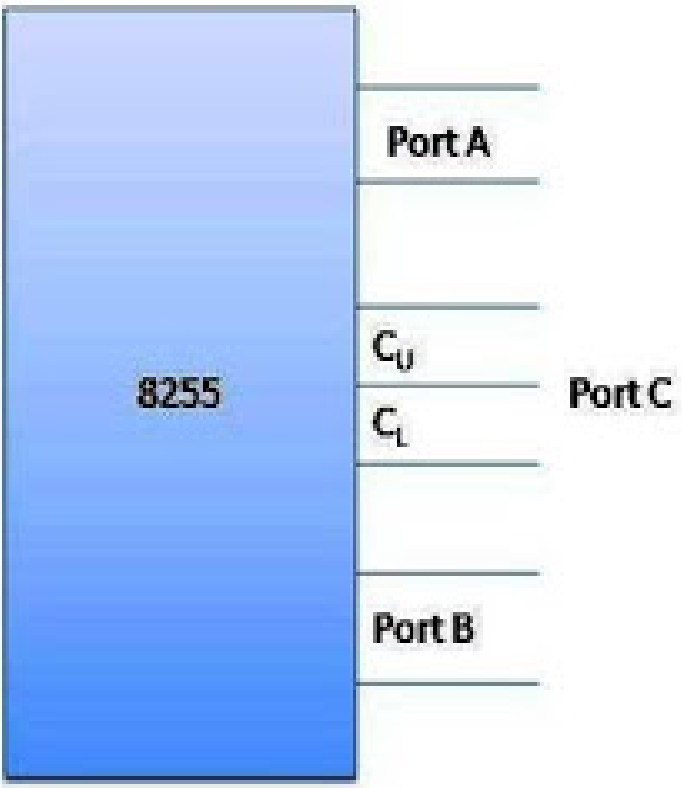
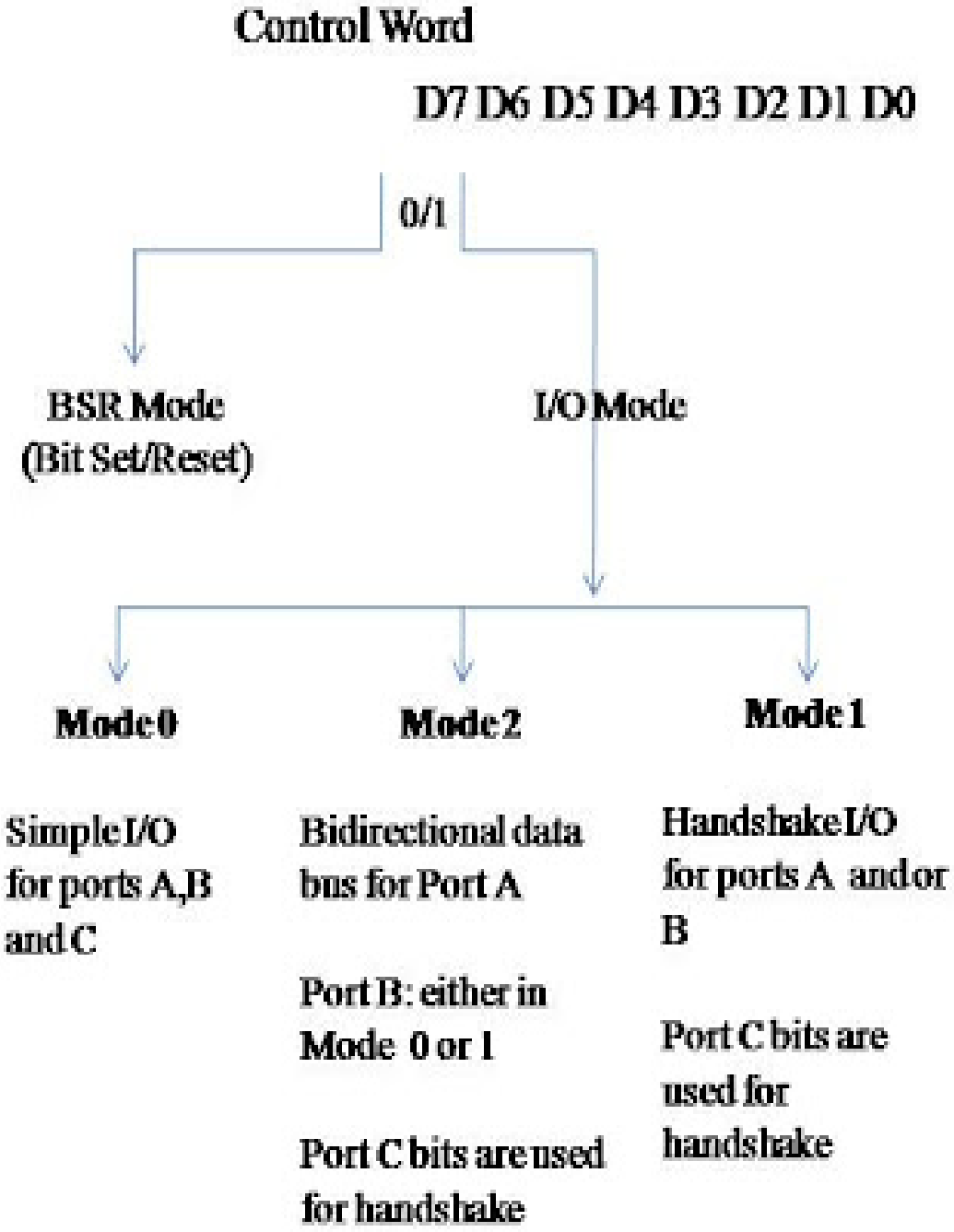

