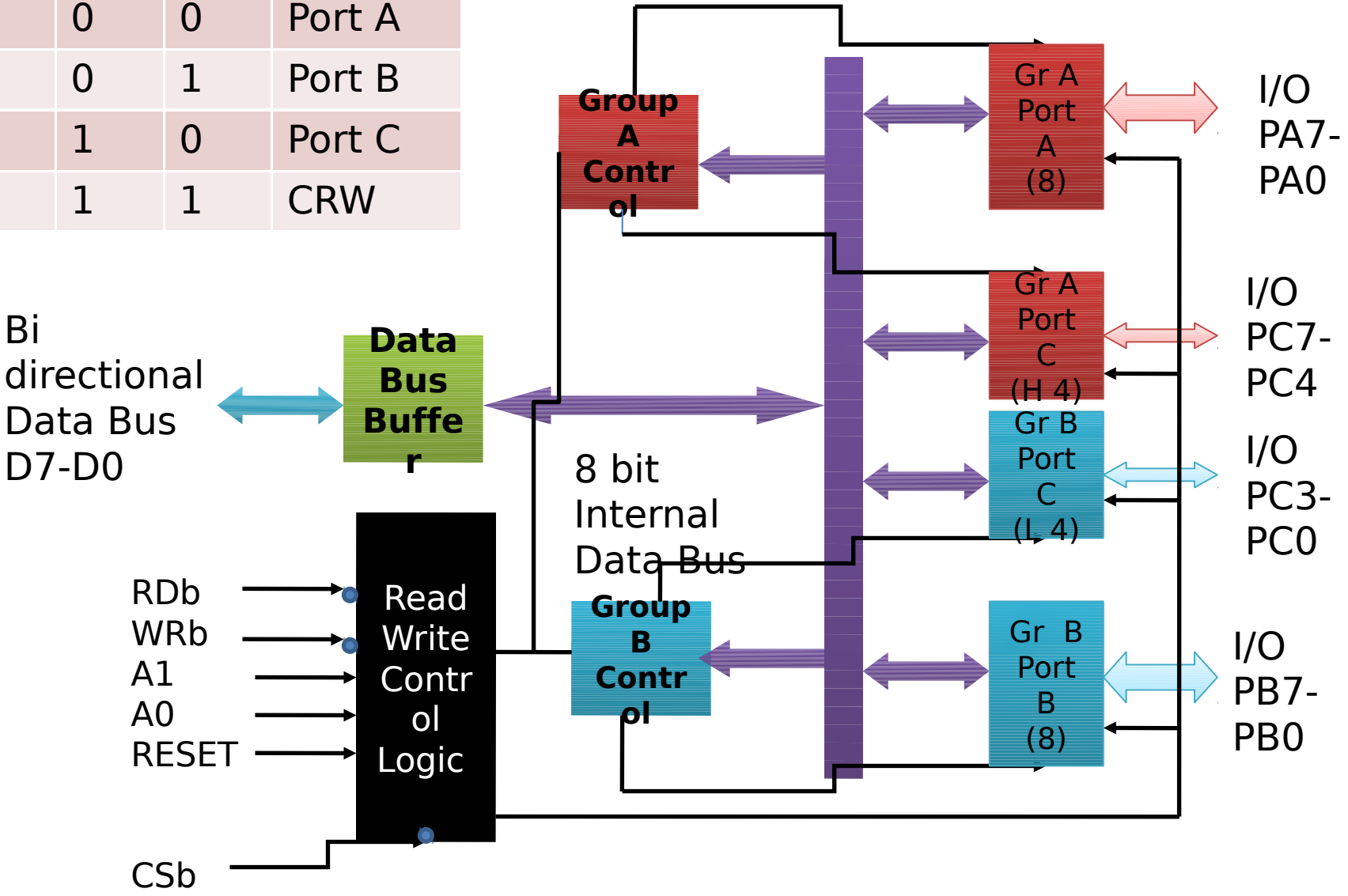
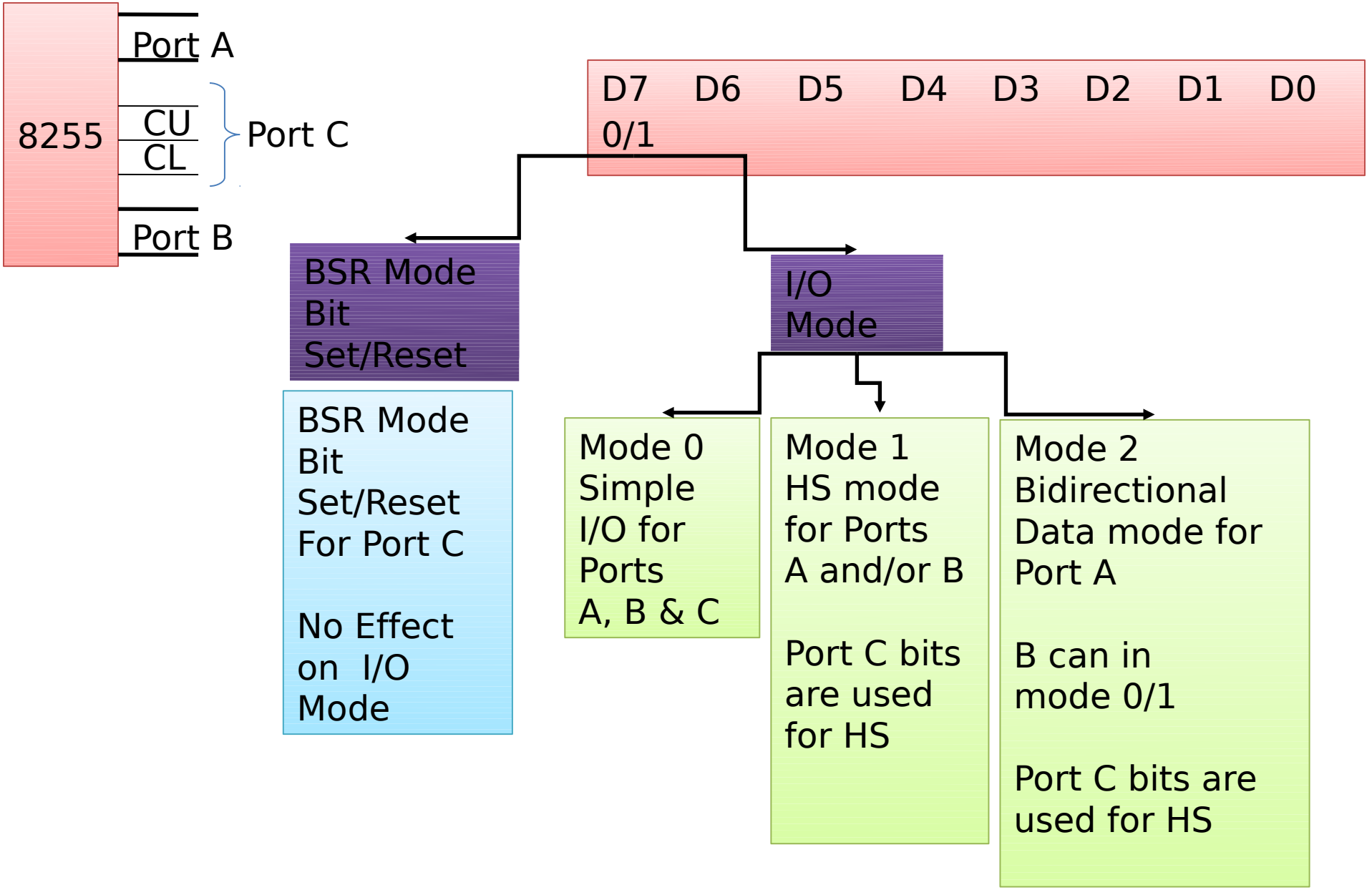
Programmable peripheral interface: 8255
Ch-15

