

Chapter 7 : Parallel Interface (PPI 8255)

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Instruction to I/O devices



Several I/O chips were developed by Intel to ease design burden and to provide a complete I/O interface on a single chip. Examples of common I/O interface chips are:

- 8255A** *Programmable Peripheral Interface* **(PPI)**
- 8259** *Programmable Interrupt Controller* **(PIC)**
- 8253/4** *Programmable Interval Timer* **(PIT)**
- 8237** *Programmable DMA Controller*

The 80x86 family can access data from I/O ports using the **IN** and **OUT instructions** introduced briefly in the data movement instructions. These instructions can send (out) data from accumulator (AL or AX) to outside ports or receive (in) data from ports to accumulator. The format of these two instructions is as follows:

Instruction to I/O devices



<i>Receiving Data</i>	<i>Sending Data</i>	<i>Remarks</i>
IN AL, PORT#	OUT PORT#, AL	;8-bit data ports
IN AL, DX	OUT DX, AL	;DX contains 8-bit port address.
IN AX, PORT#	OUT PORT#, AX	;16-bit data ports
IN AX, DX	OUT DX, AX	;DX contains 16-bit port address.

Example:

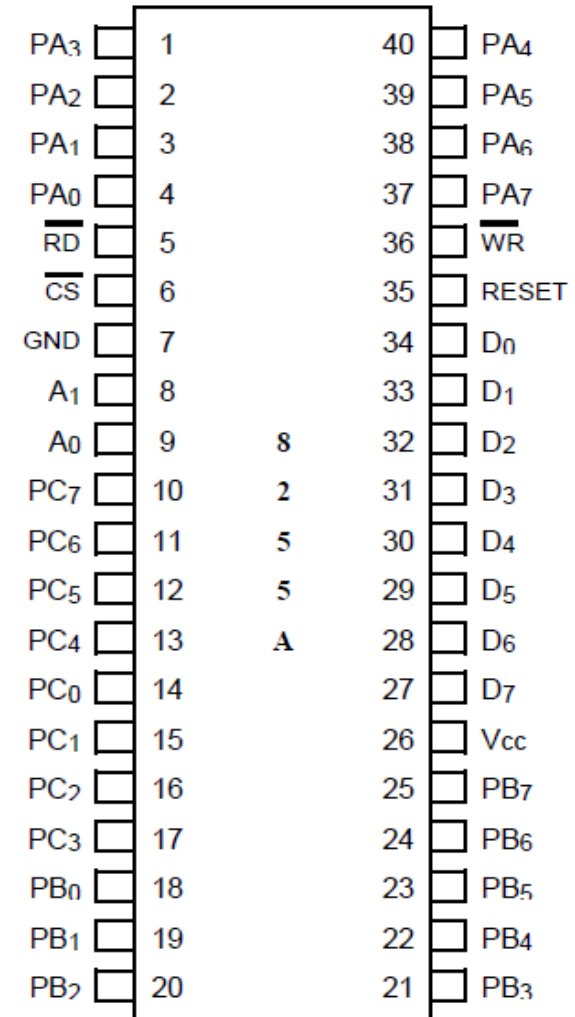
MOV	DX, 278h	;DX contains port address
MOV	AL, BL	;move data into accumulator
OUT	DX, AL	;send data to port #278h

The 8255A Programmable Peripheral Interface (PPI)

The **8255A** is a programmable peripheral interface (PPI) device designed for use in Intel microcomputer systems. It is a general purpose I/O chip to interface peripheral equipment to Intel-based microcomputer systems. It can be used for both memory-mapped and peripheral I/O.

The **8255A** integrates:

- Port A
- Port B
- Port C
- Control register



The 8255A Programmable Peripheral Interface (PPI)

The functional configuration of the 8255A is programmed by the systems software so that normally no external logic is necessary to interface peripheral devices or structures.

- Inside the **8255A** there are three ports called Port A, Port B and Port C. In addition, there is a one byte command register on the chip.
- Each of the **Ports A** and **B** can be programmed as an **8-bit** input or output port.
- **Port C** can be split into two nibbles (upper nibble **PC7 – PC4** and lower nibble **PC3 – PC0**) which can be programmed to be each an input or output. Programming of the ports is restricted to bytes or nibbles.
- That is, individual bits of a particular port cannot be programmed. The pin definitions of the 8255A Chip are shown in figure above.