8255
Port A
C_U
C_L
Port C
Port B

Figure 1.1

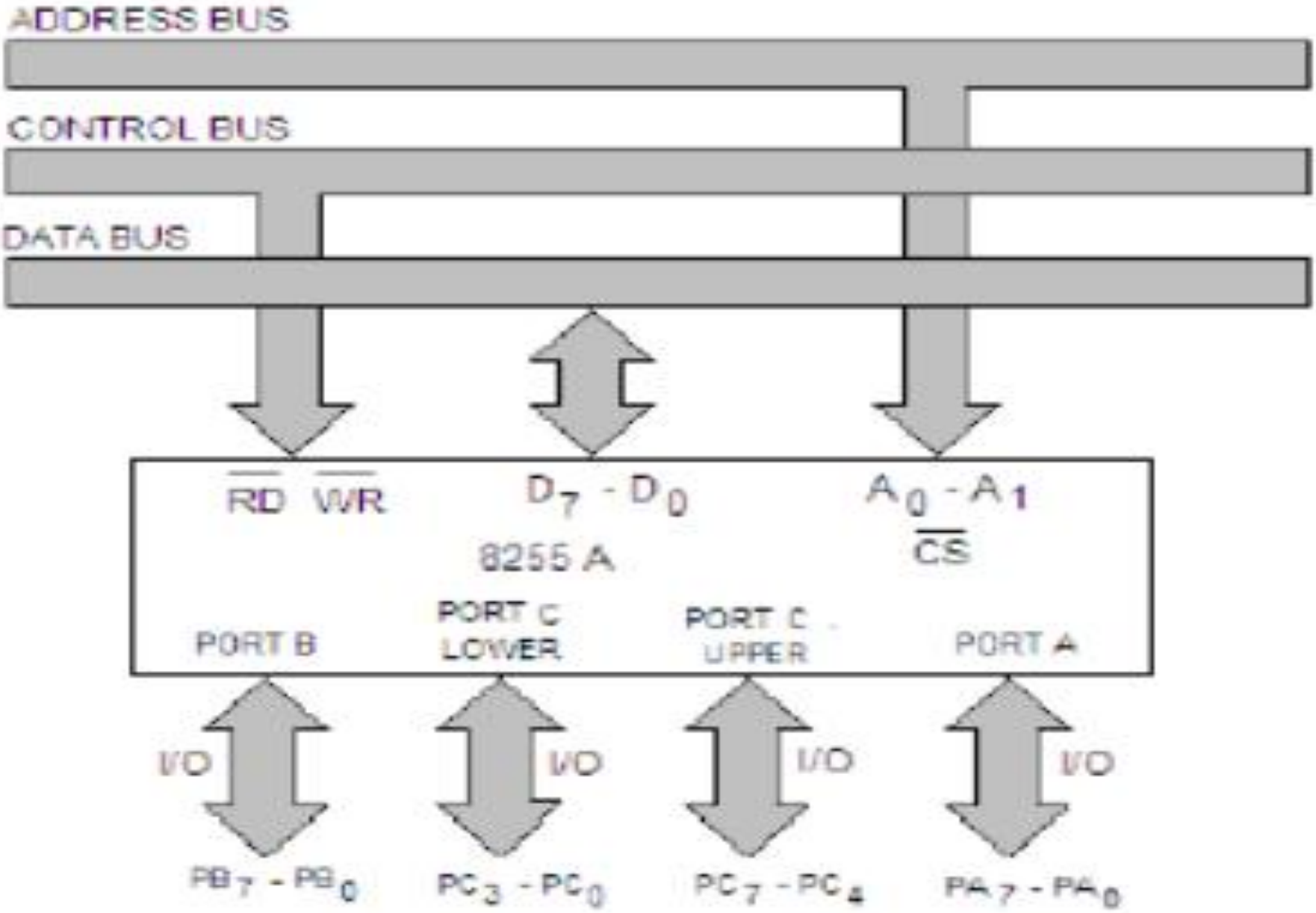

Control Word
D7 D6 D5 D4 D3 D2 D1 D0
0/1
BSR Mode
(Bit Set/Reset)
I/O Mode
Mode 0
Mode 2
Mode 1
Simple I/O for ports A,B and C
Bidirectional data bus for Port A
Port B: either in Mode 0 or 1
Port C bits are used for handshake
Handshake I/O for ports A and or B
Port C bits are used for handshake

Two Modes of 8255 PPI:

- **8255 PPI operate in two modes of operations :-**
- **Input/ Output Mode.**
  - **Mode** 0 – Simple or basic I/O **Mode**.
  - **Mode** 1 – Handshake or Strobed I/O.
  - **Mode** 2 – Bidirectional I/O.
- **Bit Set Reset (BSR) Mode**.

1.Mode 0 (Basic Input/Output).