Block diagram of 8255

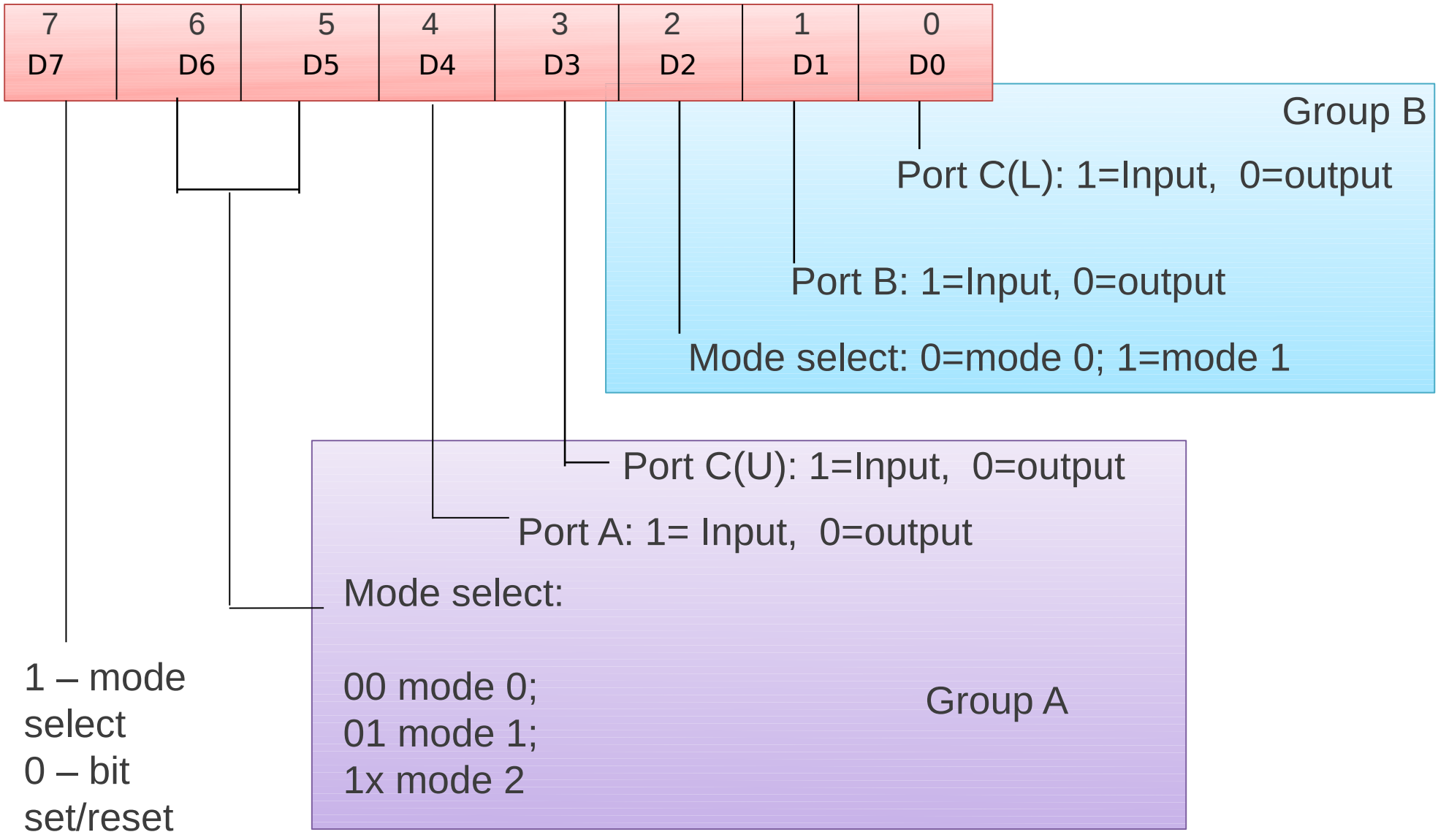
CSb	A1	A0	Sel
0	0	0	Port A
0	0	1	Port B
0	1	0	Port C
0	1	1	CRW