The 8255A Programmable Peripheral Interface (PPI)

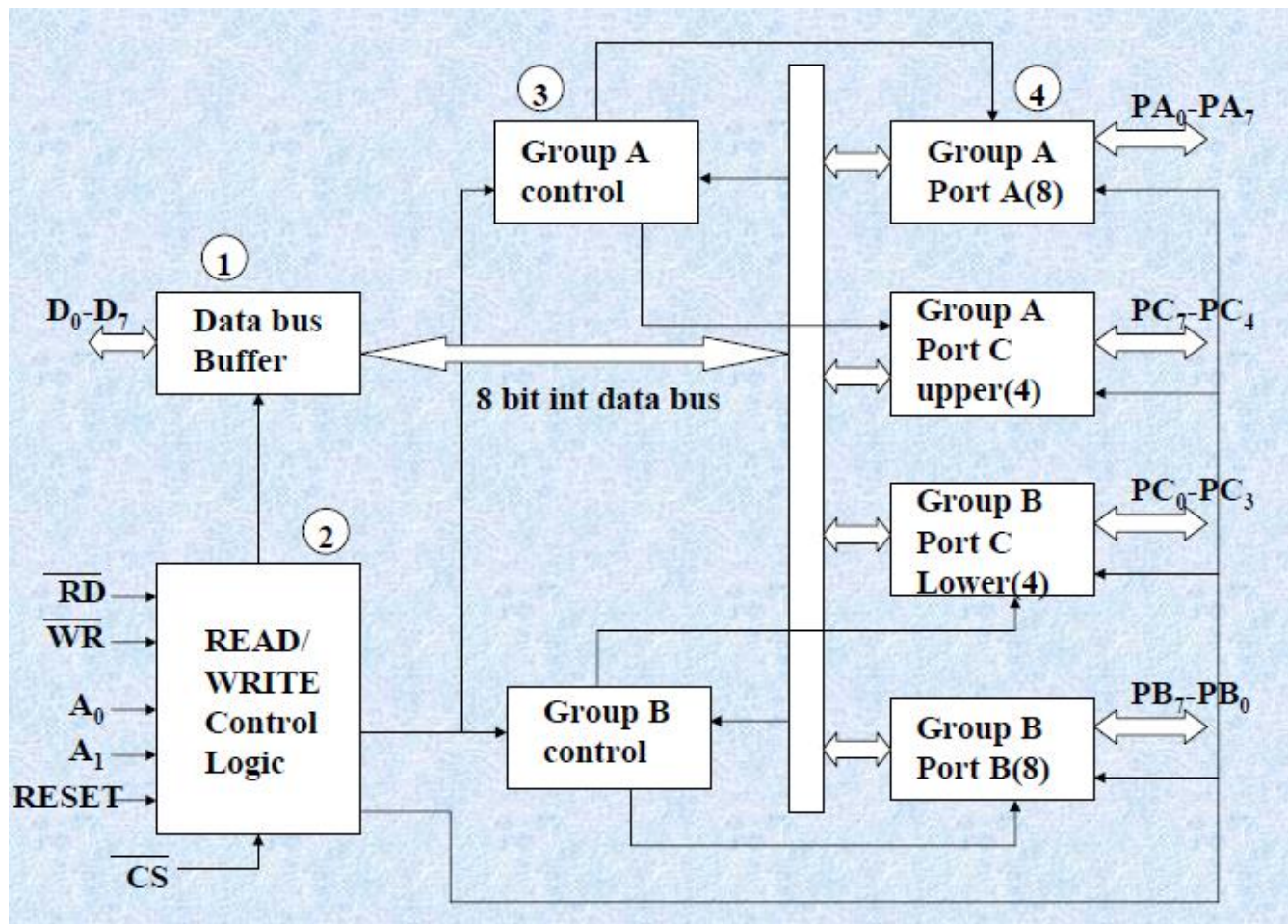
The 8255A Function Selection



A_1	A_0	$\overline{RD}$	$\overline{WR}$	$\overline{CS}$	Function Selection
Input Operation (READ)					
0	0	0	1	0	Port A $\rightarrow$ Data Bus
0	1	0	1	0	Port B $\rightarrow$ Data Bus
1	0	0	1	0	Port C $\rightarrow$ Data Bus
Output Operation (WRITE)					
0	0	1	0	0	Port A $\leftarrow$ Data Bus
0	1	1	0	0	Port B $\leftarrow$ Data Bus
1	0	1	0	0	Port C $\leftarrow$ Data Bus
1	1	1	0	0	Control Register $\leftarrow$ Data Bus
Disabled					
$\times$	$\times$	$\times$	$\times$	1	Data Bus Tristate
1	1	0	1	0	Illegal Condition
$\times$	$\times$	1	1	0	Data Bus Tristate