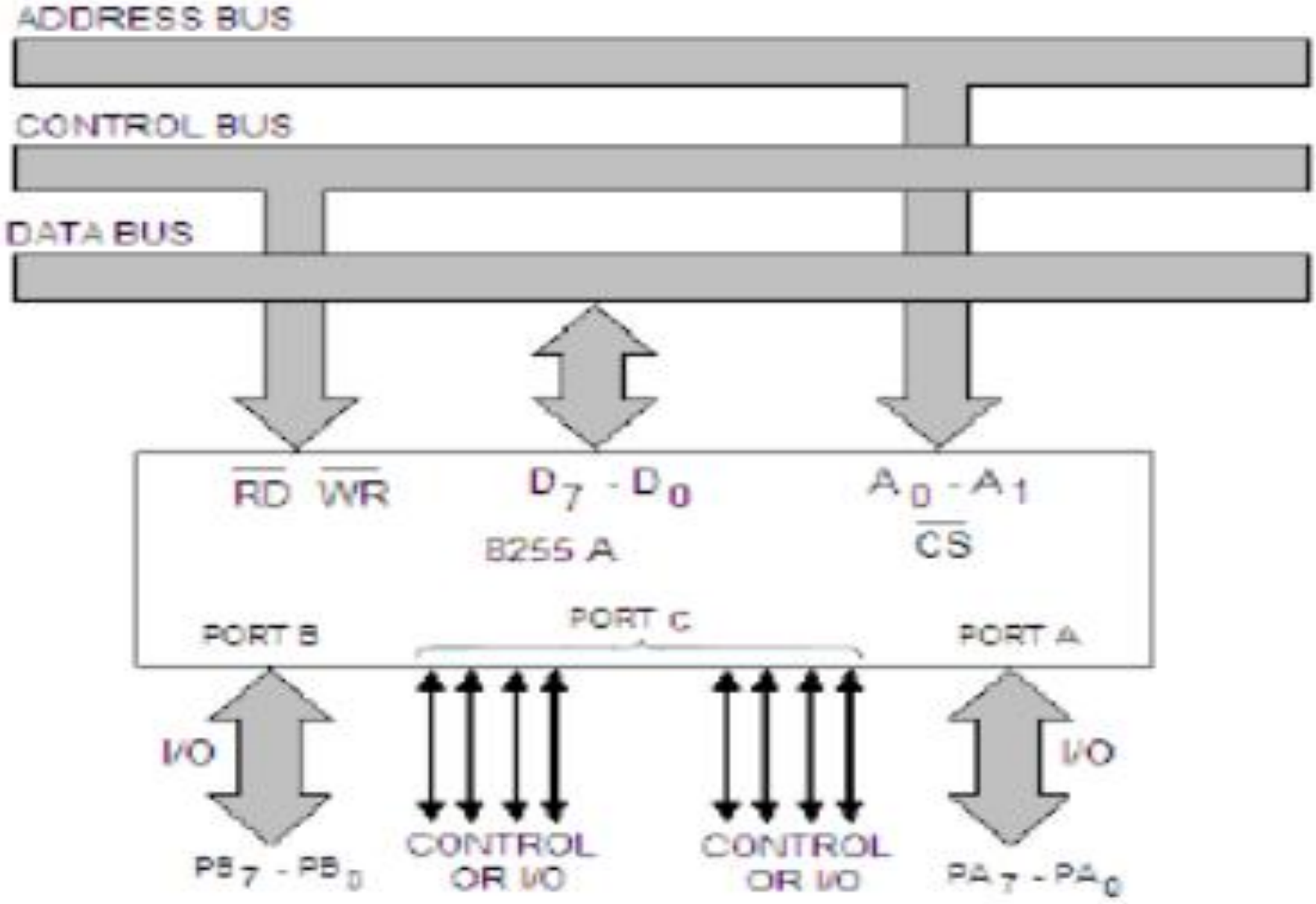
- ***This mode is also called as*** basic input/output mode.
- This mode provides simple input and output capabilities using each of the three ports.
- Data can be simply read from and written to the input and output ports respectively, after appropriate initialisation.
- No “handshaking” is required, data is simply written to or read from a specified port.



Mode-0 Operation

2.MODE 1 (Strobed Input/Output)

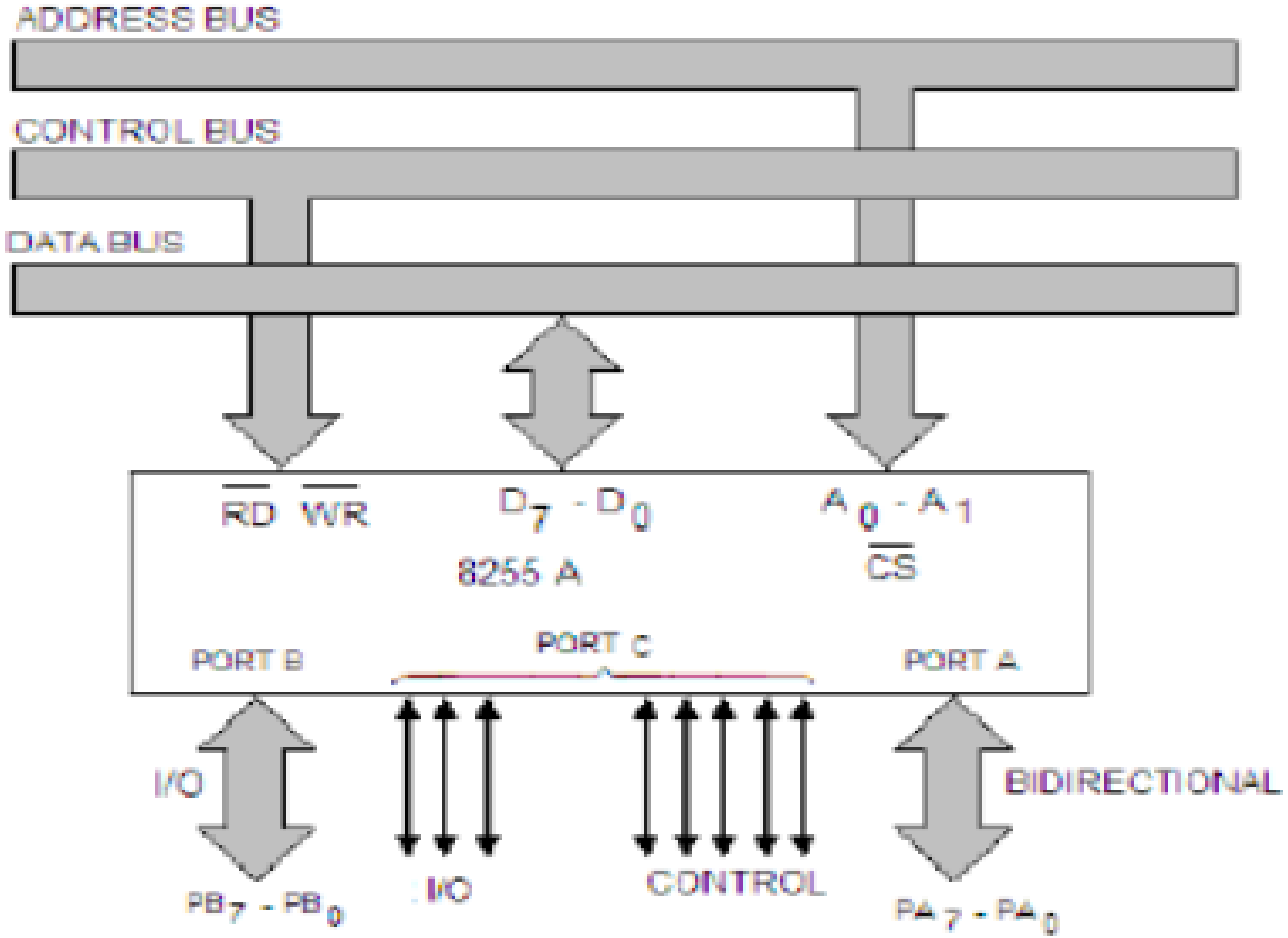
- Two groups – group A and group B are available for strobed data transfer.
- Each group contains one 8-bit data I/O port and one 4-bit control/data port.
- The 8-bit data port can be either used as input and output port. The inputs and outputs both are latched.
- Out of 8-bit port C, PC0-PC2 are used to generate control signals for port B and PC3-PC5 are used to generate control signals for port A.
- the lines PC6, PC7 may be used as independent data lines.



