# Microprocessor | 8255 (programmable peripheral interface)

8255 is a popularly used parallel, programmable input-output device. It can be used to transfer data under various condition from simple input-output to interrupt input-output. This is economical, functional, flexible but is a little complex and general purpose i/o device that can be used with almost any microprocessor.

8255 pin diagram –

It has 24 pins that can be grouped in two 8-bit parallel ports: A and B called Port A(PA) and Port B(PB) with the remaining eight known as Port C(PC). Port C can be further divided into groups of 4-bits ports named Cupper(Cu) and Clower(Cl). There are 40 pins and operates in +5 regulated power supply.
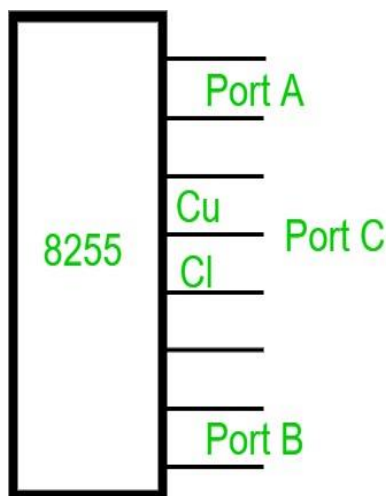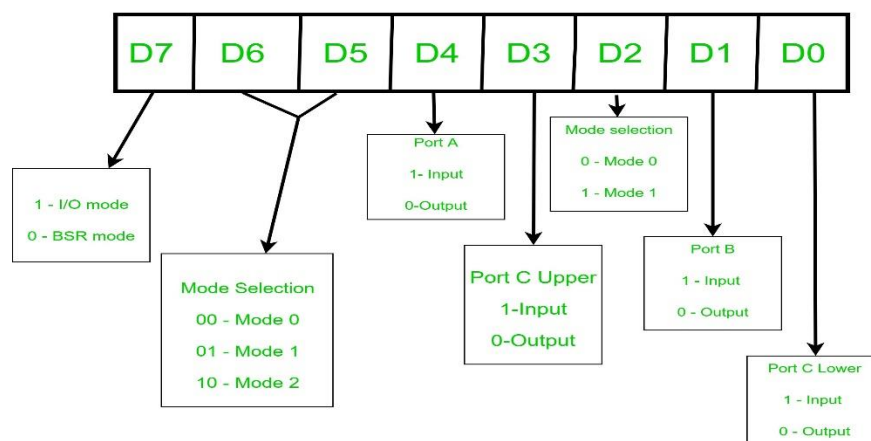

Modes of 8255 – It works in two modes:

1. Bit set reset (BSR) mode
2. Input/output (I/O) mode

To know in which mode the interface is working we need to know the value of **Control word**. Control word is a part of control register in 8255 which specify an I/O function for each port. This is format of control word 8255.

Control Word Format

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

1 - I/O mode
0 - BSR mode

Mode Selection
00 - Mode 0
01 - Mode 1
10 - Mode 2

Port A
1- Input
0-Output

Port C Upper
1-Input
0-Output

Mode selection
0 - Mode 0
1 - Mode 1

Port B
1 - Input
0 - Output

Port C Lower
1 - Input
0 - Output

If the most significant bit of control word or D7 is 1 then 8255 works in I/O mode else, if it's value is 0 it works in BSR mode.

1. BSR Mode **–** When MSB of the control register is zero(0), 8255 works in Bit Set-Reset mode.in this only PC bit are used for set and reset.
2. I/O Mode **–** When MSB of the control register is one(1), 8255 works in Input-Output mode.it is further divided into three categories.
3. Mode 0 **–** In this mode all three ports (PA, PB, PC) can work as simple input function or output function also in this mode there is no interrupt handling capabilities.
4. Mode 1 **–** In this either port A or port B can work and port C bits are used as Handshake signal before actual data transmission plus it has interrupt handling capabilities.
5. Mode 2 **–** In this only port A works and port B can work either in Mode 0 or Mode 1 and the 6 bits of port C are used as Handshake signal plus it also has to interrupt handling capability.