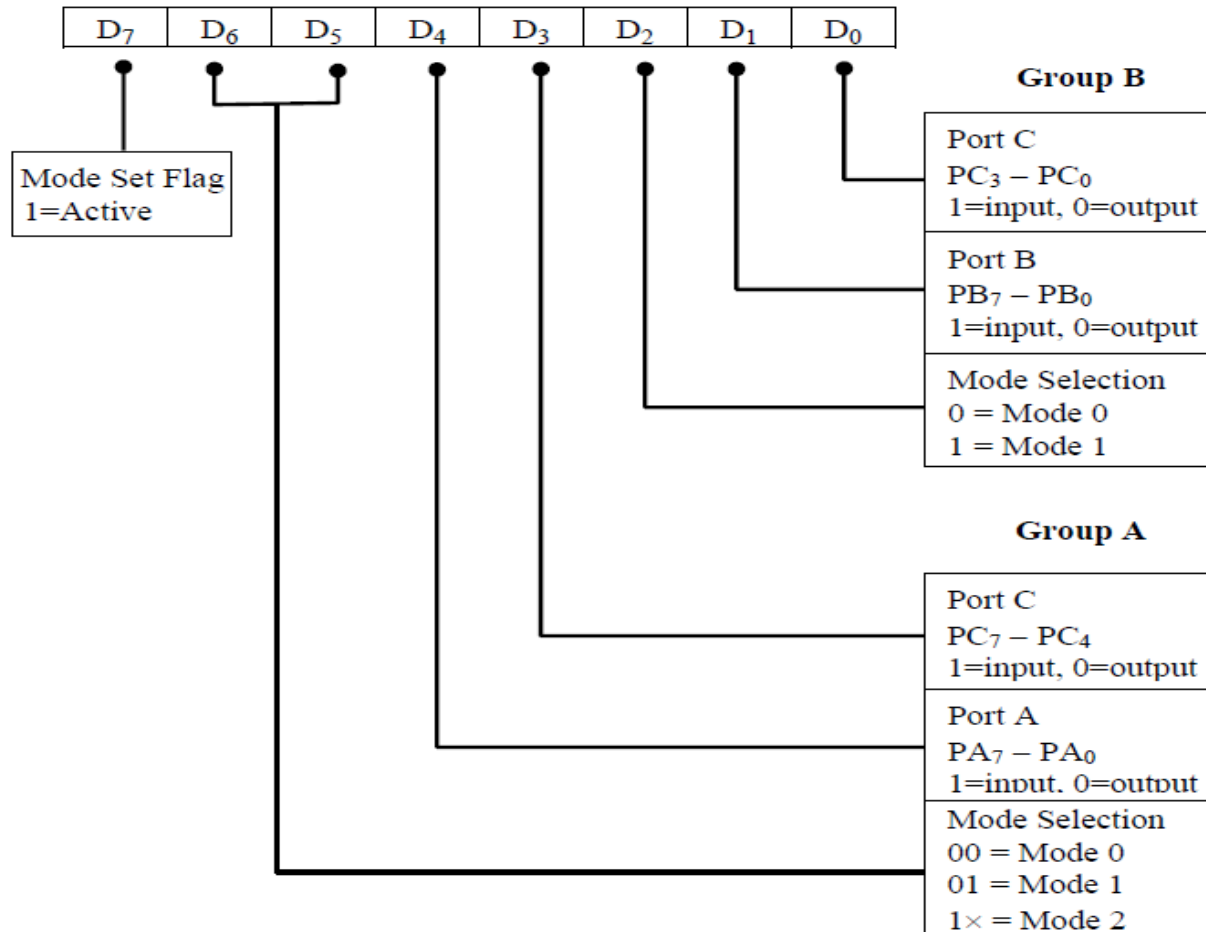
The 8255A Programmable Peripheral Interface (PPI)

Block Diagram of 8255A



The 8255A Programmable Peripheral Interface (PPI)

The 8255A Control Word Format (I/O mode)



The 8255A Programmable Peripheral Interface (PPI)

8255A Port Selection

Table: The **8255A** Port Selection.