Mode-1 Operation

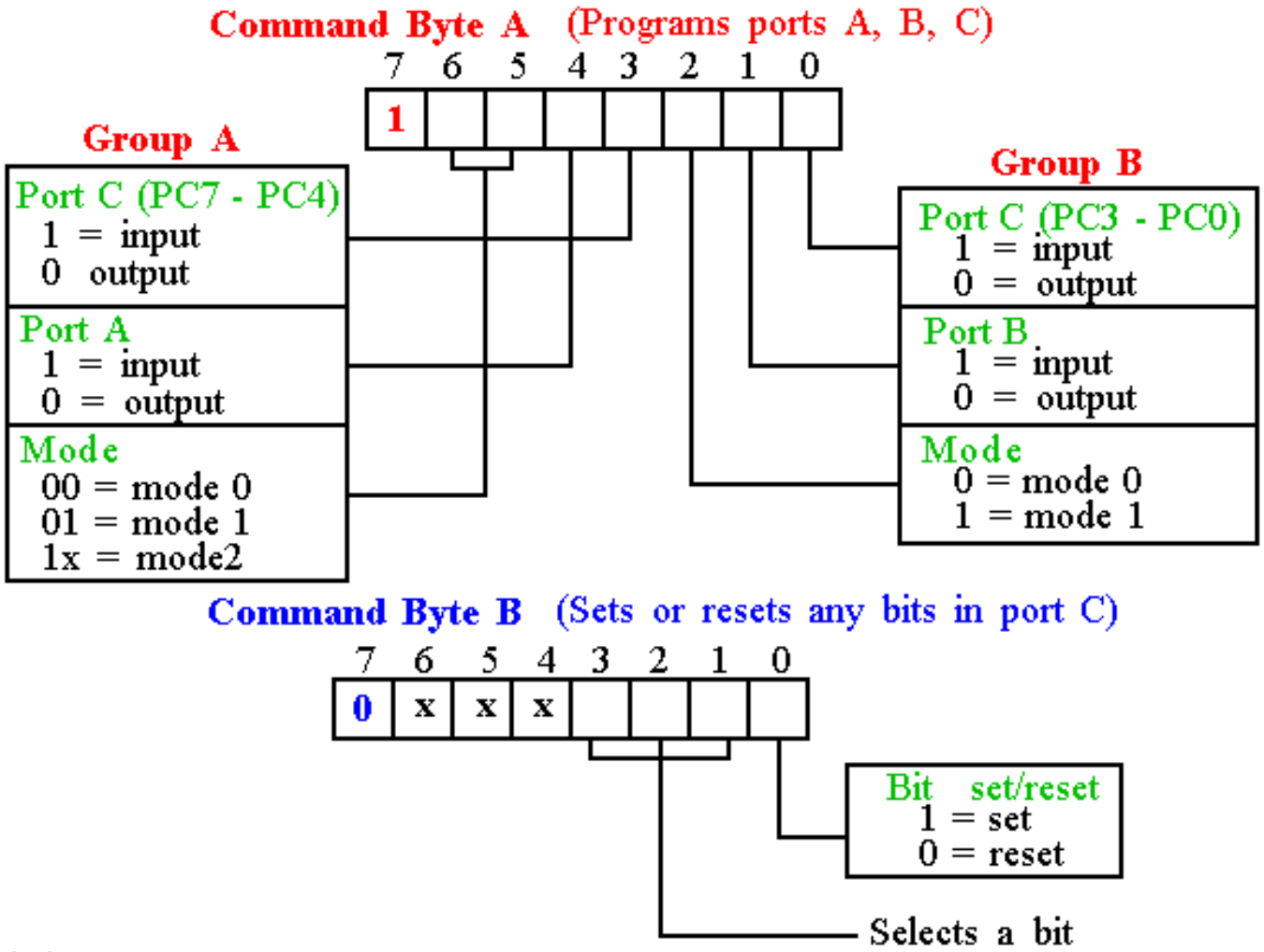
3. Mode 2 (Bi-directional Operation)

- The single 8-bit port in group A is available.
- The 8-bit port is bidirectional and additionally a 5-bit control port is available.
- Three I/O lines are available at port C.(PC2 – PC0)
- Inputs and outputs are both latched.
- The 5-bit control port C (PC3-PC7) is used for
- generating / accepting handshake signals for the 8-bit data transfer on port A.