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 intructions 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

Programmable peripheral interface 8255

PPI 8255 is a general purpose programmable I/O device designed to interface the CPU with its outside world such as ADC, DAC, keyboard etc. We can program it according to the given condition. It can be used with almost any microprocessor.

It consists of three 8-bit bidirectional I/O ports i.e. PORT A, PORT B and PORT C. We can assign different ports as input or output functions.
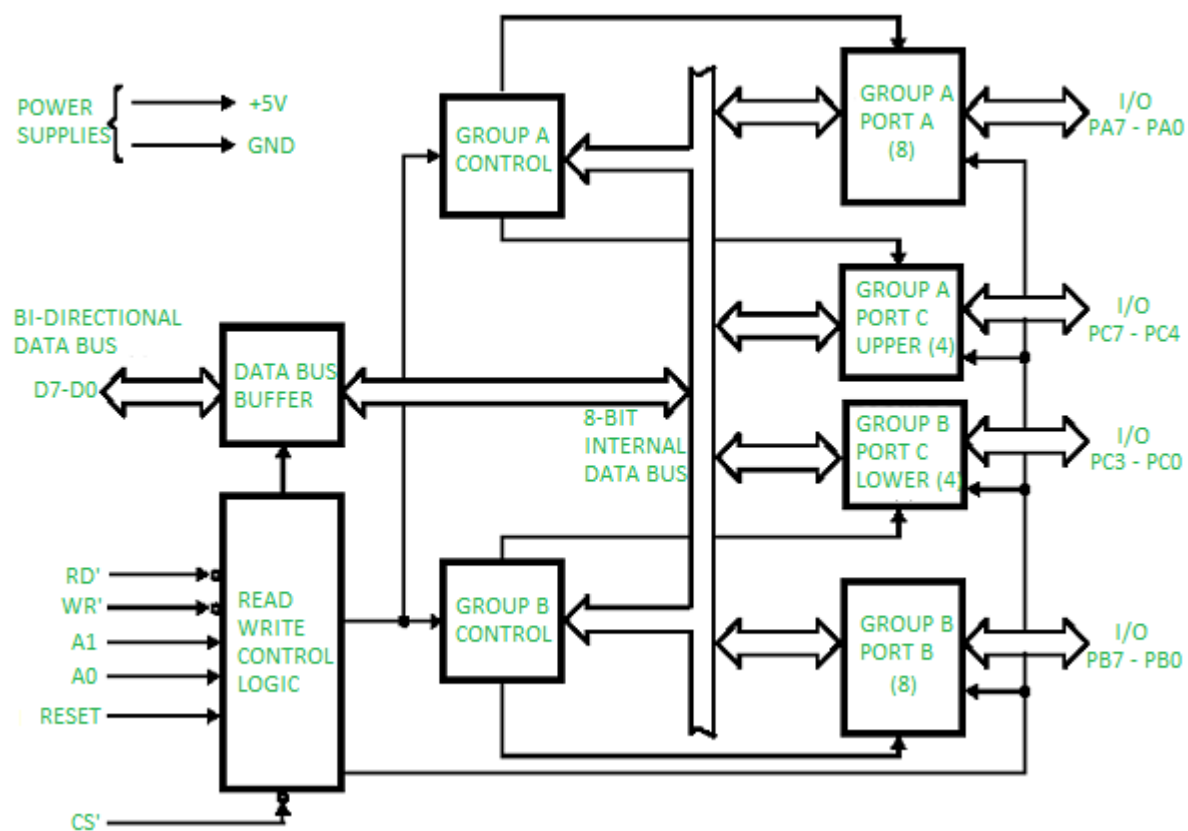

It consists of 40 pins and operates in +5V regulated power supply. Port C is further divided into two 4-bit ports i.e. port C lower and port C upper and port C can work in either BSR (bit set rest) mode or in mode 0 of input-output mode of 8255. Port B can work in either mode or in mode 1 of input-output mode. Port A can work either in mode 0, mode 1 or mode 2 of input-output mode.