Ports and modes in 8255

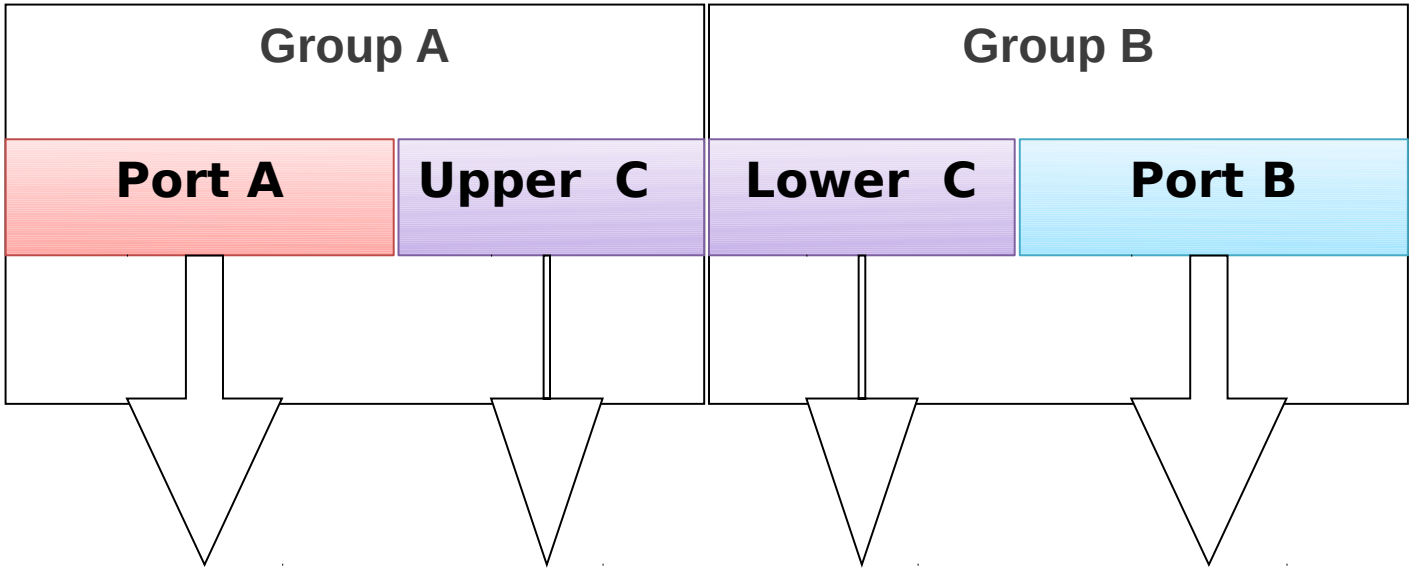


Control register



Ports

- Control register controls the operation of 8255
- All other ports are grouped into two as shown below



Operation modes

- 8255 has 3 modes
- Mode-0: simple input or output
  - Each group (A with U-C) and (B with L-C) can be programmed as either input or as output
- Mode-1: input or output with handshake
  - Ports A and B used as either input or output
  - Each port uses 3 lines of C as handshake signals
- Mode-2: bidirectional data transfer
  - To transfer data between two computers or floppy disks

Bit set or reset (BSR) mode

- Set or reset bits in port-C
- Used for handshake signals
- BSR control word
- Examples:
- Set PC-7
- Reset PC-7
- Set PC-3

D7	D6	D5	D4	D3	D2	D1	D0
0=BSR Mode	Not used, So (000)			Bit Select			S/R (1/0)

Bit set or reset (BSR) mode

- Examples:
- Set PC-7 = 0 000 111 1 = 0FH
- Reset PC-7 = 0 000 111 0 = 0EH
- Set PC-3 = 0 000 011 1 = 07H

D7	D6	D5	D4	D3	D2	D1	D0
0=BSR Mode	Not used, So (000)			Bit Select			S/R (1/0)

BSR example

- Generate activation pulse of delay 'D' on PC7 and PC3
- Set PC7 and PC3 and after delay reset PC7 and PC3

BSR example

- Generate activation pulse of delay 'D' on PC7 and PC3
- Set PC7 and PC3 and after delay reset PC7 and PC3

```
MVI   A,0FH   ; Load ACC to set PC7
OUT   83H     ; set PC7=1
MVI   A,07H   ; Load ACC to set PC3
OUT   83H     ; set PC3=1
CALL  DELAYD  ;
MVI   A,06H   ; Load ACC to Reset PC3
OUT   83H     ; set PC3=1
MVI   A,0EH   ; Load ACC to Reset PC7
OUT   83H     ; set PC7=1
```