Mode- 2 Operation

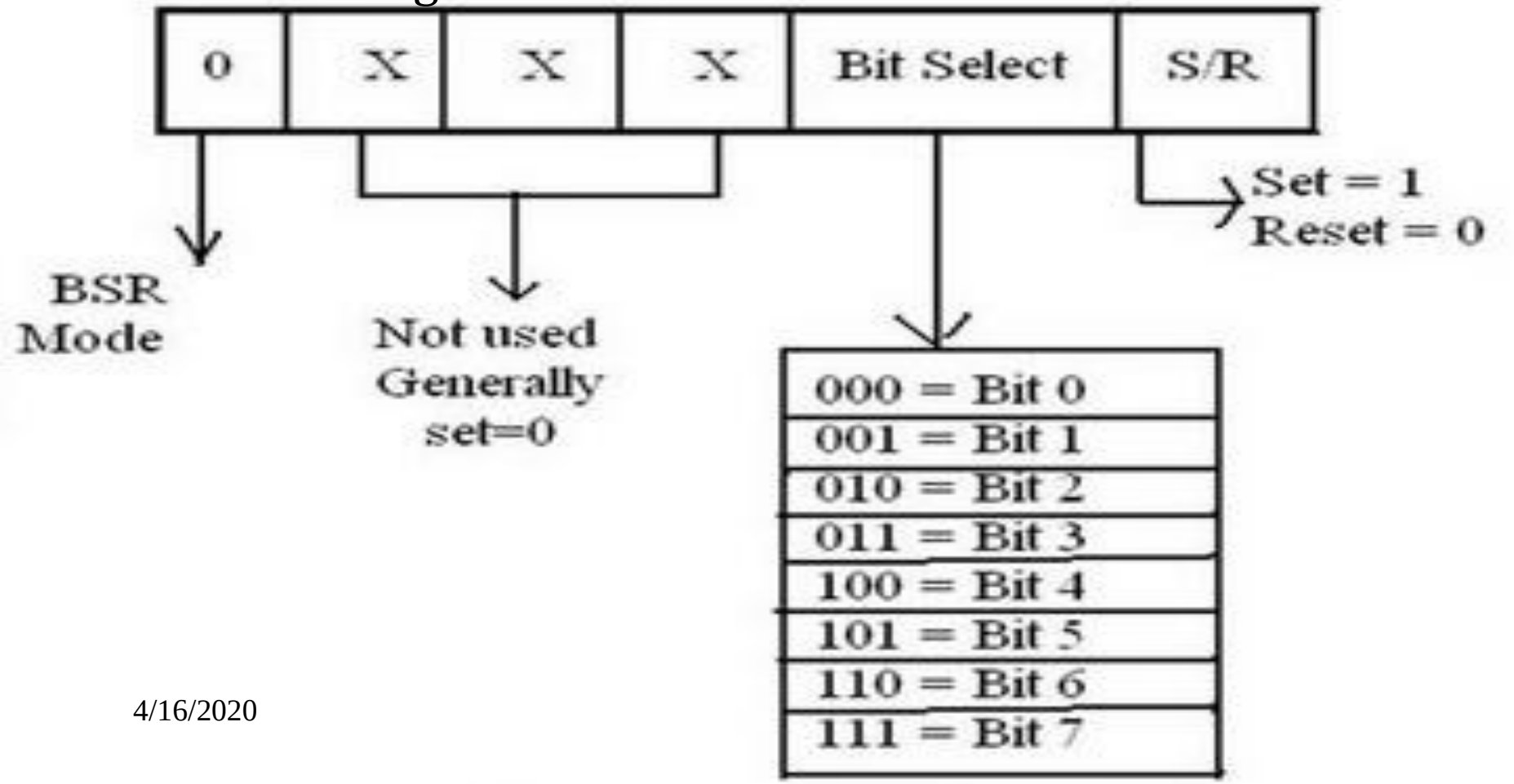
Control word register Bit format for 8255 for I/O mode and BSR Mode



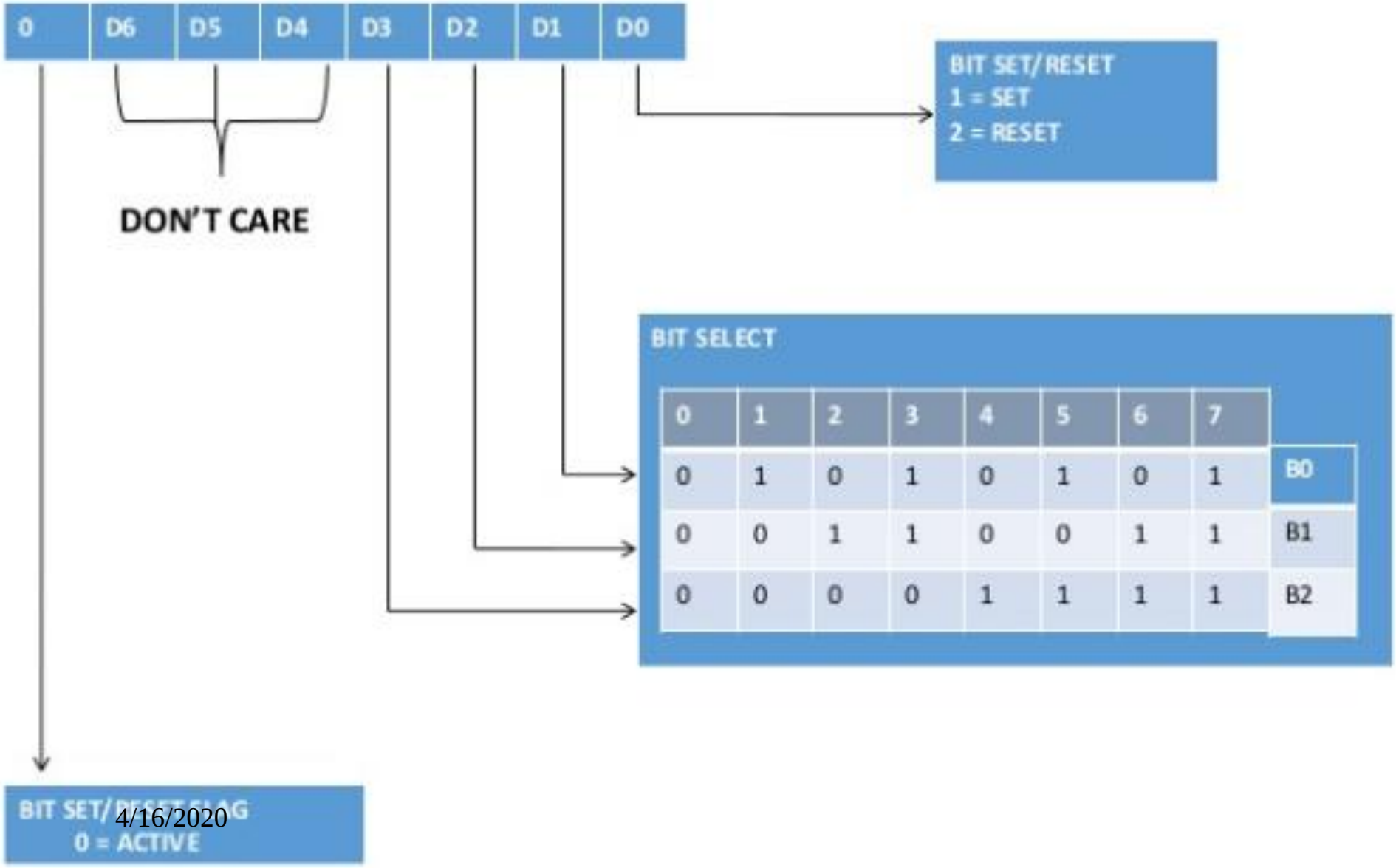
BSR CONTROL WORD

BSR Mode: In this mode any of the 8-bits of port C can be set or reset depending on D0 of the control word. The bit to

be set or reset is selected by bit select flags D3, D2 and D1 of the CWR as given in table.