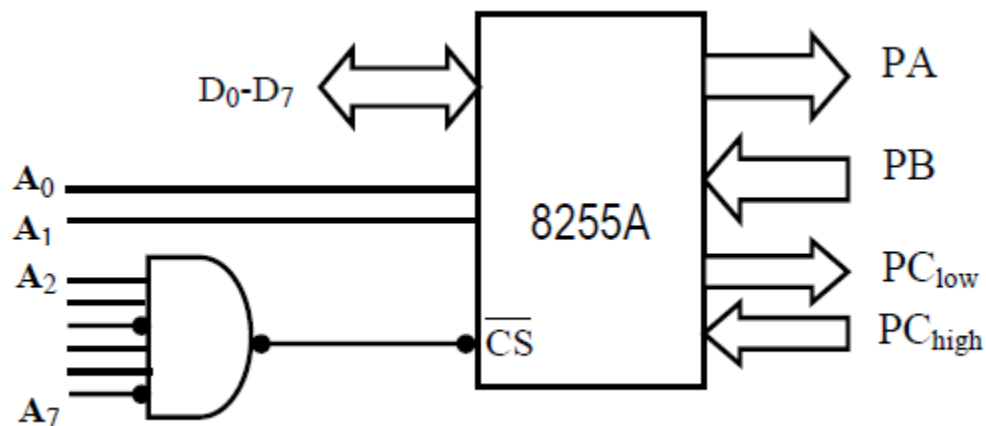
$\overline{CS}$	A_1	A_0	Selection
0	0	0	Port A
0	0	1	Port B
0	1	0	Port C
0	1	1	Control Register
1	×	×	Chip not selected

Example

Programming of 8255A

Consider the 8255A configuration shown and determine:

- (a) PPI port address
- (b) Find control word
- (c) Write a program that reads a data byte from Port B and writes it to Port A

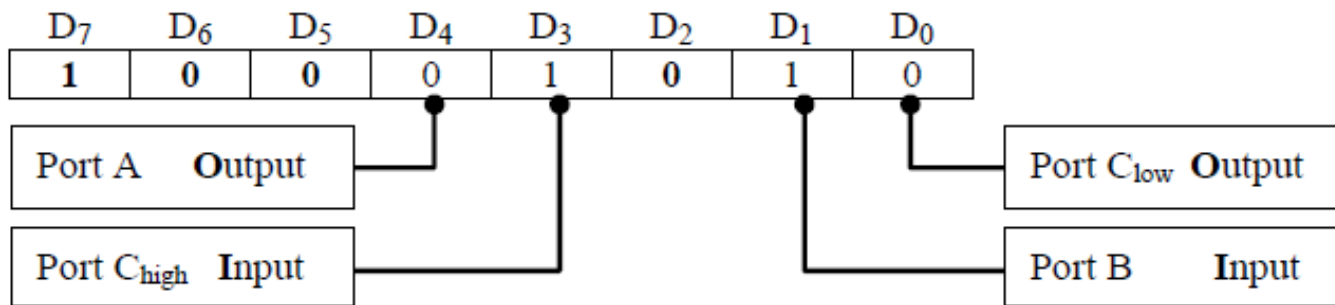


Example

PPI Port Address Calculation

$\overline{CS}$	A_1	A_0	Address	Selection
0110 11	0	0	6Ch	Port A
0110 11	0	1	6Dh	Port B
0110 11	1	0	6Eh	Port C
0110 11	1	1	6Fh	Control Register

Control word is 1000 1010 (8Ah)



Example

Assembly Program

<i>Assembly code</i>	<i>Comments</i>
MOV AL, 8Ah	;Put the control word in AL (8-bit data ports)
OUT 6Fh, AL	;Send the content of AL to the Control Reg. address.
IN AL, 6Dh	;Read data from the port B
OUT AL, 6Ch	;Send the data in AL to the port A

In the previous code we can replace :

OUT 6Fh, AL by:

MOV DX, 6Fh
OUT DX, AL