It has two control groups, control group A and control group B. Control group A consist of port A and port C upper. Control group B consists of port C lower and port B.

Depending upon the value if CS', A1 and A0 we can select different ports in different modes as input-output function or BSR. This is done by writing a suitable word in control register (control word D0-D7).

| CS'	A1	A0	SELECTION	ADDRESS
0	0	0	PORT A	80 H
0	0	1	PORT B	81 H
0	1	0	PORT C	82 H
0	1	1	Control Register	83 H
1	X	X	No Seletion	X

Pin diagram –
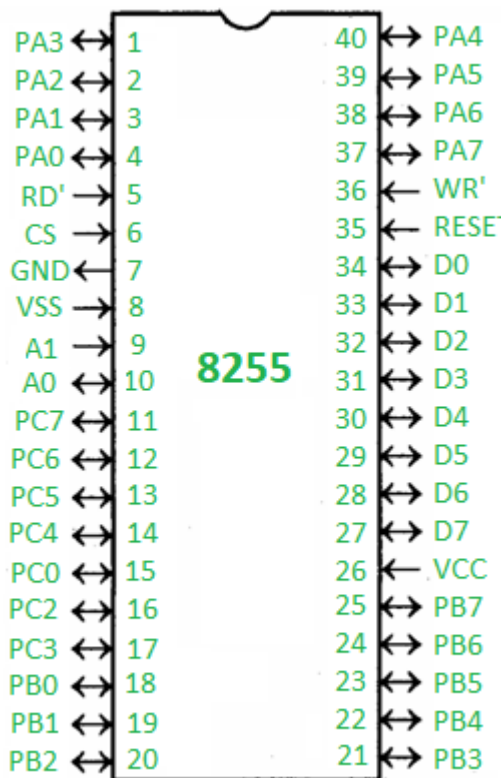
- **PA0 – PA7 –** Pins of port A
- **PB0 – PB7 –** Pins of port B
- **PC0 – PC7 –** Pins of port C
- **D0 – D7 –** Data pins for the transfer of data
- **RESET –** Reset input
- **RD' –** Read input
- **WR' –** Write input
- **CS' –** Chip select
- **A1 and A0 –** Address pins

8255 microprocessor operating modes

There are 2 modes in 8255 microprocessor:

1. Bit set reset (BSR) mode – This mode is used to set or reset the bits of port C only, and selected when the most significant bit (D7) in the control register is 0. Control Register is as follows:

D7= 0	D6	D5	D4	D3	D2	D1	D0

X

PC bit number

0 : Reset
1 : Set
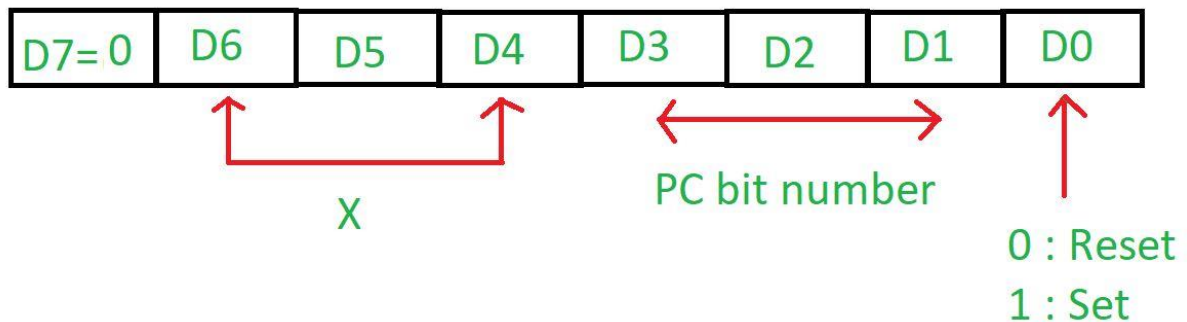
| D3	D2	D1
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

This mode affects only one bit of port C at a time because, as user set the bit, it remains set until and unless user changes it. User needs to load the bit pattern in control register to change the bit.