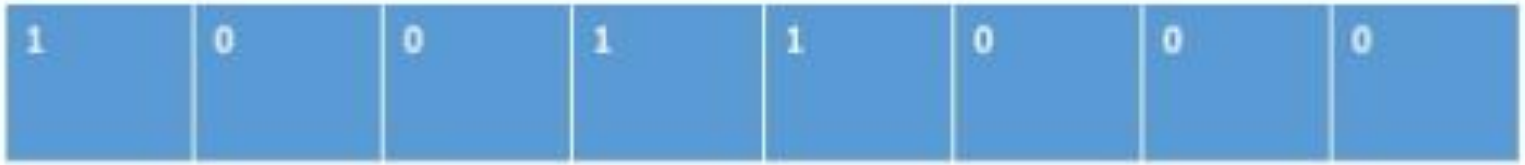


Control Word Format in BSR Mode



Write a program to initialize 8255 in the configuration below.(assume address of the CW register as 83H).
(1) Port A: simple input (2) Port B: simple output
(3) Port CL: output (4)Port CU: input

- **Solution:**



= 98H

Program:

```
MVI A,98H  ; LOAD CONTROL WORD

OUT 83H    ; SEND CONTROL WORD
```

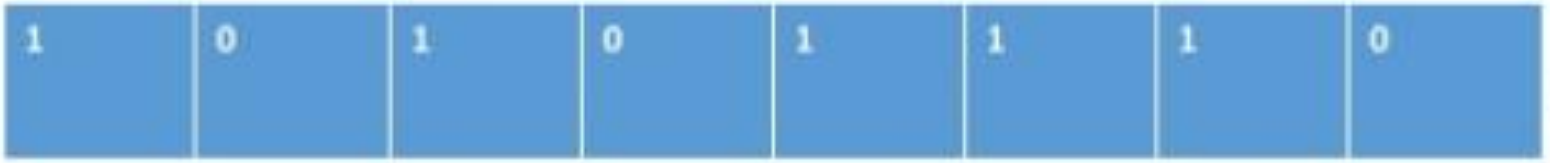
Write a program to initialize 8255 in the configuration below.(assume address of the CW register as 23H).

(1) Port A: output with handshake

(2) Port B: input with handshake

(3) Port CL: output (4)Port CU: input

- **Solution:**



= AEH

Program:

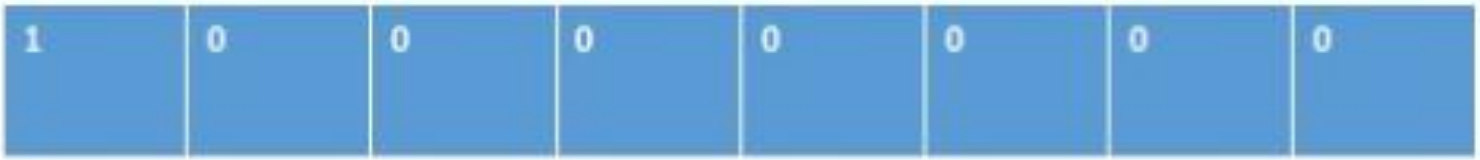
```
MVI A,AEH  ; LOAD CONTROL WORD

OUT 23H    ; SEND CONTROL WORD
```

Find the control word for the register arrangement of the ports of intel 8255 for mode 0 operation.

- **Port A: Output, Port B: Output,**
- **Port CU: Output, Port CL: Output**

Solution:



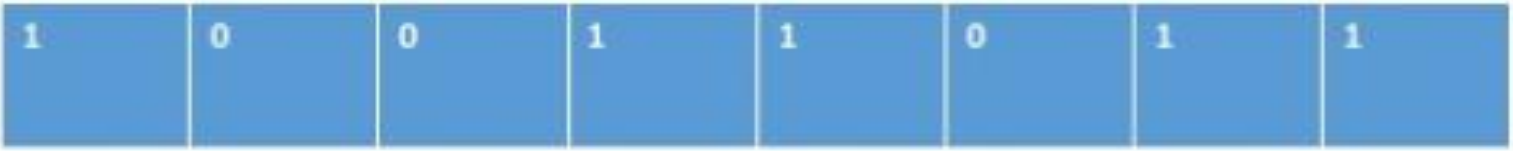
= 80H

The control word register for the above ports of intel 8255 is 80H.

Find the control word for the register arrangement of the ports of intel 8255 for mode 0 operation.