Mode-0: example-1

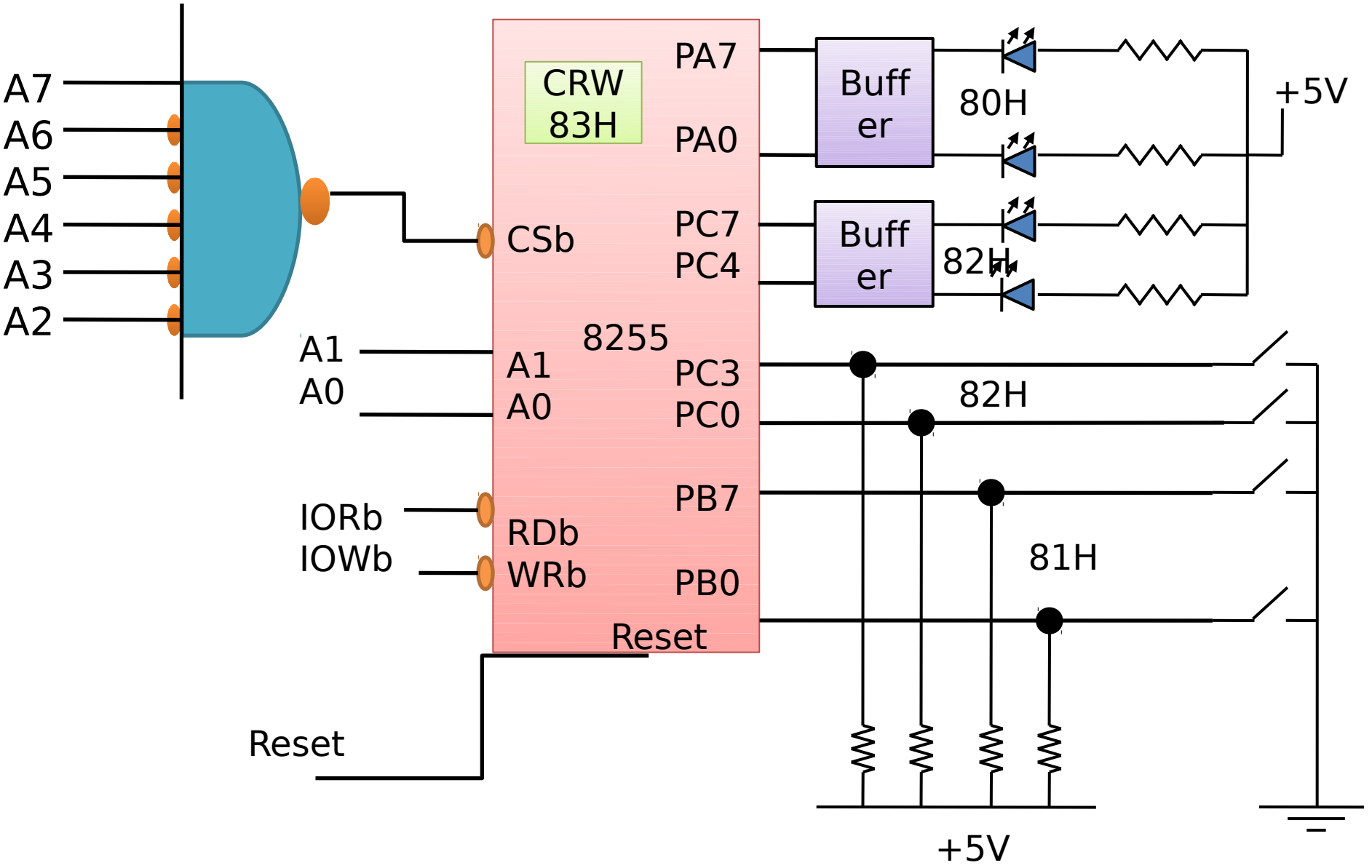
- Mode-0: simple input or output
  - Each group (A with CU) and (B with CL) can be programmed as either input or as output
  - Outputs are latched
  - Inputs are not latched
  - Ports do not have handshake or interrupt capability
- Configure port-A and port CU as out port
- Port-B and port CL as in port
- Interface to read from input DIPs and display the read value at output LEDs
- What is the control word?

Mode-0

- Configure port-A and port CU as out port
- Port-B and port CL as in port
- Interface to read from input DIPs and display the read value at output LEDs
- What is the control word = 83H

D7	D6	D5	D4	D3	D2	D1	D0
1	0	0	0	0	0	1	1
I/O function	Port A in Mode 0		Port A as O/P	Port CU as O/P	Port B in Mode 0	Port B as I/P	Port CL as I/P

Interface circuit



Mode-0: example-1

```
MVI A,83H     ; Load acc with Control word
OUT 83H       ; Load control register with 83 at port address 83
IN  81H       ; Read DIP from port B
OUT 80H       ; Write to LEDs
IN  82H       ; Read DIP from port  C
ANI 0FH       ; Mask upper part of port C, as it is not i/p
RLC
RLC
RLC
RLC           ; Rotate 4 time
OUT 82H       ; Display data at port CU
HLT
```