2. Input/output mode (I/O) **–** This mode is selected when the most significant bit (D7) in the control register is 1.

- Mode 0 – Simple or basic I/O mode:
  Port A, B and C can work either as input function or as output function. The outputs are latched but the inputs are not latched. It has interrupt handling capability.
- Mode 1 – Handshake or strobed I/O:
  In this either port A or B can work and port C bits are used to provide handshaking. The outputs as well as inputs are latched. It has interrupt handling

capability. Before actual data transfer there is transmission of signal to match speed of CPU and printer.

Example: When CPU wants to send data to slow peripheral device like printer, it will send handshaking signal to printer to tell whether it is ready or not to transfer the data. When printer will be ready it will send one acknowledgement to CPU then there will be transfer of data through data bus.
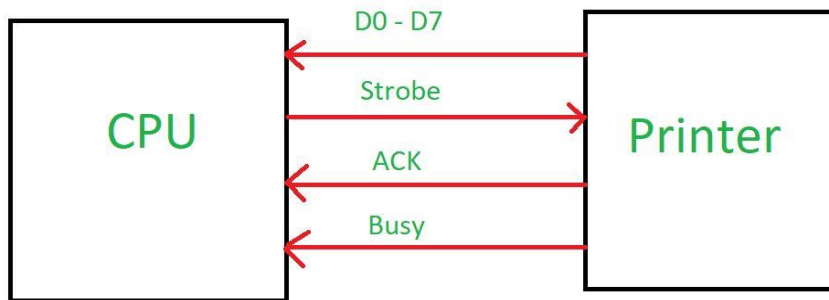
Mode 2 – Bidirectional I/O:

In this mode only port A will work, port B can either is in mode 0 or 1 and port C bits are used as handshake signal. The outputs as well as inputs are latched. It has interrupt handling capability. Control Register is as follows:
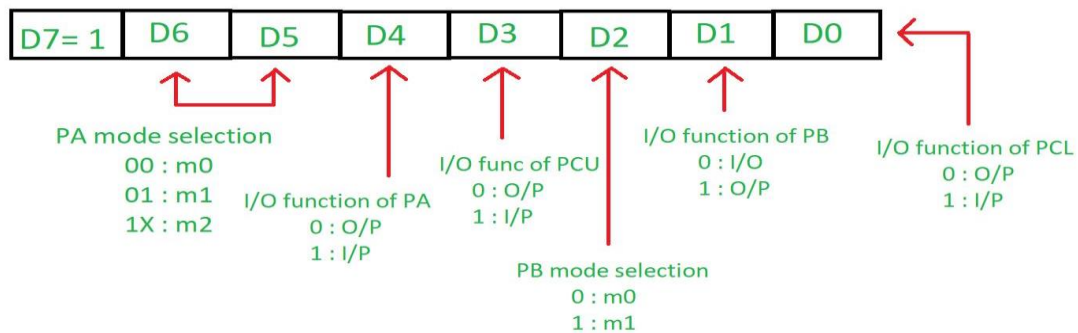
The most significant bit (**D7**) is 1 for the I/O mode and 0 for the BSR mode.

D6 & D5 It is used to set the port A mode.

D6	D5	Mode
0	0	m0
0	0	m1
0	X	m2

D4 is used to tell whether port A is taking input or displaying the result. If it is 1 then it is taking input otherwise displaying output.

D3 is used to tell whether port C higher bits is taking input or displaying the result. If it is 1 then it is taking input otherwise displaying output.

D2 tells the mode of port B. If it is 0 then port B is in m0 mode otherwise in m1 mode.

D1 is used to tell whether port B is taking input or displaying the result. If it is 1 then it is taking input otherwise displaying output.

D0 is used to tell whether port C lower bits is taking input or displaying the result. If it is 1 then it is taking input otherwise displaying output.

When 8255 microprocessor is reset, it will clear the control word register contents, setting all the ports to input mode.