- **Port A: Input, Port B: Input,**
- **Port CU: Input, Port CL: Input**

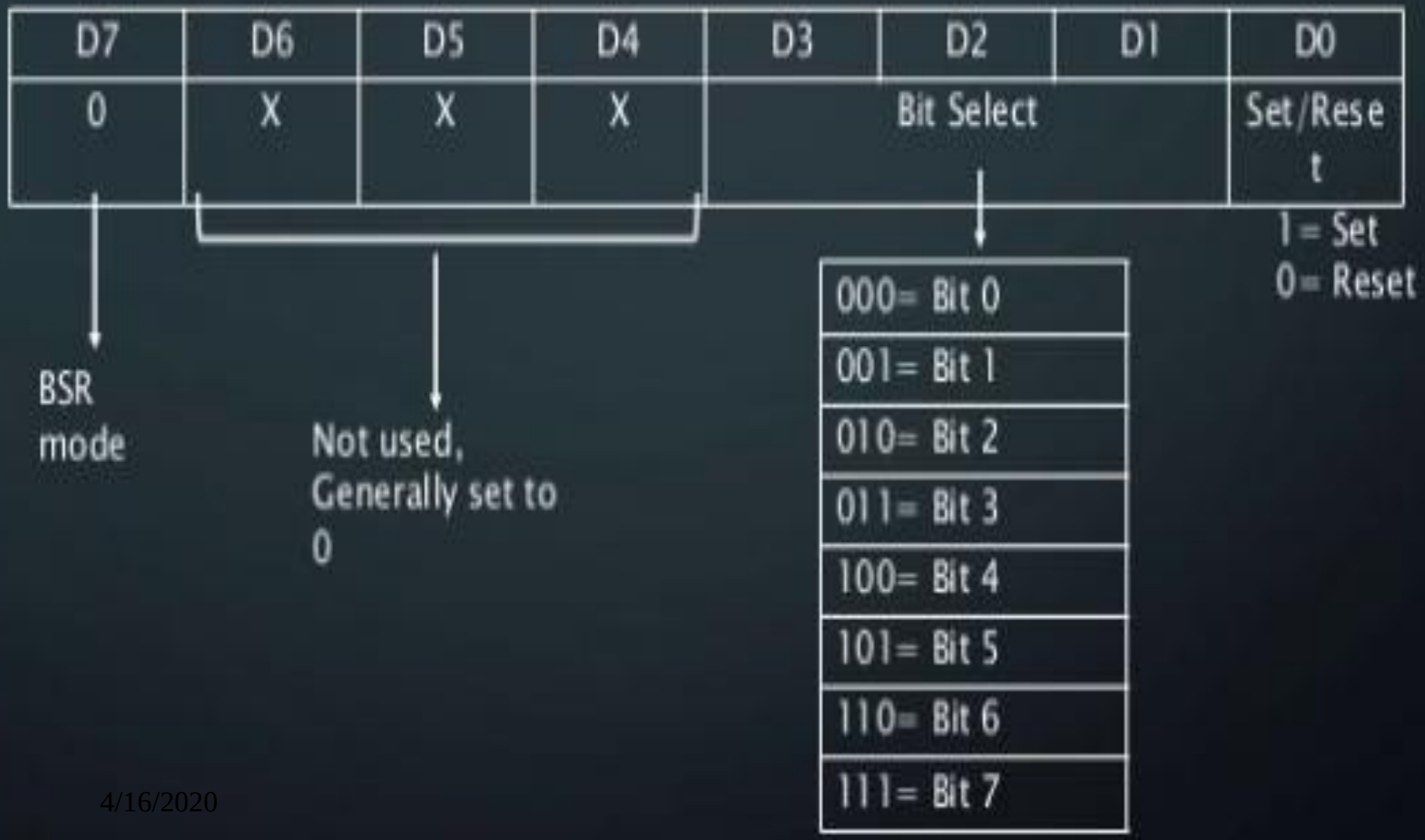
Solution:



= 9BH

The control word register for the above ports of intel 8255 is 9BH.

WRITE A BSR CONTROL WORD TO SET BITS PC7 AND PC0



To set PC7 control word will be

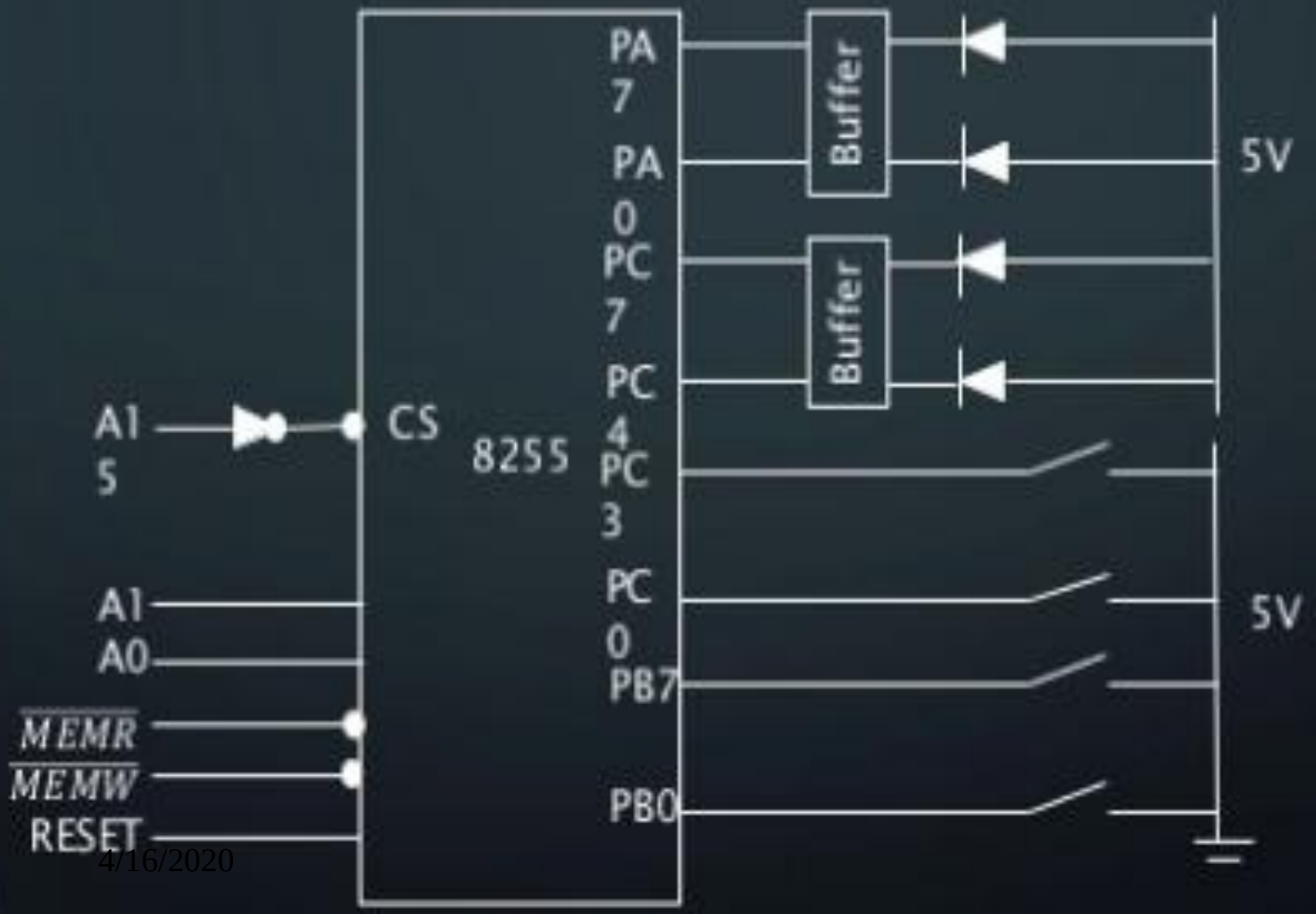
D7	D6	D5	D4	D3	D2	D1	D0	
0	0	0	0	1	1	1	1	=0FH