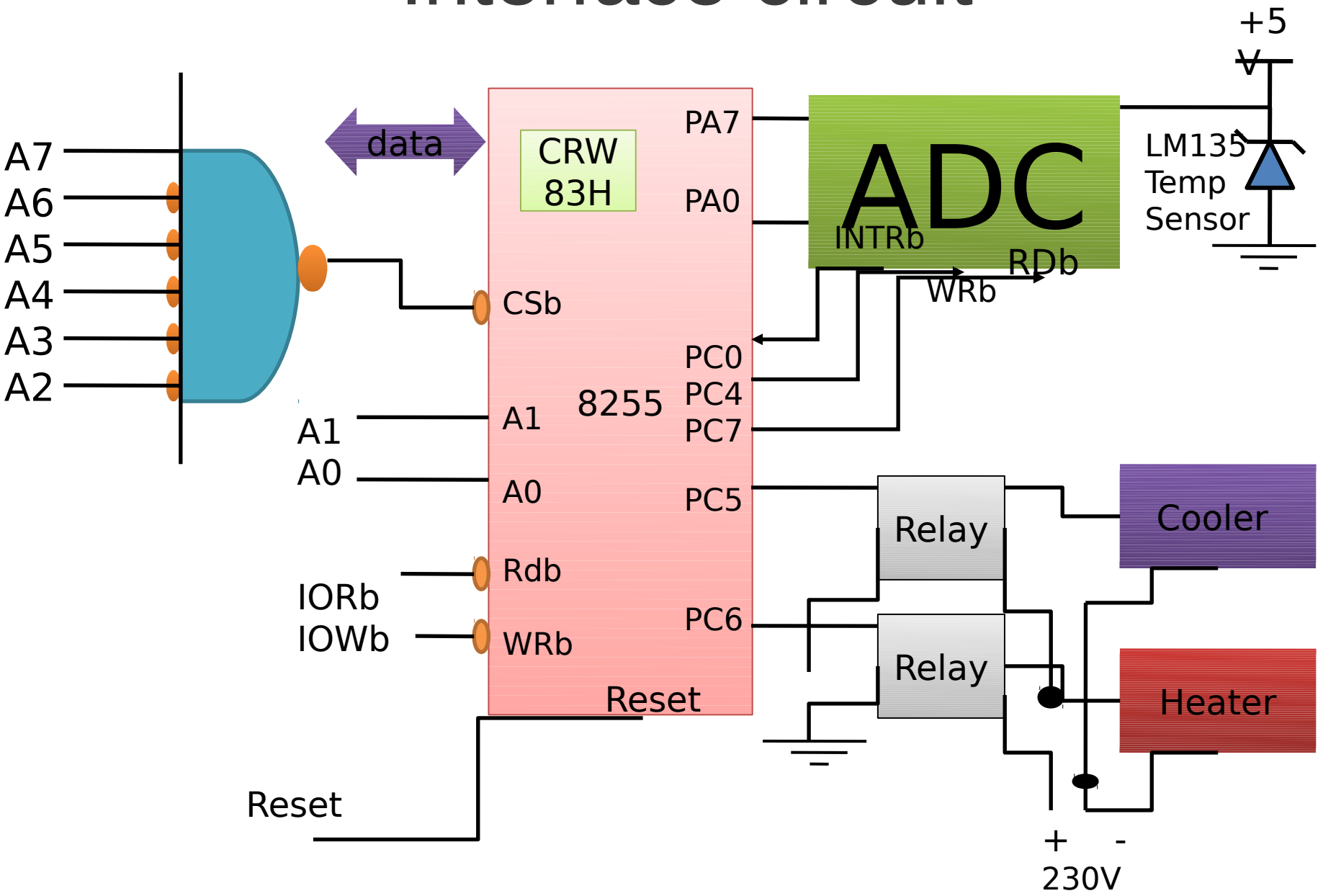
Mode-0: example-2

- Temperature controller for a room
- Devices:
  - Heater,
  - Cooler
  - Temperature sensor
  - A/D converter
  - Driver switch to drive heater/cooler
- Read temperature and control temperature between 20-30 degree Celsius

Mode-0: example-2

- Temperature controller for a room
- Devices:
  - Heater,
  - Cooler
  - Temperature sensor
  - A/D converter
  - Driver switch to drive heater/cooler
- Read temperature and control temperature between 20-30 degree Celsius
- Port-A as input in mode-0, port-C in BSR mode

Interface circuit



Mode-0: example 2

- Port-A as input
- Port-B not used
- Port-CU = output (PC4=WRb, PC7=RDb)
- Port-CL = input (PC0 = INTRb)
- Control word = ?

Mode-0: example 2

- Port-A as input
- Port-B not used
- Port-CU = output (PC4=WRb, PC7=RDb)
- Port-CL = input (PC0 = INTRb)
- Control word = 91H

D7	D6	D5	D4	D3	D2	D1	D0
1	0	0	1	0	0	0	1
I/O function	Port A in Mode 0		Port A as I/P	Port CU As O/P	Port B Is Not used		Port CL As I/P

Mode-0: ex-2

- Control word = 91H
- BSR control words
  - Send start conversion on PC4 = WRb
    - 0000 1000, 0000 1001 (set)
  - Send RDb to ADC on PC7
    - 0000 1110, 0000 1111 (set)
  - Set PC5=high for Fan-ON
    - 0000 1011 (ON), 0000 1010 (OFF)
  - Set PC6=high for heater-ON
    - 0000 1101(ON), 0000 1100 (OFF)