To set PC3 control word will be

D7	D6	D5	D4	D3	D2	D1	D0	
0	0	0	0	0	1	1	1	=07H

```
MVI A, 0FH      Load byte in accumulator to set PC7
OUT 83H             Set PC7=1
MVI A, 07H      Load byte in accumulator to set PC3
OUT 83H             Set PC3=1
RET
```

WRITE A PROGRAM FOR IC 8255 TO READ DIP SWITCHES AND DISPLAY THE READING FROM PORT B TO PORT A AND FROM PORT C_L AT PORT C_U



Port Address: Since 8255 is memory mapped I/O, suppose it is addressed at 8000H. Then when Chip select is enabled, then port addresses of 8255 will be-

Port A- 8000H (A1=0, A0=0)

Port B- 8001H (A1=0, A2=1)

Port C- 8002H (A1=1, A2=0)

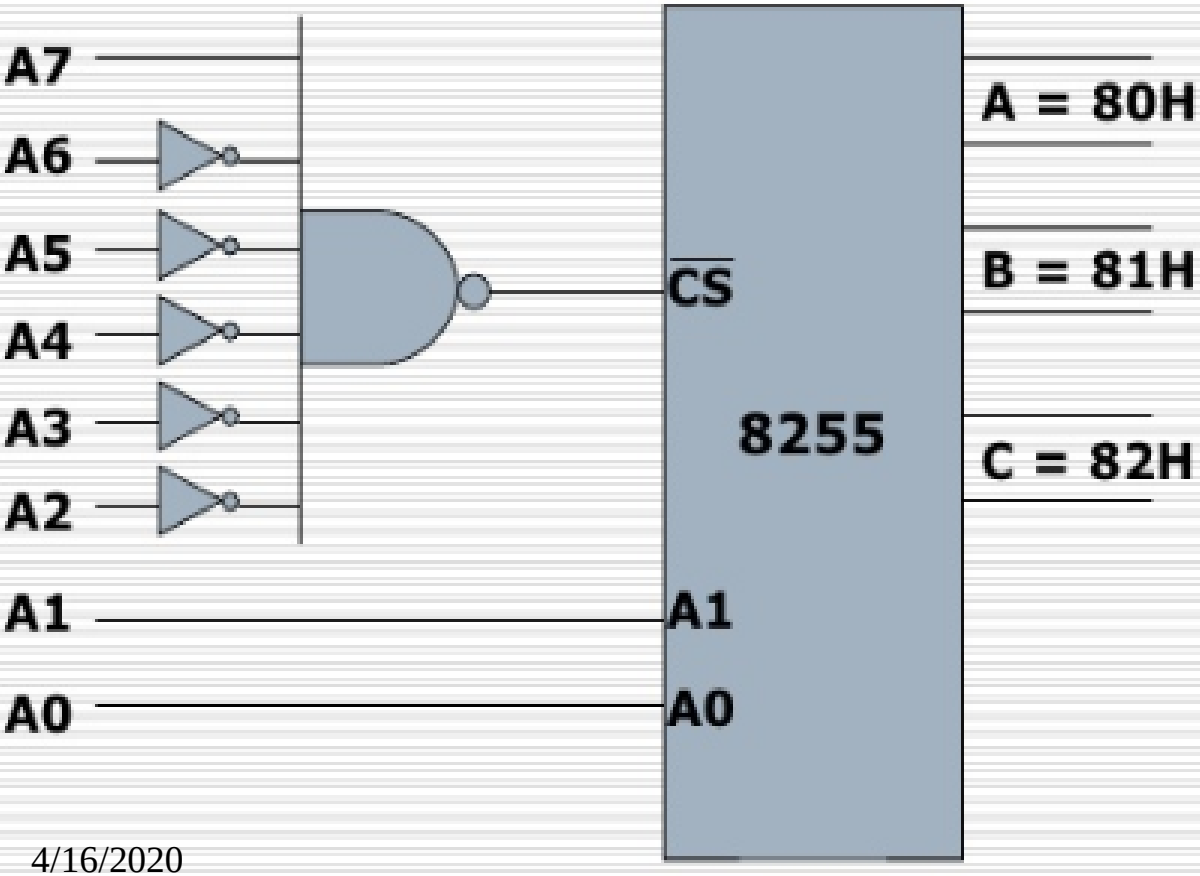
Control Register- 8003H (A1=1, A0=1)

Control Word:

D7	D6	D5	D4	D3	D2	D1	D0	
1	0	0	0	0	0	1	1	=83H

- D7 = 1: I/O mode
- D6, D5 = 0, 0: Port A in Mode 0
- D4 = 0: Port A = Output
- D3 = 0: Port C_U = Output
- D2 = 0: Port B in Mode 0
- D1 = 1: Port B = Input
- D0 = 1: Port C_L = Input

8255 Chip selection & Port Addresses



A1	A0	Port
0	0	A
0	1	B
1	0	C
1	1	CWR

To communicate with peripherals through 8255 three steps are necessary:

1. Determine the addresses of Port A, B, C and Control register according to Chip Select Logic and the Address lines A0 and A1.
2. Write a control word in control register.
3. Write I/O instructions to communicate with peripherals through port A, B, C.

The common applications of 8255 are:

Traffic light control

Generating square wave

Interfacing with DC motors and stepper motors