Mode-0: ex-2 program

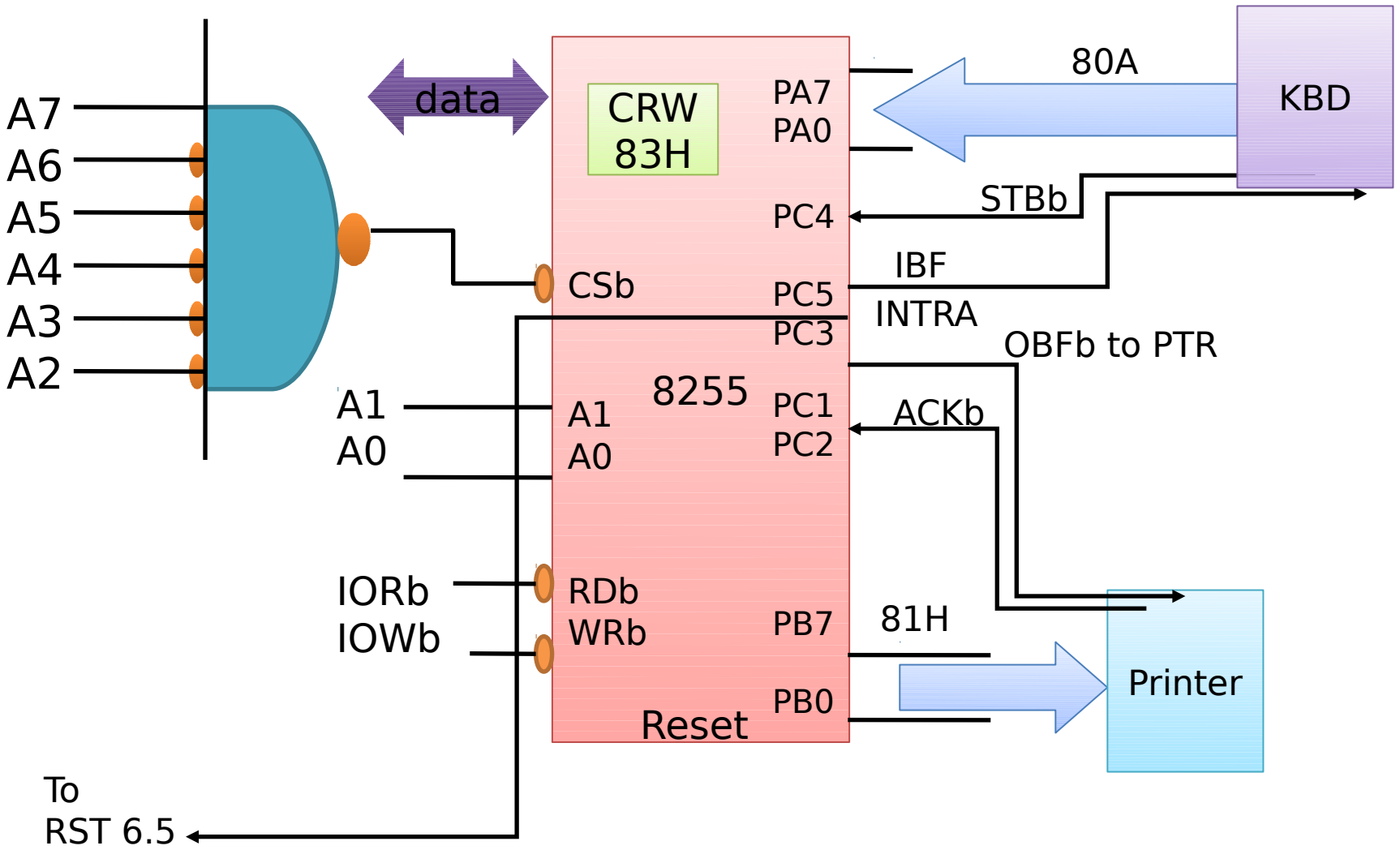
```
MVI A, 91H ;control word
OUT CNTRL
MVI A, 0FH ; set PC7 high to
           ; disable Rdb
OUT CNTRL
MVI A, 08H ;word to set Wrb low
OUT CNTRL
MVI A, 09H ;word to set WRB high
OUT CNTRL
READ: IN PORTC ;read port-C PC0
               ;to check if
               ;conversion over
      RAR
      JC READ
```

```
MVI A, 0EH ; assert Rdb
OUT CNTRL
IN PORTA ; read A/D converter
MOV B, A ; save temperature reading
...      ; compare if temp is more
         ; than 35 deg-C
...      ; yes then turn on fan by
         ; calling sub-routine FANON

FANON:
PUSH PSW ; save A and flags
MVI A, 0CH ; set PC5 to turn on fan
OUT CNTRL
POP PSW
RET

;similar program to turn on cooler
```

Mode: 1

- Mode-1: input or output with handshake
  - Ports A and B used as either input or output
  - Each port uses 3 lines of C as handshake signals
  - Other 2 lines of C used for I/O
  - Input and output data are latched
  - Interrupt logic is supported
  - Example
    - Port-A : keyboard with interrupt I/O and port-B to printer
    - Read key press and print using the printer

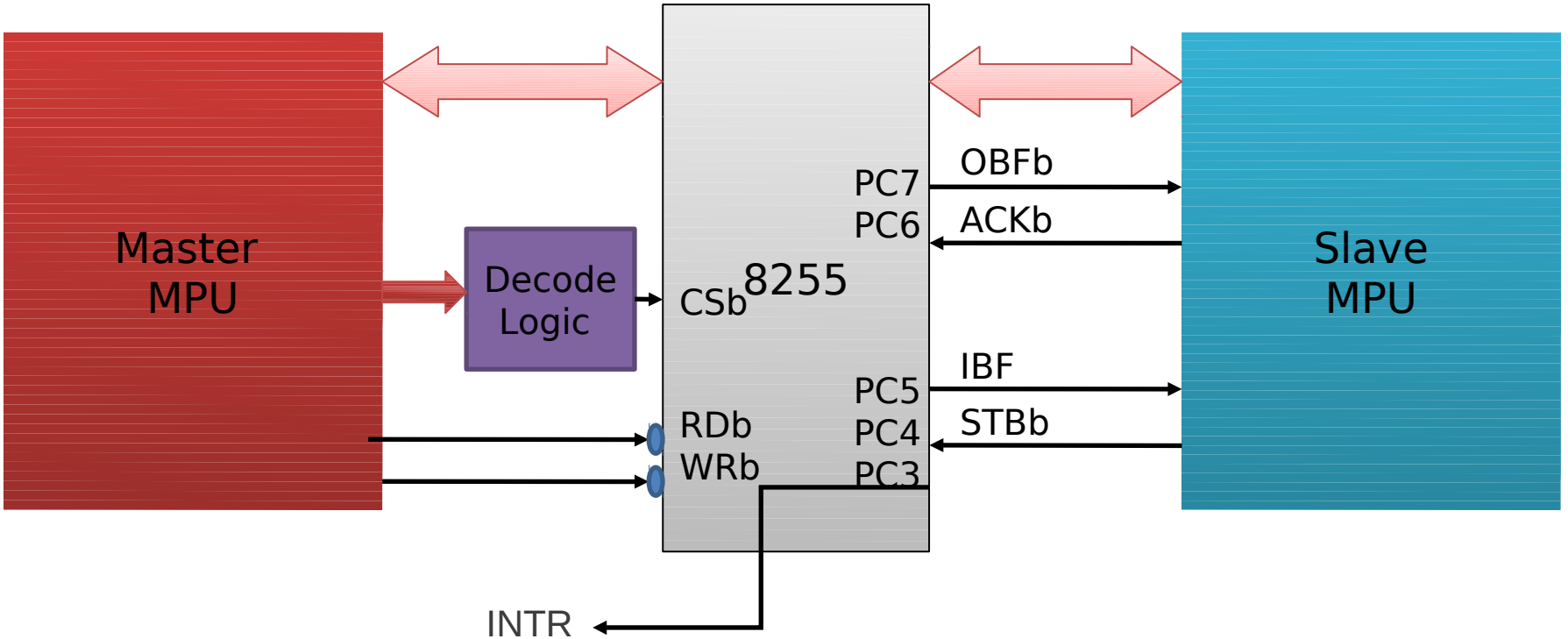
Inteface circuit



Mode: 2

- Mode-2: bidirectional data transfer
  - To transfer data between two computers or floppy disks
  - Port-A as bidirectional and port-B in mode-0 or mode-1
  - Five lines from c are used for handshake
  - Remaining lines used for I/O or as handshake for B
  - Example: data tranfers between master and slave MPU
    - Use port-C to handshake between two computers, to check input/output buffer full and ready status
    - From Master to Slave
      - Master writes data to port-A and sends OBFb (output buffer full) to slave via 8255
      - Slave checks OBFb and then reads data from port-A and then sends ACK to master via 8255
    - From Slave to Master
      - Slave checks IBF (input buffer full) to find whether port-A is available
      - It then writes data to port-A and informs master by sending STBb (strobe) signal
      - Master then reads data from port-A and makes IBF low

Interface circuit



Interface circuit